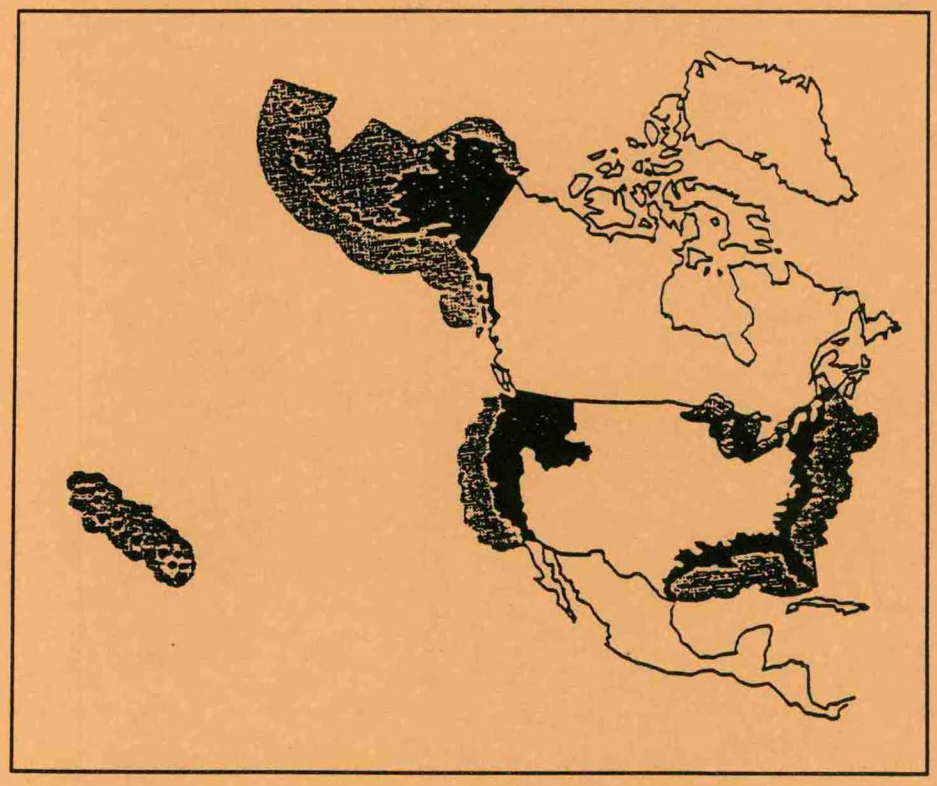
Science for Solutions

A'S COASTAL OCEAN PROGRAM

NOAA HABITAT STRATEGIC PLAN



U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
Coastal Ocean Office

L. D., 1986: Development of Forecast Guidance for Santa Ana Conditions. ather Digest, Vol. 12 No. 1, 8pp.

W. S., D. J. Schwab, Y. Y. Chao, and D. M. Wright, 1986: Lake Erie Wave ecasts Generated by Empirical and Dynamical Methods -- Comparison and n. Technical Note, 23pp.

, 1986: Determination of Errors in LFM Forecasts Surface Lows Over the Northwest Atlantic Ocean. Technical Note/NMC Office Note No. 313, 17pp.

No. 4. Rao, D. B., S. D. Steenrod, and B. V. Sanchez, 1987: A Method of Calculating the Total Flow from A Given Sea Surface Topography. NASA Technical Memorandum 87799., 19pp.

No. 5. Feit, D. M., 1986: Description of Marine Meteorological and Oceanographic Products of the Ocean Products Center. NOAA Technical Memorandum NWS NMC 68, 93pp.

No. 6. Auer, S. J., 1986: A Comparison of the LFM, Spectral, and ECMWF Numerical Model Forecasts of Deepening Oceanic Cyclones During One Cool Season. Technical Note/NMC Office Note No. 312, 20pp.

No. 7. Burroughs, L. D., 1987: Development of Open Fog Forecasting Regions. Technical Note/NMC Office Note. No. 323., 36pp.

No. 8. Yu, T. W., 1987: A Technique of Deducing Wind Direction from Satellite Measurements of Wind Speed. Monthly Weather Review, 115, 1929-1939.

No. 9. Auer, S. J., 1987: Five-Year Climatological Survey of the Gulf Stream System and Its Associated Rings. Journal of Geophysical Research, 92, 11,709-11,726.

No. 10. Chao, Y. Y., 1987: Forecasting Wave Conditions Affected by Currents and Bottom Topography. Technical Note, 11pp.

No. 11. Esteva, D. C., 1987: The Editing and Averaging of Altimeter Wave and Wind Data. Technical Note, 4pp.

No. 12. Feit, D. M., 1987: Forecasting Superstructure Icing for Alaskan Waters. National Weather Digest, 12, 5-10.

No. 13. Sanchez, B. V., D. B. Rao, S. D. Steenrod, 1987: Tidal Estimation in the Atlantic and Indian Oceans. Marine Geodesy, 10, 309-350.

No. 14. Gemmill, W.H., T.W. Yu, and D.M. Feit 1988: Performance of Techniques Used to Derive Ocean Surface Winds. Technical Note/NMC Office Note No. 330, 34pp.

No. 15. Gemmill, W.H., T.W. Yu, and D.M. Feit 1987: Performance Statistics of Techniques Used to Determine Ocean Surface Winds. Conference Preprint, Workshop Proceedings AES/CMOS 2nd Workshop of Operational Meteorology, Halifax, Nova Scotia., 234-243.

No. 16. Yu, T.W., 1988: A Method for Determining Equivalent Depths of the Atmospheric Boundary Layer Over the Oceans. Journal of Geophysical Research, 93, 3655-3661.

No. 17. Yu, T.W., 1987: Analysis of the Atmospheric Mixed Layer Heights Over the Oceans. Conference Preprint, Workshop Proceedings AES/CMOS 2nd Workshop of Operational Meteorology, Halifax, Nova Scotia, 2, 425-432.

No. 18. Feit, D. M., 1987: An Operational Forecast System for Superstructure Icing. Proceedings Fourth Conference Meteorology and Oceanography of the Coastal Zone. 4pp.

The development of this strategic plan was coordinated by NOAA's Coastal Ocean Office as part of its ongoing effort to enhance NOAA's coastal ocean capabilities.

To obtain a copy of this report or to learn more about the mission of the office, please write:

NOAA Coastal Ocean Office
1825 Connecticut Ave., N.W.
Suite 518
Washington, D.C. 20235
or phone: 202-606-4330.

Science for Solutions

NOAA'S COASTAL OCEAN PROGRAM

NOAA HABITAT STRATEGIC PLAN

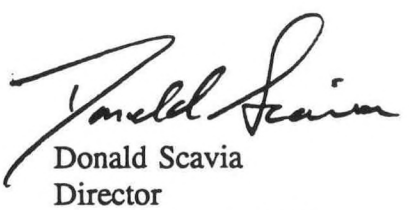
April 1993

U.S. DEPARTMENT OF COMMERCE
Ronald H. Brown, Secretary
National Oceanic and Atmospheric Administration
Diana H. Josephson, Acting Under Secretary
Coastal Ocean Office
Donald Scavia, Director

FOREWORD

The ongoing loss or degradation of coastal habitat ecosystems is a national problem which, among other things, has adversely impacted U.S. fisheries. Continued population growth in U.S. coastal counties is predicted for the future and will put increasing pressures on these vital habitats. A healthy U.S. economy must be based on a healthy environment. To insure sustainable development in coastal areas, there is a clear need for effective ecosystem protection supported by scientific information on various land-use effects on habitat and on the living marine resources which use them.

As steward of the Nation's living marine resources, the National Oceanic and Atmospheric Administration (NOAA) has the responsibility for the health of coastal ecosystems. To bring about the coordination of NOAA's efforts in this area, the Coastal Ocean Office facilitated the development of this strategic plan. The plan provides detailed, agency-wide guidance for addressing the priority issues affecting habitat and develops strategies for extending this coordination to other Federal agencies, the states, and academia. It is hoped that this plan, when implemented, will provide the Nation with effective management strategies that will both conserve and restore the quantity and quality of these habitat ecosystems and provide for the sustainable use of the land which adjoins them.



Donald Scavia
Director
Coastal Ocean Office

April 28, 1993

NOAA HABITAT STRATEGIC PLAN

CONTENTS

EXECUTIVE SUMMARY

Background

The nation's interconnected coastal waters, which include inshore marine waters, bays, sounds, estuaries, the Great Lakes, tributary rivers, and their adjacent wetlands, are valuable natural treasures which provide essential habitat to an estimated 75% of those living marine resources having commercial importance. Such inshore ecosystems will be referred to collectively as "coastal" waters throughout this document. These waters are also thought to be equally important in sustaining species having recreational and ecological (food web) value. These inshore ecosystems also provide the location and basis for extensive commercial, recreational, residential, and industrial activities. Demographic trends indicate that by 2010, approximately 54 percent of the U.S. population will live within 50 miles of the coast, representing an increase of 27% above coastal counties' population levels in 1980. Accompanying this explosive growth will be increasing pressures on and competing uses of coastal waters and their living resources. A sound economy depends upon a sound environment. Consequently, there is a clear need for effective habitat protection, supported by specific scientific information on land use effects, if the nation is to achieve "sustainable" development of its coast and inshore areas. It is the responsibility of the National Oceanic and Atmospheric Administration (NOAA), as steward of the nation's living marine resources, to provide federal leadership in this critical area.

Living Marine Resources

Dramatic population declines have been experienced by many inshore-connected species because of habitat alteration and overfishing in concert with natural mortality. (As used in this document, the term "habitat" includes both water and substrate throughout the ranges of living marine resources. "Living marine resources" will refer primarily to fish and shellfish, but includes all plant and animal life which inhabit coastal waters at some point in their life cycle.) The four primary threats to living marine resources' habitats, which are addressed by the NOAA Habitat Strategic Plan, are: 1) physical habitat alteration, 2) alterations in freshwater inflow, 3) toxic contaminants, and 4) nutrient over-enrichment.

Physical Habitat Alteration

Many riverine, estuarine, and coastal areas that are known to provide critical habitat for important fisheries are being degraded and some of the most important are rapidly disappearing. Human activities and natural causes have resulted in the loss of over half of the nation's original coastal wetlands. California has lost an estimated 91% of its original coastal wetlands. Louisiana is losing an estimated 30 square miles of coastal wetlands per year. Our ability to assess the immediate and long-term effects of human activities on estuarine resources depends on an increased understanding of habitat functions, the rate of habitat loss, and the cause of such loss and degradation. Our ability to evaluate the effects of additional development and to

mitigate the effects of habitat loss occurring through existing water resource development and regulatory programs depends on such information. An improved understanding of habitat functioning is critical for the protection our inshore-dependent fisheries.

Alteration of Freshwater Flows

The health of estuaries and even oceanic waters that are bathed by estuarine plumes are influenced by a complex set of hydrological characteristics determined largely by freshwater inflows. Major alteration of flows by the construction of dams, diversion of flows, and land use practices (e.g., clearcutting and grazing) have had disastrous effects on such ecosystems as well as on populations of both resident and migratory species dependent upon such marine, estuarine, and riverine systems. Examples include the Pacific Northwest, the Central Valley of California, Florida's "Everglades," the Texas coast, the Nile Delta, the Sea of Azov, and the Aral Sea. Alterations of freshwater flows to estuaries can affect nutrient budgets and salinity regimes and, thus, adversely affect the health and productivity of estuarine and coastal systems. Advances in our basic knowledge of how alterations of freshwater systems influence the biological productivity of our riverine corridors to the sea, will allow us to consider the advisability of both existing and future modifications of these valuable ecosystems.

Toxic Contaminants

Runoff and waste discharges introduce many contaminants to riverine, estuarine, and coastal systems. Primary among these are toxic contaminants, including chlorinated hydrocarbons, petroleum hydrocarbons, and trace metals. A number of studies have demonstrated that many of our inshore waters are "contaminated," and that living marine resources' health is being compromised. Monitoring is needed to identify the magnitude of coastal contamination. Even more important, however, is research to determine the specific effects of existing levels of contaminants on individual organisms, and eventually populations and communities of organisms. Improved knowledge of the significance of important classes of contaminants in inducing disease in living marine resources will significantly increase our capability to predict the effectiveness of control measures and better protect coastal ecosystems.

Nutrient Over-Enrichment

The addition of nutrients in excessive quantities from agricultural areas and from municipal sources threatens the health of coastal, estuarine, and riverine systems. Over-enrichment can also cause shifts within estuarine and coastal communities toward algal species which, by virtue of their size, are unavailable and thus no longer capable of serving as the basis of coastal food chains. More importantly, nutrients can stimulate nuisance and toxic growths of algae and depletion of oxygen when these growths decay, frequently with attendant kills of fish and other living resources. Those estuarine and coastal areas experiencing low oxygen concentrations that can be traced to nutrient enrichment are often located adjacent to population centers that discharge sludge and organic waste into surrounding waters or are downstream of agricultural

areas. Humans can contract a variety of diseases, such as hepatitis, if they become infected with pathogens, associated with human sewage, through ingestion during water-based activities or through the consumption of contaminated fish or shellfish.

NOAA Habitat Strategic Plan

The NOAA Habitat Strategic Plan is the agency's long-range strategy for coordinated and concerted action to address the deterioration of the nation's coastal, estuarine, and riverine habitats and populations of living marine resources dependent upon such habitats. NOAA is uniquely qualified to respond to this challenge. NOAA's legislative responsibilities and capabilities in habitat protection, wetlands ecology, resource conservation, toxicology, ocean system dynamics, fishery management, biological processes, and coastal habitat management provide a solid foundation for addressing these issues through an inter-disciplinary approach. NOAA has invested over $100 million per year in programs and activities that focus on habitat-related problems and issues along the nation's coasts and throughout its Exclusive Economic Zone (EEZ), including its protectorates and trust territories in the Pacific Ocean and Caribbean Sea. (The map on the cover illustrates the extent of NOAA's coastal habitat concerns and jurisdiction, extending offshore from the edge of the 200 nautical mile limit to the inland extent of migration of living marine resources, for only that portion of the EEZ surrounding the 50 states.)

The NOAA Habitat Strategic Plan provides detailed, agency-wide guidance for addressing the priority issues affecting habitat important to living marine resources throughout the nation's coastal waters. This document complements "NOAA's Investment in Coastal Environmental Quality," which is being published separately, but focuses specifically on living marine resources' habitats. NOAA's role in this effort is (a) to develop the scientific understanding of how human activities affect natural ecosystem functioning, and (b) assessing and predicting the effects of specific land and water development proposals on coastal environments and their living marine resources. NOAA's Goal for habitat protection is to

"PROTECT, CONSERVE, AND RESTORE THE QUANTITY AND QUALITY OF HABITATS OF LIVING MARINE RESOURCES TO MAINTAIN POPULATIONS OF COMMERCIAL, RECREATIONAL, AND ECOLOGICALLY IMPORTANT SPECIES AT OPTIMAL SUSTAINABLE LEVELS."

Strategies to address the priority problem areas are examined within the context of NOAA's Goal and Objectives. Actions and Products are identified for each Objective and Sub-objective to provide direction for NOAA's efforts.

Plan Implementation

NOAA will concentrate the agency's multi-disciplinary resources and capabilities on the priority problem areas described above. Primarily, this will be accomplished through coordinated agency strategies to address priority issues over the short-term through involvement

in federal and state decisionmaking processes affecting habitats important to living marine resources. Over the longer term, NOAA will build its scientific understanding of the importance of habitat to living marine resources' productivity as a basis for its determining the effects of habitat degradation on future population size. Through directed scientific investigation, NOAA will improve the understanding of ecosystem functioning and the capability to predict the impact of alterations on these coastal and inshore ecosystems. This, in turn, will provide NOAA's resource managers with a stronger scientific basis for influencing management and regulatory decisions.

It is crucial that NOAA promote closer integration of its habitat-related programs. NOAA's programs provide an extensive network of management and scientific expertise as well as substantial investment in laboratories, ships, and satellites. NOAA will strengthen and better coordinate this network to improve the effectiveness of its involvement in the decisionmaking processes which control coastal, estuarine, and riverine habitat quality. Integral to this will be an expansion of cooperative programs with academia and other federal agencies that have mandates and responsibilities concerning living marine resources and their habitats.

NOAA will use its oversight and consultative responsibilities with federal, state, and regional management plans to emphasize NOAA's habitat priorities. NOAA will encourage alignment of states' coastal management goals and standards more closely with the NOAA Habitat Strategic Plan's Goal and Objectives in areas such as wetlands protection, water management, cumulative effects of coastal development, fisheries, and nonpoint source pollution control programs.

I. INTRODUCTION

Inshore Ecosystems: a National Treasure

Inshore ecosystems, including coastal waters, bays, estuaries and their tributary rivers and streams, form the vital margins of the global ocean system. For convenience, such inshore ecosystems will be referred to collectively as "coastal" waters throughout this document. The nation's narrow coastal borders and freshwater systems in adjacent drainage basins (including the Great Lakes) are the most productive, accessible, and vulnerable portion of those aquatic habitats which support living marine resources for which NOAA bears stewardship and trusteeship responsibility. Enriched by nutrients from the land, mixed by tides from the seas, and saturated by sunlight, these dynamic habitats feed, support, and shelter living marine resources including fish, shellfish, and their food webs. These waters and adjacent wetlands also provide a tremendous bounty for the civilization at its borders. In fact, although these coastal waters comprises less than 1% of the ocean environment, they provide much of the biological foundation for the adjacent marine ecosystem.

About 75% (77% by weight and 71% by value) of the total U.S. commercial landings of fish and shellfish in 1985 (the last year for which such an analysis was made) were composed of species dependent upon inshore ecosystems for their reproduction, growth, migration, and survival[1]. Such species will be referred to as inshore-dependent, yet they include migratory species such as salmon, which spawn far inland and mature at sea. Including the value added in processing, these species had an estimated value of $5.5 billion in 1986[1]. (However, with the discovery in recent years of hugh stocks of pollock off Alaska, this offshore species now dominates U.S. landings and would dramatically skew the inshore-dependence of the U.S. commercial catch, if it were computed again today.) Inshore-dependency of the commercial catch is highest along the Gulf of Mexico and the Southeast Atlantic coasts - estimated in 1985 at 94% and 98%, respectively. However, even the Northeast (41%), Northwest (56%), and Alaskan (76%) coasts record substantial inshore-dependent landings[1]. Moreover, these inshore waters are essential in sustaining what is thought to be an even larger proportion of the catch of sport anglers, who number an estimated 17 million and who generated annual expenditures estimated at $8.2 billion in 1985[2].

For centuries, society has placed enormous value on these coastal areas for living, working, and enjoyment. In 1980, an estimated 52.6% of the U.S. population lived within 50 miles of the coast (including the Great Lakes). By 2010, this coastal population is expected to increase to 53.6%, by rising from 119 to 151 million people - a 27% increase[3]. Most of this increase will occur in the "Sun Belt" where inshore-dependency of living marine resources is the highest. Consequently, the most productive and valuable natural aquatic ecosystems are also becoming the most intensively populated, heavily used, and highly stressed areas.

