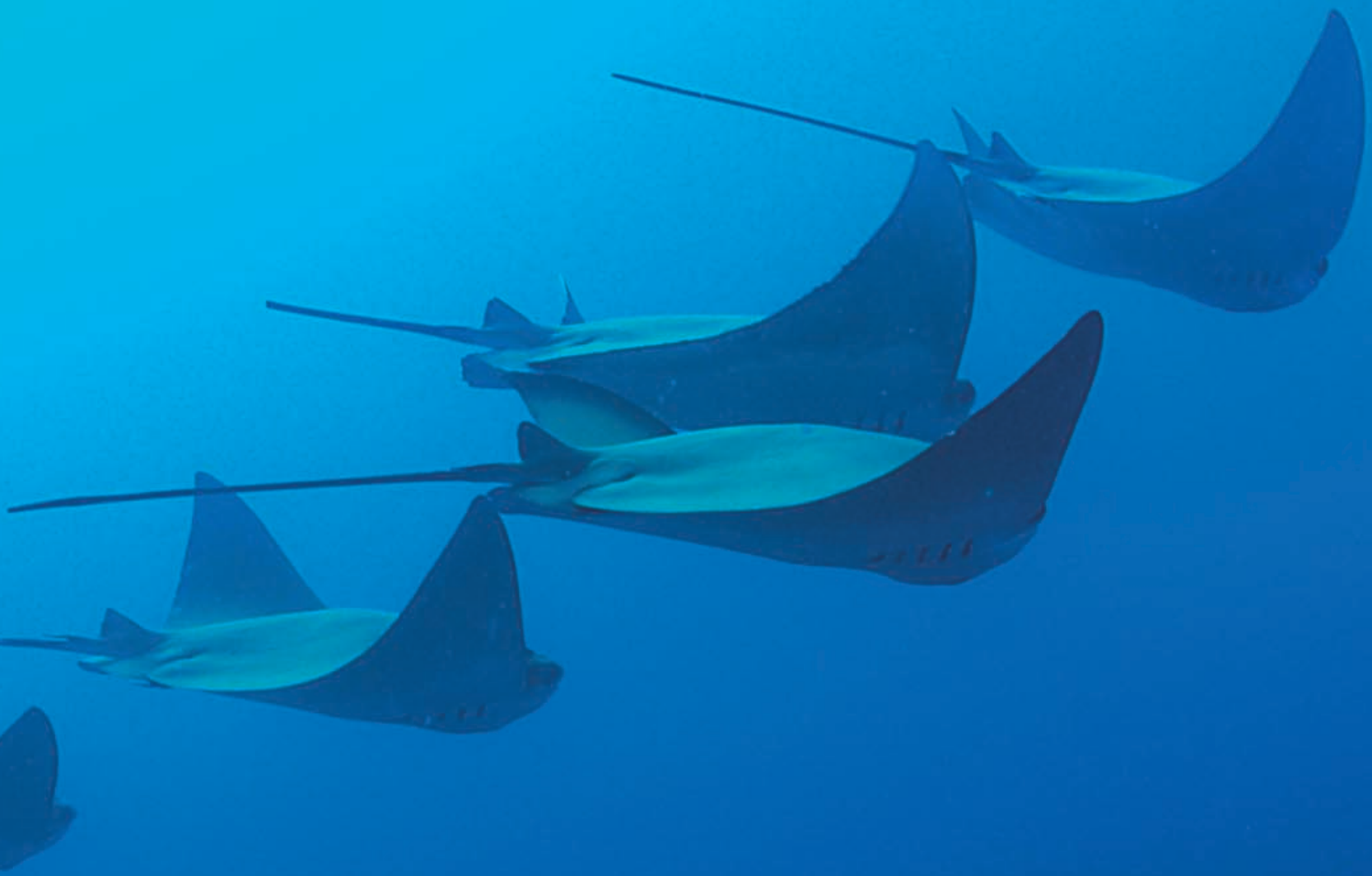
Executive SUMMARY



Defying Ocean's End

An agenda for action

Executive SUMMARY

MAY 29TH TO JUNE 3RD, 2003

In recent years, human actions have had an unprecedented impact on the health of the oceans. A crisis is growing that threatens not only coastal communities that depend directly on living marine resources, but also all people everywhere. The Earth's ocean is a unique feature in our solar system, and is essential for maintaining life on this planet.

As never before, we are seeing the consequences of abuse in collapsing fish populations, biodiversity loss, and physical and chemical changes that are leading to the decline of entire ecosystems. As never again, we have an opportunity now to respond to this crisis, learn from centuries of experience in management of land, and move beyond localized and *ad hoc* initiatives — however good they may be — to coordinated global action.

Our collective challenge is nothing less than the creation of a framework and steps for a practical agenda of global action — including costs and impacts — to safeguard the ocean for generations to come.

Sincerely,

Gordon E. Moore

Sylvia A. Earle

Photo © Jennifer Jeffers

Overview

The Concern

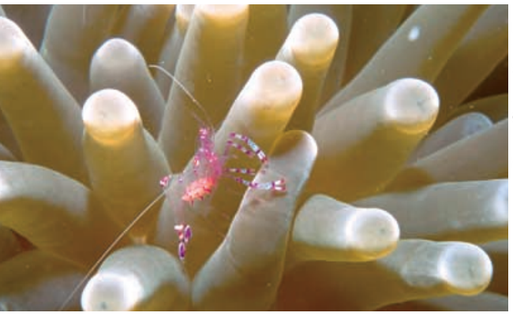


Photo © Jennifer Jeffers

The ocean contains 97% of Earth's water, drives climate and weather, shapes planetary chemistry, regulates temperature, generates more than 70% of the oxygen in the atmosphere, absorbs much of the carbon dioxide, and replenishes fresh water to land and sea through formation of clouds bearing rain, sleet and snow. The ocean is home to most of the life on Earth, including nearly all major groups of animals, plants and microbes, comprising 97% of the biosphere. A three-dimensional realm with an average depth of 2½ miles — every drop filled with life — the ocean is a living system absolutely critical to how our world works. We are putting millions of tons of trash and toxic materials into the ocean and extracting millions of tons of wildlife from it each year. Urgent action is needed to address serious ocean concerns, but there is a profound lack of awareness of both the recent sharp decline in ocean health and the importance of the ocean to human survival. Without the living ocean, Earth would be as barren and inhospitable as Mars, but few understand that trouble for the ocean means trouble for humankind.

The Approach

Defying Ocean's End is the culmination of a year-long effort that engaged a team of nearly 150 experts from more than 20 countries to develop an approach to articulating a global plan of action. Ocean scientists, economists, conservationists and a select number of senior representatives from world governments, corporations and the media gathered in Los Cabos, Mexico May 29th to June 3rd to build this plan. The ***DOE*** effort was structured into 5 regional case studies, 7 thematic working groups and a business team.

The ***DOE*** Conference focused on developing action plans that address specific issues and outcomes — with priorities and costs identified — for 1-year, 3-year, and 10-year timeframes. Five case studies, which addressed lessons learned and recommendations in very different regions, were presented to all Conference participants. Break-out discussions were divided into seven Thematic Working Groups on widely ranging science, conservation, social, economic and legal topics. These Theme Groups also interacted with the Business Team to identify key cost drivers and estimate reasonable total solution costs.

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COLLABORATING INSTITUTIONS Center for Applied Biodiversity Science at CI • Conservation International • Natural Resources Defense Council • The Nature Conservancy • The Ocean Conservancy • Wildlife Conservation Society • IUCN – The World Conservation Union • World Wildlife Fund

COORDINATORS Linda K. Glover • Jennifer Jeffers

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Case Studies:

- The Caribbean
- Seamounts
- Antarctic Waters
- The Coral Triangle
- Gulf of California

Thematic Working Groups:

- Ocean-Use Planning and Marine Protected Areas
- Economic Incentives and Disincentives
- Land-Ocean Interface
- Maintaining/Restoring Functional Marine Ecosystems
- Communications
- Ocean Governance
- The Unknown Ocean

Photo © Jennifer Jeffers

The Results

A summary of the highest-level recommendations includes:

- **Global Governance:** Treat the 60% of the world ocean outside of national Exclusive Economic Zones as a World Ocean Public Trust. Establish legal and implementation approaches concerning ocean uses in the high seas — including fisheries — under coordinated, international multi-use zoning regimes.
- **Fisheries Reform:** Use market-based mechanisms and subsidy changes to reform fisheries through development of sustainable fishing programs, and the establishment of a global fund to provide incentives for the adoption of sustainable practices.
- **Communications:** Implement global and regional communications plans to focus on educating the general public worldwide to ocean problems. Initiate global all-media campaigns on major issues. In developing nations, tailor the message to local cultural concerns and information networks (e.g., tribal elders), and build local capacity for disseminating the message.
- **Marine Protected Areas/Large Marine Ecosytems:** Create, consolidate and strengthen Marine Protected Areas (MPAs) into a globally representative network. Develop/implement coordinated, global Large Marine Ecosystem (LME) programs in identified priority regions. Provide more robust multi-use zoning and enforcement mechanisms to protect these LMEs. Establish LME/MPA protections over 5% of the world ocean within the next 10 years (0.7% currently).
- **Global Science:** Develop an expanded applied research program focused on top priority marine environments high in endemism and biodiversity — seamounts, shallow- and deep-water reefs, continental slopes, caves and blue holes.

