

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

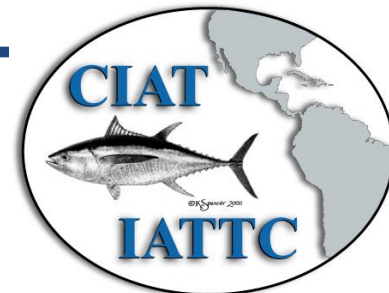


Juan L. Valero, Alexandre Aires-da-Silva, Mark N. Maunder, Carolina Minte-Vera,  
Jimmy Martínez-Ortiz, Edgar J. Torrejón-Magallanes and Miguel N. Carranza

... y muchos otros colaboradores de la region

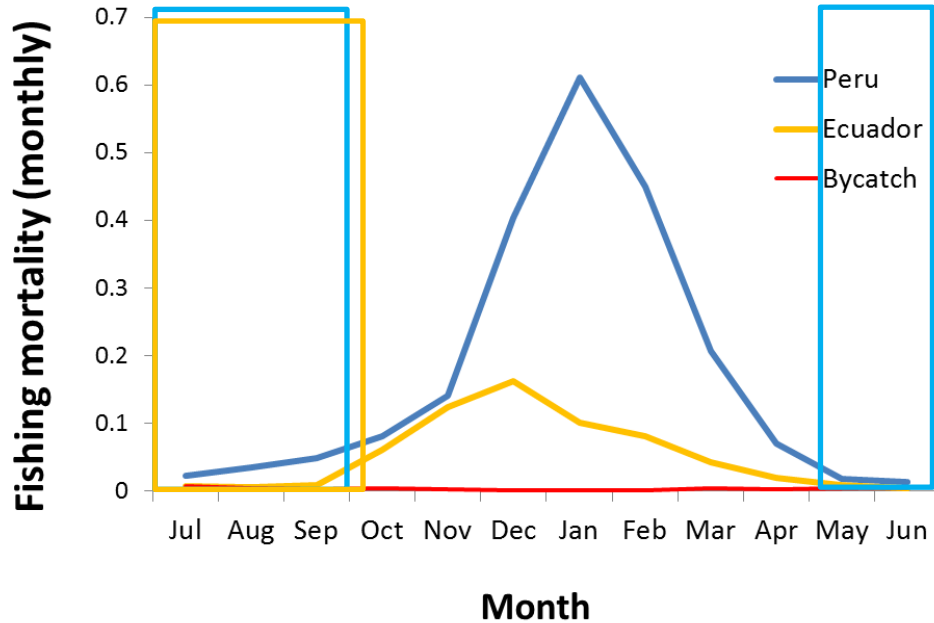
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7<sup>th</sup> Meeting of the IATTC Scientific Advisory Meeting  
La Jolla, California (USA), 9-15 May 2016





# Current strategy



Average monthly  $F_s$  during 2007-2014 from Aires-da-Silva *et al.* 2016

## Seasonal closures

**Peru:** May 1-Sep 30, since 2014

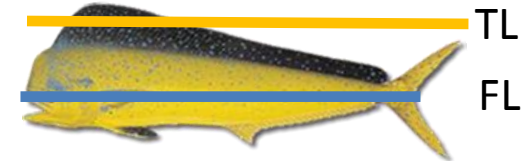
**Ecuador:** Jul 1-Oct 7, since 2011



## Size limits

**Peru:** 70 cm min FL, since 2011

**Ecuador:** 80 cm min TL, since 2011



# Alternative strategies



- Some alternatives discussed at the 2<sup>nd</sup> 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

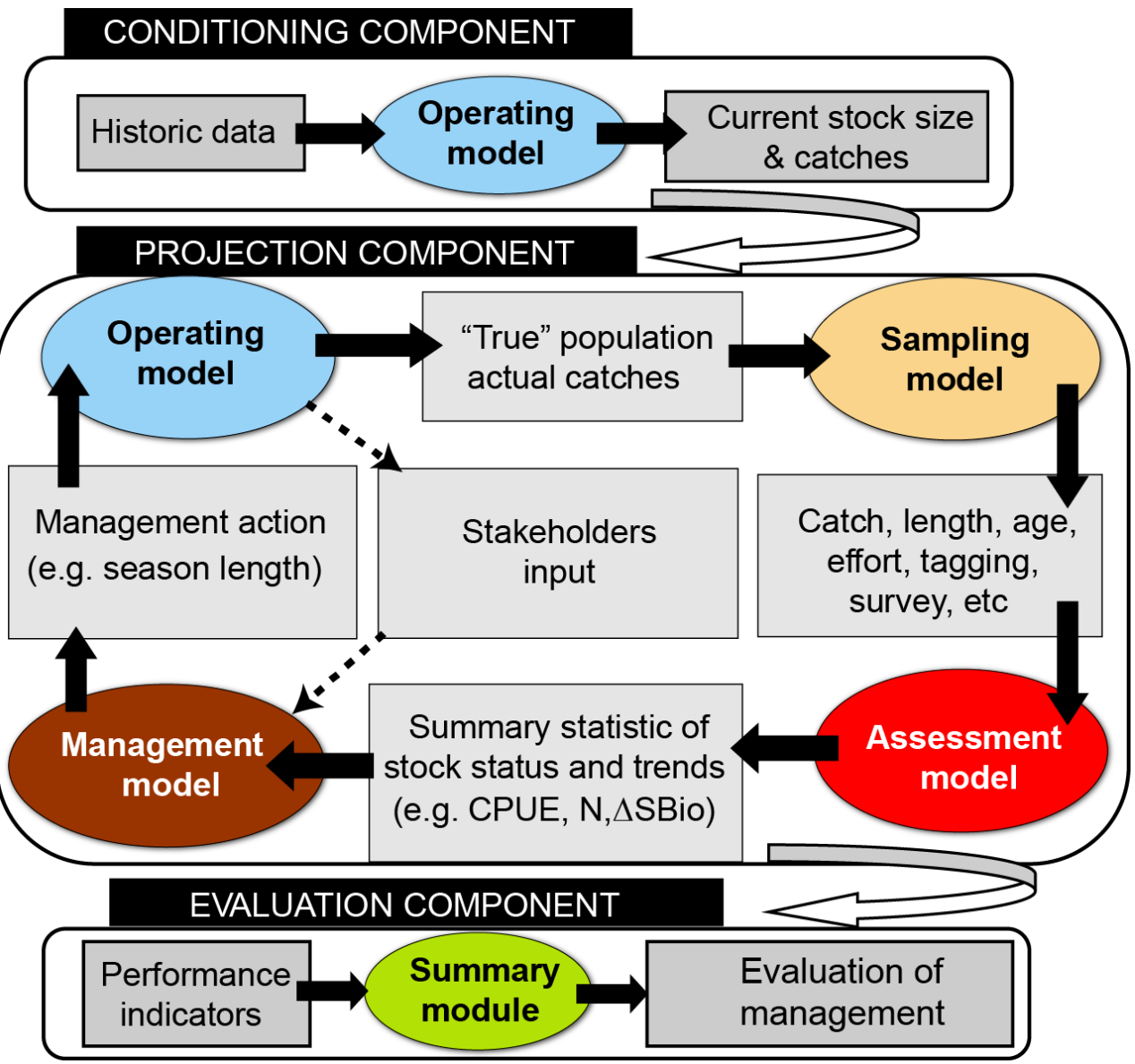


# Performance indicators

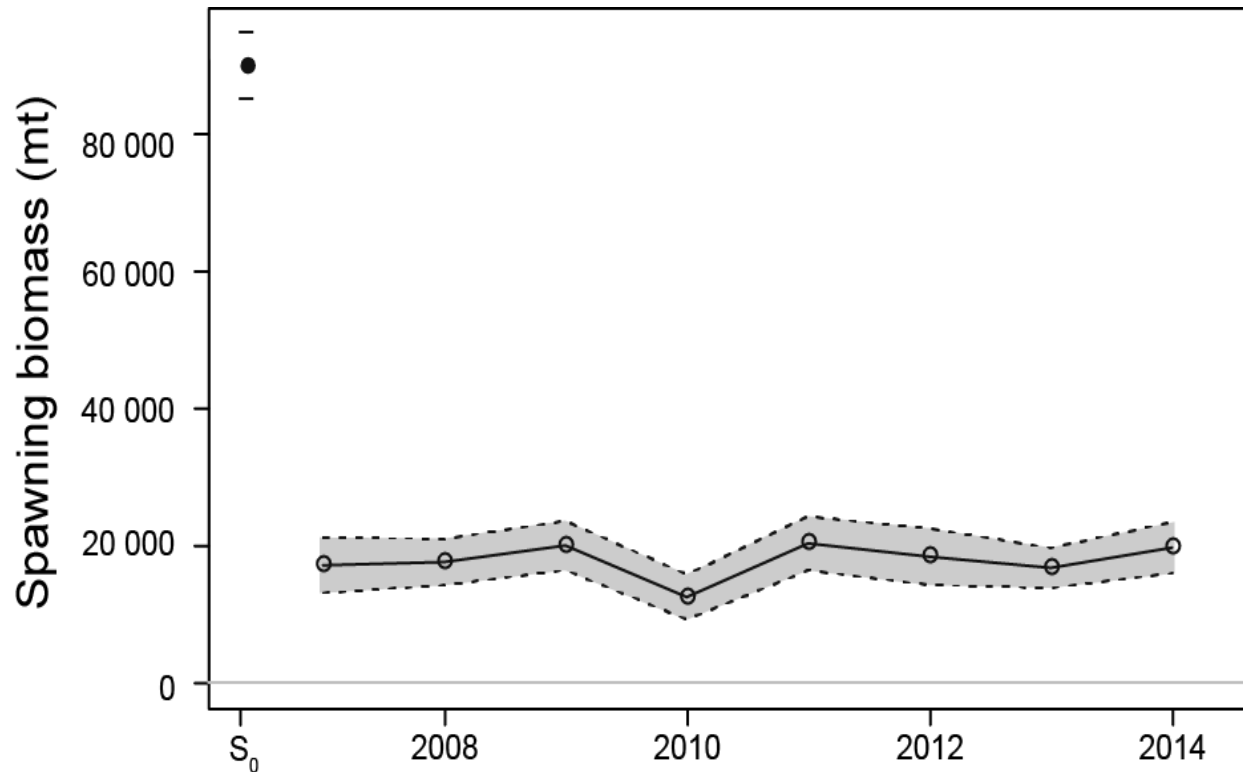
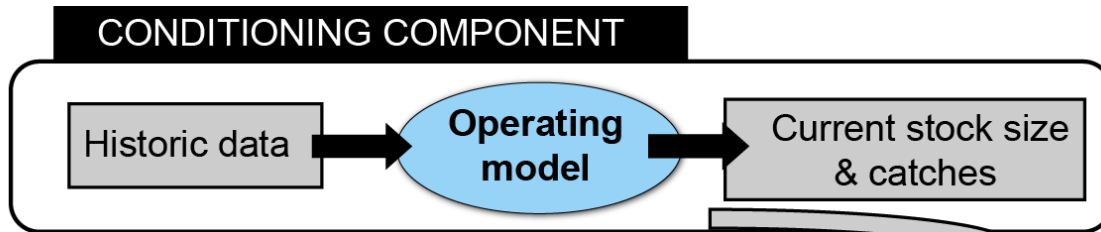
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- Some possibilities:
  - Total catch
  - Fish size in the catch
  - CPUE
  - Spawning biomass
  - SBR (Spawning Biomass Ratio)

