# AN OCEAN BLUEPRINT

FOR THE 21st CENTURY



U.S. Commission on OCEAN POLICY

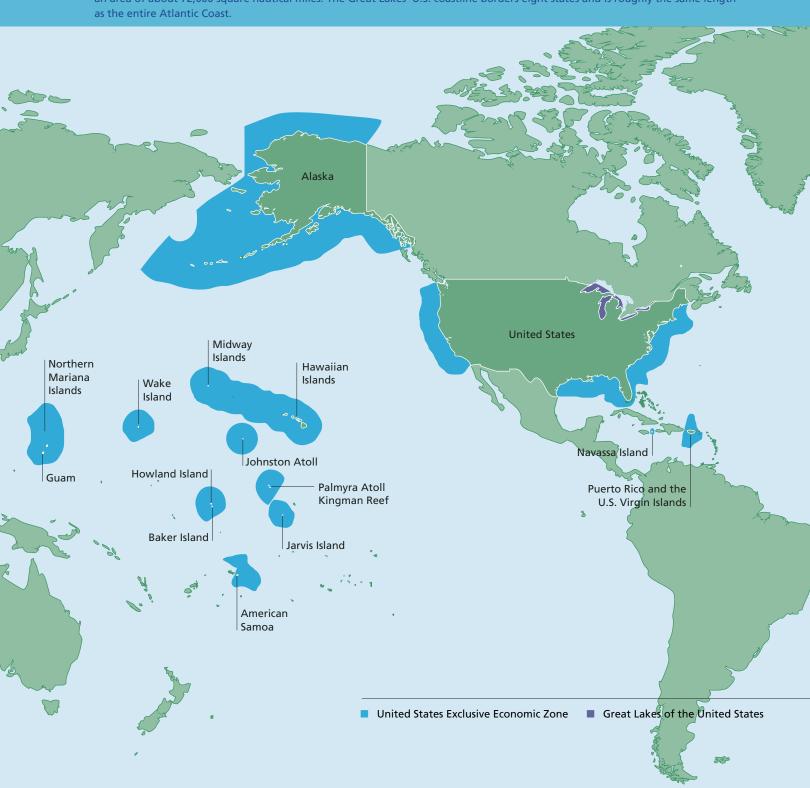
You may electronically download this document from: http://www.oceancommission.gov

This document may be cited as follows: U.S. Commission on Ocean Policy. *An Ocean Blueprint for the 21st Century.* Final Report. Washington, DC, 2004 ISBN#0–9759462–0–X

# THE UNITED STATES IS AN OCEAN NATION

The U.S. exclusive economic zone (EEZ) extends 200 nautical miles offshore, encompassing diverse ecosystems and vast natural resources, such as fisheries and energy and other mineral resources. The U.S. EEZ is the largest in the world, spanning over 13,000 miles of coastline and containing 3.4 million square nautical miles of ocean—larger than the combined land area of all fifty states. (A square nautical mile is equal to 1.3 square miles.)

U.S. states also have jurisdiction over a significant portion of the Great Lakes. This chain of freshwater lakes and its tributaries constitute the largest reservoir of fresh surface water on the planet, containing 6.5 quadrillion gallons of fresh water and covering an area of about 72,000 square nautical miles. The Great Lakes' U.S. coastline borders eight states and is roughly the same length as the entire Atlantic Coast





# U.S. COMMISSION ON OCEAN POLICY

July 22, 2004

The Members of the U.S. COMMISSION ON OCEAN POLICY, directed by the United States Congress and appointed by the President under the Oceans Act of 2000 (Public Law 106-256) to make recommendations for a coordinated and comprehensive national ocean policy, hereby approve

# An Ocean Blueprint for the 21st Century,

the final report of the Commission's findings and recommendations in fulfillment of our responsibilities and obligations under such Act.

Admiral James D. Watkins, USN (Ret.), Chairman

for D. Watting

Robert Ballard, Ph.D.

Mr. Ted A. Beattie

Lillia & Borrone

Tex A. Butter

J.M. LO.
Dr. James M. Coleman

ann D'amoto

Ms. Ann D'Amato

Mr. Lawrence Dickerson

Vice Admiral Paul G. Gaffney II, USN (Ret.)

Man & Horekenner
Professor Marc J. Hershman

Paul L. Kelly
Mr. Paul L. Kelly

Churdyla Koch

Mr. Christopher Koch

Luck Hickory Dr. Frank Muller-Karger

Mr. Edward B. Rasmuson

Dr. Andrew A. Rosenberg

WURDER

Mr. William D. Ruckelshaus

Red a. Santife

Dr. Paul A. Sandifer



1120 20th Street, NW • Suite 200 North • Washington, DC 20036
Phone: 202-418-3442 • Fax: 202-418-3475 • www.oceancommission.gov

# September 2004

The President The White House Washington, D.C. 20500

Dear Mr. President:

I am pleased to submit for your consideration *An Ocean Blueprint for the 21st Century*, the final report of the U.S. Commission on Ocean Policy. As mandated by the Oceans Act of 2000, this report contains balanced and practical proposals for the establishment of a comprehensive and coordinated ocean policy for our nation. The sixteen Commissioners you appointed, representing diverse interests and experience, unanimously support the Commissions' findings, recommendations and vision for the future.

The value of the oceans and coasts to the nation is immense and their full potential remains unrealized. Over half the U.S. population lives in coastal watershed counties and roughly one-half of the nation's gross domestic product (\$4.5 trillion in 2000) is generated in those counties and in adjacent ocean waters.

However, there is widespread agreement that our oceans and marine resources are in serious trouble, increasingly affected by rapid growth along our coasts, land and air pollution, unsustainable exploitation of too many of our fishery resources, and frequently ineffective management. The consistent message we heard throughout the country is that we must act now to halt continuing degradation.

We believe that a historic opportunity is at hand to make positive and lasting changes in the way we manage our oceans. The comments we received from Governors of states and territories, tribal leaders, industry, nongovernmental organizations, and the public at large were strongly supportive of our assessment of declining ocean and coastal conditions, the need for a new management approach, and our call for immediate action.

A comprehensive and coordinated national ocean policy requires moving away from the current fragmented, single-issue way of doing business and toward ecosystem-based management. This new approach considers the relationships among all ecosystem components, and will lead to better decisions that protect the environment while promoting the economy and balancing multiple uses of our oceans and coasts.

The Commission, therefore, considers the following actions essential. First, a new national ocean policy framework must be established to improve federal coordination and effectiveness. An important part of this new framework is strengthening support for state, territorial, tribal, and local efforts to identify and resolve issues at the regional level. Second, it is also critical that decisions about ocean and coastal resources be based on the most current, credible, and unbiased scientific data and information. Finally, formal and informal

ocean education should be strengthened to better engage the general public, cultivate a broad stewardship ethic, and prepare a new generation of leaders to meet future ocean policy challenges.

Implementation of the Commission's recommendations, which will require a new and modest investment over current funding levels, can create a system that sustains our resources and generates significantly greater benefits for our nation. We have recommended creation of an Ocean Policy Trust Fund that will dedicate funds generated from ocean activities to implement our Ocean Blueprint for the 21st Century.

The urgent need for action is clear. It is equally clear that, by rising to the challenge today and addressing the many activities that are affecting our continent at its edges, our nation can protect the ocean environment, create jobs, increase revenues, enhance security, expand trade, and ensure ample supplies of energy, minerals, food, and life-saving drugs.

