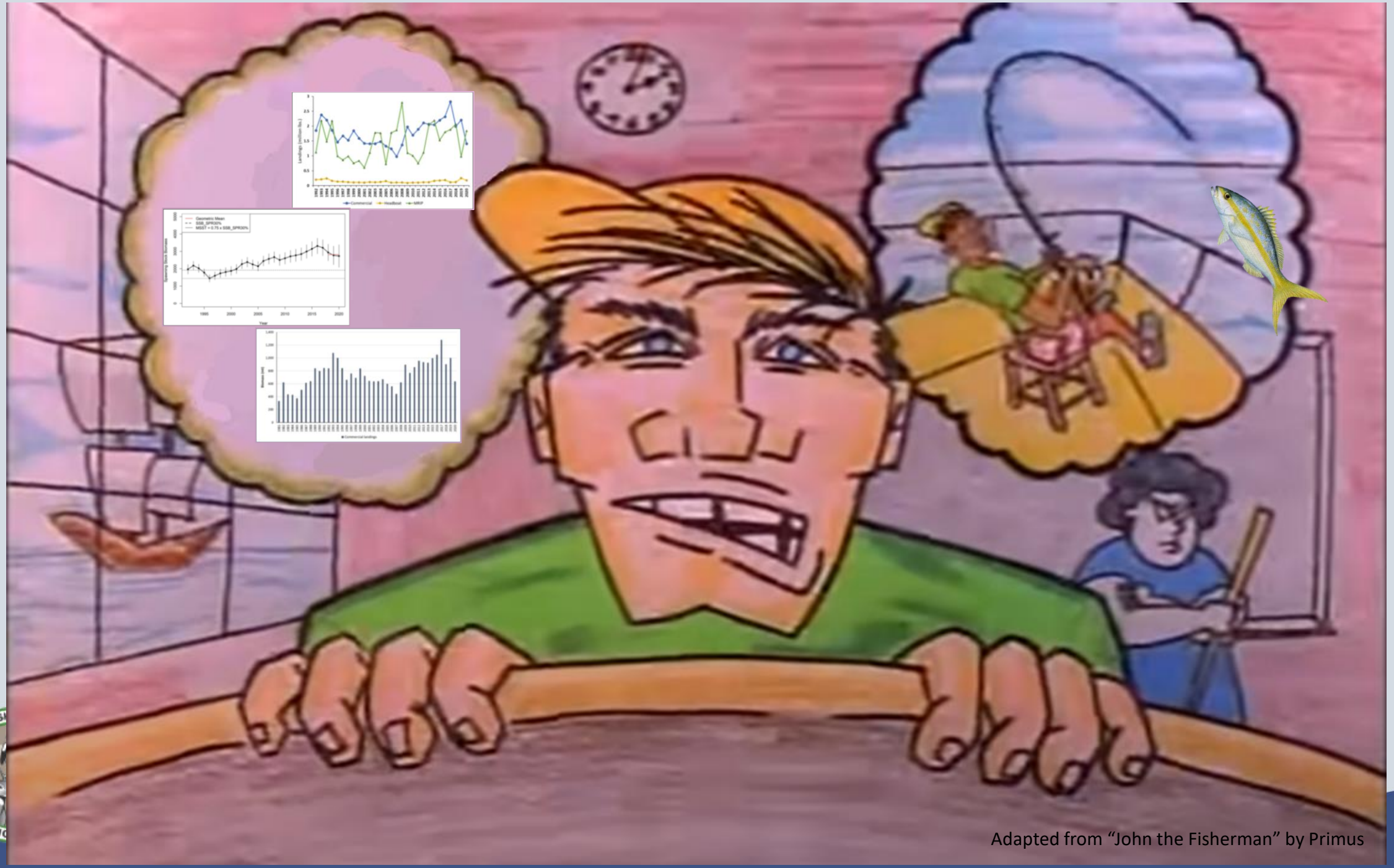
SEDAR 64 Interim Analysis:
Southeastern U.S. Yellowtail Snapper

Joint SSC Meeting

Aug 4, 2022

Shanae D. Allen and Christopher E. Swanson

FWRI Stock Assessment Group, St. Petersburg, FL



Adapted from “John the Fisherman” by Primus

Outline

Part 1

- Orientation: assessment and quota history
- Updates to the data
- Updates to model configuration
- Model results
- Model diagnostics

Part 2

- Sensitivity runs
- Model uncertainty
- Stock status overview
- Projection scenarios

S64 Interim Analysis: Yellowtail Snapper

Assessment History

Assessment History

SEDAR 3 (2003)

- Integrated and Statistical Catch-at-Age model (ICA)
- Data from 1981 – 2001
- F_{2001}/F_{msy} = 0.57 (**not overfishing**); SSB_{2001}/SSB_{msy} = 1.43 (**not overfished**)

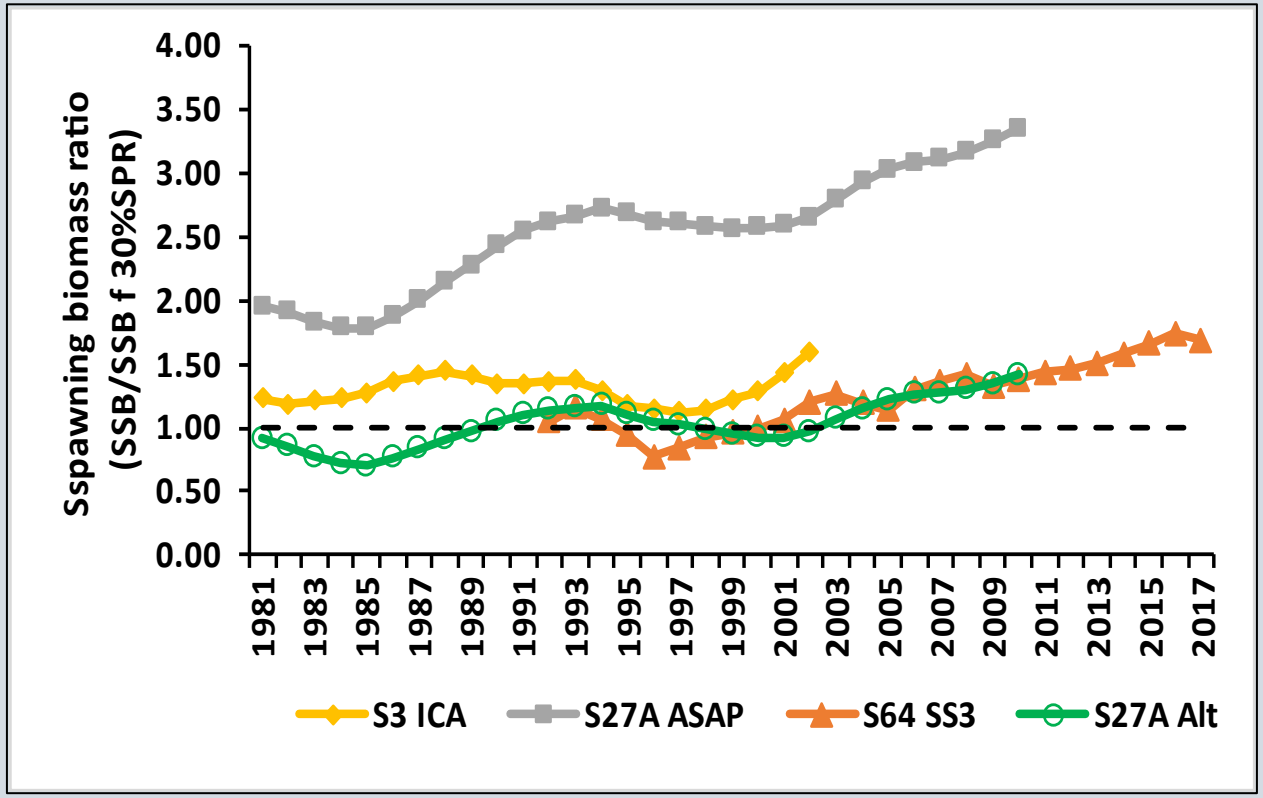
SEDAR 27A (2012)

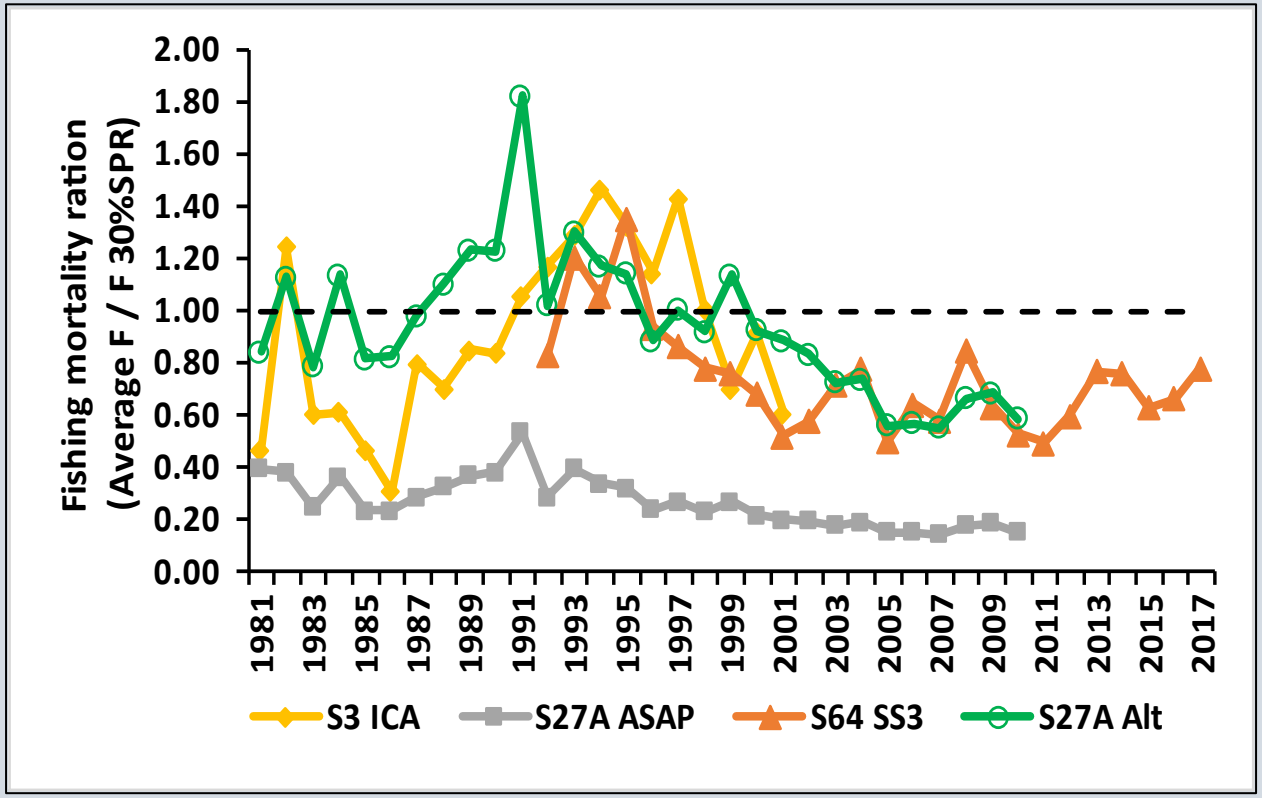
- Statistical catch-at-age model (ASAP2)
- Data from 1981 – 2010
- $F_{msy} \rightarrow F_{30\%SPR}$; MSST = $(1-M)*SSB_{30\%SPR}$
- $F_{2001}/F_{30\%SPR}$ = 0.15 (**not overfishing**); SSB_{2001}/MSST= 3.36 (**not overfished**)

SEDAR 64 (2020)

- Age- and size-structured assessment model in the integrated analysis class of models (SS 3.30.14)
- Data from **1992** – **2017**
- $F_{30\%SPR}$; MSST = $0.75*SSB_{30\%SPR}$
- $F_{current}/F_{30\%SPR}$ = 0.68 (**not overfishing**); $SSB_{current}$/MSST= 2.26 (**not overfished**)

S64 Model Bridging





Model	Description
S3 ICA	SEDAR 3 Final Model
S27A ASAP	SEDAR 27A Final Model
S27A Alt	Alternative SEDAR 27A Model with additional weight at age matrices
S64 SS3	SEDAR 64 Final Model

Quota History

Date	Total ACL
1/30/2012 – 11/2012	2,898,875 lbs. (1,315 mt)
9/3/2013 – present	**3,938,625 lbs. (1,787 mt)**

South Atlantic	Date	ACL
Commercial	Apr 2012 – Nov 2012	1,142,589 lbs.
	Nov 2012 – Current	**1,596,510 lbs.**
Commercial Closures	10/31/2015 – 12/31/2015 6/3/2017 – 7/31/2017 6/5/2018 – 7/31/2018 6/7/2019 – 7/31/2019	
Recreational (CHTS)	Apr 2012 – Sept 2013	1,031,286 lbs.
	Sept 2013 – Current	**1,440,990 lbs.**

Gulf of Mexico	Date	ACL
Commercial and Recreational (CHTS)	Jan 2012 – Sept 2013	725,000 lbs.
	Sept 2013 – Current	**901,125 lbs.**

S64 Interim Analysis: Yellowtail Snapper

Data

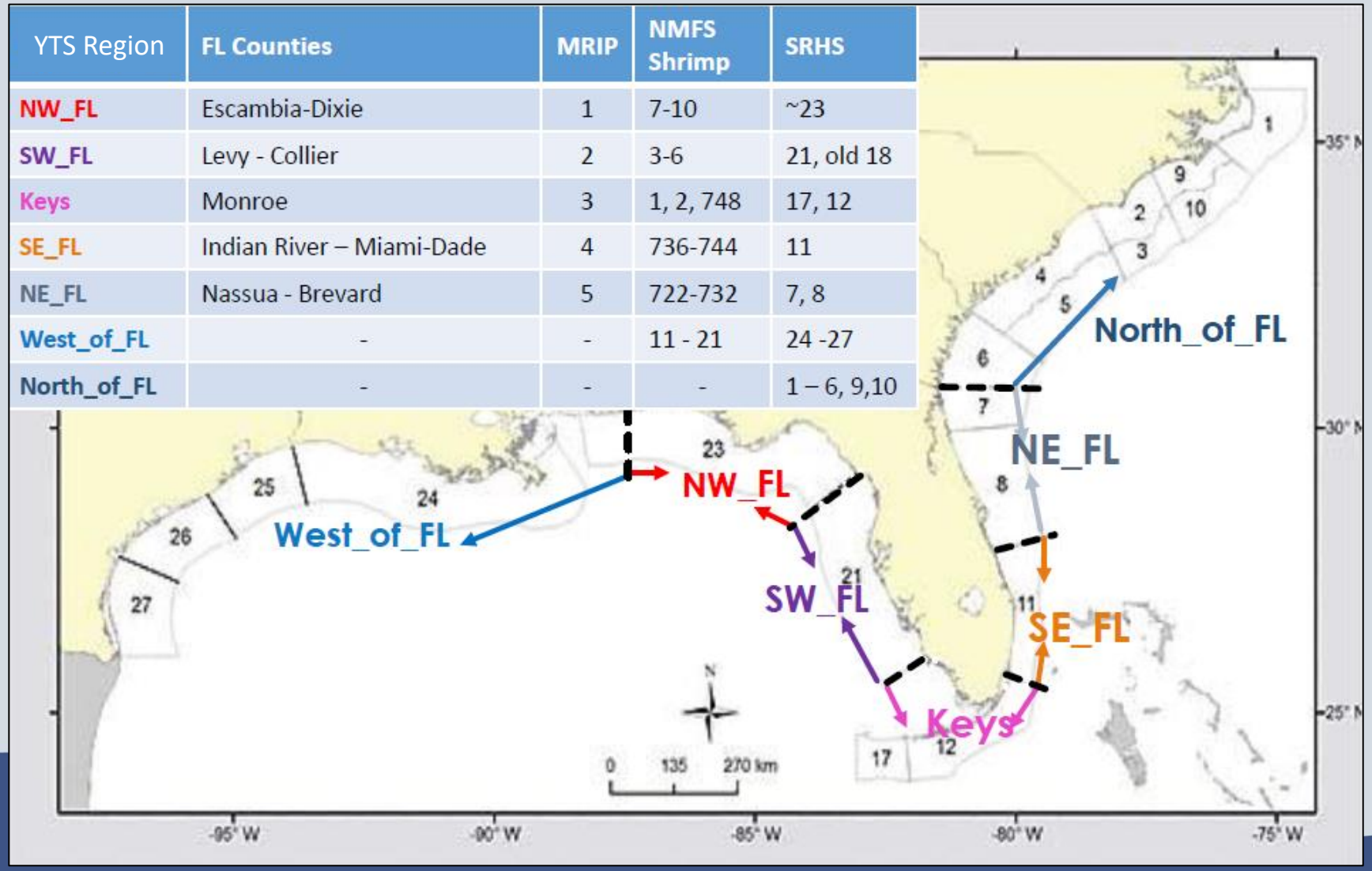
Term of Reference #1

- *"Update the SEDAR 64 Southeastern U.S. Yellowtail Snapper base model in SS v.3.30.13 with landings and discard data for commercial, headboat, and other recreational fishing modes from 2018 to 2020."*
  - Therefore, no indices nor any length and age composition data were updated.

- As was determined for the S64 benchmark assessment, only landings and discards data from Florida waters were considered as input.

Regions of Florida

YTS Region	FL Counties	MRIP	NMFS Shrimp	SRHS
NW_FL	Escambia-Dixie	1	7-10	~23
SW_FL	Levy - Collier	2	3-6	21, old 18
Keys	Monroe	3	1, 2, 748	17, 12
SE_FL	Indian River – Miami-Dade	4	736-744	11
NE_FL	Nassua - Brevard	5	722-732	7, 8
West_of_FL	-	-	11 - 21	24 -27
North_of_FL	-	-	-	1 – 6, 9,10



Updated Commercial Landings

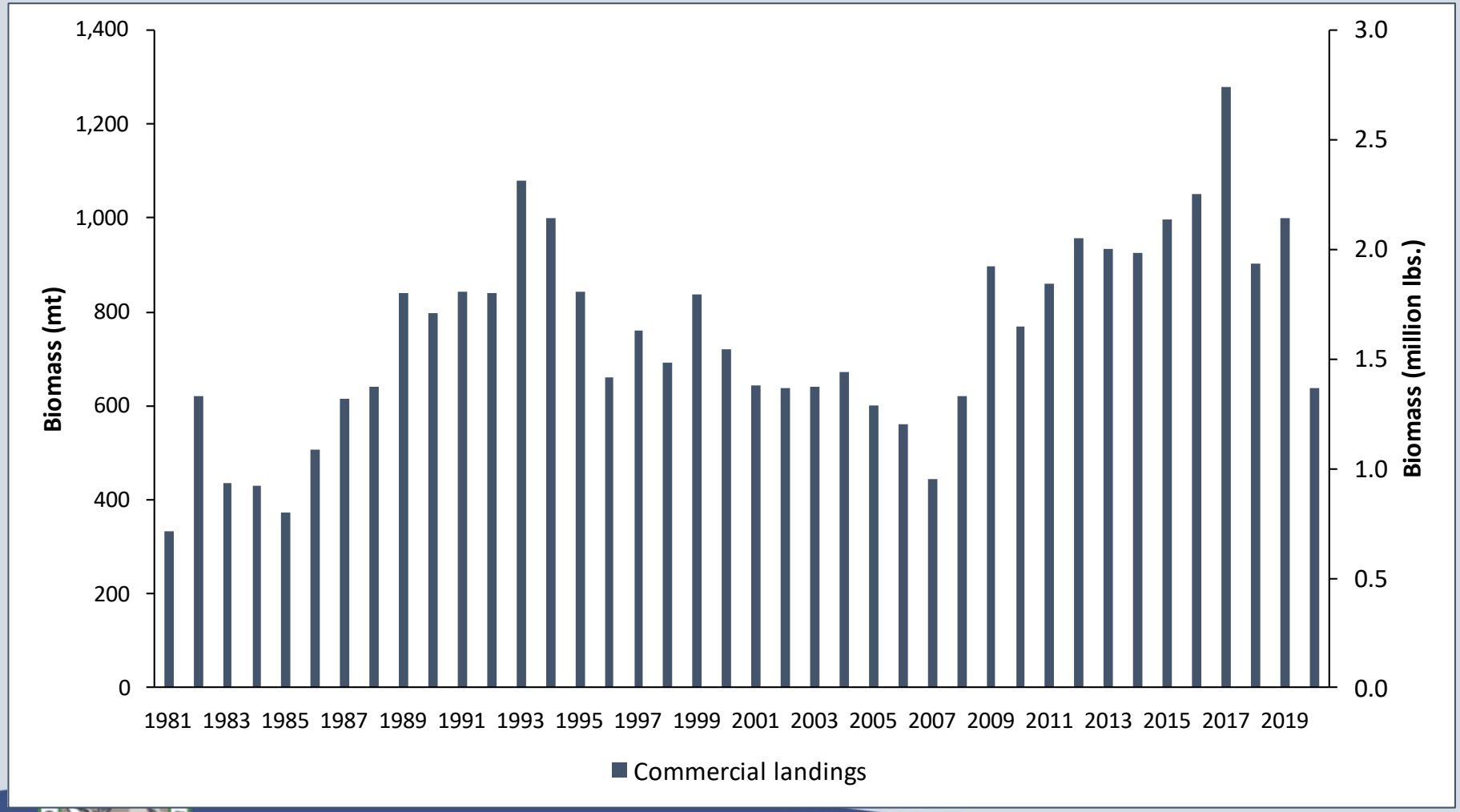
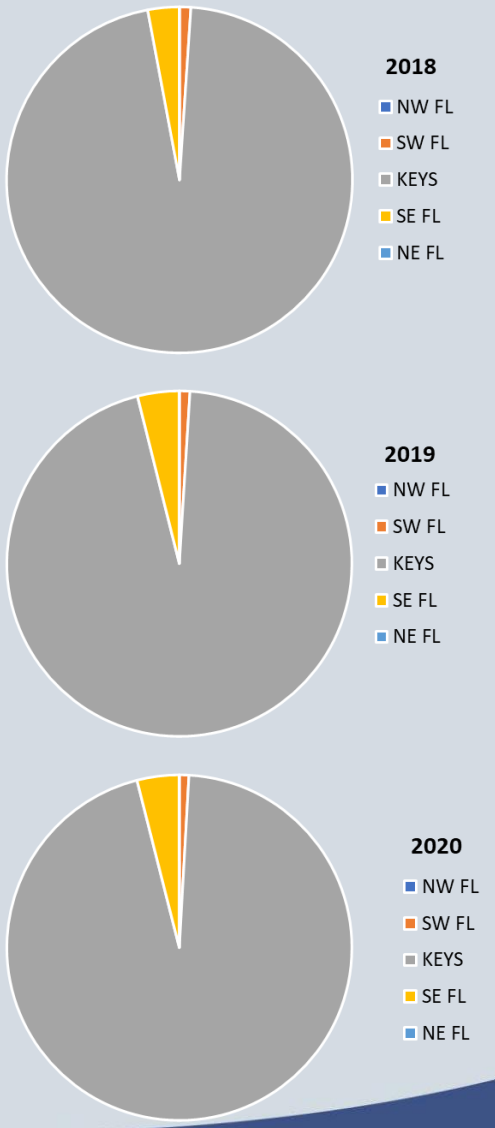
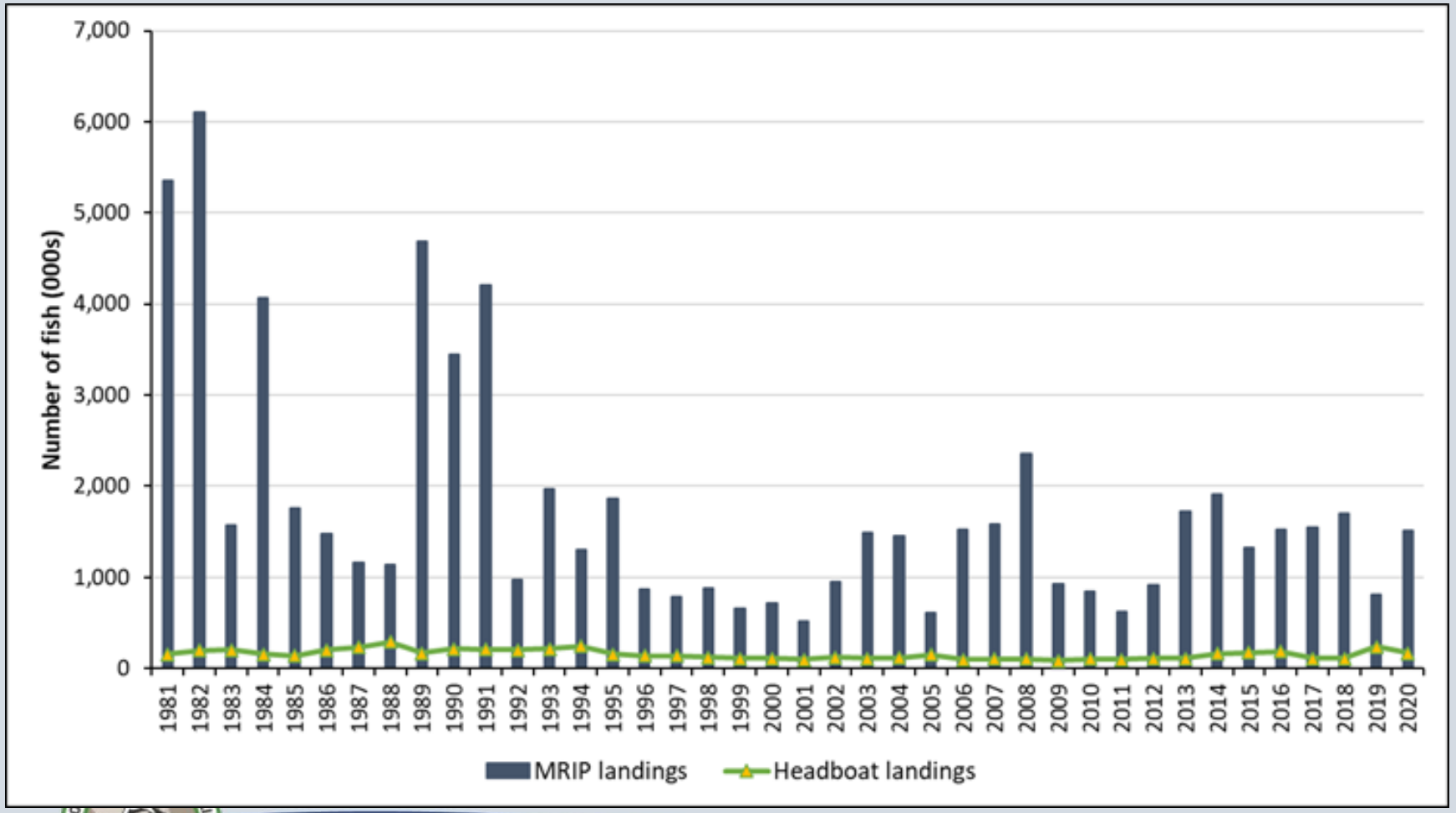


Figure 1

Comm Landings by Region



Updated Recreational Landings



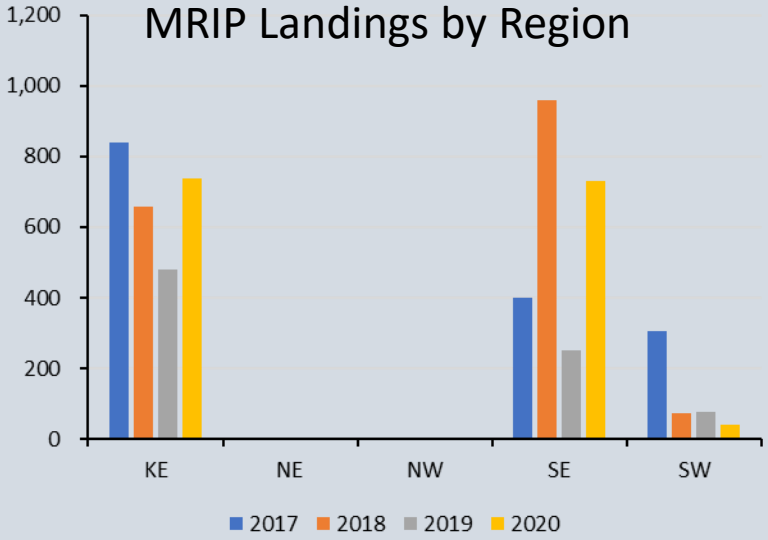


Figure 2

Updated Commercial and Recreational Discards

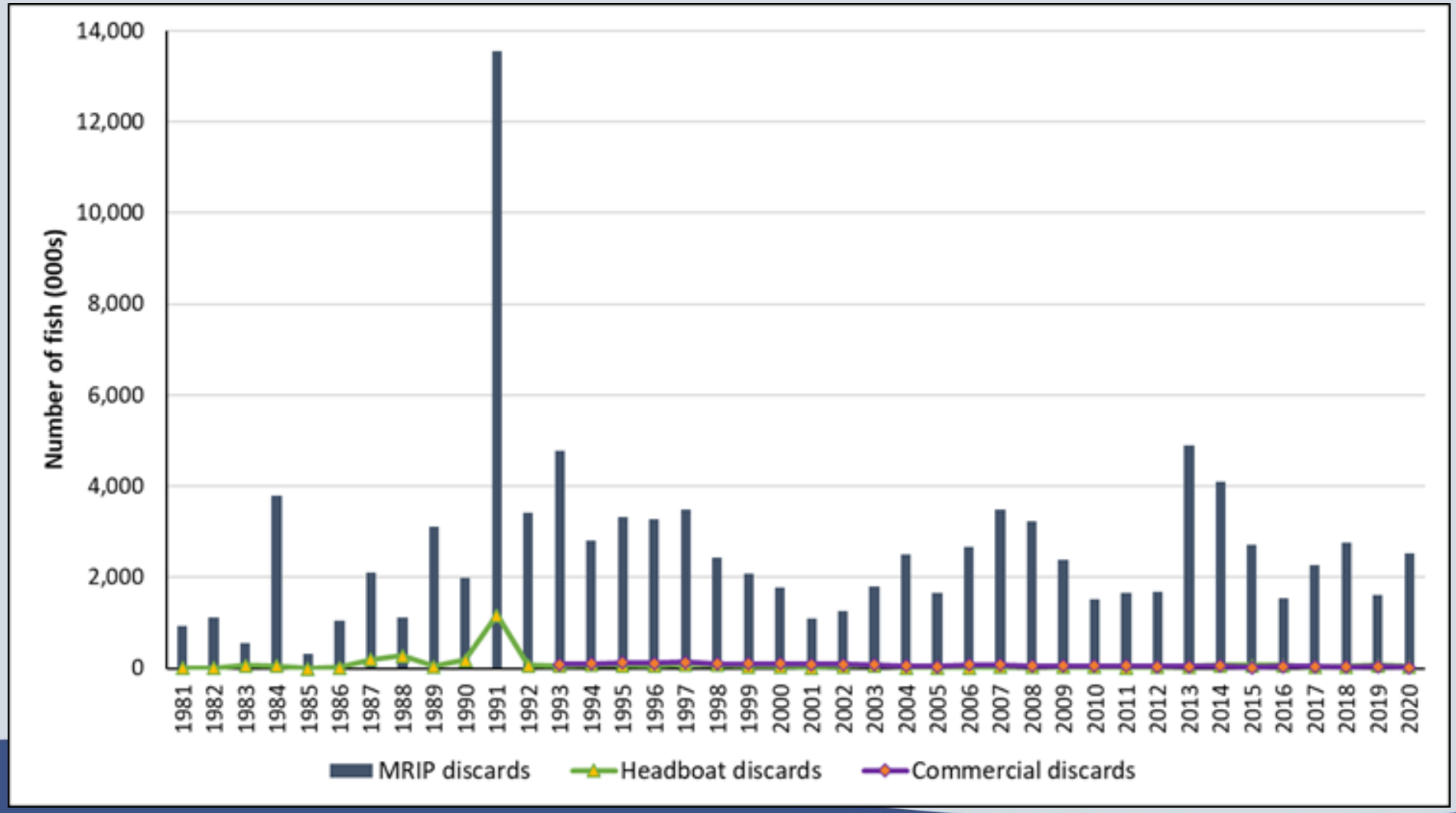
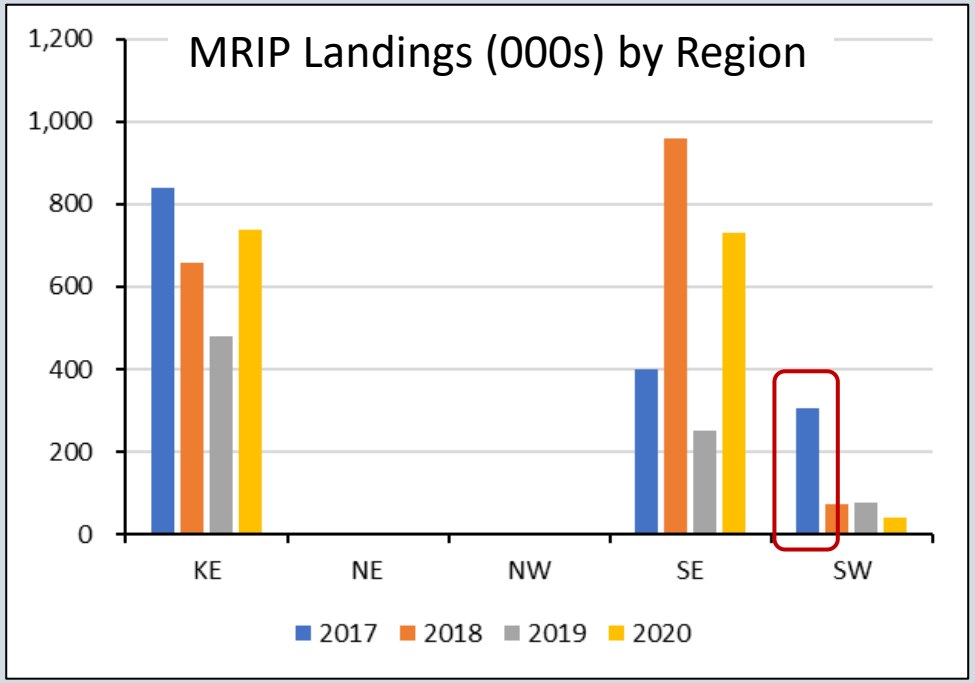


