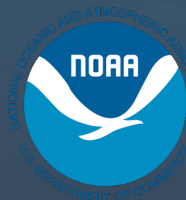


Ecosystem Socioeconomic Profile (ESP)

Sablefish (Report Card)

Editors: Kalei Shotwell, Dan Goethel, Alison Deary, Katy Echave, Ben Fissel, Dana Hanselman, Chris Lunsford, Kevin Siwicke, Jane Sullivan, Marysia Szymkowiak, Abigail Tyrell, Ben Williams, Stephani Zador

Contributors: Mayumi Arimitsu, Steve Barbeaux, Curry Cunningham, Bridget Ferriss, Jens Nielsen, Clare Ostle, Patrick Ressler, Cara Rodgveller, Elizabeth Siddon, Kally Spalinger, Jordan Watson, Sarah Wise



NOAA
FISHERIES

Overview

Appendix in SAFE report

- Full ESPs in 2017-2019
- Partial ESP in Nov 2020
- Report card in Nov 2021
 - Simplified template allows for including current year data
 - Some indicators missing due to cancellations, data timing
- 13 editors, 12 contributors

Appendix 3C. Ecosystem and Socioeconomic Profile of the Sablefish stock in Alaska - Report Card

S. Kalei Shotwell, Daniel Goethel, Alison Deary, Katy Echave, Ben Fissel, Dana Hanselman, Chris Lunsford, Kevin Siwicke, Jane Sullivan, Marysia Szymkowiak, Abigail Tyrell, Ben Williams, and Stephani Zador

November 2021



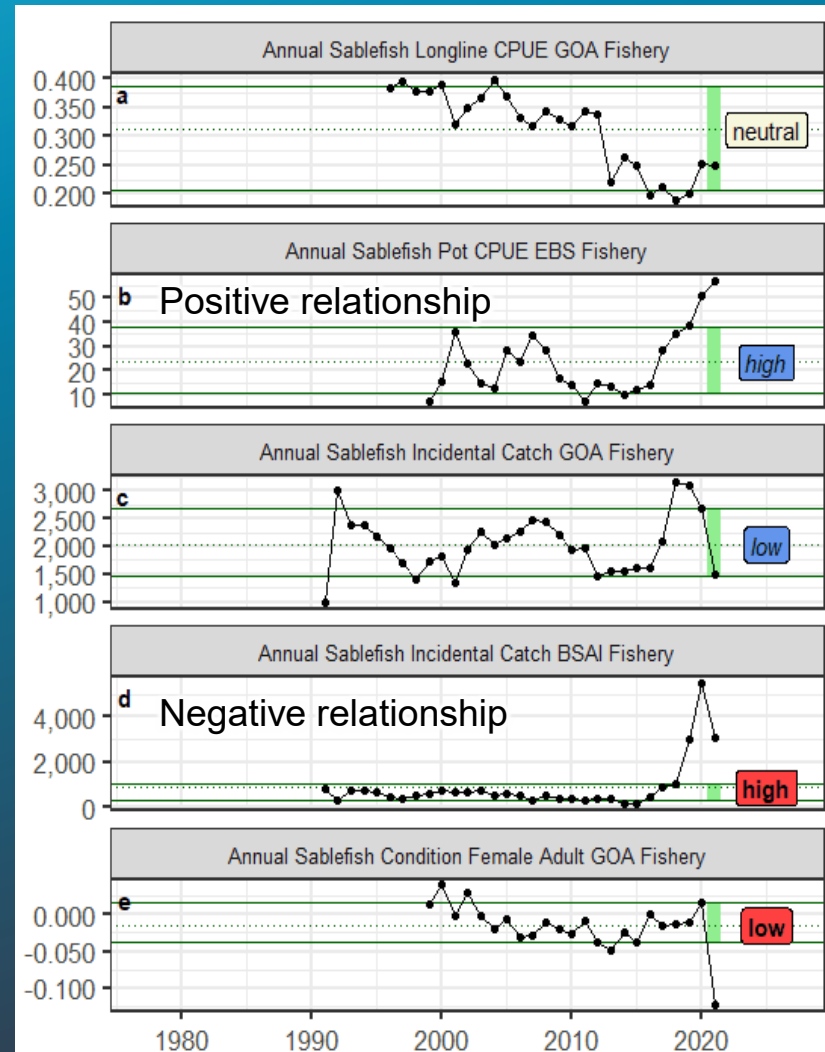
With Contributions from:

Mayumi Arimitsu, Steve Barbeaux, Curry Cunningham, Bridget Ferriss, Jens Nielsen, Clare Ostle, Patrick Ressler, Cara Rodgveller, Elizabeth Siddon, Kally Spalinger, Jordan Watson, Sarah Wise

Pp. 202-227

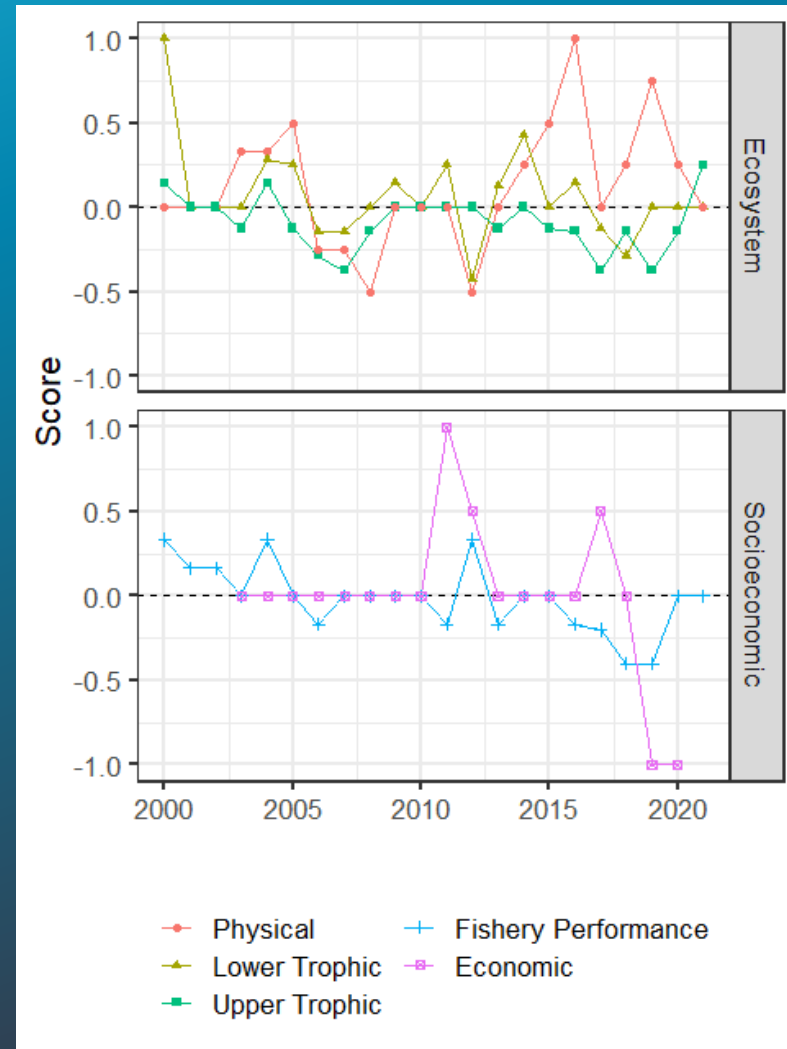
Traffic Light

- Time series and Table
 - Historical time series of indicators suite (~ starts 1977)
 - Evaluate a given year 1 stdev from the long term mean
 - High (H), low (L), neutral (N), color is relationship with stock
- Summary Score
 - Score by category last 20 yrs
 - Sum of H, L, N, color is -1,1

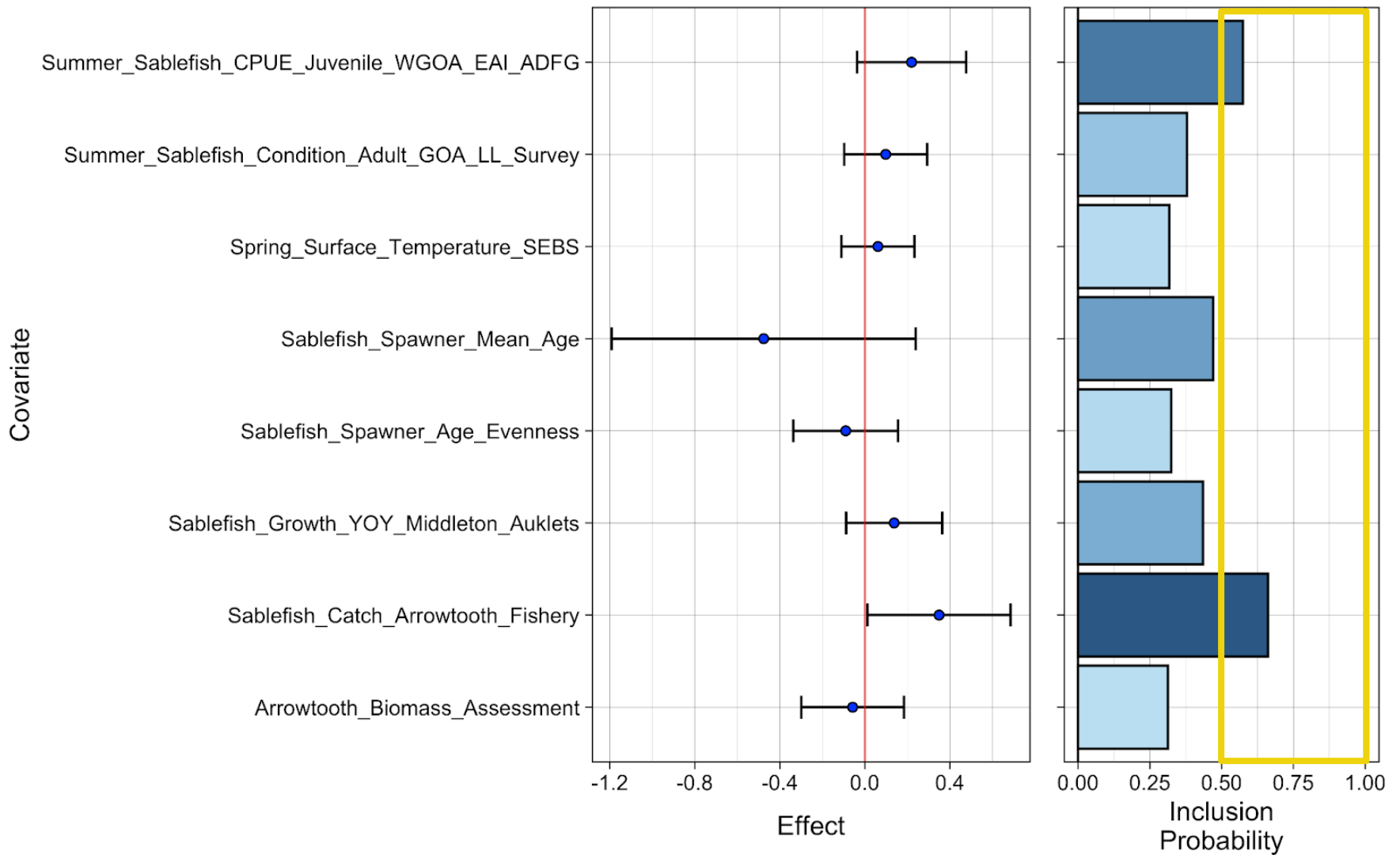


Traffic Light Score

- Ecosystem (16 of 22 total)
 - Physical < to average
 - Lower trophic remains average
 - Upper trophic > to above average
- Socioeconomic (7 of 8 total)
 - Fishery performance > to average
 - Economic lagged by one year and remains very low
- 7 indicators missing



Importance



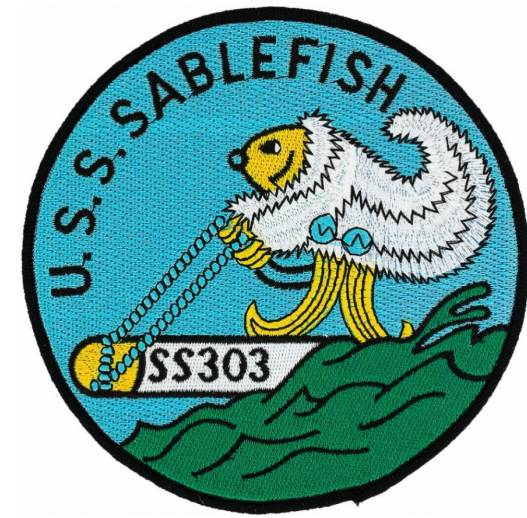
Considerations

- Management Summary

- Cooling overall in GOA, still warm in EBS, plankton average
- YOY growth average, juveniles high nearshore, avg offshore
- Survey condition avg or below avg, fishery condition poor
- BSAI pot CPUE & incidental catch high, value & price low

- Modeling Summary

- 2 potential covariates for sablefish recruitment
- Several potential research ecosystem models (life cycle model with IBM, temperature projection model, tag model)



ALASKA SABLEFISH

DAN GOETHEL, DANA HANSELMAN, CARA RODGVELLER, KALEI SHOTWELL, KATY ECHAVE, BEN WILLIAMS, JANE SULLIVAN, PETE HULSON, PAT MALECHA, KEVIN SIWICKE, CHRIS LUNSFORD

MARINE ECOLOGY AND STOCK ASSESSMENT

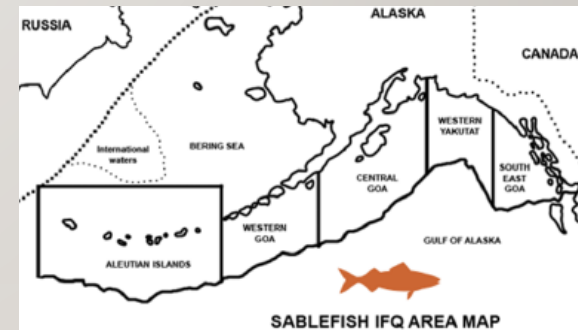
ALASKA FISHERIES SCIENCE CENTER

JUNEAU, AK



8 OUTLINE

- Model Development and Comparisons
- Stock Assessment Overview
 - Review Key Data Inputs
 - Results and Model Fit
 - Diagnostics
- Summary of Assessment and ABC
- Apportionment



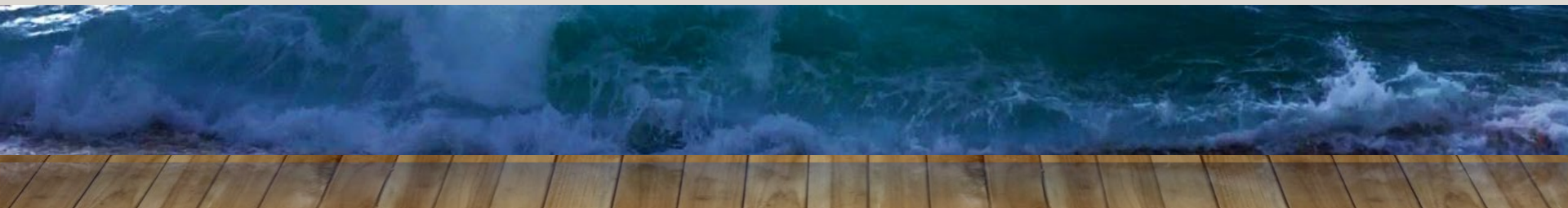
9 BOTTOM LINE

- New model, same upward trends
- More consistent recruitment estimation allows use of max ABC projections
- 2022 Author's ABC = Max ABC = 34,521 t
- **Apportionment based on 5-year average survey biomass proportions and year 2 (50%) of SSC 4-year stair step**

Year	2021				2022*		2023*	
Region	OFL _w	ABC _w	TAC	Catch**	OFL _w	ABC _w ***	OFL _w	ABC _w ***
BS	--	3,396	3,396	3,667	--	5,264	--	6,529
AI	--	4,717	4,717	1,359	--	6,463	--	7,786
GOA	--	21,475	17,992	12,919	--	22,794	--	22,003
WGOA	--	3,224	2,428	1,609	--	3,727	--	3,951
CGOA	--	9,527	8,056	5,868	--	9,965	--	9,495
***WYAK	--	3,451	2,929	2,156	--	3,437	--	3,159
***EY/SEO	--	5,273	4,579	3,286	--	5,665	--	5,398
Total	60,426	29,588	26,105	17,945	40,432	34,521	42,520	36,318

