SEFSC Climate, Ecosystems and Fisheries Initiative (CEFI) Overview

March 2025 South Atlantic Fisheries Management Council Meeting

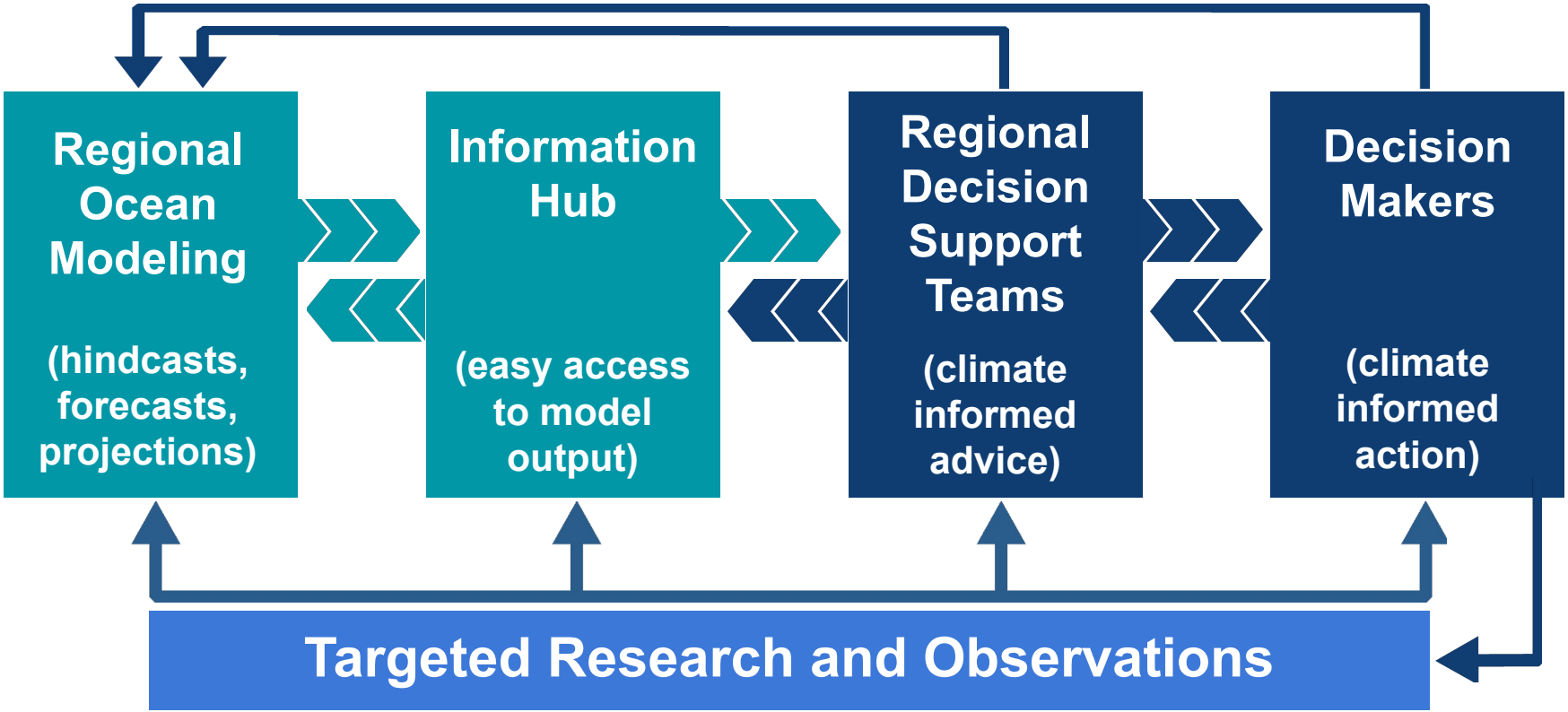
CEFI…

Cross-NOAA effort to integrate atmospheric/climate, ocean, ecosystem, and population modeling

Builds on stakeholder needs and NOAA investments in research, modeling and decision-making to:

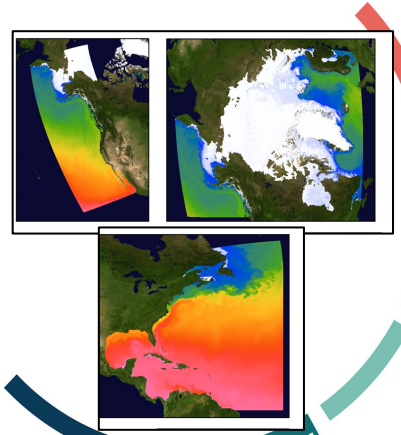
1. **Provide reliable** ocean forecasts and projections.
2. **Support operational** climate-informed advice
3. **Leverage research & observations** for validation & innovation.
4. **Boost capacity** for adaptive and resilient decision-making.

