CCSBT-ESC/2208/13
(ESC Agenda item 7.1)

Australia's National
Science Agency

An update on Australian otolith collection activities and direct ageing activities for the Australian surface fishery - 2022

Jessica Farley

CCSBT-ESC/2208/13

Prepared for the CCSBT Extended Scientific Committee for the Twenty Seventh Meeting of the Scientific Committee

29 August – 6 September 2022

Acknowledgments

There are many people we would like to acknowledge for their support. Our thanks go to Seatec Pty Ltd for collecting otoliths as part of routine collecting from the South Australian tuna farms in Port Lincoln under AFMA supervision. Our appreciation also goes to Kyne Krusic-Golub and Admir Sutrovic (Fish Ageing Services) for sectioning and reading the otoliths, and Scott Cooper for database support. This work was funded by AFMA and CSIRO Oceans and Atmosphere.

1.1 Abstract

This report provides an update on the southern bluefin tuna (SBT) otolith collection and ageing activities in Australia in 2021. Otoliths from 123 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 and the age data were provided to CCSBT during the 2022 data exchange. An additional 173 otoliths sampled in 2022 have just been received but are not yet archived.

Last year 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 age data from 2021.

Quality control of age data is extremely important to ensure high quality age estimates are generated for assessment and management needs. An SBT age determination workshop was proposed in 2014 to standardise approaches for converting increment counts to age estimates amongst member laboratories. Paper CCSBT-ESC/1509/15 reiterated the requirements for an ageing workshop, including the need for pre-workshop inter-laboratory otolith exercises to estimate precision and bias, because the last age validation workshop was in 2002 (Anon 2002).

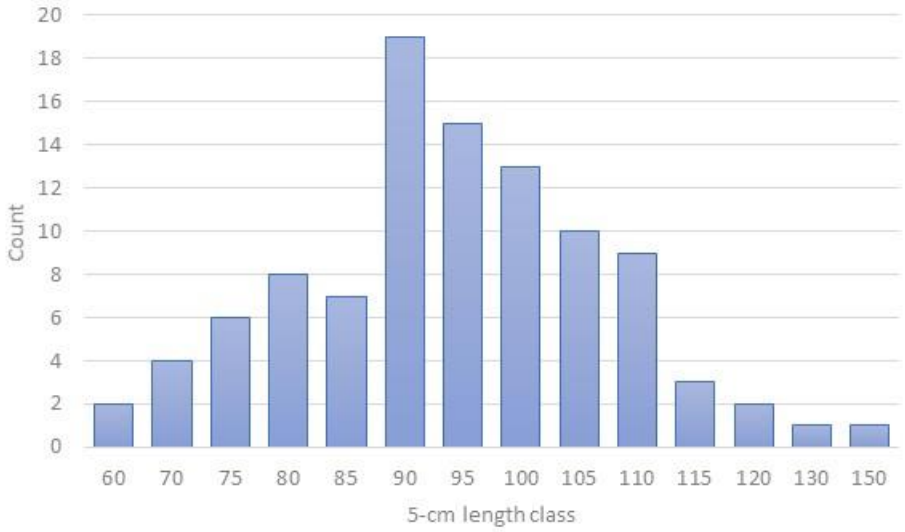
1.2 Introduction

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 123 sets of otoliths were collected from the Australian surface fishery in the 2020/21 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 64 to 150 cm FL (mean 96.3



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 8 years and the length to age relationship is given in Figure 2. The age (i.e., count) data were provided to CCSBT during the data exchange.

Last year 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 age data from 2021 (Figure 2). Further work is needed to refine the age algorithm - specifically the relationship between daily age and otolith size, and the estimation of the values of mean increment widths.

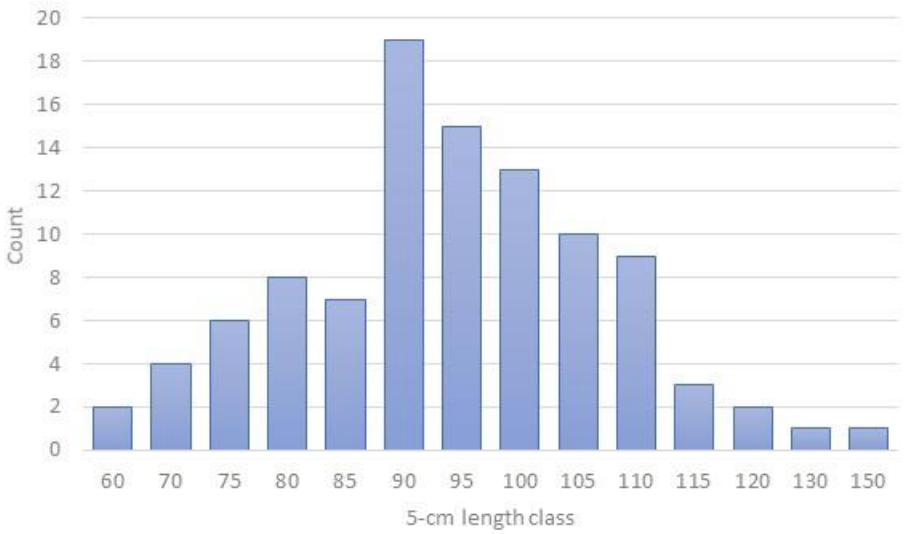


Figure 1. Length frequency of SBT with otoliths sampled from the Australian surface fishery in the 2020/21 fishing seasons.

