

INTER-AMERICAN TROPICAL TUNA COMMISSION
3rd WORKSHOP ON MANAGEMENT STRATEGY EVALUATION (MSE)
FOR TROPICAL TUNAS:

(by videoconference)
08-09 December 2022

REPORT OF THE MEETING REVISED

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SUMMARY

The third IATTC workshop on Management Strategy Evaluation (MSE) for tropical tunas was held during December 8-9, 2022. The workshop was held as a bilingual (Spanish and English with simultaneous interpretation) plenary meeting by videoconference during December 8-9, 2022, preceded by two informal, educational sessions either in Spanish or English during December 7, 2022. The objectives of this workshop were to continue to enhance communication and foster mutual understanding among fisheries scientists, managers, and other stakeholders on matters related to harvest strategies and MSE, refine potential performance metrics, reference points and harvest control rules discussed during previous workshops. Although the discussion was relevant to tropical tuna in general, the main focus was on specific elements of the ongoing MSE for bigeye tuna (Operating models, Harvest Control Rules). The workshop had 80 participants from 18 countries (16 members, 76% of total IATTC members), non-governmental organizations (NGOs) and IATTC staff. The workshop format included lectures, discussions, and hands-on work with computer tools to illustrate major points, elicit discussions and dialogue and create diverse learning opportunities. Two invited speakers presented recently completed MSE processes for North Pacific Albacore and Indian Ocean Bigeye tunas as well as Southern bluefin tuna. A list of potential management objectives developed in previous workshops was further refined during this workshop. Additional workshops, funded and organized by the IATTC, are planned for 2023 and 2024 (dates to be determined), and are expected to continue to enhance communication and foster mutual

understanding among fisheries scientists, managers, and other stakeholders on matters related to management strategies and their evaluation, as well as show MSE results to refine elements of candidate strategies for further evaluation and presentation to the SAC and Commission Annual meeting during 2024.

1. BACKGROUND

The purpose of the Management Strategy Evaluation (MSE) process in fisheries is to compare the performance of alternative management strategies in meeting management objectives, using computer simulations and relevant fisheries performance metrics. MSE is recognized as best practice to evaluate alternative management strategies (Punt *et al.*, 2016) and has been widely used both nationally (*e.g.* Australia, New Zealand, South Africa and the United States) and internationally (*e.g.* ICES, IWC, NAFO), including all tuna regional fisheries management organizations (RFMOs: IATTC, IOTC, WCPFC, ICCAT and CCSBT), which are in different stages of evaluation and implementation (Nakatsuka *et al.*, 2017).

Some parts of the MSE process are highly technical and done by scientists, but others, such as defining objectives, performance metrics and management strategies, require input and participation of managers and other stakeholders. A better understanding of the MSE process and its components strengthens communication among scientists, managers, industry, and other stakeholders, as well as foster their participation in the process.

The IATTC adopted elements of a management strategy, such as the interim reference points and the harvest control rule (HCR), in [Resolution C-16-02](#). The [IATTC Strategic Science Plan](#) includes a [work plan](#) for evaluating the IATTC's current strategy, along with alternatives, using MSE. Because the elements, concepts and approaches involved in MSE are mostly new for managers and other stakeholders, a series of workshops was planned to introduce them to MSE. With financial support from the FAO-GEF Common Oceans project, introductory workshops on MSE for tropical tunas in the eastern Pacific Ocean (EPO) were held in Panama (2015) and the United States (2018), aimed at managers, and a further five, aimed at the tuna industry, took place during 2019 in Colombia, Ecuador, Mexico, Panama, and the United States.

