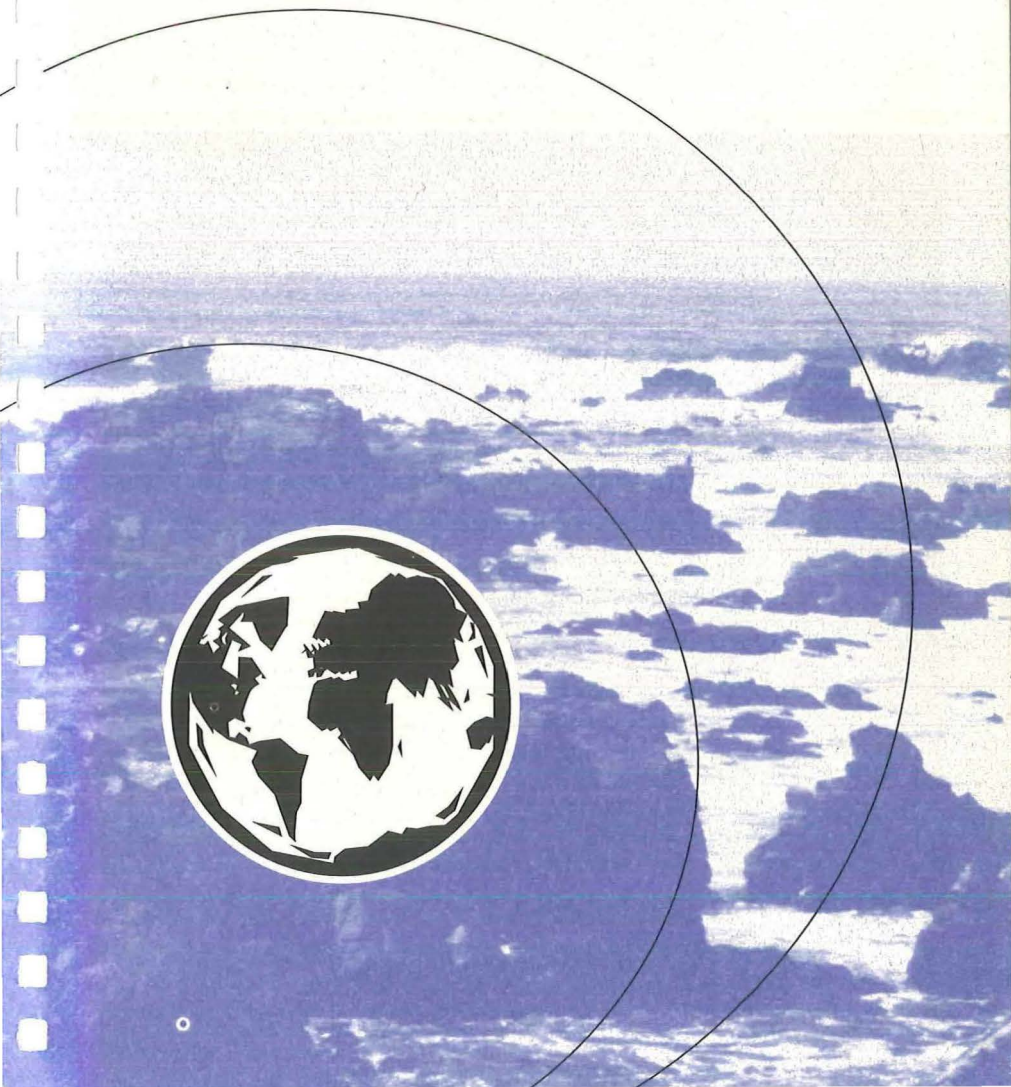
COVERING THE COASTS

A Reporter's Guide to Coastal and Marine Resources



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A publication of the
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Preface

America's coastal environments present the nation with a bounty of tangible and intangible benefits. Home to a growing percentage of the country's population, the coasts provide a wealth of resources, serve as habitat to many marine species, and also attract vacationers.

And for print and broadcast reporters, the coastal environments present an unlimited range of story ideas.

Covering the Coasts: A Reporter's Guide to Coastal and Marine Resources is a resource tool for journalists and editors, and the result of an innovative effort of Coastal America, a consortium of federal agencies, and the not-for-profit, nongovernmental National Safety Council's Environmental Health Center (EHC), which has been active in environmental journalism since its founding in 1988.

A companion publication to EHC's *Chemicals, The Press & The Public* and its *Reporting on Radon*, this guidebook broadly defines the marine and coastal environments, the resources themselves, and also the wide range of challenges that must be effectively addressed in managing them. It defines and explains ... shows connections and contrasts ... draws parallels and points to dissimilarities. It does not attempt to answer all questions. Rather, it is intended to provide reporters with information that can aid them in more effectively pursuing answers on their own.

Covering the Coasts is intended to be a "one-stop read" on the background on coastal issues. It is not the *final* word but rather a constructive *first* word in helping journalists to better inform the public so that it can assist in shaping and implementing programs needed to manage the coasts.

The guide makes clear that no single entity working on its own -- not the federal government or state and local governments, not regulated industries or academia, not even the combined efforts of U.S. citizens -- can succeed in accomplishing all that must be done to achieve a diverse range of goals.

This guide represents an unusual coming together of diverse professional interests, including journalists, government officials, citizens' representatives, academics and researchers, and regulated industries, to achieve a common goal.

Produced with the help of both a technical committee of coastal resource experts and of journalists, the guide, we hope, is a working tool that reporters will find authoritative, timely and

comprehensive as they inform their audiences on the options, challenges and opportunities they face.

The Technical Review Committee provided invaluable assistance in helping EHC wend its way through volumes of complex data and statistics and regulatory details, always with an eye to honing-in on the most current, the most accurate descriptions and nuances.

Coastal America -- consisting of representatives of the federal agencies making up the unique consortium -- was particularly diligent and unsparing in their efforts to help ensure access to the most authoritative and most timely information sources, and EHC appreciates the cooperative spirit among staff throughout the development of multiple drafts.

The Technical Review Committee members: Virginia Tippie, Director, Coastal America, Executive Office of the President; Dan Ashe, House Merchant Marine and Fisheries Committee; Hope M. Babcock, Visiting Professor of Law, Georgetown University Law Center; Donald F. Boesch, President, Center for Environmental and Estuarine Studies, University of Maryland; Roger McManus, President, Center for Marine Conservation; Robert B. Stewart, President, National Ocean Industries Association; and Sarah J. Taylor, Ph.D, Executive Director, Chesapeake Bay Critical Area Commission.

The Press Review Committee members: Michael Dunne of Baton Rouge, Louisiana; Tom Horton of Cambridge, Maryland; and Paul MacClennan of Buffalo, New York.

The Press Review committee provided many insights and recommendations on successive drafts leading up to the final guide. Their advice and recommendations proved of inestimable worth in ensuring the journalistic timeliness and usefulness of the guide.

Chapter 1
Introduction

Coastal and marine resources are among the world's most-treasured but least-understood wealths. For reporters, the "coastal beat" offers endless opportunities and challenges. Retired *Buffalo News* reporter Paul MacClennan, whose coverage of the Great Lakes spanned more than three decades, says it this way:

> Reporters will find the coastal beat to be an all inclusive assignment covering environment, economics, business, legislative, the police beat, law, social issues, weather, in total the entire spectrum of specialized beat reporting wrapped into one issue. Some editors will have to be educated to this fact.

The mere scale humbles the mind. Along the Atlantic and the Pacific, the Great Lakes and the Gulf of Mexico coasts, the U.S. has more than 95,000 miles of coastline. For recreation, livelihoods, and social and economic sustenance and well-being, coastal and near-shore marine resources help shape our nation's character and its distinctive personality. Our coasts are both rich in their promise for tomorrow and bountiful in their delivery of today's ecological, recreational, aesthetic, and commercial rewards. The enormity of the coasts and their resources is matched only by the dimensions of the challenges our society faces in preserving and nurturing those resources.

The ocean and freshwater coastal areas are constantly changing as a result of both natural and human forces. Our coasts are at once resilient and fragile. Under siege from all directions, our coastal lands and waters, and the resources they house, face assault from land, sea and air.

From inland, the pressures come in the form of short-sighted or misinformed development; from constantly increasing coastal populations; from inadequately planned land use decisions; and from pollutants carried downstream from cities, farms and factories.

The pressures impinge also from offshore: ever-present risks of oil spills, the continuing pollution problem from inadequate marine sanitation device programs, the high-impact development of marine mineral and energy resources, and marine and beach debris.

The atmosphere also can pose a threat. Wind currents and refreshing breezes can carry with them toxins and other pollutants from inland sources, without regard for national boundaries. Acid deposition and the long-range transport of toxic air pollutants over time can harm even the seemingly most serene coastal reserve.

Citizens routinely worry about such pressures. But if they are to contribute meaningfully to the management of coastal and marine resources, they need an understanding of the issues and legal processes involved. That day-to-day understanding most commonly comes from the mass media.

Reporters will find no "silver bullet" in their coverage of coastal and marine resource issues or in the eventual "cure" to the ills facing those resources. They'll need to understand and address transportation systems for one deadline; elements of aquatic biology and atmospheric chemistry for the next. Their sources will include citizens desperate over long-term resource declines they can only feel or sense, and also researchers frustrated by the absence of better data on which to base sensitive scientific judgments. The public sector often will face inadequate resources in their efforts to manage competing demands.

For reporters, the challenge lies not only in adequately and accurately describing the nature and extent of coastal and marine resource problems, but also in offering their audiences insights into available, effective and affordable management options.

The scope and complexity of the programs in place to manage and protect the country's ocean and coastal resources are as extensive as the resources themselves are expansive.

Policy makers dealing with coastal resource management activities face the same day-in/day-out dilemma as do those dealing with so many other environmental and natural resource programs. Data alone never are, may not ever be, fully adequate for informed decisionmaking. The desire for more and better scientific information and "certainty" will remain, all the more so with the most dedicated and most conscientious policy makers. "Hard data" can go only so far in pointing the direction toward sound policies and practices.

The limitations on scientific certainty and the inevitable limitations on data per se, are important and so, too, is monitoring in providing long-term trends data. Monitoring may be

particularly helpful in estuaries, where year-to-year saltwater and freshwater conditions can vary widely. Monitoring may not capture many headlines, but in terms of helping policy makers identify the scope of the challenges facing them, reliable monitoring data are invaluable. The absence of long-term data drawn from monitoring can greatly complicate priority setting and decisionmaking.

In the end -- with a thorough understanding of the best available information gathered and presented in the most conscientious fashion -- judgment and professional decisionmaking inevitably come into play.

This does not set coastal and marine resource issues apart from others that environmental decision makers must cope with regularly. In fact, it unifies rather than distinguishes these kinds of policy activities.

As unattainable scientific "certainty" is pursued, so are the financial resources for researching, managing and protecting coastal and marine resources. And, put simply, the pockets don't come so deep that society can afford *all* that could, should or might be done to fully protect our coasts and marine resources from potential damages. This also is not unique to coastal management programs, but it's certain to need continuing efforts to refine and revise program priorities, timetables and overall goals in order to ensure the most cost-effective strategies and implementation. That will be the case all the more as population and development pressures on coastal resources exert increasing pressures in coming years and decades.

Covering the Coasts is designed to help steer reporters through this broad spectrum of issues. It provides an overview of the complexity of the issues and of the regulatory framework -- the numerous agencies with responsibility for various coastal and marine resource management programs -- and it provides a wealth of sources to more detailed information.

Print and broadcast reporters can expect to hear more and more about the environmental and natural resources challenges characterizing the coasts. The challenge will never be that there isn't enough to report on, but rather that reporters inform and enlighten their audiences in the most responsible fashion.

Chapter 2
Defining Coastal and Marine Waters

Highlights

- The United Nations Convention on the Law of the Sea, a document drawn up by a United Nations conference between 1973 and 1982, contains 320 articles and nine annexes. This convention has been called a constitution for the oceans.
- Though the U.S. has not signed the "treaty" -- and as of January 7, 1993, the convention was six nations short of the support needed to bring it into force -- the U.S. nonetheless accepts most of its provisions as binding customary international law.
- The Law of the Sea provides for five basic maritime zones -- the Territorial Sea; Contiguous Zone; Exclusive Economic Zone; Continental Shelf; and the "High Seas" -- and special regimes for archipelagic states, ice-covered areas and international straits.
- In March 1983, the U.S. declared its 200-mile Exclusive Economic Zone by presidential proclamation, thereby asserting sovereign rights over the resources in the 200-miles extending beyond its coastline, including fishing and mineral resources, and jurisdiction for the protection of the marine environment.
- Thirty-six (36) U.S. states and territories have more than 95,000 miles of coastline bordering the Pacific and Atlantic oceans, the Gulf of Mexico, the Gulf of Alaska, the Bering Sea, the Arctic Ocean, and the Great Lakes (which has 5,000 miles of coastline).

Language used to describe the coastal environment can be a mix of words that conjure romantic images of nature or words that sound like the stuff only geologists and lawyers could love. Sandy beaches and saltwater marshes sit side-by-side with continental shelves and exclusive economic zones.

Scientific findings, economic values and political considerations all influence to varying degrees how the definitions and terminology of the coastal environment are developed. For

journalists, these influences sometimes come into such conflict that the debate over a definition becomes the heart of hot stories. That was the case, for instance, in late 1991 as federal officials struggled to delineate wetlands for regulation.

Usually, though, the words and their interpretations become like any other jargon in environmental reporting: tools or turn-offs. Take care to define terms and these words can help tell a rich story. Throw them in carelessly and without explanation and they become just excess verbiage that sends lost readers and viewers looking elsewhere for news.

Internationally Declared 'Zones'

The language that defines the marine environment from "the coast" to the "open ocean" reflects centuries of international conflict and compromise about who has jurisdiction over the sea. Typically, coastal countries have attempted to set limits on other nations' access to protect what they perceived as their economic and military interests. This approach usually meant that coastal countries declared waters within a certain distance from their coasts as territorial waters. Other nations would be allowed to pass through these waters, but would be prohibited from fishing or engaging in other economic or military activities.

By the early 1900s, the world was a crazy quilt of irregular territorial zones. Some countries claimed their zones extended three miles from their shoreline out to sea; others claimed six miles and more. In 1945, the drive was accelerated when President Harry S. Truman proclaimed the United States had exclusive control over its continental shelf, the underwater extension of the North American continent that at some points stretches more than 200 miles beyond the U.S. shoreline. This followed the discovery of rich stores of oil and mineral resources on the continental shelf.

In 1984, Luc Cuyers in *Ocean Uses and Their Regulation* wrote that with Truman's proclamation, "the United States called the world's attention to the notion that there was something of great value besides fish in the sea, and nothing in international law prevented a coastal state from claiming it."

Other countries followed the U.S. lead and declared control over broader ocean territories. The crazy quilt of zones became

even more irregular. The United Nations responded by recommending that its member nations confer. In 1958 the first United Nations Conference on the Law of the Sea, held in Geneva, Switzerland, attracted representatives of 86 countries. At this conference, delegates hammered out four agreements or conventions that began to define sea rights and responsibilities. A second conference in 1960 expanded on the earlier agreements.

Finally, a third conference was convened in 1973. The third United Nations Conference on the Law of the Sea (UNCLOS III) proved to be the most difficult, complicated and comprehensive. It began with more than 400 draft articles. Conference delegates spent nearly 10 years whittling these down to about 320 articles and 9 annexes, forming a manageable convention that defines ocean boundaries and the rights and responsibilities of the world community in using the oceans.

Notably, this convention, more than any of its predecessors, specifically addressed ocean pollution, making it each country's "duty" to protect the ocean environment and conserve its living resources. It mandated cooperation among neighboring coastal states to control ocean pollution from all sources.

However, this convention has not been ratified by the U.S. In 1982, the United States voted against the convention, primarily because of concerns that provisions regarding deep seabed minerals would limit access of U.S. mining interests to seabed minerals.

During the previous two decades, the ocean's great mineral wealth beyond oil had come to light. Capturing that sea-bottom wealth, which included fields of manganese nodules, would be technologically challenging and expensive. But industrialized countries, such as the United States, anticipated that as technology improved, those fields could be mined economically in the near future.

The UNCLOS convention placed deepwater seabeds outside the jurisdiction of any individual country and within the jurisdiction of a new institution (to be established after the convention is ratified), the International Seabed Authority.

The Reagan Administration favored de-regulation and rejected the UNCLOS approach to governing seabed mining, believing it would unduly restrict access to and development of valuable

seabed minerals. In 1982, the majority of the conference delegates voted to adopt the convention despite U.S. opposition. However, the convention only comes into force after 60 member nations adopt it. As of January 7, 1993, the convention had only 54 ratifications.

The United States generally agrees with other key parts of the Law of the Sea convention and has established its ocean boundaries accordingly, for certain purposes. Likewise, most other countries have established their ocean boundaries consistent with the convention.

Specifically, the convention establishes six ocean zones:

Territorial Sea. This zone may extend out to 12 nautical miles (1 nautical mile = 1,852 meters or 6,076 feet), measured from a baseline on a country's coast. It is considered part of a country's sovereign territory, although ships may pass through as long as passage is innocent (e.g., not done to harass, attack or exploit the host country or its resources).

Contiguous Zone. This zone extends an additional 12 nautical miles from the territorial sea. A host country has rights to control immigration, customs, sanitary, and pollution regulations.

Exclusive Economic Zone (EEZ). A country may declare an EEZ extending from the outer boundary of the territorial sea to 200 nautical miles from the coast baseline (i.e., maximum EEZ width is 188 nautical miles where the territorial sea is 12 miles). Within this zone, the coastal country does not have complete sovereignty. Other countries may fly over, navigate through, or lay pipes or cables. However, the coastal host country has all rights to control the resources in these waters, including fisheries and mineral resources. It also may assert jurisdiction (which the U.S. has not) over scientific research conducted in these waters. In March 1983, the United States declared its own 200-mile EEZ through presidential proclamation.

Continental Shelf. The Law of the Sea convention provides a complex definition of this zone. It extends a minimum of 200 nautical miles from the coastal baseline and may extend up to 350 miles in special circumstances. The coastal country has exclusive jurisdiction over the mineral resources of its shelf, including oil. Up to 7 percent of the profits from mineral development beyond the 200-mile-line from shore must be shared with the international community. (The U.S. currently does not

accept this provision as customary international law.) The coastal country is obligated to take measures to protect the shelf's marine environment from negative consequences of oil development.

High Seas. This maritime zone extends beyond areas of national jurisdiction and is generally open and freely available for use by all. No country may interfere with the justified and equal rights of other countries. The seabed under the high seas, home to certain mineral beds, is the common heritage of humankind, according to part of the convention. Mineral resources of the seabed are under the jurisdiction of the United Nations International Seabed Authority, once the convention comes into full effect.

Archipelagic Waters. These waters border the coasts of island countries, such as Indonesia and the Philippines. UNCLOS defines archipelagos and provides the rules governing archipelagic waters.

Nationally Recognized Definitions

Apart from the United Nations convention, the U.S. also recognizes state jurisdiction (approximately three miles, except 10 miles for Texas and the Florida western coast). States have significant coastal resources management in these waters.

Thirty-six (36) U.S. states and territories have 95,429 miles of coastline bordering the Pacific and Atlantic oceans, the Gulf of Mexico, the Gulf of Alaska, the Bering Sea, the Arctic Ocean, and the Great Lakes (which has 5,000 miles of coastline). The area where water meets land -- the beaches, bays and wetlands -- is the coastal zone.

The ***coastal zone*** is formally defined by Section 304 of the Coastal Zone Management Act as "the coastal waters (including the lands therein and thereunder) and the adjacent shorelands (including the waters therein and thereunder), strongly influenced by each other and in proximity to the shorelines of the several coastal states, and includes islands, transitional and intertidal areas, salt marshes, wetlands, and beaches."

Among the many commercially valuable fish and shellfish that are dependent upon coastal waters, particularly the bays and estuaries, are striped bass, shad, salmon, sturgeon, shrimp,

clams, crabs, oysters, lobsters, mussels, abalone, and bay scallops. The National Marine Fisheries Service has estimated that living marine resources of the U.S. contribute -- through marine fishing industries -- over $24 billion annually to the U.S. economy. These waters also serve as habitat and breeding areas for hundreds of varieties of birds and other animals, including marine mammals, such as seals, manatees, sea lions, and otters. They also provide important recreational, aesthetic and cultural value to people.

Rocky Shores, Sandy Beaches, Wetlands

The natural shoreline geography and geology of these coastal waters are diverse, too. There are three basic types of shoreline, and within these types are various subtypes. The three basic forms are:

- rocky shores,
- sandy beaches, and
- wetlands.

Rocky shores and sandy beaches are best defined in the U.S. Geological Survey's 1991 report, *Coasts in Crisis:*

"***Rocky shores*** form on high-energy coasts where mountains meet the sea at the base of sea cliffs. Active tectonic environments, such as in California, produce rocky coasts as a result of mountain-building processes, faulting and earthquakes. Rocky coasts also form where ice and strong waves have effectively removed fine-grained sediment. In Maine and parts of Alaska, glaciers have scoured most of the sediment cover from the shore. In the Arctic, ice gouging and rafting have removed sand-sized particles from some beaches, leaving cobbles and boulders."

The U.S. Geological Survey categorizes ***sandy beaches*** into three types: *mainland, pocket* and *barrier beaches.*

"*Mainland beaches* stretch unbroken for many miles along the edges of major land masses. Some are low standing and prone to flooding; others are backed by steep headlands. They receive sediment from nearby rivers and eroding bluffs. Examples of mainland beaches include the coast of Long Island, northern New Jersey and southern California.

"*Pocket beaches* form in small bays surrounded by rocky cliffs or headlands. The headlands protect the sandy alcoves from

erosion by winter storms and strong currents." Pocket beaches are common in Maine and the Pacific Northwest.

"*Barrier beaches* are found along the Gulf of Mexico, Cape Cod, the Hatteras National Sea Shore, and much of Alaska. They are part of complex integrated systems of beaches, dunes, marshes, bays, tidal flats, and inlets. The barrier islands and beaches are constantly migrating, eroding and building in response to natural processes and human activities."

Wetlands are a third type of coastal environment. In general terms, wetlands are semi-aquatic lands that are either inundated or saturated by water for varying periods during the growing season. In all wetlands, the presence of water creates conditions that favor the growth of specially adapted plants (hydrophytes) and promotes the development of characteristic hydric soil properties.

In general, there are two broad categories of wetlands: *inland* and *coastal. Inland* wetlands include marshes and wet meadows dominated by grasses and herbs, shrub swamps, and wooded swamps dominated by trees and woody vegetation.

Coastal wetlands, as their name suggests, are found along the Atlantic, Pacific, Alaska, Great Lakes, and Gulf of Mexico coasts and are closely linked to our nation's estuaries. For instance, saltwater and fluctuating water levels (due to tidal action) combine to create a rather difficult environment for most plants. Consequently, many shallow coastal areas are mud flats or sand flats lacking vegetation. Certain grasses and grass-like, salt-tolerant (halophytic) plants form extensive colonies called *coastal marshes*. These marshes are particularly abundant along the South Atlantic and Gulf of Mexico coasts. Mangrove swamps, dominated by halophytic shrubs or trees, are common in Hawaii and in southern Florida. (See Chapter 3 for discussion of wetlands' functions and Chapter 4 for a discussion of wetland delineation and related issues.)

Estuaries

Coastal wetlands are integral parts of estuaries, water bodies where freshwater empties into and mixes with saltwater. In recent years, scientists and regulators have begun to recognize that estuaries, a combination of ocean and river waters, are different from either of the two individually -- chemically,

biologically and hydraulically -- and highly productive, increasingly leading to separate regulations and strategies to deal with them.

About 75 percent of commercially important fish and shellfish in the U.S. are estuarine-dependent -- they rely on estuaries and upper reaches of tidal rivers for early life stages, food, migration, or spawning.

Under the Water Quality Act of 1987, the estuary has its own legal definition and protection. An estuary, according to that Act, is "all or part of the mouth of a river or stream or other body of water having unimpaired natural connection with the open sea and within which sea water is measurably diluted with freshwater derived from land drainage." Examples of estuaries are the San Francisco Bay, Chesapeake Bay, Long Island Sound, and Mobile Bay (Alabama).

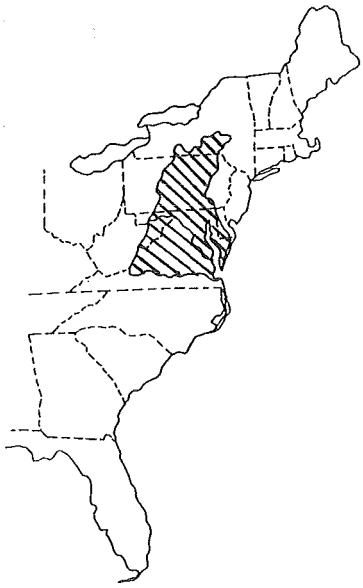
The definition of estuary under the Water Quality Act also takes upstream waters into account: "associated aquatic ecosystems and those portions of tributaries draining into the estuary up to the historic height of migration of anadromous fish or the historic head of tidal influence, whichever is higher." Anadromous fish are those fish that live in the sea but spawn in freshwater, such as salmon and herring. [The reference to the "historic height of migration" is often cited as justification by those maintaining that an estuarine zone extends beyond just a narrow tidal region. By this approach, for instance, part of New York State is included in the Delaware Bay Estuary Program (see National Estuaries Program, Chapter 5), and some argue the same logic should lead to New York's being considered as part of the Chesapeake Bay Estuary Program.]

Watersheds

A watershed, also known as a drainage basin, is defined by the U.S. Environmental Protection Agency as a geographic area in which water, sediments, and dissolved materials drain to a common outlet -- to a point on a larger stream, a lake, an underlying aquifer, an estuary, or an ocean (see Figure 1).

The impact of streams and rivers on the ocean environment can begin well upstream, miles from the coast and well above the spawning grounds of anadromous fish. Here, the rivers and streams begin to gather the silt and sand that is carried downstream to build beaches. Any change in the course of the

Figure 1
Chesapeake Bay Drainage Basin



Source: Framework for Action, *U.S. EPA, 1983.*

river, through dams, diversions and/or draining, can cause fluctuations in sand and water delivery to the ocean. Here, also, the quality of water that later feeds coastal wetlands can begin to deteriorate from pollutants.

A large river's watershed may cover thousands of square miles. Watersheds are increasingly the basis for public/private water quality protection efforts. The Chesapeake Bay watershed extends from Central New York State to Central Virginia, and the Gulf of Mexico drainage area covers nearly 60 percent of the land area of the continental U.S. -- from the Appalachians to the Rockies and parts of Canada.

The Great Lakes

It's important to keep in mind not only North America's Atlantic and Pacific coasts and shorelines in considering the general term "coasts," but also those of the Gulf of Mexico and the Great Lakes.

For millions of Americans, the term "coast" conjures up images of the five Great Lakes -- Superior, Huron, Michigan, Erie, and Ontario. Shared with Canada, the complex Great Lakes ecosystem supports a wide variety of freshwater flora and fauna.

The Great Lakes: An Environmental Atlas and Resource Book, published in 1987 by the U.S. Environmental Protection Agency,

points out that "the magnitude of the Great Lakes water system is difficult to appreciate, even for those who live within the basin."

The *Atlas* offers these facts about the significance of the Great Lakes:

- One-tenth of the U.S. population and one-fourth of Canada's live in the Great Lakes basin (or watershed).
- The Great Lakes span more than 750 miles (1,200 kilometers) from east to west. The five lakes contain the largest system of fresh surface water in the world and about 18 percent of the world's fresh water (only the polar ice caps contain more).
- Nearly one-fourth of Canadian agricultural production and 7 percent of U.S. agricultural production are located in the Great Lakes basin.
- The eight Great Lakes states have over 5,000 miles of shoreline.
- The Great Lakes basin is home to about 40 percent of U.S. manufacturing.

Other key factors make the Great Lakes a major consideration in trying to determine environmental risks facing coastal and marine resources. Among those mentioned in the *Atlas*: outflows from the Lakes are small -- less than 1 percent -- compared with the total volume of water (23,000 km^3 or 94,000 cubic miles), meaning that pollutants entering the lakes "are retained in the system and become more concentrated with time."

Chapter 3
Importance of the Resource: Facts at Your Fingertips

Highlights

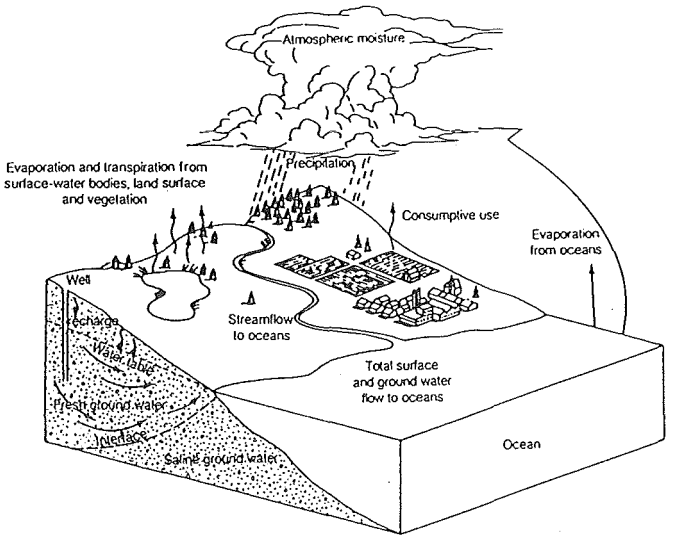
- Oceans contain more than 97 percent of the Earth's water.
- The U.S. "Exclusive Economic Zone" (EEZ), which reaches 200 miles from the coast into the oceans, contains about one-fifth of the world's harvestable seafood.
- There are an estimated 15,000 to 40,000 species of fish in the oceans and 180 species of fish in the Great Lakes. More than 2,000 plant and animal species have been identified in the Chesapeake Bay estuarine region alone.
- Gulf of Mexico coastal wetlands serve as essential habitat for 75 percent of the U.S. migrating waterfowl.
- Commercial landings by fishermen at U.S. ports in 1991 were 9.5 billion pounds, an increase of 80 million pounds compared with 1990 figures.
- In 1991, there were 73.4 million recreational boaters who spent $10.5 billion on related products and services.
- Individual states manage oil and gas leasing within three miles of their coastline (except Texas and the west coast of Florida where it's approximately 10 miles), while the Department of the Interior manages minerals from that three-mile offshore area to the Exclusive Economic Zone.

Oceans cover more than two-thirds of the Earth's surface and comprise more than 97 percent of all the water on Earth. They play a critical role in the energy and nutrient cycles (see Figure 2). We rely on the oceans for many things, including energy and mineral resources, and they are a habitat for sustaining living resources, an important food source.

We also rely on the oceans as "a medium for recreation, learning and enlightenment ... for reinvigorating our own energy,

learning and enlightenment ... for reinvigorating our own energy, our imagination and our creativity as human beings," says James Broadus of the Woods Hole Oceanographic Institution.

Figure 2
Water's Natural Cycle



Source: Environmental Quality, 22nd Annual Report, *Council on Environmental Quality, 1992.*

The U.S. coastline is comprised of many types of geological and ecological systems, including rocky shores, mangrove marshes, wide sandy beaches, barrier islands, barrier reefs, tidal flats, sea grass shallows, cypress swamps, and river delta systems.

Coastal waters teem with rich and varied marine life. U.S. salt marshes, the Atlantic coastal shelf and coral reefs are among the most productive ecosystems found anywhere in the world. The U.S. Exclusive Economic Zone (EEZ) -- waters to 200 miles offshore -- is the largest and perhaps the richest, containing fisheries, oil and gas, and hard minerals, and it provides recreational opportunities.

The U.S. 200-mile zone that reaches into the Atlantic and

> ***"The greatest resource of the ocean is not material but the boundless spring of inspiration and well-being we gain from her."***
> *Jacques Cousteau*

Pacific oceans, Gulf of Mexico, Gulf of Alaska, and the Bering Sea, a total of about 2.2 million square miles, contains about one-fifth of the world's harvestable seafood. The Gulf of Mexico is home to vast fisheries, and the fisheries of the colder North Pacific waters make Alaskan fishing ports prosperous. U.S. coastal waters are also home to enormous populations of marine birds and mammals.

While the coast is highly populated and competing uses are hotly debated, the marine environment to a great extent remains relatively unexplored.

