

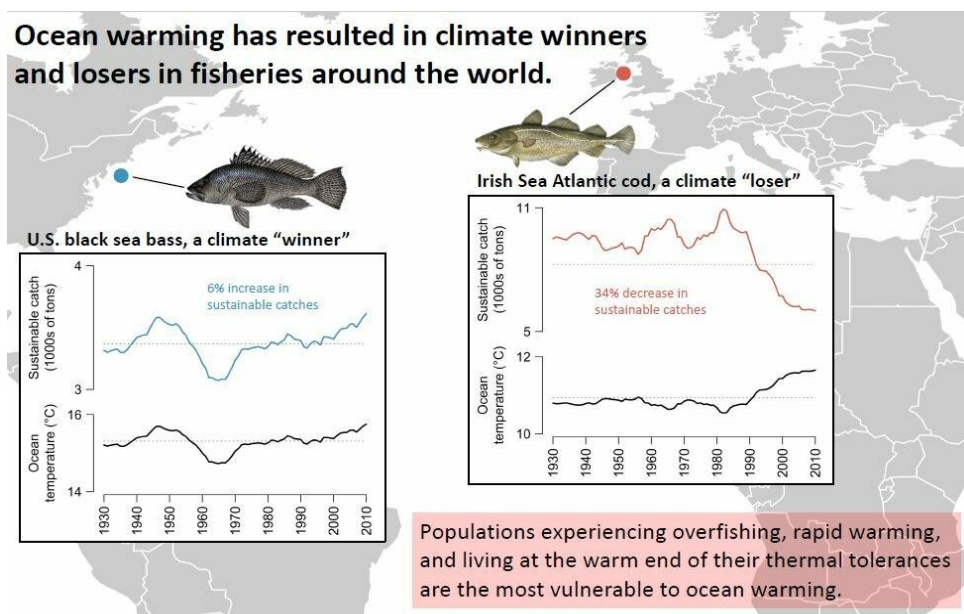
Warming oceans affect fisheries productivity worldwide, study reveals

A team of scientists carried out an investigation to evaluate how warming waters may affect the productivity of fisheries around the world, as climate change is beginning to disrupt the complex, interconnected systems that underpin this major source of food.

The researchers looked at historical abundance data for 124 species in 38 regions, which represents one-third of the reported global catch. Then, they compared this data to records of ocean temperature and found that 8 percent of populations were significantly negatively impacted by warming, while 4 percent saw positive impacts. Overall, though, the losses outweigh the gains.

"We were surprised how strongly fish populations around the world have already been affected by warming, and that, among the populations we studied, the climate 'losers' outweigh the climate 'winners,'" said Christopher Free, postdoctoral scholar at UC Santa Barbara's Bren School of Environmental Science & Management, and the team's leader." According to the study, published in the journal *Science*, species in the same region tended to respond in similar ways. Fish in the same families also showed similarities in how they responded to changes.

The researchers concluded that related species would have similar traits and lifecycles, giving them similar strengths and vulnerabilities.



Impact of ocean warming on 235 fish and invertebrate populations around the world. A population is shown that has experienced benefits from ocean warming, as well as a population that has experienced losses from ocean warming.

When examining how the availability of fish for food has changed from 1930 to 2010, the researchers saw the greatest losses in productivity in the Sea of Japan, North Sea, Iberian Coastal, Kuroshio Current and Celtic-Biscay Shelf ecoregions.

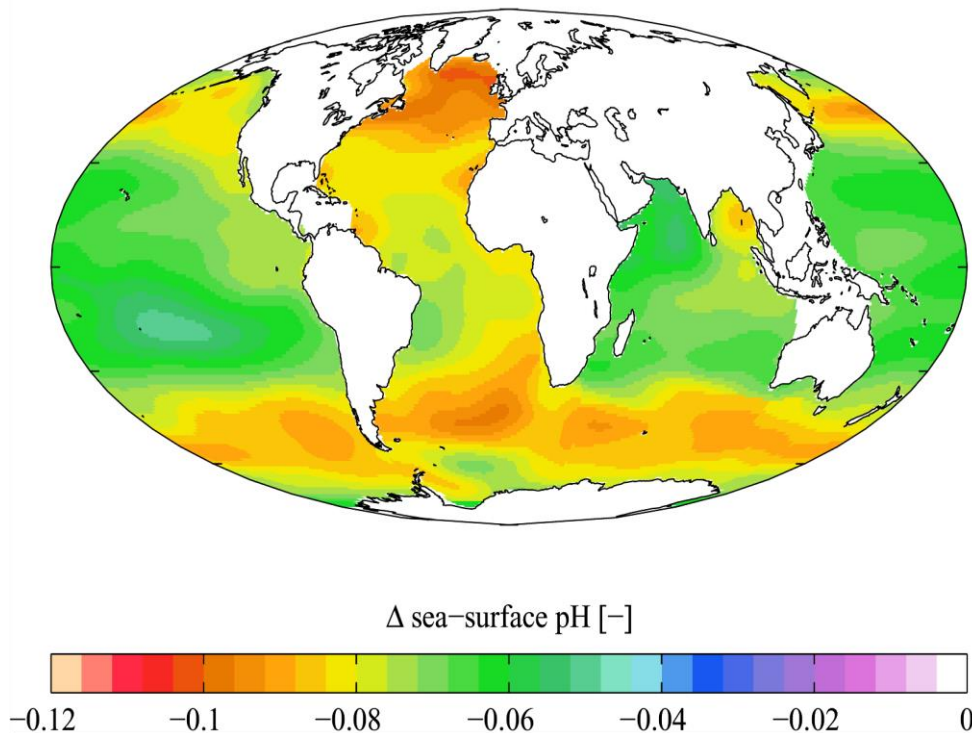
On the other hand, the greatest gains occurred in the Labrador-Newfoundland region, Baltic Sea, Indian Ocean and Northeastern United States.

The researchers highlight that although the changes in fisheries productivity have so far been small, there are vast regional discrepancies. For instance, East Asia has seen some of the largest warming-driven declines, with 15 to 35 percent reductions in fisheries productivity.

"This means 15 to 35 percent less fish available for food and employment in a region with some of the fastest growing human populations in the world," said Free. Mitigating the impacts of regional disparities will be a major challenge in the future," he added.

These findings highlight the importance of accounting for the effects of climate change in fisheries management. This means coming up with new tools for assessing the size of fish populations, new strategies for setting catch limits that consider changing productivity, and new agreements for sharing catch between winning and losing regions.

Besides, preventing overfishing will be a critical part of addressing the threat that climate change poses to the world's fisheries.



Estimated change in sea water pH caused by human created CO₂ between the 1700s and the 1990s, from the Global Ocean Data Analysis Project (GLODAP) and the World Ocean Atlas



Free stresses that ocean warming is just one of many processes affecting marine life and the industries that rely on it. Ocean acidification, falling oxygen levels and habitat loss will also impact marine life.

The scientists highlight that more research is necessary to fully understand how climate change will affect fish populations and the livelihoods of people that depend on them.

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