Management Strategy Evaluation for the SAFMC Snapper-Grouper Fishery

Snapper-Grouper Advisory Panel Meeting

Charleston, SC

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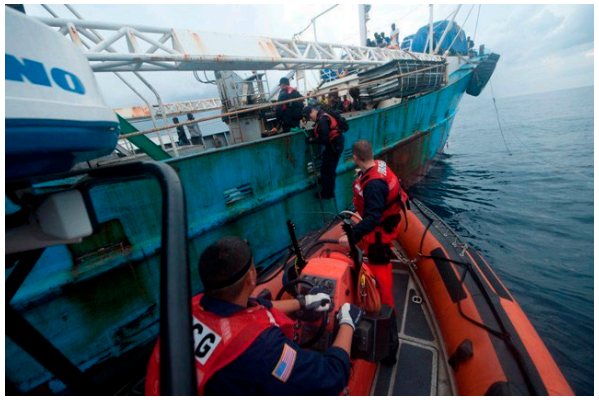
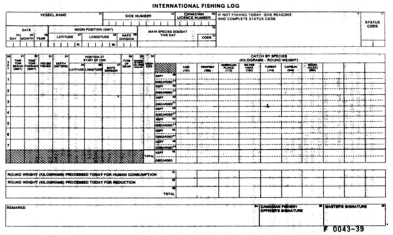
Outline

1. MSE: A quick re-cap
2. Management Options
3. Performance Metrics
4. Operating Model Development

MSE: A Quick Re-Cap

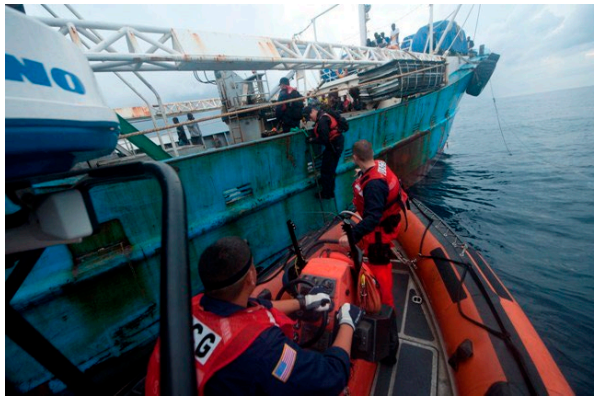
A Fishery System

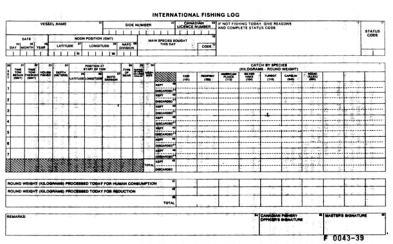




Virtual Fishery System

Operating Model





Virtual Fishery System

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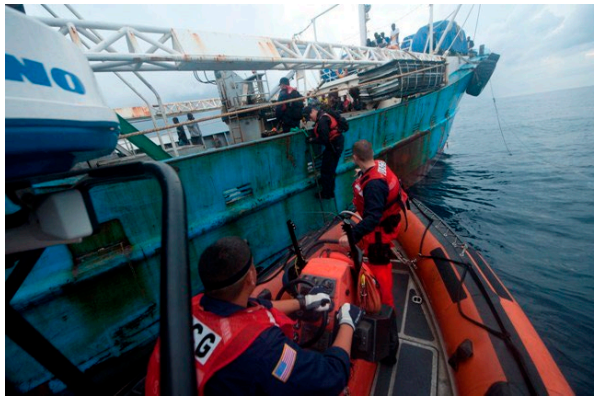
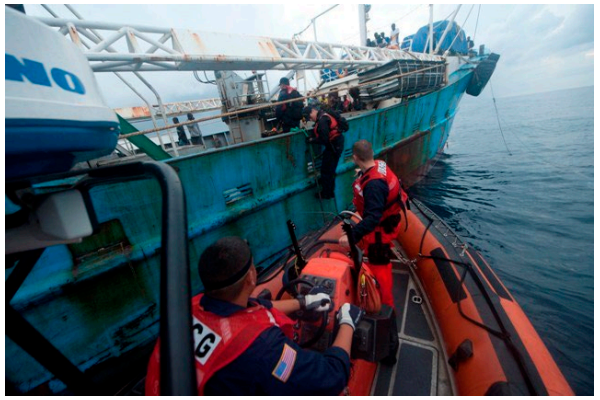


Observation Model

Virtual Fishery System

Operating Model



Observation Model

Management Procedure

Virtual Fishery System

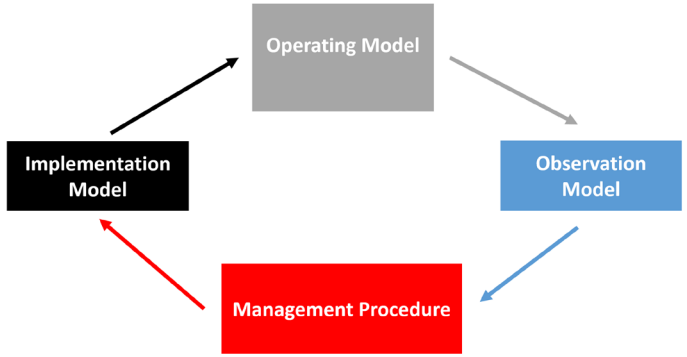
Operating Model

Observation Model

Management Procedure

Implementation Model

Management Strategy Evaluation (MSE)



A framework for ***reproducible***, ***transparent***, ***defensible*** decision-making for a system with high uncertainty

Reproducible: analysis can be repeated by others and gets the same result

Transparent: all steps in the decision-making process are explained and documented

Defensible: decisions are based on data, with clearly explained rationale

Components of an MSE

1. What do we ***know***?

2. What do we ***want***?

3. What ***can*** we do?

4. What ***should*** we do?

Components of an MSE

Operating Model

What do we ***know***?

Components of an MSE

Operating Model

What do we ***know***?

A *plausible* description of the properties of the fishery system

Components of an MSE

Operating Model

What do we ***know***?

A *plausible* description of the properties of the fishery system

1. Biology of the exploited species
2. Historical pattern of exploitation
3. Spatial distribution of stock and fleet(s)
4. Current stock status

Components of an MSE

Operating Model

What do we ***know***?

A *plausible* description of the properties of the fishery system

1. Biology of the exploited species
2. Historical pattern of exploitation
3. Spatial distribution of stock and fleet(s)
4. Current stock status

System uncertainties are captured in multiple operating models

Components of an MSE

Operating Model
What do we ***know***?

