Management Strategy Evaluation for the Snapper-Grouper Fishery

SAFMC – Council Meeting

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Wrightsville Beach

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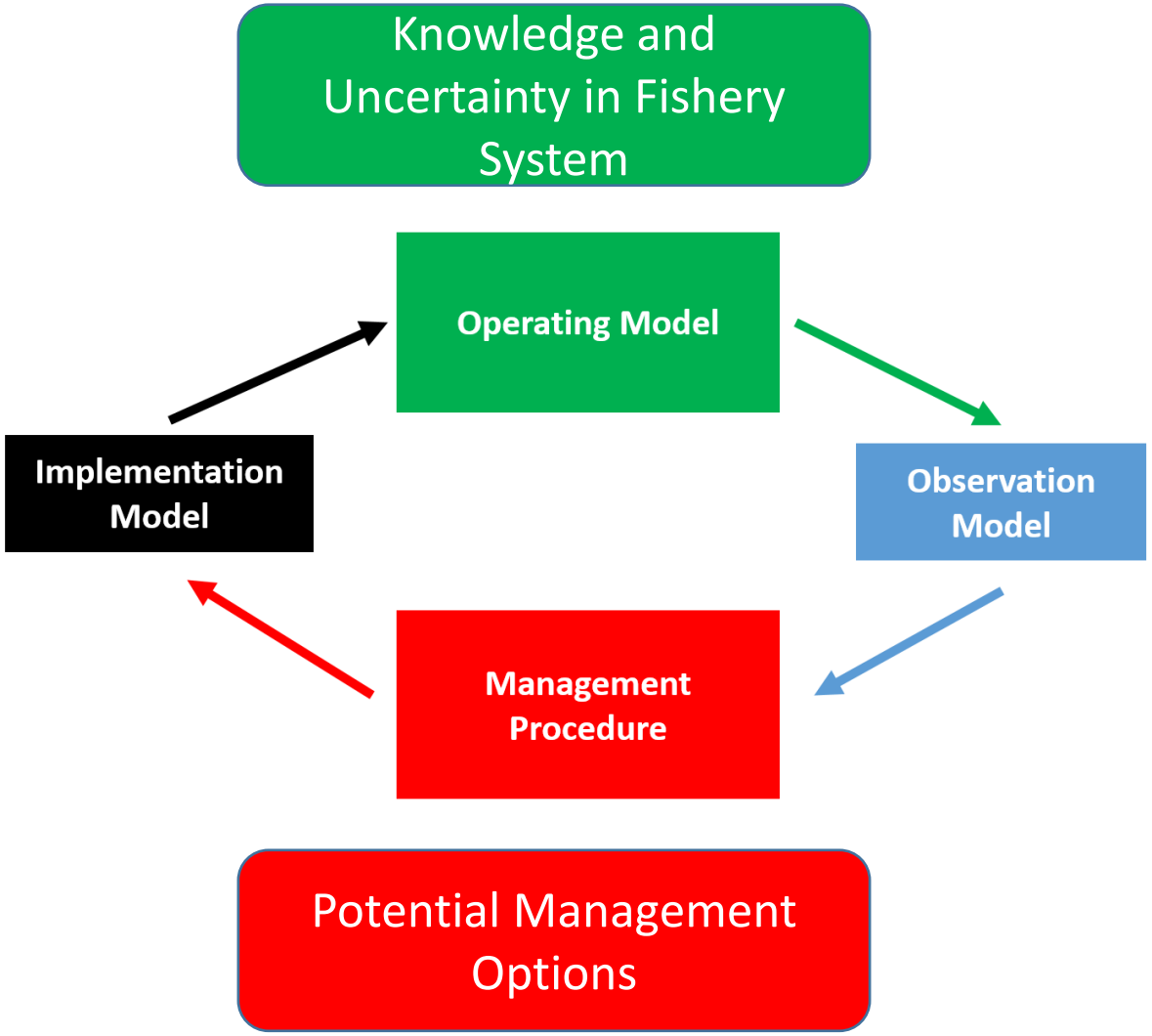
Background

Overall Objective

Develop a Framework for Comparing the Expected Performance of Different Management Approaches for the Snapper-Grouper Fishery

The MSE Approach

Closed-Loop Simulation Testing



Stakeholder Consultation

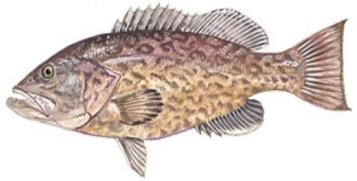
- Snapper-Grouper Advisory Panel
- SSC
- Public Scoping Meetings

