Re-inventing the Wheel Has its Challenges: Investigating New Methods for Aging Spiny Dogfish

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Introduction

There are many challenges associated with aging fish species, and the spiny dogfish (*Squalus suckleyi*) of the eastern North Pacific Ocean is no exception. This study is investigating histological methods of viewing vertebrae sections as opposed to using fin spines for aging spiny dogfish. As has been documented in previous studies, using fin spines has challenges, such as the spines can be broken. There are many aspects to developing new aging methods; this presentation will focus on two challenges that are faced in this project. First, there are inconsistencies in the criteria readers use to age spines. To address this, we obtained known-age specimens and developed a new set of criteria for aging spines. A set of reference spines was created. The second issue is that the location where the vertebrae are collected along the vertebral column may impact readability. Previous studies have suggested that the location of vertebrae samples did not significantly influence the annuli counts; however our research suggests that sample location may impact readability. To address this, a subset of animals were double-sampled, collecting vertebrae from the area ventral to each dorsal fin. Results suggest that, while there is no significant difference in the annuli count, the anterior vertebrae are preferred. The anterior vertebrae are larger and easier to process and read, whereas the posterior vertebrae are smaller, often rendering them more be difficult to read or even unreadable.

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Selected reference: Campana, S. E., C. Jones, G. A. McFarlane, S. Myklevoll. 2006. Bomb dating and age validation using the spines of spiny dogfish (*Squalus acanthias*). Environmental Biology of Fishes 77:327-336.

The recommendations and general content presented in this poster do not necessarily represent the views or official position of the Department of Commerce, the National Oceanic and Atmospheric Administration, or the National Marine Fisheries Service.

Objective: Reader Agreement

PROBLEM: Different labs aging spiny dogfish were using different criteria for interpreting annuli.

SOLUTION: We are using a set of known-age specimens to calibrate readers. Structures are being sent to multiple labs to assess inter-lab aging differences.

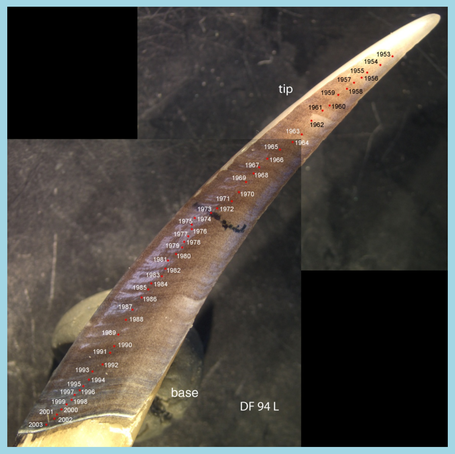

Figure 1. Known-age spine with annuli and year of formation noted. Specimen from Campana et al. 2006. (image used with permission)

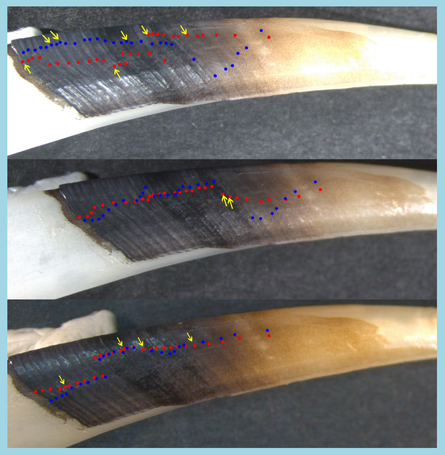

Figure 2. Reader interpretations of annuli before and after calibration. Each panel is a separate reading of the same spine. Differences in the images are due to changes in the light, zoom and focus. The blue dots are the reader interpretations of annuli before calibrating with the known age specimens and the red dots are after. Yellow arrows highlight differences between the before and after.

