NMFS/SEFSC South Atlantic Ecosystem Science Activities

1 - Ecosystem Status Report

2 - Climate Vulnerability Assessment

3 - Multispecies (aggregate) production modeling

Relevance to SAFMC FEP II and NMFS / SEFSC EBFM Implementation Plan

Kevin Craig, Todd Kellison, Mike Burton
NMFS / SEFSC / Beaufort, NC

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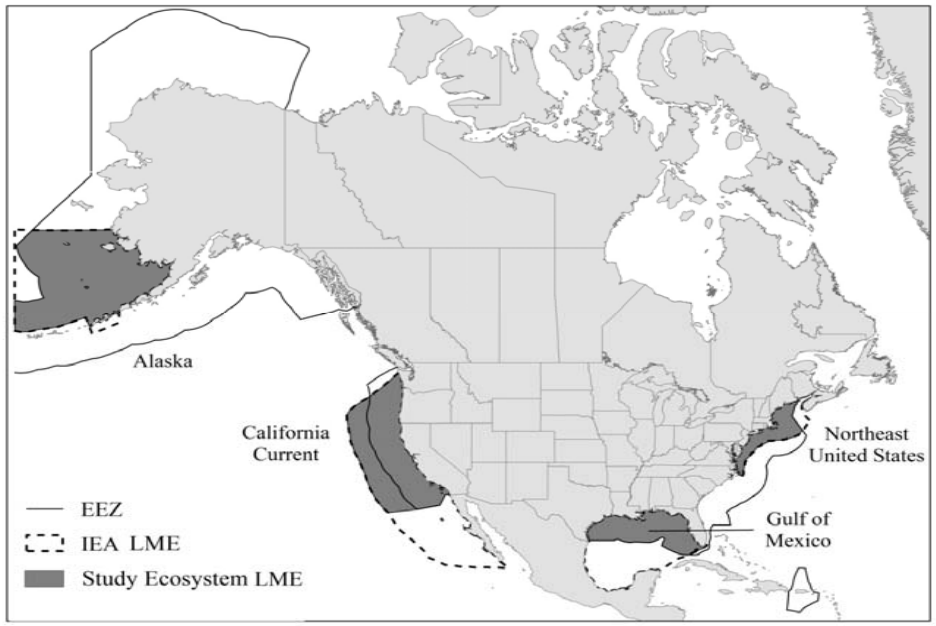
Ecosystem Status Reports

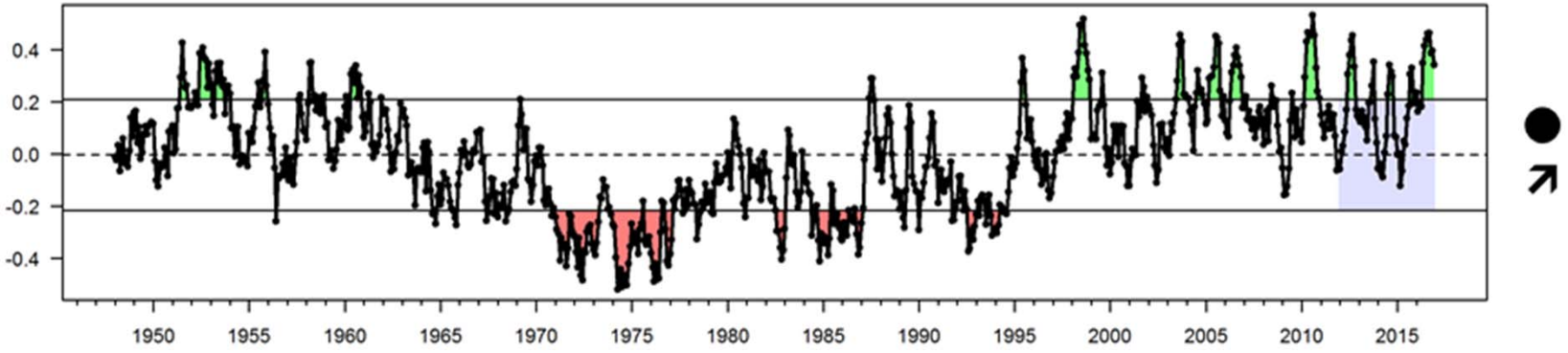
- Prescribed under NMFS EBFM Policy and Road Map
- Intended for use by Fishery Management Councils, other management bodies, and updated periodically
- Developed for California Current, Bering Sea/Gulf of Alaska, Northeast shelf, Hawaii, Gulf of Mexico



Ecosystem Status Reports

- Provide trends over time in multiple ecosystem components (i.e., indicators)
- Typically focused on regional spatial scale and monthly to annual time scale
- How have ecosystem components changed over time, and are they interrelated?

Atlantic Multidecadal Oscillation (AMO)



Typical Indicator Categories

- Climate drivers
- Physical/chemical pressures
- Habitat state
- Lower trophic levels
- Upper trophic levels
- Fishery indicators
- Human dimensions

