

THE INTERNATIONAL CORAL REEF INITIATIVE

Partnership Building and Framework Development

Report of the ICRI Workshop

The International Coral Reef Initiative

Silliman University

Dumaguete City, The Philippines

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Preface

THE DUMAGUETE CITY INTERNATIONAL CORAL REEF INITIATIVE (ICRI) Workshop was uniquely successful in bringing together a group of individuals with diverse roles and responsibilities who share an interest in the health and well-being of coral reefs. It is our intention that this report of the workshop reflect the different expertise, interests, and perspectives that contributed to what we consider to have been a highly productive meeting; that the information contained herein will be widely shared and utilized by colleagues in diverse fora; and that the report will serve as a tool to describe the vision of ICRI to other organizations and institutions in their deliberations on actions affecting coral reef ecosystems.

Although thanks and appreciation are due to many individuals who contributed long hours, much good humor, and a fundamental willingness to collaborate for the greater good of the workshop, the Secretariat would be remiss if we did not single out the good offices of our Operational Chair, Ambassador Penelope Wensley. Ambassador Wensley, Australia's Ambassador for the Environment, contributed the deft ability to keep a tightly scheduled workshop on track while not losing any substantive input. We are all grateful for her advice and assistance in preparing the documents which will no doubt characterize ICRI for some time to come. We are reminded in her closing remarks to stay enthusiastic, optimistic and committed and to carry the message of ICRI beyond Dumaguete City.

We appreciate the participation and contributions of our honorary workshop chair, U.S. Assistant Secretary of State Elinor Constable. Personifying the high level of interest for ICRI in one of its founding partner governments, Ambassador Constable's admonition to translate the workshop results into coordinated policy action, continue the partnership, and keep ICRI issues on high profile at key international fora during the coming years encouraged everyone to work extra hard. Likewise, each of the founding partners (Australia, France, Japan, Jamaica, the Philippines, Sweden, the United Kingdom and the United States) contributed significant resources and expenditure of time in support of the international workshop.

The workshop would not have been possible, however, without the great generosity and support of the Philippine government. Our venue was Silliman University, located in Dumaguete City. Philippine Secretary of the Department of Environment and Natural Resources, Dr. Angel Alcala, a well-known coral reef expert, was instrumental in supporting both the logistical arrangements for the workshop as well as its positive tenor. Silliman's "can-do" spirit and willingness to make virtually all facilities available to workshop participants was exemplified by the friendly hospitality of its President, Dr. Mervyn J. Misajon. The ICRI Secretariat was provided with a large staff of highly qualified officials, teachers, graduate students, and transportation and security personnel who greatly assisted in the execution of the international workshop. Special thanks also goes to the U.S. Agency for International Development (USAID) mission in Manila, without whose support the workshop would not have been possible.

As always, the behind-the-scenes work so critical to the success of any endeavor such as the International Coral Reef Initiative and the Philippines workshop in Dumaguete City often goes unnoticed. It is in that spirit that the ICRI Secretariat and Steering Committee would like to thank the University of Rhode Island Coastal Resources Center

and the USAID Coastal Resources Management Project. Karla Boreri ably assisted with launching the ICRI, organizing the first ICRI Workshop, and producing the final documents; and Stacey Tighe coordinated the workshop program.

Although throughout the week all of the workshop participants contributed to both the workshop itself and therefore to ICRI, the keynote addresses of Dr. Jeremy Jackson, Dr. John McManus, and Dr. Bernard Salvat were in fact “key” to setting the tone for the workshop. Each speaker not only presented fundamental concerns about coral reefs, which were the topics of ongoing discussions throughout the week-long workshop, but also conveyed the urgency of the issues at hand and the “take action” attitude which exemplified the workshop in its entirety. Special thanks go to Richard Kenchington for his diligence in supervising the development of the Framework for Action; to Dr. Stephen Jameson, Dr. John McManus and Mr. Mark Spalding for preparing State of the Reefs: Regional and Global Perspectives; and to Lynne Zeitlin Hale and Dr. John McManus who acted as workshop facilitators.

The ICRI Secretariat is grateful to all those who participated as speakers, chairs and co-chairs, and rapporteurs. The Secretariat Report Writing Team, consisting of Ben Mieremet, Dr. Karen Koltas, Dr. Stephen Jameson, and Connie Arvis, Esq., thanks all those who provided written materials to make the job of writing the report an easy task.

Susan F. Drake, Coordinator

The ICRI Secretariat

June 26, 1995

Executive Summary

THE ICRI WORKSHOP represents a major milestone in a long and difficult campaign to reverse current trends of coral reef degradation. This workshop was the first global response to the ICRI Call to Action. The collective charge answered this call by developing a Framework for Action.

The assembled group included an extraordinary mix of participants – ambassadors, ministers and mayors; scientists, resource managers and enforcement personnel; donor, nongovernmental (NGO) and private sector representatives – all of whom share the same commitment. That commitment is to the conservation, restoration and sustainable use of coral reefs and related ecosystems.

Three keynote speakers outlined the challenges before us. Dr. John McManus presented the excellent State of the World's Reefs report, in which he emphasized that pollution, sedimentation and destructive fishing are rapidly deteriorating reefs bordering the crowded coastlines of the tropical world. While information is incomplete in many areas, we do know that a significant portion of this global heritage has already been lost or seriously degraded. Dr. Jeremy Jackson poignantly illustrated this loss as he described how reefs of a few hundred years ago differed greatly from the reefs of today. He explained that many reef species already may be doomed to extinction and are simply awaiting inevitable natural or anthropogenic calamities to finish the job. He highlighted the need for more long-term and larger-scale research, pointing out that the nature and significance of events such as widespread coral bleaching is only little known to science. Dr. Bernard Salvat introduced a concept which was to become a recurring theme throughout the workshop: that the well-being of human societies and the integrity of coral reefs are closely linked. Because human activities are the major source of reef degradation, we must better understand the linkages between humans and the impacts of their activities on coral reefs. He emphasized that this knowledge is essential to effective and proper management.

The challenge of reef conservation became increasingly clear with the presentation of regional reports on the status of coral reefs. The growing problems in the Americas were exemplified by the case in Jamaica, where a combination of human-induced and natural events has depleted fish populations and reduced coral cover from more than 50 percent to less than 5 percent. The Pacific report emphasized the need for education, monitoring and coastal management, while The East Asia report discussed widespread degradation from pollution, sedimentation and destructive fishing. Reefs in south Asia were shown to be subjected to a variety of stresses, including the effects of mining and overfishing. The threats associated with coastal construction, oil spills and tourist activities were highlighted in the Middle East report. Prominent among the problems affecting reefs in the Western Indian Ocean were pollution, mining, dredging and overharvesting. Nearly all the problems mentioned are caused by humankind and it is humans who can fix them.

With the challenges clearly set before us, participants shared their collective experience and knowledge on topics critical to an effective framework for action: management, capacity building, and research and monitoring. We then addressed how that knowledge and experience could support essential work at the regional and national levels. Using this information as a base, the group worked long and hard for three days and nights to thrash out the

Framework for Action. In the midst of the deliberations, participants spent a day visiting nearby Apo Island and Bais Bay, observing real-world problems and promising solutions. These trips allowed participants to successfully connect the framework to the realities of the world. They also reinforced the workshop's strong view that local communities – whether they are village fishermen at Apo Island and Bais Bay or dive boat operators in St. Lucia – are central to the success of all coral and coastal management efforts.

Special sessions before and after the field trips covered ecotourism, marine protected areas, community-based management and the interaction of the ICRI with the multitude of international and U.N. organizations with whom participants must coordinate.

The important role of NGOs, enforcement agencies, funding agencies and the private sector in reef management became increasingly clear. The presence of all these sectors at the workshop was a particularly valuable asset.

The need for meaningful dialogue among scientists, managers and policymakers was emphasized, as was the need for management-relevant research and monitoring. Wide support was expressed for the implementation of the global coral reef monitoring program, an activity which has been planned for several years. There was broad recognition that ecological monitoring needs to be supplemented by monitoring human factors, particularly economic, cultural and social aspects. Other emphasized points included the need for better sharing of information and expertise and the need to increase public awareness and political support at all levels.

All of these factors, and many others, were considered in the development of a final Framework for Action. This final document is clear and concise, and – with commitment and hard work on the part of each of us – will move us forward on the path to sustainable use.

This workshop resulted in other immediate outputs as well. It initiated a dialogue which we all hope will continue among a much expanded set of ICRI partners. It also raised awareness of coral reef issues through numerous articles, radio spots and television reports both in the Philippines and the international press.

Last, and perhaps most important, each participant departed with a renewed and enhanced commitment to be an active participant in making the Framework for Action a reality.

Adapted from Dr. Angel Alcala's closing remarks.

CARICOMP	Caribbean Coastal Marine Productivity
CBCRM	Community-Based Coastal Resources Management
CENRO	Commission of Environment and Natural Resources Office
CEP	Caribbean Environment Programme
CNPPA	Commission on National Parks and Protected Areas
COBSEA	Coordinating Body on Southeast Seas
COMAR	The Coastal Marine Programme of UNESCO
CORAL	The Coral Reef Alliance
CRI	Coral Reef Initiative
CSD	Commission on Sustainable Development
DENR	Department of Environment and Natural Resources
EIA	Environmental Impact Assessment
EIS	Environmental Impact Survey
ENCORE	Environment and Coastal Resources (project) USAID
EPC	(ICRI) Executive Planning Committee
FAO	Food and Agricultural Organization
GBR	Great Barrier Reef
GBRMP	Great Barrier Reef Marine Park
GBRWHA	Great Barrier Reef World Heritage Area
GCRMN	Global Coral Reef Monitoring Network
GEF	Global Environment Fund
GIS	Geographic Information System
GOOS	Global Ocean Observing System
ICLARM	International Center for Living Aquatic Resources Management
ICM	Integrated Coastal Management
ICRI	International Coral Reef Initiative
ICRS	International Coral Reef Symposium
ICZM	International Coastal Zone Management
IDB	Inter-American Development Bank
IFC	International Finance Corporation
IGBP	International Geosphere-Biosphere Programme
IMO	International Maritime Organization
IOC	Intergovernmental Oceanographic Commission
IPIECA	International Petroleum Industry Environmental Conservation Association
IUCN	International Union for the Conservation of Nature
JICA	The Japan International Cooperation Agency
LOICZ	Land-Ocean Interactions in the Coastal Zone
MAG	Marine Advisory Group
MARPOL	The International Convention for the Prevention of Pollution from Ships
MPA	Marine Protected Areas
NEAP	National Environmental Action Plans
NEMS	National Environmental Management Strategy
NGO	Nongovernmental Organization
NPDP	National Physical Development Plans
OCA/PAC Centre	Oceans and Coastal Areas Programme Activity
OECS	Organization of Eastern Caribbean States
OES	Bureau of Oceans and International Environmental and Scientific Affairs
ONEB	Office of National Environmental Board
PACICOMP	Pacific Coastal Marine Productivity
RAC	Regional Activities Center
RAMSAR	Convention on Wetlands of International Importance especially on Waterfowl Habitat
SIDS	Small Island Developing States
SPREP	South Pacific Regional Environment Programme
STRI	Smithsonian Tropical Research Institute (Panama)
TNC	The Nature Conservancy

U.N. United Nations
UNCED United Nations Conference on Environment and Development
UNCLOS United Nations Convention on Law of the Sea
UNDP United Nations Development Programme
UNEP United Nations Environment Programme
UNESCO United Nations Educational, Scientific and Cultural Organization
URI CRC University of Rhode Island Coastal Resources Center
USAID United States Agency for International Development
WG Working Group
WIO Western Indian Ocean
WMO World Meteorological Organization
WTTC World Travel Tourism Centre
WWF The World Wildlife Fund

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Chapter One

THE INTERNATIONAL CORAL REEF INITIATIVE

BACKGROUND: ICRI ORGANIZATION AND PARTICIPATION

As of 1991, of the 5.6 billion people on Earth, 3.5 billion lived in coastal areas. Many of the world's densest population clusters are found on tropical coasts bordered by coral reef ecosystems. Intensification of coastal zone use is a consistent trend.

Coral reefs rank among the most biologically productive and diverse of all natural ecosystems. They are a powerful symbol of both the economic and ecological significance of coastal ecosystems, as well as the rapid loss of marine biodiversity and resources around the world.

Coral reefs provide basic sustenance for a large but unquantified number of economically marginalized communities. The fishing and tourism associated with reefs is a source of jobs and revenue. Reefs protect tropical coasts from storm damage, and provide recreation and enjoyment to residents and visitors. In addition to serving as the habitat for numerous species and offering unique materials for education and scientific research, reefs support the social fabric of many coastal communities. Worldwide research and monitoring have produced compelling evidence that coral reefs and coastal ecosystems generally are at risk from both natural and human impacts.

In 1992, at the United Nations Conference on Environment and Development, the world community adopted Agenda 21. Chapter 17 of Agenda 21 identifies the importance of marine and coastal issues in the achievement of sustainable economic development and environmental cooperation. It identifies coral reefs, mangroves and seagrass beds as marine ecosystems of high biodiversity and production and it recommends that they be accorded high priority for identification and protection.

The ICRI is a partnership consisting of like-minded nations and organizations seeking to implement Chapter 17 of Agenda 21, and other international conventions and agreements, for the benefit of coral reefs and related ecosystems. Founded by eight governments – Australia, France, Japan, Jamaica, the Philippines, Sweden, the United Kingdom, and the United States of America– the ICRI was announced at the First Conference of the Parties (COP) of the Convention on Biological Diversity in December 1994, and at the high level segment of the U.N. Commission on Sustainable Development (CSD) Intersessional Meeting in April 1995. Since then, the ICRI has come to encompass the participation and support of additional governments, U.N. organizations, regional environmental organizations, multilateral development banks, environmental and developmental NGOs, and the private sector.

As ICRI became more active, it became clear to the partners that a coordinating body should be established. In January 1995, the eight founding ICRI partner governments, as well as representatives from other interested entities, met in Washington and established an ICRI Planning Committee from which an Executive Planning Committee

(EPC) was derived. The ICRI Planning Committee is composed of the eight founding partner governments as well as representatives from the International Union for the Conservation of Nature (IUCN), Inter-American Development Bank, the World Bank, United Nations Environmental Programme (UNEP) and UNEP's Caribbean Environment Programme (CEP), the United Nations Educational, Scientific and Cultural Organization (UNESCO), the United Nations Development Programme (UNDP), the Coordinating Body on Southeast Asia (COBSEA) and the South Pacific Regional Environmental Programme (SPREP). The EPC is composed of the same eight founding partner governments and representatives of the IUCN, UNEP, and the World Bank.

In practice, the EPC has become the working level coordinating body for ICRI. It meets periodically to provide guidance to the ICRI Secretariat and to facilitate planning and decision making. For the sake of continuity and consistency, the ICRI Planning Committee has agreed to retain the present composition of the EPC meeting in April 1996.

One of the first decisions of the EPC was to recognize the need for, and give its concurrence to, the establishment of an ICRI Coordinating Office/Secretariat. Presently, the United States of America hosts the Coordinating Office.

A second early EPC decision was to sponsor an international workshop focusing on coral reefs. In anticipation of the workshop, the ICRI Secretariat and the EPC worked to produce a "Call to Action." The purpose was to provide the broad principles which could be used to unify the participants in a partnership and to set the direction for the workshop. The Call to Action reflects a concern over the continuous degradation and damage to coral reef and related seagrass bed and mangrove communities or ecosystems; the difficulty of determining the threat spectrum (direct, indirect, potential) to the ecosystems; the significance of reefs to the world community as well as to individuals; measures that can help to reduce the threats; and what types of actions under those measures the ICRI might best collectively focus its attention upon – either through encouragement or direct activities.

Participants of the Dumaguete workshop provided additional insights, leading to changes in the draft of the Call to Action approved by consensus at the workshop.

The international ICRI workshop was held at Dumaguete City, the Philippines from May 29 through June 2, 1995. The intent of the workshop was to enable nations, donors and funding agencies, development organizations, NGOs, the research community and the private sector to work together in order to develop a Framework for Action for coral reefs. The Framework, which appears in its entirety in this report (see Chapter 4) and which was developed from the collective deliberation and wisdom of the participants, will serve as a comprehensive guide to mobilize national, regional, and international actions on behalf of coral reefs.

OBJECTIVES AND APPROACH

The long-term vision for ICRI is to build and sustain partnerships with particular emphasis on increasing the capacity of countries and regions to achieve effective management and sustainable use of coral reefs and related environments. The ICRI seeks to provide for the protection, restoration, and sustainable use, understanding and

enjoyment of coral reefs and associated ecosystems of the world for the benefit of present and future generations, in perpetuity.

The approach of the initiative is twofold: 1) to raise global and local awareness and obtain national, regional and global commitments to conserve and sustainably use coral reefs and associated ecosystems; and 2) to use and better coordinate governmental and regional agency efforts, as well as stimulate and facilitate the development of new activities, to address coral reef issues. The initiative has, and will continue to, involve partnerships and coordination with international and regional organizations including UNEP and its Regional Seas programs; IUCN; COBSEA; the U.N. Food and Agricultural Organisation (FAO); UNESCO and its Coastal Marine Programme (COMAR) and Intergovernmental Oceanographic Commission (IOC); UNDP; U.N. Conference on Environment and Development (UNCED); the World Bank and the regional multilateral development banks; and NGOs, the private sector and the scientific community.

The ICRI seeks to facilitate the leveraging and channeling of resources among all sectors (governments and nongovernmental organizations) for the benefit of coral reefs and associated environments. The ICRI does not intend to establish a new bureaucracy or act as a funding source.

The broad objectives of the ICRI are:

- For governments and international organizations: To strengthen implementation of existing programs at the local, national, regional, and international level to conserve, restore and promote sustainable use of coral reefs and associated environments;
- For each country and region: To incorporate management provisions for protection, restoration, and sustainable use of the structure, processes and biodiversity of coral reefs and associated environments into existing local, regional, and national development plans;
- To strengthen capacity for development and implementation of policies, management research, and monitoring coral reefs and associated environments; and
- To establish and maintain coordination of international, regional and national research and monitoring programs, including the Global Coral Reef Monitoring Network in association with the Global Ocean Observing System; and to ensure efficient use of scarce resources and a flow of information relevant to management of coral reefs and associated environments.

THE CALL TO ACTION

The following Call to Action was approved by the EPC and the participants of the International Planning Workshop on Friday, June 2, 1995.

International Coral Reef Initiative Call to Action

June 2, 1995

The nations and organizations supporting the International Coral Reef Initiative (ICRI) urge attention to the following:

The Global Problem:

Coral reefs are in serious decline globally, especially those near shallow shelves and dense populations. It has been estimated that 10 percent of the earth's coral reefs have already been seriously degraded and a much greater percentage is threatened. If allowed to continue, this decline is likely to lead to the loss of most of the world's reef resources during the next century.

The Threats to Coastal Ecosystems:

The reasons for the decline in reef health are varied, complex, and often difficult to accurately determine. While natural events—such as storm damage, predator infestations, and variations in temperature—have some impact on reef ecosystems, human activity is a primary agent of degradation. Contributing factors include:

- Direct impacts from activities such as resource extraction, in-filling, overharvesting, and diving and boating activities, as well as nutrient enrichment and toxic pollution;
- Inadequate planning and management of coastal land use, including upland activities;
- Potential adverse effects of climate change, including temperature and sea-level changes, alteration of natural patterns of precipitation, tropical storms, and ocean circulation; and
- Population growth, increasing pollution and increased uses of the fragile resources will accelerate the decline in coral reef ecosystems, with societal and ecological effects extending beyond reef environments.

The Significance of Coral Reef Ecosystems

Coral reef ecosystems offer benefits to humankind beyond those realized for food production, tourism, recreation, aesthetics, and shoreline protection. Capable of sustaining innumerable coastal communities worldwide, these ecosystems also have great economic, social, and cultural importance to nations, and to entire regions. As competition among multiple uses of reef resources increases, so too will their significance to the human populations that depend on them.

Coral reef ecosystems are among the most biologically productive and diverse in the world; they also serve as indicators of environment health. These facts were recognized at the 1992 United Nations Conference on Environment and Development, where coral reefs and associated systems were accorded a high priority for protection in Agenda 21.

Reducing the Threats

Threats from human-related impacts can be minimized or eliminated through:

- Improved and sustained management practices;
- Increased national and local capacities for coral reef ecosystem management;
- Increased political support for managing coral reef ecosystems; and
- The sharing of existing important and new information related to maintaining the health of these ecosystems.

The ICRI governments endorse the following measures, to be implemented through global, regional, and national actions:

Coastal Management

- Incorporate integrated coastal management measures into local, national, and regional coastal development plans and projects and support their long-term implementation.
- These measures will serve as the framework for achieving the sustainable use of, and maintaining the health of, coral reefs and associated environments.
- Develop coral reef initiatives (regional, national and/or local). These should use an ecosystem-based, integrated approach that encourages participation and includes programs for community-based management or comanagement of reef resources.

Capacity Building

- Establish regional networks to share knowledge, skills, and information.
- Develop and support educational and informational programs aimed at reducing adverse impacts of human activities.
- Establish information exchanges with stakeholder communities.
- Improve developing nations' access to bilateral, multilateral, and other forms of financial and technical support for coral reef management.

Research and Monitoring

- Use regional networks to achieve better coordination and cooperation among national research programs.
- Promote linkages between regional and global research and monitoring networks, such as CARICOMP (Caribbean Coastal Marine Productivity), PACICOMP (Pacific Coastal Marine Productivity), and GOOS (Global Ocean Observing System).
- Support research and monitoring programs, projects, or activities identified as essential to managing coral reef ecosystems for the benefit of humankind.
- Promote the development and maintenance of a global coral reef monitoring network.

Review

- Periodically review the extent and success of implementation of actions identified in the initiative.

The nations and organizations supporting ICRI call upon all other relevant, international entities, governmental and non governmental organizations, including the private sector and scientific communities, to undertake the actions above.

Chapter Two

MESSAGES TO GUIDE THE ICRI

MESSAGES FROM KEYNOTE SPEAKERS

THE ROLE OF SCIENCE IN CORAL REEF CONSERVATION AND MANAGEMENT

Presented by

Dr. Jeremy B.C. Jackson

Smithsonian Tropical Research Institute

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Introduction

Coral reefs are grossly overused and abused throughout much of the Caribbean and Pacific. Exponentially increasing numbers of people cause exponentially increasing exploitation and destruction of reefs. Sustainability of any resource is ultimately a function of numbers of people and nothing any scientist may say or do can change that. Organizing and raising political and social consciousness about the limits of reef sustainability and devising viable economic alternatives is what the International Coral Reef Initiative (ICRI) is all about, and for this purpose science quite properly plays a minor role. But on the happy assumption that ICRI is somehow successful in gaining commitments to change reef use, then ICRI does need science—strictly applied science to be sure—to help guide and give flexibility to new approaches to coral reef conservation and management.

We have learned so much so fast about what's wrong with reefs that it's difficult to imagine the fool's paradise of coral reef science only 20 years ago, when ecologists waxed eloquently about community ecology of Jamaican and other Caribbean reefs, all the while ignoring all the fish that were gone and what their ecological roles may have been. A few weeks ago, John Ogden and I had the opportunity to dive for the first time at Los Cochinos in the Bay of Honduras. Corals were reasonably abundant—even the vulnerable elkhorn acroporids. But all the now-classic Caribbean danger signs were also evident: no big fish or long-spined sea urchins, myriad gardening damselfish, and abundant macro algae (seaweeds in this paper) overgrowing corals. The situation was so clear that our diagnoses of the future of these reefs were virtually identical.

We call this common sense now, but only 10 to 12 years ago when the long-spined sea urchins were still dying, these ideas were at the cutting edge of reef ecology. And it is still an open question whether the present situation can be reversed. Los Cochinos is a new Honduran coral reef reserve. It is also an experiment. Can stopping intensive

fishing on a scale of 20 to 30 kilometers (km) make a difference for these reefs? We know that this is possible from studies by Alcala and colleagues in the Philippines. However, the Philippines are an oceanic archipelago, whereas the Caribbean is almost a Mediterranean Sea. We do not know what will happen to the balance of corals and seaweeds as pollution builds up throughout the region.

Questions like these are fundamentally scientific questions. Thus, my basic theme is that coral reef conservation and management won't work if we lose sight of science, even though reef scientists have not been very helpful in the past. This is because we will have to respond to rapidly changing realities in many very different ways. But before explaining why, I will briefly review some critical features of coral reefs and why we should care about them.

Why Are Reefs Special?

In the simplest sense, coral reefs are just huge, wave-resistant piles of limestone and sediments built by a thin veneer of living organisms. But these piles are of great ecological and resource significance for their massiveness of bioconstruction, extremely high biodiversity, and distinct trophic structure and primary production.

1. Bioconstruction

First and foremost the scale is enormous. Reefs are the largest biological construction projects on earth. The Panama Canal is still the largest human construction project ever completed, but it is paltry by comparison with the modest coral reefs along the Caribbean coast of Panama. The U.S. Army Corps of Engineers finally gave up trying to control erosion along the mid-Atlantic coast of North America, but without even considering the Great Barrier Reef, coral reefs all over the world stabilize vastly greater tropical coastlines. Moreover, modern reefs are only youngsters less than 10,000 years old. Over the longer term of millions of years, even small atolls like Enewetak have accumulated 2- to 3-km-thick piles of limestone, all produced by the same thin living veneer.

We tend to take the enormity of reefs for granted because it is so difficult to imagine tropical coasts without them. Moreover, coastal stability is not the same kind of obviously marketable resource as fisheries or tourism. However, there are two aspects of the bigness of reef bioconstruction which are of special importance to us here. First, reefs redefine the physical structure of the coastline and that of adjacent environments. Wherever they co-occur, reefs are the barrier against the sea for seagrass beds and mangroves, just as mangroves and sea grasses trap and stabilize runoff from the land. The physical connectivity among these three ecosystems is usually obvious. Protected by reefs, sea grasses and mangroves are able to grow behind them on wave-swept shores, whereas mangroves and sea grasses protect reefs by preventing them from being drowned in sediments. The latter function was dramatically illustrated after a major oil spill in Panama, when mangroves died and sedimentation and coral mortality on reefs increased severalfold. In contrast, biological and chemical interconnections are more subtle, although mangroves and sea grasses commonly serve as nurseries for reef fishes, and reefs may act as a refuge for many grazers on sea grasses.

The second major point about bioconstruction is that the apparent physical stability of reefs belies an underlying natural turmoil of growth, death and destruction of calcareous organisms. Much like a modern city, reefs are constantly being rebuilt and torn down at the same time. Corals are the bricks, broken pieces of plant and animal

skeletons the sand, and algal crusts and chemical cements the mortar. Reef growth is determined by the production, accumulation, and cementation of all this calcareous stuff into solid limestone. Destruction is due to storm damage and far more pervasive grazing and excavation by organisms.

The key point is that even small changes in rates of construction or destruction may cause big increases or decreases in reef mass. For example, Eastern Pacific reefs virtually disappeared within a decade after the strong El Niño of 1983 due to coral death and intense bioerosion. Eastern Pacific reefs are small and marginal, but their vulnerability to physical destruction is indicative of what could happen elsewhere if carbonate production were seriously curtailed or destructive processes increased. This fragility also scales up in geological time; the history of reefs over the past 500 million years is punctuated by long episodes of no reef development due to climatic change.

2. Biodiversity

Coral reefs support the greatest biodiversity in the sea. Numbers of phyla are much greater than even tropical rain forests, and numbers of species per area of habitat exceed any other marine environment. The modern reef fauna is the product of a burst of evolution about 2 million years ago, when two-thirds of all coral species went extinct and new species originated with very little evolution since. This was the “Acropora revolution” that transformed reef communities to give them their characteristic graceful structure dominated by tall branching corals. Thus, the modern fauna is the evolutionary byproduct of the onset of intense climatic and sea-level fluctuations of the ice age, so that many living corals are adapted to rapid sea-level change but also to generally lower temperatures than now.

High diversity is an obvious positive asset for prospecting for marine natural products like pharmaceuticals as well as an attraction for tourism. However, high diversity is a liability for understanding how reefs work ecologically and for detecting change, as in the case of depletion of multispecies fisheries. Functionally, it is now clear that high diversity provides ecological redundancy, as in the Caribbean where invertebrate grazers replaced fishes in consuming seaweeds on overfished reefs. But the relation of diversity to primary productivity is still unknown.