The Business Plan

Photo © Jennifer Jeffers

A team of business professionals worked with the theme groups to develop costs for the recommended strategies. The Business Team joined the theme group deliberations and assisted in organizing the recommendations into 1-, 3- and 10-year outcomes. The team then used the program development and costing experience of the theme group members to estimate significant cost drivers and total solution costs.

There was considerable overlap among the recommendations of several of the seven theme groups and, to address this, the business team aggregated costs into implementation areas that are somewhat different from the Conference theme groups. The consolidated activity costs in these cross-cutting areas form the foundation of the preliminary cost model:

- Global Science
- Large Marine Ecosystems Programs
- Marine Protected Areas
- Fisheries Reform
- Global Governance
- Communications Plan
- Program Coordination

SUMMARY PROGRAM FINANCIALS (US$BILLIONS)

CONFERENCE ACTION AGENDA	First 3 Years	10 Year Total
Global Science	$0.32	$0.65
Large Marine Ecosystems Programs	$2.38	$9.32
Marine Protected Areas	$1.18	$5.42
Fisheries Reform	$0.17	$0.49
Global Governance	$0.14	$0.38
Communications Plan	$0.08	$0.44
Program Communication	$0.51	$1.93
Total	**$4.78**	**$18.63**

The overall cost estimate for the practical action agenda is **US$18.6 billion** over ten years — a reasonable sum balanced against the much greater costs involved in inaction and further resource losses, and certainly reasonable compared to the more than $50 billion annually paid out by governments for "perverse subsidies" of various kinds that are actually supporting the catastrophic decline of life and health in the ocean.

The immediate priorities are estimated to require an investment of approximately **US$4.8 billion** over the next three years. Some of these key activities can be executed as individual programs, but the power of the agenda is that these programs will support each other if implemented in a coordinated fashion. The table below outlines the short term and longer term costs for the agenda.

This integrated cost model is preliminary and not comprehensive. The financial estimates should be considered reasonable only as an order of magnitude. For example, they do not include all activities and associated costs needed ultimately to protect the 20% to 30% of the global oceans recommended by many of the ***DOE*** experts. Rather, the plan focuses on the highest priority actions required in the next 3-year and 10-year periods. This initial model does not fully account for several significant cost factors:

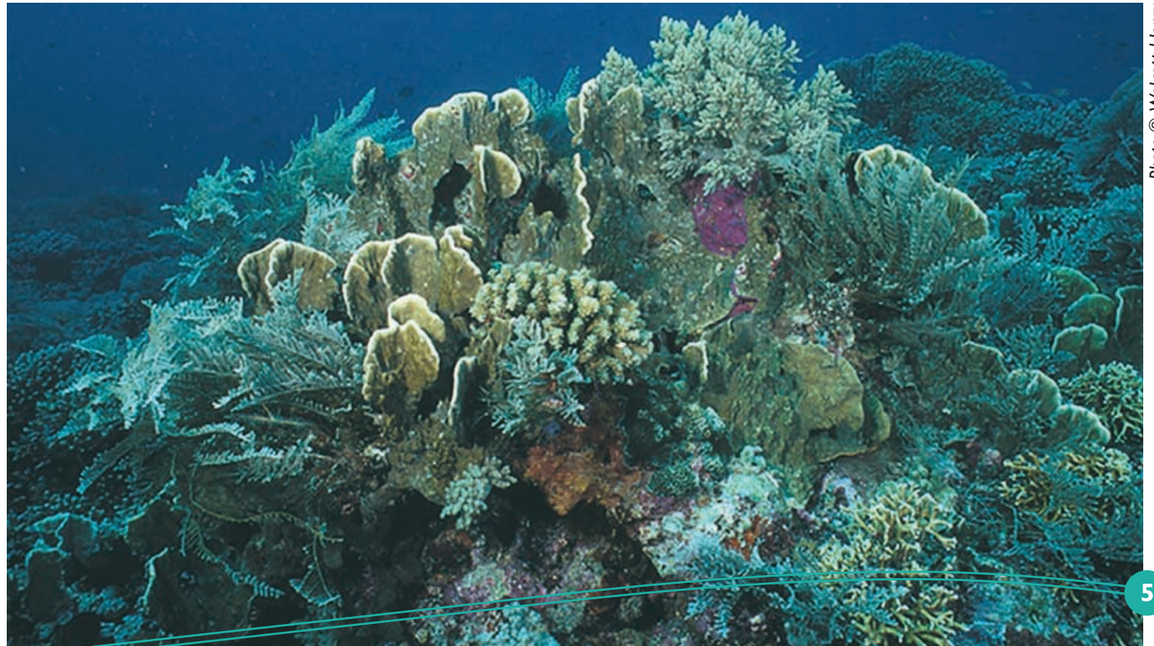
- The model includes programs to protect over twenty LMEs and four hundred MPAs that would together cover only about 5% of the world's oceans, and the model contains only limited support for existing MPAs.
- The plan assumes that all sustainable economic and community development costs created by establishment of LMEs and MPAs will be covered by current global aid programs.
- The fisheries reforms will be piloted in only a few fisheries, and the plan assumes the global fisheries programs will be largely self-funded by leveraging current subsidy structures and expected economic benefits resulting from the reforms.
- The cost model has not included resources to cover perpetuity costs for MPA operations, from trust funds for example, nor other potential revenue sources resulting from MPAs.
- The general scope of recommendations and the resulting cost model do not allocate significant resources to address regional or global land-based threats.
- The model also does not include the costs or revenue potential of aquaculture activities.
- The plan assumes that enforcement costs, required to make LME or MPA management effective, will be covered by local government agencies.

Two funding decisions were announced at the Conference:

- There is an initial commitment of $5 million over five years from Conservation International to implement the agenda.
- Conservation International and the Government of Indonesia signed a Letter of Intent to work collaboratively on marine conservation, resulting in a commitment of $1 million from the Global Conservation Fund for MPAs in Indonesia.

Next Steps

- Follow-on meetings are planned for the leadership of NGOs and other organizations, with the aim of coordinating and implementing global initiatives.
- The business team recommends further refinement of the costing and preparation of a broader business plan, to include:
  - Thorough vetting of some of the more novel action items.
  - Costs for ensuring expanded stakeholder involvement in many of these actions.
  - More rigorous revenue and funding plans.
  - Mechanisms for coordinating implementation across all participating groups.
- Results of the ***DOE*** Conference will be summarized in a journal article, and a book will include details of the final reports and recommendations of each of the Case Study authors, Thematic Working Group teams, and the Business Team.
- Final reports will be made available to all participating organizations.



