

# Snapper-Grouper MSE

## Preliminary MSE Results

### Advisory Panel

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- 2 Operating Models**
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- 5 Results**
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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)

- Closed-Loop Simulation Testing
- Simulation Model of a Fishery System
- Project Forward with Different Management Methods

# Key Components

- 1 Biological properties of the fish stocks
  - 2 Characteristics of the fleets that exploit them
  - 3 Management options to consider
  - 4 Methods to summarize performance
- } Operating Model (OM)

# 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 Probability of Rebuilding Under Range of Scenarios
- 3 Identify Management Options to Explore in More Detail
- 4 Determine Direction for Further Research

# 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 → Operating Models

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

**Base Case OM**

# Sensitivity Tests

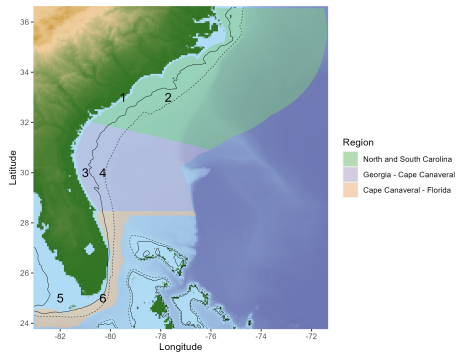
OM		Description
1	Lower M	Lower M from assessments
2	Higher M	Higher M from assessments
3	Reduced. Rec. Removals	Gen. Rec. removals reduced by 40%
4	Effort Creep	Gen. Rec. effort increased by 2% per year
5	Recent Recruitment	Recruitment pattern based on 10 most recent years

# Spatial Structure

## 3 Geographic Regions

## 2 Depth Zones

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



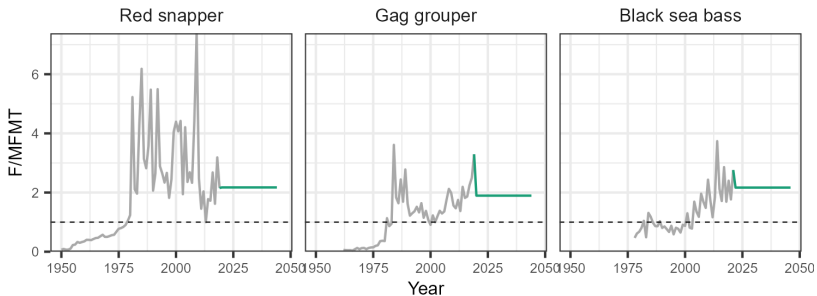
Recruitment occurs in the Nearshore

## 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	<ul style="list-style-type: none"> <li>• Red snapper: 24 inch</li> <li>• Gag: 12 inch</li> <li>• Black Sea Bass: 12 inch</li> </ul> <p>Fish below the MLL were discarded and suffer from discard mortality</p>
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:

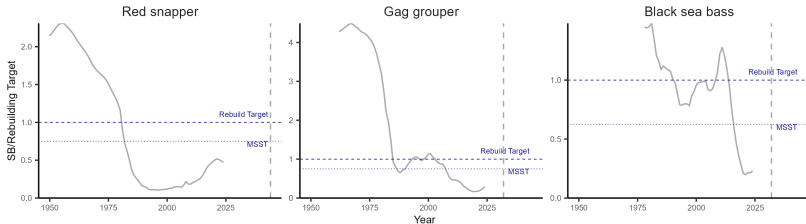
- Red Snapper:  $SB > SB_{F30\%}$  by 2044
- Gag:  $SB > SB_{MSY}$  by 2032
- Black Sea Bass:  $SB > SB_{MSY}$  by 2032 (not under rebuilding plan)

## Minimum Stock Size Threshold (MSST):

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



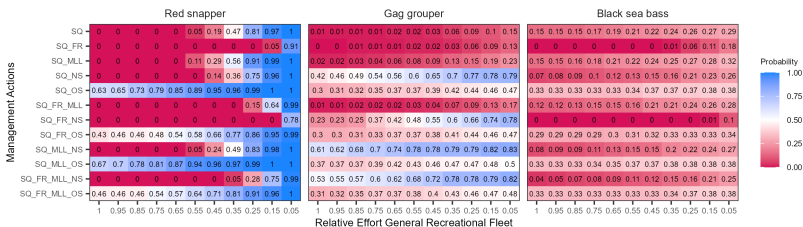
# Historical SSB relative to Rebuilding Target



