Evaluación de estrategias de ordenación (EEO) para el atún patudo en el OPO: Informe de avances SAC-15-07

Management strategy evaluation (MSE) for bigeye tuna in the EPO: Progress report SAC-15-07

Juan L. Valero, Mark N. Maunder, Haikun Xu, Alexandre Aires-da-Silva
¿Qué son las Estrategias de Ordenación?
What are Management Strategies?

• Combination of monitoring, stock status evaluation, control rule and management actions designed to achieve fisheries objectives.
Combinación de monitoreo, evaluación stocks, regla de control y acciones de manejo diseñadas para lograr objetivos de ordenación

• Strategies can’t be properly evaluated without specific management objectives, data, analyses, control rule, uncertainty, other components
Estrategias no pueden ser evaluadas sin especificar objetivos, datos, análisis, regla de control, incertidumbre y otros componentes

• Development and success of Management Strategies benefit from involvement of all stakeholders in the planning stage
El desarrollo y éxito de Estrategias de Ordenación se benefician con el involucramiento de todas las partes interesadas en su planificación

• Management Strategy Evaluation components/Componentes de EEO
• Dialogue: define alternative strategies to evaluate/Diálogo: definir estrategias a evaluar
• Technical: evaluate strategies via simulations/Técnico: evaluar estrategias con simulación
Evaluación de Estrategias de Ordenación (EEO)
Management Strategy Evaluation (MSE)

- Used to evaluate management alternatives via computer simulations:
  Usadas para evaluar alternativas de ordenación vía simulación con computadoras
  - Quotas / Cuotas
  - Closures (time, spatial) / Vedas (temporales, espaciales)
  - Fishing effort limits (number of sets, FADs, etc) / Límites de esfuerzo (núm. lances, FADs, etc)
  - New data (tagging, ageing, genetics, etc) / Nuevos datos (marcado, edad, genética)
  - Alternative harvest control rules / Reglas de control alternativas

Real world
Vida real

Wind tunnel
Túnel de viento

Early simulator
Simulador básico

Simulated Management Strategy
B

Simulador de vuelo

FLYING SIMULATOR

Exploitation
Biomass

Year

Catch

Year

Biomass
**Tropical Tuna Harvest Control Rules** (Resolution C-16-02, Resolution C-23-06)
“...management strategy evaluation (MSE) is necessary to evaluate the HCR; and alternative HCRs should be considered that include hard and soft limit reference points, that use reference points based on biomass, and that establish well-defined scientific management recommendations”

- Workshops Terms of Reference (Resolution C-19-07)
- SAC Recs. supported staff’s MSE workplan
- 5-year IATTC staff MSE Workplan (SAC-12-01)
- 2021-2023 MSE funding from the European Union
  - Two components:
    - Consultative/dialogue process (e.g. series of MSE workshops)
    - Technical implementation of MSE
- 2024 new permanent harvest strategy IATTC staff position, securing MSE work
Species focus (BET), rationale

Initial MSE technical focus on BET, moving to other species towards the end of current work plan

- Historically, BET has required the strictest management
- Recent work to improve YFT modeling
- Recent lack of assessment models (or operating models) for SKJ (although recent assessments in 2022, 2024)
- Ongoing YFT and SKJ modeling work to incorporate hypotheses for assessment and operating models
- As further SKJ and YFT models are developed, they will be included in the MSE work
Evaluación de Estrategias de Ordenación: Componentes

Management Strategy Evaluation: Components

ELEMENTS

- Operating Models
- Management Model
- Estimation Model
- Sampling Model
- Summary Model
Operating Models and Conditioning

- Describes fishery and population dynamics
- Different hypotheses / model configurations to incorporate real world uncertainty; e.g.:
  - Spawner / recruit relationship
  - Selectivity / catchability changes
  - Changes in fleet composition
  - Natural mortality
  - Alternative growth scenarios
  - Etc, etc, etc…

- Consistent with historical data!
Hypotheses for conditioning BET Operating Models
Issues with OMs from 2020 BET reference models

Large recruitment shift coincidental with increase of PS FAD catches in 1990s

2020 BET Benchmark Assessment
Issues with OMs from 2020 BET reference models

Bimodal distribution of Operating models
Based on 2020 BET Assessment
Changes from 2020 to 2024 BET reference models

Recruitment shift removed

Operating Models
New OMs from 2024 BET reference models

Operating Models

New Operating Models
2024 BET Assessment
Operating Models

Sample design for OMs from BET reference models

Level 1 hypothesis: 1) Model Fix,
2) Gro (estimate growth),
3) Sel (all selectivities dome-shape),
4) Mrt (Natural mortality $M$ values for adult male 0.1, 0.12, 0.125, 0.13

Level 2 hypothesis: Annual increase in longline catchability (effort creep) 0%, 1%, 2%
Level 3 hypothesis: Steepness of the Beverton-Holt stock-recruit relationship ($h$) of 1.0, 0.9, 0.8

• The combination of the three hypothesis yields $4 \times 3 \times 3 = 36$ models
• Models will be given equal weights in the MSE
Define how data (e.g., catches, size compositions, CPUE) are collected from the simulated “true” population (including observation uncertainty, the effect of measurement error and bias).