CEFI Decision Support System

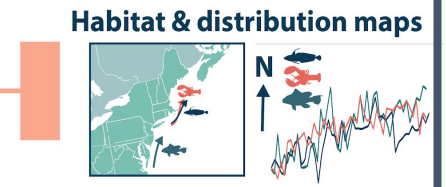


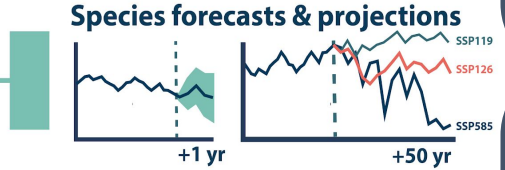
CEFI End-to-end Framework

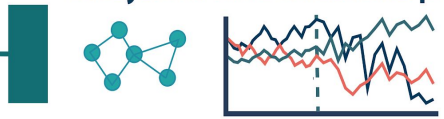
Regional Ocean Modeling Outlooks



Regional Decision Support Team Products







Advice Pathways

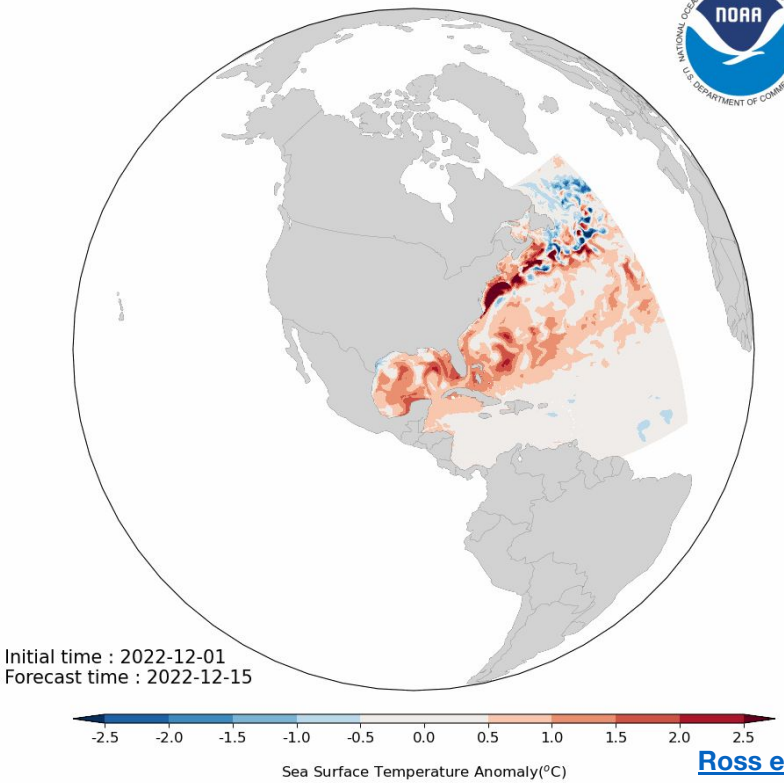
- Stock Assessments
- Socio-Econ Assessments
- Ecosystem Assessments
- Risk Assessments
- Scenario Planning
- Strategy Evaluations

Regional Applications

- Rapid responses
- Fisheries strategies
- Recovery plans
- Community adaptation Strategies

CEFI Ocean Model Products

CEFI Regional Ocean Model



NWA12-MOM6-COBALT2 ocean model:

- **Model domain:** **Northwest Atlantic (NWA)**, including U.S. N. Atl., S. Atl., Gulf, and Caribb. Sea
- **Resolution:** 1/**12°**
- **MOM6**: 6th version “Modular Ocean Model”---developed by NOAA's Geophysical Fluid Dynamics Laboratory (GFDL)
- **COBALT2**: 2nd version “Carbon, Ocean Biogeochemistry, and Lower Trophics” model simulates biogeochemical processes, including nutrient cycling, primary production by phytoplankton, and small organisms (zooplankton)

