Strategic Plan for MSE within the SEFSC

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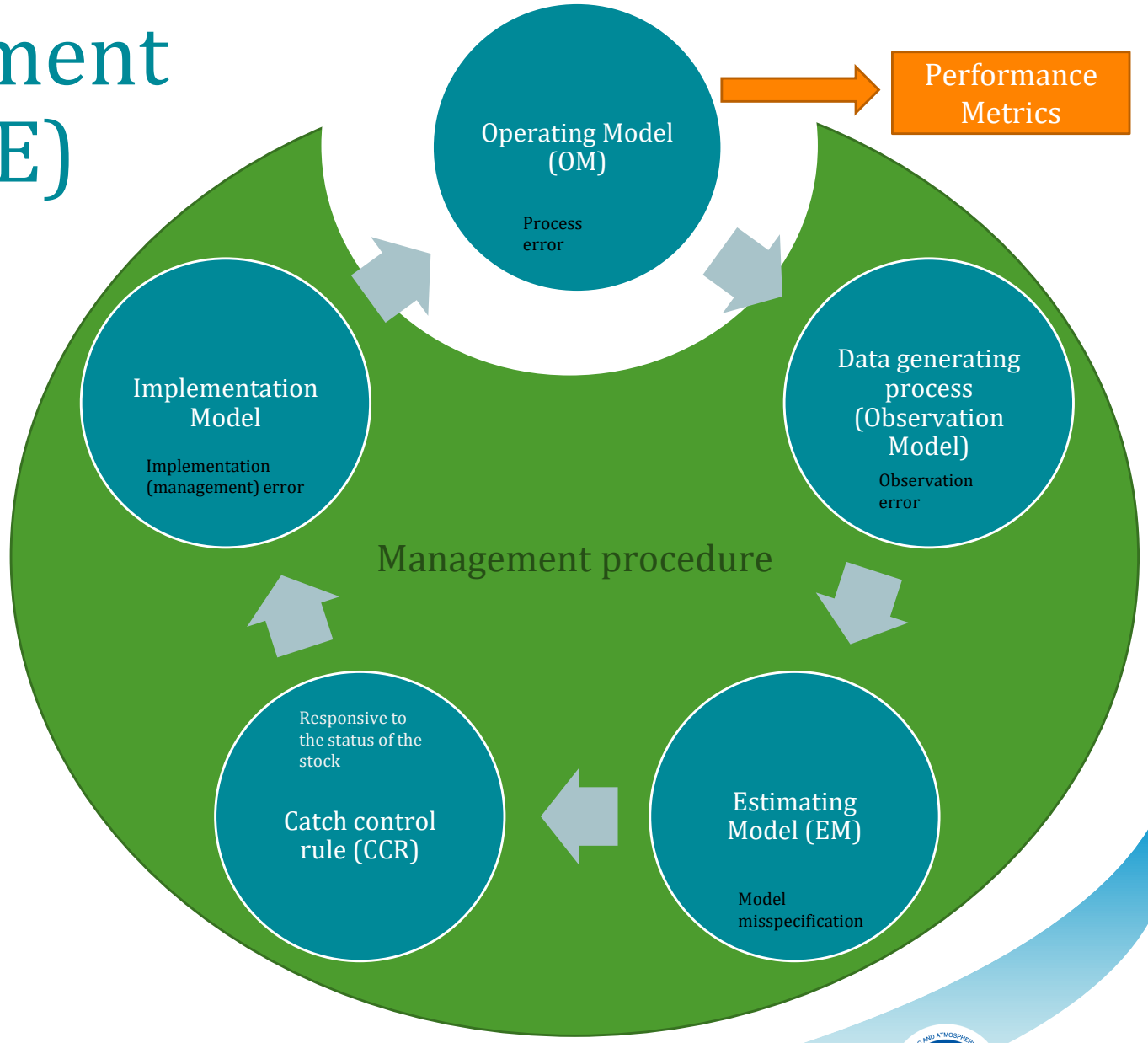
Background on Management Strategy Evaluation (MSE)

Management Strategy Evaluation (MSE) – process designed to develop management procedures (MPs) that are robust to uncertainty

1. Identify fishery-specific, stakeholder-defined management objectives
2. Identify relevant uncertainties over which MP should be robust
3. Develop operating models, 'true' states of nature, and condition operating models
4. Identify management procedures that are responsive to stock dynamics (feedback loop)
5. Simulation exercise; summarize and present resulting performance statistics



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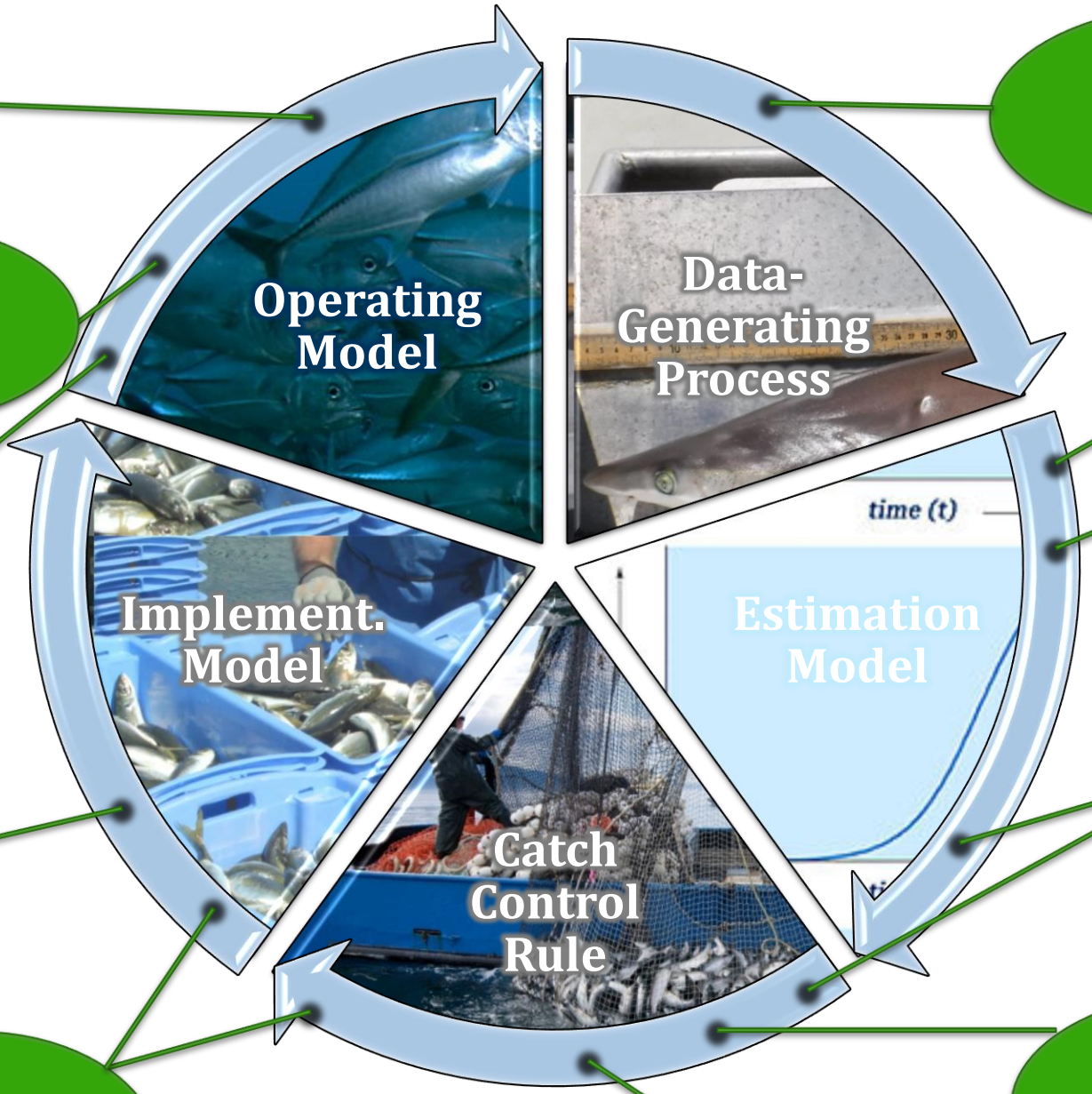

Nonstationarity; climate impacts

Ecosystem considerations

Fishery dynamics (technical interactions; sectors; etc.)