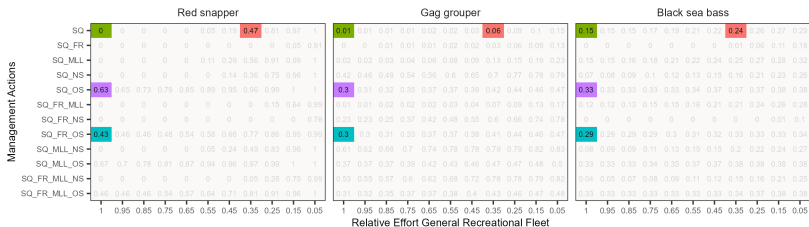
# Results

# Prob. of Rebuilding by Target Year

All 132 management options for Base Case OM:

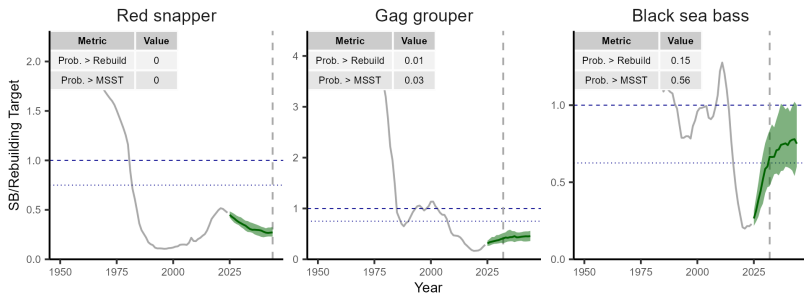


# Prob. of Rebuilding by Target Year

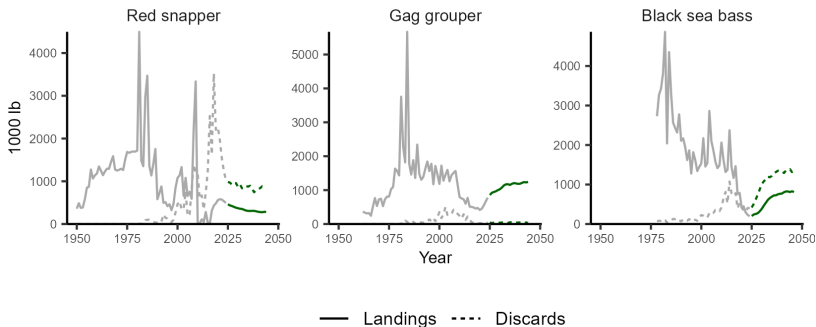


- 1 Status Quo (SQ)
- 2 SQ with Gen. Rec. Effort reduced to 35%
- 3 SQ with Fishing Offshore
- 4 SQ with Fishing Offshore and Full Retention