Ross et al., 2023

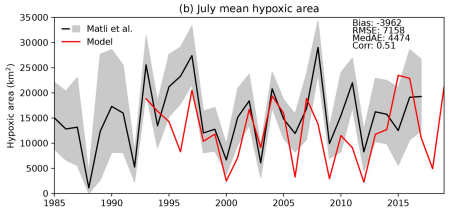
Data Produced (included for reference)

Monthly 2D			Daily 2D		Monthly 3D
Ice concentration	Sea Surface Height (SSH)	Surface NO3	Surface Salinity	Bottom Oxygen	Salinity
Surface Dissolved Inorganic Carbon Concentration	Sea Surface Temperature (SST)	Surface Carbonate Ion Solubility for Aragonite	Surface v-velocity	SSH	Temperature
Surface Total Alkalinity	Bottom Temperature	Surface PO4	Surface u-velocity	SST	
Surface Carbonate Ion	Surface Salinity	Mesozooplankton Biomass	Bottom Salinity		
Mass. conc. phytoplankton	Density	Mixed Layer Depth	Bottom Temperature		

NWA12 Implementations

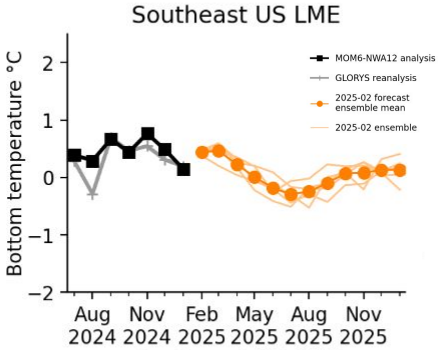
(1) Hindcasts

- Model validation
- 1993–2019
- Every year
- Available



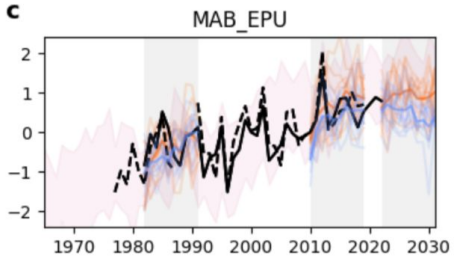
(2) Seasonal forecasts

- Real-time planning
- 12 months
- Every 3 months
- Soon



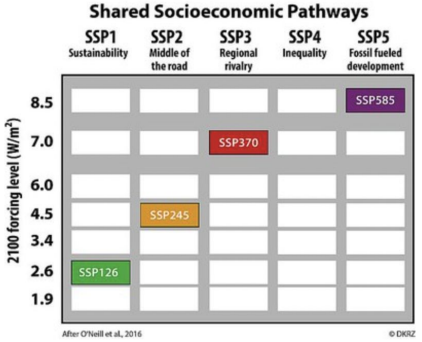
(3) Decadal forecasts

- Tactical decisions
- 10 years
- TBD
- Soon



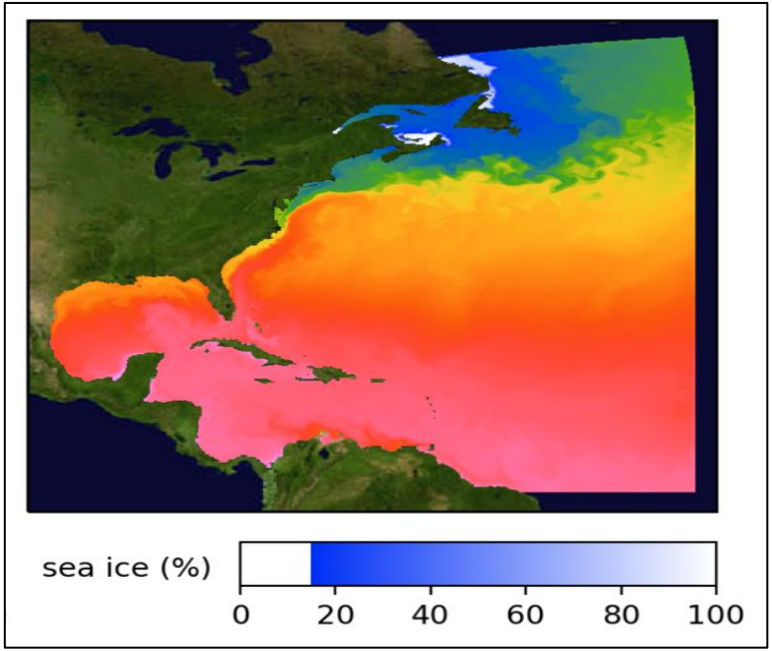
(4) Projections

- Climate strategy
- 100 years
- TBD
- Soon



NWA12 Delivery Timeline (included for reference)