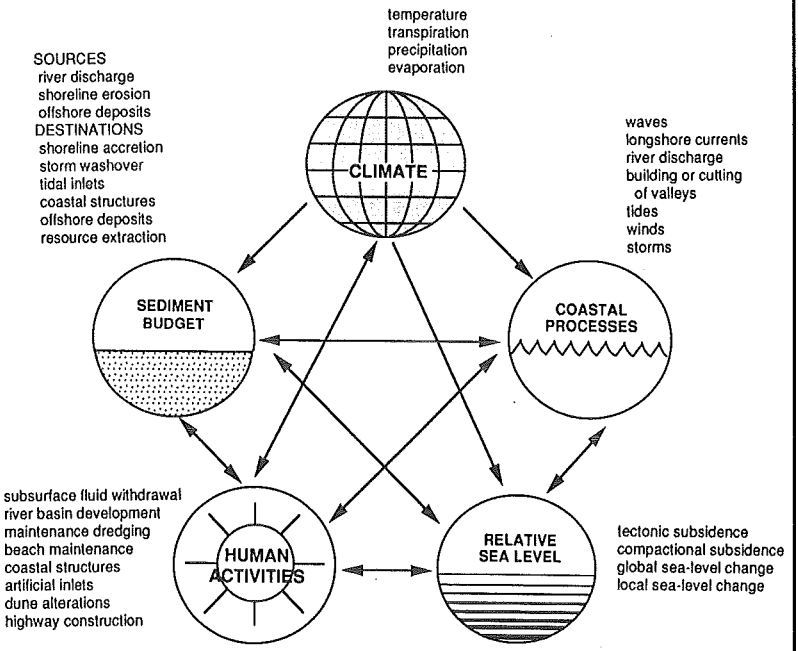
For example, a completely new type of ecosystem, hydrothermal vents -- areas located along deep seabeds, particularly along the central rift valleys of the East Pacific where hot, sulfur-rich water is released from geothermally heated rock -- was discovered less than 15 years ago. Deep sea ecosystems also have high biological diversity that is only beginning to be understood.

The ecological and habitat values of deep sea thermal vents are being appreciated more and more by conservationists, scientists, developers, and the general public. These ecosystems and their enormous variety of marine life are part of complex food chain interactions. Disruption of any part can harm many other parts of the ecosystem (see Figure 3).

The U.S. is and always has been a maritime nation and has derived a significant amount of its wealth and power from the sea. The value of goods and services currently sold by the ocean/marine industry is estimated at $54 billion annually (not including the world merchant fleet), according to Charles W. Covey, in the October 1991 issue of *Sea Technology* magazine. The future of the U.S. will in no small measure depend on its ability to intelligently harness the great wealth of the sea on a sustainable basis without harming the marine resource itself.

David Graham, editor of *Sea Technology*, said also in the October 1991 issue that, "As a current and potentially increasing

Figure 3
Factors Affecting Coastal Environments



Source: Modified from Coasts in Crisis, *U.S. Geological Survey, 1990.*

source of food, energy, and minerals; as a conveyor of ships, communications, and wastes; and as a place of recreation, the oceans will come under increasing pressure in the next decade. This pressure will result from economic necessities and the relentless demographic push toward our coastlines as populations there will jump some 20-25 percent in the next two decades or

so." About one-half of the Earth's population lives on approximately 5 percent of its land, and most of that land is near coasts and mouths of rivers.

Background Reading

Overviews of the diversity of life in and around the coasts, can be found in the following books: Rachel Carson's *The Sea Around Us or The Edge of the Sea*; Jacques Cousteau's *The Ocean World;* or *The Living Ocean* by Boyce Thorne-Miller and John Catena.

The oceans also serve to regulate the world's climate. They help to maintain the global equilibrium between hot and cold by constantly pushing toward a more even distribution of temperatures.

In a relatively stable pattern, oceans transfer heat from the equator to the poles in huge currents near the surface, such as the Gulf Stream, and transfer cooler temperatures from the poles toward the equator in deep ocean currents. As the warm ocean water from the tropics moves northward, some of it evaporates. In the Atlantic Ocean, when it hits the cold polar winds between Greenland and Iceland, the evaporation accelerates, leaving behind saltier sea water that becomes denser and heavier. This rapidly cooling water sinks to the bottom at the rate of five billion gallons per second, forming a deep current as powerful as the Gulf Stream and flows south underneath the Gulf Stream near the ocean floor. In the process, it transfers cold from the poles back toward the equator, along with a large volume of nutrients essential to numerous temperate and tropical species.

Plant and Animal Species

Jacques Cousteau wrote, "The oceans are superior to land as an environment for life support. They provide directly the water fundamental to all forms of growth, laden with vital salts, dissolved gases and minerals. The water temperature is more constant than air, reliably warmer in shallow and surface areas, reliably cooler in the deeps -- freeing many species from the need to adapt, as most land animals must, to wide variations in temperature." However, this lack of adaptability also increases

the risk from environmental disturbances.

Aquatic systems are highly diverse. Estimates of the number of species of ocean fish range from as many as 15,000 to 40,000 species. A cubic foot of ocean surface water may have as many as 20,000 microscopic plants, together with hundreds of planktonic animals. An estimated 180 species of fish are native to the Great Lakes.

More than 2,000 plant and animal species have been identified in the Chesapeake Bay estuarine region, according to *Life in the Chesapeake Bay* by Alice Jane and Robert L. Lippson. The Sierra Club's *Adventuring in Florida* says that there are 350 species of birds, 1,000 varieties of plants, 250 species of trees, 40 of mammals, and 50 of reptiles in the vast Florida Everglades. More than 50 species of mollusks live in Long Island Sound, and Puget Sound is home to more than 200 varieties of fish and 14 marine mammal species. Countless species of microscopic algae and plankton form the base of the food web.

Ecosystems and habitats in coastal and near-shore waters teem with life because of interactions between inland and oceanic systems. Critical habitat for a wide range of fish, shellfish, birds, and other aquatic and terrestrial life can be found in coastal wetlands, estuaries and salt marshes. Coral reef systems provide food and shelter for fish, plants, mollusks, and crustaceans. In coastal areas, nutrients from land runoff combine with organic matter from near-coastal waters. Food washes in and wastes wash out regularly with the tides. In some coastal areas, particularly along the Pacific coastline, colder, nutrient-rich waters are brought to the coastal surface waters in a process called "upwelling," yielding highly productive systems.

Estuaries and coastal areas serve as feeding, spawning and nursery grounds for many species that spend most of their adult lives in the ocean. Salmon, for instance, spawn upriver in freshwater, while shrimp spawn and grow to adults in coastal waters. Up to 70 percent of other commercially valuable species spend all or part of their lives in coastal waters, according to the National Marine Fisheries Service. These coastal waters also support a great share of the clam, oyster, lobster, and mussel fisheries, and 100 percent of the blue crab, abalone and bay scallop fisheries. The continued viability of these fisheries depends on the continued good health of these habitats.

Many marine mammals, such as seals, sea lions, manatees, and sea otters, live in or near coastal water habitats, and a variety of birds depend on wetlands and other coastal habitats for their food, breeding, migratory, and resting areas.

Energy and Mineral Resources

Some coastal and marine areas hold vast oil and gas reserves. Gold, cobalt, phosphorites, other valuable minerals, and sand and gravel abound in some areas. Offshore energy sources account for 25 percent of worldwide and 13 percent of U.S. oil production, and about 22 percent of worldwide and 26 percent of U.S. natural gas production. The U.S. accounts for about 8 percent of worldwide ocean oil production and 38 percent of natural gas production. The value of U.S. production from offshore federal sources has ranged from $10 billion to $25 billion annually since 1985, according to Scott Farrow, a former fellow with the President's Council on Environmental Quality.

We are just now beginning to tap the vast saltwater and freshwater bodies for new "alternative" energy sources. For instance, the prospects for Ocean Thermal Energy Conversion (OTEC), which derives energy by tapping the temperature gradients in sea water, remain bright, yet will not likely be developed on a large scale for many years. Harnessing tidal power one day may be another way to produce energy from the oceans, but this, some say, also may have environmental side effects. For example, a contemplated tidal energy project in Canada's Bay of Fundy has raised fears that it would harm the summering shad.

The waters of the Great Lakes are also a source of energy. About 20 billion kilowatt hours of electricity are produced each year from the water flowing into or out of the Great Lakes.

Offshore oil and gas production has become very important to domestic energy production. Since 1954, the annual market value of crude oil produced from federal offshore leases has been more than $1 billion, reaching a peak of more than $9 billion in 1984. The 1990 value was almost $6 billion, and annual offshore production in U.S. waters is decreasing.

The Minerals Management Service of the Department of the Interior (MMS) manages oil and gas leasing on the 1.4 billion

Additional Resources

The Minerals Management Service (MMS) of the Department of the Interior, the agency which manages offshore production, publishes a number of annual reports that may be useful to journalists, including the *Federal Offshore Statistics: Leasing, Exploration, Production and Revenues* and *Mineral Revenues: Report on Receipts from Federal and Indian Leases.* Contact the MMS Office of Statistics and Information at (703) 787-1036.

acres of the Outer Continental Shelf (OCS). States manage and lease the areas within three miles of shore, except on the Texas coast and the west coast of Florida where three marine leagues, about 10 miles, are retained as state waters.

About 32 million of the 1.4 billion acres were under lease to oil and gas exploration, development and production companies in 1990. There are more than 3,700 oil and gas production facilities and 37,000 petroleum workers offshore on the U.S. OCS, according to the Congressional Office of Technology Assessment. In 1990, more than 1,600 OCS leases were in production in the Gulf of Mexico, yielding about 90 percent of U.S. offshore production. An estimated 38 percent of all petroleum and 48 percent of natural gas reserves in the U.S. are in the Gulf of Mexico.

Condensates, or liquid hydrocarbons such as pentanes and heavier hydrocarbons that are blended with crude oil for refining, are also produced. In 1990, the market value exceeded $1 billion.

In 1990, the OCS oil and gas lease program generated more than $3.4 billion in production royalties and lease-related revenues for the federal government.

Most mineral, oil and gas offshore production takes place offshore Louisiana, followed by Texas, California, Alaska, Florida, and Alabama (the exact order of the states depending on which mineral or statistic is being computed).

Recent estimates show about 14 percent of the U.S. oil reserves and about 24 percent of the natural gas reserves lie under federal OCS lands. The MMS estimates that about 33 percent of America's undiscovered oil resources and 37 percent

Table 1
Largest Private Operators on the Outer Continental Shelf

Oil	*Natural Gas*
Chevron	Chevron
Shell	Shell
Exxon	Atlantic Richfield
Conoco	Exxon
Mobil	Texaco

Source: Federal Offshore Statistics: 1991, *Minerals Management Service.*

of its natural gas resources are in the Outer Continental Shelf.

Table 1 lists the five largest private operators of oil and natural gas facilities on the Outer Continental Shelf.

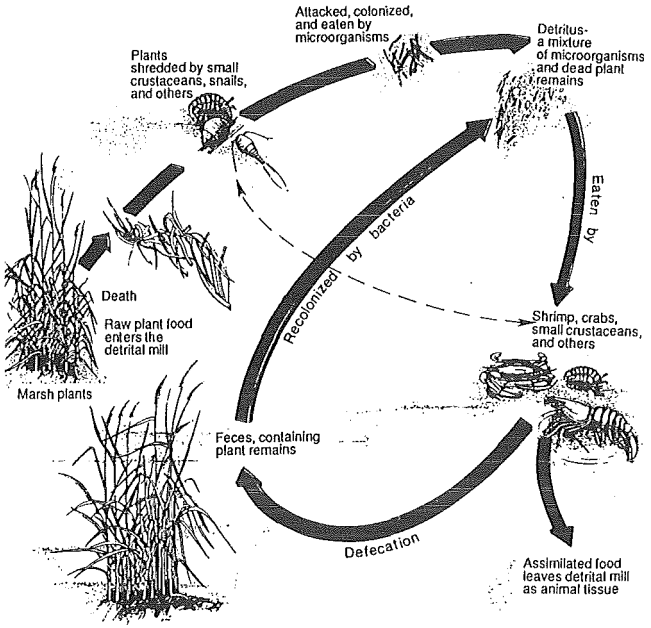
Federal lease revenues go to the U.S. Treasury General Fund, The Land and Water Conservation Fund (LWCF), and the National Historic Preservation Fund (NHPF) through a complex process. Bonus payments (one-time payments for the exclusive right to the leases), rental payments, and royalty payments contributed more than $75 billion to the Treasury between 1971 and 1990.

Wetlands Functions

While wetlands sometimes are pejoratively referred to as mere "swamps" -- wastelands, some say, that are best filled or drained for agriculture or development -- they now are recognized for a variety of important ecological functions. Each wetland works in combination with other wetlands and adjacent uplands and aquatic systems as part of a complex, integrated system that can deliver a range of benefits to society. Wetlands form an important transition zone between upland and aquatic ecosystems and are typically very productive because they contain elements common to both systems.

Wetlands provide habitat for a wide variety of fish and wildlife. Coastal wetlands are especially important habitats for

Figure 4
Marsh Grasses Support the Food Web



Source: The Fragile Fringe: Coastal Wetlands of the Continental United States; *Watzin, M.C., and J.G. Gosselink, 1992. Louisiana Sea Grant College Program, Louisiana State University, Baton Rouge, Louisiana; U.S. Fish and Wildlife Service, Washington, DC; and National Oceanic and Atmospheric Administration, Silver Spring, MD.*

estuarine and marine fish and shellfish, various waterfowl, shore birds and wading birds, and several mammals. Although many commercial and game fish rely on near-shore and coastal waters, many others use coastal marshes and estuaries as nursery and/or spawning grounds. Wetlands are among the world's most productive ecosystems (often more productive than artificial agricultural systems), producing great volumes of organic matter which forms the base of the aquatic food chain (see Figure 4).

EPA has estimated that Gulf of Mexico coastal wetlands serve as essential habitat for 75 percent of the U.S. migrating waterfowl.

One of the most important values of wetlands is their ability to help maintain and improve the water quality of estuaries, rivers and other water bodies. Wetlands remove and retain nutrients; process chemical and organic wastes; and reduce sediment loads in surface and ground waters before they enter streams, lakes or oceans. Ground water, a supply of fresh water beneath the Earth's surface, can be a major source of water flow into coastal waters.

Wetlands also provide flood protection by storing flood waters that overflow riverbanks and surface water that collects in isolated depressions. In addition, because wetlands often are located between rivers and high ground, they buffer shorelands against erosion.

Wetlands also have recreational and aesthetic values. For example, wetlands can provide many opportunities for such recreational activities as hiking, boating and swimming.

Table 2 shows the estimated total acreage of coastal wetlands on the Atlantic, Pacific and Gulf of Mexico coasts.

Commercial Uses

More than 90 million metric tons of fish and shellfish -- representing 16 percent of all animal protein consumed -- are harvested worldwide annually. Sixty (60) percent of the world's population receives more than 40 percent of their animal protein from fish, and the sea provides the entire annual protein supply for 1 billion people, according to Lee Weddig of the National Fisheries Institute.

World fish landings in 1989, a record 99.5 million metric tons, continue to increase from the 60 million metric tons recorded in the early 1970s. The former Soviet Union has been the leading nation with slightly more than 11 percent of the total catch, and the U.S. was sixth with about 6 percent.

Fisheries continue to grow in importance, both economically and as a food source. Many historically rich fisheries, however, have been virtually depleted, among them the once plentiful New England groundfish. Though they consumed less seafood per capita than in most other industrialized countries, Americans are

eating more seafood than in the past, and the Japanese are buying more tuna and other species from U.S. fishermen than ever before.

Table 2
Coastal Wetland Acreage in the Continental U.S.[1]

	Salt Marsh	Fresh Marsh	Forested Wetlands[2]	Total Wetlands
Atlantic Coast	1,651,900	1,490,600	8,410,900	11,553,400
Gulf of Mexico	2,496,600	2,751,100	8,211,800	13,459,500
Pacific Coast	121,900	291,200	757,100	1,170,200
Total	4,270,400	4,532,900	17,379,800	26,183,100

[1]*Excludes Alaska, the Great Lakes and Hawaii.*
[2]*Includes mangroves.*

Source: The Fragile Fringe: Coastal Wetlands of the Continental United States*; Watzin, M.C., and J.G. Gosselink, 1992. Louisiana Sea Grant College Program, Louisiana State University, Baton Rouge, Louisiana; U.S. Fish and Wildlife Service, Washington, DC; and National Oceanic and Atmospheric Administration, Silver Spring, MD.*

National fishery statistics are compiled annually by the National Marine Fisheries Service and published annually in *Fisheries of the United States*. This resource includes information on commercial and recreational fisheries of the U.S. and foreign catches in its Exclusive Economic Zone (EEZ). Information is broken down by species, geographic locations, fishing effort, employment, and other criteria.

According to *Fisheries of the United States 1991*, commercial landings by U.S. fishermen at U.S. ports were a record 9.5 billion pounds (4.3 billion metric tons), which includes 7.0 billion pounds of edible fish and 2.5 billion pounds of industrial fish. This total represents an increase of 80 million pounds (less than 1 percent) compared with 1990 figures. Landings of American lobsters,

crabs, flounder, and salmon increased, while landings of shrimp, clams and tuna decreased. (Table 3 lists the top commercial fish according to quantity and value.)

During the last 10 years, the availability of better technology to commercial and recreational fishermen has increased the efficiency of catching fish, influencing the supply of edible marine life.

Table 3
Rankings for Commercial Fish Landings

According to Quantity	*According to Value*
1 Alaska pollock (single species)	1 shrimp
2 menhaden	2 crabs
3 salmon	3 salmon
4 crabs	4 Alaska pollock
5 cods	5 lobster
6 flounder	6 cods
7 shrimp	7 scallops

Source: Fisheries of the U.S. 1991, *National Marine Fisheries Service.*

The U.S. annual per capita consumption of commercially caught fish and shellfish has risen slowly from 11.8 pounds in 1970 to between 14.9 and 16.2 pounds every year since 1985. About two-thirds of that consumption is fresh and frozen fish, one-third canned fish, and about 2 percent cured fish.

Overfishing, combined with other factors such as pollution, habitat degradation and bycatch waste, has left many fisheries on the verge of collapse. In the Chesapeake Bay, the once-thriving oyster fishery may disappear, striped bass fishing has been highly regulated and in some instances banned, and there are few of the once abundant shad. Programs in place to bring back striped bass shad are meeting with some success. In the Great Lakes, many species such as lake trout and sturgeon have virtually disappeared or are under state fishing bans because of high levels of contamination. Salmon cannot swim past dams to spawn

upstream in many rivers. Several species have been officially listed as endangered as a result of habitat degradation/destruction and hydroelectric dams. Chapter 4 includes additional statistics on overfishing, along with associated issues.

Aquaculture, mariculture or fish farming is a potentially enormous industry. Growing oysters, mussels, shrimp, and other seafoods for human consumption is already a large industry in some coastal nations, with a practical potential to match the present world fisheries harvest. Among the major species raised are salmon, catfish, clams, oysters, crawfish, prawns, shrimp, and abalone.

Additional Resources

For information on fisheries statistics, write to the Fisheries Statistics Division, (F/RE1), National Marine Fisheries Service (NMFS), NOAA, 1335 East West Highway, Room 8313, Silver Spring, MD 20910; (301) 713-2328. For international fisheries data, write to the United Nation's Food and Agricultural Organization (FAO) at 1001 22nd St., N.W., Washington, DC 20037, (202) 653-2400. Information is also available from the Center for Marine Conservation, 1725 DeSales St., N.W., Washington, DC 20036, (202) 429-5609.

EPA estimated in a 1986 report that private aquaculture operations produced more than 40 percent of the nation's oysters and 11 percent of the total fish harvest in 1982. However, aquaculture can also harm the marine environment by introducing a variety of potentially toxic chemicals, according to a 1991 report by the National Academy of Science Institute of Medicine. Other concerns include nutrient over-enrichment and other habitat degradation and risks to wild stocks. The major fears in the latter category are introduction of exotic diseases and parasites, inability to distinguish between cultured and wild forms of the same species, and interbreeding and replacement of wild stocks by escaped cultured species.

There are also small-scale but encouraging projects that combine various land/water systems for sewage treatment, algae production and mariculture. Woods Hole scientist John Ryther has calculated that a 50-acre algae farm and a one-acre

production facility could produce 1 million pounds of shellfish per year by using effluents from a town of 11,000 people. Some argue there are problems with these programs, such as discharge that may be contaminated with pathogens and heavy metals.

Shipping, Ports and Harbors

Statistics and economic information about shipping are compiled by the U.S. Maritime Administration (MARAD), a branch of the Department of Transportation. (The Army Corps of Engineers generates waterborne commerce statistics.)

According to MARAD, 473 privately owned, deep-draft vessels made up the U.S. Merchant Marine fleet in 1991, including 396 ocean-going ships and 77 Great Lakes vessels. The privately owned American-flag merchant fleet ranked ninth in the world on a dead weight tonnage basis and 14th in total number of ships in 1990. The largest fleets by far are Liberian- and Panamanian-flagged ships, followed by ships registered in Greece, Japan and Cyprus. The flag does not necessarily determine ownership, or for that matter the operator of the ship. While all U.S. ships are U.S.-owned, many foreign ships actually may be owned or controlled by American companies or individuals.

MARAD estimates that as of August 1, 1991, a total of 8,543 persons were employed on U.S. cargo ships. Clerks, checkers and allied crafts jobs, collectively listed as "longshoremen," accounted for another 25,718 jobs.

MARAD estimates also that total U.S. water-borne commerce has been growing at an average annual rate of 2.2 percent since 1955. Foreign trade has been expanding more than three times as fast as domestic trade, or at a rate of 3.9 versus 1.2 percent per year. The higher growth rate for foreign goods reflects the increased imports of foreign oil and manufactured goods together with growing exports of grains and foodstuffs. Table 4 lists the top 10 U.S. ports by tonnage of freight handled.

Petroleum products and coal accounted for more than 50 percent of the tonnage of U.S. water-borne commerce. But general cargo commodities are higher in value, produce more revenue, and have a greater economic impact per ton than bulk goods such as coal and oil. General cargo accounts for only 10

Table 4
Top Ten U.S. Ports
(by tonnage of freight handled, 1986)

Rank	*Port*	*Millions of Tons*
1	New Orleans, Louisiana	167
2	New York/New Jersey	155
3	Houston, Texas	113
4	Valdez, Alaska	107
5	Corpus Christi, Texas	54
6	Long Beach, California	46
7	Tampa, Florida	44
8	Los Angeles, California	41
9	Norfolk, Virginia	40
10	Baltimore, Maryland	38

Source: Shipping Safety and America's Coasts, *Center for Marine Conservation, 1990.*

percent of U.S. foreign water-borne tonnage.

The Great Lakes and connecting waterways have also played a major role in U.S. and Canadian transportation. Beginning about 1825 the Erie Canal primarily carried settlers westward and freight eastward. When the Welland Canal joined Lake Erie and Lake Ontario, and other canals joined the Ohio and Mississippi rivers, the Great Lakes became the hub of transportation in eastern North America, says the *Great Lakes Atlas and Resource Book*. With the completion of the St. Lawrence Seaway in 1959, ocean-going vessels were able to navigate the Great Lakes. Competition from trains and trucking, however, has prevented the expansion of shipping as much as had been expected, and the fleet is continuously being reduced.

Recreational Uses

Americans increasingly visit beaches and coastal resorts to enjoy such recreational uses as fishing, boating, sunbathing, snorkeling, scuba diving, surfing, and swimming.

According to Gallup organization polls, fishing has consistently

Additional Resources

For statistical and economic information on shipping, contact the U.S. Maritime Administration, Department of Transportation, 400 Seventh St., S.W., Room 7219, Washington, DC 20590, at (202) 426-5812.

been among the public's three leading sports since Gallup began collecting such data 30 years ago. Recreational fishery statistics, however, are not collected in as much detail as commercial statistics. The real economic values in sport or recreational fishing can be found in money spent on fishing-related products and services (transportation, fuel, tackle, lodging, charter boat fees, food, gear, magazines, and so forth) rather than in dollars generated by selling fish. The non-monetary values are the pleasures derived from the sport and from the consumption of the fish.

The Washington, D.C.-based Sport Fishing Institute (SFI) produces recreational fishing statistics for both saltwater and freshwater. The SFI reported that in 1990, Americans participated in 166 million days of saltwater fishing and 869 million days of freshwater fishing.

According to SFI, overall, about 2 percent of the U.S. population age 16 or older, or about 4 million people, participate in shellfishing -- the taking of oysters, clams, crabs, lobsters, and so forth. Table 5 lists the top five shellfishing states based on the number of residents that shellfish and on the number of person-days spent shellfishing.

Boating information can be obtained from the National Marine Manufacturer's Association, an industry trade group that researches and publishes boating data (see Appendix B). In 1991, 261,000 new boats came into use throughout the U.S., bringing the country's recreational boat population to more than 16.2 million. There were approximately 73.4 million recreational boaters in 1991 who spent a total of $10.5 billion on related products and services, the group reports.

Because public policy decisions about the coasts and oceans must take recreation and tourism into account, the U.S. Department of Agriculture's Forest Service and the National

Table 5
Top Five Shellfishing States

Based on No. of Residents That Shellfish	*Based on No. of Person-days Spent Shellfishing*
1 Florida	1 Maryland
2 California	2 Florida
3 Texas	3 California
4 Maryland	4 Texas
5 Washington	5 Virginia

Source: Sport Fishing Institute, 1990.

Oceanic and Atmospheric Administration (NOAA) are undertaking a National Coastal Recreation Inventory Project (NCRIP) to learn ore about coastal recreation. NCRIP in a 1989 report stated that, "coastal outdoor recreation opportunities will become a major factor in land use and resource allocation decisions into the 21st century."

The NCRIP report pointed to the need to develop an increased understanding of issues surrounding coastal recreation: "How great are the recreational values of the nation's coastal areas, what are their characteristics, and how should public policy consider them? Existing information is inadequate to resolve these issues." The project is developing a database that will be integrated into the NOAA National Estuarine Inventory Data Atlas.

A 1986 study by NOAA, "Public Expenditures on Outdoor Recreation in the Coastal Areas of the USA," examined state, local and federal government expenditures in the 328 coastal counties of the U.S. (excluding the Great Lakes) that are influenced by tidal waters. It reported that public agencies spend about $19,500 per square mile for outdoor recreation in coastal counties, compared with only about $3,000 in noncoastal counties. Between 1972 and 1984, public recreation lands in estuarine and coastal areas increased by about 27 percent, according to NOAA. A total of approximately $4.5 billion in

public funds was spent to support and maintain outdoor recreation in coastal counties in 1982, versus $2.7 billion in noncoastal counties.

Coastal tourism, like the coastal population, has grown tremendously and will continue to grow. The second largest and fastest growing industry in Hawaii is marine tourism, and on a typical summer weekend the beach population of California's Ventura, Los Angeles and Orange counties is comparable to that of the seventh largest city in the U.S. More than 2.1 million Americans went on cruises in 1991, and a half-million sport scuba divers are trained every year, reports Don Walsh, president of International Marine Inc., in a January 1992 issue of *Sea Technology.*

An April 1987, Office of Technology Assessment publication, *Wastes in Marine Environment,* discussed a National Park Service study showing that Park Service "lands that include marine waters recorded more than 60 million recreational visits in 1985; over 25 million of these were recorded at National Seashores."

Waste Disposal

In addition to supplying living and non-living resources and meeting transportation and recreation needs, coastal waters long have been used for disposing of sewage treatment effluent (liquid) and sludge (semi-liquid), dredged materials and industrial wastes. Marine bodies have a great capacity to assimilate certain wastes, but this capacity is not uniform and improper disposal practices can affect coastal and marine resources.

In 1989, about 10 percent of all sewage sludge produced in the U.S. was disposed of into the ocean from vessels or through pipelines, according to David Bulloch in *The Wasted Ocean.* Today, ocean dumping of sewage sludge and industrial waste from vessels is prohibited by U.S. law, as is the discharge of sewage sludge from pipes. The discharge of sewage effluent and industrial waste from pipes is regulated under the Clean Water Act.

According to *Ebb Tide for Pollution,* a Natural Resources Defense Council report, U.S. factories dispose of more than 5 trillion gallons of wastewater and 2.3 trillion gallons of sewage annually into coastal waters. Nonpoint source pollution, such as

urban and agricultural runoff, also can affect coastal environments. Another Natural Resources Defense Council report, *Testing the Waters*, estimated there were more than 2,000 beach closings or advisories issued for swimming in 1991 (see Chapter 4, Table 6). High levels of bacteria, primarily from sewage, caused the majority of closures and advisories.

When a harbor or channel is dredged, the dredged materials or "spoils" -- clean sand and gravel or muck which may be contaminated with heavy metals and oil -- are often disposed of in diked disposal areas or in a limited number of ocean disposal sites. According to the U.S. Army Corps of Engineers, it disposes about 300 to 350 million cubic yards (Mcy) of dredged material per year; 90-95 percent is categorized as clean (i.e., free from contamination); the balance (30-35 Mcy) is disposed of by using special management techniques intended to minimize or eliminate potential adverse effects. Dredged material disposal is subject to permitting and regulation under the Marine Protection, Research and Sanctuaries Act (for ocean waters) or the Clean Water Act (for internal waters such as the Great Lakes and estuaries).

The variety of resources in coastal areas can create much pressure for conflicting uses of coastal resources. Chapter 4 offers additional statistical information and discusses some of the coastal and ocean issues resulting from these pressures.

Additional Resources

For a complete list of publications, contact the National Oceanic and Atmospheric Administration (NOAA), Strategic Environmental Assessments Division (N/ORCA1), 1805 East-West Highway, Silver Spring, MD 20910.

Basta, Daniel, et al., "Estuaries of the United States: Vital Statistics of a Natural Resource Base," The National Ocean Service, Strategic Assessments Branch, Silver Spring, MD.

Coastal Trends Series: Report 1, "Selected Characteristics in Coastal States: 1980-2000," October 1989, NOAA Strategic Assessments Branch, Rockville, MD.

Culliton, et al., "Fifty Years of Population Change Along the Nation's Coasts: 1960-2010," The National Ocean Service, Strategic Assessments Branch, Rockville MD.

Questions for Reporters to Consider

- What are the priority risks currently posed to the well being of the Great Lakes? How are public resources appropriately allocated according to those priorities?
- The enormity of America's coasts and its resources appear to some to mitigate the concern that such extensive resources might face practical ... and manageable ... risks. Is the abundance of these resources their greatest insurance against damage or impairment? Is abundance alone enough?
- What are the most effective, and most realistic, measures or barometers of the health of the nation's or a specific region's marine resources? What data points might be considered most rigorous, and which are most uncertain? Are our assessments based on actual monitored data or on models? What potentially critical assumptions underlie those assessments?
- With some data pointing to coastal and marine resources increasingly "at risk" and other data indicating those same resources to be in improving health, how can the public best evaluate the overall well being of the resource?
- What is the practical promise for "alternative" energy sources derived from the nation's saltwater and freshwater resources? Which of these energy sources are expected to be available on a commercial scale in the short term, and which in the long term? What are the comparative economic considerations with traditional energy sources, and what, if any, environmental "trade-offs" must be considered?
- What role can coastal resources appropriately play in an integrated waste management/waste disposal strategy? For what kinds of waste products might coastal resources be best suited from an overall environmental and economic perspective? How should society best dispose of those wastes for which it marks coastal or marine disposal as being "off limits"?

Chapter 4
Major Coastal and Marine Resource Issues

Highlights

- More than half of the 280 million U.S. population live in coastal counties which encompass less than 10 percent of the continental U.S.
- The primary sources of direct discharges into marine waters are dredged material, municipal sewage sludge, and industrial wastes.
- Nationally, the primary nonpoint sources of water pollution involve urban runoff and agricultural activities.
- The 48 contiguous states of the U.S. lost 53 percent of their original inland and coastal wetlands between the 1780s and the 1980s.
- Increasing population, development and conflicting natural resource policies have left coastal areas vulnerable to natural and man-made hazards -- coastal storms, chronic erosion, and potential sea-level rise among them.

The host of issues and challenges confronting coastal program policy makers should be viewed not in isolation of each other but rather as one continuous web. Progress in one area can be either enhanced or offset by what happens in another area.

Furthermore, no single action can totally solve a unique set of challenges confronting a particular coastal environment. While "lessons learned" and "pitfalls to be avoided" can help in addressing coastal resource challenges generally, each situation can provide its own unique circumstances and its own set of priorities for local decision makers. Reporters need to understand both the broad outline and the unique contours of their own readership or broadcast areas.

Among major issues often facing coastal management

programs and discussed in this chapter are: population, pollution, habitat loss, coastal hazards, marine/beach debris, oil spills, global climate change, overfishing, and biological diversity and introduced species.

A separate section at the end of this chapter, "Reporting on Wetlands Issues," addresses definitions, questions and policy issues on this topic.

Population

The number of people living in coastal areas, and their associated resource uses, have a tremendous impact on coastal areas. In 1990, 5.3 billion people inhabited the Earth and that number is expected to rise to 10 billion by 2029. Nearly 280 million people live in the U.S., and more than 50 percent live in coastal counties which encompass less than 10 percent of the contiguous states in the U.S. The average population density is almost five times greater in coastal counties than in noncoastal counties.

