



ENCOUNTER

Magazine of the International Society for Reef Studies



Get Active - Get Elected! Enter our photo competition **Pacific invaders in US waters**
Marine protected areas that work **Certified sustainable aquarium trade**

Reef Encounter No. 31 March 2002

Magazine of the International Society for Reef Studies

Editor Kristian Teleki
Production Editor Maggie Watson
Contributing Editor Maria João Rodrigues



Editors@ReefEncounter.org

CONTENTS

- 3 **Editorial**
K Teleki, M Watson, MJ Rodrigues
- 3 **ISRS Comment**
From the President *T. Done*
- 4 **ISRS News**
Financial report *J Ware*
- 5 Graduate fellowship
ISRS election
- 6 ISRS European meeting
- 7 Coral Reef special issues
- 8 **News**
Help design lasting protected areas
New protected areas project for the Philippines
A White
- 9 SCMRT succeeds Shoals *R Payet*
Compleat Reef Encounter
- 10 Pacific Invaders in US Waters *M Watson*
28 Million days a year! *P Fletcher*
- 11 Reefs at risk *L Burke*
Dive In to Earth Day *S Flumerfelt*
- 12 **Currents**
Certified Sustainable *P Holthus*
- 14 Glover's Reef - conservation and research on a remote Caribbean Atoll *L Lauck, T McClanahan*
- 15 Rare Reefs *N Chapman*
- 16 International coral trade workshop: sustainable management guidelines *A Bruckner*
- 20 ReefBase revised *J Oliver*
- 22 Tortugas surveyed *JS Ault et al*

(Contents continued on back cover)

Reef Encounter is designed by Maggie Watson and printed on recycled paper by Allen Press Inc., 1041 New Hampshire, Lawrence, KS 66044, USA.

The cover image is from the Coral Reef Photo Bank, which is just one of the Tools and Resources available on the International Coral Reef Information Network (ICRIN) web page (www.coralreef.org). By providing resources for the coral reef community, ICRIN aims to support and amplify local, regional and global efforts to protect coral reefs.

COPY DEADLINE FOR REEF ENCOUNTER 32
(due out SEPTEMBER 2002) IS JULY 1 2002

President

Terry Done, Australian Institute of Marine Science, PMB #3 Mail Centre, Townsville Qld 4810, Australia. Tel 61 7 47 534 344 Fax 61 7 47 275 852 Email tdone@aims.gov.au

Vice President

Barbara Brown, Centre for Tropical Coastal Management Studies, Dept. Marine Sciences, Ridley Building, University of Newcastle NE1 7RU, UK. Tel +44(0)191 22 6659 Fax +44 (0)191 222 7891 Email 101515.1267@compuserve.com

Treasurer

John Ware, SeaServices Inc., 19572 Club House Road, Montgomery Village, MD 20886, USA. Tel +1 301 987 8507 Fax +1 301 987 8531 Email jware@erols.com

Corresponding Secretary

Richard Aronson, Dauphin Island Sea Lab., P.O. Box 369-370, Dauphin Island, AL 36528, USA Tel +1 334 861 7567 Fax +1 334 861 7540 Email aronson@disl.org

Recording Secretary

Peter Edmunds, Department of Biology, California State University, 18111 Nordhoff Street, Northridge, CA 91330, USA Tel +1 818 677 2502 Fax +1 818 677 2034 Email peter.edmunds@csun.edu

Magazine Editors

K Teleki (UK) M Watson (UK), MJ Rodrigues (Australia)

Coral Reefs

Managing Editor R Dodge, Geological Editor PK Swart, Ecological Editor PF Sale, Biological Editors D Barnes, RC Carpenter, HR Lasker, Environmental Editor BG Hatcher

Council

Loke-Ming Chou (Singapore), R Dodge (USA), J Garzon-Ferrera (Columbia), H Guzman (Panama), H Kayanne (Japan), L Montaggioni (France), N Polunin (UK), R Richmond (Guam) K Sealey-Sullivan (USA), Suharsono (Indonesia), K Teleki (UK), C Wallace (Australia), R van Woeseik (Japan), H Vogt (UK)

ISRS Sustaining Members

H Arnold, BE Brown & R Dunne, DG Fautin & RW Buddemeier, RN Ginsburg, AJ Hooten, LL Jackson, M Keyes, WE Kiene, T McClanahan & N Muthiga, S Miller, J Ruitenbeek, DR Stoddart, JRWare & W Ware

ISRS Honorary Members

Jl Tracey Jr, J Connell, JE Randall, DW Kinsey, G Scheer, S Kawaguti

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

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

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

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

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

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

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

Editorial

This issue sees continuing changes for Reef Encounter and the editorial team. Kristian remains Editor, with overall responsibility for gathering articles and corresponding with contributors. Maggie has taken over the layout (previously done by Allen Press) and shares the copy editing tasks with Kristian. Maria Joao remains as contributing editor but Karenne Tun leaves us for pastures new. Over the next several issues we expect to continue to upgrade the magazine, so please do send us your comments and feedback. An exciting new development is that Reef Encounter

ISRS Comment

From the President

Greetings and best wishes for 2002 in this my second last **Reef Encounter** message as President... it is election year again. This September, there will be an election for the positions of President, Vice-President, Corresponding Secretary and six of the twelve Councilors. Our current Treasurer, Recording Secretary and six Councilors will remain in office to provide continuity, along with the editors in chief of **Coral Reefs** and **Reef Encounter**. I encourage members who would like to serve our membership, now over 1000, to apply. A call for nominations is published in **ISRS News**.

The Society finished 2001 on a high note, due to the hard work and generosity of a lot of people. Dick Dodge, his Topic Editors and Special Issue Editors put in an enormous effort to bring **Coral Reefs** back on schedule. Thanks also to the twenty-seven members of the Editorial Board, to all of you who submitted and reviewed manuscripts during the year, and to Maggie Watson and Kristian Teleki for getting **Reef Encounter** onto its new schedule while continuing to increase the magazine's breadth and quality. Also on the publishing front, the Society can look forward to the

Editors@ReefEncounter.org
www.ReefEncounter.org

is soon to have its own web identity at www.ReefEncounter.org. The site, which will still link to the **ISRS** site at www.uncwil.edu/isrs, will offer a PDF version of Reef Encounter. But instead of a single large file for the entire issue we will be putting articles up individually so you can save time by downloading just the articles you

Proceedings of the 9th International Coral Reef Symposium in 2002. In our continuing joint venture with the Indonesian Organizing Committee, they have agreed to donate 500 copies of the Proceedings to **ISRS**. Along with them, we plan to donate a number of copies of the Proceedings to needy institutions, and we will offer the rest for sale to other institutions, and to persons who do not receive a copy as a right of full-registration at the Bali symposium.

The Society has a busy program of meetings in its Calendar for 2002 and 2003. A European Meeting will be held at Robinson College, Cambridge University on 4-7 September 2002, and we are hopeful of holding another during 2003 in Bremen, Germany. In July 2003, a North American Meeting of **ISRS** will be held at Lawrence, Kansas in conjunction with the Seventh International Conference on Coelenterate Biology. These will take us nicely up to the 10th International Coral Reef Symposium, to be held in Okinawa, Japan, in June or July 2004 (the first announcement is due June 2002).

The **ISRS** President is a member of the Coordinating and Planning Committee of the International Coral Reef Initiative (ICRI). Council recently ratified our involvement and agreed

want. We will include additional material that didn't fit into the issue, as well as more colour images and links to other coral reef sites. Please bear with us as we get this up and running. Please also note that your editors are also moving to a new email address: Editors@ReefEncounter.org.

to support the President's travel to one meeting annually. This year, ICRI will meet during the Second International Marine Ecosystem Management Symposium (ITMEMS), scheduled for October in the Philippines. I have been asked to report on 'the science messages for management from *9ICRS*'. I have been pondering this task a bit, and recently heard this witticism from a scientist: 'Science is to management as a lamppost is to a drunkard: used more for support than illumination'. They say that many a true word is said in jest, but I will be looking to highlight examples of illumination. What can we agree upon, and how can we support policy makers and managers in the cause of conservation and sustainable use of coral reefs and their resources? How can we, or how much need we, give broad public airing to those uncertainties, qualifications and differences of opinion that characterize the process of scientific investigation and discovery? I look forward to getting my head around these issues in coming weeks, and would welcome relevant ideas and suggestions, practical or philosophical, from any of you.

Terry Done
President

ISRS Financial Report 2001

Membership

As anticipated the number of members for 2001 was 902, down from the high of 1,062 in the year 2000 (which was due in significant part to interest the 9th ICRS generated for the society). However, there were 89 new members. The total end-of-year membership included:

Individual	689
Student	109
Family/Spouse	85
Sustaining Patron	13
Honorary	6

Total cash assets as of December 31, 2001 were \$156,201.50 of which \$143,050.97 are in interest checking accounts and \$13,150.53 are in certificates of deposit. At the beginning of the year the figures were \$130,196.97 total of which \$105,334.38 were in checking and \$24,862.59 were in certificates of deposit. The net change for the year is \$26,004.53. (All amounts are in US dollars.)

INCOME		OUTGO	
Memberships	\$69,537.00	Coral Reefs	\$16,203.55
Donations	2,638.80	Allen Press	12,410.34
Interest	5,022.10	Reef Encounter	11,517.86
Editorial Allowance	<u>3,583.89</u>	Miscellaneous*	5,451.88
TOTAL	\$80,781.79	Bank Card Charges	1,346.47
		Postage	1,713.71
		Bank Service Charges	210.05
		Travel	3,181.40
		Editorial Subsidy	<u>2,742.00</u>
		TOTAL	\$54,777.26

*Note: Miscellaneous includes preparation of annual tax return (\$315.00), triennial audit (\$1,500.00), subsidy for European ISRS Meeting (\$2,000.00), publishing software for **Reef Encounter** (\$999.00), and carry over expense from year 2000 (\$637.88).

Financially, the ISRS appears to have had a very good year, and indeed it has. However, we should keep in mind two facts. First, a goodly portion of the apparent financial success in 2001 was due to a "spillover" effect from the 9th ICRS in Bali. Second, we are currently anticipating significant expenditures in 2002 associated with 9th ICRS proceedings. The details of these expenditures will be reported in future **Reef Encounter** when and if they occur.

John R. Ware, Treasurer, ISRS, jware@erols.com

Photo Competition!

Now we have some colour in the magazine, we'd like to make the most of it. We need to build up a small library of images, and we're asking for your help. Come on all you photographers out there! Enter our photo competition!

The winning five photos will be printed on the front of upcoming issues of **Reef Encounter**, with a credit on the inner cover. But if you don't make the top five, you can still see your picture in print! We'll keep all the entries and use as many as possible to illustrate the inside pages of future issues. If we use your photo you will be credited in the margin of the page.

Send us pictures of corals, fish, fossils, fishers, researchers at work, tourists – whatever you like. There's no limit to topic but the judges will be looking for unusual and striking images. Entries should be submitted electronically to Editors@ReefEncounter.org (note: not ReefEncounter@bigfoot.com). Your entry will be acknowledged by email. If you do not get an acknowledgement it may mean your image was not received. Please email us to alert us to the problem.

Images must have a resolution of 300-350 dpi and must be no larger than 20cm by 20cm and no smaller than 10cm by 10cm. They should be submitted as TIF or JPEG format files. The closing date is 1st July 2002 and the judges decision is final.

By entering the competition you confirm that you are the photographer, that you own the copyright, and that you give us permission to use the image once both in the paper version of the magazine and in the electronic version on the **Reef Encounter** website.

Graduate Fellowship for Coral Reef Research 2002

International Society for Reef Studies and the Ocean Conservancy

Coral reefs are among the most diverse ecosystems on the planet, they are globally distributed, and they support various aspects of coastal economies. Yet coral reefs are widely recognized to be in decline and studies are needed to provide information to manage and understand processes that cause coral reef change. This year the ISRS and the Ocean Conservancy continue their support of Ph.D. students in the general area of coral reef ecosystem research. Two fellowships will be awarded to focus on understanding and predicting coral reef responses to management or disturbance-caused change (human-

caused or natural). The call for proposals, which was advertised on the society's website, closed at the end of January and successful applicants will be announced by 30 April 2002. Research supported by the Fellowships will emphasize an ecosystem approach. Work may focus on factors that control productivity, nutrient dynamics, carbonate accretion or erosion, fisheries, or the effects of exploitation of coral reef resources. Projects that address such issues within the context of marine reserves are deemed especially suitable for these Fellowships. Projects have not been

limited to these topics, but research is intended to increase understanding of reef function in a way that is relevant to management at local, regional, or global scales.

The Fellowship is likely to be available again next year, and if it is Reef Encounter 32 (out in September) will carry details of how to apply. Alternatively, keep an eye on the ISRS and the Reef Encounter web sites www.uncwil.edu/isrs/ and www.ReefEncounter.org or contact Peter J. Edmunds, ISRS Recording Secretary at email peter.edmunds@csun.edu.

Election of Officers and Councillors: Call for Nominations

The International Society for Reef Studies will be holding elections in September 2002 to replace outgoing officers and members of the ISRS Council. We will be electing a new President to replace retiring President Terry Done, a Vice President (currently Barbara Brown) and a Corresponding Secretary (currently Rich Aronson). In addition, we will be replacing six retiring members of the ISRS Council: Loke-Ming Chou, Héctor Guzmán, Nicholas Polunin, Robert Richmond, Suharsono and Carden Wallace. Treasurer John Ware and Recording Secretary Peter Edmunds will continue for another two years, as will six members of the ISRS Council: Robert van Woesik, Lucien Montaggioni, Kathleen Sullivan-Sealey, Helge P. Vogt, Jaime Garzón-Ferreira and Hajime Kayanne. **Coral Reefs** Editor Dick Dodge and **Reef Encounter** editor Kristian Teleki will also remain on the council as unelected members. The tenure of each elected position is 4 years, and new officers and

councillors will take over beginning 1 January 2003. These positions are open only to members of ISRS.

This is your chance to participate. We look forward to hearing from you!

Nominations should be submitted to Corresponding Secretary Rich Aronson *by post* (Dauphin Island Sea Lab, 101 Bienville Boulevard, Dauphin Island, AL 36528, USA), *by fax* (251-861-7540), or *as an email attachment* (ronson@disl.org). Because of constitutional requirements, a nomination submitted as text of an email message cannot be accepted unless it is also submitted by one of the above methods. Each nomination should consist of the person's name, institution and country, and the post for which s/he is running. Each candidate should provide a one-paragraph statement about his/her qualifications for the position (a brief

history of his/her involvement in coral reef work) and objectives while in that position (how s/he envisions working to the benefit of ISRS). Also required by the Society's bylaws is a statement of disclosure of any financial arrangements the candidate may have with any publisher of scientific literature. Self nominations are welcome. If you wish to nominate someone other than yourself, please ask that person to mail, fax or email Rich Aronson a confirmation of his/her willingness to run for the office.

DEADLINE: The deadline for nominations is 7 June 2002. Ballots and biographical sketches will be mailed to all members of ISRS, to be returned to the Recording Secretary in September (exact date to be announced). The biographical sketches of the candidates will also be posted on the ISRS web site, www.uncwil.edu/isrs, until the day ballots are due. The results of the election will be announced once the ballots have been counted.

ISRS European Meeting

4 - 7 September 2002, Cambridge, UK

The Scientific Program Committee of the ISRS European meeting is pleased to announce the names of the Plenary Speakers for the meeting in Cambridge next September.

Plenary Speakers

Angela Douglas, University of York *Linking zooxanthellae function with reef "health"* **Katharina Fabricius**, Australian Institute of Marine Science, Townsville *Reefs in turbid and polluted waters: why the fuss?* **Jeremy Jackson**, Scripps Institution of Oceanography *Can we imagine a pristine coral reef and why should we try?* **Sandy Tudhope**, University of Edinburgh *Environmental variability and change: high resolution records from corals and coral reefs*

After – Dinner Talk

David Stoddart, University of California at Berkeley *'Be of good cheer, my weary listeners, for I have espied land'*

Thematic Sessions

Expressions of interest and abstracts should be sent as soon as possible to the session convenors listed below. We also encourage submissions on aspects of coral reef research not covered by these themes. Offers of papers or groups of papers for a whole or part session should be sent to the organisers at info@isrs2002.org

Marginal and non-reef building coral environments	Chris Perry (c.t.perry@mmu.ac.uk) and Piers Larcombe (piers.larcombe@jcu.edu.au)
Indicators of environmental stress	John Bythell (J.C.Bythell@newcastle.ac.uk) and Jane Hawkridge (jhaw@mote.org)
Dynamics of reef ecosystems in space and time	Helge Vogt (HelgePeterVogt@aol.com)
Advances in molecular biology and their application to reef sciences	Martin Le Tissier (m.d.a.le-tissier@ncl.ac.uk)
Disease in the reef ecosystem	Edmund Green (Ed.Green@unep-wcmc.org)
Management of reefs and marine parks	Elizabeth Wood (ewood@globalnet.co.uk)
Reef geometries and sea level fluctuations	Lucien Montaggioni (Lucien.Montaggioni@newsup.univ-mrs.fr) and Cloin Braithwaite (cjrb@earthsci.gla.ac.uk)
Corals as recorders of ocean-atmospheric processes	Christian Dullo (cdullo@geomar.de) and Sandy Tudhope (sandy.tudhope@ed.ac.uk)
Cold water reefs	Jason Hall-Spencer (gbfa20@udcf.gla.ac.uk)
Ancient reef record: ecology and environment	Rachel Wood (rwood2@cambridge.scr.slb.com) and Brian Rosen (brr@nhm.ac.uk)
Bioerosion in reef environments	Marcos Gektidis (info@gektidis.de)

We would welcome further submissions on aspects of reef geology not covered by the themes above. Send expressions of interest and inquiries to Tom Spencer (ts111@cam.ac.uk) please. Applications for the ISRS Student Travel Award Program are still being accepted. Instructions for applications can be found at the meeting website. Further details and registration forms for the ISRS 2002 European meeting in Cambridge can be obtained from www.isrs2002.org or by contacting info@isrs2002.org

Call for submission of manuscripts - Coral Reefs special issues

Environmental and climatic proxies in reef organisms

Vol. 22 of **Coral Reefs** will include a Special Issue entitled "Environmental and Climatic Proxies in Reef Organisms." Papers are requested which will focus on issues including geochemical signals and their calibration thereof in corals and other reef organisms. Topics which might be applicable are the use of geochemical and other indicators including stable C, O, and N isotopes; trace elements in calcareous as well as organic components of the reef ecosystem, and growth records which could document natural and anthropogenic change in the reef environment. The purpose of the issue is to provide further information on the reliability and calibration of proxies as indicators of environmental change and reef health. Manuscripts may be empirical or theoretical, long or short.