Year	East Coast
FY23	Initial hindcast
FY24	Hindcast update, retrospective seasonal predictions
FY25	Hindcast update, retrospective decadal predictions, initial long-term projections
FY26	Hindcast update, expanded projections, seasonal outlooks reliably delivered
FY27	All products reliably delivered
FY28	All products reliably delivered
FY29	All products reliably delivered



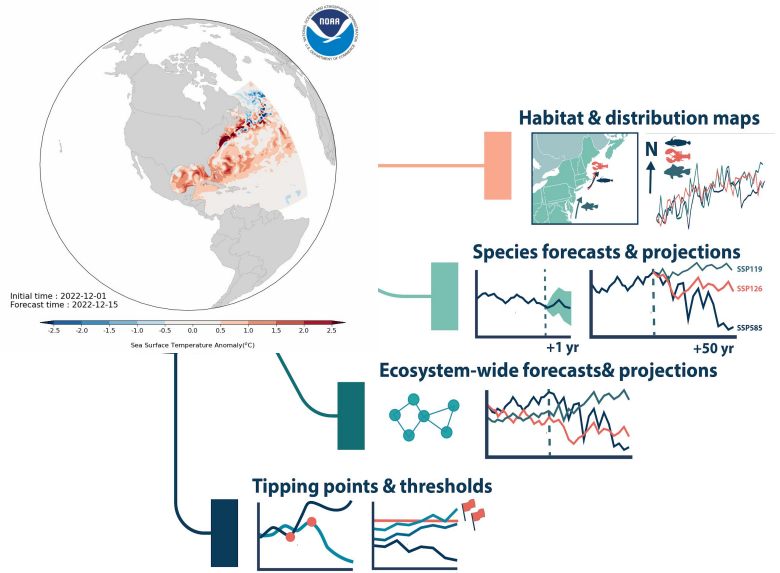
A sample of CEFI-enhanced SEFSC Projects

CEFI-enhanced SEFSC research

End-to-end framework links cross-disciplinary modeling applications

CEFI ocean model products integrates into SEFSC research to help:

1. *Understand and predict* **environmental-fisheries interactions**
2. *Understand and support* **resilience in fishing communities**
3. *Understand and optimize* **climate-ready management outcomes**



Project: Climate-enhanced ESRs

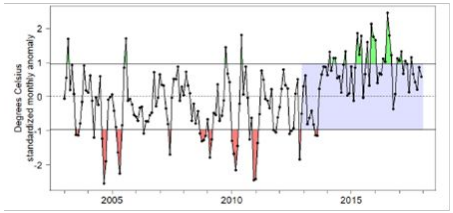
Issue: **Environmental, ecosystem, and socioeconomic data and trends are needed to inform hypotheses and management decisions. Annual ESRs has been requested by all Councils.**

Approach: Develop automation capacity to more rapidly report ecosys. info to managers and stakeholders.

CEFI integration: Climate Appendix with CEFI NWA12 forecasts & projections from CEFI projects.

Status: Progression towards automated updates; Caribbean ESR released in 2025, then updating GOM (2017) and SA (2022) ESRs