Heavy population densities are by no means limited to the Atlantic and Pacific seaboards. Today the Great Lakes basin is home to more than one-tenth of the U.S. population and one-fourth of Canada's. About 40 percent of American industry and almost half of Canadian industry is located in the Great Lakes drainage basin, and 7 percent of U.S. and 25 percent of Canada's agriculture production is in the basin.

Increasing populations in coastal areas affect coastal environments in a variety of ways. Increasing populations naturally demand more housing, transportation, commercial services, freshwater, and energy. They inevitably generate larger supplies of solid waste and pose growing demands on community services, such as waste disposal and sewage treatment. Each of these efforts, alone and combined, poses challenges for those managing coastal resources.

Growing populations result in increased pressures also on agricultural lands and on recreational facilities, and coastal population increases lead to growing pressures on wetlands, coastal forests and land use considerations generally. Reduction of the amount of permeable surface -- through construction of roads, parking lots and buildings -- increases the amount of runoff

from an area. Urban runoff can contain contaminants such as oils, greases, metals, and bacteria.

With less permeable areas, ground water recharge capacities are reduced, leading to an increased potential for flooding and for more serious flooding when it occurs. Construction also can lead to increased erosion. The larger volumes of topsoil deposited in riverbeds, delta lands and behind dams can increase flooding potential, impede power generation, reduce reservoirs' storage capacities, and lead to unexpected and possibly undesirable alterations in stream or river flows.

Pollution

Point Sources: Direct Discharges

The Center for Marine Conservation, in *Cleaning Up North America's Beaches*, describes the term "direct discharges" as the "intentional release of wastes to marine waters, whether through direct dumping or through pipeline discharges."

Regulation of ocean dumping began with passage of the Marine Protection, Research and Sanctuaries Act in 1972. Ocean dumping of municipal sewage sludges was phased out and ended in June 1992 under the Ocean Dumping Ban Act of 1988 (see Key Laws and Associated Programs, Chapter 5). Pipeline discharges from coastal municipalities and industrial facilities and disposal of dredged material into marine waters are permitted activities and regulated by the Clean Water Act.

In the U.S., more than 2,000 sewage treatment plants and industrial facilities discharge effluent, treated to various extents, directly to estuaries and other coastal waters. More than four out of every 10 gallons of water used in the U.S is used for industrial purposes. Typically, about one in five gallons is used in the finished product; the remainder is treated and discharged back to coastal and inland waters.

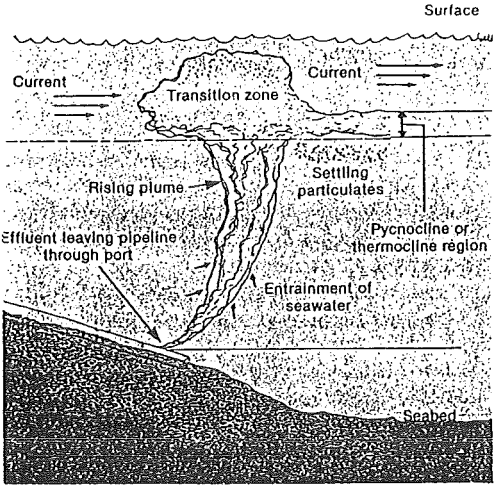
Figure 5 shows the general fate of effluent discharged into marine waters.

Municipal discharges come from publicly owned treatment works that discharge into marine waters. About 2.3 trillion gallons of effluent are discharged from sewage treatment facilities into marine waters annually.

Most sewage in the U.S. is treated to meet secondary

treatment standards prior to disposal. In some areas during heavy rains, the contents of storm sewers and sanitary sewers combine, bypassing the sewage treatment facilities and going directly into coastal and inland waters (see Figure 6). Combined sewers are no longer constructed but are still operational in many older urban areas.

Figure 5
General Fate of Effluent Discharged Into Marine Waters



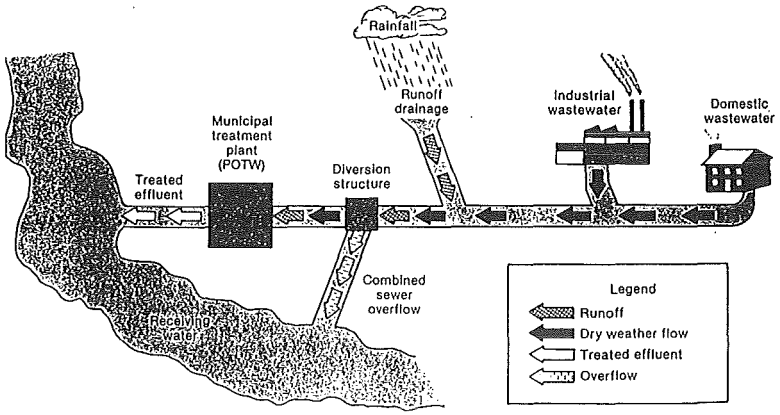
Source: Wastes in the Marine Environment, *Office of Technology Assessment, 1987.*

Industrial and municipal discharges are regulated through a permitting system under the Clean Water Act's National Pollutant Discharge Elimination System (NPDES) (see Chapter 5). For reporters, it's important to consider not only that the discharger is complying with a lawfully issued state or federal NPDES permit, but also the specific limitations of that permit.

Nonpoint Sources

While substantial progress has been made in addressing pollution from direct discharges and dumping, experts from various perspectives agree that considerably less progress has been made in addressing nonpoint source pollution. The explanation lies in part with the absence of specific legislative guidance on how to address nonpoint sources and in part with the practical and institutional difficulties posed in addressing numerous and diverse pollution sources.

Figure 6
Typical Combined Sewer Collection Network During A Storm



Note: During a storm event, flow beyond the capacity of the treatment facility is diverted.
Source: Wastes in the Marine Environment, *Office of Technology Assessment, 1987.*

Nonpoint source pollution comes from many different sources and enters coastal waters in several ways. For example, contaminants such as pesticides, grease, fertilizers, heavy metals and oil from roads and parking lots, and runoff from agricultural lands and lawns are picked up by rain water as it washes over the land and drains into water bodies. One- to two-thirds of the pollution in coastal waters stems from nonpoint sources, according to EPA.

Nonpoint sources of pollution include:

- runoff from urban/suburban areas (oil, grease, lead, chromium, bacteria, lawn chemicals and fertilizers, and sediments);
- runoff from farms (sediments, fertilizers, nutrients, and

pesticides);
- excess erosion (leading to increased sediment loads in rivers);
- construction sites and mining operations;
- air deposition (chemicals, heavy metals, nutrients, acids); and
- other releases of pollutants -- such as phenols from plastics, leaching of tributyltin from ship hulls, and landfill leachates into ground and surface waters.

Nonpoint pollutants can enter water bodies through direct runoff, runoff through storm sewers and drains, wet or dry air deposition, and underground aquifers.

Urban Runoff and Agricultural Activities. Nationally, primary sources of nonpoint source water pollution are urban runoff and agricultural activities. Pollutants include sediments from eroded or overgrazed lands, fertilizers, pesticides, and animal waste, which contains nutrients and bacteria. Excessive nutrients can be harmful to aquatic life because they stimulate growth of algae and other plants and animals which may in turn deplete the supply of oxygen.

Varied methods are being used to help reduce erosion, limit pesticide and fertilizer use, and reduce water contamination without decreasing agricultural productivity. The Soil Conservation Service, the U.S. Environmental Protection Agency, and many state agencies are working to promote use of these methods and technologies, known as "best management practices (BMPs)," mostly on a voluntary basis.

Development also can contribute to nonpoint source pollution. Land cleared of trees and plants for development has reduced capacity to absorb water, therefore producing more and faster-flowing runoff. Runoff from land development projects can carry sediment and toxic materials. Runoff also increases in urban areas where rain water channels off rooftops and pavement rather than soaking into the ground.

Progress in reducing nonpoint source pollution can be slow because there are many more nonpoint sources and they are more difficult to identify than point sources. Traditional regulatory approaches used for direct discharges are not easily applied to nonpoint sources of pollution. Nonpoint source pollution for the most part results from how the land is used, and

land use management traditionally has been a function of local governments, with agriculture in many cases being exempt from local control.

Congress in 1987 amended the Clean Water Act with an eye toward addressing the dichotomy between point and nonpoint source controls. Under the amendments, all 50 states have conducted assessments and prepared management programs to address nonpoint source pollution under their jurisdiction. In addition, Congress enacted the Coastal Zone Act Reauthorization Amendments of 1990 (CZARA), requiring states to develop coastal nonpoint source programs with regulatory mechanisms. On the whole, however, there remains an enormous disparity in funding for point versus nonpoint controls, the former receiving the lion's share of resources.

Two general methods are used to reduce nonpoint source pollution: reducing runoff by maintaining or increasing the ability of the land to retain water (e.g., increased vegetation, protection or restoration of wetlands, and use of natural channels and sedimentation ponds); and minimizing the uses of contaminating pollutants through product substitution or encouraging increased recycling and reuse of those products, for instance, through recycling of used motor oil or better managed and controlled application of pesticides and fertilizers.

Atmospheric deposition, pollution entering the water from the atmosphere either as precipitation or in dry form, is another type of nonpoint source pollution that is particularly problematic in lakes throughout the northern and northeastern U.S. and Canada. The deposition in many cases has been shown to have travelled substantial distances by wind currents.

For instance, DDT, PCBs and heavy metals were found in Great Lakes precipitation in 1971 and on a remote island in Lake Superior, according to studies done for and by EPA and the International Joint Commission. In some cases, DDT-tainted deposition traveled south-to-north across the entire U.S. from Mexico and from Central and South America. Numerous studies indicate that 80 percent of the toxic chemicals entering Lake Superior result from atmospheric deposition rather than from water discharges.

"Acid precipitation" is the term used to refer specifically to ***wet atmospheric deposition*** -- rain or snow containing significant

amounts of sulfuric and nitric acid or other pollutants. Major sources include fossil fuels used for transportation and emissions from generation of electrical power. Other atmospheric pollutants that may be deposited on surface water can include organic substances, nutrients, pesticides, heavy metals and radioactive residue, according to *Population and Water Resources*. The 1987 U.S.-Canada Great Lakes Water Quality Agreement contains specific provisions on air-borne toxic pollutants in an effort to better understand and allow for improved management of this problem.

Chemicals and Other Substances

A variety of agents also can impact marine ecosystems in different ways. These include chemicals, pathogens, nutrients and thermal pollution.

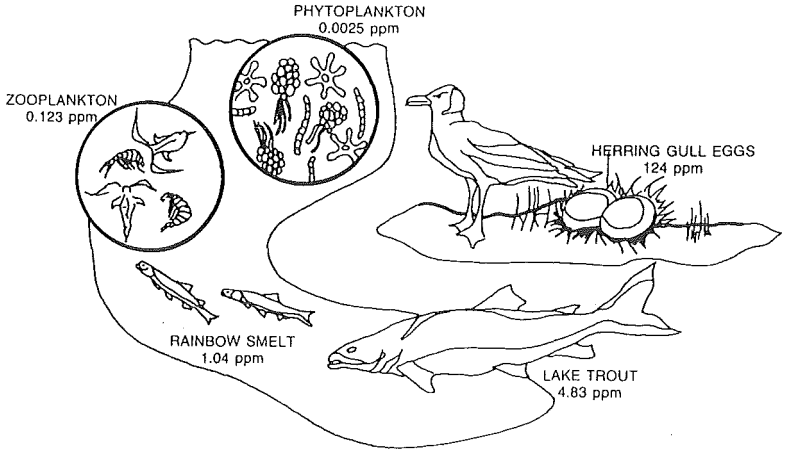
Chemical pollutants can cause threats to human and ecological health either directly or through bio-concentration in and up the food chain. Certain chemicals can be particularly harmful for several reasons -- many pose risks even at very low concentrations and can remain potentially dangerous for long periods of time while they bioaccumulate in animal or human tissue.

More than 1 billion pounds of chemical pollutants are discharged directly into U.S. waters each year, according to *Saving our Bays, Sounds and the Great Lakes: the National Agenda.* These include heavy metals and organic chemicals, some of which in small amounts can be acutely poisonous if human exposures occur. The pollutants can settle to the bottom of water bodies, creating "hot spots" of contamination that can work their way up through the food chain, ultimately concentrating in higher forms of life and eventually leading to human exposures (see Figure 7).

Some examples of impacts that chemical and other pollutants can have in marine environments are:

- Methyl mercury, a highly toxic form of mercury, has been found in large predatory fish, such as swordfish and tuna.
- Many human carcinogens such as PAHs (Polycyclic Aromatic Hydrocarbons), petroleum hydrocarbons, dioxins, and PCBs have also been found in seafood, leading to fishing bans in a number of cases.

Figure 7
Bioaccumulation



Persistent organic chemicals such as PCBs, bioaccumulate. This diagram shows the degree of concentration in each level of the Great Lakes aquatic foodchain for PCBs (in parts per million, ppm). The highest levels are reached in the eggs of fish-eating birds such as herring gulls.
Source: The Great Lakes, An Environmental Atlas and Resource Book, *U.S. EPA and Environment Canada, 1988.*

- Sixteen (16) coastal states have issued consumption advisories for fish and three have issued advisories on consuming waterfowl; all eight Great Lakes states at various times have issued consumption advisories for specific fish.
- In some areas, fish and shellfish have developed physiological and genetic defects, such as tumors in fish and chemical burns on lobster and crab shells.

- Portions of the Puget Sound have been designated as marine Superfund sites because of the levels of sediment contamination.
- While PCB levels in the Hudson River have declined in recent years, striped bass are still considered unfit for human consumption because of PCB contamination.

Additional Resources

The following publications may be useful resources for journalists reporting on issues involving chemical risks and toxic substances: *News & Numbers: A Guide to Reporting Statistical Claims and Controversies in Health and Related Fields,* by Victor Cohn (Iowa State University Press), 1989; *Covering the Environmental Beat: An Overview for Radio and TV Journalists,* by Lou Prato (The Media Institute for Radio and Television News Directors Foundation), 1991; and *Health Risks and the Press: Perspectives on Media Coverage of Risk Assessment and Health,* edited by Mike Moore (The Media Institute and American Medical Association), 1989. Another resource for reporters might include the Media Resource Service of the Scientists' Institute for Public Information, a New York-based group: (800) 223-1730 or (212) 661-9110.

The most severe problems are found in non-migratory, bottom-feeding fish located around discharge points near urban and industrial areas. Also, shellfish, including oysters, mussels and clams, are especially vulnerable to contamination from toxic metals such as lead, mercury, cadmium, and chromium because they remain in the same location throughout much of their lives. Also of concern are long-lived, top-of-the-chain species, like bluefish.

More than 350 different chemicals find their way into the Great Lakes alone, including PCBs, DDT, chlordane and dieldrin, according to *Great Lakes, Great Legacy*. In 1990, EPA and Congress' General Accounting Office calculated that permitted industries alone were discharging 7.3 million gallons of oil and grease, 89,000 pounds of lead, 933 pounds of mercury, and 1,935 pounds of highly toxic PCBs into the Great Lakes each

year. The International Joint Commission has identified 43 toxic hot spots in the Great Lakes. While paper mills built along the shores and tributaries of the Lakes have greatly reduced their discharges, they still are primary sources of mercury pollution.

Pathogens -- Bacteria and Viruses

Pathogens -- disease-causing bacteria and viruses -- can also contaminate fish and shellfish, and the number of cases of illness linked to eating contaminated fish and shellfish remains a concern. More than 4,500 cases of shellfish-associated gastroenteritis, believed to be caused by viruses, were documented between 1980 and 1989. As of late 1992, nearly one-third of the shellfish beds in the U.S. were closed or restricted because of pollution; of those more than half of the shellfish-producing areas along the Gulf Coast also were closed.

Human exposures can occur not only from eating contaminated shellfish, but also from swimming and other water contact sports in water bodies that in some way are contaminated. High levels of bacteria in waters at various times have led to beach closures, particularly along the North Atlantic coast and the Great Lakes. Those beach closures can be a community's "worst dream" -- and potentially an economic nightmare -- when they occur during what otherwise would be a prime tourist season.

Table 6 shows the number of ocean and bay beach closures and advisories between 1988 and 1991, according to the Natural Resources Defense Council.

Pathogens can come from agriculture and urban runoff, malfunctioning septic tanks or sewage plants, or combined storm/sewer overflows that bypass treatment during storms. Overboard discharges from small or recreational boat toilets also lead to introduction of pathogens into the waterways.

Sewage treatment plants built and upgraded with grants under the Clean Water Act have significantly improved the situation in many areas, including the Great Lakes and Chesapeake Bay. Journalist Tom Horton, author of *Turning the Tide*, reports that far fewer areas are closed to swimming than would otherwise have been the case.

(Cont'd on p. 47)

Table 6
Ocean and Bay Beach Closures and Advisories, 1988-1991

State	1988	1989	1990[1]	1991
CA[2]	**	At least 64	At least 338	745 (5 permanent)
CT	**	At least 103	218	293
DE	1	62	11	11
FL[3]	**	**	303	299
HA[4]	At least 9	At least 23	At least 22	106
ME	**	1	30	47 (3 permanent)
MD	0	0	0	24 (3 permanent)
MA[5]	At least 75	At least 60	At least 59	At least 59
NJ	126	266	228	108
NY[6]	273 (3 permanent)	473 (5 permanent)	383 (3 permanent)	314 (3 permanent)
RI	0	0	0	0
VA	**	**	**	2
Total	At least 484 (3 permanent)	At least 1,052 (5 permanent)	At least 1,592 (4 permanent)	At least 2,008 (15 permanent)

Note: The following states had no monitoring of marine beaches -- Alabama, Georgia, Louisiana, Mississippi, New Hampshire, North Carolina, Oregon, South Carolina, Texas, and Washington.

[1]From 1988 to 1990, the area surveyed by NRDC was limited to either all or portions of California, Connecticut, Delaware, Florida, Maine, Maryland, Massachusetts, New Jersey, New York, and Rhode Island. Only the 1991 total includes all coastal states with the exception of portions of Massachusetts (see note 5). In addition, in 1988 several states had not yet begun to maintain records of their beach closures and advisories.

(Table 6 cont'd next page)

[2]1989 data are for Los Angeles and San Diego counties; 1990 data are for Los Angeles, Mendocino, Monterey, San Diego, San Francisco, San Luis Obispo, Ventura, and San Mateo counties; and 1991 data are for all 17 coastal and bay counties.
[3]1990 data are for Dade and Palm Beach counties; 1991 data are for all 35 coastal counties.
[4]Estimate made by the State Department of Health, Clean Water Branch, based on county health department closure reports.
[5]1988-1990 data are only for the area subject to the Metropolitan District Commission's jurisdiction; 1991 data are from the MDC, the Lynn-Swampscott area, Quincy, Hull, Plymouth, and Crane's beach.
[6]1991 totals for New York City include 48-hour advisories against swimming after every rainfall event in excess of four inches per day. The NYC Department of Health issued an annual rainfall advisory by press release for Locust Point, Little Neck Bay, Coney Island, and Seagate in 1990, and for Coney Island and Seagate in 1991. Based on this advisory, NRDC estimated 72 rainfall advisories for 1990 and 54 rainfall advisories for 1991 using NOAA climate data for Central Park.

Source: Testing the Waters, *Natural Resources Defense Council, July 1992.*

(Cont'd from p. 45)

Excessive Nutrients and Eutrophication

Excessive nutrients in water also can pose risks to the coastal environment. These nutrients, primarily nitrogen and phosphorus, come mostly from agriculture, urban runoff and sewage treatment plants. Soil erosion also contributes to nutrient enrichment; some nutrients such as phosphorus attach to soil particles washed into the water. Nitrogen then can reach ground water because it is water soluble, although by this stage, control measures inevitably can be costly and time consuming.

Nutrient pollution causes ***eutrophication*** -- excessive growth of plankton (algal blooms) in surface water (sometimes known as "green tides" or "brown tides").

Excessive eutrophication can deplete oxygen in coastal waters and lead to "dead zones," or patches of water depleted of oxygen where little can live. In Summer 1988, as many as 1 million fluke and flounder were trapped and killed in an oxygen-depleted zone off the New Jersey coast. A 3,000-square mile "dead zone" has been documented off the Louisiana and Texas coasts, according to EPA, and similar phenomena persist in Lake

Erie. Algal blooms can cause irreparable damage when aquatic grasses are excessively shaded.

In the Great Lakes basin, primary sewage treatment plants, use of phosphate detergents, industrial discharges of phosphorus, and fertilizers in the run-off from farmlands have contributed to eutrophication in Lake Erie and Lake Ontario, and in embayments of Lake Huron and Lake Michigan. The overgrowth of algae, and resulting depletion of oxygen in the lakes, has killed numerous native fish species, and at the same time it has brought about an increase in more pollution-tolerant types of fish, shifting the balance of the lakes' ecosystems.

In 1972, amid widespread concerns that Lake Erie was "dying" as a result of eutrophic conditions, the solution lay in reducing the incoming phosphate load. Phosphorus was found not only in agricultural runoff, but also in sewage treatment plant effluents, in discharges from factories located along the shores and tributaries and household laundry detergents. Regulations, funding and a concerted international effort since that time have significantly reduced Lake Erie phosphate levels, and the area of eutrophication has stabilized. Construction of secondary treatment plants has resulted in less algae growth and less sewage and seaweed on the beaches, but the dead zone remains.

Excessive nutrients are particularly harmful to coral reef ecosystems found in southern waters such as those off the Florida Keys and the Gulf of Mexico. Algae can smother the corals and reduce the strength of their calcium carbonate skeletons which can be fatal for the coral.

Heated (Thermal) Water

Temperature is one of the single most important environmental variables affecting marine life.

Thermal pollution involves the discharge of water sufficiently warm to harm aquatic life. If water temperatures rise too high, dissolved oxygen levels drop, directly threatening aquatic life and contributing to eutrophication and thereby making the water unusable for drinking and recreation, according to the National Audubon Society's *Population and Water Resources.*

Thermal pollution occurs mostly from electric generating plants which use large quantities of water for cooling. Water is drawn from lakes, rivers or the ocean and pumped through

condensers at the plants before being returned to its source sometimes as much as 10 degrees Celsius (18 degrees Fahrenheit) warmer, reports *Population and Water Resources*. To minimize thermal pollution, most plants now are regulated to control discharged effluent temperatures and to also control the extent of mixing zones. Cooling towers are used extensively prior to returning the heated water to the water body.

Heated water from electric generating plants is not the sole source of thermal pollution. Urban runoff can also significantly increase the water temperature; the water becomes heated as it passes over highways, pavements and buildings.

Habitat Loss

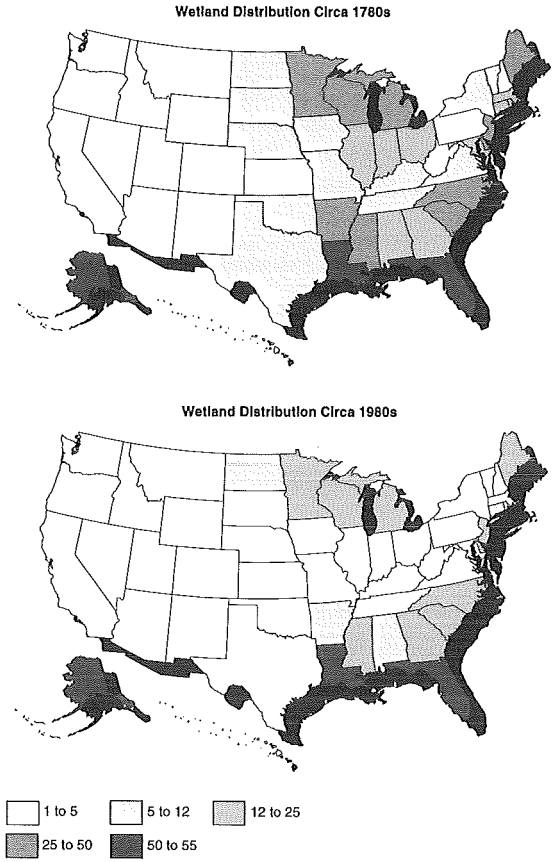
According to the Interior Department's Fish and Wildlife Service, the contiguous 48 states lost 53 percent of their original wetlands between the 1780s and 1980s (see Figure 8). In the 1700s there were an estimated 221 million acres of wetlands in the lower 48 states. In the mid-1970s the estimate dropped to 106 million acres, plus 170 million in Alaska and about 52,000 in Hawaii.

Much of the coastal wetlands were lost as a result of development. In addition, many of Louisiana's coastal marshes have been submerged by rising Gulf of Mexico waters, land subsidence and shoreline erosion. Over the past two decades, Louisiana, which has more than 40 percent of the wetlands in the continental U.S., lost valuable coastal wetlands at rates between 30 and 50 square miles per year. Louisiana's wetlands losses represent up to 80 percent of the coastal wetlands loss for the contiguous U.S., according to EPA.

Coastal wetland loss also has resulted from human activities such as oil and gas exploration and river channelization that accelerate natural processes. Most of the lost forested wetlands, inland marshes and wet meadows were drained for agricultural uses.

Wetlands losses are by no means limited to Louisiana. Virginia is losing wetlands at a rate of 2,300 acres annually; California has lost 91 percent of its historical wetlands, and Connecticut has lost more than half of its coastal wetlands.

Figure 8
Percent of Wetlands Present in the U.S. (1780s and the 1980s)



Source: Wetlands Overview, *U.S. Government Accounting Office, 1991.*

Both natural events and human activities contribute to coastal habitat loss and degradation (see Table 7). Natural threats to wetlands include:

- erosion;
- subsidence;
- sea level rise;
- droughts;
- hurricanes and other storms; and
- overgrazing by wildlife.

Human activities exacerbate or accelerate nearly of all these natural processes.

Other coastal habitats have also been damaged. For example, the Chesapeake Bay watershed has only 10 percent of the submerged aquatic grasses that existed several decades ago, and Tampa Bay had lost 80 percent of its original seagrass beds by 1982. Activities which increase water turbidity -- such as dredging, runoff and increased nutrient loading -- can have devastating effects on the seagrasses. About 150,000 acres (23 percent) of Florida's mangrove forests have been lost, and there has been serious damage to coral reefs and barrier beaches.

Tidal flats, a major resource of the middle and lower Texas coastal zone, serve as a foraging area for wading birds and export nutrients to other estuarine habitats. Yet, because of their superficial "wasteland" appearance, tidal flats continue to be developed and destroyed.

Oyster reefs in the Gulf of Mexico, which provide a number of ecological and environmental benefits, are being threatened by point and nonpoint source pollution and by lack of nutrients resulting from construction of dams and reservoirs. Previously, oyster dredging depleted stocks severely.

Many barrier islands, unique habitats for many plants and animals and protection for coastal mainland, are overdeveloped.

Dredging and the deposition of dredged material can also affect ocean life, altering the habitat of bottom-dwelling and marine plants. Dredging for navigation in harbors and inlets also removes sediment and can interfere with longshore movement of beach materials. Dredging in adjacent freshwater or brackish wetlands to create canals for navigation, pipelines and drainage opens the way for saltwater intrusion and other hydrologic impacts during storms and high tides.

In coastal Louisiana, the increased salinity associated with dredging, navigation and pipelines (as well as other impacts from these activities) has resulted in deterioration of wetlands and

Table 7
Types of Wetlands Alteration

Physical

Filling -- adding material to change the bottom level or replace with dry land.

Draining -- removing the water by ditching, tilling, pumping and so forth.

Excavating -- dredging and removing soil from wetlands.

Diverting Water -- preventing water from entering the wetland (diking, damming), or adding more water to a wetland than exceeds normal amounts.

Clearing -- removing vegetation by burning, cutting and so forth.

Flooding -- raising water levels by damming or channeling water.

Diverting Sediment -- trapping sediment and inhibiting regeneration of wetlands.

Shading -- placing platforms or bridges over wetlands, killing vegetation.

Adjacent area activities -- disrupting interaction between a wetland and an adjacent area.

Chemical

Nutrient levels -- increasing or decreasing nutrient levels in local water and/or soil system.

Toxics -- adding toxic compounds to a wetland (intentional, such as herbicide treatment, or unintentional).

Biological

Grazing -- consumption, compaction and damage of vegetation by domestic or wild animals.

Disrupting natural populations -- reducing populations of existing species, introducing exotic species or otherwise disturbing resident organisms.

accelerated land loss. In some areas where dramatic wetlands loss has occurred, clean dredged material has been used as a beneficial source of sediment to restore wetlands and other habitats. When the sediment is contaminated, toxins can bioaccumulate in fish and shellfish and pass up the food chain.

Dams, stream channels and other hydromodification projects can also alter habitats by changing water flow or increasing deposits. *Population and Water Resources* states that in coastal areas, where freshwater and saltwater meet and mix, any

alteration of the coastal water system can damage the freshwater system by decreasing the amount of freshwater, transferring pollution or increasing salinity.

Diversity of species is often greatest where two ecosystems meet. Changes in the balance of freshwater and saltwater in coastal ecosystems can lead to the loss of species sensitive to this balance. For example, if a barrier island becomes eroded, the tidal action can increase, raising the salinity levels in wetlands behind the island. The increased salinity can kill plants and destroy wetlands as seen along Lake Pontchartrain's North Shore in Louisiana.

See end of this chapter, "Reporting on Wetlands Issues."

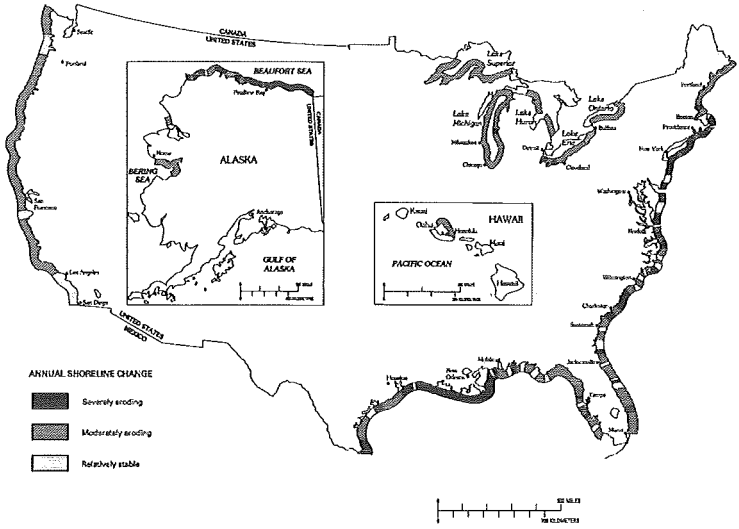
Coastal Hazards

Increasing population and development have left coastal areas more vulnerable to a variety of hazards, including coastal storms, chronic erosion and potential sea level rise. Twenty-five (25) percent of the 95,000 miles of U.S. coastline is experiencing significant chronic erosion (see Figure 9). Storms are a primary cause of erosion along many coasts. Storms often bring strong winds and large waves, raising water levels as much as seven meters above normal, according to *Coasts in Crisis.*

Development of coastal areas not only can create increased risk for human life, it also can create a substantial financial risk. The federal government's flood insurance program poses inestimable tax liabilities in the future to compensate for land and property damages brought about by coastal hurricanes, storms, erosion, flooding, or other hazards. In addition, sensitive and frequently controversial property rights issues arise when individual property owners exercise "rights" on properties that a coastal state or local jurisdictions might view as undermining the health and safety of both the individual and the community at large.

This was the issue addressed in June 1992 in the U.S. Supreme Court's decision in *Lucas v. South Carolina Coastal Council*, one of the most closely watched cases the Court

Figure 9
Shoreline Erosion



Uncolored U.S. shoreline indicates no data are available; data are also lacking for parts of Alaska, as well as Puerto Rico, U.S. Virgin Islands, and the U.S. Pacific Islands, which are not shown on this map. All 30 coastal States are experiencing erosion along their coastlines. (Modified from Dolan and others, 1985, Coastal erosion and accretion; U.S. Geological Survey National Atlas.)
Source: Coasts in Crisis, *U.S. Geological Survey, 1991.*

addressed in its 1991-1992 term. Future court decisions on these matters are virtually inevitable.

Geography professor Rutherford H. Platt, University of Massachusetts, and author of *Land Use Control: Geography, Law, and Public Policy* (Prentice-Hall, 1991), has written that the *Lucas* holding "will likely join a short list of modern Supreme Court decisions that will influence, for better or worse, the relationship of public and private interests in land use well into the next century."

