# Executive Director's Report

## HMAP/IVCP Committee

In February the Council recommended establishing a committee to help develop two proposals to reduce bycatch, the Halibut Mortality Avoidance Program (HMAP) proposed by Groundfish Forum, and the Individual Vessel Checklist Program (IVCP) proposed by Alaska Marine Coastal Coalition. The analysis of these two proposals is due for initial review next October. We have had two nominations to be on the committee, but could use some advice from the Council on which groups should be represented. It has been suggested that observers should be represented as well as trawl associations, and AMCC. Does the Council have any additional recommendations? The committee will likely meet in mid-May, back to back with the VBA committee.

## Socioeconomic Data Committee

This committee will meet Wednesday night to organize themselves and report back to the Council later in the week. The chairman will be Dennis Austin and the rest of the membership is still being settled. Their terms of reference will be to move the economic data collection effort and plan amendment along so we are not continually stuck in our present bind of having no cost data to perform a quantitative net benefit assessment.

## AP Officers

The Council needs to confirm the newly elected AP officers.

## June Meeting

This June we meet in Dutch Harbor. All the items that you see on this April agenda for initial review will be on the June agenda for final action. So, it should be a long and arduous meeting, Wednesday, June 10 to at least Monday, June 15. Hopefully when we get done with it, we won't be weathered in for a day as happened in 1995.

## 1998 Year of the Ocean

The United Nations has declared 1998 as the International Year of the Ocean and it is being used as an opportunity to raise public awareness about the value of the ocean to all Americans. Along those lines, our federal agencies with ocean-related programs have developed a series of discussion papers which address wide ranging issues such as exploration, living resources, tourism, transportation, climate change, etc. Item B-1(a) is the section on living marine resources. I am distributing it to you not only because it represents to some degree, a synthesis of national policy on use and management of ocean living resources, but also because it recognizes Alaska groundfish management as an example of a success story (see p. C-9). This type of recognition can be very fleeting, but still, as I attend various conferences and meetings on fisheries management, more and more I receive positive feedback on the exemplary job this Council has done, and I thought you ought to know about it. There will be a national YOTO conference in Monterey starting June 8, and an international conference about the same time in Lisbon, Portugal. I will keep you posted as YOTO develops further in the coming months.


# *YEAR OF THE OCEAN*

## *Discussion Papers*

*March 1998*

*Prepared by the U.S. Federal Agencies with ocean-related programs*

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# 1998 Year of the Ocean

## ENSURING THE SUSTAINABILITY OF OCEAN LIVING RESOURCES

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This Year of the Ocean document was prepared as a background discussion paper and does not necessarily reflect the policies of the U.S. Government or the U.S. Government agencies that participated in its preparation.

## EXECUTIVE SUMMARY

The ocean covers nearly three fourths of the planet and embraces most of the earth's biosphere—the region where life occurs. The ocean's living resources are a treasure for current and future generations of humankind. Fisheries provide food for billions of people; through science, new medicines and materials from the amazing diversity of marine life forms are being discovered; and the ecosystem functionings of marine life sustain human life in ways just now beginning to be discovered. Marine aquaculture holds the promise of helping to meet the food demands of a growing world population. As worldwide observance of the Year of the Ocean proceeds, it is worth taking stock of current perceptions about the living ocean, the status of its resources, the threats it faces, and the steps that the United States is taking to secure this treasure for successive generations.

Knowledge about marine species and ecosystems lags far behind the state of information about terrestrial systems. Despite the value that living marine resources represent, relatively little still is known abou. them—indeed, most species are unknown and whole new ecosystems have been discovered in the last two decades. Yet, for those species and ecosystems most studied to date—particularly commercially exploited fish, protected marine mammals and turtles, and certain coastal ecosystems—trend indications have convinced many observers that the productive limits of the ocean are being reached and often exceeded..

Both U.S. and world fisheries, with a few exceptions, exhibit flat or declining trends in harvests and the majority are thought to be fully or overutilized. Recent trends in catches, trade. contribution to food supplies, and overall economic viability are not encouraging. Certain marine mammals and sea turtles in U.S. waters appear to be recovering after years of population declines. Still, habitat destruction and human activities are increasingly placing other species. such as salmon, in jeopardy, while less well studied marine organisms are probably being lost before ever being identified, much less protected. The world's most biologically diverse marine ecosystems, coral reefs, provide home to hundreds of commercially valuable fish species. Despite their importance, the health and cover of shallow water coral have declined worldwi.. over the last two decades. Without another marine ecosystem, coastal wetlands, many spec.. fish and shellfish cannot survive. Yet, existing programs to protect wetlands notwithstandi.. habitat, acreage, and function of wetland areas continues to decline.

Research and experience have shown that the bounty of the ocean is not limitless. Increasing population and the accompanying expansion of human activities have the capacity to diminish the ocean's productivity in numerous ways. The ocean's living resources and the benefits derived from them are threatened by fisheries operations, chemical pollution and eutrophication, alteration of physical habitat, and invasions of exotic species. Looming on the horizon are new threats caused by ozone depletion and human-induced climate change, whose potential negative impacts on whole ecosystems add further to the impact of already existing threats caused by other human activities.

The U.S. government, in partnership with public and private stakeholders, has recognized these threats to the marine environment and is taking steps to address these problems. Evidence already shows that U.S. management and conservation practices are paying dividends in healthier resources. For example, the United States has set a policy framework for sustainable utilization of fisheries through the Sustainable Fisheries Act of 1996. Provisions of the Act being implemented include prevention of overfishing, designation and conservation of essential fish habitat, reducing bycatch, and managing harvesting capacity. As fishery harvests are reduced to sustainable levels, marine aquaculture will play an increased role in meeting domestic and world food needs. The United States is developing the technology and policy framework that will allow this expansion in food production in an environmentally sustainable manner.

Regarding other concerns, strong protection under the Endangered Species Act and Marine Mammal Protection Act has enabled the recovery of certain marine mammals and increased populations of at least two sea turtle species in U.S. waters. Integrated coastal area management, meanwhile, is providing new tools to protect the most productive coastal and marine ecosystems. The United States has also been a leader in advancing international initiatives to conserve marine fisheries and biological diversity—a shared resource. In each of these natural resource management areas, the United States is beginning to apply a precautionary approach that acknowledges the limits of scientific knowledge and requires erring on the side of conservation. The key to success will depend on sound science and strengthened partnerships with all stakeholders to conserve and sustainably use the nation's marine living heritage.

The Year of the Ocean is an opportune time to examine the challenges confronting marine living resources in light of new tools: advanced and expanded scientific information, the precautionary approach, increased inclusiveness and partnerships, and the potential of ecosystem-based management. Much has been done in the past 20 years, and 1998 provides an excellent starting point for a new direction for the next 20 years.

## INTRODUCTION

Humans have sailed the seas for centuries, but considered anything beneath the surface or beyond the horizon to be "incognito," and to be labeled as dangerous: *Here be dragons*. While our modern perspective may lead us to scoff at the early map makers, even today many maps treat the ocean as essentially flat, blue, empty space between the continents—featureless and devoid of interest. Despite quantum leaps in scientific knowledge about the ocean, many Americans still view the ocean as limitless, vast, and unknowable. According to recent survey research, however, citizen awareness of the value of ocean resources and the threats they face is growing (The Mellman Group, 1997). As worldwide observance of the Year of the Ocean proceeds, it is worth taking stock of existing knowledge about the ocean—and the health and abundance of its living resources—in order to be better able to chart a course for the future.

Life on earth arose from the ocean, and living marine resources continue to provide essential ecosystem services on which all life depends. Only in recent years has the extent to which the ocean is host to a vast diversity of species and ecosystems been recognized. Even though no "dragons" have been found, exploration of the ocean, which covers nearly three-fourths of the planet, has revealed creatures even more unusual, and living resources even more valuable, than could have been imagined by our ancestors. Only in the last 20 years have the seas begun to yield the secrets of the deep ocean floor. For example, the deep ocean is home to communities of organisms whose productivity is based on chemosynthesis instead of photosynthesis, the latter being the process by which most plant life on the earth and in the sea converts sunlight into useable biological energy. Other whole new ecosystems have been discovered in the ocean in recent years, and the vast majority of species remain to be discovered. Although the ocean may have fewer species overall than terrestrial environments, the array covers a much higher degree of diversity at higher taxonomic levels. All but one of the several dozen known animal phyla are represented in the ocean, while only about one half occur on land.[1]

Providing humanity with food, economic benefits, and recreation, living marine resources represent a treasure for current and future generations. These resources range from the tremendously productive phytoplankton, which help maintain atmospheric gas balances, sequester carbon, and form the base of many marine food chains, to corals, which build reefs that protect coastlines and create the most biologically diverse ecosystems; and from pelagic fishes upon which many of the world's commercial fisheries depend, to deep sea hydrothermal vent communities with unique adaptations that may provide important resources for future biotechnology breakthroughs (see Box 1).

[1] Taxonomy is the system used by biologists to describe and classify organisms. The so-called taxonomic pyramid is divided into kingdom, phylum, class, order, family, genus, species. A whole new Kingdom, the Archaea, was discovered in deep sea hydrothermal vents. The Archaea are as different from bacteria as bacteria are from plants and animals.

### Box 1: The Value of Living Marine Resources[2]

The diversity of life in the ocean provides a natural "hope chest" for current and future generations. The ocean's biological diversity—the living resources that compose it and the ecological processes that sustain it—form a foundation for the quality of human life as well as the raw materials to enrich it. Biological diversity, or biodiversity, refers to the variety and variability among living organisms, and among the ecological complexes of which they are a part. It encompasses all of the world's living resources. Marine living resources provide essential economic, environmental, aesthetic, and cultural benefits to humanity.

**Direct use values:** The fish humans consume represent the most widely recognized economic value, whether from capture fisheries or marine aquaculture. Sixteen percent of all animal protein consumed worldwide comes from the ocean. In Asia alone, one billion people rely on fish as their main source of protein. The Food and Agriculture Organization of the United Nations estimates the total value to fishers of the world's marine catch at $80 billion per year. The comparable value of fishes landed by U.S. fishers is $3.5 billion. Fishes and seaweeds provide important fertilizers and livestock feed. Besides food, marine living resources provide products including ornamental marine life, raw materials, and medicines. Marine bioprospecting extracted Arabinosides from the sponge, *Tethya crypta,* leading to more than $50 million annual sales in derived antiviral medicines. Just five drugs developed over the past few years in research funded by Sea Grant have a market potential estimated at $2 billion annually.

Direct uses also include non-consumptive uses such as ecotourism, recreation, and research. The economic return from whale watching, SCUBA diving, and visits to aquariums far exceeds that which could be earned from consumptive use of the organisms in question. Millions of tourists spend about $2 billion a year in the Florida Keys, with the National Marine Sanctuary and other marine protected areas providing a major attraction. Without sustainable management of these nature-based tourist attractions, economic potential can diminish or be lost entirely.

**(continued)**

[2]The system for valuations for marine biodiversity (direct, indirect, option, and non-use values), follows: UNEP 1995. Global Biodiversity Assessment. Cambridge University Press, Cambridge, U.K. 1140 pp.

**Box 1 (continued)**

**Indirect use values:** Maintenance of intact, healthy ecosystems provides global and local benefits. Marine ecosystems provide natural goods and services such as carbon storage; atmospheric gas regulation, particularly by the ocean's enormously productive phytoplankton; nutrient cycling; and waste treatment. Coral reefs, mangroves, and kelp forests protect coastal areas from weather and storms. Marine algae contribute nearly 40 percent of global photosynthesis. In many cases, indirect use values greatly exceed direct use values, yet they often are not incorporated into economic calculations. Globally, the indirect use values of marine ecosystems recently have been estimated at $5.2 trillion per annum for open ocean ecosystems and $11.7 trillion for coastal ecosystems (Costanza *et al.* 1997).