The IATTC MSE [work plan](#) includes a series of workshops, the [first held](#) at the end of 2019 and a [second one](#) in May 2021, whose terms of reference were established in [Resolution C-19-07](#). This report summarizes the third MSE workshop for tropical tunas in the EPO, funded and organized by the IATTC and held during December 8-9, 2022. Its goals were to explain and clarify the MSE process, enhance communication and foster mutual understanding among fisheries scientists, managers, and other stakeholders on matters related to harvest strategies and MSE, and further discuss potential management goals, performance metrics, alternative reference points and harvest control rules (identified during the first and second workshops) with managers and other stakeholders. Additional workshops, funded and organized by the IATTC, are planned for 2023 and 2024 (dates to be determined), and are expected to continue to enhance communication and foster mutual understanding among fisheries scientists, managers, and other stakeholders on matters related to management strategies and their evaluation, as well as show MSE results to refine elements of candidate strategies for further evaluation and presentation to the SAC and Commission Annual meeting during 2024.

2. OBJECTIVES OF THE REPORT

This report summarizes the activities conducted during the workshop, including presentation outlines, and discussions on alternative management objectives, performance metrics, reference points, harvest control rules and operating models for both tropical tunas in general, and in particular for the ongoing MSE for EPO bigeye tuna.

3. WORKSHOP DESIGN

This workshop aimed to provide background skills on management strategies for new participants and a refresher for participants of previous MSE workshops. Presentations, discussions, online tools and presentations of invited experts were used to illustrate how MSEs contribute to the development of robust and functional management strategies. The intention was to empower the participants with knowledge and skills related to MSE in general, to foster communication among stakeholders, and to elicit input (such as alternative objectives, performance metrics, reference points and harvest control rules) required for the technical component of the work. The specific objectives of this workshop were to provide training on management objectives, harvest strategies elements and MSE, in line with the recent IATTC Performance Review and the proposed Strategic Science Plan, which recommended improving knowledge sharing, human-institutional capacity building and communication of scientific advice.

The workshop was designed to address general concepts, specific characteristics of the IATTC context, and some case studies including presentations by two invited speakers that presented recently completed MSE processes for North Pacific Albacore (Dr. Desiree Tommasi, NOAA Fisheries) and Indian Ocean Bigeye tunas as well as Southern bluefin tuna (Dr. Richard Hillary, CSIRO). The format included presentations and simplified MSE models (“toys”) available online to illustrate the main points, issues, and tradeoffs, and foster dialogue, discussion and understanding among participants. The languages of the workshop plenary (December 8-9, 2022) and workshop materials were [Spanish](#) and [English](#), with simultaneous translation. The workshop plenary was preceded by two informal, educational sessions either in Spanish or English during December 7, 2022. The agenda (Appendix 1) was designed to be flexible and interactive, to allow it to be modified based on feedback during the workshop, emphasizing active two-way dialogue and discussion rather than a focus on a one-way series of presentations.

4. WORKSHOP DESCRIPTION

4.1. Overview

The workshop was facilitated and co-chaired by Dr. Juan Valero and Dr. Alexandre Aires-da-Silva, who opened the meeting. It was attended by 80 participants (Appendix 2), mainly tuna industry stakeholders, managers, scientists, from 18 countries, non-governmental organizations (NGOs) and IATTC staff (Figure 1). Compared to previous IATTC MSE workshops, this one had the largest number (16) of IATTC members represented, or 76% of total IATTC members and up from 62% during the 1st and 72% during the 2nd IATTC MSE workshops respectively (Figure 2). Given the relatively large turnover of participants from previous IATTC workshops and other EPO MSE workshops (Figure 3), it was decided to have two informal overview and review meetings (one in Spanish, one in English) prior to the workshop, like what was done during the 2nd IATTC MSE workshop. Although the original plan was to have the workshop in person, given lingering complications from the COVID-19 pandemic the workshop was held via online videoconference. The pre-workshop informal meetings and workshop plenary sessions included presentations and questions and answer session to clarify the MSE process for tropical tunas. The discussions focused on clarification of general concepts related to the MSE approach and comparison with the current approach used in the IATTC.