The bootstrap functionality of Stock Synthesis is used to generate the observed data.

- Standardized Japanese longline index of abundance and total catches
Alternative EMs for BET (simpler assessment model)

- ASPM-Rdevs in *Stock Synthesis*
- Gear-aggregated simpler integrated model in Stock Synthesis
Management Model / Modelo de Ordenación

Use the perceived stocks status and trends to derive management action

Model-based Harvest Control Rule, based on surplus production model (ASPM-R)
Management Model / Modelo de Ordenación

• Applied on a 1-year to 3-year cycle
  – Effort controls (days of closure, $F$) for surface fleets
  – Catch limits for longline fleets or keep $F$ at previous historical 3-year average $F$

• Data inputs for Model-based HCR:
  – Standardized Japanese longline index of abundance and total catches for ASPM-R
• Rick Deriso’s formula between Fishing mortality ($F$) and closure days
• Other relationships (e.g., $F$ & OBJ sets) and their uncertainty could be included if more information about their relationships with $F$ is available

• Implementation error between intended and realized changes in $F$ (0%, 10%, 20%) to represent the different approaches to implement the HCR (e.g., closure days, IVT, active FAD limits).
Expand MSE Shiny app to illustrate OMs and MSE results

https://valeromaspez.shinyapps.io/TunaMSE_EPO ENG/

Summary Model

https://ofp-sam.shinyapps.io/hierophant/

Alternative strategies
MSE dialogue and stakeholder input

• Training and enhancing dialogue / communication among scientists, managers, and other stakeholders regarding harvest strategies and the MSE process

• Input and feedback on important elements to use in the MSE process

• MSE Workshops Terms of Reference (Resolution C-19-07)

• Intro HS workshops (2015-2019), 3 IATTC MSE workshops (2019-2022, WSMSE-1; WSMSE-2; WSMSE-3)

• Recent requests by stakeholders for the establishment of a dedicated dialogue Working Group (WG), to enhance or replace the MSE workshops.

• Recommendations from SAC-14 and from staff in SAC-15 for the Commission consider a Science-Management Dialogue (SMDWG) or informal workshops approach to continue the MSE process.
3rd IATTC Tropical Tuna MSE Workshop, December 2022, participants
3er Taller CIAT sobre EEO, Diciembre 2022, participantes

80 participants / *participantes*

- **Members**
  - **44**
  - **97**
  - **80**
  - **Members (%)**: 13 (62%), 15 (71%), 16 (76%)

- **Cooperating Non-Members**
  - **1st MSE WS**
  - **2nd MSE WS**
  - **3rd MSE WS**
Participation in previous EPO tropical tuna MSE workshops
Participación en talleres previos de EEO de atunes tropicales en el OPO

