Science, Service, Stewardship

Minimizing Discards in Snapper Grouper Fishery

Dr. Scott Crosson and Dr. Kyle Shertzer
NOAA SEFSC

NOAA FISHERIES SERVICE

Discards regulations project (Crosson et al.)

1) Compute improved discard estimates for the reef fish fishery in the U.S. South Atlantic

2) Model the economic and biological effects of a limited number of significantly different regulatory regimes that would minimize those discards *while potentially increasing retained catch*.

Workgroup: Rick DeVictor (SERO), Erik Williams and Kyle Shertzer (SEFSC), Genny Nesslage and Chris Dumas (SSC), Scott Crosson (PI/SEFSC/SSC)

Discards Project timeline

One in person meeting in Beaufort in May 2022, online since then

Looking for a contractor to go through logbooks ASAP, looking for a postdoc or grad student

Preliminary modeling underway by Kyle Shertzer

Scenario Modeling

Shorter term options–e.g., area and time closures

Longer term options–individually-oriented effort reduction (tags etc)

Tradeoff between regulatory ease and “angler freedom” (ability to fish when and how you would like to)

Key species

Eventually needs to be multispecies to be truly effective

Start with RS model and add rest of SG complex

- Red snapper, BSB, red grouper, gag, scamp, red porgy, vermilion, gray triggerfish, greater amberjack (cluster together and have assessments, and high landings & discards)
- Add deepwater (blueline, golden, snowy complex) later if well received

Model details

- *N* age-structured populations
- *A* areas in the system (we decided to use A=6)
- Two sectors: commercial and recreational
- Fishing effort $E_{a,s,y}$ is area-, sector, and year-specific. It is common to all species (mixed stock fishery).
- Species-specific catchability *q* links effort to the applied fishing rate, $F_{i,a,s,y} = q_i E_{a,s,y}$ for species *i* in area *a* in sector *s* in year *y*.
- Species-specific discard mortality rate by sector and area, which allows for a depth effect

Project phase one

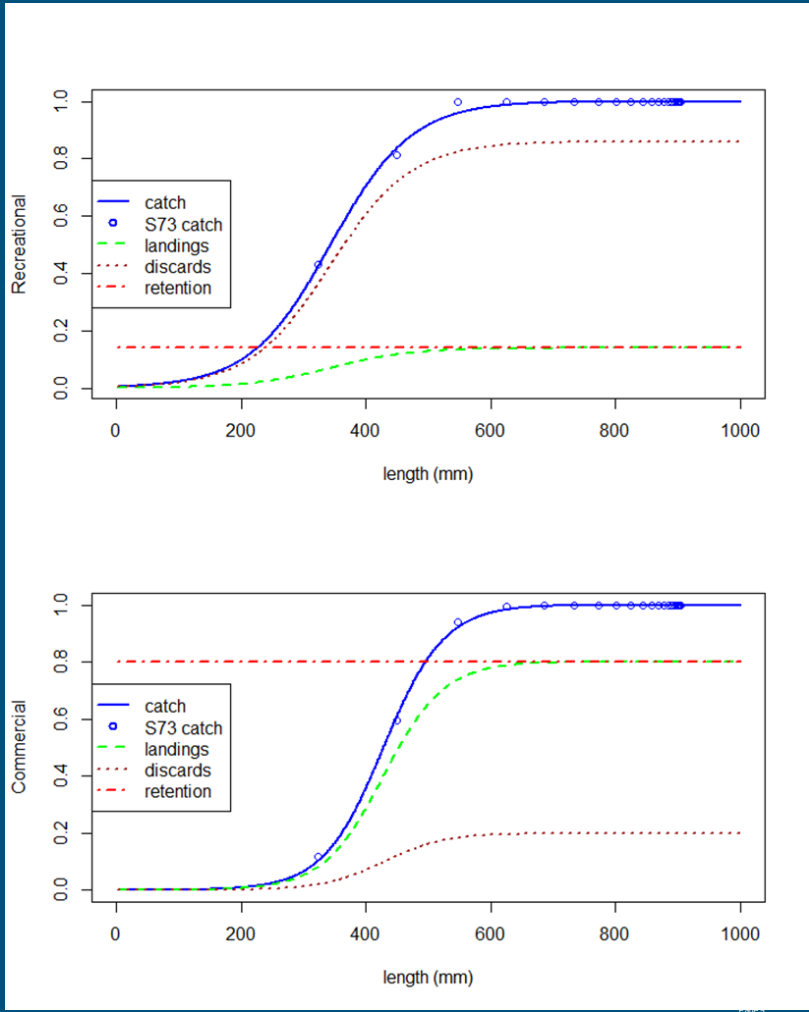
- Focus on red snapper only; phase two will include more species
- Six data needs
  - Life-history info (M, growth, maturity, recruitment)
  - Selectivity
  - Discard M by depth
  - Spatial distribution of abundance
    - Snapper-grouper commercial effort by year, month, area
    - Snapper-grouper recreational effort by year, month, area

Life-history info

- M, growth, maturity, recruitment all from the S73 stock assessment
- A trivial difference is that here we use the Beverton-Holt recruitment model, whereas S73 used the mean recruitment model.
  - Steepness = 0.99 to approximate the mean model
- The model allows for stochastic recruitment, but that’s turned off for now.
  - Dynamics are deterministic; results are expected values

Selectivity

- Different approach from S73.
  - S73 used age-based selectivity with landings and discards as separate fleets
  - This model uses length-based catch selectivity with retention functions for separating landings from discards
- Based on S73 in the following ways
  - Assumed the catch selectivity by sector was logistic, with ascending limb equal to the ascending limb of discards selectivity from S73 (ages to lengths using mean growth)
  - Assumed retention by sector equals the ratio of landings F to total F



Discard M by depth

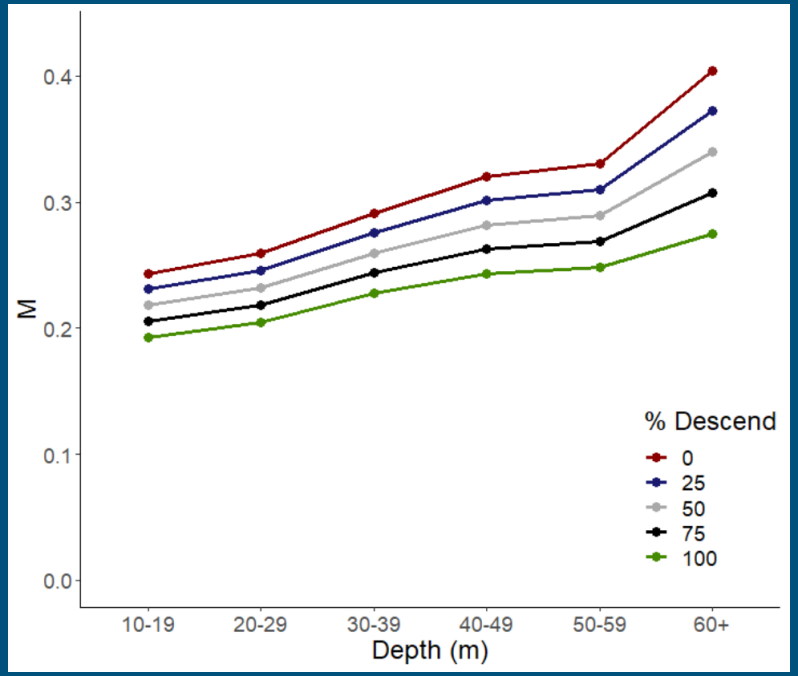
- First, need to define a depth break for areas in the model
- We chose 35m (115 ft) to distinguish shallow from deep water, where barotrauma might be more prevalent in the deeper areas

