INTER-AMERICAN TROPICAL TUNA COMMISSION

1st WORKSHOP ON MANAGEMENT STRATEGY EVALUATION (MSE) FOR TROPICAL TUNAS: Overview, objectives and performance metrics

La Jolla, California (USA)
9-10 December 2019

REPORT OF THE MEETING

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CONTENTS

SUMMARY

The first IATTC workshop on management strategy evaluation (MSE) for tropical tunas was held in San Diego, USA, on 9-10 December 2019. 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, and discuss potential management goals and performance metrics with managers and other stakeholders (identified as a priority for the first workshop). The workshop was attended by 44 participants from 13 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. Feedback during and after the workshop, along with a workshop evaluation form, indicated that participants increased their understanding of the components and functioning of management strategies and their role in the process. A list of potential management objectives was developed during this workshop, which will be further discussed and refined at future meetings. A second workshop, funded and organized by the IATTC, is scheduled for 8-9 May 2020, 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, and discuss potential performance metrics, reference points and harvest control rules.

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, beginning in 2019, whose terms of reference were established in Resolution C-19-07. This report summarizes the first MSE workshop for tropical tunas in the EPO, funded and organized by the IATTC and held during December 2019. 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 discuss potential management goals and performance metrics with managers and other stakeholders. A second workshop, also funded and organized by the IATTC, is scheduled for 8-9 May 2020, and will continue and build on the progress achieved at the first workshop, and discuss reference points and harvest control rules.

2. OBJECTIVES OF THE REPORT

This report summarizes the activities conducted during the workshop, including presentation outlines, results of online questionnaires and discussions on alternative management objectives, participant demographics, hands-on exercises and input from participants about the workshop.

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 begin eliciting input (such as alternative objectives and performance metrics) 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") to illustrate the main points, issues, and tradeoffs, and foster dialogue, discussion and understanding among

participants. The languages of the workshop and workshop materials were Spanish and English, with simultaneous translation. Feedback during and after the workshop, along with a workshop evaluation form, indicated that participants increased their understanding of the components and functioning of management strategies and their role in the process.

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, IATTC Coordinator of Scientific Research, was opened by the IATTC Director, Dr. Guillermo Compeán. It was attended by 44 participants (Figure 1, Appendix 2), mainly tuna industry stakeholders, managers, scientists and NGO representatives. The workshop included lectures, discussions, "hands-on" exercises with simplified MSE computer tools and online input forms 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. The online input forms and subsequent dialogue helped elicit input from stakeholders on potential management objectives and performance metrics.

4.2. Presentations

The first presentation contrasted 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 the recent MSE work with dorado in the EPO as a case study. 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).

4.3. 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 2). 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 on the projection screens, time was devoted to a series of hands-on working sessions. In each of them, participants, working individually or in groups of 2 to 4, were free to try alternative scenarios while workshop presenters circulated among the different groups, asked and answered questions and led some of the work to explore scenarios and tradeoffs of interest. The exercises 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. Participants were asked to try maximizing catches and minimizing their variability while keeping the stock in the green zone of the Kobe plot. Unlike similar workshops of other tuna RFMOs, no competitions between the groups were suggested. Instead, each group/individual was encouraged to explore the suggested exercises on their own, and if they found something that was of interest, the scenario was recreated on the projection screen and discussed with the whole group.

4.4. Online questionnaire on management objectives

Participants were asked to complete an online questionnaire (Appendix 3), similar to those used in recent ICCAT workshops. 31 responses were received from the 44 participants (72%). They selected one or more options and ranked them on a scale of 1 (Not important) to 5 (Very important). The results are summarized as a ranking of the average importance given across participants. However, this should not be interpreted as weighted-priority ranking, nor as a consensus ranking of objectives, since there are tradeoffs between some of the objectives. Objectives are expected to be refined during upcoming meetings and workshops, as well as their ranking and prioritization for work during the technical component of the MSE.

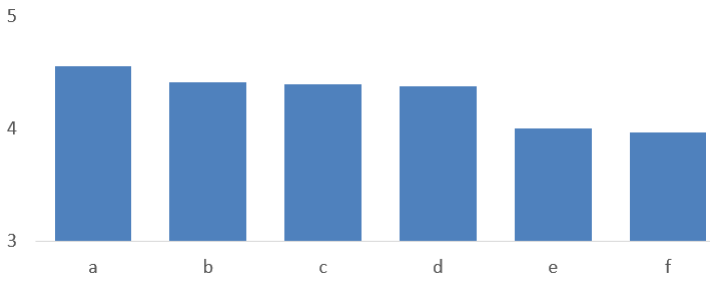
4.4.1. General objectives

Participants were asked about what types of general objectives they considered important, using the following categories:

a. **Status:** Maximize the probability of maintaining the stock in the green zone of a fishery's Kobe plot (*i.e.*, not overfished, no overfishing).
b. **Safety:** Minimize the probability that the stock will fall below the biomass limit reference point (B_{LIM}).
c. **Yield:** Maximize catch (or effort) across regions and/or fishing gears.
d. **Abundance:** Maximize catch rates to enhance fishery profitability.
e. **Stability:** Maximize stability in catches to reduce commercial uncertainty by minimizing variability in catch from year to year.
f. **Other:** Other priorities not listed above