4.2. Presentations

4.2.1. Preliminary sessions

Presentations during the preliminary sessions included an overview and review of concepts and processes related to MSE, both in general terms and specific to the IATTC context. Topics covered included contrasting the “best assessment approach” and approaches based on “tested management strategies” with a focus on the IATTC context. This was followed up with presentations on how the provision of

scientific advice for management is conducted at present at IATTC (“best assessment” approach) and basic concepts of harvest strategies, harvest control rules, management objectives, tactics and strategies. Other aspects covered reference points, alternative harvest control rules (based on model results vs. based on empirical data), the current treatment of uncertainty in IATTC stock assessments and alternative ways to deal with uncertainty via management strategies evaluated via simulation. The evaluation of management strategies via simulation was covered both in general terms and using examples from other tuna RFMOs (including North Pacific albacore tuna, southern bluefin tuna). To help in the introduction of new concepts, analogies were taken from everyday life (such as reference points and harvest control rules re-imagined as human body temperature thresholds, thermometers and agreed actions at different temperatures) and non-fishery systems (such as re-imagining management procedures as airplane autopilots, and their testing as working with airplane models before using real airplanes).

4.2.2. Plenary sessions

The plenary sessions included presentations followed by discussions on each topic. The workshop started with an overview of the workshop’s goals, modality, agenda and logistics. The first presentation was a recap of the 1st and 2nd IATTC workshops on MSE for tropical tunas, recent developments in management of tropical tuna fisheries in the EPO, current MSE workplan status and next steps. The second presentation focused on “*Management Objectives*”, which included a review of the list of objectives proposed and discussed during previous IATTC MSE Workshops along with a review of objectives from other MSE processes including North Pacific Albacore tuna, Southern bluefin tuna as well as those considered in the Indian Ocean Tuna Commission. The third presentation included a generic overview and description of “*Performance Metrics*”, along with those used for North Atlantic Albacore tuna, for southern bluefin tuna and those considered in the Indian Ocean Tuna Commission. The fourth presentation was on “*Reference Points*” including an overview of those used in the IATTC, those used in other tuna RFMOs and from other organizations around the world. A summarized table (Table 1) of Management Objectives, and Performance Indicators which included elements discussed during previous workshops was presented and modified during the workshop (see also Appendix 3 for an edited version submitted by the USA after the workshop). The fifth presentation was on “*Harvest Control Rules*” which focused on a general overview of HCRs components, illustration of alternative HCR types and functioning of HCR using a MSE demonstration tool, HCR implementation in the IATTC context and in other tuna RFMOs, and candidate HCRs to use during the BET MSE (empirical and model-based HCRs). Three alternative HCRs were presented and discussed for candidates for the bigeye tuna MSE (Figure 4). The HCRs would be applied on a 3-year cycle with effort controls (days of closure) for surface fleets and catch limits for longline fleets. The data inputs for the HCRs will be 1) Empirical HCR: standardized Japanese longline index of abundance; 2) Model-based HCR: standardized Japanese longline index of abundance and total catches. The sixth presentation was on the MSE development for EPO bigeye tuna. Alternatives were presented and discussed including differences between MSE and management procedures, the impact of different levels of different levels in specification and type of strategies on the complexity of their evaluation, feedback cycles and an example potential chronogram for harvest strategy implementation for EPO bigeye (Table 2). Alternative roles of the stock assessment, either as estimation model of the strategy or decoupled from the HCR or management procedure, were also discussed. Rules and metarules were also discussed but only in general terms as there was no time to get into specifics for the bigeye tuna MSE. Other bigeye tuna MSE elements presented and discussed were candidates operating models (ensemble from the benchmark assessment), candidate estimation models (ASPM, other simpler models), candidate HCRs (empirical vs model-based) and potential modifications to the tuna MSE online demonstration tool for the presentation of actual MSE results. All presentations are available at the [IATTC workshop website](#) in both Spanish and English.

