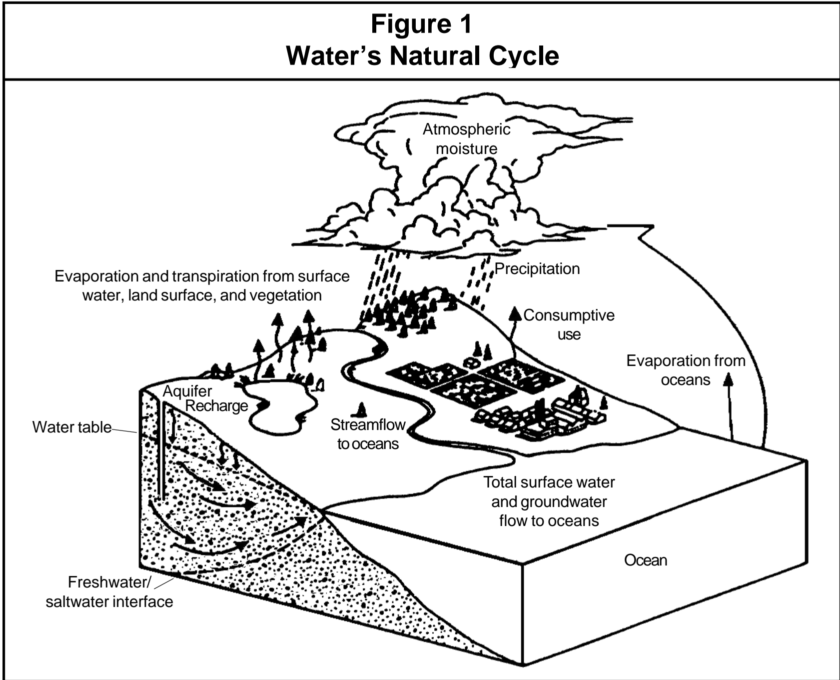
Chapter 3
Importance of the Resource: Facts at Your Fingertips

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, is estimated to contain about one-fifth of the world's harvestable seafood.
- Approximately 15,000 to 40,000 species of fish live in the oceans and 180 species of fish live in the Great Lakes. More than 2,000 plant and animal species have been identified in the Chesapeake Bay estuarine region alone.
- Offshore energy sources account for 11.8 percent of world-wide and 18.6 percent of U.S. oil production. Offshore sources provide about 25 percent of worldwide and 26 percent of U.S. gas production.
- Gulf of Mexico coastal wetlands serve as essential habitat for 75 percent of U.S. migrating waterfowl.
- Commercial landings by fishers at U.S. ports in 1996 were 9.6 billion pounds, a decrease of approximately 223 million pounds (2 percent) from 1995.
- In 1996, an estimated 77.7 million recreational boaters spent approximately $17.75 billion on products and services related to recreational boating.

Oceans cover more than two-thirds of the Earth's surface and contain more than 97 percent of all the water on Earth. They play a critical role in the planet's energy and nutrient cycles (see figure 1). People rely on the oceans for many things, including

Figure 1
Water's Natural Cycle



Source: Council on Environmental Quality 1992

energy and mineral resources, and oceans are a habitat for sustaining living resources, an important food source. People also rely on the oceans as "a medium for recreation, learning, and enlightenment … for reinvigorating our own energy, our imagination, and our creativity as human beings," said James Broadus of the Woods Hole Oceanographic Institution.

The U.S. coastline consists of many types of land forms and ecological systems, including rocky shores, mangrove marshes, 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. Salt marshes, the Atlantic coastal shelf, and reef systems along the U.S. coastline are among the most productive ecosystems in the world.

