



ARE WE RUNNING OUT OF FISH?

FAO /18298/ P. CENINI

Historically, oceans were considered an inexhaustible source of fish. While fishing rights in near shore waters were often locally controlled, waters beyond easy boating distance from the shore were open to everyone. Open access resources, as they are called, are those that are owned by no one, and as such are particularly difficult to govern, precisely because no one individual has an exclusive right to use them, yet each person's use can diminish the remaining resource (WRI et al. 2003). Although open access resources are often subject to heavy and unsustainable use, over the last 35 years research has shown that degradation is not always inevitable (Feeny et al. 1990; Ostrom et al. 1999).

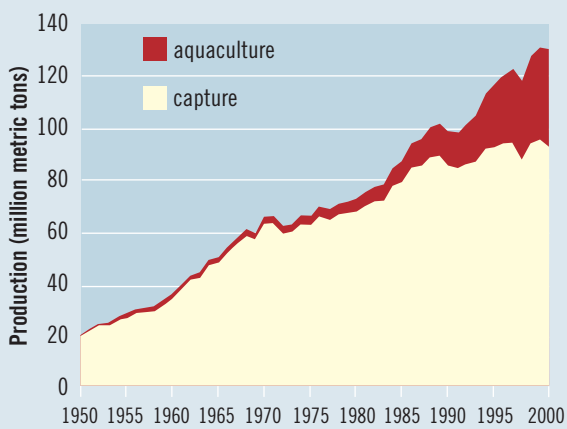
In 1968, author Garrett Hardin highlighted the vulnerability of open access resources when he popularized the concept of the “tragedy of the commons” arguing that these resources will inevitably be overexploited (Hardin 1968). The state of global fish stocks is perhaps the purest modern expression of Hardin's thesis. As new technology made fishing more productive and lucrative, the open accessibility of ocean and

coastal waters was an invitation to overfishing—the action of excessive harvesting that leads to the depletion of the fish stock. This was fueled by the growth in human population with its increased demand for fish as food, as well as the growing demand for economic opportunities. Even as overfishing of traditional stocks became apparent, the economics of the fishing enterprise rewarded continuous expansion of activities into new fishing grounds and unexploited stocks—the birth of today's fisheries crisis.

Overfishing was formally recognized as a localized problem as far back as the early 1900s (FAO 1997a; Engesaeter 2002). According to historical documents from the International Council for the Exploration of the Sea (ICES), there were concerns about overfishing of North Sea plaice as early as 1912, and then over the stocks of Atlantic cod and haddock (Engesaeter 2002). The first multinational meeting to discuss fish size and mesh limits, known as the “Overfishing Conference,” was held in London in 1936, with participants from 12 European countries (Engesaeter 2002). But until the 1950s, the problem

was confined to a few regions such as the North Atlantic, the North Pacific, and the Mediterranean Sea, and to specific stocks which were heavily fished, while the majority of global fish stocks were not extensively exploited.

Figure 3-1: Increasing Proportion of Aquaculture in Fish Production



Source: Fishstat 2003.

ued to grow, catches in traditional fishing grounds had long since reached their maximum and declined. One of the clearest examples of decline was the heavy depletion of groundfish stocks in the North Atlantic, including Atlantic cod, haddock, flounder, and plaice. These species historically supported much of the commercial fish catch in northern Europe and the East Coast of Canada and the United States.

By the 1990s, the fisheries crisis was receiving major media coverage. One of the most dramatic and public occurrences was the collapse of Canadian cod stocks and the closure of the fishery in 1992—an event that idled some 30,000 people employed in or affiliated with the industry (Milich 1999). The cod fishery had been a key source of employment and one of the most productive fisheries in the world for hundreds of years. In 1620, the fleet on the eastern coast of North America numbered more than 1,000 vessels with the average landing of cod for each vessel being around 125,000 fish (Mowat 1984). According to accounts from an English fisher at the time “cods are so thick by the shore that we hardly have been able to row a boat through them” (Mowat 1984 citing John Mason).

Not only was the abundance of fish impressive, but the average size of the cod was larger than in the last 40 years (Mowat 1984). This abundance continued for centuries until the 1960s when factory freezer

trawlers from the former Soviet Union, Poland, Iceland, Norway, and the United Kingdom arrived in the region. After that Atlantic cod catches began a precipitous decline (Berril 1997; Fishstat 2003) ending in the closure to groundfishing of Newfoundland waters, the Grand Banks, and most of the Gulf of St. Laurence by the Canadian government in 1992 (Kurlansky 1997).