The *Lucas* case involved a Fifth Amendment "takings"

challenge against the South Carolina Beachfront Management Act (BMA). David H. Lucas, owner of two vacant lots on the South Carolina coast, argued that he had been wrongfully deprived of the full economic value of the lots through the state's efforts to manage coastal development and redevelopment through a "setback" or no construction zone along the ocean. Based on "the most landward point of erosion at any time during the past 40 years," as specified in the BMA, the setback was placed entirely land-ward of Lucas' lots, precluding the building of permanent habitable structures on the lots. Lucas sued, and a trial court awarded him $1.2 million on the basis that he had been deprived of all economic value of the lots.

South Carolina's Coastal Council appealed the trial court ruling to the state's supreme court, which in a 3-2 decision reversed the trial court and said the BMA did not constitute a compensable taking of Lucas' property.

While the U.S. Supreme Court's majority decision, written by Justice Antonin Scalia, is confined to the specific facts of the *Lucas* case -- involving Lucas' specific claim of "total loss of value" -- Platt concludes that the Court's holding "certainly invites landowner challenges to public land use regulations of many types," including but not limited to other coastal erosion management decisions.

"If read carefully, *Lucas* need not be considered devastating either to coastal erosion management laws or to broader environmental regulatory programs such as wetlands, historic preservation, and growth management," writes Platt. "However, its impact will not be limited to its fairly narrow area of application -- `total takings.' Politically, it will be invoked throughout the country as a club over the heads of state and local officials to dissuade them from regulating private property, even where `total taking' is not an issue."

In any event, Platt concludes that the ruling "threatens to cloud the environmental management landscape for years." For reporters, *Lucas* and follow-ups to the decision should provide a continuing story on coastal management and "takings" issues for years to come.

In addition, the coasts are not static, but continually changing as a result of a variety of natural forces and human activities -- ranging from microscopic to global -- making coastal area land

management particularly complex.

In many coastal areas, much of the sediment that maintains the coast is supplied by upstream rivers. Dams built for flood control and water catchment along these rivers inhibit the flow of sediment to the coastal area. Lacking the sediment, the coastal areas erode more quickly. Some areas of the Gulf of Mexico coast are eroding at a rate of 100 feet per year, according to EPA.

For example, the amount of sediment carried by the Mississippi River has declined by one-half, exacerbating the deterioration of Louisiana's wetlands. The U.S. Army Corps of Engineers is working to counteract wetlands loss by building structures to divert sediment-laden freshwater from the Mississippi to adjacent wetlands, reports the U.S. Geological Survey in *Coasts in Crisis.*

Increased sediment from erosion of stream banks also can cause problems -- smothering aquatic plant life, clogging fish gills, and cutting off essential light to underwater plants. Stream bank erosion is typical in developed areas where pavement, compacted soil and other nonpermeable surfaces prevent water infiltration and result in increased water and sediment runoff.

Sediment from soil erosion in tropical areas can be particularly harmful to coral reefs. The increased sedimentation "adversely affects the structure and function of reefs by smothering coral colonies and reducing the light available for photosynthesis by corals and algae," according to Caroline Rogers of the National Park Service.

In sandy beach areas, destruction of dune grasses and compaction and alteration of dunes can increase wind velocities and lead to increased tidal erosion and movement of beach materials. The result leaves the coastal area more vulnerable to storm damages. Increased sediment movement can also destroy breeding grounds for fish and can require additional dredging of existing navigation channels.

In some areas, attempts have been made to reduce coastal erosion by directly replenishing beach materials with sand brought in from elsewhere. In other areas -- as in Cape May, New Jersey -- efforts have been made to halt the natural drift of sand with jetties built out into the water. The beach expands on the updrift side while the downdrift side loses sand. Jetties have

not proven to be a panacea but rather have become controversial in themselves because of concerns that they may end up increasing coastal erosion. The success of beach replenishment has been mixed.

In the late 1970s, $64 million was spent to replenish Miami Beach. While not intended as a long-term solution, the Miami Beach restoration has lasted more than a decade. Many replenished beaches endure only a briefer time -- one-half of the replenished beaches on the East Coast lasted less than two years, according to *Coasts in Crisis.*

For example, in the fall of 1991, a $44 million beach replenishment project was completed in Ocean City, Maryland. In January 1992, the beach suffered storm damages expected to cost an additional $12.2 million to repair, reports a January 1992 article by Charles Babington in *The Washington Post.* The Army Corps of Engineers estimates that the costs of protecting Ocean City -- not including costs of protecting it from direct hurricane damages -- will total more than $550 million over the next 50 years.

As with other threats to America's coastal and marine resources, the potential for harm is by no means restricted to the Atlantic and Pacific seaboards. Attempts have been made to address Great Lakes coastal hazards in a variety of ways. The level of the Great Lakes varies significantly over short-term, seasonal, and long-term periods as a result of natural forces. These might include annual changes in precipitation and runoff, long-term changes in precipitation, and temperature and changes in winds. While wave and tidal action is generally limited in lakes, storm surges can quickly raise the lake water level and inflict considerable damage. Chicago's Lake Michigan shoreline contains many badly deteriorated manmade structures built since the beginning of the century to protect the city from flooding after severe flood damages had occurred.

The only regulation of water flow and lake level, designed to facilitate shipping, occurs on the St. Mary's and St. Lawrence rivers under the auspices of the International Joint Commission (IJC). Water is diverted at Niagara Falls for hydropower and then returned to the river, affecting the flow over Niagara Falls. The diversion is regulated to help control effects on aesthetics for tourists visiting the world-famous falls. Many experts say the

impact of these controls is minimal compared to natural fluctuations.

Flooding and erosion damage to private property on the heavily developed Great Lakes shorelines has led to public pressure on governments to "further regulate lake levels through diversion manipulation and control structures on outlet channels," according to the EPA publication *The Great Lakes: An Environmental Atlas and Resource Book.* Ongoing analyses and studies have provided preliminary estimates of high costs, but the IJC by late 1992 had not made recommendations, pending completion of the analyses.

Major diversions -- transfers of water from one watershed to another -- including diversions from the Great Lakes to the arid southwestern U.S., have been proposed over the past several decades. The *Atlas* reports that proposals have failed primarily because of intense political pressures, economic reasons, and also, increasingly, because of environmental concerns over such large-scale diversions. A bi-national Lake Levels Board of the International Joint Commission is studying possible measures to control levels.

Part of the political pressure and economic concern results from the desire to keep the water in the Great Lakes coastal states to attract new industry and keep existing industry, in addition to using the resource for water power, recreation and other uses. Federal law gives each of the eight Great Lakes state governors a veto over diversions.

Marine/Beach Debris

Despite attempts to control ocean pollution, marine and beach debris continues to be a visible and often emotional problem. In addition to aesthetic harm to coastal areas, debris in marine environments directly affects fish and wildlife, commercial and recreational fishers, recreational boaters, marine merchants, and recreational users of coastal beaches. Wildlife can ingest the debris or become entangled in it, either of which can be fatal. Of particular concern are plastics, such as monofilament fishing line, fishing nets, pellets, plastic bags, and balloons.

The increasing use of plastics for consumer and industrial products and processes has led to an increase in plastics debris in

the ocean. According to the Center for Marine Conservation's *Citizen's Guide to Plastics in the Ocean*, "no one knows just how much plastic is out there." Most estimates are only for isolated concentrations, but plastics are now the most common manmade objects sighted at sea, according the Center for Marine Conservation.

The same characteristics that can make plastic so useful -- its lightness, durability and strength -- also can make it particularly harmful when disposed of improperly in the coastal or marine environment.

Common types of marine debris include:

- fishing gear -- nets, lines, traps;
- plastic strapping used in shipping;
- petroleum industry plastics, including hard hats and "write-enable" rings (plastic rings used to protect tapes used during seismic recording and other computer-related activities);
- plastic pellets, the raw form of plastic before it is melted down for consumer goods;
- sewage-associated plastic, including tampons, condoms and disposable diapers;
- plastic bags;
- six-pack holder rings; and
- domestic plastics (i.e., plastic utensils and polystyrene cups).

The image of a shore bird or sea turtle entangled in a six-pack holder has become a well-recognized symbol of the problem. Plastic nets, lines and strapping can trap and entangle wildlife (such as marine and terrestrial birds), mammals and marine and freshwater fish, exhausting or suffocating them.

Sea turtles sometimes eat plastic bags, mistaking them for a favorite food, jellyfish. When ingested, plastics can damage an animal's stomach lining or inhibit the animal's hunger sensation and thus its hunger drive. Ingested plastic can also block the intestinal passages of turtles and whales.

Plastic debris also affects commercial and recreational fishing activities. Lost traps can continue catching lobsters and crabs long after they can be retrieved. In the Gulf of Mexico, concerns have been raised about plastic sheeting caught in fishing nets, disrupting fishermen's ability to fish. Nets, lines, ropes, and

plastic sheeting can ensnare vessels and entangle scuba divers. Plastic bags can also clog cooling water intakes on boats, causing engine failures.

Water-based sources of marine debris include:

- recreational fishing and boating wastes, such as fishing line, floats and lures;
- commercial fishing wastes, such as plastic rope, plastic light sticks, fishing nets, wood and metal fish and crab traps;
- litter from streets or sidewalks that is washed into storm sewers during rains and released into waterways;
- operational wastes from merchant shipping vessels, such as plastic strapping bands and plastic sheeting;
- offshore petroleum activities, specifically garbage from oil drilling rigs and production platforms;
- galley-type wastes, such as egg cartons and bleach bottles assumed to originate in ships galleys;
- passenger cruise lines, which disposed of an estimated 62 million pounds of garbage into the sea each year prior to 1987 (new restrictions for plastic garbage in place since then, see Chapter 5); and
- military ships and vessels, which prior to 1987 could legally dispose of wastes overboard (new restrictions in place since then, see Chapter 5).

Land-based sources of marine debris include:

- sewage-associated wastes, both from sewage treatment and from combined sewer overflow during heavy rainfall;
- plastic manufacturing and processing, including plastic pellets;
- barges carrying garbage to coastal landfills where lightweight litter can be blown off the barge decks and into the water; and
- littering of beaches by the general population. In Los Angeles County alone, for instance, beachgoers typically leave behind approximately 75 tons of trash a week.

In 1988, the Center for Marine Conservation (CMC) organized an annual nationwide beach cleanup project. The project is now international, and on September 21, 1991, more than 145,666 volunteers in 12 countries participated in the effort, which CMC says reached more than 4,000 miles of beach and coastline and

collected more than 3 million pounds of trash. The beach cleanup has both practical and symbolic value, as it actively involves thousands of individuals in a "do something" environmental project that can have a lasting impact on those participants.

The results of the effort are recorded, and efforts have been made to identify sources of the debris. Plastic was the most abundant "material," accounting for almost 60 percent of all trash. The number one "item" was cigarette filters. Because many types of items are in general use, identifying specific sources is difficult, although in some cases types of sources or even specific sources are identified.

Oil Spills

Oil spills can cause major short-term damages to marine and coastal environments. Petroleum hydrocarbons at sufficient concentrations are toxic to a wide variety of marine organisms. In addition to oiling shorelines and killing wildlife, petroleum hydrocarbons can reduce growth, alter feeding behavior and lower reproductive success of marine life, according to the Natural Resource Defense Council's *Ebb Tide for Pollution.*

Oil spills occur mostly during shipping, but also can occur on land and contaminate soil and surface water. Based on reports required under the Clean Water Act, the Coast Guard says that between 1981 and 1986 the average number of oil and hazardous materials spills into U.S. waters per year was 10,200, with an average quantity of 56,300 tons per year or about 17 million gallons (including inland spills). Oil accounted for the largest portion, 77 percent in 1986, and most incidents occurred in river channels, ports and harbors rather than in the "open sea."

The March 1989 Exxon *Valdez* grounding in Alaska's Prince William Sound was the largest spill (10.8 million gallons or 257,000 barrels) in U.S. history and unquestionably one of the most widely reported environmental disasters ever, both domestically and internationally.

According to the Alaska Department of Environmental Conservation, the spill covered more than 1,240 miles of shoreline. More than 980 sea otters, 135 bald eagles and 33,000 seabirds were found dead as a result of the spill. Some

estimates put the number of birds that died because of the spill at more than 500,000.

Such spills have occurred worldwide at the rate of three to five per year since 1967, according to the U.S. Congress's Office of Technology Assessment. Iraqi President Saddam Hussein's 1991 intentional oil spills during the Persian Gulf war were the largest in history, an estimated 6 million barrels of oil, 25 times the amount from the Exxon *Valdez*. The Persian Gulf spill, covering about 600 square miles of water and blackening about 300 miles of shoreline, is seen as the first extensive and deliberate use of environmental terrorism as part of a war strategy.

On Reporting on Oil Spills ...

"We're a landward looking society. We look at the frontier as being terrestrial. Just one manifestation is that we eat more red meat, and not as much fish, than do most other industrialized societies. We traditionally and consistently under-value our oceans and coastal resources. In the debate over the Alaska pipeline in the early 70s -- arguably the seminal environmental debate in our nation's history -- we centered on the risks between Prudhoe Bay and Valdez, the land-based risks. The debate virtually ignored the environmental risks from Valdez southward, the cultural blind spot for our oceans, and that's one of the crucial lessons we can learn from the Exxon *Valdez* spill." Ross Anderson, *Seattle Times*, speaking before a panel of journalists at an Environmental Health Center seminar September 25, 1992, in Seattle. Anderson was part of the *Times* reporting team whose coverage of the 1989 Exxon *Valdez* spill won a Pulitzer Prize.

Varied methods are used to combat oil spills, but a common lesson learned from most spills is that the best strategy is to avoid the spill in the first place: Once sizable amounts of oil are spilled into the marine environment, cleanups by definition are difficult.

Mechanical spill cleanups, involving containment booms and oil recovery skimmers are the primary U.S. oil spill response methods. Dispersants also are used, although some raise concerns about their potential toxicity and about their overall effectiveness.

An Office of Technology Assessment report, *Coping With An Oiled Sea,* found that cleanup efforts recovered less than 10 percent of the oil discharged in large ocean tanker spills, and it says contingency plans often have been found to be ineffective in big spills. In fact, recent experiences with major spills on coastal areas is showing that cleanup activities sometimes can prove more harmful than *not* cleaning up, according to David Kennedy of the National Oceanic and Atmospheric Administration's Hazardous Materials Division. The image of Exxon company employees' and contractors' "washing rocks" after the *Valdez* spill may be a convincing one on the national evening news, but serious doubts arise over whether such high-publicity steps actually help or hurt the environment in the long run. (About 12 percent of the oil from the Exxon *Valdez* spill eventually was recovered, about 30 percent eventually evaporated, and more than half remains in the environment, according to the Alaska Department of Environmental Conservation.)

Reporter Ross Anderson of the *Seattle Times* says a whole string of "lessons learned" from the March 1989 Alaska spill suggests that it was the product of inadequate preventive measures that lead up to the grounding. Anderson was part of a *Times* reporting team whose coverage of the 1989 spill won a Pulitzer prize (see box, previous page). The absence of double-hulled ships and inadequate advance preparation for a major spill in a remote environment are two examples of areas in which superior preparation might have helped to prevent, or at least mitigate, the spill, Anderson suggests. He feels a major lesson from the *Valdez* spill lies not in how best to respond to such a grounding once it occurs, but rather in how best to prevent such an incident in the first place.

While recognition of the benefits of double hulls is widespread (and the 1990 Oil Pollution Control Act contains new requirements), some naval engineers fear double-hulled ships sometimes are more vulnerable to capsizing. As with other environmental issues, "trade-offs" may arise.

Double-hulled ships are by no means "invincible." For instance, on December 5, 1992, a double-hulled Greek tanker, the *Aegean Sea*, ran aground off the coast of La Coruma, Spain, damaging more than 60 miles of rocky coastline with a crude oil slick reportedly spanning some 19 square miles.

Not *all* oil spills into the marine environment inflict permanent or, in some cases, serious environmental damages. The 1990 *Mega Borg* spill of some 5 million gallons of light crude oil in the Gulf of Mexico, for instance, is believed not to have caused major damages because of a variety of factors: temperature and ocean current conditions, the nature of the crude oil itself, and the ability of spill response teams to limit the amount of oil that actually reached the shoreline and the most vulnerable areas and species.

The impact of an oil spill and the success of cleanup efforts depend on characteristics of the water and land nearby, and weather conditions. In some cases, luck -- good or bad -- plays the prominent role in determining the severity of a spill. The shallower the water, the greater the damage likely to occur to life on the bottom. High winds and ocean currents can spread oil faster and impede cleanup efforts, and tidal mud flats and shallow grass beds are especially difficult to clean. The time of day a spill occurs also can be important, as initial responses can only benefit from adequate sunlight and good visibility.

Smaller, routine and non-accidental disposals, on land and in the water, can have a less newsworthy but equally damaging overall effect. We see few headlines or continuing stories about the 180 million gallons per year of used motor oil dumped in sewer drains or landfills by do-it-yourself mechanics. Also, coastal barges, which carry more oil than tankers, are less regulated. (The point that Americans dispose of more oil from their crankcases than was spilled by the Exxon *Valdez* is a valid one for reporters to keep in mind. A related valid point, however, is that spills are concentrated in time and location, something not true of the shade-tree mechanic casually and irresponsibly disposing of crankcase oil ... which, of course, does not excuse the latter.)

None of this is intended to minimize or down-play the potential environmental harms that can result from oil spills into the marine environment, but rather to help reporters keep in mind the need to examine each incident and its impacts individually, mindful of a wide array of factors that can either mitigate or exacerbate the environmental effects.

Offshore drilling operations can also cause coastal pollution through the disposal of wastes mostly made up of drilling muds.

The drilling muds, which lubricate the drill bit and maintain downhole pressure, sometimes contain toxic chemicals. The Natural Resources Defense Council has estimated that each offshore drilling can lead to some 1,500 to 2,000 tons of drilling muds and cuttings having to be discharged into surrounding waters. Those discharges of course are subject to regulations under the Clean Water Act's National Pollutant Discharge Elimination System (NPDES), requiring they be permitted.

Both exploration and the actual practice of offshore oil drilling have been controversial in terms of environmental, social and aesthetic costs. Substantial research is under way to better evaluate costs and benefits. At a 1991 conference on ocean conservation, Scott Farrow, a former fellow with the President's Council on Environmental Quality, pointed out some social costs he believes society overall must more adequately consider in evaluating private sector decisions on ocean energy production. Those include costs for oil spills (clean-up and control costs); lost opportunities for commercial fishing and recreation and tourism; legal, research and administrative outlays; and non-spill costs, such as commercial fishing area pre-emption, air pollution, wetlands losses, and costs associated with infrastructure.

Farrow said many economists conclude that these "social costs" are small relative to the overall value of production from marine energy resources, but others disagree. "Economic research, based on the results of private companies' bids for lease rights, spending on exploration and development, royalties to the government if production occurs, and product sales, indicates that ocean-based oil and gas development has yielded only average or below-average rates of return for the private companies that undertake it," according to Farrow. Returns on investment among the major firms in the domestic oil exploration and production business averaged 2 to 6 percent from 1986 to 1990, less than the cost of capital, according to a September 1991 First Boston report.

Note: See Chapter 5 for a discussion of the Oil Pollution Control Act of 1990, which includes new requirements for emergency response planning.

Global Climate Change

Global climate change refers to climatic changes resulting from the build-up of "greenhouse gases" and stratospheric ozone depletors such as carbon dioxide, methane, nitrous oxide, and chlorofluorocarbons. While the environmental effects of global climate change are uncertain, climate changes inevitably will influence the global water cycle.

The buildup of greenhouse gases results primarily from a 25 percent increase in the total amount of atmospheric carbon dioxide since the beginning of the Industrial Revolution. Carbon dioxide comes from burning fossil fuels (coals, oil and gas), and from destruction of forests. (Deforestation releases carbon dioxide whether the trees are burned or left to rot, and it destroys a primary source of carbon dioxide absorption and oxygen production.) Increases in methane concentrations have resulted in part from increased wetland cultivation of rice and from increased livestock rearing. Chlorofluorocarbons -- manufacture chemicals used in refrigeration, air conditioners, foam and insulation, and as solvents and cleaners in electronics manufacturing -- make up about one-quarter of the pollutants causing the Earth's greenhouse effect, according to the National Oceanic and Atmospheric Administration.

Potential consequences of a warming Earth include a rise in sea level resulting from melting polar ice caps and thermal expansion of ocean waters. A rise could cause coastal flooding, resulting in eroding shorelines, destruction of some coastal urban areas and much of the remaining wetlands, increased salinization of rivers, bays and ground water, and substantial lowering of the Great Lakes due to increased evaporation. Some futurists say vast lake areas in fact will become mud flats, as periodic level changes flow back and forth over some of the shallow lakes, like Lake Erie.

Along much of the U.S. coast, a one-foot rise in sea level could result in the erosion of up to 2,000 feet of beach. The cost of protecting beaches and coastal structures along the Atlantic coast alone has been estimated at $10 billion to $100 billion.

Overfishing

Overfishing is the term used "when fishing pressure exceeds a sustainable level and when abundance has been reduced so that production is much lower than the potential," according to the National Marine Fisheries Service. Overfishing is most severe along the Atlantic coast and in the Gulf of Mexico. Reporters most familiar with fishery resources along those coasts emphasize that it often is too easy to simply blame "pollution" for fish declines. They urge that the impacts of overfishing not be ignored when evaluating overall risks to those fisheries and fish stocks.

The National Marine Fisheries Service says that of stocks where the status is known, 45 percent (or 67 species) are overfished, including haddock, cod, some flounder, swordfish, Pacific Ocean perch, and many southeastern U.S. snappers and groupers. Of stocks where status has been assessed, 26 percent are fully utilized, 12 percent are underutilized, and the status of a full 34 percent of assessed stocks has not been determined because of inadequate scientific information.

The agency estimates that rebuilding of the nation's overfished fisheries, and efficient management of all its living marine resources, could contribute an additional $2.9 billion annually to the $14.4 billion produced in 1991 in commercial fishing benefits to the U.S. economy, and hundreds of thousands of new jobs. A like amount, and countless hours of fishing pleasure, would also be generated to the recreational fishing sector. Therefore, the agency says, depleted stocks result in significant loss of productivity, loss of jobs and lost recreational fishing opportunities.

"Close to half of the U.S. coastal finfish stocks are now overexploited -- meaning that more are being caught than are replenished by natural reproduction. Scientists say 14 of the most valuable species -- New England groundfish, red snapper, swordfish, striped bass, and Atlantic bluefin tuna among them -- are threatened with commercial extinction, meaning that too few would remain to justify the cost of catching them," according to a June 22, 1992, cover story in *U.S. News & World Report.*

Another issue that contributes to overexploitation and economic loss is incidental capture, or bycatch, of nontarget species. The management of many stocks, including the

recovery of protected species of marine mammals and sea turtles, can potentially be undermined by bycatch in other fisheries. For example, the recovery of depleted reef fishes in the Gulf of Mexico may be slowed or prevented by bycatch of young fish by shrimpers. This is an issue that affects almost all U.S. fisheries to some extent, but it is especially severe in trawl fisheries. Finding a management scheme which allows full utilization to productive species while protecting nontarget ones is a major challenge everywhere.

Throughout the 1980s, commercial and recreational fishermen have benefitted from a tremendous increase in the availability of improved technology: sonar, radar, computerized navigational devices, better boats and engines, and electronic fish finders. One result is that the pressures on fishery resources have increased faster than just the numerical increase in boats and fisherman might suggest. Also, stocks of king and Spanish mackerels in the South Atlantic are beginning to be restored as a result of stringent and effective management.

While efforts are being made to address overfishing, the problem clearly persists. At a November 1991 Smithsonian Institution conference on oceans, Colin Clark of the University of British Columbia pointed out that although recognition of the nonsustainability problem is widespread, "understanding of the fundamental economic process underlying the crisis is woefully weak." In the area of marine conservation, Clark noted that although "the need to manage fisheries so as to prevent overfishing has long been recognized ... attempts at management have repeatedly failed to conserve fish stocks, or to maintain economic viability of potentially productive fisheries." He acknowledged two noteworthy exceptions -- rockfish in Chesapeake and Atlantic salmon in Merrimac River -- where fishery restoration efforts have been more successful.

A summary report from the Smithsonian Institution's 1991 conference on oceans notes that threats to marine fisheries have "biological as well as economic and social implications. Because of their integral roles in marine food webs, drastic fluctuations in fish populations will cause reverberations throughout marine ecosystems." Also, overfishing of oysters can harm water quality because the oysters play an important role in filtering and cleaning the water.

Biological Diversity and Introduced Species

Many issues addressed in this chapter can contribute to problems of biological diversity. Twenty-nine (29) marine mammals and birds in American coastal waters are listed as threatened or endangered marine species (see Table 8). Table 9 lists threatened and endangered marine edge species, that is, those that are coastal-dependent on, for instance, near-coastal or intertidal areas.

The three levels of biological diversity, as described by Elliott A. Norse, chief scientist for the Center for Marine Conservation, are:

- *species diversity,* which varies enormously over the surface of the Earth and over time;
- *genetic diversity,* a lower level comprising the genetic variation among different individuals within each species, provides the raw material for evolution and selective breeding; and
- *ecosystem diversity,* the highest level of biological diversity, the diversity of communities of organisms in their physical settings. Ecologists examine the differences in the composition of species in ecosystems, the physical structure of ecosystems, and the way they function.

Norse also identifies five major classes of threats to biological diversity:

- overexploitation of living things, including those we intend to take and those that we do not;
- physical destruction of ecosystems, from sea grass beds and mangrove forests to the soft seabed;
- pollution of all sorts;
- global atmospheric change, including stratospheric ozone depletion and global climate change; and
- the introduction of alien species, such as the blue crab species once native to the U.S., now well established in the Mediterranean, or the introduction of zebra mussels from the Mediterranean Sea to the Great Lakes.

According to James Carlton, director of the Maritime Studies Program at Williams College in Massachusetts, the introduction of alien species can "cause fundamental irreversible alterations in

Table 8
Marine Species Protected by the Endangered Species Act

Species	Endangered	Threatened
Mammals	Blue Whale Bowhead Whale Finback Whale Grey Whale Humpback Whale Right Whale Sei Whale Sperm Whale Vaquita (Cochito) Dugong West Indian Manatee Marine Otter Caribbean Monk Seal Hawaiian Monk Seal Mediterranean Monk Seal	Southern Sea Otter Steller Sea Lion Guadalupe Fur Seal
Reptiles	Hawksbill Sea Turtle Kemp's Ridley Sea Turtle Leatherback Sea Turtle American Crocodile Saltwater Crocodile[2]	Green Sea Turtle[1] Olive Ridley Sea Turtle[1] Loggerhead Sea Turtle
Fish	Shortnose Sturgeon Totaba (Seatrout)	Chinook Salmon[1] Sockeye Salmon[2]
Birds	Short-tailed Albatross[2] Abbott's Booby Cathow (Bermuda Petrel) Andrew's Frigatebird Audouin's Gulf Brown Pelican[2] Galapagos Pensuin Hawaiian Dark-Rumped Petrel California Least Tern	Newell-Townsend Shearwater Roseate Tern[2]

[1]Denotes threatened species which are endangered throughout certain portions of their range or species with endangered breeding populations.
[2]Denotes species which are endangered or threatened only in certain portions of their range.
Source: Center for Marine Conservation, 1992.

Table 9
Marine Edge Species Protected by the Endangered Species Act

Species	Endangered	Threatened
Mammals	Alabama Beach Mouse Anastasia Island Beach Mouse Choctawhatchee Beach Mouse Perdido Key Beach Mouse Saltmarsh Harvest Mouse Shark Bay Mouse Morro Bay Kangaroo Rat False Water Rat Florida Salt Marsh Vole	Southeastern Beach Mouse
Birds	Lysan Duck Chinese Egret Nordmann's Greenshank New Zealand Shore Plover California Clapper Rail Lightfooted Clapper Rail[2] Cape Sable Seaside Sparrow	Piping Plover[1] Marbled Murrelet
Reptiles		Atlantic Salt Marsh Snake
Invertebrates		Northeastern Beach Tiger Beetle

[1]Denotes threatened species which are endangered throughout certain portions of their range or species with endangered breeding populations.
[2]Denotes species which are endangered or threatened only in certain portions of their range.
Source: Center for Marine Conservation, 1992.

the structure of aquatic communities. No introduced marine organism, once established, has ever been successfully removed or contained."

Heightening public awareness of the potential risks of introducing non-indigenous species are experiences associated

with introduction of zebra mussels into some marine environments. The mussels can block pipes and cause extensive damage. (The zebra mussels were brought to North America from the Mediterranean Sea via ballast water, water purposefully pumped into a ship's hull.)

In the Great Lakes, accidental and deliberate introduction of exotic species such as the sea lamprey played a part in the decline of fisheries. Today, the sea lamprey is controlled with a lampreycide (TFM), and some fish such as the walleye, yellow perch, and white bass by and large have recovered. Other species, such as the coho and chinook salmon, have been introduced, resulting in a new sport fishing industry. However, expensive efforts to restore lake trout to the Great Lakes (more than 125 million lake trout have been stocked) have fallen far short of expectations, according to a report by Trout Unlimited, and much of the gene pool of this once abundant fish has been lost.

Additional Resources

For more information contact the World Resources Institute, 1735 New York Avenue, NW, Washington, D.C. 20006, (202) 638-6300.

Questions for Reporters to Consider

- How is sewage sludge treated and discharged in your region?
- If there are local harbors in your region that are dredged, where does the material go?
- Do conflicts exist between local sport and commercial fishing interests?
- What emergency response plans required by the Oil Pollution Control Act are in place for your region? Are they up-to-date?

Reporting on Wetlands Issues

The Public Policy Debate In Perspective

The term "wetlands" is beguiling in its simplicity -- on paper straightforward, absolute, unequivocal -- but, in reality, it's nothing of the sort.

Hidden behind the seeming simplicity, the absoluteness of the language, lies much that is subjective and judgmental, the stuff of public policy debate and controversy.

For reporters getting into wetlands stories, either coastal or inland, a likely "peg" could be the public policy controversy that swirled around the "no net loss" issue throughout much of the Bush Administration. Debate over management of wetlands is unlikely to end any time soon. There's just too much riding on issues involving protection, restoration and development of wetlands, which cumulatively make up some 5 percent of the contiguous 48 states (and 45 percent or 170 million acres of Alaska). And there's too much that remains to be determined in shaping future public policies toward these invaluable resources.

Where does a wetland begin? Where does it end? What is, and what is not, a wetland? What do wetlands do? Do the aesthetic, recreational and regulatory images of wetlands parallel each other? Do the scientific and political or regulatory definitions always coincide, and should they always? Can wetlands be managed and protected in and of themselves, or only as part of a total ecosystem, a watershed for instance, of which they are an integral part? How do private property rights apply to wetlands?

For reporters seeking to communicate effectively, it might help to start, as always, with the definition.

What is a Wetland?

The definition of course is critical, but not simple. To an ecologist, a wetland is a transitional area between deepwater environments on one side and well-drained upland areas on the other. Wet and dry areas are graded, mostly aquatic here and mostly dry there, with areas of subtle and gradual transitions.

Wetlands vary from region to region, but they share three characteristics, as described in the publication, *The Fragile Fringe*:

- They are periodically flooded, or at least saturated to or near the surface.
- They have unique hydric soils characterized by periodic wetness and differing from those of adjacent upland areas.
- They support plant species that have adapted to or are dependent on periodically wet conditions.

How wet is wet? The question is critical in defining a wetland, and that judgment was at the heart of the public policy debate that characterized the wetlands issue in 1991 and 1992.

In fact, some wetlands may at times look very much like dry land. In a 1989 manual establishing field procedures for drawing wetlands boundaries, the Environmental Protection Agency, the U.S. Army Corps of Engineers, the Fish and Wildlife Service, and the Soil Conservation Service posited that an area is a wetland *for regulatory purposes* if it is wet for at least seven consecutive days a year with the water table to within 6 to 8 inches of the surface, depending upon the capillary ability of the soil.

The Bush Administration's Domestic Policy Council Task Force on Wetlands and its Council on Competitiveness, however, feared such a definition would put too much land off limits for development. The proposal instead was that an area should be regulated as a wetland only if the land is covered with water for at least 15 consecutive days, or if the surface is saturated for 21 consecutive days during the growing season. In addition, the area would be subject to stringent technical requirements concerning the plant species composition of vegetation present.

Policy makers refer to wetlands "identification" as involving the decisions on whether an area is a wetland and to wetlands "delineation" as involving determinations of the boundaries of a particular wetland. For journalists, it's critical to understand that these wetlands identification and delineation activities are likely to remain central to wetlands regulation and controversies surrounding it. Decisions made in this context will determine what percentage of the country's wetlands resources are regulated and protected from development, and will have important economic implications.

As of the writing of this guidebook, the 1989 manual was in use.

What Do Wetlands Do?