Our report is just the beginning of what must be a sustained effort. The Commission encourages you to work with Congress, the Governors and other stakeholders, and, where appropriate, to use existing Presidential authorities to commence implementation of our recommendations at an early date.

On behalf of all sixteen Commissioners, I would like to thank you for the opportunity to serve our nation as members of the U.S. Commission on Ocean Policy. It has been a privilege to contribute to a new age of ocean awareness and stewardship. Although our work officially ends ninety days after submission of this report, we stand ready now and in the future to assist in the implementation of our recommendations and achievement of our vision—one in which our oceans and coasts are clean, safe, sustainably managed, and preserved for the benefit and enjoyment of future generations.

Respectfully,

James D. Watkins

Admiral, U.S. Navy (Retired)

Chairman



1120 20th Street, NW • Suite 200 North • Washington, DC 20036 Phone: 202-418-3442 • Fax: 202-418-3475 • www.oceancommission.gov

# September 2004

The Honorable William H. Frist, M.D. Majority Leader United States Senate Washington, D.C. 20510

Dear Mr. Leader:

I am pleased to submit for your consideration *An Ocean Blueprint for the 21st Century*, the final report of the U.S. Commission on Ocean Policy. As mandated by the Oceans Act of 2000, this report contains balanced and practical proposals for the establishment of a comprehensive and coordinated ocean policy for our nation. The sixteen Commissioners, appointed by President Bush and representing diverse interests and experience, unanimously support the Commissions' findings, recommendations and vision for the future.

The value of the oceans and coasts to the nation is immense and their full potential remains unrealized. Over half the U.S. population lives in coastal watershed counties and roughly one-half of the nation's gross domestic product (\$4.5 trillion in 2000) is generated in those counties and in adjacent ocean waters.

However, there is widespread agreement that our oceans and marine resources are in serious trouble, increasingly affected by rapid growth along our coasts, land and air pollution, unsustainable exploitation of too many of our fishery resources, and frequently ineffective management. The consistent message we heard throughout the country is that we must act now to halt continuing degradation.

We believe that a historic opportunity is at hand to make positive and lasting changes in the way we manage our oceans. The comments we received from Governors of states and territories, tribal leaders, industry, nongovernmental organizations, and the public at large were strongly supportive of our assessment of declining ocean and coastal conditions, the need for a new management approach, and our call for immediate action.

A comprehensive and coordinated national ocean policy requires moving away from the current fragmented, single-issue way of doing business and toward ecosystem-based management. This new approach considers the relationships among all ecosystem components, and will lead to better decisions that protect the environment while promoting the economy and balancing multiple uses of our oceans and coasts.

The Commission, therefore, considers the following actions essential. First, a new national ocean policy framework must be established to improve federal coordination and effectiveness. An important part of this new framework is strengthening support for state, territorial, tribal, and local efforts to identify and resolve issues at the regional level. Second, it is also critical that decisions about ocean and coastal resources be based on the most

current, credible, and unbiased scientific data and information. Finally, formal and informal ocean education should be strengthened to better engage the general public, cultivate a broad stewardship ethic, and prepare a new generation of leaders to meet future ocean policy challenges.

Implementation of the Commission's recommendations, which will require a new and modest investment over current funding levels, can create a system that sustains our resources and generates significantly greater benefits for our nation. We have recommended creation of an Ocean Policy Trust Fund that will dedicate funds generated from ocean activities to implement our Ocean Blueprint for the 21st Century.

The urgent need for action is clear. It is equally clear that, by rising to the challenge today and addressing the many activities that are affecting our continent at its edges, our nation can protect the ocean environment, create jobs, increase revenues, enhance security, expand trade, and ensure ample supplies of energy, minerals, food, and life-saving drugs.

Our report is just the beginning of what must be a sustained effort. The Commission encourages Congress to work with the Administration, the Governors, and other stakeholders to implement our recommendations.

On behalf of all sixteen Commissioners, I would like to express our appreciation for this opportunity to serve our nation as members of the U.S. Commission on Ocean Policy. It has been a privilege to contribute to a new age of ocean awareness and stewardship. Although our work officially ends ninety days after submission of this report, we stand ready now and in the future to assist in the implementation of our recommendations and achievement of our vision—one in which our oceans and coasts are clean, safe, sustainably managed, and preserved for the benefit and enjoyment of future generations.

Sincerely,

James D. Watkins

Admiral, U.S. Navy (Retired)

for D. Watkins

Chairman

cc: The Honorable Tom Daschle



1120 20th Street, NW • Suite 200 North • Washington, DC 20036 Phone: 202-418-3442 • Fax: 202-418-3475 • www.oceancommission.gov

# September 2004

The Honorable J. Dennis Hastert Speaker of the House of Representatives Washington, D.C. 20515

Dear Mr. Speaker:

I am pleased to submit for your consideration *An Ocean Blueprint for the 21st Century*, the final report of the U.S. Commission on Ocean Policy. As mandated by the Oceans Act of 2000, this report contains balanced and practical proposals for the establishment of a comprehensive and coordinated ocean policy for our nation. The sixteen Commissioners, appointed by President Bush and representing diverse interests and experience, unanimously support the Commissions' findings, recommendations and vision for the future.

The value of the oceans and coasts to the nation is immense and their full potential remains unrealized. Over half the U.S. population lives in coastal watershed counties and roughly one-half of the nation's gross domestic product (\$4.5 trillion in 2000) is generated in those counties and in adjacent ocean waters.

However, there is widespread agreement that our oceans and marine resources are in serious trouble, increasingly affected by rapid growth along our coasts, land and air pollution, unsustainable exploitation of too many of our fishery resources, and frequently ineffective management. The consistent message we heard throughout the country is that we must act now to halt continuing degradation.

We believe that a historic opportunity is at hand to make positive and lasting changes in the way we manage our oceans. The comments we received from Governors of states and territories, tribal leaders, industry, nongovernmental organizations, and the public at large were strongly supportive of our assessment of declining ocean and coastal conditions, the need for a new management approach, and our call for immediate action.

A comprehensive and coordinated national ocean policy requires moving away from the current fragmented, single-issue way of doing business and toward ecosystem-based management. This new approach considers the relationships among all ecosystem components, and will lead to better decisions that protect the environment while promoting the economy and balancing multiple uses of our oceans and coasts.

The Commission, therefore, considers the following actions essential. First, a new national ocean policy framework must be established to improve federal coordination and effectiveness. An important part of this new framework is strengthening support for state, territorial, tribal, and local efforts to identify and resolve issues at the regional level. Second, it is also critical that decisions about ocean and coastal resources be based on the most current, credible, and unbiased scientific data and information. Finally, formal and informal

ocean education should be strengthened to better engage the general public, cultivate a broad stewardship ethic, and prepare a new generation of leaders to meet future ocean policy challenges.

Implementation of the Commission's recommendations, which will require a new and modest investment over current funding levels, can create a system that sustains our resources and generates significantly greater benefits for our nation. We have recommended creation of an Ocean Policy Trust Fund that will dedicate funds generated from ocean activities to implement our Ocean Blueprint for the 21st Century.

The urgent need for action is clear. It is equally clear that, by rising to the challenge today and addressing the many activities that are affecting our continent at its edges, our nation can protect the ocean environment, create jobs, increase revenues, enhance security, expand trade, and ensure ample supplies of energy, minerals, food, and life-saving drugs.

Our report is just the beginning of what must be a sustained effort. The Commission encourages Congress to work with the Administration, the Governors, and other stakeholders to implement our recommendations.

