

Uncertainties in the 2019 stock assessment for Indian Ocean albacore tuna and suggestions of further researches in 2020 for improving the assessment and providing management advice

Jiangfeng Zhu and Toshihide Kitakado

Chair and vice Chair of Working Party on Temperate Tunas

Abstract: The stock status of Indian Ocean albacore tuna was assessed in WPTmT07 held in July 2019, and the stock status was recognized as “not overfished” but “subject to overfishing”. However, at the same time, the assessment result was regarded as subject to high uncertainties. By summarizing the main uncertainties in the assessment and observations of potential improvements both in fishery data and biological information, we strongly suggest conducting an assessment meeting for albacore tuna in 2020. This will not be a meeting for a new full assessment, but to update the 2019 assessments using new information on biology, most recent catch data, revised CPUE indices, improved recruitment estimates for projection and wider ranges of natural mortality and steepness.

1. Purpose

To inform the Scientific Committee (SC) on problems of uncertainties in the results of albacore tuna stock assessments conducted in WPTmT07 (July 2019) and suggest to improve assessment of the stock by reducing uncertainties and incorporating new and improved information, in order to provide more plausible stock status and management advices.

2. Background

Two meetings were held for the Indian Ocean albacore tuna in 2019. The data preparatory meeting of the 7th Session of the Indian Ocean Tuna Commission's (IOTC) Working Party on Temperate Tunas (WPTmT07-DP) was held in Kuala Lumpur, Malaysia, from 14 to 17 January 2019, and the stock assessment meeting of the 7th Session of the WPTmT (WPTmT07-AS) was held in Shizuoka, Japan, from 23 to 27 July 2019. This document addresses the main uncertainties associated with the albacore from the two meetings, and highlights areas where new and improved information could be further available. Then, we suggest to assess the stock in 2020 by incorporating the new and improved information.

3. Stock assessment and uncertainty

3.1 Uncertainty in biology

There are number of uncertainties in the biology of Indian Ocean albacore tuna. Growth, maturation, natural mortality, and recruitment are key biological information used in developing the assessment model in the age-structured assessments.

For the assessments in 2016 and before 2016, growth of Indian Ocean albacore was parameterized based on information of growth curve from the north Pacific albacore. A study to determine the age and growth of Indian Ocean albacore using otoliths was recently completed (Farley et al. 2019). The new study sampled albacore from the western Indian Ocean, primarily from the longline fishery with smaller fish also sampled from pole-and-line and purse seine fisheries. There is some concern that the initial growth may be over-estimated due to the limited number of smaller fish included in the sample (Farley et al. 2019, Nishida & Dhurmeea 2019). In addition, insufficient data were available from the Indian Ocean to investigate spatial variation in growth (Langley 2019).

Reproductive information of albacore in the Indian Ocean was also lack. A recent study of reproductive biology was conducted using sample from the western Indian Ocean (Dhurmeea et al. 2016), however, the derived maturity ogive was considered less reliable due to the limited number of fish sampled from the smaller length classes (Langley 2019).

In the current assessment (2019), recruitment was estimated by B-H stock recruitment relationship and annual recruitment deviates were estimated for the “data rich” period of the model (1975-2015). SigmaR of recruitment deviates was fixed at 0.3 in the initial reference model. This value was based on estimated recruitment deviations from initial runs. However, SigmaR is likely to be underestimated if there is lack of information in the data, in addition 0.6 is normally applied as the default value in other species. Although the WPTmT agreed to increase sigmaR to 0.6 for the reference model, lake of length composition data and CPUE indices for fisheries catching small tunas in the earlier period (1950-1974) undermine the estimation of the recruitment deviates for that period (Langley 2019). Therefore, the recruitment deviates need to be more reliably estimated, considering it is an important component in the estimation of population dynamics.