Implementation error

Management Regulation Type

CCR Type

CCR Parameterization

Biological Reference Points

Model Complexity

Model vs. empirical

Data type / Quality / Sampling design

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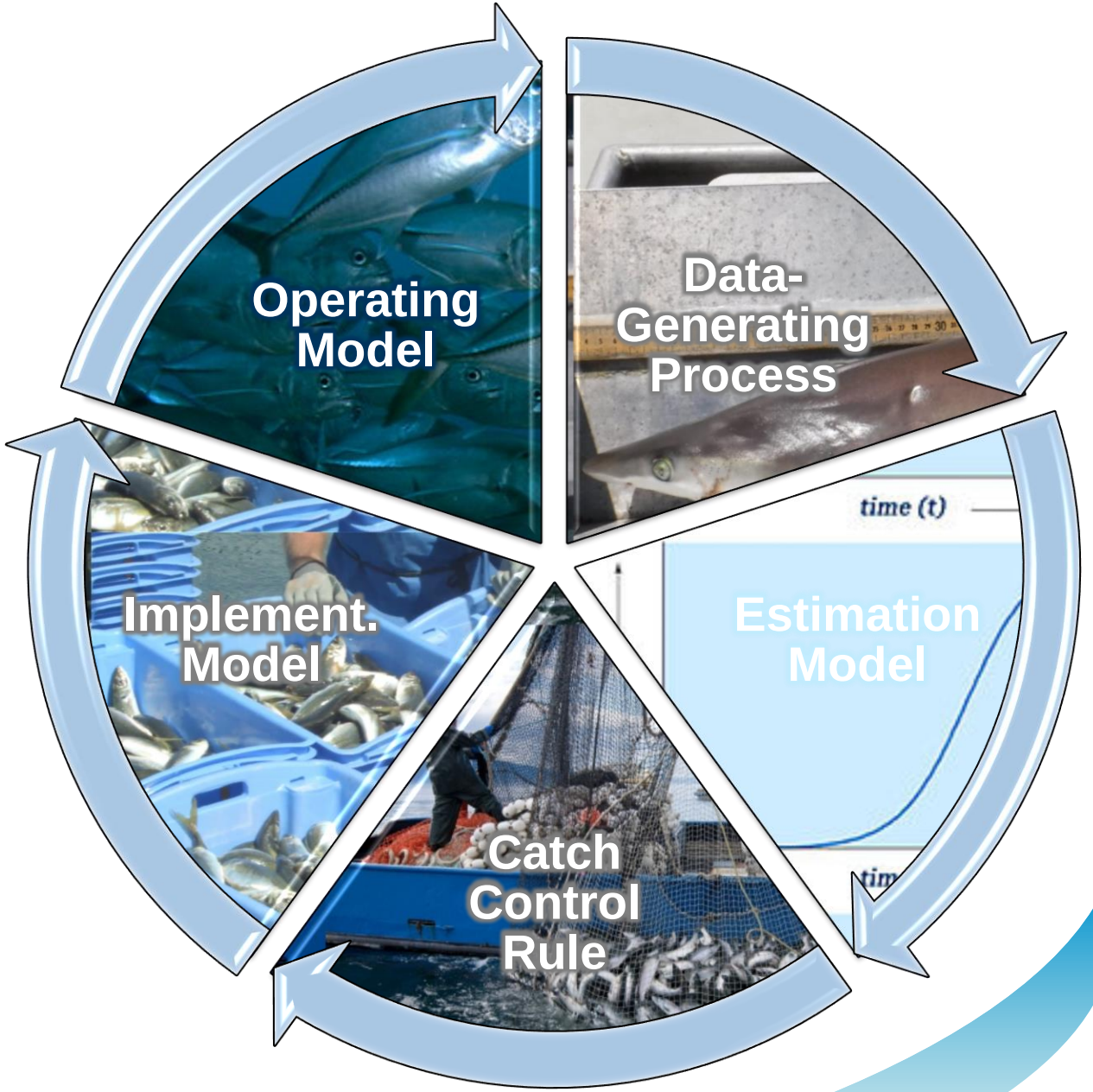
MSE Ancillary Benefits

- Identify management objectives of system
- Foster increased communication and transparency with stakeholders
- Understand stock-specific trade-offs inherent in management of system
- Highlight future research priorities and improve understanding of system uncertainties
- Clearly identify management approaches that will not work
- Take a short-, mid-, and long-term view of the resource
- Improve overall understanding of the management system



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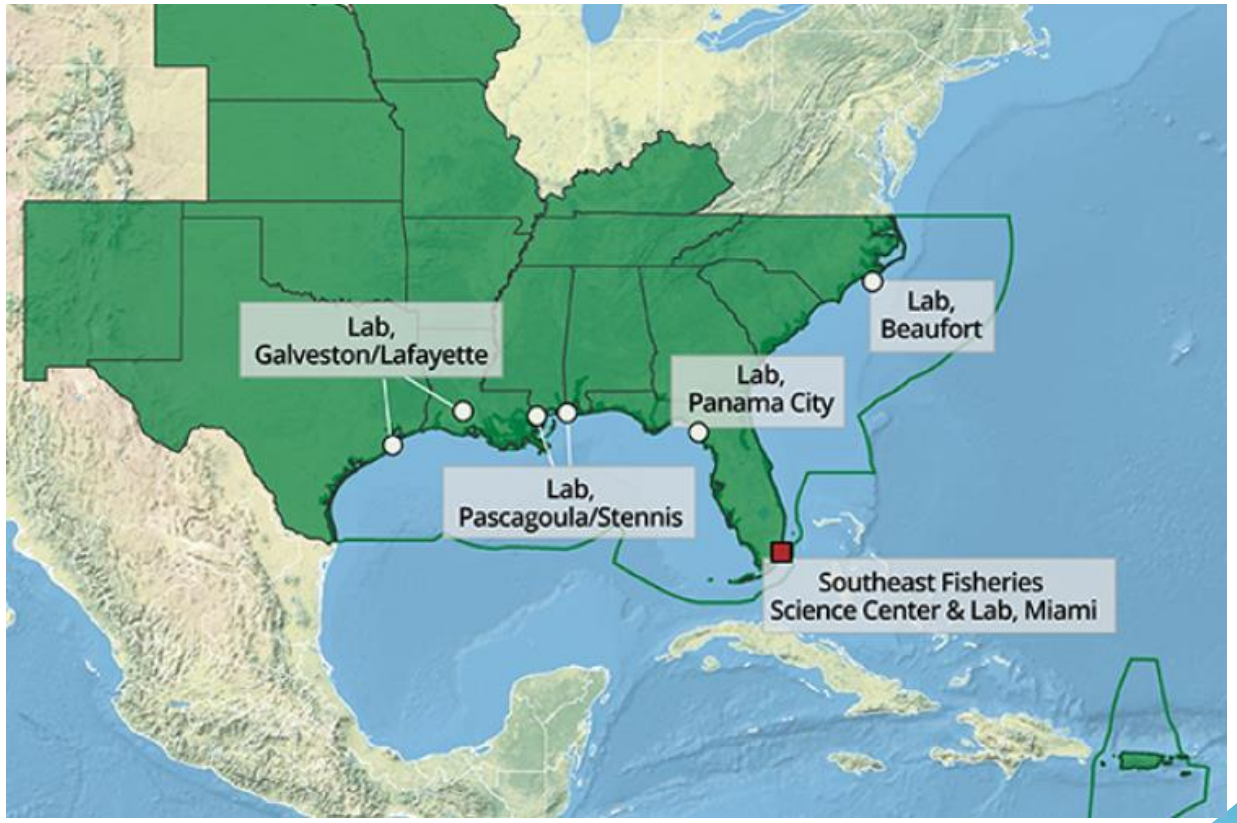
MSE Specialist

- MSE Specialist hired at each Science Center
  1. Take stock of where MSE will be the most valuable within the Center and centralize into SEFSC MSE Strategic Plan
  2. Catalyze and coordinate MSE activities within the region that align with the Plan



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National MSE Working Group

- Comprised of MSE specialists at each Science Center and NMFS Senior Scientists
- Designed to
  - develop MSE best practices across the Science Centers,
  - coordinate cross-regional activities,
  - track regional MSE activities
  - group problem-solving, assistance, and shared resources

National MSE Working Group Vision Statement:

"We anticipate that MSEs will result in improved understanding of our ability to assess stocks, ecosystems, and fishing and coastal communities. This will lead to more efficient allocation of survey and assessment resources, greater potential for stakeholder ownership of the process and, ultimately, increased economic benefits and improved capacity for sustainable management for current and future generations"

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National MSE Working Group

- Be strategic about what MSEs will have the largest impact for the Southeast region.