Before addressing what wetlands *do*, it's important to step back and remember also what wetlands are, for on their own -- and regardless of their strictly functional roles -- wetlands to many are beautiful ecosystems independent of function. From a strictly aesthetic standpoint, wetlands can extend to the horizon, stretching the eye, the mind, and the imagination. They reflect the nuances of sunlight and wind and breeze in ways that for many go beyond the importance of their functional values.

That intrinsic beauty merely complements their functional mission. Wetlands also provide a number of useful services, depending on their type, location and geographical factors. Not all wetlands perform all functions, nor need a particular wetland perform them equally well.

Among the functions associated with wetlands overall, based on a compilation done by the National Wetlands Policy Forum in 1988 (see note at the end of this section):

Flood Conveyance -- Wetlands help mitigate the severity of floods, storing water during floods and releasing it gradually to downstream areas, thereby helping to reduce flood peaks. By reducing the velocity of flood waters, wetlands help reduce erosion.

Barriers to waves and erosion -- Coastal wetlands help reduce the effects of storm tides and waves, helping to protect adjacent upland areas. Wetlands vegetation also helps protect shorelines from erosion.

Habitat -- Coastal and inland wetlands provide essential breeding, nesting and feeding habitats for waterfowl, other birds, mammals, and reptiles. Some 35 percent of all federally listed rare and endangered animal species either live in or are dependent on wetlands. Wetlands provide nutrients for commercial and recreational fish and shellfish. Because they form the transition zone between terrestrial and aquatic systems, wetlands are highly diverse in animal and vegetative composition, a highly desirable trait ecologically.

Water Quality, Quantity, Supply -- Wetlands are a source of ground water and surface water recharge, and they help to purify streams, lakes and coastal waters by filtering urban and agricultural runoff and trapping sediments that otherwise could harm aquatic life.

Recreational, Educational, Commercial Services -- Wetlands are popular sites for fishing, hunting and wildlife observation; they provide unique educational opportunities for nature and scientific observation and study; and they can provide an important source of commercial timber, of marsh grasses, and of food plants such as cranberries.

Note: The National Wetlands Policy Forum was established in 1987 by The Conservation Foundation at EPA's request. The group was chaired by former Governor Thomas H. Kean of New Jersey. Among its 20 members were three governors, a state legislator, state agency heads, a town supervisor, farmers, ranchers, academics, and citizens group and business representatives.

How Much Wetland? How Much is Lost Annually?

In Colonial America, the U.S. mainland had some 221 million acres of wetlands nationwide. An estimated 106 million acres, about 47 percent, remained in the mid-1980s in the mainland U.S. as wetlands.

How much of the nation's wetlands are lost annually? The National Wetlands Policy Forum -- widely regarded as a credible and authoritative voice -- says, "No one knows what the current national loss rate is." It points to estimates that wetlands losses during the 1950s and 1960s had averaged 400,000 to 500,000 acres annually, and it points to a "controversial" Office of Technology Assessment estimate of 275,000 acres a year by 1980, adding that "some regional estimates seem to indicate that higher loss rates are continuing." The Fish and Wildlife Service's National Wetlands Inventory estimates losses of 290,000 acres per year during the 1970s and 1980s.

How Are Wetlands Converted or Altered?

Wetlands can be altered physically, chemically or biologically. Table 7 on page 52 illustrates types of wetlands alteration.

An important aspect of this question is: Who owns the wetland?

For some 75 percent of wetlands in the contiguous states, the answer is that ownership is in private hands. That's important, because many of the benefits derived from wetlands often accrue

to the public at large, while benefits from development or conversion of wetlands frequently accrue to individual property owners. "The fact that the protection of wetlands makes good economic as well as environmental sense for society but not necessarily for the individual owning them is critical to much of the conflict over wetlands protection policies," says the National Wetlands Policy Forum.

This issue raises important public policy questions, and reporters might consider posing questions regarding individual landowners' responsibilities involving overall public interest issues.

Policy Issues

Responsible public policy debate over wetlands involves not whether but rather how to manage the country's wetlands, as decision makers increasingly recognize the values that can be provided by these unique resources, questions of ownership notwithstanding.

Among issues to be considered in shaping prudent policies:

"Takings" and Property Rights -- Limitations placed on private property to protect a larger public interest (the issue addressed, for instance, in the Supreme Court's 1992 *Lucas* ruling on page 53) raise difficult public policy and equity questions, and reporters can expect to encounter "takings" issues in many debates involving uses of and restrictions on wetlands.

Functions/Values -- Evaluating the functions served by a particular wetland is a key component of effective wetlands management. Different wetlands may well provide different benefits, both quantitative and qualitative, and the relative values of those benefits are likely to differ, depending upon the context of the wetland, for example, surrounding land uses.

Among questions to be considered: With an understanding of the functions served by a particular wetland, and with an estimate of the relative values of that wetland, is it possible to next prioritize protection efforts, giving greater protection to more valuable wetlands where impacts are likely to have the most adverse effect? Scientists inside and outside of government are exploring these questions. There may also be trade-offs in maximizing one function over another such as flood absorption versus fish production.

Wetlands Restoration and Creation -- The National Wetlands Policy Forum has recommended an interim national wetlands goal of "no overall net loss of the nation's remaining wetlands base," with a long-term goal of increasing "the quantity and quality of the nation's wetlands resource base."

The group emphasized that its recommendation "does not imply that individual wetlands will in every instance be untouchable or that the no net loss standard should be applied on an individual permit basis -- only that the nation's overall wetlands base reach equilibrium between losses and gains in the short run and increase in the long run."

That "no net loss" goal is unrealistic "without initiating active programs of wetlands restoration and creation," the group said in its final report. Wetlands restoration involves re-establishing a pre-existing habitat or condition; creation involves establishing habitats or conditions where they did not previously exist.

Among questions reporters might consider: How successful is creation? Restoration? What are the practical limitations of wetlands restoration or creation efforts? (Creation is a more experimental endeavor and as such offers less potential for providing full wetlands functions or values.) To what extent can degradation of one range of benefits be offset by improvements in another category, or by creation of new wetlands elsewhere? Which benefits are comparable in considering restoration options? To what extent is continued success of a restoration or creation effort dependent on ongoing human intervention and maintenance, and what are the ongoing maintenance costs?

Mitigation Banking -- This approach allows for the restoration or creation of wetlands specifically to compensate for future unavoidable losses. Compensation for multiple projects is consolidated into a single site, where units of restored or created wetlands become "credits." The accumulated credits subsequently can be "withdrawn" to offset debits at the project site.

In practice, the concept is somewhat akin to the kinds of "offsets" or "banking" strategies used in emissions control programs -- allowing emissions from this source so long as they are more than offset by emission reductions elsewhere -- but it may place unrealistic confidence in yet-unproven wetlands restoration/creation efforts. The National Research Council, for

instance, has suggested increased research on means of creating self-sustaining and low-maintenance restored wetlands.

Sequencing -- Once a wetland is identified as warranting regulatory protection, what are the management guidelines? Regulators use a series of sequential steps or "gates" through which a wetlands development proposal might pass: 1) first, avoid development in the wetland to the extent practicable; 2) secondly, minimize the areas or extent of degradation of the wetland; 3) and finally, require compensation for wetlands impairments that cannot be avoided or minimized. This concept of sequencing is designed to ensure that, where appropriate, alternatives to wetlands development are considered and losses are fully offset.

Scope of Clean Water Act Section 404 -- The primary federal regulatory authority over wetlands is included in Section 404 of the Clean Water Act (see Chapter 5), but it's important to understand that effective wetlands management goes well beyond Section 404, and protection of wetlands will require more than "just" sound implementation of the federal 404 dredged and fill materials permitting program, or of more stringent state and local programs. Societal pressures far greater than the activities subject to 404 can damage or threaten wetlands -- airborne pollution, waste disposal, land use decisions, and abuses resulting from public use.

Along with recognizing limitations of Section 404 -- and recognizing that protection of wetlands goes beyond Section 404 -- it is important also to recognize the contributions that nonregulatory programs can play in wetlands management. Environmental education, use of easements and land trusts, wetlands stewardship programs, protection of wetlands on federal lands, improved agricultural practices, and the role of private landowners in managing wetlands resources -- each plays a critical role in the overall effort to manage wetlands.

Perhaps most important is the growing societal recognition that wetlands cannot be, will not be, effectively managed in isolation from all that surrounds them. That recognition has led to an increased understanding that wetlands should be managed not on an individual wetland basis, but rather on a total watershed, landscape or biodiversity basis.

Effective reporting on wetlands issues -- just like effective

management of wetlands resources overall -- will require attention to all these issues ... and, unquestionably, more.

Five federal agencies have responsibility for protecting wetlands -- the U.S. Environmental Protection Agency, the U.S. Army Corps of Engineers, the Department of the Interior's Fish and Wildlife Service, the Department of Commerce's National Oceanic and Atmospheric Administration, and the Department of Agriculture's Soil and Conservation Service -- under the Federal Water Pollution Control Act of 1972's Section 404 (as amended) and other federal laws.

Chapter 5
Key Laws and Associated Programs

Numerous federal laws and regulations have been enacted to manage and protect coastal and marine resources of the United States. These laws authorize regulation of activities such as dumping, dredging, fishing, or extracting mineral resources. In addition, scores of laws are specifically intended to preserve and protect wildlife, water quality and ecosystems. Others address conflicts over resource issues such as commercial versus recreational uses, preservation versus development, and states versus federal authority.

The federal laws and regulations are framed within massive bureaucratic structures with occasionally overlapping and even contradictory goals and responsibilities.. Many of the laws have been amended several times, adding to the complexity. In addition, Executive Orders and numerous state and local laws and regulations also cover coastal areas.

This broad overview is not intended to present the definitive word on, nor to be an exhaustive list of, these federal laws and programs, about which volumes have been and still could be written. Rather, it offers a basic history, highlighting the more far-reaching of these directives. They are described below essentially in chronological order. Additional laws and programs are outlined in Appendix A.

National Environmental Policy Act (1969)

Among the most significant of these laws enacted to protect coastal and marine resources is the National Environmental Policy Act (NEPA) of 1969. Its main goal is "to create and maintain conditions under which man and nature can exist in productive harmony, and fulfill the social, economic and other requirements of present and future generations of Americans." Federal agencies address this goal by ensuring that potential environmental impacts and effects of proposed federal projects and activities are identified and considered in the decision-making process. NEPA requires that the applicable federal agency prepare a detailed environmental impact statement (EIS) for major federal actions that may significantly affect the quality of the

human environment. In coastal areas, such actions can include but are not limited to oil and gas leases, port and harbor construction, and military construction. Not only does NEPA require full disclosure of a proposed project's environmental impacts, but the authorizing agency must evaluate a complete set of alternatives to the project including the "no build" alternative.

The President's Council on Environmental Quality (CEQ), established by NEPA, developed regulations for implementing the EIS process. CEQ advises the President and is required to prepare for Congress an annual "Environmental Quality Report." The report presents information concerning trends in environmental quality, reviews federal actions in light of the policies of the Act, and makes recommendations.

The U.S. Environmental Protection Agency (EPA) reviews and comments on EISs. When a draft EIS is filed with EPA by a federal agency, it is also distributed to other agencies, organizations and concerned individuals. Public hearings may be held and a public comment period opened. Comments received on the draft EIS are evaluated and included in a final EIS. If an EIS is found to be inadequate or deficient, it may be referred to the Council on Environmental Quality. An EIS, especially for a large project, may take years and great expense to prepare, but the intended benefit is that adverse environmental effects have been evaluated and, where appropriate, avoided, minimized and/or mitigated.

Early Federal Water Pollution Acts

A series of laws regulating water pollution has been enacted and then amended over a period of many decades beginning with the **Rivers and Harbors Act of 1899** (see Appendix A), which established regulations for construction and discharges of pollution in navigable waters of the U.S. The **Oil Pollution Control Act of 1924** was the first federal law specifically prohibiting the discharge of oil into the navigable waters of the United States.

In 1948, Congress passed the original **Water Pollution Control Act** as a result of evidence that water pollution was a health danger that damaged beaches and shellfish beds and caused typhoid, diarrhea, and dysentery.

In 1956, Congress amended the 1948 law, passing the

Federal Water Pollution Control Act.

The 1972 Amendments to the Federal Water Pollution Control Act, known as the Clean Water Act or Public Law 92-500, substantially rewrote and expanded the Act. Among other programs, the Clean Water Act established the **National Pollutant Discharge Elimination System** (NPDES), Section 402, which authorizes EPA to issue permits specifying limitations on industrial and municipal discharges, with dischargers required to monitor and report their compliance. Under Section 404 of the Act, the U.S. Army Corps of Engineers and EPA jointly regulate the discharge of dredged and fill material into waters of the U.S., including wetlands. Discharges of oil and hazardous substances into waters of the U.S. also are prohibited under Section 311 of this Act.

Federal Water Pollution Control Act Amendments (1972 & 1987)

The Amendments of 1972 to the Federal Water Pollution Control Act, commonly known as the Clean Water Act, authorized $18 billion over five years for grants to local communities to build sewage treatment plants. The law also expanded pollution abatement programs in navigable waters, both intrastate and interstate.

Like the Clean Air Act that predated it by two years, the 1972 Amendments were an entirely new step in the progress of American environmental legislation, more comprehensive and far more costly than any previous legislation for reducing the pollution in the waters of the United States.

Its original goal -- the so-called "zero discharge goal" -- was to eliminate the discharge of all pollutants into navigable waters by 1985. An interim goal consisted of ensuring water quality sufficient for the propagation of fish, shellfish, and wildlife and for recreation by mid-1983, the so-called "fishable-swimmable" goal.

National Pollutant Discharge Elimination System

The National Pollutant Discharge Elimination System (NPDES) is essentially an "end-of-pipe" program: it regulates effluents discharged directly from municipal and industrial facilities into

navigable waters. Under the Act, it is illegal to discharge pollutants into navigable waters without an NPDES permit.

NPDES permits contain discharge limits to assure that the Act's treatment requirements are met. In the case of discharges to the territorial sea, contiguous zone or oceans, the Act also provides that EPA is to consider pollutant effects on human health, marine life, marine ecosystem diversity and productivity, and aesthetic and recreational values.

EPA or delegated states administer the permit system. Dischargers receive permits that specify the limitations for particular pollutants, monitoring requirements and reporting requirements. Permittees must report periodically on the characteristics of their effluent. This requirement allows EPA and citizens to review compliance records.

Water Quality Criteria, Effluent Guidelines and Secondary Treatment Requirements

The Clean Water Act requires states to set water quality standards to preserve designated uses of water, such as recreation and fishing, within their boundaries. To help states set these standards, the law requires EPA to establish water quality criteria for states to use as guidance. Those criteria indicate safe and unsafe levels of exposure for both humans and aquatic animals to specific water pollutants. States may use the EPA criteria or, as many have, set higher standards.

The Act requires EPA to create standards for effluents released from industrial plants (effluent guidelines) and municipal facilities. These standards are based on either the best available technology for cleaning the effluent, or on the allowable amount of the effluent's constituents that can be released into the water without causing significant degradation or a health hazard. These standards are then used by states or EPA to set effluent limitations on permits granted through the National Pollutant Discharge Elimination System.

Before 1972, most sewage treatment plants provided only primary treatment, which includes physical settling of solids before the raw sewage is discharged. The Clean Water Act required that all plants upgrade their treatment to a secondary level by 1977. That deadline was later extended to 1988. In secondary treatment, after primary treatment, the sewage is

subject to a biological treatment process which results in increased removal of solids and oxygen-demanding wastes.

Some facilities, like Blue Plains in the District of Columbia, have gone to tertiary treatment (more aggressive treatment that removes nutrients, such as phosphorus and nitrogen, and most suspended solids).

Section 301(h)

Section 301(h) allows qualified publicly owned treatment works that discharge into coastal or ocean waters to provide less than secondary treatment if certain conditions are met. A 301(h) waiver may only be allowed if the applicant can demonstrate that it will not exceed applicable water quality standards specific to the pollutant for which the modification is requested and that the discharge of pollutants to the marine waters will not interfere, alone or in combination with pollutants from other sources, with the attainment or maintenance of water quality that will assure the protection of public water supplies, the protection of balanced indigenous populations of shellfish, fish and wildlife, and allow recreational activities on the water.

The Water Quality Act of 1987 modified the 301(h) program by requiring a minimum of primary treatment, adding additional pretreatment requirements for discharges from urban areas (i.e., with populations of more than 50,000), and a prohibition of waivers to secondary treatment in stressed saline estuarine waters.

Section 319

Section 319 of the Clean Water Act requires states to assess water quality impacts due to nonpoint source pollution and to develop management programs for nonpoint source control. EPA approves all state management programs and provides grants to support program implementation. A new program jointly administered by the National Oceanic and Atmospheric Administration and U.S. Environmental Protection Agency for coastal nonpoint sources (Section 6217 of the Coastal Zone Management Reauthorization Act) is in development.

Section 403(c)

Secton 403(c) of the Clean Water Act requires that all NPDES-

permitted discharges from point sources into the territorial seas, the contiguous zone and the oceans must not "unreasonably degrade the marine environment." Section 403(c) authorizes EPA to assess the impact of a point source discharge to the marine environment on the surrounding biological communities and provides for additional effluent limitations or prohibition if necessary to protect marine ecosystems.

No NPDES permit may be issued for discharges into the territorial sea, the waters of the contiguous zone or oceans unless it is in compliance with Ocean Discharge Guidelines developed by EPA. These Guidelines address 10 subject areas, including:

- bioaccumulation;
- transport of pollutants;
- exposed biological communities;
- receiving waters;
- special aquatic sites;
- human health effects;
- fishing;
- Coastal Zone Management Program;
- marine water quality criteria; and
- other factors as appropriate.

National Pretreatment Program

Another significant pollution control program created under the 1972 Amendments addresses effluents that are discharged from an industrial facility into a public sewage treatment facility and from there into waters of the U.S.

The National Pretreatment Program has two main parts: general pretreatment regulations and national categorical standards. These regulations and standards set levels for discharges that flow from industrial facilities into publicly owned sewage treatment plants. In a nutshell, the general pretreatment regulations require sewage treatment plants to regulate pollutants which might cause fire or explosion or otherwise upset or interfere with its operation. In addition, certain pollutants from industries are also controlled through technology-based categorical standards issued by EPA.

The pretreatment program makes public sewage treatment plants responsible for monitoring and developing programs to limit

industrial pollutants entering their waste stream. The publicly owned plants can be approved by EPA as the control authority responsible for ensuring that industrial dischargers comply with program standards.

The Section 404 Program

Section 404 of the Clean Water Act established the permit program to regulate discharges of dredged or fill material into wetlands and other waters of the United States. The Section 404 program is jointly implemented by EPA and the U.S. Army Corps of Engineers. The Corps, through its 37 district offices, is responsible for the day-to-day administration of the Section 404 permit program. It reviews the permit application and makes the decision whether to issue or deny a permit. Section 404 is intended to help maintain the physical, chemical, and biological integrity of the nation's waters and therefore allow advisory review by the National Marine Fisheries Service and the Fish and Wildlife Service.

EPA also has numerous Section 404 responsibilities. Section 404(b)(1) of the Act directs EPA, in conjunction with the Corps, to develop guidelines for use by both agencies in reviewing Section 404 permit applications. These Section 404(b)(1) guidelines are federal regulations and provide the environmental criteria to be satisfied before a Section 404 permit can be issued. Under Section 404(q), the Corps has developed individual Memoranda of Agreement (MOA) with various federal agencies that set out procedures to be followed when there is disagreement between agencies over a significant permit application or policy issue.

Under Section 404(c), EPA has the authority to veto a Corps decision to issue a permit, or to otherwise prohibit or restrict the discharge of dredged or fill material to wetlands or other waters of the U.S. Generally, EPA uses this authority only for the more significant and controversial permit applications.

EPA is responsible for determining the geographic scope of the Clean Water Act, i.e., whether an area is a wetland or other water of the U.S. and the applicability of Section 404(f), which exempts certain discharges from permit requirements. However, as a practical matter, the Corps makes these determinations on a case-by-case basis. EPA and the Corps share authority for

enforcing the requirements of Section 404.

Wetlands are delineated based on three parameters: wetlands vegetation, hydric soils, and hydrology, in the form of flooding or soil saturation. Once an area has been identified as a wetland within the meaning of the three-parameter definition, it is necessary to determine whether it falls within the geographic scope of the Clean Water Act, i.e., whether it is a "water of the United States." The courts generally have interpreted the term broadly to include all waters the degradation or destruction of which *could* affect interstate commerce. Thus, waters of the U.S. include wetlands adjacent to interstate rivers and streams and coastal waters. Also within the geographic scope of Section 404 are isolated waters and wetlands if it is determined that their degradation *could* affect interstate commerce.

Under Section 404 the courts have interpreted the term "discharge" to include both additions and redeposits into the wetland or other waters of the U.S. Section 404(f)(1) exempts certain discharges from the permit requirement, such as "normal" farming, ranching and silviculture practices. It is important to note that these exemptions are limited by Section 404(f)(2), which does not allow the exemption of discharges incidental to any activity that converts waters of the U.S. to another use and either impairs the flow or circulation of the waters of the U.S., or reduces the reach of such waters.

Anyone wanting to discharge dredged or fill material into wetlands or other waters of the U.S. must first obtain authorization from the Corps, either through issuance of an individual permit or as authorized under a general permit. Section 404(e) authorizes general permits for categories of activities that are similar in nature and will have only minimal environmental impact. General permits can be issued on a nationwide, regional or state level. As 1992 closed, 36 nationwide permits had been issued; all nationwide permits may not apply in states.

For discharges into wetlands that are not authorized by general permits, the discharger must first apply to the Corps for an individual Section 404 permit. The Corps cannot issue an individual Section 404 permit unless it determines that 1) the proposed project complies with the Section 404(b)(1) Guidelines, and 2) the proposed project is not contrary to the public interest. Regional offices of various federal agencies review the Corps

public notices for individual permit applications and provide comments back to the Corps regarding the proposed project's compliance with the Guidelines.

Under the Guidelines' required alternatives analysis, consideration is given to whether the proposed discharge is the least environmentally damaging, "practicable" alternative. An alternative is practicable if it is available and capable of being accomplished considering cost and existing technology and logistics, and in light of the overall project purpose.

The Guidelines also require that the discharger undertake all appropriate and practicable mitigation measures to minimize any potential harm to the aquatic ecosystem. The Corps evaluates permit applications to ensure that mitigation occurs in the following sequence: avoidance of impacts where practicable through the evaluation of alternative sites, followed by minimization of impacts, and finally, appropriate and practicable compensation of unavoidable impacts through wetlands creation or restoration.

Note: Further details on the regulatory program are available from the Army Corps of Engineers, attention: Chief, Regulatory Program Office.

Marine Sanitation Devices

Under the Clean Water Act, EPA is required to set standards for marine sanitation devices, i.e., on-board boat toilets. The Coast Guard has responsibility for enforcing the standards and certifies devices as to compliance with the EPA standards.

> Note: A shortage of resources for fully enforcing the program, combined with inadequate on-shore pump-out stations, has led to concerns that many small boats and recreational boaters do not adequately comply with marine sanitation device requirements. Enforcement of these requirements is not easy, given the nature of the program, and like many other programs, voluntary compliance -- fueled by increased environmental education -- is essential.

There are three classes of devices. A Class One device is an on-board toilet that provides some sewage treatment before

releasing the waste into receiving waters. A Class Two device provides a higher level of treatment, then releases the waste into receiving waters. A Class Three device has a holding tank and does not release the sewage into receiving waters. According to regulations adopted in 1978, any U.S.-registered or any boat or ship over 65 feet long must have at least a Class Two device.

In addition, the Act contains provisions under which states may, with EPA approval, declare "no discharge zones" -- waters into which the discharge of vessel sewage is prohibited.

Clean Water Act Amendments of 1987 (Water Quality Act of 1987)

The Federal Water Pollution Control Act was reauthorized and amended in what became known as the Water Quality Act of 1987. The Act focused attention on protecting and restoring coastal resources through the National Estuary Program (see below and Table 10), the Great Lakes Program, and the Chesapeake Bay Program. In this respect, it went beyond national pollution control standards to address site-specific problems and maximize environmental results. Congress recognized population and development pressures, along with pollution, as problems needing to be addressed. It authorized EPA to convene management conferences to assess water quality trends, collect data, monitor effectiveness of programs, and take other actions.

The **National Estuary Program**, established by the Clean Water Act Amendments of 1987, identifies nationally significant estuaries that are threatened by pollution, development or overuse. The program promotes creation of plans to protect each estuary.

The program is managed by EPA, but it emphasizes collaboration with other federal agencies, state agencies, local governments, and private citizens. The program was inspired by restoration efforts on the Chesapeake Bay and the Great Lakes.

Governors must nominate an estuary before it can be designated for protection under the estuary program. If the estuary nominee meets certain criteria, which include national significance, EPA selects it for the program and the agency convenes a Management Conference. The Management Conference includes representatives of EPA, state, federal, and

Table 10
National Estuaries
(as of November 1992)

Albemarle-Pamlico Sounds, North Carolina
Barataria-Terrebone Estuarine Complex, Louisiana
Buzzards Bay, Massachusetts
Casco Bay, Maine
Corpus Christi Bay, Texas
Delaware Bay in New Jersey, Pennsylvania and Delaware
Delaware Inland Bays, Delaware
Galveston Bay, Texas
Hudson Bay, New York
Indian River Lagoon, Florida
Long Island Sound in Connecticut and New York
Massachusetts Bays (including Cape Cod Bay and Boston Harbor)
Narragansett Bay, Rhode Island
New York-New Jersey Harbor
Peconic Bay, New York
Puget Sound, Washington
San Francisco Bay, California
San Juan Bay, Puerto Rico
Santa Monica Bay, California
Sarasota Bay, Florida
Tampa Bay, Florida
Tillamook Bay, Oregon

regional agencies, local governments, affected industries, educational institutions, and the general public.

The group's main tasks are to identify and prioritize an estuary's problems; then create a Comprehensive Conservation and Management Plan (CCMP) for reducing pollution and restoring the estuary; and, finally, see that the plan is implemented. The initiatives recommended in the CCMP can go beyond what is currently required in the Clean Water Act and can reach activities, such as land use, not directly regulated under the Act. The group also must include in the plan strategies for funding the plan's proposed actions as Estuary Program funding ends with adoption of the CCMP. Finally, the group must create

a monitoring program to evaluate the Management Plan's effectiveness. This monitoring plan includes repeated sampling of water and sediment over time.

Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (London Dumping Convention) (1972)

The London Dumping Convention (LDC) grew out of proposals made by the 1972 United Nations Conference on the Human Environment in Stockholm, a predecessor of the 1992 "Earth Summit," held in Rio de Janeiro, Brazil. The LDC regulates ocean dumping to prevent pollution of the marine environment, harm to living marine resources, hazards to human health, and damage to amenities. Dumping involves any deliberate disposal at sea from vessels, aircraft, platforms, or other man-made structures, but excludes waste disposal from normal operation of vessels. The U.S. implements the Convention through Title I of the Marine Protection, Research and Sanctuaries Act (see below).

With few exceptions, the LDC prohibits ocean dumping without a permit. Three annexes accompanying the LDC and contain the technical criteria to be used in evaluating permit applications.

- Annex I lists prohibited materials such as organohalogens (e.g., PCBs), mercury, petroleum products, plastics, cadmium, and high-level radioactive wastes in other than trace amounts;
- Annex II identifies materials for which "special care" status must be applied, including "wastes containing significant amounts" of arsenic, zinc, copper, fluorides, lead, and pesticides; and
- Annex III contains general criteria to be used in evaluating permit applications and selecting disposal sites.

The Convention requires that records be kept on permitted dumping activities, and conditions of their adjacent seas be monitored and reported.

Marine Protection, Research and Sanctuaries Act -- Title I or Ocean Dumping Act (1972)

Title I of the Marine Protection, Research and Sanctuaries Act (MPRSA), commonly known as the Ocean Dumping Act, regulates the transportation of material for the purpose of dumping into ocean waters. In general, the Act prohibits the transportation of material from the U.S. or by U.S.-registered vessels for the purpose of ocean dumping unless authorized by a permit issued under the Act. Material subject to the Act's requirements is broadly defined. In addition, the Act also serves to implement an international treaty regulating ocean dumping known as the **London Dumping Convention (LDC)** (see above).

The Act flatly prohibits the issuance of permits for:

- radiological, chemical and biological warfare agents;
- high level radioactive waste;
- medical waste (added by 1988 amendment to MPRSA); and
- dumping of material which would violate applicable water quality standards.

In addition, as discussed below, the MPRSA was amended in 1988 (the Ocean Dumping Ban Act, Public Law 100-688) to make the ocean dumping of industrial waste and sewage sludge unlawful.

Section 102(a) of MPRSA directs EPA to develop regulatory criteria for use in reviewing permit applications and sets forth a number of statutory factors which EPA is to consider when developing its regulatory criteria. Basically, the statutory factors fall into three broad categories: 1) marine impacts, 2) the "need" for ocean dumping, and 3) alternatives to ocean dumping. The regulatory criteria developed by EPA are intended to protect marine life from potential adverse effects of dumping.

Except for dredged material, the Act assigns permitting authority to EPA. For dredged material, the U.S. Army Corps of Engineers is the permitting authority and is directed by the statute to use EPA's environmental criteria in making its permit decisions. Under the statute, Corps determinations to issue dredged material ocean dumping permits are subject to EPA review. In addition, for all materials, EPA is assigned

responsibility for designating recommended ocean dumping sites, and the Corps is directed by the statute to use such EPA-designated sites to the maximum extent feasible. EPA has designated approximately 110 dredged material ocean disposal sites, and approximately 65 million cubic yards per year are disposed of in the oceans annually.

Discharges through pipelines or from stationary drilling platforms and disposal in estuaries are covered under the Clean Water Act.

Marine Protection, Research and Sancturies Act -- Title III National Marine Sanctuary Program

Table 11
National Marine Sanctuaries

Channel Islands, CA
Cordell Bank, CA
Fagatele Bay, American Samoa
Florida Keys, FL:
Key Largo and Looe Key
Flower Garden Banks, LA/TX
Gray's Reef, GA
Gulf of the Farallones, CA
Humpback Whale (Kaho'olawe Island), HI
Monitor, NC
Monterey Bay, CA
Stellwagen Bank, MA

The National Marine Sanctuary Program, established in 1972 by Title III of the Marine Protection, Research and Sanctuaries Act, is administered by the National Oceanic and Atmospheric Administration, including preparation of an Environmental Impact Statement, management plan and public comment. Under the Act, NOAA is charged with preserving and protecting marine areas that have special significance based on their "conservation, recreational, ecological, historic, research, educational, or aesthetic qualities."

To be designated a national sanctuary, an area must go through a detailed nomination and selection process administered by NOAA. If an area passes such review, the nomination is sent to the Secretary of Commerce for designation, subject to congressional approval. If part of the proposed national marine sanctuary contains state waters, that state's governor may disapprove the inclusion of any or all of those waters or

regulation within those waters in the national marine sanctuary. Designation of these sanctuaries can be extremely controversial, as many competing interests are involved.

As of 1992, there were 12 sanctuaries covering a total of 10,000 nautical miles (see Table 11 and Figure 10).

Ocean Dumping Ban Act (1988)

The Ocean Dumping Ban Act of 1988 amended the Marine Protection, Research and Sanctuaries Act, discussed above. Its primary purpose is to prohibit ocean dumping of sewage sludge and industrial wastes after December 31, 1991. Specifically, provisions include:

- no sewage sludge or industrial waste dumping after August 14, 1989, without an MPRSA permit and an enforcement or compliance agreement to terminate ocean dumping; and
- no dumping of sewage sludge or industrial waste after December 31, 1991.

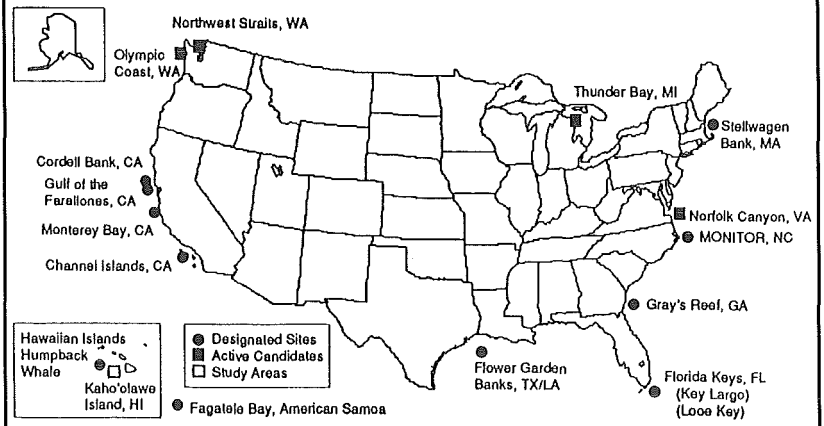
The Act further stipulates that there be no new dumpers of sewage sludge or industrial waste after the Act's starting date. EPA, the states and individual dumpers have been required to negotiate the agreements necessary to implement programs under this Act.