Performance Metrics
What do we ***want***?

Quantitative measures of management outcomes

Components of an MSE

Operating Model
What do we ***know***?

Performance Metrics
What do we ***want***?

Quantitative measures of management outcomes

1. How do we define good management outcomes?
2. How do define bad management outcomes?
3. What does the law require?

Components of an MSE

Operating Model
What do we ***know***?

Performance Metrics
What do we ***want***?

Quantitative measures of management outcomes

1. How do we define good management outcomes?
2. How do define bad management outcomes?
3. What does the law require?

May differ among stakeholders

MSE used to evaluate the trade-offs among management options

Components of an MSE

Operating Model
What do we ***know***?

Performance Metrics
What do we ***want***?

Management Options
What ***can*** we do?

Set of rules for converting data to a management decision

Components of an MSE

Operating Model
What do we ***know***?

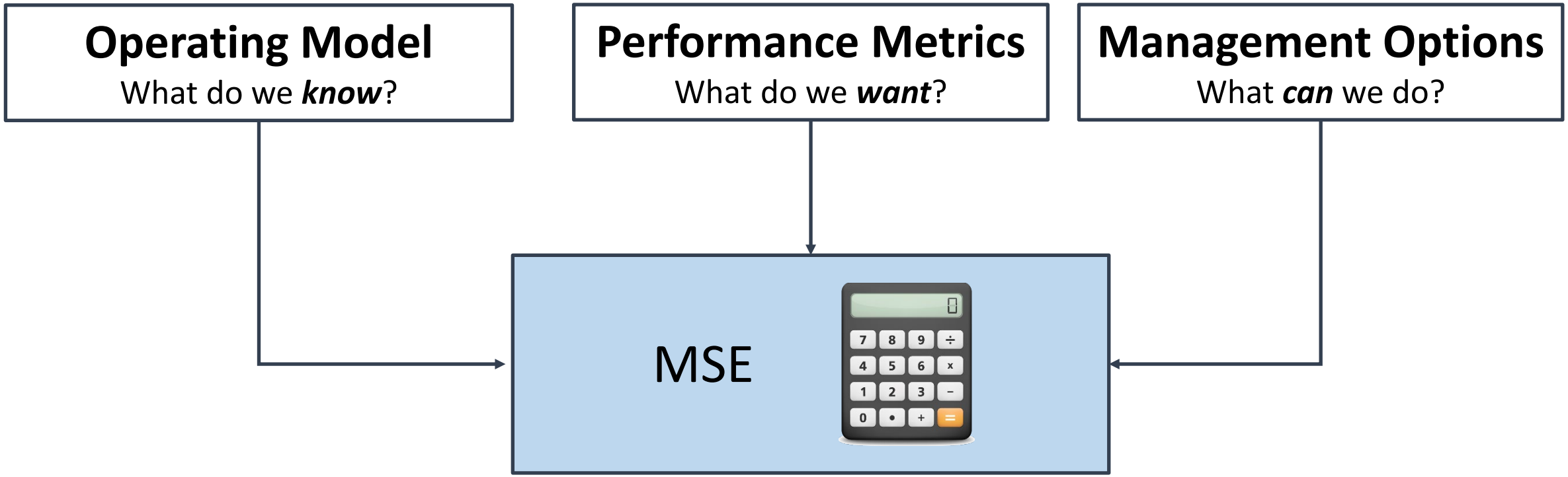
Performance Metrics
What do we ***want***?

Management Options
What ***can*** we do?

Set of rules for converting data to a management decision

1. What options exist for management?
2. What data can be used for management advice?
3. What additional data could be collected (improved)?

Components of an MSE



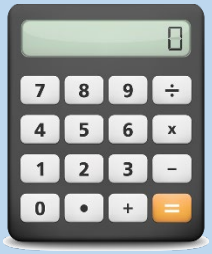
Components of an MSE

Operating Model
What do we ***know***?

Performance Metrics
What do we ***want***?

Management Options
What ***can*** we do?

MSE



Results
What ***should*** we do?

Components of an MSE

Results

What ***should*** we do?

1. What management option is most likely to achieve the desired outcomes?
2. What is the most important data to collect for generating management advice?
3. What are the most important system uncertainties that determine management performance?

Management Options

Management Options: What can we do?

Static Controls

Fixed regulations that don't change

1. Seasonal closures
2. Bag/retention limits
3. Size limits
4. Total allowable catch
5. Regional management

Dynamic Controls

Regulations change in response to data

1. Size frequency of catch
2. Trends in catch-rate
3. Indices of abundance (surveys)

Management Options: What can we do?

Evaluate management options by sector:

1. Commercial
2. Recreational Headboat
3. General Recreational

Performance Metrics

Performance Metrics: What do we want?

Quantitative measures of management outcomes

1. Biological
    a. Sustainability
    b. Probability of low biomass
    c. Probability of overfishing

2. Economic
    a. Catch
    b. Stability of catches
    c. Size composition of catch
    d. Opportunity

Performance Metrics: What do we want?

Biological

Management Objective

1. Avoid stock being in an overfished state

Quantitative Metric

1. Probability SSB > MSST (min. stock size threshold)

   MSST = 0.75 SSB_{MSY}

Performance Metrics: What do we want?

Biological

Management Objective

1. Avoid stock being in an overfished state
2. Avoid overfishing the stock

Quantitative Metric

1. Probability SSB > MSST (min. stock size threshold)
2. Probability F < MFMT (max. fishing mortality threshold)

   MFMT = F30% (red snapper) F_{MSY} (gag)

Performance Metrics: What do we want?

Biological

Management Objective

1. Avoid stock being in an overfished state
2. Avoid overfishing the stock
3. If overfished, rebuild stock to target within desired time-frame

