An Update on the U.S. South Atlantic Ecosystem Status Report

Kevin Craig, Todd Kellison, Samantha Binion-Rock
Southeast Fisheries Science Center, Beaufort Lab, NC

Seann Regan
NOAA National Ocean Service, Charleston, SC

Mandy Karnauskas
Southeast Fisheries Science Center, Miami Lab, FL

April 14 2021

U.S. South Atlantic Ecosystem Status Report

Outline:

1. What is an Ecosystem Status Report (ESR)?
2. Brief overview of South Atlantic Ecosystem Status Report
3. How are Ecosystem Status Reports used in other regions?

What is an Ecosystem Status Report

Definition:

- Synthesis of scientific information on a wide range of ecosystem components, including human communities, in a concise and readable report

- Core component of NOAA EBFM Road Map, regional EBFM Implementation Plans, Climate Science Strategy (NCSS), and Integrated Ecosystem Assessment (IEA) regional plans

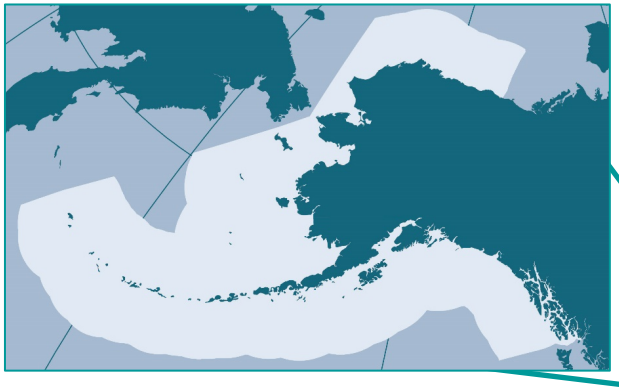
Objectives:

1. To provide a broad-level overview of the current state of an ecosystem with respect to recent and historical trends using a suite of indicators

2. Transfer knowledge to managers to provide context and information for a range of decisions affecting marine ecosystems

3. Facilitate increased communication and information exchange between scientists, managers, and various stakeholder groups

Where are ESRs being done?



Eastern Bering Sea (late 1980s, annual)

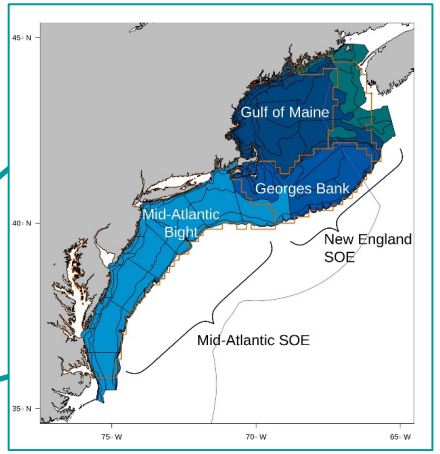
Gulf of Alaska (1993, annual)

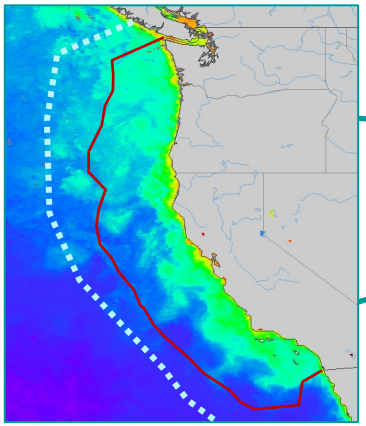
Aleutian Islands (2016, biennial)

Arctic Ocean (in progress)

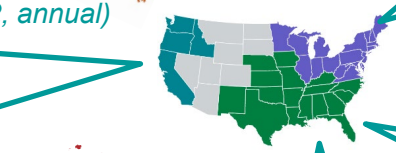
New England (2009, annual)

Mid-Atlantic (2009, annual)



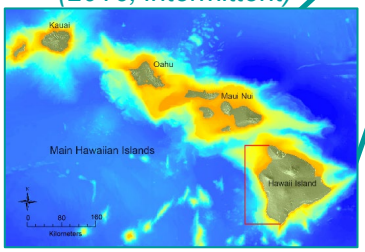


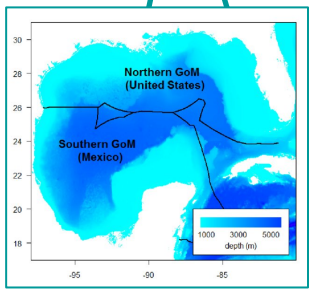
California Current (2012, annual)



South Atlantic (2021, TBD)

West Hawai'i (2016, intermittent)





Gulf of Mexico (2013, 2017 intermittent)

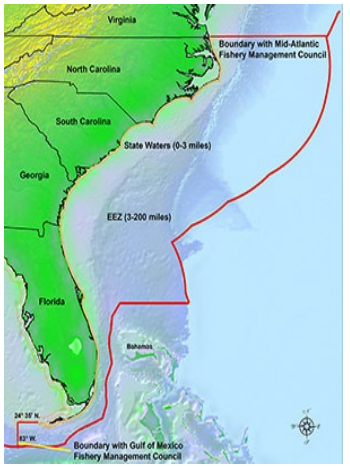
Caribbean Sea (in progress)

Contributors to U.S. South Atlantic ESR

- Southeast Fisheries Science Center
  - *Beaufort Laboratory*
  - *Miami Laboratory*
  - *Pascagoula Laboratory*
- Southeast Regional Office
- National Ocean Service (NOS)
- Atlantic Oceanographic and Meterological Laboratory (AOML)
- Gulf Integrated Ecosystem Assessment (IEA)
- National Center for Atmospheric Research (NCAR)
- US Geological Survey (USGS)
- NOAA Integrated Drought Information Center
- NOAA National Center for Environmental Information
- Atlantic Coastal Cooperative Statistics Program
- State agencies:
  - *Florida Fish and Wildlife Conservation Commission*
  - *Florida Department of Environmental Protection*
  - *North Carolina Division of Marine Fisheries*
  - *North Carolina Wildlife Resources Commission*
  - *Georgia Department of Natural Resources*
  - *South Carolina Department of Natural Resources*
- Universities:
  - *North Carolina State University*
  - *Duke University*
  - *University of North Carolina-Chapel Hill*
  - *University of Delaware*
  - *University of Georgia*

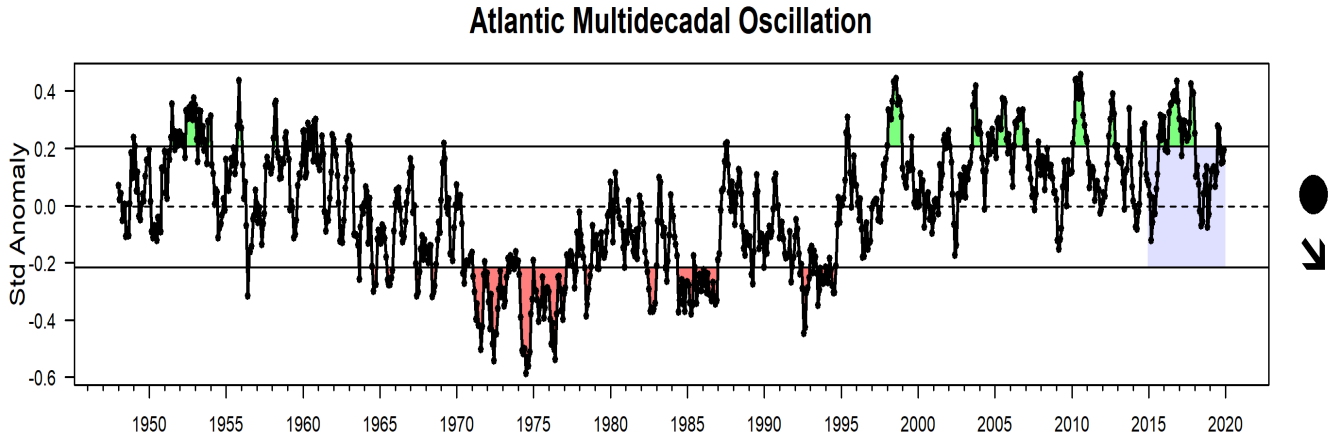
57 individuals from 23 organizations have contributed to the report

