C5 Gulf of Alaska Groundfish Harvest Specifications (SAFE report)

Report of the
Gulf of Alaska Groundfish
Plan Team meeting
Nov 14th-18th, 2022

GOA Plan Team Members

James Ianelli (co-chair)	AFSC/REFM
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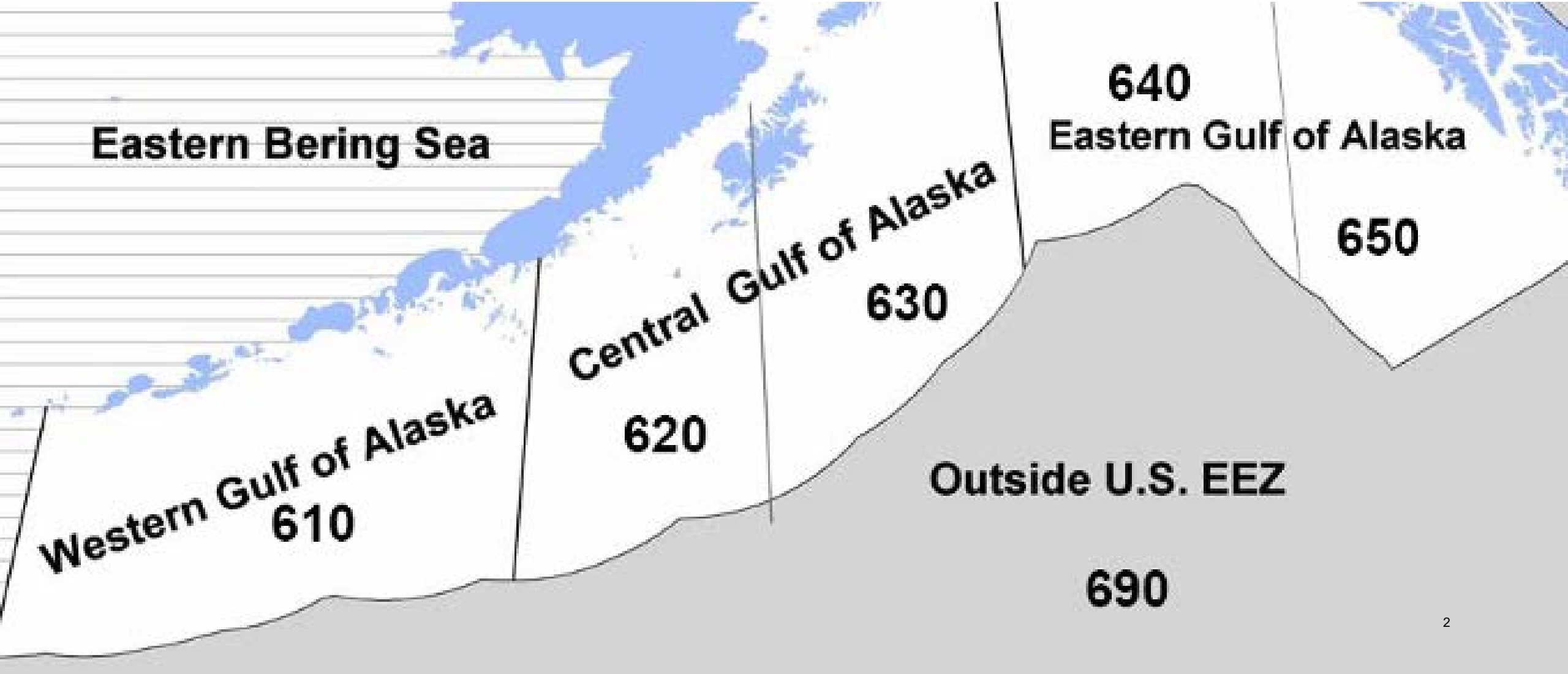
GOA Assessment Overview

"Off" year for GOA, 10 "full" assessments, 7 "partials"



Ecosystem Considerations summary

Western Gulf of Alaska 2022 Report Card

- Winter average PDO index negative trend continued cooling sea surface temperatures
- Sea-surface temperatures in the summer slightly warmer than average
- Copepod biomass average
- Slightly more larger copepods in community relative to small compared to average
- Motile epifauna biomass slightly below average
- Capelin abundance sampled by rhinoceros auklets at Middleton Island slightly below average
- Fish apex predator biomass (2021 data) slightly below mean, due to Pacific cod
- Black-legged kittiwakes reproductive success in 2022 above the long-term mean at the Semidi Islands
- Western Gulf of Alaska Steller sea lion non-pup model predicted counts slightly decreasing (from 2021)

Ecosystem Considerations summary

Eastern Gulf of Alaska 2022 Report Card

- Multivariate ENSO Index was negative, La Niña conditions predicted for winter 2022/2023.
- Sea-surface temperatures in the summer slightly warmer than average
- Zooplankton density in southeastern Alaska inside waters increased (above 1SD of the long-term mean,
- Copepod community size ratio of large calanoid copepods to total calanoid copepods average
- Motile epifauna biomass slightly below average
- Estimated total mature herring biomass above average (Sitka) southeastern AK inner waters and Prince William Sound increased but remained low.
- Fish apex predator biomass low in 2021
- Growth rates of piscivorous rhinoceros auklet chicks below average but increasing trend
- Eastern Gulf of Alaska Steller sea lion non-pups model predicted (2021) counts decreasing but above average

Stock Assessment schedule for the Gulf of Alaska

Stock	Assessment	Tier	Frequency (yrs)	Full assessment year due
Pollock	Full	3	1	2023
Pacific cod	Full	3	1	2023
Sablefish	Full	3	1	2023
Shallow water flats N. & S. rock sole	*Partial*	*3*	*4*	*2025*
Shallow water flatfs balance	*Partial*	*5*	*4*	*2025*
Deepwater flatfish (Dover)	*Partial*	*3/6*	*4*	*2023*
Rex sole	*Partial*	*3*	*4*	*2025*
Arrowtooth flounder	*Partial*	*3*	*2*	*2023*
Flathead sole	Full	3	4	2025
Pacific ocean perch	*Partial*	*3*	*2*	*2023*
Northern rockfish	Full	3	2	2024
Shortraker rockfish	None	5	2	2023
Other rockfish	None	4/5/6	2	2023
Rougheye & blackspotted rockfish	*Partial*	*3*	*2*	*2023*
Dusky rockfish	Full	3	2	2024
Demersal shelf rockfish	Full	4/6	2	2024
Thornyheads	Full	5	2	2024
Atka mackerel	None	6	2	2023
Octopus	None	6	2	2023
Skates	None	5	2	2023
Sharks	Full	6	2	2024
Sculpins	None	eco	4	2023
Forage species (including Squid)	Report	eco	2	2024
Grenadiers (BSAI/GOA)	None	eco	4	2024

GOA SAFE report overview

- 10 full assessments
- 7 partials

Stock	Assessment	Tier
Pollock	Full	3
Pacific cod	Full	3
Sablefish	Full	3
Flathead sole	Full	*3*
Northern rockfish	Full	*3*
Dusky rockfish	Full	3
Demersal shelf rockfish	Full	4/6
Thornyhead rockfish	Full	5
Sharks	Full	4/5/6
Forage species (including Squid)	Report	eco
N & S rock sole	*Partial*	*3*
Shallow water flatfish	*Partial*	*5*
Deepwater flatfish (Dover)	*Partial*	*3/6*
Rex sole	*Partial*	*3*
Arrowtooth flounder	*Partial*	*3*
Pacific ocean perch	*Partial*	*3*
Rougheye & blackspotted rockfish	*Partial*	*3*
Shortraker rockfish	*None*	*5*
Other rockfish	*None*	*4/5/6*
Atka mackerel	*None*	*6*
Skates	*None*	*5*
Octopus	*None*	*6*

Web access and Nav…

Stock Assessment and Fishery Evaluate (SAFE) for the NPFMC SSC/Council review
Note, links will become live as documents are completed, please "refresh" browsers, also some assessments are in an "off" year.

Ecosystem status reports:
EBS ESR
Aleutian Islands ESR
GOA ESR

Bering Sea and Aleutian Islands (BSAI)	Gulf of Alaska (GOA)
BSAI Introduction (with links to each chapter) **BSAI Entire SAFE (zip file, 120mb)**	**GOA Introduction (with links to each chapter)** **GOA Entire SAFE (zip file, 131mb)**
Eastern Bering Sea Pollock Muti-species model supplement Aleutian Is. Pollock Bogoslof Pollock	GOA Pollock
Eastern Bering Sea Pacific cod Aleutian Is Pacific cod.	GOA Pacific cod
AK Sablefish	AK Sablefish
BSAI Yellowfin Sole	GOA Shallow-water Flatfish

C5 GOA PT Report
December 2022

Stock Assessment and Fishery Evaluation Report for the Groundfish Resources of the Gulf of Alaska

GOA Introduction Contents

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Bookmarks

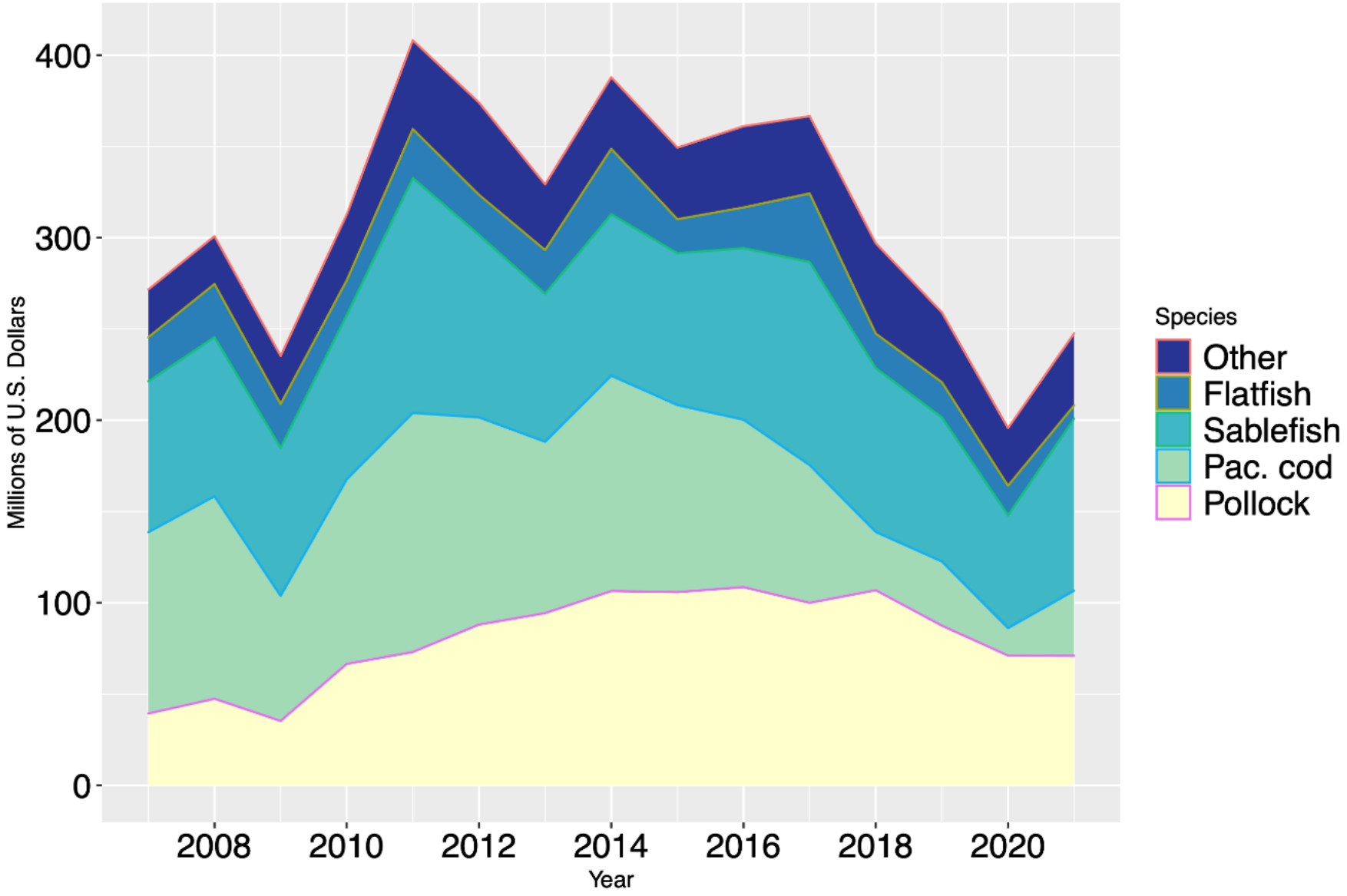
Year	610 Western	620 Central	630 Central	640 WYAK	650 SEO	PWS GHL	Total
2022	23,720	69,259	30,053	6,722	11,363	3,327	144,444
2023	23,511	68,651	29,789	6,663	11,363	3,298	143,275

2. Pacific cod

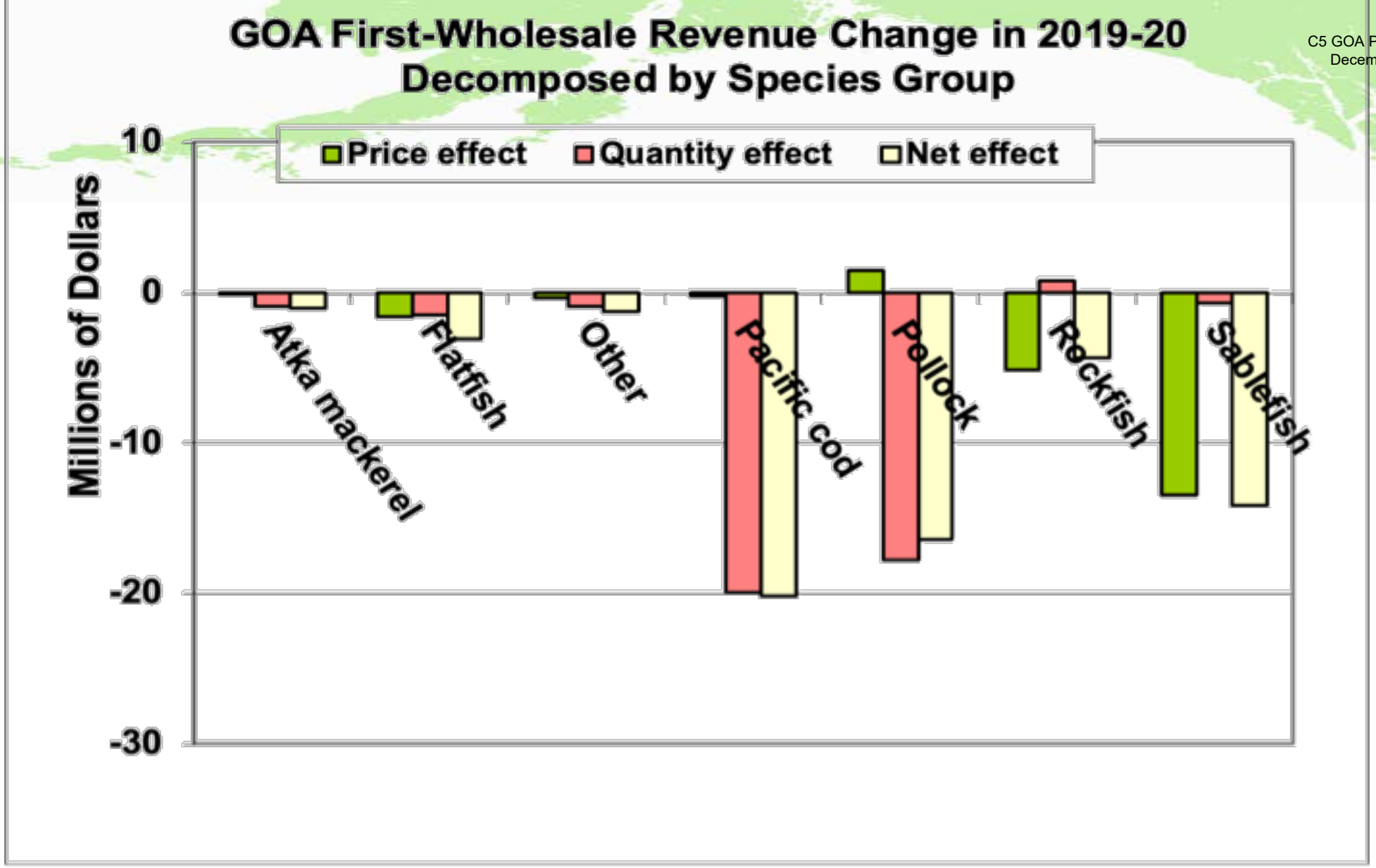
Status and catch specifications (t) of Pacific cod in recent years. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. The OFL and ABC for 2022 and 2023 are those recommended by the Plan Team. Catch data are current through November 6th, 2021.

Year	Age 0+ biomass	OFL	ABC	TAC	Catch
2020	203,373	17,794	14,621	6,431	3,944
2021	265,661	28,977	23,627	17,321	12,272
2022	159,837	29,131	24,043		
2023		27,715	22,882		

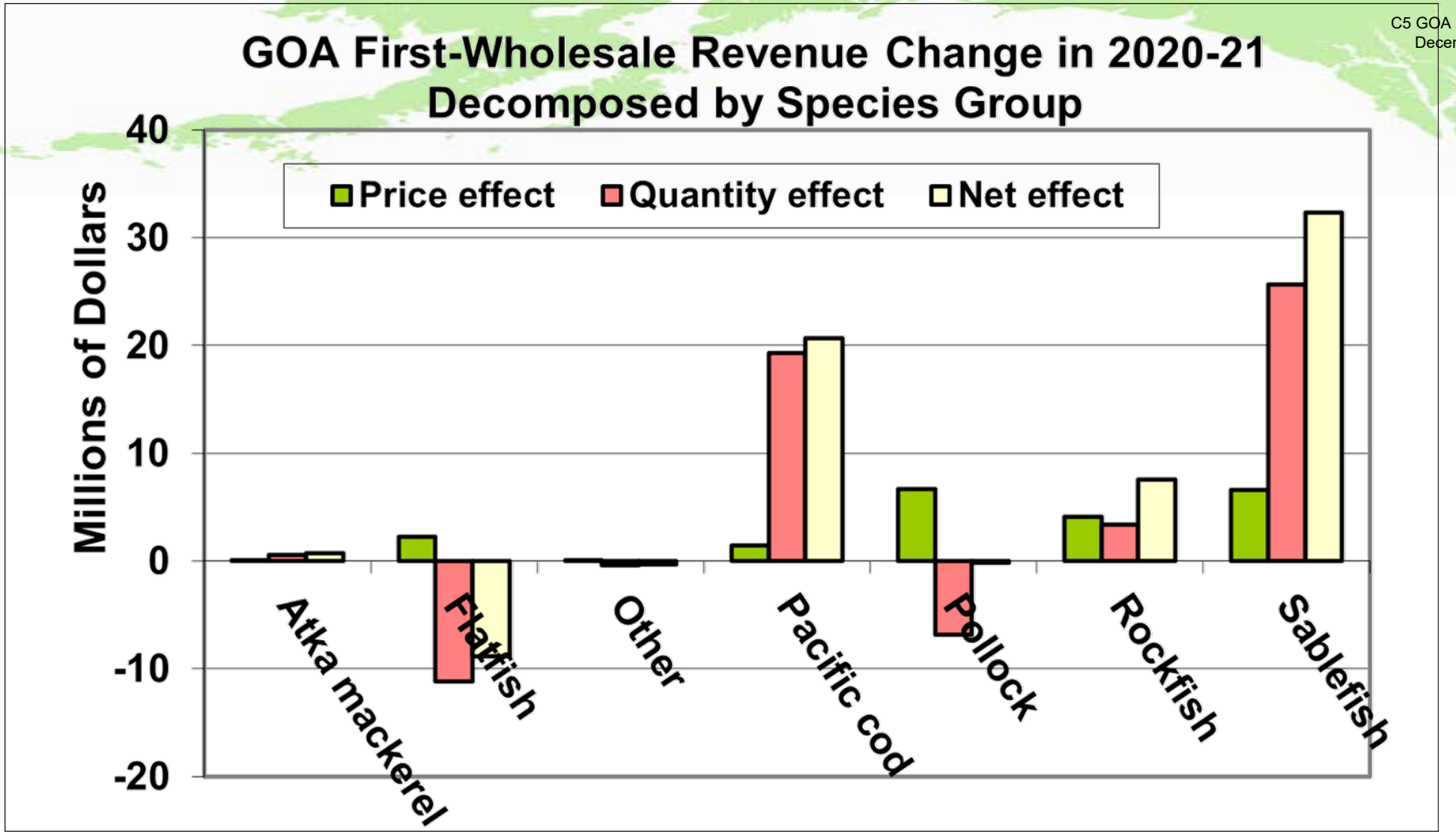
Changes from the previous assessment
Data updated from the 2021 assessment included federal and state fishery catch for 2020 and 2021 (preliminary catch projected through the end of 2021), federal and state fishery size composition for 2020 and preliminary size compositions for 2021, 2021 AFSC longline survey abundance index (Relative



GOA Economic synopsis

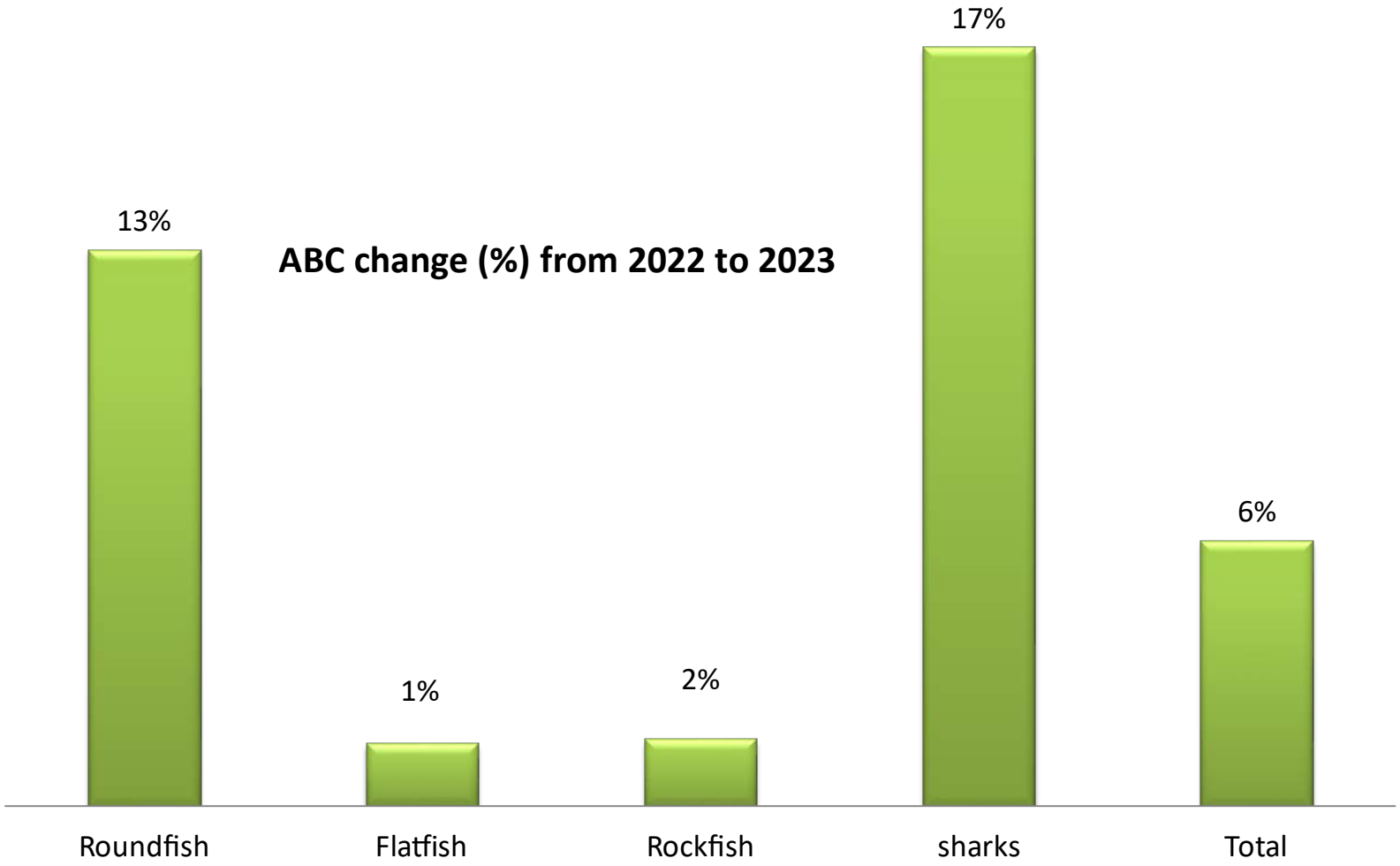


Revenue changes (and source)



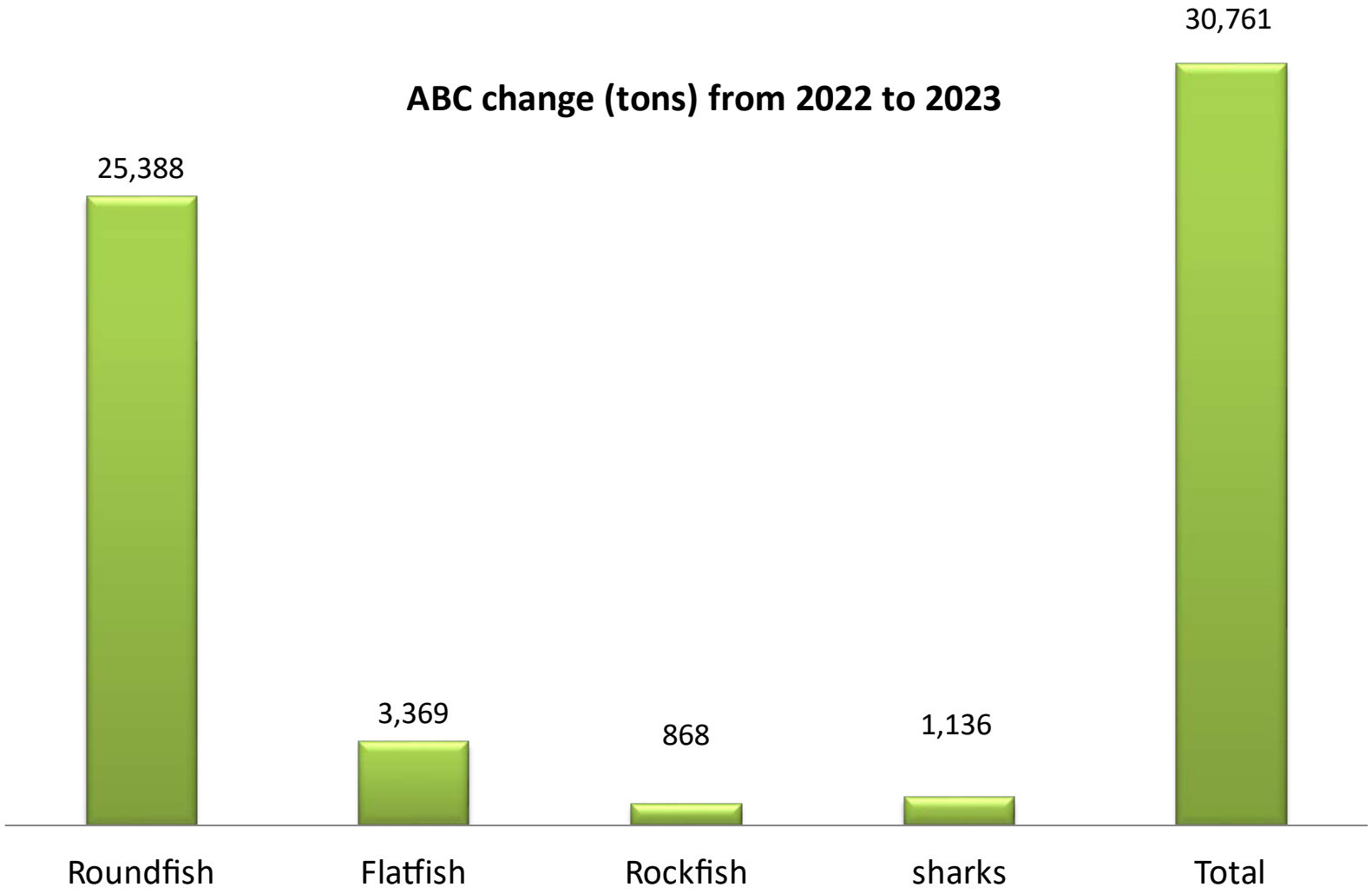
Revenue changes (and source)

2022-2023 ABC change

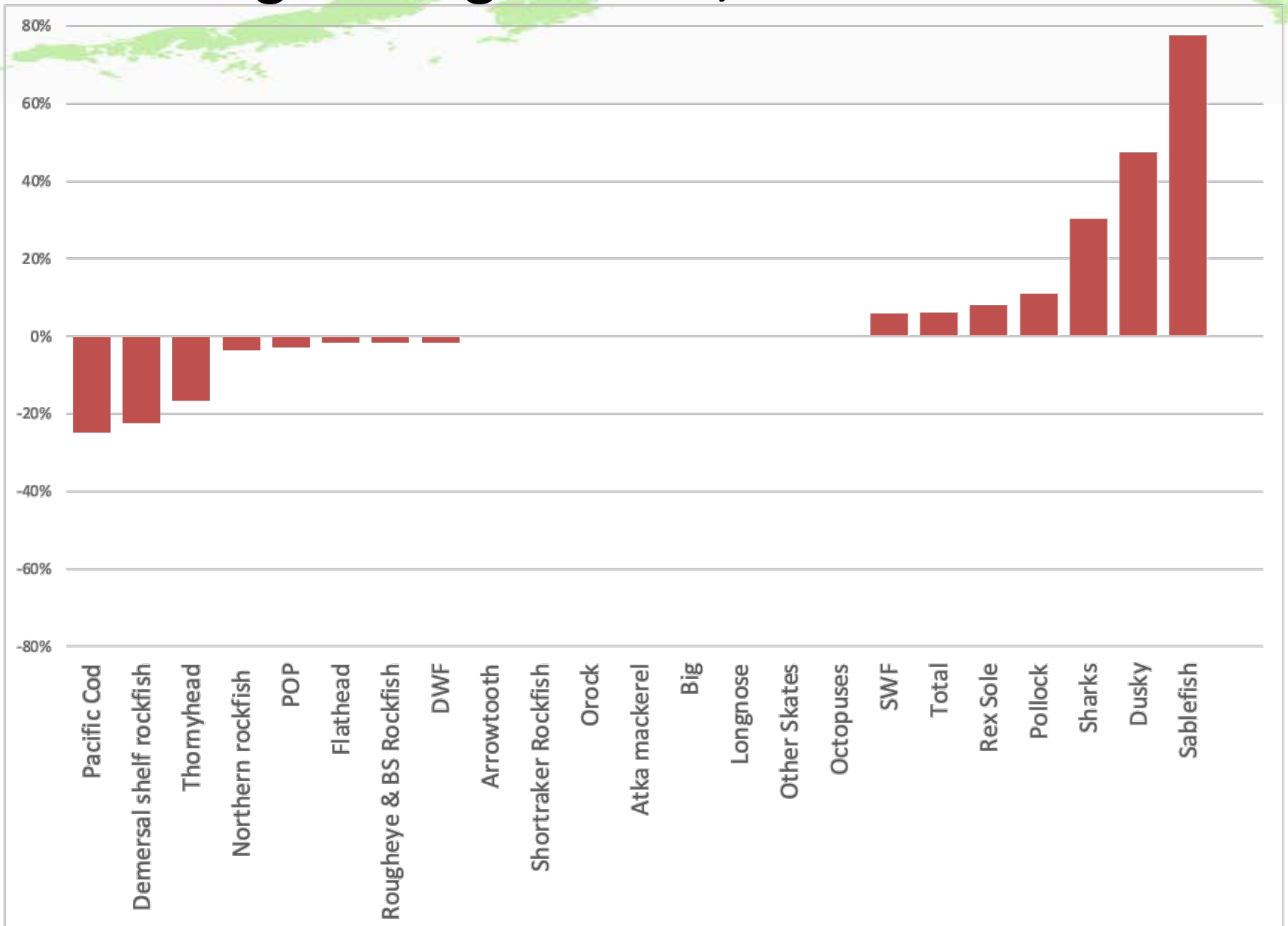


Overall a 6% increase

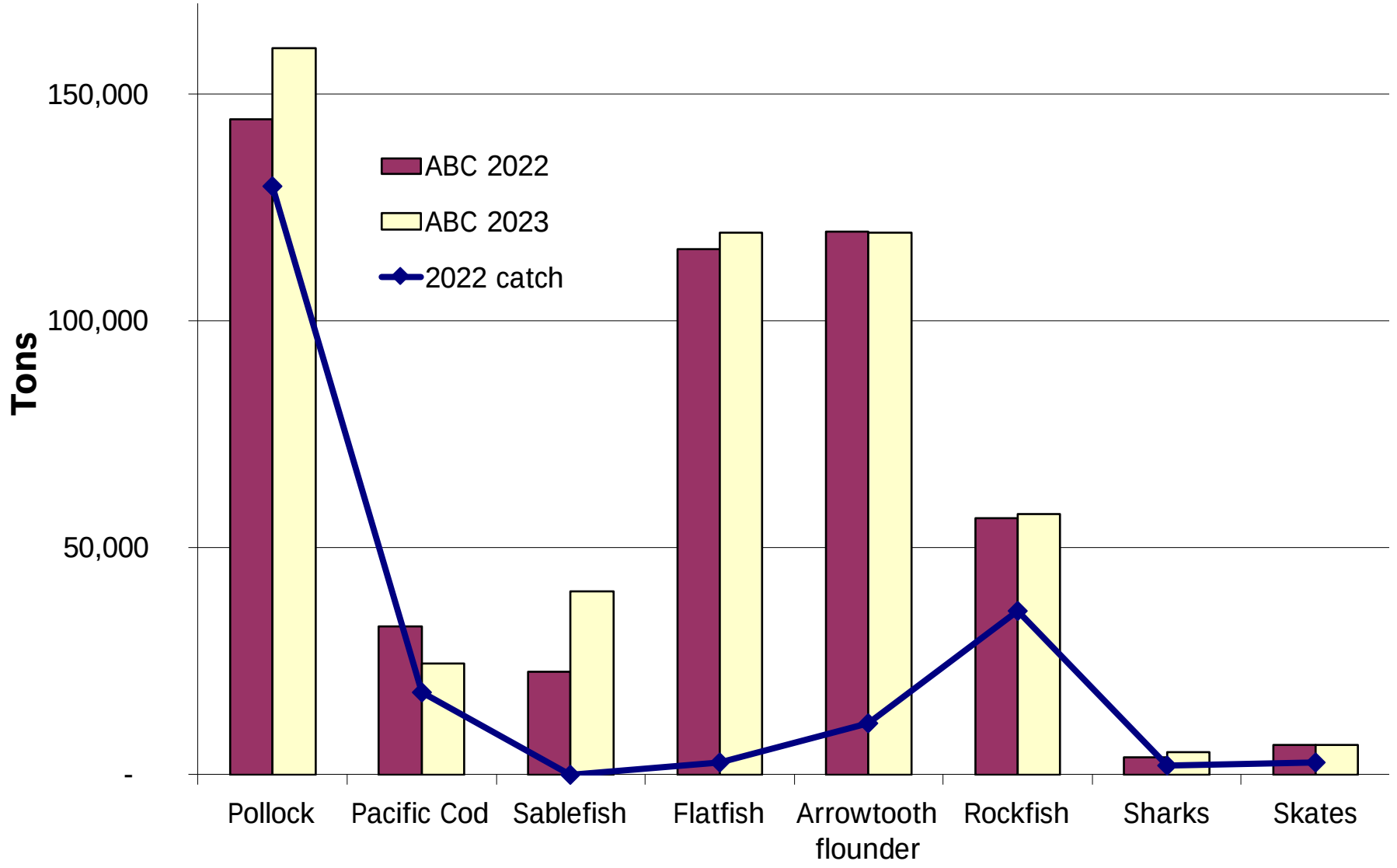
2022-2023 ABC change



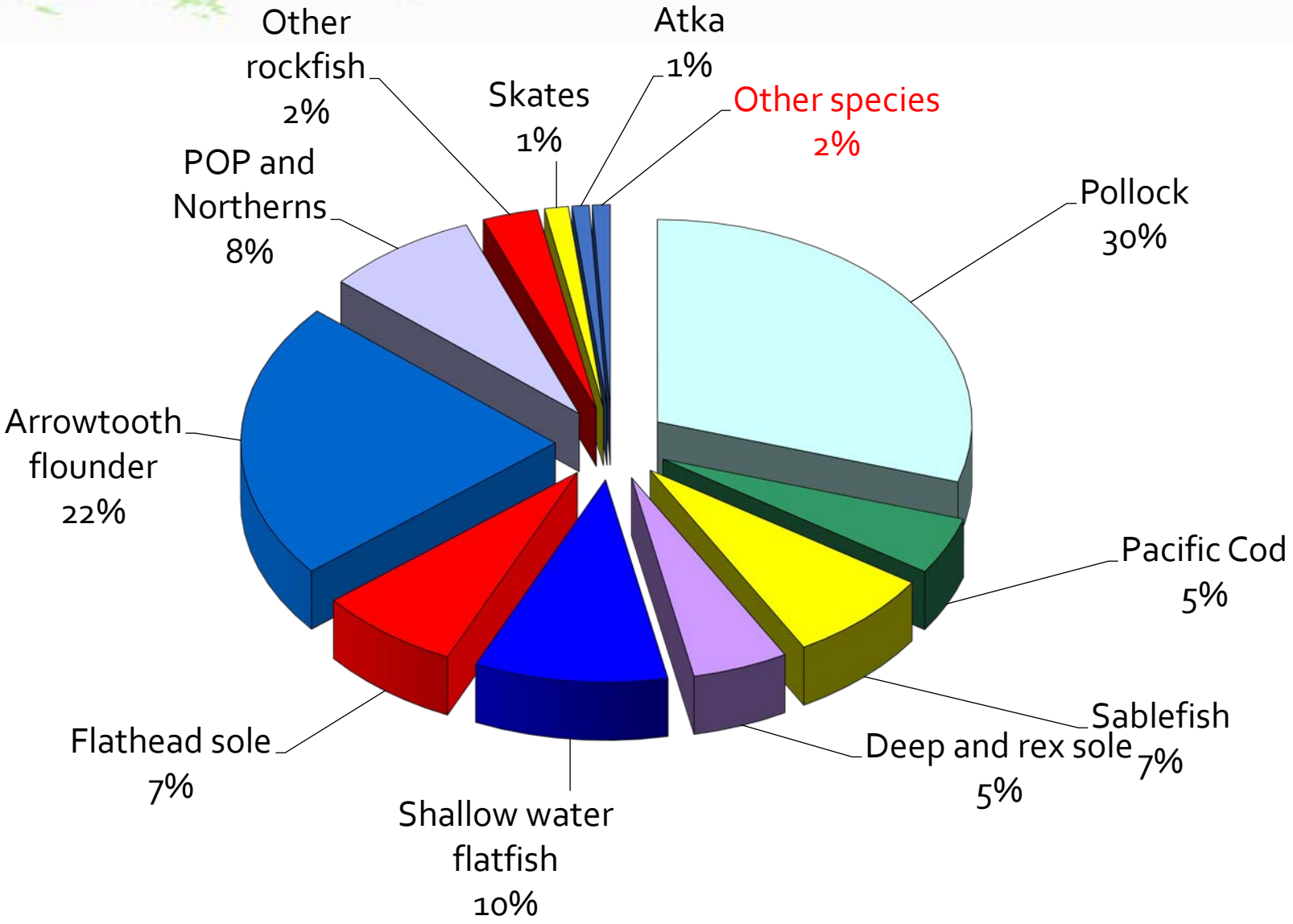
Percentage change in ABC, 2022-2023



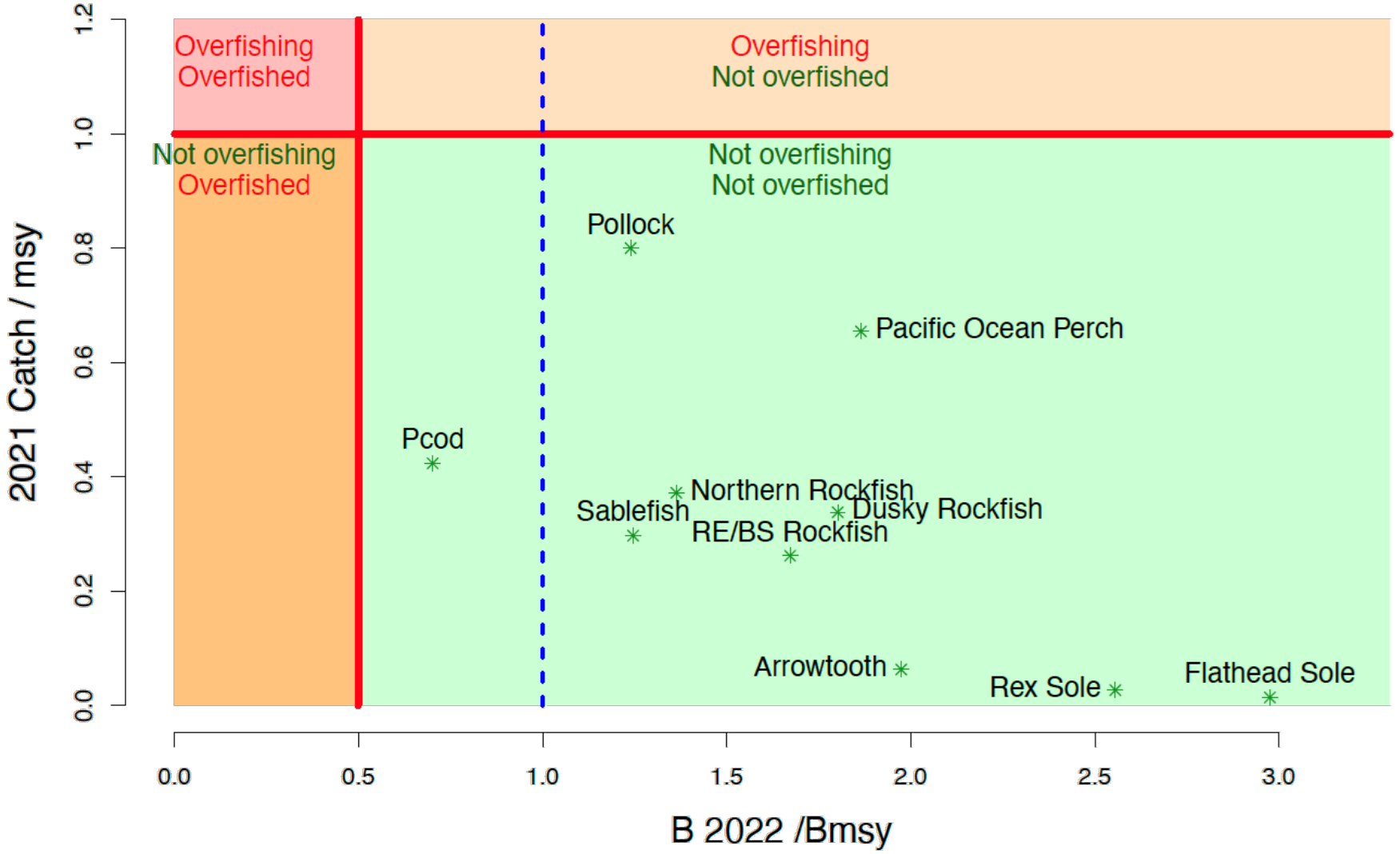
GOA Catch and ABC levels



GOA 2023 ABC's: 539,072 t



Stock status summary last year



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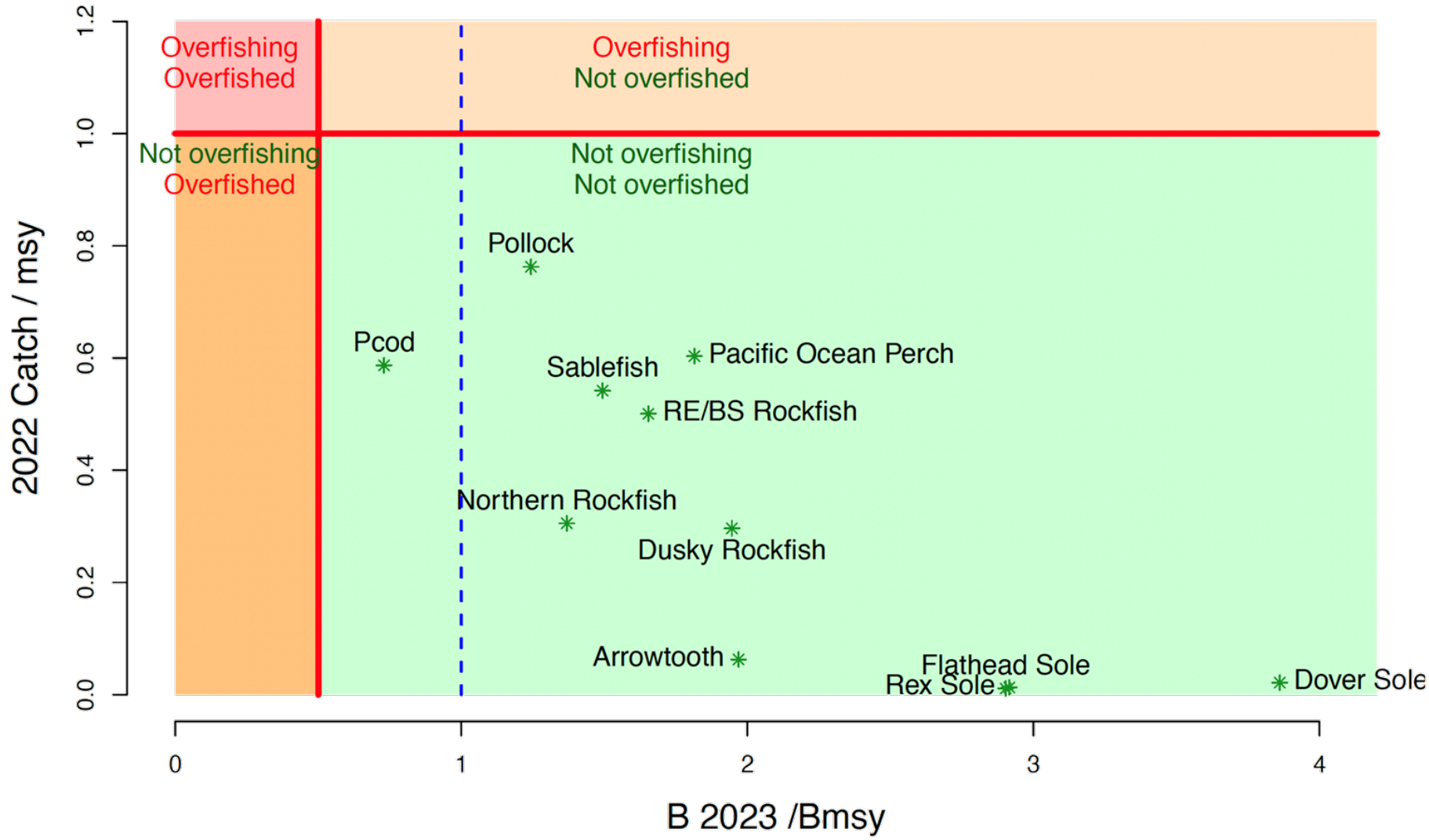


Partial assessments in 2022

Stocks

- Pacific ocean perch
- blackspotted/rougheye
- arrowtooth flounder
- rex sole
- shallow water flatfish (+N & S rock sole)
- deep water flatfish

Each stock was presented as one slide in a draft template approach

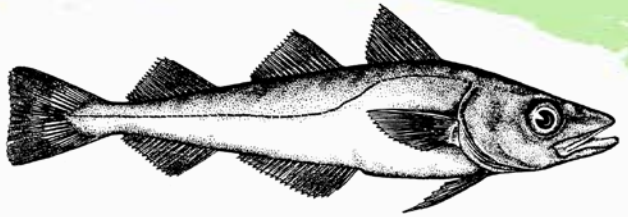
Team recommended having:

- Summary table for the stock or complex.
- Schedules (survey, next assessment)
- Next year's spawning stock biomass and trend for tier 1-3 stocks
- Any unusual trends are occurring in the fishery

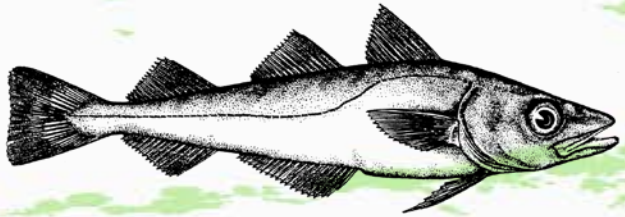
Species overviews

1. 2022 ABC/Catch and recommended changes
2. Highlights
   - New data
   - Analytic approach (changes)
3. Stock status and trend
4. ABC/OFL
   - Tier history and recommendations
   - 2023, 2024 maxABC; recommended ABC

GOA Pollock (Full assessment)



Species	2022 catch	ABC 2022	ABC 2023	Change
Pollock	129,876	144,444	160,301	up 15,857 (11%)
Pacific Cod	18,275	32,811	24,634	down 8,177 (25%)
Sablefish	17,531	22,794	40,502	up 17,708 (78%)
Flatfish	2,673	115,834	119,497	up 3,663 (3%)
Arrowtooth flounder	11,456	119,779	119,485	down 294 (0%)
Rockfish	36,055	56,651	57,519	up 868 (2%)
Atka mackerel	880	4,700	4,700	same (0%)
Skates	2,706	6,563	6,563	same (0%)
Sharks	2,112	3,755	4,891	up 1,136 (30%)
Octopus	111	980	980	same (0%)
Total	221,675	508,311	539,072	up 30,761 (6%)