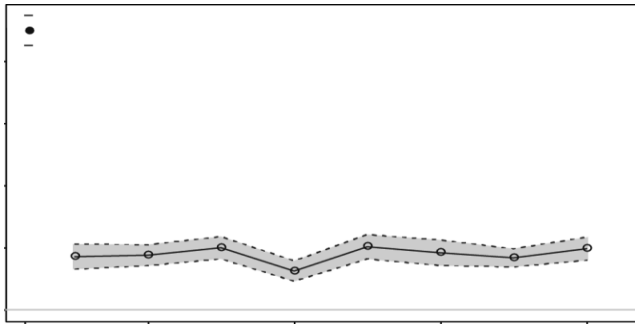
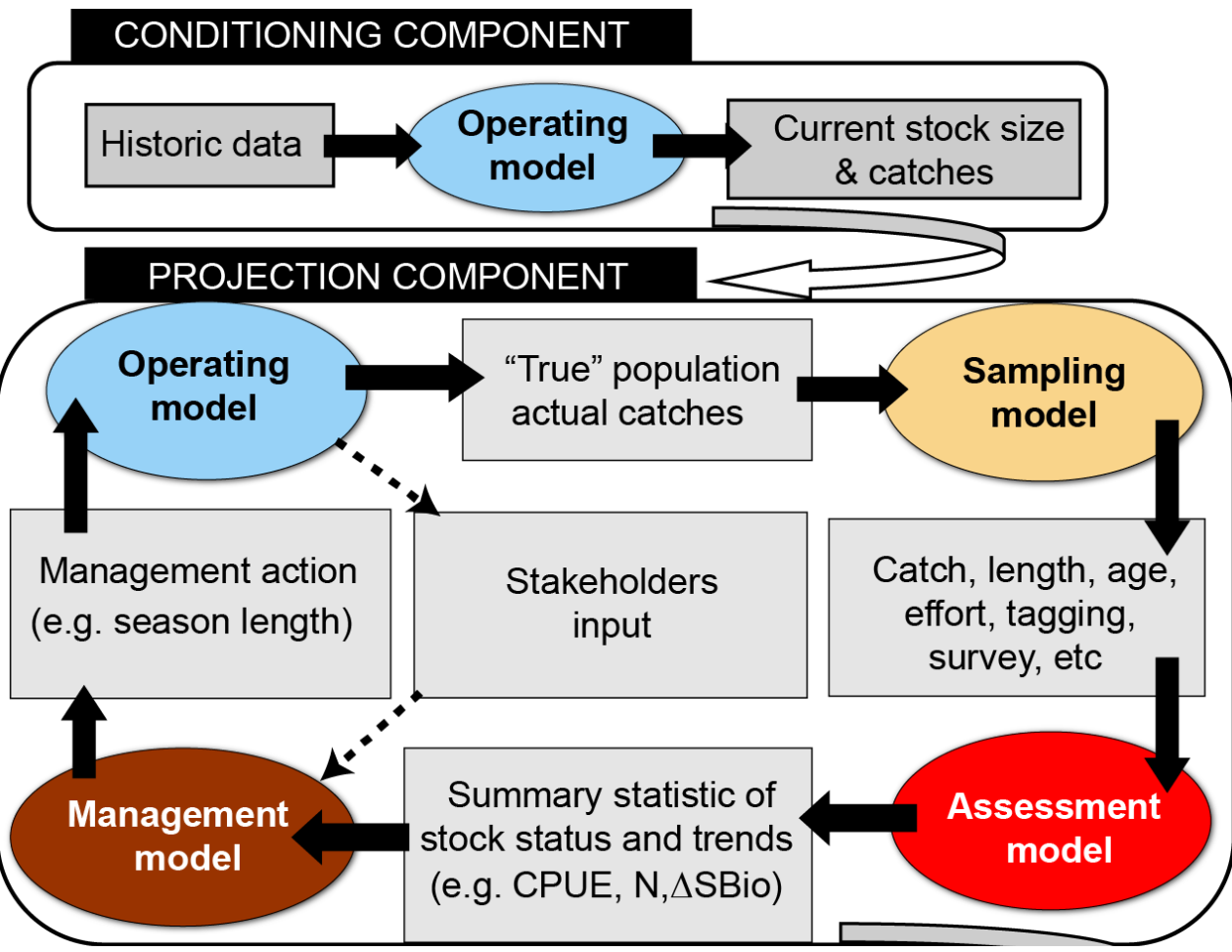
# Management Strategy Evaluation (MSE)



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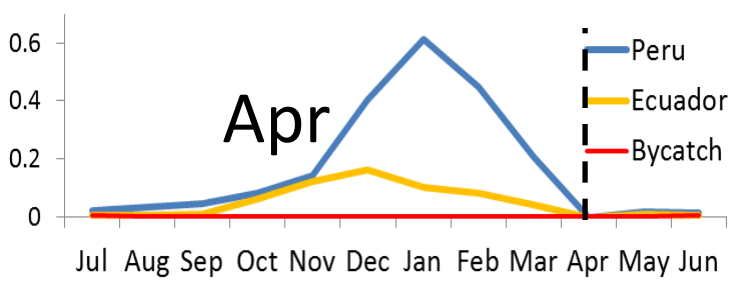
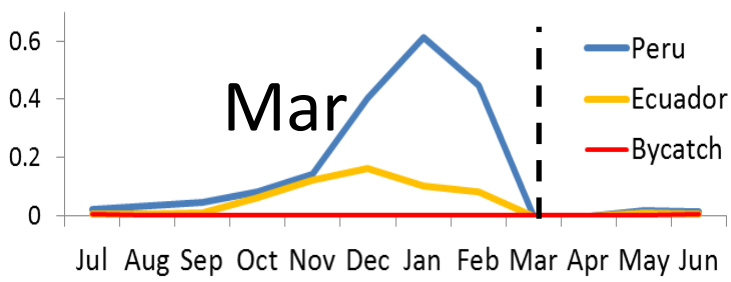
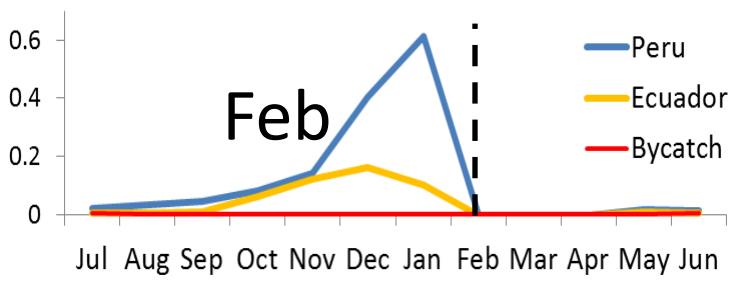
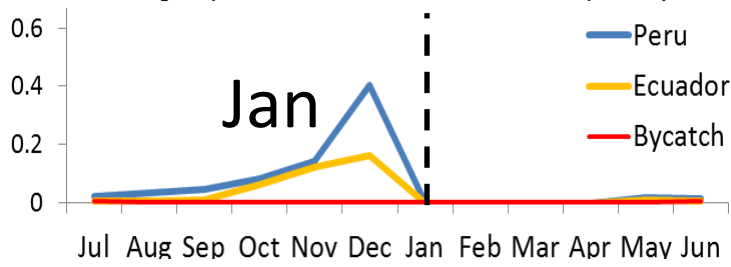
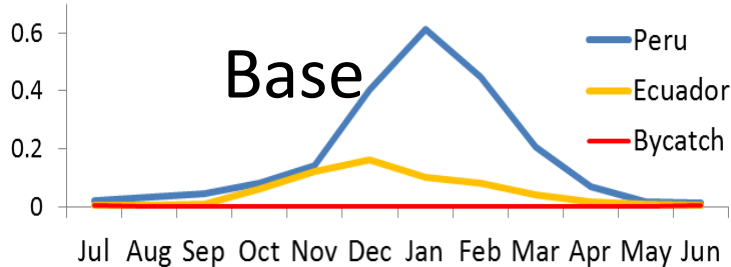


