

Comisión Interamericana del Atún Tropical
Inter-American Tropical Tuna Commission



Review of MSE components used or proposed in other tuna RFMOs

[WSMSE-04-01](#)

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4th IATTC Tropical Tuna MSE Workshop, by videoconference, March 20-21, 2025

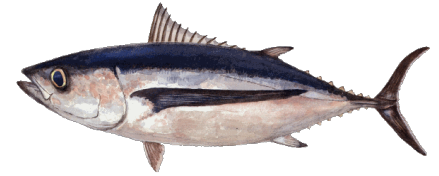


Ejemplos de Estrategias de Ordenación en OROP atuneras

Examples of harvest strategies from tuna RFMOs

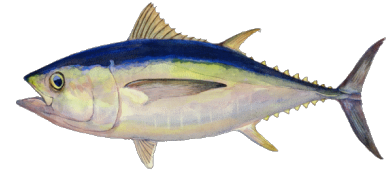
IATTC / WCPFC North Pacific Albacore tuna

Adopted in 2023, elements adopted gradually in previous years



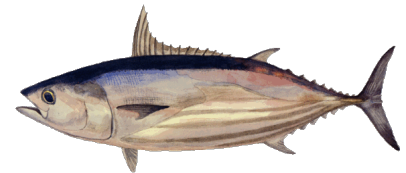
IOTC Bigeye tuna

Adopted in 2022, elements adopted in previous years



WCPFC Skipjack tuna

Adopted in 2022, run for the first time in 2023, implementing arrangements adopted in 2023, monitoring strategy adoption 2024



Atún albacora del Pacífico Norte (CIAT-WCPFC) North Pacific Albacore (IATTC-WCPFC)



Type of strategy: Model-based (full stock assessment)

Management cycle: 3 years

Strategy inputs: Regular stock assessment estimates

Management measures: work on fishing intensity to actual management action ([SAC-15 INF-T](#))

Operating models: 4 representing plausibility and stock productivity

Management Objectives:

- i. Maintain Spawning Stock Biomass (SSB) above the Limit Reference Point, with a probability of at least 80% over the next 10 years.
- ii. Maintain depletion of total biomass around historical (2006-2015) average depletion over next 10 years.
- iii. Maintain fishing intensity (F) at or below the target reference point with a probability of at least 50% over the next 10 years.
- iv. To the extent practicable, management changes (e.g., catch and/or effort) should be relatively gradual between years.

Atún albacora del Pacífico Norte

North Pacific Albacore



Performance Indicators:

- a) Probability that SSB in any given year of the MSE forward simulation is above the LRP
- b) Probability that depletion in any given year of the MSE forward simulation is above minimum historical (2006-2015) depletion.
- c) Probability that catch in any given year of the MSE forward simulation is above average historical (1981-2010) catch.
- d) Probability that catch averaged over years 7-13 of the simulation is above average historical (1981-2010) catch.
- e) Probability that catch averaged over years 20-30 of the simulation is above average historical (1981-2010) catch.
- f) Probability that a decrease in TAC (or catch for mixed control) is $<30\%$ between consecutive assessment periods (once every 3 years), excluding years where TAC=0.
- g) Probability of SSB $>$ SSBthreshold

Atún albacora del Pacífico Norte

North Pacific Albacore



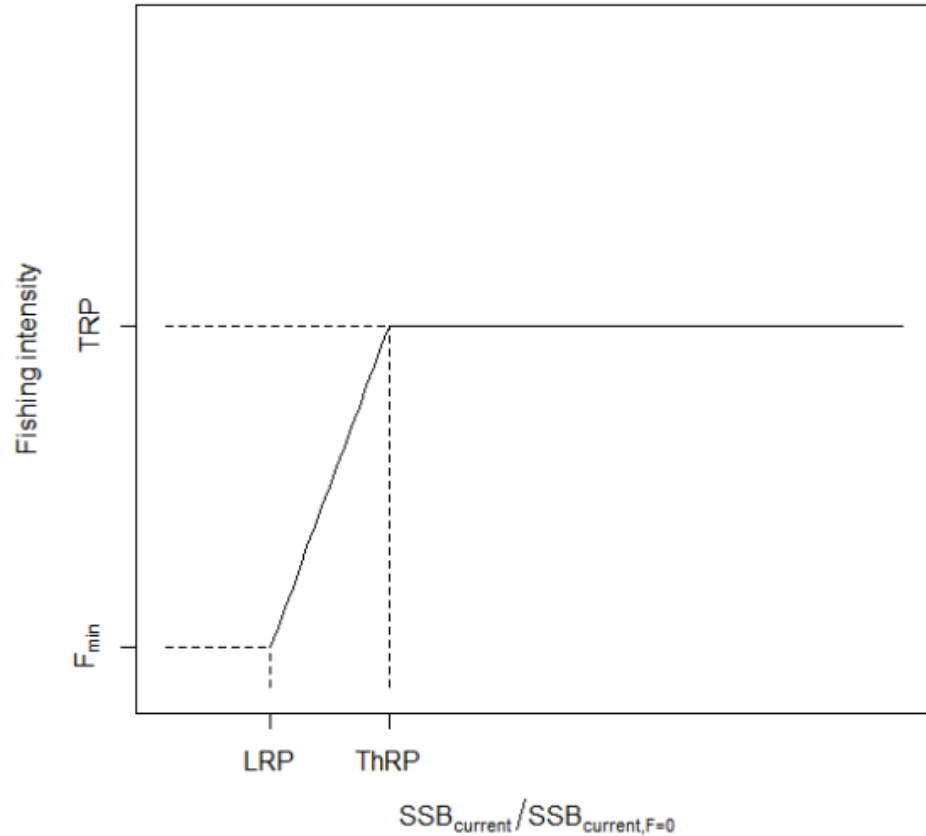
Limit reference point: $LRP = 14\%SSB_{\text{current},F=0}$, which is 14% of the dynamic SSB_0 .

