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An update on Australian otolith collection activities and direct ageing activities for the Australian surface fishery - 2023

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1.1 Abstract

This report provides an update on the southern bluefin tuna (SBT) otolith collection and ageing activities in Australia in 2022. Otoliths from 173 SBT caught in the Great Australian Bight (GAB) by the purse seine fishery were received and archived into the CSIRO hard-parts collection. Age was estimated for 100 of these fish. An additional 177 otoliths sampled in 2023 have just been received but are not yet archived.

In 2021 we developed a preliminary algorithm to estimate fractional (decimal) age from otoliths using the zone counts and otolith measurements. We applied this algorithm to the current age data. Further work is needed to refine the age algorithm - specifically the relationship between daily age and otolith size. We hope to obtain these data through the daily ageing work undertaken in preparation for the CCSBT funded SBT age determination workshop planned for early 2024.

1.2 Introduction

Since the 2002 fishing season, Australia has been obliged to provide annual length-at-age estimates for the surface (purse seine) fishery in the Great Australian Bight (GAB) to CCSBT. The current protocol requires that all farm operators provide a sample of 10 fish that have died either in towing operations or within the first weeks after fish have been transferred to stationary farm cages. A company contracted to the Australian Fisheries Management Authority (AFMA) measures the length of each fish and extracts the otoliths from these mortalities. In the past there have been between ~25 and 40 tow cages a year, giving a total of 250-400 otoliths collected from this sector each season. In recent years, however, the number of fish available for otolith sampling has declined primarily because of low mortalities in the cages during the towing operations (Farley et al., 2013).

1.3 Otolith sampling and reading

A total of 173 sets of otoliths were collected from the Australian surface fishery in the 2021/22 fishing seasons by Seatec Pty Ltd. The fish were measured to the nearest cm (fork length, FL) and the otoliths removed and sent to CSIRO in Hobart. The size range of fish sampled was 66 to 110 cm FL (mean 84.3 cm FL) (Figure 1).

A total of 100 otoliths were selected for ageing. Otoliths were selected based on size of fish (length stratified sampling strategy rather than random sampling) to obtain age estimates from all length classes, even those where sample sizes were small. One otolith from each fish was selected and sent to Fish Ageing Services Pty Ltd (FAS) in Victoria to be weighed, sectioned and read. Transverse sections were prepared for each otolith (Anon., 2002). Opaque zones were counted along a transect that ran from the first inflection point on the otolith to the edge of the otolith. An opaque zone on the margin of the otolith was only counted if it was fully formed (i.e., translucent otolith material could be observed between the last opaque zone and the otolith margin). Prior to reading each year's otoliths, an ageing reference set (n=50 sectioned otoliths) was read by FAS for calibration purposes. The selected otoliths were then read at least two times by FAS without reference to the previous reading, size of fish, otolith weight or capture date. An otolith reading confidence score was assigned to each otolith reading. A customised image analysis system was

used to record an image of the otolith section and measure the distance between the primordium to the distal edge of each of the opaque zones counted, and to the edge of the otolith.

A final age (count of opaque zones) was obtained for all 100 otoliths selected for ageing. Ages ranged from 1 to 3 years and the length to age relationship is given in Figure 2.

In 2021 we developed a preliminary algorithm to estimate decimal (biological) age from otoliths using the zone counts and otolith measurements, which is more precise than whole years (zone counts). We applied this algorithm to the current age data (Figure 2). Further work is needed to refine the age algorithm - specifically the relationship between daily age and otolith size. We plan to obtain these data through the daily ageing work undertaken in preparation for the CCSBT-funded SBT ageing workshop, to be held in early 2024.