# Management Strategy Evaluation (MSE)



# Season closures

Fishing mortality by month



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

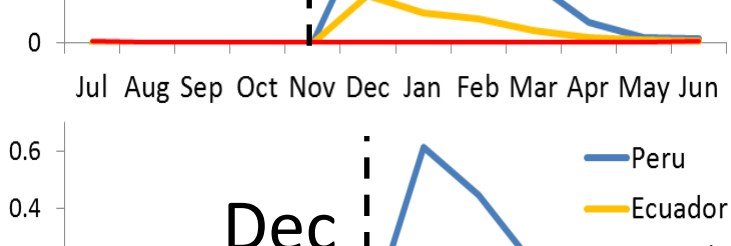
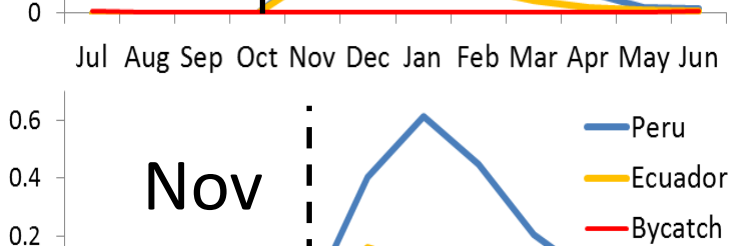
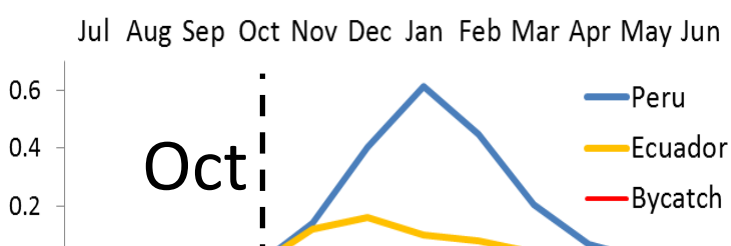
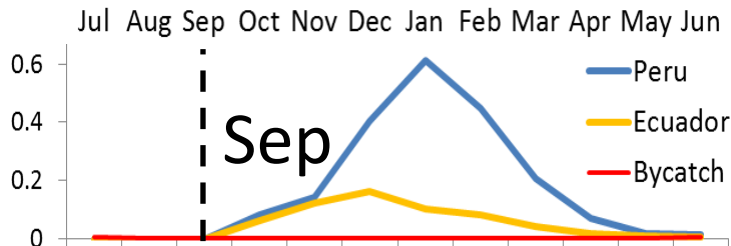
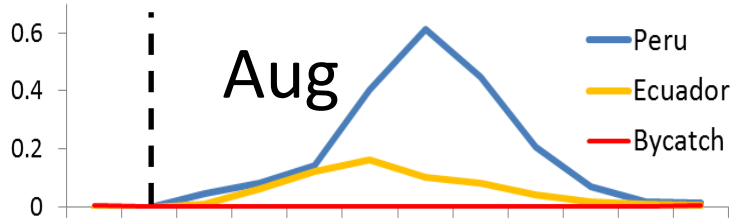
\*We are not suggesting additional closures, simply evaluating potential effects of alternative options

Month



# Season openings

Fishing mortality by month



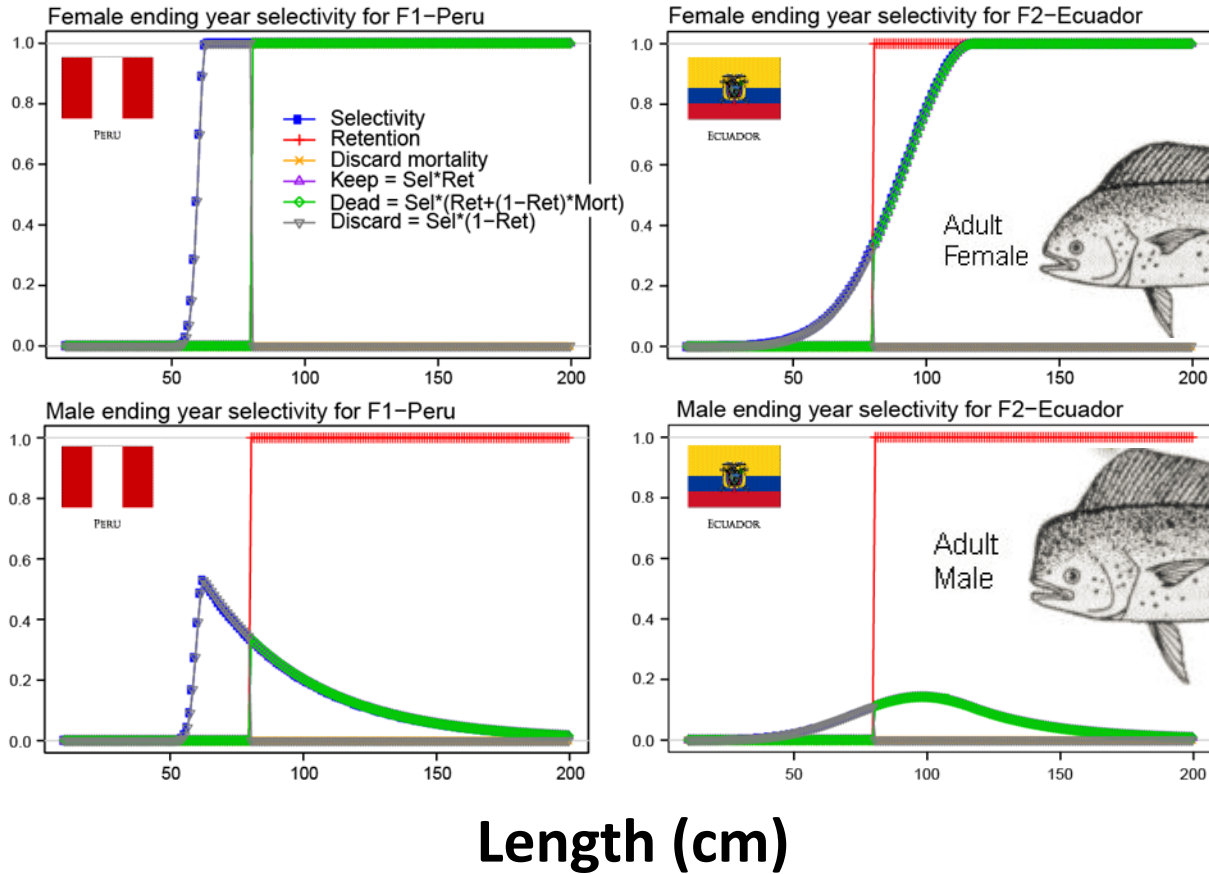
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Month

# Size limits and discard mortality

Selectivity and retention

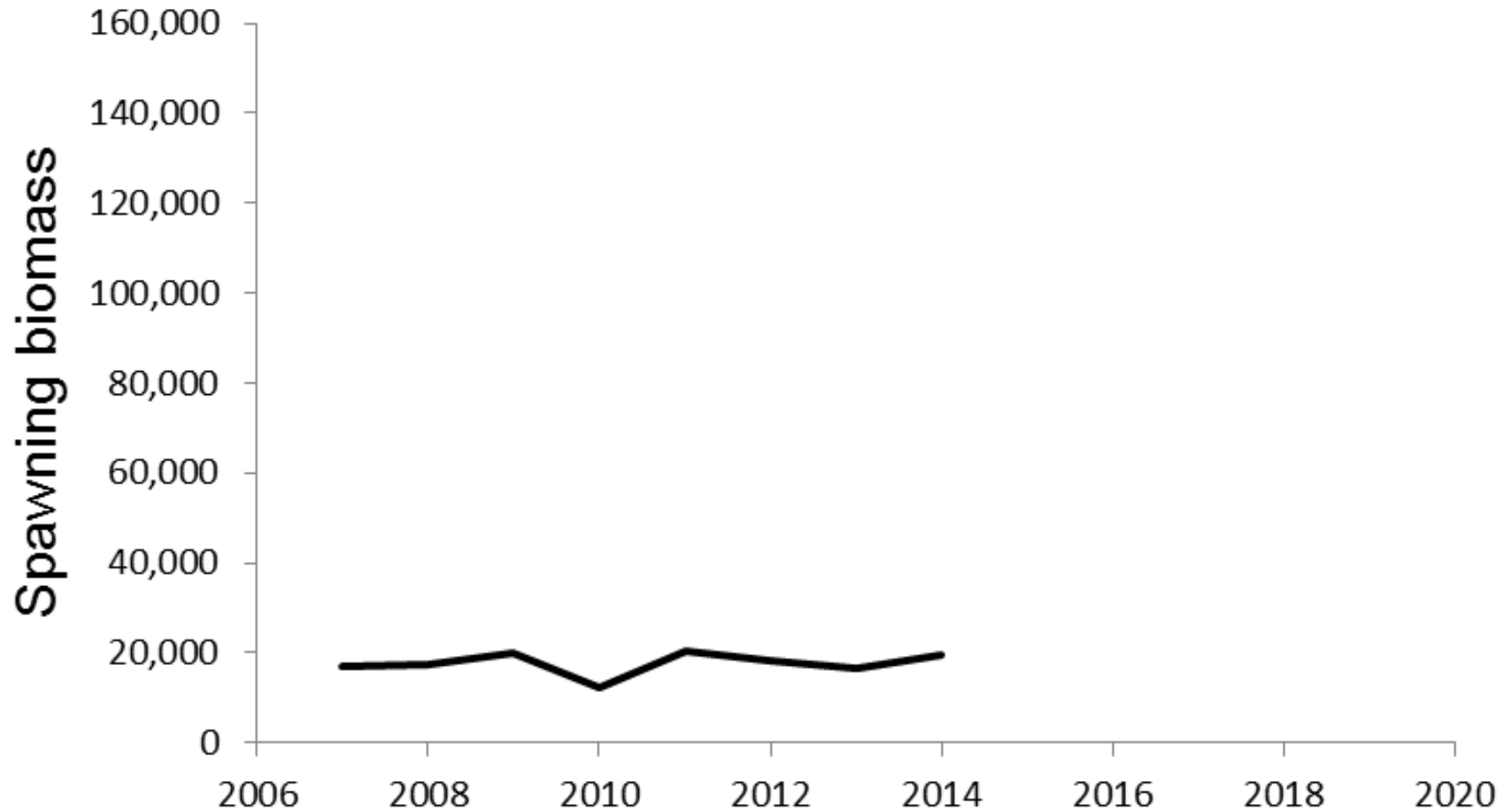


Size limit (cm)	Discard mortality
70	0
80	0
90	0
100	0
80	0.1
80	0.3
80	0.5



# Projection framework

Bayesian application of Stock Synthesis using Markov Chain Monte Carlo (MCMC)



