EVALUATE THE IMPACTS OF ALTERNATIVE MANAGEMENT SCENARIOS FOR THE EASTERN PACIFIC TROPICAL TUNA SPECIES WITH POSEIDON

FWG, June 2024

Katyana A. Vert-Pre, Nicolas Payette, Alexandra Norelli, Brian Powers, Michael Drexler, Jon Lopez, Gala Moreno, Steven Saul, Alexandre Aires-da-Silva, Mark Maunder, Carolina Minte-Vera, Dan Ovando, Haikun Xu, Aarthi Ananthanarayanan, Ernesto Altamirano, Richard Bailey, Ernesto Carrella, Dan Fuller, Cleridy E. Lennert-Cody, Jens Koed Madsen, JoyDeLee Marrow, Dan Ovando, Victor Restrepo, Marlon Roman, Kurt Schaefer, Dale Squires, Nick Vogel

EPO Poseidon overview

Fish prices

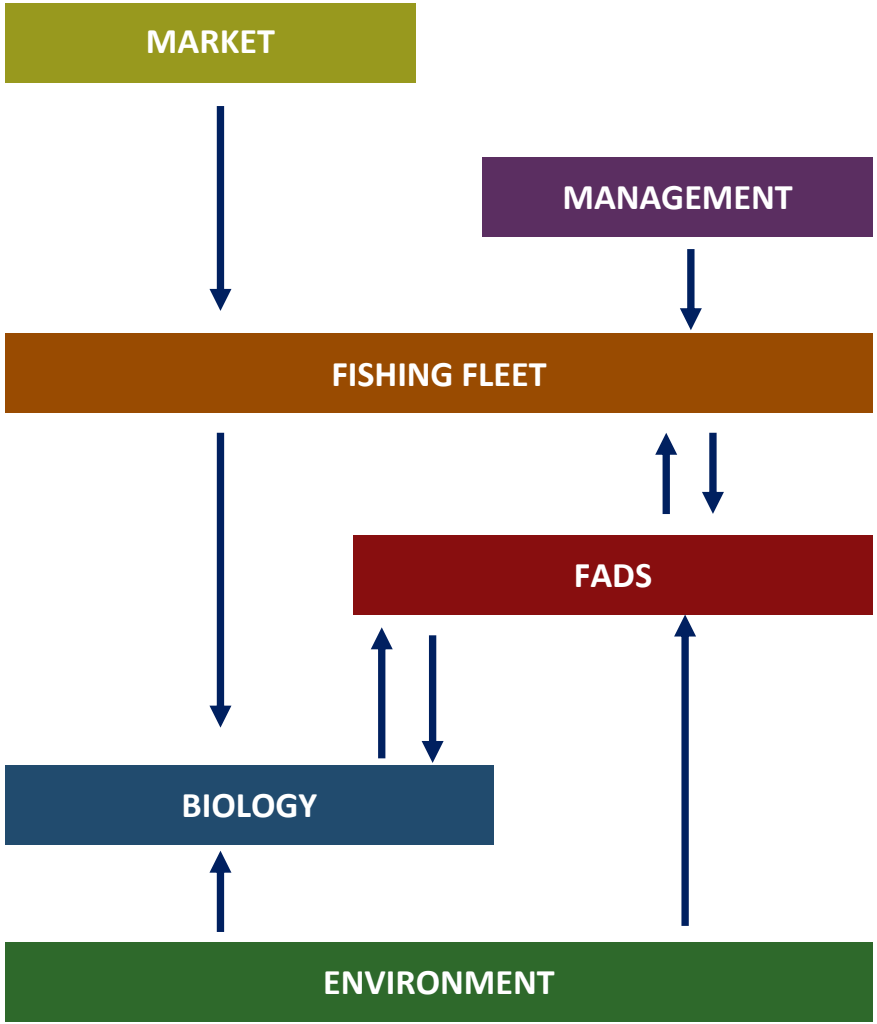
Existing Measures

Observed data
Operating costs

2018-2021
Buoy locations
HYCOM vectors

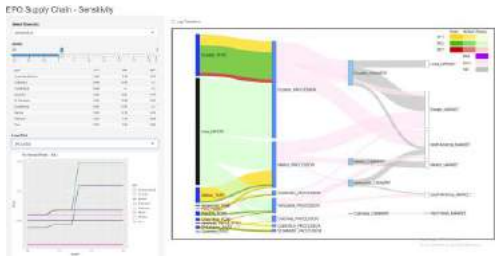
Stock assessments
- Biomass
- Recruitment
- Natural Mortality