Figure 3

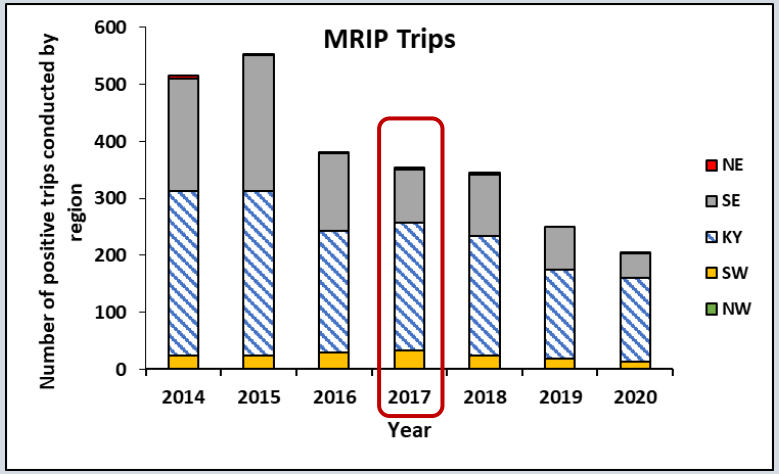
2017 MRIP Landings: Southwest FL

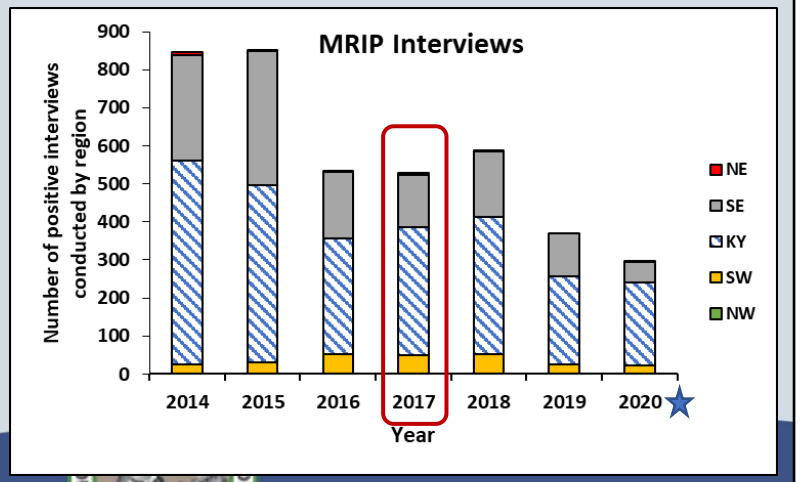
- *"Evaluate potential issues with 2017 MRIP recreational landings data. Determine if special treatment is appropriate."* (TOR #1 sub-point).

- Total catch in southwest FL
  - 2015 – 2016; 2018 - 2019: 2.7%
  - **2017**: **10.9 %**



2017 MRIP Landings: Southwest FL

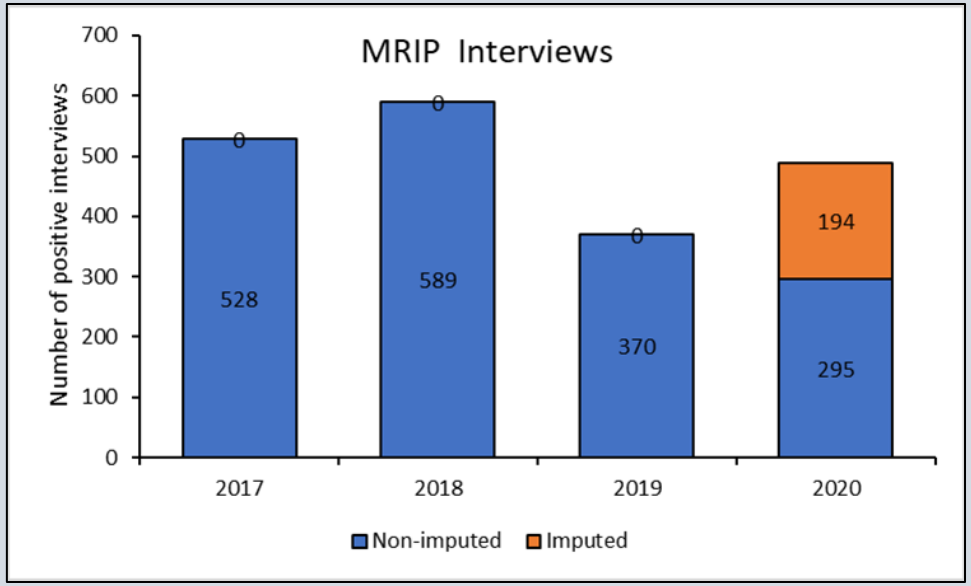




	Wave 1	2	3	4	5	6	Total Catch
B1000920171202001						167	167
B1297920170121012	244						244
B1297920170826001				33			33
B1297920171104001						2,026	2,026
B1546420171020001					17		17
B1546620170211018	237						237
B1546620170703004				5,228			5,228
B1546620170806001				1,275			1,275
B1546620170806020				542			542
B1546620171104029						2,739	2,739
B1546620171203036						97,916	**97,916**
B1565420170520025			29				29
B1565420170927004					2,711		2,711
B1574020170112001	649						649
B1574020170126001	70,888						**70,888**
B1574020170401059		1,267					1,267
B1574020170428005		60					60
B1574020170603017			611				611
B1574020170630005			523				523
B1574020170727007				39,534			**39,534**
B1574020171012008					173		173
B1574120170729006				5,933			5,933
B1574320170727013				9,490			9,490
B1574820170421005		331					331
B1574820170512020			87,352				**87,352**
B1575620170210006	6,634						6,634
B1575620170225001	114						114
B1575620170225009	17						17
B1575620170225029	101						101
B1575620170522027			3,766				3,766
B1575620170624033			75,897				**75,897**
B1575620170722016				619			619
B1575620171223068						1,808	1,808
Grand Total	**78,884**	**1,659**	**168,179**	**62,654**	**2,901**	**104,656**	**418,933**

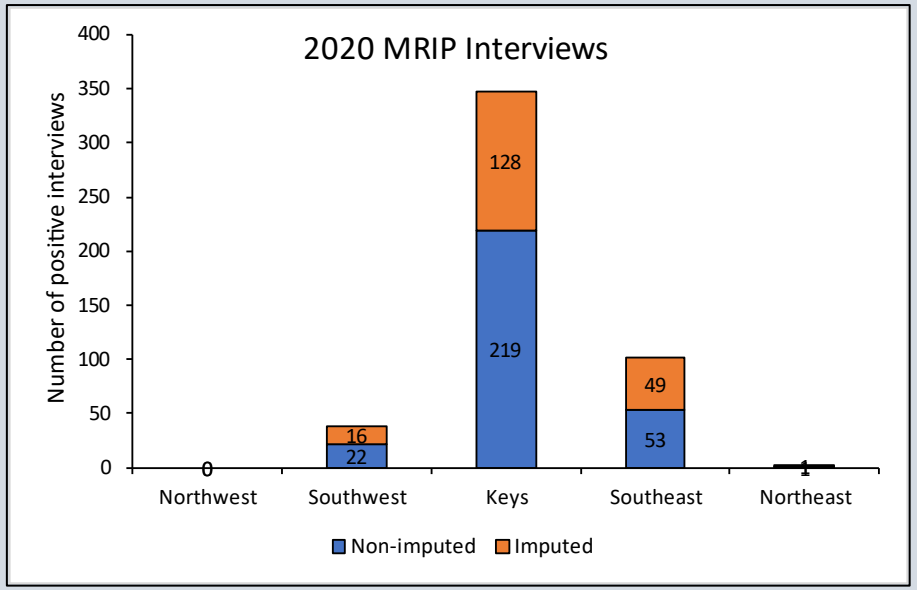
2020 MRIP Landings

- *"Evaluate potential issues with 2020 MRIP recreational landings data due to the COVID-19 pandemic."* (TOR #1 sub-point)
  - Reduced sampling coverage
  - Higher than usual boating activity
- 489 total positive interviews
  - 295 (60.3%) were conducted by samplers in 2020.
  - 194 (39.7%) were imputed (i.e., 'imp_rec'==TRUE) from 2018 – 2019 APAIS data collected from the same strata.
  - Original sample weights were also reduced by a factor of two.



2020 MRIP Landings

- *"Evaluate potential issues with 2020 MRIP recreational landings data due to the COVID-19 pandemic."* (TOR #1 sub-point)
  - Reduced sampling coverage
  - Higher than usual boating activity.
- 489 total positive interviews
  - 295 (60.3%) were conducted by samplers in 2020.
  - 194 (39.7%) were imputed (i.e., 'imp_rec'==TRUE) from 2018 – 2019 APAIS data collected from the same strata.
  - Original sample weights were also reduced by a factor of two.



- Imputations mostly in the Florida Keys (n = 128) and southeast Florida (n = 49) regions.
- Landings and discards data for 2020 were consistent with recent years and we determined that the reviewed methods of imputation were sufficient for Yellowtail Snapper

S64 Interim Analysis: Yellowtail Snapper

Interim Base Model Configuration

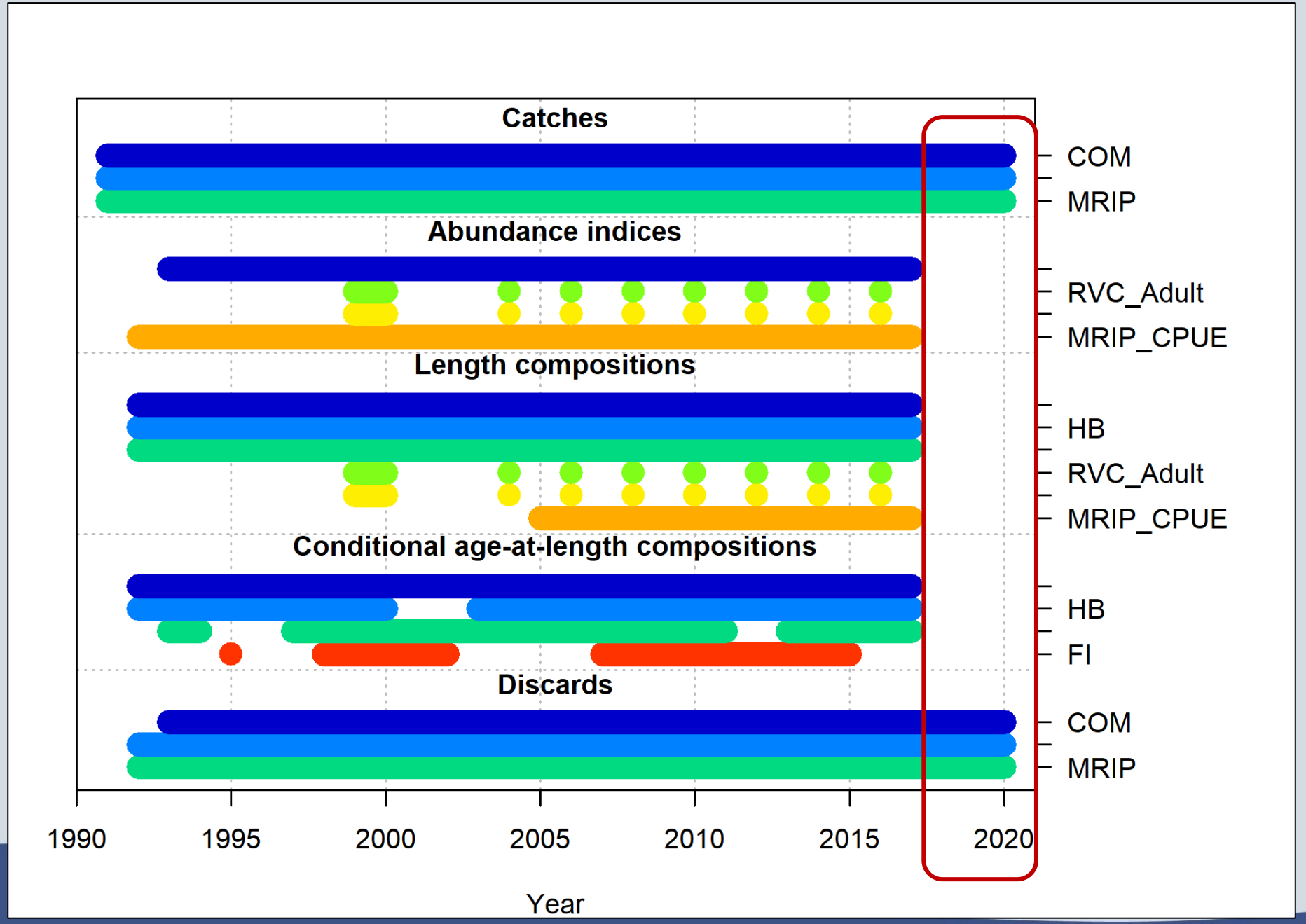
Interim Base Model Configuration

Stock Synthesis v. 3.30.15

- Moderate complexity
- Years: 1992 – **2020**
- 1 season, 1 area
- Spawning: January
- Settlement: January at age 0, 2 cm FL
- Combined sex model with female-only SSB (frac_female = 0.5)

Life History (No change)

- Estimated growth using external VB growth model inputs as initial guesses
- 20 ages in the model; Age 12+ group
- Natural mortality: Fixed vector by age (Lorenzen 2005)
- Maturity: Fixed vector by age
- Fecundity = Spawning biomass at length
- Length-Weight: fixed


Catches
COM
MRIP
Abundance indices
RVC_Adult
MRIP_CPUE
Length compositions
HB
RVC_Adult
MRIP_CPUE
Conditional age-at-length compositions
HB
FI
Discards
COM
MRIP
1990
1995
2000
2005
2010
2015
2020
Year

Interim Base Model Configuration

Recruitment Dynamics (Updated)

- Beverton-Holt stock-recruitment relationship
  - Virgin recruitment in log-space (*ln(R0)*), the standard deviation of log of recruitment (*sigmaR*), and *steepness* estimated in model
- Simple recruitment deviations
  - no sum-to-zero constraint
- Early recruitment deviations
  - 1981 – 1990 (period of lower data-richness)
- Main recruitment deviations
  - 1991 – **2020** (period of higher data-richness)
- Bias adjustments (following Methot and Taylor 2011)
  - Updated in the IBM

Interim Base Model Configuration

Parameters

- 88 out of 120 parameters estimated
  - No status change for IBM
  - Estimated values consistent with S64 Base Model

Priors

- Symmetric betas on initial Fishing mortality rates for Commercial, Headboat, and MRIP fleets
  - No added priors for IBM

Lambda

- No emphasis on model fit (=0)
  - Initial equilibrium catch for all three fleets
  - No added lambda values

Reported Fishing Mortality Rates

- Age 4

Interim Base Model Configuration

Model Convergence Criteria

- Total likelihood (sum of individual data source component's likelihoods)
- Invertible Hessian matrix
- Maximum gradient <0.0001

Error Structure

- Assumed log-normal for all landings, indices, and discard data (except commercial discards)

Multinomial Distribution

- Length composition and conditional age-at-length data

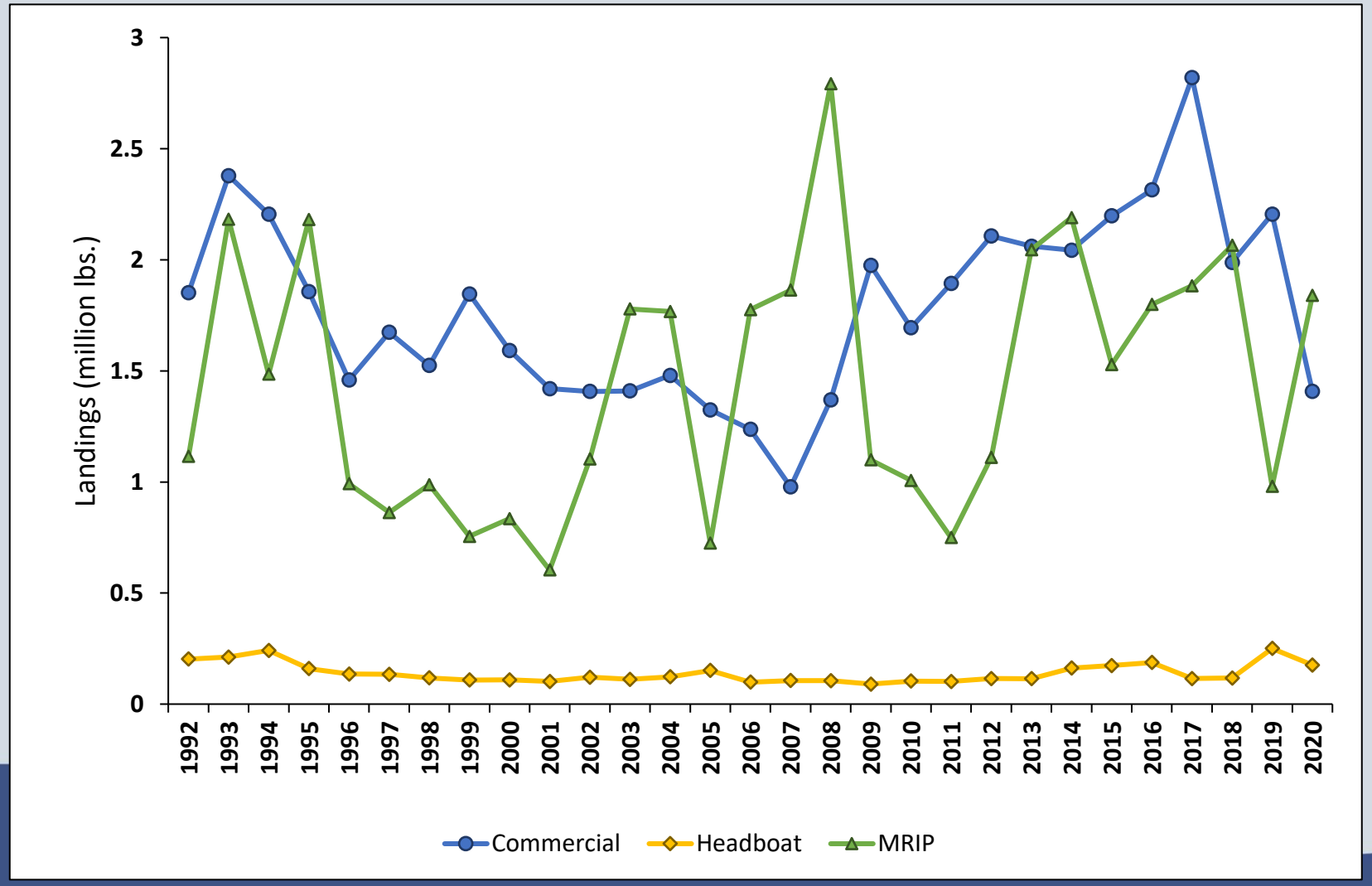
Data Weighting (Updated)

- Length composition and conditional age-at-length data
- Initial sample sizes equal to sqrt (number of trips or number of fish)
- Iterative re-weighting following Francis (2011)
  - Updated in IBM
  - No significant changes to weights

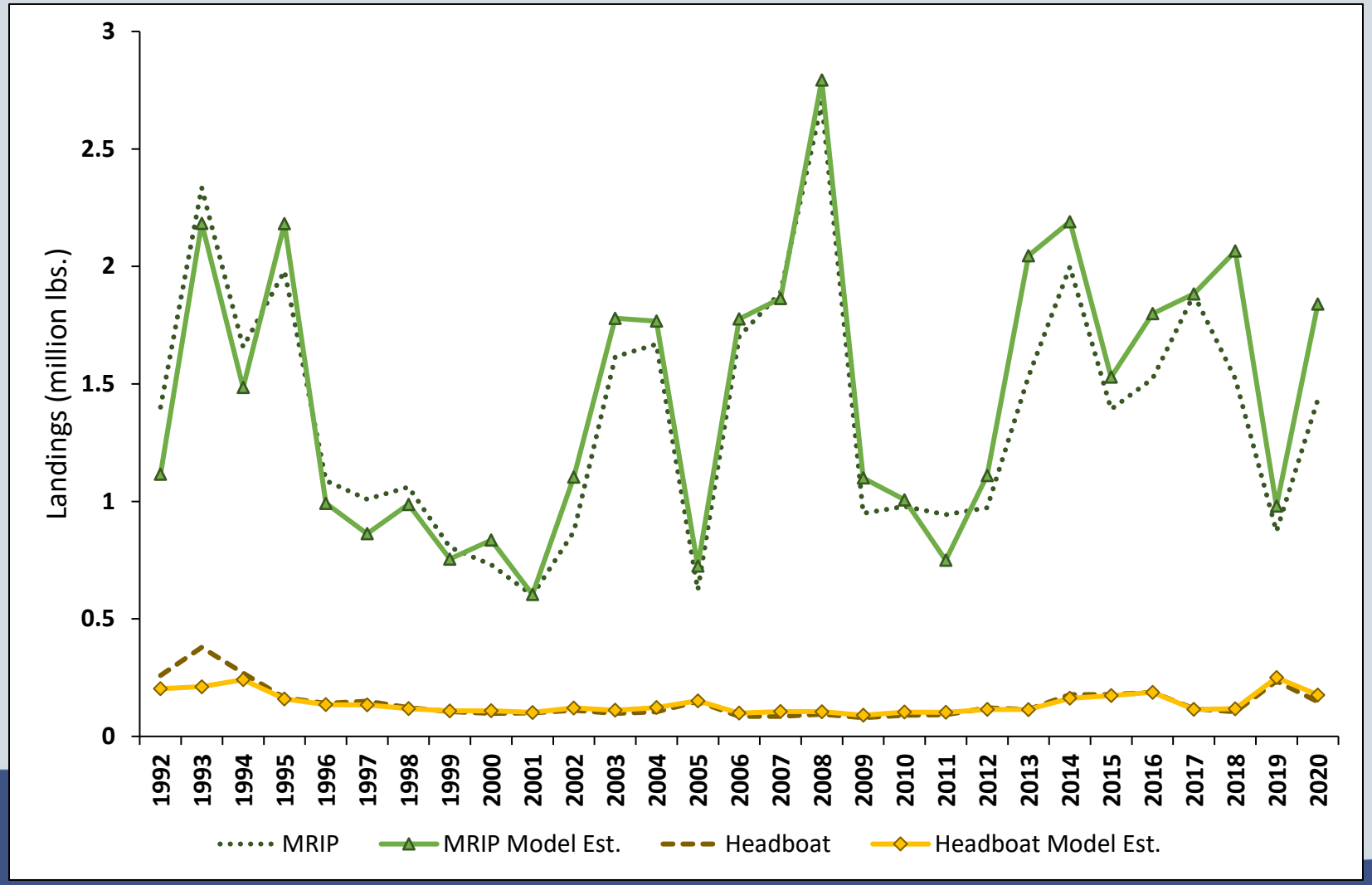
S64 Interim Analysis: Yellowtail Snapper

Interim Base Model Results

Model Estimated Landings



Reported vs Model Est. Recreational Landings (lbs.)



