**INTER-AMERICAN TROPICAL TUNA COMMISSION**

**SCIENTIFIC ADVISORY COMMITTEE**

**16TH MEETING**

**La Jolla, California (USA)**
**02-06 June 2025**

# DOCUMENT SAC-16-11

## STAFF RECOMMENDATIONS FOR MANAGEMENT AND DATA COLLECTION, 2025

**CONTENTS**



## A. MANAGEMENT

### 1. TUNAS

### 1.1. Conservation of tropical tunas: bigeye, skipjack and yellowfin


**Summary**

Resolution C-24-01 establishes conservation measures for tropical tunas in the eastern Pacific Ocean (EPO) during the biennial period of 2025-2026. Therefore, the adoption of a new resolution is not necessary in 2025 to establish conservation measures for 2026, unless the Commission decides otherwise. However, according to paragraph 14 of the Resolution:

> *If the implementation of this measure has positive effects that demonstrate an improvement of the status of the bigeye tuna stock, the scientific staff shall analyze the conservation measures in force in order to submit to the Commission for consideration new measures that consider, among others, reducing the number of closure days or eliminating the "corralito".*

In 2025, the staff evaluated the status of the stocks using various sources of scientific information. In addition to reviewing recent trends in stock status indicators (SAC-16-02), the 2024 benchmark assessments were used to assess the status of bigeye and skipjack tuna (SAC-15-02, SAC-15-04). Most importantly, the staff successfully overcome the challenges encountered during the 2024 exploratory assessment of yellowfin tuna (SAC-15-03), and a new benchmark assessment and risk analysis is now available (SAC-16-03), one the staff considers reliable for providing management advice for yellowfin tuna in

the EPO. Finally, a risk analysis assessing the probability of exceeding reference points was completed for skipjack tuna (SAC-16-04). With this, risk analysis results are now available to support management advice for all tropical tuna species in the EPO.

**RISK ANALYSIS TABLE**. Stock status of yellowfin, bigeye and skipjack tunas, expressed in terms of the probabilities of exceeding the reference points specified in the current interim HCR.

| | Probability (%) of exceeding RP | | |
|---|---|---|---|
| **Target RP** | **Yellowfin** | **Bigeye** | **Skipjack** |
| $F_{cur}>F_{MSY}$ | <7 | 25 | 0 |
| $S_{cur}<S_{MSY}$ | <3 | 47 | 4 |
| **Limit RP** | | | |
| $F_{cur}>F_{LIMIT}$ | 0 | <1 | 0 |
| $S_{cur}<S_{LIMIT}$ | 0 | <1 | <1 |

All three stocks are assessed to be in healthy condition, with low to moderate (for bigeye only) probabilities (risks) of exceeding the reference points. Bigeye tuna remains the species with the highest risk of exceeding the reference points; however, these risks are below 50% for the target reference points and less than 1% for the limit reference point.

In response to the request made to the staff in paragraph 14 of Resolution C-24-01, and based on an evaluation of the best available science in 2025, the staff concluded that the implementation of Resolutions C-21-04 and, subsequently, C-24-01 has had a positive effect on the status of the bigeye tuna stock. The main reason underlying this improvement was the implementation of the IVT program to promote an incentive for fleets to change their behavior and reduce their catches of juvenile bigeye tuna in floating object sets. Furthermore, all tropical tuna stocks in the EPO are currently in healthy condition. Therefore, a reduction in the current measures is possible under the harvest control rule (HCR) specified in Resolution C-23-06.

Under the current HCR, conservation measures for all tropical tuna stocks are determined by the species requiring the strictest measures among yellowfin, bigeye and skipjack tunas. If the Commission elects to pursue a fishing mortality rate that corresponds with the Maximum Sustainable Yield (MSY), this would correspond with a reduction in the closure of the purse seine fishery from 72 to 8 days[1]. The IATTC staff does not recommend this course of action for three reasons: 1) for bigeye, the spawning biomass corresponding with $S_{MSY}$ is relatively low, only slightly above the limit reference point (LRP) of 20% used at WCPFC, and the staff has previously recommended $S_{30\%}$ as an alternative proxy for the interim target reference point, SAC-15-05); 2) if the Commission decides to pursue such significant changes in a conservation and management regime (e.g. large reductions in number of closure days), the staff considers that it would be preferable for such changes to be implemented incrementally to allow for careful evaluation of their effects on the stocks and the ecosystem, and also to help minimize variability in catch and effort; and 3) such adjustments should be made within the framework of an adopted harvest strategy, and the Commission has not yet concluded this work. For these reasons, if the Commission wishes to consider reductions in the measures, the staff recommends that any reduction in the number of closure days be

[1] Calculation of the new closure ignoring any changes in fishing capacity:

$$Closure = 365 - (365 - Closure_{old})\left(\frac{F_{MSY}}{F_{cur}}\right) = 365 - (365 - 72)\left(\frac{1}{0.82}\right) = 8$$

limited to a maximum of 10 days (corresponding to an approximately 15% reduction of the duration of the current closure).

The staff were also requested to provide candidate harvest strategies for managing bigeye tuna (paragraph 43 in Resolution C-24-01). A candidate harvest strategy is presented in SAC-16-06. This candidate harvest strategy could be adopted on an interim basis if a multi-year management cycle is desired.

Accordingly, the staff presents the following two options for consideration should the Commission decide to revise the conservation measures in 2025, and adopt new measures for 2026 and beyond:

- **Option 1:** If the Commission wishes to adopt revised management measures for **2026 only,** a maximum reduction of 10 days in the purse seine fishery closure is recommended (or alternatively a maximum reduction of 7 days if the *corralito* is eliminated).
- **Option 2:** If the Commission wishes to initiate a **new triennial cycle (2026-2028)** with revised management measures, the staff recommends the adoption of the proposed **candidate harvest strategy** (developed in response to paragraph 8 of Resolution C-24-01; see SAC-16-06).

If the Commission decides to pursue significant reductions in management measures, the staff strongly recommends that this should be accompanied by two related decisions. The first is that the Commission maintains the incentive provided by the Individual Vessel Threshold (IVT) program for fisheries to avoid large catches of bigeye, as evidence indicates that this is the primary driver behind the recent improvement in the stock status of bigeye. This would include continuation of the Enhanced Monitoring Program (EMP) or, preferably, adoption of the staff's proposed Integrated Port Sampling Program (IPSP) to merge the EMP with the traditional sampling program (see proposed IPSP in SAC-16-05 developed in response to the Commission's request on paragraph 8 of Resolution C-24-01). Second, the Commission should agree in 2025 to commit the necessary financial and other resources and action to enable the staff to conduct a benchmark assessment for skipjack in 2028-2029, including funding necessary to carry out a tropical tuna tagging program in the EPO during 2026-2027 (see unfunded project in SAC-16 INF-E.b).

### 1.1.1. Background

This background section reviews important science and management outcomes leading to the current stock status of the tropical tuna stocks in the EPO at the start of 2025.

#### a) Safeguarding the *status quo* through tropical tuna conservation Resolution C-21-04 (2022-2024)

At its 98th meeting in 2021, the IATTC adopted Resolution C-21-04, which established conservation measures for tropical tunas during the 2022–2024 triennial management cycle in the eastern Pacific Ocean (EPO). This resolution introduced a package of management measures aimed at preventing fishing mortality from exceeding the *status quo*, defined as the average fishing mortality conditions during the 2017–2019 period.

An important piece of scientific work determining the measures adopted in Resolution C-21-04 was the 2020 risk analysis for tropical tuna management in the EPO (SAC-11-08). According to the 2020 risk analysis results, the stocks of yellowfin, bigeye, and skipjack were all assessed to be in a healthy condition at the start of 2020. For bigeye tuna in particular, the species requiring the strictest management, it was estimated that the fishing mortality ($F$) and spawning stock biomass ($S$) were fluctuating around the target reference points[2], specifically the fishing mortality and the spawning stock biomass corresponding to the

[2] The 2020 risk analysis estimated a 50% probability of fishing mortality ($F$) exceeding $F_{MSY}$ and a 53% probability that spawning biomass ($S$) was below $S_{MSY}$ for bigeye.

maximum sustainable yield ($F_{MSY}$ and $S_{MSY}$). However, the number of floating object sets continued to increase, raising concerns that this trend could lead to fishing mortality exceeding $F_{MSY}$. Resolution C-16-02, defined the harvest control rules for the tropical tunas, implied that new management measures should aim to prevent *F* from exceeding $F_{MSY}$ for bigeye. Accordingly, to maintain the healthy status of these stocks and avoid breaching the *status quo*, Resolution C-21-04 extended most of the provisions of Resolution C-20-06 through 2022–2024, such as the 72-day closure for the purse-seine fishery and catch limits for the longline fishery, and also introduced a new measure to prevent increases in fishing mortality for bigeye. The new measure consisted of Individual Vessel Thresholds (IVT) on annual bigeye tuna catches by purse-seine vessels, which trigger additional closure days for vessels that exceed the thresholds.

