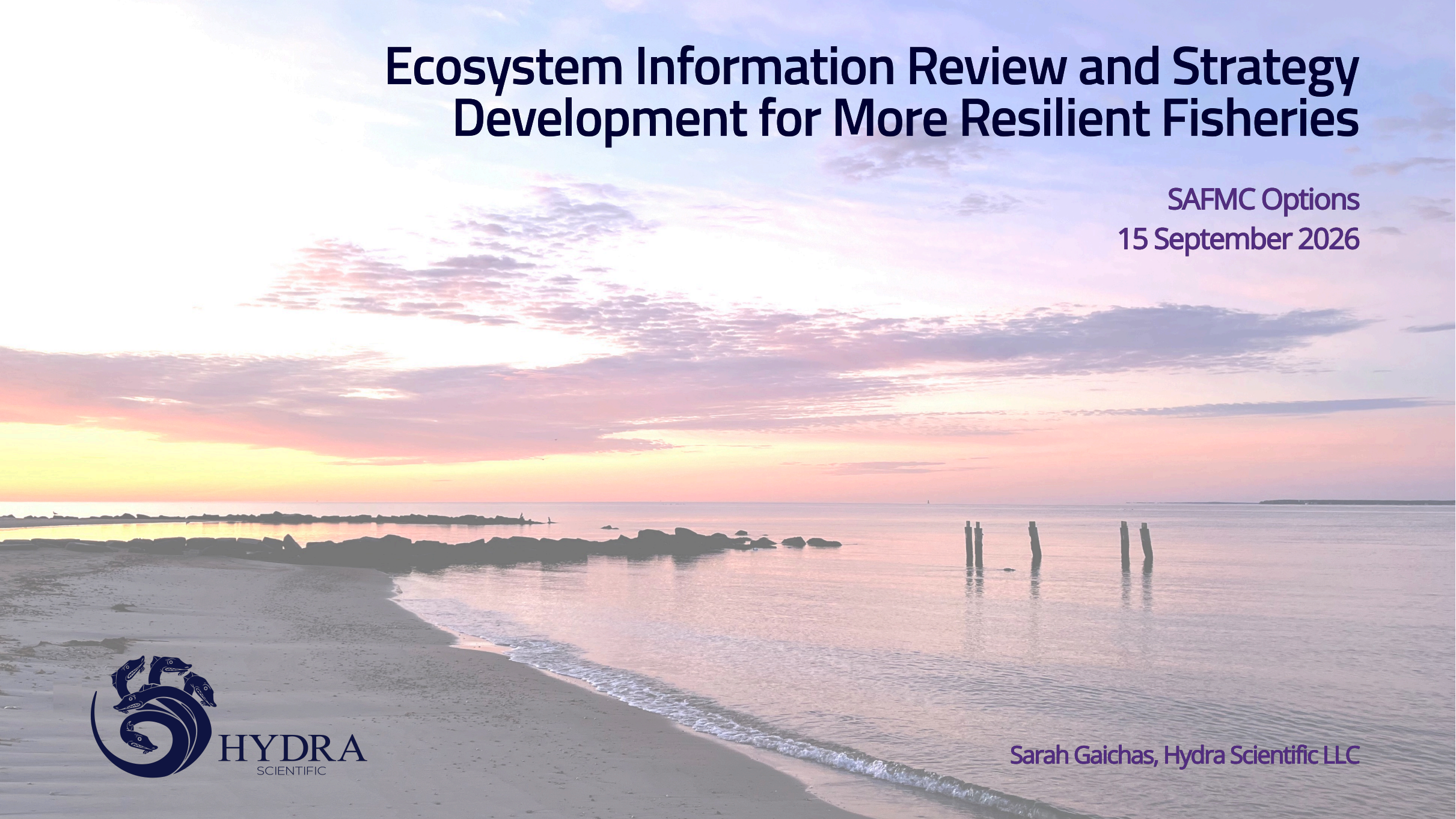
Ecosystem Information Review and Strategy Development for More Resilient Fisheries

SAFMC Options
15 September 2026



HYDRA SCIENTIFIC

Sarah Gaichas, Hydra Scientific LLC

Project Overview: Objectives

1) Review the different types of ecosystem data and information including data products and decision-support tools (e.g. Ecosystem Status Reports, Climate Vulnerability Assessments, risk assessments) currently available to the regional management councils and evaluate how they are used in council management processes;

2) Identify opportunities and methods for incorporating identified ecosystem information into SAFMC management processes, including inter-jurisdictional management decision-making processes, and identify practical requirements for successful implementation (e.g. data quality, frequency of information updates, regional council process consistency, implementation timelines); and

3) Identify opportunities to continue to expand cooperative, constituent-engaged data collection and research to improve the available ecosystem information in the South Atlantic region (e.g., study fleets, cooperative research, citizen science).

Methods: Objective 2

Identify opportunities and methods for incorporating identified ecosystem information into SAFMC management processes, including inter-jurisdictional management decision- making processes, and identify practical requirements for successful implementation (e.g. data quality, frequency of information updates, regional council process consistency, implementation timelines)

Review of 3+ years of Council actions

- List decisions linked or potentially linked to ecosystem information
- Recommend practical further uses of ecosystem information

Alignment of EFH/FEP policies and indicators

- Three example policies
- Existing ESR, CVA indicators plus feasibility of new indicators

Catch specification

- Climate vulnerability consideration in current SAFMC risk policy?
- Utility of ecosystem profiles or risk tables used in other regions?