Fishery analysis makes it clear that the conditions that led to the collapse of Canadian cod stocks are spreading to other areas and commercially important fish stocks. Overfishing has become one of the major natural resource concerns in developed countries and, increasingly, in the developing world. While industrial fisheries are more visible in terms of their expansion, level of catch, and overcapacity, small-scale fishers have also proliferated throughout the world in the last two decades, particularly as a result of increased technology and access to markets. In some areas small-scale fishers are as capable and responsible for overfishing as the industrial sector (Verdin, pers. comm. 2004).

HOW WIDESPREAD IS THE CRISIS?

Global fish production from today is near its historical maximum—some 130 million metric tons in 2001 (Fishstat 2003). This hardly seems like a “crisis” situation. But just looking at statistics on the annual global fish harvest does not tell the whole story. For one, aquaculture now accounts for nearly one third of global fish production—a proportion that has steadily increased over the last decade as production from capture fisheries has stagnated (see *Figure 3-1*).

Even so, the harvest from capture fisheries—the catch of wild fish from boats and nets—is still impressively high, in spite of the fact that many major fish stocks are in decline. That is because the impact of overfishing has been masked by steady expansion of the fishing enterprise into new fishing grounds, intensification of fishing effort using new technologies, and rapid exploitation of alternative fish stocks as traditional species are fished out.

Continuous geographic expansion of fishing effort. The last 50 years have seen an unprecedented geographic expansion of fishing effort by industrial fleets. They have ventured far from their “core” fishing areas in the North Atlantic and North Pacific to areas unexploited or underexploited prior to the 1960s—areas such as the Indian Ocean and the southern waters around Antarctica. At the same time, the fishing intensity in traditional grounds continued to increase as improved fishing gear and fish-finding technology came into wide use and as governments subsidized the growth of their fishing fleets.

Together, these factors set in motion a pattern of systematic overexploitation common throughout the world's fishing regions. First, production levels increase, then fishing continues at high intensity even after peak production levels have passed. Catch data from around the world show that many ocean fishing areas have already passed their peak harvest, and that production has subsequently declined (see *Map 3-1*).

As *Map 3-1* shows, fish landings (or catches) peaked in the Northern and the Southeast Atlantic regions between 1968 and 1980. In the Central Atlantic, the Eastern Pacific, and the Mediterranean, landings reached their maximum between 1981 and 1990; in the South Pacific, the Southwest Atlantic, and the Indian Ocean, peak harvests occurred between 1991 and 2001. So far, only the Western Pacific has continued to produce at its historical maximum (Burke et al. 2001; Caddy et al. 1998; Fishstat 2003). Most fishing areas, even those more recently exploited from a commercial point of view, show fully fished and overfished stocks (see *Table 3-1*). Fisheries experts warn that few ocean regions now remain underexploited, signaling that the cycle of relentless fisheries expansion is nearing an end. In a very real sense, greater production has led to greater depletion.