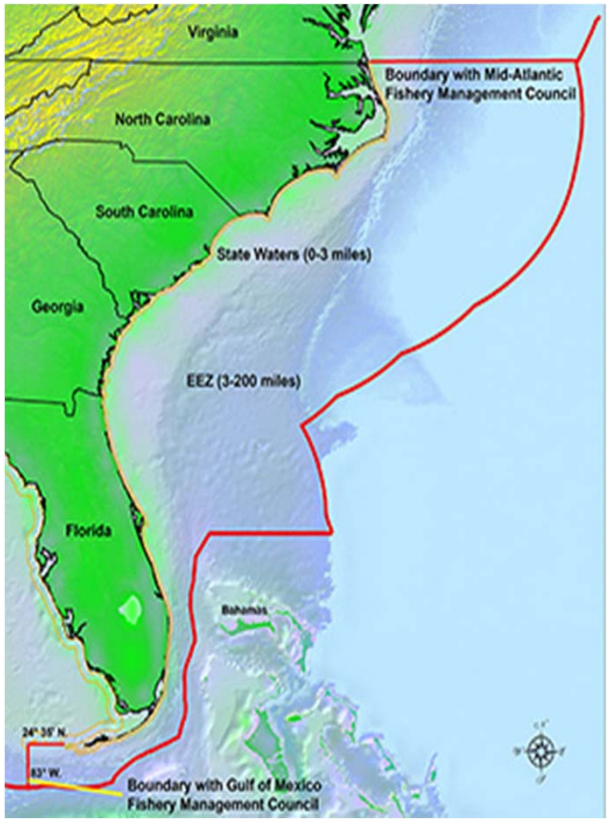
Physical and chemical pressures
Sea Surface Temperature
Bottom Temperature
Florida Current Transport
Gulf Stream Transport/Position
River Flow
Nutrient Loading
Precipitation and Drought
Sea Level Rise
Storms and Hurricanes
Ocean Acidification

Human Dimensions
Human population
Population density
Coastal urban land use
Total ocean economy
Social connectedness
Commercial and recreational fishing engagement

South Atlantic Ecosystem Status Report

Contributors

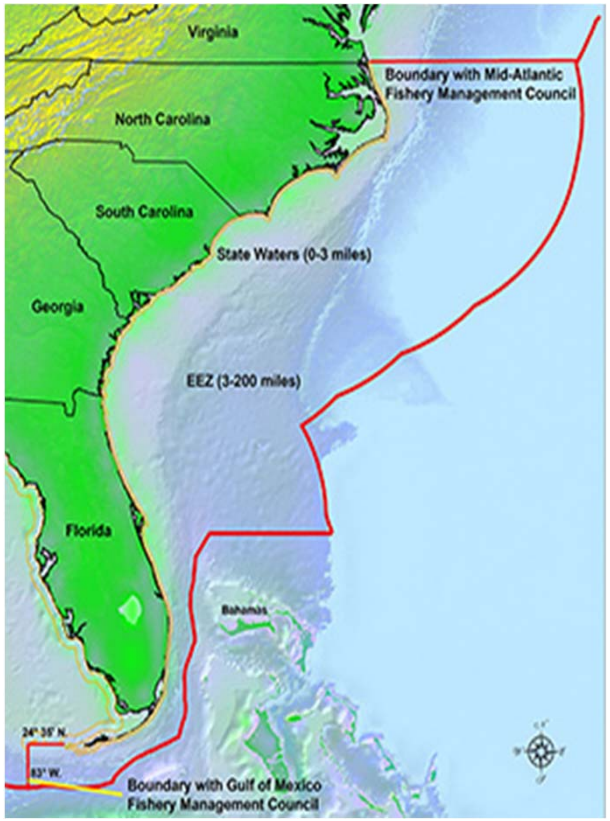
- SEFSC (Beaufort, Miami, Pascagoula Labs)
- NOS (Beaufort, Charleston)
- NOAA/OAR/AOML
- National Center for Atmospheric Research
- USGS
- ACCSP
- FL-FWC, GA-DNR, SC-DNR, NC Wildlife Resources Commission
- U. Delaware, Duke, UNC, NCSU



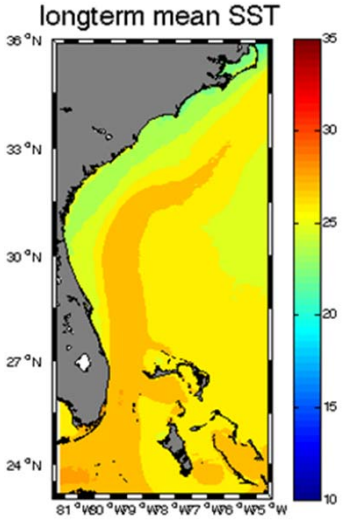
South Atlantic Ecosystem Status Report

Ecosystem components

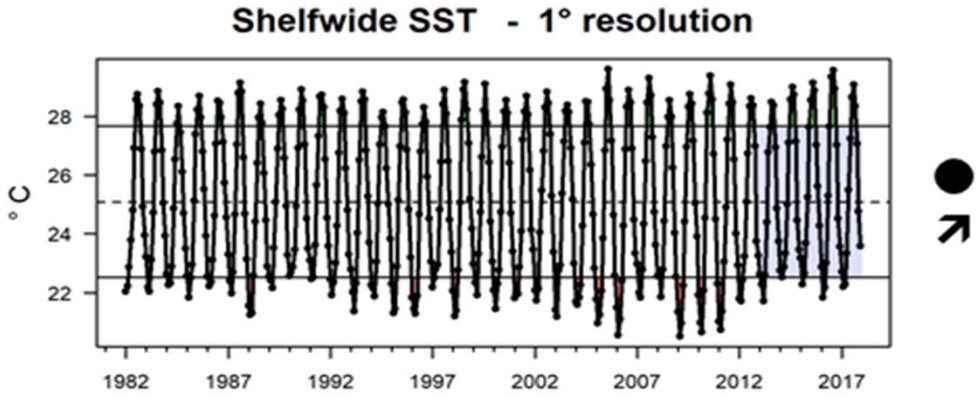
- Climate drivers
- Physical/chemical pressures
- Habitat state
- Lower trophic levels
- Upper trophic levels
- Fishery indicators
- Human dimensions