MSE Technical Team: SAFMC & NOAA Scientists

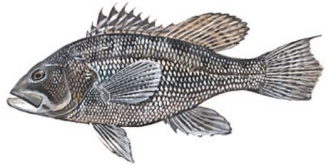
Methods

Operating Models

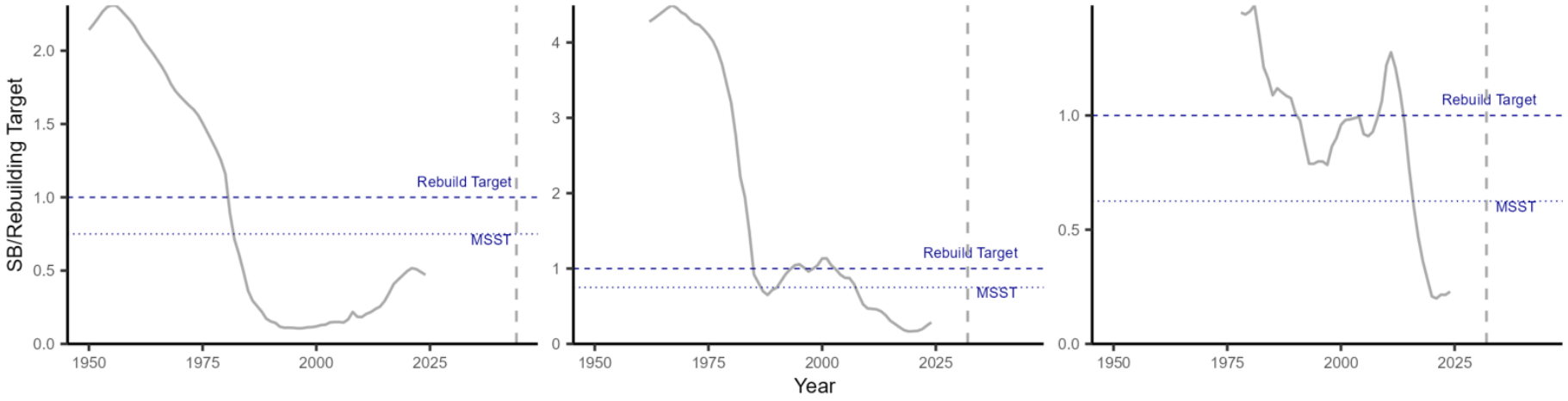
Red Snapper



Gag Grouper



Black Sea Bass



SEDAR 73

SEDAR 71

SEDAR 76

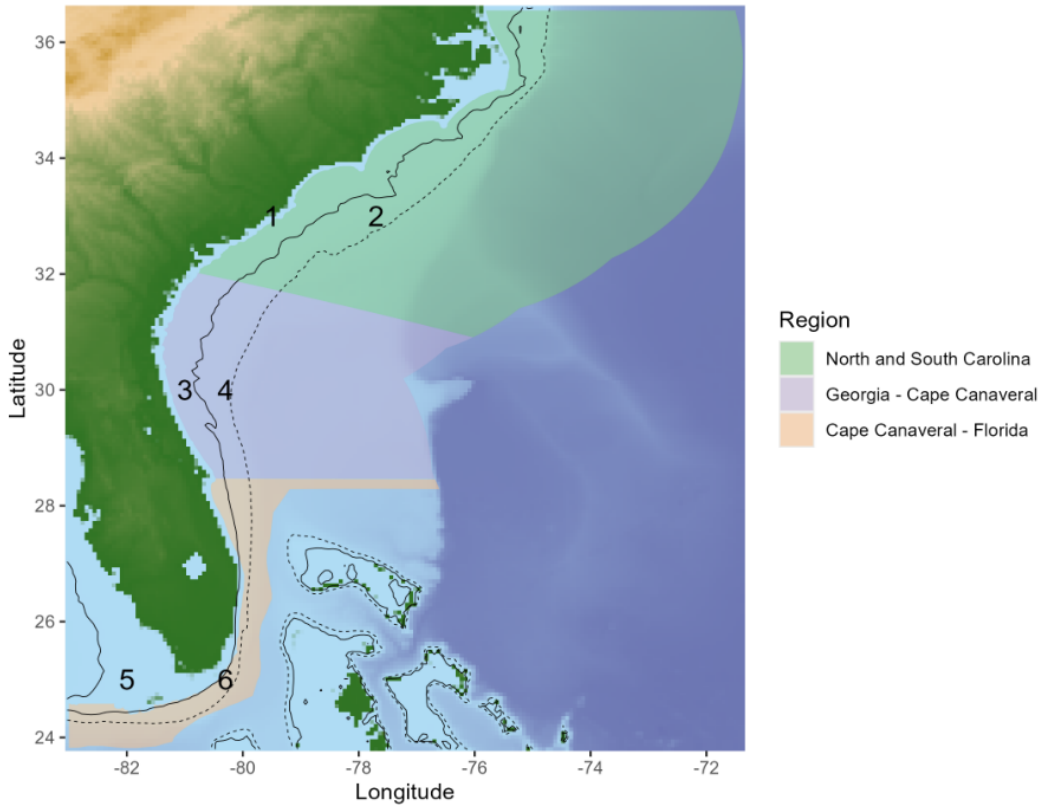
Base Case OM

Spatial Areas

3 Geographic Regions

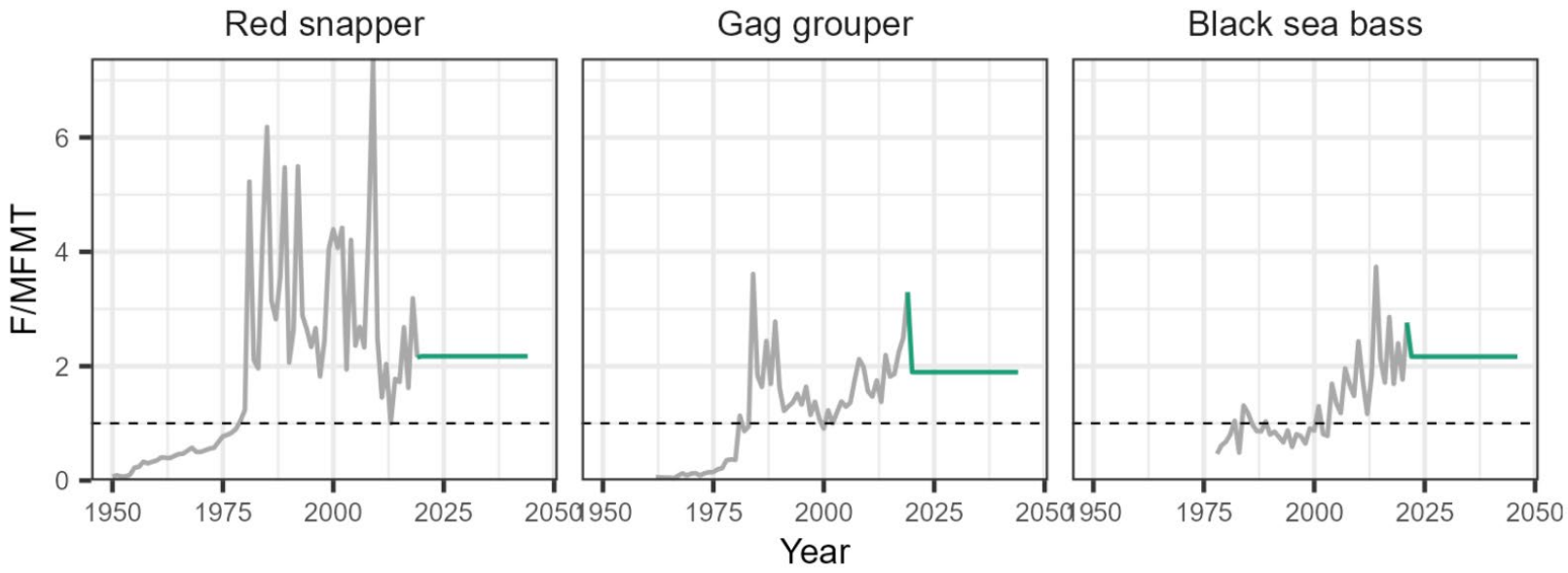
2 Depth Zones

- Nearshore (NS) $<$ 100 ft
- Offshore (OS) $>$ 100 ft



Management Approaches

1. **Status Quo**: fishing mortality fixed to geometric mean from last 3 years (Constant Effort)



Management Approaches

1. **Status Quo**: fishing mortality fixed to geometric mean from last 3 years (Constant Effort)
2. **Full Retention (FR):** No discarding. All fish that are caught are retained
3. **Minimum Legal Length (MLL):** Fish below MLL are discarded (24" RS & GG, 12" BSB)
4. **Spatial:**
    a. **Nearshore (NS):** All fishing effort shifted to Nearshore region
    b. **Offshore (OS):** All fishing effort shifted to Offshore region

12 Combinations: SQ, SQ_FR, SQ_MLL, … , SQ_FR_MLL_OS

Reduction in General Recreational Effort

1. **100%** Effort remains at SQ level
