Exploratory Management Strategy Evaluation (MSE) of Dorado (*Coryphaena hippurus*) in the Southeastern Pacific Ocean

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... y muchos otros colaboradores de la region

7th Meeting of the IATTC Scientific Advisory Meeting
La Jolla, California (USA), 9-15 May 2016
Current strategy

Seasonal closures

**Peru:** May 1-Sep 30, since 2014  
**Ecuador:** Jul 1-Oct 7, since 2011


Size limits

**Peru:** 70 cm min FL, since 2011  
**Ecuador:** 80 cm min TL, since 2011
Alternative strategies

Some alternatives discussed at the 2\textsuperscript{nd} Dorado meeting in Peru:

- No season closure
- Later openings of fishing season
- Earlier closures of fishing season
- Minimum size limit with discard mortality
- Timing of fishery based on Yield Per Recruit (YPR) considerations
Performance indicators

Some possibilities:

- Total catch
- Fish size in the catch
- CPUE
- Spawning biomass
- SBR (Spawning Biomass Ratio)
Management Strategy Evaluation (MSE)

CONDITIONING COMPONENT
- Historic data
- Operating model
- Current stock size & catches

PROJECTION COMPONENT
- Operating model
- “True” population actual catches
- Sampling model
- Catch, length, age, effort, tagging, survey, etc
- Stakeholders input
- Management action (e.g. season length)

EVALUATION COMPONENT
- Summary statistic of stock status and trends (e.g. CPUE, N, ΔSBio)
- Assessment model
- Performance indicators
- Summary module
- Evaluation of management
Management Strategy Evaluation (MSE)

CONDITONING COMPONENT

Historic data → Operating model → Current stock size & catches

Spawning biomass (mt)

Management Strategy Evaluation (MSE)

CONDITIONING COMPONENT

Historic data → Operating model → Current stock size & catches

PROJECTION COMPONENT

Operating model → “True” population actual catches → Sampling model

Management action (e.g. season length) → Stakeholders input → Catch, length, age, effort, tagging, survey, etc

Management model → Summary statistic of stock status and trends (e.g. CPUE, N, ΔSBio) → Assessment model
Season closures

- Current strategy includes closures
- We could evaluate alternative timing of closures
- What could we expect if we do it?

*We are not suggesting additional closures, simply evaluating potential effects of alternative options*
Fishing mortality by month

- Current strategy includes closures
- We could evaluate alternative timing of closures
- What could we expect if we do it?

*We are not suggesting additional closures, simply evaluating potential effects of alternative options*
Size limits and discard mortality

### Selectivity and retention

<table>
<thead>
<tr>
<th>Length (cm)</th>
<th>Discard mortality</th>
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</thead>
<tbody>
<tr>
<td>70</td>
<td>0</td>
</tr>
<tr>
<td>80</td>
<td>0</td>
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<tr>
<td>90</td>
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<td>80</td>
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<td>80</td>
<td>0.5</td>
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Projection framework

Bayesian application of Stock Synthesis using Markov Chain Monte Carlo (MCMC)
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SB and SBR & Season closures

- Spawning biomass
- SBR

Season closures
SBR, Yield & Closures and openings
SBR, Yield & Size limits + discard mortality
Retrospective runs

![Graph showing biomass and catch over time for different scenarios: Base, Jul-Jan closure, SL 90cm, 30% DM.]
YPR by age of entry and $F$
Conclusions

First exploratory evaluation of alternative strategies for EPO dorado

- SBR and yield tradeoffs of alternative season openings, closures and size limits with discard mortality rates

- **Without size limits:**
  - Later fishery openings increase SBR with little effect on yield, unless opening after November, in which case yield decreases
  - October-November openings consistent with YPR considerations

- **With size limits:**
  - SBR increases with increasing minimum size limits
  - Yield increases with no or moderate discard mortality and decrease with higher discard mortalities
Future directions

- Alternative strategies
  - In season dynamic opening as function of timing of recruitment, size progression and YPR considerations
  - Openings based on predictive relationships (ie SST & CPUE)
  - Preserving a % of CPUE at the start of the fishing season

- Alternative Metrics
  - Fish size in the catch
  - CPUE

- Alternative fishery and population dynamics in the operating model

- Others? The input from interested parties is fundamental to define and evaluate alternatives that are viable and possible to implement
Acknowledgements

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