Discards

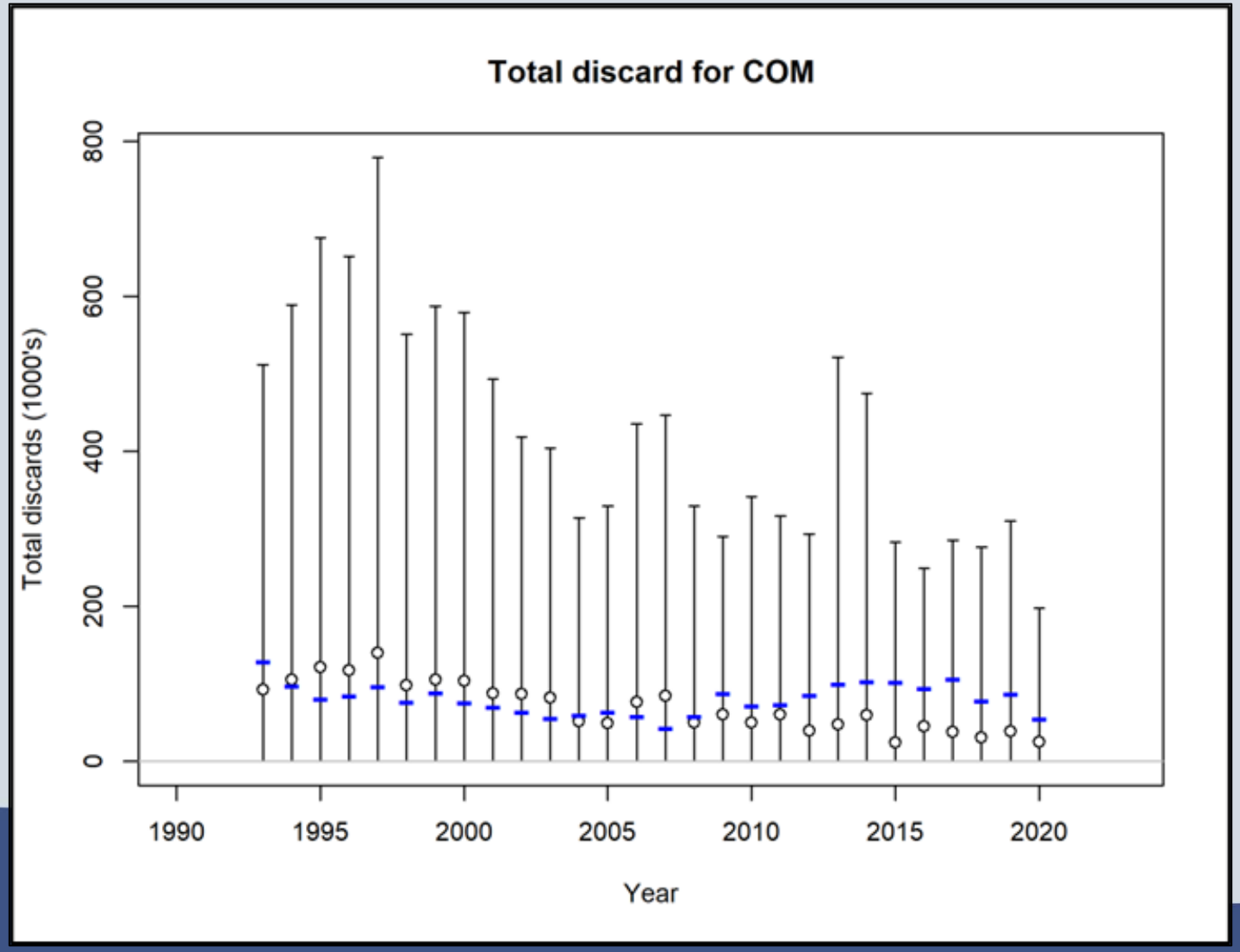


Figure 4

Discards

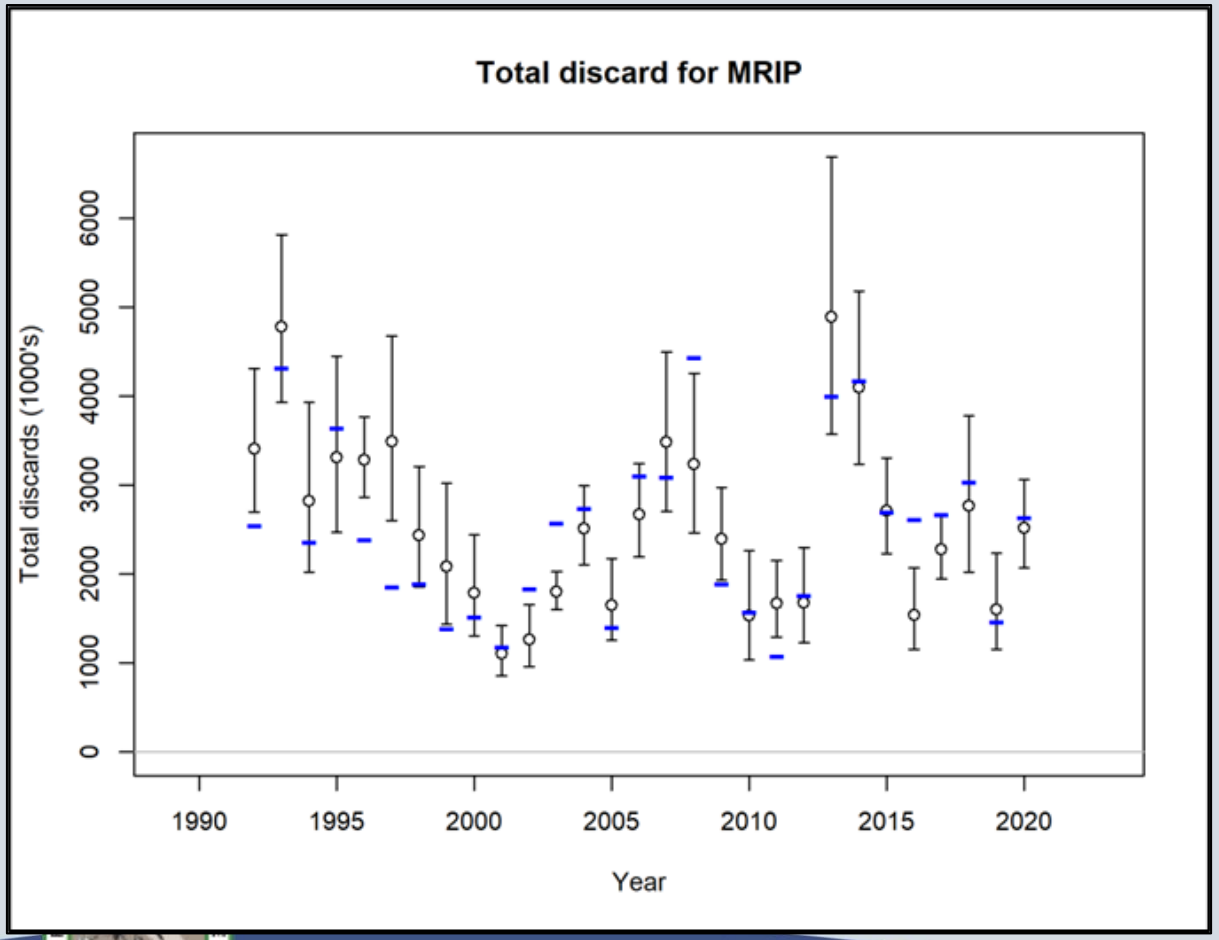


Figure 5

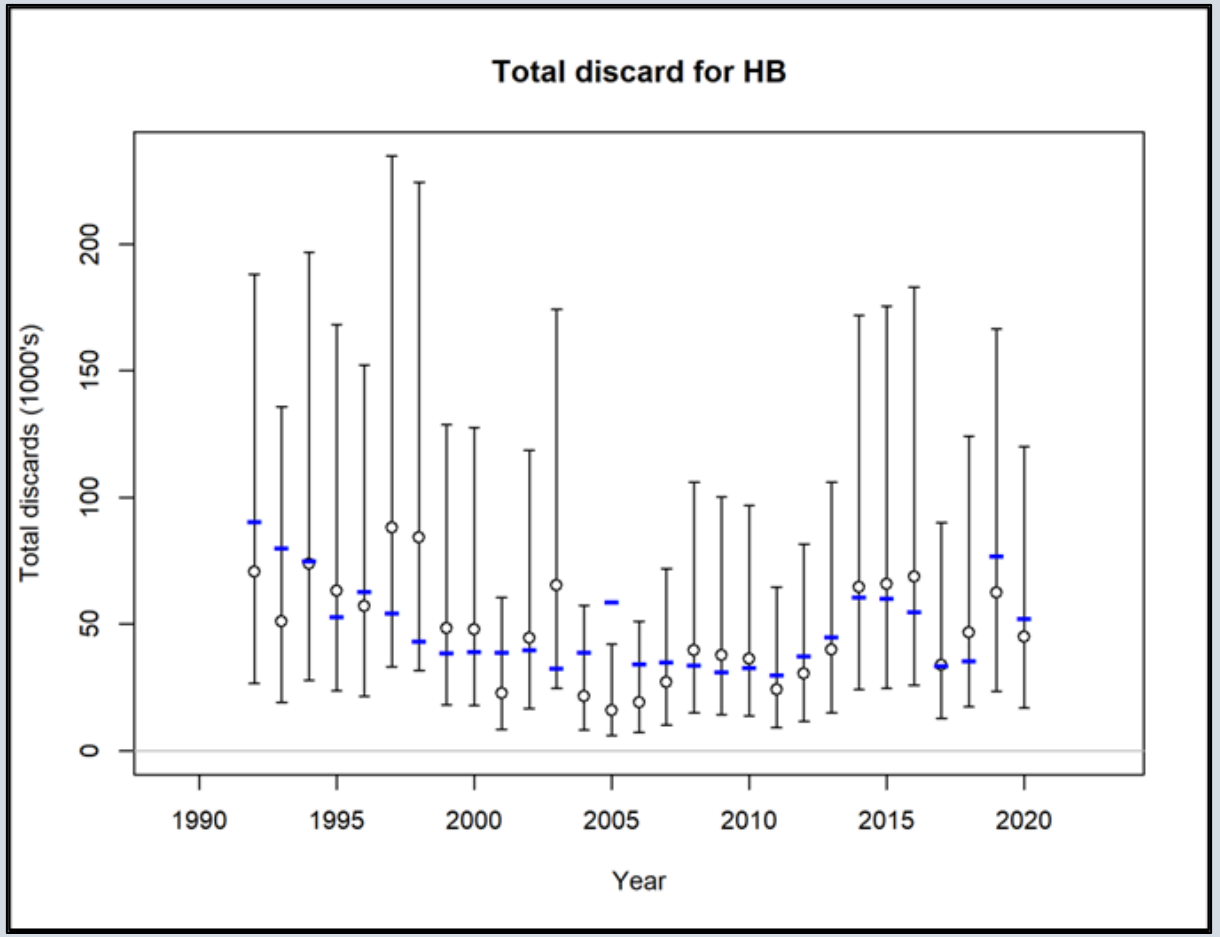
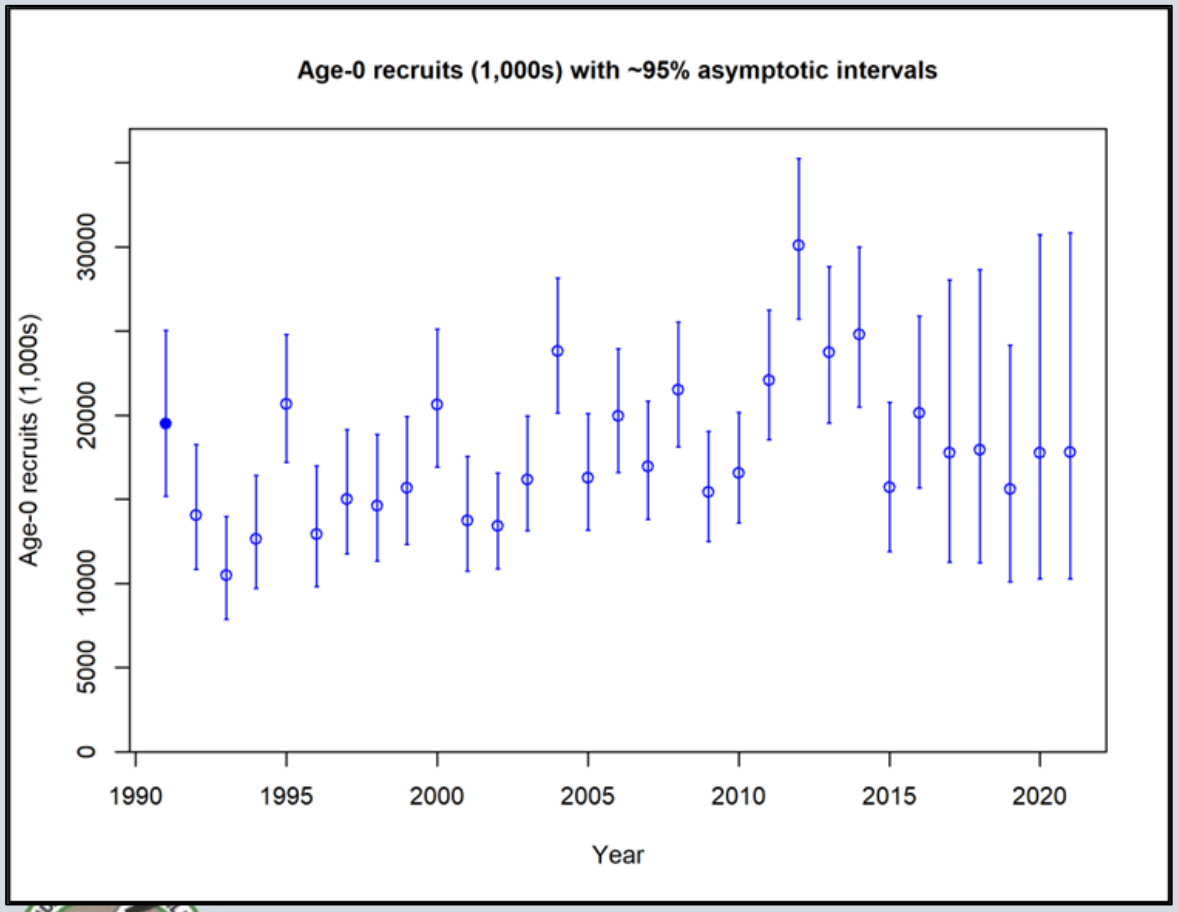


Figure 6

Estimated Recruitment



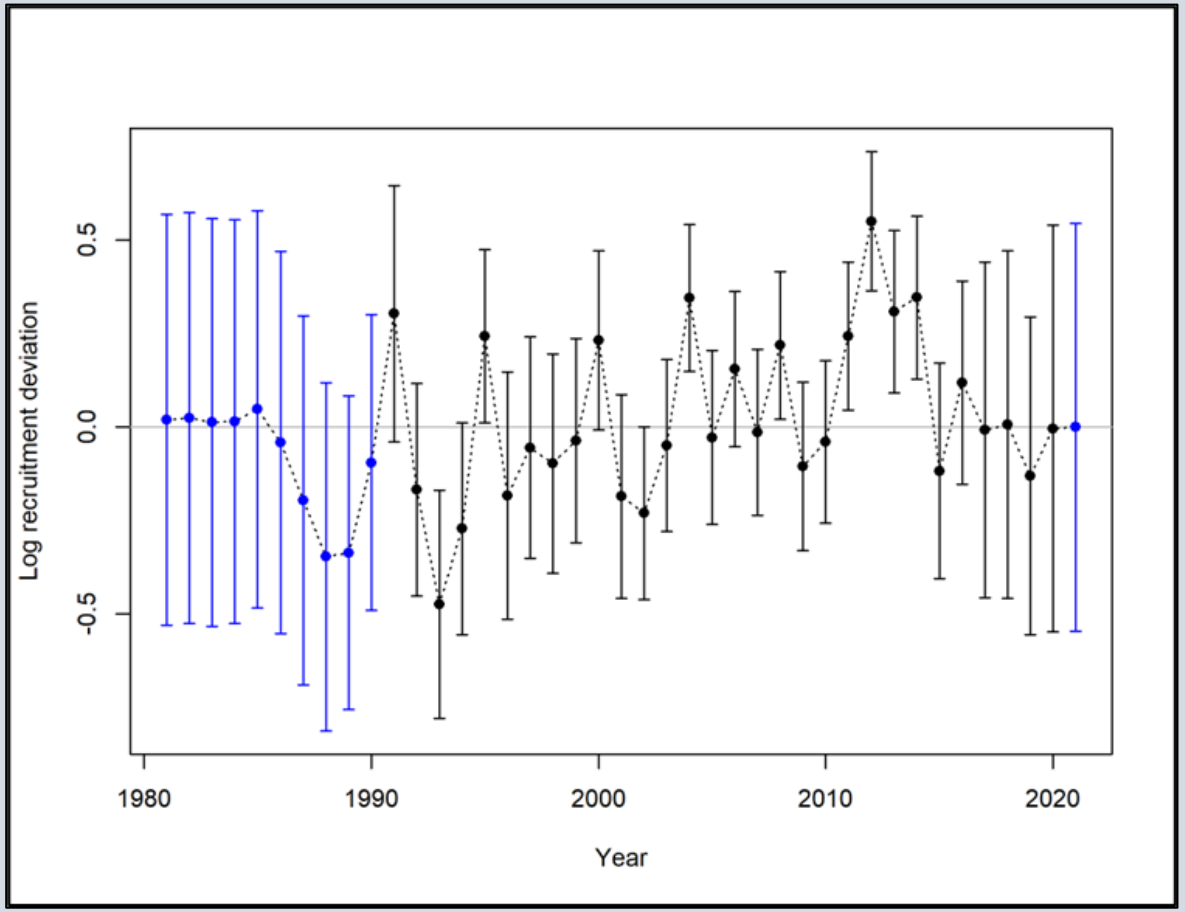


Figure 7

Total and Spawning Stock Biomass

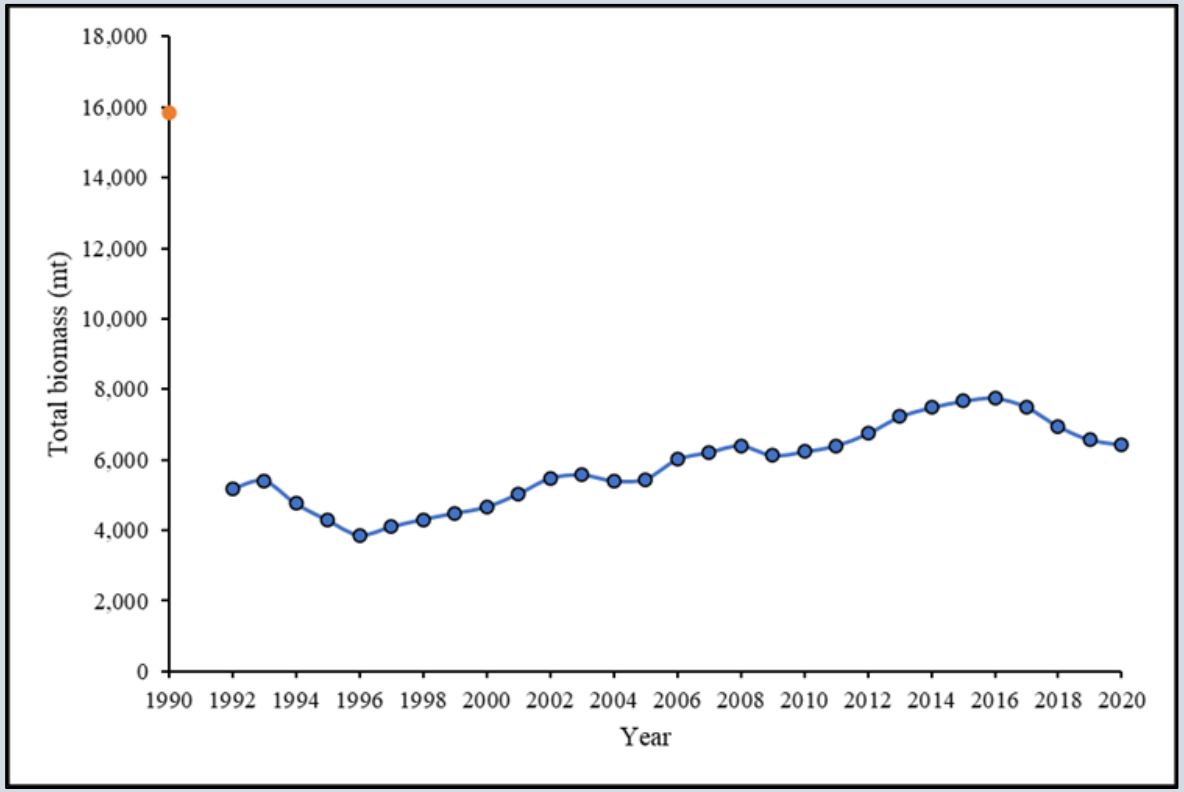


Figure 8

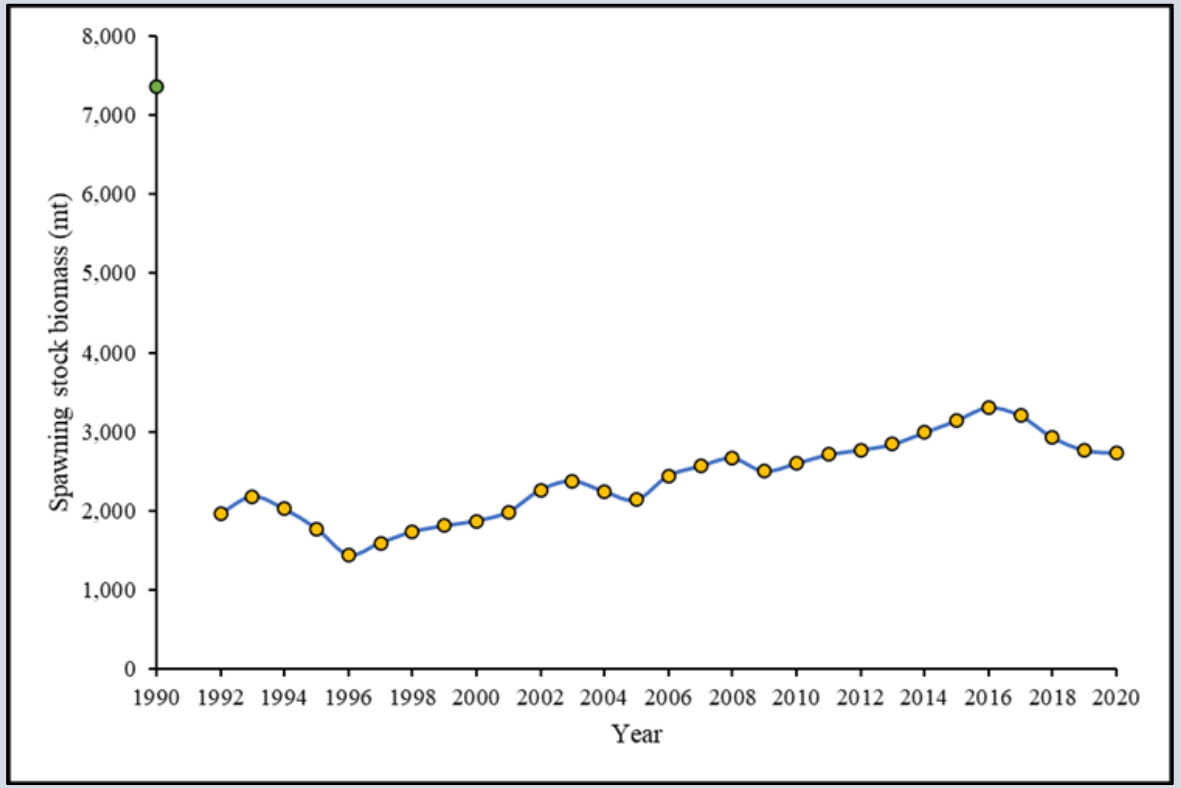
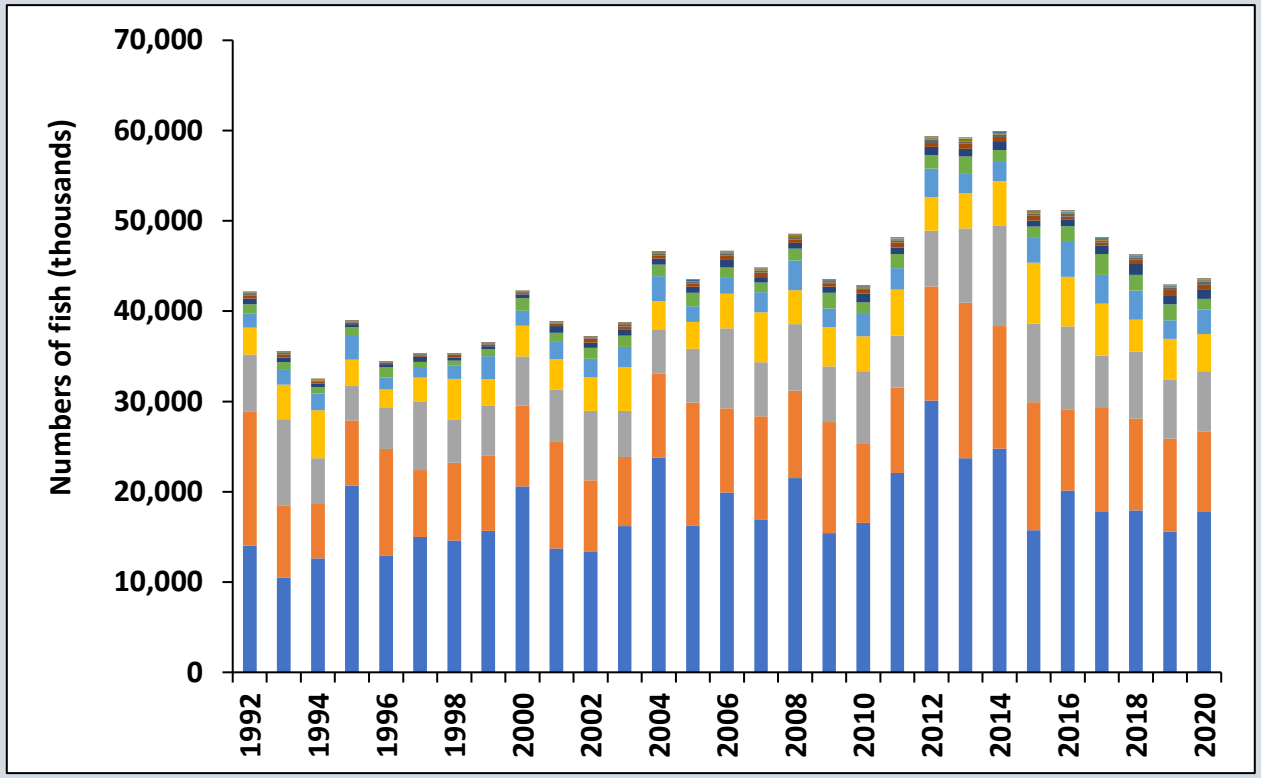
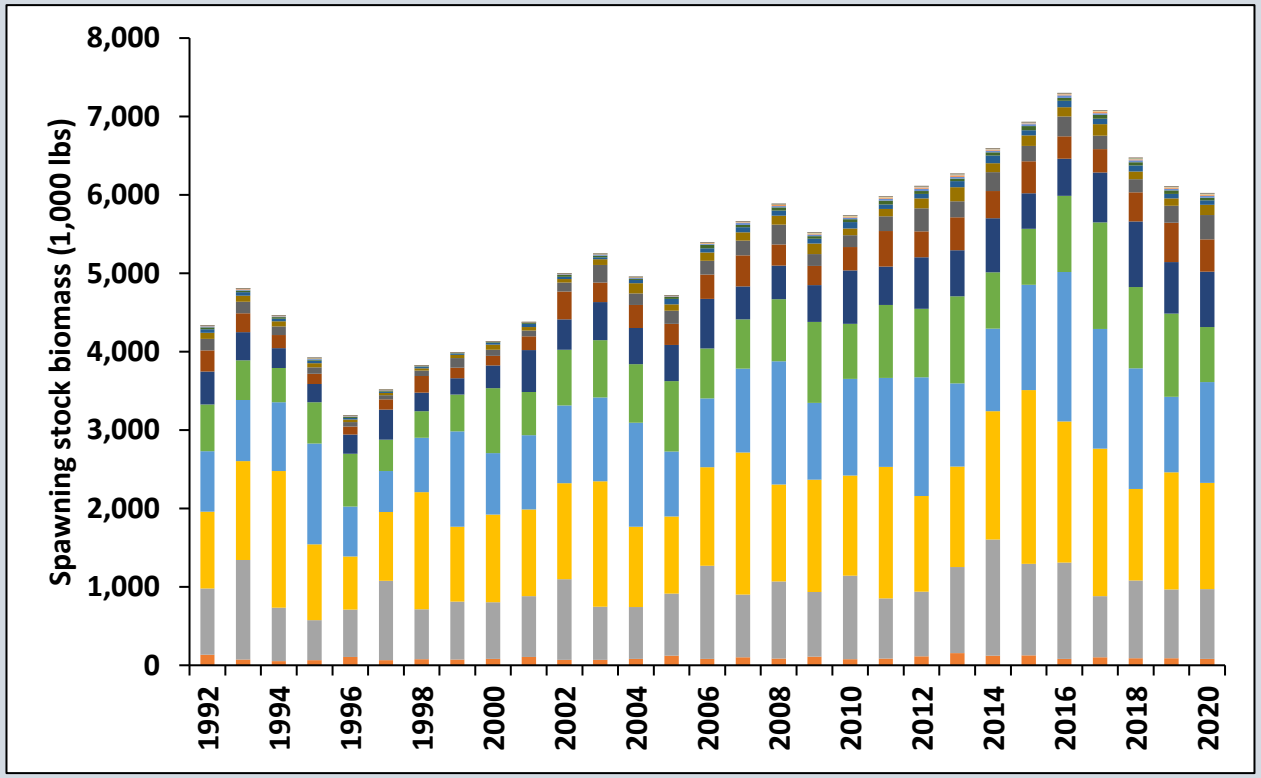
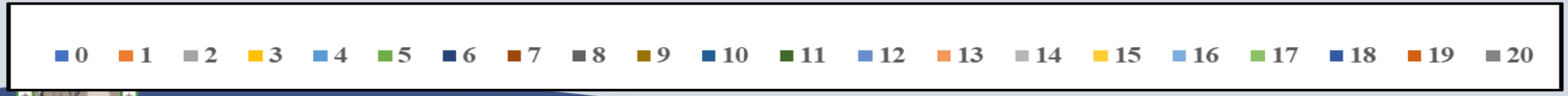