SDM models



Model inputs

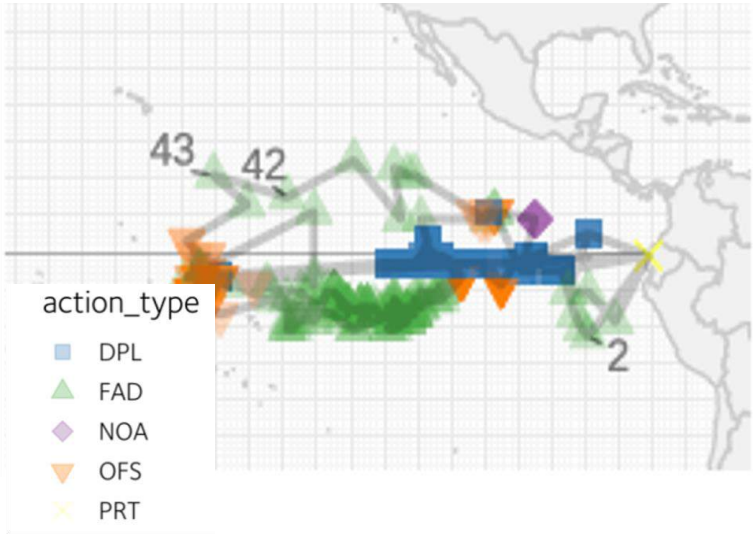
- operating model based on 6 modules
- Informed by various data sources
- Represented on a spatial 1°×1° square grid cells



