MEMBERSHIP

The annual subscription for individual membership of **ISRS** is currently US$80, provided renewal payments are made by 1st March each year. Individual and Family Members receive the journal **Coral Reefs**, the magazine **Reef Encounter** and other periodic mailings. Family membership is US$90. Student membership costs US$25 and benefits include all of the above except the journal **Coral Reefs**.

The Category - Sustaining Member- is for those supporting the society with a subscription of $200. In addition to other benefits, sustaining members will see their names printed in each issue of **Reef Encounter**.

Renewals received between 1 March and 30 April will cost US$30 for a student member, US$90 for a full member and US$100 for a family membership. Those received after 1st May will cost US$32, US$100 and US$110 respectively. New members can join at the base rate of US$25, US$80 and US$90 at any time of the year. Financial assistance may be available to prospective members with legitimate needs. Please contact **ISRS** Corresponding Secretary Richard Aronson at raronson@jaguar1.usouthal.edu.

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

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

NOTES FOR CONTRIBUTORS

Reef Encounter is the International Society for Reef Studies' magazine-style newsletter. In addition to our main feature articles, we include news on all aspects of reef science, including meetings, expeditions, book reviews, and information on student opportunities. We encourage discussion and debate on issues concerning reefs or the **ISRS**, and we welcome letters to the Editor for our correspondence column (Upwellings). We aim to complement the Society's journal, **Coral Reefs**, by publishing brief reviews of recent trends and developments that bear on reef studies. Please note that **Reef Encounter** does not publish original scientific data. We do, however, have a section reporting on recent publications (Reef Briefs). To have a paper included, please send a copy (reprint or corrected proofs only) to the Editor. Articles should range between 200 and 2000 words. Except in exceptional circumstances, text should be sent by email to bprecht@pbsj.com.

Reef Encounter has an informal and journalistic style, and while references are permitted, they should be kept to a minimum. Please number references in the text using superscript, and list them at the end of the article in the order in which they are cited, first through the text, and then through the table and figure legends. Each reference should have a unique number, and references should not be combined. Avoid the use of op.cit. or ibid, and use World List abbreviations. In all other aspects, references should follow the style prescribed for **Coral Reefs**.

We particularly welcome artwork and photographs to help us illustrate the magazine. Images can be sent as hard copy to the Editor. Electronic images should have a resolution of 350 dpi and must be a size appropriate for the magazine format. In particular, we cannot enlarge small electronic images and retain publishable quality. We prefer tiff format files. Where images are included in the article, please send legends and/or captions separately (not in the image file). Explain all symbols, abbreviations, shading patterns, etc. Maps should have a scale and indicate orientation. Please use either metric units or imperial with metric units. Please send with your article a short 'by-line' explaining who you are. Include your full address and email details which will be published with your article. We have no regular reprint system, but contributors who are not already members will receive a free copy of the relevant issue. Please consider joining the Society if you are not already a member!

We acknowledge contributions by email. If you do not receive an acknowledgement within one week of submitting electronic material, please contact us to verify that it was received. We reserve the right to edit text to achieve a consistent style, and to minimize our changes you should use recent issues as style guides. We do not usually return articles for checking unless we consider our editorial changes may have altered your meaning. Articles are not refereed, and opinions expressed and errors of fact remain largely the author's responsibility. No published item should be taken as **ISRS** opinion unless indicated. Please note that **Reef Encounter** is an entirely voluntary effort. We do not have funds to pay contributors, and the editors are also unpaid.

We welcome contributions regardless of when they arrive. Submissions for issue 34 are due by 1 October 2005. If you are planning a substantial contribution, it will help the Editor plan ahead by contacting him well in advance of the deadline. Thank you for your support.

DEADLINE FOR COPY FOR REEF ENCOUNTER 34
(DUE OUT EARLY 2006) IS 1 OCTOBER 2005

Please send correspondence and submissions to one of these addresses:

Editor, William F. Precht, PBS&J, 2001 NW 107th Avenue, Miami, FL 33172. Email: bprecht@pbsj.com

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APPLICATION FORM FOR MEMBERSHIP

Name: .....
Address: .....
.....
.....
Title: .....
Fields of Interest: .....

Bank drafts and cheques to be made payable to: International Society for Reef Studies. If a receipt is required, please request it at the time of payment. Send completed application forms and payment to ISRS, P.O. Box 1897, Lawrence, Kansas 66044-8897, USA.

I/We enclose a cheque (in US$ ONLY please) of:
..... US$80 for FULL membership
..... US$90 for FAMILY membership
..... US$25 for STUDENT membership
..... US$200 for SUSTAINING membership

Credit Card Payment: VISA/Mastercard

No. ..... Expir. Date .....

Signature .....

Number 33 October 2005

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Magazine of the International Society for Reef Studies

Editor William F Precht
Associate Editors Martha L Robbart and Beth Zimmer
bprecht@pbsj.com

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(Contents continued on inside back cover)

Reef Encounter is printed on recycled paper by Allen Press Inc., 810 East Tenth, Lawrence, KS 66044, USA.

Cover image: This photo of a spotted eagle ray was taken on the Belizian barrier reef in 2004 by Dr. Ian Macintyre.

COPY DEADLINE FOR REEF ENCOUNTER 34
(due out early 2006) is 1 October 2005

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

Its aim under the consttution 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

Welcome to the 33rd edition of **Reef Encounter**. This edition is rife with topics of interest to the **ISRS** community, including changes to the ISRS Council and Offices. We have included two articles relating to the **ISRS** membership survey (*Who are we? A Survey of the ISRS Membership* and *Strengthening the ISRS*). Be sure to note the 10th ICRS Declaration (**ISRS News**), which was adopted in Okinawa. The **Currents** section contains articles from a variety of locales, including Australia, India, Borneo, American Samoa, Belize, and Fiji and describes two educational programs for local children.

We would like to express our appreciation to all the contributors for this issue. The next issue is due out in early 2006, so please contribute submissions before October 1, 2005. Reef Encounter welcomes all articles or announcements that may be of interest to the **ISRS** community. We look forward to hearing from you!

WF Precht, B Zimmer and ML Robbart

ISRS NEWS

From the President

With the 10th ICRS over and this second issue of RE after a break, let us briefly consider some ways in which the Society is changing and better positioning itself to meet these challenging times. First of all, though, I hope most who attended agree that the 10th ICRS set new records in the series, based on the quality and disciplinary breadth of presentations and also in its time efficiency, despite the meeting's huge size. This was the first large meeting I have ever been to where everything went like clockwork. I thank our JCRS partners for this huge success, but it is also a major scientific event of which we should be proud as a Society! Thanks in particular to Kathleen Sullivan Sealey for so ably leading this task. The Web site alone is something to be proud of, and Rob van Woesik and the Florida Institute of Technology are especially to be thanked for taking on that task and getting the site off to such an excellent new start. Our journal, skilfully edited by Dick Dodge and his team, goes from strength to academic strength. With help from the donors and The Ocean Conservancy, the Society's fellows are being substantially assisted to gain relevant experience and contribute to the understanding of reef ecosystems. Our gratitude extends also to Bill Precht and his team for picking up the job of editing and producing this newsletter. In Okinawa, the ISRS issued three briefing papers (on marine protected areas, reef fisheries, and effects of land runoff) which make sound scientific assessments of difficult topics of concern accessible to the wider community. These are downloadable from the web site along with attractive posters.

Thanks to our Corresponding Secretary, Pete Mumby, and the team at Allen Press, for our first e-election.

This mechanism brings with it possibilities for interaction and wider involvement such as we've never had before. The Society is run by a volunteer team, but with the will and extra resources it can do more. We must be out there looking for ways to contribute. The ISRS is **THE** world scientific body concerned with coral reefs. As coral reefs are probably the most threatened of the planet's marine ecosystems, the Society occupies a pivotal position. Key decisions are being and will be made, and the Society can help to make sure that these are as well and objectively guided as they can be, because its members and officers are globally the best informed about reefs. Fortunately, the ISRS is moving, in some ways quite profoundly, and I hope it is now better positioning itself to foster the science and provide firmer foundations for the management challenges ahead.

Nicholas Polunin
ISRS President
University of Newcastle, England

Strengthening the ISRS

In their report in this issue, entitled *Who are we?*, McClanahan and Nzuki provide the first comprehensive analysis of the membership of the ISRS. This survey was requested at the meeting of the ISRS Council (Kansas 2003) with the goal of determining how our Society, the world scientific body concerned with coral reefs, might strengthen itself institutionally at what appears to many of us to be a crucial time. If the Society membership is better known, then the hope is that the ISRS will be better positioned to foster interactions among its members, and may be better able to prepare itself to contribute to major tasks in reef science and management as they arise.

The membership survey highlights a number of important things about the ISRS. First, biodiversity and conservation of corals and fish in marine protected areas in the Caribbean and the Indo-Pacific regions are the major foci of the current ISRS members. This does signify a considerable challenge, if the results of investigations are to be applied at a pan-tropical level when possible. People doing the application are conservation Non-governmental Organizations (NGO), International Government Organiza-

tions (IGO), and national government employees, which are not well represented in the ISRS membership. Additionally, there are considerably large and diverse areas of coral reef outside of the present major regional foci that demand relevant work, and where appropriate funding and membership are desirable.

What changes might be initiated to attempt to compensate for these weaknesses? Some changes might be cosmetic, albeit important, while other potential options are more substantial. Cosmetic changes should be geared towards attracting a broader membership by increasing the Society's attractiveness to the underrepresented groups. Like the existing members, many conservation and management people are attracted to the beauty of coral reefs and there is a need to incorporate this into all of our publications and public image. This might extend to the cover of the Society's journal (*Coral Reefs*), this newsletter, the Society's Web pages, and the ISRS briefing papers and posters. The Society has one of the most strikingly beautiful ecosystems on the planet as its subject, and maybe this needs to be more fully promoted in all publications and public images of the ISRS. We welcome ideas as to what needs doing and how it should be done.

Of greater substance than these image-related issues is the information that the Society's members provide. There is a need to broaden the scope of existing publications to embrace the interests of underrepresented groups. Such people are likely to be interested in policy, management, economics, and the whole underrepresented human and social side of coral reef use and management. For example, the Society, as a whole, needs to consider how the journal and this newsletter can broaden their focus. This might mean increasing the types and scope of material eligible for publication (including, perhaps, an editorial in every journal issue) and the addition of policy, management, and social science sections that invite regular or frequent submissions.

In addition to broadening the information base, the Society might increase its explicit representation at global forums that address coral reef and related issues, including climate change, fishing, park management, pollution, and biodiversity assessment. The Society needs to seek stronger links with these forums and assure that its officers, councilors, and members are representing the ISRS and are directly involved in the processes and decisions, even if this means that the Society covers the costs of their attendance and involvement. In addition, the Society might consider cosponsoring these types of meetings and encouraging members to attend them by reducing registration fees. Some clear examples are the developing International Tropical Marine Ecosystems Management Symposium (ITMEMS) and Intergovernmental Panel on Climate Change (IPCC) meetings. Co-sponsorship of such meetings would make it clear that the ISRS seeks involvement and commitment to these programs and seeks their membership.

The results of the survey by McClanahan and Nzuki will be posted on the ISRS web site (now hosted by the Florida Institute of Technology) in order for all ISRS members to be more aware of whom it is that makes up the Society and to help monitor changes in direction and membership. The Society intends to periodically revisit the responses and consider the trends. In due course, it is hoped that the membership directory will contain the sub-disciplines of members in order to identify expertise and facilitate communication. The hope is that this self-assessment becomes a regular part of the Society's business and encourages the needed engagement by our world scientific body in local and global environmental concerns affecting coral reefs.

Tim McClanahan
ISRS Council member
Wildlife Conservation Society, Kenya

Nicholas Polunin
ISRS President
University of Newcastle, England

2004 ISRS Election Results

The results of the International Society for Reef Studies 2004 election are in. The results are:

ISRS Treasurer - John WARE

ISRS Recording Secretary - Robert VAN WOESIK

ISRS New Councilors (2005-08): Rolf BAK, Annadel CABANBAN, Yoshimi SUZUKI, Bernhard RIEGL, Guillermo DIAZ PULLIDO, and Lawrence McCOOK.

Welcome back John, Rob, and Rolf, and welcome Annadel, Yoshimi, Bernhard, Guillermo, and Lawrence. The President, Vice-President, Corresponding Secretary and existing Councilors look forward to having you on the team!

10th International Coral Reef Symposium Declaration on Conservation and Restoration of Endangered Coral Reefs of the World

At the closing ceremony of the 10th International Coral Reef Symposium in Okinawa, Japan, the participants agreed to issue the following Declaration:

> Coral reefs and associated ecosystems are invaluable human treasures. They support the most diverse marine communities and beautiful seascapes on the planet, and provide wave-resistant structures and resources for local communities, fisheries, and tourism. However, coral reefs and associated ecosystems are now under serious threat of collapse because of over fishing, development of the coastal zone, including dredging and landfill, and terrestrial run-off. Moreover, the increase in sea surface temperatures, the decrease in carbonate levels as well as sea-level rise, caused by increasing anthropogenic CO2 in the atmosphere, all act synergistically to stress coral reefs, which lead to severe bleaching and extensive coral mortality. The degradation of coral reefs by local, regional, and global environmental stresses is at the very least destroying the health, function, and positive values associated with coral reefs, and at the worst leading to loss of this treasure.
>
> We, the participants of the 10th International Coral Reef Symposium (28 June to 2 July, 2004, Okinawa, Japan) acknowledge that the degradation of coral reefs worldwide has now reached a critical stage. We declare in the strongest terms that additional destruction of coral reefs must be avoided and more effort is necessary to prevent further reef demise. Conservation and restoration of coral reefs should be made without delay in each nation acting individually and in concert through closer international cooperation. To this end, we advocate scientific research and rigorous monitoring, management-tool development, and appropriate measures for conservation and sustainable use of coral reefs. In addition, scientifically sound restoration measures for already-degraded coral reefs must be applied.
>
> A twin strategy must be taken over the longer term to reduce human induced climate change by reducing greenhouse gases, but at the same time a reduction in CO2 must be matched by action to reduce immediate threats of declining water quality because of land-use changes and pollution, and mass exploitation of fish biomass. To achieve these goals, we recommend four key strategies: 1) achieve sustainable fishery on coral reefs, 2) increase effective marine protected areas on coral reefs, 3) ameliorate land-use change impacts, and 4) develop technology for coral reef restoration. Such efforts must be fostered and sustained through stewardship and cooperation among scientists, managers, policymakers, non-governmental organizations, and the general public. The task must be enhanced through international linkages among the principal global scientific body (International Society for Reef Studies [ISRS]), the main international management initiative (International Coral Reef Initiative [ICRI]), as well as leading international organizations (e.g. UNESCO, UNEP, IUCN) and NGOs.
>
> As participants in the 10th International Coral Reef Symposium, we collectively appeal to all researchers, managers, users, and lovers of coral reefs to accomplish the above tasks, and we urge relevant international organizations, national governments, and NGOs to find common understanding and means to collaborate towards this goal."