Marginal and non reef-building coral environments

Volume 23 of **Coral Reefs** will include a Special Issue entitled "Marginal and Non Reef-Building Coral Environments." The aim of this thematic issue is to highlight the varied character, processes, and issues relevant to more marginal coral-dominated settings, including high-latitude environments, high-turbidity sites, fluviially influenced sites, upwelling-influenced areas, and high-salinity settings.

Under varied marginal conditions, reef framework is often either restricted or, in extreme cases, entirely absent. These settings are of significant interest from both biological and geological perspectives because they emphasize the highly variable nature of reef and coral community structure, may still harbour an important array of tropical coral-related species, and are often locally important from socio-economic perspectives. In addition, their marginal nature (perhaps close to the

Reviews and Reef Sites on an appropriate theme are also welcome.

The issue (approximately 100 pages) will be published in 2003 as soon as 12 papers have been accepted; additional submissions will be considered for publication in subsequent issues.

Papers should be submitted no later than August, 2002 and preferably before. Papers should follow the guidelines for **Coral Reefs** and may be submitted to the Guest Editors in pdf format.

Prospective authors should first contact the Guest Editors, Peter K. Swart or Andrea Grotoli. To ensure a speedy publication, manuscripts should be submitted as soon as possible.

environmental thresholds for coral survival) may make them particularly susceptible to environmental disturbance and climatic change.

From the geological perspective, there are interesting questions relating to the nature of marginal reef growth, their accumulation potential, and the processes of carbonate cycling (e.g., bioerosion, encrustation). Marginal sites may also have potential as analogues for the highly diverse coral-dominated settings that are preserved in the fossil record.

Potential topics might include (but are not limited to) geological evolution and significance, sedimentary settings, species assemblages and ecological significance, coral physiology, environmental disturbance, management, and conservation.

The issue (approximately 100 pages) will be published as soon as 12 papers have been accepted; additional submissions will be considered for publication in subsequent issues.

*Dr. Peter K. Swart, Geological Editor
Coral Reefs, University of Miami,
4600 Rickenbacker Causeway,
Miami Fl 33149, USA. Tel. 305-361 -
4103 Fax 305-361-4632 Email:
Pswart@rsmas.miami.edu Webpage
<http://mgg.rsmas.miami.edu/faculty/pswart/pswart.htm>*

*Dr. Andrea G. Grotoli, Assistant
Professor, University of
Pennsylvania, Department of Earth
and Environmental Science, 240
South 33rd Street, #162 Hayden
Hall, Philadelphia, PA 19104-6316
USA Tel: 215-898-9269 (office) 215-
898-6336 (lab) Fax: 215-898-0964
Email: grotoli@sas.upenn.edu
Webpage <http://www.sas.upenn.edu/earth/Andrea.html>*

Reviews and Reef Sites on an appropriate theme are also welcome.

Papers should be submitted no later than 1st September 2002. Papers should follow the guidelines for **Coral Reefs** and may be submitted to the Guest Editors in pdf format (they will also be accepted by the Guest Editors at the ISRS Meeting in Cambridge at which there is a related thematic session running). To ensure a speedy publication, manuscripts should be submitted as soon as possible.

*Prospective authors should
first contact the Guest
Editors, Chris Perry
(c.t.perry@mmu.ac.uk)
or Piers Larcombe
(piers.larcombe@jcu.edu.au).*

Help Design Lasting Protected Areas!

Mitigating coral bleaching impact through MPA design - a questionnaire

Did reefs you know succumb to the recent severe outbreak of bleaching? Or did they survive? The Nature Conservancy and the World Wide Fund for nature want to use your experience to help design marine protected areas that are resilient to climate change impacts (see Meeting Report page 25). Together with several other Non Governmental Organisations, they have come up with a questionnaire to look for correlations between environmental factors and reef resilience. Please contribute your experience! When the responses are in it is hoped that the data will help show which environmental factors actually confer bleaching resistance and recovery. The questionnaire will be available for another couple of months. All people who respond to the questionnaire will be acknowledged. The assessment is a contribution to the International Biodiversity Observation Year.

<http://www.reefbase.org/questionnaire/index.asp>

New Protected Area Project for the Philippines

The Philippines' 27,000 km² of coral reefs provide food and livelihood to many communities, but are under serious threat. The Philippines already has marine protected areas, but many don't perform as intended because of poor governance and the lack of guidance and evaluation for management. It's difficult to value MPA functions and resources, and the scarcity of existing successful and sustainable MPA models means role models are few and far between. To help tackle the problem the Coastal Conservation and Education Foundation (previously

known as the Sulu Fund for Marine Conservation) is embarking on *The Marine Protected Area Project*. The project's aims include quantifying coral reef uses, values and benefits in monetary terms. For existing protected areas the project will develop a certification and rating system and link this with the valuation work. This rating system will be tested through strategic field monitoring, and then refined. The project aims to help with the development of up to 10 MPAs. The results will be widely

published and lesson's learnt will be disseminated. Many of the results will be held in a reference database. The ultimate goal of the project is to develop MPA models as an effective management tool so that effective strategies can be replicated elsewhere.

Alan White can be contacted at The Coastal Conservation and Education Foundation Inc. (formerly Sulu Fund), Room 302, Third Floor, PDI Condominium, Banilad, Cebu City, 6000 Philippines Tel (6332) 233-6909 and (6332) 233-6947 Fax (6332) 233-6891 Email: ccef@mozcom.com

Who's involved?

The programme has support from the *Pew Fellows Program in Marine Conservation*, an initiative of *The Pew Charitable Trusts* in partnership with the New England Aquarium. Partners in the government and non-government sector will collaborate on the project including:

- The Coastal Conservation and Education Foundation (previously the Sulu Fund for Marine Conservation),
- The Coastal Resource Management Project (CRMP) of the Department of Environment and Natural Resources (DENR), Philippines,
- ONEOCEAN Foundation, Inc.,
- The Silliman University through the Marine Laboratory,
- The Silliman University-Angelo King Center for Research and Environmental Management (SUAKCREM)
- The Philippine Reef and Rainforest Conservation Foundation, Inc. (PRRCFI).

SCMRT Succeeds Shoals

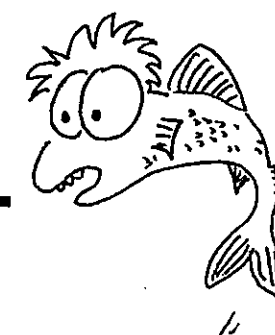
Seychelles Centre for Marine Research and Technology grows out of the Shoals of Capricorn Programme

Following the successful completion and hand-over of resources from the Royal Geographical Society's (with IBG) and Royal Society's *Shoals of Capricorn Programme* to the Government of Seychelles, a new marine research facility has been created. The Seychelles Centre for Marine Research and Technology (SCMRT) will continue and expand the marine research and education work initiated under the *Shoals* umbrella.

The Centre is on the main island of Mahé, within Morne Seychellois National Park, and adjacent to Cap Ternay Marine National Park, where the Headquarters for the Marine Parks Authority (MPA) are also housed. The surrounding area hosts excellent examples of Seychelles marine and coastal habitats (seagrass beds, mangroves, coral reefs, and rocky shores). The capital, Victoria, the deep water harbour, the hyperbaric facility, and the international airport can be reached in approximately 30 minutes by car.

Collaborative Programmes of the SCMRT include: a 3 year zooplankton research programme in association with Plymouth Marine Laboratory, UK; a sea level reconstruction programme in collaboration with GEOMAR (Research Centre for Marine Geosciences, Kiel, Germany); and a coral reef and fish community monitoring programme focusing on the World Heritage Site of Aldabra Atoll (the Aldabra Marine Programme, affiliated with Cambridge University, Department of Geography).

The SCMRT is looking to further develop international institutional links, research programmes (for researchers and students) and funding opportunities. For further information about the SCMRT, please contact Rolph Payet (Director General; Policy, Planning and Services) Email <rolphap@seychelles.net> Tel: +248 224644. Fax: +248 224500



Compleat Reef Encounter

Evolving Funding Agency Jargon.

Working for the SPD in a certain science funding agency supporting the PRC, a HOT and the SISB, gives you a pretty good feel for MLAs (Multi Letter Acronyms). But how about this conversation between two PRS (Peer Review Secretaries).

First PRS, plonking the phone down after a particularly difficult call "God I just hate arsy PIs!" (Principal Investigators)

Second PRS "Yeah." And then later... "But what exactly is an RCPI?"

SCMRT

SCMRT is managed by the Ministry of Environment (Policy, Planning and Services Division), and aims to:

- increase co-operation among the various institutions involved in marine activities.
- insure the development of specialised facilities.
- act as a one-stop-shop for research applications, especially by external researchers.
- promote Seychelles as a research destination.

The SCMRT boasts:

- two fully equipped offices (including information and communication equipment);
- a large laboratory suited and equipped for a variety of marine research projects;
- a combined training/education room (including AV equipment); diving equipment, compressor and accessories;
- research library;
- on-site accommodation (4 large dormitory rooms);
- two self-contained flats (managed by the Marine Parks Authority);
- access to facilities hosted by collaborating institutes; and
- on-site support from the resident SCMRT staff.

Pacific Invaders in U.S. Waters

'We have lionfish on our coast from Georgia to New York' announced photographer Bill Mansfield in a discussion on the Gulf and Caribbean Fisheries Institute listserver.

A handful of *Pterois* spp (family Scorpaenidae) have been reported from wreck sites at the Frying Pan Shoals 30-40 miles off the Carolina coast (south of Beaufort Inlet). Mansfield has seen both adults and juveniles. He

has received another report from Georgia, and Paula Whitfield of the USA's National Oceanographic and Atmospheric Administration received a lionfish report from the south shore of Long Island last summer. Bill Eschmeyer of the California Academy of Science has confirmed at least one of the lionfish found on the Atlantic coast is *Pterois volitans*, the Turkeyfish.

But are all the individuals the same species? When Mansfield alerted the discussion group,

researcher Mark Tupper wondered whether the fish might be the spotted lionfish *P. antennata*. This species, although less common in the aquarium industry than *P. volitans*, has a wider geographical range. It is found from 42°N - 40°S and in both the Pacific and

We have lionfish on our coast from Georgia to New York!

Indian Oceans, so it would be able to withstand greater temperature fluctuations. But Tupper used image analysis techniques to investigate the number and structure of fin rays and the structure of the mouth in a photo of a lionfish from North Carolina taken by Cindy Burnham of the Fayetteville Observer. The analysis suggested that this fish was also *Pterois volitans*.

Alien species can often arrive in ship's ballast waters, but the most likely explanation for these introductions is deliberate or accidental releases by aquarists. The fish off Carolina might have been set free in the warm waters of Florida and

swept north with the Gulf Stream, which flows northwards from the Caribbean, past the coast of Florida and on to Hatteras before it turns east.

Although most introduced 'non-native' animals and plants fail to establish themselves, some can become invasive. They can displace native species or expand into a vacant ecological niche, sometimes threatening the stability of entire ecosystems.

Story by Maggie Watson. You can see Bill Mansfield's work at <http://home.ec.rr.com/divingphotos/> and contact him at Billman@ec.rr.co.

Mark Tupper is an Associate Professor at the University of Guam, Email mtupper@guam.uog.edu.

Cindy Burnham's email is burnhamc@fayettevillenc.com. Paula Whitfield can be reached at Paula.Whitfield@noaa.gov and Bill Eschmeyer is at the California Academy of Science.

28 Million Days a year!

Southeast Florida residents and visitors spent a total of 28 million days using natural and artificial reefs in a 12 month period! That's the conclusion of a study led by Hazen and Sawyer, P.C. in association with Florida State University and the National Oceanic and Atmospheric Administration.

The study calculated that Reef-related expenditures generated US\$1 billion in income to Broward County (which received approximately one third of the visits to the region) while creating 36,000 jobs. The researchers used a 'willingness to pay' study to determine the value of reefs to the local economy.

Recreational fishers, divers and snorkelers who use Broward County's reefs said they would be willing to pay \$126 million per year to maintain reefs in their existing condition. Visitors to natural reefs would pay \$83.6 million per year to maintain them, and people who use artificial reefs are willing to pay \$55.9 million per year to maintain the existing artificial reefs and \$15.7 million per year to add new ones to the Broward County system. A majority of the County's resident reef users would support "no take" zones on 25 percent of the natural reef system.

For more information about the study, contact Pamela Fletcher at the Broward County Biological Resources Division, pfletcher@broward.org

Reefs at Risk

In 1998 The World Resources Institute (WRI) released Reefs at Risk, a map-based indicator of threats to the world's coral reefs. This global analysis of human pressure on coral reef ecosystems has raised awareness of the threat to these precious ecosystems.

In collaboration with many partner institutions, WRI has now completed a more detailed analysis of threat to coral reefs in Southeast Asia. This new analysis is many times more detailed than the global analysis, and integrates available information on coral reef status, protection and management, and economic valuation of coral reefs. The report provides a detailed, country-by-country analysis of coral reefs across Southeast Asia and provides recommendations for management and protection. The report, maps, and data products are designed for use by planners and resource managers, government officials, and others interested in coral reef conservation. The English-language version of the report was released in Southeast Asia in early March 2002, while a Bahasa Indonesian version is planned for May. The full report, maps, and downloadable data set will be available from www.wri.org/wri/reefsatrisk.

An analysis of threats to coral reefs in the Caribbean, Reefs at Risk in the Caribbean is underway, with release planned for 2003.

Dive In To Earth Day

April 15-22th 2002

For the past two years, The Coral Reef Alliance (CORAL) has teamed up with environmental organizations, scientists, aquariums, students and divers to coordinate *Dive In To Earth Day*, an international event encouraging people to join in with marine-related activities during the week around Earth Day (April 22).

Dive In events are fun while raising awareness and taking action to protect oceans, coral reefs, beaches, lakes, rivers and bays around the world. In

the past *Dive In* has organized underwater and beach clean-ups, mooring buoy installations, fish and coral surveys, children's art contests, aquarium exhibits, and more.

Last year, an estimated 32,500 people participated in events in 46 countries. Together, they managed to remove 15,455 kg (34,000 pounds) of trash from beaches and shorelines around the world.

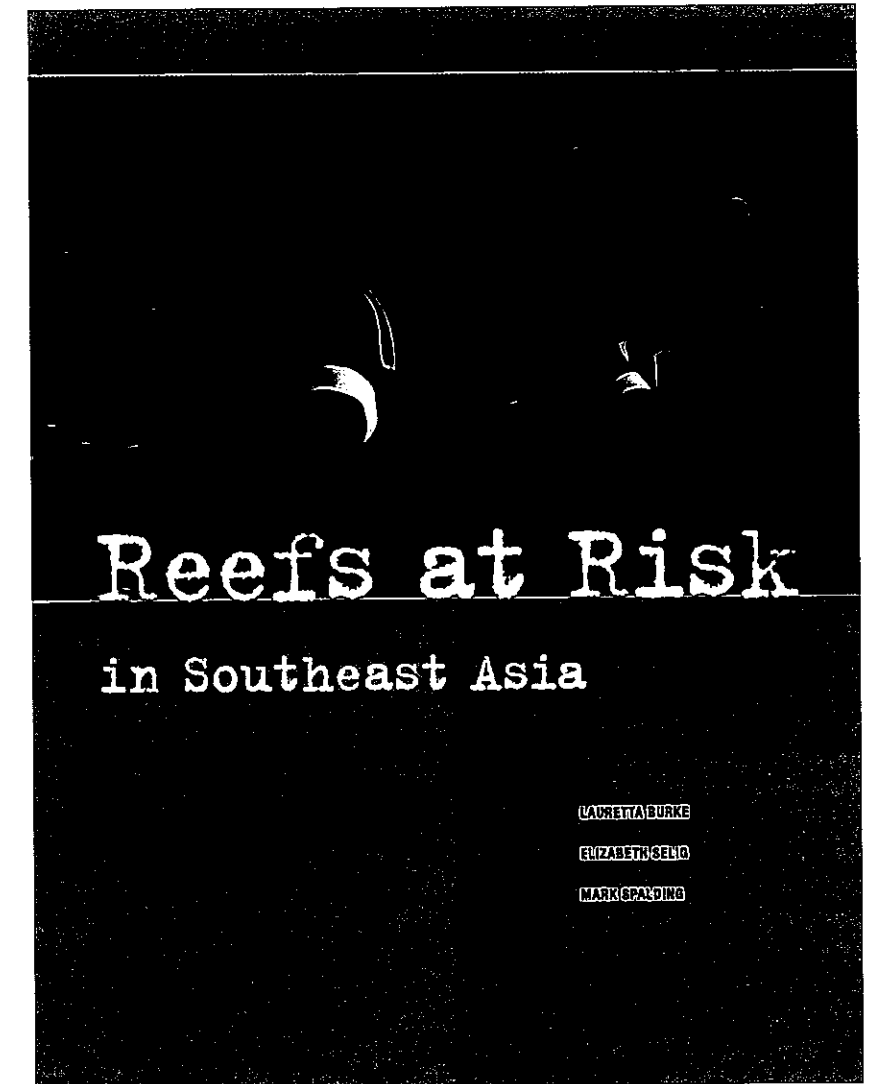
To find out how you can become involved in *Dive In* this year or in

subsequent years, please visit the website at:

<http://www.divein.coralreefalliance.org/>

or contact Sherry Flumerfelt at divein@coral.org.

More News on page 27



The Reefs at Risk project is a component of the International Coral Reef Action Network (ICRAN). For more information contact Laretta Burke, Senior Associate, Information Program, World Resources Institute 10 G Street, NE Washington, DC 20002, USA Tel +1 (202) 729 -7774 Fax: 729 -7775 www.wri.org

Certified Sustainable

Cyanide fishing and other damaging aspects of the marine aquarium industry often grab the headlines, but much of the trade has a beneficial impact on reefs by providing incentives for sustainable management. Marine ornamentals are in fact one of the highest value-added products from coral reefs. Reef fish harvested for food from one island country were valued at US\$6,000 per metric ton. Aquarium fish from the same country realized a return of more than US\$496,000 per metric ton¹.