For the period of 1988 through 1991, the Act established a fee system for permitted dumping to help sewage authorities find alternative means of disposal. Initially, a large portion of ocean dumping fees of $77 million in 1989 and 1990 were turned back to dumpers to develop land-based sludge disposal alternatives. Some of the fees were used to support federal research, monitoring and surveillance of ocean dumping activities.

After the December 31, 1991, deadline, penalties were assessed beginning at $600 per dry ton and increasing over time. Those penalties in most cases were initially allocated to the municipality for use in developing land-based disposal alternatives.

When the Ocean Dumping Ban Act was first signed in 1988, nine municipalities were actively engaged in ocean dumping -- three in New York and six in New Jersey. Collectively, they dumped some 8.7 million wet tons of sludge each year. None of

Figure 10
National Marine Sanctuaries



Source: National Oceanic and Atmospheric Administration.

them currently is ocean-dumping, as each has met phase-out dates between March 1991 and June 1992. (The last industrial waste ocean disposal subject to the Ocean Dumping Ban Act ended in September 1988). As a result, ocean dumping of sewage sludge and industrial waste has been terminated.

Coastal Zone Management Act (1972)

The Coastal Zone Management Act (CZMA) provides for management of the nation's coastlines, including the Great Lakes, by balancing economic development with environmental preservation. Its goals are to "preserve, protect, develop, enhance, and restore where possible, the coastal resources." The federal government encourages states to exercise full authority over their coastal lands and waters.

The Act also provides for establishment of National Estuarine Research Reserves to serve as natural field laboratories for research and environmental education.

Coastal Zone Management Program

The Coastal Zone Management Act (CZMA) of 1972 encourages states to produce and enforce their own Coastal Zone Management Program consistent with the federal law and its goals. Under the law, the federal government provides financial assistance to states that produce CZM programs approved by the Secretary of Commerce.

Once the state program is accepted, the federal government is responsible for assuring that federal activities on the coast conform to the state program. States with approved plans may "veto" federal permits for activities that are inconsistent with the state's Coastal Zone Management Plan. This is a complex and disputed section of the law which involves the federal "consistency" requirement that mandates federal programs or actions be consistent with state federally approved CZM programs. In some cases, federal activities have clashed with state interests resulting in appeals to the Secretary of Commerce or even have gone to court for resolution.

The Secretary of Commerce, through NOAA, periodically evaluates state program performance, and Commerce can withhold federal funds for states not meeting federal standards.

Each state program at a minimum must provide for standards that address protecting natural resources and fish and wildlife, managing coastal development, providing public access to the coast for recreational purposes, and including public and local government participation in coastal management decisionmaking.

States must submit CZM programs to NOAA for approval in order to receive federal funds to implement their programs. The programs designate the boundaries of the coastal zone, prioritize land and water uses, and identify critical areas of concern and legislation concerning the coast. Environmental, economic, social, and cultural aspects of the zone are considered, and the programs and their annual implementation plans must identify problems and propose solutions.

The state CZMA programs have included efforts to improve governmental decision-making including expediting and simplifying permit reviews and improving information resources and public participation. The Act was intended primarily to change how federal, state and local agencies and officials manage these resources and allocate them among competing users.

CZMA funds have also helped to establish setback lines and erosion protection efforts, protect marshes, clean up beaches, rebuild fishing piers, revitalize waterfronts, improve public access to beaches, and increase tourism benefits to local communities.

Thirty-six (36) states and territories are eligible to participate in the CZM program, which includes the shoreline of the Great Lakes. By early 1992, 29 states had created approved programs covering more than 95 percent of the country's coastline. Georgia, Indiana, Minnesota, Ohio, and Texas are developing CZM programs. Illinois and Palau (South Pacific) were not pursuing development as of late 1992.

Coastal Nonpoint Pollution Control Program

In 1990, Congress passed the Coastal Zone Act Reauthorization Amendments adding a section designed to reduce nonpoint source pollution of coastal waters. Section 6217 requires states that have Coastal Zone Management Programs to develop and implement Coastal Nonpoint Pollution Control Programs.

Each state's nonpoint program must be designed with two tiers. The first tier is to develop technology-based management measures which reflect the best available technology for nonpoint sources. These state measures must be "in conformity with" guidance established by EPA for nonpoint pollution sources.

Note: The statute will be tested over the next few years as federal agencies interpret it, and state agencies put it into operation. Just how and what kind of programs states create over the next few years, and how effectively they carry them out, will be a fresh story worth following.

These first tier management measures should address certain nonpoint pollution sources, such as agricultural runoff, urban runoff, shoreline erosion, and marinas. Management measures in this first tier should address protection of wetlands, riparian habitats, and treatment systems (i.e., filter strips and constructed wetlands).

If, after applying the management measures in the first tier, a state is unable to meet coastal water quality standards and properly protect certain coastal areas, it next must implement a

second tier of more stringent management measures adequate to meet water quality objectives in those areas.

State programs must be submitted to NOAA and EPA for review and approval. If a state does not submit a program, a portion of Coastal Zone Management Program funding and funding under Section 319 of the Clean Water Act would be reduced.

Marine Mammal Protection Act (1972)

This Act places a moratorium on the taking and importing of marine mammals and their products for any purpose other than scientific research or public display. The term "take" means to harass, hunt, capture, or kill any marine mammal.

The Secretary of Commerce may grant exceptions to the taking and importing prohibition; e.g., a particular exemption is granted to coastal Alaskan natives based on historical practice. The Act also prohibits imports of fish caught with gear which causes incidental death or injury to marine mammals.

As part of the requirements of the 1988 Act's amendments, NOAA submitted plans to Congress in 1992 on a solution for marine mammal/fishery conflicts.

Administration of the Act is divided between NOAA's National Marine Fisheries Service (NMFS) and the Interior Department's Fish and Wildlife Service (FWS). NMFS is responsible for seals, sea lions, porpoises, and whales, while the FWS is responsible for sea otters, polar bears, walruses, and manatees.

The Act also establishes a three-member Marine Mammal Commission to review existing activities to protect marine mammals, undertake studies, and recommend appropriate policies to protect and conserve marine mammals.

Great Lakes Water Quality Agreements (1972 & 1978)

The Great Lakes Water Quality Agreements between the U.S. and Canada establish common water quality objectives and establish processes for control of pollution, research on Great Lakes problems, and surveillance and monitoring and information dissemination.

Canada and the U.S. agreed to develop a systematic and

comprehensive approach to control pollution, abate contamination and restore beneficial uses of the waters. The International Joint Commission, originally established under the Boundary Waters Treaty of 1909, advises both governments on issues affecting the Great Lakes and recommends action; the parties evaluate progress. (Some critics contend that the IJC has no real enforcement authority and that the Great Lakes Water Quality Agreements need to be modified into a formal treaty with the force of law.)

The 1978 Agreement expanded the scope and approach to cover the whole ecosystem, including atmospheric deposition and reintroduced residuals from past pollution, rather than focusing only on the water, as had the 1972 Agreement. In calling for target loadings for phosphorus, the 1978 Agreement acknowledged the concept of mass balance into Great Lakes management. A target loading is the level judged not to cause undesirable effects, including over-production of algae and anoxic conditions on lake bottoms. Mass balances are used to calculate the amount of pollutant that remains active after all sources and losses are considered.

The 1978 Agreement also calls for elimination of most discharges of persistent toxic chemicals.

International Convention for the Prevention of Pollution From Ships (1973 & 1978)

The 1973 International Convention for the Prevention of Pollution From Ships, known as MARPOL (for marine pollution), did not go into effect until 1983 after several modifications. Its intent is to end "the deliberate, negligent or accidental release of ... harmful substances from ships" and to "achieve the complete elimination of international pollution of the marine environment ... by harmful substances." It deals with wastes generated during the normal operations of vessels.

The Convention is under the auspices of the International Maritime Organization, a specialized agency of the United Nations established in 1959 and headquartered in London. Domestically, the U.S. Coast Guard was given authority to implement MARPOL through the Act to Prevent Pollution From Ships and the Ports and Waterways Safety Act.

MARPOL is organized into five annexes:

- Annex I concerns oil discharges from ships, including restrictions on light refined oil. It disallows discharges of all oil within 50 miles of land and disallows discharges into the Mediterranean, Red, Black, and Baltic seas and the Persian Gulf.
- Annex II aims to prevent pollution from dry noxious or liquid substances. Ships are required to keep a cargo record book and have an International Pollution Prevention Certificate aboard. These certificates are issued by the country of registry.
- Annex III deals with containerized or packaged harmful substances.
- Annex IV governs disposal of both treated and untreated shipboard sewage, setting limits on how far from shore each may be discharged.
- Annex V is concerned with ship-generated garbage, including a prohibition on disposal of plastics into the sea. By mid-1992, 39 countries had agreed to this Annex, which took effect on December 31, 1988.

Fisheries Conservation and Management Act of 1976 (Magnuson Act)

Known informally as the "Magnuson Act" after its primary Senate sponsor, this law provides for the conservation and management of all fishery resources within the U.S. Exclusive Economic Zone (EEZ). It also provides for fishery management authority over EEZ resources and anadromous species beyond the EEZ, except when they are found within a foreign nation's territorial sea or fishery conservation zone (or equivalent), to the extent that such sea or zone is recognized by the United States.

Under the Magnuson Act, the U.S. Department of State, with cooperation from the National Oceanic and Atmospheric Administration, negotiates Governing International Fishery Agreements (GIFA) with foreign nations wanting to fish within the EEZ. Those agreements are subject to presidential and congressional review.

Vessels of nations which have a GIFA with the U.S. may fish in the EEZ for species managed under the Act after receiving an

allocation of that species and a valid fishing permit. After a GIFA is in force, a foreign nation must submit a permit application to the State Department for each vessel to fish in the EEZ or conduct any other operation in the EEZ related to fishing. The State Department provides copies of the applications to the Congress, Coast Guard, appropriate Regional Fishery Management Councils, and to NOAA's National Marine Fisheries Service, along with recommendations.

NMFS reviews recommendations and, after consulting with the State Department and Coast Guard, may approve an application in whole or in part. Any conditions or restrictions are sent to the foreign nation through the State Department and must be accepted by the nation before a permit is issued. Various permit, poundage and observer fees are charged to the foreign nations. The total allowable level of foreign fishing (TALFF), if any, for any fishery subject to the exclusive fishery management authority of the U.S. is that portion of the optimum yield of such fishery that will not be harvested by vessels of the United States.

The Act also establishes eight Regional Fishery Management Councils charged with preparing Fishery Management Plans (FMPs) for their regions. These plans are to prevent overfishing, while allowing for maximum harvesting of fish based upon the best scientific information available. The plans are submitted to the Secretary of Commerce for approval and implementation. The NMFS and Coast Guard enforce the law and regulations.

More than 30 fishery management plans are in place for species such as Atlantic salmon, American lobster and Pacific groundfish.

Endangered Species Act (1973)

This law is intended to protect endangered or threatened species by requiring all federal agencies and their permittees and licensees to ensure that their actions not jeopardize these species or damage their critical habitats. It is administered by the Department of the Interior, through its Fish and Wildlife Service, and by the Department of Commerce, through NMFS, in consultation with other federal agencies.

The Secretaries of the Interior and Commerce are required to make a public list of all threatened species and review it every

five years to determine if any species can be removed or changed in status. The Act also prohibits imports and exports of endangered species and the taking of any endangered species within the territorial sea or on the high seas.

The law authorizes civil and criminal penalties and gives federal and state agencies enforcement authority. If any prospective agency action may harm a threatened or endangered species or its habitat, the Secretary of Commerce or the Secretary of the Interior must be consulted, depending on jurisdictional authority. The Secretary then must determine whether the proposed action will jeopardize the species or critical habitat, what the impact would be, reasonable and prudent measures to minimize impacts, and terms and conditions to minimize impacts. Taking of an endangered species is prohibited, except in certain limited situations (see Chapter 4, Table 8, for a list of marine endangered species).

Note: Reauthorization of the Endangered Species Act is expected in 1993 or 1994. Some timber, mining, commercial fishing, and other development interests want to weaken the Act. Proponents say it is underfunded and that too many species languish waiting for action.

Oil Pollution Control Act (1990)

In response to the Exxon *Valdez* oil spill of March 1989, Congress enacted the Oil Pollution Control Act of 1990.

The law combines various oil spill response mechanisms from the Clean Water Act, the Deepwater Port Act of 1974, the Trans-Alaska Pipeline Act, and the Outer Continental Shelf Lands Act and seeks to harmonize them with state laws, international conventions and the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA or Superfund).

The Act addresses all oil discharges to navigable waters and shorelines. It raises liability limits for vessels where gross negligence or willful misconduct is involved, and it expands cleanup and economic damage collections. It creates a $1 billion Oil Spill Liability Trust Fund to pay for removal costs and

> ***"The Valdez spill, with its dramatic television footage of a huge and grotesque environmental disaster, was the `Pearl Harbor' of the U.S. environmental movement."***
>
> *Attorney Russel V. Randle*
> *The Oil Pollution Deskbook.*

damages if the government is unable to collect clean-up costs from the liable party. The Fund -- much higher than other previously authorized funds for such purposes -- is supported by a five--cent-per-barrel fee on the industry.

The law authorizes the federal government to order or conduct removal actions; strengthens prevention control requirements for vessels and facilities; and provides for tougher criminal penalties and higher civil penalties for spills. The law also imposes tighter standards and reviews for licensing of tank vessel personnel, making it easier to suspend, revoke or terminate such licenses.

The law requires the phasing-out of single-hulled tank vessels, to be replaced by double-hulled vessels. All new (and some existing) oil tankers and barges operating in U.S. waters are required to have double hulls. New vessels of less than 5,000 gross tons, such as inland barges, must have some form of double containment though not necessarily double hulls.

The 1990 Oil Pollution Control Act also provides for emergency response planning. It mandates the Coast Guard to establish a National Response Unit and smaller response units for each of the 10 Coast Guard districts to coordinate equipment used in spill cleanup. The law requires EPA and the Coast Guard to oversee creation of contingency plans for specific areas to deal with worst-case scenario oil spills.

The National Contingency Plan (NCP), a series of regulations under the Act, provides a method of ranking waste sites for inventory and cleanup. In addition, the NCP suggests techniques for cleanup and coordinates intergovernmental cleanup activities. States played an active role in developing contingency plans, including natural resource recovery plans.

Comprehensive Environmental Response, Compensation and Liability Act of 1980, as Amended (Superfund)

Emergency Response Programs

The basic purpose of this statute is to respond to past releases of hazardous substances into the air, water or land. If no responsible party takes appropriate removal and remedial actions, EPA can order it to do so. If it still does not respond, EPA can use federal funds to do the necessary work and then recover expenses from responsible parties at a particular site. If there is no "potentially responsible party" (PRP), the cleanup costs come from Superfund.

EPA and the Coast Guard share responsibilities for responding to emergencies such as oil or hazardous chemical spills in coastal waters. The Coast Guard investigates spill reports and determines potentially responsible parties for penalties and liability assessment. The Coast Guard also monitors or supervises these cleanups. It is usually the first agency contacted about a marine spill, and it is responsible for notifying other federal, state and local agencies. It also supports regional and national emergency response teams and develops and maintains chemical assessment databases.

See Table 12, Key Federal Authorities and Programs, on the following pages.

Table 12
Key Federal Authorities and Programs

U.S. Environmental Protection Agency

Scope	Legislative Authority	Major Programs
Protect, maintain, restore and enhance water quality	Clean Water Act (P.L. 92-500) 33 U.S.C. 1251 et. seq.	1. National Estuary Program 2. Discharge permits (NPDES) program 3. Oil and hazardous substance spill 4. Toxic (priority) pollutant and pretreatment program 5. Ocean discharge criteria 6. Nonpoint source control program 7. Chesapeake Bay Program 8. Combined sewer overflow in estuaries 9. Individual control strategies for toxic pollutants 10. Contaminated sediment strategy 11. Gulf of Mexico Program 12. Great Lakes Program 13. Section 404 dredged and fill material permits (jointly implemented with the Corps)
Regulate ocean dumping	Marine Protection, Research & Sanctuaries Act (MPRSA) (P.L.92-532) 33 U.S.C. 1401 et. seq.	1. Establish environmental criteria for evaluation of permit applications 2. Site designation of ocean dumpsites for wastes and dredged material 3. Review of U.S. Army Corps of Engineers' permits for dredged material ocean dumping
Regulate the introduction into commerce of new hazardous chemical substances and mixtures; avoidance of unreasonable risk of injury to health or environment	Toxic Substances Control Act (TSCA) (P.L. 94-469) 15 U.S.C. 2601	1. Regulation of hazardous chemical substances and mixtures 2. Health and environmental data on toxic substances 3. Regulation of PCBs
Regulate pesticide chemicals	Federal Insecticide, Fungicide and Rodenticide Act (FIFRA) (P.L. 92-516) 7 U.S.C. 136 et. seq.	1. Deny or cancel registrations of pesticides whose use would/does cause fish contamination 2. Collect data on pesticides that may be causing fish contamination 3. Set "action levels" or "tolerances" for unavoidable pesticide contaminants in fish and shellfish
Protect coastal waters from litter and pollution	Shore Protection Act of 1988 (P.L. 100-688) 33 U.S.C. 1401 et. seq.	Regulate waste-handling practices by waste sources, vessels and receiving facilities to minimize deposition of waste into coastal water

Table 12 (Continued)
Key Federal Authorities and Programs

EPA (Continued)

Protect coastal waters from nonpoint source pollution	Coastal Zone Act Reauthorization Amendments of 1990 (P.L. 101-508) 16 U.S.C. 1455b	Nonpoint source pollution controls (jointly implemented with NOAA)
Environmental impacts of proposed federal projects and activities	National Environmental Policy Act, 1969	Requires submission of environmental impact statement for all major federal actions that may significantly affect the quality of the human environment

Table 12 (Continued)
Key Federal Authorities and Programs

U.S. Fish & Wildlife Service

Scope	Legislative Authority	Major Programs
Natural resource trustee for: migratory birds; anadromous & interjurisdictional fish, endangered species, & marine mammals; and certain federally managed water resources	Comprehensive Environmental Response, Compensation and Liability Act (CERCLA or Superfund) (P.L.96-510), 42 U.S.C. 9607(1), 9601(16)	1. Natural Resources Damage Assessment Program CERCLA, Section 107(1), CWA Section 311(0)
	Clean Water Act (P.L. 92-500), 33 U.S.C. 1321 (1 X 5)	2. Remedial Action Program, CERCLA Section 104
Land and water conservation	Land and Water Conservation Fund Act (P.L. 88-578), 16 U.S.C. 4601-4 - 4601-11	1. Establishment of fund to acquire land or waters, or interests in land or waters to promote outdoor recreation opportunities
Coastal barrier islands	Coastal Barrier Resources Act of 1962 (P.L. 97-348), 16 U.S.C. 3501-3510	1. Establishment of coastal barrier resources system 2. Coverage of undeveloped coastal barriers, including associated aquatic habitats 3. Restriction of federally subsidized development of underdeveloped coastal barriers along the Atlantic and Gulf Coasts
Threatened and endangered species and their critical habitat	Endangered Species Act of 1973 (P.L. 93-205) 16 U.S.C. 1531-1543	Any action authorized, funded or carried out by any federal agency should not be likely to jeopardize continued existence of any endangered or threatened species or result in the destruction or adverse modification of habitat critical to such species
Estuarine areas	Estuary Protection Act (P.L. 90-454), 16. U.S.C. 1221 et seq.	Conservation of estuarine areas
Marine mammals	Marine Mammal Protection Act of 1972 (P.L.92-522)	Prohibition or strict regulation of the direct or indirect taking or importation of marine mammals
Migratory birds	Migratory Bird Hunting and Conservation Stamp Act (P.L. 85-585),	Use of hunting stamp funds for acquisition of bird refuges and waterfowl production areas
	Migratory Bird Conservation Act (P.L. 87-812) 16 U.S.C. 715-715s	Acquisition of areas for the management and protection of migratory birds
	Migratory Bird Treaty Act (P.L. 86-732) 16 U.S.C. 701-711	Prohibitions against the taking of migratory birds protected under treaties with Great Britain, Mexico and Japan
Fish and wildlife conservation	Fish and Wildlife Coordination Act of 1958 (P.L. 85-624) 16 U.S.C. 661- 666c.	Consultation when federal agency or federal permittee proposes to modify a body of water

Table 12 (Continued)
Key Federal Authorities and Programs

F&WS (Continued)

	Fish and Wildlife Conservation Act 2901 et seq.	Conservation and promotion of nongame fish and wildlife and their habitats, including grants to states
	Fish Restoration and Management Projects Act (P.L. 91-503) 16 U.S.C.777-7771.	Funding of state programs for the restoration and management of fishery resources
	National Wildlife Refuge System Administration Act (P.L. 91-135) 16 U.S.C. 668dd.	Resources management programs for fish and wildlife habitat; acquire lands and waters for purposes of fish and wildlife conservation
	Federal Water Project Recreation Act (P.L. 94-576) 16 U.S.C. 460	Provides federal funds for fish and wildlife enhancement and land acquisition for these same purposes in conjuctions with Federal water development projects
	Fish and Wildlife Act of 1956 as amended, 16 U.S.C. 742a-j	Establishes a comprehensive national fish, shellfish and wildlife resources policy emphasizing commercial fishing industry (Transferred from FWS to NOAA responsibilities for commercial and marine sportfish, except for the Great Lakes)
	Great Lakes Fish and Wildlife Restoration Act of 1990	Undertake studies and develop restoration strategies for fish and wildlife of the Great Lakes
	Sikes Act (16 U.S.C. 670 a-o)	Provides for planning, development and maintenance of fish and wildlife on military lands
Control of nonindigenous aquatic species	Nonindigenous Aquatic Nuisance Species Prevention and Control Act	Established a broad federal program to prevent introduction and control the spread of introduced aquatic nuisance species (jointly administered with NOAA, EPA, COE and U.S. Coast Guard)
Anadromous Fish	Anadromous Fish Conservation Act of 1965 (P.L.98-304)	Conservation, development and enhancement of anadromous fishery resources
	Atlantic Striped Bass Conservation Act	Evaluate population status and determine need for moratorium on take
	New England Fishery Resources Restoration Act of 1990 (P.L.101-593)	Cooperative programs to restore and maintain nationally significant and interjurisdictional fishes of New England river systems
	Klamath River Basin Fishery Resources Restoration Act (P.L. 99-552)	Establishes a 20-year program to restore and maintain anadromous fish population of the Klamath River Basin
	Trinity River Basin Fish and Wildlife Restoration (P.L. 98-541)	Restore fish and wildlife populations damaged as a result of the construction of Trinity Dam
	Mitchell Act (16 U.S.C. 755-757)	Funding for salmon smolt production in national fish hatcheries in the Columbia River Basin

Table 12 (Continued)
Key Federal Authorities and Programs

F&WS (Continued)

Wetlands conservation	North American Wetlands Conservation Act (P.L. 101-233)	1. Funding for purchase of critical wetlands in the U.S., Canada and Mexico 2. Matching funds for wetlands conservation projects in North America
	Coastal Wetlands Planning, Protection and Restoration Act of 1990, Title III (P.L. 101-646), 16 U.S.C. 3951 et. seq.	Wetlands conservation and planning in U.S. coastal areas State grants for wetlands conservation
Protect anadromous fish and wetlands in California	Omnibus Water Reclamation Act of 1992, Title 34	Provides opportunity for restoring anadromous fish and wetlands in conjunction with Bureau of Reclamation Projects

Minerals Management Service

Scope	Legislative Authority	Major Programs
Outer Continental Shelf	Outer Continental Shelf Lands Act	Manages the outer continental shelf including leasing to private companies for oil and gas exploration and development

Table 12 (Continued)
Key Federal Authorities and Programs

National Oceanic and Atmospheric Administration

Scope	Legislative Authority	Major Programs
Natural resource trustee for marine fishery resources and supporting ecosystems; anadromous fish; certain endangered species and marine mammals; National Marine Sanctuaries; and Estuarine Research Reserves	Comprehensive Environmental Response, Compensation and Liability Act (CERCLA or Superfund) (P.L.96-510) 42 U.S.C.9607(1), 9601 (16) Clean Water Act (P.L. 92-500) 33 U.S.C. 13221(1)(5)	1. Natural Resources Damage Assessment Program 2. Remedial Action Program
Marine mammals	Marine Mammal Protection Act of 1972 (P.L.92-522) 16 U.S.C. 1361 et seq.	Prohibition or strict regulation of the direct or indirect taking or importation of marine mammals
	Fur Seal Act of 1966 (P.L.89-702) 16 U.S.C. 1151 et. seq.	Prohibition of the taking of fur seals on lands or waters under U.S. jurisdiction
	Whale Conservation and Protection Study Act (P.L.94-532)	
Anadromous fish	Anadromous Fish Conservation Act of 1965 (P.L. 89-304) 16 U.S.C.757a-757g	Conservation, development and enhancement of anadromous fishery resources
	Salmon and Steelhead Conservation and Enhancement 16 U.S.C. 3301-3345	Management and enhancement of salmon and steelhead stocks
	Atlantic Striped Bass Conservation Act	Evaluate population status and determine need for a moratorium on take
Threatened and endangered species and their critical habitats	Endangered Species Act of 1973 (P.L.93-205) 16 U.S.C.1531 et seq.	Insures that any action authorized, funded or carried out by any federal agency is not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or modification of habitat critical to such species
Marine fisheries	Magnuson Fishery Conservation and Management Act of 1976 (P.L. 94-265) 16 U.S.C. 1802 et seq	Conservation of fish stocks throughout a 200-mile U.S. Fishery Conservation Zone through the development of Fishery Management Plans by 8 Regional Fishery Management Councils
	Interjurisdictional Fisheries Act (P.L.99-659) 16 U.S.C.4101-4107	Promote and encourage management of interjurisdictional fishery resources throughout their range
	North Pacific Fisheries Act of 1954 (P.L.85-114) 16 U.S.C. 1021-1032	Enforcement of International Convention for the High Seas Fisheries of the North Pacific Ocean

Table 12 (Continued)
Key Federal Authorities and Programs

	North Pacific Halibut Act of 1982 16 U.S.C. 772-773k	Enforcement of the Convention Between the U.S. and Canada for the Preservation of the Halibut Fishery of the Northern Pacific Ocean and Bering Sea
Marine sanctuaries	Marine Protection, Research and Sanctuaries Act (Title III) (P.L. 92-532) 16 U.S.C. 1431-1439	National Marine Sanctuary Program - manage designated marine areas which are special due to their natural or human use values
Management of coastal activities and protection of coastal natural resources, including wetlands, floodplains, estuaries beaches, dunes, barrier islands, coral reefs, fish and wildlife and their habitat, and national estuarine research reserves	Coastal Zone Management Act of 1972 (P.L.92-583) 16 U.S.C. 1451 et. seq.	1. Coastal Zone Management grants 2. Review and approval of state CZMPs 3. Federal consistency determination 4. Review of state performance 5. Natural Estuarine Reserve Program 6. Nonpoint source pollution control program 7. 6217 provisions - 1990 Reauthorization Amendments
Deep seabed minerals	Deep Seabed Hard Minerals Resources Act (P.L.96-283)	Licenses consortia for the mining of hard minerals beyond the continental shelf
Ocean thermal energy	Ocean Thermal Energy Conversion Act (P.L. 96-326)	Licenses the construction and operation of ocean thermal energy conversion plants

Table 12 (Continued)
Key Federal Authorities and Programs

U.S. Department of Transportation

Scope	Legislative Authority	Major Programs
Conserve marine life, wetland protection/ restoration	Reefs for Marine Life Conservation (P.L. 92-402); National Fishing Enhancement Act of 1964 (P.L.98-623)	Use of obsolete ships as artificial reefs for the conservation of marine life
	Intermodal Surface Transportation Efficiency (ISTEA) (P.L. 102-240)	Allows state transportation agencies to contribute highway funds to wetland conservation and mitigation efforts and wetland mitigation banks
	Oil Pollution Act of 1990	Project mitigation
	Rivers and Harbors Act of 1899	1. Transportation enhancement activities 2. Respond to marine pollution
	Act to Prevent Pollution From Ships	Control discharges of operational wastes from ships
	Federal Water Pollution Control Act of 1972	1. Promulgate and enforce comprehensive shipboard and waterfront facilities pollution prevention regulations 2. All transportation-related on-shore facilities (tank trucks, rail cars and pipelines) are required to have response plans and discharge removal equipment for responding to oil spills
	Ports and Waterways Safety Act of 1972	1. Finance cleanup operations from Federal Trust Fund 2. Develop new preventative and contingency planning requirements for oil pollution
	Department of Transportation Act	Section 4(f) provides that the DOT may approve use of a publicly owned park, recreation area, wildlife or waterfowl refuge or any historic site only if there is no feasible alternative and if all possible planning to minimize harm is done
	Airport and Airway Improvement Act, as amended	Provides that grants for airport development may not be approved unless certain conditions and environmental standards are met
	Hazardous Materials Transportation and Uniform Safety Act and Hazardous Materials Transportation Act	1. Regulates transportation of hazardous materials 2. Impose standards on states for setting hazardous materials transportation routes 3. Train local officials on response to hazardous materials transportation incidents

Table 12 (Continued)
Key Federal Authorities and Programs

U.S. Army Corps of Engineers

Scope	Legislative Authority	Major Programs
Wetlands	Clean Water Act (P.L. 92-500)	Section 404 dredged and fill materials permits (Jointly implemented with EPA)
	Coastal Wetlands Planning, Protection and Restoration Act	Authority to create wetlands across the U.S. and specifically in Louisiana
Environmental restoration	Water Resources Development Act - Section 1135 (1986)	1. Modification of existing projects or operations for environmental improvement
	- Section 704 (1986)	2. Authorizes development projects for environmental purposes
	- Section 204 (1992)	3. Authorizes the use of dredged material for beneficial uses
Environmental protection	Water Resources Development Act - Section 306 (1990)	Authorizes the protection of the environment as a major mission of the Corps of Engineers
Wetlands conservation	Water Resources Development Act of 1976 (P.L. 94-587) 42 U.S.C. 1962d-5f	Authority to utilize dredged material for wetlands creation (Section 150)
Avoiding obstructions to navigation	River and Harbors Appropriation Act of 1899, 33 U.S.C. 401	Regulation of construction activities in and adjoining navigable waters which alter the course, condition, location, or capacity of such waters
Regulation of dredged materials ocean dumping	Marine Protection Research and Sanctuaries Act - (P.L. 92-532) 33 U.S.C 1401 et seq.	1. Issuance of ocean dumping permits subject to environmental criteria (Section 103)
Fish and wildlife mitigation	Water Resources Development Act of 1986 (P.L. 99-622), 33 U.S.C. 2201-2283	Mitigation of fish and wildlife losses associated with authorized water resources projects, including the acquisition of lands or interests in lands
	Fish and Wildlife Coordination Act of 1958 (P.L. 85-624), 16 U.S.C. 661-666c.	Consultation with U.S. Fish and Wildlife Service and mitigation and enhancement of fish and wildlife resources
Navigable waters	Rivers and Harbors Act of 1899 Section 10 and 13	Navigable water structure permits

Table 12 (Continued)
Key Federal Authorities and Programs

Department of Agriculture

Scope	Legislative Authority	Major Program
Control of pollution of surface waters due to agriculture runoff	Department of Agriculture Organic Act 16 U.S.C. 500 et seq. Water Quality Initiative Food, Agriculture, Conservation and Trade Act of 1990 (FACTA)	1. Nonpoint Source Contaminants Research 2. Habitat Modification Program (mitigation of adverse effects of land management activities) 3. Point Source Contamination Program (investigation of chemicals in bottom sediment) 4. Watershed projects to enhance water quality 5. Watershed Protection & Flood Prevention Program 6. Rural Abandoned Mine Program 7. Agriculture Conservation Program 8. Water Bank Program 9. Great Plains Conservation Program
Wetlands Protection	Water Bank Act (p.L. 91-559) 16 U.S.C. 1301-11, 150&03	Preserve, restore and improve wetlands, conservation assessments
	Food Security Act of 1985 (P.L. 99-196) 16 U.S.C. 3801 et seq.	1. Wetlands conservation program 2. Conservation compliance 3. Conservation reserve 4. Sodbuster 5. Swampbuster
	Food, Agriculture, Conservation and Trade Act of 1990 (FACTA)	1. Wetlands Reserve Program 2. Water Quality Incentives Program