3. Primary Production

The big difference between reefs and other shallow-water tropical communities is that primary production occurs mostly on the bottom by plants (algae, sea grasses) and plant-animal symbioses (corals) rather than in the water column above by microscopic algae (plankton). Primary production is also more tightly recycled within the reef ecosystem than in other communities. These differences are reflected in major differences in fisheries. Centuries ago, reefs and adjacent environments were dominated by abundant, large, bottom-feeding turtles, manatees, and fishes such as groupers; reef fisheries are still predominantly based on the bottom. In contrast, the great fisheries of tropical upwelling areas are in the water above.

The really big consumers on coral reefs, seagrass beds and mangroves have been gone so long that we have no idea of what was normal. I was just in the Cayos Moskitos of Nicaragua, whose turtles fed Jamaicans for centuries. Long ago, turtles littered the nearly 100,000 square km of the Mosquito Bank like so many millions of stones, and were even so abundant that they stopped Columbus' ships for a day along the south coast of Cuba because he

couldn't make way through a migrating horde. However, I did not see one turtle during my entire week on the Moskito Bank. But I did once see a protected turtle grass bed at Los Roques, Venezuela—with no turtles, of course, but a dense, protected population of large conchs. The sea grass was grazed down like a putting green on a golf course, something I have never seen elsewhere. Interestingly, the highest land in Los Roques is mountains of millions of conch shells, whose bottom layers carbon-date back to aboriginal times.

Observations such as these raise serious doubts about generalizations of tight recycling on reefs which were all made one century after the last big consumers were ecologically extinct. Heavy calcification of many reef species is almost certainly a relic of predation past, just like the hat-needle—long spines on neotropical trees that guard them against giant herbivores that were hunted to extinction 10,000 years ago.

How Are Reefs Threatened?

John McManus addresses this in detail and I offer only a few generalizations. The virtual disappearance of turtles and large fish is obviously due to overfishing. This loss of large consumers set off a chain reaction beginning with an increase in small, mostly invertebrate microconsumers; subsequent shift in dominance from animal-plant symbioses like corals to seaweeds; increased bioerosion; and little or no reef growth. The most important forms of pollution are probably deforestation and modern agriculture, which increase sedimentation and nutrient runoff. These in turn break down the buffering by adjacent ecosystems and cause a shift from animal-plant symbioses to sea-weeds. Thus, overfishing and pollution both result in dominance by seaweeds over corals and the destruction of reef framework. Physical damage due to mining and dynamiting is increasing widely, and can also destroy the very framework of reefs built up over thousands of years.

There are also real concerns about increasing temperature, ultraviolet light, and carbon dioxide due to climate change over the next few decades—assuming there are reefs remaining to be concerned about. However, possible climatic effects are complex and poorly understood. For example, coral bleaching has been described both as a normal adaptive response and the harbinger of reef destruction.

Role of Science?

So what is the useful role of science? We know already that reefs will be much better off if we decrease the numbers of people using reefs, overfishing, or deforestation. Moreover, we do not need any new science to try to do those things. But, the best we can hope for is to partially curb these activities because people always push as hard as they can. This leaves us with the much more complex problem of sorting out probable consequences of partial actions, deciding which ones are more likely to be effective, and understanding why. And for this we need science. I will briefly consider four general issues, critical to ICRI in my judgment, that need a strong dose of science:

1) concepts and assays of reef health; 2) the importance

of scale, metapopulations, and the emerging concept of an “extinction debt”; 3) the necessary relationship of monitoring, prediction and theory; and 4) the role of large-scale experiments in reef conservation and management.

1. Reef Health

The very concept of global coral reef monitoring and rapid assessment is based on the assumptions that we know 1) what is healthy; and 2) what to measure to diagnose reef health (i.e., what John Ogden and I did after our dive at Los Cochinos). Given economic realities and the critical state of many reefs, monitoring has to be rapid and cheap. But monitoring also has to be useful to avoid the folly of selling the world the idea of global monitoring and having little to show for it in the end. For example, high coral cover is commonly used as a measure of reef health. While very low cover on once-luxuriant reefs is unquestionably telling us something is wrong, the opposite is definitely not the case. Coral cover on most Jamaican and many other Caribbean reefs was more than 50 percent for several decades after extreme over fishing had set up the eventually catastrophic sequence of events that followed.

Monitoring must therefore include simple assays of rate processes that change community structure such as coral growth, grazing, bioerosion and recruitment instead of just counting organisms and measuring physical parameters like temperature. These observations can be made extremely simply by coring corals to count and measure growth bands, attracting grazers to standard baits, and placing calcareous tiles on the reef surface to photograph and weigh their increase or decrease in mass. Bands, baits and tiles are not a luxury or question of increased precision. Rather, they are the difference between futility and utility, and anyone can use them with a decent protocol.

2. Regional Scale

Scale is an issue ICRI was made to promote, and I just want to emphasize new insights from the metapopulation theory that underlines the essential importance of larger scales. Metapopulations are the sum of local, geographically isolated populations connected only intermittently by movements of organisms between them. Species survival depends on the number of different sites inhabited (approximately the number of local populations) and the kinds and strength of linkages between them. Thus, it is of vital importance to understand larval dispersal and recruitment and their relation to the physical environment, as pioneered by the crown-of-thorns starfish project at the Australian Institute of Marine Science.

The minimum number of local populations or sites required for a species' survival varies as a function of its life history traits, such as its recruitment potential or ability to compete for space. This minimum is generally greater for competitively dominant species than for weedy species. Thus, loss of habitat, which inevitably decreases the number of sites and local populations, should cause an increase in relative abundance of weeds to dominants, and the eventual extinction of the latter. Moreover, species should go extinct, even if they have healthy populations on many reefs, if the sum total of local populations is less than the critical number. This is because local extinction on any reef is inevitable due to chance. Thus, overall species survival depends on continued recolonization from elsewhere.

Arguments such as these have led to the concept of an extinction debt, which in the context of coral reefs means that healthy populations of coral species on isolated, undisturbed reefs may already be evolutionarily dead because too few sites are left overall. In the Caribbean, this could easily lead to dominance by small, weedy species and the accompanying loss of species that form the reef "canopy" such as the tall acroporids and head corals. The possibility of an extinction debt also raises more problems for our concepts of reef health. For example, in a recent important

paper, Clive Wilkinson classified coral reefs in three states: critical, threatened and stable. This system is obviously useful for local assessments. However, so-called stable reefs may not be stable at all if the total number of populated reefs is already below the critical number for some species. Therefore, I also worry about the idea that isolated archipelagos can act as refuges for threatened species. To the contrary, such islands are more likely to be sinks rather than sources of coral larvae, and themselves dependent upon the threatened mainland populations they are supposed to save.

3. Monitoring, Prediction and Theory

Monitoring must lead to useful, predictive models for conservation and management. Models mean theory and theory means assumptions. However, both theory and models are commonly dismissed by most reef managers, policymakers, and nongovernmental organizations who, perhaps understandably, believe they have more important real world concerns. But quantum theory, which is understood by very few and is rife with assumptions and inconsistencies, has given us the transistor and microchip used by billions. Likewise, in population biology, the models of Anderson and May have contributed to successful new vaccination policies and help to understand the spread of AIDS.

Terry Hughes' pioneering matrix calculations of coral population growth or decline were rife with assumptions, but they "worked" and are now widely used to project coral growth. Theories of thresholds and breakpoints, prey-predator cycles, and metapopulations have all yielded new conceptual frameworks and rough estimates of the consequences of different actions or events that are essential to guide what we do. Epidemiologists are not sitting back for 20 years to perfect new models to understand AIDS. Rather, they use what they've got, but still the models usefully lead the research. We critically need the same mix of theory, models and monitoring regarding coral reefs to avoid making mindless measurements and not knowing what they mean.

4. Experiments

There is a long and powerful tradition of small-scale, manipulative experiments to elucidate mechanisms of ecological interactions and community structure. However, we need now to shift to very large-scale manipulations to critically test our management options for the future. Castilla and colleagues in Chile stopped human harvesting along a half-kilometer of rocky shore which caused changes in intertidal community composition beyond recognition within only a few years. We need the same kinds of experiments on coral reefs. Obvious candidates are to repeat, on larger scales and in different places, Alcalá's demonstration of the positive effects of stopping fishing and Guzman's demonstration of the potential for coral transplantation as a means of restoring damaged reefs. Other important possibilities include a Hubbard Brook type of ecosystem experiment to determine the benefits for reefs of different strategies of land use and conservation, and the reintroduction of large consumers like turtles, conchs or sharks.

Establishment of new reserves or other changes in policy should be planned as scientific experiments from the start to test the feasibility of policy alternatives on an opportunistic basis. Moreover, the financial costs of such experiments are trivial relative to those of setting up and genuinely protecting a reserve, and are realistic economic and social alternatives for everyone affected.

Conclusion

For decades, the vast majority of coral reef scientists ignored what was happening to reefs so that managers, what few there were of them, had to manage alone. But now, though we have the best of intentions, we are in danger of doing the reverse. One of the greatest opportunities and challenges for ICRI will be to bring the research, conservation and management communities together to make policy and to continually challenge all that we do to make it better. Furthermore, we should not limit our commitment to meetings like this one, but should hassle over the nitty gritty of real-world decisions and follow through on them. This is where large-scale experiments can really shine to mix management, science and the interests of local people to produce alternative models for action. The International Society for Reef Studies and International Coral Reef Symposia can provide important for a for exploring alternative actions. We look forward to hearing the latest developments in Panama next year.

HUMAN SOCIETIES AND REEFS. WHY THE SITUATION? WHY THE CHALLENGE?

Presented by

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My presentation is the views and feelings of a scientist working on coral reefs and on the relationship of human societies to coral reefs, for a little more than three decades.

This workshop is an intergovernmental meeting. Probably no more than two-fifths of you work on coral reefs – conducting field work, diving, etc. Nevertheless, most of you have had the opportunity to snorkel on reefs. Probably only a small number of you know reefs only through reading or television.

Our workshop is not a meeting on coral reef science. I would like to ask all of you looking at human societies and coral reefs on earth from a long distance in time and space, far away from our planet, “What is happening?”

Two Partners

To understand the partnership between humans and coral reefs, we must go back some hundred million years ago.

During this period, reefs had appeared and disappeared, but always reappeared, sometimes after absences of some millions of years. Reefs, as they are today, or reef organisms as they were before, are and have been a community, building carbonate rock on earth. No other living community has been more important as biological builders since our planet's birth. Coral reefs have always developed in intertropical waters and, at the moment, about 600,000 square kilometers of reefs are distributed among three oceans as a typical marine coastal ecosystem. This is the first partner.

Humans, the second partner, have been on earth for a little less than 2 million years. A land animal—not a marine one swimming among the reefs—the number of inhabitants of the agrarian society of two centuries ago was 800 million. As human society moved to industrial activities, its population size increased to 6 billion, or seven times more than it was two centuries ago.

This leads to two observations: 1) human concentrations are increasing in the coastal zone because of the intrinsic rate of population growth and because of migration of populations away from agricultural areas due to decreasing soil fertility; and 2) tropical countries, which possess most of the world's coral reefs, have the greatest rates of population growth.

The Interrelationships Between the Two Partners

We will limit discussion of these interrelationships to four major items.

Extractive Activities: Either for food or coral materials, reefs were and are important for humans. Today, reefs provide about 10 percent of the harvest of finfish and shellfish of tropical countries and about 25 percent of the fish catch of developing countries. The potential harvest of living resources on coral reefs is about 10 million tons per year, equivalent to 12 percent of the present world fisheries catch. Fortunately, this quantity is not being harvested at the moment, due partly to limitations in harvesting technology, to human disease problems (e.g., ciguatera), and to trade commercialization. However, many of these limitations may be overcome during the next decade.

Uses of Space: Either for transportation or, primarily for tourism activities, coral reefs have become a major and key economic factor for developing countries.

Services of Reefs to Humans: Very often overlooked, the most important benefit of reefs is protection of the coastal zone. On many oceanic islands, there would be no littoral zone for human activities if reefs disappeared. Additionally, more than 400 low-relief or atoll islands inhabited by humans were formed by coral reefs.

Waste Disposal: Coral reefs, and the sea in general, are the receptacle of all human waste, not only from activities in the coastal zone, but also those taking place far inland. These include terrigenous runoff, sewage, nutrients, pollutants, etc.

Independent of the above relationships, there is a political aspect of reefs that contains a broad economic component. About 100 countries have coral reefs along their coastlines. Almost all are developing countries, with the exception of Australia, France, Japan, the Netherlands, New Zealand, United Kingdom, and the United States. Many of these areas are island states and archipelago or island countries, many with atoll islands, that are concerned primarily with reef health and resources. These political and economical elements, which derive from the organization of human society, impact all relationships between the two partners.

State of the Reefs

Four conclusions emerged from the regional reports, the importance of which varies with region:

- Loss of food resources (subsistence or fisheries) and artisanal products;
- Detrimental effects on tourism industry;
- Social impacts relating to loss of work and resources; and
- Harmful impacts on indigenous cultures.

Authors of these reports concluded:

“Degradation of coral reef ecosystems would have significant impact on world food sources, and long-term negative economic impacts on fishery and tourist industries,” and “unless effective management is implemented, more than two-thirds of the world’s coral reefs may collapse within the lifetime of our grandchildren.”

How did we arrive at this situation?

The Reasons for the Current Situation

If we want to know what to do, we need to understand what happened, what are the weak points, and why until now we have failed. To do this we must go back 30 years.

In 1969, the first international meeting on coral reefs, held in India, was attended by only about 50 scientists. Successive meetings have been held every four years in Australia, Miami, Manila, Tahiti, Townsville and Guam. The next meeting, scheduled to be held in 1996 in Panama, will probably attract about 1,000 scientists.

The year 1968 marked the start of the famous Club of Rome (Italy). Its objective was to look at human activities at global world scales. Discussing a large series of global environmental problems, the Club of Rome made some predictions, but its main impact was to alert scientists and politicians to the problems humanity will face as the limited resources on earth diminish.

What has happened since then, some 30 years later? What can explain the present situation, especially the state of the reefs which have become endangered? The following have occurred:

- Human population has grown exponentially.
- Science and knowledge of reef structure and functioning, ecosystems and resources, has made enormous progress leading to technology and management.
- Western lifestyles, laws and market economics have spread throughout the world.
- Global and world concepts emerged (limited resources, pollution, global change).
- There was a massive development of commercial fisheries; more and more fishermen with technologically advanced equipment have resulted in maximization of catches.
- Developing countries adopted cash economies with the desire, and then the necessity, for the population to buy imported products such as outboard motors and televisions. The result has been overharvest of resources.
- Tourism activities shifted from temperate areas to intertropical ones as air service has expanded.
- Tourism has become one of the major sources of income for developing countries with reefs.
- Pollution and degradation increased; examples of the collapse of reef ecosystems include Kaneohe Bay (Hawaii), Jamaica, and Jakarta Bay (Indonesia).

- Waste disposal problems emerged which were not predicted by the Club of Rome.
- Pollution and waste disposal affected coral reefs as well as coastal ecosystems.
- After protection and conservation, the sustainable development concept has emerged.

All these elements are proof or testimony to an uncontrolled growth of human populations and human activities leading to endangerment of the reefs. The problem is not to manage the reefs but to manage human population and their activities. Urgently needed solutions will not be found through additional research but through application of that which we already know.

The Challenge of Preserving Coral Reefs

Now we are faced with the challenge of preserving coral reefs for sustainable use and for future generations. In fact, our societies, organizations, and economies, extracting more and more, are, at the moment, very capable of the contrary. I see no possibility for them to take care of the long term.

Nevertheless—except to suggest strong modification of our fundamental approach—there are a few other points we can make on ways in which to avoid or limit reef degradation. Among the most radical and revolutionary concepts is the privatization of coral reefs. In other words, coral reefs, as coastal lands, would be owned by people as individuals, families, or local communities. This is not a suggestion, of course, just an idea to show how different the outcome could be of management of a “common” environment which suffers from human activities. Note that in some countries like Papua New Guinea there is a tradition of ownership of coastal resources, including reefs. This was the case in French Polynesia two centuries ago.

Another revolution will be to ban, in all countries, trade of the import and export of any product from reef resources. I have in mind shellfish and crafts for tourists, and also as an example, the billions of dollars involved in the aquarium fish trade. Of course, I am dreaming; this is impossible. These two examples—privatization of coral reefs and banning the trade of coral reef products—have merit in that they demonstrate how we are constrained in our human organization and economic system. In fact, our society wants too many things—exploitation and conservation. The problem is that we now know that we need the second for our survival but that there is no other system which is compatible with the first.

Returning to reality, I would like to briefly comment on some points which will, perhaps, help to avoid a catastrophic collapse of all reefs around the planet at the end of the next century. These comments will be on science, management, economics, legal status and, lastly, on government/nongovernment bodies—meetings and money. Some of the following may shock you!

Scientists have played their role in the past decades. A lot is known about reefs and on how not to degrade them. I would like to make just three points. First, research has to go on in all fields, especially in restoration, in understanding long-term changes in reefs in relation to natural and anthropogenic effects and their synergy, and in research to collect and culture larvae of edible species. Second, governments of developed countries, which have the human resources to work on reefs, must invest in management problems (scientists, engineers, applied research and

training). Third, the science of coral reefs must include not only the natural sciences such as biology and geology, but it must also include social science to develop sociological and economical research related to reefs and reef uses. Links between coral reef environments and some human societies have to be considered within the context of the traditions and cultures of these populations. We must also consider the acculturation of these societies which is occurring with the westernization of these countries.

Management of coral reefs; Please don't forget that reefs in developing countries with heavy population pressure are still hunted and gathered—a human activity that no longer exists on land.

Developed countries, with little or no coral reefs along their coast, are looking and speaking of reefs in terms of preservation, biodiversity, aesthetics, science, genetics, resources and ecotourism. For the approximately 100 developing countries with coral reefs, the problems are subsistence, food, exploitation, materials and tourism. The situations are not the same—the latter must rely on reefs for food, while the former does not.

We may note that there are two ways, two strategies, to manage the reefs. One is top-down management from a strong central government to local users through laws and administration. This is generally the case in developed countries, and sometimes of developing ones, as in Indonesia, although developing countries sometimes have a lack of money and trained personnel. The other strategy is bottom-up, starting with resource users; the Philippines has been successful with this strategy, which is probably the best one for developing nations.

Economics has made real progress in terms of valuation of reef resources and benefits. The objective is to have a monetary value for each element of the ecosystem related to human interests and activities. These reef values then can be integrated into the decision-making process by economists and politicians. Even with this integrated approach and new presentation, economics are unable to express social and cultural value and long-term advantages of reefs for future generations. Nevertheless, integrated coastal zone management has to include economic analysis and perspective. As mentioned by the President of Silliman University, Dr. Mervyn Misajon, what we have in our hearts, according to our culture, is difficult to introduce into economics.

Law and the legal status; This is probably the area in which little progress has been made at national levels as knowledge of reefs has developed over past decades. Attempts to address these issues between lawyers and scientists in the International Society for Reef Studies have failed because of lack of interest among the scientists. International environmental law is restricted, in fact, by the sovereignty of each country. No mechanisms exist for dealing with noncompliance. Criticism is left to the NGO community – except, maybe, they receive too much funding from U.N. bodies to be considered totally free.

Many coral reef protected areas are paper parks. What body is really involved in an honest state of protected areas. Where are the reports on paper parks?

Finally, I would like to call to mind the role of bodies –institutions at national and international levels–meetings, and money. I would like to say, clearly, what everybody knows, sometimes agrees upon, but rarely mentions in speech.

Enough bodies and commissions have been created to try to solve environmental problems. Please, use the ones existing at international and national levels and don't set up a new one for coral reefs.

Too many meetings have occurred. Many of my colleagues, of course among the oldest coral reef scientists, are tired of participating when nothing happens after discussion. In some recent projects more money has been spent on meetings and reports to decide what to do in the future than the amount of money spent in the field on any implementation. It is impossible also not to mention funds for projects in developing countries which vanish in per diems, salaries, organization, and so forth, with only a small part for the objective of the project.

Dear participants to the workshop, I was asked to give my feelings as a scientist on the interrelationships between an ecosystem (coral reefs) and a species organized into society (Man) at the world scale. Such are the comments of a scientist. I was provocative by nature and because I cannot manage very well the English language. Objectives were to think freely and to look at us (humans) and at reefs, as we will be seen in the future.

To save the reefs for future generations will be very, very difficult. Past and present situations do not allow us to be very optimistic. We have to be realists in order to act correctly and not to dream or only be happy to be here and to discuss.

May all these comments on "Why the coral reef situation?" and "How difficult is the challenge to save them?" help you during the week.

THE STATE OF THE REEFS REPORT: A SUMMARY

Presented by

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General

Coral ecosystems are found in 100 countries and island states around the world. More than 60 countries depend on coral reefs for the majority of the fish they harvest. Coral reef fish may comprise more than 30 percent of all tropical harvests. Most of the millions of people around the world who depend on reefs for food and livelihood are poor, and thus have limited options when reefs become degraded. In many archipelagos, the coastlines along which people live are protected from wave erosion by coral reefs. Reef flats are used increasingly for mariculture of fish, giant clams, pearl oysters, topshells, green snails, seaweeds and other organisms. In this way, they provide the world with hundreds of products including food, pharmaceuticals, aquarium organisms, jewelry, buttons, shell products, paint emulsifiers and more. Coral reefs are the most biodiverse of all known marine ecosystems, and maintain much higher genetic diversity than tropical rainforests. They therefore represent the world's most significant storehouse of potential future products. Coral reefs and associated ecosystems, including mangrove forests and seagrass beds, are rapidly degrading on a global scale due to a variety of causes.

Selected Stresses

Pollution affecting reefs comes from a variety of sources, including organic materials from cities, villages and tourist facilities; oil from shipment, transfer and drilling; and fertilizers and pesticides from fields and mariculture ponds. Organic pollution associated with tourist facilities built along fringing reefs or on small islands is particularly problematic, often causing corals to be overgrown by algae. These facilities thus become self-destructive. The problem of economically disposing of nitrates and nitrites from human waste in such areas is compounded by the generally porous nature of the raised coral reef on which the facilities rest.

Corals live under a broad range of natural silt conditions, to which the individual colonies and species combinations are specifically adapted. Degradation occurs when there is an increase in sedimentation, resulting in reduction of available sunlight; physical abrasion; the triggering of excessive mucous production; reduction of feeding capacity; reduction of suitable settlement space; or other problems including the actual burial of the corals. Sources of such changes are often man-made and can include deforestation; construction of airports, roads, buildings, etc.; the dumping of mine tailings; and sedimentation associated with drilling muds used in oil exploration or dredging.

Overfishing and destructive fishing can result from greed, desperation or both. This latter has become increasingly important as populations along tropical coastal areas continue to grow with increasing rapidity.

Overfishing in Jamaica is directly linked to ecological shifts resulting in a decline of coral cover from 50–70 percent to less than 5 percent. Globally, the use of blasting devices and poisons to catch fish for food, and of poisons to supply fish to the aquarium trade has increased phenomenally over the last two decades. The use of weighted lines to break coral in fish-driving operations (muro-ami) continues in the Philippines and surrounding areas. Increases in the use of less destructive gears has been accompanied by major increases in the used of anchors which destroy corals. Predictably, destructive fishing is particularly prevalent in developing countries with rapid population growth, constituting a problem known as Malthusian overfishing. The latter arises not only because of the population growth per se, but also because of the increasing levels of inequity in the distribution of benefits from existing resources. Additionally, it is becoming increasingly clear that bottom trawling for fish and shrimp is a major cause of reef destruction, as vast areas of coral are inadvertently or even deliberately cleared away by the trawlers each year. The coral communities are generally very poorly known, and determining the extent of this damage, which is certainly substantial, should be a priority for future research.

There have been increasing reports of coral communities which have exhibited major bleaching events. This involves the massive expulsion by corals of the microalgae in their tissues (zooxanthellae) which normally contribute to their nutrition and growth processes. Serious cases have led to widespread mortalities of corals and possibly even some local extinctions. Recent studies indicate that global warming processes may be involved.

The most commonly reported form of biological outbreak affecting Indo-Pacific reefs has been that of the coral-eating crown-of-thorns starfish (*Acanthaster*). This starfish undergoes population bursts resulting in mortalities of corals on sections of reefs or whole reefs commonly ranging from 50-90 percent. Small corals are often replaced in only a few years because of the presence of abundant dead corals on which the new corals can settle. However, under conditions of increasing organic pollution, algae may dominate the available surface. Under heavy sedimentation, the available surfaces for the settling of new corals may be similarly reduced. Thus, the resilience of many reefs to natural outbreaks appears to have been seriously reduced by human activities. Additionally, many researchers believe that the frequency of outbreaks of these starfish may have increased because of human activities. Other destructive outbreaks which have been reported increasingly include coral-eating snails, herbivorous sea urchins, and a disease of sea urchins which caused widespread mortalities and complex problems related to the decline of the sea urchins.

Military activities constitute a major threat to certain major coral reefs. Military bases in areas such as the Chagos Islands, the Spratly Islands and parts of the Pacific and Caribbean involve destructive coastal development and the decimation of turtle nesting grounds and shallow water corals by idle soldiers. Certain reefs, such as Scarborough Reef in South China, have been used for military bombing practice by the U.S. Air Force. Large, unique coral structures on the latter reef were devastated by this activity. The use of reefs in the North-Central Pacific for nuclear bomb testing had ceased by 1988, but the effects of the radiation on the reefs and the people dependent on these reefs continue to be a problem to the present. Nuclear testing has continued until recently on certain large reefs in French Polynesia, and there is a possibility of renewed activity within 1995–1996.

Recommended Actions

Problems in the coastal zones of developing countries are generally complex and multifaceted. Solutions require interdisciplinary analysis and planning in the framework of integrated coastal management. In most cases, a strong emphasis on village-level community development is needed so as to improve the equity of resource distribution, to facilitate the management of the resources by making their misuse socially unacceptable and to generally improve the enforcement of regulations. This should generally be accompanied by actions at the provincial and national level to support the small-scale actions, to provide for larger-area coordination and to cover other aspects of resource management.

A common problem arises because of confusion over the goals of coastal management. Generally, the objective is to raise the quality of life of the local people and to encourage sustainable use of natural resources. This is often done by assisting the villagers in taking an inventory of and planning for uses of the limited resources available to them, including public lands, mangroves, seagrass beds and coral reefs. Small-scale uses involving value-addition from local processing help to ensure optimal and equitably distributed returns to the villages. Examples may include small-scale tourism, abaca weaving and seaweed mariculture for liquid fertilizer production. However, governments often institute large-scale development projects in these areas, justifying them in terms of macroeconomic national goals and vague concepts of “trickle-down” benefits. Examples include the construction of large, luxury hotels in poor regions (thus often reducing access to fishing grounds and other resources), the destruction of mangroves for large fish or shrimp ponds which employ minimal labor, and the introduction of mining fossil coral for cement in areas where the increased sedimentation will severely disrupt small-scale reef fisheries. The concept that valid national macroeconomic goals must necessarily conflict with the goal of raising standards of living of coastal dwellers is highly questionable, and may be an indication of the application of faulty assumptions in economic and development models. A serious reevaluation of such conflicts is desperately needed by many countries. The conflict seriously undermines the proper management of reef and related resources in developing countries.

The widespread loss of coral reefs and associated ecosystems require a variety of approaches. In addition to the general problem of improving coastal management in heavily used areas, there is a need to set aside protected areas of controlled or minimal use. A reasonable goal proposed by Secretary Angel Alcala of the Philippine Department of Environment and Natural Resources is to set aside 20 percent of all coastal waters as fishing reserves. A similar goal was earlier proposed, but not yet implemented, for the coastline of the Southeastern United States. Recent studies have strongly indicated that small reserves of a few square kilometers can substantially enhance catches in nearby reef fishing grounds.

In addition, there is a need to set aside a number of large marine protected areas of hundreds of square kilometers in ecologically strategic areas. These areas will provide larvae to the more ephemeral, smaller reef reserves and fishing grounds. They will also accommodate life histories of species not well-suited to survival among small scattered reserves. Controlled use of such marine parks can provide income to make the ventures economically justifiable. An existing example is the Great Barrier Reef Marine Park in Australia.