Threshold reference point: $SSB_{\text{threshold}} = 30\%SSB_{\text{current},F=0}$, which is 30% of the dynamic unfished spawning stock biomass.

Target reference point: $TRP = F45\%$, which is the fishing intensity (F) level that results in the stock producing 45% of spawning potential ratio (SPR).

Atún albacora del Pacífico Norte - RCE

North Pacific Albacore - HCR



Atún albacora del Pacífico Norte

North Pacific Albacore



Exceptional circumstances:

Not been adopted yet, criteria developed ([SAC-15 INF-S](#))

- Changes on stock and fleet dynamics beyond previously simulated in the MSE,
- Substantial changes in biology of the stock or fleet structure/or fishing operations
- Data collection required to produce the stock assessment is no longer available/appropriate to apply the adopted harvest strategy) and implementation
- Management action substantially different from what is prescribed by the HCRs

Atún patudo en IOTC

Bigeye tuna in IOTC



Type of strategy: Model-based (simple biomass dynamic model)

Management cycle: 3 years

Strategy inputs: catches and longline CPUE

Management measures: Catch quota

Operating models:

Reference set of 72 OMs, uncertainty combinations of different levels of:

1. Recruitment: (3 levels)
2. Natural mortality: (3 levels)
3. Tag recapture reliability: (3 levels)
4. Assumed longline catchability trend: (2 levels)
5. Regional scaling of longline CPUE (2 levels)
6. Longline fishery selectivity (2 levels)
7. Effective Sample Size of size composition data is (2 levels)

Robustness set of 5 OMs, longline CPUE, overcatch, 3% catchability increase, recruitment reduction shock

Atún patudo en IOTC

Bigeye tuna in IOTC



Management Objectives:

- a) Maintain the stock biomass in the green zone of the Kobe plot, while maximizing average catch and reducing the variation in TAC between management periods.
- b) Spawning stock with 60% probability of achieving target reference point SB_{MSY} by 2034-2038;
- c) Spawning stock avoids breaching interim limit reference point 50%BMSY with high probability

Performance Indicators:

- a) Average catches
- b) Probability of initial catch decrease
- c) Catch variability
- d) Range of Biomass and Fishing mortality at the end of projection period
- e) Probability $B > BLIM$ over the projection period (in robustness test)
- f) Probability $F < FMSY$ over the projection period (in robustness test)
- g) Recovery from a poor recruitment period (in robustness test)

Atún patudo en IOTC

Bigeye tuna in IOTC



Limit Reference Point (Interim): 50% B_{MSY} , 130% F

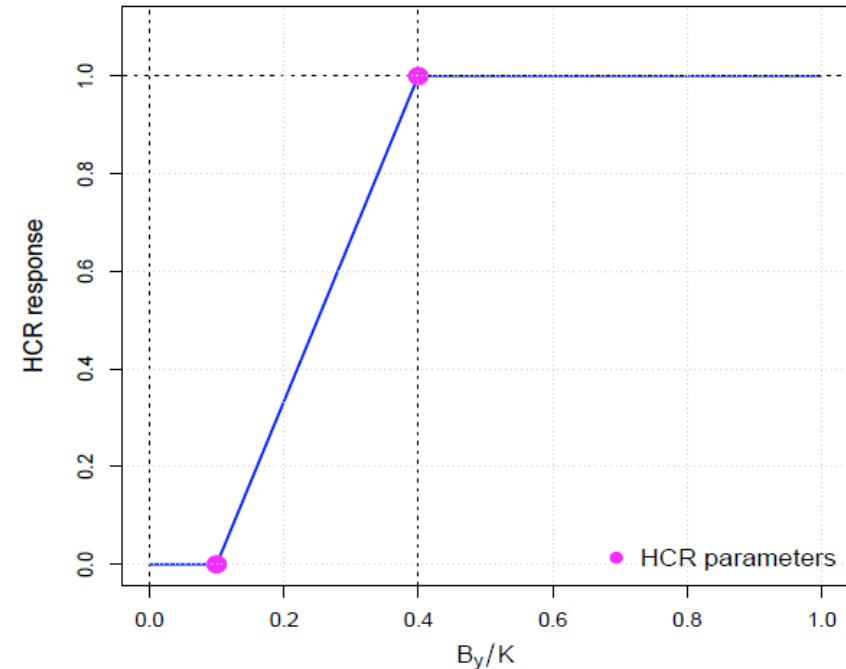
Target Reference Point (Interim): B_{MSY} , F_{MSY}