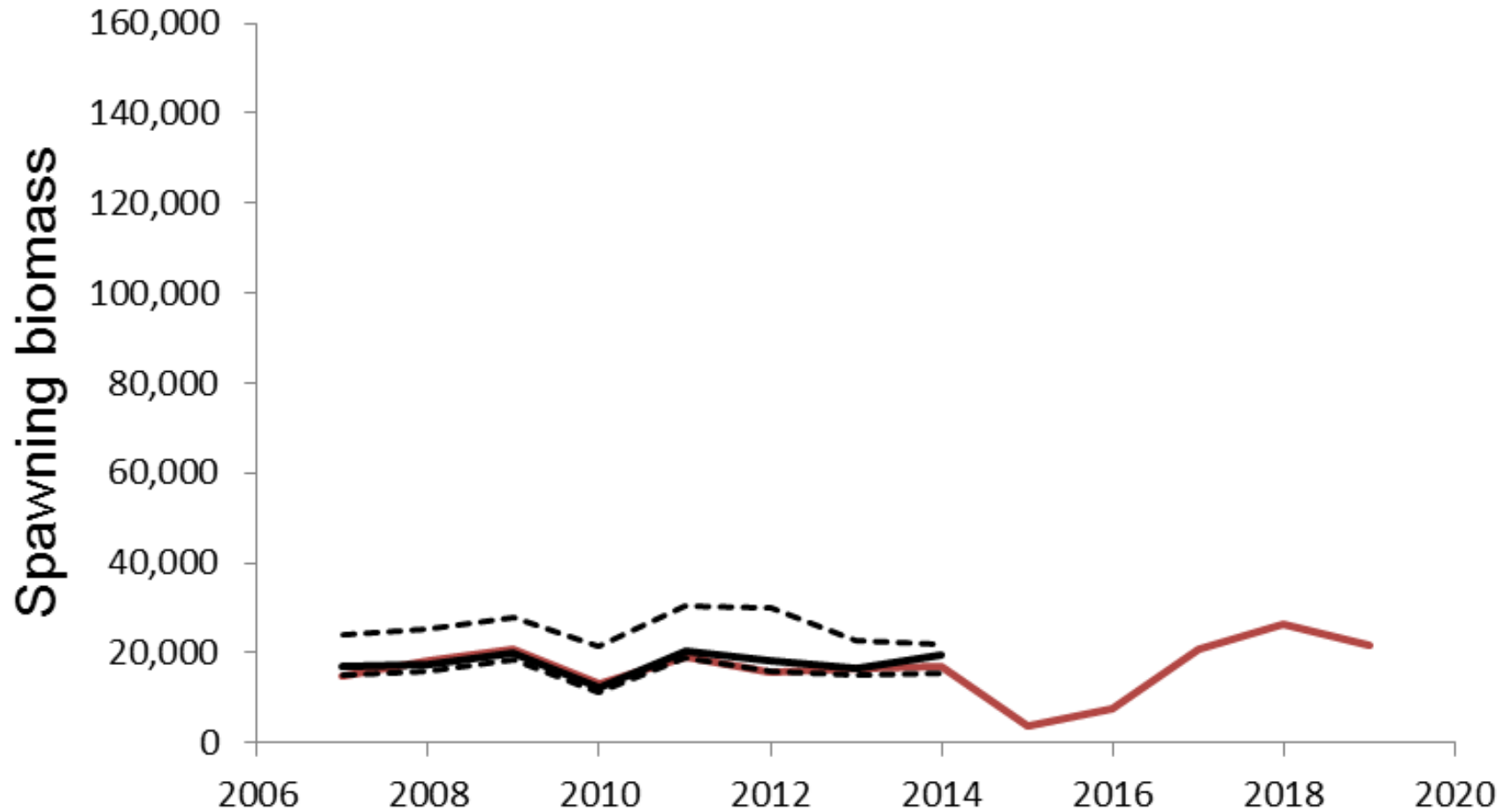
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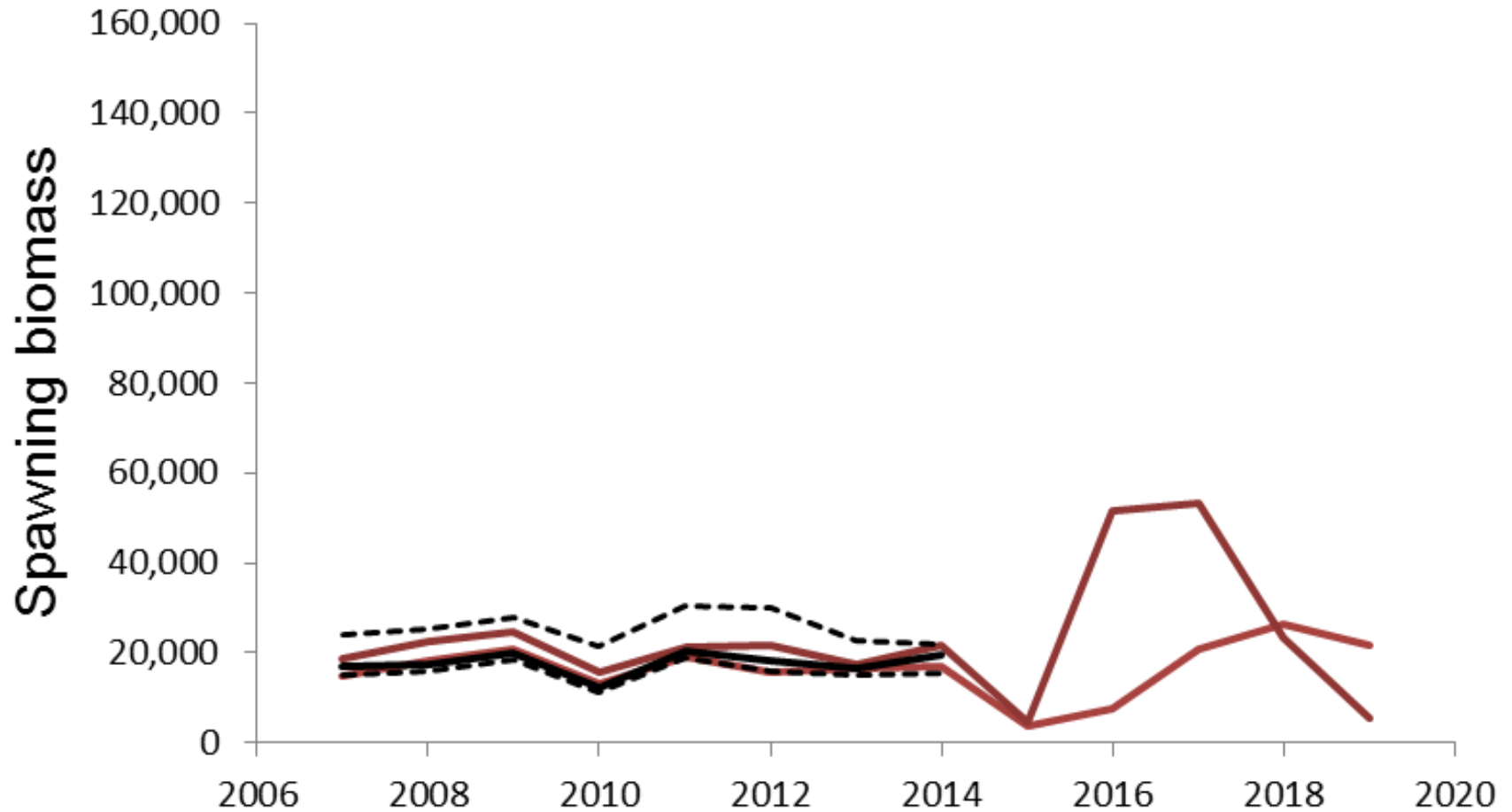
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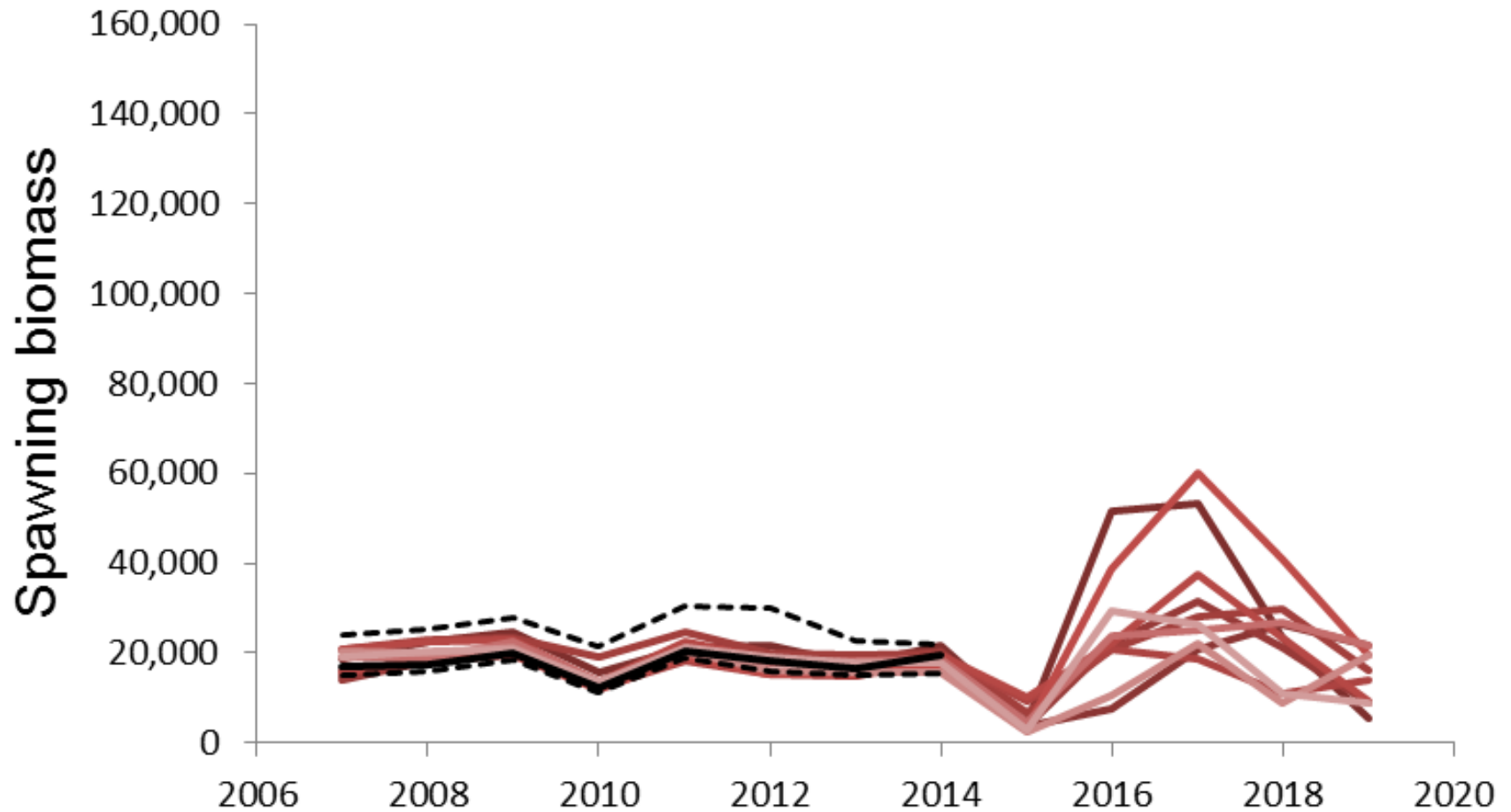
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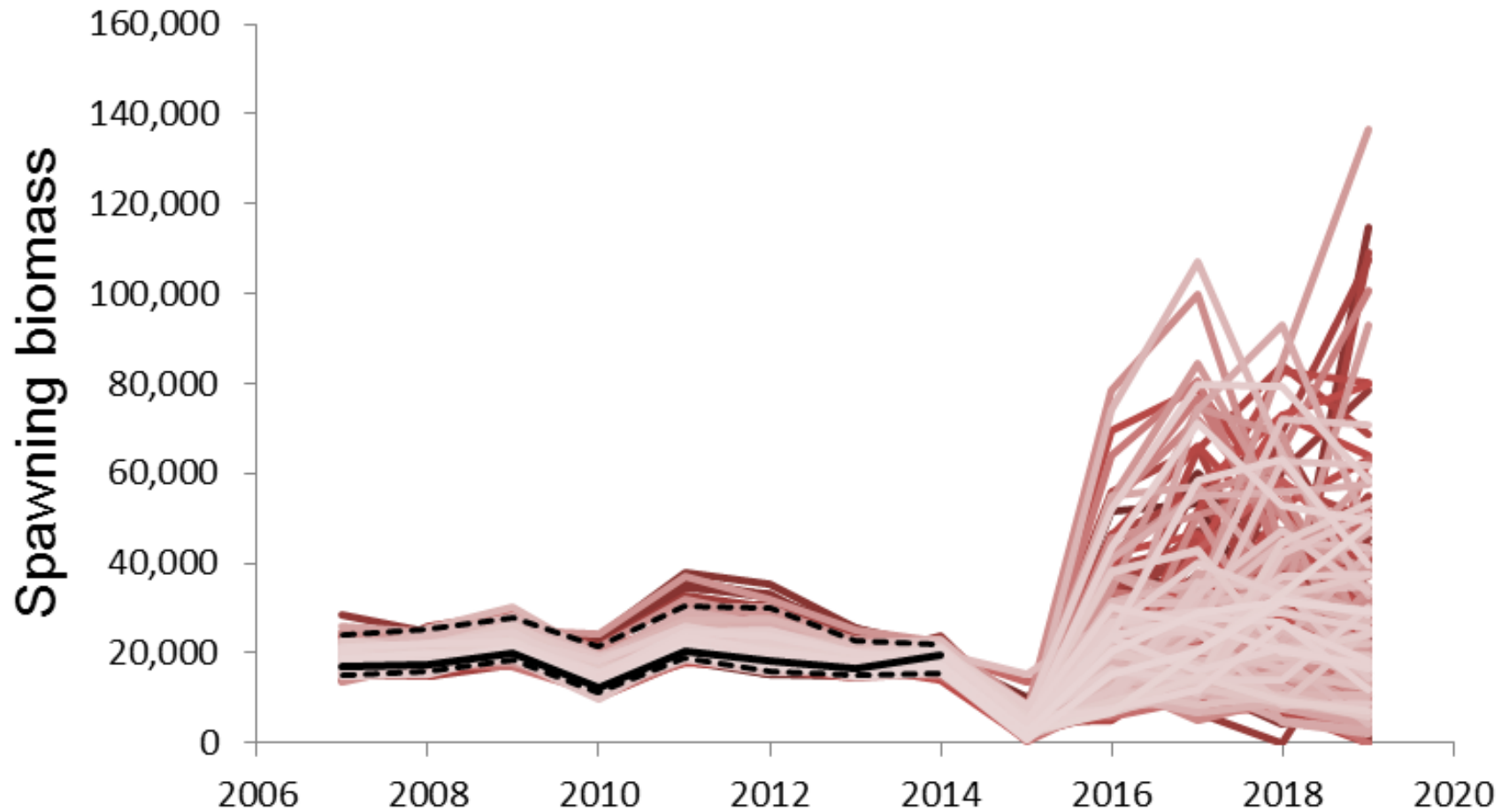