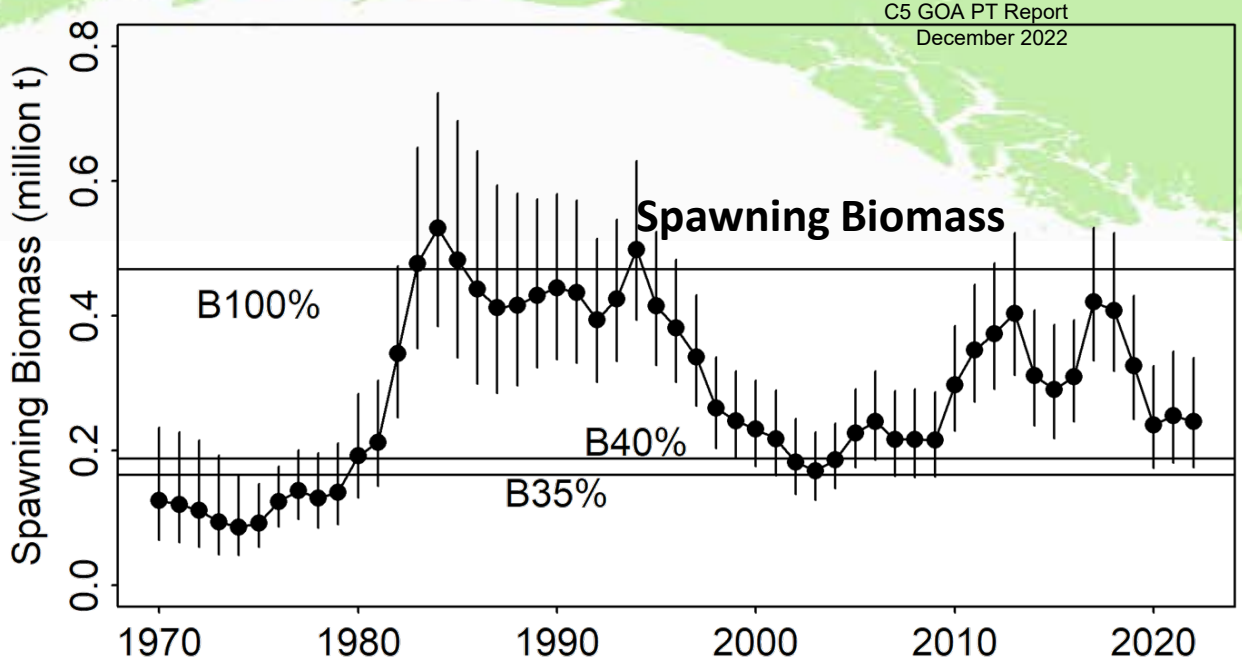
GOA Pollock

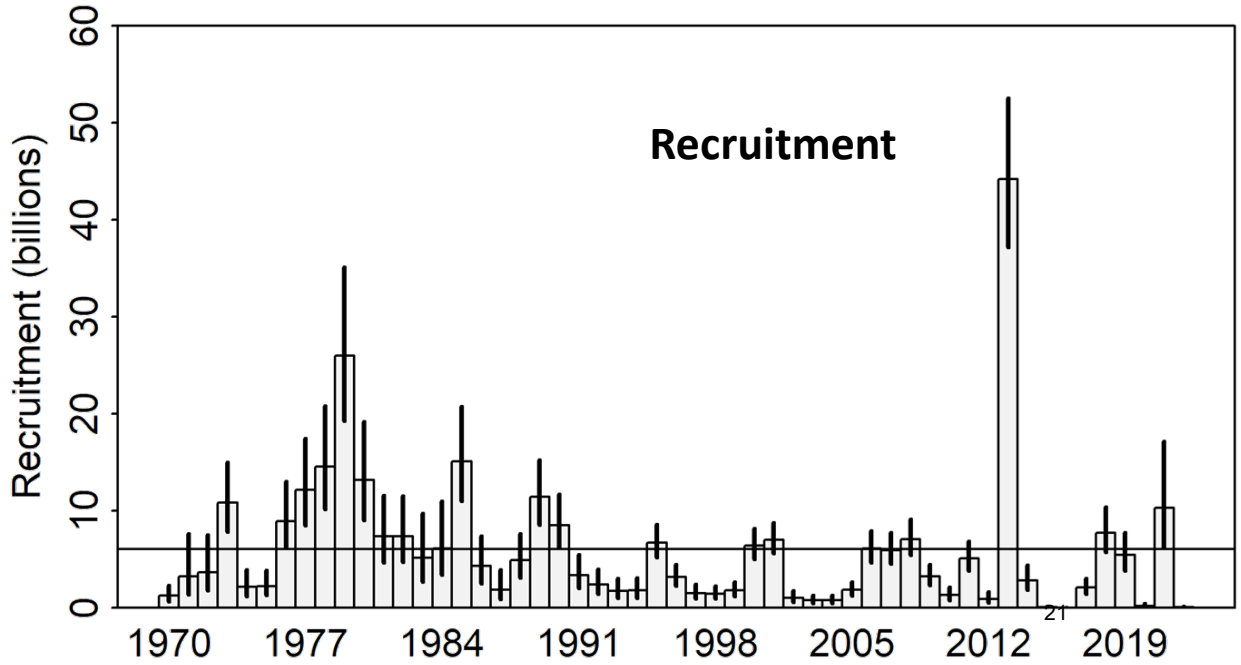
Model Changes

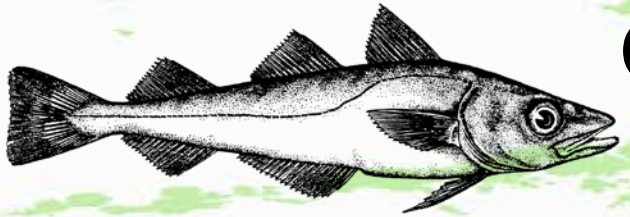
- Summer acoustic selectivity estimated
- σ_R=1.3 (model 19.1a)

Summary

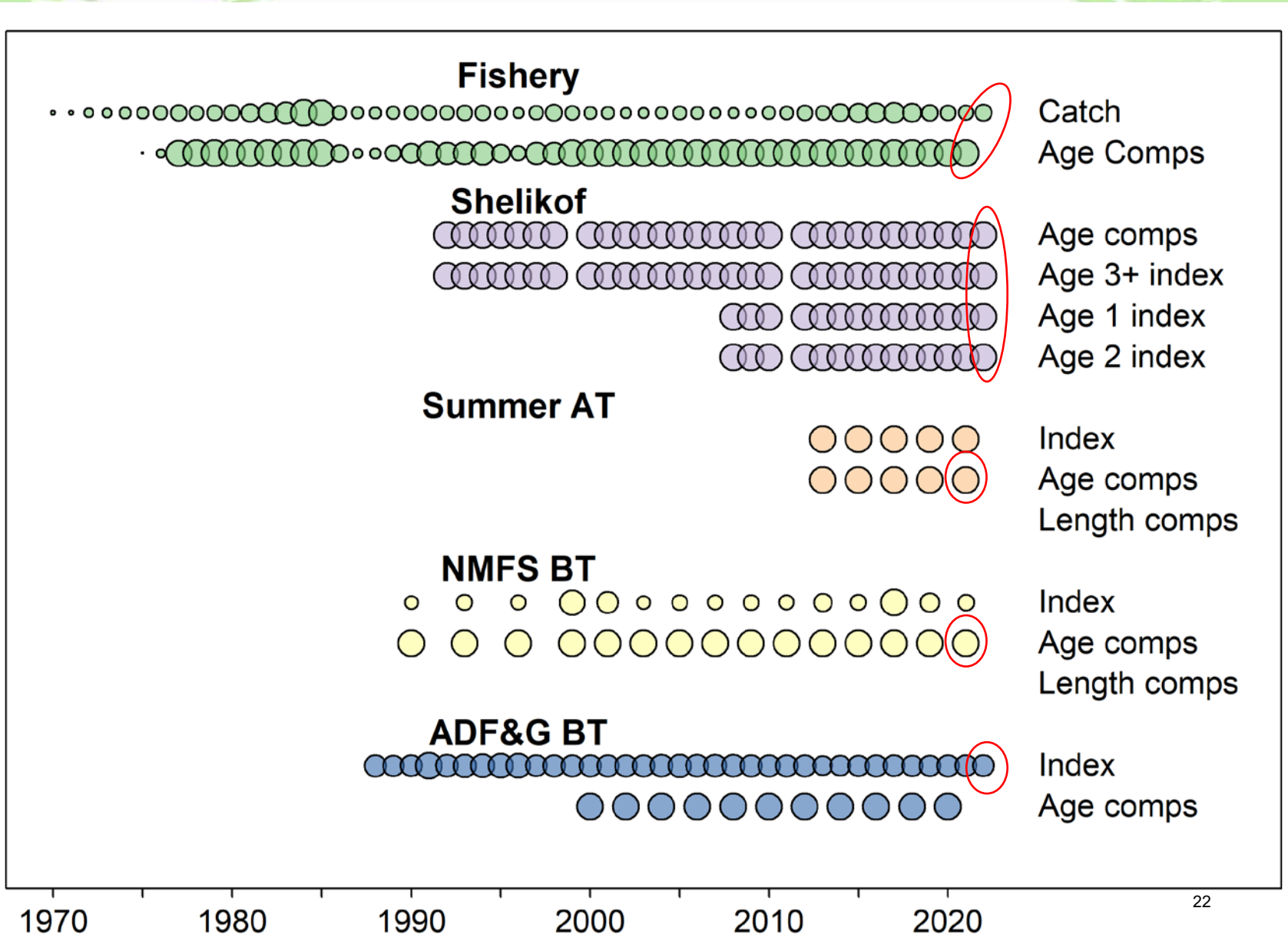
- Return to normal age diversity w/ decline in 2012 cohort
- Above-average 2017, 2018, 2020 cohorts
- 12% Increase in 2023 ABC: **148,937 t**



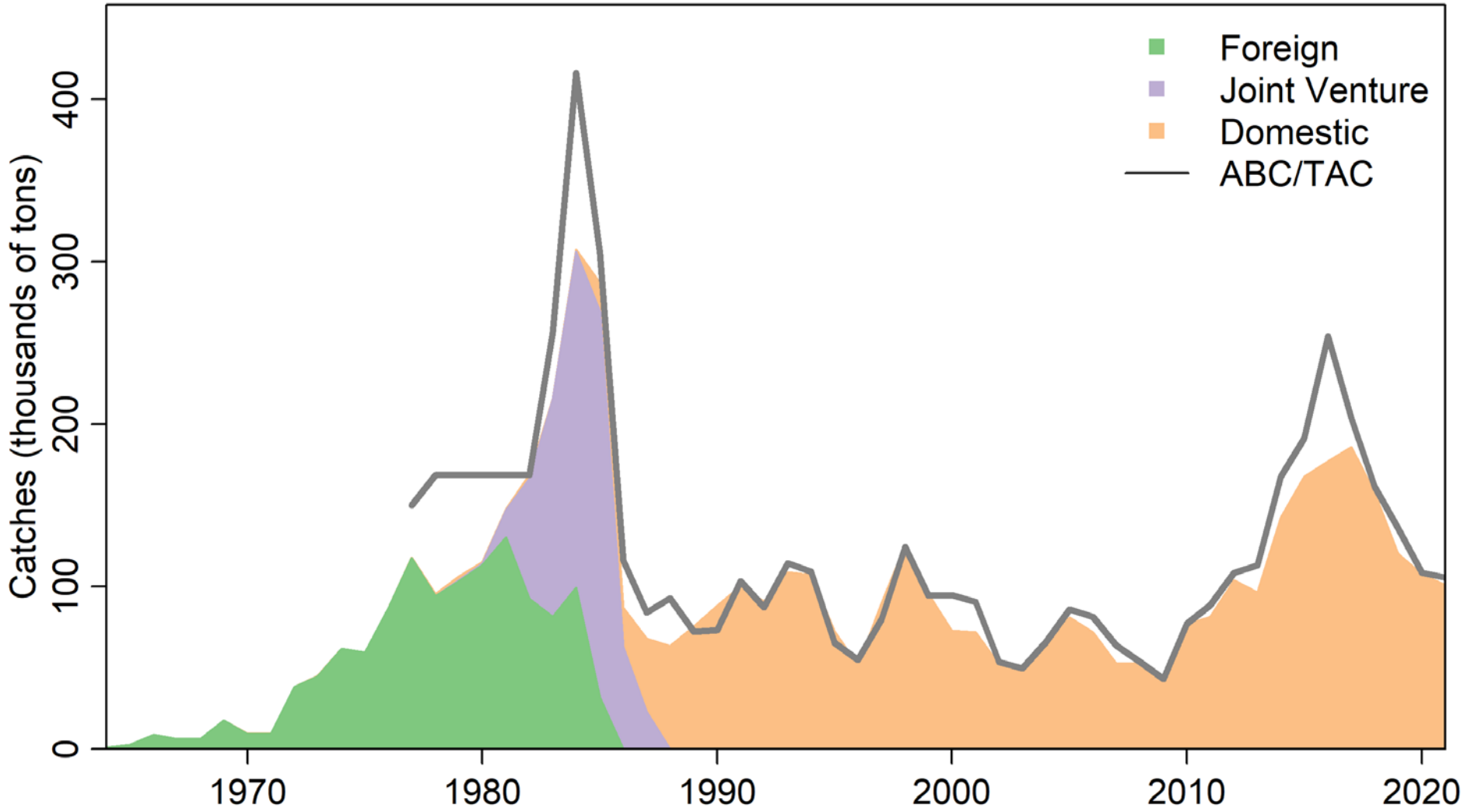




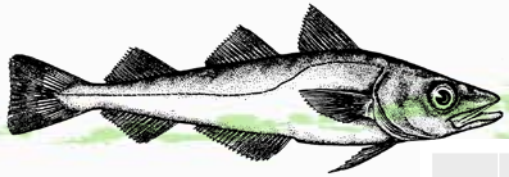
GOA Pollock: Data

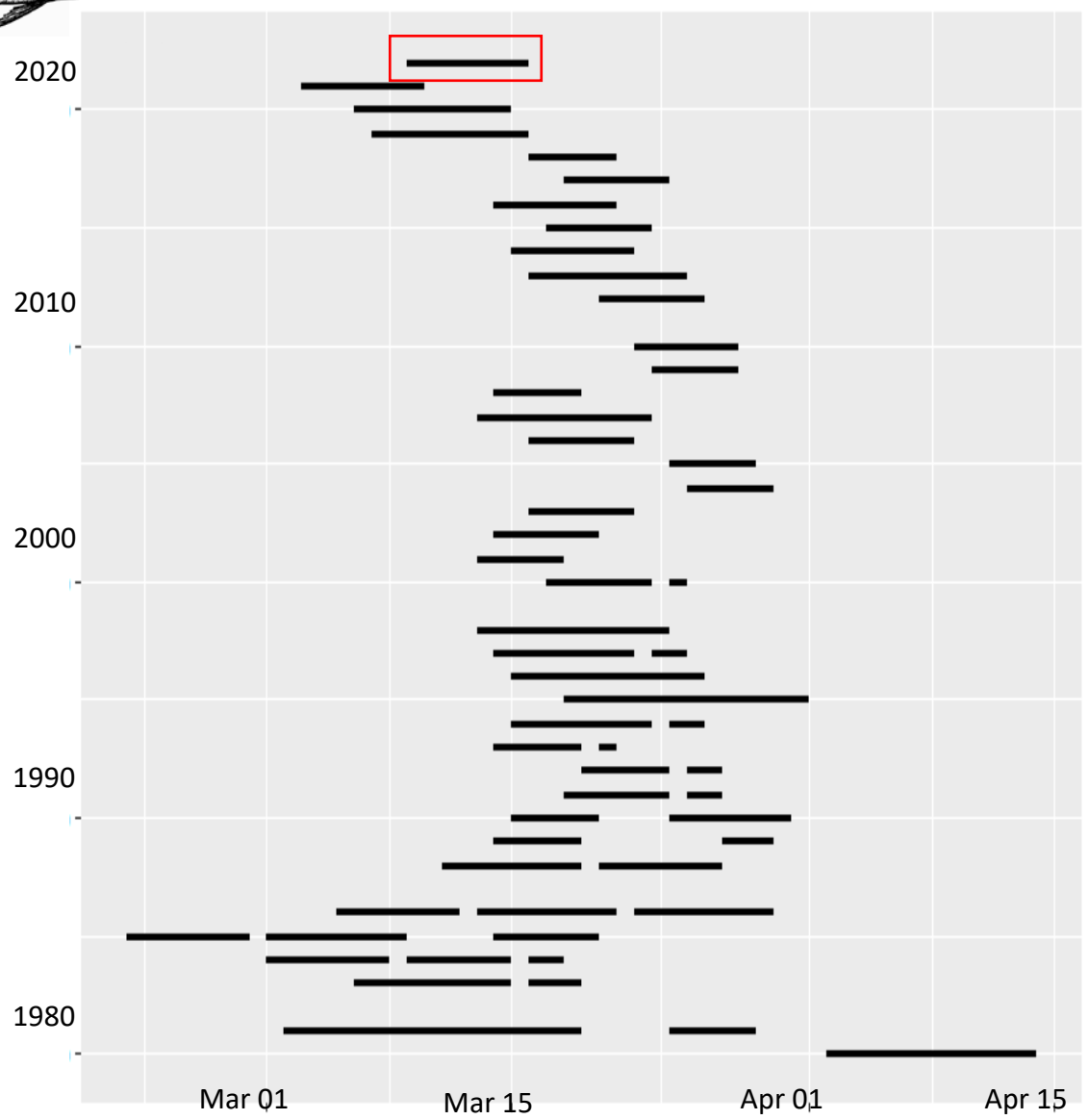


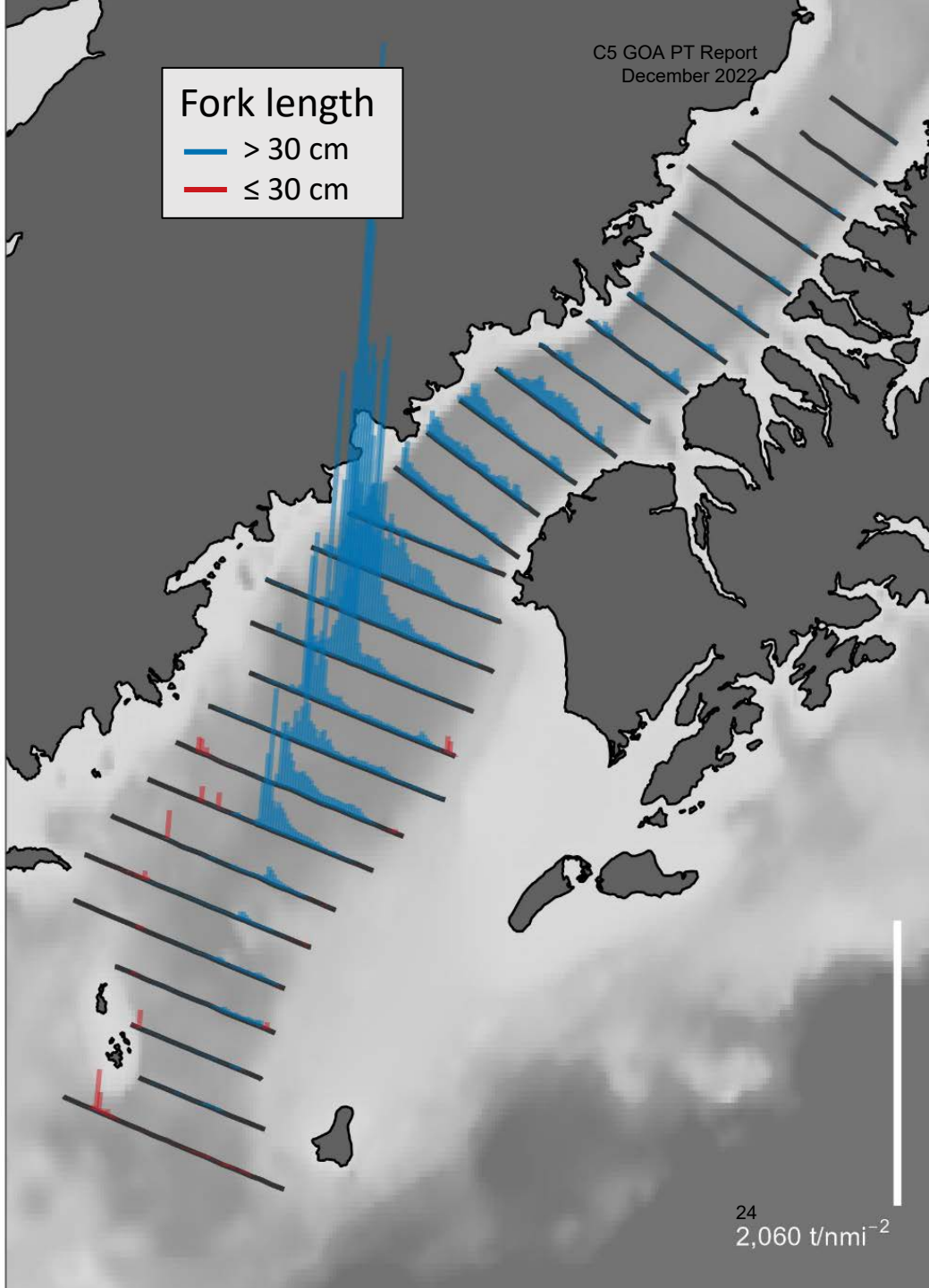
GOA Pollock: Catch



GOA Pollock: 2022 Shelikof Strait pollock AT survey

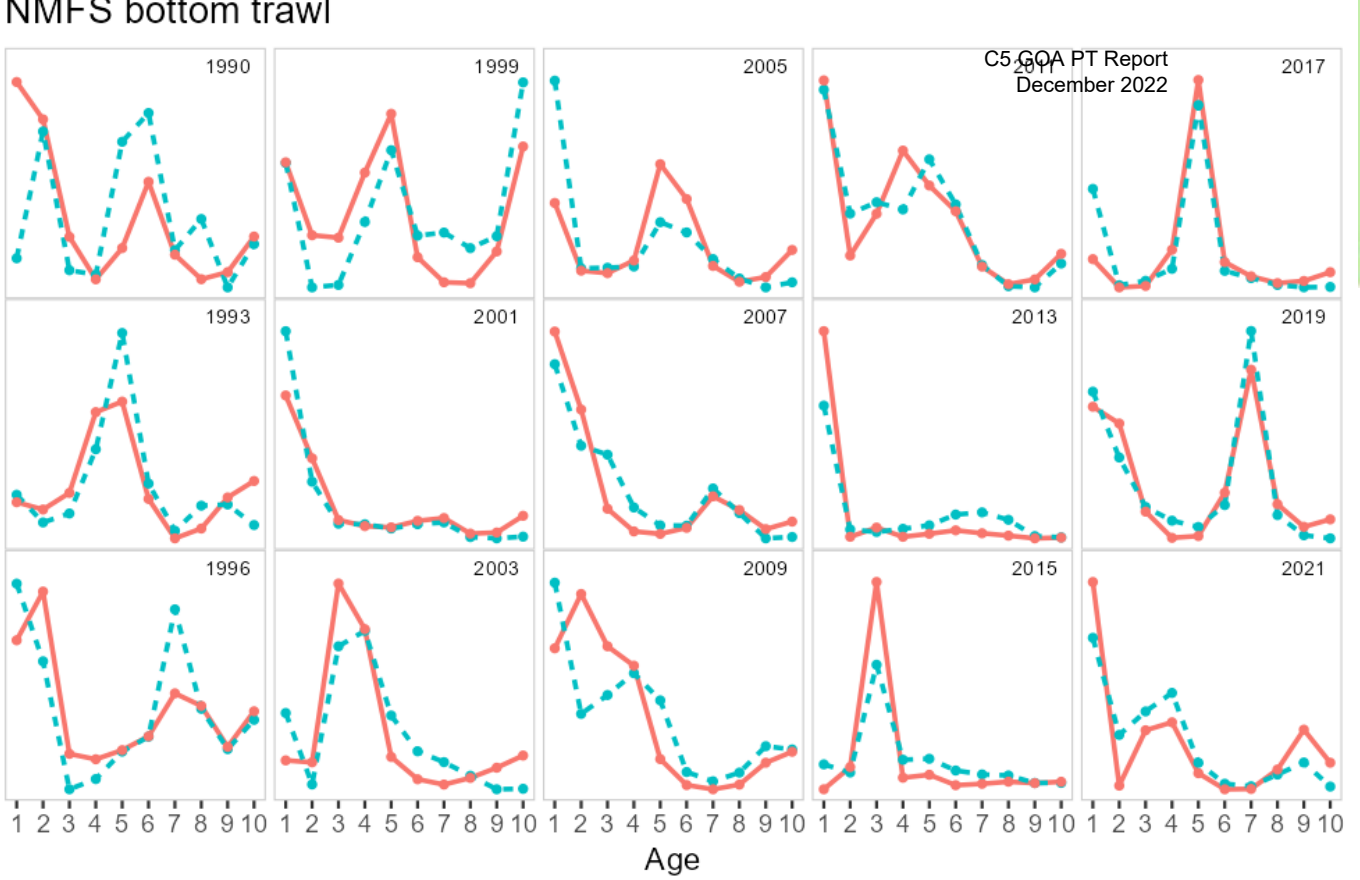




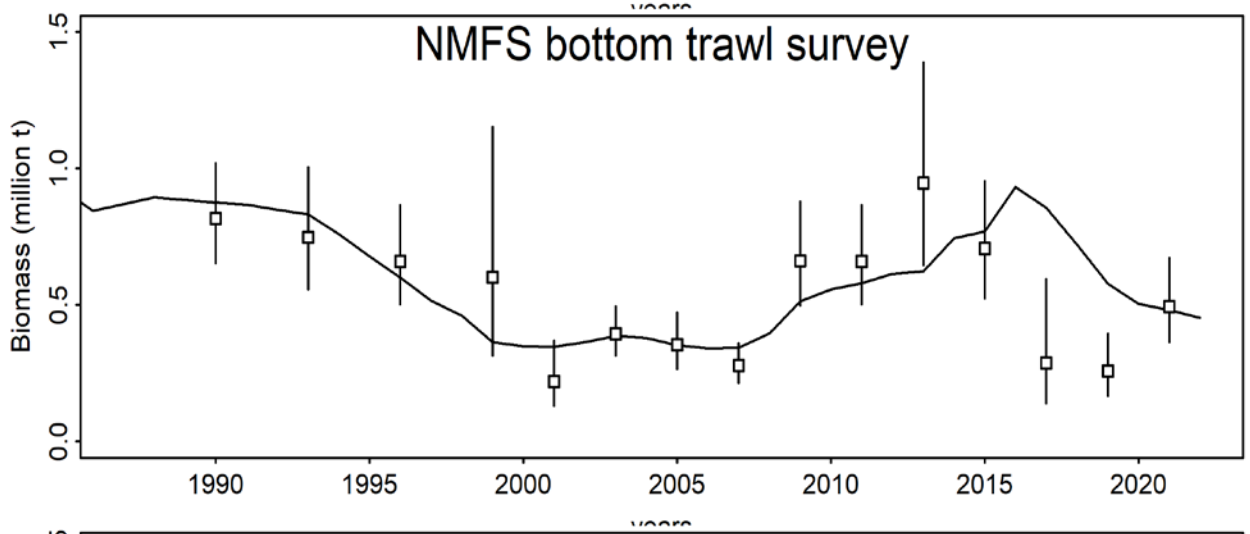


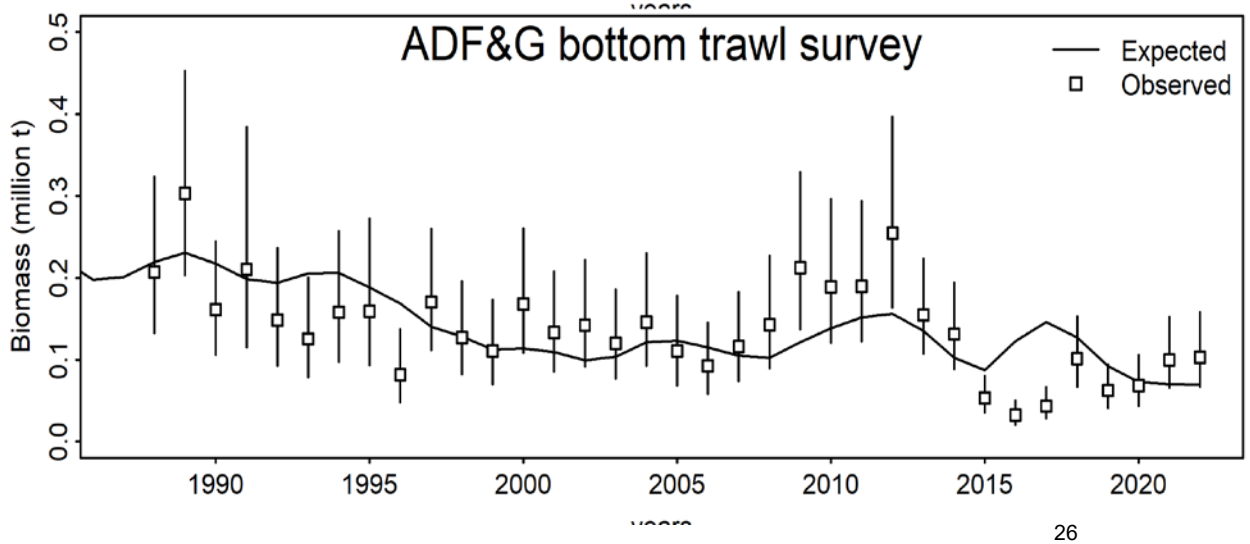
GOA Pollock

- Bottom trawl survey fit to age composition data

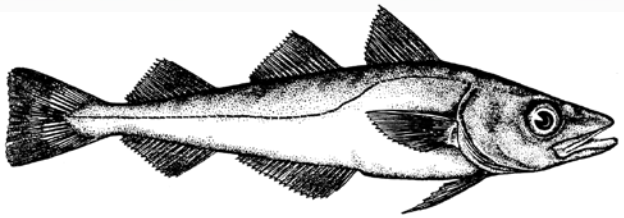


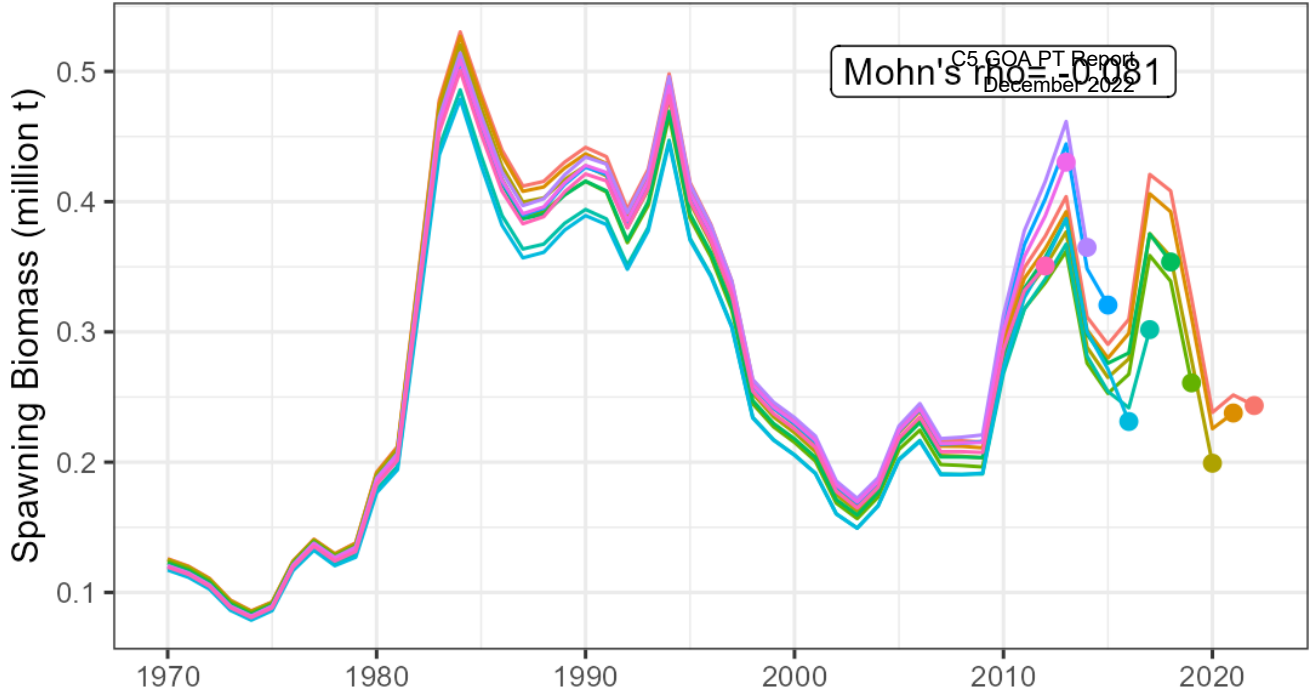
GOA Pollock: Fits to indices

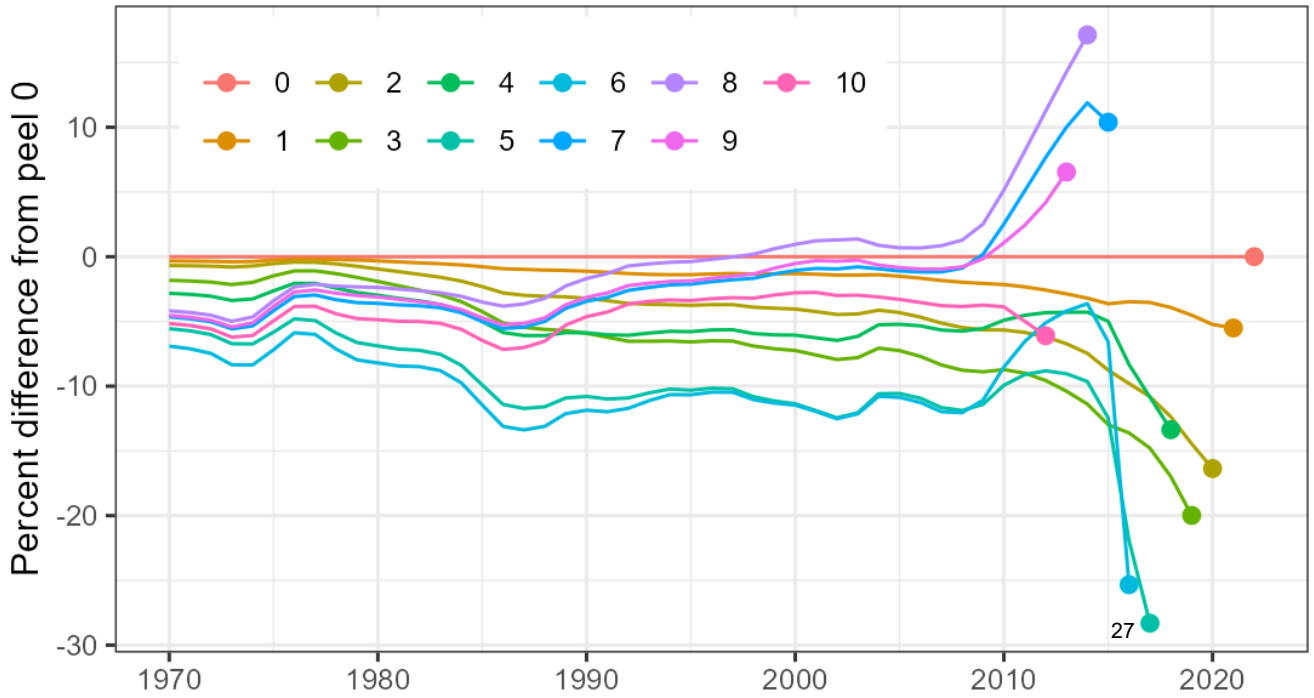




GOA Pollock: Retrospectives

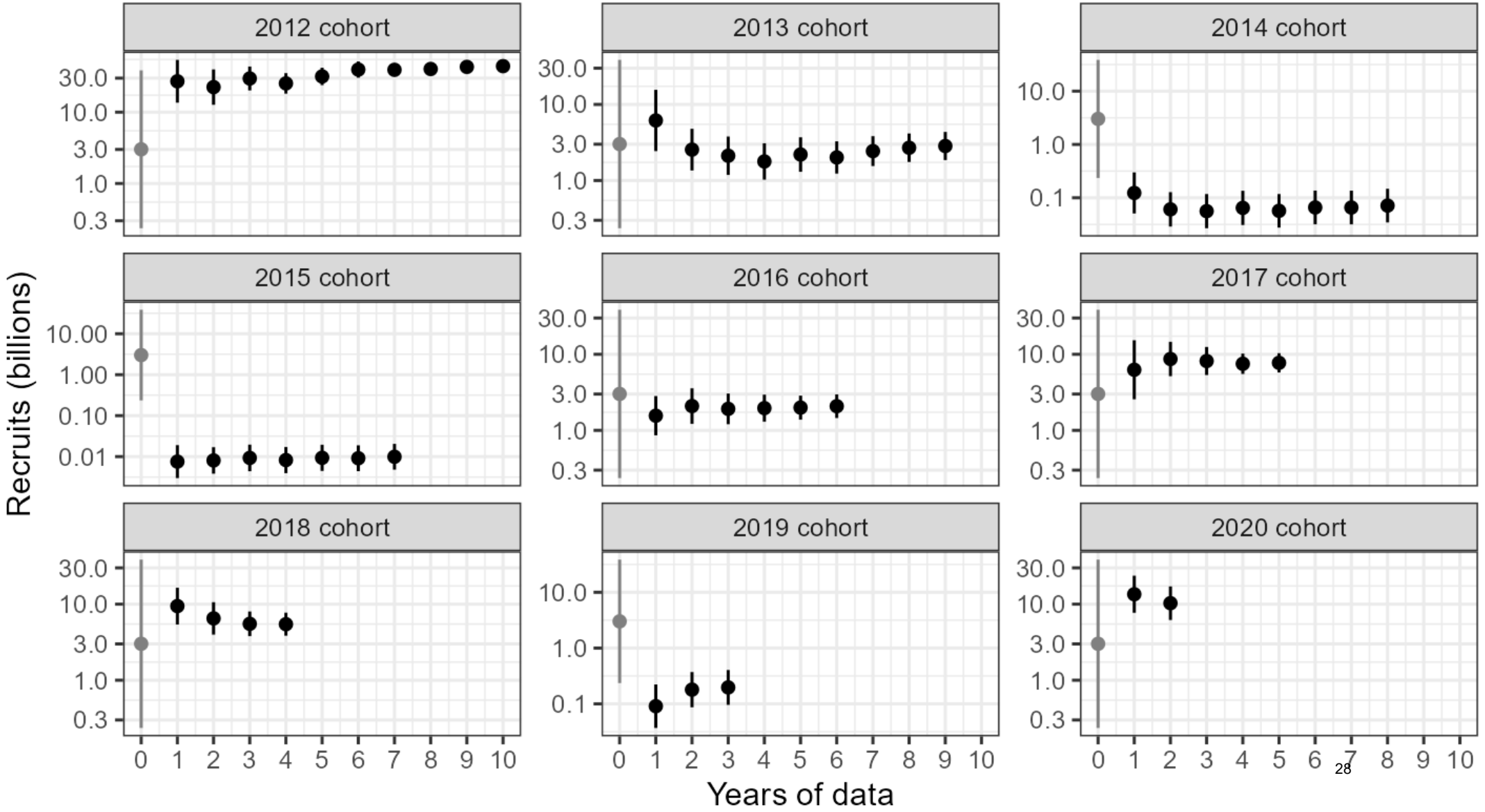




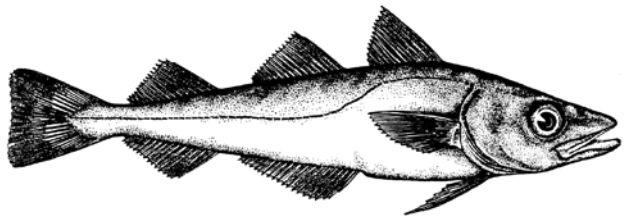


GOA Pollock: Year-class stability

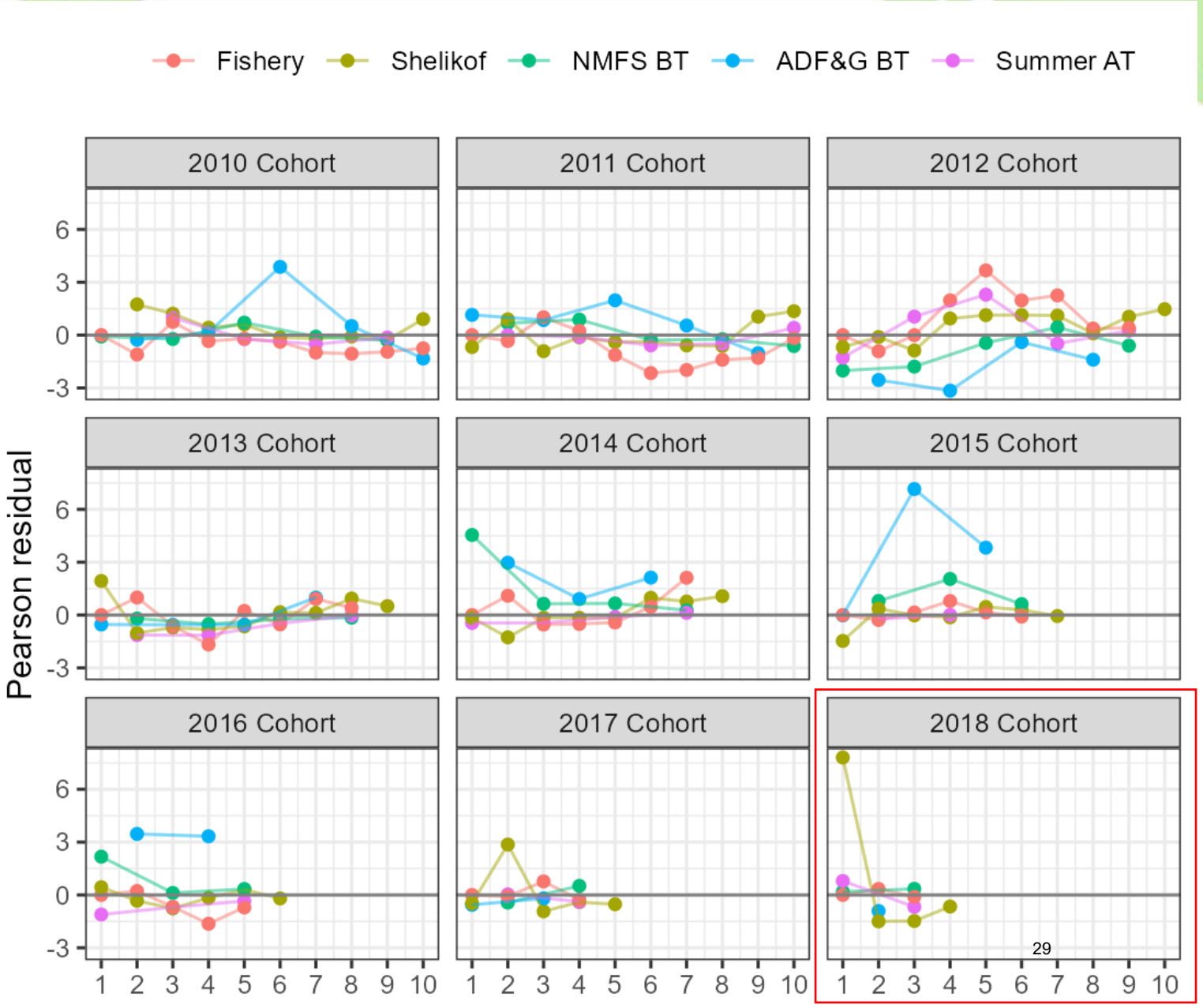
- Consistently estimated as data added



GOA Pollock: Residuals by cohort



- Some conflict in cohort size by data source
- Residuals high for Shelikof age 1

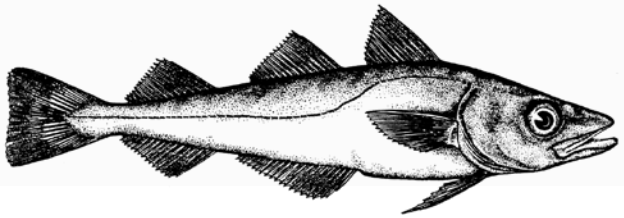


GOA Pollock

Final 2023 apportionment if TAC=148,937 t

Area	TAC (t)		Percent	
	Season A	Season B	Season A	Season B
610	1,685	25,272	1.2%	17.4%
620	58,039	18,965	40.0%	13.1%
630	9,121	24,608	6.3%	16.9%
640	7,523		5.2%	

GOA Pollock: Team Discussion



Agreed with author's recommendations for model, ABC/OFLs

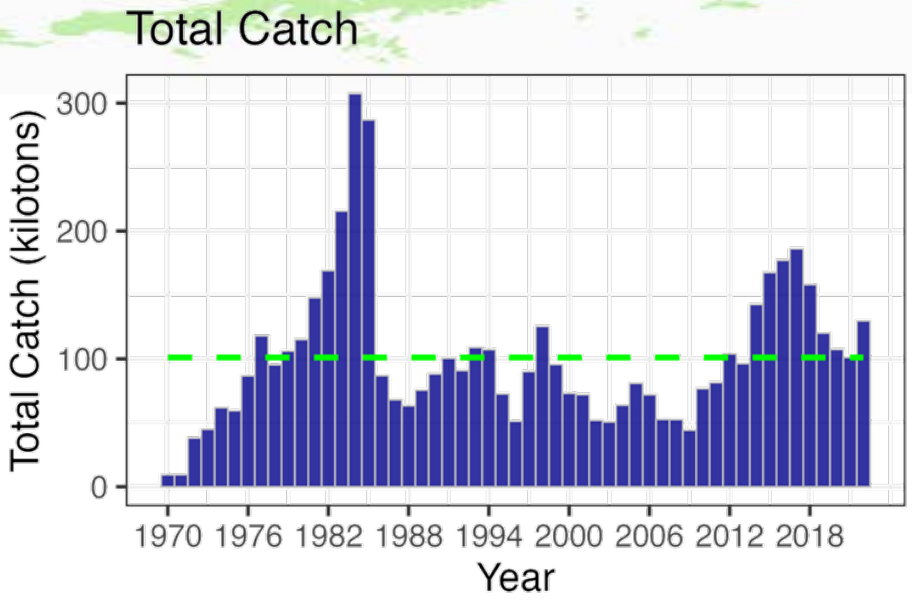
Related to residual analysis:

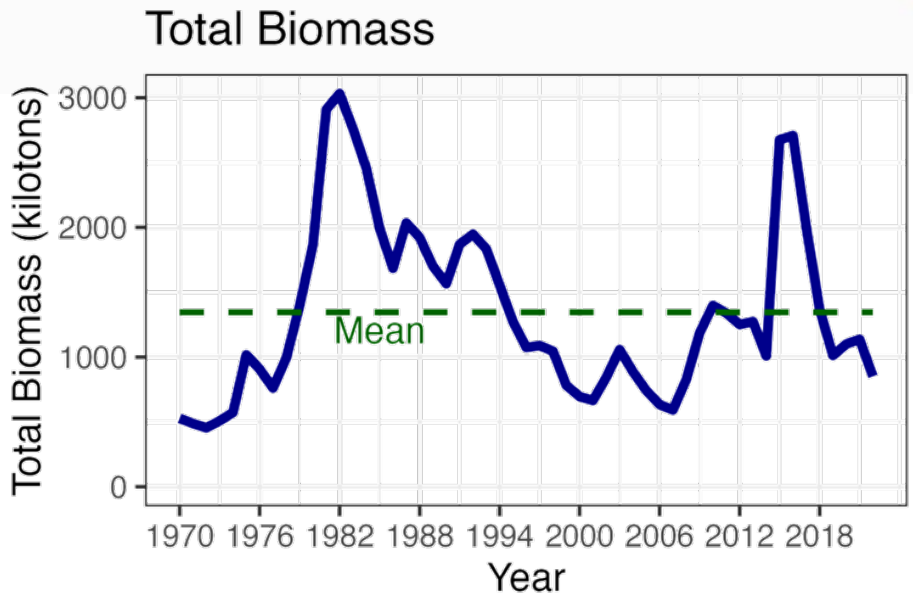
The Team recommended that the author work with the MACE program to develop uncertainty estimates for the age-1 index and supports investigation of alternative methods to implement uncertainty into this index.

