

Gulf of Alaska

SAFE report

Report of the
Gulf of Alaska Groundfish
Plan Team meeting
Nov 13th-16th, 2018

GOA Plan Team Members

James Ianelli (co-chair)	AFSC/REFM
Chris Lunsford (co-chair)	AFSC/ABL
James Armstrong	NPFMC
Ben Williams	ADFG
Nate Nichols	ADFG
Jan Rumble	ADFG
Dan Lew	AFSC/REFM
Pete Hulson	AFSC/ABL
Sandra Lowe	AFSC/REFM
Paul Spencer	AFSC/REFM
Craig Faunce	AFSC/FMA
Kresimir Williams	AFSC/RACE
Obren Davis	AKRO

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Overview

“off” year for GOA, NMFS bottom trawl survey slated for 2019

8 “full” assessments reviewed (5 in Tier 3)

8 “partial” assessments (5 also in Tier 3)

6 stock complex assessments scheduled for future years

none in tier 3



- Document layout and links...

Econ and Ecosystem summary in SAFE Introduction

GOA Ecosystem SAFE...

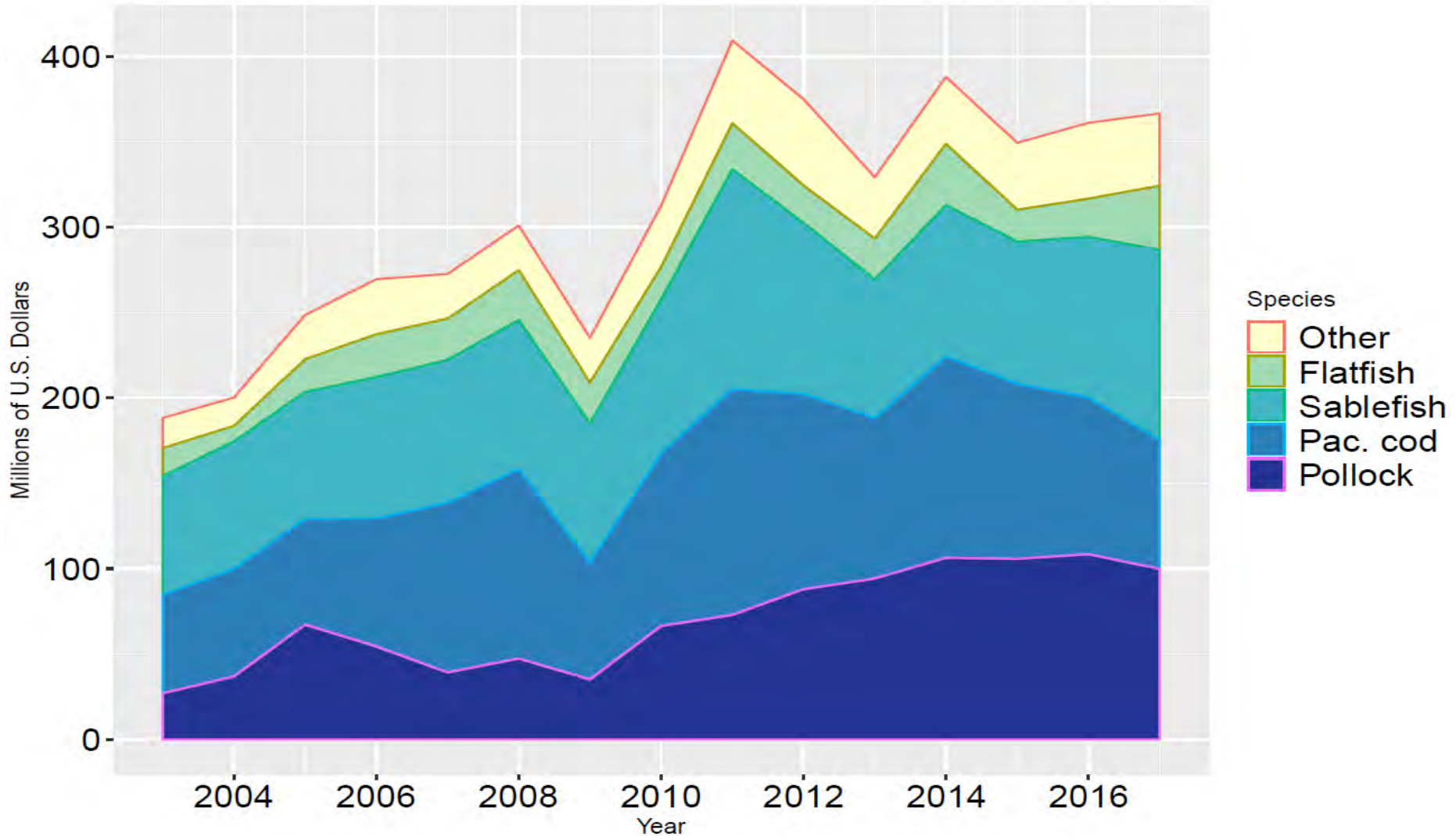
- ◆ an executive summary with separate Eastern and Western GOA ecosystem report cards showing and physical, environmental, ecosystem, fishing, and fisheries trends,
- ◆ a recap of the 2017 Ecosystem state with updated data sources,
- ◆ a current (2018) Western and Eastern GOA ecosystem state summary, and
- ◆ a listing of the ecosystem indicators.