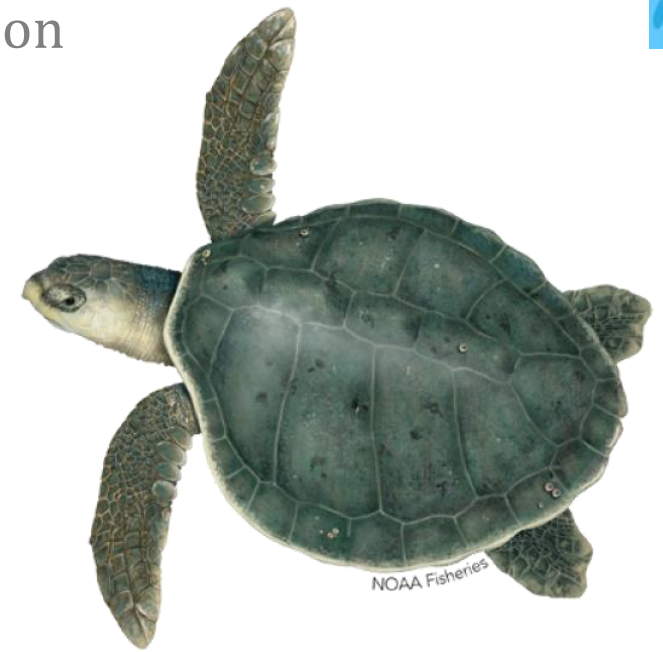
Full stakeholder MSE	Intermediate MSE	Desk MSE	Not MSE
• Full iterative stakeholder involvement • MSE intended to result in management action • Where management objectives are not fully developed • Expensive and time consuming	• Spectrum between full stakeholder MSE and desk MSE • To moderate resource requirements	• No stakeholder input • General research questions • To develop MPs where management objectives are known	• Simulation exercises where the full feedback-loop characterizing the MSE is not necessary • Consider other less resource-intensive approaches

Walter, Peterson, Marshall, Deroba, Gaichas, Williams, Stochs, Tommasi, Ahrens (*in prep*) When should we conduct management strategy evaluation?

MSE Strategic Plan

3 Flagship MSEs in the SEFSC

- Focus on regime-changing, high profile applications that have the potential to improve management of fisheries in the southeast region



1. Dolphin in South Atlantic

Motivation

- Dolphin are highly migratory, with an international distribution, which results in limited data availability and limited capacity for management
- Current management is static catch limits based on the third highest catches observed between 1994-2007 (SAFMC 2021)

"The Dolphin Wahoo FMP was developed to maintain existing harvest levels of dolphin, including the historical allocation between recreational and commercial fisheries, and ensure that no new fisheries develop." (SAFMC.net)

1. Dolphin in South Atlantic

Motivation

- Dolphin are short-lived, with high productivity that is largely environmentally-driven
- Static catch limits do not allow us to take advantage of the annual fluctuations in availability

Consequently, we propose managing using an Empirical Management Procedure.

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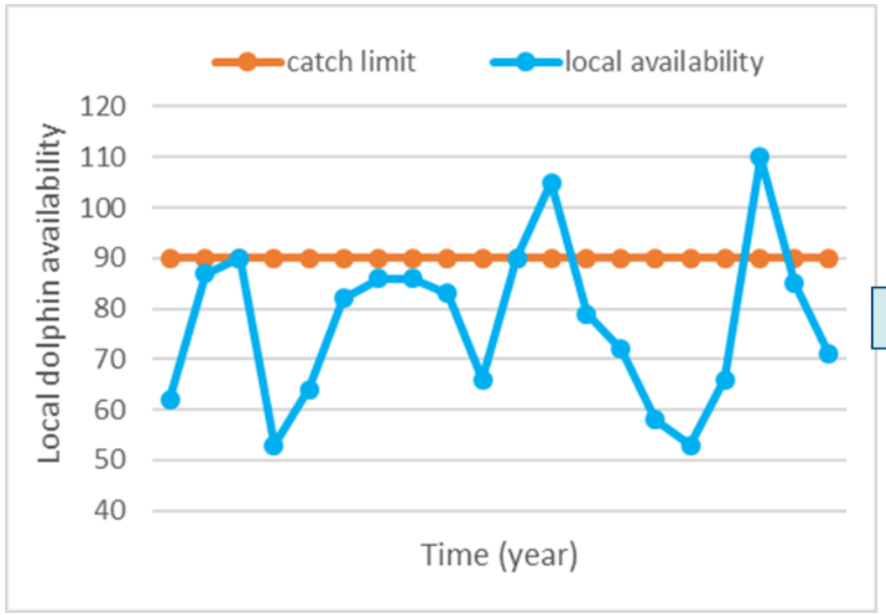
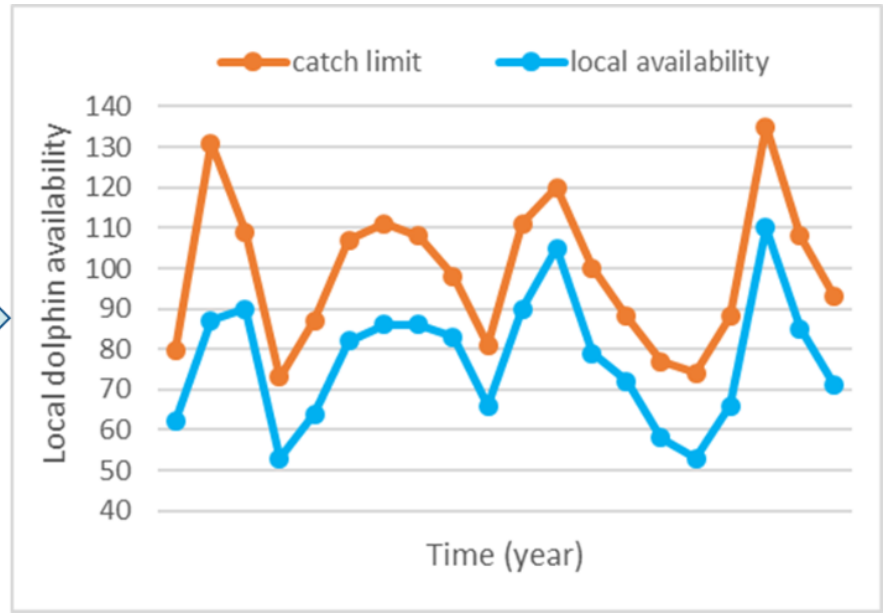
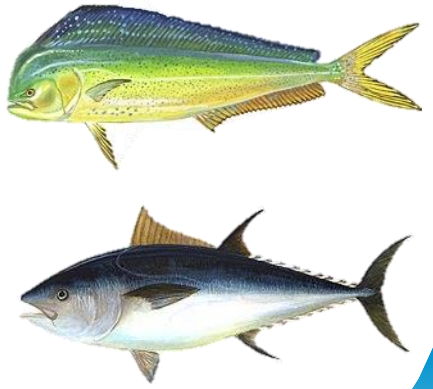
Explore Data-Limited Catch Control Rules (CCR's)

- Model-based (traditional) management procedures – population dynamics model used to generate stock status information that is fed into the control rule to generate management advice
- Empirical (indicator-based) management procedures – no population dynamics model; some other indicator of stock abundance / trajectory (i.e., index of abundance) used to adjust management advice