The public, government officials and policymakers often never hear this side of the story. Similarly, it's been hard for consumers to know whether their purchases are helping or harming reefs. That is now changing. On Nov. 27, 2001, the international Marine Aquarium Council (MAC) Certification system was officially launched.

Working with stakeholders around the world, the system allows aquarists to buy marine ornamentals that have passed "from reef to retail" through sustainable operations

Supporting Reef Conservation

Collecting and exporting marine aquarium organisms creates jobs and income along the rural coasts of developing countries where there are few economic alternatives². Half a billion people—eight percent of the total world population—live within 100 km of a coral reef³. The most widespread human impact on coral reefs undoubtedly comes from land-based sources of pollution, such as sediment and nutrients^{4,5}. For many collectors in rural villages, the alternatives to the aquarium industry would be worse for the reefs.

The most important suppliers of marine ornamentals are Indonesia and the Philippines, with Brazil, Maldives,

The Role of Certification for the Marine Aquarium Trade

Fiji, Vietnam, Sri Lanka and Hawaii also supplying significant quantities⁶. The bulk of the specimens, probably well over 98 percent, are taken from the wild⁷. About 7,000 aquarium collectors, many whom support families, operate in the Philippines. In Sri Lanka UNESCO estimates as many as 50,000 people are directly involved in the export of reef animals⁸.

Only a few collectors favour destructive fishing methods. The socioeconomic benefits mean collectors have an incentive to ensure reefs are healthy and productive. They often become active reef stewards, guarding their valuable resources and sometimes creating informal management systems or *de facto* conservation areas. For example, at a collecting site in Bagac, Bataan, in the Philippines, collectors declare a no-collecting season during the months of November

and December or December to January, depending on when they notice fish are fragile or most species are spawning. Collectors from this site also do not allow collectors from their neighboring provinces to gather fish in this area. These local efforts are important. Collection areas are often



far from the reach of law enforcement. Many government agencies admit that they will never have the staff or funds to adequately manage or police most coral reefs.

But coastal communities in developing countries are not the only ones to benefit from an environmentally sound aquarium industry. In developed countries, public and private aquariums contribute to the love of nature in general and coral reefs

in particular. A 1999 survey conducted by the National Aquarium in Baltimore by the American Zoo and Aquarium Association found that after a visit to the aquarium people's attitude and judgment on conservation issues improved.

Aquaria can also help research. Rigorous, regular observation of reef animals and systems are exactly what so many aquarists do best. Consequently, many have made significant contributions to reef science. They have advanced our understanding of fish behavior, reproduction, feeding and growth; the propagation and growth of corals, soft corals and other invertebrates; and the balance of nutrients, light and water motion needed to maintain a reef ecosystem.

"from reef to retail" through sustainable operations

The Scheme

Many measures are required in order to get MAC certification, such as a collection area management plan to conserve the ecosystem and a ban on destructive fishing practices such as cyanide. Proper dive training for people using scuba or hookah gear and regular servicing of equipment are other requirements. Collectors—many of whom have only a grade-school education—learn about decompression sickness, which some believe is caused by "sea ghosts." During a feasibility study in the Philippines, 250 collectors in 18 collection areas were recently trained to the MAC Standards through a partnership with International Marinelife Alliance. Certification also requires transparency and traceability, e.g., documented collection numbers, species, locations and collecting effort. This will help sellers and buyers negotiate a fair price based on full information. The Certification process will collect and analyze information on the state of marine aquarium resources, the ecosystem and the kinds and level of human use and impacts, using this information to continually improve the certification system. In 2000, MAC teamed up with the UN Environmental Program - World Conservation Monitoring Centre to create the Global Marine Aquarium Database (GMAD). This database has grown steadily and now includes data from more than 15 coral reef countries that export marine ornamentals and all the major importing countries. MAC is also working with Reef Check and the Global Coral Reef Monitoring Network to develop international scientific methods for monitoring marine ornamental collection areas.

Will consumers and retailers support the scheme? Using popular demand to modify industry behavior is already working in forestry and seafood industries. The prospect for success in the marine aquarium industry is promising. Most retailers contacted during a recent survey of 200 U.S. pet stores involved in the marine aquarium trade felt that MAC Certification would improve the health

and longevity of reef creatures available to their customers.

Paul Holthus is the executive director of the Marine Aquarium Council. For more on MAC Certification, visit www.aquariumcouncil.org.

References

- ¹FAO (1999) Ornamental aquatic life: What's FAO go to do with it? News highlights: 2 Sept (1999) UN Food and Agricultural Organization (FAO).
- ²Holthus P. 1999. Sustainable development of oceans and coasts: the role of the private sector. UN Natural Resources Forum 23 (2):169-176.
- ³Bryant D, Burke L, McManus J, Spalding M (1998) Reefs at risk: A Map-Based Indicator of Potential Threats to the World's Coral Reefs. World Resources Institute.
- ⁴Johannes R (1975) Pollution and degradation of coral reef communities. In: Tropical Marine Pollution. Wood E, Johannes R (eds), Elsevier, Oxford pp. 13-51.
- ⁵Richmond R (1994) Coral Reef Resources: Pollution's Impacts, Forum for Applied Research and Public Policy 9(1) (Spring 1994): 55-56
- ⁶Wood EM (2001) Collection of Coral Reef fish for Aquaria: Global Trade, Conservation Issues and Management Strategies. Marine Conservation Society, UK. 80pp.
- ⁷Moe MA (1999) Marine ornamental aquaculture. First International Conference of Marine Ornamentals. Hawaii. In Woods, 2001.
- ⁸Kennington R (1985) Coral reef ecosystems: A sustainable resource. Nature and Resources UNESCO, Paris, 21(2): 18-27.

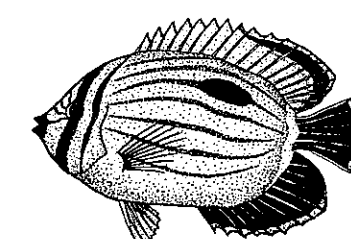
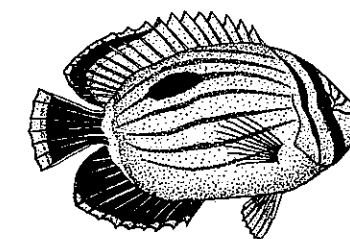
The Marine Aquarium Council

- MAC is an international, not-for-profit organization which was established in 1998 to bring the aquarium industry, hobbyists, conservation organizations, government agencies and public aquariums together to address the sustainable use of coral reef ecosystems by the marine aquarium industry.

- Its mission is to conserve coral reefs and other marine systems by using the marketplace to reward good conservation practices in the marine aquarium trade.

- MAC creates industry standards, accredits third parties to certify those in the marine ornamental trade who adhere to these standards and educates industry operators, hobbyists and the general public about coral reef issues.

MAC participates in the International Coral Reef Initiative Co-ordination and Planning Committee meetings.



Drawings by Sue Daly

Glover's Reef – Conservation and Research on a Remote Caribbean Atoll

The Belize Barrier Reef is the largest barrier reef in the northern hemisphere. Three offshore atolls, hundreds of sand cays and patch reefs, mangrove forests, coastal lagoons, and estuaries combine to make up this habitat which supports one of the world's largest populations of West Indian manatee (*Trichechus manatus*), as well as 500 species of fish, 134 bird species, and three species of nesting sea turtles. Despite its conservation and scientific importance, the reef has come under increasing human pressure, including over-fishing, coral bleaching, diseases, fleshy algal dominance, and increases in tourism damage.

Lying 45 kilometres off the mainland of Belize, Glovers Reef Atoll is the most southerly of the Belizean atolls. The elongate 13,200 hectare atoll has some of the best developed reef growth and the greatest variety of reef types in the Caribbean. The atoll boasts six sandy cays linked by an emergent reef crest. The reef is broken in three places by channels, where water flows in and out of the lagoon. The lagoon itself contains approximately 700 patch reefs of variable size and these patches are excellent sites for experiments requiring whole reef replication. The central lagoon of Glovers Reef Atoll averages 6-18 meters in depth and is deeper than the lagoons of the two other offshore Belizean atolls. Just a short distance from the atoll's rim off the eastern side the sea floor drops to a precipitous 1000 meters, making the atoll a crossroads between the open marine environment and the protected shallow waters of the lagoon.

numbers of grouper aggregating at this site are probably more than ten times lower than they were before the area was fished

Glovers Reef Atoll was declared a Marine Reserve by the Government of Belize in 1993 and was designated as part of the Belize Barrier Reef World Heritage site in 1996. In a broad sense, the Glovers Reef Marine Reserve was established to maintain ecological processes, and preserve genetic diversity and sustainable yields through informed management of species and their habitats. The reserve maintains natural areas for education and research, and provides social and economic benefits through ecologically sensitive tourism and recreation. The reserve has three management zones: a small

wilderness zone, a larger conservation zone which is a no-take reserve allowing non-extractive uses but banning fishing, and the general use zones where fishing is allowed.

The Glovers Reef Marine Research Station (see box on page 17) has supported a wide variety of research and conservation activities since it was established in 1993. Studies have shown that populations of commercially important species are more abundant and larger inside the reserve compared with populations outside the reserve^{1,2,3}. Lower numbers of predatory fishes in the

Continued on page 18

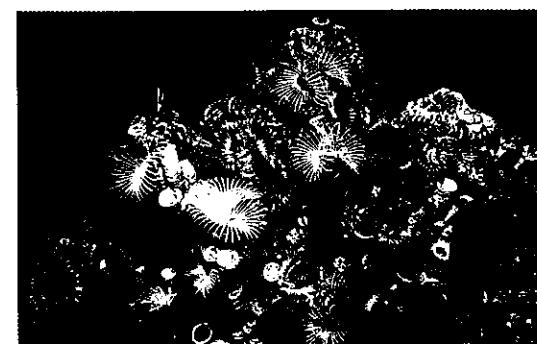


Rare Reefs

The polychaete worm *Serpula vermicularis*, is a seemingly unremarkable creature found throughout the British Isles. It grows attached to the shells of bivalve molluscs such as clams scallops and oysters. But in just three known sites (one in Ireland and two in Scotland), the worms form huge aggregations. They can secrete a calcium tube up to 50 cm long and 6 mm wide, and these can actually form reefs when neighbouring tubes entwine. The open, complex lattice structure can reach 2 m high and be 1 m across, with the worms' fan-like white, orange and red crowns creating a spectacular display on the sea bed.

S. vermicularis reefs were first recorded in Ardbear Lough, Ireland^{1,2} and have also been recorded in nearby Killary Harbour³. But they are few and far between, and already appear to have declined. Reefs have been reported from Linne Mhuirich, a sheltered lagoon within Loch Sween, Scotland², but none were found living during a recent survey⁴. The last stronghold for these reefs is Loch Creran, Scotland where reef cover is high in some areas.

Within Loch Creran reefs appears to form only between a depth of 1 and 16 m. It's probable that the floor of the loch is particularly suitable here, and predation pressures are not too high. Loch Creran is a mostly muddy environment so the hard substrate the reefs provide enhances local biodiversity. You can easily see crabs, tunicates, echinoderms and fish around these structures, and ongoing studies predict that hundreds of species are associated with these



The striking branchial crown of *S. vermicularis* is the only visible part of the polychaete from the reef. When threatened it can completely withdraw into its tube (C. Moore).

reefs⁵. Unfortunately, moorings and fishing gears have caused localised damage in the past, and given the very limited distribution of these reefs there is reason for concern about their conservation. However, since last year the reefs have received some protection as Loch Creran has been given *Special Area of Conservation* status.

References

- ¹Ten Hove HA, Van der Hurk P (1993) A review of recent and fossil serpulid reefs actiopaleontology and the 'Upper Malm' serpulid limestones in NW Germany. *Geologie en Mijnbouw* 72: 23-67
- ²Bosence DA (1979) The factors leading to the aggregation and reef formation in *Serpula vermicularis* L. In Larwood G, Rosen BR (eds) *Biology and Systematics of Colonila organisms*, Academic Press, London and New York, 299-318
- ³Minchin D (1987) *Serpula vermicularis* L. (Polychaeta: serpulidae) reef communities from the west coast of Ireland. *Irish Naturalist Journal* 22: 314-316
- ⁴Moore G, Saunders G, Harries, D (1998) The status and ecology of reefs of *Serpula*

vermicularis L. (polychaeta: Serpulidae) in Scotland. *Aquatic Conservation: Marine and Freshwater Ecosystems* 8: 645-656

⁵Chapman N (2001) Rare Scottish Reefs Threatened. *Marine Pollution Bulletin* 42(8): 674

Nicola Chapman is at the Department of Biological Sciences, Heriot-Watt University, Riccarton, Edinburgh, Scotland. She hopes her research will raise awareness and help management plans for sites containing these unique reefs. Email <N.D.Chapman@hw.ac.uk>

Portable Papers

You probably already know that articles accepted for publication in *Coral Reefs* are published with Springer's *Online First* in electronic form weeks before distribution of the print journal, even before the issue and page numbers have been assigned (see <http://link.springer.de/link/service/journals/00338/contents/tfirst.htm>)

Springer also offers articles as PDF (portable document format) files. If you are a full member of **ISRS** (excludes the student subscription) you can have access to these online PDF articles. See the website <http://link.springer.de/link/service/journals/00338/tocs.htm>.

International Coral Trade Workshop:

Corals are harvested worldwide, but most corals are collected in Indonesia and Fiji, with smaller volumes from Vietnam, Solomon Islands, Tonga and Vanuatu. In the 1980s, over 90% of the corals for international markets were harvested live, then bleached and cleaned to remove tissue, and exported as curios. Although the trade in coral skeletons has remained fairly constant, the volume of live corals for the aquarium trade has grown at a rate of 12-30% per year in the 1990s and it now exceeds the curio trade. CITES* trade data indicates that 60-80% of the live coral, over 50% of the coral skeletons and 95% of the live rock is imported by the U.S., and this trade is growing by 10-30% per year.

Now the USA, the world's largest importer of corals, is concerned that the demand for these organisms may be a major force driving overexploitation and destructive collection practices. To begin addressing these environmental concerns, the U.S. sponsored the International Coral Trade Workshop in Jakarta, Indonesia in April 2001 to develop recommendations for the sustainable harvest of stony corals. The meeting developed recommendations on best practices for a stony coral fishery, and these are briefly summarized here.

Sustainable management of a stony coral fishery

To ensure that corals are harvested without damaging coral ecosystems and species, coral fishery management is needed at all levels from the coral fisher, through to the middleman and the exporter. A holistic ecosystem management approach should consider:

- 1) **Target Species**, their role in the ecosystem and whether collection in areas severely impacted by other factors is sustainable.
- 2) **Other Species** and their interactions with target species and the ecosystem.
- 3) Other natural or anthropogenic **Causes of Reef Damage**.

Zoning can minimize conflicts between resource uses and help conserve biodiversity. Zoning can define coral collection areas and areas where collection is permanently prohibited. Managers should limit the number of coral collectors and the amount of coral that can be collected in each area. If a quota is used this must be set for a geographically defined collection area for each target species.

Management must follow a precautionary approach because we don't yet fully understand all coral species and how they interact within their ecosystems. Management must also be flexible and must involve all stakeholders, while distributing benefits equitably within communities.

Article by Andy Bruckner, email: andy.bruckner@noaa.gov.

* CITES is the Convention on international trade in endangered species.

Sustainable Management Guidelines

Best collection practices for stony corals

Best collection practices involve:

- 1) **Collection techniques that minimize collateral damage to non-target organisms and the surrounding reef environment.** The meeting proposed a maximum size limit for corals, depending on their growth form.
- 2) **Choosing optimal locations for collecting.** Collection is best where dense coral growth or competition threatens the existence of the target coral.
- 3) **Setting preferred target species.** Collectors should preferentially target locally abundant species, fast growing corals, or corals which replenish their populations quickly. The number of corals collected from any one area should not threaten the local population's ability to regenerate.
- 4) **Proper handling techniques.** Specific collection and handling techniques are necessary for different target species in order to minimize stress and to maximize their health and survival. This includes limiting the distance between the collection site and the holding facility; minimizing exposure to direct sunlight, and ensuring sufficient water changes to maintain ambient temperature and salinity and prevent the build-up of toxic metabolites.

Although the meeting didn't recommend banning collection of any particular coral species it did note that a number of species have high mortality rates after collection and/or transport and don't survive well in home aquaria. Others may be particularly vulnerable to overexploitation based on their abundance or biology. The meeting called for more research into these species and considered that collecting may need to be limited or even banned in the future.