The Declaration is currently available to the public on the ICRS website under the "News and Update" section: http://www2.ims-plaza.co.jp/icrs2004/

11th International Coral Reef Symposium Announcement

The 11th International Coral Reef Symposium (ICRS) will be held in Ft. Lauderdale, Florida in 2008. The ICRS will be hosted by Nova Southeastern University's National Coral Reef Institute (NCRI). http://www.nova.edu/ocean/ncri/

The ICRS has not been held in the continental United States for over 30 years. Florida Governor Jeb Bush said about the ISRS's decision to hold the 11th ICRS in Florida: "The Sunshine State is a natural location for this prestigious gathering of ocean scientists. Florida's commitment to coastal protection serves as an international model. This meeting of the minds will increase protection for some of the world's most diverse and sensitive natural systems."

Best Paper Awards in Coral Reefs

Voting for best papers in the last few volumes of *Coral Reefs* has occurred. The votes were cast by Topic Editors and Advisory Editors of *Coral Reefs*. An announcement was made at the general ISRS meeting in Okinawa, Japan.The winners were:

- 2003: Volume 22: JM Guinotte, RW Buddemeier, and JA Kleypas: Future coral reef habitat marginality: temporal and spatial effects of climate change in the Pacific basin. (Issue 22:4; p. 551–558)
- 2002: Volume 21: PL Mumby: Does habitat availability determine geographical-scale abundances of coral-dwelling fishes? (Issue 21:1; p. 105–116)
- 2001: Volume 20: WK Fitt, BE Brown, ME Warner, and RP Dunne: Coral bleaching: interpretation of thermal tolerance limits and thermal thresholds in tropical corals. (Issue 20:1; p. 51–65)
- 2000: Volume 19: Anthony KRN: Enhanced particle-feeding capacity of corals on turbid reefs (Great Barrier Reef, Australia) (Issue 19:1; p. 59–67)

Congratulations to the Winners!

Who are we? A Survey of the ISRS Membership

If the International Society for Reef Studies (ISRS) is to continue to make efforts to increase its inclusiveness, its involvement with other organizations with similar missions, and to take part in real-world problem solving, it needs to better appraise itself of its members and what they do. What are the membership's strengths and weaknesses and in what directions should the ISRS consider going to achieve the broader missions of 1) engaging reef scientists and managers both in the ISRS and in the broader community of reef stakeholders and 2) influencing local and global issues in reef science, use, and management.

Below is a brief description and analysis of the survey that was undertaken during the last membership renewal, in response to a request from the Council of the ISRS. The questionnaire was developed and approved by the ISRS Council and distributed to members by Allen Press. Approximately half of the members responded to the questionnaire, but there was a systematic bias in the survey in that only those members who received a renewal were able to complete the survey. New members and members who renewed via phone, fax, or email were unable to participate in the survey. The ISRS member data and information are drawn from 16 geographic regions. The analysis of the data and information focused on education level, professional status, major areas of study, major geographic areas of work, and sub-disciplines of work. The survey results are presented as frequency distributions of responses to each of the questions and a chi-squared contingency analysis was performed to see if the sub-discipline interests of the members varied by regions and level of education.

Survey Results

The ISRS members constitute a well-educated group, with 79% of the members holding PhDs, 15% master's degrees, 5.3% bachelor degrees, and 0.5% with a primary school education (Fig. 1a). No member had only a secondary level education. Three quarters of the ISRS members are academics, with 55% working as lecturer-academic-professors, 10% as graduate students, 5% post-docs, and about 0.7% undergraduates (Fig. 1b). Around 10% are either national government employees or consultants and only a small group are employed by Non-governmental Organizations (NGO) or International Government Organizations (IGO). Most members study either biology or ecology (62.5%), with ecologists the dominant discipline (35.8%), followed by biology (26.7%), conservation, geology, and management (Fig. 1c). Physical and chemical oceanography are the least-studied disciplines. ISRS members' work is mostly focused on the Caribbean (32%) and Atlantic (9%) regions, followed by Southeast Asia and Australia. Most other regions are studied by less than 12% of the members (Fig. 1d). The membership is most involved in studies focusing on marine protected areas (18%), with corals, fish, and biodiversity assessment as focal groups (Fig. 2). Climate change, larval biology, population dynamics, evolution, water quality, and fossil reefs are also common foci.

Education level and regional focus do not influence the broad professional foci ($p > 0.05$). Thus, there is a balanced distribution of ISRS member expertise in the respective disciplines across the various regions. However, tests for independence among the individual sub-disciplines with respect to the geographic areas revealed

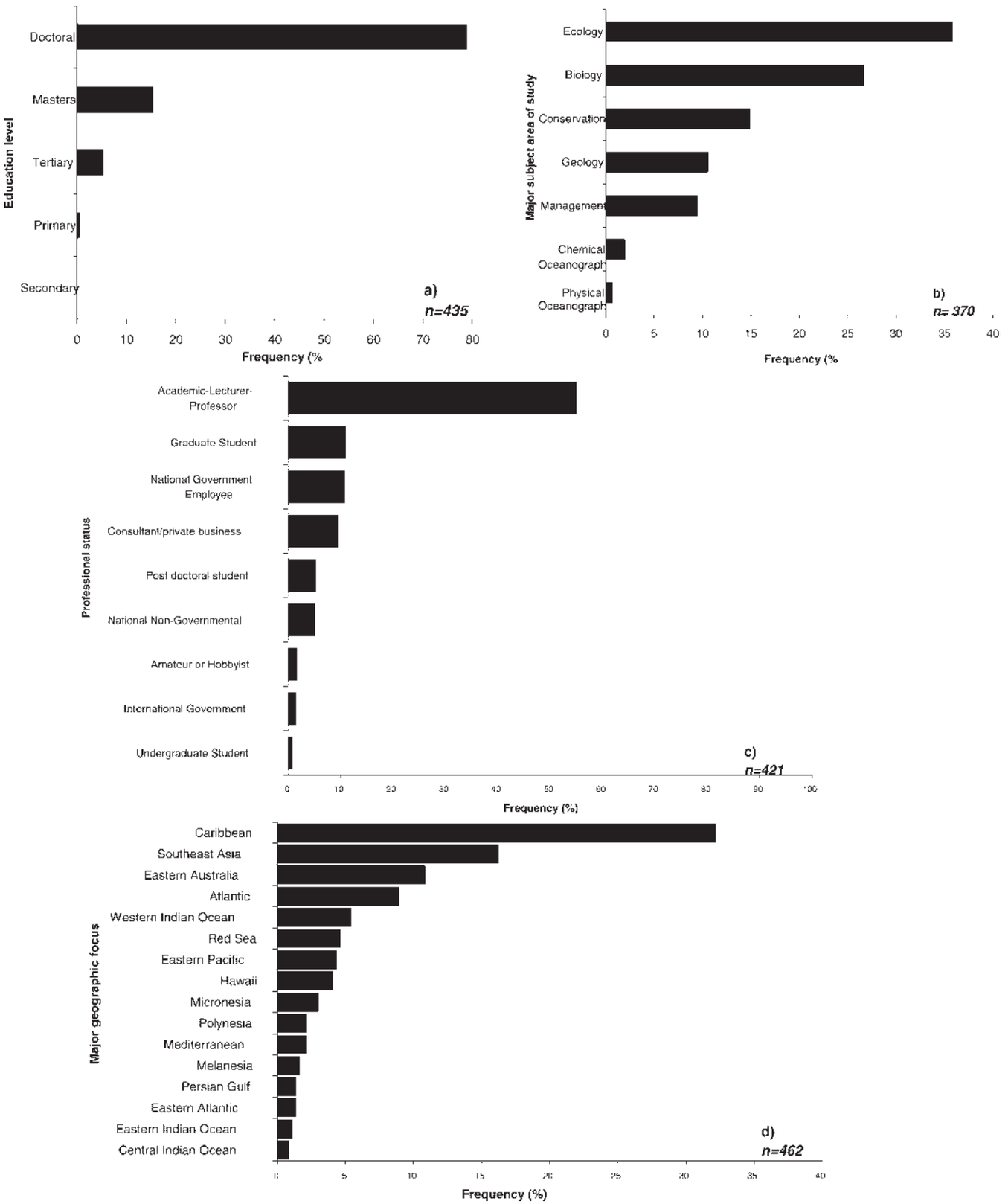

Figure 1. Frequency (%) bar graphs showing (a) education level, (b) major subject area of study, (c) professional status, and (d) major geographic region of work for ISRS members.

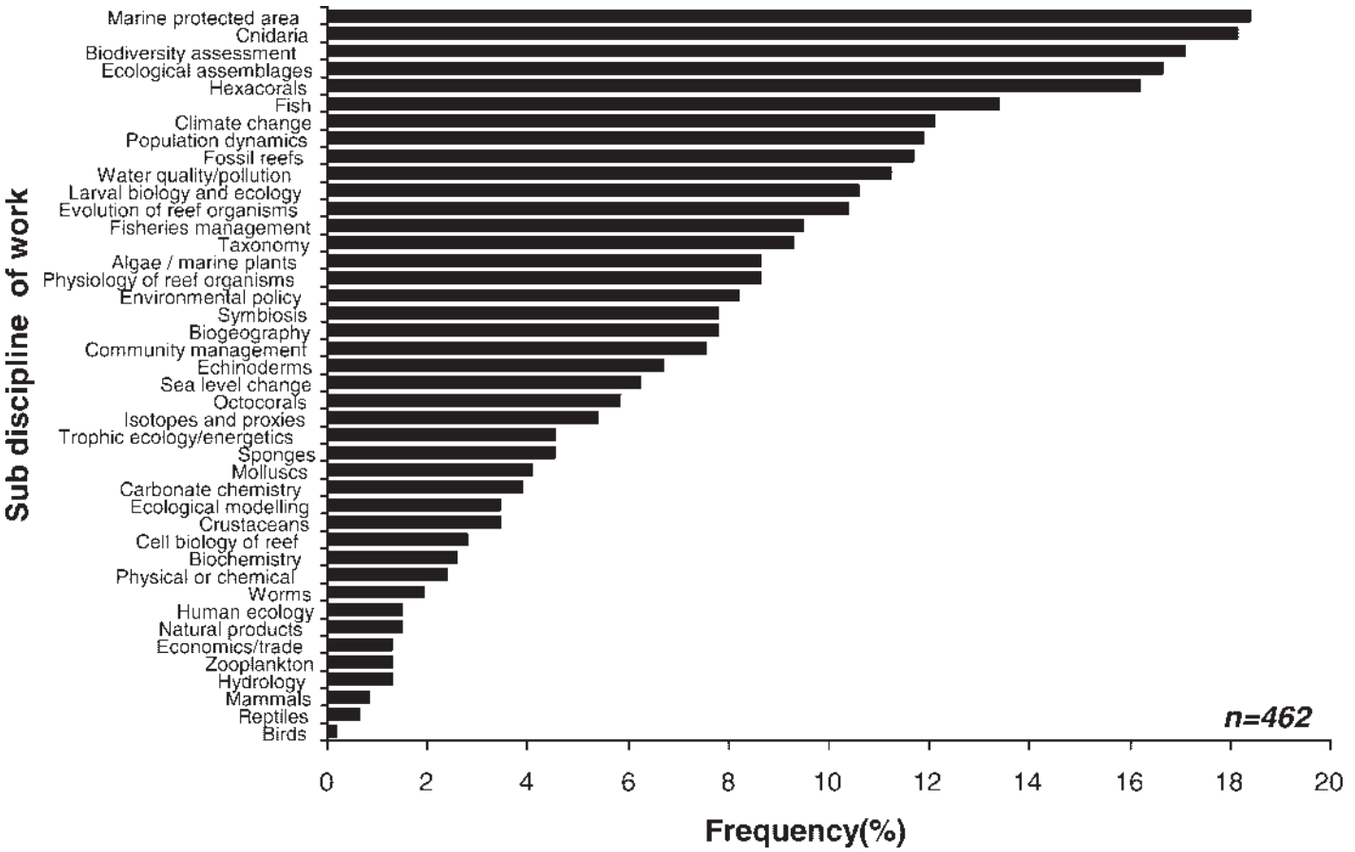

Figure 2. Frequency (%) bar graph showing the sub disciplines of ISRS members.

significant χ^2 values for a number of sub-disciplines in some of the regions relative to those in others. For example, the Central Indian Ocean region has more ISRS members studying mammals (χ^2=12.0, DF=1, p> 0.05) and birds (χ^2=37.1, DF=1, p> 0.05) than the other region. Similarly, more ISRS members focusing on the Mediterranean region are studying fossil reefs (χ^2= 3.9, DF=1, p> 0.05), while the Melanesia and Eastern Indian Ocean regions have more members studying molluscs (χ^2= 4.0, DF=1, p> 0.05) and physical oceanography (χ^2=5.41, DF=1, p> 0.05).

The relationship between the level of education and some of the sub-disciplines was found to be significant (p< 0.05). There are fewer master's degree holders studying climate change than PhD holders (χ^2=4.2, DF=1, p> 0.05). The water quality/pollution sub-discipline showed lower numbers for masters and primary education levels respectively (χ^2=4.8 and 4.7, DF=1, p> 0.05). There were also fewer tertiary level members studying cell biology of reef organisms (χ^2=4.4, DF=1, P> 0.05), algae/marine plants (χ^2=4.0, DF=1, P> 0.05), and Cnidaria (χ^2=7.2, DF=1, p> p0.05). None of the members in the primary level category study symbiosis (χ^2=7.8, DF=1, P> 0.05), population dynamics (χ^2=4.6, DF=1, p> 0.05), or community management (χ^2=8.07, DF=1, P> 0.05).