The U.S. exclusive economic zone (EEZ)—waters to 200 miles offshore—contains fisheries, oil and gas, and hard minerals and provides many recreational opportunities. It is the largest, 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*

perhaps the richest, EEZ in the world. The zone reaches into the Atlantic and Pacific Oceans, the Gulf of Mexico, the Gulf of Alaska, and the Bering Sea, encompassing about 2.2 million square miles. The U.S. EEZ, which includes vast fisheries off the Gulf of Mexico and the prosperous Alaskan fishing ports fed by colder North Pacific waters, is estimated to contain about one-fifth of the world's harvestable seafood. U.S. coastal waters are also home to enormous populations of marine birds and mammals.

Many so-called "ecosystem services"—benefits derived from the world's natural ecosystems, including raw materials, food, and recreation—are traded in economic markets and therefore have readily identifiable economic values. Some ecosystem services, however, are not traded, including regulating the atmosphere, treating natural waste, buffering storms and floods, cycling nutrients, and providing habit for wildlife. In a May 1997 *Nature* article, a group of ecologists attempted to place a value on ecosystem services, especially in the coastal zone. They estimated that the worth of these services for marine ecosystems is approximately $21 trillion each year. Coastal environments (e.g., continental shelves, estuaries, reefs, tidal marshes, and mangroves) cover only about 6 percent of the Earth's surface, yet provide 32 percent of the value of all ecosystem services.

The United States has always been a maritime nation and has always derived a significant amount of its wealth and power from the sea. According to *Sea Technology* magazine, the value of goods and services sold by the ocean/marine industry (including manufacturing plants, research laboratories, test facilities, shipyards, and all types of support facilities) was estimated in 1995 at $60 billion annually.

The future of the United States 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 M. Graham, editor of *Sea Technology* magazine, noted in the October 1991 issue,

> As a current and potentially increasing 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.

In June 1997, *Sea Technolog*y reported that about two-thirds of the world's cities with populations exceeding 1.6 million are located on or near coasts.

In addition to the economic and recreational benefits that they provide, the oceans also 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. Deep ocean currents transfer cooler temperatures from the poles toward the equator. As the warm ocean water from the tropics moves northward, some of it evaporates. In the Atlantic Ocean, when warm ocean water hits the cold polar winds between Greenland and Iceland, the evaporation accelerates, leaving behind saltier seawater that becomes denser and heavier. This rapidly cooling water sinks to the bottom at the rate of 5 billion gallons per second, forming a deep current as powerful as the Gulf Stream that flows south underneath the Gulf Stream near the ocean floor. In the process, the current 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.

This lack of adaptability, however, also increases the risk to species from environmental disturbances.

Aquatic systems are highly diverse. Estimates of the number of species of ocean fish range from 15,000 to 40,000. 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. According to the Sierra Club's *Adventuring in Florida*, 350 species of birds, 1,000 varieties of plants, 250 species of trees, 40 species of mammals, and 50 species of reptiles dwell in the vast Florida Everglades. More than 50 species of mollusks live in Long Island Sound, and the Puget Sound is home to more than

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* and *The Edge of the Sea*; Jacques Cousteau's *The Ocean World*; and *The Living Ocean* by Boyce Thorne-Miller and John Catena.

200 varieties of fish and 14 marine mammal species. Countless species of microscopic algae and plankton form the base of the food web.