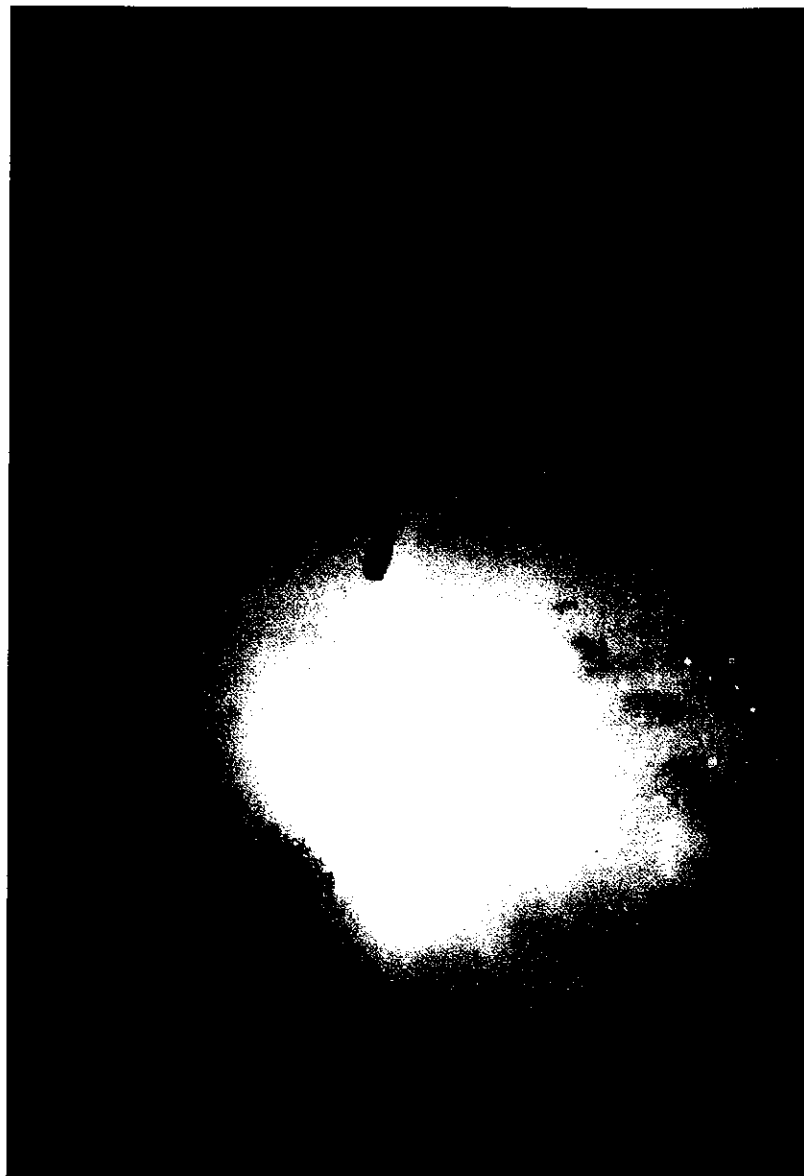
Monitoring needs of a stony coral fishery

Effective monitoring requires a tiered approach including:

- 1) **A baseline assessment** of abundance and size frequency of target stocks, the aerial coverage of the habitats, and how much of the total habitat will be used for collection.
- 2) **Periodic monitoring** to detect changes associated with collection or other impacts.
- 3) **Analysis** of fisheries data and trade statistics to check that the industry is complying with management measures.

Few stock assessment models are available for stony corals, and additional research on the biology of target species, and the development of an appropriate fishery model is necessary to set sustainable harvest quotas. Ultimately, a monitoring approach should help determine the total allowable catch that a particular management area can sustain without detriment, and allows quotas to be refined in response to natural or anthropogenic changes.

Continued from page 14



general use zone has led to higher grazing by the sea urchin *Echinometra viridis*^{4,3}. The Nassau grouper (*Epinephelus striatus*) aggregates each year on the northern tip of the atoll and this area has been made a temporary closure area at the discretion of the Belize Fisheries Department. Recent research suggests that the numbers of grouper aggregating at this site are probably more than ten times lower than they were before the area was fished⁵. Continued protection of the reserve and grouper aggregation sites is

important to ensure long-term conservation is a success.

A wide range of conservation science is developing at Glover's reef. In the lagoon, studies of the spiny lobster *Panulirus argus* found movements between patch reefs depend on the surrounding habitat. Seagrass provides a much better corridor between patches than rubble and sand⁶. 'Wildlife corridors' can have a strong influence on population sizes

the sea floor drops
to a precipitous
1000 meters

and these findings have important implications for managing lobsters and other species that use patchily distributed habitats. Other studies found increasing fleshy algae on the patch reefs^{7,8} and show that where erect fleshy algae dominates, a number of coral reef fishes are suppressed⁴

In the early 1970s hard coral dominated the patch reefs, and three ecological zones or serres existed, delineated by the dominant coral species, *Porites*, *Acropora* and *Montastrea*⁹. But coral cover has been lost, and these zones have largely disappeared. The fact that coral cover decreased in all the zones suggests that it was not simply the loss of *Acropora* from white-band disease¹⁰ that caused this change to algal dominance. Rather, reduced herbivory is the most likely factor as *Porites* and *Montastrea* zones show equal losses in hard coral and increases in erect algae^{7,11}. Disturbance and recovery patterns from hurricanes were originally suggested to be the cause of the ecological zonation, and hurricanes do hit the Belizean coast about every 10 years. But when Hurricane Mitch passed near the atoll in 1998 the storm caused severe damage to the windward edge of the atoll but very little damage to the patch reefs or leeward side of the atoll^{12,3}. Unless hurricanes pass directly over the reef, the effect on patch reefs is likely to be minor. These topics deserve further investigation, and studies of reef recovery from fishing, hurricanes and diseases will be a priority for future investigations at the research station.

Not all the research at Glover's Reef Atoll investigates the sea. Anthropologists working on the island have discovered Mayan activity on Middle Cay from 900 BP as well as evidence Spanish and British settlers living on the island in the 1700s¹³. Birds and plants have also been investigated. As well as doing research, the Station's staff work with the other atoll

Glovers Reef Marine Research Station

The Wildlife Conservation Society (WCS) established the Glover's Reef Marine Research Station on Middle Cay in 1993 in recognition of the atoll's strategic importance to long-term marine conservation in the Caribbean Sea. The Station works to promote the long-term conservation and management of the Belize Barrier Reef through *in-situ* research, cooperative management, training and education. The Glover's Reef Marine Research Station at Middle Cay is both a scientific field research station and a marine park headquarters for the Government of Belize, providing an operations base for both rangers and scientists.

WCS is eager to bring interested researchers to Glover's Reef Marine Research Station to help support the long-term stewardship of this international marine treasure. The society invites researchers and occasionally provides limited support for applied, conservation-relevant investigations of coral reef systems, reef fish and invertebrates, and other aspects of marine conservation. The Station can house eight researchers and is staffed by a full-time manager, cook, dive master, and experienced coxswains. There are several small skiffs and dinghies available, as well as a larger 28-foot vessel for studies further at sea. The laboratory building has workspace, running fresh water, refrigeration, and some scientific equipment. A weather station next door provides continuous meteorological data. Room, board and boat fees are reasonable (see www.wcs.org/glover for current rates). If you are interested in doing research at Glover's Reef you can apply to the WCS Glover's Reef Marine Research Station Manager, P.O. Box 272, Dangriga, Belize or by email to glover@btl.net.

stakeholder groups, including fishers and tourism operators, to develop and support management programs designed to meet the needs of the many different of people using the atoll. The Wildlife Conservation Society has also established a small internship program with the University College of Belize to help train local staff to protect and manage the reef system.

References

- Carter J, Sedberry GR (1997) The design, function and use of marine fishery reserves as tools for the management and conservation of the Belize barrier reef. Proc. 8th Int. Coral Reef Symp. 2: 1911-1916
- Sedberry GR, Carter J, Barrick PA (1999) A comparison of fish communities between protected and non-protected areas of the Belize Barrier Reef ecosystem: implications for conservation

and management. Carib. Fish. Inst. 45: 95-127

³McClanahan TR, McField M, Huitric M, Bergman K, Sala E, Nystrom M, Nordemar I, Elfving T, Muthiga NA (2001) Responses of algae, corals and fish to the reduction of macro algae in fished and unfished patch reefs of Glover's Reef Atoll, Belize. Coral Reefs 19: 367-379

⁴McClanahan TR, Bergman K, Huitric M, McField M, Elfving T, Nystrom M, Nordemar I (2000) Response of fishes to algal reductions at Glover's Reef, Belize. Mar. Ecol. Prog. Ser. 206: 283-296

⁵Sala E unpublished data

⁶Acosta CA (1999) Benthic dispersal of Caribbean spiny lobsters among insular habitats: implication for the conservation of exploited marine species. Cons. Biol. 13: 603-612

⁷McClanahan TR, Muthiga NA (1998) An ecological shift in a remote coral atoll of Belize over 25 years. Env. Cons. 25: 122-130

⁸McClanahan TR, Aronson RB, Precht WF, Muthiga NA (1999) Fleshy algae

dominate remote coral reefs of Belize. Coral Reefs 18: 61-62

⁹Wallace RJ, Shafermann SD (1977) Patch reef ecology and sedimentology of Glover's Reef Atoll, Belize. In Frost SH, Weiss MP, Saunders JB (eds) Reefs and related carbonates: ecology and sedimentology. American Association of Petroleum Geologists, Tulsa, 37-53

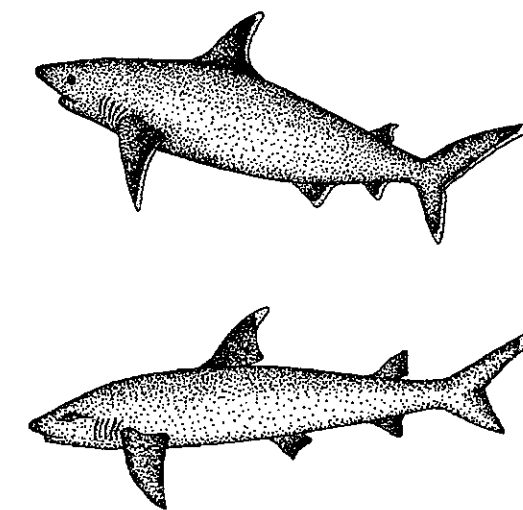
¹⁰Aronson RB, Precht WF, Macintyre IG (1998) Extrinsic control of species replacement on a Holocene reef in Belize: the role of coral disease. Coral Reefs 17: 223-230

¹¹McClanahan TR (1999) Predation and the control of the sea urchin *Echinometra viridis* and fleshy algae in the patch reefs of Glover's Reef, Belize. Ecosystems 2: 511-523

¹²Mumby PJ (1999) Bleaching and hurricane disturbances to populations of coral recruits in Belize. Mar. Ecol. Prog. Ser. 190: 27-35

¹³Perkins JS (1983) The Belize Barrier Reef Ecosystem: an assessment of its resources, conservation status, and management. NYZS, New York.

Liz Lauck is Assistant Director of Marine Programs for The Wildlife Conservation Society. You can email her at lilauck@wcs.org. Tim McClanahan is a conservation zoologist with the society and can be reached at rcrp@africaonline.co.ke.



Drawings by Sue Daly

ReefBase Revised

Many Reef Encounter readers are familiar with ReefBase, the database that structures and consolidates coral reef related information useful for research and management. In 2001 ReefBase underwent a major revision, and you can see the results at: www.reefbase.org.

Since it started out in 1993, ReefBase has had regular updates on CD-ROM, with the 4th version (ReefBase 2000) released during the 9th International Coral Reef Symposium. But as the amount of information and its complexity has increased, the ReefBase team has had to carefully review the database's objectives and target audience. The emphasis has now switched from data storage to information access, and the world wide web has superseded CD-ROMs as main way ReefBase is distributed.

ReefBase is now a global information system on coral reefs rather than simply a database, with more emphasis on reaching reef managers and policy makers who need rapid access to summary information on coral reefs, their status, threats and measures available to manage and protect them.

Status reports online

ReefBase has made available online the entire text of the last two Global Coral Reef Monitoring Network Status Reports. The team has also sought out and published on the website national status reports for more than 50 countries. In addition excerpts from these reports are now in the text database, and this allows users to search for summary information using a combination of country and topic selections. For instance, using just two pull down menu choices, a user can get an instant report on legislation relevant to coral reefs of Malaysia. Other topics use the same headings as GCRMN

reports and are grouped in to the following categories:

Resources: General descriptions of coral reefs, reef fish communities, marine biodiversity and reef fisheries/industries.

Status: Information on status and trends in coral reefs, reef fish communities and reef fisheries.

Threats: What are the various natural and anthropogenic threats impacting coral reefs?

Management: What is being done to manage these resources in terms of monitoring programmes, protected areas and legislation? This category also addresses research and management capability including gaps in capacity.

References: Lists of links to additional information such as publications and contact information of key experts.

Maps and GIS

By drawing on the most recent coral reef maps developed by UNEP-WCMC**, ReefBase now provides access to a large variety of interactive maps that can be tailored to your desired scale and interests. The maps can show protected areas, coral bleaching records, disease records, monitoring sites, Reefs at Risk threat areas, and summary socio-economic data.

Reefs at Risk

In 1998 the World Resources Institute's Reefs at Risk report highlighted the vulnerability of coral reefs to a variety of human-caused impacts. ICLARM, the main partner in ReefBase* worked closely with the World Resources Institute and UNEP-WCMC** in the production of both the global report and the recently released regional report for Southeast Asia (see **News**, p9). The results and underlying information from these reports will be put into ReefBase as it becomes available. Currently, ReefBase has reproduced the global threat layers on

its online GIS so that you can display these together with other relevant information such as location of protected areas, monitoring sites, or the location of coral disease reports and bleaching.

Literature

ReefBase has more than 12,000 references relating to coral reefs available online and searchable by author, keyword and country. Over 270 of these have links to the full text in either html or pdf format. Since a great deal of the coral reef management and conservation literature is informally published as reports (the so-called grey literature), we are actively seeking out references from agencies in order to ensure that the valuable information and lessons contained in these reports are available to people in other agencies, countries and regions.

Coral bleaching

ReefBase is collaborating with the USA's National Oceanographic and Atmospheric Administration (NOAA) and UNEP-WCMC** in providing up to date information on coral bleaching around the world. We have an online bleaching report form (developed with NOAA) which feeds directly into a bleaching database, containing a comprehensive list of bleaching records from various sources throughout the world. The database can plot bleaching records on our online GIS, and can be queried by searching under *Threats: Bleaching area for each country*.

Images

Many people are attracted to coral reefs by stunning images of reef scenes and colorful marine life, but images can also be an important way of showing how people interact with reefs, and the threats and stress to reefs these interactions can cause. ReefBase has more than 2000 images which illustrate different reef uses and misuses, as well as a wide variety of reef habitats and organisms. These

can be searched by keyword and stress category. Coral reef users around the world have made the image bank possible by generously donating their images for free downloading.

Feedback needed

The ReefBase team is very keen to use feedback from you to help increase the range and relevance of the information we offer. There are several different ways in which you can help us with this. Firstly, please submit material for inclusion in ReefBase. Please send us unpublished reports, new records of coral bleaching, images, GIS coverages and summary data relating to reef status and threats. Secondly, we encourage you to comment on the website and the information that we have at present. There are inevitably going to be errors of omission and commission, and we would like to hear about them. Feedback is welcomed via a number of forms at various places in the site (for example there is an innovative feature where you can capture a GIS view and provide comments on features in that map view). Finally, we welcome ideas on new facilities and information categories that would enhance ReefBase. We encourage you to email us suggestions, or even better, to think of ways in which ReefBase can work in collaboration with your agency to maximize the dissemination of information on coral reef issues to as wide an audience as possible.

CD's revisited

While putting ReefBase onto the web has enabled the team to provide a greater range of information which can be updated on a continuous basis, feedback from many people reminds us that many countries do not have adequate internet connections to use the site to its full potential. Later this year we will be developing a range of

CD ROM products that will provide subsets of the ReefBase information on CD. These will, in effect, allow users to recreate parts of the ReefBase web site on their hard drive and access the information using a normal web browser. Since ReefBase is now much bigger than the capacity of a CD ROM, we will make subsets of data available according to specific themes (e.g.

more than 2000 images for free downloading

Country CD's with records of all tables relating to a particular country; and theme CD's with all status reports, images or references).

We hope you find the new ReefBase site useful and informative, and look forward to your comments and ideas.

Jamie Oliver (email j.oliver@cgiar.org) and Marco Noordeloos work in the ReefBase team at ICLARM – The World Fish Center



Map of coral bleaching records in the Philippines created using ReefBase's online Geographic Information System

*ReefBase is an initiative of ICLARM - The World Fish Center (ICLARM stands for The International Centre for Living Aquatic Resources Management) and an important project of the International Coral Reef Action Network (ICRAN). ReefBase is also the central information repository of the Global Coral Reef Monitoring Network (GCRMN).

**UNEP-WCMC is the United Nations Environment Programme – World Conservation Monitoring Centre, based in Cambridge, UK.

Tortugas Surveyed

Synoptic habitat and reef fish surveys support establishment of marine reserves in the Dry Tortugas, Florida, USA.

Because of its position up-current on the southwestern Florida shelf of the USA in the Florida Current, the Tortugas region is widely considered a principal spawning ground and an essential source of invertebrate and fish larvae for the Florida Keys and southeastern Florida¹. However, visitor numbers, fleet sizes, and their effective fishing power are all increasing, and pose clear threats to long-term productivity. In response to concerns about declining regional trends in coral reef habitats and multispecies reef fish stocks, 151 nm² (518 km²) of 'no-take' ecological reserves and natural research areas were designated in Florida's Dry Tortugas (Figure 1) (Reef Encounter 30 p. 20-22) by the Florida Keys National Marine Sanctuary, U.S. National Park Service, State of Florida, and the Gulf of Mexico Fishery Management Council.

A team of more than 30 research scientists (see *Who's involved?*) recently conducted a series of surveys in the region to learn more about the Tortugas' coral reef fishery and habitat resources. SCUBA divers carried out visual censuses of 450 sites during

2,158 dives (see Figure 1 for an idea of the locations). We investigated reef fish species composition, abundance, and size structure, and also assessed key habitat variables such as relief and substratum cover. Surveys of benthic

a principal spawning ground providing an essential source of invertebrate and fish larvae to the Florida Keys and southeastern Florida

(bottom dwelling) algae, sponges, cnidarians, and urchins complemented the reef fish community assessments^{2,3}. We used the latest technologies, including digital laser video cameras, remotely operated submersible vehicles, and split-beam hydro acoustics.

