Aging Giant Pacific Octopus using Beaks and Stylets for Better Stock Structure Assessment

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Introduction

Despite being a highly charismatic and frequently exhibited organism, Giant Pacific Octopus (Enteroctopus dofleini) population dynamics are poorly understood. Basic monitoring data for this species is limited to bycatch and stomach contents of other fisheries species. An essential step to a better estimation of population size and productivity is to establish efficient procedures and accuracy of a size at age model. The objectives of this research project are to determine the most efficient method for analyzing the hard parts of the Giant Pacific Octopus (GPO) (Figure 1), and to provide fisheries management professionals with a weight at age relationship for population stock structure modelling. This information would be extremely useful in reducing bycatch that can cause serious economic issues through fishery closures.

Methods

Embedding process
- 2.3 cross sections were cut from 1 stylet of each specimen and embedded
- They were dehydrated from 70% to 100% ethanol
- Each cross section was embedded using LR White
- Cross sections were sanded with 800-2000 grit paper and polished with 5.0 and 1.0 alumina solution

Imaging for stylets
- Compound microscope and AmScope software were used to analyse the stylen and take images
- Images from the core to the outermost edge of the stylet were taken and strung together so that a count could be taken
- Secondary counts were conducted by another person to improve accuracy. Any stylet that had a difference of more than 3 rings between the two counts was discarded

Imaging for Beaks
- Beaks were cut in half
- Dissecting microscope was used to look for growth rings on the inner lateral wall

Results

Out of all the specimens collected, 30 had 2-5 cross sections taken which resulted in 78 embedded stylets. Originally, 24 stylets were determined to be usable for counting growth rings. Through the process of sanding and polishing followed by analysis with a microscope, that number was reduced to 15. Growth rings were visible on both beaks and stylets, as seen in figures 2 and 3 respectively, meaning that both hard parts could potentially be used to obtain actual age estimates. This also implies that the methods used for embedding could be repeated in the future. A counting protocol was written to standardize how the age estimates would be obtained by different counters. Figure 4 shows that the stylet wet weight had a positive correlation with the total body weight and an $R^2$ value of 0.7863.

Discussion

The main purpose of this project was to create an efficient and accurate method for aging the Giant Pacific Octopus. This project shed some much needed light on the population age structure of this species, which will help people better understand the ramifications of bycatch or directed fisheries. By defining weight as a proxy for age, this research can also provide an alternate, non-lethal method for estimating age. This information has the potential to assist in planning conservation strategies and management of related fisheries.

All of the beaks and stylets experienced a significant amount of stress through the dehydration process both when they were initially extracted and before being embedded. This is most likely the reason why the number of usable stylen was so low compared to the total number of specimen collected. Future GPO aging studies should take special action to avoid this. This work represents one of the very first attempts at finding methods to age GPOs. The fact that growth rings were seen in both the beaks and stylets indicates that both hard parts have the potential to be used to attain actual age estimates in future studies.

Broader Impacts

Having an accurate size at age model would be extremely valuable to those trying to create a population stock structure model for GPOs. This would aid any conservation efforts for the species and direct fishing regulations.

References


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