

## High-Tech Fishing Is Emptying Deep Seas, Scientists Warn

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The demand for fresh fish in homes and restaurants around the world is soaring at a time when well-established fisheries are becoming exhausted. To meet the demand, fishing boats are venturing into farther reaches of the ocean, guided by high-tech devices that include technologies originally developed for the Cold War.

The sophisticated equipment makes it possible to scope out fish and cast nets with greater accuracy, even in areas that in the past were difficult to trawl.

As a result, many deep-water species are being fished so heavily they could soon reach the point of no return, scientists warned last week in Boston at meetings of the American Association for the Advancement of Science (AAAS).

The intensified fishing operations over the past three decades "have peeled the lid off the oceans," said Callum Roberts of the University of York in Great Britain, one of the speakers in Boston.

Devices designed or perfected for precise military operations—including sonar technology, satellite navigation systems, and depth sensors—are now routine equipment for many commercial fishing fleets. These devices combined with detailed maps of the ocean floor prepared by the U.S. Geological Survey give boats access to deep-sea areas where fish gather and spawn.

In many cases aerial surveillance is part of the picture. Some fishing boats in the Atlantic use spotter planes while the high-value tuna industry in the Pacific uses helicopters and other tracking equipment to seek out schools of prized fish and scoop them up in huge quantities, according to the scientists.

Citing the findings of a recent survey of North Atlantic fisheries, the scientists warned that stocks of highly favored fish—such as cod, tuna, haddock, flounder, and swordfish—could disappear from plates within a decade if these species continue to be fished at present levels.

The survey, headed by Daniel Pauly of the University of British Columbia Fisheries Center and sponsored by the Pew Charitable Trust, found that catches of popular food fish in North Atlantic waters have decreased by half over the last 50 years, although fishing has tripled in intensity.

Although the study focused on the North Atlantic, fisheries expert Andrew Rosenberg of the University of New Hampshire said similar depletion is occurring worldwide. "Around the world the percentages [of fish declines] may differ, but there is no question that overfishing is a global problem," he said.

### Call for Marine Reserves

A critical measure to restore productivity, the scientists agreed, is establishing "no-take" marine reserves so fish will have some relief from the hi-tech, round-the-clock exploitation. "When there is no place for fish to hide, we can devastate entire populations," said Jeff Hutchings of the University of Dalhousie in Canada.

Some evidence suggests that severely overexploited species may not recover even decades after depletion, he said. In Canada, for example, northern cod were fished so intensively that today the population is only a small percentage of the once-abundant stocks.

Yet, over time, Hutchings and others said, marine reserves can benefit local fishing communities as well the commercial fishing industry by increasing fish yields.

According to Charles Birkeland, a researcher at the University of Hawaii, the Philippines began establishing marine reserves in the mid-1970s and now has as many as 500. Support for the conservation measure grew, he said, after local people experienced the benefits. Several decades ago, a scientist helped villagers on Apo Island and Sumilon Island set up marine reserves, which demarcated 25 percent of the local reefs as "no-take" zones. Eventually, fish yields in the remaining 75 percent of the reefs nearly doubled.

The fish in the protected areas grew larger, were more plentiful, and produced more offspring, which also improved stocks in adjacent areas as the fish migrated and spawned, Birkeland said.

In a study designed to evaluate such spillover effects, reported late last year in *Science*, Roberts and his colleagues showed that the creation of marine sanctuaries off St. Lucia and Florida led to higher yields and larger fish in neighboring fisheries. "Reserves are like money in the bank," Roberts said at the meetings in Boston, "because what they do is protect the spawning stocks of fish."

But creating marine reserves isn't enough to revive fish populations that are declining rapidly to alarming levels, the scientists said. Among their recommendations, they called for a substantial reduction in the size of fishing fleets and the elimination of taxpayer subsidies that enable fishing boats to augment their technological capabilities.

### **Scramble to Exploit**

According to the scientists, commercial fishing companies began tapping deep-water fisheries in the 1960s and 1970s, when shallow-water fisheries were yielding smaller catches. Fishing boats became more powerful, with sturdier winches, cables, and nets.

As fishing fleets traveled farther afield, previously unfamiliar species of deep-sea fish began showing up widely in international markets and on restaurant menus. The annual catches of some of these now-popular varieties, such as the species marketed as Chilean sea bass and orange roughy, have already declined significantly, according to data cited in Boston and in other scientific reports.

For example, stocks of orange roughy (*Hoplostethus atlanticus*) in some regions are less than 20 percent of what they were only a decade ago.

The fish dwells deep in the ocean and travels long distances to spawn above seamounts in the Southern Hemisphere. Protected in the deep, it can grow to 150 years old. Because of this long lifespan, it matures and reproduces relatively late in life.

In the 1980s, fishing fleets discovered the fish's spawning grounds off New Zealand and southern Australia. Catches were often remarkable—as many as 60 tons in only 20 minutes of trawling. In the face of such intensive harvesting, *H. atlanticus* can't breed fast enough to ensure that the species will be available for future generations.

"If we want to keep seafood on our plates, we need refuges so some fish survive long enough to reproduce," said Roberts.

### **Going for Broke**

Even as fish stocks steadily dwindle, there are no signs that commercial fishing companies will voluntarily change their practices because the soaring demand for fish continues to push up prices. Fish prices—especially for prime species such as cod, haddock, and flounder—have risen as much as eight times the consumer price index over the past 20 years, according to Rosenberg.

"Fish is rapidly becoming a luxury in so many places that the prices are rising as dramatically as the harvest is falling," he said. "This means the big fishing operations have big incentives to extract even small fish, and it enables them to invest in even more technology and more powerful boats."

In Asia, reef fish are paying the price, according to Yvonne Sadovy, a scientist at the University of Hong Kong.

In the past, most of the locally consumed fish came from South China Sea waters, she noted. But, "as economies boomed and local fisheries became overfished, fishing boats began traveling farther away from Hong Kong—as far east as Fiji and into the Indian Ocean—looking for supplies to keep up with the growing demand," she said.

Imports of live reef fish to Hong Kong increased from about 4,000 metric tons in 1988 to 30,000 metric tons in 2000, she said, adding that demand is particularly strong in China.

Live-fish carrier vessels, called viviers, can carry up to 30 metric tons of fish from reefs throughout much of the Indo-Pacific Ocean, Sadovy explained. The giant vessels often deploy smaller boats, as many as 20 per trip, to reach inner reef sites, and the fish are brought back to the mother ship for transport to major demand centers in Southeast Asia.

"The high prices paid for luxury live reef fish make such expensive operations possible," she said.

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