Prototype indicators from global sources

Novel approach: food web based multispecies MSE

- Outline Council decision points
- Highlight use of existing resources

SAFMC Options report outlining these opportunities and methods posted online

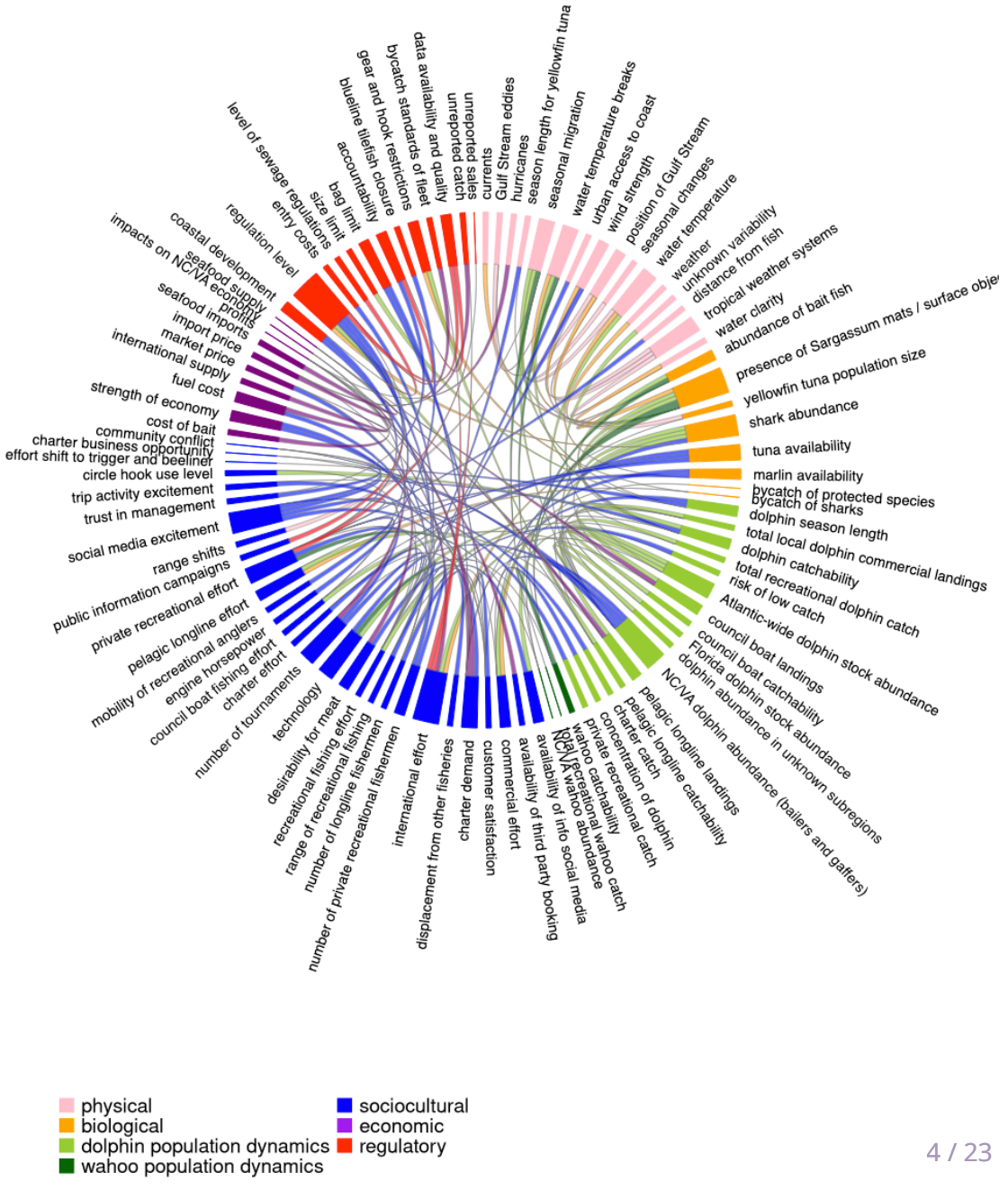
Methods: Objective 3

Identify opportunities to continue to expand cooperative, constituent-engaged data collection and research to improve the available ecosystem information in the South Atlantic region (e.g., study fleets, cooperative research, citizen science).

Review existing SAFMC Citizen Science efforts

Prioritize potential cooperative data collections based on the analysis of SAFMC management processes most likely to benefit from ecosystem information noted under the previous objective, and outline opportunities for expansion to collect this priority data

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



https://safmc-shinyapps.shinyapps.io/NCVA_DolphinWorkshops2020/

Results: Objectives 2 and 3

1. SAFMC already addresses ecosystem issues and requests ecosystem information in its decision making process. Further opportunities were identified for SAFMC to request or use ecosystem information its decision making process. These include assessment prioritization, defining assessment and MSE Terms of Reference, and collecting stakeholder observations of ecosystem, economic, and social conditions, as well as more complex processes.

2. Existing SAFMC habitat and ecosystem policies align with existing ecosystem indicators, facilitating use of these indicators to support policy-related decisions.

3. The SAFMC ABC setting process (used in 3 FMPs) already has a framework where existing ecosystem indicators could be used to support risk rankings. A range of simpler to more complex approaches can be used to evaluate risks of overfishing.

4. Information is available to develop spatially and seasonally resolved habitat indicators for the South Atlantic region from global ocean model data products. These indicators can be ground-truthed using both existing scientific surveys and by further developing existing Citizen Science priority research areas.

5. SAFMC's multispecies complexes combined with its long term investment in food web modeling create an opportunity to evaluate multispecies management and reference points while accounting for species interactions. Management strategy evaluation could include climate scenarios as well as food web interactions to test the robustness of any multispecies management measures.

Key Recommendation

Develop a structured process for ecosystem-based decision making

The FEP loop is an interpretation of adaptive management as applied to Fishery Ecosystem Planning. Reprinted from Levin et al. 2018, Fig. 1

This process can address any of the "quick wins" as well as more complex big picture issues as prioritized by the Council

Review of Council Motions

More than half of motions had no obvious ecosystem pathway, but 18% addressed or included ecosystem issues, and 26% more had the potential for ecosystem linkages.

Number and percent (%) of motions with ecosystem linkages, March 2023 - March 2026

Ecosystem	n	%
no	111	56
maybe	51	26
yes	35	18

Potential ecosystem actions

Simpler

- Prioritize assessments based on ecosystem concerns
- Request ecosystem ToRs in assessments and MSEs
- Request ecosystem information at stakeholder meetings

Moderate; consider climate robustness

- Evaluate spawning seasonal or spatial closures
- Evaluate single species and multispecies reference points
- Evaluate catch, effort, and discard projections
- Evaluate allocations

Complex; not currently addressed

- Address productivity changes across multiple stocks
- Evaluate and address recreational fishing objectives
- Develop options to manage discards across stocks

EFH/FEP Policy Alignment: Summary

Given the Council emphasis on habitat issues, habitat FMPs and other policy documents were reviewed along with current ecosystem data products to evaluate “quick wins” aligning objectives and current indicators, and identifying where data from citizen science programs might augment existing indicator data products.

Summary Results:

- Food Web Policy: 5 of the 9 policies have potential indicators with high feasibility, 2 have moderate feasibility, and only 2 have low or unknown feasibility. Research information needs are already partially addressed by existing CVA and ESR indicators, and by current MSE efforts.
- Climate and Fisheries: current ESR indicators directly address policy statements. Gaps related to species distribution shifts and forecast conditions could be filled with existing information. Collaborative Council and NOAA review of current indicators should prioritize a subset for refinement and annual updates.
- Existing ESR indicators for SAV, coastal habitat attributes, land use and ocean economy align with SAV policy. However, comprehensive SAV indicators and research would require dedicated effort from multiple partners.