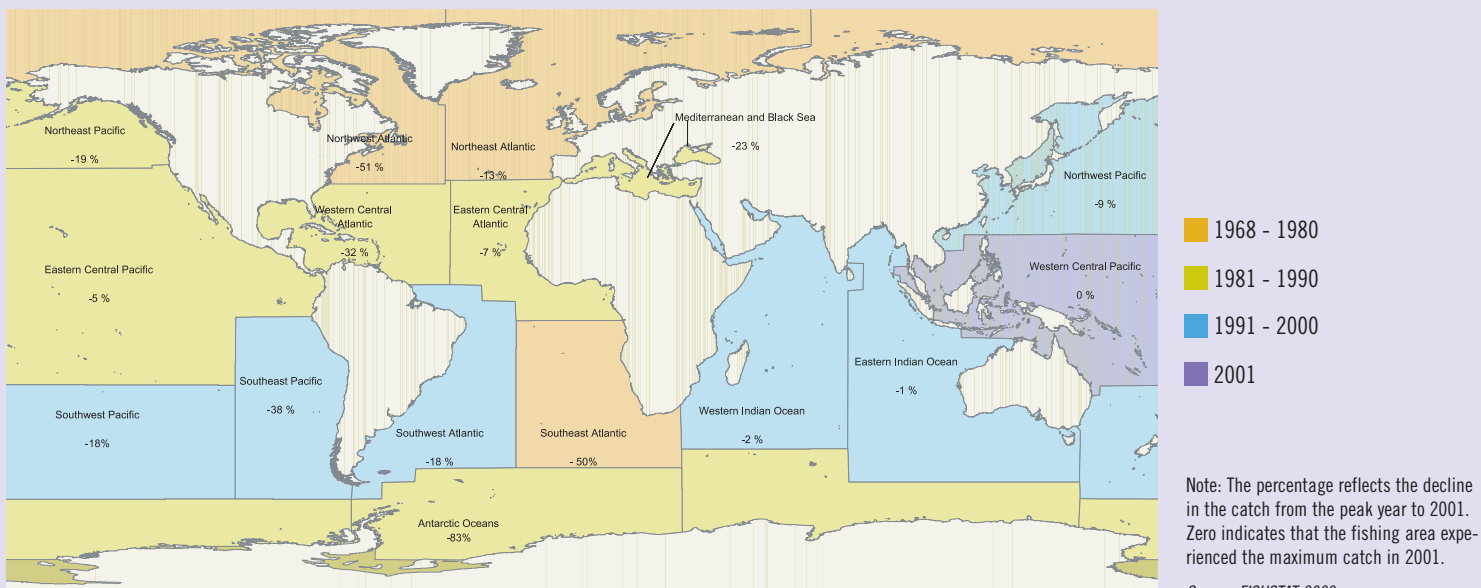
Substituting new stocks for old. In addition to expanding to new fishing areas, fishers have also turned to new species to keep their nets full. Traditionally, most industrial fishers focused their efforts on a relatively small number of highly abundant and valuable demersal species, such as Atlantic cod, flounder and haddock. However, thousands of

Table 3-1: Key Overfished Species by Major Fishing Area

Major Fishing Area	Key depleted (d), overfished (o), and fully fished (f) species
Northwest Atlantic	Atlantic cod (d), haddock (d), flounders (f), hakes (f), shrimps (f)
Northeast Atlantic	Atlantic cod (f/d), capelin (f/d), European plaice (o), European pilchard (o), Atlantic redfishes (o), Atlantic mackerel (o)
Western Central Atlantic	Groupers (f/o?)* croakers/drums (f/o?)* Stromboid conchs (f/o), manhadens (f)
Eastern Central Atlantic	Bigeye tuna (o), tropical spiny lobsters (o), croakers and drums (f/o), squids and octopuses (f/o)
Mediterranean and Black Sea	Shads (d), Northern bluefin tuna (d), albacore tuna (d), European hake (f/o), red mullets (f/o)
Southwest Atlantic	Brazilian sardinella (o), Argentine hake (f/o), Argentine shortfin squids (f/o)
Southeast Atlantic	Kingklip (o), Southern bluefin tuna (o), Cape rock lobster (o), Southern African pilchard (f)
Western Indian Ocean	Indian oil sardine (f), Penaeus shrimps (f), Bombay-duck fish (f)
Eastern Indian Ocean	Croakers and drums (f), Indian oil sardine (f), skipjack tuna (f)
Northwest Pacific	Yellow croaker (f/o), Alaska pollock (f), Pacific cod (f), red fish, basses and congers (f)
Northeast Pacific	Chinook salmon (f/o), coho salmon (f/o), Pacific ocean perch (d), king crabs (f/d), Pacific shrimps (f/o/d)
Western Central Pacific	Bali sardinella (f), yellowfin and skipjack tunas (f)
Eastern Central Pacific	Shrimps & prawns (f/o)
Southwest Pacific	Southern blue whiting (f), Southern hake (f), orange roughy (f), red fishes (f)
Southeast Pacific	South Pacific hake (f/o), Patagonian grenadier (f/o), South American pilchard (d/f/o)
Antarctic	Mackerel icefish (d), Patagonian toothfish (f)

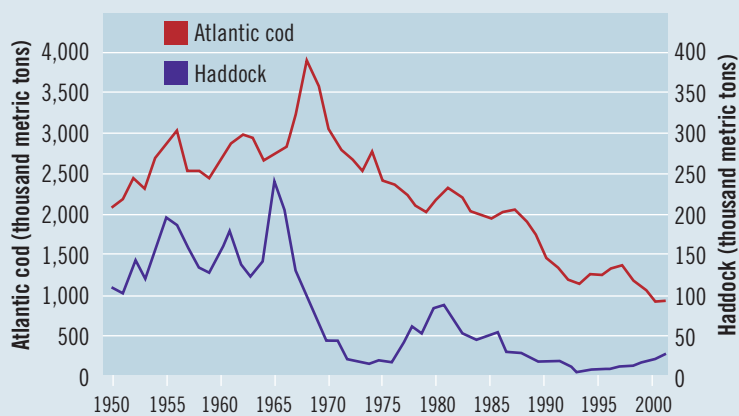
Source: FAO 1997a. * A question mark indicates that there is significant uncertainty in the assessment.