10 2021 SAFE PROPOSED MODEL

- *21.12_Proposed_No_Skip_Spawn*
 - Same as *21.10_Proposed*, but using an **age-based GLM to estimate maturity *without* incorporating information on skipped spawning** (using recent histological data)
 - 2 time blocks for growth, updated with recent data
 - 1 time block for weight, updated with recent data
 - No catchability priors
 - Recent time block (starting in 2016) for fishery catchability+selectivity and survey selectivity parameter estimation
 - Francis reweighting



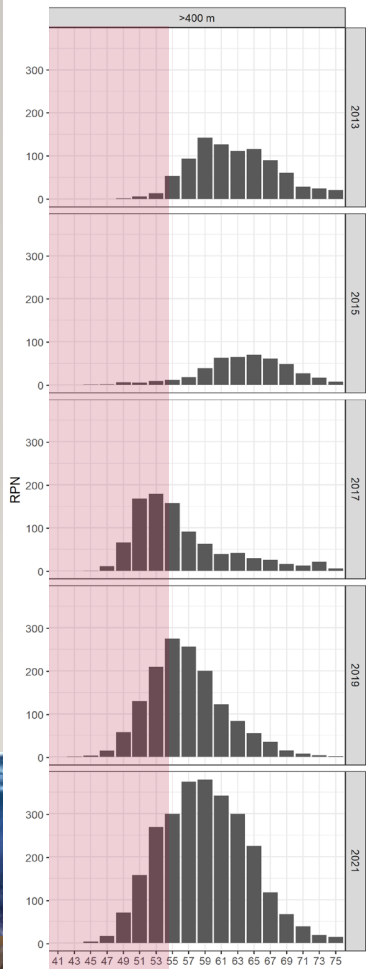
11 MODEL UPDATES RATIONALE

- Gear composition (>50% catch from pots) and targeting (avoidance of small sablefish) clearly changing
 - Impacts availability (catchability) and selectivity
- Indications that survey availability may be changing, but primarily for younger ages (smaller sizes)
 - Impacts availability of certain ages, which is best accounted for through selectivity (not catchability)

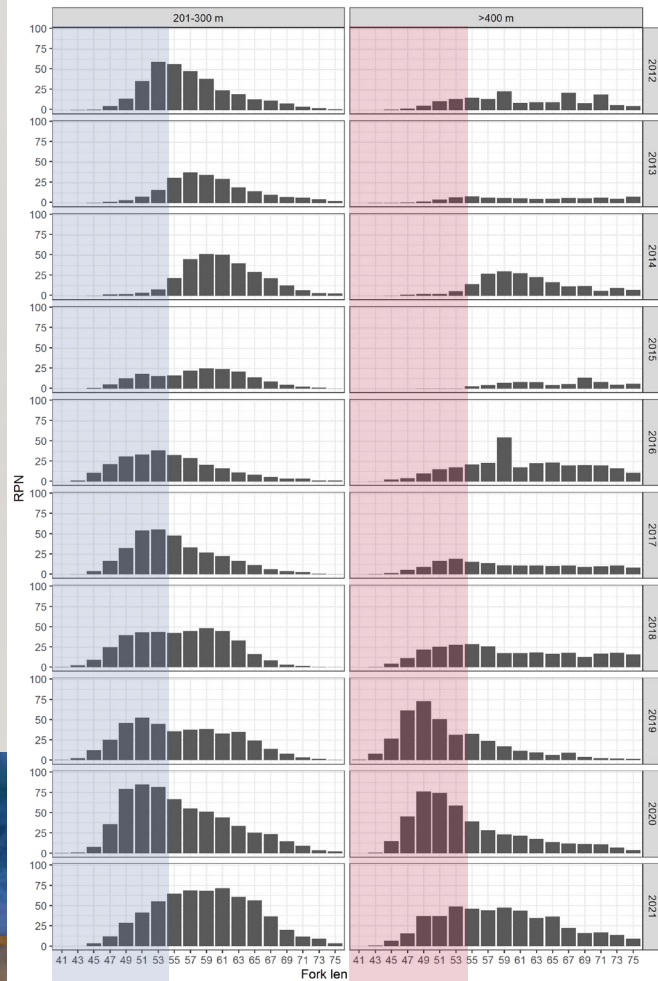


12 LONGLINE SURVEY RPN BY LENGTH

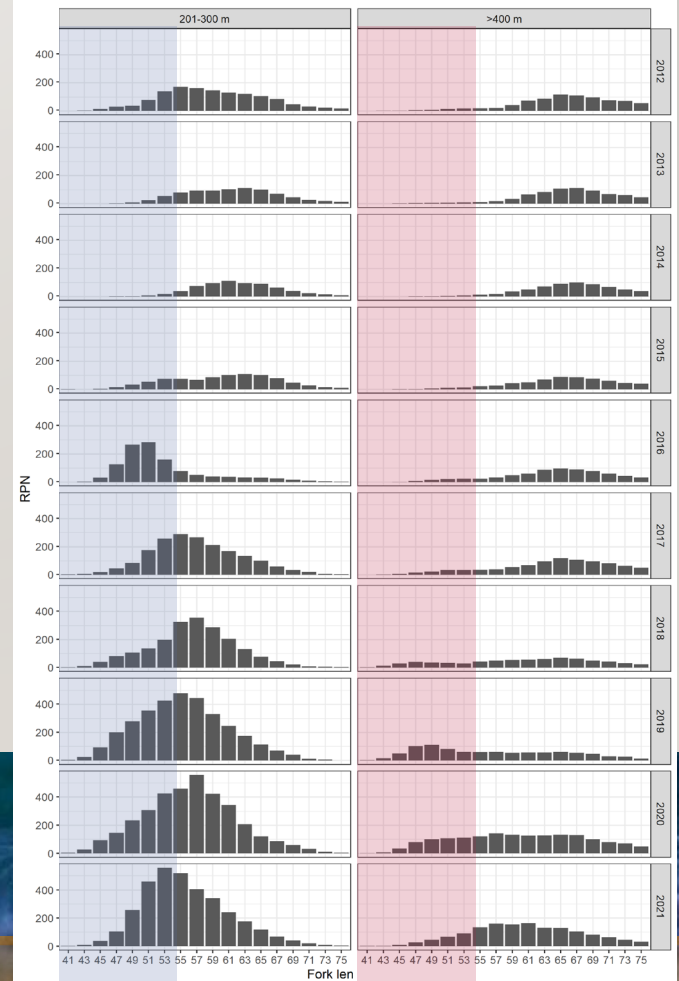
Bering Sea



Western GOA

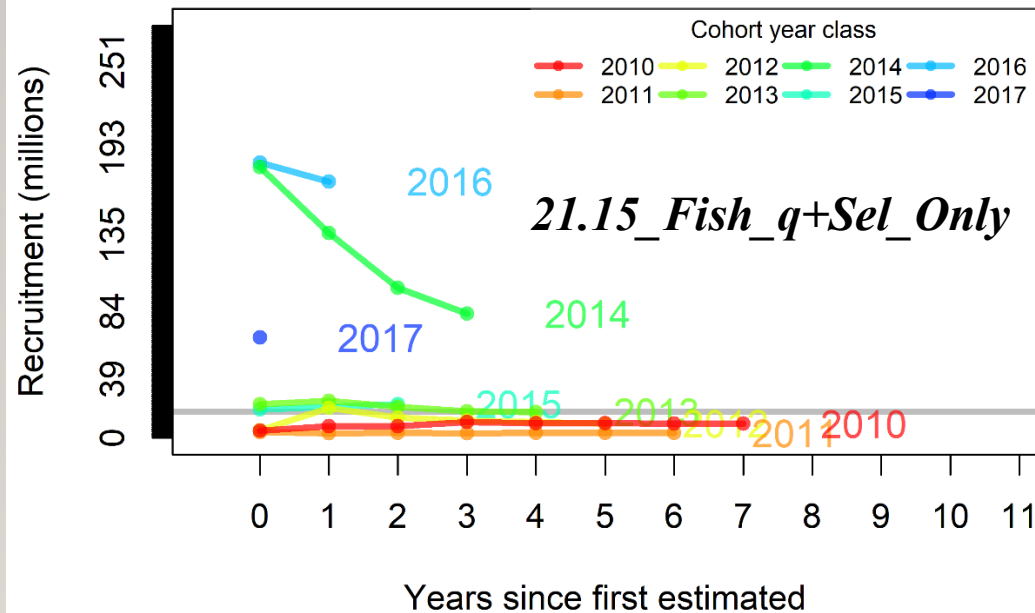


Central GOA



13 FULL MODEL BUILDING RESULTS

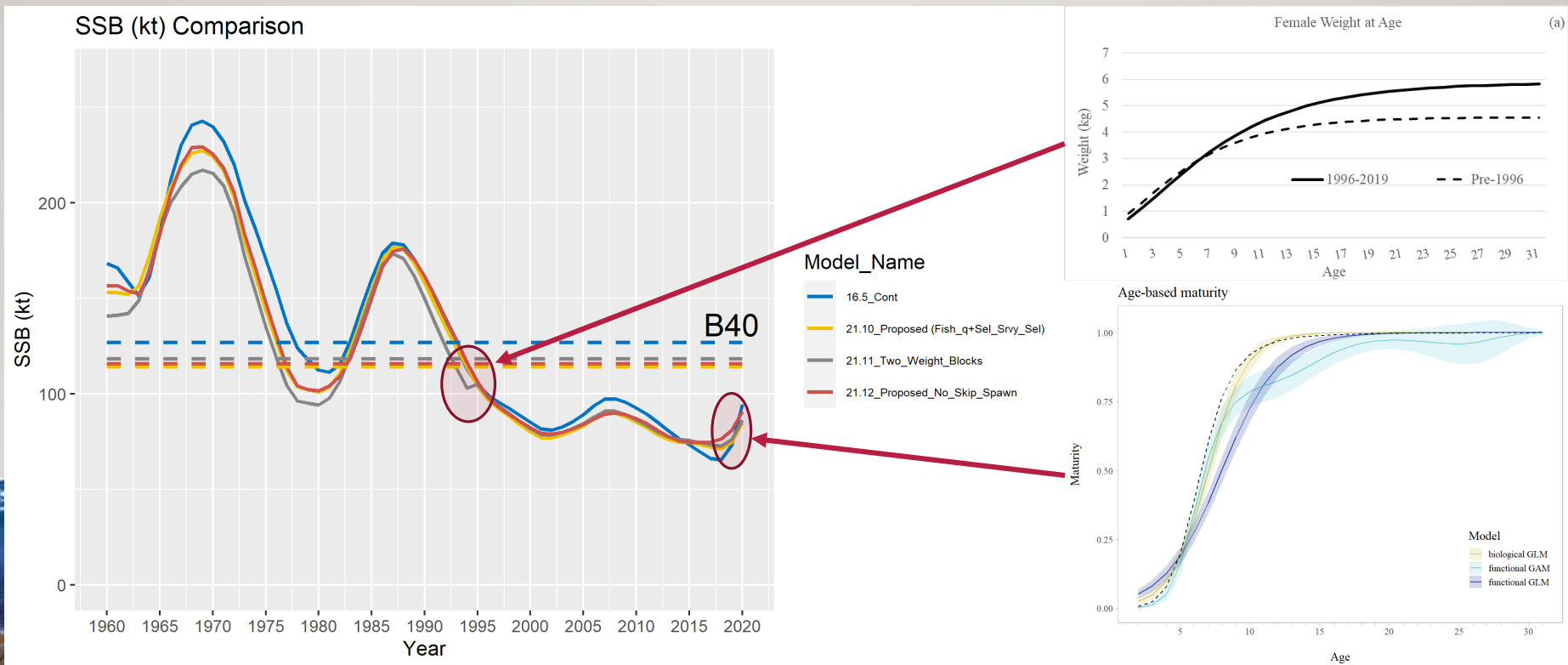
Sablefish recruitment retrospective



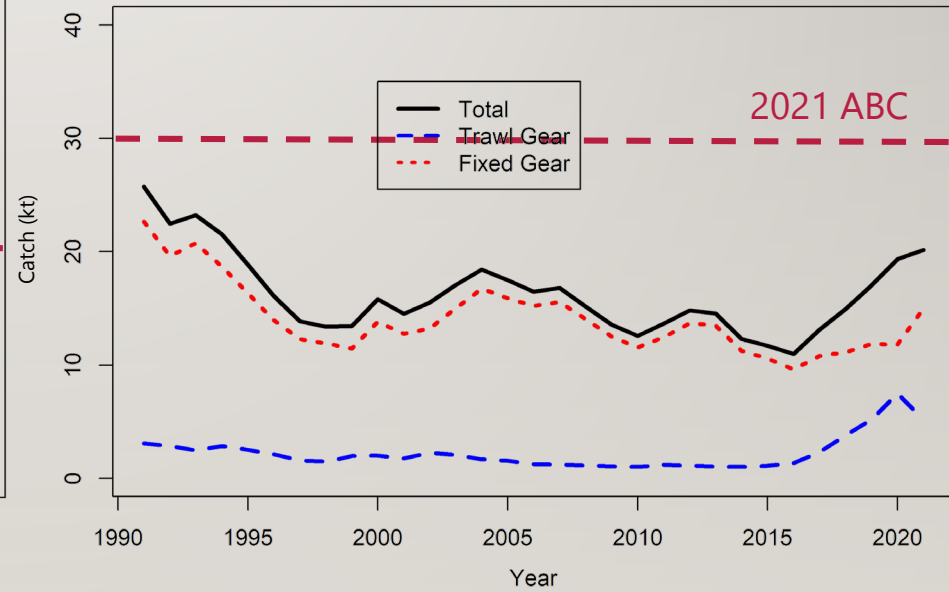
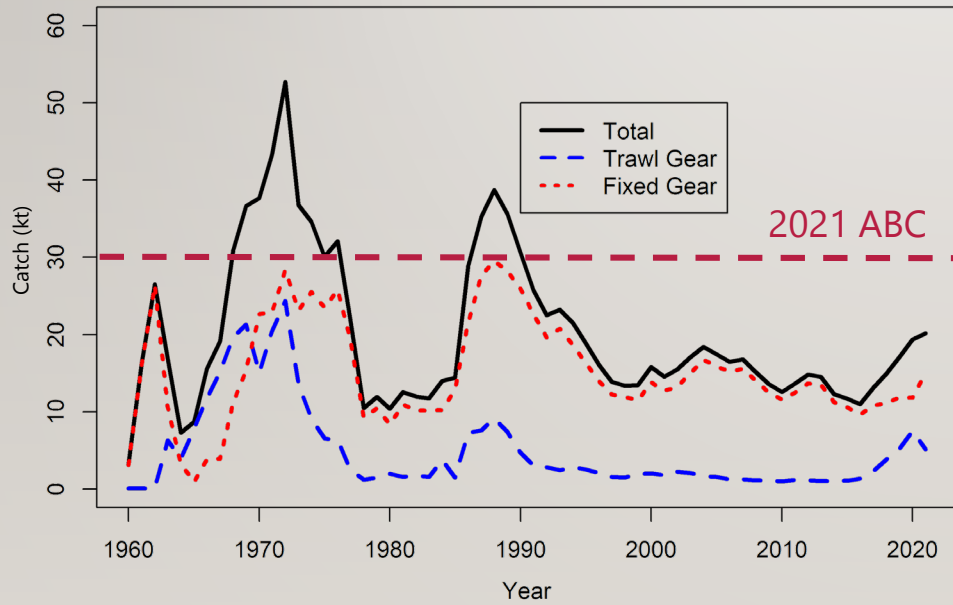
- Summary:
 - Survey time blocks have biggest impact
 - Catchability changes scaling, selectivity impacts recent recruitment
 - Fishery catchability allows better fit to CPUE data, while causing minor population rescaling
 - Fishery selectivity reduces recruitment, but does not resolve retrospective patterns