- That choice was based on
  - Expert opinion (expert = Jeff Buckel): some barotrauma at 80-90 ft, but lots at >120 ft
  - Sauls SEDAR52 working paper shows increasing discard M with depth and then saturation around 30-40 m
  - Our analysis of Bohaboy et al. (2019) data (from GoM) suggested a break point at 39m, although they did not find an effect of depth in their own analysis

Discard M by depth

- For recreational, used trip-weighted estimates from Vecchio S73 working paper (75% descender devices, as in S73)
  - $D_{shallow}$= 0.23
  - D_{deep} = 0.25
- Apply this ratio to the commercial discard M from S73
  - $D_{shallow}$= 0.32
  - D_{deep} = 0.25/0.23*0.32 = 0.35

- In the Atlantic, RS show little effect of depth on discard M. Indicates lack of barotrauma.
  - Descender devices the solution?
  - Depth break may be more important for other spp



From Vecchio et al.

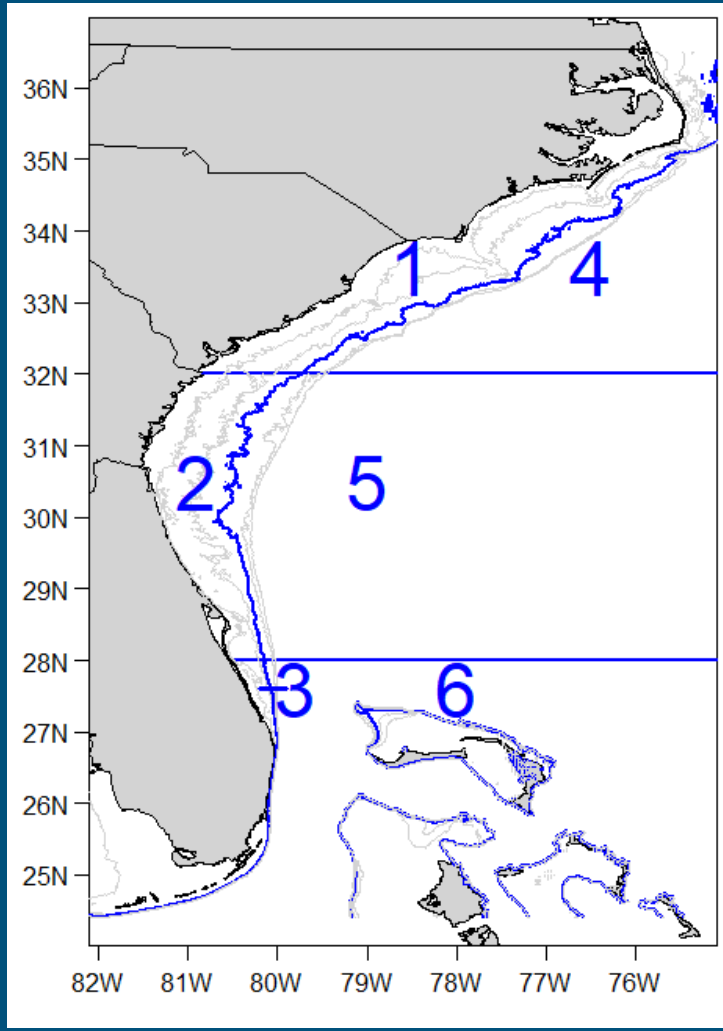
Spatial distribution of abundance

- What is the relative abundance of RS in our six designated areas?
- Based on VAST output (provided by Jie Cao)
- Assign depths to VAST locations using NOAA bathymetry data

RELATIVE ABUNDANCE

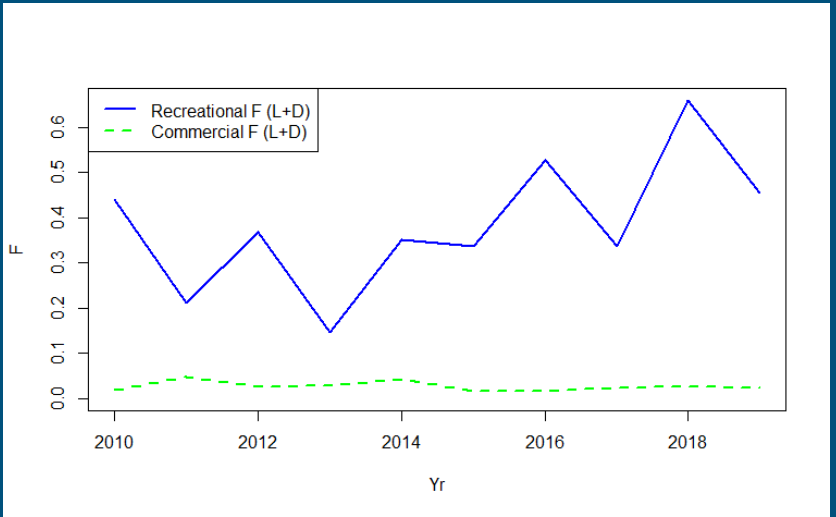
Area 1 -- 3%
Area 2 -- 77%
Area 3 -- 2%
Area 4 -- 1%
Area 5 -- 16%
Area 6 -- 1%

82% in < 35m (115ft)
93% off NFL/GA



Snapper-grouper recreational and commercial effort by year, month, area

- Do not have this information yet
- For now, we can still examine relative effectiveness of management scenarios
- Assume base level of effort by sector equal to one
  - This gets scaled by q anyway, so the most critical deficiency is the spatial variation in effort
- Set q to achieve mean F from S73
- q.rec = 0.38
- q.comm=0.03



Example management scenarios (1 of 2)

1. Recreational gear modifications (e.g., automatic reel ban, single-hook rigs)
    - Reduces catchability. For red snapper, by how much does q need to be reduced to drop dead discards by 65%?
2. Reduction in discard mortality rate (more descender devices?)
3. Size limits
4. Recreational effort reduction
5. Temporal closures
    - Scenario1: Red snapper moratorium; affects retention but not effort
    - Scenario2: Seasonal opening that allows full retention of everything caught, but bottom fishing closed the rest of the year

Example management scenarios (2 of 2)

6. Area closures
   - Scenario1: by depth, with effort shifting to shallow water
   - Scenario2: by latitude (northern, middle, and southern areas)
7. Spatial/temporal closures
   - Rolling area closures (e.g., each latitudinal zone closed every third year or open every third year). This might be more interesting when we have multiple species with different spatial distributions of abundance.

