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Cold War Technology Helps Deplete Ocean Fisheries

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In homes and restaurants around the world, the demand for fresh fish and other seafood is soaring at a time when well-established fisheries are nearly exhausted. To meet the demand, fishing fleets are venturing into farther reaches of the ocean, aided by an armament of high-tech gear that includes technologies originally developed for the Cold War.

The sophisticated equipment gives fishing boats close-up views of the seafloor and enables them to penetrate areas of the ocean that in the past were too risky to trawl.

Left with no place to hide out and breed, many deep-water species are rapidly disappearing—with some already near the point of no return, scientists warned last week in Boston at meetings of the American Association for the Advancement of Science (AAAS).

U.S. Geological Survey maps offer highly detailed landscape vistas of the seabed, illuminating crevices



Will It All Soon Be Gone?

Commercial fishing has intensified so heavily in recent decades that fish stocks are depleted to the point that many species may not be able to adequately recover, scientists say. Sophisticated equipment is enabling boats to track and catch fish even in once-inaccessible regions of the sea where fish had a measure of protection that gave them space to breed.

Photograph by Jeffrey L. Rotman/CORBIS

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where fish gather and spawn. Sonar technology and satellite navigation systems make it possible to scope out fish stocks and cast nets with greater precision.

On-board sensors for water temperatures and depth guide fleets to regions favored by prized species, such as swordfish and bluefin tuna.

Even aerial surveillance is part of the picture. Fishing boats in the Atlantic use spotter planes, while high-value tuna fisheries of the Pacific regularly use helicopters and other high-tech tracking equipment to detect schools of fish and scoop them up in huge quantities, according to the scientists.

These 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.

Based on a new comprehensive survey of fisheries in the North Atlantic, an international group of scientists at the AAAS meeting said stocks of favored fish species—such as cod, tuna, haddock, flounder, and swordfish—could disappear from plates within a decade if they continue to be fished at present levels.

The study, headed by Daniel Pauly of the University of British Columbia Fisheries Center and sponsored by the Pew Charitable Trust, found that catches of these and other popular food fish in North Atlantic waters have decreased by half over the last 50 years, even as fishing efforts have tripled.

While the study focused on the North Atlantic, fisheries expert Andrew Rosenberg of the University of New Hampshire said similar depletion is occurring

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Coral Hotspots Named

New research based on a survey of highly threatened coral reefs around the world has led to a list of 10 hotspots that scientists say should be protected right away because of the unique organisms they harbor.

The list of reefs recommended for priority attention was based on the first-of-its-kind study of the range of endemic species (those found only in small areas) that are at risk because of impacts from human activities. Many people have long contended that marine species aren't likely to become extinct because of their vast geographic ranges in the oceans, an argument that's refuted by the new study.

The authors of the study, who reported the results February 15 in the journal *Science*, said their report provides the scientific foundation for a strategy of reef protection that concentrates on places where marine biodiversity is disappearing most rapidly.

The oceans have long been considered limitless places where we have little impact on species' survival. But the richest of the shallow tropical marine habitats are at risk of disappearing at an incredibly fast rate, said marine scientist Sylvia Earle, executive director for Conservation International's

worldwide. "Around the world the percentages [of fish declines] may differ, but there is no question that overfishing is a global problem," he said.

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.

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

Other actions the scientists recommended include substantially reducing the size of fishing fleets and eliminating the hefty taxpayer subsidies that enable fishing boats to augment their technological capabilities.

Scramble to Exploit

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. Some of those now-popular varieties have already fallen to alarmingly low levels, according to

Marine Programs and an explorer-in-residence at National Geographic.

This study, she added, is further proof that we need to dramatically increase conservation efforts at sea.

The 10 coral reef hotspots, ranked according to their degree of threat, are: 1. Philippines 2. Gulf of Guinea Islands 3. Sunda Islands (Indonesia) 4. Southern Mascarene Islands (near Madagascar) 5. Eastern South Africa 6. Northern Indian Ocean 7. Southern Japan, Taiwan, and southern China 8. Cape Verde Islands 9. Western Caribbean 10. Red Sea and Gulf of Aden

Together, the 10 areas make up hardly a quarter of all the world's coral reefs, but they have a third of all species that are restricted to a certain range. Eight of the 10 reef hotspots are adjacent to areas designated as terrestrial biodiversity hotspots.

Past reports have indicated that about 58 percent of the world's reefs are threatened by agriculture, deforestation, fishing, development, and global warming. Besides causing the extinction of unique marine species, the degradation poses hardships for millions of poor people who obtain food and livelihoods from reefs.

To determine the top reef hotspots, scientists mapped the geographic ranges of a 3,235 species, including

researchers.

Orange roughy (*Hoplostethus atlanticus*) is an example. It 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.

