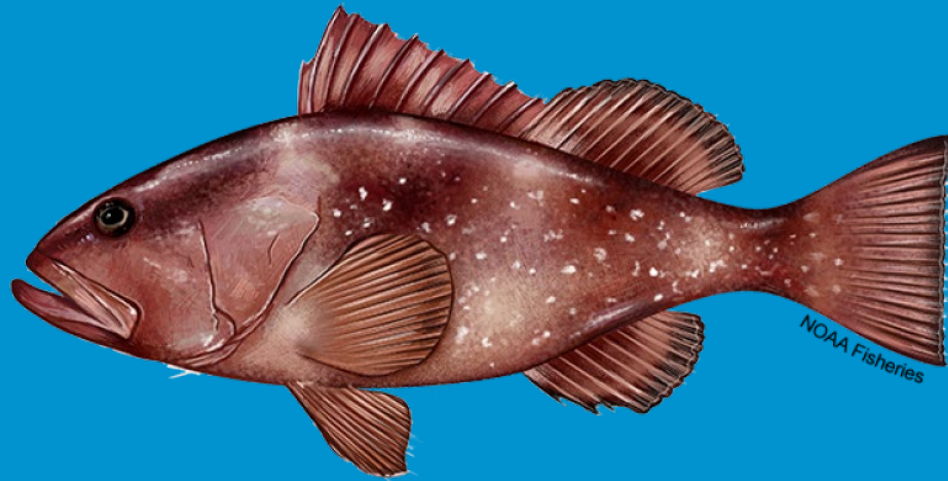




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SEDAR 88: Gulf of Mexico Red Grouper



Red Tide Topical Working Group
May 30th, 2024

Overview



SEDAR

SouthEast Data, Assessment, and Review

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Terms of Reference:








2. Explore the potential effects of red tide with consideration of past red tide events, and more recent events in 2018 and thereafter. Explore age-specific episodic mortality of red grouper due to red tide.

- Review red tide approach S61
- Review SEDAR 72 Gag Grouper approach (TY 2019)
- Newer approaches to modeling red tide in Stock Synthesis
- Preliminary results
- **Decisions needed from this TWG**
 - Modeling approach:
 - Predator fleet
 - Years of red tides: only input severe years
 - How to define severe years?
 - Potential sensitivity runs




SEDAR 88 Gulf of Mexico Red Grouper
Operational Assessment Terms of Reference
April 2023

Red tide assessment history



<u>Species</u>	<u>Assessment Milestones</u>	<u>Year</u>	<u>References</u>
	<ul style="list-style-type: none"> • Raised issue of 2005 red tide event and potential negative implications for stock 	2006	SEDAR, 2006
 	<ul style="list-style-type: none"> • Red tide model developed which estimated extra mortality due to 2005 red tide event 	2009	SEDAR, 2009a, 2009b
 	<ul style="list-style-type: none"> • Integrated Ecosystem Assessment Working Group formed to review multiple red tide data products 	2013/2014	SEDAR, 2014, 2015 SEDAR33 (DW07, DW08, DW11, AW22, AW21) SEDAR42 (DW02, DW04, AW01, AW05)
	<ul style="list-style-type: none"> • Switched to bycatch fleet approach to estimating red tide mortality in 2005 within Stock Synthesis • Sensitivity runs for incorporating red tide mortality into Stock Synthesis conducted • Red tide mortality due to 2014 red tide event considered during projections 	2014	SEDAR, 2014; GMFMC SSC Review, 2014
	<ul style="list-style-type: none"> • Switched to bycatch fleet approach to estimating red tide mortality in 2005 within Stock Synthesis • Sensitivity runs for incorporating red tide mortality into Stock Synthesis conducted 	2015	SEDAR, 2015 SEDAR42-RW02

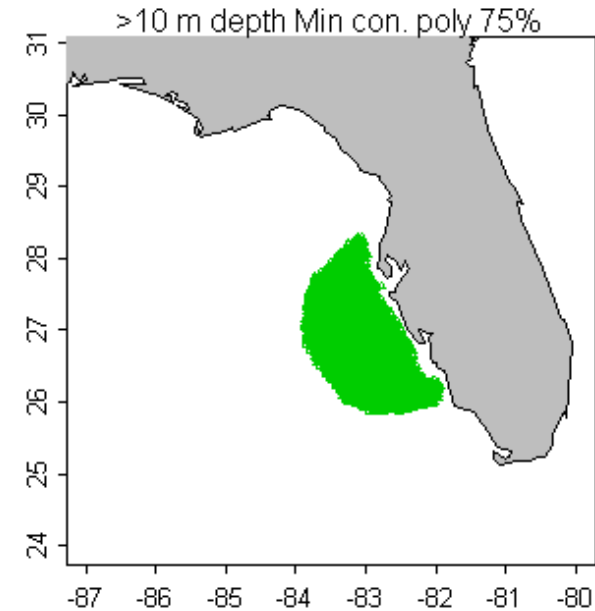
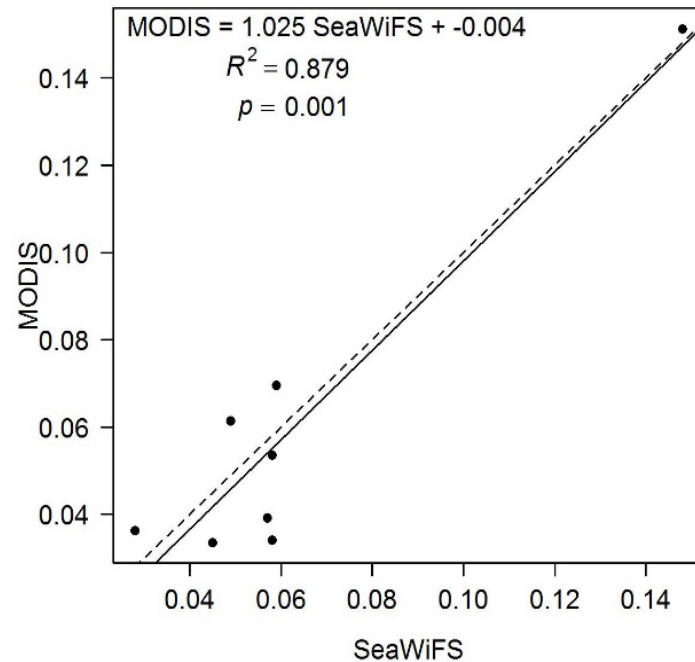
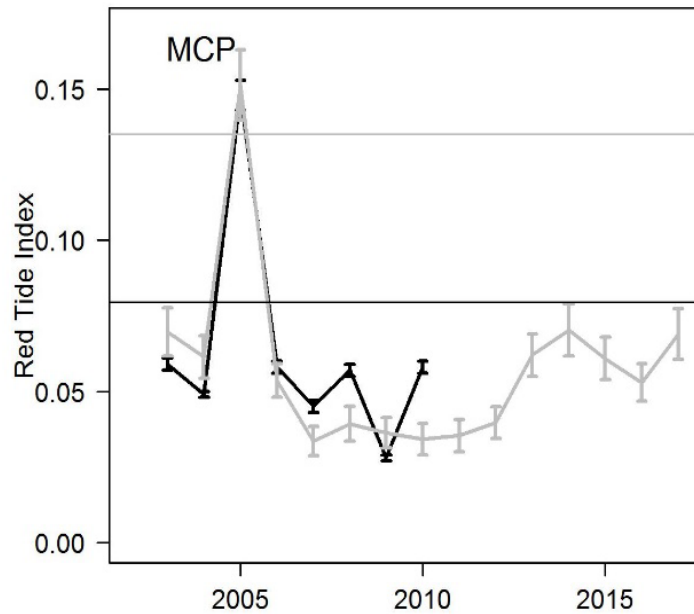
Red tide assessment history

<u>Species</u>	<u>Assessment Milestones</u>	<u>Year</u>	<u>References</u>
	<ul style="list-style-type: none"> • Explicit Term of Reference (TOR) to consider recent red tide events in stock assessment • Bycatch fleet approach to estimating red tide mortality in 2005 within Stock Synthesis 	2016	SEDAR, 2016
	<ul style="list-style-type: none"> • Explicit Term of Reference (TOR) to consider recent red tide events in stock assessment • Multiple red tide data products submitted for consideration • Bycatch fleet approach to estimating red tide mortality in 2005 and 2014 within Stock Synthesis, with years identified via a combination of quantitative and qualitative analyses • Projection scenarios developed based on different assumed severities of the 2018 red tide event 	2019	SEDAR, 2019 SEDAR61-WP06, WP07, WP20 Sagarese et al. 2021
	<ul style="list-style-type: none"> • Explicit Term of Reference (TOR) to consider recent red tide events in stock assessment • Multiple red tide data products submitted for consideration • Bycatch fleet approach to estimating red tide mortality in 2005, 2014 and 2018 within Stock Synthesis, with years identified via a combination of quantitative and qualitative analyses • Sensitivity runs for incorporating red tide mortality into Stock Synthesis conducted • Projection scenarios developed for different assumed severities of the 2021 red tide event based on the West Florida Shelf EwE derived indices of red tide mortality 	2021	SEDAR, 2021, 2022 SEDAR72-WP01, WP09, WP10 Vilas et al. 2023



