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ELECTRONIC MEETING

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Terms of Reference for a project to identify appropriate Limit Reference Points for Southwest Pacific Ocean striped marlin and consideration of other billfish species

WCPFC-SC16-2020/ MI-IP-12 (Rev.01)
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Rev 1 includes some minor modifications to text relating to importance of billfish as either targeted or catch components (para 1 in *Scope*), additional text to Activity 6, and removal of a sentence related to recruitment overfishing (para 1 in *Scope, and relevant sections in Appendix 1*).

Background

In response to the WCPFC16 that "*noted with concern the current status of South Pacific striped marlin and agreed to revisit the limit reference point in 2020 at WCPFC17*" (para 54, WCPFC16-2019-outcomes), this document outlines terms of reference (ToR) for a project to identify performance indicators and appropriate limit reference points (LRPs) for Southwest Pacific Ocean striped marlin. While the focal species is striped marlin, the project will also consider the appropriateness of the recommendations for striped marlin for other billfish (i.e. blue marlin, black marlin and swordfish). The work under this ToR would be provided for consideration by SC17 and WCPFC18 in 2021.

The most recent stock assessment for South West Pacific Ocean (SWPO) striped marlin was conducted in 2019 (SC15), using data inputs up until 2017 (Ducharne-Barth et al. 2019). The assessment indicated declining trends in biomass and that levels of depletion and indicators of fishing mortality (F) were in the vicinity of LRPs applied to the key tuna stocks in the WCPO. While uncertainty in the assessment outcomes were notable due to uncertainty in key biological parameters, many of the model runs from the uncertainty grid suggested the stock was likely overfished based on reference points used for tuna species. Concern over a lack of specific management reference points for SWPO striped marlin was raised and that a suitable LRP for this stock should be identified.

The WCPO has commissioned previous detailed work to inform identification of LRPs for key tuna species (Preece et al. 2011) and elasmobranchs (Clarke and Hoyle 2014; Zhou et al. 2019). Reviews of LRP options have also been conducted for the IATTC (Valero et al. 2017). The work by Preece et al. (2011) was followed by WCPFC8 approving a number of SC7 recommendations related to LRPs for key tuna species, thus provided some guiding principles for identifying LRPs for key stocks under the WCPFC jurisdiction, as follows:

- They define a state of the fishery that is considered to be undesirable and which management action should avoid;
- The probability of breaching an LRP should be very low;
- Management actions should be taken before the fishery falls below or is at risk of falling below an LRP.

Furthermore, a 3-level hierarchical approach to defining LRPs for key species was adopted (below). https://www.wcpfc.int/harvest-strategy

Level	Condition	LRPs
Level 1	A reliable estimate of steepness is available	F_{MSY} and B_{MSY}
Level 2	Steepness is not known well, if at all, but the key biological (natural mortality, maturity) and fishery (selectivity) variables are reasonably well estimated.	$F_{X\%SPR_O}$ and either $X\%SB_o$ or $X\%SB_{current,F=0}$
Level 3	The key biological and fishery variables are not well estimated or understood.	$X\%SB_o$ or $X\%SB_{current,F=0}$

However, this approach was largely developed around the key tuna species and has not formally been applied to billfish species in the WCPO.

Objectives of the work under this ToR

1. Review options and identify 'feasible' candidate performance indicators and related LRPs for SWPO striped marlin, including LRPs for biomass depletion, spawning potential and fishing mortality.

2. Identify and provide an assessment of the uncertainties associated with each feasible LRP option and their sensitivities to the various uncertainties identified.

3. Based on outcomes of objectives 1 and 2, recommend performance indicators and related LRPs for SWPO striped marlin, and consider their relevance to other billfish in the WCPO (blue marlin, black marlin, swordfish).

4. Provide an assessment of the appropriateness of the WCPFC hierarchical approach to defining LRPs for striped marlin and other billfish (blue marlin, black marlin and swordfish) in the WCPO.

Scope

As indicted by the guiding principles for defining LRPs (above), an *LRP defines a state of the fishery that is considered to be undesirable and which management action should avoid*. This is a broad definition and could potentially involve undesirable conditions from biological/ecological and socio-economic perspectives. Striped marlin (and other billfish) in the WCPO are generally not key target species, however, they may be important target species for some fleets and more often can be considered an important component of the total catch. Review of LRPs for SWPO striped marlin under this ToR should therefore be based primarily on 'biological sustainability' and 'conservation' objectives as opposed to social or economic considerations.

The scope of this work does not include definitions of probability of breaching any LRP or associated management actions, as these require management and stakeholder advice. The work should report on the uncertainty in estimation of candidate LRPs, considering the available data and other information for striped marlin in the SWPO or elsewhere throughout the species range. A review of existing LRPs for striped marlin or similar species of billfish should be conducted along with the suitability of the WCPO hierarchical approach for defining a LRP for SWPO striped marlin, and billfish in general.

Key activities within the scope of this ToR:

1. Literature review of LRPs used for striped marlin (and other billfish with similar biological characteristics, i.e. blue marlin, black marlin, swordfish) in other jurisdictions,
2. Meta-analysis to provide insights into the levels of depletion and fishing mortality that may serve as appropriate LRPs for SWPO striped marlin and consider relevance for other billfish,
3. Assess the appropriateness of the WCPFC hierarchal approach for defining LRPs for billfish in the WCPO, and if not appropriate recommend alternatives,
4. Review the key data requirements and feasibility of potential LRP options considering currently available information for SWPO striped marlin,
5. Estimate candidate LRPs and their associated uncertainties for SWPO striped marlin, and;

6. Recommend additional information requirements to improve the estimation of LRPs for SWPO striped marlin and other billfish (i.e. blue marlin, black marlin, swordfish) as either target or non-target species.

