

Northeast Salmon Team (NEST) Factsheet Collection TALES TOLD BY SALMON SCALES



If you were to capture an Atlantic salmon in one of Maine rivers, the Gulf of Maine, or in the Atlantic Ocean, it could have any one of a variety of different backgrounds; they are produced in two very different ways and experience very different environmental conditions.

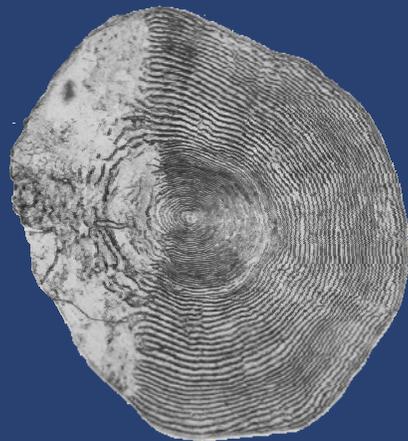
Origin and Rearing

For instance, some are produced under Maine's conservation hatchery program from river-specific *broodstock* (the adults from which eggs and sperm are obtained) or by Maine's commercial aquaculture industry from broodstock that, until recently, could be of any origin, including European. Individuals from these backgrounds are reared in an artificial environment for at least a portion of their life history. Others are the product of natural reproduction between adults that have returned to Maine's rivers to spawn. These individuals, along with those that have been stocked as fry as part of the conservation hatchery program, spend all or most of their juvenile life in Maine's rivers.

Unique Marks

Although a portion of hatchery-reared parr are given identifiable fin clips and many smolts are marked with Visual Implant Elastomer (VIE) tags specific to stocking date and site, not all are marked and these marks can be lost over time (retention of VIE tags is only 50%). Additionally, stocked fry are not administered a distinguishing mark or clip prior to release. Because a fish's fins can become deformed when constantly in contact with the concrete hatchery environment, fin deformities can also indicate hatchery-rearing.

Luckily, all Atlantic salmon have **natural marks** that can also inform fishery scientists and managers about their background. For instance, the parasites on an individual and the isotopic signature of its *otoliths* (the inner ear bones) correspond to its region of origin. And its unique genetic makeup provides a natural identifier as well. Scales are particularly informative, providing a natural record of age, rearing, and growth-related information. Although each natural mark has its own limitations (some require lethal sampling or currently unavailable baseline data), they are all useful in learning something about the identities of individuals captured in Maine's rivers or at sea.



“ Scales provide a natural record of age, growth and rearing conditions.”



Left: In addition to having a clipped adipose fin and green VIE tag behind its eye, this smolt's scales and other natural marks can provide important information about its history.

SCALE PATTERN ANALYSES

When NEST researchers capture an unmarked fish, it is important to identify its origin and the conditions under which it was reared to answer questions such as:

- How much are stocked fry, parr, and smolts contributing to adult returns?
- Do fish reared under natural conditions experience less mortality?
- Which rearing and stocking strategies (e.g. location and timing of release) under the conservation hatchery program are best?
- Are there aquaculture escapees present in the population?
- What is the age structure of the population?

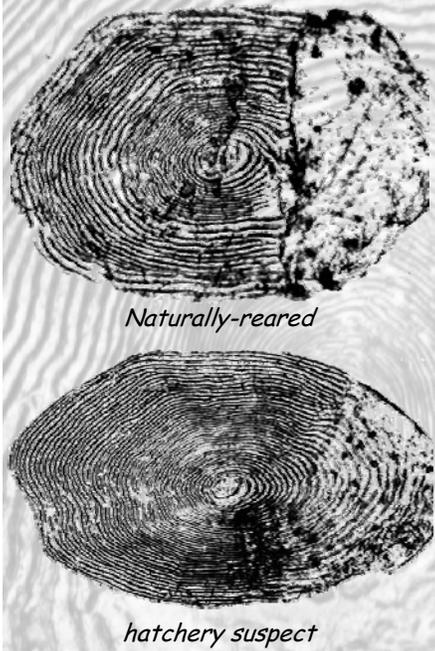
“Much like the rings of a tree, the number and pattern of rings on a scale can tell a story about a fish’s history.”

Scale pattern analysis is one technique NEST uses to address these questions. Much like the rings of a tree, the number & pattern of rings on a scale can tell a story about a fish's history.

For instance, counting a scale's **annuli**, identified by patterns of widely and narrowly spaced **circuli** (rings), enables NEST researchers to effectively age Atlantic salmon captured in the wild. Knowing the age structure of populations is an important aspect of managing any species.

Evenly spaced circuli indicate that growth was consistent and therefore food was consistently available. Since hatchery fish are fed a regimented diet, you would predict that this particular individual was reared in a hatchery. These predictions can be verified by observed dorsal fin condition/deformities or other distinguishing marks.

Scales can also tell us about a fish's growth and origin. Using computer image analysis and statistics software, the patterns found on a captured fish's scales can be analyzed and compared to known scale patterns from hatchery and naturally reared specimens. This allows researchers to determine what kind of rearing conditions an individual likely experienced.



Advancements in scale pattern analysis techniques may soon allow NEST to better understand the finer details of a captured fish's history—for instance, if a naturally-reared individual was stocked as a fry or spawned by naturally reproducing adults; if a hatchery-reared individual was stocked in the fall as a parr or in the spring as a smolt; and which adults make it back to Maine rivers to spawn. Scale pattern analysis, in conjunction with a variety of other tools, continues to play an important role in informing NEST's scientists and managers about the status of Atlantic salmon and success of recovery efforts.



Left: NEST scientist Ruth Haas-Castro analyzes an Atlantic salmon scale using special computer software.

The Northeast Salmon Team (NEST) is comprised of Northeast Regional Office (NER) managers and Northeast Fisheries Science Center (NEC) scientists. NER administers NOAA's Programs in the Northeastern United States to manage living marine resources for optimum use while NEC is the research arm of NOAA Fisheries in the region that plans, develops, and manages a multidisciplinary program of basic and applied research.

Please visit the NEST website at: <http://www.nefsc.noaa.gov/salmon/>