Econ and Ecosystem summary in SAFE Introduction

Discussion points from the Plan team

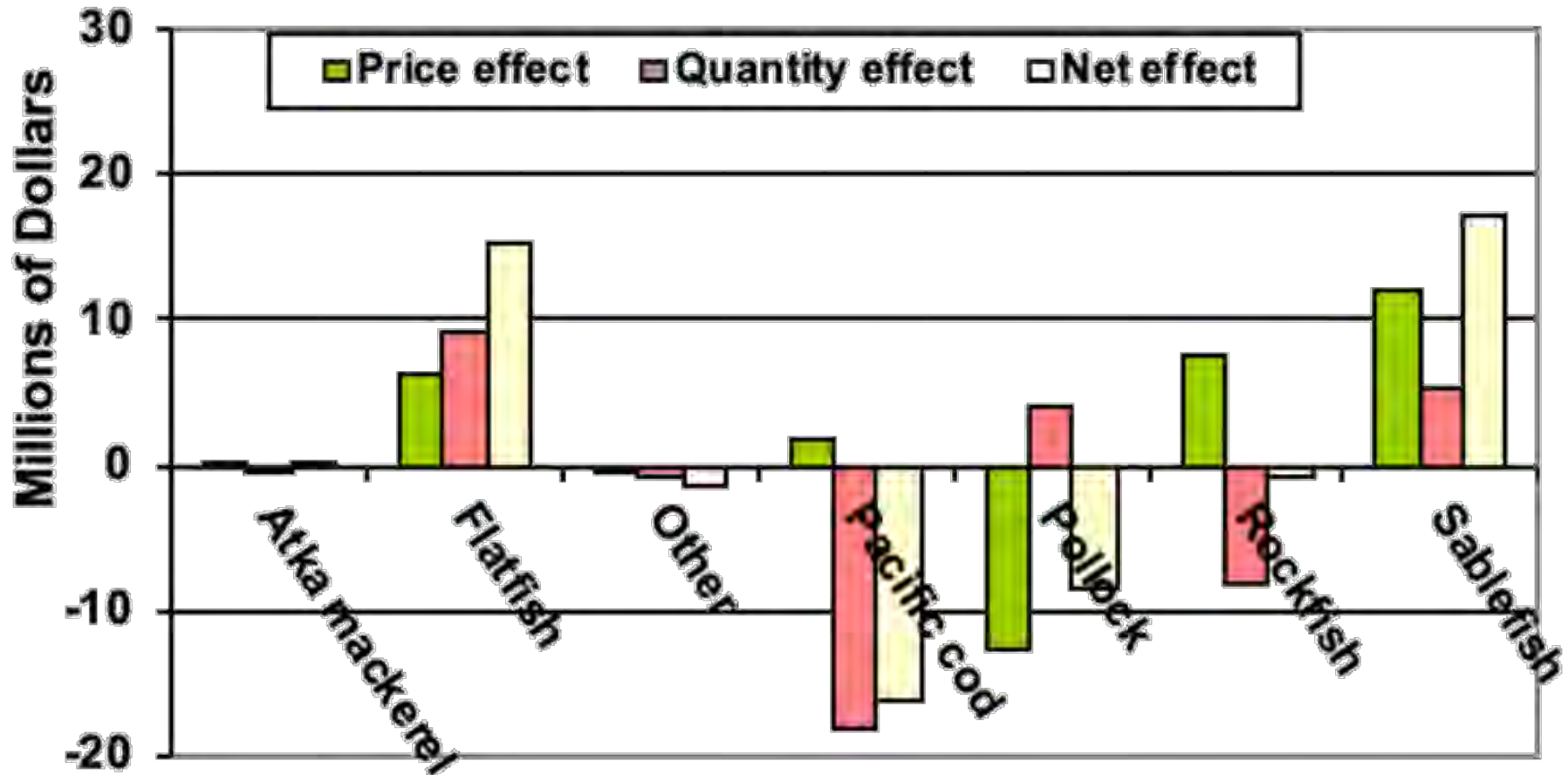
- The methodology for detecting the possibility of the current heat wave state
- Consideration of a small area index for humpback whales (Glacier Bay)