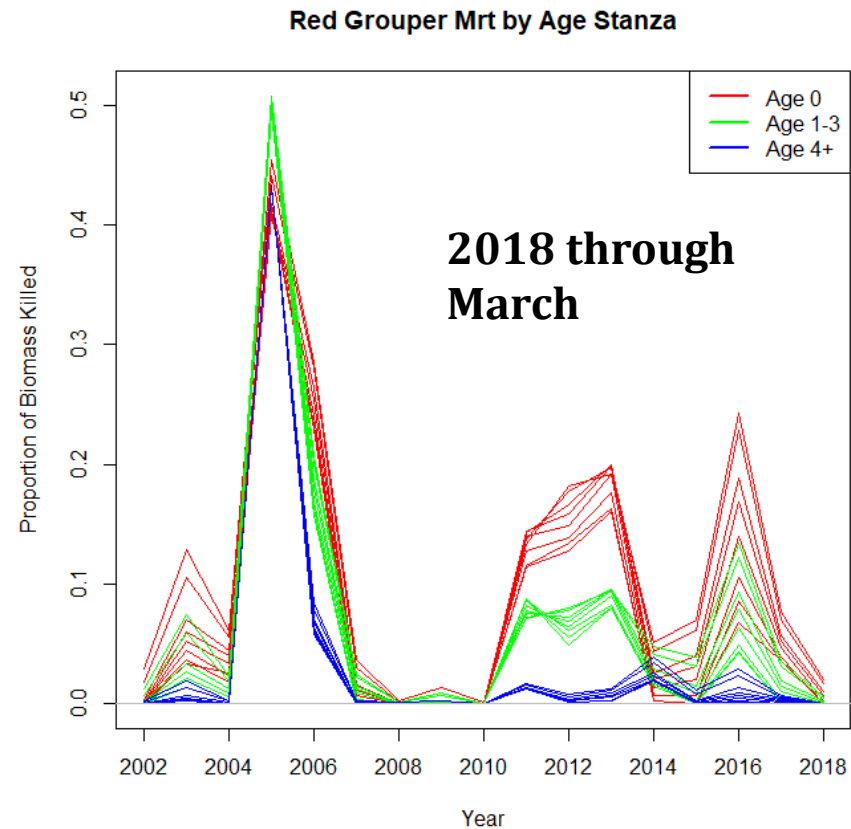
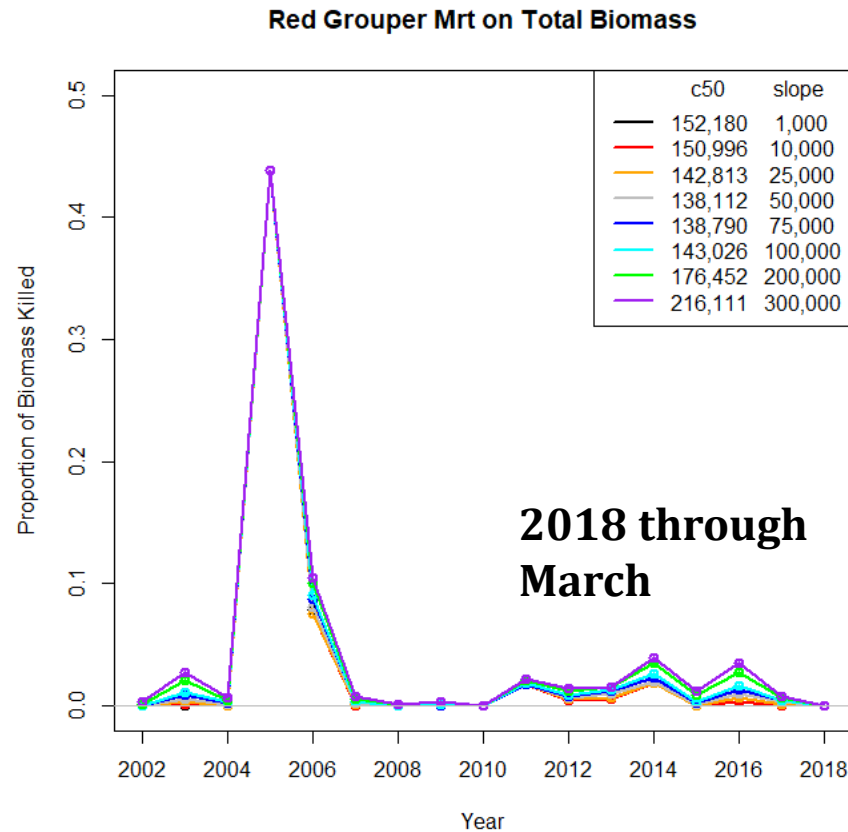
S61 – Red Grouper

- Updated indices of red tide severity using MODIS data (originally presented in Walter et al. 2013)



S61: Use of Ecosystem Analysis

- Objective: estimate the mortality rate of red grouper caused by red tides from 2002-2017



Chagaris, SEDAR61-WP-06

Modeling Approach S61 cont.

- bycatch fleet approach
- Constant selectivity across ages

Combinations of years with red tide mortality were tested to explore the impact on model results:

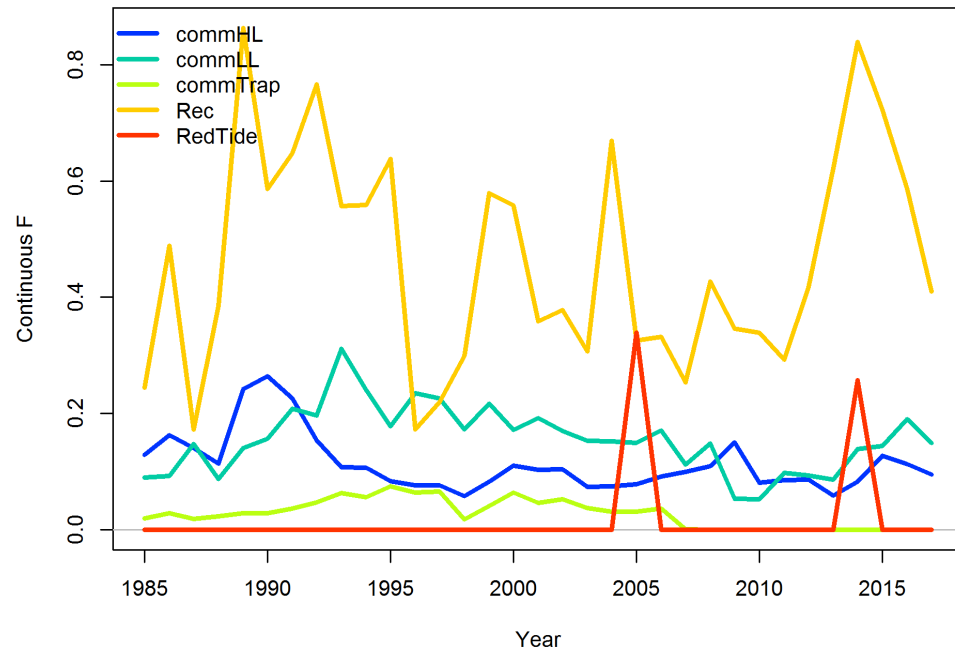
1. 2005 and 2014 (**SEDAR61 Base Model**) – assumes 2014 was a severe event
2. 2005 only – assumes the 2014 red tide was not severe enough to warrant estimation of red tide mortality
3. 2005 and 2015 – assumes a severe red tide occurred in 2015 and not 2014;
4. 2005, 2014, and 2015 – assumes a severe red tide occurred in both 2014 and 2015 in addition to 2005.



