Climate Change & Commercial Fisheries in Scituate, MA

Gulf of Maine Research Institute

INTRODUCTION

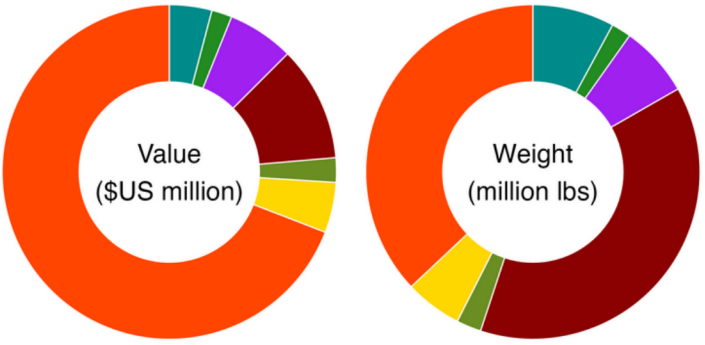
Climate change is altering the physical and chemical characteristics of our ocean and affecting marine ecosystems and fisheries. As environmental conditions continue to change, fishing communities may be affected by changes in the distribution and availability of species. This report summarizes the current status of fisheries in Scituate 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.

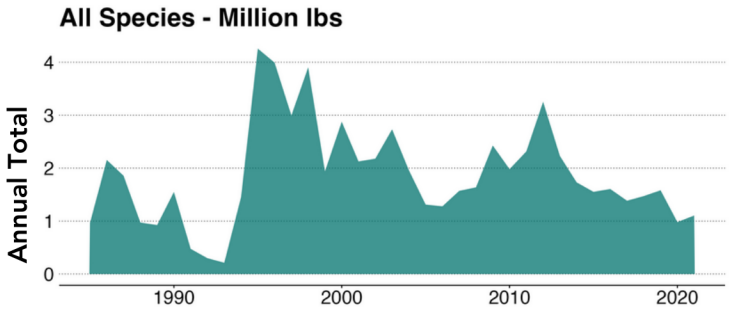
WHAT IS LANDED HERE?

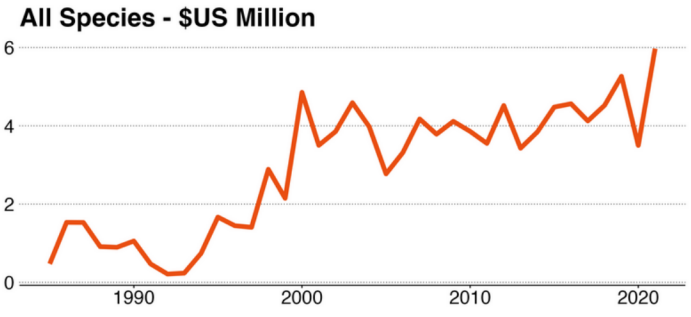
Commercial fishing vessels in Scituate landed an average of 1.7 million pounds of finfish and shellfish per year spanning 2012-2021, valued at $4.4 million per year on average.* American lobster was the most economically valuable species landed, contributing an average of 625,000 pounds, valued at an average of $3 million per year. Cod landings accounted for slightly more than 93,000 pounds, valued around $215,000, on average per year. Over 100,000 pounds each of winter flounder and yellowtail flounder were landed per year on average, valued at $284,000 and $182,000 respectively. The total volume of landings has fluctuated substantially, with periods of relatively high landings in the late 1990s through early 2000s and again in the mid-2010s. The overall value of landings in Scituate increased substantially during the late 1990s and has fluctuated at this higher level since 2000.