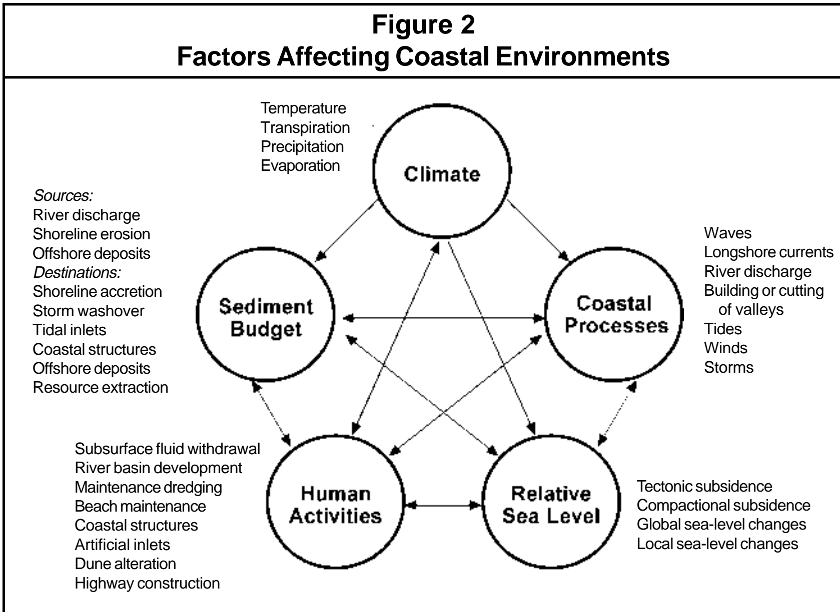
Ecosystems and habitats in coastal and nearshore waters teem with life because of interactions between inland and oceanic systems. Coastal wetlands, estuaries, and salt marshes are critical habitat for a wide range of fish, shellfish, birds, and other aquatic and terrestrial life. Reef systems provide food and shelter for fish, plants, mollusks, and crustaceans. In coastal areas, nutrients from land runoff combine with organic matter from nearshore 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 be adults in coastal waters. Coastal waters and estuaries provide habitats for more than 75 percent of the total commercial fish catch and 80 to 90 percent of the recreational catch of fish and shellfish in the continental United States. 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. Many species of birds depend on wetlands and other coastal habitats for food, breeding, migration, and resting areas.

The marine environment remains relatively unexplored. The high biological diversity of deep sea ecosystems is only beginning to be understood. For example, 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—were discovered less than 20 years ago. The

Figure 2
Factors Affecting Coastal Environments



Source: Modified from Williams, Dodd, and Gohn 1990

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 web interactions. Disruption of any part can harm many other parts of the ecosystem (see figure 2).

Energy and Mineral Resources

Some coastal and marine areas hold vast oil and gas reserves. Gold, cobalt, phosphorites, and other valuable minerals, as well as sand and gravel, abound in some areas. Offshore energy sources account for 11.8 percent of worldwide and 18.6 percent of U.S. oil production, and about 25 percent of worldwide and 26 percent of U.S. natural gas production. The United States accounts for about 8 percent of worldwide ocean oil production and 38 percent of ocean natural gas production. The value of U.S. production from federal offshore sources has ranged from $12 billion to $22.4 billion

annually from 1985 through 1996, according to the Department of the Interior Minerals Management Service's (MMS's) *Mineral Revenues: Report on Receipts from Federal and Indian Leases*.

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 $3.4 billion, reaching a peak of $10.8 billion in 1984. The 1996 value was more than $8 billion, and annual offshore production in U.S. waters is increasing.

MMS manages oil and gas leasing on the 1.4 billion acres of the U.S. 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, or nine nautical miles, are retained as state waters.

In 1996, 32.8 million of the 1.4 billion acres of the U.S. OCS were under lease to oil and gas exploration, development, and production companies. According to MMS, 3,860 oil and gas production facilities and more than 80,000 petroleum workers are located on the U.S. OCS. In 1996, nearly 1,800 OCS leases were in production in the Gulf of Mexico, yielding about 95 percent of U.S. offshore production. In 1996, the OCS oil and gas lease program generated more than $4.2 billion in production royalties and lease-related revenues for the federal government. Table 1 lists the five largest oil and gas operators producing on the OCS (ranked by production quantity) in 1996.

Additional Resources

The Minerals Management Service (MMS), a Department of the Interior bureau that manages offshore production, publishes several reports: *MMS Offshore Stats*, a quarterly newsletter; *Federal Offshore Statistics*, published annually; *Mineral Revenues: Report on Receipts from Federal and Indian Lands*, published annually; the *Annual Report to Congress: OCS Oil and Natural Gas Leasing and Production Program*. For copies, contact MMS's Document Distribution Center at (703) 787-1080. The MMS World Wide Web site is http://www.mms.gov.