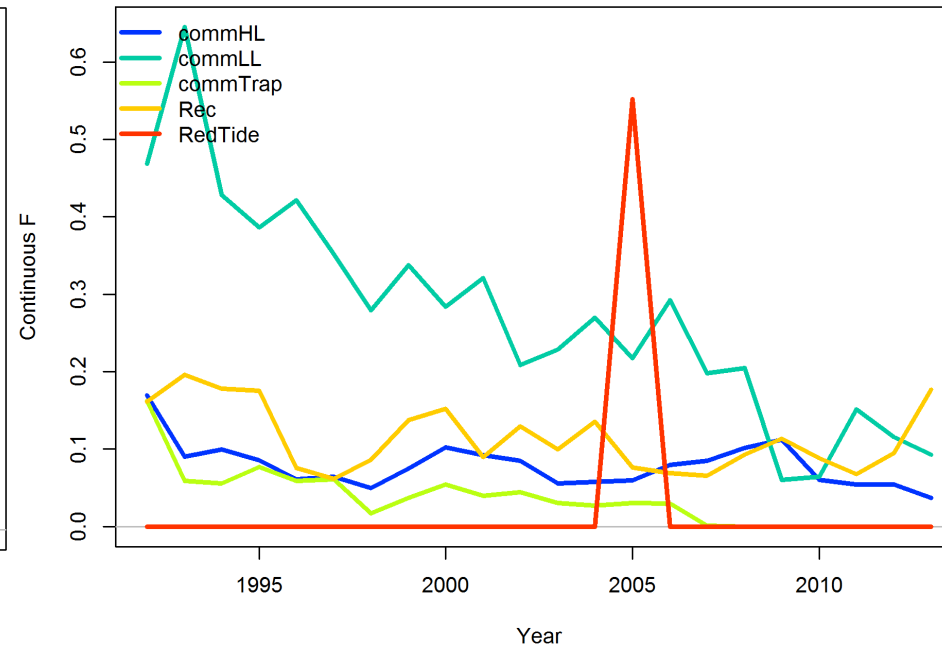
Fleet Specific F Rate

- Fraction of population removed in biomass
- Red tide modeled as fishing fleet

SEDAR 61

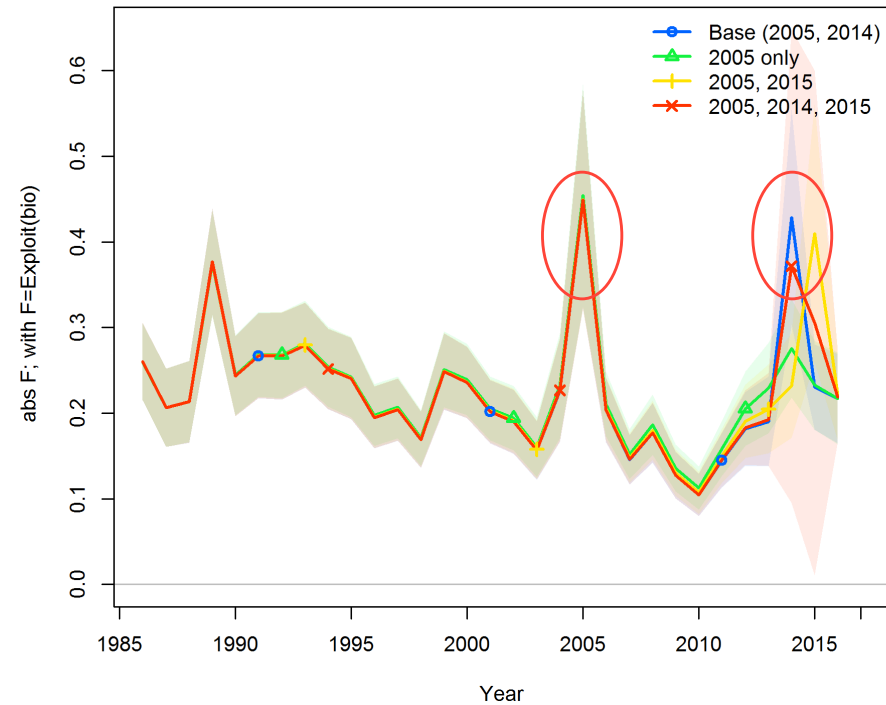
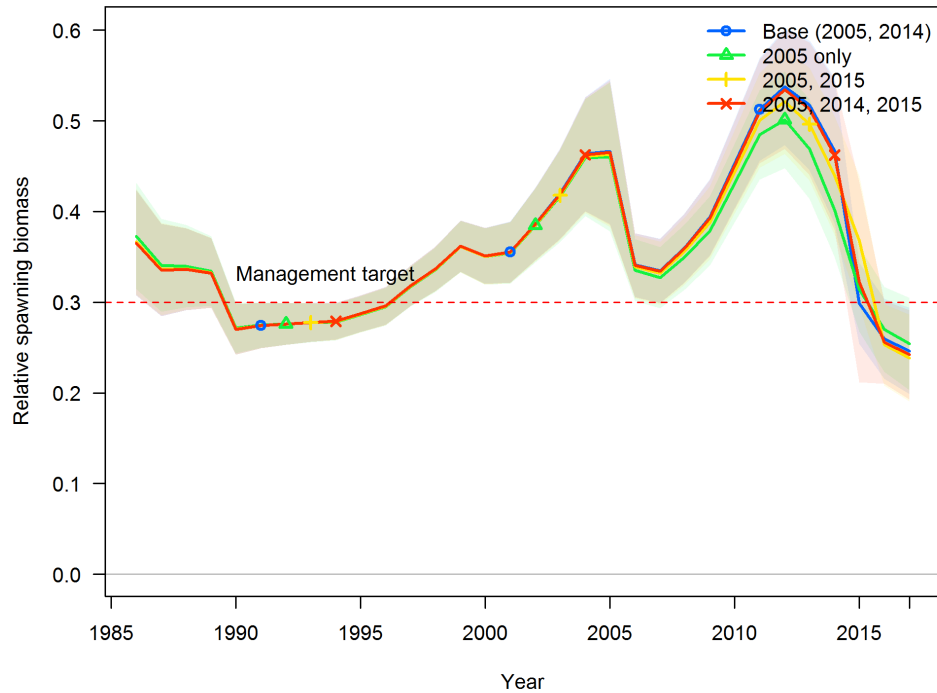


SEDAR 42



S61: Red Tide Sensitivity Runs

- Model cannot distinguish between a red tide event occurring in 2014 and 2015



Modeling Approach S72

Base model: bycatch only fleet with constant selectivity 0+ ages (RT years: 2005, 2014 and 2018)