Ecosystem Indicators



- Provide <u>quantitative</u> trends over time that reflect the biological, chemical, physical, social, or economic condition or state of the ecosystem
- Typically focused on regional spatial scale and monthly to annual time scale
- Allow an assessment of how ecosystem components have changed over time and whether those changes are interrelated
- **South Atlantic ESR: 7 categories, 48 indicators, 182 times series**

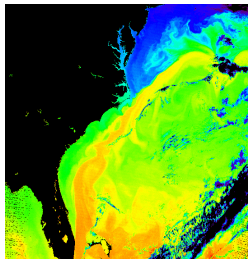
- Standard reporting format:



Ecosystem Indicator Categories

- Climate drivers *(AMO, NA Tripole)*
- Physical & chemical pressures *(SST, acidification, SLR)*
- Habitat state *(wetland, seagrass coverage)*
- Lower trophic levels *(primary/secondary productivity)*
- Upper trophic levels *(fish abundance/diversity)*
- Ecosystem services *(fisheries, protected species)*
- Human dimensions

(popn trends, fishing effort, economic indicators)



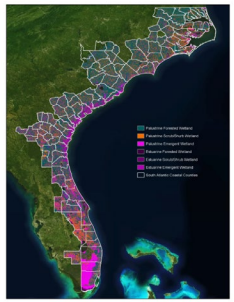
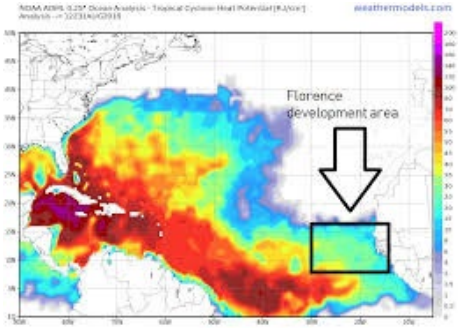


