

Draft terms of reference for an independent peer review of the 2021 Indian Ocean yellowfin tuna assessment

Introduction

The 2021 yellowfin tuna assessment in the IOTC (Fu et al., 2021) using the Stock Synthesis (Methot Jr and Wetzel, 2013) was adopted by the 23rd Working Party of Tropical Tunas to inform the IOTC Commission of stock status and management advice (until discussion and endorsement by the 24th Scientific Committee). However, the IOTC's WPTT and SC has noted (in this and previous assessments of this stock) that areas of uncertainty of the assessment require follow-up investigation and expert advice, and that the assessment outcomes may be affected by alternative model configurations, data streams, biological parameters, assumptions and other sources of uncertainty. WPTT23 recommended a follow-up work, including an independent peer review, is important to improve confidence in future yellowfin stock assessments in the IOTC. Given the similarities in model structure and data inputs, the follow-up work and peer review of the yellowfin assessment would also be relevant to the bigeye and skipjack assessments.

This document outlines the Terms of Reference (ToR) for the peer review of the yellowfin assessment to be considered by 24th Session of the IOTC SC, which will guide the external review panel in their work. See **Table I** for the relevant extract relating to the WPTT23 recommendation for this peer review and suggested timelines.

Background

The yellowfin assessment uses catch, catch per unit of effort, size frequency and tagging data. A general concern is that there is conflict among data sources in the assessment and that stock assessment key management quantities are sensitive to the amount of weight placed on different data sources. The model structure (spatially disaggregated and in quarterly time steps) may be overly complex given the available data and biological information.

Additionally, recent studies suggest that the biological information (growth, fecundity and natural mortality) used in the stock assessment may need to be updated and the model configuration may need to be adapted to these changes too. Also, alternative CPUE data are available but haven't been used in the assessments due to different reasons (pole and line, purse seine from FADs, buoy derived indices).

The general configuration of the model and the abovementioned issues require follow-up investigations and advice. These considerations form the basis for the scope of this review.

Objectives

1. Undertake, in consultation with the stock assessment expert from the IOTC as well as IOTC WPTT, WPM and SC chairs and vice-chairs, a peer review of the 2021 yellowfin stock assessment in the Indian Ocean (IOTC).
2. Based on the review work provide recommendations for improving the assessment, including data inputs, model configuration, biological parameters, modelling approaches and treatment of uncertainty.
3. In conjunction with the IOTC Working Party on Tropical Tunas scientists, identify improvement options that are feasible for application to the 2024 yellowfin assessment and how these can also be applied in the assessments of bigeye, skipjack and other IOTC stocks.

Scope

The key areas for consideration by the peer review panel based on the recommendations of the YFT stock assessment paper (IOTC-2021-WPTT23-12), WPTT stock assessment report and follow-up considerations of the assessment team are listed below:

1. Model inputs, commenting on the adequacy and appropriateness of data sources and data inputs to the stock assessment, with particular attention to:
 - a. **Growth:** review the approach to estimation of growth parameters and consider the implications of the new growth curves developed in 2021 (Farley et al., 2021).
 - b. **Natural mortality:** review the approach used to determine M-at-age and implications of alternative M assumptions (Hoyle, 2021).
 - c. **Tagging data:** review the approach used to treat tagging data as model inputs, and how the tagging data are used within the model, including an evaluation of their use in the stock assessment.
 - d. **Size composition:** review the approach for pre-treatment of size composition data (i.e., re-weighting) and how size composition is weighted for the likelihood function.
 - e. **Catch per unit of effort:** Review the standardization of the joint longline CPUE (Kitakado et al., 2021) and of the EU purse seine (free school) index (Guéry et al., 2021) developed in 2021. Also, evaluate alternative fishery dependent CPUEs and buoy derived indices available for the assessment and its potential use.
 - f. **Data inputs:** identify and provide recommendations on the key areas for improvement in data collection (both fishery data and biological information).

2. Model configuration, assumptions and settings, with particular attention to:
 - a. **Model complexity:** review the appropriateness of the model complexity, including spatial and fishery structure, in relation to data inputs and other available information.
 - b. **Selectivity:** review selectivity assumptions and settings.
 - c. **Uncertainty:** review the approach used to represent uncertainty in model-derived management quantities, considering structural, model and input data uncertainty as well as development of criteria to select the final models in the grid.

3. Model diagnostics, with particular attention to:
 - a. Review the suitability of the diagnostics used and reported for the assessment.
 - b. Consider the diagnostics provided for the 2021 yellowfin assessment and provide guidance on follow-up work where the diagnostics suggest issues, i.e., data conflicts.

4. Future research areas, with the identification of priorities to improve future assessments.

While these key topics will be a focus of the peer review, other aspects of the assessment and data inputs may become focus areas as the review progresses.

Table 1: Key activities and outputs from peer review (Process should be discussed in the SC):

Activity	Output	Timeframe	Possible dates
Review of the 2021 yellowfin stock assessment document and report of the 2021 WPTT	Summary paper of general comments and suggestions for any pre-workshop modelling or further information/data required by the review panel	In the year following the assessment	August 2022
Pre-workshop planning meeting. (Online)	Plan for the workshop developed	At least 1 month prior to the workshop	January 2023

Review workshop at a location to be decided	Completion of 5 day + travel in-person modelling workshop	To be discussed	February 2023
Review outcomes of modelling workshop	Draft workshop report to IOTC WPTT/SC for review and response	With 2 weeks of the end of the modelling workshop	March 2023
Finalise peer review report	Final report provided to IOTC WPTT/SC	To be discussed	October 2023
Report finalised	Deliver report to IOTC WPTT and SC for posting	To be discussed	December 2023

Logistics

The SC24 will review and finalize these ToRs for the expert peer review. The starting dates of the peer review will be agreed with the experts with the aim of informing the development of the 2024 assessment of yellowfin. One workshop will be prepared that will involve the IOTC analyst and participants identified by the SC, including the Chair (and vicechair) of the SC, the Chair (and vicechair).

References

- Farley et. al (2021) Preliminary estimation of growth parameters for yellowfin tuna (*Thunnus albacares*) in the Indian Ocean from otolith-based age estimates (Farley et al), IOTC-2021-WPTT23-05.
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- Fu, D., A., U., Cardinale, M., Methot Jr, R.D., Hoyle, D.S., and Merino, G. (2021). Preliminary Indian Ocean yellowfin tuna stock assessment 1950-2020 (Stock Synthesis).
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- Hoyle, D.S. (2021). Approaches for estimating natural mortality in tuna stock assessments: application to Indian Ocean yellowfin tuna. IOTC-2021-WPTT23-08_Rev1.
- Kitakado, T., Wang, S.P., Satoh, K., Lee, S.I., Tsai, W., Matsumoto, T., et al. (2021). Updated report of trilateral collaborative study among Japan, Korea and Taiwan for producing joint abundance indices for the yellowfin tunas in the Indian Ocean using longline fisheries data up to 2020. IOTC–2021- WPTT23-11.
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