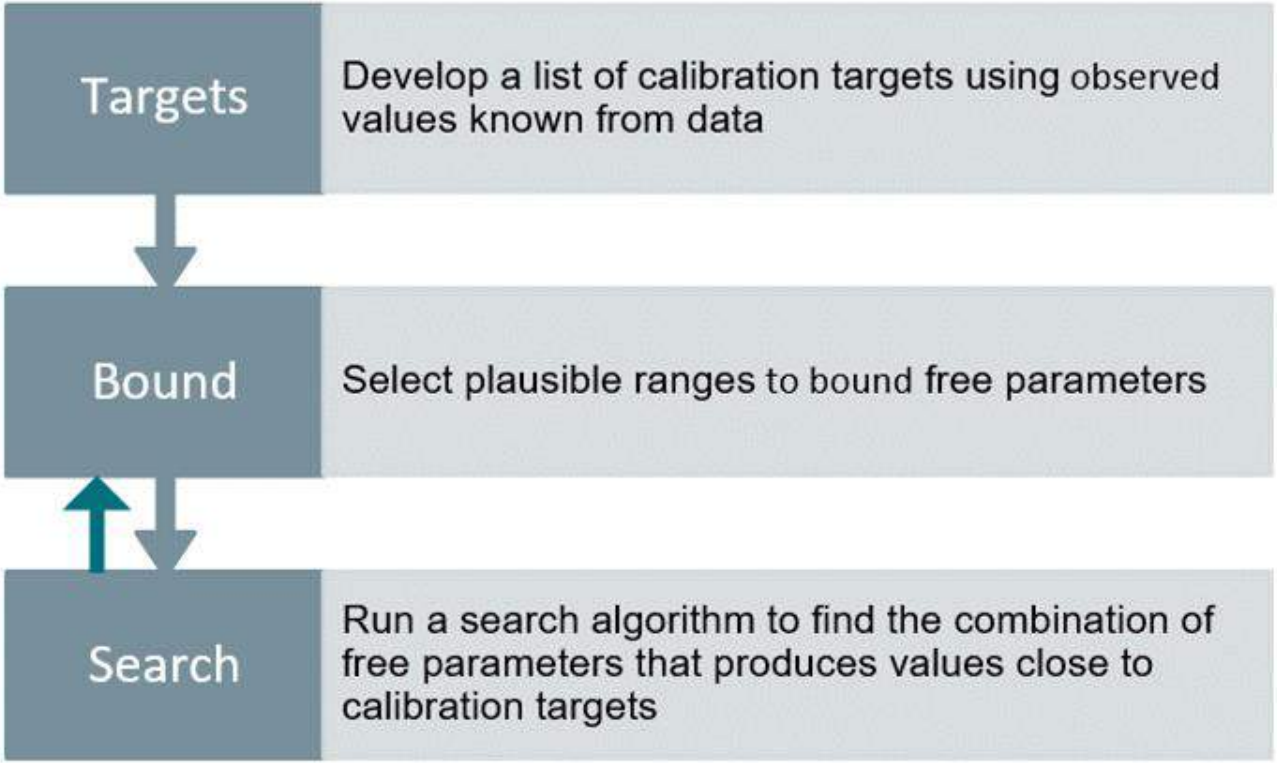
ABM dynamics

- fleet dynamics are emergent based on calibrated behavior

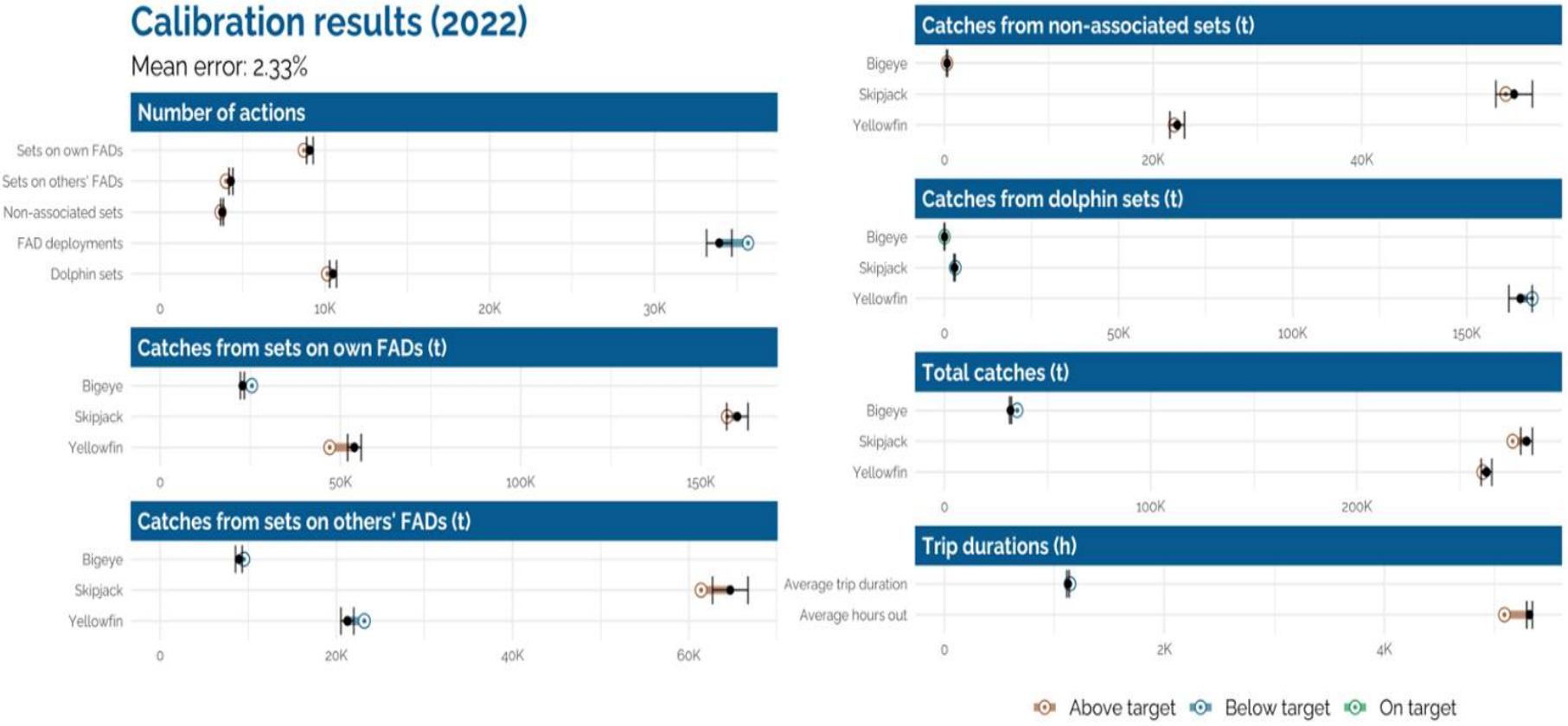
- produces realistic trip trajectories, timing and actions (FAD distributions, FAD sets and other purse seine sets)



Model Fitting



Model fit


Calibration results (2022)
Mean error: 2.33%
Number of actions
Sets on own FADs
Sets on others' FADs
Non-associated sets
FAD deployments
Dolphin sets
0
10K
20K
30K
Catches from sets on own FADs (t)
Bigeye
Skipjack
Yellowfin
0
50K
100K
150K
Catches from sets on others' FADs (t)
Bigeye
Skipjack
Yellowfin
0
20K
40K
60K
Catches from non-associated sets (t)
Bigeye
Skipjack
Yellowfin
0
20K
40K
Catches from dolphin sets (t)
Bigeye
Skipjack
Yellowfin
0
50K
100K
150K
Total catches (t)
Bigeye
Skipjack
Yellowfin
0
100K
200K
Trip durations (h)
Average trip duration
Average hours out
0
2K
4K
Above target
Below target
On target