Table 12 (Continued)
Key Federal Authorities and Programs

Department of Health & Human Services
Food & Drug Administration

Scope	Legislative Authority	Major Program
Healthfulness of fish and shellfish marketed in interstate commerce	Federal Food, Drug and Cosmetic Act 21 U.S.C. 301-392	1. Set standards of quality for foods, including seafood 2. Set "action levels" and "tolerances" for unavoidable contaminants in foods, including seafood
	Pubic Health Service Act 42 U.S.C. 201 et seq.	1. Federal assistance to states in preventing the interstate transmission of disease 2. Interstate Shellfish Sanitation Program
	Anadromous Fish Conservation Act (P.L. 89-304) 16 U.S.C. 7571	Enforcement action to eliminate or reduce polluting substances detrimental to fish and wildlife in interstate or navigable waters

Table 13
Key Resources-Specific Programs

Resource	Legislative Program	Lead Agency	Regulatory	Funding	Acquisition	Research/ Monitoring	Management
Fish	Anadromous Fish Conservation Act	NOAA, FWS	•	•	•	•	•
	Salmon & Steelhead Conservation & Enhancement Act	NOAA, FWS			•	•	•
	North Pacific Fisheries Act of 1964	NOAA					•
	North Pacific Habitat Act of 1982	NOAA					•
	Magnuson Fishery Conservation & Management Act	NOAA	•	•			•
	National Fishing Enhancement of 1964	DOT					•
	Interjurisdictional Fisheries Act	NOAA		•			•
	Fish Restoration and Management Project Act	FWS		•			•
	Atlantic Salmon Conservation Act of 1982	NOAA	•				•
	Atlantic Striped Bass Conservation Act	FWS, NOAA		•		•	
	Atlantic Tunas Conservation Act of 1975	State Dept., NOAA	•				•
	Tunas Conventions Act of 1950,	State Dept., NOAA	•				•
	Central Western & South Pacific Fisheries Development Act	NOAA		•		•	•
	Commercial Fisheries Research & Development Act	NOAA		•		•	
	National Fish and Wildlife Foundation Establishment Act	FWS			•		•
	Pacific Salmon Treaty Act of 1985	State Dept. NOAA, FWS	•				•
	New England Fishery Resources Restoration Act	FWS				•	•
	Mitchell Act	NOAA, FWS				•	•
	Klamath River Basin Fishery Resources Restoration Act	FWS		•	•	•	•
Shellfish	National Shellfish Sanitation Program	FDA	•			•	•
Mammals	Marine Mammal Protection Act	NOAA, FWS	•	•		•	
	Fur Seal Act	NOAA	•			•	
	Whale Conservation and Protection Study Act	NOAA				•	
Waterfowl and Other Birds	Migratory Bird Conservation	FWS			•		•
	Migratory Bird Treaty Act	FWS		•	•		•
	Migratory Bird Hunting and Conservation Stamp Act	FWS		•	•		•

Table 13 (Continued)
Key Resources-Specific Programs

Resource	Legislative Program	Lead Agency	Regulatory	Funding	Acquisition	Research/ Monitoring	Management
Wetlands	North American Wetlands Conservation Act	FWS		•	•		
	Water Resources Development Act	COE			•		
	Water Bank Act	USDA		•	•		•
	Food Security Act of 1985	USDA		•			
	Clean Water Act (Section 404)	EPA, COE	•				
	Coastal Wetlands Planning, Protection & Restoration Act	USFWS		•			•
	Food, Agriculture, Conservation and Trade Act	USDA	•	•			•
Watersheds	Food, Agriculture, Conservation and Trade Act	USDA	•	•			•
Estuarine	Clean Water Act (National Estuary Program)	EPA		•		•	•
	Coastal Zone Management Act (National Estuarine Research Reserve System)	NOAA		•	•	•	•
	Estuary Protection Act	FWS		•	•	•	•
	Coastal Wetlands Planning, Protection & Restoration Act	FWS		•	•	•	
Barrier Islands	Coastal Barrier Resources Act	FWS	•				•
Marine Sanctuaries	Marine Protection, Research, and Sanctuaries Act	NOAA	•	•		•	•
Deep Seabed Hard Minerals	Deep Seabed Hard Minerals Resources Act	NOAA	•			•	
Water Quality	Clean Water Act	EPA	•	•		•	
Fish and Wildlife	Fish and Wildlife Act of 1956	FWS				•	•
	Great Lakes Fish and Wildlife Restoration Act	FWS				•	•
	Nonindigenous Aquatic Nuisance Species Prevention and Control Act	FWS, NOAA		•		•	•
	National Wildlife Refuge System Administration Act	FWS	•		•	•	•
	Federal Water Project Recreation Act	FWS		•	•	•	•
	Fish and Wildlife Coordination Act	FWS				•	•
	Sikes Act	FWS, DOD		•		•	•
	Trinity River Basin Fish and Wildlife Restoration Act	FWS		•	•	•	•

Table 14
Broad Regulatory and Resources Management Programs

Resource	Legislative Program	Lead Agency	Regu-latory	Funding	Research/ Monitoring	Manage-ment
Surface waters, wetlands and aquatic biota	Clean Water Act	EPA, COE	•	•	•	•
		USDA	•		•	
Ocean waters and marine biota	Marine Protection, Research and Sanctuaries Act	EPA	•		•	
		NOAA	•	•	•	•
		COE	•		•	
Coastal Resources	Coastal Zone Management Act	NOAA	•	•		•
		EPA	•			
Coastal Barrier Resources	Coastal Barrier Improvement Act	USFWS	•			
Submerged lands and marine biota	Submerged Lands Act	MMS				•
Water and resources of the outer continental shelf	Outer Continental Shelf Lands Act	MMS				•
Endangered species and their critical habitat	Endangered Species Act	USFWS				
		NOAA	•	•	•	•
Fish and wildlife in their habitat	Fish and Wildlife Coordination Act	USFWS	•		•	•
		NOAA	•		•	•
Safety of commercially marketed fish and shellfish products	Food, Drug & Cosmetic Act	FDA	•			•
		NOAA			•	
		EPA	•			
Resources affected by federal activities	National Environmental Policy Act	EPA	•			•
		CEQ				
Environmental restoration activities	Water Resources Development Acts of 1986, 1988, 1990 & 1992	COE		•		•
		NOAA		•	•	
		DOI		•	•	•

Source: Coastal America, 1992

Appendix A
Additional Laws and Programs

Rivers and Harbors Act of 1899

This Act, administered by the Army Corps of Engineers, prohibits the building of bridges, causeways, dams, or dikes in any navigable waters without Corps approval. In addition, Section 13 of the law prohibits throwing, discharging or depositing any refuse matter, other than that flowing from streets and sewers and passing into a liquid state, into navigable waters or their tributaries.

This prohibition does not extend to operations for the improvement of navigation and the construction of public works. The law had given the Secretary of the Army authority to permit disposal into navigable waters, but with the creation of the National Pollutant Discharge Elimination System program of the Clean Water Act, the 1972 Federal Water Pollution Control Act provides Section 13 permits would no longer be issued.

Until passage of the 1972 Federal Water Pollution Control Act Amendments, the 1899 Rivers and Harbors Act had provided the primary federal basis for managing and regulating dredged and fill activities in wetlands.

Submerged Lands Act (1953)

Ownership of lands beneath navigable waters within the boundaries of the states and the right to develop these lands was established by the Submerged Lands Act. The lands beneath navigable waters are defined as lands within state boundaries that were navigable when the state became a member of the Union; lands periodically or permanently covered by tidal waters; or lands that were filled in or reclaimed lands which were formerly beneath navigable waters. The seaward boundary of each state was confirmed as a line three geographical miles from its coastline or, in the case of the Great Lakes, to the international boundary.

The federal government retained certain rights to use the

submerged lands for commerce, navigation, defense, and international affairs, but not the rights of ownership or management which were specifically granted in the Act.

Fish and Wildlife Coordination Act (as amended in 1958)

The Fish and Wildlife Coordination Act provides that the Fish and Wildlife Service review all proposed federal actions that may affect any stream, wetland or other body of water and to make recommendations for the conservation of fish and wildlife. The Service reviews both development and regulatory actions.

The Fish and Wildlife Service recommendations are to be "as specific as practicable with respect to features recommended for fish and wildlife conservation and development, lands to be utilized or acquired for such purposes, the results expected, and shall describe the damage to fish and wildlife attributable to the project and the measures proposed for mitigating or compensating for these damages."

The Act further requires the Fish and Wildlife Service to investigate the impact of water pollution on fish and wildlife including: 1) determining standards for water quality for maintenance of fish and wildlife; 2) studying methods of abating and preventing pollution and recovery of useful products; and 3) collecting and distributing data on the results of the investigations.

Land and Water Conservation Fund Act (1965)

This Act is intended to ensure that present and future generations be assured adequate outdoor recreational resources. The Act mandates that governments and private interests conserve, develop and use such resources for the benefit and enjoyment of the American people.

The Act authorizes the Land and Water Conservation Fund to be collected from surplus property sales, motorboat fuel taxes, certain revenues authorized from the Outer Continental Shelf Lands Act, and user fees at designated National Park system "units." It authorizes the Interior Department to acquire lands or allocate funds to states to carry out the Act.

Outer Continental Shelf Lands Act

The Outer Continental Shelf (OCS) or undersea land lying seaward and generally beyond the three-mile seaward boundaries of the states encompasses great oil and gas reserves. The federal government, which administers control through the Department of the Interior's Minerals Management Service (MMS), has exclusive jurisdiction of this subsoil and seabed, which it leases to private companies for exploration, drilling and production.

As of September 30, 1990, the OCS encompassed 1.4 billion acres, of which approximately 32 million acres were under lease to natural gas and oil development, exploration and production. Rents, royalties and other revenues from these lease activities are the source of billions of dollars to the U.S. Treasury and various funds.

The Outer Continental Shelf Lands Act requires the Interior Department to develop and maintain estimates of reserves and undiscovered resources in the OCS. It must assess the likely effects of gas and oil activities on marine, coastal and human environments. It administers competitive lease sales of offshore tracts and regulates OCS activities to ensure safety and environmental protection.

Activities which threaten to harm life or the environment may be suspended by the Secretary of the Interior, although no such action has yet been taken on the basis of potential environmental damage. Areas for oil and gas leases must undergo studies of environmental impacts on the human, marine and coastal environments of the OCS. Holders of leases and permits must operate in compliance with environmental protection regulations.

The law instructs the Coast Guard to inspect facilities and investigate major oil spills, fires, death, or serious injury. The law provides for penalties and remedies for violations.

Resource Conservation and Recovery Act (1976)

Just as Superfund is designed to clean up existing and abandoned hazardous waste sites, the Resource Conservation and Recovery Act (RCRA) is intended to prevent creation of new

threats to human health by improper hazardous waste disposal. The law establishes a "cradle-to-grave" system to track hazardous wastes from generation to final disposal.

New hazardous waste landfills must obtain a permit from the state or the U.S. Environmental Protection Agency, and existing landfills must meet minimum technology requirements. Amendments passed in 1984 add other requirements, including:

- controls on leaking underground storage tanks;
- encouragement for using alternative waste disposal methods such as waste reduction, recycling and resource recovery;
- new technology requirements for disposal methods such as incineration and resource recovery as well as landfills;
- identification of hazardous wastes so they can be disposed of separately from nonhazardous materials; and
- new public participation rights for citizen involvement in RCRA permits and the right to sue EPA for adequate enforcement of RCRA requirements.

Underground Storage Tank Provisions

Subtitle I of RCRA was intended to prevent ground water contamination from underground storage tanks. Under the law, underground storage tanks are required to have spill and overfill prevention devices and leak detection devices. The requirements are being phased in over several years.

Some states, including California and Florida, have much more stringent regulations requiring secondary containment of tanks and piping.

Medical Waste Provision

RCRA Subtitle J, the Medical Waste Tracking Act, was passed in 1988. The Act established a two-year demonstration tracking program as a first step in controlling irresponsible disposal of medical wastes. The demonstration program addressed institutional and commercial medical waste but not household or individual medical waste. The Act was passed in part because medical wastes along the shoreline caused numerous beach closings along the East Coast in the summer of 1988.

Toxic Substances Control Act (1976)

The Toxic Substances Control Act (TSCA) aims to regulate premanufacture production and distribution of chemicals that could threaten human health or the environment. It requires notification to EPA and testing of materials *before* they are introduced into interstate commerce.

It is important to know whether substances have been listed as toxic under TSCA. For more information about TSCA, call (800) 424-9065.

Outer Continental Shelf Lands Act Amendments of 1978

In 1978, Congress determined that the need for domestic energy production had become more crucial to national security. It amended the Outer Continental Shelf Lands Act Amendments to expedite Outer Continental Shelf exploration and development. Congress acted to develop these resources to make them available for energy needs; to balance that need with environmental protection; "to insure the public a fair and equitable return on the resources"; and "to preserve and maintain free enterprise competition."

The Act seeks to minimize or eliminate conflicts between oil and gas activities and fishing interests and establishes a fisherman's contingency fund to pay for damaged vessels and gear resulting from OCS activities.

The amendments also established the Offshore Oil Pollution Compensation Fund, which receives fees collected from OCS oil production for use in financing cleanup of oil spills and paying for damages to natural resources and property. Private vessel and offshore facility operators that cause oil pollution are liable for removal costs and damages.

Coastal Barriers Resources Act/ Improvement Act (1982)

This Act addresses coastal barrier islands of the Atlantic and Gulf coasts. It seeks to minimize the loss of human life and

reduce damage to fish and wildlife habitats of the coastal barrier islands by restricting federal expenditures and financial assistance which encourage development on those islands.

The law forbids the use of major types of federal funds such as loans, grants and insurance for promoting development and economic growth within certain areas of the fragile, unstable and vulnerable barrier islands coastal system. Flood insurance, Corps of Engineers development projects, Department of Veterans Affairs and Federal Housing Administration loans, and federal assistance for the construction of sewer systems, highways, water supply systems, airports, bridges, and jetties are no longer allowed in these areas.

The Act also requires federal agencies to consult with the Fish and Wildlife Service prior to the obligation of funding or performance of any activities within units of the system.

The Act establishes the Coastal Barrier Resources System, a network of undeveloped coastal barrier units, located along the coast from Maine to Texas, that are targeted for protection. Initially, the system included just under 453,000 acres of natural barriers. The U.S. Fish and Wildlife Service, the lead agency overseeing the system, has recommended expanding the system.

The Act is not designed to penalize existing communities, and it applies only to a specified group of largely undeveloped barrier islands. While Massachusetts, Florida and Texas have large areas protected, the states of Maryland, New Jersey and New Hampshire have none of their areas protected. (A large portion of Maryland's barriers, for example, already come under the protection of the National Park Service and The Nature Conservancy.)

The Act continues to allow federal assistance for certain purposes including energy exploration, extraction or transportation, military activities essential to national security, and Coast Guard facilities.

Safe Drinking Water Act (1984)

National standards for drinking water were required to be established under the Safe Drinking Water Act of 1984. The law is administered by states meeting federal requirements; some states have chosen to leave administration of this law to EPA.

Drinking water systems, like sewage treatment, are generally managed by local governments. The law requires two things for all community drinking water systems: 1) routine monitoring for several pollutants, and 2) compliance with minimum standards. EPA is required to set standards for 100 pollutants, including several toxic chemicals.

The law gives the public a major role in enforcement. The Safe Drinking Water Act requires public notification if standards are violated or monitoring requirements are not met. If the problems are not corrected, citizens have the right to sue for compliance.

Food, Agriculture, Conservation and Trade Act of 1990

The Food, Agriculture, Conservation and Trade Act (FACTA) of 1990, implemented primarily by the U.S. Department of Agriculture, reinforces and expands conservation provisions under the Food Security Act of 1985. It encourages the reduction of soil erosion, the retention of wetlands and protection of other environmentally sensitive cropland. Provisions include:

- *Conservation Reserve Program:* offers long-term rental payments and cost-share assistance to farm owners or operators to establish permanent vegetative cover for land that is highly erodible or contributing to a serious water quality problem. Under the 1985 Act, nearly 34 million acres have been enrolled. Because of reduced funding for fiscal 1993, no new areas can be designated.
- *Wetlands Reserve Program:* a voluntary USDA easement program to restore and protect wetlands.
- *Wetlands Conservation, or "Swampbuster":* discourages the alteration of wetlands for agricultural purposes.
- *Conservation Compliance:* discourages the production of crops on highly erodible cropland unless the land is protected from erosion under an approved conservation system.

Swampbuster: The wetland conservation provision commonly known as "swampbuster" was passed as part of the Food Security Act (FSA) of 1985 and amended by the Food,

Agriculture, Conservation and Trade Act (FACTA) of 1990. The "Swampbuster" program discourages the alteration of wetlands for agriculture purposes.

If wetlands are drained, dredged, filled, leveled, or otherwise altered to make possible the production of an agricultural commodity after November 28, 1990, or if an agricultural commodity is planted on a wetland that was converted after December 23, 1985, U.S. Department of Agriculture (USDA) program benefits generally will not be available. Programs subject to this provision include, but are not limited to, price and income supports, crop insurance, Farmers Home Administration loans, and programs under which USDA makes commodity-related payments.

Under FACTA, wetlands are defined as hydric soils that are covered by standing water or saturated for extended periods of the year and are capable of supporting aquatic plants. The Soil Conservation Service maintains a list of the kinds of combinations of soils and plants that define wetlands and that agency must determine if a proposed action is subject to the "Swampbuster" provision.

Fish and Wildlife Service Bay/Estuary Program

The Bay/Estuary Program is a national effort involving 23 bay and estuary areas along the U.S. coastline (see Table 10). Each of these watershed-based programs serves as a focal point for U.S. Fish and Wildlife Service activities within the program's geographic area. The overall goal of the Bay/Estuary Program and all Service coastal efforts is to "achieve a net gain of coastal fish and wildlife and the natural ecosystems that support them."

The Program's approach is to work in partnership with federal, state, international, native American and local agencies, non-governmental organizations, and the private sector to develop and implement ecosystem-based policies and programs that protect and enhance coastal living resources.

The emphasis of each Bay/Estuary program is data acquisition and advanced planning to: 1) avoid problems before they occur; 2) protect key habitats; 3) remediate contamination and pollution; and 4) restore important habitats that have been destroyed and enhance those that have been degraded.

Wetlands Grants Program

The Wetlands Grants Program, enacted as Title III of the Coastal Wetlands Planning, Protection and Restoration Act, was intended to help states and Indian tribes increase their knowledge about and develop wetlands protection programs. EPA began a program of "seed" grants in 1989 and the program has since expanded. Thirteen (13) proposals were funded in fiscal 1992 totaling $5.7 million.

The grants fund local efforts to collect basic information and data on wetlands resources, identify the threats to the resources, examine techniques for protecting the resources, create comprehensive wetlands protection plans, and conduct public education campaigns to promote wetlands protection. The program is administered by the Fish and Wildlife Service.

Legacy Resource Management Program

The Legacy Program was established as part of the Fiscal 1991 Department of Defense appropriation. Its purpose is to preserve, protect, list, and manage the sensitive and significant biological, geophysical, cultural, and historical resources on 25 million acres of Department of Defense land and to do so in a manner consistent with military requirements.

In its first year, the program undertook 90 projects in 37 states totaling $10 million. In 1992 the program expanded to $25 million, and in 1993 to $50 million.

Additional Federal Activities

Databases

Public agencies rely on the power of the computer to collect and process the volumes of data they collect in the course of creating, monitoring and enforcing their pollution control programs. The result is a variety of databases that can generate in various forms information about such things as the number of regulated pipeline dischargers and exactly how much of what they discharge where.

The databases, like all computer technology, evolve and change and usually improve over time. When searching for

specifics about the coastal environment, reporters might ask agency sources about databases they use and their accessibility and availability.

A few EPA database systems that might be useful to environmental reporters covering ocean issues are described below.

Ocean Data Evaluation System (ODES). This database contains marine environmental data associated with sewage discharge statutes, the National Pollution Discharge Elimination System, ocean dumping, the National Estuary Program, industrial discharges, the Great Lakes, and the National Coastal Waters Program.

The database is on EPA's mainframe computer and is designed for publicly owned treatment works and their supporting contractors, federal agencies, state agencies, EPA programs, and universities. Publicly owned treatment works are the main source of the database information and the system is updated once a week.

Permit Compliance System (PCS). This management system contains data on facilities that have discharge permits under the National Pollutant Discharge Elimination System. There are more than 65,000 active permits.

Information recorded in this database includes the identity and location of permitted facilities, discharge limits for the facilities, actual amounts of pollutants measured in facilities' wastewater, and compliance schedules and violations.

Storage and Retrieval of U.S. Waterways Parametric Data (STORET). This system includes information on effluent and biological water quality of the waterways within and contiguous to the United States.

The public can gain access by subscribing to an EPA user account through the National Technical Information Service.

Emergency Response Notification System (ERNS). This database contains information on oil and hazardous substance spills or releases. Online access is available only to EPA and relevant federal officials, but diskettes, hard copy or tapes are available through Freedom of Information Act requests. EPA's Emergency Response Division of the Office of Emergency and Remedial Response is the sponsoring office.

Also, some agencies have created publicly accessible

electronic bulletin boards that offer access to reports, legislative highlights and other information about coastal issues. Usually, all it takes to enter the bulletin board is a computer, a modem, a telephone, and a user identification number obtained by calling the agency sponsoring the bulletin board. Both NOAA and EPA have electronic bulletin boards. EPA's name is Coastnet.

A directory of information is available (see *Access EPA,* EPA/IMSD-91-100, 1991) from the U.S. Government Printing Office and the National Technical Information Service.

Fish and Wildlife Information Exchange (FWIE). This exchange is a technical assistance center and clearinghouse for fish and wildlife information systems which is housed at Virginia Polytechnic Institute and State University as part of the Multi-State Fish and Wildlife Information Systems Project.

The FWIE works with agencies that have fish and wildlife management responsibilities to build systems, acquire data, and plan fish and wildlife information management activities to better utilize existing data resources. The FWIE maintains copies of important national and regional fish and wildlife datasets. The FWIE also publishes a quarterly newsletter and holds annual meetings.

Monitoring

More than $133 million is spent annually on monitoring programs in the U.S. Monitoring is mandated by various statutes, including the Federal Water Pollution Control Act, the Marine Protection, Research and Sanctuaries Act, the Outer Continental Shelf Lands Act, and the National Ocean Pollution Research, Development and Monitoring Planning Act.

Monitoring is defined in many ways and conducted for various purposes. It is generally intended to produce information about three broad categories of problems: 1) compliance, to ensure that activities are carried out in accordance with regulations and permit requirement; 2) model verification, to check the validity of assumptions and predictions used as the basis for sampling design or permitting and for evaluation of management alternatives; and 3) trend monitoring, to identify and quantify longer-term environmental changes anticipated (hypothesized) as possible consequences of human activities. Most agencies conduct or require monitoring to ensure compliance with permit

conditions.

Marine environmental monitoring is conducted by federal, state and local agencies, waste dischargers and researchers. Five (5) federal agencies conduct marine environmental monitoring activities in the coastal ocean: National Oceanic and Atmospheric Administration, Environmental Protection Agency, Army Corps of Engineers, Coast Guard, and Minerals Management Service of the Department of the Interior.

The main purpose of EPA's monitoring and analysis program is to monitor contaminated waters and provide technical guidance to states to monitor and plan for cleanup of those waters. The program also helps develop monitoring approaches and helps states adopt those approaches. Among the monitored targets are estuaries, surface waters, sediment, and fish tissue (for signs of bioaccumulation of toxics). The monitoring program also helps states determine what controls are needed on point and nonpoint sources to reduce discharges.

Environmental Monitoring and Assessment Program (EMAP). EMAP is a national multi-year program initiated by EPA's Office of Research and Development (ORD). EMAP was developed in response to the need for information about the degree to which existing pollution control programs and policies protect the nation's ecological resources. EMAP-Estuaries represents one portion of EMAP's efforts in near-coastal environments. These efforts, now conducted in cooperation with NOAA, are designed to provide a quantitative assessment of the regional extent of coastal environmental problems by measuring status and change in selected ecological condition indicators.

Activities are currently under way in monitoring the Virginian Province (between Cape Cod and Cape Hatteras) and the Louisianian Province (Gulf of Mexico). Results will include information on dissolved oxygen levels, fish pathologies, marine debris, sediment toxicity, and overall ecological condition.

For more information contact: Dr. John Paul, Associate Director, EMAP-E, EPA, Environmental Research Lab, Narragansett, RI 02882, (401) 782-3037.

Additional Department of Agriculture programs that might be of interest include:

- Conservation Technical Assistance;
- Watershed Protection and Flood Prevention Program;

- Great Plains Conservation Program;
- Rural Abandoned Mine Program;
- Agricultural Conservation Program;
- Water Bank Program; and
- Colorado River Salinity Control Program.

Coastal America

Coastal America is a federal interagency partnership established in 1991 to restore, preserve and protect America's coastal heritage. This unique partnership builds coalitions for action among federal agencies, state and local governments, the private sector, and concerned citizen groups. It leverages resources, legislative authorities and expertise to accomplish together what no single program or agency can do alone.

The founding agencies are the four with coastal resource stewardship responsibilities: Army, Commerce, EPA, and Interior. The partnership expanded to nine Department-level federal agencies in the spring of 1992 when Agriculture, Air Force, Housing and Urban Development, Navy, and Transportation joined. The President's Council on Environmental Quality coordinates the partnership. Coastal America is inclusive; the partnership is open to any federal agency whose activities affect the coastal system. In addition, state, local and nongovernmental organizations are partners in more than 100 all-project activities.

In fiscal 1992, the Coastal America process initiated approximately $10 million in 24 local projects focused on loss of habitat, contaminated sediments and nonpoint source pollution. Each site-specific project requires a minimum of three federal partners and a non-federal sponsor to be actively involved and incorporates both a monitoring component and an education/outreach component to inform and involve the public. Seven regional implementation teams identify priority projects.

Coastal America collaborative projects are under way to help restore productivity to more than 5,000 acres of coastal wetlands; re-establish fish access to more than 200 miles of spawning streams; protect more than 10 endangered species of fish, birds and mammals; and install nonpoint source controls on more than 50 farms. Regional and national teams are identifying additional opportunities for reuse and environmental enhancement

both at coastal military facilities targeted for closure and in coastal infrastructure improvement or development projects.

Navy Agricultural Outleasing Funds

Under 10 U.S.C. 2667(d), rental fees received from a lease for agricultural or grazing purposes of land under control of the Secretary of a military department may be retained and spent on the installation to cover administrative expenses of leasing and natural resources program costs. Total income from agricultural and grazing outleases on naval installation varies from year to year, but is typically about $3 million annually.

Proceeds are used to administer the agricultural and grazing outleasing program. Priority is given to ensuring that proper conservation measures are implemented on the leases. Funds available over and above lease conservation work are utilized for natural resources conservation projects such as: endangered species protection; nonpoint source pollution abatement; fish and wildlife habitat management; and wetlands enhancement. Coastal America projects are implemented on Navy installations. Coastal America partnership projects will receive priority consideration amongst the funds available for natural resources conservation projects.

Defense and the Environment Initiative

In 1990, the Defense and the Environment Initiative (D&EI) was established to help meet Defense Secretary Richard Cheney's goals of making the Department of Defense the "federal leader in agency environmental compliance and protection," and integrating and budgeting environmental consideration into defense activities and operations.

In June 1990, the Secretary of the Navy approved an environmental strategic plan. One of the five environmental strategies is to participate in the Defense and the Environment Initiative through several activities:

- Washington State Initiative -- With the State of Washington and the Environmental Protection Agency, the Navy is developing a program to implement the State's PROJECT 2010, a vision of its environmental state in the year

2010. Actions thus far have included a Seaplane Base Saltmarsh Restoration Project and a Wetland Restoration/Enhancement Program. This program proposes to emphasize the sharing of environmental knowledge, development of public involvement and outreach, and pollution prevention.

- The Department of the Navy is the lead Service in promoting recycling within the Department of Defense. A multi-service committee is working to remove impediments to the recycling effort and to "close the loop" by encouraging the purchase by Department of Defense of goods made with recycled materials.
- The Department of the Navy joined other federal partners in the Coastal America Initiative in March 1992 and participated in three habitat restoration/protection projects in fiscal 1992.