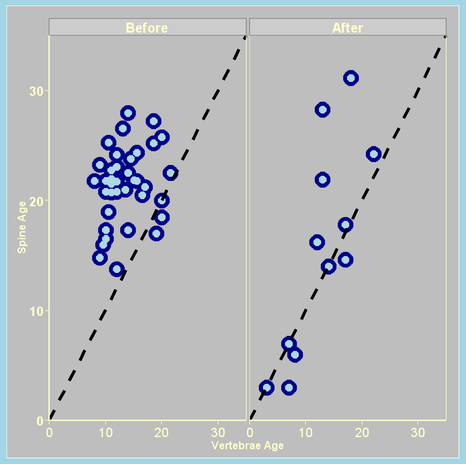

Figure 3. Age agreement between the two structures from early in the study ("Before" calibration) and recent data ("After"). This is still underway, thus final results are not presented. Dashed line is the 1:1 replacement line.

- At the beginning of the study ("Before") spine ages were generally higher than vertebra ages.
- After establishing a standard criteria for aging and calibrating readers, the spine and vertebrae ages appear more similar ("After").
- Data collection is still underway.

Objective: Anterior vs Posterior

PROBLEM: We observed size and readability differences between a small number of anterior and posterior vertebrae.

SOLUTION: We collected a larger sample size of vertebrae from both locations and statistically compared annuli counts and readability.

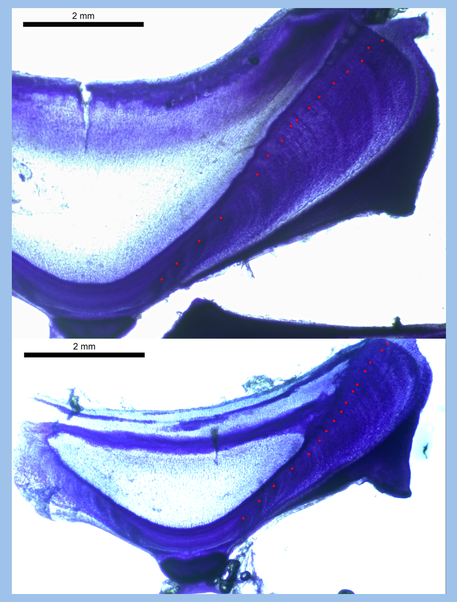

Figure 4. Comparison of the vertebrae collected from beneath the anterior dorsal fin (top) and those collected from beneath the posterior dorsal fin (bottom). Images are taken at the same magnification and red dots denote annuli.

- Annuli counts from the posterior vertebrae are not significantly different from annuli counts from the anterior vertebrae.
- Paired t-test
- P-value=0.068

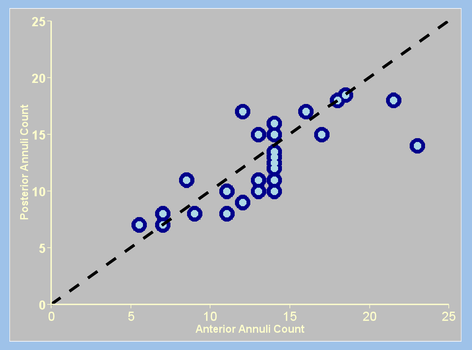

Figure 5. Annuli count agreement between anterior and posterior vertebrae. Dashed line is the 1:1 replacement line.

- Between reader agreement is significantly greater (i.e. closer agreement) for anterior vertebrae annuli counts than posterior vertebrae annuli counts.
- Variance of reader agreement for anterior vertebrae annuli counts is significantly smaller than variance for reader agreement for posterior vertebrae annuli count.
- F-test
- P-value=0.022

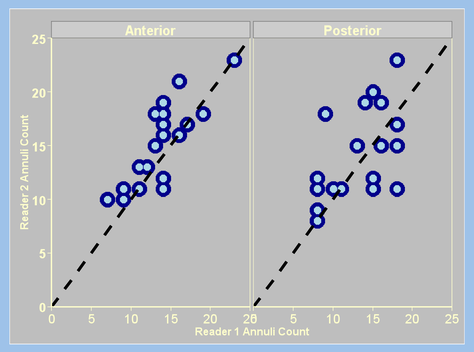

Figure 6. Between-reader agreement for both anterior and posterior vertebrae annuli counts. Dashed line is the 1:1 replacement line.

Conclusions

1) All participants should calibrate with reference samples prior to reading samples to be used in studies or for stock assessment, regardless of prior experience.
2) Location of collection of vertebrae does not influence the annuli count in vertebrae, but can influence readability and precision.