

global issues



Shared Oceans, Shared Future

An Electronic Journal of the U.S. Department of State – April 2004 Volume 9, Number 1

From the Editors

Humankind has explored, mapped, developed, or settled all but the most hostile corners of Earth's landmass. But our understanding of the oceans—more than 70 percent of Earth's surface—remains highly limited. We know more about the contours of Mars than those of the oceans' floors.

Though we frolic on the oceans' shores, sail and swim their waters, draw food from their depths, and transport freight across their vast horizons, we know very little about life and conditions below the surface. Recent studies have highlighted the urgent need for more knowledge. Vast as they are, the oceans are not unassailable. They cannot endlessly absorb the wastes that human beings are dumping into their waters. The bounty of the sea, which has nurtured life on Earth for millennia, is not limitless.

Technological and financial resources devoted to research have not been adequate to accomplish all that scientists want to learn about our oceans, but attempts are being made in many quarters in the United States to address the situation. We examine many of them in this edition of *Global Issues*. The U.S. government's top policy maker in ocean-related programs provides an overview of the initiatives being taken to better understand and preserve the seas. A U.S. State Department official describes the many ways the United States works with the international community on matters relating to the oceans. We offer a preview of a comprehensive report about reshaping U.S. oceans policy. And a prominent U.S. oceanographer shares his sense of wonder and curiosity about all that we have yet to learn.

We hope that these and the other features in this electronic journal will inform readers as well as encourage them to learn more about the oceans and about how we can all work together to preserve this resource so vital to us all.

Table of Contents

Shared Oceans, Shared Future

□ FOCUS

A Strategic Approach to Managing the Oceans5

The U.S. government sets strategic goals for ocean protection, management, and research.

By Conrad C. Lautenbacher, Jr., Undersecretary of Commerce for Oceans and Atmosphere, and Administrator, National Oceanic and Atmospheric Administration

Law of the Sea Treaty Balances U.S. and World Interests9

The Senate Foreign Relations Committee and the Bush administration are urging the Senate to approve U.S. entrance into the U.N. Convention on the Law of the Sea.

By Senator Richard G. Lugar, Chairman, Senate Foreign Relations Committee

Diplomacy and the Oceans12

The U.S. Department of State engages with the international community in many ways to fulfill nations' shared responsibilities in formulating policy and managing ocean resources.

By David A. Balton, Deputy Assistant Secretary for Oceans and Fisheries, U.S. Department of State

An Ocean Blueprint for the 21st Century15

A commission created by the U.S. Congress works to draw a blueprint for a new, comprehensive, and sustainable ocean policy.

By James D. Watkins, Chairman, U.S. Commission on Ocean Policy

□ COMMENTARY

Oceanographer Rewrites the Conventional Wisdom19

American oceanographer Robert Ballard has played a prominent role in deep-sea discoveries in geology and biology.

An Interview with Dr. Robert Ballard, Founder and President, Institute for Exploration at Mystic Aquarium, Mystic, Connecticut

Saving Louisiana's Delta24

The Mississippi River meets the Gulf of Mexico in Louisiana's wetlands where state and federal officials are now working to correct ecological damage.

By Kathleen Babineaux Blanco, Governor, State of Louisiana

The Chesapeake Bay: Lessons Learned from Managing a Watershed28

A tri-state legislative commission participates in a unique partnership that has been directing the restoration of the Chesapeake Bay's living resources, vital habitats, and water quality.

By Ann Pesiri Swanson, Executive Director, Chesapeake Bay Commission

Communities Around the Globe Protect the Underwater World	33
The Dive In To Earth Day program focuses international attention on preservation of the reefs and other marine resources. <i>By Brian Huse, Executive Director, Coral Reef Alliance</i>	
Coral Reefs & Sustainable Coastal Development: Planning for a Sustainable Reef	38
Excerpted Issue Brief from The Coral Reef Alliance	
Farming the Seas	40
In the Americas, Europe, and Asia, ocean-based aquaculture is a burgeoning technology with both benefits and risks that require management. <i>By Colin Woodard, Special Correspondent</i>	

❑ **ADDITIONAL RESOURCES**

Scientists Return to the Titanic	44
A press release from the National Geographic Society and a consortium of other scientific and educational institutions describes a new expedition to the wreck of the <i>Titanic</i> .	
Bibliography	47
Books, documents, and articles on ocean issues.	
Selected Internet Resources	51
A list of sites on the World Wide Web offering further information on ocean issues.	

Global Issues

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FOCUS

A Strategic Approach to Managing the Oceans

By Conrad C. Lautenbacher, Jr.
Undersecretary of Commerce for Oceans and Atmosphere
Administrator, National Oceanic and Atmospheric Administration

The U.S. government sets strategic goals for ocean protection, management, and research.

Over the last 50 years, scientists and policy makers have developed a much more profound understanding of the way in which oceans, as complex and dynamic systems, influence many facets of daily life for people around the globe. That broadening understanding—among government officials and the publics they serve—has led to new efforts to develop comprehensive policies on the use and protection of the waters that comprise more than 70 percent of our planet's surface. Two current reports by distinguished panels in the United States—representing both government and the private sector—provide thoughtful and considered recommendations on appropriate next steps.

This is a time of great promise for humanity to act upon our ever-growing understanding of the oceans and their connection to the land, the climate, and all of life. As we examine these valuable new studies, we shall have a unique opportunity to reevaluate the way we do business.

The National Oceanic and Atmospheric Administration (NOAA), over the past three years, has aggressively retooled the way in which it carries out oceans research and policy development as it has prepared a new strategic plan.

NOAA's Strategic Plan – Four Strategic Goals

Making effective and sound oceans policy begins with a strong strategic plan that sets clear and identifiable goals and lays out a path to accomplish them. NOAA, with much input from employees and constituents, has worked hard to develop a plan that encompasses our diverse portfolio of responsibilities.

The plan is focused on four strategic goals:

1. **Ecosystems:** To better protect, restore, and manage the use of coastal and ocean resources through ecosystem approaches to management.
2. **Climate:** To better understand climate variability and enhance society's ability to plan and respond.
3. **Weather and Water:** To improve accuracy and timeliness of weather predictions.
4. **Commerce and Transportation:** To support and boost the nation's commerce with information for safe, efficient, and environmentally sound transportation.

These goals represent the backbone of all of NOAA's mandates and initiatives. We are aligning our budget structure and tracking our performance in the context of these goals. While they all draw upon nearly every sector at NOAA, they all also have a significant impact on oceans policy.

Ecosystem Approach to Management

It is hard to understate the importance of coastal communities given that they are the most developed and the fastest-growing areas in our country. Coastal and marine waters alone support more than 28 million jobs and generate more than \$54 billion annually. These areas are a precious resource, and it is easy to see why it is so important that we protect, restore, and manage these areas.

Managing coastal areas cannot happen in a vacuum,

Of all the great mysteries the oceans hold in their depths, their effect on climate may be the least understood.

which is why ecosystem-based management is a top priority at NOAA. An ecosystem approach to management is founded in the fact that all ecosystems and their various parts are closely interrelated and that actions in one will have impacts upon the rest.

One example of how ecosystem management affects oceans policy is the White Water to Blue Water (WW2BW) initiative, which is based on recognition that you cannot protect the oceans without effectively managing influences upstream. The United States recently announced a partnership with key interests in the wider Caribbean region as part of the WW2BW initiative, and we hope the work done there will serve as a model worldwide.

When the goals of WW2BW are realized, we hope to have increased the number of coastal and marine ecosystems maintained at a healthy, sustainable level, as well as the social and economic value of the marine environment and resources, and the number of hectares and stream-kilometers restored for coastal and ocean species.

Climate

Of all the great mysteries the oceans hold in their depths, their effect on climate may be the least understood. For example, we are just beginning to understand the critical role the oceans play in the formation of the El Niño and La Niña atmospheric circulation systems that influence weather and moisture patterns around the world. Only in the last couple of decades have we developed tools and technology that allow us to predict the formation and movement of these systems with their capacity for enormous destruction due to withering drought or crashing storms. In 1997 and 1998 El Niño caused \$25 billion in economic damages, but as our understanding grows, policy makers and business planners are able to make adjustments to mitigate the loss.

Predicting and monitoring El Niño/La Niña are possible because of investments in technology that allow scientists to monitor ocean temperatures.

Continued investment will not only further understanding of short-term climate variability, but will also help answer more long-term questions such as the reasons behind global climate change. It is widely believed that the oceans have a significant impact on climate change, but many questions remain.

Weather and Water

Everyone in the country reaps the benefits when NOAA improves its weather forecasting ability, but those in coastal regions literally stake their lives and livelihoods on our ability to predict the actions of severe storms and hurricanes. Severe weather in the United States takes dozens of lives per year and can cost more than \$11 billion.

NOAA's significant investment in technology to improve our ability to forecast hurricanes is directly impacting those living in coastal regions. For example, hurricane paths can now be forecast five days into the future with the same accuracy as three-day forecasts 10 years ago.

As we move forward, we want to continue improving this technology and the computer models that provide those forecasts. Key also will be educating a new generation of meteorologists and forecasters in the latest technology and techniques. Finally, watches and warnings do no one any good if they are not effectively communicated to those who need them. We will continue working to improve communication so that people are aware of forecasts and understand how vitally important they can be to safety and well-being.

Commerce and Transportation

Given that more than 95 percent of the tonnage of our foreign trade moves through the oceans and our ports, it is clear that they play a major role in our economy.

NOAA's fourth strategic goal is to support the nation's commerce with information for safe, efficient, and

We have reached a time for an "earth science renaissance," a new era in which human ingenuity must be applied to developing a deeper understanding of the complex systems of planet Earth.

environmentally sound transportation. This goal encompasses all forms of transportation, including air and surface, but ocean travel and related commerce offer a particular set of challenges.

Obviously, improving weather forecasts make sea travel much safer. Also important, however, is ensuring that port operations and development proceed efficiently and in an environmentally sound manner. In the end, reducing the risk of marine accidents and oil spills, better search and rescue capabilities, and other efficiencies from improved navigation and coastal and ocean information and services could be worth \$300 million annually to the nation's coasts.

Earth Observation

The four strategic goals cut across and define all the work done at NOAA. One issue, however, threads through all four of these goals. There is hardly a scientific, economic, or social category that does not involve Earth observations in some way. This central issue will play a large role in oceans policy for a long time to come.

I strongly believe we have reached a time for an "earth science renaissance," a new era in which human ingenuity must be applied to developing a deeper understanding of the complex systems of planet Earth. That understanding begins with observations. Every day we reap the manifold benefits of satellite, aircraft, and ocean and ground-based measurements that document environmental changes across the globe. These measurements are essential to every nation to assist in such essential tasks as monitoring crops, exploring the oceans, improving weather forecasts, managing fisheries, or assessing disasters.

However, collectively, we can and we must do much more. The forces of social change and global development present a number of serious issues for the world's leaders, decision makers, and inter-

national societies. We are facing a future that requires advancing our existing systems to the next level of Earth observation; that is, to build a system of systems that will give us the tools we need to "take the pulse of the planet."

Support for Ocean Science and Technology

Around the world, there is considerable support to maintain these technological advancements in ocean science, but it is important for the ocean community to promote these initiatives to our supporters and educate America and the world on the value of these advancements.

Making this happen will require strengthening intergovernmental, academic, and industry partnerships to leverage that support in order to move forward in the field of ocean science.

It is essential that people understand and support the full value of ocean science: how it impacts their daily lives; how it adds to our understanding of the interrelationship between the oceans and atmosphere, indeed the entire Earth. Investing in an education effort to communicate these benefits will further the cause of ocean science and can eventually allow us to give something back to the oceans—the oceans that have done so much for humankind.

Further information about NOAA's ocean-related programs is available at <http://www.noaa.gov/ocean.html> and <http://oceanservice.noaa.gov/>.

Undersecretary Conrad Lautenbacher is a retired admiral of the U.S. Navy with more than 30 years of service. Upon retirement, he became president of the Consortium for Oceanographic Research and Education (CORE). President Bush appointed him to head NOAA in 2001.

Law of the Sea Treaty Balances U.S. and World Interests

By Senator Richard G. Lugar
Chairman, Senate Foreign Relations Committee

The U.S. Senate will soon exercise one of the fundamental responsibilities granted to it by the U. S. Constitution and vote whether to ratify the U. N. Convention on the Law of the Sea. The Bush administration supports ratification and is joined in that position by a leading member of the U.S. Senate.

The Foreign Relations Committee, which I chair, voted 19-0 to recommend to the Senate that the United States join 145 other parties to enter the U. N. Convention on the Law of the Sea (UNCLOS). That Senate decision is pending as this publication goes to press.

The Senate Foreign Relations Committee took up the treaty after President George W. Bush placed it in the "urgent" category of his treaty priorities. This agreement sets forth a comprehensive framework governing uses of the oceans that strongly upholds U. S. national security, economic, and environmental interests and is supported by affected industries, associations, and environmental groups.

It should be noted that the United States has already made a considerable investment in this agreement, and though not a party, has adhered to most of its precepts in our policies on navigation, commerce, and the environment. The United States played a prominent role in the negotiating sessions that culminated in the 1982 convention, which entered into force in 1994 when it was ratified by 60 nations.

As the world's largest maritime power and a nation with one of the longest coastlines in the world, the United States has enormous interests in the oceans and their uses. The convention advances U. S. interests in a number of ways.

- Our armed forces rely on the ability to navigate freely on, over, and under the world's oceans to protect U. S. security interests worldwide. The convention reinforces U. S. national security by preserving the rights of navigation and overflight across the world's oceans. Both of these rights are critical to the protection of U. S. interests around the world.

- UNCLOS advances U. S. economic interests by enshrining the right of the United States to explore and develop the living and nonliving resources of the oceans.

- It advances U. S. interests in the protection of the environment by addressing marine pollution from a variety of sources and providing a framework for the conclusion of further agreements to protect and conserve these natural resources.

The Law of the Sea convention provides a comprehensive legal framework to maximize use of the oceans' resources, while ensuring their health and productivity.

The agreement also gives the coastal nation sovereign rights for the purpose of exploring and exploiting, conserving and managing natural resources, whether living (e. g. , fisheries) or non-living (e. g. , oil and gas), in an exclusive economic zone (EEZ) that may extend to 200 nautical miles from the coast. In addition, the convention accords the coastal nation sovereign rights over the continental shelf both within

and beyond the EEZ, where the geological margin so extends.

Joining the convention is also important to the ability of the United States to exercise leadership and influence over oceans issues globally.

