INTER-AMERICAN TROPICAL TUNA COMMISSION

2nd WORKSHOP ON MANAGEMENT STRATEGY EVALUATION (MSE) FOR TROPICAL TUNAS

(*by videoconference*)
03-04 May 2021

REPORT OF THE MEETING

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SUMMARY

The second IATTC workshop on management strategy evaluation (MSE) for tropical tunas was held by videoconference during May 3-4, 2021. Given the need to conduct the workshop via conference during the ongoing COVID-19 pandemic, the workshop was structured as a bilingual (Spanish and English with simultaneous interpretation) plenary for May 3-4, 2021, preceded by two informal, educational sessions either in Spanish or English during April 29, 2021. The objectives 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, further discuss potential management goals and performance metrics (identified during the first workshop) and extend the discussion on alternative reference points and harvest control rules with managers and other stakeholders. There were 97 workshop participants from 18 countries, non-governmental organizations

(NGOs) and IATTC staff. The workshop included lectures, discussions, and hands-on work with computer tools to illustrate major points, elicit discussions and dialogue and create diverse learning opportunities. A list of potential management objectives was developed during this workshop, which will be further discussed and refined at future meetings. A third workshop, funded and organized by the IATTC, is planned for 2022 (date to be determined), and is 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 initial MSE illustrative results to refine elements of candidate strategies for further evaluation.

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 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, whose terms of reference were established in Resolution C-19-07. This report summarizes the second MSE workshop for tropical tunas in the EPO, funded and organized by the IATTC and held during May 3-4, 2021. 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 (identified during the first workshop) and extend the discussion on alternative reference points and harvest control rules with managers and other stakeholders. A third workshop, also funded and organized by the IATTC, is scheduled for 2022, and will continue and build on the progress achieved during the previous workshops, as well as show initial MSE illustrative results to refine elements of candidate strategies for further evaluation.

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 and harvest control rules.

3. WORKSHOP DESIGN

This workshop aimed to provide background skills on management strategies and on 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 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. 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 (May 3-4, 2021) 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 April 29, 2021. 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, facilitated and co-chaired by Dr. Juan Valero and Dr. Alexandre Aires-da-Silva, was opened by the IATTC Director (*ad interim*), Jean-François Pulvenis. It was attended by 97 participants (Appendix 2), mainly tuna industry stakeholders, managers, scientists, and NGO representatives (Figure 1). Given the relatively large turnover of participants from the first IATTC workshop and previous EPO MSE workshops (Figure 2), it was decided to have two informal overview and review meetings (one in Spanish, one in English) prior to the workshop. The original plan was to have the workshop in person, however this was not possible due to the COVID-19 pandemic and the workshop was held via online videoconference (Figure 3).

The pre-workshop informal meetings and workshop plenary sessions included presentations, discussions, "hands-on" exercises with simplified MSE computer tools to illustrate major points, elicit discussions and dialogue and create diverse learning opportunities. 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 and 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 presentations focused on reference points, alternative harvest control rules (based on model results vs. based on empirical data). This was followed by results of a simple model projections under alternative harvest control rules. The goal was to illustrate the impact of uncertainty in the biological, fisheries and

management characteristics of a simulated stock on interpretations of results from Kobe plots. The discussion that followed focused on the current treatment of uncertainty in IATTC stock assessments and alternative ways to deal with uncertainty via management strategies evaluated via simulation, which was the topic of the following presentation. 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 following by discussions on each topic. The first presentation was on "*Management Objectives*", which included a review of the preliminary list of objectives proposed and discussed during the 1st IATTC MSE Workshop 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 second presentation was on "*Performance Metrics*", which included a generic overview and description, along with those used for North Atlantic Albacore tuna, for southern bluefin tuna and those considered in the Indian Ocean Tuna Commission. The third presentation was on "*Reference Points*" including an overview of those used in the IATTC context, those of other tuna RFMOs and also from other organizations around the world. The fourth presentation was on "*Harvest Control Rules*" which focused on a general overview of HCRs components, illustration of alternative types and functioning of HCR using a MSE demonstration tool (described in the next section), HCR implementation in the IATTC context and in other tuna RFMOs. Discussions on the topics of each presentation followed after the talks, a summary of the main points follows later in the report.

