

Tropics face fish famine due to climate change, report warns

The first study to look at how climate change will affect food supplies offshore warns of severe declines in fish stocks in some of the world's poorest regions

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Fisherman off Rodrigues island, Mauritius. Many people in poorer nations depend on fish for their livelihoods. 'Income-wise and consumption-wise they are affected directly by the decline in catch,' the report warns. Photograph: Marc Dozier/Hemis/Corbis

Fish populations in the tropics could fall by as much as 40% over the next half century because of global warming, jeopardising a vital food source for the developing world, a new study published today has found.

The waters off Indonesia - which rank among the most plentiful areas for fish today - could see supplies fall by well over 20% by 2055 because of changes in ocean conditions. Fishermen operating in US coastal waters (excluding Alaska and Hawaii) could also face large declines in fish stocks, as would those working off Chile and China.

"Fish are very sensitive to temperatures, and when the temperatures warm because of climate change, the fish will move away. And some of the species - those that can't swim that far - may locally go extinct," said William Cheung, lead author of the study.

The study, conducted by the Sea Around Us project at the University of British Columbia, is the first to look at how climate change will affect food supplies offshore. It is published in the journal, *Global Change Biology*.

But not all regions would be losers. Cooler climates would see their catch potential rise by between 30% and 70% by 2055, with Norway, Greenland, Alaska and the east coast of Russia seeing the biggest increases. This is because fish will migrate northwards as the oceans warm to seek out suitable cooler waters.

But while the overall productivity of the world's oceans will remain roughly the same, the sharp declines in fish stocks in Asia, the Caribbean, and semi-enclosed seas like the Mediterranean could cause severe shortfalls in some of the poorest regions of the world.

Sub-saharan Africa and south Asia are already threatened with food shortages because of climate change. A study last week by the International Food Policy Research Institute projected sharp declines in rice and wheat crops by mid-century because of global warming, which could see more than 25 million malnourished children around the world.

In many parts of Africa and south-east Asia, people depend on fish and seafood for half of their animal protein.

"It is devastating," said Daniel Pauly, a marine biologist at the University of British Columbia who worked on the study. "Basically you have lots of people living at the edge of the sea. They depend on fisheries, not in the way we do in northern countries. So income-wise and consumption-wise they are affected directly by the decline in catch."

The study used computer modelling to gauge the effects of climate change on more than 1,000 species of fish, from krill to shark, across the 20 largest fishing zones.

It did not take into account the effects of ocean acidification - caused by more carbon dioxide dissolving in seawater and which scientists expect will reinforce the effects of warming on the oceans. "We think that our estimates should be considered conservative because adding ocean acidification into the equation would further decrease future fishery potential," said Cheung. He said a follow-up study would look at the effects of acidification.

The scientists found that the warming seas were driving fish from their current habitats, with for example, tropical mainstays like snapper moving north. Some will successfully migrate to colder waters - reflected in the projected increase in fish populations in more northern waters. But others will not survive the changes. "Not all of them will make it. They can handle it only by shifting more energy to resisting the higher temperatures, which means less growth and less potential for harvesting," said Pauly.

The study did not focus on individual species. However, scientists said the changes brought by warming seas would see the decline and possible disappearance of familiar fish even in colder waters, like those off Britain. Cod stocks will flee British waters for Iceland, Norway and Greenland.