**b) Impact of the Individual Vessel Threshold (IVT) program on reducing bigeye catches in 2022-2024**

In 2024, significant improvements were made to the stock assessment for bigeye tuna in the EPO, as reflected in a new benchmark assessment (SAC-15-02). Two major advancements were achieved: first, resolving the prominent regime shift in recruitment associated with the expansion of the floating-object fishery in the mid-1990s; and second, the elimination of the bimodal pattern in management quantities observed in the 2020 benchmark and risk analysis (SAC-11-08), which had resulted from two distinct sets of models, optimistic and pessimistic. Using the 2020 methodological framework, the 2024 assessment included a new risk analysis for bigeye, based on the probability of exceeding reference points defined under the harvest control rule (HCR) in Resolution C-23-06 (amending C-16-02). The results indicate an improved stock status, largely attributed to the implementation of the IVT program during the 2022–2024 management cycle. This improvement is primarily reflected in two key findings:

1 – A significant decrease in fishing mortality (*F*) for young bigeye (1-8 quarters of age) over recent years coinciding with the implementation of the IVT in 2022 (**Figure 1**);
2- A decrease in the probability of exceeding $F_{MSY}$ from 58.5% in 2017-2019 (the *status quo* period) to 24.7% in 2021-2023 (**Figure 2**).

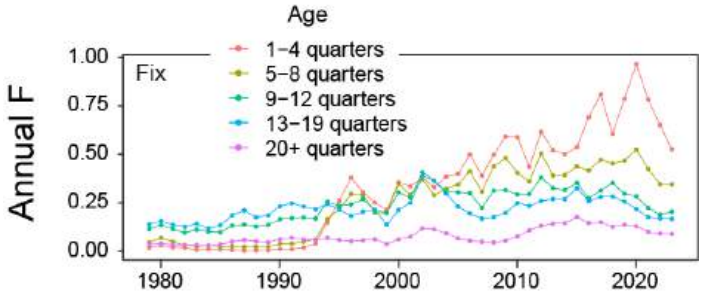


**FIGURE 1.** Comparison of average annual fishing mortality (*F*), by age groups, of bigeye tuna between 1979 and 2023 from the base reference model. The values for each age group are weighted across the second- and third-level hypotheses (see SAC-15-02).
**FIGURA 1.** Comparación de la mortalidad por pesca (*F*) anual promedio, por grupos de edad, del atún patudo entre 1979 y 2023. Los valores para grupo de edad se ponderan en las hipótesis de segundo y tercer nivel (ver SAC-15-02).

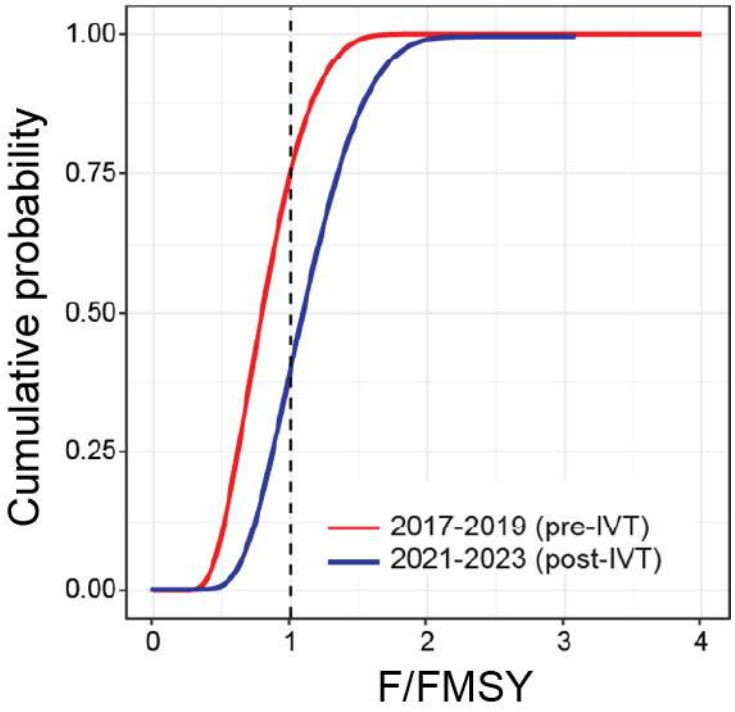


**FIGURE 2.** The joint cumulative probability distribution for fishing mortality (*F*) in 2017-2019 and 2021-2023 relative to their MSY reference points ($F_{MSY}$).
**FIGURA 2.** Funciones de distribución de probabilidad acumulada para la mortalidad por pesca (*F*) en 2017-2019 y 2021-2023 en relación con sus puntos de referencia de RMS ($F_{RMS}$).

The staff also conducted a comprehensive evaluation of the impacts of the IVT scheme on tropical tuna catches and fleet behavior in the EPO (SAC-15 INF-K, SAC-16 INF-S). In summary, the staff estimated that the IVT caused meaningful decreases in catches of bigeye in floating-object sets by class 6 purse seine vessels in 2022, 2023 and 2024. This change appears to have been driven largely by a decrease in catch-per-unit-effort of floating-object sets, as opposed to a decrease in the number of total sets or a shift from floating-object to unassociated sets. The estimated reduction in bigeye catches caused by the IVT takes into account the effects of underlying bigeye abundance. These results are further supported by results showing that highliner vessels[3] appeared to have decreased their probability of catching $\geqslant$ 10 t of bigeye in a floating-object set relative to other background trends in this rate. In a recent anonymous skipper survey conducted in 2024 – 2025, the responses provided some support for the mechanisms behind the estimated reduction in bigeye catches. A majority of respondents (60%) reported having taken steps to reduce bigeye captures since 2022. The most commonly cited measures included changes in fishing locations (~23%), modifications to FAD design (10%), and avoidance of FADs associated with bigeye presence (7%) (SAC-16 INF-S).

**c) Tropical tuna conservation Resolution C-24-01 (2025-2026)**

Since Resolution C-21-04 applied to the 2022–2024 triennial period, a new resolution needed to be adopted in 2024 to establish management measures for tropical tunas in the EPO for 2025 and beyond. Although new benchmark assessments were available for bigeye and skipjack, both indicating healthy stock status, a benchmark assessment for yellowfin was not available in 2024. Consequently, the Commission chose not to modify the primary management measures previously established under Resolution C-

[3] Vessels that historically caught levels of bigeye that could put them at risk of exceeding the IVT (see SAC-15 INF-K for details).

21-04 and extended them into a new biennial management cycle for 2025–2026 through the adoption of Resolution C-24-01. However, the Commission did request the staff to provide advice on updating the conservation measure (Paragraphs 13 and 14) and on a candidate harvest strategy (Paragraph 43).

### 1.1.2. Rationale for staff recommendations

The technical rationale underlying the staff's recommendations for the conservation of tropical tunas in 2025 is summarized below.

#### 1.1.2.a Stock status

In 2025, the staff evaluated the status of the stocks using various sources of scientific information. In addition to reviewing recent trends in stock status indicators (SAC-16-02), the 2024 benchmark assessments were used to assess the status of bigeye and skipjack tuna (SAC-15-02, SAC-15-04). Most importantly, the staff successfully overcome the challenges encountered during the 2024 exploratory assessment of yellowfin tuna (SAC-15-03), and a new benchmark assessment and risk analysis is now available (SAC-16-03), one the staff considers reliable for providing management advice for yellowfin tuna in the EPO. Finally, a risk analysis assessing the probability of exceeding reference points was completed for skipjack tuna (SAC-16-04). With this, risk analysis results are now available to support management advice for all tropical tuna species in the EPO.

The results below summarize the stock status[4] for each of the tropical tunas (bigeye, skipjack and yellowfin) at the start of 2024. The reported status of the stocks is associated with the average fishing mortality ($F$) conditions estimated in the latest benchmark assessments for the tropical tuna in the EPO during 2021-2023. The results of the risk analysis, expressed in terms of the probabilities of exceeding the reference points specified in the current HCR, are presented in **Table 1**. All three stocks are assessed to be in healthy condition, with low to moderate (for bigeye only) probabilities (risks) of exceeding the reference points. Bigeye tuna remains the species with the highest risk of exceeding the reference points; however, these risks are below 50% for the target reference points and less than 1% for the limit reference point (**Table 1, Figure 3**).

**TABLE 1**. Stock status[5] of yellowfin, bigeye and skipjack tunas, expressed in terms of the probabilities of exceeding the reference points specified in the HCR.

| | Probability (%) of exceeding RP | | |
|---|---|---|---|
| **Target RP** | **Yellowfin** | **Bigeye** | **Skipjack** |
| $F_{cur}>F_{MSY}$ | <7 | 25 | 0 |
| $S_{cur}<S_{MSY}$ | <3 | 47 | 4 |
| **Limit RP** | | | |
| $F_{cur}>F_{LIMIT}$ | 0 | <1 | 0 |
| $S_{cur}<S_{LIMIT}$ | 0 | <1 | <1 |

[4] In this report, the terms "overfished" and "overfishing" are not used, because the Commission has not defined the threshold probabilities associated with those terms.

