PROJECT CROOS
Collaborative Research on Oregon Ocean Salmon

www.PacificFishTrax.org & www.projectCROOS.com

Otolith Project Summary *(as of January 6, 2010)*

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Summary

A component of ProjectCROOS involves an on-going effort to determine the feasibility of providing relevant information on the ocean ecology of Chinook salmon using otolith structural and chemical analyses. Otoliths are crystalline structures comprised primarily of calcium carbonate, located in the inner ear of bony fishes, which function as balance organs. Otoliths grow by continuous deposition of calcium carbonate, which generates growth increments much like the annual rings in trees. Therefore, an otolith provides a permanent chronological record. If fish reside in water masses with different chemical compositions and/or temperatures, those properties are reflected in the otolith composition. Certain elements, such as strontium and barium provide different types of information about the life of an individual fish. Studies that examine a suite of elemental ratios, such as Ba:Ca, Sr:Ca, and Mg:Ca, within otoliths can provide information on whether fish collected from different areas mixed together during past periods. By measuring the strontium and oxygen isotopic composition in otoliths, we can generate relative information about natal sources, maternal run timing, and the temperature of the waters in which the salmon lived. By examining the concentration of Sr:Ca across the otolith growth axis, we can determine when an anadromous fish, such as Chinook salmon, entered the ocean can be determined. These chemical analyses can be combined with microstructural analysis, which is the counting of daily or annual increments within the otoliths, to provide information about discrete periods in the life of a fish. Therefore, otolith chemical and structural analyses can be combined to provide novel information on individual life histories.

Progress

- ⇨ Chemical information has been collected from over 200 CROOS otoliths to develop a methodology for reconstructing juvenile migratory history and examining the relative contribution of distinct juvenile migration patterns to the adult Central Valley Chinook salmon population.
- ⇨ Chemical information from CROOS otoliths contributed to the development of a methodology to differentiate between spring and fall Chinook salmon based on their otolith strontium isotopic composition.
- ⇨ Preliminary data on oxygen isotopic composition of ProjectCROOS otoliths from the Rogue River, mid-Columbia River, and Central Valley Chinook salmon stocks identified distinct patterns within stocks, which indicate that this marker may provide information on stock-specific ocean migration patterns.

Results to Date

- ⇨ A manuscript detailing the methodology to differentiate between spring and fall Chinook salmon based on their otolith strontium isotopic composition has been published in Fisheries Research.
- ⇨ A manuscript describing the method for reconstruction of juvenile migratory history based on otolith chemistry and structure has been submitted for peer-review. By combining CROOS data with information on juvenile migration patterns within the Central Valley, California, we measured the contribution of small migrants (fish that migrated to the ocean at sizes ≤55 mm in length). These fish are not considered in current management practices due to the assumption that they do not survive. Our data indicate that these small migrants comprised 20% of the adult Central Valley fall Chinook salmon that were collected in Oregon in 2006.

Future Actions

- ⇨ A summer intern from the National Science Foundation's Research Experience for Undergraduates (NSF REU) program will work with Oregon State University researchers in Newport and Corvallis to collect additional information on the oxygen isotopic composition of otoliths from the Rogue River, mid-Columbia, and Central Valley stocks.