Development of an Agent-Based Bio-Economic Model of Eastern Pacific Tropical Tunas Fisheries (POSEIDON)

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01 Poseidon overview

P Process based

O Ocean system

S Simulator for

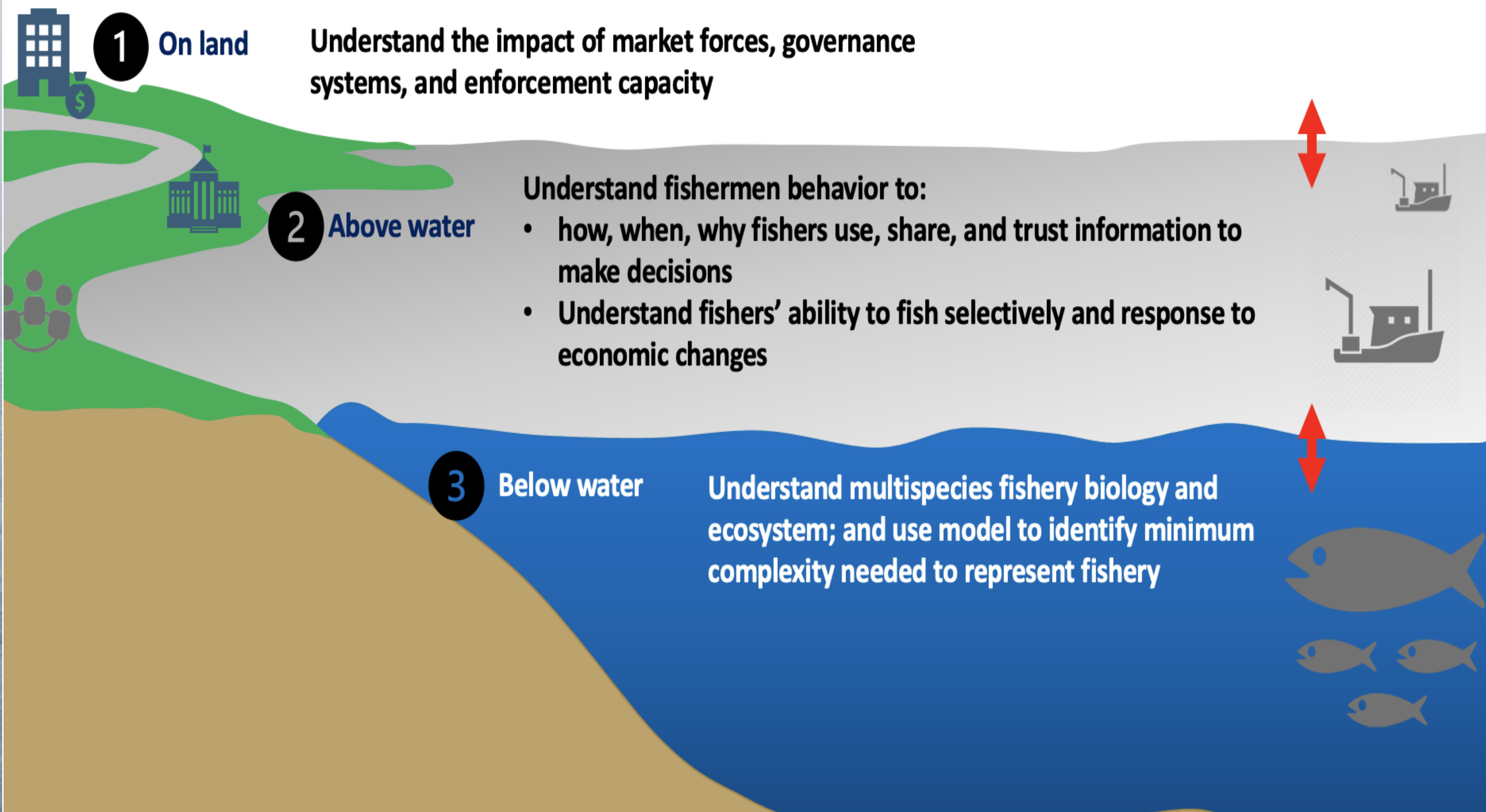
E Evolving

I Integrated

D Domains and

O Operational

N Needs



US West Coast Groundfish

Indonesia Deep Water Snapper

Eastern Pacific Ocean Tropical Tuna

Evaluate behavior algorithms

↓

Adapt to data-challenged, real-world fishery

↓

Work directly with IATTC to develop operating model – evaluate FAD management strategies

02 | EPO Fishery

Applying POSEIDON for EPO tuna management:

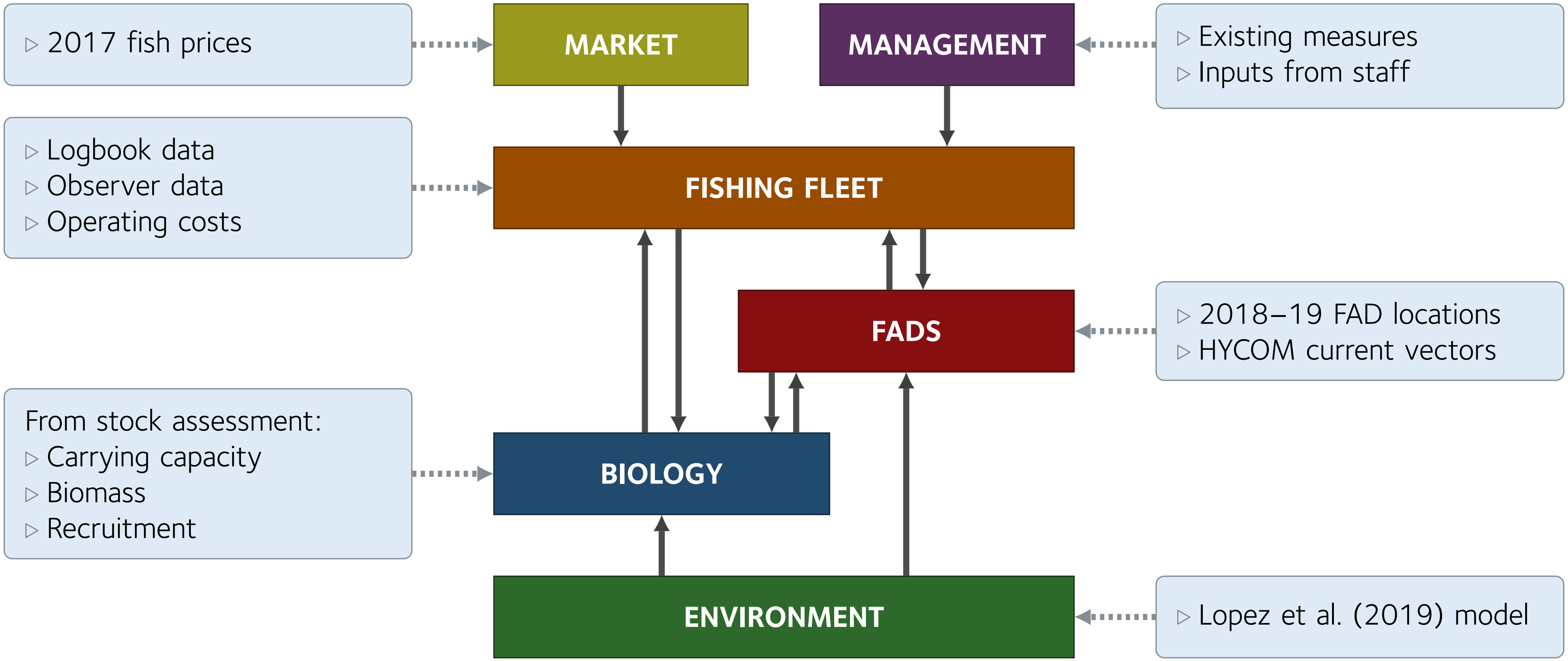
Challenges for management:

- Highly dynamic fishery with changing technology and growing FAD use
- Multispecies
- Spatial dynamics are important
- Need for quick evaluation of multiple management alternatives
- Social and economic impacts important for member states in evaluating policies

POSEIDON is a decision-support tool that:

- ✓ Uses adaptive behavior, allowing for introduction of novel policies/conditions
- ✓ Explicitly models technical interactions across multiple species
- ✓ Models space explicitly
- ✓ Enables quick, flexible simulation of management measures
- ✓ Outputs social, economic, and biological outcomes