2. **95%** Effort reduced by 5%
3. **85%** Effort reduced by 15%
4. **75%** Effort reduced by 25%

…

11. **5%** Effort reduced by 95%

Management Scenarios

12 Management Combinations

x

11 Levels of Gen. Rec. Effort

=

132 Management Scenarios

Broad management scenarios to quantify key trade-offs and identify management *directions* with best performance

Summarizing Results

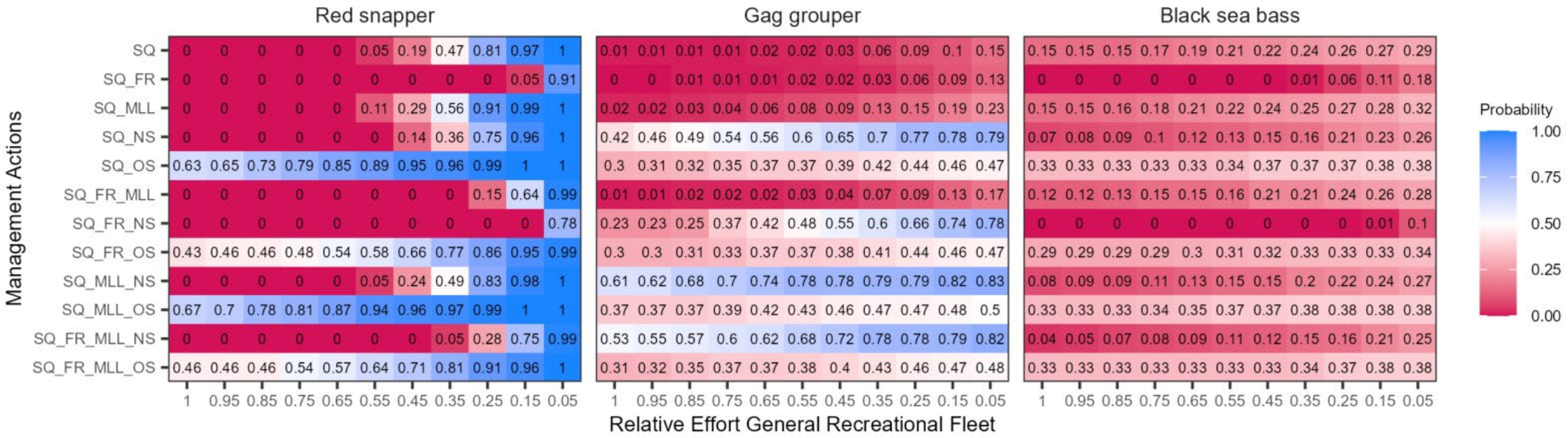
1. **P. Rebuild**: Probability of rebuilding by target year
    - Red Snapper: $SB > SB_{\text{F30\%}}$ by 2044
    - Gag: $SB > SB_{\text{MSY}}$ by 2032
    - Black Sea Bass: $SB > SB_{\text{MSY}}$ by 2032 (not under rebuilding plan)

Summarizing Results

1. **P. Rebuild**: Probability of rebuilding by target year
2. **SB/Rebuild:** Median SB relative to Rebuild Target
3. **Relative STY**: Median landings in first 5 years (2025 – 2029) relative to median landings from 3 most recent years
4. **Relative LTY**: Median landings in second 5 years (2030 – 2034) relative to median landings from 3 most recent years
5. **Fraction Discarded**: Fraction of total removals that are dead discards