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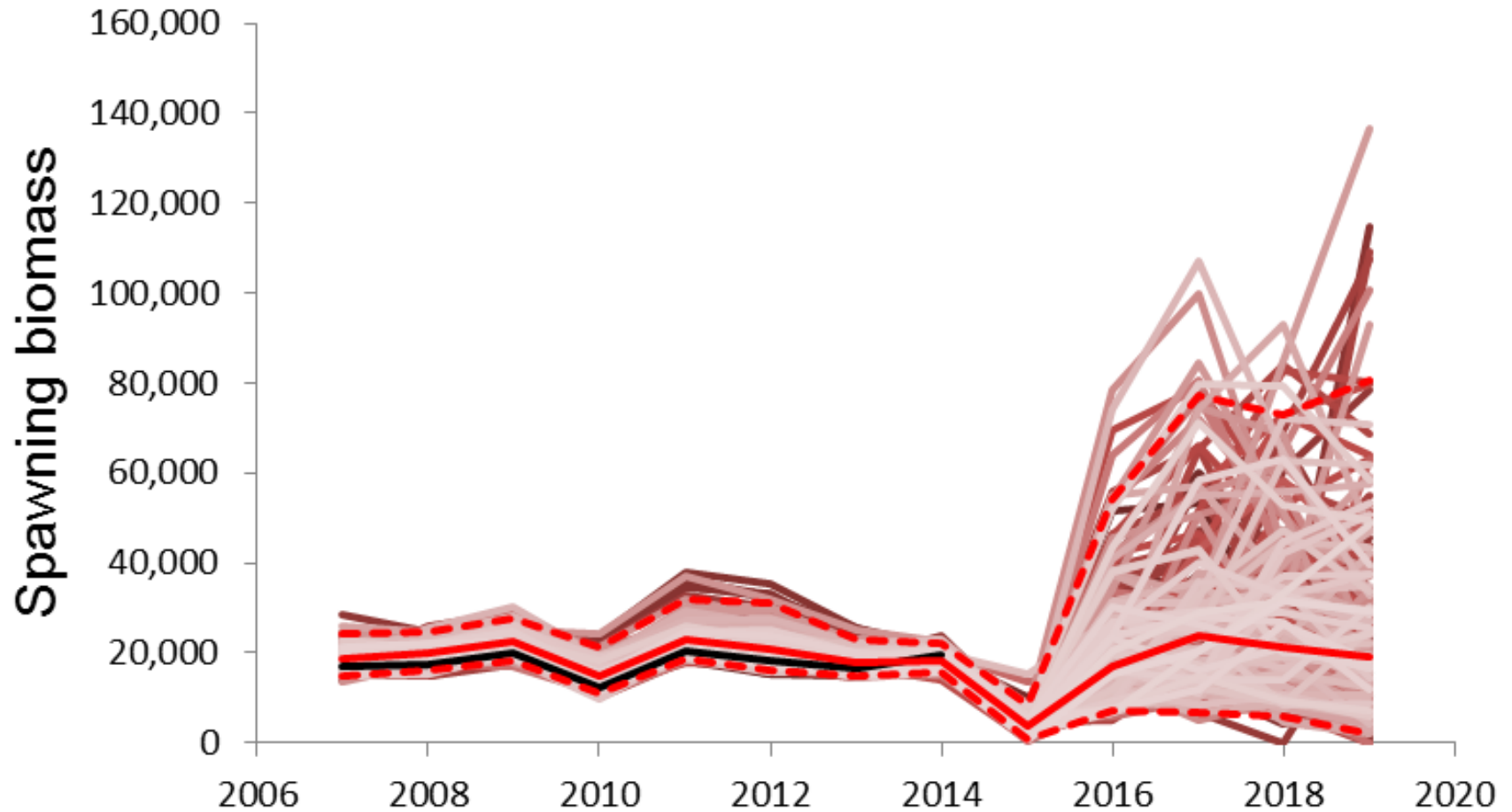
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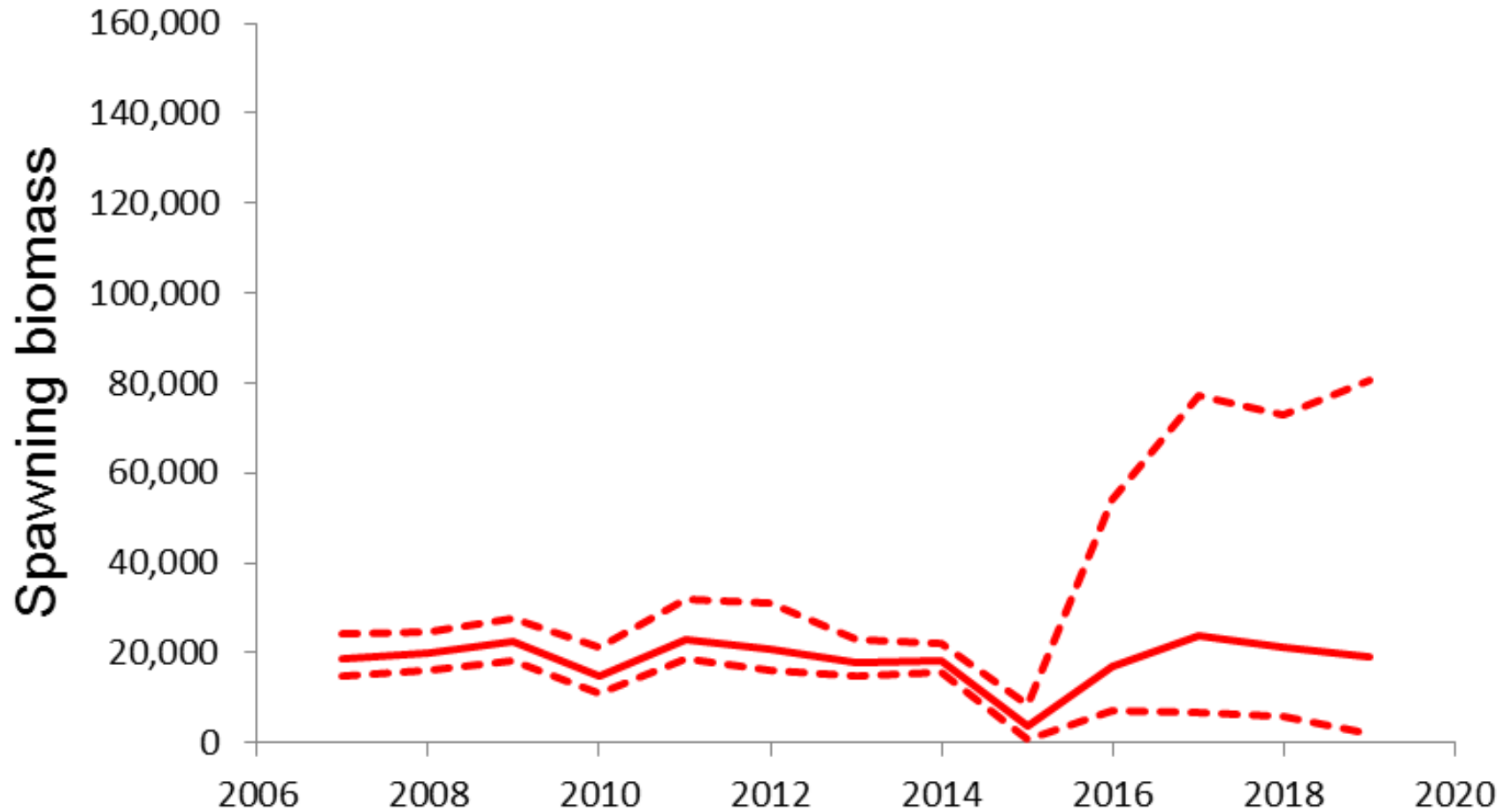
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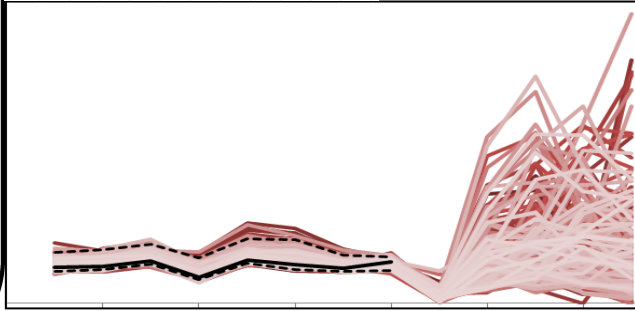
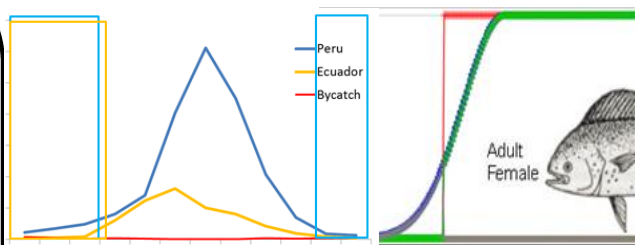
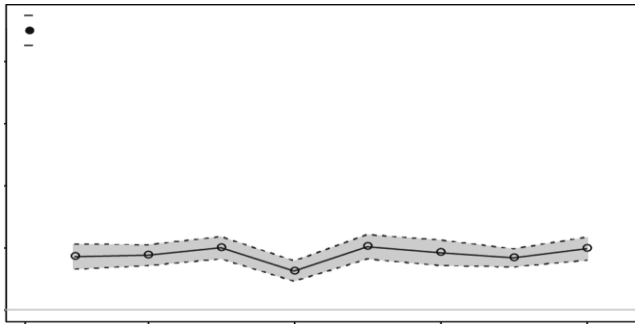
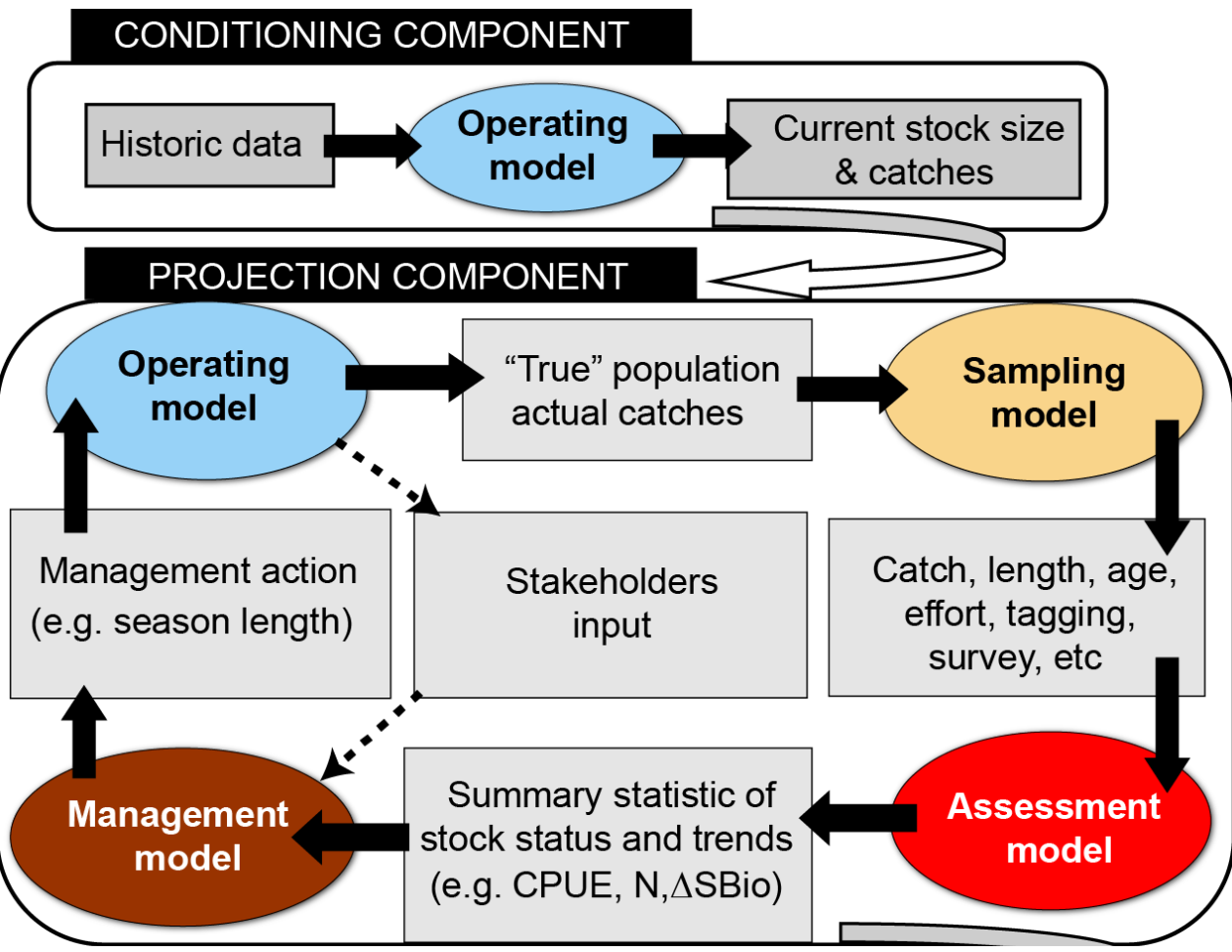


