Fish Famine

BY JAMES SCHULTZ

One sample comes from land and the other from the sea. But under a microscope, both are eerily similar. Because for trees and fish ear bones, growth rings tell the tale of birth, maturation, trauma and death.

By looking carefully at fish "otoliths," says Cynthia Jones, associate director of Old Dominion's Applied Marine Research Laboratory, one can glean the details of lives otherwise cloaked by the vastness of bay and open ocean.

"Fish live in a three-dimensional mobile house in an opaque world," Jones says. "They are a mystery, a mystery we can plumb if we do it properly. The only time we can learn about them is when we catch them and bring them to the surface to study."

The lives of fish are etched in their "hard parts:" fin rays, scales and, most clearly, in their inner ear otoliths. As otoliths grow, they add layers of calcium carbonate that accumulate daily during the first year of life and annually thereafter. Different waters through which fish swim contain distinctive trace elements that the fish breathe through gills. In turn, the elements enter the bloodstream and leave their singular chemical marks within the otoliths.

These chemical traces can be read through a newly developed technique pioneered by Jones and colleagues Simon Thorrold and Steven Campana. The process, known as laser-ablation inductively-coupled mass spectrometry, or LA-ICPMS, vaporizes select portions of the otolith. The resultant gases are collected and analyzed by mass spectrometry revealing where the fish was born, where it's been and precisely how old it is.

Jones has used the technique to confirm that a key Bay species, the black drum, can live as long as 60 years, attaining an average age of 26. She determined the creature's life span by measuring the amount of radioactive carbon released during atmospheric nuclear testing and incorporated into creature's otoliths.

"It's just like taking a census," Jones says. "Only better. We can age fish down to a particular day. We've never had that ability until now."

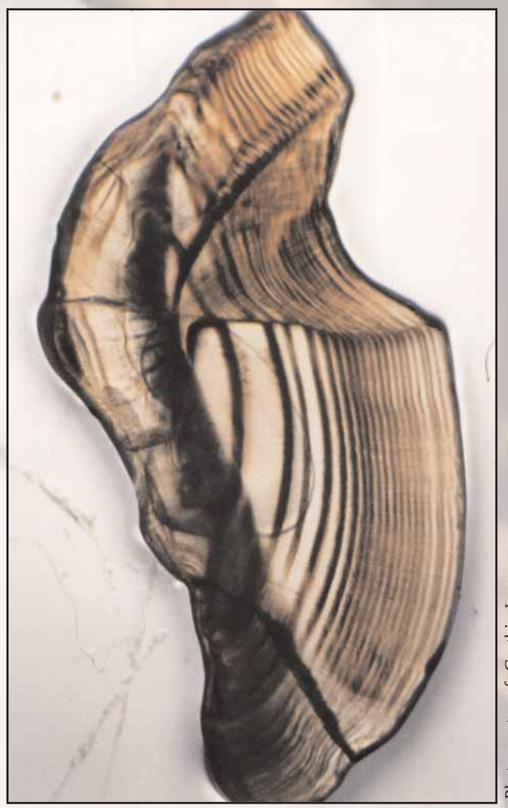

Photo courtesy of Cynthia Jones.

Growth rings in a fish's inner ear otoliths, like those seen on Cynthia Jones' personal computer (right) and above, give the associate director of Old Dominion's Applied Marine Research Laboratory and her colleagues a fascinating look at important events in these creatures' lives.

Pressure from the Coasts

As more and more people have moved from the nation's interior, coastal populations have ballooned. Some studies estimate that 90 percent of U.S. inhabitants live within a day's drive of the East, West and Gulf coasts.

With population growth has come increasing harvesting pressure on fish species. Appetites for fresh fish have increased. A vital food source for hundreds of millions around the world, fish in this country are prized as a low-fat part of the national diet. In addition to their dietary attraction, Jones points out that fish historically have also served an important geopolitical function.

"Fishing is important," she says. "It's a way of life. It's a source of food. The presence of fish creates sovereignty for most nations. Having an active fishery has meant historically that you can convert your fishermen into sailors if you need a navy."

Once it was assumed that seas provided endless bounty. Not so today. The cod, herring and flounder fisheries off the northeast New England coast have been decimated. The oyster has nearly disappeared from the Chesapeake Bay, while the numbers of other species have plummeted. Even the hearty blue crab, thought too prolific to be at risk from overfishing, has been the victim of population decline.

Bleak harvests have prompted regional and national governments to impose fishing moratoria on certain species. Otherwise, say the experts, there is the prospect of outright collapse — perhaps even extinction.

"Fish populations have gone to hell in a handbasket," Jones says. "The number of overexploited fish has burgeoned. There's simply much more pressure on the fisheries than there's ever been."

Jones has been using her otolith research to determine which fish populations best withstand harvesting pressures. The most robust are those that can grow quickly and mature early. Along with colleagues and graduate students, Jones has recently identified sea trout and black drum as among those fish that have endured despite heavy harvests.

"As a scientist, it is my job to get society and managers the most accurate information I can," she says. "I consider the choices to be very difficult. I certainly don't want to have to make the decisions."

Future of the Fisheries

The days of the lone, heroic fisher battling the elements seems long past. Jones says that more aggressive fisheries management appears the only alternative to a gradual drift toward widespread extinctions.

"If you overfish, you had better have a plan to fix that," Jones maintains. "If the situation is dire enough, there will be a legal means presented to shut down the fishery. Under the new laws it will happen sooner than later."

While fishing and farming have similarities, Jones points out that the ocean cannot be fenced like a fertile field. But fishers, like farmers, must stockpile seed so that next year's, or next decade's, "crops" can once again grow to maturity. Neglect the seed, and the pastures will lie fallow indefinitely.

Jones says, first, prevent overfishing. Then restore marine habitat. Let fish breed, grow older, and breed some more. Abundance is part of their genetic code. Work with, not against, nature.

"It's like a forest," Jones argues. "If you use a forest wisely, you can use its wood forever. The same is true for fishes in the sea."

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