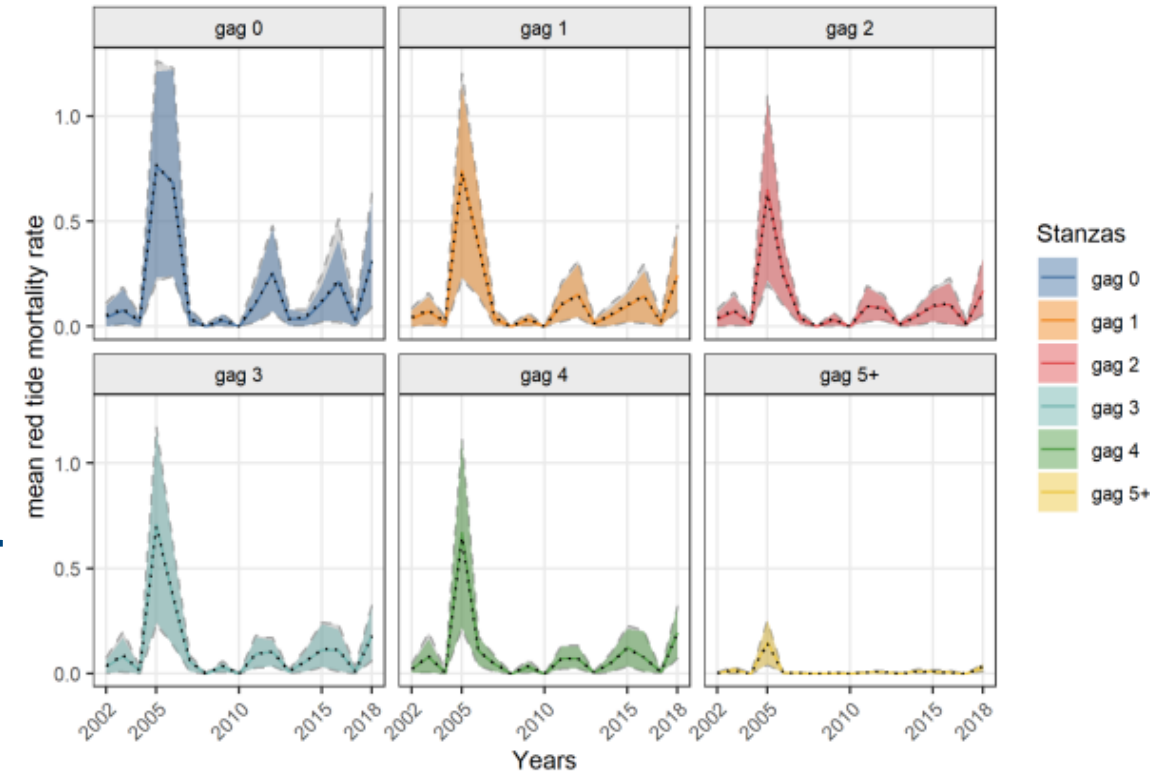
Two sensitivity runs

1. Red Tide Selectivity:

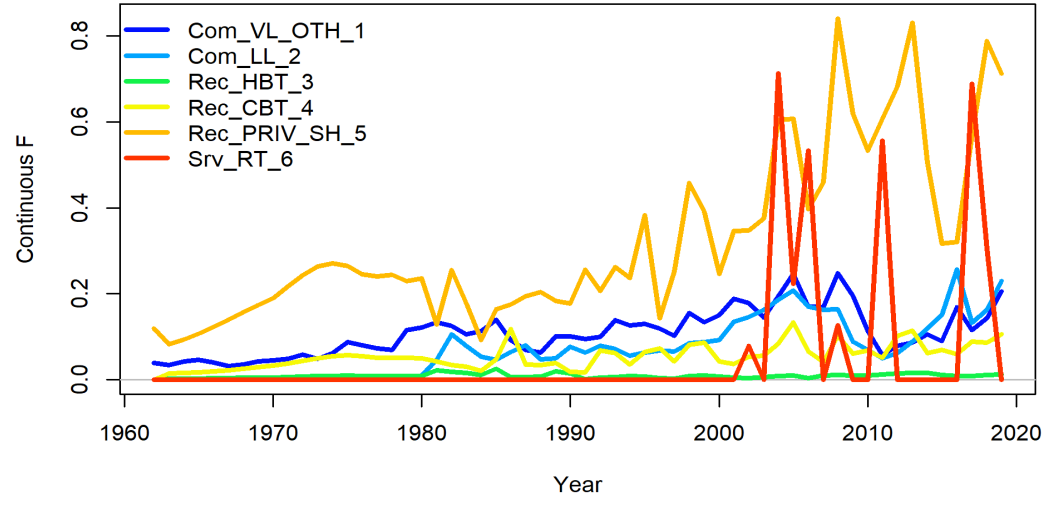
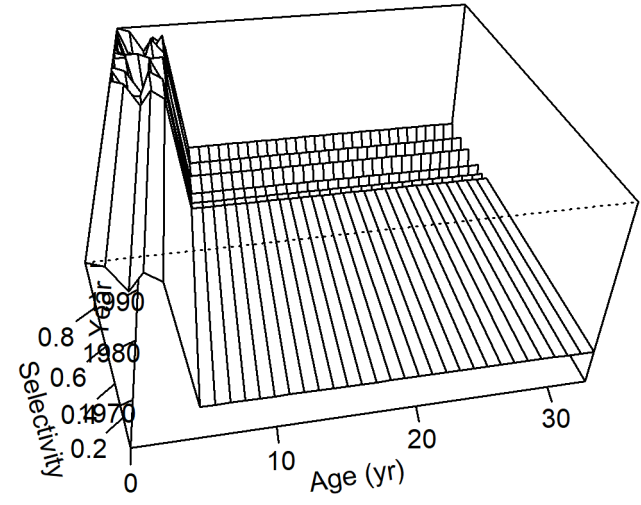
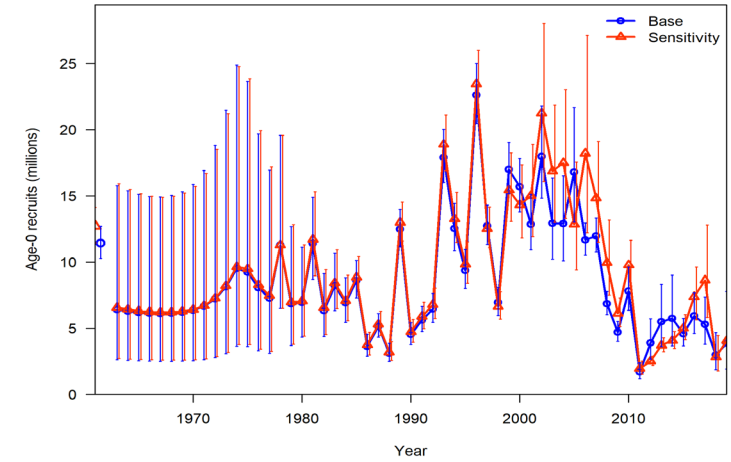
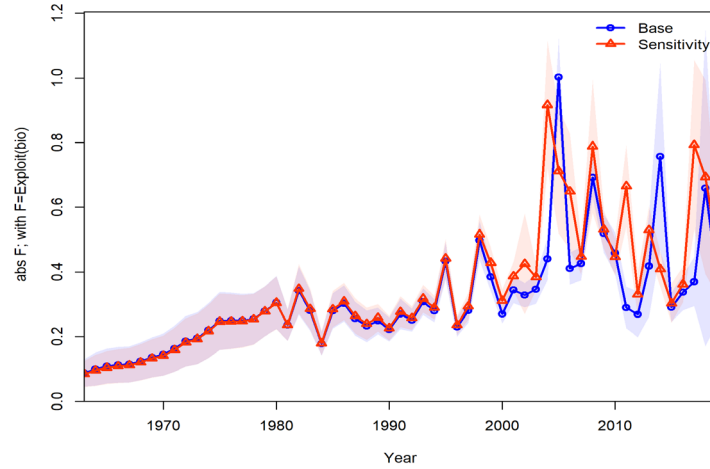
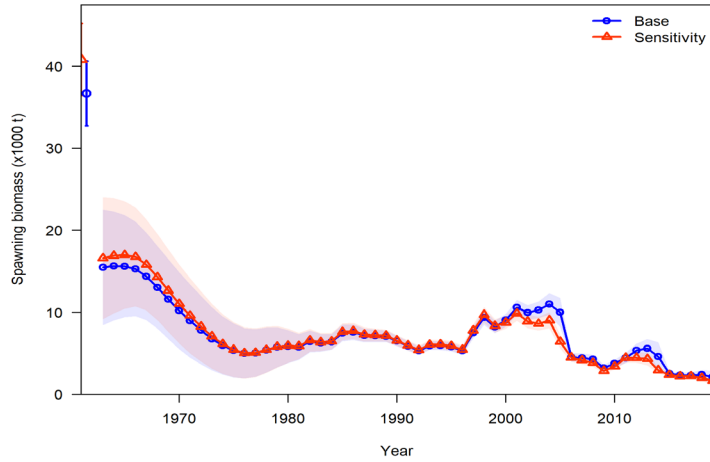
- Empirical selectivity vectors for ages 0-5+ constructed from Ecospace estimated mean red tide mortality estimates for each age in each year

2. Red Tide Time Blocks on M

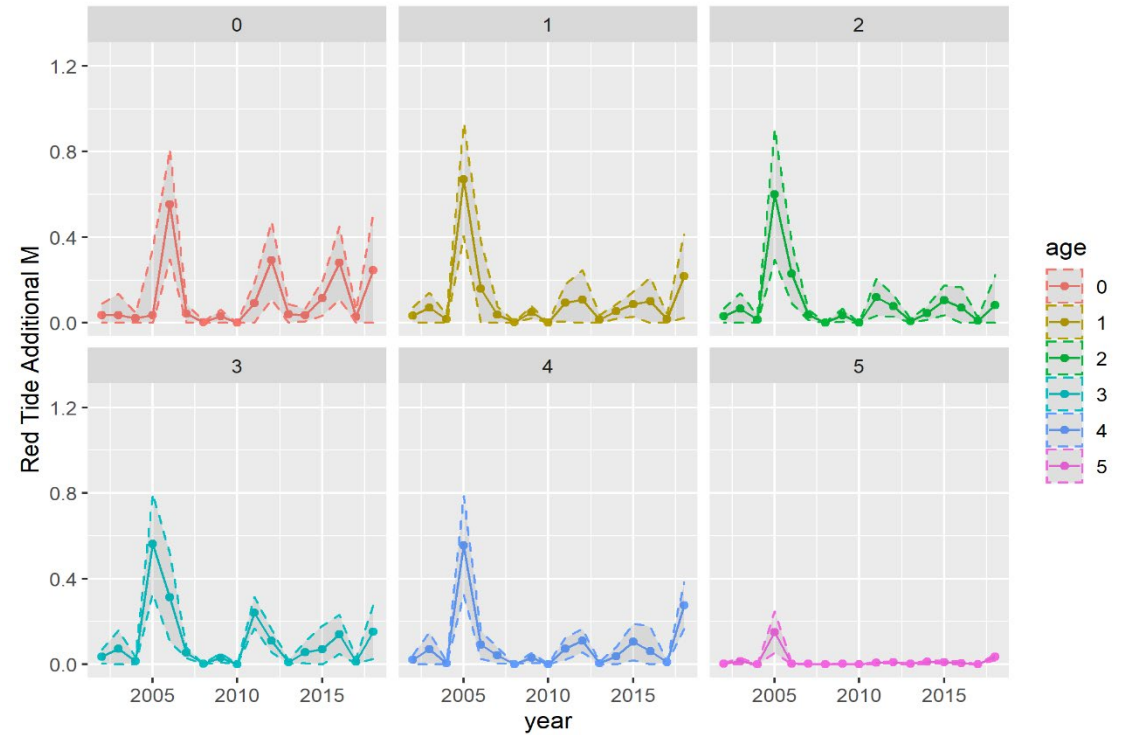
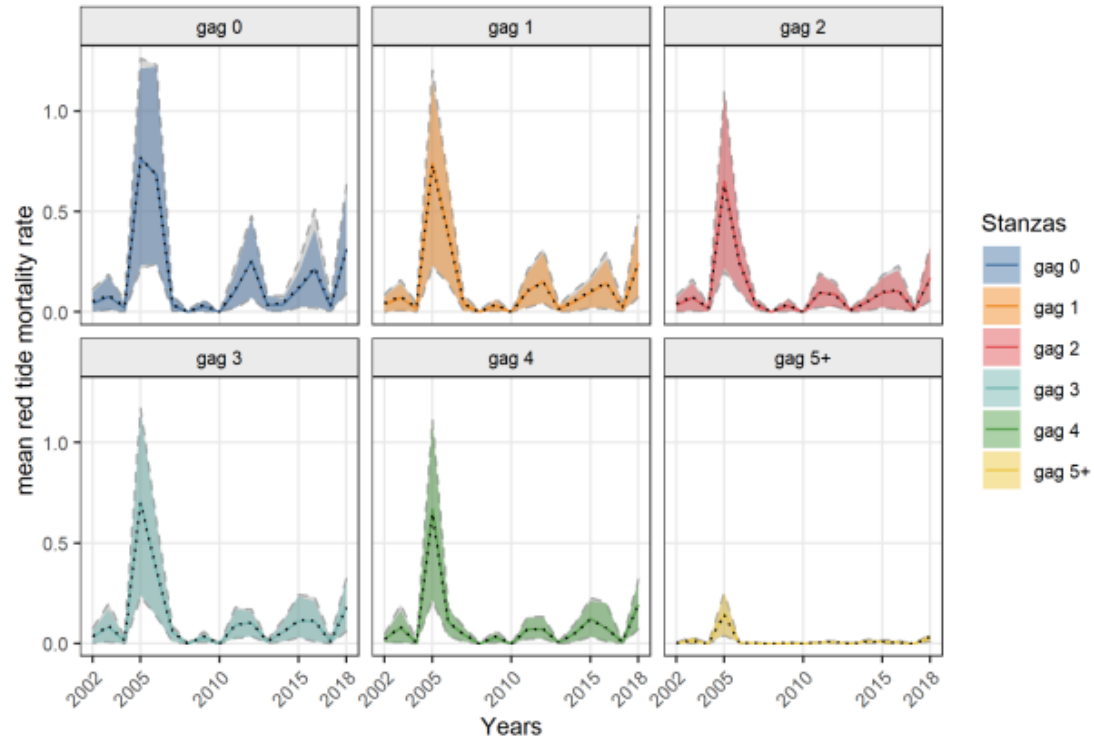
- Set of 1-year time blocks on ages 0-5 (no red tide on ages 6+) using an additive deviation. Prior mean and sd obtained from Ecospace model estimates.