ABM and
Management

Simulation Objective

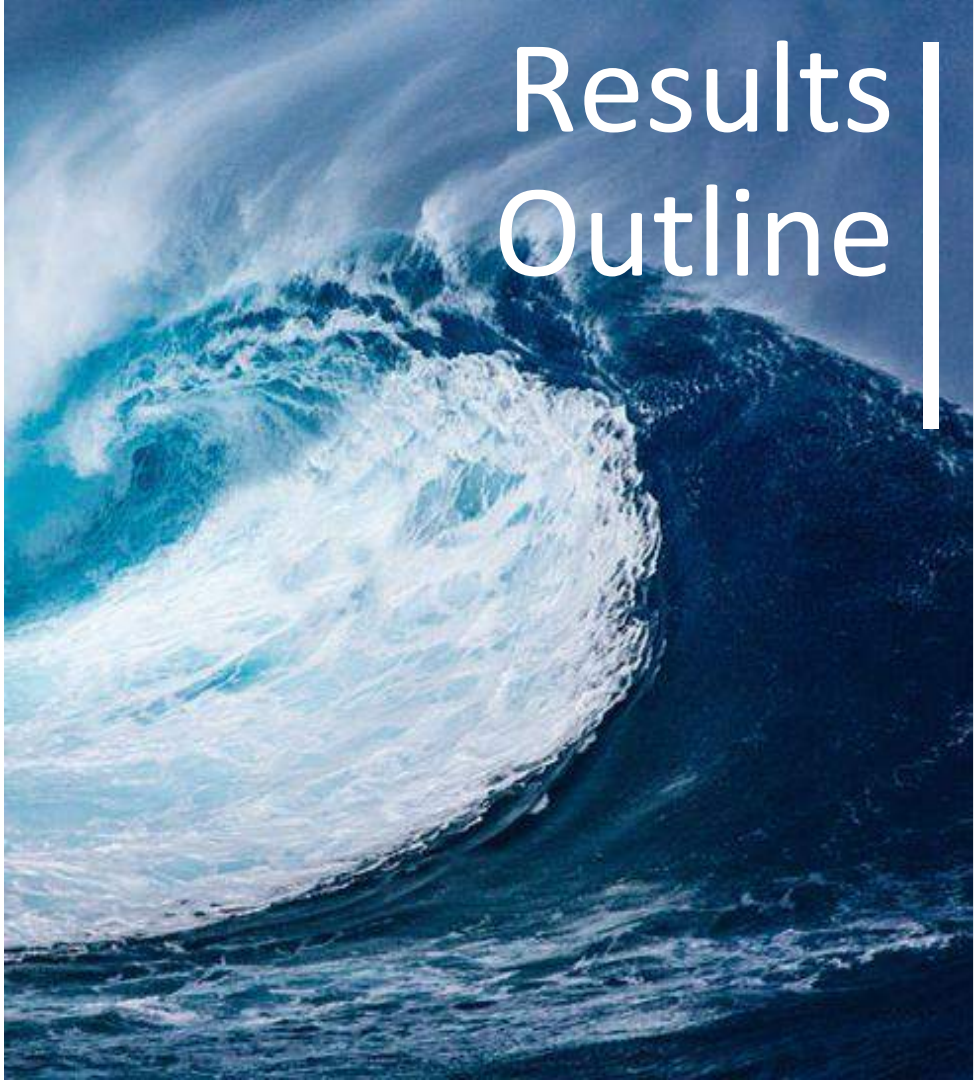
- ➔ Simulate reductions of **current individual vessel active FAD limits (by vessel class)** at different levels
- ➔ Calculate the corresponding % **reduction in global and per vessels' number of active FADs monitored** and some other associated metrics of interest.
- ➔ Compare the difference between the two assumptions

Vessel type	2022 limit	2023 limit
Class 6.a (1,200m3 and greater)	400	340
Class 6.b (<1,200m3)	270	255

Total Simulations	Assumptions	FAD Limit Scenarios	Stochasticity
160	Deploy at emergent rate from calibrated 2022 model	5% increments (0-100% current)	8
160	Deploy at maximum rate allowed	5% increments (0-100% current)	8

Results Outline

1. Relationship between FAD limits and active FADS
2. Relationship between FAD limits and fleet
3. Effect of FAD limits on OBJ sets and catch
4. Multispecies outcome
5. Behaviors behind the results



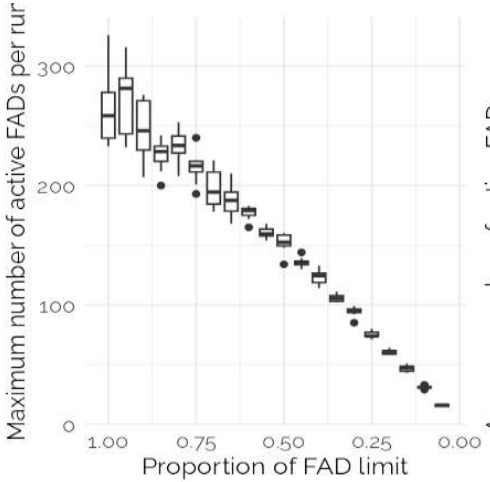
Relationship between FAD limits and active FADS

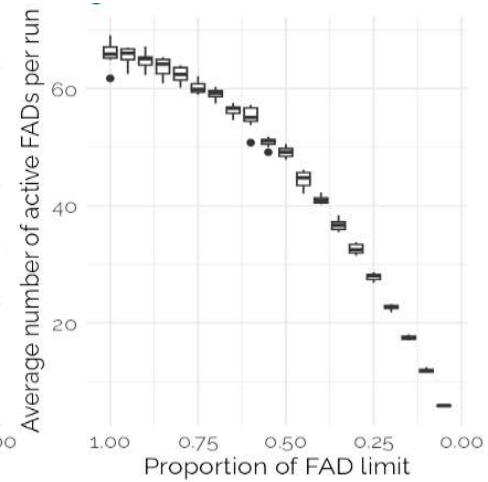
Proportional relationship between proportion of FAD limit and number of active FAD per vessel

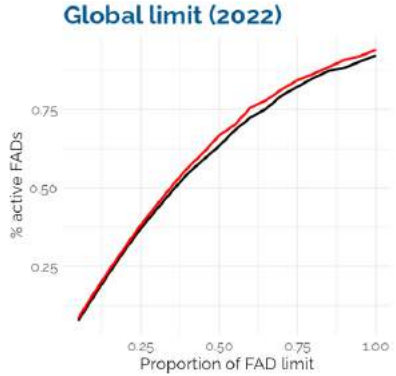
25% reduction in FAD limit

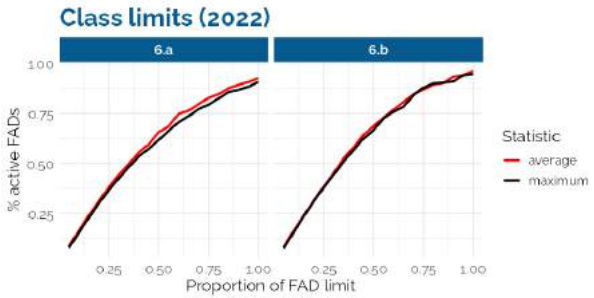
→ 60 active FADs per class 6 vessel
→ 200 maximum active FADs per class 6 vessel