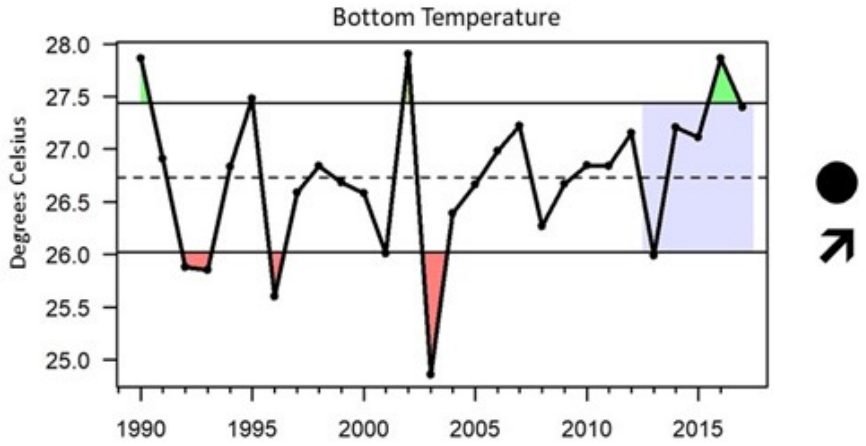


Example: temperature



Data from NOAA Reynolds OI SST

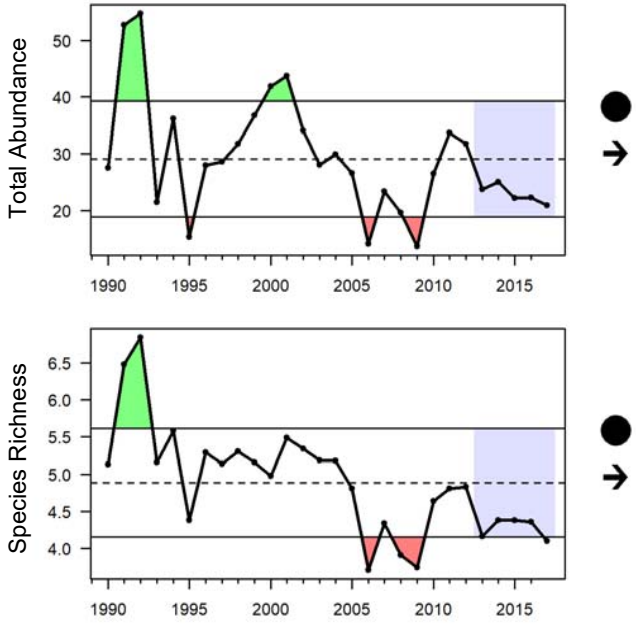




- Some indication of increasing sea surface temperature over the last ~ 5 years
- Driven by winter temperatures--rarely below 22 °C over last 5 years
- Greater than average bottom temperatures for most years since 2005

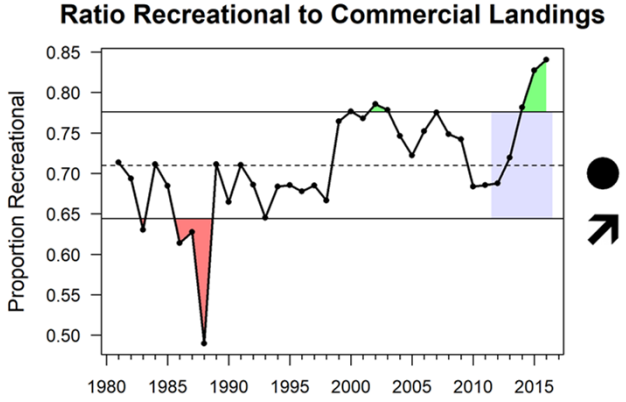
Example: Fishery Indicators

Declines in hard-bottom fishes



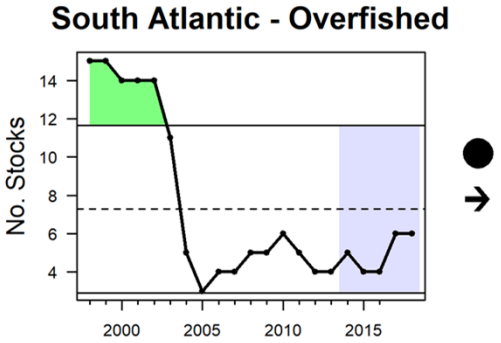
Bacheler & Smart (2016)

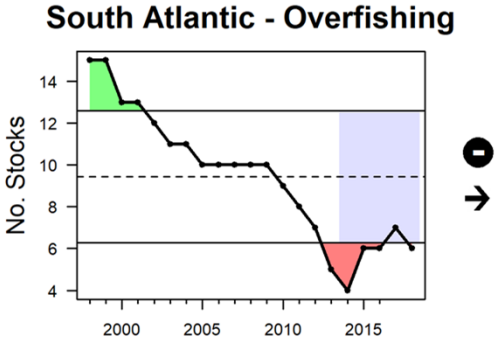
Changing South Atlantic fisheries



Shertzer et al. (2019)