Table 1
Largest Oil and Gas Operators on the Outer Continental Shelf in 1996
(Ranked by production quantity)

Oil (in barrels)		Gas (in millions of cubic feet)	
1. Shell Offshore Inc.	68,850,388	1. Shell Offshore Inc.	516,799,845
2. Chevron U.S.A. Inc.	44,410,288	2. Chevron U.S.A. Inc.	465,135,278
3. Marathon Oil Company	22,883,810	3. Union Oil Company of California	281,107,091
4. Exxon Corporation	22,026,588	4. Texaco Exploration & Production	264,613,378
5. BP Exploration & Oil Inc.	20,310,139	5. Exxon Corporation	244,217,360

Source: Minerals Management Service 1997

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

Most offshore mineral, oil, and gas production takes place offshore of Louisiana. Following Louisiana, the leaders in U.S. offshore production of minerals, oil, and gas are Texas, California, Alaska, Florida, and Alabama (the exact order of the states depends on which resource is being computed). Discoveries of oil and gas have recently expanded production into the deeper waters of the Gulf of Mexico.

According to December 1995 estimates, about 13 percent of U.S. oil reserves and about 18 percent of U.S. natural gas reserves (or potential for production) lie within the federal OCS. MMS estimates of OCS resources and U.S. Geological Survey estimates of onshore and state water resources indicate that about 55 percent of the nation's conventionally recoverable oil resources and 51 percent of the nation's conventionally recoverable gas resources are located in the OCS.

Federal OCS oil and gas lease revenues go to the U.S. Treasury General Fund, the Land and Water Conservation Fund, and the National Historic Preservation Fund through a complex process. Bonus payments (one-time payments for the exclusive

rights to the leases), rental payments, and royalty payments contributed more than $75 billion to the U.S. Treasury from 1971 through 1990.

The United States is 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, which derives energy by tapping the temperature gradients in seawater, 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.

Wetlands

While wetlands sometimes have been referred to as mere "swamps," they are now recognized for a variety of important ecological functions. Each wetland works in combination with other wetlands, adjacent uplands, and aquatic systems as part of a

Table 2
Coastal Wetland Acreage in the Continental United States[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: Watzin and Gosselink 1992

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 vary from region to region, but they share three characteristics, as described in *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.

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

The U.S. Army Corps of Engineers (USACE) defines wetlands as areas that are inundated by surface water or groundwater "at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions." The guidelines for determining which areas meet this definition, called "delineation criteria," have been under debate.

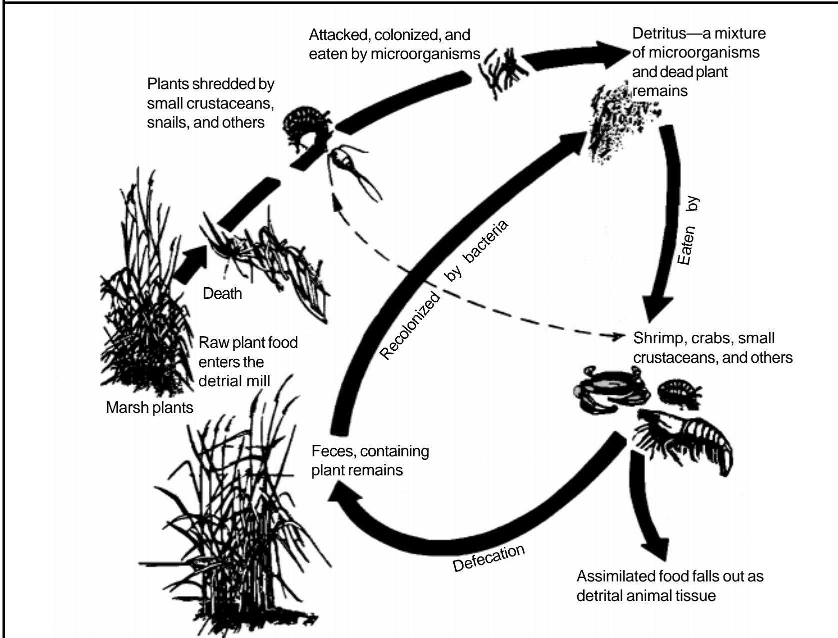
In 1987, the USACE issued a manual for identifying and delineating wetlands to provide regulators, landowners, and others with guidelines and methods to determine whether an area is a wetland for the purposes of carrying out the Clean Water Act (CWA) section 404 permit program (see chapter 5). The USACE is responsible for regulating the discharge of dredge and fill materials into U.S. waters, including wetlands. The USACE manual presents technical guidelines for identifying wetlands and distinguishing them from aquatic habitats and other nonwetlands. It also provides methods and supporting documentation for applying technical guidelines.