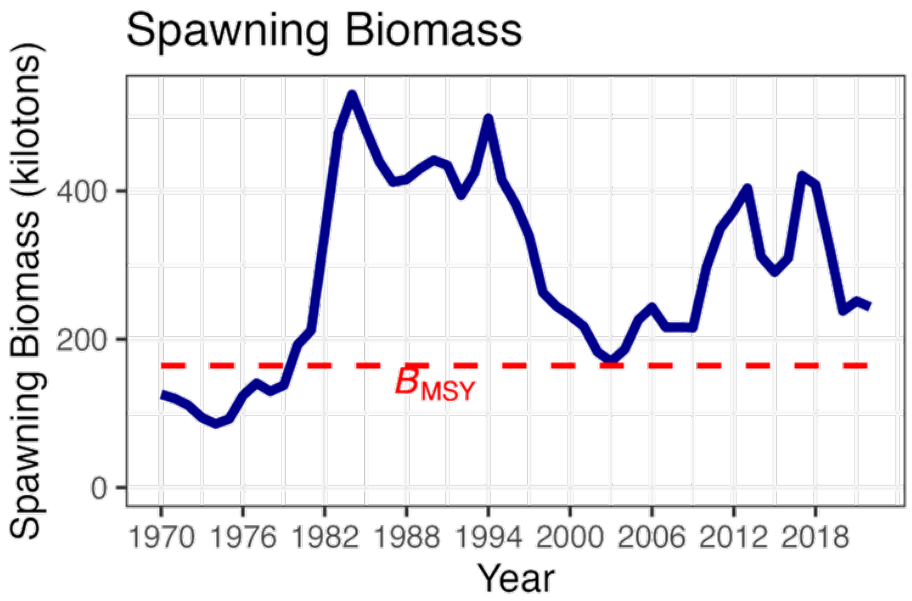
The Team requested a presentation on one-step-ahead residuals for the Sept Team 2023 meeting

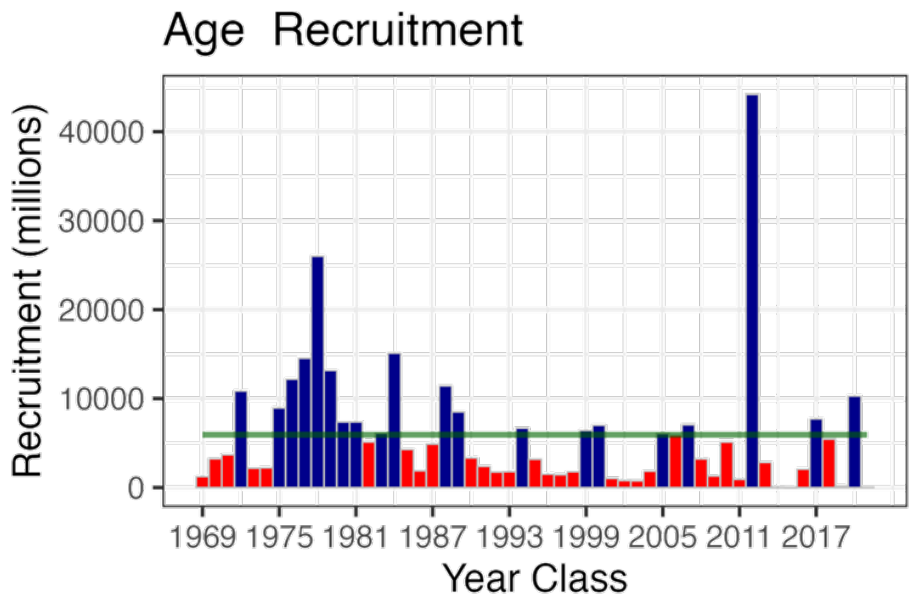
This approach has advantages over Pearson residuals for composition data

GOA Pollock: Overview

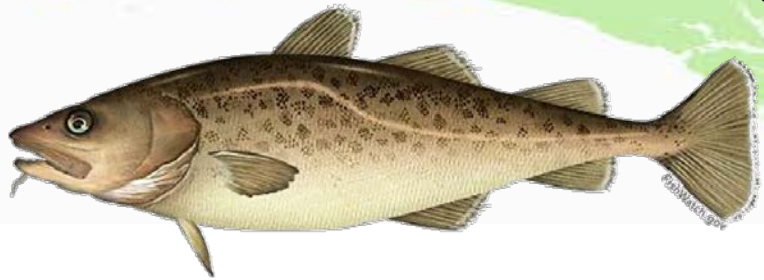








GOA Pacific cod (Full assessment)



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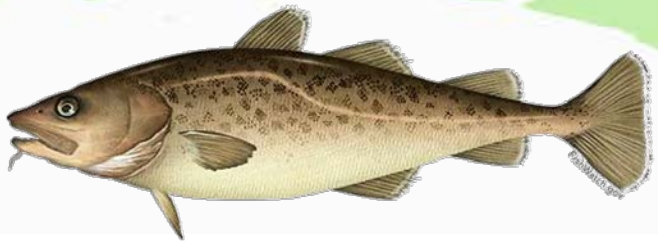
GOA Pacific cod

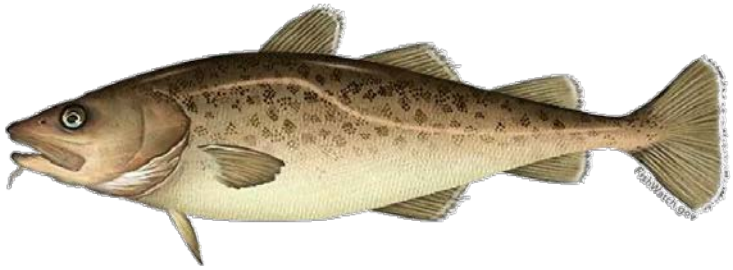


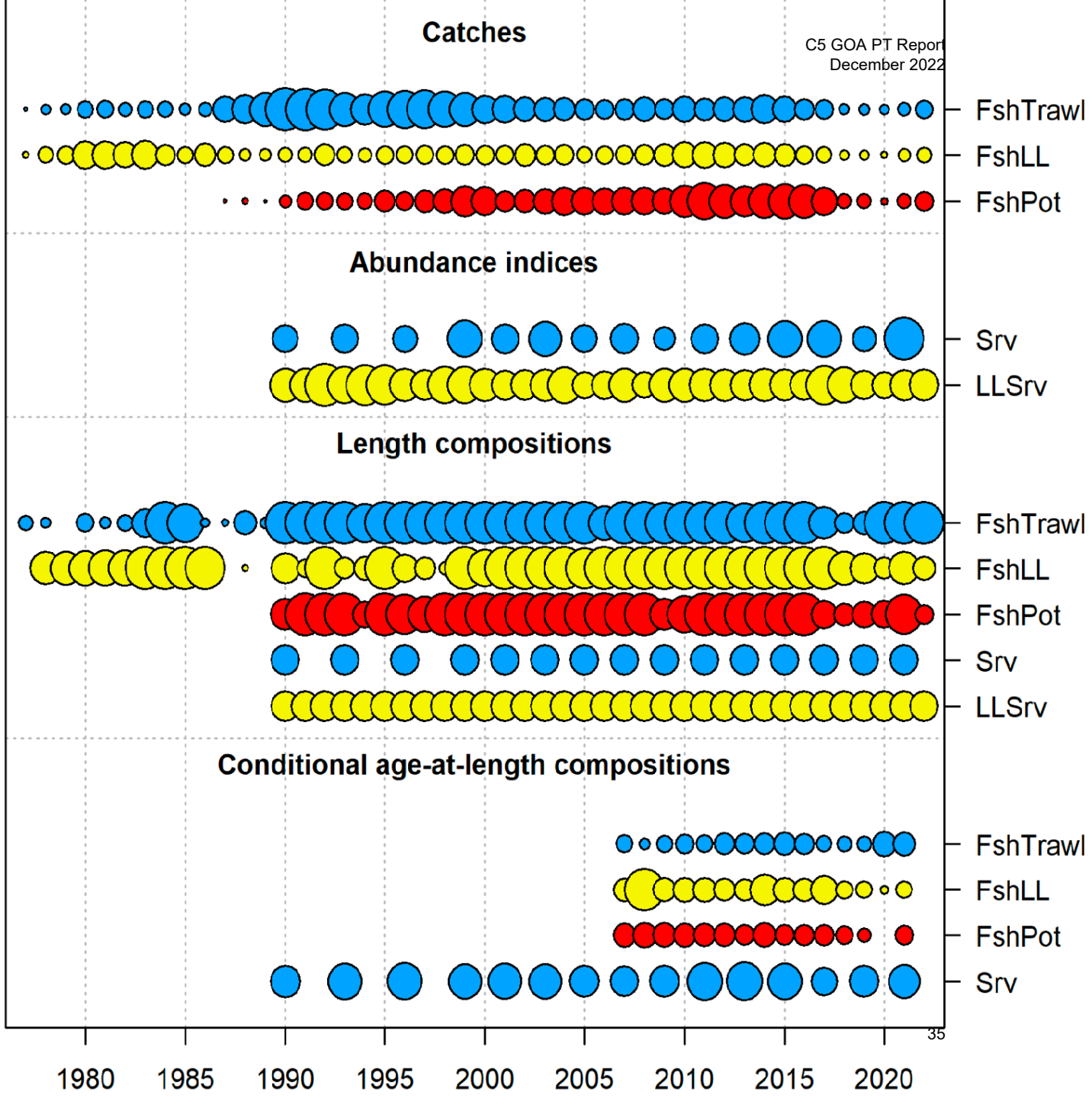
2023 projected spawning biomass to be at *B25.5%*

Same model as in 2022, with updated data since 2022

- State catch from 1997-2002 added

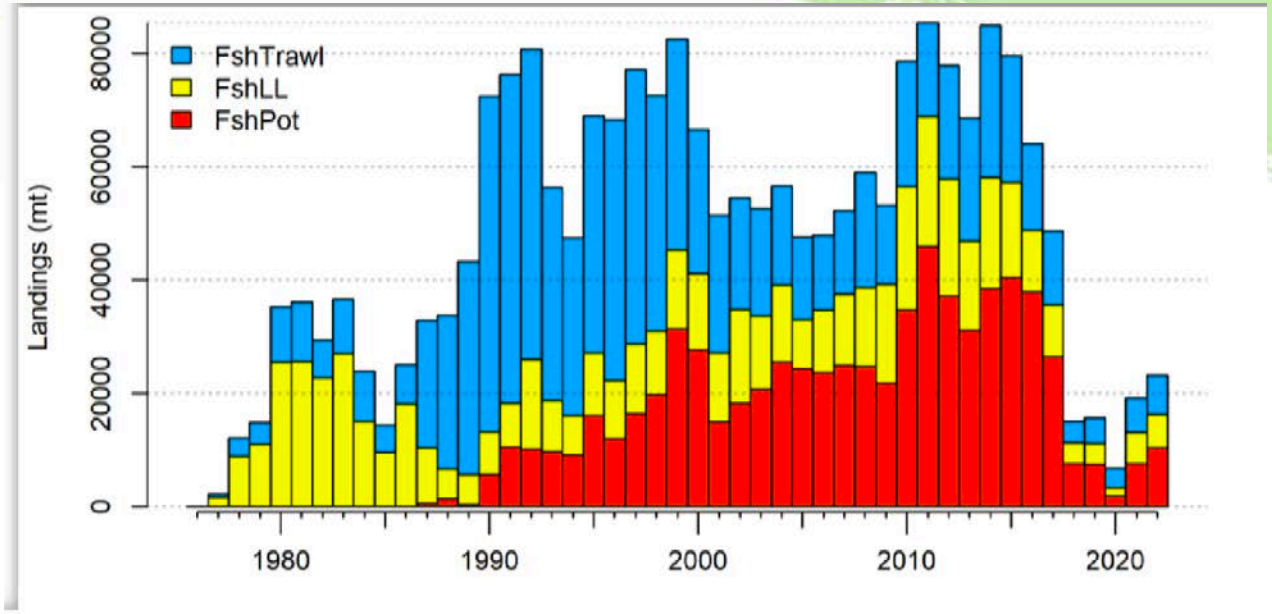
GOA Pacific cod: Data

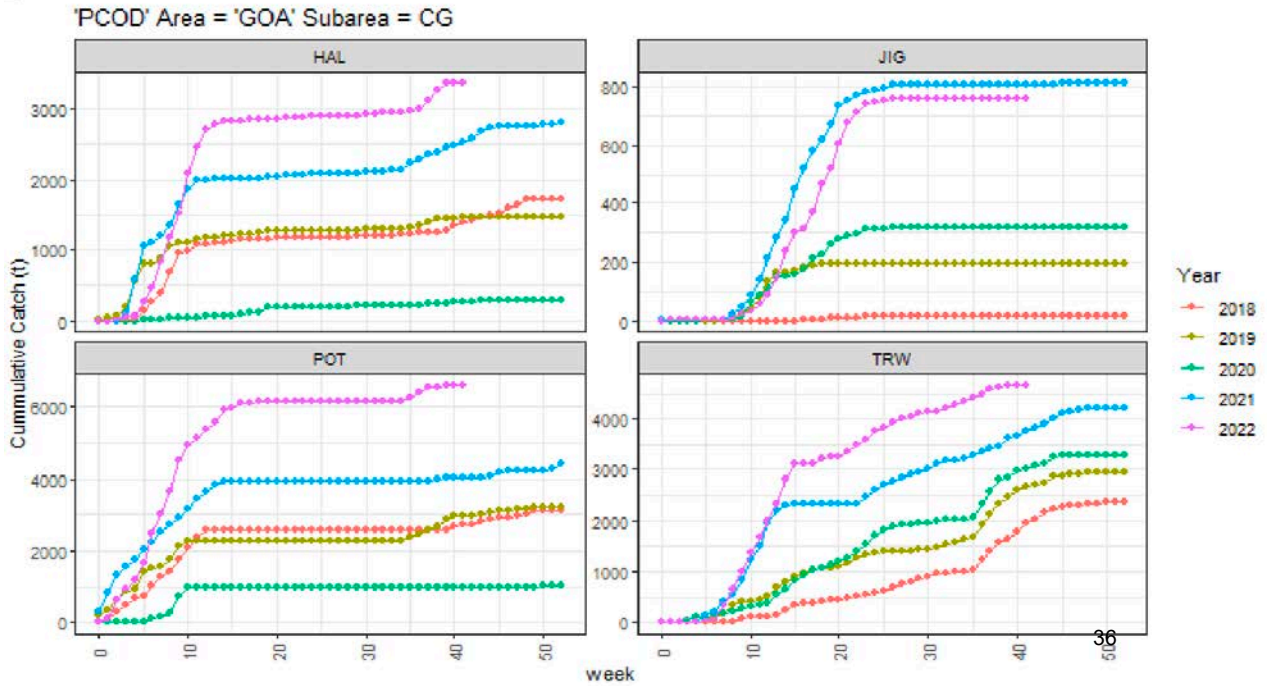




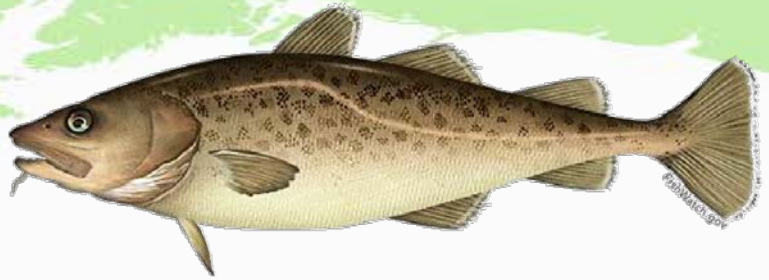
GOA Pacific cod

- Increased since 2021
- Pot majority > Trawl > LL
- CG greatest increase compared to last year

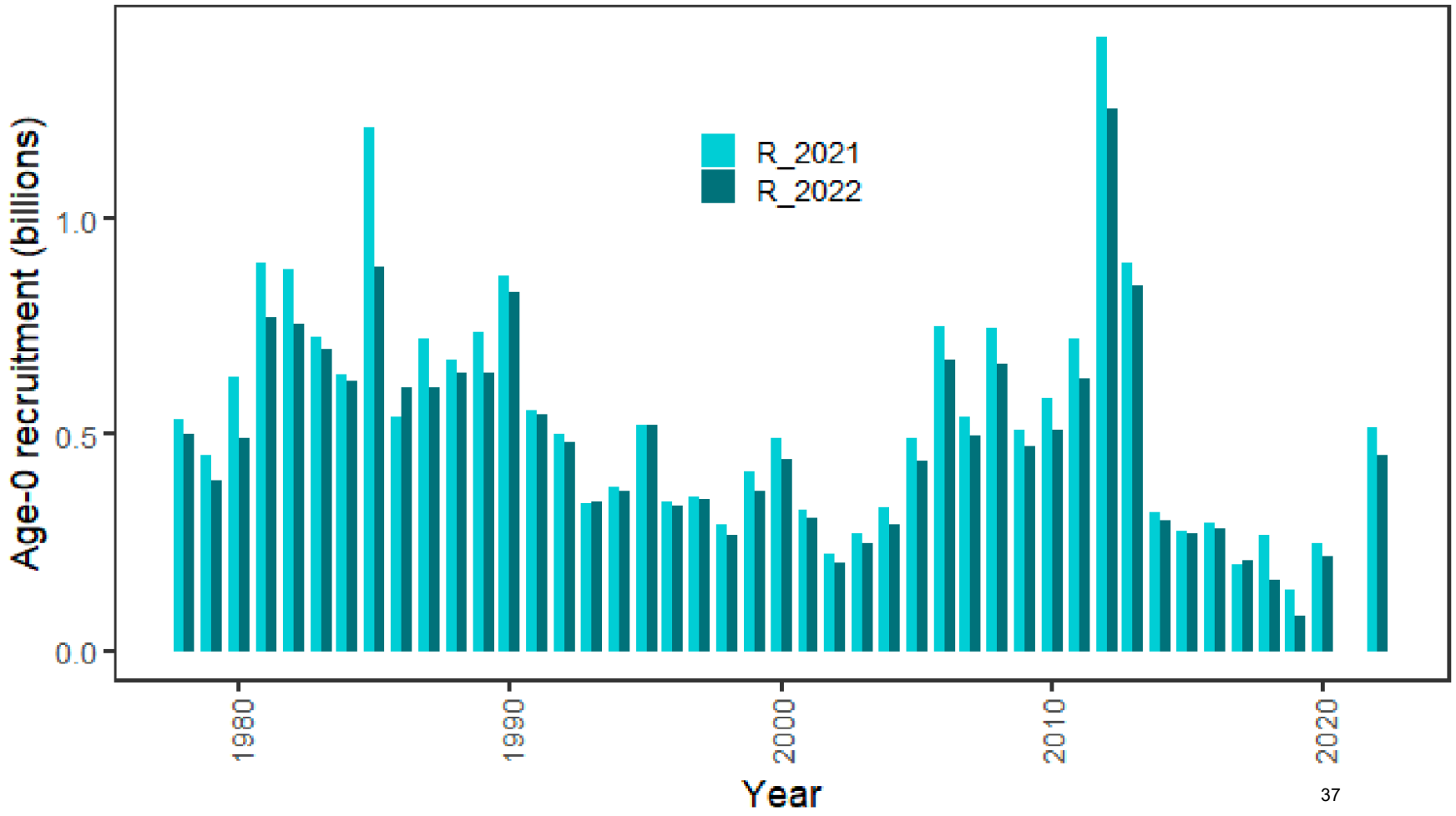




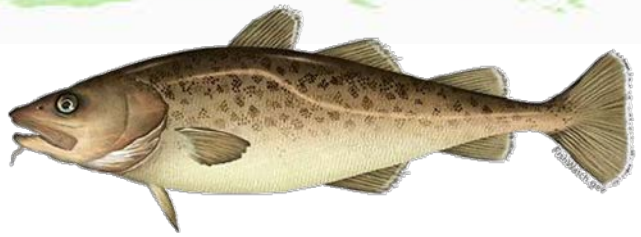
GOA Pacific cod



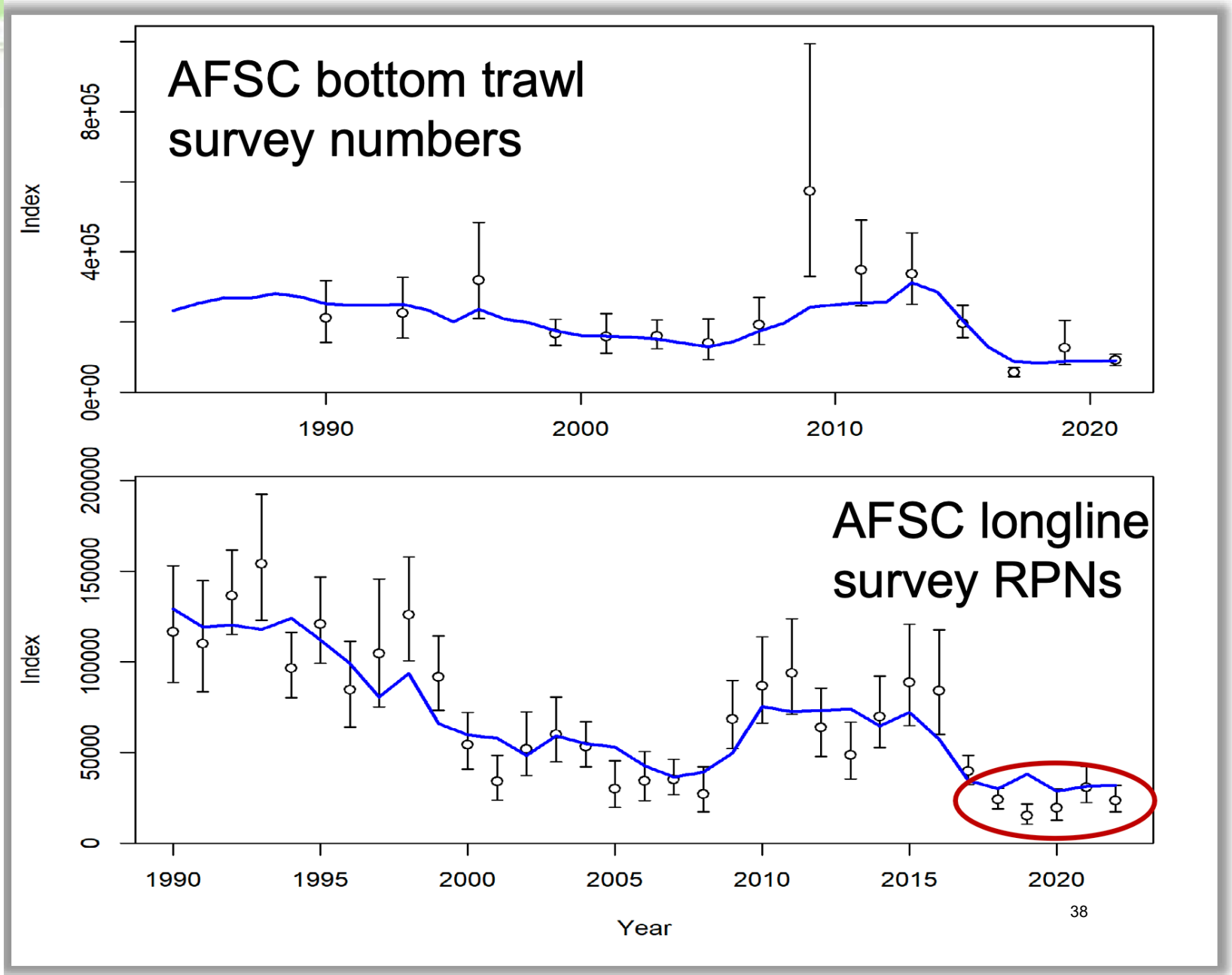
Population scale shifted downwards from 2021 assessment



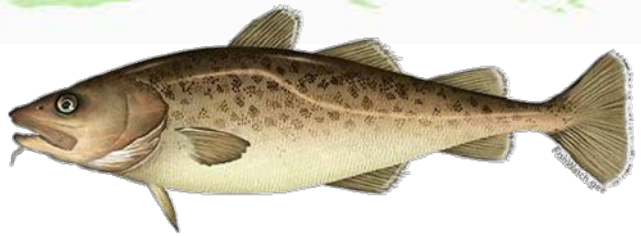
GOA Pacific cod



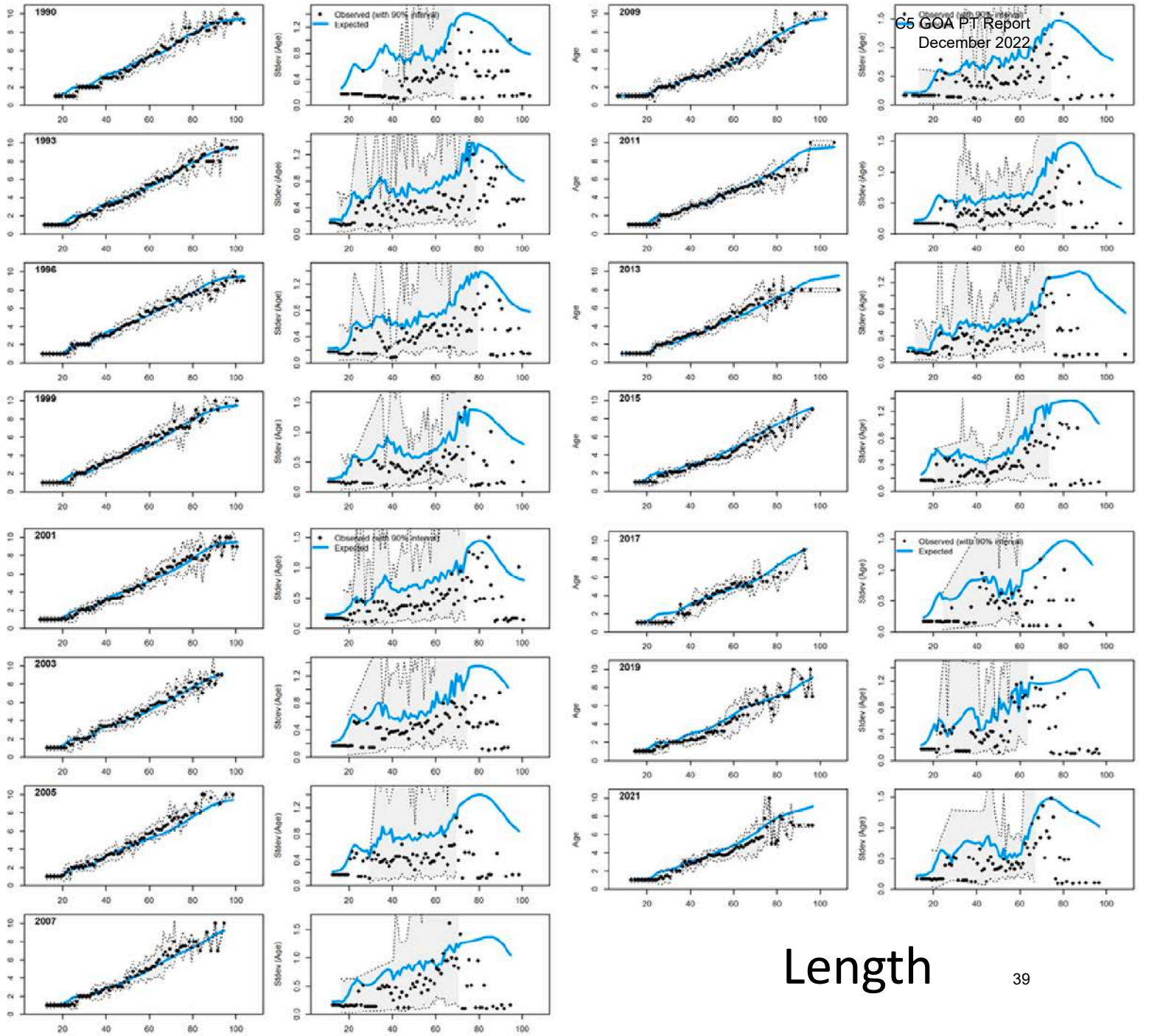
- Continuing to fit 2021 trawl survey precisely
- Expecting larger RPN from longline survey in 4 of last 5 years



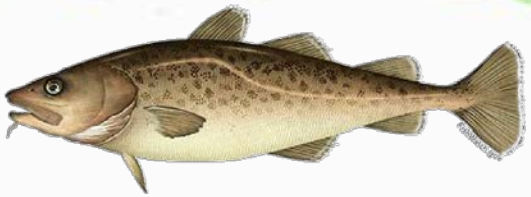
GOA Pacific cod

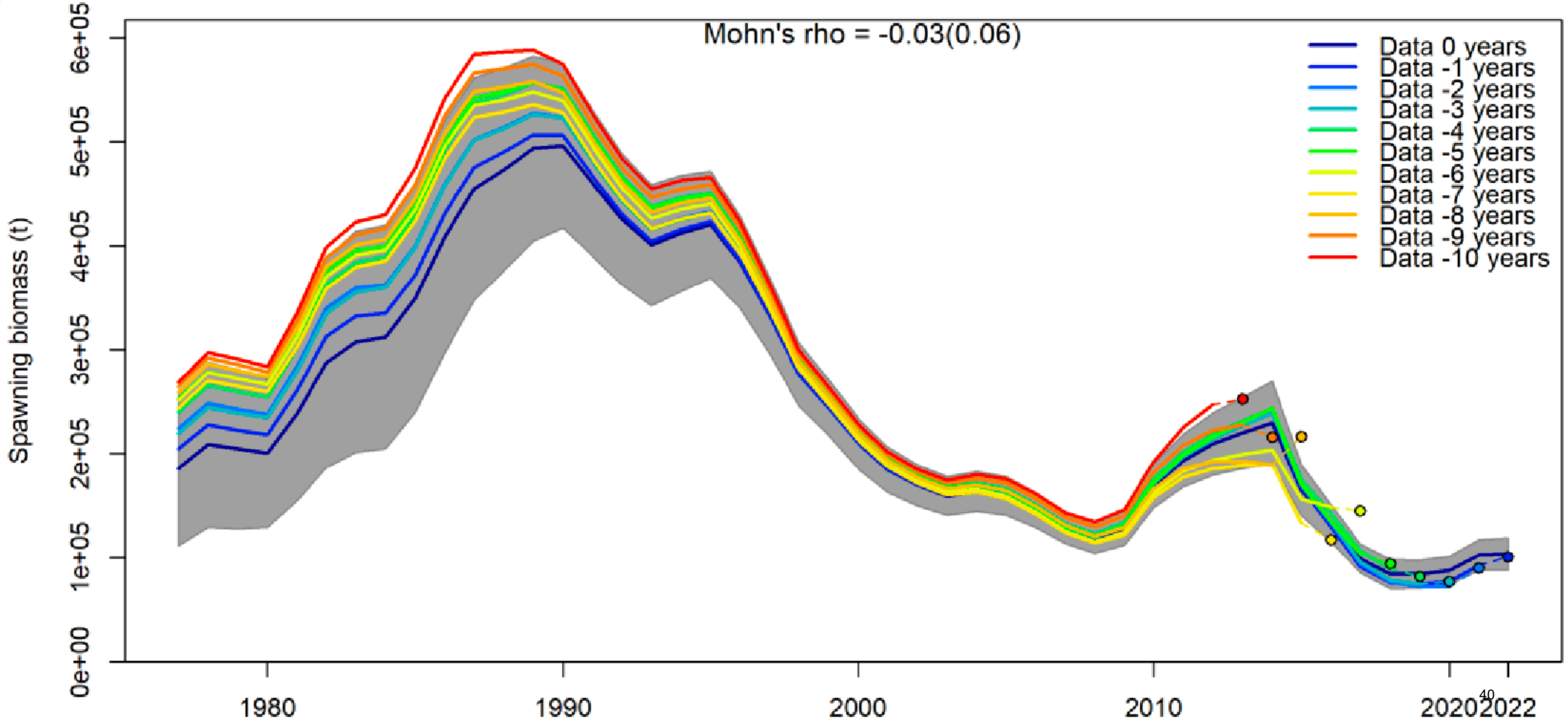


- Constant growth
- Fit as conditional-age-at-Length (CAAL)

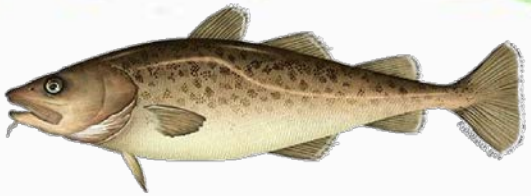


GOA Pacific cod: Retrospectives

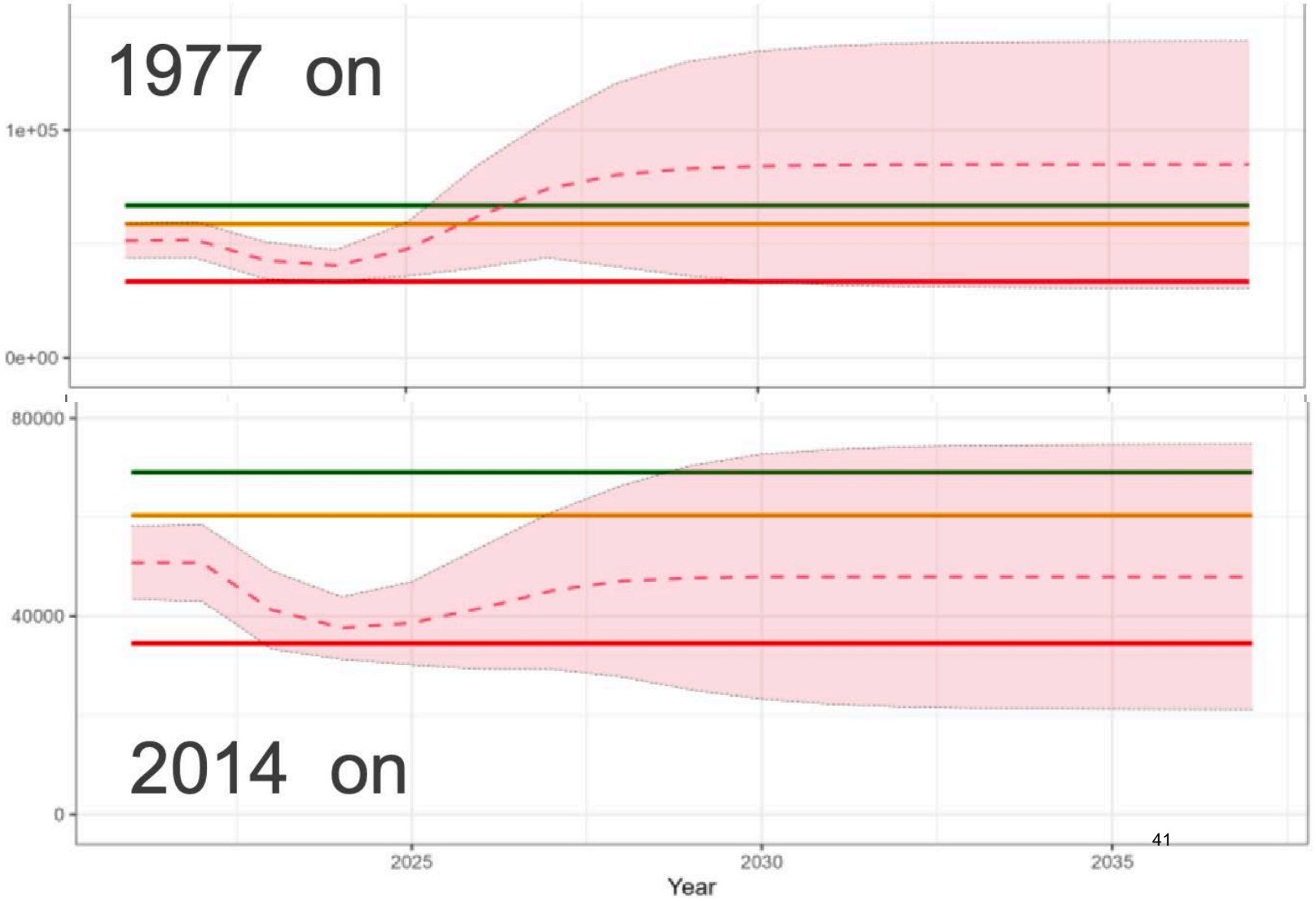




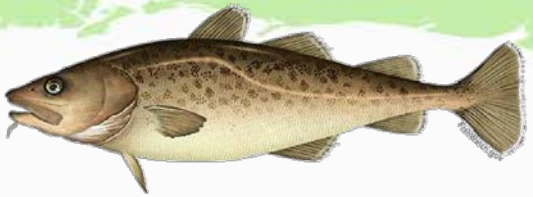
GOA Pacific cod

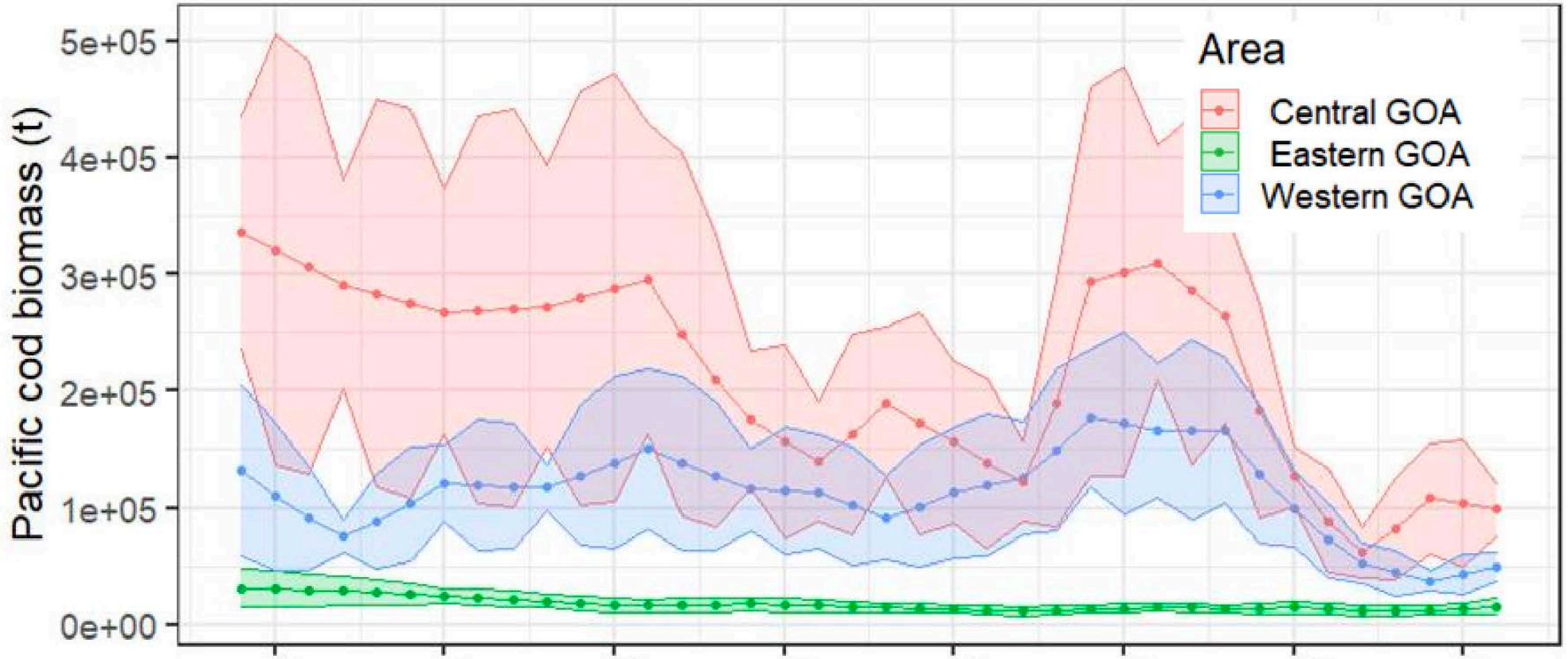


Projection impact of recruitment series



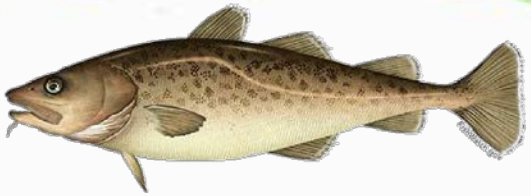
GOA Pacific cod: Apportionment





	Western	Central	Eastern	Total
Random effects area apportionment	30.3%	60.2%	9.5%	100%
2023 ABC	7,464	14,830	2,340	24,634
2024 ABC	6,873	13,655	2,155	22,683

GOA Pacific cod: Team Discussion



Relative to size composition patterns:

The Team recommended adding confidence intervals on the mean lengths by depth strata. Additionally, the Team recommended that the authors compare total fishing effort or catch (in addition to total sample size) to be sure that the observer coverage is capturing effort appropriately

Relative to growth:

The Team recommended that the data for length-weight relationships be re-evaluated and examined for sensitivity to the trends over time and areas

The Team recommended the authors look at the model-predicted mean weight-at-age (by gear type), and compare to the observed weight-at-age data to see if there are discernible spatial or temporal patterns that the model is missing.

The fit of the age-length matrix on pot data, as shown by the Pearson residuals, shows a distinct pattern through time therefore:

The Team recommended that an evaluation comparing how growth changes may affect the residuals be pursued. The Team also recommended the author investigate whether size-based selectivity affects the patterns observed.

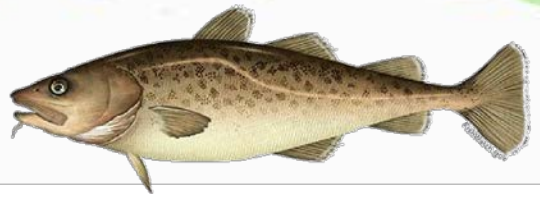
Relative to MCMC diagnostics:

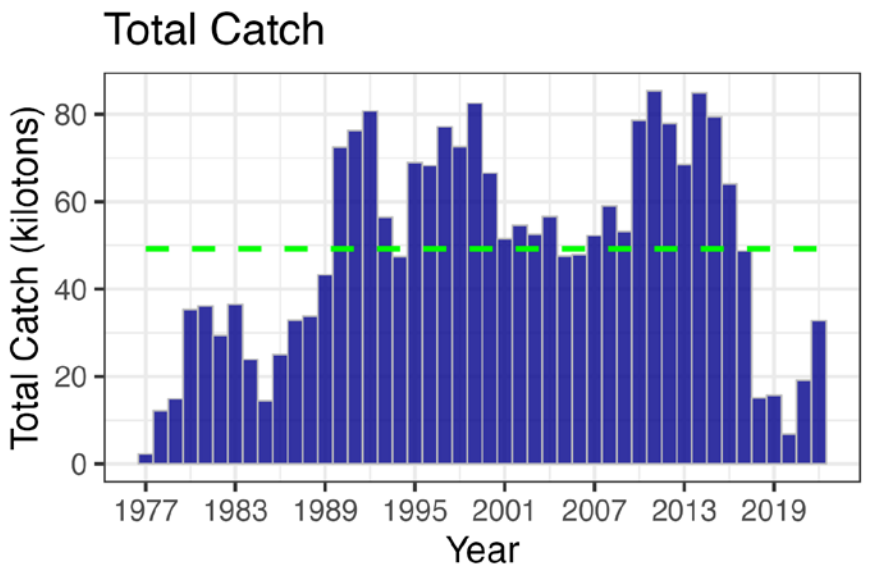
The Team recommended examining the updated MCMC tools (e.g., adnuts) and diagnostics.

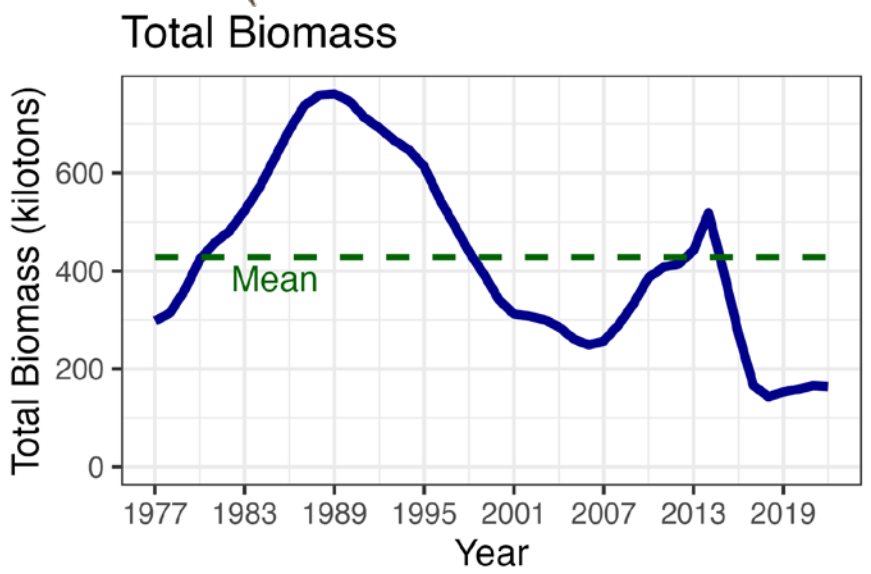
Relative to the time-varying longline survey catchability being linked to an environmental covariate:

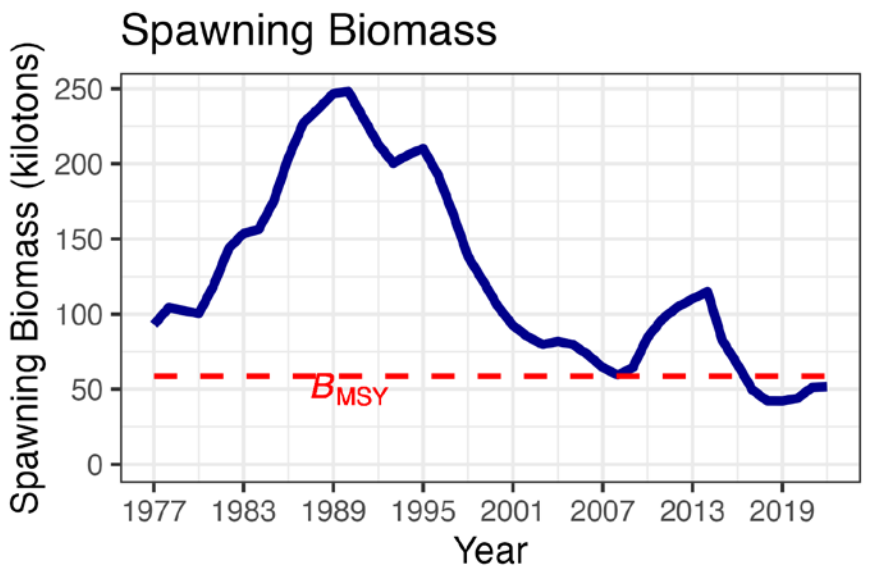
The Team recommended that it be re-examined against a fixed value for comparison.

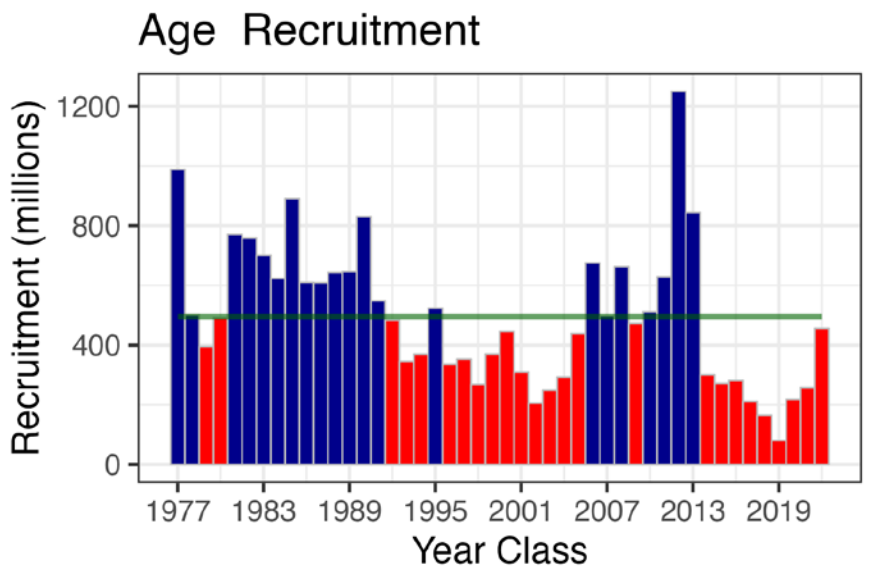
GOA Pacific cod: Overview











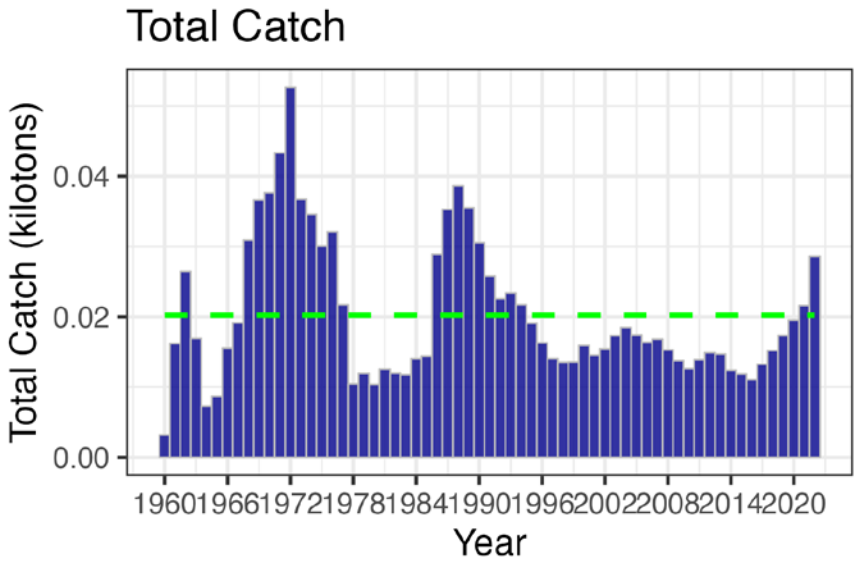
Sablefish (Full assessment)

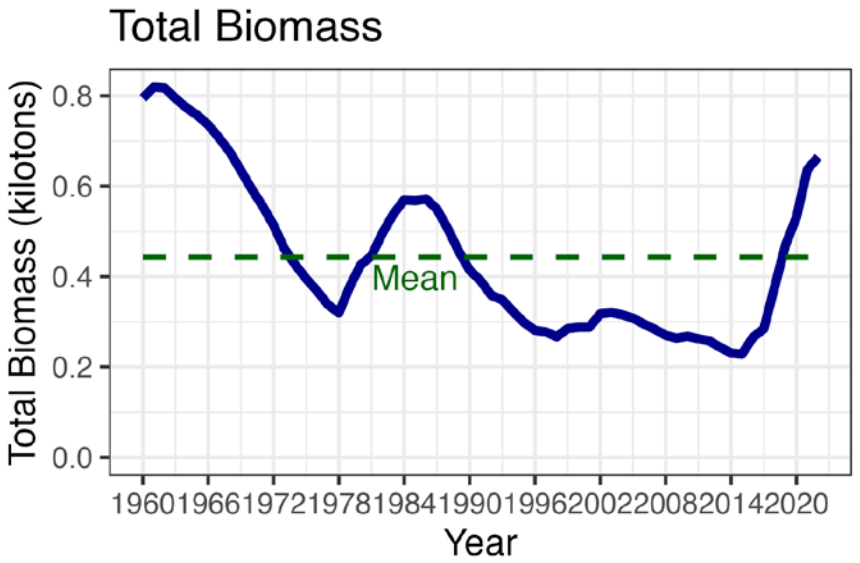
Species	2022 catch	ABC 2022	ABC 2023	Change
Pollock	129,876	144,444	160,301	up 15,857 (11%)
Pacific Cod	18,275	32,811	24,634	down 8,177 (25%)
Sablefish	17,531	22,794	40,502	up 17,708 (78%)
Flatfish	2,673	115,834	119,497	up 3,663 (3%)
Arrowtooth flounder	11,456	119,779	119,485	down 294 (0%)
Rockfish	36,055	56,651	57,519	up 868 (2%)
Atka mackerel	880	4,700	4,700	same (0%)
Skates	2,706	6,563	6,563	same (0%)
Sharks	2,112	3,755	4,891	up 1,136 (30%)
Octopus	111	980	980	same (0%)
Total	221,675	508,311	539,072	up 30,761 (6%)

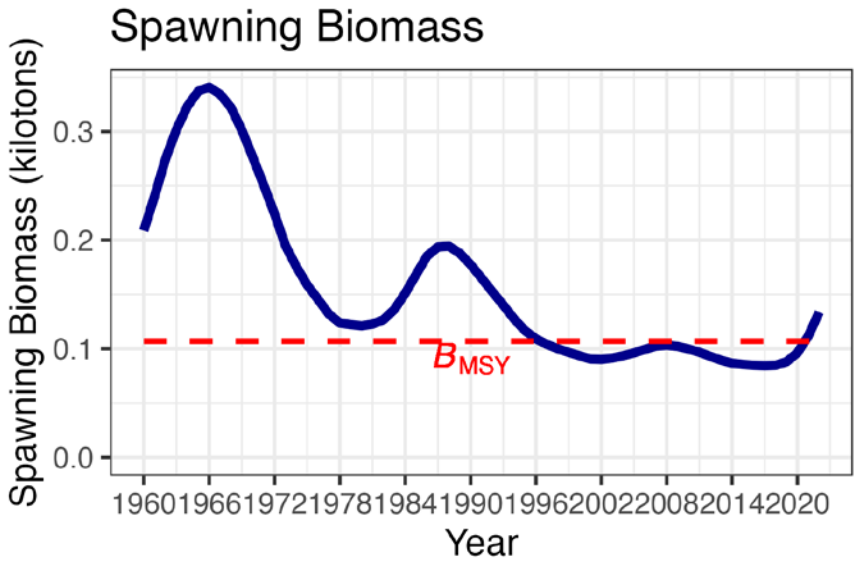
Sablefish: *Covered in Joint Team*

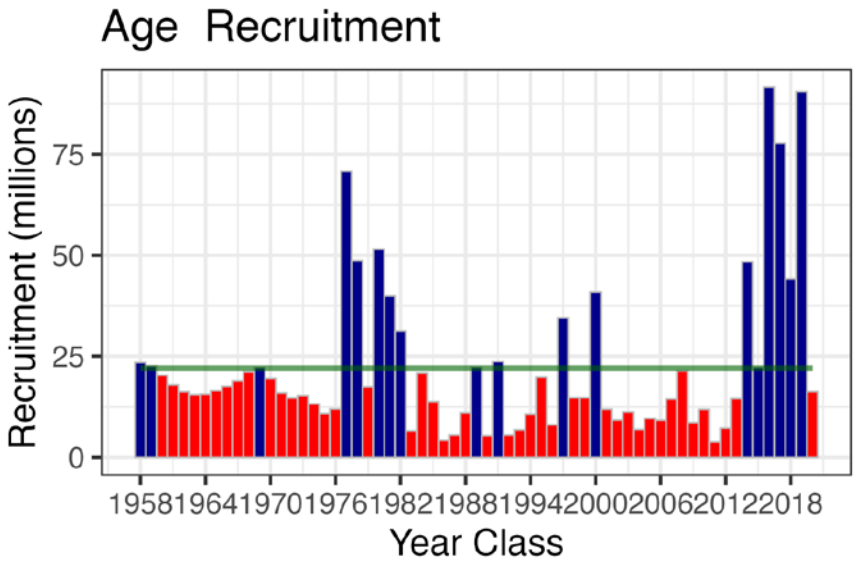
Method	Area						ABC
	AI	BS	WG	CG	WY*	EY*	
2022 ABC[+]	6,486	5,305	3,821	10,008	3,179	6,064	34,863
Status Quo (Fixed at Current)[**]	7,650	6,231	4,411	11,795	4,069	6,705	40,861
Fixed[***]	5,392	3,987	4,408	13,939	4,689	8,446	40,861
25% Stair Step	6,558	5,475	4,450	12,616	4,116	7,646	40,861
50% Stair Step	7,725	6,963	4,492	11,294	3,543	6,844	40,861
75% Stair Step[****]	**8,892**	**8,450**	**4,533**	**9,972**	**2,970**	**6,044**	**40,861**
5-year Survey Avg.[^]	10,058	9,938	4,575	8,650	2,397	5,243	40,861
2024 ABC[$]	10,308	10,185	4,688	8,865	2,457	5,373	41,876