Sensitivity Run: Selectivity-at-age

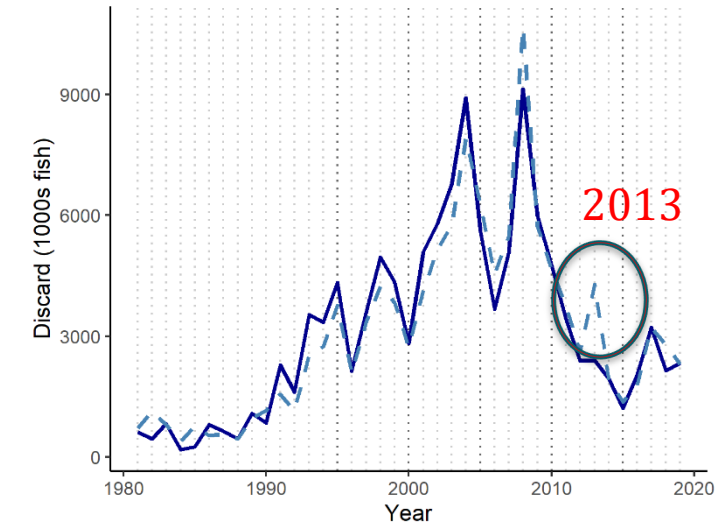
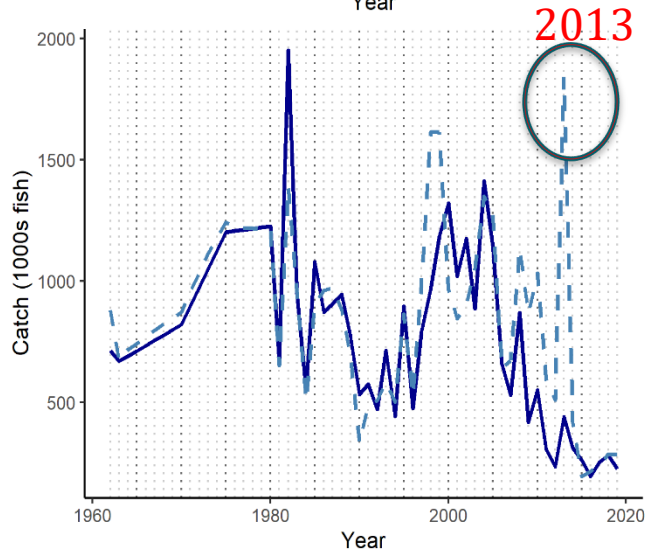
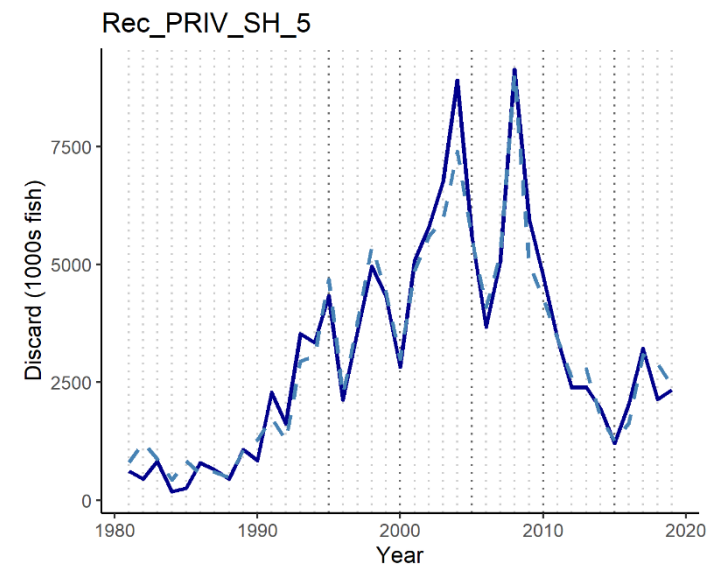
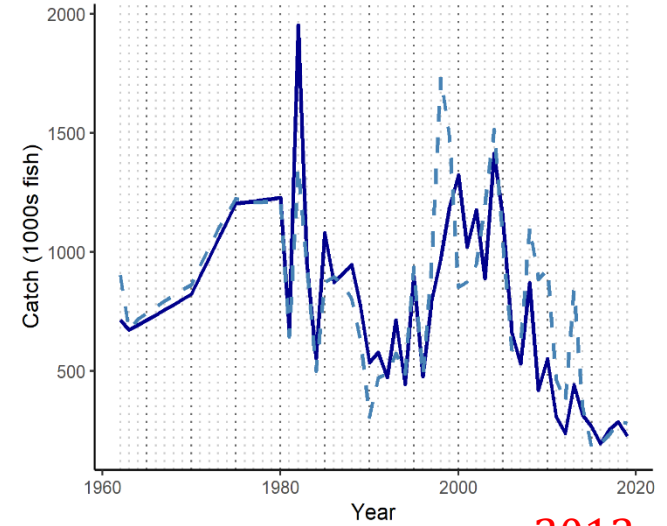


Sensitivity Run: Time blocks on M

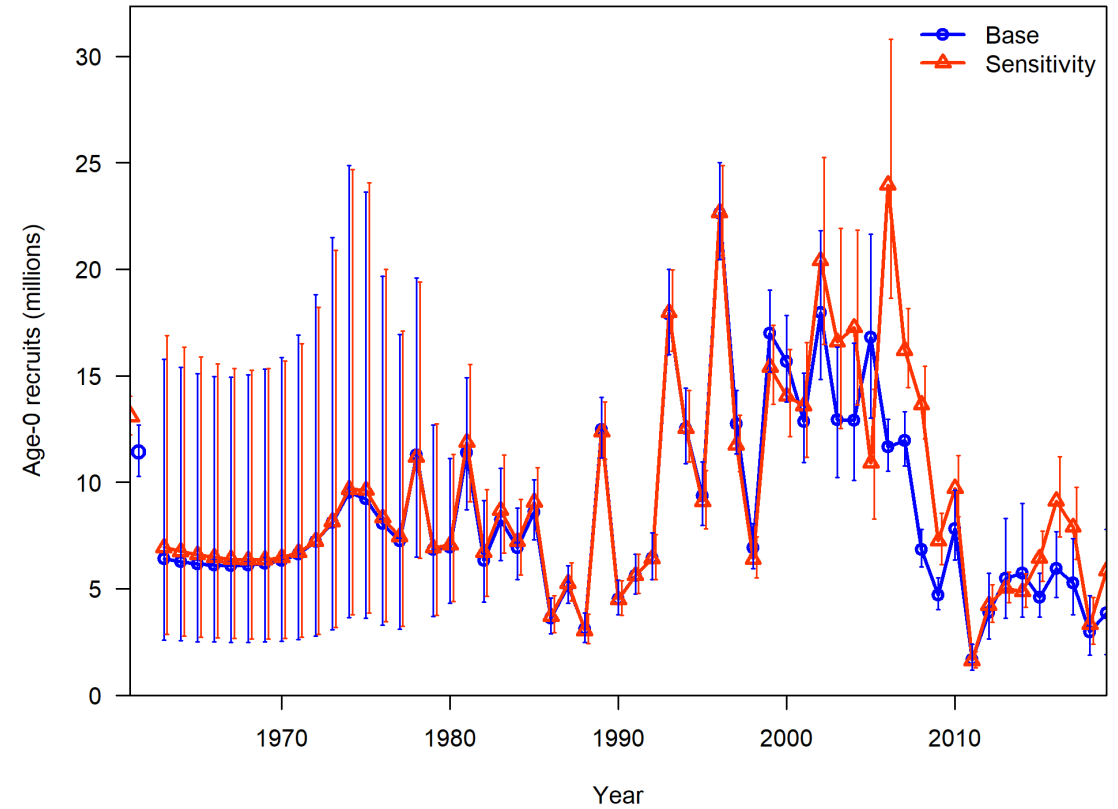
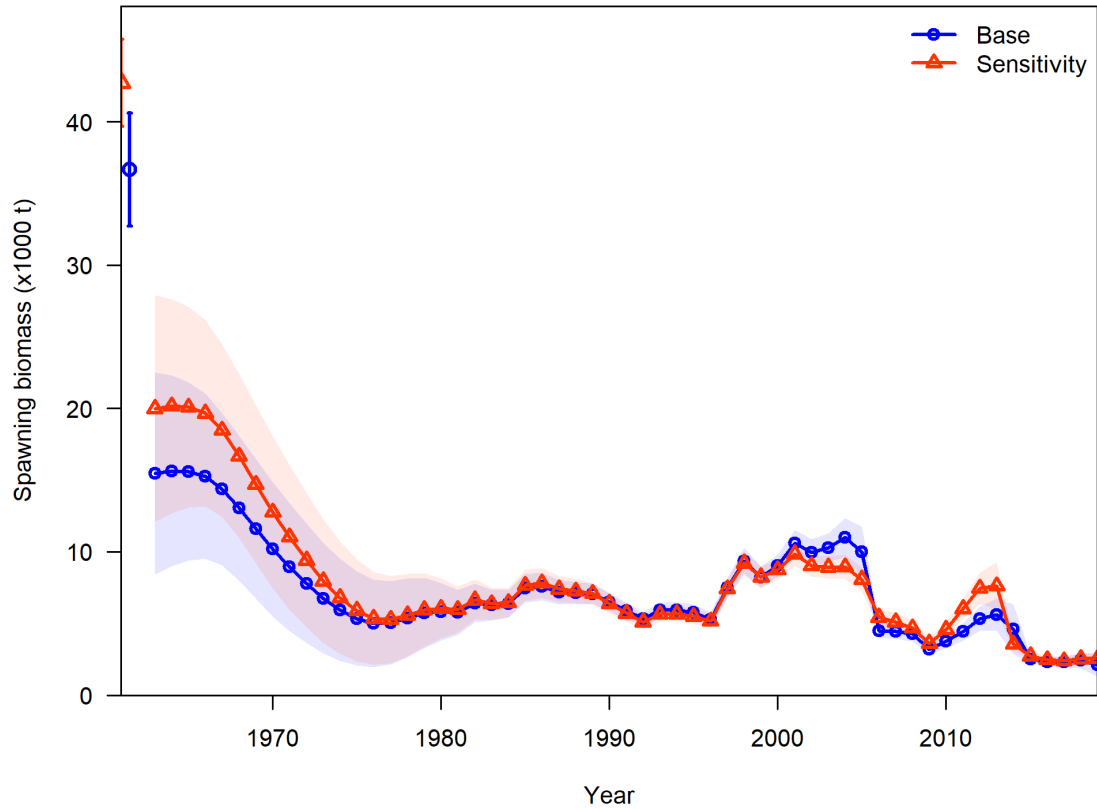