3.2 Uncertainty in data for assessment

The current assessments of albacore were conducted using both biomass dynamics models and age-structured model (the SS3 model). The data used with biomass dynamics models consist of aggregated catch and standardized longline CPUE indices. The data used with SS3 model consist of fishery specific catch, length composition data, standardized longline CPUE indices and biological information.

Retained catches are considered to be fairly reliable until the early-1990s; since then the quality of catch estimates has been compromised due to poor catch reports from some of the main fleets. For example, albacore catch from Indonesia are estimated to account for around 20% of the total catches of albacore in the Indian Ocean in recent years. However, the quality of the catch estimates is generally considered to be relatively low. While catches for the most recent years are considered more reliable, catch estimates prior to 2013 continue to remain highly uncertain. Catches of albacore estimated for the fresh-tuna longline fishery of Taiwan,China are only available from 2001 onwards. Prior to 2001, catches for the Taiwanese fleet remain relatively uncertain (IOTC–WPTmT07-DP, 2019).

Catch-and-effort data from some of the industrial fisheries have not been reported or been reported with low coverage. For example, no catch-and-effort has been reported by

Indonesia's industrial longline fishery. Catch-and-effort data for Taiwan,China fresh-tuna longliners is only available since 2010. Catch-and-effort data from longline fisheries of India, Malaysia, Oman, and Philippines remain incomplete.

Main CPUE series available are from Korea (longline), Japan (longline), and Taiwan,China (longline). The WPTmT noted that the Japanese CPUE data has some unresolved issues in south the most recent years, especially since 2006 (possibly relating to southern bluefin tuna ITQ issue and piracy effects) which gives less confidence in the Japanese data in the joint CPUE analysis from that period onwards. Although the WPTmT agreed to exclude the recent Japanese southeast data from the Joint CPUE standardizations in the 2019 assessment of SS3 model, the issue in the Japanese CPUE data since early 2000s need to be further understood.

The Joint CPUE standardization which was based on a unified, well documented procedure is currently considered as the best practice in standardizing the operational level data from the main longline fleets (IOTC–WPTmT07-AS, 2019). The CPUE in the southwest area are mostly likely to represent the abundance of albacore tuna at the time. Conversely, the CPUE in the southeast area is more likely to be problematic. The standardization has not adequately accounted for the differential trend between the eastern and western part of the region, and thus the increase in CPUE from the eastern part of the region was not explained.

Size frequency data for the current assessment are from longline fishery of Taiwan,China and Japan. Size frequency data form longline fisheries of India, Malaysia, Oman, and Philippines have not been reported. A review of the Taiwanese length frequency data identified major differences in the length frequencies of albacore recorded before and after 2003, with the majority of the smaller albacore missing from the length distributions since that year (Geehan and Hoyle 2013). It appears more likely that the observed trends in length composition of the Taiwanese longline fisheries are due to changes in the sampling of the fishery and may indicate unrepresentative sampling of the catch from the Taiwanese longline fleet (Langley 2019). This issue has not been fully resolved and the influence of this data set was considered by sensitivity analysis in the current assessment.

3.3 Stock assessment

Comparing different modelling approaches can better increase our understanding of the population dynamics. However, the production model-based approaches during this meeting was lack of extensive explorations with regard to model structures and assumptions/scenarios, compared with the SS model.

The WPTmT requested that future stock status estimates incorporate a wider range of uncertainty including additional natural mortality options and steepness values. Due to a lack of time during the assessment meeting in July, this was not possible (IOTC–WPTmT07-AS, 2019).

The WPTmT noted the recruitment in the terminal years of the assessment model are estimated to be well below average levels and this is projected to cause the stock to decline considerably over the short term. However, these recruitment estimates are poorly determined (IOTC–WPTmT07-AS, 2019).