Coastal economies have long operated under the presumption that the nation's waterways could be used endlessly to: accept pollutant loads from land drainage and waste discharges; accommodate dam construction, navigation channel construction, and port development;

provide waters for agriculture, municipal, industrial, and energy production; withstand logging, agriculture, and other resource consumptive uses in adjoining watersheds; and provide more land for housing and other development through sacrifice of additional wetlands and shallow water habitats. Because these varied uses adversely affect the ability of ecosystems to support aquatic life and maintain biotic integrity of the system, competition and social conflict over the fate of these inshore habitats has risen with the accommodation of increasing coastal development. Such uses jeopardize not only ecosystem integrity, but also "sustainability" of coastal growth and the economic and societal values that can be derived in perpetuity from clean and productive coastal ecosystems. It has now become more widely understood by the general public that a healthy economy cannot exist without a healthy life support system.

Declines in Living Marine Resources and their Habitats

Inshore-dependent fishery resources have been exploited heavily, yet we also have evidence that reproduction and growth have also been limited by cumulative habitat degradation and loss. Populations of many fish species off the Atlantic, Pacific, and Gulf of Mexico coasts, which have been fished both commercially and recreationally, have been reduced to historic low levels of abundance. These include such highly valued species as Atlantic salmon, striped bass, weakfish, spotted seatrout, summer flounder, winter flounder, American shad, hickory shad, croaker, king mackerel, cobia, pompano, red drum, black drum, snook, California halibut, diamond turbot, English sole, and hundreds of distinct races of Chinook salmon, coho salmon, sockeye salmon, chum salmon, and steelhead. The major cause for most fishery declines is broadly thought to be overfishing, but we now have evidence that many inshore-dependent populations are also being affected by cumulative habitat degradation and loss. Degradation of marine, estuarine, and riverine systems affects such species at their most sensitive stages and can have long-term consequences for their populations.

Regional losses of fishery resources associated with increasing habitat degradation highlight the significance of this problem. Salmon and steelhead produced in the Columbia River Basin, and now numbering an estimated 1 million fish, have declined by approximately 90-94% compared to historic levels estimated at 10-16 million fish[4]. California's winter run Chinook salmon populations have declined by 99% since 1969[5]; in 1991 this race was designated as a species threatened with extinction. All other native races of salmon and steelhead in California's Central Valley and more than half of those of the Columbia River Basin have experienced similar declines, with many approaching threatened or endangered status. The American Fisheries Society estimates that over 200 separate races of Pacific salmon and steelhead may have now been lost, and of those 211 remaining, 101 are at high risk of extinction[6]. In Chesapeake Bay, landings of American oyster have declined more than 96% from levels obtained 100 years ago[7]. Striped bass and other migratory stocks have declined an average of 82% between the mid-1960s and mid-1980s[8]. Coastal wetland losses have been extensive in California, Texas, Louisiana, Florida, New York, and Connecticut, and large areas

of submerged aquatic vegetation have disappeared in many coastal areas, including Chesapeake, Galveston, San Francisco, and Florida Bays. An estimated 91% of California's coastal wetlands have been lost compared to historic acreages[9].

There is also substantial evidence of contamination by highly toxic and long-lived PCBs, DDT, trace metals, and a vast number of chlorinated hydrocarbon compounds in sediments and benthic organisms from urbanized inshore areas,[10] as well as downstream of major agricultural areas of the U.S.[11] The areas most affected include the coastal waters of Puget Sound, San Francisco Bay, Los Angeles, San Diego, Laguna Madre, Galveston Bay, coastal Louisiana, Mississippi Sound, Mobile Bay, Tampa Bay, Miami River, St John's River, Winyah Bay, Cape Fear River, Albemarle-Pamlico Sound, Elizabeth River, Baltimore Harbor, Delaware Bay, the Hudson-Raritan Estuary, Hudson River, Western Long Island Sound, Narragansett Bay, Buzzards Bay, Boston Harbor, Salem Harbor, Casco Bay, Penobscot Bay, and Lakes Michigan, Huron, Ontario, and Erie. New Bedford Harbor, until recently the nation's leader in commercial fishery landings (derived almost entirely from offshore harvests), has even been "tarnished by association" as a designated Superfund cleanup site. A high percentages of bottom-dwelling fish from the more degraded coastal sites show contaminant-induced body damage (lesions). Moreover, liver cancer has been found in 20% of the English sole collected from two of the most contaminated areas of Puget Sound[12] and in 15% of winter flounder samples from similarly affected areas of Boston Harbor[13].

A National Concern

Broad public concern for protecting the integrity of riverine, estuarine, and coastal systems spurred the U.S. Congress to recognize the problem of inshore habitat degradation. The House Committee on Merchant Marine and Fisheries issued a report[14] entitled, "Coastal Waters in Jeopardy: Reversing the Decline and Protecting America's Coastal Resources," which states:

> "The evidence of the decline in the environmental quality of our estuaries and coastal waters is accumulating steadily. The toll of nearly four centuries of human activity becomes more and more clear as our coastal productivity declines, as habitats disappear, and as our monitoring systems reveal other problems... The continuing damage to coastal resources from pollution, development, and natural forces raises serious doubts about the ability of our estuaries, bays, and near coastal waters to survive these stresses. If we fail to act and if current trends continue unabated, what is now a serious, widespread collection of problems may coalesce into a national crisis by early in the next century."

Further expression of Administration concern for the protection of aquatic habitats has come in response to the recommendations of the Wetland Forum[15]. The President has declared a national goal, over the short term, of "No Net Loss" of wetlands with the long term objective being a "Net Gain"[16]. The Domestic Policy Council has established interagency Working Groups to develop various means to achieve the goal.

Science in Federal Decision-Making

Since inshore waters are the transition between land and sea, they are also at the nexus of federal, state, and local jurisdictions. Consequently, no governmental entity has complete dominion over the uses and management of inshore waters or the coastal ocean. Governmental responsibilities to address the problem of the deterioration of the nation's inshore ecosystems and their living marine resources are derived from common law, public trust obligations, Constitutional law, and specific statutory mandates. The federal government and the individual states share concurrent jurisdiction over inshore and coastal waters. For the stewardship of living marine resources, the federal government shares responsibility with the states and acts in behalf of the public interest in both federal and state governmental decisionmaking affecting living marine resources' habitats or health. Appendix A provides an overview of legislation authorizing NOAA's habitat-related science and management programs involving coastal waters, estuarine systems, and their watersheds.

A large number of federal and state agencies are involved in coastal decisionmaking under the authority of a complex array of statutes. These include the Environmental Protection Agency (EPA), U.S. Fish and Wildlife Service (FWS), U.S. Army Corps of Engineers (Corps), Federal Energy Regulatory Commission (FERC), Bureau of Reclamation (BuRec), Soil Conservation Service (SCS), Minerals Management Service (MMS), Nuclear Regulatory Commission (NRC), U.S. Department of Agriculture (USDA), U.S. Coast Guard (CG), Federal Highway Administration (FHWA), Forest Service (FS), and many others. (Acronyms used frequently in this document are listed in Appendix D.) NOAA works closely with these agencies and with counterparts at the state level in the conduct of its programs. Descriptions of the habitat-related programs of NOAA and other federal agencies are summarized in Appendix B. The NOAA Line Offices primarily involved include the National Marine Fisheries Service (NMFS), the National Ocean Service (NOS), and the Office of Oceanic and Atmospheric Research (OAR).

Federal agencies that intend to construct or authorize the construction of projects or activities affecting "waters of the U.S." including their adjacent wetlands, are bound by the Fish and Wildlife Coordination Act (FWCA), to consult first with the federal (NMFS and FWS) and state fish and game agencies on the effects of these activities. As the federal steward for living marine resources, stemming from authority contained in the Fish and Wildlife Act of 1956, NMFS is responsible for representing the interests of living marine resources in all agency decisionmaking processes. The FWCA is NOAA's primary mechanism to convey its scientific understanding of the effects of proposed activities on habitats, ecosystems, and living marine resources. Consequently, NMFS is the primary NOAA "user" community for information developed by NOAA's habitat-related programs (Appendix B). NMFS utilizes its multi-disciplinary expertise in fisheries biology, ecology, toxicology, chemistry, oceanography, hydrology, law, engineering, economics, and related fields to advise other agencies and private citizens on the advisability of their proposed projects, programs, and policies. A second user community includes the state CZM Programs, whose resource managers either participate in and influence state agency decisionmaking processes or, in some cases, act as the final

decisionmaker on specific issues. State CZM programs can also affect federal agency actions through the "consistency" authority provided by the Coastal Zone Management Act (CZMA). Both of these user communities rely on the same broad base of information to support decisionmaking on proposed development and policies, as do all other state and federal agencies involved in such decisionmaking. Other NOAA user communities include resource managers of the National Marine Sanctuary Program (NMSP), National Estuarine Research Reserve System (NERRS), and NOAA Damage Assessment and Restoration Program (DARP).

Strategic Plan Development

In early 1990, the Under Secretary for Oceans and Atmosphere directed the NOAA Coastal Ocean Program Director to develop a strategic plan for coastal habitat protection. The strategic plan is intended to provide long-term guidance for the habitat-related portions of NOAA's base activities and direction to the agency's emerging Coastal Ocean Program. To develop the strategic plan, a team composed of representatives from all NOAA Line Offices was organized under the direction of a leader from the NOAA Coastal Ocean Program Office. Extensive prior NOAA and interagency planning[17,18,19,20] was reviewed by the team and utilized to frame the priority habitat issues to be addressed. In addition, the key information needed to manage coastal ecosystems, as developed in previous NOAA habitat-related planning, was used to focus development of detailed approaches. The priority information needs of NOAA's user communities are listed in Appendix C.

A statement of Principles provides broad policy guidance on plan development and implementation. The core of the strategic plan was structured using an overall Goal, Objectives, Sub-objectives, and detailed Strategies for each, composed of priority Actions to be taken. Drafts were circulated to recognized experts within NOAA for development of detailed Strategies and to all concerned organizations within NOAA for review of successive versions of the plan. Representatives from the FWS, EPA, Corps, and USDA met with the development team to discuss the consistency of their agencies' needs with the plan's proposed objectives. Following necessary revisions, detailed elements of the plan were drafted by NOAA staff from both headquarters and field organizations. Members of the team and invited authors who contributed to development of the plan are listed in Appendix D. Discussions on the scope, content, and structure of the plan were held with each NOAA Assistant Administrator responsible for significant habitat-related activities, with the NOAA General Counsel, and at NOAA Monthly Operating Reviews convened by senior management.

II. PRINCIPLES

NOAA recognizes the need for its habitat-related programs to complement and support each other to achieve mutual objectives. Such coordination requires a convergence toward common directions. To promote such convergence of purpose, NOAA's habitat-related programs will be managed and conducted in accordance with the following general Principles.

1. NOAA considers the conservation of habitat that is important to living marine resources to be a national priority.

2. NOAA will actively fulfill its stewardship responsibilities to conserve, protect, and restore habitat important to living marine resources.

3. NOAA's primary mechanism for achieving its habitat conservation goal is through active involvement in the public interest decisionmaking by government agencies whose policies, programs, and projects affect habitats important to living marine resources.

4. NOAA's habitat-related programs will be designed to contribute to and maximize NOAA's effectiveness in influencing the decisionmaking of other agencies to protect habitats and ecosystems important to living marine resources.

5. NOAA will strengthen its influence on other agencies' projects, programs, and policies by improving the scientific basis of NOAA's reviews and by integrating and better focusing existing programs.

6. NOAA will focus its habitat-related research and synthesis activities on determining and predicting the effects of human-induced ecosystem alterations on populations of living marine resources.

7. NOAA will utilize partnerships with other governmental organizations and academic institutions to further its habitat conservation objectives.

III. GOAL, OBJECTIVES, AND SUB-OBJECTIVES

GOAL

PROTECT, CONSERVE, AND RESTORE THE QUANTITY AND QUALITY OF HABITATS OF LIVING MARINE RESOURCES TO MAINTAIN POPULATIONS OF COMMERCIAL, RECREATIONAL AND ECOLOGICALLY IMPORTANT SPECIES AT OPTIMAL SUSTAINABLE LEVELS.

OBJECTIVE I

Implement an effective strategy for improved habitat protection through active involvement in federal policy and decisionmaking processes on projects and programs that affect essential habitats and supporting ecosystems.

I.A. Establish national policies to reverse the negative trends in habitat quality and quantity and declining populations of living marine resources.

I.A.1. Seek federal legislation that would provide NOAA with the authority to prohibit or modify proposed activities that could adversely affect essential habitat.

I.A.2. Pursue inter-agency policy opportunities that could increase NOAA's ability to influence habitat-related decisions.

I.A.3. Establish NOAA policies or position statements on priority habitat issues.

I.B. Evaluate plans, provide guidance to other agencies, and act as steward of the nation's living marine resources on all proposed projects, programs, and policies significantly affecting essential habitats.

I.B.1. Participate successfully in federal and state decisionmaking processes for all those projects having individual or precedent-setting significance; utilize appeal mechanisms as needed.

I.B.2. Represent the interests of living marine resources in regional land use and waterbody planning and management programs.

I.B.3. Conduct damage assessments to quantify injuries to living marine resources and their habitats; recover damages to support restoration efforts; and implement restoration plans to restore lost habitats, resources, and uses.

I.B.4. Fully incorporate habitat protection within the concept of "fishery management" employing the authorities of NMFS, the Regional Fishery Management Councils, Interstate Marine Fishery Commissions, and special multi-state plans.

OBJECTIVE II

Develop the scientific understanding and information needed to wisely manage habitats and ecosystems important to living marine resources through a comprehensive program of research on their habitat requirements, natural ecosystem functioning, and the way society's activities affect living marine resources and essential habitats.

II.A. Develop a basic understanding of the status of living marine resources' populations and their ecological and habitat requirements.

II.A.1. Determine the functional importance of specific habitats and ecosystems to living marine resource productivity.

II.A.2. Determine population trends of recreational, commercial, and ecologically important species and the status and historical trends of their habitats.

II.A.3. Develop effective techniques for habitat restoration, enhancement, and creation.

II.B. Determine the biological effects of habitat degradation to provide a sound scientific basis for habitat management, environmental impact assessment, inter-agency negotiation, and conflict resolution.

II.B.1. Determine the effects on living marine resources of physical habitat alteration and hydrologic modification of ecosystems.

II.B.2 Determine the risks to living marine resources' health and productivity of exposure to existing levels of toxic chemicals and nutrient enrichment of coastal, estuarine, and riverine systems.

II.B.3. Evaluate and predict the biological and economic consequences of cumulative, region-wide habitat alteration and pollution.

IV. STRATEGIES TO ADDRESS THE GOAL AND OBJECTIVES

OBJECTIVE I

Implement an effective strategy for improved habitat protection through active involvement in federal policy and decisionmaking processes on projects and programs that affect essential habitats and supporting ecosystems.

I.A. Establish national policies to reverse the negative trends in habitat quality and quantity and declining populations of living marine resources.

I.A.1. Seek federal legislation that would provide NOAA with the authority to prohibit or modify proposed activities that could adversely affect essential habitat.

NOAA's abilities to influence directly most habitat-related decisions are compromised by mandates that restrict the agency's role to providing recommendations and technical information to other agencies' decisionmakers. Other than through limited habitat jurisdiction in the Magnuson Fishery Conservation and Management Act (MFCMA), the lone exception is the Federal Power Act, where 1987 amendments gave NOAA and other resource agencies authority to prescribe performance standards and conditions on activities related to hydropower and pipeline facilities. NOAA should seek amendments to its enabling legislation (MFCMA, Fish and Wildlife Coordination Act (FWCA), Clean Water Act (CWA), National Environmental Policy Act (NEPA), Coastal Zone Management Act (CZMA) and others) to add similar powers of prescription.

The eventual goal of these changes is to escalate NOAA's role in habitat decisions beyond current advisory mandates. Given conflicting legislative mandates in many regulatory and construction agencies and NOAA's expertise in habitat science and management, the best opportunity to conserve trustee resources is through a greater role for NOAA, not continued attempts to sway decisions in other agencies.

Questions

* **How can NOAA strengthen its role** in reviewing wetland, waterway, and other projects such that construction, licensing, leasing and regulatory agencies adopt its views regarding habitat conservation?

* **Is current legislation amenable to amendment** to accomplish NOAA's objectives for more active decisionmaking involvement, or is new legislation necessary?

Actions

1. Determine which mandates offer the greatest prospects of conserving habitat, and focus effort on amending those.

2. Calculate the budget and staff needed to meet these expanded legislative powers. Separate those needs between science and management offices, and ensure that each receives the necessary funds and personnel.

3. Meet with other resource and regulatory agencies to clarify NOAA's new roles; negotiate inter-agency agreements.

Products

1. Established priorities in research and management by region and nationally, to be used to focus legislative intent on topics of greatest concern.

2. Statements of budget and staff projections for use in determining authorization and appropriation levels.

3. Analyses of program implications of shift from advisory to prescriptive role.

I.A.2. Pursue inter-agency policy opportunities that could increase NOAA's ability to influence habitat-related decisions.

Numerous opportunities arise continually for the development of federal policy concerning habitat conservation and protection of living marine resources. Moreover, NOAA can initiate national policy development and involve other agencies having similar concerns. National policy can be highly effective in furthering NOAA's stewardship goals through defining agency philosophies, procedures and objectives. Such policy-setting is also useful in guiding state policy development. Recent examples include the president's goal of "No Net Loss" of Wetlands and interagency policies on mitigation.

Questions

* **How can existing or new inter-agency agreements** improve NOAA's ability to manage essential habitats? Given suitable language, how should the agency shift its budget and staff to ensure full implementation?

* **How can NOAA exert a leadership role** on priority habitat issues? Should NOAA assume federal leadership in coastal habitat restoration, wetland science, pollution effects, Superfund site restoration, or other habitat issues?

* **How can NOAA implement a strong resource conservation ethic** in state CZM program policies?

Actions

NOAA elements having direct involvement in habitat policy issues (NMFS, GC, NOS, and OAR/Sea Grant) will coordinate their activities to strengthen NOAA's authorities to provide stewardship for trust resources and their habitats. NOAA's policy development will be jointly pursued, with lead responsibility taken by the NOAA element having primary expertise in the subject area.

1. **Expand NOAA's use of administrative reviews and appeals** under authority of the Clean Water Act, National Environmental Policy Act, Federal Power Act and others to challenge decisions viewed as detrimental to the goal and objectives of the Strategic Plan.

2. **Renegotiate existing inter-agency agreements**, particularly NOAA's Memorandum of Agreement (MOA) with the Department of the Army concerning the regulatory program, to strengthen NOAA's role in decisionmaking.

3. **Upgrade state CZM programs'** policy requirements to provide a basic level of protection to habitats affected by development in or having an effect on the coastal zone.

4. **Effectively participate in interagency policy-making initiatives**, such as the Domestic Policy Council Working Group designed to achieve the President's goal of "No Net Loss" of wetlands and development of a National Coastal Marine Protection Policy.

5. **Seek new interagency agreements** to establish a national reporting system to improve the effectiveness of regulatory programs, to allow budget transfers between agencies for technical assistance under the FWCA, Water Resources Development Act, "Superfund," or other habitat-related programs, and to integrate federal habitat restoration activities, including wetland, waterway, and pollution cleanup initiatives.

Products

1. **New 404(q) MOA** to strengthen NOAA's role in wetland and waterway permit decisions.

2. **Policies integrating federal programs** involving national habitat issues to increase effectiveness in conserving habitat and to reduce administrative obstacles, increase efficiency, and save money.