14 PT & SSC CONCERNS — WEIGHT BLOCKS & SKIPPED SPAWNING

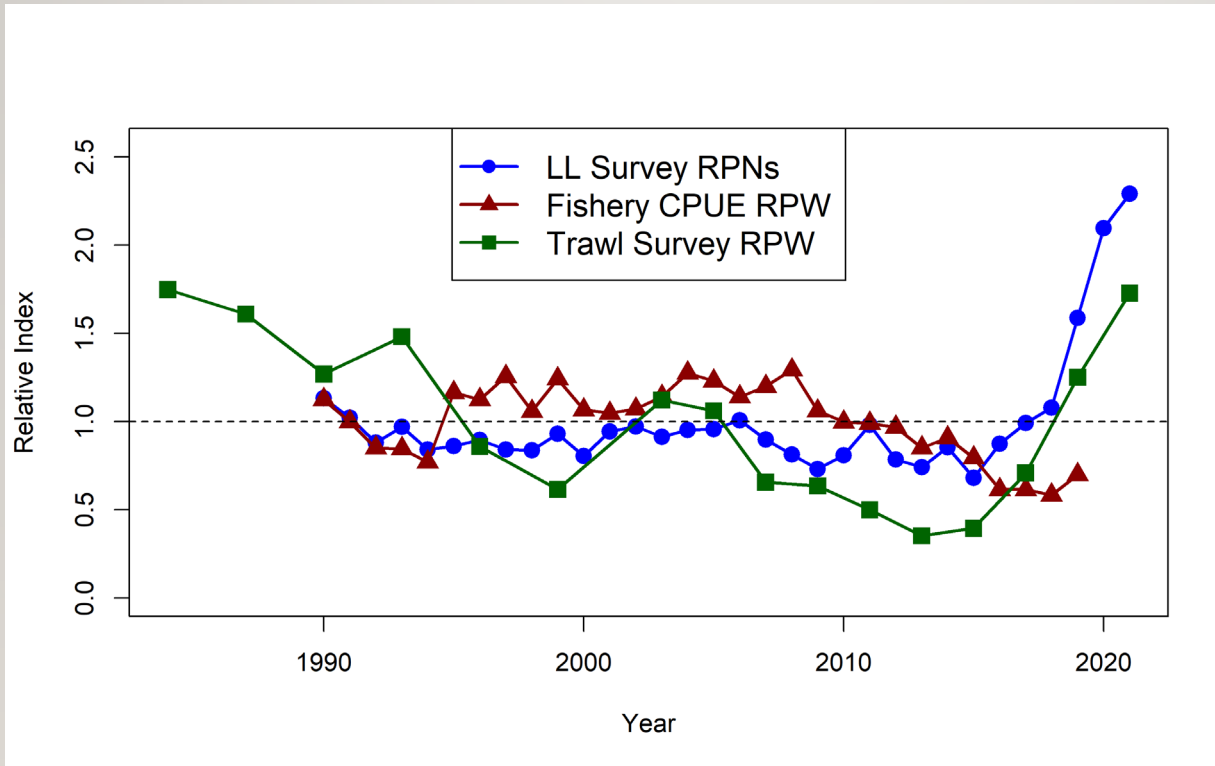
- Historic weight-at-age not realistic
- Skipped spawning has limited impact until recent years (due to young fish), but high uncertainty



15 DATA: CATCH



16 DATA: INDICES IN THE MODEL



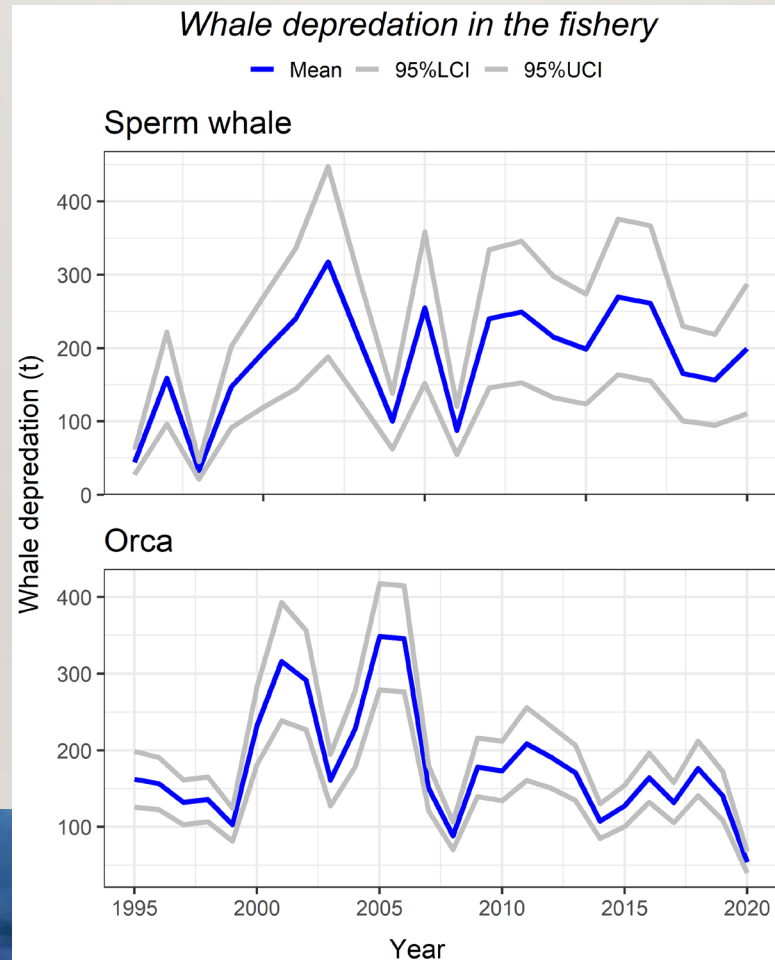
10% Increase

40% Increase

10% Increase
(in 2019; no 2020 data)

17 DATA: WHALE DEPREDATION

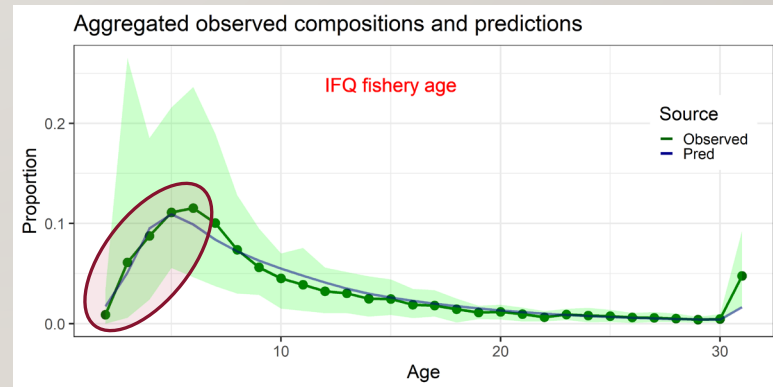
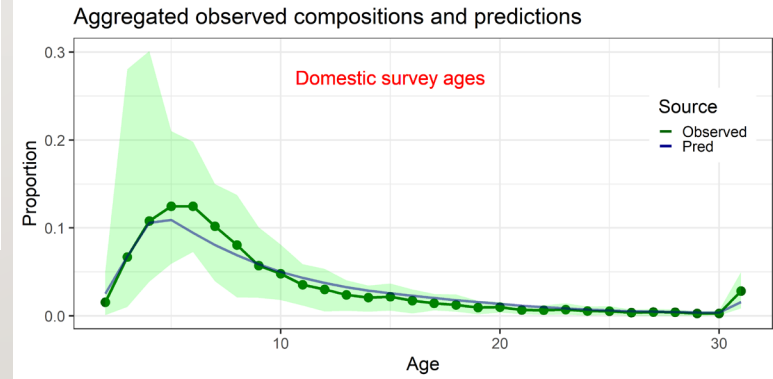
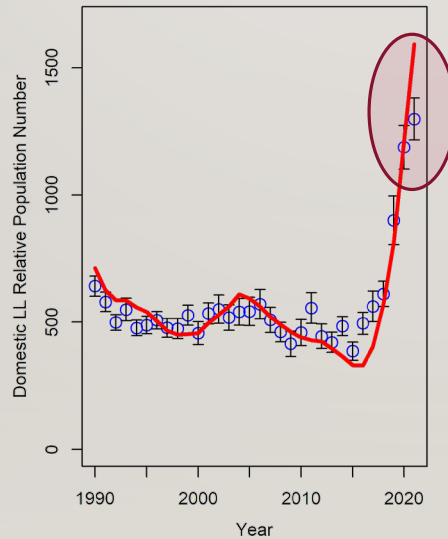
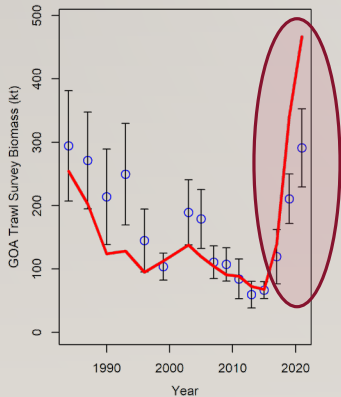
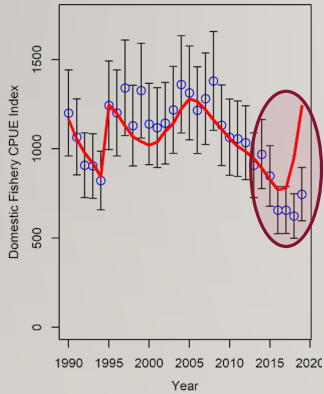
We are now getting whale observations in logbooks! But not yet incorporated due to short time series.



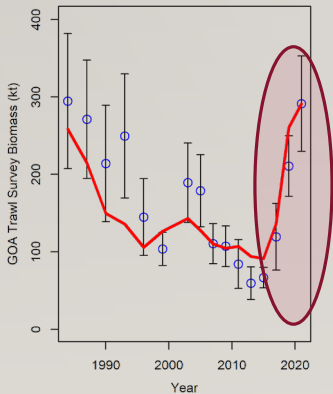
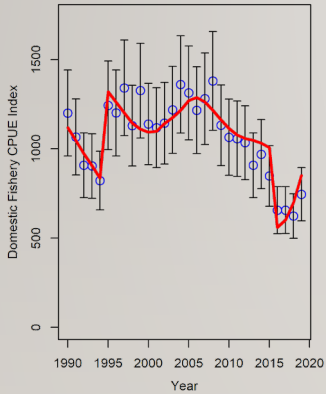
Depredation directly accounted for in assessment and projections.

18 MODEL 16.5: POOR FIT TO INDICES

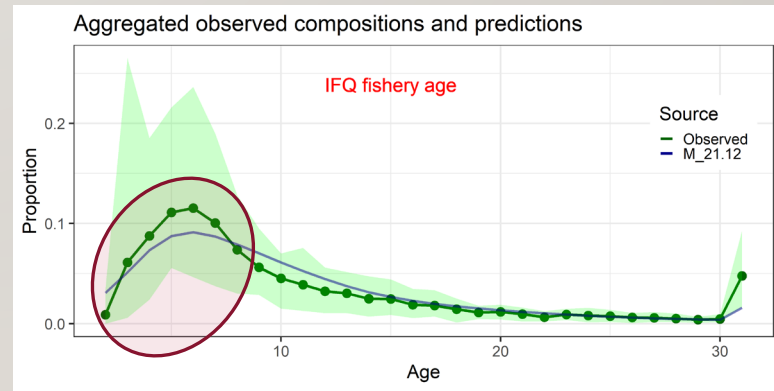
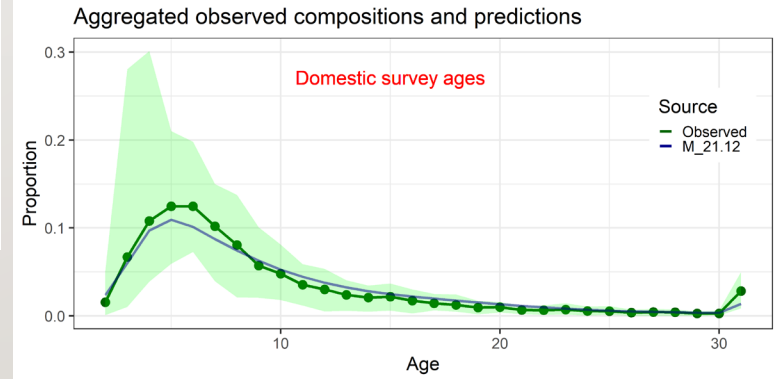
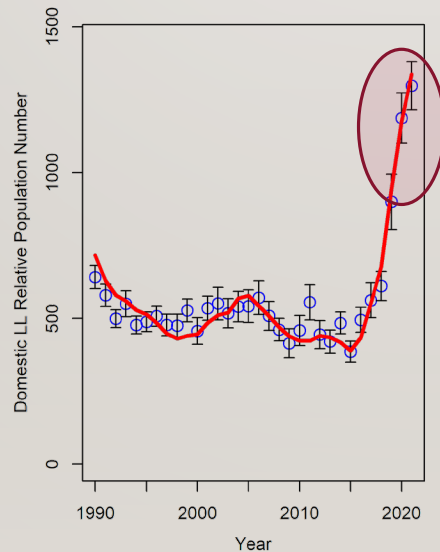
Extreme year class strength informed by compositional data, which leads to overpredicting population growth from indices.



19 MODEL 21.12: WHO DO YOU TRUST?

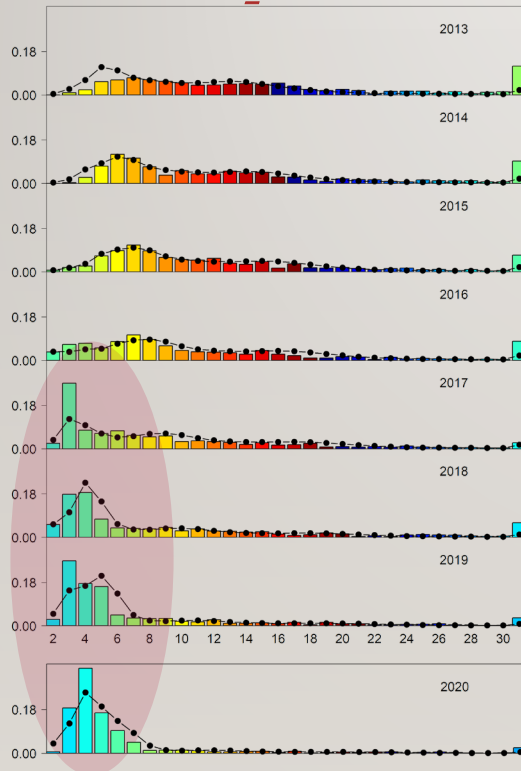


New parametrization with Francis reweighting better fits indices, but at cost of fitting age compositions.