In its all-encompassing treatment of these issues, the Law of the Sea convention provides a comprehensive legal framework to maximize use of the oceans' resources, while ensuring their health and productivity for generations to come. Achieving a widely accepted treaty that enshrines and provides legal protections for key rights of navigation and overflight has been a principal objective of U. S. oceans policy for decades. UNCLOS fully achieves that objective.

The convention carefully balances the interests of individual member states and the interests of the world community at large. It allows nations to control activities off their own coasts at the same time it protects the freedom of all states to use ocean spaces without undue interference.

UNCLOS provisions allow countries to claim a territorial sea of a maximum breadth of 12 nautical miles, within which the coastal state may generally exercise plenary authority as a function of its sovereignty. The convention also establishes a contiguous zone of up to 24 nautical miles from coastal baselines, in which the coastal nation may exercise limited control necessary to prevent or punish infringements of its customs, fiscal, immigration, and sanitary laws and regulations that occur within its territory or territorial sea.

These provisions are important to the United States because our coastal waters and EEZ generate vital economic activities such as fisheries, offshore mineral development, ports and transportation facilities, and, increasingly, recreation and tourism. The majority of Americans live in coastal areas, so their health and well-being are intimately linked to the quality of the coastal marine environment.

The convention also establishes a legal framework for the protection and preservation of the marine environment. In this area as well, UNCLOS achieves an effective and appropriate balance between the interests of nations in protecting natural resources with their interests in freedom of navigation and communication. The agreement addresses sources of marine pollution, such as pollution from vessels, seabed activities, ocean dumping, and land-based sources. The provisions obligate member nations to prevent and control pollution of the oceans' waters and to cooperate in the management and conservation of living resources. Existing U. S. laws for the protection of rare and fragile ecosystems and the habitat of depleted, threatened, or endangered species are already consistent with UNCLOS.

As noted, a coastal nation has sovereign rights over living marine resources in its exclusive economic zone, that is, out to 200 nautical miles from shore. The convention's provisions on fisheries are entirely consistent with U. S. domestic fisheries laws as well as forward-looking international fisheries agreements

and understandings made in the last decade. Effective implementation of these agreements can bring about an end to rampant overfishing in the years to come.

The United States was an active participant in the talks that led to the convention in 1982, but declined to ratify because of objections to provisions on deep seabed mining. With the Oceans Policy Statement in 1983, President Ronald Reagan declared U.S. commitment to the principles of UNCLOS with the exception of the mining provisions. Subsequent amendments to the agreement by signatory nations have now satisfied U.S. concerns about deep seabed mining.

It is time for the United States to become a fully participating member in this landmark convention to protect more than 70 percent of our planet's surface. I look forward to leading the Senate toward a vote for ratification.

Senator Richard Lugar has served in the U.S. Senate since 1977, representing the state of Indiana.

The opinions expressed in this article are those of the author and do not necessarily reflect the views or policies of the U. S. government.

Diplomacy and the Oceans

By David A. Balton
Deputy Assistant Secretary for Oceans and Fisheries
U.S. Department of State

The Department of State
is engaged with the world
community to ensure responsible
use of ocean resources.

Protection and sustainable development of the oceans and their resources are critical to the future of our planet, its people, and myriad life forms. Worldwide, more than 50 percent of the population lives in coastal areas—a figure that will rise to 75 percent by 2025. Our daily lives are affected by weather systems with oceanic origins, by the availability of protein in the form of seafood, and by opportunities for recreation and tourism. Maintaining and restoring healthy marine ecosystems, understanding the role of the oceans in global processes, and protecting the safety of commercial navigation are vital goals for the United States, goals that can be achieved only through international cooperation.

International Ocean Initiatives

One of the highest ocean policy priorities for the Department of State is U.S. accession to the U.N. Convention on the Law of the Sea. The United States will benefit, perhaps more than any other nation, from becoming party to the convention. This treaty and the legal framework it codifies provide a structure in which the international community can work to reach agreement on the complex issues associated with the vast resources of the ocean—including navigational freedoms, sustainable resource use, biological diversity, deep seabed mining, and use of the continental shelf.

The Department of State has been actively engaged with its international partners in pursuing objectives compatible with the convention. One of our most exciting initiatives is the White Water to Blue Water Partnership (WW2BW), first announced at the World Summit on Sustainable Development held in Johannesburg, South Africa, in September 2002. The program has been launched in the Wider

Caribbean Region, but this model may serve as a blueprint for future programs in Africa and the South Pacific.

The initiative creates an international alliance of governments, international organizations, financial institutions, and others to promote integrated watershed and marine ecosystem-based management. It promotes regional cooperation in pursuit of a shared goal to protect and utilize a shared resource. The objectives are to address land-based sources of marine pollution, promote sustainable fisheries, improve agricultural and forestry practices, meet the challenges associated with tourism, and prevent the degradation of coastal areas. WW2BW also facilitates cooperation and good governance within and among nations and stakeholders.

At a recent conference in Miami, Florida, WW2BW moved closer toward the realization of its objectives. More than 700 participants from 32 countries in the Wider Caribbean Region gathered for the March 22-26 event hosted by the Department of State. Forming and fostering some 70 partnerships was an important achievement of the meeting as international organizations, national governments, nongovernmental organizations, private business, and academic institutions joined in agreements to pursue various resource conservation efforts.

Living Marine Resources

The international community faces a critical time in the quest for sustainable fisheries. The most recent statistics of the U.N. Food and Agriculture Organization (FAO) indicate that more than 70 percent of fisheries are either overfished or are fished at their maximum capacity. In coming years, production from many key fisheries will likely decline. Demand for fisheries products, however, will continue to increase. The prospect of this growing shortfall poses our greatest fisheries challenge today.

At the Sustainable Development Summit, world leaders acknowledged the vital contribution of marine fisheries to economic and food security and to biodiversity in general. Leaders established a number of fisheries commitments, including a call "to maintain or restore stocks to levels that can

produce maximum sustainable yield with the aim of achieving these goals for depleted stocks on an urgent basis and where possible not later than 2015."

Fulfillment of these commitments will require a great deal of cooperation at the international level. The Department of State, primarily through its Office of Marine Conservation, actively pursues sustainable fisheries worldwide at the global, regional, and bilateral levels. For example, we are working globally through the United Nations and the FAO to make sure that critical international agreements, such as the 1995 U.N. Fish Stocks Agreement, are implemented. That agreement made new strides in attempting to conserve and manage species that cross jurisdictional lines on a sustainable basis.

The United States is also an active partner in international cooperative efforts to reduce "overcapacity" in fisheries industries. In many fisheries there are simply more boats than are economically viable. The ecosystem cannot replenish the resource at the rate at which the fish are being harvested. An additional strain on fish stocks comes from illegal, unreported, and unregulated fishing. The United States helped to craft an international plan of action that encourages states and regional fisheries management organizations to use all available measures, in accordance with international law, to combat illegal fishing.

Regionally, the United States is actively engaged in efforts through regional fisheries management organizations to conserve and manage the fish stocks under their purview. In these organizations, the Department of State promotes a strong conservation agenda while also seeking to ensure that U.S. fishers receive a fair allocation of shared resources.

The Department of State also works one-on-one with individual countries to address fisheries problems. With Canada, for example, we recently overhauled a complex 1985 treaty to manage the salmon fisheries off our west coast and concluded another agreement to manage fisheries for salmon returning to the Yukon River, one of the longest transboundary rivers in the world. We have recently developed other agreements with Canada for

sharing Pacific whiting and to better regulate fishing for albacore tuna in the Pacific, and we have negotiated another treaty with Russia to protect polar bears in the Bering Sea area.

A common thread that runs through virtually all of these undertakings is the need to manage fisheries as part of the oceans ecosystems in which they occur. As difficult as it is to manage fisheries on a stock-by-stock basis, we now recognize the imperative to take account of other affected species, including those nontarget species caught as "bycatch." These are species simply caught in the nets, but not intended for harvest. These incidental catches are causing serious depletion of some species, and U.S. law now requires commercial fishers to take a variety of precautions to keep bycatch to a minimum. Still, it remains a huge challenge, even for wealthy and technologically advanced countries such as the United States. Developing countries face even a more difficult task in adopting the advanced equipment that is necessary to prevent excessive bycatch.

Broad Engagement

The preceding examples are illustrative of the broad engagement that the United States maintains with the international community on oceans issues, many of which are discussed in various bodies of the United Nations. The Department of State will participate in an upcoming U.N. informal meeting to focus on new uses of the ocean, such as conservation and management of biological diversity in areas beyond national jurisdiction and offshore energy generation. The department also participates as an observer in the work of the International Seabed Authority, established by the Law of the Sea Convention, to regulate the exploitation of minerals in the deep seabed.

We are engaged in preparatory work leading to the U.S. submission of data to the Commission on the Limits of the Continental Shelf to establish the outer limits of the U.S. shelf beyond 200 nautical miles from shore. The commission is composed of experts who review submissions from nations seeking to establish the limits of their extended continental shelves.

We also work at the International Maritime Organization (IMO) on vessel safety and vessel-source pollution. For example, in the IMO we have taken a leadership role on maritime and port security rules in order to counteract threats of terrorism. The Department of State also advocated a science-based solution to the threat of introduction of invasive species in ships' ballast water and is working to improve guidelines for the establishment of Particularly Sensitive Sea Areas.

Conclusion

For generations, humans have believed that it was beyond their power to damage the oceans or to deplete its vast resources. We now see the fallacy of this view, as mounting evidence demonstrates the human impact upon oceans. The oceans and their resources, by their very nature, are international matters, for no nation acting alone can effectively manage and protect them. It is not surprising, then, that oceans issues have risen on the international agenda and have become a key focus of the mission of the Department of State.

David A. Balton serves as deputy assistant secretary of state for oceans and fisheries in the Bureau of Oceans and International Environmental and Scientific Affairs. He previously served as director of the State Department's Office of Marine Conservation.

An Ocean Blueprint for the 21st Century

By James D. Watkins
Chairman, U.S. Commission on Ocean Policy

A commission created
by the U.S. Congress works to
draw a blueprint for a new,
comprehensive, and sustainable
ocean policy.

As the 21st century dawns, the cumulative impacts of human activities threaten the long-term sustainability of the oceans and coasts and our continued use of their invaluable resources. In the United States, we have already depleted some of our major fishery resources, lost treasured recreational areas, and damaged wetlands that help keep our water clean. In many cases we have paid dearly with lost jobs, degraded water quality, increased health care costs, and decreased revenue.

Despite these challenges, the United States and other nations have an unprecedented opportunity. Today, we understand as never before the necessity of treating the Earth, its oceans, and human life as part of a larger, interconnected system. We also have access to advanced technology and timely, high-quality scientific information. And we recognize the cumulative, detrimental impacts wrought by human influences. The stage is set for us to alter our course toward a new vision, one where the ocean is healthy and productive, and our use of marine resources is sustained and economically bountiful.

To achieve these objectives, the U.S. Commission on Ocean Policy was tasked to establish findings and make recommendations to the president and Congress for a coordinated and comprehensive national ocean policy. The law passed by the Congress specifically charged the commission with developing recommendations on a range of ocean issues, including strategies for a national ocean policy that "...will preserve the role of the United States as a leader in ocean and coastal activities." The president appointed 16 commissioners who represent a broad spectrum of ocean interests. Twelve appointees were drawn from a list of nominees submitted by the leadership of Congress, and four were appointed directly by the president.

A Startling Message

Beginning in September 2001, the commission conducted a series of 15 public meetings and 17 site visits and heard from hundreds of people across the nation—from the Great Lakes, Alaska, the Gulf of Mexico, the Atlantic and Pacific coasts, and the island territories. The commission also heard from international experts who testified on a variety of issues, including the implementation of a global ocean-observing system, the importance of ocean exploration, and the need for additional research on climate variability and predictability.

U.S. and international experts alike emphasized a common theme—major changes are urgently needed in how we manage, protect, and study the oceans, coasts, and marine resources. The message was startling and urgent.

In the fact-finding phase, we learned firsthand that the nation's existing system of ocean governance does not allow us to manage our precious natural resources adequately for today or for the future. We also learned that U.S. investments in ocean science, technology, and education are insufficient and that our national infrastructure for ocean science and technology is quickly becoming obsolete. The majority of Americans do not understand the importance of the oceans and how their own everyday activities influence the sea. There are growing concerns about science illiteracy and maintaining a sufficient, well-educated, ocean-related workforce in the future. Our hearings also made clear that the time for change is now, while it is still possible to turn the tide, reversing adverse impacts and protecting the ocean's valuable assets for future generations.

The Preliminary Report

The commission's fact-finding and deliberations are now over. We are set to release a preliminary report on April 20, 2004, as part of a two-stage process. In stage one, the report will be available for review and comment by the nation's governors and interested stakeholders. Comments are due by May 21, 2004. An electronic copy of the report and instructions for submitting comments will be available on the commission Website, www.oceancommission.gov.

Stage two begins when the public comment period closes on May 21. After reviewing the comments received from the governors and others, the commission will prepare and deliver a final report to the president and Congress. Within 90 days of receiving the final report, the president must submit to Congress a statement of proposals to implement or respond to the commission's recommendations.

The findings and recommendations of the preliminary report respond to America's cry for action, heard by the commission in talks with so many citizens concerned about the fate of the oceans. The report creates a far-reaching blueprint for change, built on action-oriented recommendations for a new ocean policy that will help ensure sustainable use of the ocean and its resources. The commission is proposing solutions that transcend local and state political boundaries and emphasize the need to move toward an ecosystem-based management approach that accounts for and addresses the interrelationships among all ecosystem components, including humans and other living creatures and the environments in which they live. The plan outlined in the preliminary report will be laid out in nearly 200 recommendations covering a diverse range of topics from governance, science, and education, to fisheries, marine commerce, and emerging offshore uses.

International Initiatives

While national policy is at the center of our report and recommendations, the commission has also taken a strong interest in the international implications of ocean policy. In fact, an entire chapter in the preliminary report is devoted to international ocean issues. In that chapter, the commission says that to influence ocean management globally the United States should start by enacting and enforcing exemplary policies at home. However, coordinated international action will also be required. To this end, the United States must work with other nations and international organizations to develop policies and mechanisms to improve all aspects of ocean governance.

The United States has long been a leader in developing and supporting international initiatives vital to the health of the world's oceans and coasts.

The United States has been engaged with the world community in activities to protect the marine environment, conserve marine mammals, implement responsible fishing practices, preserve coral reefs, and enhance port security. The international chapter of the report finds that the United States can best protect and advance its maritime interests by continuing to engage actively in international policy-making, global scientific initiatives, and programs that build ocean science and management capacity in other nations.