On behalf of all sixteen Commissioners, I would like to express our appreciation for this opportunity to serve our nation as members of the U.S. Commission on Ocean Policy. It has been a privilege to contribute to a new age of ocean awareness and stewardship. Although our work officially ends ninety days after submission of this report, we stand ready now and in the future to assist in the implementation of our recommendations and achievement of our vision—one in which our oceans and coasts are clean, safe, sustainably managed, and preserved for the benefit and enjoyment of future generations.

Sincerely,

James D. Watkins

Admiral, U.S. Navy (Retired)

en D. Wattins

Chairman

cc: The Honorable Nancy Pelosi

# U.S. Commission on Ocean Policy

#### Chairman

Admiral James D. Watkins, USN (Ret.) Chairman and President Emeritus, Consortium for Oceanographic Research and Education, Washington, D.C.

# Robert Ballard, Ph.D.

Professor of Oceanography, Graduate School of Oceanography, University of Rhode Island

#### Ted A. Beattie

President and Chief Executive Officer, John G. Shedd Aquarium, Illinois

# Lillian Borrone

Former Assistant Executive Director, Port Authority of New York and New Jersey

# James M. Coleman, Ph.D.

Boyd Professor, Coastal Studies Institute, Louisiana State University

# Ann D'Amato

Chief of Staff, Office of the City Attorney, Los Angeles, California

#### Lawrence Dickerson

President and Chief Operating Officer, Diamond Offshore Drilling, Inc., Texas

# Vice Admiral Paul G. Gaffney II, USN (Ret.)

President, Monmouth University, New Jersey

# Marc J. Hershman

Professor, School of Marine Affairs, University of Washington

# Paul L. Kelly

Senior Vice President, Rowan Companies, Inc., Texas

#### **Christopher Koch**

President and Chief Executive Officer, World Shipping Council, Washington, D.C.

# Frank Muller-Karger, Ph.D.

Professor, College of Marine Science, University of South Florida

### Edward B. Rasmuson

Chairman of the Board of Directors, Wells Fargo Bank, Alaska



The U.S. Commission on Ocean Policy- (I-r) front row: Professor Marc J. Hershman; Dr. Thomas R. Kitsos (Executive Director); Mr. Ted A. Beattie; and Dr. Paul A. Sandifer. Second row: Mr. Lawrence Dickerson; Mrs. Lillian Borrone; Ms. Ann D'Amato; and Mr. Paul L. Kelly. Back row: Mr. Christopher Koch; Mr. Edward B. Rasmuson; Dr. James M. Coleman; Admiral James D. Watkins, USN (Ret.) (Chairman); Mr. William D. Ruckelshaus; Dr. Andrew A. Rosenberg; Vice Admiral Paul G. Gaffney II, USN (Ret.); Dr. Robert Ballard; and Dr. Frank Muller-Karger.

# Andrew A. Rosenberg, Ph.D.

Professor, Department of Natural Resources and Institute for the Study of Earth, Oceans, and Space, University of New Hampshire

# William D. Ruckelshaus

Strategic Director, Madrona Venture Group, Seattle, Washington

# Paul A. Sandifer, Ph.D.

Senior Scientist, National Oceanic and Atmospheric Administration, South Carolina

# **Executive Director**

Thomas Kitsos, Ph.D.

# SCIENCE ADVISORY PANEL

# Donald F. Boesch, Ph.D.

President, University of Maryland Center for Environmental Science

#### Kenneth Brink, Ph.D.

Director, Coastal Ocean Institute and Rinehart Coastal Research Center, Woods Hole Oceanographic Institution

# Daniel W. Bromley, Ph.D.

Anderson-Bascom Professor of Applied Economics, University of Wisconsin-Madison

# Otis Brown Ph.D.

Dean, Rosenstiel School of Marine and Atmospheric Science, University of Miami

### Biliana Cicin-Sain, Ph.D.

Director, Gerard J. Mangone Center for Marine Policy and Professor of Marine Policy, University of Delaware

# Robert A. Frosch, Ph.D.

Senior Research Associate, John F. Kennedy School of Government, Harvard University and former NASA Administrator

# Robert B. Gagosian, Ph.D.

President and Director, Woods Hole Oceanographic Institution

# J. Frederick Grassle, Ph.D.

Director, Institute of Marine and Coastal Sciences, Rutgers, The State University of New Jersey

# D. Jay Grimes, Ph.D.

Provost, Gulf Coast and Director, Gulf Coast Research Laboratory, University of Southern Mississippi

# Susan Hanna, Ph.D.

Professor, Marine Economics, Oregon State University

#### Ray Hilborn, Ph.D.

Richard C. and Lois M. Worthington Professor of Fisheries Management, School of Aquatic and Fishery Sciences, University of Washington

# DeWitt John, Ph.D.

Director, Environmental Studies Program, Bowdoin College

# Geraldine Knatz, Ph.D.

Managing Director of Development, Port of Long Beach, California

#### Marcia McNutt, Ph.D.

President and Chief Executive Officer, Monterey Bay Aquarium Research Institute

# Jacqueline Michel, Ph.D.

President, Research Planning, Inc.

# Edward L. Miles, Ph.D.

Virginia and Prentice M. Bloedel Professor of Marine Studies and Public Affairs, School of Marine Affairs, University of Washington

# Michael K. Orbach, Ph.D.

Director, Marine Laboratory and Coastal Environmental Management Program, Nicholas School of the Environment and Earth Sciences, Duke University

# John A. Orcutt, Ph.D.

Deputy Director for Research, Scripps Institution of Oceanography and Director, Center for Earth Observations and Applications, University of California, San Diego

# Shirley A. Pomponi, Ph.D. President and CEO, Harbor Branch

President and CEO, Harbor Branch Oceanographic Institution, Inc.

# David B. Prior, Ph.D.

Provost and Executive Vice President, Texas A&M University

# Andrew R. Solow, Ph.D.

Director, Marine Policy Center, Woods Hole Oceanographic Institution

# Robert C. Spindel, Ph.D.

Director Emeritus, Applied Physics Laboratory, University of Washington

# Carolyn A. Thoroughgood, Ph.D.

Dean, College of Marine Studies and Director, Sea Grant College Program, University of Delaware

# Sharon Walker, Ph.D.

Administrator, J.L. Scott Marine Education Center and Aquarium and Professor, Department of Coastal Sciences, College of Science and Technology, University of Southern Mississippi

# Warren M. Washington, Ph.D.

Senior Scientist, National Center for Atmospheric Research and Chair, National Science Board

# Robert M. White, Sc.D.

President Emeritus, National Academy of Engineering and former NOAA Administrator



# **COMMISSION STAFF**

**Thomas Kitsos** 

**Executive Director** 

Colleen (Lee) Benner

Associate Director, Administration

Christine Blackburn

Policy Associate, Research, Education

and Marine Operations

Sylvia Boone

Administrative Officer

**Brooks Bowen** 

Policy Associate, Stewardship

Laura Cantral

Associate Director, Governance

Polin Cohanne

Executive Assistant to the

**Executive Director** 

Angela Corridore

Policy Associate, Stewardship

Aimee David

Policy Associate, Governance

Morgan Gopnik

Senior Advisor

Peter Hill

Special Assistant to the Executive Director

for Government Relations

Michael Kearns

Special Assistant to the Executive Director

and Assistant Project Manager

Gerhard Kuska

Policy Associate, Governance

Frank Lockhart

Policy Associate, Stewardship

Macy Moy

Special Assistant to the Chairman

Kate Naughten

Public Affairs Officer and Project Manager

Roxanne Nikolaus

Policy Associate, Research, Education

and Marine Operations

Stacy Pickstock

Administrative Assistant

Robyn Scrafford

Administrative Assistant

Ken Turgeon

Associate Director, Research,

**Education and Marine Operations** 

CAPT Malcolm Williams, USCG (Ret.)

