

Climate Change & Commercial Fisheries in Portland, ME

INTRODUCTION

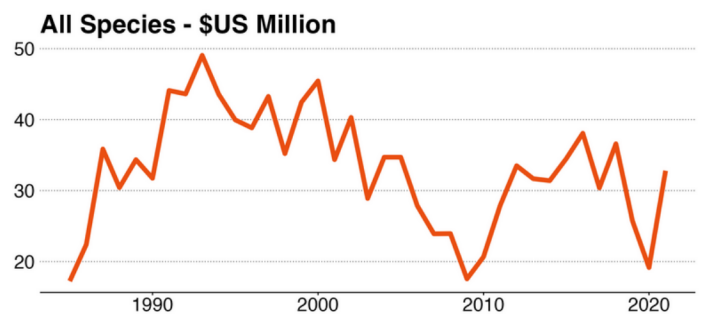
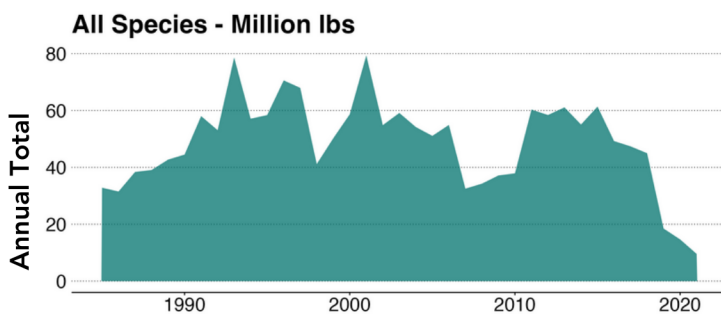
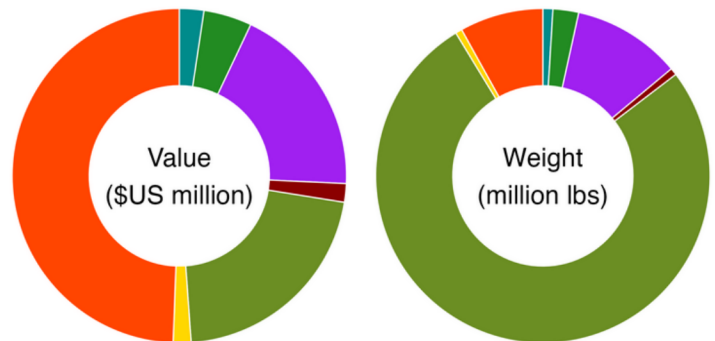
Climate change is altering the physical and chemical characteristics of our ocean and affecting marine ecosystems and fisheries. As environmental conditions continue to change, fishing communities may be affected by changes in the distribution and availability of species. This report summarizes the current status of fisheries in Portland and shares information on changes in harvested species that may occur in the future. Used alongside the [Climate Adaptation Resource Hub for Fishing Communities](#), this report provides information for understanding potential impacts on a fishing community, which can be used to consider ways to adapt to a changing climate.

WHAT IS LANDED HERE?

Commercial fisheries in Portland landed an average of 42 million pounds of finfish and shellfish per year spanning 2012-2021, which was valued at \$31.4 million per year on average.* A diverse mix of species is landed in the port. American lobster was the highest value species landed, representing an annual average of \$15.5 million. Atlantic herring was the highest volume species, with over 32 million pounds landed in Portland each year on average. The total landed volume has varied but has been above 40 million pounds for many years since 1990. Landings surpassed 78 million pounds in 1993 and 2001; however the volume has recently declined from 45 million pounds in 2018 to 9 million in 2021. The overall economic value of landings was high in the mid-late 1990s and early 2000s and has fluctuated between \$30-40 million per year in the past ten years.