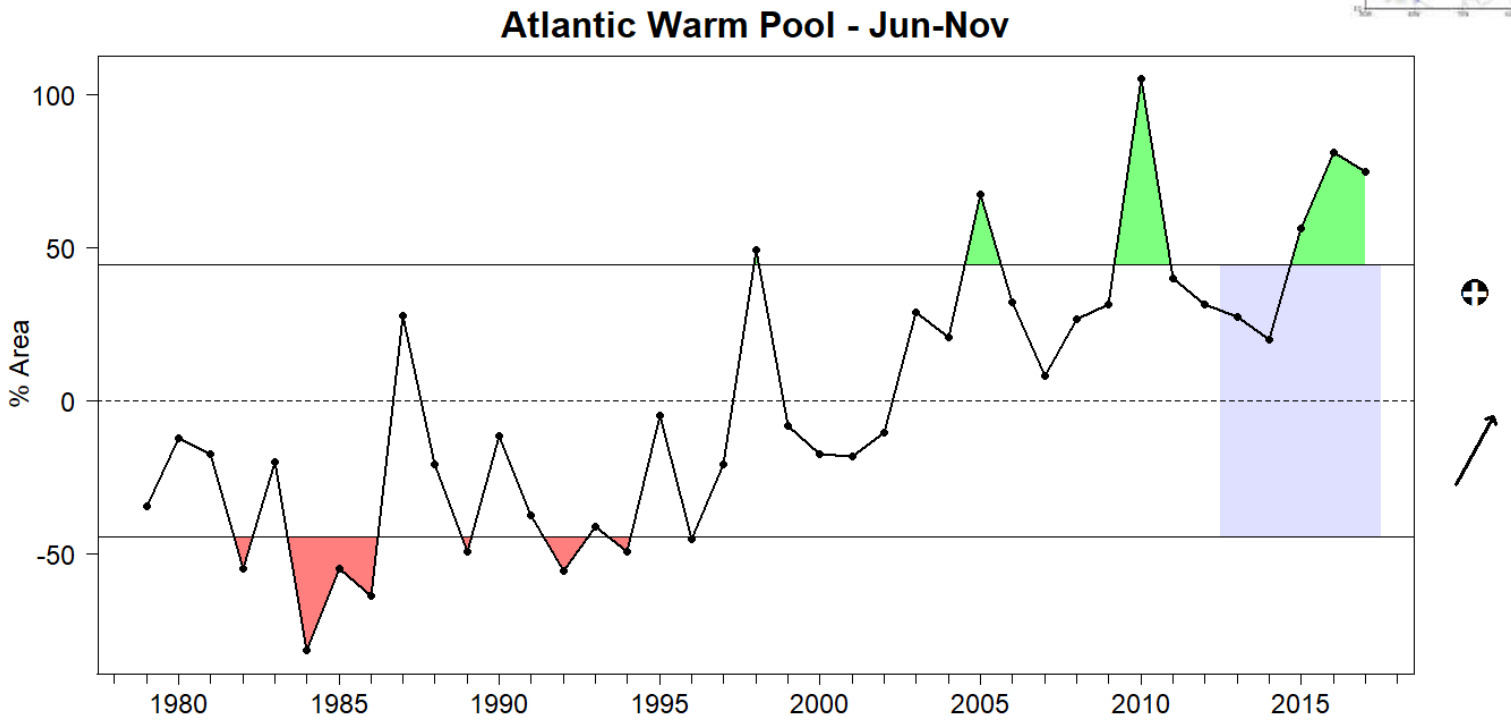
Table of Contents

Contents

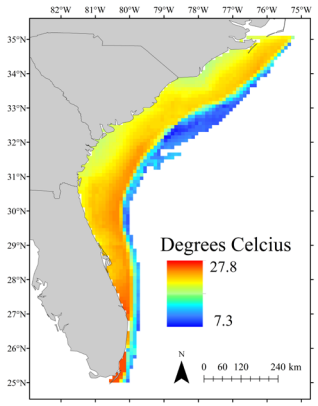
Report Highlights—Temperature

Increasing temperatures at seasonal, annual, and decadal time scales

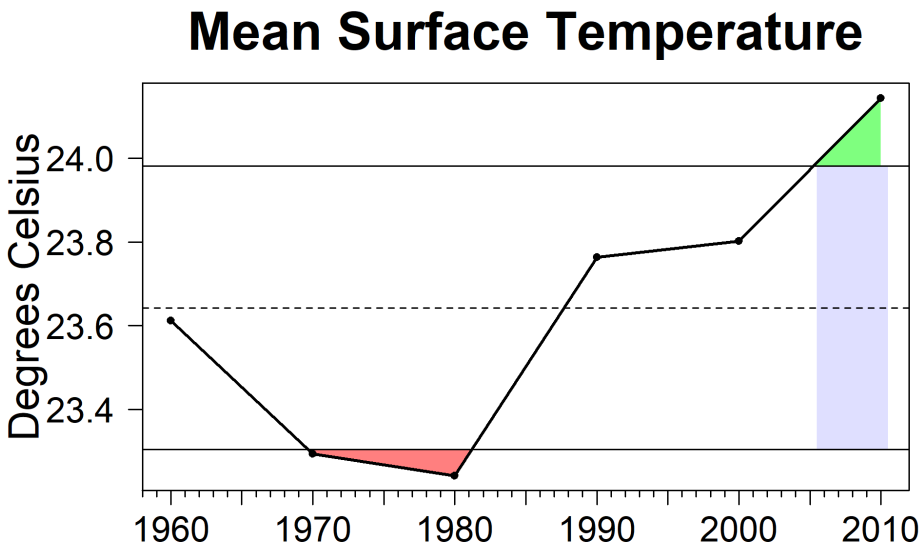


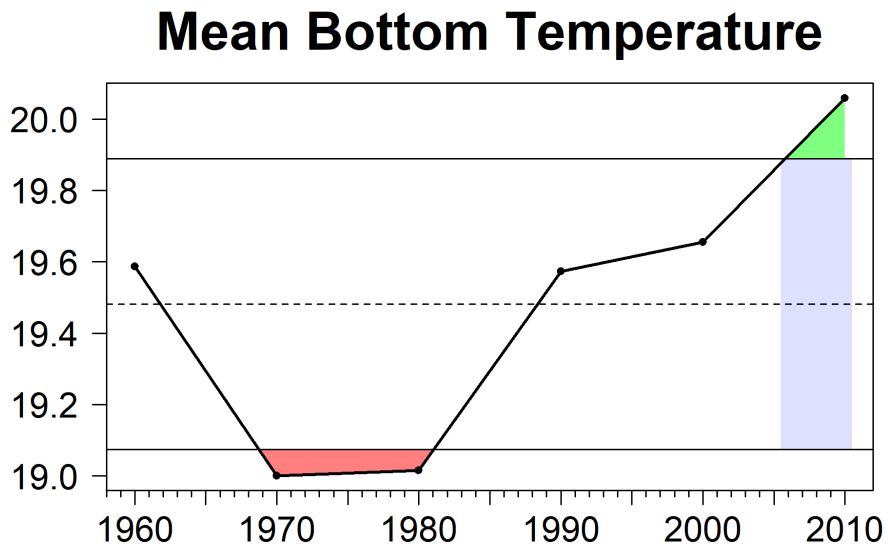


Report Highlights—Temperature



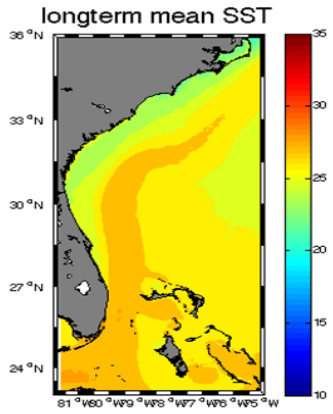
~1 ºC increase in decadal mean surface and bottom temperature in the U.S. South Atlantic since the 1980s



