

Age Validation of Pacific Cod (*Gadus macrocephalus*) Using Stable Oxygen Isotopes ($\delta^{18}\text{O}$)

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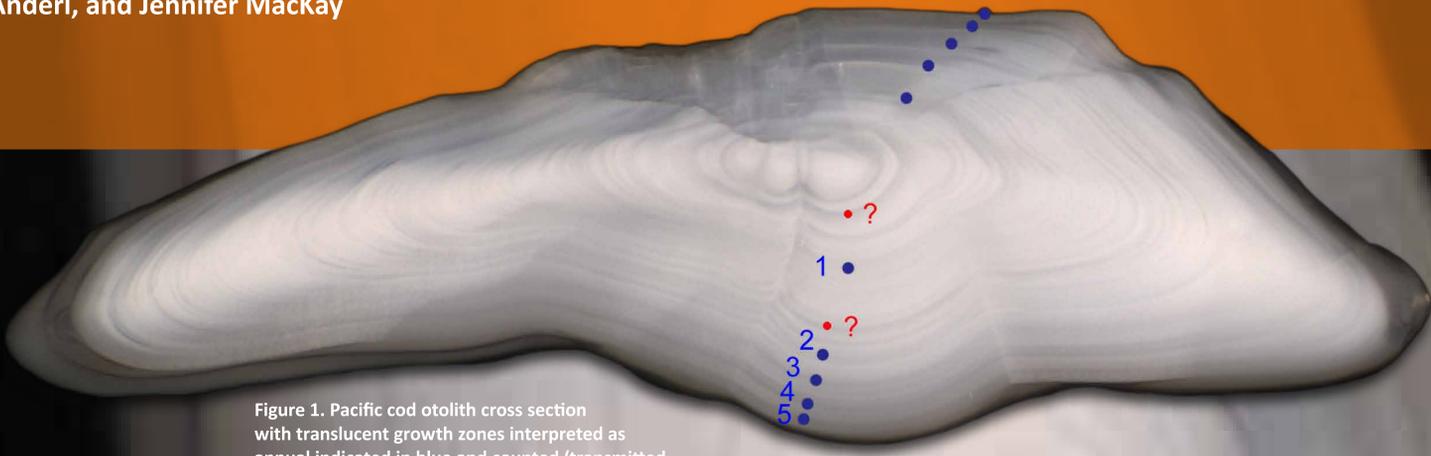


Figure 1. Pacific cod otolith cross section with translucent growth zones interpreted as annual indicated in blue and counted (transmitted light). Translucent zones not interpreted as annual are indicated in red with a question mark.

THEORY

1. The ^{18}O 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 ^{18}O 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 ^{18}O by AMS, and plotted results by sample location representing the life of the specimen.

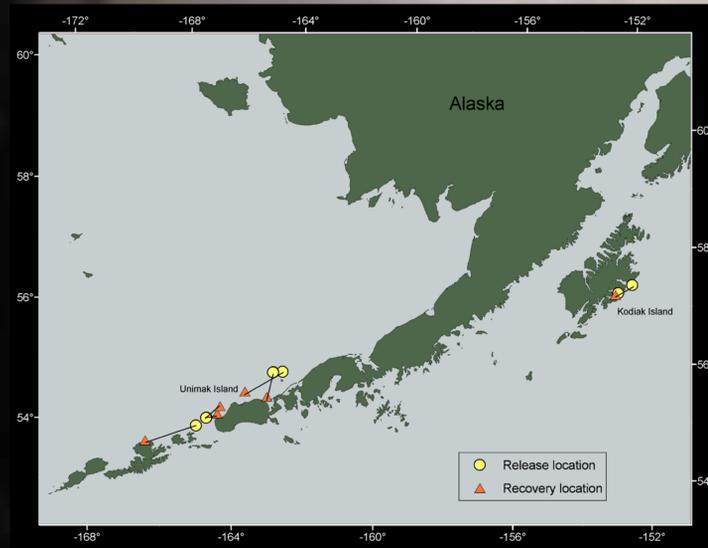


Figure 2. Pacific cod tagging release and recovery locations for specimens used in current study.

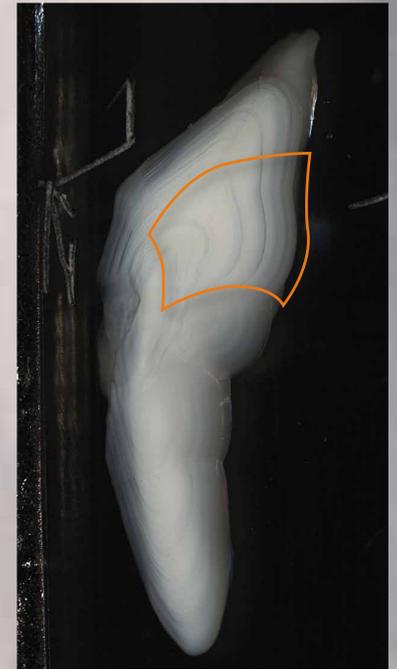


Figure 3a. Pacific cod otolith cross section before micromilling (transmitted light).