[5] Defined as the spawning biomass ($S$) at the start of 2024 or the average fishing mortality ($F$) during the most recent three years in the benchmark assessment (2021-2023).

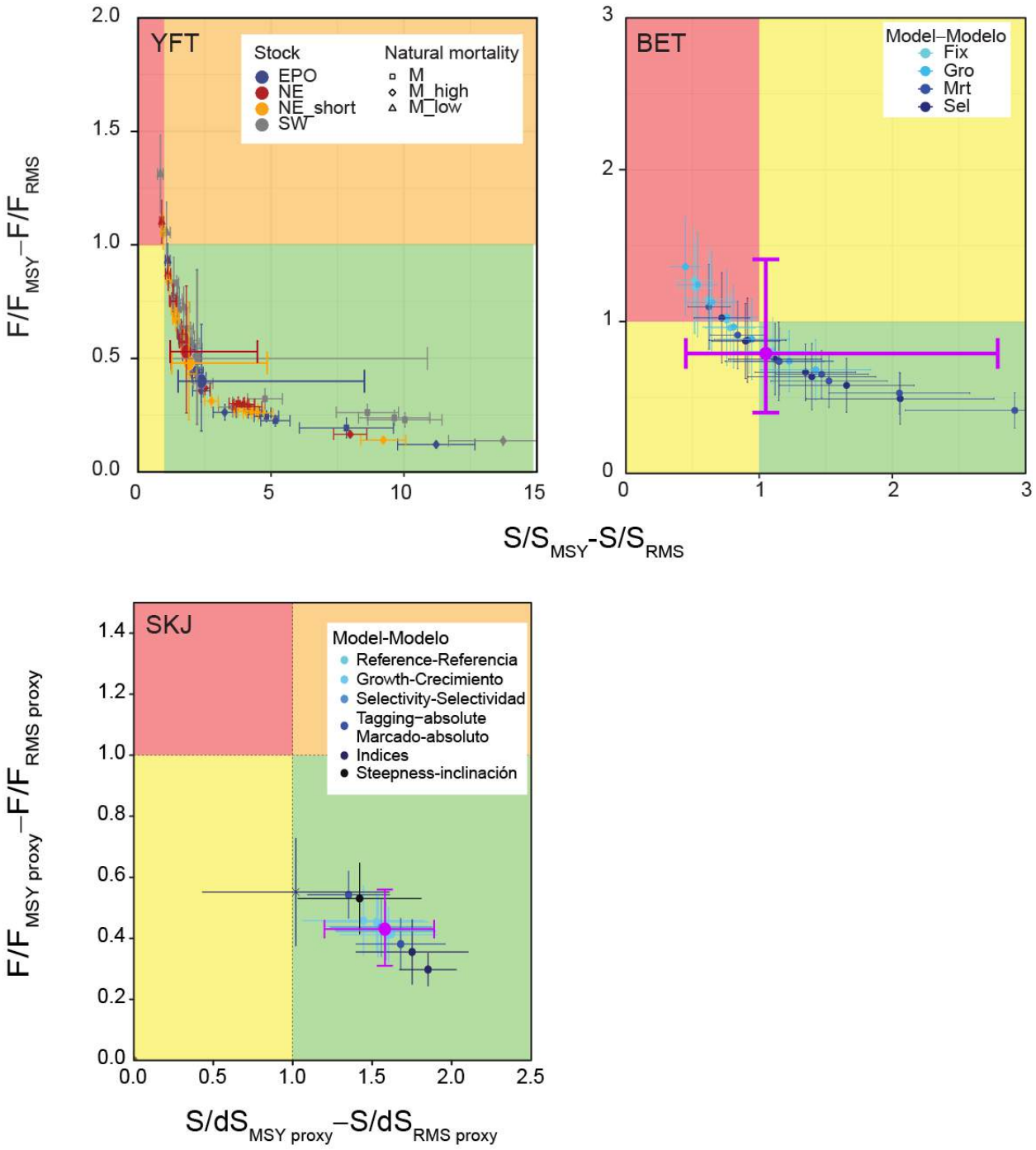


**FIGURE 3.** Kobe plots of the most recent estimates of spawning biomass (*S*) and fishing mortality (*F*) relative to their target reference points ($S_{MSY\_d}$ and $F_{MSY}$ for yellowfin and bigeye, $S_{MSY\text{-}proxy}$ and $F_{MSY\text{-}proxy}$ for skipjack) from the reference models used in the benchmark assessments and risk analysis for a) yellowfin, b) bigeye, and c) skipjack tuna. Each dot is based on the average *F* over the most recent three years, 2021-2023, and the error bars represent the 80% confidence interval of that model's estimates. The large dot and error bars represent the medium and 80% confidence interval of values combined acrtoss models.

**Yellowfin**

The previous benchmark assessment for yellowfin in the EPO was carried out in 2020 (SAC-11-07), and the results were included in a risk analysis for management[6] (SAC-11-08). An attempt to conduct a new benchmark assessment for yellowfin tuna in 2024, as initially planned, was unsuccessful due to by major uncertainties in the stock assessment (SAC-15-03).

Since the 15th Meeting of the Scientific Advisory Committee (SAC) in May 2024, substantial research has been conducted to improve the yellowfin assessment. In 2025, a benchmark sock assessment and risk analysis were conducted for yellowfin tuna in the EPO which the staff considers reliable for management advice (SAC-16-03). The main uncertainty addressed in this benchmark assessment was spatial structure with advances made in determining the areas and spatial definitions of fisheries. A total of 72 models based on three levels of hypotheses were used in the risk analysis. The hypotheses addressed (1) the spatial structure; (2) effort creep, uncertainty in growth and natural mortality; and (3) the steepness of the stock-recruitment relationship. A model starting in 2006 was also conducted to account for the possibility of change in population or fishery dynamics before and after this period to explain differences in information content between the index of relative abundance and length composition data.

The overall results, expressed in terms of the probabilities of exceeding the reference points specified in the harvest control rule (HCR) under Resolution C-23-06, indicate the following (**Table 1, Figure 1**):

- With respect to the target reference points, less than 7% probability that $F_{MSY}$ has been exceeded ($P(F_{cur}>F_{MSY}) < 7\%$) and less than a 3% probability that $S_{cur}$ is below $S_{MSY}$ ($P(S_{cur}<S_{MSY}) < 3\%$).
- Regarding the limit reference points, the risk analysis estimates that there is no probability that the *F* and *S* limit reference points have been exceeded ($P(F_{cur}>F_{LIMIT}) = 0\%$; $P(S_{cur}<S_{LIMIT}) = 0\%$), both below the 10% threshold for triggering an action specified in Resolution C-23-06.

**Bigeye**

Two great improvements were achieved in the 2024 benchmark assessment for bigeye (SAC-15-02). The first one is resolving the prominent regime shift in recruitment coinciding with the expansion of the floating-object fishery in the mid-1990s. The second one is resolving the bimodal pattern in estimated management quantities which resulted from two distinct groups of models, optimistic and pessimistic, in the previous 2020 benchmark and risk analysis (SAC-11-06, SAC-11-08). For bigeye, the risk analysis includes 33 reference models. The hypotheses addressed (1) misfit to the composition data for the longline fishery that is assumed to have asymptotic selectivity; (2) effort creep in the longline fishery; and, (3) the steepness of the stock-recruitment relationship.

The overall results, expressed in terms of the probabilities of exceeding the reference points specified in the harvest control rule (HCR) under Resolution C-23-06, indicate the following (**Table 1, Figure 2a**):

- With respect to the target reference points, a 25% probability that $F_{MSY}$ has been exceeded ($P(F_{cur}>F_{MSY}) = 25\%$) and a 47% probability that $S_{cur}$ is below $S_{MSY}$ ($P(S_{cur}<S_{MSY}) = 47\%$).
- Regarding the limit reference points, the risk analysis estimates that there is very low probability that the *F* and *S* limit reference points have been exceeded ($P(F_{cur}>F_{LIMIT}) = 0.1\%$; $P(S_{cur}<S_{LIMIT}) = 0.2\%$), both below the 10% threshold for triggering an action specified in Resolution C-23-06.

[6] The overall results of the 2020 risk analysis, which included 48 reference models, indicated only a 9% probability that the fishing mortality corresponding to the maximum sustainable yield ($F_{MSY}$) had been exceeded, and there was a 12% probability that the spawning stock biomass corresponding to the maximum sustainable yield ($S_{MSY}$) had been breached. The probability that the *F* and *S* limit reference points had been exceeded was zero.

**Skipjack**

In 2024 the staff completed the first benchmark assessment for skipjack tuna in the EPO. This assessment represents a significant improvement from the *interim* assessment conducted in 2022. It reflects major advancements in the assessment methodologies and incorporates new data sets, including an updated index of relative abundance based on recently developed echosounder buoy data (FAD-08-02), and an absolute biomass estimate derived from the tagging data collected under the Regional Tuna Tagging Program in the EPO (SAC-15 INF-G). There is substantial uncertainty about several model assumptions and sensitivity analyses were conducted and determined that the management advice is robust to the uncertainty.