Map 3-1: Period of Peak Catch and Percentage Decline Since Peak Year

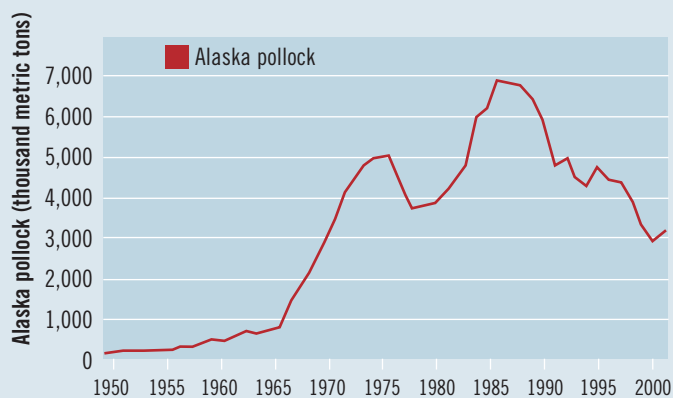


Are We Running Out of Fish?

Figure 3-2a and 3-2b: As Atlantic Cod and Haddock Catch Declines, the Alaska Pollock Fishery Expands

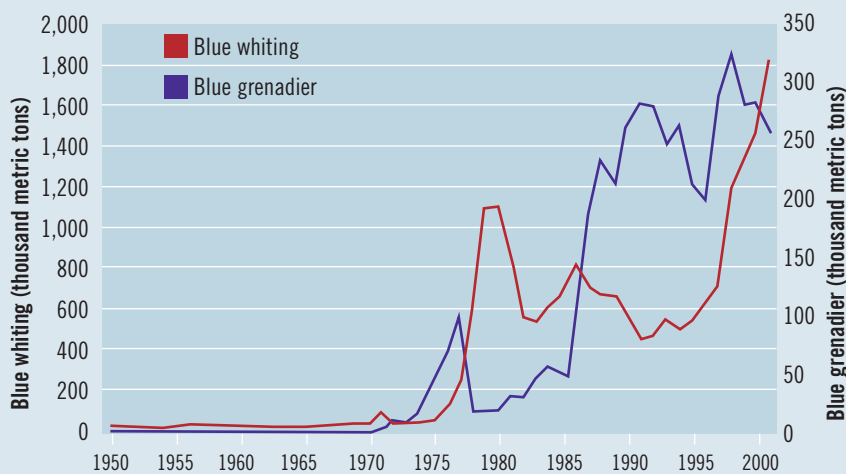


Source: Fishstat 2003.



Source: Fishstat 2003.

Figure 3-3: Species in the Cod Family Increasingly Exploited Since the 1970s, as More Traditional Cod Stocks Decline



Source: Fishstat 2003.

fish species are known to exist in the world's oceans. Improvements in fishing gear and on-board storage technology have allowed many new species to become commercially viable—even species found in remote locations and in deep waters. Many of these new species have acted as effective substitutes for over-fished species, helping to fuel fisheries growth over the last three decades (Grainger and Garcia 1996).

Catch statistics show discernable cases of the commercial replacement of a depleted fishery with a previously underexploited one. For example, the Alaskan pollock fishery dramatically expanded in the 1970s and 1980s as the Atlantic cod and haddock fisheries were in decline (see Figures 3-2a and b). Another substitute for depleted white fish such as cod, flounder, hake, and haddock are deep-water fish such as orange roughy and Patagonian toothfish. Although these species were commercially unknown only a little more than a decade ago, they are now widely sold in supermarkets and restaurants. A similar pattern can be seen with small pelagic fish targeted for fishmeal production. Species such as blue whiting, blue grenadier, and Chilean jack mackerel, which were virtually unexploited before the 1970s, are now among the top ten species harvested (see Figure 3-3).