4.3. Hands-on exercises with MSE demonstration tool

A presentation by Juan Valero introduced a MSE demonstration tool initially developed by Dr. Andre Punt and used in previous tuna MSE workshops. For this workshop the tool was customized to represent EPO bigeye tuna (Figure 4). The tool is available online in English and Spanish.

Emphasis was put into clarifying that this tool does not conduct a real MSE but is more akin to a video game that incorporates only some aspects of what is included in a real MSE. The goal was to learn by using this simplified tool, but no conclusions on real management actions can be drawn about bigeye tuna or any other stock by using this tool, which is in no way a substitute for a real MSE.

After familiarizing the participants with the tool interface and running some initial scenarios as demonstration of the tool capabilities. The demos included comparisons between using constant catch and varying catch manually year to year, contrasting manual changes in catch levels with projections following harvest control rules (HCRs), HCRs based on either constant catch or constant exploitation rate with or without thresholds, or empirical HCRs. Tradeoffs were discussed between projections under different scenarios, both in the short and long-term.

4.4. Discussion on management objectives

A moderated discussion was held on potential management objectives, not to determine or negotiate any particular objective but with the goal of eliciting dialogue and ideas from participants. Some of the proposed "objectives" could be included in other categories of the harvest strategy, such as performance metrics and others, since the goal was to elicit dialogue and ideas, the refinement of objectives will continue in the future. It is expected that some of the objectives will be further discussed during future

meetings. The following were discussed during the meeting, they represent a further iteration from the initial draft of potential objectives during the 1st IATTC MSE workshop, they do not represent agreement in all or in part by the workshop participants. Other topics were discussed in this session including the fact that the current MSE framework does not include economics, so this could be a topic for future work, proxies could be considered. Considerations on other proposed topics such as rebuilding plans by stock status and life-history of species, defining emergency rules when faced with substantial changes, considerations about climate change where deferred to discussions on harvest control rules and operating models.

4.4.1. Objectives on Status and Safety of the Stocks

* Maintain stocks at healthy levels in the green sector of the Kobe plot (MSY)
    - *With a probability greater than 75% over 20 years*
    - *With a probability of 50%*

* Minimize annual probability of falling below trigger/limit reference points (spawning biomass)
    - What trigger reference points? More to discuss during HCR presentation
        - More proposed by US by e-mail and mentioned during session (see Appendix 3)
    - What limit reference points? Define actions when crossing RPs as part of HCRs
        - *Current IATTC's: 7.7% of virgin spawning biomass, less than 10% probability*
        - *More precautionary limit level: 7.7% of virgin spawning biomass, less than 5% probability*

4.4.2. Objectives on Yield and Abundance

* Maintain catches by different fisheries above historical ranges (Changes in capacity considerations)
    - *What range of years?*
    - *What fisheries? Caps?*

* Increase the maximum sustainable yield (MSY)
    - *Species-specific MSY*
    - *What combination of gears? What reference years?*

* Minimizing the bycatches of juvenile stages (sizes-ages) of non-target species (BET-YFT)
    - *What combination of gears? What reference years?*

* Maintain viable fisheries in the long term (CPUE, all fisheries) (Depend on economics)
    - *Use proxies such as CPUE reference levels, reference years? Short-term Long-term*

4.4.3. Objectives on Stability

* Maintain low annual variability of allowed catch or effort (include Effort)
    - *Changes in catch limit (Effort, Days of closure) between management periods less than 20%*
        - *Less than 10% fishing effort?, less than 20% capture?*

* Consider asymmetry of changes (precautionary)
    - *How asymmetric?*

* Consider different time span of management periods and associated variability in Catch or Effort

4.5. Discussion on Performance Metrics

Although alternative performance metrics were discussed as part of the discussion of Objectives, there was not enough time during the workshop to draft a list of potential performance metrics. Alternative performance metrics were illustrated and compared via the online MSE demonstration tool (Figure 5).

4.6. Discussion on Reference Points

The discussion on reference points focused on the fact that IATTC current target reference points are model-based biomass and fishing mortality at MSY, however MSY has changed over time, particularly for BET as the majority of share the catch changed from longline fisheries to purse-seine fisheries after its expansion in the mid-1990s. In addition, there are no model estimates of MSY quantities for SKJ. It was also agreed that limit reference points cannot be evaluated in isolation of other elements of strategy (target reference points, HCR), and as part of the harvest strategy. Which limited reference points are appropriate depends on management action to be applied if the limit is exceeded and the probability of exceeding them. The impact of potential changes in recruitment history was also discussed and how that may impact the interpretation of reference points. The main points of the discussion are listed below:

* Dynamic & Equilibrium Reference Points? Do we adjust for changes in recruitment history?