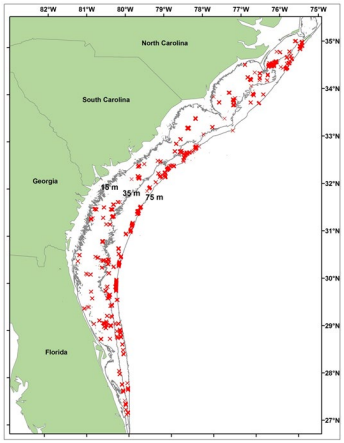


National Centers for Environmental Information (NCEI) World Ocean Database

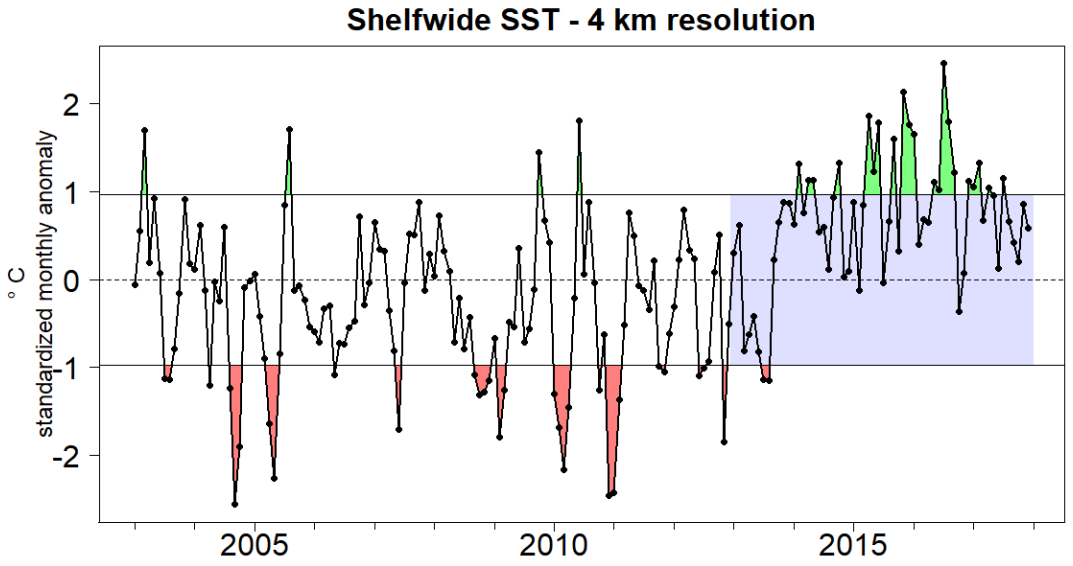
Report Highlights—Temperature

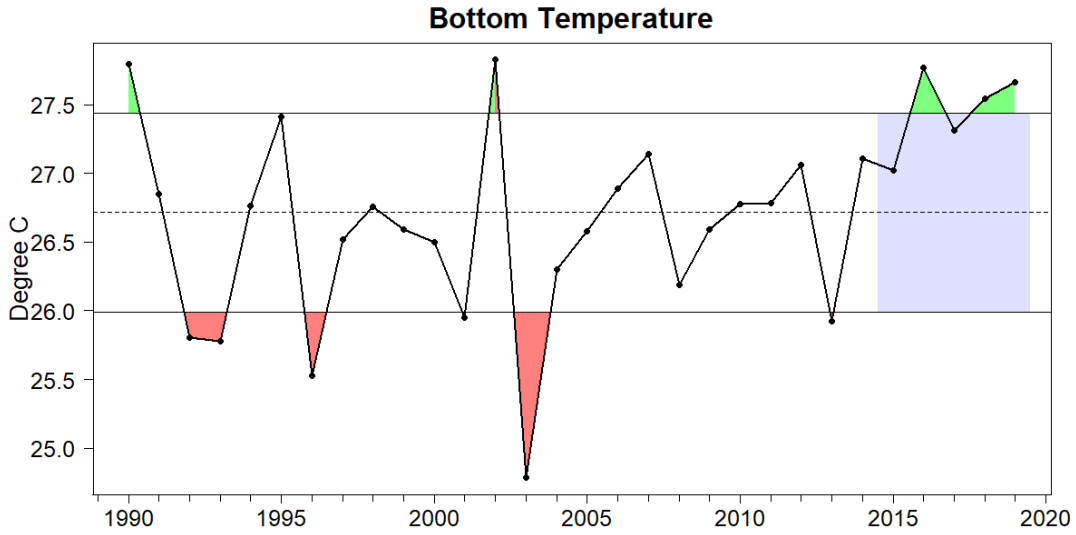


MODIS Satellite imagery

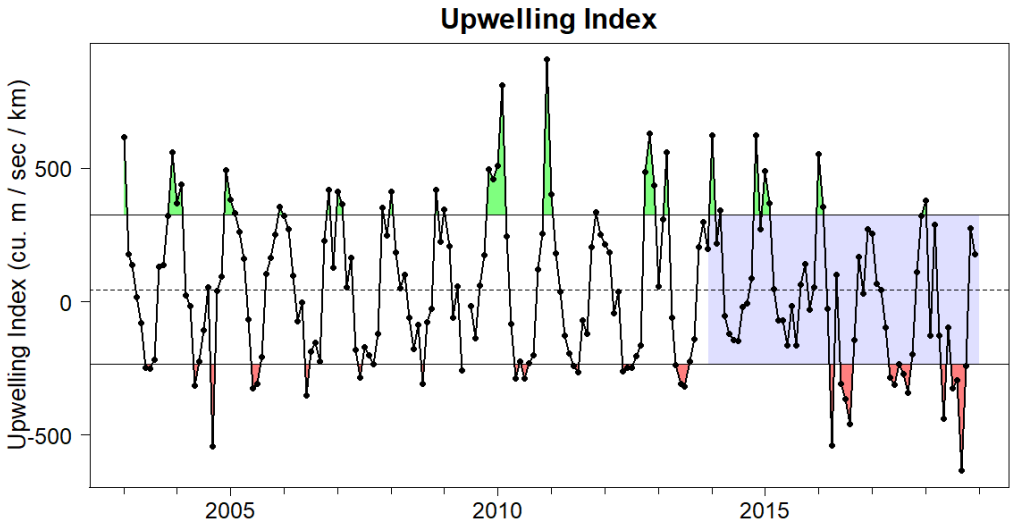


SERFS trap-video survey

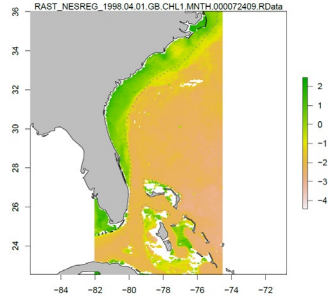


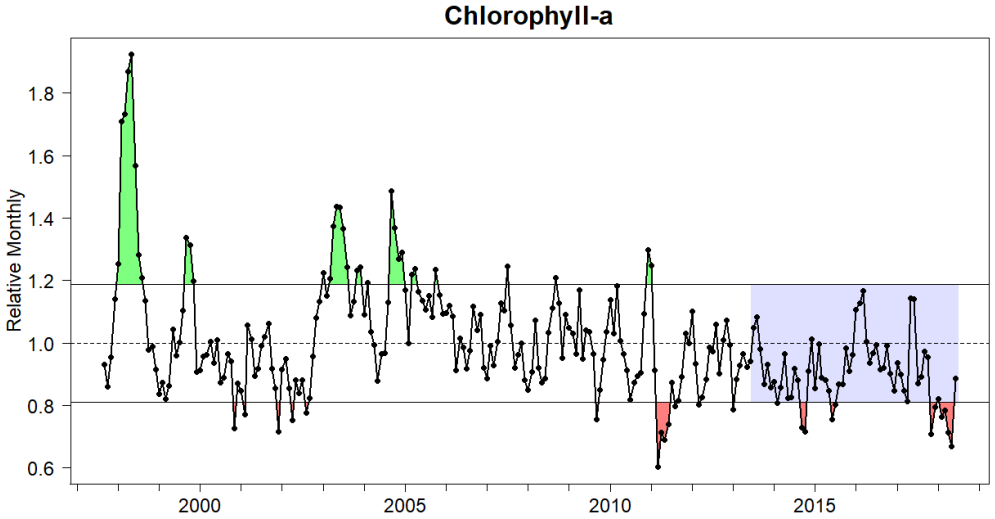


Report Highlights—Upwelling and Primary Productivity

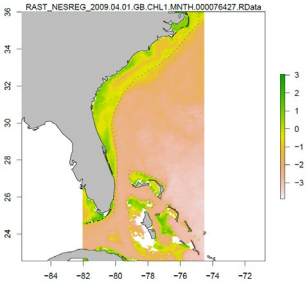


High Productivity Year



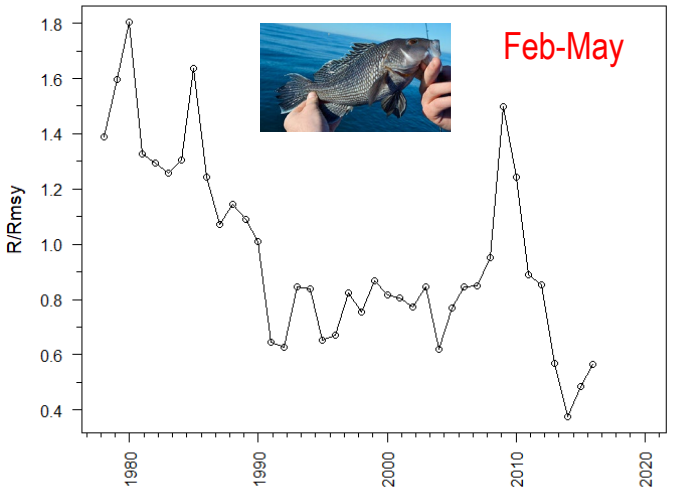


Low Productivity Year

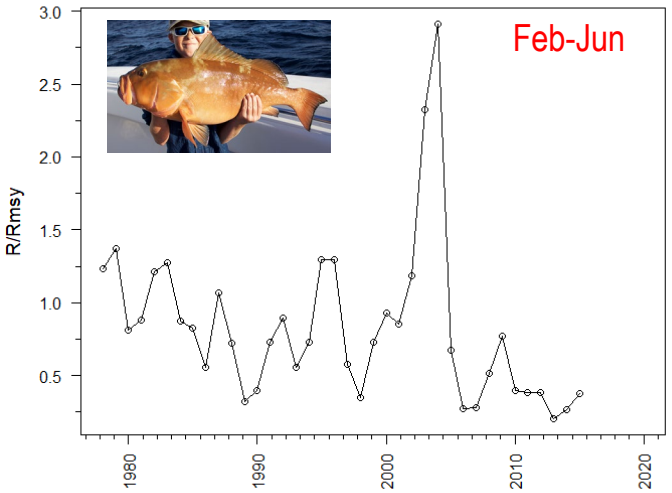


Declining Recruitment for Winter-Spring Spawning Reef Fishes

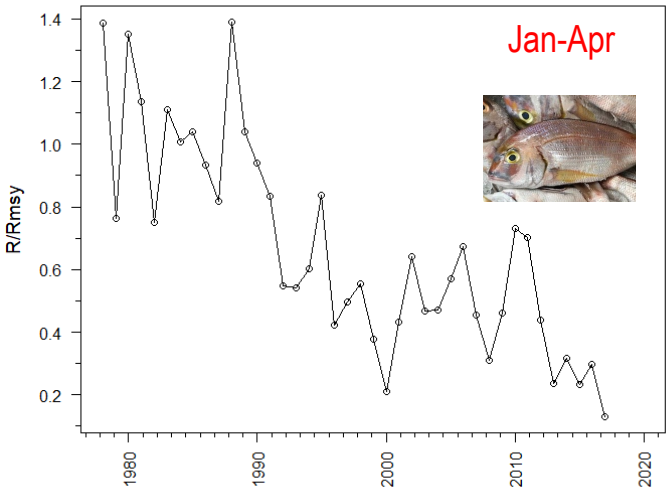
Black Seabass



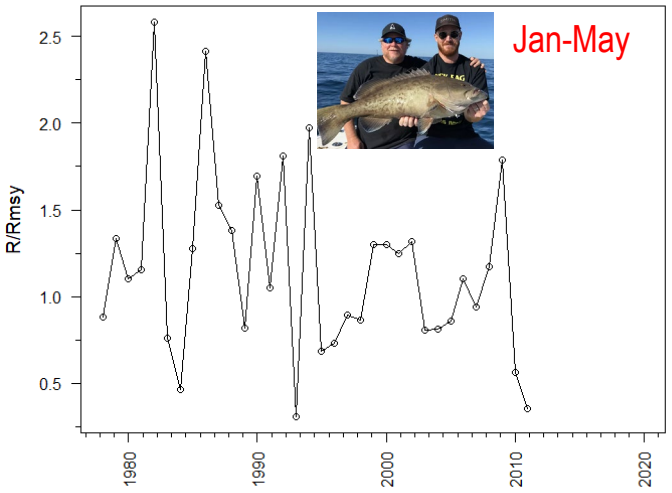
Red Grouper



Red Porgy



Gag Grouper