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Thematic Working Groups

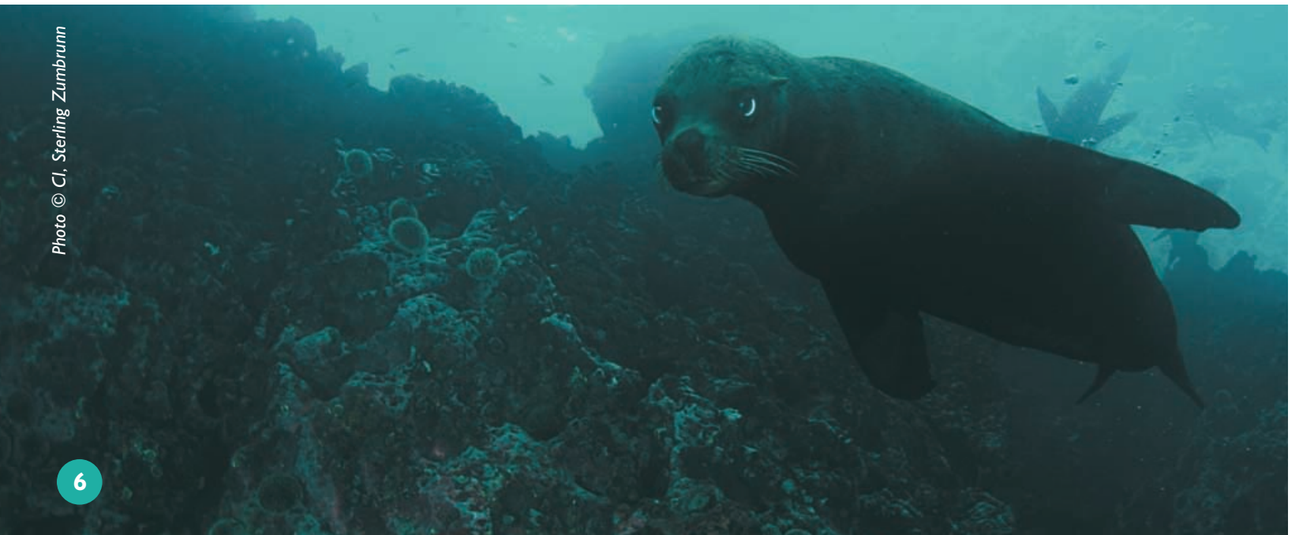
To develop a high-level, practical, global agenda for action in marine conservation, seven themes were chosen for the ***Defying Ocean's End*** Conference that would cut across a wide range of traditional ocean issues. Seven Thematic Working Groups were formed in early 2003, with scientists, economists, legal, and communications experts from many countries. Before the ***DOE*** Conference, they outlined the major issues and drafted recommendations for their areas of expertise.

Photo © Jennifer Jeffers

At the Conference, these theme groups:

- Heard the results — lessons learned and recommendations — from five very different regional Case Study areas *(see page 14)*.
- Were joined by additional experts who helped to refine their priorities and recommendations.
- Were also joined by the Business Team that helped to develop the timing and costs of their recommended actions.
- Were supported by a Geographic Information System (GIS) team for information analysis and display.

Some of the maps, prioritized recommendations for action and costs are shown in the following pages.



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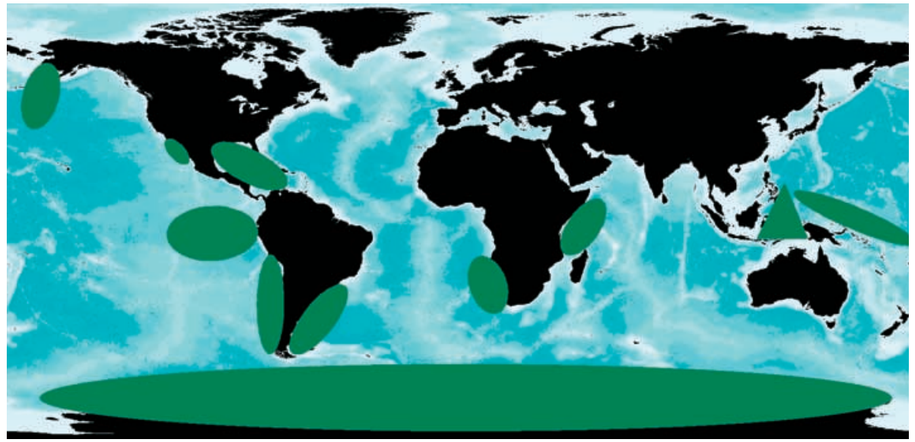
Ocean Use Planning and Marine Protected Areas

Chairs: Dee Boersma & John Ogden



LEGEND:
Large Marine Ecosystems proposed for high-priority attention: *Benguela, Bering Sea, Baja Californian System (Baja and Sea of Cortez), Caribbean, Central West Pacific (Palau to Tuvalu), Convention for the Conservation of Antarctic Marine Living Resources (CCAMLR), Coral triangle (Tropical Indo-Pacific), Eastern Tropical Pacific (Costa Rican basin), Humboldt (Chilean/Peruvian) System, Patagonian, and Western Indian Ocean (East Africa).*

Large Marine Ecosystem (LME) areas have been outlined in several global schemes. Despite the lack of clarity or agreement in LME boundaries, this group has proposed areas for near-term action.

The concept of Ocean Use Planning recognizes that we must use the oceans, but can't afford to use them up. It broadens the stakeholders from resource exploitation industries to society as a whole. We know enough now to begin a comprehensive long-term, ocean use planning process. We also know that if we do not act soon, the continued growth of coastal human populations combined with current use of marine resources will destroy any chance we have for sustainable use.

This Theme Group used the Patagonian shelf as an example for discussing ocean-use zoning and costing. Group members have detailed knowledge of the area — the largest temperate continental shelf in the world. With its 2 million square kilometer extent physically bounded by the Brazil and Falklands/Malvinas Currents, and its enormous productivity, this region qualifies as an important Large Marine Ecosystem. A spreadsheet was developed outlining the required actions, timing and costs to implement an Ocean Use Plan for the Patagonian shelf ecosystem — $64 million for the first 3 years, $300 million over ten years.

The overarching goal is global implementation of ecosystem management. Although some large scale marine ecosystems have been identified, there is no scientific agreement on where Large Marine Ecosystems management areas should be. Nevertheless, a preliminary list *(see map)* is proposed here for consideration.

Recommended Actions

- Convene a group *this year* to identify the global large-scale ecosystems upon which management should be based.
- Develop an appropriate system of governance that includes defining stakeholders and responsible parties for each unit managed. *Within 3 years* develop maps of priority areas for protection, with all current and planned uses and threats, to support zoning decisions in identified LME areas.
- Develop/implement Large Marine Ecosystem (LME) ocean use and conservation plans, with zoning of areas for all commercial uses and protection goals. Implement a minimum of 5 LME management programs in the *next 3 years*, and more than 20 *in 10 years*.
- Include within the LMEs nested local plans for smaller-scale ecosystems (e.g. kelpbeds, seamounts). Develop programs for 80 existing and new Marine Protected Areas *within 3 years,* and more than 400 *over 10 years,* based on studies of the biology, uses and threats in each region.
- Develop and pilot sustainable systems of reporting, surveillance, monitoring and enforcement, including deployment *within 10 years* of an Ocean Conservation Satellite System to support these goals.

Economic Incentives and Disincentives

Chairs: Andrew Solow & Jim Wilen

Many problems concerning global marine capture fisheries can be traced to economic incentives to overfish and invest in excess capacity. A desperate "race to fish" often results. This contributes to catches above sustainable levels, adoption of destructive fishing gear, bykill of non-targeted species, and surprisingly little economic return. Farming on land "managed" in analogous ways — increasingly large harvesting equipment, no soil replenishment, no sowing of new seed — would be obviously ineffective and unacceptable.

Photo © Kim Westerskov

Photo © Sylvia A. Earle

Global fishing approaches range from local subsistence fishing to industrial-scale deep trawling for orange roughy.

The solution required for global fisheries is wholesale reform of incentives, away from those promoting the race to fish. All approaches we discussed include some kind of dedicated harvest privilege, either to individuals or to groups, that guarantees a fixed share of some biologically sustainable target catch. Many such programs already implemented around the world in diverse fisheries have shown some success in meeting both conservation and economic development objectives.

But fear of change — coupled with a lack of funding for education, consensus building, and implementation — continues to block implementation of more rational ways of managing precious marine resources. In developing countries, these obstacles are compounded by poor alternative employment opportunities, inadequate financial resources, and lack of management infrastructure and capacity.

If fisheries are to be rationalized on a scale that will make a difference for the world ocean, a catalyst is needed that can overcome these obstacles. While forces are emerging independently in many areas that are tackling the symptoms and causes of global depletion of ocean resources, it is likely that large gains — in time, efficiency and effectiveness — are possible by joining forces, coordinating, and leveraging expertise and funding.