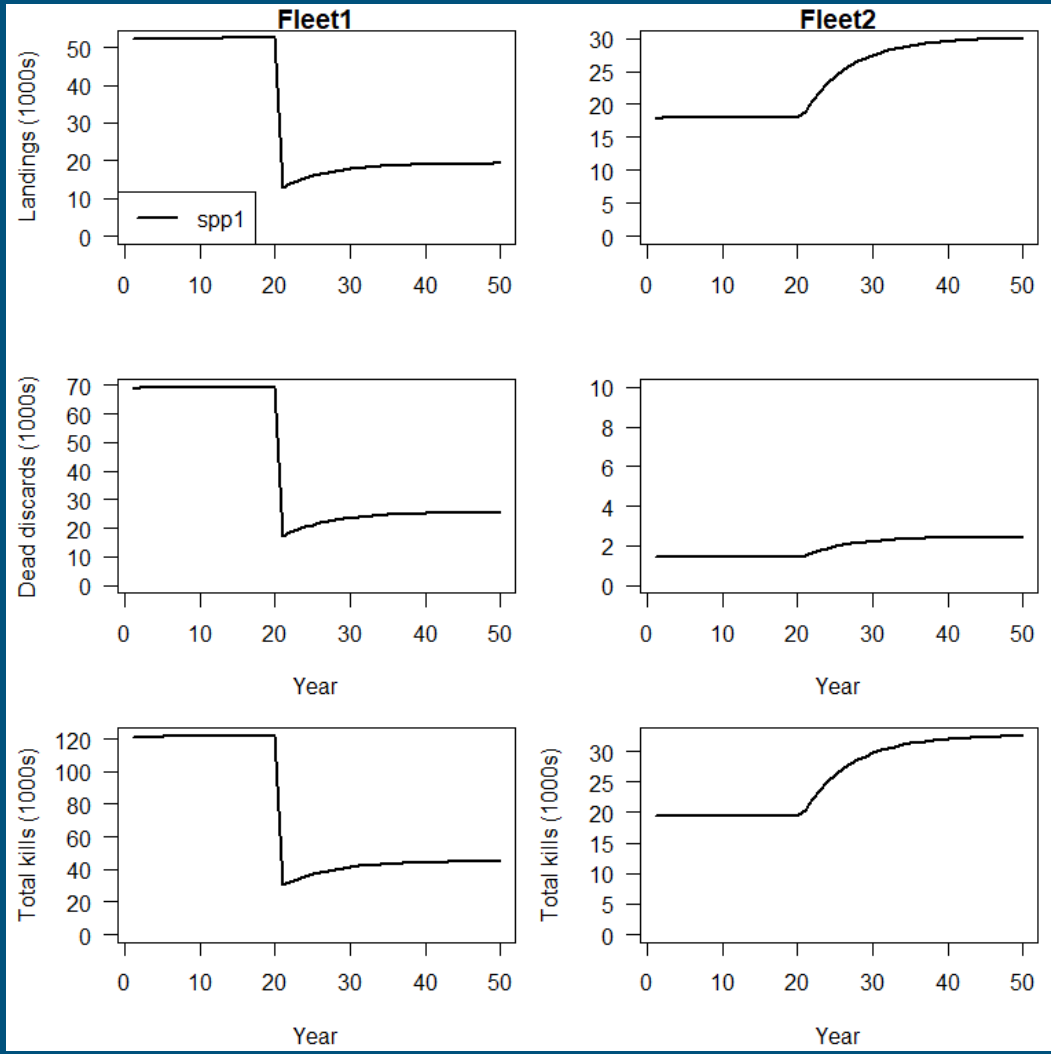
Preliminary results of three example scenarios

- Gear modifications reduce catchability
- Seasonal opening to recreational bottom fishing with full retention
- Area closure (middle latitudes of NFL and GA)

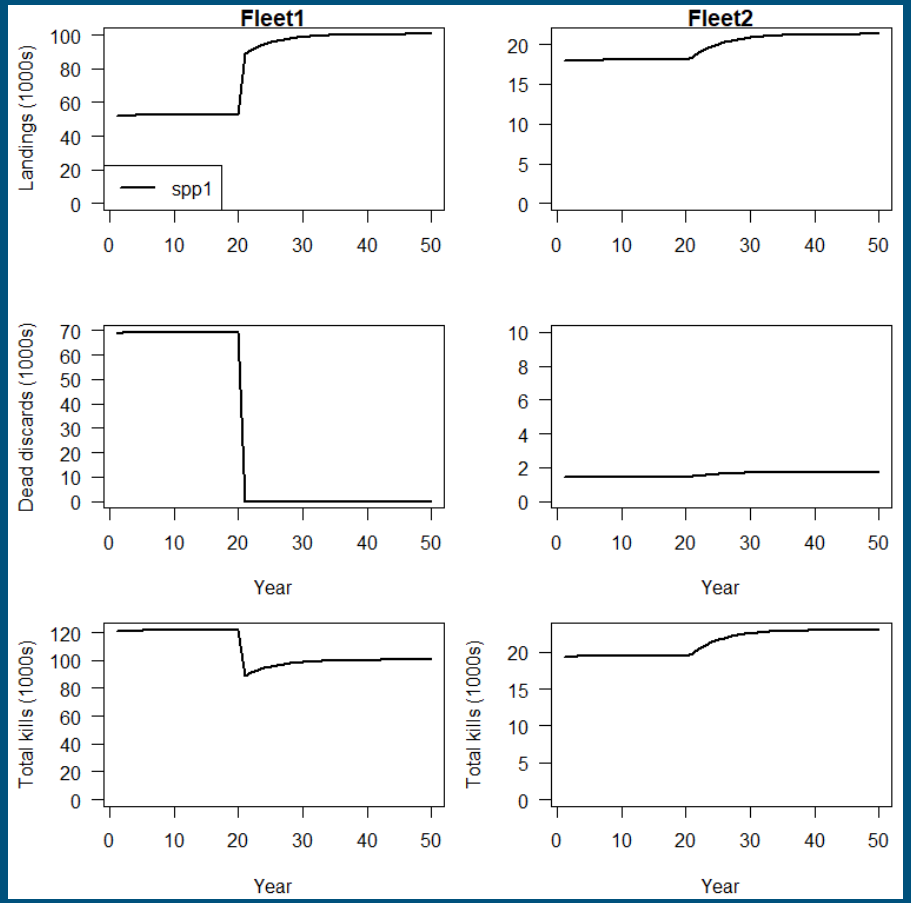
- Simulation details
  - Run each for 50 yr
  - In yr 21, implement the modification
  - Compare new equilibrium to the old