Species	Annual Average Value	Annual Average Volume
American lobster	$3,057,172	625,604 lbs
Winter flounder	$284,326	116,666 lbs
Atlantic cod	$215,127	93,124 lbs
Yellowtail flounder	$181,943	133,736 lbs
Monkfish	$104,790	40,472 lbs
Witch flounder	$86,946	32,303 lbs
Other	$491,590	647,756 lbs

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





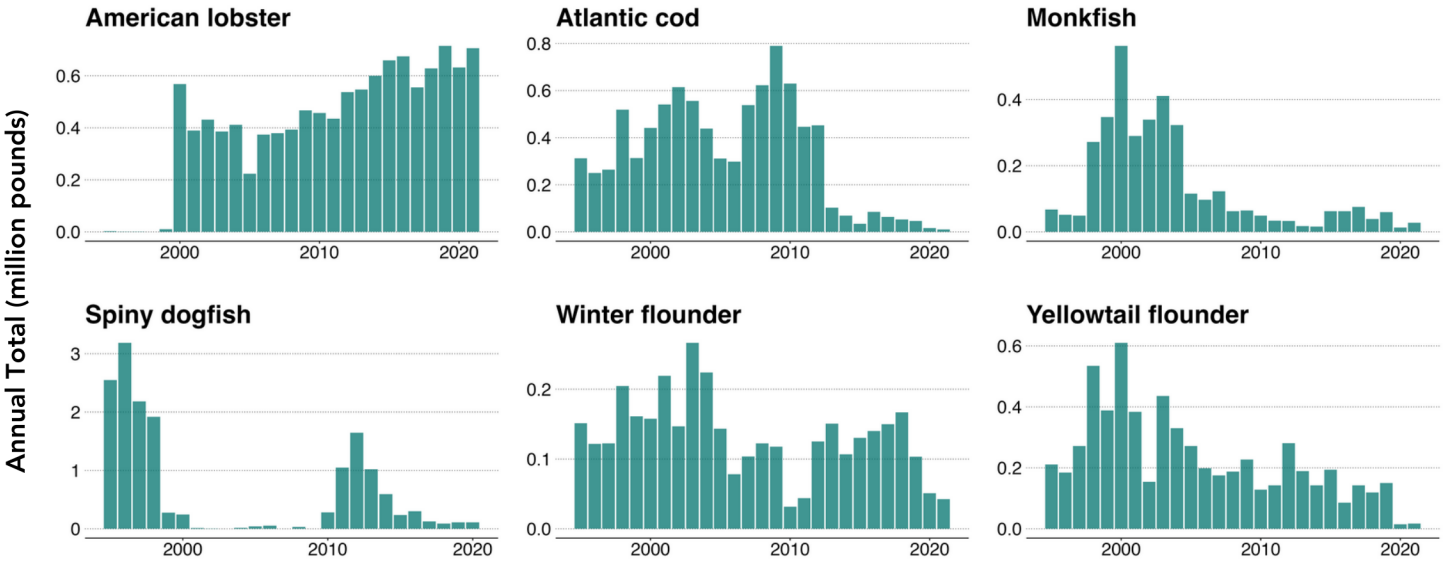


*Landings data were provided by NOAA Fisheries' Greater Atlantic Regional Fisheries Office. Due to confidentiality restrictions, some data may not be fully representative of the historical landings at a given location.

This report was developed through projects led by the Gulf of Maine Research Institute with funding from the National Oceanic and Atmospheric Administration's Climate Program Office under awards NA15OAR4310120 and NA19OAR4310384. Please contact Kathy Mills (kmills@gmri.org) for more information or questions.