4. New information coming up for albacore tuna population and fishery

The WPTmT further noted that, since the WPTmT Data Preparatory meeting in early-2019, the IOTC Secretariat has commissioned a number of projects that focus on long-standing issues with the quality and availability of data for the stock assessment of albacore tuna. Among them, two projects are scheduled **to complete in late-2019** and be helpful in the update of stock assessment (IOTC–WPTmT07-AS, 2019):

(1) Review of potential inconsistencies in the longline size frequency data, and the implications for the stock assessment of IOTC species;

(2) A scoping study that outlines options for improving the biological parameters used in IOTC stock assessments of albacore tuna; in addition, a benefits component involving sensitivity analysis to consider how much the assessment reliability might be improved by estimating the biological parameters.

5. Suggestions

The recent WPTmT meetings were held every two years (e.g. 2012, 2014, 2016), and the WPTmT06 recommended that future stock assessment cycle for albacore tuna should be conducted every three years and this recommendation was endorsed by SC 2016.

However, if the stock was perceived to be overfishing or overfished, it needs to be more closely monitored, which will be essential to prevent further decline of the stock. This has been practiced in other IOTC species, e.g., the WPTT 2016 meeting scheduled the full assessment for bigeye tuna, while yellowfin tuna assessment was also been updated considering the overfished status of this stock which deserve close monitoring. The stock status from the assessment meeting in July 2019 indicates that the albacore tuna stock was not overfished but was subject to overfishing (IOTC–WPTmT07-AS, 2019). This was the first time that overfishing was perceived for the Indian Ocean albacore tuna since 2012.

Therefore, we **strongly suggest** conducting an assessment meeting for albacore in 2020 (e.g. in April 2020 before the commission meeting). This will not be a meeting for a new full assessment, but to update the 2019 assessments using new information on biology if available (e.g. growth), 2018 catch data, revised CPUE indices considering the historical fishery of the main fleet (i.e. Japanese longline fishery since early 2000s), improved recruitment estimates for projection and wider ranges of natural mortality and steepness.

Reference

Dhurmeea, Z.; Zudaire, I.; Chassot, E.; Cedras, M.; Nikolic, N.; Bourjea, J. et al. 2016. Reproductive Biology of Albacore Tuna (*Thunnus alalunga*) in the Western Indian Ocean. PLoS ONE 11(12): e0168605. doi:10.1371/journal.pone.0168605

Farley, J.H.; Eveson, J.P.; Bonhommeau, S.; Dhurmeea, Z.; West, W.; Bodin, N. 2019. Growth of albacore tuna (*Thunnus alalunga*) in the western Indian Ocean using direct age methods. Seventh Working Party on Temperate Tunas: Data Preparatory Meeting, Kuala Lumpa, Malaysia, 14–17 January 2019. Indian Ocean Tuna Commission. IOTC-2019-WPTmT07(DP)-21.

Geehan, J. and S. Hoyle. 2013. Review of length frequency data of the Taiwan,China distant water longline fleet, IOTC-2013-WPTT15-41 Rev_1. Indian Ocean Tuna Commission Working Party on Tropical Tunas, San Sebastian, Spain, 23–28 October, 2013.

IOTC-WPTmT07-AS. 2019. Report of the Seventh Session of the IOTC Working Party on Temperate Tunas: Assessment Meeting. Shizuoka, Japan, 23–27 July 2019. IOTC-2019-WPTmT07(AS)-R[E]: 36 pp.

IOTC-WPTmT07-DP. 2019. Report of the Seventh Session of the IOTC Working Party on Temperate Tunas. Kuala Lumpur, Malaysia, 14–17 January 2019. IOTC-2019-WPTmT07(DP)-R[E]: 43 pp.

Langley A. 2019. Stock assessment of albacore tuna in the Indian Ocean using Stock Synthesis for 2019. IOTC-2019-WPTmT07(AS)-11

Nishida, T.; Dhurmeea, Z. 2019. Review of Indian Ocean albacore biological parameters for stock assessments. Seventh Working Party on Temperate Tunas: Data Preparatory Meeting, Kuala Lumpa, Malaysia, 14–17 January 2019. Indian Ocean Tuna Commission. IOTC-2019-WPTmT07(DP)-12