HCR control points:

40% and 10% of carrying capacity (K)

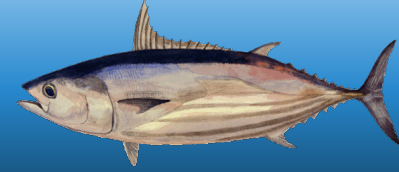
Exceptional circumstances:

Not adopted yet. If triggered, pre-existing TAC shall remain in place until new management action is agreed by the Commission.



Atún barrilete en WCPFC

Skipjack tuna in WCPFC



Type of strategy: model-based

Management cycle: 3 years

Strategy inputs: stock assessment spawning biomass ratio for latest year ($SB_{\text{latest}}/SB_{F=0, t1-t2}$),

Management measures: Effort or catch measures

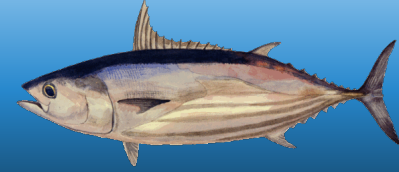
Operating models:

Based on the 2019 skipjack stock assessment, 96 models, representing configurations of Recruitment Variability, Observation Error, Catch and effort, Size composition (ESS), Tag recaptures, Model Error, Steepness, Mixing period, Growth, Movement, El Nino/La Nina, DD catchability, Implementation Error and Effort creep.

Reference set (most plausible hypotheses, used to calculate performance metrics) and a robustness set (considered less likely but still plausible).

Atún barrilete en WCPFC

Skipjack tuna in WCPFC



Management Objectives:

To ensure that:

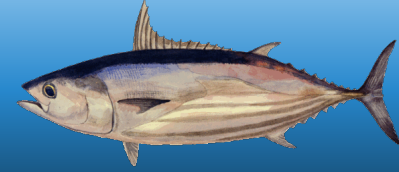
- a) spawning potential depletion ratio is maintained on average at a level consistent with the target reference point;
- b) the spawning potential depletion ratio is maintained above the limit reference point with a risk of the limit reference point being breached no greater than 20%

Performance Indicators:

- a) Maintain SKJ, YFT, BET biomass at or above levels that provide fishery sustainability.
- b) Maximize economic yield from the fishery (average expected catch).
- c) Maintain acceptable CPUE.
- d) Catch stability.
- e) Effort stability: effort variation relative to a reference period.
- f) Proximity of $SB/SBF=0$ to the average $SB/SBF=0$ in 2018-21.