Stock Abundance $\propto$ **Allowable Catch**







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1. Dolphin in South Atlantic

Stakeholder workshops

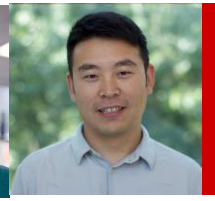
- South Florida
  (Oct 4-6, 2022)
- Mid-Atlantic
  (Jan 2023)
- S New England
  (Nov 2-3, 2022)

MSE analysis

- Spatial & seasonal
- Exploring indices for predictive ability
- Empirical MP

Goals:

- identify conceptual management objectives for the dolphin fishery
- identify uncertainties in the stock and fishery
- identify participants for continued involvement in the MSE process
- introduce the concept of management procedures and management strategy evaluation



NC STATE UNIVERSITY

South Atlantic Fishery Management Council
"To Conserve and Manage"

BEYOND OUR SHORES FOUNDATION

DOLPHINFISH RESEARCH PROGRAM

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2. Gulf of Mexico Shrimp

Motivation

- "Annual crop" with short lifespan and highly environmentally driven productivity
- Previously assessed with a full statistical catch-at-age Stock Synthesis model
- Delay between data collection, assessment, and management implementation is longer than the lifespan of Gulf of Mexico shrimp

2. Gulf of Mexico Shrimp

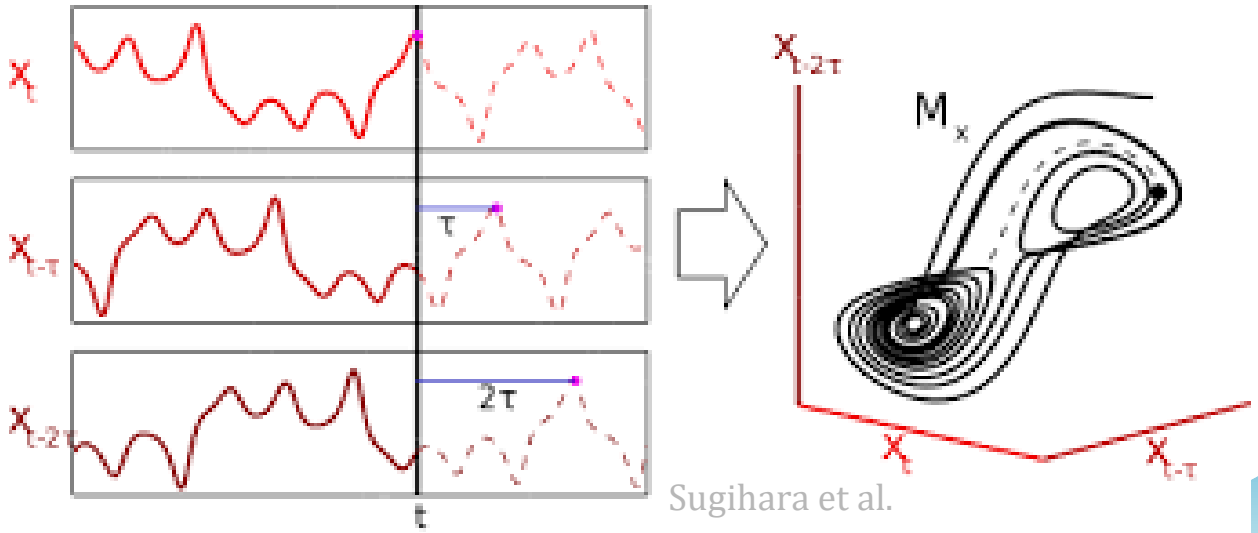
Empirical dynamic modeling (EDM) to manage shrimp in the Gulf of Mexico

- Empirical dynamic modeling – numerical modeling approach that has proven useful for forecasting time-series in nonlinear dynamical systems

We propose development of an EDM-based empirical MP, where the EDM prediction would be the basis for management adjustments in future years.

Collaborators:

- Steve Munch (SWFSC & USC)
- Cheng-Han Tsai (USC)
- Michelle Masi (SERO)
- Lew Coggins (SEFSC)



Sugihara et al.

3. Kemp's Ridley Sea Turtle

- Protected resource management aims to protect species, but does not always outline the parameters of the management system or explore resource monitoring dynamics, socioeconomics, potential ecosystem or climate impacts, and nonstationarity, etc.

- Nesting levels are reduced and more variable following the Deepwater Horizon oil spill
- *Undertake an MSE to thoroughly explore conservation strategies and identify management objectives for Kemp's Ridley, potentially using this as a blueprint identifying research to inform management strategies*

3. Kemp's Ridley Sea Turtle

- Spatially-explicit individual-based model (Netlogo)
- Focus on exploring
  - bycatch mitigation approaches
  - potentially, additional data collection regimes
- Collaborators:
  - Susie Piacenza (OSU)
  - Paul Richards, Melissa Cook, Chris Sasso, Joe Pfaller (SEFSC)
  - Jenny Lee (SERO)

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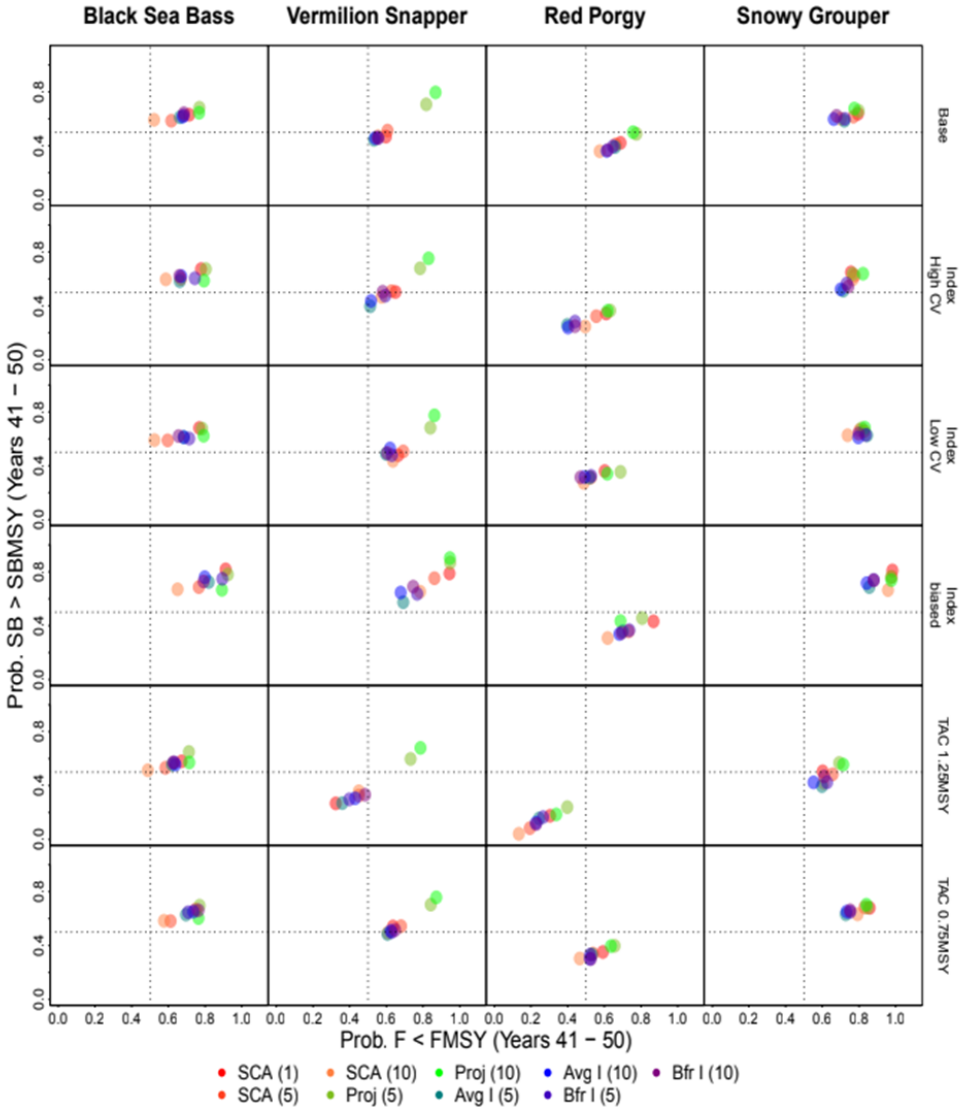
Beyond the Flagships