Conclusions

As a gross generalization, the ISRS is a society of academics that study the biodiversity and conservation of corals and fish in marine protected areas of the Caribbean and Indo-Pacific regions. There is, however, a considerable spread of expertise as shown by the generally low dominance of the various sub disciplines, with the top-most listed sub discipline, marine protected areas, being listed by only 18% of the members. Consequently, Society members are broad in their academic interests, if not broad in professional employment or regional interests. This is not entirely surprising for a Society where the main output is in peer-reviewed journals and where funding levels are probably greatly influenced by the implicit or explicit regional priorities of donors. The narrowness of professional employment and regional interests of Society members is an issue that the Society needs to consider if it is to engage itself with issues beyond the science of coral reefs.

Tim McClanahan and
Simmons Nzuki

NEWS

ISI Essential Science Indicators[SM] Special Topics Report on Coral Reef Literature Citations

The ISI Essential Science Indicators[SM] have posted a special topics report on coral reef citations. A database was created spanning literature published from 1994–2004 using the keywords "coral reef." The database was used to generate lists of the top 20 papers (two-year and ten-year periods), authors, journals, institutions, and nations cited during a time span of 1994–2004 (third bimonthly). Results of this report are available on-line at: http://www.esi-topics.com/coralreef/index.html

UPWELLINGS

Open Letter Concerning the Management of the Bunaken National Park, North Sulawesi, Indonesia

Bunaken National Park (Park), located in the province of North Sulawesi in Indonesia, was established in 1991 and consists of 75,265 hectares of underwater area around islands in the Bunaken group (Bunaken, Manado Tua, Siladen, Montehague, and Nain Islands) and islands that face the Sulwesi Sea. A group of French divers, teachers, and researchers, we spent two weeks diving in the Park in the summer of 2002. Our goal for this trip was to gain a better understanding of the submarine fauna of the area. We stayed on the tiny island of Siladen, a stone's throw northeast of Bunaken. Diving at this location is superb and biodiversity is exceptional. Little damage from fish bombing is visible, in part because the reefs are so steep and the drop-off is so close to shore. Because of this, we believe that the creation of a marine park around Bunaken is an excellent idea.

Each of us willingly paid a Park tax of 150,000 rupees (US$16), as we do not mind paying when our contribution helps to develop protection measures. In that sense, by creating business and employment opportunities through tourist services, dive tourism provides an alternative to destructive fishing methods for the local community[1]. Moreover, dive tourism gives local communities an incentive to actively conserve coral reefs by establishing marine sanctuaries and installing reef protection facilities[2]. Sanders et al.[3] found that non-local tourists visiting Bunaken National Park presented a recreational value of approximately US$328/person/year in 1996. When aggregated to all non-local tourists, a total recreational value of US$4.2 million/year was estimated[1]. Therefore, dive tourism is a great source of revenue for people living in and around Bunaken National Park.

We would like to note several problems that we observed during our trip relating to enforcement within the Park and the tourist resort being built on Siladen. On our numerous dives around the island of Siladen, we never saw that the reefs were closely monitored by the Park. Only four Park employees came to verify that we had paid the Park's diving tax. In addition, we found some aspects of the tourist resort being built on Siladen troubling. We did not observe any drainage system or equipment for wastewater treatment. Will wastewater be released onto the reef or into the thin aquifer? Siladen has very little fresh water for its inhabitants. The resort is planning to fill the swimming pool with fresh water, but does the island have sufficient water resources for this? The pool was filled once as a trial test, which resulted in the dry-out of all of the island's wells. We have also observed pieces of rubble stone, insulation boards, and half-charred plastic on the beach and in the water in the vicinity of the resort. The herbarium and the beach have become a garbage heap for substances that are not biodegradable. Last year, the property developer was granted permission to cut trees for several months in order landscape the resort and grow a lawn. Since the roots of these trees had maintained the sand and soil in place, what will be the result of these actions? It is a well-known fact that heavy wave action can cause destructive erosion on the island. We also know that luxury resorts have been constructed on similar islands and subsequently abandoned (e.g. Gili Meno, just off the west coast of Lombok). Why create a National Park if a property developer can build tourist resorts without taking into consideration the mid- and long-term consequences?

Acknowledgements: We would like to thank all the participants (members of the submarine biology committee of the French Federation of SCUBA diving) and all others who assisted us in the field. We would like to extend our sincere thanks to Ginette Allard for the organization of the SCUBA diving trip in Indonesia.

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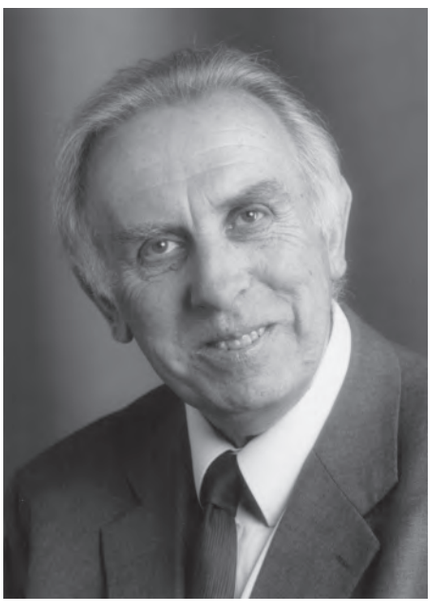
OBITUARIES

Erik Flügel (April 6, 1934–April 14, 2004)

"He was a giant in his field" was Ian Macintyre's spontaneous reaction upon learning that Erik Flügel had passed away. Indeed, Flügel was outstanding in many ways. A leading researcher in paleontology (and geology) since 1973, he attracted thousands of participants to his inter-university courses on the topic of facies analysis and facies models in carbonates. His pre-eminent didactic abilities came into play particularly during his lectures where he developed multi-colored diagrams and color codes to differentiate between the various ages, between which he moved like a fish in water to delineate the reef facies. He also was a far-sighted science manager who promoted the paleontology discipline by linking it to geological and biological sciences. His oeuvre, which comprises some 260 papers and several books (e.g. "Phanerozoic Reef Patterns," co-edited by Erik Flügel, Wolfgang Kiessling, and Jan Golonka in 2002 as SEPM Special Publication vol. 72), can be adequately acknowledged only by paleontologists.

Erik Flügel was born near Graz, Austria in 1934. He completed his PhD thesis on Devonian hydrozoans of the Graz area in 1957. After five years at the Natural History Museum in Vienna, he moved to the Technical University of Darmstadt (near Frankfort) where he became a professor of paleontology



(1968) and Geology (1971). It was in 1972 when he took over the chair of the newly founded Institute of Paleontology at the University of Erlangen-Nuremberg, which he developed into a renowned institution world-wide. He retired from his official duties in 1999, though he continued with his scientific work which was acknowledged by outstanding honors (e.g. Honorary Fellow of the Geological Society of America).

I came into a closer collaboration with him from 1990-1996 during the Priority Research Programme "Global and Regional Controls of Biogenic Sedimentation - Reef Evolution and Cretaceous Sedimentation," funded by the Deutsche Forschungsgemeinschaft (DFG). Erik Flügel prepared and coordinated this project, which included up to 140 representatives of paleontology, geology, ecology, microbiology, oceanography, biochemistry, and physics. The project contributed new insights to reef formation through the ages.

As many readers are researchers into present reef ecology and coral physiology, we have a less developed understanding for the timeline of reef development measured in thousands and millions of years. This becomes evident when one recognizes that reefs have been in existence for ca. 2 billion years and that "modern" reefs have been in existence for only 1 - 10 % of this time. Flügel's merit brought awareness of the importance of a collaborative view on the past and present to paleontologists as well as biologists. He aptly described the benefits of the collaborative approach in his foreword to the exhibition "Cities under Water" (Naturmuseum Senckenberg, Frankfort, 1997) from which the following is taken in an abbreviated form:

> The paleontological and geological information preserved in fossil reefs allows one to draw con-

clusions regarding the long-term and global scale of changes in reef structure and reef organisms, the time course and reasons for reef crises, and the correlation between biological diversity and environmental changes. The concurrent research in fossil and extant reefs provides an opportunity to evaluate the effects of "Global Change" in the past and allows predictions of what to expect in the future.

Many of the results of the Priority Programme as well as those of his numerous disciples were published in *FACIES*, the highly regarded interdisciplinary journal that Flügel founded with his wife, Erentraud Flügel-Kahler, and which reached 49 volumes under their joint editorship.

Flügel's death was untimely to say the least. He was one of the most active promoters of interdisciplinary research and his voice will be missed by many who fear that sectionalism will obscure a comprehensive view of past and present reef ecology.

Helmut Schuhmacher
Germany

Georg Scheer (August 17, 1910–March 14, 2004)

Georg Scheer was the nestor of German coral and reef workers. The decisive impulse to indulge in the world of corals came during two cruises on the *Xarifa*, a three-masted-schooner under the leadership of Hans Hass. These expeditions led him to the Caribbean, Galapagos, and Cocos Island (1953-54) and to the Red Sea, Maldives, and Nicobar Islands (1957-58). The second cruise especially yielded important reports on the respective coral fauna (co-authored by Gopinadha Pillai). It was also in the Maldives where he introduced the phytosociological method of Braun-Blanquet to study coral communities. These records are now valuable references to compare the present reef status after bleaching and other disturbances.

In 1960, Georg was appointed director of the zoology department of the Hessian State Museum in Darmstadt (near Frankfurt). One of his first exhibition projects was to build a coral reef (1:1 scale). Corals, fish, and other material were collected during an expedition to Port Sudan (central Red Sea) in 1962, which was done completely by train (except for the ship

transfer between Europe and Egypt and a passage on the river Nile)! The museum was his professional base, as it harbors his considerable coral collection. The neat hand-written labels, descriptions of diagrams, and sketches give an idea of his most accurate working style. From Darmstadt, he attended all ISRS symposia until 1985 (Tahiti). He became an honorary member of ISRS in 1987 at the European ISRS meeting in Marburg.

For the coral reef youngsters of today, it is noteworthy that he was one of the last witnesses of the early days of scientific diving. Moreover, his curriculum vitae already included remarkable milestones before he passed his PhD in zoology (ornithology – 1952). His first academic career was that of an electrical engineer (assistant professor at TU Darmstadt 1934-39). During the war (1939-45), he was sent to Peenemuende to join the team of Wernher von Braun, where he developed steering controls of rockets. After an intermezzo as a designer of toys and as a taxidermist, his second career started in 1949 with the study of biology in Darmstadt. His knowledge and skills as an engineer and a biologist qualified him for the team of the *Xarifa*, where he took responsibility for corals and birds as well as for the electricity system.

Georg survived his wife of 64 years, Anneliese, by three years. Both are survived by three children, eight grandchildren, and four great-grandchildren. See also Reef Encounter 28, p.10 for a description of the occasion of Georg's 90th anniversary.

Helmut Schuhmacher
Germany

Robert F. Dill (1927–2004)

The year was 1964 when I met Bob Dill. The occasion was a geological field trip in the Florida Keys. Bob showed up wearing a fake bloodshot eye. He told funny stories. His booming voice was full of fun. It was a surprise to discover he had kids who were almost my age! We hit it off so well that he stayed with us over the weekend so we could go scuba diving. What struck me was that everywhere we dove, he hand-fanned holes in the sand. In one place near a reef ledge, he exposed a hard rock surface under the sand in 25 feet of water. It was a brown calichee-coated surface that proved sea level had been lower. I might never have seen it. This was one

of Bob Dill's underwater techniques that I would see many times over the years. I too became a devoted hole-digger.

Twenty-five years later, Dill was bottom scratching and came upon what turned out to be giant living stromatolites in the Bahamas near Lee Stocking Island, home of the Caribbean Marine Research Laboratory. The only other known examples at the time were in the tidal zone at Shark Bay, Australia, and some small stromatolites near Eluthera, Bahamas. Dill had struck geological pay dirt once again by proving that stromatolites could grow below the intertidal zone and could also form in normal salinities. It became a cover story in *Nature* (1986).

Although I did not know Dill before 1964, I had heard and been fascinated by his lectures on sedimentary processes in submarine canyons. This kind of direct observation underwater science was a new frontier at the time. As a sideline to his work at the Naval Electronics laboratory in San Diego, Bob became a founding member of General Oceanographics. The focal points of the company were the little 2-person yellow *Nekton* submarines. The Nektons, including the more recent *Delta* submarine, were the brainchildren of his colleague Douglas Privitt. Some of the original members later formed the current Delta Oceanographics.

A few years ago, I learned even more of Dill's past and his contribution to geology and scientific diving. At an annual meeting of the American Association of Underwater Scientists, Bob and I put on a two-part program about scientific diving. I discussed the history of scientific diving on the East Coast and Dill covered the West Coast. For his presentation, he used a 1950s vintage 16-mm movie film. Watching people born in the computer age stare at the strange contraption with its whirling reels was entertaining in itself. What Bob showed was oceanographic history in the making. It featured four diving graduate students who, between them, could afford only two sets of a new invention called the wet suit. They took turns wearing the two suits, or sometimes one would wear the top while the other wore the bottom. These were young students who would become famous in the marine sciences. Included were Harris B. Stewart, Bill Menard, Bob Dill, and a professor, Dr. Edwin Hamilton. To make extra money, they hired their services to several California oil companies and called themselves Geological Diving Consultants (GDC). They measured dip and strike, using devices of their own design, of outcrops in the nearshore zone where state law prevented the use of explosives and traditional seismic methods. Their new underwater techniques were published in a 1954 volume of the *American Association of Petroleum Geologists Bulletin*. It was the first use of scuba diving to make these kinds of geological observations. Over a period of about 4 years, GDC had mapped from the Mexican border to the northern edge of California! Their measurements led to the discovery of closed anticlines, some of which are still producing oil. A trim, young, non-diving oil company representative accompanied them. He took their note pads and rock samples after each dive. He also took the offerings of abalone and lobster, which, when out of season, were called "marine red rabbit." The young geologist's name was Tom Barrow. Years later, Tom became the president of EXXON. Harris Stewart, known to friends as "Stew," traveled the world's oceans, eventually establishing NOAA's Atlantic Oceanographic and Meteorologic Laboratory in Miami. Much later, Menard served as Director of the U.S. Geological Survey (USGS). Another member of the team not in the 16–mm film was Bob Dietz, one of the early discoverers of seafloor spreading. It was an eclectic and enlightened group of diving geologists.