- *Dynamic targets F_{MSY} and B_{MSY} (probability around them not defined, 50%?)*
- *Equilibrium limits for F and B (not to be exceeded, 10% probability)*
    - *Finding corresponding Probability values relative to risk but not so low that are difficult to estimate appropriately*
    - *Relate interpretation of limits or triggers to the action to take*

* Consider additional control points in addition to Target and Limit Reference points, for example to create precautionary buffers to scientific or implementation uncertainty.

- *Should F_{MSY} only be considered a target? Limit? Buffer?*
- *Consider relationships between limit and recovery to target*

* Consider terminology such as HCR control parameters vs. Reference Points

4.7. Discussion on Harvest Control Rules

The discussion on HCRs focused on the historic and recent implementation of management measures in the IATTC context. In particular to the current IATTC's HCR described in C-16-02, the discussion focused on HCR elements in need of further specification in order to be able to appropriately evaluate its performance relative to alternatives. Options to clarify include management measures for purse-seine fisheries, such as consideration of days of closure, catch limits and limits on number of sets, either as separate measures or in combination. Differences between global purse seine measures or by type of set (NOA, DEL, OBJ) were also discussed, as well as global tropical tuna measures versus by species. For longline fisheries which currently have catch limits, there was discussion on consistency with other gears and accounting impact on the stocks compared other gears. The timespan and application of management measures following HCR action was also discussed. Timespan of management measures has varied between 3 to 1 years or less, so the MSE should consider alternative timespans, considering as well adjustments in between. The immediacy of management actions was also discussed, with potential lags and buffers for consideration. Some alternative HRCs to be included in the MSE were discussed and illustrated with the MSE demonstration tool (Figure 4), including model-based HCRs, empirical, model-

based but with simpler models, and combination of model-based and empirical rules.

4.8. General discussion

As at previous MSE workshops, some time was devoted to clarification of technical aspects, such as the importance of detailed information about FADs for deriving CPUE (relative abundance) indices from purse-seine data to complement the current longline indices. Some basic examples of CPUE indices were explained, along with how more detailed FAD information could be used to derive meaningful standardized indices of relative abundance. Of particular interest was the discussion of potential alternative management options. There was concern over the current use of common management measures across species and fisheries, such as the temporal closure for purse-seine fisheries. The discussions were frank and open and, as reported in the participants' evaluations, contributed greatly to their understanding of, and trust in, the work conducted and planned both for the current tropical tuna stock assessments and ongoing/future MSE work.

The last presentation was a summary of proposed next steps towards MSE development by IATTC staff. The ensuing discussion focused on the scope of the MSE plan, particularly whether it would cover all three tropical tuna species, or a single species, and if so, which one. 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. The current MSE for bigeye tuna is funded by the European Union for years 2021 to 2023.

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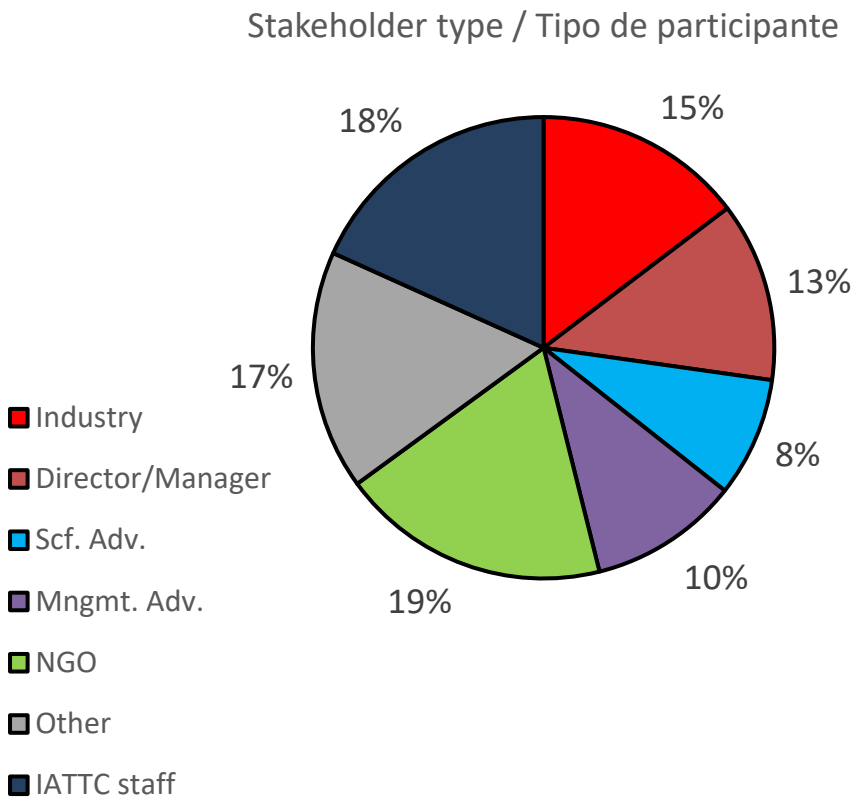

