

# Climate-Ready Fisheries

FOR A SUSTAINABLE FUTURE



## THE CHALLENGE











**Climate change is dramatically reshaping our ocean and the communities that rely on it.**

Greenhouse gas emissions have made our ocean waters warmer, more acidic, and lower in oxygen. At the same time, sea levels are rising and extreme events such as hurricanes, marine heatwaves, coastal erosion and sea ice loss are becoming more frequent.

**These environmental changes are harming marine life and marine ecosystems and threaten our ocean and the people and fisheries that depend on healthy marine ecosystems.** Climate change is

disrupting where fish are found, what they can eat, where they can live, and how many there are. These changes are already impacting fisheries in our ocean waters, and fishery-dependent coastal economies and Indigenous communities and cultures are particularly vulnerable as the effects of climate change worsen. While many fishermen are ready to adapt, our systems to manage fisheries are not.

### Climate impacts put fisheries and communities at risk

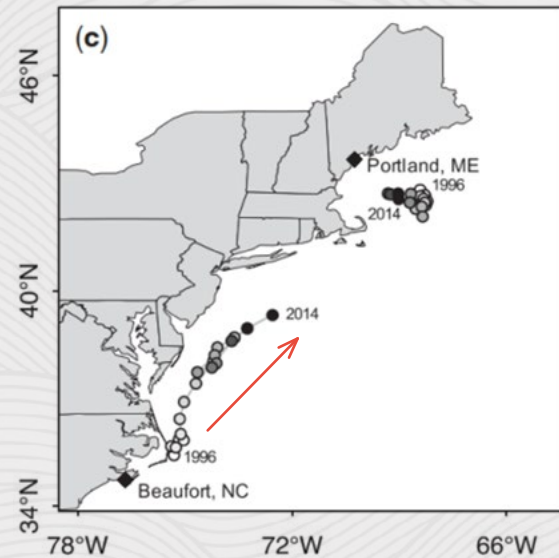
 <b>Organism productivity</b> 	 <b>Fleet production costs</b> 	 <b>Shell-building organism erosion</b> 	 <b>Coastal erosion, sea ice &amp; habitat loss</b> 
 <b>Food security</b> 	 <b>Community vulnerability</b> 	 <b>Extreme weather events</b> 	 <b>Stock distribution</b> 

The distributions of marine animals are predicted to shift an estimated 18-32 miles per decade as a result of warming.



Average shift in suitable habitat by 2100. Pew Charitable Trusts. Data from Morley, J.W., et al. 2018. Projecting shifts in thermal habitat for 686 species on the North American continental shelf. *PLOS One*.

As fish move, so do fishermen. Fishing fleets out of Beaufort, NC, shifted 13 miles a year since 1996.



Young, T., et al. 2019. Adaptation strategies of coastal fishing communities as species shift poleward. *ICES Journal of Marine Science*.

On average, maximum sustainable yield of fish stocks declined

↓ 4.1%

from 1930 to 2010 as oceans have warmed.

Free, C.M. et al. 2019. Impacts of historical warming on marine fisheries production. *Science*.

**One of the most well-documented impacts of climate change is shifting fish stocks, which are disrupting fishing traditions along our coasts.**

The distribution of fish is changing as fish seek cooler waters in a warming ocean. Fishermen have to make choices about whether to follow the fish and leave traditional fishing grounds. New fisheries will emerge in some areas and disappear in others, making it more challenging to manage sustainably and opening up previously unfished areas to new threats.


Another impact is that warming waters are also making fish populations less productive, and **fish abundance is predicted to decline – meaning fewer fish for fishermen and the ecosystem.**

**In addition, marine heatwaves, harmful algal blooms, hurricanes and other extreme events are expected to increase in frequency and become more intense.** These events can kill marine life and disrupt or close fisheries entirely. Critical fisheries infrastructure like ports, marinas and processing facilities will face **sea level rise and frequent and severe flooding and storms, which makes it more difficult for fishermen to get on the water and for seafood to get to consumers.**

Climate change also challenges each part of our management system, from research and collecting data to making decisions about how to manage fisheries sustainably. Our science and management systems are based on assumptions that underlying conditions in the future will largely stay the same as they were in the past, which puts the system at risk of becoming increasingly ineffective in a rapidly changing world. In addition, the management system tends to be reactive instead of proactive, which can make it difficult to adapt quickly and to be prepared for unexpected changes and disruptions ahead.

## Key challenges include:

- Increased unknowns and a greater need for new research to understand climate impacts and assess whether existing knowledge and assumptions about fisheries and their ecosystems are still relevant (e.g. to determine how productivity or growth has changed);
- Expanded need for timely and accurate data across larger geographies (e.g. to cover shifting stock ranges; to monitor changing bycatch interactions);
- Adapting stock assessments or other predictive tools to account for changing ecological and biological conditions and to handle greater uncertainty;
- Ensuring today's management decisions prioritize long-term sustainability by acting on available climate information; and
- Planning for and weathering marine heatwaves and other disasters.