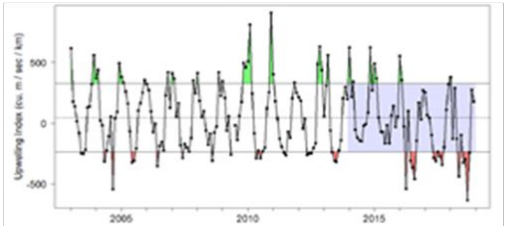
SST increasing



Craig et al., 2021

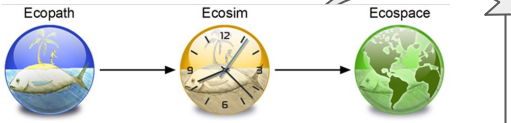
South Atlantic

Nutrient Upwelling decreasing

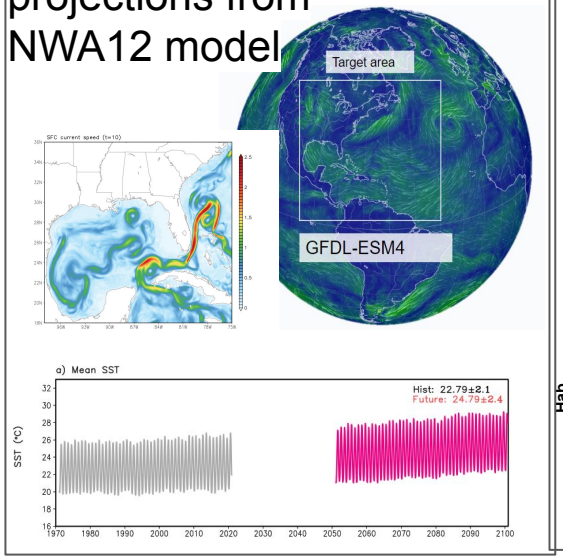


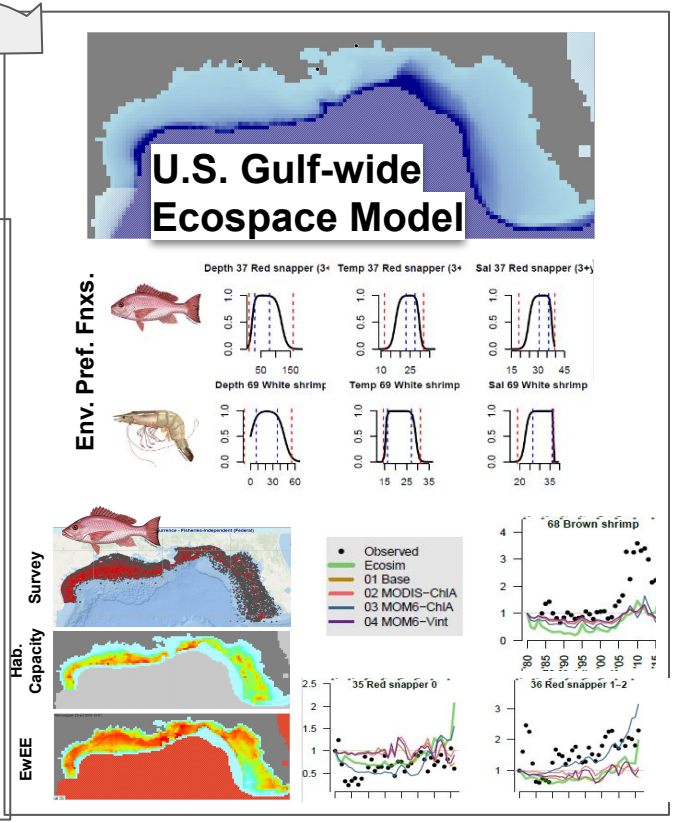
Recent recruitment declines

Project: Ecosystem modeling — USGWEM + SARF-EM



Future ocean projections from NWA12 model





Issue: **Multiple env. stressors will have direct and indirect (via food web) impacts**

Approach: Apply Ecopath with Ecosim and Ecospace (EwEE) foodweb modeling to identify species and fisheries of concern simulate management scenarios.

CEFI integration + **Status:** NWA12 ocean outputs synthesized for physical and primary production drivers for **Gulf-wide Ecosystem model (USGWEM)** and **South Atl. Reef Fish Model (SARF)**

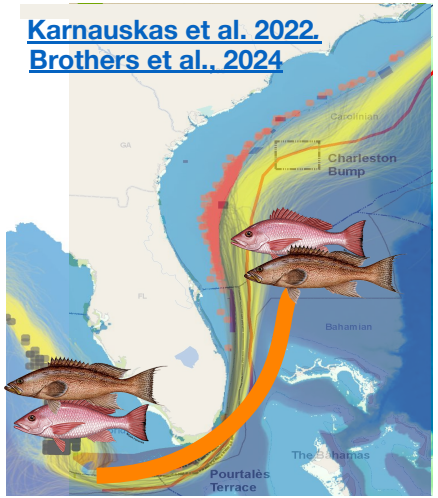
Project: Oceanographic impacts on recruitment

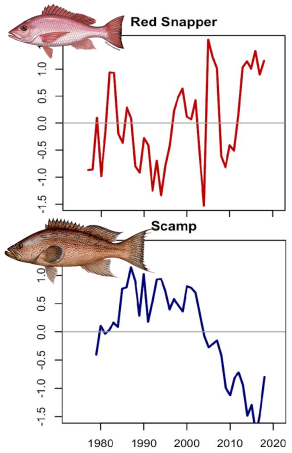
Issue: **Oceanography and changing environment may drive observed declines in snapper-grouper recruitment**