Capacity Development

- MSEs are resource-intensive processes
- Pursue external collaborations
  - SAFMC
  - University partners
  - ICCAT and other RFMOs
  - Science Centers

- Pursue internal collaborations across divisions / branches

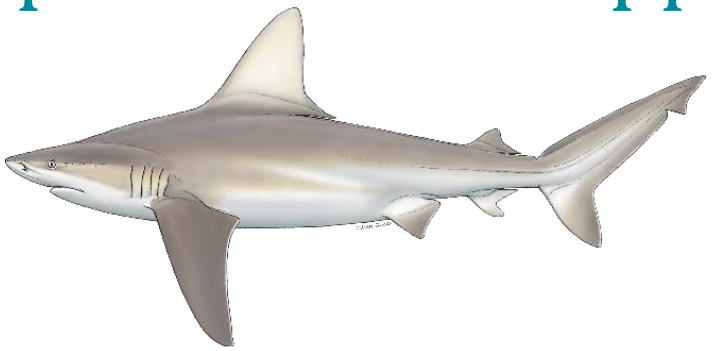
Explore Interim Approaches and Assessment Frequency



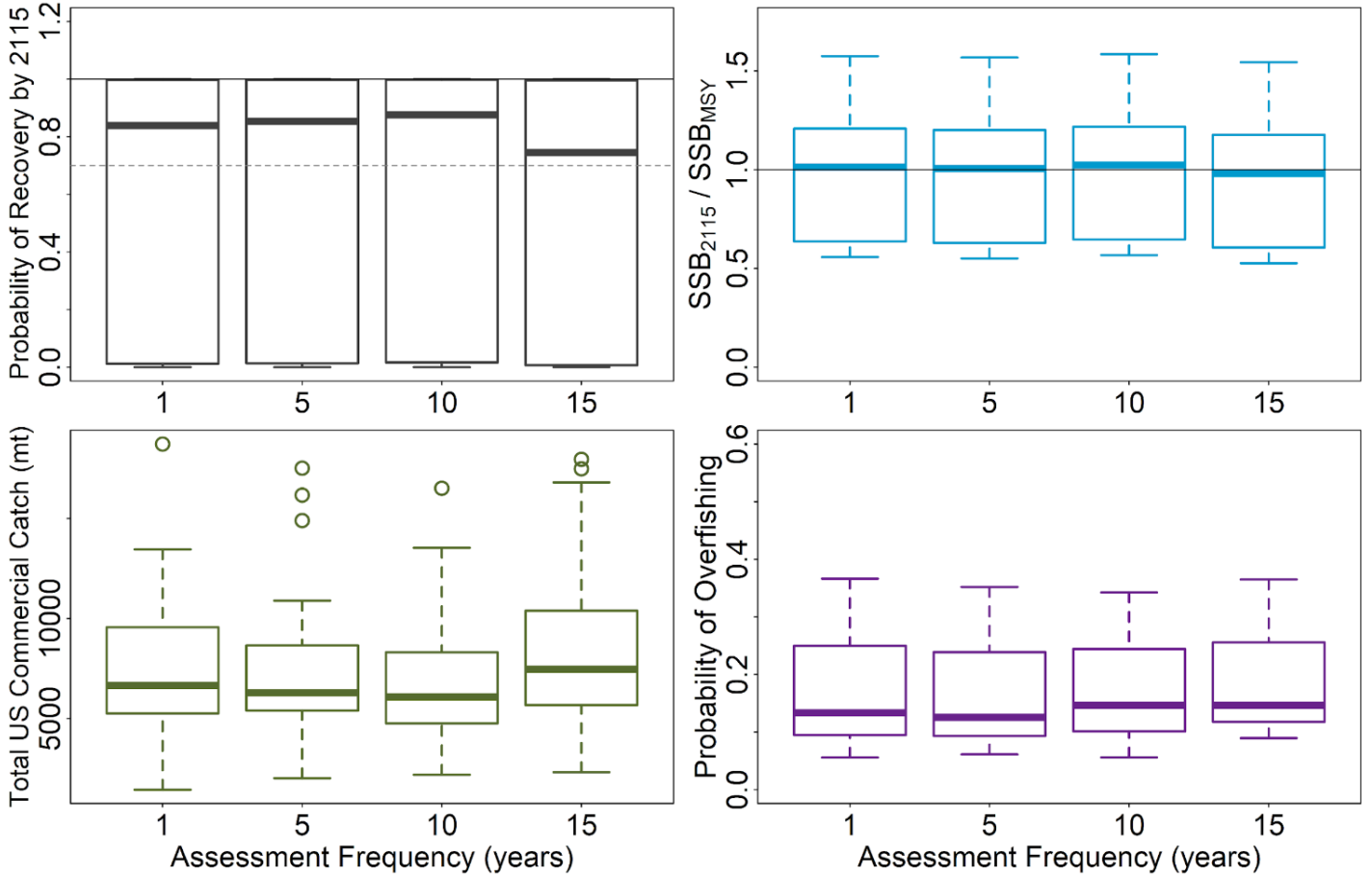
- MSE to explore interim assessment approaches for South Atlantic species
- Results indicate that interim assessment approaches are a valid approach, and additional research is warranted

Klibansky, Peterson, Shertzer,, Vincent, Williams. Evaluating procedures for updating catch advice between stock assessments of reef fishes with management strategy evaluation.

Explore Interim Approaches and Assessment Frequency



- MSE examining assessment frequency for sandbar shark
- Results indicate that assessment frequency can be reasonably reduced without adverse impacts to the stock.



Peterson CD. Wilberg MJ. Cortés E. Courtney DL. Latour RJ. (*in press*) Effects of altered stock assessment frequency on the management of a large coastal shark. Marine and Coastal Fisheries. 14(5).

