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Has the Sea Given Up Its Bounty?

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Most of the earth's surface is covered by oceans, and their vastness and biological bounty were long thought to be immune to human influence. But no more. Scientists and marine experts say decades of industrial-scale assaults are taking a heavy toll.

More than 70 percent of commercial fish stocks are now considered fully exploited, overfished or collapsed. Sea birds and mammals are endangered. And a growing number of marine species are reaching the precariously low levels where extinction is considered a real possibility.

"It's an incipient disaster," said Richard Ellis, author of "The Empty Ocean."

A rush of recent studies, reports, books and conferences have described the situation as a crisis and urged governments and the industry to enact substantial changes.

Behind the assault, experts say, are steady advances in technology, national subsidies to fishing fleets and booming markets for seafood. Demand is up partly because fish is considered healthier to eat than chicken and red meat.

Directed by precise sonar and navigation gear, more than 23,000 fishing vessels of over 100 tons and several million small ones are scouring the sea with trawls that sweep up bottom fish and shrimp; setting miles of lines and hooks baited for tuna, swordfish and other big predators; and deploying other gear in a hunt for seafood in ever deeper, more distant waters.

Flash freezers allow them to preserve their catch so they can sweep waters right to the fringes of Antarctica. The trade is so global that an 80-year-old Patagonian toothfish hooked south of Australia can end up served by its more market-friendly name, Chilean sea bass, in a San Francisco bistro.

Seafood industry officials say overfishing and disregard for environmental harm peaked a decade ago. They point to the spreading adoption of gear that avoids unintended catches, acceptance of quotas and other limits, and agreements to conserve ocean-roaming fishes like tunas.

"We now have a better understanding of the limitations of the resources," said Linda Candler of the National Fisheries Institute, an industry lobbying group.

Federal fisheries officials note that although 80 American fish stocks have serious problems, restoration plans are in the works, and other stocks are rebounding. The North Atlantic swordfish is often cited as a sign of success. After limits were imposed four years ago, it has now largely recovered.

Pietro Parravano, who trolls for salmon out of Half Moon Bay, Calif., said fishery critics tended to overlook damage done by pollution and destruction of coastal wetlands. "It's not just our activity that's

leading to this decline," he said. "If fishermen are doing something wrong, they're willing to adapt."

The Problems

Experts Worry About Extinctions

Marine scientists have recently reported that improvements in fish stocks, where seen, are from depleted base lines that are a dim hint of the ocean's former bounty.

In the early 20th century, harpooned swordfish were routinely 300 pounds apiece. Swordfish caught on long-line hooks by the mid-1990's averaged less than 90 pounds, barely big enough to reproduce. Improvements since then, biologists say, hardly represent a resurgence.

Cod, which once could reach six feet in length, have essentially vanished off eastern Canada. Despite closures of fishing grounds, they may never come back, biologists say, because overfishing has so profoundly changed the ecosystem.

One consolation to biologists measuring such changes is knowing that commercial extinction — the point when a fishery is abandoned because of plummeting yields — generally comes before outright extinction.

Regional extinction appears to be possible, though. In 2000, the American Fisheries Society, representing fishery scientists and managers, reported that populations of 22 species, including various skates, sturgeons and groupers, had almost vanished.

As industrial fleets push into new waters, experts say, the danger and damage spread. The laws and international pacts that do exist can be circumvented, producing persistent illegal markets in coveted species.

The global fleets are sustaining harvests only by moving into untapped resources, said Dr. Daniel Pauly, a marine scientist at the University of British Columbia and co-author of "In a Perfect Ocean," a detailed analysis showing enormous drops in North Atlantic catches over the last century.

"It is like a ring of fire burning through a piece of paper," he said. "Since the 1970's, when the big fishing areas of the Northern Hemisphere saw catches drop, you've had this front moving out, with a massive effort off West Africa, in Southeast Asia, the southern Atlantic."

Moreover, scientists add, global fishing is spreading so fast that it is devastating marine ecosystems before scientists study them or get a rough idea of the size of populations. Off the coasts of North America and Australia, for example, biologists probing ridges and seamounts have found areas where trawls have uprooted communities of cold-water corals and other bottom dwellers that are centuries old.

Recent studies estimate that stocks of many fishes are now a tenth of what they were 50 years ago. As prized species have diminished, fleets have gone further down the food chain, for smaller fish, more squid, even jellyfish and shrimplike krill.

Industry calls it "biomass extraction" and turns the harvest into everything from fish sticks to protein concentrates for livestock or pellets to feed cage-raised salmon.

International agreements protect some species, like tuna and swordfish in the Atlantic. But most fisheries in international waters are rarely monitored.

Falling catches have led to fast growth in fish farming and other aquaculture. But these activities have exacted an ecological price, as well. Salmon and shrimp farms expanding in coastal waters from the Bay of Bengal to the Bay of Fundy displace ecosystems that are nurseries for much sea life or threaten local species through releases of nutrient-loaded waste, non-native species or diseases.

The result has been a profound transformation of the oceans that is terrifying, said Dr. Sylvia A. Earle, formerly the chief scientist of the National Oceanic and Atmospheric Administration. "Fleets of squid boats can be seen by astronauts," she said. The lights attract the big-eyed cephalopods. "And with the demise of these creatures," she said, "the ecosystems upon which they're dependent become unraveled."