**Option values:** Many components of biodiversity not used, or even recognized today, may help meet human needs in the future. Technological advances in food production and pharmaceuticals rely heavily on the natural genetic diversity of plants, animals, and microorganisms. Advances in molecular biology have ensured that the coming century will see an acceleration in the use of genetic materials. Marine organisms have evolved complex chemical compounds and processes for defense and predation, or for survival in extreme environments—such as deep sea hydrothermal vents. These compounds and the underlying genetic diversity have tremendous potential economic importance that would be foreclosed by the loss of marine biodiversity.

**Non-use values:** The sea has been a source of ideas on subjects from past global climates to the ecology of uncommon species, as well as a source of inspiration: "The oceans, with their powerful storms, their shimmering palette of colors, and their varied mysterious sea life, have inspired some of the world's finest painting, poetry, stories, and music." (Norse 1993) The spiritual, cultural, or aesthetic regard in which people hold the natural world and its resources and the values humans place on retaining these systems for future generations are usually not captured by current market or economic models, but are inextricably linked to human appreciation of the sea and its inhabitants. This appreciation stimulates the formation of conservation values and a stewardship ethic.

Yet at the same time that humankind was learning more about the diversity of living marine resources, it was also learning how to better exploit the marine environment in search of minerals, food, waste disposal, and transportation. As population increased, demands accelerated for food, products, and services from the ocean, as did demands for living and recreational space on its shores.

In the past, most human activities were seen as separate from the ocean, or of such insignificance in the face of the sea's vastness that they didn't matter. Pollution was one of the first human actions to be seen as possibly damaging to the ocean. Huge oil spills in the early 1970s coincided with the emergence of the environmental movement and spurred governments and the public to focus on pollution from ships. Blowouts from oil rigs off Santa Barbara, California heightened concern about offshore oil drilling. Also at that time, ships routinely disposed of wastes overboard, and concern was just beginning about land-based sources of pollution or the effects of either of these sources on the marine environment. By the 1980s, ocean dumping was internationally recognized as a problem and agreements were put in place to control disposal of shipboard waste and intentional dumping. By then, Americans had made the connection between clean water and healthy coasts. Control of industrial and municipal waste water discharges into rivers, streams and coastal waters has been regulated in the United States since the passage of the Clean Water Act in the early 1970s. Dumping of industrial wastes and sewage sludge into the ocean off U.S. coasts ended in 1988 and 1992, respectively, as a result of the Ocean Dumping Ban Act of 1988.

As the United Nations and its member nations, including the United States, prepare to observe the Year of the Ocean, there is both increased awareness of human impacts on living marine resources as well as good news about how these impacts are being addressed. The good news is the growing worldwide acceptance of the precautionary approach to marine resource management. A concept unheard of a decade ago, the precautionary approach states that in the face of uncertainty, managers and decision makers must err on the side of conservation of living marine resources and protection of the environment. This is the opposite of earlier resource management approaches, where the proponent of resource use prevailed until something went wrong. Representing a radical shift of the burden of proof from those who would conserve resources to those who would use them, the precautionary approach is now being integrated into U.S. policy and practice, as well as into many international agreements. And this is occurring none too soon, since many ocean resources continue to decline in the face of increasing demands upon them.

The federal government, as steward of U.S. living marine resources in partnership with the American people, has the opportunity to observe the Year of the Ocean in both a reflective and forward-looking manner. The Year of the Ocean provides a vehicle to accomplish several goals including;

- increase public awareness of what is known about the marine environment
- solidify and strengthen federal partnerships and cooperation with stakeholders
- use acquired knowledge to act on behalf of the resources
- use enhanced communication to engage others to act
- expand the knowledge base and the application of the precautionary approach

This paper is intended to provide stakeholders and interested constituents with information on what is known about the state of living marine resources, how human actions affect these resources, and what tools resource managers can use to progress from this year's

observance of the Year of the Ocean to a future wherein the ocean's living resources are used sustainably. Not only does the Year of the Ocean observance provide an opportunity for federal managers to communicate to the public and to bridge the gap between perception and today's best available science, it will provide avenues through which the public and user groups can participate in the important decisions regarding marine living resources.

## THE STATUS AND TRENDS OF LIVING MARINE RESOURCES

Knowledge about marine species and ecosystems lags far behind that of terrestrial systems. In the last two decades, discoveries in the ocean have been made that have shaken the foundation of human understanding of what is in the sea. These discoveries have highlighted how little is still known about the oceans, and have led to greatly increased estimates of overall marine biodiversity. Recent discoveries have ranged from a new large cetacean—the pygmy beaked whale (*Mesoplodon peruvianus*)—first recorded in 1991, to the discovery in 1997 of an entire new deep-sea ecosystem of eyeless worms living in symbiosis with bacteria that feed on methane ice in the Gulf of Mexico. Contributing to the improved understanding of the state of marine life that has been acquired in recent decades have been improved information gathering techniques, more stringent reporting requirements, advances in technology, cooperation among states, academia, and other nations, and increased outreach to stakeholders, user groups, and others.

Yet, as the U.S. government and its partners in marine resource management observe the Year of the Ocean, it is important that the limitations regarding human understanding of marine organisms, their habitats, and the factors that affect them be recognized. Notwithstanding the important strides that have been made, what relatively little is known about the state and trends of marine living resources is concentrated in the areas of commercially exploited species, protected marine mammals and turtles, and certain commercially significant and accessible coastal ecosystems such as wetlands and coral reefs.

Until recently, the oceans were thought to be a limitless source of food and natural resources, and a limitless sink for human pollution. Trends for living marine resources during the last few decades, however, have convinced many observers that human activities are reaching and often exceeding the productive limits and recuperative potential of the ocean. Many fishery resources are being overexploited, and the ability of many species and ecosystems to recover from overutilization or excessive pollution is limited. The following section summarizes what is known about the status and trends of fisheries, protected species, coral reefs, and coastal wetlands.

### Fisheries

Among the best known ocean living resources are wild populations of fish and shellfish that are harvested commercially and used directly and indirectly as human food. Worldwide, there are 15 to 20 million fishers, 90 percent of whom are small-scale fishers; moreover, fisheries

provide up to 180 million more jobs in associated sectors (FAO 1993). Recent trends indicate that both worldwide and in the United States, about one-third of the resources on which these fishers depend are overfished (Figure 1).

The domestic and global status of many commercial fish stocks reveal a pattern of declining populations and are increasingly a source of serious concern to scientists, managers, and policy makers. On a global basis, fishery resource reports by the UN's Food and Agriculture Organization (FAO) since the early 1990s have highlighted that many of the traditional commercial stocks are overutilized and thus showing declining yields and productivity. Increases in total catch from capture fisheries in the last two years consist of low-value pelagic species taken by a small number of countries, and the harvesting of new deepwater stocks that are unlikely to support current levels of exploitation. In its latest annual report, FAO has concluded that 60 percent of commercial stocks are either overfished or fully harvested (Figure 1; FAO 1996).

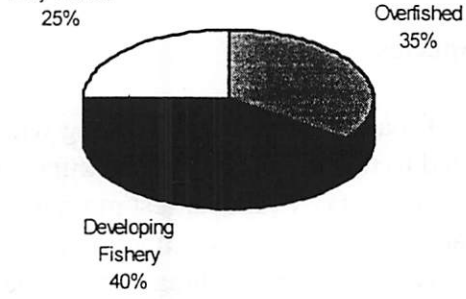
Since the enactment of the Magnuson Fishery Conservation and Management Act in 1976,[3] fisheries in the United States have been managed by a system of eight regional councils, which develop Fishery Management Plans in accordance with national standards. Under this system, limits on catches, seasons, areas, and gear have contributed to the conservation of U.S. fishery resources. Among management successes are Alaska groundfish, where the transition from foreign fleet to U.S. fleet vessels for harvesting (provided for by the 1976 Magnuson Act) was made while maintaining the stock, which is the most abundant in the nation. Other management successes include king and Spanish mackerel, where significant declines in the late 1970s and early 1980s were reversed with a strict rebuilding plan and stocks are no longer considered overfished. Other successes include management actions that led to the recovery of stocks of striped bass , and surf and ocean quahogs on the Atlantic coast (Matlock in press). In all, the Councils have developed 39 management plans covering hundreds of species.

Despite management successes, many fish stocks in the United States are threatened. The National Marine Fisheries Service's (NMFS) 1997 *"Report to Congress on the Status of Fisheries in the United States"* (NMFS 1997) covered 727 marine species under federal management in the nation's 200-mile offshore exclusive economic zone. Of these 727 species, sufficient information to determine their fishery status was available for only 279 species, less than two-fifths of the total. Of these, 86 species (31 percent) were listed as "overfished," 183 species (66 percent) were listed as "not overfished," and 10 species (3 percent) were considered to be approaching an overfished condition (Figure 1). The overfished species included some of the most valuable commercial fish and shellfish. The basis for the identification of overfished stocks in the NMFS report was the overfishing definition used in the Fishery Management Plans, supplemented with information from the 1995 edition of *"Our Living Oceans"* (NMFS 1996). The Sustainable Fisheries Act of 1996 provided a more scientifically rigorous definition

[3] The Sustainable Fisheries Act of 1996 reauthorized and amends the Magnuson Fishery Conservation and Management Act (which has been renamed the Magnuson Stevens Fishery Conservation and Management Act.)

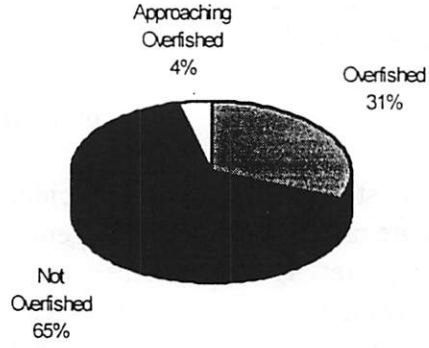
of "overfished" and "overfishing." Fishery Management Plans are currently being amended based on this definition and it is likely that additional stocks will be identified as overfished.

**Fig. 1. Status of Fisheries**




Status of World Fisheries
Based on 200 major fish resources.

Source: FAO 1996.




Status of U.S. Fisheries
Based on 279 of 727 federally managed species for which sufficient data are available.
Source: NMFS 1997.

Annual U.S. catches have fluctuated between 4.5 and 5.0 million tons since 1990 and the gross first-sale value has not varied much from an annual average of $3.5 billion. To put these quantities and revenues in perspective, the United States is the fifth largest fishing nation, and its catch represents about 5 percent of world totals.

Internationally, FAO estimates that without major changes in fishery management, landings will not be able to exceed current levels despite increased demand from growing populations, and could in fact be reduced by as much as 25 percent (FAO 1996). In recent years, the fishery sector's contribution to the world's growing food needs has been supported largely by a booming inland and coastal aquaculture sector. The culture of marine species offers important opportunities for enhancing global food production and food security. Indeed, aquaculture is the fastest growing segment of U.S. food production. Without careful planning and oversight, however, aquaculture in marine and coastal environments can have negative impacts on natural biodiversity. These impacts include:

- habitat degradation (e.g., intentional destruction of mangroves in shrimp culture or unintentional negative impacts on benthic communities from the buildup of wastes under culture pens);
- eutrophication;

- genetic effects on or competition with native species by non-indigenous cultured species;
- introduction of disease to natural populations.

Economically important shrimp aquaculture operations in Asia were hit hard by disease in 1996. The international community has acknowledged the need for sound marine aquaculture practices so that it remains a sustainable industry with minimal adverse impacts on the surrounding environment (Allsopp 1997).