Spawning Period

Declining Recruitment for Winter-Spring Spawning Reef Fishes

Working Hypothesis

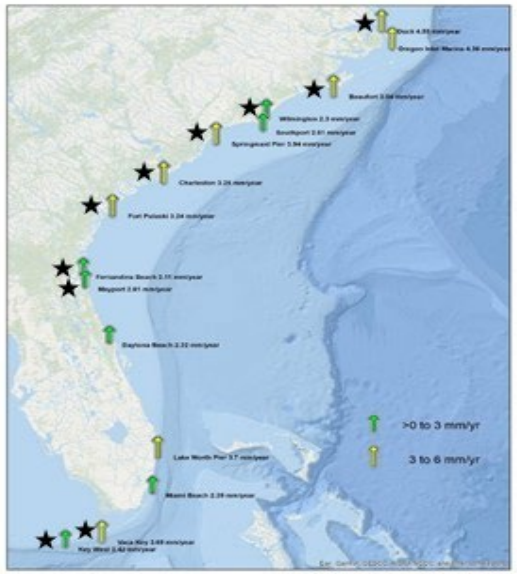
Warm winter-spring temperatures promote water column stratification that inhibits nutrient upwelling leading to lower primary production and lower recruitment of multiple snapper-grouper species

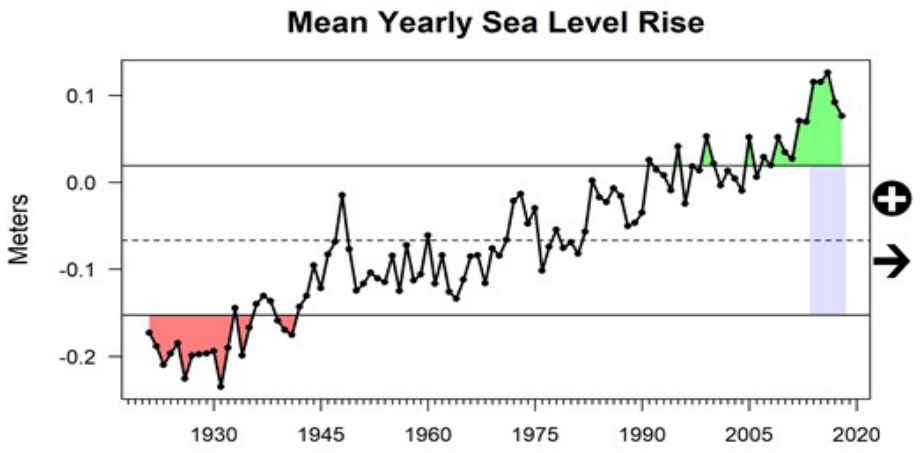
By synthesizing available but often disparate information, ESRs can lead to the development of novel hypotheses that focus additional research

Highlights: Physical and Chemical Pressures

Sea Level Rise:

- Sea level rise (SLR) has negative effects on coastal infrastructure as well as marsh and beach dependent species
- Average rates of SLR in the Southeast has been comparable to the long-term global average (1.7 mm/yr)
- Some indication of accelerated SLR since 2011