The prime example of an area in need of such protection is the Spratly Island system in the South China Sea. The area is claimed by six countries and the conflict is often cited as a major obstacle to economic cooperation and peace in the region. Studies have indicated that the supply of larvae to surrounding coastlines from this dense reef system is probably crucial to the maintenance of overharvesting small-scale fisheries in the region. There is thus ample reason to set aside the conflict by agreeing to a freeze on claims and the institution of a jointly-sponsored marine park management scheme for the area. Other archipelagoes in the world suitable for large-scale protection include the Chagos Archipelago in the Indian Ocean and a number of reef complexes in the Pacific and Caribbean regions.

A major source of difficulty in managing the reefs of the world is the paucity of critical information on the reefs. The majority of the world's reefs have not been surveyed. Most reefs are subsurface and have not been charted. There is currently no acceptable definition of reef health which can be used in a practical, analytical manner. More information is needed on aspects of reef ecology, including aspects of resilience to stresses. Furthermore, it is currently impossible to make any reasonable evaluation of coral reef biodiversity patterns at national and regional scales because of the historical lack of support for research in systematics, and the consequent confusion over field identifications for virtually all groups of reef organisms.

The ReefBase project of the International Center for Living Aquatic Resources Management (ICLARM) is designed to assimilate existing information on the world's coral reefs to facilitate situational analyses and informed management decisions. There is a need to strengthen this program, to enable it to assemble and summarize the tens of thousands of reports which have been completed based on coral reefs surveys and never properly published. A number of national and regional databases are also under development for this and similar purposes. However, this is only a first step. Efforts must be intensified to survey existing reefs, especially considering that the set of reefs about which we know the most is highly misrepresentative of the average subsurface reef in the world's oceans. The sheer volume of survey work to be completed among hundreds of thousands of poorly-known coral reefs suggests a need for the use of trained volunteers in well-coordinated research programs. This effort must be accompanied by programs to strengthen the research and management capacities of institutions in developing countries. In order to clarify exactly how various stresses are affecting the world's reefs, a well-designed and coordinated international monitoring program is needed. The success of such a program rests largely with the development of an effective coordination body, strategically located, staffed and equipped to interact with the developing country's scientists and managers on whom the future of the coral reefs of the world most heavily depend.

IDEAS FROM PLENARY SESSIONS

PLENARY 1: THE MANAGEMENT OF REEFS

Co-Chairs: Dr. Barbara Brown, United Kingdom

Mr. Abdulla Naseer, Republic of Maldives

Facilitator: Ms. Lynne Hale, United States

Rapporteur: Mr. Pascale Joannot, New Caledonia

LARGE-SCALE MANAGEMENT REGIMES AND THE ICRI

Presented By

Dr. Ian McPhail, Great Barrier Marine Park Authority, Australia

and

Dr. Richard Kenchington, Great Barrier Marine Park Authority, Australia

The scale and linkages of components of marine environments are such that comprehensive management involves addressing a number of scales from global oceanic or regional to local. This paper considers some of the experience of the Great Barrier Reef Marine Park (GBRMP) which is a very large-scale and relatively well-established management system. It is supported by a substantial capacity for research and monitoring in physical, biological and, increasingly, social sciences. It has a legislative basis which clearly establishes the objectives of conservation and sustainable use and provides a requirement and basis for review of progress against those objectives.

The Great Barrier Reef Region is some 350,000 square kilometers (km), including 2,000 km of the northeastern continental shelf of Australia. It contains about 2,500 reefs and 300 islands. The Great Barrier Reef Marine Park Act of 1975 appears to have been the first piece of legislation in the world designed specifically to provide for conservation in terms of preservation and ecologically sustainable use of large marine environments. The essence of the legislation was to provide for a system of management which could address the GBR as a large marine ecosystem.

The Act requires the GBRMP Authority to establish the purposes for which the GBRMP may be used or entered. The primary strategic approach is through a system of five objectives which the Authority must consider in the development of a zoning plan, including:

- The conservation of the Great Barrier Reef;
- The regulation of the use of the Marine Park so as to protect the GBR while allowing reasonable use of the GBR region;
- The regulation of activities that exploit the resources of the GBR region so as to minimize the effect of those activities on the GBR;
- The reservation of some areas of the GBR for its appreciation and enjoyment by the public; and
- The preservation of some areas of the GBR in its natural state undisturbed by man except for the purposes of scientific research.

Special management areas can provide the means for short-term closure of parts of the GBRMP. The provisions of the Act make the zoning plan an inflexible instrument which cannot be altered readily. This is intentional in order to ensure that management strategies which are developed by an open consultative process cannot be easily altered. Anticipatory management response to new, major or sensitive activities is provided by the permit system on a case-by-case basis.

The jurisdictional complexities are such that neither the state nor federal government has power on its own to manage the GBR as a single ecological entity. Most of the GBR falls under federal jurisdiction, while the adjacent mainland, almost all of the islands and the intertidal strip of the mainland and islands fall under the jurisdiction of the state of Queensland. Both governments work cooperatively in the management of the GBRMP. To date, most observers would judge the Authority to be a highly successful mechanism to manage a large natural system. Nevertheless, a number of management issues such as agricultural runoff, fishing, wastewater, tourism, and anchor damage will test the capacity of the management system to cope.

To address the long-term strategy for the adjacent coastal areas, the Authority worked with the Queensland Government agencies and stakeholders to develop a 25-year strategic plan for the Great Barrier Reef World Heritage Area (GBRWHA). The plan includes eight broad program areas to achieve its vision for the GBRWHA. It provides guidance and direction to the agencies directly responsible for the GBRWHA and for those whose activities and management of the adjacent coast are major factors in the future of the GBR.

Despite the large size of the GBRMP, it shares with other coral reef management agencies the need to involve the stakeholders with interests in the survival and productivity of reef environments. Management of coral reefs can be achieved only through involvement, influence and management of the actions of people who use, have impacts upon, or care about coral reefs and associated environments.

While consideration of small and large scales is a useful separation for the purposes of the workshop, these are not alternative management approaches. The implementation of large-scale approaches depends upon a system of management actions at the local level. The long-term success of local action requires a framework which can take account of recruitment, genetic, oceanic and regional socioeconomic process linkages which can be major factors in determining local conditions.

PROTECTIVE MANAGEMENT OF SMALL CORAL REEF AREAS

Presented by

Dr. Angel Alcala, Secretary

Department of Environment and Natural Resources,

The Philippines

Centrally planned and technically oriented government plans for coral reef protection and management have not prospered in the Philippines, largely because the people who use reef resources, the stakeholders, were not involved in the planning and implementation process.

Pilot activities by staff of a private university concerned with measuring reef fish harvests determined that stakeholders on small islands are willing to work together to protect their coral resources, especially when they benefit economically from the process. In a well documented example, island-wide coral protection and the establishment of a sanctuary comprising about 25 percent of the reef area resulted in a near doubling of fish harvests outside the sanctuary within five years and a 250 percent increase over 10 years. When the management system broke down, harvests dropped by 54 percent in just a few years. When protection resumed, fish harvests increased. Coral protection and sanctuary establishment were clearly related to increased harvests and incomes for artisanal fishermen. An added bonus has been the development of protected reefs as tourist attractions.

The key in these pilot activities has been the acceptance and support of stakeholders in coral reef management. As communities better understand how coral reefs function and how they benefit economically from healthy reefs, they become ready to adopt management regimes. This model, termed community-based coastal resources management (CBCRM) has been adopted and successfully applied by nongovernmental organizations (NGOs) in many other parts of the country. In addition, the Department of Environment and Natural Resources (DENR) initiated its Coastal Environment Program (CEP) in 1993 and has begun to serve as the assisting organization for the CBCRM process in more than 30 sites nationally.

The CBCRM approach recognizes coastal resource users as the primary stakeholders and real day-to-day managers of coastal resources. Key steps in improving their management of coastal resources include: 1) community organization, education and training; 2) resource assessment and monitoring; 3) management planning and implementation; 4) support for alternative livelihoods; and 5) networking. Demonstrations of the positive benefits of healthy coral and the negative effects of coral destructive practices, such as fishing with explosives or cyanide, are important in the educational process. Cross visits to sites with successful projects, where fishermen learn from other fishermen, represent an important extension tool. Support for alternative income sources is important but must be linked with and follow the adoption of regulations that restrict access to reef areas if they are to be beneficial to reef management. Competent assisting organizations are vital to initiating CBCRM and to developing the community capability to sustain the process later.

There is a continuing need for research on coral reefs and associated habitats to provide feedback to coral reef assemblages so that management systems can be improved. It appears that sanctuary establishment (about 25 percent of the reef area), in addition to overall coral protection is needed for the system to support the critical spawning stock biomass required to provide recruits to maintain fisheries in fished areas. There is also a need to learn how communities can regulate fishing efforts on reef areas. Biological and oceanographic studies indicate that recruits of most reef-inhabiting fish arrive on ocean currents from distant spawning grounds. Thus, reef sanctuaries appear to play an important role in supporting a critical spawning stock biomass that can provide recruits to distant areas. This hypothesis is specially applicable to the Philippines, where many small reefs exist and large numbers of people

exploit reef resources. The establishment of an extensive network of small sanctuaries maintained by communities of stakeholders could do much to maintain important reef fisheries. This must, of course, be blended with a program to keep harvest effort within sustainable limits in fished areas.

Is the CBCRM approach the right approach to protective management of coral reef areas? Judging by the many successful examples of its application, CBCRM appears to be well-suited for the Philippines and other countries with similar social and cultural traditions. However, success is not automatic and failures do occur. CBCRM is a logical and natural response to the need for protection and management of now open-access resources. The new Local Government Code and tenure instruments such as DENR's 25 year Mangrove Stewardship Agreement provide opportunities to limit access to key stakeholders. Another indicator of success is the adoption of CBCRM by the Asian Development Bank/Department of Agriculture Fisheries Sector Program and the U.S. Agency for International Development (USAID) Coastal Resources Management Project. CBCRM is a strategy that works and it has the potential for inclusion of management of a variety of other coastal resources in addition to coral reefs.

Discussion: Rapporteur's Report

The discussion was steered toward what could be done at the international level to ensure more effective coastal zone management. In particular, what should priorities be for improving coordination among international organizations, the U.N. and NGOs for effective delivery of programs at the regional and national level. It was clear from the discussion that the issues surrounding improved coordination were complex both from the standpoint of the donor and the developing country. However, some steps were already underway to improve coordination of projects, these being initiated by the donor agencies themselves. These should be encouraged and extended, wherever possible, by the ICRI.

Both the speakers supported greater dialogue between scientists and managers, potentially with the aim of encouraging further focused strategic research efforts.

PLENARY 2: GLOBAL, REGIONAL AND LOCAL LEGAL PERSPECTIVES ON REEF SYSTEMS

Co-Chairs: Dr. Ian Dight, United Nations Environment Programme

Mr. K.W.P. Hiew, Malaysia

Facilitator: Dr. John McManus, The Philippines

Rapporteur: Ms. Karen Lanyon, Australia

THE POSSIBILITIES OF INTERNATIONAL LAW AND INSTITUTIONS FOR SUSTAINABLE USE OF MARINE BIODIVERSITY: FOCUS ON CORAL REEF ECOSYSTEMS

Presented by

Dr. Graeme Kelleher

International Union for the Conservation of Nature,

Switzerland

This paper identifies many of the international laws, conventions, instruments, codes, programs and institutions which are relevant to the conservation of marine biodiversity and to the sustainable use of marine resources. Their methods of operation are outlined briefly, and suggestions are made as to how their provisions may be used to achieve environmental objectives – with particular reference to coral reefs.

A dramatic change has been brought to the international and national marine scene by the empowerment in 1994 of the U.N. Convention on the Law of the Sea (UNCLOS) and the Convention on Biodiversity. These two interlinked conventions provide the world, for the first time, with a clear legal framework for guiding nations in their use of the sea. They placed obligations on all nations, not only the signatories, to protect the marine environment in all activity areas, including those that are land-based. The obligation applies to areas both within and outside national jurisdictions.

Other international conventions which are important for marine conservation in general, and coral reefs in particular, include the Convention on International Trade in Endangered Species (CITES), the International Convention for the Prevention of Pollution from Ships (MARPOL), the World Heritage Convention, the U.N. Framework Convention on Climate Change, the Convention on Wetlands of International Importance (which may include coral reefs) and the Convention on the Conservation of Migratory Species of Wild Animals.

One provision of CITES that deserves special mention is Appendix III, which allows species which are not endangered, but which are subject to regulation of trade within the jurisdiction of one country, to be listed and to be subject to international trade control. This provision has particular relevance to corals.

Instruments, events and programs which provide, or will provide, a foundation for coral reef conservation include Agenda 21, Chapter 17; the U.N. Food and Agriculture Organization's (FAO) Code of Conduct for

Responsible Fisheries; the Regional Marine Agreements (most of them developed under the auspices of UNEP; the UNEP Conference on Protection of the Marine Environment from Land-based Activities, to occur in October 1995 and the U.N. Conference on Straddling Fish Stocks and Highly Migratory Fish Stocks.

LOCAL AND REGIONAL LEGAL ISSUES AND APPROACHES IN CORAL REEF MANAGEMENT

Presented by

Dr. Vaughan Pratt, International Marine Life Alliance, The Philippines

Summary of presentation, provided by rapporteur

Dr. Pratt emphasized that the two most important issues in coral reef management are political will and empowerment of local people. He discussed recent changes in the Philippine government and the resulting improved political climate for resource management from the highest levels of government down to the local level. He suggested that the role of higher-level government agencies in coral reef management should be to supply manpower, funds and equipment, but that enforcement and management should be devolved to the local level. Dr. Pratt noted that resource managers need to focus on specific management issues. For example, in the Philippines, Dr. Pratt's organization is working closely with the government on the cyanide fishing issue, testing fish at their facilities for cyanide contamination and conducting education and outreach programs, including the training of local fishermen in nondestructive fishing methods such as net catching.

Other actions that governments can take to improve the management of coral reefs are to:

1) create protected areas and empower the local people to manage them; 2) strengthen laws and empower people to enforce them; 3) gather evidence for convictions through the court system; and 4) educate people about the laws.

He also recommended that these efforts be conducted regionally to prevent enforcement of regulations in one country from driving problems into other areas. For example, certain practices such as cyanide and dynamite fishing are decreasing in the Philippines, but are increasing in Indonesia as practitioners take their business to areas where local laws and/or enforcement are not as effective.

Dr. Pratt summarized his presentation by stressing that effective management must be "hands-on," must emphasize empowerment at the local level, and must enforce existing laws, and make the penalties for violations immediate (e.g., confiscation of cyanide-contaminated fish) and sufficient to discourage continuation of the practice.

Discussion: Rapporteur's Report

Dr. Alcala noted that in the Philippines, laws still need to be strengthened in-country, that there need to be more convictions in fishery and forestry resource violations, more cyanide-testing stations need to be set up, and that pressure needs to be exerted on exporters not to accept fish caught with cyanide. Presently 80–90 percent of the fish

are caught with cyanide, but the trade will stop if there are no buyers. Dr. Pratt responded that in the next few months, the Philippines is expected to adopt regulations requiring all exported fish to be certified cyanide-free. He hopes that by the end of this year there will be a sharp decrease in the cyanide fishing in the Philippines, but that a wider regional effort needs to be undertaken to prevent export of this practice to other areas outside the Philippines.

Mayor Azcuna noted that in Mindanao, the human population is increasing rapidly and that they depend very heavily on the sea. If fishing is stopped, alternative livelihoods need to be developed. There is also difficulty at the local level with enforcement of laws and an unwillingness of locals to take actions against other members of the community.

Mr. Jean-Pierre LeDanff conveyed some of the French Ministry of the Environment's thoughts about ICRI. He stated that although the ICRI should give importance to conservation biology and to the synthesis of the present scientific knowledge, the state of corals reefs and associated ecosystems needs to be addressed promptly, without waiting for new research and new results. France believes that we currently know enough about the biology of these ecosystems and their threats to undertake actions as soon as possible.

Mr. LeDanff stated that an up-to-date assessment of coral reefs and related ecosystems could be made from available data and used to elaborate strategies and to identify priorities at national and regional levels. Moreover, these strategies and programs are likely to facilitate appropriation of funds to: 1) inventory, at national and regional levels, actions and measures that could be undertaken immediately without requiring particular new instruments, important funds or heavy means; 2) develop codes of conduct with the involvement of all users of these ecosystems; 3) stimulate progress in the Law of the Sea (e.g., under which, many coral reefs may be designated as "specially vulnerable zones" or "special zones" through the International Maritime Organization (IMO) (such as occurred for the Great Barrier Reef in Australia); and 4) adopt, as soon as possible, impact assessment study regulations, which France considers as a first step to implementing sustainable management of coral reefs and associated ecosystems.

France does not see the need to develop new instruments or to establish new organizations under the ICRI, but rather to strengthen existing ones. France views the UNEP Regional Seas Programme as having a major role in this effort. France is also ready to contribute to a work-shop in the South Pacific region in partnership with Australia, and perhaps in the Indian Ocean in partnership with the Indian Ocean Commission.

France is already committed to conservation and the sustainable management of coral reefs around the world. France has decided to increase its effort by hosting and sponsoring a regional activities center (RAC) in Guadeloupe for specially protected areas and wildlife under the Caribbean Environmental Program. France is also launching a new program in the West Indies for protection and appreciation of coral reefs (St. Lucia, St. Vincent, Grenadines, Dominique and Grenada) with French GEF funding. It will be undertaken at the end of the year 1995.

Dr. Kelleher noted that it took six years to get the IMO to declare the Great Barrier Reef a special protected zone, due to opposition particularly from the United Kingdom and the United States. These nations felt that this designation was a threat to freedom of passage of shipping, which has enormous economic and strategic (military) implications. Dr. Kelleher believes that it will be very difficult to achieve this sort of designation again because of international shipping concerns.

Dr. Edgardo Gomez discussed the U.S. Lacey Act, which was amended in the 1980s to prohibit illegal taking of corals. He believes that CITES is not the appropriate mechanism for regulating cyanide fishing and proposed that the International Union for the Conservation of Nature (IUCN), through its office in Bonn, conduct a study of how many countries have laws similar to the Lacey Act so that there is protection on both ends, and that the workshop make recommendations for all countries to institute laws similar to the Lacey Act.

Dr. Kelleher responded that under Appendix III of CITES, species were identified as needing regulation because of trade, not because there were endangered (i.e., a species does not have to be endangered to be regulated). Mr. George Myvette noted that Belize does not have any regulations specific to coral reefs – management of coral reefs falls under three departments.

Ms. Sue Wells suggested that in many countries more legislation is needed to control development activities, including the creation and/or improvement of legal instruments such as environmental impact surveys (EIS). She stated that the legal system also needs to address the fact that penalties are insufficient compared to potential economic gains.

Dr. Rebecca Hawkins recommended that regulations be simplified so that they are more understandable to resource users such as the tourism industry. For example, the British authorities have posted CITES regulations in airports so that travelers are made aware of these regulations. She also recommended that managers look at all instruments including economics and education.

Dr. Pratt noted that there needs to be more prosecution. He also noted that penalties may be strong, but are not a deterrent because too much time elapses between apprehension and payment of penalties. He said to be more effective, existing laws should be modified so that penalties are immediate—i.e., confiscation of goods. Immediate actions are a much stronger deterrent to illegal activities than a drawn-out legal process.

PLENARY 3: SUSTAINABLE FINANCING MECHANISMS FOR CORAL REEF MANAGEMENT

Co-Chairs: *Mr. Robert Dobias, The Philippines*
 Mr. Guillermo Morales, The Philippines
Facilitator: *Ms. Lynne Hale, United States*
Rapporteur: *Mr. Clem Bobb, St. Lucia*

SUSTAINABLE FINANCING FOR CORAL REEF CONSERVATION

Presented by
Dr. Marea Hatzios, The World Bank, United States

Just as development must be environmentally sustainable to meet long-term objectives for improving human welfare, so too must conservation efforts be financially sustainable to ensure long-term environmental protection and its continuous benefits. Concern about the sustainable financing of marine conservation has grown with the realization that identifying solutions to problems is not enough. Actions must be initiated and sustained through continuous investments until conservation objectives are met. In the marine realm, traditional financing (e.g., through public sector support) is generally not a viable option for the long term. Governments alone are unable to provide full support for conservation and sustainable use. While initial start-up funds for establishment of conservation efforts are often forthcoming, economic uncertainty and competing sectoral demands on public sector budgets limit the level of investment for operations and maintenance. Shifting political support for the environmental agenda, in both developed and developing countries, can prevent the type of long-range planning required for sustainable management of coral reef and associated marine systems.

There is, then, a need for a mixed strategy to finance conservation efforts, which involves a combination of approaches and partnerships. For developing countries, this includes blended financing – a mix of grants and loans; new approaches to revenue generation; the development of public/private partnerships and community-based comanagement arrangements that builds on local incentives for conservation. We will be exploring these and other strategies for sustainable financing of coral reef conservation in a one-day workshop at the World Bank on June 23, 1995. We hope to initiate a dialogue involving private sector perspectives, Bank perspectives, NGO perspectives, the role of government and the International Coral Reef Initiative in identifying the conditions necessary for sustainable financing of marine conservation.

Among the potential funding sources for the establishment and maintenance of marine protected areas (MPAs) are:

- Budget allocations (domestic and international assistance);
- Trust funds;
- User fees; and
- Eco-enterprises:
 - Ecotourism;
 - Mariculture; and
 - Marine bioprospecting.

A combination of national budget allocations, foundation grants and donor support have been used to set up MPAs in Belize, Haiti, the Seychelles, Mafia Island and elsewhere. While sufficient for start-up, these sources are generally not adequate to support the long-term management of MPAs nor to respond to changing conditions that may render habitats vulnerable with new programs designed to assure protection of these resources from new threats.

Maintaining protected areas requires the recovery of recurrent costs for operations and for access to MPA benefits. This will involve, increasingly, the introduction of user fees (as in Bonaire and Saba of the Netherlands Antilles) and some form of eco-enterprise or income-generating activity linked to the productivity of the marine

resource base. Ecotourism, while requiring careful monitoring and control, is being successfully linked to MPA management in the Philippines, Ras Mohammed in the Sinai, the Virgin Islands and the Great Barrier Reef Marine Park.

Opportunities for sustainable mariculture of export crops such as pearls, giant clams, algae, aquarium fish and live rock are expanding in the Indo and South Pacific as production technologies become simplified and markets for these products expand. In response to growing demand for products and services that are generated in an ecologically sound way, eco-labeling (such as the “green globe” in the tourist trade, or certification of cyanide-free aquarium fish exports) has the potential to become a powerful conservation tool in marketing products to environmentally conscious consumers.

Marine bioprospecting – the development of natural products for the pharmaceutical industry and traditional medicine markets, or in bioremediation and other biotechnological applications (including wastewater treatment) – is holding increasing promise for coral reef countries, particularly in areas with high degrees of endemism. To be both sustainable and profitable to local communities, as well as serving the national interest of host countries, bioprospecting ventures should provide:

- Controlled access and harvesting regimes;
- Significant and continuous benefit flows to the host country, e.g.:
 - Royalties;
 - Equity participation to tenured resource users; and
- Access to markets.

Various models for joint ventures with private pharmaceutical firms involving rain forest products are now being tested in Central America and West Africa. Marine bioprospecting opportunities are being evaluated in Fiji and elsewhere in the South Pacific with assistance from NGOs and the international community.

Trust funds or environmental funds, a relatively new device in the arsenal of conservation financing, are another means of guaranteeing revenues for conservation programs well beyond the “life of project.” Through interest generated on an initial endowment of approximately 10 times the annual dividend rate, trust funds can be used to build institutional capacity and finance long-term conservation programs, including community development or alternative livelihood programs adjacent to marine protected areas. Trust funds can be capitalized in a variety of ways, including environmental taxes on development activities, tourist taxes or surcharges (such as being explored in Belize), debt swaps (as in the Jamaica Conservation Development Trust established for Montego Bay Marine Park), private donations and through support from the Global Environment Facility (GEF).

Increasingly, partnerships with the private sector and NGOs are being sought for the administration of marine protected areas. Not only do these open up new opportunities for financial support and investment not available to government-run entities, but they take advantage of the flexibility and management expertise of these organizations in running cost-effective enterprises. Similarly, comanagement arrangements with local communities, as pioneered in the Philippines, have proved effective in applying traditional knowledge and skills to management of living

resources, enlisting community support for monitoring and enforcement, and providing, in exchange for curtailed use rights, employment opportunities and other benefits.

At the regional level, partnerships among small island states are particularly important in facilitating access to international funding, to training and technical assistance, and in avoiding duplication of effort – something the economies of these small nations can ill afford. In this regard, the ICRI can provide both political leadership and a mechanism for regional cooperation through policy coordination, priority setting in regional workshops and fora, and a means to leverage donor and other financing for the implementation of coral reef conservation and management activities on the ground.

Identifying innovative financing for coral reef conservation will likely rely more and more on opportunities from the private sector. Two examples of new venture capital funds linking biodiversity conservation to small-scale enterprises are exemplified in the Biodiversity Conservation Network, an NGO activity focusing on Asia and the South Pacific, and the Biodiversity Enterprise Fund for Latin America. The former is being funded through USAID in conjunction with the U.S./Asia Environmental Partnerships program. It provides planning grants of up to \$50,000 for the identification of potentially profitable micro enterprises directly linked to the sustainable use of natural resources and systems of high biodiversity value. Those proposals deemed financially feasible are eligible for implementation grants of between \$500,000 and \$900,000. Several proposals for marine ecotourism, mariculture and bioprospecting ventures have been awarded planning grants and are being considered for implementation grants in the next stage.

The Biodiversity Enterprise Fund for Latin America is being developed by the International Finance Corporation (IFC), an affiliate of the World Bank. The Fund is being created in response to an emerging market for eco-enterprise investments and is characterized by the following:

- **Objective:** To catalyze private investment in commercially viable, sustainable uses of biological diversity.
- **Fund Structure:** Investment firm run by a fund manager with emerging market and biodiversity experience.
- **Capital:** \$20 million–\$30 million equity capital and \$5 million grant funds.
- **Geographic Focus:** Latin America.
- **Investment Focus:** Ecotourism, bioprospecting, remediation and pollution control, alternative agriculture, sustainable forestry, non-timber forest products.
- **Investment Criteria:** Projects with medium to long-term profit potential.
- **Biodiversity Criteria:** Sustainable uses of biodiversity or activities that protect biodiversity.

Although currently focusing on terrestrial biodiversity, investments could be directed to opportunities in coral reef conservation once these are identified and shown to satisfy feasibility criteria.

In summary, designing a self-financing strategy for coral reef conservation will require flexible and varied sources of incomes for program support. To achieve this, it will be necessary to:

- Diversify funding sources and leverage financing;
- Identify capital requirements over different stages of project development;

- Identify opportunities for private sector investment/ community involvement and benefit sharing in profitable eco-enterprises;
- Wed income-generating activities to medium-to-long-term budgetary requirements;
- Cooperate regionally to facilitate access to information, capital management resources; and
- Coordinate policies in the collective interest of coral reef member states and maximize benefits from regional resources.

Regional cooperation in policies related to revenue generation from ecotourism is particularly relevant for small island states that cater to the same potential pool of clients, as, for example, in the Caribbean. Levying tourist taxes and user fees will be more effective if there is general agreement to do so in the region. Similarly, consensus on policies controlling ship-based waste (from cruise ships) and requirements for effective wastewater treatment by resort hotels (e.g., demand for GREEN GLOBE labeling) can create the necessary conditions for self-sustaining efforts to protect coral reefs and related ecosystems for generations to come.

PLENARY 4: ICRI PARTNERSHIPS IN CAPACITY BUILDING

Co-Chairs: Ms. Joannot Pascale, New Caledonia

Mr. Moses John Amos, Vanuatu

Facilitator: Ms. Lynne Hale, United States

Rapporteur: Ms. Tooti Tekinaiti, Kiribati

ROLES AND PARTNERSHIPS AT THE LOCAL, REGIONAL AND GLOBAL LEVELS FOR CORAL REEF MANAGEMENT

by Mr. Shuichi Fujiwara

Presentation made by Kazuaki Hoshino, Marine Parks Center of Japan

Representative and invaluable reef areas should be legally protected as reserves for the remaining pristine eco-system. Because it is less difficult to provide protected areas than to implement substantial management, there are many areas which exist in name only. That is why economic development takes far more precedence over environmental protection in today's budget. In most cases, the budget for the management of protected areas is insufficient. A survey of the biological resources and monitoring of these areas are often lacking. Important items for management, such as boats, equipment and laboratories, staff and operation costs are entirely insufficient. If these basic needs are ignored, no management plan will succeed.

