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Scientists Warn Fewer Kinds of Fish Are Swimming the Oceans

By [CORNELIA DEAN](#)

Researchers who studied decades of catch records from Japanese fishing fleets say fishing has greatly reduced the diversity of fish in the world's open oceans, leaving ocean ecosystems less resilient against environmental changes like global warming.

The scientists, who report their findings in today's issue of the journal *Science*, say it has been known for some time that fishing has reduced species diversity in coastal areas. But they say their study is the first broad look at diversity across open oceans.

The Japanese data records the catches in 50 years of fishing for 15 species of tuna and billfish like marlin and swordfish. But the researchers cross-referenced this information with data collected about more than 140 species by American and Australian government agencies in the 1990's, and the results suggest their conclusions apply more widely. Boris Worm, a biologist at Dalhousie University, in Nova Scotia and a lead author of the paper, said, "The oceans have been drained of species, basically." He said that more must be done to protect areas where diversity persists.

Dr. Worm and another author of the new study, Ransom A. Myers, also of Dalhousie, reported in 2003 that industrial-scale commercial fishing had reduced the ocean's populations of large predatory fish by 90 percent. That study also involved data from Japanese fleets.

In many areas, the researchers say, species diversity has fallen by half since the 1950's, meaning that boats now typically catch half the number of tuna and billfish species they did then.

"It doesn't mean that all those species are extinct," Dr. Myers said in an interview. But he said the fact that they are not being caught "is pretty dramatic."

Daniel Pauly, who heads the Fisheries Center at the University of British Columbia and who was not involved in the research, said it was interesting that the researchers could "tease out the long-term trend" from normal diversity variations in space and time. But he noted that they concentrated on relatively few species.

The researchers said fishing records show how areas with high diversity in the 1950's have been shrinking in the years since. The area between northern Australia and Indonesia used to be one of these areas, Dr. Worm said. But he said the area of robust diversity "just got smaller and smaller till it became indistinguishable from the rest of the ocean."

Lack of species diversity is a problem, Dr. Worm said, because ecosystems with fewer species are less robust in the face of environmental disruptions like climate change.

For example, he said, the world's tuna fishery today is largely a matter of yellowfin and skipjack tuna because bluefin, albacore and other species rarely appear on fishermen's lines.

"If the ocean changes in a way that doesn't favor these two species any more, we have very little to fall back on," he said. "If you have a rich portfolio of species, it's like a diverse stock portfolio. You are better off."

Global warming was particularly worrisome, he said. On land, warm areas generally were richest in diversity, he said, but in the ocean, diversity was highest in subtropical areas, where temperatures average about 77 degrees Fahrenheit, and where fronts of warmer and cooler water come together. In these areas, he said, currents and eddies caused plankton and small fish to collect, food for the larger species.

In areas where water is warmer or colder, diversity drops. In particular, Dr. Worm said, warmer water was bad for strong swimmers like tuna and billfish, fish that generate enormous quantities of internal heat as they swim.

When they compared their findings to earlier work on global distribution of tiny animals called zooplankton, they found

similar patterns. Steven L. D'Hondt, a professor of oceanography at the Graduate School of Oceanography at the University of Rhode Island and a leader of that work, said the similarity was "kind of a shock" given that large predator fish and zooplankton are far apart on the food chain.

"These two groups are moving together and they have very different niches," he said. He said the new findings suggested that some environmental properties were acting on both groups of creatures in the same ways.

The researchers said that five good-sized diversity hot spots remain. Two of them - the area off the east coast of Florida and the area south of the Hawaiian Islands - are in United States waters. The others are off the Great Barrier Reef in Australia, in the central southeast Pacific north of Easter Island and in the Indian Ocean near Sri Lanka

"These areas should be protected," he said. "They are important, not just for fish, but for everyone."