Alignment of EFH/FEP policies and indicators: Climate Variability and Fisheries

SAFMC Climate Variability and Fisheries Policy Objectives and Current Indicators

Policy	Brief Policy Description	Indicators Outlined in the Policy	Available Indicators	Potential Indicators	Potential Indicator Feasibility
Collaboration	Work across jurisdictions with multiple organizations and stakeholders	Species distribution shifts	None	Latitudinal and depth shifts for all or individual species	High: available on DisMAP website
Climate Indicators	Develop and present climate indicators annually	Climate, ecological, social, and economic trends and status, environmentally driven fishery trends	5 Climate, 13 Physical, 5 Habitat, 4 Low and 6 Upper Trophic Level, 8 Fishery, Social, and Economic indicator categories	Review and refine existing before considering additional indicators	High: prioritize available indicators for refinement
Tradeoffs	Consider increased uncertainty and changing productivity in management	Uncertainty and stock productivity	Biomass and Recruitment of Commercially Important Species, Shrimp, Crab, and Oyster landings	Short term ocean forecasts including uncertainty, MSE with changing productivity	Moderate: resources required to integrate regional ocean forecasts and uncertainty in MSE
Precautionary	Apply precautionary principle under uncertain future climate conditions	Not listed	None	Short term ocean forecasts including uncertainty	Moderate: resources required to process regional ocean forecasts
New Fisheries	Manage new fishery development to avoid negative EFH impacts	Not listed	None	Landings of currently unmanaged species	Moderate: resources required to compile information from multiple sources

Alignment of EFH/FEP policies and indicators: Climate Variability and Fisheries

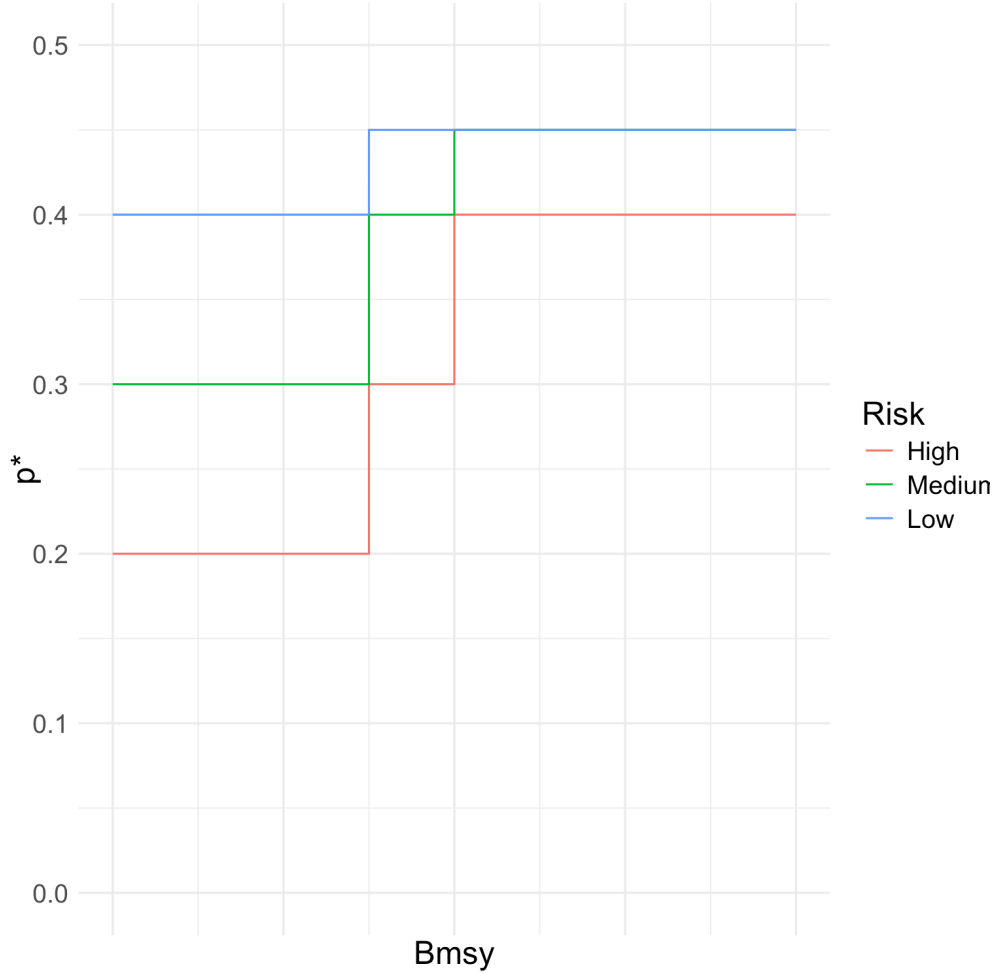
SAFMC Climate Variability and Fisheries Research Needs and Current Indicators

Research	Available Indicators	Potential Council Actions	Potential Action Feasibility
Climate Impacts on Productivity	CVA combined with many ESR indicators	Prioritize and tailor existing indicators to species based on CVA	Moderate: resource intensive depending on priority species
Climate Impacts in Assessments	ESR indicators need refinement for assessment application	Prioritize and tailor existing ESR indicators to assessments based on CVA	Moderate: resource intensive depending on priority species
3D Estuarine-Coastal-Ocean Observations	Surface and Bottom Temperature, FL Current Transport, Gulf Stream Position, Upwelling	Add ocean model reanalysis products (GLORYS) to existing indicators	High: apply methods and code developed in other regions
Climate Robust MSE	Peterson et al 2025	Consider standard climate scenarios in all MSEs	High: develop simple climate scenarios as robustness tests
Socioeconomic Impacts and Fishery Responses	CVA, Community CVA, Sea Level Rise, FL Current Transport, Gulf Stream Position, Upwelling	Prioritize and tailor existing indicators	High: existing CVA, Community CVA, and ESR indicators
Offshore Habitats for Estuarine Species	Surface and Bottom Temperature, FL Current Transport, Gulf Stream Position, Upwelling, Primary Productivity, Ocean Acidification	Prioritize and tailor existing indicators to species based on CVA	Moderate: resource intensive depending on priority species

Note that an example of indicator development for the “3D Estuarine-Coastal-Ocean Observations” research priority is reviewed under Prototype Indicator Development.

Catch Specification: Opportunities within the Comprehensive ABC Control Rule

Dolphin-Wahoo, Golden Crab, Snapper Grouper



Council reviews SSC and AP advice on risk rating. Council can deviate, up or down, from default P* by up to 10% (not exceeding 0.5).

Specific attributes that can inform risk of overfishing:

- Biological (low-high):
  - Estimated natural mortality
  - Age at maturity
- Human Dimension (low-high):
  - Ability to regulate fishery
  - Potential for discard losses
  - Annual commercial value
  - Recreational desirability
  - Social concerns
- Environmental (high only):
  - Ecosystem importance--Food web indicators
  - Climate change--CVA indicators
  - Other environmental variables--stock specific indicators

Catch Specification: Consider a Two Way Street

Pacific Risk Tables (in testing)

Pacific Pilot Risk Levels and Indicator Criteria.