3. **New national policies** on coastal habitat protection, wetland conservation, and mitigation.

I.A.3. Establish NOAA policies or position statements on priority habitat issues.

Each year NOAA organizations develop an agency position on thousands of habitat-related issues. Inevitably, certain issues recur, such as the effectiveness of various mitigation strategies and NOAA's position on various types of projects which could affect living marine resources or their habitat. This objective recognizes the value of well-substantiated pronouncements of NOAA's position concerning habitats (e.g., seagrass beds and emergent marsh), human activities (e.g., wetland fills, freshwater diversions and dredging), and associated policies that represent the combined effort and judgement of NOAA's habitat-related programs.

NOAA could improve its ability to influence habitat-related decisions by strengthening and clarifying the basis for its position on specific habitat science, management, and policy questions. These positions would augment, not replace, the agency's strong advisory capabilities under the FWCA, such as those used to provide technical comments on proposed wetland and water projects, pollutant discharges, flow alterations, and other man-induced stress.

Questions

* **What is NOAA's recommended strategy to deal with cumulative effects?** How should construction, licensing, leasing and regulatory agencies factor long-term, cumulative impacts into decisions on individual projects or policies?

* **What is the agency's position on the major habitat issues?**

* **How vigorously should NOAA pursue its anadromous fish stewardship mandates?** Should NOAA allocate resources to protect and restore habitats throughout the historic ranges of anadromous species, thereby becoming more vigilant of chemical and physical impacts to those habitats?

Actions

To develop an agency policy or position on recurring issues, NOAA staff in the NMFS Habitat Conservation Program, OAR Sea Grant College Program, NOS Office of Ocean and Coastal Resource Management (OCRM), and NOS Office of Ocean Resources Conservation and Assessment (ORCA) should cooperate. Recommended actions are to:

1. **Develop regional or national policies and positions on recurring habitat threats.**

2. **Develop guidance on specific techniques, research and monitoring** needed to protect, conserve, restore, or create habitats through improved operation of federal and state agencies' programs.

3. **Establish techniques that provide information** for assessment of long-term ecological effects of priority habitat threats, including chemical contamination.

4. Convene meetings, including experts outside the agency, to develop background information on life history requirements and recurring habitat-related issues.

5. Urge regulatory agencies to incorporate all agency positions into their decisionmaking processes.

Products

1. Agency policy on broad habitat issues such as wetland loss, mitigation, contaminants' effects, nonpoint source controls, land-use management, anadromous fish conservation, oil and gas development, and federal and state water policies.

2. Technical pronouncements on recurring habitat threats such as: chemical introductions (creosote from pilings, nutrients and chlorine from sewerage systems); riparian habitat protection (buffer zones, temperature control); physical alterations (shading from raised walkways, platforms raised over coastal habitats); public versus private access (community piers instead of individual facilities); siting criteria (mooring fields, marinas, aquaculture ventures); and mitigation strategies (habitat restoration, seagrass and marsh plantings, mitigation banking).

3. Protocols for coordinating NOAA offices and developing joint statements, positions and policies on priority habitat issues.

I.B. Evaluate plans, provide guidance to other agencies and act as steward of the nation's living marine resources on all proposed projects, programs, and policies significantly affecting essential habitats.

I.B.1. Participate successfully in federal and state decisionmaking processes for all those projects having individual or precedent-setting significance; utilize appeal mechanisms as needed.

Tidal coastal wetland habitats are declining at a rate conservatively estimated at about 20-40,000 acres per year[21,22,23]. Over one-half of the nation's original coastal wetlands have already been destroyed and those remaining are suffering from pollution and other forms of human-induced stress. Other vital habitats, including forested wetlands of headwater streams, seagrass beds, and unvegetated tidal flats are also dwindling as a result of cumulative development activities. This loss is of great concern since roughly three quarters of the nation's living marine resources are inshore-dependent, often at their most sensitive life stages.

To fulfill its responsibilities as federal steward for living marine resources and their habitats, NOAA must actively pursue all significant opportunities to influence state and federal decisions. That mandate applies to issues ranging from individual permit applications to national policies, with special attention on decisions that set precedence. To achieve NOAA's goal, it must strive

for appropriate attention to be given to habitat issues, beginning in the early planning stages, and perhaps extending through the full appeal processes afforded by interagency agreements and legislative authorities.

NOAA's objective is to effectively utilize its review and prescription authorities to ensure that coastal habitat concerns are fully considered in agency decisions affecting such resources.

Questions

* **Which processes** offer NOAA the best opportunity to influence agency decisionmaking to protect and conserve habitat?

* **How can NOAA become more effective** in using those processes? Are the controlling agencies or legislation amenable to more influential NOAA participation?

* **What resources (budget and personnel) are needed** to achieve optimal participation?

Actions

NOAA's positions on proposed water resource development activities and programs will capitalize on the agency's FWCA authorities. Research programs (NMFS's habitat-related research, Sea Grant environmental research, and OAR's Environmental Research Laboratories) will focus their activities to satisfy the priority information needs of federal and state agency habitat managers (particularly the NMFS Regional Habitat Conservation Programs, state CZM programs, and related agencies). NOS/ORCA should complement NMFS' position statement development by providing supporting habitat-related assessments and information management systems.

1. **Participate in all significant decisionmaking** concerning federal projects, licenses, leasing, and land use affecting living marine resources or their habitats and policy development processes controlling such decisionmaking, to ensure that NOAA's habitat goal is met.

2. **Represent the interests of living marine resources in regulatory programs** related to Sections 402 and 404 of the Clean Water Act and to Section 10 of the Rivers and Harbors Act, including pre-application consultation to help applicants design environmentally-sound projects and mitigation strategies. When NOAA recommendations are not given full consideration, invoke all elevation powers in existing inter-departmental Memoranda of Agreement (MOA).

3. **Utilize the prescriptive powers** of the Federal Power Act. Use intervention authorities afforded by the Federal Energy Regulatory Commission (FERC) when necessary to protect trust resources in the public interest.

4. Establish the conditions that would protect living marine resources' habitats when providing recommendations and technical assistance to other agencies under the FWCA, MFCMA, NEPA, Endangered Species Act (ESA), and other authorities.

Products

1. Detailed NOAA position statements provided to other agencies' decisionmakers on the ecological effects of all proposed projects and policies significantly affecting habitats that are or could again be important to living marine resources.

2. Detailed organizational plan to describe the allocation and role of necessary staff in field and headquarters offices.

3. Prescriptive positions under authority of existing legislation.

4. Guidelines for each appeal process, including elevations, interventions, and referrals.

I.B.2. Represent the interests of living marine resources in regional land use and waterbody planning and management programs.

A means of encouraging more comprehensive resource protection has been to establish frameworks for planning and management action in aquatic ecosystems. Several mechanisms exist.

NOAA is the only federal agency with authorizing legislation providing for comprehensive state and local coastal management programs. Through the CZMA, 29 states and trust territories are conducting federally-approved coastal management programs with federal matching funds and oversight. These states have regulatory and planning programs in place to balance economic development with the need for protection of the land and water resources of the coastal zone.

The CZMA was amended in 1990 to reflect current coastal conditions and management needs. State coastal zone management programs have been encouraged to strengthen a number of resource protection elements including: protection and restoration of coastal wetlands; reduction of marine debris; the assessment and control of cumulative and secondary impacts on resources and habitats from coastal activities; and the preparation and implementation of Special Area Management Plans. Further, to restore and protect the quality of coastal waters, Congress requires that states with coastal management programs develop and implement Coastal Nonpoint Pollution Control Programs to enforce the use of structural and land use control measures to manage activities responsible for degrading coastal waters and habitats. Linked with NOAA in this effort are the EPA and state coastal water quality agencies, respectively involved in administering and developing/implementing state nonpoint source pollution plans under Section 319 of the CWA.

Under amendments to the CWA in 1987, the EPA established the National Estuary Program (NEP), in which selected estuaries are assessed and management plans developed to address

priority environmental problems. Management conferences have been convened for 17 estuaries. Several are nearing the end of the five-year funding period and have draft Comprehensive Conservation and Management Plans (CCMPs) under review. The FWS has initiated a site-specific estuary program which would complement EPA's NEPs by focusing on restoring living marine resources of the nation's bays and estuaries.

Coastal land-use policies, regulations, standards, and criteria all play a role in dictating the location, amount, and type of development and its ultimate impact on coastal resources and habitats. Yet even with such controls, the coastal environment is not being adequately protected. In order to justify imposing land use regulations, state, and federal decisionmakers need to be equipped to assess and predict development's impacts on resources and habitats. NOAA can contribute significantly by providing habitat-related expertise and information tailored to assist decisionmakers at all levels in meeting their programmatic needs, be they regulatory, construction, planning/zoning, or educational.

Questions

* **How can local, state, and federal efforts be better integrated** to make the protection of living marine resources and habitats more effective, efficient and economical?

* **Should NOAA assume a greater role** in state-federal ecosystem management initiatives, including the National Estuary Program? If so, how should NOAA orchestrate that role and allocate staff as needed?

* **How can NOAA's scientific and management expertise** and information be applied more effectively to assist state and regional decisionmaking?

Actions

The General Counsel, NOS/OCRM, and NMFS will cooperate to strengthen the effectiveness of land use and waterbody planning and management programs. NOS/ORCA, Sea Grant, and NMFS's research components will provide supporting information to guide other agencies' decisionmaking to better conserve living marine resources.

1. Provide agency-wide support to implement habitat-related CZMA reauthorization elements including: stronger state wetlands protection and restoration programs; coordination between state water quality and coastal management authorities to reduce nonpoint source pollution; and consider cumulative impacts on resources and habitats in the planning and regulatory process.

2. Influence the content of Comprehensive Conservation and Management Plans being developed for estuaries designated under the NEP so that their habitat-related recommendations can be incorporated as enforceable policies in state CZM programs.

3. Encourage and support regional waterbody management planning and proactive resource protection initiatives. Determine the optimal level of NOAA involvement in regional waterbody management planning processes (e.g., NEPs, the Gulf of Mexico Program, and the Gulf of Maine Program) for maximum effectiveness and implement subsequent NOAA decisions. Use existing tools and funding mechanisms, such as the CZMA provisions for Special Area Management Plans or Sections 308 and 310.

4. Develop detailed plans for NOAA's involvement in interagency habitat conservation initiatives, in concert with other involved federal agencies; determine necessary NOAA staff resources and support requirements.

Products

1. Successful demonstration projects initiated, addressing non-point source pollution and habitat restoration, including continuing research to assure that restoration projects lead to the re-establishment of functional values and contaminants or other anthropogenic stresses are being reduced.

2. Future Comprehensive Conservation and Management Plans developed which incorporate the intent of NOAA's habitat goal.

3. Interactive regional information management systems established at NOAA field program facilities (with access by other agencies) to allow habitat-related information to be applied to NOAA's effect assessment activities and thus contribute to its ability to positively influence land and water use decisionmaking by the agencies involved.

I.B.3. Conduct damage assessments to quantify injuries to living marine resources and their habitats; recover damages to support restoration efforts; and implement restoration plans to restore lost habitats, resources, and uses.

NOAA's mandated responsibilities require it to be the federal trustee for resources under its jurisdiction in assessing monetary damages for oil spills, hazardous waste sites, and toxic contaminants releases. NOAA is also responsible for directing the restoration of habitat damage resulting from those activities. Improved support for policy and project review activities, agency support for NOAA's habitat mission, and steady coordination among NOAA components offers unparalleled opportunities for NOAA to become a leader in federal efforts to reduce impacts to living marine resources. CWA and Superfund authorities also offer realistic prospects of financial support, for restoration, from those parties responsible for the injury to trust resources and their habitats.

Questions

Most of these activities have been performed by NMFS and NOS offices. However, with new oil spill legislation and the increase in Superfund effort, NOAA/GC is now intimately involved and both a NOS Damage Assessment Center and NMFS Restoration Center are operational. In that context, several questions remain:

* **How can NOAA meet this goal and integrate** the programs and opportunities with existing activities? Should NOAA's responsibility for injury determination be transferred from NOS to NMFS, which has the agency's primary ecological and effect assessment expertise?

* **Should NOAA seek federal leadership** of habitat restoration efforts, initiated with the national conference held in 1990?

* **Should NOAA redirect part of its research and management program** to address the needs of damage assessment and restoration mandates? Should NOAA address these needs with in-house or extramural talent?

* **How should NOAA use recovered damages** and redirected funds to support research and management efforts related to damage assessment and restoration?

Actions

General Counsel, NOS, and NMFS will provide primary leadership for litigation, monetary damages assessment, and restoration activities, respectively. Associated NOAA elements (in NOS, Sea Grant, and OAR) will undertake a supporting role. In view of NOAA's burgeoning mandates under the CWA, Superfund, OPA, assorted legislation for living marine resources and others, this area of activity will have increasing implications to the agency for decades.

1. **Create a national habitat restoration program** with opportunity for partnership participation by other federal agencies, state governments, resource management organizations, the academic community and industry having complementary goals.

2. **Ensure that habitat-related programs are integrated and supported** by all requisite policies and statements. NOAA's role must be clearly supported by necessary staff and budget.

3. **Convene periodic national and international conferences** to share progress, suggest new initiatives, and advance the field of habitat management (damage assessment, site restoration, long-term monitoring, etc.).

4. **Evaluate the agency's personnel and programs** to determine whether existing capabilities match the shifting needs of damage assessment and restoration. NOAA may need more economists, engineers, etc. to meet future demands, or be prepared to pay for consultants.

Products

1. **Budget initiative** requesting staff and budget needs to meet the expanding responsibilities.

2. **Successful habitat restoration projects** initiated to restore injuries to trust resource using financial resources obtained under CWA, OPA, or Superfund authorities.

I.B.4. Fully incorporate habitat protection within the concept of "fishery management" employing the authorities of NMFS, the Regional Fishery Management Councils, Interstate Marine Fishery Commissions, and special multi-state plans.

NOAA's habitat-related mandates include the Magnuson Fishery Conservation and Management Act (MFCMA) which creates a partnership with the eight Regional Fishery Management Councils (FMCs) for the conservation and management of fisheries in the U.S Exclusive Economic Zone (EEZ). Under the Act and other authorities, NOAA also has stewardship responsibilities for living marine resources throughout their range, including all habitats important to species managed under the MFCMA and their food webs. This responsibility extends offshore to the edge of the EEZ and inland throughout the drainage basins supporting migratory species. Agency habitat positions can be taken in association with fishery management decisions under powers granted by the MFCMA and cooperative agreements with states coordinated by the Interstate Marine Fishery Commissions (IMFCs). It is in the public's best interest for NOAA to participate cooperatively with those fishery management organizations and ensure that habitat-related concerns are fully integrated in their fishery management plans (FMPs) and regulations.

All Fishery Management Councils have adopted policies of "No Net Loss" of habitat, most have created Habitat Committees and many have begun a variety of habitat initiatives to strengthen the Councils' effectiveness in influencing policy and project decisionmaking processes. A recent example is the consensus statement on habitat being developed by the Atlantic States Marine Fisheries Commission, all east coast Councils, and state and federal agencies. The Gulf Council has been effective in protecting trust resources and their habitats by intervening in major habitat issues affecting Gulf of Mexico living marine resources. Such examples of success, and the lack of progress elsewhere, pose several questions:

Questions

* **Should NOAA define a standard procedure** for developing a strong habitat conservation ethic in each Council and Commission?

* **How should the Secretary of Commerce encourage and support** Councils and Commissions to take strong habitat positions on proposed development? How should NOAA respond to Councils and Commissions that choose not to fulfill their MFCMA mandates or to properly address habitat concerns?

* **As success builds, how strongly can Councils, Commissions, and NOAA** push federal action agencies to adopt findings and recommendations in FMPs?

* **Can FMP findings and recommendations be included in such documents as state coastal zone management plans** to gain the legal strengths of consistency?

Actions

NMFS, GC, and representatives of both the Councils and Commissions will coordinate their efforts to achieve the following:

1. Revise the Operational Guidelines for FMPs to specify that habitat management demands consideration equal to harvest management in a comprehensive program of fishery management.

2. Provide Secretarial support for Councils' and Commissions' habitat positions to improve the effectiveness of their involvement in habitat issues by developing a Secretarial policy statement endorsing Council and Commission positions on proposals which would compromise the intent of federally-approved FMPs by destruction of essential habitats.

3. Evaluate the effectiveness to date of habitat-related initiatives undertaken by the Councils and Commissions; determine how such involvements could be strengthened.

Products

1. Secretarial policy statement endorsing strong habitat positions to be taken by Councils and Commissions to protect the habitats of species or their food webs which are the subject of an approved FMP.

2. FMPs developed which incorporate sufficient life history information to **fully consider all significant habitat issues.**

3. Report documenting successful uses of Council and Commission powers, with recommendations on applications elsewhere. Pronouncements such as the Corps of Engineers' "Regulatory Guidance Letters" and special letters from its commanding officer provide such information to field districts; NOAA could adopt a similar communication network.

4. Protocol for improved cooperation among Councils, Commissions, and NOAA offices, with an emphasis on NMFS science and management programs, NOS ocean and coastal programs, OAR marine advisory and grant activities, and special NOAA efforts like the Coastal Ocean Program.

5. An analysis of our collective legal powers to use FMP-related statements as effective positions in influencing decisions by regulatory, construction, licensing and leasing agencies.

OBJECTIVE II

Develop the scientific understanding and information needed to wisely manage habitats and ecosystems important to living marine resources through a comprehensive program of research on their habitat requirements, natural ecosystem functioning, and the way society's activities affect living marine resources and essential habitats.

II.A. Develop a basic understanding of the status of living marine resources' populations and their ecological and habitat requirements.

Federal agencies (e.g., NMFS, FWS, Corps, EPA, USDA, BuRec, MMS, and FERC), and state counterparts whose programs affect or are concerned with habitat, need quantitative information on the functional mechanisms by which coastal habitats and ecosystems support living marine resources. Habitat managers need to know the location, extent, and rate of loss or modification of existing habitats and the consequent effects on living marine resources. Finally, managers need to know how to restore and/or create these habitats more effectively. Information on which to base management decisions must be easily available in the form of synthesis documents, scientific literature, reports, accurate maps, and computerized data bases for interactive analysis.

II.A.1. Determine the functional importance of specific habitats and ecosystems to the productivity of living marine resources.

NOAA's habitat-related research programs have been conducted for over three decades. This research has been carried out as part of 1) NMFS's habitat-related research program, 2) the National Sea Grant College Program of the Office of Oceanic and Atmospheric Research (OAR), 3) the National Marine Sanctuaries and National Estuarine Research Reserves Programs of the National Ocean Service (NOS), and 4) the NOAA Coastal Ocean Program (COP), a cooperative effort of all NOAA organizational elements.

A more comprehensive knowledge of the functional value of specific habitats is a prerequisite for understanding how marine and freshwater ecosystems and habitats contribute to the production of living marine resources. An ecosystem level approach is necessary, incorporating all significant marine, estuarine and anadromous habitats including commonly known wetlands (e.g., salt and brackish marshes, seagrass meadows, and mangroves), coral reefs, riparian habitats (rivers, streams and adjacent wetlands) and unvegetated habitats composed of mud, shell, sand, gravel or rock.