Limits of the boom and bust cycle. Once they are targeted for industrial exploitation, fish stocks follow a predictable pattern of boom and bust. Fishing effort rapidly intensifies as more fishermen join in to fish the new resource; the fishery generates high yield until it reaches peak production; the stock begins to be depleted; and the fishery subsequently collapses. This cycle may not take long to run its course. One recent analysis—disputed by some⁴—estimated the effects of industrial fishing in 13 different fisheries around the world and suggested that substantial depletion—defined as an 80 percent reduction in the original fish biomass—typically occurred within 15 years of initial exploitation (Myers and Worm 2003).

For some vulnerable stocks the cycle may be shorter. For example, deep sea species such as deep water sharks, orange roughy and Patagonian toothfish are susceptible to more rapid depletion due to their slow growth and low reproduction rates (FAO 2002a). It took only a few years of intense fishing of orange roughy and Patagonian toothfish before some of the initial fishing grounds were depleted and had to close (Smith 2001).

Once stocks have collapsed, recovery may take years or may never fully occur. The Atlantic cod and haddock that were heavily exploited in the 1950s and 1960s have never recovered and today yield only 30 percent of the peak catch in 1969. Other cod-

⁴Details on the points of contention on this analysis can be found on-line at: http://www.soest.hawaii.edu/PFRP/large_pelagic_predators.html.

related species targeted in the 1970s with flagging yields have also not recovered since being heavily depleted. Catches of Alaskan pollock, Argentinean hake, Norway pout, and silver hake have all declined 40-90 percent from their peak production levels (Fishstat 2003).

If overfishing of a stock continues long enough, it can put the fishery at risk of commercial extinction. It was once thought that commercial fish species that were widely distributed and abundant were unlikely to be threatened with biological extinction even if heavily fished. But in recent years it has become clear that this is not the case. A small number of commercial fish species have now joined endangered whales and sea turtles on the *IUCN Red List of Threatened Species* (see Table 3-2). Scientists warn that when fish populations become severely depressed, a threshold can be breached making recovery questionable even if fishing effort is reduced or stopped. In May 2003, Canadian biologists declared the Atlantic cod an endangered species after concluding that some stocks face imminent extinction, in spite of the fact that the Canadian cod fishery is closed (COSEWIC 2003). Canadian cod populations have declined more than 99 percent from historic levels (Schiermeier 2002).

Compounding the problem of stock depletion is the likelihood that we cannot keep replacing depleted species with newly-discovered ones indefinitely. In fact, we may already have run out of species that can be used as substitutes for today's declining stocks. FAO statistics from the last decade or so suggest that production of the world's capture fisheries has reached its maximum potential, with the majority of the stocks that can be economically harvested being fully exploited (FAO 2001a). Experts warn that without serious efforts to combat overfishing and restore depleted stocks the harvest from capture fisheries will plateau and eventually decline, perhaps precipitously (Pauly et al. 2002).

WHAT IS THE CURRENT STATUS OF MARINE FISH STOCKS?

Global Status

A comprehensive and accurate assessment of the majority of the world's marine fish stocks is not really possible given today's fisheries data. Only a portion of commercially exploited fish stocks are scientifically and routinely monitored, and even these assessments suffer from many shortcomings (see *Annex A: What Is a Stock Assessment?* and *Annex B: Limitation of Global Fisheries Production, Capture, and Trade Statistics*). As a result, it is hard to determine exactly the condition of all marine

fish stocks, and whether they are depleted or not, especially those in tropical waters.

Nonetheless, data collected by FAO and national and regional fishery agencies provide a general picture of the state of marine fisheries. As of 2002, FAO reported that 75 percent of the 441 fish stocks for which information was available are in urgent need of better management. Of these, 28 percent are currently being overfished or are already depleted from past overfishing. Another 47 percent are being fished at their biological limit and cannot sustain increased fishing pressure without risk of collapse (Garcia and De Leiva Moreno 2000; FAO 2002a).

