# Scientists decry loss of big ocean predators

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Washington — The variety of tuna, marlin, swordfish and other big ocean predators has declined up to 50 per cent over the past half-century due to overfishing, scientists say.

For the first time, ecologists and oceanographers mapped the hot spots with the largest concentrations of many big fish species, then and now. Their findings are reported in Thursday's on-line edition of the journal Science.

Researchers who had previously reported an overall decline in the abundance of big fish now say there has also been a significant drop in the number of different types of fish such as tuna and billfish being found in many areas.

They did find a few places where fish remain abundant.

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“We found five large hot spots that are still remaining today, and two of those are in U.S. waters,” said lead author Boris Worm, a marine ecologist at Dalhousie University in Halifax.

Those two spots are in the Atlantic Ocean, east of Florida, and in the Pacific Ocean, south of Hawaii. Two of the other areas are in the South Pacific, east of Australia's Great Barrier Reef and north of Easter Island. The other is in the Indian Ocean, east of Sri Lanka.

The scientists examined the only global data set for big fish species since large-scale fishing fleets began spreading globally just after the Second World War. It is based on Japanese fishing between 1952 and 1999 with the most widespread type of fishing gear, longlines, that are used in the open ocean. Those float for up to 110 kilometres on the water's surface, with baited hooks reaching down to 300 metres below.

Based on those data, the scientists found average declines of about 50 per cent in diversity in the Atlantic and Indian oceans, and an average decline of about 25 per cent in the Pacific.

They also discovered that the sea-surface temperature and level of oxygen in the water correlate with where the big fish concentrate.

“The peak in big fish diversity is at middle temperatures,” said co-author Ransom A. Myers, a fisheries scientist also at Dalhousie. “Ocean animals don't like it too hot, or too cold, they like it just right” – about 25 degrees Celsius.

That contrasts with the general distribution of species on land, which is richest in diversity at the equator and wanes toward the poles.

Nathan Mantua, a climate scientist at the University of Washington in Seattle, who was not part of the research group, said the study is useful for identifying the combined effects of climate variations and fishing on the distribution of the ocean's largest predator fish.

“They highlight that there are biodiversity hot spots that are tied directly to physical structure in the ocean,” which includes temperature, dissolved oxygen and currents, he said. “Out in the ocean, it's pretty clear that the primary cause of the long-term declines in biodiversity is fishing.”

They also found that concentrations of many big fish lined up closely with the only other known global mapping of ocean life – that of single-celled zooplankton.

Steven D'Hondt, a University of Rhode Island oceanographer and a co-author of that 1999 mapping, said “the smallest animals in the ocean and some of the largest show the same pattern of diversity at the global scale.”

Callum Roberts, a marine conservation biologist at Britain's University of York, said the study could help policy-makers and conservationists determine where best to locate marine-protected areas on the high seas – an issue being debated by the United Nations.

“While some hot spots have disappeared, there are still some very special places where species concentrate,” Mr. Myers said.

Two years ago, he and Mr. Worm used the same data to show that commercial fishing had depleted the world's oceans of 90 per cent of the overall abundance of big fish that flourished 50 years ago.

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