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Warming Oceans Drive East Coast Fish to Cooler Waters

Fish larvae are moving to more habitable waters

ClimateWire

By Niina Heikkinen and ClimateWire | October 15, 2015 |

Young East Coast fish are making moves to cooler waters, and researchers say that could mean changes for regional stock assessments.

For decades, the National Oceanic and Atmospheric Administration has been charting fish movement along the Northeast U.S. Continental Shelf Ecosystem—from Cape Hatteras, N.C., to Cape Sable in Nova Scotia. Most of that research has focused on adult fish, but that is only giving researchers and fishery managers part of the picture of how stressors like climate change and fishing are affecting different species. Spawning, as well as larval and juvenile development, will often occur in different habitats, and little was known about what the impact of changes in those environments is having on fish development, according to Harvey Walsh, a fisheries biologist at NOAA's Northeast Fisheries Science Center at the Narragansett Laboratory in Rhode Island.

Not only are fish changing when they spawn, but climate change could also be altering the direction of the currents themselves.

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Now, Walsh and his colleagues at NOAA are finding evidence that both the occurrence and distribution of fish larvae had changed along the East Coast within the last 40 years. To make matters more complicated, larvae that are shifting their habitats aren't always matching the movements of their adult counterparts.

The researchers compared data collected during NOAA's Marine Resources Monitoring Assessment and Prediction Program from 1977 to 1987, with a similar NOAA data set from 1999 to 2008 that was collected by its Ecosystem Monitoring Program (which continues into the present). Their analysis revealed that 43 percent of the larval taxa and 50 percent of the adult taxa had shifted their distribution between those time periods.

Most of the species movement was to the north along the continental shelf, but some species like the Atlantic mackerel moved closer to shore, while others like silver hake moved into deeper waters. Altogether, the researchers studied 45 taxa of larval fish and 40 taxa of adults.

Changes parallel climate change predictions

The changes were consistent with previously predicted responses to climate change. What proved more complex was how timing of different life stages was altered by higher temperatures. When the researchers looked at fish larvae and adults of the same species (27

taxa in total), they found that in 49 percent, the timing of larval occurrence had shifted, and in 60 percent of the taxa (13 in total), the movements of the adults and the larvae were out of sync with each other, according to the researchers, who published their findings last month in the open access journal *PLOS ONE*.

They also found evidence that some spring spawners had started spawning earlier in the year. In the Northeast, many adult fish reproduce out on the continental shelf, but their young develop to adulthood in inshore estuaries. In order to get to those nursery habitats, the larvae have to be carried by seasonal ocean currents. Timing is important because if larvae appear too early in the spring, they might not get transported to those habitats at all, or they might end up in habitats that are less well-suited for their survival, said Walsh, the lead author of the study.

Not only are fish changing when they spawn, but climate change could also be altering the direction of the currents themselves. Though no long-term studies have focused on currents on the Northeast U.S. Shelf, there have been documented changes over the past 15 years in currents in the Gulf of Maine and currents along the shelf in the Mid-Atlantic Bight, according to the study.

A challenge for fisheries?

Malin Pinsky, an ecologist at Rutgers University who studies population dynamics of coastal marine species and who was not involved in the research, described the study as significant because of its unusually large scope, as well as its focus on different fish life stages. The large amount of data helps researchers to better identify what population changes in East Coast waters represent trends and which are species-specific, he said.

Understanding what is happening in the Northeast waters could also be an indicator of future changes elsewhere. Surface water in the region is warming at twice the rate of the global average. Between 1982 and 2006, waters along the continental shelf warmed by .23 degree Celsius.

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“We’re seeing changes here that we aren’t likely to see elsewhere for many years. We’re really in the front lines in many ways,” Pinsky said.

The fact that young fish as well as adults are moving their habitats could have serious implications for fisheries, the researchers said.

“If we start to have fish moving across stock boundaries, that will complicate our estimates and complicate how much fishing we allow,” Walsh said.

Currently, most stock assessments of fish populations do not include climate signals in their calculations. Instead, estimates are based mainly on the size and variability of past populations in a specific area. Models assume that a specific number of fish will generate a certain amount of offspring.

But as species begin to move in response to new climate-driven stressors, past populations will become a less reliable predictor of future stocks. That same-size population of fish may not be producing the same number of offspring, said Jonathan Hare, a co-author of the study and director of NOAA’s Narragansett Laboratory.

Hare is among the researchers working on incorporating ocean temperature into the models to better reflect that uncertainty.

According to NOAA’s Fisheries Climate Science Strategy, there is “an urgent need to identify and evaluate alternate management strategies under different climate and ocean scenarios,” as well as a “tremendous need for improved near-term forecasts.”

What those strategies will be will depend on the results of more studies like this one, according to Hare.

“The long-term observations are fundamental to this work; you can’t understand the mechanism if you don’t have the data,” he said.

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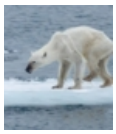


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