Can regulate number of active FADs in the ocean with efficacy by adjusting FAD limit









Relationship between FAD limits and Fleet

At 100% of the current FAD limit:

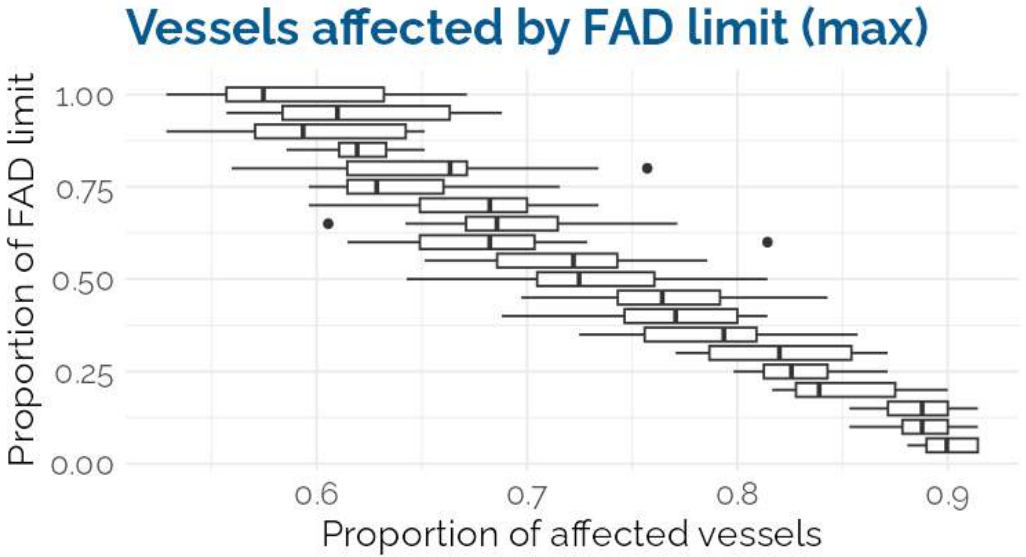
➔ 58% of vessels are affected by the regulation

At 70% of the current FAD limit:

➔ 68% of vessel are affected by the regulation

At 15% of the current FAD limit:

➔ 90% of vessels are affected by the regulation



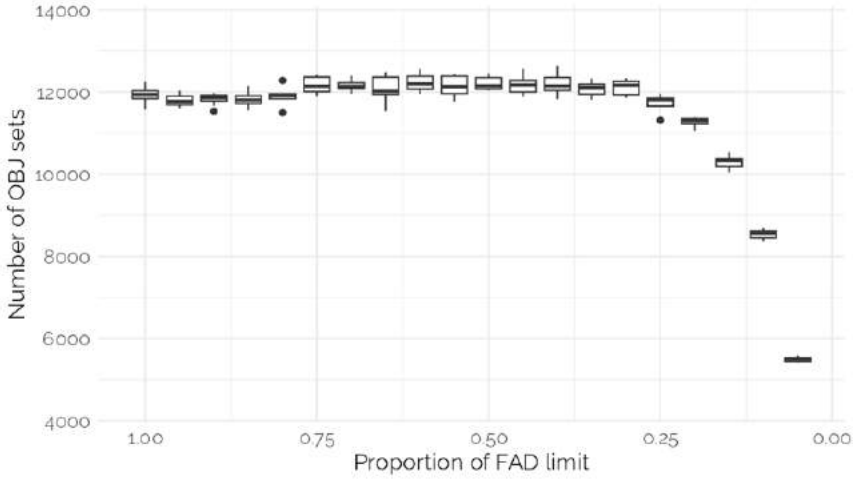
Vessels are not affected uniformly

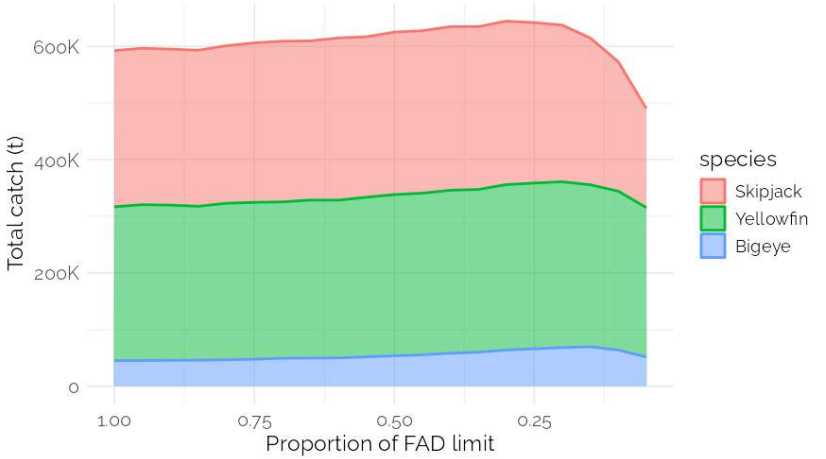
Effect of FAD limits on OBJ sets and catch