Table 3-2: Selected Fish and Shark Species Threatened by Commercial Exploitation

Common Name	Scientific Name	Red List Status*
Southern Bluefin Tuna	<i>Thunnus maccoyii</i>	Critically endangered
Harrison's Deepsea Dogfish	<i>Centrophorus harrissoni</i>	Critically endangered
Giant Catfish	<i>Pangasianodon gigas</i>	Critically endangered
Brazilian Guitarfish	<i>Rhinobatos horkelii</i>	Critically endangered
Pondicherry Shark	<i>Carcharhinus hemiodon</i>	Critically endangered
Atlantic Halibut	<i>Hippoglossus hippoglossus</i>	Endangered
Borneo Shark	<i>Carcharhinus borneensis</i>	Endangered
Common Skate	<i>Dipturus batis</i>	Endangered
Freshwater Sawfish	<i>Pristis microdon</i>	Endangered
Knifetooth Sawfish	<i>Anoxypristis cuspidata</i>	Endangered
Smalltooth Sawfish	<i>Pristis pectinata</i>	Endangered
Smoothback Angel Shark	<i>Squatina occulta</i>	Endangered
Whitefin Topeshark	<i>Hemirhamphys leucoperiptera</i>	Endangered
Angel Shark	<i>Squatina squatina</i>	Vulnerable
Atlantic Cod	<i>Gadus morhua</i>	Vulnerable
Basking Shark**	<i>Cetorhinus maximus</i>	Vulnerable
Bigeye Tuna	<i>Thunnus obesus</i>	Vulnerable
Giant Freshwater Stingray	<i>Himantura chaophraya</i>	Vulnerable
Great White Shark	<i>Carcharodon carcharias</i>	Vulnerable
Grey Nurse Shark	<i>Carcharias taur</i>	Vulnerable
Gulper Sharks	<i>Centrophorus granulosus</i> <i>Centrophorus squamosus</i>	Vulnerable Vulnerable
Haddock	<i>Melanogrammus aeglefinus</i>	Vulnerable
Sharptooth Lemon Shark	<i>Negaprion acutidens</i>	Vulnerable
Smoothtooth Blacktip	<i>Carcharhinus leiodon</i>	Vulnerable
Tope Shark	<i>Galeorhinus galeus</i>	Vulnerable
Whale Shark	<i>Rhincodon typus</i>	Vulnerable
Yellowtail Flounder	<i>Pleuronectes ferrugineus</i>	Vulnerable

* Species with a Red List status of Critically Endangered, Endangered and Vulnerable are all considered threatened with extinction.

** The Northeastern Atlantic population is considered Endangered.

Source: IUCN 2003.

Nor is the status portrayed by these numbers likely to remain stable for long. Analysis reveals that of the 200 fish stocks that are commercially most valuable, 35 percent show declining yields, indicating that the state of these fisheries continues to deteriorate (FAO 1997b).

The conventional goal of a fishery is to exploit the stock at its biological limit, but this means that any increase in fishing pressure also increases the risk of overfishing. This makes expansion of the fishery difficult to achieve in a sustainable manner, particularly when our knowledge of fishery conditions is incomplete.

Regional and National Status

In some cases, assessments conducted by national and regional fishery agencies provide a more detailed, although fragmented, picture of how fish stocks in particular regions are doing. One note of caution here is that countries use different methods of assessment and different criteria for categorizing the status of fish stocks, sometimes generating conflicting results. For example, members of the Commission for the Conservation of Southern Bluefin Tuna (CCSBT)—namely Australia, New Zealand, and Japan—undertook separate assessments of the bluefin tuna stock and arrived at different conclusions, resulting in disagreement on what the total allowable catch should be (Foster 2001).

National data reveal that stock assessments are regularly conducted for only a small fraction of species that are commercially exploited. In the United States, for example, only 304 out of 959 commercially fished stocks have been assessed, and this represents a relatively high rate of assessment compared to most countries (NMFS 2001a). Of the 304 assessed stocks, 175 are major stocks representing a considerable portion of the US fish landings. Of the remaining 655 stocks, whose status is unknown, 18 percent are major commercial stocks (NMFS 2001a). In the 2001 assessment of fish stocks in United States waters, a total of 27 percent were found to be overfished (NMFS 2001a).

In Japan, catch statistics on about 600 species are reported to the FAO database. Of the 81 Japanese stocks assessed in 2002, more than 50 percent (42 stocks) are considered to be at a “low” abundance level or a “mid” abundance level with a declining trend (JFRA 2002).

In European Union (EU) waters, about 70 stocks are assessed annually. Approximately 40 percent

of the stocks assessed in 2000 were found to be depleted (European Commission 2000).

Together, these estimates give a good sense of the severity of commercial stock depletion in the Northern Hemisphere and the challenges that face fishery managers as they try to find ways to reduce fishing pressure and allow stocks to recover.

In the Southern Hemisphere, summary information on the condition of fish stocks is not as readily available, with many countries only assessing a few of their commercial stocks on a regular basis. Argentina, for example, commercially exploits about 99 species (Fishstat 2003), of which a few key stocks are regularly assessed. Several of these stocks, including Argentinean hake, Southern blue whiting, Patagonian toothfish, seatrout, and flathead are all currently being overexploited (Prado and Drew 1999). In Chile, which fishes about 131 species (Fishstat 2003), pelagic resources including horse mackerel, anchovy, and sardine are all heavily exploited (Prado and Drew 1999).