MSY-based quantities cannot be estimated for skipjack. The tradeoff between growth and natural mortality, in combination with the assumption that recruitment is independent of stock size, implies that fish should be caught at the youngest ages to maximize yield. Therefore, the optimal fishing mortality is infinite. Under these circumstances Resolution C-23-06 allows for the consideration of MSY *proxies* as interim target reference points. Therefore a conservative *proxy* for the target biomass of SBR[7] = 0.3 and the fishing mortality corresponding to that biomass are used as the interim target reference points (SAC-14-09).

In 2025, the results of the 2024 skipjack assessment were incorportated into a risk analysis to evaluate the probabilities of exceeding the interim *proxy* reference points (SAC-16-04). For skipjack, the risk analysis includes 18 reference models. The hypotheses addressed (1) misfit to the composition data for the longline fishery that is assumed to have asymptotic selectivity; (2) effort creep in the longline fishery; and (3) the steepness of the stock-recruitment relationship.

The risk analysis reveals unimodal probability distributions for key management metrics, indicating the following (**Table 1, Figure 2a**):

- With respect to the MSY-proxy target reference points, zero probability that $F_{\text{MSY-proxy}}$ has been exceeded ($P(F_{cur}>F_{\text{MSY-proxy}}) = 0\%$) and a 4% probability that $S_{cur}$ is below $S_{\text{MSY-proxy}}$ ($P(S_{cur}< S_{\text{MSY-proxy}}) = 4\%$).
- Regarding the limit reference points, the risk analysis estimates that there is very low probability that the *F* and *S* limit reference points have been exceeded ($P(F_{cur}>F_{LIMIT}) = 0\%$; $P(S_{cur}<S_{LIMIT}) < 1\%$), both below the 10% threshold for triggering action specified in Resolution C-23-06.

### 1.1.3. Management advice

#### a. Staff response to paragraph 14 of Resolution C-24-01

Resolution C-24-01 establishes conservation measures for tropical tunas in the EPO for the 2025–2026 biennial period. Therefore, the adoption of a new resolution is not necessary in 2025 to establish conservation measures for 2026, unless the Commission decides otherwise. However, according to paragraph 14 of the resolution:

> *If the implementation of this measure has positive effects that demonstrate an improvement of the status of the bigeye tuna stock, the scientific staff shall analyze the conservation measures in force in order to submit to the Commission for consideration new measures that consider, among others, reducing the number of closure days or eliminating the "corralito".*

In response to paragraph 14, and based on an evaluation of the best available science in 2025 (Section

[7] Spawning biomass ratio: SBR; spawning biomass divided by the spawning biomass in the unfished state.

1.1.2), the staff concluded that the implementation of Resolutions C-21-04 and, subsequently, C-24-01 has had a positive effect on the status of the bigeye tuna stock. Furthermore, all tropical tuna stocks in the EPO are currently in healthy condition, specifically yellowfin, bigeye and skipjack. Therefore, a reduction in the current measures is possible under the harvest control rule (HCR) specified in Resolution C-23-06.

**b. Reduction in the closure of the purse-seine fishery**

Under the current HCR, conservations measures for all tropical tuna stocks are determined by the species requiring the strictest measures among yellowfin, bigeye and skipjack tunas. In 2025, this species is bigeye although the risk of exceeding the MSY-based reference points remains below 50% (**Table 1**). To achieve the fishing mortality corresponding to the MSY for bigeye, a reduction in the seasonal closure of the purse seine fishery from 72 to 8 days would be necessary[2]. Such a large reduction is not recommended for various reasons. First, for bigeye, the spawning biomass at $S_{MSY}$, based on current age-specific fishing mortality and stock assessment model assumptions, is relatively low (with a median estimate of 22.2%, SAC-15-02), only slightly above the limit reference point (LRP) of 20% used at WCPFC. Therefore, targeting this level would not align with the IATTC's intention to move toward compatibility with the measures adopted by WCPFC, as reflected in spirit of paragraph 40 in Resolution C-24-01. A biomass target above this level might be more appropriate and also aligned with target biomass levels adopted by other tuna RFMOs (MSE-04-01). The IATTC staff has previously recommended $S_{30\%}$ as an alternative proxy for the interim target reference point (SAC-15-05). Second, if desired, large reductions in management measures should be implemented incrementally to allow for careful evaluation of their effects on the stocks and the ecosystem, as well as to minimize variability in catch and effort. Such adjustments should be made within the framework of an adopted harvest strategy (see Section 1.1.4.a below). For these reasons, if the Commission wishes to consider reductions in the measures, the staff recommends that any reduction in the number of closure days be limited to a maximum of 10 days per year (corresponding to an approximately 15% reduction of the duration of the current closure).

**c. The *corralito***

Paragraph 14 of Resolution C-24-01 specifically mentions reducing the number of closure days or eliminating the *corralito* as possible reductions of the conservation measures. The IATTC has utilized the spatiotemporal closure known as "the *corralito*" as part of its conservation and management measures package for many years. The *corralito* has been in the same location since 2009, but the exact dates of the closure have varied slightly (most recently from Oct 9 to Nov 8 within 2017 through 2024). In response to a request in Resolution C-21-04, the IATTC staff assessed evidence for the effects of the *corralito* on a range of outcomes of the purse-seine fishery in the EPO (SAC-15 INF-M). The new analysis did not find clear empirical effects of the *corralito* on the evaluated metrics (catch, effort, catch-per-unit effort, mean length of tropical tunas, and catches of sharks and other vulnerable non-target taxa). This is not surprising, given the limited expected effect sizes of the *corralito* previously predicted by the staff (IATTC-77-04 REV, Section 3.1). As such, while the staff cannot point to clear empirical evidence confirming the predicted impacts of the *corralito*, the estimates were consistent with the previous predicted levels of impact, on average 3 days of closure for bigeye but with substantial year-to-year variation, on which the original decision to implement the corralito was based. Therefore, this new study should not be considered to substantially change the staff's previous evaluation of the potential benefit of the *corralito* as a tropical tuna management measure (i.e. equivalent to, on average, to 3 days of EPO purse-seine closure for bigeye). Accordingly, if the Commission wishes to consider the elimination of the *corralito* as part of a reduction in management measures, its estimated average effect, equivalent of 3 days of closure for bigeye, should be deducted from the maximum allowable 10-day reduction in the closure (e.g. a reduction up to 7 days and the elimination of the *corralito*).

**d. Request for a candidate harvest strategy for bigeye tuna**

Paragraph 43 of Resolution C-24-01 tasks the staff, in consultation with the SAC, with presenting a candidate harvest strategy for bigeye tuna to the Commission in 2025. Although the Management Strategy Evaluation (MSE) for bigeye is still ongoing and expected to be completed in 2026, the staff is proposing a candidate harvest strategy for consideration by the SAC, the Commission, and the Ad Hoc Working Group on MSE (SAC-16-06). The proposed strategy is based on the best available scientific information, taking into account management objectives, stock and fishery dynamics, the performance of the stock assessment model, insights from IATTC MSE workshops, and lessons learned from MSEs conducted on other stocks, particularly Pacific bluefin tuna (SAC-16 INF-Q). The candidate harvest strategy could be considered in the case that the Commission wishes to adopt measures for a new triennial management cycle (2026-2028) rather than only for 2026. See Section 1.1.4.a for additional information and recommendations on Development of Harvest Strategies for the Tropical Tunas in the EPO.

**e. Additional actions that staff believes should accompany any significant reductions in management measures**

**The IVT and EMP programs are maintained:** The main assumption underlying any reductions in the management measures is that the measure that greatly contributed to the recent reduction in the fishing mortality (*F*) of bigeye remains in place. Specifically, that the IVT program to reduce bigeye catches will continue to work effectively as in recent years (SAC-15 INF-K, SAC-16 INF-S, see section 1.1.1.b) maintaining the lower levels of fishing mortality. In addition, a continuing reduction in *F* on bigeye by the floating-object fishery due to improved effectiveness of the IVT could potentially allow for continuing reductions in the closure increasing fishing opportunities for skipjack and yellowfin. Eliminating the IVT and consequently the motivation for purse-seiners to avoid large catches of bigeye tuna could result in increased bigeye catches on floating-object sets similar those observed before the implementation of this measure (average of 68,000 during 2019-2021 versus 41,000 t during 2022-2024, a 40% decrease). As a result, this would require returning to the management regime associated with the *status quo* period (2019-2021) with a duration of the closure set back to at least 72-days.

