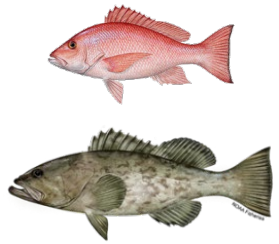
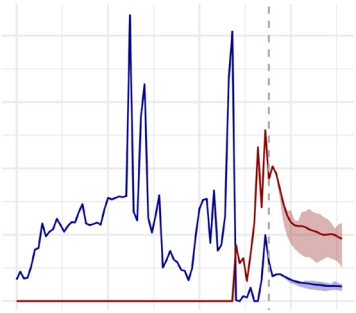
Management Strategy Evaluation for the South Atlantic Snapper-Grouper Fishery

Progress Report 2

Snapper Grouper Advisory Panel
Charleston, 11th October 2024

Adrian Hordyk & Tom Carruthers
tom@bluematterscience.com

bluematter

openMSE
www.openmse.com

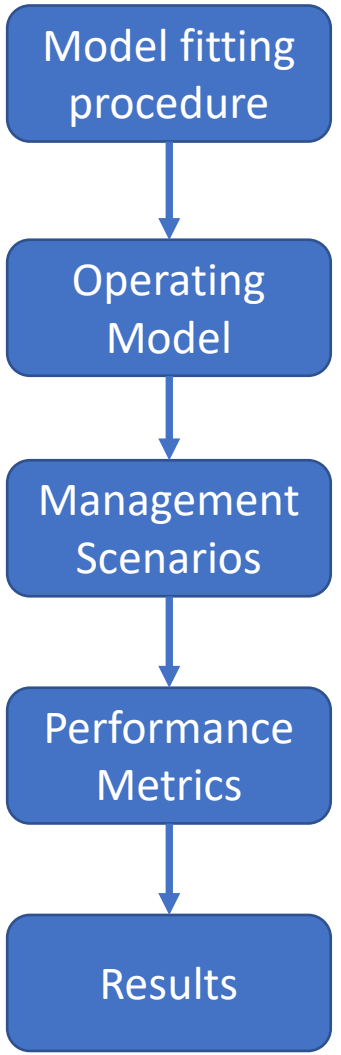
Outline

1. Project overview & progress
2. Model structure
3. Management questions that can be addressed
4. Example results
5. Challenges
6. Next steps
7. Resources

Project overview

Objective: Develop a framework to:

- construct multispecies operating models
- model potential management strategies for SAFMC fisheries
- evaluate results against established performance metrics
- extend analysis to additional species



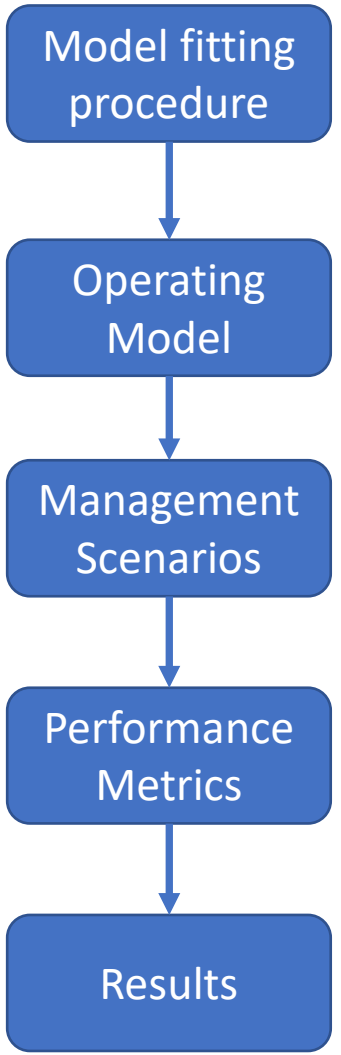
Progress

We have made a complete first pass at all of these steps

Hence we have a working MSE framework that can be used to demonstrate the effectiveness of various management options and show how performance can be evaluated.

Now we need feedback and direction on how to expand / improve it:

- additional system hypotheses
- management options
- performance metrics



Model Structure

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

Multi-Species Operating Model

Additional species to be added later

Model Structure

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

Multi-Species Operating Model

Assessment: Fleets structured into 'Landings' and 'Discards'

Operating Model: Require structure for On- and Off-Season fleets (landings & discards through selectivity and retention curves)

Model Structure

Red Snapper

Assessment

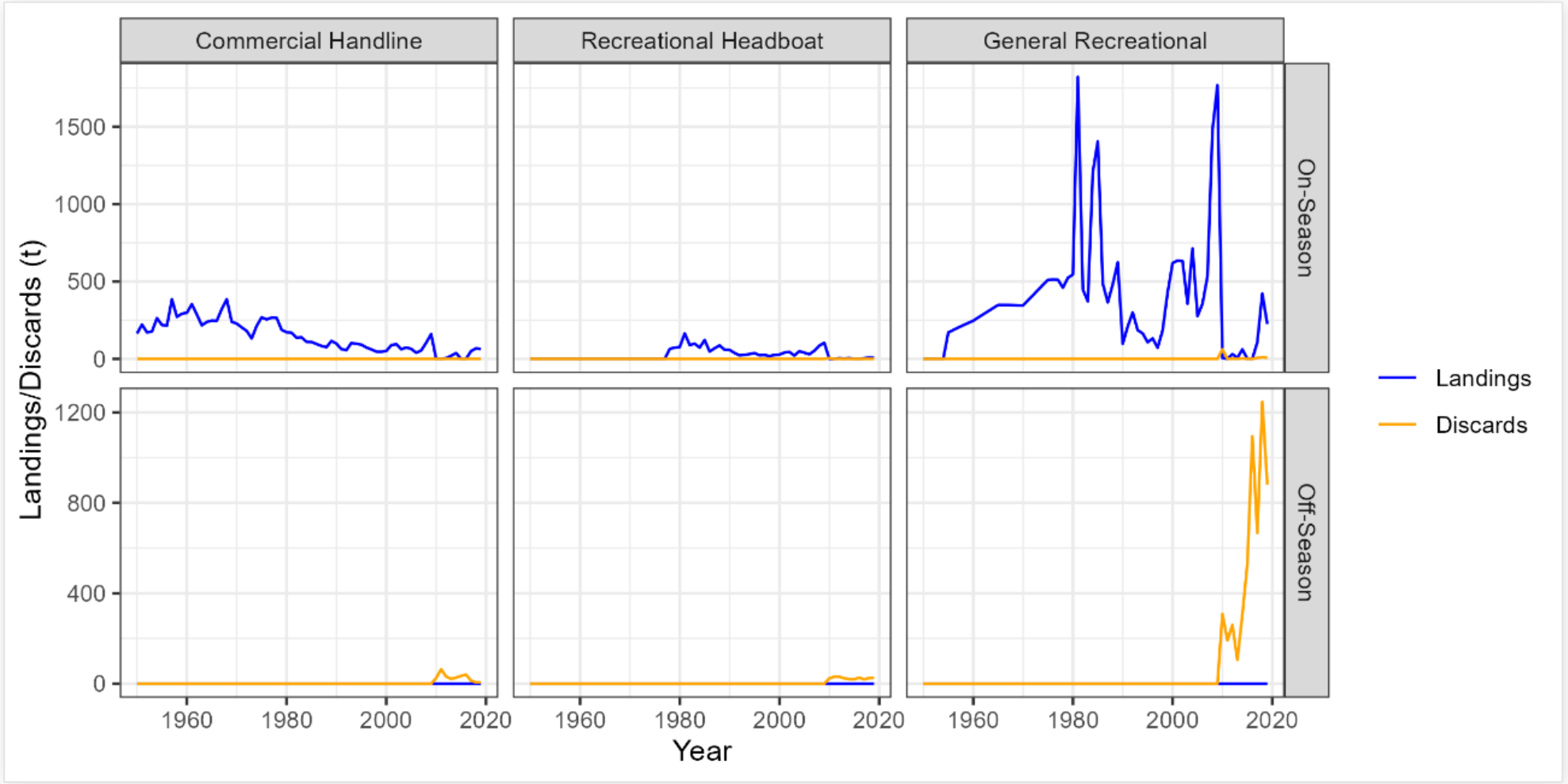
1. Commercial Handline (cHL)
2. Commercial Handline - Discards (cHL.D)
3. Recreational Headboat (rHB)
4. Recreational Headboat - Discards (rHB.D)
5. General Recreational (rGN).
6. General Recreational - Discards (rGN.D).