In 1989 and again in 1991, USACE, the U.S. Environmental Protection Agency (EPA), the Fish and Wildlife Service, and the Natural Resources Conservation Service attempted to revise the 1987 manual used to identify wetlands. The two revised manuals use the same three parameters as the original manual—soils, vegetation, and hydrology—to delineate wetlands, but differ in how they assess those parameters. For example, the 1989 manual required an inundation, or elevated water table, within 6 to 18 inches of the surface for seven consecutive days during the growing season, while the 1987 manual required inundation within major portions of the root zone during the growing season. For now, all the federal agencies have agreed to use the 1987 manual to provide greater federal consistency to delineate wetlands.

Wetlands provide habitat for a wide variety of fish and wildlife. Coastal wetlands are especially important habitats for estuarine and marine fish and shellfish, various waterfowl, shore birds, wading birds, and mammals. Approximately 35 percent of all federally listed rare and endangered animal species either live in or depend on wetlands. The EPA has estimated that Gulf of Mexico coastal wetlands serve as essential habitat for 75 percent of U.S. migrating waterfowl. Wetlands are among the world's most productive ecosystems (often more productive than artificial agricultural systems), producing great volumes of organic matter that forms the base of the aquatic food chain (see figure 3). Although many commercial and game fish rely on nearshore and coastal waters, many others, including two-thirds of commercial fish and shellfish on the Atlantic seaboard, use coastal marshes and estuaries as nursery or spawning grounds. 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.

Wetlands also provide a number of useful services, depending on their type, location, and geographical factors. According to the National Wetlands Policy Forum, wetlands also serve the following functions:

Figure 3
Marsh Grasses Support the Food Web



Source: Watzin and Gosselink 1992

- ❑ ***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. In addition, because they often are located between rivers and high ground, estuarine wetlands buffer shorelands against erosion.
- ❑ ***Water Quality, Quantity, Supply.*** Wetlands are a source of groundwater and surface water recharge. 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, hiking, boating, and wildlife observation. They provide unique educational opportunities for nature and scientific observation and study. They also provide an important source of commercial timber, of marsh grasses, and of food plants such as cranberries.

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.

The "no net loss" goal is unrealistic "without initiating active programs of wetlands restoration and creation," the group said in its final report. In October 1997, Vice President Gore asked the federal agencies to form a "net gain" strategy that would create as many as 100,000 acres of wetlands by 2005. The Department of Agriculture's Buffer Initiative will be the basis for achieving 2 million miles of riparian buffer strips to protect waters from agricultural runoff by 2002.

Two approaches to the "no net loss" policy involve sequencing and mitigation banking. Once a wetland is identified as warranting regulatory protection, regulators use a series of sequential steps, or "gates," through which a wetlands development proposal must pass: (1) avoid development in the wetland to the extent practicable,

(2) minimize the areas or extent of degradation of the wetland, and finally, (3) require compensation for wetlands impacts 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.