In the 1980s, fishing fleets discovered the fish's spawning grounds off New Zealand and southern Australia, setting off a scramble to exploit the species. Because the spawning sites attracted large concentrations of fish to a small area, catches were often remarkable—as many as 60 tons in only 20 minutes of trawling.

Today, stocks of orange roughy in that region have been reduced to less than 20 percent of what they were only a decade ago.

Orange roughy have a long lifespan and don't mature and reproduce until relatively late, when they've reached a size that makes them a prime target of the fishing industry. This means they can't breed fast enough to ensure 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.

1,700 species of reef fish, 804 species of coral, 662 species of snail, and 69 species of lobster—four separate animal groups that require healthy reef environments to survive.

One way to immediately protect the hotspots, scientists say, is to establish marine reserves that are off limits to fishing. Now, only about one-half of one percent of the world's oceans is under any kind of protection, compared with about six percent of the world's land that has been converted to parks.

Last September, the United National Environment Program published a comprehensive atlas of the world's coral reefs. It showed a much smaller total area of reefs than previously assumed 284,300 square kilometers (109,770 square miles), about half the size of France.

Source: United Nations Environment Program

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Sustainable Seas

The Sustainable Seas Expeditions are a pathbreaking partnership between the National Geographic Society and the U.S. National Oceanic and Atmospheric Administration (NOAA) to explore the United States' last frontier: the ocean. The five-year

The prices of fish have risen as much as eight times the consumer price index over the past 20 years for prime species such as cod, haddock, and flounder, said 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. "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," Sadovy said.

Imports of live reef fish to Hong Kong have increased from about 4,000 metric tons in 1988 to about 30,000 metric tons by 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

program investigates, conducts research in, and promotes the 12 U.S. National Marine Sanctuaries, which range in size from a tiny bay in far-off American Samoa to a 5,328-square-mile (13,800-square-kilometer) expanse of ocean off the California coast.

Famed ocean scientist and National Geographic explorer-in-residence Sylvia Earle serves as the project's director, and former National Marine Sanctuaries program director Francesca Cava oversees its day-to-day operations. Funding is provided by a five-million-dollar grant from the Richard and Rhoda Goldman Fund.

The sanctuaries that are the focus of the Sustainable Seas missions encompass some of the world's most biologically diverse, geologically varied, and visually stunning marine habitats. The life-forms they sustain range from tiny luminescent organisms to possibly the largest creature ever to inhabit the Earth, the blue whale.

With the help of a revolutionary one-person submersible called *DeepWorker*, the expedition's scientists will photodocument the plants and animals that inhabit the uncharted regions of the sanctuaries and study the overall health of the marine environment. Online dispatches, live video and audio links, and chat rooms will enable ocean

expensive operations possible," she said.

Call for Marine Reserves

Roberts says marine reserves are crucially needed because two centuries of fishing has eliminated what were once naturally protected areas where fish could breed and supply fishery stocks over the long term.

In an online interview with Habitat Media, he explained: "Over the last 200 years or so of fishing we've gradually been working our way to the ends of the Earth. We've been fishing all of the areas that hadn't been overly exploited up to then, and every time we exhausted a local stock of fish we would move on to something else.

"What's happening now," he added, "is that we've reached the end of those resources," so fishing fleets are moving into the last remaining refuges.

"We've got to put those refuges back—we have to create them artificially," he said.

The idea is not to put all the ocean's waters strictly off limits to fishing, the scientists emphasize. Marine reserves can potentially support a fishing industry, they argue, because fish that reproduce within protected areas spawn offspring that migrate into fisheries zones, where they can be caught.

In some places of the world, people have taken that message to heart and are changing their traditional fishing patterns.

Marine reserves have been in effect in the Philippines since the mid-1970s, according to University of Hawaii researcher Charles Birkeland. Reserves have won

enthusiasts to share in the aquanaut's voyage of discovery.

For more information about the Sustainable Seas Expeditions: [Go>>](#)

acceptance in the region, he explained, because local people directly saw that reserves can increase fishing yields.

Several decades ago, a scientist helped villagers on Apo Island and Sumilon Island set up marine reserves, demarcating 25 percent of the reefs as "no-take" zones. Eventually, fish yields in the remaining 75 percent of the reefs nearly doubled.

The benefits occurred because the fish in the protected area grew larger, were more plentiful, and produced more offspring, and there was a spillover effect into the surrounding areas, Birkeland said.

"Theory and lectures don't work to change people's habits, but demonstration of success does," he said. "In the tropics, the most effective method of guidance [in creating reserves] has been the demonstration of success."

Today, the Philippines has 500 marine reserves, Birkeland noted. Reserves have also been established in some other parts of the world, such as Chile, New Zealand, the Caribbean, and some Atlantic regions off the United States.

"Reserves are like money in the bank," Roberts said, "because what they do is protect the spawning stocks of fish."

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