Operating Model

1. Commercial Handline - On-Season
2. Commercial Handline - Off-Season
3. Recreational Headboat - On-Season
4. Recreational Headboat - Off-Season
5. General Recreational - On-Season
6. General Recreational - Off-Season

Model Structure

Red Snapper



Model Structure

Gag Grouper

Assessment

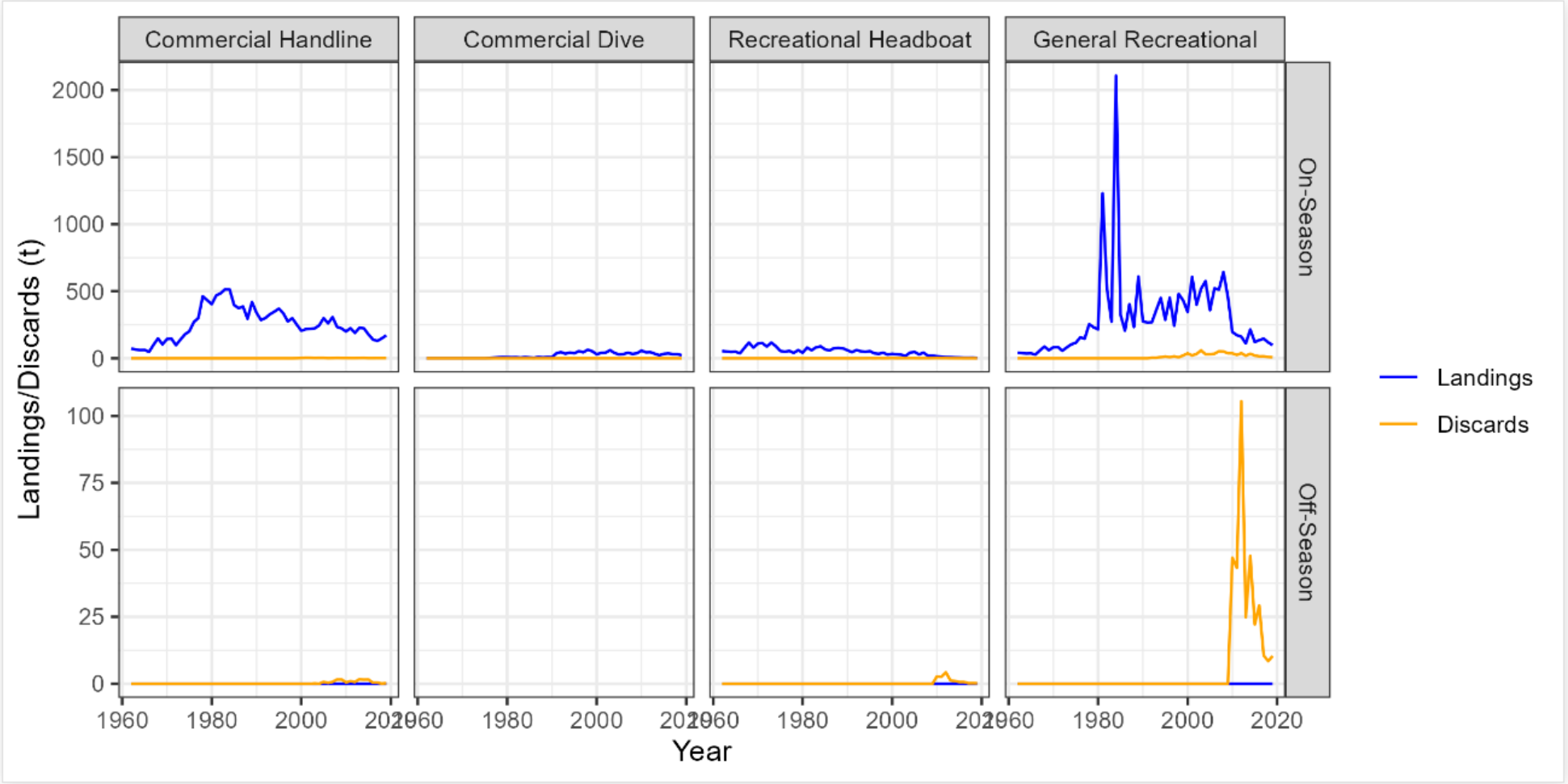
1. Commercial Handline (cHL)
2. Commercial Handline - Discards (cHL.D)
3. Recreational Headboat (rHB)
4. Recreational Headboat - Discards (rHB.D)
5. General Recreational (rGN).
6. General Recreational - Discards (rGN.D).
7. Commercial Dive (cDV)

Operating Model

1. Commercial Handline - On-Season
2. Commercial Handline - Off-Season
3. Recreational Headboat - On-Season
4. Recreational Headboat - Off-Season
5. General Recreational - On-Season
6. General Recreational - Off-Season
7. Commercial Dive - On-Season