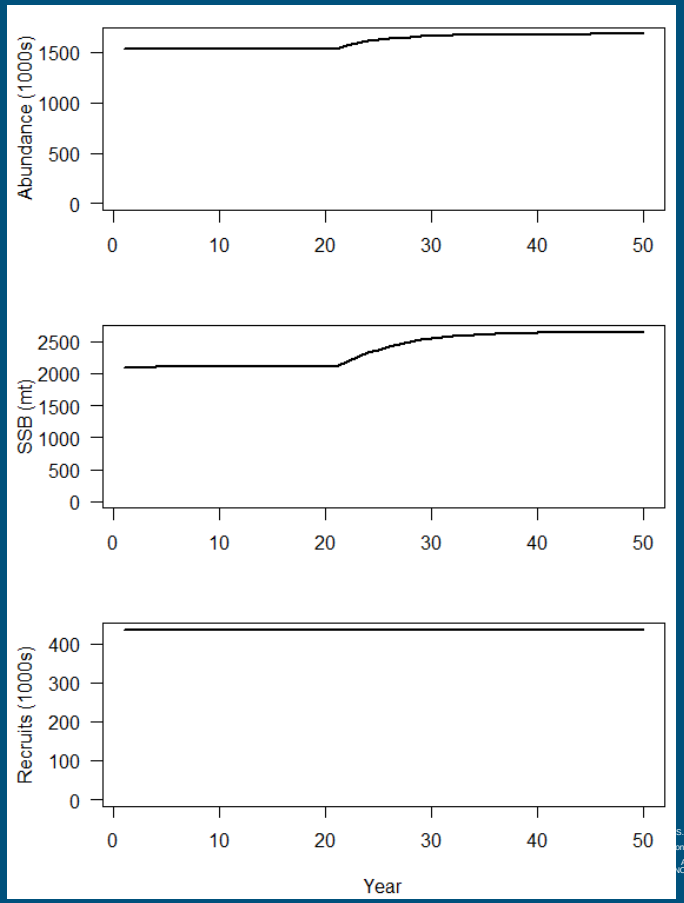
Gear modification (reduce recreational q)

- Achieving ~65% reduction in dead discards would require ~75% reduction in recreational fishing efficiency

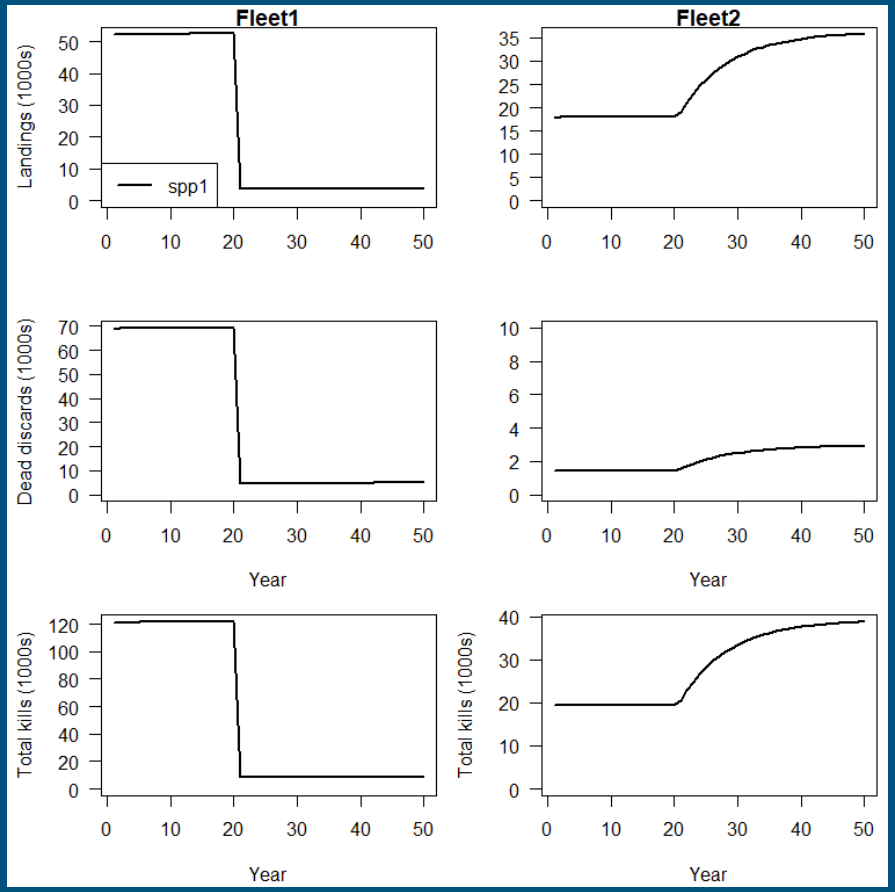


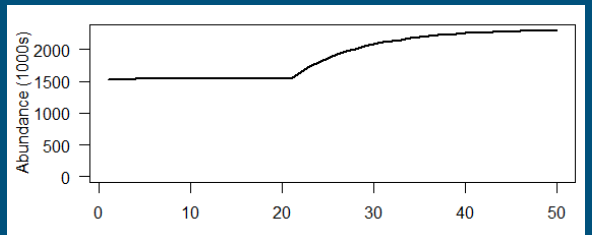
Seasonal opening to recreational bottom fishing with full retention

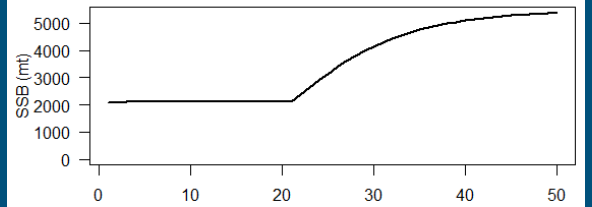


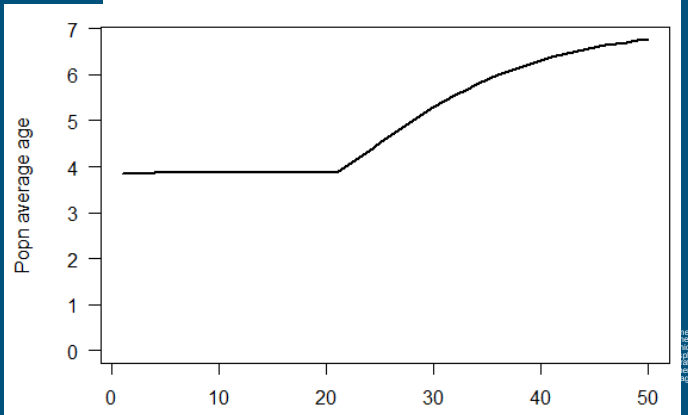


Recreational area closure – middle latitudes (areas 2,5)