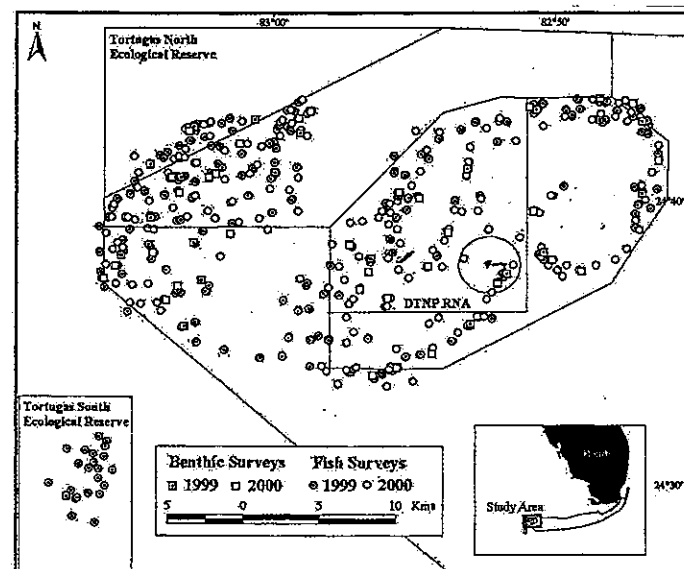
Preliminary results show rich biological diversity in the region. Divers encountered approximately 230 species of fish, 41 hard corals, 26 gorgonians, and 42 sponges, and several locations with relatively high

coral cover (>30%). In fact, luxuriant coral covered a much greater area than previously believed. In particular, we found two extensive deep reef areas on the western Tortugas Bank and another west of Loggerhead Key in Dry Tortugas National Park (DTNP). Extensive deep reef habitats covered approximately 15 km² along the western Tortugas Bank, an area 20 to 30 times greater than previously known⁴. Also, a lush 1.5 km² reef area named "Loggerhead Forest" was surveyed inside Dry Tortugas National Park, only part of which was previously mapped⁵. Other unmapped reefs were also found southwest of the Marquesas Keys. Interestingly, many juveniles of economically and ecologically important reef fish used gorgonian-dominated hard-bottom much more than has been documented before, suggesting that this habitat type is perhaps more important to fisheries productivity than previously thought.

Although the Dry Tortugas area is remote, our visual observations and preliminary quantitative stock assessments demonstrate overfishing and localized damage to the seabed from shrimp trawls. Fished species that grow large were generally scarce, as were large individual fish, especially groupers and snappers. We saw surprisingly few barracuda and sharks. Fishing mortality estimates for 14 of 34 species in the snapper-grouper-grunt species complex exceeded the rates that produce maximum sustainable yields by two to six times².

The Sanctuary, National Park Service, and federal and state fishery management agencies will use these research results to help assess current

Figure 1. Locations of multidisciplinary studies of benthic habitats and multispecies reef fishes during 1999-2000 in the Tortugas Region, southeastern Florida.



conditions and evaluate long-term changes in the Florida Keys Marine Sanctuary and Dry Tortugas National Park. The data provide a baseline for evaluating the recently established no-take zones and monitoring whether these achieve the goals of building sustainable fisheries while conserving marine biological diversity. We will also model linkages between fish community distribution, abundance, and size structure in relation to key habitat characteristics, and this information will in turn help design higher precision and more cost-effective sampling surveys in the future.

References

- Lee TN, Clarke ME, Williams E, Szmant AF, Berger T (1994) Evolution of the Tortugas Gyre and its influence on recruitment in the Florida Keys. *Bull Mar Sci* 54: 621-646
- Ault JS, Smith SG, Luo J, Meester GA, Bohnsack JA, Miller SL (2001) Baseline multispecies coral reef fish stock assessment for the Dry Tortugas. Final Report to Florida Keys National Marine Sanctuary and Dry Tortugas National Park. RSMAS-University of Miami, FL, 123 p
- Chiappone M, Miller SL, Swanson DW, Ault JS, Smith SG (2001) Comparatively high densities of the long-spined sea urchin in the Dry Tortugas, Florida. *Coral Reefs* 20: 137-138
- Miller SL, Chiappone M, Swanson DW, Ault JS, Smith SG, Meester GA, Luo J, Franklin EC, Bohnsack JA, Harper DE, McClellan DB (In press) An extensive deep reef terrace on the Tortugas Bank, Florida Keys National Marine Sanctuary. *Coral Reefs*
- Davis GE (1982) A century of natural change in coral distribution at the Dry Tortugas: A comparison of reef maps from 1881 and 1976. *Bull Mar Sci* 32: 608-623

Who's Involved?

The researchers are from the University of Miami's Rosenstiel School of Marine and Atmospheric Science, NOAA's National Marine Fisheries Service, the Florida Fish and Wildlife Conservation Commission, and the National Undersea Research Center at the University of North Carolina-Wilmington. Key people are:

Jerald S. Ault, Steven G. Smith, Geoffrey A. Meester, Jiangang Luo and Erik C. Franklin, Rosenstiel School of Marine and Atmospheric Science, University of Miami, Division of Marine Biology and Fisheries, 4600 Rickenbacker Causeway, Miami, FL 33149, USA. Email <ault@shark.rsmas.miami.edu>

James A. Bohnsack, Douglas E. Harper and David B. McClellan, Southeast Fisheries Science Center, National Marine Fisheries Service, NOAA, 75 Virginia Beach Drive, Miami, FL 33149, USA. Email <jim.bohnsack@noaa.gov>

Steven L. Miller, Mark Chiappone and Dione W. Swanson, Center for Marine Science and NOAA's National Undersea Research Center, University of North Carolina at Wilmington, 515 Caribbean Drive, Key Largo, FL 33037, USA. Email <millers@uncwil.edu>

Miami Meeting



Would you recognise your council members if you bumped into them at a conference bar? Here's a line up of those who attended a recent Council in Miami, Florida USA. Left to right starting with the back row: Peter Edmunds, John Ware, Terry Done, Kathleen Sealey-Sullivan. Front row: Dick Dodge, Helge Vogt, Kristian Teleki.

Shoals of Capricorn Programme Finishes

The RGS-IBG / Royal Society Shoals of Capricorn Programme has drawn to a close after three years of field study in Mauritius and Seychelles

The Shoals of Capricorn programme was a multi-disciplinary marine research, training and education initiative, run jointly with the UK's Royal Society and the Governments of Mauritius and Seychelles. The programme studied the Mascarene Plateau in the western Indian Ocean.

Since 1998, the *Shoals* Programme has hosted over 200 scientists from 21 countries at its field bases on Ste Anne Island, Seychelles and on the Mauritian island of Rodrigues. The *Shoals* science programme has greatly increased the knowledge and understanding of the marine environment in this region.

The Programme's comprehensive training and education work complimented this research. In just three years, more than 300 local people were trained in marine research skills, SCUBA diving, marine safety and first aid, and an exciting range of education projects have involved over 400 children and teenagers.

The findings of the *Shoals* Programme, alongside wider research from the western Indian Ocean region, are to be the focus of an International Discussion Meeting, planned for 2004. Following the *Shoals* research, we are now in a better position to ask further scientific questions about the region, and focus future research efforts more effectively. Such further research is encouraged by the field centers established by the *Shoals* Programme – the new Seychelles Centre for Marine Research and Technology (SCMRT@seychelles.net) (see **News**) and *Shoals* Rodrigues (shoals.rod@intnet.mu), a new non-

governmental organisation in Mauritius. These centers are staffed and assisted by local people, many of whom were trained through the *Shoals* Programme. Both field centers welcome researchers and will continue to promote marine research and education activities in the western Indian Ocean.

A comprehensive overview of all *Shoals* activities is presented in a Field Report detailing the 50 individual science projects and the wide-ranging training and education projects in Mauritius and Seychelles. Copies can be obtained through the website www.rgs.org/shoals.

Highlights of the *Shoals* research include:

- Planktonic data collected by the Plymouth Marine Laboratory, showed that the Mascarene Plateau causes large scale ocean mixing, and that the waters of the Mascarene Basin, to the west of the Plateau, are some of the richest in the world.
- The first film footage of remote coral reefs on the Saya de Malha banks, only previously observed by satellite imagery, was taken by *Shoals* researchers.
- A three year data-set from the reefs of Seychelles, which suffered from the dramatic coral bleaching associated with the warm water episode of 1997/98, has shown signs of new coral recruitment and growth.
- The first International workshop on the biodiversity of the Rodrigues Lagoon raised the total species list for the lagoon of Rodrigues from 45 to over 1,000 species, more than 100 of which are thought to be new to science.

The *Shoals* team extends their thanks to the many international researchers who have contributed to the efforts of the programme, and to our colleagues in Mauritius and Seychelles.

Juliet Burnett was the Director of the *Shoals* Programme. Email <J.Larcombe@RGS.org>. If you are interested in the International Discussion Meeting you should contact Tom Spencer, the meeting coordinator, at the Cambridge Coastal Research Unit, Department of Geography, University of Cambridge, Cambridge, CB4 3EN, United Kingdom

Bazaruto Archipelago

The coral gem of the Western Indian Ocean

A ridge of large and picturesque sand dunes dominates the narrow chain of islands that makes up the Bazaruto Archipelago. Extensive tidal flats and inland saline lakes support a wide variety of seabird species, including Palearctic waterbird migrants and 26 species of waders. The dunes and woodlands harbor such relict indigenous mammals as the samango monkey, lesser bushbaby, red duiker, and four-toed elephant shrew.

The real wealth of the Park, however, lies in the full range of tropical marine ecosystems found within this varied seascape. Spectacular coral reefs and rich pelagic waters hold over 2,000 species of fish, 100 hard and 27 soft coral species, four whale and five dolphin species, and 20 species of crustaceans. The extensive sea grass beds support all five of the marine turtle species plying the waters of the Western Indian Ocean as well as the largest and only viable dugong population along the eastern African coast.

Pristine for most of this century, the five islands that comprise the Bazaruto Archipelago are considered ecological gems. For more than a decade the World Wide Fund for Nature (WWF) has worked to keep them that way. The islands, located within the Mozambique Channel 500 kilometers north of the capital Maputo, received some measure of formal protection in 1971 when three were declared a national park. After years of active lobbying hopes for the permanent protection of this outstanding conservation area soared when the government gazetted an extension to the national park on November 27, 2001. This decision effectively doubled the area under protection to 1400 km² and incorporated the remaining islands and surrounding waters. The park is

now one of the largest in the Indian Ocean and represents a critical milestone in global marine conservation.

Since 1989, WWF has been working with local governments and other conservation organizations to promote programmes to help local Tsonga communities manage resources in and around the park sustainably. With its key local partner, Endangered Wildlife Trust, WWF has also worked to develop sustainable tourism, which it is hoped, will bring critical revenue to improve the livelihoods of the resident communities and offset overexploitation of the rich but vulnerable biological resources.

WWF's success in advocating the extension of the park, developing a full management plan and fostering a successful community conservation program is still only the beginning. Controlling the huge commercial fishing trawlers and long-liners that pass through the area, and mitigating the impacts of a growing human population and tourism infrastructure are only two of the many tasks remaining in the future.

In the coming years conservation success in Bazaruto will depend on continuing empowerment of the community and a government management system that promotes collaborative management, best practices by the private sector, and long-term, sustainable financing mechanisms for the park. With this combination of strategies, a lot of hard work, and the foundation of its now-appropriate protected status, the vision for Bazaruto and its rich array of marine life is now optimistic.

If you want to learn more about Bazaruto contact Kate Newman (newman@wwfus.org) and Philipp Goeltenboth (Philipp.Goeltenboth@wwfus.org) at WWF

IGOS Coral Reef

Theme

The Integrated Global Observing Strategy (IGOS) is a strategic planning process that links satellite and surface-based observing systems, research, monitoring and operational programs, data producers and users, in a way that helps determine observation gaps and identify the resources required to fill observation needs. The IGOS Partnership includes the Global Observing Systems and their international sponsoring agencies, the world's space agencies through the Committee on Earth Observation Satellites, and major international research programs (see www.igospartners.org). The partners organize their strategic planning around themes, such as oceans, the global carbon cycle, atmospheric chemistry, and the water cycle.

Recognizing the urgency of problems facing coral reef ecosystems around the world, the IGOS Partners recently approved work on a Coral Reef Sub-theme as the first step in the development of an IGOS Coastal Theme. The coastal area presents special challenges for both remote and *in situ* observations because of the land-water and air-water interfaces. Yet, new technologies including hyperspectral instruments and advanced data processing may now make it possible to collect large-scale data about reef health and to build long-term time series. There is an urgent need to explore how these technologies could improve observations of coral reefs, and to coordinate and integrate space-based and *in situ* observing programs in support of management action. The Coral Reef theme report will make strategic recommendations to encourage such action.

A theme team representing space agency and user organizations¹ is being assembled, co-led by Arthur Dahl of the United Nations Environment Program (UNEP) and Al Strong of the USA's National Oceanographic and Atmospheric

The theme team will explore the potential of observing systems to:

- quantify the global extent and distribution of coral reefs;
- quantify the loss of coral reefs and associated ecosystems over time;
- document the health of coral reef ecosystems;
- monitor changes in coral reef ecosystems over time;
- provide early warning and monitoring of major stress events;
- supply improved data on stresses and risks coral reefs face from land-based sources and human uses;
- document large-scale and long-term phenomena important to the productivity and maintenance of coral reefs;
- develop a classification and mapping method for reef habitats;
- generate observational products of immediate use to coral reef and coastal zone managers and users; and
- provide evidence of the effectiveness of marine protected areas for conserving coral reefs.

To prepare the Coral Reef theme report, the team will:

- inventory the relevant existing observational activities and research programs (remote sensing and *in situ*);
- identify the observational techniques best able to meet the objectives defined above;
- develop specifications for a set of observational products optimizing different user requirements;
- define partnership roles and responsibilities for implementation of the report;
- identify potential resources for implementation of the theme proposals;
- relate the Coral Reef Theme to other themes and programs.

Administration (NOAA). The latest work plan is available at www.unep.ch/coral/igoscr.htm

For the observing systems and space agencies, the Coral Reef Theme report will propose a specific set of observational requirements corresponding to the special needs of the coral reef and coastal research/management communities. It will review the usefulness of various sensors, image processing techniques, resolutions, and sampling frequencies for collecting relevant data or imagery in shallow coastal waters with coral reefs. It will provide the basis for coordinating existing operational and research observing programs for coral reefs and for linking them to major user programs such as the International Coral Reef Action Network (ICRAN). It will recommend remote sensing products meeting the objectives of the coral reef community, and stimulate wider use of such products for coral reef research, protection, and management.

Strategic planning will support the development of the Global Coral Reef

Monitoring Network (GCRMN), as well as data management mechanisms such as ReefBase and the United Nations Environment Programme - World Conservation Monitoring Centre (UNEP-WCMC), and provide inputs to coral reef assessment processes and coral reef management action through the International Coral Reef Action Network (ICRAN) and other activities.

*The themes team includes representatives from National Oceanic and Atmospheric Administration (NOAA), the Florida Keys National Marine Sanctuary, the International Geosphere-Biosphere Programme (IGBP), Intergovernmental Oceanographic Commission (IOC), Global Ocean Observing System (GOOS), United Nations Environment Programme - World Conservation Monitoring Centre (UNEP-WCMC), Reef Check, Australia's Commonwealth Scientific and Industrial Research Organisation (CSIRO), The National Center for Caribbean Coral Reef Research (NCORE), The University of Newcastle-upon-Tyne, ICLARM - The World Fish Center (ICLARM stands for the International Centre for Living Aquatic Resources Management), École Pratique des Hautes Etudes - CNRS, Australian Institute of Marine Science (AIMS), the Convention on Biological Diversity Secretariat, Global Coral Reef Monitoring Network (GCRMN) and the International Coral Reef Action Network (ICRAN).

Arthur Dahl is the Director of the Coral Reef Unit, United Nations Environment Programme, Geneva, Switzerland Email dahla@unep.ch

These will all benefit from the improved integration of space-based observations into their work. It is expected to take a year to complete the report for submission to the IGOS Partners in 2003. Once a theme report is accepted by the IGOS Partners, it will serve as a guide to commitments.

Coral Status 2002 – can you help?

Can you help the Global Coral Reef Monitoring Network (GCRMN) and Reef Check compile data on coral reefs? In 2002 we will produce an update of the *Status of Coral Reefs of the World* report to provide the best picture possible on reef status and trends. *Status 2002* will focus on assembling existing data and providing the compiled information to countries with reefs.

When we put together the *Status 2000* report, many countries found they had large gaps in their data so that they couldn't assess trends in data from reefs over the past few decades. The reporting gaps were frustrating as frequently people in these countries knew of past reef monitoring by researchers and project consultants from other countries,

but did not have access to the data. Our goal is to 'repatriate' these data and help countries with reefs resurvey sites to provide the historical record we need to assess reef trends.

You can help by:

- Letting us know if you have old data on reef assessment and preferably providing these in a format that countries can use.
- Giving us the best possible descriptions of your survey sites with accurate geographical coordinates.

- Informing regional and country GCRMN and Reef Check coordinators about any other previous reef assessments and monitoring that you know about.
- Assisting countries resurvey sites you have visited in the past, or which you know about.

We will ensure that your contributions are cited.

Many reefs could provide important historical data. For example, the Great Barrier Reef Authority has photographic assessments of some sites going back five decades or more. The GCRMN, Reef Check and CARICOMP networks now have large teams of trained people who can resurvey some of these old sites - as Chuck Birkeland

and colleagues have done for sites in Palau and Samoa.

Status 2002 will include the latest coral reef monitoring findings assembled by Reef Check, CARICOMP, AGRRA and other GCRMN activities around the world. The report will help show how reefs responded after the damaging 1997-1998 El Niño-La Niña, especially reefs in the Indian Ocean, Southeast and East Asia and the far West Pacific.

The report will also be an important contribution to the Convention on Biological Diversity

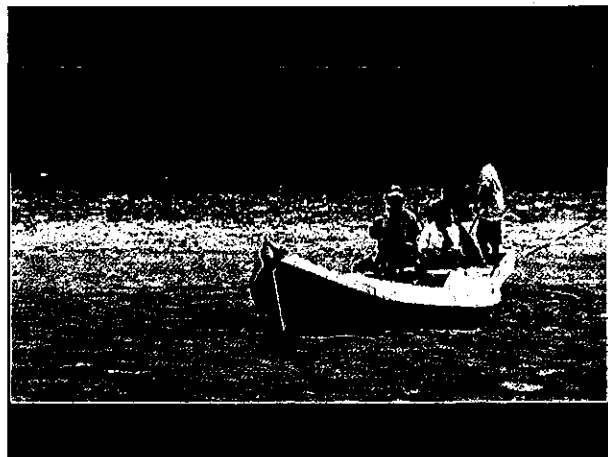
(CBD), which requests that all countries produce State of the Environment reports every two years (under Agenda 21, Chapter 17 of the Rio UNCED conference in 1992). The Secretariat of CBD and the GCRMN are seeking to strengthen their partnership so that reporting will be coordinated to save time and to increase the audience for reef status reports. CBD reports will be available at the World Summit on Sustainable Development in Johannesburg later in 2002. GCRMN's *Status of Coral Reefs of the World 2002* report will be formally released at the International Coral Reef Initiative's 2nd International Tropical Marine Ecosystems Management Symposium (2nd ITMEMS), in Manila late 2002 (see *Diary*). *Status 2002* will also contribute to the Millennium Ecosystem Assessment now in the planning stages.

