

Summary of the U.S. Stakeholder Meeting on Harvest Strategy Components for a Management Strategy Evaluation for Pacific Bluefin Tuna

April 19, 2023

Pacific Islands Regional Office And West Coast Region

On April 19, 2023, National Marine Fisheries Service (NMFS) Pacific Islands Regional Office and West Coast Region hosted a webinar to gather input from U.S. stakeholders on inputs for a management strategy evaluation (MSE) for Pacific bluefin tuna (PBF). NMFS posed several questions to participants, and used the input received during the webinar to draft the summary below, as well as to develop a draft proposal to refine candidate harvest control rules and reference points (see Appendix I). A background paper and slides presented during the webinar are included in Appendices II and III, respectively.

During the webinar, NMFS presented the proposed operational management objectives and performance indicators that were proposed by the United States and subsequently revised, but not adopted at the 7th Meeting of the Joint Inter-American Tropical Tuna Commission (IATTC) - Northern Committee (NC) Working Group on the Management of Pacific Bluefin Tuna (JWG), and solicited comment on prioritizing the objectives or revising them further. Several participants supported prioritizing management objectives related to safety first and secondly, status. Another participant expressed support for prioritizing the management objective related to yield, specifically regarding proportional fishery impact between the eastern and western and central Pacific ocean. However, another participant stated that if the yield objective was not acceptable for other members at the JWG, that they hoped the United States would be able to find a path forward. Participants suggested any caps on changes to catch limits between management periods should apply both upward and downward to promote stability, and inclusion of a biomass-based target reference point in the objectives.

NMFS also reviewed the candidate harvest control rules (HCRs) and reference points that were adopted by JWG and NC in 2019. While noting that the International Scientific Committee for Tuna and Tuna-Like Species in the North Pacific Ocean (ISC) had requested the JWG consider refining the candidates, NMFS requested input from participants on retaining or setting aside any of the original candidates or input on any additional candidates for consideration. Several participants supported dropping HCRs 2 and 3. One participant suggested considering the development of an empirically based HCR for the entire size composition of the fishery, or creating an additional variant of HCR 1 that references a biomass-based target reference point (TRP) such that reductions in fishing intensity would occur between this biomass-based TRP and the limit reference point (LRP). Participants had no comments on preferences between HCRs 1a or 1b. A participant asked if the fishing intensity could be calculated for those fisheries that are not targeting PBF, and NMFS said they were not aware of what this level would be, but a participant noted it would be important to allow a *de minimis* level of catch considering we know there are several passive gears that are currently incidentally catching PBF. On the candidate reference points, several participants suggested eliminating the lowest candidate reference points

and allowing either 15% of the unfished spawning stock biomass ($SSB_{F=0}$) or 20% $SSB_{F=0}$ as candidate LRPs. There was also a suggestion to add a candidate TRP of FSPR35%, which represents a fishing intensity that leads to 35% of the SSB per recruit (or spawning potential) that there would have been in an unfished situation (i.e., removing 65% of the unfished SSB per recruit).

Additional topics were raised by participants. On the MSE, participants also noted the preliminary evaluation of some of the candidate harvest control rules by Tommasi et al. (2023)¹ did not include uncertainty around biological parameters and that it will be important to re-evaluate performance with greater uncertainty factored in. When asked if Japan still had a dedicated MSE person assisting the working group, NOAA Fisheries stated that there has been some turnover, but the entire ISC's Pacific Bluefin Tuna Working Group is very involved in the development of the MSE. A participant also asked about the loss of the Japanese troll recruitment index, and if any data from the eastern Pacific Ocean (EPO) could help inform the assessment. NMFS stated that size data from the EPO is included in the stock assessment, but is not used to inform recruitment because we do not have a good understanding of the proportion of fish that migrate from the western Pacific Ocean to the EPO.

The meeting concluded with NMFS indicating that they would develop a meeting summary to share with the Permanent Advisory Council to the U.S. Section of the WCPFC, the General Advisory Committee to the U.S. Section of the IATTC, and the Pacific Council, and that information received may be considered in developing positions and proposals to JWG8.

¹ Tommasi et al. (2023) conducted a preliminary, simplified MSE on the existing candidate harvest control rules and reference points from the 2019 Joint Working Group recommendation. The paper can be found on the ISC website: https://isc.fra.go.jp/pdf/PBF/ISC23_PBF_1/ISC23_PBF_1_14.pdf

APPENDIX I

REFINING CANDIDATE REFERENCE POINTS AND HARVEST CONTROL RULES FOR PACIFIC BLUEFIN TUNA

Proposal by the United States of America to the Eighth IATTC and WCPFC-NC Joint Working Group Meeting on the Management of Pacific Bluefin Tuna

Explanatory Note

In 2019, the Northern Committee at its 15th Regular Session adopted candidate reference points and harvest control rules (HCRs) for management of Pacific bluefin tuna with the intent that these may be used in a future management strategy evaluation (MSE) (see Attachment G of [NC15 Summary Report](#)).¹ Since then, the International Scientific Committee for Tuna and Tuna-like Species in the North Pacific Ocean (ISC) has begun the MSE process and, in 2022, recommended reducing the number of candidate reference points and HCRs because it is infeasible to evaluate the full suite in the 2019 recommendation.

Additionally, in 2022, the IATTC and WCPFC, adopted harvest strategies that referenced a harvest control rule for North Pacific albacore that is similar to HCR 1a because it contains limit, threshold and target reference points (LRP, ThRP and TRP, respectively).

In March 2023, the ISC Pacific Bluefin Working Group (PBFWG) reviewed [Tommasi et al. \(2023\)](#) which conducted a preliminary examination of the performance of the candidate model-based HCRs for Pacific bluefin tuna. The results indicate that

- The greater the distance between the TRP and the ThRP and LRP results in a smaller likelihood of breaching the ThRP and/or LRP, respectively.
- Some HCRs are able to maintain a decrease in median catch between management periods of 15% or less, but due to high variability in recruitment, all HCRs saw at least one management period with greater than 15% decrease in catch
- There is no single best performing HCR as there are tradeoffs in management objectives
 - HCRs with higher F_{target} performed best in terms of safety and stability, but resulted in lower annual catch
 - HCR shapes 1a and 1b performed similarly in terms of safety, status and yield metrics, but HCR shape 1b had lower stability than HCR shape 1a
 - For the same F_{target} , HCR shapes 1a and 1b performed better than HCR shape 2 in terms of yield and safety, but worse in terms of stability.

¹ For clarity, this paper uses the same names for the HCR shapes as those in Attachment G of the [NC15 Summary Report](#).