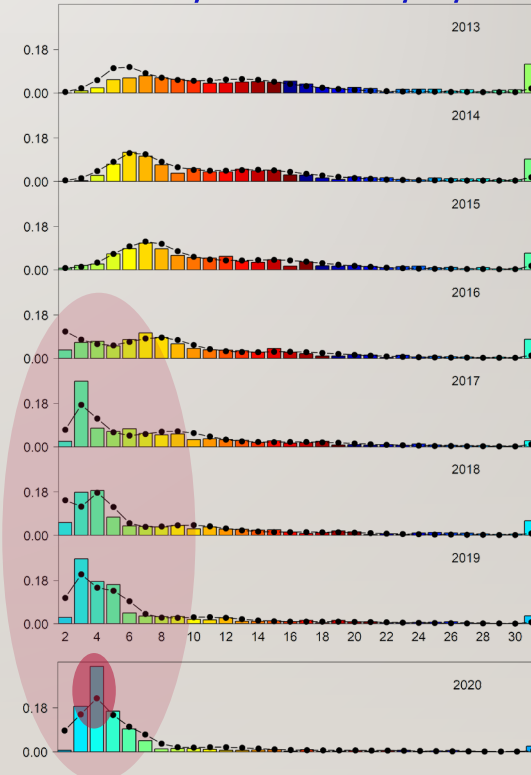


20 FIT TO FIXED GEAR FISHERY AGES

16.5_Cont



21.12_Proposed_No_Skip_Spawn



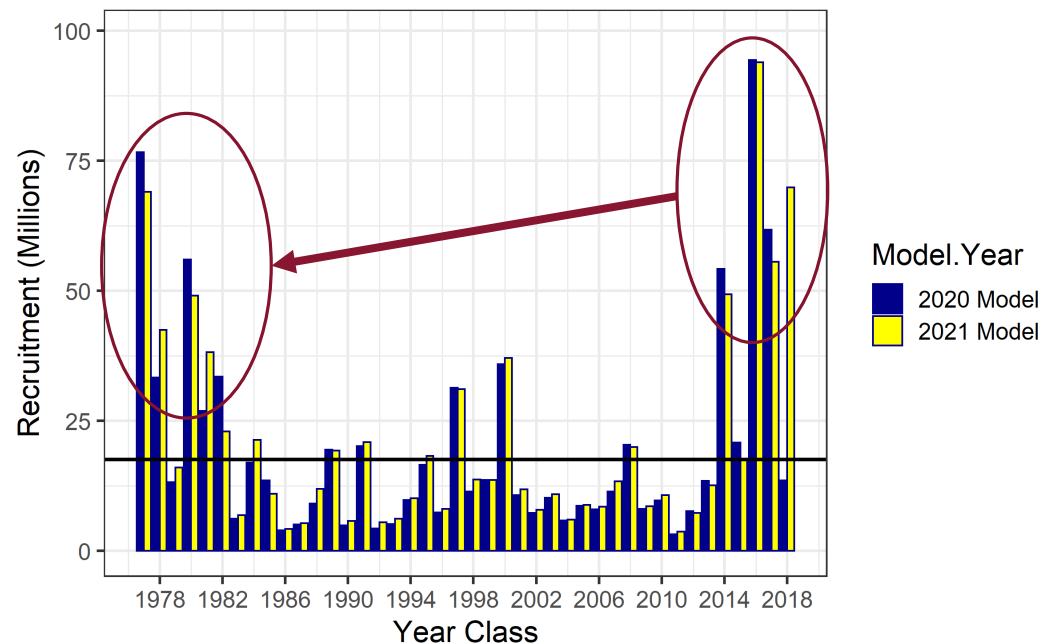
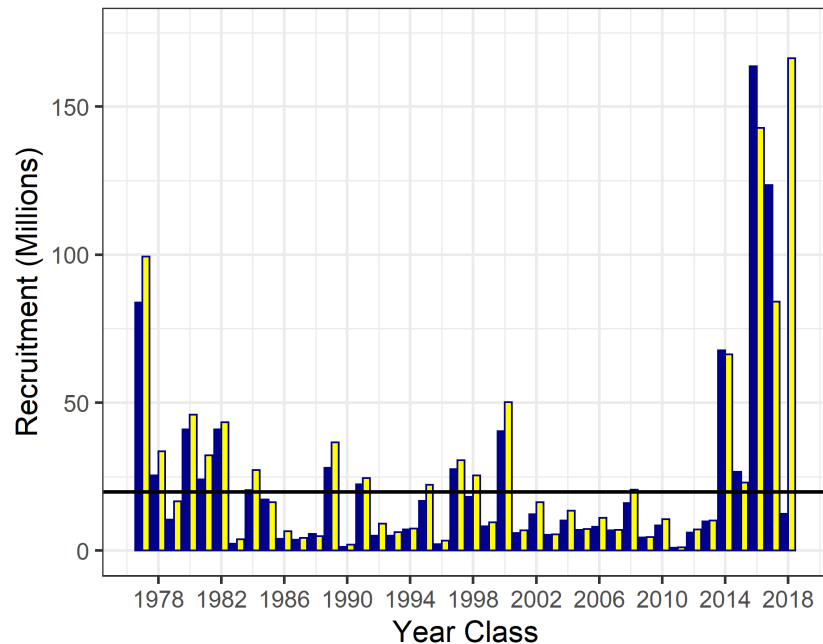
Overestimating cohort sizes as they age in fishery.

Overestimation of age-2 abundance. Good fit to cohort decay in fishery.

21 RECRUITMENT

16.5_Cont

21.12_Proposed_No_Skip_Spawn



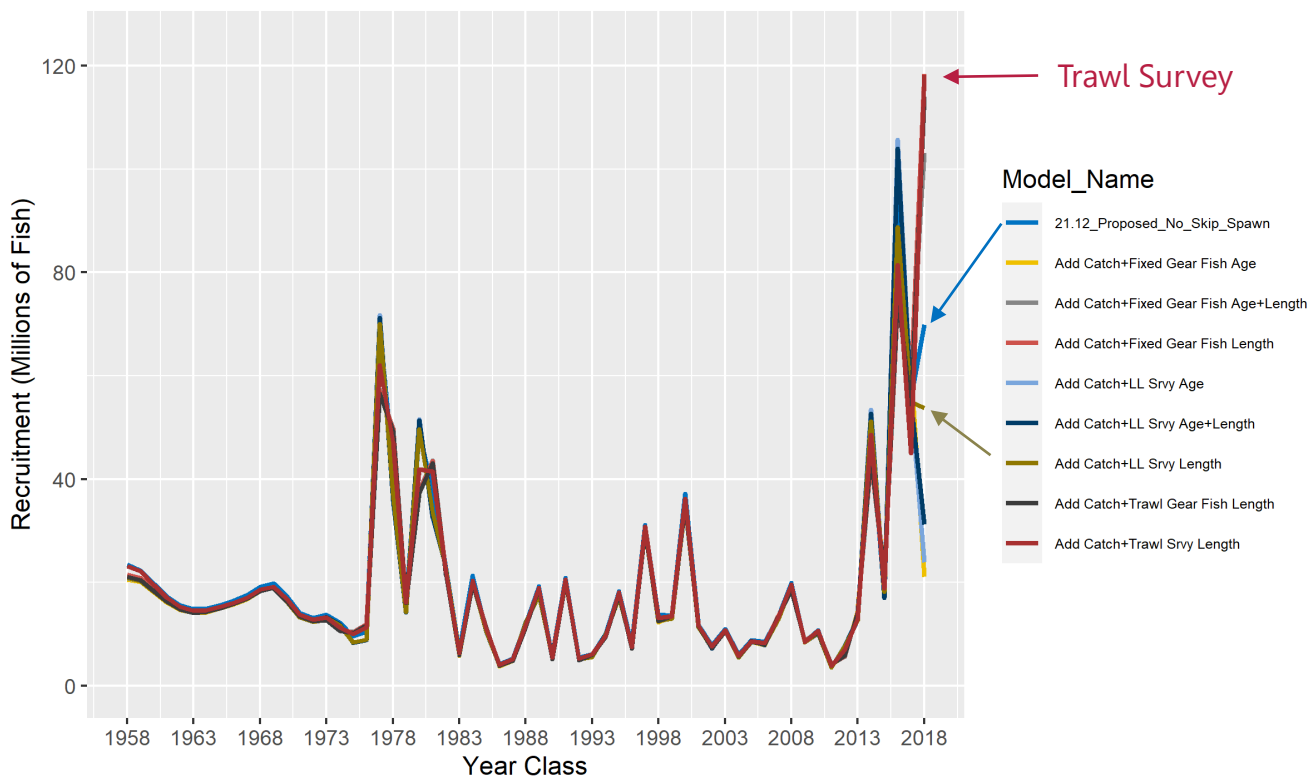
Blue bars are the given model run with the 2020 SAFE data. Yellow bars are the given model run with the 2021 SAFE data.

Notice rescaling of recruitment magnitude between models.

Current recruitment appears to reflect similar pattern as late 1970s recruitment.

22 2018 RECRUITMENT UNCERTAINTY

Recruitment (Millions of Fish) Comparison

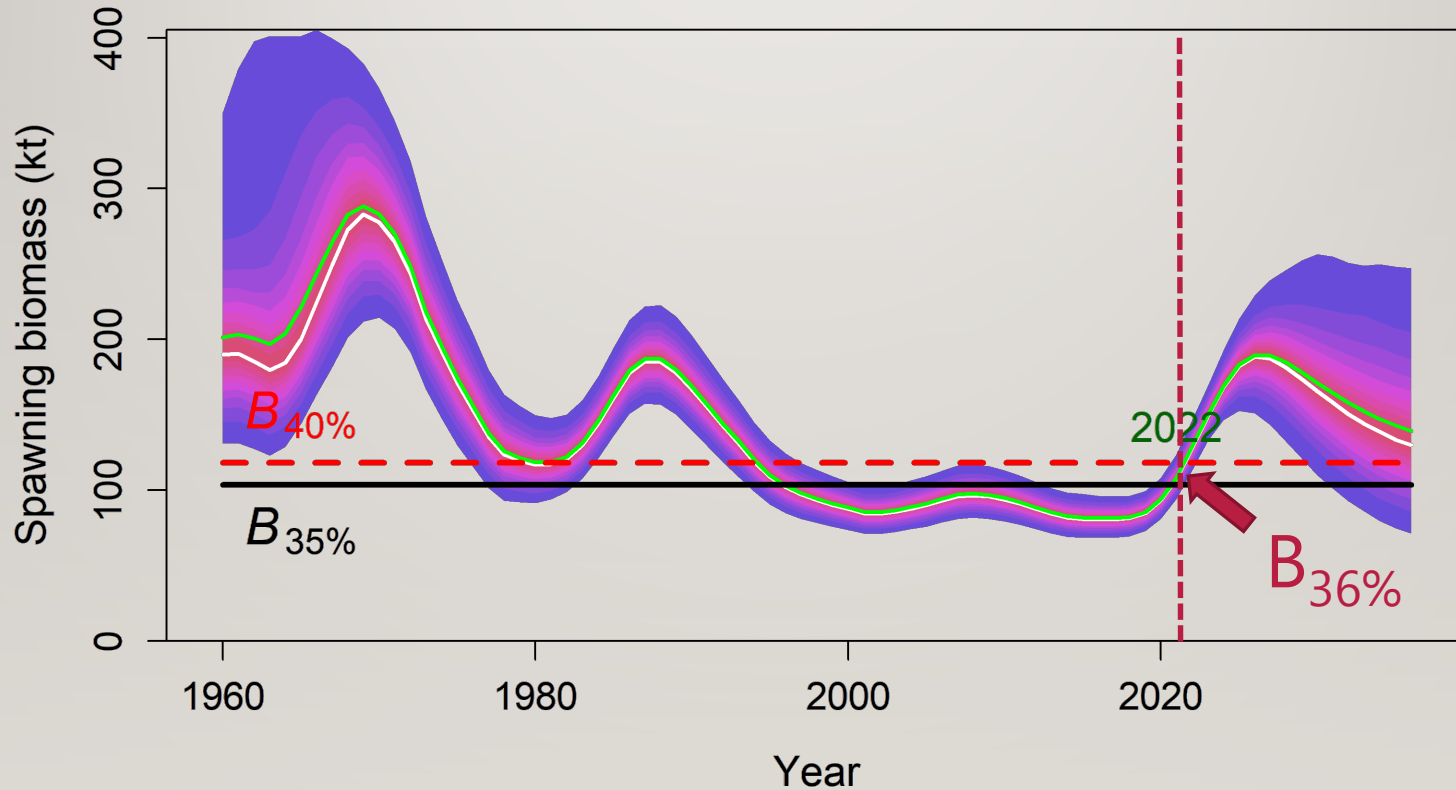


2018 recruitment based primarily on 2021 trawl survey.

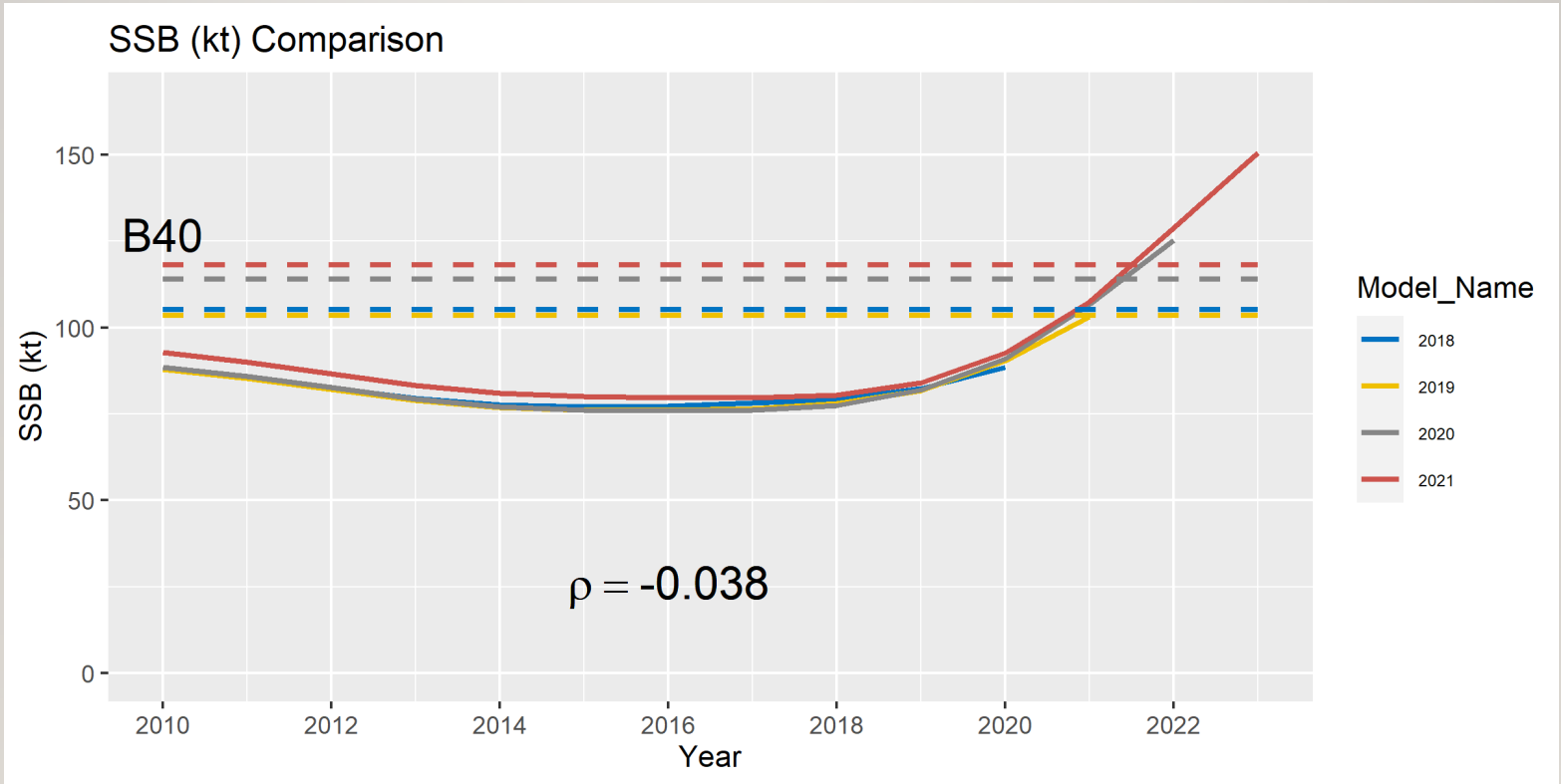
LL survey lengths suggest more moderate year class size.