After the Naval Electronics lab, where he had many adventures in deep-diving submersibles, and where he spent time with a young Frenchman named Jacques Cousteau, Bob went to NOAA in Rockville, Maryland to join a new organization called MUST (Man Under Sea Technology). The group evolved into what is now called NURP (National Undersea Research Program). There he worked with colleagues Bob Nevin (who had been Officer in Charge of the *Trieste*, the world's deepest diving bathysphere for the Navy), Morgan Wells, Don Beuamariage, Jim Miller, Elliot Finkle, and other notables in the diving world.

Bob left MUST to become Director of the Fairleigh Dickinson University West Indies Laboratory in St. Croix, U.S. Virgin Islands. We collaborated many times while he was there and I helped him conduct modern carbonate training courses for the American Association of Petroleum Geologists. Bob had always supported the idea of undersea habitats. At MUST, he was involved with the Perry-built *Hydrolab* and others, but later in St Croix his former connections with MUST allowed for the use of the *Aquarius* underwater habitat (now in operation off the Florida Keys). Through his new job and access to *Aquarius,* he developed a "drinking buddy" relationship with then Senator Lowell Weicker who spent several days in the habitat and, because of this and the Senator's earlier diving experiences with Bob Wicklund, Weicker became an avid advocate of undersea research. With Bob Wicklund serving as his senatorial aid, Weicker played a pivotal role in furthering the NOAA/NURP program and establishment of the Lee Stocking Caribbean Research Laboratory. Bob Dill was in the middle of it all.

Island life, some call it island fever, eventually took hold and Dill moved on for a one-year stint with the USGS at their Reston, Virginia headquarters where he completed his 30 years of government service. After retirement, Bob moved back to California and taught geology at San Diego State. Bob retired again, in a way, and he morphed into Dill Geomarine, Inc., remaining active as a consultant until his passing and spending much of his time away from cold California waters

working with Harold Hudson and Bill Goodman at the Florida Keys National Marine Sanctuary. He taught them the computer and GPS skills needed to plot ship-grounding damage. When not in the Keys, he worked with Barbara Lidz and me at the USGS Fisher Island Station in Miami and later in St. Petersburg after our transfer to the west coast of Florida. Bob had known Barbara since school days at the University of Southern California. During that period, we made many trips to the research station on Lee Stocking Island where Bob, with students from San Diego State, had discovered the giant stromatolites. Life on the island was outstanding. One night while observing Halley's Comet and empty rum bottles, we went from water cistern to water cistern where we sang into and enjoyed the echo of Bellafante's "Midnight Come and I Wanna Go Home." We called ourselves the "Cistern Chapel Choir."

I owe my late conversion to computers to Bob Dill. He converted Barbara Liz and Jack Kindinger while at Fisher Island Station. I decided if this 60-year-old nitrogen narcosis survivor could master computers, then a 50-year-old carbonate geologist could at least try. The future was pushing in on us fast. Nevertheless, Bob attracted many outstanding geologists such as Christopher Kendall at University of South Carolina with whom we studied the stromatolites. Even after so-called retirement, he mentored several young geologists. Among those were Russell Shapiro and Tony Jones, all fine scientists who made him very proud.

Bob's 60th birthday is vivid in my memory. Bob and I and about 25 geologists/biologists interested in stromatolites (the first form of life on Earth over three billion years ago) attended what was called the First International Stromatolite Conference. I don't know if it was actually the first, but it certainly was the first for a small village in northern Mexico. It was the biggest event ever for the town of Quatro Cienagas. A huge banner on the town hall greeted this odd group

of scientists who came to dive in their freshwater springs. Stromatolites were growing in their springs! The eclectic group included NASA-funded microbiologists. It was suspected the bacteria that form stromatolites were probably the first forms of life on distant planets. An elaborate fiesta was held, featuring barbecued goats and pigs on rotating spits, and there was abundant music and traditional Mexican dancers. (Did I mention that Bob Dill had played the saxophone in high school? This was another of our bonding agents, as I played drums). The male dancers wore white trousers and black shiny boots. Girls wore dresses like Spanish dancers in Spain. Tequila flowed. And, there was Bob celebrating his 60th birthday on stage dancing the Flamenco with young nubile dancers. Unforgettable!

But that was only one birthday highlight. On his 70th birthday, Bob dove to a depth of 170 feet in Lighthouse Reef Blue Hole off Belize. Why 170 feet? He explained that the 70 of the feet were for his birthday and the other 100 were just thrown in for good measure. Many years earlier, on a Cousteau expedition in the Bahamas aboard the *Calypso*, I had followed him into a blue hole down to 125 feet and watched him go another hundred feet below me. I was dizzy from nitrogen, though Bob never seemed to be affected. Sometimes I thought his natural bubbling personality on land was due to nitrogen.

On Bob's trip to Belize, an elaborate underwater cave associated with the Lighthouse Blue Hole was investigated. After the Cambrian Research Foundation divers whom he accompanied had explored the cave and collected stalactites for isotopic dating, they named it Dill's Cave in his honor. With the samples, he was able to determine when the freshwater cave had been flooded by rising sea level back during the Pleistocene.

What I was too late appreciating was the many other lives Bob had lived before we met in 1964. I learned even more after his passing by reading his biography at http://www.AUAS-NOGI.org/Dill.htm. I never knew he had been a Navy pilot! I never knew that he made suggestions to a Frenchman on how to modify an old mine sweeper that would become the *Calypso*. I did know he worked in the Persian Gulf in the 1950s with legendary K.O. Emery, but did not know they had evaluated the "tractability" of shorelines near Kuwait. That's service talk for whether it will support tanks. He had told me about measuring the acidity of sea cucumber intestines by poking pH-meter electrodes in their anus. His description was vivid. He wanted to know if the critters were dissolving the lime sediment with their stomach acids. And, who would have guessed that he was one of the first divers to reach the ocean liner *Andrea Doria* 19 days after it sank in 225 feet of frigid water off New England. One of his possessions I coveted most is a coffee table made from the wooden grate upon which the Captain stood when it collided in the fog with the Norwegian freighter. Bob had recovered the memento on his first dive. Bob spoke frequently of California friends I had never met. They included Andrew Rossfelder, inventor of the Rossfelder vibracoring system, and Andreas Rechnitzer to whom he always referred as Andy. Bob seemed to know everyone. Dill often used the expression "good Andys and bad Andys" to describe people. I thought it was some unfamiliar California expression. I can say that Andreas Rechnitzer was a good Andy.

Bob's most recent memorable moment was when he was inducted into the "Offshore Pioneers" by the Offshore Energy Association in Houston. To attend the banquet, he had to wear what he described as "his first tuxedo." Once there, he was thrilled to be seated next to his old friend Tom Barrow, that same young company representative with whom he had shared "red marine rabbit" during leaner years. They truly were offshore pioneers.

One can only imagine what Bob would have done for his 80th birthday. I suspect he would have wanted to make a dive to 180 feet, and I have no doubt he would have done it.

E. A. Shinn

Dr. Siro Kawaguti (January 1, 1908–2004)

Dr. Kawaguti began his career as a coral reef scientist after graduating from the Tokyo Imperial University's Zoology Department in 1930. He then obtained a position at Taihoku Imperial University in Taiwan. Dr. Kawaguti visited Okinawa to study corals in 1931 and visited Belau (Palau) for four months in 1936 as a JSPS visiting researcher. Dr. Kawaguti served as professor at Okayama University where he directed the animal morphology laboratory from 1949 to 1973. He was a director of the Tamano Marine Station for four years starting in 1954 and was honored as Eminent Coral Biologist at the 6th International Coral Reef Symposium at Townsville, Australia in 1988.

Much of Dr. Kawaguti's work was ahead of its time, destined to form the foundation of many of the most exciting topics of coral reef research today. He cultured zooxanthellae isolated from a coral, *Acropora corymbosa*, and found that zooxanthellae became motile cells with two flagella. This observation clearly showed that zooxanthellae are dinoflagellates (Kawaguti 1942, 1944). He also showed, by chemical titration of seawater, that hermatypic corals calcify faster in light than in darkness (Kawaguti and Sakumoto 1948). Additionally, he studied the diurnal rhythm of polyp contraction, phototaxis of planula larvae, and effects of light on the colonial morphology of corals, suggesting that this response to light is related to the symbiosis with zooxanthellae (Kawaguti 1937, 1941, 1942). He was the first researcher to study the regeneration processes of corals in detail (1937), and studied relationships between colonial morphology and environmental factors such as water motion and light intensity (1943). He also carried out early research on fluorescent pigments of corals (1944).

Dr. Kawaguti at the first meeting of Coral Reef Research Group (Sesoko Station, 1989)

After moving to Okayama University, Dr. Kawaguti studied the ultrastructure of various marine animals with his students. Some of his students are still working at universities or have now become emeritus professors (e.g. Dr. Yamasu and Dr. Kamishima).

Dr. Kawaguti gave a special lecture entitled "Symbiosis between scleractinian corals and bluegreen algae (cyanobacteria)" at the meeting of the coral reef research group at Sesoko Station, University of the Ryukyus. This group later developed into the Japanese Coral Reef Society. In June 2003, he delivered the opening address at the Palau Coral Reef Conference. On 29 June 2004, a dinner party dedicated to Dr. Kawaguti was held in Okinawa during the 10th ICRS. Though he was unable to attend the party, he did discuss his research history through a video message. Researchers from several countries attended the party, including many young coral reef scientists. A video recording was made at the party with many of the attendees sending messages and good wishes to Dr. Kawaguti. The video was later shown to Dr. Kawaguti by his former student, Dr. Kamishima, who is also an emeritus professor of Okayama University. I believe that the enthusiasm and thanks expressed by the attendants touched Dr. Kawaguti.

Dr. Michio Hidaka
University of the Ryukyus

William (Bill) Gladfelter (1943–2003)

It is with great sadness that we announce the death of William Bayard Gladfelter. Bill died in his home in West Falmouth on Cape Cod on Christmas morning after a valiant seven-month battle with cancer. He was 60 years old.

Bill's contributions to reef science mirrored his diversity of interests. They include the first description and warning of the implications of White Band Disease, early community structure work comparing Atlantic and Pacific fishes, studies on cassiduloid urchins (in Anegada), the twilight migration

of copper sweepers, the functional morphology and physiology of Lebrunea sea anemones, and the resource partitioning in Caribbean squirrelfishes..

He documented the changes in community structure of *A. palmata* around St. Croix, US Virgin Islands, as well as documenting sponge and mollusc faunas in the Virgin Islands. He was also a regional expert on the natural history of Caribbean birds and plants. Bill shared this knowledge formally as a professor at the West Indies Laboratory in St. Croix for 20 years, and informally with many students, colleagues, and friends.

An avid athlete his entire life, he was a Deleware state medalist in wrestling and rowed on a championship varsity boat while at Cornell University. Bill competed in several marathons and was one of the top Caribbean cyclists and triathletes of the past 20 years. As with his marine studies, he inspired numerous people to participate and compete in athletics.

His last endurance competition was a strong finish in the May 2003 St. Croix International Half-Ironman Triathlon.

Perhaps his greatest interest was exploring both the natural world and ancient human traditions of the land in his many travels throughout the world. Most often accompanied by his wife, Betsy, he visited the Andes, Australia, India, Africa, the Pacific and Caribbean islands, North America, and Europe. During the last 20 years, Bill and Betsy developed a passion for the Pyrenees and its' people. They would travel by foot, bike or sail; camping, birding, observing natural history, and interacting with local populations most often in their native language.

Bill is survived by his best friend and wife of 38 years, Betsy, and his loving and supportive relatives in the McGuire-Higgins and Garton-Gladfelter clans. He will be missed by many friends and colleagues. Please make any contributions in his name to the University of Washington's Friday Harbor Laboratories Endowment for Foundational Courses, 920 University Road, Friday Harbor, WA, 98250.

Jeff Miller

CURRENTS

Rezoning of the Great Barrier Reef Marine Park: Implications for the Tourism Industry

Introduction

This report analyzes the Representative Areas Program (RAP) and rezoning of the Great Barrier Reef Marine Park (GBRMP) with regard to the changes of use and access for the tourism industry. In particular, it focuses on the implications for the continued operations of the industry in terms of economic, social and cultural aspects, and the protection of biodiversity. Conclusions and recommendations for future planning, implementation and management have been made. It must be noted that the definition of tourism users and the discussion about the consequences of the RAP included in this report do not include extractive users such as recreational fishers.

Summary of changes to access and use

The Great Barrier Reef Marine Park's (GBRMP) original zoning plan was first introduced in 1983. Since this time, the GBRMP has been increasing in size with the addition of new sections. Currently, there are five operational sections within the GBRMP:

- Central Section (October 1987)
- Mackay/Capricorn Section (August 1988)
- Cairns Section (April 1992)
- Far Northern Section (April 2002)
- Gumoo Woojabuddee Section (December 2002)

Because the addition of these zoning sections has been staggered, the management provisions of these sections differ slightly. These differences make management difficult, particularly near the section borders. Additionally, the current zoning system does not provide adequate protection of the GBRMP's biodiversity.

Such difficulties with the current zoning system have led to the implementation of a rezoning process known as the Representative Areas Program (RAP). The RAP will amalgamate the five current zoning sections to form the Amalgamated Great Barrier Reef (AGBR) Section which, in turn, will enable consistency between the sections with a reef-wide management plan. The rezoning process will use coordinate-based zoning where the boundaries were designed

to capture representative examples of all flora, fauna and habitats. This will allow these areas to be protected while still supporting other uses, ensuring sustainability. Additionally, while the existing section boundaries are difficult to determine, the new coordinate-based boundary system provides clearly defined boundaries. The AGBR section will also include some previously excluded 4830m^2 of reef, comprised of 28 coastal zones (which was done in 2000–2001). To assist with regional management of the GBRMP and for administrative purposes, the AGBR section will be split into four Management Areas (MA) that have no legislative effect:

- Far Northern MA
- Cairns/Cooktown MA
- Townsville/Whitsundays MA
- Mackay/Capricorn MA

Inside this new AGBR section, there are eight types of zones, each representing a different level of resource use which relates to the conservation and protection of the area. Since the new zoning system will be reef-wide, it will eliminate the current inconsistencies of differing names, zoning, and resource use between the five current zoning sections.