- In comparing performance of HCR shapes 1a and 1b which include a minimum fishing level (F_{\min}), the value of F_{\min} did not generally have a large impact on performance

The United States is proposing the following changes to the 2019 recommendation:

- Remove HCRs 1b, 2 and 3. Tommasi et al. (2023) found HCR1a and 1b had similar results, but the HCR 1b had lower stability than HCR1a with TRPs of F10, F15, and F20, and for some F30 HCRs. HCR 2 does not comport with the HCR shape referenced in the harvest strategies agreed to by the WCPFC and IATTC in 2022 in that it does not use two control points. HCR 3 was not evaluated in Tommasi et al. (2023), but with recently uncertain indices of abundance for small fish, it may not be feasible in the near future. The United States would encourage the ISC to explore potential for an empirically-based HCR after review of available indices during the 2023 data preparatory meeting.
- Test the HCRs with and without a built-in limit to ensure that any change in total allowable catch (TAC) between consecutive management periods is no more than [20%].
- Test the HCRs with an allocation based on the recent exploitation pattern and with an allocation tuned to reach the WCPO: EPO fishery impact ratio of [70:30].
- Remove candidate limit reference points (LRPs) $5\%SSB_{F=0}$, $7.7\%SSB_{F=0}$; remove candidate ThRPs $15\%SSB_{F=0}$; remove candidate TRPs FSPR10%, FSPR15%, and FSPR20%; and remove candidate F_{\min} of $5\%F_{\text{target}}$. The United States does not want to retain LRPs of $5\%SSB_{F=0}$ and $7.7\%SSB_{F=0}$ as they represent levels of the stock that are lower than the reference point used in U.S. domestic legislation, below which a stock would be considered overfished. Removing $5\%SSB_{F=0}$ and $7.7\%SSB_{F=0}$ has implications on the ThRP and TRP candidates as if LRPs are potentially $15\%SSB_{F=0}$ or higher—it would not make sense to have a ThRP $15\%SSB_{F=0}$ or less because HCR 1a requires a ThRP higher than the LRP, and the TRPs of FSPR 10%, 15% and 20% would result in depletion levels likely at or below the candidate LRPs and ThRPs. Add FSPR35% because based on the chosen TRP for albacore, it may be helpful to evaluate a TRP between FSPR30% and FSPR40%. Tommasi et al. (2023) found minimal differences in HCR 1a performance between the candidate F_{\min} of $5\%F_{\text{target}}$ and $10\%F_{\text{target}}$, so the United States is proposing to move forward with one candidate F_{\min} of $10\%F_{\text{target}}$.

Candidate HCRs

The HCR is illustrated in Figure 1 where fishing mortality is controlled depending on stock status relative to the defined reference points. The F_{target} rate applies when the stock is larger than $SSB_{\text{threshold}}$, while F_{min} rate applies when the stock is smaller than SSB_{limit} , and there is a linear transition in F for stock sizes between SSB_{limit} and $SSB_{\text{threshold}}$. F_{min} would be defined as an F rate that is less than the F rate corresponding to the SSB_{limit} . This HCR shall be tested with and without a limit that constrains changes in TAC between consecutive management periods of no more than [20%]. This HCR shall also be tested with an allocation based on the recent exploitation pattern and with an allocation tuned to reach the WCPO:EPO fishery impact ratio of [70:30]

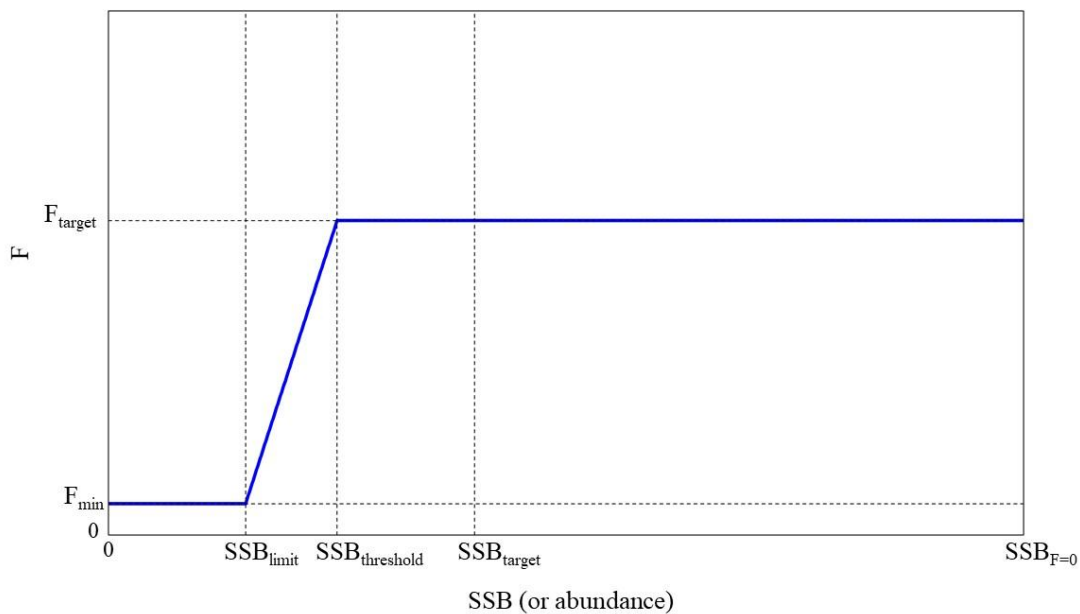


Figure 1. Candidate HCR

Candidate Reference Points

Candidate Limit Reference Points: $15\%SSB_{F=0}$, $20\%SSB_{F=0}$

Candidate Threshold Reference Points: $20\%SSB_{F=0}$, $25\%SSB_{F=0}$

Candidate Target Reference Points: FSPR30%, FSPR35%, FSPR40%

Candidate F_{min} : $10\%F_{\text{target}}$

These new candidate HCRs and reference points replace those from the 2019 recommendation.

APPENDIX II

Refining Candidate Operational Management Objectives, Performance Indicators, Reference Points and Harvest Control Rules for Pacific Bluefin Tuna

Background

In 2014, the Western and Central Pacific Fisheries Commission (WCPFC) adopted [Conservation and Management Measure \(CMM\) 2014-06](#) on establishing a harvest strategy for key fisheries and stocks in the western and central Pacific Ocean. This CMM was replaced by [CMM 2022-03](#) in 2022. It described general provisions and principles for harvest strategies, identified six elements harvest strategies should contain, and for Pacific bluefin (PBF) and North Pacific albacore, tasked the Northern Committee (NC) to develop and recommend work plans and harvest strategies for the WCPFC's consideration.

As PBF are distributed throughout the Pacific Ocean, international management of PBF is split between the Inter-American Tropical Tuna Commission (IATTC) and WCPFC. To facilitate communication between these two organizations, an informal body was established to provide a forum for members of both organizations to discuss and coordinate management of PBF. In 2016, the IATTC adopted [Resolution C-16-03](#) which aimed to establish objectives for this Joint IATTC - WCPFC-NC Working Group (JWG). Among those objectives was to develop a long-term harvest strategy for PBF.

Based on recommendations from the thirteenth regular session of the NC (NC13), the WCPFC adopted a harvest strategy for PBF fisheries in 2017, and revised the harvest strategy in 2021 (see [HS 2021-01](#)). Although the WCPFC has adopted a harvest strategy for PBF, this harvest strategy does not contain all the elements identified in CMM 2014-06, but primarily focuses on rebuilding the stock to the second rebuilding target.¹ The IATTC adopted similar elements focused on rebuilding to the second rebuilding target (Resolution [C-18-02](#) later amended by [C-21-01](#)).