Under "Other", participants included:

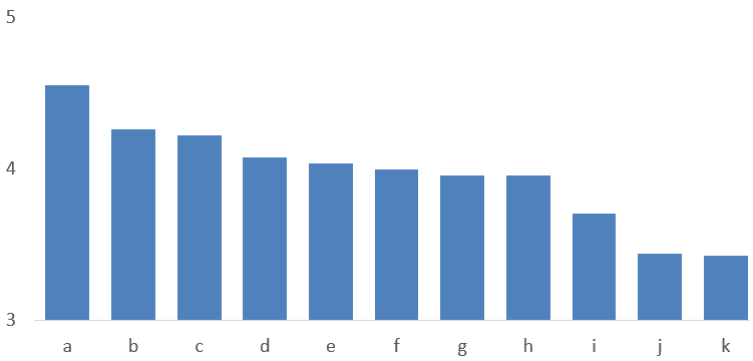
- Minimize the capture of juveniles of non-target species
- Management based on catch quotas
- Management based on ecosystem considerations
- Increase the size of tunas in the catch



Participants ranked "Status" (a) highest, followed by "Abundance" (b), "Stability" (c), "Safety" (d), "Other" (e) and "Yield" (f). See figure below.

4.4.2. Specific objectives

Regarding specific objectives and their importance, participants ranked "Minimize risk of being below B_{LIM}" (a), "Catch stability" (b) and "Management measures by fishery" (c) highest, followed by "Size composition of the catch" (d), "Gradual changes in management" (e), "Management measures by species" (f), "Minimize risk of being below B_{MSY}" (g), "Global Management measures" (h), "Maximize captures" (i), "Maximize profitability" (j) and "Other" (k). See figure below.

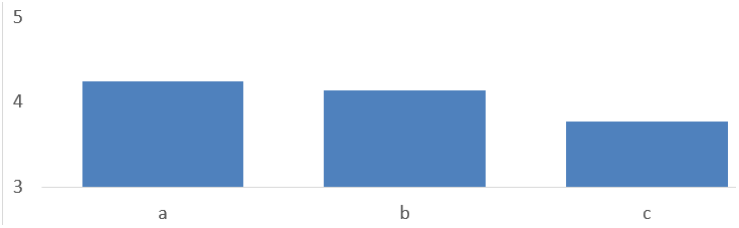


Under "Other", the participants included:

- Resilience
- Stability of the fishing cycle
- Minimize catches of non-target incidental species
- Profitability
- Maintain historical catch levels
- Adaptability
- Minimize ecosystem impacts
- Fair sharing of the resource and/or conservation burden
- Sustainability

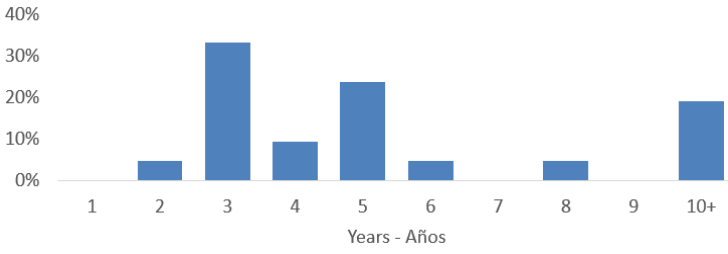
4.4.3. Time

Regarding the importance of time in the objectives, the participants preferred the medium term of 3 to 9 years (a), followed by long term of 10 years and longer (b), and short term of 1 to 3 years (c).



More specifically, the most common was 3 years, which matches the current 3-year cycle of IATTC conservation resolutions, (C-17-02, for example), followed by 5 years and 10 years and longer.

The results of this survey helped during the following discussion on management objectives and will be used to inform the dialogue at future workshops regarding management issues and potential choices among alternatives to evaluate during the technical component of the MSE.



4.5. Discussion on management objectives

On the second day, 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, such as during the second IATTC MSE Workshop. The following were proposed by participants:

- Maintain stocks at healthy levels within the green sector of the Kobe plot (with a high probability)
- Maintain stocks at healthy levels within the green sector of the Kobe plot (50%)
- Minimize the annual probability of falling below trigger and limit reference points (spawning biomass)
- Maintain catches by different fisheries above historical ranges
- Increase the maximum sustainable yield (MSY)
- Maximizing economic yield (MEY) in the long term
- Minimizing the bycatches of juvenile stages of non-target species
- Establish rebuilding plans depending upon stock status and life-history of species
- Maintain viable/sustainable fisheries in the long term (CPUE, taking into account all fisheries)
- Maintain low variability of catch or effort (10% for example, consider asymmetry depending upon increment or decrease)
- Define emergency rules when faced with substantial changes
- Consider climate change

Not all these proposals reflect management objectives, some are performance metrics or other categories of a harvest strategy, but all will be considered as the objectives continue to be refined in the future, such as the second IATTC MSE Workshop.

The United States and The Ocean Foundation submitted draft objectives in writing for consideration (Appendices 5 and 6) to the Workshop Chairs, and these ideas were included in the discussion. As with the above list of potential objectives, they represent an initial draft of potential objectives, they do not represent agreement in all or in part by the workshop participants.