Associate Director, Stewardship

Former Staff

Amie Chou

CMDR Peyton Coleman, USCG

Katherine Gallagher

CDR James Jarvis, USN

Margretta Kennedy

RADM Timothy McGee, USN

Patrick Newman

LCDR Justin Reeves, USN

Terry Schaff

CAPT David W. Titley, USN

Deborah Trefts

Jennifer Welch

CAPT George White, NOAA Corps

# **ACKNOWLEDGEMENTS**

An effort of this magnitude could not have been completed without the help of many dedicated people. The Commission is deeply grateful to the scores of individuals who provided testimony, technical input, insightful comments, figures and photographs, production help, and many other forms of assistance in completing this momentous task.

A complete record of testimony presented to the Commission can be found in Appendices 1 and 2, and on the Commission's Web site at www.oceancommission.gov. These presentations were invaluable in communicating the problems facing our oceans and coasts—and suggesting positive solutions.

A number of consultants were instrumental in helping the Commission conduct its meetings and complete its report, particularly in the following areas:

Meeting facilitation, strategy, and advice—John Ehrmann and Jay West of the Meridian Institute, and Philip Angell.

Research, writing, and editing—Charles Colgan, M. Richard DeVoe, Peter Fippinger, Jeremy Firestone, Gabriela Goldfarb, Montserrat Gorina-Ysern, Ray Kammer, Fredrika Moser, Joan O'Callaghan, Julie Phillips, Ellen Prager, Robert Wayland III, and Bill Woodward.

*Public relations*—Scott Treibitz, David Roscow, Victoria Sackett, and Dean Tinnin of Tricom Associates, and Herbert Rosen.

Report design and production—Cynthia Cliff, James Durham, and Lisa Wells of Janin/Cliff Design, Inc.

Web site development and maintenance—Tom LaPoint, Jerry Lau, and Davida Remer of the National Oceanic and Atmospheric Administration's National Ocean Service.

The members of the Commission's Science Advisory Panel (listed in the preceding pages) were at our side from start to finish, answering questions, clarifying technical points, preparing and reviewing written materials, and generally sharing their decades of collective wisdom. In addition, we extend our thanks to the following individuals who served as researchers, reviewers, and wise advisors, or helped in dozens of other ways:

Craig Allen, Donald Anderson, Anthony Andrady, Lori Arguellas, Stefano Belfiore, Joan Myers Bondareff, Nicole Breznock, Richard Brill, David Brower, R. Steven Brown, Joedy Cambridge, James Carlton, Thomas Chase, David Colson, James Corbett, Barry Costa-Pierce, Penelope Dalton, Shelley Dawicki, Richard Delaney, Jessica Demian, Alex Echols, Carolyn Elefant, Amanda Enser, Karen Foerstel, Kim Fulton-Bennett, Marc Gaden, Joseph Geraci, Roger Germann, W. Rockwell Geyer, Suzanne Giles, David Godschalk, James Good, Shannon Gordon, Dale Green, Karl Gustavson, Kathryn Hayes, Amy Heywood, Barbara Hinthorn, Robert Hofman, Edward Houde, John Justus, Geri Kantor, Jill Karsten, David Keeley, Jim Kent, Joanna Knight, Robert Knox, Kei Koizumi, Jennie Kopelson, Judith Krauthamer, Stephen Leatherman, James R. Lyons, Tony MacDonald, Elizabeth Martin, Emily McBride, Tom McCann, Shannon McCoy, David McGrath, James Murley, Savithri Narayanan, Scott Newsham, John Ogden, Rafael Olivieri, Joan Oltman-Shay, John O'Shea, Edward Page, Richard Pittenger, Eugene Proulx, Timothy Ragen, Andrew Read,

Robert Richmond, Robert Ross, Amy Schick, Sarah Schoedinger, Gerry Schubel, Richard Seymour, Seba Sheavly, Rexford Sherman, Andrea Sanico, Judson Starr, Denise Stephenson-Hawk, Robert Stickney, Maurice Tarares, Joanne Tromp, Nicole Vickey, Daniel Walker, Ferris Webster, Robert Weller, and Art Wong.

The members and staff of the Pew Oceans Commission, led by the Honorable Leon Panetta, also deserve our recognition and thanks for their contributions to the development of a new national ocean policy and their steadfast support for the work of this Commission.

Input from Governors and other state-level representatives and groups were invaluable to the development of this report. The official comments from thirty-seven state and territorial Governors and five tribal leaders can be found in the Special Addendum to this report, and on the Commission's Web site at www.oceancommission.gov. Special thanks go to the members and staff of the Coastal States Organization and the National Governors Association for their critical roles in conveying state level interests and perspectives.

Although too numerous to list by name, the Commission extends its heartfelt appreciation to the many knowledgeable and dedicated federal agency employees who supplied detailed information, answered a barrage of questions, and offered excellent advice. Particular thanks go to the Council on Environmental Quality for its role as the Administration's chief liaison to the Commission.

We also appreciate the support provided to the Commission by the Members of Congress and their staffs, in particular those who serve on committees with key jurisdiction over ocean and coastal issues and who have closely followed the progress of the Commission's work. This includes the Members and staff of the Senate Committee on Commerce, Science and Transportation, and the Committee on Appropriations, as well as the House Committees on Science, Resources, and Transportation and Infrastructure. Additional thanks are extended to the Members of the House Oceans Caucus and their staff.

Finally, the work reflected in this report would simply not have been possible without the support and dedication of a talented group of professionals, the members of the Commission staff, to whom we extend our deepest gratitude for their tireless effort on behalf of a new national ocean policy.

# **CONTENTS**

Letter to the President Letter to the Senate Majority Leader Letter to the Speaker of the House Members of the U.S. Commission on Ocean Policy Members of the Science Advisory Panel Commission Staff Acknowledgements.  EXECUTIVE SUMMARY	ixxixiixivxvi
OUR OCEANS: A NATIONAL ASSET	
CHAPTER 1 RECOGNIZING OCEAN ASSETS AND CHALLENGES	30
Evaluating the Vast Wealth of U.S. Oceans and Coasts	30
Economic and Employment Value	
Marine Transportation and Ports	
Marine Fisheries	
Offshore Energy, Minerals, and Emerging Uses	
Human Health and Biodiversity	
Tourism and Recreation	
Coastal Real Estate	
Nonmarket Values	
Undermining America's Ocean and Coastal Assets	
Degraded Waters	
Compromised Resources	
Conflicts Between Man and Nature	
Acting Today for Tomorrow's Generations	44
CHAPTER 2 UNDERSTANDING THE PAST TO SHAPE A NEW NATIONAL OCEAN POLICY	48
Ocean Policy from World War II to the Oceans Act of 2000	48
Formative Years	
From Sputnik to Stratton	
Years of Activism	
Contention and Stalemate	
Search for Coherence	
Consensus for Change	
Launching the U.S. Commission on Ocean Policy	
A Broad Mandate	
The Commission Members	
How the Commission Did Its Work	
The Preliminary Report and Governor's Comments	
The Result	