The 2017 WCPFC harvest strategy included a request that the International Scientific Committee for Tuna and Tuna-Like Species (ISC) begin a management strategy evaluation (MSE) for PBF, and the ISC conducted two introductory MSE workshops in 2018² and 2019.³ In 2019, the JWG

¹ The rebuilding plan contains two rebuilding targets with stock level targets, timelines to achieve the rebuilding target levels, and assumptions on the recruitment scenario used for projections. The ISC confirmed in the 2022 stock assessment that the first rebuilding target had been met, and that the second rebuilding target is likely to be met well before the 10 year timeline. Details on the rebuilding targets are provided in the reference points section of the paper.

² https://isc.fra.go.jp/reports/pbf_mse_workshop_2018.html

³ https://isc.fra.go.jp/reports/pbf_mse_workshop_2019.html

(and, formally, NC15) identified a list of candidate reference points⁴ and harvest control rules⁵ (HCRs). In 2021, the ISC suggested that to make progress toward developing a long-term harvest strategy, the JWG develop: 1) operational management objectives and, 2) performance indicators⁶ to measure whether a proposed harvest strategy will meet those agreed-upon management objectives. NC17 prioritized further development of the PBF harvest strategy, and tasked itself in 2022 to work through the JWG to identify performance criteria to evaluate candidate reference points and HCRs. In 2022, the United States submitted a proposal containing candidate operational management objectives and performance indicators to JWG7. Although JWG7 made several amendments to the proposal, JWG7 was unable to finalize the proposal, and agreed to continue the discussion at JWG8 to be held in 2023. Additionally, at JWG7 the ISC requested that the JWG consider narrowing down the list of candidate reference points and HCRs that were agreed to from 2019. See the [JWG7 meeting page](#) for a summary report and proposals.

Meeting Objectives

The aim of this meeting is to solicit stakeholder feedback on the following:

1. Candidate operational management objectives and performance indicators, and
2. Revising the list of candidate reference points and HCRs for a future MSE evaluation.

Candidate Operational Management Objectives and Performance Indicators

[WCPFC HS 2021-01](#) contains the following management objective for Pacific bluefin tuna.

The management objectives are, first, to support thriving Pacific bluefin tuna fisheries across the Pacific Ocean while recognizing that the management objectives of the WCPFC are to maintain or restore the stock at levels capable of producing maximum sustainable yield, second, to maintain an equitable balance of fishing privileges among CCMs and, third, to seek cooperation with IATTC to find an equitable balance between the fisheries in the western and central Pacific Ocean (WCPO) and those in the eastern Pacific Ocean (EPO).

⁴ Reference points are benchmarks that help define the status of a stock, and are explained in more detail in the reference points section of the paper.

⁵ Harvest control rules are pre-agreed management actions that generally depend on the status of the stock or other agreed upon indicators.

⁶ The terms performance metrics, performance criteria and performance indicators have been used interchangeably in various harvest strategy and MSE-related literature. In this paper, we are using “performance indicators.”

Management objectives often need to be translated into operational objectives (i.e., objectives that are more specific and can be measured) in order to evaluate candidate HCRs and reference points.

Performance indicators are needed to evaluate how the candidate reference points and HCRs work towards achieving the overarching management objectives for the PBF fishery. Performance indicators are ways to quantitatively define management objectives. Based on JWG recommendations, [WCPFC HS 2021-01](#) outlines criteria that should be considered in developing appropriate performance indicators for PBF. The following are some of the criteria related to development of the long-term harvest strategy:

1. *Expected annual yield, by fishery.*
2. *Expected annual fishing effort, by PBF-directed fishery.*
3. *Inter-annual variability in yield and fishing effort, by fishery.*
4. *Probabilities of SSB falling below the B-limit and the historical lowest level.*
5. *Probability of fishing mortality exceeding FMSY or an appropriate proxy, and other relevant benchmarks.*
6. *Expected proportional fishery impact on SSB, by fishery and by WCPO fisheries and EPO fisheries.*

Based on feedback from domestic stakeholder meetings that NMFS hosted in [April](#) and [May](#) 2022, NMFS submitted a proposal to JWG7 ([IATTC-NC-JWG07-DP-12](#)) containing candidate operational management objectives and performance indicators. As noted above, JWG7 made several amendments to the proposal (See Appendix 1), but was unable to finalize the proposal, and agreed to continue discussion on this proposal at JWG8.

Questions for stakeholders

1. **Are there any changes you would like to see to the proposed candidate operational management objectives or performance indicators and why?**
2. **Are there certain candidate operational management objectives and performance indicators that you would prioritize for inclusion and why?**

Candidate Harvest Control Rules and Reference Points

Appendix 2 contains the candidate HCRs and reference points recommended by JWG4 and agreed to at NC15. At JWG7, the ISC requested the JWG consider narrowing the list of candidate reference points and HCRs in order to create a more limited set of scenarios for consideration in the MSE evaluation.

Harvest Control Rules

Paragraph 10 of WCPFC's [CMM 2022-03](#) defines HCRs as “*a set of clear, pre-agreed rules or actions used for determining a management action response to changes in indicators of stock status or other indicators, as appropriate, with respect to reference points....*”

In 2019, JWG4 agreed to consider four HCRs for PBF (see Appendix 2 for detailed descriptions of each HCR, titled 1a, 1b, 2, and 3). HCRs typically define actions based on status relative to reference points, which are generally standards that help identify the levels of the stock that are desirable or undesirable (see the next section for more on reference points). The candidate values associated with reference points in the candidate HCRs described below are not determined at this time, and will be discussed in more detail in the next section on Reference Points.

The primary differences between HCRs 1 (1a and 1b) and HCR 2 is the inclusion of a threshold reference point (ThRP).⁷ With the ThRP, reductions in fishing mortality (F) compared to the target F (F_{target}) level would occur when abundance is below the ThRP (HCRs 1a and 1b). For HCR 2, there is no ThRP, therefore reductions in F would occur after abundance is found to be below the limit reference point (LRP). HCRs 1a and 1b also allow a constant minimum level of fishing (or F_{min}) when biomass is below the LRP. HCR2, on the other hand, has a linear relationship between the LRP and the origin, which requires a rebuilding plan to bring abundance back above the LRP that could potentially result in close to zero fishing.

HCR 3 is a combination of HCRs 1 and 2, and is intended to account for differences in impact to the spawning biomass resulting from different fisheries targeting different age groups. For large, or mature fish, the choice could be either HCR 1 (a or b) or HCR 2; and for small, or juvenile, fish the HCR would rely on an index of abundance to determine the fishing mortality level.

Questions for stakeholders

⁷ A threshold reference point is generally defined as a benchmark between the limit and target reference points where management actions change to help the fishery avoid breaching the limit reference point and to maintain performance of the fishery near the target reference point.

3. Do you have a preference for retaining or setting aside any of the candidate harvest control rules and if so why?
4. Are there modifications to any of the candidate harvest control rules that you would like considered?

Reference Points

The following section gives a brief summary of general information on limit and target reference points from the WCPFC and IATTC, and other types of reference points.

Limit Reference Points (LRPs)

WCPFC8 agreed to a working definition of an LRP that contained the following characteristics:

- *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.*

WCPFC8 also established a hierarchical approach to identify key LRPs for key target species, and PBF has been identified as a Level 2 stock.⁸ Therefore, appropriate metrics for LRPs include $F_{X\%SPR_0}$ and either $X\%SSB_0$ or $X\%SSB_{current, F=0}$.⁹

The WCPFC has not adopted an LRP for PBF. For context, the WCPFC has adopted $20\%SSB_{current, F=0}$ as the LRPs for tropical tunas and for SP albacore, and adopted $14\%SSB_{current, F=0}$ as the LRP for NP albacore. For the tropical tuna and SP albacore stocks $20\%SSB_{current, F=0}$ is greater than the SSB_{MSY} level for the stock, so the LRPs are considered very conservative. If PBF were considered a Level 1 stock in WCPFC, the default LRP would be either F_{MSY} or SSB_{MSY} . SSB_{MSY} for PBF roughly equates to $20\%SSB_0$.