Sablefish: Overview

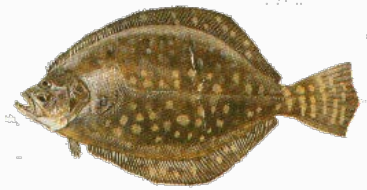








Flatfish ABC Summary



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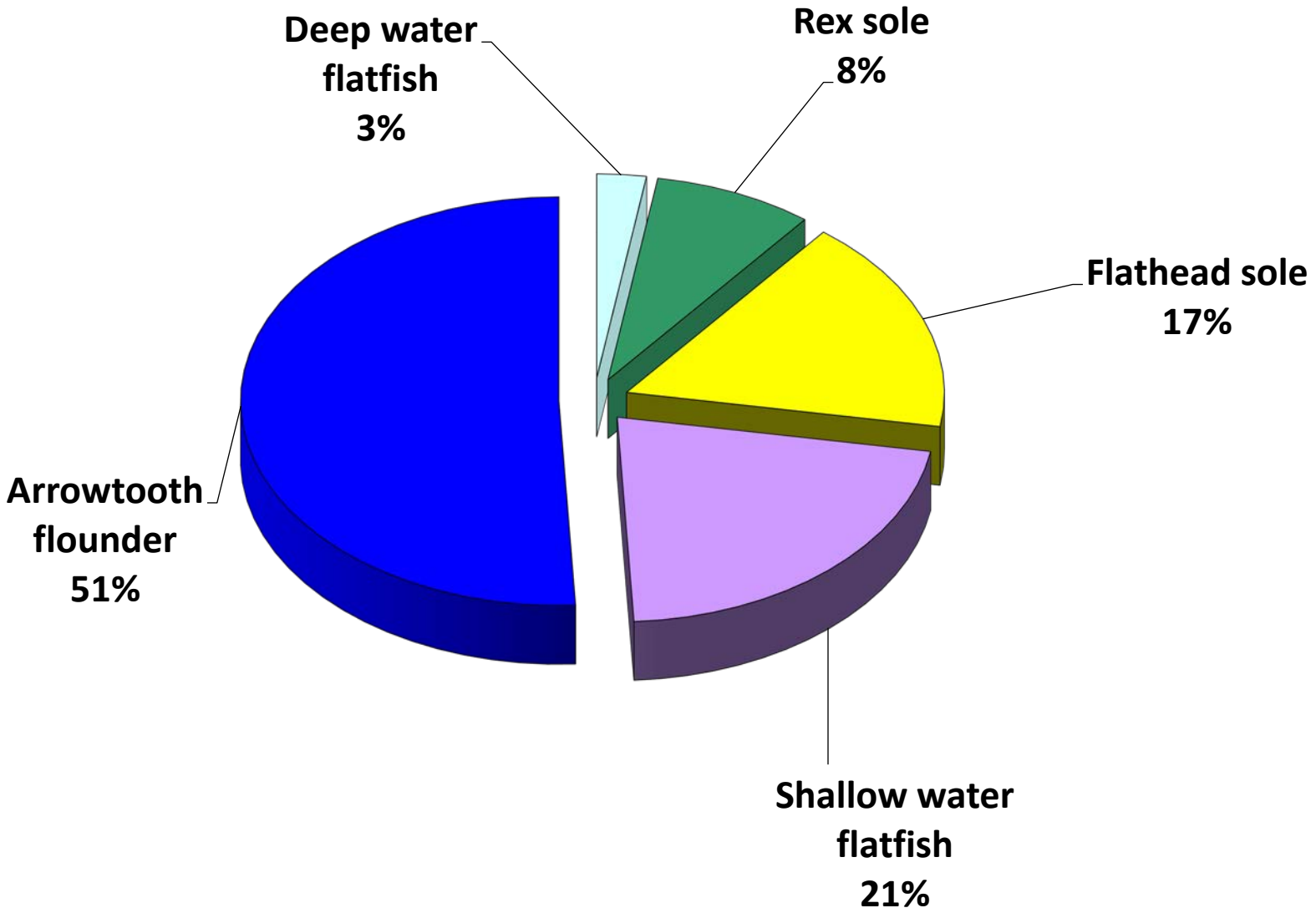
Flatfish ABC's

Species	2022 ABC	2023 ABC	Change
Shallow water flatfish	50,610	53,537	up 2,927 (6%)
Rex sole	19,141	20,664	up 1,523 (8%)
Deep water flatfish	5,908	5,816	down 92 (2%)
Flathead sole	40,175	39,480	down 695 (2%)
Arrowtooth flounder	119,779	119,485	down 294 (0%)
Subtotal	235,613	238,982	up 3,369 (1%)
Subtotal (without ATF)	115,834	119,497	up 3,663 (3%)

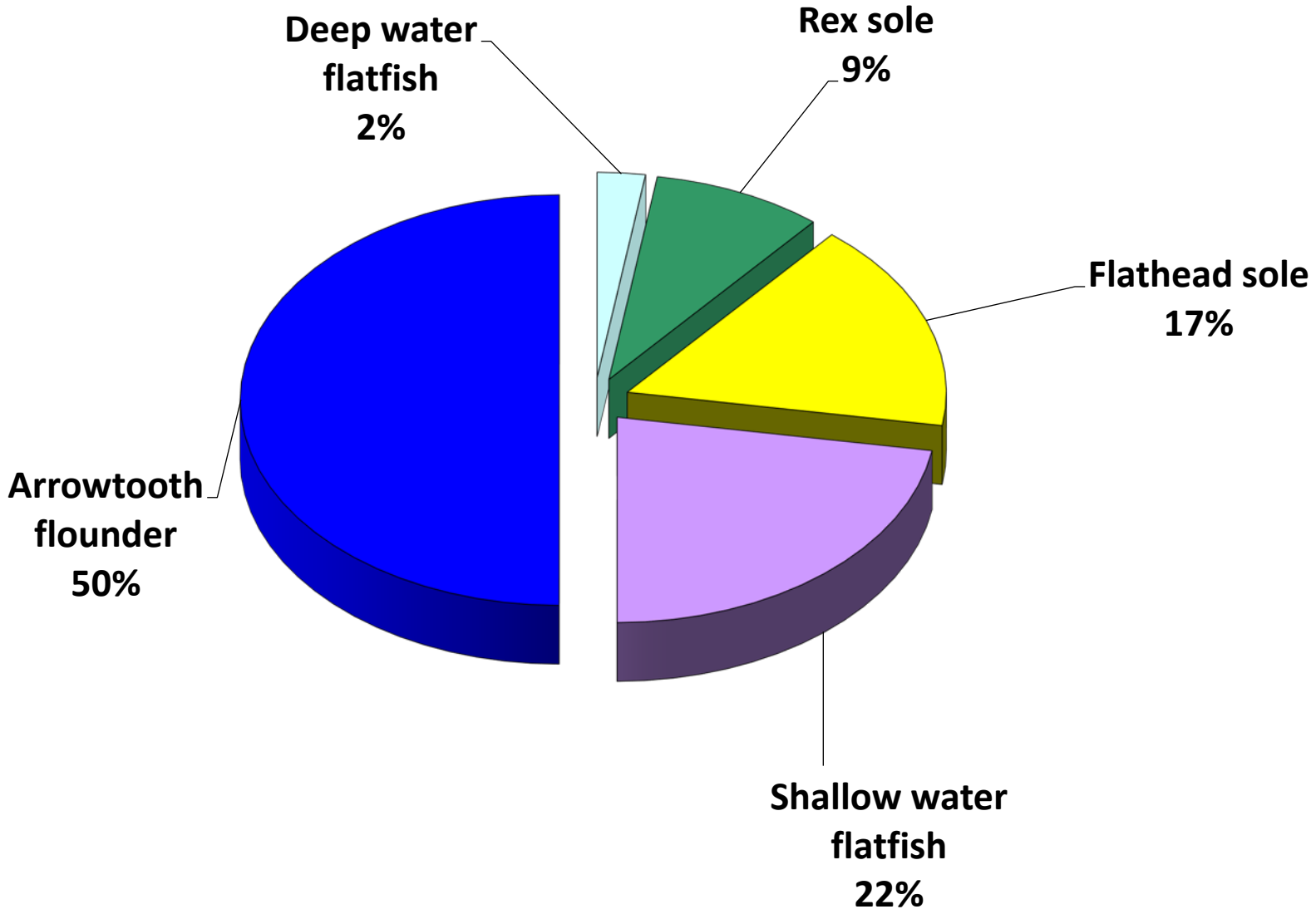
Deep-water ABC from Dover assessment Tier 3 + others Tier 6

Shallow water flats: N and S rock sole Tier 3, others Tier 5

Flatfish 2022 ABC's
235,613 t combined



Flatfish 2023 ABC's 238,982 t combined



Flatfish ABC's

Species	2022 ABC	2023 ABC	Change
Shallow water flatfish	50,610	53,537	up 2,927 (6%)
Rex sole	19,141	20,664	up 1,523 (8%)
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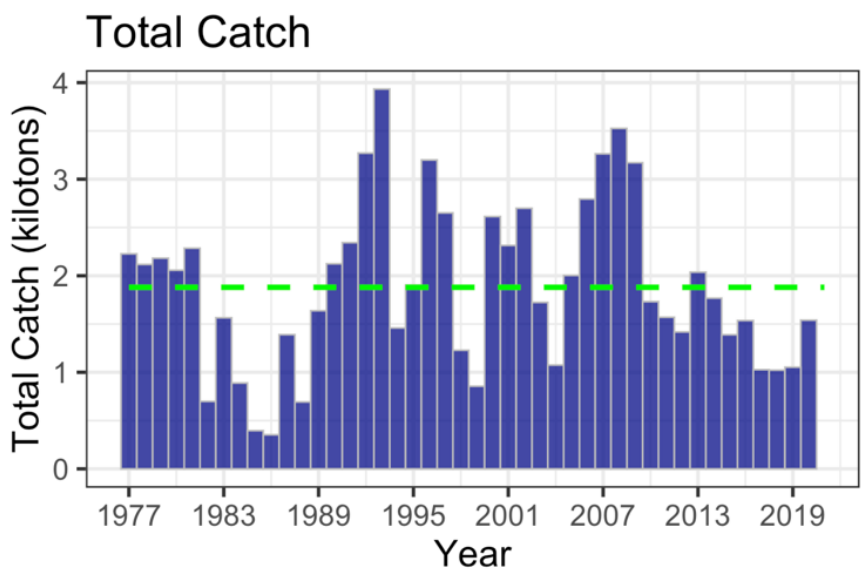
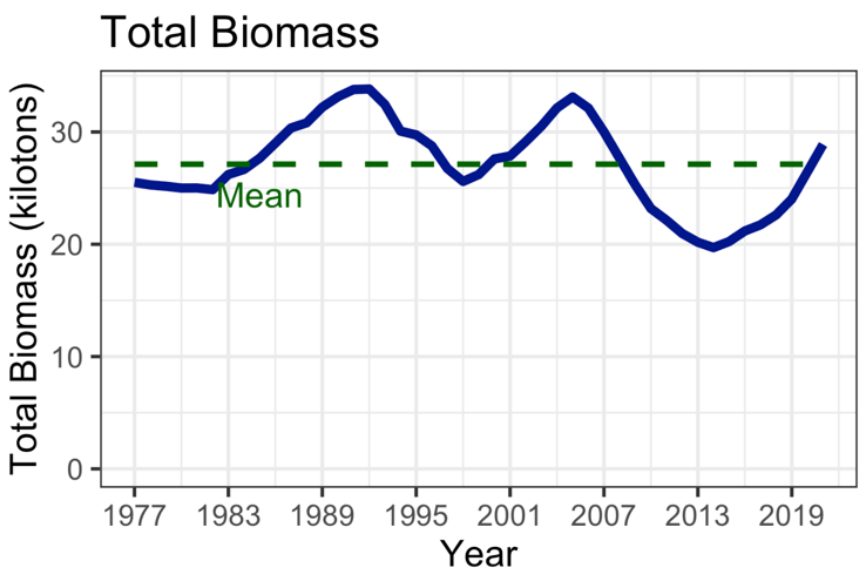
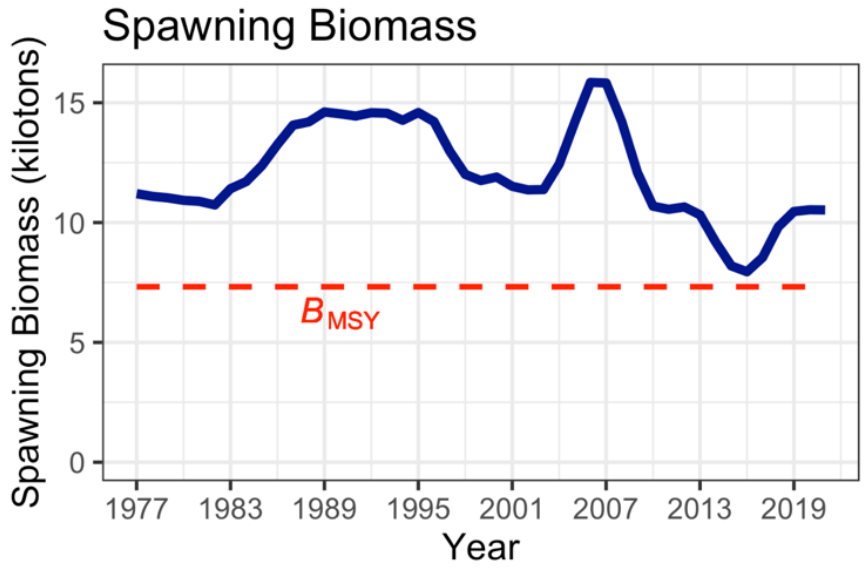
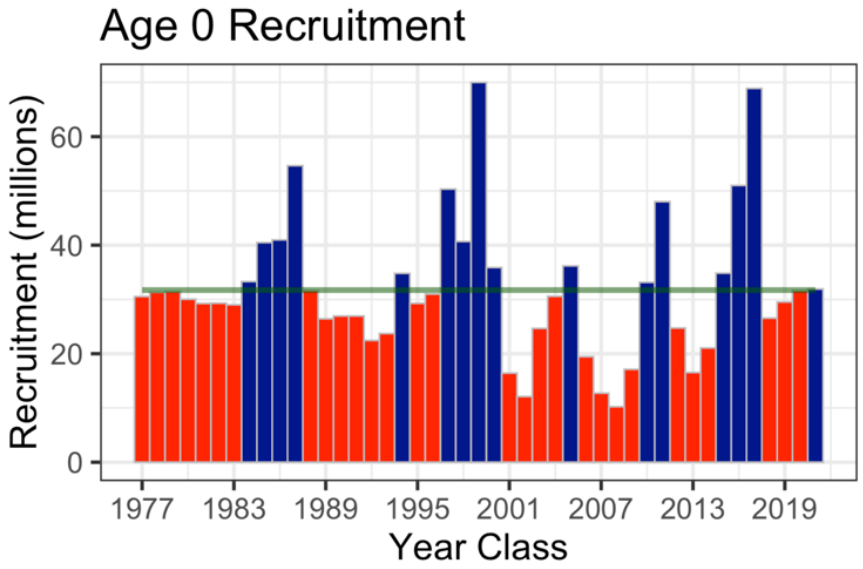
Shallow water flats: N and S rock sole Tier 3, others Tier 5

4. Northern rock sole central GOA

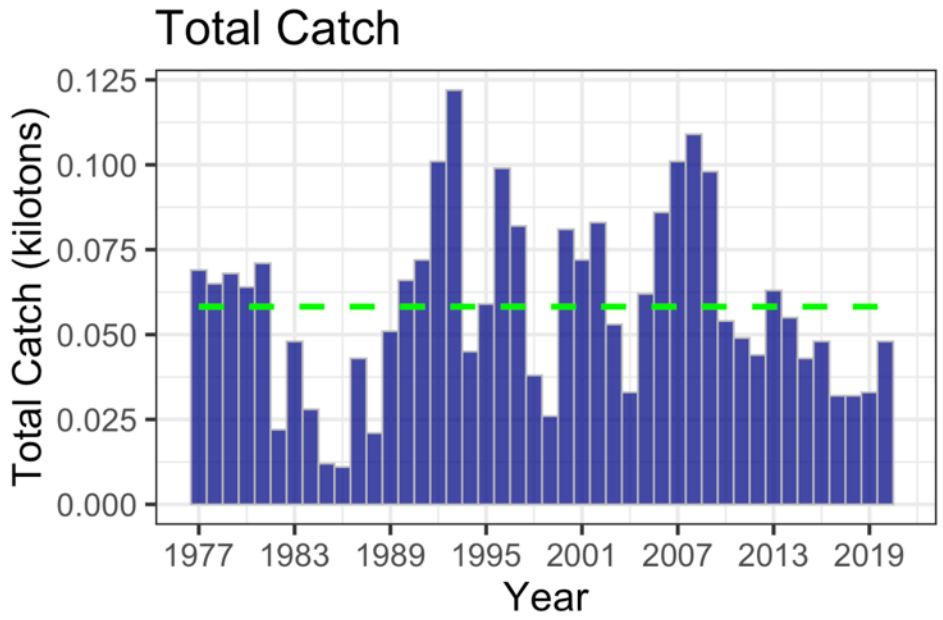


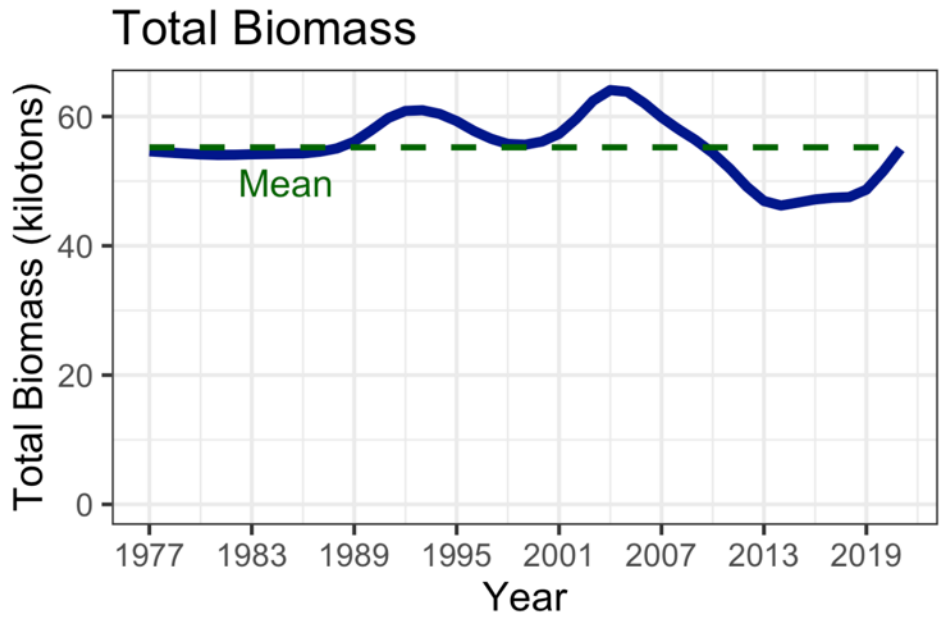


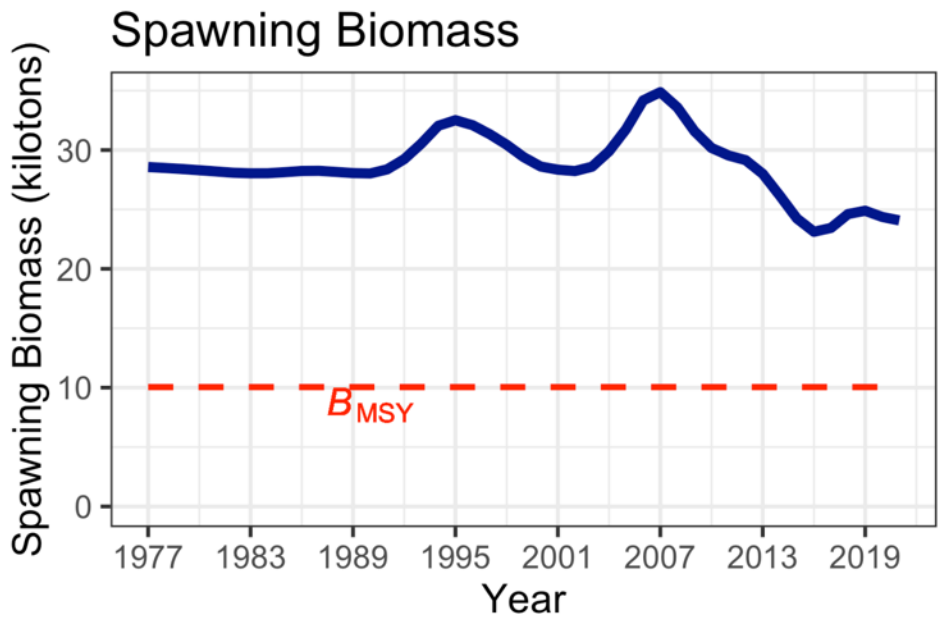


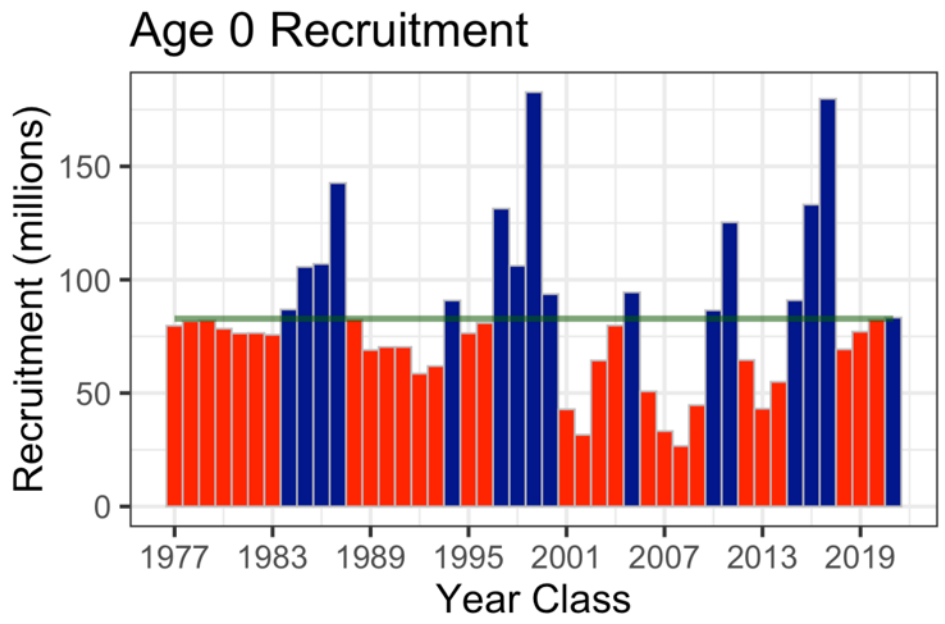


4. Northern rock sole western GOA

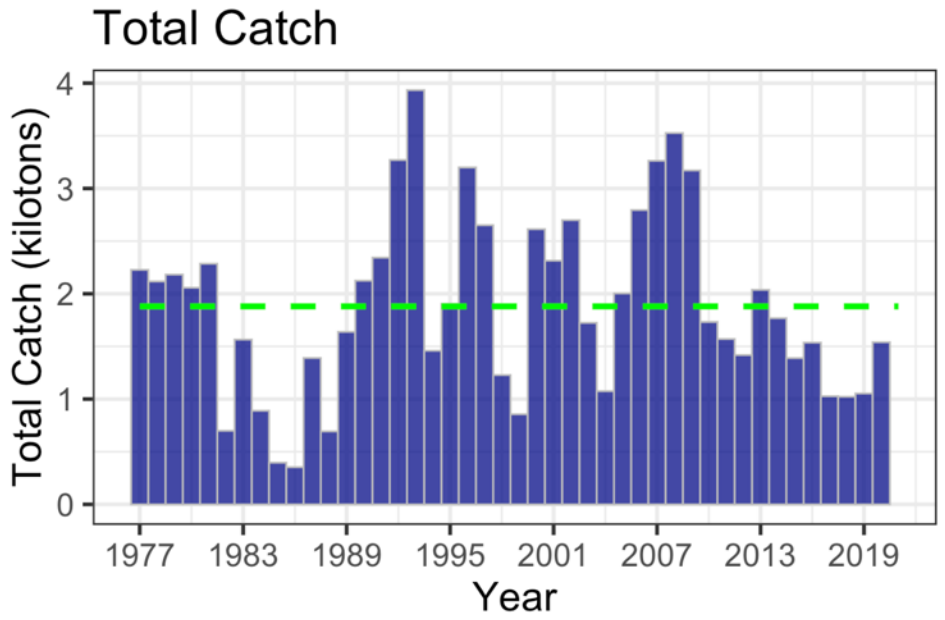


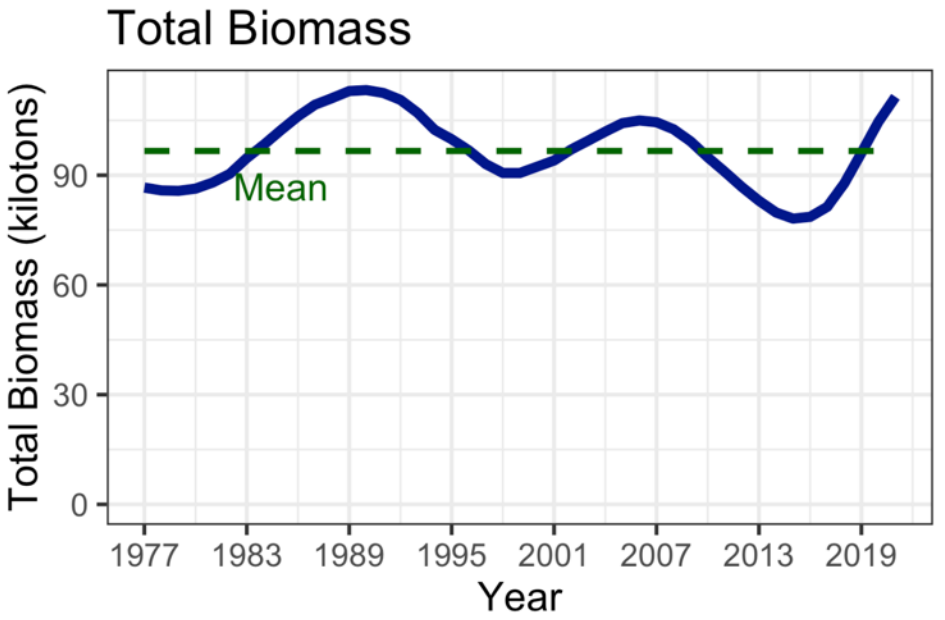


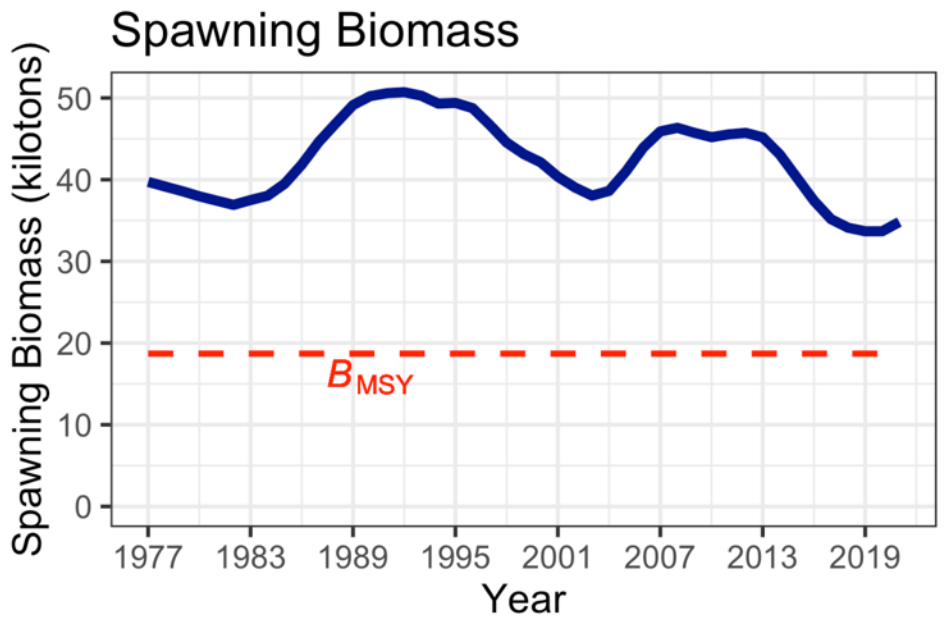


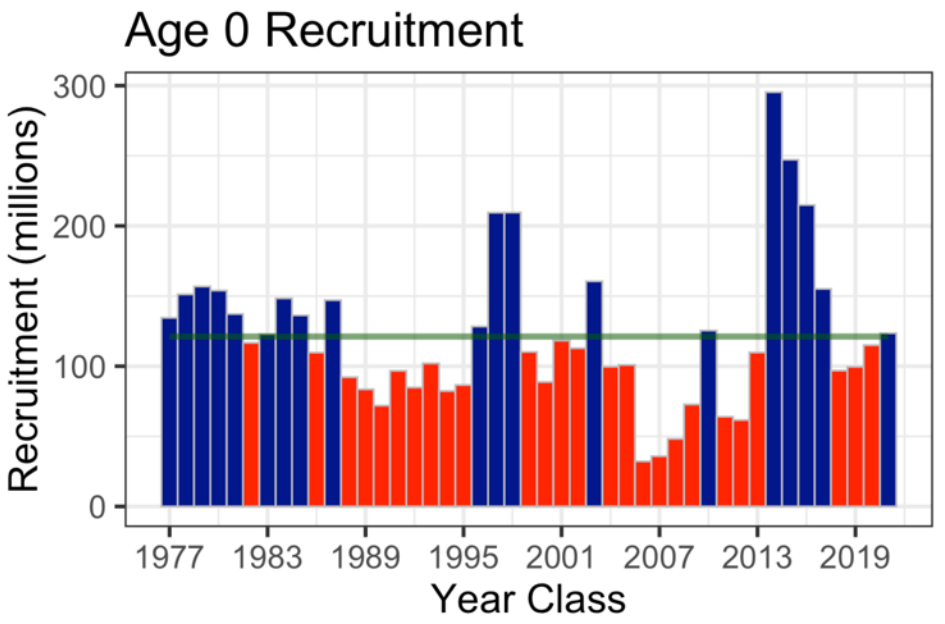


4. Southern rock sole-central GOA

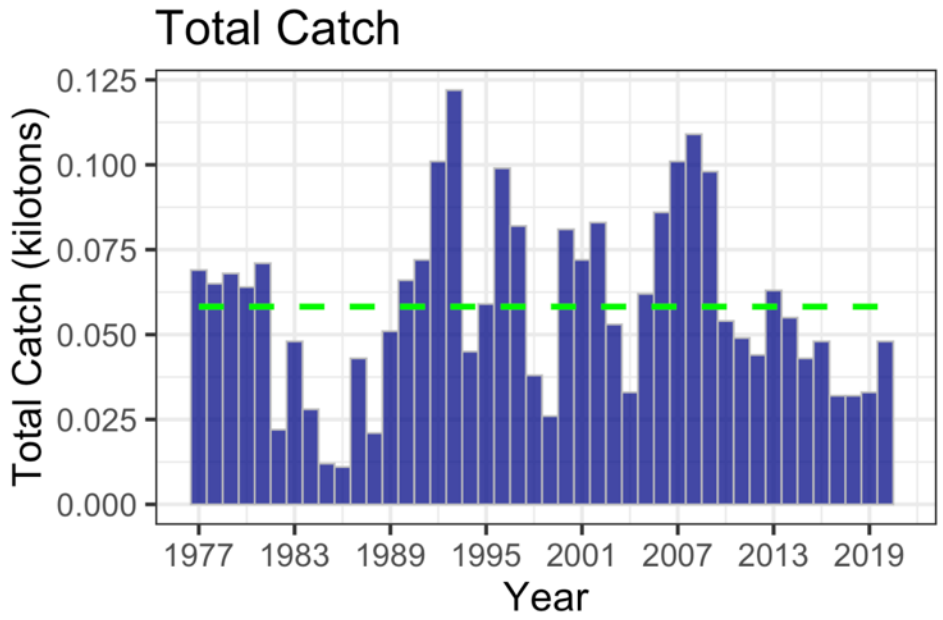


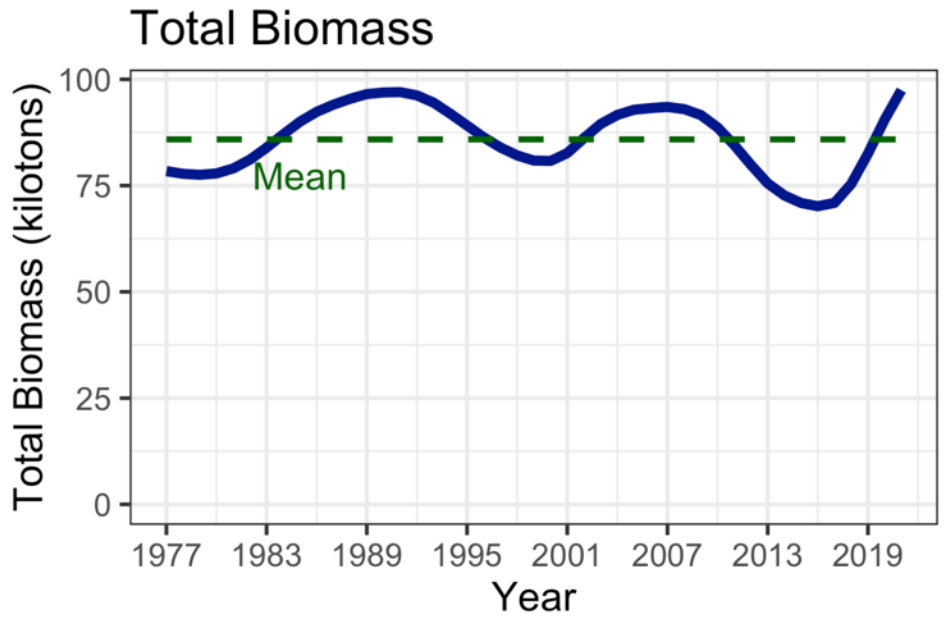


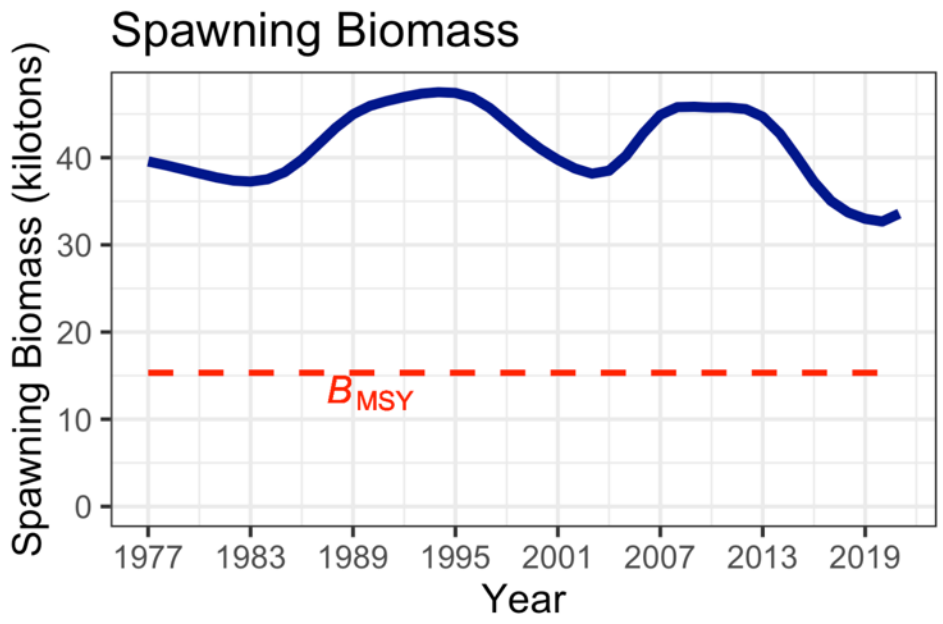


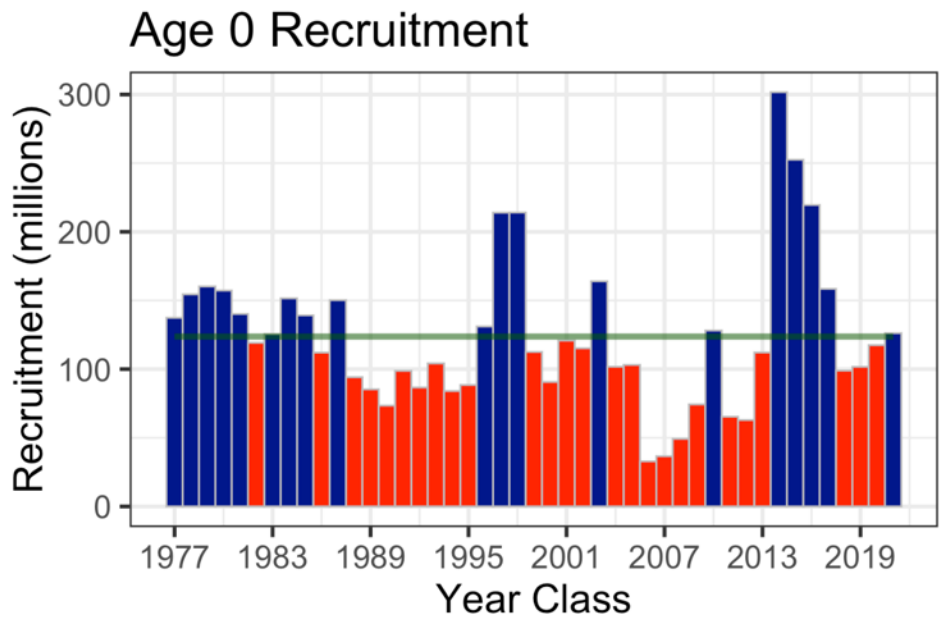


4. Southern rock sole-western GOA









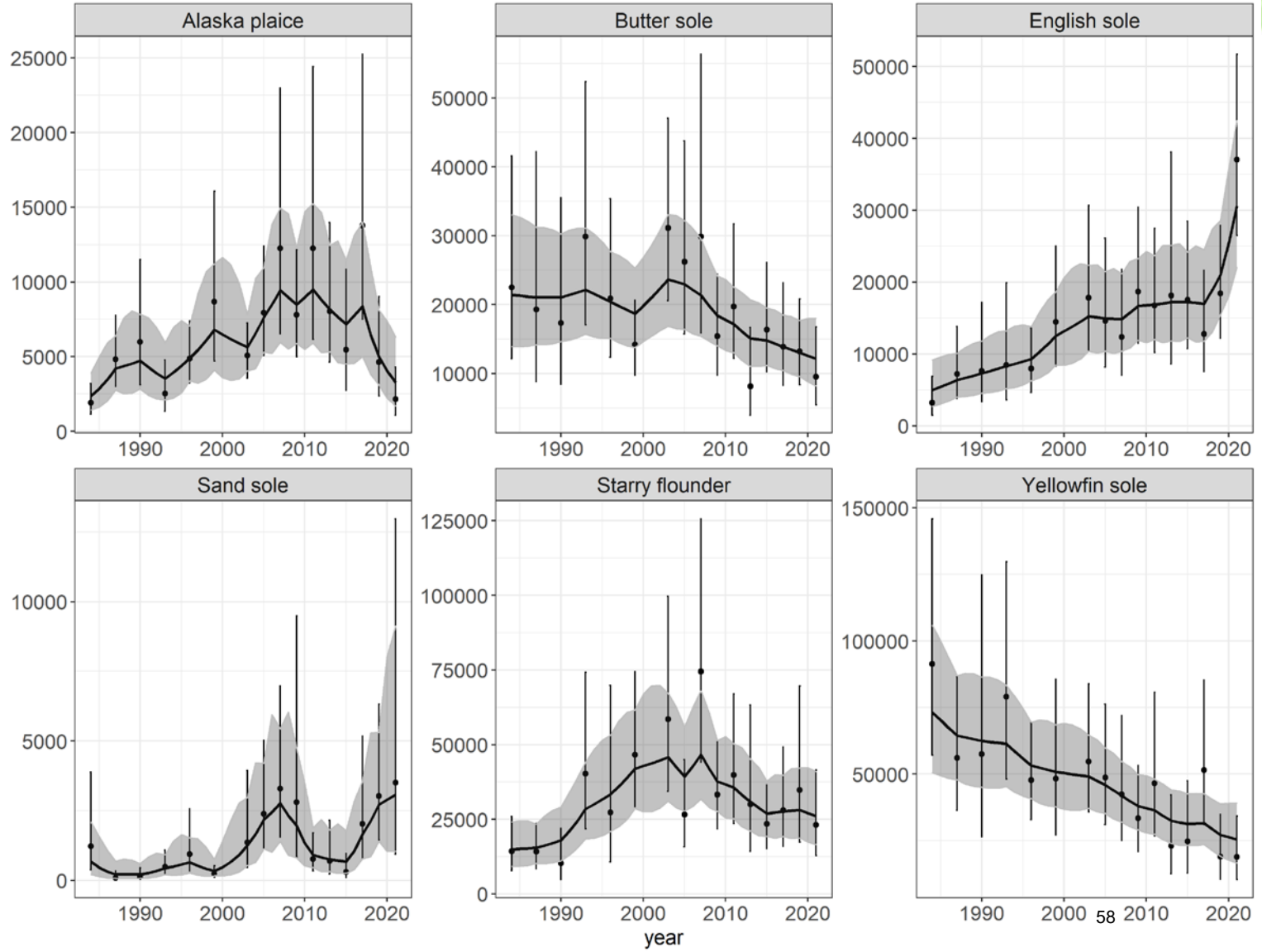
4. Shallow-water flatfish: Catch

4. Shallow-water flatfish

Partial assessment

Many components

	As estimated or *specified last* year for:		As estimated or *recommended this* year for:	
Quantity/Status	2022	2023	2023	2024
M (natural mortality)	0.2*	0.2*	0.2*	0.2*
Tier	3a, 5	3a, 5	3a, 5	3a, 5
Biomass (t)	442,423	449,250	449,607	452,916
F_{OFL}		*	*	*
$maxF_{ABC}$		*	*	*
F_{ABC}		*	*	*
OFL (t)	62,273	65,676	65,736	68,015
*max*ABC (t)	50,610	53,486	53,537	55,474
ABC (t)	50,610	53,486	53,537	55,474
	As determined *last* year for:		As determined *this* year for:	
Status	2020	2021	2021	2022
Overfishing	No	n/a	No	n/a



Flatfish ABC's

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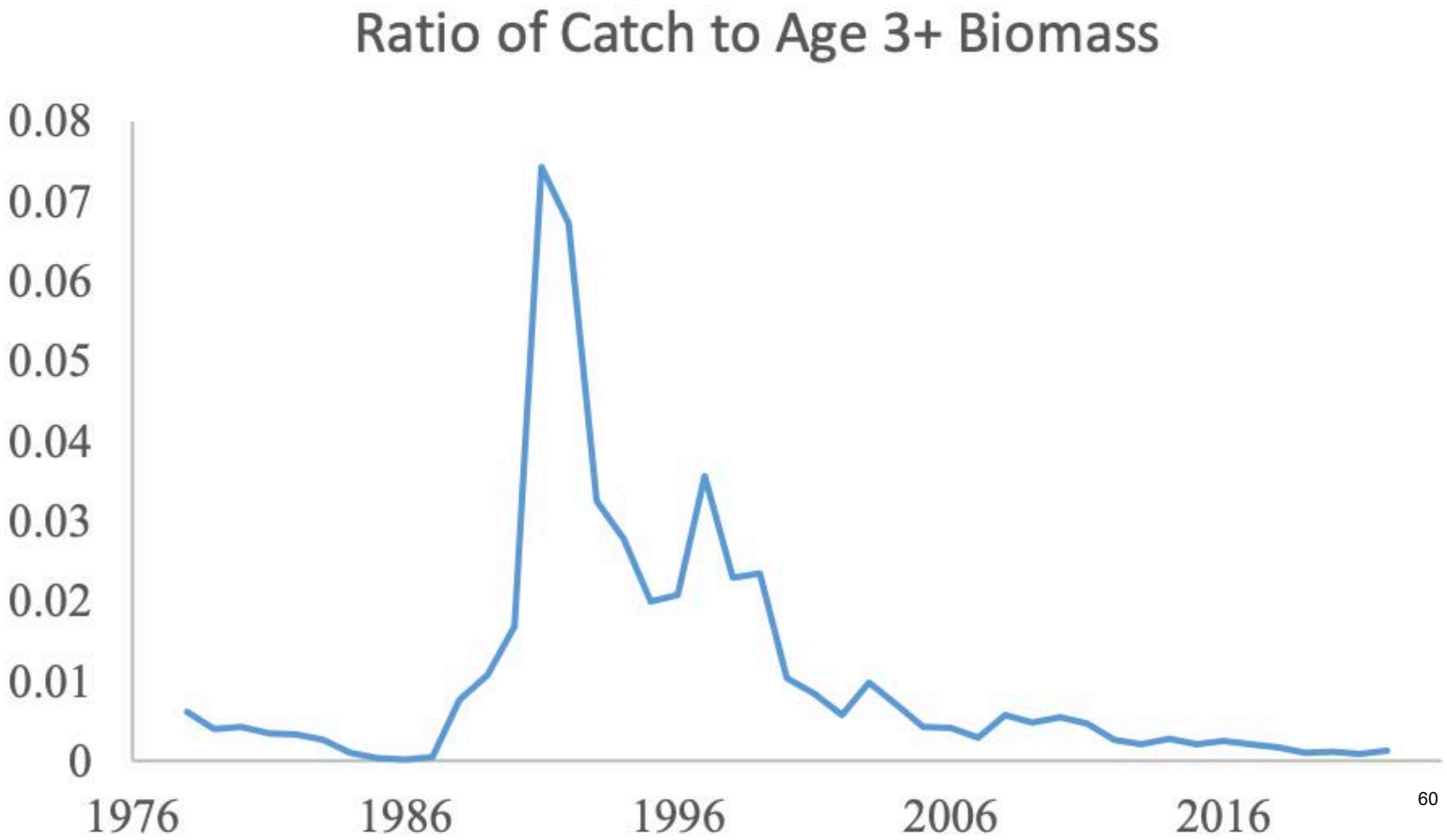
Subtotal	235,613	238,982	up 3,369 (1%)
Subtotal (without ATF)	115,834	119,497	up 3,663 (3%)

Next full **Deepwater flatfish** assessment due in 2023

Projection model run w/ updated catches, minor change in ABC

5. Deepwater flatfish

- Partial
- Mainly Dover sole



Flatfish ABC's

Species	2022 ABC	2023 ABC	Change
Shallow water flatfish	50,610	53,537	up 2,927 (6%)
Rex sole	19,141	20,664	up 1,523 (8%)
Deep water flatfish	5,908	5,816	down 92 (2%)
Flathead sole	40,175	39,480	down 695 (2%)
Arrowtooth flounder	119,779	119,485	down 294 (0%)
Subtotal	235,613	238,982	up 3,369 (1%)
Subtotal (without ATF)	115,834	119,497	up 3,663 (3%)

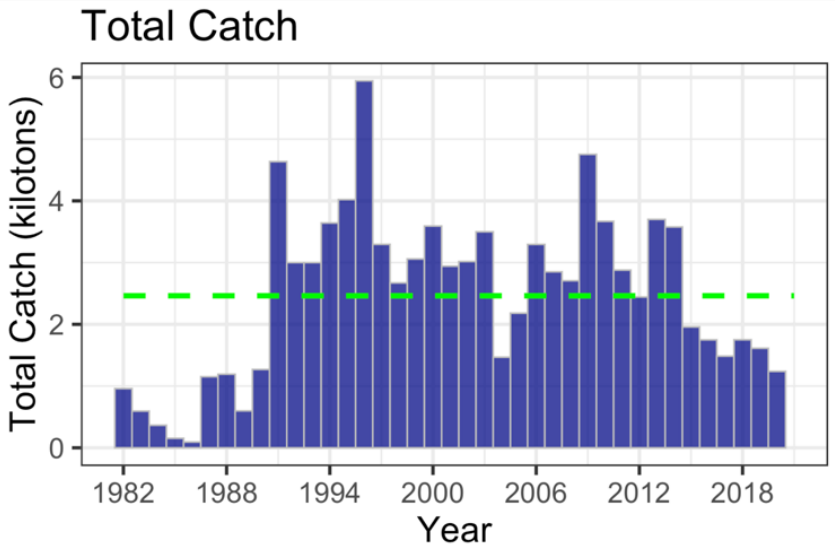
Shallow water flats: N and S rock sole Tier 3, others Tier 5

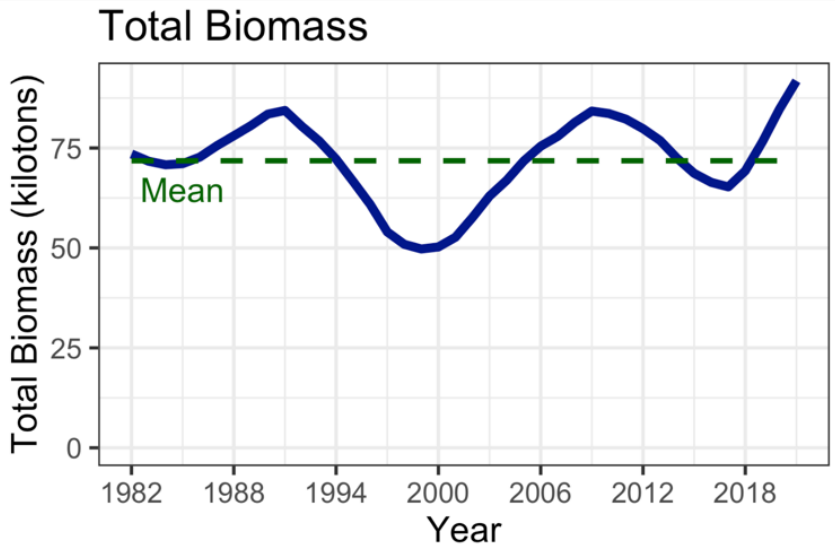
6. Rex sole (Partial assessment)

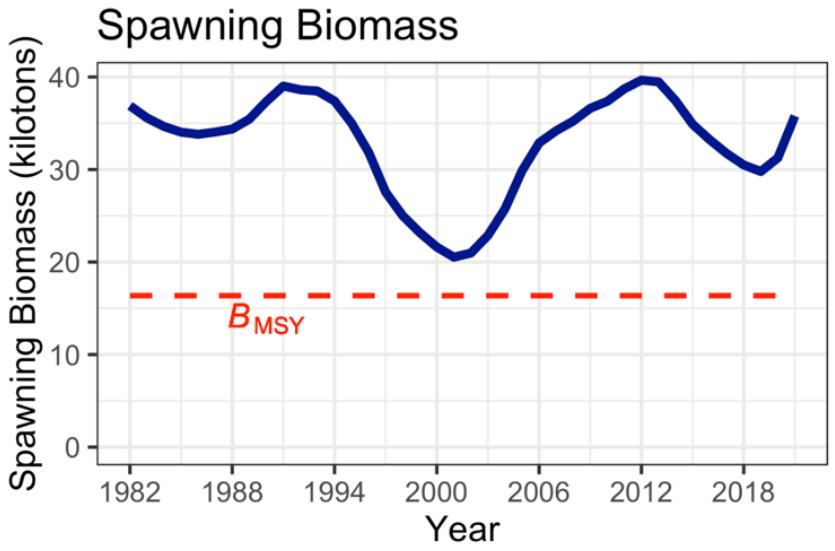
Executive summary tables (Model 21.0)

