

INTER-AMERICAN TROPICAL TUNA COMMISSION
4TH WORKSHOP ON MANAGEMENT STRATEGY EVALUATION (MSE)
FOR TROPICAL TUNAS

(by videoconference)
20-21 March 2025

HARVEST STRATEGY FOR BIGEYE TUNA IN THE EASTERN PACIFIC OCEAN

The IATTC has adopted elements of a harvest strategy for tropical tunas in the EPO, such as interim HCR and reference points, amended recently to include proxy reference points. However, some elements may need to be refined (e.g. specificity of management objectives, probability of being above target reference points) and other elements added (e.g. type, duration and derivation of management actions) to constitute a complete strategy and help in its evaluation.

This document describes harvest strategy elements already adopted or in development at IATTC for tropical tuna in general and in particular for bigeye tuna, which is the focus of an ongoing Management Strategy Evaluation (MSE). It also outlines some elements in need of refinement or in need of adoption. It is not intended as a complete or agreed strategy, as some items still require further specification or agreement, but instead it is intended as a living document that can be updated as development of harvest strategies, their evaluation and adoption continue at IATTC.

Type of strategy: Model-based (age structured production model with recruitment deviates)

Management cycle: 3 years

Strategy inputs: total catch, Japanese longline index of relative abundance (CPUE)

Limit Reference point: interim as defined in [Resolution C-16-02](#) and its amendment [C-23-06](#). 7.7% equilibrium virgin spawning biomass under a conservative steepness of h : 0.75, fishing mortality associated with that level of B_0 .

Target Reference point: interim as defined in [Resolution C-16-02](#) and its amendment [C-23-06](#). Dynamic reference points are based on B_{MSY} and F_{MSY} . Note that the IATTC scientific staff proposed new proxy reference points for tropical tuna, around $30\%B_0$ ([SAC-15-05](#)).

Management Objectives:

General objectives are defined in IATTC's Antigua Convention's Article IV (c) stating "*to ensure the long-term conservation and sustainable use of the fish and to maintain or restore the populations of harvested species at levels of abundance which can produce the maximum sustainable yield*".

Additional proposed objectives resulting from stakeholder input and IATTC MSE workshops are listed in Table 1.

Performance Indicators: Alternative performance indicators discussed during recent IATTC MSE workshops are listed in Table 1.

Operating models used on the EPO Bigeye tuna MSE:

Based on the model grid from the 2024 bigeye tuna stock assessment ([SAC-15-02](#), [SAC-15-07](#)). Main structural uncertainties of the 2024 bigeye tuna model ensemble that will be carried into the MSE as alternative states of nature includes 36 model configurations with different assumptions on individual growth, selectivity for fisheries (asymptotic or all dome), steepness of the Beverton-Holt stock recruitment relationship (h values: 1.0, 0.9, 0.8), natural mortality (Natural mortality M values for adult male 0.1, 0.12, 0.125, 0.13) and three rates of annual increase in longline catchability (0%, 1%, 2%).

Harvest control rules:

Alternative HCRs were discussed during the 3rd IATTC Workshop on tropical tuna MSE as candidates for evaluation during the bigeye tuna MSE. Figure 1 shows a potential intermediate HCR with a declining/ramping up from the origin to a threshold reference point that acts as an HCR control point at $S_{20\%}$ where fishing mortality is set at $F_{30\%}$. The specific quantities used in the Figure 1 HCR are illustrative only, but are based on what are considered reasonable and consistent with previous decisions or discussions during previous workshops. Some factors to consider. Clearly, action should be taken before a limit reference point is exceeded to avoid the abrupt introduction of restrictive management measures and therefore the fishing mortality should be reduced before the limit is reached. Fishing at levels corresponding to the target biomass level even when the biomass is below the target biomass level will, on average, drive the biomass towards the target. The biomass will fluctuate around the target due to a variety of factors.

Management actions:

A review of alternative management actions and analyses carried out over the past several years by the IATTC staff with respect to the purse seine fishery for tropical tuna in the EPO was conducted by Maunder et al (2021). Tropical tunas in the EPO are currently managed using temporal closures for purse seine vessels and catch limits for longline vessels. Other measures such as capacity limits, full retention, active FAD limits, spatial closures and BET Individual Vessel Thresholds (IVT) are also in place for some fleet components. Presently, only fishing mortality strategies can be tested in the MSE and the relationship between the actual management action(s) and fishing mortality needs to be estimated or assumed.

Exceptional circumstances:

Although exceptional circumstances have not been defined yet, some candidates are outlined below.

- When there is evidence that the stock is in a state not previously considered to be plausible in the context of the management strategy evaluation (MSE);
- When there is new evidence about the biology of the stock that will likely impact the MSE results or fleet structure/or fishing operations have changed substantially;
- When one or a combination of stock status indicators exceed their historical ranges;
- When the number of OBJ sets exceeds the historical status quo level;
- When there is evidence that the data (e.g. longline CPUE index of abundance, sampling/monitoring for the BET IVT program) required to apply the harvest strategy are not available or are no longer reliable or appropriate; and/or,
- When there is evidence that implementation of the HCR (i.e. converting the specified F into actual management action e.g. effort or catch limits) is different than intended or evaluated.
- When a stock assessment indicates that the previous MSE is no longer applicable

- When a stock assessment for the other tropical tuna stocks indicates that another stock requires stricter management measures.