The GBRMP has many activities of both a commericial and recreational nature. There are approximately 1.8 million tourists visiting the GBRMP each year (excluding ferry passengers), making tourism the largest commercial activity, both in terms of numbers of people and dollars brought into the Australian economy and into local communities.

Green zones in the GBRMP can attract tourists just as protected areas attract visitors on land. Green zones contain special and unique natural features and are thus generally popular destinations for tourism and recreational activities. Therefore, an increase in protected areas (to 20% protection) covering each of the 70 identified bioregions will become an advantage when marketing an area for tourism or recreational use.

All vessels operating in the GBRMP under commercial charter, including super-yachts, will require a Great Barrier Reef Marine Park Authority (GBRMPA) permit. All cruise ship operations are required to obtain a permit from the GBRMPA to operate in the GBRMP. This provides consistency throughout the GBRMP and reduces the combination of permits, regulations and plans of management that are currently required by operating vessels, making working in the GBRMP easier to manage. By reducing the paperwork required for tourist operators and by increasing the coverage of protected areas from the current 4.6% to the proposed 33%, tourism, local prosperity, protection and sustainability would all increase within the GBRMP.

Economic, social and cultural implications of changes to access and use

Tourism growth in the GBRMP is estimated to increase 72% by 2020, with recreational users, tour operators and tourists constituting the most numerous and economically significant group of reef users[1]. This increase in visitor numbers will put pressure on existing tourist locations and increase pressure for development in new locations, which will have major social, cultural and economic implications.

The adoption of the RAP will ideally prove to be an investment in a scarce resource and a maximization of the Great Barrier Reef (GBR) system as an ongoing utility. Values that people associate with the GBR, i.e. direct values such as tourism, will also become more important in time due to the declining global status and health trends of reef systems around the world.

According to the GBRMPA[1] and the presenters and participants of the CRC Reef Research Centre's Tourism Future Forum of 2003, the implementation of the RAP, along with other measures, will ensure the long-term viability of the GBRMP's tourism industry, which is currently worth $1.4 billion. To emphasize the economic importance of the GBR even further, an advance figure of $4.3 billion (plus 48,000 jobs) is applied when including catchment areas[2]. The GBRMPA also identified that the Gross Value Product (GVP) of tourism, worth over $4,000 million (28% of total value), will benefit from the implementation of the RAP[3]. The Forum group also point out, however, that the commercial viability of the tourism industry is dependent on the ecological sustainability of the GBR, as detailed in a later section of this report. The tourism industry believes that one way this sustainability can be achieved (and therefore ensuring future losses are minimized) is by lessening the impact of human activities on the reef ecosystems through support and respect of the RAP.

Currently, the zoning plan utilizes approximately 30% of total locations and the proposed zoning plan will increase the percentage of total locations to 60%[4]. More specifically, the network of highly protected Green zones will be increased from roughly 5% to over 30%, spread throughout all of the 70 bioregions in the GBRMP, thus contributing to the viability of the tourism industry and therefore economics.

According to Bailey et al.[5], these new zones will increase protected access points for tourism activities such as diving, snorkeling, reef boating/cruising, in turn reducing impacts on coral and fish that attract growth in tourism by changing the access and use of hundreds of reefs and islands in the GBRMP. The new zones will also improve the protection of high value key destinations such as Agincourt/Ribbon reefs in Cairns/Far North. Further south, the Yongala Shipwreck, Helix Reef, Myrmidon Reef and Whitsundays' Bait and Hardy reefs will also be subject to increased protection.

The implementation of the RAP will also help to fulfill Federal government responsibilities associated with international conventions (many of which include references to tourism), such as the World Heritage Convention, for which it is responsible to the global community.

With further regard to the issue of economic impacts arising from the RAP, the question of forecast analy-

sis arises. Bailey et al.[5] notes that to value the potential impact of zoning based on a cost-benefit framework is difficult to implement. This is because zoning changes are based on ecological grounds to develop a sustainable framework for marine life, reduce potential human impact and preserve industry activity. It is also complex because of micro-level changes of reef access for different users in different areas, and strong correlations between reef-island/mainland regions and earnings. As a result, a tourism-based economic framework was not developed to aid decision-making. Nevertheless, forecasts were made for mainland/island regions (assuming there is no loss of environmental amenity value that could deter tourism). Total tourism expenditure from 2003/4 to 2022/23 is expected to raise 4–5% to $62.2 billion, mainly based on international visitation. This figure also takes into account that the 635,000 visits to Marine National Park B and National Park zones in 2002 will approximately double in the proposed plan, thus increasing the Environmental Management Charge revenue.

A trend is expected to result in the area becoming reliant on the international sector, increasing by 5% per annum, while domestic travel is expected to decline[5]. It is further evident that international interest in the GBRMP is strong from the number of overseas submissions placed in the consultation phase of the RAP[1].

One problem noted is that issues such as terrorism, political uncertainty, natural disasters and especially declining reef health can become risk-factors. If the perceived risk is lower, there will be a subsequent rise in visitor numbers, which could result in a rise in the expected cumulative expenditure by $13 billion[5].

The RAP hopes to reduce negative impacts on communities. The RAP may promote economic growth for indigenous people by improving employment outlooks through involvement in local tours, events and education centers. The RAP is expected to increase the level of protection to culturally or socially important sites and places by restricting access or impacts when it is implemented. Through education of tourists, the RAP hopes to promote awareness of local traditions and values. It also hopes to improve tourist/host relations by gaining more information about what is important to both parties.

It has been suggested that the RAP will offer greater incentive for site stewardship, and potentially decrease conflicts of use. Visitor compliance and authority enforcement will be easier due to simpler boundaries. In addition, healthy ecosystems with increased biomass and diversity will result in downstream effects with a higher value for tourists, leading to repeat visits, word-of-mouth endorsements and a heightened sense of appreciation.

Operators within the GBRMP will have more scope to develop different products such as eco-tourism because they will have more protected areas to utilize. Similarly, industry representatives (such as the Association of Marine Park Tourism Operators, Queensland Tourism Industry Council and Tourism Queensland) recognize the benefits from the plan because it offers greater security for members, expands the potential for sustainable tourism and enables them to offer higher quality destinations in the future.

Finally, it was also found that non-extractive tourism users generally believe that the RAP will protect their industry-dependent healthy reef, that the growth of Marine National Park Zones which separate extractive and non-extractive conflicting users should be increased to at least 50%, and that certain commercial fishing practices such as netting need to be restricted or banned[1].

Social impacts are complex in the matrix of potential factors affected by the implementation of the RAP. On a much larger scale, other examples such as political, economic, environmental and technological issues are also continually impacting the community. These impacts need to be understood in order to manage them effectively and sustain tourism on the GBR.

Implications for the protection of biodiversity of the GBRMP

Currently, tourism is managed on the Great Barrier Reef (GBR) by a combination of zoning plans, plans of management of intensively used sites, codes-of-practice and permits. The changes in the volume and profile of tourism on the GBR over the last 20 years have resulted in the revisions to tourism management by the GBRMPA that are presently in progress.

Pandolfi et al.[6] have recently published the results of their study which concludes that the GBR is showing evidence of declining ecosystems and "*will not survive for more than a few decades unless promptly and massively protected from human exploitation.*" Protection of the biodiversity of the GBR is the major objective of the RAP. This involves protecting representative examples of each of the range of habitats and biodiversity within the highly protected reserves that prohibit extractive uses. The integrity of the biodiversity of the GBR is critical to future tourism growth by ensuring that visitors enjoy a satisfactory experience in the GBRMP. Without a healthy biodiversity, the GBR tourism industry is likely to suffer a decline in visitor numbers, as the integrity of the ecosystem is critical to the quality of the tourism product. Understanding, enjoyment and appreciation of the GBR are increasing priorities for our tourism consumers[7].

The Great Barrier Reef World Heritage Area encompasses all of the GBRMP and the islands and state waters within the GBR region. GBR World Heritage listing and its associated obligations confirm the objectives of conservation within a framework of sustainable use. This also brings the obligation to present those values to the global community. Tourism is the primary means of directly presenting those values to the majority of visitors. The RAP is also a key element of

Australia's Oceans Policy and meets Australia's obligations under the *Convention on the Conservation of Biological Diversity 1992*[8].

Tourism is an important commercial activity on the GBR and involves millions of visitors each year. This requires careful joint management by the GBRMPA and Queensland Parks and Wildlife Service. The use of zoning plans is considered to be an appropriate instrument for defining the strategic settings for use and access. In more intensively used areas, regulating use is generally achieved under Plans of Management[9].

In particular, the new RAP Zoning Plan has been designed to[8]:

- Recognize and maintain the outstanding values of the GBRMP, in particular its biodiversity, World Heritage values and ecological integrity;
- Recognize the cultural, tourism and recreational values of the GBRMP; and
- Ensure that existing and future uses of the GBRMP are ecologically sustainable, and that any future expansion of use does not have an unacceptable impact on natural, cultural or GBR World Heritage values.

Specific measures are being taken to protect dugongs and marine turtles through habitat protection, reduction of threatening activities and restrictions on use and entry of important areas.

Some impacts of tourism that have been studied are those associated with pontoons, anchoring and diving. The impacts of pontoons on the surrounding reef areas have been shown to be minimal, apart from the area directly under the pontoon and its moorings. Damage caused by anchoring of both tourist and recreational boats is a significant issue in heavily visited sites in the GBRMP. Anchors and anchor chains are capable of breaking multiple coral colonies at each drop. Management strategies can include the installation of both private and public moorings, designation of 'no-anchor' areas in heavily used sites, and education programs for boaters[10].

Studies of the impacts of diving and snorkeling have shown that most divers do not break corals; however, a small percentage of divers who swim too close to the coral may break many coral branches on each dive. The studies have determined the carrying capacity of coral reefs to be about 5,000 divers per site per year. Diver numbers in excess of this have been shown to cause environmental deterioration. No site on the GBR is currently subject to this level of diving activity due to the large number of sites available. The diving industry has taken up suggestions for reducing diver and snorkeller impacts, such as dive briefings and careful selection of sites[1].

The new RAP zoning plans with significantly increased Green zones will help to conserve biodiversity and safeguard the commercially and educationally important tourism industry in the long term. "*It is vital for the animals and plants of the Reef, and for the economic future of both Queensland and Australia, that the Great Barrier Reef is kept in good condition and to ensure that human activities do not affect the viability and attractiveness of this outstanding natural ecosystem*[2]."

Recommendations

The implementation of the Representative Areas Program will potentially raise visitor numbers and impacts in the GBRMP. This will pose negative implications if monitoring is not put into place to monitor ecological, social and economic factors. The current Environmental Management Charge is an essential economic tool in maintaining the integrity and monitoring of the GBRMP. This charge must continue to be allocated to the GBRMP, and increased if necessary, in order to maintain the GBRMP. Another tool that is key in curbing the impacts of the increase in visitor numbers is maintenance of strict operating guidelines within the tourist industry. This will minimize the impact on the reef and is essential to both the tourist industries and the GBRMP. Other ways in which industry self-regulation might assist in managing the expansion of tourism and its potential impacts is through the use of codes of conduct and eco-certification schemes.

Conclusion

The implementation of the Representative Areas Program will benefit tourism greatly. The implications of the increased protected areas (from 5% to 30%) will only increase the appeal of tourism in the GBRMP. With potential for increased interaction and stewardship, tourism should play a key role in helping to maintain these new areas. There are some potentially negative impacts suggested by the tourism industry, such as moorings, but the number of structures and permits is not estimated to increase, so additional infrastructure is not expected. The overall health of the reef and increased fish abundance and biodiversity will help draw domestic and international tourists. Estimates of increase in tourist numbers vary, but all predict a growing trend. Tourism will also serve as an aid in education pertaining to the ecology, biology and indigenous interests of the reef. The RAP program is predicted to have a positive effect on the tourism industry and should help this billion-dollar industry, the largest revenue generator on the reef, grow and thrive within the GBRMPA.

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The Coral Reefs of the Islands Pulau Talang Talang Besar and Kecil at the Westernmost Coastline of Sarawak State, Borneo

Introduction

Relatively isolated fringing coral reefs exist around small islands at the westernmost coastline of the state of Sarawak, Malaysia, northwest Borneo, next to the border of Indonesia. These coral reefs are unique because they grow on granodiorite rock (not true coral reefs[1]). Information on these coral reefs is very sparse. A recent report[1] gives a brief qualitative description of the overall species diversity and status of the habitats of the shoreline of western Malaysia, Borneo (with a major emphasis on the marine habitats in Sabah State). One other relatively old (1979) qualitative dive survey from this area is available[2]. A couple of local unpublished reports have been made by the Department of Sarawak Fisheries, Kutching which briefly mention these coral reefs. No quantitative studies have been published. The aim of this preliminary study was to observe selected local coral reefs near these islands, concentrating on health status and species abundance.

Materials and methods

The survey was conducted in September 2001. The examined sites were 1) the Fishermen's Ground next to the Indonesian border and 2) the Islands Pulau Talang Talang Kecil and Besar (PTT K&B). These sites are shown on Figure 1 (position is: 1°55'N; 109°47'E). All sites were surveyed by visual census. SCUBA surveys were conducted and the fringing coral reef at PTT K&B was furthermore surveyed with snorkeling gear. Each surveyed site included an area of approximately 100 meters x 30 meters, beginning straight from the shoreline.

Results

No coral reefs were found on the Fishermen's Ground site. This area is typically comprised of dead rock, with typical rock fish. Visibility in this area is poor, 1.0–1.5 meters with heavy siltation. Only one coral species, *Turbinaria* spp., was observed.

At PTT K&B, a healthy fringing coral reef was observed, ranging in depth from approximately 2.0 meters to approximately 10–15 meters. Visibility was approximately 5.0 meters and there was some sediment in the water. Most of the seabed is composed of dead coral and coral rubble, confirming the recent report by Pilcher and Cabanban[1]. However, contrary to Pilcher and Cabanban, an abundance of sediment was not observed on the rock substrate. The corals did not show any sign of coral bleaching, and no coral diseases were observed.