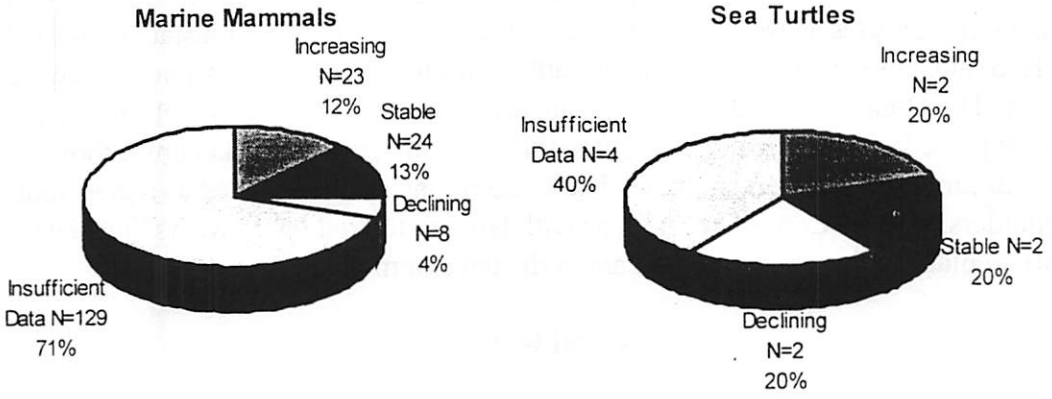
## Protected Marine Species

In the past, the exploitation or incidental capture of many marine species, along with a lack of adequate natural resource management policies, led to the decline and even extinction of many marine species. This process began early—the Steller's sea cow, the largest marine herbivore known to have occupied America's coastal waters, was hunted to extinction in 1768—and has continued into the second half of the 20th century. Current threats to marine species remain significant. For example, many West Coast Pacific salmon populations are at risk; scientists continue to seek answers to declines among some sea turtle, sea lion, seal, and seabird populations; and the northern right whale is critically endangered with fewer than 300 animals remaining in the Atlantic Ocean.

Since the enactment of the Marine Mammal Protection Act (MMPA) in 1972 and the Endangered Species Act (ESA) in 1973, selected marine species, particularly marine mammals, sea turtles, and salmonids have received greatly enhanced levels of protection in the United States. Pacific grey whale populations have largely recovered from overexploitation and have been removed from the endangered species list. However, other species have shown little sign of recovery despite two decades of protection. Of the 163 marine mammal stocks managed under the MMPA, there is sufficient long-term population data to describe trends for only about one third of the stocks. Eight of these are declining, 24 are stable, and 23 are believed to be increasing (Figure 2; NMFS 1996).

There were 38 marine species and seabirds listed under the ESA as of December 1997. Endangered marine species in U.S. waters include the northern right whale, sei whale, sperm whale, finback whale, bowhead whale, blue whale, humpback whale, Hawaiian monk seal, West Indian manatee, California least tern, hawksbill sea turtle, leatherback sea turtle, Kemp's ridley sea turtle, shortnosed sturgeon. Certain populations of Steller sea lions, brown pelicans, roseate tern, green sea turtles, olive ridley's sea turtles, sockeye salmon, chinook salmon, cutthroat trout, and steelhead trout are also endangered. Threatened species in U.S. waters include marbled murrelet, loggerhead sea turtle, Gulf sturgeon. Also threatened are certain populations of coho salmon, chinook salmon, cutthroat trout, steelhead trout, Steller sea lion, southern sea otter, green sea turtle, and olive ridley turtle.

**Fig. 2. Status of Marine Mammals and Sea Turtles in U.S. Waters**




Source: NMFS 1996

Six species of sea turtles regularly occur in U.S. waters (Figure 2). All are listed as endangered or threatened under the ESA. The Kemp's ridley sea turtle (*Lepidochelys kempi*), is the most endangered species of sea turtle in U.S. waters. After precipitous declines in population size, it is now showing signs of recovery. In 1947 an estimated 40,000 females nested in one day. By 1966, only 6,000 nests were documented, and the plummeting population continued to decline to a low of 702 nests documented in 1985. Among the causes for the decline of this species were the incidental capture of the species at sea and taking eggs and nesting females from the primary nesting beach in Mexico. The Mexican government began full protection of the nesting beach in 1966, and in 1978, the U.S. Fish and Wildlife Service and Mexico's Instituto Nacional de la Pesca began a cooperative program to enhance the recovery of the Kemp's ridley sea turtle. The National Marine Fisheries Service has provided funding in recent years to maintain and enhance protection efforts on the nesting beach. In addition, NMFS required that shrimp trawlers install turtle excluder devices in their nets by the early 1990s. As a result of increased hatchling production and protection at sea, the turtle population is showing signs of recovery. More than 2,200 Kemp's ridley nests were documented in 1997. Green sea turtle populations also appear to be increasing in the U.S. Atlantic and in Hawaii, although there is great concern about the increasing frequency of fibropapillioma disease in this species (NMFS 1996).

As a result of human activities such as logging, dam building, overgrazing, mining, urbanization, overfishing, poor hatchery policies, and natural events such as floods, drought and El Niños, Pacific salmonids are rapidly disappearing in California, Oregon and Washington. Since 1990, five stocks have been listed as endangered and seven as threatened under the ESA.[4]

[4] Endangered stocks are the Sacramento River winter run chinook (*Oncorhynchus tshawytscha*), Snake River sockeye (*O. nerka*), Umpqua River cutthroat trout (*O. clarki clarki*), southern California steelhead (*O. mykiss*) and the upper Columbia River steelhead (*O. mykiss*). There are two chinook stocks, two coho (*O. kisutch*) stocks and three steelhead stocks listed as threatened.

Coastwide reviews of all chinook, sockeye, cutthroat, chum (*O. keta*) stocks will be completed in 1998. Listing determinations will follow immediately after the status reviews are completed. The ESA provides strict prohibitions on taking endangered salmonids and provides for the responsible federal agency to put rules in place that will reduce, or in some instances prohibit, takes of threatened species as well. The ESA has flexibility that allows both state conservation plans and Habitat Conservation Plans with private parties to aid in conservation and recovery of listed species. The Oregon Coastal Salmon Restoration Plan is a positive model for other states to follow as it provides scientifically based strategies for conservation and couples those strategies with funding to implement them. The Oregon Plan was developed as a grassroots effort with stakeholders. Habitat Conservation Plans with large industrial land owners and state agencies are in place in the west and more are in the development phase.

## Coral Reefs

As the world's most biologically diverse marine ecosystems, coral reefs are home to one-third of all marine fish species and tens of thousands of other species. Recent estimates suggest that while nearly 100,000 species are known to occur on coral reefs, the number may be underestimated by a factor of ten (Reaka-Kudla, 1997) Coral reef areas under U.S. jurisdiction cover approximately 16,879 square kilometers (NOAA 1998). They are home to approximately 550 coral-dependent species of commercially valuable fishes are under federal management, with an annual commercial value of nearly $75 million. The value of recreational fisheries is at least this much (Spurgeon, P.G. 1992, NMFS 1996). Coral reefs provide critical protection to shorelines and attract SCUBA divers and other forms of tourism. Despite their importance, shallow water coral health and cover has declined worldwide over the last two decades. This decline is directly attributable to human influences, including: siltation from onshore deforestation and construction, pollution, physical damage, dredging, overfishing and destructive fishing practices, and other abuses. Although the collection of live corals is largely prohibited in the United States, a growing international trade in corals and coral reef species is contributing to the degradation and destruction of coral reef ecosystems worldwide.

Concomitant with increasing human pressures on coral reefs, the last decade has seen an alarming increase in coral diseases, with growing evidence that susceptibility to disease is in part linked to human-induced stresses. It has been estimated that 10 percent of the earth's coral reefs have been degraded beyond recovery, and another 30 percent are likely to decline significantly within the next 20 years (Jameson *et al.* 1995). It is difficult to generalize about the condition of coral reefs in the United States. There is agreement, however, that coral reefs are threatened wherever they are close to large concentrations of people, and that data are available to evaluate the status and trends of coral reefs in only a few sites (NOAA 1998). The International Year of the Reef, 1997, provided impetus to several international reef monitoring programs, such as the International Coral Reef Initiative's Global Coral Reef Monitoring Network and the all volunteer ReefCheck. These efforts will serve to greatly increase understanding of the status and outlook for coral reefs worldwide.

## Coastal Wetlands

If coral reefs represent the most diverse marine communities, coastal wetlands and estuaries rank among the most productive ecosystems. These ecosystems, including salt marshes, seagrass beds and mangroves, provide habitat for migrating waterfowl and are associated with some of the world's greatest fisheries. They also provide critical ecological functions as the sources of nutrients for nearshore production, as filters for land runoff, and as stabilizers for coastal lands.

The relationships between wetlands and fish production are an essential and important part of the ongoing debate on wetland regulation and policy. Although research continues to increase understanding of wetland ecosystems, the life cycles of most commercial fish and shellfish species are fairly well understood. Biologists have determined that wetlands play an important part in providing food, protection, and spawning areas. For example, wetlands are crucial for shrimp production, and estuarine habitat is critical for salmon. Approximately 75 percent of the nation's commercial fishes and shellfishes depend on estuaries at some stage in their life cycle. Estuaries themselves depend on their wetlands to maintain water quality and provide the basis for food chains that culminate in seafood harvests. Many estuarine-dependent species have even closer ties to wetlands in that they feed, take refuge, or reproduce within them. Without wetlands, these fishes and shellfishes cannot survive.

Until quite recently, the United States was losing wetlands at an alarming rate. The Clean Water Act, and other federal environmental laws have been instrumental in decreasing wetland losses since that time. From 1982-92, the losses totaled 31,000 acres of wetland per year, down from 157,000 acres per year in 1974-83, and down further from the 398,000 acres per year in 1954-74 (USDA/NRCS 1995). However, despite regulatory programs and natural resource management plans, human population growth and development continue to yield a net loss of habitat acreage and function. Coastal population has risen by 40 million people since 1960, and continues to grow at four times the national average. This challenge will become more acute as each year marine, estuarine, and riverine fish habitats are further sacrificed to physical destruction, nonpoint and point discharges, eutrophication, waste dumps, and other human activities. These losses are complicated by natural changes predicated on geology and climate. Globally, coastal wetlands are also among the most threatened habitats—mangroves are being cleared for timber or for shrimp farms, and estuaries are being dredged or polluted.

## Summary

Basic assessment and information on status and trends are the fundamental tools managers of natural resources require. Uncertainty is a reality in marine resource management. The greater the uncertainty, the more conservative the management must be. Managers rely upon scientifically based information to reduce the degree of uncertainty. The need for accurate, timely, and precise scientific information has never been greater. Current knowledge of marine resources—the threats they face and their condition—is tremendously improved from what it was 20 years ago. However, in the ocean realm, many of the fundamentals are still unknown. Yet,

what is known indicates that the trend in U.S. waters and worldwide is toward overutilization and increased damage. The following section describes the threats to marine living resources that have resulted from the observed trends.

## THREATS TO THE SUSTAINABILITY OF LIVING MARINE RESOURCES

The international observance of 1998 as the Year of the Ocean comes at a time when the earth's living marine resources face unprecedented stress from human activity. As human population and economic growth increase, particularly in coastal zones, the worldwide trend is for more pressure on coastal areas, the ocean, and the marine wildlife that inhabit those regions. Moreover, because marine species do not occur or function in isolation, it is not sufficient to simply protect marine mammals, manage salmon, etc. Rather, management and conservation regimes that recognize and take into account the interrelationships of all ocean life must be developed . However, public perception continues to operate considerably behind the state of the knowledge of scientists, decision makers, managers, and various other marine-oriented constituencies about the threats facing the marine environment.

In a landmark report, "*Understanding Marine Biodiversity*," (NRC 1995) the National Research Council identified the five most important agents of present and potential threat to marine biodiversity at the genetic, species, and ecosystem levels. These factors also have been identified by the Parties to the Convention on Biological Diversity[5] as key threats (UNEP/CBD 1995). The five categories are:

1. fisheries' operations;
2. chemical pollution and eutrophication;
3. alteration of the physical habitat;
4. invasions of exotic species; and
5. global climate change.