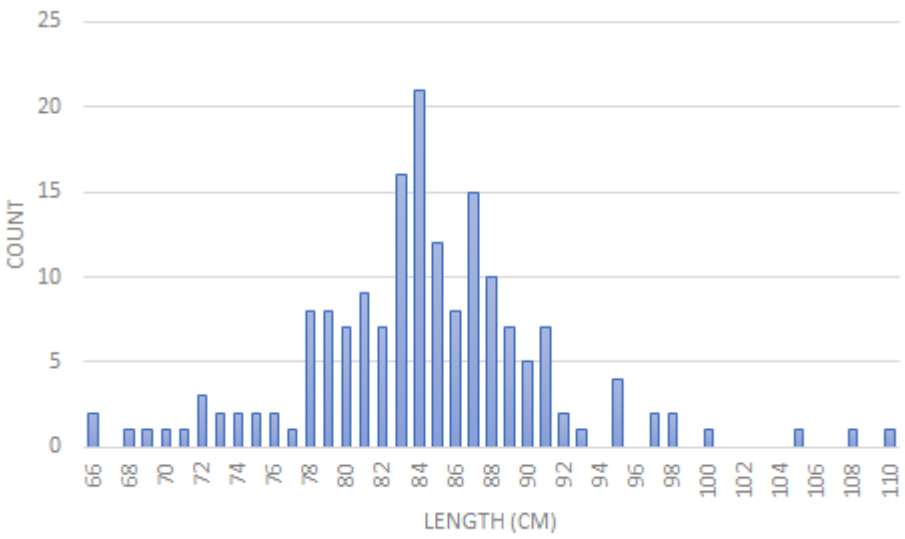

Figure 1. Length frequency of SBT with otoliths sampled from the Australian surface fishery in the 2021/22 fishing seasons.

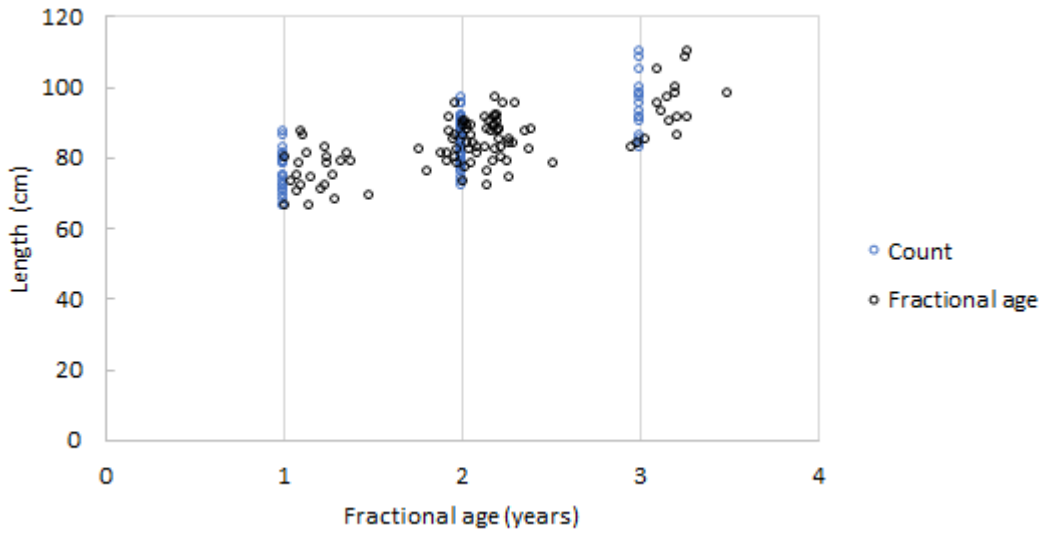

Figure 2. Length-to-age (count and decimal age) relationship for SBT caught in the 2021/22 fishing season.

1.4 Summary

Direct age estimates were obtained for 100 SBT caught in the GAB in the 2021/22 fishing season. The age data were provided to CCSBT in 2023. We applied the preliminary age algorithm to the count data from 2022 to estimate a decimal age. Further work is needed to refine the algorithm.

Quality control of age data is extremely important to ensure high quality age estimates are generated for assessment and management needs. It is recognised that there is a need to regularly examine the precision and bias of age estimates between readers and among laboratories to maintain a consistent level of precision and minimise the potential for systematic biases in ageing estimates. An SBT age determination workshop was supported by the CCSBT in 2022 and we intend to hold the workshop in early 2024. In preparation for the workshop, daily ageing of 100 small SBT will be undertaken in late 2023.

References

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