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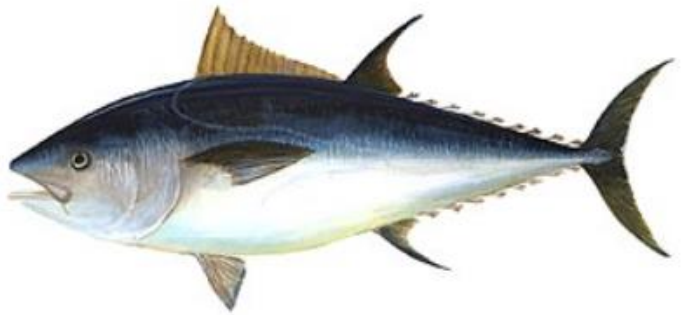
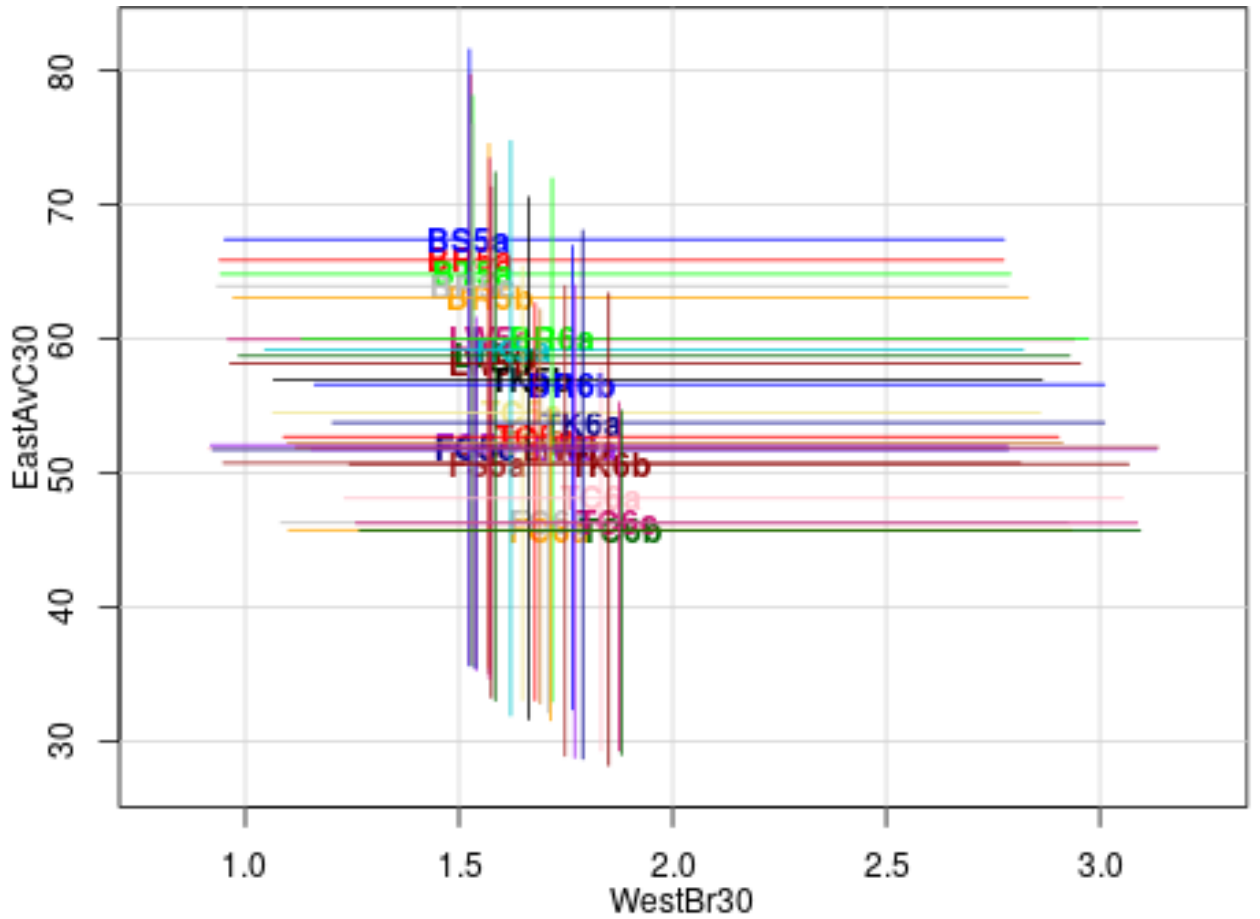
Consider Broader Ecosystem Impacts of Fisheries Management

Atlantic Bluefin Tuna MSE

Tom Carruthers tom@bluematterscience.com

12 June, 2022





https://apps.bluematterscience.com/ABTMSE/

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Consider Broader Ecosystem Impacts of Fisheries Management

Dolphin / Wahoo Stakeholder Participatory Workshops

- Socioeconomics
- Local Ecological Knowledge
- Ecosystem Approaches

https://safmc.net/citizen-science/dolphin-wahoo-participatory-workshops/

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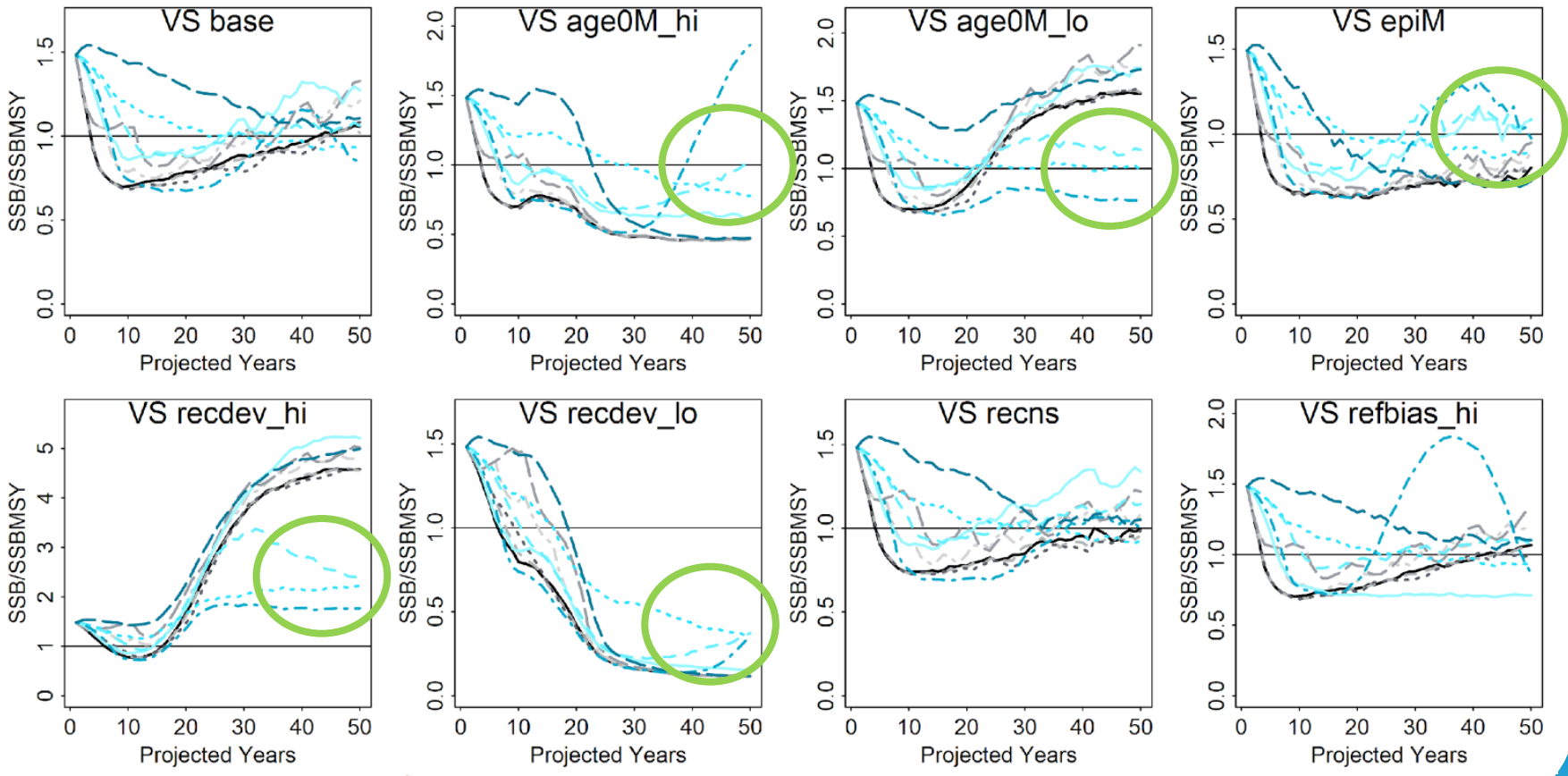
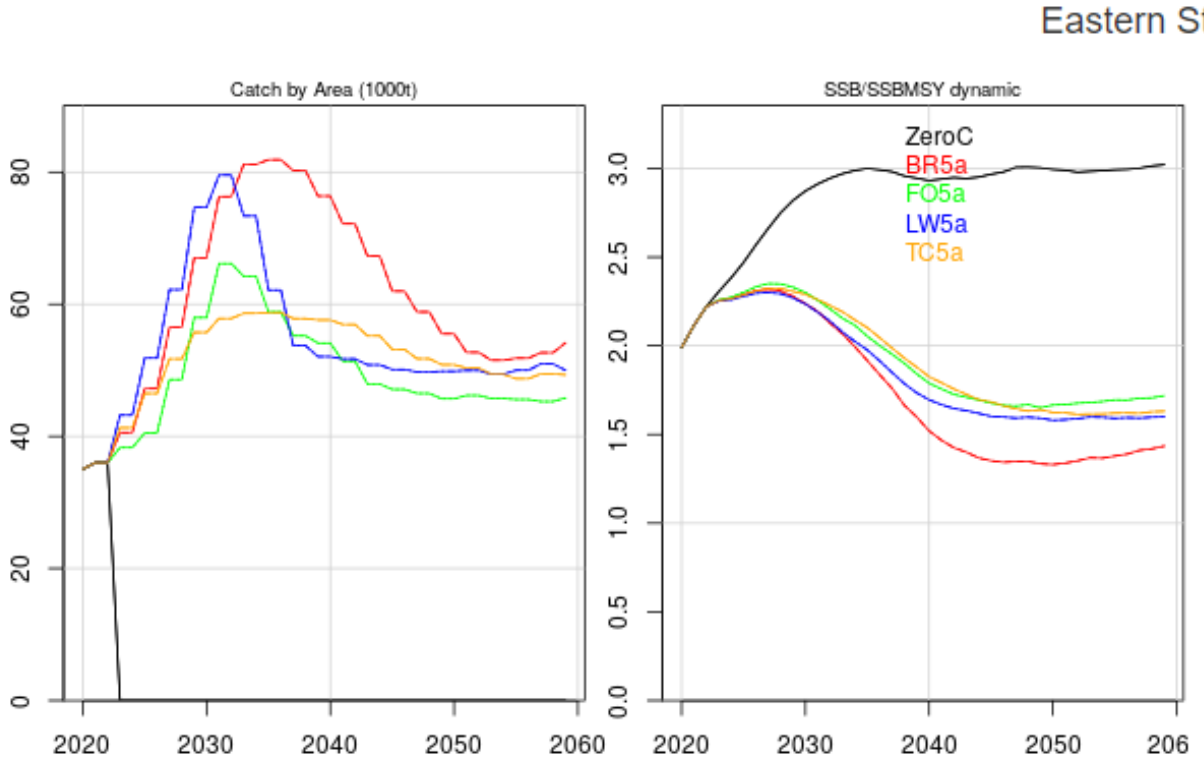
Management Procedure Performance in the Face of Climate Change