**Traditional Knowledge** is defined as a living body of knowledge acquired and utilized by Indigenous communities and individuals through long-term sociocultural and environmental engagement. Traditional Knowledge is deeply rooted in history, time and place and is foundational to an equitable, climate-ready fishery platform.<sup>1</sup> Climate-ready fishery management must prioritize co-production of knowledge and center Traditional Knowledge and Traditional Knowledge holders in a way that respects Tribal sovereignty and traditions.



Photo credit: Clark James Mishler

<sup>1</sup>Raymond-Yakoubian, J., et al. 2017. The incorporation of traditional knowledge into Alaska federal fisheries management. *Marine Policy*.

## THE OPPORTUNITY: CLIMATE-READY FISHERIES

**Fundamentally, we must reduce emissions of greenhouse gases to head off the most severe impacts of climate change. But additional action is needed now to help fisheries adapt.** The U.S. has been a model for sustainably managing its fisheries, but climate change is threatening the progress we have made.

Climate-ready fishery management means taking action now to **understand, predict, plan and adapt** to the impacts of climate change on fisheries and the communities that depend upon them. **Fisheries that are climate-ready prioritize sustainability, resilience and equity in the context of rapid changes and increased uncertainty in order to preserve our ocean's long-term ability to provide food and support businesses, recreation and culture.** By working together, fishermen, scientists and managers can chart a course to a sustainable fishing future.

To achieve climate-ready fisheries, we must first ensure that our fisheries are healthy by ending overfishing and rebuilding them to sustainable levels. Then we must go further, **using the best science and information to understand how our fisheries are changing and then responding quickly to adapt to those changes.** Much of this can be built onto the foundation of sustainable management created under the Magnuson-Stevens Fishery Conservation and Management Act (MSA), through policy change, budgetary priorities, new regulations or guidance, or implementation of best practices in fishery management plans (FMPs). However, strengthening the law would provide new tools and authorities to address this systemic threat to sustainability and will provide new mandates for funding support from Congress.

### We need to:

- 1 Incorporate climate considerations throughout the management process, from data collection to on-the-water outcomes, to ensure sustainable management decisions are robust to likely climate futures.
- 2 Increase production of climate-relevant science and data, and create mechanisms to use that information to produce climate-ready management decisions. This must include multiple ways of knowing, particularly Traditional Knowledge.
- 3 Address management and jurisdictional challenges from shifting stocks, increased disasters and sea level rise with new policies and approaches.
- 4 Apply a precautionary approach to fishery management, including by keeping some areas closed to fishing, and ensure existing or new fishing opportunities remain sustainable.
- 5 Deploy solutions and tools, like data-limited approaches, use of indicators, scenario planning and management strategy evaluation (MSE), to enable broader and more consistent use by managers.
- 6 Ramp up support, staff and funding necessary to adapt all parts of the management system, including using or expanding existing funding programs and grants.
- 7 Prioritize action on fisheries we know are most vulnerable to climate impacts.
- 8 Increase transparency and equity in fishery management decisions and processes.

## MAKING THE MSA CLIMATE-READY

Because climate change affects each part of the management system, many tools and actions are needed to address the problem. There are opportunities to update the Magnuson-Stevens Act to implement these tools and make fisheries climate-ready.

SCIENCE AND DATA	ASSESSMENT	MANAGEMENT
------------------	------------	------------

Impacts of Climate Change on Fisheries		
<ul style="list-style-type: none"> <li>• More survey and data needs, including climate and biological data.</li> <li>• Greater need to reassess existing understanding.</li> <li>• More unknowns and unanswered research questions.</li> </ul>	<ul style="list-style-type: none"> <li>• More uncertainty in underlying assumptions.</li> <li>• More difficult to produce useful management advice.</li> <li>• Greater challenge of how to include knowledge of changes.</li> </ul>	<ul style="list-style-type: none"> <li>• More tradeoffs to balance.</li> <li>• More extreme events and disasters that put pressure on management.</li> <li>• Need to adjust management frameworks to address changes.</li> </ul>

Needed Tools and Actions		
<ul style="list-style-type: none"> <li>• Strategically expand surveys and research.</li> <li>• Assess the risks to fish, fishermen and ecosystem.</li> <li>• Include Traditional Knowledge.</li> </ul>	<ul style="list-style-type: none"> <li>• Incorporate ecological indicators and ecological considerations in assessments.</li> <li>• Develop forecasts.</li> <li>• Include Traditional Knowledge.</li> </ul>	<ul style="list-style-type: none"> <li>• Explore tradeoffs and the robustness of strategies (e.g. scenario planning and MSEs).</li> <li>• Reduce other pressures on fish stocks (e.g. protect habitat and reduce pollution).</li> <li>• Include Traditional Knowledge.</li> </ul>

Policy Opportunities		
<ul style="list-style-type: none"> <li>• Prioritize climate in cooperative research and other funding vehicles.</li> <li>• Identify and address climate science information gaps.</li> </ul>	<ul style="list-style-type: none"> <li>• Have Scientific and Statistical Committees provide advice on climate change and its influence on fish stocks.</li> <li>• Bring consideration of fish population resilience and vulnerability into the law.</li> </ul>	<ul style="list-style-type: none"> <li>• Integrate climate information into FMPs.</li> <li>• Create policies to sustainably manage fisheries across jurisdictions and handle fishery disasters.</li> </ul>