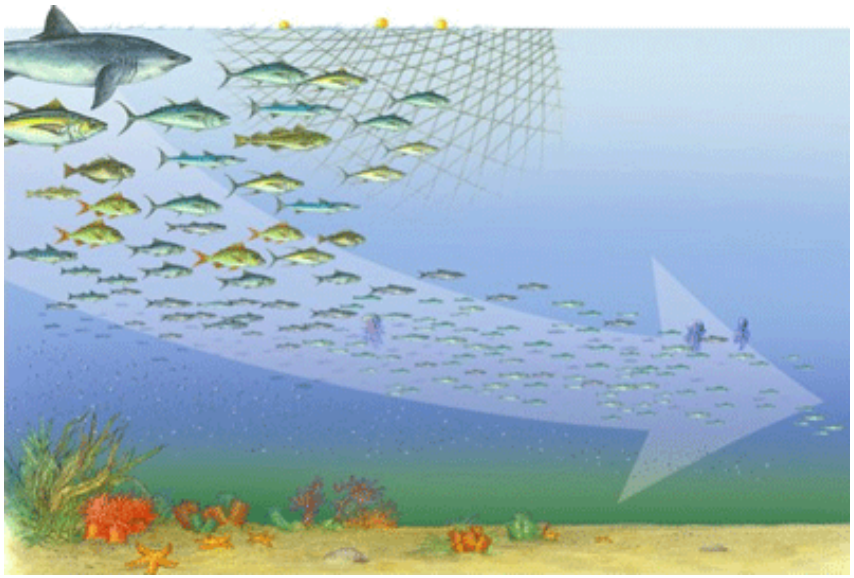




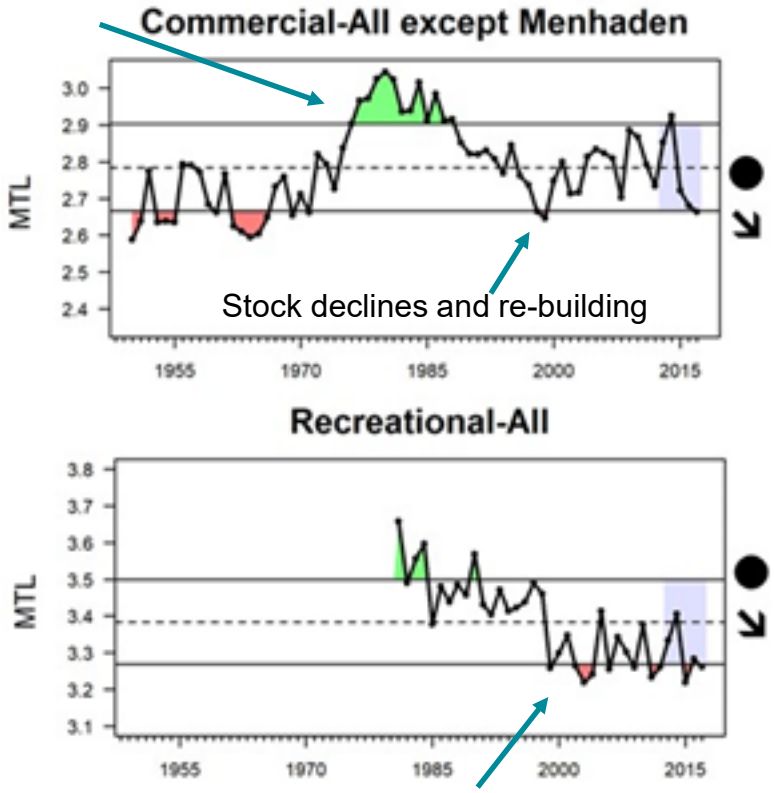
Highlights: Upper Trophic Levels

Mean Trophic Level (MTL):

- Measure of the change in the components of the food web harvested by fisheries
- ‘Fishing down the food web’
- Common indicator of ecosystem health

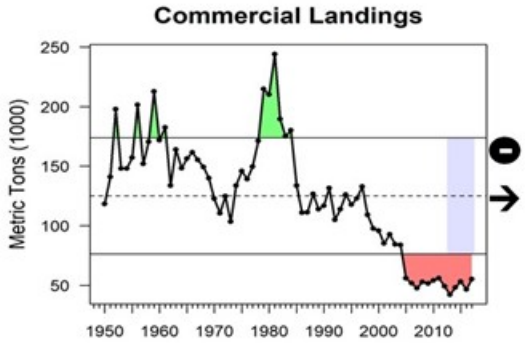


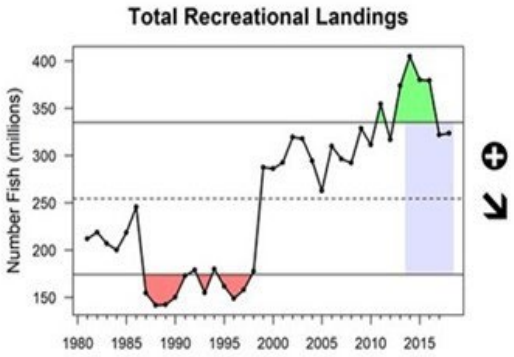
Development major U.S. domestic fisheries

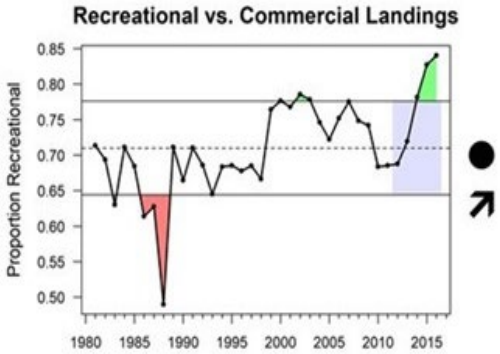


- Reef fish stock declines and re-building
- Increased harvest small, estuarine species (Spot, Croaker, Mullet)

Highlights: Ecosystem Services







- Declining commercial landings and revenue since the 1980s
- Increasing recreational landings and effort since the early 2000s
- Federally managed species increasingly recreationally-dominated

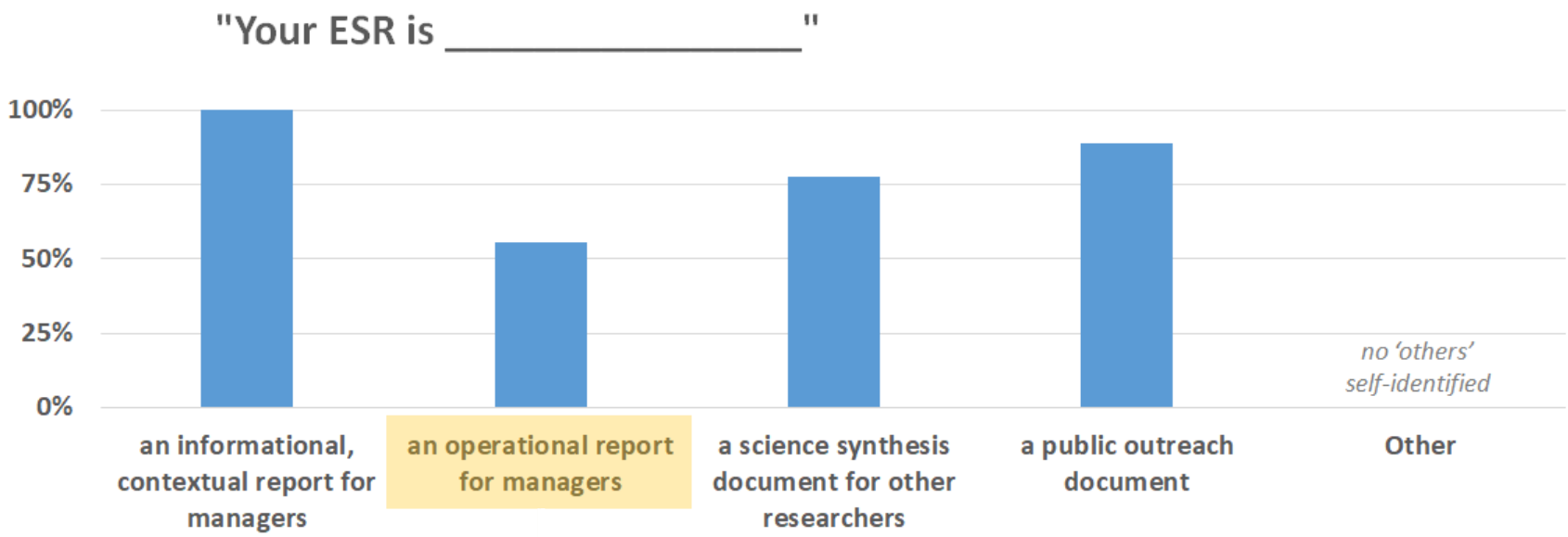
U.S. South Atlantic Ecosystem Status Report

Outline:

1. What is an Ecosystem Status Report (ESR)?
2. Brief overview of South Atlantic Ecosystem Status Report
3. How are Ecosystem Status Reports used in other regions?

