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# SRP Proposal:

# Second workshop on otolith-based ageing of southern bluefin tuna

Jessica Farley[1], Campbell Davies[1] and Budi Nugraha[2]

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[1] CSIRO Marine and Atmospheric Research, Hobart, Australia
[2] RCFMC Research Institute for Tuna Fisheries, Benoa, Bali, Indonesia

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# 1 Abstract

In 2002, the CCSBT led the development of standardised direct ageing methods for SBT among member nations. It is recognised, however, 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. At the 17th meetings of the Scientific Committee of the CCSBT "a cross-laboratory recalibration of ageing techniques was suggested to avoid drift, since it was 10 years since the 2002 direct ageing workshop". Concerns have also been raised over assigning an age to fish caught during winter months when translucent zones are forming. A systematic bias was detected in age estimates for SBT caught by New Zealand in 2001-2004 (winter fishery) when compared to CCSBT length-at-age data, and although it was suggested that interpretation of the otolith terminal edge may be the cause of the bias, the issue remains unresolved. Here we provide a draft proposal, for further development with member scientists at this year's ESC, for a second SBT age determination workshop to re-estimate the precision and bias among otolith readers, and standardisation of approaches to interpretation of the otolith edge and converting increment counts to age estimates amongst member laboratories.

# 2 Introduction

In 2013, the Extended Scientific Committee (ESC) requested costed proposals for consideration for the CCSBT Scientific Research Program (SRP) for 2014-2018, to enable recommendations to be made to the Commission for future activities. Here we provide a draft proposal for a second SBT age determination workshop for development with member scientists.

Accurate estimates of age and growth are essential for understanding population dynamics and assessing the productivity of a stock. In the 1990s, validated techniques were developed to estimate the age of southern bluefin tuna (SBT) using otoliths (Clear *et al*. 2000; Gunn *et al*. 2008). In June 2002, an age estimation workshop for SBT was held in Queenscliff, Australia, to standardise otolith ageing methods and protocols among CCSBT member nations (Anon 2002a). Ageing specialists from Australia, Japan, Korea, New Zealand and Taiwan attended the workshop and substantial improvements in reading consistency were achieved (Anon 2002b).

Prior to the workshop, an otolith exchange exercise using 90 otoliths was undertaken and the results showed good consistency in age estimates among readers although differences were detected in ages of young fish (Anon 2002a). Results of additional otoliths readings undertaken during the workshop again suggested "acceptable precision" could be attained by experienced readers (Anon 2002a). An age determination manual was produced that documented the protocols for sampling, preparing and reading SBT otoliths, as well as methods to estimate precision of age estimates (Anon 2002c). A references set of 60 otoliths with annotated images on CD was established and is maintained by the CCSBT. A second inter-laboratory calibration exercise was undertaken prior to the eighth meeting of the Scientific Committee based on this reference set (Anon 2003). It was noted that, although there were some differences in readings, there was sufficient consistency to suggest that members were able to produce similar age estimates.

In 2005, the CCSBT Scientific Committee recognised there was uncertainty in assigning New Zealand SBT to their correct cohort as the fish are caught in winter (April to July) when the translucent zone is forming in the otoliths (Anon 2005). Krusic-Golub (2005) included the opaque zone at the otolith margin in counts only if a new translucent zone was visible on the edge, and he converted the count to an age using theoretical birth date, date of capture and edge type (narrow or wide). The results indicated a systematic bias of -1 year compared to CCSBT data. Krusic-Golub (2005) suggested that the decision of whether to include the opaque zone on the otolith edge was affecting the final age estimate and recommended that 'edge type' is also provided in ageing studies so that data sets can be better compared. The ESC recognised this problem and it was recommended that the issue be discussed inter-sessionally but it remains unresolved.

Quality control of age data is extremely important to ensure high quality age estimates are generated for assessment and management needs (Morison *et al*. 2005). In 2008 and 2012, inter-laboratory comparisons were suggested as a quality control measure for ageing methods to reduce the potential for drift in age estimations occurring over a long period (Anon 2008; 2012). We propose that another otolith exchange be undertaken before and during a second age determination workshop to check the precision and bias of readers and standardise the interpretation of the otolith margin and converting counts to age estimates.

# 3 Workshop issues for consideration

It is suggested that an appropriate venue for a second age determination workshop is the new building of Indonesia's Research Institute for Tuna Fisheries[3] in Bali as this is central for most members and would also provide the opportunity for capacity building activities. It is recommended that an inter-laboratory otolith exchange exercise be undertaken before and during the workshop. The main objective of the calibration exercise would be to estimate precision and relative bias in readings from scientists at CCSBT member laboratories, and to ensure that the precision/bias levels are within acceptable limits.

The exchange could include a subset of the 90 otoliths from the CCSBT reference set supplemented by an additional set of otoliths. Preferably all readers would be required to annotate the digital images of otoliths (i.e. the position of opaque or translucent zones) so that the workshop can evaluate what each reader is counting. These and additional otoliths could be re-read during the workshop after protocols for reading are re-established. It would be important to avoid using the exact same set of otoliths on the before and after comparisons.

During the workshop, discrepancies in the interpretation of exchanged otoliths can be resolved, and the performance of readers between the start and end of the workshop can be compared. Templates can be used to quickly estimate precision and bias, for example Eltink *et al*. (2000) or Sutherland (2006).

Potential issues to be considered during the workshop include:

- Ageing errors and difficulties identified during the calibration exercise
- Standardising otolith margin interpretation and converting counts to age estimates
- What constitutes acceptable ageing error?
- Future research requirements

# 4 Proposed aims

1 Review otolith extraction, sectioning and reading methods including any recent age validation work
2 Provide capacity building training for members who have not been involved in SBT age estimation
3 Improve age estimation protocols and quality control procedures (checking precision and drift)
4 Update otolith reference set and determine a future quality control agenda
5 Revise the age determination manual with respect to methods related to reading otolith margins

# 5 Costs

The estimated contribution from the Commission for this proposal is approximately $40,000. This would cover:

1 Travel for 1 scientist from each member, additional scientists would be welcome.
2 Costs of and invited expert: eg Kyne Krusic-Golub (Fish Ageing Services Pty Ltd, Australia).
3 Workshop expenses in Bali.

[3] Research Institute for Tuna Fisheries is a sub-institute of Research Centre For Fisheries Management and Conservation, Indonesia. The new building of RITF has been operational since February 2014.

# 6 Benefits

It is expected that the workshop will improve the accuracy of SBT age estimates provided to the CCSBT by member nations. Through collaborative efforts, it is likely that further development and improvements in ageing techniques will be made. The results from the ageing workshop will be reported to CCSBT Scientific Committee meeting and the updated age determination manual and training video will be available through the CCSBT website. The project will improve age-based parameters for assessment and management advice for SBT.

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CONTACT US

**t** 1300 363 400
+61 3 9545 2176
**e** enquiries@csiro.au
**w** www.csiro.au

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**CSIRO Oceans and Atmosphere Flagship**
Jessica Farley
**t** +61 3 6232 5222
**e** Jessica.Farley@csiro.au
**w** www.csiro.au