In particular, it is imperative that the United States ratify the U.N. Convention on the Law of the Sea (UNCLOS), the preeminent legal framework for addressing international ocean issues. (The Bush administration announced its support for UNCLOS ratification on March 23, 2004. The U.S. Senate must still vote for ratification.) Until that step is taken, the United States will not be able to participate directly in the bodies established under the convention that make decisions on issues of importance to all coastal and seafaring nations. Also, while we remain outside the convention, we lack the credibility and position we need to lead in the evolution of ocean law and policy.

The commission took up the issue of accession to UNCLOS at an early stage in its work. At its second meeting in November 2001, the commissioners heard testimony from members of Congress, federal agencies, trade associations, conservation organizations, the scientific community, and coastal states—all of whom supported the ratification of the convention. After reviewing these statements and related information, the commissioners unanimously passed a resolution in support of U.S. accession to UNCLOS. The fact that this resolution was the commission's first policy pronouncement demonstrates the real sense of urgency and importance attached to this issue.

The commission's resolution was forwarded to the president, Congress, the secretaries of state and defense, and other interested parties. The responses were positive. Secretary of State Colin Powell wrote that he shared our views on the importance of the convention, and Admiral Vern Clark, chief of naval operations, stated that he "...strongly believe[d] that acceding to this convention will benefit the

United States by advancing our national security interests and ensuring our continued leadership in the development and interpretation of the law of the sea." Our ensuing public meetings, and the additional information we have gathered, have served to reinforce the commission's conviction that ratification of UNCLOS is very much in the national interest.

The U.S. Role

However, the commission's findings and recommendations in the international area cover much more than the Law of the Sea. In the preliminary report, we lay out a number of "guiding principles." One calls for the United States to "act cooperatively with other nations in developing and implementing international ocean policy, reflecting the deep connections between U.S. interests and the global ocean." This principle is the basis for three areas of emphasis in the international arena.

First, the United States must take a leadership role in effectively shaping, implementing, and enforcing ocean policies developed on the world stage. Next, we must deepen our understanding of the world's oceans and strengthen ocean science partnerships. Third, the United States should increase its commitment to long-term capacity-building in ocean science and management in other nations through funding, education, and training; technical assistance; and the sharing of best practices and management techniques.

Based on these priority areas, the preliminary report addresses the importance of:

- meeting financial commitments associated with the treaty obligations we have accepted;
- enhancing communication, coordination, and collaboration among U.S. government agencies to strengthen U.S. performance at international negotiations and enable the nation to be more influential in shaping and executing world ocean policy;
- finding appropriate global mechanisms to ensure that emerging international ocean-related issues—marine protected areas, the loss of ice

cover in polar regions, and carbon sequestration in the ocean—are addressed in accordance with sound ecosystem-based management principles;

- integrating scientific expertise into the nation's foreign policy process, notably within the Department of State;
- strengthening international scientific partnerships for the purpose of deepening the world's understanding of the oceans.

The broad variety of stakeholders interested in ocean issues may not agree with every recommendation in the preliminary report. Some may think their particular issues did not receive adequate treatment. That is understandable and inevitable, but it should not prevent anyone from supporting the creation of a comprehensive and coordinated national ocean policy. There has been a tremendous national and international focus on marine issues over the past few years and we must not lose that momentum. This is the first opportunity we have had since the 1969 Stratton report¹ to focus national attention on the myriad ocean and coastal issues facing us and to implement a bold, new national

ocean policy that protects and sustains coastal and ocean resources for the benefit of all. The time is now and the opportunity is here—we can make positive and lasting change in how we manage our priceless marine resources. I urge everyone in the ocean community to help us carry this ocean blueprint for the 21st century forward to achieve meaningful change.

1. The Stratton report is formally known as *Our Nation and the Sea: A Plan for National Action*. The report was issued in 1969 by the Commission on Marine Science, Engineering and Resources, chaired by Julius A. Stratton. It is considered the last comprehensive examination of U.S. ocean policy.

James Watkins, chairman of the ocean policy commission, is a retired admiral of the U.S. Navy and the former chief of naval operations under President Ronald Reagan, the former secretary of energy under President George H.W. Bush, and the founder of the Consortium of Oceanographic Research and Education.

The Ocean Commission homepage is located at www.oceancommission.gov.

The opinions expressed in this article are those of the author and do not necessarily reflect the views or policies of the U.S. government.

COMMENTARY

Oceanographer Rewrites the Conventional Wisdom

An Interview with Dr. Robert Ballard
Founder and President, Institute for Exploration at Mystic Aquarium, Mystic, Connecticut

American oceanographer
Robert Ballard has played a
prominent role in deep-sea
discoveries in
geology and biology.

As this publication went to press, Robert Ballard announced that he will return to the Titanic in June 2004 for further study of the legendary 1912 shipwreck he first discovered in 1985. See the Additional Resources section for further details on the announcement made jointly with NOAA and the National Geographic Society.

Dr. Robert Ballard might be best known to the general public as the scientist who led a mission to the floor of the North Atlantic to rediscover the sunken hulk of the cruise liner *Titanic*, one of the most storied shipwrecks of all time. Ballard is also a pioneer in deep-sea science, still a fledgling discipline. He is linked to landmark scientific discoveries that overturned the conventional wisdom of their time. Ballard is also a member of the U.S. Commission on Ocean Policy that will soon issue a report proposing significant change in ocean policy. Ballard talked with *Global Issues* Managing Editor Charlene Porter.

Question: People on your staff say you've been known to wave your arm across a world map, with its vast blue expanses, and say, "All of this, we know nothing about." But you've been at this oceanography business for almost 40 years. Surely you know something?



Oceanographer Robert Ballard on the eve of his expedition to the Black Sea in June 2003. (AP/Wide World Photo/Victoria Arocho)

Ballard: We know how much we don't know.

Q: That's the question then. What's the state of oceanography today in terms of your accumulation of knowledge about the deep seas?

Ballard: In the first place, we start with the fact that 72 percent of the Earth is under water. Then, the majority of that, 80-some percent, is deep water. A large amount of that is in the high seas, beyond the exclusive economic zones of other nations. Most of it—the majority of it—is in the Southern Hemisphere. We are a Northern Hemisphere-centric civilization. With most of the water in the Southern Hemisphere, most of the land is in the north. As a result, all the wars we have fought, all the lines of commerce [are mostly in the Northern Hemisphere], the places closest to home. We tend to spend a lot of time up there.

During the 18th and 19th centuries, England had more exploratory ships in the Southern Hemisphere than we have today. We're seldom down there. There are vast stretches of ocean that have never had an oceanographic ship pass over it.

Although we're up on Mars right now, we already have better maps of Mars than we have of the

Earth's surface if we include all that undersea territory. We don't have very good [ocean] maps, particularly of the Southern Hemisphere. It's sort of ironic, for example, that Neil Armstrong and Buzz Aldrin¹ went to the moon before ocean explorers went to the biggest mountain range on Earth², which was in 1973.

As we look to where we are in exploration currently, NOAA's [National Oceanic and Atmospheric Administration] exploration budget is one-tenth of 1 percent of NASA's [National Air and Space Administration] budget. It's very much in the Lewis and Clark phase.³

Despite how little we know, how little we've explored, we've made some pretty phenomenal discoveries recently in the parts we have explored.

Q: One of those is the discovery of hydrothermal vents, the hot springs of the sea floor where magma erupts from the center of the Earth to form new oceanic crust and lends heat to the coldest depths of the sea.

Ballard: I was chief scientist of that expedition in 1977, working with a wonderful team from the Woods Hole Oceanographic Institute, Oregon State University, and the Massachusetts Institute of Technology.

Q: In addition to the geologic discovery of the vents, describe the surprising biologic discovery—deep-sea life forms never previously seen.

Ballard: The irony was we weren't even looking for them. It was serendipity. We didn't even have a biologist on the expedition when we made the largest, most important discovery made on Earth. We weren't even prepared for the discovery. Imagine how much is out there that we aren't looking for that will have comparable repercussions.

Prior to that discovery we didn't understand the chemistry of the world's ocean. We couldn't explain why the ocean was salty. Until we discovered there was a whole other circulation system; in addition to the hydraulic cycle, there was a hydrothermal cycle that we were not aware of. Now we are aware that the entire volume of the world's oceans goes inside the Earth through a hot system every 6 to 8 million

years. Once we discovered that system—and understood the magnitude of it—and once we began to look at its chemistry, we were finally able for the first time in the 1980s to balance the equations. We could do the mathematic calculations and finally explain why the ocean is salty.

At the same time, we made the discovery of the circulation system—which we were looking for—we made this biologic discovery of this whole new system that was not based upon the Sun through the process of photosynthesis. That's what we were all taught in the textbooks: life on Earth is due to the Sun, and the Sun sends its photons through space, and they're captured by the chlorophyll of plants, and plants are the basis of the food chain, and up, up, up through the orders of life until you get to humans.

Now we realize there is a whole other system, a system based on extremophiles, that is, bacteria living in very hostile environments, that are able to replicate photosynthesis in the dark chemically. It was huge, huge.

Q: What was it like to be in the midst of a "Eureka!" moment like that?

Ballard: It was amazing. We were stunned. We were flabbergasted. We were just trying to comprehend it. It was really a moment when you felt somewhat insane, or like you were hallucinating until it started to sink in what you'd discovered.

Now it helps us understand the origins of life on Earth. It's also helping us in our prospecting for life on Mars, and our future prospecting for life on the moon of Jupiter, particularly Europa where we think there's an ocean under an ice canopy and there could be life.

So all of a sudden, it changed the rules of looking for life elsewhere. All of a sudden, there were many more possibilities than we previously thought. We found that life is much more resourceful, much more robust than we ever thought. It totally reshaped our thinking in a very dramatic way.

I've been lucky to be involved in several major "gotchas" [discoveries that contradict accepted science]. Plate tectonics was certainly one of them

with our first dives to the mid-ocean ridge in the early 1970s, followed by the discovery of hydrothermal vents in 1977, followed by the discovery of black smokers and the major mineral deposits in 1979. Then I went on to human history with the discovery of the *Titanic* and a number of things after that.

So it's been really a great adventure, and I can't wait for the next one, and I'm confident that it's out there.

Q: When you experience a moment like that—when you see the conventional wisdom upended—do you continue to question the conventional wisdom in all your work after that?

Ballard: Absolutely! Science is a work in progress. Everything I was taught as a geologist in undergraduate school was shown to be wrong later on. The textbooks were absolutely, categorically wrong. First we threw out the geology textbooks. Then we threw out the biology and chemistry textbooks, and now we're starting to throw out the anthropology and archaeology textbooks.

Q: You refer there to the recent work you've done in underwater archaeology in which you've found ancient shipwrecks in the Mediterranean and the Black seas. What conventional wisdom is overthrown with those discoveries?

Ballard: The fact that the wrecks are out there at all. The conventional wisdom was that ancient mariners hugged the coastline. We're finding that to be balderdash. We're finding that they went far out to sea. We're just beginning to see how adventurous they were. We're also finding the wrecks to be in high states of preservation, which also defies conventional wisdom that they wouldn't be intact.

Q: You call these shipwrecks "museums of the deep." Why? What can they tell us?

Ballard: They are time capsules. We now think there are 1 million ships of antiquity in the ocean.

Q: On what basis do you make that estimate?

Ballard: Through estimates made by scholars on the loss of ships through time. Remember societies have

been going to sea for thousands of years, particularly the Romans. They kept very good records, and you get a sense of the mortality. They had about a 10-percent ship loss; then you spin that out over thousands of years. Then you look at sea battles where they lost a thousand here and a thousand there. It starts to really add up. Even if I was only half right, half a million is still a lot.

Shipwrecks are pure moments in time; they are time capsules. Whereas you go to an archaeological site on land, and you begin digging and there's someone on top of someone on top of someone. The last culture borrowed from the previous one. They commingle. It gets complicated to figure out what's going on.

A ship sank on that one day, and its shipboard society of that moment went into a museum on the ocean bottom. We were in the Black Sea this summer where there's no oxygen, and what we're discovering now is that the ships are perfectly preserved, and we suspect we're going to start pulling out absolutely, perfectly preserved humans.

Q: How will they inform our understanding of who we are today and where we came from?

Ballard: That's the point. They will, but we don't know until we open the time capsules and read them. It's a work in progress.

This hasn't happened yet, but say we find Phoenician shipwrecks off Brazil. What would that do to our thinking? What will those discoveries be? You won't know 'til you do it.

Q: So ancient shipwrecks could redefine our entire understanding of world history and civilization?

Ballard: We're going to better define who these people were. We'll pull their bodies out, and perform DNA testing. We'll find out who the Phoenicians were. Who were the Minoans? We don't know.

So the discovery of these ancient mariners is going to change our thinking.

Q: The technology has been progressing rapidly in recent years so that oceanographers can reach the

depths where these discoveries are made. What further advances do you foresee in that arena?

Ballard: The thing we're moving forward is what we call "telepresence remote accessing." We see, for example, the *Titanic* or some of these shipwrecks becoming wired as museums in situ. We see the ocean being wired, whether it's for monitoring earthquakes or volcanic activity or environmental monitoring, or whether you're creating underwater battlefields, underwater memorials, and underwater museums that are accessed via Internet 2. Internet 2 is a new technology that's revolutionizing remote accessing and telepresence, and we're in the middle of all that. We see Internet 2 as a tremendous empowerer of people able to go to remote areas without having to physically go, and the whole evolution of the technologies of autonomous vehicles is cutting-edge. We're on all those cutting edges. That's where the action is and that's going to continue to accelerate the process.

Q: Another project to which you're very committed is education. We've been talking for some years in this country about the need to improve science and math education. How is that effort going from your perspective?

Ballard: The way of educating, motivating, and captivating youngsters needs to be very different. Utilization of technology that puts a student in direct contact with the scientist in the battlefield is the way to go. That's what the JASON Project⁴ does. We have 1.7 million children in our program; we have 38,000 teachers.

Q: You launched the JASON Project after receiving heaps of letters from young people asking, "How did you find the *Titanic*?" How does the project involve kids in oceanography?

Ballard: They go out in the field. You bring students and teachers into the field with you and—with this telepresence technology—they then become the surrogates connected to the classroom teacher and classroom student. They are then interacting on a peer-to-peer level—student-to-student, teacher-to-teacher—with a scientist who is in an exciting frontier. The learning environment is so much more engaging for kids, in contrast to a static interaction with a scientist in a laboratory or material in a textbook.