4.2.3. Invited speakers

The workshop included presentations followed by questions/answers by two invited speakers that presented recently completed MSE processes for North Pacific Albacore (Dr. Desiree Tommasi, NOAA Fisheries) and Indian Ocean Bigeye tunas as well as Southern bluefin tuna (Dr. Richard Hillary, CSIRO). Both invited experts on MSE provided insight on the MSE processes they were involved in, lessons learned along the way. Main takeaways from the presentation by Desiree Tommasi included considering simpler models and empirical rules during the MSE as a tradeoff instead of using the full stock assessment model to be able to complete a broader set of scenarios and evaluation runs, remind stakeholders of simplifications often used in the MSE process as compared as with the real world, have regular meetings and interactions with stakeholders during the process. Main takeaways from Richard Hilary included advantages of decoupling the timing of the full stock assessment from the application of the strategy/management procedure, separate full stock assessment from management decisions, considering and adapting to a different role of the stock assessment is often difficult and takes time, MSE processes are time consuming, multiyear projects but worth the effort by improving assessment and management of stocks where MSE have been successfully implemented.

4.3. General discussion and next steps

The last presentation was a summary of proposed next steps towards MSE development by IATTC staff. The MSE [work plan](#) in the [IATTC Strategic Science Plan](#) focuses initially on bigeye tuna, and will move to the other species towards the end of the plan, pending securing of funds. In other RFMOs and international and national organizations, MSE processes have been multi-year undertakings, even for single species. Also, the MSE process requires sustained funding for the technical aspects of the work in addition to the workshops/meetings for dialogue and communication. Additional workshops, funded and organized by the IATTC, are planned for 2023 and 2024 (dates to be determined), and are expected to continue to enhance communication and foster mutual understanding among fisheries scientists, managers, and other stakeholders on matters related to management strategies and their evaluation, as well as show MSE results to refine elements of candidate strategies for further evaluation and presentation to the SAC and Commission Annual meeting during 2024. The current MSE for bigeye tuna is funded by the European Union until the end of 2023. Funding has not been secured yet for 2024 and beyond.

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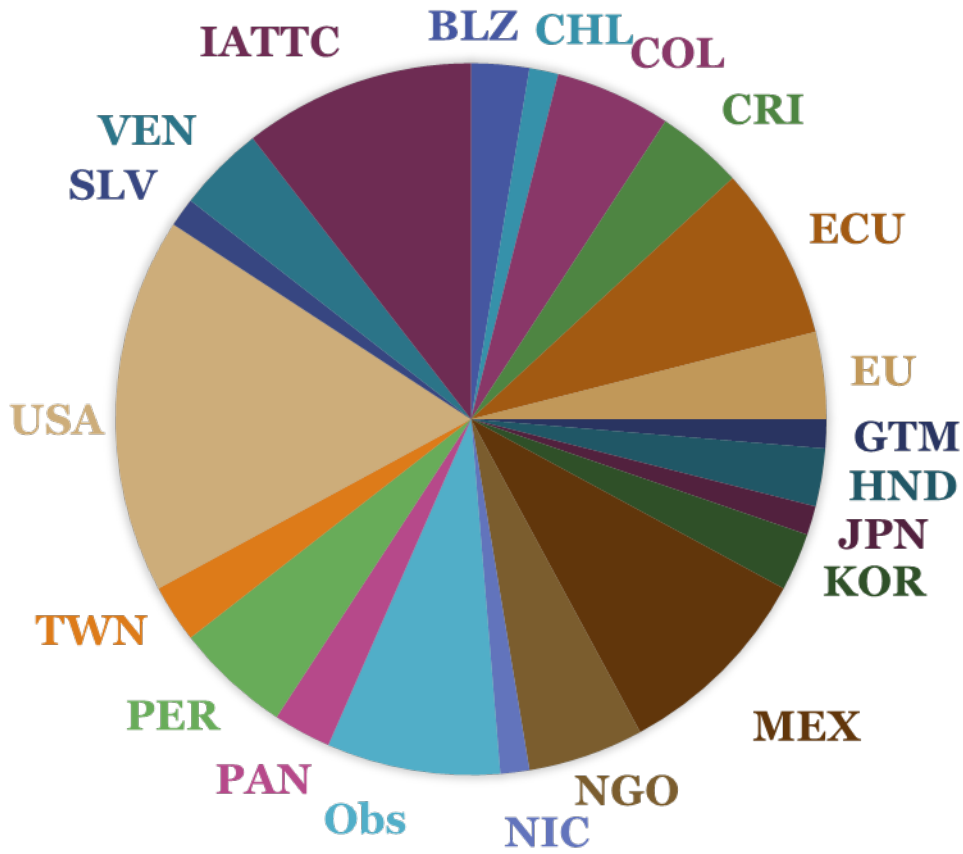