Risk Level	Ecosystem and Environmental Conditions	Assessment Data Inputs	Assessment Model Fits and Structural Uncertainty
Level 1: Favorable	Indicators not used in the stock assessment show medium to high level of agreement and moderate to strong evidence supporting high species productivity.	...	...
Level 2: Neutral	Majority of indicators show no notable trends and/or no apparent environmental and ecosystem concerns.	...	...
Level 3: Unfavorable	Majority of indicators show medium to high level of agreement and moderate to strong evidence supporting low species productivity	...	...

Potential Action:
Favorable Conditions → Decrease Risk Buffer (Higher Catch Recommendation)
Neutral Conditions → Keep Standard Risk Buffer (Standard Catch Recommendation)
Unfavorable Conditions → Increase Risk Buffer (Lower Catch Recommendation)

Source: CCIEA Risk Table Report

Prototype Ocean Indicators: what do they add?

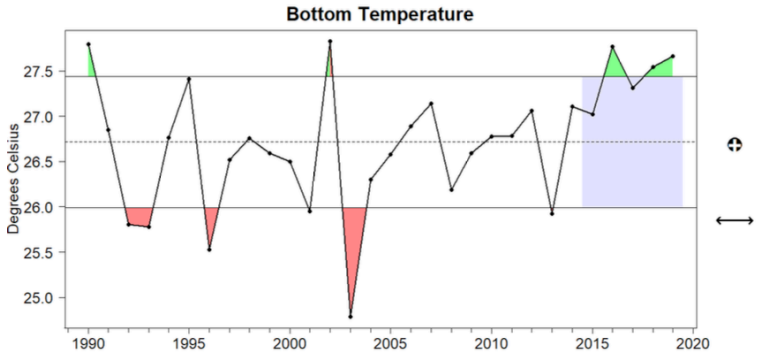


Figure 4.2. Mean annual (April to September) bottom temperature from shipboard surveys in the U.S. South Atlantic.

The objective is to produce maps and time series indicating where and when bottom temperature conditions approach or exceed stressful levels relevant to particular species ranging from corals to targeted fish species.

Stressful temperature levels for key species would need to be determined from literature or other studies if unknown.