An eventual objective of NOAA's habitat research is to develop and validate models of habitat function for each habitat type. This is likely to involve separate formulations to relate complex ecological information for each distinct region of the coast. The modeling effort should focus on the way habitats respond to environmental change and the consequences of this response on the

ability of habitats to support living marine resources. These models will enable managers to evaluate habitat health, to predict the consequences of habitat change, and to determine the need for and success of restoration projects.

Questions

* **What is the relationship between habitat quality and recruitment** of important living marine resources? What are the habitat requirements of key species, particularly those whose populations are declining?

* **How do living marine resources utilize coastal and riparian habitats?** Which habitats are the most critical nurseries, and what are the age-specific patterns of habitat use for purposes of feeding, refuge from predation, and spawning?

* **How do habitat functions vary** in space (locally, regionally, and geographically), time (seasonally, and interannually), and among species?

* **Which ecosystem characteristics regulate and limit habitat function and capability? Physical characteristics** include tidal energy and flooding patterns (hydrology), basin morphology, habitat geomorphology, amount of freshwater inflow and water quality (turbidity, dissolved oxygen and toxic substances). **Biological characteristics** include system productivity (eutrophic vs. oligotrophic), dominant sources of primary production (phytoplankton, macrophytes, benthic microalgae), importance of detritus as a food source, and the number and kind of consumers (herbivores and carnivores).

Actions

NOAA will conduct research on habitat functions through 1) the NMFS habitat-related programs, 2) the National Sea Grant College Program (NSGCP), and 3) the NOAA Coastal Ocean Program. Priority actions are to:

1. Conduct life history studies of key living marine resources to determine their habitat requirements and community relationships.

2. Determine the normal levels of recruitment, species specific resource use, competition, and predator-prey interactions in undisturbed habitats. Determine the use of and movement between coastal/estuarine/riverine habitats by early life history stages of representative species.

3. Characterize and quantify habitat quality of estuarine, coastal, and riverine habitats that optimally or effectively meet the functional needs of critical life history stages of representative species. Factors include hydrology, salinity, temperature, oxygen, sediment characteristics, nutrients, microbial abundance, food availability, and habitat structure (e.g., sediment composition and grain size; plant composition and density).

4. Experimentally manipulate habitat characteristics (e.g., hydrology, turbidity, nutrients, structural complexity, geomorphology, and the abundance of food and predators) to determine their role in habitat function.

5. Determine the ecological interdependence of habitats in terms of the exchange of energy, carbon, and nutrients, and by determining the seasonal and age-specific patterns of habitat utilization by ecologically, recreationally and commercially important species.

6. Compare coastal ecosystems on local, regional, and geographic scales to determine how species productivity varies in relation to the abundance of particular habitats, habitat function, and ecosystem characteristics.

7. Convene workshops to identify the most promising modelling approaches and to determine the direction of future habitat research so that it complements model development.

Products

1. Scientific literature documenting the importance of various habitats to the productivity of populations of living marine resources and to serve as a basis for management decisionmaking.

2. Synthesis documents on the habitat requirements of selected species upon which to base agency position statements and policy and as a guide for future research.

3. Data and conceptual models for use by the scientific community to increase understanding of natural ecosystem functioning.

II.A.2. Determine population trends of recreational, commercial, and ecologically important species and the status and historical trends of their habitats.

Historical trend information for stocks of estuarine-dependent and anadromous species of recreational, commercial, and ecological value is one criterion for assessing effects of human development in coastal areas. Information on trends of important fish and shellfish species is currently developed for selected stocks by reconstructing population data from historical catch and effort data, where possible. Severe difficulties are often encountered because of short or incomplete temporal records, changes in methodology, and biased or incomplete sampling (e.g., for recreational catches). It is also often difficult to attribute a cause (e.g., fishing, economics, habitat) to an observed trend.

Historical trend information for critical habitats is a second criterion for assessing effects of human development in coastal areas. Two federal programs are designed to map coastal habitats on a comprehensive, nation-wide basis. These programs are conducted by the FWS and NOAA. The FWS' National Wetlands Inventory (NWI) is the largest national habitat mapping program. However, the NWI includes only emergent wetlands and does not inventory other critical habitat

types (e.g., seagrasses). As part of its Coastal Ocean Program/Estuarine Habitat Studies (COP/EHP), NOAA is developing a comprehensive, nationally standardized, information system for land cover and habitat change in the coastal region. An holistic program is being developed incorporating all habitats making up the ecosystems important to living marine resources.

There is no nation-wide system of accounting for the consequences to habitats arising from government decisionmaking on all federally conducted, sponsored, or permitted projects. Regional assessments based on Corps-permitted activities do not measure actual habitat change since there is little follow-up to evaluate permitted projects, and since no effort is made to account for federal projects or illegal activities. Remotely-sensed data, coupled with innovative ground-truth efforts, can augment knowledge of habitat losses attributable to legally permitted and illegal activities.

The eventual goal is to relate trends in the amount and quality of inshore habitat types to potential trends in inshore and offshore populations of living marine resources.

Questions

* **What are the historical trends in the population size** of important species dependent on inshore habitats?

* **What is the current availability (quantity and quality) of various habitat types** and their rates of loss or gain?

NOAA should develop a comprehensive Geographic Information System (GIS) for each ecologically distinct region of the U.S. combining: 1) models of habitat function; 2) information on population trends of important species; 3) habitat classification and change analysis; and 4) other spatial data (e.g., demographic, land use, pollution, economic activity). In this way demographic patterns can be linked to habitat stability or loss on an area-specific basis. Spatial and temporal patterns of habitat change (or loss) can be related to changes in (or loss of) fisheries productivity. Economic assessments can be made of alternative management strategies. Regional habitat and fisheries managers require this type of information synthesis and will participate in the planning for its generation.

Existing NOAA stock assessment programs (e.g., Chesapeake Bay stock assessment program), grant-in-aid allocations (for commercial fisheries and anadromous species) and special funds (e.g., Dingell-Johnson) offer immediate opportunities to contribute to achieving the following:

Actions

While NMFS has lead responsibility in this area, OAR and NOS also have important roles which can be coordinated with those of NMFS to more effectively complement the development of information under this sub-objective.

1. Determine living marine resource population trends.

a. Assemble and evaluate the quality of available data. Such data should include catch/effort data as well as relatable data on economics, human demographics, climate and any other available records concerning the habitat.

b. Develop methods to relate dissimilar data from separate collecting programs to provide a common data set.

c. Reconstruct population estimates from existing data on catch/effort or other relatable data set (e.g., juvenile indices, landing data) for primary inshore-dependent species of fish and shellfish.

d. Improve collection of catch, effort, and economic data for all major recreational and commercial species in inshore areas. Location, date, and time of catch, in addition to port landed, would further improve our ability to more specifically relate trends in species to trends in habitat.

e. Gather fishery-independent resource survey data from inshore waters to determine abundance levels, distribution patterns, migration or movement patterns, and residence times of important species.

f. Determine or develop statistical methods (time series models, etc.) to make possible assessment activities and trend analysis.

2. Determine the status and trends of habitats.

a. Develop an operational protocol for classifying and mapping coastal habitats from satellite images, aerial photos, and surface level data. The protocol should be compatible with that used by the FWS to develop its NWI maps. The protocol should also provide a uniform basis for habitat classification and thereby allow comparison of two or more time periods. It should be produced through a series of workshops, eventually to be recognized nationally and followed by all groups conducting habitat classification and change analysis.

b. Determine the existing quantity and distribution of estuarine and coastal habitat types by region, state, county, and/or hydrologic unit. Products should include digital and hard copy maps and reports describing and tabulating areal coverage of each habitat type.

c. Determine the historical rates of change of estuarine and coastal habitats by region, state, county, and/or hydrologic unit. Change in land/habitat cover should be mapped every one to five years according to the standard protocol, with areas of significant change being mapped more frequently.

d. Determine biomass, productivity, and health status of estuarine and coastal habitats from the spectral radiances observed via remote sensing.

e. Determine and document the causes of changes of coastal, estuarine, and riverine habitats. Initiate an interagency accounting system to monitor habitat affected by regulatory program decisionmaking and actual compliance.

f. Apply habitat classification and change analysis to habitat and fisheries research and coastal land-use management. Data integration and analysis should be undertaken to begin linking demographic patterns and habitat management practices to wetlands stability or loss and to levels of living marine resource populations. The results will be used to develop models, described elsewhere, to assess present status and predict future trends in fishery resources.

Products

1. **Population estimates and historical trends** for important species.

2. **Methodologies to estimate population dynamics and trends** for application where such data exist, for other living marine resource species.

3. **Maps showing habitat cover and change** at a resolution of about 1 acre and with the ability to distinguish among habitat types sufficient for use by NOAA's Habitat Conservation Program and resource managers of state CZM programs. Inclusion of detailed habitat cover types on NOAA coastal hydrographic and nautical charts.

4. **Quantification of the acreages and rates of change** of land cover types digitized from the NOAA mapping efforts for all coastal and riverine drainage basins important to living marine resources, and assessments of regional and national trends.

5. **Protocols** for use by states and other federal agencies to develop cooperative national mapping and change analyses programs.

II.A.3. Develop effective techniques for habitat restoration, enhancement, and creation.

Effective ways must be found to restore habitats that have been lost or modified by development activities. Shellfish (oyster) habitat restoration has focused on the provision of hard substrate (cultch) for the settlement and growth of juvenile stages. Riverine restoration has included removal of blockages and placement of boulders to create pool and riffle habitats essential for migratory species. Restoration of vegetated habitats has focused on planting techniques often using stock obtained from, and thus also affecting, natural habitats. While techniques exist to create most habitat types, they are labor intensive. Some habitat types have received very little scientific attention in terms of restoration and enhancement (e.g., coral reefs and unvegetated subtidal habitat).

Priority will be given to the restoration of those habitats that provide essential habitats, including spawning and nursery areas, migratory pathways, important refuges from predators and

the inshore areas producing essential food resources for a majority of the living marine resources of concern. Although planting techniques have been given high profile by NOAA, very little data exist as to the functional value of restored or enhanced habitats, especially in the context of natural variation in habitat function. We do not know how long is required for restoration and enhancement techniques to take effect, or what levels of recovery are to be expected. While individual projects provide insight to these questions, these data are insufficient to provide management guidelines under the range of environmental conditions to which we might wish to apply them.

Questions

* **What is the status of past restoration, enhancement, and creation efforts?** Have they been successful? Are we using the right criteria to measure success? Have anthropogenic factors precluded successful restoration or creation efforts?

* **What is the degree of functional equivalency between restored and natural wetlands?** What are the causes of inequivalent functioning?

* **How can functional equivalency be restored most rapidly** (e.g., by means of hydrologic manipulations, nutrient additions, and/or the use of genetically selected plants)? What are the best methods for propagating key plant species to use in restoration projects?

Information is needed to develop habitat restoration and enhancement protocols. These protocols would provide a mechanism to evaluate the success of management decisions, especially permit-related projects. Users of these protocols would be NMFS's Habitat Conservation Divisions, the NOAA Restoration Center, the NOAA Damage Assessment Center, the U.S. Army Corps of Engineers, the Environmental Protection Agency, and the U.S. Fish and Wildlife Service and state counterparts, including state CZM programs.

Actions

Habitat restoration is one form of habitat manipulation. As such, much research on the effectiveness of habitat restoration and enhancement techniques will be conducted as a complementary element to NOAA research on habitat functions (II.A.1.). NMFS, Sea Grant, and some state CZM programs will be involved in conducting habitat restoration activities, often jointly.

1. Initiate regional habitat restoration projects to provide a scientific assessment of our ability to successfully re-create various habitat types under a variety of conditions.

2. Develop habitat-specific restoration/enhancement methodologies and criteria for measuring success to provide guidance for decisions on proposals, developing compensatory mitigation projects, and to serve as a basis for the enforcement of permit conditions.

3. Determine the effectiveness of historic restoration/enhancement efforts.

4. Determine the best methods for propagating key plant species for use in restoration projects.

Products

1. Protocols and technology for habitat restoration, enhancement and creation.

2. Guidance to regulatory agencies, resource agencies and the public for decisionmaking concerning habitat losses and the compensatory value of various restoration, enhancement, and creation techniques.

3. Guidance for mitigation planning such as ratios of acreages of habitat restoration needed to compensate for project-induced losses, length of time to recover, degree of success required, and related characteristics.

4. Documentation of past restoration efforts.

5. Development of new planting stock (genotypes) to increase diversity and improve success in restoration, enhancement, and creation.

II.B. Determine the biological effects of habitat degradation to provide a sound scientific basis for habitat management, environmental impact assessment, inter-agency negotiation, and conflict resolution.

The ultimate aim of NOAA's ecological effects studies is to link observed effects on individual organisms to populations and fishery yields, and to develop conceptual models that can be used to provide managers with realistic options for protecting populations and habitats.

Recent national and international analyses and reports suggest that where human populations reach certain levels, generally in the tens or hundreds of thousands, local coastal waterways are found to undergo significant physical and chemical changes. The Regional Seas Programs, commissioned by the United Nations' Environment Programme, have found a strong correlation between concentrations of people, industrial activities, and urbanization and regional changes in living marine resources' abundance and health. Major U.S. port and urban coastal areas are examples of the deleterious effects of development.

Although it is critical to assess the habitat needs and ecological relationships among species, the results of numerous studies conducted to date emphasize that human activities are directly affecting these relationships and the health of living marine resources. An understanding of the species-specific habitat requirements must necessarily take into account human impacts on those

environments, including physical alterations, chemical contamination, and efforts to restore or enhance habitats already damaged.

II.B.1. Determine the effects on living marine resources of physical habitat alteration and hydrologic modification of ecosystems.

Essential coastal habitats are degraded and destroyed by human activities directly, and indirectly by upland activities in upstream watersheds. Dredging, filling, diking, ditching, mining, coastal and upland construction, dams and reservoirs, freshwater diversions, stream realignments, farming practices, logging operations, and many other commercial, industrial, and residential activities cause direct physical damage. This damage ranges from dramatic obliterations to subtle alterations that may result in long-term, cumulative harm to living marine resources' health and productivity.

Wetland habitat losses parallel declines in several inshore-dependent species. Despite the efforts of many effective habitat protection programs, these losses continue; effects on ecosystems and living marine resource populations are largely unquantified. Events controlling fish production are poorly understood, and it is difficult to differentiate between the effects of natural events, fishing, and other human activities.

Freshwater flows are a controlling factor in establishing and maintaining riverine and estuarine ecosystem functioning[24]. The volume and timing of freshwater flows are critical in determining survival of anadromous species and in determining estuarine circulation, salinity patterns, nutrient availability, contaminant fate, and the distribution of habitats and living marine resources.

The eventual goal of NOAA's physical habitat effects research is to relate trends (losses and degradation) in the amount and condition of habitat to effects on populations. Results of these studies will be combined with information on habitat availability, species usage, rates of habitat change, living marine resources' population trends, regional similarity and comparability of various habitat types, and functional values of natural and restored habitats garnered from studies conducted under elements of Objective II.A. NOAA's research is designed to improve our capability to predict the effects of physical and hydrological changes on riverine and estuarine habitats and systems through an increased understanding of ecosystem functioning.

Questions

* **How do changes in the amount, distribution, and condition** of critical habitats affect the recruitment, growth, and survival of living marine resources?

* **What is the effect of current regional habitat losses** on future populations of living marine resources?

* **What are the quantitative relationships** between freshwater inflow, riverine and estuarine structure and function, and productivity of living marine resources?

Actions

NOAA will conduct research on the effects of physical habitat loss through: (1) NMFS's habitat-related research programs, (2) the National Sea Grant College Program (NSGCP), and (3) the Coastal Ocean Program's Estuarine Habitat Program (COP/EHP). NOAA will work cooperatively with many other agencies and groups including the Corps, FWS, EPA, USGS, BuRec, state counterparts, academia, and resource conservation groups.

1. **Determine how physical changes in coastal, estuarine, and riverine habitats affect** the size and health of living marine resource populations. Determine the relative importance of regional changes in habitat (amount and condition) to the abundance, distribution, growth, and survival of populations of living marine resources.

2. **Determine the quantitative relationships** between freshwater flows and living marine resources' productivity, for both riverine and estuarine systems which have been subjected to significant flow alterations.

3. **Compare reactions of early life history stages** of important species to physical habitat changes and estimate mortality rates due to physical habitat alteration and loss.

4. **Experimentally manipulate habitat** availability and condition to determine reactions of organisms to habitat alteration or denial (e.g., effects on growth, behavior, survival, and ability to locate and use other sites).

5. **Determine how alterations in natural water inflow and circulation patterns** affect turbidity, salinity, nutrients, and the distribution and productivity of estuarine habitats.

Products

1. **Syntheses of research on the effects of habitat loss** on living marine resources and ecosystem function.

2. **Guidance to resource and land-use management agencies** on the effect of habitat losses to future living marine resource productivity and fishery harvests.

3. **Conceptual approaches (models) to assess and predict** the effects of changes in habitat loss and changes in freshwater flows on ecosystem structure and function. These models will be used to evaluate the relative impacts of alternative management strategies throughout drainage basins.

4. Reports establishing what is known about potential changes in freshwater inflow that may influence important estuarine systems in the future; demand projections and estimates of resource impacts, based on information developed in watersheds subjected to flow diversions.

5. Data contributing to modelling efforts under Objective II.B.3 that will help NOAA predict the effects of physical habitat loss on living marine resource populations.

II.B.2 Determine the risks to living marine resources' health and productivity of exposure to existing levels of toxic chemicals and nutrient enrichment of coastal, estuarine, and riverine systems.

Human activities release hundreds of toxic chemical contaminants into coastal, estuarine and riverine environments[25]. These toxics include trace metals, petroleum hydrocarbons and synthetic chlorinated compounds such as DDT, PCBs, and dioxin. Chemical contamination of coastal waters degrades the habitats of important living marine resources, may affect entire marine ecosystems, and can affect human consumers and other apex predators. NMFS scientists have found evidence of impaired health, organ dysfunction and compromised reproductive capability in organisms from highly contaminated coastal and estuarine systems[26,27,28]. NOAA's Status and Trends Program, which intentionally avoids areas of extreme contamination, has found high levels of toxic materials in the sediments of many urban estuaries and has documented the presence of disease in fish collected from many of those areas[29].

There is an immediate need for improved biochemical, immunological, and physiological bioindicators of contaminant exposure and biological effects to assess environmental quality[30]. A suite of sensitive biological indices are needed that respond predictably to chemical insult, are sensitive to sublethal effects of chemical contaminants, and indicate bioeffects due to relatively short-term exposures to contaminants. Bioindicators are powerful tools because they can detect early effects in individuals, often being the harbingers of more serious disease conditions that can occur at a later date. Bioindicators can also be used successfully in areas experiencing moderate levels of contamination where serious, visible effects (i.e., lesions and pathologies) have not yet occurred. With improvement, they may serve as early-warning signals of effects on individuals, populations, or communities.

It has been well demonstrated that a suite of measures is needed because not all animals respond uniformly to any one technique, and not all bioindicators respond to the same levels of contamination. The concurrent use of several bioindicators should provide a better assessment of stress from exposure to complex mixtures of toxic compounds present in contaminated environments, than measurement of a single indicator.