Overfished & overfishing



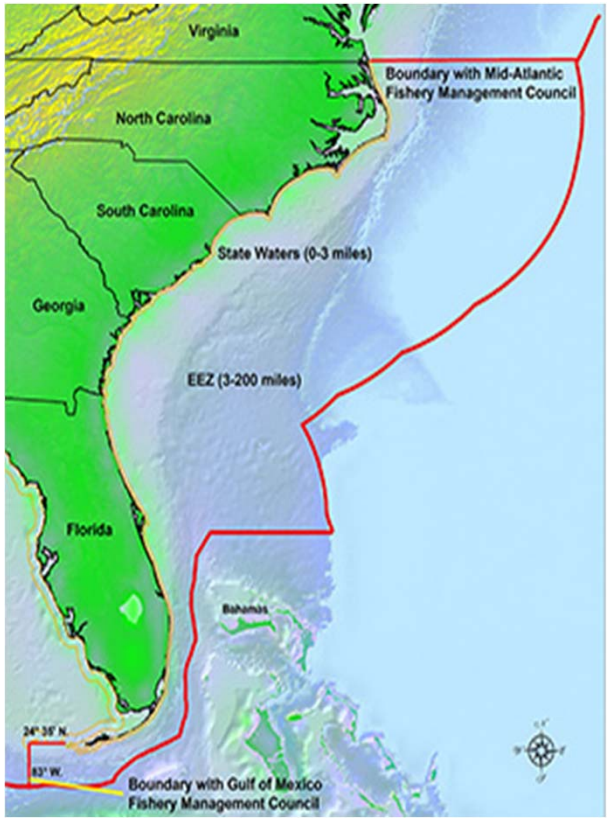


End of 2018:

- 29% overfishing
- 21% overfished
- 37.5% overfishing or overfished

Next Steps

- Complete compilation of time series
- Data synthesis and interpretation
- Goal: draft report completed in 2019 / early 2020
- Reviews and feedback in 2020
  - 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)
- Finalize report and update at regular intervals



Relevance to regional-scale priorities

SAFMC Fishery Ecosystem Plan II

- Actions 3 & 5 under “South Atlantic Food Webs and Connectivity and EFH”
  - Develop ecosystem indicators for key species and environmental drivers
  - Compile time series and/or spatial maps of temperature, chlorophyll -a, freshwater flow, salinity, etc.
- Action 2 under “South Atlantic Climate Variability and Fisheries”
  - Develop or select previously developed climate indicators and define triggers for when management action is needed

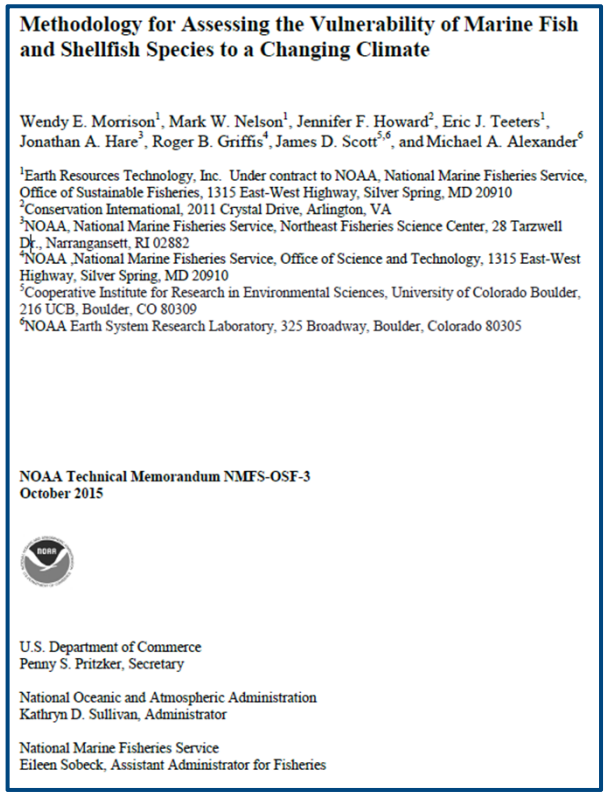
NMFS / SEFSC EBFM Implementation Plan

- One of five priority activities

Questions?

Climate Vulnerability Assessment

- A tool to determine which stocks/species will respond with a shift in abundance or productivity to a changing climate
- Priority under the NMFS National Climate Science Strategy and South Atlantic Climate Science Regional Action Plan
- Morrison, et al. 2015. Methodology for Assessing the Vulnerability of Marine Fish and Shellfish Species to a Changing Climate. U.S. DOC. NOAA Technical Memorandum NMFS-OSF-3, 48 p.
- Completed or underway for all NMFS regions



Methodology for Assessing the Vulnerability of Marine Fish and Shellfish Species to a Changing Climate

Wendy E. Morrison[1], Mark W. Nelson[1], Jennifer F. Howard[2], Eric J. Teeters[1], Jonathan A. Hare[3], Roger B. Griffis[4], James D. Scott[5,6], and Michael A. Alexander[6]

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NOAA Technical Memorandum NMFS-OSF-3
October 2015

U.S. Department of Commerce
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National Oceanic and Atmospheric Administration
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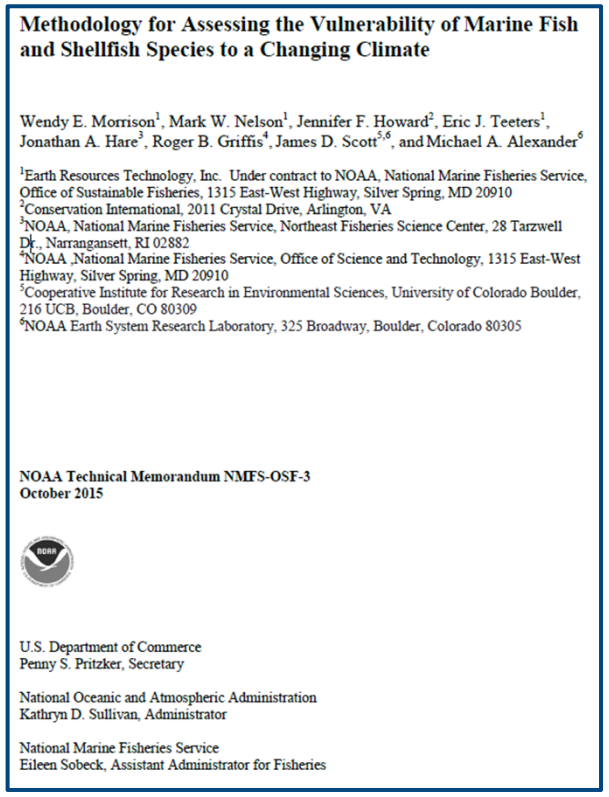
Climate Vulnerability Assessment