2024 NEFSC SOE Report: Number of days at scallop-stressing bottom temperature in 2023

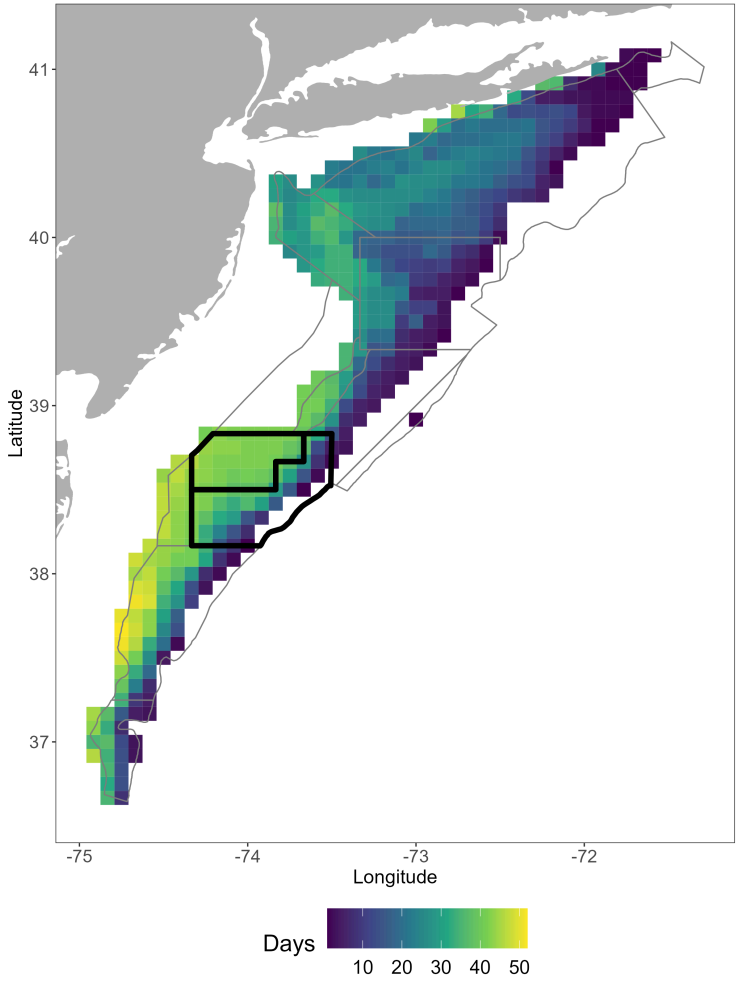
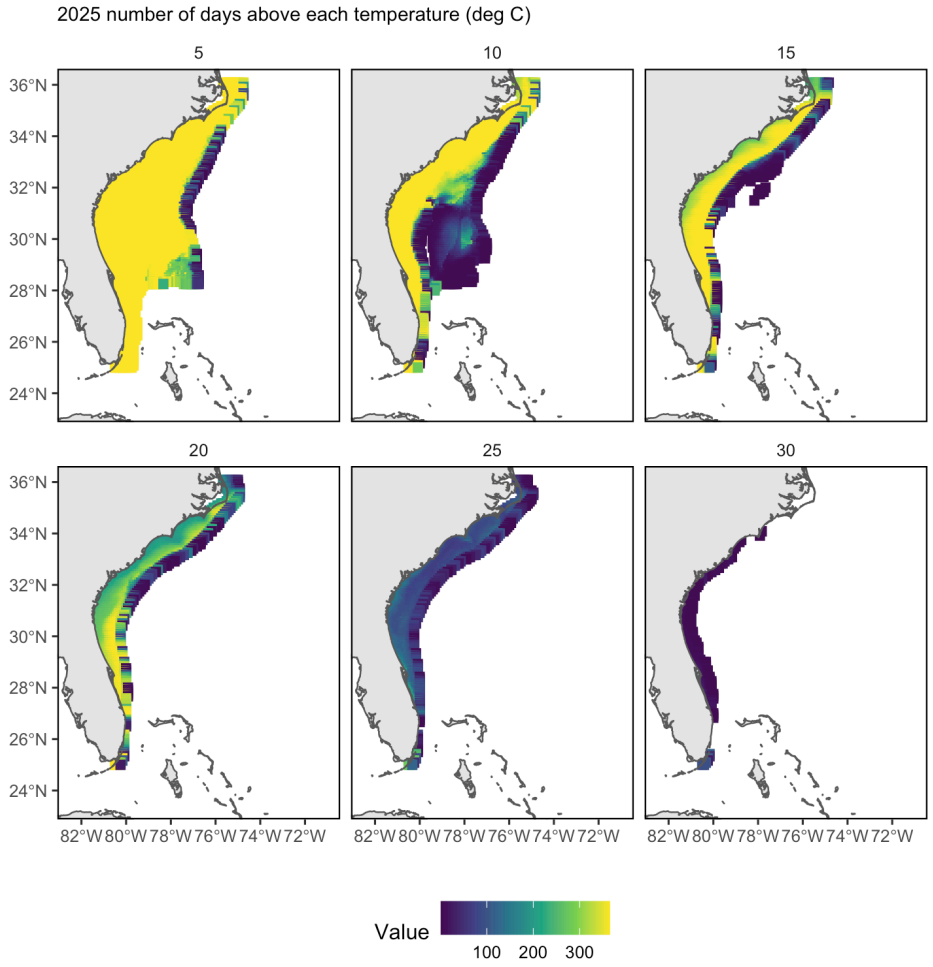
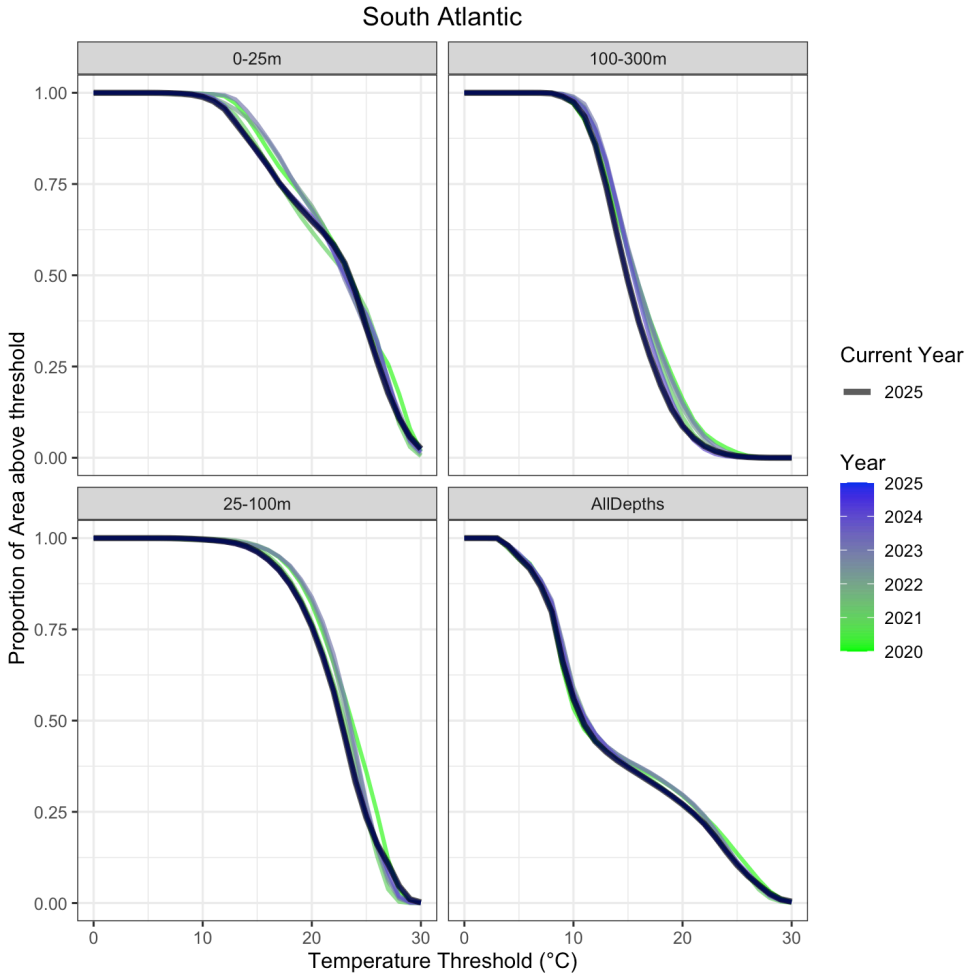
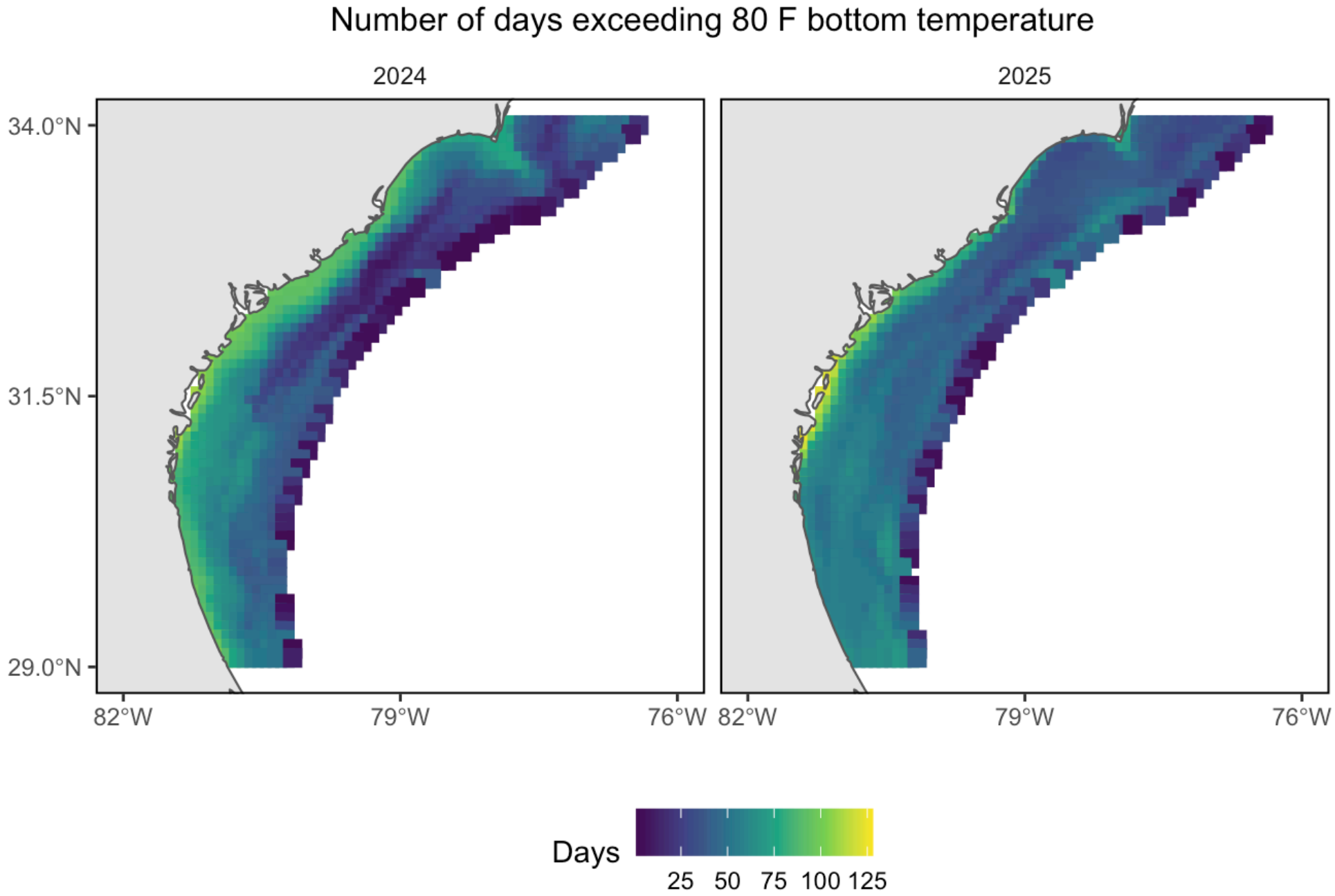