Textbooks? Forget them. Throw them away. They're out of date by the time they get into the students' hands. As the rate of information advances today, a textbook becomes a history book. You can't use that traditional form. You have to have curriculum that's dripping wet, that you just wrote, that's almost news. When it becomes news, it becomes exciting. So when you get it in that kind of format, it's in keeping with the way our society is moving, the way entertainment and news are paced. It's very energized, more so than it's ever been. People want to be where the action is—bam-bam-bam—want to know, get on the Internet—boom-boom-boom. In that kind of social atmosphere, you can't expect the old classroom methods to work anymore.

Q: That's how you want to get youngsters interested in oceanography. What about adults? Do you find that the general public doesn't really share your sense of wonder and discovery about what's out there?

I think it's more of trying to get people to realize how little we know about our own planet. It's an assumption that we know it. "Now that we've got Earth all figured out, let's go to outer space," is what people are thinking. I have to say, "No, no, no. We don't have Earth done."

It's hard for that to sink in. People think that since we know where all the land is, that's it. The land is only 28 percent. That's our biggest challenge.

1. Astronauts who first walked on the moon in 1969.
2. The Mid-Atlantic range is more than 12,000 kilometers long, stretching almost from the North to the South Pole.
3. Meriwether Lewis and William Clark explored America's unsettled northern wilderness in 1804-1806.
4. Begun by Ballard in 1989, the JASON Project is a multidisciplinary education program that enhances the classroom experience. It takes its name from the mythical Greek hero Jason, who explored the seas on a ship called the *Argo*.

The Institute for Exploration homepage is available at <http://www.mysticaquarium.org/ballard/home/>.

The JASON Project homepage is located at <http://www.jasonproject.org>.

Explorer and scientist Robert Ballard is a National Geographic explorer-in-residence, a professor of oceanography at the University of Rhode Island, and the author of 18 books.

The opinions expressed in this article are those of the subject and do not necessarily reflect the views or policies of the U.S. government.

Saving Louisiana's Delta

By Kathleen Babineaux Blanco
Governor, State of Louisiana

The Mississippi River basin, the largest in North America, empties into the ocean at the Gulf of Mexico after passing through a delta wetland that is also among the largest in the world. Complex interrelated factors of land and water use have created serious ecological problems in the delta that state officials work to correct.

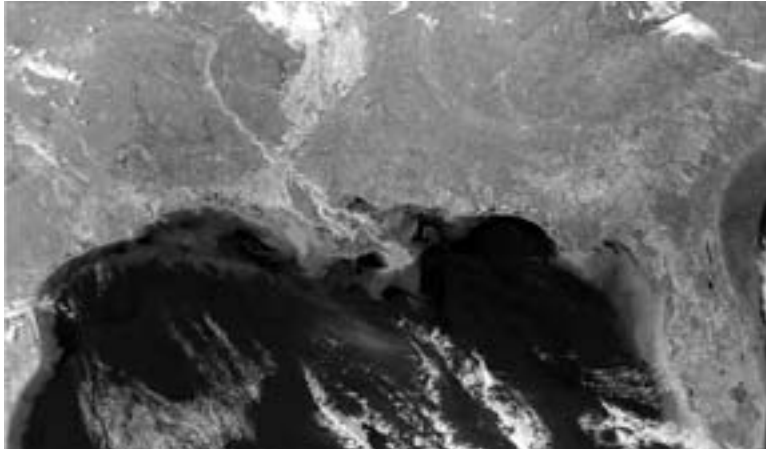
When I became governor of Louisiana in January, our state faced many challenges, among them the need to maintain momentum and sustain ongoing initiatives critical to our people. A good example is our continuing efforts to combat the state's coastal land loss of 62 square kilometers a year, through natural and man-made causes—a loss that has local, national, and global impacts.

Our coastal restoration program is at a critical juncture. State and federal officials are grappling with how to fund a complex restoration effort that will ultimately cost billions of dollars and with how to craft a short-term plan that will begin to implement a long-term effort. I'll share some initiatives with you that are proving successful, but first I'd like to put in context the urgent challenges we face.

Ecological and Economic Impacts for the Nation and the World

The vital wetlands along Louisiana's coast are truly "America's Wetland," one of the largest and most productive expanses of coastal wetlands in North America. This vast landscape represents more than 90 percent of all coastal saltwater marsh loss in the continental United States. During the past 50 years, we have lost more than 5,000 square kilometers of land. In the next 50 years we will lose almost 2,500 more square kilometers if nothing is done.

Louisiana's wetland, the seventh-largest delta on Earth, is of global ecological significance. This intricate ecosystem has enormous environmental consequences for wildlife habitat and marine life. It is also a working wetland, hosting production and distribution of 80 percent of America's offshore oil and gas supply. Almost 30 percent of all oil and gas consumed in the United States comes across



The Mississippi River watershed runs straight through Louisiana, center, and into the Gulf of Mexico. Florida is at right; Texas is at left. (NASA/Goddard Space Flight Center)

Louisiana's shore by tanker, barge, or pipeline and it is from this area that distribution of energy for the entire eastern United States begins.

As the protective wetlands and barrier islands disappear, oil and gas infrastructure along the coast becomes exposed to open conditions in the Gulf of Mexico. Wells, pipelines, ports, roads, and levees become more vulnerable, and the potential for damaging oil spills increases. As these conditions worsen, the environmental damage in the event of a hurricane or storm may be catastrophic, and the nation's economic and energy security is put at risk as the probability increases for interruption of oil and gas production and distribution.

Protection for the Nation's Ports, Cities, and Inland Waterways

The Louisiana wetlands serve as protection from hurricanes and storm surges for more than 2 million people living in the coastal zone, including the city of New Orleans, and they act as a buffer for the number-one port system in the United States, responsible for moving the nation's goods to world markets. The navigation corridors and port facilities for commerce and national defense are valued at more than \$15 billion annually.

Dead Zone, Nursery Ground, and Wildlife Habitat

Louisiana's wetland accepts the drainage of two-thirds of the United States through the Mississippi

River, along with high concentrations of nitrogen from agricultural runoff. This abundance of nitrogen supports excessive algal growth, which depletes oxygen in the water to the point where other life forms cannot survive. It's a condition called hypoxia and creates what the scientists are calling a "dead zone." These lifeless stretches of water are showing up in oceans all over the world, but the one in the gulf, offshore from my state, now measures more than 18,000 square kilometers.

More than 30 percent of the nation's fisheries catch in the continental United States comes from offshore

Louisiana. Our delta is the natural nursery ground for much of the country's seafood, with 95 percent of all marine life in the Gulf of Mexico spending part of its life cycle in these coastal wetlands.

These wetlands also are located on the migratory flight paths of millions of waterfowl and songbirds that find winter habitat on the Mississippi and Central flyways. As the wetlands disappear, habitat is lost, threatening national refuges and putting numerous threatened and endangered species at risk.

Causes of Loss

A combination of both man-made and natural causes is contributing to the loss of coastal land. In many ways, Louisiana's wetland suffered the unintended consequences of federal policies made without awareness of long-range environmental impact. The following factors have come into play:

- In the 1940s, the federal government built levees along the Mississippi River to provide flood protection for cities and ports and to channel the river for navigation and transportation. The river's fresh water was cut off from the wetlands. As a result, the nutrients and sediments that had replenished and rebuilt the wetlands since their formation now pours out into the Gulf of Mexico and off the continental shelf.
- This is an organic coast made of vegetative matter that easily erodes, leaving nothing but

open water. Various forms of marine life begin their life cycles in this vegetative matter, so this loss of coast is also a loss of habitat. Natural subsidence of the coast has been occurring since the beginning of this delta's formation millennia ago. Before the levees were put in place, the river was able to replenish and rebuild to counteract these natural losses.

- When offshore oil and gas exploration and development began in earnest in 1947 with the first offshore, out-of-sight-of-land well drilled near Morgan City, Louisiana, the first pipeline canal was dug through Louisiana's coastal wetlands. Since that time, canals that carry more than 38,000 kilometers of pipeline come across Louisiana's shore, anchored on its barrier islands, then on to distribution points to supply a fuel-hungry nation with its energy. These pipeline canals, along with navigation canals, exacerbate the wetland loss. North-south canals allow salt water and stronger tides into fresh marshes. East-west canals and levees hold excess water on the marshes and swamps.

- Hurricanes and storm surges do untold damage to the wetlands. As these events occur, the protective ability of the wetlands continues to diminish.

Pay Now or Pay Later

The Louisiana delta is a prolific area that is of vital importance to the nation and the world, yet few people are aware of the benefits of the ecosystem or of what is at stake if we continue to lose ground. If nothing is done, the economic and ecological consequences will have repercussions for generations to come. To rehabilitate the ecosystem and sustain its assets will cost billions of dollars and will require continuing support from federal and state governments. The cost of not acting with deliberate speed has been estimated at more than \$100 billion in infrastructure alone.

Solving the Problem

Louisiana and its federal partners developed a plan for restoring coastal Louisiana through the Coastal Wetlands Planning, Protection and Restoration Act (CWPPRA) in 1990. The state and five federal

agencies led by the U.S. Army Corps of Engineers, together with scientists, local governments, environmentalists, landowners, industry representatives, recreational and commercial fishermen, and concerned citizens, reached unprecedented consensus on a blueprint for coastal restoration known as Coast 2050.

The main strategies of Coast 2050 are watershed management, such as river diversions and improved drainage, and watershed structural repair, such as restoration of barrier islands. It exceeds in scale, complexity, and geographic extent the effort currently underway to restore the Everglades in the state of Florida.

Although CWPPRA has been providing about \$40 million a year for coastal restoration efforts, the complexity of the problem will require larger projects than current funds allow. The restoration of America's Wetland is predicted to become the largest engineering project ever attempted in the world.

The Call to Congress

CARA

In the recent past, members of Louisiana's congressional delegation have advocated legislation—the Conservation and Reinvestment Act (CARA)—to reinvest revenues earned from the depletion of nonrenewable assets (oil and gas reserves on the outer continental shelf) in conservation of renewable resources, including the restoration of coastal wetlands. This type of legislation is particularly important to Louisiana since the great majority of the nation's offshore oil and gas revenues come from offshore Louisiana, and since the wetlands that protect that distribution and production is being lost at such a dramatic rate. This legislation is still pending before the Congress.

Energy Legislation

Energy legislation also currently pending in Congress would provide funding to states with oil and gas production off their coasts to secure critical energy infrastructure facilities from human or natural threats, to support public service or transportation activities needed to maintain the

safety and operation of energy infrastructure facilities on the outer continental shelf, and to restore coastal wetlands, which provide protection from open gulf conditions. However, direct spending provisions, which would have provided a steady stream of funding to states to sustain restoration efforts, were recently stripped from the bill. Louisiana is urging Congress to reinstate those provisions.

Water Resources Development Act (WRDA)

Congress is presently considering a 2004 WRDA bill that would include ecosystem restoration in Louisiana. In partnership with the Army Corps of Engineers, my administration is crafting a provision that would authorize the first phase of a longer term plan, which would establish an ongoing science and technology program to support restoration efforts, construct near-term projects, and continue studies on longer term, more complex strategies.

Sustaining the Effort and Momentum

Several mechanisms have been put in place to ensure continuity in Louisiana's coastal restoration program: public-private and state-federal partnerships, a coastal commission that advises the governor, a state and national public awareness initiative to spread the word about Louisiana's land loss and its consequences, and a nonpartisan approach to solutions.

- As mentioned earlier, the state-federal partnerships forged by CWPPRA over the past 13 years have proven powerful in forging relationships with agencies and programs, relationships that are critical to our ability to sustain coastal restoration efforts.
- The Governor's Advisory Commission on Coastal Restoration and Conservation includes 31 members who represent different coastal stakeholder groups, including industry, national and local environmental groups, local and state

governments, landowners, fisheries interests, ports, agriculture, business, science and technology interests, higher education, and others. Commission members serve staggered terms, thus spanning different political administrations. They work together through controversial issues to forge compromises. The commission meets monthly and is briefed on every aspect of state-federal efforts, and it will play an important role in helping the state legislature and our citizens understand the need to pay our fair share of the cost of this vital restoration effort.

- It was recognized several years ago that most Americans were not aware of the land loss occurring on Louisiana's coast, nor of the vast benefits the nation and world derive from these working wetlands. After seven months conducting research and focus groups, the state launched America's Wetland: Campaign to Save Coastal Louisiana, a national and statewide public awareness effort that is focusing on the global ecological significance of this area and the impact it has on the nation's economic and energy security.

Louisiana will continue its fight to save this valuable landscape for future generations and welcomes you to join our efforts. I urge you to visit the campaign Website, www.americaswetland.com. It is a wealth of information, with links to government Websites that detail restoration efforts and partnerships. If you would like more information or have questions, please call the Louisiana Office of Coastal Activities at 225-342-3968.

Kathleen Babineaux Blanco, the first female governor of the state of Louisiana, began serving a four-year term in January. She has been serving in public office for 20 years.

The opinions expressed in this article are those of the author and do not necessarily reflect the views or policies of the U.S. government.

The Chesapeake Bay: Lessons Learned from Managing a Watershed

Ann Pesiri Swanson
Executive Director, Chesapeake Bay Commission

A 25-year campaign to reverse ecological damage in the United States' most significant estuary has resulted in environmental improvements and important lessons on how to manage a complex water system.

The Chesapeake Bay, the largest and most productive estuary in the United States, has often been referred to as the "crown jewel" of the nation's 850 estuaries. Located midway along the east coast of the United States, it extends 290 kilometers from the tidal reaches at the mouth of the Susquehanna River in Maryland to Cape Charles, Virginia, where it meets the Atlantic Ocean. It cuts across virtually the entire north-south length of these two states helping to define their landscape, their cultures, and their economies.

The Chesapeake Bay contains a highly complex range of aquatic environments, from fresh water to nearly full-strength seawater, allowing a broad spectrum of organisms to flourish. It has complicated physical circulation patterns that vary with changes of season, tide, and weather. Outside of its boundaries, adjacent or sometimes remote ecosystems influence the Chesapeake Bay, contributing to its remarkable complexity.

The abundance and diversity of the bay, enjoyed by fishermen, boaters, and nature lovers for centuries, created the false belief that the Chesapeake could withstand any abuse at the hands of humans. By the 1970s, the impact of unrestrained harvests and decades of neglect had sharply impaired the Chesapeake's health and productivity. Efforts to address these problems and begin a recovery started taking shape in the mid-1970s, roughly the same time that a wider environmental consciousness was dawning in the United States as a whole.

Research conducted at that time led to a genuine turning point in understanding the relationship between human beings and the estuary. Land use practices were found to be inextricably linked to the waters of the Chesapeake Bay. Thus, the two must be studied and managed as one.