Sensitivity Run: Time blocks on M

Legend
— Expected
— Observed



Sensitivity Run: Time blocks on M



S88 Red Tide: Predator Fleet

- Introduced as option in Stock Synthesis v.3.30.18 (released Sept 2021)
- Ability to define a “predator” that adds additional mortality to base natural mortality
- No longer necessary to use bycatch fleets to mimic predators (or fish kills, red tide etc)
- Bycatch fleets used to mimic “predator” still create fishing mortality that was included in total F (even if not included in MSY protocol)



Data for predator inputs

- “Predator” (M2) parameter is:
 - Age-specific, but not sex or morph specific
 - Distributed across ages according to the selectivity for this fleet
- Part of the total M used in the SPR and MSY benchmark calculations
- Can be input as:
 - Total kill (as discard data), analogous to calculating catch for fishing fleets
 - Predator effort (as survey index)
 - Predator age-length composition: used if there are stomach contents or collections from fish kill



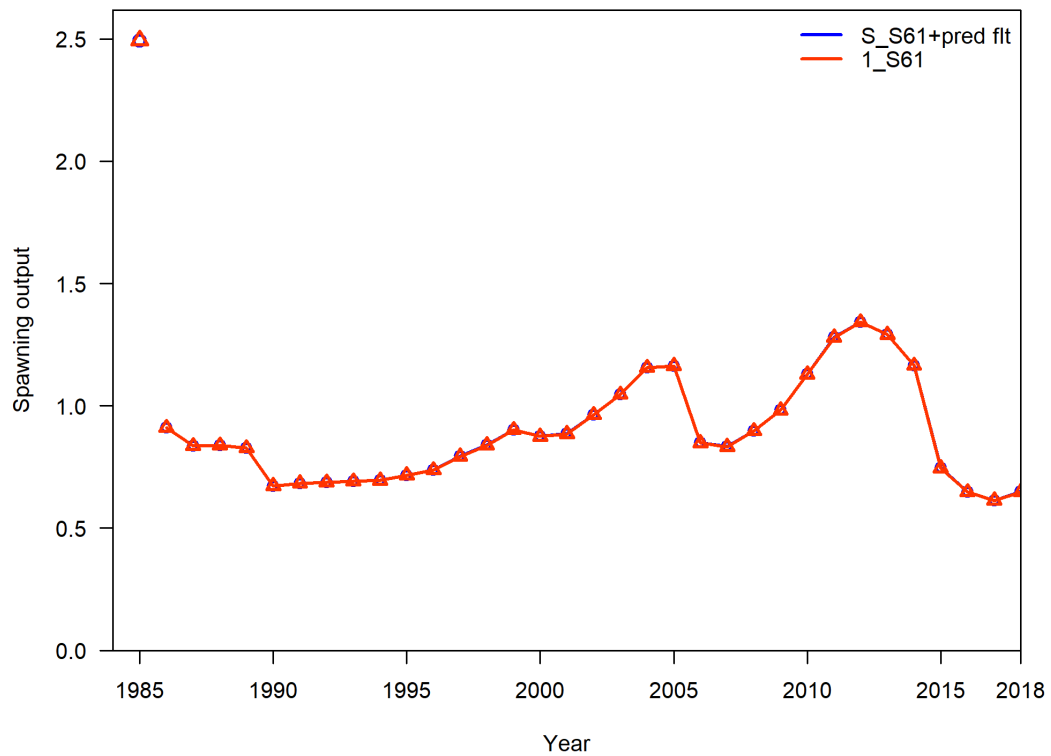
Preliminary Runs for S88 RT TWG

- Apply predator fleet method to S61 base model
- Added two additional years of data (2018 and 2022) as placeholder to red tide **bycatch fleet** to S88 working model
- Added two additional years of data (2018 and 2022) as placeholder to red tide **predator fleet** to S88 working model