Summary

- Spatial model to explore how various management approaches affect landings, discards, abundance, spawning biomass, age structure, …
- Currently parameterized for red snapper, but has multispecies capability

- Designed to compare relative effectiveness of management approaches
- Not designed for providing Acceptable Biological Catch

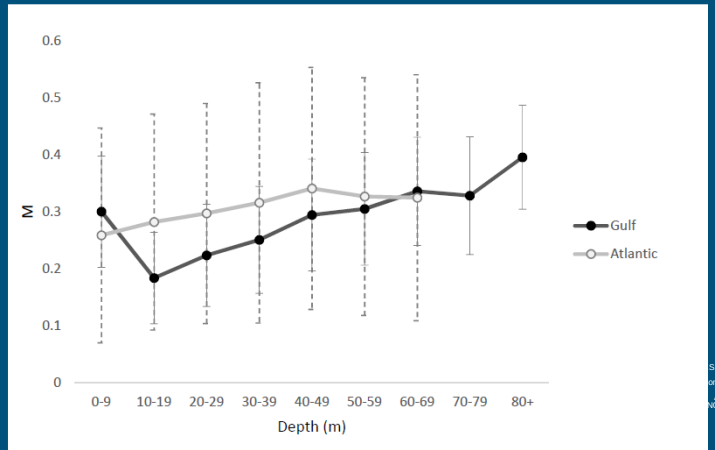
Discussion questions

- Does this modeling approach have potential utility?
  - Specifically, could it help the SSC frame its scientific guidance to the Council?
- Any recommendations for model configuration or development?
- Any recommendations for specific output that would be useful?
- Any recommendations of additional management scenarios to explore?

EXTRA SLIDES

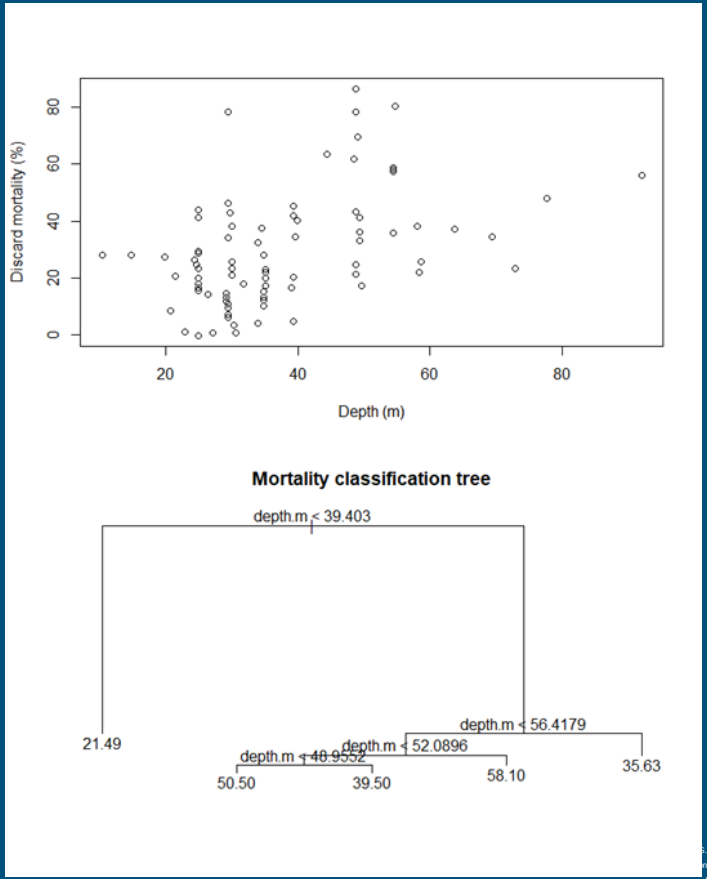
Discard M by depth – depth break (1 of 2)

- Define our depth break at 35m (115 ft)
- Expert opinion (Jeff Buckel email to Genny 8/3/2022) “For red snapper, you start to see some barotrauma at 80-90 feet, but lots at >120 ft (5 atmos)”
- Sauls S52 working paper shows increasing discard M with depth and then saturation around 30-40 m



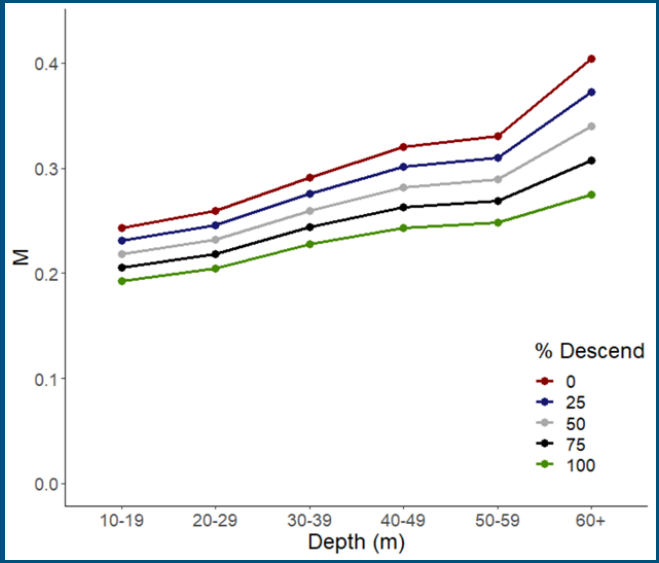
Discard M by depth – depth break (2 of 2)