⁸ See <https://www.wcpfc.int/harvest-strategy> for more information on WCPFC's hierarchical approach for identifying LRPs for key target species.

⁹ SSB_0 is a static or equilibrium B_0 , it's the average unfished spawning biomass under equilibrium population assumptions (e.g., average recruitment from the S/R relationship). By contrast, $SSB_{current, F=0}$ is dynamic B_0 , which is the spawning biomass at any point in time had fishing not occurred. The dynamic B_0 fluctuates over time with changes in recruitment or any other time varying parameter (e.g., growth).

Until adoption of the NP albacore harvest strategy that mirrors what was adopted at WCPFC and is described above, conversations on harvest strategies at the IATTC have focused on tropical tunas, and in 2016, the IATTC adopted Resolution C-16-02 (*Harvest Control Rules for Tropical Tunas (Yellowfin, Bigeye, and Skipjack)*), which included the following definition of an LRP:

“A limit reference point is a conservation reference point based on a level of spawning biomass (S_{LIMIT}) or fishing mortality (F_{LIMIT}) that should be avoided because going beyond it could endanger the sustainability of the stock;...”

The IATTC does also not currently have a LRP limit for PBF, but has adopted the following limit reference point for tropical tunas in the IATTC Convention Area: $F_{0.5R0}$ (fishing mortality that causes spawning biomass to be reduced to $S_{0.5R0}$ with steepness of 0.75) and $SSB_{0.5R0}$ (spawning biomass corresponding to that which produces a 50% reduction in recruitment as calculated in a Beverton-Holt spawner-recruit model with steepness of 0.75). This limit translates to a depletion of $0.077B_0$, or $7.7\%SSB_0$. As noted above, the IATTC adopted a LRP for NP Albacore of $14\%SSB_0$.

Domestically, the Fishery Management Plan for the U.S. West Coast Fisheries for Highly Migratory Species (HMS FMP) and Fishery Ecosystem Plan for Pelagic Fisheries of the Western Pacific Region (Pelagics FEP) use the concept of minimum stock size threshold (MSST) corresponding to the level of biomass below which the stock is considered to be overfished. MSST is calculated as the greater of:

$$B_{MSST} = (1-M)B_{MSY} \text{ when } M \text{ (natural mortality)} \leq 0.5, \text{ or } B_{MSST} = 0.5B_{MSY} \text{ when } M > 0.5.$$

For PBF, the adult M is assumed to be 0.25 y^{-1} in the stock assessment, which would result in a B_{MSST} of $0.75*B_{MSY}$ and translate to a depletion of $0.15SSB_0$ or $15\%SSB_0$.

The candidate LRPs identified in 2019 were $5\%SSB_{F=0}$, $7.7\%SSB_{F=0}$, $15\%SSB_{F=0}$, and $20\%SSB_{F=0}$. For reference, the initial rebuilding target was the median SSB estimated for the period from 1952 to 2014, which from the 2022 assessment was estimated to be $6.3\%SSB_0$, and the second rebuilding target is $20\%SSB_{F=0}$.

While not currently the case, there could be conflicting interpretations of the status of the stock if there were different LRPs adopted by the IATTC and WCPFC, as well as potential conflicts when compared to MSA metrics (MSST). An LRP adopted by the RFMOs that uses the LRP for stock status that is more conservative than MSA's MSST may be beneficial to U.S. stakeholders because the opposite could require the United States to take action to rebuild the stock under MSA, while the RFMO is not obligated to take action.

Target Reference Points (TRPs)

Neither the WCPFC nor the IATTC have adopted TRPs for PBF. The WCPFC's CMM 2022-03 defines TRPs as “*targets intended to meet management objectives*” and the IATTC offered a similar definition of a TRP in Resolution C-16-02:

“A target reference point is a management objective based on a level of spawning biomass (S_{TARGET}) or a fishing mortality rate (F_{TARGET}) that should be achieved and maintained”

The candidate TRPs identified in 2019 were $F_{SPR_{10\%}}$, $F_{SPR_{15\%}}$, $F_{SPR_{20\%}}$, $F_{SPR_{30\%}}$, and $F_{SPR_{40\%}}$. For reference, the fishing mortality ($F_{\%SPR}$) in 2018-2020 was estimated to produce a level of 30.7%SPR, but historically has ranged from 0.03% (1982) to 35.1% (2020)

Other Reference Points

As noted, HCRs 1a and 1b, reference a ThRP and F_{min} . In 2019, the candidate ThRPs identified were $15\%SSB_{F=0}$, $20\%SSB_{F=0}$, and $25\%SSB_{F=0}$. The candidate F_{min} identified were $5\%F_{target}$ and $10\%F_{target}$.

Questions for stakeholders

- 5. How would you prioritize the candidate reference points for consideration, or are there preferences for candidate reference points to retain versus set aside?**
- 6. Are there additional candidate reference points that you would like considered?**

**JOINT IATTC AND WCPFC-NC WORKING GROUP MEETING ON THE MANAGEMENT OF
PACIFIC BLUEFIN TUNA
SEVENTH SESSION (JWG-07)**

ELECTRONIC MEETING
09:00-13:00, Japan Standard Time
12-14 July 2022

**CANDIDATE OPERATIONAL MANAGEMENT OBJECTIVES AND PERFORMANCE INDICATORS
FOR PACIFIC BLUEFIN TUNA**

Note: JWG07 reviewed JWG07-DP-12, produced this Annex, and agreed to revisit this at JWG08.

Category	Operational Management Objective	Performance Indicator
Safety	There should be a less than [5-20%] ⁸ probability of the stock falling below the LRP	<ul style="list-style-type: none"> Probability that $SSB < LRP$ in any given year of the evaluation period (<u>[10-30] years subject to the number of scenarios; NPA use 30 years; can be confirmed in 2023</u>)
Status	To maintain fishing mortality at or below F_{Target} with at least <u>[50-75]</u> % probability	<ul style="list-style-type: none"> Probability that $F \leq F_{TARGET}$ in any given year of the evaluation period
Stability	To limit changes in overall catch limits between management periods to no more than <u>[15%]</u> downwards[, unless the ISC has assessed that there is a greater than 50% chance the stock is below the LRP]	<ul style="list-style-type: none"> Percent change upwards in catches between management periods excluding periods when $SSB < LRP$ Percent change downwards in catches between management periods excluding periods when $SSB < LRP$
Yield	<u>[Maintain a proportional fishery impact between the WCPO and EPO [similar to the average proportional fishery impact from 1971-1994]]</u>	<ul style="list-style-type: none"> Median fishery impact (in %) on SSB in any given year of the evaluation period by fishery and by WCPO fisheries and EPO fisheries The probability that the proportional EPO fishery impact is at least the 1971-1994 average in any given year
	To maximize yield over the medium (5-10 years) and long (10-30 years) terms, as well as average annual <u>catch</u> <u>yield</u> from the fishery.	<ul style="list-style-type: none"> Expected annual yield over years 5-10 of the evaluation period, by fishery. Expected annual yield over years 10-30 of the evaluation period, by fishery. Expected annual <u>catch</u><u>yield</u> in any given year of the evaluation period, by fishery.
	<u>[To increase average annual catch in all fisheries across WCPO and EPO]</u>	

⁸ The acceptable levels of risk may vary depending on the LRP selected, but should be no greater than 20%.