FIGURE 1. Participants in the third IATTC workshop on MSE for tropical tunas, by CPC and other representations.

	1st MSE WS	2nd MSE WS	3rd MSE WS
Cooperating Non-Members	FALSE	FALSE	FALSE
	FALSE	TRUE	TRUE
	FALSE	FALSE	TRUE
	FALSE	FALSE	FALSE
	FALSE	FALSE	FALSE
Members	TRUE	TRUE	TRUE
	FALSE	TRUE	FALSE
	FALSE	FALSE	FALSE
	FALSE	FALSE	TRUE
	TRUE	TRUE	TRUE
	TRUE	TRUE	TRUE
	TRUE	TRUE	TRUE
	FALSE	TRUE	TRUE
	FALSE	TRUE	TRUE
	FALSE	FALSE	FALSE
	TRUE	TRUE	TRUE
	TRUE	TRUE	TRUE
	FALSE	FALSE	FALSE
	TRUE	FALSE	TRUE
	TRUE	TRUE	TRUE
	TRUE	TRUE	TRUE
	TRUE	TRUE	TRUE
	TRUE	TRUE	TRUE
FALSE	FALSE	FALSE	
TRUE	TRUE	TRUE	
Members	13	15	16
% Members	62%	71%	76%

FIGURE 2. Participation of IATTC Members and Cooperating Non-Members during the three IATTC MSE for tropical tuna workshops. “FALSE”: not represented during the workshop, “TRUE”: represented during the workshop.

Participation in EPO IATTC tropical tuna MSE workshops
Participacion talleres CIAT de EEO atunes tropicales en OPO

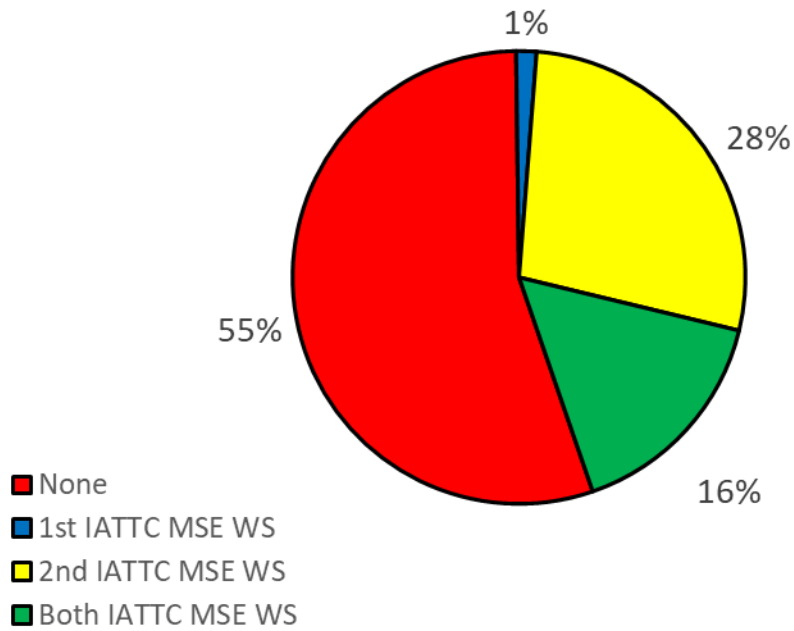


FIGURE 3. Participants in the third IATTC workshop on MSE for tropical tunas and their participation during previous workshops on MSE for tropical tunas in the EPO.