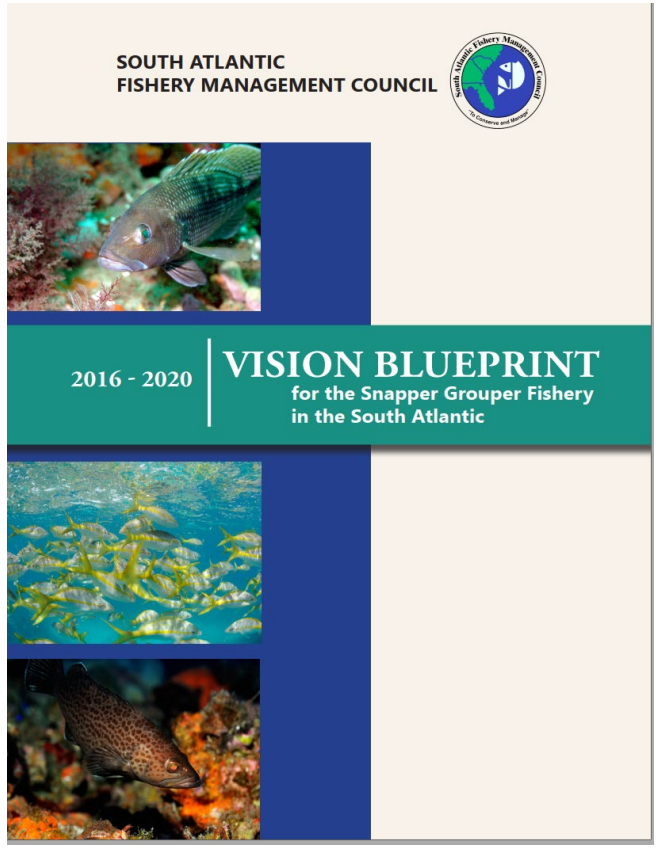
Quantitative Metric

1. Probability SSB > MSST (min. stock size threshold)
2. Probability F < MFMT (max. fishing mortality threshold)
3. Probability SSB > $SSB_{F30\%}$ or SSB > SSB_{MSY}(rebuilding target) by 2044 (red snapper) 2040 (gag)

Performance Metrics: What do we want?

Recreational and Commercial Objectives

SAFMC Council Meeting
March 2023



Performance Metrics: What do we want?

Recreational

Management Objective

1. Catch a lot of fish, keep enough to make the trip worthwhile; ‘Enough’ fish = one trophy fish to keep and some to take home

Quantitative Metric

1. Average catch rate (relative to current); Probability of catching trophy size fish

Performance Metrics: What do we want?

Recreational

Management Objective

1. Catch a lot of fish, keep enough to make the trip worthwhile; ‘Enough’ fish = one trophy fish to keep and some to take home
2. Maximize fishing opportunity; opportunity to go fishing when it best suits the angler

Quantitative Metric

1. Average catch rate (relative to current); Probability of catching trophy size fish
2. Season length and average catch

Performance Metrics: What do we want?

Recreational

Management Objective

1. Catch a lot of fish, keep enough to make the trip worthwhile; ‘Enough’ fish = one trophy fish to keep and some to take home
2. Maximize fishing opportunity; opportunity to go fishing when it best suits the angler
3. Reduce discards compared to kept fish

Quantitative Metric

1. Average catch rate (relative to current); Probability of catching trophy size fish
2. Season length and average catch
3. Calculate ratio of discards : kept fish

Performance Metrics: What do we want?

Commercial

Management Objective

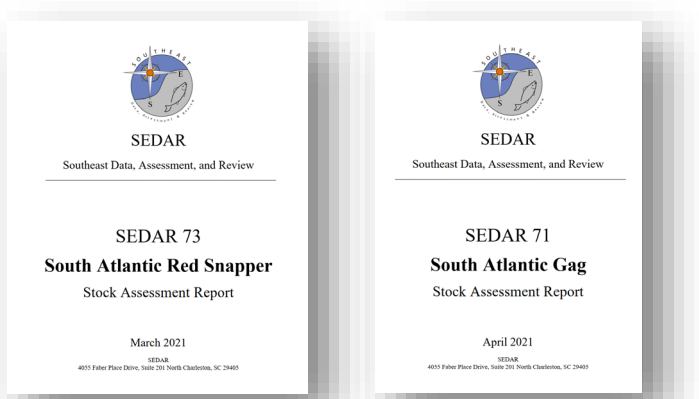
1. Stability in catch
2. Maximize yield
3. Reduce discards compared to kept fish

Quantitative Metric

1. Average inter-annual variability in catch
2. Average yield
3. Calculate ratio of discards : kept fish

Operating Model Development

Initial Approach


SEDAR

Southeast Data, Assessment, and Review

SEDAR 73

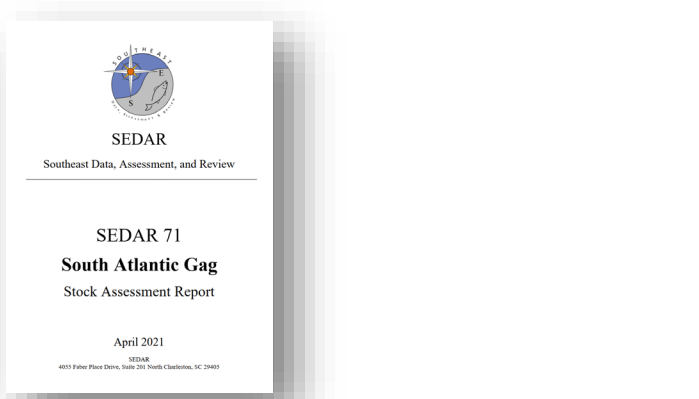
South Atlantic Red Snapper

Stock Assessment Report

March 2021

SEDAR

4055 Faber Place Drive, Suite 201 North Charleston, SC 29405


SEDAR

Southeast Data, Assessment, and Review

SEDAR 71

South Atlantic Gag

Stock Assessment Report

April 2021

SEDAR

4055 Faber Place Drive, Suite 201 North Charleston, SC 29405

Operating Model

What do we ***know***?

Initial Approach

Operating Model

What do we ***know***?

Issues:

Assessments structured fleets into:
Landed and Discarded Catch

Discarded Catch: discards during closed season + discards due to size limit, bag limit, etc

Need to separate removals (landings + discards) by season (on- and off-season)

Initial Approach

Operating Model

What do we ***know***?

Issues:

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Discarded Catch: discards during closed season + discards due to size limit, bag limit, etc

Need to separate removals (landings + discards) by season (on- and off-season)

Re-condition new operating models with raw data

Operating Model Conditioning: Data

Require data by season: On- and Off-Season (since 2012 RS; 1999 Gag)

Fishery Dependent

- Landings and Discards (Commercial; General Recreational, Recreational Headboat)
- Headboat Index of Abundance
- Length Composition
- Age Composition

Surveys

- SERFS Video Index
- SERFS Chevron Trap

Operating Model Conditioning: Structure of Fleets

Three Fleets:

1. Commercial Handline
2. General Recreational
3. Recreational Headboat

Four Fleets:

1. Commercial Handline
2. Commercial Dive
3. General Recreational
4. Recreational Headboat

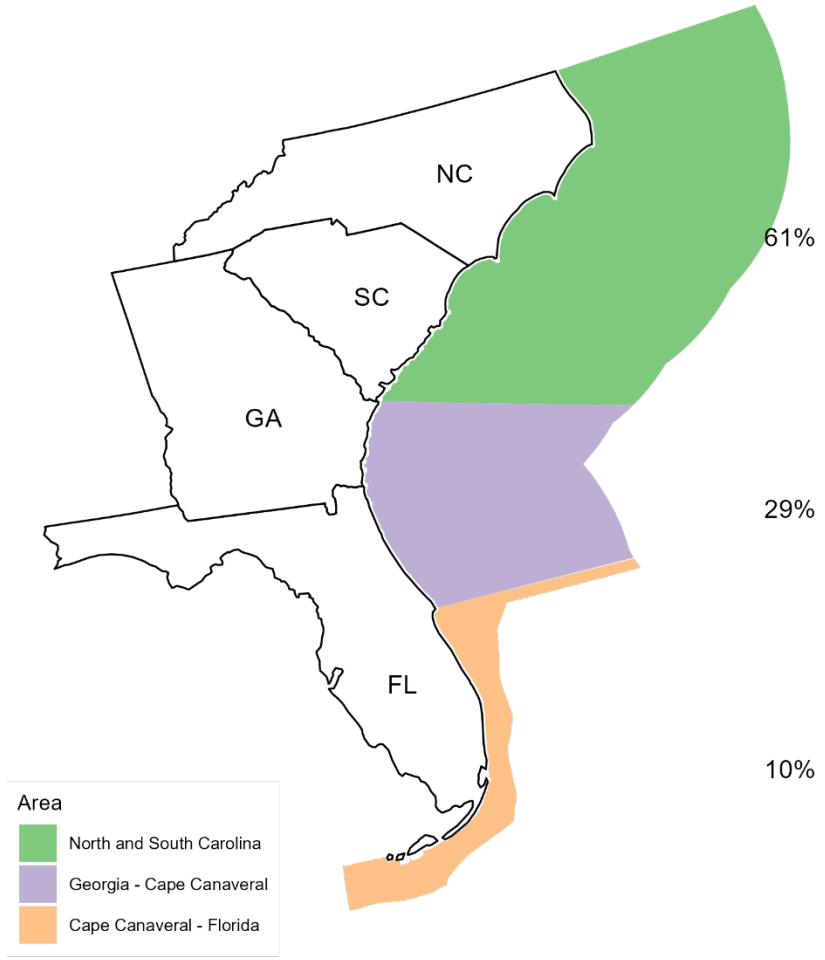
Split into On-Season and Off-Season

- Mini-seasons (red-snapper)
- Spawning closures (gag)

Operating Model Conditioning: Spatial Structure

Three Regions:

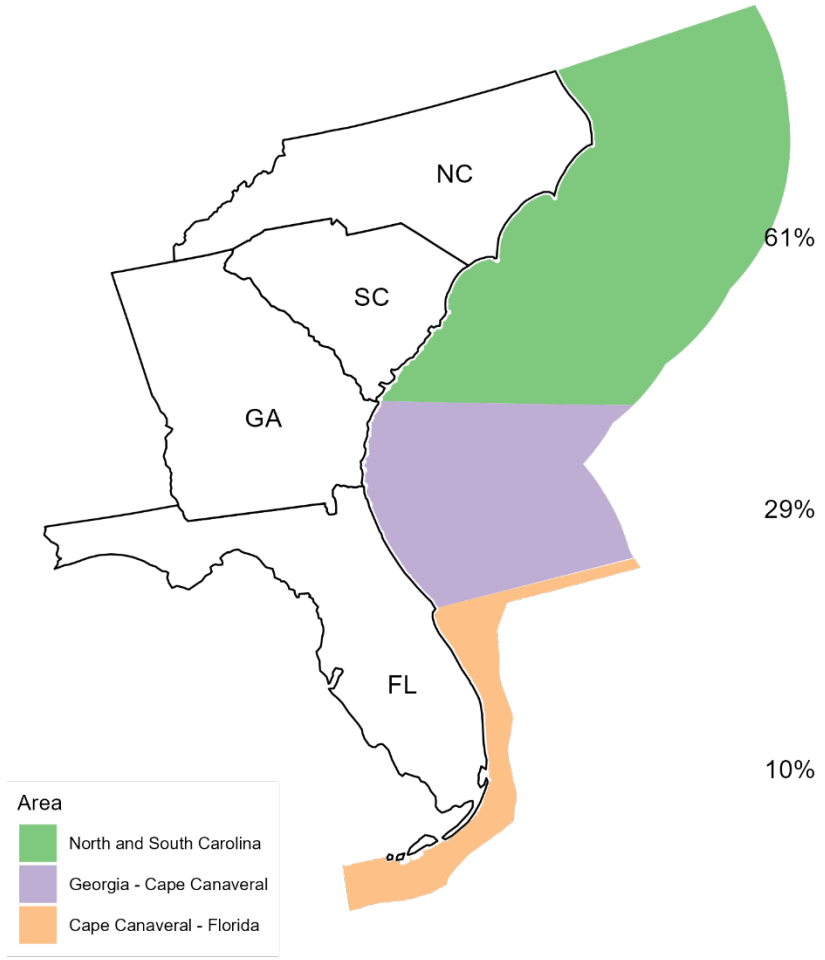
1. North and South Carolina
2. Georgia – Cape Canaveral
3. Cape Canaveral - Florida



Operating Model Conditioning: Spatial Structure

Key Uncertainties:

1. Distribution of stock biomass
2. Distribution of fishing effort (by fleet)



Operating Model Conditioning: Distribution of stock biomass

Trends in relative abundance of reef fishes in fishery-independent surveys in waters off the southeastern United States (SERFS)

Standardized Abundance Based on Southeast Reef Fish Survey Chevron Trap and the MARMAP/SEAMap-SA Short Bottom Longline and Long Bottom Longline Surveys

Bubley, W, et al. (2022)

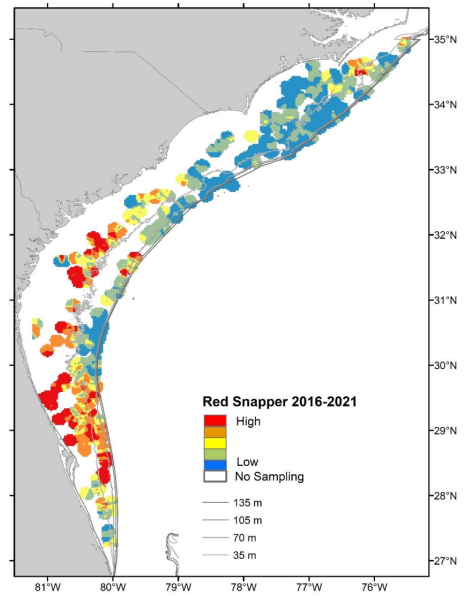


Figure 18. Distribution map of Red Snapper catch by SERFS from CHV in 2016-2021. Colors indicate quartiles by catch per trap hour and white indicates areas not sampled by SERFS. The map smoothing was accomplished with inverse distance weighting.