# **CHAPTER 3**

SETTING THE NATION'S SIGHTS	60
Imagining a Brighter Future	60
Building Ocean Policy on Sound Guiding Principles	61
Translating Principles into Policy	63
Ecosystem-based Management	63
Science for Decision Making	67
Effective Ocean Governance	68
Public Education	68
PRIMER ON OCEAN JURISDICTIONS:	
DRAWING LINES IN THE WATER	70

ENHANCING OCEAN LEADERSHIP AND COORDINATION ......76 Making Improvements at the National Level......**76** 



# PART II BLUEPRINT FOR CHANGE: A New National Ocean Policy Framework

National Ocean Council	
Assistant to the President	
President's Council of Advisors on Ocean Policy	
Other Needed Elements	81
CHAPTER 5	
ADVANCING A REGIONAL APPROACH	86
Addressing Issues Across Jurisdictional Lines	86
Facilitating Bottom-up Responses	
National Support and Guidelines	
Nature and Functions of Regional Ocean Councils	
Building on Existing Regional Initiatives	
Enhancing Federal Support for a Regional Approach	
Federal Agency Coordination	
Moving Toward Common Regional Boundaries	
Meeting Regional Research and Information Needs	
Developing Regional Ecosystem Assessments	96
CHAPTER 6	
COORDINATING MANAGEMENT IN FEDERAL WATERS	98
Meeting Growing Needs	98
Clarifying Offshore Responsibilities	100
Establishing a Coordinated Offshore Management Regime	
A Fair Return for the Use of Offshore Resources	
Employing Marine Protected Areas as a Management Tool	103

Federal Efforts	104 105 106 108 109 110
OCEAN STEWARDSHIP: THE IMPORTANCE OF EDUCATION AND PUBLIC AWARENESS	
CHAPTER 8	
PROMOTING LIFELONG OCEAN EDUCATION	422
Strengthening the Nation's Ocean Awareness	
Ocean StewardshipScience Literacy	
Future Ocean Leaders	
Crosscutting Themes	
Building a Collaborative Ocean Education Network	
Participants in Ocean Education	
Coordinating Ocean Education	
Funding and Assessment	128
Linking the Research and Education Communities	
Incorporating Oceans into K-12 Education	
Using Ocean-based Examples to Meet Education Standards	
Bridging the Gap between Scientists and Educators	
Investing in Higher Education and the Future Ocean Workforce  The Leadership Void	
Drawing Students into the Field	
Expanding Graduate Educational Opportunities	
Workforce Needs	
Specific Federal Responsibilities	
Strength through Diversity	
Bringing the Ocean and Coasts to All Americans	
Multifaceted Approaches	
Coordinating Messages	143



# PART IV

# LIVING ON THE EDGE: ECONOMIC GROWTH AND RESOURCE CONSERVATION ALONG THE COAST

Managing Coasts and their Watersheds	150
Attracting Crowds, Creating Opportunities	150
Implications of Growth	
Strengthening Coastal Planning and Management	152
Multi-layered Decision Making	
Federal Area-based Coastal Programs	
Other Relevant Federal Programs	
Linking Coastal and Watershed Management	
Linking Coastal and Offshore Management	
Increasing Understanding of Coastal Ecosystems	160
CHAPTER 10	
GUARDING PEOPLE AND PROPERTY AGAINST	
NATURAL HAZARDS	162
Assessing the Growing Cost of Natural Hazards	162
Improving Federal Management of Hazards in Coastal Areas	
Changing Inappropriate Federal Incentives	
Improving Understanding	
The National Flood Insurance Program	166
Hazard Mitigation Planning	168
CHAPTER 11	
Conserving and Restoring Coastal Habitat	170
Assessing the Threats to Coastal Habitat	
Conserving Coastal Habitat	170
Habitat Conservation Programs	
Restoring Coastal Habitat	
Improving Habitat Conservation and Restoration	
Enhancing Information and Understanding	
Protecting the Nation's Wetlands: A Special Case	
CHARTER 12	
CHAPTER 12  MANAGING SEDIMENT AND SHORELINES	10/
Understanding the Dual Nature of Sediment	
Reviewing Federal Roles in Sediment Management	
Altering Sediments through Human Intervention	
Changing Sediment Quality	
Developing Regional Strategies for Sediment Management	
Moving Toward Regional Sediment Management at USACE	
Weighing the Costs and Benefits of Dredging	
Navigational Dredging	
Beneficial Uses of Dredged Material	

Techniques of Cost-Benefit Analysis	197
National and Regional Dredging Teams	
Improving Understanding, Assessment, and Treatment	
Coordinated Strategy Needed	
Contaminated Sediment	
CHAPTER 13	
SUPPORTING MARINE COMMERCE AND TRANSPORTATION	192
Connecting People, Places, and Products	
Components of the Marine Transportation System	
Positioning the U.S. Marine Transportation System for the Future	
Federal Roles	
Links to the National Transportation Infrastructure	
Information Needs	199
Emergency Preparedness	200
PART V	
CLEAR WATERS AHEAD:	
COASTAL AND OCEAN WATER QUALITY	
CHAPTER 14	
Addressing Coastal Water Pollution	204
Stopping the Degradation of Coastal Waters	
Reducing Point Sources of Pollution	
Existing Management Tools	
Major Point Sources	
Improving the Control of Point Sources	211
Increasing the Focus on Nonpoint Sources of Pollution	
Existing Management Tools	
Major Nonpoint Sources	
Improving the Control of Nonpoint Sources	
Collaboration at the Watershed Scale	
Addressing Atmospheric Sources of Pollution	
Improving Control of Atmospheric Sources	
improving control of rumospheric sources	223
CHAPTER 15	
Creating a National Monitoring Network	226
Recognizing the Value of Monitoring	
Monitoring at the Federal Level	
Federal Programs	
Shortcomings in Federal Programs	
Promoting Interagency Coordination	
Ensuring Comprehensive, Coordinated Coverage	231
Creating an Effective Monitoring Network	232
System Goals and Objectives	
System Design	
Technical Coordination	233



Periodic Review and Modification	
Design Based on User Input	
Making Data Accessible and Useful	235
CHAPTER 16	
LIMITING VESSEL POLLUTION AND IMPROVING VESSEL SAFETY	236
Assessing the Benefits and Risks of Vessel Activities	236
Strengthening Vessel Safety, Security, and Environmental Compliance	237
A Culture of Compliance and Safety	
Flag State Oversight and Enforcement	
Port State Control	
Reducing Vessel Pollution	
Waste Stream Discharges	
Oil Releases	
Increasing Knowledge to Guide Change	
Improving Awareness of Ocean Activities	
CHAPTER 17	
PREVENTING THE SPREAD OF INVASIVE SPECIES	252
Acknowledging the Problem	252
Assessing Existing Approaches	
Federal Statutes	
State and Federal Programs	
Identifying Major Pathways for Introduction of Non-native Species	
Ballast Water	
Global Trade in Marine Organisms	
Ballast Water Management	
Controlling Other Pathways	
Accelerating Detection and Response	
Improving the Control of Invasive Species	
Coordinated Action	
International Partnerships	
Research Needs	262
CHAPTER 18	
REDUCING MARINE DEBRIS	264
Assessing the Sources and Consequences of Marine Debris	
Addressing Marine Debris Nationally	
Existing Programs	
NOAA's Role	
Expanding Marine Debris Efforts	
Reducing Derelict Fishing Gear	
Ensuring Adequate Facilities for Disposal of Garbage from Ships	270