FIGURE 1. Participants in the second IATTC workshop on MSE for tropical tunas, by stakeholder type.

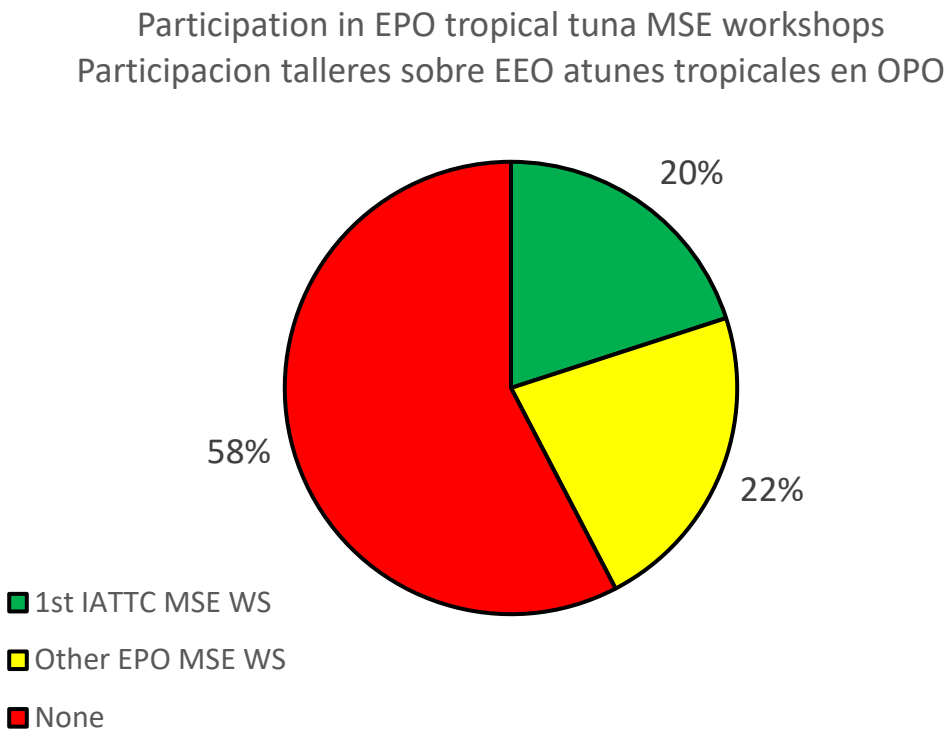

FIGURE 2. Participants in the second IATTC workshop on MSE for tropical tunas and their participation on previous workshops on MSE for tropical tunas in the EPO.