23

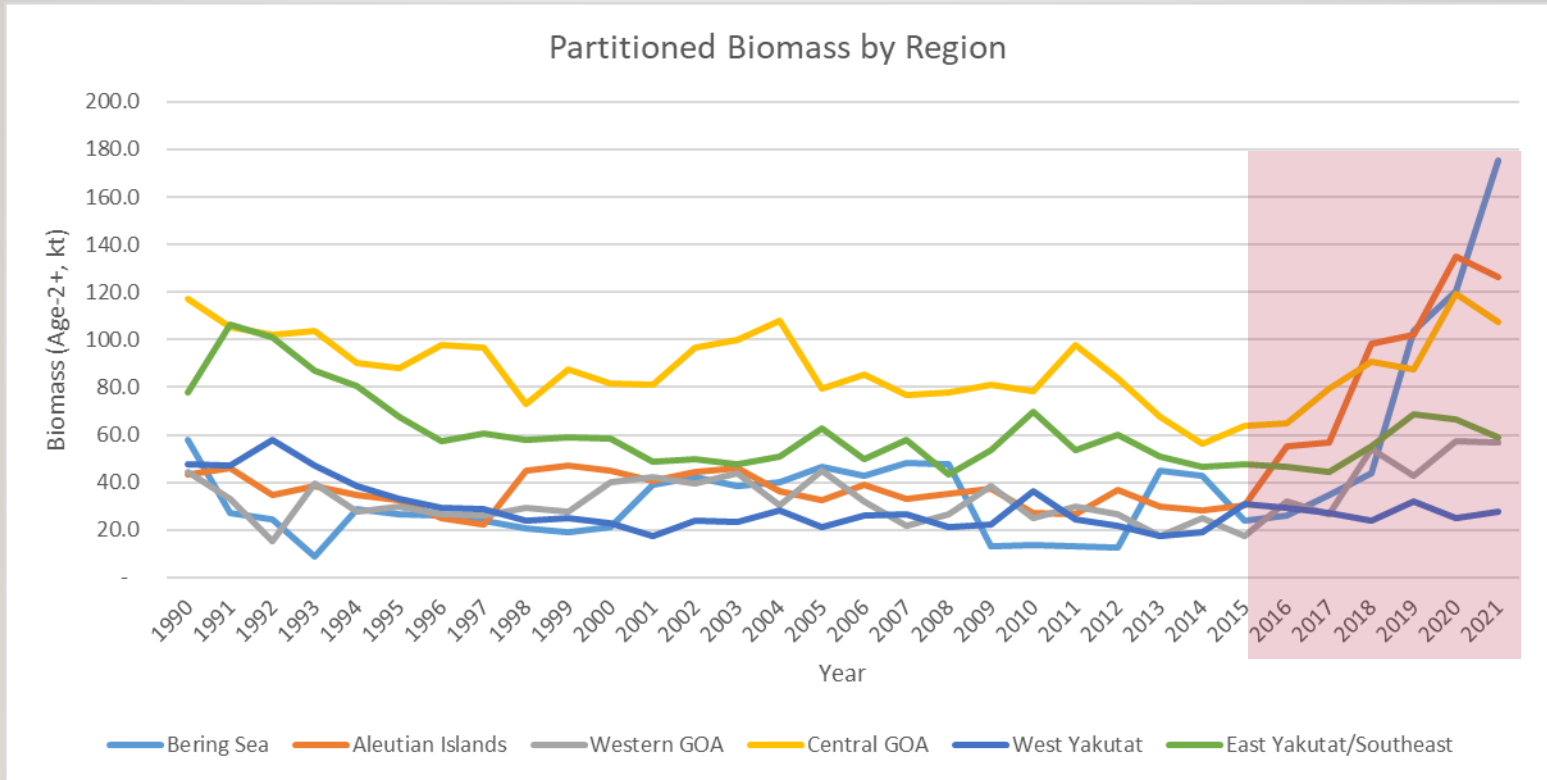
SPAWNING BIOMASS INCREASING



25 PROJECTION CONSISTENCY



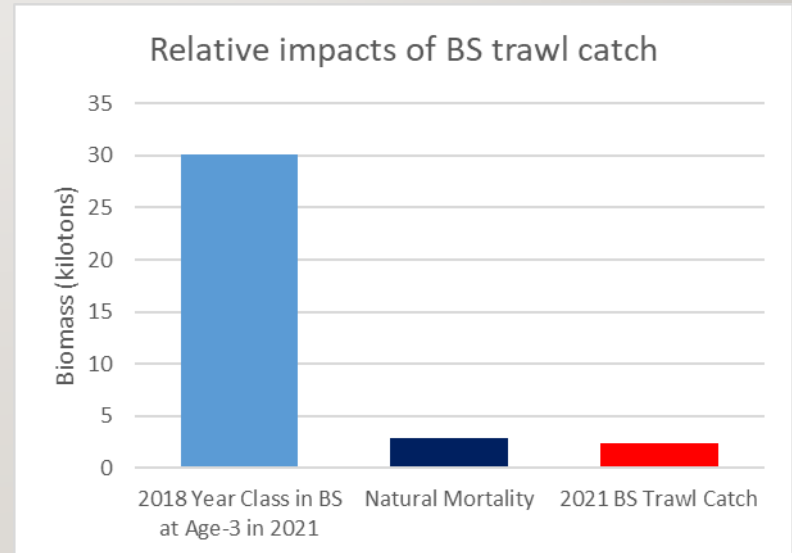
26 APPROXIMATE DISTRIBUTION



27 EBS TRAWL REMOVALS

Year	Non-pelagic	Pelagic	Total
2010	29	1	30
2011	44	0	44
2012	93	0	93
2013	133	0	133
2014	34	0	34
2015	17	0	17
2016	239	18	257
2017	588	91	679
2018	623	395	1,018
2019	1,283	1,223	2,506
2020	1,071	3,397	4,468
2021	1,248	1,076	2,324

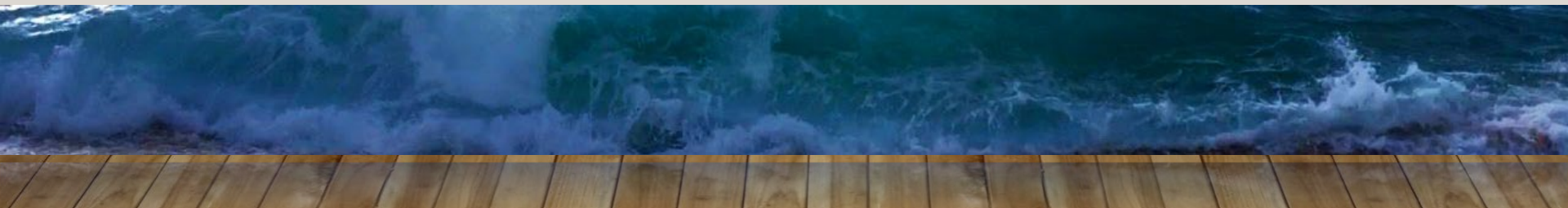
BS trawl catch decreased in 2021 along with % of catch coming from the trawl fleet.



Trawl removals in BS represent a small proportion of the total biomass for the most recent cohort estimated in the model (2018; assuming 32% of biomass is in the BS, based on LL survey proportions).

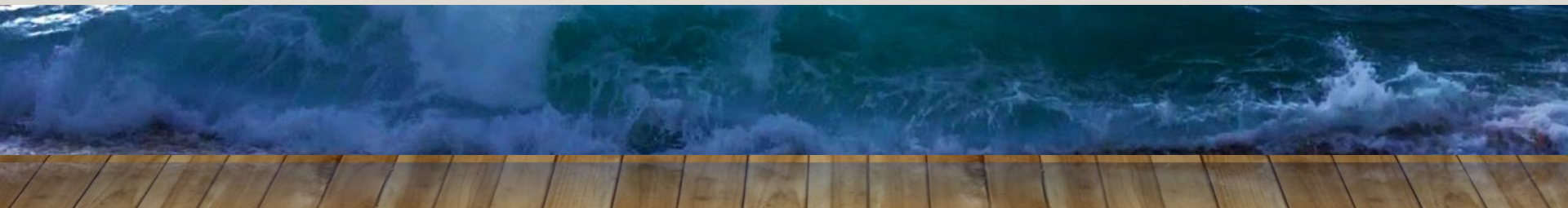
28 ASSESSMENT SUMMARY

- Model tension when fitting indices and compositional data
 - Model 16.5 is overfitting variability in compositional data
 - Likely suffering from process error (overestimating cohort abundance or overestimating recruitment?)
 - Model 21.12 emphasizes indices over compositions (due to reweighting)
 - Assumes a change in availability/selectivity, which leads to smaller estimates of initial year class sizes and better fit to cohort decay in age data
- Recent year classes are large, but may not be unprecedented
- SSB increasing rapidly and should be above *B40%* in 2022
- F is decreasing and well below M
- Reduced retrospective patterns from model 21.12



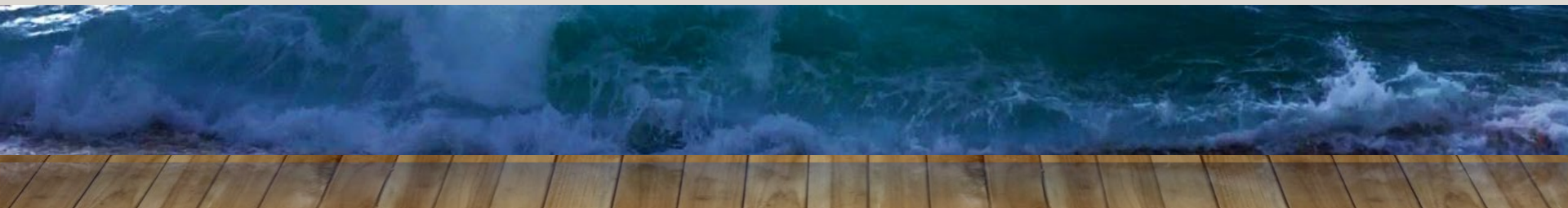
29 FUTURE CONSIDERATIONS

- Logbook data availability is uncertain, which is a key component of the CPUE index
- Uncertainty in biological sampling as EM coverage replaces observer coverage
- Updated whale depredation coefficients in 2022 (M. Williams)
- Refined CPUE index that accounts for pot gear transition
 - Masters student at UAF has begun work
- Explore time-varying/non-parametric selectivity
- Explore time- or age-varying natural mortality and develop parsimonious parametrizations
- Further refine spatial modeling efforts
 - Post-doc in process of being hired to develop tag-integrated spatial model
- Develop 'desktop' MSE to test robustness of NPFMC HCR to spasmodic recruitment dynamics of sablefish
 - Post-doc being sought to develop MSE tool



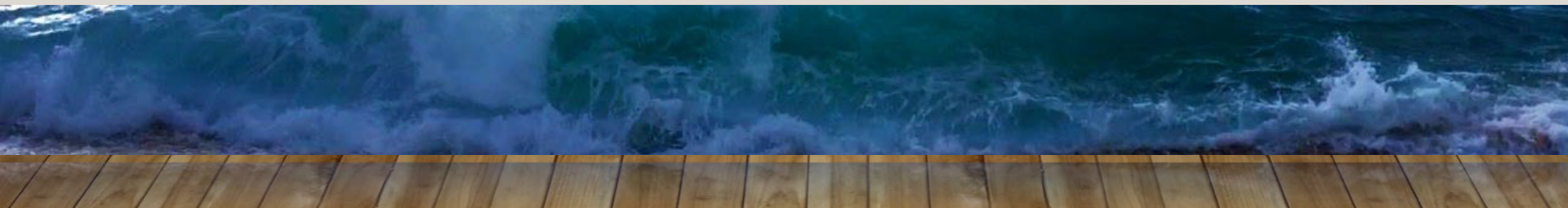
30 RISK TABLE

- Assessment model: 1 -- Normal
 - No data issues, retrospective patterns eliminated
- Population dynamics: 2 -- Increased Concern
 - Contracted age structure, rapid change in abundance
- Ecosystem: 1 -- Normal
 - Neutral to positive indicators, reduced competition
- Fishery Performance: 2 -- Increased Concern
 - Rapid transition to pot gear, potential changes in targeting
- **No recommended reduction in Max ABC**

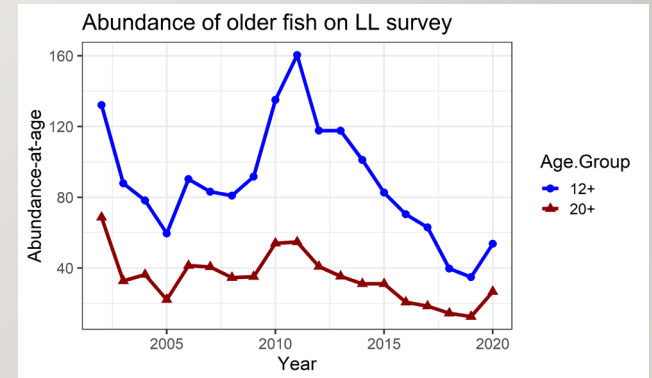
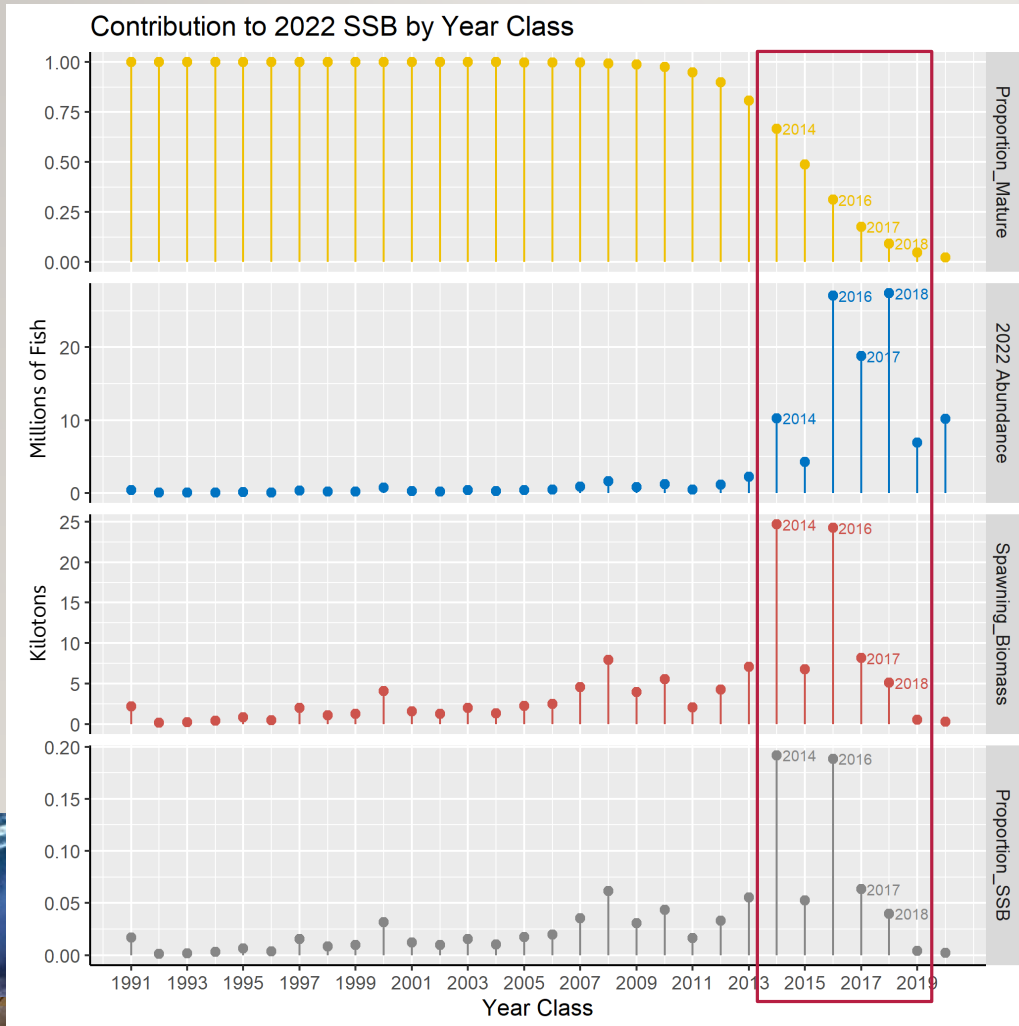


31 BOTTOM LINE

- New model, same upward trends
- More consistent recruitment estimation allows use of max ABC projections
- 2022 Author's ABC = Max ABC = 34,521 t
 - **+18% from 2021 ABC**
 - Would represent an ~tripling of quota since 2016 (11,795 t)
- **Apportionment based on 5-year average survey biomass proportions and year 2 (50%) of SSC 4-year stair step**



32 IMMATURE SABLEFISH

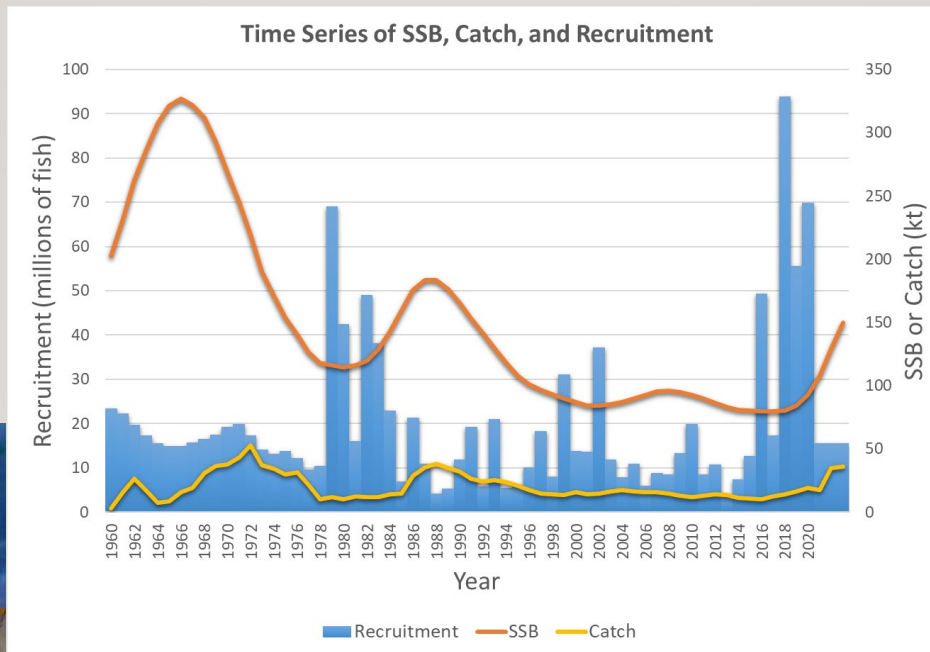


SSB relies heavily on these recent year classes (> 50% of SSB), which are not fully mature.