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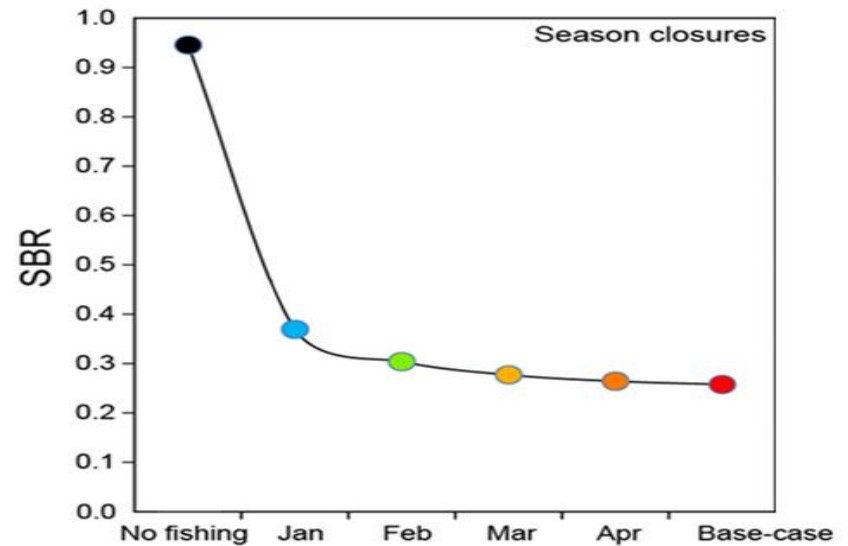
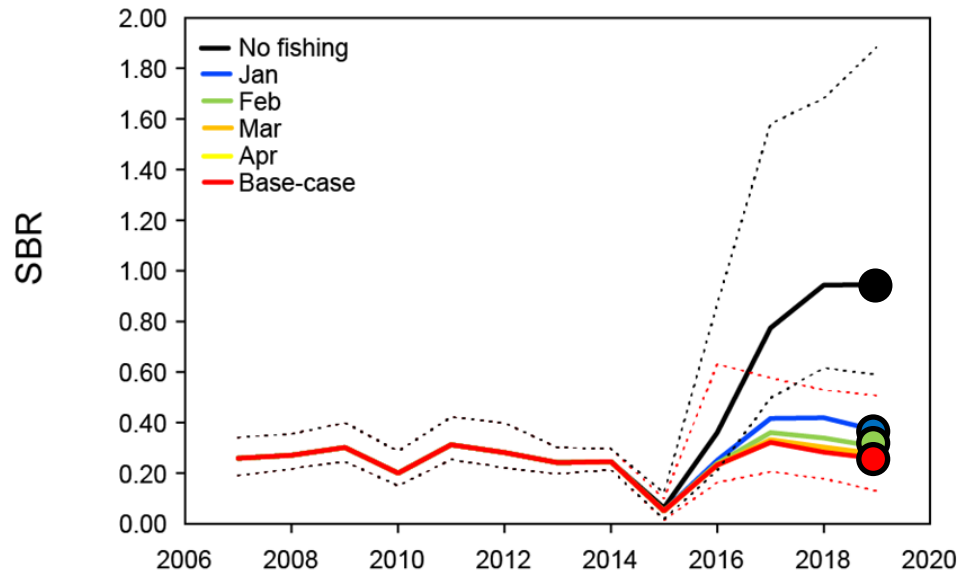
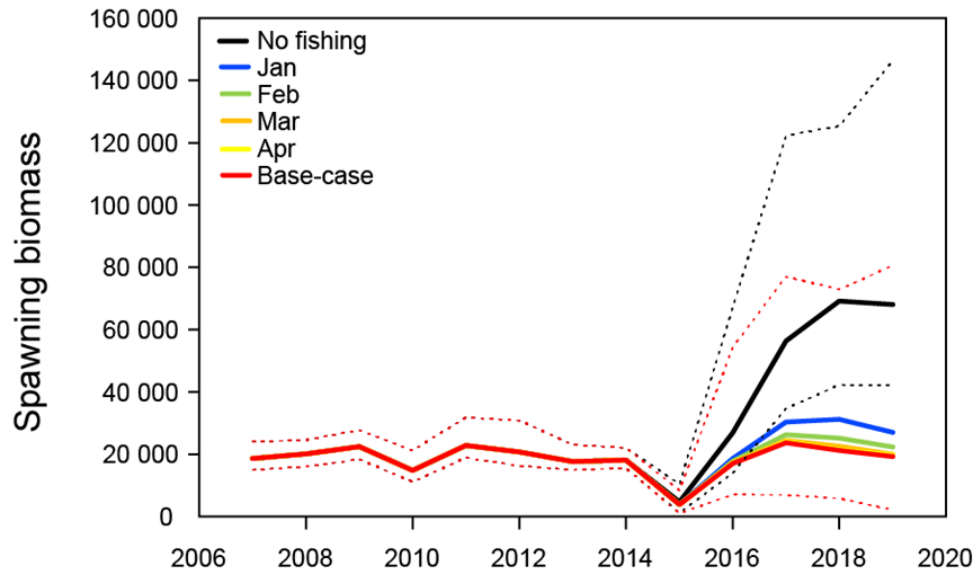
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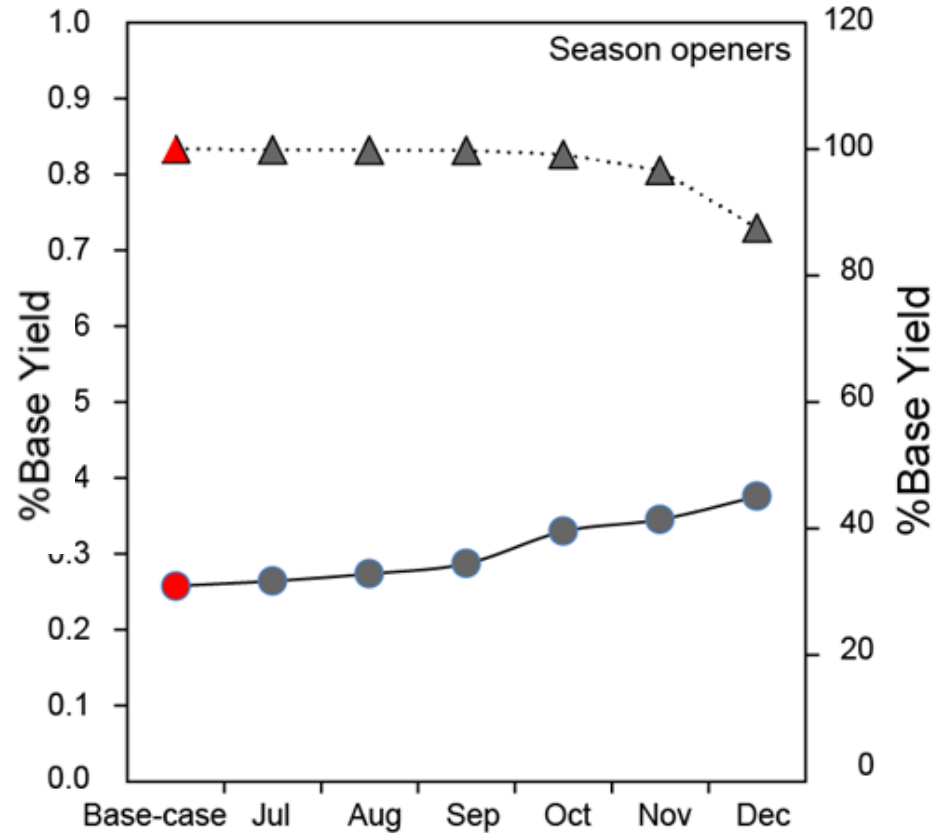
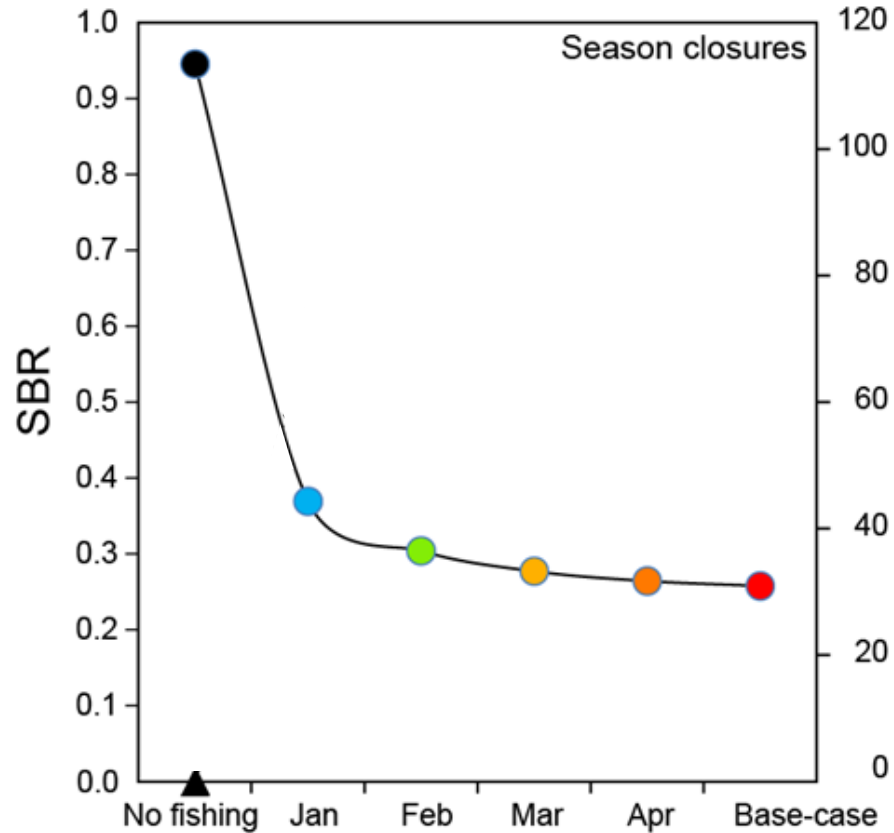
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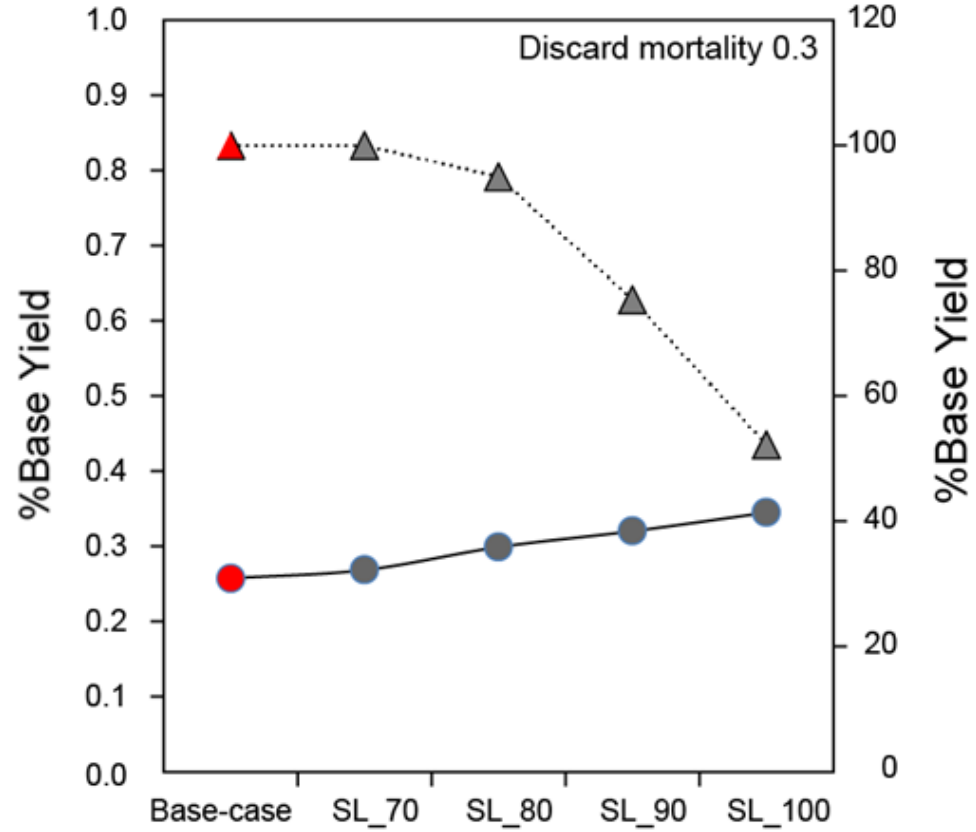
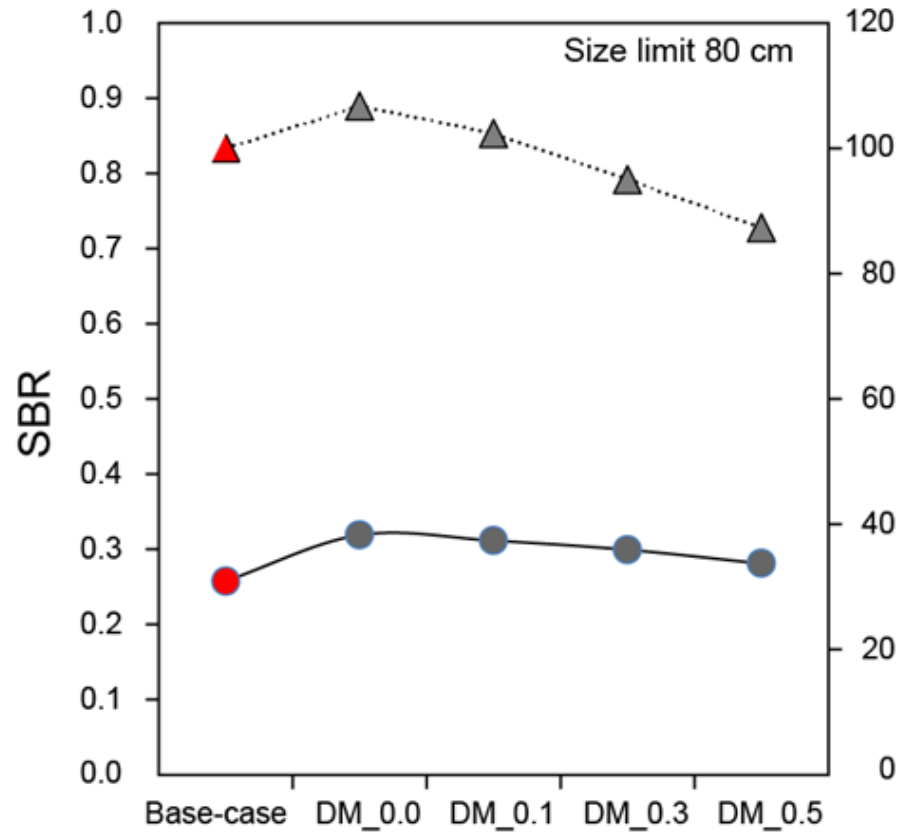
# SB and SBR & Season closures