- Establish which stocks (species) might decline or expand in response to climate change in order to guide management, monitoring, and research decisions
- Identify key data gaps or information needs
- Identify communities dependent on vulnerable stocks to build greater economic resilience



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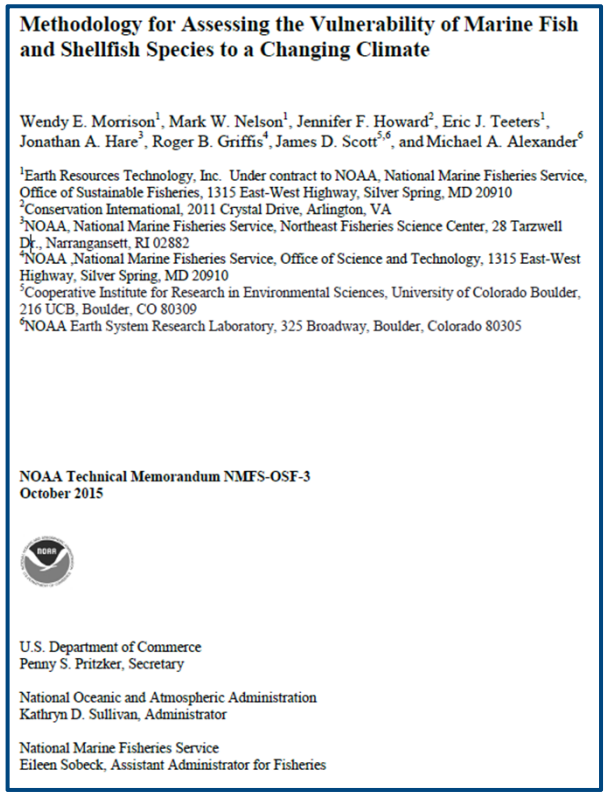
Steps in the CVA process

1. Identify species (N = 69) and compile detailed species-specific information (species profiles)

    - Snappers
    - Groupers
    - Other reef fishes
    - Sharks
    - Coastal nearshore species
    - Coastal pelagics
    - Invertebrates
    - Biomass / forage species
    - Lionfish



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Steps in the CVA process

2. Assess species-specific sensitivity to climate change across a suite of life-history characteristics (sensitivity attributes)

- Complexity in Reproduction
- Spawning Cycle Specifics
- Dispersal of Early Life Stages
- Early Life History Survival and Settlement Requirements
- Habitat Specificity
- Prey Specificity
- Adult Mobility
- pH preferences
- Thermal preferences
- Population Growth Rate
- Stock Size/Status
- Other stressors (e.g., HABs, invasive species)

Steps in the CVA process

2. Assess species-specific sensitivity to climate change across a suite of life-history characteristics (sensitivity attributes)

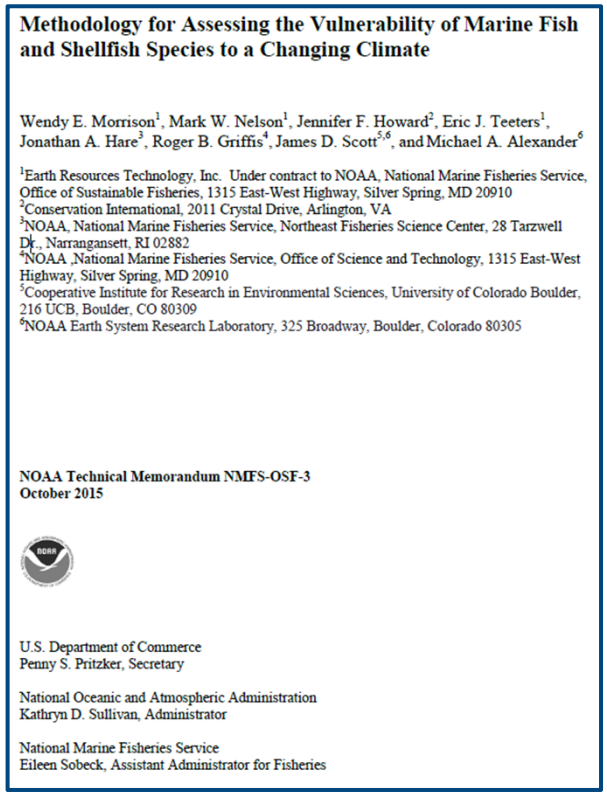
Contributors

- NOAA Beaufort Laboratory
- South Atlantic Fishery Management Council
- Atlantic States Marine Fisheries Commission
- North Carolina Division of Marine Fisheries
- South Carolina Dept. Natural Resources
- Georgia Department of Natural Resources
- Florida Fish and Wildlife Commission
- Academic partners
- Retired experts (Laney, Sedberry, Smith)

Steps in the CVA process

3. Compile time series of potential physical and biological drivers ("exposure factors")

- SST
- Air temperature
- Salinity
- pH (ocean acidification)
- Productivity
- Precipitation
- Currents / upwelling - qualitative
- Sea level rise - qualitative