Species	Annual Average Value	Annual Average Volume
American lobster	\$15,507,319	3,395,221 lbs
Atlantic herring	\$6,694,693	32,228,979 lbs
Pollock	\$1,462,004	1,044,356 lbs
White hake	\$743,675	405,566 lbs
Monkfish	\$564,752	287,666 lbs
American plaice	\$540,686	269,468 lbs
Other	\$5,869,529	4,414,108 lbs

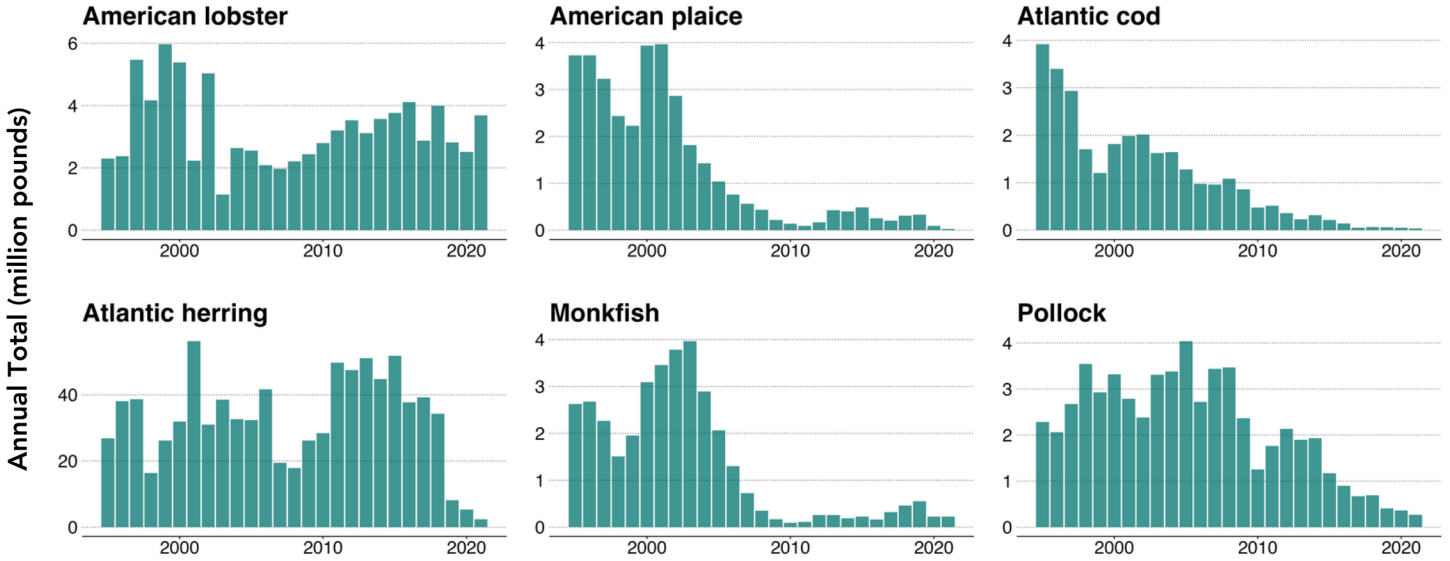
Above are the annual average value and volume for the top species landed at this port in each year from 2012-2021.



*Landings data were provided by NOAA Fisheries' Greater Atlantic Regional Fisheries Office. Due to confidentiality restrictions, some data may not be fully representative of the historical landings at a given location.

