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Considerations for yellowfin tuna within the mixed fishery harvest strategy framework

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1. Executive summary

Under the mixed fishery framework, there is no WCPFC management procedure (MP) that explicitly considers the stock status of yellowfin and controls the associated fisheries. Instead, the fisheries that catch yellowfin are primarily managed through the MPs of bigeye, skipjack and South Pacific albacore. However, it is still necessary to evaluate likely outcomes for the yellowfin stock and assess the probability of achieving agreed yellowfin management objectives. It will, therefore, be necessary to develop a management strategy evaluation (MSE) framework for yellowfin to perform those evaluations.

Key technical and policy considerations for developing the MSE framework for yellowfin include:

- The key uncertainties to include within the yellowfin operating model (OM) grid
    - These may include alternative assumptions surrounding archipelagic waters catch
- Management objectives and target reference point
    - The potential role of a threshold TRP as raised at WCPFC21
- Performance indicators to be developed
- The role and content of the monitoring strategy for yellowfin

To meet the targets currently specified within the harvest strategy framework for yellowfin and facilitate work over the next 12 months, some decisions are required. We note that decisions must also be made to further develop the bigeye MP evaluations as part of the mixed fishery modelling framework.

We invite SC to:

- note the proposed approach for evaluating the outcomes for yellowfin under the mixed fishery approach
- provide initial guidance on:
    - candidate scenarios for the yellowfin OM grid
    - proposed performance indicators for yellowfin
- request WCPFC22 provide guidance on:
    - the potential role of a threshold TRP for yellowfin tuna and associated acceptable risk of falling below any threshold
    - the role of the monitoring strategy in triggering management actions related to yellowfin tuna stock status.

2. Introduction

WCPFC12 agreed to a workplan for the adoption of harvest strategies for WCPO skipjack, bigeye, yellowfin and South Pacific albacore tuna (WCPFC21 Summary Report attachment 16). An important consideration when developing harvest strategies for these stocks is to account for mixed fishery interactions (Table 1).

Table 1. Proportion of mean catch by weight (2020-2022) in the WCPFC-CA (south of the equator for albacore) of the four main tuna stocks by fishery. 'Other' fisheries are the domestic fisheries of Vietnam, Indonesia and the Philippines. The figures include catches in archipelagic waters. Colours relate to the single-stock MP under which each fishery falls under the proposed mixed fishery framework: blue = skipjack, red = bigeye, green = South Pacific albacore. Northern longline is potentially aligned with NP albacore management.

Stock	Tropical longline	Southern longline	Northern longline	Pole and line	Purse seine	Troll	Other
Skipjack	0	0	0	0.09	0.83	0	0.08
South Pacific albacore	0.12	0.81	0	0	0	0.07	0
Bigeye	0.27	0.05	0.06	0.01	0.45	0	0.15
Yellowfin	0.08	0.02	0.01	0.03	0.55	0	0.31

Noting that the status of key tuna stocks was strongly influenced by specific gears, SC15 agreed to initially consider a multi-species framework for developing mixed fishery harvest strategies. Under the proposed mixed fishery approach, single-stock management procedures (MPs) are being developed for skipjack, South Pacific albacore and bigeye, with the MPs defining fishing levels in the purse seine and pole and line fisheries as well as 'other' fisheries (skipjack), the southern longline fishery (South Pacific albacore) and the tropical longline fishery (bigeye). An interim skipjack MP was adopted in 2022 (CMM 2022-01). The South Pacific albacore and bigeye MPs are scheduled for adoption in 2025 and 2026 respectively.

Under the mixed fishery framework, there is no WCPFC MP that explicitly considers the stock status of yellowfin and controls the associated fisheries. Instead, the fisheries that catch yellowfin are primarily managed through the MPs of bigeye, skipjack and South Pacific albacore. However, it will still be necessary to evaluate likely outcomes for the yellowfin stock under the MPs for those stocks, and assess the probability of achieving agreed yellowfin management objectives. It will, therefore, be necessary to develop a management strategy evaluation (MSE) framework for yellowfin to perform these evaluations.

3. MSE framework considerations

We note in this section some key considerations when developing evaluations for the yellowfin tuna stock within the mixed fishery framework.

Operating model framework

To evaluate the effectiveness of the mixed fishery approach, a suitable operating model (OM) grid will be needed. As for other stocks, this may comprise a 'reference set' of OMs that represent the most important sources of uncertainty and plausible states of nature for yellowfin tuna, and a 'robustness set' that reflects hypotheses that are considered less likely but still plausible and which provide a secondary level of testing.