Through the 1980s, a region-wide plan for improving and protecting water quality and the living resources of the Chesapeake was negotiated with the cooperation of all the jurisdictions and agencies that had a stake in protecting the bay. They included the governments of neighboring jurisdictions—Maryland, Virginia, Pennsylvania, and the District of Columbia, along with the federal government in the form of the U.S. Environmental Protection Agency (EPA) and a tri-state legislative commission known as the Chesapeake Bay Commission.

These six leaders formed the Chesapeake Bay Program and made commitments to improve the management of fish and wildlife, restore water quality, plan for development, increase public awareness and access, and promote intergovernmental cooperation. With these steps they created a unique regional institution, guiding and coordinating bay-related activities of hundreds of federal, state, local, and interstate government agencies, and working with dozens of nongovernmental business, civic, and environmental organizations as well.

The complexity of this man-made agreement to save the bay is minor contrasted with the complexity of the resource itself. With a width of between six to 50 kilometers, the water surface of the tidal Chesapeake covers 6,475 square kilometers. The Chesapeake's 165,760-square-kilometer watershed encompasses part or all of six states and includes a variety of geologic formations, from the flat coastal plains to the forested mountains of the mid-Atlantic region, with the fertile, largely agricultural piedmont in between.

The bay receives most of its fresh water from about 50 major tributaries and thousands of streams, creeks, and ditches penetrating its sweeping watershed. Eight of these 50 rivers contribute about 90 percent of the fresh water contained in the main stem of the Chesapeake Bay.

A Huge Drainage Basin

But even describing the bay in the context of a watershed does not fully describe the land's influence on its waters. The Chesapeake Bay, compared to other bodies of water, has a huge drainage basin for the amount of water it contains, a ratio of

2,743 square kilometers of land for every one cubic kilometer of water. The principle reason is the Chesapeake's extreme shallowness—its average depth is only seven meters, with 75 percent less than three meters.

This shallowness contributes to its amazing productivity. The bay is home for more than 3,200 species of plants and animals, from tiny creatures wallowing in the marsh mud to giant bald eagles, which have made an awe-inspiring comeback around the Chesapeake region. Some 250 types of fish, crabs, clams, and oysters live in the bay—many in extraordinary numbers. Together, they have a commercial value of more than \$1 billion annually. Half of the national catch of the Atlantic blue crab is harvested from bay waters. Based on a catch of 36 million kilograms in a good year, it equates to between 150 and 240 million individual crabs. Of the nation's soft shell crab catch, 90 percent is taken from the Chesapeake.

This productivity remains under constant threat from the pressures of population, pollution, and development that surround the bay. The Chesapeake acts as a giant catch basin for everything that drains from its massive watershed.

Today, much of the bay's watershed lies in some of the fastest developing regions of the United States and is at the southern end of an area of intense urban development from Washington, D.C., to New York to Boston. Two of the country's five major North Atlantic ports—Baltimore and Hampton Roads—are on the Chesapeake, and more than 10,000 ocean vessels ply its waters each year.

Close to 16 million people live in the watershed that drains into the Chesapeake. Thousands of municipalities, farms, and industries use water from the bay and its tributaries to do everything from irrigate crops to cool nuclear reactors. The same entities in some cases also use the bay as a place to dispose of treated waste.

It is estimated that 5.7 million liters of treated sewage flow into the bay each day from more than 5,000 sources. This does not include the soil, fertilizer, and pesticides running off the farms. By their very nature, pesticides are toxic, while heavy amounts of the nitrogen and phosphorus in fertilizer



The Chesapeake Bay, center, is on North America's mid-Atlantic coast. Rivers throughout the region drain into the bay, which empties into the Atlantic Ocean. (NASA/Goddard Space Flight Center)

set off an aquatic chain reaction that ultimately chokes out underwater grasses, the spawning ground for a variety of aquatic life.

The influences of human activity around the bay permeate the ecosystem and have inalterably changed it. The Chesapeake Bay Program recognized that restoration of the bay depended upon reducing the levels of nutrients pouring into the bay, and jurisdictions set targets for reversing the damage done by fertilizers.

The Chesapeake Bay Program is currently guided by an agreement among its partners called Chesapeake 2000: A Watershed Partnership. It couples hard-hitting, specific, and often deadline-driven goals with the clear cry for the participation of all—public and private sector alike. Without that partnership, the bay simply cannot be saved.

Chesapeake 2000 takes an aggressive stance by calling for the reduction of sediments as well as nutrients, ambitious recovery goals for oysters and subaquatic vegetation, a sustainable crab catch, a measurable decrease in the rate of conversion of farms and forests to developed lands, the permanent

preservation of 20 percent of the watershed's land, and more effective community-based stewardship of the bay's rivers and subwatersheds.

Requirements of Success

Success in reaching the goals requires a substantial investment of time and money from every citizen in the watershed. It requires incentives to promote proper environmental management practices. It requires upgrading waste treatment to prevent the influx of nutrients. It requires using less fertilizer on farm fields and building ponds, pits, and other protections against nutrient runoff. It requires developing our landscape in more environmentally sensitive patterns. It requires levying heavy fines against scofflaws who continue to pollute. The current restoration effort attempts to seek a balance whereby the human population can prosper while the native fish and

wildlife are provided with the ample habitat, clean water, and harvest restrictions sufficient to sustain their populations.

A quarter-century has passed since the EPA began its research on the Chesapeake Bay and the multi-jurisdictional management effort was launched. We now have declining or at least leveling nutrient loads in spite of a growing population in the watershed. There has been restoration of some commercially important resources like the striped bass. There is an increased environmental awareness on the part of our citizenry that many visitors to our region quickly observe.

Much has been accomplished, yet many more challenges lie ahead. In our almost quarter-century campaign to improve environmental quality in this resource, the commission has learned some key lessons. Some of these lessons may be transferable to other large-scale environmental management and restoration efforts.

1. Begin with comprehensive scientific studies that combine theory, detailed knowledge, monitoring, and modeling. Comprehensive

coastal management programs must be based on the best available science and technology.

2. Involve the highest levels of leadership possible. High-ranking political figures in each participating jurisdiction should be visibly involved in a coastal management program. Only these officials have the authority to endorse and implement policies developed by the program infrastructure.

3. Embrace clear, strong, specific, comprehensive, and measurable goals. The commitments should be realistic, but they should also challenge the programs to implement significant change. In addition, they should form the basis for periodic reevaluations of progress.

4. Encourage the participation of a broad spectrum of participants. Ecosystems like the Chesapeake's are extraordinarily complex, and managing them requires a complex array of representatives from all levels of government, the private sector, science, and the general public.

5. Provide incentives and methods for institutional cooperation. Behavioral change, such as the implementation of a phosphate detergent ban in the Chesapeake region, can have a huge multiplier effect. Effective coastal management cannot reside solely with governmental agencies and nongovernmental organizations.

6. Inform and involve the public. An informed and vocal public is the policy makers' greatest ally. Over two-thirds of the world's population lives close to a coastal sea or great lake. In addition to formal announcements and newsletters, nations can take advantage of their education infrastructure to teach ecological principles and environmental stewardship to the next generation of citizens.

7. Balance management strategy with available resources. No coastal management program will be successful if it exceeds available financial resources. When choices must be made, combating known sources of pollution

must be the immediate goal. Most programs begin with point sources: improving wastewater treatment or regulating toxic discharges. However, the phosphate detergent ban taught us not to ignore the opportunities for large-scale change that are possible by changing peoples' behavior.

8. Choose pollution prevention before restoration or mitigation. Restoration of a polluted waterway or habitat is a complex, expensive process. In the bay region, the prevention of pollution at its source has repeatedly proven to be the preferred approach, and a regional consensus to achieve that goal must be built.

9. Test scientific theories and management approaches on a small scale. In many cases, small-scale project testing can be melded with local jurisdiction program development. This provides for development of partnerships and encourages more participants to become vested in the demonstration project.

10. Focus on integration of the work of government agencies. Integration requires the cooperation of diverse players who are often worlds apart. It involves constant communication and collaboration of multiple agencies at numerous levels of government to assure that activities complement, rather than conflict or duplicate. We strongly recommend that a coastal program provide for the integration of management, science, and citizen stewardship as a critical first step.

11. Regularly reassess goals and progress. Periodic assessments involving the full range of stakeholders should be undertaken to gauge progress toward goals. That process must also allow for changes in goals or the establishment of new ones as a result of advances in research.

12. Demonstrate and communicate results. Measuring progress and publicizing results are key to sustaining leadership commitment and public support. Honesty, even when the findings are disheartening, is critical. The frequent and open sharing of information—whether good or bad—has been essential to

maintaining the trust and commitment of the stakeholders involved.

Conclusion

The Chesapeake Bay Program was officially launched in 1983. Since that time, its efforts have held the line on nitrogen and achieved a 20-percent reduction in phosphorus in the Chesapeake Bay. The outlook remains optimistic. We are, at the very least, stabilizing our pollution loads and are beginning to see significant improvements in many of our rivers. We have seen demonstrable gains in the ways we manage land, provide fish passage, restore sea grasses, manage fisheries across state lines, and ban the use of toxic chemicals known to have an impact on our ecosystem.

Through the course of these achievements, the bay program has undergone its own evolution. What began as a water-quality program has grown to involve integrated management of land, air, water, and living resources, including humans. Ecology, sociology, and culture all play a role in the

commission's decision-making and management. We must constantly look for new and creative approaches to managing our resources, integrating and financing our programs, structuring our agencies, and soliciting our citizens' support.

This article was abridged and adapted from a report the author prepared in 1997 and updated in 2003. It is available online at www.chesbay.va.state.us. More information about the Chesapeake Bay Commission is available at <http://www.chesbay.state.va.us/home1.htm>.

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The opinions expressed in this article are those of the author and do not necessarily reflect the views or policies of the U.S. government.

Communities Around the Globe Protect the Underwater World

By Brian Huse
Executive Director, Coral Reef Alliance

Marine conservation partnerships between community officials, dive operators, snorkellers, students, and other aquatic enthusiasts have developed around the world to protect ocean resources.

Every year in April, in recognition of Earth Day, the Coral Reef Alliance (CORAL), a San Francisco-based environmental organization, rallies tens of thousands of people from across the globe to focus on a common cause: protecting the planet's oceans, coral reefs, and aquatic ecosystems. The program, "Dive In To Earth Day," was designed to ensure that the underwater world is not forgotten and becomes an integral part of the annual Earth Day campaign.

Hundreds of volunteers organize and participate in activities to protect their local aquatic environments and raise awareness of the need for marine conservation. Organizers come from all walks of life and every corner of the planet: elementary school students in the Cayman Islands organize beach cleanups; scientists in China conduct reef surveys; environmental organizations in the United States hold fundraising events for marine parks; and dive businesses in Indonesia install mooring buoys. Although most activities occur around Earth Day, April 22, the program has resulted in successful year-round marine conservation in communities throughout the world.

History and Need

CORAL launched Dive In To Earth Day in 2000 to commemorate the 30th anniversary of the first Earth Day, April 22, 1970. On that historic day, 20 million Americans gathered on the streets and in parks and auditoriums to demand a healthy and sustainable environment. That landmark event led to the creation of the U.S. Environmental Protection Agency and the passage of the Clean Air, Clean Water, and Endangered Species acts. It also marked the beginning of the environmental movement as we know it today. Earth Day is now celebrated by hundreds of millions of people in nearly every country, and it is a driving force for environmental awareness around the globe.



A diver explores a coral reef in the Red Sea, near Egypt's Brothers Islands. (Photo courtesy Mary L. Frost)

Coral reefs have more species per unit-area than the densest tropical rainforests, and they provide habitat to 25 percent of all known marine species. They are the primary source of food and income for millions of people, produce valuable chemical compounds for medicines, and provide natural barriers that protect beaches and coastlines from storms and waves. Yet, according to recent estimates, 11 percent of the world's coral reefs have already been lost; another 16 percent have been severely damaged; and scientists predict that 32 percent may be lost in the next 30 years if human threats are not reduced.

Dive In To Earth Day was seen as an opportunity to build on the success of the global Earth Day campaign to raise awareness of the urgent need to protect coral reefs and the underwater world. The program was developed in support of CORAL's mission to work with communities around the world, helping to identify and solve coral reef conservation challenges and to change attitudes and behavior through education. As global awareness of the value of coral reefs increases, so will efforts to reduce current threats.

Prior to 2000, CORAL had noticed a significant lack of marine conservation activities during the Earth Day celebrations. Most activities focused on land-based environmental issues, such as deforestation and pollution. There seemed little emphasis on the impact of these problems on the underwater world, even though more than 70 percent of the planet is covered by water. Aquatic ecosystems are under increasing threat from coastal development, overfishing, destructive fishing, pollution, climate change, and a host of other human impacts.

Coral reefs rank as one of the most diverse ecosystems on the planet and one of the most threatened. Only recently have we begun to understand their role in the health of the oceans.

With the support of partner organizations including Project AWARE Foundation, Environmental Defense, Reef Check, REEF, the International Coral Reef Action Network (ICRAN), and the Ocean Conservancy, CORAL launched the first ever Dive In To Earth Day in April 2000, and it was an immediate success. Dive In reached out to tens of thousands of people across the planet. In just four years, 874 organizers in 83 countries and territories around the world coordinated local activities. More than 70 percent of Dive In activities focused on protecting the world's threatened coral reefs. By 2003, Dive In To Earth Day generated more than 20 percent of all registered Earth Day activities worldwide, reaching out to many small island nations and territories that had never before participated.

Community Partnerships

Dive In To Earth Day brings together different stakeholder groups, stressing the need for collaboration to effectively protect marine resources. The events have generated new conservation partnerships in which environmental groups and marine protected areas team up with local communities, dive operators, snorkellers, students, and other aquatic enthusiasts. Dive In helps build connections between these different stakeholders and their local marine environments, and it provides the impetus for them to take stewardship of their waters, often well beyond the April festivities.

Dive In activities generally fall under four categories: education and awareness; threat reduction; research and monitoring; and support of coral parks.

Education and Awareness

A majority of Dive In activities focus on educating the public about pressing coral reef and marine conservation issues. In 2003, 75 percent of the organizers felt their Dive In activities educated participants about threats to coral reefs, coral reef ecology, low impact diving, and the importance of marine conservation. Moreover, 58 percent said their activity motivated people to become more involved in coral reef conservation.