Recommended Actions

- Establish a Global Fisheries Reform Fund *within 3 years* that is jointly financed by public and private sources interested in promoting marine conservation and biodiversity conservation.
- Leverage funds — in many cases, redirect current subsidies — to overcome hurdles to reform, with the specific approach depending on the fishery.
- Target candidate fisheries that promise both high environmental benefits and good financial returns from adopting rationalization schemes.
- Review proposals and *within 3 years* implement pilot projects in 4 fisheries.
- Develop *within 3 years* engagement strategies for an additional 100 fisheries.
- *By or before 10 years,* obtain positive return from the initial pilot projects under the Global Fund and begin reinvesting in additional fisheries projects.

The Land-Ocean Interface

Chairs: Stephen Olsen & Alejandro Robles

This Group considered the Gulf of California *(see page 19)*, as well as regional programs for the Great Barrier Reef, the Chesapeake Bay and the Wadden Sea, and concluded that governance at this scale can successfully address the root causes of coastal and marine degradation and instigate necessary changes in societal behavior. The group also recognizes that such regional efforts must be "nested" with those at municipal, provincial, national and global scales.

An approach is proposed that avoids the weaknesses in many coastal management programs that have emerged since the Rio Conference in 1992: the absence of common frameworks for assessing progress and for disseminating innovations; the absence of funding to reward and sustain sound programs in low-income nations; and the absence of global mechanisms to encourage collaborative learning.

Recommended Actions

Establish a Global Fund for Coastal Stewardship — not to initiate and finance stand-alone programs, nor create new organizations, but to recognize and support those that meet set standards for coastal conservation. The Fund will include formation *within 3 years* of:

- Global standards of program accountability and transparency in management decisions, to be established as a Code of Conduct for the Stewardship of Coastal Ecosystems.
- A Coastal Stewardship Incubator Network of approximately 20 regional programs, many rewarding successful programs in low-income nations that meet Fund standards, and having an established mechanism for "celebrating" these programs.
- A global, but regionally grounded, knowledge network to disseminate successful practices.
- A small to medium grants program for quick responses to emerging crises or high-priority opportunities.
- A globally coordinated, but regionally grounded, public education program.

Photo © Sylvia A. Earle

Larger issues of watershed agricultural practices and man-induced global climate change were discussed, but funds needed to address them are not included in the integrated cost model *(pages 4-5)*.

Estimated cost of the Fund recommended here is $150 million for ten years, assuming $5 million per year for global collaborative learning and knowledge management and $0.5 million per year to sustain 20 programs in the Incubator Network.

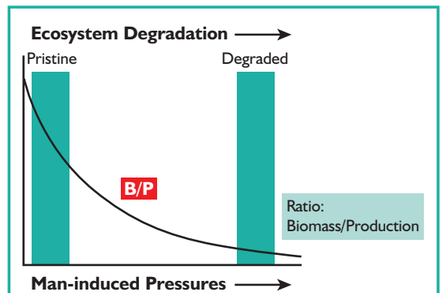
Within 10 years, this focused approach is expected to produce numerous measurable outcomes in Incubator areas: restoration of depleted fish and shellfish populations; reductions in nutrient outflow from land and reduced risks of coastal eutrophication or "dead zones"; and coastal communities acting to modulate the behaviors that lead to coastal and marine degradation.

Restoring & Maintaining Marine Ecosystem Function

Chairs: Les Kaufman & Jeremy Jackson

Marine ecosystems worldwide have been severely degraded by the effects of pollution, overfishing, and global climate change. Marine ecosystems respond to these combined insults by shifting from a state of high ratio of standing biomass to production to a low ratio. Accompanying this shift has been the loss of large animals, reduced biological diversity, and an astonishingly rapid degradation of complex underwater habitats such as coral reefs, sea grass and kelp beds. The losses herald a weakening of the self-restorative capacity of marine ecosystems, triggering a cycle of further decline.

As ecosystems degrade, the amount of biomass for a given amount of biological production falls, and ecosystem complexity and integrity are undermined.



The goal of this Group was to propose a scientifically sound program to reverse this decline in the vitality and functionality of marine ecosystems, and to maintain those systems that are either intact or can be restored to good condition. Actions are recommended in every Large Marine Ecosystem worldwide, encompassing seven types of marine domain — tropical nearshore, temperate nearshore, estuaries, seamounts, polar seas, open ocean and deep ocean.

The costs of the approach outlined below are integrated with those of other working groups in the business plan. Estimated costs of recovery for regional Large Marine Ecosystems will range from $500 million to $1 billion each over ten years.

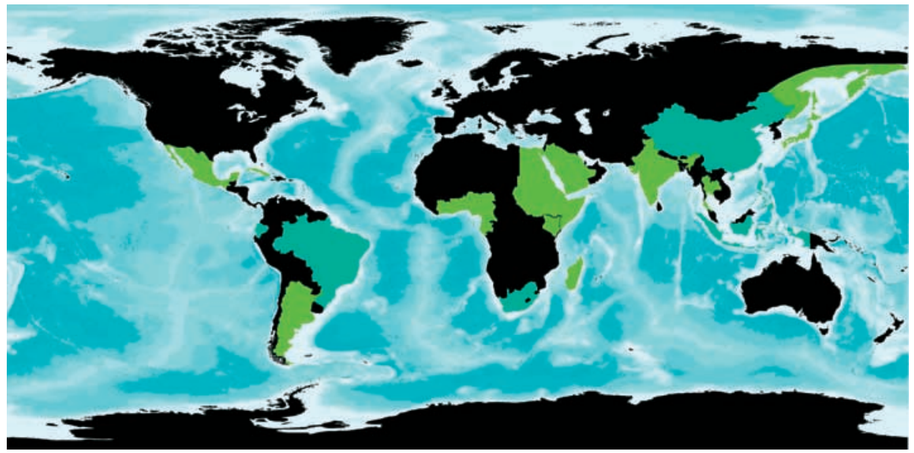
Photo © Jennifer Jeffers

Recommended Actions

- Prevent the spread of destructive fishing practices to remaining areas of ocean wildernesses; for example, ban trawling on most seamounts.
- Create a global system of marine reserve networks to conserve representatives of intact marine systems.
- Institute monitoring of the reserves as reference areas to separate natural from man-induced effects; include rapid large-scale mapping and monitoring of key biological processes.
- Implement integrated ocean management using differences between impacted and reference sites to judge the effectiveness of management regimes.
- Discover and create the environmental conditions conducive to marine ecosystem recovery. Develop a better understanding of the effects of pollution, global climate change, and bad watershed management, as well as the natural conditions that favor recruitment, strong year-class strength and system recovery.
- Develop and apply new technologies to support interventions for accelerated ecosystem recovery.
- Establish new, or employ existing, key institutions distributed among the major marine ecosystems of the world. Ensure these centers integrate research, monitoring, restoration and communication functions for their region.

Communications

Chairs: Nancy Knowlton & John McCosker



Within 3 years: Indonesia, Taiwan, China, Philippines, South Africa, Brazil, Jamaica, Ecuador

Within 10 years: Japan, Gulf of Guinea, Mexico, India, Thailand, Argentina, Cuba, Far eastern Russia, East Africa/Kenya, Madagascar, The Red Sea

Proposed regional communications efforts for marine conservation, to be implemented in two phases.

"We don't care about what we cannot see." This is one of the most challenging aspects of addressing the state of the world's ocean: to fundamentally change the attitudes toward the ocean that we have held for millennia.

Widespread popular support is needed if marine conservation efforts are to be successful and sustainable. Conservation begins with people — they cause the problems and can help solve them. Consumers drive demand for sustainable fisheries. Coastal zone residents can insist on an end to upstream pollution. Constituencies drive policy-makers to adopt — or not — key regulations. Journalists set the agenda, create a sense of urgency, and inform the public about the problems, the causes and the solutions behind key issues in marine conservation.

Marine scientists and conservationists must involve communications as an integral element of their strategies. With the help of communications professionals, we can launch a coordinated effort that produces a much better informed public — on a global scale — that changes mindsets, shatters the myth that the oceans are too vast to be irrevocably damaged, and advocates dramatic shifts in behavior.

