Snapper-Grouper MSE
Preliminary MSE Results
Scientific and Statistical Committee

Adrian Hordyk

adrian@bluematterscience.com

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Background

Overall Objective

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

Management Strategy Evaluation (MSE)

1. Biological properties of the fish stocks
2. Characteristics of the fleets that exploit them

} Operating Model (OM)

3. Management options to consider
4. Methods to summarize performance

Stakeholder Consultation

- Advisory Panel
- SSC
- Council
- Public Scoping Meetings

Specific Aims

1. Develop MSE Framework for Snapper-Grouper Fishery
2. Use the Framework to:
    a. Build OMs for 3 Key Overfished Stocks
    b. Evaluate Rebuilding Potential Under:
        - Status Quo Conditions
        - A Broad Range of Management Options
        - Core System Uncertainties
    c. Examine Trade-Offs between Rebuilding, Landings, and Discards

Expected Outcomes

1. Evaluate Suitability of the MSE Framework
2. Quantify Expected Stock Dynamics Under Range of Scenarios
3. Compare Alternative Management Options
4. Provide Guidance for Further Research

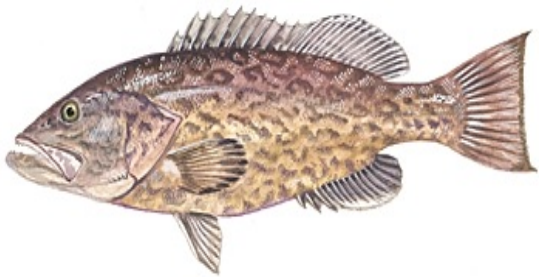
Technical Details

- R Package based on openMSE framework
- Technical Specifications: safmc-mse.bluematterscience.com

Operating Models

Selected Stocks

Red Snapper



Gag Grouper

Black Sea Bass

Fishing Fleets

1. Commercial Line
2. Recreational Headboat
3. General Recreational
4. Dive (Gag Only)

Dive Fleet not shown in Results

Fishery Dynamics

Recent Assessment $\longrightarrow$ Operating Models

- Red Snapper: SEDAR 73
- Gag Grouper: SEDAR 71
- Black Sea Bass: SEDAR 76

Base Case OM

Sensitivity Tests

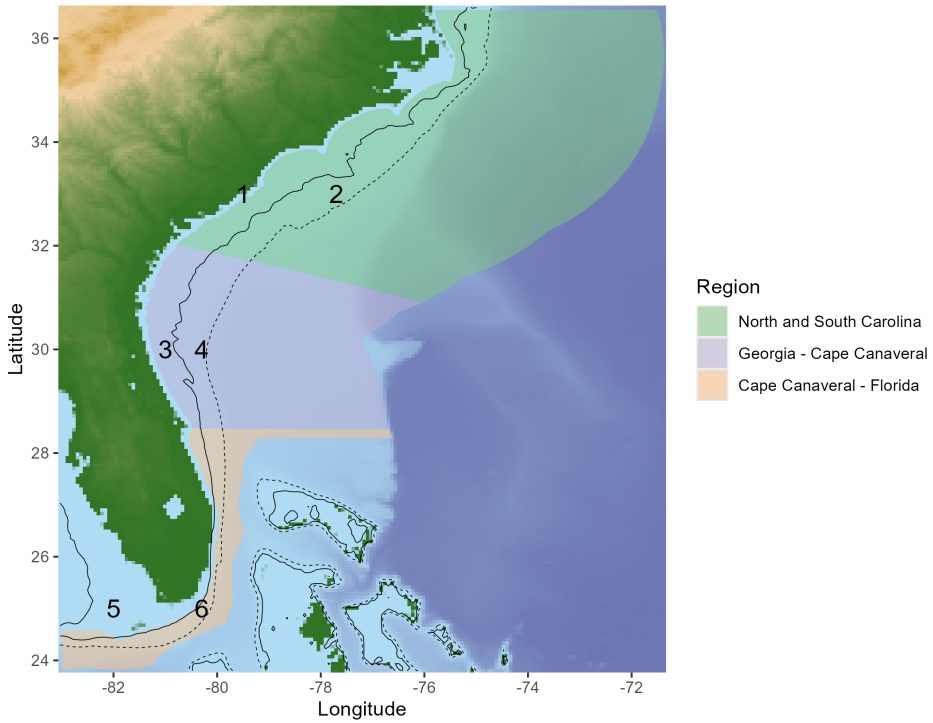
	OM	Description
1	Lower M	Lower M from assessments
2	Higher M	Higher M from assessments
3	Reduced. Rec. Removals	Gen. Rec. removals reduced by 40%
4	Effort Creep	Gen. Rec. effort increased by 2% per year
5	Recent Recruitment	Recruitment pattern based on 10 most recent years