### Fisheries Operations

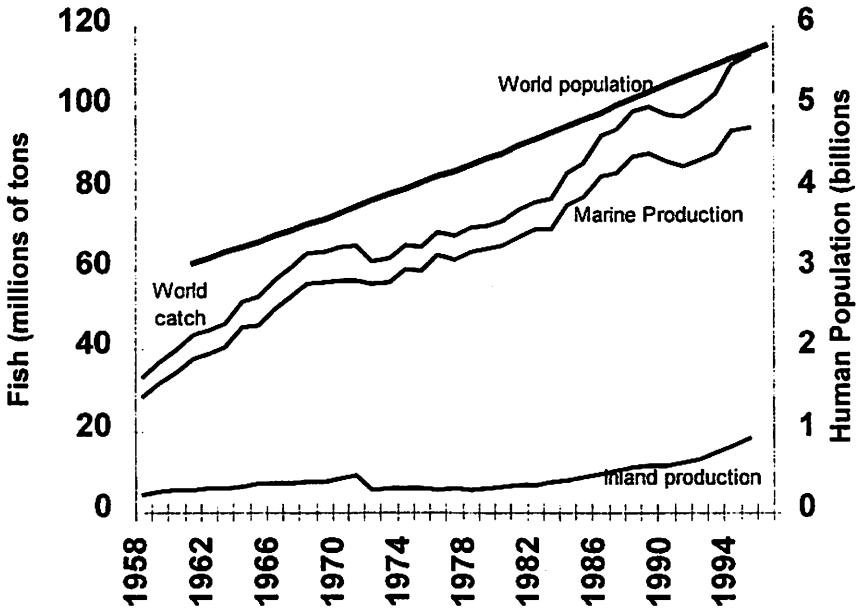
Until very recently, far more effort has been expended on trying to increase catches of fish than on developing conservation and management efforts. This was in keeping with the historic view that the abundance of marine fishes was so vast, and the impacts of fishing so small, that there was no need to regulate it. In fact, serious management of U. S. marine fisheries began only 20 years ago. The passage of the Magnuson Fishery Conservation and Management

[5] Note: The United States has signed but not yet ratified the Convention on Biological Diversity

Act in 1976 was the first comprehensive federal legislation to address this subject. It was as much focused on fishery development as conservation, but at the time, was considered revolutionary in its scope and vision.

The period from 1885 to 1950 was one of developing marine fisheries and slowly increasing research in fisheries both in the United States and abroad. Marine fishing regulations were very few. Catches continued to increase, particularly after World War II, through the application of newer technology and bigger and faster boats. In the 1970s and 1980s, fleets expanded at twice the rate of catches, which peaked in 1989, leveled off for a few years, then climbed again as a result of large catches of low-value pelagic species (FAO 1997; Figure 3).

**Fig. 3. Human Population and Global Fish Production 1958-1995**




Note: Production includes aquaculture and fisheries both for human consumpt and for livestock feed. Source: FAO 1996

In the early 1970s, a public constituency developed for the protection of whales, seals, and dolphins. It exerted tremendous influence on the United States and governments around the world to halt commercial exploitation of these marine animals. The U.S. Congress enacted the Endangered Species Act and the Marine Mammal Protection Act in the same era as it addressed issues of clean water and clean air. During this era of environmentalism, Congress also enacted the Magnuson Fishery Conservation and Management Act. By the mid-1980s, laws and regulations governing marine mammals had been revisited and made more stringent, but the emphasis in fisheries was still in the development mode. This included federal financial assistance to encourage and promote new fisheries and greater fishing power.

The constituencies supporting fish conservation have grown tremendously in recent years. Scientists and managers who had predicted and tried to stop calamities such as the New England groundfish collapse were joined by environmentalists, who saw the connections between protecting endangered and threatened marine mammals and fishing operations. The decline of New England's groundfish fishery finally served as the wake up call—to managers and fishermen, as well as conservationists—who all pressed for reform in fishery management.

It is now recognized that fishing can and already has had profound effects on marine fish populations. Underscoring the issue, the National Research Council reported in 1995 that fishing activity has affected "... virtually every habitat except the deepest sea floors. Even with management practices now in place, fisheries have major impacts on ocean environments, ranging from direct harvest to bycatch effects, habitat destruction, genetic changes, and food web changes" (NRC 1995).

Fishing affects marine living resources both directly and indirectly. The principal direct impact is taking out more fish than the populations can replace. Indirect impacts include bycatch, the destruction of habitat, and other ecosystem effects that may accompany fishing activities. The most visible attention to overfishing focused on international commercial fisheries, such as those using large-scale driftnets on the high seas, conservation of highly prized fishes that cross boundaries between or among nations and the high seas (known as straddling and highly migratory stocks), and the problem of reflagging vessels to avoid conservation measures. Several accords reached through the UN have addressed these issues. However, destructive overfishing even occurs in artisanal and small-scale fisheries worldwide, where biomass fishing (using fine-mesh nets to capture all fish species and age classes), blast fishing, poisoning (with cyanide, rotenone, bleach, etc.) deplete stocks and destroy habitats.

*Direct fishing impacts from overfishing*

Although a wide variety of both human-caused and natural factors affect the living resources of the ocean, the most widely studied and probably best understood is resource overuse. Under this broad heading, managers generally agree that the immediate pressure points are overfishing and overcapacity. Overfishing generally refers to harvesting at excessive levels: The term was defined in the latest Sustainable Fisheries Act amendments to the Magnuson-Stevens Act as "a rate or level of fishing mortality that jeopardizes the capacity of a fishery to produce the maximum sustainable yield on a continuing basis." Overcapacity, on the other hand, refers to excessive levels of catching power, usually measured in terms of the number and size of vessels, and the power and technical efficiency of the engines and gear. In other words, overcapacity refers to boats and technology; and overfishing to the impact of the boats and gear on the target fisheries.

Overfishing and overcapacity reflect fundamental global demographic, economic, and technological trends. Specifically, continuing population growth, increased economic activity, the general trend toward more abundant and protein-rich diets, and the evolution of fish finding

and capture technology, all tend to promote operations and investments in the global fisheries sector. The resulting overfishing and overcapacity has placed major and difficult responsibilities on governments, especially with respect to management and fisheries enforcement. These trends are exacerbated by the tendency of many governments to continue to promote fishery development in the absence of meaningful access controls.

In the United States, the passage of the 1976 Magnuson Fishery Conservation and Management Act was intended to allow the domestic fishing fleet to replace foreign fishing within the area between the states' outer territorial sea limits (usually three miles) and 200 miles seaward—the Exclusive Economic Zone. However, the fisheries management system at that time was not operating under the premise that these resources were threatened by overexploitation. In the late 1970s to late 1980s, managers did not adequately consider the impact that fishing, albeit by domestic fishermen rather than foreign vessels, would have on fish stocks. As a result, domestic fishing capacity increases were generally unconstrained and even encouraged. By the early 1990s, one objective of the Magnuson Fishery Conservation and Management Act had been accomplished—foreign fishing was gone. However, a second objective—to stop overfishing—was far from being met. By the 1990s, the realization that overfishing could occur on a large scale, and actually had occurred, was reaching an audience beyond the scientific community in the United States and throughout the world.

In the past two decades, the world's fishing nations have so excessively increased their efforts that global fishing capacity in the traditional fisheries is estimated to be 30 percent greater than required to take the world catch (Garcia and Newton 1995). In the United States, it has been estimated that about one- third of all the fisheries for which sufficient data exist are overfished. There is no similar calculation for the level of overcapacity in U.S. fisheries, but it is assumed to be significant. A good example is the halibut fishery in the Gulf of Alaska, which before regulations were instituted that limited access, saw 8,000 boats vying for the catch quota in two 24-hour marathon fishing derbies.

In summary, overfishing has become a global problem. Evidence indicates that overfishing and overcapacity exist worldwide:

- in the countries that are developed, traditional fishing powers;
- in resource-rich coastal countries that have tended to overestimate the potential of these resources and have failed to institute adequate safeguards;
- in countries in transition from centralized to market-based economies where governments are struggling to reorder investment and economic policies in the fisheries sector; and
- in developing countries that have promoted their fishery sectors too aggressively, or where demographic changes have provided incentives for destructive fishing practices.

*Indirect fishing impacts*

The most significant indirect impacts of fishing on marine biodiversity include bycatch, habitat destruction and ancillary impacts on interacting species or ecosystems (NRC 1995). Bycatch is the capture and associated mortality of nontarget species or of the mortality of the target species that are discarded because of size, quality, or other preferences. For example, in the southeast U.S. shrimp fishery, for every pound of landed shrimp, approximately 4-5 pounds of non-target species (mostly juvenile fish) are also captured and mostly discarded. The high level of bycatch in shrimp trawls has contributed to the closure of some commercial fisheries in the Gulf of Mexico. Bycatch is also a major concern for endangered or threatened species—e.g., sea turtle bycatch in shrimp fisheries; marine mammal drowning in gillnets; and shark, seabird, and sea turtle bycatch in longline fisheries. It is estimated that the unregulated longline fisheries for toothfish in the Southern Ocean may have contributed to the incidental mortality of 66,000 to 100,000 seabirds in 1997 alone (CCAMLR 1997).

By its very operation, fishing changes the relationships among species in a marine foodweb. It can change the functioning of a marine system by altering the composition of a particular marine community—either by simply removing large amounts of all types of organisms, as in the shrimp example above, or by taking large numbers of fish of a certain age or size from a system. For example, in the Georges Bank/Gulf of Maine fishery, the "bottom fish" species of cod, hake, flounder, and haddock were severely overfished resulting in their replacement by commercially less valuable fish species (i.e., skates and dogfish). The ensuing ecosystem shift may preclude the recovery of the cod fishery, despite a stable but much reduced biomass for this species.

Marine fisheries may alter or destroy habitats. Fishery practices that can harm habitats include bottom trawling, blast fishing, and the use of fish traps and poisons on coral reefs. Bottom trawls can be particularly destructive, with impacts on benthic habitats and invertebrate communities lasting for many years (Jones 1992). Habitat destruction is extensive and may contribute to the decline of fish and other species; yet because the destruction is hidden below the surface, it is seldom well documented or quantified.

## Chemical Pollution and Eutrophication

Land-based sources are estimated to account for more than 75 percent of the pollutants entering the world's ocean. Human communities daily generate new pollution that further degrades already diminished ecosystems. Some forms of pollution originate hundreds of miles inland and are carried to the sea by rivers or through the air. Point sources originate from a specific place, such as an industrial facility or municipal sewage treatment plant. Non-point sources originate from dispersed areas, such as agricultural lands (silt, pesticides, fertilizers, and animal wastes), roadways and other paved surfaces (hydrocarbons), deforested hillsides (silt), septic tanks, and atmospheric deposition. These sources cause at least as much harm to marine living resources as do point sources, but are generally much more difficult to address.

The various land-based sources of pollution affect marine biodiversity in many ways. Soil erosion and contamination from pesticides and fertilizers all degrade ocean habitats. Chemical pollution also can cause physiological effects such as increased mortality rates, decreased growth, impaired reproduction, genetic mutations, tumors, disease, or endocrine disruption. Pollution can cause physical as well as chemical harm to ocean organisms and their habitats, for instance, by smothering ocean bottom communities, blocking pathways, entangling animals, or by changing the level of light availability for photosynthesis. Eutrophication, the process of organic enrichment, results from excess nutrients from runoff (particularly nitrogen in the coastal zone). Eutrophication can cause harmful or noxious algal growth, shifts in food chains, oxygen depletion (anoxia), and other undesirable effects on marine ecosystems. Finally, pollution is believed to contribute to the observed increase in the occurrence of blooms of unicellular marine algae, which can cause mass mortalities in a variety of marine organisms and cause illness and even death in humans who consume contaminated seafood.[6]

## Alterations of Physical Habitat

The health of living marine resources is dependent upon the integrity of their habitat. No organism can live in isolation; all are dependent upon the health and biodiversity of the surrounding ecosystem, which provides the necessary ingredients of life. However, human activities can change, degrade, or destroy these habitats and the biodiversity associated with them. Habitat degradation is an important factor in the decline of many species, salmon being the prime example. Moreover, as world population increases, so do demands on the coastal environment. According to the United Nations, more than half of the world's population lives within 60 km of the shoreline and this could rise to 75 percent by the year 2020.

