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North Atlantic Fish Populations Shifting as Ocean Temperatures Warm *Southern Species like Atlantic Croaker May Become Common in Northeastern Waters*

About half of 36 fish stocks in the Northwest Atlantic Ocean, many of them commercially valuable species, have been shifting northward over the last four decades, with some stocks nearly disappearing from U.S. waters as they move farther offshore, according to a study by NOAA researchers.

The findings, published in the journal *Marine Ecology Progress Series*, show the impact of changing coastal and ocean temperatures on fisheries from Cape Hatteras, N.C. to the Canadian border.

Janet Nye, a postdoctoral researcher at NOAA's Northeast Fisheries Science Center (NEFSC) laboratory in Woods Hole, Mass. and the lead author of the study, analyzed research vessel survey data collected every spring from 1968 through 2007. The study focused on familiar fish species, including Atlantic cod, haddock, yellowtail and winter flounders, spiny dogfish and Atlantic herring, as well as several less well-known species like blackbelly rosefish. Historic ocean temperature records and long-term processes like the Atlantic Multidecadal Oscillation and the North Atlantic Oscillation dating back to 1850 were also analyzed to put recent temperature increases into context.

"During the last forty years, many familiar stocks have been shifting to the north where ocean waters are cooler, or staying in the same general area but moving into deeper, cooler waters than where they traditionally have been found," Nye said. "They all seem to be adapting to changing temperatures and finding places where their chances of survival as a population are greater."

Nye and coauthors Jason Link, Jonathan Hare and William Overholtz of NEFSC selected the 36 species to study because these were consistently caught in high numbers in the Center's annual spring bottom trawl surveys. NEFSC conducts annual spring and fall trawl surveys and has the world's longest time series of standardized fishery population data.

The researchers looked at where the fish were caught and their total population weight in each year of the survey. For each stock, they estimated the center of abundance, or where the bulk of the fish were found, as well as average depth, the range or area that the stock occupied, and the average temperature at which the stock was found.

They also took into account fishing activities on the species over time, as well as natural cycles in ocean temperature. Ocean temperatures in the northwest Atlantic have increased since the 1960s and 1970s, and the authors found significant changes in species distribution consistent with warming in 24 of the 36 stocks studied.

Ten of the 36 stocks examined had significantly expanded their range, while 12 had significantly reduced it. Changes in a species range can be caused by both temperature changes and fishing activity, with heavily fished stocks appearing more sensitive to climate change and often showing a larger shift.

Seventeen of the 36 stocks occupied increasingly greater depths, and three stocks occupied increasingly shallower waters. However, the temperature at which each stock was found did not change over time, suggesting that fish are moving to remain within their preferred temperature range.

While consumers will find familiar fish species at their local fish markets for the foreseeable future, fisherman may have to travel farther to catch some species until eventually it will not be economical.

“Consumers in the Northeast, for example, may eventually start seeing less familiar species like Atlantic croaker at local markets and on restaurant menus as southern and Mid-Atlantic species move northward into New England waters,” Nye said. “The fish appear to be adapting to a changing environment, and people will as well over the next few decades.”

The authors say the study has implications beyond the Northeast U.S. “It is another example of the need for an ecosystem-based management approach to our fisheries,” said co-author Jason Link, a fisheries biologist at NEFSC. “Many factors, temperature among them, affect the status of a fish stock, and all of these influences need to be considered in management decisions. Looking at ‘the big picture’ helps put each piece of the puzzle in perspective.”

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Related links:

Marine Ecology Progress Series article: <http://www.int-res.com/abstracts/meps/v393>

Fisheries Oceanography article (2007) on Atlantic croaker and climate:

2009 Ecosystem Status Report:

http://www.nefsc.noaa.gov/press_release/2009/SciSpot/SS0912/index.html and

<http://www.nefsc.noaa.gov/publications/crd/crd0911/>