

Genetic study of river herring populations identifies conservation priorities

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This shows biologists sampling the spring alewife spawning run in Bride Brook, Conn. Credit: Photo by Steve Gephard

A genetic and demographic analysis of river herring populations along the U.S. east coast, published October 2 in *Evolutionary Applications*, has identified distinct genetic stocks, providing crucial guidance for efforts to manage their declining populations.

River herring include two related species, alewife and blueback herring, which migrate between freshwater spawning grounds and the ocean, where they spend most of their lives. The species are important for both ecological and economic reasons, according to Eric Palkovacs, assistant professor of ecology and evolutionary biology at the University of California, Santa Cruz, and first author of the paper.

"River herring are a primary food source for economically important species like striped bass and Atlantic cod, and they are important ecologically as a key link in the food web in both freshwater and marine ecosystems," Palkovacs said. "Their decline has the potential to disrupt the ecological integrity of these systems, so it's not just these two species in isolation that we're concerned about."

In recent years, continued declines in river herring populations have prompted regulatory actions on several levels. The National Marine Fisheries Service (NMFS) declared them "species of concern," and several states imposed harvest restrictions, which were extended to all states on the Atlantic coast in 2012. In 2011, the Natural Resources Defense Council filed a petition to list river herring under the Endangered Species Act, prompting NMFS to conduct a comprehensive review of the status of both species.

By identifying distinct genetic stocks of each species, the study by Palkovacs and his coauthors provides a biological foundation for management decisions. Like salmon, river herring return to spawn in the same river where they hatched. As a result, the populations in different rivers have different genetic signatures. A genetic stock encompasses a set of populations that are genetically related.

"We wanted to understand which rivers should be grouped together and where the geographic break points are between genetically related groupings," Palkovacs said. "Once we had an understanding of the

genetic stocks, the second part was to look at the demographic data to see where the declines are most severe and which stocks deserve greater attention for conservation."

Historically, blueback herring ranged from Nova Scotia south to the St. John's River in Florida, and alewife ranged from Labrador to South Carolina. Palkovacs and his coauthors identified three distinct stocks in alewife (Northern New England, Southern New England, and Mid-Atlantic) and four stocks in blueback herring (Northern New England, Southern New England, Mid-Atlantic, and South Atlantic). For both species, the most severe declines have occurred in the Southern New England stocks and the Mid-Atlantic stocks.

"Interestingly, those stocks have traditionally received less attention, especially the Mid-Atlantic. River herring have gotten a lot more management attention in New England," Palkovacs said.

Blueback herring have been declining at particularly concerning rates, but both species have experienced dramatic declines, the study found. The most severe declines were seen toward the center of each species' range in the U.S. "The Mid-Atlantic states, in particular, need to start paying more attention to managing these species," Palkovacs said.

In 2012, the researchers provided pre-publication results from their study to a working group that was advising NMFS on the endangered species review. Ultimately, NMFS determined that listing under the Endangered Species Act was not warranted for either alewife or blueback herring. According to Palkovacs, however, evaluation of these species will continue. The Atlantic States Marine Fisheries Commission conducts stock assessments of 23 key coastal fish stocks, and completed a major benchmark stock assessment for river herring in May 2012.

"Our hope is that the next stock assessment will use our information on

stock structure throughout the process of evaluating these [species](#) for management decisions," Palkovacs said.

In September 2013, the New England Fishery Management Council approved the region's first limit on the amount of river herring that can be caught by industrial trawlers as incidental by-catch. By-catch of river herring in offshore fisheries, particularly those targeting mackerel and Atlantic herring, may be a major factor in the ongoing declines of river herring, Palkovacs said.

Early declines, dating as far back as the 1700s, were probably the result of overharvesting in the rivers, dam construction blocking access to spawning grounds, and water pollution. In the 1970s, a burgeoning offshore marine fishery for river herring is thought to have driven additional declines. Now, however, river herring are no longer directly targeted, and conservation efforts, including dam removal and improved spawning habitat, have reduced many of the freshwater threats.

"It's looking more and more like offshore by-catch could be playing a role in preventing the recovery of these populations. The regional area of the declines is suggestive, because Southern New England and the Mid-Atlantic is where most of this by-catch is happening," Palkovacs said.

Provided by University of California - Santa Cruz

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