4.6. General discussion

As at previous MSE workshops for the tuna industry, 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.

These workshops are valuable for explaining the scientific methodology used to calculate these indices, since a better understanding of the usefulness of, and need for, this information, and the way it is used, will lead to a resolution of the current difficulties in obtaining it, some of which stem from misunderstandings about concepts such as CPUE and CPUE standardization, and about the intended use of this information.

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. Participants manifested their perception that a relatively small number of vessels are responsible for a disproportionally large amount of the bigeye tuna catch, particularly of small fish. Participants asked about potential measures specific to particular fleets (or fleet sectors), stocks, *etc*. All in all, 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 (Table 1). 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. Finally, the participants were asked to complete a workshop evaluation survey (Appendix 4), after which the workshop was closed.

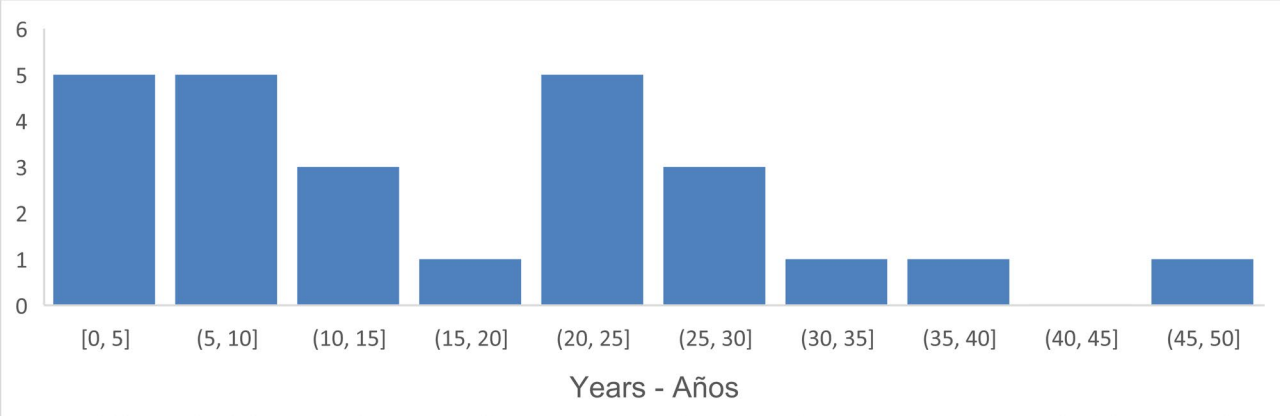
TABLE 1. Timeline and deliverables for tropical tuna MSE	
2018	Improved bigeye assessment for use as spatial operating model (OM)
	Workshop on training, communication and evaluation of management strategies (San Diego)
2019	SAC-10: Report improvements to bigeye model for use as OM
	Introductory workshops on harvest strategies for industry (Ecuador, Panama, USA, Mexico, Colombia)
	Workshop for scientists-managers to elicit objectives, performance metrics (USA)
2020	Workshop for scientists-managers to elicit alternative HCRs (USA, tentatively in May)
	SAC-11: Report on revised MSE plan and outcomes of workshops
	IATTC-95: Consideration of a MSE working group for scientists, managers, other stakeholders
	Workshops with managers-stakeholders to show initial results and gather feedback; technical meeting
2021	Updated MSE results based on input from managers and stakeholders
	SAC-12: Report on revised MSE plan and preliminary results based on outcomes of workshops
2022	Final MSE results based on revised input from managers and stakeholders
	SAC-13: Report on revised MSE plan and preliminary results based on outcomes of workshops
2023	SAC-14: Report final results, present plan for other tropical tunas
	IATTC-98: Recommend evaluated HCR/management procedure for adoption, based on bigeye

5. WORKSHOP EVALUATION SURVEY

Prior to the workshop and at its end, participants were asked to complete a survey, whose goal was to evaluate how well the workshop objectives had been met. In particular, participants were asked whether the workshop: (1) improved their understanding of harvest strategies, MSE principles and tools; (2) would enable them to engage more effectively in ongoing tuna MSE processes. The results of the survey are summarized below.

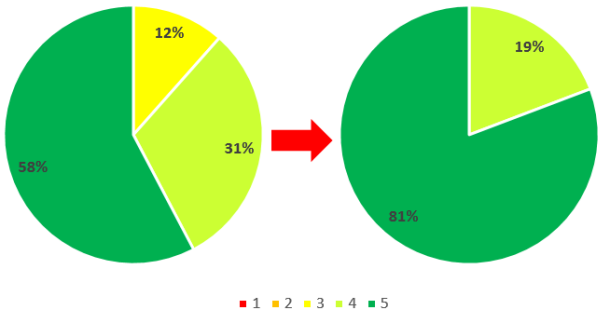
5.1. Participant data

In addition to IATTC staff members, the workshop was attended by 31 participants from 13 countries, representing governments and NGOs, of whom 26 (60% of all participants; 80% of non-IATTC staff participants) completed the survey. Of the respondents, 88% participate in IATTC-related meetings: Scientific Advisory Committee (77%), Commission meetings (64%), national preparation meetings and working groups (42%), most frequently as advisors in science (50%), management (23%), and policy (19%), but also as representatives of NGOs (13%) and industry (12%), and as fisheries managers (12%), with considerable overlap among these categories. On average, they have 18 years' experience in fisheries (range: 2 to 50), with about a 75:25 male:female ratio.