Spatial Areas

3 Geographic Regions

2 Depth Zones

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

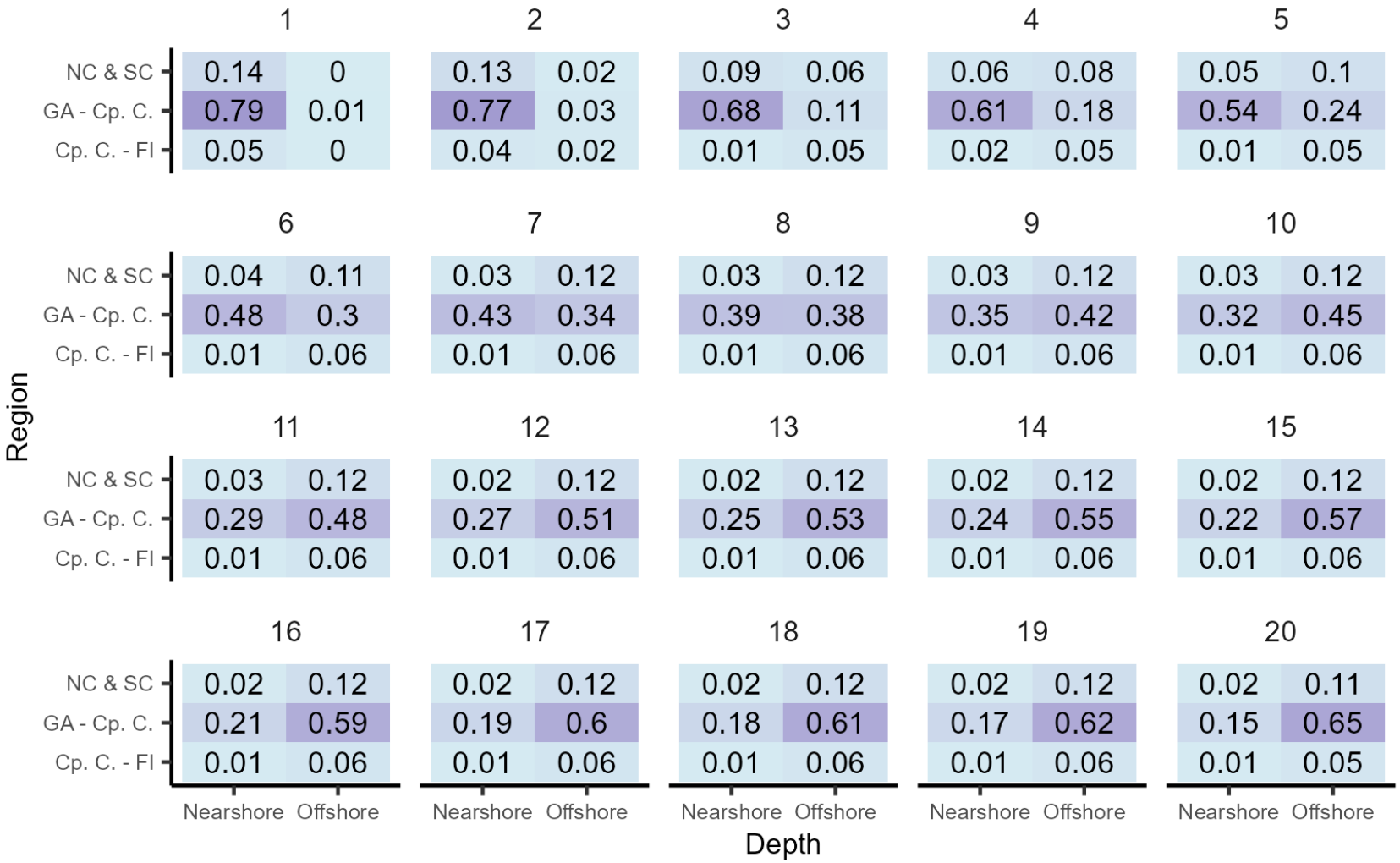


Stock Distribution

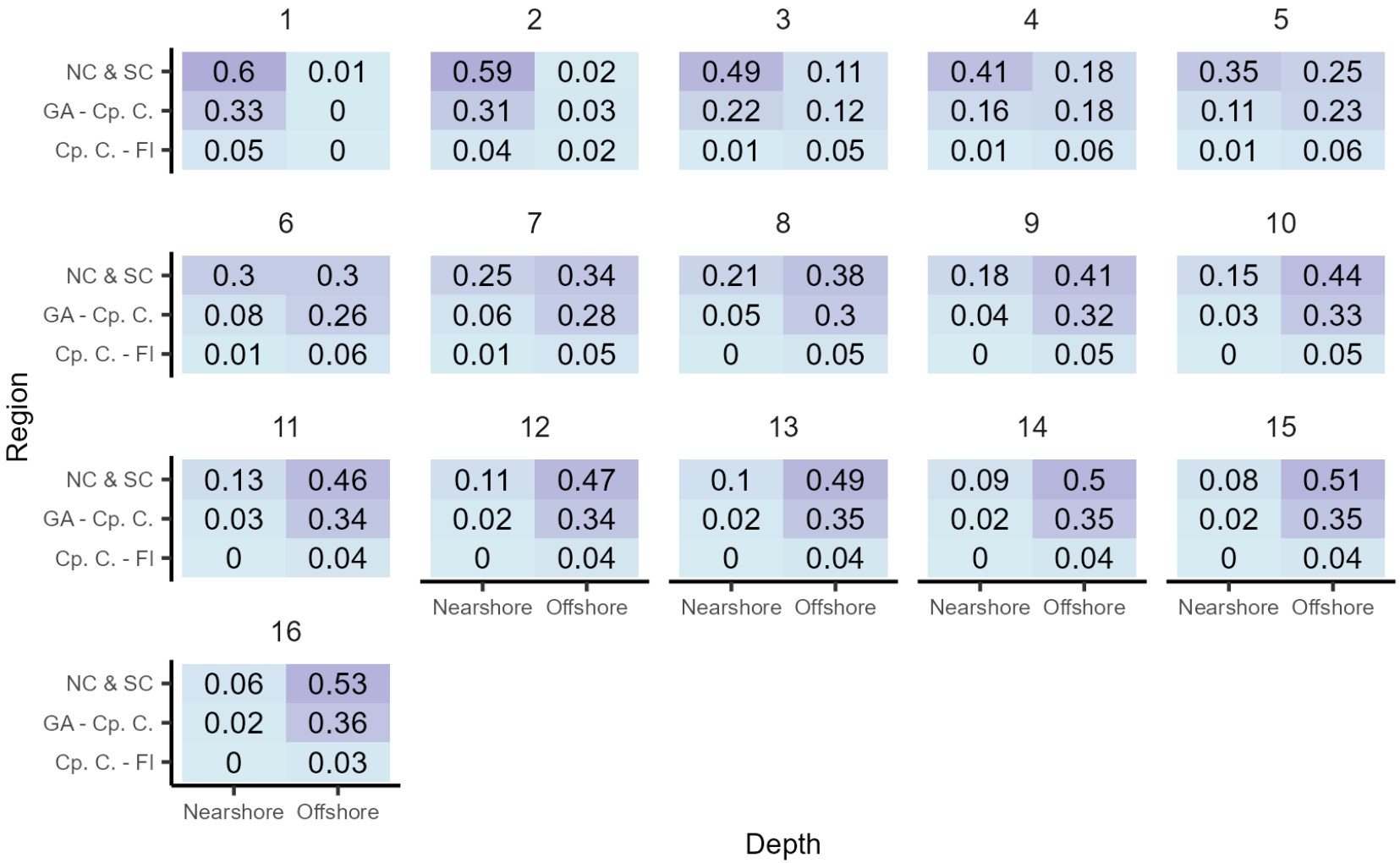
	Red Snapper		Gag Grouper		Black Sea Bass	
Region	Nearshore	Offshore	Nearshore	Offshore	Nearshore	Offshore
North and South Carolina	10	5	32	30	45	5
Georgia Cape Canaveral	50	31	15	18	41	5
Cape Canaveral Florida	2	3	2	3	3	1

- Recruitment (age-0) 100% in the Nearshore
- Age-based distribution and movement calculated so that biomass distribution in terminal year matched distribution from VAST model applied to SERFS data
- Spatial distribution of fishing effort solved so that overall F matched assessment

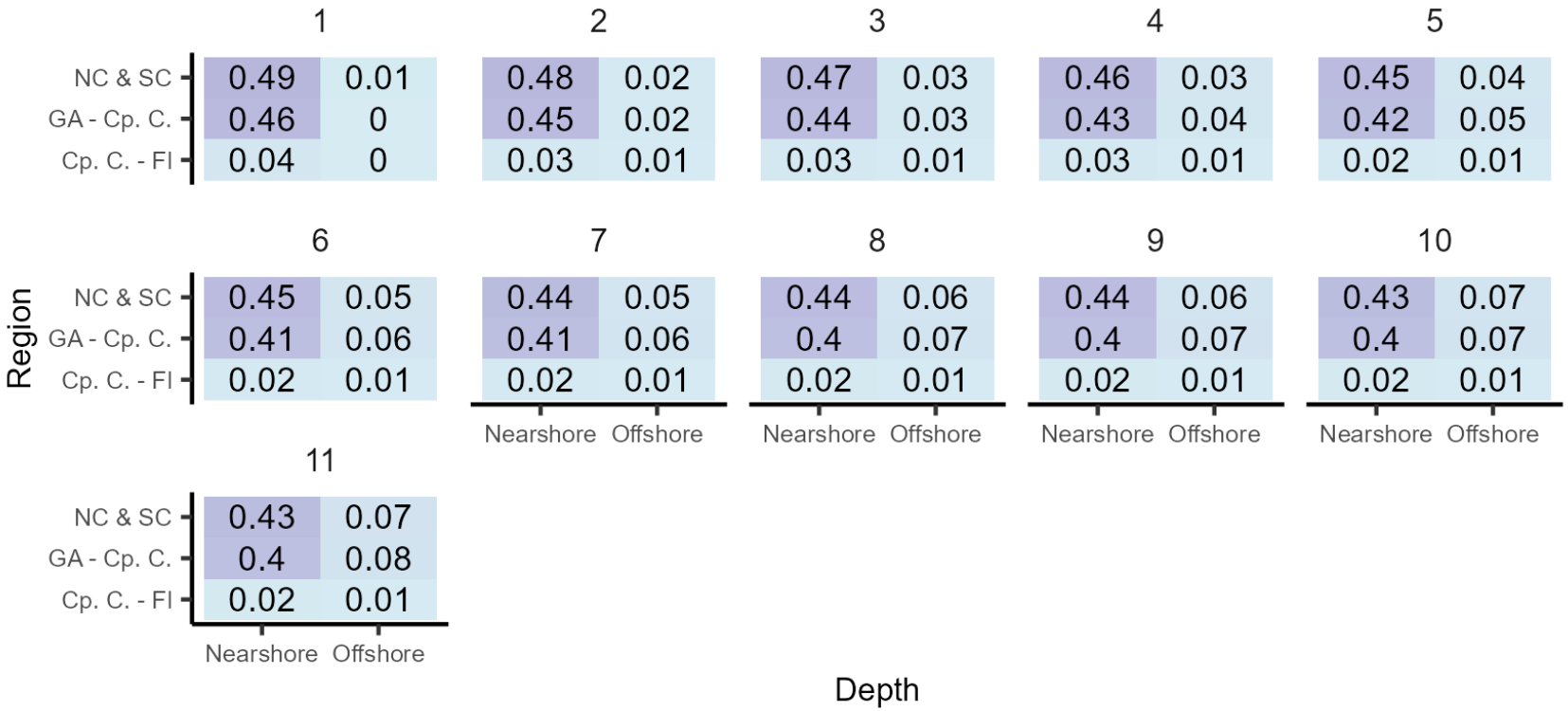
Distribution by Age: Red Snapper (terminal year)



Distribution by Age: Gag Grouper (terminal year)



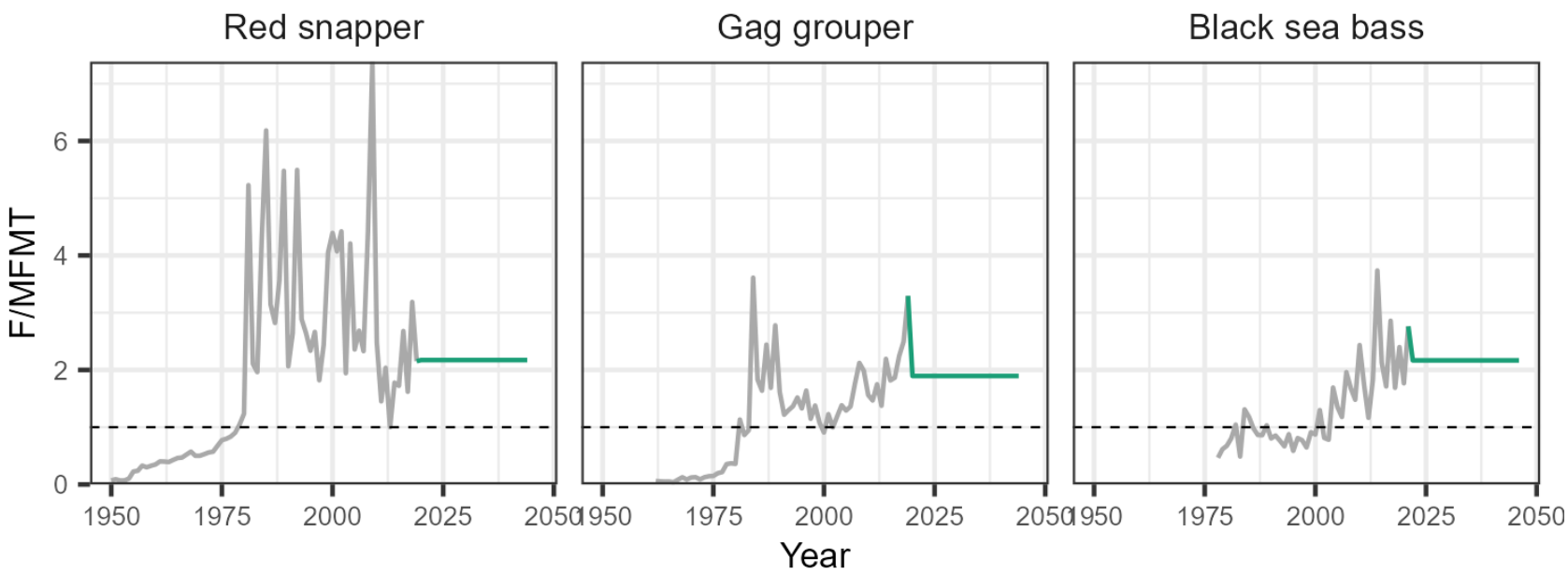
Distribution by Age: Black Sea Bass (terminal year)



Management Scenarios

Status Quo (SQ)

F fixed to geometric mean from last 3 years



Modifications to SQ Management

Code	Name	Description
FR	Full Retention	All fish that are caught are retained. No discarding.
MLL	Minimum Length Limit	• Red snapper: 24 inch • Gag: 12 inch • Black Sea Bass: 12 inch Fish below the MLL were discarded and suffer from discard mortality
NS	Nearshore	All fishing effort is shifted to the Nearshore region
OS	Offshore	All fishing effort is shifted to the Offshore region

Management Combinations

12 Combinations:

1. ***SQ***: Status Quo
2. ***SQ_FR***: Status Quo with Full Retention (no closed season)
3. ***SQ_MLL***: Status Quo with a Minimum Size Limit

...