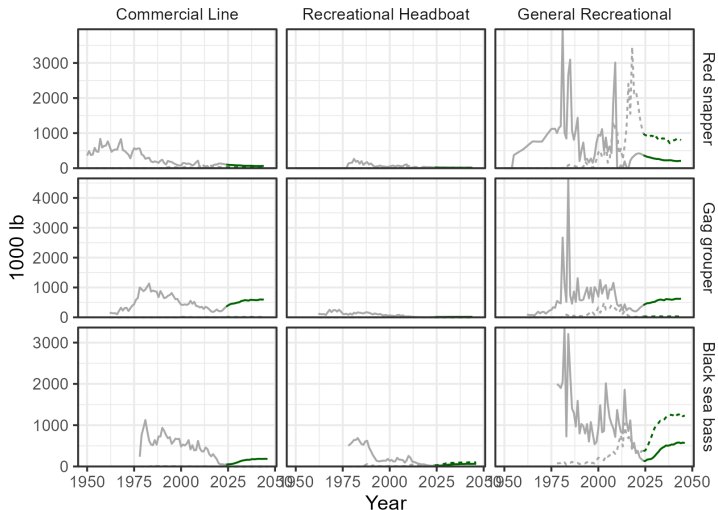
# 1. Status Quo: Rebuilding



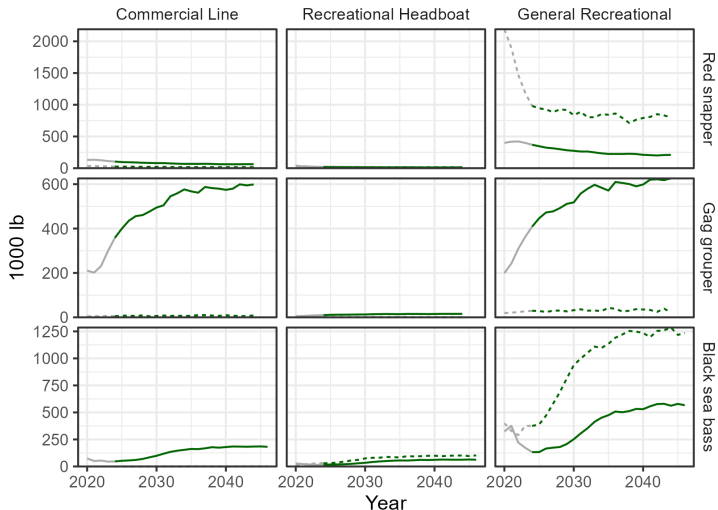
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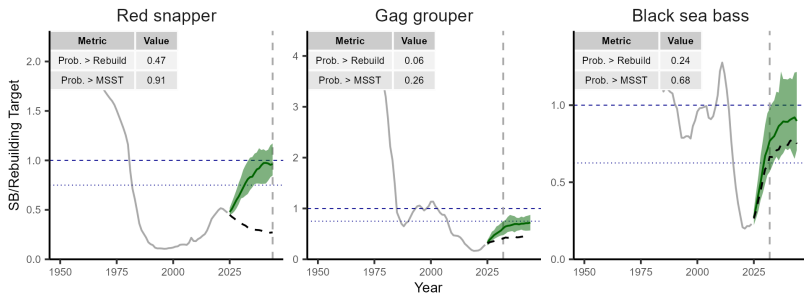


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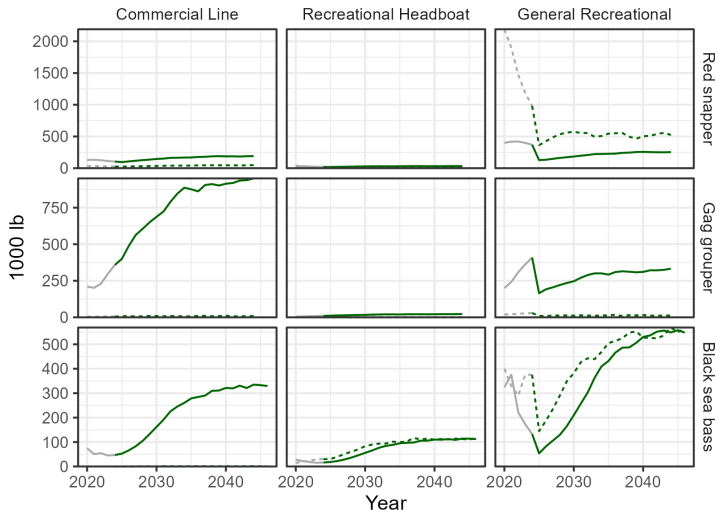