Japan also does not have a lot of staff for the 59 marine parks in the national and quasi-national park systems. Therefore, various sectors cooperate with the Government for park management.

I would like to introduce the Kushimoto Marine Park (KMP) as an example. KMP is located at the southern tip of the main island where the Kuroshio warm current closes off the coast and coral communities thrive. The Marine Park was designated in 1970 by the Environment Agency of the Government. In that year, a tourism company which operates an aquarium, underwater observatory, glass-bottomed boats and diving service, was established at the park site by a railway company, a municipality, a fishermen's cooperative association and the Marine Parks Center (an NGO) under permission of the government. Some 400,000 people have annually visited the park since its opening. The most important key sector is the fishermen's association, because park conservation could not succeed without their agreement. They have regarded coral as a useless and obstructive material because coral snags their fishing nets. But after the marine park was established, fishermen have closely cooperated with a fishing ban in the park area because they profit from the company. They have stock interest. They sell fish to the restaurant, souvenir shop and as food for aquarium life. Their families are employed family by the company. The fishermen's association also receives about \$4 per diver for the fish nursery fund from the company. The company cooperates with daily inspections and research at the park, and in educational programs by marine biologists who are employed by the company for maintaining the aquarium. The municipality provides arrangements between the fishermen's association and the company. MPC operates the laboratory and advises the operation.

Such cooperation can be used in marine protected areas in developing countries which have difficulty covering the expenses for management. The park can be financially self-sustaining through the generation of park revenues. A fee-charging, small-scale aquarium with a laboratory and management facilities should be provided. The initial costs such as a primary survey, completion of specimen photographs and aerial photographs that provide base information, and construction of the infrastructures might be supported by developed countries. Tongan environmentalists concerned with marine protected areas were invited to Japan in 1994 for researching these factors by the MPC. The initial finances were provided by the Japan Fund for Global Environment of the Japan Environment Corporation. Capacity building, like staff training on species identification and research methodology, should also be promoted. The Japan International Cooperation Agency (JICA), in collaboration with the Environment Agency, begins a training course on coral reef conservation and sustainable management for technical officials of developing countries this year.

Examples of the roles and partnerships at the other marine parks in coral reef areas of Japan are as follows:

- Removal of crown-of-thorns starfish in marine parks
 - Government and Prefecture: Finance
 - Fishermen: Removal
 - MPC: Presurvey and technical advice

- Transplanting of coral
 - Government and Prefecture: Finance
 - Divers and fishermen: Transplanting
 - MPC: Research and technical advice
- Cleaning turtle nesting beaches
 - Government and Prefecture: Finance
 - Local residents: Attending
 - MPC: Research nesting behavior and patrol beach
- Public awareness
 - Various sectors hold educational programs
 - Publish materials for reef conservation

The National Park Office of the government, prefecture, municipality, diving instructor's union and MPC have joined together to establish the coral reef conservation workshop.

MECHANISMS FOR CAPACITY BUILDING

Presented by

Ms. Sue Wells, United Nations Development Organization/Global Environment Facility Coastal Zone Management Project, Belize

There are three main aspects to capacity building for effective coral reef management and research:

- Building up human resources through training and education activities;
- Strengthening institutions involved in research and management; and
- Developing the financial capabilities of countries to manage coral reefs and related ecosystems.

Perhaps the most essential element in all activities relating to capacity building is the recognition that this is a long-term process and requires careful targeting and adequate funding.

Building Up Human Resources: Training and Education

A basic problem in many countries with coral reefs is a shortage of trained people – in all sectors of society – to actively participate in management and research.

Formal Education

There is a need for more qualified professionals in traditional sectoral disciplines who also have an understanding of the broader field of integrated coastal zone management (ICZM). Equally important is the need to develop interdisciplinary courses, which provide degree level training in ICZM itself.

Although training overseas is often of a high quality and provides exposure to a wide range of experiences, opportunities for tertiary education in developing countries urgently need to be increased. This provides training in a more relevant setting, and may subsequently help to induce a commitment in trained professionals to remain in their own countries.

The establishment and expansion of tertiary education programs in developing countries can be encouraged through collaborative programs with academic institutions in developed countries. Equally important is the need to support and develop regional centers of training and learning, as well as partnerships between academic institutions within a region.

Environmental issues are now generally featured in school curricula in most countries, but there is often still a need for additional and higher quality materials, further focus on specific issues, development of audiovisual training and long-distance education aids where these are appropriate, and training of teachers in methods of imparting the relevant information.

Nonformal Education

Short training courses, workshops and internships satisfy short-term specialist requirements and have been supported extensively in recent years by the international aid and development communities. They are particularly useful for training in technical and management skills such as monitoring and survey techniques, environmental impact assessment (EIA), protected area management, basic approaches to ICZM, etc.

Training in skills as basic as swimming, diving and boat handling is often overlooked but is essential for successful reef management and research programs.

The role of on-the-job training also should not be overlooked. The concept of counterparting is vitally important, and greater emphasis should be placed in project design to ensure that adequate counterparts are available for overseas consultants, and that consultants see training and technology transfer as an important component of their work.

Public Awareness

The popular appeal of reefs has meant that there is perhaps greater public awareness of them and their vulnerability than of other marine ecosystems, but this nevertheless needs to be channeled into more positive action. There is a need for materials and programs targeted at the following:

- Reef resource users, for which simple, culturally specific educational materials are needed;
- Tourists and divers; and
- Policymakers and decision-makers, the business community, and coastal engineers and developers; this audience has not been well served yet, but ICRI is itself a new approach to this need.

Partnerships in public awareness programs relating to reefs should include:

- The media;
- Aquaria, museums, zoos and other public entertainment and education centers;

- Volunteer programs;
- NGOs; and
- The diving and tourism industries.

Institutional Infrastructure

A sound institutional basis is an essential prerequisite for long-term reef management. Most management and research agencies and organizations (including government departments, academic institutions, NGOs, and local community bodies) are understaffed, underequipped and underfunded.

Lack of communication between government agencies is often an obstacle to the development of the ICZM approach, and this requires the development of a more appropriate government institutional basis. This may require: the establishment of appropriate authorities and a clear definition of their responsibilities, the provision of infrastructure – buildings and equipment – and the improvement of the legislative basis.

Academic and other educational institutions in developing countries also generally need strengthening, and often lack facilities and teaching materials. Developing a strong NGO community is equally essential, with effective partnerships between them and government agencies, the private sector and local communities. The role of the private sector in reef management is often overlooked but, as other sessions at the workshop are showing, the private sector can often play an important role, particularly through tourism and recreation. Local communities should also be considered in the context of capacity building, as it will be through empowering them to manage their own resources, that some of the most effective management will be achieved.

Improving the financial capacity of countries to manage their reefs has two principle components, both of which are discussed in other presentations:

- Improving access to bilateral, multilateral and other forms of financial and technical support for coral reef management; and
- Developing the in-country financial capacity, through both the government and the private sector.

Conclusion

Capacity building is a slow process, and partnerships need to take this into account. The major donor programs now have institutional strengthening, training and education, and financial sustainability as components, but in many cases these terminate before these objectives have been achieved. Training and education must be seen as long-term activities and not simply as a matter of sending people away on a series of short courses. Small-scale efforts, such as those carried out by NGOs, are often important for capacity building, and may have a more continuous long-term impact.

Discussion: Rapporteur's Report

The discussion session focused on three main points: technical training, education and awareness programs, and issues relating to external consultants.

Technical Training

Mr. Alvin Nacu discussed the “greening” of Master Business Administration (MBAs) through enrollment in short courses on the ecology and protection of coral reefs and associated environments. He stated that the results of the program were extremely encouraging and that there are now discussions expanding to a full course and making it a requirement for the degree.

Both short-term and long-term training courses are required for officials whose responsibilities cover or involve coral reefs and related ecosystems since, in most cases, current personnel are untrained. Donor agencies should allocate a portion of their funding for such training purposes. Ms. Netatua Prescott stated that training is a national priority of Tonga and that many opportunities exist, but only a small number of training scholarships are made available and these tend not to be given for coastal management specialists.

The need for institutional strengthening, as well as capacity building at the local level, was emphasized by Mr. Samaranayake. Where there is no formal institution to implement or carry out coastal management, a committee comprising representatives of groups involved in related activities should be established.

Training of policymakers and other government officials involved in management of coral reefs and related ecosystems is essential. This could be carried out through workshops.

Education and Public Awareness Campaigns

It was stressed that these are an important part of all coral reef conservation and sustainable utilization programs. There is a need for capacity building in local communities in terms of training, and providing educational materials on coral reefs.

Dr. Jeremy Woodley discussed the need to involve the media and to train and educate journalists about coral reefs in order for ideas to be disseminated widely. He cited an example of such an initiative in Jamaica.

Dr. Hansa Chansang suggested that public education could be a budgetary “black hole” and raised the question of how to measure the success of public awareness and education programs. Although there was no clear answer to this, it was pointed out that prior to carrying out such campaigns, a survey into public awareness could be carried out using tools such as questionnaires, and that this activity could be repeated at intervals further into the project.

Ms. Sophie Mounier noted that there is a publication available from the International Petroleum Industry Environmental Conservation Association (IPIECA) on oil contingency plans and ways to minimize biological impacts.

Mr. Richard Kenchington discussed the development, by the Australians, of training materials on marine protected areas, for dive operators and a series on capacity building focused on solving specific case study problems.

Consultants

Mr. George Myvette, Mr. Cedric Shuster and Ms. Lorna Inniss discussed problems with reliance on foreign consultants. There appears to be a widespread tendency for aid projects to fail to carry out sufficient capacity building. Foreign consultants are sent in with the aim of carrying out a task and in the process transferring knowledge and skills to local people who should subsequently carry on the project. In reality, many projects are

completed and funds exhausted before such skills have been transferred, so that there are no local people sufficiently trained and motivated to continue the work.

Furthermore, many foreign consultants fail to understand the language or social context of a project, and consequently progress is slow due to misunderstandings and confusion.

Conclusions

There were three particular points that came out of the presentations and discussions:

- The importance of ‘training trainers’ – i.e., ensuring that training and education programs reach the widest possible audience by targeting those who will pass the information and skills on to others and to subsequent generations.
- Capacity building is a long-term activity, and aid projects need to take this into account and ensure some form of sustainability.
- Assistance directed at capacity building often needs to be more carefully targeted, to ensure that training and institutional strengthening activities achieve their desired objectives.

PLENARY 5: REGIONAL REPORTS

*Co-Chairs: Dr. Kiyoshi Yamazato, Japan
Ms. Lorna Inniss, Barbados*

***Note to readers:** The following reports are a summary of the regional reports presented at the workshop. The regional reports are not included in their entirety in this report of the workshop as they will form a basis for further discussions at the regional workshops and be modified as appropriate.*

Regional report authors are as follows:

- *Pacific Ocean Regional Report on the Issues and Activities Associated with Coral Reefs and Related Ecosystems*, prepared by Mr. Andrew Smith, South Pacific Regional Environment Programme
- *South Asian Regional Report on the Issues and Activities Associated with Coral Reefs and Related Ecosystems*, prepared by Mr. Alan White, URI CRC–Coastal Resources Management Project, and Arjan Rajasuriya, National Aquatic Resources Agency, Sri Lanka
- *East Asian Regional Report on the Issues and Activities Associated with Coral Reefs and Related Ecosystems* (no author listed)

- *Coral Reefs and Related Ecosystems of the Western Indian Ocean*, prepared by Dr. Magnus Ngoile, Institute of Marine Science, Zanzibar, Tanzania; Dr. Rodney V. Salm, International Union for the Conservation of Nature, Eastern Africa Regional Office; and Ms. Marion Westley, U.N. Volunteer–UNEP Oceans and Coastal Areas Programme Activity Centre
- *Regional Report on the Middle East Seas: Issues and Activities Associated with Coral Reefs and Related Ecosystems*, prepared by Dr. Moustafa M. Fouda, Sultan Qaboos University, Sultanate of Oman
- *Tropical Americas Regional Report on the Issues and Activities Associated with Coral Reefs and Related Ecosystems*, prepared by Jeremy D. Woodley, Centre for Marine Sciences, University of the West Indies, Jamaica, Caribbean Environment Programme and CARICOMP

EAST ASIAN REGIONAL REPORT ON THE ISSUES AND ACTIVITIES ASSOCIATED WITH CORAL REEFS AND RELATED ECOSYSTEMS

Presented by

Dr. Kiyoshi Yamasoto, Department of Biology University of the Ryukyus, Japan

This report covers China, Indonesia, Japan, Malaysia, the Philippines, Singapore, Taiwan, Thailand and Vietnam. This region is characterized by high biological diversity, and has been regarded as the center of biological diversity. However, even in this area of coral species richness, corals and coral reefs are deteriorating from several factors. In southern Japan, *Acanthaster* has been the major cause for coral devastation, although anthropogenic agents such as dredging and filling of coastal areas, and sedimentation from coastal as well as inland development projects are causing much damage. However, in most other areas, *Acanthaster* seems not to have caused major problems. Major factors contributing to reef destruction ascribed to the high human population that characterizes this region include land filling, over fishing, dynamite- and poison-fishing, siltation due to land development and deforestation, and harvesting of corals and coral reef organisms.

Countermeasures have been attempted by several nations but have met with little success due mainly to lack of funds, technically trained personnel, facilities, and infrastructure.

Among the proposals outlined for sustainable use of coral reef resources are education, enhanced monitoring efforts, user fees and involvement of stakeholders (resource users) in management. Meeting the needs will require the cooperation of the international community.

TROPICAL AMERICAS REGIONAL REPORT ON THE ISSUES AND ACTIVITIES ASSOCIATED WITH CORAL REEFS AND RELATED ECOSYSTEMS

Presented by

Dr. Jeremy Woodley, Centre for Marine Sciences, University of the West Indies, Jamaica

Coral reefs extend, in the tropical Americas, from the Galapagos Islands to the Flower Garden Banks off Texas, and from Bermuda to the Abrolhos Archipelago of Southeastern Brazil, but they are best developed in the region known as the Wider Caribbean.

This is a geologically complex and geographically varied region, divided politically among more than 40 culturally diverse countries. Its coastal zone has provided important resources to millions of people for two or three centuries. Here, as elsewhere, many benefits have been enjoyed while people were unaware of the environmental costs.

In the present century, the human population has increased at a great rate, doubling in the last 50 years, and the pace of economic development has increased greatly. Increasing stresses on coral reef resources have pushed them to their limits, and beyond.

Reports from across the region indicate that the major impacts on coral reef resources have been the terrestrial runoff of sediments and nutrients, the overexploitation of fishery resources and physical damage by various agents.

These chronic stresses may compound one another. Overfishing depletes important food resources, but the removal of herbivores may permit the growth of seaweeds which can overgrow corals. Thus, overfishing makes reefs more sensitive to nutrient pollution, which will stimulate the growth of seaweeds unchecked by grazing. Furthermore, chronic stress from human impacts decreases the ability of coral reef communities to recover from acute natural impacts such as storms or outbreaks of predators or disease.

There are reports from across the region of the degradation of reef resources—either great reduction of reef fish populations, decline in coral cover, or both. Degradation of reef resources due to human influence is naturally greater in proportion to their proximity to human communities and the size of those communities. Reef resources are still in good health in areas with wide shelves and low populations, such as the Yucatan Peninsula, including Belize; and the Bahamas. In contrast, the Antillean islands often have narrow shelves and high populations; the reefs are readily influenced by land-based pollution, and easily accessible to fishers.

In this report, data is presented on coastal management practices in 40 countries, summarizing changes since the 1988 publication of *Coral Reefs of the World*, and including perceived needs for further action. They represent a range of management regimes, within which two trends can be distinguished. The first is a progression from species-level legislation, through the habitat conservation of Marine Protected Areas (MPAs), to larger-scale ecosystem management. MPAs, whether designed for tourism or fisheries, act as a local stimulus and focus for the ideas and practice of integrated coastal zone management. Second, there is the transition from only “top-down” legislation and decree, backed by enforcement, through involvement of resource users in the management of the

resources on which they depend, to comanagement. Here, all stakeholders are in partnership within a legislative, institutional, and enforcement framework maintained by the government. There are two other important ingredients for successful ICZM: 1) environmental education at all levels; and 2) institutional changes to overcome inter-departmental divisions, and to unify environmental decision-making. In some countries this has been achieved by amalgamation of departments; in others by the creation of consultative committees.

The current activities in the region of diverse agencies are identified, including: the Caribbean Environment Programme, multilateral banks, national donors, and international and regional NGOs. These activities are tabulated as an annex. Other annexes list 82 marine research institutions and 27 universities believed to offer training in coastal science and management.

The perceived needs of a majority of countries are presented under three headings. Under Management, the most frequently cited priority was management planning, followed by the creation of MPAs, and institutional changes to facilitate integrated coastal zone management. In the region, capacity building is needed by most resource management agencies, which are understaffed and underfunded. Another important need is for more environmental education. The most frequently expressed need under Research and Monitoring was for the nationwide assessment of the status of coral reef resources and their subsequent monitoring. Diverse other research topics were suggested, e.g., on the design and use of MPAs; on community-based management; and on impact mitigation.

PACIFIC OCEAN REGIONAL REPORT ON THE ISSUES AND ACTIVITIES ASSOCIATED WITH CORAL REEFS AND RELATED ECOSYSTEMS

Presented by

Dr. Andrew J. Smith, South Pacific Regional Environment Programme, Western Samoa

Coral reefs are one of the most important and extensive ecosystems within the Pacific islands region. When considered in conjunction with mangrove and seagrass systems, their importance to the well-being of the Pacific people and their island environments cannot be overstated. They are a critical element of the complex and vulnerable tropical small island environment. The social, cultural and economic prosperity of the Pacific islands region has been, and will continue to be, directly dependent upon the health of coral reefs and associated ecosystems.

This regional report briefly outlines the major issues and priorities for coral reef conservation and management in the Pacific islands. The eastern Pacific coast and associated islands have been included in the regional report for the intertropical Americas; Japan and China's Pacific coasts and associated islands are included in the East Asia Regional Report.

The Country Description section briefly describes the countries of the region and the main issues affecting coral reefs and related ecosystems in those countries. An overview of the regional situation is then provided, identifying the major regional issues and the regional priorities for the next five to 10 years. Annexes 1 to 6 summarize additional information for the region concerning the conservation and management of coral reefs and associated areas.

The nature of small islands within the Pacific region means it is not possible to single out coral reef ecosystems, including mangrove and seagrass systems, for separate conservation and management attention. The sectoral approach to environmental management within this region has been the predominant approach used in the past and has proven largely unsuccessful. Therefore, in this report, although the emphasis is on coral reefs and related ecosystems, reference is often made to the broader environmental issues which must be taken into consideration and the essential integrated approach to their management and sustainable development.

The major issues for each country are noted. The following have been identified as key issues affecting Pacific islands coral reefs. Their importance varies from island to island, but they exist in virtually all countries to varying degrees. They are (in no particular order):

- Pollution from sewage, fertilizers, biocides, toxic wastes, oil spills, solid wastes and other land-based sources of pollution;
- Siltation due to soil erosion from inappropriate land-use practices (e.g., agriculture; forestry; site clearance; road building);
- Overexploitation of coral reef resources (e.g., commercially valuable species such as beche-de-mer, trochus, certain fish);
- Live coral harvesting for aquariums and tourist trade; mining coral heads for construction;

- Destructive fishing and collecting methods (e.g., poisons; dynamiting);
- Land reclamation and inappropriate coastal protection works;
- Coastal and marine development projects (often internationally funded and driven) without environmental impact assessments (EIAs);
- Channel blasting and dredging activities (e.g., beach and lagoon sand mining); and
- Natural disasters (e.g., tropical cyclones, coral bleaching, crown-of-thorns starfish infestations, and possible climate change and sea-level rise).

Priorities

The following are regional priorities. However, the implementation of any actions to address them will largely be at the national level, and the specific priorities will vary from country to country. The possibility of duplication of effort, and alternatively, of leaving gaps, is always a prospect considering the number and varying capacities of governments within the region and the range and variability of technical and financial assistance provided bilaterally and multilaterally to the region. The region does, however, have a history of being able to coordinate its activities, especially in the area of the environment.

Capacity Building

- Technical training, especially on survey techniques, environmental impact assessment and management strategies;
- Education and awareness programs on the benefits derived from healthy coral reefs and related ecosystems; and
- Improved coordination and cooperation of activities and information exchange

Research and Monitoring

- Acquisition of baseline information on the status of coral reefs and mangroves within the region, especially through rapid assessment techniques for remote areas;
- Monitoring of coral reefs and related ecosystems to detect disturbances due to natural and/or anthropogenic stresses;
- Adoption of basic survey and monitoring methods and standards; and
- Applied research into reef management, conservation and sustainable use options, e.g., reef fisheries management, marine protected area siting and design, local tenure and use rights.

Management

- Adoption of integrated coastal management appropriate to Pacific islands circumstances;
- Adoption of EIA procedures for all development activities; and
- Establishment of effective marine conservation and protected areas.

REGIONAL REPORT ON THE MIDDLE EAST SEAS: ISSUES AND ACTIVITIES ASSOCIATED WITH CORAL REEFS AND RELATED ECOSYSTEMS

Presented by

Dr. Moustafa Mokhtar Ali Fouda, Department of Fisheries Science and Technology College of Agriculture, Sultan Qaboos University, Sultanate of Oman

Coral reef ecosystems in the seas of the Middle East (the Red Sea and its Gulfs of Aqaba, Suez and Aden; the Arabian Sea; the Gulf of Oman and the Arabian (Persian) Gulf) are rich, biodiverse and generally in good condition. Well-developed fringing reefs thrive on both coasts of the Red Sea (less in the southern region). Fringing reefs in the Gulf of Suez are less developed than those in the Gulf of Aqaba. In the Gulf of Aden, well-developed coral reefs exist in restricted areas (e.g., Mukalla and west of Aden). In the Arabian Sea, Gulf of Oman and Arabian Gulf, coral reefs occur mainly as numerous patch reefs and fringing reefs in protected areas of Dhofar (Salalah), the Gulf of Masirah, Muscat area, Musandam and the offshore islands of Oman and in the Arabian Gulf. Coral cover is usually less than 50 percent. Extreme temperatures, high salinities and elevated nutrient concentrations during upwelling (in Oman) affect coral diversity, and many species are living near their maximum tolerances. Coral diversity in the Arabian Gulf and Gulf of Suez is low (57 and 45 species, respectively) compared to the Gulf of Aqaba (130 species), Gulf of Oman and Arabian Sea (100 species) and the Red Sea (more than 200 species). Coral reefs in the Gulf of Aqaba represent the northernmost limit for coral reefs in the Indian Ocean. Similarly, the world's northernmost mangroves live along the southern coast of the Gulf of Aqaba (Sinai). The extent of mangroves (three species) in the region has been declining with only 575 to 700 square kilometers remaining, mostly in the Red Sea. However, they still play an important role in the ecology of the region; their communities include faunal assemblages of many species of fish (86 species), crustaceans (40), mollusks (83), and smaller numbers of sponges, echinoderms, polychaetes and ascidian species. Eleven seagrass species are known from the region; diversity is greatest in the Red Sea (10 species) and lowest (four) elsewhere. Seagrass beds are abundant in shallow coastal areas and form the basis for many food chains; more than 600 species of plants and animals were recorded. Fishes and seaweeds are diverse with more than 1,000 and 300 species respectively. Large wildlife include turtles (five species), birds (more than 200 species) and mammals (more than 15 species), with the dugong population in the Gulf of Aqaba being the second in global importance after Australia.

Seventeen countries border the Middle East seas, with an estimated population of 280 million and annual average growth rate of 3.5 percent. In many countries, the coastal region is a focal point of development and construction. The increasing human pressures are causing harmful environmental effects. Pollution can be ascribed to three major sources: 1) urbanization with tourism; 2) oil exploitation (less than 50 percent of world oil resources) and transport; and 3) other industries. The magnitude of pollution may be less at present than elsewhere in the world, but because these waters are enclosed, with limited water exchange, the dispersal of pollutants into the Indian Ocean (i.e., flushing) is minimal.

The environmental issues concerning the coral reefs and other marine habitats are numerous and interrelated. Although reefs may be constantly experiencing natural stresses, there is increasing evidence that human impacts combined with natural disturbance may lead to a slow recovery rate of a reef, particularly since human-induced change is often chronic rather than temporary. Environmental impacts resulting from natural stresses include: extremes in temperature, extreme low tides, bioerosion, episodic rainfall and massive discharge of silt-laden flood waters, water turbulence during upwelling, turbidity and sedimentation. Environmental impacts resulting from human activities include: loss of coral areas, mangroves and other marine habitats; coral degradation; decline in species abundance; changes in species composition; physical damage to coral reefs by divers and boat anchors; alteration in marine communities; reduced turtle breeding and expected global warming and sea-level rise.

Most countries have their own marine laboratories and centers involved in education and research programs. They are also involved in regional and international cooperative environmental programs. Although a considerable number of research projects have dealt with baseline studies, very little appears to have been done regarding environmental monitoring. However, very successful projects (e.g., establishment of a marine habitat and wildlife sanctuary for the Gulf region, the R/V Mt. Mitchell expedition following the Gulf War) have demonstrated fruitful cooperation between the countries of the region and European and American scientists and conservation managers.

Regional conservation activities include the Kuwait Action Plan (Arabian Gulf, Gulf of Oman and Arabian Sea), the Red Sea and Gulf of Aden Action Plan of the UNEP Regional Sea Programme, the Global Environmental Facility (GEF) of the World Bank for the Red Sea, and the marine environmental initiative for the Gulf of Aqaba (USAID, EEC countries and Japan). In most countries, certain marine reserves exist, but their extent is small and their effectiveness varies from one country to another. Between countries, the requirement for environmental impact assessment for coastal development projects varies from being a legal necessity to adherence to a voluntary code of conduct. Fisheries management programs exist but are still in their early stages. Efforts are being made to combat oil pollution. Existing management and education efforts need to be complemented by more effective enforcement programs.

Opportunities for improved environmental protection and understanding of the marine environment of the region fall into three main categories: research, integrated coastal zone management and environmental education. It is suggested that a regional office be established and be linked with a global coral reef project.

CORAL REEFS AND RELATED ECOSYSTEMS OF THE WESTERN INDIAN OCEAN

Presented by

Mr. Christopher Muhando, University of Dar es Salaam, Institute of Marine Science, Tanzania

Rich coral reefs dominate the near shore marine environment of the East African region. Fringing reefs are the most common type in the Western Indian Ocean (WIO). They border much of the shore from northern Mozambique

along the length of mainland Africa to the Red Sea, and surround the relatively stable granitic islands of the Seychelles and younger volcanic islands (Comoros, Mauritius, Le Reunion).

In the Indian Ocean, coral diversity decreases west along the equatorial belt away from Australasia, the area of highest coral diversity. However, this decrease is only marginal because the endemic corals of the WIO compensate for the westward loss of species.

Reefs support important fisheries on which the majority of coastal fishing communities of the region depend for their livelihoods, and are significant drawing cards for coastal tourism. Reef tourism, especially the related sail and glass-bottom boat operations, give employment to many coastal inhabitants, supplementing the incomes of fishermen, or providing them with alternative earnings opportunities. Reefs also break the force of the Indian Ocean swells to provide safe anchorages for fishing boats and shelter for beaches and productive lagoons that support the growth of vast seagrass meadows.

Although the biological diversity of seagrass beds and mangroves is low compared to coral reefs, they are of inestimable value as nurseries for many species of direct commercial or subsistence value, and as ecological support systems for the near shore WIO environment.

Given the expanding development of mariculture worldwide, it is inevitable that wild genetic material will be drawn upon increasingly to improve farmed stock. Wild stock is currently harvested for mariculture in the region, which argues strongly for protecting marine biological diversity.