An important data collection tool associated with the IVT that also needs to be maintained if any reductions in the measures are planned is the Enhanced Monitoring Program (EMP). The EMP is a provisional sampling program established in 2023 under Resolution C-21-04 in order to fulfill the Commission's request to the IATTC scientific staff for the Best Scientific Estimate (BSE) of bigeye catch per trip and per vessel, in support of the IVT management measure (SAC-14-10, SAC-14 INF-I). Paragraph 8 of Resolution C-24-01 tasks the staff to present to the SAC a proposal to maintain and merge the existing EMP with the Commission's traditional port sampling program. To this end, the staff is proposing the establishment of the IATTC Integrated Port Sampling Program (IPSP, SAC-16-05). The staff supports the merging of the EMP with the traditional port sampling program through the IPSP. In relation to the IVT, the IPSP would provide coverage of prioritized vessel trips similar to or greater than that expected by the EMP in 2025, and would generate data that can be used to estimate bigeye catch per trip from a model of the well-level relationship between port-sampling and observer data (SAC-16 INF-I). In addition, the data collected by the IPSP will be used to estimate fleet-level catch by species, and the variance on those estimates, and update the morphometric relationships necessary for stock assessment modelling. See Section 1.1.4.b. ahead for additional information about the EMP.

**Securing a benchmark assessment for skipjack in 2028-2029:** Finally, if reductions in management measures are being considered, the staff must be able to evaluate the impact of increased fishing mortality on all three tropical tuna stocks in order to provide sound management advice to the Commission. Although there are challenges associated with the stock assessments for all three species, the assessments

for bigeye and yellowfin appear to be secured for at least the next management cycle. This is not the case for skipjack, which is short lived, highly variable, and whose stock assessment depends on the availability of estimates of absolute abundance derived from tagging data. Fortunately, in collaboration with external scientists at Technical University of Denmark (DTU), the staff has developed a spatiotemporal approach to derive estimates of absolute abundance from tagging data (SAC-13-08, SAC-14 INF-E, SAC-16 INF-D). The potential of this approach and its benefits for stock assessment are shown for the first time in the 2024 benchmark assessment for skipjack (SAC-15-04).

The staff's ability to conduct a benchmark assessment for skipjack in 2028–2029 will depend upon the successful implementation of a tropical tuna tagging cruise in late 2026 to early 2027. For skipjack, at least one year of time at liberty is required after tagging and release where fish are recaptured and reported during 2027 and 2028 to provide adequate information for estimating absolute abundance. Consequently, a stock assessment for skipjack could only be conducted in late 2028 or early 2029, after the tags are recovered, reported, and the data are analyzed. To initiate a tagging cruise in 2026, funding must be secured in 2025 (see unfunded project in SAC-16 INF-E.b).

**RECOMMENDATIONS:**

Resolution C-24-01 establishes conservation measures for tropical tunas in the EPO for the 2025–2026 biennial period. Therefore, the adoption of a new resolution is not necessary in 2025 to establish conservation measures for 2026, unless the Commission decides otherwise.

If the Commission chooses to update the conservation measures in 2025, substantial reductions are possible under the harvest control rule specified in Resolution C-23-06. However, the staff recommends that any reductions in management measures be planned incrementally to allow for a careful evaluation of their effects on the stocks and the ecosystem, and also to help minimize variability in catch and effort.

Accordingly, the staff presents the following two options for consideration should the Commission decide to revise the conservation measures in 2025, and adopt new measures for 2026 and beyond:

- **Option 1:** If the Commission wishes to adopt revised management measures for **2026 only,** a maximum reduction of 10 days in the purse seine fishery closure is recommended (or alternatively a maximum reduction of 7 days if the *corralito* is eliminated).
- **Option 2:** If the Commission wishes to initiate a **new triennial cycle (2026-2028)** with revised management measures, the staff recommends the adoption of the proposed **candidate harvest strategy** (developed in response to paragraph 43 of Resolution C-24-01; see SAC-16-06).

**Additional actions that the staff believes should accompany any significant reductions in management measures:**

- **Maintain the incentive provided by the Individual Vessel Threshold (IVT) program for fisheries to continue reducing fishing mortality for bigeye** (see Section 1.1.1.b). This includes the continuation of the EMP program or, preferably, the staff's proposed Integrated Port Sampling Program (IPSP) to merge the EMP with the traditional sampling program (see proposed IPSP in SAC-16-05 developed in response to Commission request on paragraph 8 of Resolution C-24-01).
- **Secure the staff's ability to conduct a benchmark assessment for skipjack in 2028-2029**. This requires securing funding in 2025 to carry out a tropical tuna tagging program in the EPO during 2026-2027 (see unfunded project in SAC-16 INF-E.b).

### 1.1.4. Opportunities and challenges related to management advice

#### a. Opportunity: Development of harvest strategies for the tropical tunas in the EPO

The staff acknowledges that there may always be unresolved issues in knowledge, and inherent limits of modelling complex and changing natural systems and their fisheries, which may impact the scientific advice for taking appropriate management actions. These uncertainties need to be taken into consideration when providing management advice. The "gold standard" in dealing with uncertainty to manage fish stocks is through the development and testing of harvest strategies within a MSE framework. The IATTC is in the process of conducting MSE for tropical tunas with the goal of evaluating the robustness of the management advice and the likelihood of alternative strategies achieving desired management objectives. However, some, if not all, of the harvest strategy elements still need specification or refinement as well as full specification of alternative harvest control rules.

The evaluation of harvest strategies can be conducted using Management Strategy Evaluation (MSE), a process that uses computer simulations to test the robustness of alternative management strategies (designed using stakeholder's input) to different sources of uncertainty. An MSE process for tropical tunas (SAC 15-07, Report of 4th Workshop on MSE, WSMSE-05-01) is ongoing at IATTC, with an initial focus on bigeye given that it has been historically the tropical tuna driving management measures.

Implementing reliable stock assessments to act as operating models is an essential part of the MSE process. The bigeye assessment has been evolving over time with several substantial improvements being made recently. The 2020 bigeye assessment still had substantial uncertainties, including a bimodal pattern in management quantities (one group of models with estimates of biomass above the level corresponding to maximum sustainable yield ($B_{MSY}$), another group below $B_{MSY}$ with little probability in between) along with an apparent regime shift in recruitment coincidental with the increase of floating object purse seine catches in the 1990s that was suspected to be a modelling artifact. Although the 2020 assessment models covered the range of uncertainties, this led to operating models that may not result in the best strategy being selected had a better set of operating models been available. Recently, substantial changes in modeling of bigeye tuna (SAC-15-02) related to data, biology, and model specifications, with input from panel recommendations of the two recent stock assessments external reviews (RVDTT-01-RPT and RVMTT-01-RPT), removed the apparent regime shift in recruitment estimates and the bimodal pattern in management quantities. Since the 2024 assessment has resolved many of the structural issues of previous bigeye assessments, using that assessment for the operating models in the update of the MSE should result in a better strategy being selected.

Staff revisited target reference points for tropical tunas in 2024 (SAC-15-05) following concerns about the definition of the target reference point and estimated highly depleted stock levels at MSY ($S_{MSY}/S_0 = 0.17$) for some scenarios of the 2024 bigeye tuna assessment given recent changes in the assumptions about age-specific natural mortality. A more global approach to defining MSY, which is designed to support a range of proportioning of catch among the fleets, occurs at a less depleted biomass ($S_{MSY}/S_0 = 0.3$). The staff has proposed to consider $S_{MSY}/S_0 = 0.3$ as interim target reference point until discussions under a comprehensive Management Strategy Evaluation framework process determine target reference points based on a variety of objectives.

These changes prompted the staff to revise the workplan for the bigeye tuna MSE work by replacing the original set of operating models with a new set of operating models derived from the 2024 bigeye tuna benchmark assessment, as well as incorporating proposed alternative HCRs and reference points. The staff's organized MSE dialogue component has included a series of educational and stakeholder input workshops (see recent Workshops).

The revised timeline includes bigeye MSE work during 2025 and 2026, with plans to expand the MSE work to the other tropical tunas (likely skipjack next and then yellowfin).

Resolution C-24-08 created the Ad Hoc Working Group to Strengthen the Dialogue among Scientists, Managers and other Stakeholders on Management Strategy Evaluation (Working Group on MSE), expected to convene its first meeting on May 31, 2025. It is expected that this WG will enhance or replace the staff organized workshops in the near future, and help expedite the development and testing of harvest strategies at IATTC.

**Request to provide a candidate harvest strategy**

Paragraph 43 of Resolution C-24-01 tasks the staff, in consultation with the SAC, with presenting a candidate harvest strategy for bigeye tuna to the Commission in 2025:

> *The IATTC shall continue efforts to develop harvest strategies for tropical tunas. The IATTC scientific staff shall continue to establish the scientific basis, through Management Strategy Evaluation testing, to advise the Commission on initial candidate harvest strategies, starting with bigeye tuna. The staff, consulting with the SAC, shall then present for the Commission's consideration in 2025 a candidate harvest strategy for bigeye tuna, including candidate management actions to be taken under various stock conditions.*

A set of candidate harvest strategies tested through Management Strategy Evaluation (MSE) is not yet available due to the ongoing nature of the IATTC's MSE process. Therefore, the staff has proposed a candidate harvest strategy, based on best available science, for consideration by the SAC, the Commission, and the Ad Hoc Working Group on MSE (SAC-16-06). This proposed strategy synthesizes management objectives, stock and fishery dynamics, the performance of the stock assessment model, insights from IATTC MSE workshops, and lessons learned from MSEs conducted on other stocks, particularly Pacific bluefin tuna (SAC-16 INF-Q). The candidate harvest strategy could be considered if the Commission wishes to adopt measures for a new triennial management cycle (2026-2028), rather than for 2026 alone (see Option 2 in recommendations under Section 1.1.3).