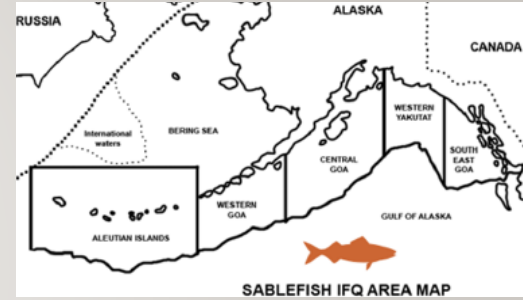


33 FOOD FOR THOUGHT

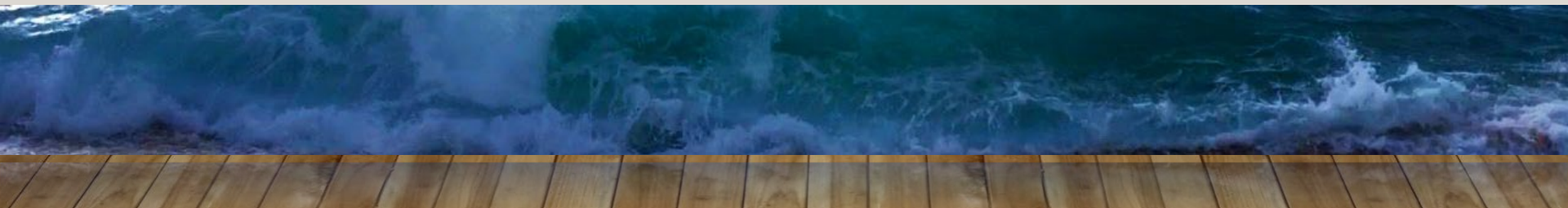
- ABC would be highest catch since late 1980s and early 1970s
 - Both periods were associated with subsequent, protracted population declines
- IF recruitment reverts back to a low productivity regime, high catches could lead to faster than projected population declines
- Capped management procedures and/or alternate SSB metrics could help rebuild age structure and improve population resilience



34 APPORTIONMENT



- 5-year average of regional survey biomass proportions
 - Addresses biological concerns (avoids localized depletion)
 - This is **NOT** a static apportionment, the proportions will change yearly based on changing distributions and updated survey biomass
 - High BS longline survey catch in 2021 (~32% of LL survey biomass) resulted in increased apportionment to BS region
- Continuation of the SSC 4-year stair step approach
 - 50% step in 2022 (but SSC decision)



35 WHALE ADJUSTED AUTHOR ABC

- Assumes 5-year average of regional survey biomass proportions
- 50% step from 2020 Fixed apportionment to 2021 5-year survey average apportionment

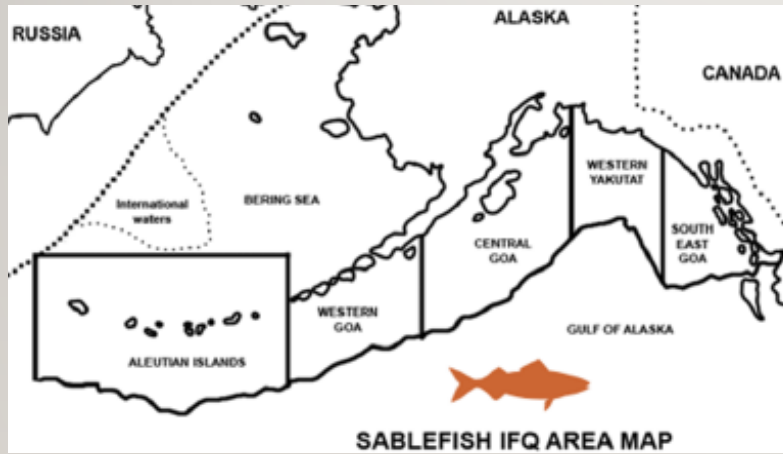
Year	2021				2022*		2023*	
Region	OFL _w	ABC _w	TAC	Catch**	OFL _w	ABC _w ***	OFL _w	ABC _w ***
BS	--	3,396	3,396	3,667	--	5,264	--	6,529
AI	--	4,717	4,717	1,359	--	6,463	--	7,786
GOA	--	21,475	17,992	12,919	--	22,794	--	22,003
WGOA	--	3,224	2,428	1,609	--	3,727	--	3,951
CGOA	--	9,527	8,056	5,868	--	9,965	--	9,495
***WYAK	--	3,451	2,929	2,156	--	3,437	--	3,159
***EY/SEO	--	5,273	4,579	3,286	--	5,665	--	5,398
Total	60,426	29,588	26,105	17,945	40,432	34,521	42,520	36,318

*Based on model *21.12_Proposed_No_Skip_Spawn* and assuming a 50% stair step from fixed apportionment towards author recommended 5-year average survey apportionment.

**As of October 28, 2021 Alaska Fisheries Information Network, (www.akfin.org).

***After 95:5 trawl split and after whale depredation adjustments.

36 QUESTIONS?



37 SUMMARY TABLE

Quantity/Status	As estimated or specified <i>last</i> year for (model 16.5):		As estimated or recommended <i>this</i> year for (model 21.12):	
	2021*	2022*	2022*	2023*
<i>M</i> (natural mortality rate)	0.098	0.098	0.100	0.100
Tier	3a	3a	3a	3a
Projected total (age 2+) biomass (t)	753,110	789,584	574,599	582,536
Projected female spawning biomass (t)	134,401	191,503	128,789	153,820
<i>B</i> _{100%}	317,096	317,096	295,351	295,351
<i>B</i> _{40%}	126,389	126,839	118,140	118,140
<i>B</i> _{35%}	110,984	110,984	103,373	103,373
<i>F</i> _{OFL}	0.117	0.117	0.094	0.094
<i>maxF</i> _{ABC}	0.100	0.100	0.080	0.080
<i>F</i> _{ABC}	0.042	0.048	0.080	0.080
OFL (t)	61,319	71,756	40,839	42,948
OFL_w (t)**	60,426	70,710	40,432	42,520
max ABC (t)	52,427	61,393	34,863	36,670
ABC (t)	22,551	29,723	34,863	36,670
ABC_w (t)**	22,237	29,309	34,521	36,318
Status	As determined <i>last</i> year for:		As determined <i>this</i> year for:	
	2019	2020	2020	2021
Overfishing	No	n/a	No	n/a
Overfished	n/a	No	n/a	No
Approaching overfished	n/a	No	n/a	No

*2020 projections for biomass and SSB were based on approximate estimated catches of 21,100 t and 23,600 t (based on the ratio of estimated catch to max ABC in 2020) used in place of maximum permissible ABC for 2021 and 2022. The same approach was utilized for the 2021 projections with specified catches of 23,700 t in 2022 and 24,400 t in 2023 (a yield ratio of 0.68 was assumed based on a 2021 estimated catch of 20,120 t and an ABC of 29,588 t). Similarly, the 2023 ABC is based on removals equivalent to the 2022 specified catch. This was done in response to management requests for a more accurate two-year projection. SSB and biomass are slightly less than presented when the full ABC is removed.

**ABC_w and OFL_w are the final author recommended ABCs and OFLs after accounting for whale depredation. They are also based on a 50% stair step from fixed apportionment towards author recommended 5-year average survey apportionment in 2022 and a 75% stair step in 2023 (i.e., following SSC recommendations from 2020).

38 APPORTIONMENT OPTIONS

Method	Area						
	AI	BS	WG	CG	WY*	EY*	ABC
2021 ABC ⁺	4,727	3,420	3,253	9,644	3,471	5,326	29,841
Status Quo (Fixed at Current)**	5,558	4,001	3,799	11,226	4,066	6,213	34,863
2020 5-year Survey Avg. Fixed***	8,231	5,742	4,296	8,945	2,990	4,660	34,863
25% Stair Step	5,543	4,353	3,791	10,950	3,590	6,635	34,863
50% Stair Step****	6,486	5,305	3,821	10,008	3,179	6,064	34,863
75% Stair Step	7,428	6,256	3,852	9,066	2,768	5,493	34,863
5-year Survey Avg. [^]	8,371	7,207	3,882	8,124	2,357	4,922	34,863
50% Stair Step from 2021 [#]	6,964	5,604	3,840	9,675	3,212	5,568	34,863

⁺This is the final 2021 ABC and associated regionally apportioned ABCs based on the 2020 SAFE. Other approaches utilize the 2022 ABC.

*Before 95:5 hook and line : trawl split shown below.

**Apportionment fixed (i.e., status quo) at the 2020 SSC recommended apportionment that used a 25% stair step from fixed apportionment to the 2020 5-year survey average apportionment.

*** Fixed at the 2013 assessment apportionment proportions (Hanselman et al. 2012b).

**** A 50% stair step from fixed apportionment to the 2021 5-year survey average apportionment. This represents the next incremental step in the 2020 SSC recommended 4-year stair step approach.

[^]The 5-year survey average is the biologically recommended long-term apportionment strategy. This approach does not utilize a stair step (i.e., it represents a 100% step).

[#]The 50% stair step from the 2020 SAFE apportionment values to the 2021 5-year survey average apportionment is an alternative to a 50% stair step from the fixed apportionment.

39 APPORTIONMENT % CHANGE FROM 2021

Method	Area						
	AI	BS	WG	CG	WY*	EY*	ABC
2021 ABC ⁺	4,727	3,420	3,253	9,644	3,471	5,326	29,841
Status Quo (Fixed at Current)	18%	17%	17%	16%	17%	17%	17%
2020 5-year Survey Avg.	74%	68%	32%	-7%	-14%	-13%	17%
Fixed	-3%	-1%	16%	23%	15%	35%	17%
25% Stair Step	17%	27%	17%	14%	3%	25%	17%
50% Stair Step	37%	55%	17%	4%	-8%	14%	17%
75% Stair Step	57%	83%	18%	-6%	-20%	3%	17%
5-year Survey Avg.	77%	111%	19%	-16%	-32%	-8%	17%
50% Stair Step from 2021	47%	64%	18%	0%	-7%	5%	17%

⁺This is the final 2021 ABC and associated regionally apportioned ABCs based on the 2020 SAFE. Other approaches utilize the 2022 ABC.

*Before 95:5 hook and line : trawl split shown below.

**Apportionment fixed (i.e., status quo) at the 2020 SSC recommended apportionment that used a 25% stair step from fixed apportionment to the 2020 5-year survey average apportionment.

*** Fixed at the 2013 assessment apportionment proportions (Hanselman et al. 2012b).

**** A 50% stair step from fixed apportionment to the 2021 5-year survey average apportionment. This represents the next incremental step in the 2020 SSC recommended 4-year stair step approach.

^The 5-year survey average is the biologically recommended long-term apportionment strategy. This approach does not utilize a stair step (i.e., it represents a 100% step).

#The 50% stair step from the 2020 SAFE apportionment values to the 2021 5-year survey average apportionment is an alternative to a 50% stair step from the fixed apportionment.

40 APPORTIONMENT HARVEST RATE

Method	Area						
	AI	BS	WG	CG	WY*	EY*	ABC
Status Quo (Fixed at Current)**	0.03	0.03	0.06	0.10	0.14	0.10	0.06
2020 5-year Survey Avg. Fixed***	0.05	0.04	0.07	0.08	0.10	0.08	0.06
25% Stair Step	0.03	0.03	0.06	0.10	0.12	0.11	0.06
50% Stair Step****	0.04	0.04	0.06	0.09	0.11	0.10	0.06
75% Stair Step	0.04	0.05	0.07	0.08	0.10	0.09	0.06
<i>5-year Survey Avg.</i> ^	<i>0.05</i>	<i>0.05</i>	<i>0.07</i>	<i>0.07</i>	<i>0.08</i>	<i>0.08</i>	<i>0.06</i>
50% Stair Step from 2021#	0.04	0.04	0.06	0.09	0.11	0.09	0.06

+This is the final 2021 ABC and associated regionally apportioned ABCs based on the 2020 SAFE. Other approaches utilize the 2022 ABC.

*Before 95:5 hook and line : trawl split shown below.

**Apportionment fixed (i.e., status quo) at the 2020 SSC recommended apportionment that used a 25% stair step from fixed apportionment to the 2020 5-year survey average apportionment.

*** Fixed at the 2013 assessment apportionment proportions (Hanselman et al. 2012b).

**** A 50% stair step from fixed apportionment to the 2021 5-year survey average apportionment. This represents the next incremental step in the 2020 SSC recommended 4-year stair step approach.

^The 5-year survey average is the biologically recommended long-term apportionment strategy. This approach does not utilize a stair step (i.e., it represents a 100% step).

#The 50% stair step from the 2020 SAFE apportionment values to the 2021 5-year survey average apportionment is an alternative to a 50% stair step from the fixed apportionment.

LL SURVEY BIOMASS PROPORTIONS BY REGION

Year	BS	AI	WG	CG	WY	EY
1990	0.15	0.11	0.11	0.30	0.12	0.20
1991	0.07	0.13	0.09	0.29	0.13	0.29
1992	0.07	0.10	0.05	0.31	0.17	0.30
1993	0.03	0.12	0.12	0.32	0.14	0.27
1994	0.10	0.12	0.09	0.30	0.13	0.27
1995	0.10	0.12	0.11	0.32	0.12	0.24
1996	0.10	0.09	0.10	0.37	0.11	0.22
1997	0.09	0.09	0.10	0.37	0.11	0.23
1998	0.08	0.18	0.12	0.29	0.10	0.23
1999	0.07	0.18	0.10	0.33	0.09	0.22
2000	0.08	0.17	0.15	0.30	0.08	0.22
2001	0.14	0.15	0.16	0.30	0.06	0.18
2002	0.14	0.15	0.13	0.33	0.08	0.17
2003	0.13	0.15	0.15	0.33	0.08	0.16
2004	0.14	0.12	0.10	0.37	0.10	0.17
2005	0.16	0.11	0.16	0.28	0.07	0.22
2006	0.16	0.14	0.12	0.31	0.09	0.18
2007	0.18	0.12	0.08	0.29	0.10	0.22
2008	0.19	0.14	0.11	0.31	0.08	0.17
2009	0.05	0.15	0.16	0.33	0.09	0.22
2010	0.05	0.11	0.10	0.31	0.15	0.28
2011	0.05	0.11	0.12	0.40	0.10	0.22
2012	0.05	0.15	0.11	0.35	0.09	0.25
2013	0.20	0.13	0.08	0.30	0.08	0.22
2014	0.20	0.13	0.11	0.26	0.09	0.21
2015	0.11	0.14	0.08	0.30	0.14	0.22
2016	0.10	0.22	0.13	0.26	0.12	0.18
2017	0.13	0.21	0.10	0.29	0.10	0.17
2018	0.12	0.27	0.15	0.25	0.06	0.15
2019	0.24	0.23	0.10	0.20	0.07	0.16
2020	0.23	0.26	0.11	0.23	0.05	0.13
2021	0.32	0.23	0.10	0.19	0.05	0.11