The operating models for yellowfin tuna can be informed by the most recent stock assessment (for yellowfin, performed in 2023). However, as is the case for bigeye tuna (see SC21-MI-WP-05),

while the assessment examines uncertainties that influence historical and current assessed status, the OM grid should consider key uncertainties that affect future stock dynamics. We also note that a new yellowfin stock assessment is scheduled for presentation to SC22 in 2026, which may identify additional uncertainties that need to be considered within the OM grid.

Similar to the bigeye tuna OMs, the reference set is likely to include alternative settings for steepness, tag mixing and effort creep. We note that additional sources of uncertainty could include alternative spatial structures and movement dynamics, hyperstability in CPUE, and climate change scenarios.

With regards to spatial structure, Hamer et al. (2023) provided a review of available information that will inform these considerations. However, there is a need to ensure that the structure is compatible with the application and management of the other tuna MPs and that fisheries can be mapped across to the yellowfin tuna OMs in an efficient way. To the extent possible, model areas should be consistent with boundaries for MP application to simplify and streamline the implementation of the mixed fishery approach.

We note the work of WCPFC SC Project 128 (Understanding the connectivity of the yellowfin and skipjack stocks in the WPEA region and the WCPFC-CA) may ultimately provide further scenarios. However, the timeline of that work is likely incompatible with the initial running of the mixed fishery framework. Scenarios guided by this work may be progressively developed and added to the OM grid through the monitoring strategy.

Under the WCPFC harvest strategy workplan SC is scheduled to agree the OMs for yellowfin tuna in 2026. To enable progress of the mixed fishery framework modelling, SC21 may wish to identify relevant uncertainties upon which an initial grid of OMs can be developed.

Management objectives

Management objectives have been noted for the key fisheries within the WCPFC and used to define the desirable levels of fishing for the management procedures for skipjack, South Pacific albacore and bigeye. However, decisions have not been explicitly made for yellowfin tuna.

We note that CMM 2023-01 states ‘pending agreement on a target reference point the spawning biomass depletion ratio ($SB/SB_{F=0}$) is to be maintained at or above the average $SB/SB_{F=0}$ for 2012-2015’ with regard to yellowfin. WCPFC21 supported a “sequenced approach” to the adoption of TRPs for bigeye and yellowfin, whereby the Commission first addresses the TRP for bigeye tuna and then evaluates its implications for achieving management outcomes for yellowfin tuna (WCPFC21 Summary report, para 432).

Given the challenges in simultaneously achieving TRPs for multiple stocks, WCPFC21 also noted that candidate TRPs may in future be specified as threshold targets for which associated probabilities of being 'at or above' would need to be specified (WCPFC21 Summary report, para 434). This discussion related to both bigeye and yellowfin. At present, modelling for bigeye (SC21-MI-WP-07) has assumed that candidate TRPs represent targets (i.e. those depletion levels are achieved on average).

The use of a threshold TRP for yellowfin may provide flexibility given the multiple MPs that will influence yellowfin stock status. Managers would need to consider their long-term objectives for yellowfin and specify a threshold value for minimum stock status, as well as an agreed level of risk of falling below it, similar to a limit reference point (LRP). A threshold reference point differs from an LRP in that it is used primarily for monitoring performance, whereas breaching an LRP

would trigger more immediate action to rebuild the stock. The probability of falling below an identified threshold TRP should be captured within a performance indicator for yellowfin. SC may wish to consider the role of threshold TRPs within the mixed fishery approach.

We note that in the absence of specific management objectives and a TRP for yellowfin, initial performance indicators to progress the work will include: stock status; probability of falling below the LRP; expected catches, catch variability and catch rates in key fisheries (e.g. purse seine, longline) relative to recent levels; and the probability of falling below any specified threshold stock depletion level.

4. Testing and implementing the mixed fishery framework

As the yellowfin tuna stock is expected to be influenced by at least three other stock MPs, extensive testing of the robustness of the stock under the mixed fishery framework will be needed. Previous analyses have investigated how the MP evaluations of individual stocks can be linked together in the mixed fishery modelling framework through the transfer of effort between model fisheries (Scott et al., 2021).

Currently the northern longline fishery is not a dynamic component within the mixed fishery framework for yellowfin. Table 1 indicates that 1% of the recent total yellowfin catch is from this fishery. This may be considered as a fixed catch level within the evaluations, consistent with the approach currently taken for this fishery in the candidate bigeye MP evaluations, and monitored through the monitoring strategy.