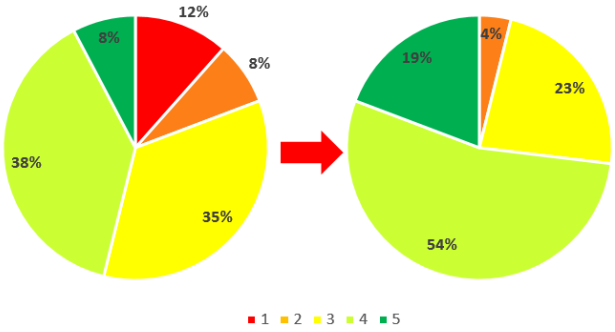
5.2. Perception of MSE: before and after

Participants were asked to rate the importance of management strategies as a tool for improving the sustainability of tuna fisheries, on a scale of 1 (not very important) to 5 (very important). Before the workshop, 12% of respondents thought that management strategies were somewhat important, while 58% thought that they were very important; afterwards, none considered them less than fairly important, while 81% considered them very important.

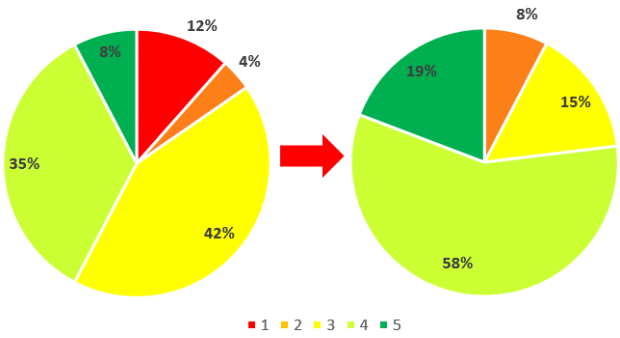


5.3. Understanding of MSE: before and after

Participants were asked to rate their knowledge of management strategies and reference points, on a scale of 1 (limited) to 5 (very good). Before the workshop, 55% indicated moderate to limited knowledge; afterwards, that number had fallen to 27%. Before the workshop, only 46% considered their knowledge to be good or very good, which improved to 73%.



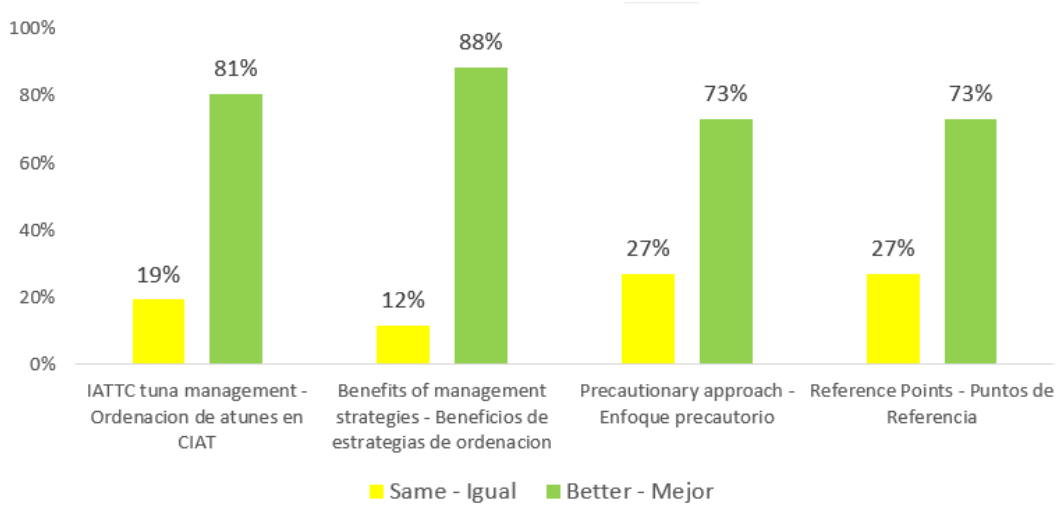
Participants were also asked to rate their knowledge of the processes required to improve the development and implementation of management strategies and conservation measures in the IATTC context, using the same scale. Before the workshop, 58% of the responses indicated moderate to limited knowledge; after the workshop, that number had fallen to 23%. Before the workshop, 43% of the responders considered their knowledge to be good or very good, which improved to 77% after the workshop.