The staff's candidate harvest strategy could also facilitate the development of alternative candidate harvest strategies within the MSE process. It is fully specified and includes all the necessary components, making a suitable a starting point, while taking into consideration previous discussion during the IATTC staff's workshops, for the specification and discussion of alternative strategies. The staff's candidate harvest strategy will be presented at the 5th IATTC MSE workshop (May 30, 2025), allowing for discussion during the 1st meeting of the IATTC Ad Hoc WG on MSE (May 31, 2025) prior to SAC-16.

**RECOMMENDATIONS:**

1. The Commission adopt management objectives (WSMSE-05-01 , SAC-16-06) and revised reference points for tropical tunas (SAC-15-05).
2. If the Commission wishes to initiate a new triennial cycle (2026-2028) with revised management measures, the staff recommends the adoption of the proposed candidate harvest strategy (developed in response to paragraph 8 of Resolution C-24-01, SAC-16-06)
3. Continue development and testing of harvest strategies for tropical tuna in the EPO with support from the IATTC WG on MSE.

**b. Opportunity: Integrated Port-Sampling Program for data collection for scientific research in support of fisheries management**

The management measure for bigeye tuna catch thresholds per vessel (IVT) for the EPO Class 4 – 6 purse-seine vessels, established in Resolution C-21-04 and ratified by Resolution C-24-01, utilizes the Enhanced Monitoring Program (EMP) as a science-based support tool. The EMP started in 2022 with a pilot study for the development of a well-level sampling protocol through the intensive within-well sampling of 71 floating-object-set wells from 42 trips. Since March 2023, this program has been collecting port-sampling data that allows for the estimation of the bigeye tuna caught by a vessel during a fishing trip and a measure of precision on that catch estimate. As of the first quarter of 2025, the EMP has sampled 1,224 floating-object-set wells and provided Best Scientific Estimates (BSEs) of bigeye tuna catch per trip based exclusively on those sample data for 166 trips (SAC-16 INF-H).

Scientific analyses related to the development of the EMP trip-level sampling protocol, identified several potential areas for improvement to the sampling protocol for fleet-level species catch estimation that is implemented through the Traditional Port-Sampling (TPS) (SAC-16 INF-J). Key features of the improved protocol include random selection of trips, wells, and fish groups within the well. The purpose of these and other features is to: 1) minimize bias by eliminating opportunistic data collection practices; 2) allow greater flexibility in stock assessment modelling by removing temporal and spatial sampling restrictions; and, 3) reduce the estimated variance on species composition estimates for the floating-object fishery by obtaining greater within-well sampling coverage for floating-object-set wells. Additionally, EMP data for 2023-2024 were used to develop a model for the well-level relationship between the EMP estimates of the proportion of bigeye tuna in the well and those from the observer for the same wells (SAC-16 INF-I). This model, updated with recent data, could be used in the future to predict well-level bigeye tuna catch from observer data for unsampled wells and trips of vessels historically covered by the EMP, providing an alternate approach for obtaining trip-level BSEs when sufficient port-sampling data are not available for a sample-only estimate.

Based on this research, the recommendations of the first external review of the data used in stock assessments for tropical tunas in the eastern Pacific Ocean, held in October of 2023, and in response to the task given on paragraph 8 of Resolution C-24-01, that requires the scientific staff perform an analysis of components, actions, technical feasibility, implications for scientific output and budget needed to merge objectives and actions of the EMP and the TPS, including any suggested improvement to the latter, the scientific staff proposes the creation of the Integrated Port-Sampling Program (IPSP) (SAC-16-05). The IPSP would serve as the operational platform that implements the collection of port-sampling data under the improved sampling protocol for fleet-level species catch estimation, and would support other scientific needs, such as the collection of morphometric data to update the morphometric relationships necessary for stock assessment modeling. In support of the IVT, the IPSP would provide sampling coverage of prioritized vessel trips similar to or greater than that expected by the EMP in 2025, and would generate well-level data that can be used to obtain BSEs of bigeye tuna catch per trip using the model of the well-level relationship between port-sampling and observer data.

**RECOMMENDATIONS:**

Establish the Integrated Port Sampling Program (SAC-16-05) as a regular program at the IATTC, to merge the scope of the Enhance Monitoring Program (EMP) and the traditional Port Sampling Program. The IPSP will support data collection for scientific research in support of fisheries management and continuing development of harvest strategies for the tropical tuna in the eastern Pacific Ocean

### 1.2. Pacific bluefin tuna

The Pacific bluefin tuna working group of the International Scientific Committee for Tuna and Tuna-like Species in the North Pacific Ocean (ISC) completed a benchmark assessment of the species in 2024 (SAC-15 INF-N). The stock achieved the second rebuilding target of 20%$SSB_{F=0}$ in 2021, 13 years earlier than originally scheduled. The working group has also conducted a Management Strategy Evaluation (MSE) (SAC-16 INF-Q).

IATTC Resolution C-24-02 establishes management of Pacific bluefin tuna in the EPO for the period 2025-2026 defining total commercial catches and biennial catch limits for each CPC.

The assessment evaluates several catch scenarios, with different increases in catch and different distributions of the catch between small and large fish and between the eastern and western Pacific Ocean. Catching larger fish increases the total catch in weight for a given level of rebuilding. While most catch increase scenarios maintain the probability of spawning biomass being above the second rebuilding target 20%$SSB_{F=0}$ by 60% or more, some of the scenarios have a 10% or higher probability of being below the interim limit reference point of 7.7%$SSB_{F=0}$, at least once by 2041, and high probability of breaching potential target reference points, including the 30% proxy proposed by the staff for tuna, billfish and other highly migratory fishes (SAC-14 INF-O). The Joint IATTC-WCPFC-NC Working Group requested additional scenarios that reduce these probabilities. However, without specific target and limit reference points defined for the IATTC, these scenarios cannot be evaluated appropriately by the staff. In addition, these projections have been superseded by the MSE process.

Target and limit reference points have not been defined for Pacific bluefin tuna. Preferably, permanent or interim reference points would be defined so that catch scenarios can be appropriately evaluated. For example, a target proxy reference point of 30%$SSB_{F=0}$ (dynamic), and associated F, as proposed by the staff for highly fecund pelagic spawning species managed by the IATTC, and the limit reference point 7.7%$SSB_0$ (equilibrium) currently used for tropical tunas in the EPO, should be considered (SAC-14 INF-O; SAC-15-05). This recommendation is related to Harvest Control Rules 11 and 12 requested for MSE evaluation by the JWG. However, the staff recognizes that adopting reference points is challenging and progress in the MSE process will identify reference points and evaluate harvest control rules in context of these reference points.

The Harvest Control Rules (HCRs) requested for MSE evaluation by the JWG have been evaluated under a set of operating models based on performance metrics. The assessment working group has provided some clear patterns in the performance of the HCRs. For example, HCRs with a spawning biomass control point close to that associated with the F target have higher catch variability and there is a tradeoff between the level of catch and catch stability. In addition, robustness tests show that the HCRs, which are all based on spawning biomass, do not perform well in scenarios of a low recruitment regime. The staff recommends that one of the HCRs should be selected taking these performance metrics into consideration. The staff also recommends that recruitment should be monitored, and an exceptional circumstance that activates additional analyses and/or management when several years of low recruitment is identified should be included in the harvest strategy. Future work should focus on improving the HCRs to ensure they are robust to possible low recruitment scenarios (e.g., use an estimation model that includes information on recruitment, base implemented values for F and consequent catch on estimates of biomass for young individuals. A more inclusive measure of biomass other than spawning biomass should be considered for the HCR).

**RECOMMENDATIONS:**

1. Reference points should be adopted (e.g. taking into consideration those proposed in SAC-14 INF-O).
2. Choose one of the harvest control rules requested by the Joint IATTC-WCPFC-NC Working Group and tested using MSE (SAC-16 INF-Q), considering performance relative to the possible future reference points for bluefin tuna (e.g. the reference points proposed in SAC-14 INF-O) and other performance metrics.
3. Recruitment should be monitored, and the harvest strategy should include provisions for an exceptional circumstance that triggers additional analyses and/or management actions if several consecutive years of low recruitment are observed.
4. Future work should focus on improving the harvest control rules (HCRs) to ensure they are robust to potential low recruitment scenarios and other factors (e.g. using an estimation model that incorporates recruitment data, basing implemented fishing mortality (*F*) values and resulting catch levels on estimates of biomass for young individuals). A more inclusive measure of biomass other than spawning biomass should be considered for the HCR.