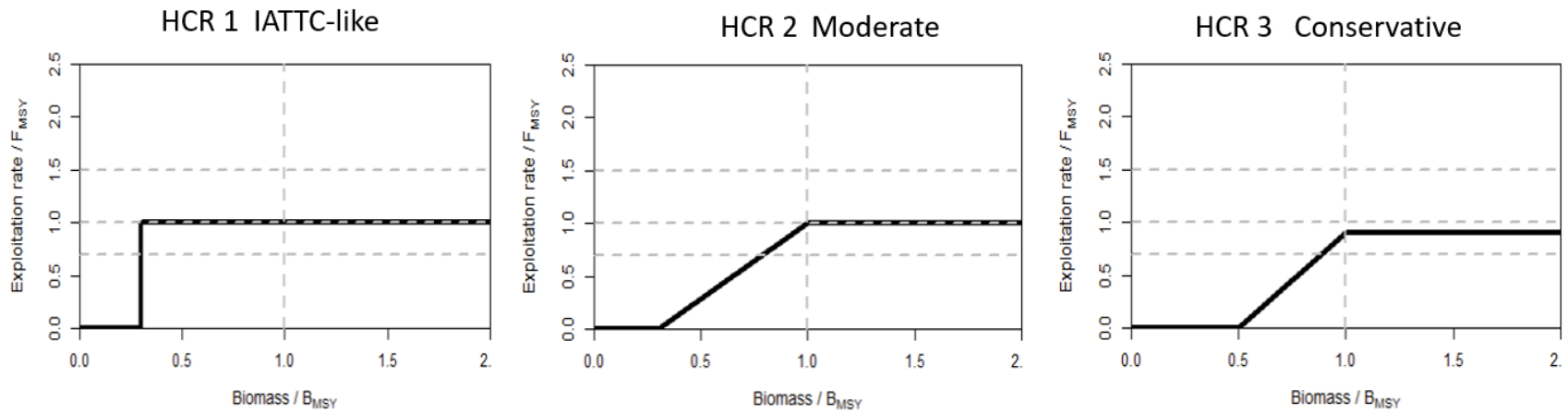


FIGURE 4. Alternative Harvest Control Rules (HCR) discussed during the workshop as candidates for evaluation during the bigeye tuna MSE.

Table 1. Objectives, quantities and performance indicators summarized during the workshop. Yellow indicates elements not defined yet.

OBJECTIVE	Quantity	Performance Indicators
Safety Maintain stock above limit reference points	Equilibrium virgin spawning biomass SB_0 <ul style="list-style-type: none"> < 10% probability SB below 7.7% of SB_0 < 5% probability SB below 7.7% of SB_0 < 10% P SB < SB_{msy} Flim (< 5% P F > F_{msy})	Ratio of SB_{yr} over SB_0 Probability calculated over projected 30 years (All years, any year by replicates)
Status Maintain stock in green quadrant of Kobe plot	$SB \geq$ dynamic SB_{MSY} and $F < F_{MSY}$ <ul style="list-style-type: none"> 50% probability (too low?) 60% probability 75% probability 80% probability (too high?) 	% of simulated runs falling in Kobe's green quadrant Probability calculated over projected 30 years
Stability Maintain low variability of catch and effort limits, gradual changes in management measures. Caps at 10% (effort), 15% (catch), Min. change (X%)	Standard deviation of annual catch, effort Average interannual proportional change (catch, effort)	% change in catch and/or effort between years Calculated over projected 3, 15 and 30 years
Yield/Abundance Maintain catches/effort/CPUE above historical ranges	Average catch/effort/CPUE by fishery (PS and LL) <ul style="list-style-type: none"> 1994-2019 (since FAD expansion) 2017-2019 (latest status quo) 	Ratio of projected 3, 15 and 30-year average catch/effort/CPUE by fishery over historical period
Status quo Maintain the stock at levels near the (2017-2019) status quo	Spawning biomass, Index (LL CPUE)	Ratio of projected 3, 15 and 30-year average SB, Index (LL CPUE) over status quo period (2017-2019)

Table 2. Potential chromogram of harvest strategy implementation for EPO bigeye tuna.