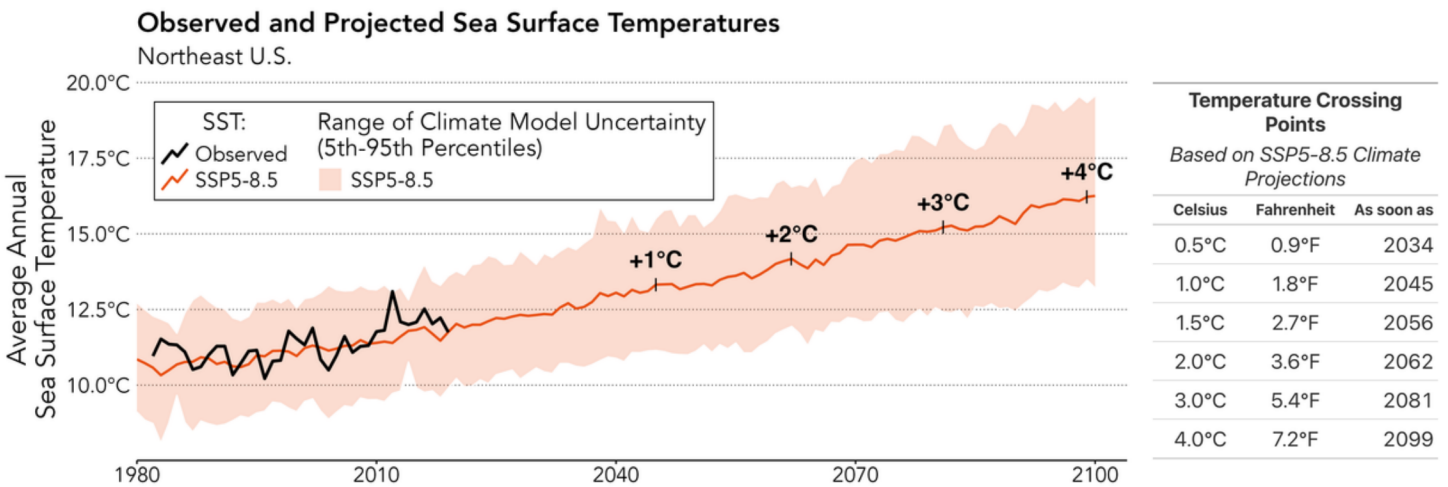
LANDINGS OVER TIME

Multispecies groundfish landings in Portland have experienced substantial and sustained declines since the 1990s. Atlantic cod and American plaice landings were high in the late 1990s but have declined to low levels since 2000; pollock landings declined later, experiencing progressively lower landings over much of the 2010s. Atlantic herring and American lobster have generally persisted as the most economically valuable species landed in Portland, although herring landings have declined substantially in recent years. Monkfish landings began increasing in 1998, peaking in 2003 and declining to very low levels by 2010.