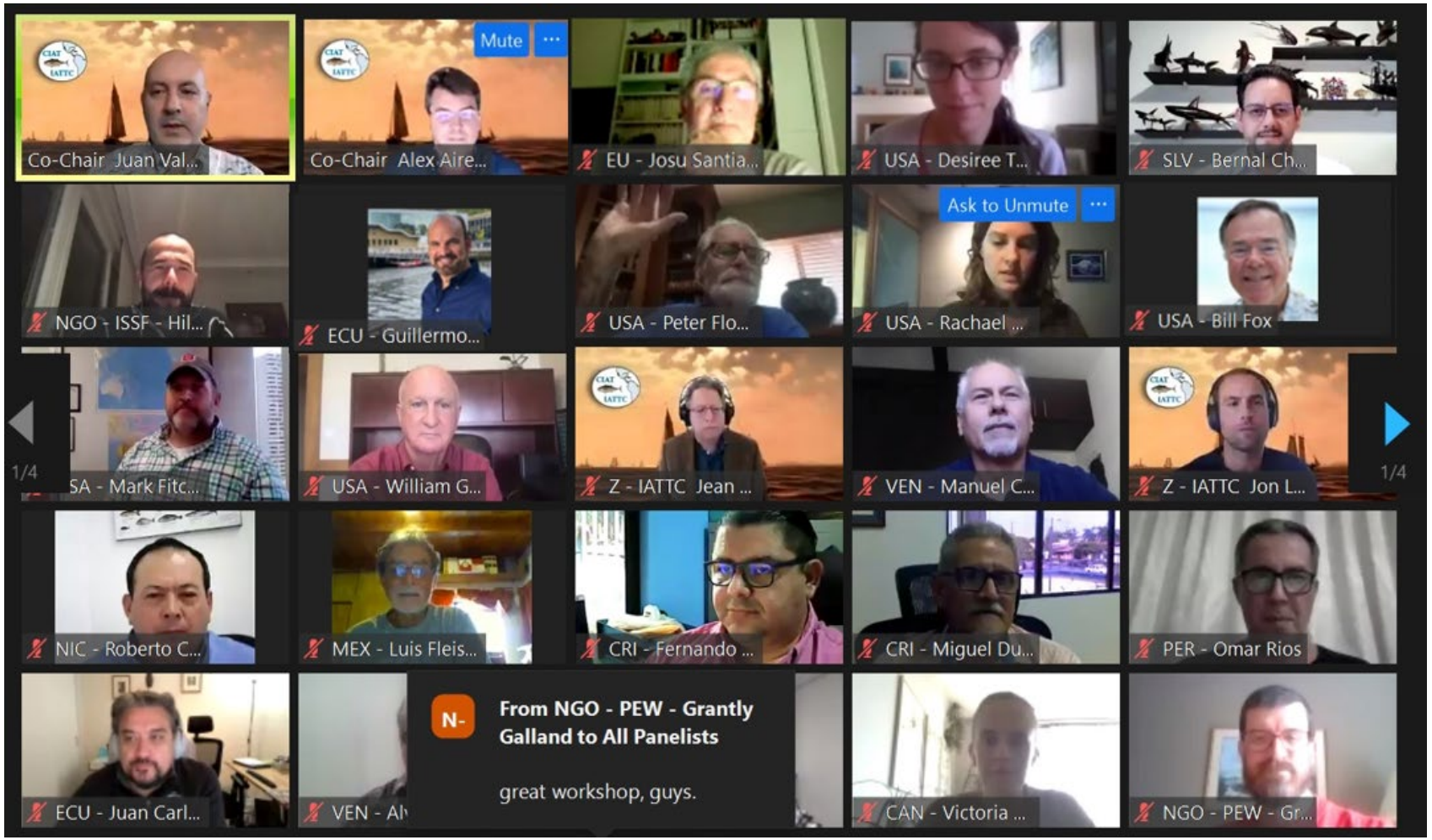

FIGURE 3. Participants in the second IATTC workshop on MSE for tropical tunas.

