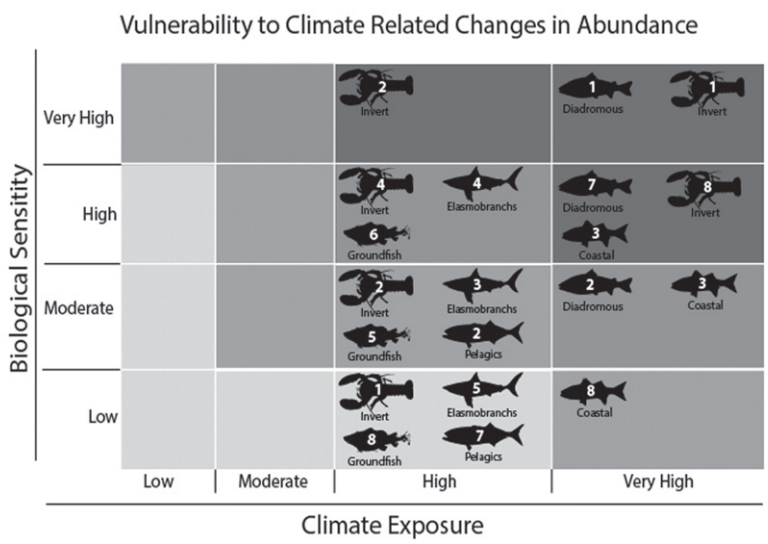
The NOAA FISHERIES NAVIGATOR

How Vulnerable Are Northeast US Fish to Climate Change?

Climate-related changes in ocean ecosystems are impacting the nation's marine species and the people, businesses, and communities that depend on them. Scientists are linking changes in ocean temperatures to shifting fish species distributions and abundances in many marine ecosystems, and these impacts are expected to increase in the future. Our scientists are working to understand the effects of climate change and ocean acidification so we can minimize the disruptions they cause, adapt to the changes that are coming, and ensure that future generations can enjoy the benefits of healthy marine ecosystems.

As part of these ongoing nationwide efforts to address climate-related issues, NOAA scientists recently released the first multispecies assessment of just how vulnerable US marine fish and shellfish species are to the effects of climate change. The study examined 82 species that inhabit the waters of the Northeastern US, where ocean warming is occurring rapidly. Researchers found that most species evaluated will be affected, and that some are likely to be more resilient to changing ocean conditions than others.



The 82 Northeast species evaluated included all commercially managed marine fish and invertebrate species in the Northeast, a large number of recreational marine fish species, all marine fish species listed or under consideration for listing on the federal Endangered Species Act, and a range of ecologically important marine species.

The study is formally known as the Northeast Climate Vulnerability Assessment and is the first in a series of similar evaluations planned for fishery species in other US regions. Conducting climate change vulnerability assessments of US fisheries is a priority action in the NOAA Fisheries Climate Science Strategy. Similar assessments are now underway for the Bering Sea and California Current Ecosystems.

"Our method identifies specific attributes that influence marine fish and invertebrate resilience to the effects of a warming ocean and characterizes risks posed to individual species," said Jon Hare, a fisheries oceanographer at NOAA Fisheries' Northeast Fisheries Science Center and lead author of the study. "This work will help us better account for the effects of warming waters on our fishery species in stock assessments and when developing fishery management measures."

See CLIMATE CHANGE, page 4

How To Mark Your Buoys, High Flyers, and Radar Reflectors for Visibility

Bottom-tending gillnets and lobster trap trawls set in federal waters in the Northeast must be configured in specific ways to be easily seen above the surface. Below is a reminder about the requirements for this gear:

Lobster trap trawl and gillnet length restrictions:

- Lobster trap trawls cannot exceed 1.5 nautical miles (nm) measured from radar reflector to radar reflector.
- Gillnets cannot exceed 6,600 feet from radar reflector to radar reflector.

Radar reflectors are required for:

- Lobster gear in the Georges Bank Gear Area more than 3 nm from shore (see map).
- Lobster gear in the Gulf of Maine Gear Area more than 12 nm from shore (see map). For lobster traps less than 12 nm from shore in the Gulf of Maine, consult the state regulations for the state in which you land your lobsters for their surface gear marking requirements.
- All bottom- tending gillnet gear in federal waters in the Northeast.