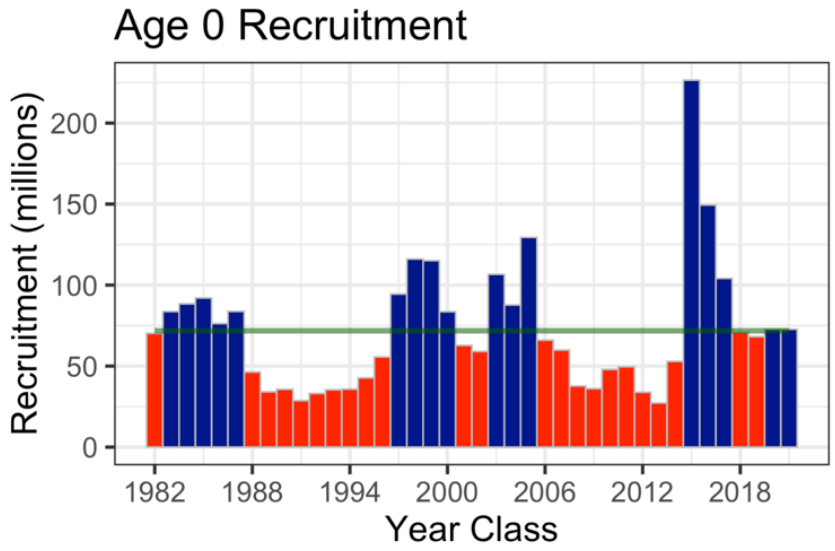
Quantity	As estimated or *specified this* year for:		As estimated or *recommended this* year for:	
	2022	2023	2023	2024
M (natural mortality rate)	0.17	0.17	0.17	0.17
Tier	3a	3a	3a	3a
Projected total (3+) biomass (t)	124,543	126,939	127,297	128,207
Female spawning biomass (t)	51,713	56,777	56,965	59,734
$B_{100\%}$				
$B_{40\%}$				
$B_{35\%}$	See area-specific tables below		See area-specific tables below	
F_{OFL}				
$maxF_{ABC}$				
F_{ABC}				
OFL (t)	23,302	25,049	25,135	25,652
maxABC (t)	19,141	20,594	20,664	21,097
ABC (t)	19,141	20,594	20,664	21,097
Status	As determined *last* year for:		As determined *this* year for:	
	2020	2021	2021	2022
Overfishing	no	n/a	no	n/a
Overfished	n/a	no	n/a	no
Approaching overfished	n/a	no	n/a	no

6. Rex sole: Overview









Flatfish ABC's

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Flathead sole	40,175	39,480	down 695 (2%)
Arrowtooth flounder	119,779	119,485	down 294 (0%)
Subtotal	235,613	238,982	up 3,369 (1%)
Subtotal (without ATF)	115,834	119,497	up 3,663 (3%)

7. Arrowtooth flounder (partial assessment)

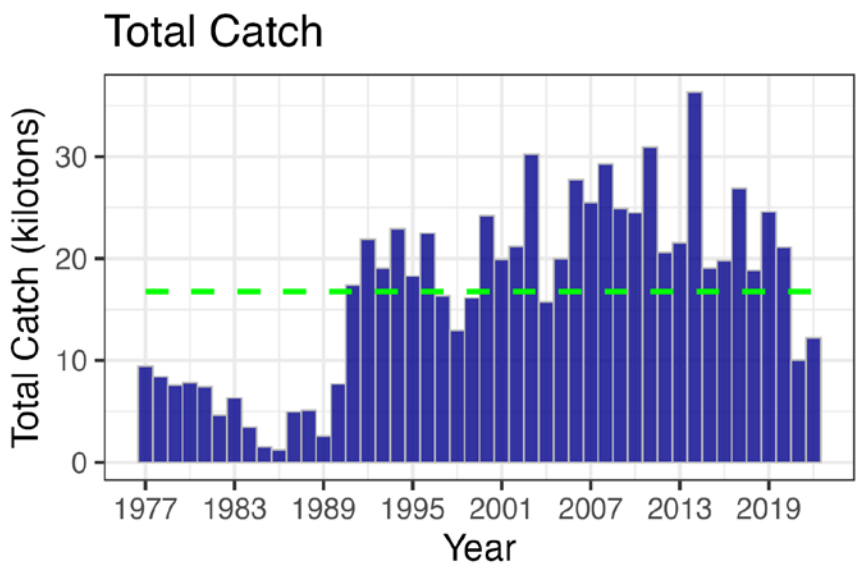
Full assessment in odd years

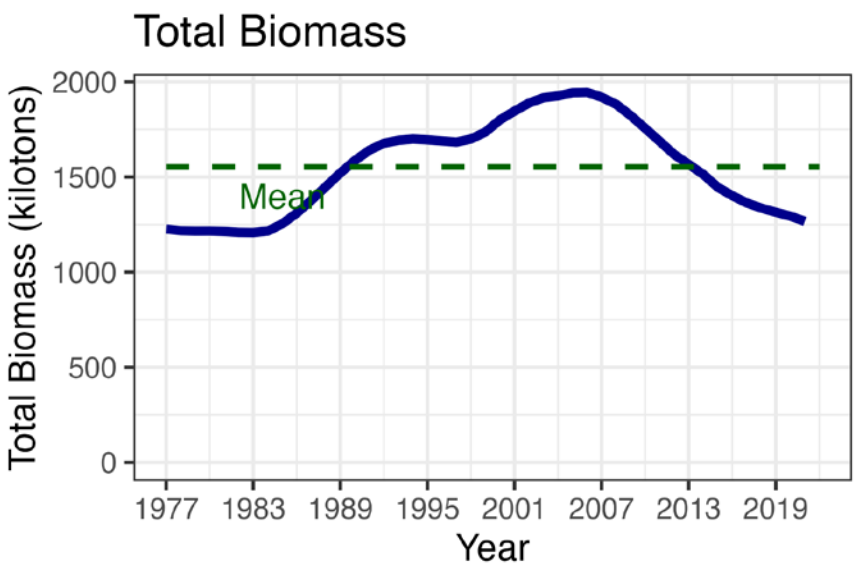
- Tier 3

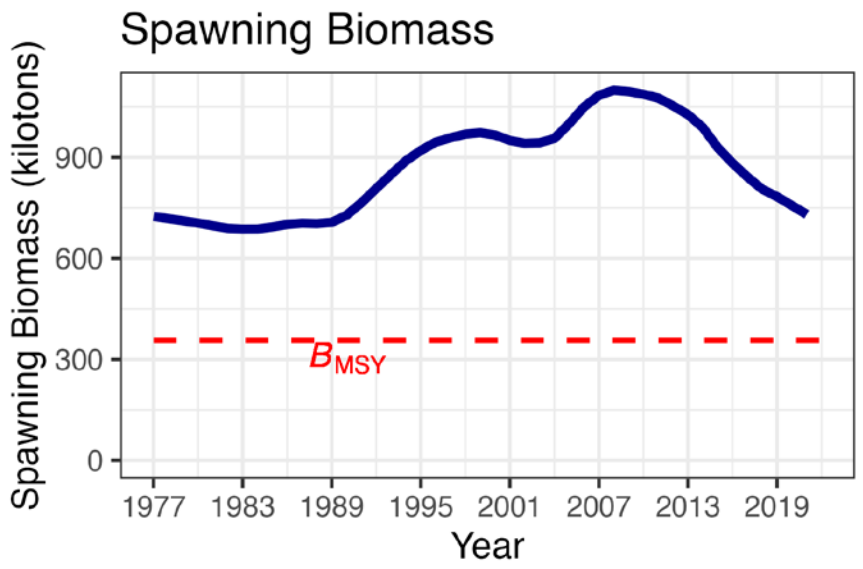
Quantity	As estimated or *specified last* year for: 2022	2023	*As estimated or *recommended this* year for: 2023	2024
M (natural mortality rate)**	0.35, 0.2	0.35, 0.2	0.35, 0.2	0.35, 0.2
Tier	3a	3a	3a	3a
Projected total (age 1+) biomass (t)	1,268,140	1,270,850	1,265,950	1,269,510
Projected Female spawning	703,853	691,941	702,074	690,799
$B_{100\%}$	1,018,700	1,018,700	1,018,700	1,018,700
$B_{40\%}$	407,478	407,478	407,478	407,478
$B_{35\%}$	356,544	356,544	356,544	356,544
F_{OFL}	0.225	0.225	0.225	0.225
$maxF_{ABC}$	0.185	0.185	0.185	0.185
F_{ABC}	0.185	0.185	0.185	0.185
OFL (t)	143,100	141,231	142,749	141,008
maxABC (t)	119,779	118,201	119,485	118,014
ABC (t)	119,779	118,201	119,485	118,014
Status	As determined *last* year for: 2020	2021	As determined *this* year for: 2021	2022
Overfishing	No	n/a	No	n/a
Overfished	n/a	No	n/a	No
Approaching overfished	n/a	No	n/a	No

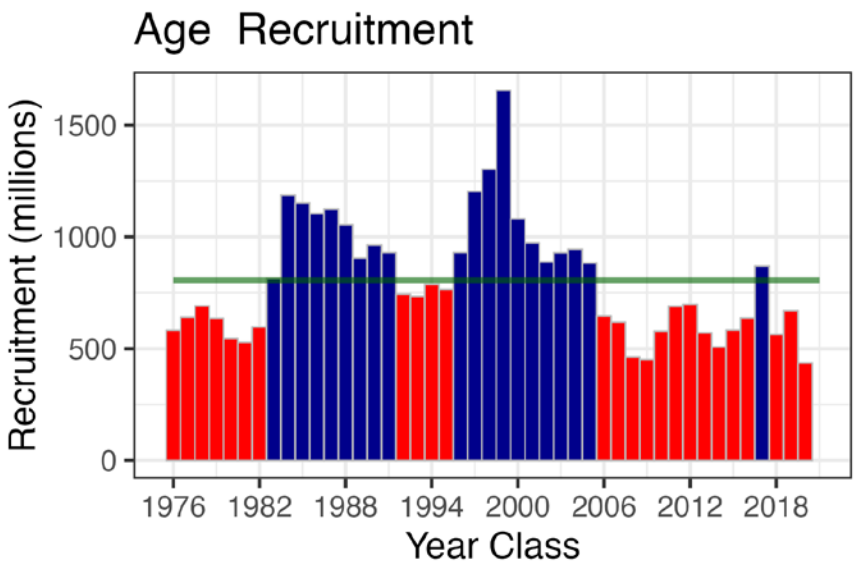
*Projections are based on estimated catches of 12,233 t for 2022, 16,382 t for 2023, and 14,292 t for 2024.
**Natural mortality rate is 0.35 for males, 0.2 for males.

7. Arrowtooth flounder: Overview









Flatfish ABC's

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Subtotal	235,613	238,982	up 3,369 (1%)
Subtotal (without ATF)	115,834	119,497	up 3,663 (3%)

8. Flathead sole (full assessment)

- Thanks Maia Kapur!

Tier 3a

Area GOA (mostly Central and Western)

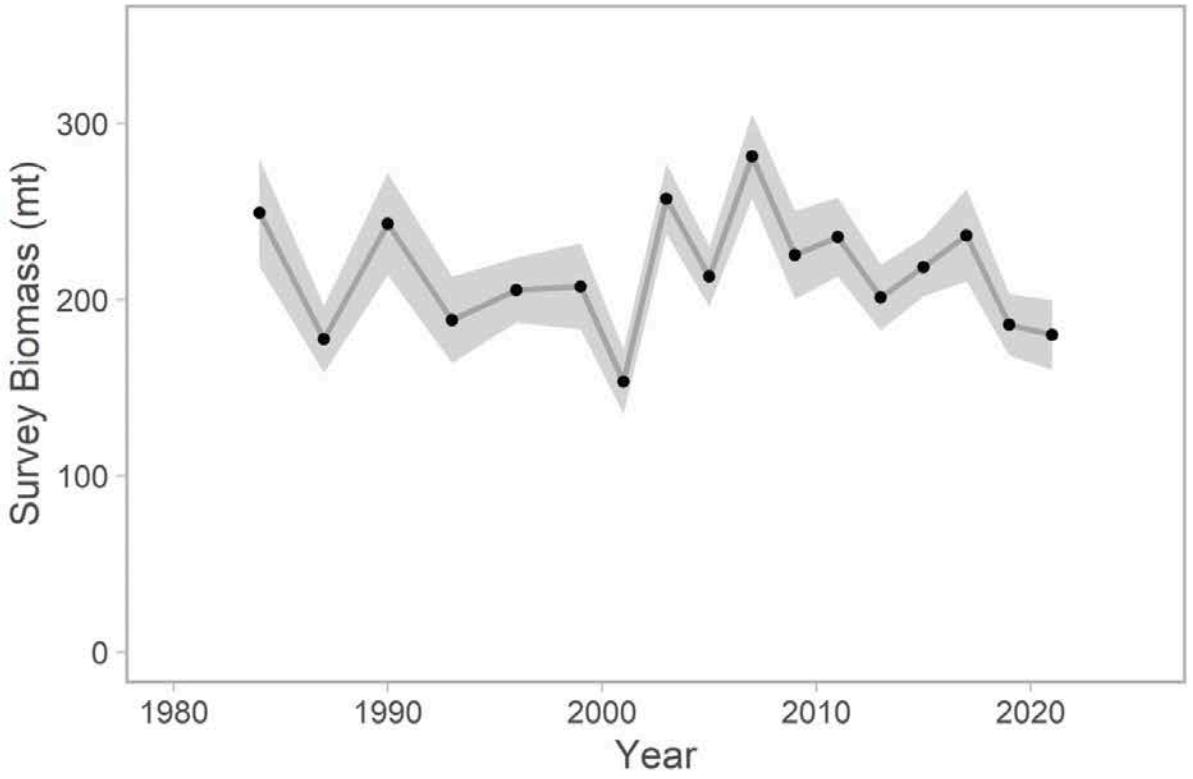
Status Not overfished/no overfishing

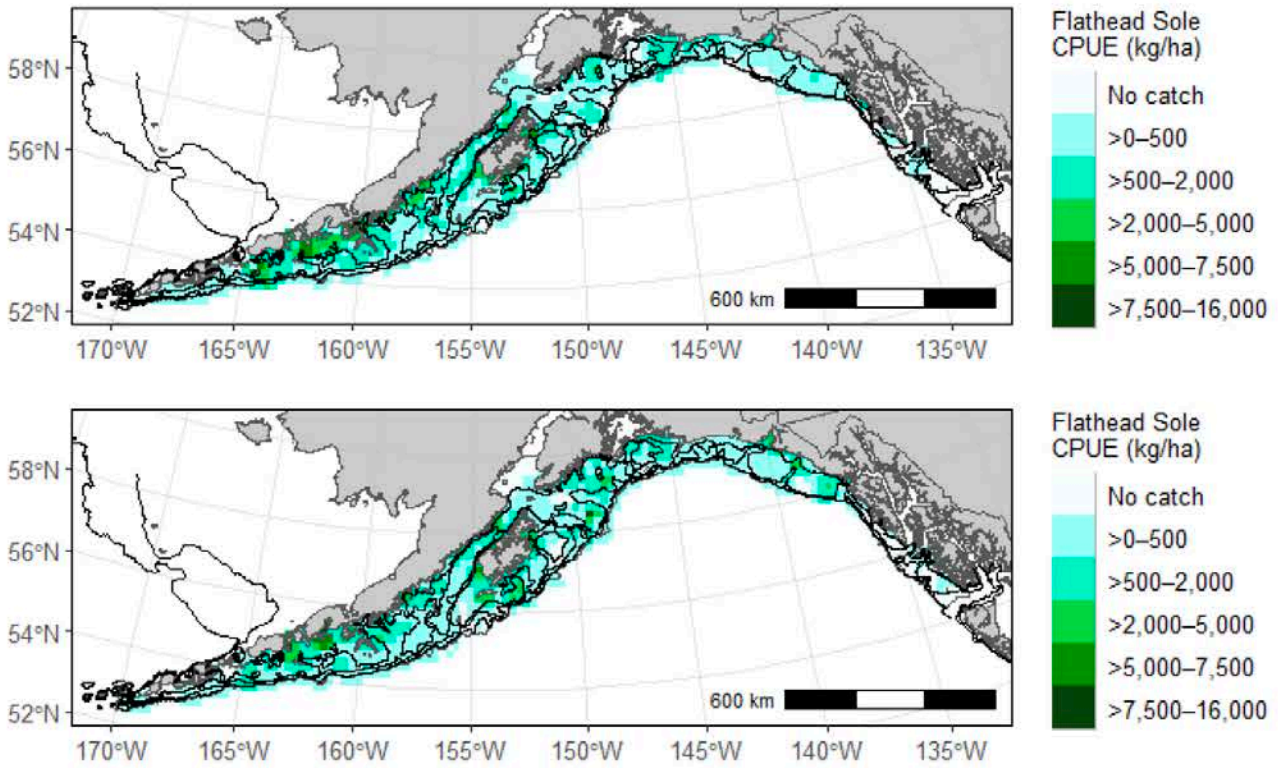
Changes

Model structure:
none
Update:
input data
ageing error matrix
software platform

Source	Data	Years
U.S. trawl fishery	Catch biomass	1977-2022
	Catch length composition	1982, 1991, 1992, 1993, 1994, 1995, 1996, 1997, 1998, 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019, 2020, 2021, 2022
GOA bottom trawl survey	Survey biomass	1984-1999 (triennial), 2001-2021 (biennial)
	Survey length composition	1984-1999 (triennial), 2001-2021 (biennial)
	Survey age composition, conditioned on length	1990, 1993, 1996, 1999, 2001, 2003, 2005, 2007, 2009, 2011, 2013, 2015, 2017, 2019, 2021

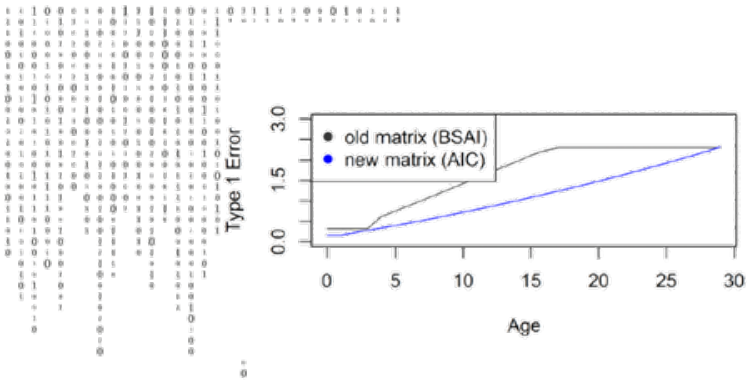
8. Flathead sole: Bottom trawl survey data





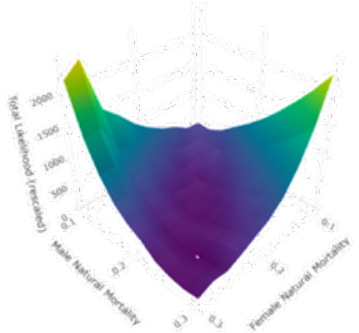
Flathead sole

SSC/CIE Comments



Update Ageing Error Matrix

Punt et al. (2008)



Explore M and q

2d likelihood profiles

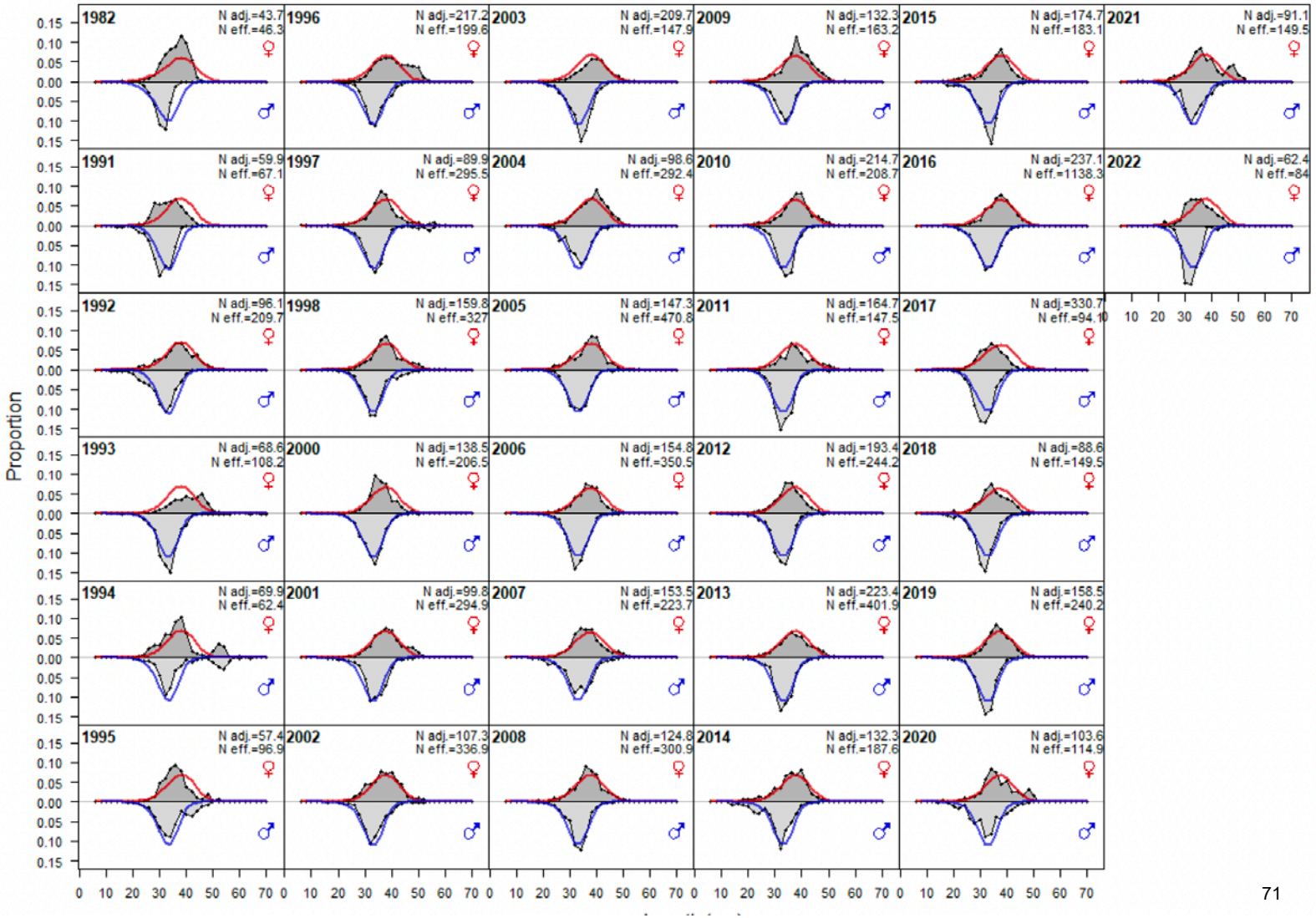
Explore/quantify scientific uncertainty

R0 profiles

Explore sensitivities and data weighting

Flathead sole

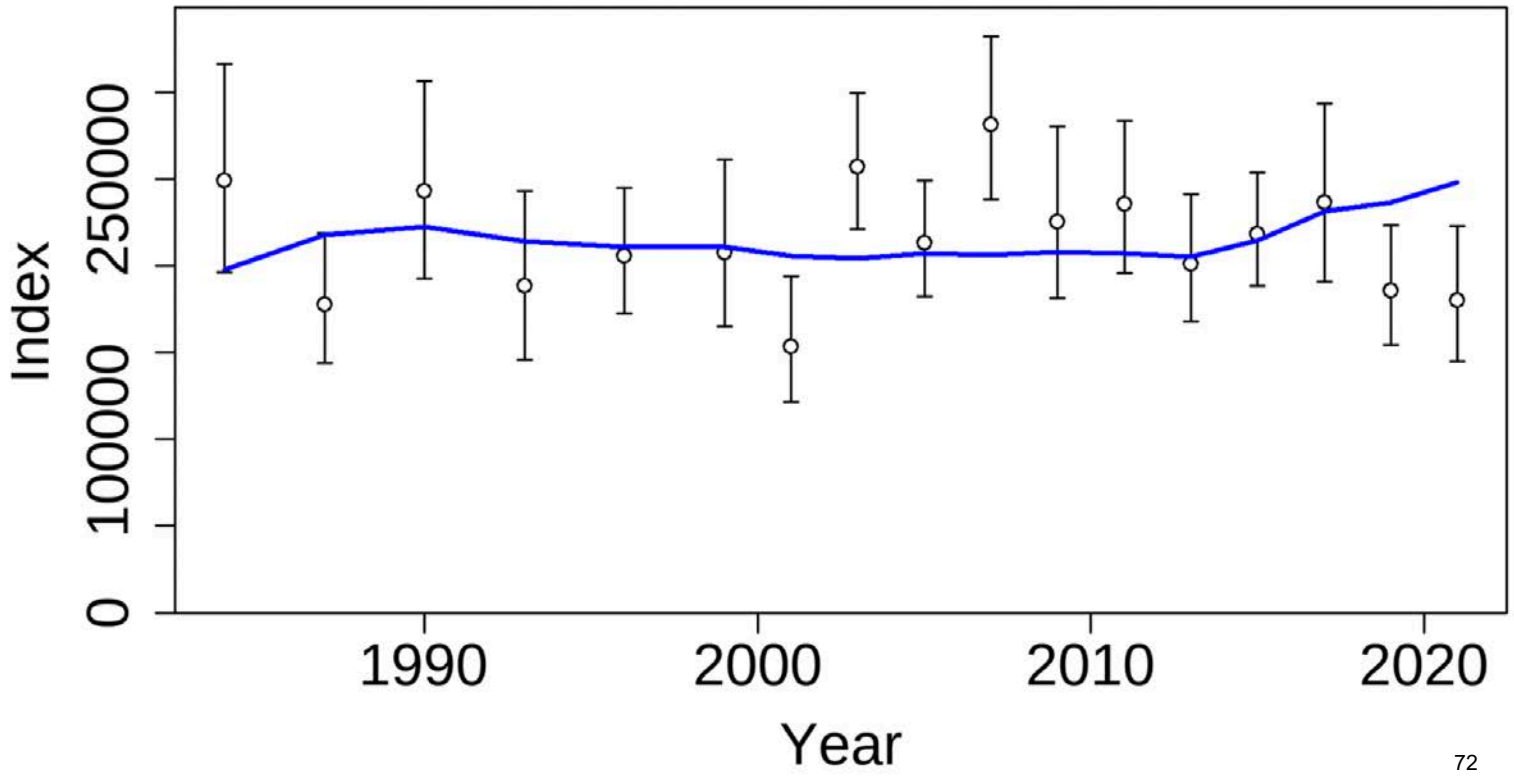
Model Fit: Fishery Lengths



Flathead sole

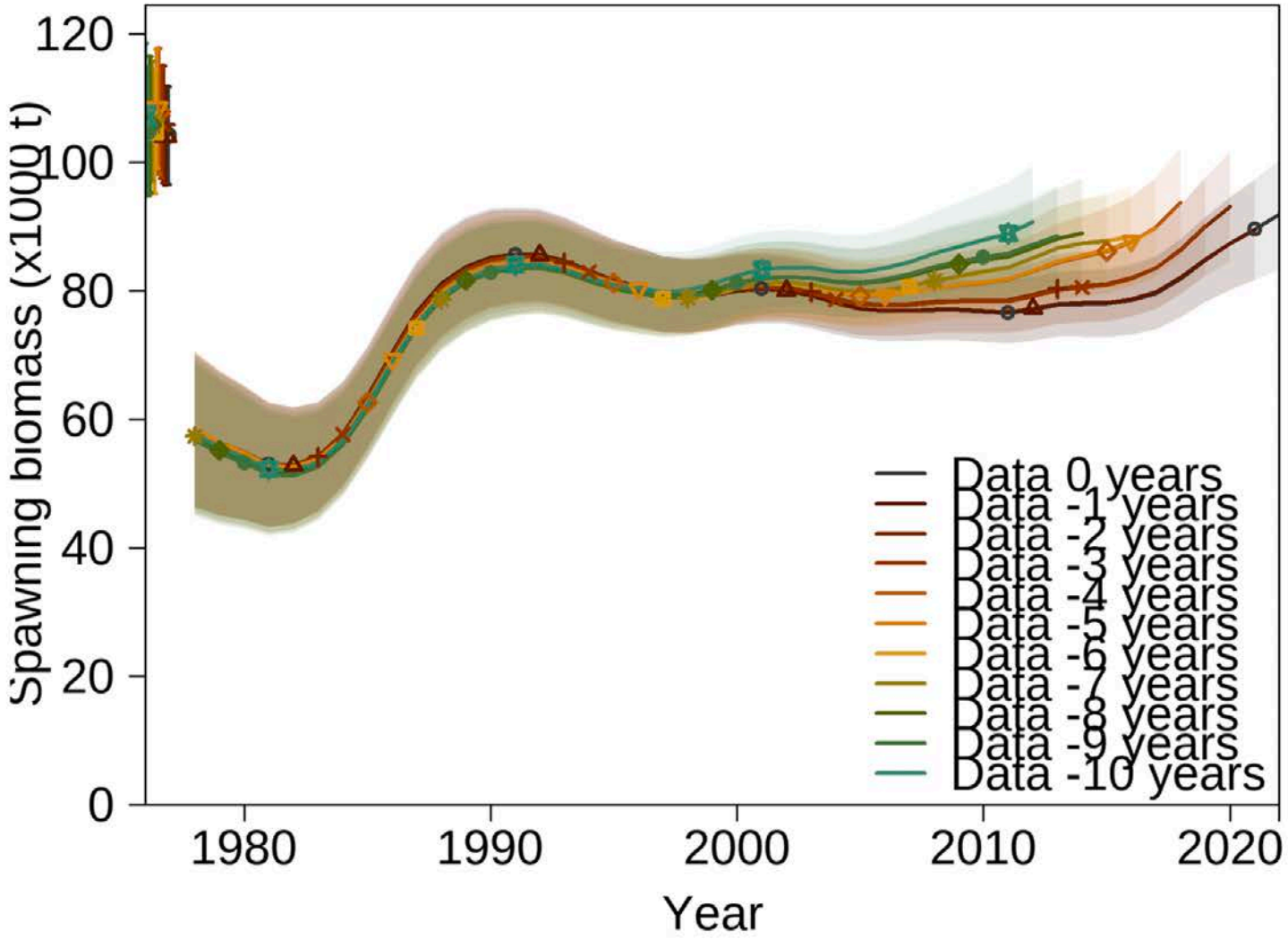
Model Fit: Survey Biomass

- Bottom-trawl survey data



Flathead sole

10-year Retrospectives



Quant	Mohn's Rho
SSB	0.1107
Rec	-0.2704
Bratio	0.0895
F	-0.0493

Flathead sole

[Online link to sensitivities]

[Online link to age-error evaluation]

The Team appreciated the ability to easily review these analyses and had a short discussion on how future documents may be more accommodating for online viewing (i.e., as an html in addition to pdf documents).

GOA Flathead sole sensitivity runs 2022

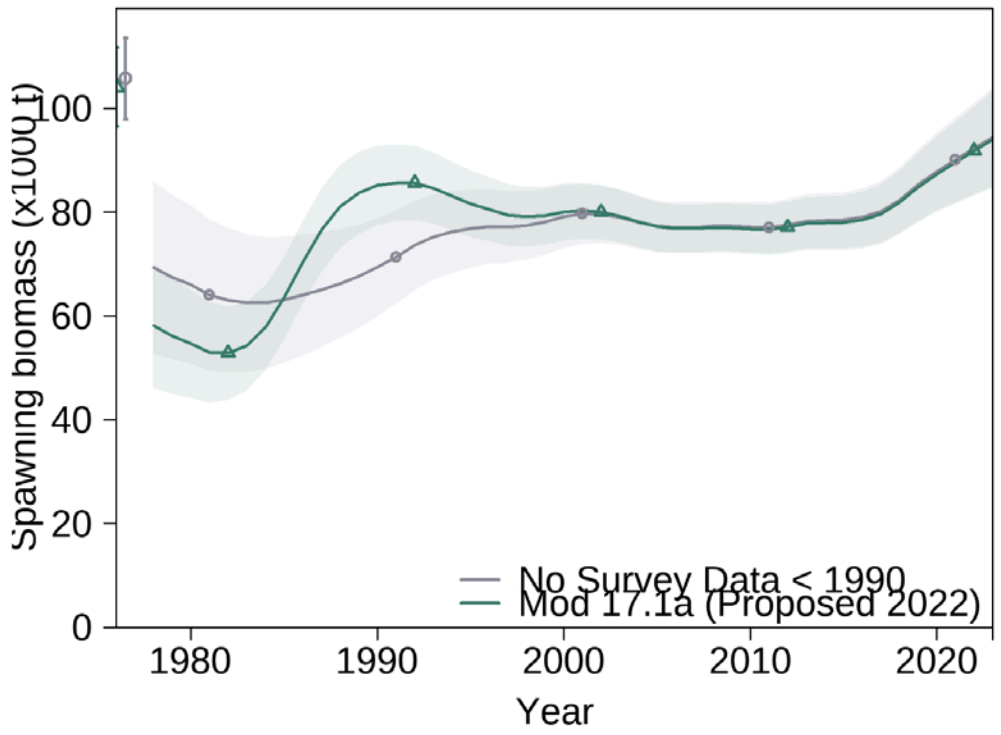
AUTHOR
Maia Sosa Kapur maia.kapur@noaa.gov

This document contains the sensitivity runs mentioned in the "responses to SSC..." and "data gaps and future research" sections of the 2022 SAFE. Because they are not presented as alternative models, we elected to provide these as online, supplementary material. Qualitative descriptions of these explorations are retained in the SAFE text.

Sensitivity Runs indicated by SSC/CIE comments

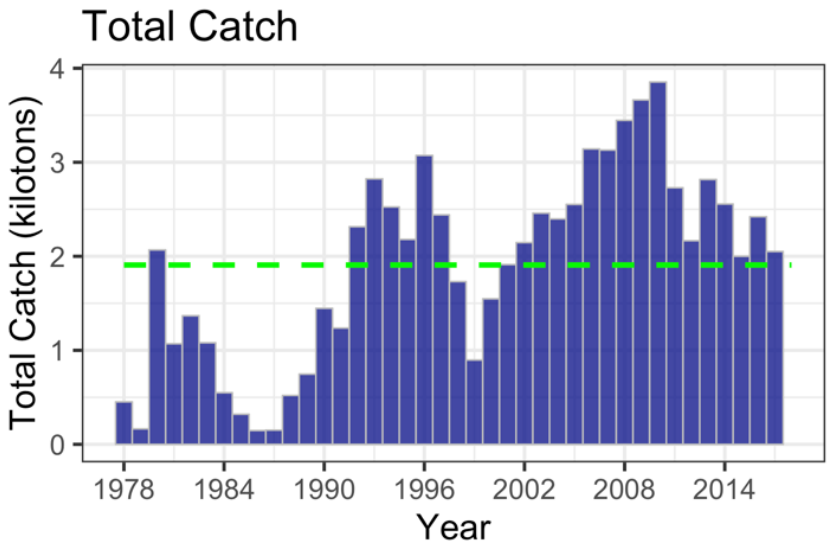
Truncate survey data before 1990

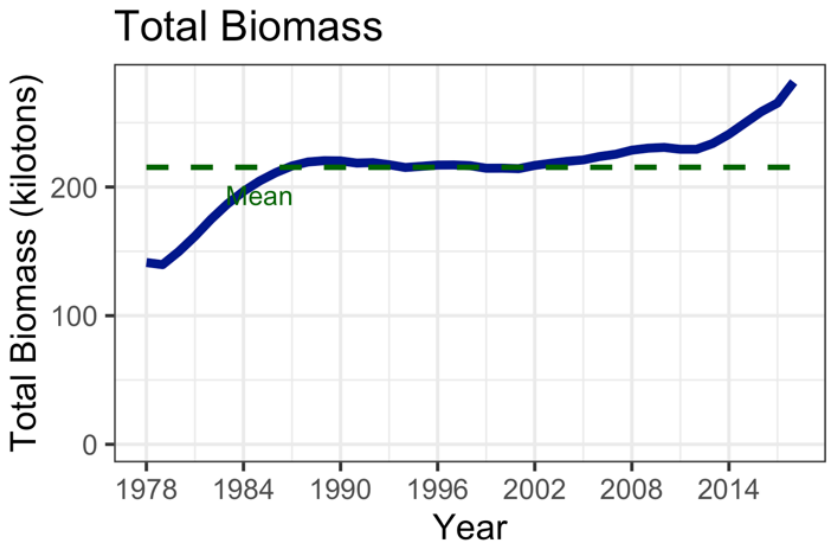
Biomass | Unfished Recruitment | Rec Deviations | Survey Fits

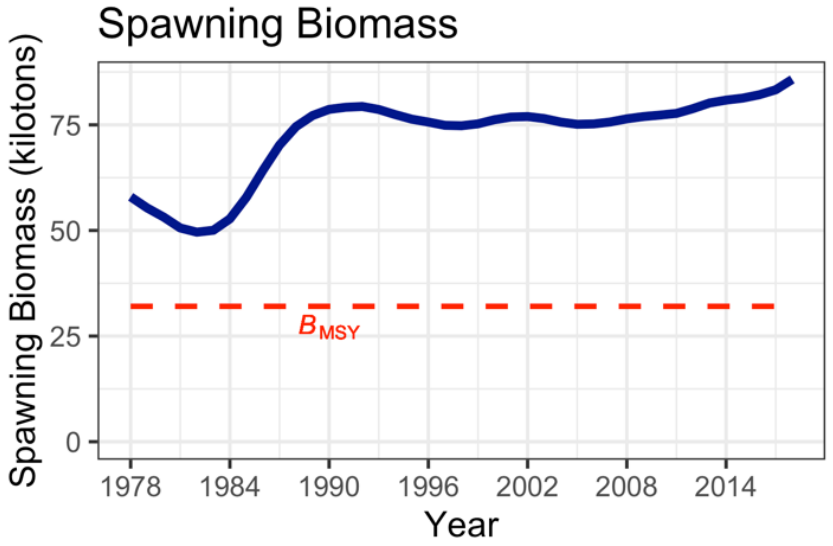


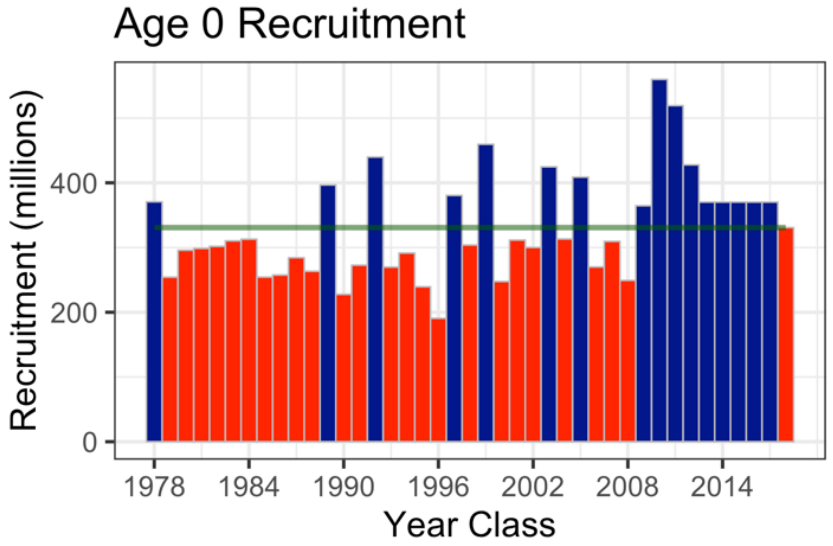
The SSB time series are basically identical during the period of shared data.

Flathead sole: Overview





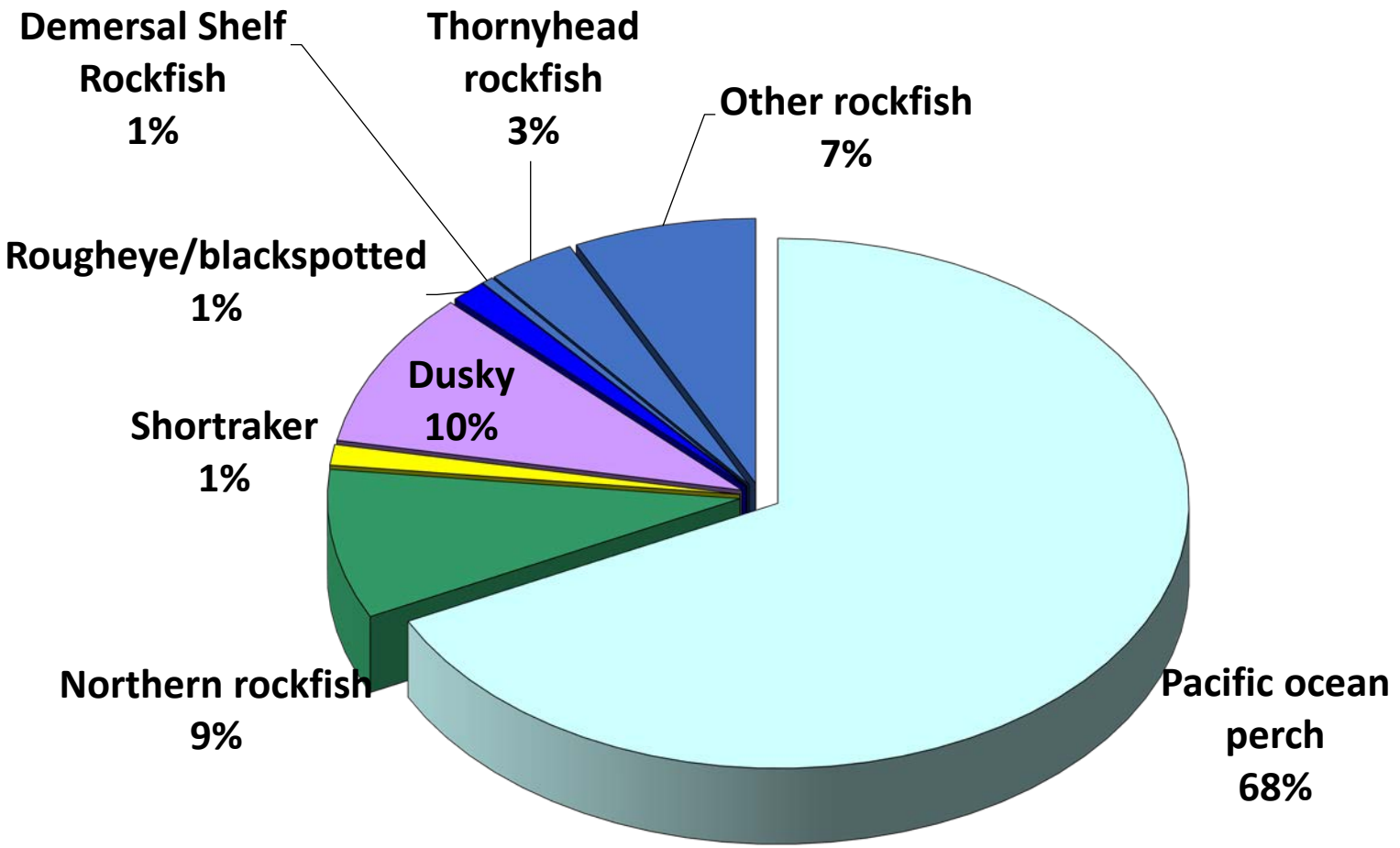




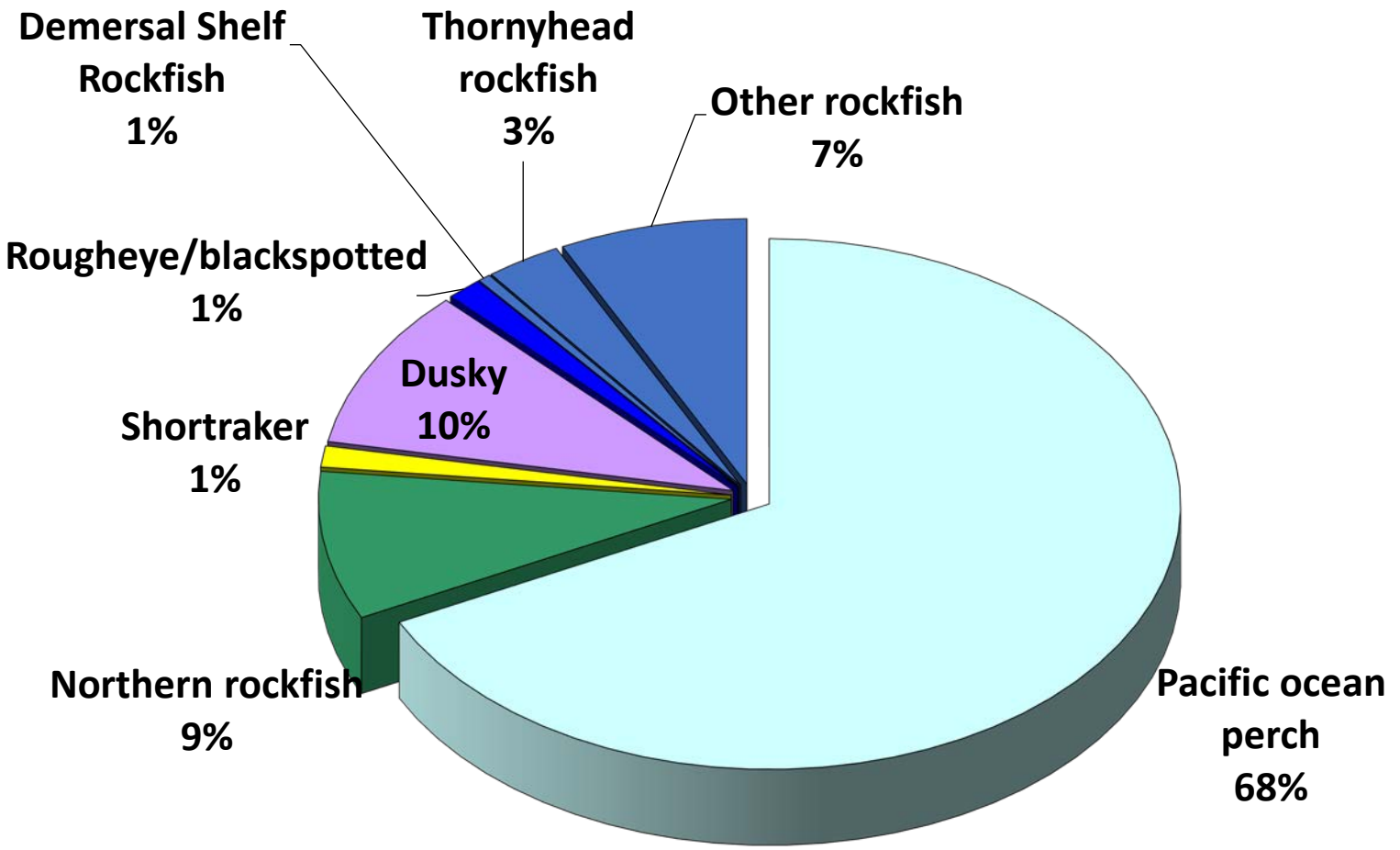
GOA Rockfish

Species	2022 catch	ABC 2022	ABC 2023	Change
Pollock	129,876	144,444	160,301	up 15,857 (11%)
Pacific Cod	18,275	32,811	24,634	down 8,177 (25%)
Sablefish	17,531	22,794	40,502	up 17,708 (78%)
Flatfish	2,673	115,834	119,497	up 3,663 (3%)
Arrowtooth flounder	11,456	119,779	119,485	down 294 (0%)
Rockfish	36,055	56,651	57,519	up 868 (2%)
Atka mackerel	880	4,700	4,700	same (0%)
Skates	2,706	6,563	6,563	same (0%)
Sharks	2,112	3,755	4,891	up 1,136 (30%)
Octopus	111	980	980	same (0%)
Total	221,675	508,311	539,072	up 30,761 (6%)

Rockfish 2022 ABC's
56,554 t total



Rockfish 2023 ABC's
57,519 t total



Rockfish ABC Summary

Species	ABC 2022	ABC 2023	Change
POP	38,268	37,193	down 1,075 (3%)
northern rockfish	5,146	4,964	down 182 (4%)
Shortraker Rockfish	705	705	same (0%)
Dusky	5,372	7,917	up 2,545 (47%)
Rougheye and Blackspotted Rockfish	788	775	down 13 (2%)
Demersal shelf rockf	365	283	down 82 (22%)
Thornyhead	1,953	1,628	down 325 (17%)
Other rock	4,054	4,054	same (0%)
Sub Total	56,651	57,519	up 868 (2%)

Pacific ocean perch (partial assessment)

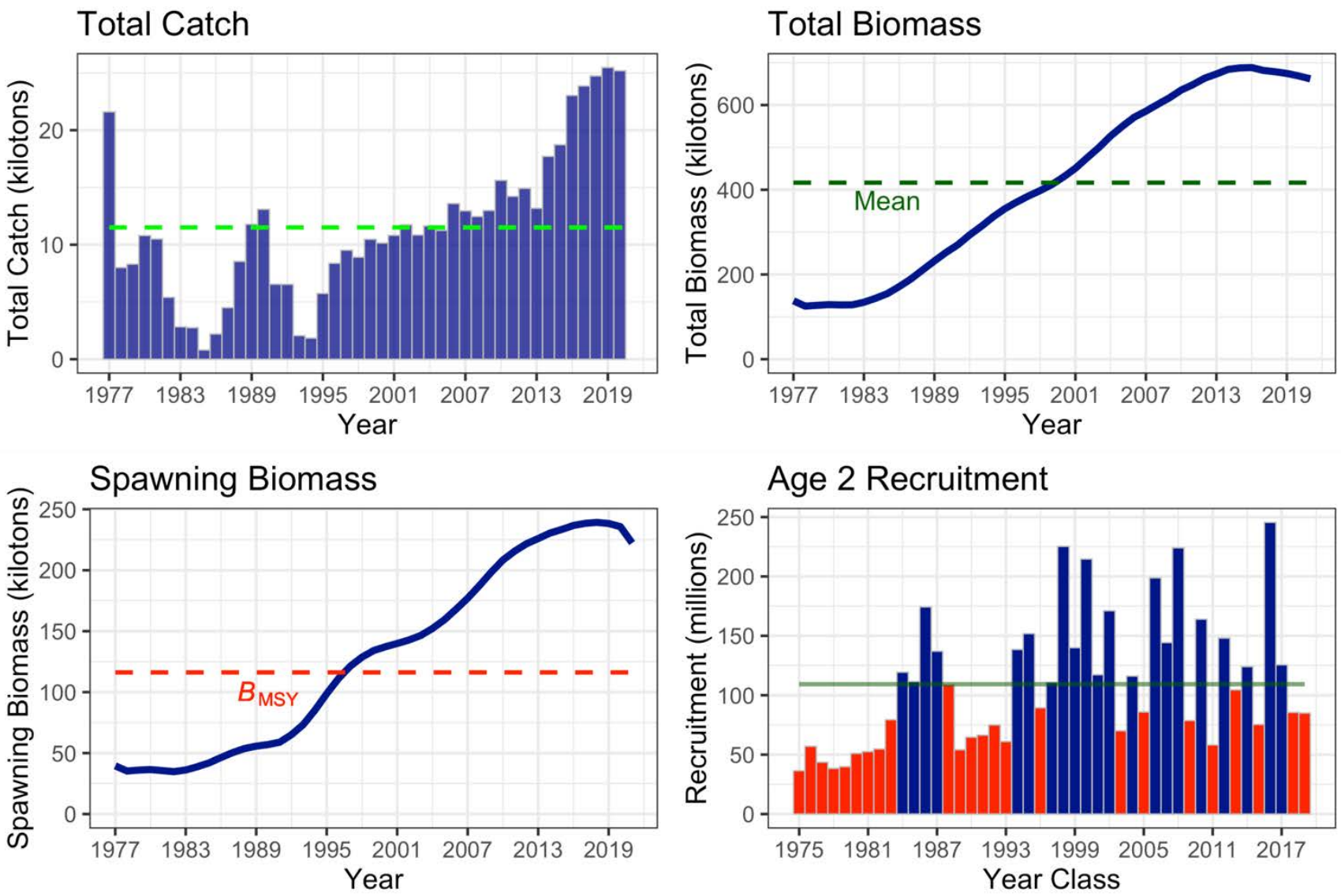
Area Apportionment	Western	Central	Eastern	Total
	6.8%	80.5%	12.7%	100%
2023 Area ABC (t)	2,529	29,940	4,724	37,193
2024 Area ABC (t)	2,461	29,138	4,597	36,196

	Western/Central/W. Yakutat (W/C/WY)	E. Yakutat/Southeast (SEO)	Total
2023 Area OFL (t)	40,308	3,994	44,302
2024 Area OFL (t)	39,229	3,888	43,117

Quantity	As estimated or specified *last* year for: 2022	2023	As estimated or recommended *this* year for: 2023*	2024*
M (natural mortality)	0.075	0.075	0.075	0.075
Tier	3a	3a	3a	3a
Projected total (age 2+) biomass (t)	650,832	634,907	636,129	621,249
Projected Female spawning biomass	216,635	210,257	210,795	205,713
$B_{100\%}$	331,917	331,917	331,917	331,917
$B_{40\%}$	132,767	132,767	132,767	132,767
$B_{35\%}$	116,171	116,171	116,171	116,171
F_{OFL}	0.120	0.120	0.120	0.120
$maxF_{ABC}$	0.100	0.100	0.100	0.100
F_{ABC}	0.100	0.100	0.100	0.100
OFL (t)	45,580	44,196	44,302	43,117
maxABC (t)	38,268	37,104	37,193	36,196
ABC (t)	38,268	37,104	37,193	36,196
Status	As determined *last* year for: 2020	2021	As determined *this* year for: 2021	2022
Overfishing	No	n/a	No	n/a
Overfished	n/a	No	n/a	No
Approaching overfished	n/a	No	n/a	No

*Projections are based on an estimated catch of 30,556 t for 2022 and estimates of 30,960 t and 29,748 t used in place of maximum permissible ABC for 2023 and 2024.