# PART VI

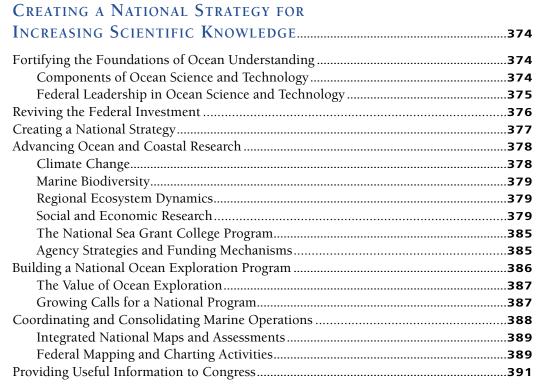
# OCEAN VALUE AND VITALITY: ENHANCING THE USE AND PROTECTION OF OCEAN RESOURCES

Achieving Sustainable Fisheries	274
Contemplating Thirty Years of Fishery Management	274
Building Sustainable Fisheries Based on Sound Science	
The Value of Science for Wise Management	276
Separating Scientific and Management Decisions	277
The Need for Independent Review	278
Using Default Measures to Ensure Progress	279
Making Research Relevant	280
Strengthening Fishery Governance	283
Clarifying Fishery Management Authority and Jurisdiction	283
Improving the Regional Fishery Management Councils	285
Ending the Race for Fish	
Traditional Management Approaches	287
Dedicated Access Privileges	
Reducing Overcapitalization of Fishing Fleets	290
Improving Fishery Enforcement	
Fishery Enforcement Mechanisms	
Enforcement Partnerships	
Technology for Enforcement	
Improving Enforceability as Part of the Management Process	
Moving Toward an Ecosystem-based Management Approach	
Linking Fisheries Management with other Regional Concerns	
Essential Fish Habitat	
Reducing Bycatch	
Managing International Fisheries	
The Status of International Fisheries	
The Law of the Sea Framework	
International Fishery Conservation Agreements	
International Fisheries and Trade	303
CHAPTER 20	
PROTECTING MARINE MAMMALS AND	
ENDANGERED MARINE SPECIES	306
Assessing the Threats to Marine Populations	306
Marine Mammals	
Endangered Species	
Reviewing Authorities and Responsibilities	
The Marine Mammal Protection Act	
The Endangered Species Act	
Identifying and Overcoming Gaps in Protection	
Clarifying Jurisdiction and Authority	
Cooperation with States	
Unclear Permitting and Review Standards	
The Meaning of Harassment in the MMPA	
The Promise of Programmatic Permitting For Marine Mammals	312



Expanding Research and Education	314
Understanding Behavior and Human Impacts	
Effects of Noise on Marine Mammals	315
Public Education and Outreach	316
Applying Ecosystem-based Management Principles	316
Domestic Action	
International Coordination	318
CHAPTER 21	
Preserving Coral Reefs and other Coral Communities	320
Assessing the Status of Coral Ecosystems	
The Value of Coral Ecosystems	
Threats to Coral Ecosystems	
Managing U.S. Coral Resources	
Federal Agency Roles and Responsibilities	
Interagency and Intergovernmental Coral Reef Management Initiatives	
Improving the Management of U.S. Coral Resources	
Promoting International Coral Reef Initiatives	
Creating More Sustainable Harvesting Practices	
Improving Understanding of Coral Ecosystems	327
CHAPTER 22	
SETTING A COURSE FOR SUSTAINABLE MARINE AQUACULTURE	220
Acknowledging the Growing Significance of Marine Aquaculture	
Addressing Environmental Impacts of Aquaculture	
Dealing with Uncertainties in the Existing Management Structure	
The Current Regulatory Conundrum	
Developing a New Marine Aquaculture Management Framework	
Coordinated Action	
Implementation	
Increasing the Knowledge Base	
Promoting International Improvements and Cooperation	
CHAPTER 23	
CONNECTING THE OCEANS AND HUMAN HEALTH	
Understanding the Links between the Oceans and Human Health	
Maximizing the Beneficial Uses of Marine-derived Bioproducts	
Specific Applications	
Encouraging Interdisciplinary Marine Biomedical Research	
Managing Marine Bioproduct Discovery and Development	
Reducing the Negative Health Impacts of Marine Microorganisms	
Harmful Algal Blooms	
Contaminated Seafood	
Implications of Global Climate Change	
Progress through Research and Technology Development	
Increasing Federal Coordination on Oceans and Human Health	
Implementing Human Health Protections	

Seafood Safety	49 50
CHAPTER 24	
Managing Offshore Energy and other Mineral Resources35	52
Exercising Jurisdiction over Nonliving Resources in Federal Waters	52 54 57 57 51 54 55 56 57 58
PART VII SCIENCE-BASED DECISIONS: ADVANCING OUR UNDERSTANDING OF THE OCEANS	
CHAPTER 25	







ACHIEVING A SUSTAINED, INTEGRATED OCEAN	
Observing System	394
Making the Case for an Integrated Ocean Observing System	394
Assessing Existing Observing Systems	
Coastal and Ocean Observing Systems	395
Committing to Creation of the IOOS	396
Creating a Governance Structure for the IOOS	397
National Planning	397
Ocean.US	
Regional Structure	398
Reaching Out to the User Community	399
Assembling the Elements of a Successful IOOS	400
Critical Environmental Variables	400
Converting Research into Operational Capabilities	402
Coordinating Civilian Satellite Observations	403
Developing Useful End Products Based on IOOS Data	405
Funding the National IOOS	406
System Cost Estimates	407
Strengthening Earth Observations through National and International Partnerships	409
Other U.S. Operational Observing Systems	
Enhancing Global Cooperation	409
CHAPTER 27 ENHANCING OCEAN INFRASTRUCTURE AND TECHNOLOGY DEVELOPMENT	412
Supporting Ocean and Coastal Activities with Modern Tools	
Improving Infrastructure and Technology	
Gaps in Infrastructure	
Gaps in Technology Development	
Maximizing Resources through Collaboration	
A National Strategy	
Periodic Reviews and Assessments	
Funding the Modernization of Critically Needed Assets	
Essential Science Infrastructure and Technology Components	
Other Essential Infrastructure and Technology Components	
Creating Virtual Marine Technology Centers	426
CHAPTER 28	
MODERNIZING OCEAN DATA AND INFORMATION SYSTEMS	428
Turning Oceans of Data into Useful Products	428
Reviewing the Data Management Structure	429
Types of Data Centers	
Ocean and Coastal Data	431
Coping with the Flood of Incoming Data	432
Reinventing Data and Information Management	432
Interagency Planning	
Access to Data and Information	435
Incorporating Data into the National Data Centers	437
Meeting the Challenges of a New Century	438

# PART VIII

# THE GLOBAL OCEAN:

# U.S. PARTICIPATION IN INTERNATIONAL POLICY

# **CHAPTER 29**

Advancing International Ocean Science and Policy	442
Acting Globally to Safeguard the Oceans	442
Reviewing the Evolution of the International Ocean Regime	443
Developing and Implementing International Policy	443
Guiding Principles	444
The Law of the Sea Convention	
Other Ocean-related International Agreements	
Collaboration for International Ocean Policy	449
Emerging International Management Challenges	
Scientific Input to U.S. Policy Makers	
Enhancing International Ocean Science	
International Ocean Science Programs	
The Global Ocean Observing System	
U.S. Scientific Activities Abroad	
Building International Capacity in Ocean Science and Management	