GOA Economic synopsis



Revenue changes (and source)

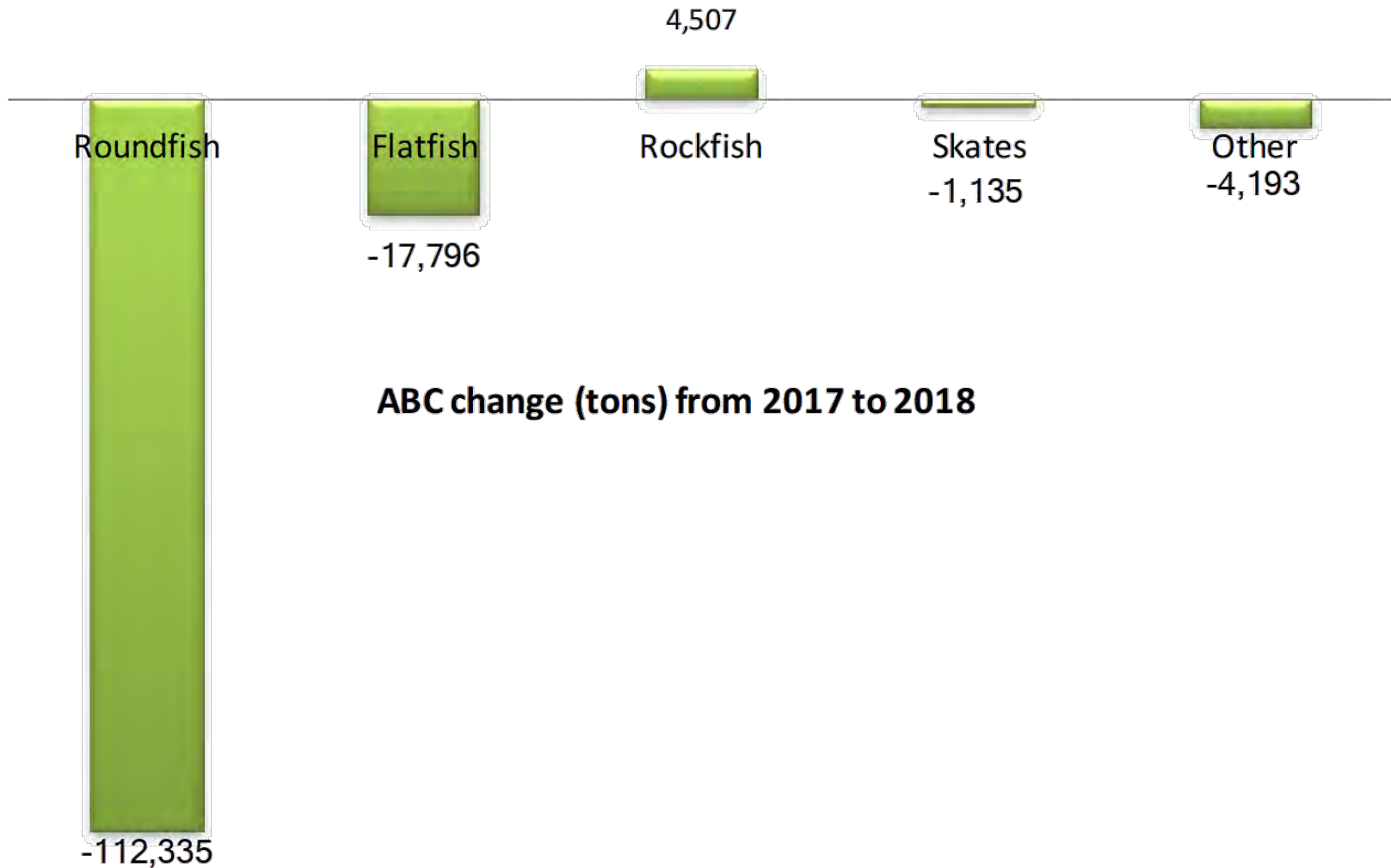
**GOA First-Wholesale Revenue Change in 2016-17
Decomposed by Species Group**