Note: new
this year for
report card

TRAFFIC LIGHT TABLE

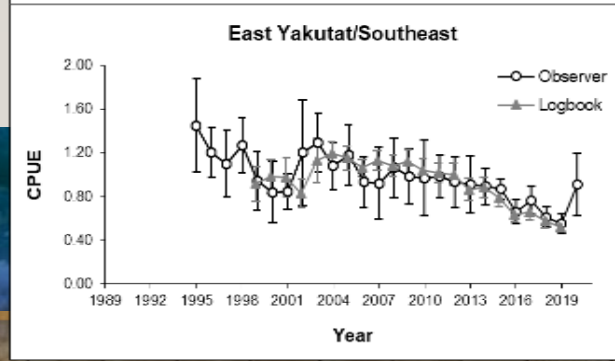
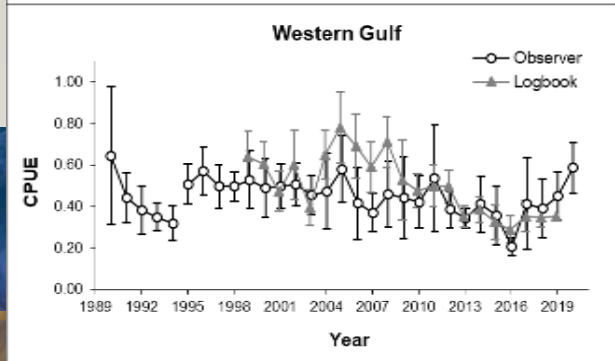
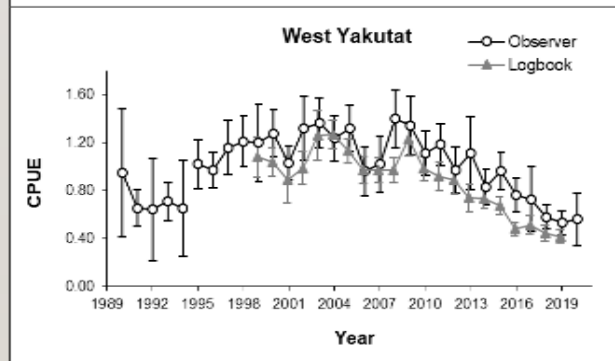
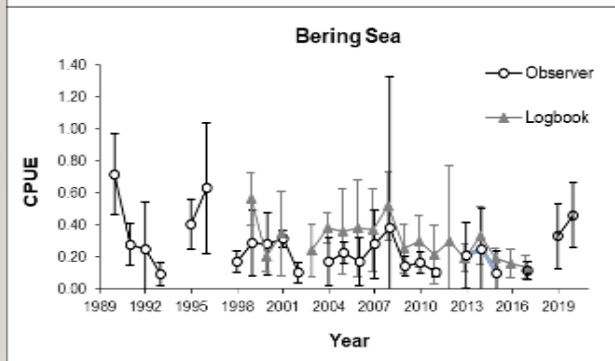
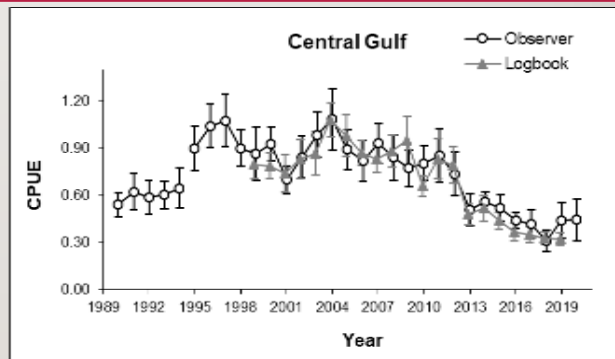
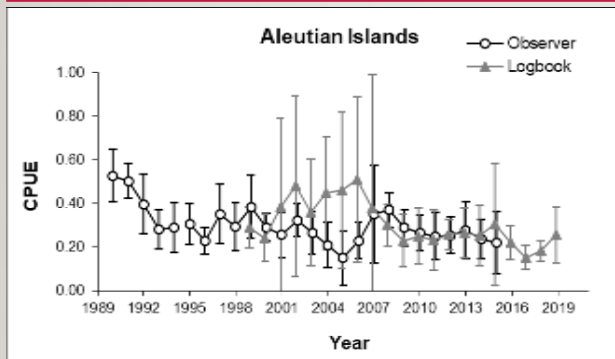
Indicator category	Indicator	2017 Status	2018 Status	2019 Status	2020 Status	2021 Status
Physical	Annual Heatwave GOA Model	neutral	neutral	high	neutral	neutral
	Spring Temperature Surface EGOA Satellite	neutral	neutral	high	neutral	neutral
	Spring Temperature Surface SEBS Satellite	neutral	high	high	high	neutral
	Summer Temperature 250m GOA Survey	neutral	neutral	neutral	neutral	neutral
Lower Trophic	Spring Chlorophyll a Biomass EGOA Satellite	neutral	neutral	neutral	low	neutral
	Spring Chlorophyll a Biomass SEBS Satellite	low	neutral	low	neutral	neutral
	Spring Chlorophyll a Peak EGOA Satellite	neutral	low	neutral	low	neutral
	Spring Chlorophyll a Peak SEBS Satellite	low	high	neutral	neutral	neutral
	Annual Copepod Community Size EGOA Survey	neutral	low	low	neutral	NA
	Annual Copepod Community Size WGOA Survey	neutral	low	high	neutral	NA
	Summer Euphausiid Abundance Kodiak Survey	low	NA	neutral	NA	NA
	Annual Sablefish Growth YOY Middleton Survey	neutral	neutral	high	neutral	neutral
	Summer Sablefish CPUE Juvenile Nearshore GOAAI Survey	neutral	high	high	high	high
	Summer Sablefish Age-1 GOA Survey	high	NA	neutral	NA	neutral
Upper Trophic	Annual Sablefish Mean Age Female Adult Model	neutral	neutral	low	low	NA
	Annual Sablefish Age Evenness Female Adult Model	low	low	low	low	NA
	Summer Sablefish Condition Female Age4 GOA Survey	low	neutral	low	neutral	NA
	Annual Arrowtooth Biomass GOA Model	neutral	neutral	neutral	neutral	NA
	Annual Sablefish Incidental Catch ATF Target GOA Fishery	high	high	high	neutral	neutral
	Summer Sablefish Condition Female Adult GOA Survey	low	neutral	neutral	neutral	neutral

Note: new
this year for
report card

TRAFFIC LIGHT TABLE

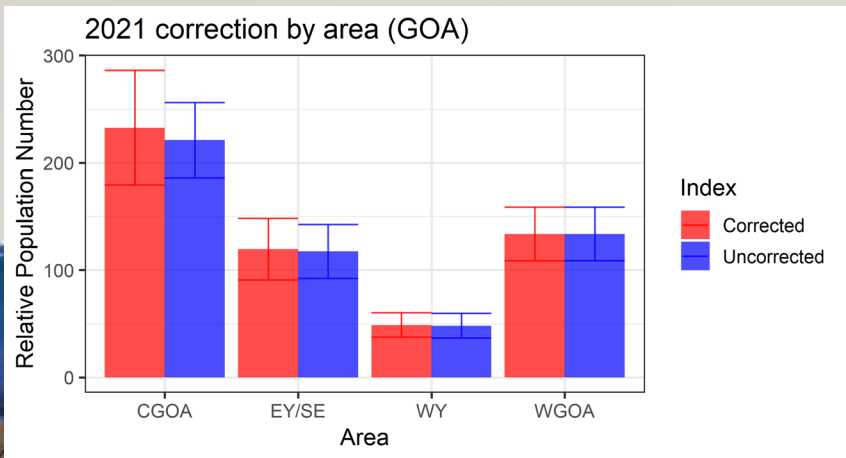
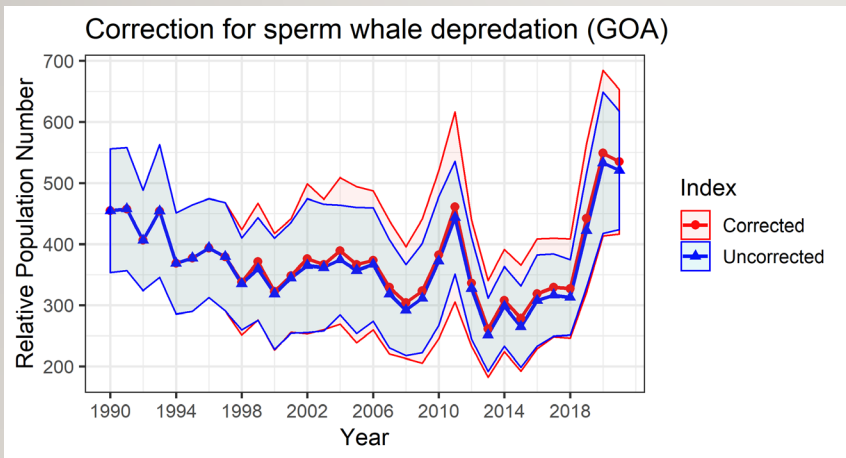
Indicator category	Indicator	2017 Status	2018 Status	2019 Status	2020 Status	2021 Status
Fishery Performance	Annual Sablefish Longline CPUE GOA Fishery	low	low	low	neutral	neutral
	Annual Sablefish Pot CPUE EBS Fishery	neutral	neutral	high	high	high
	Annual Sablefish Incidental Catch GOA Fishery	neutral	high	high	high	low
	Annual Sablefish Incidental Catch BSAI Fishery	neutral	neutral	high	high	high
	Annual Sablefish Condition Female Adult GOA Fishery	neutral	neutral	neutral	high	low
	Annual Sablefish Condition Female Adult BSAI Fishery	NA	NA	NA	NA	NA
Economic	Annual Sablefish Real Exvessel Value Fishery	neutral	neutral	low	low	NA
	Annual Sablefish Real Exvessel Price Fishery	high	neutral	low	low	NA

FISHERY CPUE BY AREA

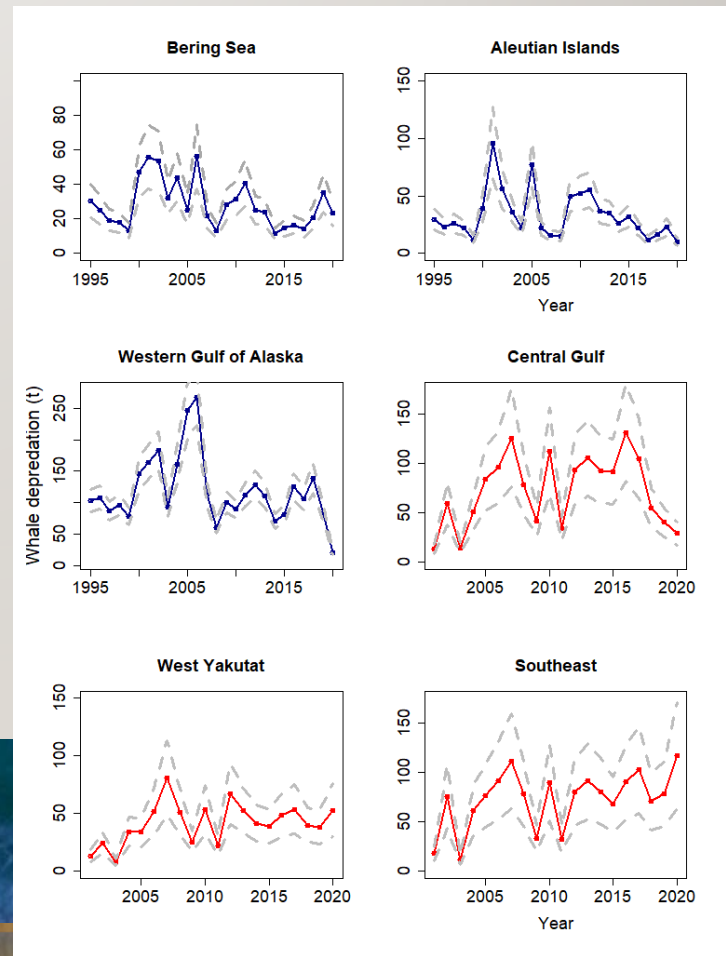


45 WHALE DEPREDEATION

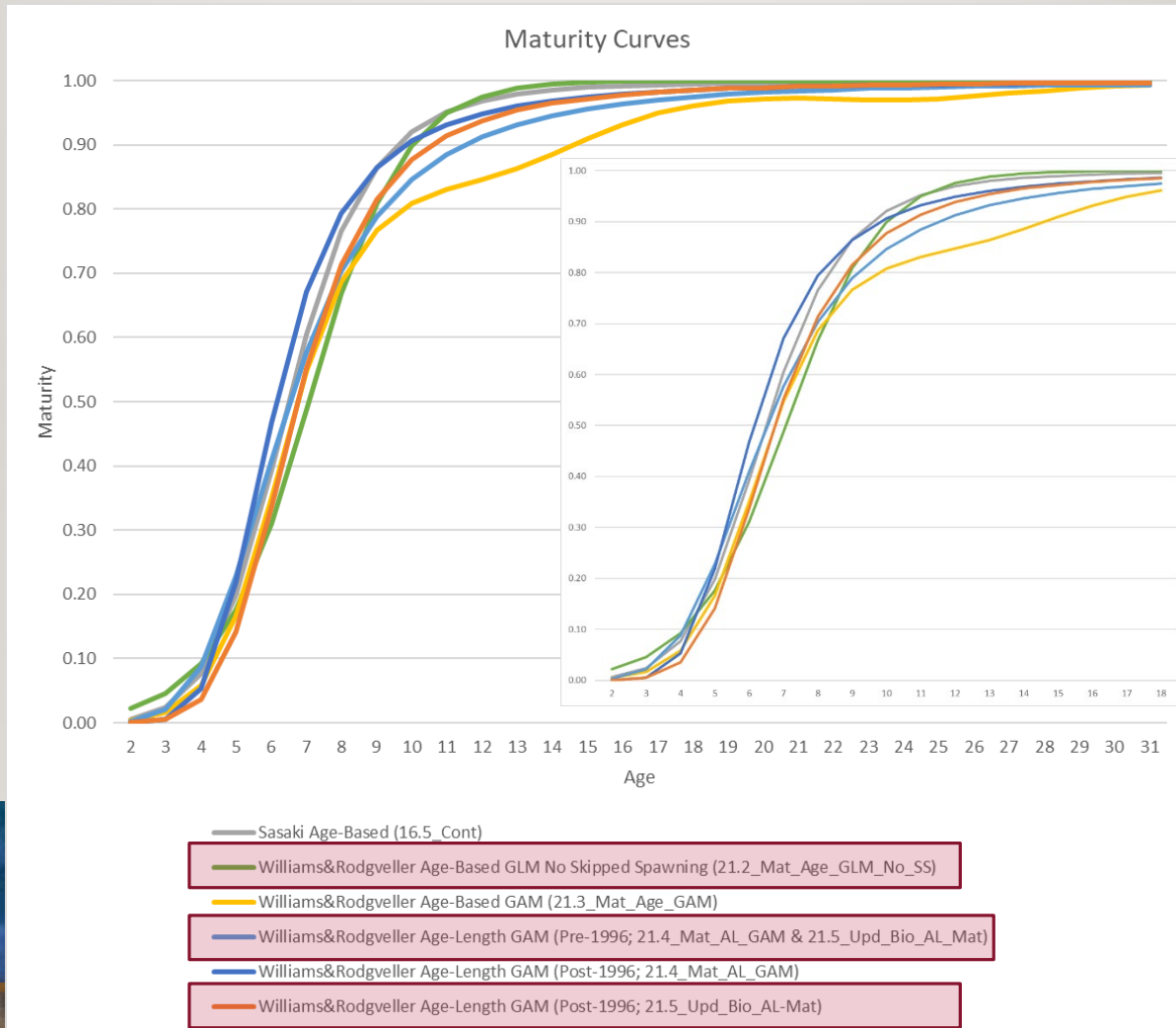
Survey Corrections



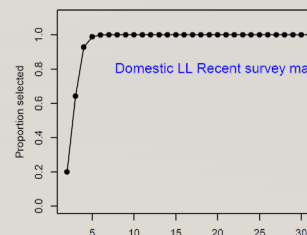
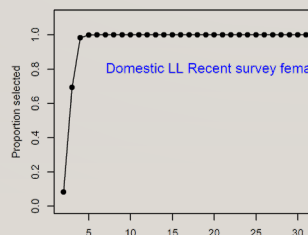
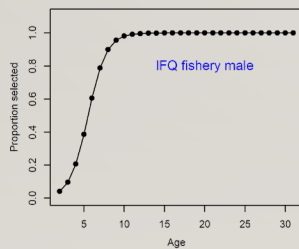
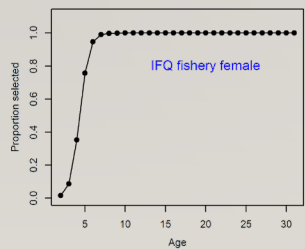
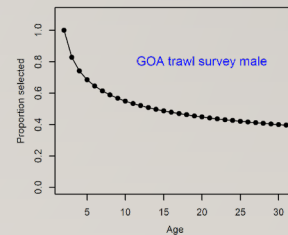
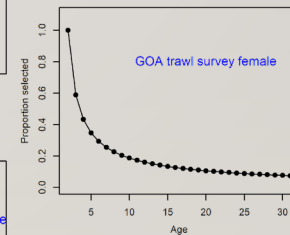
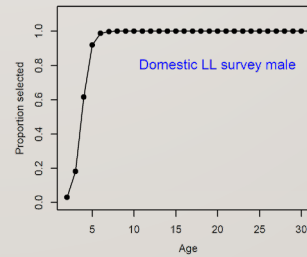
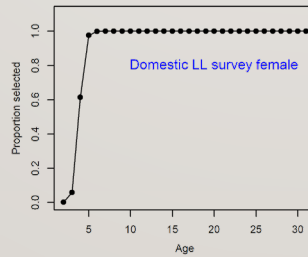
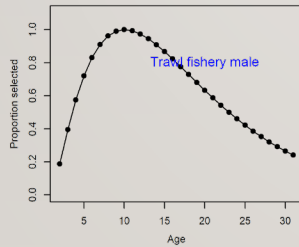
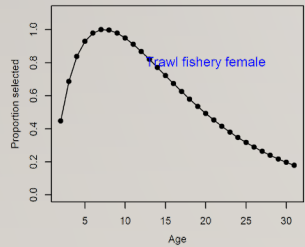
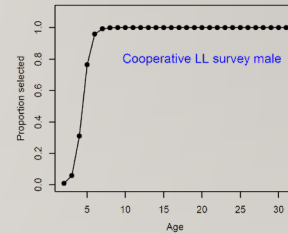
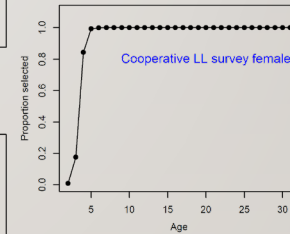
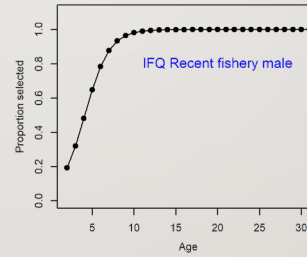
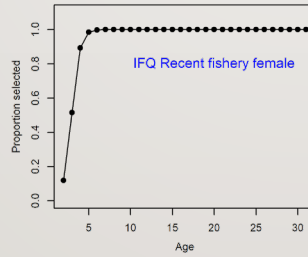
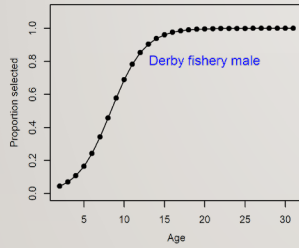
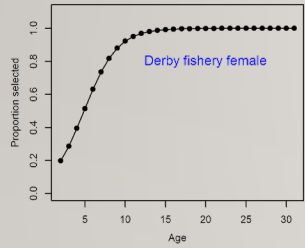
Area Depredation Fishery