More than 20 species of coral reef fish were observed on the PTT K&B site. Since relatively few dives were conducted, the actual number of coral and coral fish species is likely higher. Three species of anemonefishes, *Amphiprion ocellaris, A. frenatus* (Figure 2), and *A. melanopus, were observed* within the giant host sea anemones *Entacmaea quadricolor* (Figure 2) and *Heteractis magnifica*.

Scleractinian corals at the PTT K&B site were comprised mainly of

Porites, *Echinopora*, *Diploastrea*, and *Montastre,* which agrees with the qualitative observations by Pilcher and Cabanban[1]. In addition, I recorded the presence of at least five coral species of the family Acroporidae. Two species of soft corals (*Sarcophyton* spp.) were observed in high abundances at one site - a single cliff, approximately 1 kilometer south of PTT K&B.

Discussion

This report presents one of the first preliminary studies within the last 20 years that describes the coral reefs of the Islands Pulau Talang Talang Besar and Kecil, at the westernmost coastline of Sarawak State, Borneo. In an ecological context, it is interesting that a relatively healthy fringing coral reef is found growing on granodiorite rock in the coastal waters of Southwest Sarawak, Borneo (which is influenced by heavily silted waters flowing from numerous rivers[1]) three year after the worst worldwide coral bleaching ever recorded. Suggested future research should include detailed quantitative and qualitative studies of these coral reefs, which could be used for comparison with other areas with scleractinian coral growth in waters with high sediment loads.

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Figure 1. Map of the surveyed area along the westernmost coastline of the Malaysian state Sarawak, northwest Borneo, South East Asia. Circles show the SCUBA-surveyed local areas.

Figure 2. The anemonefish *Amphiprion frenatus* and its host anemone, *Entacmaea quadricolor*, found at the fringing coral reefs of Pulau Talang Talang, Sarawak, Borneo. Photo: Michael Arvedlund.

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Overfished Coral Reefs in American Samoa: No Quick Fix

Major hurricanes strike American Samoa at intervals of about 3–9 years, so we see a cycle of coral reef disturbance followed by a lengthy period of recovery. The hurricane in 1991 was particularly bad and many of our reefs were reduced to rubble and rolling hills of pink coralline algae with low-relief corals, but as the years progressed, coral growth was slow but steady and diverse thickets reappeared. However, a certain amount of despair has crept into our view. The one thing that hasn't recovered is the fish populations. This is hard to gauge, of course, when we don't know how many fish were present on these reefs before the hurricanes. Nonetheless, today we see what must be a shadow of former population abundances. There are relatively few and/or small sizes of the species commonly taken for food. Figure 1 shows the pooled lengths of all surgeonfish, unicornfish, parrotfish, snappers, emperors, groupers, jacks and sharks sighted during extensive surveys on the reef slope at the 10-m depth. It is readily apparent that few fish were 40 cm (16 in) or larger in total length (TL). Those data were derived from belt transects of 3 x 50 m. The same pattern emerges when wider transects (20 x 50 m) were used to focus on species that are diver wary and/or particularly vulnerable to exploitation due to the large sizes (70–200 cm) they can attain (Fig. 2). These include sharks, maori wrasse and several large species of parrotfish, but none was bigger than 50 cm (20 inches) on Tutuila Island. This depressing picture is not a sudden event. Surveys in 1996[1] and 2004 (R. Brainard, NOAA, pers. com.) document that local reefs have had few large fish for at least eight years. Birkeland[2] notes the tremendous loss of spawning potential this can represent, as one large female red snapper (61 cm) has the spawning potential of 212 smaller females (42 cm).

Observing the post-hurricane recovery of corals in the territory, a visiting ecologist captured the problem when he remarked that it was as if "the house had been rebuilt, but the rooms were empty." Where were the fish?

We don't mean to imply that hurricanes caused these problems. A much more likely culprit is fishing pressure. The consensus among local biologists and visiting coral reef experts is that American Samoa's reefs have simply been overfished, and some research supports this. Even though current levels of fishing do not seem excessive, the area of our reefs is rather small and, consequently, it is easily fished out. Fish stocks may well have been depleted years ago, as knowledgeable locals and elder Samoans recall seeing far more fish on our reefs 25 years ago.

One straightforward solution is, of course, to reduce fishing pressure. Another seldom-discussed factor may also be working to keep our fish stocks at a perpetually low level, thus increasing their longevity (or lack of it). As more and more coral reef fishes have been aged, an unanticipated pattern is emerging: there are fish far older than expected. These fish can live on the reef for decades, with maximum ages of 20–30 years common, even for small surgeonfish. This disputes the former idea that coral reef fishes are high-turnover populations that can be heavily fished because they grow quickly and die young.

The realization that coral reef fish can be old is not merely interesting, it has significant management implications. A likely rationale for this life history pattern is that mortality of their young is extremely high, so a fish has to live and spawn for decades in order to ensure that at least a few of its juveniles successfully make it back to the reef and grow to maturity. For all the millions and millions of eggs a fish spawns during its long lifetime, only two recruits must survive to adulthood in order for the population to maintain itself at its current abundance. Successful recruitment must be a very rare event, and it would be even rarer if the number of spawners has been reduced to a skeleton population through overfishing.

In American Samoa, we are looking at an entrenched case of "recruitment overfishing," where fishing reduces the size of the adult stock to a point where production of larvae and subsequent recruitment are impaired. Further, the reduced gamete production of today's small population, coupled with naturally occurring years of recruitment failure, make population recovery exceedingly difficult and may, in effect, hold the population down at a lower level of abundance, a sort of impoverished steady state.

We might then say that it is the role of MPAs to provide a vital conservation measure. True in concept, but unfortunately none of our MPAs provides long-term protection for harvested resources. None has an effective enforcement capability. Indeed, the territory itself has a limited ability to conduct marine enforcement activities of any sort, but this is not really the issue, as most fishing on the territory's coral reefs is completely legal.

Consequently, a meaningful recovery will require nothing short of a territory-wide reduction in the harvest of coral reef fishes for *at least* 10 years, with specific protection for the larger fish. That's what the long life span of the fish is telling us: there is no quick fix.

Additionally, a comprehensive recovery effort would need to address a number of related issues, particularly the essential need to (1) strengthen our MPAs, (2) promote other sources of fish for consumption (such as the bycatch of pelagic fish caught by the domestic longline fleet), (3) develop a policy relating to imported coral reef fish (i.e. we should not transfer our overfishing problem to a neighboring country by importing their coral reef fish), (4) prohibit the export of all coral

reef products, (5) strengthen territorial fisheries regulations to prevent the introduction of overly efficient types of fishing gear, (6) ensure that fishermen are well informed about protected no-take zones, and (7) implement a long-term monitoring program that specifically provides quantitative data on these fisheries issues.

A balanced solution might still allow for some subsistence needs (which appear to be at a modest level and have been declining steadily over the past 20 years due to lifestyle changes), but any overall strategy would need to demonstrate an actual reduction in harvest and meaningful protection of resources in the territory's MPAs.

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A Green,
The Nature Conservancy

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Coral Reef Ed-Ventures: An Environmental Education Program for School Children in San Pedro, Belize

Introduction and Overview

The well-documented global decline of tropical coral reef ecosystems has sparked numerous surveys and many research projects, large and small, conducted by marine scientists over the past decade. Many, if not most, reef scientists live far from their reef study areas. On the long flight home following yet another reef survey or research trip to a distant tropical location, one might suspect that many readers of *Reef Encounter* have had thoughts like "hmmm… my next journal article is coming out in the upcoming issue of *Coral Reefs*; the big field survey is done but the report deadline is looming; I've just got to write a new grant proposal… ***and, I wonder if anybody living in the community adjacent to my reef study area knows or cares about any of this***." As environmental scientists, we know that processes of global extent are affecting coral reef ecosystems, but we also recognize that local community stakeholders can and will have a big effect on the future health of individual reef systems. So, the question is, are we as scientists doing enough to share our research findings and make our knowledge available to the people of tropical communities adjacent to reef ecosystems?

Our answer to this question was - "no, but we can do something about it!" At Smith College, our experience in Belize began in the mid-1980s with field trips sponsored by the Five-College Coastal and Marine Science Program. However, it was our participation in the Atlantic and Gulf Rapid Reef Assessment Program (AGRRA) that added focus to our Belize research and caused us to think that we really could do more. In 1999, we initiated AGRRA surveys on the Mesoamerican Barrier Reef in south-central Belize and off Ambergris Caye in northern Belize. Our Ambergris surveys brought us in close contact with Mr. Miguel Alamilla, Jr., the Manager of the Hol Chan Marine Reserve in San Pedro. With this connection, Professors Al Curran and Paulette Peckol envisioned developing a marine environmental education program for the local school children. They then recruited Professor Susan Etheredge of Smith's Education & Child Study Department to join in the effort and contribute her expertise in inquiry-based science education for children.

The result of this collaboration is Coral Reef Ed-Ventures, an educational program for school children designed to increase awareness of the environmental and economic benefits of a healthy reef ecosystem. Smith College undergraduate students with backgrounds in coral reef science and education serve as the teachers for the program, with close supervision by the Smith faculty team. The program was launched in June 2000 when two Smith student teachers initiated the program for just seven local student participants. From this modest beginning, the program has grown significantly in both number of students and community support. In summer 2004, our fifth year of operation, over 60 students, ages 7 to 11, attended each day of the two-week program conducted by the five Smith student teachers.

The Coral Reef Ed-Ventures Curriculum

The intent of the Coral Reef Ed-Ventures curriculum is to teach children what an ecosystem is, and, specifically, to guide them in developing an understanding of the coral reef ecosystem. The focus is on understanding the needs of a healthy reef, how various organisms interact with the reef, the threats to the reef, and how to protect the reef ecosystem. The following questions drive our curriculum development and instruction:

- What is an ecosystem?
- How is the coral reef an ecosystem?
- What are the needs of a healthy reef ecosystem?
- How do various organisms (including humans) interact with the coral reef ecosystem?

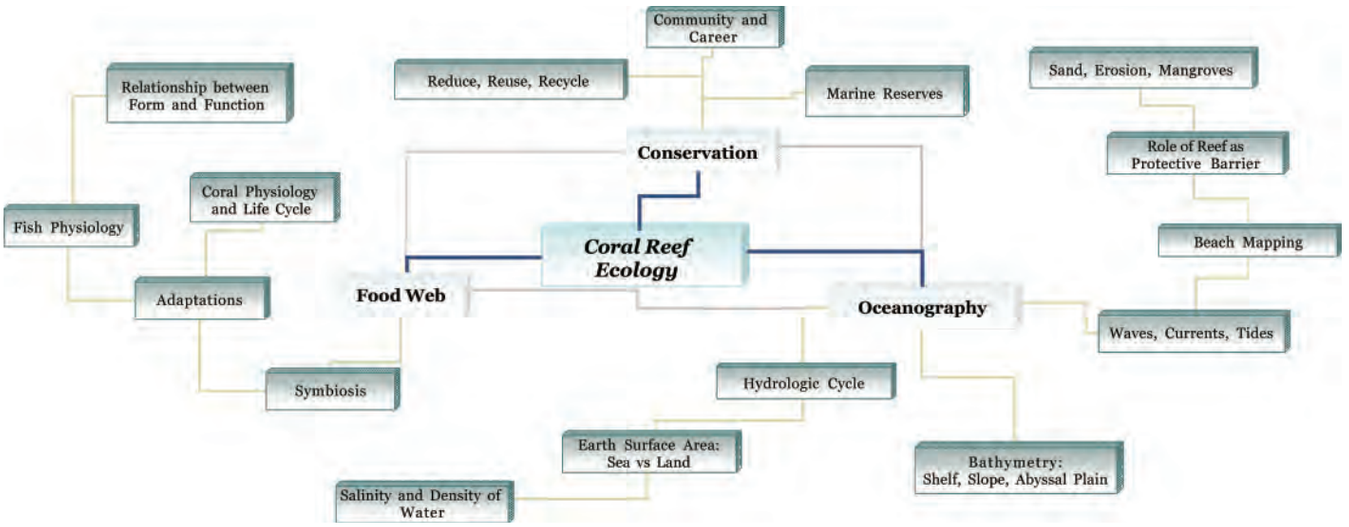

Figure 1. Concept map for the Coral Reef Ed-Ventures Program.

- What are the threats to this ecosystem?
- Why do we need to protect our coral reef ecosystem?
- What can I do to protect the coral reef? What can my community do?

The curriculum (see Figure 1) engages the children in active, hands-on classroom and field trip-based learning experiences. We visit local fisheries; explore and study beach, reef, and mangrove habitats and pursue in-class experimentation and demonstration. Our instruction teaches reef science through a multi-disciplinary approach that includes literature, the visual arts, crafts, and the performing arts. Some of the favorite activities of the children as well as our Smith student teachers are coral polyp "puppets" (purple rubber gloves with zooxanthellae dots); turtle hurdles (an outdoor game); acting out the food-web; the night-time feeding the polyps dramatization (to illustrate the feeding habits of coral); producing a mural that represents reef ecology; making art from trash; and calculating the dollar value of the reef. Read aloud, songs, and games are favorite parts of each day. Children keep their own science journals, write and perform plays ("The Barracuda and the Zooxanthellae" is a recent one), write poetry about the reef, and create t-shirt designs and conservation posters for the Hol Chan Marine Reserve. The daily participation of the Hol Chan Marine Reserve Education Coordinator and visits by Hol Chan rangers and other community members involved in reef-related activities, such as fishing, tourism, and sport diving, provide career examples and greatly enrich the program. More information about the structure and content of the curriculum can be obtained from Professors Curran and/or Etheredge.

Teacher Workshops

In addition to the two-week activities-based program for school children, we have expanded Coral Reef Ed-Ventures to include a program of teacher workshops. The primary objective of our 1- to 2-day teacher workshops is to integrate exploration and understanding of the local environment, specifically the Mesoamerican Barrier Reef, into the existing mandated curricula of the Belizean school system. In 2004, the Coral Reef Ed-Ventures team conducted our largest teacher workshop yet, attended by all 28 teachers from the San Pedro R.C. School, the only public elementary school on Ambergris Caye.