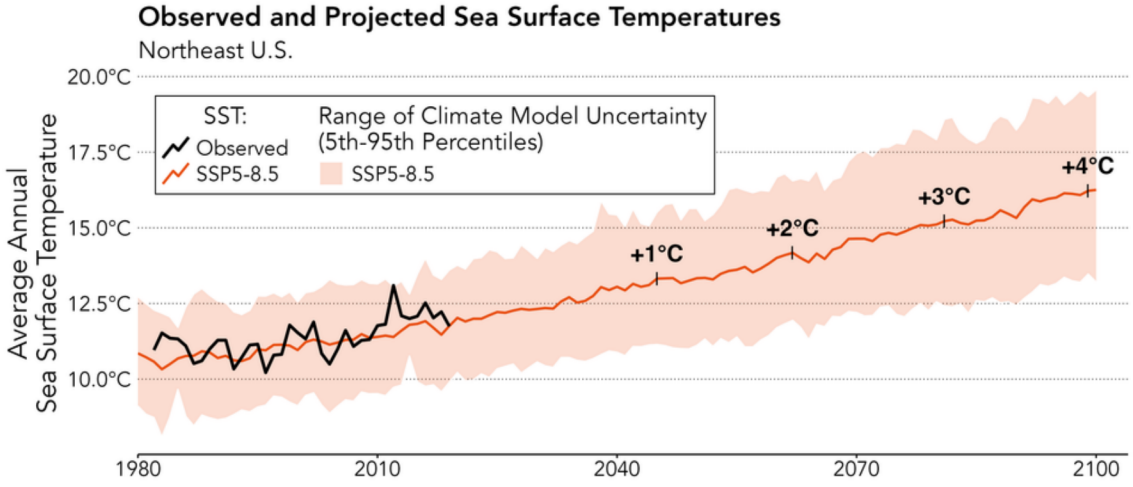
LANDINGS OVER TIME

Lobster landings in Scituate increased from around 400,000 pounds per year to between 500,000 and 600,000 pounds per year during the 2010s. Cod landings experienced two periods of relatively high landings in the early and late 2000s but have decreased to very low levels since. Monkfish landings were high in the early 2000s and have been relatively low since the mid-2000s. Spiny dogfish were landed in the late 1990s and early 2010s, but landings have been low in other years. Landings of winter flounder fluctuated between 100,000 and 200,000 pounds for most years, aside from lower landings in the early 2010s and 2020s. Yellowtail flounder landings declined since the early 2000s, with very low levels since 2020.



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.



