❑ THE ENVIRONMENTAL CONSEQUENCES AND ECONOMIC COSTS OF DEPLETING THE OCEANS

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Overfishing can not only reduce the stocks of targeted and non-targeted species but also wreak havoc with the marine ecosystem, according to Angela Somma of the National Marine Fisheries Service of the U.S. Department of Commerce. Moreover, she says, overfishing and mismanagement of fisheries cost billions of dollars a year in potential revenue to the industry while government subsidies to unsustainably large fishing fleets cost billions more.

Throughout the 1960s and 1970s, world marine and inland capture fisheries production increased steadily, on average by as much as 6 percent per year. In the 1980s, the rate of growth slowed considerably, and in the 1990s harvests leveled off. Around 1990, global fish production plateaued at about 100 million tons annually and hasn't moved much in the succeeding years. While aquaculture output continued to grow, yields from fisheries harvesting wild stocks from the oceans and inland waters were uneven and began to stagnate. A consensus emerged that the stagnation was the result of widespread overfishing. This paper examines the environmental and economic costs of that overfishing.

Over the past decade, it became increasingly clear that fisheries resources that were once thought of as nearly inexhaustible had been severely overfished as one fishery after another experienced serious decline. The once-abundant fisheries of bottom-dwelling fish such as cod in New England and eastern Canada were decimated, giant tuna species in the Atlantic were depressed to levels that jeopardized rebuilding, and several species of Pacific and Atlantic salmon were placed on the U.S. endangered species list. And the problem persists. In October 2002, an international scientific advisory commission recommended that all fisheries targeting cod in the North Sea, Irish Sea and waters west of Scotland be closed. Overfishing has obvious detrimental effects on the stocks being overharvested, but it can also harm the ecosystem in which those stocks live and cause economic hardship to fishermen and their communities.

The problem of overfishing is widespread throughout both the developed and developing worlds. The United Nations Food and Agriculture Organization (FAO) estimates that of the major marine fish stocks or groups of stocks for which information is available, 47-50 percent are fully exploited, 15-18 percent are over-exploited, and 9-10 percent have been depleted or are recovering from depletion. Thus, close to 75 percent of the world's major fisheries are fully exploited, or worse.[1]

ENVIRONMENTAL CONSEQUENCES OF OVERFISHING

The environmental consequences of overfishing are many and include reduced harvests of the targeted fish; excessive unintentional harvest of non-targeted, undersized or protected species, and ecosystems changes.

Persistent overfishing can lead to the elimination of the largest and oldest individuals from a population or stock. Overfished populations are characterized by less-productive fish that eventually lead to a decline in stocks. In the United States, recent average yields of all U.S. fisheries resources are roughly 60 percent of the best estimate of long-term potential yield from these resources.[2]

Alternatively, if overfishing is curtailed and fishery resources sustainably managed, fisheries become more productive, the cost per fish harvested declines, and harvests rise substantially. For example, in 1999 the International Commission for the Conservation of Atlantic Tunas (ICCAT) established a 10-year rebuilding program for overfished North Atlantic swordfish. Catch reductions were integral to stock recovery. Four years into the rebuilding program, the stock size is estimated to be at 94 percent of its healthy level. With the program well on track, ICCAT was able to increase catch levels at its 2002 meeting.

Harvest of non-targeted animals, or bycatch, is estimated to constitute about one-quarter of the global fish catch. Bycatch comprises all of the animals that are caught but not wanted or used, or are required to be discarded by

management regulation. It may include specially protected species such as marine mammals or endangered species, juvenile individuals too small to be marketed, or other species of fish without commercial or recreational value to the fisher. The unwanted species are usually discarded, often dead, either at sea or on shore. Various types of fishing gear are non-selective and can ensnare unwanted catch. Purse seine nets can catch juvenile fish and marine mammals such as dolphins. Longlines catch seabirds, sea turtles, and non-targeted fish along with the targeted catch. Gillnets can also catch seabirds, and lost or discarded gillnets can continue to catch and kill marine animals through what is known as "ghost fishing." Trawls are a particularly non-selective type of gear and can take considerable bycatch of many different species. In addition, concern is also growing about the changes trawls can make to fish habitat. They are often dragged along the bottom of the seabed and may damage habitat.