In Australia, about 600 marine and freshwater species are caught and marketed (FRDC 2003). The Australian Commonwealth manages 19 fisheries outside the 3-nautical-mile limit of which 67 species or stocks have been assessed (Australian Bureau of Rural Science 2004; AFFA 2003). Most known species are at or near full exploitation, and several, such as southern bluefin tuna, school shark, tiger prawn, and Torres Strait lobster are overfished (Australian Bureau of Rural Sciences 2004).

Namibia exploits 55 species, including hake, pilchard, horse mackerel, monkfish, orange roughy, rock lobster, and tuna (Fishstat 2003). With the exception of pilchard and orange roughy, catch quotas for commercial species have been increasing in the past 5 years, in response to government policies to rebuild stocks that were put in place after independence in 1990. According to Namibia’s Ministry of Fisheries and Marine Resources (2002), the general status of all but one of the main commercial stocks in Namibian waters is promising.

Finally, in India, which exploits 121 species (Fishstat 2003), including the Indian oil sardine, Indian mackerel, anchovies, cephalopods, and perch, most major stocks are fully exploited (FAO 2000f).

These estimates show that our knowledge about the condition of fish stocks in the Southern Hemisphere is partial, and that many are not regularly assessed. This is particularly true in developing countries, where capacity and resources are limited. From the few countries for which information is available, most monitored stocks are being exploited at their biological limit, and a few important stocks are being overfished.

The conventional goal of a fishery is to exploit the stock at its biological limit, but this means that any increase in fishing pressure also increases the risk of overfishing. This makes expansion of the fishery difficult to achieve in a sustainable manner, particularly when our knowledge of fishery conditions is incomplete. These estimates also show, that government policies to rebuild stocks in Namibia and Australia are for the most part working.

WHAT ABOUT THE CONDITION OF FRESHWATER FISH STOCKS?

Determining the status of freshwater fish stocks is even more problematic than assessing marine stocks. Despite the importance of inland fisheries to the livelihood and nutrition of the rural poor in many developing countries, the level of knowledge about freshwater fish stocks is quite dismal. The use of catch statistics to assess stocks, which is common practice with marine species, is difficult because much of the inland catch is underreported—by a factor of 3 or 4 according to FAO (FAO 1999a; FAO 2000a). And although recent efforts have focused on developing easier survey methods, such as electronic fish counters and echo-sounding equipment (Hickley 1996) that can count migratory fish in rivers, these are applicable to only a small number of fish species and localities. Indeed, FAO considers its data on freshwater harvests and stock conditions so uncertain that it declined to give a comprehensive analysis of inland trends in its latest report on the state of world fisheries and aquaculture (FAO 2002a).

Nevertheless, there is little dispute that major increases in the harvest of freshwater fish have occurred over the last two decades. Much of this

increase is the product of enhancement efforts such as fish stocking and the introduction of non-native fish species in lakes and rivers. As in the case of marine fish stocks, increased freshwater harvests do not indicate healthy freshwater fish stocks or healthy aquatic ecosystems. In fact, evidence indicates that most freshwater systems are stressed by habitat loss and degradation, the introduction and presence of invasive species, pollution, overfishing, and the disruption of river flows by dams and other water diversions (Revenga et al. 2000). FAO's last major assessment of inland fisheries (FAO 1999a) reported that most inland capture fisheries that rely on natural reproduction of the stocks are overfished or are being fished at their biological limit and that the principal factors threatening inland capture fisheries are fish habitat loss and environmental degradation.

Lake Fisheries Status

Some large lakes have been systematically studied because of their importance as a fishery resource. The North American Great Lakes are a case in point. The USGS Great Lakes Science Center conducts annual fish stock assessments for commercially important salmonoid species, such as lake trout and Pacific salmon, and their prey species (e.g., alewife, rainbow smelt, bloater, sculpin and lake herring), using bottom trawl and hydroacoustic surveys (USGS 2003). The prey population assessments for the five lakes show that with the exception of Lake Superior, whose status is mixed, but improving, prey species in the other four lakes are all deteriorating (USGS 2003).