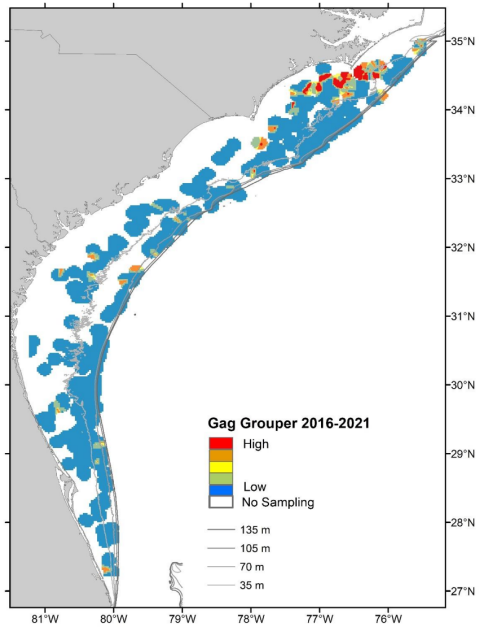
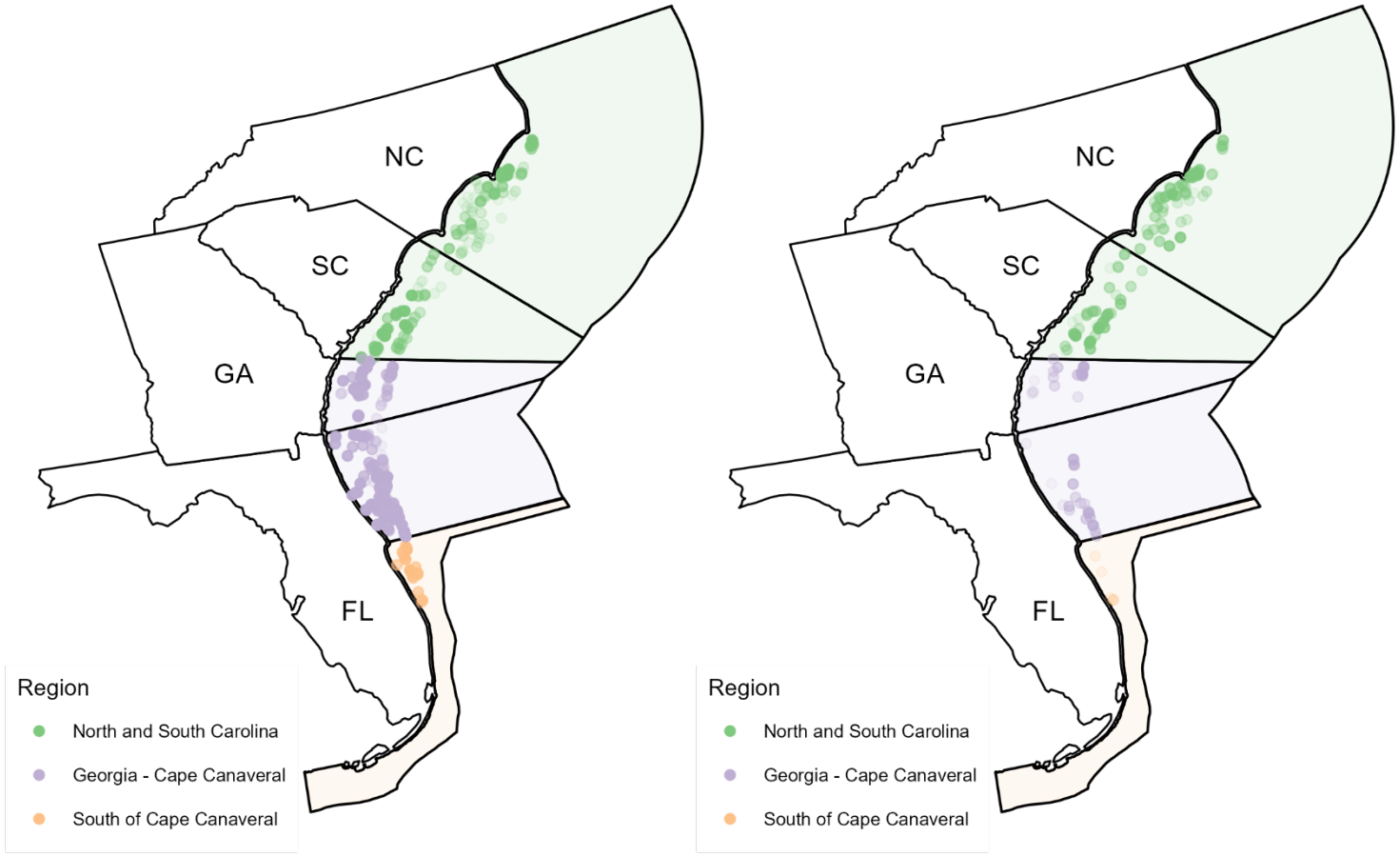


Figure 32. Distribution map of Gag catch by SERFS from CVT in 2016-2021. Colors indicate quartiles by catch per trap hour and white indicates areas not sampled by SERFS. The map smoothing was accomplished with inverse distance weighting.

Operating Model Conditioning: Distribution of stock biomass

Used SERFS data to:

- Calculate abundance (total weight/sampling duration) from all surveys (1990 – 2022)
- Calculate relative abundance by species and area