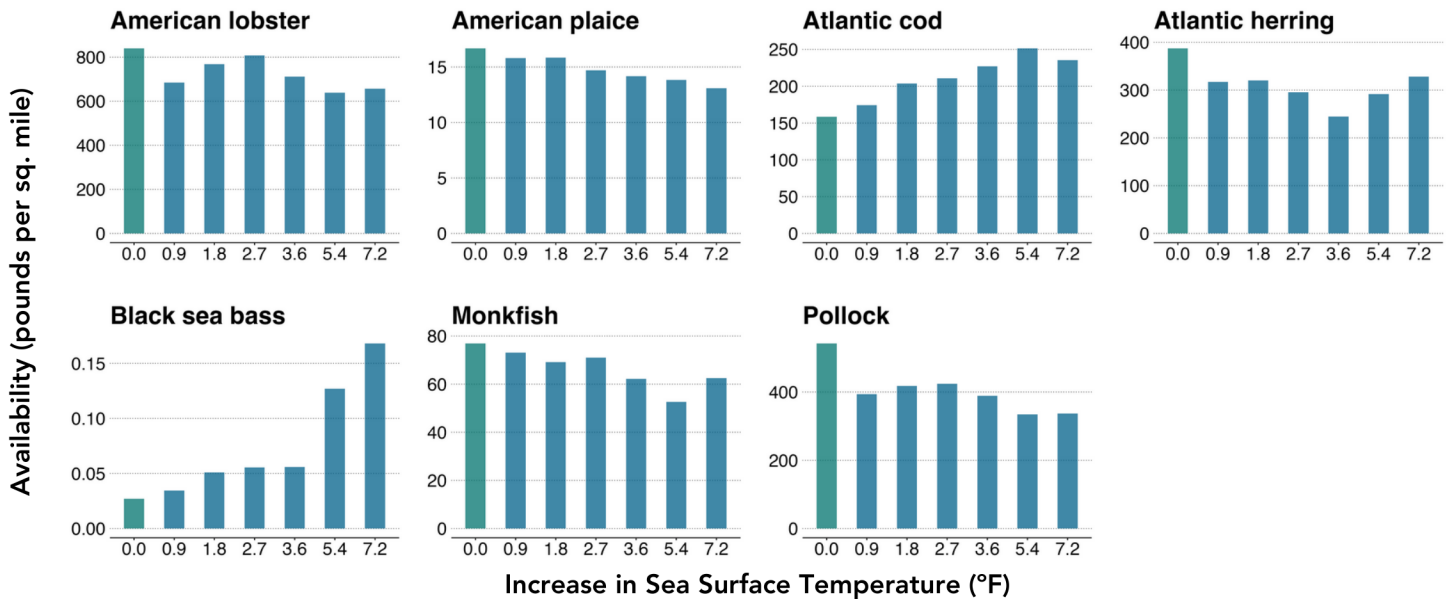
OUR CHANGING CLIMATE AND WARMING WATERS

Greenhouse gas emissions around the world are a primary contributor to the warming the planet has been experiencing over the past century. This warming affects the health and distribution of species that support fisheries in coastal communities. Scientists around the world use a common set of scenarios to project climate impacts into the future. These scenarios represent multiple global social and economic development patterns paired with different levels of greenhouse gases in Earth's atmosphere. The scenario representing the largest build-up of greenhouse gases, labeled SSP5-8.5, indicates global average temperatures will warm by approximately 4°C (7°F) above pre-industrial levels by the end of this century. We use this scenario to understand how species may respond to changes in ocean temperatures in the Northeast U.S. relative to those experienced during 2010-2019. These species projections allow us to explore different potential futures of fisheries and support decisions now that can buffer the severity of future climate change impacts on fishing communities.



FUTURE CHANGES IN AVAILABILITY

As the abundance and distribution of certain species changes with warming waters, communities may need to respond to ensure the continuity of the fishing industry. By combining historical species observations with future climate information, we can estimate how the availability of certain species may change, and what new opportunities may emerge. Availability is given here as the total estimated weight of a particular species of fish in a given area, as modeled from bottom trawl survey data. Warming ocean temperatures may affect the availability of some commercial species in the waters near Portland. Atlantic cod and black sea bass may increase with increasing temperatures. Lobster, American plaice, herring, monkfish, and pollock availability may decline at all levels of warming, with generally stronger declines at higher warming levels.



EMERGING OPPORTUNITIES AND ADAPTATION OPTIONS

Harvesting emerging species and diversifying catch are some ways individual harvesters can adapt to changing fisheries. In the table below, we outline other potential adaptation options spanning the different scales of the fishery system. As the climate continues to change, new impacts will take shape, requiring re-evaluation and revision of goals in order to respond to climate change. For more information on adaptation options in fishing communities, please visit the [Climate Adaptation Resource Hub for Fishing Communities](#).

Individual Harvester Actions

- Shifting fishing locations
- Shifting harvested species
- Diversifying livelihood (alternative fisheries, aquaculture, non-fishing jobs)

Industry Actions

- Improving product handling
- Developing supply chain capacity
- Diversifying markets and building consumer demand

Management Measures

- Reassessing quota allocations
- Altering permit access and availability
- Developing adaptive reference points
- Applying dynamic and ecosystem-based management

Community Initiatives

- Maintaining and securing shoreside infrastructure
- Improving transportation networks
- Developing local seafood initiatives
- Conducting vulnerability and resilience assessments
- Using early warning monitoring
- Community adaptation and resilience planning

Projected Changes in Species Availability in Portland

Values represent percent change in modeled species availability at potential levels of warming relative to 2010-2019 baseline conditions. Species in gray had low availability (<5 lbs/sq. mile) during the baseline period.