Pacific ocean perch: Overview



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Other rock	4,054	4,054	same (0%)
Sub Total	56,651	57,519	up 868 (2%)

Northern rockfish: Data

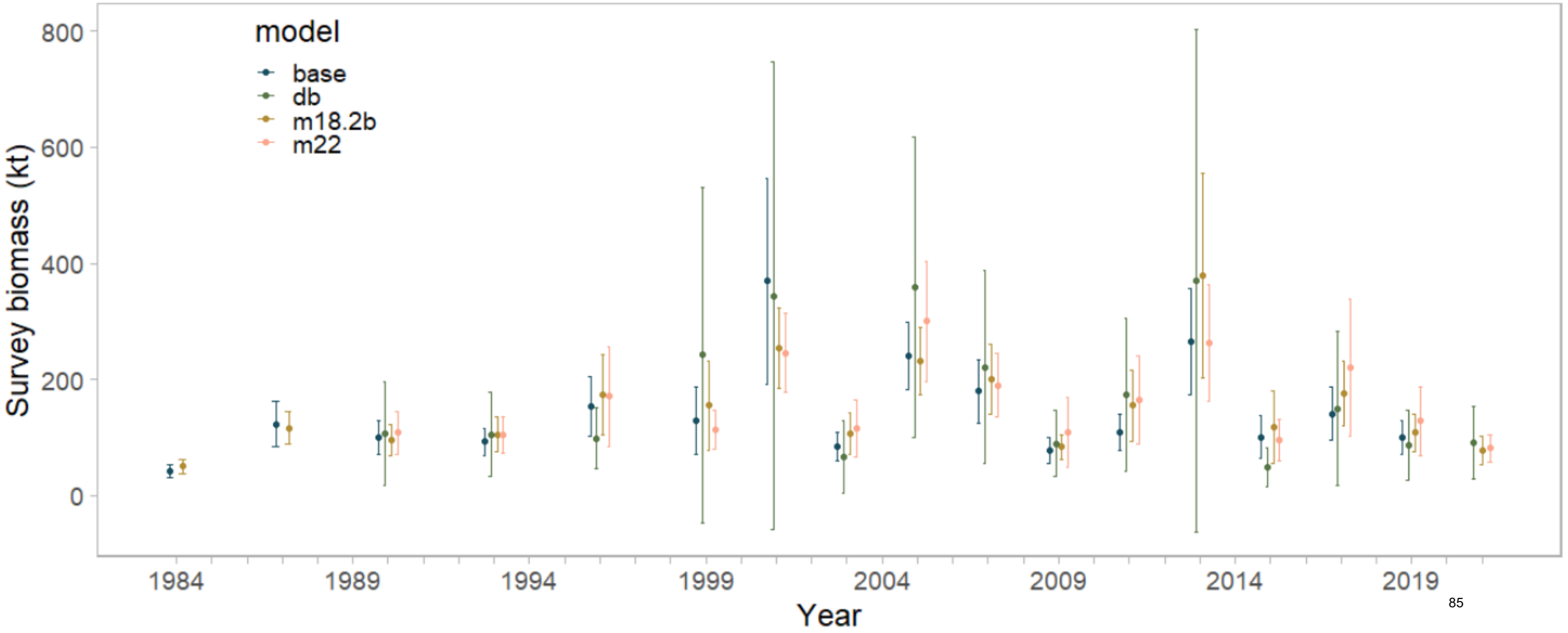
Source	Data	Years
NMFS Groundfish survey	Survey biomass	1990-1999 (triennial), 2001-2019 (biennial), **2021**
	Age composition	1990-1999 (triennial), 2003-2019 (biennial), **2021**
U.S. trawl fishery	Catch	1961-2020, **2021-2022**
	Age composition	1998-2002, 2004-2006, 2008-2018 (biennial), **2020**
	Length composition	1991-1997, 2003, 2007-2019 (biennial), **2021**

Northern rockfish: Models

Model	Description
base	2020 model (m18.2b) and results (includes 1980s survey data)
m18.2b	base model w/data updated through 2022
m22	**m18.2b using GAP default VAST (survey data 1990+)**
m22.1	**m22 w/increased length plus group**
m22.1a	m22.1 re-weighted
m22.1b	m22.1 re-weighted, with survey weight = 1

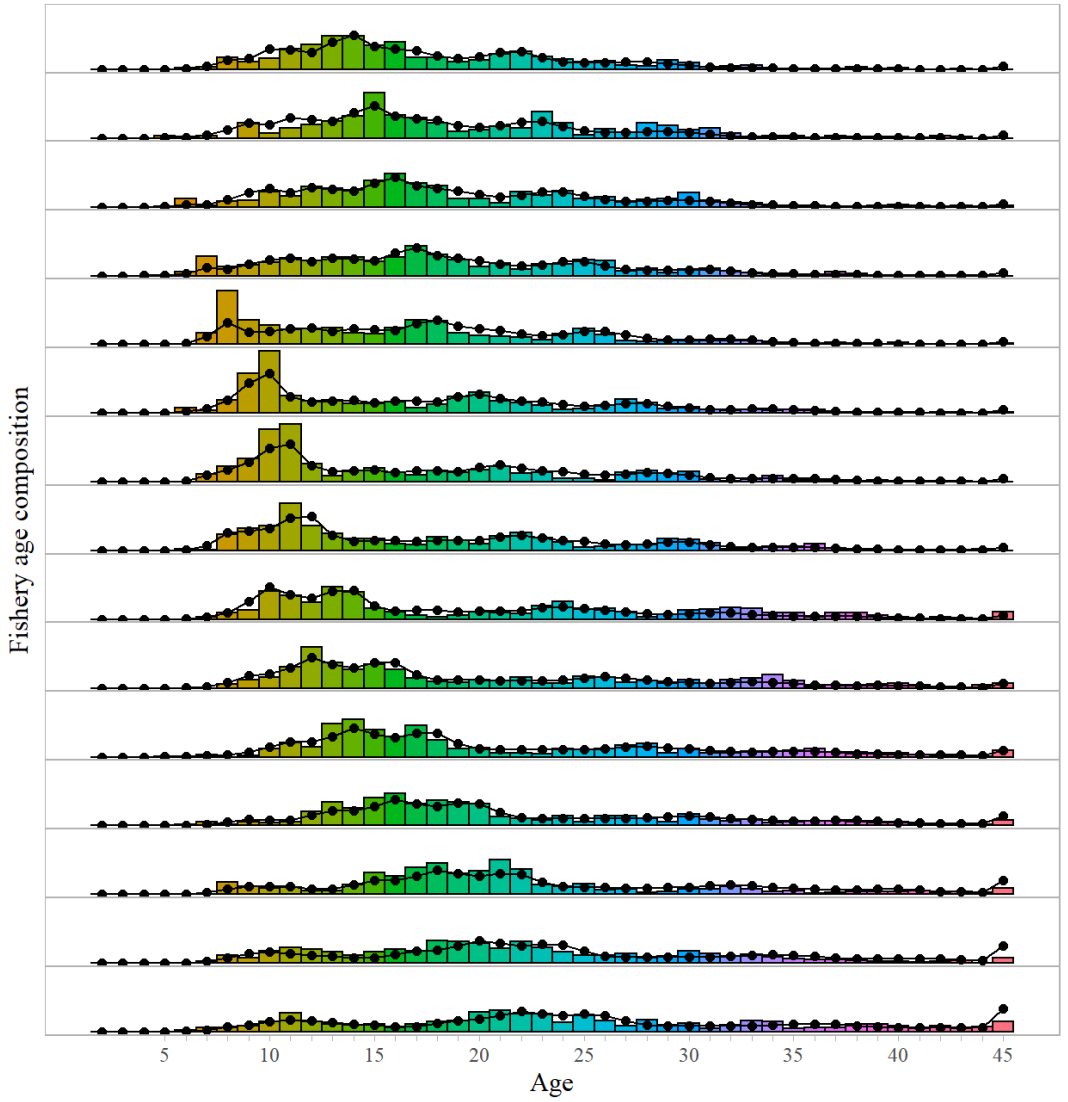
Northern rockfish

NMFS Bottom-trawl survey options

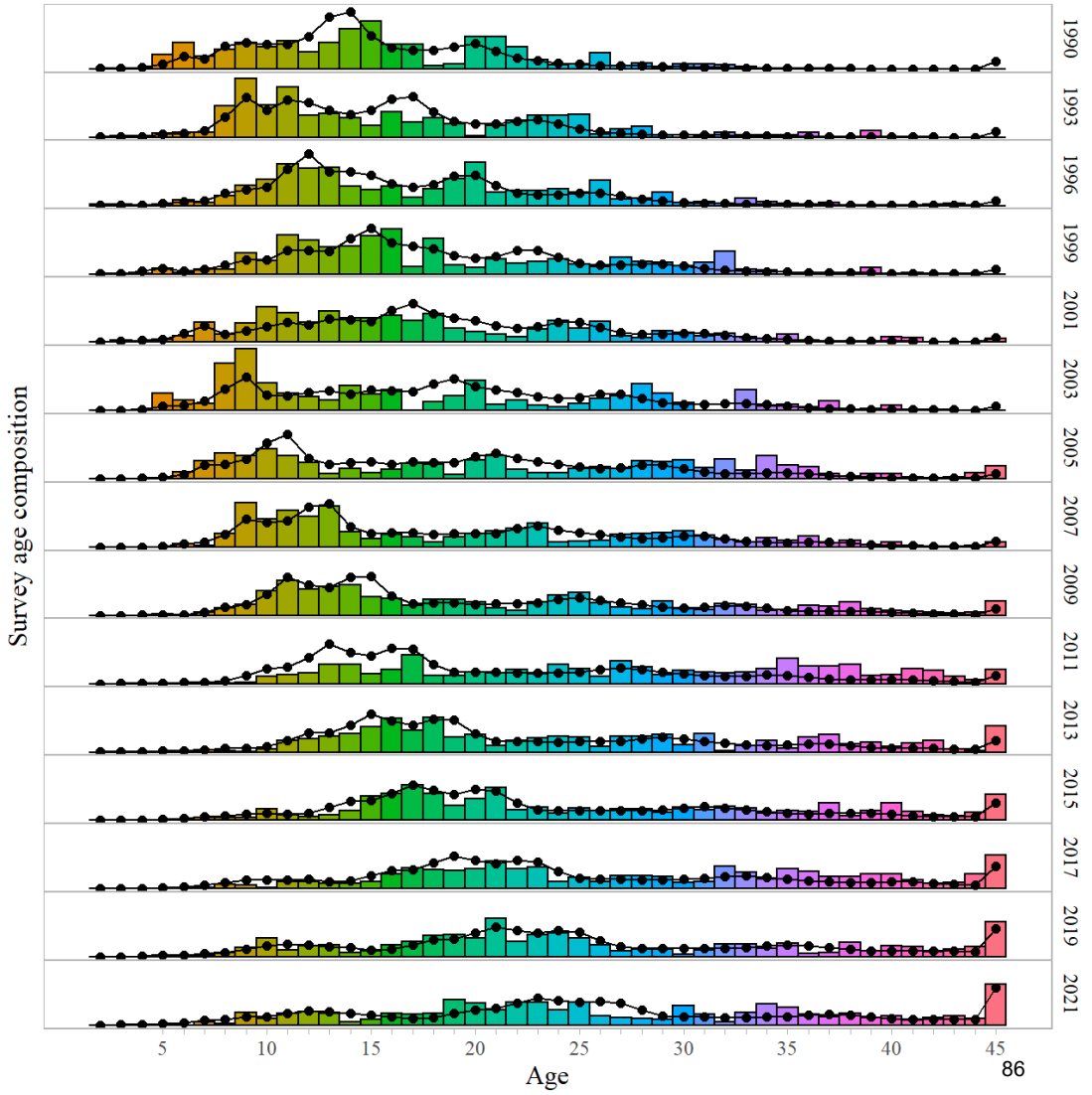


Northern rockfish: Fits to age compositions

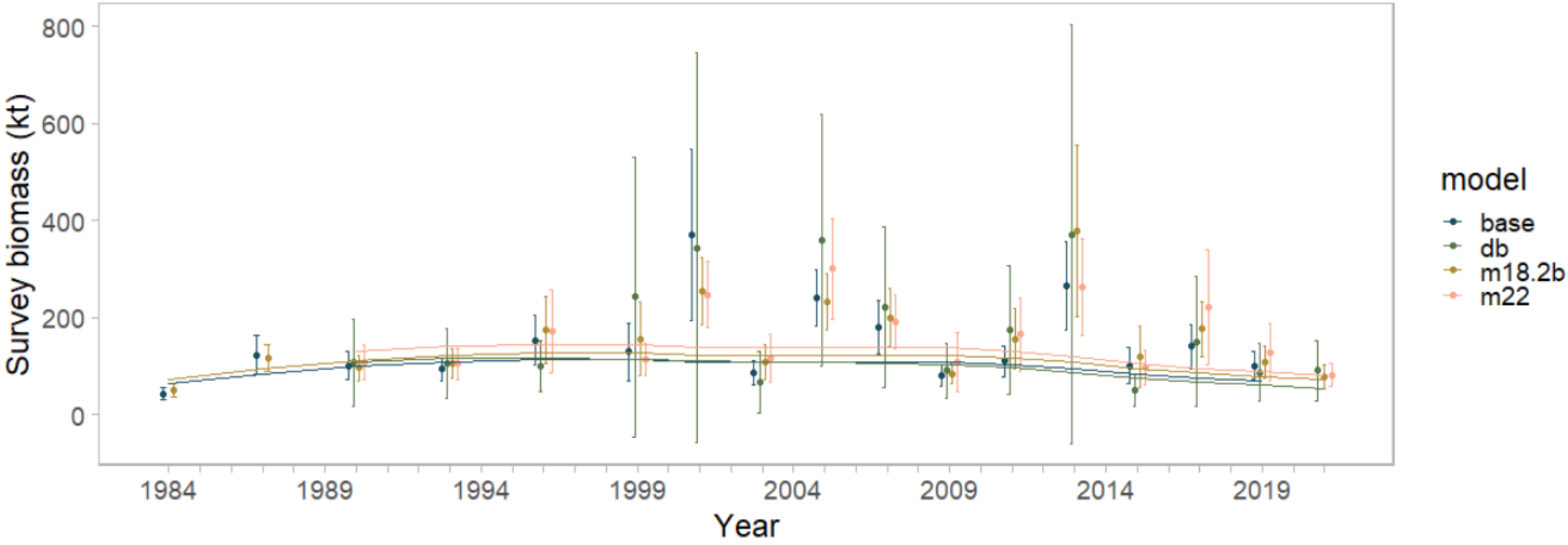
Fishery



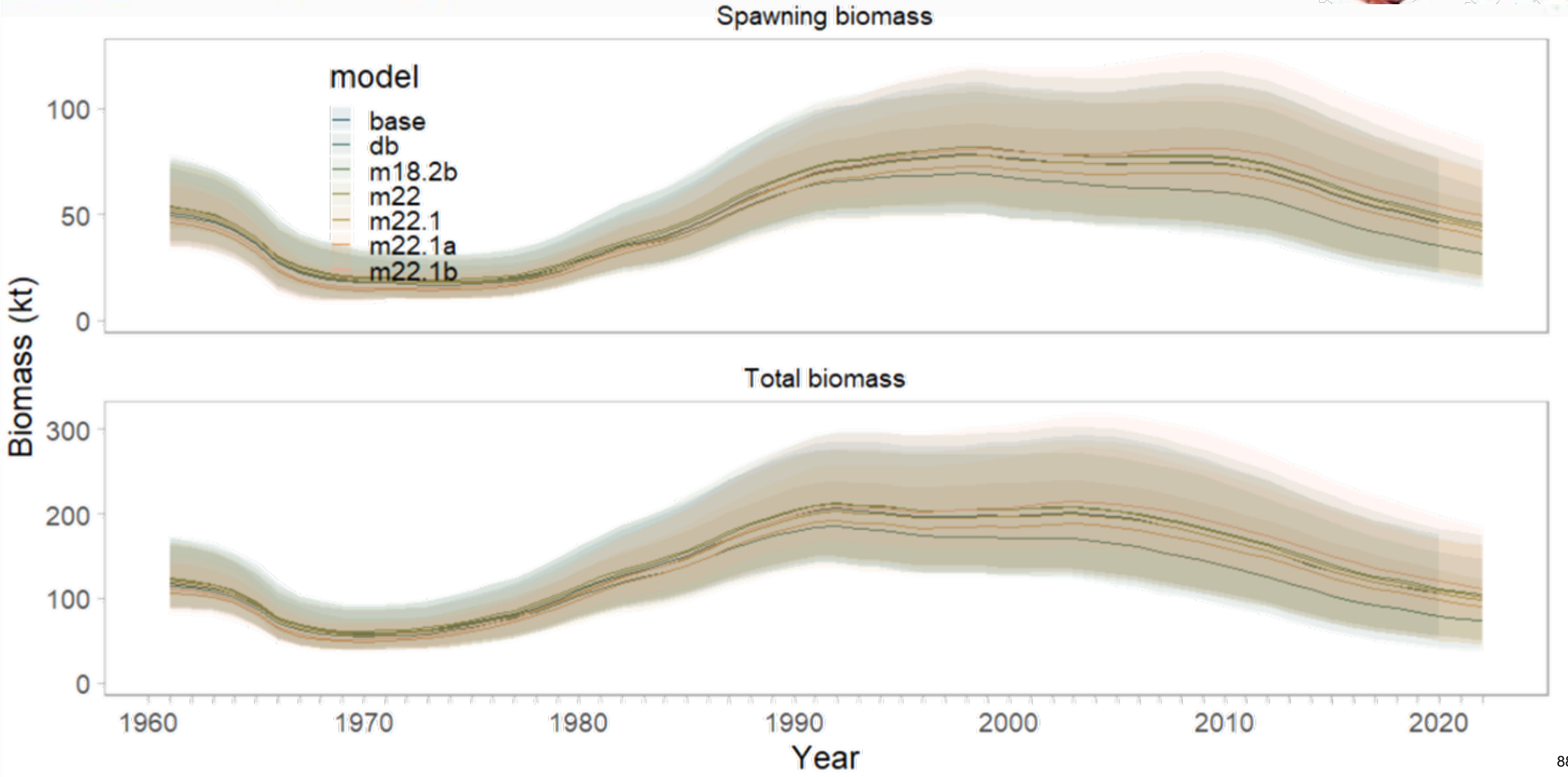
Survey



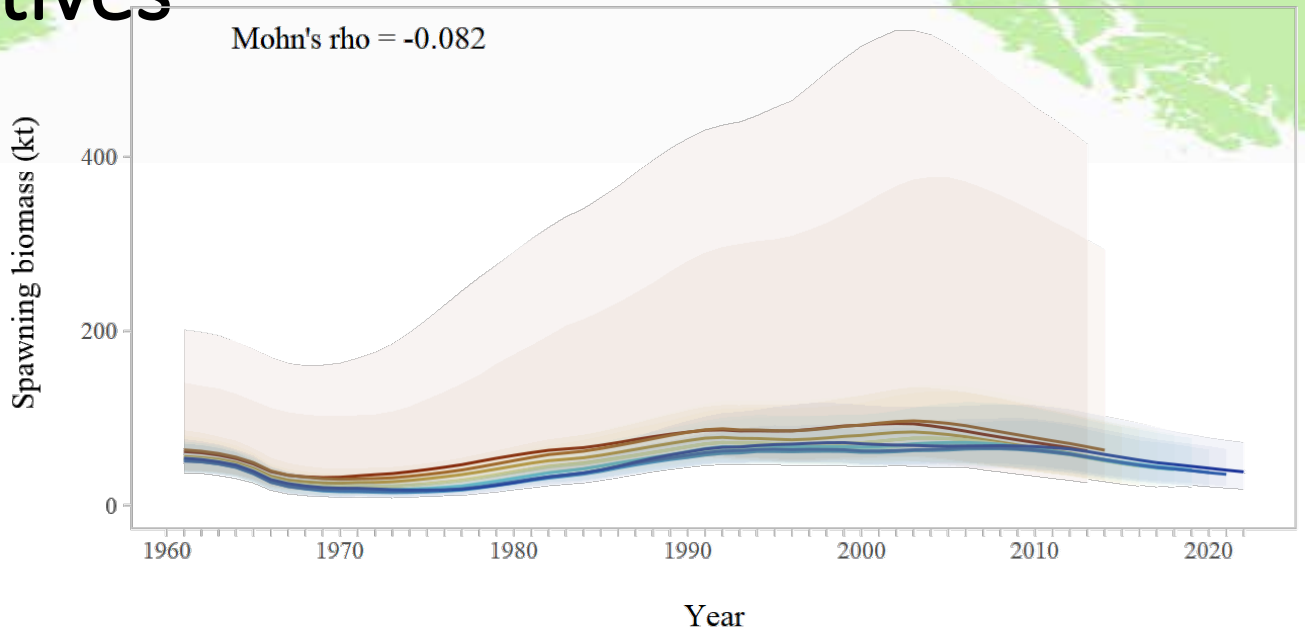
Northern rockfish: Fits to survey biomass index

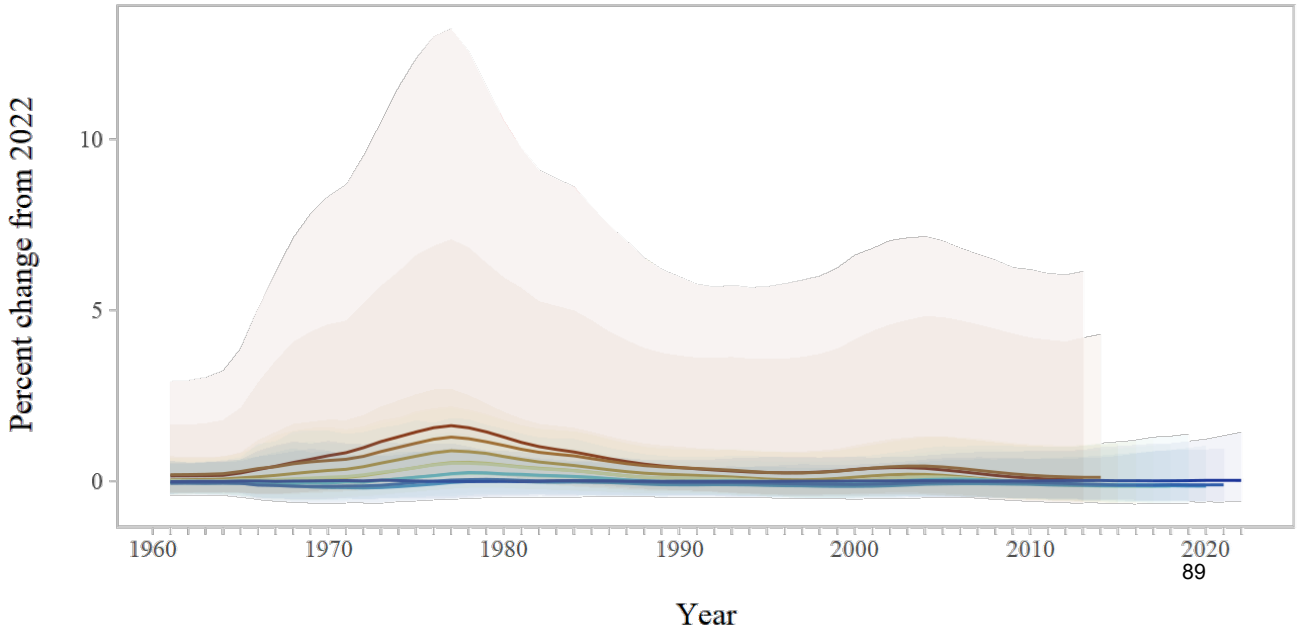


Northern rockfish

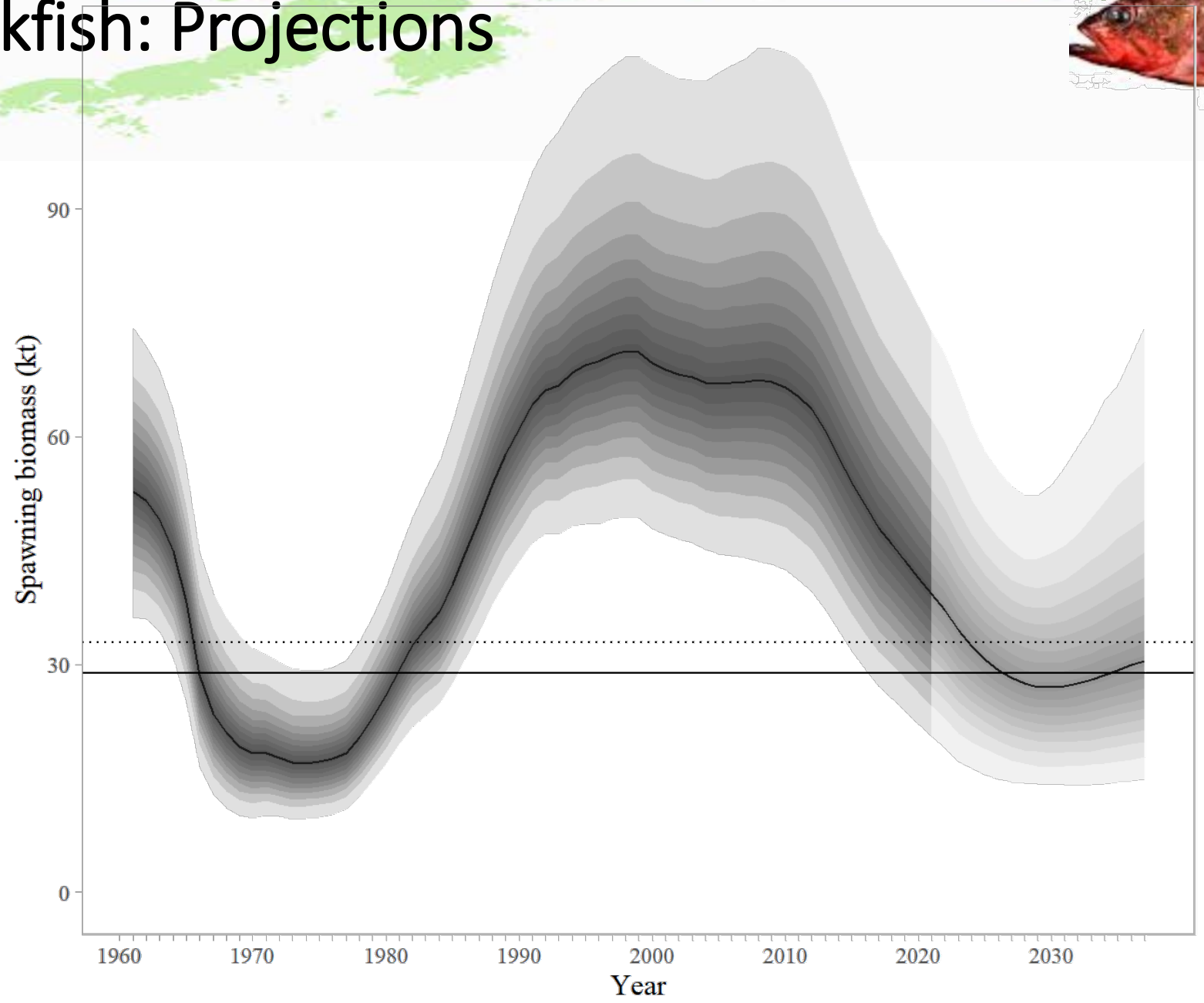


Northern rockfish: Retrospectives





Northern rockfish: Projections

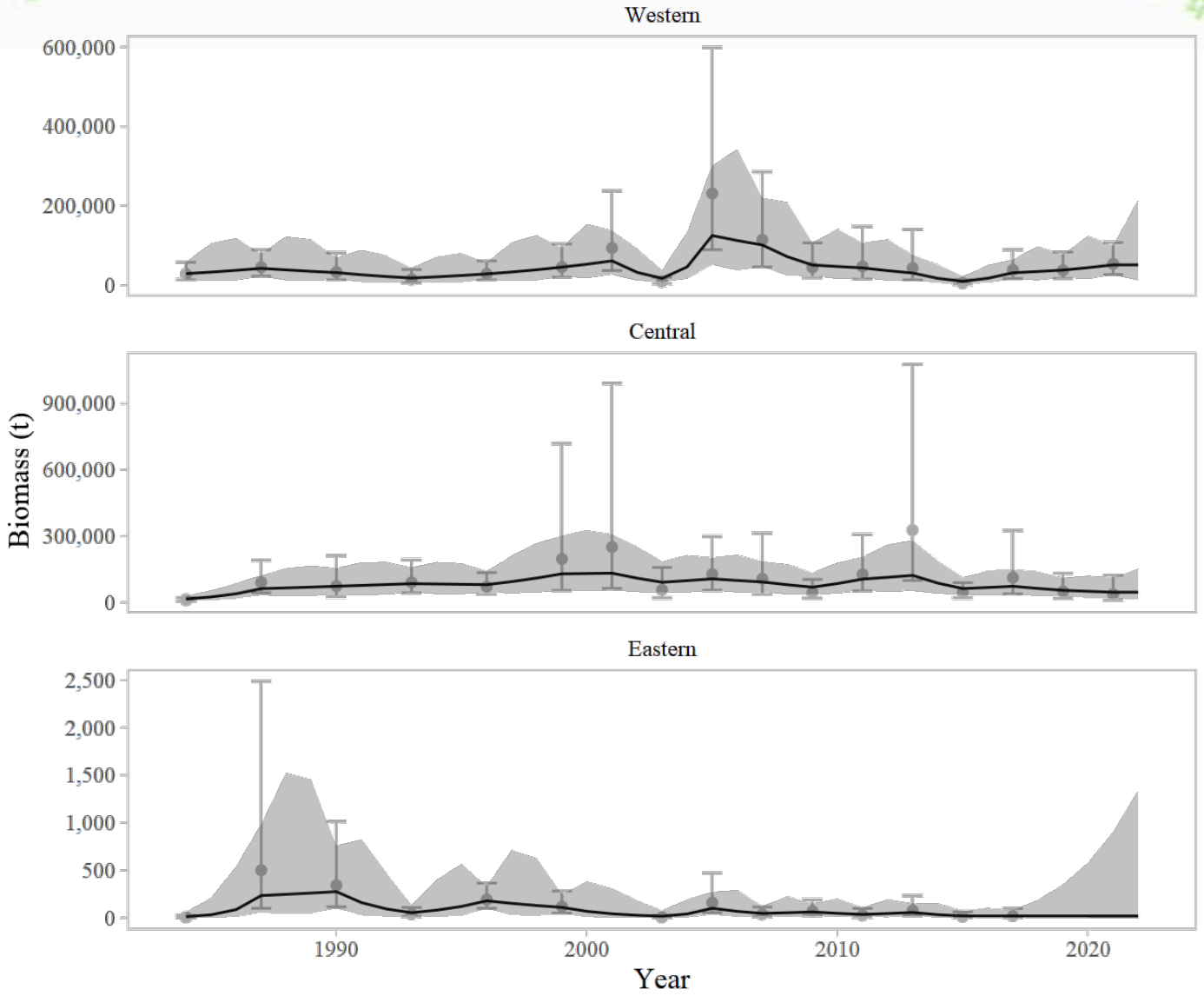


Northern rockfish: Apportionment

Western 37.76% → 52.65%

Central 62.22% → 47.33%

Eastern 0.02% → 0.02%



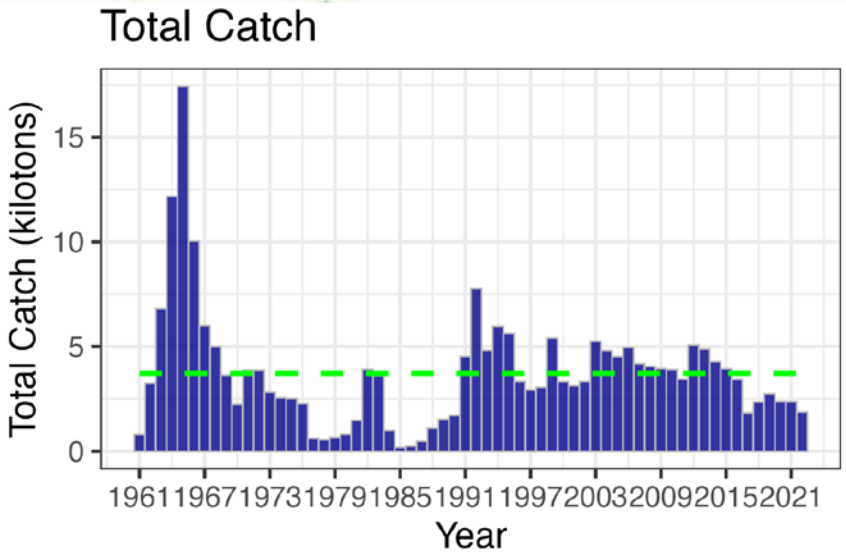
Northern rockfish: Team Discussion

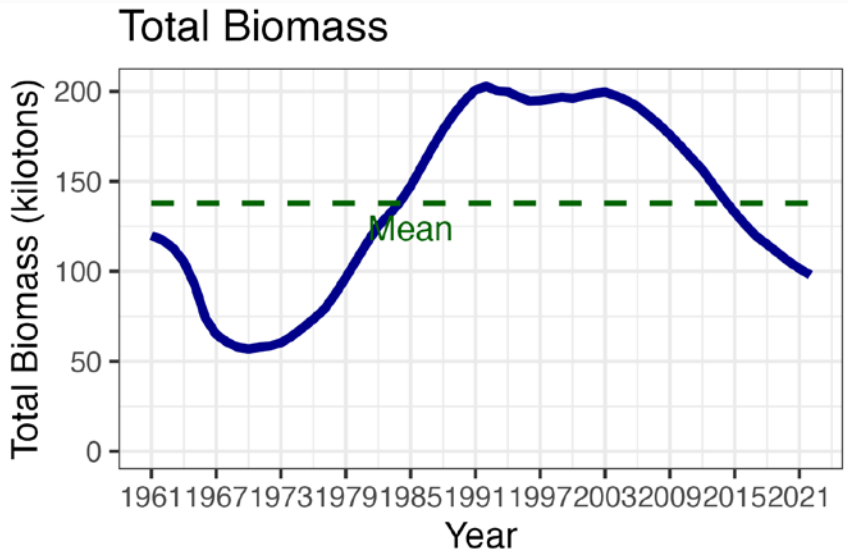
Plan Team recommended:

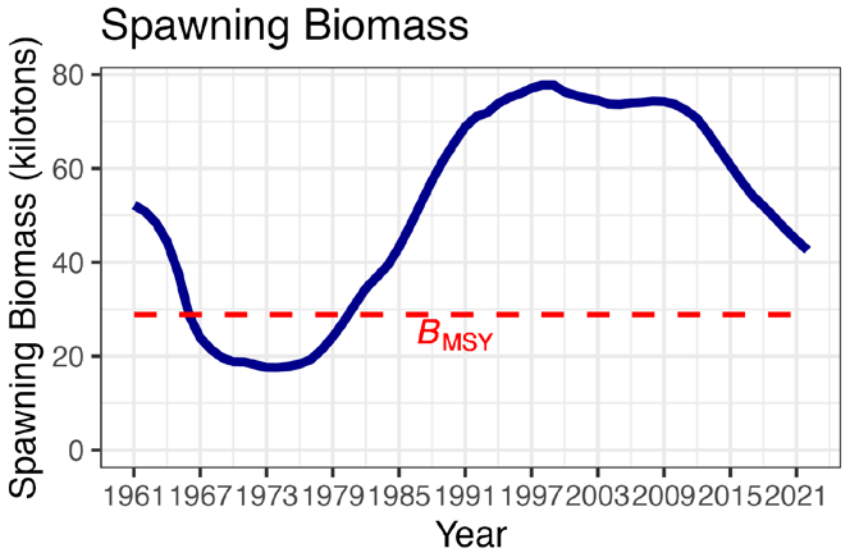
- That the author conduct a literature search to bring in more supporting information on skipped spawning from other studies on similar species in the interim until more information for northern rockfish becomes available

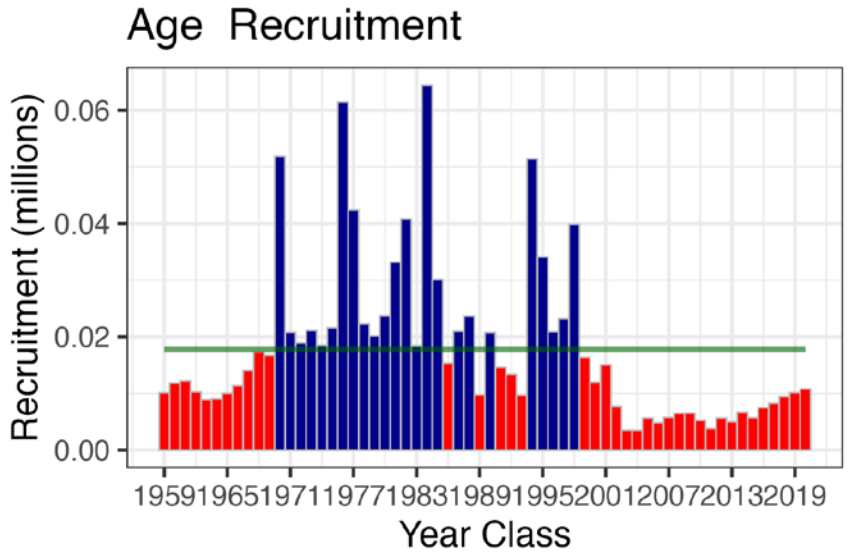
- That given the poor fits to the fishery length compositions in years prior to 2003, the author investigate these issues by evaluating separate fishery selectivity or growth patterns to better fit this older data

Northern rockfish: Overview









Rockfish ABC Summary

Species	ABC 2022	ABC 2023	Change
POP	38,268	37,193	down 1,075 (3%)
northern rockfish	5,146	4,964	down 182 (4%)
Shortraker Rockfish	705	705	same (0%)
Dusky	5,372	7,917	up 2,545 (47%)
Rougheye and Blackspotted Rockfish	788	775	down 13 (2%)
Demersal shelf rockf	365	283	down 82 (22%)
Thornyhead	1,953	1,628	down 325 (17%)
Other rock	4,054	4,054	same (0%)
Sub Total	56,651	57,519	up 868 (2%)

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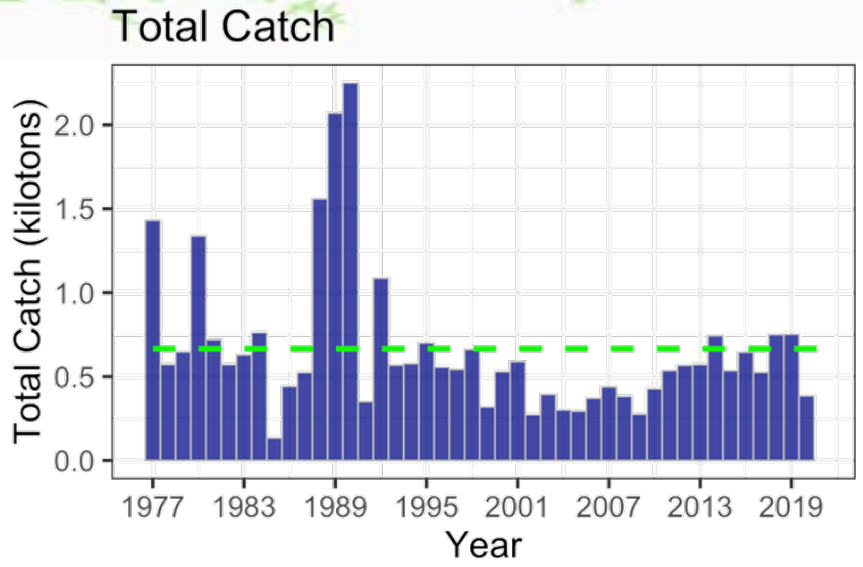
GOA Blackspotted/Rougheye Rockfish (partial assessment)

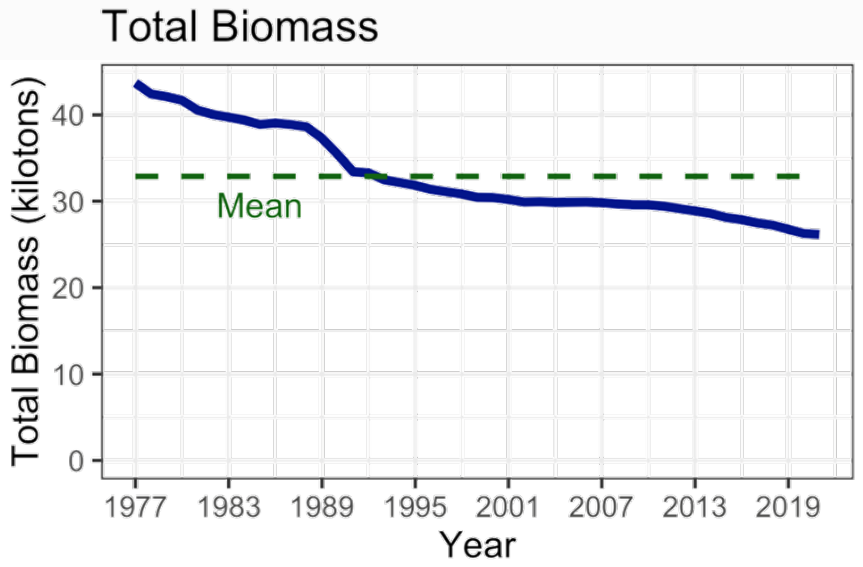
- Tier 3 species – 2021 was last full assessment
  - No model changes since 2015
  - Uses two surveys (NMFS bottom trawl & NMFS longline) for model and apportionment
  - New data: new/updated catch, new trawl/longline survey, new fishery/longline survey sizes

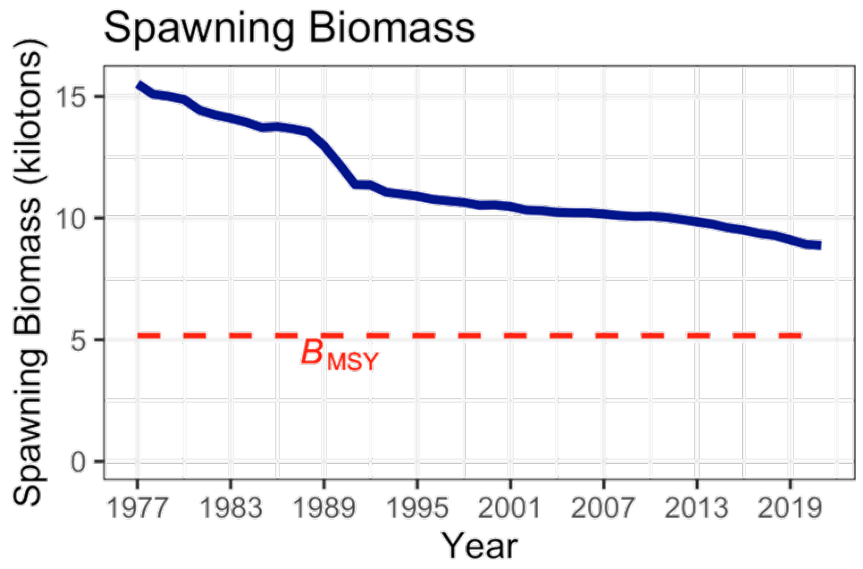
GOA Blackspotted/Rougheye Rockfish

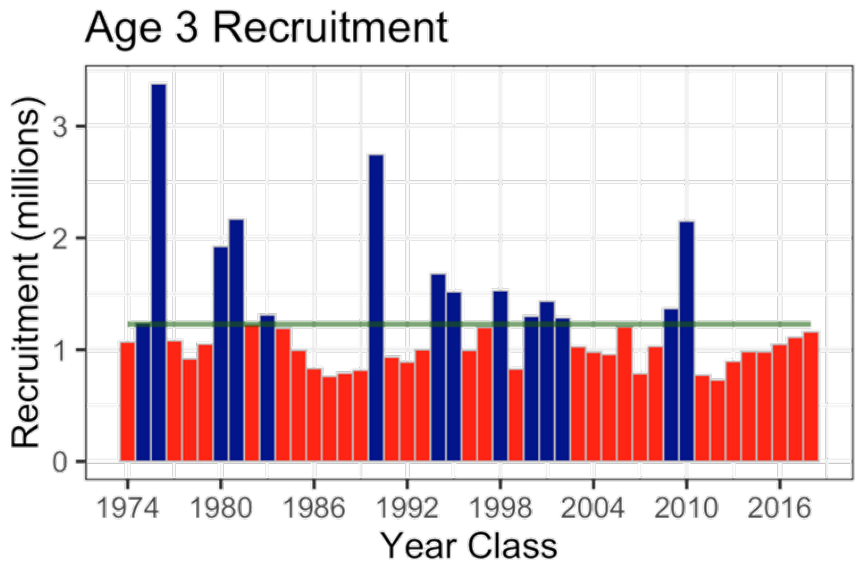
Quantity	As estimated or *specified last* year for:		As estimated or *recommended this* year for:	
	2022	2023	2023	2024
M (natural mortality rate)	0.034	0.034	0.034	0.034
Tier	3a	3a	3a	3a
Projected total (ages 3+) biomass (t)	26,060	25,997	25,837	25,755
Projected female spawning biomass (t)	8,648	8,627	8,554	8,514
$B_{100\%}$	14,776	14,776	14,776	14,776
$B_{40\%}$	5,911	5,911	5,911	5,911
$B_{35\%}$	5,172	5,172	5,172	5,172
F_{OFL}	0.046	0.046	0.046	0.046
$maxF_{ABC}$	0.038	0.038	0.038	0.038
F_{ABC}	0.038	0.038	0.038	0.038
OFL (t)	**947**	937	**930**	**927**
maxABC (t)	**788**	781	775	772
ABC (t)	**788**	781	**775**	**772**
Status	As determined *last* year for:		As determined *this* year for:	
	2020	2021	2021	2022
Overfishing	No	n/a	No	n/a
Overfished	n/a	No	n/a	No
Approaching overfished	n/a	No	n/a	No

GOA Blackspotted/Rougheye Rockfish: Overview









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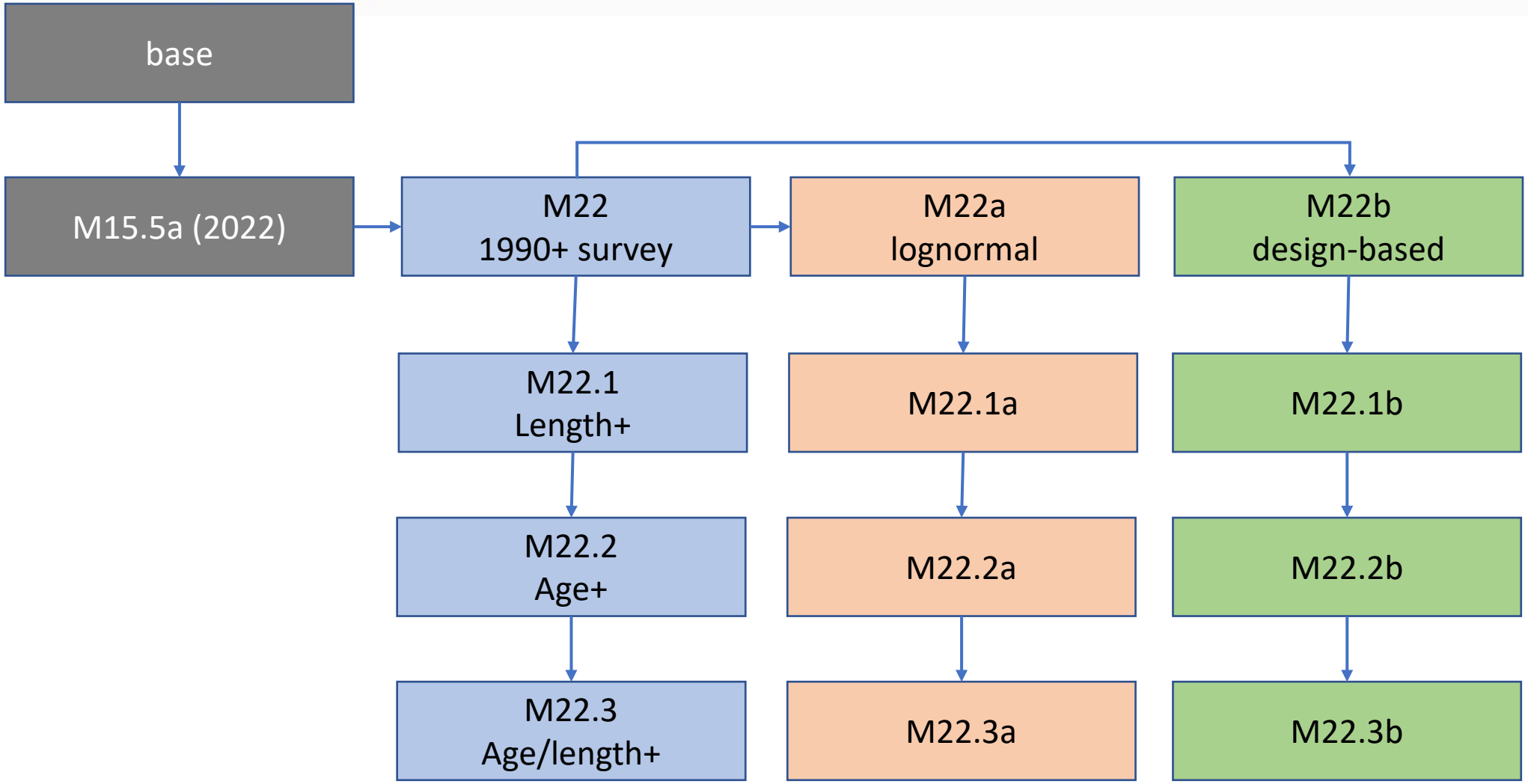
Sub Total	56,651	57,519	up 868 (2%)