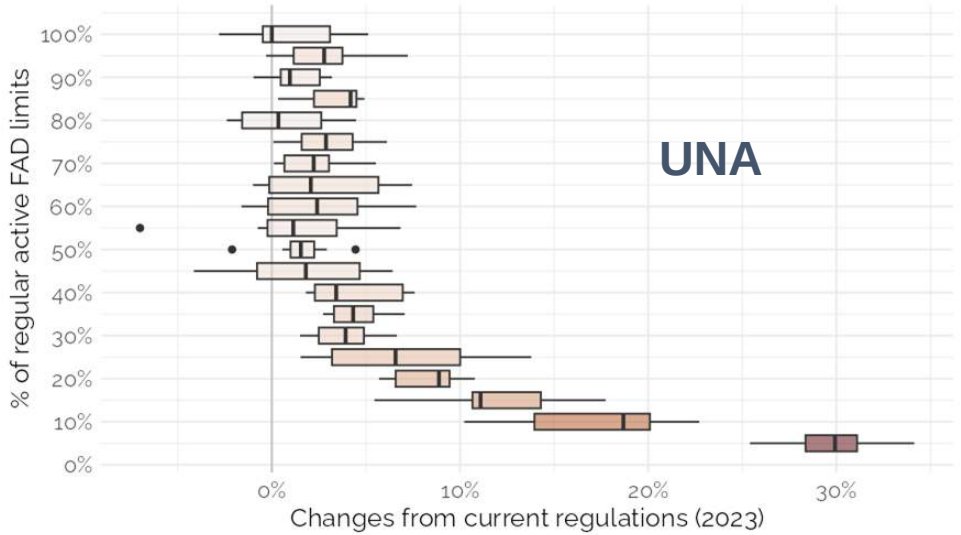
- No impacts to total OBJ sets and catch between 100 and 75% of current FAD limits
- Reducing OBJ sets and catch may require very low FAD limits relative to current levels

25% reduction of FAD limit can increase ecological benefits without impacting the fishery (~5.8% FAD stranding rate)

IFLs lower than 13% of current FAD limits are needed to reduce biological impacts (Total catch and reduced bycatch)



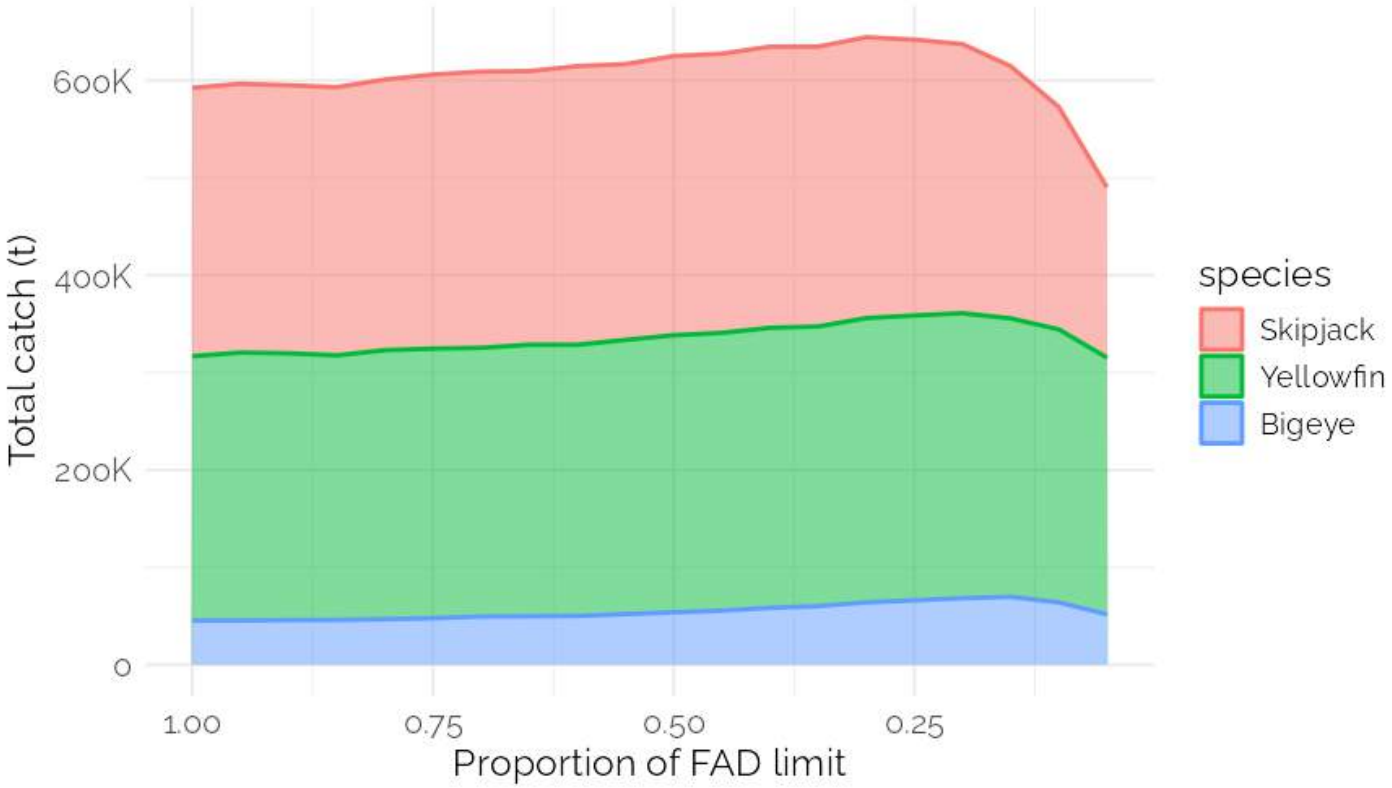




- Settype composition changes as
  - Effort shifts to other settypes
  - Spatial shift in effort to regions BET rich - west/south/ south-west
  - Few vessels go over BET limit