Figure 9

Numbers and spawning stock biomass at age







Fishing Mortality

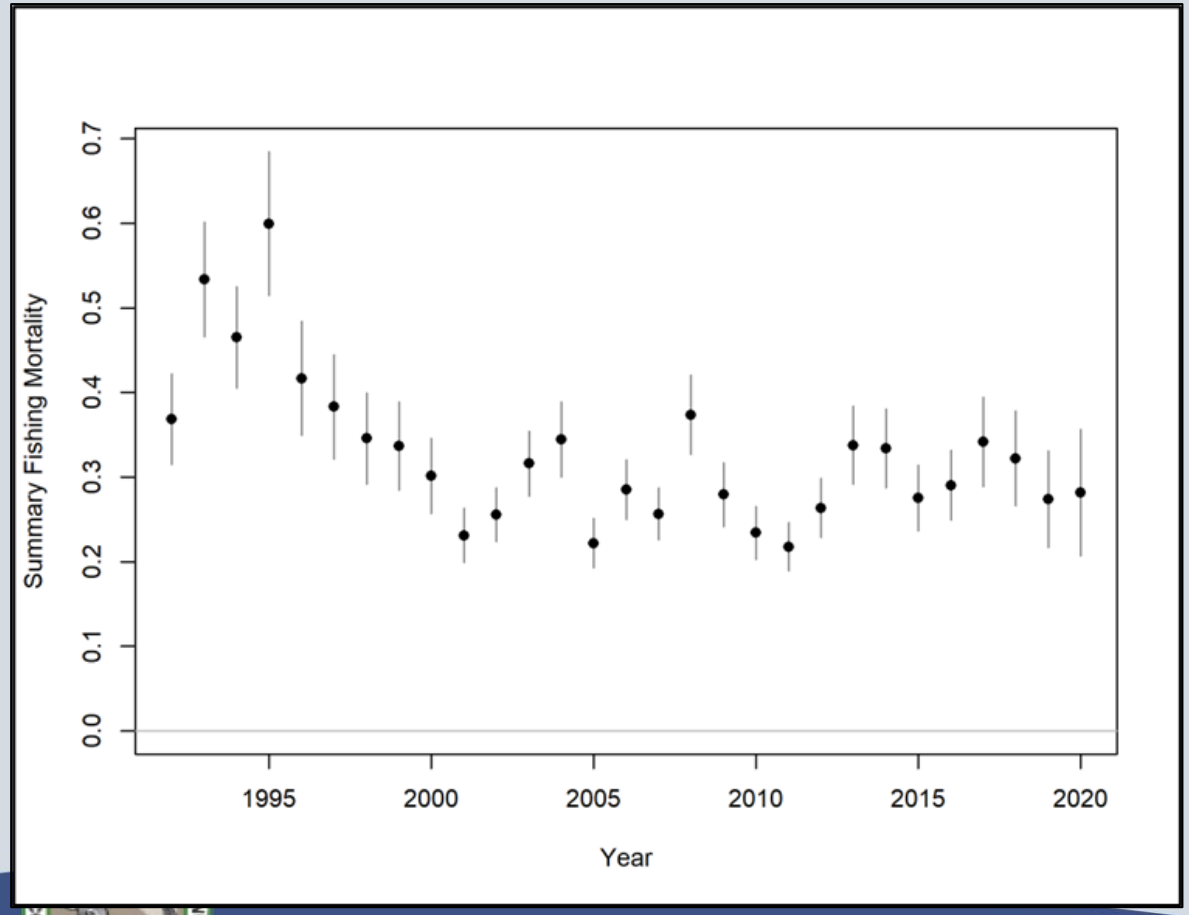


Figure 10

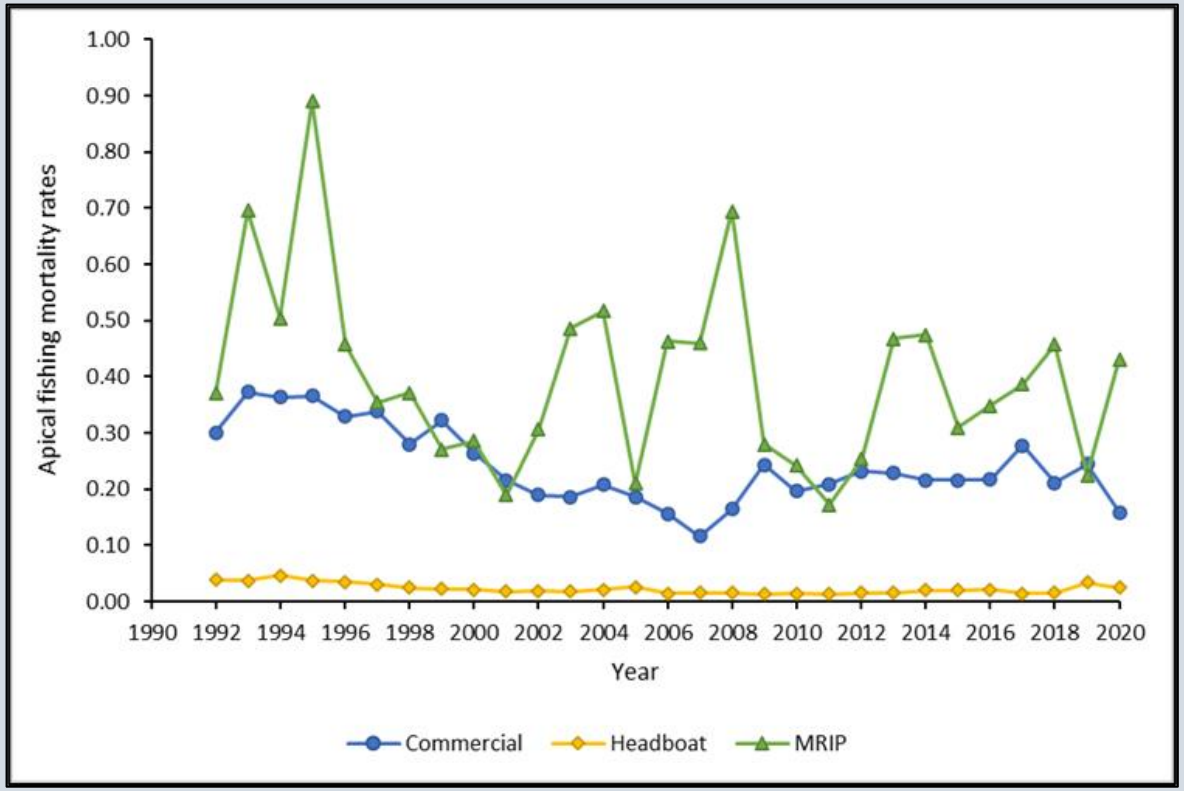
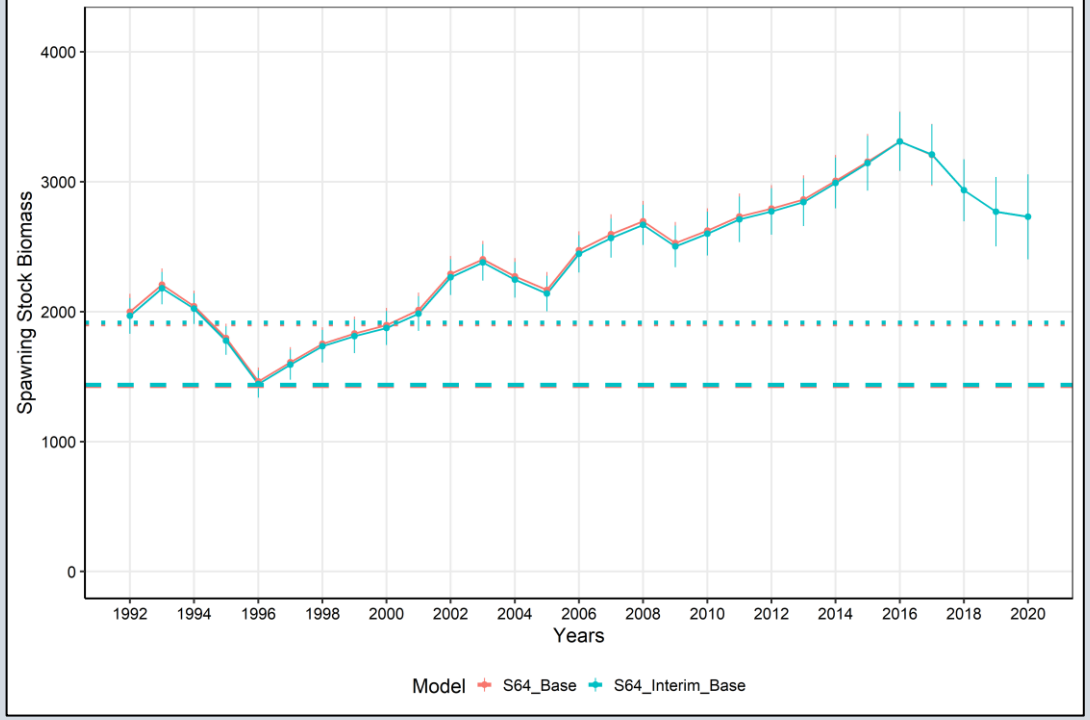
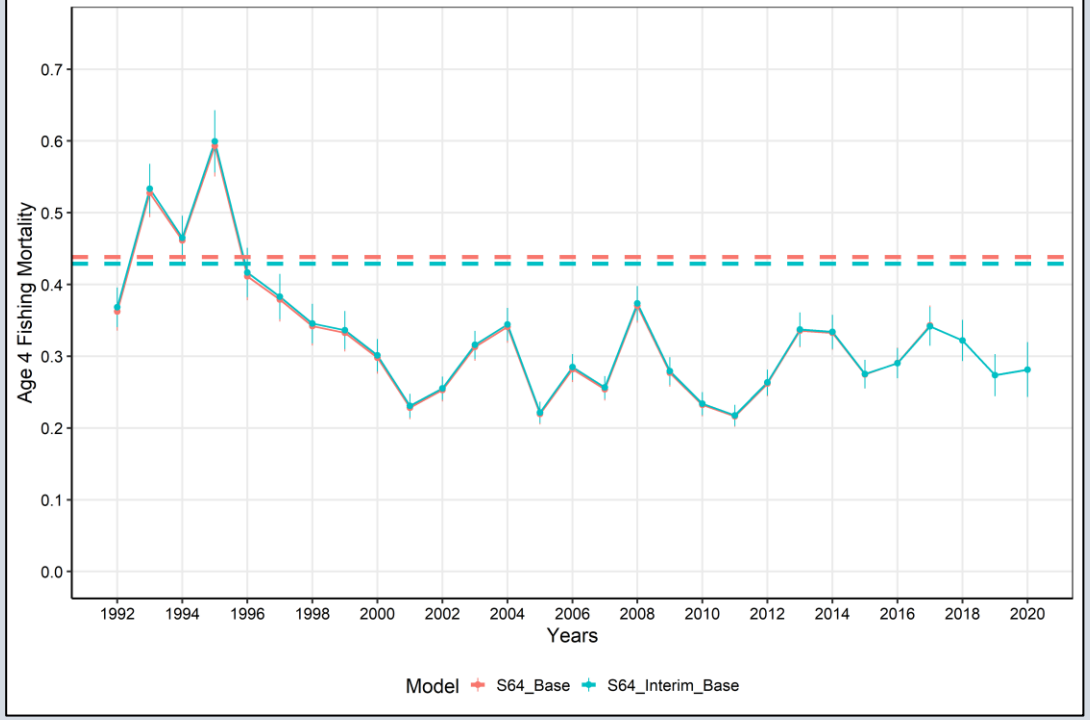
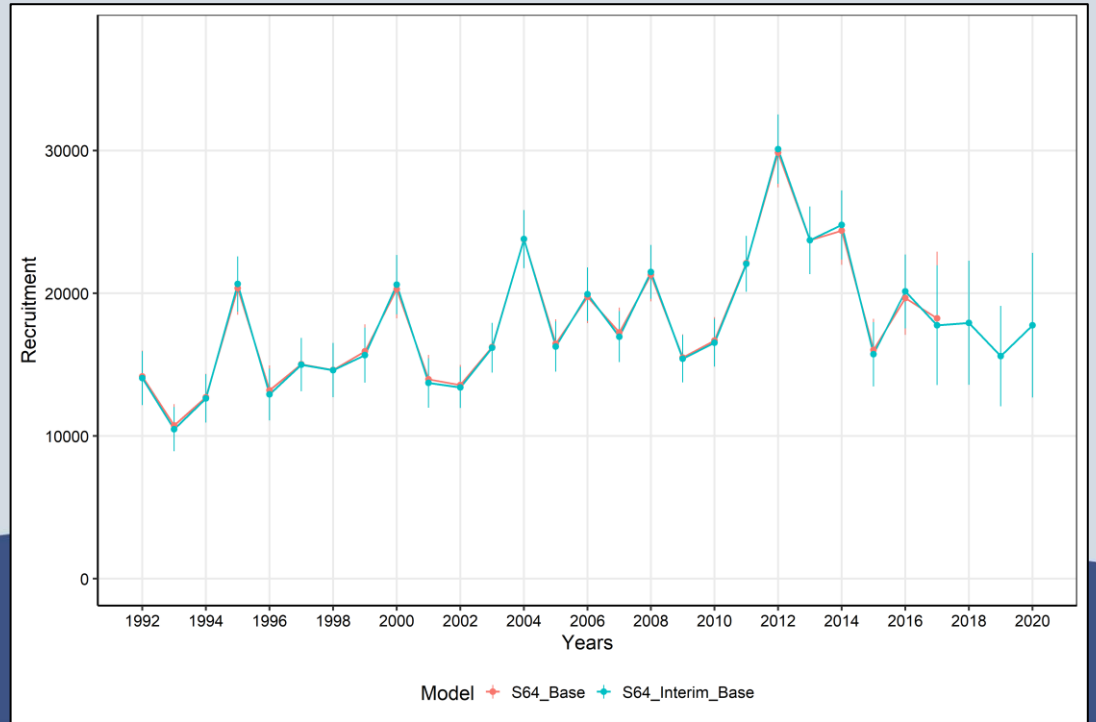


Figure 11


Spawning Stock Biomass
Years
Model S64_Base S64_Interim_Base


Age 4 Fishing Mortality
Years
Model S64_Base S64_Interim_Base


Recruitment
Years
Model S64_Base S64_Interim_Base

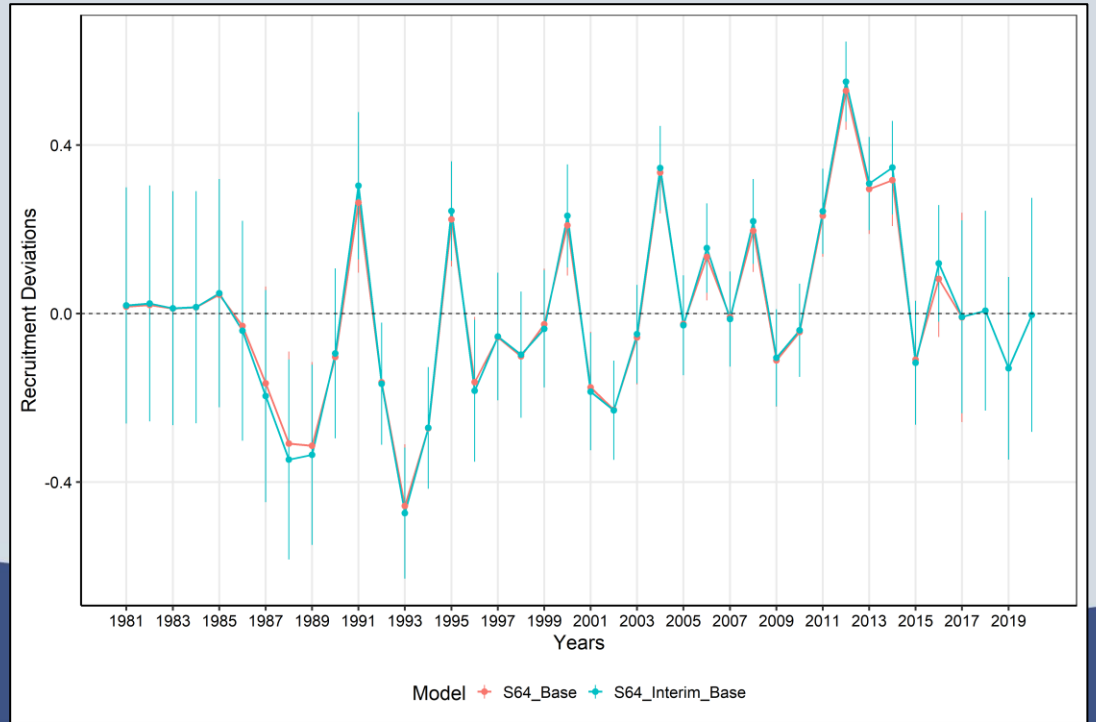

Recruitment Deviations
Years
Model S64_Base S64_Interim_Base

Figure 23 a-d.

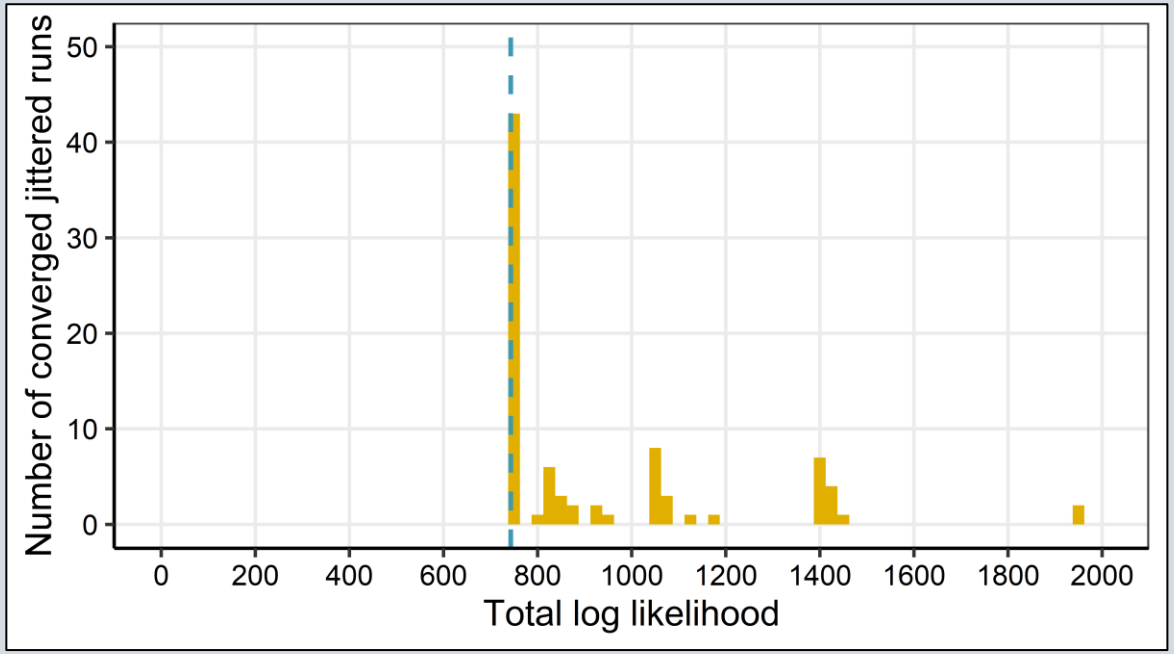
S64 Interim Analysis: Yellowtail Snapper

Model Diagnostics

Figure 12

Model Convergence

- No estimated parameters on the bounds
- Final gradient <0.0001
- Positive definite Hessian



Jitter Analysis

- 200 jittered runs
  - Initial values jittered by 20%
  - 112 runs (56%) had a high gradient and 58 runs (29%) did not have a positive definite Hessian matrix.
- No jittered runs contained a total likelihood lower than the IBM.
- Jittered runs filtered to include only those which both had a small final gradient and a positive definite Hessian matrix, indicating more plausible alternative model solutions.
- A total of 85 runs (42.5%) remained and whose results suggested that the IBM had converged on a global solution.

Goodness of Fit

Table 11

Runs Test

Index	P-value	Lower 3 SD	Upper 3 SD	Metric
Commercial CPUE	0.001	-0.395	0.395	Failed
RVC Adult	0.656	-0.909	0.909	Passed
RVC Juvenile	0.148	-0.535	0.535	Passed
MRIP CPUE	0.135	-0.328	0.328	Passed

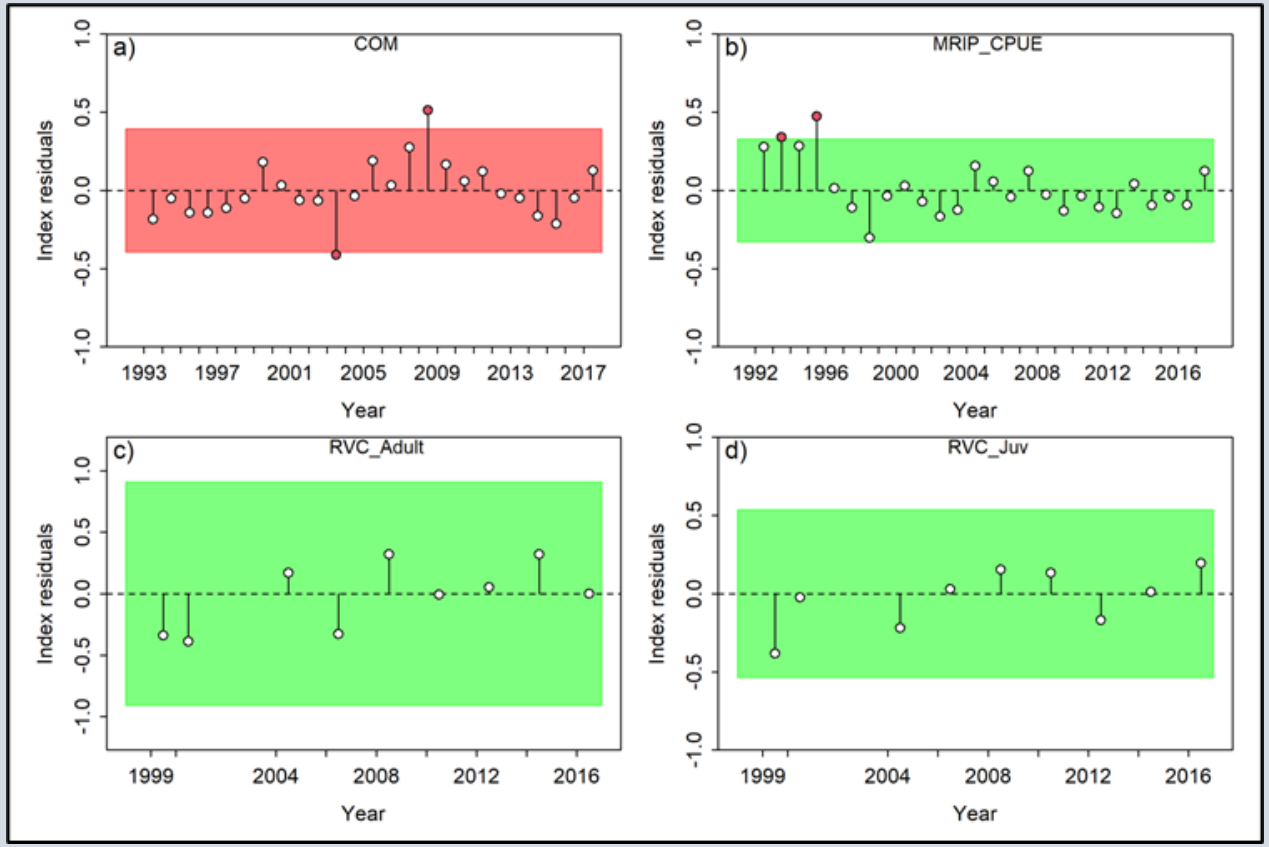


Figure 14

Goodness of Fit

Table 11

Runs Test

Index	P-value	Lower 3 SD	Upper 3 SD	Metric
Commercial CPUE	0.001	-0.395	0.395	Failed
RVC Adult	0.656	-0.909	0.909	Passed
RVC Juvenile	0.148	-0.535	0.535	Passed
MRIP CPUE	0.135	-0.328	0.328	Passed

Mean length	P-value	Lower 3 SD	Upper 3 SD	Metric
Commercial	0.244	-0.038	0.038	Passed
Headboat	0.012	-0.037	0.037	Failed
MRIP	0.290	-0.114	0.114	Passed
RVC Adult	0.500	-0.152	0.152	Passed
RVC Juvenile	0.110	-0.143	0.143	Passed
MRIP CPUE	0.699	-0.073	0.073	Passed

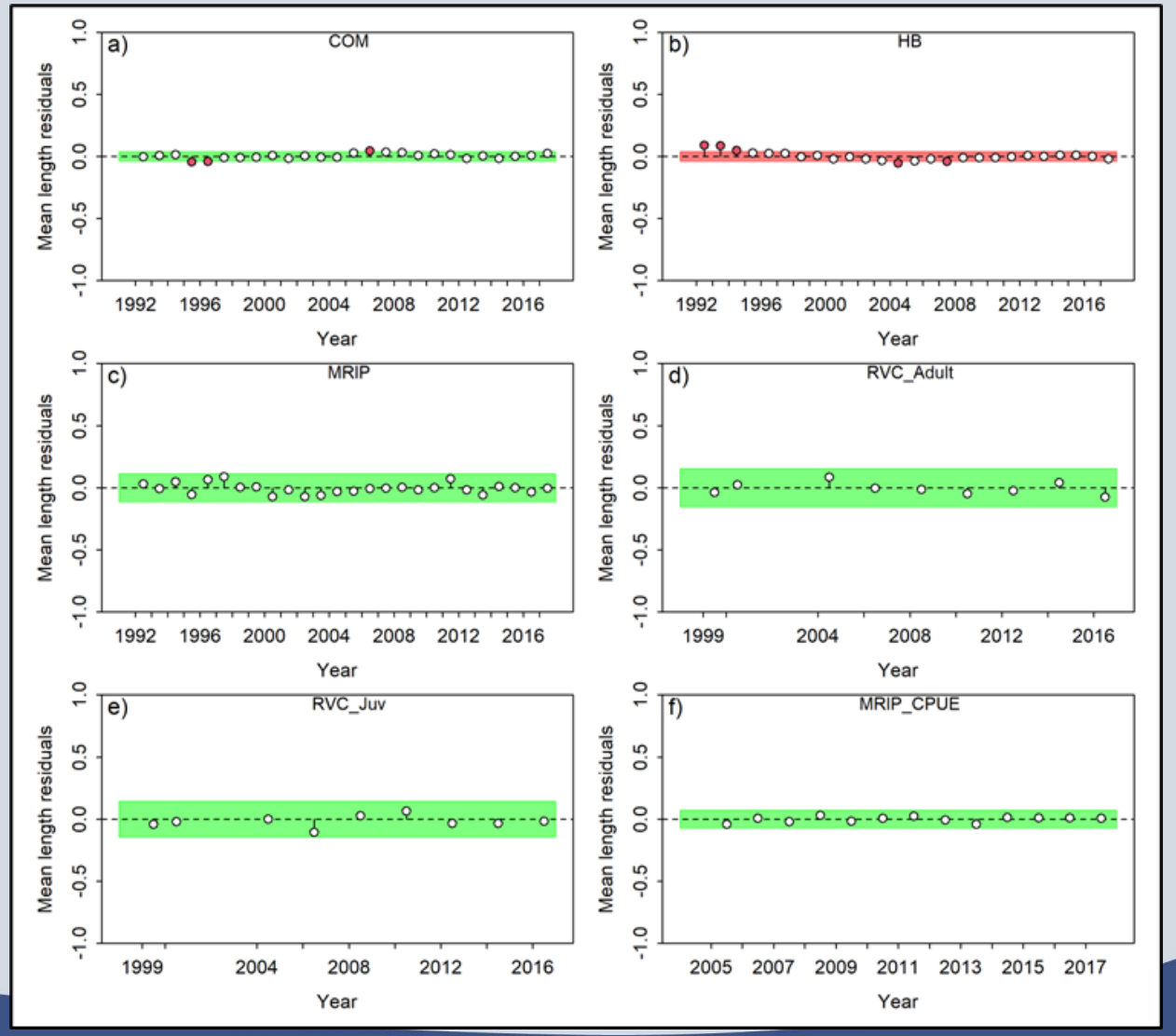


Figure 15

Goodness of Fit

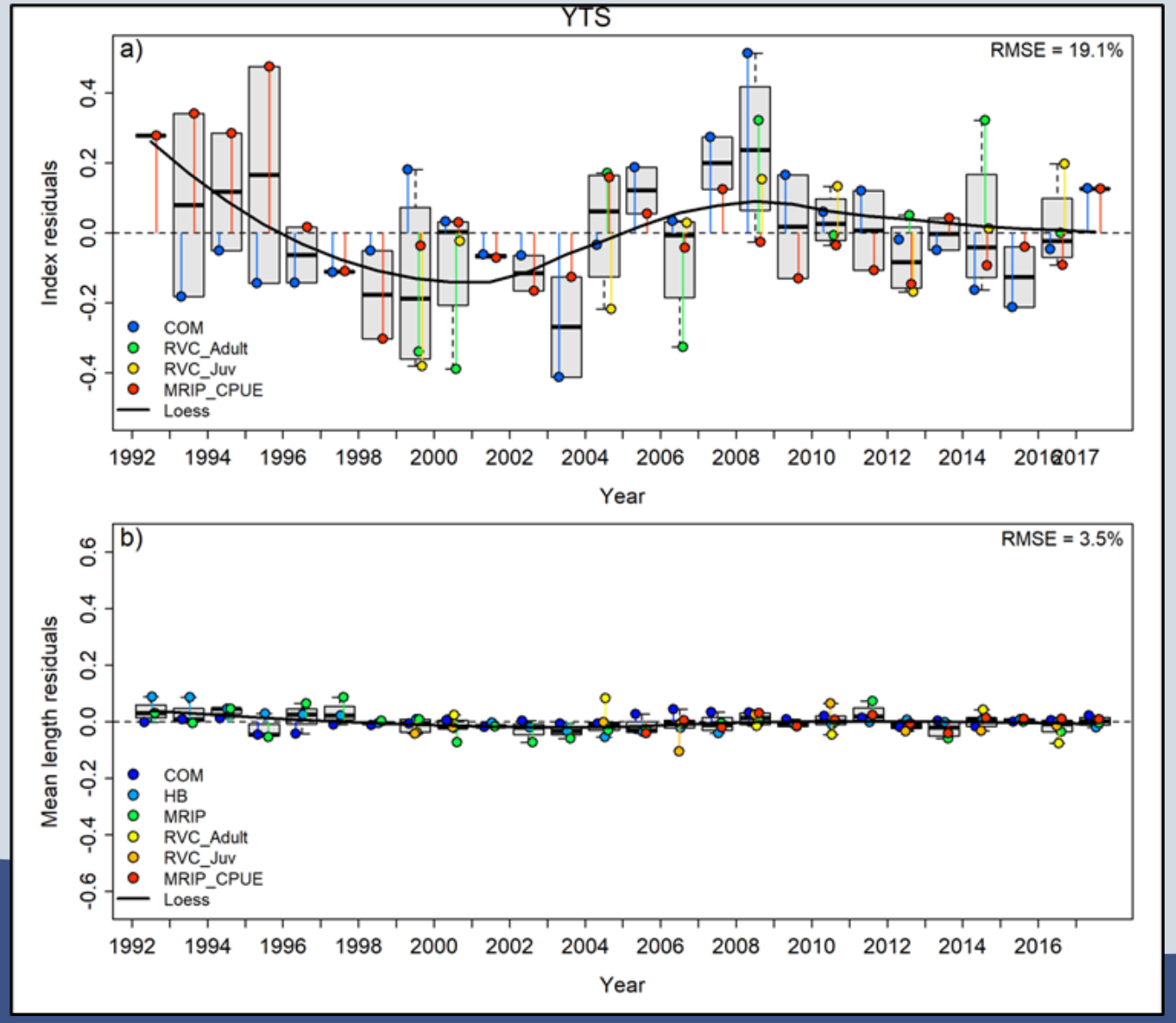


Figure 13

Model Consistency

Profiling of R0

- Identify how sources of information influence various model estimates
- R0 ≈ global scaling parameter
- R0 largely influenced by the recruitment deviations component

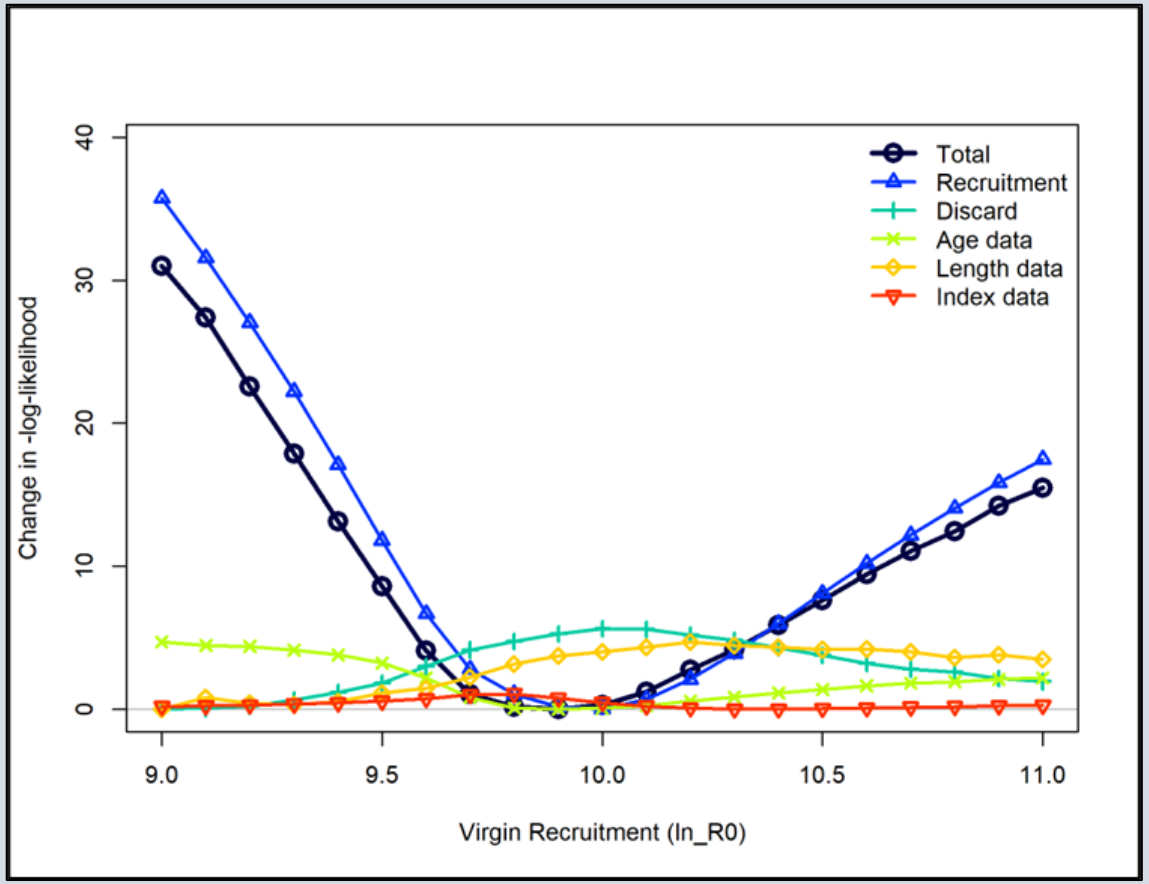


Figure 16

Model Consistency

Retrospective Analysis

- Five-year peel
- Helps evaluate the effect of the final year on model results
- Patterns can indicate model misspecification or temporal dynamics
- Evaluated visually and quantitatively
  - Mohn's Rho
  - Hurtado –Ferro et al (2015) "Rule of thumb"
    - - 0.15 – 0.20 for longer-lived species