Maureen "Mo" Riggs runs a resort in Kadavu, Fiji. Although her business keeps her busy, Riggs decided to organize a Dive In activity for children in the village. With enthusiasm and creativity, she arranged a full week of activities, bringing together 70 children and teenagers to collect litter, discuss recycling, and go snorkeling and kayaking. "The most rewarding aspect for us," Riggs reported, "was the incredible enthusiasm from all the children that participated in the recycling discussions and the energy they exerted in all the activities."

In Guam, the high school club "Marine Mania" participates in Dive In each year. The group has a

Between 2000 and 2003, Dive In To Earth Day participants collectively removed an estimated 238,140 pounds of trash from oceans and shorelines around the world.

special interest in helping sea turtles, which are threatened locally by coastal development and marine pollution. The small group organized a benefit dinner, invited guest speakers, and showed videos on the plight of Guam's sea turtles, donating the proceeds to local sea turtle research and protection efforts. The following year, the same group posted warning signs beside storm drains at various locations across the island to educate residents about the hazards of dumping oil, chemicals, and debris into storm drains that lead directly into the bays and the ocean.

Threat Reduction

Many Dive In activities actively reduce a specific threat to their waters, such as anchor damage or pollution. Between 2000 and 2003, Dive In participants collectively removed an estimated 238,140 pounds of trash from oceans and shorelines around the world.

In Bali, Indonesia, the scuba diving industry is large and varied, with limited communication between businesses. The dive operators recognized the need to work together to address threats to local reefs from anchor damage, destructive fishing, land- and marine-based pollution, and sedimentation from coastal erosion. The dive operators met in January this year and decided to use Dive In To Earth Day as motivation to take action. They formed a "Dive In Bali" committee, and plans are now underway to install a series of mooring buoys at various dive sites on the island to prevent anchors from damaging fragile corals. The committee is also preparing to hold a community awareness festival, underwater reef cleanup, and slide show at a village elementary school.

On the other side of the planet, in Port St. Lucie, Florida, Lee Hedrick holds an annual Dive In party for volunteers in her community. In 2003, approximately 70 participants cleaned hundreds of pounds of trash from her local beach, removed fishing line from local dive sites, and learned about

the need to protect reefs. Hedrick provided participants with a barbecue dinner and raffle prizes. "We found that if you communicate the need to help conserve and protect the coral parks, oceans, and beaches in a fun and casual atmosphere, more people are curious to know and see," Hedrick said. "Then they offer their help, which leads to knowledge and more understanding of why everyone should do something or contribute to being a good 'enviro-steward,' as every day is Earth Day."

Research and Monitoring

A large number of Dive In organizers monitor and assess the health of their underwater ecosystems. Reef and fish surveys have been conducted in many countries, providing scientists with invaluable data on the state of coral reefs and marine environments.

In India, Dr. K. Venkataraman of the Marine Biological Station, Zoological Survey of India, spent Dive In To Earth Day surveying the reefs off the Gulf of Mannar Island. He gathered local people and colleagues for a snorkeling and diving trip to record valuable data on the health of the coral reefs. Venkataraman wrote to CORAL expressing "thrill and satisfaction of being partner in this worldwide movement."

William Ong of Pro Diving Services in Singapore has been part of an ongoing reef survey and fish count since 1997. In collaboration with the National University of Singapore Research Team, Ong used the Dive In To Earth Day campaign as a way to educate the public about the state of the reefs and to raise awareness of the reef survey program, in hopes of increasing community understanding and support.

Supporting Marine Parks

Studies have shown that establishing marine protected areas is one of the most effective ways to protect coral reefs and aquatic ecosystems. In a recent CORAL survey of coral reef protected areas, park managers identified public support as a critical

Dive In To Earth Day provides the opportunity to focus on and initiate the protection of our underwater world.

element to improve their management capacity. Dive In To Earth Day has emerged as a way for managers to effectively communicate with their communities and engage the support of local stakeholders in coral parks.

In St. Lucia in the Caribbean, the Soufriere Marine Management Area (SMMA) decided to use Dive In To Earth Day to achieve communication goals. "Dive In To Earth Day activities seemed to me an ideal opportunity to merge our own attempts with that of the wider international community," said Glenda Allain, SMMA public relations officer. "It is a perfect opportunity to really get everyone involved—the SMMA, fishermen, dive operators, Department of Fisheries, tourism personnel, the Solid Waste Management Authority, school students, and persons from around St. Lucia." Allain and her colleagues organized a mooring installation with the park's marine rangers; a glass-bottom boat tour for students and community members; and an "Open Day" with slide presentations, video clips, and on-site explanations of scientific monitoring for students and the general public.

At Hol Chan Marine Reserve in Belize, park rangers organize an annual "Community Reef Week" as part of the Dive In celebrations. Dive In To Earth Day gives rangers an opportunity to get the community more involved in the reserve and to educate everyone on the need for its protection. In another instance, the International Marinelife Alliance, a nonprofit organization, celebrated Dive In by launching the first locally managed marine reserve in Vietnam, Reef Trao, and gained important community support. In the Philippines, Project Seahorse and The Haribon Foundation conducted an educational guided tour to the local marine sanctuary to let villagers witness the impact of protection and management.

Future: Where Is Dive In Going?

Dive In activities provide short-term solutions to specific threats but also create a platform on which to build marine conservation awareness and long-term community involvement. Dive In To Earth

Day provides the opportunity to focus on and initiate the protection of our underwater world.

Dive In has catalyzed the interest of thousands of individuals around the world on the need to protect the marine environment. As a result, Earth Day has now truly become a planetary event, capturing a strong environmental message for both the terrestrial and the marine world. CORAL will continue to build on the success of Dive In with more events that generate broader awareness. And with that, CORAL and our partners will strive to expand that awareness into responsibility and extend community conservation efforts beyond just one day a year.

The Coral Reef Alliance (CORAL) coordinates Dive In To Earth Day in partnership with Project AWARE Foundation, and with the support of West Marine, Air Pacific, Earth Day Network, and the International Coral Reef Action Network (ICRAN). For more information, visit www.coral.org/divein.

Brian Huse has worked in environmental conservation and advocacy for almost two decades. Before joining CORAL in 2002, he worked with the National Parks Conservation Association and the California League of Conservation Voters.

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Coral Reefs & Sustainable Coastal Development

Planning for a Sustainable Reef

Excerpted Issue Brief from The Coral Reef Alliance at www.coral.org

Almost half a billion people live within 100 kilometers of coral reefs, where they benefit from fisheries, wave and storm surge protection, and tourist income. With the worldwide coastal population expected to double by 2050, coral reefs will be facing increased pressure from unmanaged development along coasts. Unplanned coastal development is not only a serious threat to coral reefs; it also leads to long-term socio-economic loss. By using Integrated Coastal Zone Management (ICZM) practices, policy makers can create sustainable coastal development projects that protect their coral reef resources while meeting other economic needs.

Unplanned Development: A Threat to Coral Reefs and Tourism

Unplanned coastal development projects not only damage coral reefs, but also local economies that are supported by tourism. Coral reefs are a significant driver of coastal tourism, which represents 85 percent of tourism worldwide and fuels a US\$385-billion industry.

Ecological Impacts of Unplanned Coastal Development:

- Construction projects, such as piers, dikes, channels, and airstrips, kill corals directly. Habitat degradation causes a decrease in fish populations, as fish have fewer places to live and breed.
- Removal of sections of reef can indirectly cause sand erosion, land retreat, and sedimentation.
- Unforeseen impacts of development—such as changed water flows and runoff, chronic sedimentation, sewage effluent, and industrial discharge—impact coral immune systems, growth rates, and reproductive abilities, and can kill corals.

Socioeconomic Impacts of Unplanned Coastal Development:

- The degradation of coral reef ecosystems results in a less marketable travel destination and the decline of the tourism industry, leading to a loss in revenue.
- The mining of coral for construction materials leads to long-term economic losses.

A Solution: Integrated Coastal Zone Management

ICZM is an approach to develop and implement environmentally, culturally, and economically sustainable uses of the coastal zone. The goal of an ICZM strategy is to coordinate all coastal zone uses and activities, in both public and private sectors, according to an agreed-upon set of resource management policies and practices. Without an integrated approach, it can be difficult to effectively manage development. Governments often regulate development activities through several different laws, regulations, and agencies. There may be one set of regulations for pollution from factories, one for fisheries, and one for coastal

building permits, all administered by different agencies. This sector-by-sector approach focuses solely on one issue or constituency and could result in a loss of valuable resources. For example, if a government establishes a marine reserve, but does not use an ICZM approach to coordinate with other coastal zone activities, the reserve may be undermined by a large private development site that is planned through a different government entity.

The key to successful ICZM implementation involves cooperation among the large number of regulatory agencies that oversee coastal development as well as with private sector stakeholders. This process usually requires strong government commitment to a coordinating mechanism, such as an interministerial council or commission with representatives from all the public and private sectors. Also required are mechanisms that ensure proper implementation, such as the clarification of authorities, an accountable lead agency, and economic incentives (for example, withholding of infrastructure funding until the plan is completed or implemented).

Steps for Creating an ICZM Strategy

The following actions are useful for protecting coral reefs from unmanaged development. A model ICZM approach might incorporate many or all of the following:

- Determine whether traditional principles or resource management measures exist and whether their appropriate implementation could enhance coastal resource management.
- Engage local communities to extract anecdotal and traditional knowledge, to involve local stakeholders in policy planning and implementation, and to create local support for coastal management policies.
- Inventory coastal environments, resources, and programs to learn about, improve the health of, and better manage the coastal environment.
- Determine short-term and long-term goals that call for coastal development consistent with the preservation of the environment, and create a strategy for coastal zone management.
- Create and enforce a strong legal and institutional framework, including economic incentives to reinforce desired behaviors and outcomes.
- Develop a strong coastal management constituency and partnerships at the local, regional, and national levels.
- Establish marine protected areas (MPAs), including no-take reserves, to protect, preserve, and sustainably manage species and ecosystems of special value (this includes threatened species and habitats).
- Perform environmental impact assessments (EIAs) of all development projects in the terrestrial and aquatic sections of the coastal zone.
- Assess and monitor pollutants in the water column and make a plan for pollution control.

The Coral Reef Alliance provides further information resources at <http://www.coralreefalliance.org/resources/briefs/>.

Farming the Sea

By Colin Woodard
Special Correspondent

Ocean aquaculture has been an unfolding international experiment, troubled by a decade of environmental controversies. Now this technology may finally be on the path towards sustainability.

Beached on land, the salmon cages used in Passamaquoddy Bay's aquaculture industry look like a fleet of delicate alien spacecraft awaiting repairs. A half dozen of the huge, ring-shaped floats—each more than six meters in diameter—are strewn across the pebbly beaches of Deer Island in New Brunswick, Canada, a hardscrabble community lying in the middle of the bay.

When repairs are finished and their nets are reattached, the floating sea cages will join hundreds of others anchored on the shores of this tide-scoured bay on the U.S.-Canada border, their nets teeming with Atlantic salmon destined for North American dinner tables. But the cages are cast into waters that swirl with controversy about the potential environmental impact of the world's rapidly expanding ocean aquaculture industry.

Globally, marine aquaculture has more than doubled in size over the past decade, while aquaculture as a whole now accounts for more than 30 percent of the world's fish supply, according to the Rome-based U.N. Food and Agriculture Organization. Salmon, shrimp, and mussels raised by aquaculture enterprises are now cheaper in most markets than the same species caught in the wild, and researchers say the same may apply to cod, halibut, and red snapper in the not too distant future.

But the industry also has experienced growing pains, most of them associated with raising shrimp and salmon, two of the most lucrative species. Asian shrimp ponds were implicated in the destruction of mangrove forests, which are key nursery habitats for many marine creatures. Escapees from U.S. and Canadian salmon farms have furthered the decline of Atlantic salmon in the wild where natural stocks are overfished and close to extinction. Both

industries suffered enormous losses from disease outbreaks like infectious salmon anemia and Taura syndrome in shrimp.

Environmental Impacts

"Some types of aquaculture have minimum or even positive impacts on the environment, but just as in terrestrial agriculture, there are some types of farming that cause serious problems," says Rebecca Goldberg, senior scientist with Environmental Defense, a nongovernmental organization in New York, and author of several reports on the industry.

The vast majority of the world aquaculture industry farms with little impact on the environment. Freshwater carp, catfish, and tilapia are plant-eaters and usually are raised in special ponds where the fish help convert potentially harmful organic wastes into edible fish meat. Shellfish like mussels, scallops, and oysters filter algae and plankton from seawater, reducing the risk of runaway algae blooms that can trigger the creation of oxygen-depleted "dead zones."

But the farming of other species—particularly shrimp and carnivorous fish like salmon—can be extremely destructive, as residents of Maine and New Brunswick have learned firsthand.

The Passamaquoddy Bay area, with its six-meter tides, clean water, and undeveloped coastline, became the epicenter of North America's Atlantic salmon industry. Starting with a single experimental cage on Deer Island in 1978, the industry had expanded to 125 salmon farms with annual sales approaching \$100 million by 2000. It now employs several hundred people on both sides of the border and, in easternmost Maine, pays the average worker \$39,000 per year, more than twice the average income there.

But there also have been frequent outbreaks of diseases and parasites in the crowded cages, each of which holds tens of thousands of fish. Outbreaks of infectious salmon anemia forced the destruction of 1.2 million fish in 1998 and 2.3 million in 2002. Farmers tried to keep the fish healthy by feeding or bathing them in antibiotics and pesticides, some of which have been shown to be toxic to lobsters and other marine life in laboratory settings.

Studies by the Atlantic Salmon Federation—an early proponent of the industry—showed that the proportion of farmed salmon in local wild salmon runs increased from 5.5 percent in 1983 to 90 percent in 1990. The farmed salmon can out-compete their wild cousins, but are not genetically adapted to return to their birth stream to breed and thus do not reproduce and rebuild the stocks. As further evidence that aquaculture was disrupting the ecological balance, residents blamed the farms for a perceived increase in shoreline algal growth, claiming that feces and uneaten food falling from the cages was triggering the blooms. When the industry tried to expand down the Maine coast, some local communities rebelled, refusing to grant site permits, for fear of pollution.

Solving Problems

Globally, however, the aquaculture industry is beginning to sort out many of its problems, says Leroy Creswell, an aquaculture researcher at the University of Florida Sea Grant Office and past president of the World Aquaculture Society. "Aquaculture has been paying for the sins of terrestrial agriculture in that it's being held to a much higher standard," he says. "But aquaculture wants to be a sustainable industry and they're doing everything they can to make sure they are a nonpolluting industry with a high-quality product."