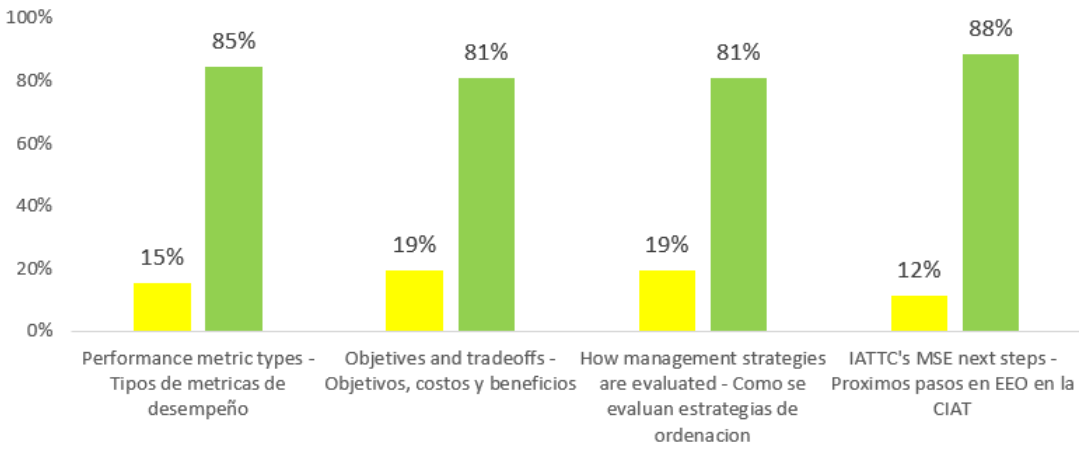
5.4. Effectiveness of workshop content

The survey sought to ascertain the workshop's effect on the participants' understanding of key concepts

and principles relating to management strategies, in both IATTC and general contexts, their confidence to engage in dialogues about the development and implementation of management strategies, and whether they expected to use these concepts and materials in their work. Most respondents thought that the workshop improved their understanding of how IATTC manages tuna fisheries (81%), of the benefits of using management strategies (88%), the precautionary approach (73%), and the difference between target and limit reference points (73%). Almost all (96 to 100%, depending on the question) expected to use this knowledge in their work.

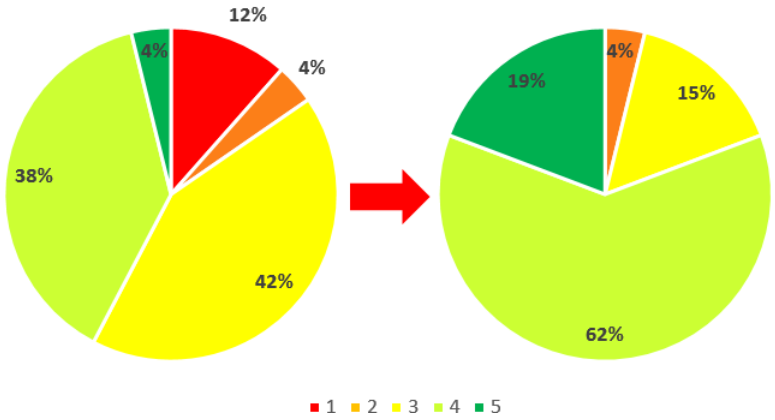


In addition, a large majority of respondents considered that the workshop improved their understanding of the types of performance metrics for fisheries (85%), that defining objectives may require tradeoffs (81%), why management strategies are evaluated via simulation (81%), and the following steps for IATTC MSE (88%). Almost all (92 to 100%, depending on the question) expected to use this knowledge in their work.



5.5. Confidence to engage in management process dialogue

Participants were asked how prepared they considered they were, before and after the workshop, to engage in dialogues on management processes and on the implementation of alternative tuna management measures to improve sustainability, on a scale from 1 (not confident) to 5 (very confident), with 3 being somewhat prepared. Before the workshop, 42% of respondents considered that they were more than somewhat prepared, compared to 81% afterwards.



5.6. Workshop delivery

Participants were asked to rate the amount and level of the content of the workshop, using the following scales: amount: too much/good/not enough; level: too simplistic/good/too complicated. 81% rated the volume as ‘good’, 18% as ‘not enough’ and 8% as ‘too much’. None considered the level of content ‘too simplistic’; 92% considered it ‘good’, and 8% ‘too complicated’.

5.7. Workshop feedback

Feedback during and after the workshop, along with the evaluation survey, indicated that participants increased their understanding of the components and functioning of management strategies and of their role in the process. Participants were asked for their opinions on the workshop, and how it could be improved, and made the following suggestions (in priority order):

- More time for dialogue
- Longer workshops
- More hands-on exercises
- Continue the use of analogies, which are highly effective
- Create a repository of material from other RFMOs, key scientific papers
- Continue the discussion remotely or via working groups

The participants noted the following as needing more attention and/or time during the workshop:

- More case studies and exercises
- More about graphical outputs, Kobe plot
- Discussions after each topic
- Fisheries-specific management measures, control of bycatch of juveniles and FADs
- More discussion about the precautionary approach
- Socioeconomics

Participants also mentioned that presentations were optimal and suggested dividing the room into smaller groups, and a more informal seating arrangement, with a common table, or smaller tables.

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FIGURE 1. Participants in the first IATTC workshop on MSE for tropical tunas.