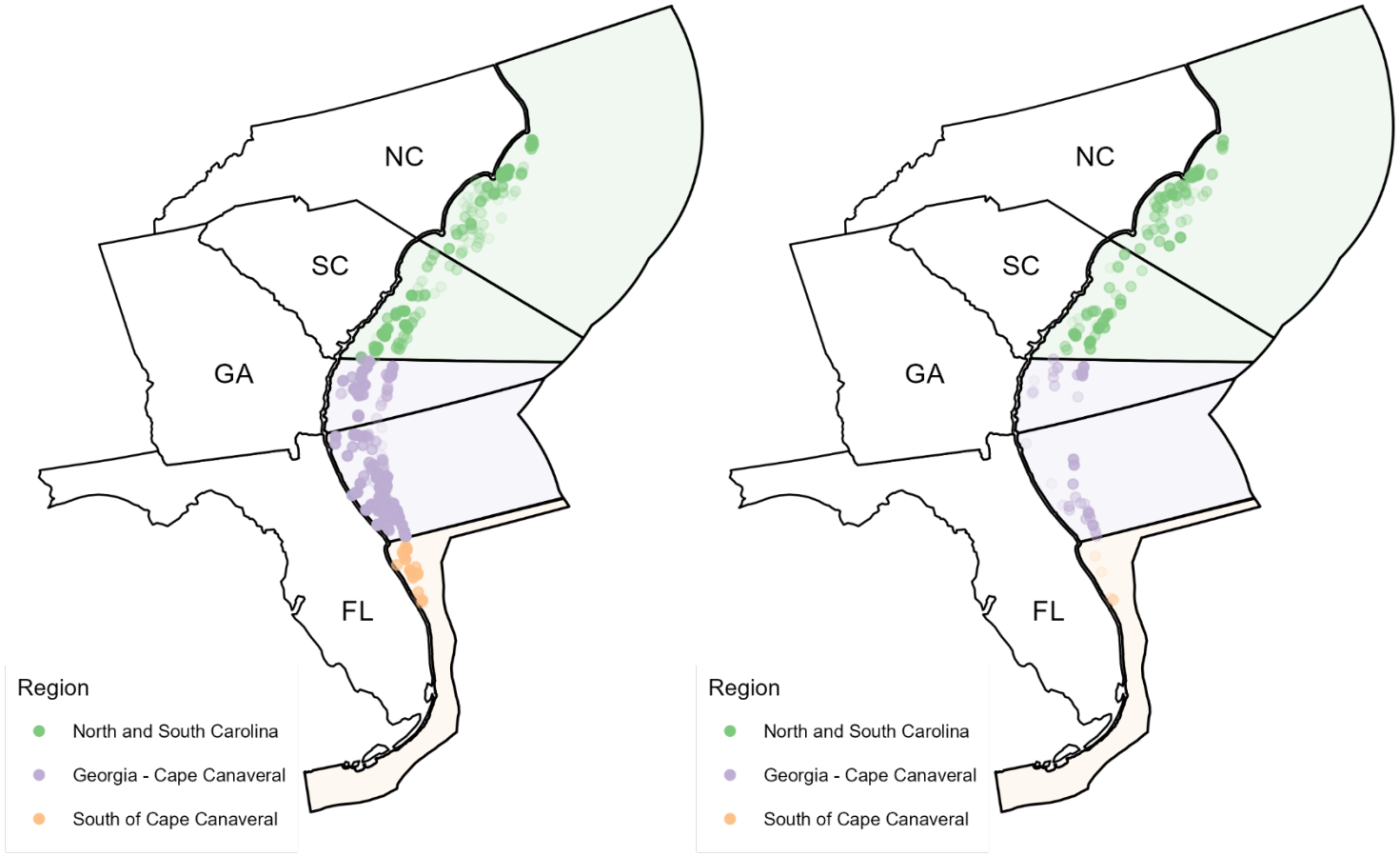


Operating Model Conditioning: Distribution of stock biomass

Used SERFS data to:

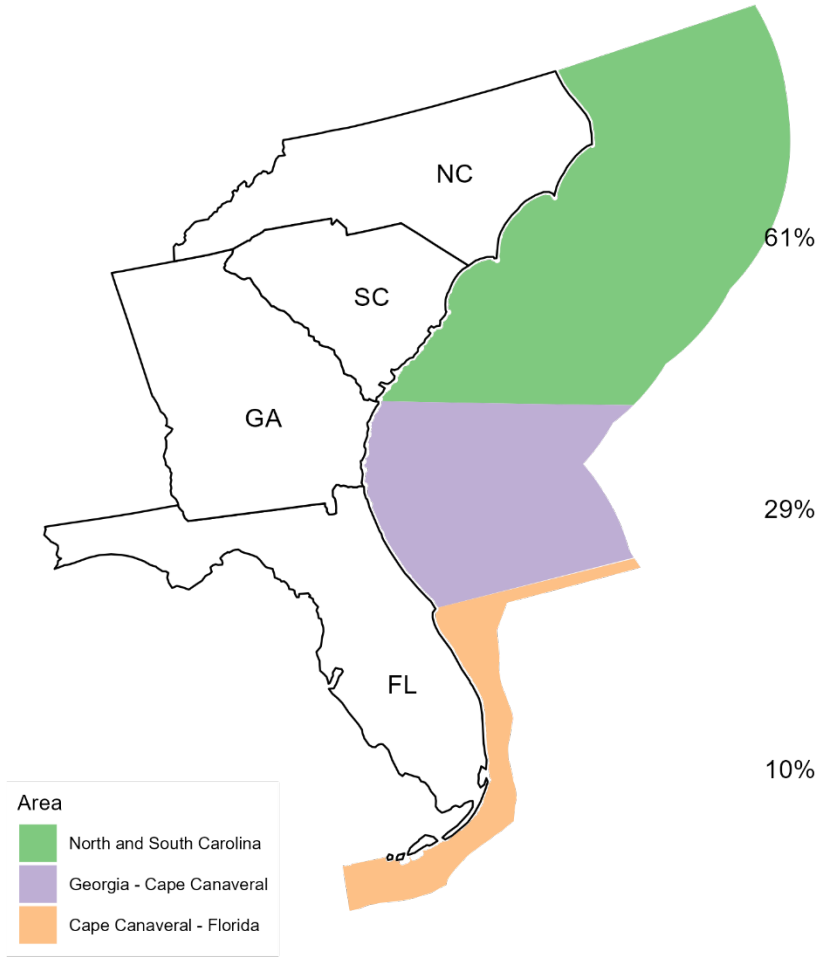
- Calculate abundance (total weight/sampling duration) from all surveys (1990 – 2022)
- Calculate relative abundance by species and area

- Extend into South Florida with Dive Survey Data?