Atún barrilete en WCPFC

Skipjack tuna in WCPFC



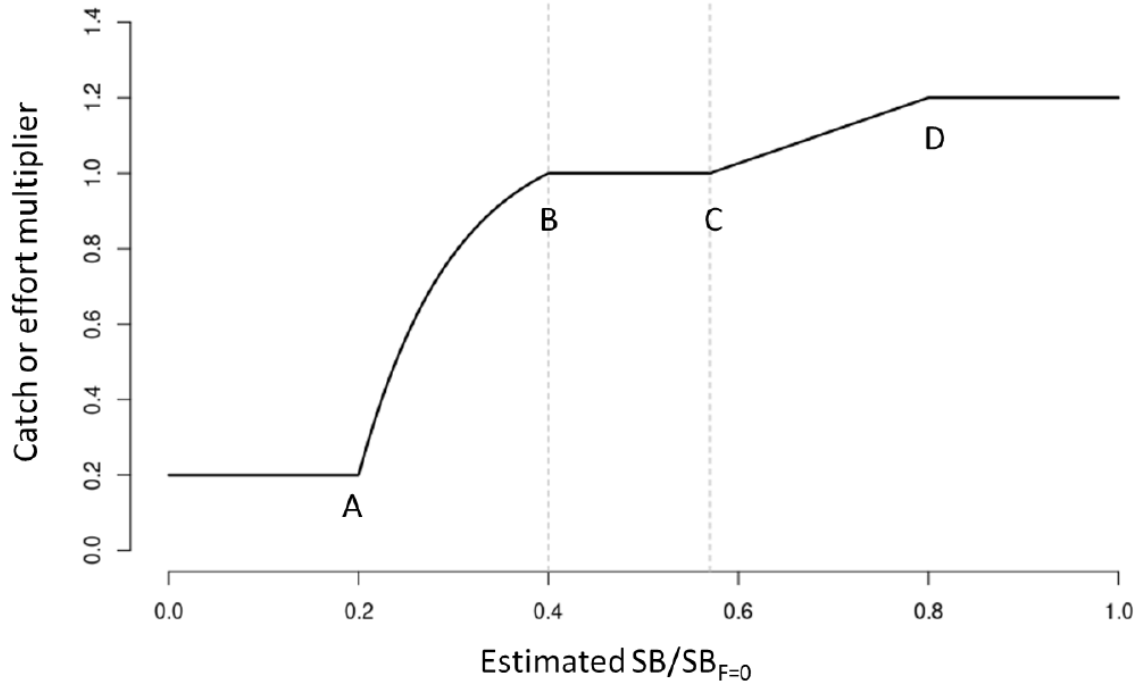
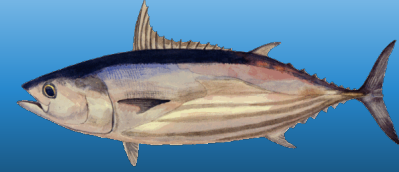
Target reference point: calculated using two biomass depletion levels:

- (a) the equilibrium SSB average depletion level over 2018-2021 and
 - (b) long-term equilibrium SSB that would be reached based on agreed baseline fishing effort.
- The TRP is the average of both depletion levels, as medians from the stock assessment grid.

Limit reference point: 20 percent of the estimated recent (last 10 years) average spawning potential in the absence of fishing.

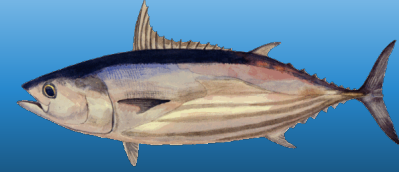
Atún barrilete en WCPFC - RCE

Skipjack tuna in WCPFC - HCR



Atún barrilete en WCPFC

Skipjack tuna in WCPFC



Exceptional circumstances:

Routine annual evaluation and detailed evaluation every 3 years with the stock assessment.

Exceptional circumstances include:

- 1) Persistent low recruitment outside the range for which the MP was tested;
- 2) Substantial improvements in knowledge on dynamics of the population which would have an appreciable effect on the operating models used to test the MP;
- 3) Non-availability of important input data resulting in an inability to run the MP;
- 4) Stock assessment biomass estimates substantially outside the range of simulated stock trajectories in the MP evaluations, calculated under the reference set of operating models;
- 5) significant increases in fisheries not affected by the MP impacting stock depletion;
- 6) Failure of reported catches/effort to be within range of the levels indicated by the MP; and
- 7) Persistent or strong negative outcome in indicators

Summary: some commonalities among tRFMOs

Type of strategy: Some empirical, some model-based with simplified assessment model

Management cycle: 3 years

Strategy inputs: catch and CPUE

Management measures: Catch or effort limits

Operating models: Ensemble based on current stock assessment

Management Objectives:

- Greater than [___]% probability of occurring in the green quadrant of the Kobe matrix
- Less than [___]% probability of the stock falling below BLIM
- Maximize overall catch levels
- Any increase or decrease in TAC between management periods should be less than [___]%.

Performance Indicators:

- Probability of occurring in the green quadrant of the Kobe matrix
- Probability of the stock falling below BLIM
- Average biomass level
- Average catch
- Catch variability i.e. probability of increase or decrease in being above [___]%.

Limit reference point: Varies, some dynamic, some equilibrium B_0

Target reference point: Varies, some dynamic, some equilibrium on varying fractions of MSY quantities (F and B), or biomass and F proxies. In other instances historical ranges of years are considered.

Harvest control rule: Varies, tend to have gradual changes and reduce F as it approaches limit reference points

Summary: EPO BET harvest strategy development

Type of strategy (proposed): Model-based (age structured production model with rec. deviates)

Management cycle (proposed): 3 years

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

Reference points: interim as defined in [Resolution C-16-02](#) and its amendment [C-23-06](#), also [note staff proposed new proxy reference points for tropical tuna \(SAC-15-05\)](#)

Operating models:

Based on 2024 BET stock assessment model grid ([SAC-15-02](#), [SAC-15-07](#)). Main structural uncertainties of the BET MSE as alternative states of nature includes 36 models with different 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 and 3 rates of annual increase in longline catchability (0%, 1%, 2%).



Questions? / ¿Preguntas?