Beginning with a beach walk to illustrate how much can be learned right outside the schoolhouse door, teachers discussed how exploring the local environment with their students can integrate all areas of the curriculum in active and engaging ways:

- The language and visual arts: listening, thinking, writing, communicating, creating, and constructing.
- The skills of science: observing, questioning, researching, hypothesizing, and experimenting.
- Mathematics: problem solving, measuring, classifying, and calculating.
- The social studies: becoming knowledgeable about the local community, developing a sense of stewardship, and exploring career possibilities and options.

Additionally, teachers explored the natural and human processes that created and continue to shape Ambergris Caye and the reef and addressed these processes through lessons in geology, biology, ecology, and economics. Discussions also addressed similar challenges that teachers in both the United States and Belize face, such as teaching the specifics students need to pass the required standardized tests while still teaching

Figure 2. Coral Reef Ed-Ventures students and Smith College student teacher "Miss Erica" thank the community of San Pedro, Belize for support of the program in summer 2004. Photo by Emily Tyner.

them the critical skills they will need to think creatively and independently and apply what they know to new situations. In their evaluations of the workshop, participating teachers commented that they discovered ways to integrate materials from the reef into their curricula and noted the variety of ways that workshop activities could be adapted for any age group. Many expressed their eagerness for extended workshops in the future.

Conclusions and Future Goals

By the end of the Coral Reef Ed-Ventures program, the students are able to demonstrate significant knowledge of the Mesoamerican coral reef environment and can identify many reef organisms and discuss their habits, adaptations, and symbiotic relationships. The program ends with a gala graduation ceremony held at the local Lion's Club pavilion in the center of San Pedro and is well attended by student families. As part of the ceremonies, the students present skits based on their newly developed knowledge of the coral reef ecosystem. Each child who successfully completes the program receives a "coral expert" card signed and presented by Mr. Miguel Alamilla, Jr., Manager of the Hol Chan Marine Reserve.

Feedback from the San Pedro community has been highly positive regarding the program. It is inspiring to witness the children's increased awareness, knowledge, and excitement about the local marine environment and to observe it penetrate the San Pedro community. Furthermore, we are gratified that community involvement and support for the program has increased each year. An ongoing goal is to strengthen links with other reef ecosystem conservation efforts in San Pedro, such as the work of Green Reef and its Peace Corps volunteer, and the year-round educational efforts at Hol Chan, under the direction of Cordelia Shal and with the assistance of the Hol Chan Peace Corps volunteer. This year several students from Guardians of the Reef, a newly formed high school environ-

Figure 3. Belizean children from San Pedro conduct a beach mapping exercise with Coral Ed student teacher.

mental club started by the Hol Chan Education Coordinator and the Peace Corps volunteers, served as interns in our Coral Reef Ed-Ventures program. These interns were a valuable addition to the program, and we plan to expand their role in the program. The children of San Pedro, Belize are the future leaders of their community and, by extension, are front-line guardians of the Mesoamerican Coral Reef Ecosystem.

Acknowledgments

We are indebted to our initial two student teachers, Catya Harrold and Kate Buckman, for their pioneering work in the San Pedro community and to all of our Smith College student teachers who have followed their lead. We thank Miguel Alamilla Jr., Manager of Hol Chan Marine Reserve, Cordelia Shal, Education Coordinator at Hol Chan, and the Peace Corps volunteers in San Pedro for their strong and continuous support of our program. Finally, we are grateful to the island school principals, Roxani Kay, Lydia Guerrero, and Frank Nunez, for their

Figure 4. Children on a glass-bottom boat ride view a part of the Mesoamerican reef. For most, this is a first look at the reef that lies immediately offshore from their community.

support of the program and permissions to use facilities and to the many members of the San Pedro community who have made us feel welcome and provided support to the program in ways too numerous to list here. Dr. Robert Ginsburg, RSMAS, University of Miami, and others of the AGRRA team provided the inspiration to do more. We are grateful for funding for the program provided by a Thoreau Grant from Northeast Educational Services of Somerville, Massachusetts, the Culpeper Foundation, and the Summer Science Program and Environmental Science and Policy program at Smith College.

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Marine Conservation Expedition on Yadua Island, Fiji - Protect the Coral Reefs School Project 2001

Introduction

Since 1998, Greenforce, a British non-profit organization, has been undertaking marine science surveys for the National Trust for Fiji on the pristine islands of Yadua Island and Yaduataba Island. Four times a year, 10-week expeditions are funded by paying SCUBA divers who undertake an intensive 2-week science training program which enables the collection of quantifiable data on fish, coral and invertebrate diversity and abundance. The aim of the project is to provide the National Trust with baseline data of the marine resources of the islands so that a report can be submitted to UNESCO for World Heritage Site application. In addition, the reports will form the basis of future coastal management and ensure the sustainable development of the Island.

As part of the ongoing science work, Greenforce has built up an excellent relationship with the community of Denimanu, the only village on Yadua Island. With help from the British High Commission, Greenforce successfully implemented a solar-powered water project which now supplies fresh water to the village. In addition, by being allowed to sit in on the Denimanu Development Committee meetings, staff have been responsible for marine conservation measures such as the rejection of a potential live fish trade venture on the island.

As part of the ongoing work in the community, Greenforce now aims to increase the environmental awareness of the village by undertaking environmental education projects in the school. Phase 14 saw the introduction of Andrew Finlay, Greenforce's new Chief Marine Scientist who has previously worked as an Education co-ordinator for an environmental charity, as well as focusing his MSc thesis on the environmental education of fishermen involved in the management of Marine Protected Areas. With the approval of the Denimanu Development Committee, a 5-week school project was planned with the boy scouts and girl guides of the village. The following report outlines the details of the project and the results of monitoring the knowledge levels of the children before and after the project.

The project aims and objects were:

- To increase the environmental awareness of the children by running a 5-week coral reef project with the help of Greenforce volunteers.
- To incorporate subjects from the National Curriculum into environmental sessions
- To monitor the increase in the children's knowledge levels to evaluate the success of the project over time and encourage the approval for the go-ahead of future projects
- To produce coral reef designs on *sulus* (traditional Fijian unisex skirts) for each child so that they have a lasting reminder of the project
- To give a presentation to the rest of the village to pass on the knowledge to the village adults.
- To further improve relationships between the villagers of Denimanu and Greenforce.

Methods

After the proposed coral reef educational project was approved by the Denimanu Development Committee, the times and dates of the educational sessions were agreed with Master Peckham, the Headmaster of the Denimanu Village School. Sections 1–2 hours in length were planned before and after lunch on Saturdays, and a presentation was planned to coincide with the school concert and prize giving ceremony at the end of term. All Greenforce volunteers were briefed on the details of the sessions and each volunteer was given the opportunity to decide which session to assist with. All volunteers took part in the school project at least once, and some more than once due to their enthusiasm in the classroom and hard work.

Summary of Project

Table 1 provides a description of each educational session covered during the program. Specially prepared worksheets were completed during each session with the children.

The boys and girls in the class had volunteered themselves for the

Session	Detail	Resources	Delivery	Subject	Duration
1. Introduction to Project	§ Knowledge Survey § What is Greenforce? § What are we doing on Yadua? § Outline of School Project § Worksheets	Posters Books	Fin, Sandy, and Pita	English	15 minutes
	§ Small skits of the Importance of and threats to Coral Reefs	Props	Volunteers	Drama	1 hour 45 minutes
2. Importance of Reefs and Threats to Reefs	§ Food, Tourism, Global Warming, Coastal Protection etc. § Over-fishing, Construction, pollution etc.	Worksheets, pencils, crayons	Fin	English	1 ½ hours
Break Activity	§ SCUBA kit dress up	SCUBA gear X 3	Iain, Fin and Volunteers		2 hours
3. Litter Survey	§ Divide kids into groups led by GF vols and survey the beach for litter	Plastic bags, gloves, pen and paper	Fin and volunteers	Environment	1 ½ hours
Break Analysis	§ Bar charts produced for the different types of litter found	Rulers, crayons and pens		Geography Maths	1 hour
3. Art Design	§ Fabric Design of Marine conservation issues	Paper, pencils, rubbers, crayons, fish books, science books	Fin	Art	2 hour
Break Letter Writing	§ Write letters to FSP	Letter template	Volunteers	English	1 hour
4. Fabric Design	§ Print designs on Fabric to make sulus and curtains	Fabric, fabric paint, pre-made stencils, sponges, water, paint mugs	Fin Paint Monitor! Volunteers	Art	2 x 2 hour sessions
5. Presentation Practice	§ Children to practice presentation to rest of school and parents	Props, paper, pens	Fin		1 hour session
6. Presentation	§ Children to act out Importance and threats to Reefs	Certificates and prizes for best fabric design	Children, Greenforce, Village		45 minutes

Table 1. Description of each session, including subject details, resource requirements, people responsible for delivering the session, National Curriculum subjects covered, and the session's duration.

project and were giving up their Saturdays to come and learn about coral reefs. Therefore, it was important to make the project fun as well as educational.

SCUBA Kit Practical and Litter Survey. A SCUBA kit activity was included not only for fun, but also to enable the children to learn about how Greenforce monitors and surveys the coral reefs. As part of the project, the children looked at the impact of litter on marine life and the aesthetic quality of their Island. With no treatment facilities, wastes with long break down durations, such as metals and plastics, have started to build up on the main village beach. The children were divided into groups and taken by a Greenforce volunteer to conduct a litter survey on various sections of the beach. The children were astounded to find 245 batteries on their beach after a 20-minute survey. They have pledged not to drop batteries in the sea in the future, as it poisons the fish that they eat from. Unsurprisingly, waste products with longer break down times were the more dominant litter types, i.e. glass, metal, and plastic.

Letter Writing. As well as trying to incorporate core National Curriculum subjects such as Math, English, Art, and Drama, the project encouraged the children to write letters to an Environmental Organization in the capital, Suva, inviting them to conduct workshops with Yadua's adult population. This is a very powerful tool, as it not only encourages the external organization to come, but also empowers the children to feel the responsibility for bringing them to their Island. The children wrote letters to the People's Foundation for the South Pacific (FSP), which has since replied

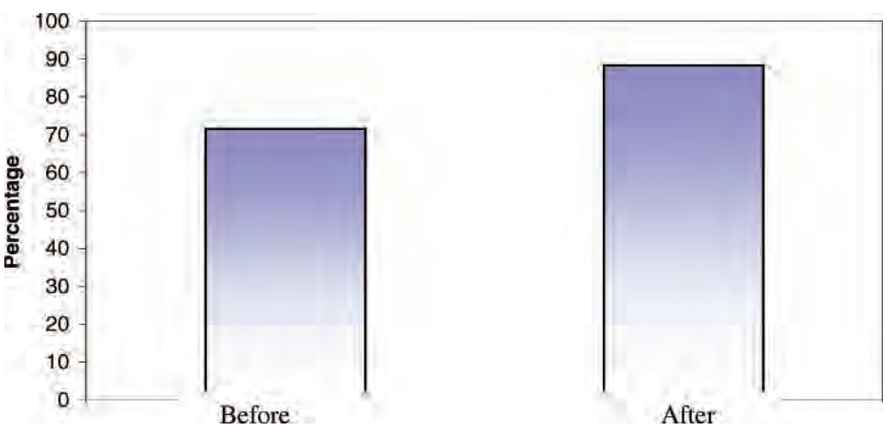

Figure 1. Graph depicts the knowledge levels of the entire class both before and after the educational program.

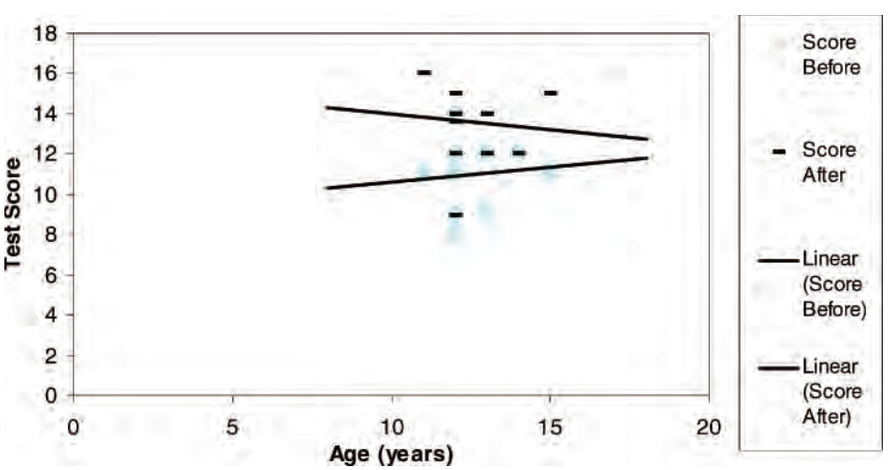

Figure 2. Knowledge levels, expressed as test scores versus age of each child, before and after project.

and accepted the children's invitation. FSP will hopefully be able to get the environmental message across to the adults and encourage coral reef and fisheries management for the future.

Sulu Making. To provide the children with a lasting reminder of the project, Greenforce volunteers cut out templates of fish and corals for the children to use in designing *sulus*. Each child designed their own *sulu* with the assistance of a Greenforce volunteer and a prize for the best *sulu* was given at the final presentation.

Presentation. The final part of the project gave the pupils an opportunity to educate the adults of the village by giving a presentation on the importance of and threats to coral reefs. At the school's annual prize giving ceremony, the children acted out different scenarios while a child explained each skit in English and Fijian to the audience.

The project was extremely successful as all the children thoroughly enjoyed themselves and learned a great deal. In addition, the adults also learned new information about coral reef protection and the Greenforce volunteers felt that they had made an excellent contribution to a worthwhile cause. The real success of past education projects have not been known, as most projects have failed to conduct any monitoring or evaluation of the students' progress.