12. ***SQ_FR_MLL_OS***: Status Quo with Full Retention, Minimum Size Limit, and all effort in Offshore

Reduction in Effort for General Recreational Fleet

11 Levels of Relative Effort:

1. **100%** Effort remains at SQ level
2. **95%** Effort reduced by 5%
3. **90%** Effort reduced by 10%

...

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

Management Scenarios

12 Management Combinations

x

11 Levels of Gen. Rec. Effort

=

132 Management Scenarios

Summarizing Results

Summarizing Results

1. Projection plots of median SB/Rebuilding Target
2. Projection plots of median Landings & Discards
3. Calculate Probability of Rebuilding

Rebuilding

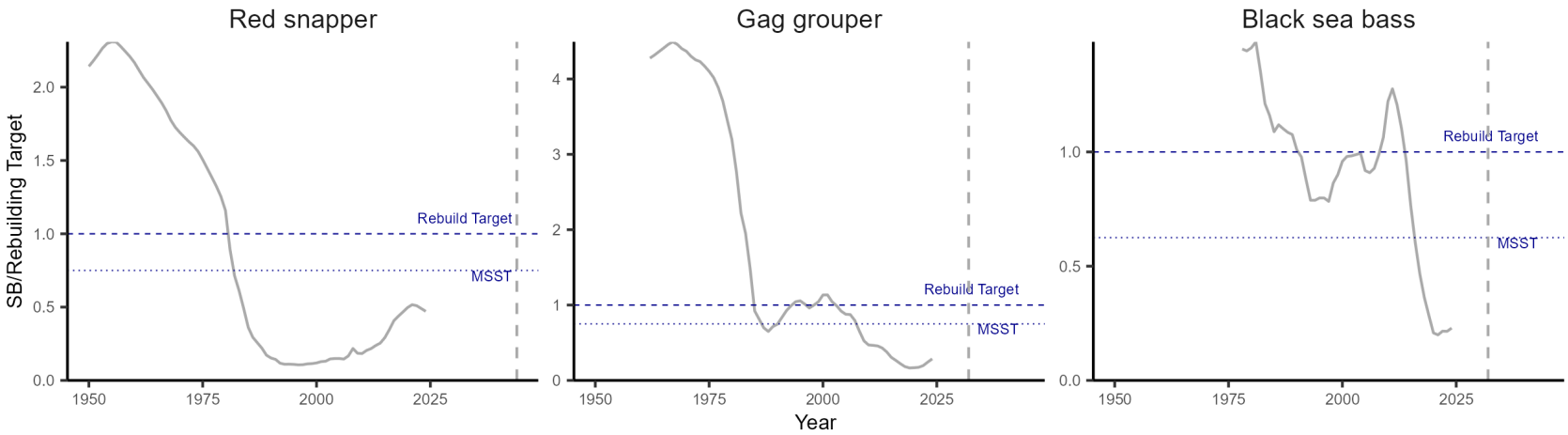
Rebuilding Target:

- 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)

Minimum Stock Size Threshold (MSST):

- Red Snapper: $0.75SB_{\text{F30\%}}$
- Gag: $0.75SB_{\text{MSY}}$
- Black Sea Bass: $(1 - M)SB_{\text{MSY}}$

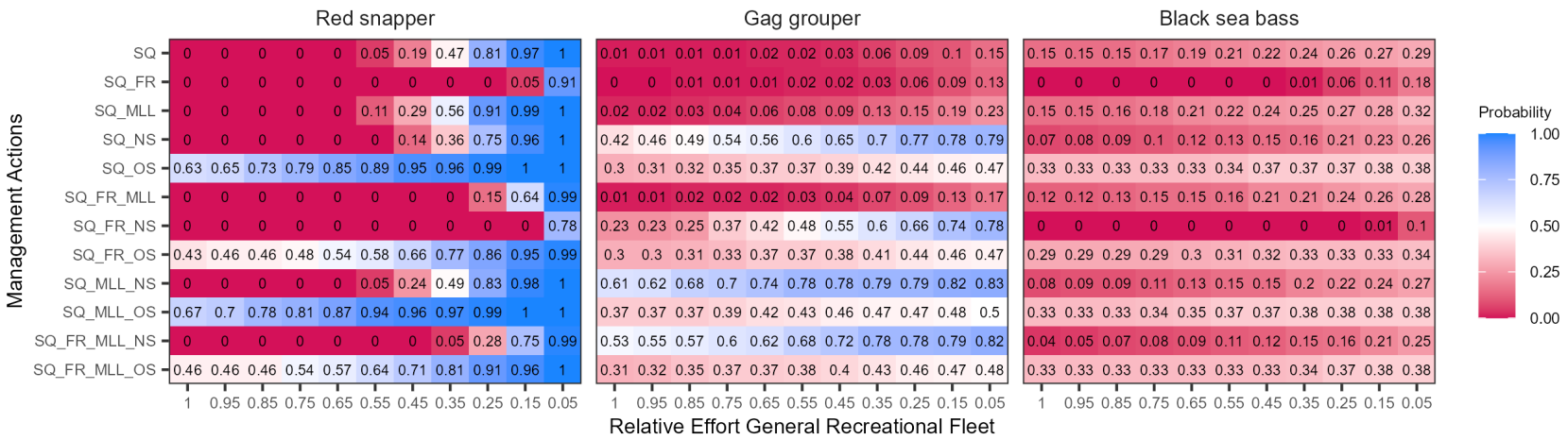
Historical SSB relative to Rebuilding Target



Results

Prob. of Rebuilding by Target Year

All 132 management options for Base Case OM:



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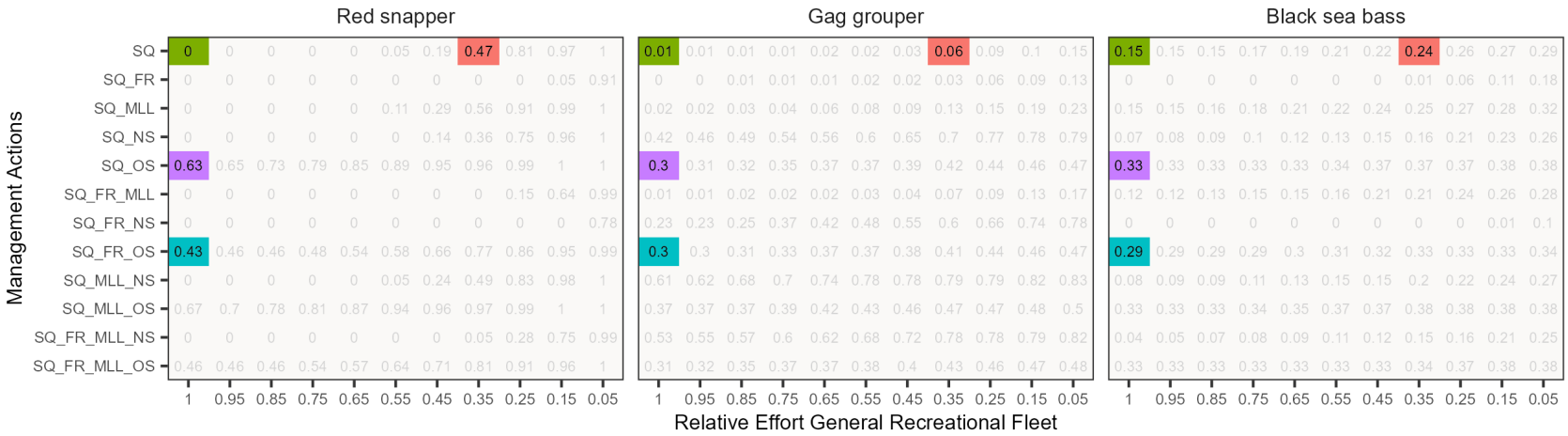
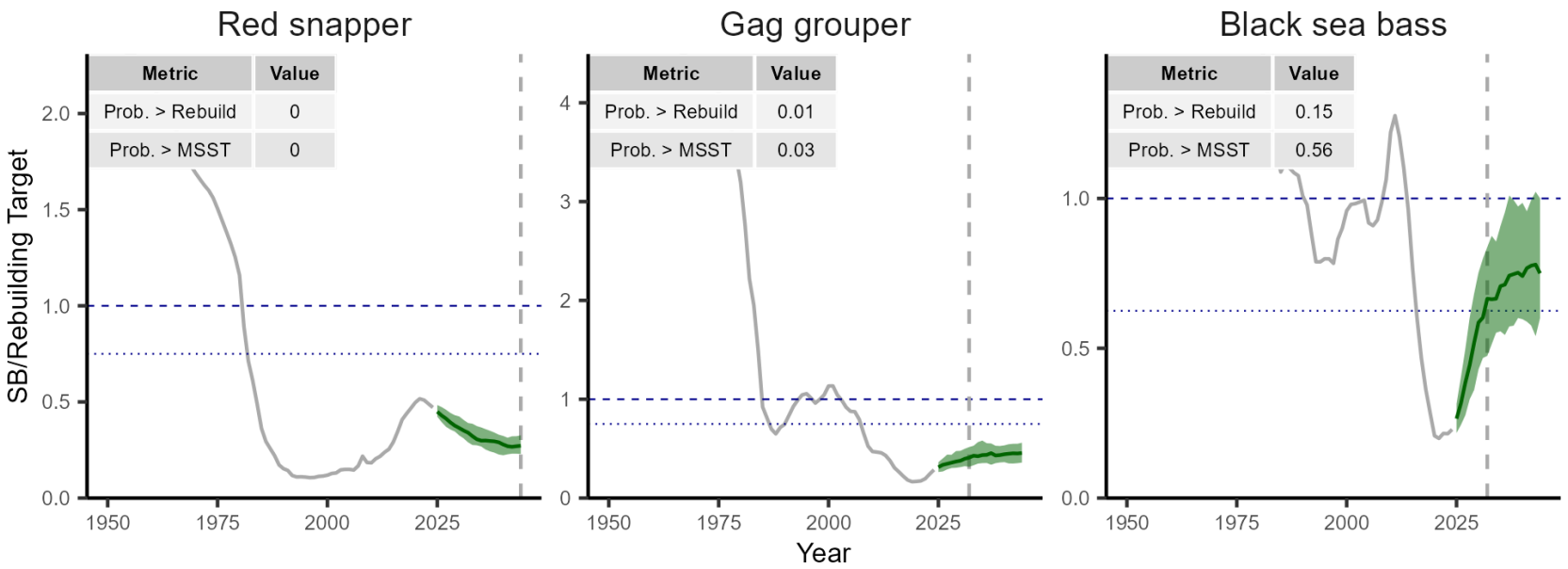