Coastal zones contain the planet's most productive marine ecosystems, providing habitats and essential spawning and nursery areas for the major portion of the commercially and recreationally important fisheries. Coastal habitats (mangrove swamps, estuaries, wetlands, seagrass beds, coral reefs, etc.) are fragile, biologically productive, and susceptible to degradation through human activities. In addition, the living marine resources in coastal waters often serve as efficient filters for land-based contaminants, and coral reefs and wetlands buffer storm surges and help retard coastal erosion. It is here, where the shore meets the sea, and where people are most inclined to build, manufacture, and recreate, that the most susceptible and diverse aspects of marine life exist.

In the United States and worldwide, coastal salt marshes have been destroyed by dredging and filling, mangroves have been removed for shrimp aquaculture, coastal development has altered natural patterns of erosion and sedimentation, and mining and dredging have directly altered habitats for marine species. The effects of development are not limited to the shoreline. As noted above, trawl-fishing operations are a major cause of underwater habitat destruction. Similarly, activities such as unsustainable forestry, mining, the diversion of water for agriculture.

[6]For a more comprehensive discussion of marine pollution, please see the Year of the Ocean Marine Environmental Quality Discussion Paper.

and dams or other construction far upstream can alter habitats for anadromous species (those that spend part of their life at sea, and part in fresh water) and alter sedimentation and water flow downstream.

### Invasions of Exotic Species

A marine scientist noted several years ago that the bottom of San Francisco Bay looked much like the bottom of Tokyo Harbor. Species that were at home on the opposite side of the Pacific had moved in and taken over, in some cases pushing out the local fauna. Over 234 exotic species have been identified in San Francisco Bay and Delta, and exotic species may account up to 99% of the biomass in some habitats (Cohen and Carlton 1998). The phenomenon, known as invasions of alien or exotic species, is one of the least known threats to marine biodiversity. Non-indigenous species are introduced both inadvertently and intentionally. Not all intentional introductions are harmful. In the marine environment, for example, introductions of oysters and other shellfish have been the basis of a multi-million dollar aquaculture industry. Yet, these same introductions have also unintentionally introduced new disease organisms traveling in shipments of the aquaculture species.

Many introductions of marine organisms occur via the exchange of ballast water in international shipping. The increase in international trade has greatly increased this pathway for non-indigenous species introductions. Inadvertent introductions through ballast water have been implicated in outbreaks of red-tide dinoflagellates in Australia; the invasion of the Black Sea by the American comb jellyfish with disastrous effects on plankton biomass and the anchovy fishery; and the invasion of the Great Lakes by Eurasian zebra and quagga mussels that have caused great economic damage in inland waterways. In most cases, the ecosystem effects of invasions of exotic species are still unknown.

### Global Climate Change

Historically, changes in global climate have significantly altered the ecosystems and processes of the world's ocean. Today, these natural changes are being joined by alterations to the earth's atmosphere as a result of human activities. Chief among these are decreases in stratospheric ozone caused by ozone-depleting substances such as chlorofluorocarbons, and global warming caused by increased atmospheric concentrations of so-called greenhouse gases such as carbon dioxide and methane, which are produced by human activities.

Ozone depletion—particularly in higher latitudes—has resulted in increases of ultraviolet-B (UV-B) radiation reaching the earth. A number of studies have confirmed that increased UV-B can damage phytoplankton and zooplankton, the basis for much of the ocean's enormous productivity. The world community has taken the issue of ozone depletion seriously, and the Montreal Protocol to the Vienna Convention has set countries on a course to the phase-out of most classes of ozone-depleting substances.

The Intergovernmental Panel on Climate Change (IPCC) in its Second Climate Change Assessment concluded that human influences on the earth's climate were already discernible, and that the climate is expected to continue to change in the future in response to human influences (IPCC 1995). IPCC further noted that "Climate change and a rise in sea level or changes in storms or storm patterns could result in the erosion of shores and associated habitat, increased salinity of estuaries and freshwater aquifers, altered tidal ranges in rivers and bays, changes in sediments and nutrient transport, a change in patterns of chemical and microbial contamination in coastal areas, and increased coastal flooding. Some coastal ecosystems are particularly at risk, including saltwater marshes, mangrove ecosystems, coastal wetlands, coral reefs, coral atolls, and river deltas. Changes in these ecosystems would have major negative effects on tourism, freshwater supplies, fisheries and biodiversity. Such impacts would add to the modifications in the functioning of coastal ocean and inland waters that already have resulted from pollution, physical modification and material inputs due to human activities."

### Summary

Through research and from the hard lessons of experience, it is now acknowledged that the ocean is not limitless. It cannot continue to absorb all the garbage, chemical spills, and other wastes from human activities, nor can it maintain its productivity in the face of ever increasing harvests of its marine life. It no longer is acceptable to act from the assumption that all is well until proven otherwise, or until the ocean itself offers proof in declining catches, diminished productivity, or lingering contamination. The primary threats to marine biodiversity are fisheries operations, chemical pollution and eutrophication, physical alteration of marine habitats, and invasions of exotic species. Looming on the horizon is the threat of human-caused climate change and its potential to aggravate existing problems.

## THE U.S. STRATEGY FOR ACHIEVING SUSTAINABLE LIVING MARINE RESOURCES

The past decade has seen two fundamental changes in the processes for making decisions about living marine resources: first, adoption of the precautionary, risk averse approach, and second, the new inclusiveness and openness of resource management decision making. In addition to these underlying process changes, the information base has been increased, new technologies have been applied, and a new way of looking at marine wildlife has been adopted—as ecosystems as opposed to single species.

Using these approaches, the U.S. government, in partnership with public and private stakeholders, is taking action to address the threats to living marine resources and to ensure the productivity and promise of these resources for future generations. In particular, the United States is investing in improved science; taking action to eliminate overfishing; promoting environmentally sustainable approaches to marine aquaculture; ensuring the health of protected marine species; and improving planning and management in coastal and marine environments.

In some cases, living marine resources are well on the way to recovery. In other cases, the policy framework has been set and new policy is just beginning to be implemented. In all cases, the themes of improved science, the precautionary approach, expanded partnerships, and application of ecosystem principles will be applied to better management of the nation's living marine resources.

## Science in the Interest of Stewardship

Effective stewardship of ocean living resources requires investment in science to better understand the components and processes of marine biodiversity. Only through a much better understanding of marine biodiversity and ecological relationships will it be possible to manage fisheries and marine aquaculture sustainably, reap the biotechnology benefits of marine genetic resources, and conserve these critical resources for future generations.

The United States is committed to improving the knowledge base necessary to conserve and manage the world's marine living resources. In these efforts, the U.S. system of private and public universities, and state and federally funded research institutions and laboratories, play a crucial role through worldwide scientific collaborations. In addition, the National Oceanic and Atmospheric Administration and other federal agencies work in cooperation with state agencies, the environmental community, Native American tribes, Pacific Islanders, international entities, non-governmental organizations, the fishing industry, and others in the private sector, to ensure access to the most recent and comprehensive data available.

Much, however, remains to be done. Most marine biological communities still need to be characterized, and there are still vast numbers of undescribed species of invertebrates and bacteria. This represents more than idle scientific curiosity, since economic opportunities in marine biotechnology will depend on this knowledge. Moreover, as information on multi-species relationships, ecosystem interactions, and environmental influences become more available, management approaches can move toward more explicit considerations of the impact of human activities on all components of the ecosystem. (See Box 2)

In every aspect of the strategic vision of U.S. marine resource management agencies, the acquisition of sound biological, economic, and social information is highlighted as the first step to focused policy decision making. Such information is crucial to pursuit of a precautionary approach to management that focuses decisions rather than allowing scientific uncertainty to fuel controversy and confusion. This information is required not just for current management decisions, but also to conserve resources and anticipate future trends, assure future use opportunities, and assess the success of management efforts.

**Box 2: Research Priorities**

The National Research Council (NRC 1995) has identified five fundamental research objectives to better understand marine living resources. These objectives are:

- to understand the patterns, processes, and consequences of changing marine biodiversity by focusing on critical environmental issues and their threshold effects;
- to improve the linkages between the marine ecological and oceanographic sciences;
- to strengthen and expand the field of marine taxonomy;
- to facilitate and encourage the incorporation of (1) new technological advances in sampling and sensing instrumentation, experimental techniques, and molecular genetic techniques; (2) predictive models for hypothesis development, testing, and extrapolations; and (3) historical perspectives in investigations of the patterns, processes and consequences of marine biodiversity; and
- to use the new understanding of the patterns, processes and consequences of marine biodiversity derived from regional-scale research to improve predictions of the impacts of human activities on the marine environment.

## A Precautionary Approach to Building Sustainable Fisheries

The United States has realigned its core marine fishery programs to address more effectively the domestic and global crisis confronting living ocean resources. To restore sustainability in this sector, the United States is dedicated to a long-term program of recovery for overfished fisheries in its own 200-mile Exclusive Economic Zone. It is also working with foreign governments, international organizations, and regional fishery management bodies to move toward the same goal in all other waters.

The new strategic direction in U.S. fisheries management is based upon the Sustainable Fisheries Act of 1996 (also known as the Magnuson-Stevens Fishery Conservation and Management Act). While not explicitly stated in the Act, the precautionary approach concept shapes the core of mandated actions to reverse the decline of U.S. fisheries and move toward rebuilding them.

Toward these ends, Congress has provided directives and discretionary means to:

1. Establish guidelines to assist in the description and identification of "essential fish habitat" and impacts on that habitat, and to take steps to ensure that programs further the conservation and enhancement of that habitat

2. To the extent practicable, avoid bycatch, and to the extent that such bycatch cannot be avoided, minimize the mortality of such bycatch

3. Place stricter conditions on the use of new fishing gear

4. Apply measures that will eliminate overfishing in domestic waters and identify management actions to rebuild those fisheries within ten years (except in cases where the biology of the fish, other environmental conditions, or specific international agreements dictate otherwise)

5. Study and, if appropriate, implement a fishing capacity reduction program

The Sustainable Fisheries Act includes U.S. commitments to apply domestically many of the same principles that have been negotiated internationally in the U.N. Straddling Stocks Agreement and the Code of Responsible Fishing. The Act now requires the optimum yield for each fishery to be set equal to or less than the maximum sustainable yield. Overfishing is now defined in the law, and managers have explicit time frames and milestones for identifying overfished fisheries and getting them on the road to recovery. The Act also directs that recommendations be developed to expand the application of ecosystem principles in fishery conservation and management activities.

The Sustainable Fisheries Act has set the stage for turning the product of a failed fisheries management system into healthy, productive, and sustainable fisheries in the very near future. The fundamental changes in the approach to management have begun, and some successes have already been witnessed.

**Box 3: International Sustainable Fisheries Initiatives**

For centuries, customary international law and practice have been *mare liberum*, freedom of the sea. It was customary that anyone possessing the wherewithal to ply the seas and cast nets was free to fish. Further, it was assumed that anyone wishing to impose any restrictions on fishing (or other activity) on the seas bore the burden of proof to show that the activity was harmful before any limitations were necessary. Moreover, the only persons permitted access to the arenas where decisions about marine wildlife were made were government officials and user groups. Over time, these two presumptions have shifted, most recently and most thoroughly in an international agreement about ocean fishing.

The United States has been a leader in promoting international agreements and initiatives that shift the focus from increasing catches at all costs to sustainable fishing, ecosystem protection, conservation of biodiversity, and the precautionary approach to fishery management. These agreements include:

- The 1982 U.N. Convention on the Law of the Sea contains a comprehensive menu of dispute settlement procedures. Universal acceptance of the Convention (including accession to the Convention by the United States) would provide additional tools to deal promptly and constructively with disputes involving fisheries management.

- The Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea Relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks has been heralded as a "sea change" in international fisheries law (Freestone 1997). The UN Agreement on Straddling Stocks has been held up as a measure against which effective fishery management regimes should be measured. In addition to its precautionary provisions, the Agreement calls for collection and use of best available scientific information, and directs signing nations to conduct their fishery business in open, accessible "transparent" forums where interested parties can observe and participate.

**(continued)**

**Box 3 (continued)**

- The 1994 Agreement to Promote Compliance with International Conservation and Management Measures by Fishing Vessels on the High Seas requires flag states to strictly regulate the activities of their high seas fishing vessels.