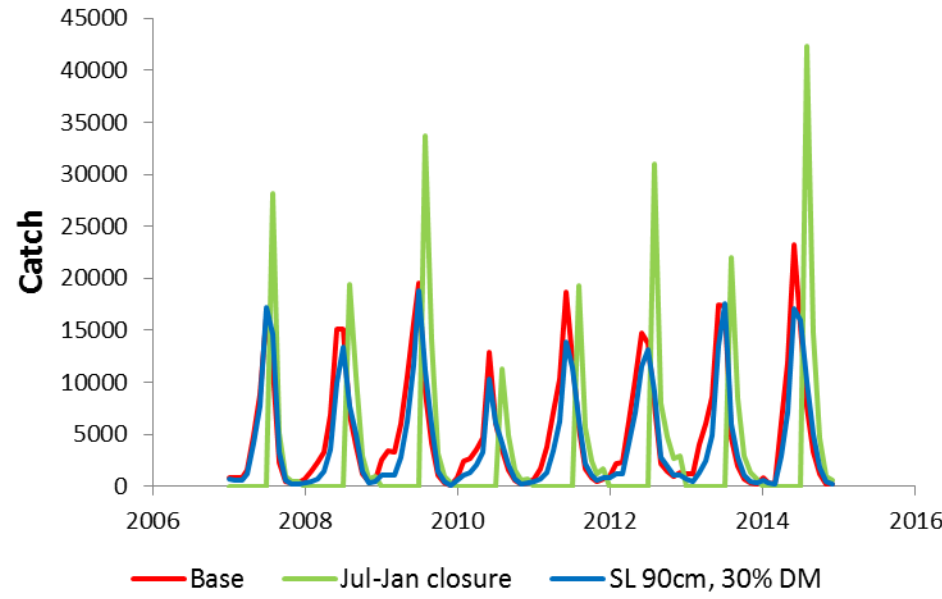
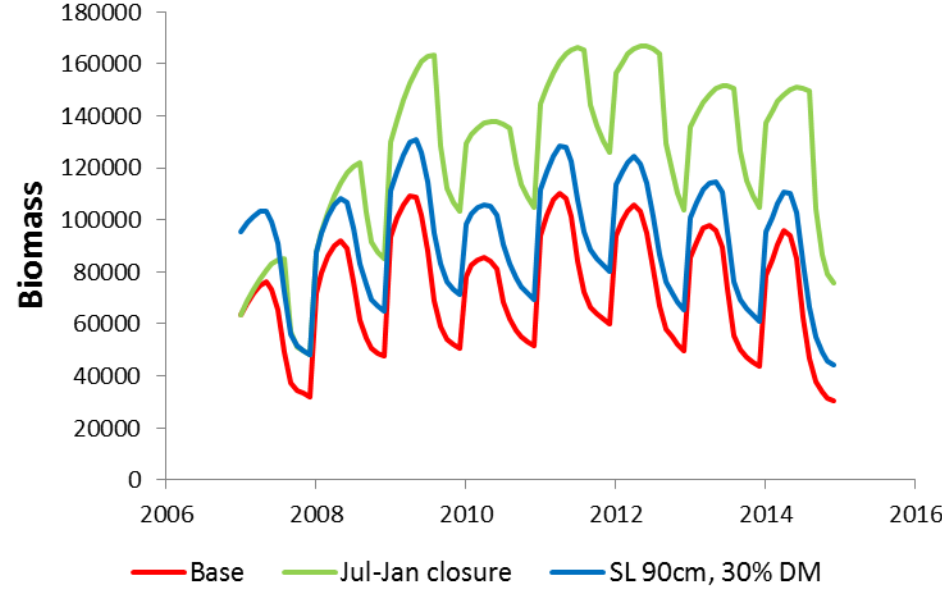
# SBR, Yield & Closures and openings