	2023	2024	2025	2026	2027
SAC		Second round MSE			
AM		Select/Adopt BET MP Set Measures (2025-2027)			Set Measures (2028-2030)
Staff work	First round MSE	Check Excep. Circumst. Assess stock status	Check Excep. Circumst.	Collate data for MP Run MP Check Excep. Circumst.	Check Excep. Circumst. Assess stock status

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Agenda

Pre-workshop meetings (December 7, 2022)

1. Overview of MSE process for tropical tunas at IATTC, including results of 1st and 2nd IATTC MSE Workshops.
2. Review of potential objectives, alternative reference points, harvest control rules and performance indicators.
3. Hands on exercises and demonstrations to elicit discussion and input from stakeholders on MSE components.

Plenary Workshop (December 8-9, 2022)

1. Overview of MSE process for tropical tunas at IATTC, including results of 1st and 2nd IATTC MSE Workshops.
2. Discussion on components of MSE for IATTC tropical tunas:
 - a. Objectives
 - b. Reference Points
 - c. Harvest Control Rules
 - d. Performance Indicators
4. Alternative Operating Models and Harvest Control Rules for BET MSE
5. Hands on exercises and demonstrations to elicit discussion and input from stakeholders on MSE Components for BET.
6. Discussion of next steps and MSE timeline.

APPENDIX 2. List of participants

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APPENDIX 3. Draft alternative reference points, harvest control rules submitted by the USA, modified from those discussed during the 3rd IATTC tropical tuna MSE workshop.

**USA recommendations for revisions to objectives, harvest control rules, and reference points
12/9/2022**

Objective	Quantity	Performance Indicator
Safety: Maintain stock above LRP	Equilibrium virgin SB0; < 10% of SB below 7.7% of SB0 and < 5% probability of SB below 7.7% of SB0 < 5% probability of exceeding Fmsy and < 10% probability of being below SBmsy	Ratio of SByr over SB0; Probability calculated over projected 30 years (all years, any years by replicates)
Status: Maintain stock in green quadrant of Kobe plot [with a high probability]	SB >= dynamic SBmsy and F<Fmsy; 50, 60, 70%, and 80% probability	% of simulated runs falling within Kobe green quadrant; probability calculated over projected 30 years
Stability: Maintain low variability of catch and effort limits, gradual changes in management measures	Standard deviation of annual catch, effort; average interannual proportional change in catch, effort	Percent change in catch and/or effort between years; Calculated over projected 3, 15, and 30 years
Yield/Abundance: Maintain catches/effort/CPUE above historical ranges	Average catch/effort/CPUE by longline, purse seine (FADs, non-associated, and dolphin fishery) 1994-2019 (after expansion of FAD fishery) and 2017-2019 (latest status quo)	Ratio of projected 3, 15, 30 year average catch/effort/CPUE by fishery over historical period

Harvest strategy

- have a gradual change in F once the target biomass reference point (or a threshold point is passed) rather than the abrupt change in F once the limit is crossed as is now the case
- Ideally the target would be high enough that the limit is not often crossed

Target RP	Threshold	Limit RP
F40 SSB40% (dynamic)	SSBmsy (dynamic)	Fmsy; 0.5*SSBmsy; If $M < 0.5$, $MSST = (1 - M) * SSBmsy$;
F40 or F45	SSB40% (dynamic)	Fmsy; SSBmsy (dynamic)
F40	SSB30% or SSB20% (dynamic)	(interim) $F_{0.5R0}$ and $S_{0.5R0}$, where $h = 0.75$ ($S_{0.5R0}$ is equivalent to 7.7% SSB₀)