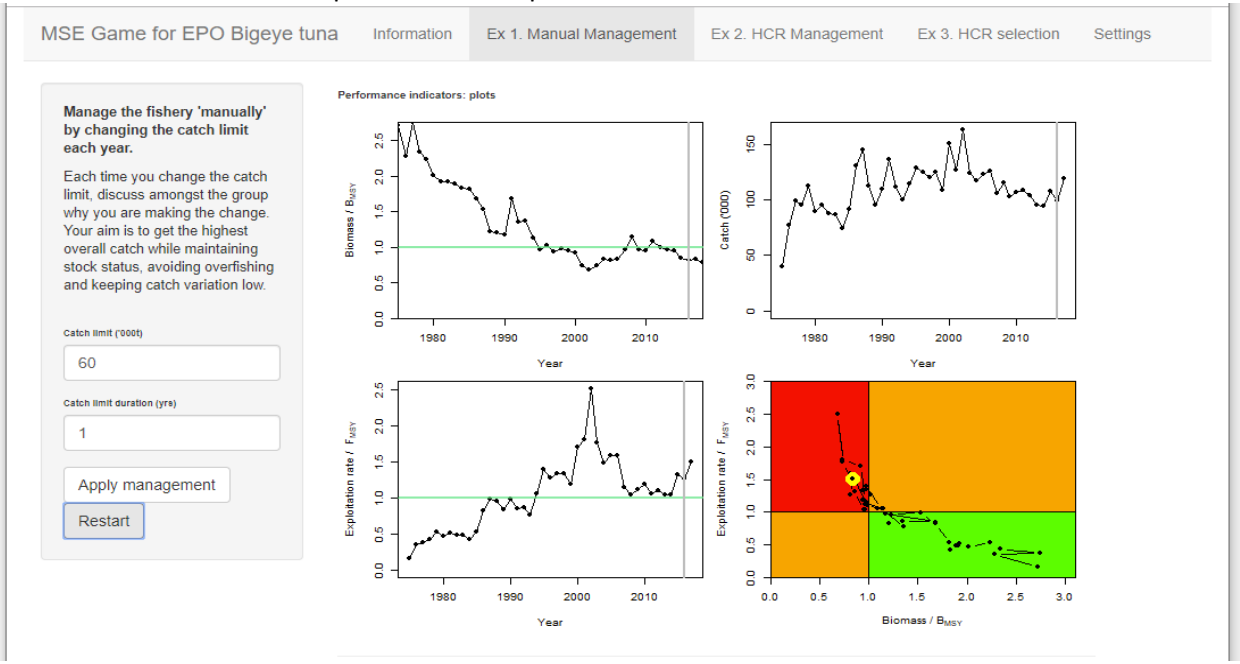

FIGURE 2. MSE simulation tool used during the workshop to provide hands-on demonstration on some of the processes involved when testing alternative management strategies. The MSE tool is available here: https://valeromaspez.shinyapps.io/tunamse_epo_eng/

APPENDIX 1. Agenda

INTER-AMERICAN TROPICAL TUNA COMMISSION

1st WORKSHOP ON MANAGEMENT STRATEGY EVALUATION (MSE) FOR TROPICAL TUNAS: Overview, objectives and performance metrics

La Jolla, California (USA)
9-10 December 2019

AGENDA

1. Inauguration and opening
2. Review of fundamental concepts of MSE, including target, limit, and threshold reference points, operating models, harvest control rules (HCRs), and harvest strategies
3. Review of management objectives, performance metrics, candidate reference points, and candidate HCRs developed for testing in other MSE workshops
4. Discussion on alternative candidate management objectives for IATTC tropical tunas
5. Discussion on alternative candidate performance metrics for IATTC tropical tunas
6. Next steps and timeline for the MSE process
7. End of meeting

APPENDIX 2. List of participants

Name	Affiliation	Email
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APPENDIX 3. Online questionnaire on objectives

What types of objectives are important to you? ¿Qué tipos de Objetivos son importantes para usted?

	1	2	3	4	5
Status / Estado					
Safety / Seguridad					
Yield / Captura					
Abundance / Abundancia					
Stability / Estabilidad					
Other? Otros?					

Liste uno o más objetivos y su importancia / Check one or more objectives and their importance

Minimizar riesgo de estar debajo de Blim / Minimize risk of being below Blim	
Maximizar las capturas / Maximize captures	
MInimizar riesgo de estar por debajo de Brms / Minimize risk of being below BMSY	
Maximizar ganancia / Maximize profitability	
Catch stability / Estabilidad en capturas	
Cambios graduales en manejo / Gradual changes in management	
Size composition of the catch / Composicion de Tallas en captura	
Medidas de manejo por especie / Management measures by species	
Medidas de manejo globales / Global Management measures	
Medidas de manejor por pesqueria / Management measures by fishery	
Otras / Others?	

Cuan importante es el plazo de sus objetivos? / How important is time in your objectives?

Short term / corto plazo (1 a 3 years/anios)	
Medium term / mediano plazo (3 a 9 anios/years)	
Long term / largo plazo (10+ anios/ years)	

Cuál es el plazo típico de sus objetivos (años) / Typical time of your objectives?