Please help by providing information directly to country coordinators. Co-ordinators are listed below and in ReefBase (www.reefbase.org). You can also find them through links on the GCRMN Home Page (www.gcrmn.org) run by Jim Hendee within the NOAA CHAMP* system in Miami.

*National Oceanographic and Atmospheric Administration Coral Health and Monitoring Program

Jaime Garzon-Ferreira of INVEMAR, Colombia (jgarzon@invemar.org.co) is assembling data on previous coral reef monitoring and research in the Wider Caribbean region with the assistance of NOAA (USA), ReefBase staff in ICLARM and the Reefs @ Risk staff of the World Resources Institute. These data will appear in *Status 2002* and be used in the Regional Reefs @ Risks assessments of the wider Caribbean area now in progress. Regional and Node Coordinators for the GCRMN are: Lionel Bigot (lionelbigot.arvam@guetali.fr) and Jean Pascal Quod (jpquod.arvam@wanadoo.fr) for the Southern Indian Ocean Islands; Nyawira Muthiga (nmuthiga@AfricaOnline.co.ke) and David Obura (dobura@africaonline.co.ke) for the Eastern African States; Ben Cattermoul (reefmonitor@eureka.lk) and Arjan Rajasuriya (arjan@nara.ac.lk) for South Asia; Fareed Krupp (fareed.krupp@persga.org), for the Red Sea & Gulf of Aden; Chou Loke Ming (dbscim@nus.edu.sg) and Kei Osada (KEI_OSADA@env.go.jp) for Southeast and East Asia; Hugh Sweatman (h.sweatman@aims.gov.au) for Australia and PNG; Carol Emaurois (emaurois2000@yahoo.com) and Robert Richmond (richmond@uog9.uog.edu) for Micronesia; David Gulko (david_a_gulko@exec.state.hi.us) and Jim Maragos (jim_maragos@fws.gov) for the Hawaiian Islands; Robin South (south_r@usp.ac.fj) and Posa Skelton (skelton_p@student.usp.ac.fj) for the Southwest IOI Pacific Islands; Bernard Salvat (bsalvat@univ-perp.fr) for Polynesia Mana; Donna Turgeon (Donna.Turgeon@noaa.gov) for US Caribbean reefs; Allan Smith (smitha@candw.lc) for the Eastern Caribbean States; Ernesto Arias (earias@mda.cinvestav.mx) and Patricia Almada-Villela (palmadav@mbrs.org.bz) for the Mesoamerican Barrier Reef countries of Central America; Jaime Garzon Ferreira (jgarzon@invemar.org.co) and Alberto Rodriguez (betorod@invemar.org.co) for Southern American States; Dulcie Linton (dmlinton@uwimona.edu.jm) and George Warner (gfwarnar@uwimona.edu.jm) for Northern Caribbean Islands. Global Contacts: Clive Wilkinson, Global Coordinator GCRMN (c.wilkinson@aims.gov.au), Mark Eakin the Chief Scientific and Technical Advisor to the GCRMN (mark.eakin@noaa.gov), Gregor Hodgson Director of Reef Check (gregorh@ucla.edu) and Jamie Oliver Director of ReefBase (j.oliver@cgiar.org).

For full Book Reviews, see pages 35-27.



People of the Reefs

Reefs where destructive fishing is a way of life...
A village where marine pollution affects health...
National Marine Parks...
The workings of national government in Jakarta...
Environmental groups in the Thousand Islands...

All these feature in a new film exploring the threats to Indonesian coral reefs and their possible solutions.

People of the Reefs (50 mins) is available in PAL or NTSC format at US\$50 for individuals and US\$100 for institutions (available in Canada in Canadian dollars, discounts available for developing countries). Contact: Nexus Media, PO Box 550, Chester, Nova Scotia, B0J 1J0, Canada Tel: (902) 275-2433 Fax: (902) 484-7813 Email: don.duchene@nexusmedia.ca Web site: www.nexusmedia.ca



Conserve Online

ConserveOnline is a website that seeks to get the best conservation science ideas and practices to everyone who needs them. The idea is to share knowledge and build a community of conservation practitioners who can share their experiences, learn from each other, and take advantage of the best minds in conservation science and practice. The site is intended to provide information and support to anyone making conservation-related decisions, from the staff of conservation organizations to land managers at government agencies to local land trusts to private landowners. ConserveOnline is an open forum for sharing successes and failures, and for

connecting scientific research with field-based conservation practice.

ConserveOnline provides an online library of conservation resources, with an indexed, easily-searchable database of best practices, published and unpublished reports, case studies, data, software, maps, and so on. The site also offers a listserv and discussion group. The library holds published and unpublished documents, fact sheets, case studies, slideshows, data sets and much more on subjects ranging from invasive species management to gaining support from local communities for conservation. ConserveOnline covers the whole gamut of conservation

issues, and holds a fair amount of information on coral reefs. If you register as a user you can add your own documents to the library as well as providing feedback to the authors and other users about documents already in the library. Any user may rank a document for usefulness and submit a Reader Review. Users may also apply to become Expert reviewers. Why not take a look!

www.conserveonline.org

Fisheries Investigations
and Management
Implications in Marine
Protected Areas of the
Caribbean.

Water Quality
Conservation in
Marine Protected
Areas.

Coral Reef
Conservation in
Marine Protected
Areas.

These three bilingual (Spanish and English) volumes are a series of case studies of the Parque Nacional del Este, southeast Dominican Republic. They represent the results of 7 years of investigations on the marine environment, coral reefs and fisheries activities of the park and its adjacent area, together with recommendations for management.

Edited by Mark Chiappone, these books are the joint effort of researchers, faculty and students of The Nature Conservancy's Marine Conservation Science Center and its Caribbean Program, the University of Miami, Universidad Autonoma de Santo Domingo, Acuario Nacional de la Republica Dominicana, Fundacion Dominicana Pro-Investigacion y Conservacion de los Recursos Marinos, and the Smithsonian Institution, with funding and sponsorship of USAID Parks in Peril Program, The Nature Conservancy and other donors and contributors.

Further information from Eva Vilarubi, Publisher, The Nature Conservancy, 4245 North Fairfax Dr., Arlington, VA 22203, USA, Fax 703-4880, Email evilarubi@tnc.org, or at the website www.nature.org.

Philippine Coral Reefs: A Natural History Guide

Alan T. White (2001) Bookmark, Inc. and Sulu Fund for Marine Conservation Foundation, Inc, Manila, 276 p. 2nd edition. ISBN 971-569-395-4

One word sums up the book 'Philippine Coral Reefs: A Natural History Guide' by Alan T. White: Complete! The book is a must-have for students and teachers of natural science, for marine biologists and for environmental advocates in the Philippines. The text thoroughly explains the symbioses and interdependencies between coastal habitats, giving readers a good understanding of the complex issues affecting marine ecosystems that for many people have until recently seemed far-removed from the pressing concerns of human well-being. Clear illustrations and diagrams show interconnectedness and interrelatedness among the mangrove, seagrass and coral reef ecosystems – how each protects and nourishes the others and how organisms and energy move between them in an intricate and fascinating food web.

Illustrations also explain the evolution of coral reef ecosystems. In storybook fashion the text provides a full chronology of events that lead to the formation of tropical islands and coral reefs. It also gives a comprehensive description of coral reefs in the Philippines – emphasizing the peril they face from human activities such as destructive fishing practices.

But equally importantly, *Philippine Coral Reefs* is a handy field guide containing a wealth of well-chosen, vivid, full-colour photographs of plant and animal species found in the reef ecosystem. It provides a clear guide to the likely locations of plants and animals in the nearshore habitat (particularly the inter-tidal zone). Serious students of the reef will value the close-up photographs, each with an informative identification caption. The book is among only a few such repositories of photographs for this region, and it both informs and amazes.

This volume will surely spur environmental enthusiasts into action on behalf of the reef's beautiful yet threatened inhabitants. White's own dedication to preserving the coastal and marine ecosystem – to keeping critical habitats safe for the organisms they shelter so as to allow the food web to follow its natural course and maintain the balance of the environment – shines from the book. Readers cannot help but heed his call to action. For many, getting a copy will be the beginning of a lifelong fascination with the reef.

Rosario Farrarons is a Social Marketing Specialist for the Coastal Resource Management Project of the Department of Environment and Natural Resources of the Philippines. She writes on reef conservation issues for newspapers in Cebu.

Coral Reefs of the Indian Ocean - Their Ecology and Conservation

Edited by Tim R. McClanahan, Charles R. C. Sheppard and David O. Obura (2000), Oxford University Press, 550 p, £65.00/\$90.00(Hardback), ISBN 0-19-512596-7

Accessible and complex, coral reefs are ideal natural laboratories for studying a wide range of ecological and biological questions. This collection focuses on the Indian Ocean and the Red Sea, which contain some of the most spectacular reefs found anywhere and which are relatively little studied. It will appeal to a broad range of researchers in ecology and will be an essential resource for anyone studying Indian Ocean reefs.

Success in Soufrière

The Soufrière Marine Management Area, St Lucia: a community initiative that has worked for fishers

Since the Soufrière Marine Management Area (SMMA) was set up on the Caribbean island of St. Lucia in 1995, four no-take marine reserves have been the most contentious part of its management plan. Recent research shows that fish stocks are recovering (see *Plenty more fish in the sea*), but is this good news for fish good news for fishers too? Recently Callum Roberts, Julie Hawkins and I undertook a study of the reef fishing community in Soufrière to investigate how catches had changed since the SMMA was established and how the fishers perceived the management.

When the no-take areas were formed reef fishers lost over a third of their fishing grounds. Although the fishers most dependent on the reefs were paid compensation for one year, most reef fishers felt they had lost out. Now the picture is changing.

We compared recent catches with a study by Renata Goodridge from the University of the West Indies in Barbados when the SMMA was first established in 1995/6. We found dramatic increases in the catches for the two main types of reef fishing – big traps (called pots) that are set for days at a time and small pots that are baited with fish and hauled several times per fishing trip.

Fishers fishing with big pots in 2000/1 were on average catching 36% more fish per pot fished than in 1995/6, and 46% more fish per trip. Small pot fishers caught 80% more fish per pot fished and 90% more fish per trip. Patricia Hubert from the St Lucia Department of Fisheries has confirmed these figures using data collected by the Department continuously since before the SMMA was established.

These results alone show that the lot of some of the poorest people in Soufrière is improving. But how do these fishers feel about the closed



areas after more than five years of management? We heard a real mixture of opinions about the closed areas and their role in managing the reef fishery. Some of the fishers still felt that the reserves mainly benefited divers, while others thought that there were too many closed areas. However, the majority of the reef fishers understood the potential fisheries benefits of a closed area and were all too well aware of what the consequences of continuing to fish everywhere would have been. Many also said the management helped them by protecting the reefs from damage by yachts and other tourist activities. The rangers now stop tourists taking marine curios or cruise ships and yachts dumping garbage. In the past fishers saw these things happening but couldn't do much about them.

It was encouraging to see our observations of more fish in the water and bigger catches reflected in the fishers' comments. "We are getting more nice fish and bigger fish. I have seen it myself when I go in the water

with my mask - where there used to be few fish now there are lots", said Glenn Prospere of Soufrière who has been fishing the reefs for 26 years. Joseph Aglan is 63 and makes his living fishing pots from a small wooden boat that he rows: "The reserves are helping me – they are bringing more fish and the fish come out of the reserve."

Younger fishers are also supportive: Berty Louisy, a young fisherman who fishes offshore for most of the year but turns to reef fish when the weather is rough commented: "If it wasn't for the marine reserves there would be less fish now." Another young fisherman, Delbert Burke, sees the importance of the marine reserves over the longer term: "For the moment it is good for the SMMA to be there - after 20 years it will be better - if you catch everything you get no fish in future."

When we presented the results of our surveys to the fishermen, normally reticent reef fishers stood up to give witness of the benefits the SMMA was bringing to them. And



when the manager of the local fishermen's co-operative asked the assembled fishers how their catches had changed since the SMMA was established, every fisher said they had improved.

The support and faith of fishers, whose livelihoods depend on the health of the reefs and the fish populations, is the most important ingredient in the success of protected areas like the SMMA. The road to this remarkable success has not been smooth and the first few years were difficult for fishers. This is something we heard a lot about in interviews we conducted together with the Department of Fisheries data collector for Soufrière.

But the difficult years and the hard work of the fishers and the SMMA staff have now really paid off. Everyone is seeing the benefits. The reef fishers of Soufrière are now generally very well-informed about fisheries management and conservation and are beginning to feel proud of their part in what is becoming a world-renowned success story for marine reserves.

There is still some illegal fishing in the marine reserves, much of it by fishers from outside the Soufrière community or by people only

casually involved in the reef fishery. Regular reef fishers do very little illegal fishing, but some still occasionally "take a chance". It is not a perfect system and there are problems, but despite these, the SMMA is delivering results. It offers a realistic model for others to follow.

"more nice fish and bigger fish. I have seen it myself when I go in the water with my mask"

There has never been a greater need to establish no-take marine reserves throughout the oceans. We hope that success stories such as this will help speed up the establishment of reserves globally. Reserves are also catching public attention through the media.

When some of our research was published in the journal *Science*¹, the non-governmental organization SeaWeb helped promote the story around the world. The Soufrière success story featured in newspapers and radio programmes in the US, UK, France, and Canada, and of course in St Lucia. In January 2002 an editorial in the *New York Times* used the St. Lucia experience along with a recent study of the over-reporting of Chinese fish catches², to illustrate the paradox of marine conservation: we can do immeasurable damage to marine ecosystems, but tools like marine

Plenty more fish in the sea...

The SMMA no-take areas were established for conservation and fisheries reasons and since their establishment Callum Roberts and Julie Hawkins at the University of York, UK have been monitoring fish stocks annually throughout the area, both inside and outside marine reserves. Their most recent results (from data collected during summer 2001) show that since the establishment of the SMMA in 1995, the fish biomass inside the marine reserves has increased four fold and in the fishing grounds outside the reserves fish biomass has increased three fold. These remarkable increases in fish biomass show the SMMA is meeting its conservation objectives. Populations of many non-target species have increased dramatically and the size and abundance of commercially fished species such as snappers and grunts have also increased.



reserves could go a long way to repairing some of this damage, and conserving what we have left. The editorial emphasized the importance of political will in changing the future of the oceans – and the importance of policy with conservation firmly in view.

In Soufrière managers have won the support of the reef fishers. Strong community involvement from the outset, together with effective enforcement, has made this an initiative the people of Soufrière can be proud of. Last year the SMMA was selected as a world demonstration site for the International Coral Reef Action Network (ICRAN), providing a shining example for coral reef management projects around the world. The Soufrière community, the SMMA staff and the staff of the Department of Fisheries have done an excellent job, particularly Kai Wulf, manager of the SMMA and Sarah George of the St Lucia Department of Fisheries. Without their commitment and vision the SMMA would not be what it is today.

Fiona Gell is a postdoctoral research associate in the Environment Department, University of York, UK, looking at the effects of marine reserves on fisheries

References

- ¹Roberts CM, Bohnsack JA, Gell F, Hawkins JP, Goodridge R (2001) Effects of marine reserves on adjacent fisheries. *Science*, 294: 1920-1923
- ²Watson R, Pauly D (2001) Systematic distortions in world fisheries catch trends. *Nature*, 414: 534-536

Fisher/diver conflict cartoon by M. Roberts



The Soufrière Marine Management Area

The Soufrière Marine Management Area (SMMA) encompasses a network of management zones along 11km of the southwest coast of St Lucia, West Indies. It includes four no-take marine reserves, accounting for 35% of the total management area. The SMMA was established in 1995 as a community initiative managed by stakeholder groups and the St Lucia Department of Fisheries. The SMMA has an office and visitors' centre on the seafront in Soufrière, and employs four fulltime rangers recruited from the fishing community who patrol the area and collect user fees from yachts mooring in the area. The SMMA also generates revenue from a dive fee, and a recently introduced snorkel fee. Mooring buoys are provided for yachts, divers must be accompanied by a local guide, and other damaging activities such as jet-skiing are restricted. There are 24 main zones within the SMMA managed as 5 different zone types: no-take marine reserves, fishing priority areas, multiple use areas, and yacht mooring areas. One of the marine reserves is designated as a marine sanctuary where recreational diving is not permitted.

The initial aim of the SMMA was to deal with growing conflicts among resource users and to rehabilitate the declining reef fishery. In the 1980s and 90s, traditional reef uses such as fishing had to compete for space with dive tourism and the increasing numbers of yachts using the area. Zoning has addressed these problems to a large extent, giving particular users priority in each zone. Other factors have also helped. A stakeholder committee provides a formal forum for voicing complaints and dealing with conflicts between user groups, and has improved the way in which problems are solved. The formation of formal resource users groups, particularly the Water Taxi Association has also helped. This organisation regulates water taxi operators, yacht guides and others involved in boat based tourism. Members benefit from joint publicity, use a rota system for working at popular tourist spots, and have vocal representation on local committees. There have been some clear community benefits of the management of the SMMA. It has raised awareness of marine conservation issues in Soufrière, and the SMMA provides school education programmes and is often featured in the local media, thus increasing awareness island-wide. The SMMA also attracts divers and other visitors to the area, bringing in additional tourist revenue. There is a lot of support for the SMMA from the dive industry and most divers visiting St Lucia will dive in the SMMA. Ponti Francis, who has been a SCUBA instructor in Soufrière for 20 years comments: "The SMMA has really helped out. The fishers and the tourists – divers and yachtsers – are really respecting the reserves. There are lots more fish – I see more chubs and jacks, and the parrotfish are bigger now."