In this program, the children were asked to complete a 20-question survey form to assess their baseline knowledge of coral reefs before the project. The children completed this same survey at the end of the 5-week project to determine whether the child's knowledge levels had increased. Figure 1 depicts the increase in the class's knowledge levels resulting from the educational program. Based on the survey results, the project was not only fun but also significantly improved the knowledge levels of the children. The class increased from an average score of 70% to 88.2%. This data has been used to

ensure that Greenforce's school projects will continue in the future, as it persuades decision makers that this type of environmental education is extremely important. Additional analysis of survey results shows that although all the children's test scores improved, on the whole, the younger children benefited the most from the project. Figure 2 shows the differential increase in knowledge levels between younger and older children, where the gap of increase in knowledge level is greater for the younger children but shorter for the older children. These data suggest that the project is ideal for the children of ages 11–13, but may be too simplistic for children aged 14–16. This data will be used when designing environmental education projects in the future.

Conclusion

The Denimnau Development Committee were very pleased with the 2001 Coral Reef Project and have agreed that Greenforce should continue their environmental educational work in the school. Greenforce aims to develop the project so that it includes all pupils from the school over the next two years. Hopefully, the children will pass on their new found knowledge to the rest of their families. Little Joekeli, was spotted soon after the litter survey telling Big Anerei "No. STOP! Don't drop that rubbish in the sea. It kills the fish!"

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Bad Newspaper Reporting Identified as a Major Cause of Coral Reef Decline

by A. Reporter

Results from a new research paper conclude that bad newspaper reporting is a major cause of coral decline. The new report flies in the face of conventional wisdom that states coral reefs are dying because of global warming, overfishing, disease, and pollution.

Dr. Marlin Billfish, lead author of the report explained, "We analyzed 625 newspaper stories about coral reefs that appeared over the last fifteen years and 92 percent of the time the reporters either got the story wrong or they made things up. We then did a survey and calculated that government officials and managers spend 12.6 million hours every year trying to correct mistakes made by newspaper reporters."

The Billfish team also reported that a significant amount of variation in public opinion was explained by the contrasting – and wrong - content of story headlines. "If managers could just focus their time and energy more efficiently, instead of responding to headlines and stories on almost a daily basis, conservation of coral resources would be much further along," said Billfish.

The reason reporters do their jobs so badly was not immediately obvious. "Our initial assumption was that reporters are stupid, but after extensive interviews we learned instead that most of them are just lazy. They don't put much effort into their stories and the result is bad reporting – we have statistical proof," added Dr. Billfish.

The Billfish report is causing quite a stir among journalists. In defense of his reporters, Arthur Dodger, a seasoned newspaper editor, said, "Look, you can't expect reporters to know everything. I'm really pissed at this Billfish guy. He doesn't understand the first thing about what makes a good story. Facts are not really that important." Dodger went on to say that reporters satisfy an important societal need. "They provide an opportunity for managers and politicians to educate the public after our stories generate conflict and controversy – heck, we're not supposed to understand this stuff, we just report it."

Environmental groups were not studied in the Billfish report. "We dodged a bullet on that one," said Beatrice Green, president of Coral Reef Action People. "The Billfish report is a good study, but let's be fair. These are complicated issues. That's why groups like ours are so important. We focus on the really important stuff." Ms. Green believes that if sewage pollution is controlled, local reefs will return to their former glory. "That's our mantra," she added. When reminded that the causes of coral reef decline are considered complex and are not related just to sewage, Green responded, "We've done studies too. We know that the public cares about coral reefs. That's why they give us money. If our campaigns get too complicated, the public doesn't pay attention and that's bad for busi… the environment."

The Billfish report is not generating much controversy among scientists. "My colleagues generally agree with the report and that's pretty unusual," said Dr. Billfish. However, one scientist was willing to be interviewed who defended journalists, but asked to remain anonymous. "The best way to get my ideas discussed these days is to talk to reporters. They love to hear me spin a story and they never really ask the hard questions. It's amazing what I can get away with! I love to talk to reporters – they're great!" When asked if this was responsible behavior for a scientist, he replied, "What harm can it do? It's only talk."

Dr. Billfish challenged journalists to dig deeper for the facts and not to take the easy way out on difficult stories. "Yeah, right," he said, laughing as he headed offshore.

A. Reporter is Dr. Steven Miller, a research professor at the University of North Carolina at Wilmington. When asked about his personal experiences with reporters he replied, "No comment."

REEF BRIEFS

These published scientific papers may be of interest to the ISRS community:

Storlazzi, CD, JB Logan, and ME Field, 2003, Quantitative morphology of a fringing reef tract from high-resolution laser bathymetry: Southern Molokai, Hawaii. *GSA Bulletin*, 115 (11): 1344–1355.

Brolund, TM, A Tychsen, LE Nielsen, M Arvedlund, 2004, An assemblage of the host anemone *Heteractis magnifica* in the northern Red Sea, and distribution of the resident anemonefish. *J. Mar. Biol. Ass. U.K.*, 84, 671–674.

BOOK REVIEW

Shorefishes of the Tropical Eastern Pacific (CD-ROM) by D.R. Robertson and G.R. Allen. 2002

Coral reef ecologists are well acquainted with and appreciate the usefulness of field guides to their taxa of interest. Some of them have produced field guides that can be found, tattered and worn, but still being used, among the field gear of their colleagues. Field guides provide that essential first layer of information on species identity, taxonomy, distribution, biology, ecology, and behavior. Until recently, field guides to the fishes of the eastern Pacific

have focused on select locations, or have covered broad regions but with limited detail and lack of comprehensiveness. Goodson[1] covers fish from Alaska to Peru, including the Gulf of California and the Galapagos islands, but includes only the more common species. Typical local guides are those for the Gulf of California[2] and the Galapagos[3]. Thomson and McKibbin[2] served many people as a proxy guide to the tropical eastern Pacific until Allen and Robertson[4] produced a more comprehensive guide. While the majority of field guides have been in English, FAO[5] provides a Spanish guide for the Pacific shore of Central America, although it deals only with fishery species.

Things have changed with the publication of *Shorefishes of the Tropical Eastern Pacific: an information system*[6] which goes well beyond their 1994 book. This CD-ROM (US $10.00, ordered from the publisher or via www.biobase.org/sftep) covers the Pacific shores of 10 countries, including Mexico (including the Gulf of California), Guatemala, El Salvador, Honduras, Nicaragua, Costa Rica, Panama, Colombia, Ecuador, and northern Peru, in addition to the Revillagigedos Islands, Clipperton Atoll, Cocos Island, Malpelo, and the Galapagos Islands groups. For all locations, this guide provides a clear, concise, and easily accessible series of databases with several particularly useful features. First, it is an interactive identification guide, including almost 3,000 images for more than 470 genera and almost 1,200 coastal fishes, representing 82% of the fish fauna of this region. This species guide is connected to a database of biogeography, biology, and ecology. Also included is *Checklist of fishes - tropical eastern Pacific*, produced by M.H. Wilson, a detailed, up-to-date annotated checklist of the shorefishes of the eastern Pacific. Appropriate for the east Pacific region, *Shorefishes of the Tropical Eastern Pacific* is fully bilingual (Spanish and English).

The CD-ROM provides information appropriate to the taxonomic resolution selected by the user (genus, species, or family). It can provide diagnostic morphological features, or images of various life stages, and it has the ability to compare similar species in a defined location of interest. Range maps can be produced for individual species, or for multiple species selected by biological or ecological attributes such as climate zone, salinity or depth range, habitat, degree of endemism, diet, foraging guild, egg type, or maximum size. Lists of endemic species can be generated for sub-regions or the entire tropical East Pacific, as well as maps of species richness that reflect the number of species per country or biogeographic province.

The search engine that helps identify fish is very flexible. The user may input information to define the search, including location, fish characteristics (shape, color pattern, size) and habitat (depth, salinity, bottom type, etc.). The engine in turn produces a short list of species, all of which are linked to their respective images and taxon pages. Up to six fish and their diagnostic characteristics may be viewed simultaneously. A detailed, yet easy-to-use key is also available. This is limited to species of Scianidae and Gobiidae (accounting for the vast proportion of diversity in the region). The user may also find a fish by entering either vernacular names or Latin binomials.

Shorefishes of the Tropical Eastern Pacific is an ambitious effort that will be useful to both researchers and laypersons. It is an important step forward in the compilation of information for this region and a template against which guides for other regions should be measured. Taking the laptop into the field is a small price to pay for access, and most ecologists' laptops get taken there anyway.

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References

[1]Goodson G. 1988. Fishes of the Pacific coast: Alaska to Peru, Including the Gulf of California and the Galapagos islands. Stanford University Press, Stanford.

[2]Thomson, D.A., McKibbin, N. 1976. Gulf of California Fishwatcher's Guide. Golden Puffer Press, Tucson AZ

[3]Humann P., Deloach N. 1994. Reef fish identification: Galapagos. New World Publications, Jacksonville FL.

[4]Allen, G.R., Robertson, D.R. 1994. Fishes of the Tropical Eastern Pacific. U. Hawaii Press, Honolulu

[5]FAO 1995. Guias FAO para la identificación de especies para los fines de la pesca. Pacifico Centro-Oriental – Volumen 2, Vertebrados, Parte 1. Food and Agricultural Organization of the United Nations, Rome.

[6]Robertson, D.R., Allen, G.R. 2002. Shorefishes of the Tropical Eastern Pacific: an information system, Vers. 1.0.0. Smithsonian Tropical Research Institute, Balboa, Panamá

MEETING REPORTS

Outline of My Okinawa Experience

Upon learning of my LOCAP fellowship award in January 2004, I was completely overwhelmed and grateful to be able to attend the 10th International Coral Reef Symposium (ICRS) in Okinawa, Japan. Receiving the award made me realize the importance of producing new and interesting research and creating an effective presentation of my work. This would be my first conference, let alone an international conference, and I wanted to make a good impression. I became very motivated to produce quality data and analyze it objectively so that it would be not only original but useful to the scientific community. For the next six months I diligently conducted field work and pulled together more than a year's worth of data in order to prepare for the meeting.

Upon arrival in Okinawa, I was a bit shocked, as everything looked a bit smaller: the cars, the streets, even the people. Yet, at the same time, the feel of the city was enormous. Immersion in a completely different culture is overwhelming but also exciting. I found communication with most local people, such as taxi drivers, waiters/waitresses, and even hotel managers difficult because English is not very common. It was definitely an eye-opening experience for someone born and raised in America. Luckily, there were numerous English-speaking Japanese students from the local university that helped with food orders, taxis, and communicating with other locals. These students were all extremely generous and made the transition into a new culture much easier.

The conference itself was a fantastic experience for me. There were 1,500 people in attendance from numerous countries and cultures. The diversity of the attendees was incredibly high and I have never been around such a large group of people with one common goal, to study and protect the world's coral reefs. This is the one coral reef conference where people from around the globe come together to readily share information with one another. Every day was packed with presentations every fifteen minutes in nine different locations. This meant that almost every topic of interest had a special session where all of the leading scientists in that field presented their best work of the past 4 years. My research presentation was nerve-wracking, but the audience was kind and very supportive. It was a great feeling when other scientists appreciated the research that I discussed and gave words of encouragement. Since the conference, I have become even more motivated to conduct new and original research and become a recognized scientist myself.

The 10th International Coral Reef Symposium created an environment which allowed scientists to establish connections with specialists from other fields of interest. It also gave young scientists like me the opportunity to meet their mentors and gather ideas. Even famous scientists were very approachable and friendly. For me, the best part of the conference was the opportunity to attach faces to the names from the literature. I believe that creating personal relationships pulls the scientific community closer and allows for easier collaboration between colleagues.

The 10th ICRS was a wonderful experience that gave me insight into the Japanese culture as well as the coral reef scientific community. I made many friends from all over the world and hope to keep communicating with them both on a personal and professional level. The presentations were very informative and I gained a great deal of knowledge. However, the highlight of the intense and somewhat intimidating symposium was definitely the personal connections that I established with other coral reef scientists.

I would like to thank my friends and colleagues at Florida Institute of Technology and Virgin Islands National Park for their help and support. Thanks also to my mentors, Dr. Robert van Woesik and Dr. Caroline Rogers, who gave me the guidance and inspiration to produce my research. Most importantly, I thank Kiyoshi Yamazato and the rest of the LOCAP committee for providing the travel award and making this experience possible.

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DIARY

Coral Reef Restoration Workshop on Scientific Frameworks for Rehabilitation

October 18–19, 2005, University of Miami, James L. Knight International Center, Miami, Florida

The Coral Reef Restoration Workshop on Scientific Frameworks for Rehabilitation will present a conceptual framework and strategies for coral reef restoration. Participants will benefit from an integrated, multidisciplinary approach that encompasses engineering, geological, biological, and socioeconomic factors. The conference provides a unique opportunity to exchange information and learn the challenges of coral reef rehabilitation projects from practical case studies. This workshop will include the following topics:

- Exploring critical issues in managing reef ecosystems
- Assessing aesthetic components of ecological restoration
- Analyzing the role of technology transfer on the rehabilitation process
- Examining applied experimental ecology
- Gaining new ideas from practical restoration case studies
- Determining how much compensatory restoration is necessary
- Analyzing the benefits of a cooperative Natural Resources Damage Assessment
- Examining ethical dilemmas in coral reef restoration

For more information, please refer to www.tfilearning.com

U.S. Coral Reef Task Force Meeting

November 4-7, 2005 - Koror, Republic of Palau

Registration for the 14th U.S. Coral Reef Task Force (CRTF) meeting is currently underway. The meeting will be held in the Republic of Palau, on the Island state of Koror. Registration will be available on the CRTF's website: www.coralreef.gov.

The Business Meeting will take place on November 5th and 7th, 2005 at the Ngarachamayong Cultural Center. The Public Comment period is tentatively scheduled on the first day of the public Business Meeting (November 5, 2005). All public comments must be submitted in written format for documentation purposes and must be provided as an electronic file using standard word-processing software or as an Adobe PDF file. For those attending the meeting, written comments may be submitted in advance from Monday, October 3, 2005 to Friday, October 22, 2005. When submitting public comment, please include your name, affiliation, contact information, mailing address, and email address. Also, indicate if you grant the CRTF permission to post your comments to the public website. The full text of all public comments will be catalogued and available of the CRTF's website: www.coralreef.gov.

Submit advance public comments to:
Beth Dieveney
U.S. Coral Reef Task Force Coordinator
National Oceanic and Atmospheric Administration
Coral Reef Conservation Program
1305 East-West Hwy. N/ORR FL. 10
Silver Spring, MD 20910
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Fax: 301-713-4389