# PART IX

# MOVING AHEAD: IMPLEMENTING A NEW NATIONAL OCEAN POLICY

Funding Needs and Possible Sources		
Investing in Change	458	
Acknowledging the Cost of Taking Action	459	
Deferred Costs		
Costs Beyond the Scope of the Commission's Report	463	
Itemizing Major Funding Areas		
The National Ocean Policy Framework	463	
Ocean Education		
Ocean Science and Exploration		
Monitoring, Observing, and Mapping		
Other Ocean and Coastal Management Challenges		
Recognizing the Important Roles of Nonfederal Authorities	466	
Dedicating Revenue from Ocean Uses for Improved Ocean Management		
Existing and Emerging Uses		
Revenues for Ocean and Coastal Management: The Ocean Policy Trust Fund		
Understanding the Changing Ocean and Coastal Budget	469	
CHAPTER 31		
SUMMARY OF RECOMMENDATIONS	472	
Context for the Recommendations	472	
Guiding Principles		
Creating a Strong Role for States	473	
The Need for Congressional Leadership	474	



Index to the Recommendations	475
Recommendations to Congress	475
Recommendations to the Executive Branch Leadership	475
Recommendations to Federal Government Agencies	476
Recommendations to Regional Bodies	479
Recommendations to States	
Recommendations Related to International Ocean Science,	
Policy, and Management	479
Complete List of Recommendations as They Appear in the Report	



# PART X

# APPENDICES

Printed in the Main Report:

# APPENDIX A

# APPENDIX B

ACRONYMS APPEARING IN THE REPORT \_\_\_\_\_\_\_B 1

# APPENDIX C

LIVING NEAR... AND MAKING A LIVING FROM...
THE NATION'S COASTS AND OCEANS, BY CHARLES S. COLGAN............C 1

# APPENDIX D

### APPENDIX E

# APPENDIX F

CONGRESSIONAL COMMITTEES AND SUBCOMMITTEES WITH

JURISDICTION OVER OCEAN AND COASTAL ISSUES......F 1

# **APPENDIX G**

INDEX

# EXTERNAL APPENDICES

Printed as Separate Documents: Available Electronically on CD or at www.oceancommission.gov

# **SPECIAL ADDENDUM**

GOVERNORS' COMMENTS ON THE PRELIMINARY REPORT

#### **APPENDIX 1**

TESTIMONY BEFORE THE U.S. COMMISSION ON OCEAN POLICY SYNTHESIS INDEXED BY POLICY TOPIC

# **APPENDIX 2**

TESTIMONY BEFORE THE U.S. COMMISSION ON OCEAN POLICY SUMMARY INDEXED BY PRESENTER

# **APPENDIX 3**

NATIONAL MARINE EDUCATORS ASSOCIATION MEMBERSHIP PROFILE

# **APPENDIX 4**

U.S. OCEAN-RELATED ACADEMIC INFRASTRUCTURE

# **APPENDIX 5**

INVENTORY OF U.S. OCEAN AND COASTAL FACILITIES

# **APPENDIX 6**

REVIEW OF U.S. OCEAN AND COASTAL LAW:
THE EVOLUTION OF OCEAN GOVERNANCE OVER THREE DECADES

# LIST OF FIGURES AND TABLES

Figure 1.1 The Value of the Oceans	31
Figure 1.2 The Value of the Coasts	
Figure 1.3 The Coasts: From the Nearshore to Coastal Watersheds	
Figure 1.4 The Shift from Goods to Services in the Ocean Economy	
Figure 1.5 Population Density Peaks Near the Shore	
Figure 2.1 Invited Panelists Represented All Sectors of the Ocean Community	
Figure 3.1 Large Marine Ecosystems Correspond to Natural Features	
Figure 3.2 The Foundations of a New National Ocean Policy	68
Figure P.1 Lines of U.S. Authority in Offshore Waters	71
Figure 4.1 Ocean and Coastal Activities Are Conducted by	
Many Federal Departments and Agencies	78
Figure 4.2 Proposed Structure for Coordination of Federal Ocean Activities	8
Figure 5.1 Alignment of Federal Regions Is Essential for Communication	94
Figure 6.1 Coordination Is Essential in Busy Offshore Waters	99
Figure 7.1 Proposals to Reorganize Federal Ocean Management	109
Table 7.1 Thirty Years of Proposals to Reorganize Federal Management	
of Ocean and Coastal Resources	116
Figure 8.1 Proposed Structure for the Coordination of Federal Ocean	
Education Activities	126
Figure 8.2 U.S. Students Fall Behind in Science	131
Figure 8.3 Environment-based Education Boosts Overall Academic Achievement	
Figure 10.1 The Growing Cost of Natural Disasters	163
Figure 11.1 Dramatic Coastal Land Loss in Louisiana	174
Figure 12.1 Dams Impede Sediment Destined for the Coast	182
Table 13.1 The Leading Role of the United States in International Trade	193
Figure 13.1 Ports Are the Primary Gateway for International Trade	194
Figure 13.2 Goods Traveling through U.S. Ports Are Transported Nationwide	195
Figure 14.1 Report Card on Regional Coastal Conditions	205
Figure 14.2 Land-based Nutrients Can Cause Death on the Seafloor	206
Figure 14.3 Changes in Funding for Water Pollution Controls	208
Figure 14.4 Controlling Nonpoint Source Pollution Is Key to Cleaner Waters	213
Figure 14.5 Thirty States Contribute to the "Dead Zone" in the Gulf of Mexico	216
Figure 14.6 Looking Skyward: Accounting for Airshed Deposition	223
Figure 15.1 Watershed Monitoring Has Been Reduced Near the Coasts	230
Figure 16.1 Most Cruise Ship Travel Originates in U.S. Waters	242
Figure 16.2 The Oil Pollution Act Curbs Spills in U.S. Waters	
Figure 17.1 Great Lakes States Take Lead in Implementing	
Aquatic Invasive Species Management Plans	254
Figure 17.2 Addressing Aquatic Invasive Species Regionally	255
Figure 18.1 Trash at the Beach Comes from Many Sources	265
Figure 19.1 Fishery Litigation Grows as Interests Clash	276
Figure 19.2 U.S. Fisheries Are Managed at the Regional Level	283
Figure 19.3 Migratory Fish Require Coordination Across Multiple Jurisdictions	284
Figure 20.1 Sea Lion Populations in Danger	317
Figure 21.1 Tropical Waters Are Home to the Majority of Known Reefs	321
Figure 21.2 Deep, Cold-water Coral Reefs Found Throughout U.S. Waters	322
Figure 22.1 The United States Imports More Seafood Than It Exports	331
Table 23.1 The Bounty of the Sea	342