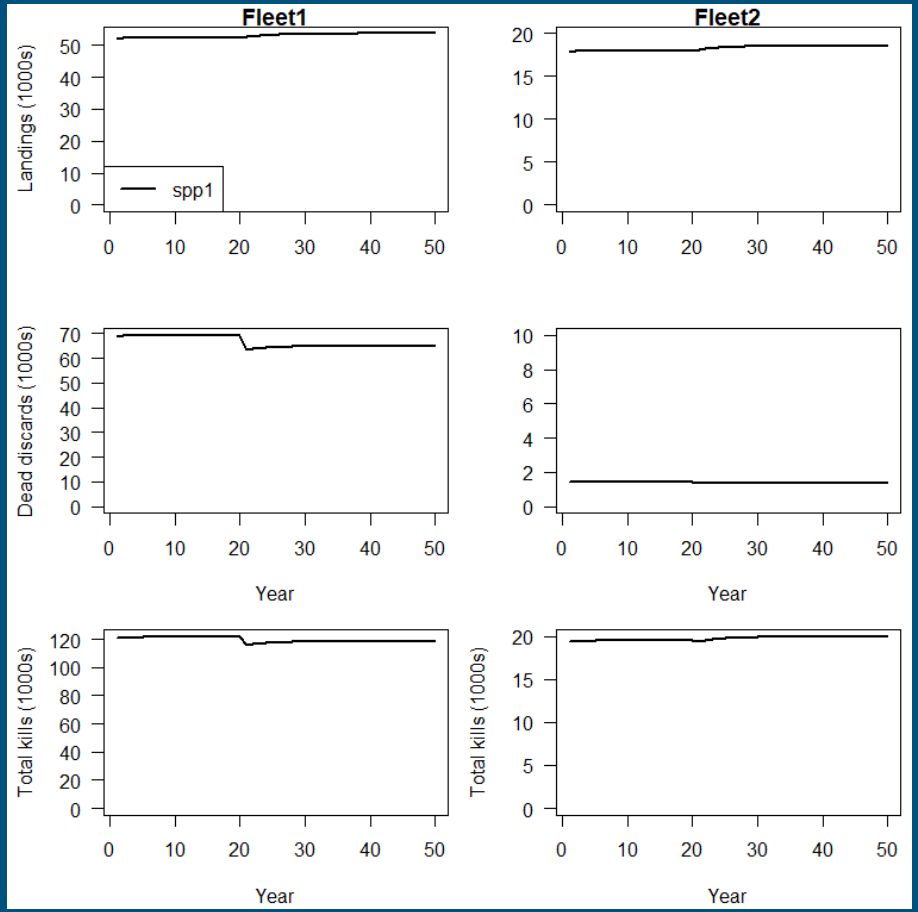
- Classification tree of Bohaboy et al. Fig 6 data (from GoM) suggests 39m, although they did not find an effect of depth in their analysis



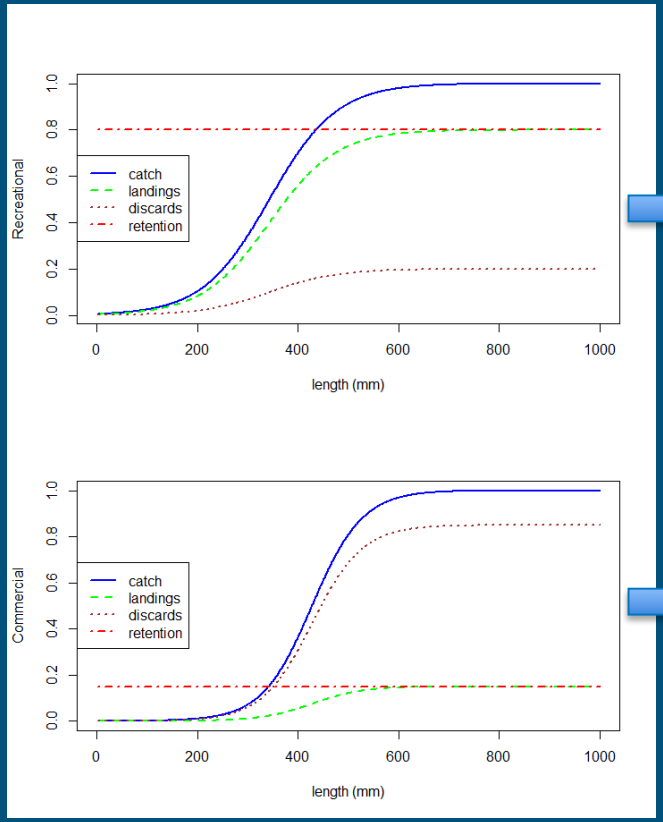
Reduction in discard mortality rate

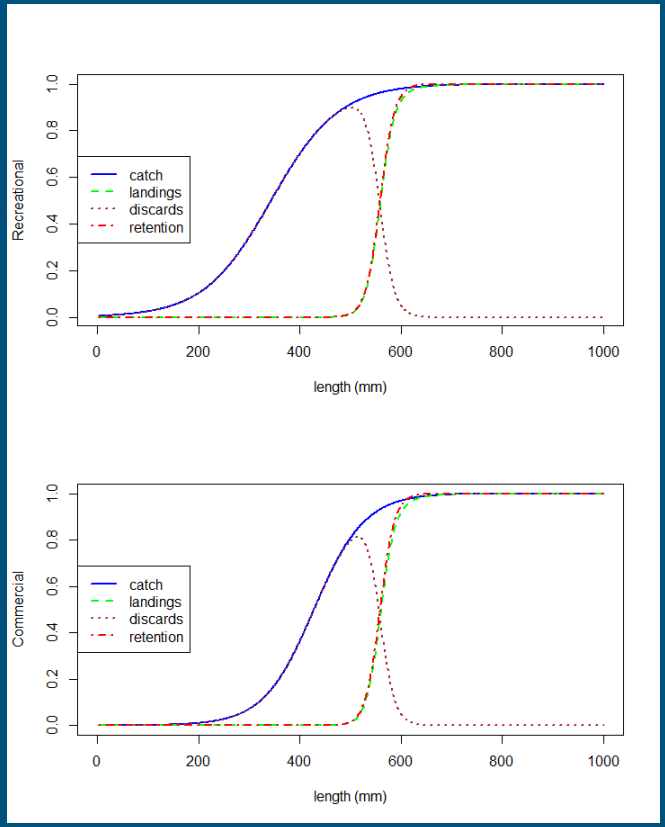
- Assume 75% descender device usage → 100%
- Assume rec % reduction applies also to commercial