1. Status Quo (SQ)
2. SQ with Gen. Rec. Effort reduced to 35%
3. SQ with Fishing Offshore
4. SQ with Fishing Offshore and Full Retention

1. Status Quo: Rebuilding



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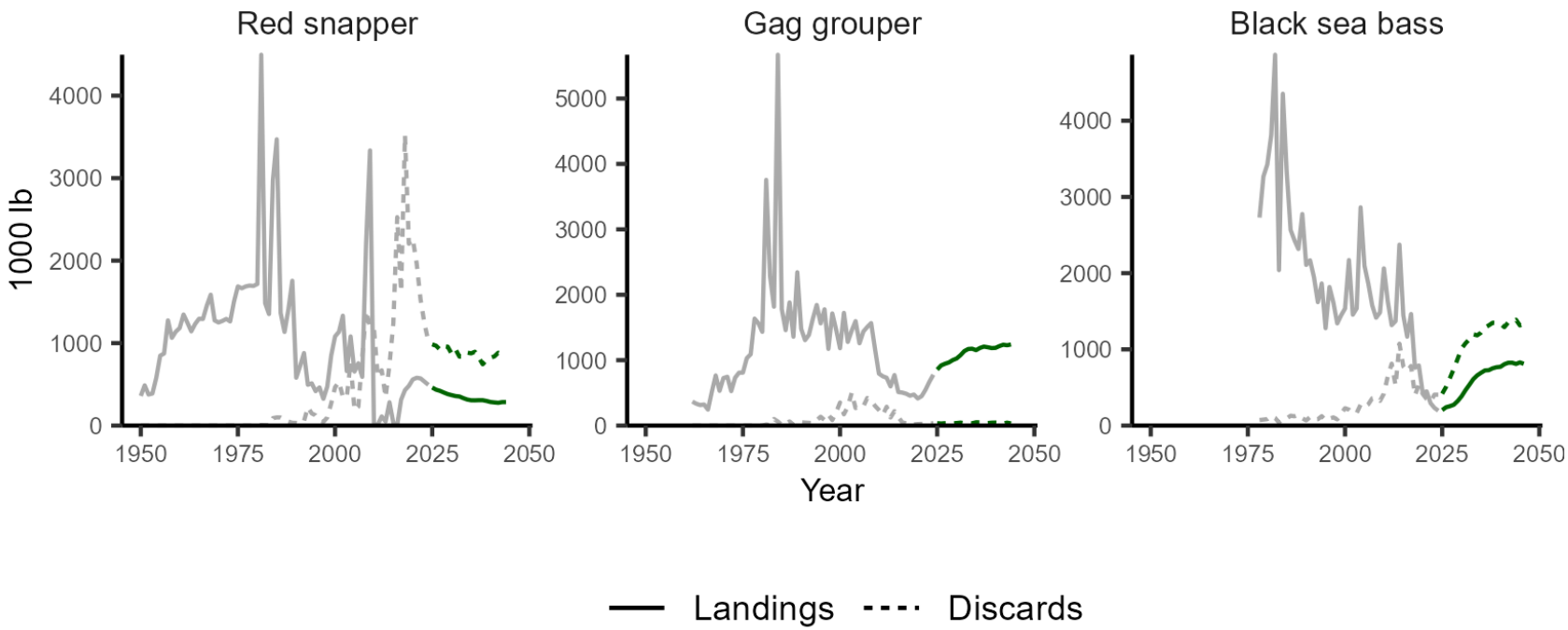

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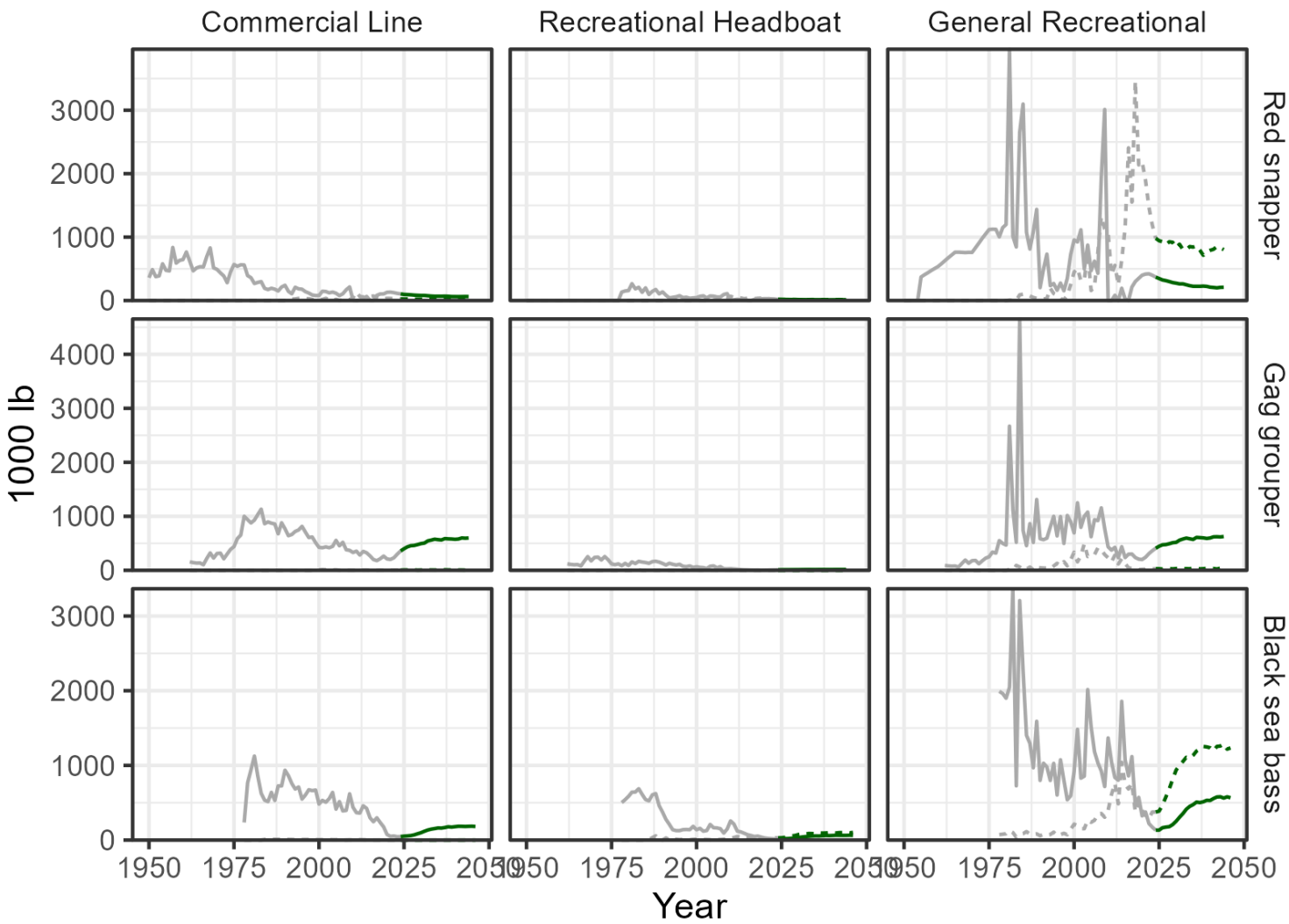