**JOINT IATTC AND WCPFC-NC WORKING GROUP MEETING ON THE
MANAGEMENT OF PACIFIC BLUEFIN TUNA
FOURTH SESSION**

Portland, Oregon, United States of America
3 – 5 September 2019

**CANDIDATE REFERENCE POINTS AND HARVEST CONTROL RULES FOR
PACIFIC BLUEFIN TUNA**

The Western and Central Pacific Fisheries Commission (WCPFC) harvest strategy for Pacific bluefin tuna fisheries states that “The Joint WG will start to discuss in 2018, and aim to finalize no later than 2019, guidelines for the MSE, including at least one candidate long-term target reference point (TRP), two candidate limit reference points (LRPs) and candidate harvest control rules (HCRs), which will be provided to the ISC.”

The following candidate HCRs and reference points will be considered in the management strategy evaluation (MSE) for Pacific bluefin tuna fisheries. Additional HCRs and reference points may be submitted and considered.

Harvest Control Rules

Candidate HCRs 1a and **1b** are illustrated in Figure 1 where fishing mortality is controlled depending on stock status relative to the defined reference points. The F_{target} rate applies when the stock is larger than $SSB_{threshold}$, while F_{min} rate applies when the stock is smaller than SSB_{limit} , and there is either a linear or sigmoidal transition in F for stock sizes between SSB_{limit} and $SSB_{threshold}$. F_{min} would be defined as an F rate that is less than the F rate corresponding to the SSB_{limit} . **Candidate HCR 1a** has a linear transition between SSB_{limit} and $SSB_{threshold}$ whereas **Candidate HCR 1b** has a sigmoidal transition between SSB_{limit} and $SSB_{threshold}$ and could be viewed as more conservative with respect to uncertainty in underlying biomass/abundance estimates when approaching SSB_{limit} , as well as avoiding abrupt management breakpoints.

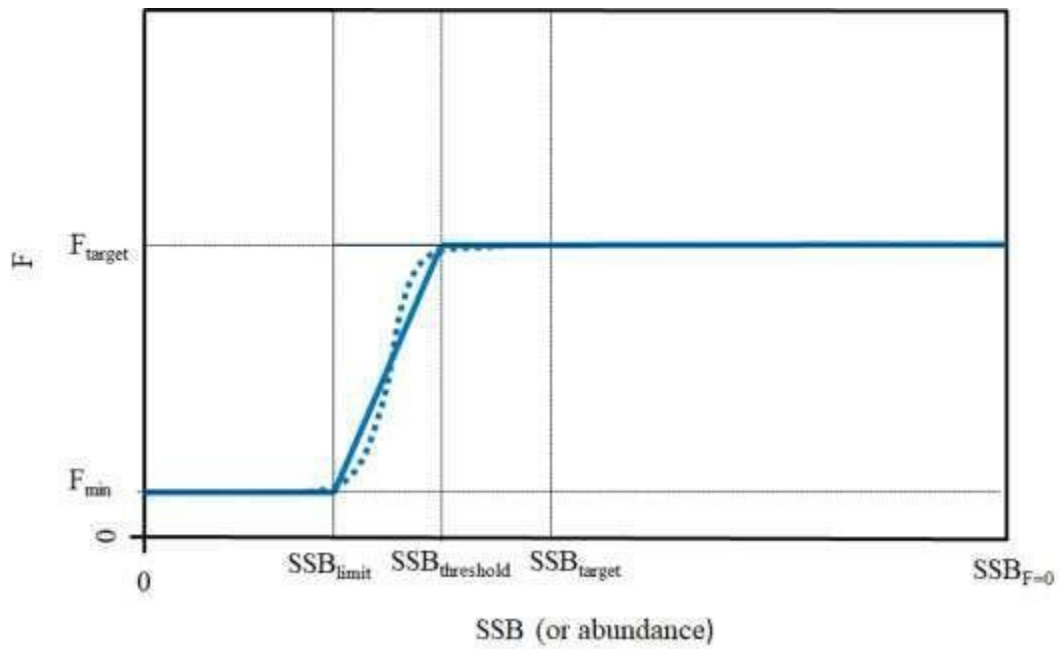


Figure 1. Candidate HCRs 1a (solid line) and 1b (dashed line)

Candidate HCR 2 is illustrated in Figure 2 and is similar to Candidate HCRs 1a and 1b in that F declines once the SSB_{limit} is breached, but unlike Candidate HCRs 1a and 1b, there is no $SSB_{threshold}$ between SSB_{limit} and SSB_{target} .

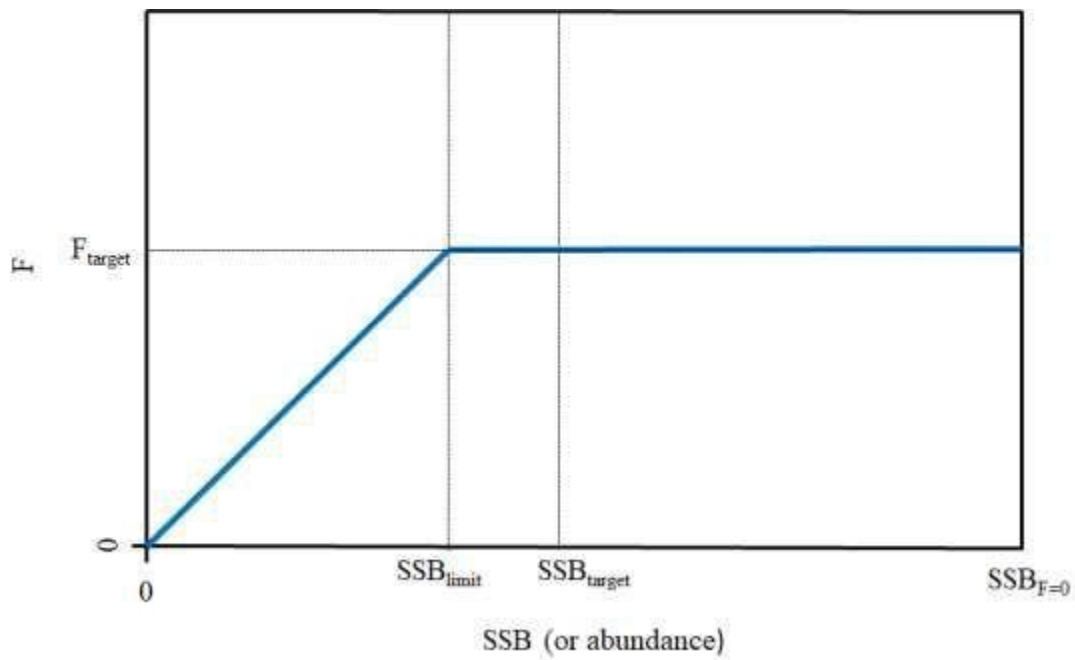


Figure 2. Candidate HCR 2

Candidate HCR 3 specifies two HCRs, one for old-fish fisheries and one for young-fish fisheries. For fisheries that harvest primarily mature Pacific bluefin tuna (e.g., longline fisheries), the HCR could be either Candidate HCRs 1a, 1b or 2 (i.e., fishing mortality is controlled as a function of the size of the spawning stock), and for fisheries harvest primarily immature Pacific bluefin tuna, the HCR would control fishing mortality as a function of recruitment, such as using an index of recruitment based on CPUE in age 0 or 1 fisheries. This approach is similar to that used in Maunder 2014². All of the above candidate HCRs are general in concept and require further work to address issues such as regional distribution, fishery selectivity and fleet allocation.

