To track winter flounder, researchers look to ear bones

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A juvenile winter flounder. Credit: Dave Bailey

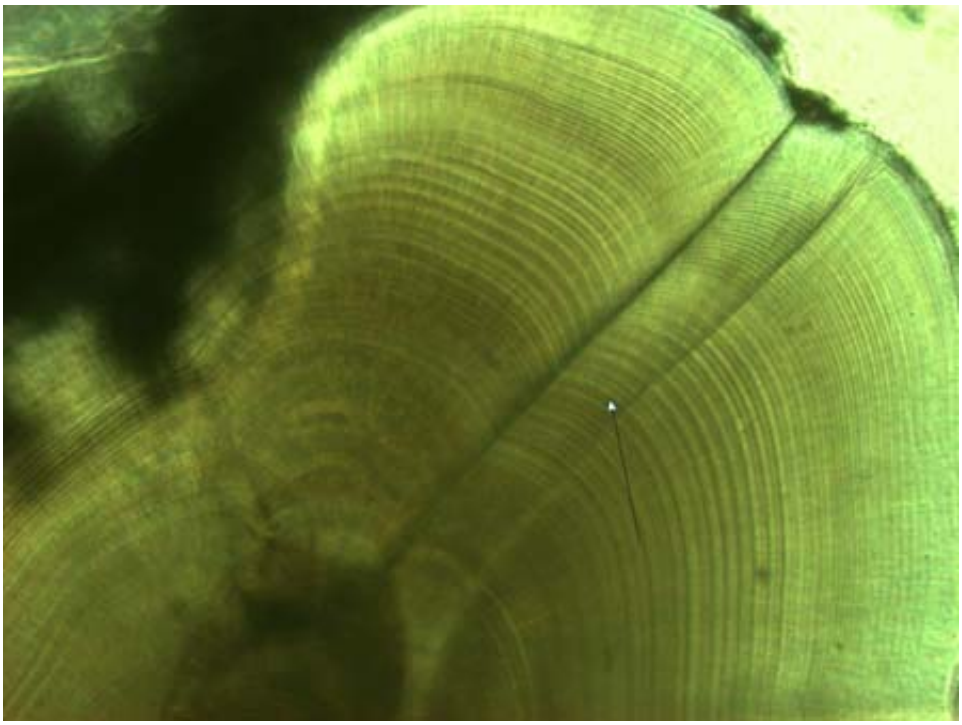
Researchers at the University of New Hampshire are turning to an

unusual source —otoliths, the inner ear bones of fish—to identify the nursery grounds of winter flounder, the protected estuaries where the potato chip-sized juveniles grow to adolesence. The research, recently published in the journal *Transactions of the American Fisheries Society*, could aid the effort to restore plummeting winter flounder populations along the East Coast of the U.S.

In addition to showing the age of a fish, much like the rings in the cross-section of a tree, otoliths carry the imprint of chemical elements found in a fish's watery surroundings. UNH graduate student David Bailey '13 and UNH faculty Elizabeth Fairchild (research assistant professor of biology) and Linda Kalnejais (assistant professor of oceanography) found that juvenile winter flounder from estuaries within 12 kilometers (about 7.5 miles) of each other share similar chemical "signatures" on their otoliths, influenced by unique geology and water chemistry from the watersheds that empty into estuaries.

Results from this study indicate that otolith chemistry can be used to trace juvenile winter flounder back to their brackish hometowns with 73% accuracy, offering scientists a new technological tool in their quest to monitor the species.

Winter flounder—known on the menu as flounder, sole and lemon sole—is a fishery valued at nearly $10 million in 2013. Yet their populations along the East Coast have plummeted in the last two decades, and despite strict regulations that have limited fishing pressure, their numbers are not rebounding, says Fairchild. Many estuaries, the nursery habitats of winter flounder, are experiencing warming waters and land development pressures that may affect the number of juveniles that can survive and make their way out to deeper offshore waters, she explains.



Cross-section of a winter flounder inner ear bone, called an "otolith," that is used to determine age and origin of the fish. Credit: Dave Bailey

"We don't know where the adults actually come from, which specific bay," Fairchild says. "We wanted to know if we could say, yes, that's a Great Bay fish, or that's a Narragansett Bay fish, or a Boston Harbor fish. If we can figure that out, we can determine which estuaries in the Northeast are the most essential in terms of providing valuable habitat for winter flounder and protect those places."

"This research is important in terms of environmental protection, trying to figure out which estuaries are producing the most number of fish for the population where people can actually fish for them, and trying to protect those estuaries so we don't harm the winter flounder," Bailey adds. "You wouldn't want to dredge an area if you know that's the prime area that produces fish for a Gulf of Maine winter flounder fishery."

For this study, researchers collected otoliths from juvenile winter flounder at 12 locations in estuaries and shallow coastal waters ranging from the Navesink River in New Jersey northward to New Hampshire's Great Bay. Lead author Bailey, currently a research assistant at the Marine Biological Lab in Woods Hole, Mass., ran the samples through a mass spectrometer to determine the chemical make-up of otoliths from each location.

Juvenile winter flounder from the three study sites in N.H., including Great Bay, Little Harbor and Hampton-Seabrook Harbor, were able to be traced back to their nurseries with reasonable (73%) accuracy and had slightly different otolith chemistries among sites, despite the relative proximity of the estuaries to one another, Bailey says. Looking at the data on a larger scale, the research results indicated regional groupings for winter flounder stocks from Cape Cod, the Gulf of Maine and New Jersey.

Fairchild and Kalnejais recently received a research grant from NOAA's Saltonstall-Kennedy Grant Program that will extend their work to adult winter flounder. Collecting adult otoliths will help them make a definitive connection between estuaries and offshore stocks.

"There's a lot of money riding on what winter flounder are doing," Fairchild says. "Fishermen would like to see the stocks rebound so they can harvest them again. The Wampanoag Tribe on Martha's Vineyard would like to see them make a comeback because of the cultural importance this species has played in their history. The Army Corps of Engineers cannot dredge navigable water channels during several months each year when winter flounder eggs may be present."

Provided by University of New Hampshire