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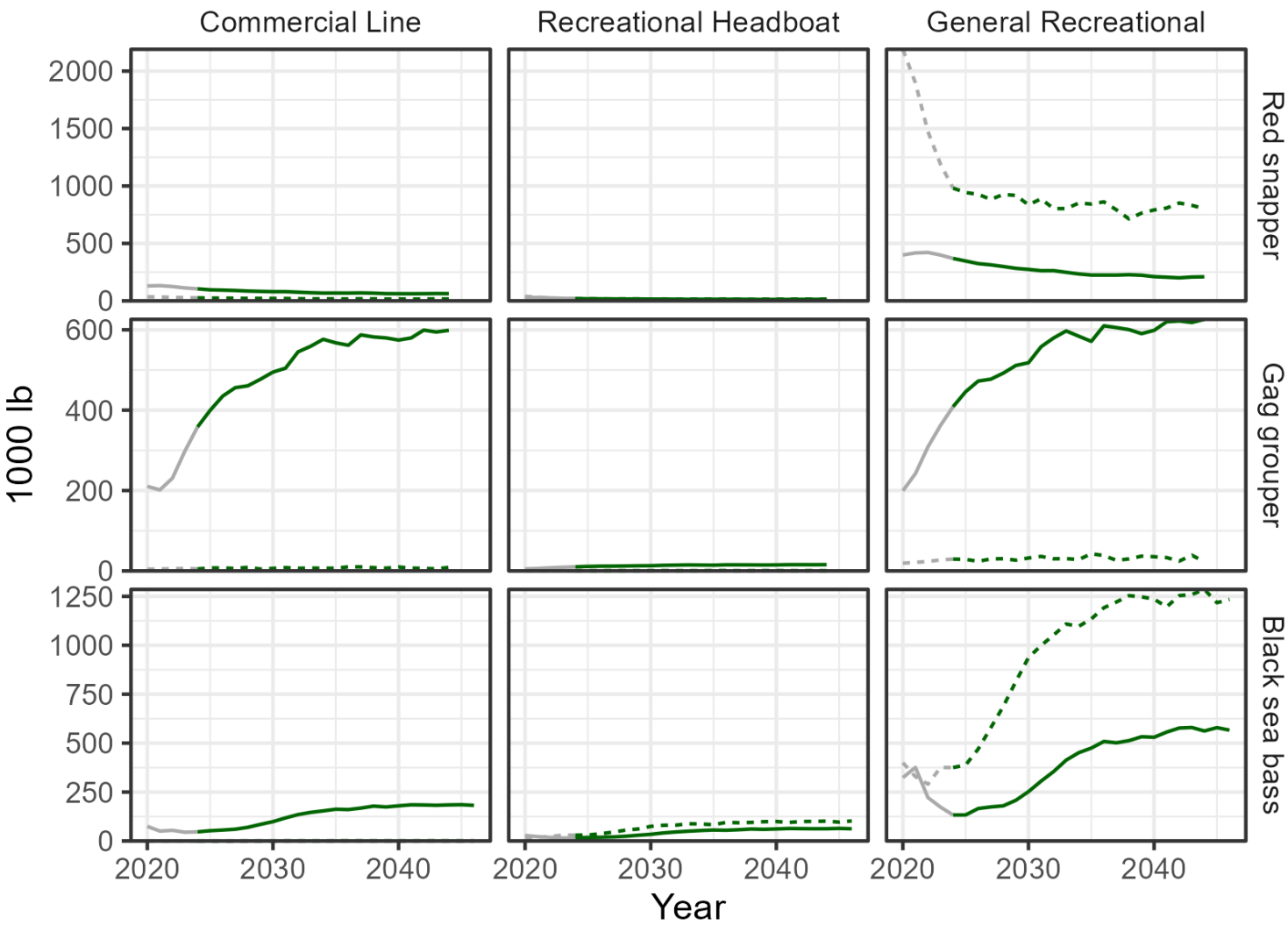
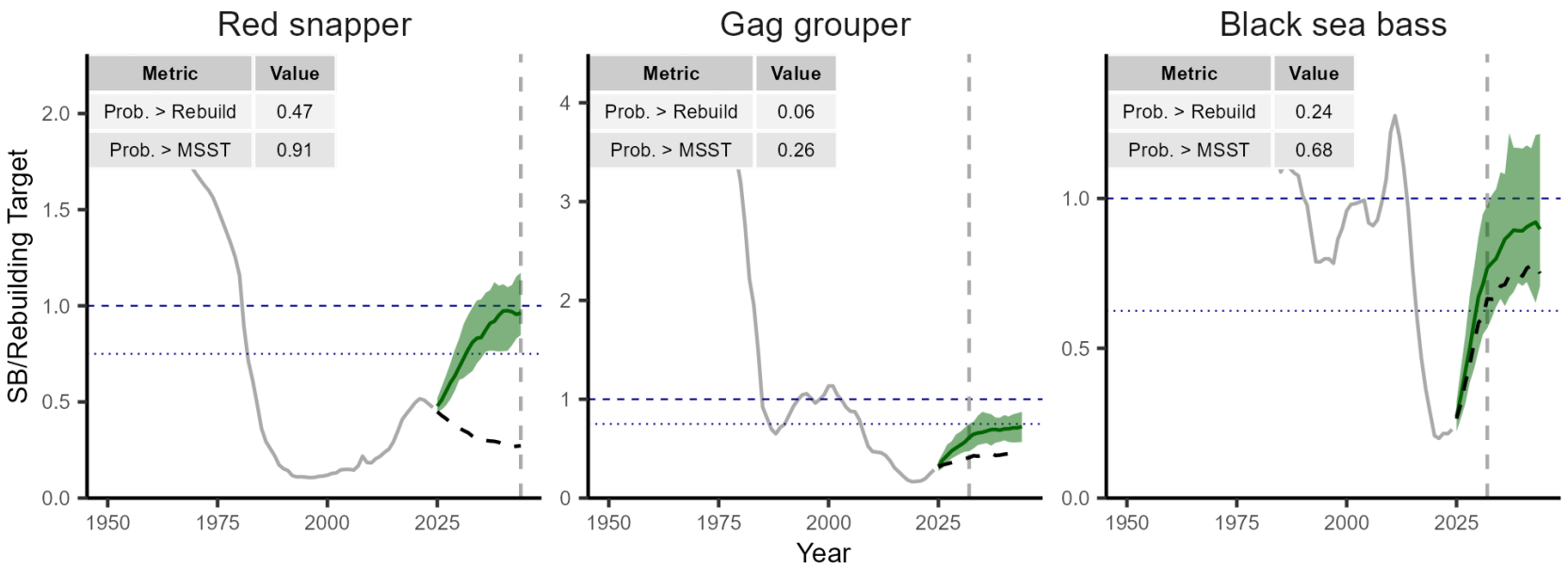


2. Gen. Rec. Effort 35%: Rebuilding



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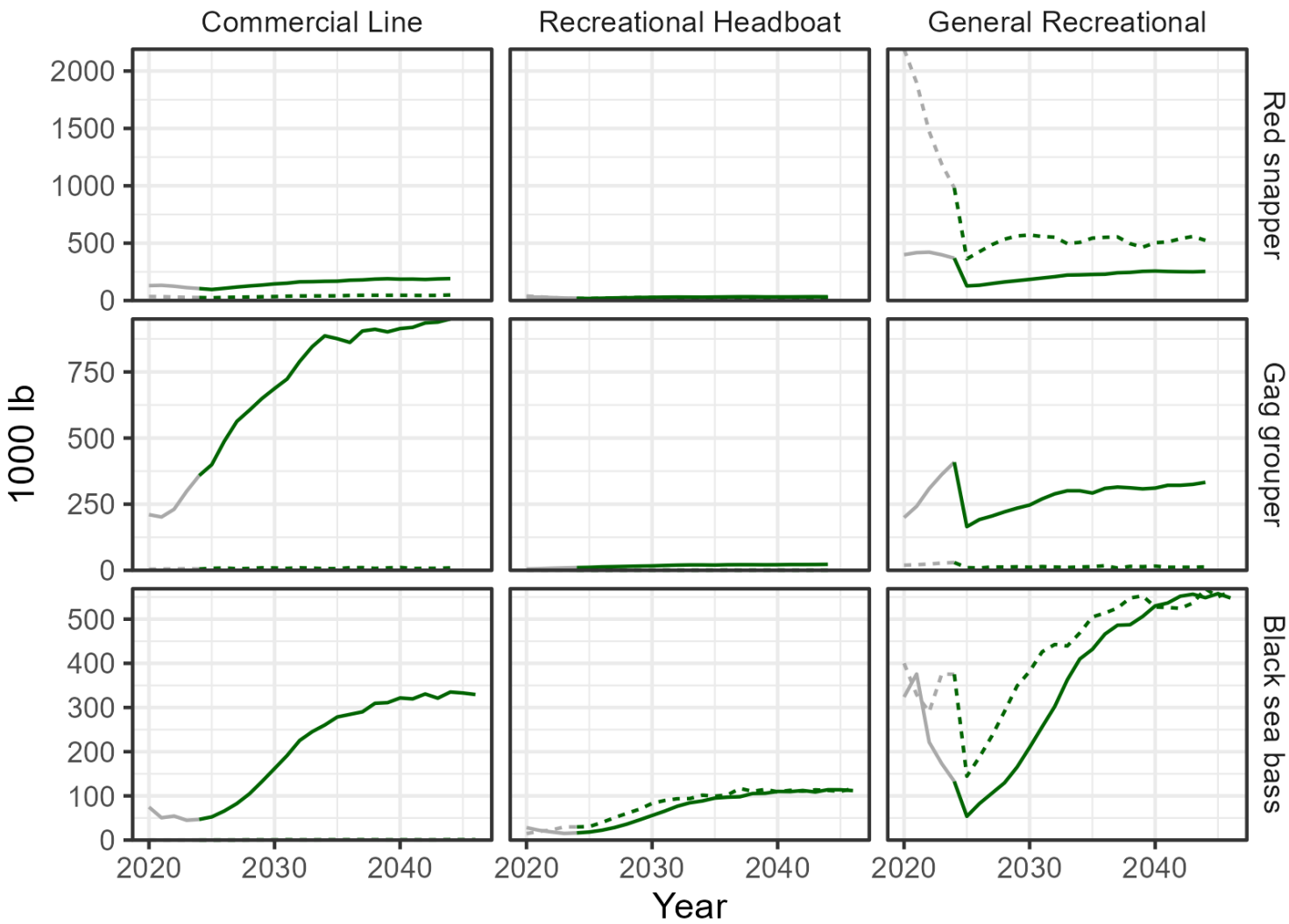
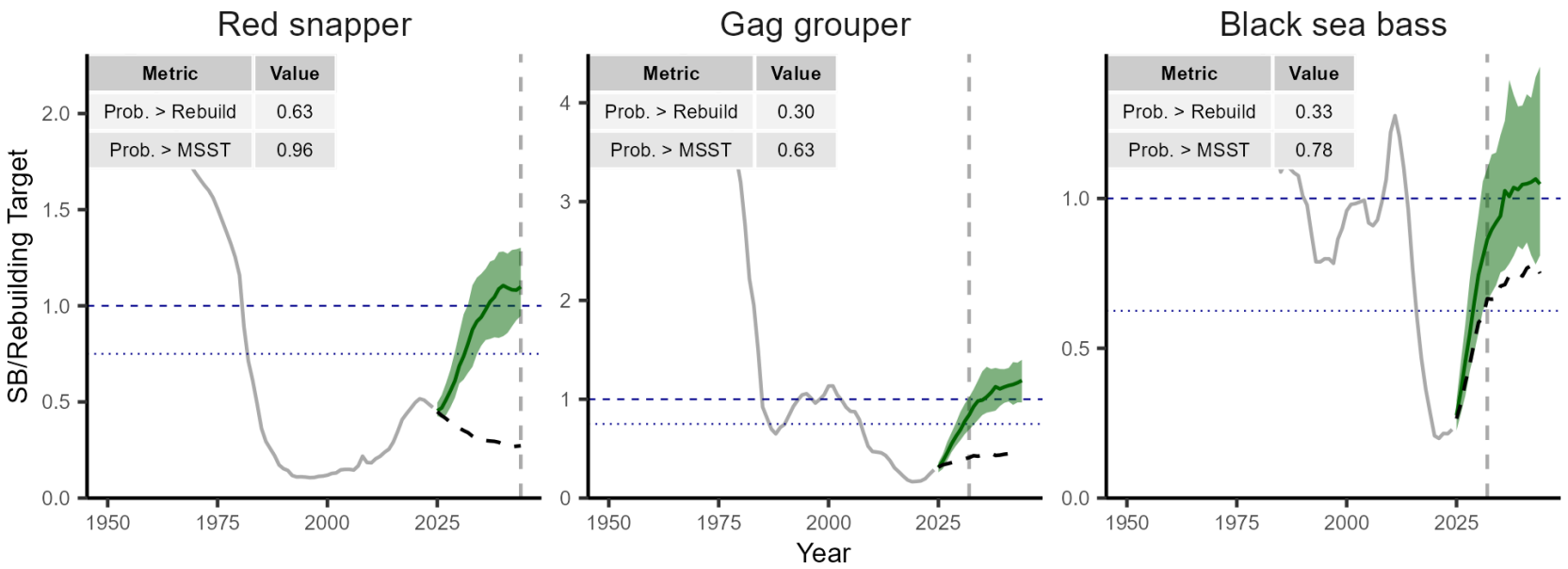