Reef Briefs

Ecosystem brinkmanship

Clear versus cloudy lakes, scrub versus desert, algal versus coral reefs – ecosystems can dramatically shift between different stable states. Disturb a stable ecosystem and, like a ball pushed to the side of a basin, it tends to return to where it was. But if there are two alternative stable states – two basins if you like – an ecosystem pushed to the brink can suddenly shift from one to another with catastrophic results. The likelihood of a shift depends on the size of the 'push' but also the size of the basin. Slowly changing environmental conditions (say increasing nutrient loads and decreasing grazing by fish) may not have a noticeable effect on reefs, but they decrease the resilience of the ecosystem – the ball stays put but the basin is shallower. Then one big chance effect (such as the 1984 disease that wiped out urchins from much of the Caribbean) can more easily push an ecosystem over the brink. Shifting back again isn't easy. Take the Caribbean reef example: older algae are less palatable to grazers even when populations recover – and algae shade existing coral colonies as well as hindering settlement of new coral larvae. Reviewing catastrophic changes in many different ecosystems, Marten Scheffer and colleagues urge us to stop fixating on occasional disturbances such as hurricanes and diseases, and start concentrating on maintaining ecosystem resilience. Perhaps those toys where you have to simultaneously coax several ball bearings into dimples on an almost flat surface should be routine training for ecosystem managers!

Scheffer M, Carpenter S, Foley JA, Folke C, Walker B (2001) Catastrophic shifts in ecosystems. Nature 413: 591-596

Sponging up the nutrients

Crevice dwelling sponges may answer a puzzle first posed by Darwin – how do coral reefs fuel their growth from nutrient poor tropical waters? Claudio Richter and colleagues think the answer is on the inside. The researchers used endoscopic cameras to explore up to 4m into Red Sea reefs for every 1m² external surface area there is up to 7.5m² of internal surface, home to large populations of sponges and other filter feeders. These creatures feed by filtering plankton out of the water, and release their waste products such as nitrogen and phosphorus in a form easily used by corals and algae. The researchers calculated that plankton uptake by cavity dwellers equaled 22% of all community metabolism of the reef, and nutrients subsequently released accounted for up to a third of the nitrogen and phosphorus in water seeping out of the cracks in the reef structure. Most plankton eaten by the sponges must come from offshore since water is flushed through the reef every few minutes. So does this efficient filtering explain how coral reefs thrive where nutrients are scarce?

C Richter M Wunsch M Rasheed, I Kötter, M Badran 2001 Endoscopic exploration of Red Sea corals reveals dense populations of cavity-dwelling sponges. Nature 413 726-730

A rough answer...

Other researchers eschew convoluted explanations of Darwin's paradox as unnecessary, and turn to the physics of drag and turbulence for an answer. Imagine a smooth coral surface in still water. The coral would soon take all the nutrients out of the water close to

it, and as long as the water is still, nutrient supplies can only be replaced by slow diffusion. But reefs are far from smooth – in fact their roughness is almost unrivaled by other structures. While most surfaces in the sea get worn down, coral growth actively maintains roughness. Waves breaking on the forereef pile up water that runs across the reef flat to the lagoon. Reefs have drag coefficients a hundred times higher than sand, and the turbulent energy of a current across reef flats can be a thousand times more than elsewhere in the ocean. This turbulent flow mixes up water in the boundary layer around corals, constantly replenishing nutrients. When water arrives periodically (as it does when brought by waves) drag is higher than it would be for a steady flow. So because of waves, forereefs and reef crests receive much higher influxes of nutrients than back reef areas, and this may help explain why reefs seem to grow best at their margins.

CJ Hearn, MJ Atkinson JL Falter 2001 A Physical derivation of nutrient-uptake rates in coral reefs: effects of roughness and waves. Coral Reefs, published online 26 Oct 2001.

Symbiont shuffle

Are corals gamblers? Some corals may bleach in order to replace underperforming algal symbionts with species better adapted to new environmental conditions. Andrew Baker examined corals transplanted between shallow (2-4m) and deep (20-23m) reefs in San Blas archipelago, Panama. After eight weeks corals transplanted from deep to shallow water had bleached much more than those moved deeper. But surprisingly,

after a year none of the transplants in the shallows had died compared to several that had been moved deeper. Baker found that of species that host varying symbionts at different depths, only those moved shallower (and subjected to the sharp shock of increased sunlight rather than the less acute shock of dimmer light) had changed their algal symbionts. Bleaching might be a high-risk response to rapid environmental change, leading to a swift symbiont shuffle.

Baker A (2001) Reef corals bleach to survive change. Nature 411 765-766

Gone fishing...

Fish stocks recover when fishing is banned, but does the recovery help neighbouring areas where fishing continues? Callum Roberts and colleagues monitored a system of 'no-take' marine reserves in St. Lucia, Eastern Caribbean since their creation in 1995. Five years later, catches from two different types of traps used in neighbouring fisheries had increased 46 and 90%. The researchers also looked at game-fish catches around Merrit Island National Wildlife Reserve in Florida. Merrit Island is the USA's longest-protected no-take reserve, created in 1962 to keep people away from the Kennedy Space Center. Some years after protection, and presumably after fish within the reserve had had time to reach their full size, trophy-sized catch records started to accumulate from the waters around Merrit Island faster than for the rest of Florida put together. This strongly suggests fish were spilling out of the reserve. But it's not always that straightforward. Researchers McClanahan and Mangi looked at catches around a no-take reserve at Mombasa Kenya. Over five years the numbers of fishers stayed constant but total catch and catch per unit effort declined each year despite the protected zone, although catches closest to the reserve declined the least. McClanahan and Mangi think environmental degradation and excessive fishing effort are the most likely causes.

Roberts CM, Bohnsack JA, Gell F, Hawkins JP, Goodridge R. (2001) Effects of marine reserves on adjacent fisheries. Science 294 1920-1923

McClanahan TR Mangi S (2001) The effect of a closed area and beach seine exclusion on coral reef fish catches. Fisheries Management and Ecology 8 107-121



Seeing red..... or blue

Unusually for mantis shrimps, *Haptosquilla trispinosa* can live in the shallows or in deep water (30m or more). So how does this species cope with the changing colour of light with depth? Seawater selectively absorbs long wavelength light (the red end of the spectrum) so colour vision that works well in the shallows wouldn't be much use at depth. Now Thomas Cronin and colleagues have shown that *H. trispinosa* individuals can tune their vision to suit the environment. Mantis shrimp use transparent coloured filters placed in front of four classes of photoreceptors. *H. trispinosa* individuals living in deep water develop filters that tune their photoreceptors to the shorter wavelengths, allowing the mantis shrimps to discriminate between subtle hues of blue, and this seems to be a response to the light environment during early life.

Cronin TW Caldwell RL Marshall J (2001) Tunable colour vision in a mantis shrimp. Nature 411: 547

Papers summarised by Maggie Watson

Tanga - who calls the tune?

Collaborative Reef and Reef Fisheries Management in Tanga, Tanzania

Horrill, J.C., Kalombo, H and S. Mwakoloweka (2001) IUCN Eastern Africa Programme, Tanga Coastal Zone Conservation and Development Programme

A field biologist with wanderlust discovers a gem of a coral reef, the central government gazettes it as a marine protected area but provides little additional support, increasing human populations, greed and the needs of migratory and multi-ethnic people lead to overexploitation and damaging fishing, and in a desperate attempt to save the reef, donors and local and national governments attempt to develop a decentralized collaborative resource use program...

The recent history of resource-use in the Tanga region of northern Tanzania is probably similar to many tropical coastlines with coral reefs. This entire story occurred in the past 25 years, and if you would like to know more about this history, examine one effort to protect reefs through a participatory approach, and to learn some of the lessons of collaborative management then this short IUCN publication will be useful.

Many of the governance issues and problems of resource use that occupied the political and ecological thinking of the 1990s are described in this case study. These include the decentralization of government from capitals to villages and the problems of co-ordinating among villages as well as between other levels of government. The authors show how local-level village government can help in resolving some resource-use problems, and that it is an essential political strategy to involve people in the rules of resource use. But without help from other levels of government, particularly the judiciary, many conflicts remain. Take reef closures for example. Neighbouring villages may

argue about whether closures are needed, the length of any closures, or which reefs to choose. The same is true for regulating fishing gear. Some neighbouring villages approve of destructive gears such as dragnets and dynamite while others do not. In some cases, a more centralized authority has to step in to provide solutions and influence decisions so that they are based on broader knowledge base and overall community interests.

In the early stages the Tanga programme was focused at the village-level, but by the middle of the programme decisions often relied on educating people (using global and collective sources of information) and enforcing national rules. In many cases, it was not just village people that required education, but also regional and national government and the judiciary, who were often ignorant, particularly on the effects of destructive gear and of the motivations of village people. There was often mistrust among the various levels of government and their cultures. Developing

Like many donor and international programs, the Tanga project had to appear successful to continue receiving support.

Understandings and trust through collaborative management may have been one of the more important outcomes of this programme. Whether this trust and collaboration will continue when donor support is no longer available to facilitate communication remains to be seen. Like many donor and international programs, the Tanga project had to appear successful to continue receiving support. And like so many other large-scale projects, there was not the high quality and objectivity in data collection and evaluation that most scientists would like to see. Nonetheless, the participants made a valiant and refreshing attempt to see that there was both a modest quality and amount of data collection used in the evaluation. Objective and high quality monitoring and evaluation are so often ignored by donors in their attempt to implement the current political thinking and "save the world" as soon as possible. Too many of the very largest environmental programs claim they don't have the resources to objectively evaluate the outcomes of their work. In many cases they simply assume they are doing the right thing, or worse, they evaluate themselves. This programs stands somewhere in between the desire to find the truth and the need to succeed and, therefore, provides a big step in the direction of true success. The authors provide us with some important lessons that we can build on and fine tune.

A big step in the direction of true success

Tim McClanahan is the coordinator of Coral Reef Programs for The Wildlife Conservation Society, P.O. Box 99470, Mombasa, Kenya. Email crcp@africaonline.co.ke

New Leis of Larval Life

The Larvae of Indo Pacific Coastal Fishes: an Identification Guide to Marine Fish Larvae

Jeffrey M. Leis and Brooke M. Carson-Ewart (2000), Brill, Leiden, The Netherlands, Fauna Malesiana Handbook 2, 805 pgs. ISBN 90-04-115773, \$243.00/EUR 209.00

The Larvae of Indo-Pacific Coastal Fishes represents the much anticipated revised and updated version of the two classic publications, "Larvae of Indo-Pacific Coral Reef Fishes"¹ and "Larvae of Indo-Pacific Shorefishes"², both published by the New South Wales University Press and both, unfortunately, out-of-print. Although I was lucky enough to have purchased what was undoubtedly one of the last copies of the 1989 volume, I spent many years combing used bookstores in vain in the hope that some naive amateur ichthyologist would have foolishly relinquished their copy of the 1983 volume, the one I really wanted! When I recently left the University of California at Santa Barbara, it was with great sadness that I returned one of the two library copies of the coral reef fish volume that had graced my shelf during my graduate studies (I did contemplate swiping a copy since I was the only one to check the book out!). Thus, when the new revised book, a single 805 page volume containing descriptions of 124 families (19 more than the previous two volumes), was recently published by Brill, as part of the Fauna Malesiana Foundation handbook series, I quickly switched my diet to instant noodles so I could save up enough cash to buy a copy. Of course I didn't tell this to the publisher so that I could get a brand-spanking new copy for reviewing the book that I will never, ever loan out to any of my graduate students!

The layout of the new book is similar to the previous two volumes and represents a monumental effort by the 38 contributing authors. The larvae of Indo-Pacific coastal fishes consists of four main chapters. Chapter 1, introduction, contains an

overview of the book, a list of other suggested references, and methods of larval collection and identification. Chapter 2, morphology, provides a detailed summary of terminology used for describing larval developmental stages, with clearly presented illustrations that are accessible to both novice and professional readers. More detailed definitions of technical terminology are included in a concise glossary. Chapter 3, guide to identification to order and family, contains one table for identifying larvae to order and one table and a 23-page pictorial guide for identifying larvae to family. The family guide is subdivided into 19 groups that are defined by body shape and gut morphology, a helpful approach for larval identification. Chapter 4, the bulk of the book, contains the descriptions of 124 families and 1 *incertae sedis* group (an informal grouping of Lobotes-like species). For each family there are helpful details about spawning mode, larval development and hatching, descriptions and illustrations of the larval development stages, often the full series, a list of similar families, and a synopsis of the material and references used for the description. In general, the meristic and morphometric characteristics for each family are clearly presented in tables and the illustrations of the range of developmental stages are excellent.

Overall, I found the book quite accessible to readers familiar with basic fish anatomy. The only criticism I have of the book is the lack of a dichotomous key to assist in classifying larvae to family. This would have greatly increased the accessibility of the book to more

novice researchers who are trying to develop their skills in larval fish identification. The authors do provide two arguments as to why such a key was not included: identifying characteristics are not the same for all developmental stages, and larvae of other species such as pelagic species may be collected at the same time but are not included in the book. Both arguments are certainly valid but are not comforting to the researcher faced with trying to figure out what they have collected! As an alternative, a non-dichotomous table for each of the 19 groups based on body shape and gut morphology, similar to the one provided to identify larvae to order, would have been useful to provide some additional guidance in narrowing the list of potential families. This would be particularly advantageous since the pictorial family guide of the 19 groups contain different developmental stages of the families, making it challenging

to form that initial 'short-list' of potential families. Even so, as a reference guidebook for tropical fish larvae, this is an important and very informative resource. At present, it is the definitive reference book on larval identification of tropical fishes (both coral reef and other coastal families). The larvae of Indo-Pacific coastal fishes is a 'must have' or at least a 'must have at the library' for any student or professional researcher working on the early life history of fishes.

References

¹Leis JM, Rennis DS (1983) The larvae of Indo-Pacific coral reef fishes. University NSW Press, Sydney. 269 p

²Leis JM, Trnski T (eds) (1989) The Larvae of Indo-Pacific Shorefishes. New South Wales University Press, Kensington. 372p

Stephen Swearer, is in the Department of Zoology, University of Melbourne, VIC 3070, Australia. Email <sswearer@unimelb.edu.au>

Economic Environment

Economic constraints to the management of marine protected areas: the case of the Kisite Marine National Park and Mpunguti Marine National Reserve, Kenya

IUCN Eastern Africa Programme, Economics Programme and Marine and Coastal Programme. Lucy Emerton and Yemi Tessema. Available from IUCN - the world conservation union, East African Regional Office, P.O. Box 68200, Nairobi, Kenya. E-mail mail@iucnearo.org.

It is essential to consider economics if you want to manage a reef that people use, and all those who are still trying to persuade policy makers of this will welcome Lucy Emerton and Yemi Tessema's case study of the reefs at Kisite and Mpunguti in Southern Kenya. This booklet makes a clear statement - until economic issues are addressed, management will be ineffective. Managers have to apportion costs fairly across stakeholder groups, and diversify the ways they generate and share income.

But biology is as important as finance, and I was disappointed that basic biology was underplayed in this case study of an East African Marine Protected Area (MPA). It's a well-rehearsed argument that *effective* protection = bigger fish = many more eggs = more juveniles returning to both fished and unfished reefs. Since Kisite is in the south of the country and the prevailing current runs north, the MPA there could have a widespread benefit. The increased reproductive potential of the unfished stocks in the park also acts as an insurance policy against recruitment overfishing and stock collapse. We can't easily put values on these benefits. Emerton and Tessema estimate only \$34,000 pa worth of extra fishing income outside the boundaries, but this is based on little actual data.

Of course, the MPA does raise income through user fees. Some of this income is used for management costs, some is shared with the local community, and some goes to a central fund. The Kenya Wildlife Service has a tough balancing act to maintain. As well as managing the

profitable parks it has to pay the cost of protecting and policing parks (land-based and marine) in places that are too underdeveloped, inhospitable, or unstable to generate their own tourism revenue. All the profitable parks chip in to the central fund, and that means less of the revenue from profitable protected areas stays with the local community.

People who used the parks before they became protected (here fishers) see the benefits going to the Wildlife Service and the tourism operators, and feel they are getting a poor deal. Emerton and Tessema calculate the 'opportunity cost' of the park to local fishers as harvest foregone. Fair enough, but they base the calculation on a 1993 yield estimate that is better described as a guestimate (I know, because I made it) to get a figure of \$172,000 lost fishing income per year. They don't discuss the fact that most of the park is bare sand and only a fraction is reef. They compare this opportunity cost not to the profits, but the gross turnover from the tourist industry, which they calculate as \$1,600,000. Although the authors point out that 'private tour operators do incur substantial personal costs in running and marketing their operations', it might be fairer to think of many of those costs as investments in the region. I don't have experience of this industry, but an ex-treasurer of the Kenyan Association of Tour Operators told me that for a land-based safari company, a profit margin might be anywhere between 1.8% and 8%, which for this example translates as \$4,4800 - \$128,000 split between the operators. The rest goes into

running the business, which largely means it goes into the local and regional Kenyan economy. When I knew the area well (in the mid '90s) the tourism operators who depended on the marine protected area for their business were also the major employers.

Importantly however, opportunities for less well off people to gain the business skills and access to capital necessary for them to move from being employees to entrepreneurs were scarce. Providing these opportunities would be an important part of helping people living locally to benefit fully from the tourism opportunities the MPA could offer.

Emerton and Tessema sum up their study by stating that ensuring the future financial and economic sustainability of East Africa's MPAs will require major changes in the way MPA benefits and costs are identified, demonstrated and translated into financial terms, at both conceptual and practical levels. They remind us that expanding and diversifying MPA funding will be a major challenge. Finally, they conclude that unless the future financial and economic sustainability of MPAs can be assured, species and ecosystems within protected areas (as elsewhere) stand little chance of survival over the long term.

Maggie Watson,
Maggie@Xpertext.com

Large-Scale Links, Large Scale-Lessons

A new centre for coral reef biodiversity is established at James Cook University.

"Coral reefs are part of a global system and they need protection that is comparably global in scope" says Terry Hughes, Director of the new *Centre for Coral Reef Biodiversity* (CCRB) at Townsville's James Cook University, Australia. Threats to coral reefs such as bleaching, introductions of exotic species, habitat degradation and over fishing act at a large—at least regional—scale and may act across international borders. "It is clear we cannot remain insular" says Hughes. The new Centre undertakes regional-scale reef research, and trains graduate students in theory and techniques applicable to global reef conservation and management issues.