Operating Model Conditioning: Distribution of fishing effort (by fleet)

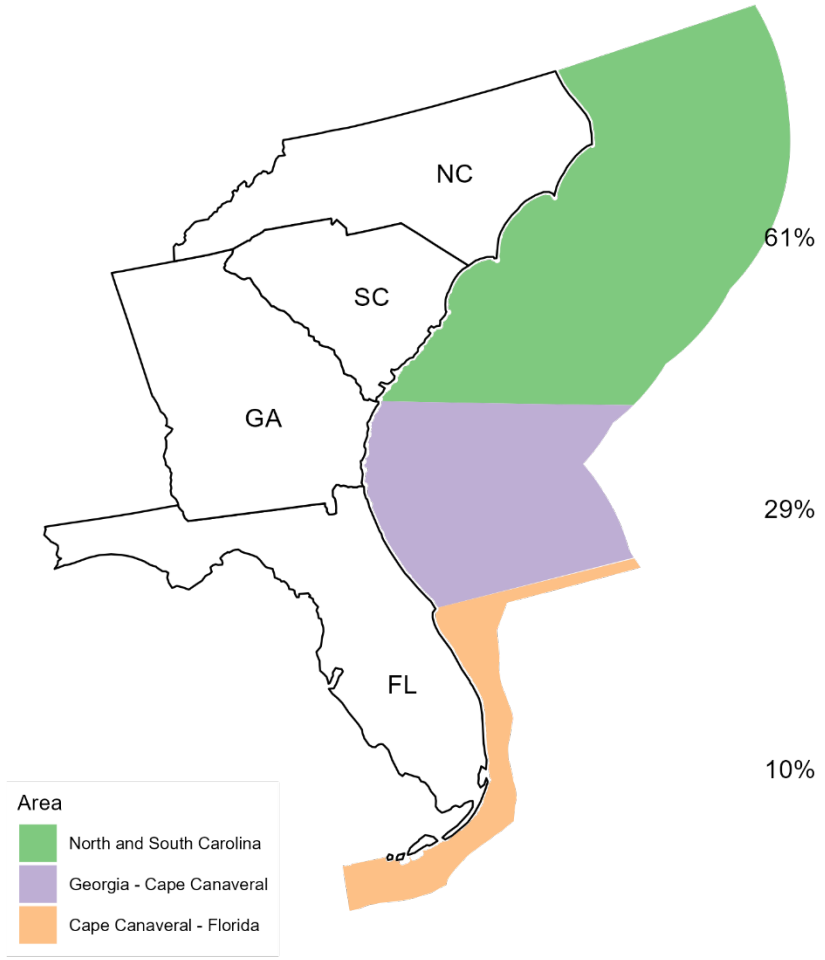
Are landings data available for these three regions (by fleet)?



Operating Model Conditioning: Distribution of fishing effort (by fleet)

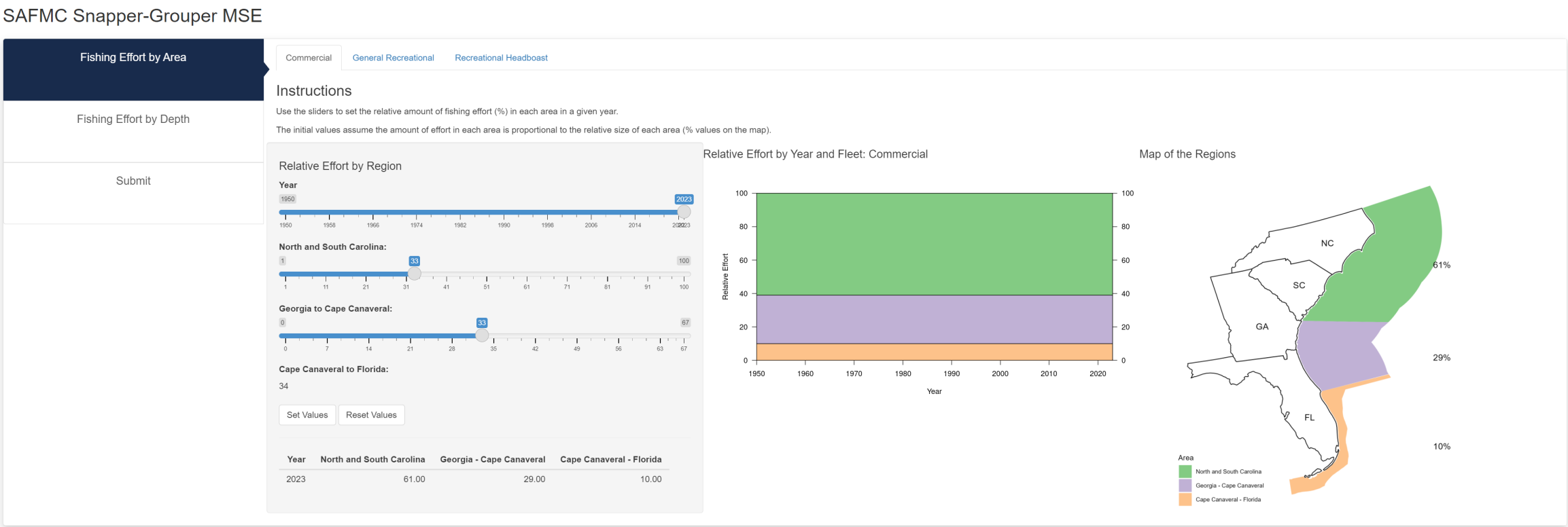
Are landings data available for these three regions (by fleet)?

If not, need to characterize distribution of fishing effort by area (by fleet, over time)



Operating Model Conditioning: Distribution of fishing effort (by fleet)

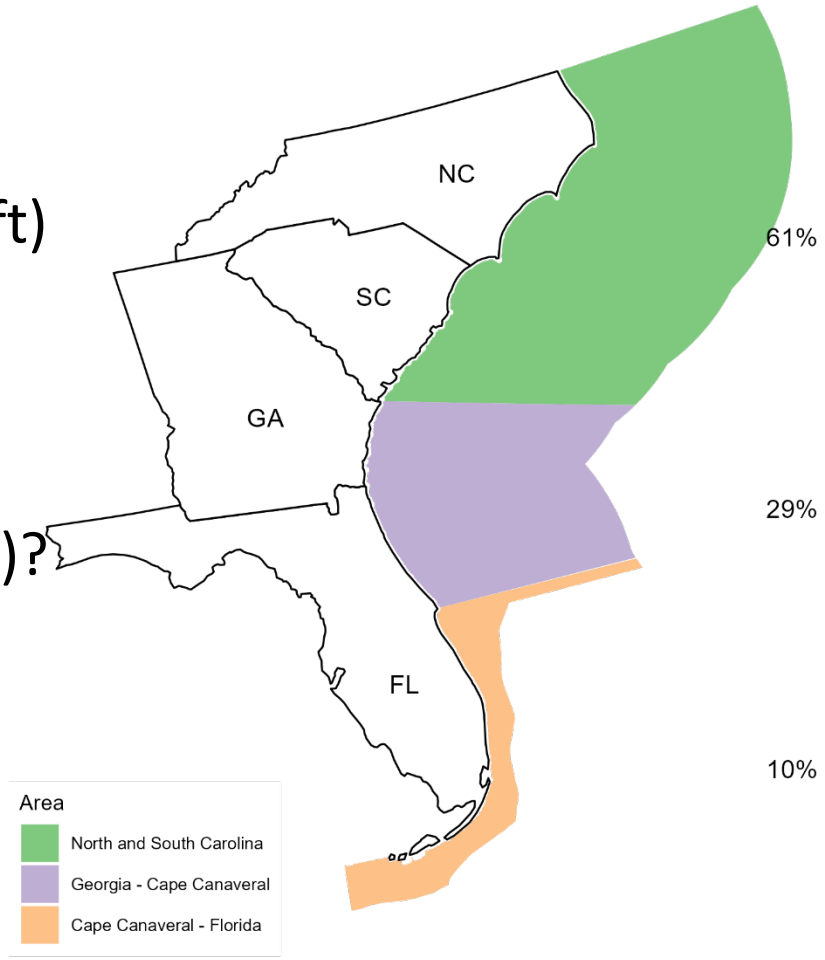
https://epa7lr-adrian-hordyk.shinyapps.io/effort_distribution/