3. SQ Offshore: Rebuilding



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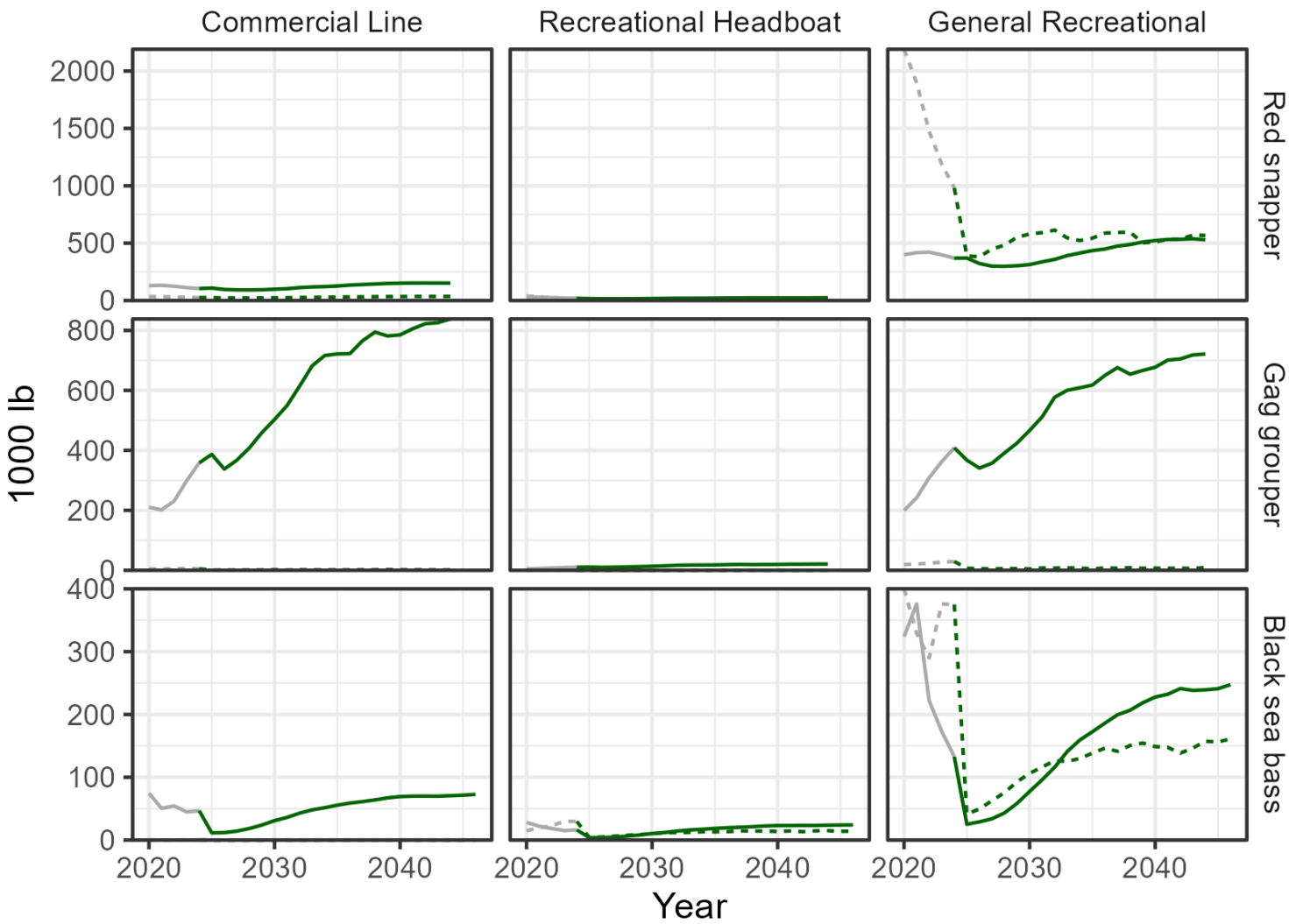
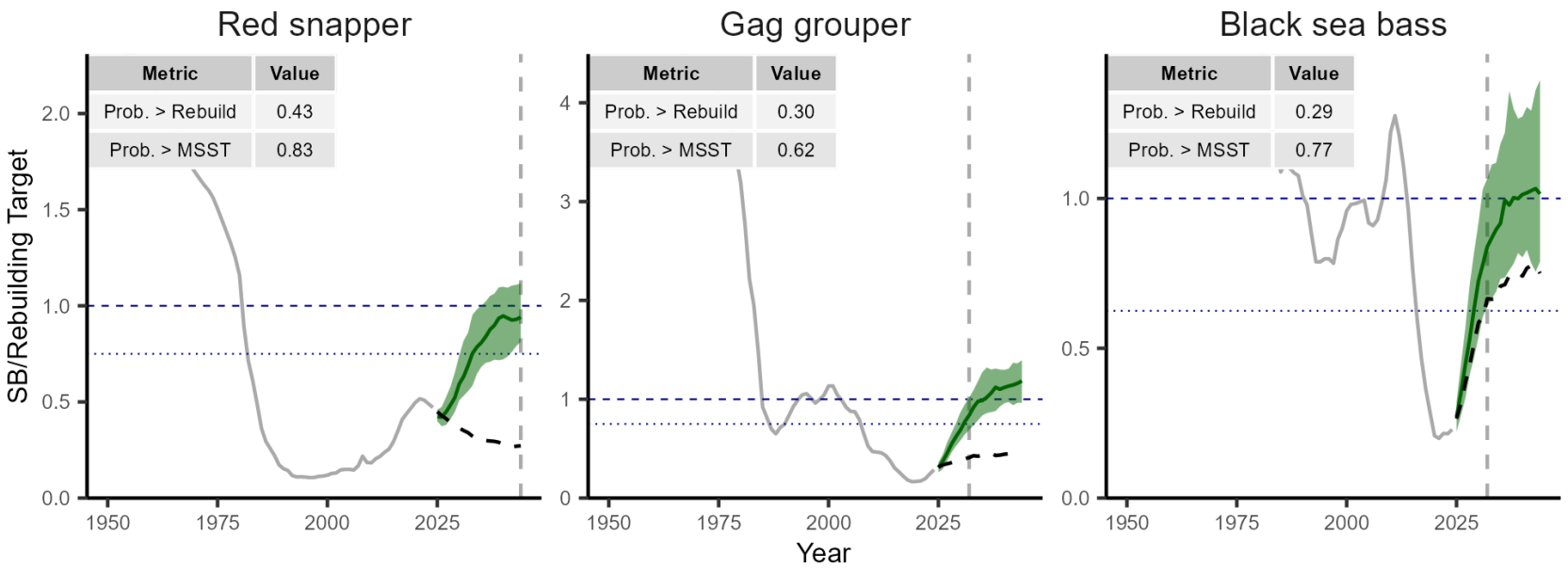