### 1.3. North Pacific albacore tuna

The North Pacific albacore tuna is assessed routinely by the Albacore Working Group (ALBWG) of the International Scientific Committee for Tuna and Tuna-like Species in the North Pacific Ocean (ISC). The ALBWG completed a benchmark stock assessment in 2023. The assessment results indicate that:

1. The spawning biomass in 2021 (54% of $SSB_{current, F=0}$[8]) was higher than the threshold and limit reference points (30% $SSB_{current, F=0}$ and 14% $SSB_{current, F=0}$, respectively).
2. The average fishing mortality during 2018-2020 ($F_{59\%SPR}$; the fishing intensity that results in the stock producing a SPR[9] of 59%) was below the target reference point ($F_{45\%SPR}$; the fishing intensity that results in the stock producing a SPR of 45%).

[8] Dynamic spawning biomass in 2021 under no fishing.

[9] Spawning potential ratio is the female spawning stock biomass per recruit (resulting from a fishing mortality pattern) relative to the female spawning biomass per recruit in the unfished population. The fishing intensity can be measured as 1-SPR.

3. The Working Group concluded that the north Pacific albacore stock is likely not overfished relative to the threshold and limit reference points adopted by the WCPFC and IATTC and is likely not experiencing overfishing relative to the target reference point.

In 2023, the Commission adopted a harvest control rule with elements specified in Resolution C-23-02. The harvest control rule parameters define the relationship between stock status and fishing intensity.

The staff has collaborated with the ISC to develop criteria for identifying exceptional circumstances for north Pacific albacore tuna that would result in suspending or modifying the application of the adopted harvest strategy, and potentially may require updated Management Strategy Evaluation simulation work (SAC-15 INF-S). Three general elements will be considered when evaluating possible exceptional circumstances for north Pacific albacore: stock and fleet dynamics, application, and implementation. In 2025, one minor change was made from the previous version of the exceptional circumstances per ISC25 plenary's request.

The staff has also collaborated with the ISC to provide scientific advice on interpreting the fishing intensity metric from the harvest strategies in terms of catch and effort management measures (SAC-15 INF-T). The ALBWG recommends that the change in fishing intensity required by the harvest strategy can potentially be translated into catch reductions for all fleet groups, and effort reductions for surface fleet groups and two Japanese longline fleets that likely target north Pacific albacore. Effort management is less precise than catch management in terms of changing the fishing intensity for surface fleet groups.

**RECOMMENDATIONS:**

1. Based on the adopted harvest control rule (C-23-02) and the 2023 assessment result that there is more than 50% probability that $SSB_{current}/SSB_{current,\ F=0}$ is above the threshold reference point, fishing intensity should be maintained at or below the target fishing mortality reference point.
2. The change in fishing intensity required by the harvest strategy is potentially translated into catch and effort measures according to the relationships described in SAC-15 INF-T.
3. CPCs should consider the criteria developed by the ALBWG for identifying exceptional circumstances for north Pacific albacore tuna (SAC-15 INF-S).

### 1.4. South Pacific albacore tuna

In collaboration with the IATTC, the Pacific Community (SPC) conducted a benchmark stock assessment for South Pacific albacore tuna in 2024. This assessment is based on a spatially-explicit stock assessment model in which the South EPO is included as a single area with multiple fishery fleets using an areas-as-fleets approach. Structural uncertainty in natural mortality and steepness were explored in this benchmark assessment using a Monte Carlo ensemble model approach with 100 models.

Based on the ensemble of models, the estimated reference points for albacore tuna in the South Pacific are:

1. The median depletion for the recent period ($SB_{2019\text{-}2022}/SB_{F=0}$) is 0.48 with a 10$^{th}$ to 90$^{th}$ percentile interval of 0.36 to 0.62.
2. All models in the uncertainty ensemble had $SB_{2019\text{-}2022}/SB_{F=0} > 0.2$, the limit reference point for WCPFC key tuna stocks.
3. The median recent spawning biomass is well above the MSY level (median $SB_{2019\text{-}2022}/SB_{MSY}$ is 3.02 with a 10$^{th}$ to 90$^{th}$ percentile interval 2.04 to 5.21).
4. The median recent fishing mortality as a ratio of that corresponding the MSY ($F_{2019\text{-}20122}/F_{MSY}$) is

0.18 with a 10th to 90th percentile interval of 0.06 to 0.44.

In summary, the benchmark assessment suggests that the South Pacific albacore stock is healthy and the recent fishing mortality is much lower than the fishing mortality at MSY. For albacore in the south EPO, the spawning biomass ratio in 2022 (spawning biomass divided by dynamic spawning biomass in an unfished condition) is estimated to be slightly below 0.5 (Figure 5).

Finally, it should be noted that a process has been initiated in coordination with WCPFC towards the establishment in the near future of a joint working group on South Pacific albacore, taking into consideration the very positive precedent of the work done in the IATTC-WCPFC Joint Working Group on Pacific bluefin tuna.

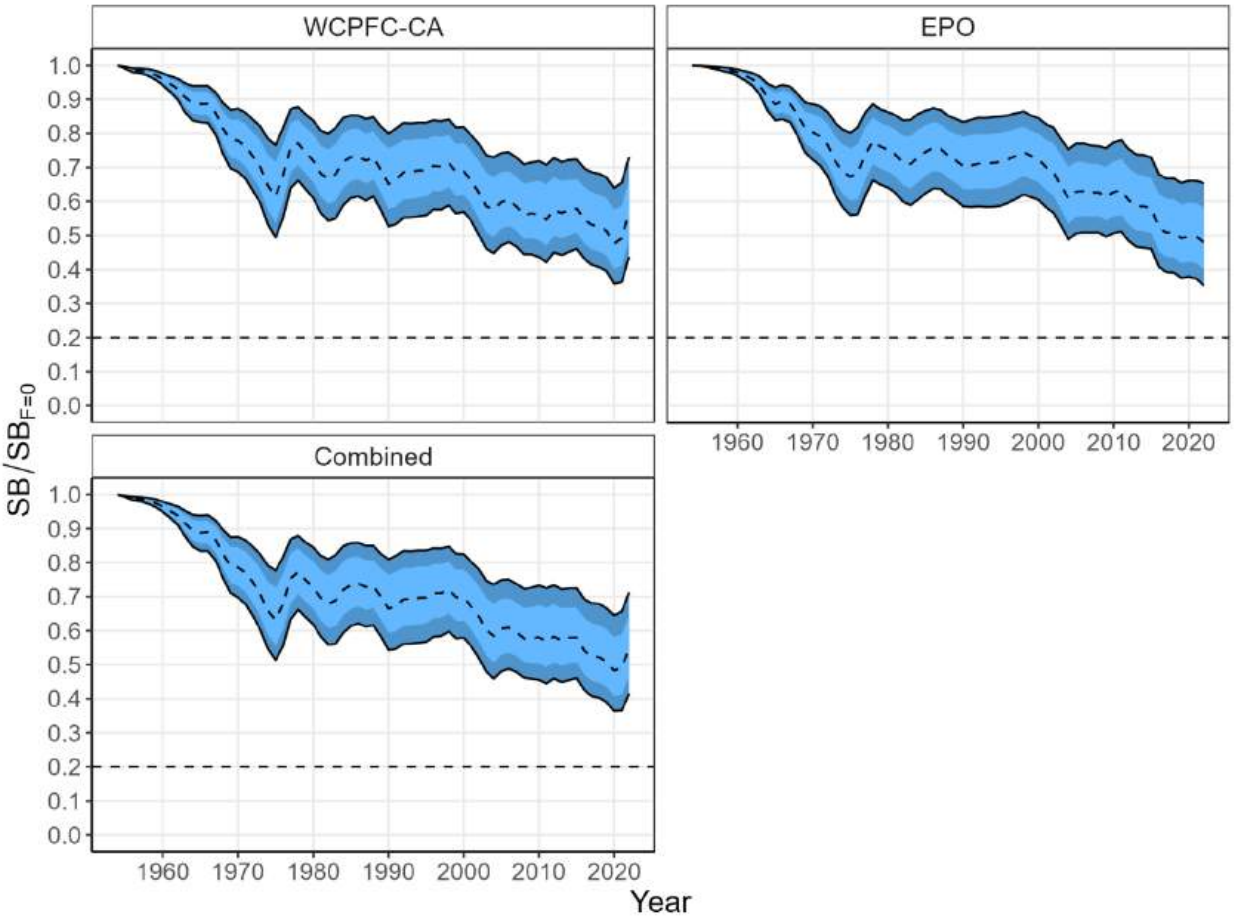


**FIGURE 5.** Estimated 90% (dark blue) and 75% (light blue) quantiles of dynamic depletion rate for south Pacific albacore by management region from the model ensemble. The dashed line within the interval indicates the median. This figure is modified from Figure 58 in SAC-13 INF-S.