- The 1995 UN FAO Code of Conduct for Responsible Fisheries, is a nonbinding document that details the full range of principles that undergird sustainable (responsible) fisheries management. Subsequently, NMFS produced a plan in 1997 to implement these principles in domestic fisheries.

- The United Nations adopted a global moratorium on the use of large-scale pelagic driftnets on the high seas which took effect in 1992. The United States has played a lead role in the detection, apprehension, and prosecution of fishing vessels violating the UN moratorium on large-scale pelagic driftnets.

- The United States is participating more actively in various regional management bodies, particularly those dealing with North Atlantic and North Pacific issues, and is a strong supporter of a recently initiated effort to launch a new management organization for the tuna fisheries of the Western Pacific.

- The United States is also promoting international efforts to reduce fishery impacts on dolphins, sea turtles, sharks, and seabirds.

- Finally, the United States is supporting initiatives designed to enhance conservation and improve the sustainability of fisheries through a number of international organizations and agreements, including FAO, the UN Commission for Sustainable Development, the World Trade Organization, the Organization for Economic Cooperation and Development, Asia Pacific Economic Cooperation, the Convention on International Trade in Endangered Species of Wild Fauna and Flora, and the Convention on Biological Diversity.[7]

[7]Note: The United States has signed but not yet ratified the Convention on Biological Diversity

The depletion of the world's fish stocks and the impact of fisheries activities on biodiversity and fishery ecosystems are a global problem and have attracted international attention in recent years. In partnership with other nations, the United States has embarked on a series of initiatives designed to improve the management of fisheries that are not restricted to one coastal nation's Exclusive Economic Zone and explore ways of dealing more effectively with the effects of environmentally harmful practices and economic incentives in the fisheries sector. (See Box 3)

### Developing Robust and Environmentally Sound Marine Aquaculture

World population is expected to increase by one billion people during the next decade. This, coupled with the increasing affluence of the world's people, means that future demand for seafood is projected to continue growing for the foreseeable future. Despite this increase in demand, future seafood harvests from the wild are not expected to increase significantly above the current levels.

A major junction in world history is fast approaching—one where humans for the first time will need to move from increased harvesting of wild fish stocks to aquaculture (the production of farmed crops of fishes, shellfishes and other aquatic plants and animals). This shift will be the next in a series of historical food production revolutions that have allowed humankind to continue feeding itself despite shrinking farmland and growing population worldwide.

Aquaculture already accounts for 25 percent of world food fish supplies, with China, India, Taiwan, and Thailand among the leaders in this field. Given current population projections, aquaculture production would have to double to 52 million metric tons by 2025 in order to maintain the present level of per-capita fish consumption. The potential for growth in this industry is obvious. The United States currently produces only about $800 million of the $33 billion annual value worldwide of aquaculture products, or less than 3 percent of the total. Aquaculture in marine and brackish water holds particular promise for increased growth.

Legitimate concern about the negative environmental effects of some aquaculture operations has hindered industry growth in the United States. Addressing these concerns and developing new environment-friendly technologies will allow the industry to expand. Two examples of new technologies that address water quality issues associated with aquaculture are: (1) the development of ways to move aquaculture to the open ocean where the water has a greater nutrient carrying capacity, and (2) using onshore recirculating systems. These technologies can be a model for other nations to use to reduce the negative environmental impacts of aquaculture. Additionally, uniform observance of an international code of conduct, such as the aquaculture provisions of the FAO Code of Conduct for Responsible Fisheries, will help to minimize future negative impacts on the environment.

Whether aquaculture is done in ponds or tanks on land, or in the ocean, it always depends on the availability of clean water and a source of broodstock (frequently from wild stocks). Many aquaculture operations also depend on wild-caught fish for feed. At the same time, aquaculture

can contribute to the restoration of fisheries through stock enhancement and by reducing pressure on wild-stock harvest. This interaction between aquaculture and fisheries suggests that a holistic fisheries management approach to the marine environment should include both components.

The goal of U.S. ocean programs should be to maximize the benefits from the nation's ocean resources that are received by U.S. citizens. This goal includes sustainable fisheries in the context of a healthy coastal and ocean environment. Marine aquaculture can begin to fulfill its potential to help achieve these goals through a dynamic effort by the federal government in cooperation with other state and local governments and the private sector to promote and refine it.

**Enhancing the Protection and Recovery of Marine Species by Working in Partnerships**

Protected marine species in the United States include marine mammals and species listed under the Endangered Species Act. Many of the direct threats to protected marine species arise from human activities such as fishing, shipping, coastal and watershed development, water pollution, seismic exploration, and offshore mineral development. Reducing conflicts between these species and human activities in the marine environment is the key to their conservation and recovery. In addition, some marine mammals may cause harm to other protected marine species, such as salmon, or interfere with fishing or aquaculture operations. All these conflicts require more "people management" than "wildlife management." Years of regulatory approaches have not been completely successful in reducing human-caused mortality and injury to protected species. A number of federal programs and policies now recognize the value of involving local stakeholders in decision making and implementation of management actions. Natural resource managers have begun employing new stakeholder models to gather information, assess problems, and find the technology or ingenuity to solve them.

Under the Marine Mammal Protection Act of 1972 and the Endangered Species Act of 1973, the National Marine Fisheries Service has been working with fishermen to identify means to reduce interactions with marine mammals during fishing operations, restore habitats for endangered salmon in the Pacific Northwest and California, develop conservation plans to restore coho salmon, and reduce the entanglement of albatrosses in longline fishing gear in the North Pacific. Similar efforts to engage user groups in helping to solve protected species problems is one strategy for recovering protected species and incorporates the new goal of openness or transparency in marine resource decision making.

In addition, the United States is working to:

- Assess the status of, and impacts to, protected species. Information is needed to identify and focus management actions, limit the scope of restrictions, and promote the recovery of all protected species.

- Develop and implement conservation and recovery plans for depleted marine mammals and endangered and threatened species. This is being done in partnership with states and the private sector.

As knowledge about the interconnectedness of living systems increases, the importance of acting with foresight and preventive measures when conserving protected marine species likewise increases. Waiting for a species to reach the brink of extinction before taking action is counterproductive. By applying ecosystem approaches, conserving remaining critical habitats, and restoring degraded habitats, the opportunity exists to conserve for future generations both individual species and the web of life on which they depend.

The United States is also working internationally to conserve marine species. The International Whaling Commission, through its ban on commercial whaling, has been instrumental in promoting the recovery of many large whale species from the brink of extinction. The Convention on International Trade in Endangered Species of Wild Fauna and Flora actively supports nations' efforts to manage species sustainably and reduce the negative impacts of international trade in species and products of species. Increasingly, the Convention has devoted attention to marine species protection. The United States has also been a leading force in the development of numerous other treaties and agreements. For example, it played a key role in the recently concluded negotiation of the Inter-American Convention for the Protection and Conservation of Sea Turtles,[8] the first international agreement devoted solely to the protection of sea turtles. The Convention establishes national sea turtle conservation programs in the signatory countries. These programs will include prohibiting intentional take (except for subsistence take as allowed under the convention), prohibiting domestic or international sale of turtle parts or products, conserving and restoring marine habitat and nesting beaches, and promoting efforts to enhance sea turtle populations. All Parties will establish a monitoring and observation program to verify that these measures are being applied.

### Sustaining Healthy Coasts by Focusing on Whole Ecosystems

Clearly, efforts to rebuild and sustain fisheries and recover and protect endangered species are important. But they rely to a large degree on traditional wildlife management approaches that concentrate on one species at a time. Single species management is limited in its effectiveness, especially as pressures on the marine environment intensify. Each individual species has a habitat which it needs to live and reproduce, and depends on a community of other species for food and survival. This community of species--their dynamic interactions with each other and the physical environment, and their overlapping mosaic of habitats--together constitute an ecosystem. Increasingly, the United States and the world community are recognizing the critical importance of conserving whole habitats and communities, both for the recovery of individual species, and for the ecosystem functions that they provide. Internationally, the

[8]Note: The United States has not yet ratified the newly completed Inter-American Convention for the Protection and Conservation of Sea Turtles.

Convention on Biological Diversity exemplifies this approach, as does the FAO Code of Conduct for Responsible Fisheries.

The importance of habitat conservation has always has been a part of the Marine Mammal Protection Act and the Endangered Species Act, and it has gained increased emphasis in fisheries with passage of the Sustainable Fisheries Act in 1996. The Sustainable Fisheries Act has provided significant new tools to protect and conserve the habitat of marine, estuarine, and anadromous fish and shellfish resources. By October 1998, all Fishery Management Plans must be amended to identify and describe "essential fish habitat"—defined as those waters and substrate necessary to fishes for spawning, breeding, feeding, or growth to maturity—for each federally managed species. The Act also includes new provisions to ensure the conservation and management of essential fish habitats once these areas are designated. Fishery Management Plans must include measures to minimize to the extent practicable adverse fishing and non-fishing related effects on essential fish habitats. In addition, federal agencies that authorize, fund, or undertake actions that may adversely affect these habitats must consult with the National Marine Fisheries Service to evaluate the effects of their actions on the habitat and the associated life stages of the fisheries involved. These new policies represent an important application of the precautionary approach to fisheries and environmental management.

Just as the sources, types, and routes by which land-based pollution affect species and ecosystems are complex, so are the mitigating measures. The human side of the equation is an equally complex, dynamic web of interrelationships among human institutions, societal and economic demands for products and services, and natural resources. Society's demands from a coastal area can exceed the area's capacity to meet the combined demands simultaneously. For that reason it can be difficult to maintain an area's long-term environmental integrity, which is critical to marine biodiversity. The management system that attempts to achieve this balance must be flexible and adaptable, and must be capable of responding to dynamic changes over time.

As a process for decision making, integrated marine and coastal area management aims to prevent, control, or mitigate adverse impacts of human activities on the coastal environment. It involves all stakeholders, including decision makers in public and private sectors, resource managers, non-governmental organizations, land users, and the general public. A central feature is the use of economic incentives. These are often more effective at changing human behavior, and can be more politically feasible. They also can be more effective in terms of results and cheaper to manage and enforce than the use of restrictive regulations.

Marine protected areas, as part of a larger integrated area management scheme, provide one of the most effective mechanisms for conserving marine living resources and the habitats on which they depend. Marine protected areas can:

- be a valuable management tool to protect areas that are repositories for marine biodiversity;

- protect unique and/or ecologically significant resources;
- provide a living "laboratory" against which to test the effectiveness of management measures;
- enrich and form a critical link among nations' food supplies;
- attract revenue-generating tourism activities; and
- provide potential future benefits from marine biotechnology development.

Marine protected areas provide one key tool for the protection, conservation, and restoration of coastal and marine habitats (and their biodiversity) in which multiple uses and demands can be balanced.

The United States has been a leader in establishing areas within its maritime jurisdiction designed to protect and conserve the biological resources of its marine and coastal regions. The National Marine Sanctuary Program was established under legislation because "this Nation historically has recognized the importance of protecting special areas of its public domain" (Marine Protection, Research, and Sanctuaries Act of 1972). Under this legislation, the Sanctuary Program identifies, designates, and manages areas of national significance with respect to conservation, research, recreational, ecological, historical, educational, or aesthetic qualities. The program administers 12 sites nationally, with two more in development. The primary goal of the National Marine Sanctuaries is to protect biodiversity, biological productivity, cultural resources, and areas of pristine condition. In addition, a number of national parks, seashores, and monuments throughout U.S. coastal regions are administered by the National Park Service, and even more areas are managed by the states. In the Caribbean region, the United States has worked toward the adoption of the Specially Protected Areas of Wildlife Protocol,[9] which promotes the concept of protected areas within the region. The concepts applied by the U.S. Man and the Biosphere in the Biosphere Reserve Program offer an ideal setting for coordination, cooperation, and interdisciplinary research in fostering harmonious relationships between humans and the biosphere.