Survey of How Are ESRs Used Across Regions

ESRs are serving multiple roles for end-users



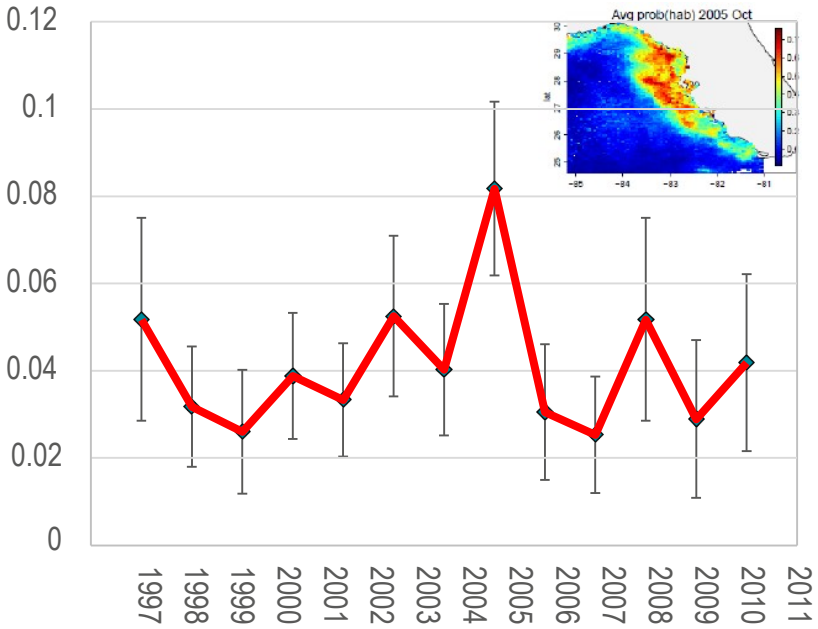
What Does Operationalizing an ESR look like?

3 Examples:

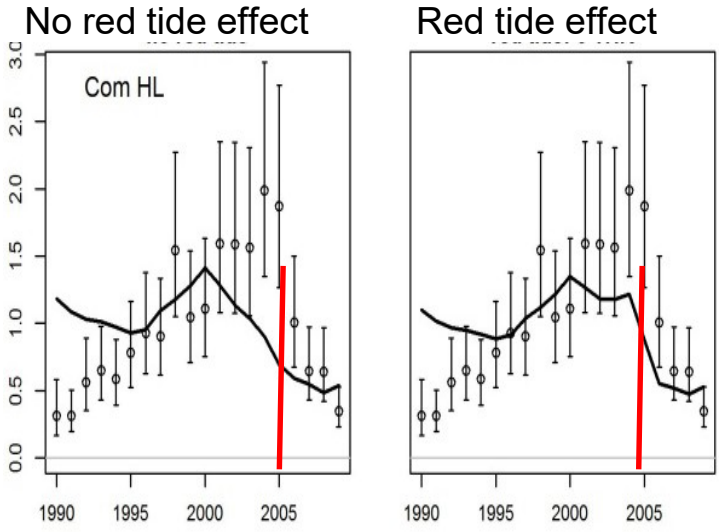
- Direct incorporation into stock assessments ('front end')
- Inform single species decision-making ('back end')
- Risk assessment

Gulf of Mexico red tide effects on fisheries

- Red tide index derived from SeaWiFS satellite oceanography



- Red tide index derived from SeaWiFS satellite imagery
- Included as a mortality source in stock assessment
- Improves fits to indices of abundance



Explained declines of **~8 million grouper** (gag and red combined) in 2005

Key Points:

- Quantitative relationship and linked to a mechanism
- Stakeholders raised the issue
- Improved the assessment (Reduce bias and variance)

NOAA FISHERIES

(S. Sagarese, J. Walter, J. Tetzlaff, M. Bryan; SEFSC Miami Lab)

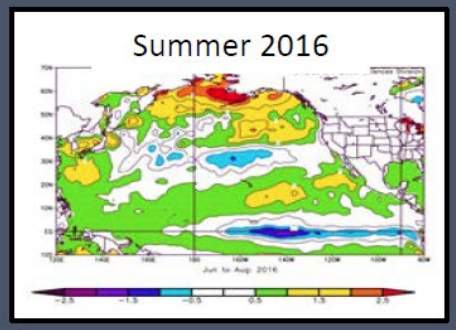
Ecosystem Indicators and Decision-Making

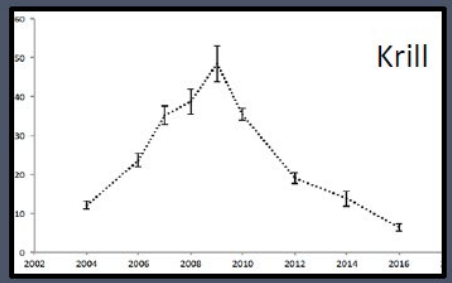
(North Pacific Fishery Management Council)

ESR Indicators suggested:

- warming temps
- declining prey
- increasing predators

2016 Eastern Bering Sea Pollock example





2016 Pollock Stock assessment

"Additional precaution may be warranted since warm conditions are thought to negatively affect the survival of larval and juvenile pollock."

Scientific & Statistical Committee

"Our current understanding of pollock early life dynamics suggests that recent survival from age-0 to age-1 may be low due to low availability of suitable prey."

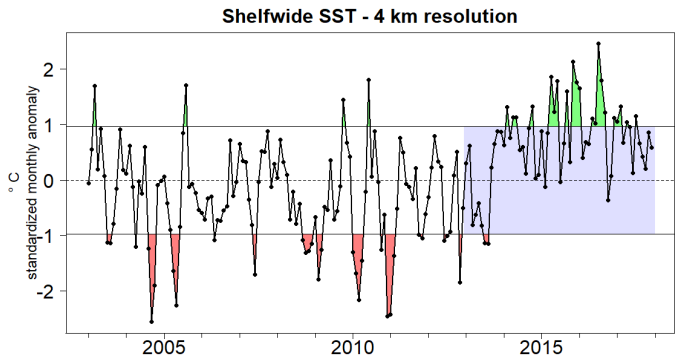
Council

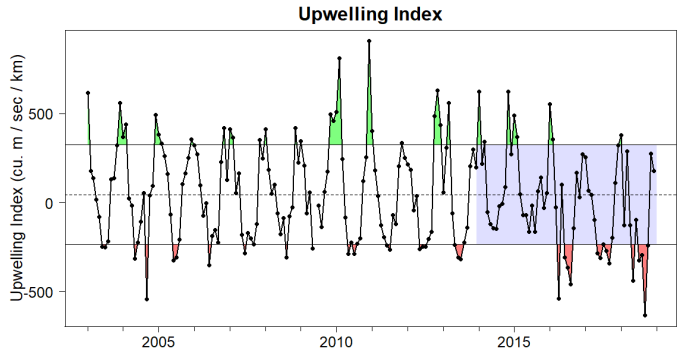
Quota was reduced under a more conservative Tier 3 approach; consideration of ecosystem indicators impacted management decisions.