Image courtesy Joseph Caracappa, NEFSC

Prototype Ocean Indicators: Number of days or amount of area exceeding stressful temperature





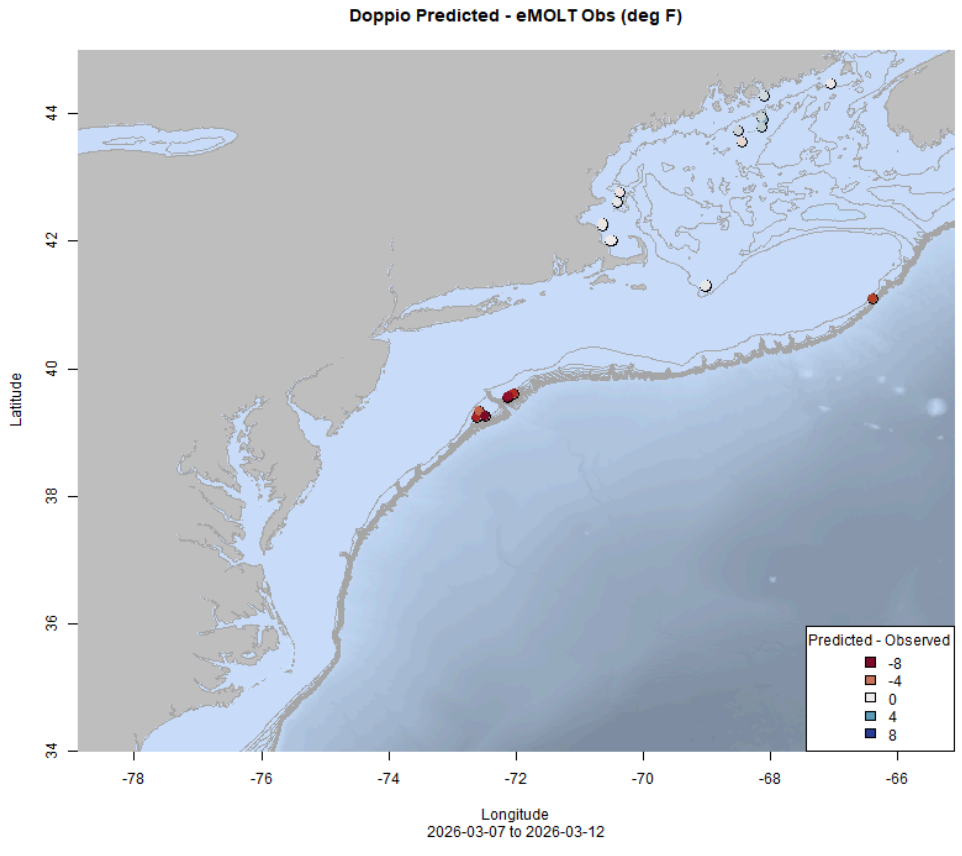

Number of days exceeding 80 F bottom temperature
2024
2025
34.0°N
31.5°N
29.0°N
82°W
79°W
76°W
Days
25
50
75
100
125

Integration with Citizen Science

One potential extension of existing South Atlantic cooperative data collection could be ocean temperature observations for comparison with regional or global ocean data products such as MOM6 and GLORYS.

Comparisons of vessel-collected temperature with model assimilated temperature can identify where improvements can be made to models as well as provide more direct information for management in near-real time.

The Northeast U.S. eMOLT (Environmental Monitors on Lobster Traps and Large Trawlers) program regularly compares bottom temperature data collected aboard fishing vessels with regional ocean model bottom temperature predictions, highlighting both areas of agreement and areas where measurements and model predictions diverge.