Ecosystem component

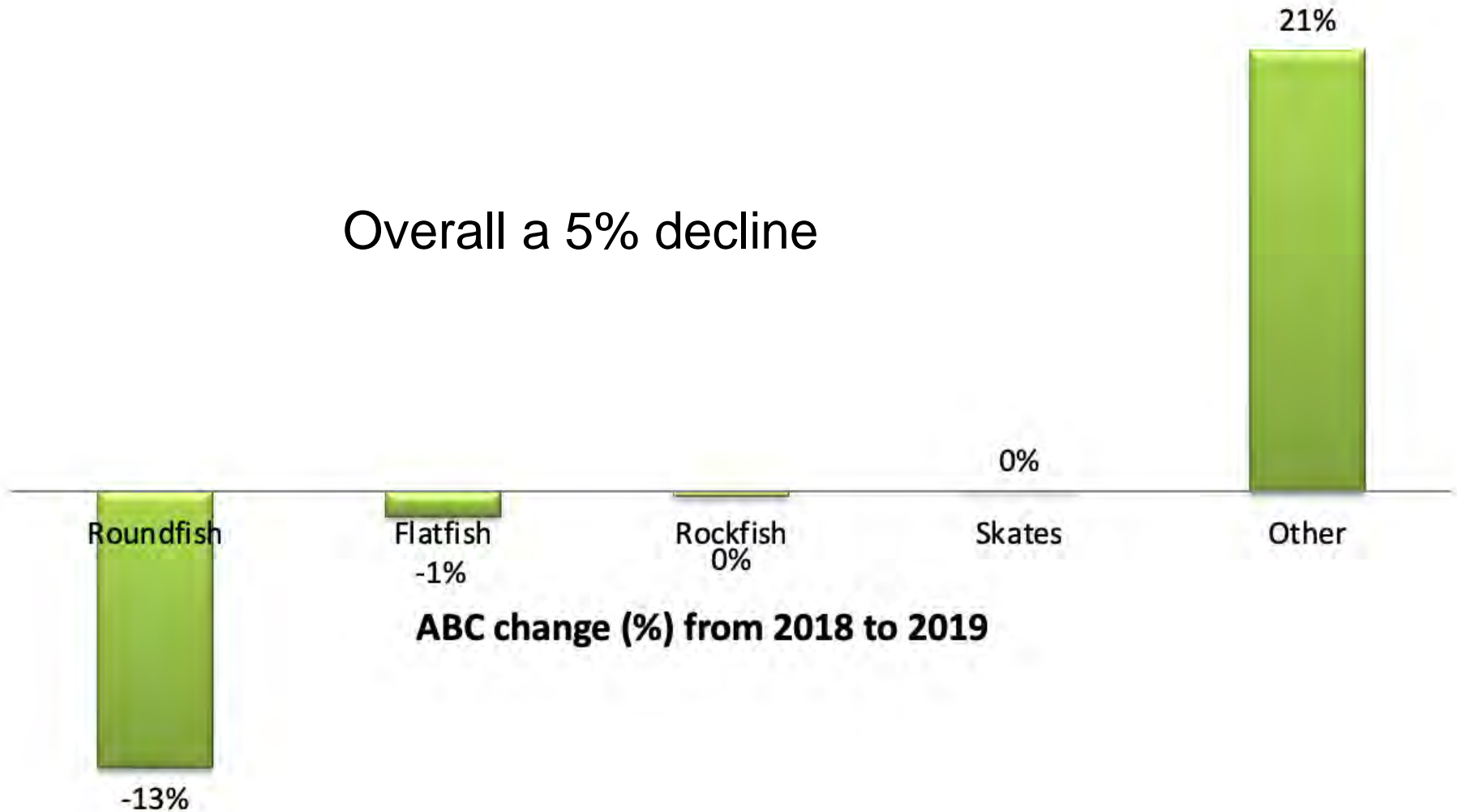
- This year the Team received a report on GOA forage fish from Olav Ormseth that included information on squids