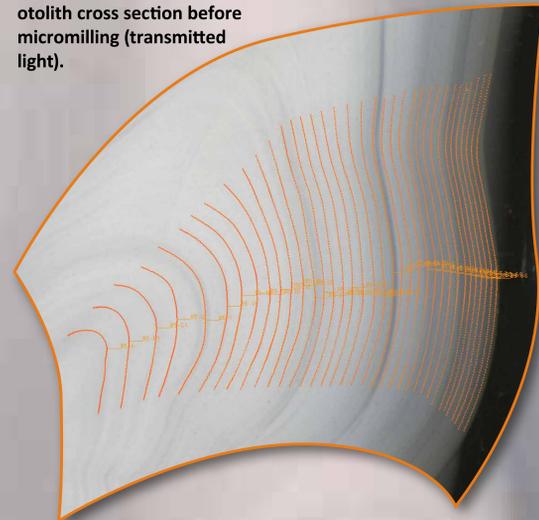


Figure 3b. Enlarged area showing region to be sampled and 36 paths for micromilling by computer controlled system.

RESULTS

The ten specimens fell into 3 categories:

1. Number of counted translucent zones = ^{18}O peaks, therefore correct age. $n = 4$ Figure 4: Plot #953 example
2. Number of counted translucent zones > ^{18}O peaks, therefore possibly incorrect age. $n = 3$ Figure 5: Plot #253 example
3. No seasonal signal in ^{18}O . $n = 3$ 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 ^{18}O measurement, and also consider ^{13}C .
4. The migration and temperature history over the live of the fish is not known; therefore it is a confounding variable.

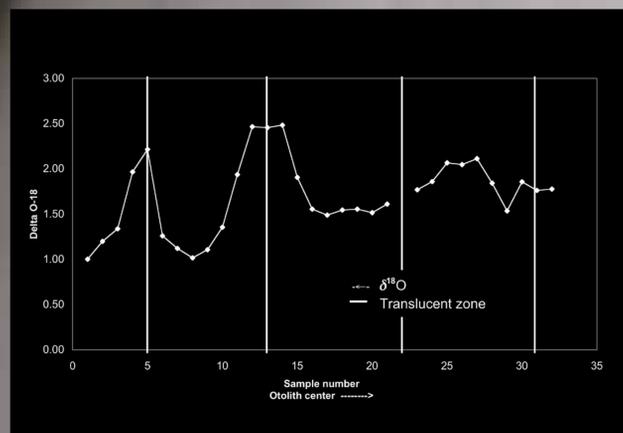


Figure 4. Example of a specimen where age estimated by counting translucent zones equaled the number of ^{18}O peaks.

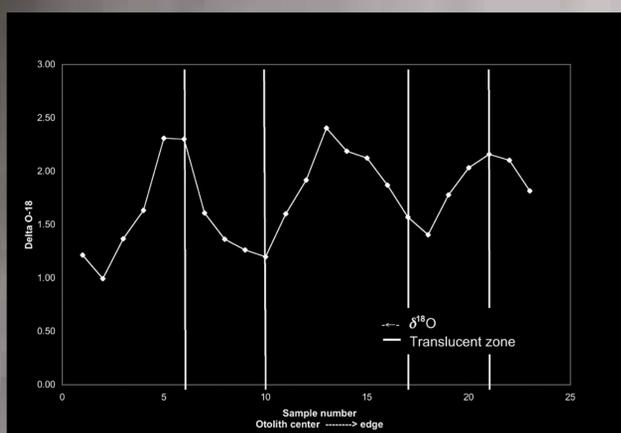


Figure 5. Example of a specimen where age estimated by counting translucent zones was greater than the number of ^{18}O peaks.

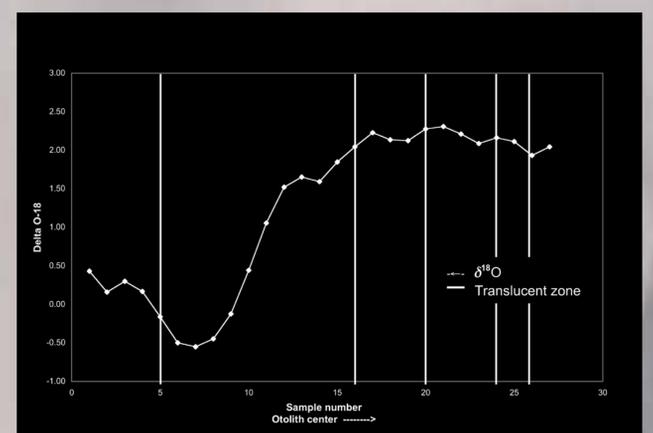


Figure 6. Example of a specimen where the ^{18}O did not show a strong seasonal signal.



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