In Norway, which pioneered salmon farming in the late 1960s, many of the problems afflicting farms in the United States, Canada, and Chile have been overcome, explains Ole Torrissen, associate director of the Institute for Marine Research in Bergen. Before being released into the cages, every fish is given a vaccination shot, virtually eliminating the need for antibiotics. As a result, antibiotic use in Norwegian salmon and trout farms has fallen from 50,000 kilograms in 1987 to less than 500 kilograms today, even as production has increased by more than tenfold. Increased attention to currents at potential farm sites has eliminated nutrient pollution problems. The currents carry the falling feces and wastes to open water, thus keeping concentrations at acceptable levels.

The fish raised in Norwegian aquaculture also use feed more efficiently than European poultry and pig operations. "Salmon farming is definitely the most

sustainable meat production you have in Europe," Torrissen says, though he notes the problem of salmon escapees has yet to be solved.

Marius Holm, a researcher at the Bellona Foundation, Norway's most influential environmental group, agrees. "If you compare salmon to other meat productions, it's not bad at all," he says, seated in a briefing room at the foundation's Oslo headquarters. Norway has set "the direction salmon farms in other parts of the world are going to go."

Meanwhile, Norwegian farmers are moving on to cod, a fish whose populations have been decimated by overfishing in much of the world. The first commercial cod farm opened last year, stocking 5 million juveniles. Next year, Torrissen says, the industry expects to harvest them, putting between 10,000 and 20,000 metric tons of cod on the market. In the United States and Canada, researchers say they are on the verge of making cod, halibut, flounder, and other species commercially viable for farming.

New Technology

But if the U.S. ocean aquaculture industry is to grow, it will probably have to move away from the shoreline, says Leroy Creswell. "Unless you're raising shellfish, you're just never going to get a permit to raise fish right along the coastline," he says, noting the stiff resistance such proposals often receive from shoreline property owners, fishermen, boaters, and environmentalists. The solution, he says, is to go either inland or right out to sea.

In Florida—where high property costs make coastal shrimp-growing ponds cost-prohibitive—some shrimp farmers have followed the lead of freshwater aquaculturists and moved inland. Pacific white shrimp, Creswell says, are now being raised in mineral-rich fresh water pumped from deep aquifers under inland Florida, with intensive water recirculation systems. "There is zero discharge, and the cost of production is much lower," he says. The main obstacle for the U.S. industry's inland expansion is competitive economics. Can U.S. aquaculture enterprises produce fish that are competitively priced against cheap imports from China and other Asian countries, where environmental standards are lax and labor costs low?

For most marine species other than shrimp, future farming may take place inside submerged ocean cages moored in federal waters several kilometers from land.

The new cage technology—much of it being perfected by researchers at the University of New Hampshire (UNH)—allows fish and shellfish to be grown in fully enclosed cages moored nine or ten meters down, beneath surface wave activity and the hulls of passing ships. Stationed in deep water with strong currents, the ocean farm's wastes and other pollutants are unable to reach harmful concentrations, as they do in calmer bays and coastal waters, researchers say, making for a more sustainable industry. The sturdy cages are thought to be relatively escape-proof and, tended and monitored by automated feed buoys, they appear to be cost-effective.

"So far the demonstration projects that are going on show that there is virtually no environmental impact at any distance and that wastes are not accumulating below the pens," says Linda Chaves, aquaculture coordinator at the National Oceanic and Atmospheric Administration (NOAA), which is drafting legislation to allow fish farmers to lease farming sites from the federal government. "Offshore farming looks really promising."

UNH researchers involved in the Open Ocean Aquaculture Project have been working with halibut, cod, haddock, summer flounder, and blue mussels, with funding from NOAA. Other researchers are raising cobia in submerged cages off Puerto Rico, while a commercial farm in Hawaii is marketing Pacific redbfin grown in deepwater cages that drift with the currents. U.S. authorities hope that investing in offshore research will help meet Washington's goal of expanding the U.S. fish farming industry by fivefold by 2025. The Department of Commerce objective in setting that goal is to meet the growing demand for seafood on American dinner tables, a demand that exceeds the capacities of wild fisheries.

Continuing Concerns

Environmentalists remain concerned about the sustainability of an industry that continues to focus on carnivorous species raised in fish farms, which

consume food made partly from fish caught from the wild. "There simply aren't enough fish [in the seas] to grind up and make fish meal and oil for feed," Environmental Defense's Rebecca Goldberg says. "And virtually all of the fish [used for aquaculture feed] could be used for human consumption in developing countries.... Aquaculture is a net consumer of wild fisheries."

It is true that the mariculture industry focuses on relatively expensive—and profitable—carnivorous species like shrimp, salmon, and cod. While these fish can be grown more efficiently than cattle or pigs, they still remain too expensive for the world's poor. Because farmed salmon and shrimp are fed meals and oils made from small, edible schooling fish like mackerel, caplin, sardines, and anchovies, opponents point out that the farms are competing with the world's poor for some of these food species.

The practice of feeding the carnivorous species on smaller fish also has raised a human health concern. Some recent studies have found that farmed fish from some sources have higher concentrations of chemicals—some of which are known or suspected carcinogens, principally PCBs—than are present in wild fish. It is possible that farmed fish raised on a diet of smaller species may develop a concentration of these chemicals. U.S. government regulators have suggested that pregnant or nursing mothers should limit their consumption of certain species of farmed fish. In addition, they have suggested that consumption of possibly harmful chemicals can be reduced if the skin and fat of the fish is not eaten. Further research on these findings is likely soon.

With further concerns about aquaculture's environmental impacts, Goldberg agrees that offshore farms will have fewer than their coastal cousins, but she is concerned that offshore farms may be built on a scale that will become ecologically harmful. "There's no question that the model for aquaculture production in [offshore waters] is going to be very similar to that of the chicken and hog farming we have today, where you put a lot of animals in one place and bring in a lot of feed," she says. "Are we essentially going to be building a new [industrial scale] hog industry three miles off our shores?"

Linda Chaves of NOAA says she does not expect offshore ocean aquaculture to become an environmental problem anytime soon. "To produce 600,000 metric tons of fish one would need about 250 square kilometers of surface area, which isn't much when you consider we have millions of square kilometers" available for use in U.S. territorial waters, she notes. "But if environmental issues do appear, we will certainly be taking them into account."

Journalist Colin Woodard is the author of Ocean's End: Travels Through Endangered Seas and The Lobster Coast: Rebels, Rusticators, and the Struggle for a Forgotten Frontier. He lives in Portland, Maine, and maintains a Website at www.colinwoodard.com.

This article is based on a survey of current fact and opinion and does not necessarily reflect the views or policies of the U.S. government.

ADDITIONAL RESOURCES

Scientists Return to the Titanic

A Press Release from the National Geographic Society

A new mission to the legendary shipwreck will assess the deterioration of the hulk with a view toward preservation.

A consortium backed by the National Oceanic and Atmospheric Administration, the National Geographic Society, the University of Rhode Island, and private foundations has announced a June 2004 mission to the Titanic shipwreck in the depths of the North Atlantic Ocean. This press release issued by the consortium describes the expedition.

Explorer Dr. Robert Ballard Returns to Titanic in June to Assess State of the Wreck

National Geographic Channel to Originate Television Event from Expedition

(Narragansett, R.I.—April 15, 2004)—Nearly 20 years after first finding the sunken remains of the R.M.S. *Titanic*, marine explorer Dr. Robert Ballard will return in June to help the National Oceanic and Atmospheric Administration (NOAA) study the ship's rapid deterioration. Dr. Ballard and his partners announced the expedition today, the 92nd anniversary of the ship's sinking.

A professor of oceanography at the University of Rhode Island (URI) and director of its Institute for Archaeological Oceanography, Dr. Ballard and scientists from NOAA, Mystic Aquarium & Institute for Exploration (MAIFE) and other institutions will

spend 11 days at the site, mapping the ship and conducting scientific analyses of its deterioration.

"We know *Titanic* has been naturally deteriorating over time, but I'm convinced that the deterioration is being accelerated by manmade impacts as well," said Dr. Ballard, president of the Institute for Exploration at Mystic Aquarium and Explorer-in-Residence at the National Geographic Society. "The 1986 photo mosaic of the ship that we published in National Geographic magazine will serve as a baseline for comparative studies to determine the level of degradation that has occurred since then."

Funded primarily by NOAA and working aboard the NOAA research vessel *Ronald H. Brown*, the May 30 through June 9 expedition will use Dr. Ballard's remotely operated vehicles (ROVs) to conduct a more sophisticated documentation of the state of *Titanic* than was possible in the 1980s.

"As the nation's ocean agency, NOAA has an interest in the scientific and cultural aspects of *Titanic*," said Capt. Craig McLean, director of NOAA's Office of Ocean Exploration. "NOAA's focus is to build a baseline of scientific information from which we can measure the scientific processes and deterioration of *Titanic*, and apply that knowledge to many other deepwater shipwrecks and submerged cultural resources."

In 1985, Dr. Ballard discovered the remains of *Titanic* in over 12,000 feet [3,600 meters] of water off the Grand Banks of Newfoundland. He returned to the site in 1986 with a National Geographic Society film crew. Since then, RMS Titanic, Inc. has obtained the rights to conduct salvage operations at the site, and has recovered more than 6,000 artifacts. Several tour companies and movie producers have also visited the site in manned submersible vehicles.

In 2001, NOAA issued "Guidelines for Research, Recovery and Salvage of RMS Titanic," including a general principle that activities should have minimum adverse impact on *Titanic* and its artifacts.

"We believe that the world's oceans are the museums of the deep and that it is in the interest of all peoples to protect and conserve both wrecks of recent history as well as submerged sites of antiquity for

future generations," Dr. Ballard said. "We are returning to *Titanic* to assess the state of the ship and help determine its future."

Lt. JG Jeremy Weirich of NOAA's Commissioned Corps will oversee the expedition's marine archaeology program. Dwight Coleman of MAIFE and URI is chief of research.

In addition to mapping *Titanic*, expedition goals include microbial research by scientist Roy Cullimore, who will study the natural deterioration of the ship's hull caused by tiny microbes that feed on iron and create icicle-shaped formations called "rusticles." While rusticles have been observed for many years, little is known about them.

Most of the wood on the ship has been eaten by mollusks that feed on organic matter, and natural environmental conditions at the site, such as pressure, temperature and salinity, have also caused the ship's remains to degrade.

On Monday, June 7, 2004 at 9 p.m. ET/PT, the National Geographic Channel will provide audiences with unprecedented access to the ongoing expedition by broadcasting a one-hour special, "Return to Titanic," which will originate from the NOAA research ship *Ronald H. Brown* and include the first live underwater telecast from *Titanic*.

MAIFE is opening a complementary exhibit on April 15 that coincides with the June expedition. The exhibit tells the story of *Titanic*, Dr. Ballard's original discovery of the ship, and the return mission this spring. The centerpiece of the exhibit is the world's only authenticated model of *Titanic*, an 18-foot [5.4-meter] model that took longer to build than the original ship and cost more than \$1.4 million to create.

Simultaneous with the expedition, Mystic's Immersion Project will allow thousands of children across the country to experience the *Titanic* mission as it is happening. From June 4 through 9, four shows a day will be transmitted live from the expedition via satellite and Internet2 to participating sites.

The JASON Foundation for Education will create a new middle school math curriculum called JASON Math Adventure: Geometry and Return to Titanic,

which will follow the work of researchers on the *Titanic* expedition. Students will learn how geometry concepts are used to position the *Ronald H. Brown* at the *Titanic* wreck and the ROV *Hercules* on the bow of *Titanic*. JASON will also provide a behind the scenes look at the expedition using the Internet and video conferencing technology to allow Dr. Ballard to teach middle school science classes across the country live from sea.

Technology partners on the expedition include EDS of Texas, whose technology team is wiring the

mission, and VBrick Systems of Connecticut, whose products will enable the mission feed to be broadcast to children across the country.

For accounts of the expedition in progress and links to partner websites, visit www.returntotitanic.com.

The opinions expressed in this press release are those of the expedition sponsors and do not necessarily reflect the views or policies of the U.S. government.

Bibliography

Books and Documents

Ballard, Robert D., with Will Hively

THE ETERNAL DARKNESS: A PERSONAL HISTORY OF DEEP SEA EXPLORATION

Princeton University Press, 2002, 388 p.

<http://www.loc.gov/catdir/samples/prin031/99043072.html>

Bigg, Grant R.

OCEANS AND CLIMATE

Cambridge University Press, 2003, 286 p.

Brown, Katrina, and others

MAKING WAVES: INTEGRATING COASTAL CONSERVATION AND DEVELOPMENT

Earthscan Publications Ltd., 2002, 224 p.

Davenport, J.

AQUACULTURE: THE ECOLOGICAL ISSUES

Blackwell Publishing, 2003, 96 p.

Davis, Donald, and Miles Richardson, editors

THE COASTAL ZONE: PAPERS IN HONOR OF H. JESSE WALKER

Geoscience Publications, Department of Geography and Anthropology, Louisiana State University, 2003, 175 p.

Dorfman, Mark

TESTING THE WATERS 2003: A GUIDE TO WATER QUALITY AT VACATION BEACHES

Natural Resources Defense Council, 2003, 148 p.

<http://www.nrdc.org/water/oceans/tw/titinx.asp>

Ellis, Richard

THE EMPTY OCEAN: PLUNDERING THE WORLD'S MARINE LIFE

Island Press/Shearwater Press, 2003, 367 p.

Ferrari, Andrea, and others

REEF LIFE

Firefly Books, Ltd., 2003, 288 p.

Field, John G., and others

OCEANS 2020: SCIENCE, TRENDS, AND THE CHALLENGE OF SUSTAINABILITY

Island Press, 2002, 365 p.

Gerdes, Louise, editor

ENDANGERED OCEANS

Greenhaven Press, Inc., 2004, 220 p.

Gorina-Ysern, Montserrat

AN INTERNATIONAL REGIME FOR MARINE SCIENTIFIC RESEARCH

Transnational Publishers, 2003, 668 p.

Helvarg, David

BLUE FRONTIER: SAVING AMERICA'S LIVING SEAS

W.H. Freeman and Co., 2001, 320 p.

Jana, B.B., and Carl D. Webster, editors

SUSTAINABLE AQUACULTURE: GLOBAL PERSPECTIVES

Haworth Press, 2003, 365 p.

Kalo, Joseph J.

COASTAL AND OCEAN LAW: CASES AND MATERIALS

West Publishing Co., 2002, 852 p.

Kirchner, Andree

INTERNATIONAL MARINE ENVIRONMENTAL LAW: INSTITUTIONS, IMPLEMENTATION AND INNOVATION

Kluwer Law International, 2003, 288 p.