2017-2018 ABC change

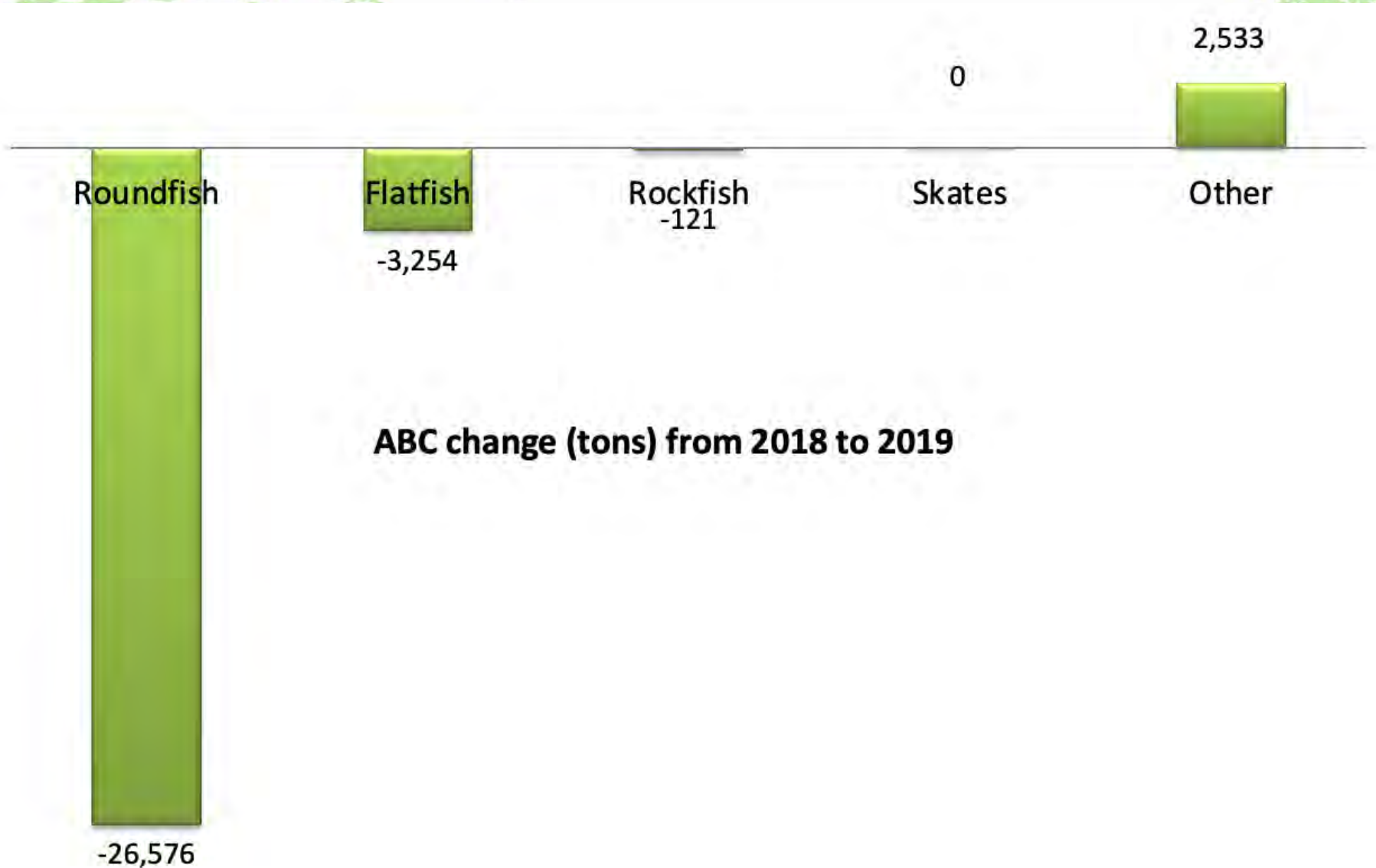