Candidate Reference Points

The following candidate reference points for the Pacific bluefin tuna MSE are based in part on the hierarchical approach that the WCPFC adopted for identifying limit reference points for key target species as well as the approach taken by the IATTC in identifying interim LRPs for tropical tunas. Under the hierarchical approach adopted by the WCPFC, and as indicated in the harvest strategy for Pacific bluefin tuna fisheries, Pacific bluefin tuna is a Level 2 stock, as the stock recruitment relationship for Pacific bluefin tuna is not well known, but key biological and fishery variables are reasonably well estimated. LRPs for Level 2 stocks are identified as either $FX\%SPRo$ and either $X\%SBo$ or $X\%SB_{current}, F=0$. In the IATTC, the interim LRP for tropical tuna stocks is the SSB associated with 50% of the unfished recruitment with assuming a stock-recruitment relationship steepness of 0.75. In addition to an LRP and a TRP, each of Candidate HCRs 1a and 1b require identification of a threshold reference point ($SSB_{threshold}$) and an F_{min} . The combinations of LRPs, threshold reference points and TRPs will depend on which of the Candidate HCRs are evaluated. Further consideration is needed for the reference points associated with the recruitment-based HCR in HCR 3.

Candidate Limit Reference Points: $5\%SSB_{F=0}$, $7.7\%SSB_{F=0}$, $15\%SSB_{F=0}$, $20\%SSB_{F=0}$

Candidate Threshold Reference Points (for candidate HCRs 1a and 1b): $15\%SSB_{F=0}$, $20\%SSB_{F=0}$, $25\%SSB_{F=0}$

Candidate Target Reference Points: $F_{SPR10\%}$, $F_{SPR15\%}$, $F_{SPR20\%}$, $F_{SPR30\%}$, $F_{SPR40\%}$

Candidate F_{min} : $5\% F_{target}$, $10\% F_{target}$

² Maunder, Mark. (2014). Management Strategy Evaluation (MSE) Implementation in Stock Synthesis: Application to Pacific Bluefin Tuna. IATTC Stock Assessment Report. 15. 100-117.

APPENDIX III

Pacific Bluefin Tuna Stakeholder Meeting

April 19, 2023
Virtual

Meeting Outline

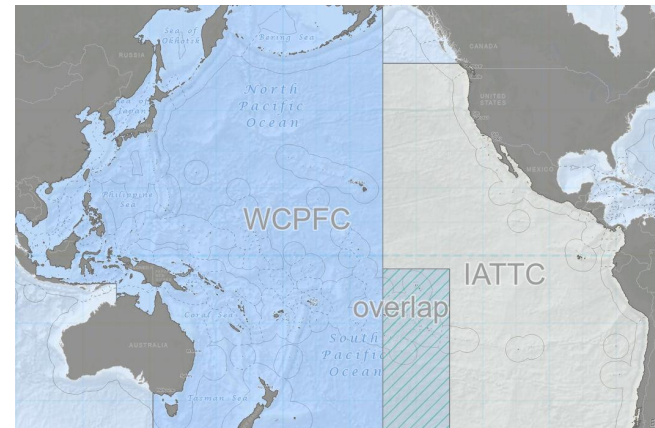
- Meeting Logistics
- Background
- Meeting Objectives
- Candidate Management Objectives & Performance Indicators
- Candidate Harvest Control Rules & Reference Points
- Next Steps

Meeting Logistics

- Please mute when not speaking
- Raise your hand if you would like to speak
- Please state your name and affiliation when speaking
- We will solicit comment after sections, not necessarily only at end

Background - International Management of PBF

International management of Pacific Bluefin Tuna (PBF) is split between the Inter-American Tropical Tuna Commission (IATTC) and the Western and Central Pacific Fisheries Commission (WCPFC)



Background -Harvest Strategy

WCPFC adopted CMM 2014-06 on establishing a harvest strategy for key fisheries and stocks in the WCPO and tasked development of NP albacore and PBF harvest strategies to the WCPFC NC.

CMM 2014-06 outlines elements of a harvest strategy

- **Management Objectives**
- **Reference Points**
- Acceptable Levels of Risk
- Monitoring Strategy
- **Harvest Control Rules**
- **Management Strategy Evaluation**



What is a management strategy evaluation (MSE)?

Process that uses computer simulations to assess the performance of candidate harvest strategies, given **management objectives** conveyed by stakeholders and managers.

The goal of an MSE is to examine the performance of alternative harvest strategies, including **reference points (e.g., limit and target reference points) and harvest control rules**, for PBF relative to the set of management objectives agreed-upon by the IATTC and WCPFC (via JWG).



Background - PBF Harvest Strategy

WCPFC adopted a Harvest Strategy (HS) for PBF Fisheries in 2017, and revised the Harvest Strategy in 2021 (IATTC Resolution C-21-01)

- Focused on rebuilding the stock
- Requested the ISC to conduct a management strategy evaluation (MSE) for PBF

2018 & 2019: ISC held two introductory MSE workshops



Background - PBF Harvest Strategy

2019

- JWG4 identified and NC15 adopted a list of candidate reference points and harvest control rules

2021

- ISC recommended JWG develop operational management objectives and performance indicators.
- JWG suggested members solicit input from their stakeholders on a long-term harvest strategy.



Background - PBF Harvest Strategy

2022

- US proposals to JWG7:
 - Candidate operational management objectives and performance indicators
 - MSE workplan
- JWG7 adopted a workplan for the development of a long-term harvest strategy (including MSE); and agreed to continue discussions in 2023 on other proposals.
- ISC recommended JWG narrow list of candidate HCRs and RPs



Meeting Objectives

Gather U.S. stakeholder input on:

1. Candidate operational management objectives and performance indicators, and
2. Revising the list of candidate reference points and HCRs for a future MSE evaluation.