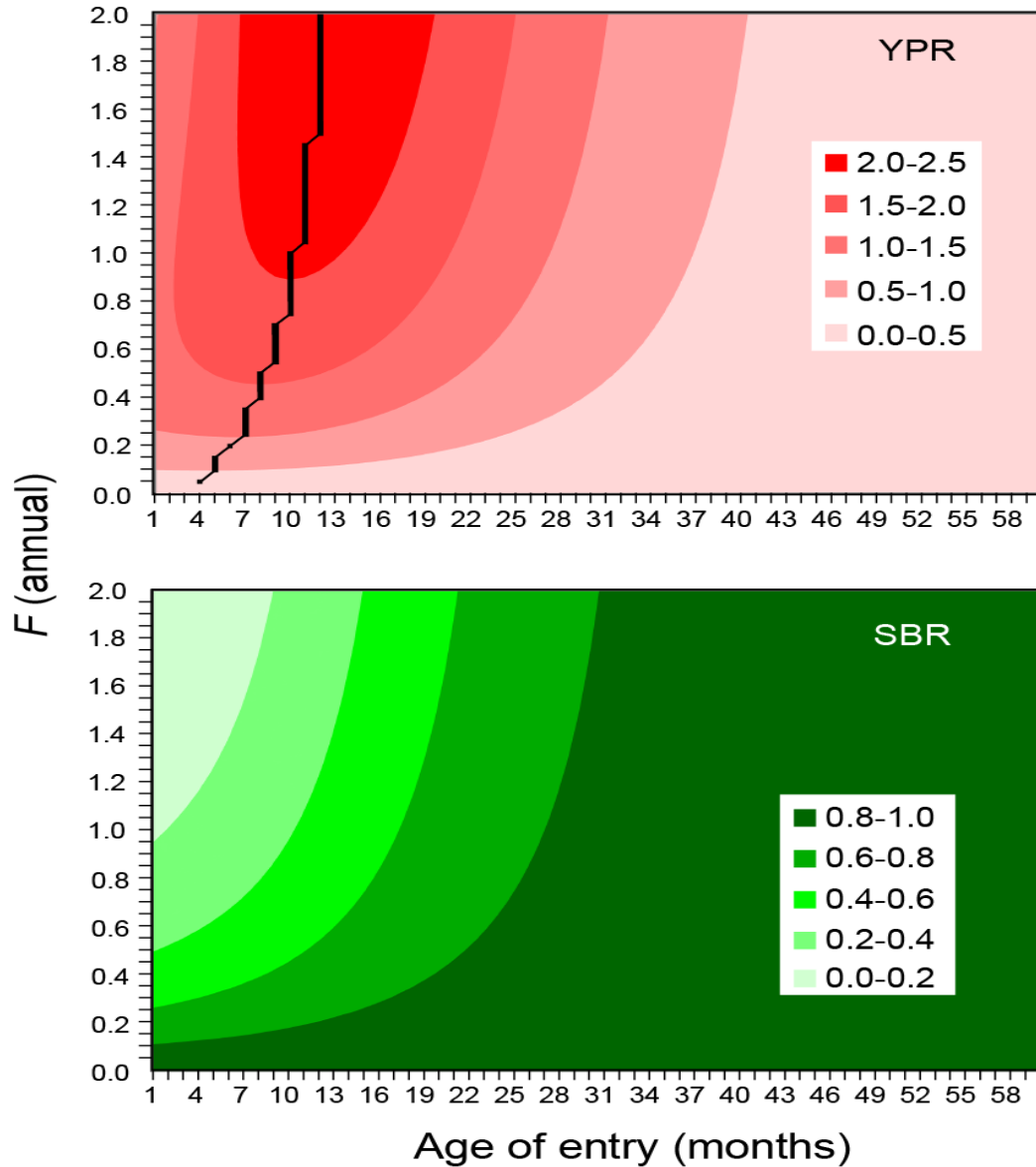
# SBR, Yield & Size limits + discard mortality



# Retrospective runs



# YPR by age of entry and $F$





# Conclusions

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## 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

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- 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



World Wide Fund (WWF) partially funded Juan Valero to conduct this work