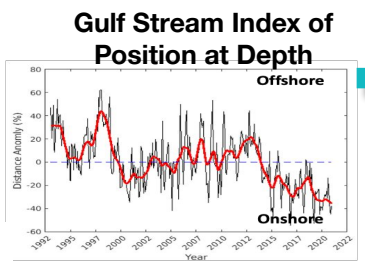
Approach:

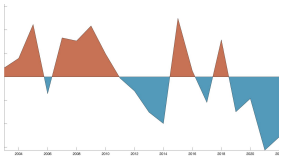
- CEFI ocean models inform physical drivers and larval dispersal modeling to develop recruitment indicators
- Recruitment indicators incorporated into ESRs and stock assessments. Including recruitment indicators has shown to reduce assessment projection uncertainty for OFL

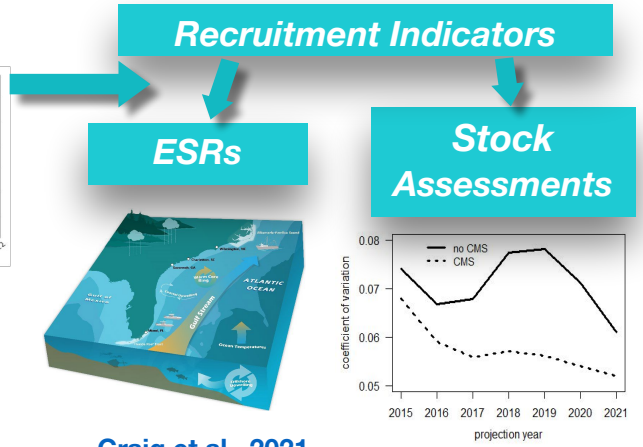
Status: Input received from SA SSC (2024); Red snapper dispersion models considered for use in upcoming SEDAR90 assmt; Collaboration with SEFSC / SA Council Poor Recruitment Working Group.









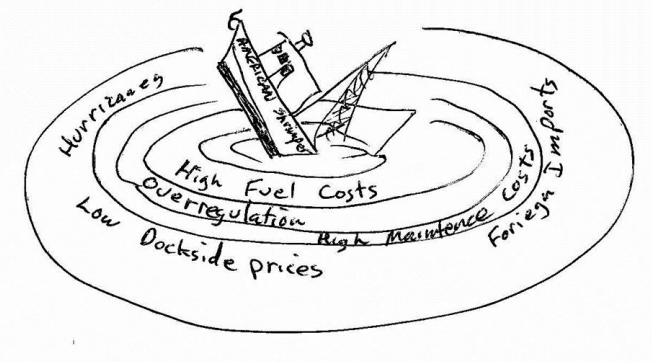


Project: Shrimp Futures

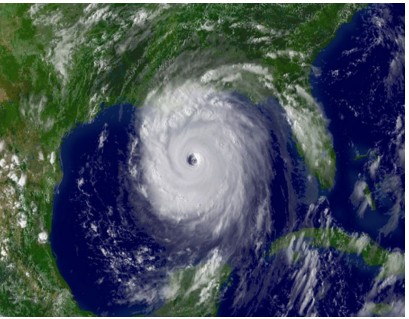
Issue: Shrimp industry is facing a myriad of stressors that are threatening the future viability of the fishery

Approach and objectives:

- Participatory modeling with stakeholders to identify challenges and solutions, uncertainty analyses, and scenario planning
- Develop a short (2025), medium (2030) and long-term (2050) vision for the fishery
- Characterize key challenges and uncertainties and pathways to success



SEDAR 87 Data Workshop Report. Source: J. D. Passwater



CEFI env./climate projections:

- Changing species distributions
- Env.-driven biological production
- Sea level rise storms impacts on working waterfronts and key infrastructure

SE-CEFI Take-aways

10-min overview for a sample of current and upcoming work

NWA12-MOM6-COBALT2 ocean models will provide operational products of past and future oceanographic conditions

Model outputs for environmental, climate, and ocean information are being **integrated** into SEFSC research efforts and products, including:

- Ecosystem status reports
- Ecosystem modeling (USGWEM + SARF)
- Larval dispersal modeling (Poor recruitment)
- Participatory modeling (Shrimp Futures)
- Species distribution modeling (SA multi-spp. VAST)
- Management strategy evaluation (e.g., dolphinfish)