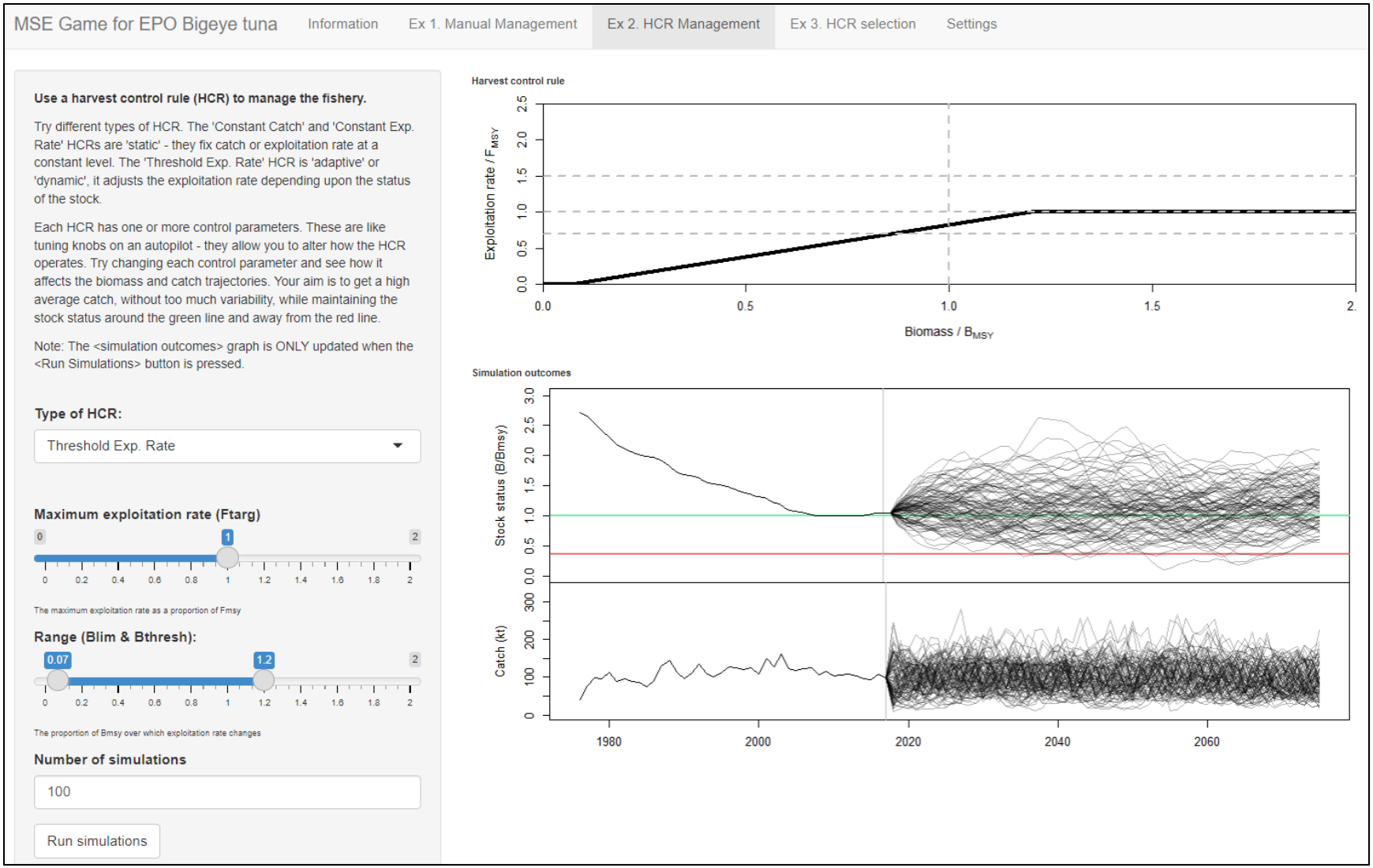

FIGURE 4. MSE simulation tool used during the workshop to provide hands-on alternative harvest control rule (HCR) types, reference points and performance metrics. The MSE tool is available here: https://valeromaspez.shinyapps.io/tunamse_epo_eng/