Environmental action along the eastern African coasts and the WIO region focuses overwhelmingly on land where environmental issues are perceived to be more urgent. Marine biodiversity has been given scant attention or largely ignored.

People are the principal force behind the need for reef conservation. Standing to benefit considerably, people are also being the principal cause of reef loss. People threaten reef biodiversity by direct exploitation and overharvest, and by habitat destruction. Destructive activities include destructive fishing techniques that break or damage coral (especially the use of explosives), coral mining for lime production or construction, dredging and reclamation adjacent to reef systems, industrial and sewage pollution, siltation resulting from inland land-use practices, erosion caused by shoreline development, or dumping of garbage and landfill. These threats operate at two principal levels: 1) escalating subsistence use, generally leading to impoverishment of reef biodiversity or possible complete loss over the long term; and, far more dangerous; 2) development activities that can lead to sudden and often irreversible loss of biodiversity, and even the whole reef system, through reclamation, industrial or domestic pollution, deforestation upstream, or removal or conversion of reefs and their community.

To be effective, reef management needs to focus at three levels: 1) the regional level to enable multinational cooperation required to safeguard circulation of larvae, nutrients and migratory species, and to maintain water quality; 2) the national decision-maker level to influence planning and avoid damaging developments; and 3) the community level to relieve pressure on the reefs imposed by burgeoning populations.

At the regional level, there is little concern for reefs in neighboring waters, even though the state of those reefs upstream may have profound effects on the quantity

and types of coral, fish and invertebrate larvae carried by currents across political boundaries and deposited on national reefs. Awareness of the in-country problems is generally low, so where it exists, the national-level actions required are so overwhelming that little concern is given to the problems of neighboring seas.

At the national level, reef management suffers from inadequate or divided institutional responsibilities and capacity. These include those to control destructive land use, guide physical planning, increase public awareness, adapt customs alongside new technology, and integrate the needs of coastal communities into development and conservation projects.

This lack of adequate institutional capacity is one of the major constraints in achieving reef conservation in the WIO. Here, responsibilities for fishery management and for reef parks and reserves are usually clear, but those for the reefs outside protected areas are undefined.

Community-level problems in the WIO formerly were 'resolved' by the creation of marine parks or reserves designed to conserve reef biodiversity and areas with good prospects for tourism. They were also designed to shut out local communities. Although this still happens in places, design of reef parks and reserves increasingly takes into account the needs and aspirations of the neighboring communities. Zones still are established to protect biodiversity, separate incompatible activities, and safeguard research and tourist sites, but also to protect breeding stocks for fishes sought by the fishing communities. Park-related jobs are reserved for these communities, and they benefit by sharing of revenues generated by the park, which are plowed back into community projects (schools, clinics, workshops).

PLENARY 6 : IMPLEMENTING ICRI AT THE REGIONAL LEVEL

Co-Chairs: Mr. Joannot Pascale, New Caledonia

Mr. Claude Morel, Seychelles

Facilitator: Dr. John McManus, The Philippines

THE ROLE OF LOCAL INSTITUTIONS AND NATIONS IN REGIONAL ICRI ACTIVITIES

Presented by

Dr. Jorge Cortes, CIMAR, Universidad de Costa Rica, Costa Rica

Participation of nations in international initiatives must be built from the bottom up. As an example I will describe my vision of CARICOMP, a Caribbean monitor-ing network. CARICOMP, which stands for Caribbean Coastal Marine Productivity, had its beginnings in the early '80s at a meeting called by John Ogden and Betsy Gladfelter in the Virgin Islands under the auspices of UNESCO. In that early meeting the idea behind CARICOMP

was born. In the mid-1980s, I attended a second meeting, as a country representative, as most Caribbeans and Latin Americans were there. The scientific agenda was dominated by First-World scientists.

Between that meeting and 1990, a steering committee was created, with the participation of scientists from the whole region, and a first draft of the monitoring manual was produced. In the 1990 meeting there was wide participation of scientists from the whole region. I'm not sure how that happened, but by a combination of planning and luck, the right people were invited from most countries. Unfortunately, in my case, the invitation was sent to someone in my country who was not interested in the program, so no one from my country attended the meeting. I will come back to this issue, which is central.

I attended the 1991 meeting. One of the striking differences between the 1985 meeting and that one in 1991, was the wide participation of everyone. If translations were necessary, they were done. So we moved from a scientific agenda, dominated by a few scientists, to open discussion of all sorts of issues by all participants independently of where they came from. At that point, CARICOMP became an international program that belonged to all of us. And this is the only way to get good data on a long-term basis. I am sure that if the central force behind CARICOMP, the steering committee, disappears today, the monitoring of reefs will continue in most countries.

This introduction brings me to the central point of my presentation: what needs to be done to promote participation of local institutions and nations in the International Coral Reef Initiative? One of the lessons I learned is that individuals make things happen, not institutions, or nations, or international organizations. These bodies can contribute, but the work is done by individuals. As I mentioned above, most of the people participating in CARICOMP are interested in the project and will make an extra effort to obtain the data. You will almost never see that extra effort made by a person assigned by an institution or a government to do that work. To ensure a compromise, a memorandum of understanding is signed between CARICOMP and the individuals' institutions. My specific suggestion on this topic is that consultations must be done in each country and in each region to choose the right persons, because I insist, the success of a program like the one proposed here rests on individuals. Most countries have local scientists and managers that could participate, if they are helped, and not supplanted, by foreign scientists.

When I thought about the role of local institutions and nations in regional ICRI activities originally, I was thinking of going through the different options in local institutions and in the incentives and requirements for participation of local institutions and nations. But now I am convinced that the effort must go to the identification of individuals that will make this initiative work at the local, national, regional and finally at the global level. So it doesn't matter which institution a person comes from, as long as the work is done.

Very clear rules must be established. What are the responsibilities and benefits of participating for the individual, the institution, and the nations, (i.e., a memorandum of understanding)? This is another area in which I think we must dedicate some effort – to identify those responsibilities and those benefits. Some of the benefits for the countries that I can think of are: 1) increase in the knowledge of the nation's coral reefs directed to a sustainable use of their resources, 2) economic assistance; and maybe 3) technical assistance. I say maybe technical assistance,

because most countries with coral reefs have scientists and managers working on them, but are limited most of the time by economic resources and not by lack of knowledge or interest.

In conclusion, I can see three areas in which efforts must be directed, two of which are closely related. First is the identification of individuals willing to make the International Coral Reef Initiative a working reality, and second is the identification of their needs to do the job. The third area in which effort must be directed is toward the definition of benefits and responsibilities of participants at the individual, local, national and regional level.

THE ROLE OF REGIONAL ORGANIZATIONS IN THE ICRI

Presented by

Ms. Kim-Looi Ch'ng, Coordinating Body on Southeast Asian Seas, Thailand

Summary of presentation, provided by rapporteur

Ms. Ch'ng described several ways in which regional organizations could strengthen regional cooperation including:

- Acting as catalyst for actions in the region;
- Expanding, strengthening or establishing new programs; and
- Providing leverage outside of the states to encourage support of coordination at the regional level, eliminating duplication.

Relevant organizations for conducting these activities include:

- ASEAN;
- IUCN;
- UNEP Regional Seas programs;
- IMO;
- IOC ;
- ICSU;
- MARPOL; and
- FAO.

Ms. Ch'ng suggested that ICRI should piggyback onto existing regional mechanisms.

Discussion: Rapporteur's Report

The December 1994 meeting in the Pacific was discussed. The outcome of this meeting was to develop local initiatives after a consensus was reached on identifying problems in the Pacific islands and tasks to address them, including public education and awareness campaigns such as the "Kids for Coral" campaign. Four island governors have established local ICRI coordinating committees whose members include administrators of programs in coastal zone management (CZM), water quality, and fisheries, as well as scientists and local NGOs.

Progress since June 1994 on developing a program of top-down leadership with bottom-up action has focused on four elements:

- Federal laws are best if they fill in gaps at the local level (e.g., the Lacey Act);
- Inclusiveness – integrated CZM is interdisciplinary;
- Funding – programs already exist, but need to be prioritized; and

- Capacity building—programs such as “Kids for Coral” needed to be developed to teach the community about coral reefs.

It was again emphasized that ICRI should assist with these local efforts, not develop new programs. It was recommended that studies be conducted on the value of reefs to tourism.

PLENARY 7: IMPLEMENTING THE ICRI FRAMEWORK AT THE NATIONAL LEVEL

Co-Chairs: Mr. Yoshihiro Natori, Japan

Mr. Ezekiel Okemwa, Kenya

Facilitator: Ms. Lynne Hale, United States

Rapporteur: Mr. Tomlinson Skippings (Turks and Caicos)

REATING THE FOUNDATION FOR A SUCCESSFUL NATIONAL STRATEGY

Presented by

Mr. Michael Ham, Coastal Management Program, Guam

Of all the lessons learned in developing the United States Coral Reef Initiative—and that process is still ongoing—perhaps the most important were those which came from mistakes. Those lessons apply to the inter-national efforts in exactly the same way they apply to national efforts.

First, and most important, is the idea that everything must be created from the bottom up. Coral reef initiatives, laws, programs and activities begin with a single fisher-man, building from the bottom up, with local strategies serving as foundations for regional strategies, and then national strategies, culminating in international products, such as those being pursued in this workshop. Accountability begins at the reef, not in the ivory towers of politics.

Second is the concept of inclusiveness. This is demonstrated on many fronts, but two in particular. In one respect it refers to the practice of holistic planning, the inclusion of the human community, as well as nature beyond the single resource. It also refers to the understanding that the goal of sustainable use and development means gaining a full enough understanding of the resource as a planetary, as well as a geographic-specific, resource, in order to develop an economic utilization which respects impacts beyond the borders of geography or generation.

Third, strategies and initiatives and work programs must be designed to function in the absence of new funds and new bureaucracies. While funding is certainly of great importance, the work can begin with existing efforts, simply by redefining the connections to reefs which many programs already contain through implication. For example, in the United States, efforts to develop state-wide programs for the management of diffuse, or nonpoint

source pollution, were not created to be elements of any coral reef initiative, but rather as simply a marine water quality program. The direct relationship between that effort and current coral reef efforts, however, quickly became evident. The same is true with a myriad of other existing programs at all levels. By simply expanding our vision, in many cases, we can understand that the human and bureaucratic resources already exist. Research, management, and public education are all programs which we can tap. If we insist on waiting for new funding, we are looking for excuses to fail.

Finally, if we fail to remember that what we are trying to achieve is the management of human activities, rather than coral reefs, we will lose sight of the target of our efforts, and will again invite disaster.

The U.S. national initiative was born fitfully because it forgot the first lesson. National leaders attempted to create it in a vacuum, without direction from the local communities or regional leaders. To their credit, the national players took several steps back and redesigned the initiative based on the need for a bottom-up approach.

At that point, the local governments within the two coral reef regions of the United States took charge of their own resources and began the definition and development of work plans, initiatives and strategies for their local communities as well as their regions. These products will be the foundation of the national effort, which will in turn support international efforts. If we continue to follow this process, we can build successful programs and constituencies. If efforts to impose “cookie cutter” approaches or visions from the top down are pursued, by either our national government or the international community, our children will pay a heavy price for our failures and arrogance.

IMPLEMENTING THE ICRI FRAMEWORK AT THE NATIONAL LEVEL—THAILAND NATIONAL CORAL REEF STRATEGY

Presented by

Dr. Hansa Chansang, Phuket Marine Biological Center, Thailand

The Thailand National Coral Reef Strategy was a product of the Coastal Resources Management Project which was a USAID-Thai project. The Office of National Environmental Board (ONEB) was the responsible national agency, with technical assistance from the Coastal Resources Center (CRC) at the University of Rhode Island. The project was initiated according to the need for effective integrated coastal resources management to reduce conflict uses and degradation of coastal living resources. The ONEB took the lead and coordinated various implementing agencies in preparing the strategy under the support of expertise from CRC.

The National Coral Reef Strategy adopted six policies, as follows:

1. To manage coral reefs according to their difference ecological and economic values and maintain balance of uses;
2. To reduce degradation of coral reefs by increasing effectiveness of existing law and measures;

3. To build and maintain public support for coral reef management;
4. To revise existing laws, administrative directives, and institutions required for effective management;
5. To monitor and evaluate progress in accomplishing the objectives; and
6. To support management by scientific research and innovation.

According to the strategy, reefs in Thailand are to be managed according to their ecological status and uses which are divided into three management categories, i.e., reefs managed for local uses, reefs managed for tourism and recreation, and reefs managed for ecological and scientific benefit. The activities to be carried out under each category differ according to management objectives.

The Thai cabinet adopted the strategy in 1992 and allocated about US\$2 million for initial implementation in certain urgent locations for 1993–1994. The implementation is to be carried out mainly by implementing agencies, i.e., Department of Fisheries which is responsible for aquatic resources management, and the Department of Forestry which is responsible for management of marine parks and provincial authorities. Subsequently, the Department of Fisheries established a five-year coral reef management program starting in 1995 based on the National Coral Reef Strategy. The major emphases are on capacity building at local level for reef management, increasing public awareness and participation and scientific capabilities to support reef management.

The challenges to achieve the objectives of the strategy are in capacity building for local managers and public participation. Reef management is a relatively new concept in Thailand. There is an urgent need for training of local managers, i.e., provincial fisheries officers and marine park officers. In addition, effective public participation requires change in public attitude and some institutional structures.

Discussion: Rapporteur's Report

It was concluded that:

- Integrated coastal zone management (ICZM) is effective whether it is “top-down” or “bottom-up.” The same middle ground is achieved where the government and community work together.
- ICRI can help in the national strategy by assisting with national capacity building and encouraging regional networks.
- The ICRI document will be a living tool for public education in a national strategy.
- Governments will act when they realize that coral reefs are important for economical, sustainable development, and therefore, governments will place ICZM higher among its priorities.

PLENARY 8: MATCHING ICRI OUTCOMES TO NATIONAL DEVELOPMENT PRIORITIES

Co-Chairs: Mr. Jorge Reyes, The Philippines

Dr. Sameer Ghazi, Saudi Arabia

Facilitator: Ms. Lynne Hale, United States

Rapporteur: Mr. Colin Higgs, Bahamas

MATCHING ICRI OUTCOMES TO NATIONAL DEVELOPMENT PRIORITIES: WHAT ARE THE ISSUES THAT NEED TO BE ADDRESSED?

Presented by

Dr. Barry Blake, Overseas Development Administration, Barbados

The planning processes of governments are, of necessity, a complex exercise. Governments have a range of development policies, priorities and plans for action which must embrace the entire spectrum of national needs. Broad strategic plans are often matched by a plethora of more specialized documents such as National Environmental Action Plans (NEAP) and Biodiversity Action Plans. Where then, does the ICRI enter the system in terms of planning for national development priorities?

Where they exist, National Physical Development Plans (NPDP) set out proposals for the development of all territorial assets. Such plans generally aim to establish a comprehensive framework for the coordination and control of development activity. An NPDP is thus an obvious entry point for consideration of coral reef management since it is likely to encompass a comprehensive survey of existing systems and selection of a development strategy based on the policies and goals of government.

There are, however, many factors which conspire to complicate the task for ICRI. At the national level, the constraints on sustainable management of any ecosystem are often the absence of a feeling of “ownership” and the temptation to regard “environment” as an entity in its own right rather than as one facet of the sustainable development process. In developing countries, there is thus often a suspicion that environmentalism is a concept promoted by foreigners anxious to promote their own agenda.

To succeed in the sustainable management of any natural system it is therefore necessary to address the issues of the people who interact with these systems and to consider planning for human development priorities rather than for environmental priorities alone. Thus for environmental elements to be successfully woven into a National Development Plan, it requires involvement of all sectors of the community including Government, the private sector, NGOs and local groups. This is particularly true for coral reef survival which depends on an integrated approach to coastal zone management – in many countries just a vague concept.

What then are the key challenges in addressing the issues of coral reef protection and management through the national development planning process?:

- The need to consider reefs first in the context of the communities who depend on or directly influence them;
- The need to consider reef preservation in terms of their value in the sustainable development of the nation rather than as a stand-alone environmental imperative;

- The need to make both government and nongovernment stakeholders aware of the reasons for, and value of, sustainable coral reef management, thereby creating the necessary body of public opinion to ensure that due consideration is given in the planning process;
- The need to create (and fund) within governments the infrastructure to deliver an integrated multidisciplinary approach geared to interact with both the community and the private sector with regard to planning and use allocation;
- The need to create, within planning departments, awareness of, and skills relevant to, reef management issues;
- The need to develop a business-like approach to the management of natural assets. Governments need to understand the nature of the biodiversity they own, its importance in national, regional and global terms, and to have guidance on priorities for preservation in the context of development planning. Yes, this area is beautiful, but what can it do for the nation in the short, medium and long term; and
- The need to generate the funding to support a sustainable approach in the face of conflicting demands for immediate improvements in human standards of life. Implementing NEAPs by generation of realistic business plans for protected area management in consultation with the communities that exploit these resources for their living and with the private sector.

What then is the role of ICRI? ICRI can only draw attention to issues, it cannot seek to provide direct solutions.

Perhaps the role for ICRI includes:

- Making governments aware of the potential benefits and costs associated with good or bad reef management so that these may be reflected in development plans;
- Ensuring that governments are aware of current problems, known solutions, and ongoing reef management programs; stimulation of information sharing at a regional and global level;
- Providing a framework to facilitate collaboration between neighbors with similar assets, and potential for sharing chapters in their development plans;
- Providing encouragement to governments to consider the necessary infrastructure to ensure rational development of reef management plans and full involvement of all sectors of the community; and
- Offering a temporary interface between reef owners and external agencies to facilitate matching available funds to national action plans.

The life span of the ICRI is finite. During its existence it can hopefully direct the attention of ministers, civil servants, volunteer organizations and private sector concerns toward the need to consider reef management as an integral part of the planning process. This is, however, a transient activity, and at the end of the day it is the feeling of national ownership of reefs which will determine their survival, and for that it will be necessary to reach the public in a way beyond the scope of the ICRI.

Discussion: Rapporteur's Report:

- National development priorities should focus first and foremost on immediate human needs.

- To ensure national-level action toward sustainable reef management, both the political leaders and community leaders have to understand and see evidence of the value of these resources to sustainable development in tangible human terms; and
- Reef survival depends on a truly integrated approach to coastal zone management.

ICRI cannot seek to provide direct solutions; however, during its existence it can direct attention of political leaders, government agencies, NGOs and the private sector toward the need to consider reef management as an integral part of the planning process.

MATCHING ICRI OUTCOMES TO NATIONAL DEVELOPMENT PRIORITIES FROM A REGIONAL ORGANIZATION'S PERSPECTIVE

Presented by

Dr. Andrew Smith, South Pacific Regional Environment Programme, Western Samoa

Summary of presentation, provided by rapporteur

Within the Pacific most countries have already prepared national environmental management strategies (NEMS), which in most cases have environmental priorities that are directly or indirectly related to coral reef and related ecosystems. Therefore the ICRI outcomes should be consistent with the national development priorities of the individual countries. ICRI outcomes must complement what is happening nationally.

A key issue for the regional organizations is to ensure that the ICRI outcomes facilitate and support the NEMS and related activities. The regional workshop will play a major role in this regard.

MATCHING ICRI OUTCOMES TO NATIONAL DEVELOPMENT PRIORITIES FROM AN EASTERN CARIBBEAN PERSPECTIVE

Presented by

Mr. Horace Walters, Ministry of Agriculture, Lands, Forestry and Fisheries, St. Lucia

Summary of presentation, provided by rapporteur

The Eastern Caribbean has for the past several years been sensitized to ICZM and attempts have been made to educate the political directorate on the importance of ICZM as an integral part of their respective national planning process.

The outcomes of the ICRI do not appear to be in conflict with the current national priorities of the Eastern Caribbean states. On the contrary they appear to provide a framework to facilitate development of programs and projects at the national and regional levels.

The Eastern Caribbean states tend to look at issues which lend themselves to harmonization in a regional context. In this regard, the regional governmental organization, namely the Organization of Eastern Caribbean States (OECS), should be the focal point to administer regional projects.

Discussion: Rapporteur's Report:

A key issue is funding. The priorities list is very long in small island states and there are insufficient funds allocated at the national levels. Therefore, the United States should assist in facilitating access to the GEF. Also, the

ICRI coordinating office should consider this a priority issue and seek to identify sources of funding to assist SIDS in the implementation of their respective coral reef initiatives.

Dr. Marea Hatzios from the World Bank noted that in GEF's latest report on the distribution and implementation of grants (April 1995) some 21 percent of the resources to date have been awarded to Latin America and the Caribbean. She offered her assistance to provide interested participants with information on The World Bank and GEF as well as on the criteria, procedure and format for the submission of project proposals for consideration of funding.

Response from Horace Walters: While 21 percent of the resources may be awarded to Latin America and the Caribbean, only a very small percentage of that amount is allocated to the Caribbean island states.

Dr. John Wilson of the U.S. Agency for International Development (USAID) advised the workshop participants of the USAID-funded ENCORE project for the OECS, which undertook a regional attempt to develop standardized policies and legislation for the Eastern Caribbean states. He noted that a key issue is to avoid downward harmonization. Solid and respectable standards should be maintained during any harmonization process.

Response from Horace Walters: The ENCORE project is welcomed in the OECS and its efforts in the region are appreciated.

Dr. Smith in concluding his remarks posed the question, "What do we do if there is no or little matching of the ICRI outcomes with national priorities?" Unfortunately, no one took up this issue during the discussion period.

IDEAS FROM SPECIAL SESSIONS

During the workshop, three sessions were devoted to address issues which have special significance to ICRI. Ecotourism, while difficult to define in many circumstances, supports local communities but is also used to bring large numbers of people to often sensitive environments. Special management measures are required to ensure the sustainable use of the coral reef resources. Both Stephen Colwell of the Coral Reef Alliance, and Dr. Rebecca Hawkins from the World Travel and Tourism Center, provided some interesting thoughts on the ever-increasing magnitude of tourism, which will be a continuing source of pressure on coral reef environments, and gave some thoughts on how to minimize the adverse consequences of that growth. Dr. Marea Hatzios of the World Bank and Prof. Graeme Kelleher from the IUCN made presentations on the use of a global network of marine protected areas to protect marine biodiversity and identified some of the reasons MPAs are failing to achieve their management objectives along with priorities for remedying the causes of those failures. Paul Holthus, from The Nature Conservancy, related some NGO experiences in the Solomon Islands and Alvin Nacu discussed World Wildlife Fund elements considered when undertaking community-based coral reef conservation projects.

SPECIAL SESSION ONE: ECOTOURISM: CONSTRAINTS AND OPPORTUNITIES FOR CONSERVATION AND ECONOMIC DEVELOPMENT

ECOTOURISM, SCUBA DIVING AND CORAL REEFS

Presented by

Stephen Colwell, Coral Reef Alliance, United States

True ecotourism encourages tourists to develop a greater understanding of a natural area's environmental and social heritage. It also contributes to the area's economic and environmental well-being. To achieve these goals, ecotourism projects must operate within the area's social and environmental carrying capacities and provide at least sufficient economic benefit to cover the costs created by the tourism. In many cases, scuba diving at coral reef destinations can be a form of ecotourism.

Early studies identified several key characteristics of ecotourists including higher than average income levels, a high level of formal education, a concern for the environment and a willingness to make financial contributions to conserve the ecosystems that they visit.

International scuba divers also display these characteristics: Surveys of scuba divers in North America who travel to international coral reef destinations show that these international dive tourists have a median household income of US\$84,000, 65 percent have college or graduate degrees, and over 75 percent identify the quality of the dive experience as the most important criterion for selecting a dive destination (rather than low price, quality of accommodations or night life). These divers take 1.25 international dive trips per year, stay an average of 8 days and spend over US\$3,000 per trip. A recent poll of U.S. divers indicated that 93 percent would be willing to make a financial contribution to support coral reef conservation. An earlier study of divers visiting Bonaire indicated that 92 percent would be willing to pay US\$10 to dive in a marine protected area (MPA) and 48 percent would be willing to pay US\$30.

There are approximately 6 million certified scuba divers in the world and at least 500,000 new divers are certified each year. There are over 300,000 international dive trips per year that collectively generate US\$1 billion in revenues; this international dive tourism appears to be growing at 16 to 17 percent per year for divers from North America and even faster in Asia and Europe. Assuming that the current trends of international dive tourism continue over the next decade, there will be greatly increased dive tourism to destinations closer to the European and Asian markets, especially Australia, the Pacific and the Red Sea. It is estimated that by the year 2005, international scuba diving tourism alone could generate revenues of approximately US\$900 million in Australia, US\$1.2 billion in the Caribbean, US\$170 million in the United States, US\$400 million in the Pacific, US\$200 million in the Red Sea, and US\$140 million at other destinations, making a total of over US\$3 billion per year. These figures are only approximate, but they may be useful to those trying to put an economic value on coral reefs; they give an indication

of the amount of revenue that destinations would forfeit if they allow their coral reefs to degrade. Because divers are primarily concerned with the quality of the dive experience, they will not continue to patronize destinations that do not have live, healthy reefs.

Governments can help promote “dive ecotourism” in their coral reef areas by: creating management plans for their areas that incorporate the concerns and objectives of ecotourism (see CORAL’s Draft Checklist for Dive-Ecotourism Operations and paper on Ecotourism Action plans); developing reasonable zoning and other regulations that protect the reefs while providing diver access; and ensuring that a substantial amount of any user fee or other charges for access to coral reefs is allocated to the maintenance of MPAs and other methods designed to conserve the reefs. Such efforts to assist in the development of dive-ecotourism require the cooperation of the private sector, local communities and other affected stakeholders if they are to be successful over the long term.

Dive ecotourism is not possible at all coral reef destinations. However, for those areas that are willing to make the commitment to planning, managing and nurturing dive ecotourism, it can provide a source of revenue, employment, foreign exchange and environmental education that can help the area achieve the twin goals of coral reef conservation and socioeconomic development.

TOURISM: CONSTRAINTS AND OPPORTUNITIES FOR CONSERVATION AND ECONOMIC DEVELOPMENT

Presented by

Dr. Rebecca Hawkins, World Travel and Tourism Council's Environment , Research Centre, United Kingdom

The session was convened to explore the role that tourism can play in providing opportunities for environmental conservation and economic development in coral reef areas.

Travel and tourism is the world's largest industry and has experienced rapid growth in recent years. A few figures illustrate the level of this growth: In 1950, a mere 25 million people crossed international borders on tourism trips; by 1990, this had risen to 425 million, and by 2000 it is expected to reach 637 million. This level of activity has made the industry into an economic powerhouse, generating

- 10 percent of gross domestic product;
- 10 percent of capital investment;
- 10 percent of employment; and
- 10 percent of consumer spending worldwide.

The industry is one of the most dynamic sectors of the economy and is expected to double in size in the early part of the next century, furthering its role as a global industry.

An industry of this size and scale has environmental impacts—both positive and negative. Negative impacts include visual intrusion into landscapes, water use and pollution, waste generation and damage to habitats. These negative impacts are not, however, an inherent part of the tourism development process; rather, they are a reflection of poor management decisions by the many organizations involved in the industry. Well-planned and managed tourism has great potential to:

- Create value for resources in the eyes of resident populations as well as tourists;
- Provide incentives for enhancement of natural, cultural, urban and industrial areas, including coral reefs;
- Establish essential infrastructure for resident and urban populations; such infrastructure includes waste water treatment facilities, mooring buoys, etc.;
- Communicate the messages of sustainable development worldwide—to tourists, residents and business people; and
- Provide markets for the produce of other sectors, including agriculture, fishing and crafts, thus generating employment and income.

Since the environment lies at the very core of the travel-and-tourism product, it is important to develop products which maximize the positive impacts of the industry. The best way to achieve this is to incorporate environmental responsibility into the management function of all travel-and-tourism companies. In this way, all travel products can be developed and operated in harmony with local communities, local cultures and local

environment, so that they become the permanent beneficiaries of that development –in both new and existing destinations.