Results

P. Rebuild: Probability of Rebuilding by Target Year



All 132 Management Scenarios

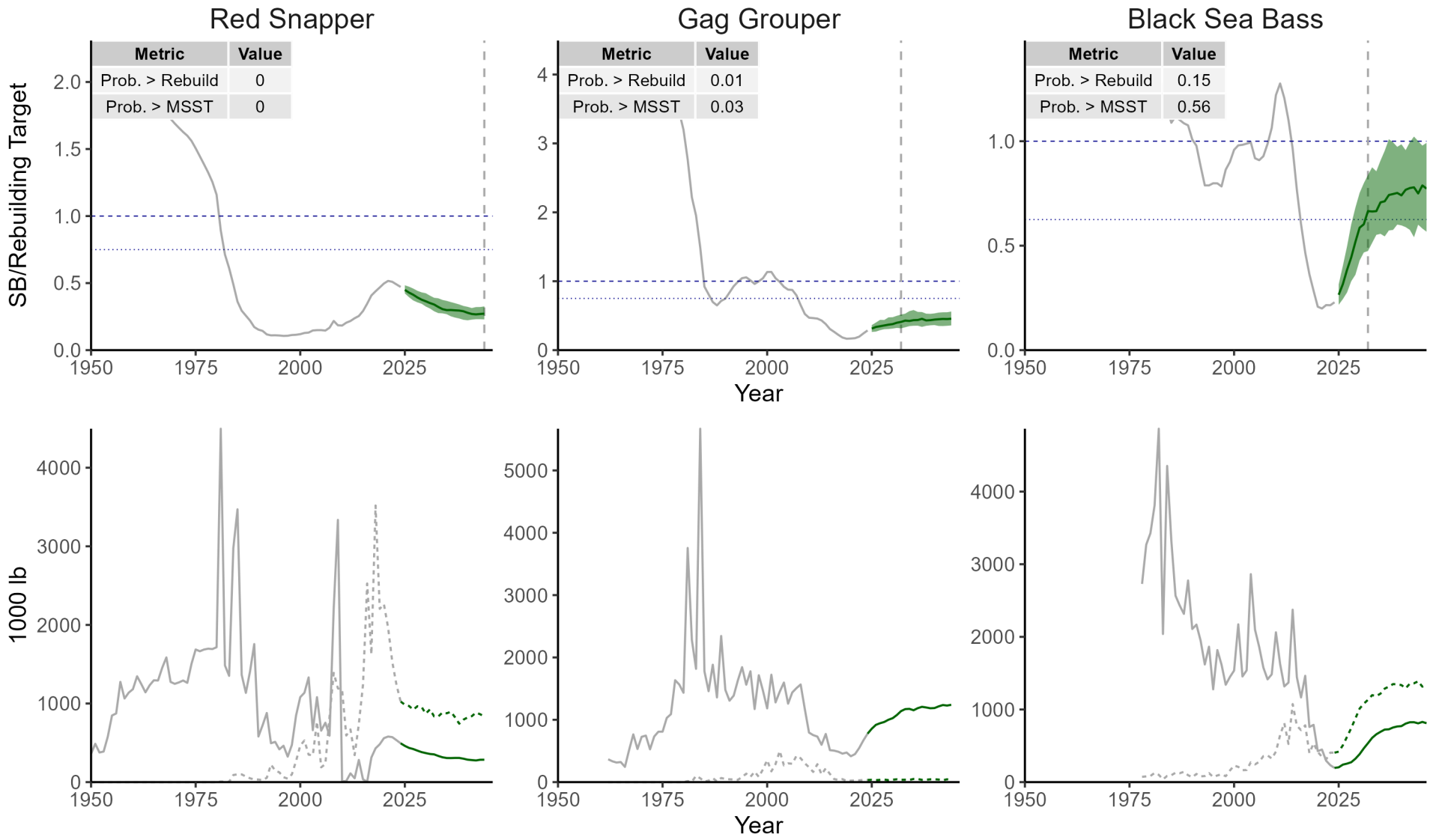
Focus Management Scenarios

1. Status Quo

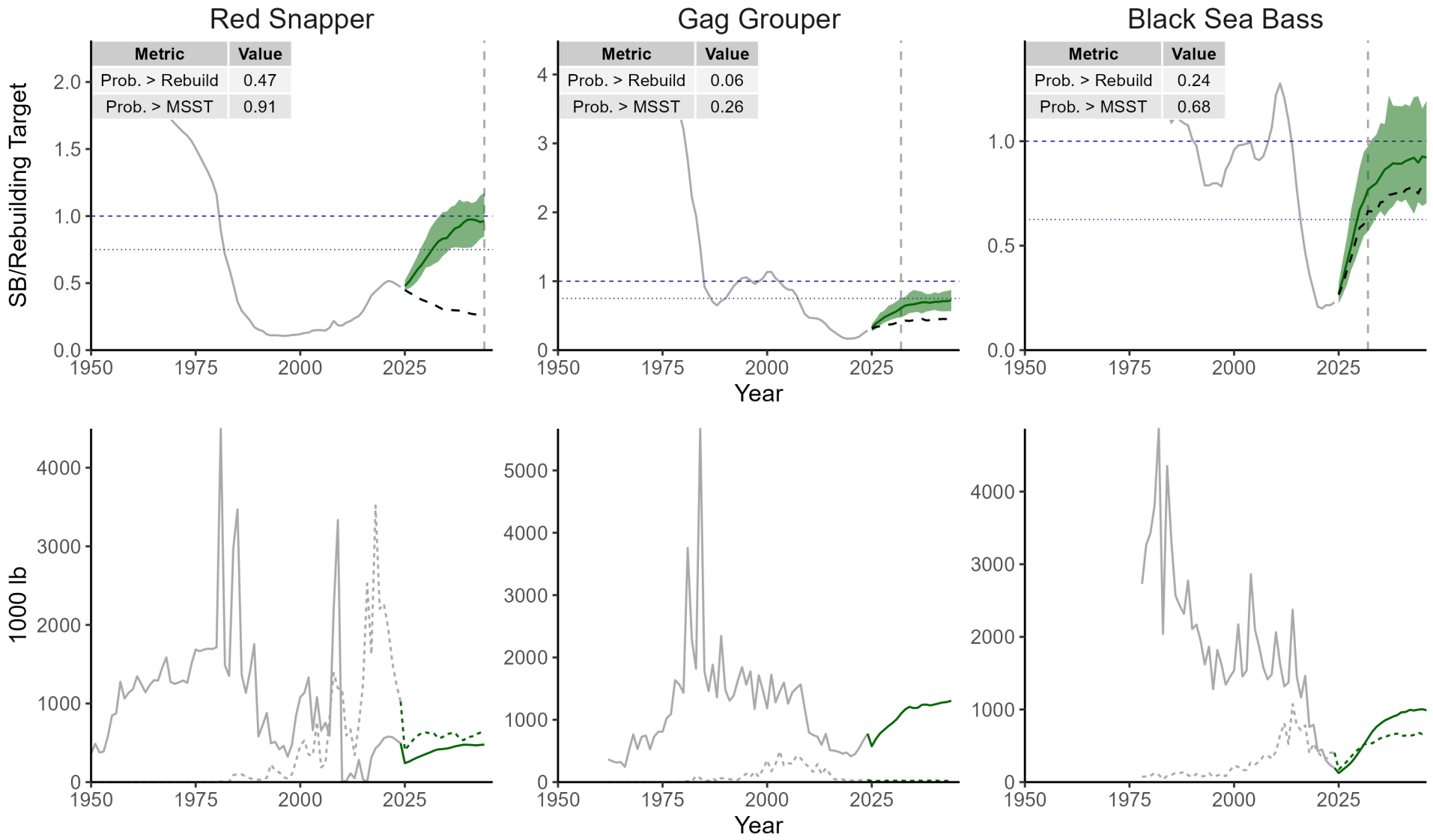
Highest Probability of Rebuilding Red Snapper