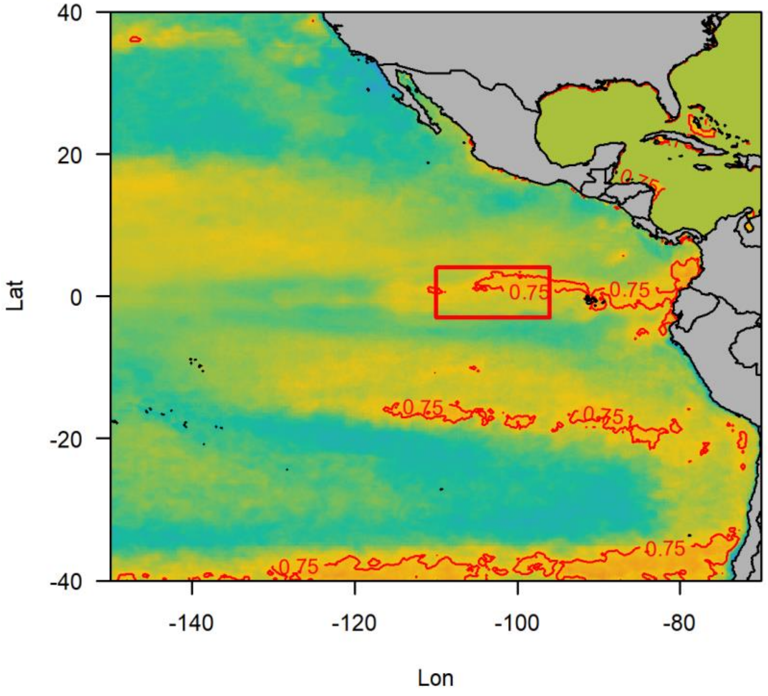
Model Inputs



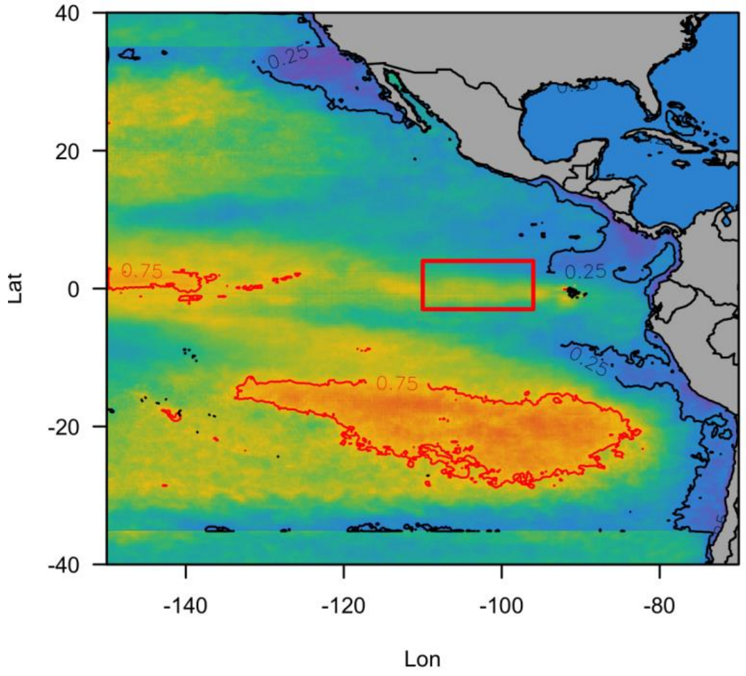
03 | Model components

Species distribution maps (juv. + adult)