Mitigation banking involves restoring, enhancing, or creating wetlands to specifically 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 as long as they are more than offset by emission reductions elsewhere. In November 1995, federal agencies issued guidance promoting the establishment and appropriate use of mitigation banks within federal wetlands programs. To date, approximately 200 wetlands mitigation banks, in virtually every state, are either in use or under development. However, the long-term viability of mitigation banking has not yet been demonstrated as an effective program to stem wetland losses.

Commercial Uses

More than 110 million metric tons of fish and shellfish are harvested worldwide annually. Sixty percent of the world's population receive more than 40 percent of their animal protein from fish. The sea provides the entire annual protein supply for 1 billion people, according to the United Nations Food and Agriculture Organization.

World fish landings, or the quantities of fish, shellfish, and other aquatic plants and animals brought ashore and sold, were 113 million metric tons in 1995, an increase of 2.4 million metric tons from 1994. China was the leading nation in fish landings,

with 21.6 percent of the total catch, and the United States was fifth, with 5 percent.

Though Americans have typically consumed less seafood per capita than inhabitants of most other industrialized countries, they are eating more seafood than in the past. The U.S. annual per capita consumption of commercially caught fish and shellfish has risen slowly from 11.8 pounds in 1970 to approximately 15 pounds each year since 1990. Of the 14.8 pounds per capita consumed in 1996, about 60 percent was fresh and frozen fish, 30 percent canned fish, and about 2 percent cured fish.

National fishery statistics are compiled annually by the Fisheries Statistics Division of the National Marine Fisheries Service and published annually in *Fisheries of the United States*. The report is available on the World Wide Web at http://kingfish.ssp.nmfs.gov. This document includes information on commercial and recreational fisheries of the United States and foreign catches in its EEZ. Information is broken down by species, geographic location, fishing effort, employment, and other criteria.

Table 3 lists the top commercial fish according to quantity and value. According to the 1996 edition of *Fisheries of the United States*, commercial landings by U.S. fishers at U.S. ports were 9.6 billion pounds (4.3 million metric tons) in 1996 (7.5 billion pounds of edible fish and 2.1 billion pounds of industrial fish). This total represents a decrease of 222.7 million pounds (2 percent) from the 1995 total. Landings that decreased from 1995 to 1996 were Pacific hake, menhaden, pollock, and pink and red salmon.

Aquaculture, or fish farming, is a potentially enormous industry. Growing oysters, mussels, shrimp, and other seafood 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. According to the National Oceanic and Atmospheric Administration (NOAA), 77 million pounds (meat weight) of shellfish were harvested from U.S. waters in 1995, with a dockside value of $200 million.

Table 3
Rankings for U.S. Commercial Fish Landings, 1996

According to Quantity	According to Value
1. Alaska pollock (single species)	1. Shrimp
2. Menhaden	2. Crab
3. Salmon	3. Salmon
4. Cod	4. Lobster
5. Hake	5. Alaska pollock
6. Flounder	6. Flounder
7. Crab	7. Cod

Source: National Oceanic and Atmospheric Administration 1997

Aquaculture, however, has the potential to harm the marine environment by introducing polluting wastes into marine waters, according to a 1997 Environmental Defense Fund report. Additional concerns about aquaculture include nutrient overenrichment and other habitat degradation and risks to wild stocks. The major fears for wild stocks are the introduction of exotic diseases and parasites, an inability to distinguish between cultured and wild forms of the same species, and potential interbreeding and replacement of wild stocks by escaped cultured species.

Small-scale, but encouraging, projects combine various land/water systems for sewage treatment, algae production, and mariculture (the cultivation of marine and brackish-water organisms in their natural environment). Woods Hole Oceanographic Institution scientist John Ryther has calculated that a 50-acre algae farm and a 1-acre production facility could produce 1 million pounds of shellfish per year by using effluents from a town of 11,000 people. Some argue that there are problems with these combination programs, such as discharge that may be contaminated with pathogens and heavy metals.

