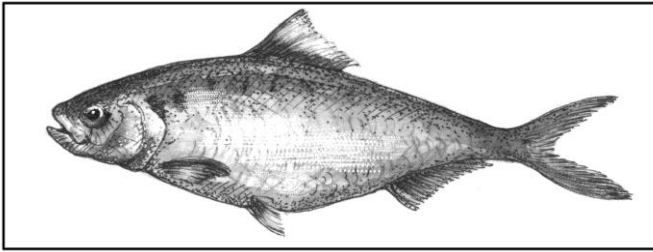


The Outside Story



Fish Scales and the American Shad

By: Tim Traver

It's tempting to simply view fish scales as armor, but there's more to them than that. They provide camouflage; they also play a role in locomotion. For scientists working on the recovery of American Shad in the Connecticut River, scales provide a record of a fish's life history and a way to measure the success of restoration efforts.

American shad is our largest river herring. The males, called bucks, run up to six pounds. The females, or roe shad, up to four. Like their cousins alewife and blue-backed herring, shad are anadromous, spending most of the year in the ocean, then running up fresh water rivers like the Connecticut in spring to spawn.

Shad have large silver scales – all the river herring do. The silver reflects the surrounding environment and allows the schooling fish to become nearly invisible to predators, sort of like that invisible car in the James Bond film. A quick shift in direction becomes a game of “Now you see us, now you don't.”

For migratory fish like the river herring, the less obvious but no less important role of scales is their function as part of a fish's lateral line system. A fish

is a delicate sensing device, like a swimming antenna. The lateral line is a system of sensors and channels that run across the fishes' head and body, controlled by the arrangement of the scales and the microscopic hairs between them that respond to flow, turning mechanical motion into electric signals. Fish are said to be able to detect earthquakes before the most sensitive of human inventions. It's the lateral line that shapes fish behavior, whether that fish is an ambush predator like northern pike or a fish like American shad that has to navigate fishways, falls, changeable flows from dams, and hot water plumes from nuclear power plants to spawn.

Shad seem made for long distance travel. The 18- to 22-inch body is ovoid in profile, a small head with an expansive back and wide sides that slim down to a narrow, deeply forked tail. Shad: one big muscle with just enough room for the stores of fat needed to make the spawning journey.

There's beauty in that economy. Scale patterns have been described as fractals: objects of “expanding symmetry.” Shad scale patterns bring to mind the art of the ancient Chinese, say from the Ming Dynasty, or a classic Zen fish you might see in an art store window. Functional beauty. You can see them migrating past the window at the Vernon Dam fish ladder, powering like pale green ghosts through the roil and bubbles on their way upstream to Bellows Falls.

Unfortunately, river herring populations across their northeastern range have been severely reduced. Dams, power plants, and habitat loss are all factors. Only about 5-10 percent of the shad that make it as far Holyoke, Massachusetts (measured in the hundreds of thousands, but down from three to five million historically) make it to Vernon. But there's hope. With some changes to the fishways and flows on Connecticut, we could see huge increases in river herring in the Connecticut River over the coming decades.

I spoke last summer with Ken Sprankle, a fisheries biologist with US Fish and Wildlife Service who's in charge of protecting and restoring migratory fishes in the Connecticut River Watershed. Sprangle described analyzing about 1,300 shad in the lab annually. He records fish age by looking at otoliths – ear bones. He also looks at scales. Scale analysis shows the number of times a fish has spawned. Shad typically return to the river to spawn after only one year in salt water, Sprangle said. Since shad can live up to ten years and spawn as many times, improving return rates and expanding upstream habitat by reducing the stress of migration and mortality, in both upstream and downstream trips, could have a profoundly positive effect on shad populations.

The challenges are great for shad, particularly at Turner's Falls, Sprangle said. Here, the fish deal with both low-flow conditions and massive surges of water when the Northfield regenerating station discharges water. Three separate fish ladders divert shad from the stream's natural channel into a mile-long canal, which is as far as many of them get.

An agreement could be negotiated in the course of the dam's relicensing process that would replace the faulty fishway at Turners Falls. Meanwhile, we're left to imagine what a half a million shad at Bellows Falls might look like.

Tim Traver writes about fish and wildlife issues from his home in Taftsville, Vermont (www.timtraver.net). The illustration for this column was drawn by Adelaide Tyrol. The Outside Story is assigned and edited by Northern Woodlands magazine (northernwoodlands.org) and sponsored by the Wellborn Ecology Fund of New Hampshire Charitable Foundation (wellborn@nhcf.org).