**RECOMMENDATION:**

1. Continue collaborating with the Pacific Community (SPC) to monitor the stock status of South Pacific albacore tuna (*e.g.*, using sock status indicators and conducting another benchmark assessment in 3-4 years).
2. That the Commission consider favorably efforts to establish a joint working group with WCPFC in order to facilitate coordinated managment strategies for South Pacific albacore tuna.

### 1.5. South Pacific swordfish

The IATTC staff have finalized the benchmark assessment for south EPO swordfish (SAC-14-15), which was possible due to the collaboration with several CPCs, national scientists and other colleagues (SWO-01-REP). The data up to 2019 was included. There is uncertainty in the stock structure, and three hypotheses were proposed. The initial reference model considered the hypothesis that all catches in the EPO south of 10°N are part of the S EPO stock, as there is support for connectivity between equatorial area and the area south of 5°S, which was the 2011 assessment stock structure assumption, and one of the hypotheses considered. The third stock structure hypothesis was that the stock extends to 170°W and 10°N, including the area of high catches in the central Pacific Ocean. The catch data compiled for the EPO south of 10°N showed a dramatic increase since the mid-2000s. The average catch per year from 2000 to 2009 was about 15,000 tons, while the average catch per year for 2010 to 2019 almost doubled to about 29,000 tons. In the last three years of the compilation (2017 - 2019) the average catch was about 34,000 tons a year. The fleets that are currently the most important are the Spanish longline fleet, which catches about 30% of the total catches in weight, followed by the Chilean gillnet fleet with 22%, and the Ecuadorian longline fleet with 20%.

Associated with the increase in catches, there was a clear increase in the indices of abundances, which was a continuation of the trends already apparent in the 2011 assessment. To inspect the possibility that the increasing trend was not real but an artifact of a particular index (for example because of changes in target), several indices were constructed using catch and effort data from different longline fleets and from gillnets. No index was considered ideal to represent the stock due to a range of limitations of each one, but all shared the increasing trend in the last 20 years. Four hypotheses were proposed to explain the simultaneous increase of catches and indices of abundance, which included both the possibilities that the increase is either real or not (increase in availability). Dynamic reference points used only for illustrative purposes, indicated that the stock is approaching the hypothetical biomass TRP (of 40% unfished biomass) for one of the hypotheses and is larger for the other hypotheses (SSBcurrent/SSBF=0> 0.5). In any case, the stock is not approaching the hypothetical limit reference point (20% unfished biomass), which is also only to illustrate the stock status (Figure S1). All models estimate a strong increase in fishing mortality since the start of the fishery in the 1950's. The fishing intensity is slightly above the fishing intensity target reference point for one of the hypotheses and below for the other models (Figure S2).

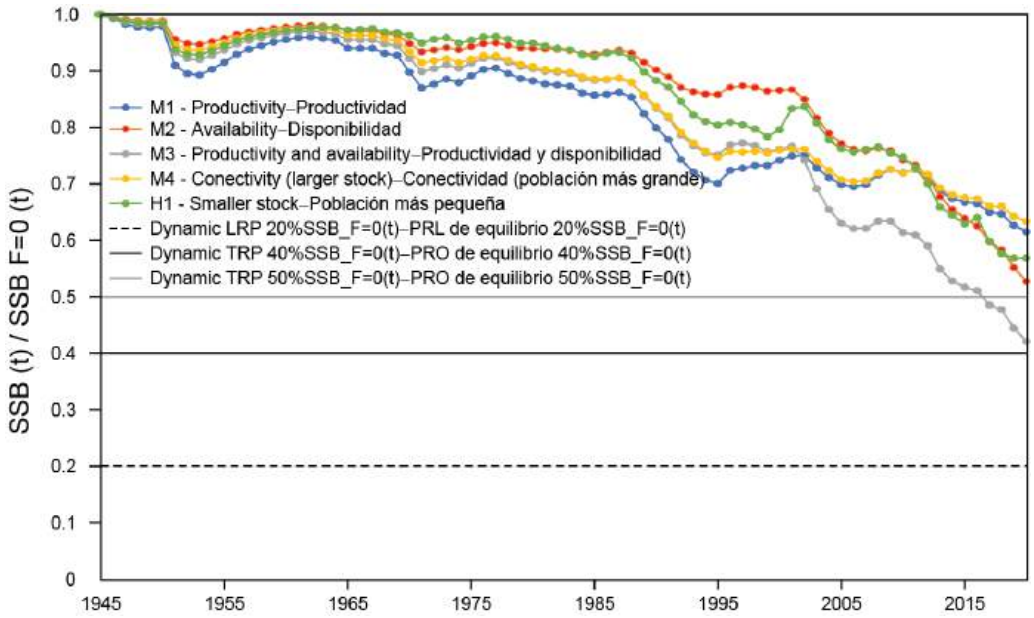


**FIGURE S1.** Ratio of the estimated spawning stock biomass and spawning stock biomass with no fishing (dynamic) for the models corresponding to the four hypotheses that explain the simultaneous increase in indices of abundance and catches and the model corresponding to the stock structure hypothesis H1 (north boundary at 5°S). Note that M4 corresponds to the stock structure hypothesis H3 (western boundary at 170°W).

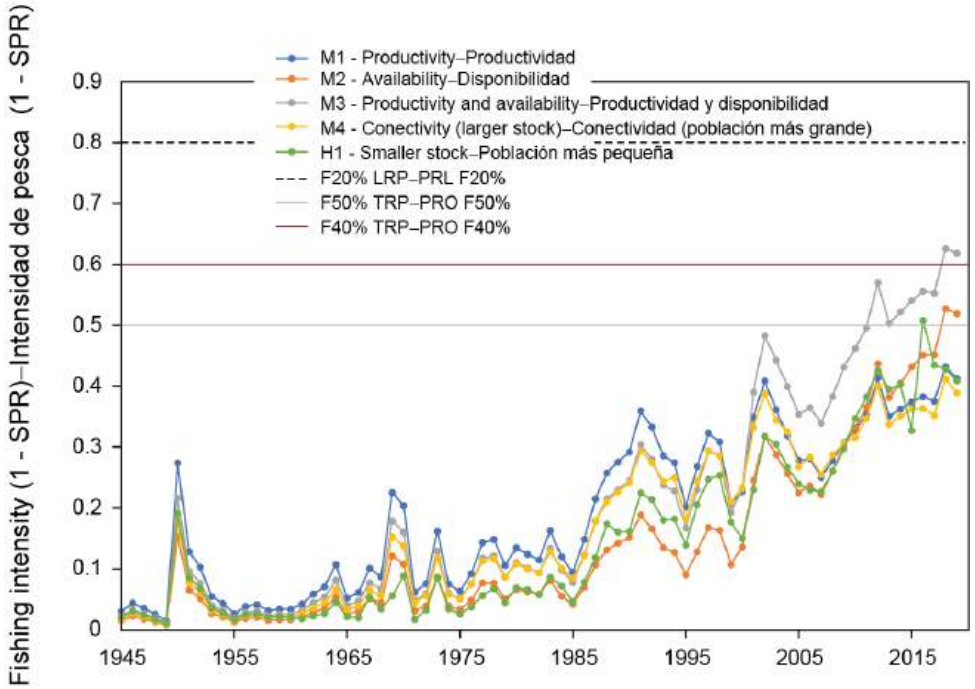


**FIGURE S2.** Fishing intensity (1-SPR) for the models corresponding to the four hypotheses that explain the simultaneous increase in indices of abundance and catches and the model corresponding to the stock structure hypothesis H1 (north boundary at 5°S). Note that M4 corresponds to the stock structure

hypothesis H3 (western boundary at 170°W). Fishing intensity is a proxy for fishing mortality, based on SPR (proportion of the spawning biomass produced by each recruit with fishing relative to biomass per recruit in the unfished condition, Goodyear 1993). Large SPR are indicative of low fishing mortality, thus a proxy for fishing mortality is 1-SPR.

There is not enough information in the current data to determine the relative plausibility of the different hypotheses that may explain the simultaneous increases in catch and indices of abundance. There is external evidence that an increase in productivity of the stock may be plausible due to increase in the main prey of swordfish in the South EPO, the jumbo squid. If this is the case, management of the stock should account for potential decreases in productivity if the prey species decreases in abundance. Nevertheless, the other hypotheses are also plausible and should be considered.

Due to the large uncertainties in both stock structure and the effect of fishing on the stock, the staff recommends that the stock be closely monitored though indicators and assessment, and that CPCs should continue to report operational level (set-by-set) catch and effort data to IATTC, size and age composition, as well as other pertinent data towards this end. The staff also recommends that future research should focus on information that could help discriminate among these hypotheses such as genomics, close-kin mark-recapture studies, electronic tagging studies, habitat modelling and changes in habitat over time and investigating changes in fishing strategies. Finally, the staff recommends that reference points be adopted for the stock, for example those suggested in SAC-14-INF-O.

**RECOMMENDATIONS:**

1. Continue to monitor the stock (e.g., using stock status indicators and conducting benchmark assessments in 3-5 years).
2. Adopt interim reference points for the stock taking into consideration those proposed in SAC-14 INF-O.