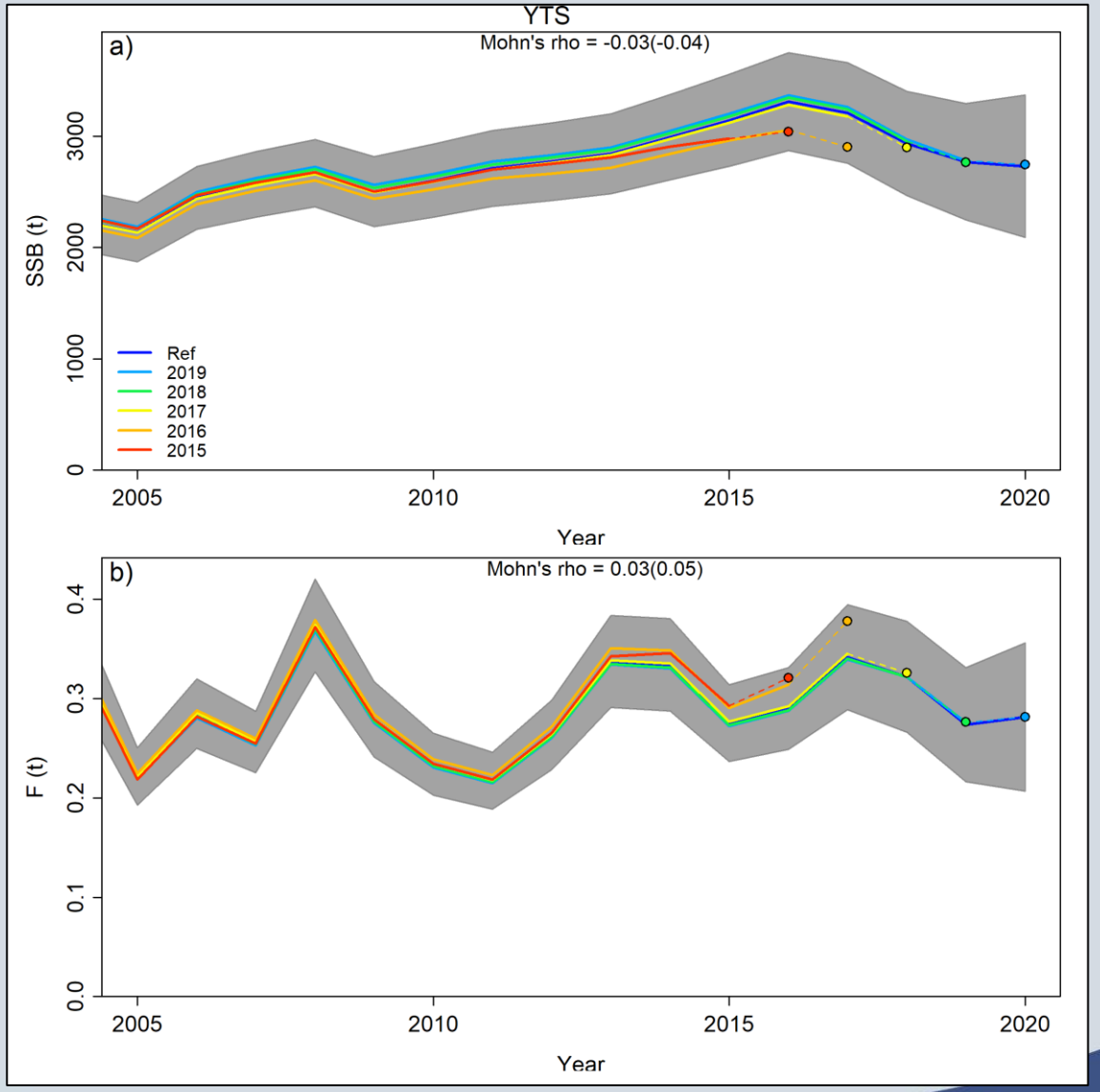


Figure 20

Predictive Skill

Retrospective Forecasting

- Based on retrospective analysis
- Model-based hindcasts to five-year peels
- Evaluated visually and quantitatively
  - Forecast bias corresponding to Mohn's Rho
  - Hurtado –Ferro et al (2015) "Rule of thumb"
    - - 0.15 – 0.20 for longer-lived species

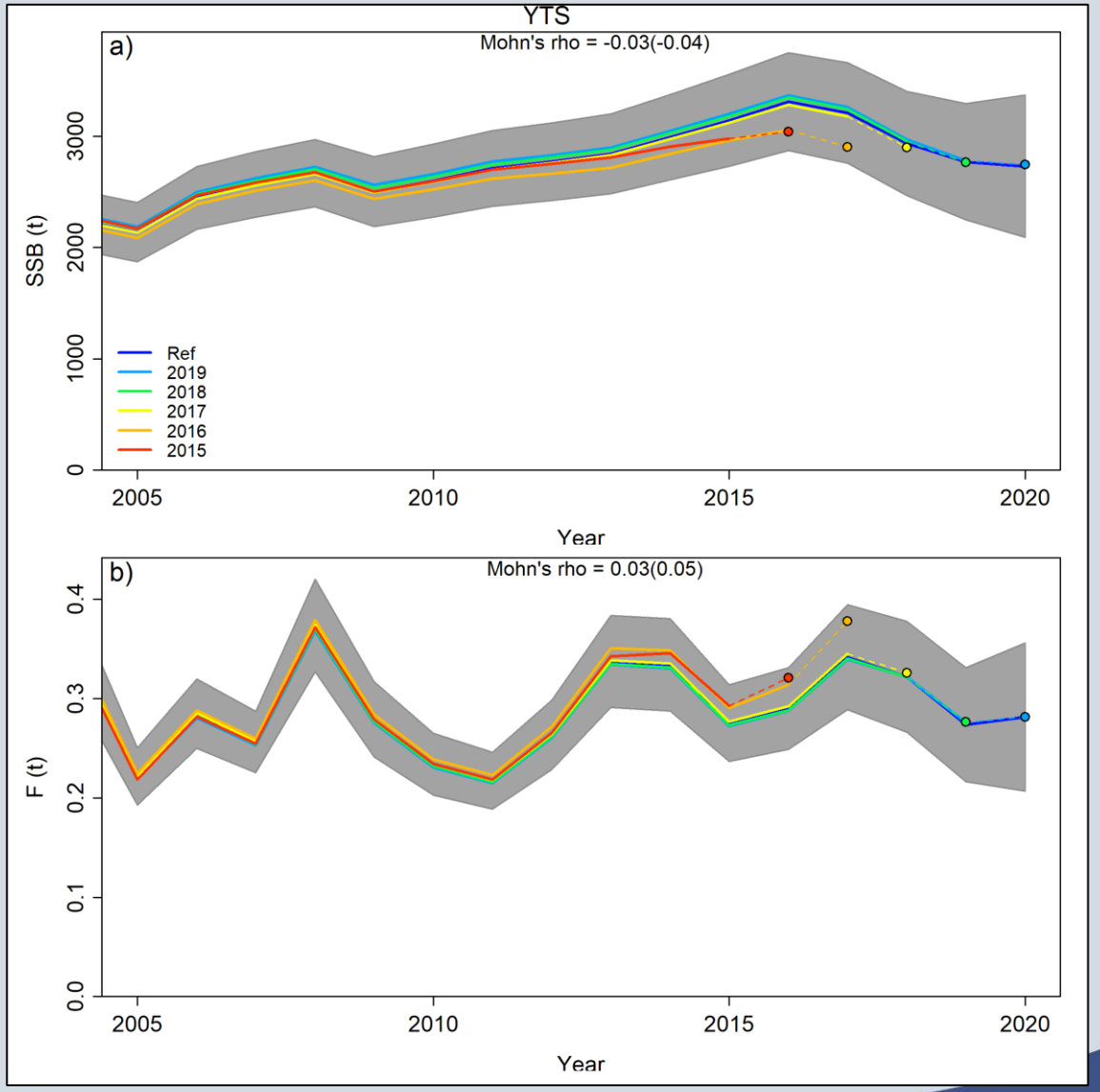


Figure 20

Prediction Skill

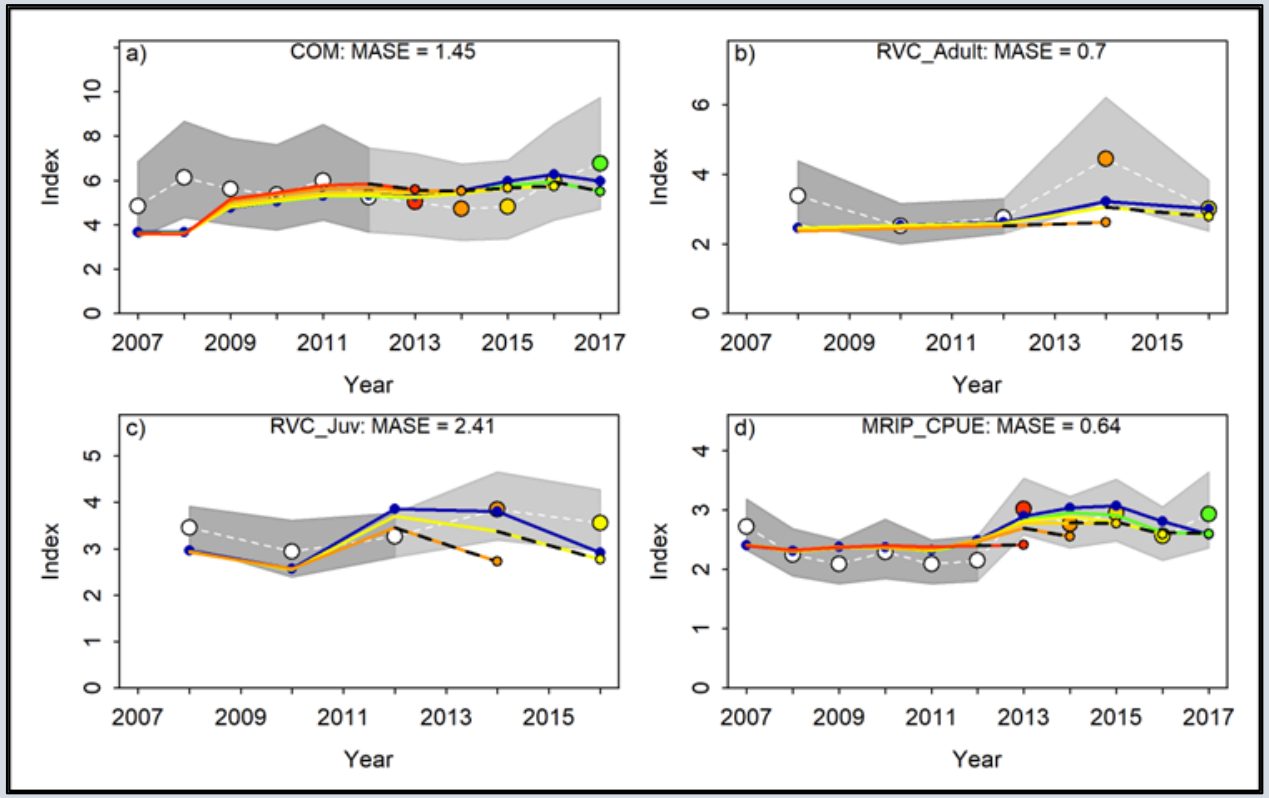


Figure 21

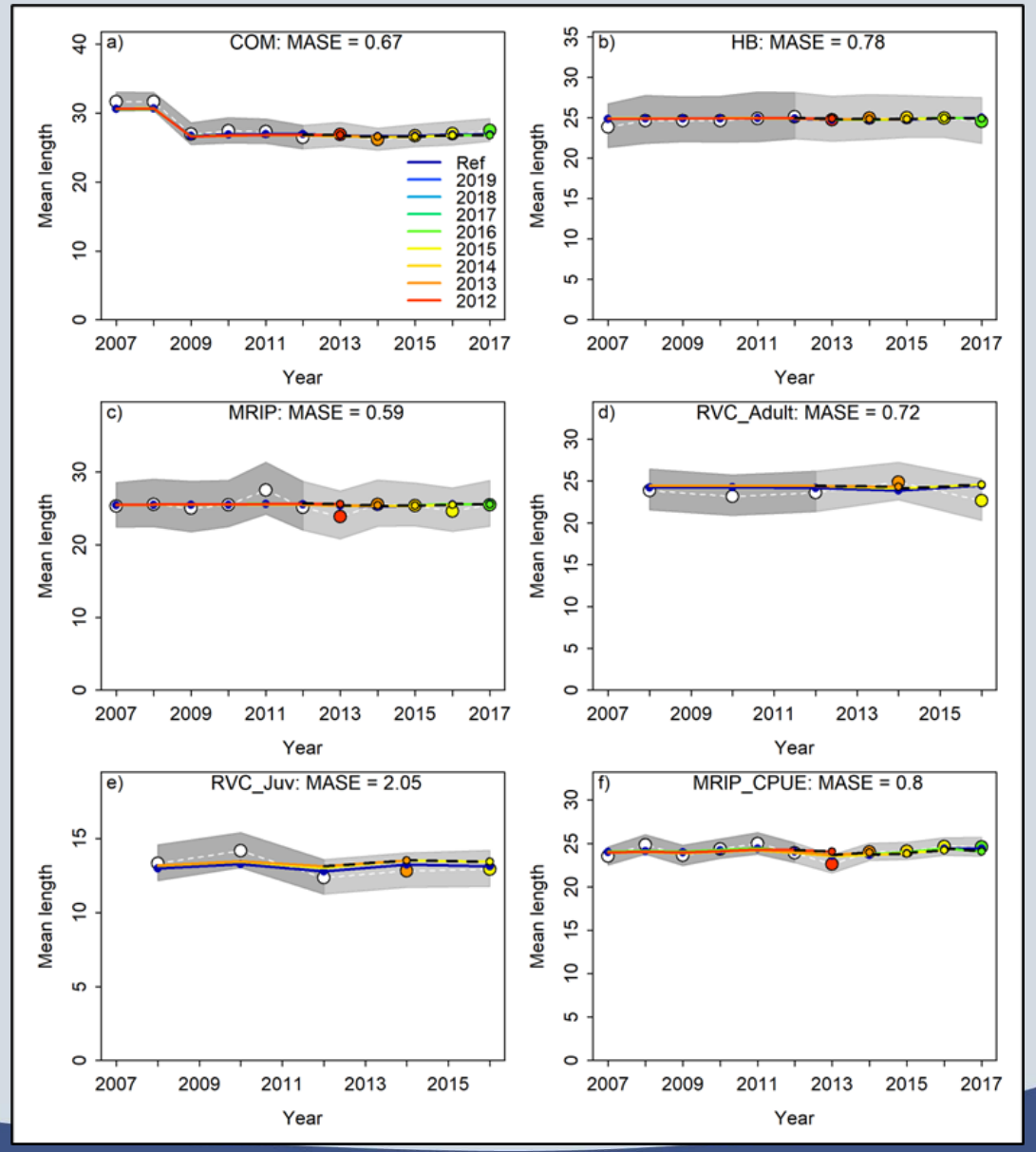


Figure 22

S64 Interim Analysis: Yellowtail Snapper

Sensitivity Runs

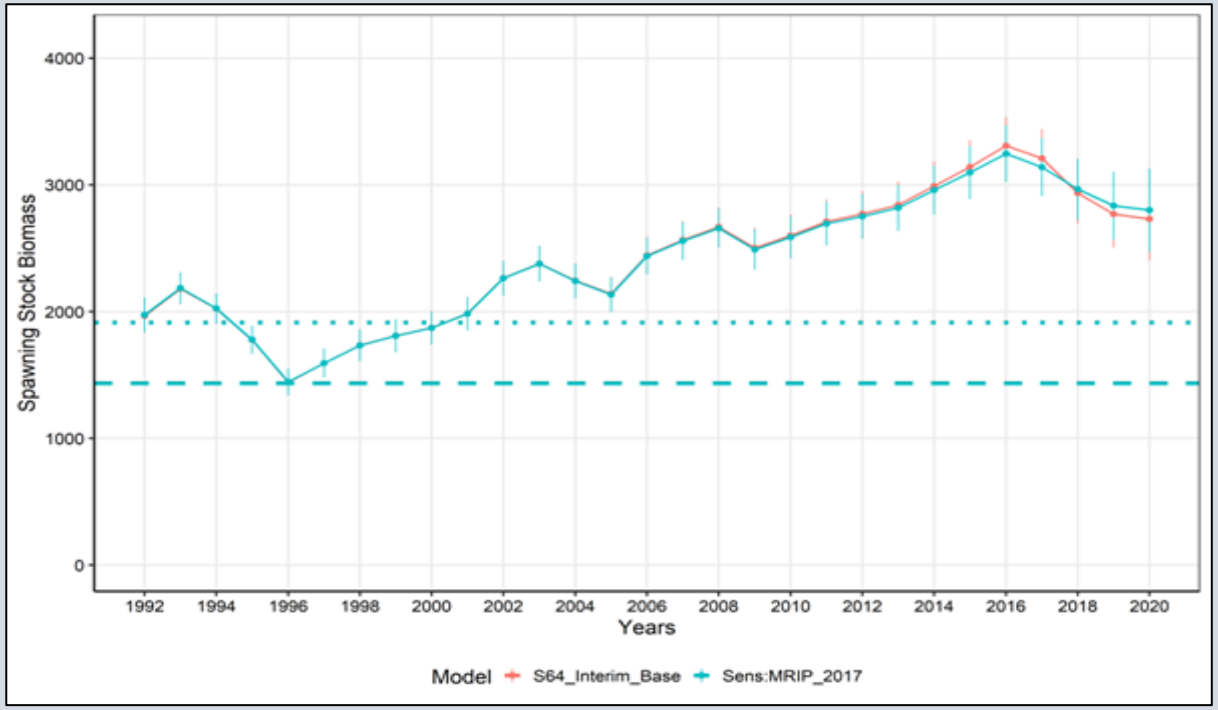
https://www.saltwatersportsman.com/howto/fishing-for-snappers-in-the-bahamas/

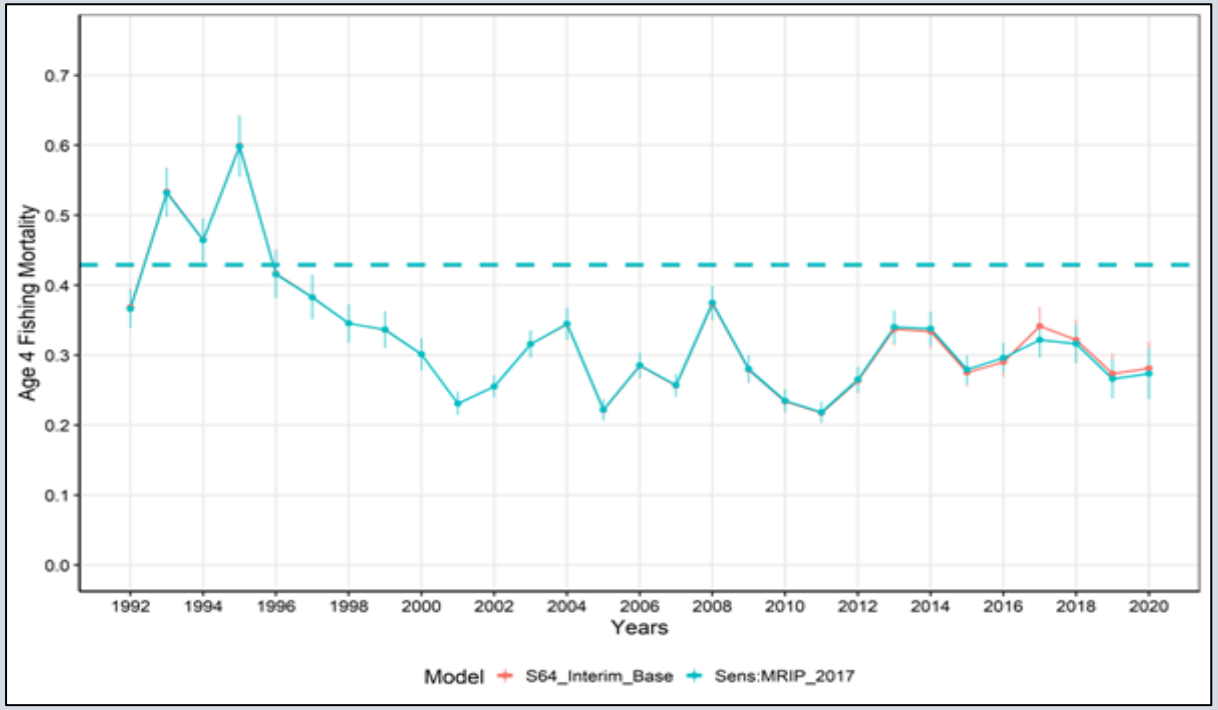
2017 Southwest FL Region MRIP Data

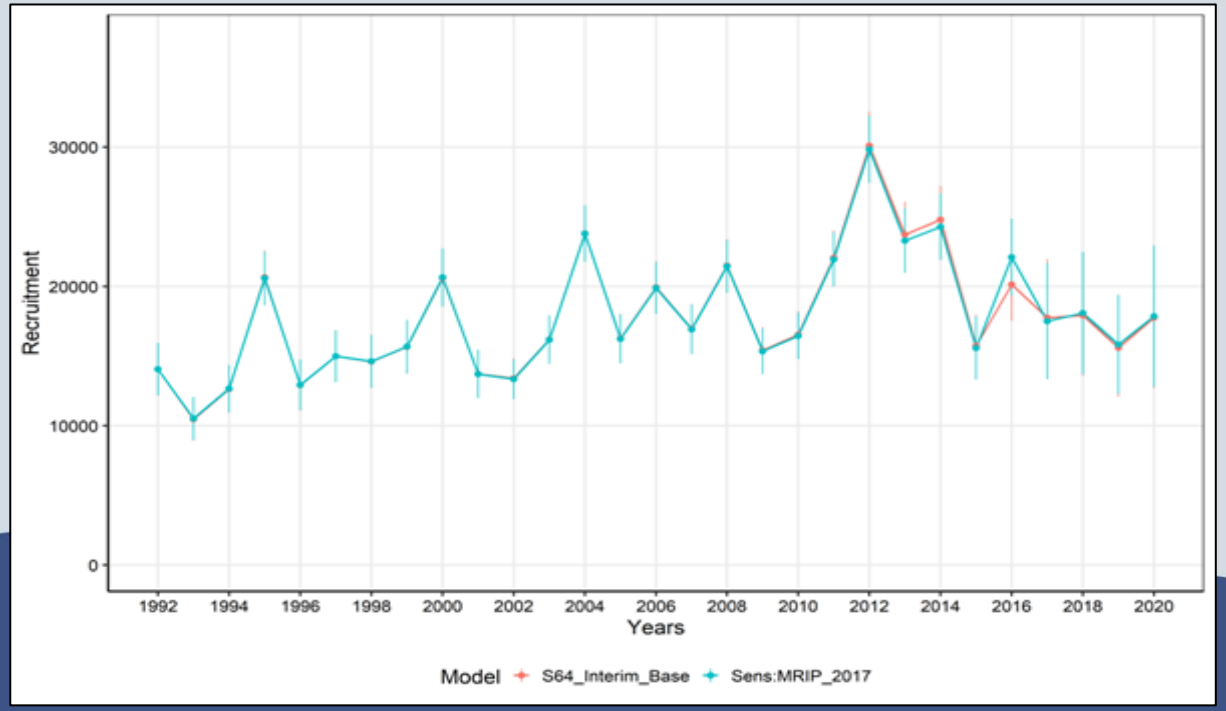
Evaluate the impact of the elevated MRIP landings and discard data in 2017 for the SW region of Florida (TOR #1 sub-point)

2017	SW FL	Total
Landings	304,551	1,550,296
Discards	114,382	2,274,882

2017	SW FL	Total
Landings	44,750	1,290,495
Discards	33,064	2,191,679


Spawning Stock Biomass
4000
3000
2000
1000
0
1992 1994 1996 1998 2000 2002 2004 2006 2008 2010 2012 2014 2016 2018 2020
Years
Model S64_Interim_Base Sens:MRIP_2017


Age 4 Fishing Mortality
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
1992 1994 1996 1998 2000 2002 2004 2006 2008 2010 2012 2014 2016 2018 2020
Years
Model S64_Interim_Base Sens:MRIP_2017


Recruitment
30000
20000
10000
0
1992 1994 1996 1998 2000 2002 2004 2006 2008 2010 2012 2014 2016 2018 2020
Years
Model S64_Interim_Base Sens:MRIP_2017

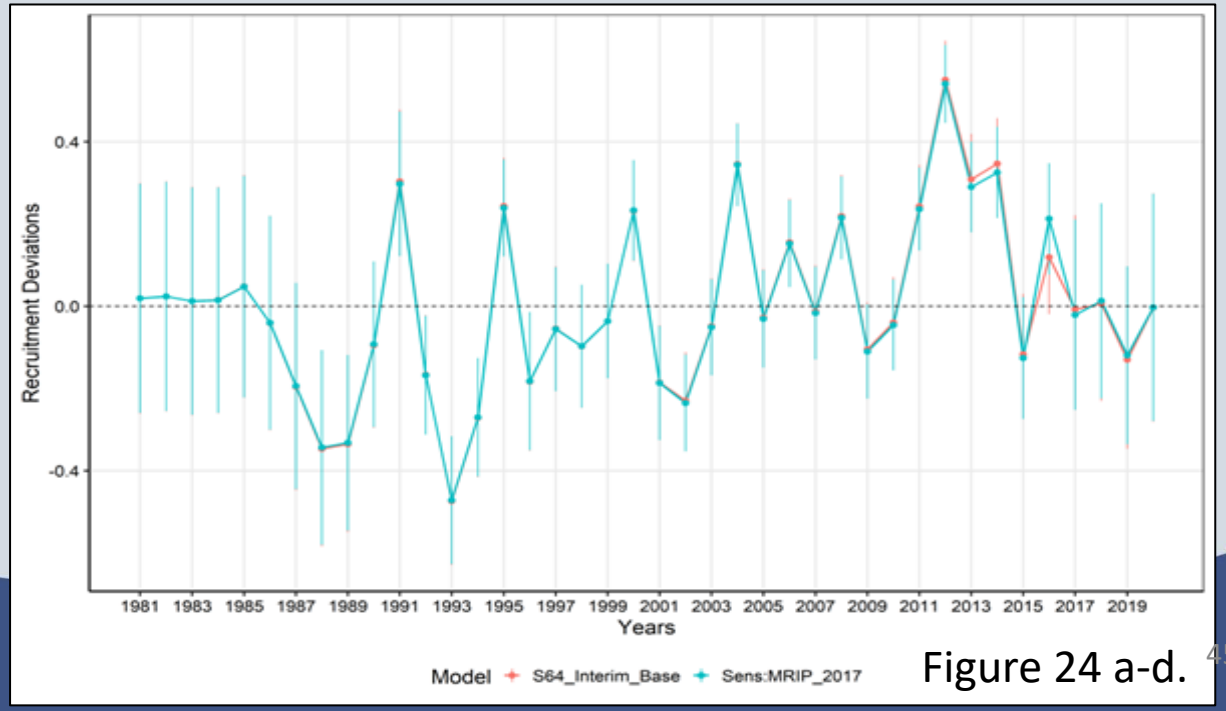

Recruitment Deviations
0.4
0.0
-0.4
1981 1983 1985 1987 1989 1991 1993 1995 1997 1999 2001 2003 2005 2007 2009 2011 2013 2015 2017 2019
Years
Model S64_Interim_Base Sens:MRIP_2017

Figure 24 a-d.

2017 SW FL Region MRIP Data

- Impacts to the model were negligible
- The observed variability in the data is reflective of catch estimates in a large region of mostly unfavorable YTS habitat.
- Approved for use during S64 DW
- The 2017 MRIP data were not altered in the IBM.