Management Objectives and Performance Indicators

Definitions of Management Objectives and Performance Indicators

Management Objective:

- Goals and objectives of the fishery
- *Ex: "I want a healthy savings account."*

Operational Management Objective:

- Stated in a way that is specific and measurable
- *Ex: "I want a savings account with at least \$100 most of the time."*

Performance indicator:

- The quantitative definition of a management objective; the metrics used to determine whether a management objective is met.
- *Ex: "My savings account has greater than or equal to \$100 90% of the time."*



WCPFC PBF HS Management Objectives

*The management objectives are, first, to support thriving Pacific bluefin tuna fisheries across the Pacific Ocean while recognizing that the management objectives of the WCPFC are to maintain or restore the **stock at levels capable of producing maximum sustainable yield**, second, to maintain an **equitable balance of fishing privileges among CCMs** and, third, to seek cooperation with IATTC to find an **equitable balance between the fisheries in the western and central Pacific Ocean (WCPO) and those in the eastern Pacific Ocean (EPO)**.*



Developing Operational Management Objectives - Examples provided in 2022

General subject/topics for objectives:

1. Status - Probability of not overfished/overfishing
2. Safety - Risk of breaching limit
3. Yield - How much catch
4. Stability - Amount of change in catch between management periods
5. Abundance - Catch rates



JWG7 Input to U.S. Proposal

Category	Operational Management Objective	Performance Indicator
Safety	There should be a less than [5-20%] ⁸ probability of the stock falling below the LRP	<ul style="list-style-type: none"> • Probability that SSB < LRP in any given year of the evaluation period (<u>[10-30] years subject to the number of scenarios; NPA use 30 years; can be confirmed in 2023</u>)
Status	To maintain fishing mortality at or below FTARGET with at least [50-75]% probability	<ul style="list-style-type: none"> • Probability that F ≤ FTARGET in any given year of the evaluation period
Stability	To limit changes in overall catch limits between management periods to no more than [15%] downwards, unless the ISC has assessed that there is a greater than 50% chance the stock is below the LRP	<ul style="list-style-type: none"> • Percent change upwards in catches between management periods excluding periods when SSB < LRP • Percent change downwards in catches between management periods excluding periods when SSB < LRP
Yield	[Maintain a proportional fishery impact between the WCPO and EPO [similar to the average proportional fishery impact from 1971-1994]]	<ul style="list-style-type: none"> • Median fishery impact (in %) on SSB in any given year of the evaluation period by fishery and by WCPO fisheries and EPO fisheries • The probability that the proportional EPO fishery impact is at least the 1971-1994 average in any given year
	To maximize yield over the medium (5-10 years) and long (10-30 years) terms, as well as average annual catch yield from the fishery.	<ul style="list-style-type: none"> • Expected annual yield over years 5-10 of the evaluation period, by fishery. • Expected annual yield over years 10-30 of the evaluation period, by fishery. • Expected annual catch yield in any given year of the evaluation period, by fishery.
	[To increase average annual catch in all fisheries across WCPO and EPO]	



Questions - Candidate Management Objectives and Performance Indicators

1. Are there any changes you would like to see to the proposed candidate operational management objectives or performance indicators and why?
2. Are there certain candidate operational management objectives and performance indicators that you would prioritize for inclusion and why?



Harvest Control Rules

Paragraph 10 of WCPFC’s [CMM 2022-03](#) defines HCRs as “a set of clear, pre-agreed rules or actions used for determining a management action response to changes in indicators of stock status or other indicators, as appropriate, with respect to reference points....”

Candidate Harvest Control Rules (HCRs) And Reference Points

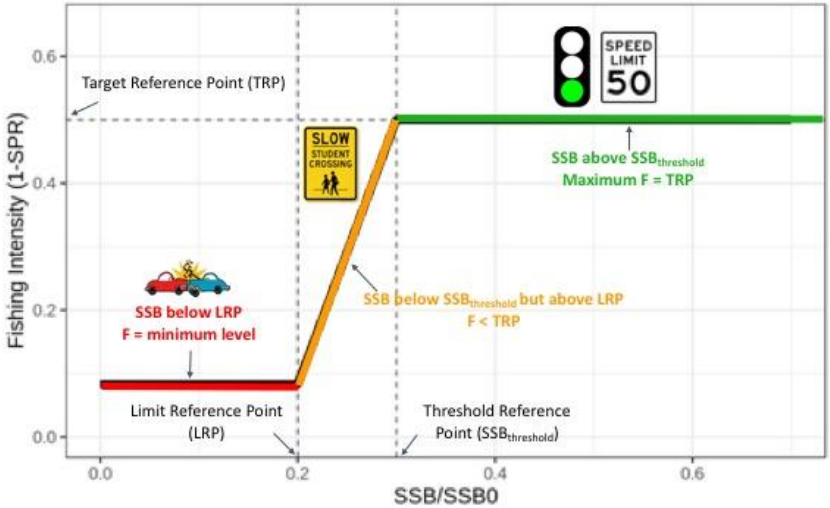


Reference Points

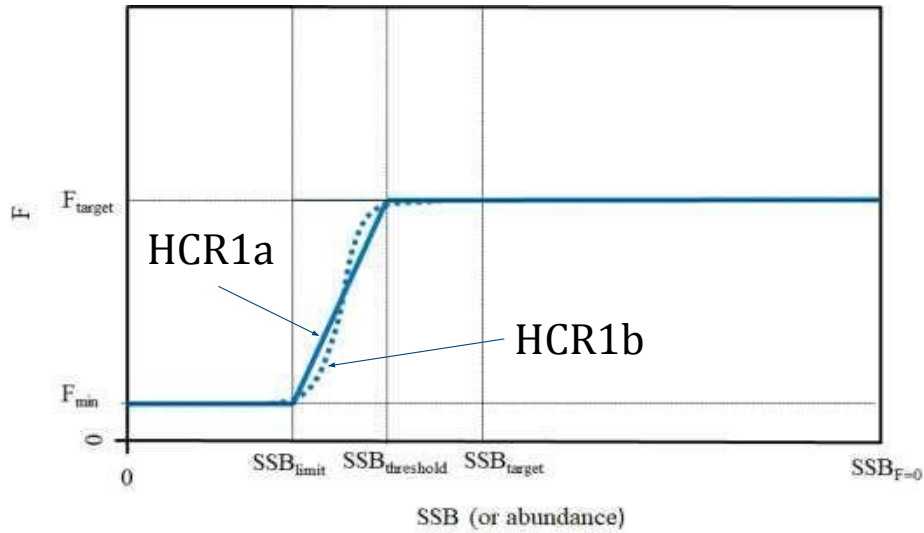
- Standards that help identify the levels of the stock that are desirable or undesirable
- No adopted reference point for PBF
- Undefined in the candidate HCRs
- More on reference points later