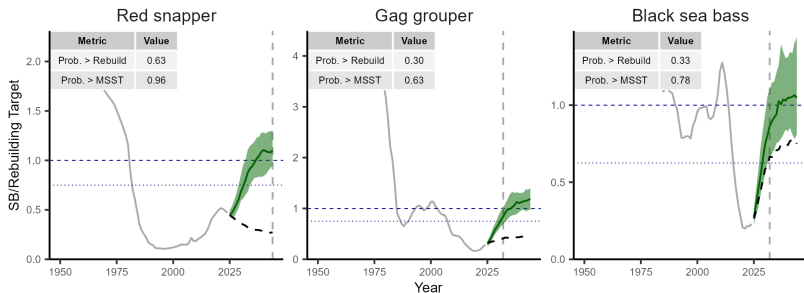
## 2. Gen. Rec. Effort 35%: Rebuilding



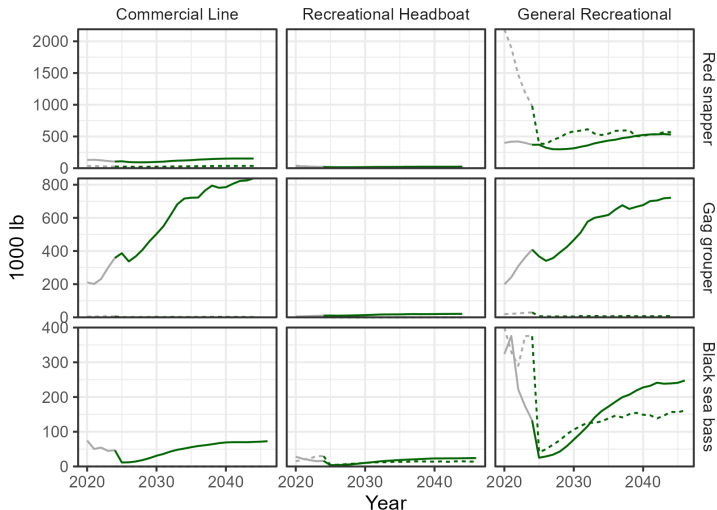
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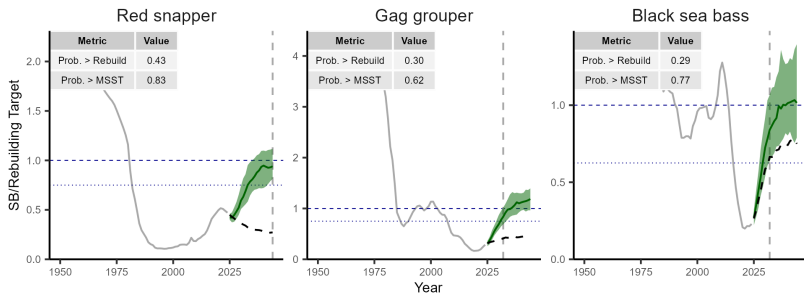
### 3. SQ Offshore: Rebuilding



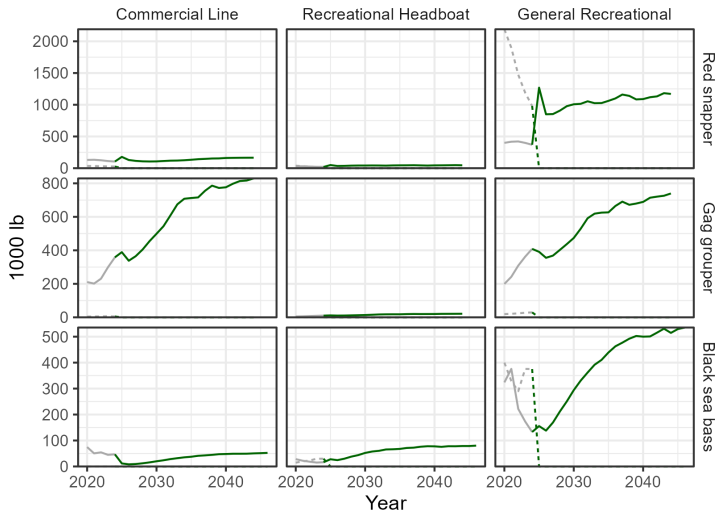
### 3. SQ Offshore: Landings & Discards



## 4. SQ OS & Full Retention: Rebuilding



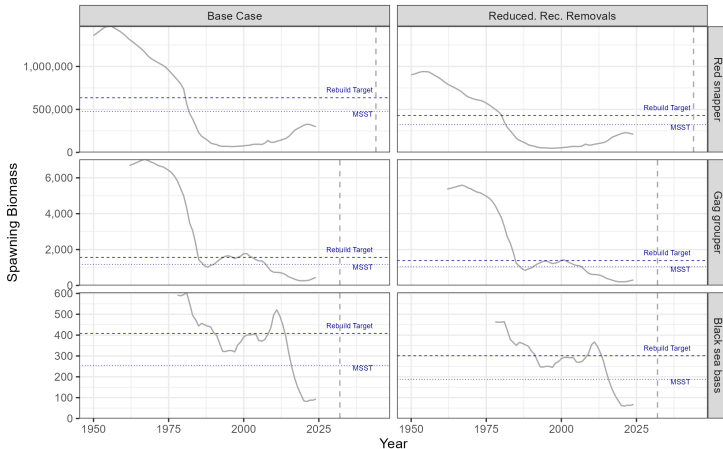
## 4. SQ OS & Full Retention: Landings & Discards