During the past few decades, estuarine and coastal waters downstream or adjacent to highly urbanized and intensely farmed areas have experienced significant increases in the concentrations of nitrogen, phosphorus, and other plant-stimulating nutrients. Upgrading of municipal and industrial treatment facilities has effectively reduced the levels of certain toxic chemicals, but

nutrient loadings remain relatively unaffected. Agricultural and suburban runoff and acid precipitation continue to contribute excessive nutrients to estuarine and coastal areas[31].

Excess nutrients can stimulate growth of less desirable species and nuisance algal blooms, thereby adversely affecting entire food chains. The resulting eutrophication promotes algal growth and decay cycles that may deplete dissolved oxygen, shade vegetated subtidal habitats, reduce productivity of valuable species and kill fish and shellfish. People may also become sick and die from eating mollusks containing high concentrations of toxins produced by certain species of phytoplankton. Moreover, pathogens from human and medical wastes introduced into coastal and estuarine waters may pose additional risks to people well after the period of immediate exposure.

Questions

* **How do toxic chemicals adversely affect individual marine organisms** and how do they affect factors controlling reproduction, growth, and survival?

* **What are the chronic effects of complex mixtures** of toxic chemicals on individual marine organisms, and the impacts of affected individuals on the integrity of populations and ecosystems?

* **What risks to the health of coastal populations are posed by observed levels of toxics?** What risk to ecosystem integrity is being engendered?

* **What are the relative roles of anthropogenic nutrient inputs** and natural environmental variability in causing the observed undesirable effects of estuarine nutrient over-enrichment?

* **To what degree is excessive nutrient enrichment of riverine and estuarine systems adversely affecting living marine resource populations?**

Actions

NMFS, NOS, and OAR each have ongoing programs which could be improved by joint coordination of plans to provide sufficient emphasis in the key areas of need, described below. NOAA should play a lead role in coordinating with scientists in academia, private organizations, and government agencies on coastal contaminants' effects studies and in assessing the significance of eutrophication to the health of estuarine ecosystems.

1. Develop and evaluate new bioindicators needed to monitor the chemical and biological status of ecosystems. Develop more sensitive indicators of exposures to low and moderate levels of contaminants and resultant biochemical, immunological, and physiological effects.

2. Relate exposure from contaminant levels found in the environment to effects on the health of individuals and the future productivity of populations, emphasizing (a) laboratory exposures of critical life stages to various levels and combinations of contaminants; (b) sublethal, synergistic,

or antagonistic effects of mixtures of toxic contaminants on organism metabolism, growth, and reproduction; (c) mechanisms of contaminant uptake, fate, and effects; and (d) relationship of bioavailability and bioaccumulation to effects.

3. Determine national trends of toxic chemicals and biological effects in representative living marine resources. Relate the distribution, concentration and variability of toxic compounds in coastal sediment, food organisms and fish tissues to sublethal biological effects.

4. Determine the biological effects of eutrophication in estuarine ecosystems by measuring effects of hypoxia on distribution, abundance, and growth. Compare long-term trends in dissolved oxygen with historical anthropogenic loading and trends in the abundance of living marine resources. Determine the major sources of estuarine enrichment. Improve indicators of nutrient over-enrichment to contribute toward early detection of ecosystem stress.

5. Determine the relative importance of nutrients and other factors in stimulating noxious and toxic phytoplankton blooms. Assess the status and trends of noxious and toxic phytoplankton blooms and their effects on living marine resources by conducting retrospective analyses of existing data, assessing possible "causative factors" (e.g., cultural eutrophication), and surveying environmental conditions and toxic plankton in areas where valuable shellfish species are affected.

Products

1. Syntheses of research results for habitat managers' use describing the biological effects of specific toxics on living marine resources; publications in the scientific literature.

2. Improved bioindicator methods which allow measurement of a variety of subtle responses of representative organisms to contaminants.

3. Reports documenting national and regional risk to living marine resource populations based on the effects of contaminants observed to exist in coastal and estuarine ecosystems.

4. Models to relate contaminant exposures to effects on the health of individuals and those factors controlling population size, for use in establishing national policy limiting the discharge of specific classes of contaminants.

5. Recommendations and guidance for land-use management to limit contaminants' (toxics and nutrient loading) adverse effects on the riverine and estuarine systems of greatest concern.

6. Syntheses of research on the relative importance of the primary nutrient sources contributing to estuarine eutrophication; assessment of relative regional coastal eutrophication.

II.B.3. Evaluate and predict the biological and economic consequences of cumulative, region-wide habitat alteration and pollution.

Assessment of cumulative effects requires correlative data and knowledge of multi-species interrelationships, physical and chemical parameters, and habitat coupling that are generally not available for a particular ecosystem or useful time period. Ecosystem modelling provides a cost-effective approach to coupling these components.

Assessment of the effects of multiple environmental impacts on coastal ecosystems is a complex problem. Impacts from chemical contaminants, eutrophication, physical habitat alterations, commercial and recreational fishing, or natural meteorological events are usually handled individually. However, real-world situations rarely involve only one stressor or forcing function. Interactions among environmental insults occur, and the resulting cumulative effects may exact a greater impact on coastal ecosystems than any single type of environmental change. NOAA must increase its capability to address these complex assessments.

Models and GIS systems can provide a workable framework for coupling disparate data sets (e.g., wetland distribution, pollutant loading, resource abundance). They can aid our ability to evaluate the ecological effects of proposed development on riverine, estuarine coastal ecosystems, and help us design habitat restoration and enhancement projects. Finally, they can aid our efforts to assess economic values of habitats in the context of competing economic interests.

Competition among alternative uses for resources in the marine environment creates conflicts that degrade the marine environment and imply growing risks to marine ecosystems and living marine resources. Market prices do not exist for most environmental benefits. Therefore, users of the marine environment do not pay cash costs for environmental damage and do not curtail or alter their activities to avoid the cost of damages.

Resource economists are developing techniques for estimating the value of non-market goods and services to society. These techniques can be evaluated to determine whether they are suitable for habitat valuation and cost benefit analyses, particularly for determining the costs of full restoration of the natural functions of specific habitat types.

Questions

* **What are the cumulative effects of coastal land-use practices** on ecosystem health and future fishery population abundance?

* **What are the combined effects of pollution, wetland losses, alteration of freshwater inflows** and other man-induced stresses to ecosystems supporting living marine resources? How can these effects be separated and quantified?

* Compared to harvest and natural mortality, **how important is habitat degradation and loss in reducing future population sizes of** our nation's fisheries?

* **What is the value to society** of the nation's coastal, estuarine, and riverine systems supporting living marine resources, and **what is the cost to the public interest** of continued rates of habitat degradation, nation-wide?

Actions

NOAA's cumulative effects studies will evaluate, develop, and use conceptual and predictive models for assessing the linkage between habitat degradation and effects on living marine resource populations. Models developed both domestically and internationally will be reviewed for this purpose. The research strategies for Objectives II.A (1,2,3) and II.B (1,2) contribute many of the components necessary to address complex, region-wide habitat threats on a comprehensive basis. Large data bases and considerable modelling expertise reside in NOAA. There should be a major effort to synthesize these data in a form that can be both retrospective and predictive of cumulative effects of habitat degradation on living marine resource populations. Such models would provide habitat managers and construction, regulatory and land-use agency decisionmakers with the basis for evaluating development proposals in the context of past habitat degradation of riverine, estuarine, and coastal habitat.

1. **Develop the capability to predict** the consequences of cumulative, region-wide habitat alteration and pollution on future living marine resource productivity, as follows:

   a. **Determine and describe the factors that control variability** within and among living marine resource populations and the ecosystem supporting them.

   b. **Evaluate, refine and develop improved population dynamics models** which include factors affecting the dynamics of early life history stages and can be used with increasing confidence to predict the effects of cumulative habitat degradation and loss on the population.

   c. **Collect and assemble necessary life history data** for selected species, which have been extensively studied, for use in population models.

   d. **Synthesize information** relating anthropogenic stresses to processes that control population size (e.g., reproduction, growth, species interactions and ecosystem structure).

   e. **Assess the effects of regional trends** of wetland losses, contaminant loadings, alteration freshwater flows and other stresses on populations of important species.

   f. **Develop and maintain information management systems**, including GIS, which allow for the storage, retrieval, and interactive (relational) analyses of data and information for use by NOAA habitat managers and other agencies (Corps, FWS, EPA, and state fisheries, CZM, water pollution control, and resource management agencies).

g. **Support synthesis efforts** focused on priority regional habitat threats **and encourage cooperative programs** among NOAA research organizations currently dealing with separate habitat issues (e.g., toxics, wetlands functions, population dynamics).

2. **Develop and apply economic methodologies** to quantify the losses associated with habitat degradation and evaluate alternative policies for protecting public trust resources.

a. **Determine the costs of successful establishment (creation)** of those habitat types which are essential to living marine resources, including restoration of the normal ecological and life support characteristics.

b. **Estimate the economic relationship between water quality**, habitat (improvements and deterioration), and the resulting changes in living marine resource populations (e.g., the quantity and value of commercial and recreational harvests).

c. **Develop methods to quantify the benefits to society** of marine, estuarine, and riverine ecosystems, incorporating those ecosystem models that best represent economic applications of habitat value.

Products

1. **Predictions of the living marine resource population losses** which could be expected to occur within the next 50 years with a continuation of current regional wetlands losses, pollutant loadings, agricultural practices and water use policies.

2. **Scientific assessments of the cumulative effects of development** for selected coastal, estuarine and riverine ecosystems which have experienced significant stress from a variety of development practices.

3. **Methodologies and models for predicting**, with increasing confidence levels as our knowledge increases, the long-term living marine resource population changes which may be attributable to habitat degradation, fishery harvest, and natural mortality.

4. **Regional information management systems and GIS** with access provided to those organizations primarily involved in coastal, estuarine, and riverine habitat decisionmaking.

5. **Reports quantifying the full economic and ecological costs and benefits** associated with successful habitat establishment for all primary habitat types of importance to living marine resources.

6. **Methodologies for determining the economic contributions** of coastal, estuarine, and riverine ecosystems, including their living marine resources, to the quality of life in our society.

V. SUMMARY

NOAA HABITAT STRATEGIC PLAN

GOAL

PROTECT, CONSERVE, AND RESTORE THE QUANTITY AND QUALITY OF HABITATS OF LIVING MARINE RESOURCES TO MAINTAIN POPULATIONS OF COMMERCIAL, RECREATIONAL, AND ECOLOGICALLY IMPORTANT SPECIES AT OPTIMAL SUSTAINABLE LEVELS.

OBJECTIVE I

IMPLEMENT AN EFFECTIVE STRATEGY FOR IMPROVED HABITAT PROTECTION THROUGH ACTIVE INVOLVEMENT IN FEDERAL POLICY AND DECISIONMAKING PROCESSES ON PROJECTS AND PROGRAMS THAT AFFECT ESSENTIAL HABITATS AND SUPPORTING ECOSYSTEMS.

I.A. Establish national policies to reverse the negative trends in habitat quality and quantity and declining populations of living marine resources.

I.A.1. Seek federal legislation that would provide NOAA with the authority to prohibit or modify proposed activities that could adversely affect essential habitat.

1. Focus effort on amending priority mandates.
2. Seek budget and staff needed to meet expanded legislative powers.
3. Clarify new roles; negotiate inter-agency agreements.

I.A.2. Pursue inter-agency policy opportunities that could increase NOAA's ability to influence habitat-related decisions.

1. Expand use of administrative reviews and appeals.
2. Renegotiate existing inter-agency agreements.
3. Upgrade state CZM programs' policy requirements.
4. Participate effectively in interagency policy-making initiatives.
5. Seek new interagency agreements.

I.A.3. Establish NOAA policies or position statements on priority habitat issues.

1. Develop policies and positions on recurring threats.
2. Develop guidance on resource conservation.
3. Establish assessment techniques.

4. Develop background life history information.
5. Urge adoption by other agencies in decisions.

I.B. Evaluate plans, provide guidance to other agencies, and act as steward of the nation's living marine resources on all proposed projects, programs, and policies significantly affecting essential habitats.

I.B.1. Participate successfully in federal and state decisionmaking processes for all those projects having individual or precedent-setting significance; utilize appeal mechanisms as needed.

1. Participate in all significant federal decisionmaking.
2. Represent living marine resources in regulatory programs.
3. Utilize the prescriptive powers of the Federal Power Act.
4. Establish conditions needed to protect living marine resources.

I.B.2. Represent the interests of living marine resources in regional land use and waterbody planning and management programs.

1. Support habitat-related CZMA reauthorization elements.
2. Influence State Comprehensive Coastal Management Plans.
3. Support regional waterbody management planning.
4. Develop plans for NOAA's involvement in interagency habitat conservation initiatives.

I.B.3. Conduct damage assessments to quantify injuries to living marine resources and their habitats; recover damages to support restoration efforts; and implement restoration plans to restore lost habitats, resources, and uses.

1. Create a national habitat restoration program.
2. Ensure role is supported by necessary staff and budget.
3. Convene periodic international conferences.
4. Evaluate expertise needs and capabilities.

I.B.4. Fully incorporate habitat protection within the concept of "fishery management" employing the authorities of NMFS, the Regional Fishery Management Councils, Interstate Marine Fishery Commissions, and special multi-state plans.

1. Revise the Operational Guidelines for FMPs.
2. Provide Secretarial support for Councils and Commissions.
3. Evaluate means to strengthen Councils' and Commissions' initiatives.

OBJECTIVE II

DEVELOP THE SCIENTIFIC UNDERSTANDING AND INFORMATION NEEDED TO WISELY MANAGE HABITATS AND ECOSYSTEMS IMPORTANT TO LIVING MARINE RESOURCES THROUGH A COMPREHENSIVE PROGRAM OF RESEARCH ON THEIR HABITAT REQUIREMENTS, NATURAL ECOSYSTEM FUNCTIONING, AND THE WAY SOCIETY'S ACTIVITIES AFFECT LIVING MARINE RESOURCES AND ESSENTIAL HABITATS.

II.A. Develop a basic understanding of the status of living marine resources' populations and their ecological and habitat requirements.

II.A.1. Determine the functional importance of specific habitats and ecosystems to living marine resource productivity.

1. Conduct life history studies of key resources.
2. Determine the use of and movement between habitats.
3. Characterize and quantify optimal habitat quality.
4. Manipulate characteristics to determine functions.
5. Determine interdependence of habitats.
6. Compare coastal ecosystems' productivity.
7. Use modelling to determine future research directions.

II.A.2. Determine population trends of recreational, commercial, and ecologically important species and the status and historical trends of their habitats.

1. Determine living marine resource population trends.
2. Determine the status and trends of habitats.

II.A.3. Develop effective techniques for habitat restoration, enhancement and creation.

1. Initiate restoration projects to provide scientific assessment.
2. Develop restoration/enhancement methodologies.
3. Determine effectiveness of historic restoration efforts.
4. Improve propagation methods.

II.B. Determine the biological effects of habitat degradation to provide a sound scientific basis for habitat management, environmental impact assessment, inter-agency negotiation, and conflict resolution.

II.B.1. Determine the effects on living marine resources of physical habitat alteration and hydrologic modification of ecosystems.

1. Determine how habitat loss affects populations of living marine resources.
2. Determine the relationships between freshwater flows and living marine resources' productivity.
3. Estimate mortality rates due to habitat alteration.
4. Experimentally manipulate habitat availability and condition.
5. Determine how inflow changes affect estuarine productivity.

II.B.2 Determine the risks to living marine resources' health and productivity of exposure to existing levels of toxic chemicals and nutrient enrichment of coastal, estuarine and riverine systems.

1. Develop and evaluate new bioindicators.
2. Determine how exposure affects the health of individuals and the future productivity of populations.
3. Determine national trends in toxics and their effects.
4. Determine the effects of estuarine eutrophication.
5. Determine nutrients' role in stimulating coastal blooms.

II.B.3. Evaluate and predict the biological and economic consequences of cumulative, region-wide habitat alteration and pollution.

1. Develop the ability to predict effects of cumulative, regional habitat degradation on future living marine resources' productivity.
2. Develop methodologies to value natural ecosystems.

REFERENCES

1. Chambers, J.R. 1992. Coastal degradation and fish population losses. In: R.H. Stroud (ed), "Stemming the Tide of Coastal Fish Habitat Loss." Marine Recreational Fisheries Symposium 14:45-51. National Coalition for Marine Conservation, Savannah, GA.

2. Prosser, N.S., G.C. Radonski and D.B. Rockland. 1988. A review of state agencies' capabilities to manage marine recreational fisheries. 118th Ann. Mtg., Amer. Fish. Soc., Toronto, Canada. 11 p.

3. Edwards, S.F. 1989. Estimates of future demographic changes in the coastal zone. Coastal Mgmt. 17:229-240.

4. Northwest Power Planning Council. 1986. Council staff compilation of information on salmon and steelhead losses in the Columbia River Basin. Columbia River Basin Fish and Wildlife Program.

5. F.W. Fisher, pers. comm., California Department of Fish and Game.

6. Nehlsen, W., J.E. Williams and J.A. Lichatowich. 1991. Pacific salmon at the crossroads: stocks at risk from California, Oregon, Idaho, and Washington. Fisheries, Amer. Fish. Soc. 16(2):4-11.

7. Kennedy, V.S. 1991. Eastern oyster. In: S.L. Funderburk, et al. (eds). Habitat Requirements for Chesapeake Bay Living Resources, Second Edition. (pp. 3.1-3.20) Living Resources Subcommittee, Chesapeake Bay Program and Chesapeake Research Consortium, Inc. Solomons, MD.

8. CBP. 1988. Draft strategy for removing impediments to migratory fishes in the Chesapeake Bay watershed. Agreement Commitment Report. Chesapeake Bay Program. Environmental Protection Agency. Annapolis, MD.

9. J.B. Zedler, pers. comm., San Diego State University.

10. Varanasi, U., S-L. Chan, B.B. McCain, J.T. Landahl, M.. Schiewe R.C. Clark, .W. Brown, M.S. Myers, M.K. Krahn, W.D. Gronlund and W.D. McLeod. 1989. National Benthic Surveillance Project: Pacific Coast. Part II, Technical Presentation of the Results for Cycles I-III (1984-86). NOAA Tech. Memo. NMFS NWC-170. 204 p.

11. Pait, A.S., D. Farrow, J.A. Lowe and P.A. Pacheco. 1989. Agricultural pesticide use in estuarine drainage areas. In: Coastal Zone '89. Proceedings of the 6th Symp. on Coastal and Ocean Mgmt. Amer. Soc. Civ. Eng. 1:452-466.

12. Malins, D.C., M.K. Krahn, M.S. Myers, L.D. Rhodes, D.W. Brown, C.A. Krone, B.B. McCain, and S-L. Chan. 1985. Toxic chemicals in sediments and biota from a creosote-polluted harbor: relationships with hepatic neoplasms and other hepatic lesions in English sole (Parophrys vetulus). Carcinogenisis. 6(10):1463-1469.

13. Murchelano, R.A. and R.E. Wolke. 1991. Neoplasms and non-neoplastic liver lesions in winter flounder, Pseudopleuronectes americanus, from Boston Harbor, Massachusetts. Environmental Health Perspectives. 90:(in press).

14. Committee on Merchant Marine and Fisheries. 1989. Coastal waters in jeopardy: reversing the decline and protecting America's coastal resources. House of Representatives, U.S. Congress.

15. Conservation Foundation. 1988. Protecting America's Wetlands: an Action Agenda. The Final Report of the Wetlands Policy Forum. Washington, DC. 69 p.