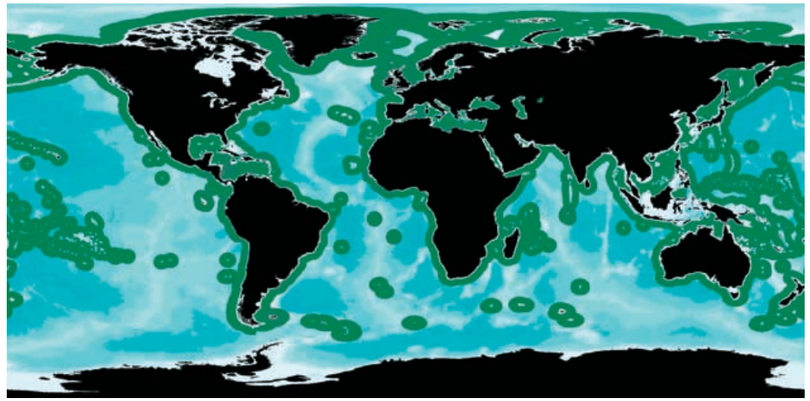
Public opinion polling for ocean issues is scarce. It does indicate, however, that people care about the ocean and its health, despite knowing very little, being often misinformed and largely unaware of the current degree of threat. Communicators must take advantage of the existing positive attitude, build awareness of the threats, and instill a sense of urgency in target audiences — policy-makers, consumers, industry and regional audiences — before widespread change can occur.

Recommended Actions

- Launch a global marine conservation communications campaign *within 3 years,* addressing international policy and consumption issues, that will provide the context for regional and local efforts. For global outreach, use a combination of earned-media, paid media, electronic media and public service announcements distributed via the establishment of a World Ad Council for ***Defying Ocean's End.*** Focus on thematic "hooks" such as overfishing and habitat destruction, seamounts, land/sea interactions and ocean governance.
- Establish a network of regional communications nodes and train local people as staff to ensure culturally appropriate communications approaches linked with local conservation efforts. For regional outreach, use a mix of earned-media, paid-media, events, education and/or social marketing appropriate to each area. Launch regional efforts in 8 countries *within 3 years* and in 12 additional areas *within 10 years. (See map).*

Ocean Governance

Chair: Michael Orbach



Global Exclusive Economic Zone (EEZ) and Fishery Zone (FZ) claims are widespread, but 60% of the world ocean still falls in largely unregulated "high seas" areas.

The ocean has historically been treated as a very different "policy space" from the land and the atmosphere. Governance structures for ocean resources and environments are underdeveloped, sector-specific, inconsistent, conflicting or non-existent.

National jurisdictions over resources have recently (1970s-80s) been extended seaward 200 nautical miles, still leaving about 60% of the ocean as "high seas" for which there is no comprehensive policy or management framework. Significant ocean uses — pharmaceuticals, genetic resources, mariculture, wind, wave and geothermal energy — have no policy or management regime on the high seas or in national jurisdictions. Public trust principles well established for the land or atmosphere — economic rent for private use of public trust resources, performance or security bonds, public trust patent protections — have been little used for ocean resources. Past limitations in monitoring and enforcement of ocean governance regimes have been overcome by technology advances, but we must now develop the political will to commit resources to this task.

Recommended Actions

▲ Initiate international discussions leading to the "policy enclosure" of the world ocean through a framework agreement addressing all human activities that affect the ocean, and providing for ecosystem-based, integrated, precautionary management of the high seas as a World Public Trust. Concepts that must be considered in this effort include:

- Integration of governance regimes across use sectors, levels of government and the land-sea boundary.
- Building scientific and policy capacity, especially in the less-developed nations.
- Comprehensive application of best available science, precautionary approach, "polluter pays" principles and public trust compensation (cost recovery and economic rent).

▲ Ensure full consideration of major policy shifts in the international dialogue leading to a framework agreement:

- Designating ocean living resources as "wildlife," with a legal and policy framework analogous to those governing terrestrial and avian wildlife.
- Shifting responsibilities for implementation and enforcement of ocean laws from flag and port states to an independent, verifiable international process.
- Developing a decision-making process based on majority or super-majority voting, rather than consensus, for prompt international decisions.

Using seamounts in the high seas as a specific implementation example:

▲ Initiate emergency action, through a UN General Assembly Resolution, for a moratorium on bottom trawling until an effective management regime is established.

▲ *Within 3 years* develop mechanisms through the Conventions on Biodiversity and Law of the Sea to select priority seamount areas and networks for protection, and implement some Marine Protected Areas with adequate monitoring and enforcement mechanisms.

▲ *Within 10 years* develop an established, operational global network of high-seas seamount MPAs.

The Unknown Ocean

Chairs: Larry Madin & Fred Grassle

source: NOAA

Sea Fan[1]

This Group considered several poorly known ocean environments to determine needs for conservation action and/or research. Species-level data are lacking for many "unknown" habitats, and further basic research in these areas is important to conservation. But elsewhere, enough is known already to plan precautionary actions. In some instances, swift action is critical to avoid irrevocably losing many unknown ocean species before they can be discovered.

Recommended Actions

▲ Initiate conservation action in 4 high priority "unknown" habitats, chosen based on: human impacts; potential irreversible loss of habitat type or biodiversity; adequate initial data; and economic feasibility of conservation actions:

- **Seamounts.** Invest in a minimum of 45 ship days per year *for 10 years* for seamount sampling. Discover and research 10,000 new species *within 10 years,* and develop a global satellite-based surveillance system to enforce fishing restrictions on seamounts.
- **Deep, "twilight zone" coral reefs.** *Within 3 years* identify priority areas, do 4 reef area surveys, and develop a pilot project for conserving one site. *Over 10 years* survey an additional 10 or more sites and develop conservation strategies.
- **Continental slope, canyons, cold seeps.** Complete ecological surveys of 3 seep sites *within 3 years* and determine changes there *after 10 years.*
- **Anchialine habitats** — underwater caves and blue holes. Complete field studies of at least 10 underwater cave environments in each major region of the world where they occur *within 3 years,* and complete at least 90% of all known cave environments *within 10 years.*

▲ Initiate research efforts in a second group of habitats with lower priority for immediate conservation attention, but warranting further research based on: high scientific or ecological value, inadequate initial data, no obvious immediate threats and opportunities for long-term conservation planning:

- **Prokaryote (microbial) ecology.** Use new genetic tools to survey microbial diversity and processes, which are fundamental to the functioning of all ecosystems but poorly understood.
- **Open-ocean water column.** Study this largest marine habitat, the source of most primary production and a vital link in the global cycles of carbon, heat, water and nutrients, and research the potential global effects of changes in these communities.
- **Deep benthos (bottom dwellers).** Research this vast habitat that has exceptionally high biodiversity.
- **Ridge and vent systems.** Study these chemosynthetic communities (not dependent on photosynthesis from the sun) for clues to the origin of life, and their unique adaptations to extreme temperature and pressure.
- **Frozen seas, ice edges.** Study the important roles of these critical polar ecosystems and the potential effects of climate warming.
- **Fronts and upwelling zones.** Research the effect of these areas on the survival of large pelagic (open ocean) fishes, reptiles and marine mammals.

▲ Invest in improved data infrastructure to support both research and conservation, in particular the Ocean Biogeographic Information System (OBIS) of the Census of Marine Life. Establish new taxonomic authority groups, assess status of marine species through the IUCN Red List, and build OBIS to 25 million records *within 10 years.*

[1] *http://oceanexplorer.noaa.gov/explorations/02alaska/logs/jul15/media/paragorgia.html*

[2] *http://oceanexplorer.noaa.gov/explorations/deepeast01/logs/sep26/media/anemone.html*

[3] *http://oceanexplorer.noaa.gov/explorations/islands01/log/sep28/media/crablarvae.html*

[4] *http://oceanexplorer.noaa.gov/explorations/deepeast01/logs/sep11/media/coralscape.html*

source: NOAA

Deep Sea Anemone[2]

photo © Ifremer-Biozaire2

Deep sea mussel and worm beds

source: NOAA

Crab Larvae[3]