The World Travel & Tourism Council (WTTC) has been involved in the development of a program to help all travel-and-tourism companies incorporate an environmental dimension into their management systems. Known as GREEN GLOBE, this program is available to any travel-and-tourism company of any size and in any location. By joining the program, companies make a commitment to progressively improve their environmental performance and may use the GREEN GLOBE logo to demonstrate their commitment to the traveling public. Based on the experience of other travel-and-tourism companies around the world, GREEN GLOBE provides all of the learning resources required to improve performance (including checklists, identification of likely costs and savings, lists of available techniques and technologies, and case studies). Companies enter the program at a level appropriate to their current environmental activity.

For companies that have as yet done little to improve environmental performance, the first step is the completion of a checklist from which to assess the environmental impacts of the operation. Once this has been completed, companies are helped to develop an environmental policy statement, gain the assistance and enthusiasm of staff, and communicate the aims of the program to customers.

The program then goes on to help companies improve performance in the areas of waste, energy and water management; these are often the areas in which companies can make the greatest contribution to local environmental improvement. Action in these areas also brings significant cost savings for many companies and these can be used to fund future environmental improvements.

Once companies have achieved improvements in these areas they are helped in the development of programs to work with suppliers to provide environmentally benign products, manage the impacts of their visitors and so on. After all, there is no point in being the greenest hotel in the world if guests damage the environment the minute they walk out the door.

The program has great potential to improve the environmental performance of the industry and minimize its impacts on all environments—especially sensitive ecosystems. Immediate improvements in a single destination will, however, only be achieved once a large number of companies work through the program with the full cooperation of all other parties involved in the tourism process. WTTC is, therefore, now seeking seed funding to establish such programs destination-wide to illustrate the very real role that the industry can play in providing alternative sources of livelihood and protecting the environment of the basic resource of the tourism industry—the natural and cultural environment.

SPECIAL SESSION TWO: PRIORITIES FOR MARINE BIODIVERSITY

PRIORITIES FOR MARINE BIODIVERSITY CONSERVATION THROUGH A GLOBAL REPRESENTATIVE SYSTEM OF MARINE PROTECTED AREAS

Presented by

Dr. Marea Hatzioiols, The World Bank, United States

and

Dr. Graeme Kelleher, International Union for the Conservation of Nature, Switzerland

A Global Representative System of Marine Protected Areas is a collaborative project of the Great Barrier Reef Marine Park Authority (GBRMPA), the World Bank Environment Department, and the World Conservation Union (IUCN) Commission on National Parks and Protected Areas (CNPPA).

Background

Since 1986, the CNPPA, under the direction of its vice chairman (marine), Graeme Kelleher, and with the support of GBRMPA, has been carrying out a program to establish a global representative system of marine protected areas (MPAs). This program has involved development of IUCN policy on marine protected areas through resolutions of the IUCN General Assembly in 1988, 1991 and 1994, publication by IUCN of "Guidelines for Establishing Marine Protected Areas" (Kelleher and Kenchington, 1992) which outline principles and practices for the establishment of MPA systems, and establishment of a network of 18 regional working to identify priorities for the establishment of a global representative system of MPAs.

The most recent phase of the program has been a collaborative project with the World Bank to identify priorities for investment in marine biodiversity conservation. Under this project a report has been produced by the CNPPA network of marine working groups which identifies priorities for the establishment and improved management of MPAs in each of CNPPA's 18 Marine Regions. The report is intended to provide strategic guidance to the Global Environment Facility (GEF) and other donors for investments in marine biodiversity conservation. For each Marine Region, the report provides a description of marine biodiversity, a biogeographic classification, a summary of existing MPAs, priority areas for new MPAs and existing MPAs which require improved management in each country, and the highest-priority MPA sites in the region.

Priority areas were selected using criteria which include both ecological and sociopolitical considerations. The criteria used were: biogeographic importance, ecological criteria, naturalness, economic importance, social importance, scientific importance, international or national significance, and practicality/feasibility.

Results

The assessment of existing MPAs showed that in most regions the MPAs are not adequate to ensure the protection and management of marine biodiversity. In the great majority of cases, the area of each major marine biogeographic zone which is included in MPAs is much less than 1 percent of its total area. About one-fifth of the marine biogeographic types identified have no MPAs. Although there are a few very large MPAs, most are relatively small areas of less than a few thousand hectares. Many are threatened by activities beyond their boundaries which are beyond the scope of existing management control.

Questions about the degree of protection provided to marine biodiversity cannot be answered without information on the extent to which MPAs are achieving their conservation objectives. However, data on management effectiveness are sketchy. The difficulty of obtaining such information points to the general absence of evaluation of management effectiveness. Data on management effectiveness were available for only one-third of the existing MPAs; of these, 70 percent did not properly achieve their management objectives.

The reasons for MPAs failing to achieve their management objectives vary among Marine Regions. However, there are some commonly recurring themes which can be summarized as:

- Insufficient financial and technical resources to develop and implement management plans;
- Lack of trained staff;
- Lack of data on which to base management decisions, including information on the impacts of resource use and on the status of biological resources;
- Lack of public support and unwillingness of users to follow management rules, often because users have not been meaningfully involved in establishing these rules;
- Inadequate commitment to enforcing management;
- Unsustainable use of resources occurring within MPAs;
- Impacts from activities in land and sea areas outside the boundaries of MPAs, including pollution and overexploitation; and
- Lack of clear organizational responsibilities for management and absence of coordination between agencies with responsibilities relevant to MPAs.

Achieving effective management of existing MPAs is of equal priority to the establishment of new areas. In most regions, a significant number of MPAs exist only on paper with no management plan and no management activity of any sort.

Recommendations

A total of 640 MPA sites has been identified as being of national priority for marine biodiversity conservation. From these, 155 MPA sites were selected as being of regional priority for the conservation of marine biodiversity. Of these, 73 (47 percent) are existing areas which require support for improved management and 82 (53 percent) are proposed new MPAs.

The report recognizes that a wide scope of activities will be necessary to develop effective MPA systems. Following an analysis of the recommendations in each regional chapter, a list of priority actions has been developed.

Priority Actions for the Establishment of a Global Representative System of MPAs

1. Develop and implement projects to address the priority areas and other recommendations in this report.
2. Establish national representative systems of MPAs which preferably encompass complete ecosystems or habitats and which are integrated with national policies and effective mechanisms for coastal zone management.
3. Develop institutional arrangements to achieve integrated management of each MPA and provide coordination mechanisms to ensure that adjacent land and sea areas are managed in a complementary way.
4. Actively involve local communities and marine resource users in the planning and management of MPAs.
5. Bring managers and scientists together to carry out integrated, multidisciplinary, management-oriented research and monitoring programs so as to provide a scientific basis, to the maximum extent practicable, for selection, planning and management of MPAs.
6. Commence a coordinated effort to systematically review the effectiveness of existing MPAs.
7. Develop and disseminate tools and guidelines which can be widely understood and applied for the following purposes:
 - Carrying out monitoring and research in MPAs; and
 - Achieving effective community support and participation in management of MPAs to strengthen the capacity and effectiveness for planning, administration and day-to-day management.
8. Carry out training programs which develop the capacity for MPA management in regions and countries. These programs should:
 - Train trainers;
 - Develop training curricula; and
 - Use these as a basis for regionally/nationally based curricula and training.
9. Establish a global network to support marine resource managers, based on existing regional networks.
10. Carry out further investigations to address biogeographic and other information gaps necessary for the identification of priority areas.
11. Mobilize domestic resources for marine protected area management from such sources as natural resource taxes and levies, user charges, joint ventures with the private sector, trust funds and endowments, and ecotourism.

The MPA reports recommend priority areas and actions for the creation of a global representative system of MPAs. With this task completed, it is now necessary to plan the next steps in the cooperative program being carried out by IUCN-CNPPA, the World Bank, GBRMPA and other partners. This program will focus on implementation of the recommendations in the report, particularly through the development of projects for the GEF and other donors that aim to achieve marine biodiversity conservation objectives and establish the global representative system of MPAs.

Conclusion

This joint project illustrates the process to be followed if the world community is to address the fundamental problems it faces against limited financial and skilled human resources. Expertise must be mobilized from all quarters, using the motivation of communities rather than depending solely on financial reward. The World Bank, IUCN and GBRMPA have supported this publication but their efforts have been magnified many times by the numerous individuals and organizations affiliated with the CNPPA who have voluntarily devoted their time and energies.

The real value of this project lies in the recommended actions and their implementation. Our success in the next action phase will depend upon the durability of the partnerships forged and our commitment to demonstrating the benefits of conserving the world's marine biodiversity to the global community. The recommendations are a call to stakeholders to join in creating the momentum for conserving the world's marine biodiversity now and in the future.

SPECIAL SESSION THREE: NGO EXPERIENCE IN COMMUNITY-BASED COLLABORATIVE MANAGEMENT

EXPERIENCE OF THE NATURE CONSERVANCY

Presented by

Dr. Paul Holthus, The Nature Conservancy, United States

Community-based coral reef management (CBCRM) is a process that involves all stakeholders in moving from inadequate management of coral reef resources to effective, participatory management. CBCRM is critical to the future of coral reefs, as it often is the only way to achieve real coral reef conservation, management and sustainable use at the local level.

In promoting and developing CBCRM, it is important to remember that: 1) there is no best way or single model for CBCRM; 2) communities will often not always initiate the management of their resources without some appropriate assistance and encouragement; 3) tangible social and economic benefits are a key motivating factor; and 4) CBCRM projects require at least two years to show initial results and a minimum 10-year commitment to achieve objectives. Most important, it is essential to ask the community what it considers important before launching coral reef management efforts at the local level.

Based on experience from around the world, there is a growing understanding of the elements which contribute to successfully initiating and sustaining CBCRM. These include:

- Starting correctly with clear, achievable objectives based on issues that are important to the community and will motivate them;
- Providing feedback and showing results early on by identifying indicators of success and collecting baseline data on these, so that change can be shown in areas that matter to the community;
- Using appropriate monitoring methods and including the community in monitoring efforts;
- Establishing a core group of committed individuals; identifying critical partnerships with outside agencies and organizations, especially to address large, complex issues;
- Recognizing problems originating from outside the community which cannot be fully solved by CBCRM alone;
- Acknowledging that education and training alone are not sufficient to change behavior; and
- Achieving and sustaining focused success in coral reef management before expanding programs into the broader realm of coastal management.

The experience of The Nature Conservancy (TNC) in the Solomon Islands illustrates the role of NGOs in encouraging and catalyzing CBCRM. TNC has worked with a wide range of stakeholders to foster the conservation and sustainable use of the marine resources of a small group of islands, the Arnarvon Islands. These islands support

globally significant hawksbill turtle populations, important subsistence marine resources, and valuable commercial resources (especially sea cucumber, trochus and pearl shell), all of which are severely depleted.

TNC engaged in dialogue with the communities, provincial governments and national government, and created the conditions for all of these stakeholders to come to the table on the conservation and sustainable use of the area's resources. This has resulted in a commitment to establish a conservation area which respects traditional use rights, recognizes the need for subsistence use, and involves all stakeholders in implementation and management. A management committee with all the stakeholders involved has developed a management plan and recruited local conservation officers from the communities.

As a result, the Arnarvon Islands Marine Conservation Area is being established as the first marine protected area in the country and the first community based conservation area which involves a full partnership of the communities, government and NGOs.

WORLD WILDLIFE FUND COMMUNITY-BASED APPROACHES TO CORAL REEF CONSERVATION

Presented by

Mr. Alvin F. Nacu, World Wildlife Fund, The Philippines

WWF has long recognized the need for conservation of coral reef and associated ecosystems. Historically, it has focused its efforts in coral reef conservation on small-scale projects in marine park development; policy and advocacy work; field research; and community-based sustainable utilization of reef areas. WWF International established the Marine Advisory Group (MAG), composed of representatives from Associate and Affiliated National Organizations, in order to provide guidelines for coordination of marine activities throughout the WWF family. With the creation of MAG, future efforts among the WWF family will be more integrated and strategic, harnessing science to influence and direct conservation policy and field projects. Recently, WWF contracted Ms. Susan Wells to develop a position paper on WWF's involvement in coral reef conservation. WWF is building on her work to strategically address the issues she and others have identified. WWF employs the following critical elements in developing community-based coral reef conservation projects:

1. Identification of all user groups and their full participation in the planning and implementation of management plans;
2. Mutually agreed-upon, specific objectives for the conservation of coral reefs;
3. A scientific basis for planning, so that the truly critical areas of the reef ecosystem get the protection they require, including associated habitats that may be overlooked in conventional protection schemes;
4. Inherent flexibility so that management can be revised as needs or conditions change; and
5. Continual, two-way feedback between stakeholders and those setting or administering border policies.

Some examples of community-based projects that WWF supported include:

1. Sian Ka'an Biosphere Reserve in Mexico. WWF-US supported the implementation for the protection of reefs and mangroves considering the needs of local communities. It also funded a three-year project on the spiny lobster fishery to improve sustainable management.
2. In Haiti, WWF-US funded a project at the Les Arcadins Marine Park (with USAID and other funding institutions). This project included the development of an artisanal fisheries program to improve sustainable use; a community conservation awareness program; and a women and development program, among others.
3. WWF-Philippines Program, in collaboration with Haribon Foundation, a local NGO, supported a project that successfully trained aquarium fish collectors to use small hand nets instead of poisons. WWF-Philippines Program is currently developing a project concept involving ornamental fish collection as a livelihood strategy.
4. WWF-Philippine Program is supporting the establishment of the Turtle Islands Heritage Protected Area. It seeks to apply the program elements in relation to a species of special concern. These elements include: integrated coastal management, pollution control and sustainable fishery management.
5. Another approach combines marine tenure with modern fishery management. This approach has proven effective in sustainable use of marine resources in some areas (e.g., Solomon Islands).

WWF's experience illustrates that the combination of careful planning and the involvement of local communities contributed significantly to maintaining the ecological balance of coral reefs and to sustainable use of their resources.

Chapter Three

IDENTIFYING ACTIVITIES FOR THE FRAMEWORK FOR ACTION

INPUT FROM THE REGIONAL WORKING GROUPS

ICRI Workshop participants broke out into four regional working groups to establish a list of issues (not necessarily listed in priority) that the Framework for Action should consider. The following reports were submitted by working group rapporteurs.

TROPICAL AMERICAS REGIONAL WORKING GROUP

Chair: Dr. Eric Dalhgren-Jordan, Mexico

Facilitator: Ms. Sue Wells, Belize

Rapporteur: Dr. John Wilson, United States

The Tropical Americas Working Group met to discuss the Framework for Action. In the brainstorming session, a number of actions were suggested. For this report, these are presented below by topical area. These actions were not prioritized by the group, however.

Management Option

- Ensure integration of the ICRI program of action with the proposal to develop a global representative system of marine protected areas, as well as with other regional programs.
- Implementation activities should proceed within the broad context of integrated coastal management.
- Establishment of coordinating mechanisms among government agencies is important to facilitate coastal zone management.
- Priority should be placed on development of sustainable financing mechanisms for coral reef management programs.
- The ICRI should encourage development of strategies, policies, plans, and legislation relating to integrated coastal management (ICM).
- Attention should be placed on supporting appropriate harmonization of policies and legislation relating to coral reef management.
- Increased cooperation between governments and NGOs should be encouraged within countries.

- Reef management needs to be identified as a priority within government policy.
- Effective management of coral reefs may require consolidation or development of legislation and strengthened enforcement of regulations pertaining to environmental impact assessment, pollution, fisheries, etc.
- While recognizing national differences, ICRI should seek to promote common approaches to ICM.
- The ICRI should assist with identification of appropriate funding sources to facilitate implementation of coral reef management programs.
- The ICRI should develop model administrative/legal frameworks for national ICM implementations.
- The ICRI should promote formulation and implementation of programs to mitigate the degradation of coral reefs and other ICM problems.
- The ICRI should encourage development of joint papers for presentation in international fora.
- Design of ICM programs should include a full analysis of economic costs and benefits.
- The ICRI should encourage establishment and sustainable management of a system of marine protected areas, using local resources and cost-recovery strategies.
- Pilot programs in community-based management should be promoted.
- The adoption of appropriate technologies to reduce land-based sources of marine pollution should be promoted.
- Identify and develop methods for combating illegal resource extraction in remote coastal and shelf areas (e.g., trawling off the Miskito Coast).
- Where feasible, apply the comanagement approach to integrated coastal management.
- Countries should be encouraged to ratify/accede to international conventions and treaties relevant to coral reef management.
- Coral reefs of regional and global importance should be identified and designated as such under appropriate conventions (e.g., World Heritage).
- Multilateral and bilateral donor agencies should be encouraged to take ICRI outcomes and recommendations into account in their deliberations on program development.

Capacity-Building Options

- The ICRI should promote development of environmental education programs, both for increasing general public awareness and for inclusion in primary and secondary education programs.
- The ICRI should seek to identify and make available appropriate literature on coral reefs and associated ecosystems.
- Needs assessments and audits of existing capacity should be conducted to provide the basis for development for human resource development and institution strengthening programs.
- The ICRI should encourage efforts to develop tools and techniques for effective ICM and to train people to use them.
- The ICRI environmental education programs should be based on assessment of existing levels of public awareness and designed accordingly.

- The ICRI should encourage establishment of linkages and networking of databases and other information systems.
- The ICRI should support development and conduct of short seminars for high officials in the public and private sectors.
- Policy briefs should be developed to educate policymakers on the ICRI.
- National seminars on ICM and ICRI should be held.
- The ICRI should encourage assessment of training needs for ICM within each country.
- The ICRI should identify and develop regional centers of excellence for ICM, and encourage these centers to strengthen their capacities to train trainers in ICM.
- The ICRI should promote development of school curricula covering ICM.

Research and Monitoring

- The ICRI should seek to ensure that coral reef management strategies are based on the best scientific data available.
- The ICRI should support development of marine habitat mapping and classification programs.
- The ICRI should encourage development of national monitoring programs, using to the maximum extent possible private sector, local communities, and other developing country institutions in this effort.
- Economic and social evaluations of reef use and resources should be conducted.
- Research on design of marine protected areas in relation to larval dispersion, population dynamics, migration processes, and other biological, physical, and social processes should be encouraged.
- Research on local socioeconomic constraints and opportunities for community-based ICM should be promoted.
- The ICRI should encourage development of rapid assessment techniques to evaluate reef condition and then promote wide adoption of these techniques to increase data comparability and trend analysis.
- A reef monitoring program should be established in the Eastern Pacific.
- Assessment of land-based sources of marine pollution should be given greater attention.
- Reef monitoring at the regional level should be supported in the Caribbean.

ASIA REGIONAL WORKING GROUP MEETING

Chair: Dr. Malikusuworo Hutomo, Indonesia

Facilitator: Mr. Arthur Paterson, United States

Rapporteur: Ms. Holly Ferrette, United States

The session's discussions were based on the following format: the session was divided into the three primary ICRI focal areas: Management, Research and Monitoring, and Capacity Building. The topics were approached one at a time, and each member of the group was given the opportunity to bring forward his or her primary concern with regards to each. As time allowed, an open discussion on each of the focal areas followed. Following is a list of all the issues that were raised in each focal area.

Management

- Greater policy integration is needed since there often is little or no integration of national policies at the federal, provincial, and local levels, (e.g., the state may have jurisdiction over the country's water resources, but the local government may have jurisdiction over the land.)
- Regional institutions should assist governments to integrate various sectors with regard to ICZM.
- There is a need at the national level to make countries more aware of the need for ICZM.
- There is a need to coordinate agencies within countries to implement ICZM.
- There is a need for policy mechanisms to coordinate ICZM.
- There should be some effort at coordination among countries for standardizing approaches to ICZM. This becomes especially important when regional or bilateral cooperation is needed for coordinated management (e.g., turtle management).
- Public awareness is needed and sustainable use of resources should be promoted.
- Community-based approach works well in some places (e.g., Philippines), however there needs to be flexibility for cultural differences.
- ICZM planning should take into account the diverse uses of different coastal areas. Different coastal areas have different uses (e.g. areas bounded by cities and rural areas).
- There is a need for donor organizations to coordinate interventions.
- There is a need for good enforcement and programs (e.g., laws, etc.).
- Local government agencies, local communities, NGOs, and the private sector should be directly involved in implementation of ICZM.
- Attempts should be made to learn from existing projects to see if they can be replicated. If the projects are not going well, then steps should be taken to see what needs to be done to improve them.
- Protective schemes for zoning/gear regulations should be included in management plans.

- Integrate IUCN/World Bank marine protected areas information (e.g., priorities for action), especially those that are only paper parks, into the ICRI Framework.
- Land-based sources of pollution should be included in management schemes, and land management agencies should be included in ICZM planning and implementation.
- Issues of marine water quality should be addressed.
- There should be respective roles for domestic and international funding.
- International agencies should be requested to commit money to coral reef conservation.

Research and Monitoring

- Data networks should be linked.
- Common methodologies, and inter-compatibility (e.g., on coral reef monitoring) should be encouraged, when possible. There is, however, a need for variation in monitoring methods.
- Research capabilities need to be improved at the national level.
- Research and monitoring should be a continuous process –one feeds into the other. Research and monitoring informs the management process.
- New satellite-based services and products should be developed.
- Research should anticipate management questions and try to answer them.
- Joint research between countries with common problems should be encouraged.
- Countries should be assisted in accessing new information systems.
- Needed research topics include: interconnectivity of reefs (sources and sinks), size of protected areas, ecotoxicology, levels of discharge that can be tolerated, research that has management implications, methods for sustainable use of coral reefs, socioeconomic research, policy research, research on tenure, access issues, and property rights.

Capacity Building

- ICZM managers don't need full-scale academic training (i.e., degrees). Just good training. Choosing your people (who will be trained well) is important.
- There is a need to start training people not just in coral reef science, but also in socioeconomic fields, as well as in basic management skills (e.g., marketing, negotiating, etc.).
- There should be better aid coordination with respect to funding of capacity-building initiatives.
- Capacity building should be integrated, when appropriate, with on-the-job training (e.g., creation of management plans). On-the-job training could also occur at already well-managed marine parks (e.g., Great Barrier Reef).
- People in the government who are responsible for funding allocation need to be trained in the issues as well, since they are the ones who usually have final approval over project budgets.
- Flexible financing by donors should be encouraged (e.g., once a project's budget is approved, there should be some flexibility in adjusting the budget).
- Use of existing training materials when possible should be encouraged.

- Training in local communities should be tied to public awareness programs.
- There should be training of politicians to build political will. Tour operators, media, etc. should also be trained in the issues.
- Training institutions in a country should be developed so that they do not need to go outside for all training.
- Values orientation should be built into training programs.
- Existing networks should be recognized, strengthened, and coordinated.
- Regional bodies should be used to help access training funds.
- Countries need to be careful of “overtraining” of people. Training opportunities within a country should be rationalized.
- Cultural differences should be recognized in training.
- When possible, national and regional consultants should be used for training.

GREATER INDIAN OCEAN - MIDDLE EAST REGIONAL WORKING GROUP

Chair: Mr. Ezekiel Okemwa , Kenya

Facilitator: Ms. Lynne Hale, United States

Rapporteur: Mr. Mark Eakin, United States

Introduction

We recognize the unique nature of many environments in the region, including extremes in temperatures and salinity, high endemism, oil transport, and the presence of both highly isolated/confined basins and widely distributed islands. In light of these considerations, the following are problems and tasks that are appropriate considerations for the Framework for Action.

Capacity Building

- Develop national coral reef profiles and hold workshops to identify priorities.
- Use regional networks to develop documents that include needs and capabilities of institutions within the region.
- Develop capacity to participate in regional and global research and monitoring networks.
- Build training networks that build on national capabilities.
- Link short-term and long-term training in coral reef science and management to the development of degree programs in national universities.
- Establish center(s) of excellence in the region.
- ICRI should facilitate matching donors and recipients and encourage donors to assist in preparation and provide seed money for developing funding proposals and funding of small activities.
- Establish funds (at regional level?) for small grants to promote ICRI objectives.

- Encourage development of creative financing of coral reef research and management through fee structures such as user fees to marine parks.

Integrated Coastal Management

- Eliminate practices that damage coral reef resources.
- Apply use of environmental impact statements for development projects.
- Improve cooperation and coordination of information exchange through regional and international actions.
- Create effective spill response capabilities that give priority to critical marine habitats.
- Establish central coordination offices for workable regions.
- Establishment and real implementation of marine protected areas (MPAs).
- Review, amend and adopt regional sections of report on global system of MPAs.
- Encourage regional geographic information system (GIS) capability for the coastal zone with initial priorities in MPAs.
- Sponsor standard guidelines to review development projects for use by national agencies.

Research and Monitoring

- Develop appropriately sized regional and local monitoring networks, including the serious need for capacity building to accomplish it.
- Encourage and train resource users to be part of monitoring network.
- Develop and use simple and quick standardized monitoring methodologies, to determine baseline status and the direction and rate of change.
- Develop a regional GIS/Information System, making data widely available.

Administrative

- ICRI should facilitate coordination by holding regional workshops for more elaboration and identification of areas of cooperation—workshop scopes should correspond with UNEP Regional Seas Programme units.
- Establish national contacts, tied to institutions actively engaged in coral reef work, not single persons.
- Encourage creative financing of coral reef research and management through instruments such as user fees to marine parks.
- Reevaluate progress by region, biennially.

PACIFIC OCEAN REGIONAL WORKING GROUP

Chair: Mr. Wayne King, Cook Islands

Facilitator: Ms. Lynne Pieper, Australia

Rapporteur: Dr. John McManus, The Philippines

Coastal Resource Management

- Adoption of integrated coastal management appropriate to Pacific island circumstances with realistic time frames.
- Adoption of environmental impact assessment procedures for all development activities.
- Establishment of effective marine conservation and protected areas.
- Recognize and build upon traditional management skills/systems.
- Support the implementation of national environment strategies.
- Establish legislative support for environment impact statements.
- Awareness-raising programs should be included in all three elements of Framework for Action.
- Strengthen the South Pacific Regional Environment Programme (SPREP) to coordinate integration.
- Links between research and monitoring and management.
- Improve coordination between international organizations, the U.N. and NGOs to provide for more effective delivery of programs at international, regional and national levels.
- Strengthen management capacity at national level.
- Strengthen project planning capacity.
- Concentrate on implementation of management issues as a priority.
- Training of local personnel should be incorporated into management projects.

INPUT FROM THE GLOBAL WORKING GROUPS

After the regional working groups discussed potential actions for management, capacity building and research and monitoring, the participants broke into global working groups on these three issues in an attempt to consolidate the list of actions.

INTEGRATED COASTAL RESOURCES MANAGEMENT

Facilitator/Rapporteur:

Mr. Arthur Paterson, United States

International

- Encourage regional and international fora to endorse the ICRI goals and objectives in the ICRI Call to Action.
- Provide improved access to financial and technological resources to enable organizations, institutions, and regional centers to assist governments and communities in matters including:
 - Waste management and the adoption of cleaner production technologies;
 - Management of marine transport;
 - National and regional disaster strategies;
 - Management of sustainable commercial and noncommercial fisheries; and
 - Ratification and implementation of relevant international instruments.
- Improve coordination of U.N., international organizations and NGOs to provide more effective delivery of programs.
- Encourage multilateral and bilateral donors to consider ICRI framework in project design.
- Identify coral reefs of regional and international importance in order that governments may designate them under appropriate conventions.
- Promote the establishment of a globally representative system of marine protected areas for coral reefs, mangroves and sea grasses, within the framework of existing international rights and obligations as exemplified by the Law of the Sea Convention; for example, through the IUCN/World Bank efforts.
- Identify mechanisms for sustainable international trade in marine species and enhance the effectiveness of national implementation of CITES regarding trade in coral species and products.

Regional

- Support regional ICRI workshop to enhance regional cooperation.
- Strengthen regional organizations, in particular UNEP Regional Seas programs and activities, to strengthen national and regional efforts to implement ICRI goals.

- Conduct biennial review of ICRI activities at national and regional levels.
- Improve donor coordination of ICZM technical assistance.
- Training of local personnel should be incorporated into management projects (national and regional levels).
- Identify funding opportunities for ICRI-related activities.
- Recognizing national differences, develop common approaches for ICZM that may provide models for in particular administrative and legislative arrangements.
- Support adoption of ICZM appropriate to small island states' circumstances with realistic time frames.
- Design and implement regional recovery plans for endangered and threatened species, in particular, migratory species, such as turtles, that are dependent on coral and related ecosystems.
- Identify and develop methods at national and regional levels for combating illegal resource extraction in remote shelf areas.
- Improve regional and international ICZM information exchange, for example on the effectiveness of management measures.
- Support implementation of national environmental strategies.
- Seek better regional policy coordination on tropical marine ecosystems in international fora.