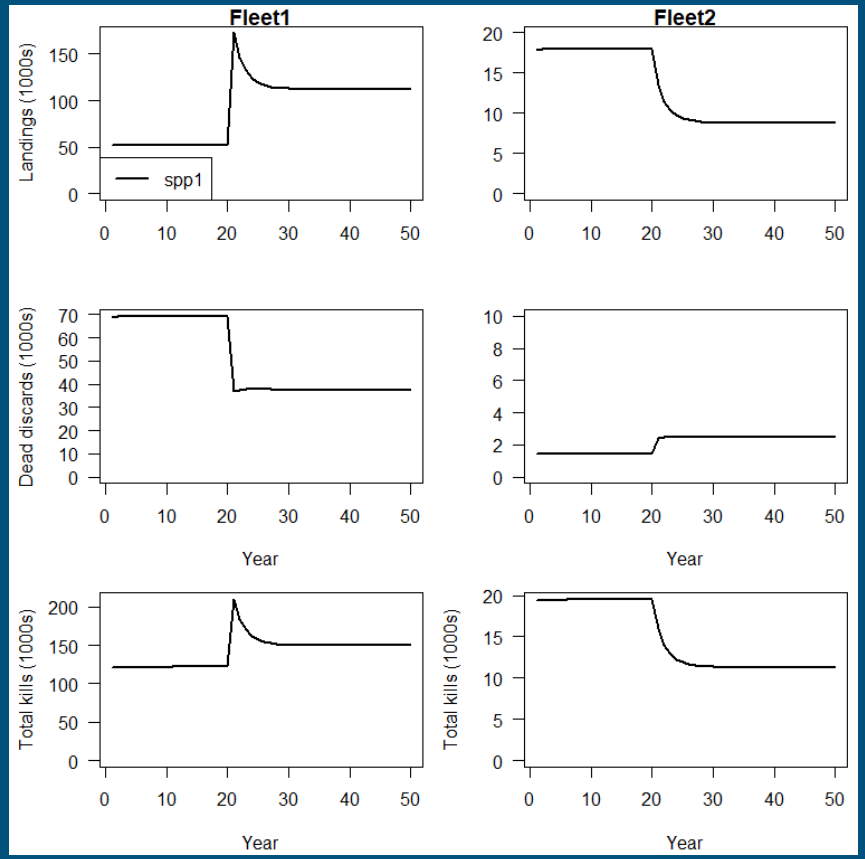


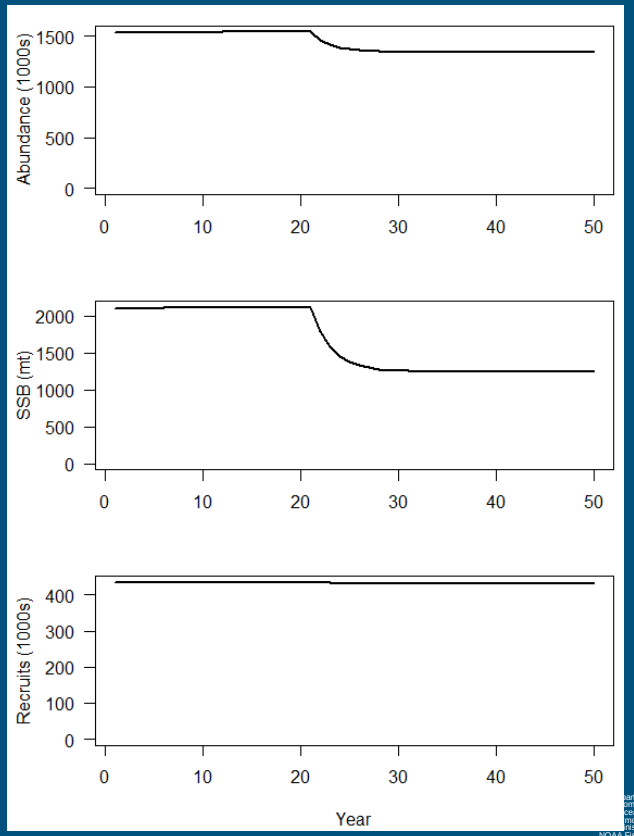
Implement a 22-inch (559 mm) size limit



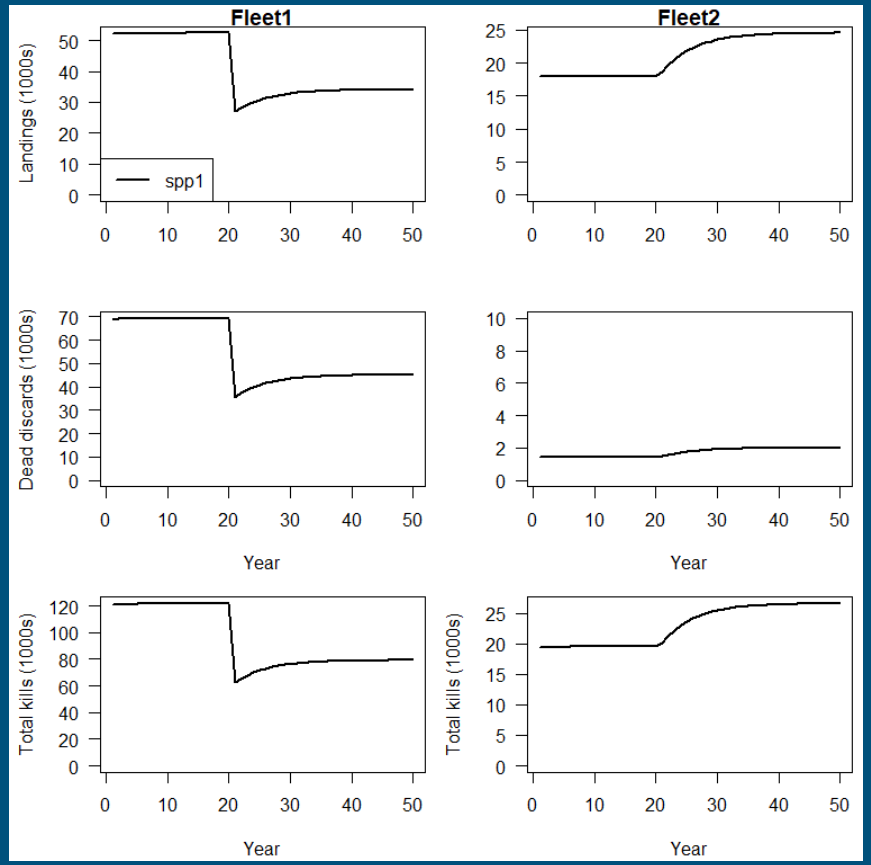


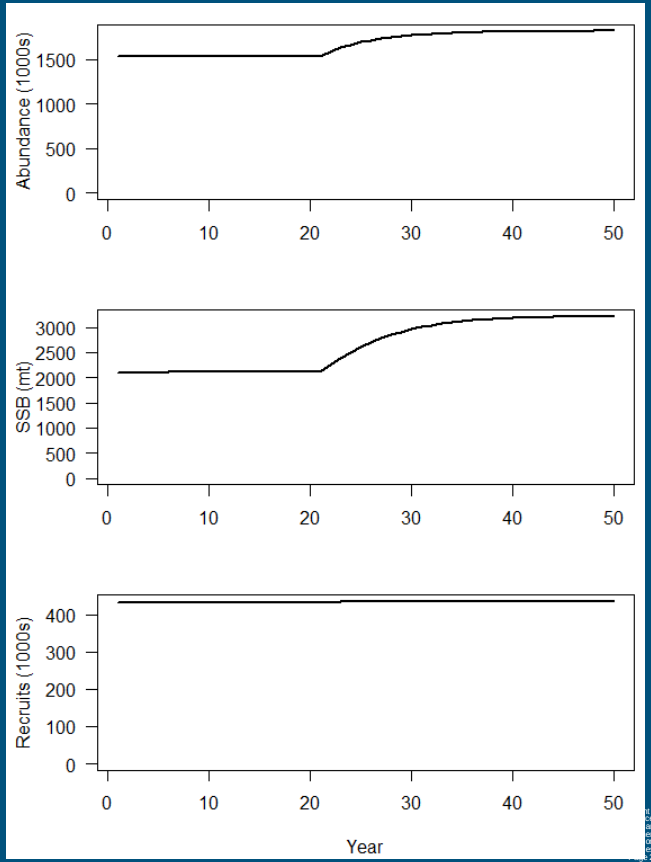
Implement a 22-inch (559 mm) size limit



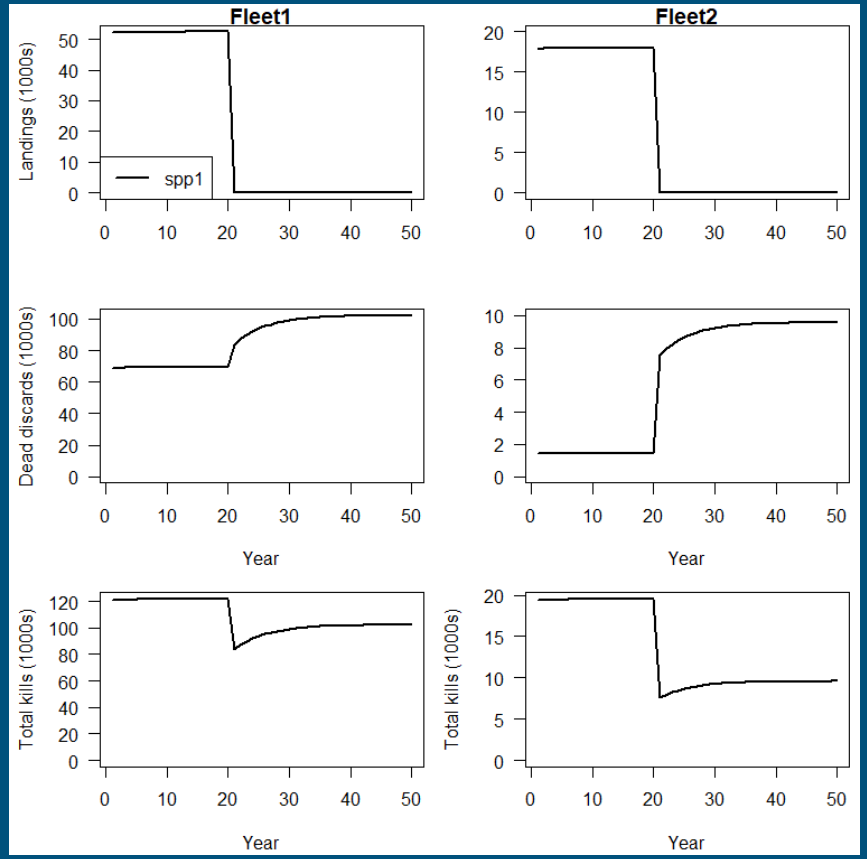


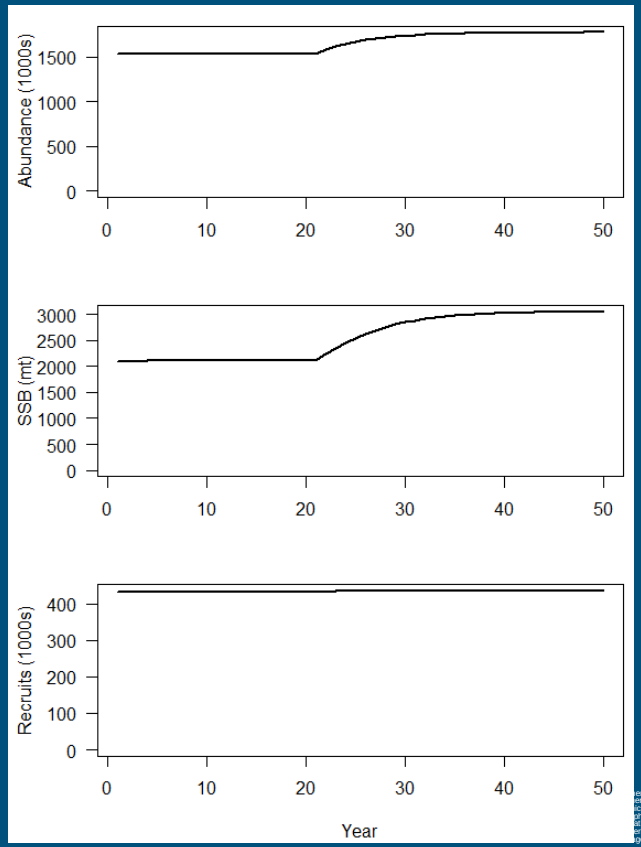
Recreational effort reduced by half





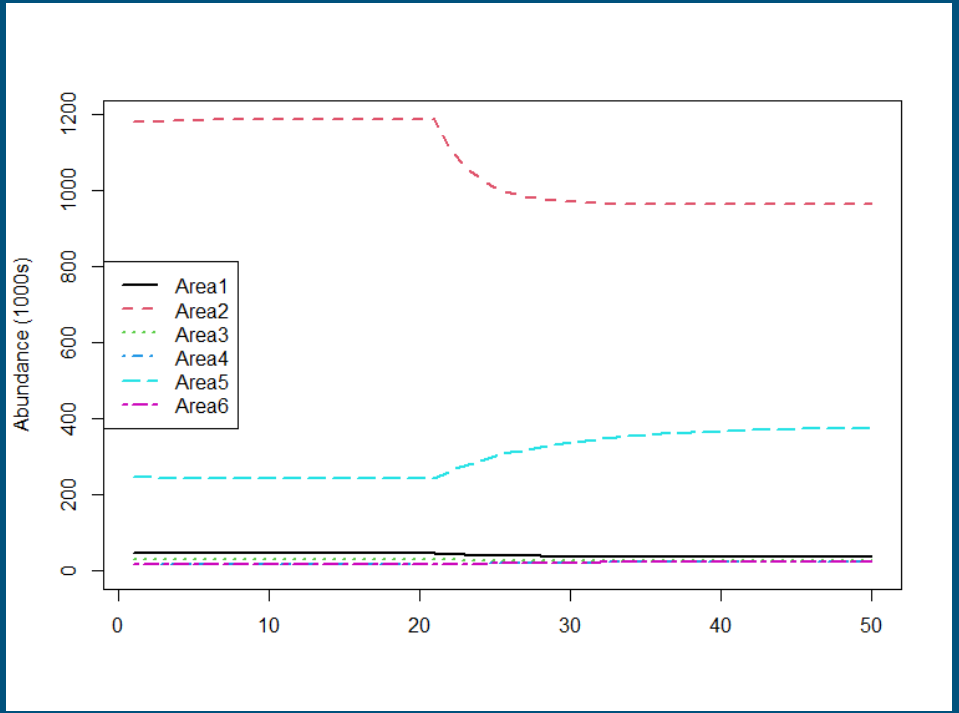
Temporal closure – RS moratorium (perfect compliance)





Area closure – deeper water

- Closure of deep water (areas 4-6)
- Assume effort shift to shallow water (areas 1-3)
- This reduces overall discard mortality rate (by a little bit), but puts more effort where red snapper live
- Net effect is an overall reduction in abundance



Spatial/temporal – rolling recreational closures by latitude zones