Age Validation of Pacific Cod (Gadus macrocephalus) Using Stable Oxygen Isotopes (δ18O)

Craig Kastelle, Thomas Helser, Daniel Nichol, Delsa Anderl, and Jennifer MacKay
Alaska Fisheries Science Center, NMFS, NOAA, Seattle, WA

THEORY
1. The 18O in otoliths is a function of temperature, inverse relationship.
2. Microsampling otolith multiple times per year to follow seasonal changes throughout life, from pre first year to capture.
3. HYPOTHESIS: The number of 18O peaks should equal the estimated age (count of translucent zones), and can be used as an AGE VALIDATION. Figure 1: otolith with questionable trans zones, checks or annual zone.

METHODS
1. Samples collected in the Gulf of Alaska and eastern Bering Sea, part of Alaska Fisheries Science Center’s (AFSC) archival tagging program, n = 10. Figure 2: Map w/ capture locations.
2. Otoliths were sampled with micromilling system, samples milled from center to edge of otolith. Figure 3: Otolith and enlarged section with tracks.
3. Analyze 18O by AMS, and plotted results by sample location representing the life of the specimen.

RESULTS
The ten specimens fell into 3 categories:
1. Number of counted translucent zones = 18O peaks, therefore correct age. n = 4 Figure 4: Plot #953 example
2. Number of counted translucent zones > 18O peaks, therefore possibly incorrect age. n = 3 Figure 5: Plot #253 example
3. No seasonal signal in 18O. n = 3 Figure 6: Plot #812 example.

CONCLUSIONS
1. Four specimens out of ten were aged correctly – these samples are considered validated.
2. Three specimens were possibly aged incorrectly – possibly overaged.
3. The method is promising but preliminary, future analysis will refine milling and 18O measurement, and also consider 13C.
4. The migration and temperature history over the life of the fish is not known; therefore it is a confounding variable.