APPENDIX 4. Feedback form

INTER-AMERICAN TROPICAL TUNA COMMISSION

1st WORKSHOP ON MANAGEMENT STRATEGY EVALUATION (MSE) FOR TROPICAL TUNAS: Overview, objectives and performance metrics

La Jolla, California (USA)
9-10 December 2019

FEEDBACK AND WORKSHOP EVALUATION FORM

We are collecting information on who attended the workshop, what participants gained from them, and how to improve future workshops. Please answer all questions that you can. The information will be aggregated with other answers collected, and any reports related to this feedback will not identify individual respondents. We appreciate your feedback as it will help to improve the value of future workshops. Please provide any additional feedback or details to any questions if you would like. This should only take a few minutes. **Thank you for your participation!**

PLEASE SAVE THE FORM AFTER YOU COMPLETE IT, BEFORE EMAILING IT

Participation

1. Do you attend… (Mark all that apply)

☐ Commission meetings
☐ Scientific Committee meetings
☐ Working Parties to Committees
☐ Preparatory meetings within your country
☐ None of the above (describe your participation):……..

2. Your role is... (Mark all that apply)

☐ Industry member
☐ Scientific advice
☐ Management advice
☐ Policy advice
☐ NGO
☐ Director/Fisheries Manager
☐ Other:…….

3. Is your country/organization considered: (Mark all that apply)

☐ A Member of the IATTC
☐ Cooperating Non-Member of the IATTC
☐ A developing country
☐ An EPO coastal country
☐ Other (please specify):….

4. Approximately how long have you been involved in the fishery sector)? _____ years

Perception Before and After the Workshop

5. BEFORE: did you consider Harvest Strategies an important tool to improve the sustainability of tuna fisheries? (Mark one)

☐ ☐ ☐ ☐ ☐

1 2 3 4 5

Not important Very Important

6. AFTER: do you consider Harvest Strategies an important tool to improve the sustainability of tuna fisheries? (Mark one)

☐ ☐ ☐ ☐ ☐

1 2 3 4 5

Not important Very Important

Knowledge Before and After the Workshop

7. BEFORE: how would you rank your knowledge of the course content?

a) Use of harvest strategies and reference points for management of tuna stocks (Mark one)

☐ ☐ ☐ ☒ ☐

1 2 3 4 5

Limited Very good

b) Processes required for further development and implementation of Harvest Strategies and conservation measures in the IATTC (Mark one)

☐ ☐ ☐ ☐ ☐

1 2 3 4 5

Limited Very good

8. AFTER: how would you rank your knowledge of the course content?

a) Use of harvest strategies and reference points for management of tuna stocks (Mark one)

☐ ☐ ☐ ☐ ☐

1 2 3 4 5

Limited Very good

b) Processes required for further development and implementation of Harvest Strategies and conservation measures in the IATTC (Mark one)

☐ ☐ ☐ ☐ ☐

1 2 3 4 5

Limited Very good_____

Effectiveness of Workshop Content

9. Do you feel you have a better understanding of:… (Mark one for each question)

a. How the IATTC manages tuna fisheries?.

☐ Same
☐ Better

Will you use this knowledge in your work?
☐ Yes
☐ No

b. Advantages of using harvest strategies to manage fisheries.

☐ Same
☐ Better

Will you use this knowledge in your work?
☐ Yes
☐ No

c. What the precautionary approach is to management.

☐ Same
☐ Better

Will you use this knowledge in your work?
☐ Yes
☐ No

d. The difference between a target and limit reference points.

☐ Same
☐ Better

Will you use this knowledge in your work?
☐ Yes
☐ No

10. Do you feel you have a better understanding of :… (Mark one for each question)

a. Types of performance metrics for the fishery.

☐ Same
☐ Better

Will you use this knowledge in your work?
☐ Yes
☐ No

b. That objectives may require trade-offs.

☐ Same
☐ Better

Will you use this knowledge in your work?

☐ Yes
☐ No

c. Why Management Strategies are tested in simulation models?.

☐ Same
☐ Better

Will you use this knowledge in your work?

☐ Yes
☐ No

d. What are the next steps for the IATTC to evaluate potential alternative harvest strategies for tropical tunas?

☐ Same
☐ Better

Will you use this knowledge in your work?

☐ Yes
☐ No

11. BEFORE the workshop, did you feel confident in engaging in dialogues around the implementation of sustainable tuna management including the formulation of Management Strategies?

☐ ☐ ☐ ☐ ☐
1 2 3 4 5
Not confident Very confident

12. AFTER the workshop, did you feel confident in engaging in dialogues around the implementation of sustainable tuna management including the formulation of Management Strategies?

☐ ☐ ☐ ☐ ☐
1 2 3 4 5
Not confident Very confident

Workshop Delivery

13. How do you feel about the volume of material covered in each section? (Mark one)

☐ ☐ ☐

Too much Good Not enough

14. How do you feel about the level of the material covered given your prior experience?

☐ ☐ ☐

Too simple Good Too complicated

15. How do you think the presentation of the material could be improved? (write in below)

16. Please identify the topics that you think needed more attention. (write in below)

Thanks for your feedback!