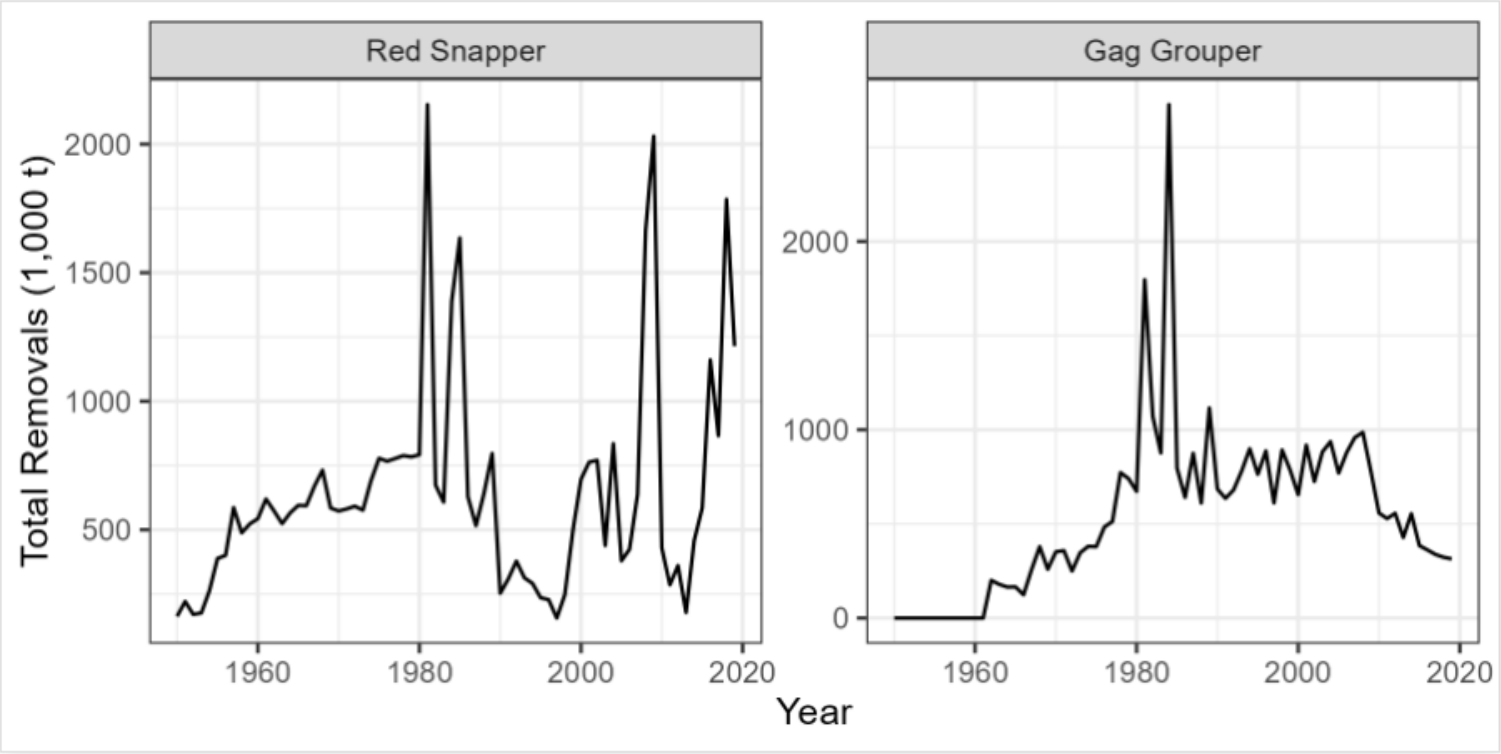
Model Structure

Gag Grouper



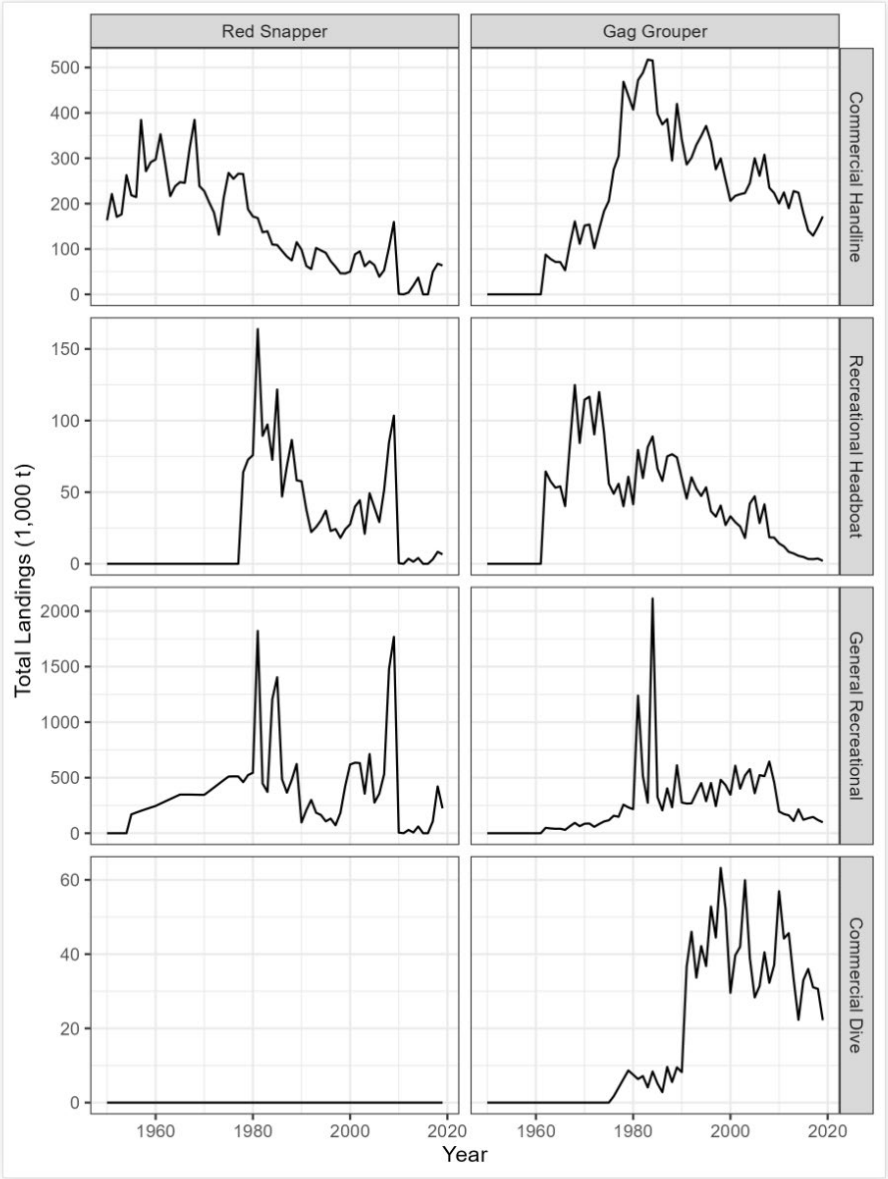
Overview of Base Case Operating Model

Removals, Landings, and Discards



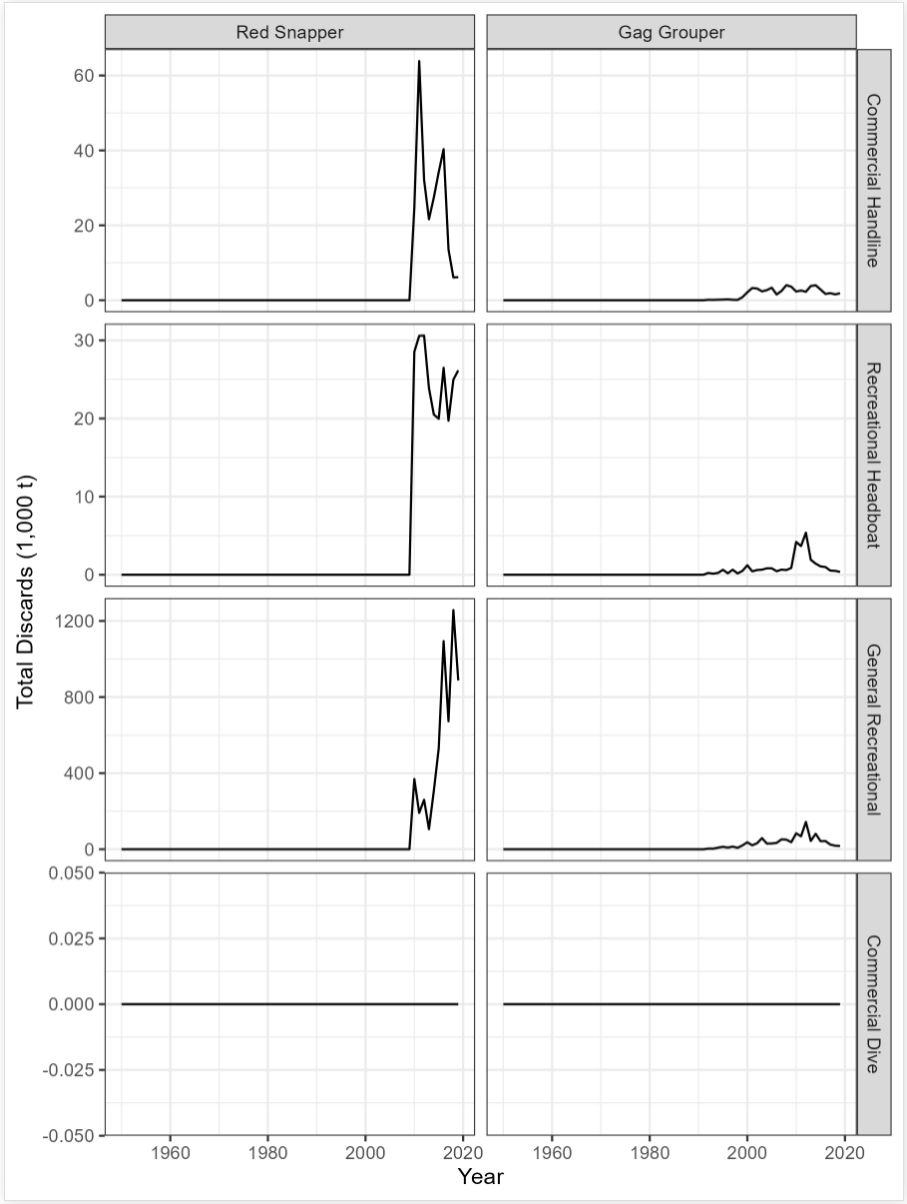
Overview of Base Case Operating Model

Removals**, Landings,** and Discards



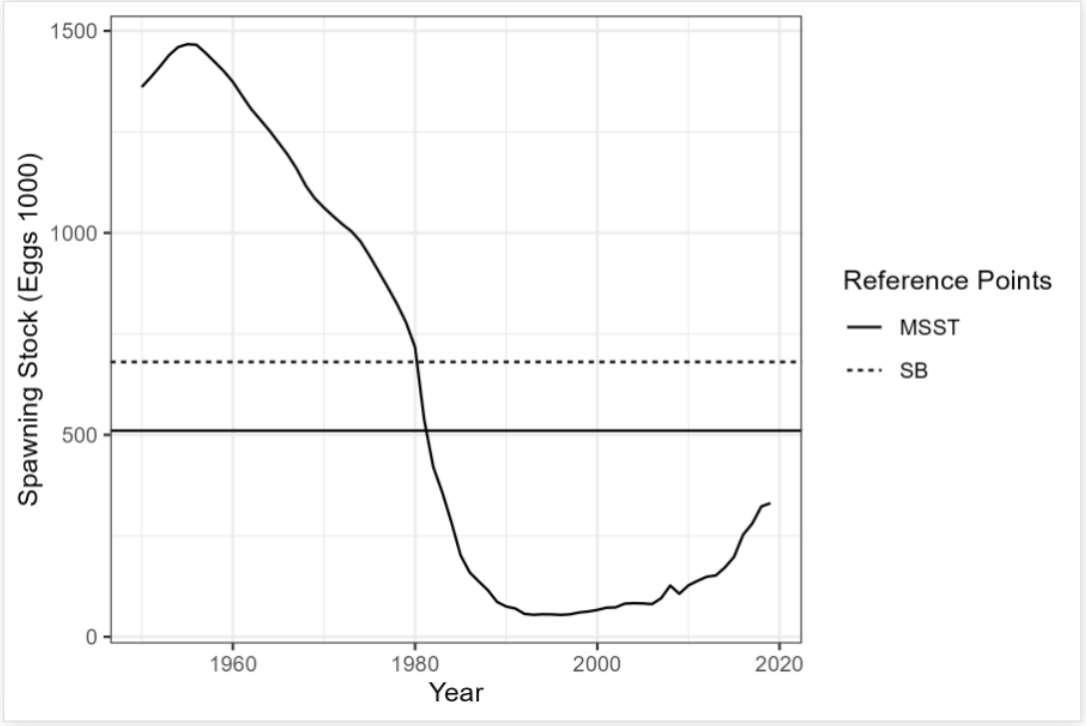
Overview of Base Case Operating Model

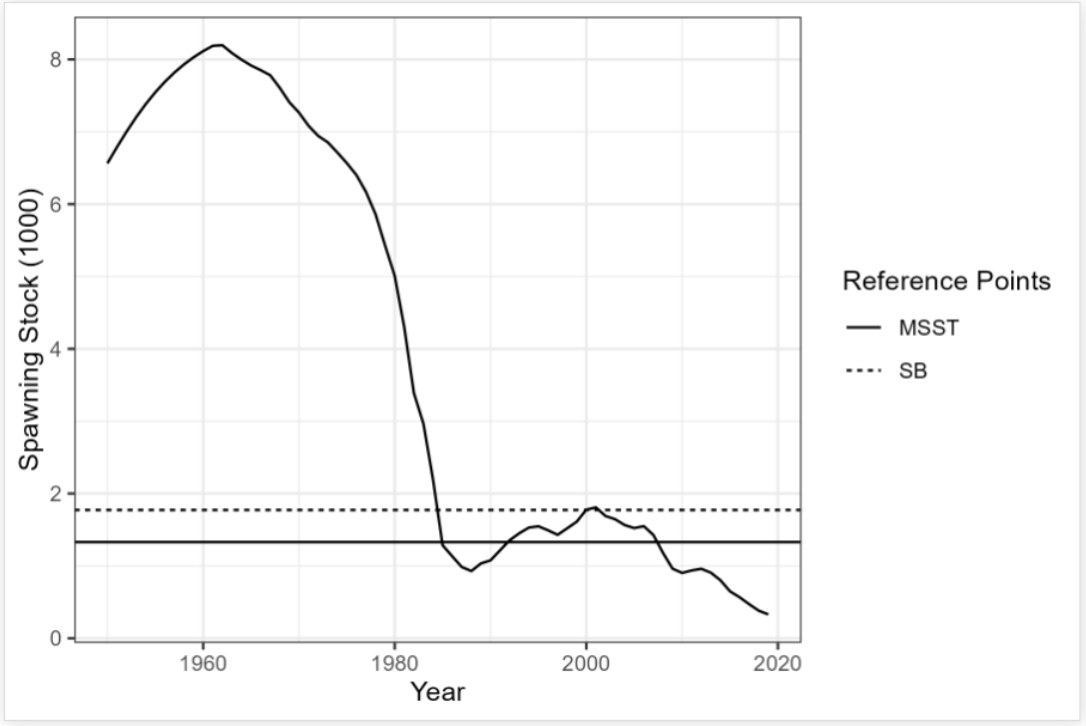
Removals, Landings, and **Discards**



Overview of Base Case Operating Model

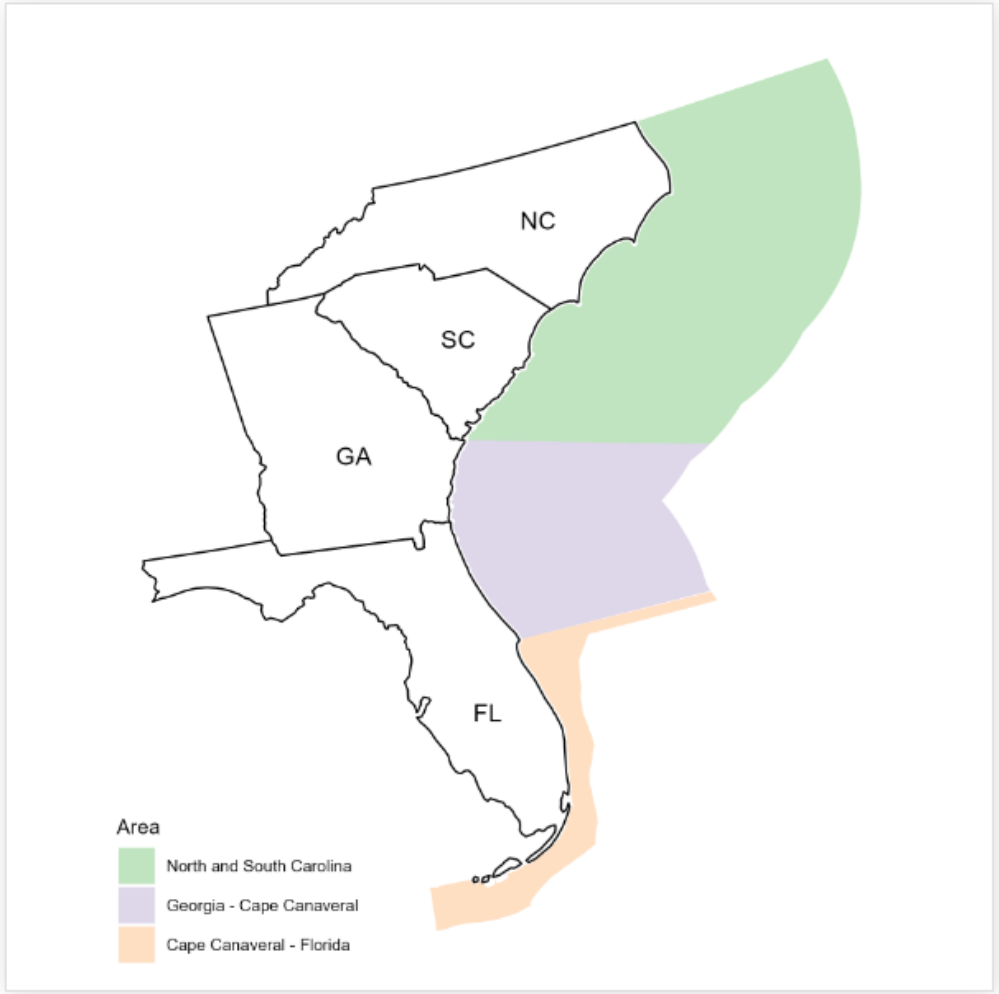