With respect to predator species in the lakes, many native species like lake trout and sturgeon are found in vastly reduced numbers and have been replaced by introduced species, while others such as coho and chinook salmon are only maintained by hatchery-reared fish (Great Lakes Atlas 2003). Important commercial species, such as blue pike and Lake Ontario Atlantic salmon are believed to be extinct (Great Lakes Atlas 2003) and in 19 of the 20 states within its original range, lake sturgeon are listed as either threatened or endangered under the U.S. Endangered Species Act (USFWS 2003).

Fish market in Thailand.



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Other regularly assessed lakes include Lake Victoria and Lake Tanganyika in Africa. These lakes also show a decline in native fisheries and their replacement with exotic species.

River Fisheries Status

Rivers are more diverse in their characteristics than large lakes and reservoirs, and consequently fish stock assessments require more complex methods. Some migratory species, such as salmon and trout are relatively well studied in developed countries, but even these assessments tend to be difficult because of the widespread distribution of life stages of migratory species and the lack of biological information about them.

The few examples of freshwater fish assessments show that many inland fisheries of traditional importance have declined precipitously. The European eel fishery, for example, has steadily declined over the last 30 years with important socioeconomic and biological implications. According to the International Council for the Exploration of the Seas (ICES), the European eel fishery maintains 25,000 fishermen and is the most widespread fishery under the ICES

management area (Dekker 2003). In the mid-1980s, the number of new glass eels (eel juveniles) entering European rivers declined to 10 percent of former levels. Recent figures show that this has now dropped to 1 percent of traditional level, putting this important fishery “dangerously close to collapse” (Dekker 2003). Some of the causes contributing to this drastic decline include overfishing, freshwater habitat loss and degradation, pollution, diseases, and changes in climate and ocean currents. Because of the gravity of the situation, ICES and FAO’s European Inland Fisheries Advisory Commission have initiated new international management measures for this shared stock (Dekker 2003).

Other fish stocks for which there is longer-term catch and status information include Pacific and Atlantic salmon in North America, fisheries of the Rhine and Danube Rivers in Europe, and fisheries of the Pearl River in China. All of these have declined to just a fraction of their former levels due to overexploitation, river alteration, and habitat loss, putting some of these species at serious risk of extinction (Bacalcaça-Dobrovici 1989; Lelek 1989; Liao et al. 1989; WDFW and ODFW 1999).

Finally, even fisheries that until recently were reasonably well managed, such as the caviar-producing sturgeons in the Caspian Sea, and fisheries from relatively intact rivers such as the Mekong in Southeast Asia are rapidly declining. For example, while almost all the 25 species of sturgeon in the world have been affected to some degree by habitat loss, fragmentation of rivers by dams, pollution, and overexploitation, much of the recent decline in the catch of caviar-producing sturgeon is a direct result of overfishing and illegal trade (De Meulenaer and Raymakers 1996; WWF 2002). Ninety percent of the caviar consumed in the world comes from just four species of sturgeon in the Caspian Sea (De Meulenaer and Raymakers 1996). Experts believe that major sturgeon populations have already declined up to 70 percent (WWF 2002). The decline has been so drastic that the five Caspian States agreed to establish the first unified system for surveying and managing sturgeon stocks (UNEP 2002a). Unfortunately, illegal harvesting and unregulated domestic consumption continue to threaten the long-term survival of Caspian Sea sturgeon species (UNEP 2002a).

In the Mekong two important fish species—the giant catfish and Jullien’s golden carp—are threatened with extinction according to *IUCN’s Red List of Threatened Species* (2003). The giant catfish in particular has recently been upgraded from endangered to critically endangered (IUCN 2003), and the giant barb (*Catlocarpio siamensis*), an endemic species in the Mekong considered one of the world’s largest cyprinid fish, is becoming increasingly rare (Mattson et al. 2002).

These examples show that inland fisheries are under pressure in most parts of the world, even though catches of selected species continue to grow. In many instances, harvests of introduced species—such as tilapia, carp, or Nile perch—mask this serious decline by substituting for wild or native species. In most cases, however, these introductions have actually hastened the decline of indigenous fish. In Africa’s Lake Victoria, the introduction of Nile perch and Nile tilapia in the 1950s has led to near extinction of more than half of the native species of cichlid fish—the basis of the lake’s traditional subsistence and commercial fishery (Witte et al. 1992; Kaufman 1992). Thus, one of the faces of the fisheries depletion in inland waters is the collapse of native fish stocks even as overall fish production rises—a *biodiversity crisis* more than a fisheries crisis.

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