Some of the large-scale work undertaken by Centre members has recently appeared in papers in *Nature*¹ and in *Science*², and both illustrate the type of approach the Centre will be taking. The *Nature*¹ study investigated the 1700 kilometre latitudinal gradient of Australia's Great Barrier Reef. Researchers analysed patterns of coral recruitment and compared them to patterns of adult abundance, sampling spatial scales from 1-5 metres to 250-500 kilometres. The paper concludes that although adult coral cover may be similar, recruitment rates vary substantially at regional scales. In one area fewer recruits are produced, but they survive better, while in another area, more recruits are produced but they do not survive as well. Understanding these underlying processes is important because lower rates of recruitment could mean that reefs are less able to recover from disturbances. This type of knowledge will be important if we are to manage human activity to reduce negative impacts on global reefs.

The recent paper published in *Science*² looked at distributions of species of corals and reef fish throughout the Indo-Pacific Oceans, and concluded that the proportion of species in each family is predictable,

regardless of the location. Of the four variables (latitude, longitude, area of shallow-water habitat, reef type) examined to explain the variation in taxonomic composition of fish and coral assemblages, regional-scale variation in habitat area stood out clearly as the major factor. The Central Indo-Pacific region happens to have extensive areas of shallow water habitats, and this may be a key factor in maintaining high species richness in the Indo-Australian Archipelago. The work suggests that to maintain existing biodiversity, we must protect habitat over large, regional-scale areas. In addition, the study showed that low-diversity regions are most vulnerable to large-scale human impacts (such as global warming). These regions are in desperate need of integrated management at international scales.

David Bellwood, Assistant Director of the Centre, is optimistic. "The biodiversity crisis is not necessarily irreversible" he says. "Our knowledge of the factors that regulate biodiversity locally has made it possible to slow, stop and even reverse the loss of diversity at these local scales. With knowledge of the mechanisms operating at global scales, restoration and effective maintenance of biodiversity across national borders is an achievable goal".

Since most reef issues are regional or global in scope, future management of impacts need international cooperation. CCRB aims to provide some of the information needed for decision-making on this scale. James Cook University is an ideal base, as it is located on the Great Barrier Reef, and within the Indo-Pacific region, which contains the world's most biologically-diverse coral reef ecosystems. In addition, the University is home to an existing pool of established coral reef expertise. Members of the new Centre include established scientists as well

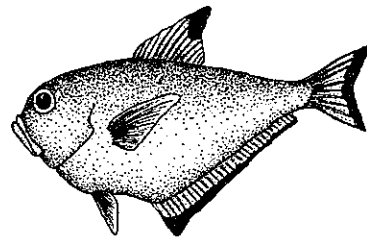
as graduate students from all over the world. "We are building on our collaborative links with institutions and scientists in the USA, France, Japan and Taiwan" says Hughes. Centre staff are currently working at field sites in Australia, the Caribbean region, French Polynesia, Indonesia, Papua New Guinea, the Philippines, American Samoa, the Solomon Islands, Taiwan and Thailand.

Sarah Lowe is the Media Liaison Officer at the Centre for Coral Reef Biodiversity, School of Marine Biology & Aquaculture, James Cook University, Townsville, Queensland, 4811 Australia. E-mail: ccrbio@jcu.edu.au Website: www.jcu.edu.au/school/mbiolaq/ccrbio/

References

¹Hughes TP, Baird AH, Dinsdale EA, Moltchanivskyj NA, Pratchett MS, Tanner JE Willis BL (1999) Patterns of recruitment and abundance of corals along the Great Barrier Reef. *Nature*, 397: 59-63

²Bellwood DR Hughes TP (2001) Regional-scale assembly rules and biodiversity of coral reefs. *Science* 292: 1532-1534



Drawing by Sue Daly

Developing Indicators of Marine Protected Area Management Effectiveness

MPA Management Effectiveness Indicator Workshop, Chichiriviche, Venezuela October 29th – November 2nd 2001

We believe we are getting better at designing and managing marine protected areas (MPAs) to conserve marine biodiversity and marine resources, but our understanding of how well these sites are actually achieving their management goals has substantial gaps. Many MPAs are not meeting their objectives. Of the 1,300 MPA sites surveyed in a recent study, only 30% had enough data to evaluate management effectiveness, and only 31% of those sites thought they were achieving their management objectives. The long-term success of MPAs depends on establishing evidence that MPAs are a useful conservation tool. With limited resources and staff at many MPAs, it is critical that the sites are more effectively and efficiently managed. Assessing management effectiveness enables managers to see how well a MPA performs and to adapt future plans to meet objectives.

IUCN World Commission on Protected Areas – Marine (WCPA – Marine) and WWF International have launched an initiative to improve MPA management by providing managers, planners and other decision-makers with methods for assessing the effectiveness of individual MPA sites and national MPA systems. This initiative will build on the work of Mark Hockings and the WCPA Management Effectiveness Task Force (METF), especially its recent publication, *Evaluating Effectiveness: A Framework for Assessing the Management of Protected Areas*¹, and apply this work to marine sites.

The main objectives and conservation outcomes of the initiative are to:

1. Develop specific indicators and guidelines for MPA managers to evaluate the effectiveness of their sites.
2. Design pilot projects and field test indicators and guidelines for MPA management effectiveness.
3. Increase awareness and use of monitoring and evaluation in the management of MPAs.

From October 29th – November 2nd 2001, the MPA Management Effectiveness Indicator Workshop was convened in Chichiriviche, Venezuela. It involved 32 experts from 17 countries, divided into three working groups who identified and evaluated indicators for management effectiveness. Before the workshop, biophysical, socioeconomic and governance management goals, objectives and indicators were researched and reviewed. The workshop itself emphasized indicators tied to specific management goals and objectives. In order to make this exercise as broadly relevant as possible, the goals and objectives were drawn from a survey covering the whole spectrum of MPAs throughout the world. Therefore the suite of indicators developed from these goals and objectives contain examples that can be applied to any MPA, depending on its specific needs.

During the workshop the participants revised the goals, objectives and indicators to ensure that they were measurable, concise, consistent and sensitive. After evaluating all the possible indicators for each goal/objective, a total of 57 priority indicators were selected including 16 biophysical, 18 socioeconomic, and 33 governance indicators.

The next step is to take the indicators developed at the workshop and incorporate them into MPA management effectiveness guidelines, which will be developed over the coming year. Building on the Hockings'/WCPA Framework, the guidelines will take the form of a simple, "how to" evaluation manual, to be used by MPA managers. The manager will be able to trace through his/her management goals and objectives to determine a suite of indicators relevant to the MPA. The manager will be able to choose from several levels of assessment, ranging from low to high costs (costs include equipment, human resources, financial capital). Ultimately, the guidelines will show how a management effectiveness evaluation can be incorporated into adaptive management so that the results inform more effective future management. The guidelines will be tested through a number of pilot projects, which are planned to begin in Spring 2002.

References

¹Hockings, M with Stolton, S. and Dudley, N. 2000. *Evaluating Effectiveness: A Framework for Assessing the Management of Protected Areas*. IUCN World Commission on Protected Areas Best Practice Protected Area Guidelines. Series No. 6. available at wcpa.iucn.org/theme/effect/mgteffect.html

*Bud Ehler Email <charles.ehler@noaa.gov>, Lani Watson, Lisa Max and Leah Bunce
<http://ipo.nos.noaa.gov/mgmteffect>*

Examples of sets of linked goals, objectives and indicators (note: the working groups developed multiple objectives per goal, but for the examples only one is listed under each goal):

Socioeconomic

Goal: To maintain and provide livelihood opportunities for coastal residents and resource users.

Objective: Improve economic status and relative wealth of communities.

Indicators: 1. Material style of life data at household level (e.g. assets, construction), 2. community infrastructure, and 3. income distribution by source by household.

Governance

Goal: To manage coastal resource use conflicts.

Objective: Reduce conflicts at four levels: 1. within each user group, 2. between user groups, 3. between user groups and community, and 4. between community and people outside the community.

Indicators: 1. Presence and degree of conflicts, 2. existence of conflict resolution process/mechanism, 3. A forum for conflict resolution, 4. use delineation well defined, 5. the extent to which the plan prioritizes uses and access among users.

Biophysical

Goal: To conserve and sustain fishery resources.

Objective: Prevent loss of biodiversity and ecosystem function and structure.

Indicators: 1. Habitat composition, 2. habitat structural integrity, 3. biological community composition, and 4. genetic variety and vigor.

International Coral Reef Initiative Indian Ocean Regional Workshop

In 2001-2002, the governments of the Philippines and Sweden are jointly hosting the International Coral Reef Initiative (ICRI) Secretariat. Three regional coral reef workshops are being organized in the build up to the 2nd ITMEMS (International Tropical Marine Ecosystems Management Symposium) to be held from 25-28 November, 2002, in the Philippines (see **Diary**). The first regional workshop (for East Asia) was held in the Philippines 2-4 April 2001, the second (for the Indian Ocean) was held in Mozambique 26-28 November 2001, and the third (for the Caribbean and tropical Atlantic), will be held in Mexico, 27-29 May 2002.

This Report summarizes the ICRI Workshop for the Indian Ocean jointly organized through ICRI, Coral Reef Degradation in the Indian Ocean (CORDIO), and the United Nations Environment Programme-Regional Coordinating Unit (UNEP-RCU,

Seychelles). The workshop was co-sponsored by the Governments of Sweden (Sida) and the International

The goal was to identify a priority coral reef action agenda for the region

Coral Reef Action Network (ICRAN), and attended by seventy six participants from 26 countries, comprising 16 countries or regions in or bordering the Indian Ocean and 10 others.

The workshop goal was for nations and organizations in the Indian Ocean to identify a priority coral reef action agenda for the region, and strategies for its implementation. The workshop noted the massive coral reef destruction caused by coral bleaching and mortality following the El Niño in 1997-98, over and above the many local threats due to anthropogenic activities such as destructive fishing

and overfishing, eutrophication, sedimentation, and localized destructive uses of reefs such as coral mining. However, corals and coral reefs are recovering on many reefs in the region. The workshop also noted that a large number of research and management initiatives are underway in the Indian Ocean with beneficial effects on coral reefs, particularly through active management in Marine Protected Areas.

The workshop covered several major themes:

Planning for coral reef conservation in the Indian Ocean

Participants strongly recommended greater activity in a regional committee or task force. This will be aligned with the Nairobi Convention (the Convention for the Protection, Management and Development of the Marine and Coastal Environment of

the Eastern African Region) and the UNEP Regional Seas programme, to maximize government commitment to coral reefs and consistency of NGO, research and other activities on coral reefs.

Global Climate Change and Impacts to Coral Reefs

Presentations focused on coral bleaching, indices predicting bleaching related to global climate change, and variation induced by local features. The workshop recommended improving access to and measurement of relevant climate data (particularly sea surface temperatures) for early warning and analysis in the Indian Ocean, as well as supporting and expanding the long term biological monitoring already conducted by institutions in the region.

Coral reef restoration and rehabilitation

Participants considered whether active restoration, such as transplanting coral, was effective and also weighed up the spin-off benefits of restoration including better awareness and participation among local communities. The workshop emphasized that the first priority of restoration is to mitigate threats and that restoration efforts need to consider direct costs as well as reasonable estimates of benefits.

Marine protected area management

The Indian Ocean contains a number of models of Marine Protected Area (MPA) management, from government-controlled, through community-based to private sector. The workshop recognized the need to expand MPA coverage in a representative, effective and comprehensive network and the need to invest in capacity building, training and increased stakeholder participation in existing MPAs. The roles of education and awareness, capacity building and of monitoring the effectiveness of MPA management were also recognized.

Socio-economic assessments and monitoring

The need to make socio-economic assessments and monitoring of coral reefs comparable to biological efforts is increasingly recognized worldwide. Participants emphasized the need for further studies, particularly around MPAs where an existing management framework can use the information.

Capacity building through education of MPA managers and stakeholders, and training of socio-economists is a high priority, as well as the need to collate information from existing sources.

International trade in coral reef organisms

International Trade in coral reef organisms was identified as a priority issue at the East Asia Regional Workshop in April 2001. Impacts of the trade in the Indian Ocean are small and localized, but likely to increase as the trade expands. Recommendations focused on proactive establishment of restrictions and monitoring systems to limit negative impacts of the trade in the region.

ICRI and regional coordinating mechanisms

A central theme identified in the workshop was the need for ICRI to build on existing regional mechanisms to support the ICRI Action Agenda.

For the Indian Ocean, the workshop called for alignment of ICRI activities with co-ordinating mechanisms in the Nairobi Convention through its new biennial workplan for 2002-2003 (i.e. through a new Coral Reef Task Force). This proposal was endorsed by the ICRI Coordinating and Planning Committee meeting that followed the regional workshop (November 29-30, 2001) and was tabled before a Ministerial meeting of the Conference of Parties to the Nairobi Convention the following week (December 5-7, 2001).

The Conference of Parties welcomed the support from scientists, organizations and countries within the region, and of ICRI as a global body, in the work of protecting coral reefs in the region, laying a strong foundation for coral reef research, conservation and management at the regional level for 2002-2003.

Workshop Outputs

Two outputs will be prepared summarizing the outcomes of the ICRI Indian Ocean workshop:

- (1) a 4-6 page summary report of the ICRI Indian Ocean workshop and priority recommendations; and
- (2) a workshop proceedings comprising the presentation papers, working group recommendations and finalized ICRI Recommendations for the Indian Ocean (in preparation).

For further information on the Indian Ocean workshop, or to obtain documents please contact the author David Obura at CORDIO, email dobura@africaonline.co.ke, Rolph Payet, UNEP-RCU, rolphap@seychelles.net, or ICRI Secretariat, secretariat@icrforum.org

For information on the International ICRI Caribbean / Tropical Atlantic regional workshop (May 02) contact Daniella Guevara Munoz - dguevara@conanp.gob.me, Alessandra Vanzella - Khouri ark.uneprcuja@cwjamaica.com, the ICRI Forum www.icrforum.org; or the ICRI Secretariat, secretariat@icrforum.org

For information on the 2nd ITMEMS contact www.icrforum.org or secretariat@icrforum.org

Second International Tropical Marine Ecosystem Management Symposium (2nd ITMEMS)

25-28 November, 2002, Manila, Philippines

Tropical marine ecosystems are under increasing pressure from many sources, including coastal land use and development, pollution, unsustainable fishing and tourism and the impacts of global climate change. Therefore, effective management that promotes sustainable use of marine resources is essential. The 2nd International Tropical Marine Ecosystems Management Symposium (2nd ITMEMS) will provide an opportunity for managers to engage in multidisciplinary discussions and share experiences and lessons learned to identify gaps and priorities for future management action.

The outputs and recommendations from the symposium will be disseminated through the partners of ICRI (including member countries, the

International Coral Reef Action Network, IUCN, UNEP, WWF, the World Bank, donor agencies, etc.) and considered in the implementation of management programs for tropical ecosystems at local, national, regional and global levels.

The 2nd ITMEMS will be conducted through a number of concurrent workshops that address the topics listed below. Each workshop will start with presentations of exemplary case studies that illustrate relevant experiences and lessons learned either by their successes or, equally importantly, their inadequacies. These will form the basis for subsequent facilitated discussions that aim to achieve clear recommendations and priorities for the management of tropical ecosystems in the future. The results

of each workshop will then be reported back to all participants and discussed in plenary sessions. The number of participants in each workshop group will be limited to approximately 20.

The organising committee welcomes nominations of case studies (deadline 30th of April, 2002) that effectively illustrate appropriate experiences and lessons learned in each of the topics listed above. In addition, we are aiming to present examples from throughout the world and that have been implemented on a range of geographic scales from local to global. Also, feel free to contribute comments on the preliminary selection of topics and suggestions for the inclusion of additional topics. Case studies that facilitate the achievement of the goals of the symposium most effectively will then be invited as an oral presentation.

Please submit your expression of interest to participate in the symposium to the ICRI Secretariat. The cost of registration will be announced closer to the event.

The 2nd ITMEMS is organized by International Coral Reef Initiative (ICRI) and Department of Environment and Natural Resources (DENR), Philippines for more information contact the ICRI Secretariat: (secretariat@icriforum.org) Fax: +632 926 2693

**For proceedings of 1st ITMEMS: www.gbrmpa.gov.au/corp_site/info_services/publications/itmems/*

- 25 Bazaruto Archipelago *K Newman*
IGOS coral reef theme *A Dahl*
- 27 **News cont.**
Coral Status 2002 - can you help? *C Wilkinson*
- 28 **Bookshelf**
People of the reefs
Conserve online
- 29 Fisheries investigations and management implications in marine protected areas of the Caribbean
Water quality conservation in marine protected areas
Coral reef conservation in marine protected areas
Philippine coral reefs: a natural history guide *R Farrarons*
Coral reefs of the Indian Ocean - their ecology and conservation
- 30 **Feature**
Success in Soufriere *F Gell*
- 33 **Reef Briefs** *M Watson*
- 35 **Book Review** *reviewed by*
Collaborative reef and reef fisheries management in Tanga, Tanzania *T McClanahan*
- 36 The larvae of Indo Pacific coastal fishes *S Swearer*
- 37 Economic constraints to the management of marine protected areas *M Watson*
- 38 **Who's who**
Large-scale links, large-scale lessons
- 39 **Meeting Reports**
Developing indicators of marine protected area management effectiveness
- 40 International coral reef initiative Indian Ocean regional workshop *D Obura*
- 42 **Diary**
2nd ITMEMS
Converging currents: science policy and culture at the coast

Preliminary topics for workshop sessions include:

- co-management and social impacts of marine and coastal management;
- economic benefits of conservation and sustainable use;
- the role of the private sector in protection and management;
- the role of protected areas and management;
- monitoring to facilitate successful management;
- management to mitigate the effects of climate change;
- dissemination of information for coastal and marine management;
- targeted research for management support;
- securing sustainable funding for management;
- restoration and rehabilitation of damaged ecosystems; and
- achieving sustainable fisheries.

Converging Currents: Science, Policy and Culture at the Coast

The Coastal Society's 18th International Conference, Galveston, Texas, USA. May 19 - 22, 2002

Exploring interrelationships among the physical, ecological, cultural and political currents that converge around the coasts of the USA by concentrating on three themes:

- Coastal Watersheds and Estuaries: Exploring the Vital Link Between Land and Water.
- Ecosystem Perspectives at the Regional Scale: The Gulf of Mexico Case Study.
- National Treasures and the International Commons: Ocean Resources in the 21st Century.

Website: <http://www.thecoastalsociety.org/tcs18/> Email: coastalsoc@aol.com