Figure 23.1 Harmful Algal Blooms on the Rise	345
Figure 24.1 Offshore Oil and Gas Leasing Has Been Limited to a	
Few Planning Areas	355
Figure 24.2 A "Process Rich" but Clear Path to Offshore Leasing,	
Exploration, and Development Activities	356
Table 24.1 Federal Revenues from Offshore Mineral Development	359
Figure 24.3 Oil Inputs to the North American Marine Environment	363
Figure 24.4 Pipelines Are a Leading Source of Oil Leaks from OCS Infrastructure	363
Figure 25.1 Proposed Structure for the Coordination of Federal Ocean	
Science Activities	376
Figure 25.2 Ocean Research Is Neglected as Part of the National Research Budget	377
Table 25.1 Organizations Collecting Socioeconomic Data on the Ocean and Coasts	383
Figure 26.1 Many Different Platforms Collect Data as Part of the IOOS	396
Table 26.1 Proposed Core Variables for the IOOS	401
Table 26.2 Proposed Supplemental IOOS Variables	401
Table 26.3 Proposed Annual Costs for Implementation of the IOOS	407
Table 26.4 Proposed Start-up Costs for the IOOS	407
Table 28.1 National Civilian and Military Data Centers	430
Figure 28.1 The Flood of Ocean and Coastal Data into NOAA	432
Figure 28.2 The Growing Demand for Ocean Data	433
Table 29.1 U.S. Participation in International Ocean Agreements	446
Table 30.1 Summary of Costs Associated with Recommendations of the	
U.S. Commission on Ocean Policy	460



# LIST OF BOXES

Box 1.1 Defining Coastal Areas	34
Box 1.2 The "Fourth Seacoast"—The Great Lakes	38
Box. 2.1 Public Meetings of the U.S. Commission on Ocean Policy	57
Box P.1 Acknowledging Change: The Need to Update Federal Laws	
Box 5.1 Regional Approaches at Work	
Box 5.2 Nature and Functions of Regional Ocean Councils	
Box 5.3 Moving Toward Improved Federal and Stakeholder Coordination	
in the Great Lakes Region	
Box 6.1 Swimming through Hoops: Establishing an Offshore Aquaculture	Facility <b>101</b>
Box 6.2 Sunken Treasure: Our Underwater Cultural Heritage	•
Box 7.1 Improving Ocean and Coastal Management by	
Enhancing NOAA's Capacity	111
Box 7.2 Federal Ocean and Coastal Activities in Agencies other than NOA	
Box 7.3 Historical Precedent for Presidential Reorganization	
of the Executive Branch	115
Box 8.1 The Need for Qualified Science Teachers	133
Box 8.2 COOL Professional Development for Teachers	134
Box 8.3 Today's Kids Tomorrow's Ocean Professionals	135
Box 8.4 The Ocean Information Gap	
Box 8.5 What Is Informal Education?	143
Box 8.6 NOAA's National Marine Sanctuaries Program as a	
Vehicle for Public Education	144
Box 8.7 Equal Opportunity Educators	145
Box 9.1 Coastal Activities Are Big Business	151
Box 9.2 The Smart Growth Movement	152
Box 9.3 What Is a Coastal Watershed?	154
Box 9.4 Balancing Federal Ocean Activities with State Coastal Managemen	nt
Programs: The Federal Consistency Tool	158
Box 10.1 Hurricanes Wreak Havoc Along the Coast	164
Box 10.2 New Orleans at Risk	165
Box 11.1 Examples of Large-scale Coastal Habitat Restoration Efforts	174
Box 11.2 A Community Habitat Restoration Effort: Friends of Heeia State	Park 177
Box 12.1 Sediment: Friend or Foe	
Box 12.2 The Legacy of Sediment Contamination	
Box 12.3 Beach Nourishment: One Use for Dredged Sediment	186
Box 13.1 Federal Members of the Interagency Committee for the	
Marine Transportation System	199
Box 13.2 Nonfederal Member Organizations of the	
Marine Transportation System National Advisory Council	199
Box 14.1 Nutrient Pollution in Coastal Waters	206
Box 14.2 The Impact of Farm Nutrients on the Marine Environment	216
Box 15.1 Ocean and Coastal Monitoring Needs	227
Box 15.2 Keeping Up With New Contaminants	234
Box 17.1 What Is an Invasive Species?	253
Box 17.2 Federal Departments and Agencies with	
Roles in Invasive Species Management	
Box 18.1 Abandoned Fishing Nets Catch a Wave to Hawaii	
Box 19.1 Dedicated Access Privileges: A Better Description	289

Box 20.1 Making a Case for Ecosystem-based Management: The Steller Sea Lion	317
Box 23.1 Special Focus on Microbial Diversity	341
Box 24.1 Offshore Liquefied Natural Gas Ports May Be on the Horizon	358
Box 24.2 The Federal Consistency Provision and Offshore Oil and Gas Development	362
Box 24.3 A Mighty Wind Blows in Cape Cod	367
Box 25.1 Examples of Ocean and Coastal Science Needs	380
Box 25.2 Primary Federal Agencies that Conduct Science-based Marine Operations	389
Box 25.3 Selected Ocean and Coastal Reports from the	
Former Congressional Office of Technology Assessment	391
Box 26.1 Components of the Integrated Ocean Observing System	396
Box 26.2 Signatories to the Ocean.US Memorandum of Agreement	398
Box 26.3 The National Weather Service: An Investment That Paid Off	406
Box 26.4 An Investment with Big Returns: The Economic Value of	
Ocean Observations	408
Box 28.1 Data Management Terminology	429
Box 29.1 Selected International Bodies with Ocean-related Responsibilities	451
Box 29.2 U.S. Involvement in International Capacity Building Efforts	

# **PHOTOGRAPH IDENTIFICATION** AND CREDITS

Bass Harbor lighthouse, ME, Fotosearch	28
Sunbathers on the beach, Corbis	30
Ship's wheel and maps, Corbis	48
Driftwood and beach, Photolink	60
Satellite photograph of Boston, MA, Corbis	74
Bridge in Newport, RI, Fotosearch	76
Waves crashing on the shore, Photolink	86
Fishing boat, Corbis	98
Storm clouds over the ocean, Photolink	108
Man and children net fishing, Wonderfile	120
Boy examining aquatic organisms, Corbis	
Fort Lauderdale, FL, Wonderfile	
Sailboats in front of Boston skyline, Photolink	150
Hurricane damage near the shore, NOAA Office of Oceanic and Atmospheric Research	
Sunset and reeds, Photolink	
A heavily silted river enters the ocean near San Juan, PR, NOAA Photo Library	
Cranes at shipyard loading and unloading cargo, Fotosearch	
Coastal waters, Corbis	
Sewage outfall, Corbis	
Polluted stream, Corbis	
Coast Guard helicopter assists sinking vessel, PhotoLink	236
Inside of a 2-inch pipe clogged with zebra mussels, Don Schloesser,	
Great Lakes Science Center, National Biological Services	
Trash and debris washed up on a beach, PhotoLink	
Pink fish near crinoid on reef, Corbis	
Fishermen haul in their catch, NOAA Photo Library	
Leopard seal, PhotoLink	
Blue starfish on coral reef, Corbis	
Fish farms in Ago Bay, Japan, Corbis	
A red-tide event off the coast of San Diego, CA, Peter J.S. Franks, SIO	
Ocean Confidence oil rig, Diamond Offshore Drilling Company	
Scientist collecting samples from Antarctic waters, Scripps Institution of Oceanography	372
Sample collecting device being lowered from a research vessel,	
Scripps Institution of Oceanography	374
False-color satellite image showing Chlorophyll A concentration, 1997–2002,	
The SeaWiFS Project, NASA/Goddard Space Flight Center and ORBIMAGE	394
DSV Alvin underwater exploration vehicle, NOAA Photo Library	412
Space Environment Center, Boulder, CO,	
NOAA Office of Oceanic and Atmospheric Research	
Planet Earth, Corbis	
Flags of the world, Corbis	
School of Bluelined Snapper fish, Corbis	
Aerial view of Seattle, NOAA Photo Library	
Jellyfish, NOAA Office of Exploration	4/2 52/1