MATURITY CURVE COMPARISONS

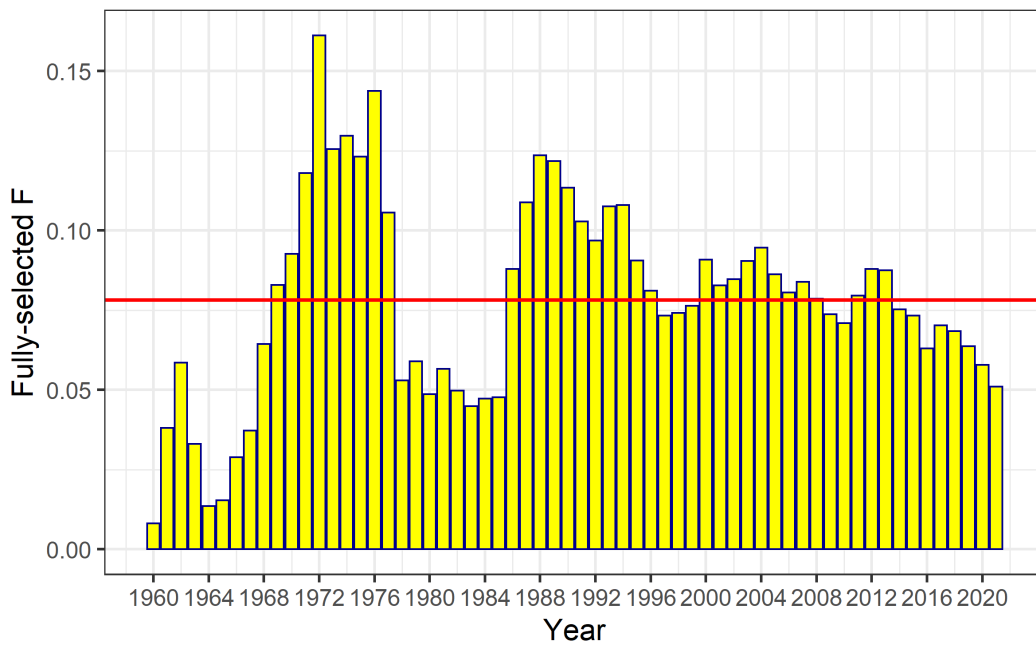
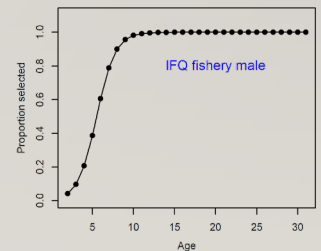
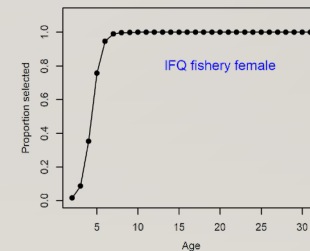
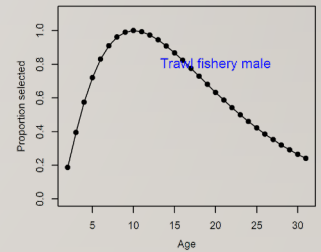
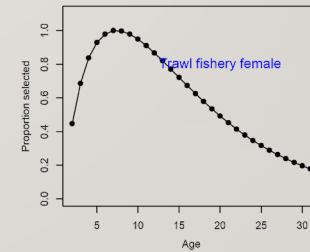
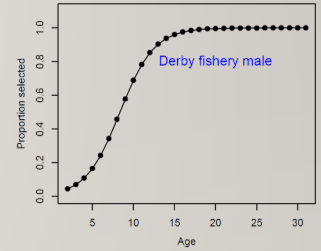
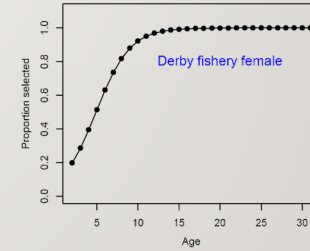
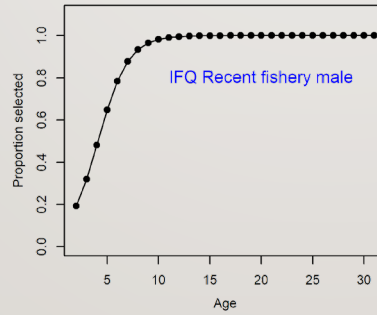
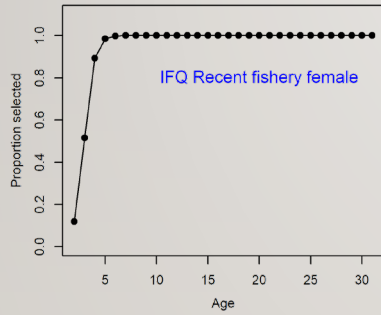


47 ESTIMATED SELECTIVITY

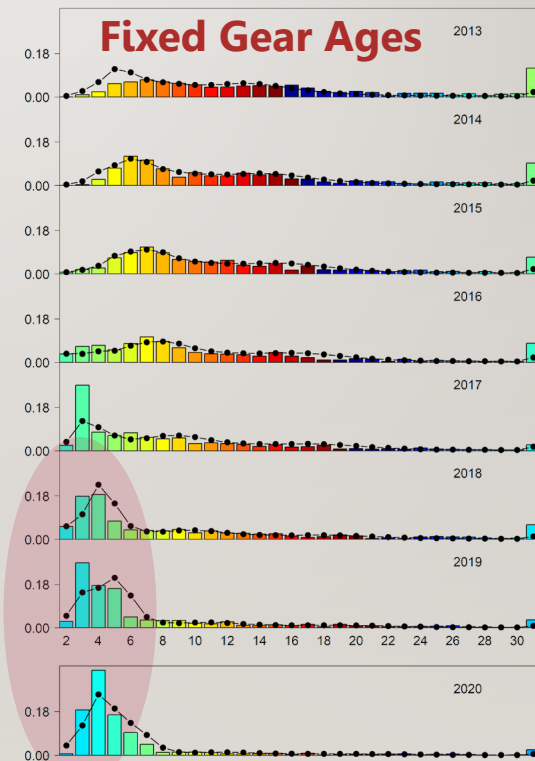
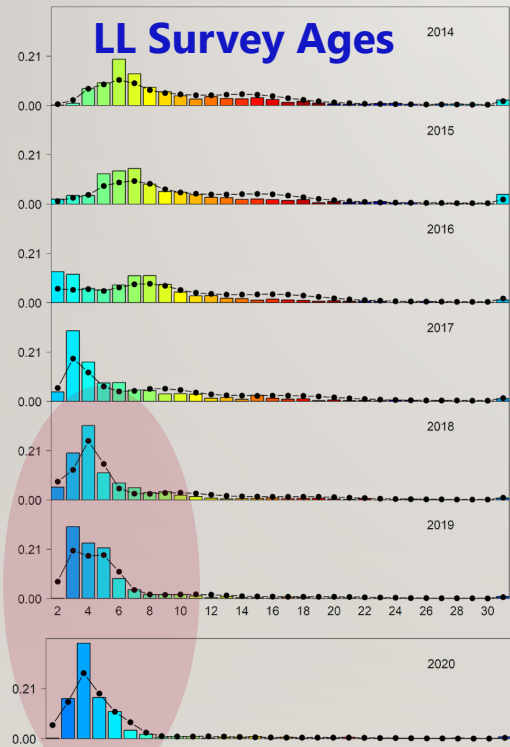


48

DECREASING FISHING MORTALITY

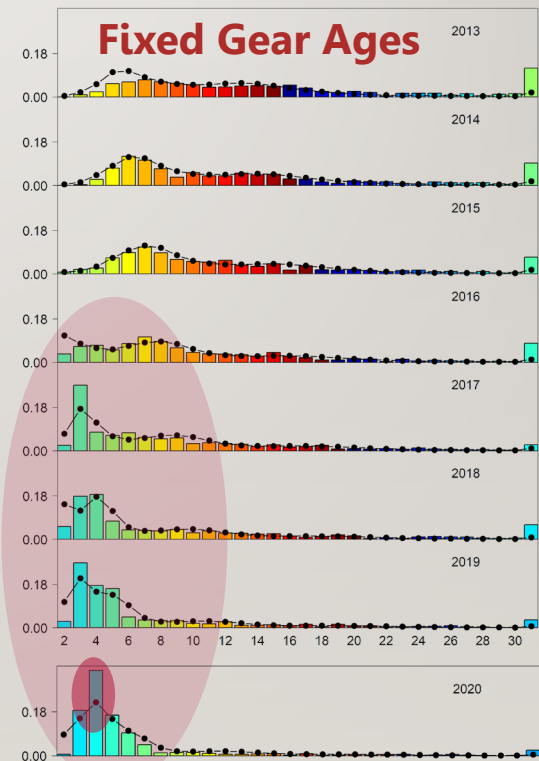
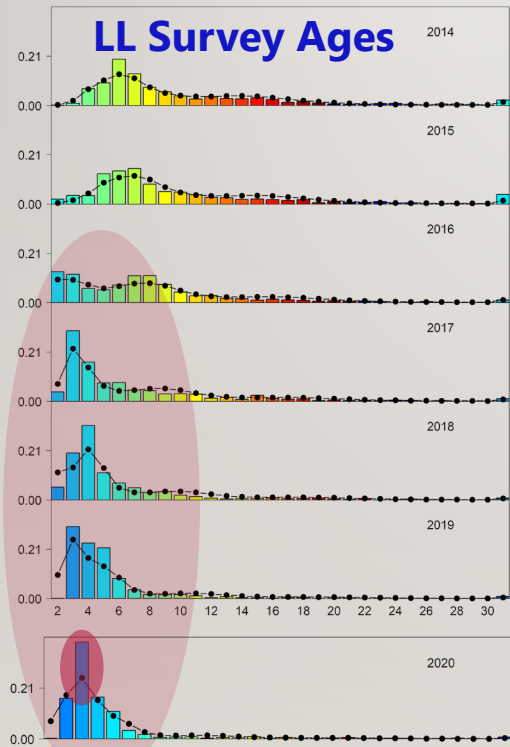


49 MODEL 16.5 CONTFIT TO AGES



Decent fit to high LL survey age comps for recent cohorts, but underestimates age-3 and age-4 abundance. Overestimating cohort sizes as they age in fishery.

50 MODEL 21.12 FIT TO AGES

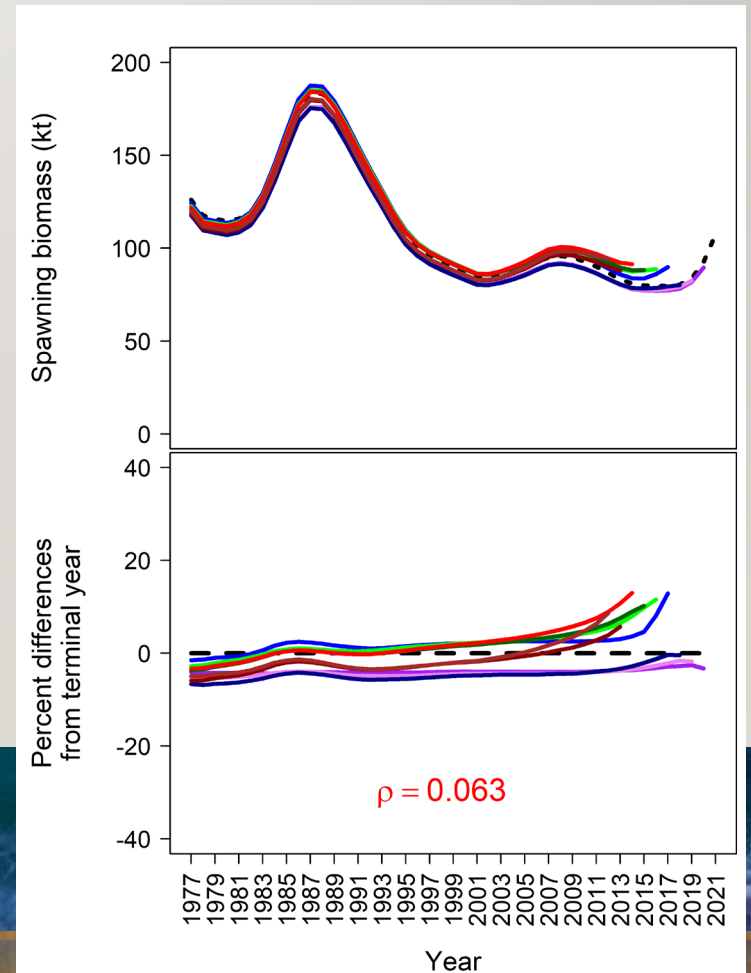
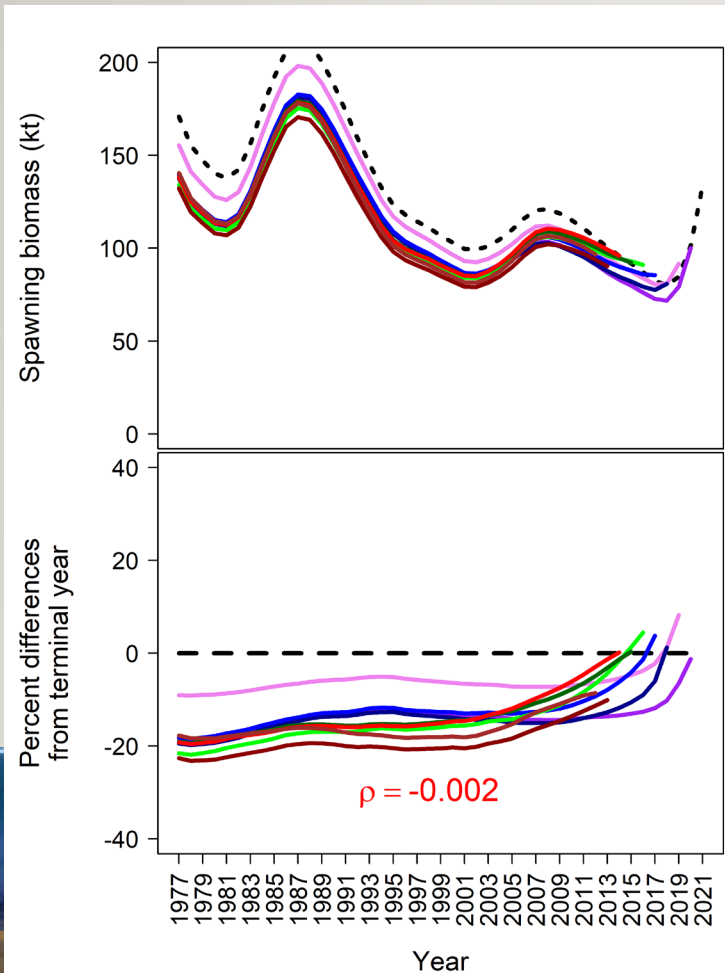


Overestimation of age-2 abundance.
Underestimation of age-3+age-4 abundance.
Good fit to cohort decay in fishery.

51 RETROSPECTIVE BIAS, RESOLVED?

16.5_Cont

21.12_Proposed_No_Skip_Spawn



52

HISTORICAL ASSESSMENT RETRO (MODEL 16.5_CONT)