Appendix B
Key National and Regional Contacts

PRIVATE ORGANIZATIONS

Alliance for the Chesapeake Bay
6600 York Road
Baltimore, MD 21212
301/377-6270

Alliance for the Chesapeake Bay
P.O. Box 1981
Richmond, VA 23216
804/775-0951

Alliance for the Chesapeake Bay
225 Pine Street
Harrisburg, PA 17101
717/236-8825

American Clean Water Project
107 Spyglass Lane
Fayetteville, NY 13066
315/637-4718

American Littoral Society
Highlands, NJ 07732
201/291-0055

American Oceans Campaign
725 Arizona Avenue, Suite 102
Santa Monica, CA 90401
310/576-6162

American Shore & Beach
Prevention Association
P.O. Box 279
Middletown, CA 95461
707/987-2385

Assembly of First Nations
EAGLE Project
Effects on Aboriginals from Great
Lakes Environment
55 Murray Street
Ottawa, Ontario KLN 5M3

Association of State and
Interstate Water Pollution
Control Administrators
444 North Capitol Street, NW
Suite 330
Washington, DC 20002
202/624-7782

Atlantic States Legal
Foundation, Inc
658 West Onondaga Street
Syracuse, NY 13204

The Audubon Institute
P.O. Box 4327
New Orleans, LA 70178
504/861-2537

Canadian Government
Law Association
517 College Street, Suite 401
Toronto, Ontario M6G 4A2
416/977-2410

Center for Marine Conservation
1725 DeSales Street, NW
Washington, D.C. 20036
202/429-5609

Center for Marine Conservation
(Pacific Coast)
312 Sutter Street, Suite 606
San Francisco, CA 94108
415/956-7441

Center for Marine Conservation
(Florida)
One Beach Drive, SE
St. Petersburg, FL 33701
813/895-3248

Center for Marine Conservation
(Gulf States)
1201 West 24th Street
Austin, TX 78705
512/473-2324

Center for Marine Conservation
(Chesapeake Bay)
306-A Buckroe Avenue
Hampton, VA 23664
804/851-6734

Chesapeake Bay Foundation
162 Prince George Street
Annapolis, MD 21401
301/268-8816

Clean Water Action Project
317 Pennsylvania Avenue, SE
Washington, DC 20003
202/547-1196

Clean Water Fund
2500 North Charles Street
Baltimore, MD 21218
301/235-8808

Clean Water Fund
46 Bayard Street, Room 309
New Brunswick, NJ 08901
201/846-4224

Clean Water Fund
2395 University Avenue
St. Paul, MN 55114
612/645-0961

Clean Water Fund
186A South Street
Boston, MA 02111
617/423-4661

Coastal Alliance
235 Pennsylvania Avenue, SE
Washington, DC 20003
202/546-9554

Coastal Conservation Association
4801 Woodway, Suite 220 West
Houston, TX 77056
713/626-4222

Coastal Society
P.O. Box 2081
Gloucester, MA 09136
508/281-9209

Coastal States Organization
444 North Capitol Street, NW
Washington, DC 20001
202/508-3860

Council of Great Lakes Governors
35 East Wacker Drive, Suite 1850
Chicago, IL 60001
312/407-0177

Cousteau Society
870 Greenbriar Circle, Suite 402
Chesapeake, VA 23320
804/523-9335

Cousteau Society
8440 Santa Monica Boulevard
Los Angeles, CA 90069
213/656-4422

Cousteau Society
425 East 52nd Street
New York, NY 10022
212/826-2940

Cousteau Society
2104 Pickwick Lane
Alexandria, VA 22307
703/660-8683

Earth Island Institute
300 Broadway, Suite 28
San Francisco, CA 94133
415/788-3666

Environmental Defense Fund
257 Park Avenue South
New York, NY 10010
212/505-2100

Environmental Law Institute
1616 P Street, NW, 2nd Floor
Washington, DC 20036
202/328-5150

Friends of the Earth,
Environmental Policy Institute,
The Oceanic Society
Executive Offices
218 D Street, SW
Washington, DC 20003
202/544-2600

Freshwater Foundation
725 County Road Six
Waqzata, MN 55391
612/449-0092

Great Lakes Advisory Council
1789 Western Avenue
Albany, NY 12203
518/869-9731

Great Lakes/Chicago
1017 West Jackson Boulevard
Chicago, IL 60607
312/666-3305

Great Lakes Protection Fund
35 East Wacker Drive, Suite 1870
Chicago, IL 60001
312/201-0601

Great Lakes Research Consortium
214 Baker Laboratory
Syracuse, NY 13210
315/470-6816

Great Lakes/Toronto
185 Spadina Avenue
Toronto, Ontario M5T 2CS

Great Lakes United
State University at Buffalo
1300 Elmwood Avenue
Buffalo, NY 14222
716/886-0142

Great Lakes Wetlands
P.O. Box 300
Conway, MI 49722
612/347-5928

Greenpeace USA
1436 U Street, NW
Washington, D.C. 20009
202/462-1177

Heal the Bay
1650A 10th Street
Santa Monica, CA 90404
213/399-1146

International Oceanographic Foundation
4600 Rickenbacker Causeway,
Virginia Key
Miami, FL 33149
305/361-4888

Lake Michigan Federation
59 East Van Buren, Suite 2215
Chicago, IL 60605
312/939-0838

Michigan United Conservation Clubs
P.O. Box 30325
Lansing, MI 48909
517/371-1041

National Audubon Society
801 Pennsylvania Avenue, SE
Washington, DC 20003
202/547-9009

National Audubon Society
Great Lakes Office
692 North High, #208
Columbus, OH 43215
624/224-3303

National Marine Manufacturers Association
3050 K Street, NW, #145
Washington, DC 20007
202/944-4980

National Ocean Industries Association
1120 G Street, NW, Suite 900
Washington, DC 20005
202/347-6900

National Wildlife Federation
1400 16th Street, NW
Washington, DC 20036
202/797-6800

Natural Resource Center
(Great Lakes)
506 East Liberty
Ann Arbor, Michigan, 48104
313/769-3351

Natural Resources Defense Council
40 West 20th Street
New York, NY 10011
212/727-2700

Pollution Probe
12 Madison Avenue
Toronto, Ontario M5R 2S1

Save the Bay
434 Smith Street
Providence, RI 02908-3540
401/272-3540

Save the River
P.O. Box 322
Clayton, NY 13624
315/686-2010

Sea Grant Consortium
287 Meeting Street
Charleston, SC 29401
803/727-2078

Sea Grant Program
Virginia Graduate Marine Science Consortium
170 Rugby Road, Madison House
University of Virginia
Charlottesville, VA 22903
804/924-5965

Sierra Club
408 C Street, NE
Washington, DC 20002
202/547-1142

Sport Fishing Institute
1010 Massachusetts Avenue, NW
Suite 320
Washington, DC 20001
202/898-0770

Societe Pour Vaincre la Pollution
CP 65 Place d'Arme
Montreal, Quebec H2Y 3E9

The Nature Conservancy
1815 North Lynn Street
Arlington, VA 22209
703/841-5300

Trout Unlimited
800 Follin Lane, SE, Suite 250
Vienna, VA 22180-4959
703/281-1100

Worldwatch Institute
1776 Massachusetts Avenue, NW
Washington, DC 20036
202/452-1999

World Wildlife Fund
1250 24th Street, NW
Washington, DC 20037
202/293-4800

GOVERNMENT AGENCIES

Executive Office of the President

Council on Environmental Quality
722 Jackson Place, NW
Washington, DC 20503
202/395-5750

Coastal America
722 Jackson Place, NW
Washington, DC 20503
202/395-3706

U.S. Air Force

The Pentagon
Washington, DC 20330-1000
301/545-6700

U.S. Department of Agriculture

Soil Conservation Service
14th and Independence
Avenue, SW
Washington, DC 20250
202/205-0027

U.S. Department of the Army

Army Corps of Engineers
Office of the Chief of Engineers
Pulaski Building
Washington, DC 20314-1000
202/272-0001

U.S. Department of Housing and Urban Development

415 7th Street, SW
Washington, DC 20410-7000
202/708-1422

U.S. Department of the Navy

Office of the Assistant Secretary
Installations and Environment
2211 Crystal Plaza, Building 5
Washington, DC 20360-5110

U.S. Department of Transportation

Coast Guard
2100 2nd Street, SW
Washington, DC 20593
202/267-2229

Federal Highway Administration
Environmental Operations Division
400 Seventh Street, SW
Washington, DC 20590
202/366-0660

Federal Railroad Administration
Nassif Building
400 7th Street, SW
Washington, DC 20590
202/366-0881

Maritime Administration
400 7th Street, SW
Washington, DC 20530
202/426-5812

U.S. Department of the Interior

Fish and Wildlife Service
1849 C Street, NW
Washington, DC 20240
202/343-5634

Minerals Management Service
Public Affairs Office
MS 0200
1849 C Street, NW
Washington, DC 20240
202/208-3983

National Park Service
P.O. Box 37127
Room 3223
Washington, DC 20013-7127
202/208-4639

U.S. Geological Survey
416 National Center
Reston, VA 22092
703/648-4460

U.S. Department of Health and Human Services

Food and Drug Administration
5600 Fisher Lane
Rockville, MD 20857
301/443-1544

U.S. Department of Commerce

National Oceanic and Atmospheric Administration
Public Affairs
14th & Constitution Avenue, NW
Washington, DC 20230
202/377-2539

National Marine Fisheries Service
1335 East-West Highway
Silver Spring, MD 20910
301/713-2370

National Ocean Service
1825 Connecticut Avenue, NW
Washington, DC 20235
202/606-4003

Smithsonian Institution
1000 Jefferson Drive, SW
Washington, DC 20560
202/357-1300

United Nations Environment Programme

New York Liaison Office
Room DC2-0816
New York, NY 10017
212/963-8138

Washington Liaison Office
1889 F Street, NW
Washington, DC 20006
202/289-8456

U.S. Environmental Protection Agency

Assistant Administrator for Water
401 M Street, SW
Washington, DC 20460
202/260-5700

Public Information Center
PM-211B
401 M Street, SW
Washington, D.C. 20460
202/475-7751

Great Lakes National Program Office
77 West Jackson Street
Chicago, IL 60604
312/886-7596

Chesapeake Bay Program Office
401 Severn Avenue
Annapolis, MD 21401
410/267-0061

EPA Region 1
John F. Kennedy Federal Building
One Congress Street
Boston, MA 02203
617/565-3420

EPA Region 2
Jocob K. Javitz Federal Building
26 Federal Plaza
New York, NY 10278
212/264-2657

EPA Region 3
841 Chestnut Building
Philadelphia, PA 19107
215/5970-9800

EPA Region 4
345 Courtland Street, NE
Atlanta, GA 30365
404/347-4727

EPA Region 5
230 South Dearborn Street
Chicago, IL 60604
312/353-2000

EPA Region 6
First Interstate Bank
Tower at Fountain Place
1445 Ross Avenue, 12th Floor
Dallas, TX 75202-2733
214/655-6444

EPA Region 9
75 Hawthorne Street
San Francisco, CA 94105
415/744-1305

International Joint Commission

United States Section
1250 23rd Street, NW Suite 100
Washington, DC 20440
202/736-9000

Great Lakes Regional Office
100 Ouellette Avenue
Eighth Floor
Windsor, Ontario N9A 6T3
519/256-7821

Great Lakes Commission

The Argus II Building
400 South Fourth Street
Ann Arbor, MI 48103-4816
313/665-9135

Great Lakes Fisheries Commission

1451 Green Road
Ann Arbor, MI 48105
313/662-3209

Great Lakes Environmental Research Laboratory

2205 Commonwealth Boulevard
Ann Arbor, MI 48105

Hotlines/Clearinghouses/ Databases (Also see Appendix A, Databases)

Clean Lakes Clearinghouse
U.S. Environmental Protection Agency
401 M Street, SW, WH-533
Washington, DC 20460
202/382-7111

EcoNet
(Many conferences on various environmental topics; electronic mail in 70 countries)
415/442-0220

Eco System BBS
Pittsburgh, PA
(Environment and economics)
BBS Number: 412/244-0675

Emergency Response Notification System
Emergency Response Division
U.S. EPA
703/603-8760

EnviroNet
(Sponsored by Greenpeace)
BBS Number: 415/861-6503

Fish and Wildlife Information Exchange
Department of Fisheries and Wildlife (Sciences)
Virginia Tech
2206 S. Main Street, Suite B
Blacksburg, VA 24060
703/231-7348
703/231-7019 (facsimile)

Ocean Data Evaluation System
U.S. EPA, Office of Water
202/260-9545

Permit Compliance System
U.S. EPA, Office of Water
202/260-9545

Safe Drinking Water Hotline (EPA)
Geo/Resource Consultants, Inc
1555 Wilson Boulevard
Suite 500
Arlington, VA 22209
800/426-4791

Storage and Retrieval of U.S. Waterways Parametric Data (STORET)
U.S. EPA, Office of Water
800/424-9067

Wastewater Treatment and
Information Exchange
Bulletin Board System
304/293-4191 (voice)
800/544-1936 (BBS)

Wetlands Protection Hotline (EPA)
Geo/Resources Consultants, Inc
1555 Wilson Boulevard
Suite 500
Arlington, VA 22209
800/832-7828

Compuserve, including:
The Network Earth Forum
The Science and Math
Educational Forum
The Good Earth Forum
The Outdoor Forum
The SafetyNet Forum
800/848-8199

Nonpoint Source
Information Exchange
U.S. EPA, Office of Water
Assessment & Watershed
Protection Division
401 M Street, SW, WH-553
Washington, DC 20460
202/382-7085
BBS: 301/589-0205

Appendix C
Glossary

Acid deposition: A complex chemical and atmospheric phenomenon that occurs when emission of sulfur and nitrogen compounds and other substances are transformed by chemical processes in the atmosphere, often far from the original sources, and then deposited on Earth in either a wet or dry form. The wet forms, popularly called "acid rain," can fall as rain, snow or fog. The dry forms are acidic gases or particulates.

Acid Precipitation: Rain or snow that contains significant amounts of sulfuric acid or nitric acid.

Anadromous Fish: Those fish, such as salmon, that live in the sea but spawn in freshwater.

Antidegradation: Process of stopping the degradation, destruction, erosion, or decomposition of the state of the environment.

Aquifer: An underground geological formation, or group of formations, containing usable amounts of ground water that can supply wells and springs.

Archipelagic Waters: Waters that border the coasts of island countries such as Japan and the Philippines.

Barrier Island: A sandy, elongated island situated just off the coast which serves to provide protection to lagoons and wetlands from marine elements. They are primarily found along the Gulf of Mexico, the East Coast and Alaska. These dynamic islands form and change position and shape in response to coastal processes and human actions.

Barrier Reef: A long narrow ridge of coral or rock parallel to and relatively near a coastline, separated from the coastline by a lagoon too deep for coral growth.

Bayou: A marshy or sluggish body of water or a creek or minor river that is a tributary to another body of water. This term is common to Louisiana.

Benthic: Occurring at the bottom of a body of water, usually in the depths of the ocean.

Bioaccumulation: The process by which some persistent contaminants accumulate through the food chain and become biologically magnified. That is, contaminants concentrate as they travel via digestive processes up to higher levels of the food chain.

Bog: A type of peatland that mostly occurs at northern latitudes. Bogs are wetlands that typically either blanket landscapes or occur in local glacially formed depressions.

Brackish: A combination of saltwater and freshwater, common to coastal wetlands and estuaries.

Brown Tide: See "red tide".

Bycatch: Fish and other marine life caught incidentally while fishing for something else.

Chlorofluorocarbons (CFCs): A family of inert, nontoxic and easily liquified chemicals used in refrigeration, air conditioning, packaging, insulation, or as solvents and aerosol propellants. Because CFCs are not destroyed in the lower atmosphere they drift into the upper atmosphere where their chlorine components destroy ozone.

Chronic Exposure Effects: Effects of low levels of a pollutant existing in an environment over a long period of time.

Coastal Zone: The area where the water meets the land -- the beaches, bays and wetlands.

Compaction: Reduction of the bulk of solid waste by rolling and tamping.

Confined Disposal Facility: An upland or in-water structure constructed solely for the disposal of contaminated dredged material.

Contiguous Zone: Area between 12 and 24 miles from the coast in which a host country has rights to control immigration, customs and pollution regulations.

Continental Shelf: A submarine shelf extending from the border of a continent usually ending in a steep slope to deep ocean waters.

Cypress Swamps: Swamplands in the Atlantic and Gulf Coast regions dominated by cypress trees.

Direct Discharge: Same as point source emissions. It refers to any intentional release of wastes into water ecosystems through direct dumping or direct pipeline discharge.

Ecosystems Approach: An approach to environmental management which takes into account the interrelatedness of a system's physical, chemical and biological components in the system.

Effluent: Waste material discharged into the environment.

Estuary: Usually shallow bodies of water, such as bays, where freshwater empties into and mixes with saltwater.

Eutrophication: The enrichment of waters by nutrients either through human-induced or natural means.

Exclusive Economic Zone: An area extending up to 200 nautical miles from the coast of a country. Within this zone, the host country controls resources, like fisheries and minerals, has jurisdiction over scientific research, and is responsible for protecting environmental health.

Food Chain: A sequence of organisms, each of which uses the next, lower member of the sequence as a food source.

Global Climate Change: Worldwide changes in the Earth's climate systems said to result from manmade emissions of greenhouse gases including carbon dioxide, methane, nitrous oxide, and chlorofluorocarbons.

Habitat: The environment in which an animal or plant can normally be found or normally grows.

High Seas: Open waters of an ocean or sea beyond the limits of national territorial jurisdiction.

Hydric Soil: A soil lacking oxygen due to the periodic presence of water; this soil supports the growth of wetlands vegetation.

Hydromodification: Changing the flow and thereby habitats of natural water systems. This includes dams, stream channels and canals.

Hydrophytic Vegetation: Plants typically found in wetlands and other aquatic habitat; such plants grow in water or substrates periodically deficient in oxygen due to excessive water content.

Hydrothermal Vents: Areas located along deep seabeds where hot water, rich in sulfur, is released from geothermally heated rock.

International Seabed: The area that extends beyond the continental shelf; generally thought of as open seas. Under the jurisdiction of the United Nation's International Seabed Authority.

Lagoon: A shallow sound or body of water, usually landward of a barrier island, connected to a larger body of water.

Leachate: A solution obtained from leaching or the action of percolating liquid in order to separate the soluble contents. Chemicals such as fertilizer are leached from soil when rainwater travels through the soil.

Macroinvertebrate: A large organism lacking a spinal cord.

Manganese Nodules: Small rounded lumps of a grayish-white, usually hard and brittle metallic element that resembles lead.

Mangrove: Any of various tropical evergreen trees or shrubs of the genus Rhizophora, having stilt-like roots and stems and forming dense thickets along tidal shores.

Mariculture: Cultivation of marine organisms by exploiting their natural environment. Like agriculture in the sea, it involves constructing farms and fields of certain animals and plants.

Marsh: A type of wetland that does not accumulate appreciable peat deposits and is dominated by herbaceous vegetation. Marshes may be either freshwater or saltwater and tidal or non-tidal.

Mass Balance: A way of measuring substances entering and leaving a body of water from all sources and outlets to determine amounts that can be safely assimilated by the ecosystem.

Nautical Mile: 6,076 feet or 1,852 meters.

Near Coastal Waters: Ecologically and economically rich and diverse area that includes the coastal zone, the territorial seas and the contiguous zone.

Nonpoint Sources: Sources of contamination that cannot be directly linked to a specific source of pollution. These include (but are not restricted to) urban/suburban runoff, agricultural runoff, erosion, construction, and mining sites.

Overfishing: When fishing pressure exceeds the sustainable level for that species, and when abundance has been reduced so that production is much lower than the potential.

Pathogen: Agent such as bacteria and viruses that cause disease.

Phosphorus: An essential chemical food element that can contribute to the eutrophication of lakes and other water bodies.

Increased phosphorus levels result from discharge of phosphorous-containing materials into surface waters.

Permeability: The rate at which liquids pass through soil or other materials in a specified direction.

Phytoplankton: That portion of the plankton community comprised of tiny plants, e.g., algae and diatoms.

Pipeline Discharges: A type of direct discharge which includes municipal and industrial discharges.

Point Source: Also known as direct discharge, it involves the intentional release of wastes from pipes into ecosystems.

Primary Waste Treatment: First steps in wastewater treatment; screens and sedimentation tanks are used to remove most materials that float or will settle. Primary treatment results in the removal of about 30 percent of carbonaceous biochemical oxygen demand from domestic sewage.

Red Tide: A proliferation of a marine plankton that is toxic and often fatal to fish. This natural phenomenon may be stimulated by the addition of nutrients. A tide can be called red, green or brown, depending on the coloration of the plankton.

Riparian Habitat: Vegetated ecosystems found along any stream or river. Riparian areas characteristically have a high water table and are subject to periodic flooding and influence from the adjacent water body. Riparian habitats are particularly significant in the Southwest.

River Delta Systems: Habitats located at the point a river empties into a larger body of water (a lake or ocean). These areas are usually rich in nutrients.

Sea Grass Shallow: A shallow coastal area, usually found on the Atlantic and Gulf of Mexico coasts, on which certain grasses that have adapted to the changing tides grow.

Secondary Treatment: The second step in most publicly-owned waste treatment systems in which bacteria consume the organic parts of the waste. It is accomplished by bringing together waste, bacteria and oxygen in trickling filters or in the activated sludge process. This treatment removes floating and settled solids and about 90 percent of the oxygen-demanding substances and suspended solids. Disinfection is the final stage of secondary treatment.

Silviculture: Management of forest land for timber; sometimes contributes to water pollution, as in clearcutting.

Spoil: Dredged material from a harbor, channel or land, containing a mix of clean gravel, sand and muddy sediments often including heavy metals and oil.

Submerged Aquatic Vegetation (SAV): Plants that grow for the most part under water.

Surface Water: All water naturally open to the atmosphere (rivers, lakes, reservoirs, streams, impoundments, seas, estuaries, etc.); also refers to springs, wells or other collectors which are directly influenced by surface water.

Superfund Program: The program operated under the legislative authority of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) and the Superfund Amendments and Reauthorization Act (SARA) that funds and carries out the EPA solid waste emergency and long-term removal remedial activities. These activities include establishing the National Priorities List, investigating sites for inclusion on the list, determining their priority level on the list, and conducting and/or supervising the ultimately determined cleanup and other remedial actions.

Territorial Sea: A zone extending 12 miles into the sea measured from a baseline on the coast of a country. This area is considered part of a country's sovereign territory.

Tertiary Treatment: Advanced cleaning of wastewater that goes

beyond the secondary or biological stage. It removes nutrients such as phosphorus and nitrogen and most biological oxygen demand and suspended solids.

Thermal Pollution: The discharge of water sufficiently warm to lower dissolved oxygen levels, cause eutrophication, or damage the quality of water for drinking or recreational use.

Tidal Flat: Level, muddy surface bordering an estuary that is alternately submerged and exposed to the air by changing tidal levels.

Turbidity: Haziness in air caused by the presence of particles and pollutants, or a similar cloudy condition in water due to suspended silt or organic matter.

United Nations Conference on the Law of the Sea: International agreement that defines basic sea rights and responsibilities. (Not yet in force.)

Upstream Waters: Rivers, creeks and tributaries that empty into an estuary or other body of water. Also, any water located in the opposite direction of the current of a river, creek or other tributary.

Upwelling: Movement to the surface of nutrient-rich lower marine water near the shore. Usually caused by the offshore drift of coastal surface water.

Vernal Pool: In California, small depressions that, due to their subsurface layer, fill during the winter from precipitation; or, in the rest of the U.S., temporary ponds or shallow depressions and remnants of old ponds that fill with water usually after the spring thaw.

Watershed: A geographic area in which water, sediments and dissolved materials drain to a common outlet -- to a point on a larger stream, lake, underlying aquifer, estuary or ocean.

Water Table: The upper limit of the portion of the ground wholly

saturated with water.

Wetland Hydrology: In general terms, inundations or saturation by water in an area creating a condition in which oxygen is lacking in the soil.

Wetland: An area that is inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances does support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.

Appendix D
List of Acronyms

BMPs	Best Management Practices
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CEQ	President's Council on Environmental Quality
CLOS	United Nations Conference on the Law of the Sea
CMC	Center for Marine Conservation
CWA	Clean Water Act
CZARA	Coastal Zone Act Reauthorization Amendments
CZMA	Coastal Zone Management Act
DDT	Dichloro Diphenyl Trichloroethane
DEIS	Draft Environmental Impact Statement
EEZ	Exclusive Economic Zone
EIS	Environmental Impact Statement
EPA	U.S. Environmental Protection Agency
ERNS	Emergency Response Notification System (an EPA database)
FAO	United Nations Food and Agriculture Organization
FEIS	Final Environmental Impact Statement
FCMA	Magnuson Fishery Conservation and Management Act
FMP	Fishery Management Plans
GAO	General Accounting Office (Congressional)
GIFA	Governing International Fishery Agreements
GLI	Great Lakes Initiative
IJC	International Joint Commission
LWCF	Land and Water Conservation Fund
MARAD	U.S. Maritime Administration
MARPOL	International Convention for the Prevention of Pollution From Ships
MMS	Minerals Management Service of the Department of the Interior
MPRSA	Marine Protection Research and Sanctuaries Act of 1972, also known as the Ocean Dumping Act
NEPA	National Environmental Policy Act
NHPF	National Historic Preservation Fund
NMFS	National Marine Fisheries Service

NMMA	National Marine Manufacturer's Association
NMSP	National Marine Sanctuary Program
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System (under the Clean Water Act)
NRDC	Natural Resources Defense Council
OCS	Outer Continental Shelf
OCSLA	Outer Continental Shelf Lands Act
OPA	Oil Pollution Act of 1990
OTA	Office of Technology Assessment (Congressional)
OTEC	Ocean Thermal Energy Conversion
PAHs	Polycyclic Aromatic Hydrocarbons
PCBs	Polychlorinated Biphenyls
SAV	Submerged Aquatic Vegetation
SFI	Sport Fishing Institute
STORET	Storage and Retrieval of U.S. Waterways Parameteric Data (an EPA database)
TALFF	Total Allowable Level of Foreign Fishing
UNCLOS	United Nations Conference on the Law of the Sea
USDA	U.S. Department of Agriculture

Appendix E
Additional Resources

Berle, Kass & Case. *Environmental Law in New York,* "Oil Spills: Liability After the Exxon Valdez," November 1989, Volume 1, Number 3.

Brower, David; David Owens; and Anna Schwab. *Evaluation of the National Coastal Zone Management Program.* Prepared for the National Coastal Resources Research and Development Institute of Newport, Oregon, 1990.

Bullock, David. *The Wasted Ocean.* Lyons and Burford, 1989. New York.

Center for Marine Conservation. *A Citizen's Guide to Plastics in the Ocean,* Washington, DC, 1988.

Center for Marine Conservation. *Cleaning North America's Beaches: 1990 Beach Cleanup Results,* "National Park Service Marine Debris Monitoring Program," 1990.

Center for Marine Conservation. *Coastal Connection,* Fall 1991.

Center for Marine Conservation. *Federal Conservation & Management of Marine Fisheries in the United States,* 1991.

Center for Marine Conservation. *Marine Conservation News,* "No Easy Solution at Hand for Marine Mammal/Fisheries Problem," Autumn 1991.

Center for Marine Conservation. *Sanctuary Currents,* Spring 1991.

Center for Marine Conservation. *Shipping Safety and America's Coasts,* 1990.

Clark, Colin W. "The Economics of Marine Conservation," University of British Columbia, November 1991 (Presented at the

Smithsonian Oceans Forum).

Chandler, W.J., et al. *Audubon Wildlife Report 1989/1990,* Academic Press, Inc., San Diego, California.

Coastal America, Brochure, 1991.

"Coastal Policy Implications of Global Warming," (No Source Listed), 1989.

Congress of the United States, Office of Technology Assessment. "Coping With An Oiled Sea," 1990.

Congress of the United States, Office of Technology Assessment. *Wastes in Marine Environments,* April 1987.

Courant, W. Joseph. "Too Long At Sea For Too Few Fish," *The Hartford Courant,* July 9-11, 1989.

Defenders of Wildlife. Annual Report 1990.

E Magazine. "North America's Third Shore: Citizens Unite to Keep the Great Lakes Great," July/August 1990.

Environmental Law Deskbook: Statuatory Outline-Water Quality, "Federal Water Pollution Control Act (the "Clean Water Act"), p. 51-53. "Outer Continental Shelf Lands Act and Amendments of 1978, §§302-314, p. 26-27. "Marine Mammal Protection Act," p.63.

Environmental Law Institute. *The Environmental Forum,* September/October 1992.

Feierabend, J.S. and J.M. Zelazny. *Status Report on our Nation's Wetlands.* National Wildlife Federation, Washington, DC, 1987.

Great Lakes Water Quality Board. Report to the International Joint Commission, "1987 Report on Great Lakes Water Quality."

Group on Natural Resource Management-Organization for

Economic Cooperation and Development. "Integration of Environmental Considerations Into Coastal Zone Management In the United States," May 1989.

Horton, Tom, and Eichbaum, William M. *Turning the Tide,* Chesapeake Bay Foundation, Island Press, 1991.

International Joint Commission-United States and Canada. "Fifth Biennial Report on Great Lakes Water Quality, Part I," 1989.

Joyner, Christopher C. and Frew, Scott. "Plastic Pollution in the Marine Environment," Department of Political Science, The George Washington University, 1991.

Kelleher, Graeme. "Recreation, Tourism and the Ocean -- Interrelationships and Effects," Presented at National Forum on Ocean Conservation, November 19-21, 1991.

Miller, G. Tyler, Jr. *Living in the Environment,* 7th ed., 1992.

Maryland Sea Grant Program. *Maryland Marine Notes,* April 1990.

National Audubon Society. "Population and Water Resources," November 1991.

National Marine Educators Association, "Current Journal of Marine Education," Vol.11, No.2, 1992, Pacific Grove, Ca.

National Marine Sanctuaries Program. "National Marine Sanctuaries. Challenge and Opportunity: A Report to the National Oceanic and Atmospheric Administration," February 22, 1991.

National Oceanic and Atmospheric Administration, National Marine Fisheries Service, U.S. Department of Commerce. "Fisheries of the U.S., 1991," May 1992.

National Oceanic and Atmospheric Administration, National Marine Fisheries Service, U.S. Department of Commerce. "Our Living Oceans -- The First Annual Report on the Status of U.S.

Living Marine Resources," November 1991.

National Oceanic and Atmospheric Administration (National Ocean Service), U.S. Department of Commerce. "50 Years of Population Change Along the Nations's Coasts 1960-2010," April 1990.

National Oceanic and Atmospheric Administration (National Ocean Service), U.S. Department of Commerce. "Estuaries of the United States -- Vital Statistics of a National Resource Base," October 1990.

National Oceanic and Atmospheric Administration (National Ocean Service), U.S. Department of Commerce. "Coastal Wetlands of the United States -- An Accounting of a Valuable National Resource," February 1991.

National Oceanic and Atmospheric Administration (National Ocean Service), U.S. Department of Commerce. "Coastal Environment Quality in the United States, 1990 -- Chemical Contamination in Sediment and Tissues," October 1990.

National Oceanic and Atmospheric Administration (National Ocean Service), U.S. Department of Commerce. "The 1990 National Shellfish Register of Classified Estuarine Waters," July 1991.

National Oceanic and Atmospheric Administration, U.S. Dept. of Commerce. "National Marine Sanctuary Program."

National Oceanic and Atmospheric Administration (Estuarine Programs Office), U.S. Department of Commerce. "NOAA Estuarine and Coastal Ocean Science Framework," April 16, 1987.

National Oceanic and Atmospheric Administration, U.S. Department of Commerce. "Coastal Nonpoint Pollution Control Program: Proposed Program Development and Approval Guidance," October 1991.

National Oceanic and Atmospheric Administration, U.S. Department of Commerce. "Report to the Nation," Winter 1991, No. 1.

National Oceanic and Atmospheric Administration, U.S. Department of Commerce. National Ocean Service, Fall 1991, Vol. 2, No. 1.

National Oceanic and Atmospheric Administration, U.S. Department of Commerce. "NOAA Media Guide-How to Find NOAA People and Programs," September 1991.

National Research Council. "Drilling Discharges in the Marine Environment."

Natural Resources Defense Council. "Ebb Tide for Pollution: Actions For Cleaning Up Coastal Waters," August 1989.

Natural Resources Defense Council. "Testing the Waters. A National Perspective on Beach Closings," July 1992.

Natural Resources Institute of the University of Maryland, Maryland Department of Tidewater Fisheries. "Striped Bass in Maryland Tidewater," 1963.

Ocean & Shoreline Management. "Estimating the Value of Beach Recreation from Property Values: An Exploration with Comparisons to Nourishment Costs," 1990.

Oceanography. "Stratospheric Ozone, Middle Ultraviolet Radiation and Phytoplankton Productivity," November 1989.

Oil & Gas Journal. "No OCS harm seen in mud discharge," November 21, 1983, p. 45.

Puget Sound Water Quality Authority. "1987 Puget Sound Water Quality Management Plan."

Save The Bay Inc. *Saving Our Bays, Sounds, and The Great Lakes: The National Agenda,* October 1987.

Smithsonian Institute. *Summary of Proceedings,* National Forum on Ocean Conservation, November 19-21, 1991, Washington, DC, 1992.

The Conservation Foundation [World Wildlife Fund]. *Issues in Wetlands Protection,* "Federal Regulation of Private Activities Affecting Wetlands," 1990.

The Council on Environmental Quality. "Environmental Quality -- 22nd Annual Report," March 1992.

Time. "The Dirty Seas," August 1988.

Torvik, Solveig. *Seattle Post-Intelligencer,* "Fish in the Duwamish Swim in Troubled Waters," June 10, 1991.

U.S. Environmental Protection Agency. "America's Wetlands: Our Vital Link Between Land and Water," 1988.

U.S. Environmental Protection Agency (Office of Marine and Estuarine Protection). "Near Coastal Waters Strategy," June 29, 1990.

U.S. Environmental Protection Agency. "EPA's Near Coastal Waters Strategic Option Paper," 1986.

U.S. Environmental Protection Agency. "Title 40 -- Protection of Environment," Chapter I.

U.S. Environmental Protection Agency. "Note to Correspondents: Highlights of the "Ocean Dumping Ban Act of 1988" As Passed by the House and Senate," November 21, 1988.

U.S. Environmental Protection Agency. "Chesapeake Bay: A Framework for Action," September 1983.

U.S. Environmental Protection Agency. "EPA's Near Coastal Waters Strategic Option Paper," 1986.

U.S. Environmental Protection Agency, *EPA Journal.* "Saving the

Nation's Great Water Bodies," November/December 1990.

U.S. Environmental Protection Agency, *EPA Journal.* "Nonpoint Source Pollution," November/December 1991.

U.S. Environmental Protection Agency, *EPA Journal.* "Can Our Coasts Survive More Growth?" Volume 15, Number 5, 1989.

U.S. Environmental Protection Agency. *The Quality of Our Nations Water,* June 1992.

U.S. Environmental Protection Agency, *EPA Activities Update.* June 21, 1991.

U.S. Environmental Protection Agency. *The Great Lakes, An Environmental Atlas and Resource Book,* 1987.

U.S. Fish and Wildlife and Service, Department of the Interior. Chapter I, "Title 50 -- Wildlife and Fisheries," Subchapter B-Taking, Possession, Transportation, Sale Purchase, Barter, Exportation, and Importation of Wildlife and Plants.

U.S. Fish and Wildlife and Service, Department of the Interior. *1985 National Survey of Fishing, Hunting and Wildlife Associated Recreation.*

U.S. Geological Survey (Water Resources Division). "Information Guide," 1991.

U.S. Geological Survey. "OPDIN Information Update," (The Upper Great Lakes), (undated).

U.S. Geological Survey. *Coasts in Crisis,* 1991.

U.S. Geological Survey. "Agency Submissions to the OPDIN" (Albemarle-Pamlico estuary), 1988.

U.S. Geological Survey. "Agency Submissions to the OPDIN" (Galveston Bay National Estuary Program), 1988.

U.S. Geological Survey (Water Resources Division). "OPDIN Pollution Updates -- Information Request," (The Chesapeake Bay, The Susquehanna, Potomac, and James Rivers), 1979-1982.

U.S. General Accounting Office. "Coastal Pollution: Environmental Impacts of Federal Activities Can Be Better Managed," June 1991.

U.S. General Accounting Office. "Water Pollution: Ocean Dumping Fee Program Is Meeting Statutory Requirements."

U.S. General Accounting Office. "Wetlands Overview -- Federal and State Policies, Legislation and Programs," November 1991. (GAO/RCED-99FS)

U.S. Navy. "National Resources Conservation. Protecting America's Natural Heritage," (undated).

University of Delaware, Center for the Study of Marine Policy. "Initiating a Mid-Atlantic Coastal Issues Forum," January 1990.

White House Domestic Policy Council. "Interagency Task Force on Persistent Marine Debris," May 1988.

Woods Hole Oceanographic Institution, *Oceanus.* Spring 1991, Vol. 34, Number 1.

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