4. SQ OS & Full Retention: Rebuilding



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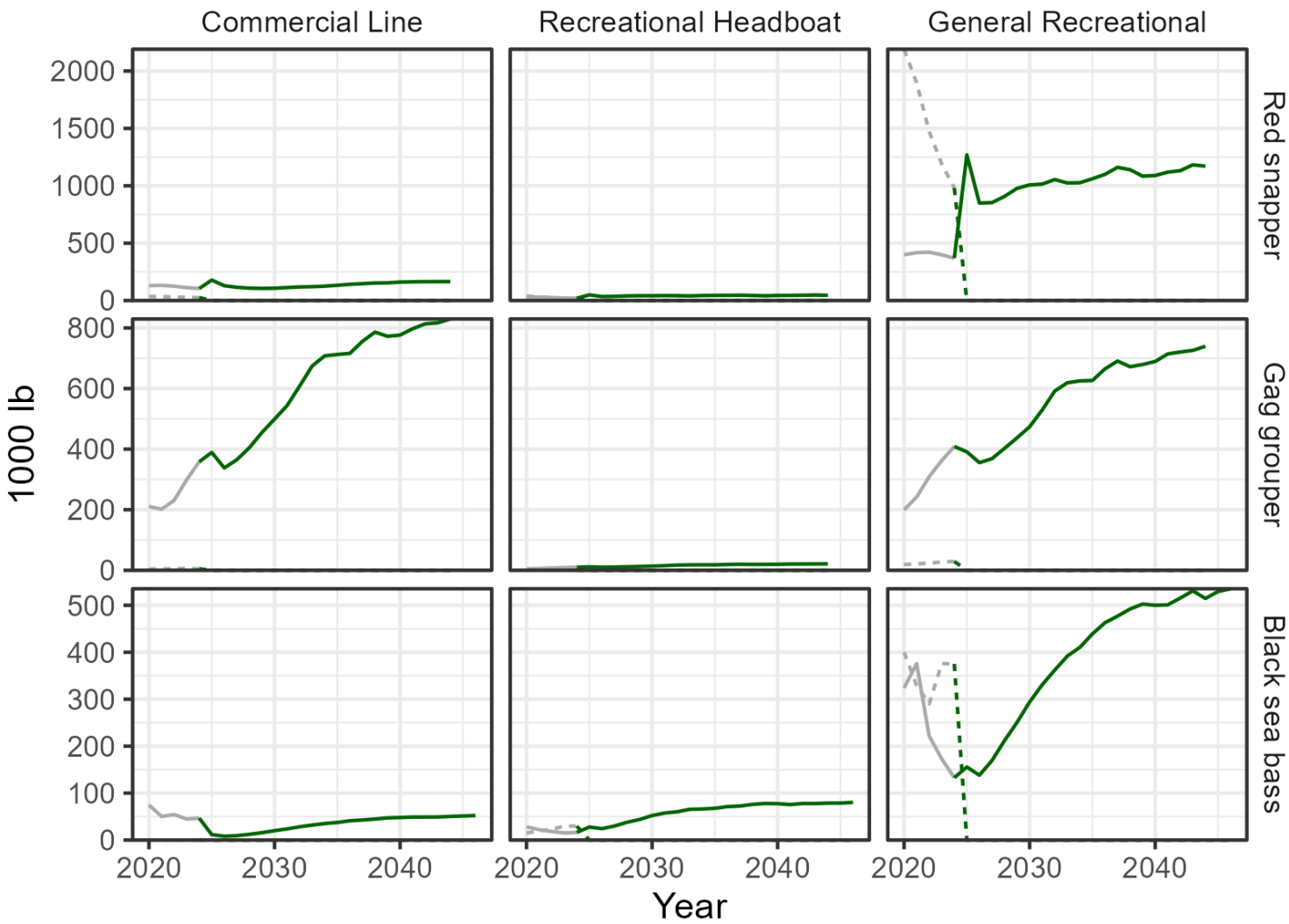

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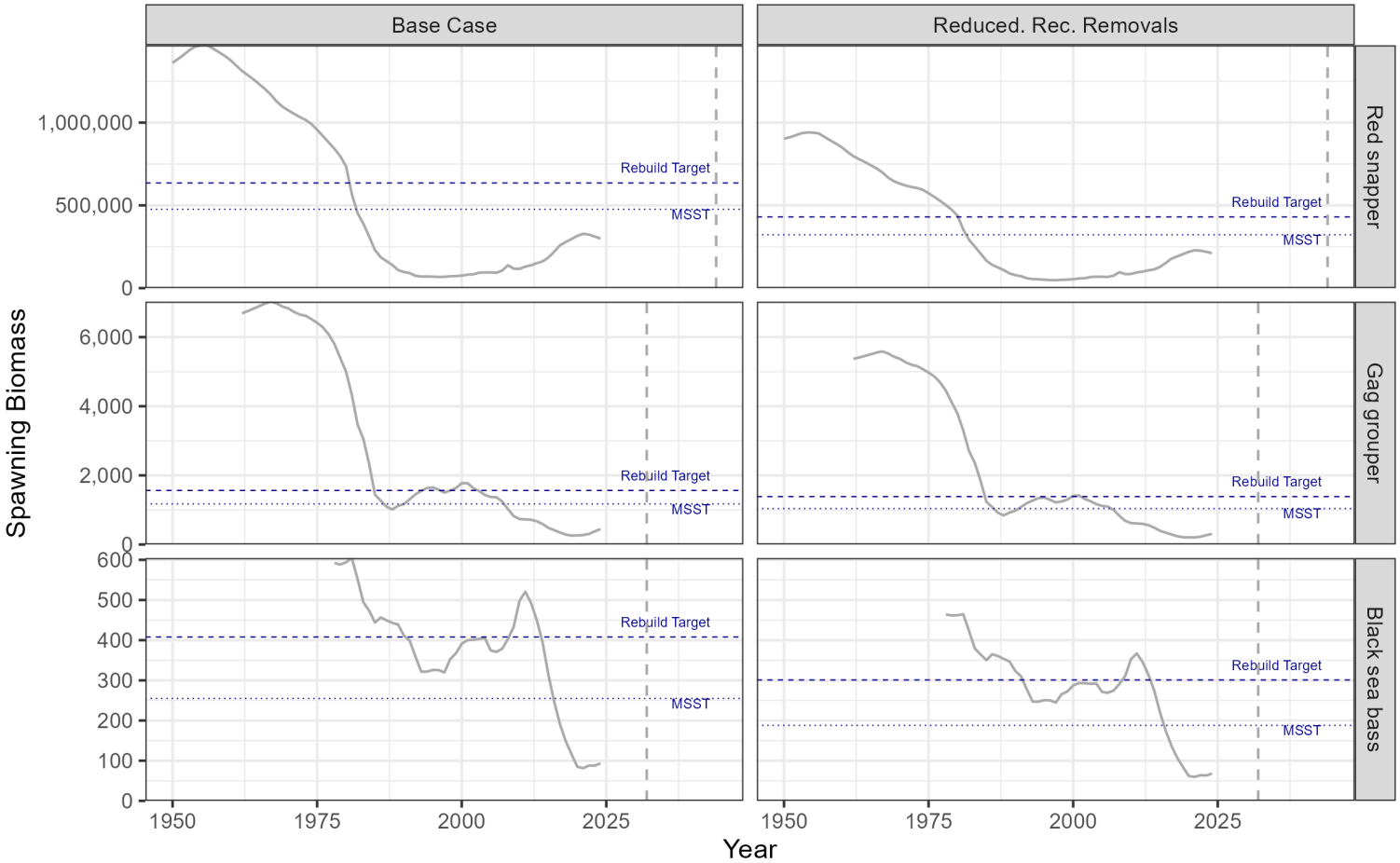
Sensitivity 3: Reduced. Rec. Removals



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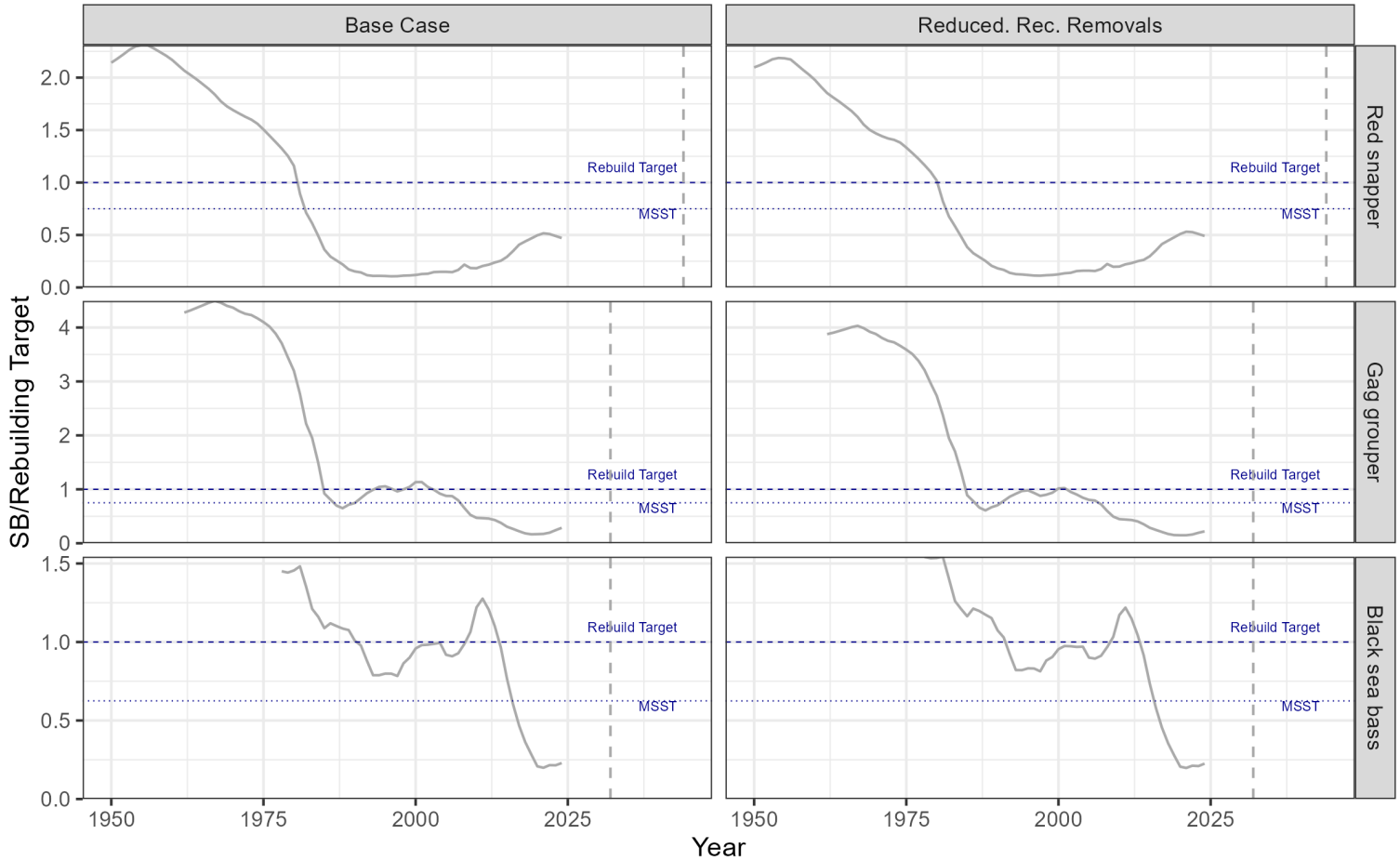