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. Factors such as overfishing, pollution, habitat degradation, and bycatch (fish and other marine life incidentally caught) waste, have left some fisheries in a fragile state. In the

Additional Resources

Statistics on fisheries are available from these organizations.

National

NOAA, National Marine Fisheries Service, Fisheries Statistics and Economics Division (F/ST1)
1315 East West Highway, Room 12339
Silver Spring, MD 20910
(301) 713-2328,
http://remora.ssp.nmfs.gov

International

United Nations Food and Agriculture Organization (FAO)
2175 K Street, NW, Suite 300
Washington, DC 20037
(202) 653-2400
http://www.fao.org

General

Center for Marine Conservation
1725 DeSales Street, NW
Washington, DC 20036
(202) 429-5609
http://www.cmc-ocean.org

Chesapeake Bay, the once thriving oyster fishery may disappear, striped bass fishing has been highly regulated and in some instances banned, and the once abundant shad are scarce. Programs to bring back striped bass and 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 they contain high levels of toxic contaminants. Elsewhere in the United States, 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 or destruction and hydroelectric dams. Chapter 4 includes statistics on overfishing.

Shipping, Ports, and Harbors

The U.S. Maritime Administration (MARAD), a branch of the Department of Transportation, compiles statistics and economic information about shipping. The USACE generates waterborne commerce statistics. According to MARAD, 364 privately owned, deep-draft vessels made up the U.S. Merchant Marine fleet as of 1 April 1997. Of these ships, 296 were ocean-going ships and 68 were Great Lakes vessels. The privately owned American-flag merchant fleet ranked eleventh in the world on a dead weight tonnage basis and fifteenth in total number of ships in 1997. The largest fleets by far are Panamanian- and Liberian-flagged ships, followed by ships registered in Greece, Cyprus, and the Bahamas. The flag does not necessarily determine the owner or operator of the ship. While all U.S.-flagged ships are U.S.-owned, many foreign-flagged ships may also be owned or controlled by U.S. companies or individuals.

MARAD estimates that as of 1 January 1997, 34,591 people were employed in commercial shipyards in the United States. Clerks, checkers, and allied craftspeople, collectively listed as "longshoremen," accounted for another 22,894 jobs.

Petroleum products and coal accounted for more than 50 percent of the tonnage of U.S. waterborne commerce. Table 4 lists the top 10 U.S. ports by total waterborne commerce. General cargo (countable items as opposed to bulk cargo) accounts for only 10 percent of U.S. foreign waterborne tonnage. However, general cargo commodities are higher in value, produce more revenue, and have a greater economic effect per ton than bulk

Additional Resources

For statistical and economic information on shipping, contact the U.S. Maritime Administration, Department of Transportation, 400 Seventh Street, SW, Room 7219, Washington, DC 20590 (202) 366-5812.

The administration's World Wide Web site is http://marad.dot.gov.

Table 4
Top 10 U.S. Ports, 1994
(ranked by tonnage of freight handled)

Port	Total (metric tons)
Port of South Louisiana	167,697,405
Houston, Texas	130,327,860
New York/New Jersey	114,395,955
Baton Rouge, Louisiana	78,240,516
Valdez, Alaska	77,197,549
Corpus Christi, Texas	70,885,650
New Orleans, Louisiana	66,526,176
Port of Plaquemine, Louisiana	58,747,729
Long Beach, California	51,275,779
Tampa, Florida	47,084,629

Source: Maritime Administration 1996

goods such as coal and oil. Table 4 shows the 1994 top 10 U.S. ports ranked by tonnage of freight handled.