Fishers adapt to a loss of active FADs in the ocean by shifting to UNA and DEL sets

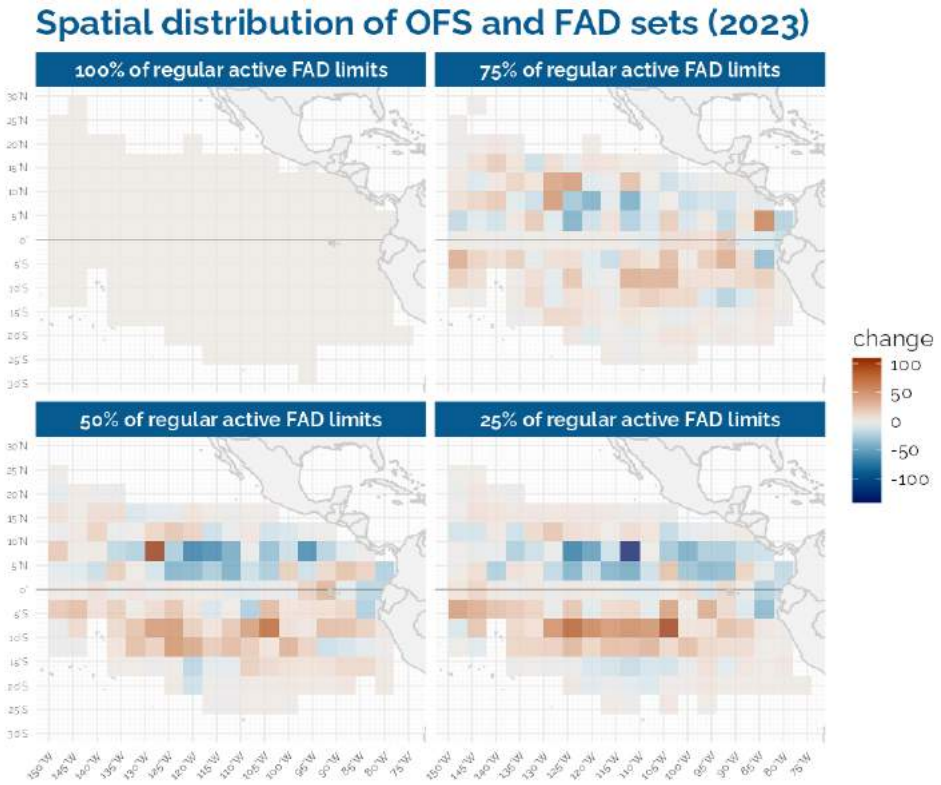
Multispecies outcomes



- Species composition changes as
  - Effort shifts to other settypes
  - Spatial shift in effort to regions BET rich - west/south/ south-west
  - Few vessels go over BET limit

Spatial shift changes the composition of available biomass under FADs

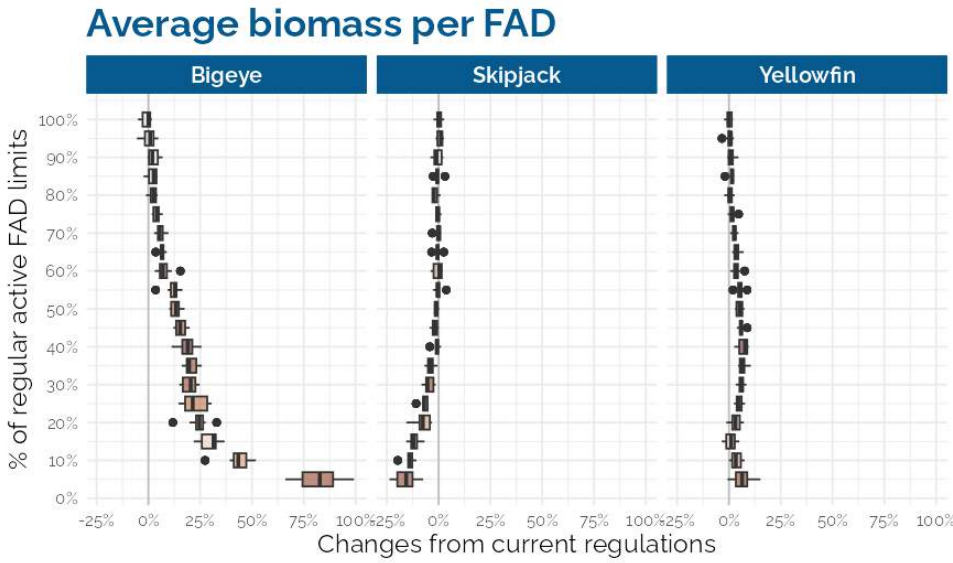
Explore alternative secondary spatial measures geared to mitigate impact on Bigeye Tuna