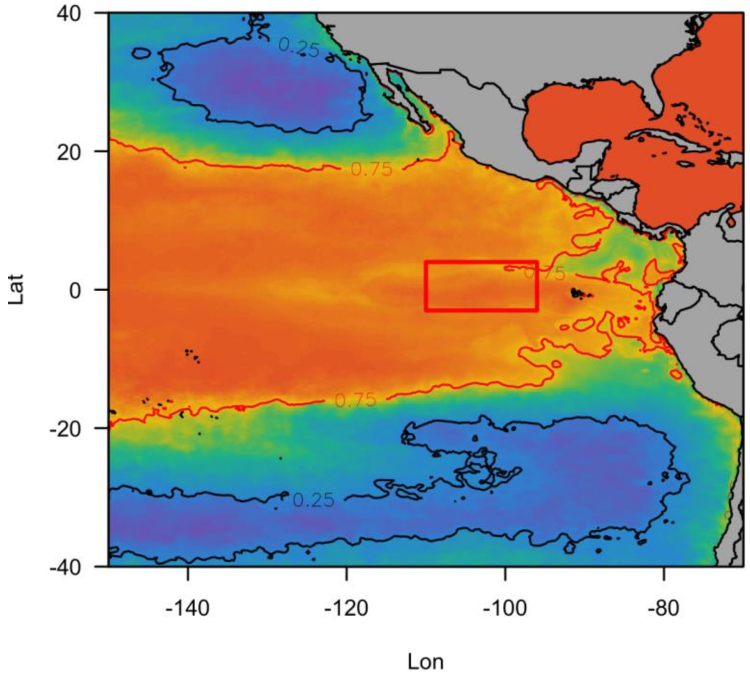
YFT

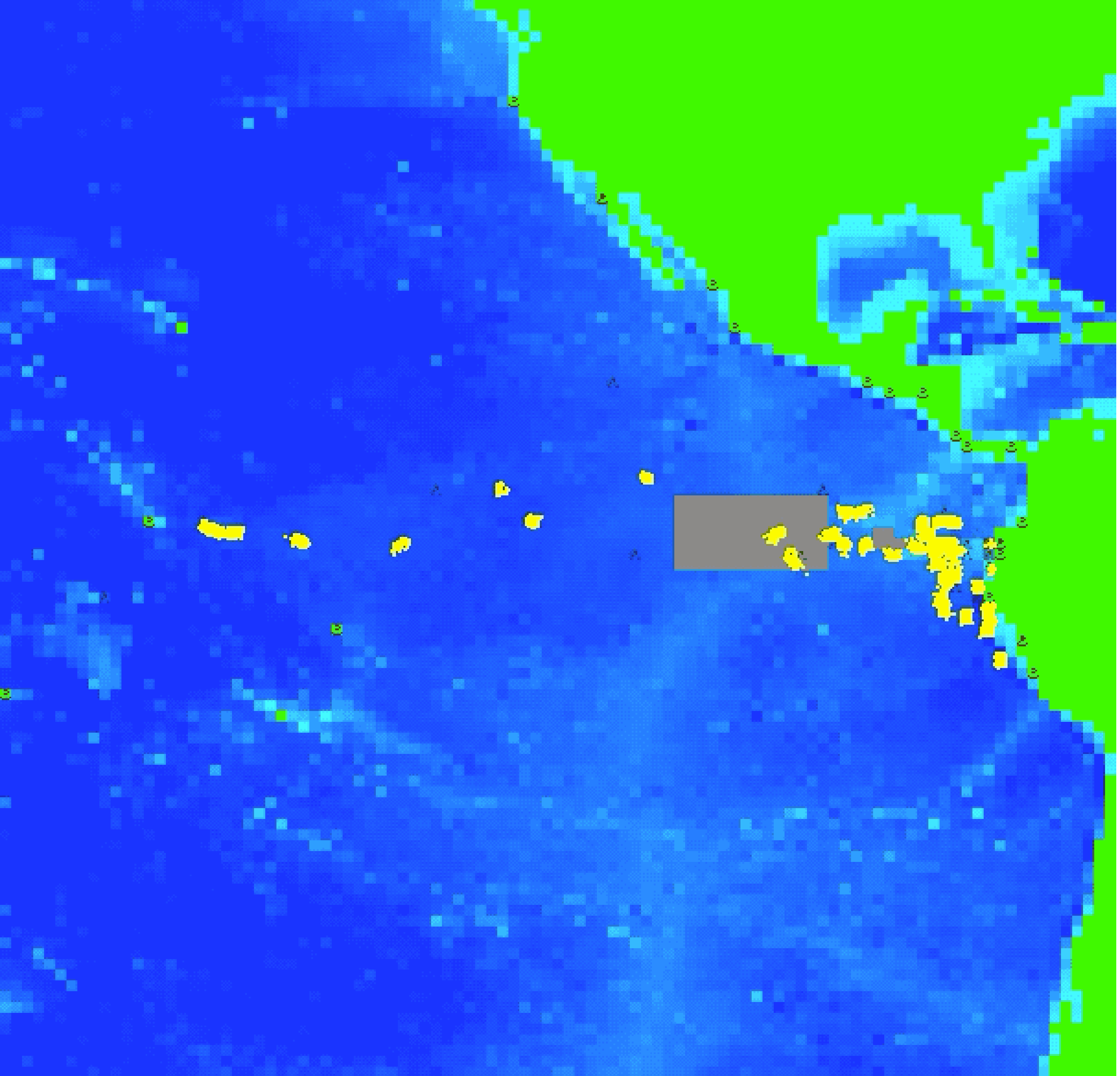


BET



SKJ





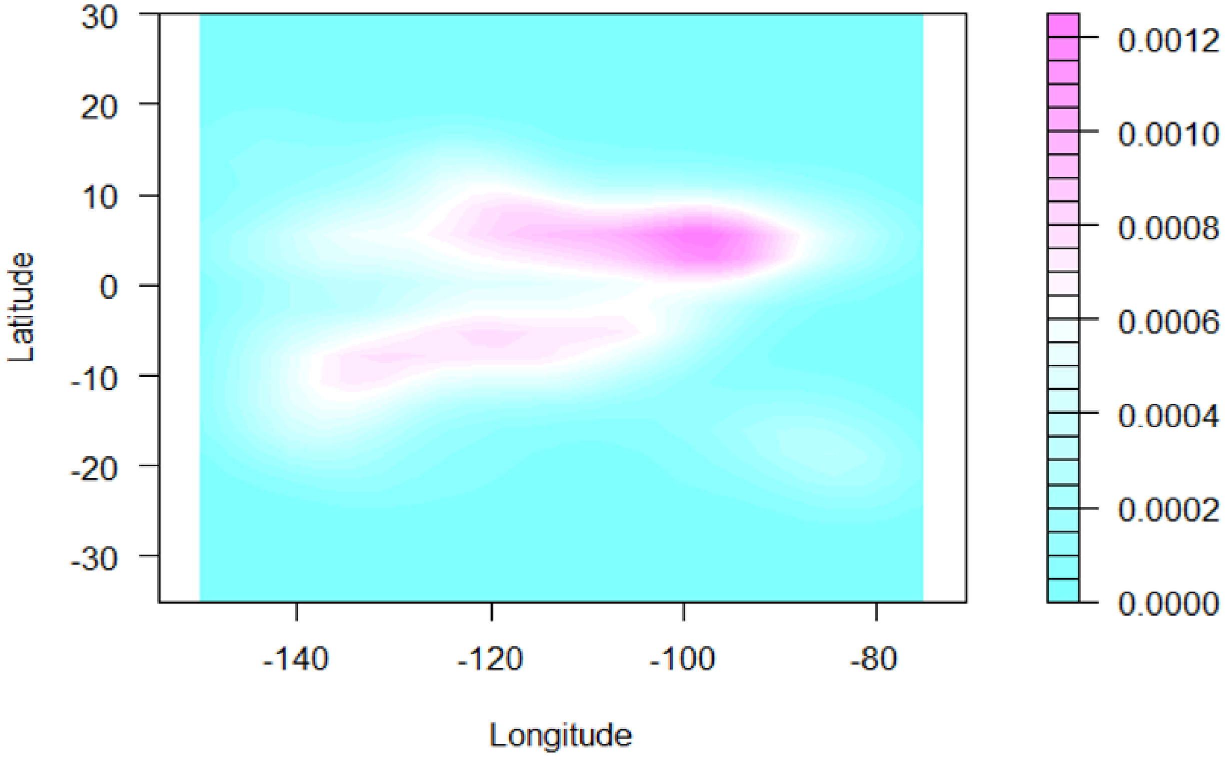
FAD drift simulation

POSEIDON needs a drift model that:

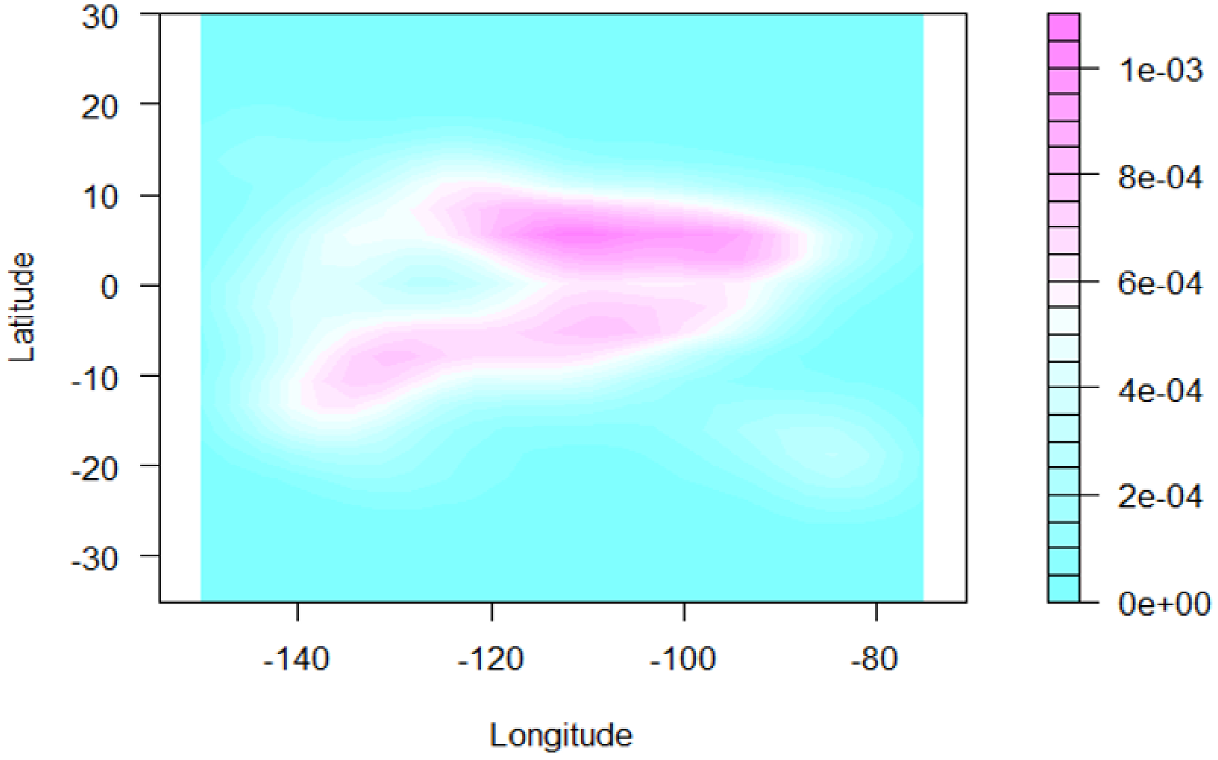
- reproduces realistic FAD distributions at a coarse scale
- varies trajectory seasonally and by environmental regime given deployment locations