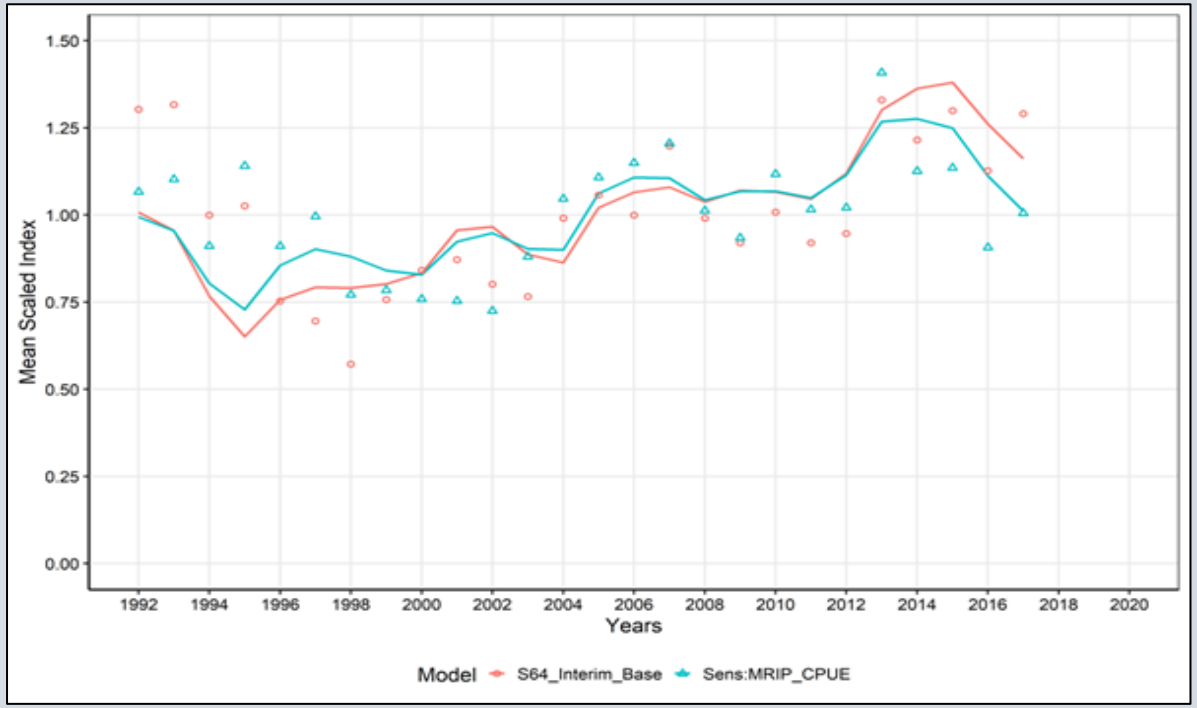
https://www.istockphoto.com/photos/yellowtail-snapper

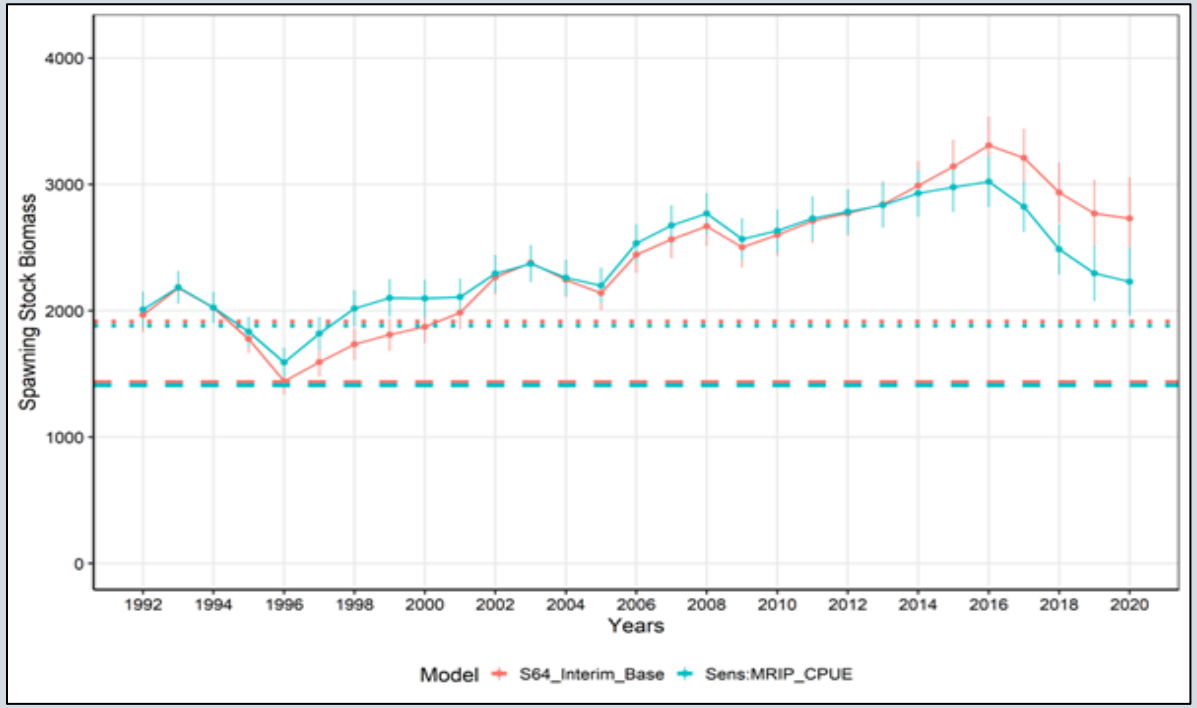
MRIP CPUE Index of Abundance

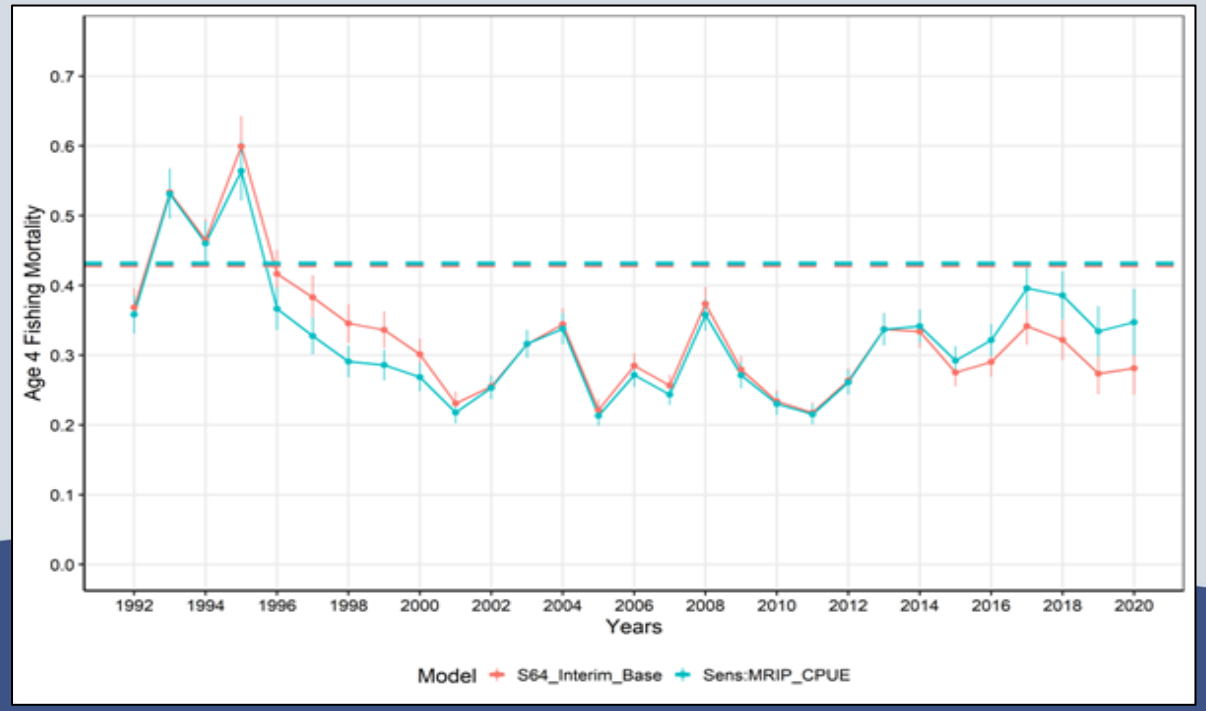
Catch Per Angler → Catch Per Trip

- Catch per angler was consistent with SEDAR 27A (2012) but the intent was to use ‘catch per trip’ (see SEDAR64-DW-09)
- A sensitivity run with the MRIP CPUE index configured as total catch per trip was performed to evaluate any potential changes in model results and to help inform discussions during future assessments.

https://www.istockphoto.com/photos/yellowtail-snapper


Mean Scaled Index
1.50
1.25
1.00
0.75
0.50
0.25
0.00
1992 1994 1996 1998 2000 2002 2004 2006 2008 2010 2012 2014 2016 2018 2020
Years
Model S64_Interim_Base Sens:MRIP_CPUE


Spawning Stock Biomass
4000
3000
2000
1000
0
1992 1994 1996 1998 2000 2002 2004 2006 2008 2010 2012 2014 2016 2018 2020
Years
Model S64_Interim_Base Sens:MRIP_CPUE


Age 4 Fishing Mortality
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
1992 1994 1996 1998 2000 2002 2004 2006 2008 2010 2012 2014 2016 2018 2020
Years
Model S64_Interim_Base Sens:MRIP_CPUE

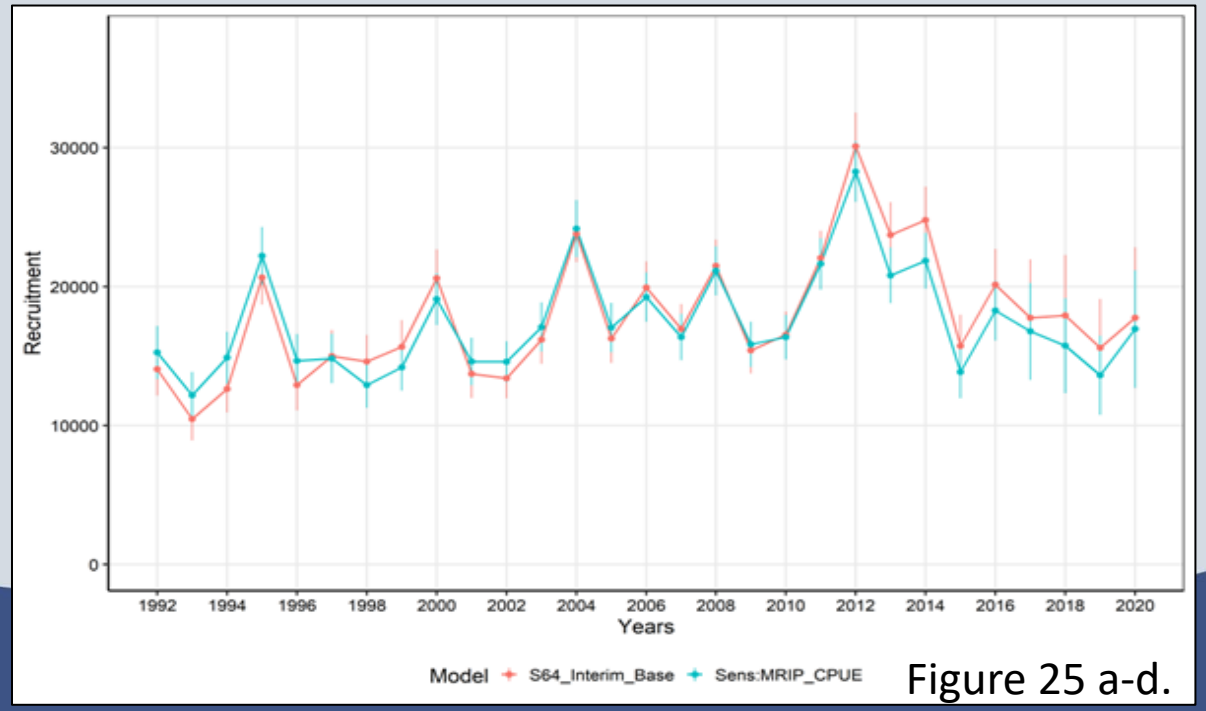

Recruitment
30000
20000
10000
0
1992 1994 1996 1998 2000 2002 2004 2006 2008 2010 2012 2014 2016 2018 2020
Years
Model S64_Interim_Base Sens:MRIP_CPUE

Figure 25 a-d.

https://safmc.net/species/snapper-yellowtail/

MRIP CPUE Index of Abundance

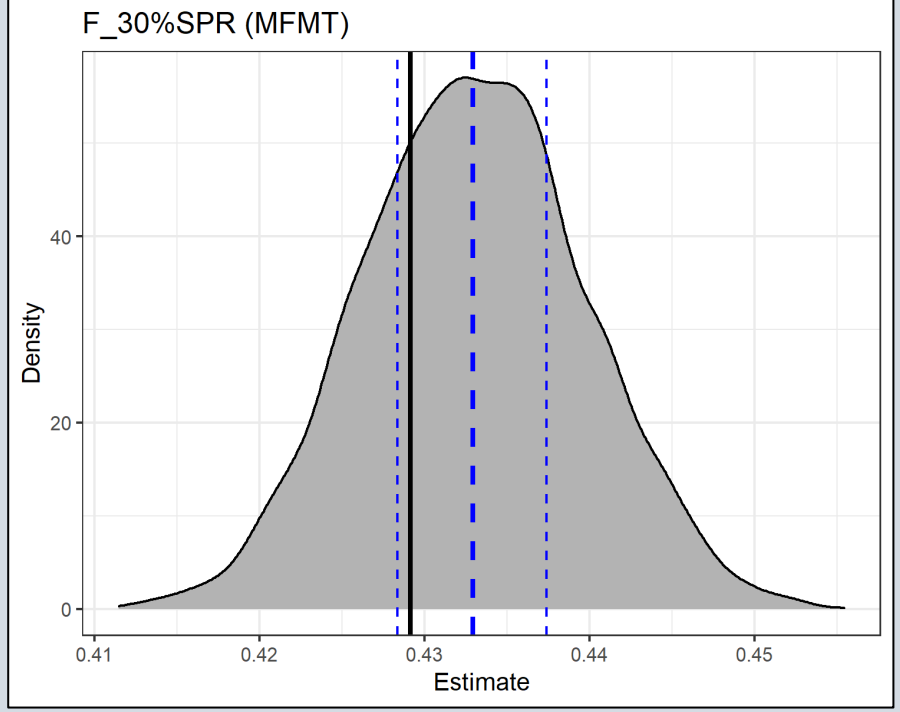
- Reference points remained unchanged, and results were mostly within uncertainty bounds.
- Resulted in a reduction in estimated scale from 2014 – 2020 and indicated that the stock may be approaching the target SSB and the MFMT

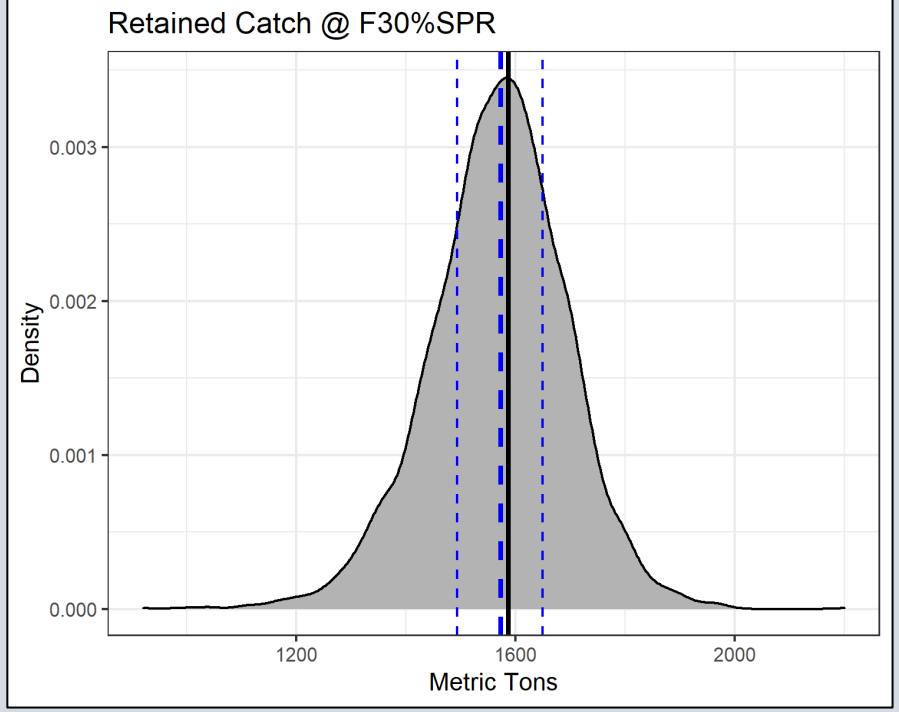
S64 Interim Analysis: Yellowtail Snapper

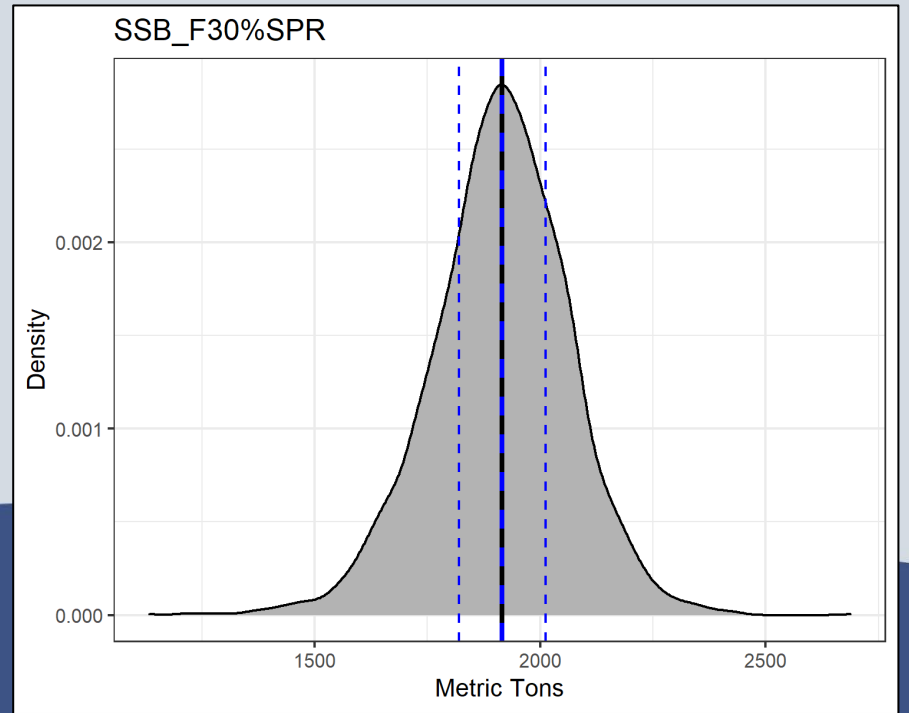
Uncertainty

Markov Chain Monte-Carlo

- Generate posterior distributions of model parameters and derived quantities
  - R0, SSB0, *steepness*, SSB_{2020}, F_{2020}, $F_{30\%SPR}$, $SSB_{F30\%SPR}$, Yield at $F_{30\%SPR}$
- Two chains
  - 5,000 iterations saved from the 10,000,000 performed
  - Burn-in set at 1,000
  - 2,000 iterations remained for each chain
- Convergence
  - Gelman and Rubin's (1992) potential scale reduction factor (PSRF)
  - Visual inspection of trace plots


F_30%SPR (MFMT)
Density
Estimate
0
20
40
0.41
0.42
0.43
0.44
0.45


Retained Catch @ F30%SPR
Density
Metric Tons
0.000
0.001
0.002
0.003
1200
1600
2000


SSB_F30%SPR
Density
Metric Tons
0.000
0.001
0.002
1500
2000
2500

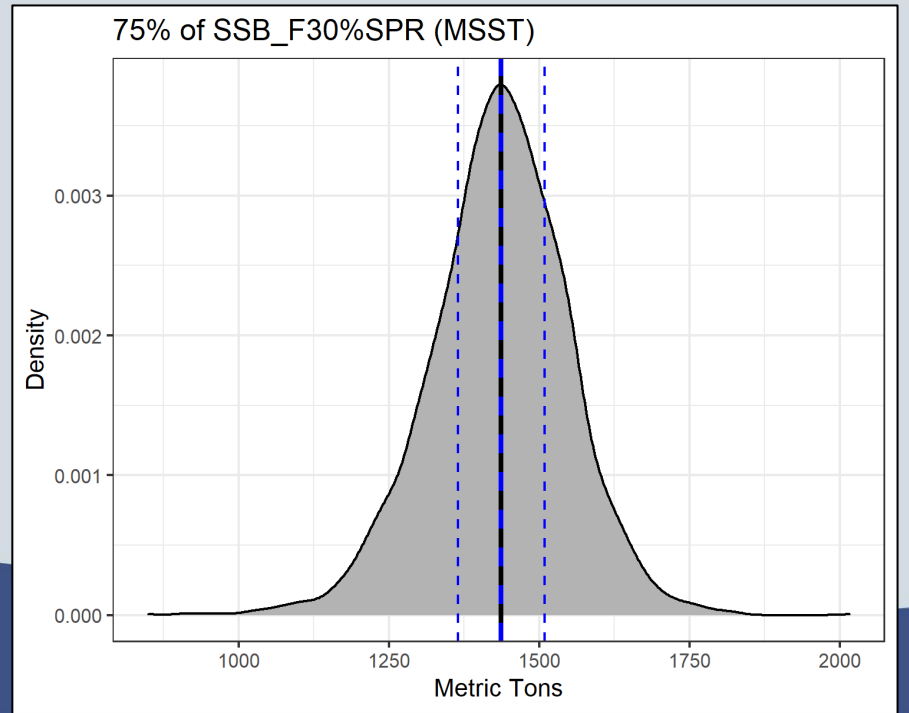
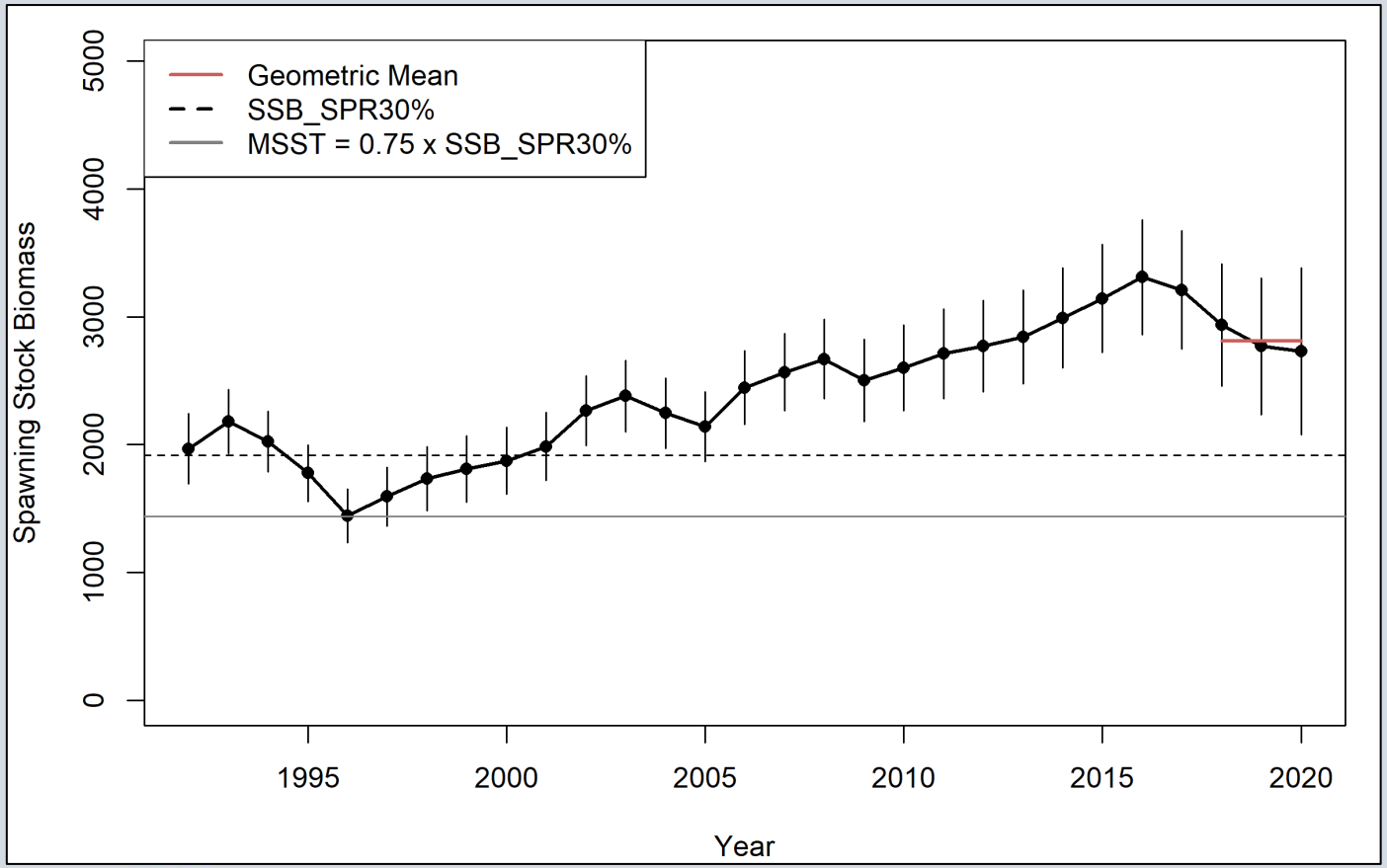
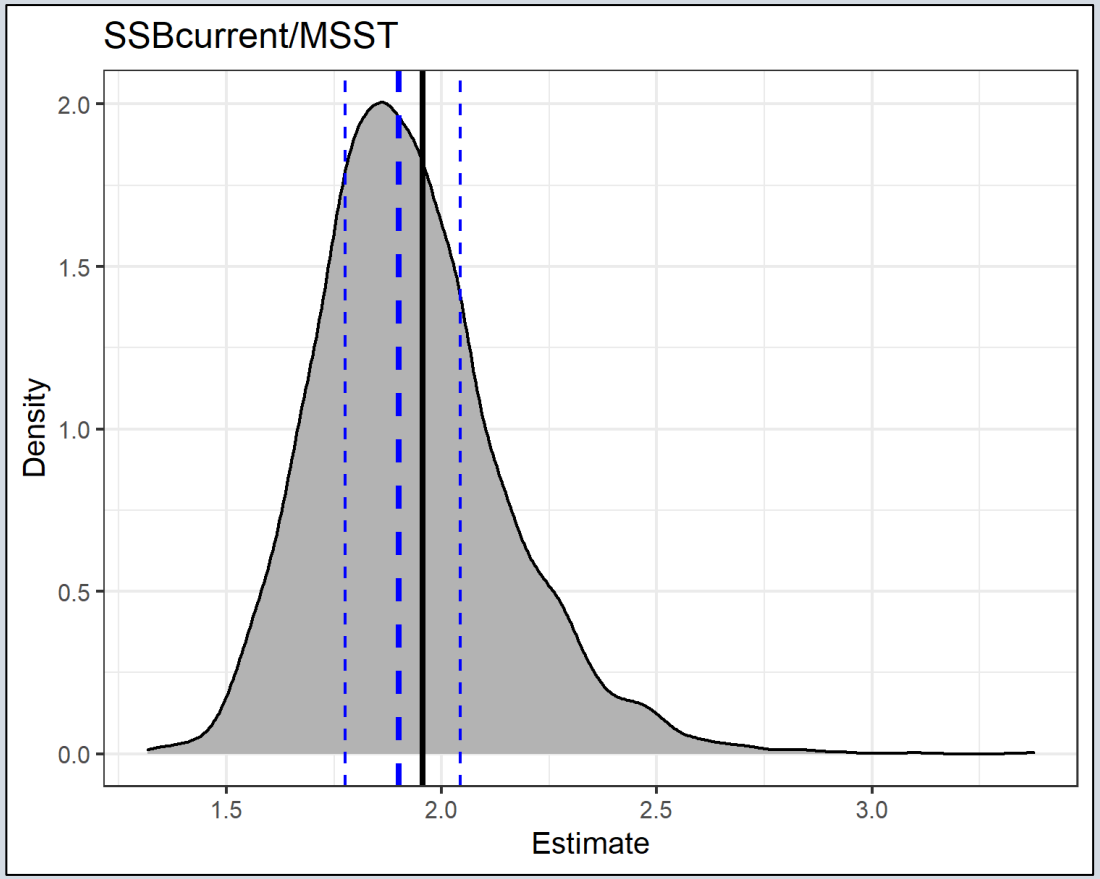
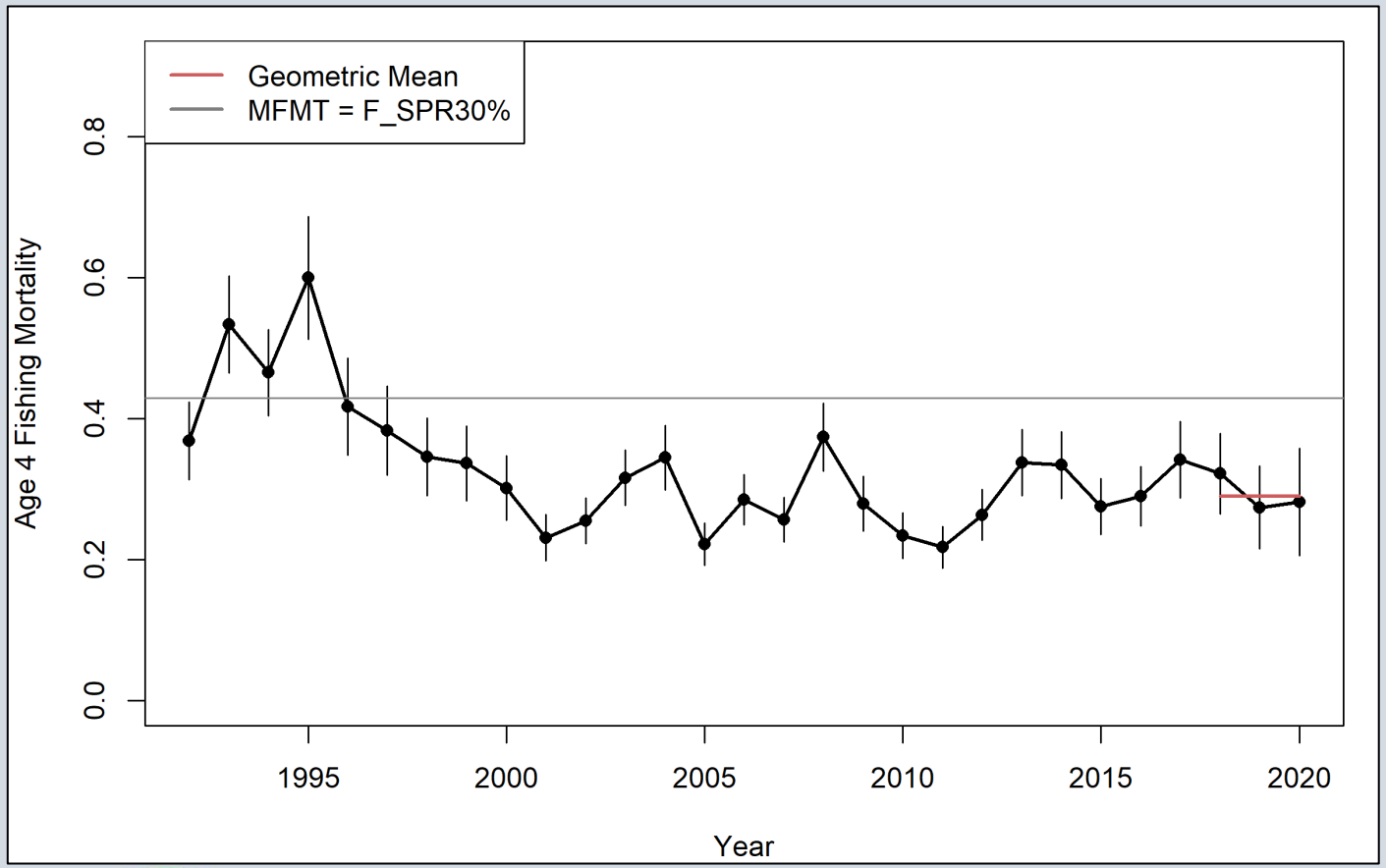
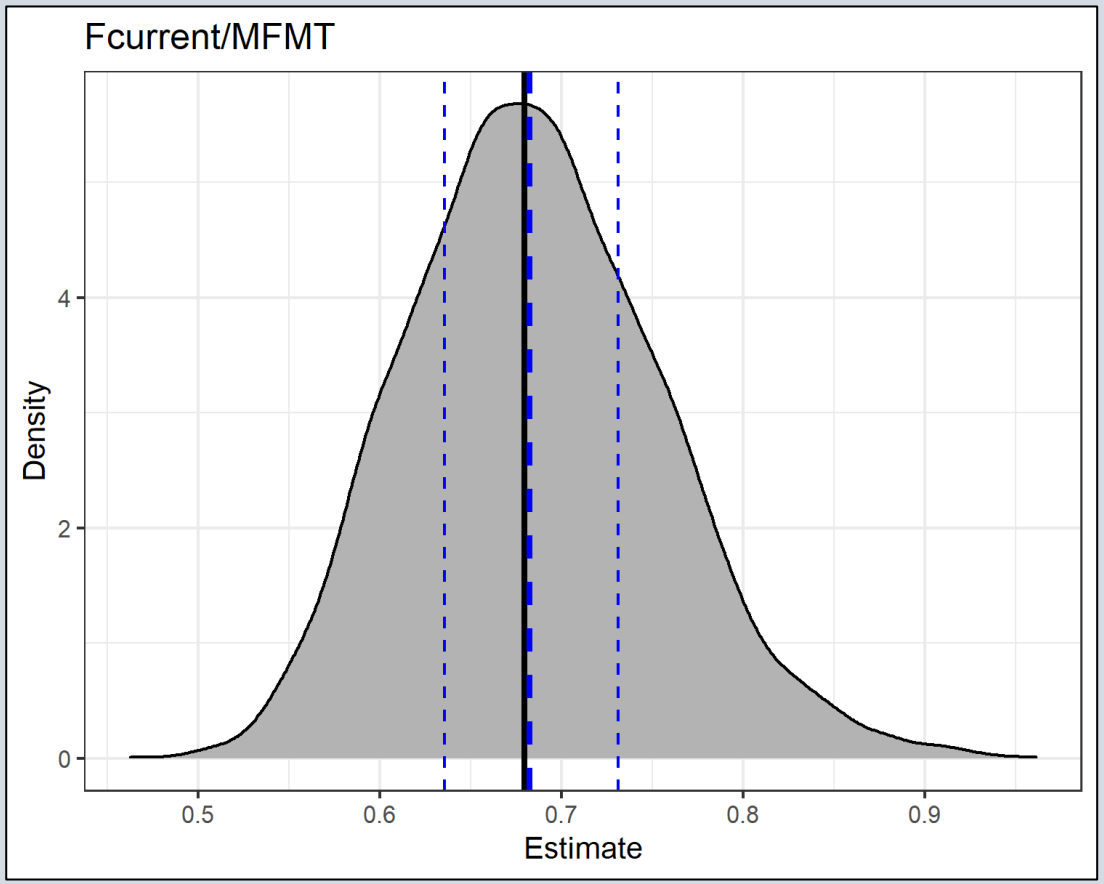

75% of SSB_F30%SPR (MSST)
Density
Metric Tons
0.000
0.001
0.002
0.003
1000
1250
1500
1750
2000

Figure 28 a-d


Geometric Mean
SSB_SPR30%
MSST = 0.75 x SSB_SPR30%
Spawning Stock Biomass
0
1000
2000
3000
4000
5000
1995
2000
2005
2010
2015
2020
Year


SSBcurrent/MSST
Density
0.0
0.5
1.0
1.5
2.0
1.5
2.0
2.5
3.0
Estimate


Geometric Mean
MFMT = F_SPR30%
Age 4 Fishing Mortality
0.0
0.2
0.4
0.6
0.8
1995
2000
2005
2010
2015
2020
Year


Fcurrent/MFMT
Density
0
2
4
0.5
0.6
0.7
0.8
0.9
Estimate

Stock Status Determination Criteria (Table 15)

Criteria	Definition	Value
MFMT ($F_{30\%SPR}$) Maximum Fishing Mortality Threshold	The fishing mortality rate associated with 30% SPR and the proxy used for F_{MSY}	0.429 yr^{-1}
P* = 0.375	The fishing mortality rate associated with the 37.5th quantile of $F_{30\%\ SPR}$	0.418 yr^{-1}
$F_{current}$	The geometric mean of F on age-4 fish for 2018 - 2020	0.292 yr^{-1}
MSST (Minimum Stock Size Threshold)	$0.75*SSB_{F30\%SPR}$	3,167,807 lbs.
$SSB_{F30\%SPR}$	The estimated spawning stock biomass associated with F at 30% SPR	4,223,743 lbs.
$SSB_{current}$	The geometric mean of SSB for 2018 - 2020	6,195,718 lbs.
Equilibrium OFL (Overfishing Limit)	Equilibrium Retained Yield at MFMT	3,498,908 lbs.
Equilibrium ABC (Acceptable Biological Catch)	Equilibrium Retained Yield at P* = 0.375	3,407,637 lbs.