National

- Promote and implement ICZM as the organizing framework for a national priority to manage coral reefs and related ecosystems and their associated watersheds.
- Develop statutory and policy support for applying environmental impact assessment for all development activities.
- Improve the coordination of all governmental national-to-local ICZM, actors including the designation of a national focal point for management of coral reef ecosystems (to coordinate at national and regional levels).
- Strengthen national agency ability to design coral reef conservation and sustainable use/ICZM projects that may compete for funding at national, regional and international levels.
- Harmonize policies and legislation at national and regional levels on environmental impact assessment, fisheries, pollution and marine protected areas.
- Implement management measures based on currently available information, adapting these measures as new information from the scientific and management communities becomes available regarding the status of reefs and the effectiveness of management measures.
- Reduce human impacts on reefs – in particular, destructive fisheries practices and land-based activities that may affect water quality and turbidity.
- Promote adoption of appropriate technology for land-based activities of marine pollution, including through voluntary programs and economic incentives to introduce appropriate technology.
- Promote the use of MPAs and zoning for multiple use purposes, at national and regional levels.
- Strengthen the governmental enforcement mechanisms through designation of clear institutional lead player.

- Promote a framework for funding domestic marine protected areas – one that features primarily domestic funding by NGOs, the private sector and communities, and possibly includes an appropriate role for international donors.
- Improve NGO, private sector, science community and government cooperation.
- Strengthen coral reef fisheries management.
- Support comanagement wherever possible.
- Expand number of pilot activities in community-based management.
- Recognize and build on traditional management skills and systems.
- Reduce pressures on coral reefs by developing alternative uses and income of coral reefs.
- Strengthen enforcement/compliance of environmental regulations.
- Promote designation of centers of excellence in ICZM and MPAs.
- Develop national response capabilities to respond to hazardous materials response events.
- Promote the awareness of the tourist industry to minimize tourism impacts.
- Support links between research and monitoring, management and capacity building at all levels.
- Promote public awareness at all three levels.

CAPACITY BUILDING

Chair: Dr. Edgardo Gomez, The Philippines

Rapporteur: Dr. John Wilson, United States

Facilitator: Ms. Lynne Hale, United States

International

- The need for building human and institutional capacity was identified in Agenda 21 of the U.N. Conference on Environment and Development, as well as by the International Coral Reef Initiative (ICRI), as established for integrated coastal management (ICM) and sustainable development in developing countries.
- The group recognized that there has been significant effort in short-term training in some regions and that these efforts must be recognized, built upon and better linked to long-term capacity building. The group also emphasized that capacity building requires long-term commitments. Capacity building is needed more urgently than ever as the need for coastal management practitioners grows. Experience shows us that capacity-building efforts need to include both short-term intensive training efforts for today's managers and long-term institutional strengthening programs so that tomorrow's coastal managers can be better trained.

Regional

- Increase university capacity within a region to sustain training and education efforts. This will decrease the long-term costs to train coastal management practitioners. Regional long-term institutional strengthening also increases job opportunities, incorporates local cultural traditions within the training programs and reduces the barriers of language.
- Utilize regional experts as trainers in international short-term training programs.
- Create regional centers of excellence to further refine ICM techniques and to increase human capacity.
- Develop and maintain a network of ICM mentors to supplement the short-term and long-term training that new and experienced coastal managers participate in.
- Assist with identifying mechanisms for sustainable funding and improve coordination with and between existing programs and their funding to avoid duplication of efforts and to better use and leverage limited resources (funds, technology and equipment).

National

- Target capacity-building efforts to key target groups, including:
 - Coastal managers who can coordinate ICM programs;
 - Technical specialists to better participate in and contribute to ICM initiatives; and
 - Local officials, private sector, resources user groups who play important implantation roles.
- Assist with identifying mechanisms for sustainable funding and improve coordination with and between existing programs and their funding to avoid duplication of efforts and to better use and leverage limited resources (funds, technology, and equipment).

RESEARCH AND MONITORING

Chair: Dr. John Ogden, United States

Rapporteur: Dr. Mark Eakin, United States

Facilitator: Dr. John McManus, The Philippines

General

The purpose of research and monitoring is to assess and provide regular updates on the condition of coral reefs and related ecosystems, understand problems and processes, to evaluate the success of management and conservation actions and to make the predictions essential for wise management decisions. Both research and monitoring require the collection of data using tools from the natural and social sciences and must be carried out as an integral part of management. It is only through this that management decisions can be made based on the best available information.

Assessment

The top priority for work in many areas is the baseline assessment of coral reefs and related ecosystems. Many coral reef areas remain unmapped and their communities poorly known. An assessment program must be established to:

- Develop rapid assessment techniques to determine patterns and processes in coral reefs and associated ecosystems;
- Apply inter-compatible assessment techniques nationally, regionally and internationally;
- Acquire baseline information on the status of coral reefs and related ecosystems, especially through rapid assessment techniques for remote areas;
- Assess land-based sources of pollution across complete drainage basins;
- Identify and quantify various forms of local human impact; and
- Develop regionally applicable ecosystem inventories and GIS (habitat and resource mapping).

Monitoring Programs

Many important events in coral reefs have gone undocumented or unexplained due to the lack of basic data to identify causes and understand problems. Monitoring and problem-based research, when modeled using sound theoretical principles, provide the basis for understanding and predicting ecological change. It is essential that a coordinated monitoring program be established to:

- Develop and apply inter-compatible monitoring methodologies, to routinely determine the status, direction and rate of change, and understand basic patterns and processes, making data widely available.
- Develop national, regional and global monitoring networks—fostering development of new networks where needed and supporting and/or expanding existing networks as appropriate (examples: expand CARICOMP to wider Caribbean, develop Eastern Pacific monitoring and Global Coral Reef Monitoring Network) as contributions to the Coastal Change module of the Global Ocean Observing System.

- Carry out monitoring through a question-based system to collect environmental, ecological, social, economic and cultural data.
- Develop programs to ensure that communities, private sector, resource users and others participate in the design, collection, interpretation and use of monitoring data, and provide training and technical assistance needed to accomplish this.
- Monitor coral reefs, related ecosystems and their associated socioeconomic systems to detect change and determine causality and responses (i.e., discriminate human effects from natural variation).
- Utilize training and technical assistance to enable local personnel to undertake monitoring.
- Assess and monitor the socioeconomic impacts of conservation and habitat destruction, and develop information management systems to provide quality control and data accessibility.

Management-Oriented Research

While much will be learned through assessment and monitoring programs, basic problems exist that require focused research to be resolved. Some of these are natural science problems pertaining to the ecosystems and their function, while others are essential to our understanding of socioeconomic problems. Some of this work includes:

- Research into interconnectedness among reefs and between reefs and related ecosystems, on varied spatial and temporal scales;
- Research into proper size, shape and placement of MPAs in relation to their environmental setting (larval supply, delivery patterns, optimal habitat space, SLOSS);
- Research on ecotoxicology to test effects of pollutants on marine organisms;
- Research into the development of sustainable resource uses;
- Research to address key conflicts between users, to provide scientific recommendations on plans/proposals;
- Policy research to enable community to protect the ecosystem;
- Research into reef management, including evaluation of management alternatives, conservation and sustainable use options (fisheries management, marine protected areas site location and design, local tenure and use rights);
- Recognition of traditional/customary knowledge;
- Economic valuation of resources;
- Research in local socioeconomic constraints and opportunities in community-based coastal zone management / comanagement; and
- Research to identify causes of degradation of coral reefs.

Chapter Four

FRAMEWORK FOR ACTION – A FOUNDATION ON WHICH TO BUILD

THE FRAMEWORK FOR ACTION

Preamble

Maintaining the biological diversity, condition, resources, and values of coral reefs and related ecosystems is a matter of global urgency. While the majority of countries which have coral reefs are developing countries, there are many reefs in the waters of developed countries. This unites the developed and developing countries and should command the attention of the international community. Coral reef survival depends upon the world community acquiring and maintaining the knowledge and capacity to conserve and sustainably use coral reefs and related ecosystems. This requires that all uses and impacts be brought within and maintained at levels which do not exceed these systems' natural capacity for production and regeneration.

The International Coral Reef Initiative (ICRI) Workshop was held at Silliman University in Dumaguete City, Philippines in May 1995 to enable countries, donors, development and funding agencies to work with coral reef managers, private sector representatives, nongovernmental organizations and scientists to develop this Framework as a basis for achieving sustainable management of coral reefs and related ecosystems.

The ICRI Framework for Action builds upon and reflects the principles and processes established by *Agenda 21*, the U.N. Commission on Sustainable Development, the Convention on Biological Diversity, the U.N. Framework Convention on Climate Change, the Global Conference on Sustainable Development of Small Island Developing States, the U.N. Convention on the Law of the Sea, Convention on International Trade in Endangered Species of Wild Flora and Fauna, Global Program of Action to Protect the Marine Environment from Land-Based Activities and other relevant international programs. It has been developed as a succinct statement which should be read and interpreted in light of these documents.

This Framework addresses the four elements of the ICRI Call to Action, which are:

- Management;
- Capacity building;
- Research and monitoring; and
- Review.

Framework Purpose

The purpose of this Framework for Action is to mobilise governments and the wide range of other stakeholders whose coordinated, vigorous and effective actions are required to implement the Call to Action.

Principles

The ICRI recognizes the following principles:

- Achieving the ICRI's purpose requires the full participation and commitment of governments, local communities, donors, NGOs, the private sector, resource users and scientists; therefore true partnerships, cooperation and collaboration exemplify the ICRI activities.
- The overriding priority is to support actions that will have tangible, positive and measurable effects on coral reefs and related ecosystems and on the well-being of the communities which depend upon them.
- Human activities are the major cause of coral reef degradation; therefore, managing coral reefs means managing those human activities. Individuals whose decisions and actions affect coral reefs—from board rooms to beaches—need to become aware of and committed to the conservation and sustainable use of coral reefs and related ecosystems.
- The diversity of cultures, traditions and governance within nations and regions should be recognized and built upon in all the ICRI activities.
- Integrated coastal management, with special emphasis on community participation and benefit, provides a framework for effective coral reef and related ecosystem management.
- Developing national capacity to conserve and sustainably use coral reefs and related ecosystems requires a long-term (decadal) commitment. Improvement of coral reef management requires a permanent commitment and an adaptive approach.
- Strategic research and monitoring programs should be an integral part of the ICRI because management of coral reefs and related ecosystems should be based on the most relevant scientific information.
- Actions promoted under this framework should take account of, and fully use, the extensive body of international agreements and organizations that address issues related to coral reefs and related ecosystems. The ICRI will facilitate the leveraging and channeling of existing resources among all sectors for the benefit of coral reefs and related ecosystems.

Actions

- All those committed to supporting the ICRI and this Framework for Action are called upon to take account of and to act on the following at the international, regional and national levels.
- Support national and regional efforts to establish and coordinate strategies, priorities and programs to implement the ICRI Framework for Action, starting with regional workshops to be held by early 1996.
- Ensure that sustainable management of coral reefs and related ecosystems is considered at future relevant international meetings.
- Develop and/or strengthen national, regional and international mechanisms for gathering and sharing information and expertise on the sustainable management of coral reefs and related ecosystems.
- Promote improved access to financial and technological resources to enable institutions, regional centers and networks to assist and inform governments, industries and communities.

- Addressing conservation and sustainable use of coral reefs and related ecosystems requires activities in the following areas:
 - Integrated coastal management;
 - Public awareness, education and training;
 - Ratification of or accession to relevant international instruments;
 - Stakeholder participation at all levels; training policymakers and private sector decision-makers in the development and implementation of coral reef management;
 - Marine science and technology;
 - Environmental law, particularly environmental impact assessment regulations; and
 - Assessing the potential for micro-enterprise development and facilitating access to financing on a small to medium scale.

Management

- Encourage governments to develop and adopt integrated coastal management measures, including:
 - Protection of the marine environment from land-based sources of marine pollution;
 - Environmentally sound land-use practices, including zoning where appropriate;
 - Measures to protect the marine environment from the adverse effect of maritime activities;
 - National and regional disaster strategies;
 - Measures to prevent illegal fishing practices, achieve sustainable fisheries and protect the ecological systems that support them;
 - Tourism management and planning;
 - Cultural aspects of resource use; and
 - Enforcement of regulations.
- Encourage governments and funding agencies to consider the ICRI Framework in project and program design and implementation.
- Encourage, where appropriate, an intersectoral systems approach to planning and management.
- Encourage improved coordination among international organizations, donors and NGOs to provide more effective programs at the regional and national level.
- Encourage prompt implementation of the outcomes of FAO Code of Conduct for Responsible Fisheries and the Global Program of Action to Protect the Marine Environment from Land-Based Activities.
- Promote awareness and action by the global tourist community to minimise individual and collective impacts of tourism on coral reefs and related ecosystems.
- Promote the establishment and effective management of coastal and marine protected areas for coral reefs and related ecosystems, within the framework of customary international law as exemplified by the U.N. Convention on the Law of the Sea. This will contribute to the development of the Global Representative System of Marine Protected Areas as proposed by the World Bank, IUCN and Great Barrier Reef Marine Park Authority.

- Promote the regulation of international trade in endangered and threatened reef-associated species through the Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES), and improve its implementation where required.
- Encourage governments to develop and promote mechanisms for regulating international trade in species that are illegally harvested.
- Encourage governments to develop legislation, policy and institutional capacity to apply environmental assessment to development activities.
- Promote appropriate technologies, including voluntary programs and economic incentives and best management practices, for control of land-based causes of marine pollution.
- Promote and replicate successes in integrated coastal management, including community-based management, as appropriate.
- Support management measures to improve the socioeconomic condition of local communities through such means as retraining and sustainable alternative livelihood development.

Capacity Building

- Capacity building includes establishing and strengthening human resource and institutional capabilities for coastal management, science, training and education.
- Encourage regional organizations to assist countries and communities implementing ICRI, for example through measures including:
 - Preparation of project proposals; and
 - Implementation of small grant programs.
- Establish, strengthen and sustain mutually supportive networks of centres of expertise in management of coral reefs and related ecosystems.
- Base human resource development strategies on needs assessments and ensure that they address:
 - The diversity of cultures traditions and governance structures;
 - Increased community awareness and involvement;
 - Improving the capacity of today's managers;
 - Providing for the education of tomorrow's managers;
 - Coverage of coral reef management issues in the training of all professionals whose work involves decisions which affect coral reefs and coastal resource management;
 - Technical training needs for people at the field level;
 - Training and supporting trainers to work at the community and field level;
 - Evaluation of the effectiveness of training; and
 - The need to target children in awareness raising.
- Improve coordination and targeting of the education and human resource development programs provided by development partners.

- Support formal and informal environmental education programs for all levels of the community on the subject of coral reefs and related ecosystems, with curricula and materials tailored to the interests and needs of the regions and end users.
- Encourage maximum use of national and regional expertise in management, research and capacity-building activities.
- Support the development, identification and dissemination of materials which address the interests and needs of the regions, including:
 - The value of coral reefs and related ecosystems;
 - Practical monitoring and management techniques;
 - Inventories of formal and on-the-job training opportunities;
 - Case studies of management, including success stories as well as examples which have not been successful; and
 - Case studies of human impact and natural variation in coral reefs and related ecosystems.
- Increase the relevance to ICRI of existing donor scholarship programs by:
 - Devoting a proportion of scholarship awards to environmental studies; and
 - Encouraging thesis and dissertation studies carried out in home countries.
- Encourage the private sector's role in management of coral reefs and related ecosystems through:
 - Use of appropriate technologies;
 - Development of a trained and educated workforce; and
 - Innovative approaches to better environmental operating standards.

Research & Monitoring

- Research and monitoring are needed to assess the status of coral reefs, evaluate the success of management and conservation actions and develop more effective management practices. As tropical ecosystems, coral reefs and related ecosystems are subject to dynamics which are generally less well-understood than temperate systems. Therefore, without evidence it should not be assumed that they will react to natural and human disturbances in the same way as temperate systems.
- Research and monitoring programs should address biological, physical, social, cultural and economic studies and should be carried out over time periods appropriate to their objectives. They should be supported by information management, interpretation and dissemination. In the collection of data for both research and monitoring, resource users should be involved to the maximum extent practicable.
- Promote the involvement of managers in the development, conduct, interpretation and application of research and monitoring programs.
- Promote and assist the development and application of resource assessment methods that:
 - Allow for rapid assessment to establish baselines and initiate management; and
 - Can be used in Geographic Information and Decision Support systems.
- Promote the development of a Global Coral Reef Monitoring Network under the Coastal Zone Module of the Global Ocean Observing System by incorporating and, as necessary, establishing or strengthening regional nodes.
- Encourage studies of coral reefs and related ecosystems which:
 - Address priority management issues in individual countries or regions;
 - Address the synergies between human effects and natural variations as causes of stress and degradation in coral reefs and related ecosystems;
 - Involve interdisciplinary research into human impacts with initial priority on fisheries and tourism;
 - Integrate traditional knowledge;
 - Quantify the socioeconomic impacts of conservation and habitat destruction;
 - Address the scales and linkages of the biological communities; and
 - Develop methods for impact mitigation and reef restoration.
- Develop programs to involve communities, resource users, the private sector and others in monitoring the condition of coral reefs and related ecosystems.
- Encourage regional and international forums which bring together managers and scientists to identify priority information requirements for management of coral reefs and related ecosystems.

Review

- Review of the state of coral reefs and related ecosystems and of action taken to implement the ICRI Framework for Action should be conducted at national, regional and international levels on a regular basis.
- The four-year cycle of the international coral reef symposia provides an excellent opportunity to discuss the ecological condition of coral reefs. This should be matched by an equivalent program to review the effectiveness of implementation of actions in accordance with the ICRI Framework for Action. At the international level, the U.N. Commission on Sustainable Development provides an appropriate forum for review of international actions taken at all levels by governments, international organizations and agencies. The 1996 session of the Commission on Sustainable Development, with its focus on Chapter 17 (Protection of Oceans) of Agenda 21 will deal, inter alia, with coral reefs and related ecosystems.
- UNEP should be encouraged to review the implementation and success of the ICRI Framework for Action through relevant programs including the Regional Seas programs.
- Similarly, the IOC through the Global Coral Reef Monitoring Network, should be encouraged to produce reports on the ecological condition of coral reefs and related ecosystems for discussion at the quadrennial International Coral Reef Symposia and other relevant international forums.

Approved 3 June, 1995

GUIDANCE FOR REGIONAL ICRI WORKSHOPS

The following section provides broad guidance developed during the Dumaguete workshop for the conduct and outcome of regional ICRI workshops. This section includes the discussions which took place during Plenary Session No. 9: Goals and Outcomes of Regional ICRI Workshops, and the final document developed by the participants.

Ms. Susan Drake, Coordinator of ICRI, introduced the discussion by outlining possible goals for the regional workshops. Dr. Jeremy Woodley presented the provisional program for the Tropical Americas workshop as a guide for other regional workshops. Ms. Drake expressed the hope that all workshops would endorse the Call to Action. She also suggested that workshops consider the idea of identifying regional and national focal points for coral reef-related activities.

In response to a question about possible timing of the workshops, Ambassador Wensley, the chairperson, said that it would be up to each region to set suitable dates, but it was hoped that all six workshops could be completed by February 1996 to enable the results to be incorporated in the package of ICRI documents to be presented to the CSD IV in April 1996.

There was a question as to the potential funding and cosponsorship of the workshops. The Secretariat stated that it was already in the process of identifying potential funding sources. The meeting was advised that Australia would fund and facilitate the Pacific work-shop; USAID would fund the Tropical Americas workshop; UNEP and France would fund the Indian Ocean work-shop; Japan the East Asia workshop, and the United States would fund the Middle East workshop.

There was a question regarding the actual technical issues in the forthcoming workshops, specifically in regard to integrated coastal management as an overriding goal. Concern was expressed that funding and personnel in many developing countries were already limited, that only a few individuals were responsible for coastal management in these areas, and that they were already having difficulty implementing existing coastal management plans under these conditions. The ICRI Coordinator replied that coral reefs shall be integrally linked to integrated coastal zone management and should bring attention needed to coastal management.

Comments were received on the need for the workshops to emphasize and focus on national (over regional) issues and programs. It was also suggested that ICRI should work at strengthening existing coastal management programs, rather than try to create new ones. The ICRI Coordinator agreed.

Participants were asked to consider the question of who should attend these regional workshops, e.g., should they be modeled on the ICRI workshop by involving a mix of scientists, bureaucrats, managers, NGOs and the private sector? Should they include politicians? That would give them a high profile and would help engender political support and translate outcomes into national policies and programs, including legislative action. On the whole, it was agreed that the regional workshops should have the widest possible audience. Although this will inevitably produce some disagreements, it was the consensus that it is essential to have a diverse group, including high-level policy and decision-makers for a successful outcome.

A participant suggested there could be benefit in including representatives of funding agencies, including the World Bank and the GEF, in addition to representatives from donors, and relevant U.N. agencies (e.g., UNEP, UNDP). There appeared to be general agreement that this would be both useful and desirable.

It was also suggested that as each workshop takes place, reports on discussion and outcomes should be shared with other regions, including advice on what worked and what did not, to help ensure the success of those workshops which follow.

Goals for Regional Coral Reef Initiative Workshops

1. Strategy for Regional Coral Reef Initiative
 - Review/develop regional priorities
 - Regional CRI coordination
 - Regional focal point organization/network
 - Existing regional programs
2. Strategy for Fostering National Coral Reef
 - Initiatives
 - National focal point organization/network
 - Process/mechanisms for implementing national CRIs
 - Possible components of a National CRI
 - Existing programs, especially NEMS
 - National coral reef report, including national priorities
3. Role of ICRI in Regional/National CRI
 - Development
 - Call to Action
 - Framework for Action
 - Role of ICRI in Assisting
 - Regional/National CRI Development
4. Regional Reports
 - Review/revise report
 - Process for report finalization and distribution to other regions
5. Outputs
 - Revised Regional Report
 - Regional CRI Plan and Priorities
 - Strategy for fostering National CRIs

Chapter Five

A STRATEGY FOR THE FUTURE OF ICRI

PHASE 1: JUNE 1995 - JUNE 1996

The Executive Planning Committee (EPC), working with comments and observations made at the ICRI workshop, is developing a plan of action for the 12 months following the ICRI Philippines Workshop (Phase I). Broadly speaking, within the next 12 months, the EPC intends to pursue the submission and adoption of the workshop's results in international fora and the implementation of the Framework for Action at the international, regional, and national levels.

At the international level, the results of the ICRI workshop will be submitted to upcoming international meetings including the Conference of Parties for the Convention on Biodiversity, the Ramsar Convention, the Commission on Sustainable Development (CSD), and the Intergovernmental Conference on the Protection of the Marine Environment from Land-Based Activities.

In coordination with these submissions, the ICRI Secretariat will be discussing with the CSD Secretariat, their interest in monitoring ICRI follow-up activities. In the context of reporting on activities related to Chapter 17 of Agenda 21, countries could report to the CSD on their implementation of the Framework for Action. The ICRI is planning to hold a Planning Committee Meeting on the side of the 1996 CSD meeting.

Further implementation of the Framework will be pursued at the regional and national levels. ICRI regional meetings will be held separately, or as part of other meetings, to develop action plans and/or initiatives to implement the Framework. Post Philippine workshop regional meetings should be held before February 1996 to allow reporting to the CSD. The proposed regional meetings include: Middle East (Red Sea and Arabian/Persian Gulf), tropical Americas, East Asia, Western Indian Ocean /Eastern Africa, South Asia and Pacific. In conjunction with the implementation of the Framework at the regional and local levels, educational efforts will be undertaken.

PHASE 2: BEYOND JUNE 1996

The EPC has entered into general discussions concerning the period beyond June of 1996 (Phase 2). The ICRI should continue to focus on the translation of the global and regional frameworks into national and local initiatives and actions. The ICRI partners should work together to coordinate approaches to relevant international organizations to implement the Framework for Action.

In order to further discuss the ICRI strategy during the Phase 2 period, a two-day EPC meeting will be held the third week of September 1995 in Washington, D.C. Discussion and agreement is anticipated on 1) a strategy for the

upcoming international meetings including the CSD; 2) the contents of a synthesis document (i.e., recommendations) for use in international meetings; and 3) a decision on ICRI's role in the June 1996 Coral Reef Symposium in Panama. As in prior meetings, EPC Washington-based representatives are expected to attend the EPC meeting. A full Planning Committee Meeting is scheduled for the third week in January to plan in greater detail for the CSD and its side ICRI Planning Committee meeting.

THE ICRI COORDINATING OFFICE – SECRETARIAT

The ICRI Secretariat has been tasked by the Planning Committee with promoting, within existing programs, a common agenda among interested countries for the conservation and sustainable use of coral reefs and related ecosystems. At the same time, it has been instructed not to duplicate the responsibilities already exercised by existing international programs (such as the UNEP Regional Seas Programme). The Secretariat, which will continue to be hosted by the United States through the 8th International Coral Reef Symposium (ICRS) in June 1996, is responsible for: 1) all follow-up to the Philippine workshop; 2) finalization of workshop documents and preparation of ICRI documents for use at, and submission to, upcoming international meetings; 3) coordination of EPC meetings; 4) preparation for the CSD meeting, including an ICRI Planning Committee side-meeting; and 5) planning the ICRI role in the ICRS in Panama.

PARTNERSHIP IN ICRI

The ICRI is dependent on the inclusion of governments, multilateral organizations, NGOs, and private-sector organizations with an interest in the sustainable management of coral reefs. The ICRI partners welcome as new partners entities that embrace the goals and objectives of the ICRI. "Partnership in ICRI" is based on: 1) endorsement of the Call to Action; 2) implementation of the Framework for Action; 3) development of a National Coral Reef Initiative or similar national or local action, or assistance to the development of such initiatives; and 4) promotion of the Global Coral Reef Monitoring Network.

FORWARD MOMENTUM

From small beginnings, great accomplishments can be achieved. ICRI partnerships will grow as the world at-large begins to realize that coral reef ecosystems are at serious risk and that the future does not look good with the combination of natural and anthropogenic impacts to the "fragile ring of life." It will only be through the concerted action of all affected parties (governments, scientists, tourism industry, lending institutions, etc.) tackling the complexities of the issues besetting the systems, that the future will be made. As Ambassador Penelope Wensley admonished the workshop participants, "much has been achieved but we have been only partially successful." It is up to committed and optimistically enthusiastic individuals to ensure the Initiative stays on-track.

The ICRI workshop is the latest in a series of successes for the Initiative. Listed below is a partial list of ICRI accomplishments to date:

- Diverse workshop participants agreed on a common Call and Framework for Action and a strategy of regional implementation.
- The UNEP Governing Council adopted a resolution which welcomed ICRI and the global coral reef monitoring network, and endorsed UNEP's continuing role in the ICRI coordination and implementation (see page 64). UNEP's Ian Dight highlighted UNEP's likely role in the Indian Ocean regional workshop as well as the role of the regional programs and the Regional Seas Programme.
- The ICRI was endorsed by the Summit of the Americas in December 1994.
- The Philippine Minister of the Environment encouraged the creation of a marine cooperation working group for the Asia region to discuss ICRI and other marine issues.
- ICRI promoted the further development of the IOC/UNEP/IUCN/IGBP global coral reef monitoring network under the Global Ocean Observing System (administered by the Intergovernmental Oceanographic Commission, IOC), which was a key priority of the workshop's scientific participants.
- An initial step toward U.N. agency coordination and leveraging resources was taken by including UNDO, IOC, UNEP, World Bank, and Asian Development Bank in the workshop. The Framework for Action's calls for the early implementation of the FAO Code of Conduct for Responsible Fisheries and Global Program of Action to Protect the Marine Environment from Land-based Activities, and a strengthening of CITES implementation.
- Promotion of bilateral, coral reef-related activities under such activities as the U.S./Japan Common Agenda.
- Over a two-year period, a Special Fund administered by the U.S. Department of State has supported approximately \$680,000 in small, special projects and activities that range from promoting the establishment of the Global Coral Reef Monitoring Network, support for the IUCN/GBRMPA/World Bank report, A Global Representative System of Marine Protected Areas, to a bilingual education curriculum on coral reefs for the Western Hemisphere.
- On behalf of ICRI, the United States Information Agency (through the financial support of several U.S. governmental agencies) completed an ICRI video entitled "The Fragile Ring of Life," which is available in English, French, Spanish, Arabic and Urdu and has been distributed to all U.S. Embassy posts worldwide to advance the Initiative's goals.
- The United States, France, Japan and the Philippines, initial ICRI partner governments, have begun to improve the policy focus on coral reefs under their jurisdiction through partnerships with local stakeholders. This trend is expected to continue with other partner governments and, it is hoped, even with other governments which may not consider themselves as ICRI partners but which might benefit from the information being made available through the ICRI.
- The XVIII Pacific Science Congress adopted a resolution in their June 1995 meeting drafted by the Pacific Science Association's Scientific Committee on Coral (see page 65).