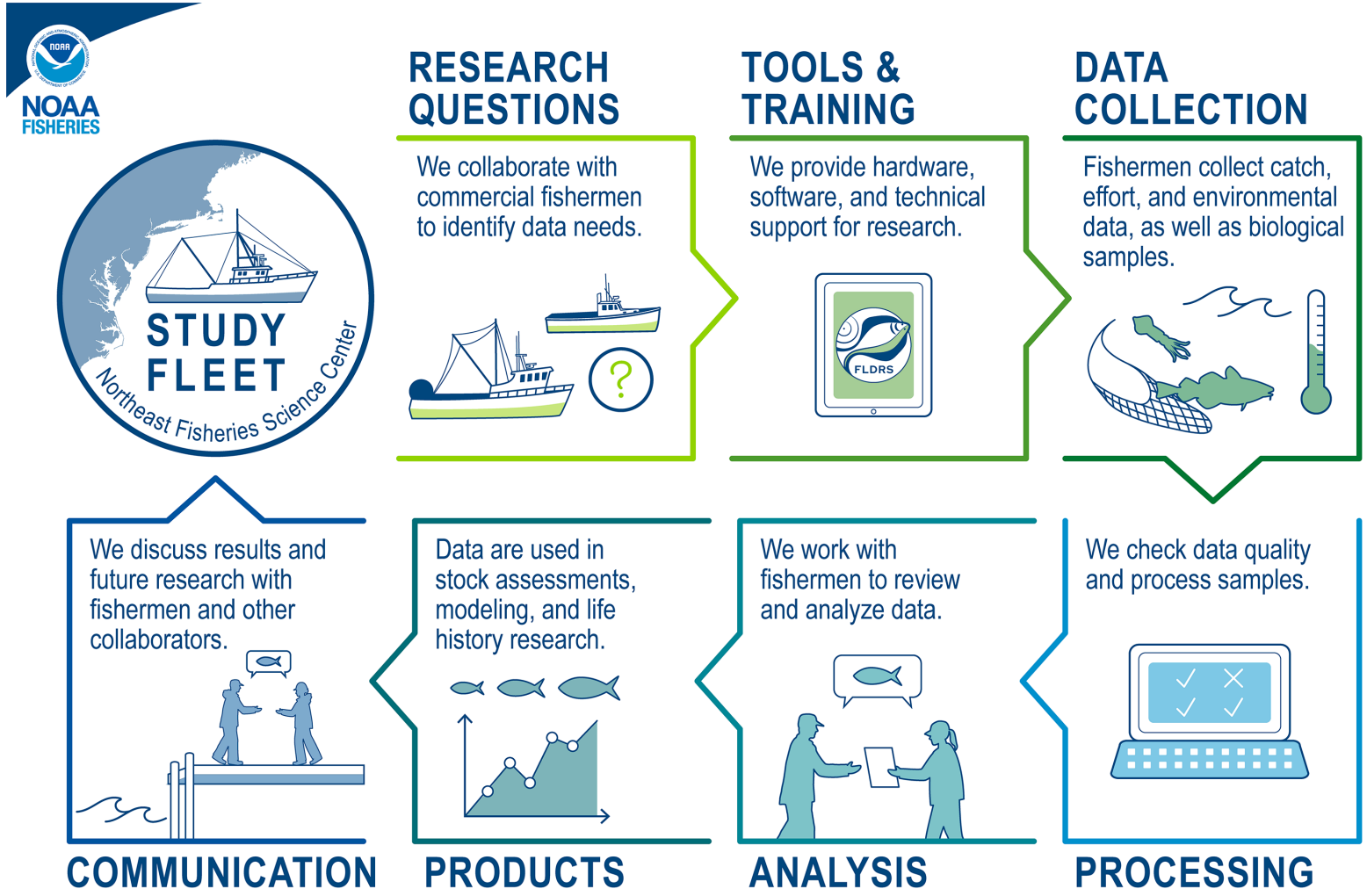
Source: weekly eMOLT update email, George Maynard, eMOLT coordinator

Cooperative Research

Multiple cooperative research programs exist in the Southeast. A study fleet could collect data for ecosystem indicators.

Data collected by vessels participating in the NEFSC study fleet program have been used in species distribution modeling, biological studies, evaluation of potential ocean industry user conflicts, and as supporting data for stock assessment.

This program also collects oceanographic indicators which are directly associated with haul level catch data, allowing analysis of habitat associations.



Source: https://www.fisheries.noaa.gov/new-england-mid-atlantic/science-data/cooperative-research-northeast

Multispecies MSE: can groups of species be managed together?

A range of stock complex level assessments and management measures were recently simulation tested in New England in a prototpye MSE project

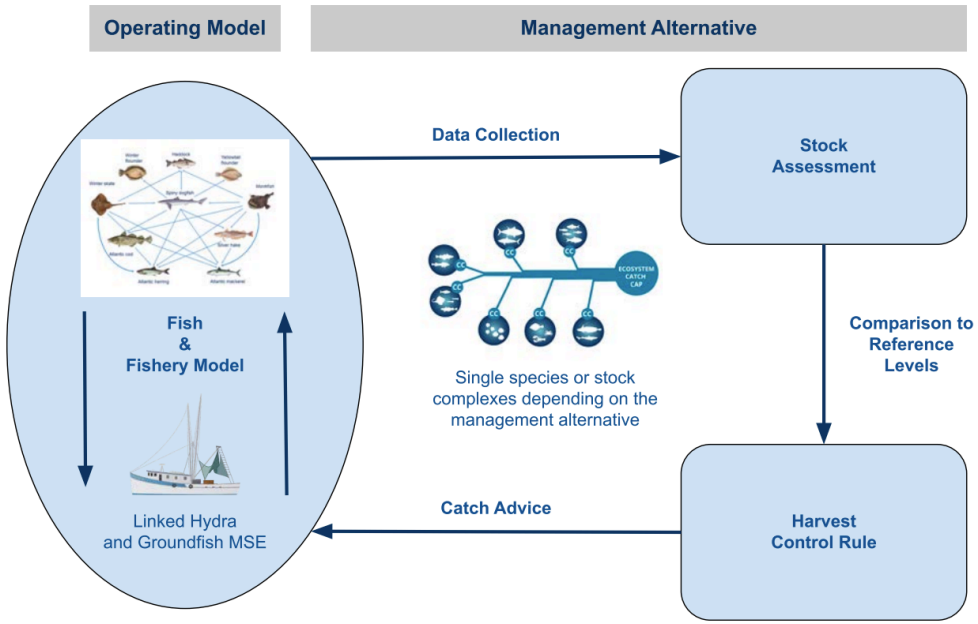
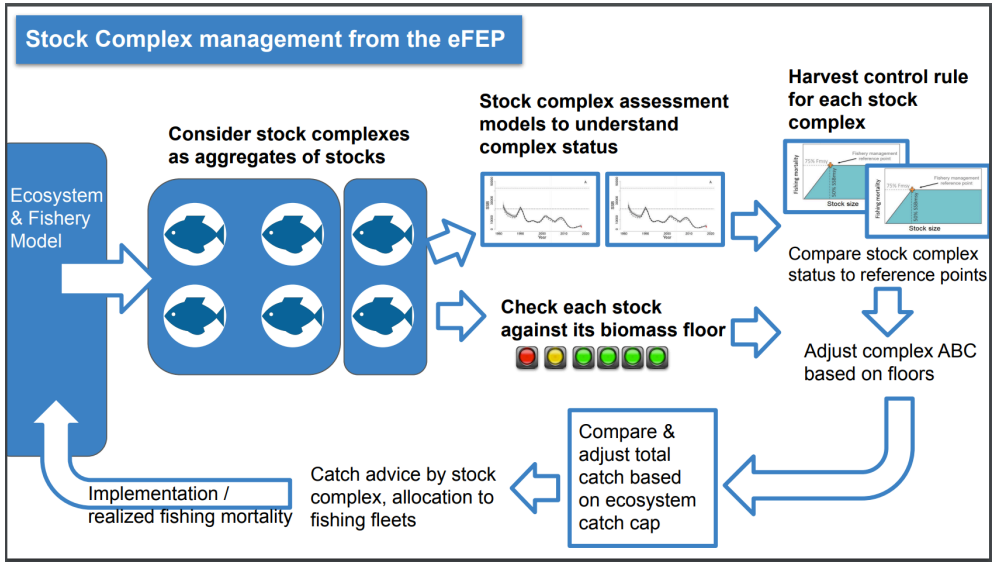