The 1987 amendments to the Clean Water Act have also served to enhance marine species protection efforts through the establishment of the National Estuary Program. Unlike traditional regulatory approaches, the National Estuary Program focuses on protecting not just water quality or individual species, but whole ecosystems. It also engages local communities in protecting estuaries and the species that inhabit them, and requires stakeholders to create a comprehensive conservation and management plan for long-term protection of these resources. Currently, 28 National Estuary Programs are working to safeguard the health of some of the nation's most important coastal waters. A second program, the National Estuarine Research

[9]The United States has not yet ratified the SPAW Protocol.

Reserve System, provides for the cooperative management, with states, of estuarine areas representing various regions and estuarine types in the United States.

The United States has also begun to address the threat of exotic invasive species in the marine environment, through interagency and international initiatives. The Non-indigenous Aquatic Nuisance Prevention and Control Act of 1990 established an interagency Aquatic Nuisance Species Task Force. This effort has begun to document the extent of the problem, develop management approaches and provide public outreach. Ballast water discharge from ships appears to be the major vector of aquatic invasions. Internationally, the United States has joined with other nations in promoting measures to control the spread of non-indigenous organisms through the regulation of ships' ballast water through International Maritime Organization (IMO), a specialized agency of the United Nations that addresses issues involving international shipping matters.

Integrated marine and coastal area management will also play a critical role in U.S. adaptation to global climate change. While the essential step to protect marine living resources—and the first responsibility of nations—is to reduce greenhouse gas emissions that are generated by humans and contribute to global warming, some level of adaptation to a changing climate will be necessary. Integrated planning efforts will help to protect the huge economic investments in coastal zones, while beginning to take into account the interactions with critical marine ecosystems.

## CONCLUSIONS AND OPTIONS FOR CONSIDERATION

Ocean living resources, the ecosystems they form, and the ecological processes they mediate, provide immense benefits to the United States and to all of human society. Increasingly, however, these resources and their benefits are threatened by human activities. Fishing, waste disposal and runoff, coastal development, and invasions of exotic species have led to worldwide declines in marine species and the integrity of marine ecosystems, particularly coastal ecosystems. Global climate change caused by human activity has the potential to further exacerbate this situation.

The United States is committed to addressing these threats in order to ensure the long-term sustainability of living marine resources and the benefits they represent. Evidence already shows that U.S. management and conservation practices are paying dividends in healthier resources. Continued improvement will require enhanced domestic action and international cooperation to:

- Expand understanding of marine genetic resources, species, ecosystems, and their functions and processes

- Address the direct and indirect impacts of fishing operations and introduce ecosystem approaches to management to ensure sustainability of the resources

- Develop environmentally sustainable marine aquaculture to meet growing demands for food
- Provide enhanced protection for species and habitats at risk
- Implement integrated marine and coastal area management to protect coastal and nearshore marine living resources
- Address the problems of the introduction and spread of non-indigenous invasive species

Against the backdrop of recent reform of the underlying fishery management law in the United States and increased national and international awareness of the value and threats to ocean resources, managers are charting the future and planning strategies for sustaining marine biodiversity. The critical elements at the heart of this new strategic vision are improvements in science; use of the precautionary approach in fisheries and environmental management; developing cooperative partnerships with users of marine resources and other stakeholders; and exploiting the full potential of ecosystem-based management. Human knowledge and approaches to life beneath the sea have come far in the past 20 years, and international observance of the Year of the Ocean provides an excellent focal point for a renewed commitment to better management in the next 20 years.

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## DOMESTIC LEGAL REGIME

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The legal regime covering this topic is based on a collection of important federal statutory authorities. The following is a brief description of some of those authorities relating to ocean living resources. The list is selective and is designed to illustrate some major ocean living resources acts. The list is not meant to be comprehensive.

**Anadromous Fish Conservation Act**, 16 U.S.C. §§ 757a-757g

The Anadromous Fish Conservation Act provides authority to enter into cooperative agreements to conserve, develop and enhance anadromous fish resources, including conducting research and investigations, stream clearances, constructing and maintaining devices to assist with feeding, spawning and migration. The Act authorizes the Secretary of the Interior to enter into cooperative agreements with one or more States for the purpose of conserving, developing and enhancing anadromous fish resources and the fish in the Great Lakes and Lake Champlain that ascend streams to spawn.

**Antarctic Conservation Act of 1978**, 16 U.S.C. §§ 2401-2412

The purpose of the Antarctic Conservation Act of 1978 is to provide for the conservation and protection of the fauna and flora of Antarctica, and of the ecosystem upon which such fauna and flora depend, consistent with the Antarctic Treaty, signed in Washington on December 1, 1959, and the Protocol on Environmental Protection to the Antarctic Treaty, signed October 4, 1991, in Madrid.

**Antarctic Marine Living Resources Convention Act of 1984**, 16 U.S.C. §§ 2431-2444

The Act provides the domestic legislative authority necessary to implement the Convention on the Conservation of Antarctic Marine Living Resources. In order to fulfill its purpose, the Act prohibits activities that harass, molest, harm, wound, or kill finfish, mollusks, crustaceans, birds, or any other species of living organism found south of the Antarctic Convergence. The transportation, sale, importation, exportation, custody, or possession of any of these species by a person who knew or reasonably should have known that the species were taken in violation of the Convention is also illegal. The Secretary of Commerce is responsible for promulgating regulations to implement this Act and for enforcing its statutory prohibitions. Both civil and criminal penalties, as well as seizure and forfeiture remedies, are available under this statute.

**Atlantic Coastal Fisheries Cooperative Management Act**, 16 U.S.C. § 5101

The purpose of the Atlantic Coastal Fisheries Cooperative Management Act is to support and encourage the development, implementation, and enforcement of effective interstate conservation and management of Atlantic coastal fishery resources. The Secretary of Commerce, in cooperation with the Secretary of the Interior, is responsible for developing and implementing a program to support the interstate fishery management efforts of the Atlantic States Marine Fisheries Commission. The Atlantic States Marine Fisheries Commission is responsible for preparing and adopting a coastal fishery management plan to provide for the conservation of coastal fishery resources. States are required to implement and enforce the plan. If the Secretary of Commerce

finds that a state has failed to carry out its responsibilities, the Secretary must declare a moratorium on fishing in the fishery in question within the waters of the noncomplying state.

**Atlantic Tunas Convention Act of 1975**, 16 U.S.C. §§ 971-971i

The Atlantic Tunas Convention Act of 1975 implements the International Convention for the Conservation of Atlantic Tunas, signed at Rio de Janeiro May 14, 1966. The Act authorizes not more than three Commissioners to serve as U.S. delegates to the International Commission for the Conservation of Atlantic Tunas. The Secretary of State is authorized to act on behalf of the United States with respect to Commission activities, with the concurrence of the Secretary of Commerce and the Secretary of the department in which the Coast Guard is operating, when appropriate. The Secretary of Commerce is authorized to administer and enforce the Convention, and to promulgate necessary and appropriate regulations. The Secretary of the department in which the Coast Guard is operating is primarily responsible for enforcement activities at sea. The Act also provides for enforcement of the Act and its implementing regulations.

**Atlantic Salmon Convention Act of 1982**, 16 U.S.C. §§ 3601-3608

The Atlantic Salmon Convention Act of 1982 implements the Convention for the Conservation of Salmon in the North Atlantic Ocean, signed at Reykjavik, Iceland, on March 2, 1982. The United States is represented on the Council established by the Convention by three United States Commissioners. The Secretary of State may receive and act upon communications of the North Atlantic Salmon Conservation Organization. The Secretary of Commerce, in cooperation with the Secretary of the Interior and the Secretary of the department in which the Coast Guard is operating, promulgates regulations necessary to carry out the purposes and objectives of the Convention and the Act and prepares statements, reports and notifications required by the Convention. The Act provides for enforcement of the Act and its implementing regulations.

**Atlantic Striped Bass Conservation Act**, 16 U.S.C. § 1851 note

The Atlantic Striped Bass Conservation Act is intended "to support and encourage the development, implementation, and enforcement of effective interstate action regarding the conservation and management of the Atlantic striped bass." Each year, the Atlantic States Marine Fisheries Commission determines whether coastal states are in compliance with the Interstate Fisheries Management Plan for Striped Bass. If a coastal state is not in compliance with the Plan, the Secretary of Commerce and the Secretary of the Interior must declare a moratorium on fishing for Atlantic striped bass within the coastal waters of that coastal state.

**Central, Western, and South Pacific Fisheries Development Act**, 16 U.S.C. §§ 758e-758e-5

The Central, Western, and South Pacific Fisheries Development Act authorizes the Secretary of Commerce to carry out a program for the development of the tuna and other latent fisheries resources of the Central, Western, and South Pacific Ocean.

**Control of "Crown of Thorns" Seastar**, 16 U.S.C. §§ 1211-1213

The Secretary of Commerce and the Secretary of the Smithsonian Institution are authorized to cooperate with and provide assistance to the governments of the State of Hawaii, the territories and possessions of the United States, the Trust Territory of the Pacific Island, and the other island possessions of the United States, in the study and control of the seastar "Crown of Thorns" (*Acanthaster planci*).

**Control or Elimination of Jellyfish or Sea Nettles**, 16 U.S.C. §§ 1201-1205

The Secretary of Commerce is authorized to cooperate with, and provide assistance to, the states in controlling and eliminating jellyfish and other pests and in conducting research for the purposes of controlling floating seaweed. The Congress also consents to any compact or agreement between any two or more states for the purpose of carrying out a program of research, study, investigation and control of jellyfish and other such pests in the coastal waters of the United States.

**Driftnet Impact Monitoring, Assessment and Control Act**, 16 U.S.C. § 1826

The Secretary of Commerce, through the Secretary of State and the Secretary of the department in which the Coast Guard is operating, is required to seek to secure international agreements to implement an international ban on large scale driftnet fishing. The Secretary of Commerce, after consultation with the Secretary of State and the Secretary of the department in which the Coast Guard is operating, must submit to the Congress an annual report describing the steps taken to carry out the Act. If the Secretary identifies any nations that conduct, or authorize their nationals to conduct, large-scale driftnet fishing beyond the exclusive economic zone, the Secretary must certify that fact to the President. Such certification is deemed to be a certification for the purposes of section 8(a) of the Fishermen's Protective Act of 1967.

**Eastern Pacific Tuna Licensing Act of 1984**, 16 U.S.C. §§ 972-972h

The Eastern Pacific Tuna Licensing Act of 1984 implements the Eastern Pacific Ocean Tuna Fishing Agreement, signed in San Jose, Costa Rica, on March 15, 1983. The Secretary of State is authorized to act on behalf of the United States and appoint a United States representative to the representative body. The Secretary of Commerce, in cooperation with the Secretary of State and the

Secretary of the department in which the Coast Guard is operating, promulgates necessary regulations. The Act provides for enforcement of the Act and its implementing regulations.

**Endangered Species Act of 1973 (ESA)**, 16 U.S.C. §§ 1531-1543

The ESA protects species of plants and animals listed as threatened or endangered. The Secretary of the Interior and the Secretary of Commerce determine, through regulations, whether any species are endangered or threatened. The Secretaries also are required to designate critical habitat and develop and implement recovery plans for threatened and endangered species. Federal agencies must insure that any action authorized, funded, or carried out by such agency is not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of critical habitat.

The ESA prohibits the taking of any member of an endangered species. "Take" is defined broadly and includes harassment, harm, pursuit, hunting, shooting, wounding, killing, trapping, capturing, or collecting, or attempting to engage in any of this type of conduct. The requirements of the ESA are enforceable.

**Fur Seal Act Amendments of 1983**, 16 U.S.C. §§ 1151-1175

The Fur Seal Act Amendments prohibit the taking of fur seals in the North Pacific Ocean, except as provided by the Act. Indians, Aleuts and Eskimos who dwell on the North Pacific Ocean may take fur seals for subsistence purposes. The Secretary of Commerce is responsible for regulating the taking of fur seals. The Amendments authorize a North Pacific Fur Seal Commission.