Operating Model Conditioning: Distribution of fishing effort (by fleet)

Additional Spatial Structure:
Near-shore (< 100 ft) and Off-Shore (> 100 ft)

Can we characterize fishing effort by depth (near-shore vs off-shore) (by fleet & season)?



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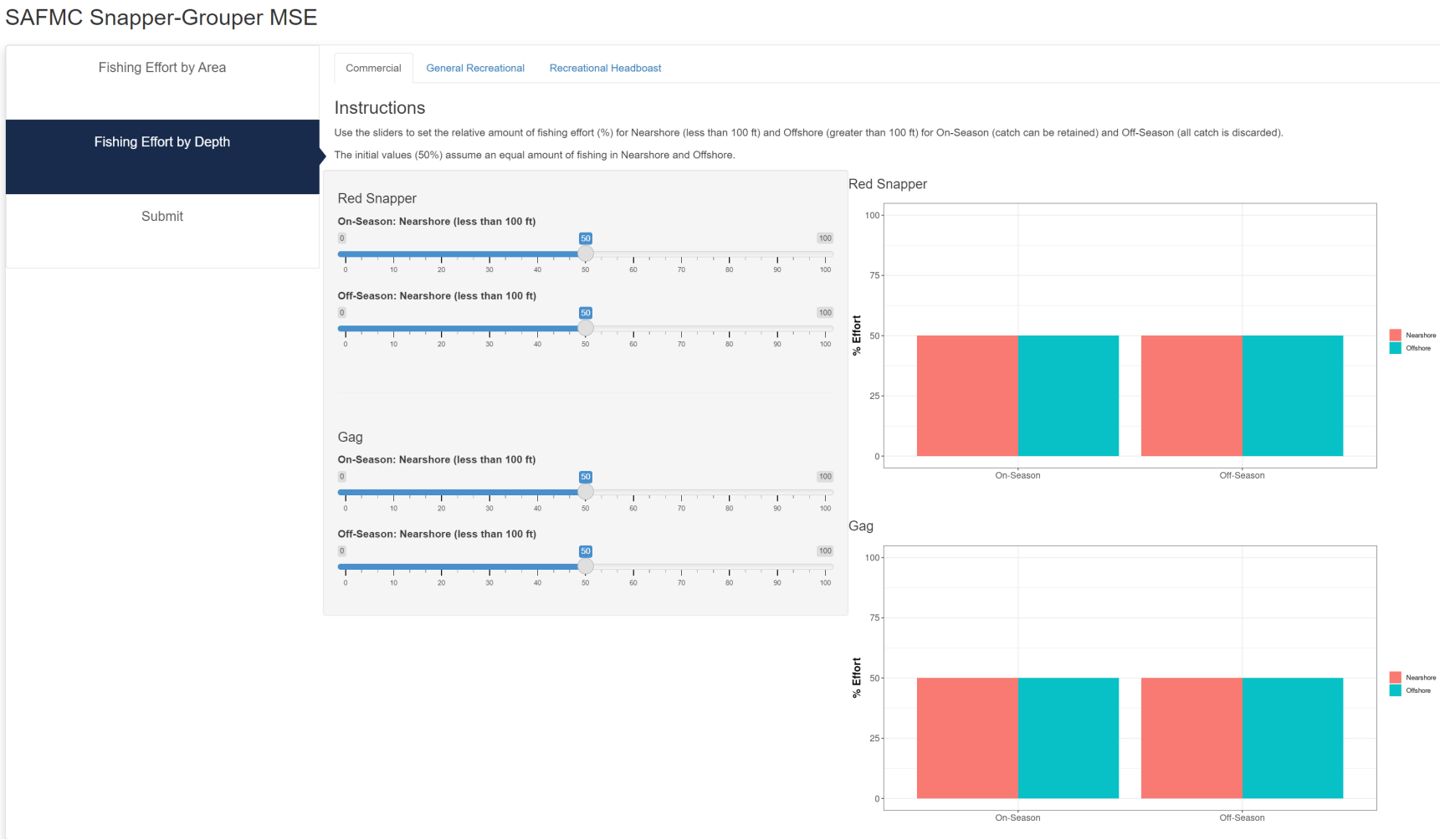

Operating Model Conditioning: Other Uncertainties

- Uncertainties in recreational data (landings, size composition)
- Uncertainties in commercial discards (logbook data & observer coverage)
- Natural mortality (assessment sensitivity tests)
- Discard mortality (assessment sensitivity tests)
- Other life-history parameters (assessment sensitivity tests)
- Recruitment scenarios (higher than average vs revert to mean)
- Estuarine/habitat issues & habitat restoration (robustness; recruitment)
- Implementation uncertainty
- Uncertainty in collected data

Conclusion

Summary

- Preliminary set of management options defined
- Preliminary set of performance metrics defined

Summary

- Preliminary set of management options defined
- Preliminary set of performance metrics defined

- Operating Models require conditioning:
  1. Working on accessing and formatting all available data
  2. Condition Base Case operating model
  3. Condition Robustness/Sensitivity OMs

Summary

- Preliminary set of management options defined
- Preliminary set of performance metrics defined

- Operating Models require conditioning:
  1. Working on accessing and formatting all available data
  2. Condition Base Case operating model
  3. Condition Robustness/Sensitivity OMs

- Add spatial structure scenarios to OMs
  1. Require definition of spatial structure of stock (SERFS & S Florida dive survey)
  2. Require definition of fishing effort by area (and depth) by fleet, season (and year)

Thank You

Questions and Discussion