2. Rec. Effort reduced to 35% of Current Level
3. Effort moved to Offshore & Full Retention

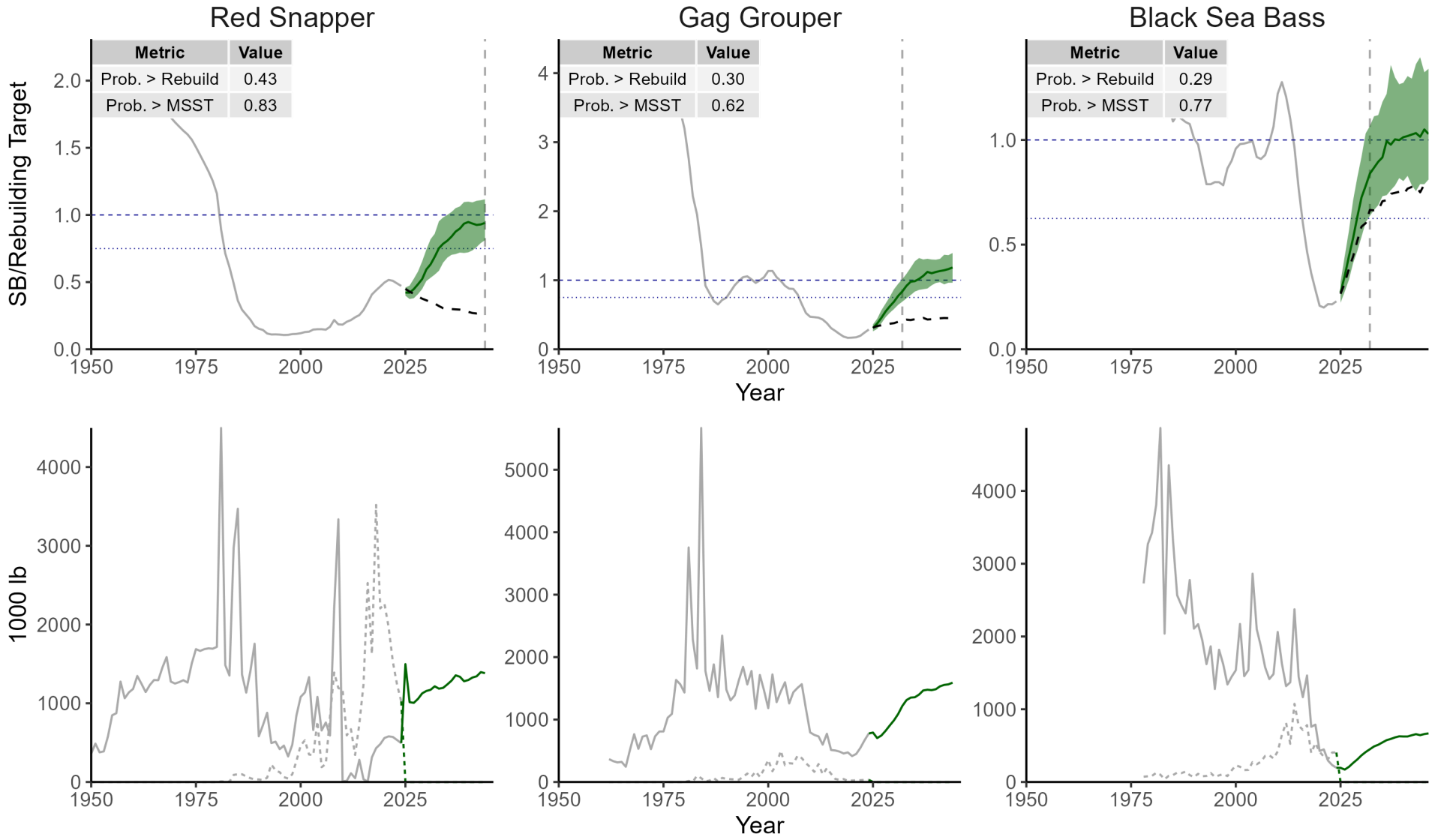
Status Quo


Red Snapper
Gag Grouper
Black Sea Bass
Metric
Value
Prob. > Rebuild
0
Prob. > MSST
0
Prob. > Rebuild
0.01
Prob. > MSST
0.03
Prob. > Rebuild
0.15
Prob. > MSST
0.56
SB/Rebuilding Target
1000 lb
Year
Year