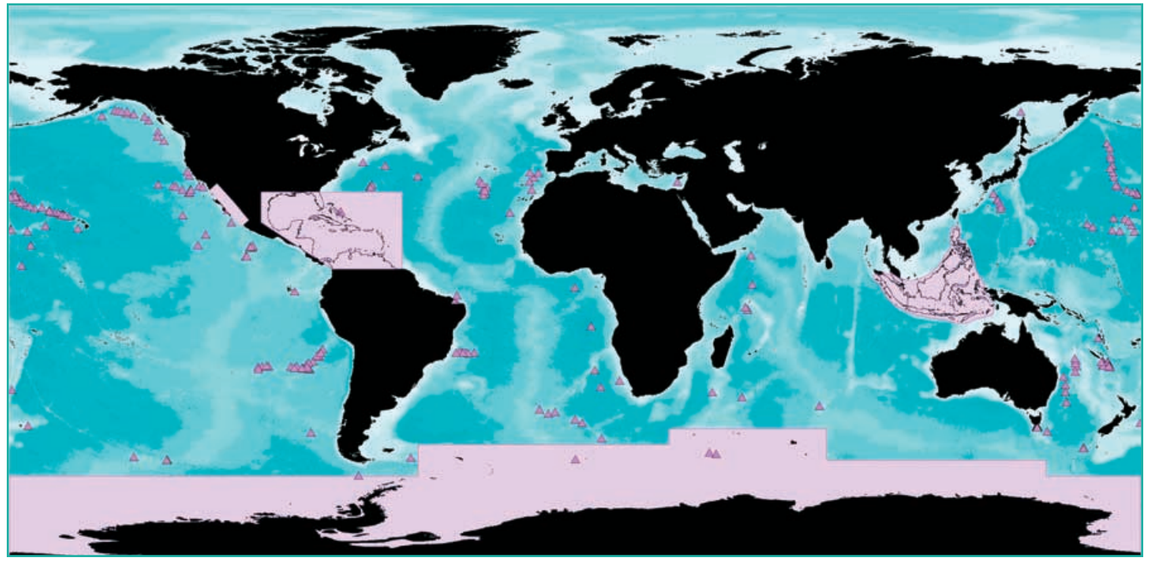
photo © Ifremer-Biozaire2

Close-up of deep sea shrimp and mussels

source: NOAA

Deep-sea corals[4]

Case Studies



Teams of ***DOE*** experts developed five regional case studies that were presented on the first day of the Conference. The areas are:

- The Caribbean
- Seamounts
- Antarctic Waters
- The Coral Triangle
- Gulf of California

The Case Study areas were chosen not just for their differences in physical environment and levels of biodiversity, but also for their varying levels of degradation, types of threat, and sovereignty and governance regimes. The lessons learned and recommendations from these diverse case studies laid a broad foundation for the seven Thematic Working Groups that were charged with a global view.

Photo © Jennifer Jeffers

The Caribbean

Mark Spalding & Phil Kramer

The modern Caribbean provides a microcosm of biodiversity, human impacts and governance issues:

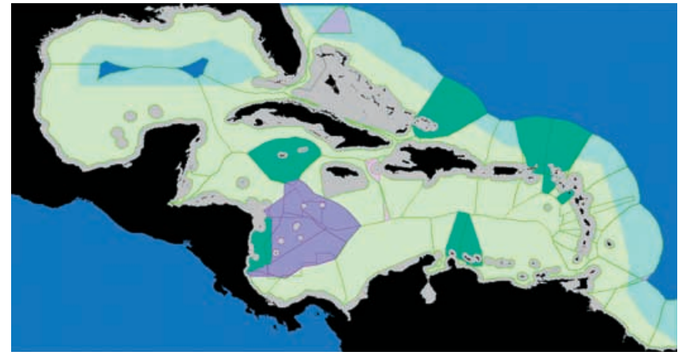
- Complex geologic history since the proto-Caribbean 130 million years ago prompted the evolution of a vast number of species found nowhere else — in extensive coral reefs, mangroves and seagrass beds, and in lesser known deep shelf ecosystems and partially isolated deep basins.
- Human presence can be traced back over six millennia, but in the last 3-4 decades, this region has suffered considerably from human impacts — widespread overfishing; pollution (only about 10% of the region's sewage is treated); and sediment runoff from coastal development. Disease outbreaks (region-wide death of branching corals and long-spined sea urchin) are indicative of an ecosystem already stressed by other factors.
- There are 35 politically independent countries and territories, with independent sovereignty claims and marine conservation management schemes. Many issues require bilateral, regional or global collaboration.

Despite these problems, the region incorporates numerous case-examples from which it is possible to develop a blueprint for recovery and sustainability.

Lessons Learned and Recommended Actions

▲ Change mindsets; raise awareness with a targeted drive towards education at all levels.
- Make fishermen aware of benefits to them of new approaches.
- Educate tourists on ecologically responsible behavior.
- Bring the marine environment into school curricula.
- Give journalists compelling, science-based "stories."
- Target government and industry decision-makers using economic arguments.

▲ Use the available science.
- Encourage regional analysis of existing datasets.
- Provide further training for Caribbean scientists and managers.
- Pursue basic research in some high-priority remote areas.



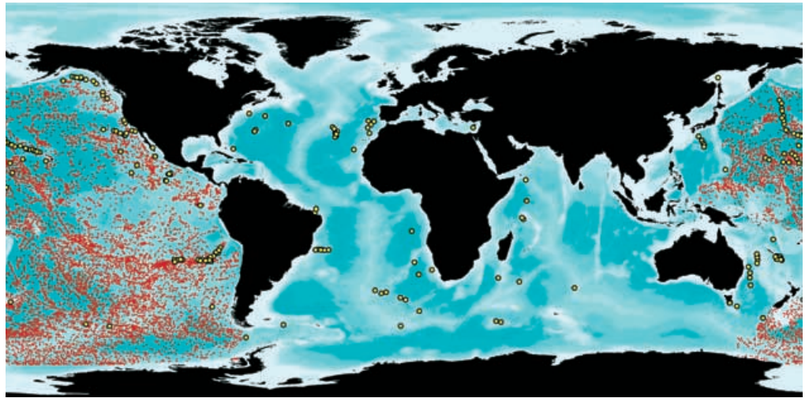
The many Caribbean nations' claims to Exclusive Economic Zones (EEZs) and Fishery Zones (FZs) complicate regional conservation schemes.

▲ Improve management systems.
- Disseminate examples like the Soufriere Marine Management Area in St Lucia and the Hol Chan Marine Reserve in Belize that demonstrate effective management improving both local livelihoods and biodiversity protection.
- Implement more — and more effective — protected areas.
- Include full stakeholder participation.
- Consider local ownership of nearshore fisheries assets as a management approach.
- Set targets: include 30% of nearshore habitats within no-take zones; install mooring buoys at all commercial dive sites and yacht anchorages; raise sewage treatment to 90%.
- Establish park user fees to support management efforts.
- Initiate active interventions where ecosystem function requires restoration.
- Include innovative approaches for industrial involvement; balance punitive measures ("polluter pays" or "zero net loss" approaches) with positive incentives.

▲ Work Internationally.
- Encourage and support multi-lateral governance approaches.
- Build up regional capacity through training and support of programs in poor or small nations.

Seamounts

Gregory Stone, Laurence Madin, Karen Stocks, Glenn Hovermale, Porter Hoagland, Mary Schumacher, Carolyn Steve-Sotka & Heather Tausig



SEAMOUNTS BIOLOGICALLY SAMPLED are shown in yellow; red indicates roughly 30,000 seamounts estimated to exist in Pacific waters.

Seamounts — underwater mountains and hills that rise at least 1,000 meters above the ocean floor — are distributed throughout the world's ocean. Although only about 1,000 have been named, it is believed there may be over 30,000 seamounts in the Pacific Ocean alone.

Only about 220 seamounts have been sampled biologically, and well under half of these have been studied in any depth. What work has been done indicates seamounts support highly unique (endemic) faunas; on many seamounts 15-40% of all species collected are new discoveries to science.

Commercial fisheries are the greatest current threat to seamounts. Newly developed fisheries for deep-sea species are altering these habitats faster than they can be studied — and large pools of unknown marine biodiversity are being destroyed before they can be discovered. Advances in fishing technology in the 1960s allowed trawling for deeper species, leading to the collapse of orange roughy and other species by the 1990s. Collateral damage from deep-sea trawling includes destruction of complex and poorly-known benthic (seafloor) communities. According to Koslow et al. (2001), unfished seamounts have almost 50% more species than fished ones, and only 10% bare rock compared to 95% bare rock on fished sites. Many species on seamounts are very long-lived and their biological communities can take hundreds, even thousands of years to develop. The accelerating collapse of conventional fisheries is stimulating further advances in deep-water fishing technology which will subject seamount populations to ever-increasing exploitation pressure.

In Australia and New Zealand waters, a small percentage of seamount habitats have been protected and catch limits imposed, but developing fisheries elsewhere are largely unregulated. The legal framework for management of seamount resources is different in territorial waters, Exclusive Economic Zones (EEZs) and international waters. Most seamounts are in international waters, where a complex array of treaties applies, but there is no agreed mechanism for creating Marine Protected Areas in international waters.