Radar reflectors must be configured as follows:

The westernmost end must have a standard 8-inch (12 inch for gillnets) tetrahedral radar reflector and a single flag or pennant that is at least 6 feet above the buoy.

The easternmost end needs only to display a standard 8 inch (12 inch for gillnets) tetrahedral radar reflector.

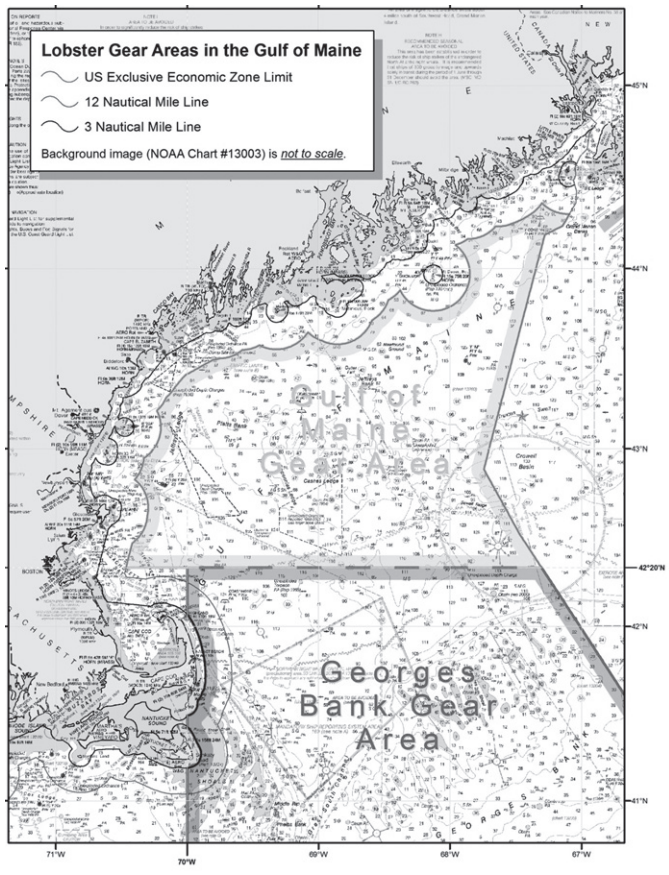
All surface buoys must be marked with one of the following:

- Vessel's state registration number or US vessel documentation number;
- Federal fishing permit number; or
- Whatever identification marking is required by the vessel's homeport state.

Unless state regulations dictate otherwise, letters and numbers to mark gear must be at least 1 inch in height in a color that contrasts with the color of the buoy and must be visible at the surface.

For more information about marking gear for visibility purposes, call the Greater Atlantic Region's Sustainable Fisheries Division at 978-281-9315.

Note that in addition to these visibility-related gear marking requirements, the Atlantic Large Whale Take Reduction Plan requires marking of surface buoy and buoy line gear to aid in determining how and where whales are becoming entangled. Call the Greater Atlantic Region's Protected Resources Division at (978) 281-9328 for specifics.



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The NOAA FISHERIES NAVIGATOR

Catching Better Data: The Northeast Cooperative Research Program's Study Fleet

Fish live in a rapidly changing ecosystem, which makes them notoriously hard to count and manage. To improve federal fisheries science and management, more information is needed than is commonly reported. To help get a better handle on this data, scientists from NOAA Fisheries' Northeast Cooperative Research Program team up with fishermen in what we call a "study fleet."

During normal fishing activities, fishing vessels in a study fleet may collect data on any aspect of fishing, such as fishing effort, area fished, catch, discard, gear characteristics, and biological and environmental observations. The Cooperative Research Program Study Fleet collects all of this information on a regular basis, and also provides platforms for participation in some special projects.

The idea of enlisting fishermen to collect the type of data fishery scientists need has been around for some time, and is continuing to gain support. In addition to providing data, it also brings scientists and fishermen together to share knowledge and information. Working together in the Study Fleet program has helped provided new perspectives and observations, and has led to advances through the development of many projects, a few of which are below:

One of the Cooperative Research Study Fleet's first projects was to collect more detailed data than that collected by paper logbooks. The study fleet provided practical on-the-boat feedback to help shape the development of this new electronic reporting technology, which collects fishing effort and catch information on a haul-by-haul basis, and is integrated with the vessels GPS, vessel monitoring system, and depth sounder feeds. Working together, fishermen and scientists were able to develop a practical and useful system that provides collects the more detailed information that is crucial for advancing fisheries science and management.