Species	Increase in Sea Surface Temperature			
	0.9°F	1.8°F	3.6°F	5.4°F
Acadian redfish	-7.4%	-8.6%	-38.3%	-53.0%
American lobster	-18.5%	-8.6%	-15.3%	-23.9%
American plaice	-5.3%	-5.0%	-15.0%	-17.0%
Atlantic cod	9.9%	28.6%	43.2%	58.6%
Atlantic halibut	5.4%	0.1%	-4.0%	-14.3%
Atlantic herring	-18.1%	-17.3%	-36.9%	-24.7%
Atlantic mackerel	18.7%	45.0%	74.7%	57.8%
Black sea bass	27.6%	88.7%	106.5%	369.0%
Butterfish	-9.0%	4.2%	19.7%	12.5%
Deep sea red crab	-15.1%	-9.3%	-34.2%	-29.4%
Haddock	4.3%	41.4%	6.0%	-19.9%
Hagfish	30.6%	63.9%	38.3%	23.6%
Jonah crab	13.8%	-15.5%	-13.5%	-41.3%
Little skate	-17.5%	-18.4%	-15.3%	-9.5%
Longfin squid	-8.0%	14.6%	-45.4%	194.1%
Monkfish	-5.0%	-10.1%	-19.2%	-31.6%
Ocean quahog clam	-31.0%	5.7%	29.8%	-50.9%
Pollock	-27.3%	-23.0%	-28.2%	-38.3%
Red hake	31.0%	8.2%	3.7%	-6.7%
Rock crab	63.0%	74.7%	81.0%	141.5%
Sand lance	-48.0%	-78.9%	-71.2%	-69.7%
Scup	-25.6%	4.4%	43.6%	144.1%
Sea scallop	25.8%	9.5%	6.5%	-26.4%
Shortfin squid	-38.3%	-22.2%	-12.5%	13.9%
Silver hake	-13.5%	-15.9%	-13.1%	-23.2%
Smooth skate	-22.6%	-25.9%	-23.9%	-20.6%
Spiny dogfish	-49.4%	-52.1%	-55.9%	-64.2%
Summer flounder	-0.2%	12.4%	48.5%	121.5%
Thorny skate	-12.6%	-8.5%	-14.0%	-24.1%
White hake	-24.7%	-19.0%	3.9%	-8.9%
Windowpane	20.6%	40.2%	34.4%	54.7%
Winter flounder	4.9%	9.8%	14.8%	2.7%
Winter skate	-23.7%	-19.2%	-10.8%	-6.1%
Witch flounder	-9.1%	-29.3%	-36.0%	-36.3%
Yellowtail flounder	-24.5%	-27.2%	-36.8%	-33.5%

MAKING SENSE OF CLIMATE PROJECTIONS AND SPECIES DISTRIBUTION MODELS

The species results shown here were developed using a spatio-temporal species distribution model, which can estimate the current and future distribution of marine species through time and space. The model uses projected regional sea surface and bottom temperature data from the globally coordinated Coupled Model Intercomparison Project (CMIP6) and species data from bottom trawl surveys conducted by the Northeast Fisheries Science Center and the Department of Fisheries and Oceans. Estimated species biomass densities are then averaged over an area fished by vessels from the port of interest. This enables us to interpret local changes in availability of a species at a specific time or temperature.

LEARN MORE

For more information regarding climate change, species distribution change, fisheries adaptation options, and adaptation barriers and enablers, please visit:

gmri.org/adaptationhub

ASK QUESTIONS

For specific questions regarding your community, contact Kathy Mills at:

kmills@gmri.org



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