Lessons Learned and Recommended Actions

There is now an urgent need to discover, explore and find means to protect seamount environments before many more are destroyed. Specific steps will include:

- Establishing a comprehensive global reserve system to protect representative seamount habitats throughout the world.
- Initiating a comprehensive effort to bring together existing international research on seamounts, to guide placement of reserves and future sampling of under-represented seamount areas.
- Requiring modifications of fishing gear to decrease impacts to habitats and marine mammals.
- Basing stock assessments on techniques appropriate for deep-sea species.
- Launching public information programs to inform consumers about the ecological dangers of deep-sea fishing; encourage the public to influence demand for these vulnerable species by electing not to purchase them.

Antarctic Waters

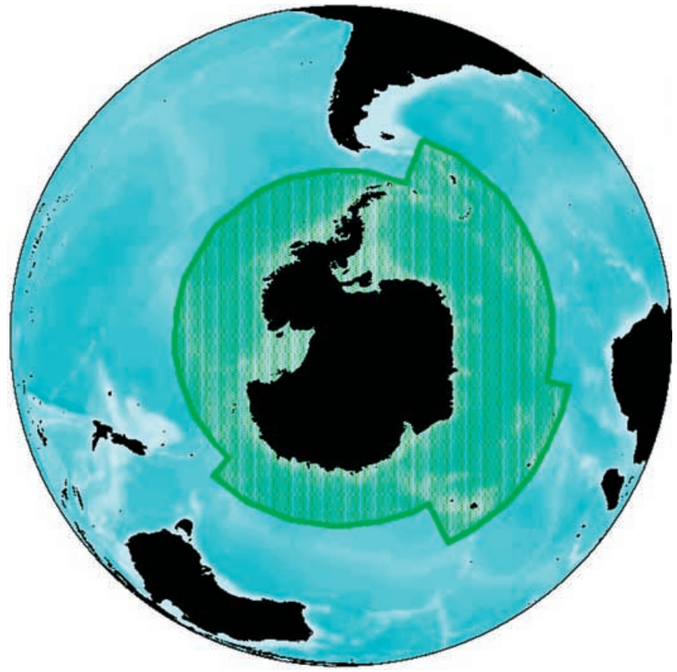
John Croxall & Phil Trathan

The Convention for the Conservation of Antarctic Marine Living Resources (CCAMLR) was developed in the late 1970s, and came into force in 1982, following recognition that uncontrolled exploitation of species such as Antarctic krill would have unprecedented effects on many other species dependent on them for food — including the recovery of previously harvested species such as whales, Antarctic fur seals and some fin-fish. CCAMLR is established on three important concepts: harvesting should be sustainable; harvesting limits should take into account the needs of dependent species; and any changes resulting from harvesting should be reversible within 30 years.

The Convention develops management advice within an ecosystem framework, and has adopted a "precautionary" approach. Management is achieved through conservation measures, agreed by consensus, which the Member nations then enact, implement and enforce. Data collection, analysis and modeling programs are developed by the Scientific Committee and Working Groups of CCAMLR and are largely funded through national research agencies.

Current CCAMLR experience with major Antarctic fisheries highlights the need to: understand factors controlling variability in stock distribution and abundance; characterize "functional relationships" between stock abundance and dependent species performance; identify appropriate monitoring variables; identify overlap between predators and commercial harvesting; understand conditions where dependent species may switch to alternative prey; identify management measures where a dependent species may also be harvested; minimize by-catch and incidental mortality of non-targeted species; and influence the management of species also harvested outside of CCAMLR jurisdiction.

Two significant challenges are to eliminate illegal, unregulated or unreported fishing (IUU), and to ensure that adjacent Regional Fishery Management Organizations (RFMOs) adopt and apply comparable environmental and resource management standards. Despite these concerns the CCAMLR Experience, which now involves 24 nations as full members, serves as a promising model for global ocean management.



THE CONVENTION ON CONSERVATION OF ANTARCTIC MARINE LIVING RESOURCES (CCAMLR) area of management is shown.

Lessons Learned and Recommendations

Important steps for governments in addressing global marine conservation will include:

- Outlawing "flags of convenience" and improving "flag state" controls.
- Transferring appropriate management responsibilities to RFMOs.
- Implementing the FAO draft International Plan of Action for IUU fishing with mandatory as well as voluntary measures.
- Improving collection and dissemination of all relevant fisheries data.
- Establishing compulsory vessel monitoring systems and effective port state inspection.
- Improving international fishery protection systems.
- Listing vessels in compliance and non-compliance.

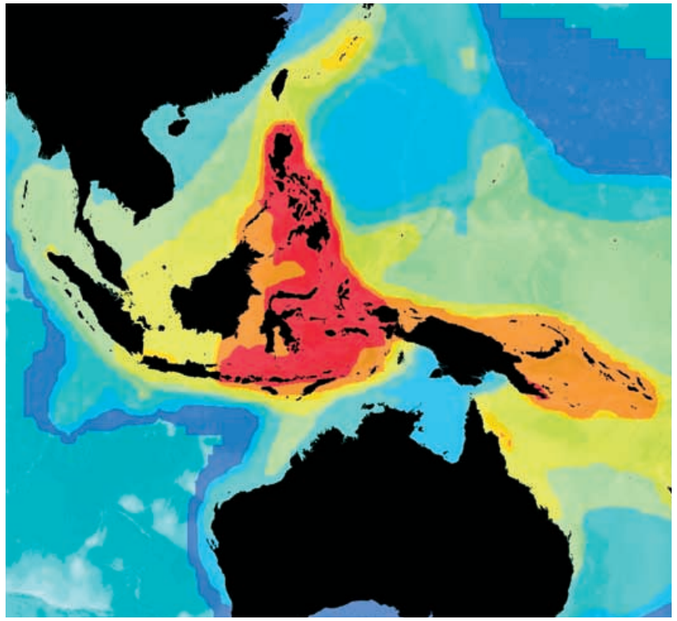
In regulated fisheries, governments will also need to ensure that all RFMOs — in a consistent, transparent and accountable fashion — adopt precautionary approaches to sustainable harvesting; fully protect the needs of dependent species; adopt methods to eliminate by-catch of non-targeted species; adopt minimum reporting standards of effort, catch and by-catch; and license only compliant vessels, linked to appropriate incentives and training schemes.

photo © Photodisc

The Coral Triangle

Timothy B. Werner, Ghislaine Llewellyn, Rod Salm & Gerald R. Allen

Source: G. Allen/CI



The Coral Triangle, its general outline indicated by distribution of reef fishes.

Reef Fish Diversity
Distribution by number of species within three families.

- *115 - 152*
- *152 - 159*
- *159 - 170*
- *170 - 185*

The geographic distribution of marine biodiversity varies greatly across the world ocean. In one striking area of the western Pacific — the waters of Indonesia, Malaysia, Papua New Guinea, Philippines, and Solomon Islands — many different kinds of marine groups attain their peak global richness. This region has only 35% of the world's coral reefs, but is home to 77% of the world's coral species, over 50% of all reef fishes, 58% of tropical marine mollusks, and the highest diversity of mangroves, sea grasses and many other groups — an astounding level of diversity concentrated in less than 1% of the world ocean's surface area. Moreover, large numbers of these species occur nowhere else, including 97 species of reef fishes endemic to Indonesia and more than 50 in the Philippines.

This region, which has been called the "East Indies Triangle" or the "Coral Triangle," is a global priority for conserving the biodiversity of coral reefs, other tropical marine environments, and globally unique high seas and deep-ocean communities.

Marine Protected Areas (MPAs) are one of the most effective tools for marine biodiversity conservation, but — excluding the area covered by whale sanctuaries — they cover less than 1% of this region. With every indication that human practices causing marine biodiversity loss will continue, a major financial commitment and increased popular and political support for marine conservation are required immediately to avoid continuing losses in species, habitats and ecosystem functionality.

Lessons Learned and Recommended Actions

▲ Maintain and restore Coral Triangle representative habitats and marine biodiversity with "functional seascapes": large-scale marine areas including networks of "no-take" MPAs, with the surrounding coastal and marine areas managed sustainably.

- Design MPAs and MPA networks in ways to increase the probability of marine biodiversity survival in the face of global climate change, coral bleaching and other catastrophic events.
- Establish priority areas for MPAs on biodiversity grounds, but also consider the likelihood of success based on attracting critical local support.