PLEASE SAVE THE FILE BEFORE CLOSING IT, PLEASE E-MAIL IT TO
jvalero@iattc.org

APPENDIX 5. Draft objectives and performance metrics submitted by the United States

General Objective	Operational Objective	Performance Metric
STOCK STATUS		
Ensure long-term conservation of the fish stocks (Antigua Convention)	Minimize the annual chance of the spawning stock biomass (SSB) going below the threshold reference point (Threshold RP) and limit reference point (LRP)	Average annual probability SSB > Threshold RP and SSB > LRP over MSE simulation period
Maintain or restore the populations of harvested species at levels of abundance which can produce maximum sustainable yield (Antigua Convention)	Maintain spawning stock biomass (SSB) above SSB_{MSY} and ensure the fishing mortality rate (F) is not above F_{MSY}	Average SSB and F relative to its value at MSY over MSE simulation period Average probability of occurring in the green quadrant of the Kobe plot over the MSE simulation
Maintain or restore the populations of harvested species at levels of abundance which can produce maximum sustainable yield (Antigua Convention)	Maintain high probability of stock status occurring in the green quadrant of the Kobe plot over the MSE simulation	Maintain spawning stock biomass (SSB) above SSB_{MSY} Ensure the fishing mortality rate (F) is not above F_{MSY} Average probability of occurring in the green quadrant of the Kobe plot over the MSE simulation
YIELD		
Ensure long-term sustainable use of the fish stocks (Antigua Convention)	Maintaining sustainable CPUE for target species over the long-term	Average CPUE for the target species over the MSE simulation period (e.g., 20 years) relative to historical sustainable CPUE levels
	Minimize incidental catch of juvenile non-target species	Average catch of juvenile non- target species over the MSE simulation period (e.g. 20 years) relative to sustainable CPUE (and catch?) levels
FISHERY STABILITY		
Minimize catch (or effort) variability	For stocks managed via a catch or effort limit, any increase or decrease in catch/effort limit between management periods should be gradual, except when the SAC determines a stock to be in a state of emergency, in which case more significant decreases in catch/effort limit shall be approved.	Standard deviation of annual catches/effort Average interannual proportional change in catch/effort
Ecosystem component?		
Minimize incidental catch?		

APPENDIX 6. Draft objectives submitted by The Ocean Foundation

IATTC Candidate Tropical Tunas Management Objectives for Bigeye, Yellowfin, and Skipjack Tunas

a. Stock Status

i. Each stock should have a greater than 75% probability of occurring in the green quadrant of the Kobe plot over 20 years; [1]

ii. here the spawning biomass for any of the three stocks has been assessed by the SAC as below the level capable of producing MSY (S_{MSY}), to rebuild biomass to or above S_{MSY}, with at least a 75% probability, and within as short a time as possible, but not longer than 1.5 generations;[2]

b. Safety

i. There should be a less than 5% probability of any of the stocks falling below the limit reference point (S_{LIMIT}) in a period of two generations of the stock or five years, whichever is greater;[3]

c. Yield

i. Maximize overall catch levels over 5, 10 and 20 years;[4]

ii. To manage the overall selectivity of the fisheries targeting any of the three stocks so that the yield at MSY and S_{MSY} for bigeye and yellowfin are equal to those values in the year [XXXX]; and; [5]

d. Stability

i. For stocks managed via a catch limit, any increase or decrease in catch limit between management periods should be less than 20%, except when the SAC determines a stock to be in a state of emergency, in which case more significant decreases in catch limit shall be approved. [6]

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[1] Requiring a high probability (e.g., 75% or above) of keeping all stocks at a sustainable level will ensure that IATTC's management approach is focused on maintaining stocks at a sustainable level and ensuring a more stable and predictable market for fishermen. For the target to function as a true target and to avoid breaching the limit, the likelihood of achieving the target should be much greater than the flip of a coin, in line with the precautionary approach (mandated by the Antigua Convention). Furthermore, Resolution C-16-02 states that F_{MSY} and S_{MSY} will function as targets, and a 75% chance of being in the green would increase compliance with this mandate.

[2] It is important to have an objective that helps determine how recovery should be achieved. This is currently most relevant for bigeye but also may be relevant for yellowfin. The probability of recovering an overfished stock should be at least as high as the probability of maintaining a healthy stock. 1.5 generation rebuilding timeframe reflects the time for young-of-the-year fish to recruit to the spawning stock and contribute to rebuilding. Several IATTC CPCs manage domestic stock recoveries based on generation time.

[3] The 5% probability is based on UNFSA, which says that risk of breaching B_{LIM} should be "very low." Canada defines "very low" as <5%; Norway also requires 95% probability of avoiding B_{LIM}. Resolution C-16-02 set the timeframe over which to evaluate the probability as "a period of two generations of the stock or five years, whichever is greater." While Res. C-16-02 set $S_{0.5R0}$ as an interim S_{LIMIT}, this level is widely criticized as too risky and out of step with international best practice since it equates to approximately 8% of unfished biomass. Therefore, a new, more precautionary S_{LIMIT} should be evaluated.

[4] To benefit both the stock and fishery, catch should be maximized over the medium to long-term. For skipjack, it might be more appropriate to instead maximize CPUE to maximize economic yield (because too many skipjack on the market could decrease prices significantly).

[5] The yield at MSY for bigeye and yellowfin can decrease due to increased juvenile mortality. To ensure higher yields at MSY, a management objective should specifically call for a return to, or maintenance of, a productivity level associated with a certain selectivity pattern in a year chosen by IATTC.

[6] Limiting TAC fluctuations serves to promote industry stability, both in the fishery and market.