Overfishing can have broader adverse effects on the ecosystem as well. As noted above, in the 1990s total world catch reached a plateau. In some cases, this plateau in production was maintained by changes in species composition and by "fishing down the food chain." Top predatory species tend to be fished for first. Once depleted, fishing moves down the food chain and can simplify the marine ecosystem. This, along with environmental changes to important habitat areas, can affect future fish production levels.

Overfishing can cause changes in marine food webs, adversely affecting other species. For example, the decline of Steller sea lions in Alaska has been attributed in part to overfishing of the Stellers' main food sources: pollock, cod, and mackerel. Overfishing also has the potential to indirectly change ecosystems such as coral reef ecosystems. When plant-eating fish are removed from coral reef ecosystems, grazing is reduced, allowing the algae that coexist with corals to flourish and potentially take over, especially if the water contains high levels of nitrogen. Because they often reduce light that enters the water, these algae contribute to the loss of corals, which depend upon light.

ECONOMIC COSTS

In addition to the numerous environmental costs, overfishing has significant economic costs as well. If fishery resources were sustainably managed, total harvests could rise an additional 10 million metric tons, adding $16 billion to worldwide gross revenues annually.[3] In the United States, rebuilding currently overfished stocks and preventing overfishing in other fisheries could generate an additional $2.9 billion in revenue each year.[4] Current revenues are $3.0-3.5 billion. Thus, sustainably managing marine fisheries in the United States' 200-mile exclusive economic zone (the source of most of the U.S. catch) could nearly double revenues in this sector of the economy.

Ineffective management and overfishing have caused the fishing industry to underperform. In 1992, the FAO estimated that worldwide revenue at first-hand sales was approximately $70 billion while the total operating cost for the world's fishing fleet was $85 billion. Thus, the fleet was operating at an annual deficit of $15 billion.[5]

The operating deficit can be traced to marked growth in the world's fleet between 1979 and 1989 — estimated by FAO to have increased by 322 percent without a concomitant increase in the resource.[6] In fact, during this period world fisheries harvests grew at only about half the rate as the fleets, causing overcapacity in the world's fishing fleet. Overcapacity in fisheries in which anyone can participate often leads to "derby" fishing in which all the fishers attempt to catch as much as they can as quickly as they can before the quota is reached. This often creates a temporary market glut and lowers prices for fishers while creating longer-term supply problems for buyers. It also leads to overcapacity in the processing sector and reduces economic benefits to consumers.

Excessive bycatch, which often accompanies overfishing, imparts economic costs on the sector as well. Those economic costs include reduced food production in fisheries directed at the adult species of juveniles discarded in another fishery, reduced employment in fisheries and processing plants, and corresponding losses to fishery-dependent communities.

The fishing sector is not the only sector to experience economic costs associated with overfishing. There can be significant costs to the public as well. A recent study by the Organization for Economic Cooperation and Development (OECD) found that the cost of fisheries services among the 30 OECD member governments (research, management, and enforcement services) accounts for approximately 36 percent of total government financial transfers to the fisheries sector.[7] The cost of those services totaled approximately $2.5 billion in 1999.[8] It is difficult to know how much of this cost is attributable to overfishing, but as stocks become

overfished, management regulations generally become increasingly complex with greater need for enforcement, thus increasing costs to the public sector to manage these dwindling resources.

The costs to the public of providing subsidies to the fishing sector are receiving ever-greater attention. Worldwide, subsidies to the fishing sector are estimated to cost somewhere between $14 billion and $20 billion annually.[9] Subsidies that reduce fixed and variable costs or increase revenues distort trade and undermine competition in global seafood markets. Because of subsidies, the level of production is higher, resulting in decreases in prices. As a species becomes overfished, reduction in supplies can eventually lead to higher prices.

The costs of reducing overcapacity, if borne by the public through publicly funded vessel buyback programs, can be substantial as well. In the United States, all but one buyback program in 1994-2002 was federally funded, at a total cost of $65 million.[10] A recent study of the costs of a buyback program to eliminate overcapacity in five federally managed fisheries in the United States (New England and West Coast groundfish, East Coast swordfish, Atlantic longline shark, and Gulf of Mexico shrimp fisheries) estimated those costs to total $999.6 million.[11]

Clearly, overfishing has substantial economic as well as environmental costs. Stopping overfishing and allowing the stocks to rebuild would increase the productivity of the stocks and maximize revenues to the industry in the long run. Such action is necessary to stabilize both the resource and the industry. ❑

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