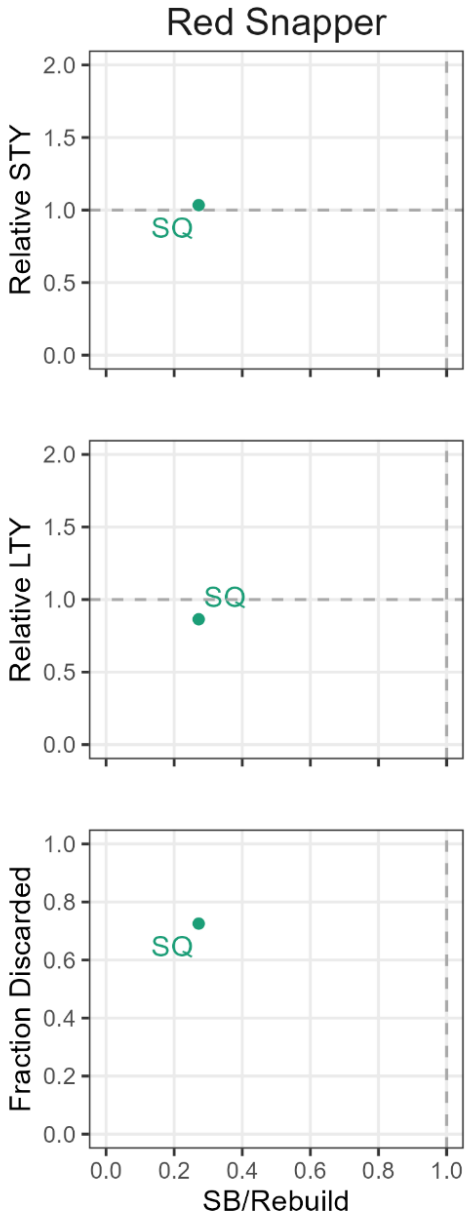
35% Rec. Effort

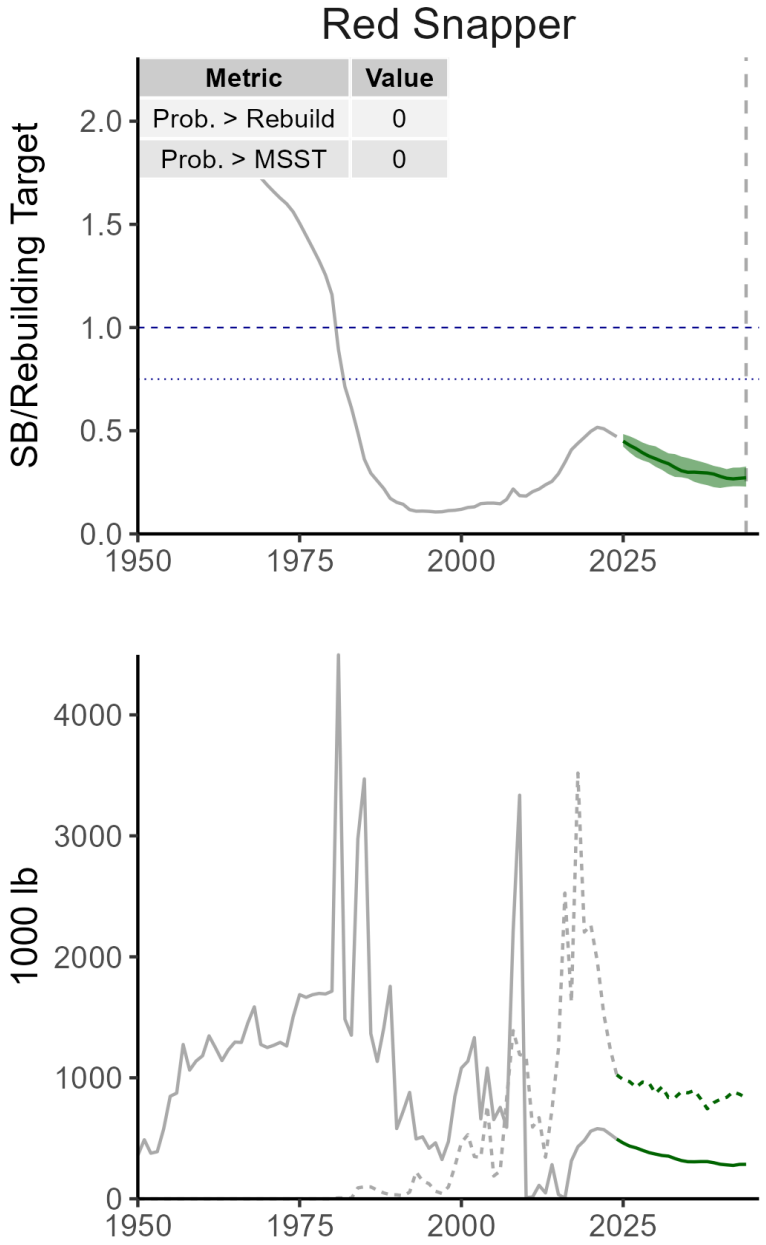


Full Retention & Offshore

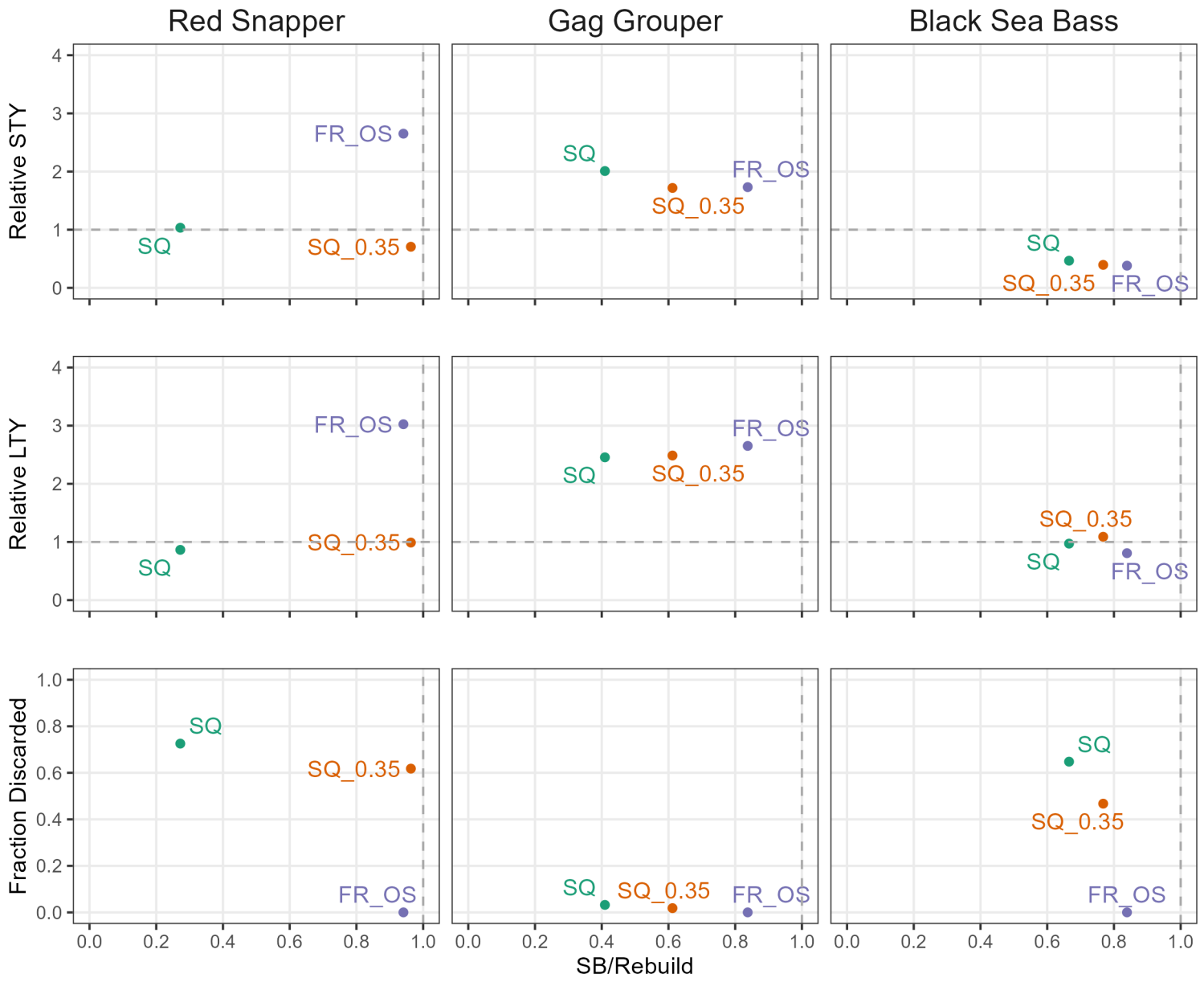


Trade Offs


Red Snapper
Relative STY
Relative LTY
Fraction Discarded
SB/Rebuild
SQ
SQ
SQ
0.0
0.5
1.0
1.5
2.0
0.2
0.4
0.6
0.8


Red Snapper
Metric
Value
Prob. > Rebuild
0
Prob. > MSST
0
SB/Rebuilding Target
1000 lb
1950
1975
2000
2025
0
1000
2000
3000
4000

Trade Offs


Red Snapper
Gag Grouper
Black Sea Bass
Relative STY
Relative LTY
Fraction Discarded
SB/Rebuild
SQ
SQ_0.35
FR_OS
0
1
2
3
4
0.0
0.2
0.4
0.6
0.8
1.0

General Conclusions 1

Status Quo

Red Snapper & Gag:

- Low prob. rebuilding
- Decline or static landings

Black Sea Bass:

- 15% prob. rebuilding by 2032
- Increasing biomass and landings

General Conclusions 2

Reducing Gen. Rec. Effort

- Reduces fishing mortality, especially for RS and BSB
- Increase prob. rebuilding (RS & BSB)
- Reduction in discards (RS & BSB)
- Decrease in short-term yield for Gen. Rec.