Biomass Trends





Overview of Base Case Operating Model

Spatial Structure



Three areas have been defined:

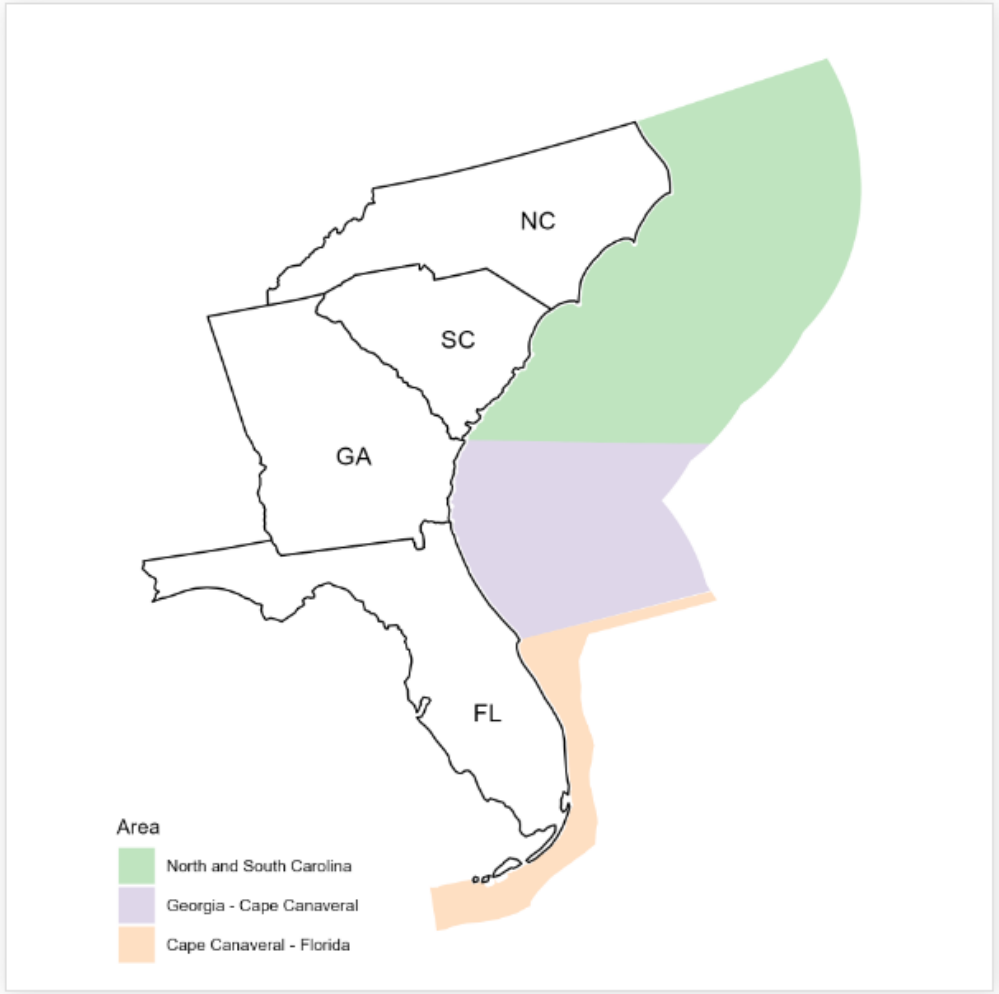
1. North and South Carolina
2. Georgia – Cape Canaveral
3. Cape Canaveral - Florida

Possibly additional depth structure:

1. Nearshore < 100 ft
2. Offshore > 100 ft

Overview of Base Case Operating Model

Spatial Structure



- Spatial structure currently not defined in the Operating Model
- Can either be modelled explicitly with spatial areas, or implicitly by assuming fractional changes in effort when areas open/closed
- Will be added once spatial management options have been proposed and developed

Management questions that can be addressed

MSE is generally focused on identifying robust rules for managing fisheries (a management procedure).

However, MSE can also inform other aspects of fishery management decision making:

- What complexity of assessment model is appropriate?
- What data should be collected?
- What is an appropriate assessment interval (yearly, once every 2 years etc)?
- What are appropriate management reference points for these stocks?