Dusky rockfish (full assessment)

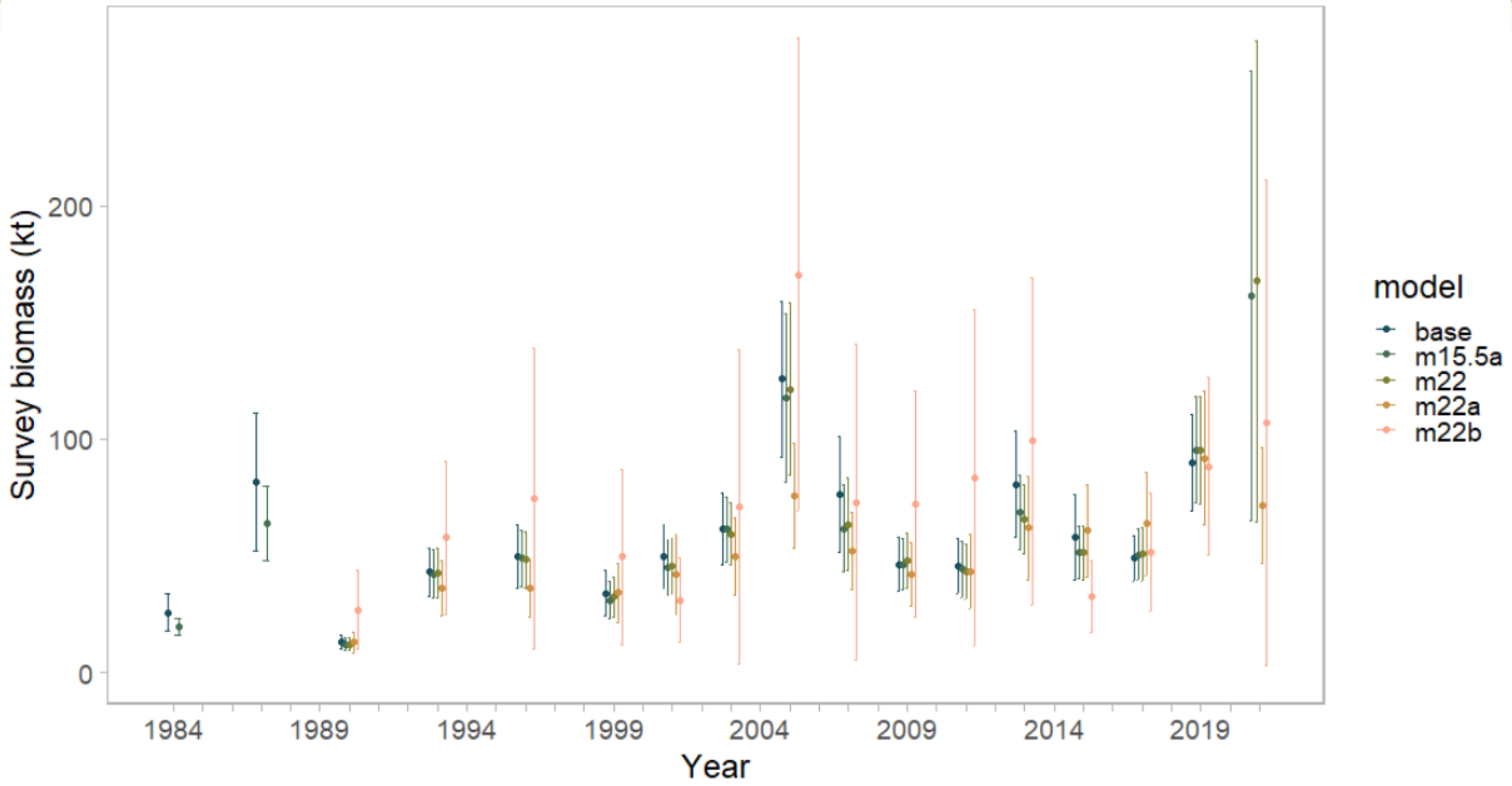
Model variants

Model	Description
base	2020 model (m15.5a) and results (includes 1980s survey data)
m15.5a	base model w/data updated through 2022, using GAP default VAST
m22	**m15.5a using GAP default VAST (survey data 1990+)**
m22.1	m22 w/increased length plus group
m22.2	m22 w/increased age plus group
m22.3	m22 w/increased age & length plus groups
m22a	m22 using lognormal error VAST (survey data 1990+)
m22.1a	M22.1 w/lognormal VAST
m22.2a	M22.2 w/lognormal VAST
m22.3a	M22.3 w/lognormal VAST
m22b	m22 using design-based survey abundance (1990+)
m22.1b	M22.1 w/db survey
m22.2b	M22.2 w/db survey
m22.3b	M22.3 w/db survey

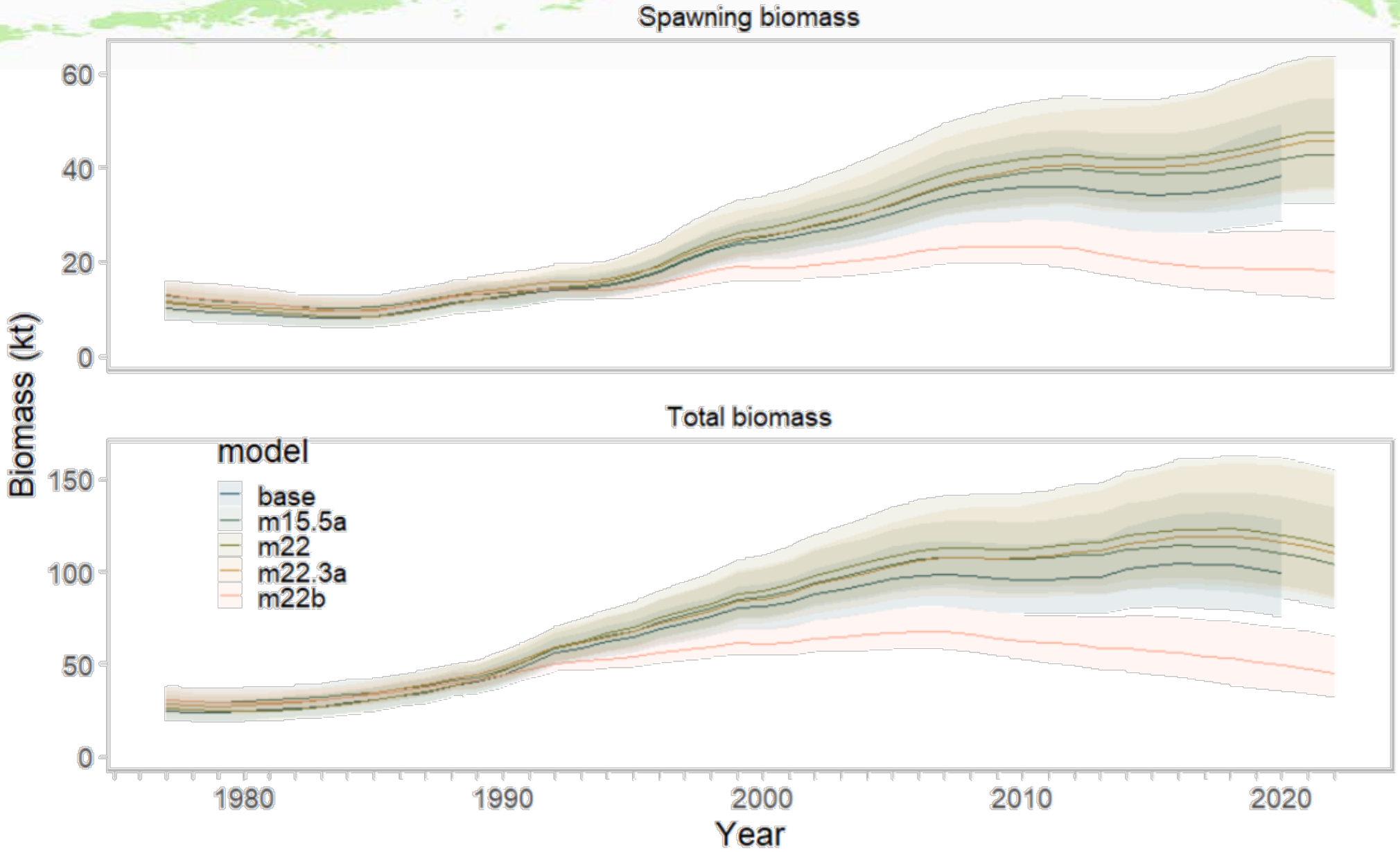
Dusky rockfish: Model variants



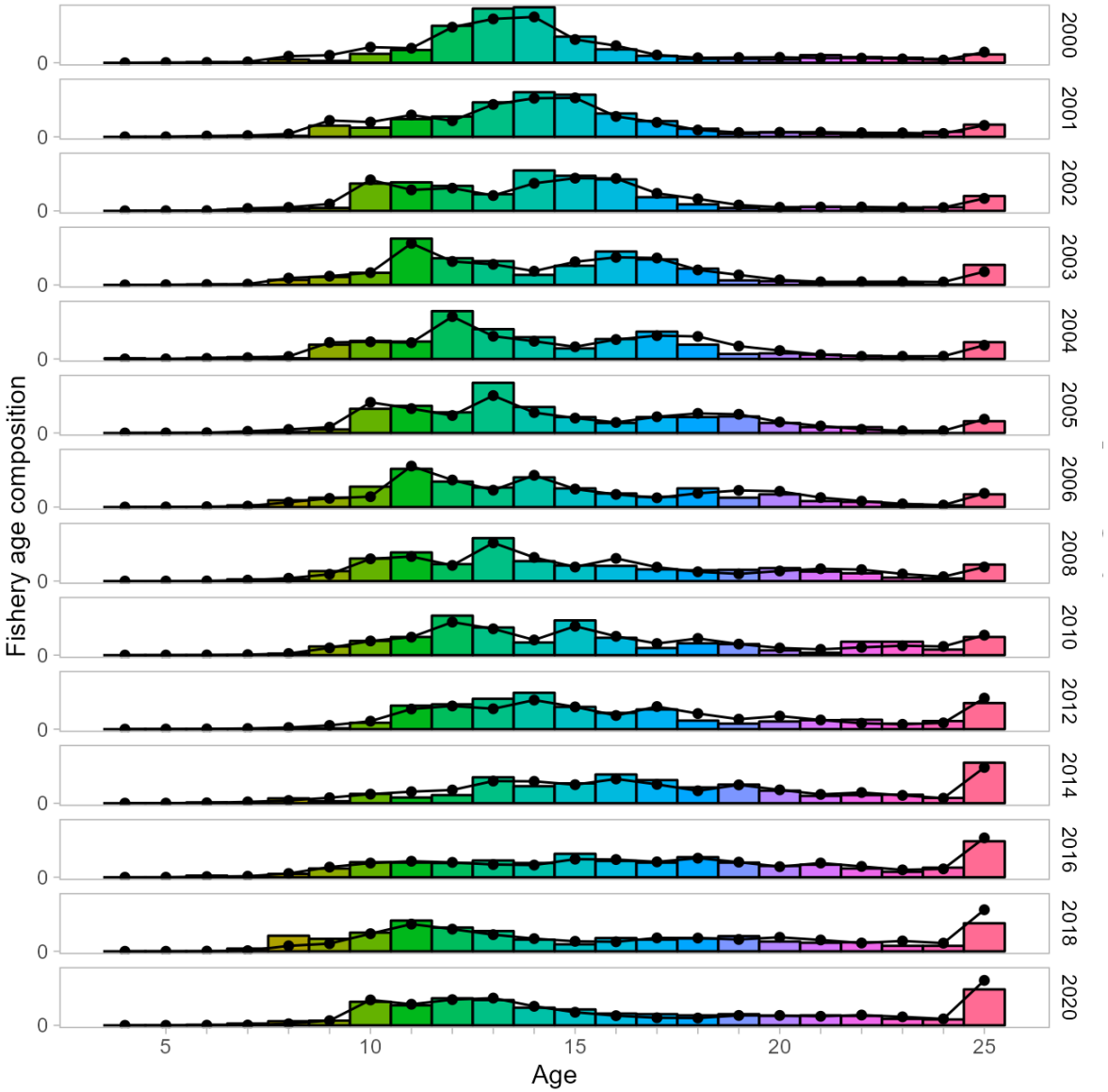
Dusky rockfish

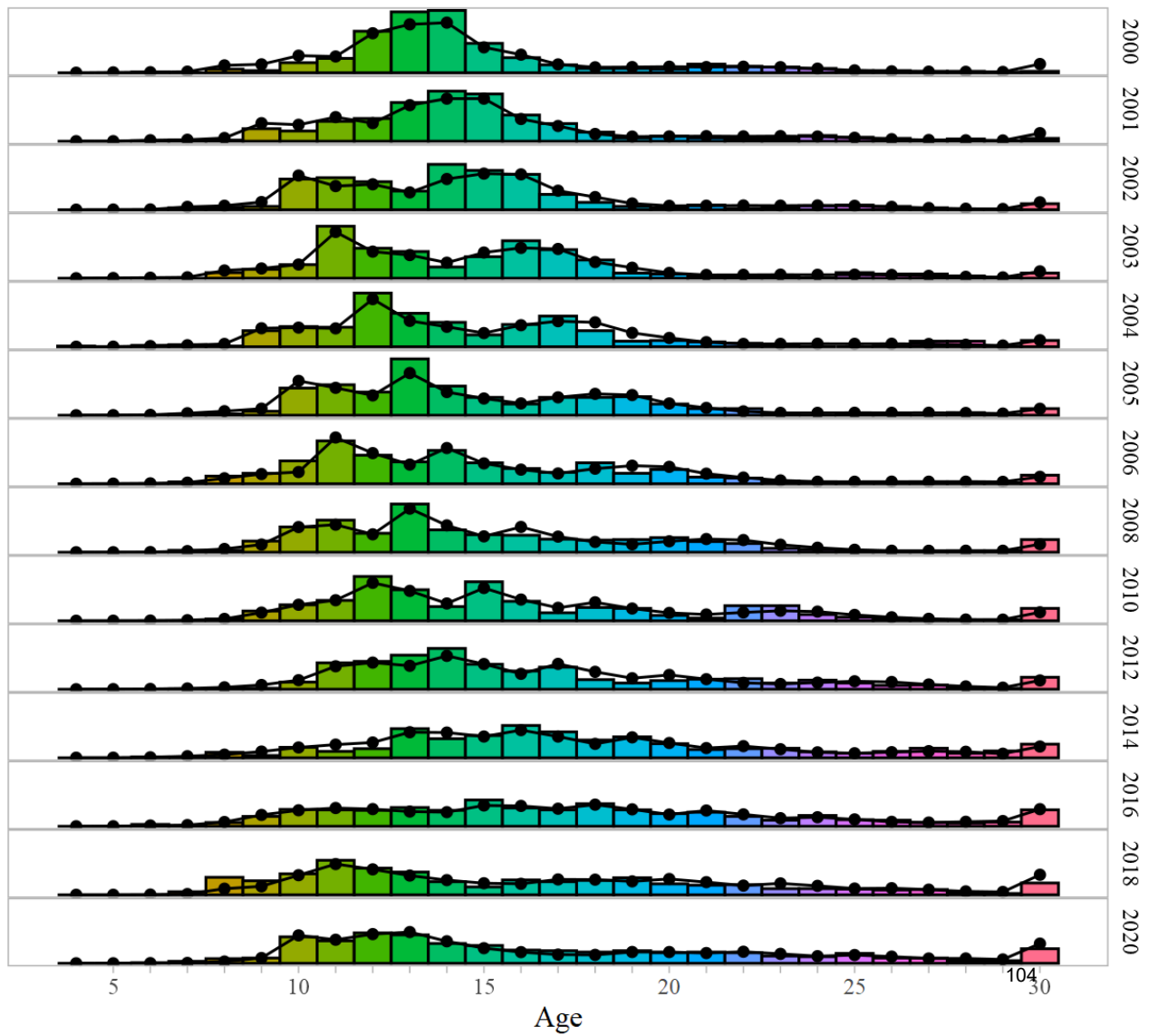


Dusky rockfish

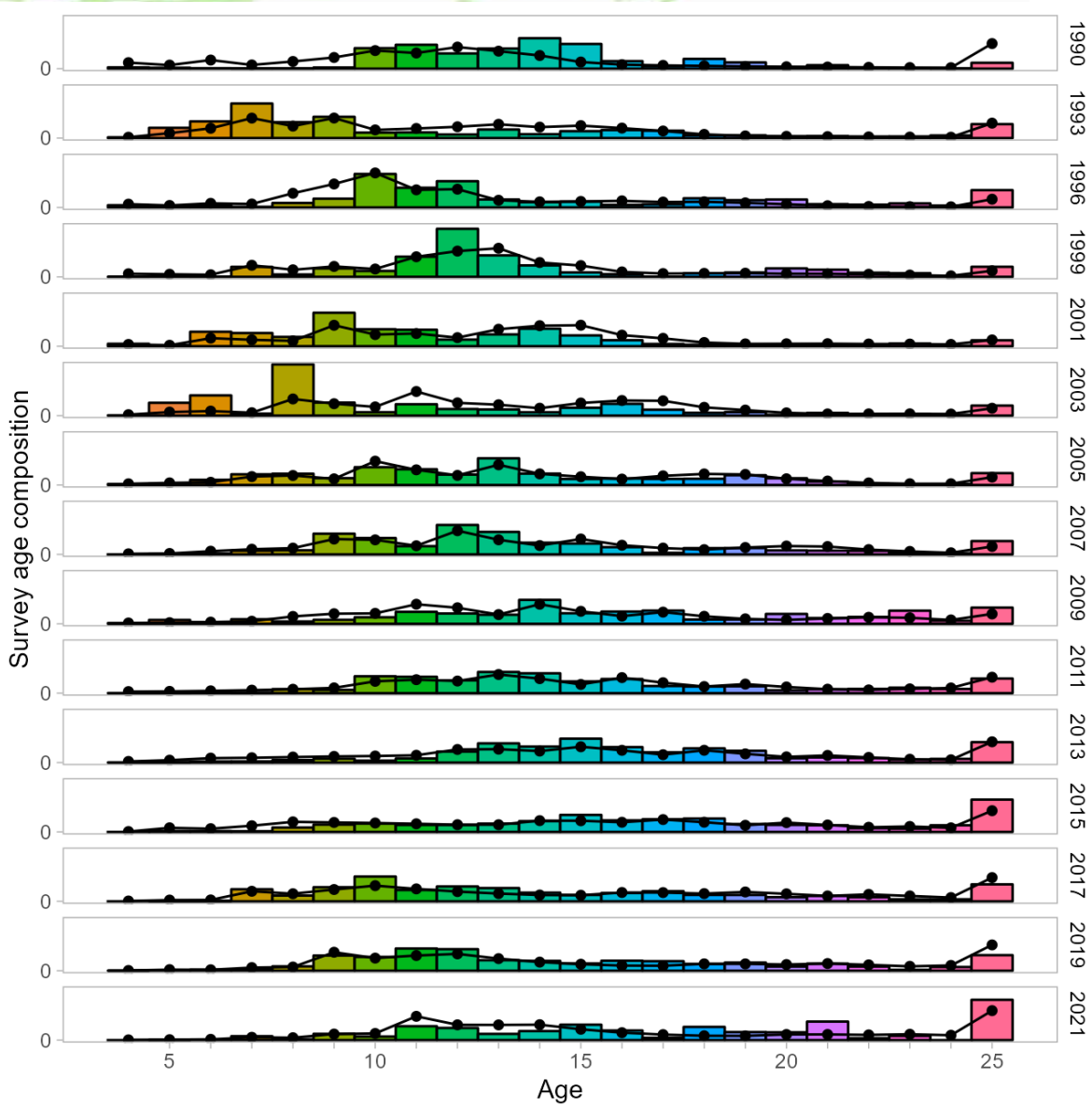


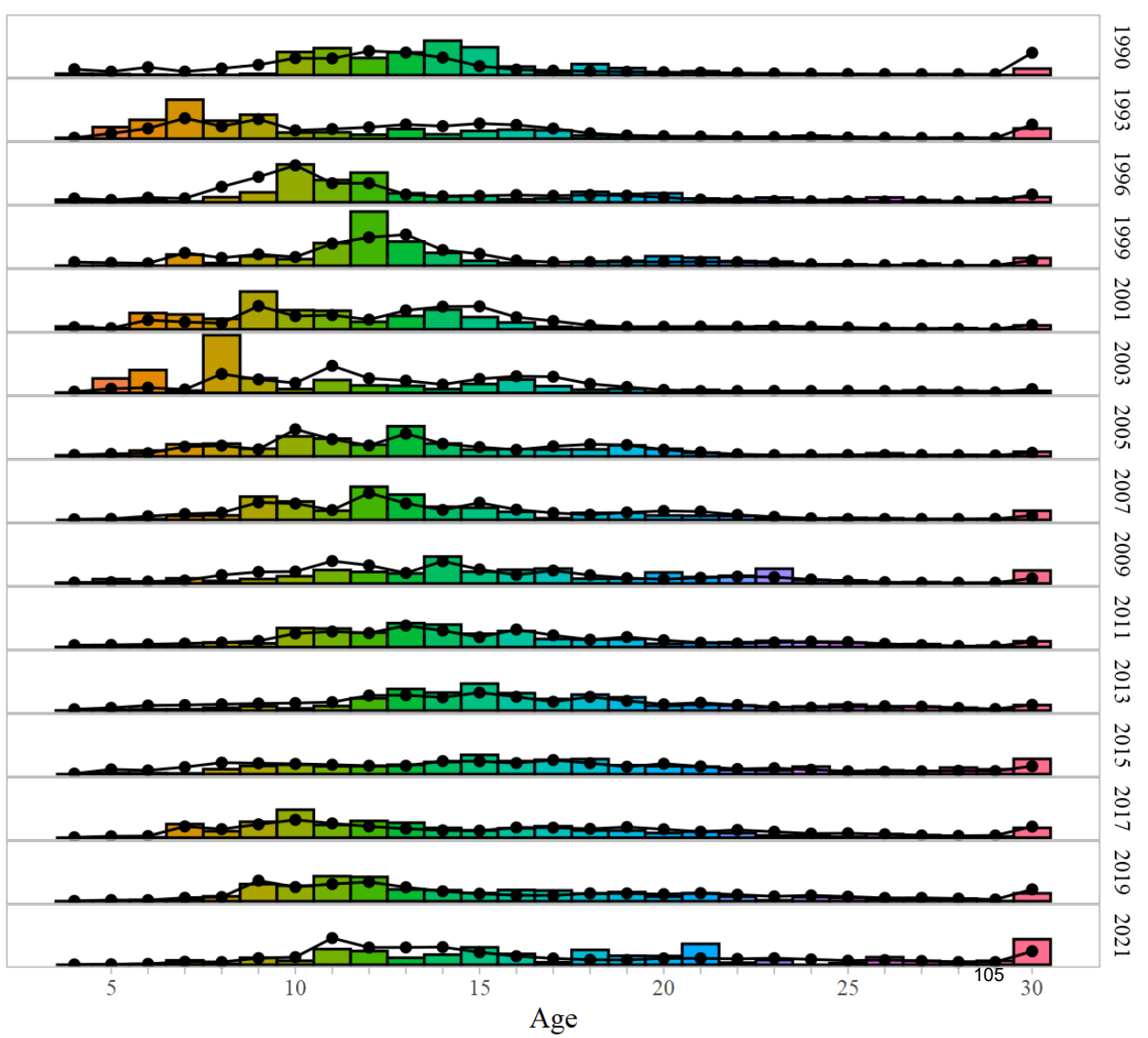
Dusky rockfish: Fit to fishery age



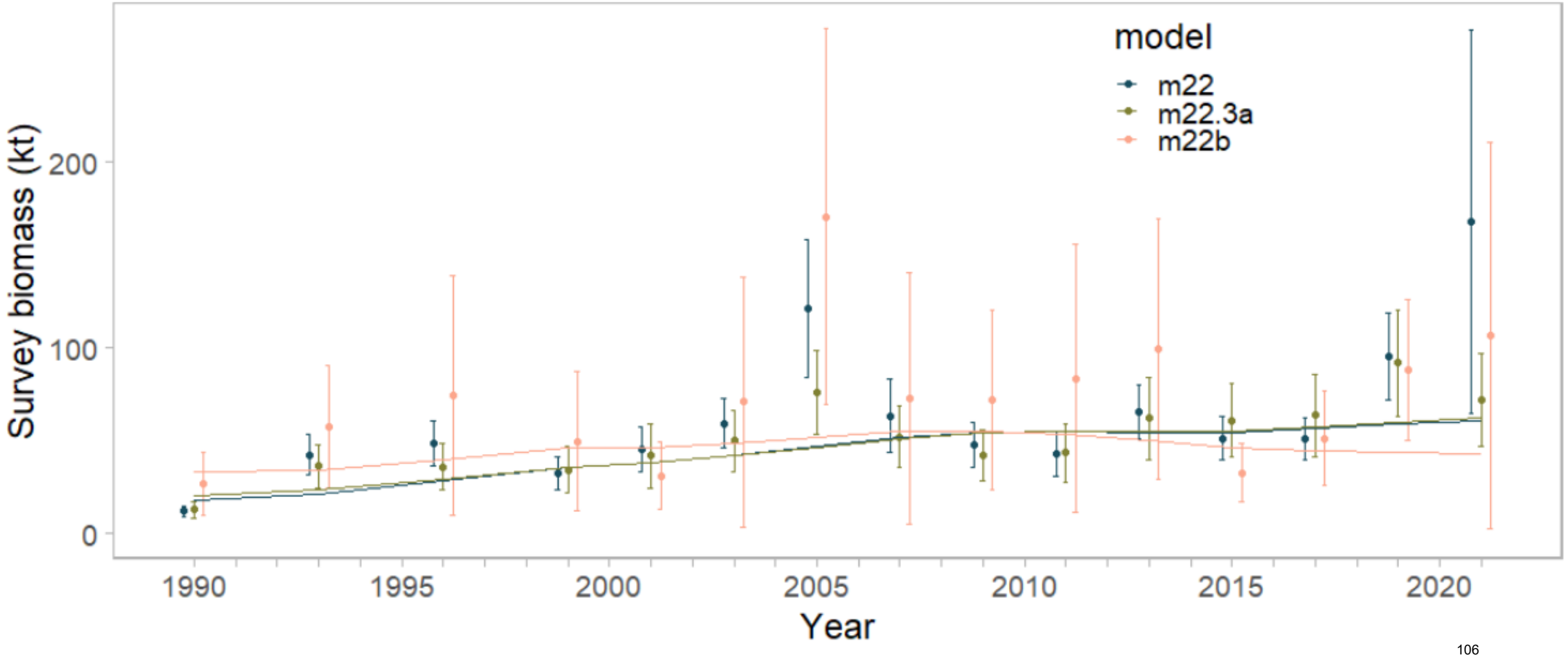


Dusky rockfish: Fit to survey age

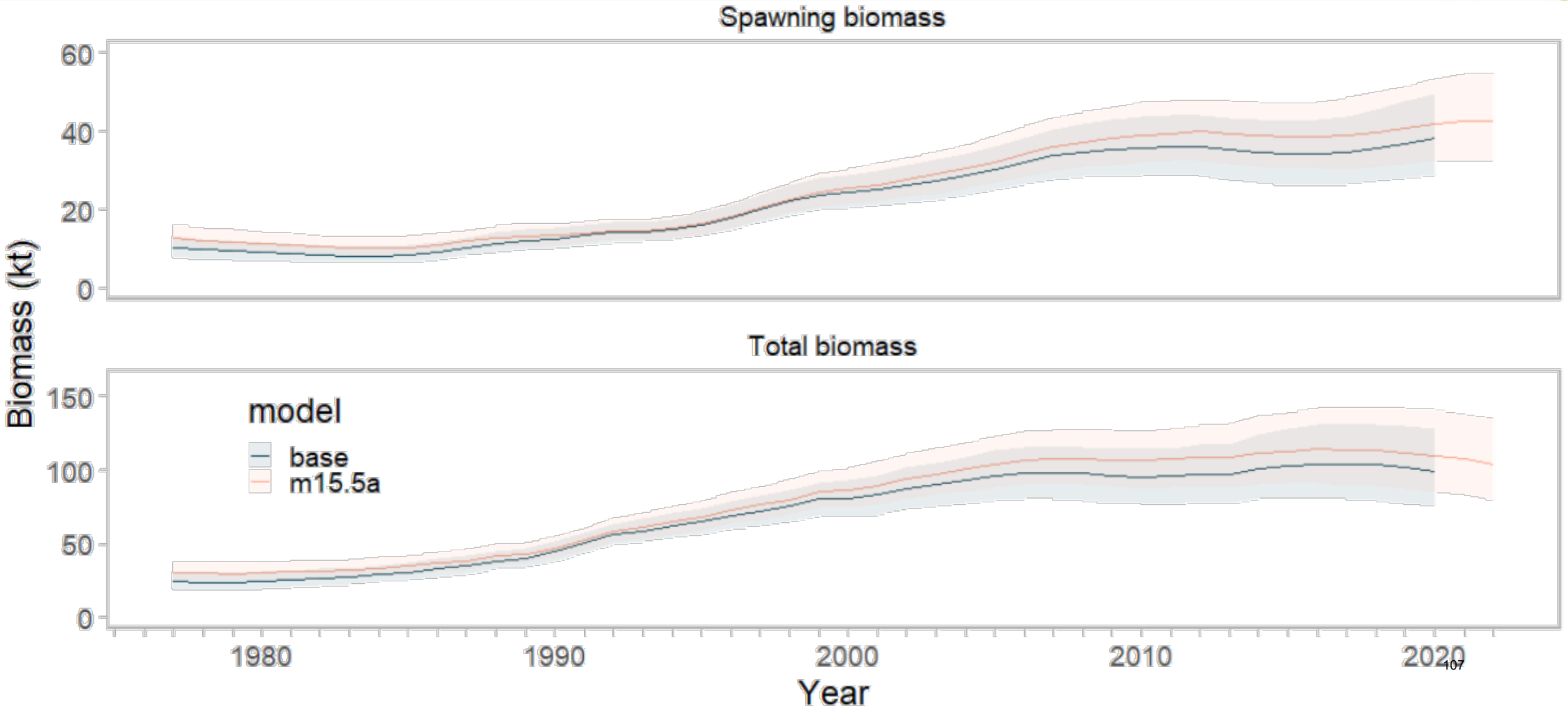




Dusky rockfish

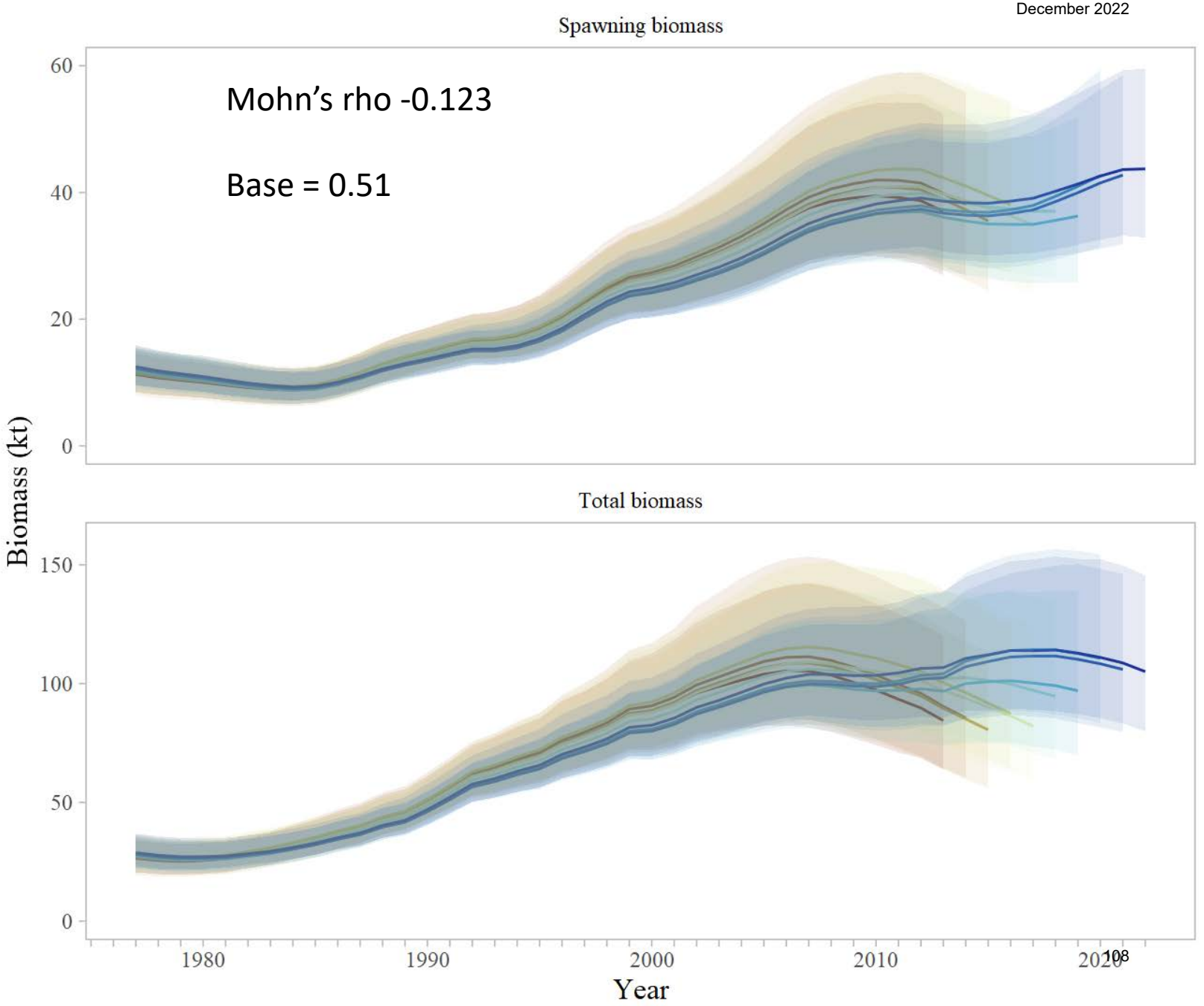


Dusky rockfish

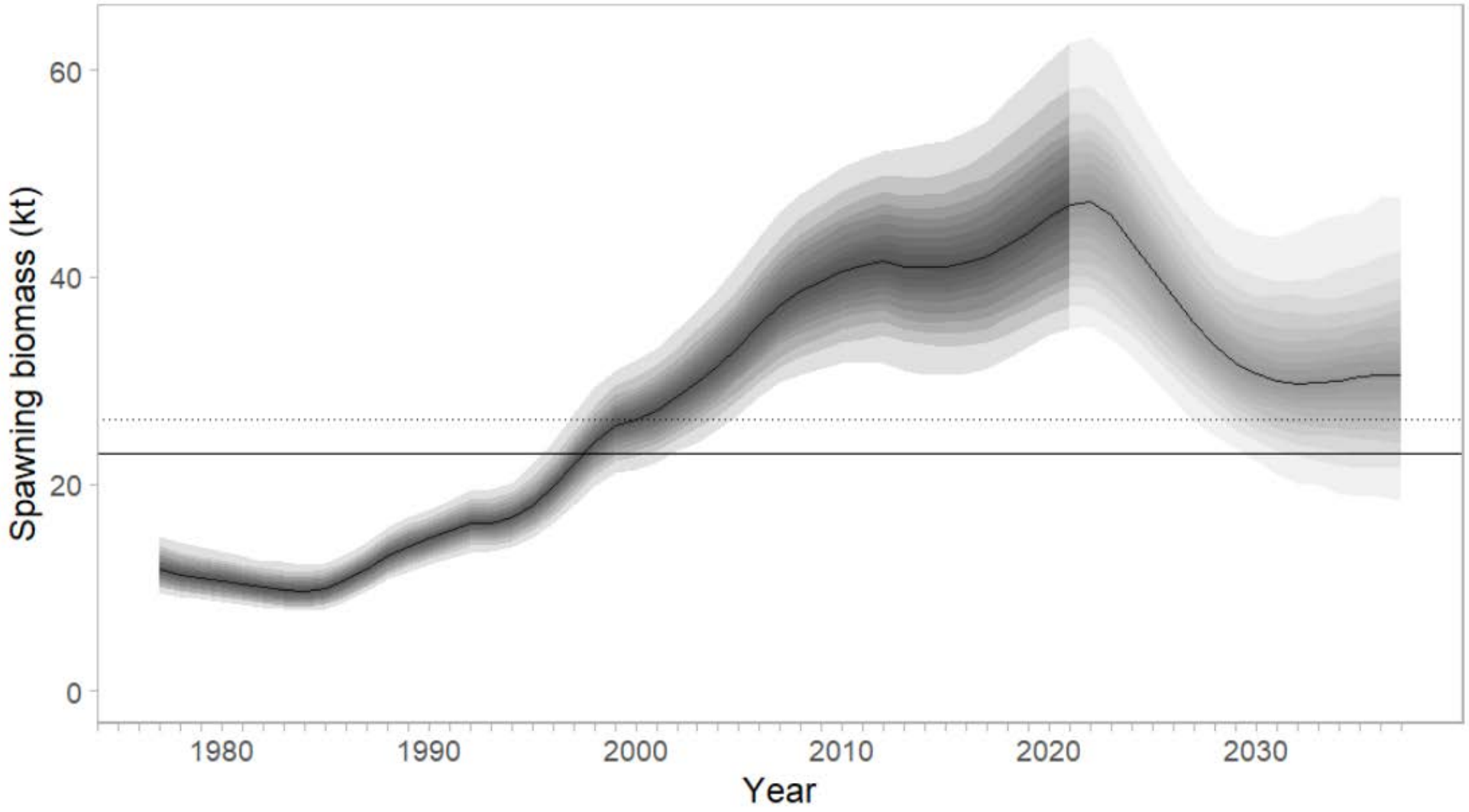


Dusky rockfish

- Big improvement over base



Dusky rockfish

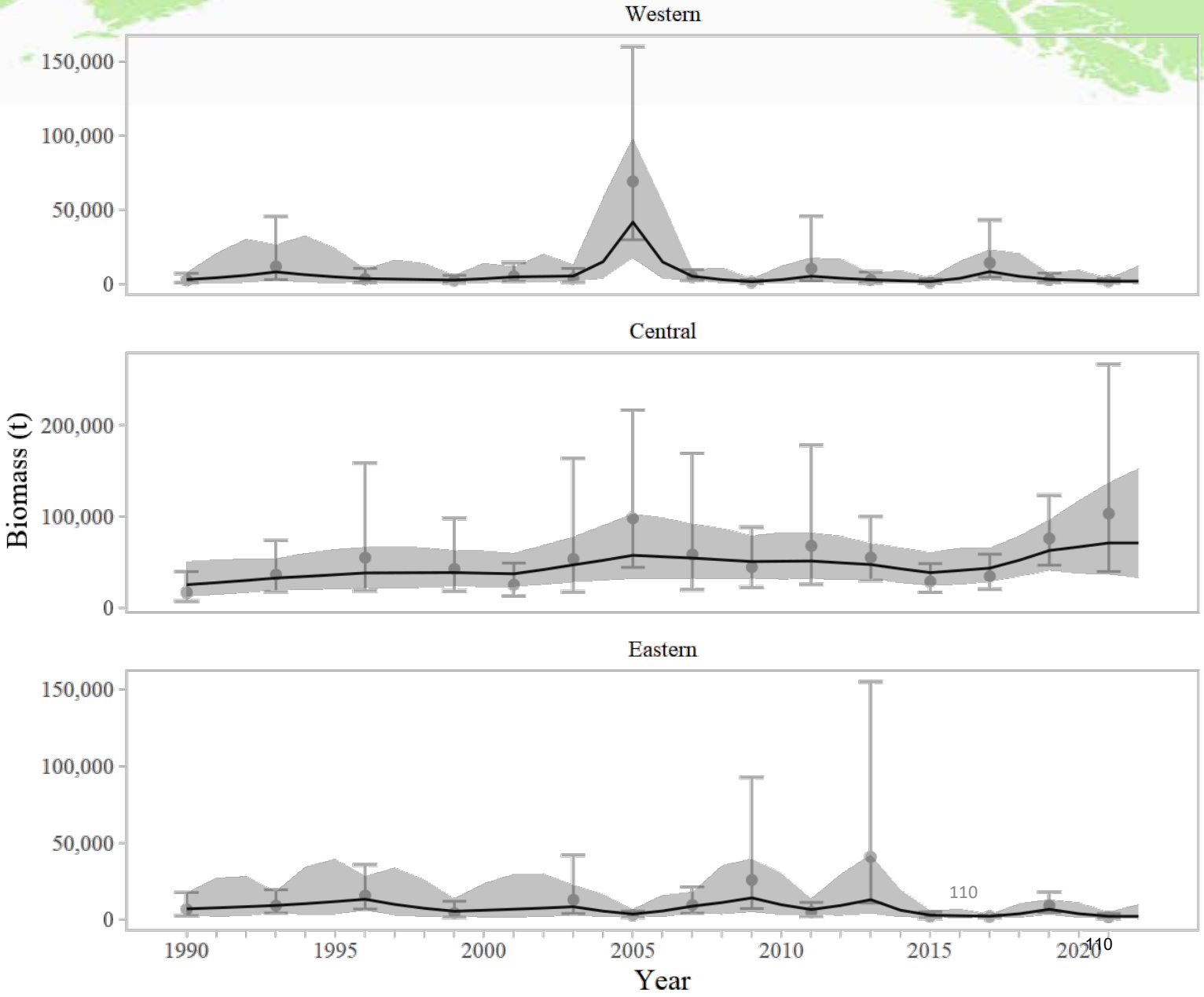


Dusky rockfish: Apportionments

Western 5.0% → 1.9%

Central 84.4% → 96.6%

Eastern 10.6% → 1.5%

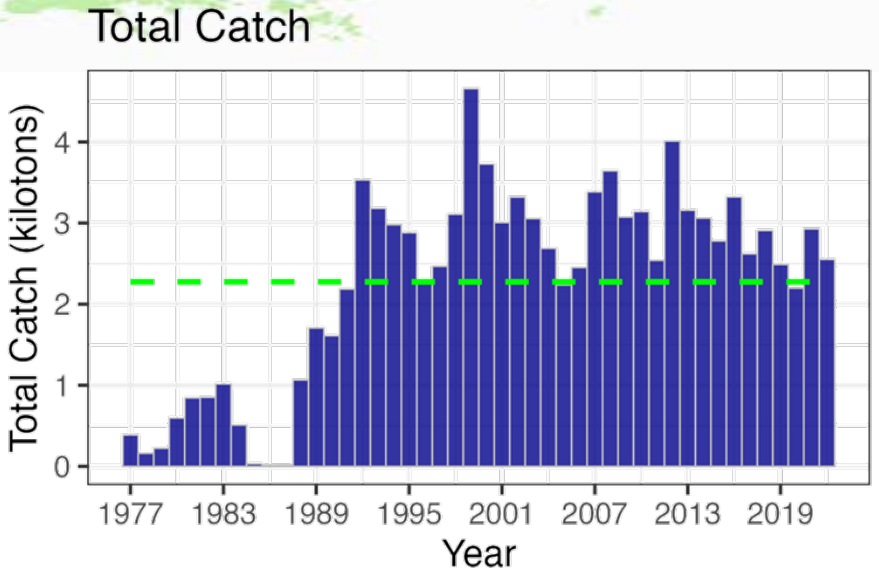


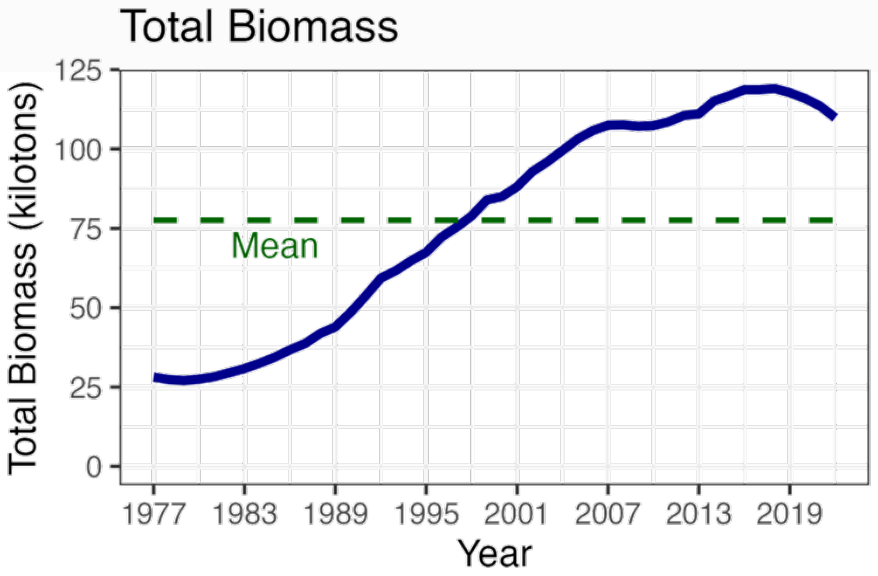
Dusky rockfish: Discussion

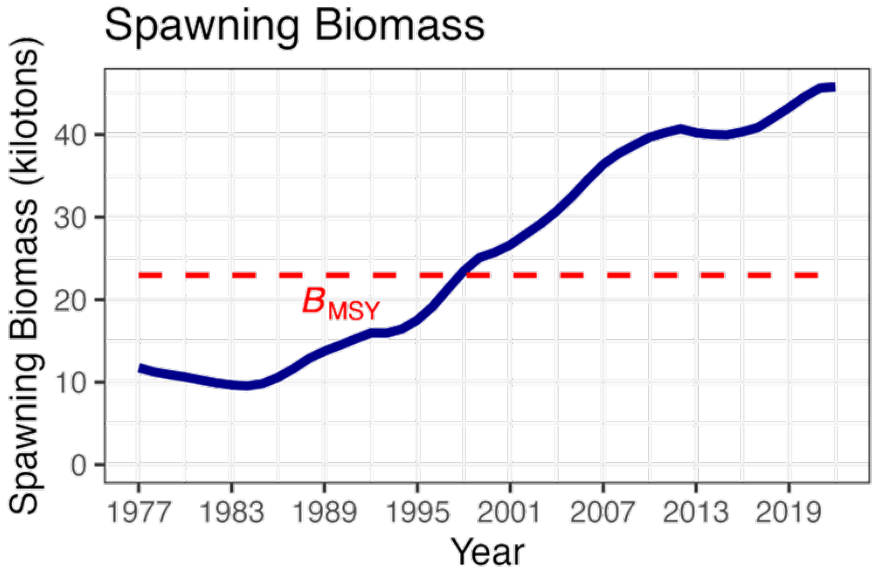
Plan Team recommended:

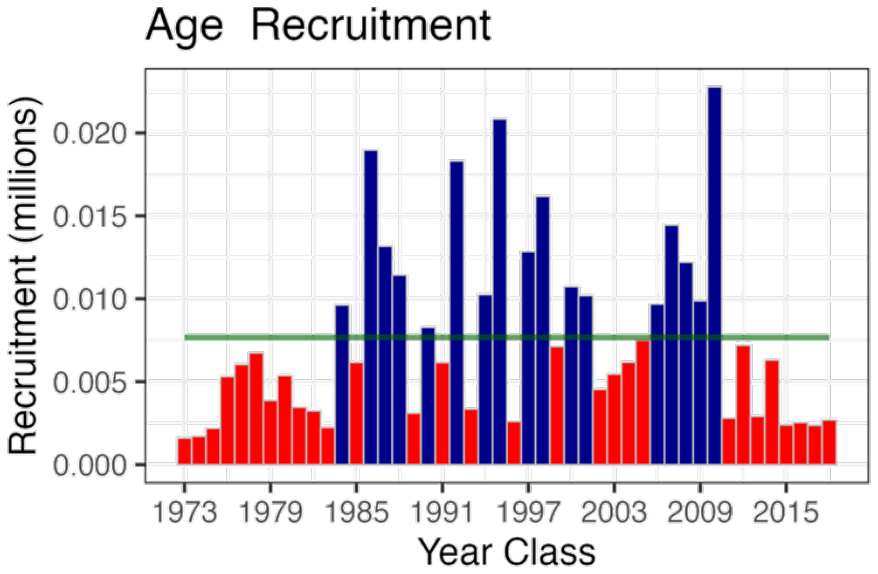
- Evaluating the use of VAST estimates of survey biomass for apportionments.
- Exploratory model runs to identify how model changes improved the retrospective pattern

Dusky rockfish: Overview









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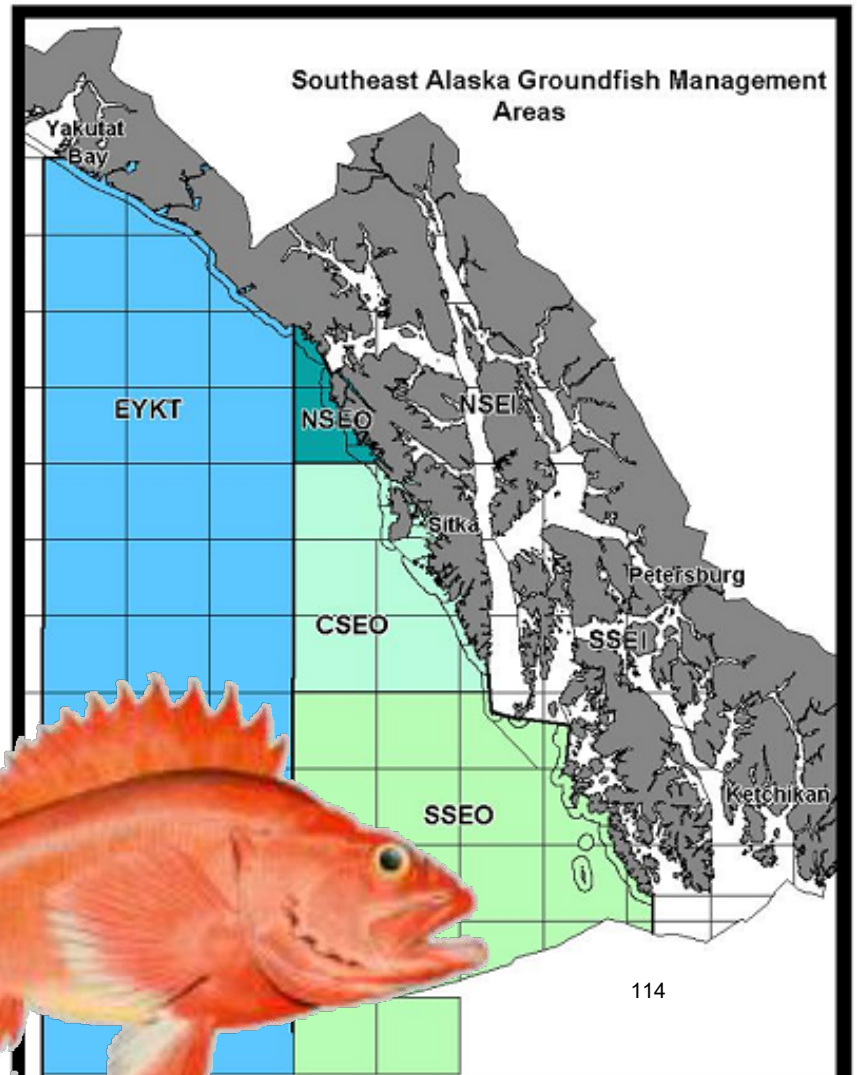
SEO Demersal shelf rockfish (full assessment)

Phil Joy
ADF&G
Phil.Joy@alaska.gov

- Tier 5 (yelloweye) and Tier 6 (6 other species)



SEO Demersal shelf rockfish

Assessment History

- Status-quo methods for over a decade
  - —Yearly justification of using lower 90% CI to establish targets
- Age-structured assessment attempted in 2015
  - —Issues with fit, stability and uncertainty
  - —High sensitivity to M
  - —Lack of recruitment signals
- Random effects model in 2013 and 2015
  - —Still aimed to use lower 90% CI
  - —Greater uncertainty and lower targets than status-quo
  - —Models rejected

Special thanks to Phil Joy and co-authors!