FAD densities, real vs. modeled

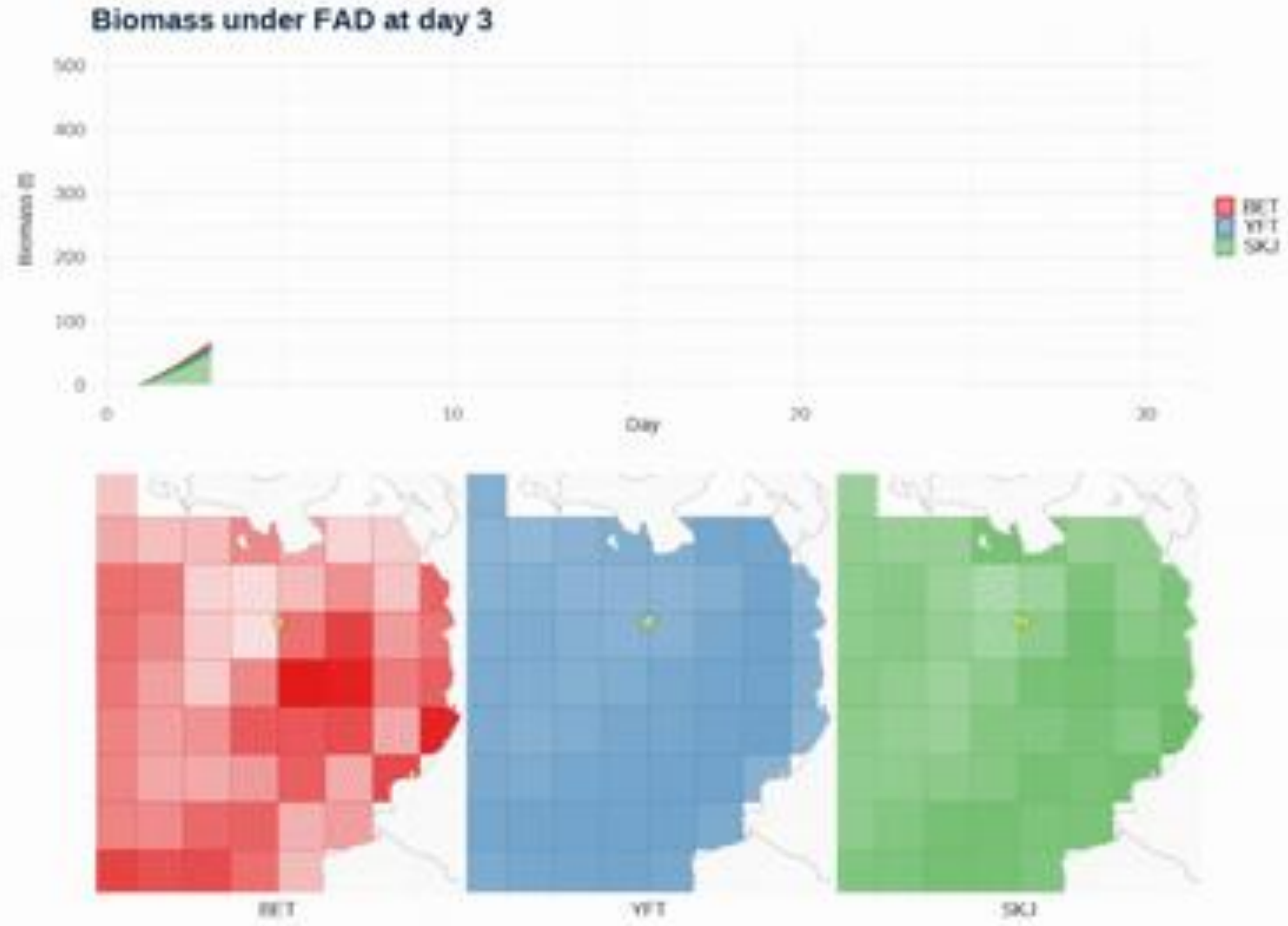
25 Day Drift Dispersion (Real)