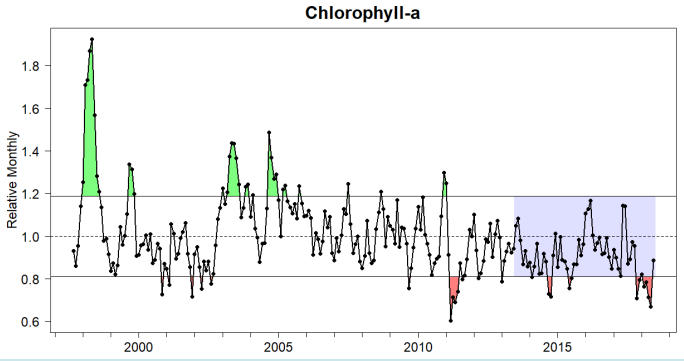
Ecosystem Indicators and Decision-Making

U.S. South Atlantic

Leading oceanographic indicators that suggest future low (or high) recruitment environments could help inform management advice from stock assessments or be used to suggest particular projection scenarios

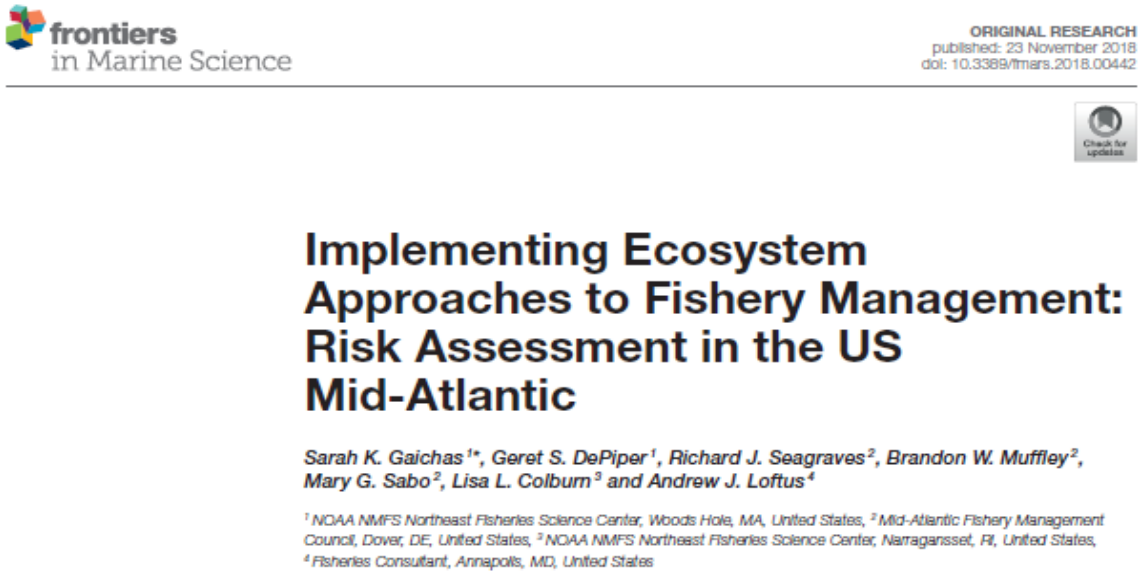






Ecosystem Indicators and Risk Assessment
(Mid Atlantic Fishery Management Council)

Risk Assessment: Evaluation of the potential magnitude and consequence of negative events that impede achieving biological, economic, and social objectives



frontiers in Marine Science

ORIGINAL RESEARCH
published: 23 November 2018
doi: 10.3389/fmars.2018.00442

Implementing Ecosystem Approaches to Fishery Management: Risk Assessment in the US Mid-Atlantic

Sarah K. Gaichas[1], Geret S. DePiper[1], Richard J. Seagraves[2], Brandon W. Muffley[2], Mary G. Sabo[2], Lisa L. Colburn[3] and Andrew J. Loftus[4]*

[1] NOAA NMFS Northeast Fisheries Science Center, Woods Hole, MA, United States, [2] Mid-Atlantic Fishery Management Council, Dover, DE, United States, [3] NOAA NMFS Northeast Fisheries Science Center, Narragansset, RI, United States, [4] Fisheries Consultant, Annapolis, MD, United States

Goal

Develop a ranked risk assessment to focus on the highest risk issues for further evaluation and mitigation

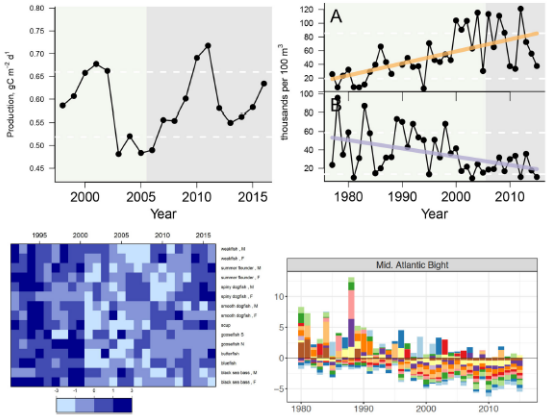
MAFMC Ecosystem-Level Risk Assessment

Step 1: Define 'Risk Elements' (ecological, economic, social, food prodn, management)

Example: Not achieving 'Optimal Yield' due to changes in ecosystem productivity at the based of the food web

Step 2: Identify indicators from an ESR related to each risk element

Example: Total primary production, zooplankton abundance, fish condition, survey recruitment index



Step 3: Use the indicator data to score each risk element

Example:

'Low Risk' no trend across all four indicators
'Low-Moderate Risk' trend in 1-2 indicators (positive or negative)
'Moderate-High Risk' trend in 3+ indicators (positive or negative)
'High Risk' (decreasing trend for all four indicators)

MAFMC Ecosystem-Level Risk Assessment

Highlight species and management issues posing higher risk to meeting Council management objectives

TABLE 3 | Species level risk analysis results; l = low risk (green), lm = low-moderate risk (yellow), mh = moderate to high risk (orange), h = high risk (red).

Species	Assess	Fstatus	Bstatus	FW1Pred	FW1Prey	FW2Prey	Climate	DistShift	EstHabitat
Ocean quahog	l	l	l	l	l	l	h	mh	l
Surfclam	l	l	l	l	l	l	mh	mh	l
Summer flounder	l	h	lm	l	l	l	lm	mh	h
Scup	l	l	l	l	l	l	lm	mh	h
Black sea bass	l	l	l	l	l	l	mh	mh	h
Atl. mackerel	l	h	h	l	l	l	lm	mh	l
Butterfish	l	l	l	l	l	l	l	h	l
Longfin squid	lm	lm	lm	l	l	lm	l	mh	l
Shortfin squid	lm	lm	lm	l	l	lm	l	h	l
Golden tilefish	l	l	lm	l	l	l	mh	l	l
Blueline tilefish	h	h	mh	l	l	l	mh	l	l
Bluefish	l	l	lm	l	l	l	l	mh	h
Spiny dogfish	lm	l	lm	l	l	l	l	h	l
Monkfish	h	lm	lm	l	l	l	l	mh	l
Unmanaged forage	na	na	na	l	lm	lm	na	na	na
Deepsea corals	na	na	na	l	l	l	na	na	na

Green = low risk
Yellow = low-moderate risk
Orange = moderate-high risk
Red = high risk

Gaichas et al. (2018)

Timeline

- Initial report complete May 2021
- Reviews and feedback in 2021
  - Southeast Fisheries Science Center (SEFSC)
  - South Atlantic Fishery Management Council (SAFMC)
  - SAFMC Science and Statistics Committee (SSC)
  - NMFS National ESR working group
  - Other partners (SECART, SECOORA, state agencies)
- Easily downloadable from a website

(e.g.,https://www.integratedecosystemassessment.noaa.gov/national/Ecosystem-Status-Reports)

- Considering more summarized versions
- Approaches to updating the information (e.g., living document)

Questions and Feedback

Kevin Craig (kevin.craig@noaa.gov)

Todd Kellison (todd.kellison@noaa.gov)