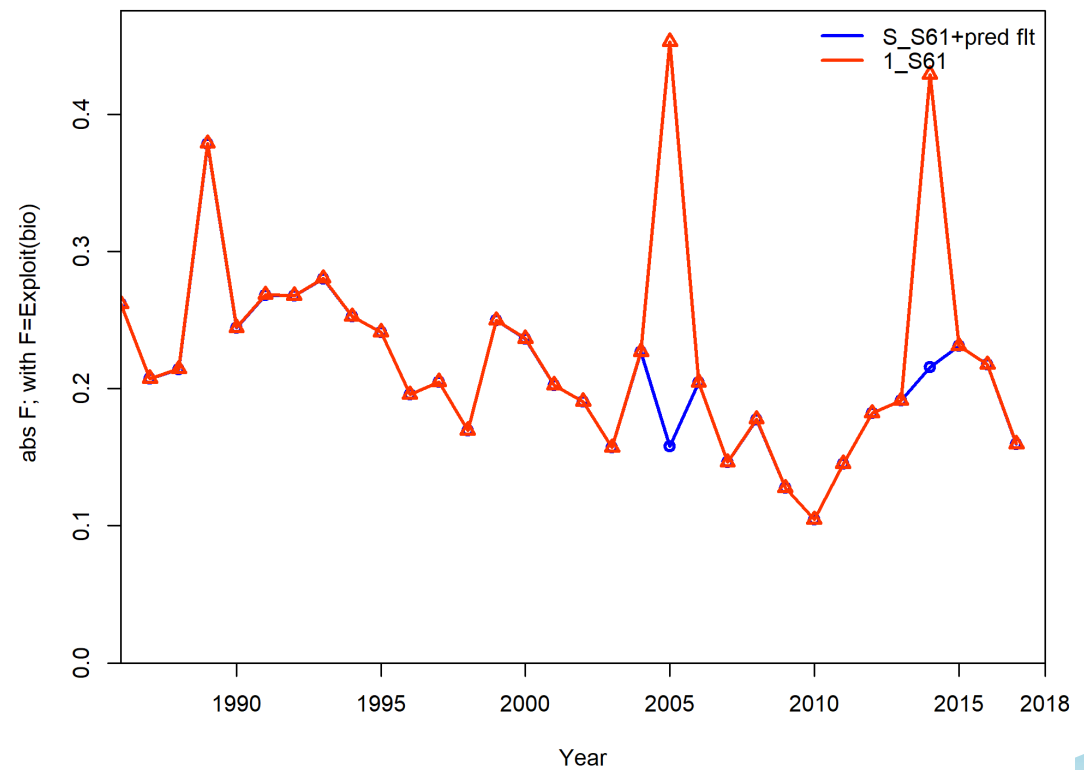


Comparison S61 vs predator fleet

Spawning output



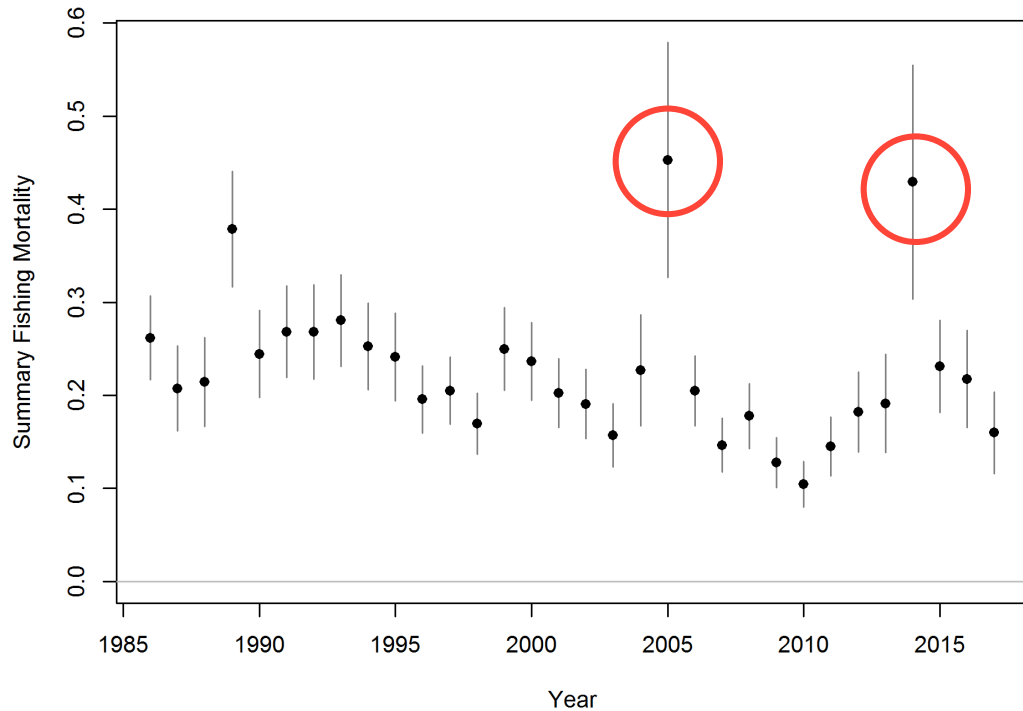
Fishing mortality



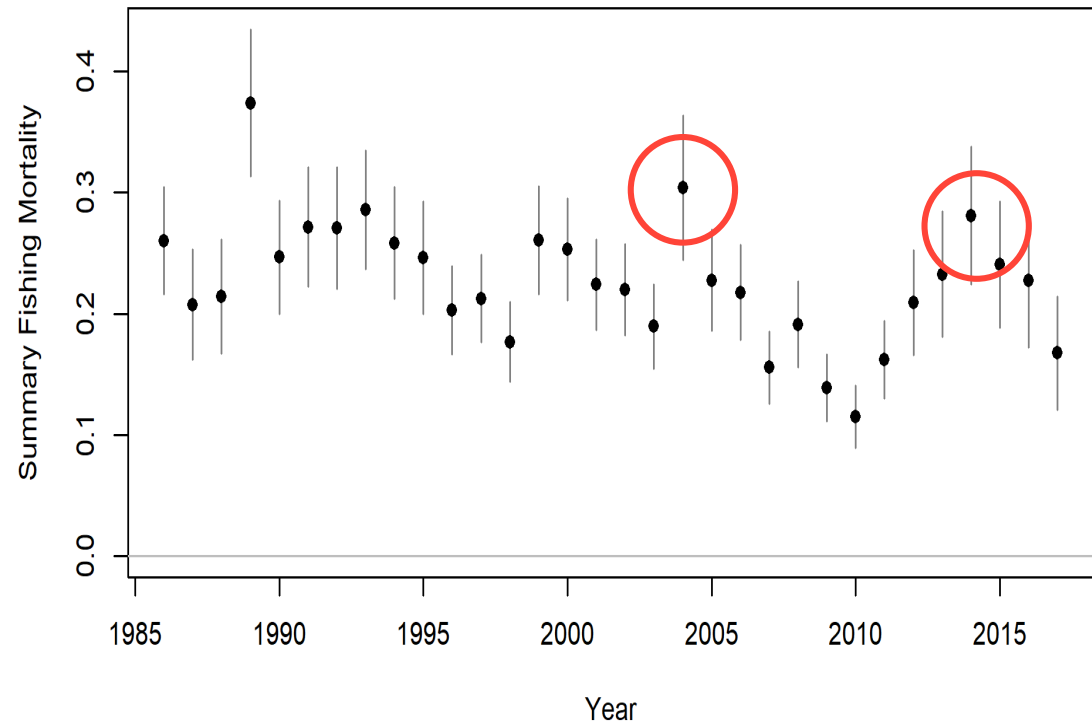
Exploitation Rate

- Red tide mortality included as bycatch fleet vs predator fleet

SEDAR 61 : bycatch fleet



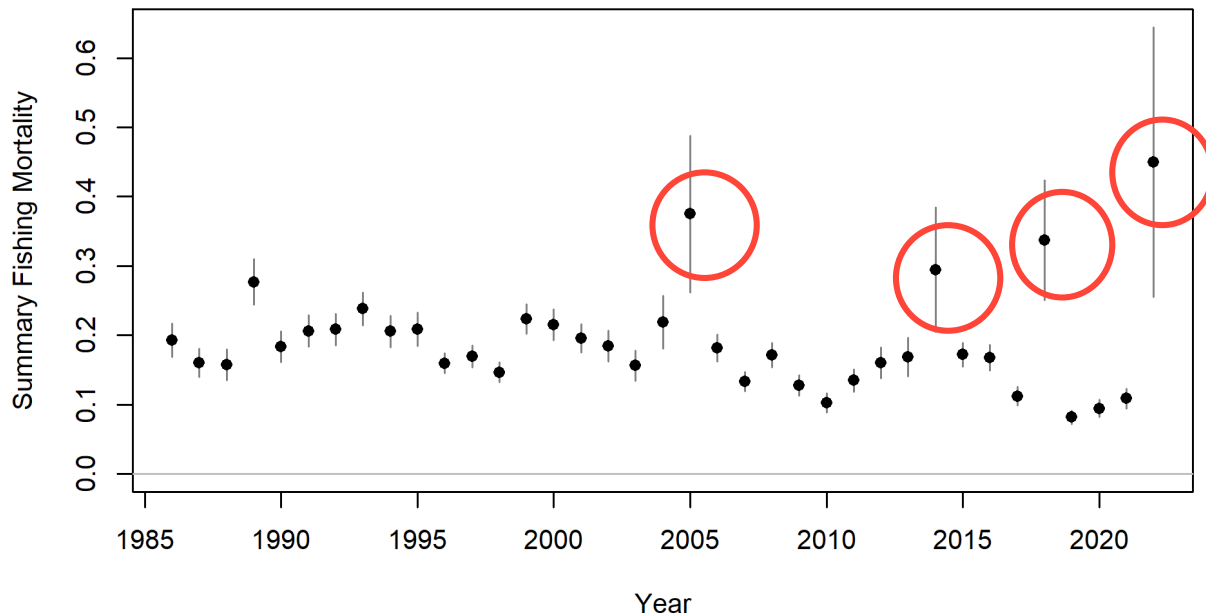
SEDAR 61: predator fleet



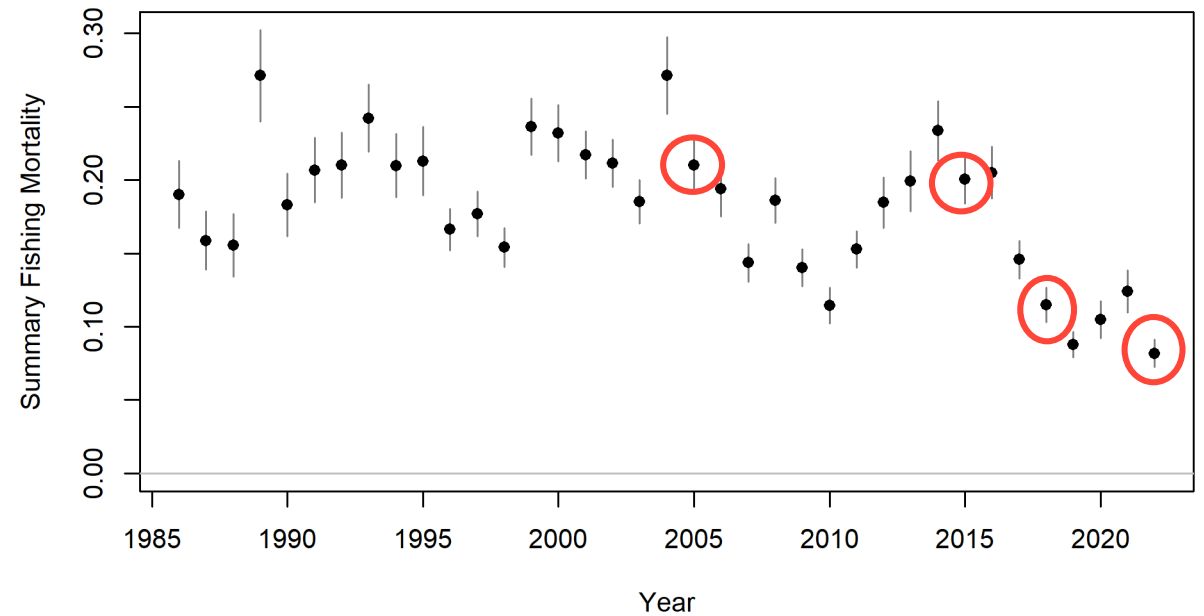
Preliminary Run – update time series

- Two additional years added to red tide
 - 2018 and 2022 (TY)
 - Magnitude same as 2005 and 2014