The Fur Seal Act Amendments also authorize the Secretary to administer the fur seal rookeries and other federal real and personal property on the Pribilof Islands.

**Fish and Wildlife Act** of 1956 and associated provisions, 16 U.S.C. §§ 742a-742d, 742e-742l, 742k, 744-748, 750-753, 753a-753b, 754, 758-758d, 760a-760g.

The Fish and Wildlife Act of 1956 authorizes the National Marine Fisheries Service to conduct investigations and prepare and disseminate information and reports regarding fish and their habitats in order to provide for the proposed development of fish resources.

**Fish and Wildlife Coordination Act**, 16 U.S.C. §§ 661-666c

The Fish and Wildlife Coordination Act requires that wildlife conservation receive equal consideration with other features of water-resource development. The Act requires that Federal permitting and licensing agencies consult with the National Marine Fisheries Service, Fish and

Wildlife Service before issuing a permit for activities that modify any body of water. The National Marine Fisheries Service provides comments and recommendations to prevent loss of, and damage to, fish populations and their habitats.

## Indian Treaty Rights to Hunt and Fish

Certain Indian tribes in the Puget Sound and Columbia River basins of the Pacific Northwest and on the Great Lakes have federally recognized and protected treaty guaranteed rights to take fish including shellfish and, in the case of the Treaty with the Makah, 12 Stat. 939 (Jan 31, 1855) also to take whales and seals. These rights are protected and enforced under the Supremacy Clause of the United States Constitution. The federal government also protects these rights pursuant to its trust responsibility towards the affected tribes. These rights, which were reserved in treaties entered into by the United States with various Indian tribes in the mid-1800's have been the subject of numerous court decisions, including seven decisions by the United States Supreme Court.

The treaties in the Pacific Northwest, commonly known as the Steven Treaties after the principal federal negotiator at the time, Territorial Governor Isaac Stevens, generally contain a provision similar to the following Article 3 of the Medicine Creek Treaty, 10 Stat. 1132 (December 26, 1854):

> The right of taking fish, at all usual and accustomed grounds and stations, is further secured to said Indians in common with all citizens of the Territory, ***: *Provided however,* that they shall not take shellfish from any bed staked or cultivated by citizens,***.

The courts have interpreted these treaties rather broadly, recognizing that they reserved unto the tribes several important legal rights, including: (1) a right of access to all usual and accustomed fishing places; (2) a right to a fair share of the fishery, which has been interpreted to mean 50 percent of the harvestable resource within each tribe's usual and accustomed area; and (3) a right to harvest each tribe's fair share free from state and federal regulations except those non-discriminatory laws necessary for conservation. Moreover, although the focal point of litigation to date has been on anadromous fish such as salmon, the courts and federal regulatory agencies have recently applied these principles to shellfish and other fish species. The interrelationship of these treaty rights with international treaties and other domestic federal laws concerning ocean living resources often raises complex legal issues.

## Lacey Act Amendments of 1981, 16 U.S.C. §§ 3371-3378

The Lacey Act prohibits domestic and international trafficking in protected fish, wildlife, and plants. It does so in two ways. First, it requires that most shipments of fish and wildlife moving in interstate or foreign commerce be accurately marked and labeled as to their contents. Second, the Lacey Act makes it unlawful to import, export, transport, sell, receive, acquire, or purchase fish,

wildlife, and certain indigenous plants taken, possessed, transported, or sold in violation of state, federal, Indian tribal, or foreign laws or regulations that relate or refer to fish or wildlife or plants. Violators are subject to both criminal and civil sanctions. The prohibitions apply broadly to all wild animals, whether dead or alive, and to any part, product, egg, or offspring, including captive-bred animals, and more narrowly to certain wild plants indigenous to the U.S.

**Magnuson-Stevens Fishery Conservation and Management Act**, 16 U.S.C. §§ 1801-1883

Under the Fishery Conservation and Management Act (FCMA), the United States claimed sovereign rights and exclusive fishery management authority over all fish, and all Continental Shelf fishery resources, within the exclusive economic zone. The FCMA established a procedure for authorizing foreign fishing, and prohibited unauthorized foreign fishing within the exclusive economic zone.

The FCMA established national standards for fishery conservation and management within the exclusive economic zone. The FCMA established eight Regional Fishery Management Councils composed of state officials with fishery management responsibility, the regional administrators of the National Marine Fisheries Service, and individuals appointed by the Secretary of Commerce who are knowledgeable regarding the conservation and management, or the commercial or recreational harvest, of the fishery resources of the geographical area concerned. The Councils are responsible for preparing and amending fishery management plans for each fishery under their authority that requires conservation and management.

Fishery management plans describe the fisheries and contain necessary and appropriate conservation and management measures, applicable to foreign fishing and fishing by vessels of the United States. The plans are submitted to the Secretary of Commerce for approval. If approved, the Secretary of Commerce promulgates implementing regulations. The Secretary of Commerce may prepare Secretarial fishery management plans if the appropriate Council fails to develop such a plan. The FCMA also provides for enforcement of the Act.

In 1996, the Sustainable Fisheries Act amended the FCMA and renamed it the Magnuson-Stevens Fishery Conservation and Management Act.

**Marine Mammal Protection Act of 1972 (MMPA)**, 16 U.S.C. §§ 1361-1407

Under the MMPA, the Secretary of Commerce is responsible for ensuring the protection of cetaceans and pinnipeds (except walruses). The Secretary of the Interior is responsible for ensuring the protection of sea otters, polar bears, walruses and manatees. The MMPA established a moratorium on the taking and importation of marine mammals and marine mammal products, except: 1) for purposes of scientific research, public display, photography for educational or commercial purposes, or enhancing the survival or recovery of a species or stock, or for importation of polar bear taken in sports hunts in Canada; 2) when taken incidentally in the course of

commercial fishing operations; 3) to deter a marine mammal from damaging fishing gear or catch, damaging private property, endangering personal safety, or damaging pubic property; 4) when taken incidentally by citizens engaged in a specified activity (other than commercial fishing) within a specified geographical region; 5) when the Secretary has waived the moratorium; or 6) if the marine mammal was taken by an Indian, Aleut, or Eskimo for subsistence purposes or for purposes of creating and selling authentic native articles of handicrafts and clothing. The MMPA provides for enforcement of the Act and its implementing regulations.

The Secretaries are directed to initiate negotiations with foreign governments to protect and conserve marine mammals. The Secretaries may transfer management authority for a species of marine mammal to a state. The MMPA also established the Marine Mammal Commission composed of three members appointed by the President.

**Migratory Bird Treaty Act**, 16 U.S.C. §§ 703-715s

It is unlawful "to pursue, hunt, take, capture, kill . . . any migratory bird, any part, nest or egg" or any product of any such bird protected by the Migratory Bird Convention, except as permitted by regulations. The Secretary of the Interior is charged with determining when, to what extent, and how to permit these activities.

**The National Aquaculture Act of 1980**, 16 U.S.C. §§ 2801-2810

The purpose of the National Aquaculture Act of 1980 is to promote aquaculture in the United States. The Secretaries of Agriculture, Commerce, and the Interior are required to establish and periodically amend a National Aquaculture Development Plan. The Secretaries are required to submit a biennial report to Congress that contains a description and evaluation of the actions undertaken with respect to the Plan. The Secretaries are to provide information and assistance on aquaculture activities.

**The National Fishing Enhancement Act of 1984** (Artificial Reefs), 16 U.S.C. § 1220, 33 U.S.C. §§ 2101 et seq.

States may apply to the Secretary of Transportation for obsolete ships which would be designated for scrapping if the state intends to sink such ships for use as an offshore artificial reef for the conservation of marine life.

**National Marine Sanctuaries Act (NMSA)**, 16 U.S.C. §§1431 et seq.

The NMSA provides the Secretary of Commerce with the authority to designate and manage nationally significant marine areas as national marine sanctuaries. The NMSA lists recreational and esthetic qualities as among the things that might give an area special national significance.

The NMSA's stated purposes and policies include comprehensive and coordinated conservation and management; enhancing public awareness, understanding, appreciation and wise use of the marine environment; and facilitating, to the extent compatible with the primary objective of resource protection, all public and private uses of resources not prohibited pursuant to other authorities.

Among the factors the Secretary must consider in determining whether an area merits designation as a national marine sanctuary are present and potential uses of the area that depend on maintenance of the area's resources, including commercial and recreational fishing, other commercial and recreational activities, and research and education; the public benefits to be derived from sanctuary status, with emphasis on the benefits of long-term protection of nationally significant resources, vital habitats, and resources which generate tourism.

**Northern Pacific Halibut Act of 1982**, 16 U.S.C. §§ 773-773k

The Northern Pacific Halibut Act of 1982 implements the Convention between the United States of America and Canada for the Preservation of the Halibut Fishery of the Northern Pacific Ocean and Bering Sea. The Act authorizes the appointment of Commissioners to the International Pacific Halibut Commission, outlines the responsibilities of the Secretary of Commerce and North Pacific Fishery Management Council in regulating the Pacific halibut fishery, and provides for enforcement of the Act.

**Pacific Salmon Treaty Act of 1985**, 16 U.S.C. §§ 3631-3644

The Pacific Salmon Treaty Act of 1985 implements the Treaty between the Government of the United States of America and the Government of Canada Concerning Pacific Salmon, signed at Ottawa, January 28, 1985. It authorizes the appointment of four United States Commissioners to the Pacific Salmon Commission, members of the Northern Panel, Southern Panel and Fraser River Panel, and members of an advisory committee. The Secretary of Commerce promulgates regulations necessary to carry out the United States' international obligations under the Treaty. The Secretary of Commerce may preempt state or tribal law if necessary to fulfill the United States' obligations under the Treaty.

**South Pacific Tuna Act of 1988**, 16 U.S.C. §§ 973-973r

The South Pacific Tuna Act of 1988 implements the Treaty on Fisheries Between the Governments of Certain Pacific Island States and the Government of the United States of America, signed in Port Moresby, Papua New Guinea, April 2, 1987. The Secretary of State is authorized to act on behalf of the United States in Treaty matters. The Secretary of Commerce, with the concurrence of the Secretary of the department in which the Coast Guard is operating, issues regulations necessary to carry out the objectives of the Treaty and the Act. Operators of vessels may request licenses to fish in the Licensing Area. The Secretary may order fishing vessels to leave the Licensing Area upon making certain findings. Vessels must stow gear while in closed areas and must allow and assist observers. The Act provides for enforcement of the Act and its implementing regulations.

**Sponge Act**, 16 U.S.C. §§ 781-785

The Sponge Act regulates the landing, curing and sale of sponges taken from the Gulf of Mexico and Straits of Florida.

**Tuna Conventions Act of 1950**, 16 U.S.C. §§ 951-991

The Tuna Conventions Act of 1950 authorizes the appointment of not more than four Commissioners to the International Commission for the Scientific Investigation of Tuna and the Inter-American Tropical Tuna Commission. The Secretary of State is authorized to act on behalf of the United States with respect to Commission activities, and the Secretary of Commerce is authorized to promulgate necessary regulations. The Act also provides for enforcement of the Act and its implementing regulations.

**Whaling Convention Act of 1949**, 16 U.S.C. §§ 916 - 916l

The Whaling Convention Act of 1949 implements the International Convention for the Regulation of Whaling, signed at Washington on December 2, 1946. The President appoints the United States Commissioner to the International Whaling Commission. The Secretary of Commerce is authorized to administer and enforce the Act. The Act prohibits persons subject to the jurisdiction of the United States to engage in whaling, or shipping, transporting, purchasing, selling, offering for sale, importing, exporting, or possessing whales in violation of the Convention or implementing regulations. The Act provides for enforcement of the Act.

## LIST OF ACRONYMS

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| FAO | Food and Agriculture Organization (United Nations) |
| ESA | Endangered Species Act |
| IPCC | Intergovernmental Panel on Climate Change |
| MMPA | Marine Mammal Protection Act |
| NMFS | National Marine Fisheries Service |
| NMSP | National Marine Sanctuary Program |
| UN | United Nations |
| UNEP | United Nations Environment Programme |