# Sensitivity Tests

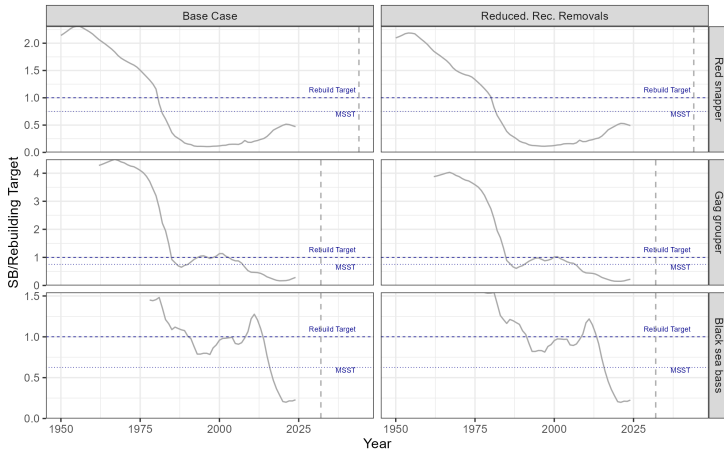
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# Sensitivity 3: Reduced. Rec. Removals



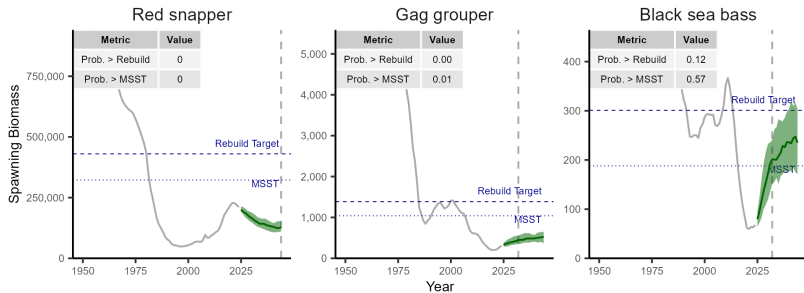


# Sensitivity 3: Reduced. Rec. Removals



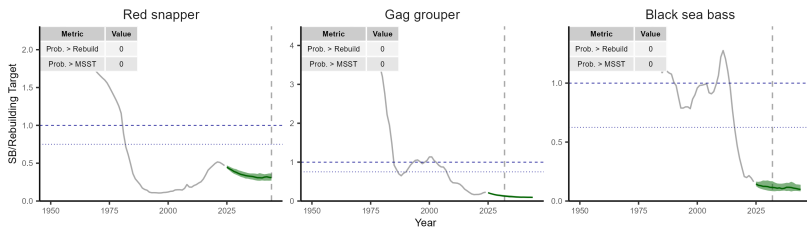
# Sensitivity 3: Reduced. Rec. Removals

## Status Quo

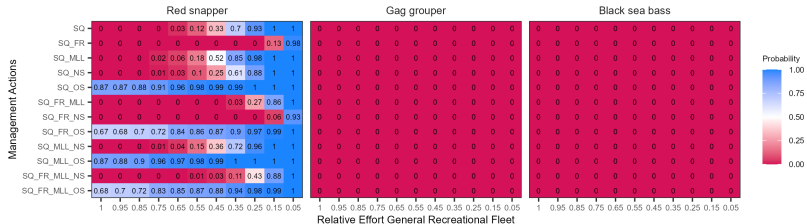


# Sensitivity 5: Recent Recruitment

## 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.  $SB > SB_{MSY}$  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*
- 2 General increase in biomass & landings (except Gen. Rec.)
- 3 Reduction in discards (RS & BSB; Gen Rec.)
- 4 *Black Sea Bass & Gag*
  - *Gag*: Commercial Line highest catches
- 5 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
  - closed seasons

# 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

# Sensitivity Tests

- 1 Assumed recruitment patterns in projection period highly influential
- 2 Quantitative results are different, but qualitatively the same finding:
  - reduce overall fishing mortality and/or shift effort from small/young fish
- 3 All OM's 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.