Management measures that can be evaluated

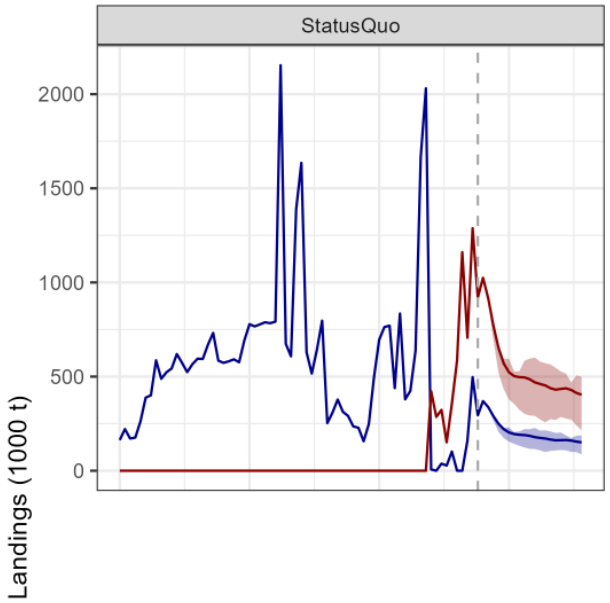
- Effort control (season opening, licenses, boat days etc)
- Spatial closures (where model and fleet structure allows)
- Size limits
- Catch limits
- Gear selectivity
- Bag limits
- Release gear

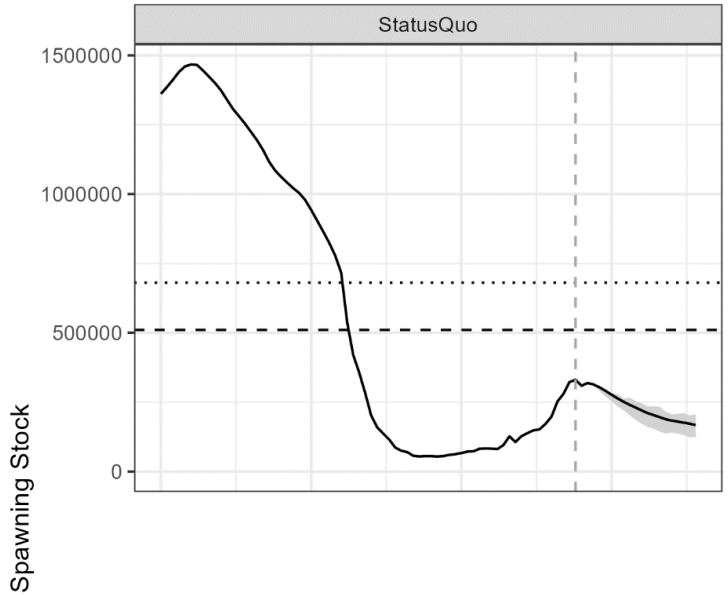
(and combinations thereof)

Example results

!! For demonstration only !!

Example Results: Current F versus target F (F30%, FMSY)





Red Snapper

Gag Grouper

Year

Year

Variable

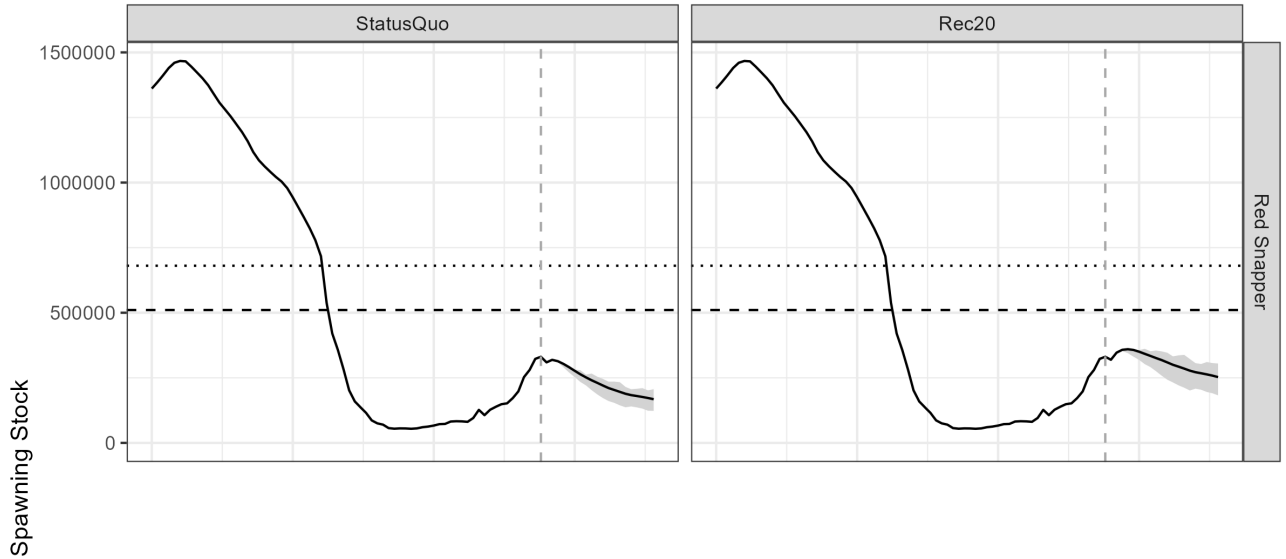
Landings

Discards

SBMSY (red snapper), SB30% (gag grouper)