There remains significant yellowfin catch taken by 'other gears' within Region 2 of the assessment model structure (Figure 1). This falls into two elements: those outside archipelagic waters, and hence influenced by the skipjack MP, and those inside archipelagic waters that are not subject to WCPFC MP controls.

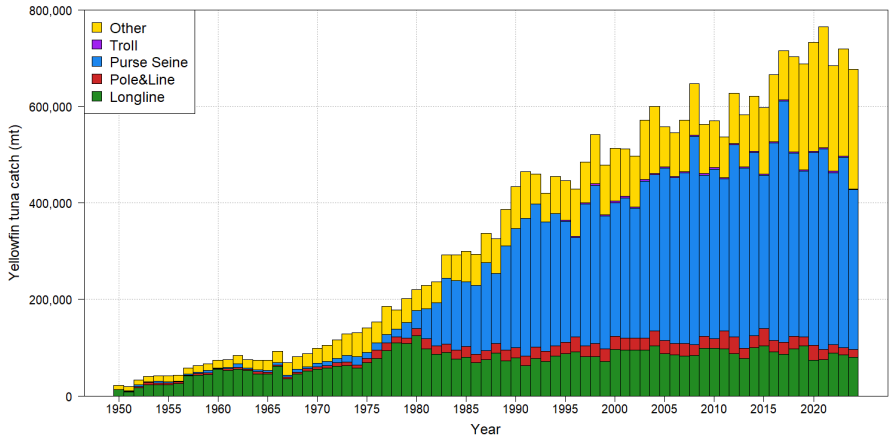

Figure 1. Yellowfin tuna catch (mt) by gear type and year for the WCPFC-Convention Area.

Ideally, in the yellowfin evaluations, the yellowfin catches for Region 2 fisheries outside archipelagic waters would be projected on levels of effort consistent with that required to take the skipjack catch limit specified by the skipjack MP. This procedure is currently limited by available data.

Catches inside the archipelagic waters of Indonesia represent approximately 85% of the recent (2020-2022) yellowfin catch within the Indonesian EEZ. Indonesia has continued to develop a

harvest strategy for yellowfin within its archipelagic waters (e.g. Satria et al., 2023). Dependent on the development of this harvest strategy and the technical feasibility of including it within the mixed fishery framework, it may be necessary to perform one-off sensitivity analyses that examine the potential impact of alternative levels of Indonesian archipelagic waters catch on the yellowfin stock. Assumptions will also need to be made about future catch levels of yellowfin in archipelagic waters elsewhere.

5. Practical implementation

The monitoring strategy and the consideration of exceptional circumstances for yellowfin tuna will be particularly important, given the lack of a yellowfin-specific MP.

The structure of the monitoring strategy will be comparable to that developed for skipjack. Monitoring of yellowfin catch levels within Region 2 of the assessment model will be a key consideration. The role of the WPEA project in further improving the monitoring in this region and identifying wider data sources is highlighted.

In the skipjack MP, exceptional circumstances have been broadly outlined (Annex 4 of CMM 2022-01). Testing within the mixed fishery framework will inform expected fishery performance and guide identification of exceptional circumstances.

6. Timeline and key decisions needed

In the harvest strategy workplan, for 2026:

SC22 is scheduled to:

- agree the operating models for MSE.
- provide advice on performance of candidate management procedures.
- provide advice on relevant elements of the monitoring strategy.

WCPFC23 is scheduled to:

- consider and refine a candidate set of management procedures
- agree a target reference point

We note that under the mixed fishery approach there is no specific yellowfin MP and any ‘candidate management procedures’ for yellowfin referenced in the workplan will refer to the implementation of the other stock MPs.

To facilitate the necessary technical work to meet these targets over the next 12 months, key decisions will be required. These may include:

- **SC21** provides initial guidance on:
    - candidate scenarios for the yellowfin OM grid
    - proposed performance indicators for yellowfin
- **WCPFC22** will need to provide guidance on:
    - the potential role of threshold TRPs for yellowfin tuna and associated acceptable risk of falling below any threshold TRP.
    - the role of the monitoring strategy in triggering management actions related to yellowfin tuna stock status.

We note that decisions must also be made to further develop the bigeye MP evaluations within the mixed fishery approach.

7. Acknowledgements

We gratefully acknowledge funding for this work from the New Zealand Ministry of Foreign Affairs and Trade (MFAT) funded project “Sustainable Pacific Fisheries”.

8. References

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