- Desk MSE
- How do model-based (traditional) MPs and empirical (indicator-based) MPs perform in the face of climate-induced future nonstationarity in the South Atlantic?
- Vermilion Snapper, black sea bass, red porgy
- **Preliminary results suggest empirical MPs may be better able to adapt to nonstationarity than traditional model-based MPs.**

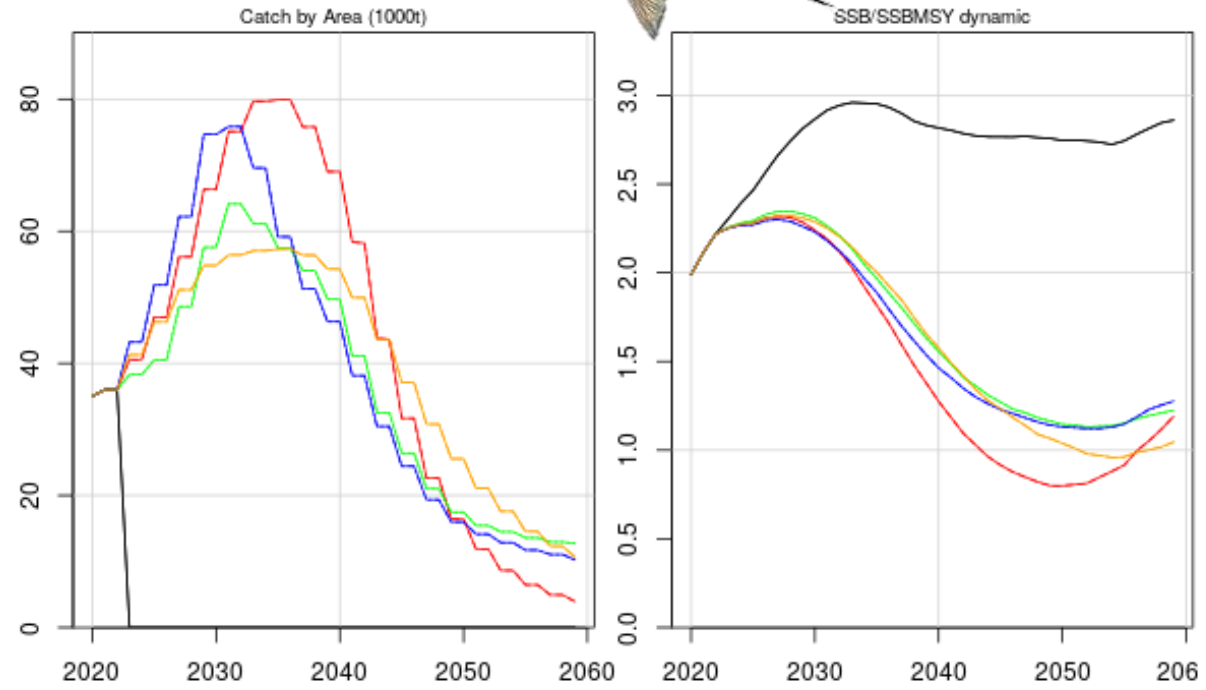


Black/grey lines = model-based MPs
Blue lines = empirical MPs

Management Procedure Performance in the Face of Climate Change



Scenario where projected recruitment is constant in East



Scenario where projected recruitment declines in the East

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Focus on Recreationally Dominated Fisheries

Development and application of a management strategy evaluation tool: tradeoffs between the management objectives of recreational and commercial fisheries.

- Intermediate stakeholder input
- Size-structured OM focused on mixed-use fisheries
- MSY- and F-based management procedures
- Impact of changing allocation and forecasted fishing participation
- Focus on exploring trade-offs between commercial and recreational sectors

MARFIN project: Jie Cao & Matt Damiano NC STATE UNIVERSITY Kyle Shertzer (SEFSC)

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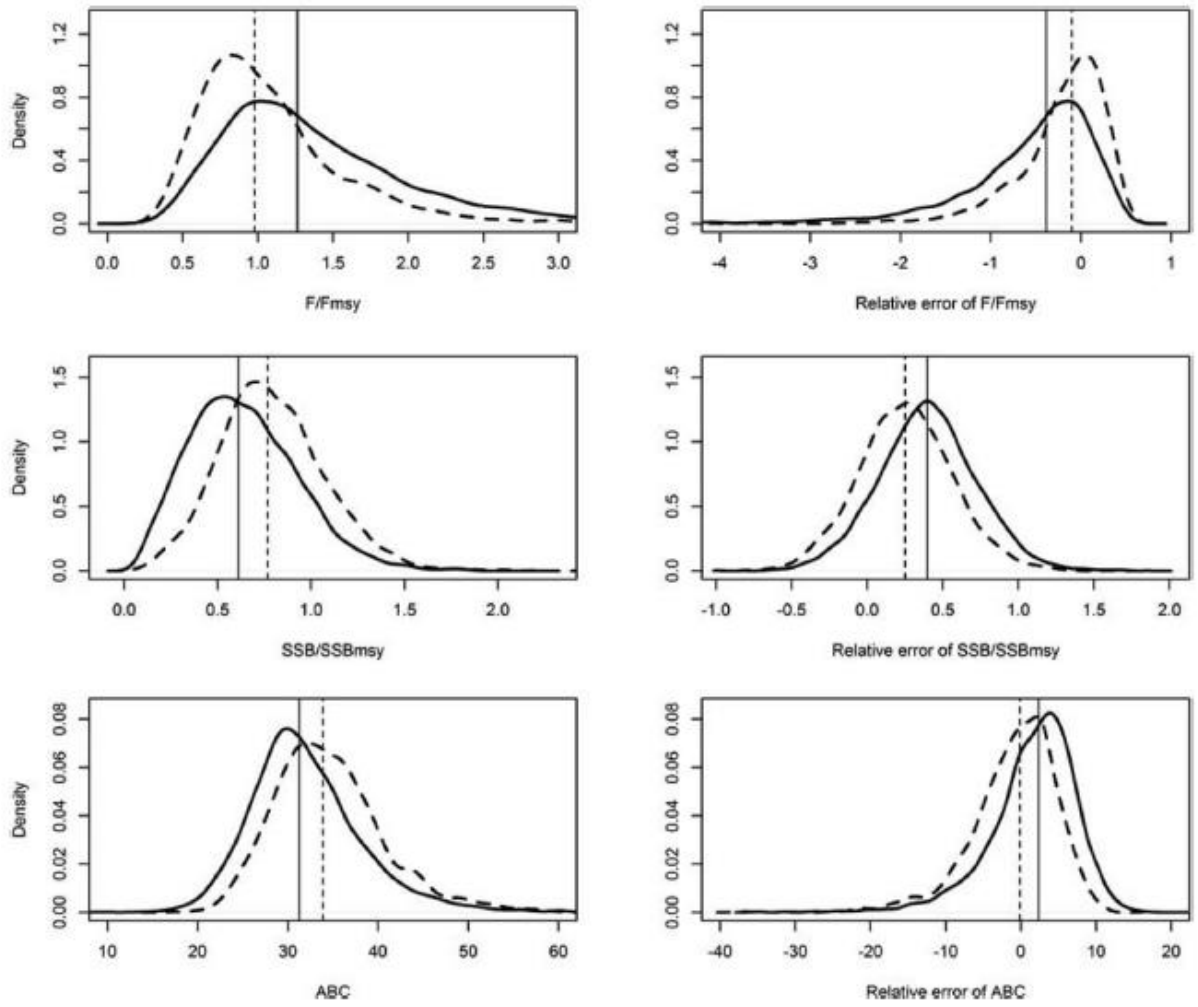
Prioritize Data Availability / Quality / Efficiency