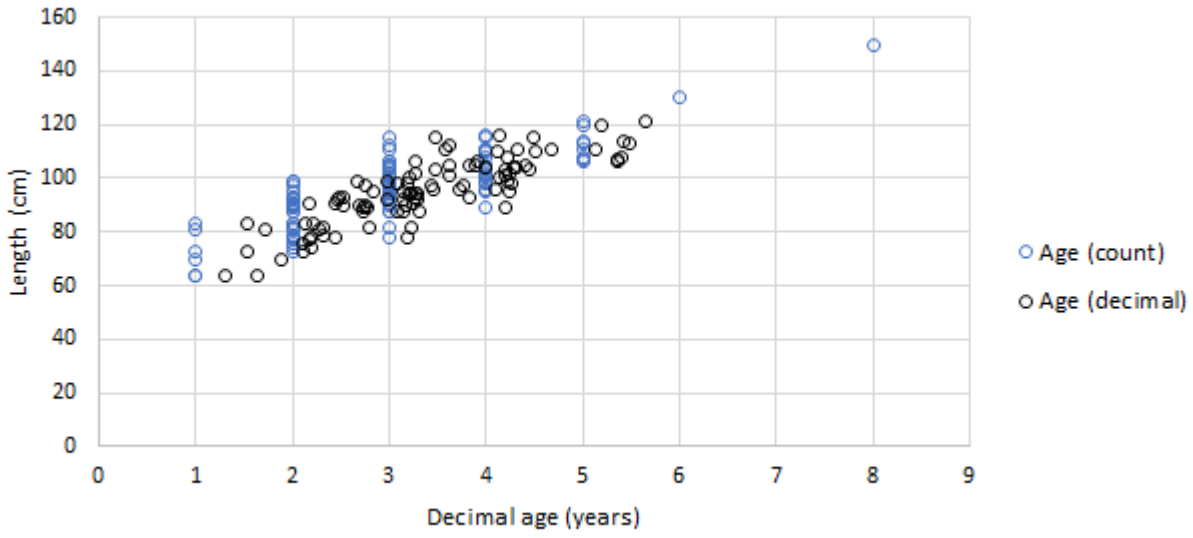


Figure 2. Length-to-age (count and decimal age) relationship for SBT caught in the 2020/21 fishing season. A decimal age was not calculated for the two oldest SBT due to insufficient data on the mean size of the 6th or 8th otolith increments in SBT.

1.4 Summary

Direct age estimates were obtained for 100 SBT caught in the GAB in the 2020/21 fishing season. The age data were provided to CCSBT in 2022. We applied the preliminary age algorithm to the count data from 2021 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 proposed in 2014 (CCSBT-ESC/1409/24) to estimate the precision and bias among otolith readers, and standardise approaches for converting increment counts to age estimates amongst member laboratories. Paper CCSBT-ESC/1509/15 reiterated the requirements for an ageing workshop, including the need for a pre-workshop inter-laboratory otolith exercise to estimate precision and bias. It has been 20 years since the 2002 age validation workshop (Anon, 2002).

References

Anonymous. (2002). A manual for age determination of southern bluefin Thunnus maccoyii. Otolith sampling, preparation and interpretation. The direct age estimation workshop of the CCSBT, 11-14 June 2002, Queenscliff, Australia, 39 pp.

Beamish, R.J. and Fournier, D.A. (1981). A method for comparing the precision of a set of age determinations. Canadian Journal of Fisheries and Aquatic Sciences 38: 982-983.

Farley, J., Eveson, P. and Clear, N. (2013). An update on Australian otolith collection activities, direct ageing and length at age in the Australian surface fishery. CCSBT ESC-1208-18.

As Australia's national science agency and innovation catalyst, CSIRO is solving the greatest challenges through innovative science and technology.

CSIRO. Unlocking a better future for everyone.

Contact us

1300 363 400
+61 3 9545 2176
csiroenquiries@csiro.au
www.csiro.au

For further information

Oceans and Atmosphere
Jessica Farley
+61 6 6232 5189
Jessica.farley@csiro.au
csiro.au