2nd Workshop / 2do Taller

- 57% 1st IATTC MSE WS
- 23% Other EPO MSE WS
- 21% None

3rd Workshop / 3er Taller

- 55% 1st IATTC MSE WS
- 28% Other EPO MSE WS
- 16% None
<table>
<thead>
<tr>
<th>OBJECTIVE</th>
<th>Quantity</th>
<th>Performance Indicators</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Safety</strong>&lt;br&gt;Maintain stock above limit reference points</td>
<td>Equilibrium virgin spawning biomass $SB_0$&lt;br&gt;• &lt; 10% probability $SB$ below 7.7% of $SB_0$&lt;br&gt;• &lt; 5% probability $SB$ below 7.7% of $SB_0$&lt;br&gt;• &lt; 10% P $SB &lt; SB_{msy}$&lt;br&gt;Flim (&lt; 5% P $F &gt; F_{msy}$)</td>
<td>Ratio of $SB_{yr}$ over $SB_0$&lt;br&gt;Probability calculated over projected 30 years (All years, any year by replicates)</td>
</tr>
<tr>
<td><strong>Status</strong>&lt;br&gt;Maintain stock in green quadrant of Kobe plot</td>
<td>$SB \geq$ dynamic $SB_{MSY}$ and $F &lt; F_{MSY}$&lt;br&gt;• 60% probability&lt;br&gt;• 75% probability</td>
<td>% of simulated runs falling in Kobe’s green quadrant&lt;br&gt;Probability calculated over projected 30 years</td>
</tr>
<tr>
<td><strong>Stability</strong>&lt;br&gt;Maintain low variability of catch and effort limits, gradual changes in management measures. Caps at 10% (effort), 15% (catch)</td>
<td>Standard deviation of annual catch, effort&lt;br&gt;Average interannual proportional change (catch, effort)</td>
<td>% change in catch and/or effort between years&lt;br&gt;Calculated over projected 3, 15 and 30 years</td>
</tr>
<tr>
<td><strong>Yield/Abundance</strong>&lt;br&gt;Maintain catches/effort/CPUE above historical ranges</td>
<td>Average catch/effort/CPUE by fishery (PS and LL)&lt;br&gt;• 1994-2019 (since FAD expansion)&lt;br&gt;• 2017-2019 (latest status quo)</td>
<td>Ratio of projected 3, 15 and 30-year average catch/effort/CPUE by fishery over historical period</td>
</tr>
<tr>
<td><strong>Status quo</strong>&lt;br&gt;Maintain the stock at levels near the (2017-2019) status quo</td>
<td>Spawning biomass, Index (LL CPUE)</td>
<td>Ratio of projected 3, 15 and 30-year average SB, Index (LL CPUE) over status quo period (2017-2019)</td>
</tr>
</tbody>
</table>

Summarized during the 3rd IATTC MSE workshop (from SAC-15-07)
Challenges / Desafíos

- **COVID-19 pandemic / Pandemia de COVID-19**
  - Limitations of virtual workshops, changes to workplan timeline
    *Inhabilidad de tener talleres en persona, cambios en el cronograma de trabajo*

- **Limited-representation** by some CPCs, high turnover of representatives
  *Representación limitada de algunas CPCs, alto recambio de representantes*

- Multiple extraordinary meetings during 2020-2021
  *Múltiples reuniones extraordinaries durante 2020-2021*

- Some challenges expected to ameliorate/*Algunos desafíos se espera que mejoren*
  - End of COVID pandemic
  - Full time harvest strategies position at staff since January 2024
  - 2024 BET assessment resolved structural issues of previous BET assessments,
    new OMs to update MSE should result in a better strategy being selected
IATTC BET MSE work for 2024 and beyond

• Recent large changes in the modeling of BET in the EPO
  – 2020 benchmark BET assessment issues (bimodal results, recruitment shift)
  – Review of data and modelling for tropical tuna assessments (Oct-Nov 2023)
  – Substantial changes and improvements on modelling for BET assessment (2024)
• Revisiting Tropical Tuna reference points (SAC-15-05)
• Continue technical work on BET MSE during 2024
  – Preliminary work with OMs based on last benchmark assessment (2020)
  – Updated runs with OMs from current benchmark assessment (2024)
  – Incorporate stakeholder feedback between preliminary and updated results
• Finalize BET MSE and plan to present results during 2025
• MSE work has been institutionalized at IATTC by establishing a permanent harvest strategy staff position in 2024
Potential chromogram of harvest strategy implementation for EPO bigeye tuna
Cronograma tentativo, implementación estrategia de ordenación para patudo en el OPO

Workshop/s to show MSE updated results, gather feedback on harvest strategy elements (e.g. TRPs), plan additional evaluation work.
Technical implementation of revised MSE with new OMs, evaluation.

2025: Workshop/s to discuss MSE results, plan for other tropical tunas.
**SAC-16** and Annual Meeting: Report / presentation of MSE results and plan for other tropical tunas.

<table>
<thead>
<tr>
<th></th>
<th>2024</th>
<th>2025</th>
<th>2026</th>
<th>2027</th>
<th>2028</th>
</tr>
</thead>
<tbody>
<tr>
<td>SAC</td>
<td>Assess stock status</td>
<td>Second run of MSE</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AM</td>
<td>Initial run of MSE</td>
<td>Select/Adopt BET MP</td>
<td>Set Measures (2026-2028)</td>
<td></td>
<td>Set Measures (2029-2031)</td>
</tr>
<tr>
<td>Staff work</td>
<td>Update MSE, new OMs</td>
<td>Start MSE for SKJ or YFT</td>
<td>Collate data for MP</td>
<td>Collate data for MP</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Check Excep. Circumst.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Assess stock status</td>
</tr>
</tbody>
</table>
Feedback cycles / Ciclos de retroalimentación

- Basic information and analysis
- Objectives
  - General, operational
  - Performance metrics
- Formulation of harvest control rules
- Application and implementation of HCR
- Monitoring
- Short-term evaluation
- Long-term evaluation of strategy

Every 3 to 5 years
1 to 3 years
Questions? / ¿Preguntas?