The project description with estimated budget based on similar work done for tuna species is included as Appendix 1.

References

Clarke, S. and Hoyle, S. (2014). Development of Limit Reference Points for Elasmobranchs. WCPFC-SC10-2014/ MI-WP-07.

Ducharme Barth, N., Pilling, G. and Hampton, J. (2019). Stock assessment of SW Pacific striped marlin in the WCPO. WCPFC-SC15-2019/SA-WP-07.

Preece, A., Hillary, R. and Davies, C. (2011). Identification of candidate limit reference points for the key target species in the WCPFC. WCPFC-SC7-2011/MI-WP-03.

Valero, J.L., Maunder, M.N., Aires-da-Silva, A.M., Minte-Vera, C., and Zhu, J. (2017). Limit reference points in marine resource management and their application for tuna and billfish stocks. Document SAC-08-05e(ii). 8th Meeting of the Inter-American Tropical Tuna Commission.

Zhou, S., Deng, A.R., Hoyle, S., and Dunn, M. (2019). Identifying appropriate reference points for elasmobranchs within the WCPFC. Report to Western and Central Pacific Fisheries Commission, Pohnpei, Federated States of Micronesia.

Appendix 1. WCPFC project template

Project XX	**Terms of Reference for a project to identify appropriate LRPs for Southwest Pacific Ocean (SWPO) striped marlin and other billfish**
Objectives	Provide recommendations for performance indicators and related LRPs for SWPO striped marlin, and consider their relevance for other billfish in the WCPO.
Rationale	In response to the WCPFC16 that "*noted with concern the current status of South Pacific striped marlin and agreed to revisit the limit reference point in 2020 at WCPFC17*" (para 54, WCPFC16-2019-outcomes). This project will aim to identify performance indicators and appropriate limit reference points (LRP) for Southwest Pacific Ocean striped marlin. While the focal species is striped marlin, the project should also consider the appropriateness of the recommendations for striped marlin, for other billfish (i.e. blue marlin, black marlin and swordfish) in the WCPO. The most recent stock assessment for SWPO striped marlin was conducted in 2019 (SC15), using data inputs up until 2017. The assessment indicated declining trends in biomass and that levels of depletion and indicators of fishing mortality (F) were in the vicinity of LRPs applied to the key tuna stocks in the WCPO. While uncertainty in the assessment outcomes were notable due to uncertainty in key biological parameters, many of the model runs from the uncertainty grid suggested the stock was likely overfished based on reference points used for tuna species. Concern over a lack of specific management reference points for SWPO striped marlin was raised and that a suitable LRPs for this stock should be identified. While the WCPFC has developed a 3-level hierarchical approach to defining LRPs for key species (https://www.wcpfc.int/harvest-strategy), this has not yet been applied to billfish species. This project will have the important objectives: 1. Review options and identify 'feasible' candidate performance indicators and related LRPs for SWPO striped marlin, including LRPs for biomass depletion, spawning potential and fishing mortality. 2. Identify and provide an assessment of the uncertainties associated with each feasible LRP option and their sensitivities to the various uncertainties identified. 3. Based on outcomes of objectives 1 and 2, recommend performance indicators and related LRPs for SWPO striped marlin, and consider their relevance for other billfish in the WCPO (i.e. blue marlin, black marlin, swordfish). 4. Provide an assessment of the appropriateness of the WCPFC hierarchical approach to defining LRPs to striped marlin and other billfish (blue marlin, black marlin and swordfish) in the WCPO.
Assumptions	SPC or another regional body has the personnel and budget available to undertake this work.

Scope	While this project will focus on the SWPO striped marlin, other billfish (i.e. blue marlin, black marlin and swordfish) will be considered in relation to the recommendations for striped marlin. Development of LRPs for SWPO striped marlin under this ToR will be based primarily on 'biological sustainability' and 'conservation' objectives as opposed to social or economic considerations. The scope of this work does not include definitions of probability of breaching any LRP or associated management actions, as these require management and stakeholder advice. The work should report on the uncertainty in estimation of candidate LRPs, considering the available data and other information for striped marlin in the SWPO or elsewhere throughout the species range. A review of existing LRPs for striped marlin or similar species of billfish should be conducted along with the suitability of the WCPO hierarchical approach for defining a LRP for SWPO striped marlin and billfish in general. **Key activities within the scope of this ToR:** 1. Literature review of LRPs used for striped marlin (and other billfish with similar biological characteristics, i.e. blue marlin, black marlin, swordfish) in other jurisdictions, 2. Meta-analysis to provide insights into the levels of depletion and fishing mortality that may serve as appropriate LRPs for SWPO striped marlin and consider relevance for other billfish, 3. Assess the appropriateness of the WCPFC hierarchal approach for defining LRPs for billfish in the WCPO, and if not appropriate recommend alternatives, 4. Review the key data requirements and feasibility of potential LRP options considering currently available information for SWPO striped marlin, 5. Estimate candidate LRPs and their associated uncertainties for SWPO striped marlin, and; 6. Recommend additional information requirements to improve the estimation of LRPs for SWPO striped marlin and other billfish (i.e. blue marlin, black marlin, swordfish) as either target or non-target species.
Budget	Salary $25,000 Travel to SC17 $6,000 Total: $31,000