25 Day Drift Dispersion (Modeled)



The life-cycle of a simulated FAD



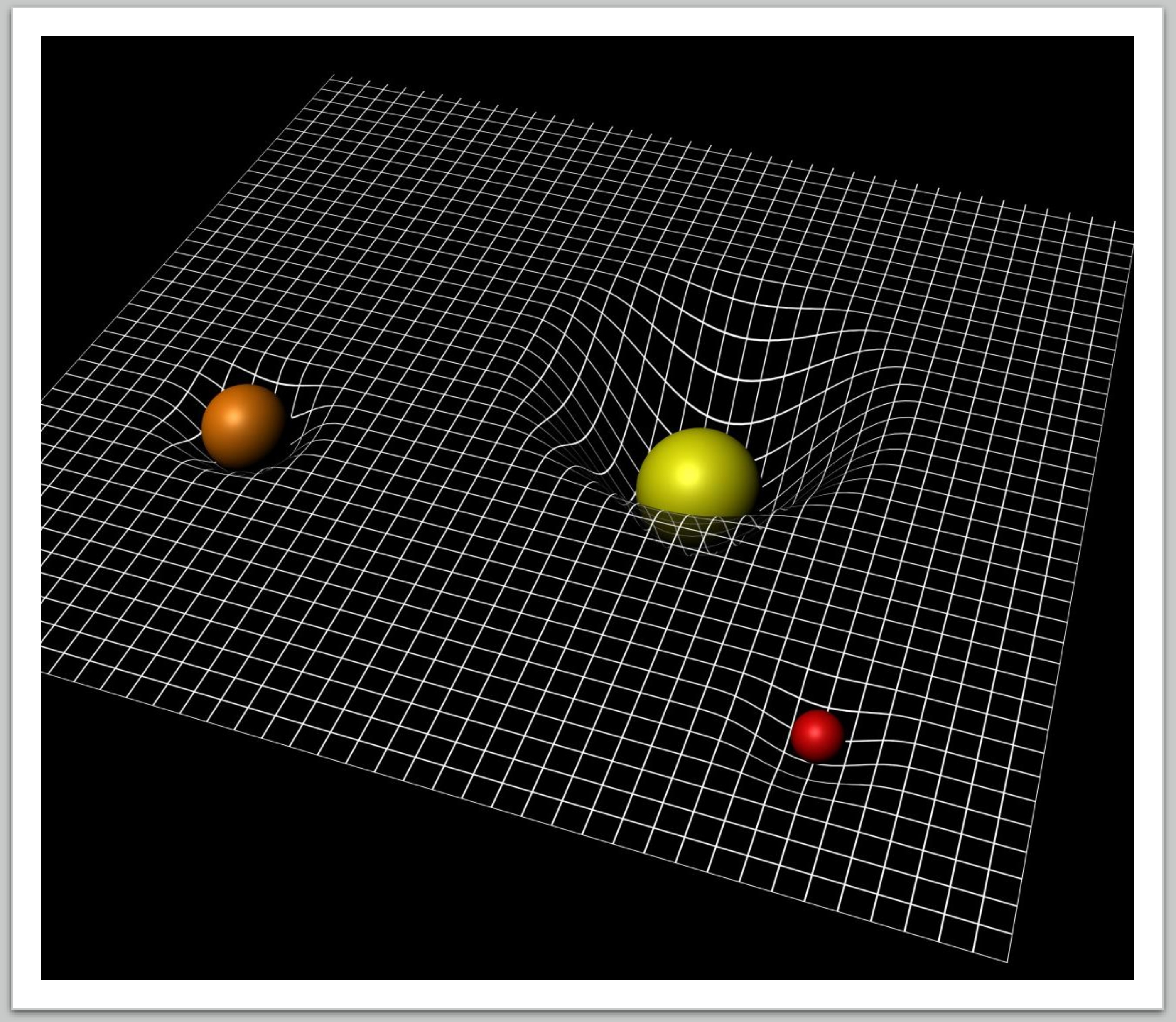
Calibrated parameters	(provisionary)
BET attraction rate	0.0682
SKJ attraction rate	0.0452
YFT attraction rate	0.0335
Fish release chance	0.0188