▲ Initiate improved incentives for establishment, maintenance and enforcement of MPAs:

- Develop more fiscal incentives, such as creating conservation concessions.
- Respond to government concerns for revenue loss from illegal fishing.
- Demonstrate fishing benefits of MPAs to coastal communities.
- Establish higher, but still commercially competitive, dive fees.
- Communicate the results of cost-benefit analyses for different resource-use options.
- Respect the economic and subsistence needs of local communities.
- Give greater roles to agents as a complement to those of central governments.

▲ Conduct more systematic biodiversity assessment and monitoring, including changes in biological composition as well as environmental condition of communities, and provide real time information to inform management responses.

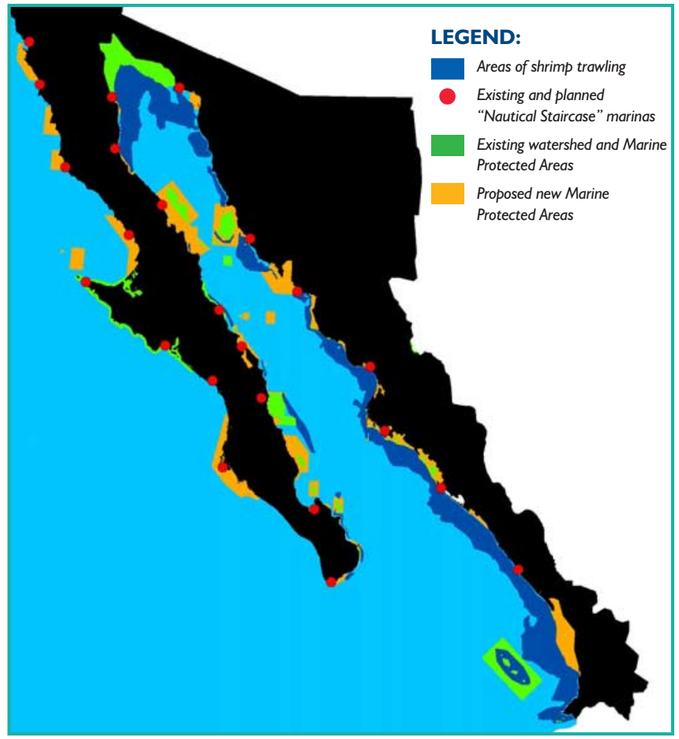
Gulf of California

Maria Carvajal, Charlotte Boyd & Mauricio Cervantes

The Gulf of California in northwest Mexico covers an area of 375,000 square kilometers. It has been called a "caricature of oceanography" because its oceanographic dynamics are dramatically exaggerated, with deep basins in its central and lower portions and some of the greatest tides in the world in its upper reaches. It contains over a hundred islands and offshore rocks, and strong upwelling of cold, nutrient-rich waters are evident along both its coasts. The great diversity of topographic and bathymetric features has produced a variety of habitats for marine life. Sixteen of its marine species are listed in the IUCN Red List as threatened or vulnerable. The Gulf's high biodiversity levels, biological productivity, and 831 endemic species make it one of the Large Coastal Ecosystem (LCE) conservation priorities on the planet.

In recent decades, natural resources have been depleted and new opportunities have stimulated demand, resulting in increasing risk of conflict both between and within different business sectors over resource use, especially in the absence of clear property rights and strongly enforced regulations.

Among the greatest threats to the health of the Gulf of California region is poorly planned economic development. Government agencies, academic institutions, private sector, and conservation organizations are addressing these issues by developing several regional initiatives for conserving the Gulf's richness and providing a basis for sustainable economic development. Two relevant initiatives are the Coalition for the Sustainability of the Gulf of California which brought together more than 150 experts to establish regional biodiversity conservation priorities in 2001, and the establishment and operation of five new coastal and Marine Protected Areas.



Regional Conservation Agenda, coordinated among local, national and international organizations.

Photo © Patricio Robles Gil/Sierra Madre

Lessons Learned and Recommended Actions

Collaborative inter-sectoral efforts to define solutions to threats are critical; improved governance structures are key to effective natural resource management; marine protected areas are useful to control open access and support fisheries management; negotiating behavior changes produces more long-lasting results than imposing the values of one group on another; and sustained progress towards measurable goals is made at the Large Coastal Ecosystem scale.

Recommendations for regional conservation agenda *(see map)* are:

▲ Improve management of protected areas.
▲ Establish new marine protected areas.
▲ Integrate management of priority coastal wetlands.
▲ Reduce the shrimp trawler fleet and improve its fishing technology.
▲ Reorient a regional tourism project (The Nautical Staircase).
▲ Establish the Gulf of California Conservation Fund.
▲ Articulate a common regional vision.

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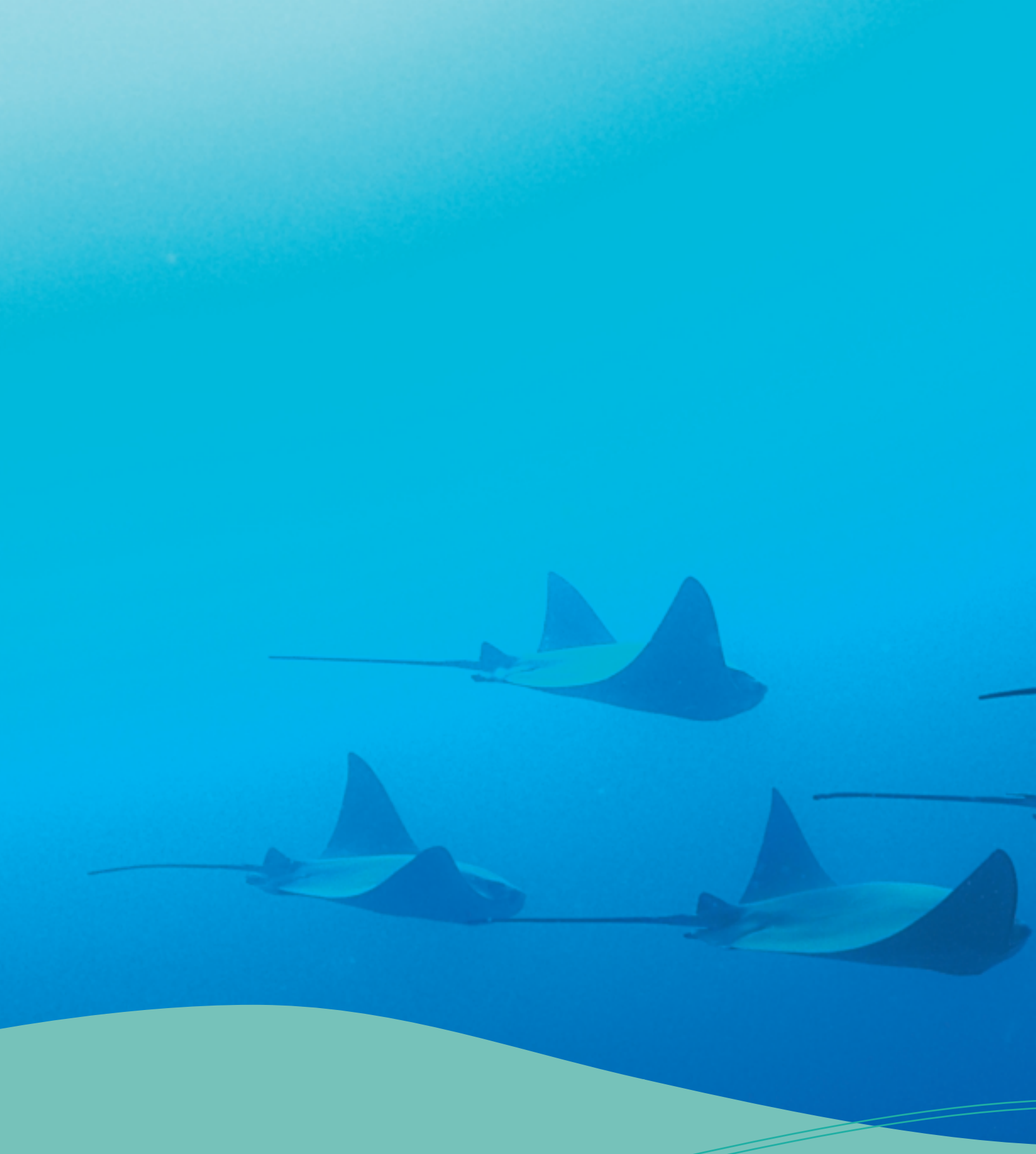

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