S64 Interim Analysis: Yellowtail Snapper

Projections

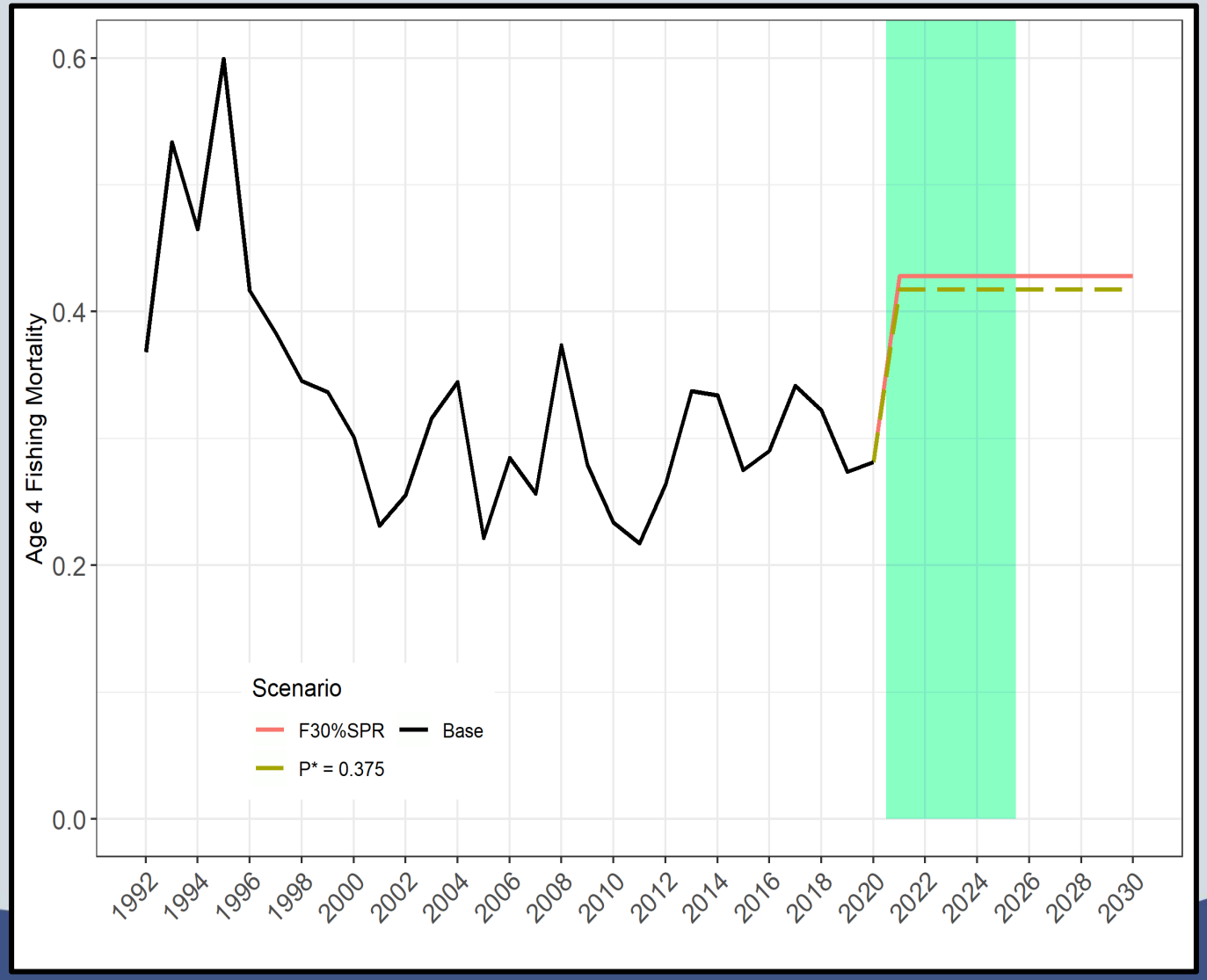
Projections

Deterministic projections were run to estimate SSB and yield under multiple constant F and constant catch scenarios (TOR #2 sub-point).

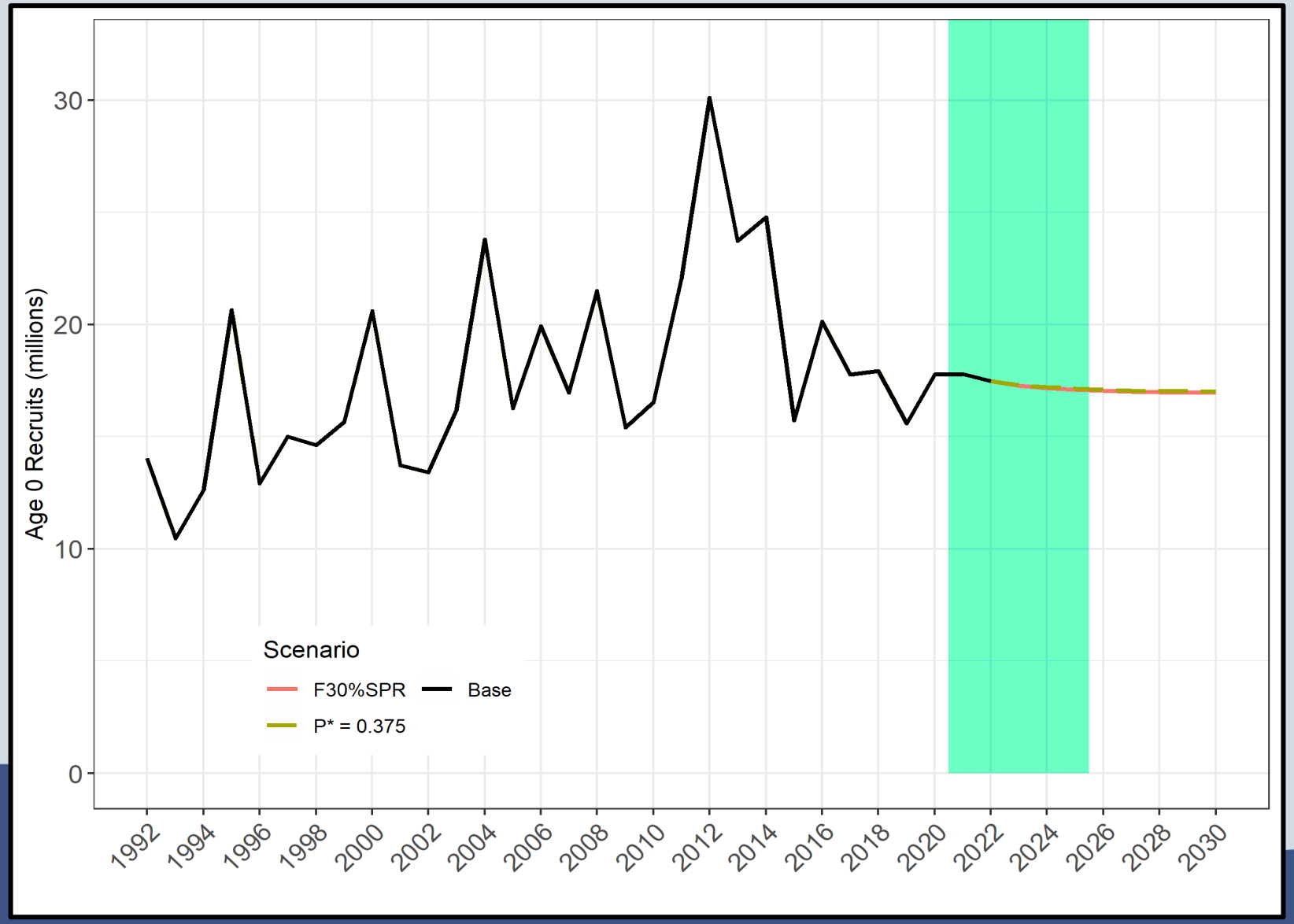
- Structure and parameters of the projection model same as assessment model.
- Recruitment for first year of projection based on S-R relationship as estimated by the IBM (17.792 million fish)
- An iterative method (provided by the SEFSC) specifies fishing mortality rates for each fleet per year (2021 – 2121). Fleet allocations are kept constant each year according to those in the SA (52.56% commercial and 47.44% recreational).

Constant F Projection Scenarios

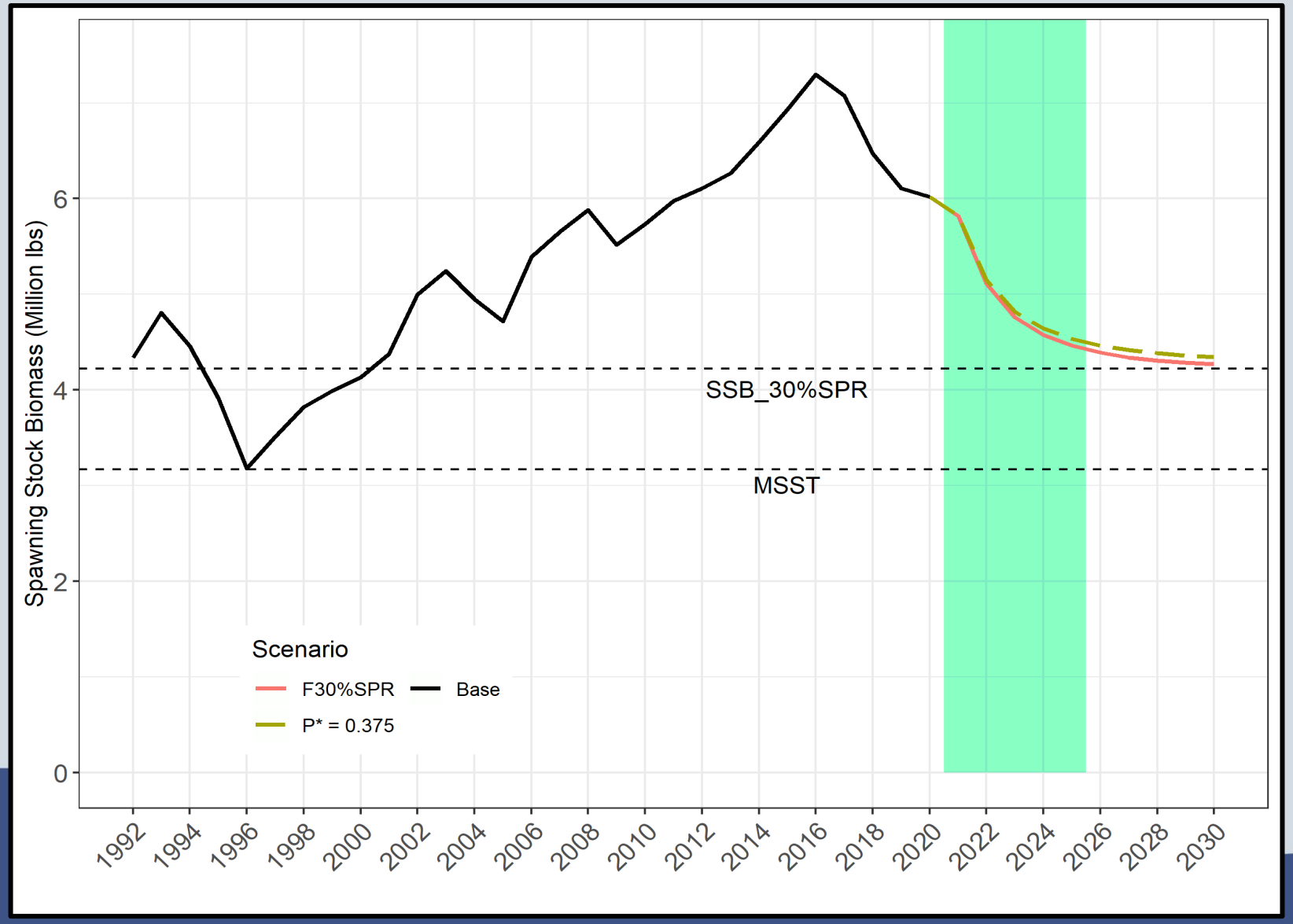
1. $F_{30\%SPR} = 0.429$
2. $F_{P^* =0.375} = 0.418$



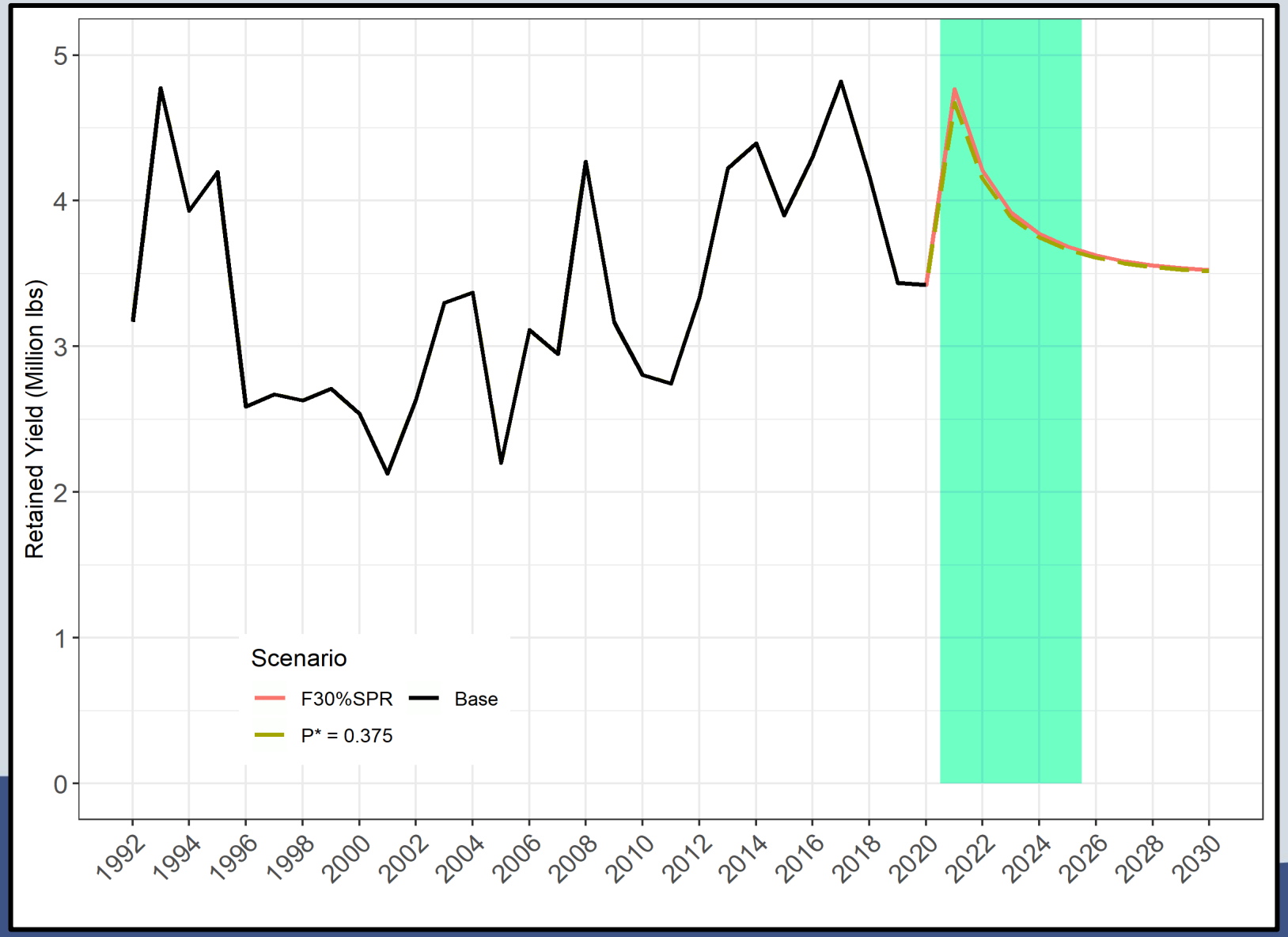
Constant F Projections: Recruitment (millions)



Constant F Projections: SSB (million lbs)



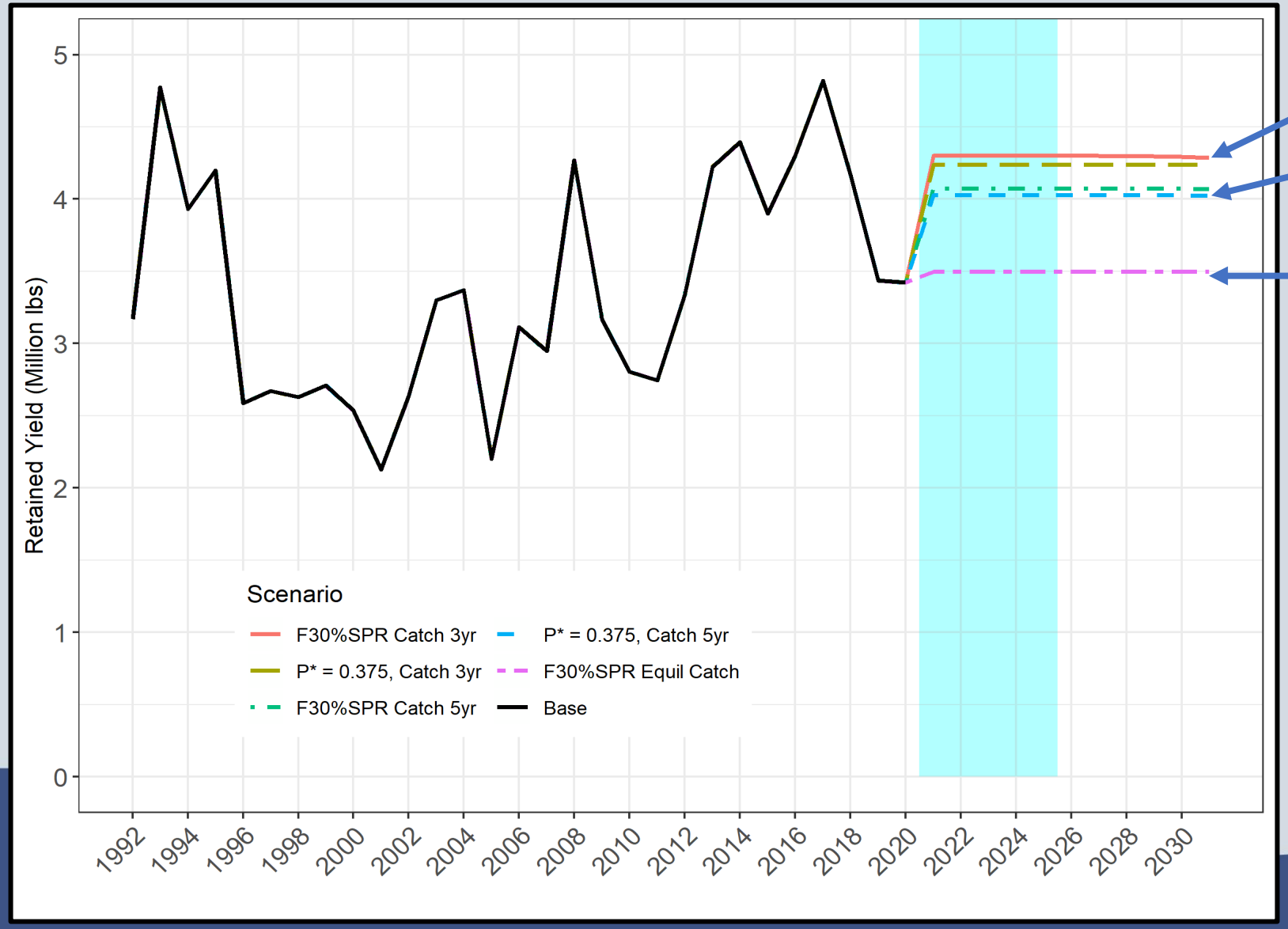
Constant F Scenarios: Retained Yield (million lbs)



Constant F Scenarios: Projected Retained Yield (lbs)

Year	$F_{30\%SPR}$ (OFL)	P* = 0.375 (ABC)	ABC/OFL	ABC=ACL	
				Com ACL (52.56%)	Rec ACL (47.44%)
2021	4,765,705	4,670,681	98.01%	2,454,911	2,215,771
2022	4,207,390	4,152,787	98.70%	2,182,708	1,970,079
2023	3,922,267	3,887,251	99.11%	2,043,149	1,844,102
2024	3,773,583	3,748,639	99.34%	1,970,295	1,778,343
2025	3,684,061	3,664,980	99.48%	1,926,322	1,738,658
2026	3,624,751	3,609,528	99.58%	1,897,173	1,712,355
2027	3,584,330	3,571,596	99.64%	1,877,241	1,694,355
2028	3,556,683	3,545,663	99.69%	1,863,607	1,682,056
2029	3,537,757	3,527,977	99.72%	1,854,312	1,673,665
2030	3,524,780	3,515,691	99.74%	1,847,857	1,667,834
2031	3,515,862	3,507,371	99.76%	1,843,483	1,663,888
3 yr Avg	4,298,454	4,236,906		2,226,923	2,009,984
5 yr Avg	4,070,601	4,024,868		2,115,477	1,909,391
Equil Catch	3,468,661			1,823,128	1,645,533

Constant Catch Scenarios: Retained Yield (million lbs)

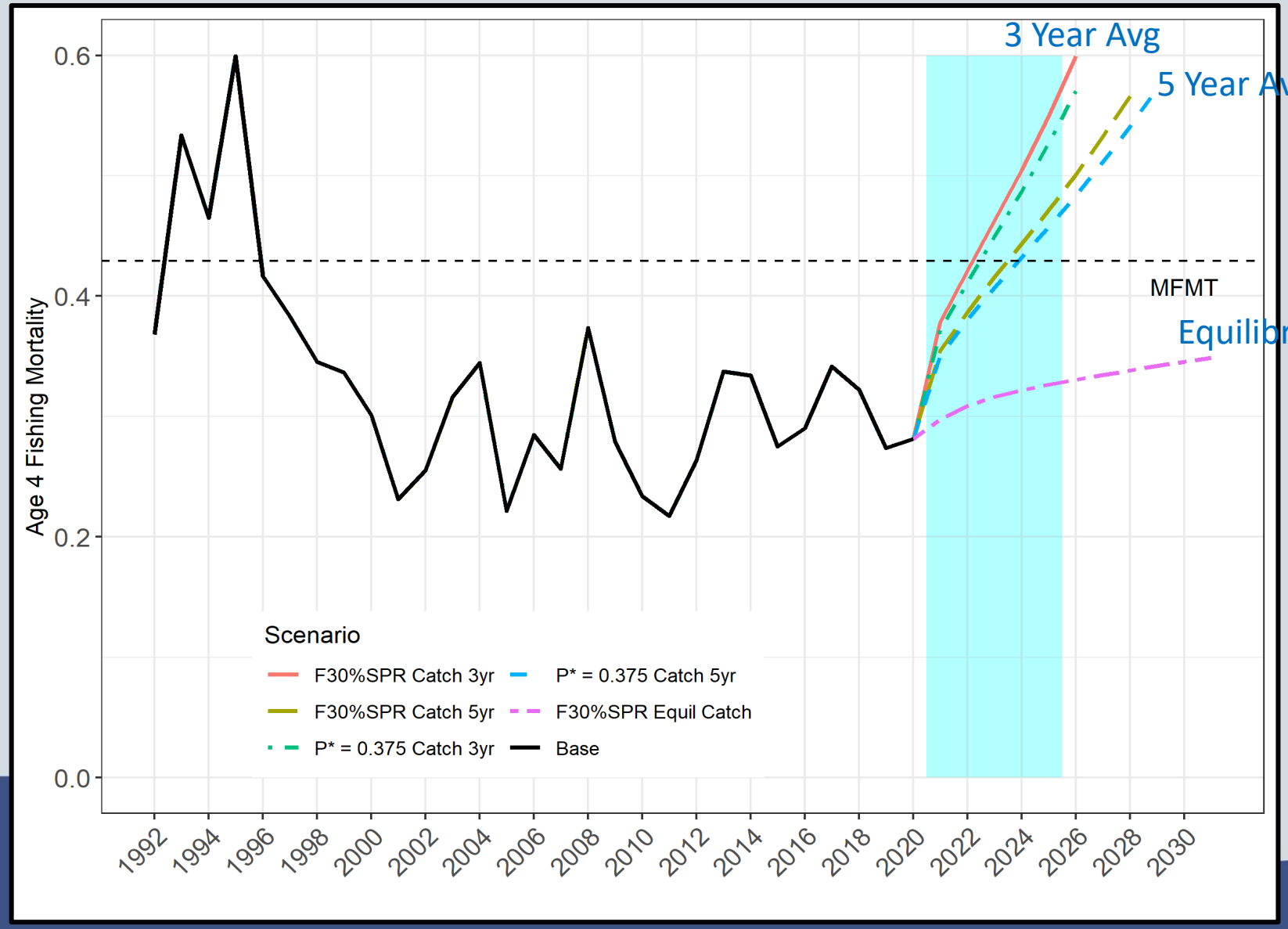


3 Year Avg

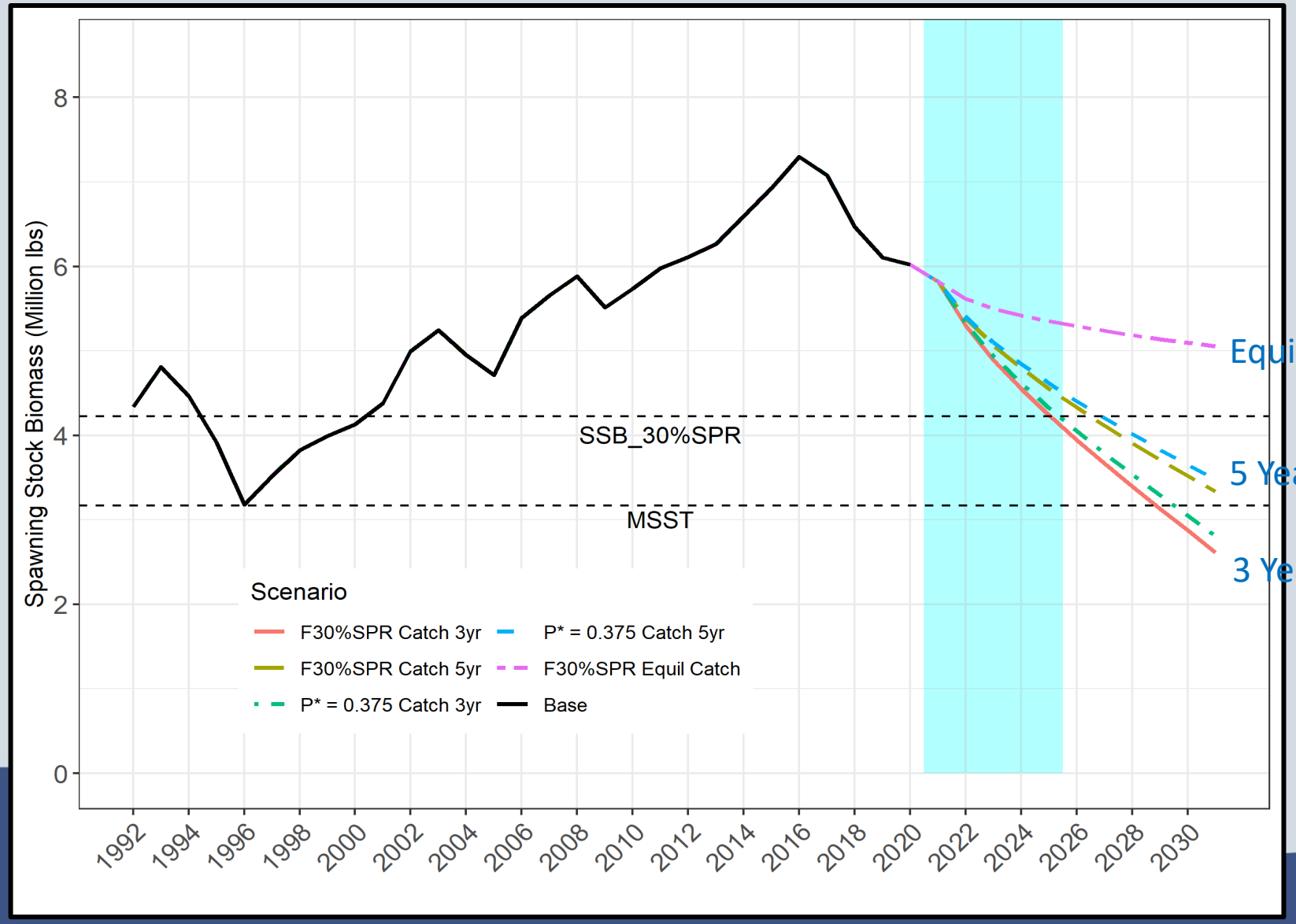
5 Year Avg

Equilibrium

Constant Catch Scenarios: Fishing Mortality Rates



Constant Catch Scenarios: SSB (million lbs)