Since 2006, the Cooperative Research program has continued to develop the scientific data collection capabilities of FLDRS, and now works with a core group of about 37 vessels from Hampton, NH to Wanchese, NC, in the groundfish, small mesh (squid, herring, and mackerel) and scallop dredge fisheries. Cooperative Research field staff also collaborated with fishermen to develop an easy-to-use Commercial Species Guide to help them identify less familiar species to improve the accuracy of their data collection and reporting.

Electronic Vessel Trip Reporting

Because the FLDRS electronic logbook system can be used either in a scientific haul-by-haul mode or a sub-trip mode that collects only the aggregated data required for electronic Vessel Trip Reports (eVTR), FLDRS has become a very useful tool for electronic vessel trip reporting.

For the past two years, Cooperative Research and other Northeast Fisheries Science Center staff have been collaborating with fishing industry and academic partners, including the Garden State Seafood Association, the North Atlantic Clam Association, Rutgers University, the Coonamessett Farm Foundation, and Cornell University Cooperative Extension, to expand and support eVTR in the Northeast and mid-Atlantic. Over 80 industry members in fisheries for squid, mackerel, herring, flatfish, monkfish, surf clam, ocean quahog, and sea scallop are now equipped to report via eVTR.

This collaborative effort includes developing and testing a new eVTR software system for the clam industry (eCLAMS), as well as new equipment for wireless data transmission of eVTRs from selected Northeast dock sites. FLDRS electronic logbook and eCLAMS software packages are available for free for any industry member, but funds are still needed to support industry transition to eVTR. Some limited funds to help cover the costs of laptops, software training, and field support, are available for 2016, but longer-term support for this transition has not yet been identified.

Converting Processed Groundfish to Pounds of Whole Fish

This project seeks to validate and/or update processed-weight to round-weight conversion factors for groundfish. These factors are used by fishery scientists and managers to calculate the total weight of a species removed from a population based on the weight of processed fish that are landed and sold.

Initial analyses of 3,656 fish (1,896 Atlantic cod, 646 monkfish, 686 haddock, 264 Atlantic pollock, 66 winter skate, and 98 white hake) indicate that conversion factors vary over time. This information is also being used as part of an Atlantic Coastal Cooperative Statistical Program effort to update conversion factors coast-wide.

Understanding Fish Reproduction to Improve Stock Assessments

A critical factor in determining how much fish can be sustainability removed from a stock is knowing how fast they replace themselves. To get this information, we need to do sampling at specific stages of development. Getting reproductive samples from collaborative projects in more areas and seasons gives researchers more information about the reproductive activities and success of various fish species. By taking advantage of the year-round fishing operations of Study Fleet, the program has supplied more than 7,500 samples for reproductive studies.

These studies have led to insights into the reproduction of yellowtail, winter, and summer flounder. Our ongoing work aims to better understand the environmental and energetic factors that influence the potential of these flatfishes to reproduce. We are also collecting herring samples to get more information on what proportion of fish skip spawning in a given year, and the timing and success of spring spawning. Right now, we are collecting samples on Georges Bank haddock, which has shown extreme fluctuation in how many young fish grow to be a big enough size to become legal targets for the fishery.

Comparing Study Fleet Data to Observer Data for Discards

Knowing the total amount of fish removed in a fishery is critical for estimating the total abundance, population growth rate, and fishing mortality of a species. This project is comparing discard estimates for selected species using both Study Fleet and observer data to determine if they can complement one another in calculating the discard estimates used in stock assessments.

Improving Oceanographic Models and Understanding of Environmental Factors

Study Fleet vessels assisted with the development and testing of an affordable wireless temperature-depth probe system that records ocean bottom temperatures. This information is a major gap in oceanography data and is important because it can help improve the understanding of fish distribution and bycatch avoidance strategies.

Accounting for environmental factors in fisheries science requires an understanding of the way environmental factors vary both at fine and broad scales. Ocean circulation models can estimate this, but current models contain biases due to inaccurate measurements and uncertainty in estimating ocean mixing processes. Because of this, it's important to compare and correct model estimates using real observations. The updated models can then provide more accurate estimates for assessment and management.