If exceptional circumstances are triggered, the pre-existing management measures shall remain in place until new management measures are implemented, or other action is agreed by the Commission. Actions after the triggering of exceptional circumstances include conducting a full benchmark stock assessment, reevaluation of components of the harvest strategy (data collection, data analyses, available management actions, etc.) and reevaluation of the harvest strategy via MSE.

Table 1. Objectives, quantities and performance indicators.

OBJECTIVE	Quantity	Performance Indicators
<p>Safety Maintain stock above limit reference points</p>	<p><i>Equilibrium virgin spawning biomass S_0</i></p> <ul style="list-style-type: none"> <i>< 10% probability SB below 7.7% of S_0</i> <p>$F_{lim} (< 10\% P F > F_{7.7\% S_0})$</p>	<p>Ratio of S_{yr} over S_0</p> <p>Probability calculated over projected 30 years (All years, any year by replicates)</p>
<p>Status Maintain stock in green quadrant of Kobe plot</p>	<p>$SB \geq$ dynamic SB_{MSY} and $F < F_{MSY}$, 60% probability</p>	<p>% of simulated runs falling in Kobe's green quadrant</p> <p>Probability calculated over projected 30 years</p>
<p>Stability Maintain low variability of catch and effort limits, gradual changes in management measures. Caps at 10% (effort), 15% (catch)</p>	<p>Standard deviation of annual catch, effort</p> <p>Average interannual proportional change (catch, effort)</p>	<p>% change in catch and/or effort between years</p> <p>Calculated over projected 3, 15 and 30 years</p>
<p>Yield/Abundance Maintain catches/effort/CPUE above historical ranges</p>	<p>Average catch/effort/CPUE by fishery (PS and LL)</p> <ul style="list-style-type: none"> 2017-2019 (latest status quo) 	<p>Ratio of projected 3, 15 and 30-year average catch/effort/CPUE by fishery over historical period</p>
<p>Status quo Maintain the stock at levels near the (2017-2019) status quo</p>	<p>Spawning biomass, Index (LL CPUE)</p>	<p>Ratio of projected 3, 15 and 30-year average SB, Index (LL CPUE) over status quo period (2017-2019)</p>

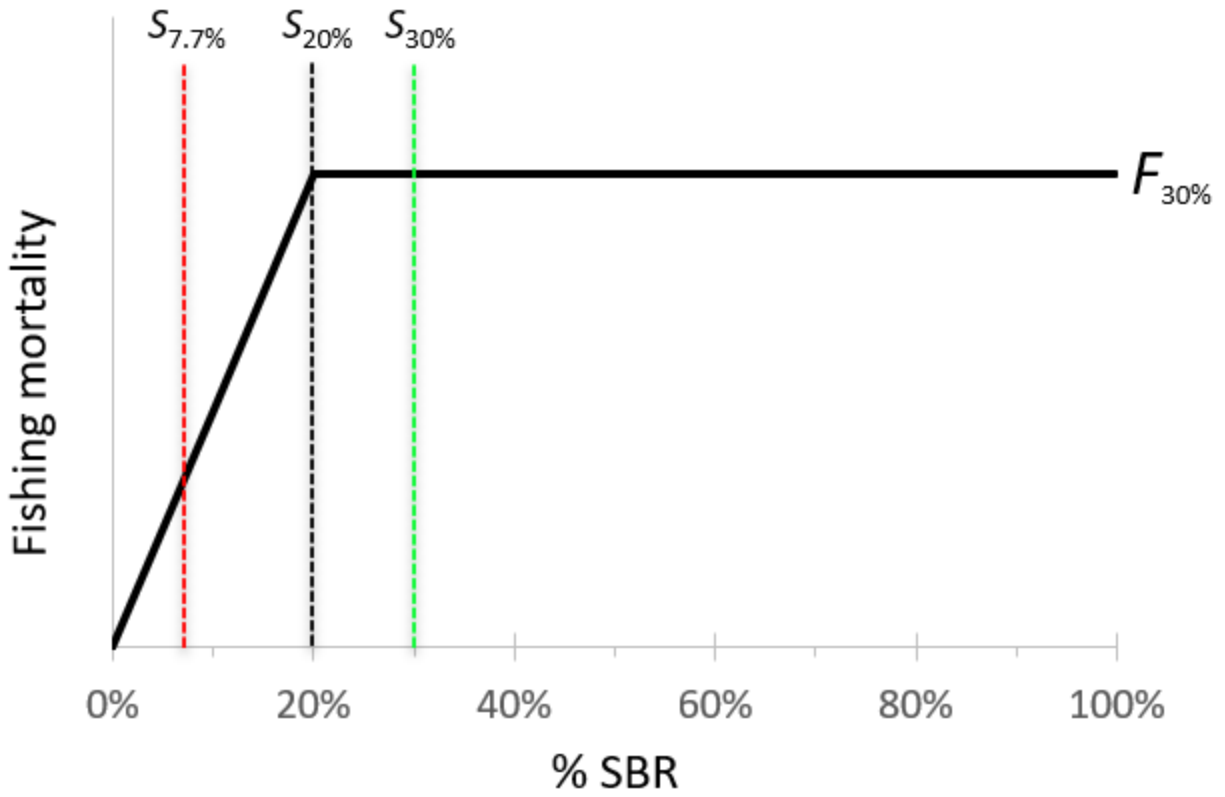


Figure 1. Working harvest control rule for bigeye tuna in the EPO and its relationship to target reference points ($F_{30\%}$, $S_{30\%}$), threshold reference point ($S_{20\%}$) and limit reference point ($S_{7.7\%}$). % SBR is percentage Spawning Biomass Ratio, spawning biomass divided by the spawning biomass in the unfished state.