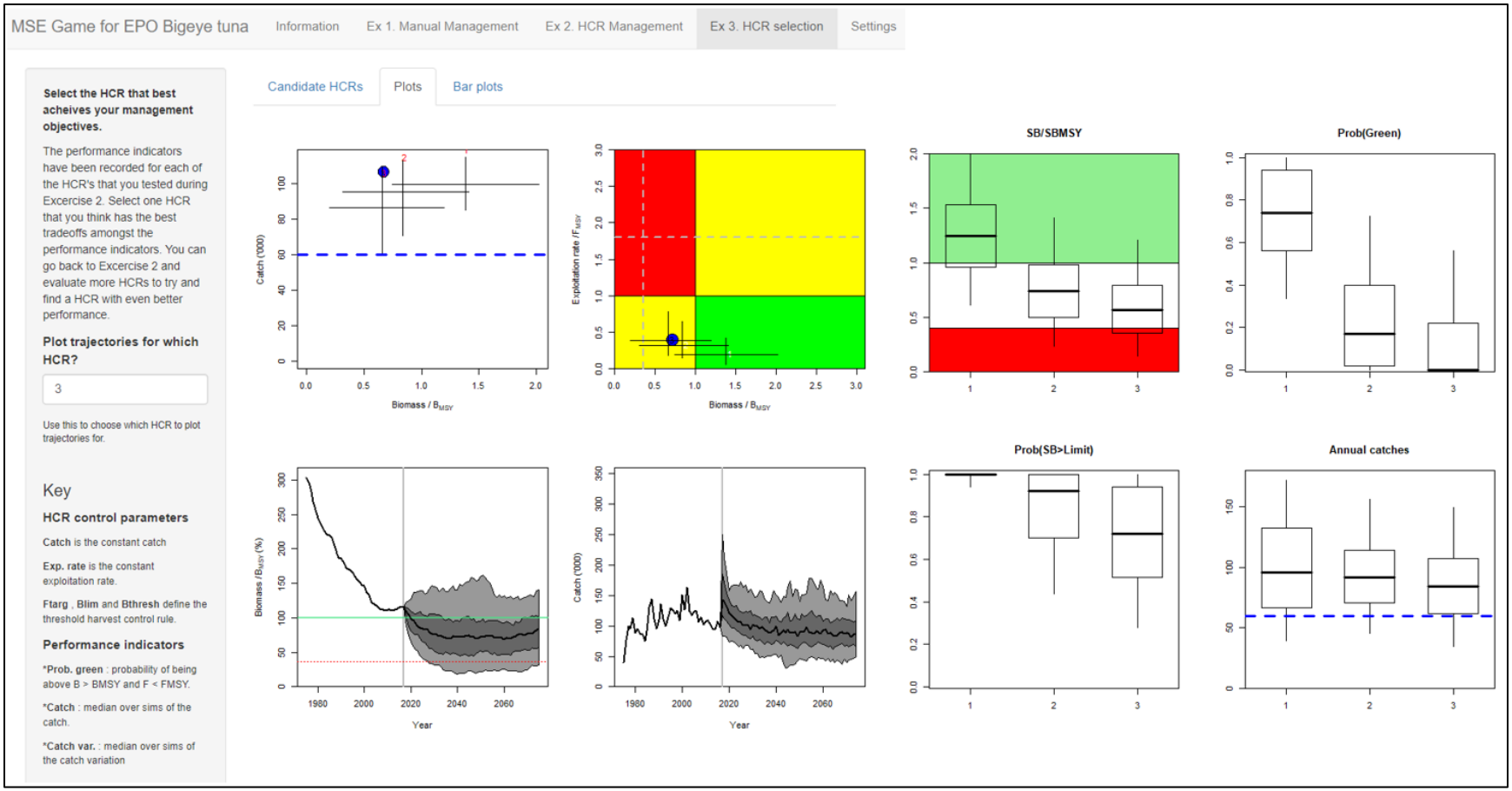

FIGURE 5. MSE simulation tool used during the workshop to provide hands-on alternative harvest control rule (HCR) types, reference points and performance metrics. The MSE tool is available here: https://valeromaspez.shinyapps.io/tunamse_epo_eng/

APPENDIX 1. Agenda

INTER-AMERICAN TROPICAL TUNA COMMISSION

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(by videoconference)
03-04 May 2021

Tentative agenda

Pre-workshop meetings (April 29, 2021)

1. Overview of MSE process for tropical tunas at IATTC, including results of 1st IATTC MSE Workshop.
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 (May 3-4, 2021)

1. Overview of MSE process for tropical tunas at IATTC, including results of 1st IATTC MSE Workshop.
2. Refinement of objectives proposed during the 1st IATTC MSE Workshop.
3. Discussion on components of MSE for IATTC tropical tunas:
    a. Objectives
    b. Reference Points
    c. Harvest Control Rules
    d. Performance Indicators
4. Hands on exercises and demonstrations to elicit discussion and input from stakeholders on MSE components.
5. 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.

US options for reference point and harvest control rules
Draft 5/4/2021

U.S. managers suggest that the MSE results compare some types of management measures, such as fad closure days, closures days. Is F going to be linked to a management action such as the above?

Harvest strategy option
-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 (something similar to the alternative option Juan presented in the tuna MSE app)

-Ideally the target would be high enough that the limit is not often crossed

Target RP	**Threshold**	**Limit RP**
F40 and F30 SSB40% and SSB30%		Fmsy; 0.5*Bmsy; If M<0.5, MSST=(1-M)*Bmsy;
F40 and F30	SSB30% or SSB20%	Fmsy; 0.5*Bmsy; If M<0.5, MSST=(1-M)*Bmsy;
F40 or F30	SSB30% or SSB20%	*(interim)* $F_{0.5R0}$ and $S_{0.5R0}$, where h = 0.75 ($S_{0.5R0}$ is equivalent to **7.7% SSB_0**)