Klein, Bernhard, and Gesa Mackenthun, editors
SEA CHANGES: HISTORICIZING THE OCEAN
Routledge, 2003, 240 p.

Marine Fish Conservation Network
BODY OF EVIDENCE: THE FRAGILE STATE OF AMERICA'S OCEANS—A REVIEW OF RECENT SCIENCE AND A FRAMEWORK FOR RECOVERY
The Network, 2004, 12 p.
http://conservefish.org/site/mediacenter/network_reports/bodyofevidence.pdf

McKay, Bruce, and others
DANGER AT SEA: OUR CHANGING OCEAN
SeaWeb, 2001
<http://www.seaweb.org/campaigns/danger/>

National Research Council, Committee on Exploration of the Seas
EXPLORATION OF THE SEAS: VOYAGE INTO THE UNKNOWN
National Academies Press, 2003, 228 p.
<http://www.nap.edu/books/0309089271/html/>

National Research Council, Committee on Potential Impacts of Ambient Noise in the Ocean on Marine Mammals
OCEAN NOISE AND MARINE MAMMALS
National Academies Press, 2004, 192 p.
<http://www.nap.edu/books/0309085365/html/>

National Research Council, Committee on the Causes and Management of Eutrophication
CLEAN COASTAL WATERS: UNDERSTANDING AND REDUCING THE EFFECTS OF NUTRIENT POLLUTION
National Academies Press, 2002, 428 p.
<http://www.nap.edu/books/0309069483/html/>

National Research Council, Committee on the Implementation of a Seafloor Observatory Network for Oceanographic Research
ENABLING OCEAN RESEARCH IN THE 21ST CENTURY: IMPLEMENTATION OF A NETWORK OF OCEAN OBSERVATORIES
National Academies Press, 2004, 240 p.
<http://www.nap.edu/books/0309089905/html/>

Nordquist, Morton, and others, editors
THE STOCKHOLM DECLARATION AND LAW OF THE MARINE ENVIRONMENT
Kluwer Law International, 2003, 464 p.

Nordstrom, Karl F.
BEACHES AND DUNES OF DEVELOPED COASTS
Cambridge University Press, 2004, 351 p.

Pauly, Daniel, and Jay Maclean
PERFECT OCEAN: THE STATE OF FISHERIES AND ECOSYSTEMS IN THE NORTH ATLANTIC OCEAN
Island Press, 2003, 160 p.

Pew Oceans Commission
AMERICA'S LIVING OCEANS: CHARTING A COURSE FOR SEA CHANGE: A REPORT TO THE NATION
The Commission, 2003, 144 p.
http://www.pewoceans.org/oceans/downloads/oceans_report.pdf

Pillay, T.V.R.
AQUACULTURE AND THE ENVIRONMENT
Blackwell Publishing, 2003, 256 p.

Prager, Ellen J., with Sylvia Earle
THE OCEANS
McGraw-Hill, 2000, 314 p.

Pugh, David
CHANGING SEA LEVELS: EFFECTS OF TIDES, WEATHER AND CLIMATE
Cambridge University Press, 2004, 278 p.

Ray, G. Carleton, and Jerry McCormick-Ray
COASTAL MARINE CONSERVATION: SCIENCE AND POLICY
Blackwell Publishing, 2002, 288 p.

Sapp, Jan
WHAT IS NATURAL? THE CORAL REEF CRISIS
Oxford University Press, 2003, 304 p.

Sinclair, Michael, and others, editors
RESPONSIBLE FISHERIES IN THE MARINE ECOSYSTEM
CABI Publishing, 2003, 448 p.

Sorensen, Jen

BASELINE 2000 BACKGROUND REPORT: THE STATUS OF INTEGRATED COASTAL MANAGEMENT AS AN INTERNATIONAL PRACTICE

Urban Harbors Institute, University of Massachusetts, 2002, 167 p.

<http://www.uhi.umb.edu/b2k/baseline2000.pdf>

Sverdrup, Keith A., and others

AN INTRODUCTION TO THE WORLD'S OCEANS

McGraw-Hill, 2003, 521 p.

U.S. Commission on Ocean Policy

DEVELOPING A NATIONAL OCEAN POLICY: MID-TERM REPORT

The Commission, 2002, 17 p. + 3 appendices

http://www.oceancommission.gov/documents/midterm_report/midterm_report.htm

U.S. General Accounting Office

OCEAN AND COASTAL ACTIVITIES: INFORMATION ON FEDERAL FUNDING

U.S. GAO, Report No. GAO-03-1070R, 2003, 27 p.

<http://www.gao.gov/new.items/d031070r.pdf>

Weber, Michael L.

WHAT PRICE FARMED FISH: A REVIEW OF THE ENVIRONMENTAL AND SOCIAL COSTS OF FARMING CARNIVOROUS FISH

SeaWeb Aquaculture Clearinghouse, 2003, 53 p.

[http://www.seaweb.org/resources/sac/pdf/](http://www.seaweb.org/resources/sac/pdf/WhatPriceFarmedFish_high.pdf)

[WhatPriceFarmedFish_high.pdf](http://www.seaweb.org/resources/sac/pdf/WhatPriceFarmedFish_high.pdf)

White, Kathryn, and others

AT A CROSSROADS: WILL AQUACULTURE FULFILL THE PROMISE OF THE BLUE REVOLUTION?

SeaWeb Aquaculture Clearinghouse, 2004, 17 p.

[http://www.seaweb.org/resources/sac/pdf/](http://www.seaweb.org/resources/sac/pdf/At_Crossroads.pdf)

[At_Crossroads.pdf](http://www.seaweb.org/resources/sac/pdf/At_Crossroads.pdf)

Articles

Agardy, Tundi

AMERICA'S CORAL REEFS: AWASH WITH PROBLEMS

Issues in Science and Technology, Vol. 20, No. 2, Winter 2004, pp. 35-42

Bergen, Lydia K., and Mark H. Carr

ESTABLISHING MARINE RESERVES: HOW CAN SCIENCE BEST INFORM POLICY?

Environment, Vol. 45, No. 2, March 2003, pp. 8-19

CONVENTION ON THE LAW OF THE SEA: INTERNATIONAL STANDARDS FOR PROTECTING THE MARINE ENVIRONMENT

International Debates, Vol. 1, No. 7, October 2003, p. 201

Duda, Alfred M., and Kenneth Sherman

A NEW IMPERATIVE FOR IMPROVING MANAGEMENT OF LARGE MARINE ECOSYSTEMS

Ocean & Coastal Management, Vol. 45, 2002, pp. 797-833

Hughes, T. P., and others

CLIMATE CHANGE, HUMAN IMPACTS, AND THE RESILIENCE OF CORAL REEFS

Science, Vol. 301, No. 5635, August 15, 2003, pp. 929-933

Juda, Lawrence

CHANGING NATIONAL APPROACHES TO OCEAN GOVERNANCE: THE UNITED STATES, CANADA, AND AUSTRALIA

Ocean Development & International Law, Vol. 34, 2003, pp. 161-187

Juda, Lawrence

RIO PLUS TEN: THE EVOLUTION OF INTERNATIONAL MARINE FISHERIES GOVERNANCE

Ocean Development & International Law, Vol. 33, 2002, pp. 109-144

Kent, David J.

REPORT URGES MORE SCIENCE IN FISHERIES LAW

United Press International, January 29, 2004

OCEAN POLICY: 2003-2004 POLICY DEBATE TOPIC

Congressional Digest, Vol. 82, No. 7, September 2003, pp. 193-224

Panetta, Leon E.

A CONSERVATION ETHIC FOR THE OCEANS

America, Vol. 189, No. 12, October 20, 2003, pp. 8-10

Pauly, Daniel, and Reg Watson

COUNTING THE LAST FISH

Scientific American, Vol. 289, No. 1, July 2003,
pp. 42-47

*THE PROMISE OF A BLUE REVOLUTION—FISH
FARMING*

The Economist, Vol. 368, No. 8336, August 9, 2003,
pp. 20+

Ryan, John

FEEDLOTS OF THE SEA

World Watch, Vol. 16, No. 5, September/October
2003, pp. 22-29

Swing, John Temple

WHAT FUTURE FOR THE OCEANS?

Foreign Affairs, Vol. 82, No. 5, September/October
2003, pp. 139-152

Wright, Gerard

IN THE ZONE

National Parks, Vol. 77, No. 11/12,
November/December 2003, pp. 26-31

Zabel, Richard W., and others

ECOLOGICALLY SUSTAINABLE YIELD

American Scientist, Vol. 91, No. 2, March/April 2003,
pp. 150-157

Selected Internet Resources

Advisory Committee on the Protection of the Sea

<http://www.acops.org/index.htm>

Cape Cod Commission

<http://www.capecodcommission.org/>

Census of Marine Life

<http://www.coml.org/coml.htm>

Chesapeake Bay Foundation

<http://www.cbf.org/>

Chesapeake Bay Program

<http://www.chesapeakebay.net/>

Coastal America

<http://www.coastalamerica.gov>

Coastal Management

<http://www.coastalmanagement.com/>

Coastal States Organization

<http://www.sso.org/cso/>

CORE

**Consortium for Oceanographic Research
and Education**

<http://www.coreocean.org/>

Estuaries: Where Rivers Meet the Sea

<http://www.estuaries.gov/welcome.html>

Estuarine Research Federation

<http://www.erf.org/>

International Council for the Exploration of the Sea

<http://www.ices.dk/>

International Council for Science

Scientific Committee on Oceanic Research

<http://www.jhu.edu/~scor/>

**Jacques Cousteau National Estuarine Research
Reserve**

<http://www.jcnerr.org/index.htm>

Joint Oceanographic Institutions

<http://www.joiscience.org/>

Large Marine Ecosystems of the World

<http://www.edc.uri.edu/lme/default.htm>

**Louisiana Department of Natural Resources
Office of Coastal Restoration and Management**

<http://www.savelawetlands.org/>

Louisiana Universities Marine Consortium

<http://www.lumcon.edu/>

**Maryland Department of Natural Resources
Maryland's Bays and Streams**

<http://www.dnr.state.md.us/bays.html>

Maryland Sea Grant

Chesapeake Bay Restoration

<http://www.mdsg.umd.edu/CB/restore.html>

Massachusetts Bays Program

<http://www.state.ma.us/envir/massbays/>

Monterey Bay Aquarium Research Institute

<http://www.mbari.org/>

National Association of Marine Laboratories

<http://www.mbl.edu/labs/NAML/>

National Marine Educators Association

<http://www.marine-ed.org/>

National Marine Sanctuary Foundation

<http://www.nmsfocean.org/>

National Research Council

Ocean Studies Board

<http://www7.nationalacademies.org/osb/index.html>

National Science Foundation

Division of Ocean Sciences

<http://www.geo.nsf.gov/oce/start.htm>

National Sea Grant Program

<http://www.nsgo.seagrant.org/NationalSeaGrant.html>

Ocean Conservancy

<http://www.oceanconservancy.org/dynamic/home/home.htm>

Ocean Futures Society

<http://www.oceanfutures.org/default.asp>

Oceana

<http://www.oceana.org/>

Oceanography Society

<http://www.tos.org/>

Ocean.US

National Office for Integrated and Sustained

Ocean Observations

<http://www.ocean.us/>

Pew Oceans Commission

<http://www.pewoceans.org/>

Reef Check

<http://www.reefcheck.org/>

**Reefbase: A Global Information System
on Coral Reefs**

<http://www.reefbase.org/>

Reefs.org

<http://www.reefs.org/>

Restore America's Estuaries

<http://www.estuaries.org/>

**Rutgers University Marine & Coastal Sciences
Coastal Ocean Observation Laboratory**

C.O.O.L. Classroom

<http://www.coolclassroom.org/home.html>

Save Our Seas

<http://www.saveourseas.org/index.html>

Scripps Institution of Oceanography

<http://www.sio.ucsd.edu/>

SeaWeb

<http://www.seaweb.org/home.shtml>

**United Nations Educational, Scientific, & Cultural
Organization (UNESCO)**

Intergovernmental Oceanographic Commission

<http://ioc.unesco.org/iocweb/index.php>

United Nations Foundation

U.N. Atlas of the Oceans

<http://www.oceansatlas.com/>

**U.S. Agency for International Development
Water and Coastal Resources**

http://www.usaid.gov/our_work/environment/water/index.html

U.S. Commission on Ocean Policy

<http://www.oceancommission.gov/>

**“Governing the Oceans” (annotated reference on
ocean law)**

[http://oceancommission.gov/documents/
gov_oceans/gov_oceans.html](http://oceancommission.gov/documents/gov_oceans/gov_oceans.html)

**U.S. Environmental Protection Agency
Oceans, Coasts, and Estuaries**

<http://www.epa.gov/owow/oceans/>

**U.S. Geological Survey
Coastal and Marine Geology Program**

<http://marine.er.usgs.gov/>

U.S. House of Representatives

House Oceans Caucus

<http://www.house.gov/greenwood/OCEAN/index.html>

**U.S. National Oceanic and Atmospheric
Administration
Ocean**

<http://www.noaa.gov/ocean.html>

Coastal Services Center

<http://www.csc.noaa.gov/>

Coral Reef Information System (CoRIS)

<http://www.coris.noaa.gov/>

Education Resources

<http://www.education.noaa.gov/>

Integrated Coastal Management

<http://icm.noaa.gov/>

National Estuarine Research Reserve System

<http://nerrs.noaa.gov/>

National Marine Sanctuaries

<http://www.sanctuaries.nos.noaa.gov/>

National Ocean Service

<http://www.nos.noaa.gov/>

National Oceanographic Data Center

<http://www.nodc.noaa.gov/>

NOAA Central Library

**Wind and Sea: The Oceanic and Atmospheric
Sciences Internet Locator**

<http://www.lib.noaa.gov/docs/wind/windandsea.html>

**Office of Ocean and Coastal Resource
Management**

<http://www.ocrm.nos.noaa.gov/czm/>

Undersea Research Program

<http://www.nurp.noaa.gov/>

Urban Harbors Institute

<http://www.uhi.umb.edu/>

Virginia Institute of Marine Science

<http://www.vims.edu/>

**White Water to Blue Water Miami Conference,
March 2004**

<http://www.umiami.edu/ww2bw/>

White Water to Blue Water Partnership

<http://www.international.noaa.gov/ww2bw/>

Woods Hole Oceanographic Institution

<http://www.whoi.edu/>

Marine Biological Laboratory

<http://www.mbl.edu/>

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Shared Oceans, Shared Future

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