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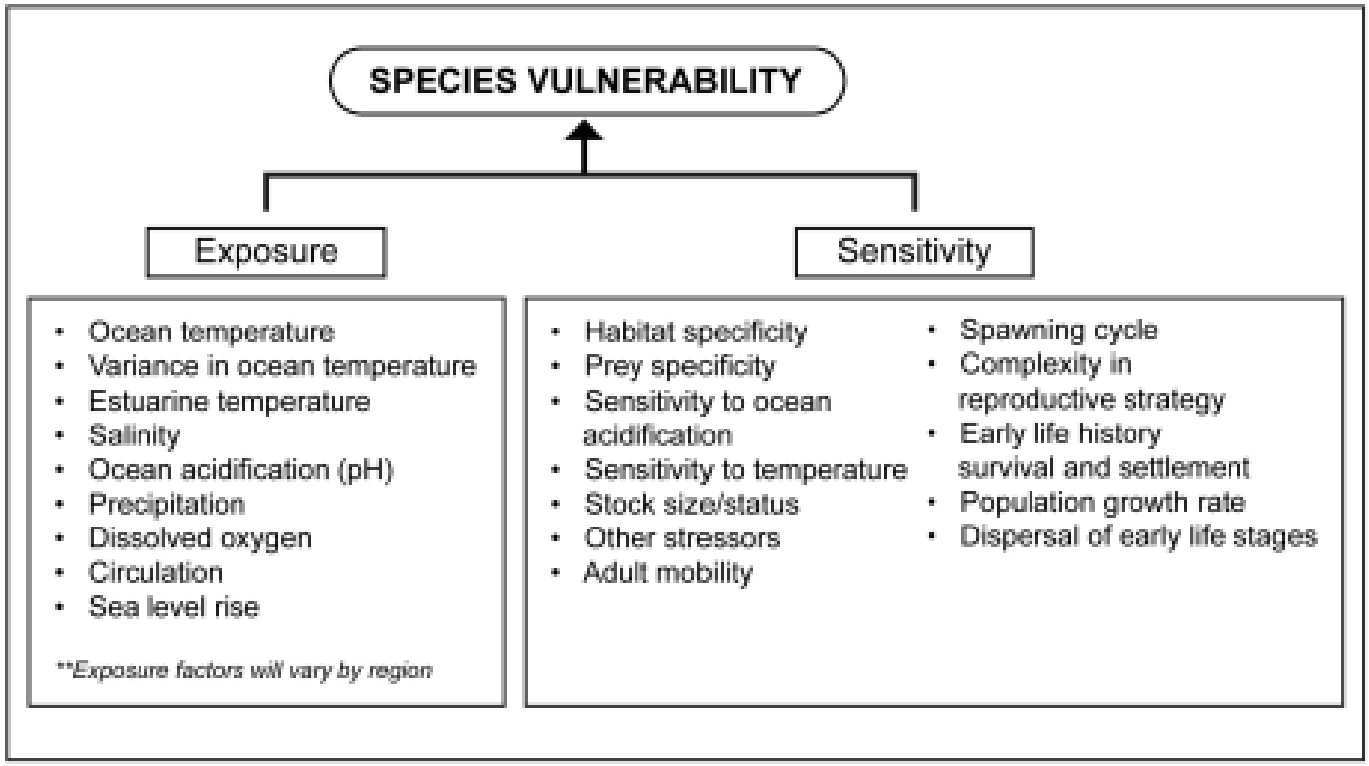
Steps in the CVA process

4. For each species, determine overall vulnerability and potential for distribution shifts



Morrison et al. 2015

Steps in the CVA process

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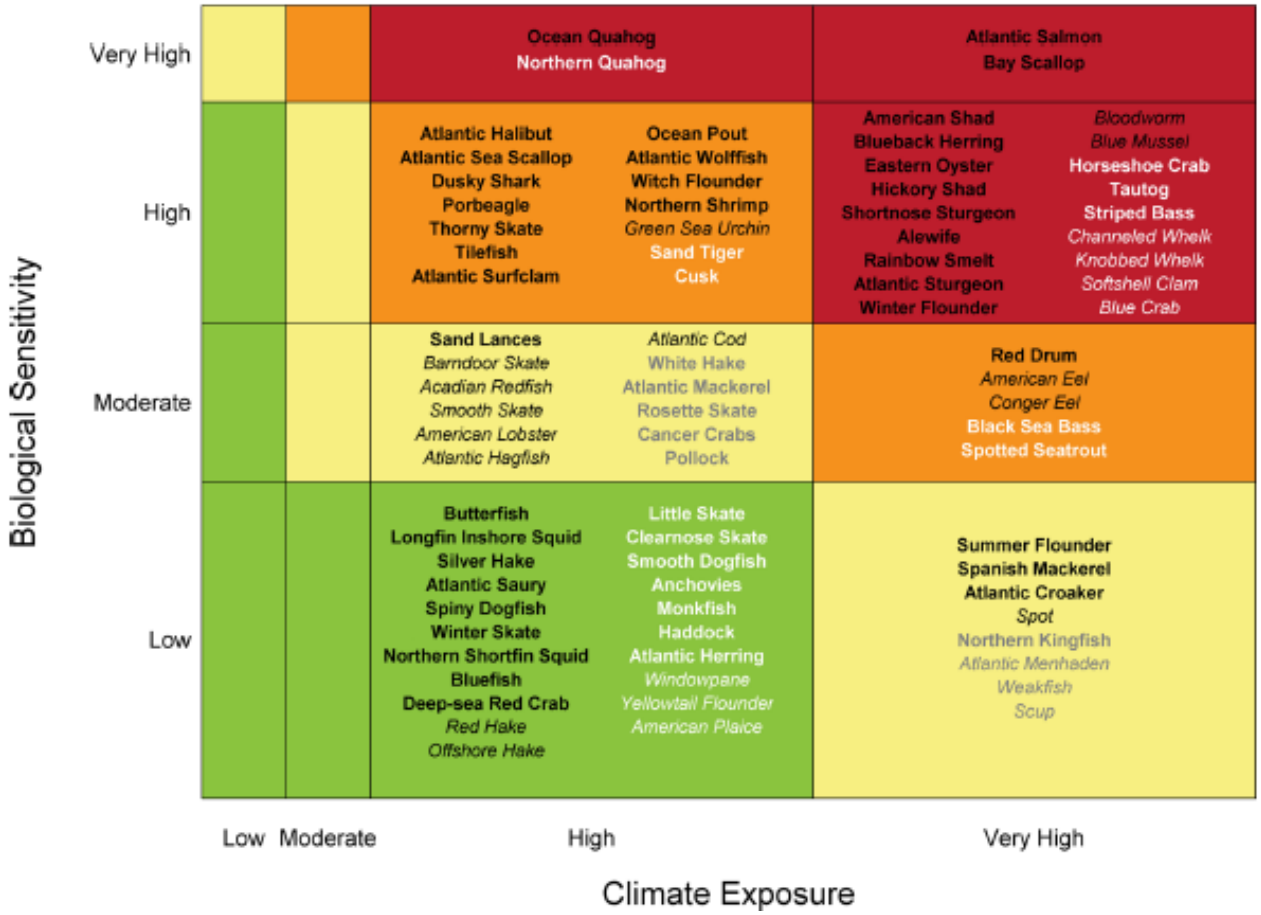