16. President Bush's Speech to Ducks Unlimited, Sixth International Waterfowl Symposium, June 6, 1989.

17. NOAA Estuarine Programs Office. 1987. NOAA Estuarine and Coastal Ocean Science Framework. NOAA, Department of Commerce. 87 p. + Appendices.

18. National Marine Fisheries Service. 1985. Regional Action Plan: Northeast Regional Office and Northeast Fisheries Center. NOAA, Department of Commerce, NOAA Tech. Mem. NMFS-F/NEC-37. 20 p. + Appendices.

19. National Marine Fisheries Service. 1987. Northeast Fisheries Center Framework for Inshore Research. NOAA, Department of Commerce, NOAA Tech. Mem. NMFS-F/NEC-49. 44 p.

20. National Ocean Pollution Program Office. 1988. Federal Plan for Ocean Pollution Research, Development, and Monitoring: Fiscal Years 1988-1992. Prepared for the National Ocean Pollution Policy Board. Office of the Chief Scientist, NOAA, Department of Commerce. 205 p. + Appendices.

21. Frayer, W.E., T.J. Monahan, D.C. Bowden and F.A. Graybill. 1983. Status and trends of wetlands and deepwater habitats in the conterminous United States, 1950s to 1970s. Dept. of Forest and Wood Sci., Colorado State U., Ft. Collins, CO. 32 p.

22. Gagliano, S.M., K.J. Meyer-Arendt and K.M. Wicker. 1981. Land loss in the Mississippi River Deltaic Plain. Trans. Gulf Coast Assn. Geol. Soc. 31:295-300.

23. Turner, R.E. 1990. Landscape development and coastal wetland losses in the northern Gulf of Mexico. Amer. Zool. 30:89-105.

24. Rozengurt, M.A., M.J. Herz and M. Josselyn. 1987. The impact of water diversions on the river-delta-estuary-sea ecosystems of San Francisco Bay and the Sea of Azov. In: D.L Goodrich (editor). San Francisco Bay: issues, resources, status, and management. NOAA Estuary-of-the-Month Seminar Series No. 6. U.S. Dept. of Comm., Washington, D.C. pp. 35-62.

25. Office of Technology Assessment. 1987. Wastes in Marine Environments, OTA-O-334. U.S. Congress, GPO, Washington, D.C. 313 p.

26. Casillas, E., M.S. Myers and W.E. Ames. 1983. Relationship of serum chemistry values to liver and kidney histopathology in English sole (Parophrys vetulus) after exposure to carbon tetrachloride. Aquat. Toxicol. 3:61-78.

27. Johnson, L.J., E. Casillas, T.K. Collier, B.B. McCain and U. Varanasi. 1988. Contaminant effects on ovarian development in English sole (Parophrys vetulus) from Puget Sound, Washington. Can. J. Fish. Aquat. Sci. 45:2,133-2,146.

28. Johnson, L.L., E. Casillas, D. Misitano, T.K. Collier, J.E. Stein, B.B. McCain and U. Varanasi. 1989. Bioindicators of reproductive impairment in female English sole (Parophrys vetulus) exposed to environmental contaminants. In: Oceans '89 Conference Record. (Seattle, WA: Mar. Tech. Soc. IEEE Ocean Eng. Soc., 1989). pp. 391-396.

29. Varanasi, U., D.W. Brown, S-L. Chan, J.T. Landahl, B.B. McCain, M.S. Myers, M.H Schiewe, J.E. Stein and D.D. Weber. 1987. Etiology of tumors in bottom-dwelling marine fish. A final report submitted to the Natl. Cancer Inst. 250 p.

30. Varanasi, U., J.E. Stein, L.L. Johnson, T.K. Collier, E. Casillas and M.M. Myers. 1991. In: Proceedings of the International Symposium of Ecological Indicators:(in press).

31. Turner, R.E. and N.N. Rabalais. 1991. Eutrophication and its effects on coastal habitats. In: H.S. Bolton (ed) Coastal Wetlands Volume, Coastlines of the World. Coastal Zone '91, Proceedings of the Seventh Symposium on Coastal and Ocean Management. American Society of Civil Engineers, New York, NY.

APPENDIX A

NOAA'S HABITAT-RELATED LEGISLATIVE CROSSCUT

NOAA'S HABITAT-RELATED LEGISLATIVE CROSSCUT

NOAA'S HABITAT-RELATED LEGISLATIVE CROSSCUT

NOAA's authorities to assess or describe ecosystems and habitats important to living resources; to conduct research in marine, coastal, estuarine and riverine ecosystems; and to help manage activities which may affect living resources and their habitats are founded in a plethora of Federal legislation spanning decades. In fact, as early as the late nineteenth century, the National Marine Fisheries Service (NMFS) and the Coast and Geodetic Survey (organizations which later became a part of NOAA) were governed by legislative mandates involving inshore activities associated with or affecting such resources and ecosystems. Since then, Congress has enacted legislation that confers much greater authority on NOAA to address specific issues such as fishery conservation and management, pollution research, and coastal zone management.

Despite NOAA's many habitat-related legislative authorities, no document has been developed which specifically relates this legislation to the focus of NOAA's habitat-related programs. The legislative crosscut addresses this need by relating NOAA's habitat-related responsibilities with its Congressional mandates. The crosscut identifies the primary legislation that gives NOAA authority to coordinate habitat-related programs and to undertake efforts in management, research and assessment. It is not intended to be a comprehensive analysis of habitat-related legislation, nor a compendium of laws. Instead, the crosscut links activities with specific sections of Federal legislation and creates a framework within which to understand NOAA's habitat-related responsibilities.

Table of Contents

I. MANAGEMENT

NOAA encourages wise management of the nation's living resources and essential coastal, estuarine and riverine habitats. NOAA administers programs for managing the nation's marine fisheries; protecting valuable marine, estuarine and riverine habitats; and promoting wise use and protection of coastal resources. Additionally, NOAA provides expertise to Federal and state agencies that have development and management responsibilities in coastal areas.

LIVING RESOURCES. NOAA is a partner in the management of living resources, with Fishery Management Councils, Interstate Fishery Management Commissions and states. NOAA is also mandated to conserve such resources througthout their range and thus act as the Federal steward for their protection. Such authorities extend to finfish, shellfish and their food webs, as well as to endangered species and marine mammals. Because most species for which NOAA has conservation and management responsibility spend portions of their life cycle in state waters, NOAA also provides information and expertise to the states to assist them in their conservation and management programs. Through the Commercial Fisheries Research and Development Act and the Anadromous Fish Conservation Act, NOAA also provides grants to states, universities, and other organizations to assess marine fisheries.

DEVELOPMENT PROPOSALS' REVIEW. Under numerous authorities, including the Fish and Wildlife Coordination Act, NOAA has stewardship responsibility and must be consulted by any Federal agency proposing to alter waters of the U.S. NOAA reviews and comments on their plans and recommends whether the project should be disapproved, approved, or modified to conserve habitat important to living resources.

COASTAL LAND USE. The Coastal Zone Management Act (CZMA) authorized the first national program to promote the wise use and protection of coastal land and water resources. Administered by NOAA, this act provides funds, policy guidance, and technical assistance to coastal states to help them establish and maintain coastal zone management programs. The CZMA also provides for the designation of national marine and estuarine research reserves, consisting of land and water areas that are managed as natural research laboratories for scientists and the public.

PUBLIC INFORMATION. Communication is an integral component of NOAA's programs, particularly its National Sea Grant College Program. Universities and institutions funded by the program develop applied information for the public that communicates important estuarine scientific findings and conveys other information about coastal resources. Publications providing advice to mariners and fishermen also are part of the program.

MANAGEMENT

CAPABILITIES	LEGISLATION	DESCRIPTION
LIVING RESOURCES		
o Fisheries Conservation and Management	Magnuson Fishery Conservation and Management Act, 16 U.S.C. 1801 et seq.	Exclusive management authority for fishery resources within the EEZ and anadromous species throughout their migratory range. Conservation authority for living marine resources and their habitat throughout their range.
	Magnuson Fishery Conservation and Management Act Amendments of 1986, 15 U.S.C. 1511c	
o Interstate Fisheries Grants & Management	Anadromous Fisheries Conservation Act, 16 U.S.C. 756 et seq.	Departments of Commerce and Interior, with states conserve, develop, and enhance anadromous fishery resources.
o Protected Species Management	Marine Mammal Protection Act, 16 U.S.C. 1361 et seq.	Responsibility for protecting and managing certain marine mammals and their habitats.
	Endangered Species Act, 16 U.S. C. 1531 et seq.	Responsibility for the management, conservation and recovery of certain endangered and threatened species and their habitat.
o Fishery Resources	Fish and Wildlife Act, 16 U.S.C. 742d et seq.	Conduct investigations on: the production of fish and fish by-products; fishery statistics; availability and biological requirements of fish and wildlife resources (commercial and sport).

MANAGEMENT

CAPABILITIES	LEGISLATION	DESCRIPTION
DEVELOPMENT PROPOSALS' REVIEW		
o Hydropower Planning	Pacific Northwest Electric Planning and Conservation Act, 16 U.S.C. 839 et seq.	Stipulate measures to protect, mitigate and enhance anadromous fish and their habitats at hydroelectric projects in the northwest.
o Hydroelectric Dams	Federal Power Act, 16 U.S.C. 791 et seq.	Prescribe fish passage facilities during the construction of dams or diversions.
o Federal Projects, Permits, Leases and Licenses	Fish and Wildlife Coordination Act, 16 U.S.C. 661 et seq.	Requires consultation with NMFS on all projects affecting waters of the U.S., proposed by a Federal agency, to give fish and wildlife resources equal consideration with other project purposes.
o Permits for Pollutant Discharges and Fill in Wetlands	Clean Water Act, 33 U.S.C. 1344 (q)	Mechanism allowing NMFS to advise the Corps of Engineers on fish and habitat impacts of dredge and fill permits and to advise those states delegated authority by EPA to issue permits for pollutant discharges.

MANAGEMENT

	CAPABILITIES	LEGISLATION	DESCRIPTION
o	Federal Projects or Authorizations	National Environmental Policy Act, 42 U.S.C. 4332	Review and comment on environmental impact statements for major Federal actions that significantly affect the quality of the human environment.
o	Pollutant Discharges	Federal Water Pollution Control Act, as amended (Clean Water Act), 33 U.S.C. 1321	Assess injury, destruction, or loss of natural resources in the coastal and marine environment caused by discharge of pollutants from vessels or facilities.
o	Spills and Toxic Dumps	Comprehensive Environmental Response, Compensation and Liability Act (Superfund), 42 U.S.C. 9607, 9611	Assess injury, destruction, or loss of natural resources in the coastal and marine environment caused by releases of hazardous substances from facilities.
o	Sewage Sludge, Toxic Material, Dredged Material	Marine Protection, Research and Sanctuaries Act, 33 U.S.C. 1443	Assess effects of ocean dumping of pollutants on living resources and their habitats.

MANAGEMENT

	CAPABILITIES	LEGISLATION	DESCRIPTION
o	OCS Oil and Gas	Outer Continental Shelf Lands Act Amendments of 1979, 43 U.S.C. 1801 et seq.	Assess effects of oil and gas exploration, development and production activities on living resources and comment on Federal approval of leasing of OCS areas for exploration and development.
COASTAL LAND USE			
o	Coastal Resources Programs	Coastal Zone Management Act, 16 U.S.C. 1451 et seq.	Approve state coastal zone programs and provide grants to develop and implement a management program for the coastal zone.
		Marine Protection, Research and Sanctuaries Act, 33 U.S.C. 1443	Cooperate with EPA to assess feasibility in coastal areas of regional plans for disposal of waste materials.
o	National Marine and Estuarine Research Reserves	Coastal Zone Management Act, 16 U.S.C. 1431 et seq.	Designate representative marine and estuarine areas as National Reserves in which education, research and interpretive activities are conducted.

MANAGEMENT

CAPABILITIES	LEGISLATION	DESCRIPTION
o National Estuary Program	Water Quality Act of 1987, 33 U.S.C. 1254, 1254a	The EPA Administrator shall provide up to $5,000,000 per fiscal year of sums to be appropriated to NOAA to carry out research in estuaries for long-term trend assessment ecosystem assessment, comprehensive water quality sampling and identification of the movements of nutrients sediments, and pollutants through coastal marine areas and their impacts.
PUBLIC INFORMATION		
o Communication; Marine Advisory Service; Estauarine Education	National Sea Grant College Program, 33 U.S.C. 1121 et seq.	Conduct research, education, and advisory services for marine resources.
	Coastal Zone Management Act 16 U.S.C. 1461	Through natural field laboratories, provide marine and estuarine research and public education programs.

CAPABILITIES	LEGISLATION	DESCRIPTION
ENFORCEMENT		
	Superfund, 42 U.S.C. 9607(f) 9611(h)	Recover damages from responsible parties for injury to natural resources, subject to NOAA trusteeship, due to releases of hazardous substances into the coastal and marine environment from a facility.
	Lacey Act, 16 U.S.C. 3373	Provides for the Secretary to impose civil and criminal penalties, and permits sanctions on any violation of the statutes.

II. RESEARCH

NOAA's habitat-related research activities emphasize physical processes, ecosystem dynamics, and living resources and their habitats. Research is focused on the effects of physical habitat alterations and contaminants on living resources and the subsequent impact on fisheries utilization. The review and synthesis of data gathered in the research phase also helps to identify topics where additional research is needed to support management decisions.

PHYSICAL PROCESSES. Hydrologic factors, together with chemical and biological processes, are important in determining the health of estuarine ecosystems as well as being an important determinant of the fate of contaminants introduced into coastal and riverine areas. NOAA has research programs on hydrologic dynamics and contaminant transport which emphasize how coastal areas trap dissolved, as well as particle-born, pollutants. NOAA also is examining the role that benthic organisms play in both resuspending and transporting contaminants.

ECOSYSTEM AND NUTRIENT DYNAMICS. Coastal areas, including estuaries and their tributaries, are among the most productive ecosystems in the world. This productivity is due partly to nutrients and their role in stimulating biological growth. Circulation patters, nutrient dynamics, primary production, and decomposition combine to create a constantly varying environment. To better understand these relationships, NOAA researchers are investigating the dynamics of food webs in coastal areas and the role of nutrients and physical conditions in regulating productivity.

LIVING RESOURCES. NOAA has extensive research programs designed to study natural variability of finfish and shellfish populations. To understand natural and anthropogenic factors affecting their productivity, NOAA investigates the life history of species having recreational, commercial or ecological importance to determine their biological requirements. NOAA also investigates diseases in a number of species and conducts aquaculture research to artificially create environments that can support valuable living resources such as salmon, striped bass, and shrimp.

HABITATS. Coastal, estuarine and riverine habitats, vital to commercial and recreational fisheries, are threatened by development-related activities such as disposal of sewage and industrial wastes, dredging, filling, freshwater diversions, damming, and channelization. Through its research programs, NOAA is determining the importance of fishery habitats, the effects of habitat loss on fishery resources, and the potential benefits of habitat restoration, enhancement, and mitigation.

CONTAMINANT EFFECTS. NOAA supports substantial research to examine the effects of contaminants on living resources, including food chain organisms. These pollutants include synthetic organics (e.g., pesticides and PCBs), toxic metals, petroleum hydrocarbons, and excess nutrients. NOAA also conducts research to determine the public health significance of contaminants in fish and shellfish.

RESEARCH COORDINATION. NOAA has legislative authority to coordinate Federal pollution and habitat alteration research programs and to develop national five year plans to focus Federal programs' activities. NOAA also funds the National Sea Grant College Program which provides support to a large number of academic research projects and information transfer.

RESEARCH

CAPABILITIES	LEGISLATION	DESCRIPTION
PHYSICAL PROCESSES		
o Circulation Dynamics	National Ocean Survey, 33 U.S.C. 883a, 883d	Conduct hydrologic and other surveys; research in geographical sciences.
ECOSYSTEM DYNAMICS		
o Ecological Relationships	Marine Protection, Research and Sanctuaries Act, 33 U.S.C. 1441 et seq.	Develop a comprehensive research program on the long-range effects of pollution, including effects on the marine environment, fish and shellfish.
LIVING RESOURCES		
o Life History	Columbia River Fishery Development Act, of 1983 (Mitchell Act), 16 U.S.C 755 et seq.	Conduct research on Columbia River fishery resources.
	Anadromous Fisheries Conservation Act, 16 U.S.C. 757a et seq.	Conduct biological studies to conserve, develop, and enhance anadromous fish.

RESEARCH

CAPABILITIES	LEGISLATION	DESCRIPTION
HABITATS		
	Fish and Wildlife Act, 16 U.S.C. 742d	Conduct investigations on: the production of fish and fish by-products; fishery statistics; availability and biological requirements of fish and wildlife resources (commercial and sport).
o Pollution and Physical Habitat Degradation	Marine Protection, Research and Sanctuaries Act, 33 U.S.C. 1441 et seq.	Develop a comprehensive research program on the long-range effects of ocean pollution, including effects on the marine environment, fish and shellfish.
	Magnuson Fishery Conservation and Management Act, 16 U.S.C. 1851	Conduct research on the effects of human activities including fishing, pollution and habitat alteration on living resources.
o Plastic Pollution	Marine Plastic Pollution and Control Act of 1987, 42 U.S.C. 6981 note, 33 U.S.C. 1902	Compliance with Annex V of MARPOL regarding a prohibition on marine disposal of plastics and guidelines for marine disposal of other ship generated garbage.

RESEARCH

	CAPABILITIES	LEGISLATION	DESCRIPTION
o	Aquaculture	National Aquaculture Improvement Act of 1985, 16 U.S.C. 2801 et seq.	Augment existing commercial and recreational products.
CONTAMINANTS EFFECTS			
o	Disease	Marine Protection, Research and Sanctuaries Act, Title II, 33 U.S.C. 1442(a)(2)(c)	Monitor diseases in fish and and shellfish
o	Acid Rain	Acid Precipitation Act of 1980, 42 U.S.C. 8903	Direct research into the effects of acid precipitation on fisheries, etc.
o	Toxic Releases	Superfund, 42 U.S.C. 9607(f), 9611(h)	Assess injury, destruction, or loss of natural resources in the coastal and marine environment caused by releases of hazardous substances.
o	Permits for Pollutant Discharges	Clean Water Act, 33 U.S.C. 1321	Assess injury, destruction, or loss of natural resources in the coastal and marine environment caused by discharge of pollutants from vessels, or onshore or offshore facilities.

CAPABILITIES	LEGISLATION	DESCRIPTION
FISHERY UTILIZATION		
o Contaminants in Fish Products	Lacey Act, 16 U.S.C. 3372	Unlawful to import, export, purchase, etc. fish and wildlife taken, possessed, transported, or sold in violation of any law of the U.S. or any state, foreign, or Indian tribal laws.

RESEARCH

	CAPABILITIES	LEGISLATION	DESCRIPTION
o	Chemical Interactions; Contamination of Shellfish	Food, Drug, & Cosmetic Act, Fair Packaging & Labeling Act, 15 U.S.C. 1451-61	Mandatory requirements for package and labeling of food, including fish and shellfish.
RESEARCH COORDINATION			
o	Five Year Pollution Plan	National Ocean Pollution Planning Act of 1978, 33 U.S.C. 1702a(a)	Establishes the National Ocean Pollution Program Office to review each department and agency's habitat-related budget request and, in consultation with other appropriate Federal officials, prepare a comprehensive 5-year plan for the overall Federal effort in ocean pollution and habitat alteration research and monitoring.
o	Academic Program	National Sea Grant College Program, 33 U.S.C. 1121	Establishes a national academic program to promote education and research in all areas of coastal marine science.