MSST = 75%

Example Results: Reducing Recreational Effort by 20%



Variable

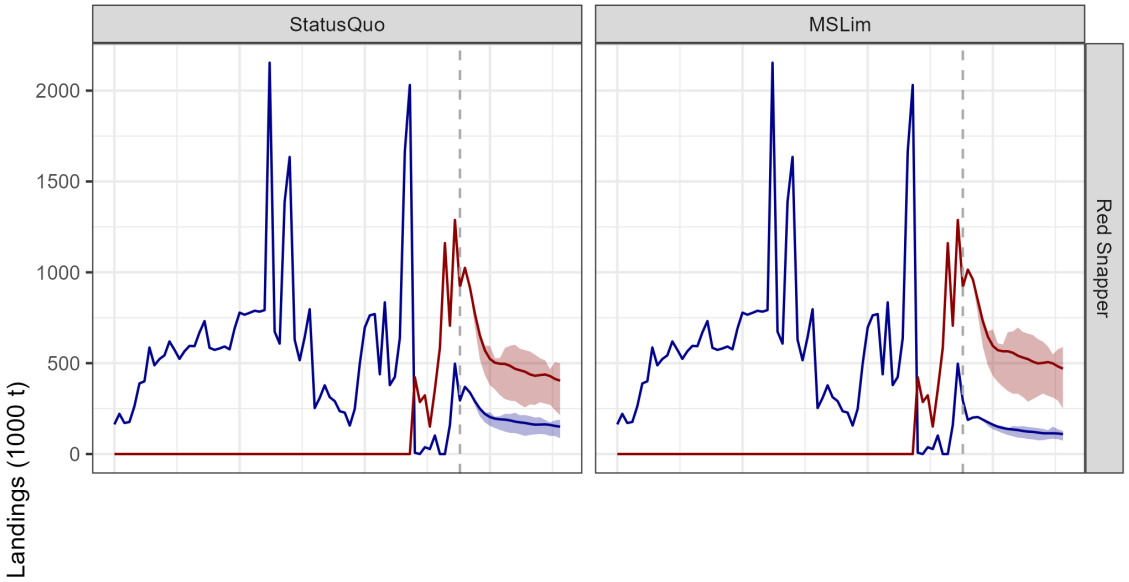
Landings

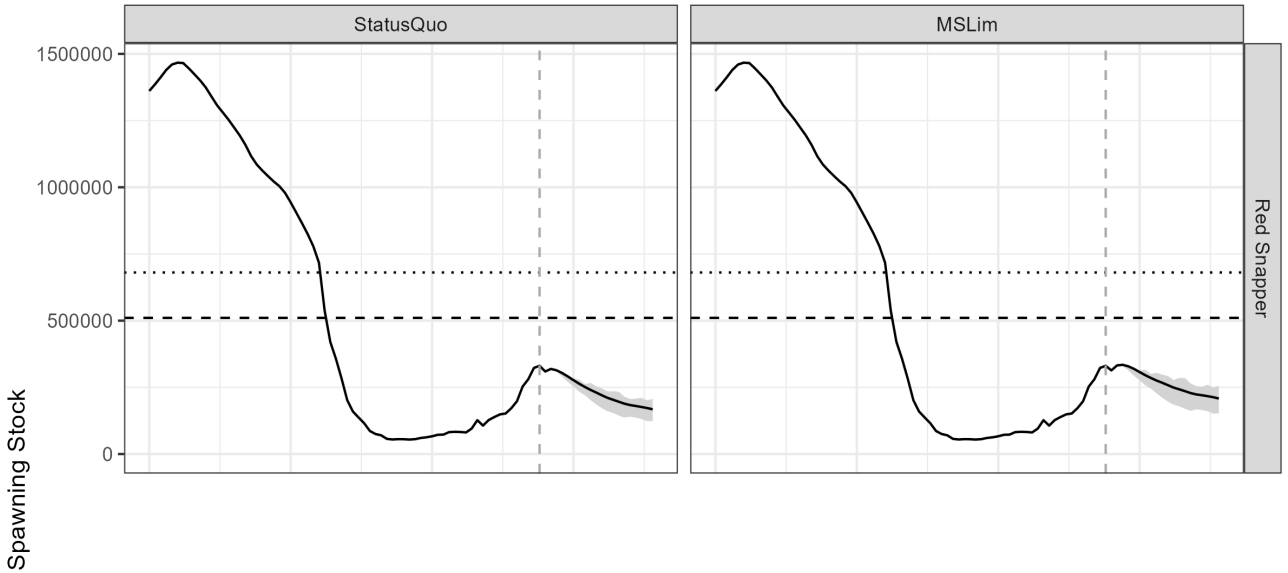
Discards

..... SBMSY (red snapper), SB30% (gag grouper)

– – – MSST = 75%

Example Results: Minimum Size Limit (60cm, 80cm)





Variable

Landings

Discards

SBMSY (red snapper), SB30% (gag grouper)

MSST = 75%

Challenges

- Realistic multi-stock fishing dynamics
  Finer-scale fishery data required (CPUE by species by trip for example)

- Spatial stock structure
  At the very least some kind of robustness test would be important

- Specifying alternative operating models from stakeholder feedback
  Alternative assessment model assumptions (e.g., selectivity, fleet structure etc.)

- Defining a range of realistic management options (Management Procedures, MPs)

Next Steps

Presentation of results:

- Meetings to present initial results?
  - Requires specification of initial management approaches
  - Shiny App for interactively reviewing results?

October 2023	Advisory Panel	• Present revised operating models and management procedures based on feedback from April meeting • Presentation of results of initial evaluation of the CMPs • Discussion of additional uncertainties
24 – 26 October 2023	SSC	• Update on MSE progress and discussion of initial results • Discussion of management options and performance metrics
15 November 2023	Progress Report 3	• Finalize development of management procedures • Conduct initial robustness testing/sensitivity analysis of the CMPs • Compile results for presentation in an online interactive app • Develop and host interactive app for reviewing results • Revise operating models and CMPs based on feedback from the AP and SSC
4 – 8 December 2023	Council	• Update on MSE progress and discussion of initial results • Discussion of management options and performance metrics

Feedback needed!

- What uncertainties should a management system be robust to?
- Are there specific alternative runs of the Base-case assessment that you would want to see as operating models?
- What management options / combinations of management options would you like to see evaluated?