- The IOC Assembly adopted a resolution (Resolution XVIII-12) in support of ICRI and a global coral reef monitoring network during the 18th Session in Paris, June 13–26, 1995 (*see page 65*).

This list should grow rapidly during the next few years. The Call to Action encourages the periodic review of the extent and success of implementation of actions identified by ICRI. ICRI partners and others are encouraged to describe activities they have undertaken in support of the Initiative or specifically the Framework for Action and submit them to the ICRI Secretariat.

RESOLUTIONS OF SUPPORT

**RESOLUTION OF THE GOVERNING COUNCIL
OF THE UNITED NATIONS ENVIRONMENT PROGRAMME**

UNEP/GC.18/33

25 May 1995

Eighteenth Session

Nairobi, May 15–26, 1995

International Coral Reef Initiative

The Governing Council,

Noting that many of the world's coral reefs are severely degraded or destroyed due to human activities,

Recalling that Chapter 17 of Agenda 21 identifies coral reefs, mangroves and seagrass beds as marine ecosystems of high biological diversity and production and recommends that they be accorded high priority for identification and protection,

Noting the report of the United Nations Environment Programme-Intergovernmental Oceanographic Commission-Association of South Pacific Environmental Institutions-World Conservation Union Global Task Team on the implications of Climate Change on Coral Reefs,

Also noting that coral reefs have been designated as the coastal system chosen as the first to be developed within the coastal zone module of the Global Ocean Observing System,

Recognizing the initiative of Australia, France, Jamaica, Japan, the Philippines, Sweden, the United Kingdom and the United States to sponsor a workshop to promote an international coral reef initiative in the Philippines from 29 May to 2 June 1995,

Noting that the initiative builds upon and reflects the processes established by the Commission on Sustainable Development, which will address Chapter 17 of Agenda 21 in 1996, the United Nations Convention on Biological Diversity, which will address marine biological diversity in 1995, the 1995 intergovernmental meetings on protecting the marine environment from land-based activities, the United Nations Framework Convention on Climate Change, the 1994 Global Conference on the Sustainable Development of Small Island Developing States, the United Nations Convention on the Law of the Sea, and other relevant international programs,

1. Welcomes the international coral reef initiative, which is a partnership of Governments, international organizations (including lending institutions), and nongovernmental organizations to address capacity building, research and monitoring and sustainable management and use of coral reefs and associated ecosystems;

2. Supports the establishment of a global coral reef monitoring network, as proposed as part of the coastal zone and shelf module of the Global Ocean Observing System by the United Nations Environment Programme, the World Conservation Union, the Intergovernmental Oceanographic Commission, the World Meteorological Organization and International Geosphere-Biosphere Programme, within existing resources, to monitor the status of reefs and enhance their management; and
3. Encourages the regional programs of United Nations Environment, particularly the Regional Seas programs, to incorporate recommendations of the coral reef initiative workshop, as appropriate, into relevant United Nations Environment Programme activities and, whenever appropriate, to translate them into concrete supporting measures on protection and conservation.

RESOLUTION OF THE XVIII PACIFIC SCIENCE CONGRESS

International Coral Reef Initiative

Whereas coral reefs are one of the most important ecosystems in the Asia/Pacific region, especially for their natural resources, biodiversity, and socioeconomic values, and

Whereas coral reefs and their resources are under substantially greater pressures from increasing human populations, urbanization, and economic development, and

Whereas an International Coral Reef Initiative has been launched by several nations and international organizations and an international meeting was convened at which a Framework for Action was developed as a basis for achieving the sustainable development of coral reefs and associated ecosystems;

Be it resolved that the Pacific Science Association endorse the Framework for Action of the International Coral Reef Initiative, and

Be it further resolved that the Pacific Science Association encourage all of its member organizations, member institutions, and their governments to participate in the implementation of the Framework for Action.

RESOLUTION XVIII-12 OF THE INTERGOVERNMENTAL OCEANOGRAPHIC COMMISSION

International Coral Reef Initiative

The Intergovernmental Oceanographic Commission,

Being concerned that many of the world's coral reefs are severely degraded,

Recalling that Chapter 17 of Agenda 21 of UNCED identifies coral reefs, mangroves and sea-grass beds as marine ecosystems of high biological diversity and productivity and recommends that they be accorded high priority for identification and protection,

Noting the report on "Global Climate Change and Coral Reefs: Implications for People and Reefs" published by IUCN in 1994 on behalf of UNEP, IOC and ASPEI,

Considering that the Global Coral Reef Monitoring Network has the potential to be a significant component of the coastal module of the Global Ocean Observing System, as acknowledged by the IOC-WMO-UNEP Committee for GOOS at its Second Session (Document IOC-WMO-UNEP/I-GOOS-II/3S),

Noting with satisfaction the initiative of Australia, France, Jamaica, Japan, the Philippines, Sweden, the United Kingdom and the United States, to convene a workshop to promote the International Coral Reef Initiative (ICRI) held in the Philippines from 29 May to 2 June, 1995,

Endorses the International Coral Reef Initiative (ICRI) Call to Action and Framework for Action which promotes the development of a Global Coral Reef Monitoring Network (GCRMN), emphasizes the important of strategic research and monitoring to address key management issues, and call on the IOC, through the GCRMN to report every four years on the ecological condition of coral reefs and related ecosystems;

Decides to support the establishment of a Global Coral Reef Monitoring Network and the appointment of a Coordinator; Instructs the Executive Secretary of IOC: i) that the Global Coral Reef Monitoring Network (GCRMN) Coordinator establishes close contact with I-GOOS and the Joint Scientific and Technical Committee for GOOS (J-GOOS) to define the potential contribution of this network to the GOOS Coastal Module, ii) to support the participation of GCRMN experts in the coral reef workshops in 1995 and the 8th International Coral Reef Symposium in 1996, subject to available resources, iii) to explore extra-budgetary funding through international and regional funding agencies;

Invites UNEP, IUCN, UNESCO, WMO and ICSU (IGBP/LOICZ) to join the IOC in the participation and cosponsorship of proposed Global Coral Reef Network, subject to available resources, and urges Member States to make direct and in-kind contributions to the IOC to support this endeavour.

Financial implications: Implementation of the actions proposed has been funded to some extent by extra-budgetary funds from Member States; additional contributions from Member States and International Organizations will be required in order to ensure the implementation of the GCRMN. About US\$40,000 will be required from IOC to support participation of the experts from the Indian and Pacific Oceans in the Eighth International Coral Reef Symposium in 1996.

ICRI WORKSHOP APPENDICES

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APPENDIX A

THE INTERNATIONAL CORAL REEF INITIATIVE PLANNING WORKSHOP

Silliman University, Dumaguete City,

Negros Oriental, the Philippines

May 29 to June 2, 1995

PROGRAM AND AGENDA

Monday, May 29

08:30 OPENING CEREMONIES

(Public is welcome to attend)

Invocation

Dr. Proceso U. Udarbe, University Chaplain

Philippine National Anthem

Mr. Dominador de los Bantos

Special Song

Ms. Jaja Vicuna

Workshop Opening Remarks

Dr. Angel Alcala, Secretary of DENR, Host and Convener of Workshop

Welcoming Remarks

Dr. Emilio Macias II, Governor of Negros Oriental

Dr. Mervyn J. Misajon, President of Silliman University

Opening Remarks from Honorary Workshop Chair

Assistant Secretary Elinor Constable, U.S. Department of State/OES (Representing Undersecretary Timothy Wirth)

Remarks from the Goldman Award Winner

Mr. Noah Idechong, Palau

Opening Remarks from the Workshop Chair (Operational)

Hon. Penelope Wensley, Ambassador for the Environment, Australia

09:30 KEYNOTE #1:

The Importance of Science for Coral Reef Conservation and Management

Dr. Jeremy Jackson, Smithsonian Tropical Research Institute, United States/Panama

10:15 Coffee Break

10:30 CALL TO ORDER (Chair)

(Public Welcome)

10:45 KEYNOTE #2:

The State of the Reefs Report: A Summary

(Public Welcome)

Dr. John McManus, International Center for Living Aquatic Resources Management, Philippines

11:30 KEYNOTE #3: Human Societies and Reefs: Why the Situation and Why the Challenge?

Dr. Bernard Salvat, Centre de Recherche Insulaires et Observatoire de l'Environnement de Moorea, France/Polynesia

12:00 LUNCH AND VIEWING OF "The Fragile Ring of Life," ICRI Video

13:30 DOCUMENT SESSION #1: Introduction to the Initiative, the Call to Action and the Draft Framework for Action

(Co-Chairs: United States and Egypt)

Ms. Susan F. Drake, ICRI Coordinator, Department of State, United States

"ICRI: Past, Present and Near Future"

Dr. Richard Kenchington, Great Barrier Reef Marine Park Authority, Australia

"Introduction to the Draft Framework for Action"

14:30 DOCUMENT SESSION #2: Open Forum on the Goals of ICRI

(Chair: Australia)

Participants: Government representatives and invited nongovernment representatives have an opportunity to briefly present their views in an open forum to the workshop participants and document drafting teams on the proposed ICRI process, goals, etc.

16:00 SNACK BREAK

- 16:15 PLENARY #1: The Management of Reefs**
(Co-Chairs: United Kingdom and Maldives)
Dr. Ian McPhail, Great Barrier Reef Marine Park Authority, Australia
“Large-Scale Management Regimes and ICRI”

Dr. Angel Alcala, Secretary, DENR, Philippines
“Protective Management of Small Coral Reef Areas in the Philippines”
- 17:30 SPECIAL SESSION #1: Ecotourism: Constraints and Opportunities for Conservation and Economic Development**
Mr. Stephen Colwell, Coral Reef Alliance, United States
Dr. Rebecca Hawkins, World Travel and Tourism Center, United Kingdom
- SPECIAL EXHIBITS #1: The ICRI Poster Exhibit**
- SPECIAL EXHIBITS #2: The ‘ICRI Resource Center’ and ‘Coral Reefs on Computers’ Demonstration [ICLARM]**
- 19:00 RECEPTION and DINNER**
(Hosted by the Government of Philippines: Department of Environment and Natural Resources and Department of Agriculture) at South Seas Resort

TUESDAY, May 30

- 08:30 NOTES and ANNOUNCEMENTS FROM THE CHAIR**
- 08:45 PLENARY #2: Global, Regional and Local Legal Perspectives on Reef Systems**
(Co-Chairs: UNEP and Malaysia)
Dr. Graeme Kelleher, IUCN, Switzerland
“The Possibilities of International Law and Institutions for Sustainable Use of Marine Biodiversity: Focus on Coral Reef Ecosystems”

Dr. Vaughan Pratt, International Marinelife Alliance, Philippines
“Local and Regional Legal Issues and Approaches in Coral Reef Management”
- 10:00 COFFEE BREAK**
- 10:15 PLENARY #3: Sustainable Financing Mechanisms for Coral Reef Management**
(Co-Chairs: Asian Development Bank and the Philippines)
Dr. Marea Hatziolos, World Bank
“Self-Financing and Investment Options for Coral Reef Conservation.”
- 11:30 SPECIAL SESSION #2: Priorities for Marine Biodiversity Conservation Through a Global Representative System of Marine Protected Areas**
Dr. Marea Hatziolos, World Bank; Dr. Graeme Kelleher, IUCN
- 12:15 LUNCH**
- 13:30 PLENARY #4: ICRI Partnerships**
(Co-Chairs: France and Vanuatu)
Mr. Kazuaki Hoshino, Marine Parks Center of Japan
“Roles and Partnerships at the Local, Regional and Global Levels for Coral Reef Management”

Ms. Susan Wells, UNDP, Belize
“Partnerships in Capacity Building for Coral Reef Management and More.”

14:45 PLENARY #5: Regional Reports

(Co-Chairs: Japan and Jordan)

The Regional Reports, which are being prepared by various groups, indicate the activities currently ongoing in the region related to coral reef ecosystems (e.g. GEF projects, Regional Seas Programme activities, etc.), describe the major resources in the area (e.g. universities, relevant institutes, etc.), and the issues and priorities of the region. Speakers will present the executive summaries.

Dr. Kiyoshi Yamazato, Tropical Biosphere Research Center, University of Ryulqus, Japan, “South East Asia Report”

Dr. Jeremy Woodley, Center for Marine Studies, University of the West Indies, “Tropical Americas Report”

Dr. Andrew Smith, SPREP, “Pacific Report”

Dr. Moustafa Fonda, Sultan Qaboos University, Oman, “Middle East Report”

Mr. Christopher Muhando, University of Dar es Salaam, Tanzania, “Indian Ocean Report”

16:00 SNACK BREAK

16:15 SITE VISIT ORIENTATION

Dr. Hilconida Calumpong, Silliman University Marine Lab, Philippines

16:45 WORKING GROUPS #1: Regional Working Groups Deliberate on the Draft

Framework for Action

Working Group Chairs:

Dr. Malikusuworo Hutomo, Indonesian Institute of Sciences, Indonesia (Southeast Asia)

Mr. Wayne King, Cook Island Conservation Service, Cook Islands (Pacific)

Dr. Eric Jordan Dalhgren, Mexico (Tropical Americas)

Mr. Ezekiel Okemwa, Kenya (Indian Ocean)

19:00 WORKING GROUPS #2: Management, Capacity Building and Research and Monitoring

Working Group Chairs:

Mr. Noah Idechong, Palau Conservation Society, Palau (Management WG Chair)

Dr. John Ogden, Florida Institute of Oceanography, United States (Research and Monitoring WG Chair)

Dr. Edgardo Gomez, Marine Science Institute, Philippines (Capacity Building WG Chair)

The Chairs, Facilitators and Rapporteurs from the four Regional Working Groups (WG# 1) meet with the Framework Drafting Team and other interested participants in three working groups (by ICRI issue) to consolidate the outputs of WG#1 for input into the Framework for Action.

EVENING: *Free, On Your Own (unless in Working Group)*

WEDNESDAY, May 31

07:30 DEPART FOR SITES (*Apo Island, and Bais Bay*)

12:00 LUNCH (*At sites*)

EVENING: *Free, On Your Own*

THURSDAY, June 1

08:30 NOTES and ANNOUNCEMENTS FROM THE CHAIR

08:45 REPORTS FROM THE FIELD: Rapporteurs' Presentations

Mr. Clem Bobb, St. Lucia “Bais Bay”

Mr. Peter Espeut, Jamaica “Apo Island”

- 09:00 DOCUMENT SESSION #3A: Implementing the ICRI Framework at Global Levels**
(Co-Chairs: Australia, Tonga)
Dr. Ian Dight, U.N. Environment Programme, OCA/PAC
“The International Policy Setting for the ICRI”
- 09:30 READING PERIOD**
Participants read the draft Framework for Action, and discuss it formally.
- 10:00 COFFEE BREAK**
- 10:15 DOCUMENT SESSION #4: Deliberations on the Revised Framework for Action**
(Co-Chairs: Australia, Fiji)
Dr. Richard Kenchington, GBRMPA, Australia
“Presentation of the Revised Framework for Action”
Discussion: Delegates discuss changes desired in the Framework
- 12:00 DOCUMENT SESSION #3B: Implementing the ICRI Framework at Global Levels**
(Co-Chairs: Australia, Fiji)
Ms. Susan Drake, ICRI Coordinator, U.S. Department of State
“A Draft Strategy for the Future of the ICRI”
Discussion
- 12:30 LUNCH**
- 13:30 SPECIAL SESSION #3: NGO Experience in Community-Based Collaborative Management**
Dr. Paul Holthus, The Nature Conservancy
Mr. Alvin Nacu, World Wildlife Fund

14:30 PLENARY #6: Implementing the ICRI Framework at Regional Levels

(Co-Chairs: France, Seychelles)

Dr. Jorge Cortes, CIMAR, Universidad de Costa Rica

“The Role of Institutions and Nations in Regional ICRI Activities”

Ms. Kimlooi Ch’ng, UN/COBSEA

“The Role of Regional Organizations in the ICRI”

15:45 SNACK BREAK-

16:00 PLENARY #7: Implementing the ICRI Framework at the National Level

(Co-Chairs: Japan, Kenya)

Mr. Michael Ham, Guam Coastal Management Program, United States

“Creating the Foundation for a Successful National Strategy”

Dr. Hansa Chansang, Phuket Marine Biological Center, Thailand

“The Thailand Coral Reef Strategy Case Study”

17:15 PLENARY #8: Matching ICRI Outcomes to National Development Priorities

(Chair: United Kingdom, Bahamas)

Dr. Barry Blake, United Kingdom Office of Development Assistance, Barbados

“Matching ICRI Outcomes to National Development Priorities: What are the Issues to be Addressed?”

Mr. Horace Walters, St. Lucia

“Matching ICRI Outcomes to National Development Priorities from an Eastern Caribbean Perspective”

Dr. Andrew Smith, SPREP

“Matching ICRI Outcomes to National Development Priorities from a Regional Organization’s Perspective”

19:00 RECEPTION and DINNER

(Hosted by the Government of Japan)

FRIDAY, June 2

08:30 PLENARY #9: Goals of the Regional ICRI Workshops

(Co-Chairs: Australia and Saudi Arabia)

Participants will discuss a draft proposal for regional workshop goals and outcomes in order to determine guidelines for ICRI.

09:30 WORKING GROUPS #3: Planning the Regional Workshops

Participants will separate into regional working groups to begin discussions on logistical and organizational issues, as appropriate.

10:00 COFFEE BREAK

10:15 DOCUMENT SESSION #5: Adoption of the Framework for Action, Presentation of WG Reports

(Co-Chairs: Australia, Papua New Guinea)

12:00 LUNCH

13:30 CLOSING SESSION

Dr. Angel Alcala, DENR, Philippines

“Summary of the Outcomes of the Workshop”

Ambassador Penelope Wensley, Australia

14:15 ADJOURNMENT

APPENDIX B

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APPENDIX C

FIELD TRIP SUMMARIES

ICRI participants went on one of the following field trips: Apo Island or Bais Bay. The purpose of these trips was to show participants some successful local coastal management projects and to show them examples of impacted coral reef ecosystems. During the field trip, participants answered predetermined questions about the area and discussed various management issues related to the experience. Below is a summary of these field trips.

APO ISLAND

Coastal Management Issues and Causes

Issues

Cause

- Reef quality in the sanctuary threatened
Increasing dive tourism
Anchor damage
Occasional illegal fishing
Poorly marked boundaries
- Empowerment of island community threatened
Municipal resolution which requires island to share sanctuary fees with the town was enacted without proper consultation with the island community
Marine management committee perceived by community not to be functioning effectively
Unplanned and unregulated tourism development and residents
resulting land speculation by mainland
Absence of any land titles for the entire island

Site Discussion–Recommendations to be Considered by ICRI

- Even with such an educated group as the ICRI participants, there was a disturbance of the coral reefs in the Apo Island Marine Reserve. Nothing should be taken for granted when tours are organized.
- From what was seen today, the community-based management (CBM) approach is clearly important and must be taken seriously.
- It is important that donor organizations be convinced about the CBM approach. Maybe more should be exposed to the Apo experience.
- McManus: In the CBM approach, it is important that benefits to the community must be obvious and immediate. On Apo Island, a women's cooperative was established which wove commodities for sale in the park. A small store was also established. Many visitors come to the park and the items sold add to the income of the residents of Apo Island.

- Clearly there will be/has been a change in the culture of the Apo residents (income, lifestyle) because of the park and the opportunities for vending. This needs to be properly documented.
- Some of the sea shells offered for sale were from species which could become endangered. Care must be taken that what is offered for sale is not contrary to the spirit of the park.
- McManus: We don't know enough about some of the mollusk species offered for sale to say that they are overfished, and this information is greatly needed. At this point no one is worried about the sale of certain common shells.
- While trying to educate and sensitize people at all levels about CBM, maybe it would be useful to distill from the language one or two phrases which will trigger meaning in the audience (such as sustainable development has done).
- There is a great deal to be gained from the demonstration effect which Apo Island offers – of being able to show what works. People should be brought to Apo Island to be influenced by the experience.
- McManus: That is already happening. Many community groups – about 20-30 – are brought here each year.
- McManus: What you are seeing is not really community-based management; what you are seeing is comanagement, but the government is not as visible as the community part.
- How does the resort hotel dispose of its sewage? There is a lot of algae in the water just in front of the hotel and restaurant.
- McManus: In many similar resorts, sewage is deposited in a tank, but the tank is never emptied. The phosphates remain in the tank, but the nitrates end up leaching into the water. It is not a perfect system. Thankfully, it does not happen around the other side of the island where the main part of the reserve is.
- The resort is a modest affair, and quite environmentally friendly. If this were the Caribbean, the hotel would be on the beach and into the water, causing lots of damage.
- We can observe in the Apo Island Marine Reserve a commitment from all levels of the Philippine government: local, provincial and national. It is important to realize that in large measure it is the commitment of the government of the Philippines that has made Apo Island work.
- McManus: When this case is studied it will be realized that persons coming from outside the community have had tremendous influence on the success of the sanctuary. A CENRO officer (Community Environment and Natural Reserve Officer) visits this community regularly, and she has the perspective on things and animates the community. She is someone from outside the community with a college degree who makes things happen. The Apo Island Marine Sanctuary is comanagement, not just community-based management.
- The resort is useful for protecting the environment and the community. Part of this is due to the small scale of the operation. They use local boats and hire local people to work in the hotel. This type of operation appears to be sustainable.
- The Framework for Action must reach policymakers who are the ones who can make a difference. If the policymakers are not aware of the goals and objectives of the ICRI, then the policies they advocate may (unknowingly?) work against the ICRI.

Rapporteur: Peter Espeut

BAIS BAY

Coastal Management Issues and Causes

Issues

- Loss of three-fourths of mangrove habitat
- Severe coral reef degradation
- uplands

Cause

- Conversion to mariculture
- Overharvesting for fuel wood
- Dynamite fishing
- Sedimentation from agricultural runoff and deforested
- Water pollution
- Discharges of sugar mills and domestic waste

With the assistance of the fact sheet we were able to get a good grasp on the physical description of the bay. We made our way from the Capinehan Pier and our first stop was the Palabong Mangrove Forest, the site of a small but effective mangrove nursery. Then through seagrass beds and coral reef towards the sandbar.

Site Discussion – Recommendations to be Considered by the ICRI

During a very spirited discussion chaired by Dr. Barry Blake, the following suggestions were offered for consideration as recommendations to the ICRI:

1. To somehow create a mechanism that would encourage leaders to motivate others, e.g. case and point the success story of the mayor;
2. To encourage implementation of laws, as it was discovered that this practice fostered adherence;
3. To encourage and help strengthen local community organizations to act in partnership with the government, e.g. local fishermen cooperatives;
4. To support and encourage established organizations in their work of raising awareness of the community by a process of public education in conjunction with the government, e.g. Silliman University;
5. To encourage funding and/or donor agencies to adopt a more flexible policy in their stipulation of conditions of funding in order to better facilitate programs tailored to the needs of local communities; and
6. To encourage and promote information centers to help educate and to supply information for both adults and children.

Rapporteur: Clem Bobb

APPENDIX D

ICRI INFORMATION EXCHANGE

Publications and Handouts

A wide variety of coral reef management and research publications were available for inspection on display tables in the library lobby. Many of these publications were donated by over 25 nongovernment and government organizations. In addition, FishBase and ReefBase computer exhibits were set up for interactive demonstration.

FishBase

FishBase is an electronic encyclopedia on fish being developed at ICLARM with the cooperation of the Food and Agriculture Organization of the United Nations and funded by the European Commission. The database provides fast access to information on a given species and allows comparative studies between groups and geographic areas.

FishBase makes use of published literature (e.g. journal articles, technical reports, theses, etc.) and recent family or species revisions. To date, FishBase contains information on over 12,000 species including all fish that are in any way important to humans:

- 800 game fish
- 450 dangerous fish
- 5,000 freshwater fish
- 3,000 electrophoretic records
- 3,000 species used in fisheries
- 5,000 species used by humans
- Population dynamics for 1,000 fish
- Morphometrics for 2,000 fish
- Metabolism for 300 fish
- Eye pigment for 200 fish
- 160 introduced fish
- 800 threatened fish
- 80 strains
- 7,000 marine fish
- 150 kinds of baitfish
- 7,000 references to the literature
- 180 species used in fish farming
- 2,000 ornamental and aquarium fish
- Swimming speed for 100 fish
- 50,000 common names of fish
- 17,000 synonyms
- Gill area of 300 fish

FishBase runs on personal computers with at least 8MB of RAM, running MS-Windows 3.1 or later. It is available on CD-ROM for US \$95 including airmail delivery. Orders and inquiries may be sent to FishBase, ICLARM, MCPO, Box 2631, Makati City, Philippines (E-mail address: iclarm@cnet.com).

ReefBase

ReefBase, a global database on coral reefs, was started in 1993 to monitor the state of coral reefs globally and regionally. The user-friendly database:

- Presents global and regional summaries about coral reefs;
- Presents available information on particular reefs;

- Defines a healthy reef;
- Identifies information gaps in the literature;
- Standardizes reef survey methods; and
- Helps to coordinate research on reefs.

ReefBase was designed to allow linkages with FishBase and CoralBase and contains information on ecology, non-extractive use, harvest, government and traditional management, natural and human stresses and protected areas. This information can also be accessed by year.

At present, ReefBase has information on 2,000 reefs. One thousand of these have information on bottom coral cover. Human and natural stress occurrences have been mapped through an ICLAR-developed GIS program called Mapper. These stresses have also been summarized. All information in ReefBase are duly referenced and documented.

The first ReefBase version on CD-ROM will be released in time for the International Coral Reef Symposium in Panama in 1996.

APPENDIX E

ICRI WORKSHOP POSTER EXHIBIT

“Tools for Coral Reef Monitoring Based on a New Coastal Inventory of Anguilla,” Dr. Barry Blake, U.K. Overseas Development Administration, Barbados.

“Reef Rehabilitation Using Artificial Structures in the Maldives,” Dr. Barbara Brown, Centre for Tropical Coastal Management, United Kingdom.

“Potential Impacts of Climate Change on Corals and Coral Reefs,” Dr. Barbara Brown, Centre for Tropical Coastal Management, United Kingdom.

“FishBase: A Global Database with Key Information on ReefFishes,” Rainer Froese and Rudy Reyes, International Center for Living Aquatic Resources Management (ICLARM), Philippines.

“Coral Reef Conservation Science in the Caribbean and Asia/Pacific Region: The Nature Conservancy,” Paul Holthus, The Nature Conservancy, Hawaii.

“ReefBase: Initial Results from the Global Database on Coral Reefs,” Dr. John McManus, International Center for Living Aquatic Resources Management (ICLARM), Philippines.

“An International Spratly Island Marine Park: Preserving Regional Harvests, Biodiversity and Peace,” Dr. John McManus, International Center for Living Aquatic Resources Management (ICLARM), Philippines.

“IPIECA Report on the Biological Impacts of Oil Pollution on Corals,” Sophie Mounier, IPIECA, United Kingdom.

“IPIECA and the Biodiversity Map Library,” Sophie Mounier, IPIECA, United Kingdom.

“Cyanide Fishing Reform Program,” Dr. Vaughan R. Pratt, International Marinelife Alliance, Philippines.

“Landscape Approach to Coastal Management: Bais Bay,” Silliman University Marine Lab, Philippines.

“Artificial Reefs and Marine Parks: Apo Island,” Silliman University Marine Lab.

“Effective Approaches to Coastal Management and Capacity Building,” University of Rhode Island Coastal Resources Center.