Empirical parameters	
FAD capacity for BET	254.70 t
FAD capacity for YFT	278.37 t
FAD capacity for SKJ	387.00 t

Gravity field

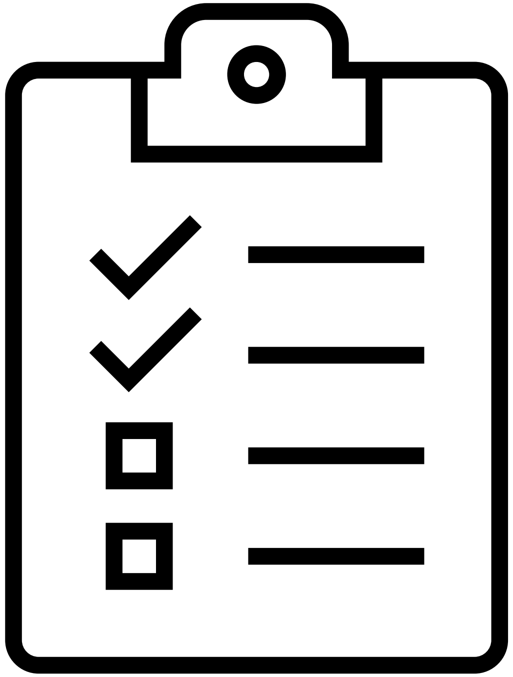
- Destination strategies
  - Generate realistic boat trajectories
  - Include more adaptive behavior
  - Based on relative cell values updated daily

- Fishing strategies
  - Represent different fishing strategies
  - UNA, DEL, FAD



04 Diagnostics

Diagnostics



- Unit testing (700 tests)
- Calibration
  - 2017 aggregate targets
    - Total catch (per set type)
    - CPUE (per set type)
    - Number of actions (deployments, sets)
    - Trip duration
  - 2018 prediction
- Validation
  - 2017 spatialized
  - 2018 spatialized prediction

05

What can ABM do for management ?

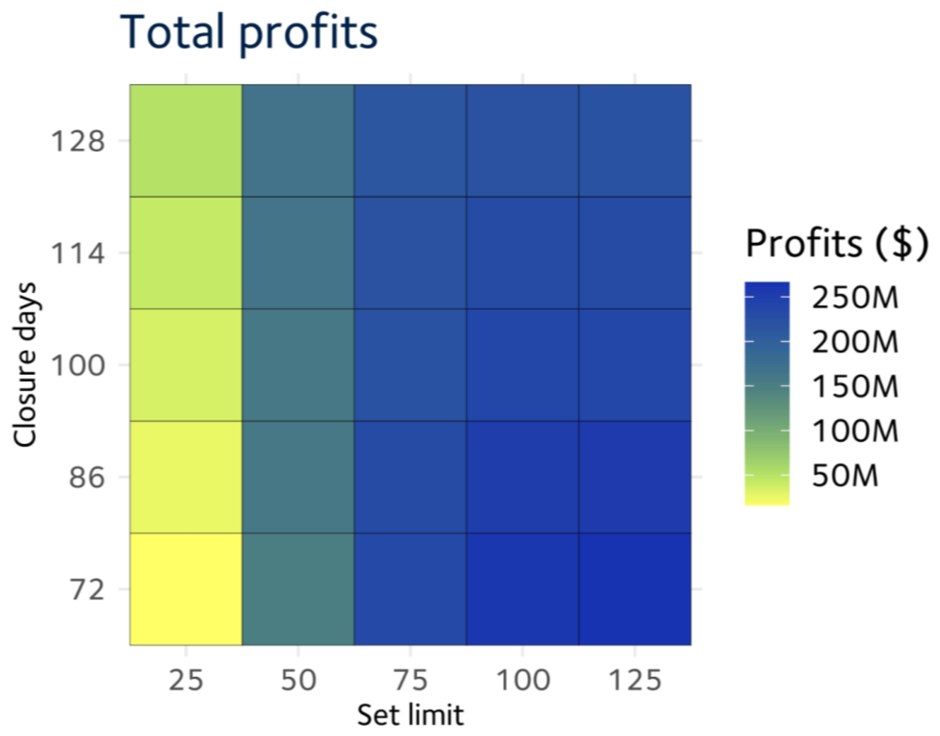
Possible simulation to inform management issues

Evaluate policy for multispecies management

Define science-based FAD limits

Avoid bycatch hotspots

Reduce FAD loss or drift to sensitive habitats



Thank you

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