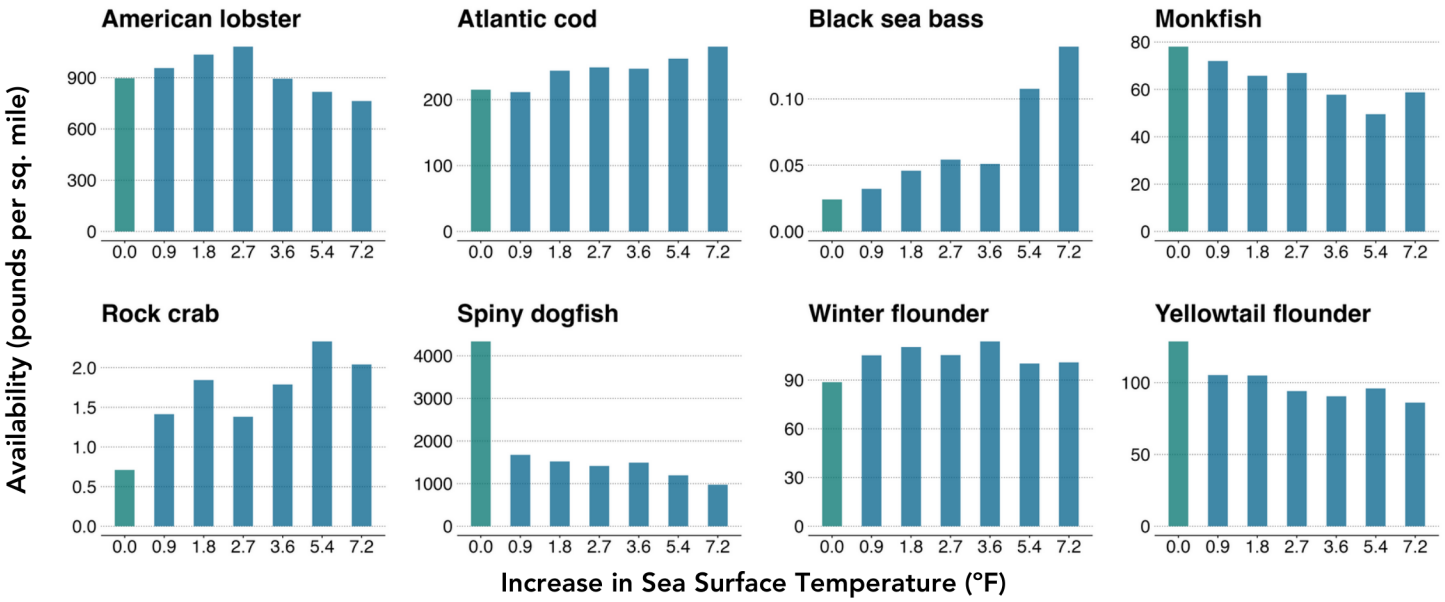
Temperature Crossing Points

Based on SSP5-8.5 Climate Projections

Celsius	Fahrenheit	As soon as
0.5°C	0.9°F	2034
1.0°C	1.8°F	2045
1.5°C	2.7°F	2056
2.0°C	3.6°F	2062
3.0°C	5.4°F	2081
4.0°C	7.2°F	2099

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 Scituate. The availability of Atlantic cod and black sea bass may increase with increasing temperatures. Lobster, rock crab, and winter flounder availability is projected to increase with warming but shows variability over different levels of warming. Monkfish, spiny dogfish, and yellowtail flounder may decline at high levels of warming.



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 Scituate

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.

	Increase in Sea Surface Temperature			
Species	0.9°F	1.8°F	3.6°F	5.4°F
Acadian redfish	−6.5%	−13.3%	−40.3%	−52.0%
American lobster	6.6%	15.4%	−0.3%	−8.9%
American plaice	−7.9%	−9.2%	−20.1%	−21.7%
Atlantic cod	−1.7%	13.4%	14.8%	22.0%
Atlantic halibut	−2.6%	−12.4%	−11.4%	−32.0%
Atlantic herring	−37.0%	−47.6%	−61.7%	−50.9%
Atlantic mackerel	15.9%	57.4%	78.9%	47.6%
Black sea bass	33.1%	89.5%	110.8%	344.8%
Butterfish	−19.2%	50.1%	30.4%	12.6%
Deep sea red crab	−27.8%	−29.7%	−49.2%	−55.9%
Haddock	−28.4%	5.4%	4.2%	−22.0%
Hagfish	26.0%	56.1%	17.6%	5.6%
Jonah crab	12.7%	−14.4%	−17.1%	−39.6%
Little skate	−10.9%	−1.2%	−6.1%	−7.0%
Longfin squid	−13.9%	−22.1%	−54.4%	198.1%
Monkfish	−7.7%	−15.8%	−26.0%	−36.6%
Ocean quahog clam	−28.5%	8.1%	60.2%	−52.5%
Pollock	−25.7%	−22.1%	−22.0%	−48.1%
Red hake	12.3%	2.6%	−4.7%	−14.5%
Rock crab	98.7%	159.4%	151.5%	227.7%
Sand lance	12.4%	−38.7%	17.7%	−17.8%
Scup	65.5%	42.0%	71.5%	258.3%
Sea scallop	−5.8%	4.3%	−4.3%	−32.7%
Shortfin squid	−47.8%	−18.3%	−27.5%	5.4%
Silver hake	−5.5%	−11.3%	−11.1%	−22.3%
Smooth skate	−27.9%	−34.5%	−33.5%	−37.2%
Spiny dogfish	−61.4%	−64.9%	−65.6%	−72.5%
Summer flounder	7.3%	21.0%	68.0%	150.7%
Thorny skate	−11.9%	−5.6%	−17.3%	−30.3%
White hake	−31.6%	−24.0%	−1.9%	−19.0%
Windowpane	24.4%	51.5%	33.4%	57.4%
Winter flounder	18.6%	24.3%	28.2%	12.9%
Winter skate	−20.8%	−14.7%	−7.0%	7.7%
Witch flounder	−11.2%	−28.7%	−38.4%	−36.5%
Yellowtail flounder	−18.2%	−18.5%	−29.7%	−25.4%

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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Science. Education. Community.