III. ASSESSMENT

Assessment is the first step in describing a system. Assessment addresses the physical environment, water and sediment quality, and associated animals and plants. Existing information must first be identified and analyzed. This step reveals where additional data are necessary to complete the assessment. NOAA programs, therefore, include collecting, archiving and analyzing data and developing descriptions of the environment and its living resources.

DATA ARCHIVES. NOAA has extensive programs to collect, interpret and use fishery and oceanographic data. NOAA maintains extensive archives for oceanographic, climatic, satellite, fisheries, and pollution data, much of which is available to the public upon request. NOAA also publishes an annual catalog of its habitat-related activities and disseminates annually an inventory of all Federal pollution research.

DATA ANALYSES. Data analyses entail gathering information from a variety of sources and standardizing it. NOAA's data analysis activities include building data bases on physical, chemical, and biological factors, as well as on land-use patterns. Some of this information is currently being incorporated into a data base, the National Estuarine Inventory (NEI), covering 92 U.S. estuaries. This information is graphically displayed in a series of data atlases. Analyzing data bases also is part of NOAA's assessment programs. NOAA also analyzes data to assess the effects of weather and oceanographic conditions on fisheries, recreation, and transportation.

ENVIRONMENTAL DESCRIPTION. A number of NOAA's programs describe the status of coastal estuarine and riverine systems, their resources, and levels of contaminants. These programs rely on observational data collection and monitoring. The data generated are used to predict trends in environmental quality and abundance of living resources. NOAA's nautical charting and tides and circulation programs fall under the category of environmental description and provide valuable information to the maritime industry and recreational boaters, among others.

ASSESSMENT

CAPABILITIES	LEGISLATION	DESCRIPTION
ACHIVES		
o Oceanographic and Geodetic Data	National Ocean Survey, 33 U.S.C. 883a, et seq.	Conduct hydrographic and topographic surveys; take tide and current observations; compile, analyze, process and publish data and charts.
o Weather, Climate and Satellite Data	National Climate Program Act, 15 U.S.C. 2904	Conduct global data collection; assess the effect of climate on the natural environment; develop systems to manage and disseminate climatological data.
	Weather Service Organic Act, 15 U.S.C. 313	Collect and distribute meteorological information and record climatic conditions of the U.S.
	Land Remote-Sensing Commercialization Act of 1984, 15 U.S.C. 4203	Acquire and disseminate remote-sensing data.

ASSESSMENT

CAPABILITIES	LEGISTATION	DESCRIPTION
DATA ANALYSIS		
o National Estuarine Inventory	Marine Protection, Research and Sanctuaries Act, Title II, 33 U.S.C.	Develop a comprehensive research program on long-range effect of pollution, overfishing and ecosystems; cooperate with EPA in assessing feasibility of regional management plans for coastal disposal of waste
o Environmental Assessments	National Climate Program Act, 15 U.S.C. 2904	Develop system to manage and disseminate climatological information and assessments.
ENVIRONMENTAL DESCRIPTION		
o Navigation, Charting, Tides, Circulation	National Ocean Survey, 33 U.S.C. 883a, et seq.	Provide charts for safe navigation; conduct tide and current observations; publish tide tables, maps; print and distribute natuical charts; cooperate with other agencies and private organizations.
o Stock Assessment	Magnuson Fishery Conservation and Management Act, 16 U.S.C. 1801 et seq.	Assess present and future conditions of fishery stocks.
	Anadromous Fish Conservation Act, 16 U.S.C. 757b	Conduct biological surveys to conserve, develop, and enhance anadromous fish.

ASSESSMENT

CAPABILITIES	LEGISLATION	DESCRIPTION
o Monitoring	Marine Protection, Research and Sanctuaries Act, Title II, 33 U.S.C. 1441 et seq.	Develop a comprehensive research program on long-range effects of pollution; assess the capacity of the marine environment to receive materials without degradation; monitor and assess the health of the marine environment, including contaminant levels in biota, sediments, fish and shellfish.
	National Ocean Pollution Planning Act, 33 U.S.C. 1701 et seq.	Monitor research efforts of other Federal agencies and use of such research in determinations that affect the coastal environmental quality.

APPENDIX B

FEDERAL HABITAT-RELATED PROGRAMS

FEDERAL HABITAT-RELATED PROGRAMS

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION (NOAA)/DEPARTMENT OF COMMERCE

NOAA's mandated responsibilities are to act as the federal steward for the nation's living marine resources throughout their range, to conduct research on the importance of habitat to living marine resources and the effects of human activities on such resources, to be consulted by any agency proposing development potentially affecting living marine resources, to describe and assess estuarine and coastal areas, to conduct research, and to provide information for management. Primary mandates include the Fish and Wildlife Act of 1956, which authorized the agency's stewardship responsibilities, and the Fish and Wildlife Coordination Act, which requires any federal agency seeking to affect "waters of the U.S." to consult first with NMFS and other resources agencies (U.S. Fish and Wildlife Service and state fish and game agencies). The Magnuson Fishery Conservation and Management Act provides broad authority to conserve and manage fisheries within the U.S. Exclusive Economic Zone (EEZ) and to conduct research on the effects of man's activities on these resources. Other habitat-related authorities, many of which are shared with other federal agencies described in Appendix B, include the Clean Water Act, National Environmental Policy Act, Superfund (CERCLA), Federal Power Act, Pacific Northwest Electric Power Planning and Conservation Act, Mitchell Act, Endangered Species Act, and Marine Mammal Protection Act. The Coastal Zone Management Act provides matching federal funding to states which have an approved program to manage coastal development and conduct programs which balance economic develop with the need to conserve coastal environmental quality. The National Sea Grant College Program Act authorizes a nation-wide program and provides funds to member academic institutions to conduct research and educational activities concerned with ocean and coastal resources. The Marine Protection, Research, and Sanctuaries Act authorizes a comprehensive federal program of monitoring and research on the long-range effects of pollution, overfishing and man-induced changes of ocean ecosystems. Appendix A provides a more complete examination of NOAA authorities. Primary habitat-related NOAA programs are:

National Marine Fisheries Service. As federal steward of the nation's living marine resources throughout their range, NMFS' Regional Habitat Conservation Divisions assess the effects and make recommendations to other federal and state agencies on programs, policies and approximately 10,000 proposed projects which otherwise would adversely affect over 300,000 acres of habitat per year. This includes any activities affecting marine, estuarine, and riverine systems important to living marine resources. Program scientists in NMFS' Fishery Science Centers conduct supporting research on the importance of habitats to living marine resources and the effects of habitat degradation and loss, contaminant effects, nutrient over-enrichment, and other stresses on ecosystem functioning.

Coastal Zone Management. Coastal management programs recognize that estuaries and related wetlands are complex natural systems which are an integral part of the value of the coastal zone. These programs provide practical, day-to-day management and improvement of estuarine and

nearshore coastal resources. Program activities include: habitat protection through permitting and reduction of non-point source pollution by both structural and land use control means; habitat restoration; development of site-specific land and water management plans; and coordination of Federal, state, and local governments and resource agencies. A major goal of coastal management is to preserve important estuarine and wetland areas through acquisition or dedication, or to protect them by minimizing the adverse impacts from other coastal activities. At present, 29 state and territorial coastal management programs have been approved by the Secretary of Commerce.

NOAA Coastal Ocean Program. This NOAA-wide program is intended to improve NOAA's scientific capabilities in all areas related to coastal ocean science. The goal of the program is improved prediction of environmental change to provide decisionmakers with better, scientifically credible options for solving coastal problems. Resources are used to strengthen existing programs of research and monitoring of toxic contaminants, coastal and estuarine habitat functioning, nutrient over-enrichment, estuarine habitat alteration, effects of storms on coastal shorelines, wetland mapping, coastal ecosystem dynamics, and supporting information collection, synthesis, and dissemination systems.

National Sea Grant College Program. This is a cooperative Federal/state grant program for academic institutions on a competitive basis. Sea Grant studies address issues of regional and national interest. The Sea Grant Program is concerned with understanding the processes that shape marine communities over time and space, the importance of specific habitats to the well-being of living marine resources, and the effects of anthropogenic stress on these systems' proper functioning. A significant component of the Sea Grant program is the Marine Advisory Service, a group of advisory and communications personnel, who disseminate current information, recent research results, and advice on a local and regional level to a broad community of marine resource users. Sea Grant marine advisory agents keep in touch with current coastal issues and organize initiatives, demonstration projects, seminars and information campaigns to address these issues.

Office of Ocean Resources Conservation and Assessment Programs. The NOS's Office of Ocean Resources Conservation and Assessment conducts surveillance and assessments of environmental quality in the coastal ocean and estuaries of the U.S., having two major activities - the National Status and Trends Program and Strategic Environmental Assessments Program. The programs provides assessment information on a national and regional scale for developing and evaluating resource management strategies; develop improved understanding of physical and chemical processes; determine trends in toxic contaminants and other indicators of marine environmental quality for use in identifying and evaluating chronic and cumulative environmental problems; and conduct a quality assurance program for marine environmental measurements.

NOAA Damage Assessment and Restoration Program. The Under Secretary for Oceans and Atmosphere (NOAA Administrator) acts on behalf of the Secretary of Commerce as a federal trustee for natural resources provided by the Superfund; Clean Water; Marine Protection, Research and Sanctuaries; and Oil Pollution Acts. NOS's Damage Assessment Center, NMFS's Restoration Center, and the NOAA Office of the General Counsel jointly determine injury to trust resources or their lost use, conduct monetary damage assessments, bring claims against potentially responsible

parties, and restore injured resources. For resources in coastal waters and anadromous fish streams, the Under Secretary may be a co-trustee with the Secretary of the Interior, the Secretaries of other federal land-managing agencies, and with designated state and possibly Indian tribal trustees.

Environmental Research Laboratories (ERL). The Atlantic Oceanographic and Meteorological Laboratory (AOML), the Great Lakes Environmental Research Laboratory (GLERL), and the Pacific Marine Environmental Laboratory (PMEL) conduct process-oriented research to improve our understanding of natural oceanic systems and the ecological impacts of human-induced stresses on these systems, and problem-oriented research to develop improved assessment capabilities, including environmental prediction and models.

ENVIRONMENTAL PROTECTION AGENCY (EPA)

EPA assumes the lead responsibility in the federal government for identifying, evaluating, and controlling environmental pollution resulting from chemical and nonchemical stressors. Priority elements of the EPA mission are to reduce public exposure to pollutants, to protect ecosystems, to regulate certain pollution sources, to clean up Superfund sites, and to improve management of environmental regulatory programs. Several program areas of the EPA related to marine habitat are described below.

Office of Wetlands, Oceans and Watersheds Programs. The Office of Wetlands, Oceans, and Watersheds brings together EPA programs that manage and protect the aquatic ecosystems of inland and coastal watersheds. It combines headquarters responsibilities for addressing nonpoint source pollution; restoring and protecting wetland, river,lake, coastal, and marine environments; and leading surface water monitoring and water quality assessment activities. OWOW assists EPA Regional offices in implementing these programs by developing policies and regulations, providing technical support, and serving as an advocate for the programs with Congress and the public.

EPA, in partnership with state and local governments, is responsible for restoring and maintaining the chemical, physical, and biological integrity of the nation's waters. EPA is also charged with protecting wetland resources. The major federal regulatory tool for this is Section 404 of the Clean Water Act, which is jointly administered by the U.S. Army Corps of Engineers and EPA. The U.S. Fish and Wildlife Service and NOAA's National Marine Fisheries Service have important advisory roles in the permit review process. EPA also encourages the participation of the public in the active protection of wetland resources.

The National Estuary Program (NEP) was established by EPA in the early 1980s and became statutorily established in the Water Quality Act of 1987. Under the Act, EPA convenes management conferences to develop comprehensive plans for estuaries of national significance. The conferences are charged with balancing conflicting uses in an estuary while restoring and maintaining its natural character. The number of estuaries now covered under the program is seventeen. These programs assess the principal factors adversely impacting water quality, direct

and coordinate management measures to address them, improve data collection and storage, and define the structure for increased coordination between agencies with water quality and resource management responsibilities.

Wetlands Research. EPA conducts a research program to determine the functional importance of various wetland habitat types to ecosystem sustainability, productivity of fish and wildlife resources, and functional values. This research also includes studies designed to determine the feasibility or restoring lost functions through habitat restoration, including that as mitigation for project induced losses. The research supports the need for scientific information to support regulatory decisionmaking and national policy development.

Marine Disposal. EPA is charged with regulating waste disposal activities in the marine environment. The marine disposal research program provides the scientific basis for regulating these activities. The program may be divided into the following activities: ocean dumping of nonradioactive materials, ocean disposal of packaged low-level radioactive waste, and ocean outfalls.

Oil and Gas Regulation. Under the provisions of Section 403 (c) of the Clean Water Act and the Outer Continental Shelf Lands Act, EPA must issue permits for the discharge of waste materials for offshore oil and gas drilling and production platforms.

Water-Quality Research. Water quality research includes research activities that relate to establishing limits on specific substances which are to be found in the marine environment. A general mandate for EPA participation in water quality research is contained in the Clean Water Act. Mandates are also contained in the Toxic Substances Control Act and the Federal Insecticide, Fungicide, and Rodenticide Act.

Great Lakes Research. EPA addresses pollution problems in the Great Lakes through two interrelated and coordinated programs: Large Lakes Research Program, which involves research and development; and Great Lakes National Program Office, which involves monitoring, abatement, and control.

Environmental Monitoring and Assessment Program (EMAP). This is an interagency effort to quantitatively evaluate ecological conditions on a regional and national basis using a rigorous statistical design. Ecological conditions in coastal waters will be observed to expand research and monitoring programs for measuring a wide spectrum of contaminants.

Related Programs. Many other EPA programs are indirectly related to coastal and marine habitat. These include various air pollution programs, treatment regulations for industrial sectors, funding of municipal treatment works, and pesticide control programs.

U.S. FISH AND WILDLIFE SERVICE/DEPARTMENT OF INTERIOR

The Fish and Wildlife Service (FWS) has general responsibility for maintaining the freshwater fish and wildlife resources in the U.S. and providing public access to these resources. Its functions include responsibility for fish and wildlife resources and habitats of national interest through research, management, and technical assistance to other federal and non-governmental agencies. Among the programs of the agency are the following related to habitat:

Ecological Services. Through its Ecological Services activity, the FWS provides expert biological advice to other federal agencies, states, industry, and the public concerning the conservation and improvement of fish and wildlife habitat in connection with land and water development activities. Working primarily through regional offices and field offices located throughout the country, the FWS provides assessment of potential fish and wildlife impacts of proposed development activities and works with project sponsors to avoid or minimize these impacts. FWS also works with federal, state, and local agencies concerning management activities that will maximize the potential of their lands for fish and wildlife habitat use. The Ecological Services Program is accomplished through five main categories: 1) agricultural wetlands protection and restoration; 2) advanced project planning; 3) project investigations; 4) permits and licenses; and 5) environmental coordination.

Research and Development Program. The objective of programs is to collect, collate, and interpret diverse information on fish and wildlife species, populations, and habitats in order to provide information, methodology and materials to assist fish and wildlife managers in decisions about protection, enhancement, and utilization of resources.

National Wetlands Inventory Program. The National Wetlands Inventory was established to generate scientific information on the characteristics and extent of the nation's wetlands and deepwater habitats. An update of the national status and trends of wetlands was to be produced in 1990 and every ten years thereafter.

Environmental Contaminants Program. This program provides support, coordination, and technical expertise to protect the quality of our nation's fish and wildlife resources from environmental contaminant degradation.

U.S. ARMY CORPS OF ENGINEERS/DEPARTMENT OF DEFENSE

The U.S. Army Corps of Engineers (Corps) is vested with the authority to maintain navigable waterways; to construct federal projects in these waters; under Section 10 of the River and Harbors Act, to issue permits for the construction of structures in navigable waterways; and, under Sections 103 and 404 of the Clean Water Act, to share with EPA the responsibility of issuing permits, respectively, for the transportation of dredged material for ocean dumping and for the discharge of dredged fill material into the waters (including wetlands) of the U.S. As the organization that administers the federal dredging programs of the nation's estuaries and coastal waters, the Corps' civil works programs affect the health of coastal and estuarine system productivity. The Corps'

habitat-related research is primarily involved with identifying solutions for dredged material disposal, effects of contaminants associated with dredging, and wetland evaluation and creation. Among the Corps' programs are:

Wetlands Research Program. The Corps is required to evaluate and minimize environmental impacts of water resources projects associated with its construction, operation and maintenance, dredging, environmental planning, and natural resource management activities. Wetland restoration and development to replace lost or impacted wetlands, including wetland stewardship and management, are often a part of Corps activities.

Environmental Quality Research and Development Program. This program has as one of its major focuses the development of guidance for Corps environmental specialists for describing the relationship between Corps activities and measurable fish and shellfish habitat value change.

Navigation Project Environmental Operations and Maintenance Program. This program has among its objectives the understanding of the impact of dredging and filling on habitats and wetland. The Long-Term Monitoring Project and the Long-Term Management Strategy Programs are grouped here. The Monitoring Project assesses the effectiveness of a number of aquatic, wetland, and confined dredged material disposal investigations. The Long-Term Management Strategy develops a strategy for dredged material disposal and is a process that considers social, economic, environmental, institutional, and operational constraints.

U.S. GEOLOGICAL SURVEY (USGS)/DEPARTMENT OF INTERIOR

The USGS is responsible for the classification of public lands and examination of the geological structure, mineral resources, and products of the national domain. Over the years its mission has expanded to include hydrological investigations of water in streams and underground.

Geologic Division Program. Under this program, the agency conducts research by means of surveys and measurements to gain understanding of geological, oceanographic, and other causes of coastal erosion and wetlands loss.

National Water Quality Assessment Program. Under this new program, water quality monitoring will be conducted on a continuous basis throughout the U.S. This monitoring will provide important data on the freshwater input to estuaries and coastal waters.

AGRICULTURAL RESEARCH SERVICE, COOPERATIVE STATE RESEARCH SERVICE, FORESTRY SERVICE/U.S. DEPARTMENT OF AGRICULTURE

The U.S. Department of Agriculture has a relatively small portion of its research effort involved in addressing the effects of agricultural and natural resources practices on the marine environment. These are:

Non-Point Source Contaminants Program. Research under this program includes pollution problems caused by soil erosion, estuarine sedimentation, slope stability in agricultural and forested watersheds, streambank and shoreline stability, organic debris and turbidity, and on-land studies to prevent erosion from occurring. Emphasis is also placed on the study of chemical and biological characteristics of soils, residues and water for agriculture.

Point Source Contaminants Program. Studies are underway to investigate chemicals in sediments originating from dump sites and chemical plants, oil spills, and contaminants from other point sources.

Habitat Modification Program. Research efforts include improving the ability to evaluate the effects of watershed development on resource conservation, and investigations of landscape and channel modification on ambient concentrations of sediments and agricultural chemicals in streams. Among studies are those of subsidence of wetlands caused by channelization and draining and determining the status and habitat requirements of anadromous salmonids (salmon and trout).

