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NOAA FISHERIES
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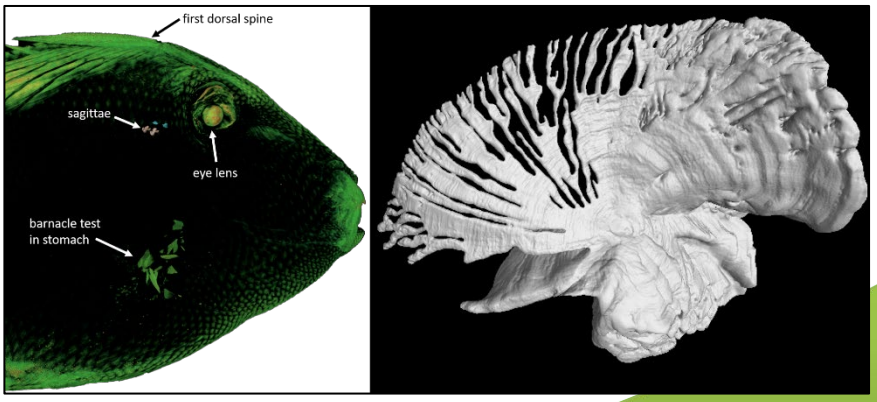
# 2024 AFSC Seminar Series

## Derek Chamberlin, REFM, AFSC

Tuesday, April 2nd @ 10 am Pacific

## Otoliths and eye lenses: modern approaches to age validation

Age is a fundamental parameter in population ecology and fisheries science. Age-structured stock assessments rely on accurate and precise estimates of age to estimate stock status and sustainable fishing limits. Ensuring the accuracy of age estimates, through age validation, is thus a critical aspect of fisheries management. The bomb radiocarbon ($^{14}C$) chronometer is frequently utilized to validate age estimation in marine fishes, with birthyear $\Delta^{14}C$ traditionally measured in otolith cores. Otoliths are approximately 12% C by mass, with the C primarily (70-80%) derived from inorganic sources. This has limited the utility of the bomb radiocarbon chronometer to fishes that spend their juvenile life stage in the well-mixed surface layer, as DIC becomes progressively depleted in $^{14}C$ at increasing depth. Current analytical limits require ~1 mg of otolith material (~100 µg of C) for the most accurate and precise analysis of $\Delta^{14}C$. Eye lens cores are a promising alternative. Like otoliths, eye lenses form prior to hatching, grow throughout a fish's life, and are metabolically inert once formed. Unlike otoliths, eye lenses are approximately 50% C by mass and this C is entirely metabolically derived, with phytoplankton from the surface layer as the basal source. This means only ~200 µg of eye lens material is required for analysis. Furthermore, because eye lenses are composed entirely of metabolic carbon they can be used as a source of surface-derived $^{14}C$ for deepwater species. Thus, using eye lens cores expands the suite of fishes we can validate ages via bomb radiocarbon chronometer and, in turn, improves age-based assessment techniques for managing fishery stocks. However, the bomb radiocarbon chronometer is limited to validating ages only back to the 1960s, the period of rapid increase in $^{14}C$. Amino acid racemization in eye lens has emerged as a potential alternative age predication and validation tool that is not temporally limited. Both methods and their application will be presented along with potential future applications in Alaska waters.

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