The Study Fleet program has shared more than 4 million bottom temperatures with modelers from the Northeast Fisheries Science Center, University of Massachusetts School for Marine Science and Technology, Rutgers University, and the Mid-Atlantic Regional Ocean Observation System to help improve oceanographic models. This data also helped develop a thermal niche model for the 2014 stock assessment for Atlantic butterfish that estimated how likely this species was to be caught during fishery surveys based on the temperature range of the areas sampled.

Linking the thermal niche model to real bottom temperatures enabled a comparison between suitable butterfish habitat and the pattern of butterfish caught in our bottom trawl surveys. This helped researchers understand whether butterfish were in an area because of their abundance or because of the suitability of the habitat. This analysis resulted in changing the reference points used in the 2014 assessment, which led to an increase in the fishing quota. Developing a more comprehensive understanding of the environmental factors that affect fish distribution is an important next step in refining fishery stock assessments.

Collecting Weather Data

In January 2016, we launched a collaborative project with NOAA's National Weather Service to gather important weather and climate-related data from mini-weather stations mounted on fishing vessels. The weather station includes a barometer to measure atmospheric pressure, anemometer to measure wind speed and direction, and an air temperature gauge. The station also has a built-in computer which factors out the ship's motion to derive a true wind speed and direction. Northeast Fisheries Science Center oceanographer Jim Manning met with a Study Fleet captain in January during a port call in New Bedford, MA., and after discussions about where best to position it on a vessel, the fisherman offered to weld the weather station in place himself on his boat that same day. Once installed and after some early bugs were worked out, the station has been automatically reporting via satellite every hour, and Manning report that the captain is happy with the wheelhouse display.

Real-time Data Collection and Transmission

Study Fleet participants are helping to test low-cost methods for real-time transmission of data that can be used immediately, and can provide quick feedback that can be used by fishermen to fish more selectively and avoid bycatch.

The telemetry technology being developed by our Northeast Fisheries Science Center oceanographers combines modifications to commonly used ocean drifter transmitters with wireless temperature depth recorders. As fishermen haul gear with the wireless temperature sensor attached, an onboard computer automatically sends time, latitude and longitude, and average temperature and depth for the tow to the GLOBALSTAR satellite system. Within minutes, the data arrives at the lab in Woods Hole, which posts it on a website for the participating fishermen and collaborating scientists.

More than 200 trawls have been reported so far, and the possibilities are exciting. Fishermen can immediately view their data to make connections between ocean bottom temperatures and catch composition, thus better targeting certain species and minimizing bycatch. Fishermen can also report catch information and other data at a fraction of the cost of commercial ship-to-shore transmission. In addition, this new technology will enable dozens of boats to report bottom temperatures along the entire Northeast continental shelf. Additional sensors are being developed, including some that report directly to a smartphone instead of a shipboard computer.

River Herring Bycatch

This project aims to help the Atlantic sea herring fishery avoid river herring bycatch by examining small-scale variations in river herring distribution and abundance. By collecting detailed environmental data and testing forecast models to help predict species overlap, fishermen can learn to better target one species and avoid the other. If not addressed, river herring bycatch caps could have serious financial impacts on the small mesh fishery. Cooperative Research field staff are working closely with the Massachusetts Division of Marine Fisheries and University of Massachusetts School for Marine Science and Technology on this project.

Myths and Facts About Completing Your Vessel Trip Reports

If you possess a federal fishing permit from the Greater Atlantic Regional Fisheries Office, you must complete a Vessel Trip Report (VTR) for each fishing trip taken regardless of where you are fishing or which species are targeted. The sole exception is for vessels that possess only a lobster permit.

We want to help you fill out your VTRs accurately! To help you along, we are providing some common misconceptions and facts about completing and submitting these reports.

Myth: VTRs can be filled out at home after a trip is complete.
Fact: VTRs are required to be kept onboard and completed prior to landing and cannot be completed after the trip.

Myth: VTRs can be completed by the dealer, sector manager, or other business representative after a trip is completed.
Fact: VTRs must be completed by the vessel owner or operator prior to landing.

Myth: The bottom portion of the VTR doesn't need to be completed until the dealer provides weights.
Fact: VTRs must be filled out with all required information except for information not yet known. In some instances, the dealer name, dealer permit number, and date sold won't be known until after the vessel lands. However, hail weights of species caught and discarded must be completed prior to landing.