General Conclusions 3

Effort moved to Offshore

- Reduces fishing mortality on young (immature) fish
- Increases spawning output
- Full retention policy increases landings and reduces dead discards

Rebuilding

1. **Reduction in fishing mortality**
2. **Increase in spawning output**

Next Steps

1. Incorporate feedback from recent SSC meeting
2. Finalize Analysis
3. Submit Project Report to Council (January)
4. Submit scientific manuscript for publication

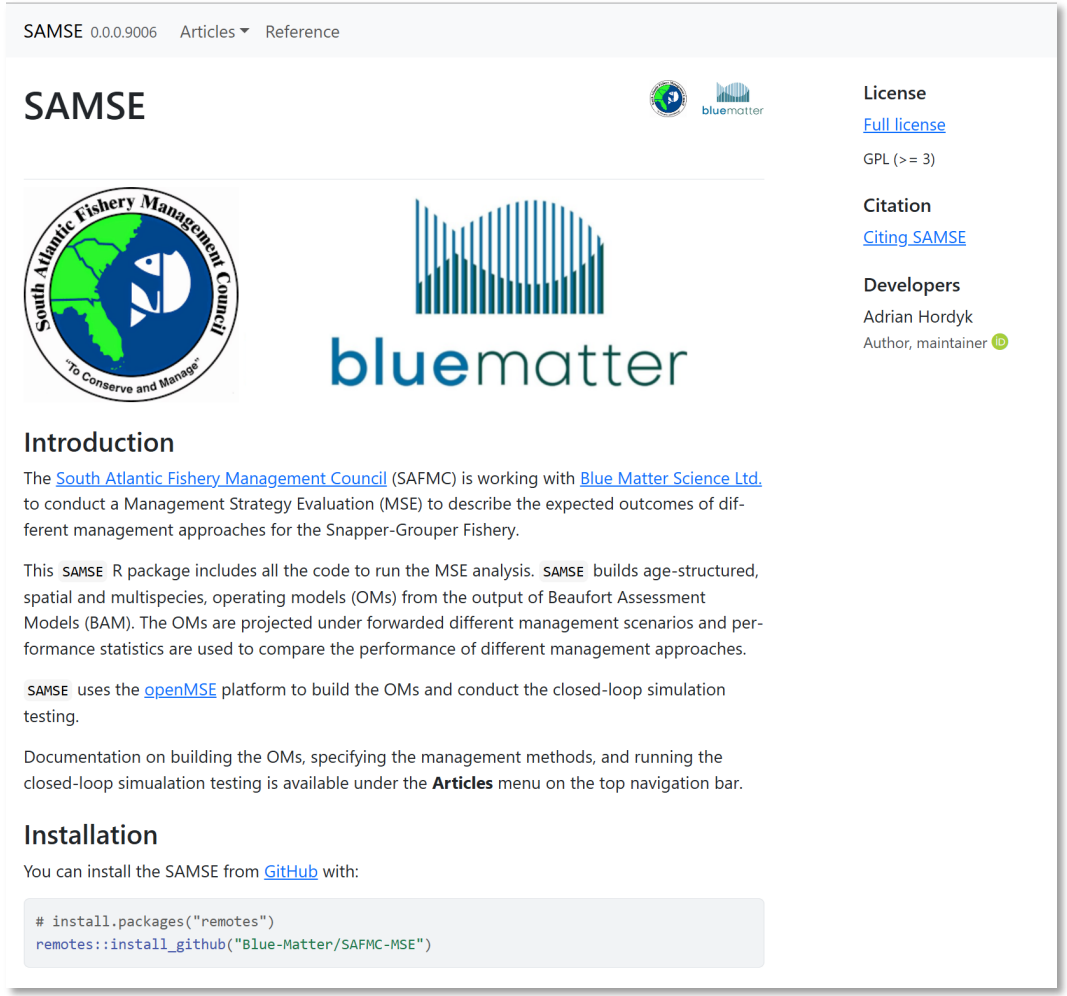
Recommendations for Future Directions

1. Identify Specific Implementable Management Strategies
    a. Specific management decisions: e.g., allocations between sectors

2. Develop models for specific management options:
    a. Aggregate bag limits: model to predict prob. release given catch rates by species
    b. Seasonal closures: model to predict fleet behavior with changes in season length

3. Key Uncertainties:
    a. Fleet dynamics: how fleets respond to changes in regulations
    b. Spatial distribution: important for spatial management options
    c. Future recruitment patterns: regime shifts & reference points?

Technical Details



SAMSE 0.0.0.9006 Articles Reference

SAMSE

bluematter

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Citation
Citing SAMSE

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Adrian Hordyk
Author, maintainer

Introduction

The South Atlantic Fishery Management Council (SAFMC) is working with Blue Matter Science Ltd. to conduct a Management Strategy Evaluation (MSE) to describe the expected outcomes of different management approaches for the Snapper-Grouper Fishery.

This `SAMSE` R package includes all the code to run the MSE analysis. `SAMSE` builds age-structured, spatial and multispecies, operating models (OMs) from the output of Beaufort Assessment Models (BAM). The OMs are projected under forwarded different management scenarios and performance statistics are used to compare the performance of different management approaches.

`SAMSE` uses the openMSE platform to build the OMs and conduct the closed-loop simulation testing.

Documentation on building the OMs, specifying the management methods, and running the closed-loop simulation testing is available under the **Articles** menu on the top navigation bar.

Installation

You can install the SAMSE from GitHub with:

```
# install.packages("remotes")
remotes::install_github("Blue-Matter/SAFMC-MSE")
```

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

- R Package based on openMSE
- Reproducible Open Source Code
- Description of Methodology

Thank You

Questions?

Thanks to the Snapper-Grouper MSE Technical Team, AP, SSC, Council, and all others who have provided input in to this process. We are grateful to the SAMFC Council for funding this project.