2022 Assessment

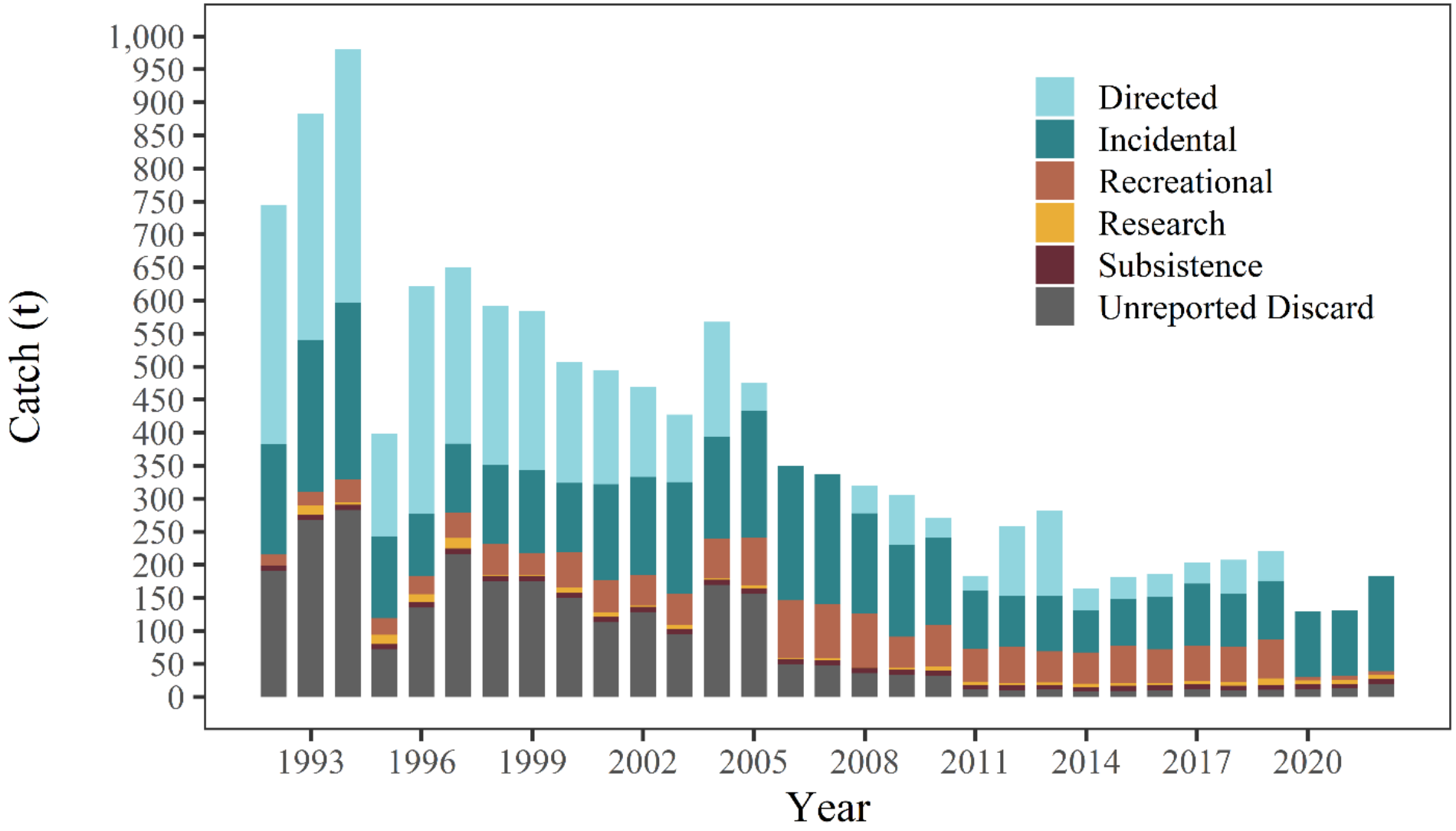
1. Standardize status-quo methods ✓
2. Random effect model updated ✓
   - Spatially stratified
   - IPHC CPUE index as secondary
3. Harvest reconstruction
   - Developing methods to estimate unobserved discards in the halibut fishery
4. State-space surplus production model
   - Development
   - Risk analysis

September Plan Team Recommendations:

OFL and ABC

Research Model
CIE review in 2023

SEO Demersal shelf rockfish



SEO Demersal shelf rockfish

Biomass estimate

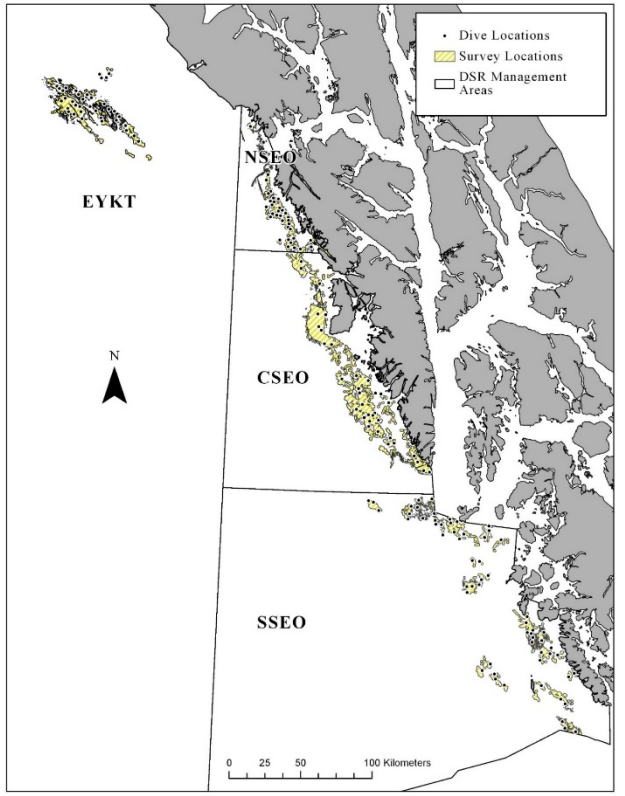
Density (+ variance)
x Avg. weight of yelloweye from portside sampling (+ variance)

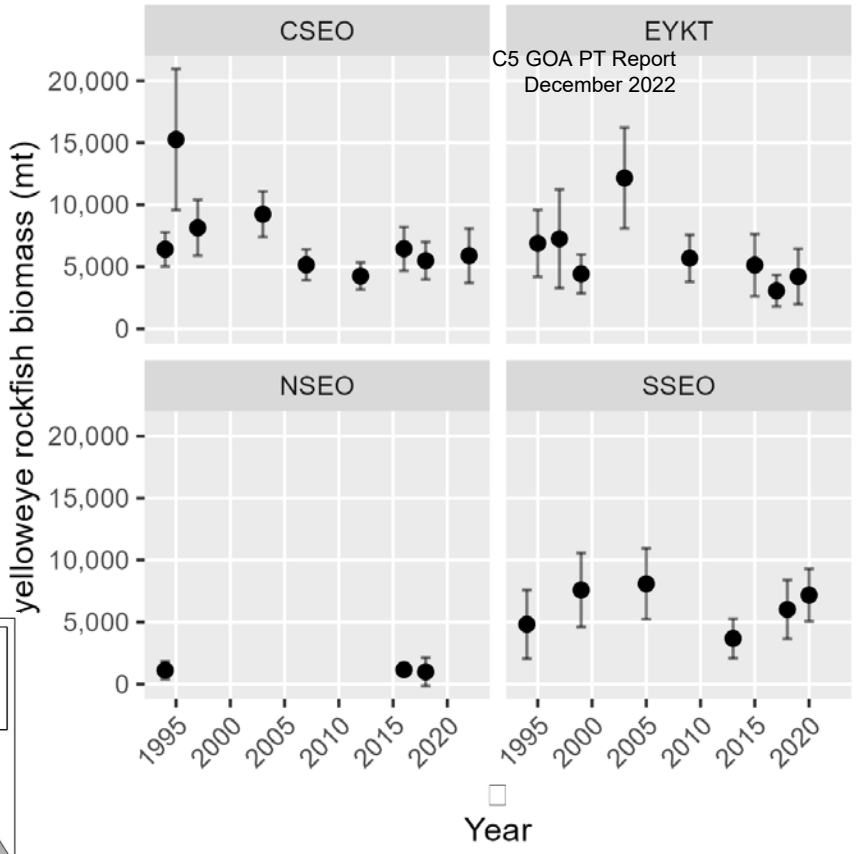
x Estimate of yelloweye habitat (no variance)

= Management Area Biomass

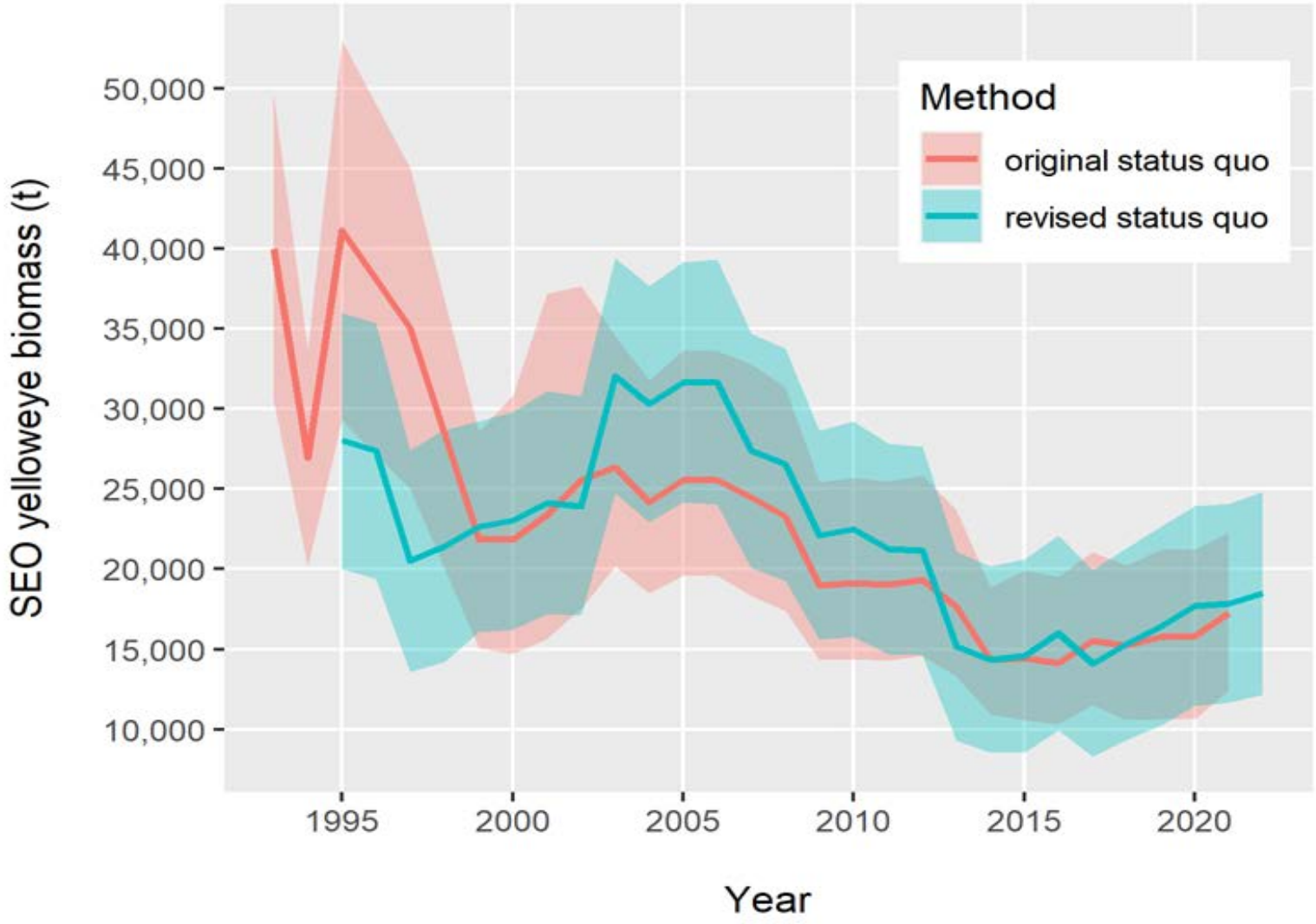
High interannual variability; unlikely for long lived species

EYKT: 739 km^2
NSEO: 442 km^2
CSEO: 1,661 km^2
SSEO: 1,056 km^2





SEO Demersal shelf rockfish



Random Effects Model

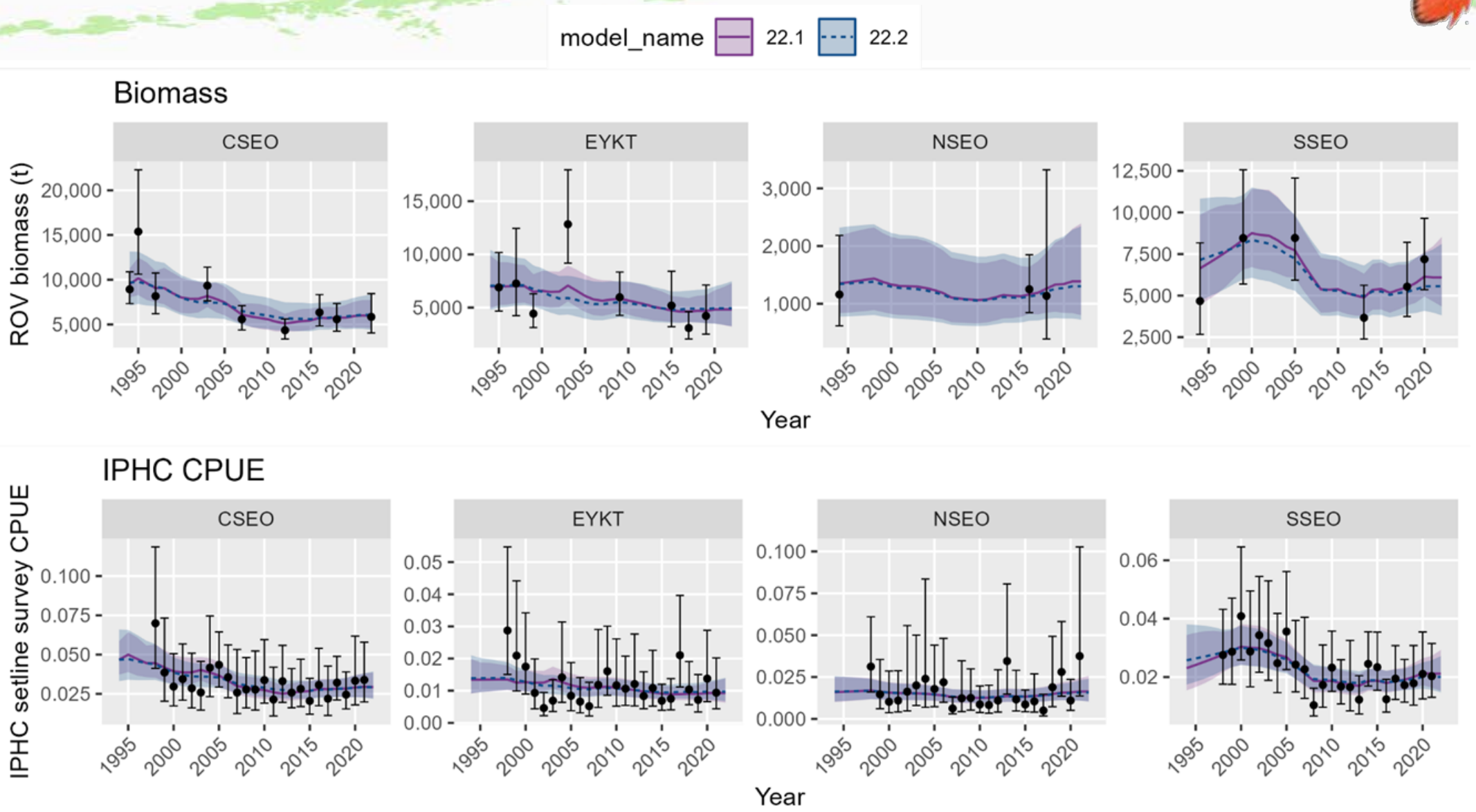
- Assess biomass across management areas
- Biomass estimated as a series of random effects
  - —Process error parameters constrained using random walk model
  - —Accommodates data gaps (missing years)
- Management area ROV biomass estimates
- IPHC survey CPUE as secondary abundance index (management area scale)
- Extra variance (observation error) on ROV biomass
- AIC and visual examination to assess fit and compare models
- *rema* package in R

SEO Demersal shelf rockfish: Random Effect Models

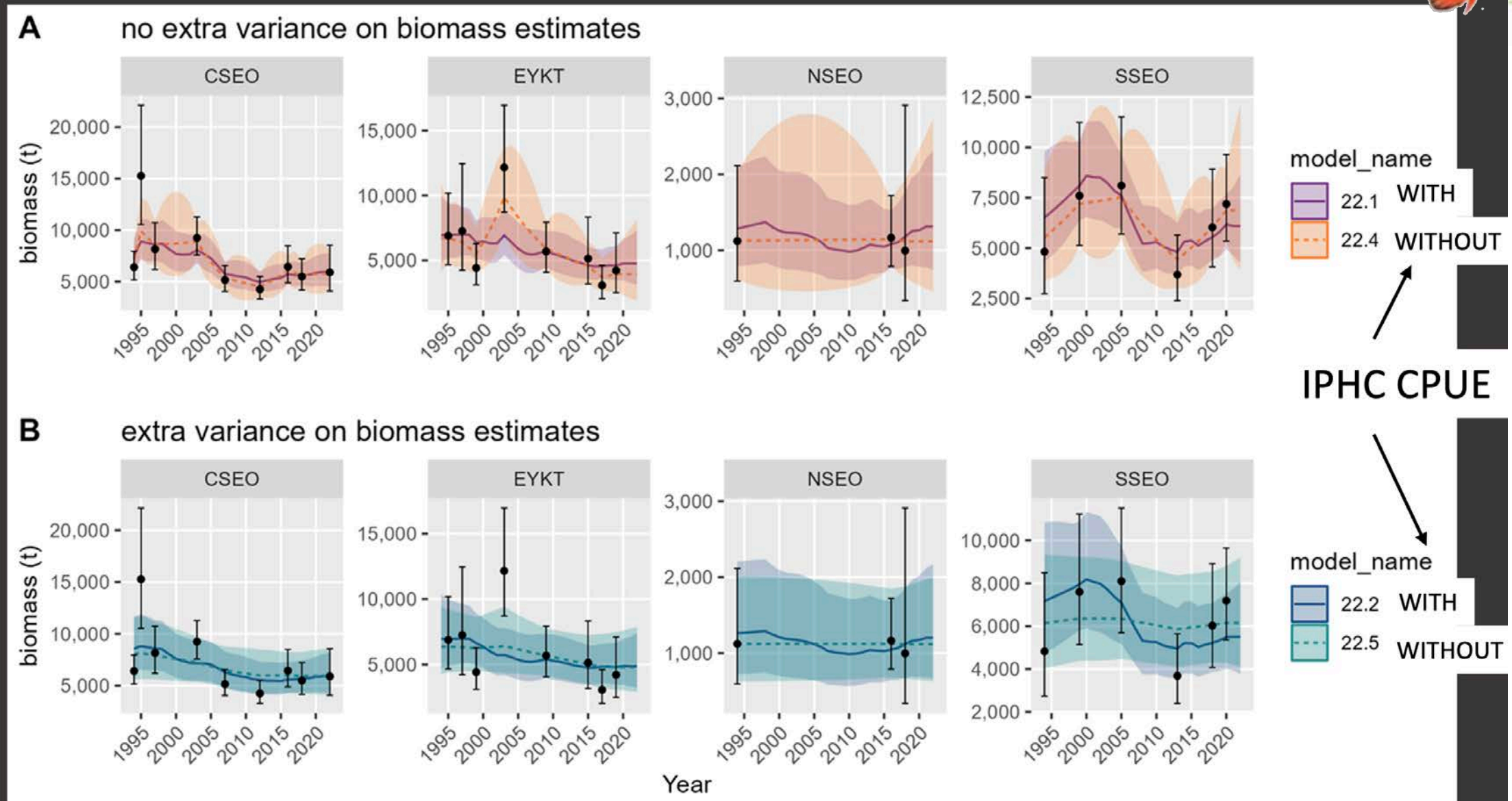
Model	IPHC CPUE	Extra variance in biomass	DAIC
22.1	YES	No	9
22.2		Yes	0
22.4	NO	No	1.6
22.5		Yes	0

- Single process error for all 4 management areas
  No convergence with area specific process error
- Area specific scaling parameters for IPHC CPUE for all 4 management areas
- AIC support for extra variance
  (can't compare IPHC CPUE using AIC)
- All models gave similar biomass estimates…

SEO Demersal shelf rockfish

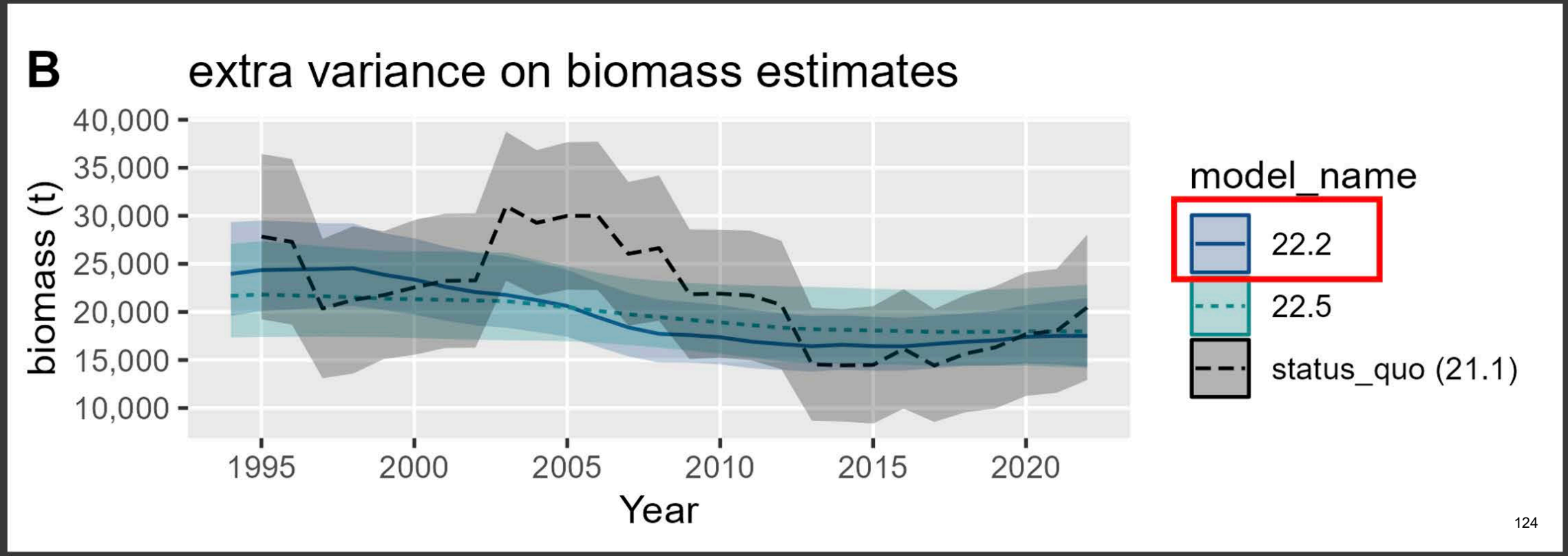


SEO Demersal shelf rockfish



SEO Demersal shelf rockfish

Preferred Model 22.2: Extra observation error & IPHC CPUE index



SEO Demersal shelf rockfish: Team Discussion

- The Team supported the author's recommended OFL (376 t)

- The Team recommended ABC of 283 t (maxABC)
  - Noted lower F rate in shift from Tier 4 to Tier 5 a sufficient conservation buffer

Council motion on Other Rockfish/DSR (Oct 2022):

"Regarding spatial management of the demersal shelf rockfish (DSR) complex, the Council supports consideration of moving the seven DSR species which currently occur in the 'other rockfish' complex (i.e., those occurring to the west of EY/SEO) into the DSR assessment and expanding the DSR complex assessment to be GOA-wide during the 2023 Plan Team cycle when the next full assessment for 'other rockfish' is scheduled. Information should be included on the impacts of this change to both DSR and the 'other rockfish' complex."

Next OROX Full assessment 2023

Next SEO DSR Full assessment 2024

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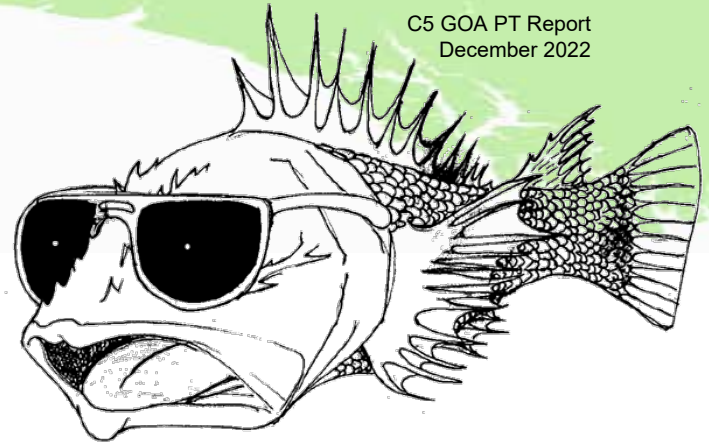
Sub Total	56,651	57,519	up 868 (2%)

No thornyhead rockfish assessment in 2021

Thornyhead rockfish (full assessment)

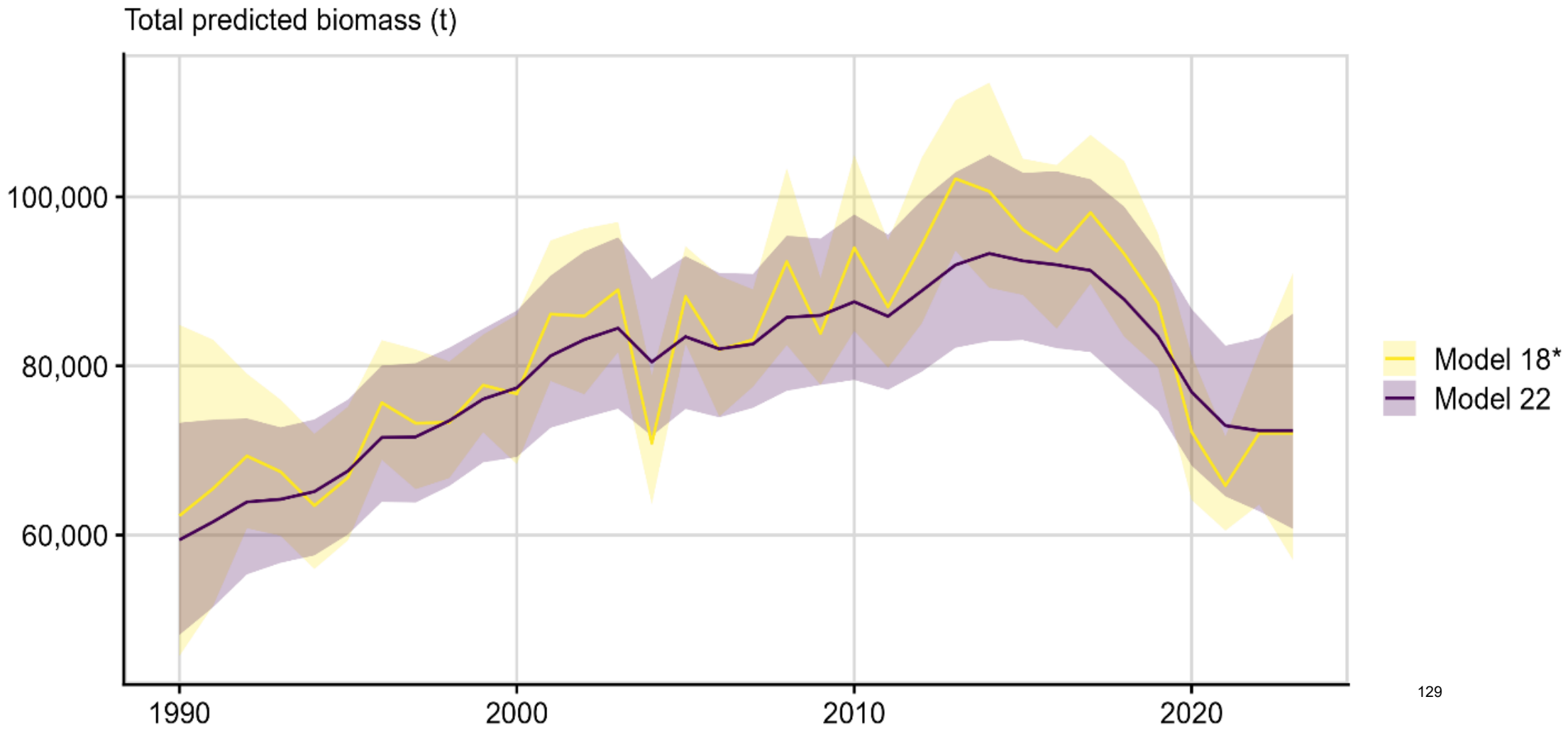


Area	2022 ABC	2022 TAC	2022 OFL	2022 Catch
Western	352	352		107
Central	910	910		167
Eastern	691	691		71
TOTAL	1,953	1,953	2,604	345*

2022 catch is up 26% from 2021 ~18% of gulfwide ABC

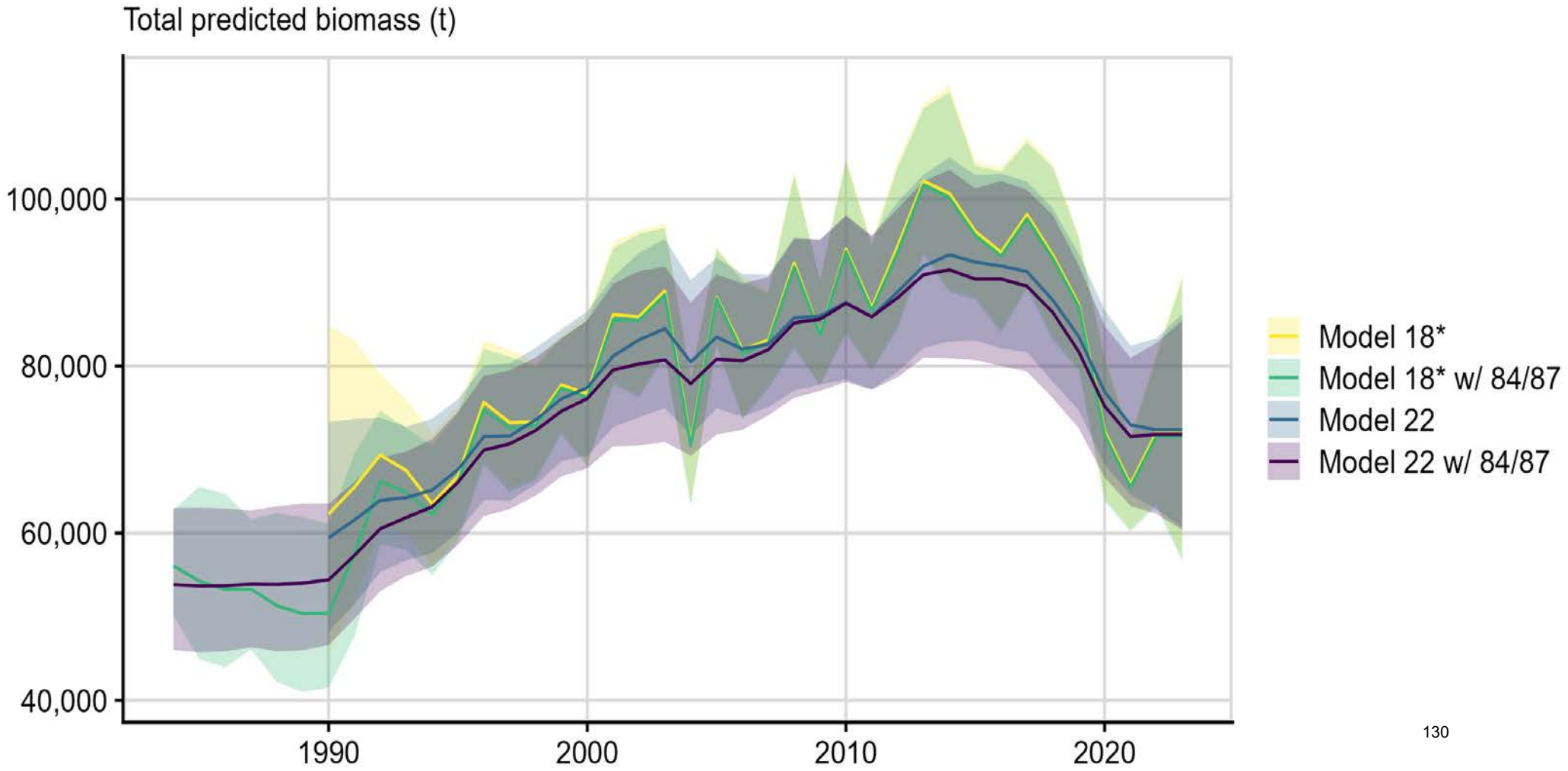
Thornyhead rockfish

Updated random-effects model run

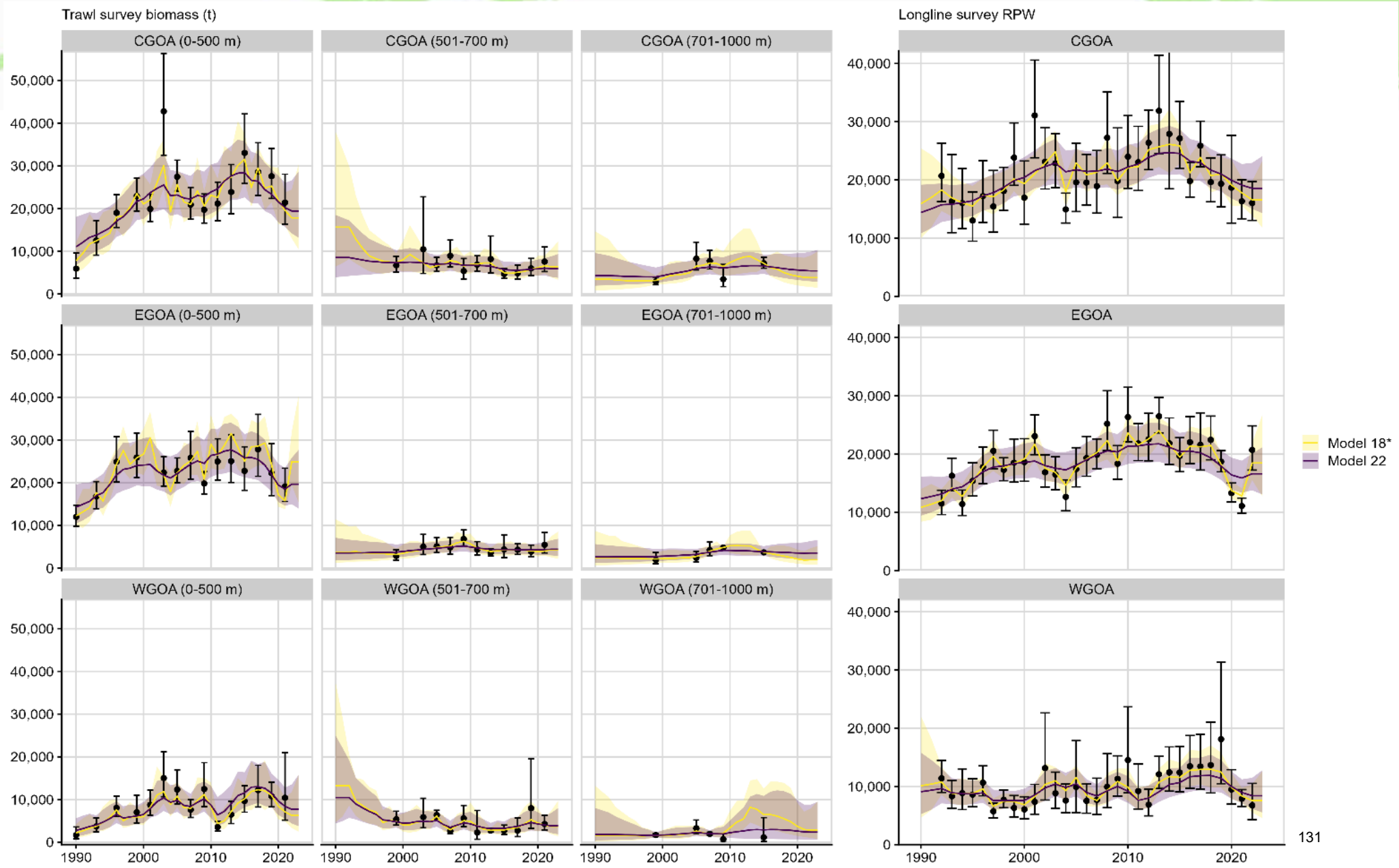


Thornyhead rockfish

Updated random-effects model run dropping early surveys



Thornyhead rockfish



Thornyhead rockfish: Apportionments

GOA Area	2023 Biomass (t)	Percent of Total Biomass	Area ABC Apportionment (t)	% Change from 2022 Apportionment
Western	13,944	19%	314	↓ 11%
Central	30,810	43%	693	↓ 24%
Eastern	27,595	38%	621	↓ 10%
Gulfwide Total	**72,349**	**100%**	**1,628**	↓ **17%**

Thornyhead rockfish: Team Discussion

The Team recommended the use of a common process error across the GOA, and would like to see a comparison of that approach with the current approach that allows process error to vary by sub-region.

Rockfish ABC Summary

Species	ABC 2021	ABC 2022	Change
POP	36,177	38,268	up 2,091 (6%)
northern rockfish	5,358	5,146	down 212 (4%)
Shortraker Rockfish	708	705	down 3 (0%)
Dusky	5,389	5,372	down 17 (0%)
Rougheye and Blackspotted Rockfish	1,212	788	down 424 (35%)
Demersal shelf	257	268	up 11 (4%)
Thornyhead	1,953	1,953	same (0%)
Other rock	4,053	4,054	up 1 (0%)
Sub Total	55,107	56,554	up 1,447 (3%)

GOA sharks (full assessment)

Species	2022 catch	ABC 2022	ABC 2023	Change
Pollock	129,876	144,444	160,301	up 15,857 (11%)
Pacific Cod	18,275	32,811	24,634	down 8,177 (25%)
Sablefish	17,531	22,794	40,502	up 17,708 (78%)
Flatfish	2,673	115,834	119,497	up 3,663 (3%)
Arrowtooth flounder	11,456	119,779	119,485	down 294 (0%)
Rockfish	36,055	56,651	57,519	up 868 (2%)
Atka mackerel	880	4,700	4,700	same (0%)
Skates	2,706	6,563	6,563	same (0%)
Sharks	2,112	3,755	4,891	up 1,136 (30%)
Octopus	111	980	980	same (0%)
Total	221,675	508,311	539,072	up 30,761 (6%)

GOA Sharks

Spiny dogfish

Biomass = 31,243 t (RE model)

Assume q = 0.21

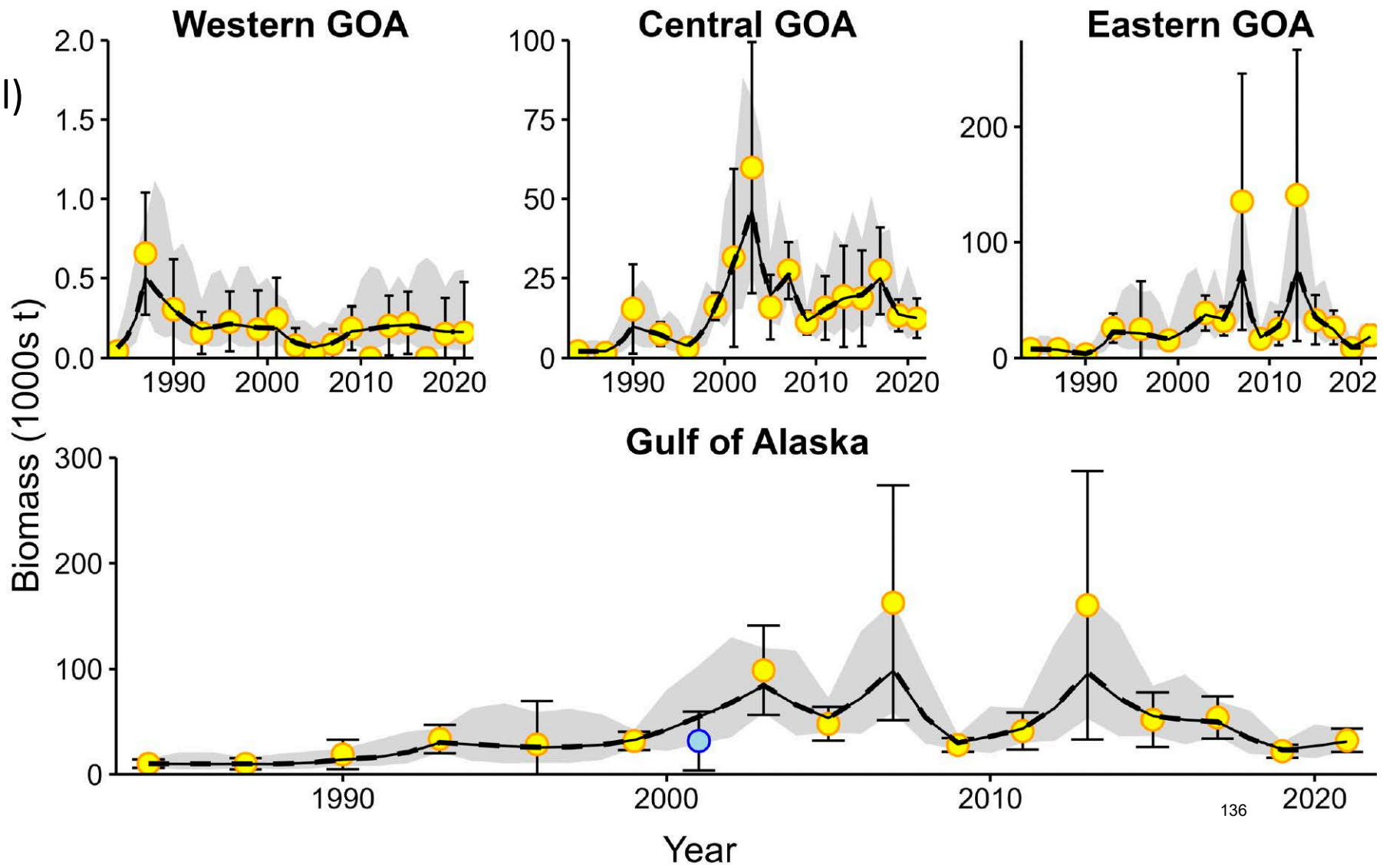
Biomass = 148,776 t

FOFL = 0.04

FABC = 0.03

OFL = 5,591 t

ABC = 4,463 t

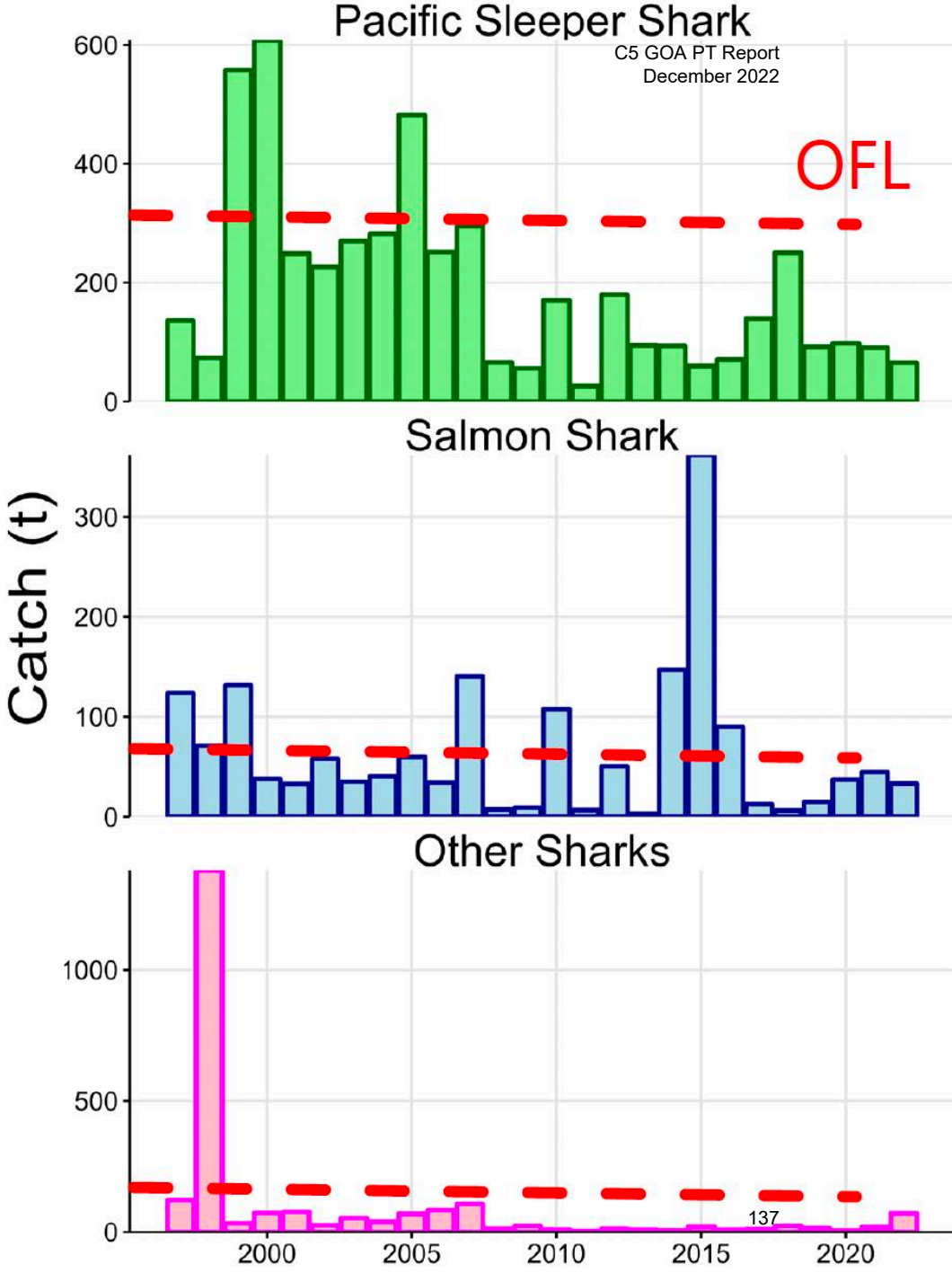


GOA Sharks

Status quo approach

OFL = mean catch 1997 – 2007
ABC = 0.75 * OFL

Pacific Sleeper Shark (PSS)	• OFL = 312 t ABC = 234 t
Salmon Shark (SS)	• OFL = 70 t ABC = 53 t
Other/unidentified Sharks (OS)	• OFL = 188 t ABC = 141 t



GOA Sharks

Status Quo

Species	Model	OFL (t)	ABC (t)
Pacific Sleeper	11.0	312	234
Salmon	11.0	70	53
Other/Unid	11.0	188	141
Spiny Dogfish	SD15.3A	5,951	4,463
Shark Stock Complex		**6,521**	**4,891**

Alternative Models

Species	Model	OFL (t)	ABC (t)
Pacific Sleeper	PSS22.0	197	148
Salmon	SS11.0	70	53
Other/Unid	OU22.0	123	92
Spiny Dogfish	SD15.3A	5,951	4,463
Shark Stock Complex		**6,341**	**4,756**

GOA sharks: Team Discussion

The Team recommended that a working group be formed to investigate alternative data-limited methods and harvest control rules for Tier 6 stocks.

- This WG should investigate how the ORCS approach might be applied to Tier 6 stocks with conservation concerns

Commended creative work of author

- But recommended status quo Tier 5/6 hybrid method for this year's specification

GOA Groundfish Harvest Specifications for 2023-2024

- Adopted the ABC/OFL recommendations as specified in *Table 1: Plan Team Recommended OFL/ABC 2023-2024.*

- *The SSC supports the GOA GPT's recommendation to approve the Halibut DMR Working Group recommendation for proposed halibut DMRs for 2023/2024.*

  -SSC Final Report October 2022

Working Groups: Plan Team Discussion

- BSAI PT recommended that the EBS pollock stock be included in any working group developed to investigate appropriate means of dealing with **irregular recruitment and alternative harvest control rules.**

- BSAI PT recommended that the methodologies described for providing **climate advice** be included in the climate change working group.

- BSAI PT discussed various options for determining average recruitment for projections and determined that this would be a good example to include in future working group discussions on **recruitment.** (BSRE)

- GOA PT recommended that a working group be formed to investigate alternative **data-limited methods and harvest control rules for Tier 6 stocks**. In particular, this WG should investigate how the ORCS approach might be applied to Tier 6 stocks with particular conservation concerns.

JOINT PT recommended:

- **A WG focused on data-limited/Tier 6 methods**

- **A WG that addresses current policies affecting harvest control rules and develop new approaches for accounting for changes in ecosystems related to climate change, including the exploration of environmental data to help inform recruitment.**