SEDAR 88 : bycatch fleet

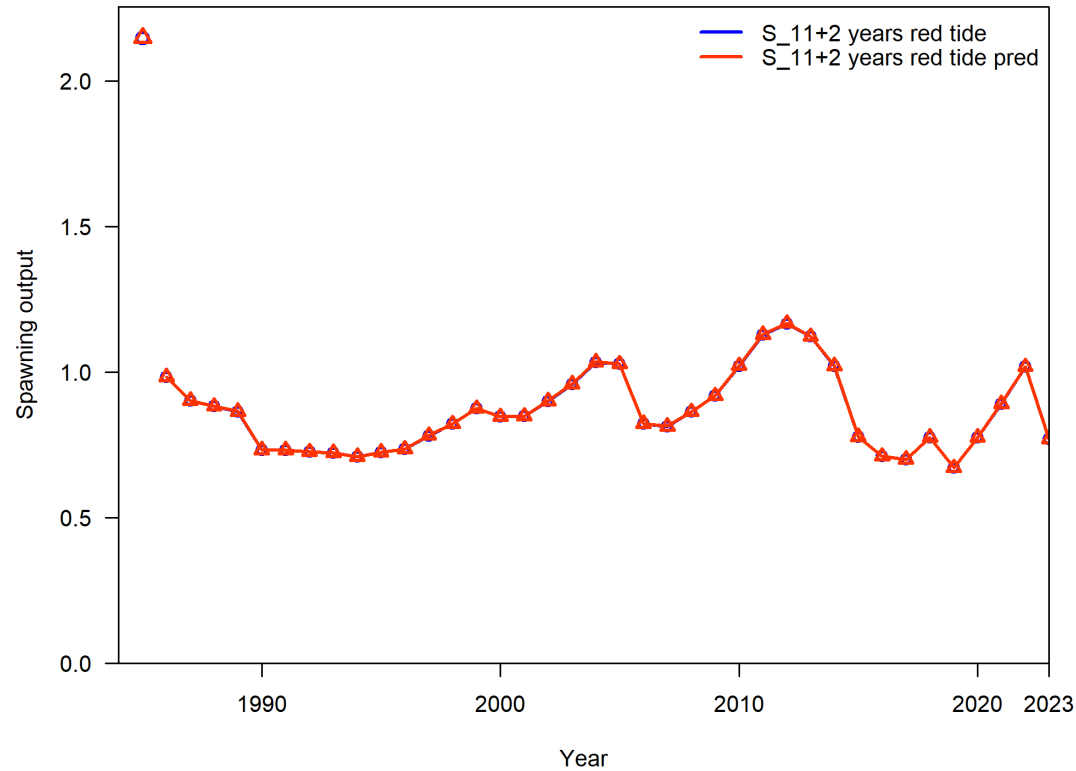


SEDAR 88: predator fleet

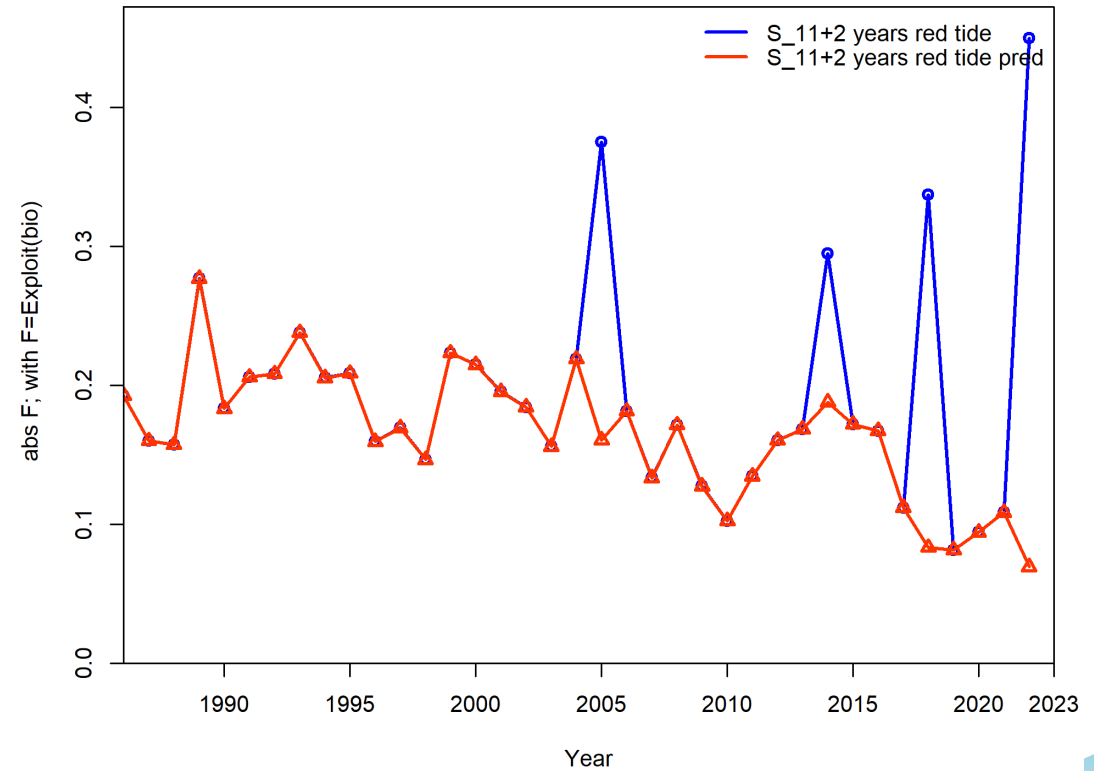


Comparison S88 bycatch vs predator fleet

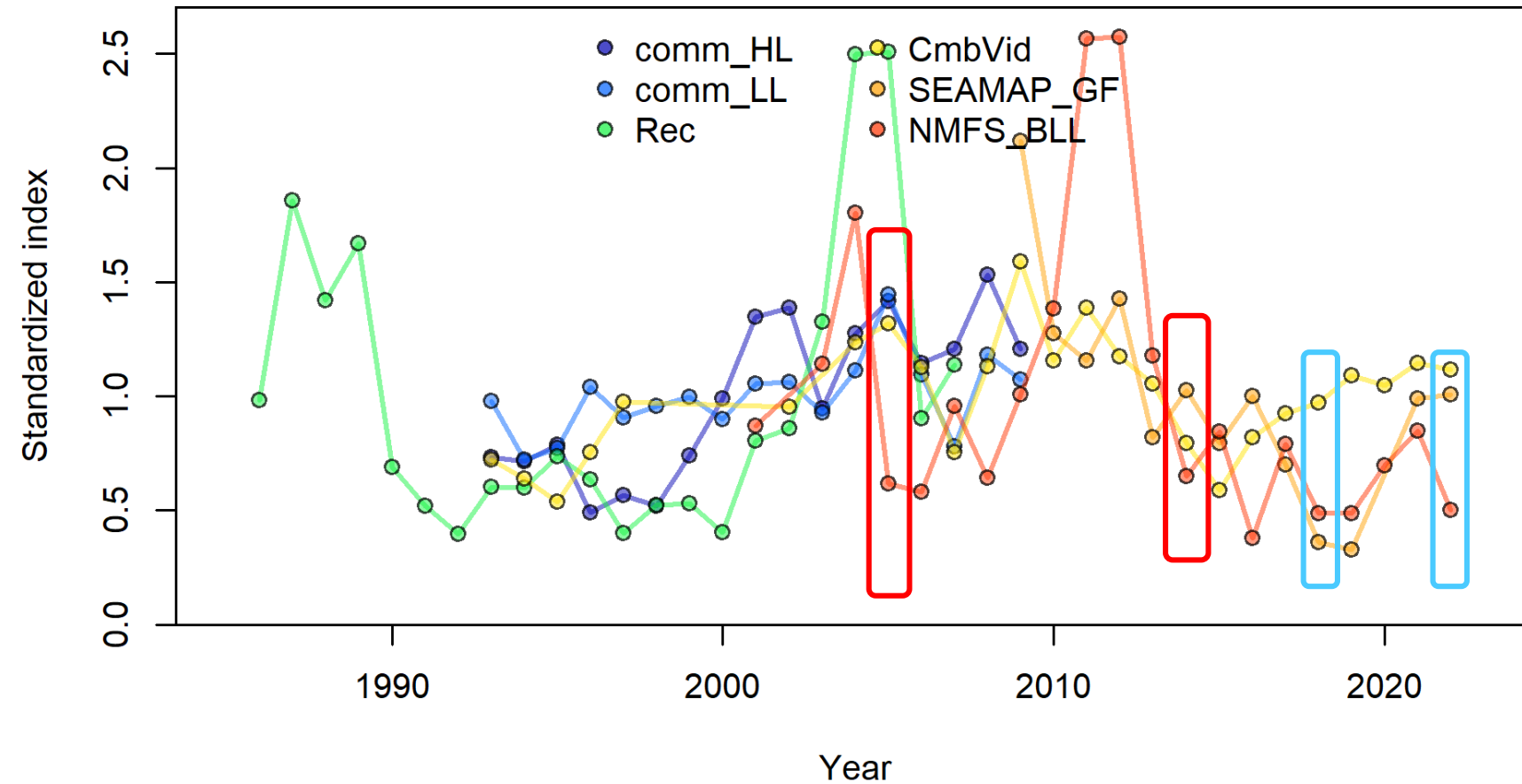
Spawning output



Fishing mortality



All indices in model



- 2005 and 2014 outlined in red
- 2018 and 2022 outlined in blue

Review

- Decisions needed from this TWG
 - Years of red tides
- Magnitude of events
- Modeling approach
- Potential sensitivity runs

Questions?/Discussion



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