Myth: VTRs do not have to be completed by federally permitted vessels fishing only in state waters (less than 3 nautical miles from shore).
Fact: Federally permitted vessels must report every trip that they take even if operating only in state waters.

Myth: Species weights reported on VTRs need to be exact.
Fact: Weights reported on VTRs are hail weights. Hail weights are a good-faith estimate in pounds (or count of individual fish if caught by a party or charter vessel) of each species or species parts, such as monkfish livers, landed or discarded for each trip.

Violations for first time offenders (if there is no other related violation) include a $500 summary settlement.

If you have any questions about completing your VTR, contact our VTR information line at (978) 281-9246.

Future Projects and Directions

Herring and Mackerel Thermal Habitat

Herring and mackerel fishermen are collaborating with oceanographers and habitat ecologists to refine real-time ocean temperature models and forecasts. This information will help researchers better understand factors that drive fish movement, and define the thermal habitat of these species to determine they were available to be caught during standard surveys. Refining the survey data in this way can improve stock assessments as was recently done for butterfish.

Squid Management Challenges

Squid fishermen are starting a project to better understand the combination of environmental, regulatory, and socioeconomic influences on fishing patterns. Fishermen have reported that storm systems and changes in the Asian stock market, set against rigid management regulations that don't allow for fish movement patterns, create an almost insurmountable hurdle in these fisheries at times. Gaining a better understanding of the relationship between these important drivers are steps towards a more comprehensive, ecosystem-based management approach, and would be beneficial in all fisheries.

Expanding the Study Fleet Model

For the past two years, the Cooperative Research Program has been working with the Study Fleet to decrease the costs of the Study Fleet program, which is necessary due to budget constraints and competition for funding. The Cooperative Research Program is also exploring more flexible approaches to contracting with fishermen to allow for more fluid and timely application of the data collection methodology. More flexibility to reach more fishermen will provide additional potential for Study Fleet data to improve assessments and address concerns about a non-random make-up of the fleet.

The FLDRS data collection software is available free to industry and/or academic groups interested in expanding this type of data collection, and partners at Cornell Cooperative Extension, the Garden State Seafood Association, the Gulf of Maine Research Institute and other institutions have been trained to provide technical support. Thus, the Cooperative Research Program is interested in exploring ways to expand the Study Fleet model to a wider segment of industry. This would allow us to speed up development of tools and acquisition of information to improve oceanographic and fishery science.

For questions and additional information on the Study Fleet Program and the NCRP, please see our website at <http://nefsc.noaa.gov/coopresearch/> or contact John Hoey at <john.hoey@noaa.gov>.

The NOAA FISHERIES NAVIGATOR

Permit and Reporting Information for Charter and Party Boat Operators

Depending on the species of fish you are harvesting, Charter/Party boat captains operating in federal waters must obtain appropriate permits. This table shows which permits you need to fish in compliance with federal regulatory mandates.

Charter/Party Vessel Trip Reporting

To provide information on when and where catch occurred, operators of vessels permitted in NOAA Fisheries' Greater Atlantic Region are required to submit vessel trip reports (VTRs). Each report must be completed prior to landing for each fishing trip, regardless of where the fishing occurred or what species were targeted. The sole exception is for vessels that possess only a lobster permit.

How to Report:

1. VTRs may be submitted via paper forms. For more information on paper reporting, go to: http://www.greateratlantic.fisheries.noaa.gov/aps/evtr/vtr_inst.pdf

2. VTRs may be submitted electronically via onboard computers. For more information on how to report electronically, go to: http://www.greateratlantic.fisheries.noaa.gov/aps/evtr/electronic/index.html

3. If you hold a HMS Charter/Headboat permit, you must report all bluefin tuna landings and dead discards, swordfish, and billfish (white and blue marlin, sailfish, and roundscale spearfish) landings to NOAA Fisheries within 24 hours of the vessel's return from the trip. You can report these trips online at http://hmspermits.noaa.gov/catchReports

If you have any questions about vessel reporting, call our VTR information line at (978) 281-9246.