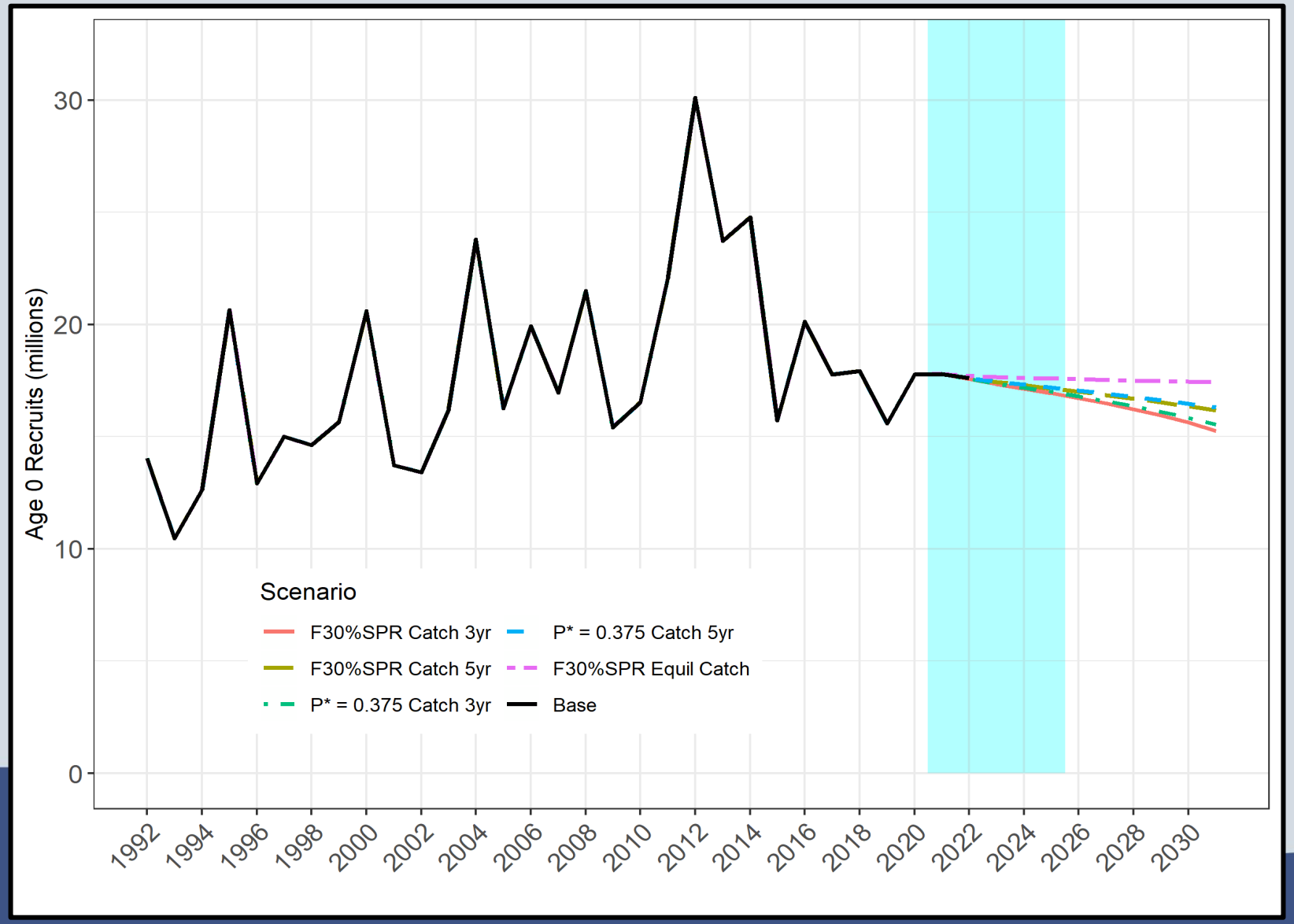


Equilibrium

5 Year Avg

3 Year Avg

Constant Catch Scenarios: Recruitment (millions)




Questions?

Management History: SAFMC

- Snapper-Grouper FMP (8/31/1983)
  - 12” (305 mm) TL minimum size limit for commercial and recreational fisheries
    - Florida state waters regulation enacted 7/1/1985
- Amendment 4 (1/1/1992)
  - Aggregate daily bag limit of 10 snappers for recreational fishery
    - Florida state waters regulation enacted 12/1/1986
- Amendment 11B (12/2/1999)
  - MSY-proxy set as 30% static SPR; OY-proxy is 40% static SPR
- Regulatory Amendment 15 (9/12/13)
  - OY = ACL = ABC
- Regulatory Amendment 21 (11/6/2014)
  - Modified MSST to be 75% of the SSB_{MSY}

Management History: GMFMC

- Reef Fish FMP (11/8/1984)
- Reef Fish Amendment 1 (2/21/1990)
  - 12” (305 mm) TL minimum size limit for commercial and recreational fisheries
  - Aggregate daily bag limit of 10 snappers for recreational fishery
- Reef Fish Amendment 48 (6/8/2022)
  - MFMT: $F_{30\%SPR}$
  - MSST: GMFMC currently defers to SAFMC
  - OY: 90% of the MSY or MSY proxy

Model Estimated MRIP Landings in Pounds

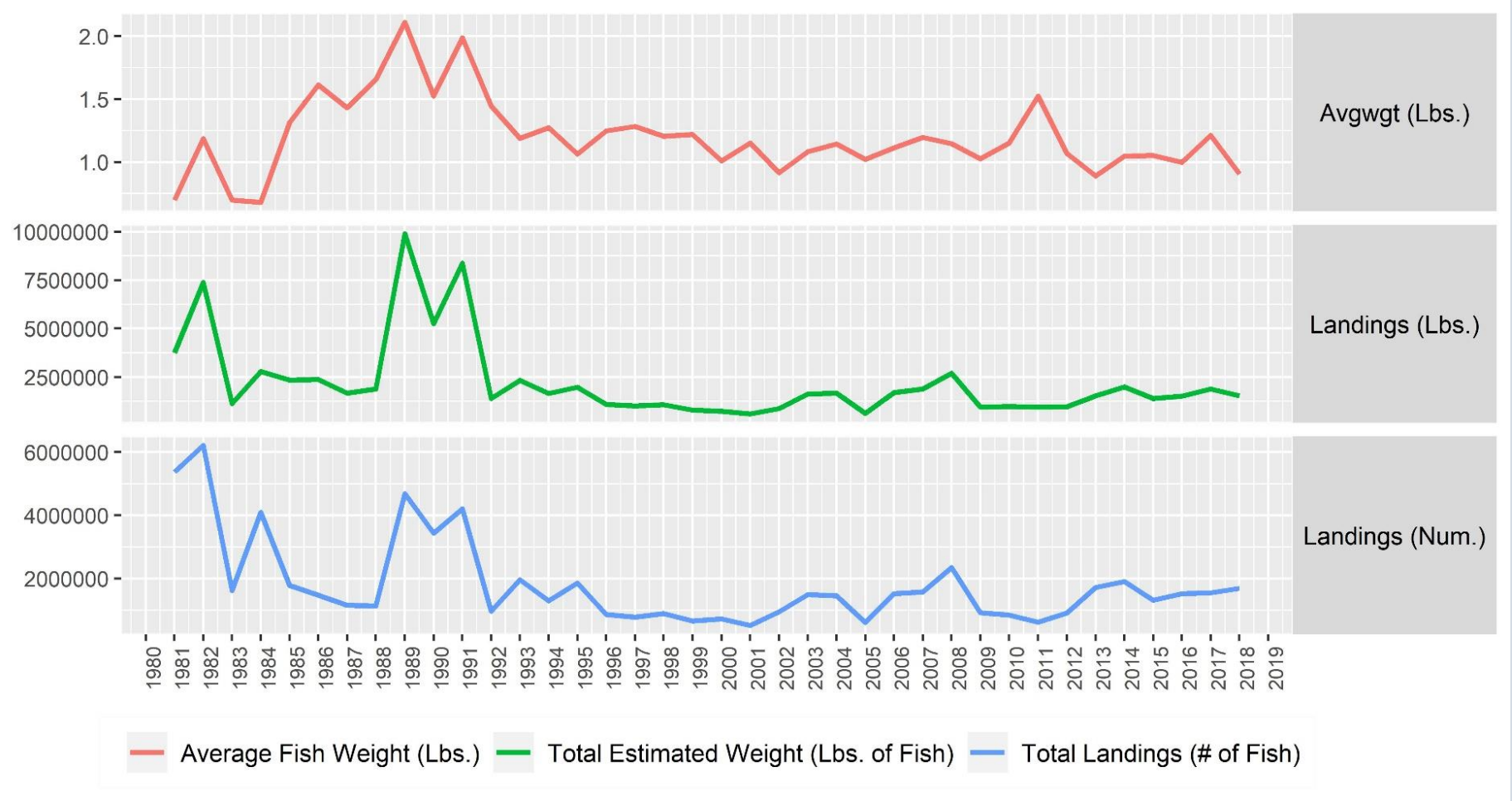


Figure 7. Landings estimates of Yellowtail Snapper by year: a) yearly average weight (lbs./#) of estimated landed Yellowtail Snapper (in pounds); b) estimated landings in weight (pounds) by year; c) estimated landings in number (whole fish) by year.

Landings by Fleet in Pounds

Year	Commercial	Headboat	MRIP	Total
2010	1,693,953	89,739	978,430	2,762,122
2011	1,893,544	92,552	943,810	2,929,906
2012	2,107,291	121,417	972,774	3,201,482
2013	2,061,143	114,676	1,532,100	3,707,919
2014	2,043,260	177,331	1,998,309	4,218,900
2015	2,197,954	177,597	1,391,931	3,767,482
2016	2,314,905	188,058	1,522,151	4,025,114
2017	2,820,426	117,929	1,880,002	4,818,357
2018	1,988,139	104,935	1,521,940 *	3,615,014
2019	2,205,944	235,374	872,478 *	3,313,796
2020	1,408,072	147,282	1,433,681 *	2,989,035

*MRIP Public Query

Table 1. Commercial landings (pounds, metric tons) in Florida by region for years 2018 – 2020.

Landings (whole lbs.)

Year	Northwest	Southwest	**Keys**	Southeast	Northeast	**Total**
2018	29	20,996	**1,908,453**	58,538	123	**1,988,139**
2019	41	21,669	**2,098,050**	85,988	196	**2,205,944**
2020	25	12,443	**1,339,926**	55,507	171	**1,408,072**

Landings (mt)

Year	Northwest	Southwest	**Keys**	Southeast	Northeast	**Total**
2018	0.013	9.524	**865.659**	26.552	0.056	**901.804**
2019	0.019	9.829	**951.659**	39.004	0.089	**1,000.598**
2020	0.011	5.644	**607.780**	25.178	0.078	**638.690**

Table 4. MRIP landings (thousands of fish) and releases (thousands of fish) in Florida by region for years 2017 – 2020.

Landings (000s)

Year	Northwest	Southwest	**Keys**	**Southeast**	Northeast	**Total**
2017	0.000	304.551	**839.815**	**400.493**	5.437	**1,550.296**
2018	0.000	74.051	**658.794**	**960.244**	3.462	**1,696.551**
2019	0.000	76.392	**478.745**	**250.499**	0.000	**805.637**
2020	0.000	41.747	**737.861**	**730.010**	0.249	**1,509.868**

Live Releases (000s)

Year	Northwest	Southwest	**Keys**	**Southeast**	Northeast	**Total**
2017	0.000	114.382	**1,669.138**	**487.509**	1.968	**2,272.998**
2018	0.456	50.630	**1,513.459**	**1,151.028**	45.240	**2,760.814**
2019	0.000	47.969	**1,081.940**	**471.446**	0.000	**1,601.356**
2020	0.000	96.067	**1,982.903**	**433.940**	1.921	**2,514.831**

Interim Base Model Configuration

Fleets

- Commercial (Updated)
  - Landings (mt) and discards (numbers)
- Headboat (Updated)
  - Landings and discards (numbers)
- MRIP (Charter, Private, Shore modes; Updated)
  - Landings and discards (numbers)

Surveys (No change)

- Commercial CPUE
  - retained lbs/hook hour
- RVC
  - Juvenile/subadult
  - Adult
  - number of fish/diver ‘cylinder’
- MRIP CPUE
  - total catch/angler (numbers)

Interim Base Model Configuration

Length Composition Data

(No change)

- Commercial
  - Landings and discards
- Headboat
  - Landings
- MRIP
  - Landings
- Headboat/MRIP Discards
  - Same length compositions
- RVC
  - Juvenile/Subadult
  - Adult

Conditional Age-at-Length Data

(No change)

- Commercial Landings
- Headboat Landings
- MRIP Landings
- Fishery-independent sources

Constant F Scenarios: Projected SSB (lbs)

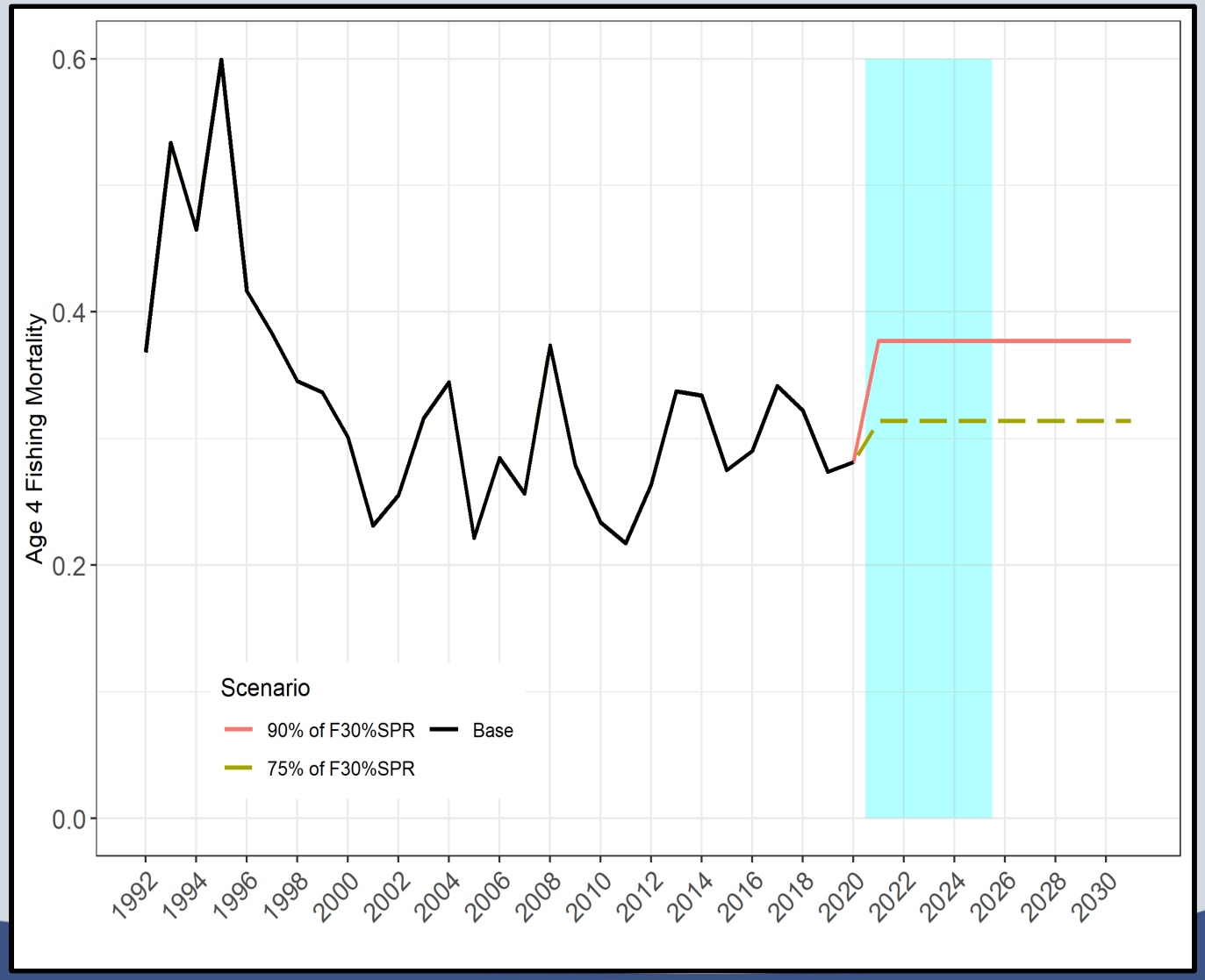
Year	$F_{30\%SPR}$ (OFL)	P* = 0.375 (ABC)
2021	5,815,920	5,815,920
2022	5,114,123	5,151,469
2023	4,761,781	4,817,359
2024	4,577,056	4,641,695
2025	4,465,149	4,535,036
2026	4,391,294	4,464,554
2027	4,341,183	4,416,625
2028	4,307,012	4,383,909
2029	4,283,621	4,361,466
2030	4,267,593	4,345,989
2031	4,256,592	4,335,363

Constant F Scenarios: Projected Recruitment (numbers)

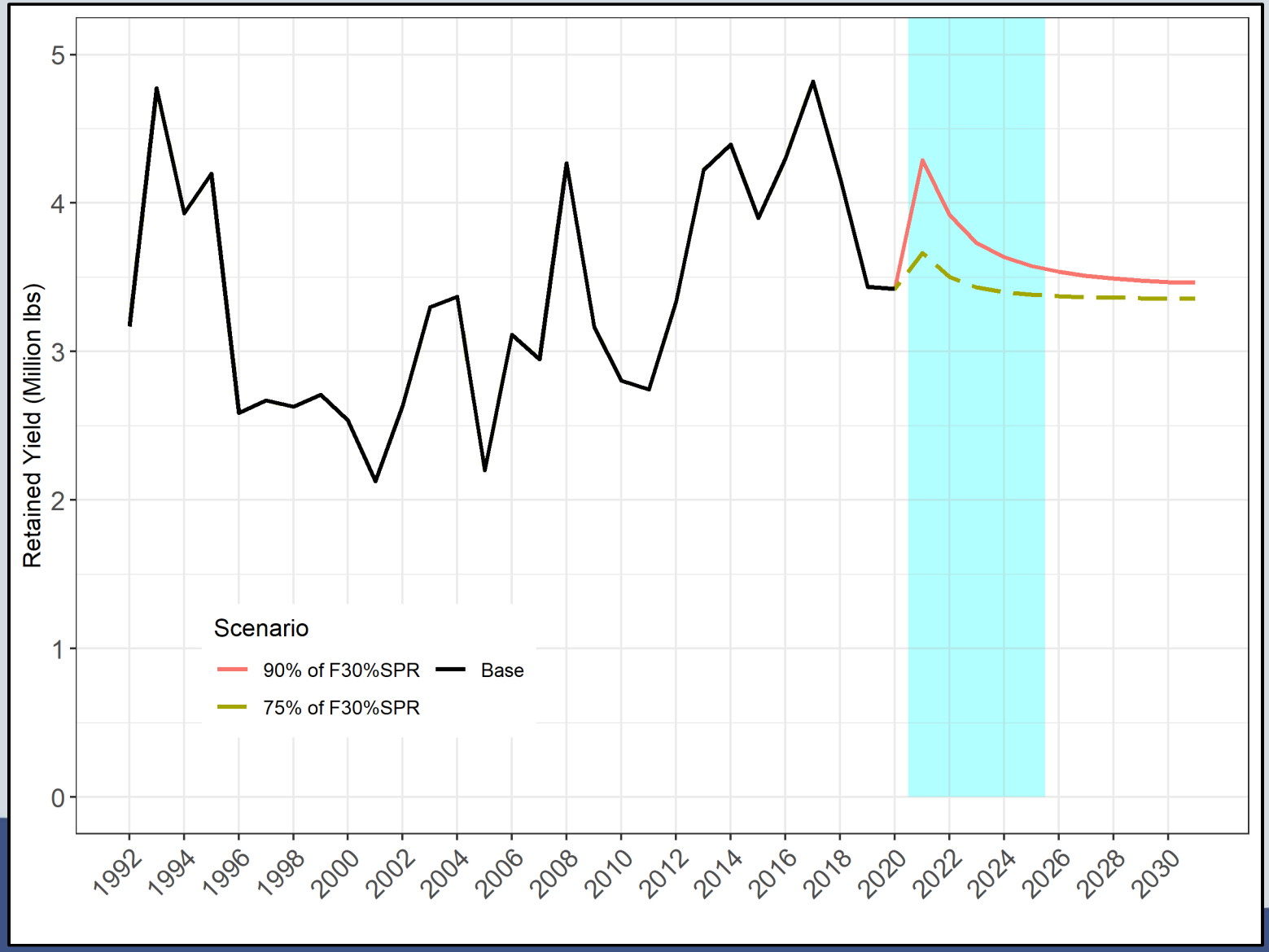
Year	$F_{30\%SPR}$ (OFL)	P* = 0.375 (ABC)
2021	17,792,000	17,792,000
2022	17,467,400	17,486,600
2023	17,274,100	17,306,200
2024	17,162,900	17,202,700
2025	17,091,800	17,136,600
2026	17,043,200	17,091,400
2027	17,009,500	17,060,100
2028	16,986,100	17,038,300
2029	16,970,000	17,023,200
2030	16,958,800	17,012,800
2031	16,951,100	17,005,600

Additional Constant F Projection Scenarios

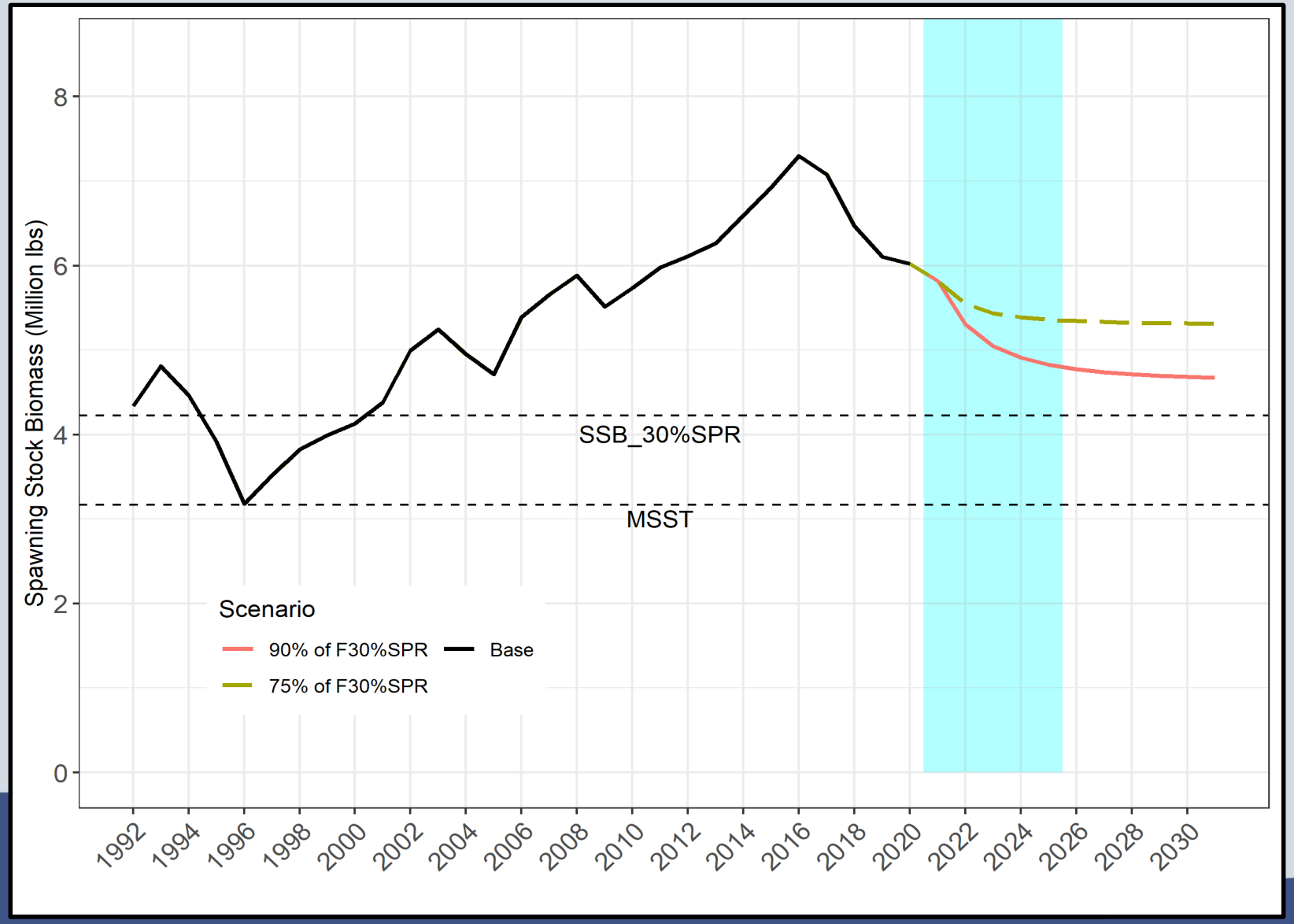
1. 90% of $F_{30\%SPR}$ = 0.377
2. 75% of $F_{30\%SPR}$ = 0.314



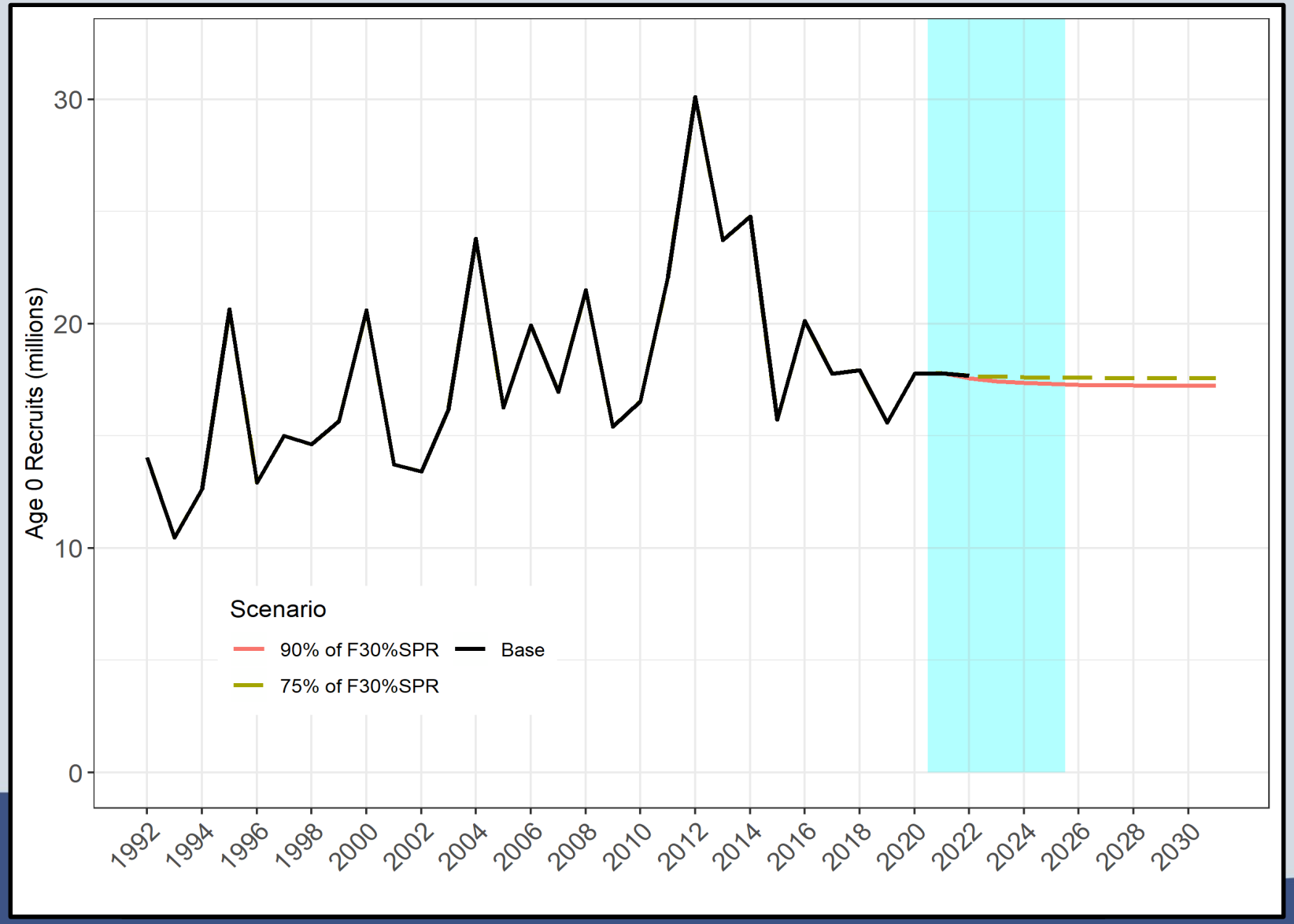
Additional Constant F Scenarios: Retained Yield (mill lbs)



Additional Constant F Projections: SSB (million lbs)



Additional Constant F Projections: Recruitment (millions)



Additional Constant F Scenarios: Retained Yield (lbs)

Year	90% $F_{30\%SPR}$	75% $F_{30\%SPR}$
2021	4,287,982	3,665,668
2022	3,920,629	3,503,435
2023	3,732,763	3,431,880
2024	3,635,227	3,400,873
2025	3,576,373	3,384,921
2026	3,537,220	3,374,999
2027	3,510,131	3,367,497
2028	3,491,446	3,362,246
2029	3,478,436	3,358,933
2030	3,469,424	3,356,297
2031	3,463,220	3,354,276
3 yr Avg	3,980,458	3,533,661
5 yr Avg	3,830,595	3,477,355