The Causes

Demand for Fish Is Booming

Experts say the industry expansion has been driven by growing populations and prosperity around the world. Almost a billion people now rely primarily on fish for protein.

Another factor is persistent subsidies that give fishing fleets breaks on fuel costs, vessel construction, insurance or other expenses. All told, according to private analysts and the Food and Agriculture Organization of the United Nations, the subsidies amount to about \$15 billion a year, or more than a quarter of the \$55 billion in annual global trade in seafood.

Japan alone provides close to \$3 billion in support for its fishing fleets. Support in the United States includes \$150 million a year in tax rebates on marine diesel fuel, according to the World Resources Institute, a private research group.

The subsidies are challenged by environmental groups and conservative organizations espousing free markets, including the Cato Institute. The problem, they all say, is simply that such aid results in too many boats for the available fish.

Jerry Taylor, the director of natural resource studies at Cato, said that regulating fishing fleets while supporting them financially was "like trying to drive a car by hammering the brake and accelerator at the same time."

Another factor has been rapid advances in fishing technology. Much of the progress has been electronic: satellites of the Global Positioning System let fleets know their exact location, while increasingly sensitive and powerful sonar gear produces detailed readouts of schools and nooks where fish may lurk.

Ted Brockett, president of Sound Ocean Systems in Redmond, Wash., which makes and sells devices for ocean vessels, said technology could help stem fishing damage if fleets used the innovations not to pursue the last fish but to find the right fish — the size or species that can be harvested without degrading ecosystems.

"There's a way to go," Mr. Brockett said. "But I think people are realizing there's a problem with the resource."

The Remedies

'New Ocean Ethic' Is Recommended

A host of scientists and organizations have recently sounded alarms and proposed solutions. Last

summer, nations at an environmental summit in Johannesburg agreed to manage fisheries in a sustainable fashion by 2015.

But long before then, ocean scientists and policy makers say, the continuing fishing threatens to damage the ecological foundations of fisheries in ways that may last for generations.

In June, the Pew Oceans Commission — with a nonpartisan membership including fishermen, scientists and elected officials — recommended "a serious rethinking of ocean law, informed by a new ocean ethic."

This fall, a federal oceans commission, after three years of study, is to issue a comprehensive report recommending new policies.

"What I find encouraging is that a great many people now seem to understand that we're utterly dependent on the ocean and that we have the power to undermine the way the ocean works," said Dr. Earle, who holds positions with Conservation International and the National Geographic Society.

Already, partnerships between boat owners and government and university scientists are producing innovations in gear to reduce unwanted catches while increasing the harvest of desired fishes.

If nations shifted billions from subsidies to programs to buy out boats and retrain their crews, experts say, the industry could shrink without exacting too great a cost in jobs.

The most important recovery strategy of all is simply to fish less, experts say. This can be accomplished in many ways.

Harvest limits can be set, with quotas allotted to individuals in a fishery who can then trade them. Iceland has set the standard for this approach, which has also been adopted in a few American fisheries. By limiting the overall catch and allowing people to buy and sell their fishing rights, the system encourages some to leave the business, said William Hogarth, director of the National Marine Fisheries Service. Environmental and conservative groups, including Cato, support the practice.

Fishing pressure can also be cut by creating marine reserves or closures that create nurseries. Some biologists have proposed that 20 percent of the oceans be set aside, although experts say that monitoring such vastness against piracy will be impossible.

Reserves in coastal waters have already proved their worth, with rising catches in nearby areas. A notable success has been in St. Lucia, in the Caribbean, where reserves established in the mid-1990's increased nearby catches up to 90 percent.

Some closures in American waters have led to sharp recoveries, said Mr. Hogarth, of the fisheries service. After a shutdown of bottom fishing in 1994 in New England, he said, "scallops came back to record levels" and overall abundance soared.

Mr. Parravano, the salmon fisherman who is president of the Pacific Coast Federation of Fishermen's Associations, called closures "a solution that does not fit for all fisheries." In some cases, he said, repairing damaged coastal habitats could better aid breeding and population recoveries.

Nelson R. Beideman, who owned a long-line vessel that was lost at sea with its crew in 1993 and is now executive director of Blue Water Fishermen's Association, said that fishermen deserved credit for some

of the initiatives. "These are the fish that our livelihoods depend on," he said. "Doing the right thing is only natural."

Experts clash on the likely outcome of the flurry of activity. Mr. Hogarth sees ample reason for optimism if sound practices can spread before irreversible damage occurs. Overall, he and others said, fish can be extraordinarily resilient if their surroundings are not degraded too severely.

Still, he said, change requires a huge shift in consciousness. "There's been too much short-term vision," he said. "You look at all that water and think, 'There's no way you could overfish it.' "

Dr. Patrick M. Gaffney, a marine biologist at the University of Delaware, said the biggest problem was that science trailed the fishing fleets. "Oftentimes," he said, "you only start studying a species in its death throes or terminal decline."

Mr. Ellis, the author of "The Empty Ocean," argued that the crisis would abate only when people better understood the threat and were persuaded to appreciate and protect the seas. "Worldwide awareness," he said, "is the root of the solution."

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