Fig. 7. Estimates of F/F_{MSY}, SSB/SSB_{MSY}, and ABC plotted alongside the relative error of the base data (solid line) and the improved data (dashed line) assessments. The vertical lines are medians of the bootstrap replicates.



Improving stock assessments through data prioritization

- Age composition data have the largest effect on the accuracy of assessments, with commercial age composition being the most influential.

Siegfried KI. Williams EH. Shertzer KW. Coggins LG. (2016) Improving stock assessments through data prioritization. Canadian Journal of Fisheries and Aquatic Sciences. 73: 1703-1711. dx.doi.org/10.1139/cjfas-2015-0398

Build / Automate MSE Tools and Packages

openMSE

bluematter

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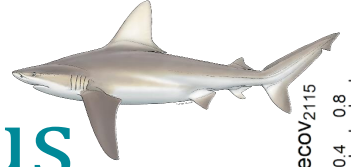
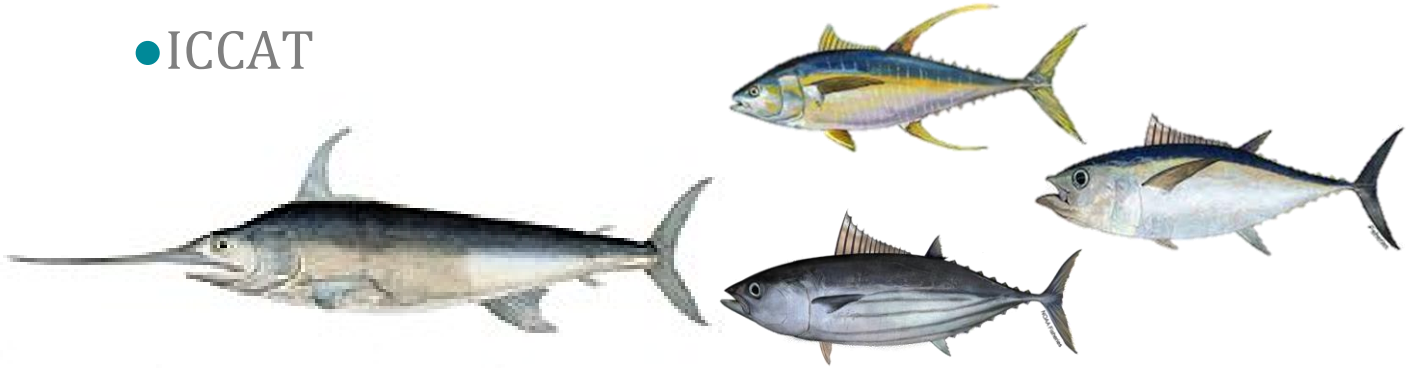
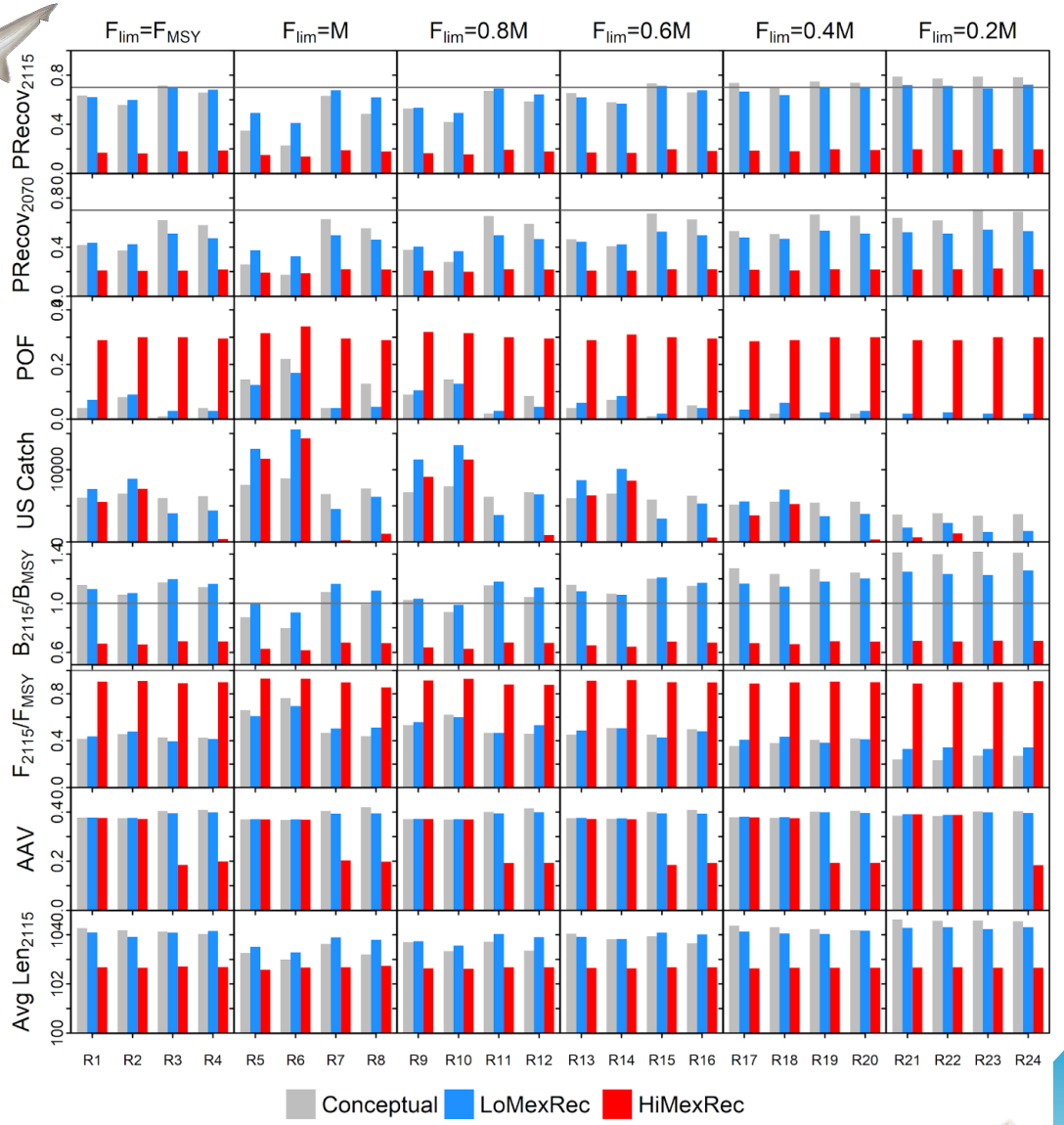
Additional Miscellaneous



- Species specific application, as necessary
- Desk MSEs
  - To improve stock assessment, management approaches
  - To address broader conceptual questions
  - To improve generic MP performance
- MSEs in collaboration with RFMOs
  - ICCAT





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Thank you

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