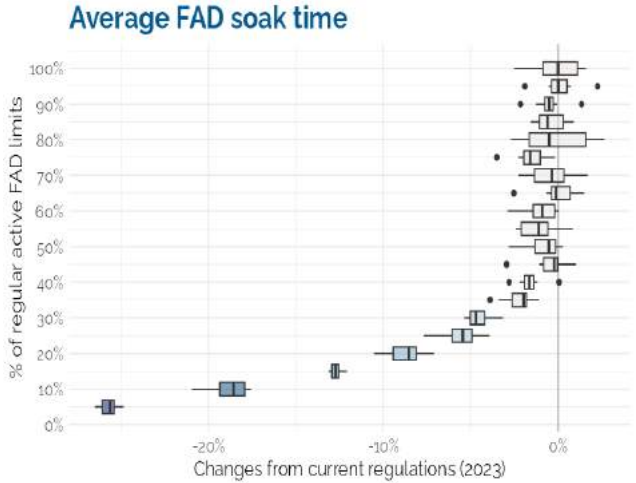


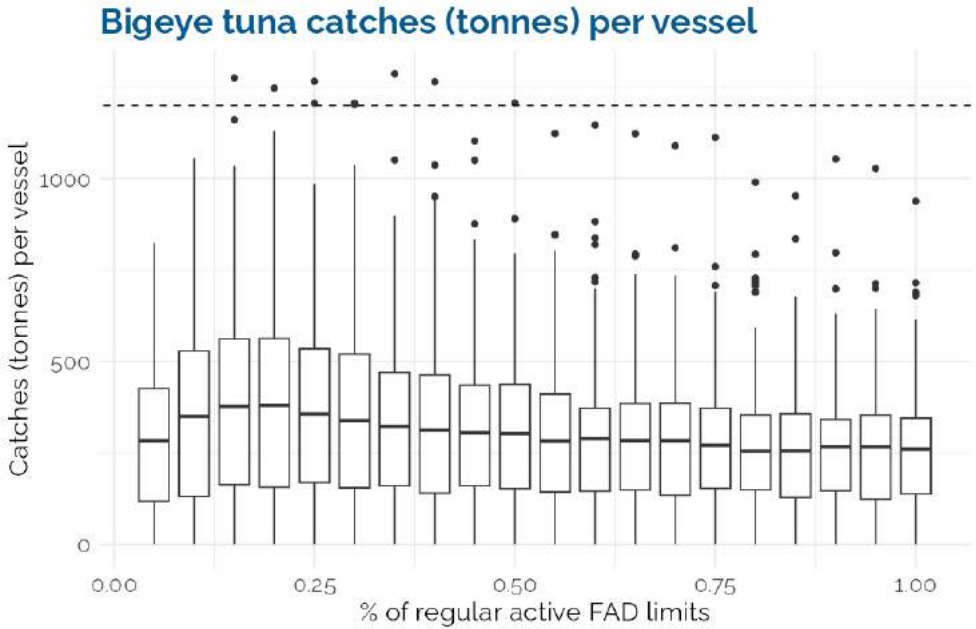
- Species composition changes as
  - Effort shifts to other settypes
  - Spatial shift in effort to regions BET rich - west/south/ south-west
  - Few vessels go over BET limit

Spatial shift changes the composition of available biomass under FADs

Explore alternative secondary spatial measures geared to mitigate impact on Bigeye Tuna







- Species composition changes as
  - Effort shifts to other settypes
  - Spatial shift in effort to regions BET rich - west/south/ south-west
  - Few vessels go over BET limit

Could additionally explore effectiveness and responses to the BET limit


Summary

Take away - Poseidon

- POSEIDON is a flexible support tool for fishery management.

- The coupled agent-based bio-economic model, POSEIDON, was adapted to represent the EPO tropical tuna FAD fishery. The adaptive nature of the agents allows for the evaluation of complex management scenarios while assessing social, biological, and economic tradeoffs.

Take away - Management

- Reducing the percentage of active Fish Aggregating Devices (FADs) per vessel to 80% of the current FAD limit could significantly reduce ecological impacts associated with FADs, such as reduced stranding, while maintaining the number of sets at levels consistent with those observed at the current FAD limit.

- To effectively mitigate the biological impact on tropical species populations, managers could consider implementing drastic reductions in the Fishery Aggregating Device (FAD) limit or regulations covering all three set types.

- Additionally, combining these measures with spatial regulations is advisable, especially considering the non-uniform effort impact on all three tropical tuna species.

- Note that these results are one of the possible outcomes according to current model specifications. POSEIDON can provide additional sensitivity analysis to model assumptions that can help map out the array of potential outcome for a specific management strategy.

- Additionally more research would be desirable to support management decision dependant on unknown processes link to FAD fishery.

Thank You & Questions

Past Funding partners

GORDON AND BETTY MOORE FOUNDATION

the David & Lucile Packard FOUNDATION

The WALTON FAMILY FOUNDATION

OXFORD MARTIN SCHOOL

UNIVERSITY OF OXFORD

Photo: Fa

vertpre.katyana@gmail.com