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. With the completion of the St. Lawrence Seaway in 1959, ocean-going vessels were able to navigate the Great Lakes. Competition from trains and trucks, however, has prevented the expansion of Great Lakes 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 recreational activities such as fishing, boating, sunbathing, snorkeling, scuba diving, surfing, and swimming. According to Gallup Organization polls, fishing has consistently 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 (e.g., transportation, fuel, tackle, lodging, charter boat fees, food, gear, magazines) rather than in dollars generated by selling fish. The nonmonetary values are the pleasures derived from the sport and from the consumption of the fish.

The National Marine Manufacturers Association (NMMA) is an industry trade group that researches and publishes boating data. The NMMA reported that in 1996, 320,850 new boats came into use throughout the United States, bringing the country's recreational boat population to more than 15.8 million. In addition, approximately 77.7 million recreational boaters in 1996 spent a total of $17.7 billion on related products and services.

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 NOAA undertook the National Coastal Recreation Inventory Project (NCRIP) to learn more about coastal recreation. In a 1989 report, NCRIP stated that

Additional Resources

- U.S. Department of Commerce, *NOAA Strategic Plan: A Vision for 2005*, May 1996, http://www.noaa.gov
- NOAA, National Ocean Service, *50 Years of Population Change Along the Nation's Coasts: 1960-2010*, 1990, http://www-orca.nos.noaa.gov/info_access/orca_infoaccess.html
- NOAA, National Ocean Service, *Estuaries of the United States: Vital Statistics of a Natural Resource Base*, http://www-orca.nos.noaa.gov/info_access/orca_infoaccess.html

Many other NOAA publications are available online and may be accessed through the NOAA Central Library home page at http://www.lib.noaa.gov. The home page provides a link to NOAA's "Wind and Sea" Internet finder. The reference desk may also be contacted at (301) 713-2600, extension 124.

"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."

Current NOAA estimates concerning the recreational uses of U.S. coastal areas include the following:

- ❑ Approximately 94 million people boat and fish annually.
- ❑ The average American spends 10 recreational days on the coast each year.
- ❑ The coasts (excluding the Great Lakes coastline) support 25,500 recreational facilities.
- ❑ More than 180 million Americans visited ocean and bay beaches in 1993.
- ❑ Recreational fishing contributes $13.5 billion annually to the U.S. economy.
- ❑ Coastal recreation and tourism generate $8 to $12 billion annually.

Coastal tourism, like the coastal population, has grown tremendously and will continue to grow. The second-largest, fastest-growing industry in Hawaii is marine tourism. 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 United States.

An April 1987 Office of Technology Assessment publication, *Wastes in Marine Environments*, 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."

Recreational use of the coasts, however, comes at a price. The USACE reported in 1996 that from 1950 to 1996 the federal government spent $440 million to maintain and replenish beaches. Because of these expenses, the future of the USACE shoreline protection program is currently being debated.

Waste Disposal

In addition to supplying living and nonliving resources and meeting transportation and recreation needs, coastal waters long have been used for disposing of sewage treatment effluent (liquid) and sludge (semiliquid), dredged materials, and industrial wastes. Marine bodies have a great capacity to assimilate certain wastes, but this capacity is neither uniform nor unlimited. Improper disposal practices can harm coastal and marine resources.

In 1989, about 10 percent of all sewage sludge produced in the United States 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 into the ocean. The discharge of sewage effluent and industrial waste from pipes is regulated under the CWA.

According to *Ebb Tide for Pollution*, a 1989 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*, estimates more than 2,600 beach closings or advisories were issued for swimming in 1996 (see chapter 4, table 5). High levels of bacteria, primarily from sewage effluent, caused the majority of closures and advisories.

Dredged materials from harbors and channels—clean sand and gravel or muck that 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. The USACE disposes of about 300 to 350 million cubic yards of dredged material per year; 90 to 95 percent is categorized as clean (i.e., free from contamination) and can be used beneficially for projects such as creating wetlands, replenishing beaches, and enhancing habitat. The remaining amount 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 CWA (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 those resources. Chapter 4 offers additional statistical information and discusses some of the coastal and ocean issues resulting from these pressures.