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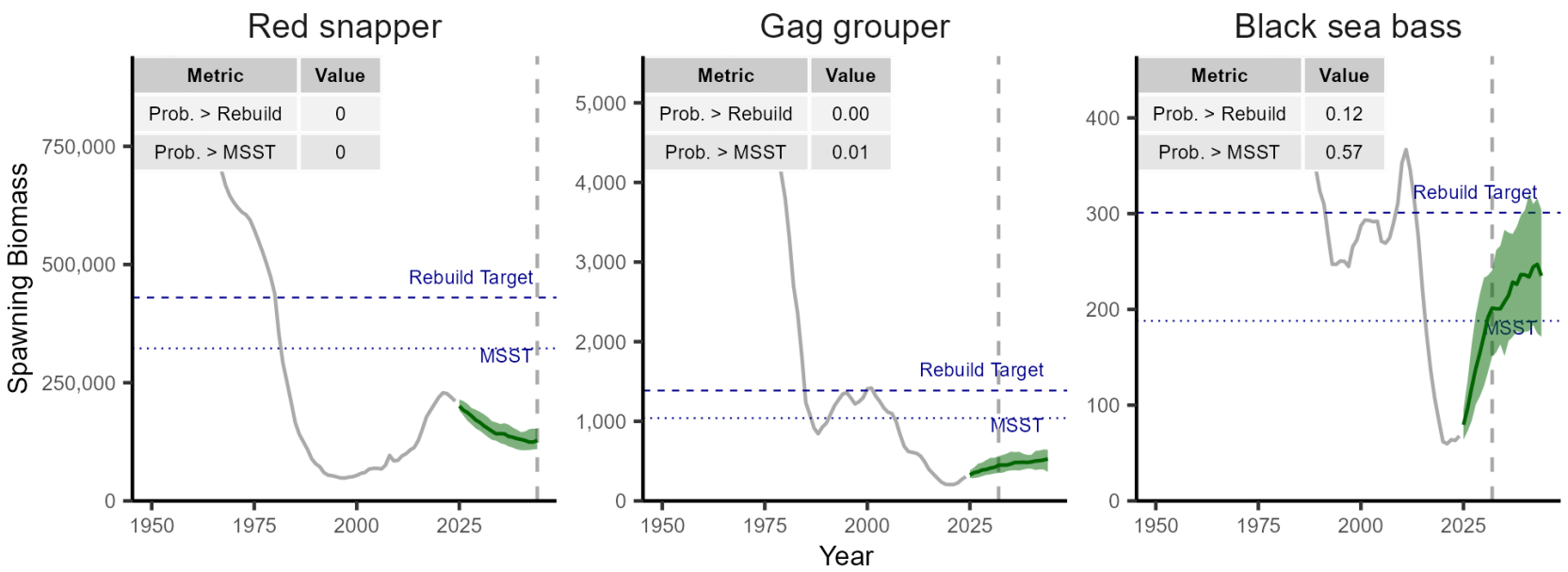
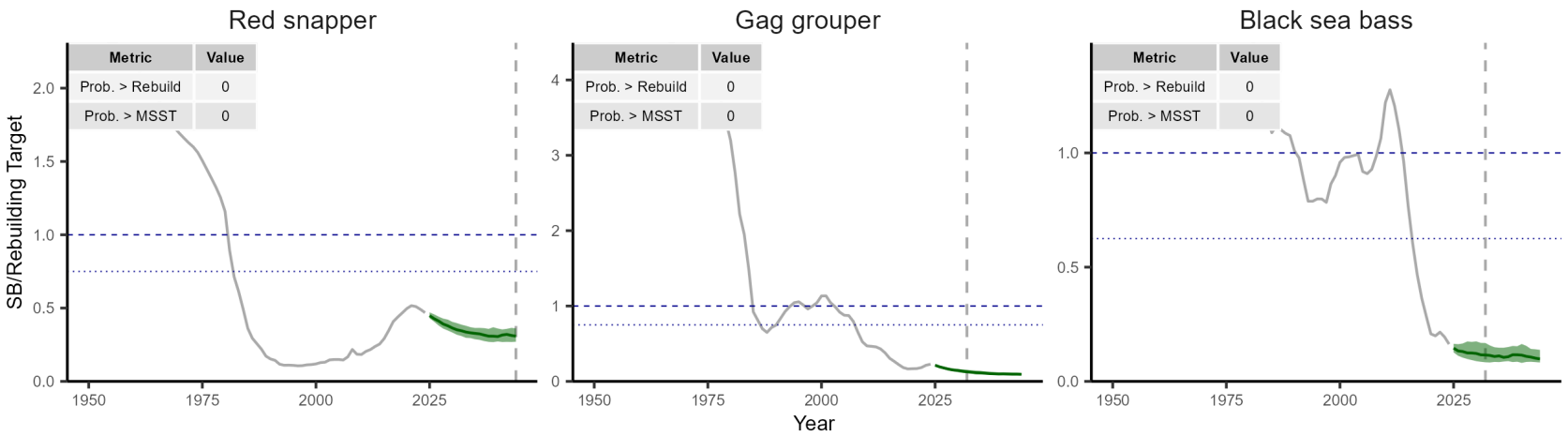
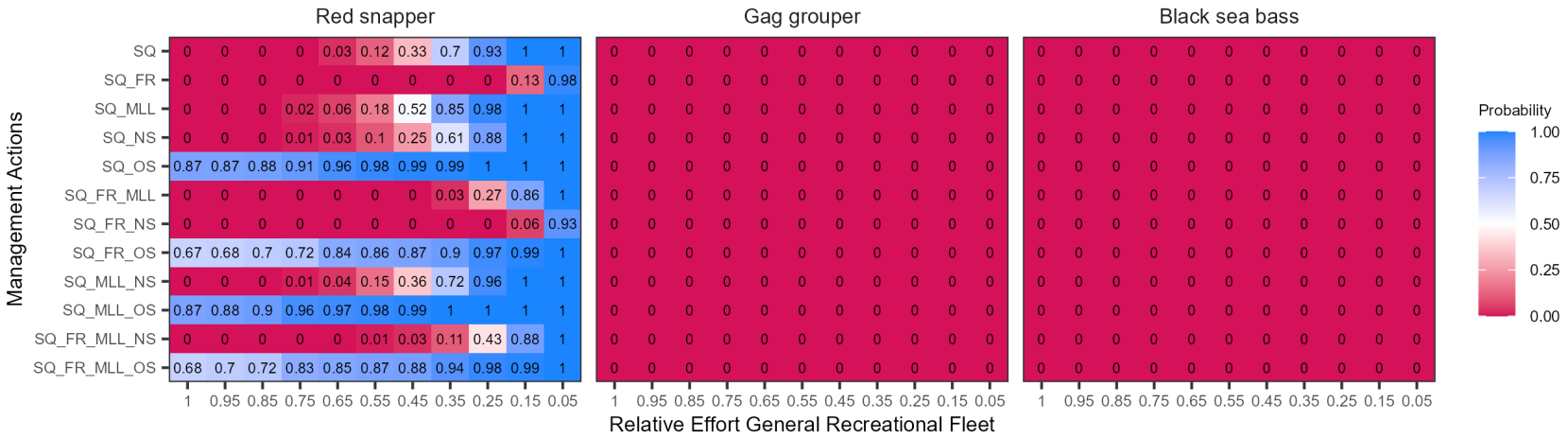


Sensitivity 5: Recent Recruitment

Status Quo



Sensitivity 5: Recent Recruitment



Discussion

Status Quo

1. Red Snapper
   - low prob. of rebuilding
   - decline in biomass and landings
   - relatively high discards
2. Gag
   - low prob. of rebuilding
   - slight increase biomass
   - gradual increase in landings
3. Black Sea Bass
   - 15 prob. $SB > SB_{\text{MSY}}$ by 2032
   - increasing biomass and landings
   - relatively high discards

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Rebuilding requires reduction in F and/or increase in spawning output

Reducing General Recreational Effort

1. Largest impact on *Red Snapper*
   - 35%; Prob. of rebuilding <1% $\longrightarrow$ 47%
2. General increase in biomass & landings (except Gen. Rec.)
3. Reduction in discards (RS & BSB; Gen Rec.)
4. *Black Sea Bass*: some increase prob. rebuild (15% $\longrightarrow$ 25%)
5. Less impact on *Gag* (1% $\longrightarrow$ 6%)
   - Commercial Line highest catches
6. Relative increase in landings for other fleets

Full Retention

1. No closed fishing season; all catch retained; no discarding
2. Short-term increase in landings
3. Decreased probability of rebuilding:
   - all caught fish are removed from population rather than a fraction that survive discarding
4. Other options could be explored:
   - aggregate bag limits; requires model to predict prob. release given catch rates by species
   - closed seasons: requires model to predict change in fishing effort (and distribution) by season length

Minimum Size Limits

1. *Red Snapper*: Not very effective without reduction in discard mortality
2. *Gag & Black Sea Bass*: Similar to Status Quo
3. Other options could be explored:
   - fleet- and/or area-specific MLL
   - reductions in discard mortality

Spatial Fishing Effort

1. *Red Snapper & Black Sea Bass*: shifting effort to Offshore largest increase in rebuilding
2. *Gag*: significant increase in rebuilding; shifting to Nearshore most effective
3. Largest impact caused by:
   - shifting fishing mortality to older fish; decreased impact on juveniles (esp. RS)
   - increase in reproductive output
   - effectively reducing F on a fraction of stock
4. Other options could be explored:
   - alternative assumptions for spatial distribution of fish stocks and fishing fleets
   - regulations by region and/or depth

Sensitivity Tests

1. Assumed recruitment patterns in projection period highly influential; additional scenarios could be explored:
   - no correlation in rec. devs
   - alternative Recent Recruitment scenarios
2. Quantitative results are different, but qualitatively the same finding:
   - reduce overall fishing mortality and/or shift effort from small/young fish
3. All OMs conditional on recent stock assessments

Thanks & Acknowledgements

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.