

The potential for global fish recovery in a changing climate

How effective management can make fish populations more abundant and resilient



If nothing is done, climate change will compound the impact of failing fisheries management, and it will have a dramatic effect on the world's oceans and the availability of seafood for three billion people worldwide. The effects will be felt most profoundly by the hundreds of millions who rely on the oceans' bounty for their nutrition and livelihoods.

But it doesn't need to be this way.

New research from scientists and economists at the University of California Santa Barbara, Oregon State University and Environmental Defense Fund shows that with effective management most fisheries could yield more fish and more prosperity, even with a changing climate. Relative to today, this preliminary research illustrates that effective management reforms underpinned by secure fishing rights can lead, globally, to a nearly 90 percent increase in profits, a third more fish in the water and a more than 10 percent increase in harvest by 2100 in the face of climate change. The research also shows the effect is even more pronounced compared to doing nothing: implementing effective management can yield nearly triple the profits, lead to a more than 50 percent increase in the amount of fish in the water and over a third more fish for harvest than if management is not adapted.

This upside potential will only be realized if we act now to reform management systems, according to the research. Improving fisheries management is the single most important thing we can do today to sustain healthy and profitable ocean ecosystems for the future.

About the Research

While the ecological effects of climate change in the oceans have been widely studied and publicized, this is the first global body of research that looks at a combination of human and ecological responses to climate change by examining how different types of management regimes and climate change projections may impact the future of global fisheries.

This research examined 780 complete species distributions plus an additional 132 country-level stocks representing 4,424 fisheries from the previous analysis ([Costello et al 2016](#)). Together the target stocks account for 74 percent of the global yield. For this analysis, researchers used a climate projection that predicts an average increase of 2.2°C in global mean surface air temperature by 2100.

What the findings show us

The analysis shows that the world's fisheries will experience two main responses to warming ocean temperatures and other climate effects: an overall change in productivity, which is on average negative, and the shift of fish stocks within the ocean and often between different countries' Exclusive Economic Zones (EEZs). But the analysis also shows that these impacts can be mitigated through the implementation of more effective management systems that address both productivity and stock shifts.

This new research shows that global productivity for the species and stocks examined will slightly decrease between now and the

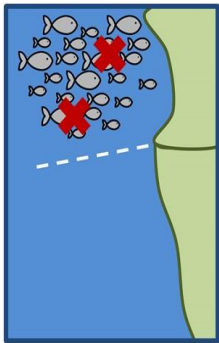
end of the century. During the same period more than one-third of the species studied are expected to move completely out of at least one EEZ while the same amount are also expected to shift into at least one new EEZ.

Determining how many fish can be harvested is a central component of any fisheries management strategy. In order to adequately address changes in productivity, harvesting approaches will need to be more adaptive, and to vary according to population swings, rather than remaining constant regardless of the size of the population. Adaptive policies are inherently resilient, respond to biomass levels better, track changes in the environment, and ensure more efficient use of fishery resources.

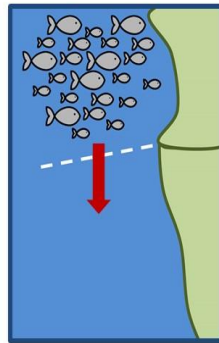
Climate Change & Fisheries



Changes in Productivity



Changes in Range



In addition to the changing productivity of the oceans, the shifting of fish stocks out of a nation's waters can pose a significant challenge to fisheries managers. Experience shows that there are real challenges with managing fish stocks that migrate across or straddle multiple EEZs, and that, on average, stocks which do so are generally less healthy than those contained within a single nation's waters ([FAO 2006](#)). When countries cannot develop agreed-upon ways to share these resources, they generally compete with one another to harvest the resource ahead of the other country, thus leading to overfishing.

The effects of shifting stocks that result from a changing climate magnify the need to develop resilient approaches to straddling stock management. Successfully managing through these changes requires multinational cooperation among nations to manage resources effectively.

Further, previous research and experience has shown that management systems incorporating secure fishing rights offer fishing communities and governments a highly flexible and effective approach for responding to challenges like stock productivity and shifting stocks.

If there is a failure to address these challenges fisheries will not realize their potential, leading to diminishing yields and profits, compared to today. This would result in a loss of 15-20 percent of the global yield, and over a third of all profits, meaning a significant reduction of fish in the sea and potentially a financial disaster for fishermen and fishing communities worldwide.

But this need not be the case, as it is now clear that effective fisheries management can not only help prevent a worsening of the problem due to the negative impacts of climate change, but that the future of the oceans can be bright, if action is taken quickly.

Helping those hit hardest

The new analysis also shows that while some regions may gain fish abundance others will lose, and that those countries where losses may be greatest also appear to be the countries that can least afford it. In many instances these are developing regions whose fisheries are already characterized by a lack of effective management, and whose people are heavily reliant on seafood for nutrition and survival.

Yet even in many of the most dire circumstances, there is still an upside to be achieved through making positive changes, and implementing effective management today is the single best thing to improve the health and productivity of the oceans. The longer we wait to implement good management, the more dire the future for these regions.



Conclusion

These challenges are not just problems of the future, but problems we are facing today. Already, we are seeing the results of climate change play out in European fisheries. Recent spatial shifts of mackerel led to the “mackerel wars” where the movement of the stock into new waters created conflict over the sharing of this resource and, ultimately, overfishing of the stock.

These changes in productivity and movement of stocks pose the greatest problems that fisheries managers, governments, NGOs and industry alike must be able to overcome as climate change takes hold to avoid potentially devastating consequences for the communities that most depend upon these resources for their survival and livelihoods.

While there is much we do not yet know about the future impacts from changes in abundance and location of stocks, we now know that there is a significant upside if effective management reforms are implemented quickly. These reforms must include: A) harvest policies that adapt to changes in biomass, B) strengthening existing international fisheries coalitions and the creation of new ones and C) implementation of secure fishing rights to help foster sound management and address issues of social and economic adaptability during the climate change transition.

Together, these reforms will help ensure that our fisheries can yield more fish, more food, and more prosperity, even in the face of a changing climate.



Contributing Authors

Steve Gaines, University of California, Santa Barbara

Christopher Costello, University of California, Santa Barbara

Michael Harte, Oregon State University

Jake Kritzer, Environmental Defense Fund