Permit Requirements for Charter/Party Vessels

Permit Type	Species	Application Link	Contact Information
Vessel Operator Permits: are required for all species listed in this table except Highly Migratory Species (Tunas, Sharks, Swordfish, and Billfish). Vessel Operator Permits can be obtained in either the Southeast OR Greater Atlantic regions and are valid in both areas. For more information on applying for a Greater Atlantic Vessel Operator Permit, go to: http://www.greateratlantic.fisheries.noaa.gov/aps/permits/fishing/index.html			
Greater Atlantic Fishing Vessel Permit	*NE Multispecies, Summer Flounder, Scup, Black Sea Bass, Squid, Mackerel, Butterfish, Atlantic Bluefish, and Tilefish*	*http://1.usa.gov/1QtPtaO*	*1 (978) 282-8438*
HMS Vessel Permit	*Tunas, Sharks, Swordfish, and Billfish*	*http://hmspermits.noaa.gov*	*1 (301) 427-8503*
Atlantic Charter/Headboat for Dolphin/Wahoo Permit	*Atlantic Dolphin and Atlantic Wahoo*	*http://1.usa.gov/1R8itq5*	*1 (877) 376-4877*
Atlantic Charter/Headboat for Coastal Migratory Pelagic (CHS) Permit	*King Mackerel, Spanish Mackerel, Cobia*	*http://1.usa.gov/1R8itq5*	*1 (877) 376-4877*

Pre-trip Notification No Longer Needed for Longfin Squid Fishery

Commercial fishing vessels that have a longfin squid and butterfish moratorium permit are no longer required to call in to the pre-trip notification system.

Previously, longfin squid vessels were required to notify NOAA Fisheries before a trip if they intended to land more than 2,500 pounds of longfin squid so that an observer could be deployed. However, in 2015, changes made to the standard bycatch reporting methodology altered the way that observers are deployed on all fishing vessels. As a result, pre-trip notification is no longer necessary for directed longfin squid trips. Instead, vessels with longfin squid and butterfish moratorium permits will be selected for observer coverage at the dock.

For more information, contact Carly Bari, Sustainable Fisheries Division, at (978) 281-9224 or email her at Carly.Bari@noaa.gov.

Climate change

Continued from page 1

Researchers from NOAA Fisheries and NOAA's Office of Oceanic and Atmospheric Research's Earth System Research Laboratory, along with colleagues at the University of Colorado's Cooperative Institute for Research in Environmental Science, worked together on the project. The collaborating scientists provided climate model predictions of how conditions in the region's marine environment are predicted to change in the 21st century. The method for assessing vulnerability was adapted for marine species from similar work by the US Fish and Wildlife Service to characterize the vulnerability of wildlife species to climate change.

The method tends to categorize species that are "generalists" as less vulnerable to climate change than are those that are "specialists." For example, Atlantic cod and yellowtail flounder are more generalists, since they can use a variety of prey and habitat, and are ranked as only moderately vulnerable to climate change. The Atlantic sea scallop is more of a specialist, with limited mobility and high sensitivity to the ocean acidification that will be more pronounced as water temperatures warm. Therefore, Sea scallops have a high vulnerability ranking.

The method also evaluates the potential for shifts in distribution into, or out of, Northeast US waters. A majority of species are likely to change their distribution in response to climate change. Numerous distribution shifts have already been documented, and this study demonstrates that widespread distribution shifts are likely to continue for the foreseeable future. Some of the species with the highest potential for distribution shifts included squid, butterfish, and several shark species. In response to changing ocean conditions, these species have the ability to move to other regions with more suitable habitats.

Researchers used existing information on climate and ocean conditions, species distributions, and life history characteristics to estimate each species' overall vulnerability to climate-related changes in the region. Vulnerability is defined as the risk of change in abundance or productivity resulting from climate change and variability, with relative rankings based on a combination of a species exposure to climate change and a species' sensitivity to climate change.

Each species was evaluated and ranked in one of four vulnerability categories: low, moderate, high, and very high. Animals that migrate between fresh and salt water (such as sturgeon and salmon), and those that live on the ocean bottom (such as scallops, lobsters and clams) are the most vulnerable to climate effects in the region. Species that live nearer to the water's surface (such as herring and mackerel) are the least vulnerable.

"Fishermen are already seeing firsthand how rising ocean temperatures affect their catch, so studies like this are urgently needed to inform fisheries management here in the Northeast," said Regional Administrator John Bullard. "We need to know how to prioritize and adapt our management strategies in the face of climate change, and this assessment provides new insights into what we should be anticipating."

The study appears in PLOS ONE, an online scholarly science journal. More details can be found here: <http://www.nefsc.noaa.gov/press_release/pr2016/scispot/ss1603/>.