Hare et al. 2016

Steps in the CVA process

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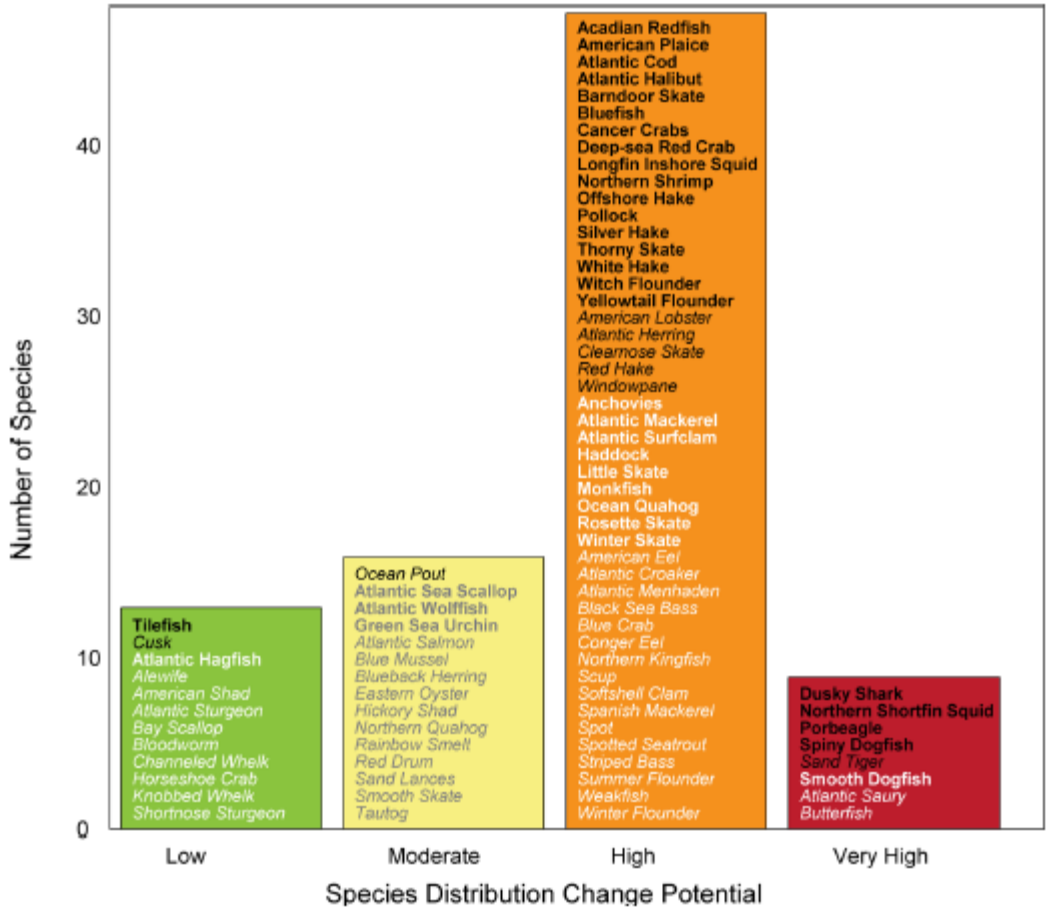
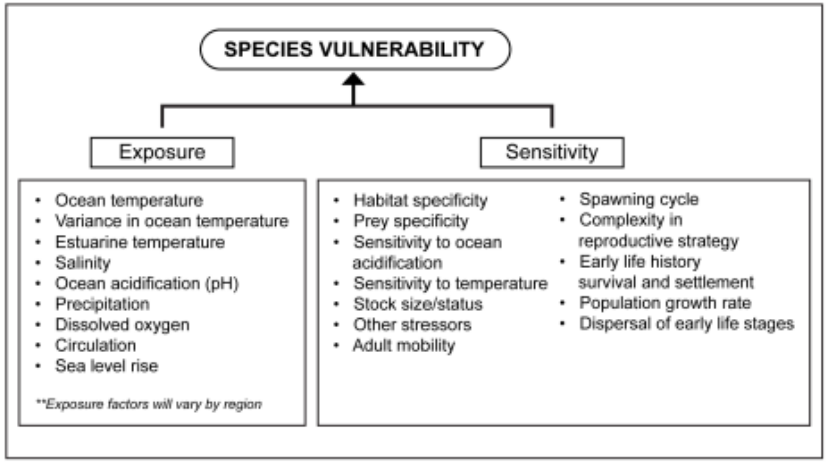