Figure 3. Overview of the pMSE closed loop simulation modeling framework

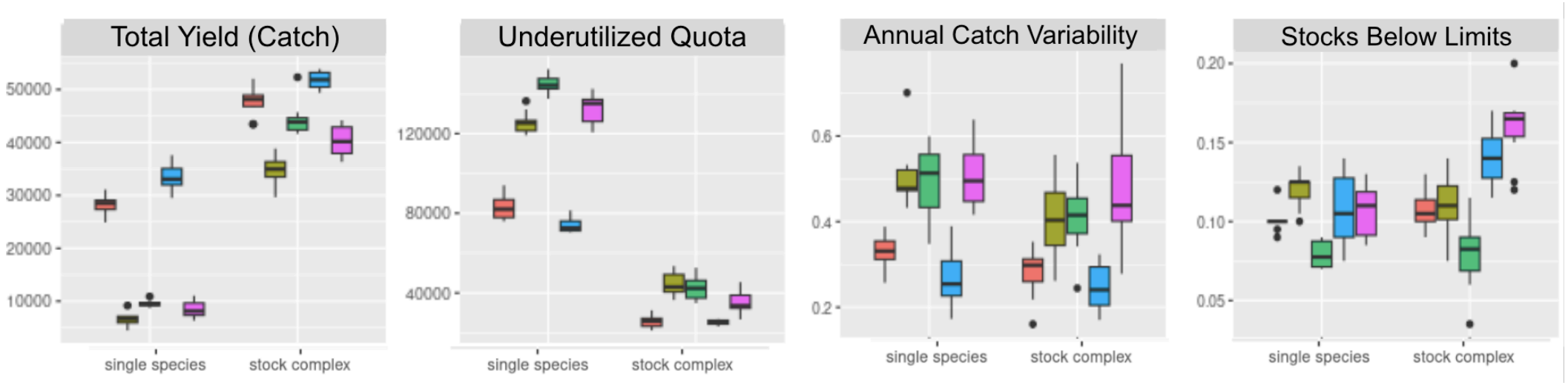


The SAFMC food web model can be used to evaluate multispecies reference points and management procedures for stock complexes using the Rpath framework.

Multispecies MSE: streamlined management with yield benefits?

Multiple objectives can be compared between current single species approaches and management of stock complexes. SAFMC can shape analysis using similar approaches for stakeholder involvement as in current MSEs, but with less need to devote resources to operating model development.

In the New England example, stock complex management resulted in higher catch and lower underutlized quota with similar variability in catch and species status.



Different starting scenarios: High Biomass, High Predators, High Prey, Low Biomass, Price-based F

New England pMSE report and presentation

Key Recommendation

Develop a structured process for ecosystem-based decision making

The FEP loop is an interpretation of adaptive management as applied to Fishery Ecosystem Planning. Reprinted from Levin et al. 2018, Fig. 1

This process can address any of the "easy wins" as well as big picture issues (climate impacts on multiple stocks, discard concerns, balancing diverse stakeholder objectives) as prioritized by the Council

Conclusions: Example Pathways for Action: South Atlantic ??

1. Outline a decision process for SAFMC

- Adapt a current SAFMC decision process, another Council's or Levin et al 2018 template and modify
- Build in iterative co-production and risk based methods
- Integrate Citizen Science program

2. Develop a list of potential action items

- Review cross-FMP issues and concerns?
- Review 2021 ESR to prioritize indicators for annual reporting?
- Develop assessment ecosystem ToRs?
- Develop ecosystem objectives (in progress)?
- ... other items from this menu

3. Prioritize an action item and apply the decision process

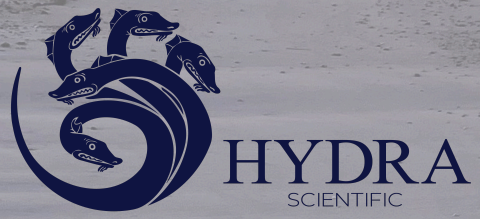
- Something that needs to be done anyway?
- Something that is a high priority for stakeholders?
- Something that is easy?
- Something that is difficult?
- ...

4. Revisit the list of action items regularly

5. Review FEP process periodically and adjust

Thoughts? Questions?

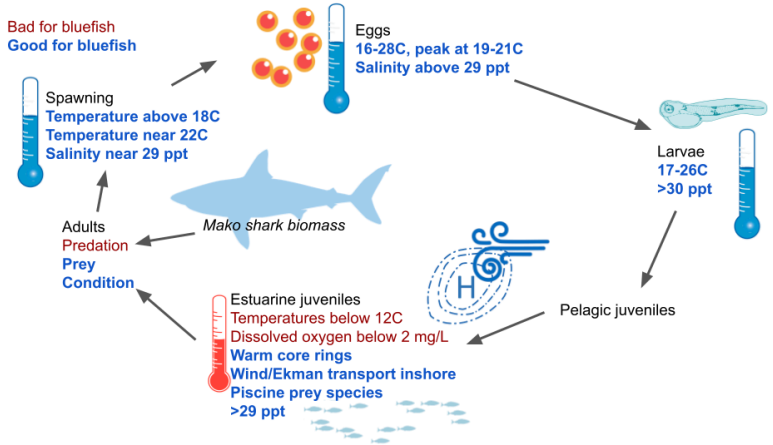
Thank you!



Slides at https://sgaichas.github.io/HSpresentations
Contact: sgaichas@hydrascientificllc.com

Catch Specification

Stock specific ecosystem indicators can be derived from literature review combined with indicator testing using an Ecosystem Socioeconomic Profile report (Alaska, Northeast),



or using a **structured conversation among experts** as piloted in the Pacific

- experts can include stakeholders
- information can include citizen science

Image courtesy Abigail Tyrell, NEFSC

Modify Pacific ecosystem factors for the South Atlantic:

- Food webs (e.g., predator abundance or productivity, competitor abundance or productivity, spatial overlap with predators/competitors, prey abundance) -- *could inform the SAFMC "ecosystem importance" risk attribute in addition to food web model*
- Habitat availability (e.g., do current or near-term predictions of ocean temperatures and oxygen match known optimal ranges for [priority species] life history stages, closed area regulations) -- *could inform the SAFMC "climate impact" risk attribute in addition to CVA*
- Changes in ecosystem productivity (e.g., upwelling indices, chlorophyll a, abundance of low trophic level organisms) -- *"other environmental variables": related to regime shifts*
- Physiological indices (e.g., growth, condition, pathogens/parasites, stomach weight/fullness) -- *"other environmental variables": possible drivers of recruitment trends*
- Reproductive indices (e.g., maturity, fecundity, spawn timing and duration) -- *"other environmental variables": possible drivers of recruitment trends*