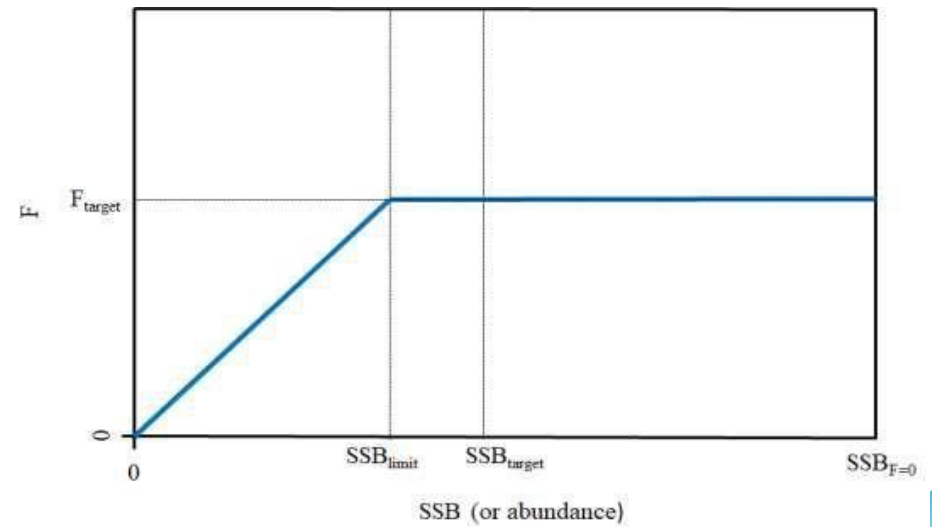
Harvest Control Rule Example



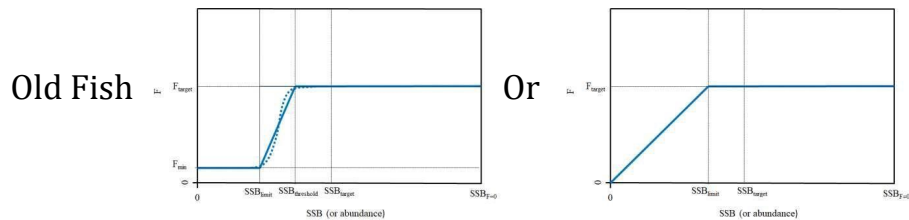
Candidate Harvest Control Rules 1a and 1b



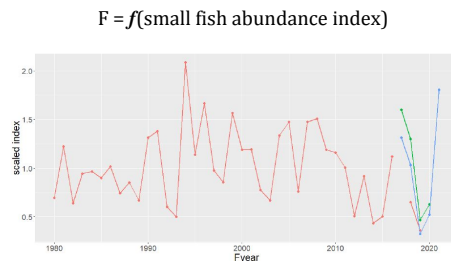
Candidate Harvest Control Rule 2



Candidate Harvest Control Rule 3



Young Fish



Limit Reference Points - WCPFC

Limit Reference Point (LRP) Working Definition from WCPFC8

- 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.

WCPFC Hierarchical Approach to LRPs for Key Species

Level	Condition	LRPs
Level 1	A reliable estimate of steepness is available	F_{MSY} and B_{MSY}
Level 2	<p>Steepness is not known well, if at all, but the key biological (natural mortality, maturity) and fishery (selectivity) variables are reasonably well estimated.</p> <p>Applied species: bigeye, yellowfin and South Pacific albacore</p>	<p>$F_{X\%SPR_0}$ and either</p> <p>$X\%SB_0$ or</p> <p>$X\%SB_{current,F=0}$</p>
Level 3	<p>The key biological and fishery variables are not well estimated or understood.</p> <p>Applied species: skipjack</p>	<p>$X\%SB_0$ or</p> <p>$X\%SB_{current,F=0}$</p>

LRP Definition - IATTC

IATTC Resolution C-16-02:

"A[n] LRP is...based on a level of spawning biomass...or fishing mortality...that should be avoided because going beyond it could endanger the sustainability of the stock;

LRP - Magnuson-Stevens Act

Minimum stock size threshold (MSST): level of biomass below which the stock is considered to be overfished.

MSST is calculated as the greater of:

$$B_{MSST} = (1-M)B_{MSY} \text{ when } M \text{ (natural mortality)} \leq 0.5,$$

or

$$B_{MSST} = 0.5B_{MSY} \text{ when } M > 0.5.$$

For PBF, the adult female M is assumed to be 0.25 y^{-1} in the stock assessment →

B_{MSST} of $0.75 \cdot B_{MSY}$ and a depletion of $15\%SSB_0$.

Candidate LRPs

- $5\%SSB_{F=0}$
- $7.7\%SSB_{F=0}$
- $15\%SSB_{F=0}$
- $20\%SSB_{F=0}$

For reference,

- the initial rebuilding target was the median SSB estimated for the period from 1952 to 2014 = $6.3\%SSB_0$ (2022 stock assessment)
- the second rebuilding target is $20\%SSB_{F=0}$

Target Reference Point

WCPFC CMM 2022-03 defines target reference points (TRPs) as

“targets intended to meet management objectives”

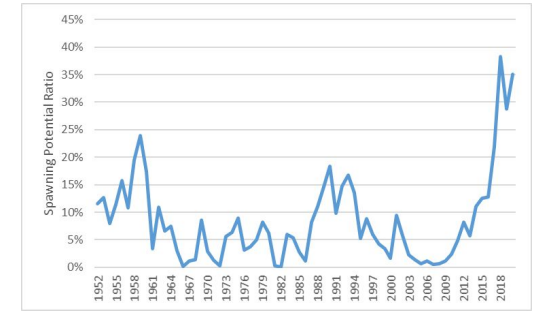
IATTC Resolution C-16-08

“A TRP is a management objective based on a level of spawning biomass...or a fishing mortality rate...that should be achieved and maintained”



Candidate TRPs

- FSPR_{10%}
- FSPR_{15%}
- FSPR_{20%}
- FSPR_{30%}
- FSPR_{40%}



For reference:

- the fishing mortality (F%SPR) in 2018-2020 was estimated to produce a level of 30.7%
- historically has ranged from 0.03% (1982) to 35.1% (2020)



Other Reference Points

Candidate Threshold Reference Points

- 15%SSB_{F=0}
- 20%SSB_{F=0}
- 25%SSB_{F=0}

Candidate F_{min} (minimum fishing level after breaching limit reference point)

- 5% F_{target}
- 10% F_{target}



ISC Working Group Progress

- ISC PBFWG evaluated HCRs 1a, 1b and 2 under a simplified model with no assumptions of error to help guide selection of which HCRs to test further with estimation error
- Demonstrated ability to calculate fishery impact metric



Preliminary Simulations

Distance between F_{target} and LRP or ThRP matters!

- HCRs with F_{target} of FSPR30% or FSPR40% are the only ones with a less than 20% probability of SSB being at or below 20%SSB₀.
- Only 2 HCR shape 2s which had an F_{target} of FSPR10% have a probability >20% of being at or below 7.7%SSB₀



Preliminary Simulations

- On stability, some HCRs are generally able to maintain a decrease in catch between management periods of 15% or less, but all HCRs have a decrease in catch that is higher than 15% in at least one management period and iteration
- No single best performing HCR - tradeoffs in management objectives
- Overall, the value of F_{min} did not have a large impact on performance



Preliminary Simulations

- F_{target} most important determinant of performance across multiple management objectives
 - HCRs with higher F_{target} performed best in terms of safety and stability, but resulted in lower annual catch
- Generally HCR shapes 1a and 1b performed similarly in terms of safety, status and yield metrics, but HCR shape 1b (sigmoidal curve) had lower stability than HCR shape 1a
- For the same F_{target} , HCR shapes 1a or 1b performed better than HCR shape 2 in terms of yield and safety, but worse in terms of stability



Questions - Harvest Control Rules

3. Do you have a preference for retaining or setting aside any of the candidate harvest control rules and why?
4. Are there modifications to any of the candidate harvest control rules that you would like considered?



Questions - Reference Points

5. How would you prioritize the candidate reference points for consideration or are there preferences for candidate reference points to retain versus set aside?
6. Are there additional candidate reference points that you would like considered?



Next Steps

Solicit Feedback and Advice from

- PAC Meeting - May 22, 2023
- GAC Meeting - June 15, 2023

Potentially submit a proposal/white paper to JWG8



Additional Questions



Thank you!