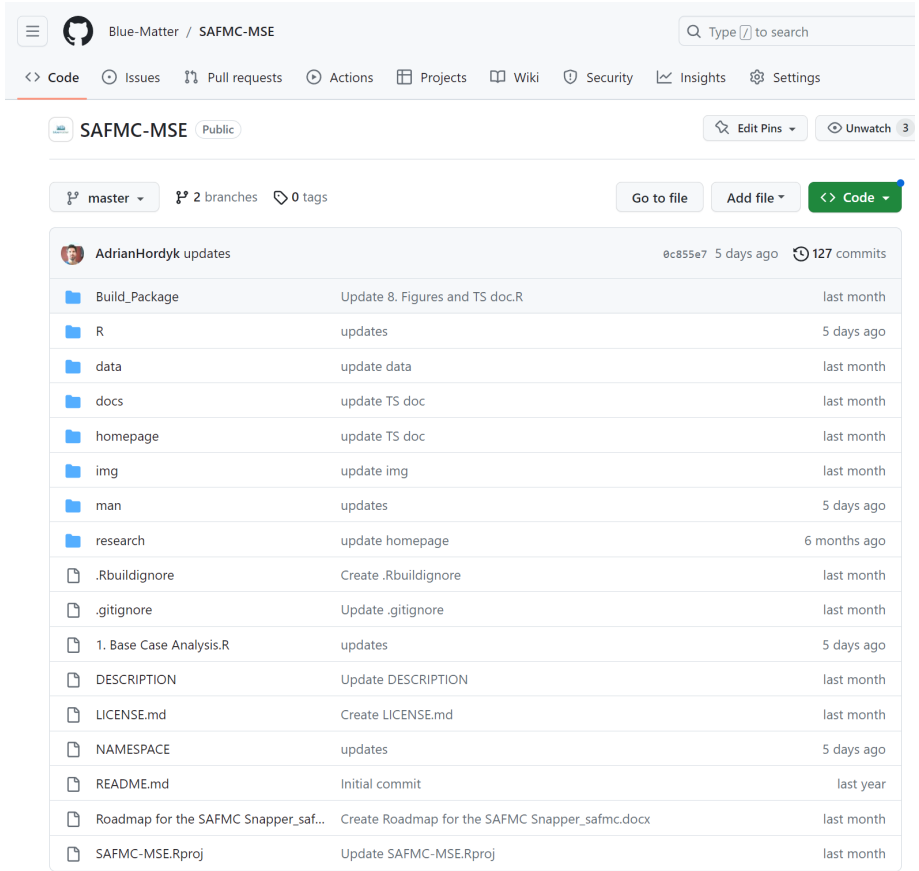
Resources

GitHub Repository

https://github.com/Blue-Matter/SAFMC-MSE

R Package: *SAMSE*

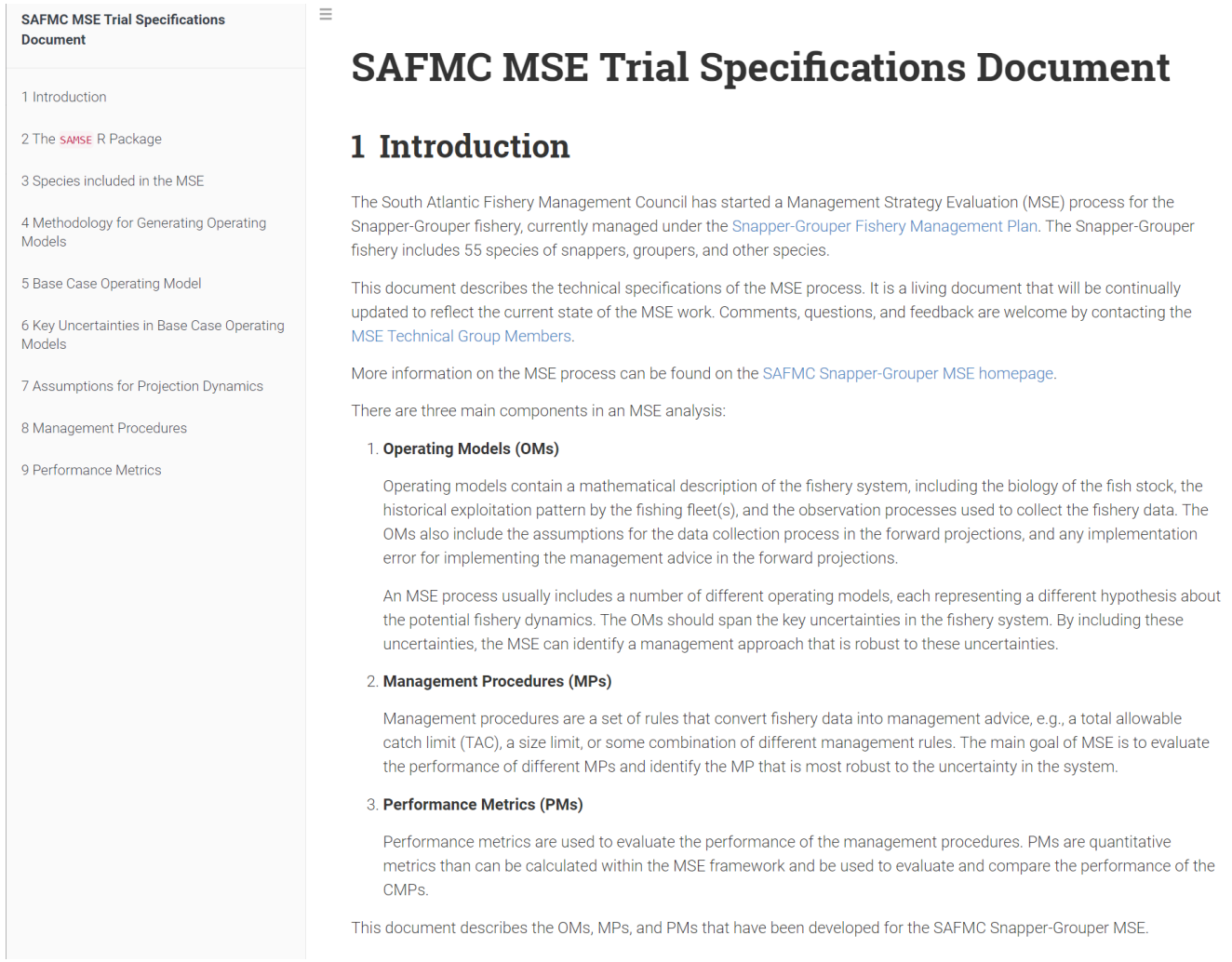
- Operating Models (currently one)
- Management Procedures (more to be developed)
- Performance Metrics



Resources

Technical Specifications Document

https://safmc-mse.bluematterscience.com/ts/ts.html



SAFMC MSE Trial Specifications Document

1 Introduction

2 The SAMSE R Package

3 Species included in the MSE

4 Methodology for Generating Operating Models

5 Base Case Operating Model

6 Key Uncertainties in Base Case Operating Models

7 Assumptions for Projection Dynamics

8 Management Procedures

9 Performance Metrics

SAFMC MSE Trial Specifications Document

1 Introduction

The South Atlantic Fishery Management Council has started a Management Strategy Evaluation (MSE) process for the Snapper-Grouper fishery, currently managed under the Snapper-Grouper Fishery Management Plan. The Snapper-Grouper fishery includes 55 species of snappers, groupers, and other species.

This document describes the technical specifications of the MSE process. It is a living document that will be continually updated to reflect the current state of the MSE work. Comments, questions, and feedback are welcome by contacting the MSE Technical Group Members.

More information on the MSE process can be found on the SAFMC Snapper-Grouper MSE homepage.

There are three main components in an MSE analysis:

1. **Operating Models (OMs)**

   Operating models contain a mathematical description of the fishery system, including the biology of the fish stock, the historical exploitation pattern by the fishing fleet(s), and the observation processes used to collect the fishery data. The OMs also include the assumptions for the data collection process in the forward projections, and any implementation error for implementing the management advice in the forward projections.

   An MSE process usually includes a number of different operating models, each representing a different hypothesis about the potential fishery dynamics. The OMs should span the key uncertainties in the fishery system. By including these uncertainties, the MSE can identify a management approach that is robust to these uncertainties.

2. **Management Procedures (MPs)**

   Management procedures are a set of rules that convert fishery data into management advice, e.g., a total allowable catch limit (TAC), a size limit, or some combination of different management rules. The main goal of MSE is to evaluate the performance of different MPs and identify the MP that is most robust to the uncertainty in the system.

3. **Performance Metrics (PMs)**

   Performance metrics are used to evaluate the performance of the management procedures. PMs are quantitative metrics than can be calculated within the MSE framework and be used to evaluate and compare the performance of the CMPs.

This document describes the OMs, MPs, and PMs that have been developed for the SAFMC Snapper-Grouper MSE.

Acknowledgements

Many thanks to the MSE technical team for their input on the MSE framework thus far:

Erik Williams

Allie Iberle

Cassidy Peterson

Chip Collier

Christina Wiegand

Judd Curtis

Kai Lorenzen

Michael Larkin

Mike Schmidke

Quang Huynh

Scott Crosson

Performance Metrics

Management Objective	Quantitative Metric	Category
Avoid stock being in an overfished state	Probability SSB > MSST	Biological
Avoid overfishing the stock	Probability F < MFMT	Biological
If overfished, rebuild stock to target within desired time-frame	Probability SSB > SSB_{targ} by 2044 (red snapper; SSB_{targ} = $SSB_{F30\%}$) and 2040 (gag; SSB_{targ} = SSB_{MSY})	Biological
Stability in catch	Average inter-annual variability in catch	Commercial
Maximize yield	Average landings	Commercial & Recreational
Reduce discards	Ratio of kept to discarded fish	Commercial & Recreational
Catch and keep enough to make the trip worthwhile	Average catch rate relative to current	Recreational
High probability of catching reasonably sized fish	Probability of catching a 10 lb fish	Recreational
High probability of catching trophy sized fish	Probability of catching a 30 lb red snapper and 45 lb gag	Recreational
Maximize fishing opportunity	Average fishing effort relative to recent historical	Recreational