MINERALS MANAGEMENT SERVICE (MMS)/DEPARTMENT OF INTERIOR

Under the Outer Continental Lands Act of 1953 and amendments of 1978 has been assigned the responsibility for leasing submerged federal lands and to provide protection for the human, marine, and coastal environments concomitant with mineral resource development. The MMS has Regional Studies Programs in the Atlantic, Gulf of Mexico, Pacific, and Alaska to determine the impacts or potential impacts of oil and gas development on habitat and wetlands.

FEDERAL HIGHWAY ADMINISTRATION (FHWA)/DEPARTMENT OF TRANSPORTATION

The primary mission of the Federal-aid highway program is to aid states in providing safe and efficient highway systems for the movement of people and goods. Under the guidance and financial assistance of the FHWA, state highway agencies initiate, plan, design, build, and operate highway projects. In recent years, the protection and enhancement of our environment has played an increasing role in determining the location of highway projects.

Development of a highway project involves many direct physical alterations to the natural environment. The nature and scope of each activity in the construction and operation of a highway facility, as well as the size, type, and function of the highway itself, determine the type and extent of ecological impacts that may occur within the various ecosystems that the highway will traverse. It is the responsibility of highway professionals to identify and evaluate these impacts. Adverse impacts can then be avoided for minimized so that the important elements of ecosystems stay in balance. It is also possible to enhance an ecosystem as a result of a highway project.

Planning. During the planning phase of a highway project, many interdisciplinary specialists may be called upon to identify the ecosystems that exist and to evaluate the impacts (changes) that can

be anticipated when the highway is constructed. These specialists may be from individual state highway agencies, or their services may be obtained from other federal and state agencies, universities, or consultants.

Location. The selection of the final highway location depends upon many social, economic, and environmental factors, including ecological impacts. The most important consideration is to insure that all impacts have been identified and made know to those who will be affected and to those who are responsible for the final decisions. Once the location has been selected, the detailed study of individual impacts can ben continued as final design plans are prepared.

Design. Some methods of lessening adverse ecological impacts have become quite routine. Drainage ditches are designed to include permanent devices to slow runoff water in order to minimize erosion and siltation downstream. Care is taken to avoid interrupting natural water courses whether above or below the ground surface. When water channels are changed, they can be designed to maintain their original characteristics. Where salmon and other migratory fish streams are crossed, fish ladders can be designed into culverts to allow passage during the spawning season. Efforts are also made to insure year round waterflow to prevent seasonal blockage of natural water courses.

The design of culverts in tidal areas is given special consideration because the dynamics of tidal flow patterns in natural channels is difficult to match unless the entire area is bridged or bypassed. Research is progressing toward successful designs to mitigate this type of impact.

Current designs also include special drainage features to keep excessive highway runoff out of environmentally sensitive areas. Certain species of weeds show promise as biological "vacuum cleaners" that could be harvested from ditches once they have absorbed unwanted chemicals.

Construction. Contract specifications and inspection operations have been amended in recent years to insure that the appropriate equipment, materials, and techniques designed to reduce adverse ecological impacts are utilized. Construction sections are planned so that the amount of surface disturbed at one time is limited, thereby lessening potential soil erosion without adversely slowing project construction. Operations are also scheduled to avoid critical periods, such as mating seasons for various animal species. Water pollution has been greatly reduced by specifications and plans requiring temporary erosion and sediment controls, such as sedimentation ponds, check dams, hay bales, silt screen fences, and prompt reseeding of disturbed earth.

Maintenance. Besides being responsible for keeping the highway itself in good operating order, the state also conducts maintenance operations in a way that minimizes ecosystem damage after the highway is complete.

Other Legislative Programs. In addition to the normal project development process that has been discussed, the FHWA and state highway agencies are required to meet many other specific legislative mandates that relate to ecological issues. Some of the more significant federal laws are identified below.

The Federal Water Pollution Control Act. Special permits must be obtained whenever effluent is discharged into navigable waters to insure that water quality standards are met. This Act also requires the State highway agency to obtain a permit whenever the project will involve the dredging or filling of most classes of waterways. Whenever practicable, corridors and alternative alignments that avoid wetlands are selected. When impacts are unavoidable, mitigation measures are taken in an attempt to recreate the basic ecological features that were disturbed by the construction of the highway facility. Mitigation techniques include restoration of the original water circulation conditions, introduction of preexisting plant species and the creation of new wetland habitats.

The Fish and Wildlife Coordination Act. This Act requires consultation with the U.S. Fish and Wildlife Service (FWS) and U.S. National Marine Fisheries Service (NMFS) before diversion, deepening, or other modification of streams or bodies of water.

The Endangered Species Act. This Act also requires consultation with FWS and/or NMFS when threatened or endangered species of animals or plants, or their habitat for which these agencies are responsible are affected by FHWA or state highway programs. Construction is not permitted in critical habitat areas (habitat that is essential for the survival of the species) unless it can be shown that there will be no significant effect on the ability of the species to survive.

The Coastal Zone Management Act. This act affects the twenty nine states and trust territories which border an ocean, the Gulf of Mexico, or one of the Great Lakes. State highway agencies participate with other state agencies in developing a plan for use of coastal zone areas, recognizing the historical, ecological cultural, and esthetics values of these areas. Once a Coastal Zone Management Program and Plan are approved by the Secretary of Commerce, highway agency programs must be consistent with its policies.

The Wild and Scenic Rivers Act and the Wilderness Act. Under the provisions of these Acts, certain rivers and lands are designated as worthy of special protection to reserve their unique characteristics. Once a river has been designated wild, scenic, or recreational by the Congress or by a state, a management plan is established for its use. It is then the responsibility of FHWA and the state highway agency to implement highway programs in accordance with this plan. The Wilderness Act establishes a wilderness preservation system on certain Federally owned lands for the purpose of preserving their wilderness character. By definition, wilderness excludes highway facilities of the type developed in the Federal-aid highway program.

FEDERAL ENERGY REGULATORY COMMISSION (FERC)

The Federal Power Act, authorizes FERC among other things to issue licenses and exemptions for most non-federal development of waterpower (hydroelectric) projects. For any license or exemption to be issued, the FERC must have determined that a proposed project is best adapted to comprehensive plans for development and use of the associated waterway. FERC decisions, which are made after consultation with local, state, and federal resource agencies and the public, must give equal consideration to environmental quality, as well as to developmental resources, such as

power, navigation and water supply. Any decision to approve an application must also address the appropriate mitigation for and/or enhancement of fish and wildlife, including related spawning grounds and habitat.

Issued licenses and exemptions include conditions for the protection, mitigation, and enhancement of affected aquatic life, and may also provide for resource monitoring. Should a proposed project have environmental conflicts, including affects on aquatic resources, which cannot be adequately mitigated for, either an alternate project design will be adopted or no license will be issued.

The Office of Pipeline and Producer Regulation (OPPR) performs the NEPA review for certificates authorizing natural gas companies to construct, extend, acquire, and operate or to abandon transmission and storage facilities for the transportation of natural gas in interstate commerce. Among the jurisdictional facilities that are most likely to be located in areas directly or indirectly affecting the habitat of living marine resources are gas transmission pipelines and related facilities from outer continental shelf production and interstate transportation projects, and liquified natural gas (LNG) import/export facilities. OPPR conducts a complete NEPA review, which also includes coordination and review of determinations by FWS or NMFS concerning threatened or endangered species, Army Corps of Engineers Section 10 and 404 permits, state Coastal Zone Management Plan consistency determinations, and development of mitigative measures. Companies must comply with all environmental conditions which are in the Commission order prior to or during the construction of any facilities.

U.S. COAST GUARD/DEPARTMENT OF TRANSPORTATION

The majority of the U.S. Coast Guard marine pollution activities focus on the active reduction of the potential for pollution and insuring the effective countermeasures and cleanup operations are conducted for accidental discharges.

U.S. NAVY/DEPARTMENT OF DEFENSE

Because of the presence of the U.S. Navy in all coastal waters, it making directed efforts to assure that its activities are not environmentally damaging. These efforts are focused in the following program:

Environmental Protection Technology Program. This program is multifaceted. It includes developing information and technology in the areas of shipboard waste management, conducting ongoing research into the impacts of antifouling paints, and assessing impacts of underwater explosion tests on the marine environment.

NEW INTERAGENCY INITIATIVES

Coastal and Ocean Science Framework. This is a nine-agency effort to develop a framework for a U.S. coastal ocean science program. NOAA chairs a working group formed, under the Science Advisor to the President, within the Committee on Earth and Environmental Sciences. The objectives are to: 1) define the role of research and development in solving both current and emerging problems, 2) develop the strategic view and goals for federal research and development in the coastal environment, and 3) ultimately increase the effectiveness of environmental decisionmaking.

Coastal America: A Partnership. Since March 1990, the four federal agencies with primary responsibility for management, stewardship, and regulation of coastal resources--Department of Commerce (NOAA), Department of Interior (Fish and Wildlife Service and Geological Survey), Environmental Protection Agency, and Department of Defense (Corps of Engineers)--have been meeting to provide a coordinated effort to solve environmental problems. The initiative focuses on three major problem areas threatening coastal resources: 1) habitat alteration and loss; 2) nonpoint source pollution; and 3) contaminated sediments.

APPENDIX C

INFORMATION NEEDS TO MANAGE COASTAL ECOSYSTEMS

INFORMATION NEEDS TO MANAGE COASTAL ECOSYSTEMS

Physical Alterations of Habitat (e.g., wetland fill, dredging, spoil disposal, impoundment, "marsh management," stream channelization, sand and gravel excavation, marinas, mosquito control, dam construction, power generation, logging operations, mining, etc.)

I. What is the relative functional importance of major habitat types to fisheries productivity (low salt marsh, high salt marsh, brackish marsh, seagrass beds, mangroves, rocky shorelines, tidal flats, non-tidal riparian forrest, etc.)?

   A. What are the critical fisheries habitats (for food, cover, spawning, nursery, and migration)?

   B. What habitat losses are we experiencing
      - location, by estuary;
      - acreage, by habitat type; and
      - due to what causes?

II. What are the effects of cumulative habitat loss on fisheries productivity and their economic value, both regionally and nationally?

   A. What conceptual approaches (models) can be used to assess and predict the effects of cumulative habitat loss on regional fisheries production?

   B. What is the relative economic value of major habitat types, based on recreational and commercial fisheries values?

   C. What are the intangible values of estuarine ecosystems to society?

Freshwater Inflow (e.g., increased or decreased flows)

I. What are the effects of alteration of flows on fisheries populations and their economic value?

   A. What are the effects on estuarine community structure and fishery populations of changes in hydrologic flow regimes?

   B. What are the effects on estuarine fishery populations of changes in salinity regimes due to alteration of freshwater inflow?

II. What are the future trends in water diversion and consumption and how can we predict their effects on living marine resources (LMRs)?

A. What is the relationship between the quantity and timing of freshwater flows to the productivity of populations of important living marine resources?

B. What conceptual approaches (models) can be used to assess and predict the effects of hydrologic changes on fishery populations?

Toxics (e.g., agricultural, municipal and industrial discharges; point and nonpoint sources)

I. What are the effects of toxics on populations of living marine resources and their economic value?

A. What are the loading rates of contaminants through estuaries?

B. What are the pathways of contaminants through estuaries?

C. What are valid indicators of stress on LMRs from exposure to toxic contaminants (lethal and sublethal)?

D. How are sensitive life history stages affected by contaminants?

E. What are the effects of toxics at the population level?

F. What are the synergistic and cumulative effects of toxics to fishery populations?

G. What is the relationship of toxic loadings to the incidence of disease in LMRs at the population level?

H. What are the economic consequences of fisheries contamination (on harvest and marketability), particularly for species managed under the MFCMA?

II. What are the human health risks associated with contamination of LMRs?

A. Are there better indicators of human health risk than those presently being used?

III. How can existing regulatory programs be improved to sustain and improve estuarine LMRs?

Nutrients (e.g., agricultural runoff, sewage discharges, non-point sources)

I. What are the effects of natural and anthropogenic nutrient loadings on fishery productivity and economic values?

A. What are the causes and extent of hypoxia affecting estuaries (sources, loading rates and geochemical cycling)?

B. What are the effects of eutrophication on critical life history stages of important, estuarine-dependent populations?

C. What changes in community composition occur as a result of excessive nutrient loading?

II. What means are available to better monitor, predict, and control point and non-point nutrient sources?

Land Use

I. How can we best predict the cumulative effects of various land-use options on fisheries productivity?

A. What are the effects of current land use practices throughout a watershed on important LMRs?

B. What regional land use changes can we expect?

C. What conceptual approaches (models) can we use to predict the effects of land use on LMRs?

II. How can land-use decisionmaking processes best be influenced?

A. How can local zoning and planning officials be better educated in making land-use decisions?

B. How can the information generated through research and analysis be synthesized and presented to better inform local decisionmakers?

Habitat Mitigation and Rehabilitation (e.g., wetland creation/restoration, artificial reefs, hatchery production, improved bypass, etc.)

I. How does the value of rehabilitated habitat compare to natural habitat, in terms of LMR productivity?

A. What criteria should be used to select habitats for rehabilitation?

B. What methodology or criteria should be used to evaluate success of rehabilitation in compensating for lost habitat functions?

C. How long does it take to regain the functional values of natural habitats by restoring or rehabilitating degraded habitats?

II. Is "mitigation banking" a viable means to compensate for lost fisheries habitat values?

III. How can natural resource production best be augmented?

Fishery Ecology

I. What are the habitat requirements of key benthic invertebrates, pelagic and demersal finfish in coastal and estuarine ecosystems?

A. What are the spawning and nursery areas of important species, and what is their relative importance to reproductive success and recruitment?

B. What habitat characteristics, water quality parameters, food availability, etc. are necessary for successful growth, maturation, reproduction and survival of selected species?

II. What are the population trends of recreational and commercially important, estuarine-dependent stocks?

III. What are the relative contributions of fishing, natural, and "pollution-related" mortalities to the population dynamics of declining fishing stocks?

APPENDIX D

PLAN DEVELOPMENT TEAM AND INVITED AUTHORS OF PLAN COMPONENTS

PLAN DEVELOPMENT TEAM

James Chambers, Chairman
Coastal Ocean Program Office, NOAA

Bruce Higgins
Fishery Management Council Liaison
Northeast Fisheries Center, NMFS

Marjorie Ernst
Science Policy Advisor, State Programs Division
Office of Ocean and Coastal Resource Management (OCRM)
NOS

Suzanne Bolton
Chief, Ocean Programs Group
Office of Constituent and Legislative Affairs, NOAA

Lawrence Pugh
Director, National Ocean Pollution Program Office
Office of the Chief Scientist, NOAA

Bruce Parker
Director, World Data Center
National Oceanographic Data Center (NODC), NESDIS

Marshall Hansen
Chief, Water Management Information Division
Office of Hydrology, NWS

Hal Stanford
Deputy Director, Office of Oceanography and
Marine Assessments (OMA), NOS

John Sutherland
Visiting Scientist
Sea Grant, OAR

Edward Christoffers, NOAA Representative
Chesapeake Bay Program, Maryland DNR

David Engel
Senior Research Scientist
Beaufort Laboratory, NMFS

Robert Lippson
Assistant Regional Director
Northeast Region, NMFS

Elaine Collins
National Oceanographic Data Center, NESDIS

Kathe Pease
Senior Counselor for Natural Resources
Office of the General Counsel, NOAA

Daniel Basta
Chief, Strategic Assessments Branch
OMA, NOS

INVITED AUTHORS OF PLAN COMPONENTS

Editor, Objective I Strategies Section
Thomas Bigford, Chief
Habitat Conservation and Protected Resources Division
Northeast Region, NMFS

Marjorie Ernst
State Programs Division, OCRM, NOS

Mark Fonseca
Beaufort Laboratory, NMFS

Editor, Objective II Strategies Section
Bruce Higgins
Northeast Fisheries Center, NMFS

John Sutherland
Sea Grant, OAR

Thomas Minello
Galveston Laboratory, NMFS

Jack Pearce, Acting Science and Research Director
Northeast Fisheries Center, NMFS

Usha Varanasi, Director
Environmental Conservation Division
Northwest Fisheries Center, NMFS

Suzanne Bolton, Chief
NOAA Constituent and Legislative Affairs

James Thomas
Office of Research and Environmental Information, NMFS

Jeannette Whipple, Chief
Groundfish Physiological Ecology Investigation
Tiburon Laboratory, NMFS

Sharon Shutler
Estuarine Programs Office, NMFS

Lawrence Pugh, Director
National Ocean Pollution Planning Office
Office of the Chief Scientist, NOAA

Jane Hannuksela
NOAA General Counsel's Office

Edward Christoffers, NOAA Representative
Chesapeake Bay Program, Maryland DNR

William Hettler
Beaufort Laboratory, NMFS

David Peters
Beaufort Laboratory, NMFS

James Waters
Beaufort Laboratory, NMFS

Bruce McCain
Environmental Conservation Division
Northwest Fisheries Center, NMFS

Andreas Mager, Chief
Habitat Conservation Division
Southeast Region, NMFS

Kathe Pease
Senior Counsellor for Natural Resources
NOAA General Counsel's Office

James Chambers
NOAA Coastal Ocean Program Office
Office of the Chief Scientist, NOAA

APPENDIX E

ACRONYMS

ACRONYMS

BuRec	- Bureau of Reclamation
CERCLA	- Comprehensive Environmental Response, Compensation, and Liability Act (Superfund)
COP	- Coastal Ocean Program (NOAA)
Corps	- U.S. Army Corps of Engineers
CWA	- Clean Water Act
CZM	- Coastal Zone Management
CZMPs	- Coastal Zone Management Programs (state)
CZMA	- Coastal Zone Management Act
EPA	- Environmental Protection Agency
ERRPs	- Estuarine Research Reserve Programs (states, NOAA/NOS/OCRM)
EEZ	- Exclusive Economic Zone
FERC	- Federal Energy Regulatory Commission
FHWA	- Federal Highway Administration
FMCs	- Regional Fishery Management Councils
FMP	- Fishery Management Plan
FWCA	- Fish and Wildlife Coordination Act
FWS	- Fish and Wildlife Service
GC	- NOAA General Counsel
IMFCs	- Interstate Marine Fisheries Commissions
MFCMA	- Magnuson Fishery Conservation and Management Act
MMS	- Minerals Management Service
MOA	- Memorandum of Agreement
MPRSA	- Marine Protection, Research and Sanctuaries Act
MSPs	- Marine Sanctuaries Programs (NOAA/NOS/OCRM)
NEP	- National Estuary Program (EPA)
NEPA	- National Environmental Policy Act
NMFS	- National Marine Fisheries Service (NOAA)
NOAA	- National Oceanic and Atmospheric Administration
NOS	- National Ocean Service (NOAA)
NWI	- National Wetland Inventory (FWS)
OAR	- Office of Oceanic and Atmospheric Research (NOAA)
OCRM	- Office of Ocean and Coastal Resource Management (NOAA/NOS)
OPA	- Oil Pollution Act
ORCA	- Office of Ocean Resources Conservation and Assessment (NOAA/NOS)
SG	- Sea Grant (NOAA/OAR)
USDA	- U.S. Department of Agriculture
USGS	- U.S. Geological Survey