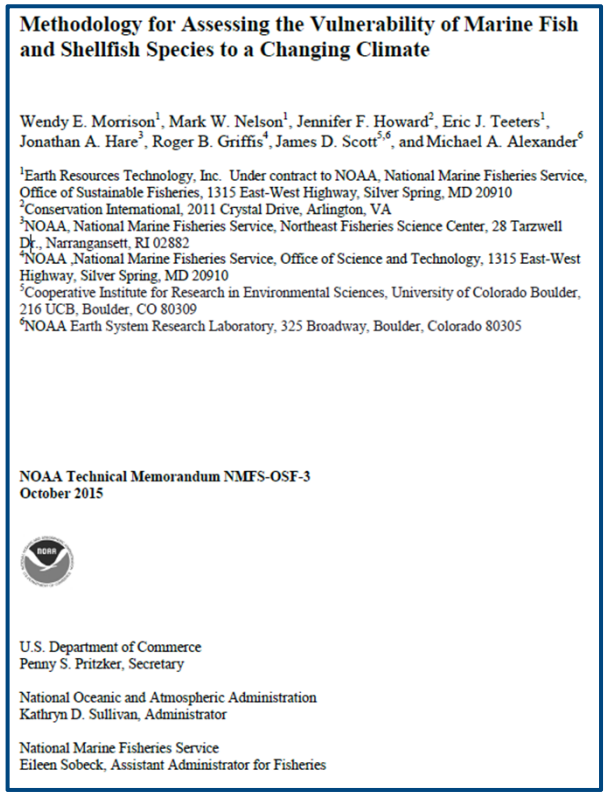
NOAA FISHERIES

Hare et al. 2016

Timeline

- Identify species (n = 69)
- Complete species profiles
- Expert scoring of species' sensitivity
- Select exposure factors and compile related data
- Data analysis and vulnerability assessment
- Final report - 2020





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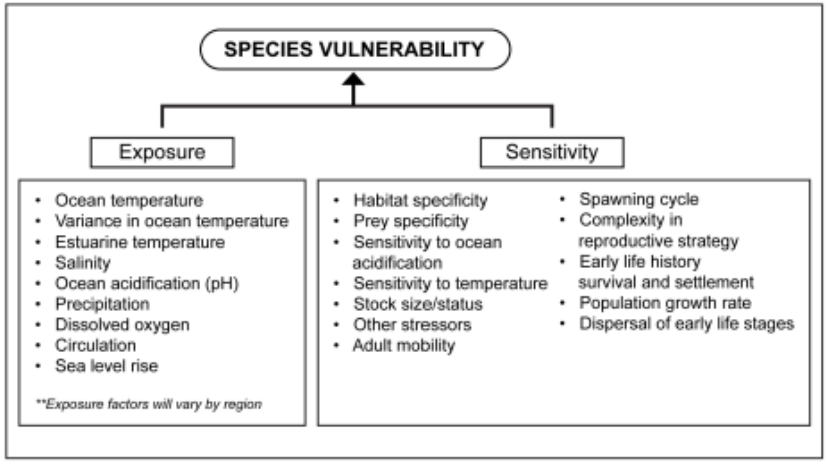

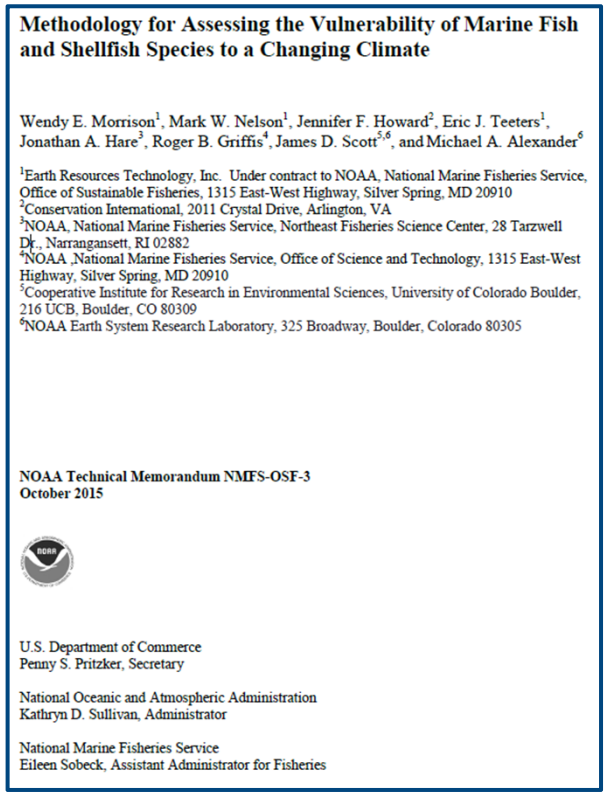

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Relevance to regional-scale priorities

SAFMC Fishery Ecosystem Plan II

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NMFS / SEFSC EBFM Implementation Plan

- One of five priority activities

Questions?