2018-2019 ABC change

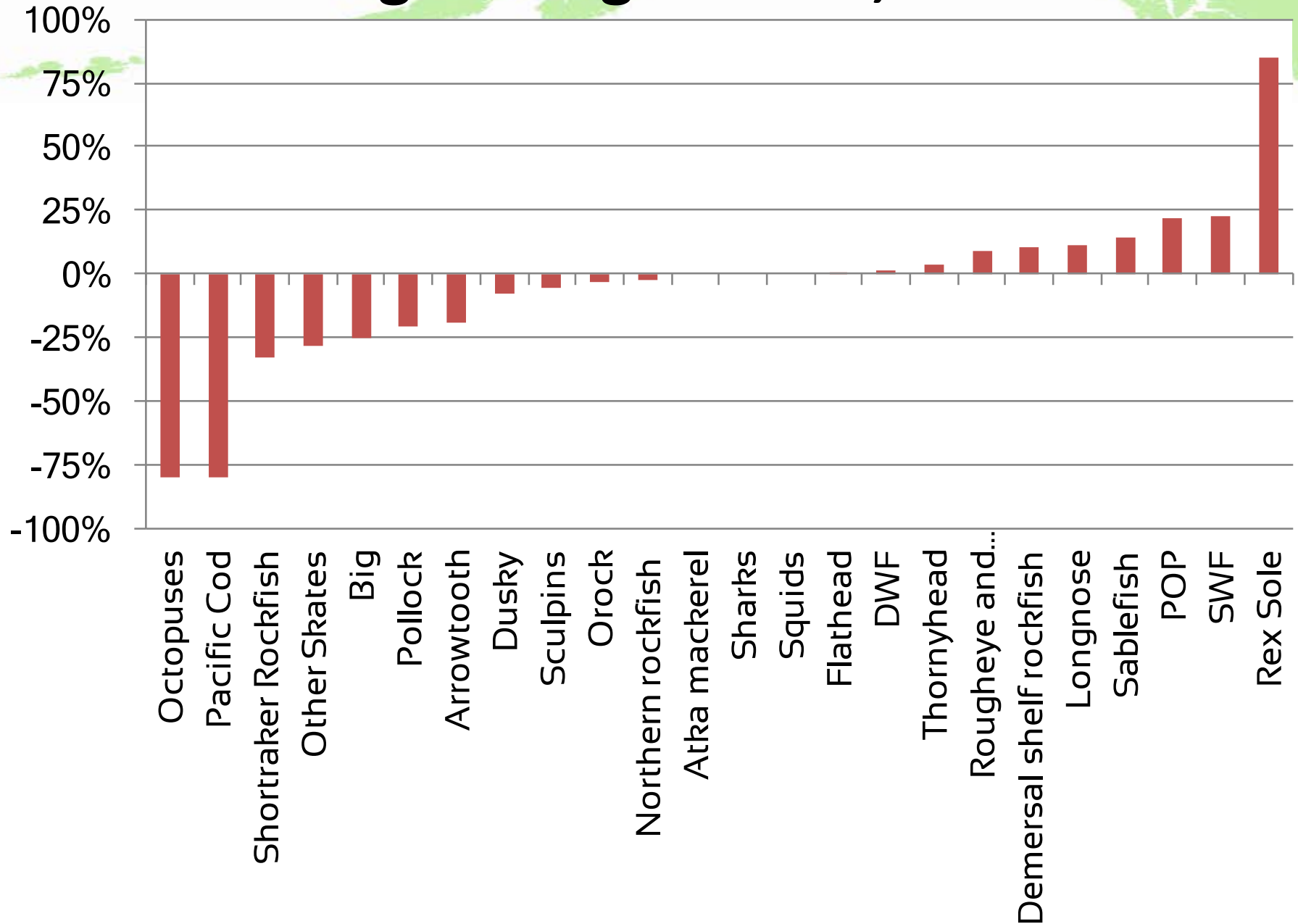
Overall a 5% decline



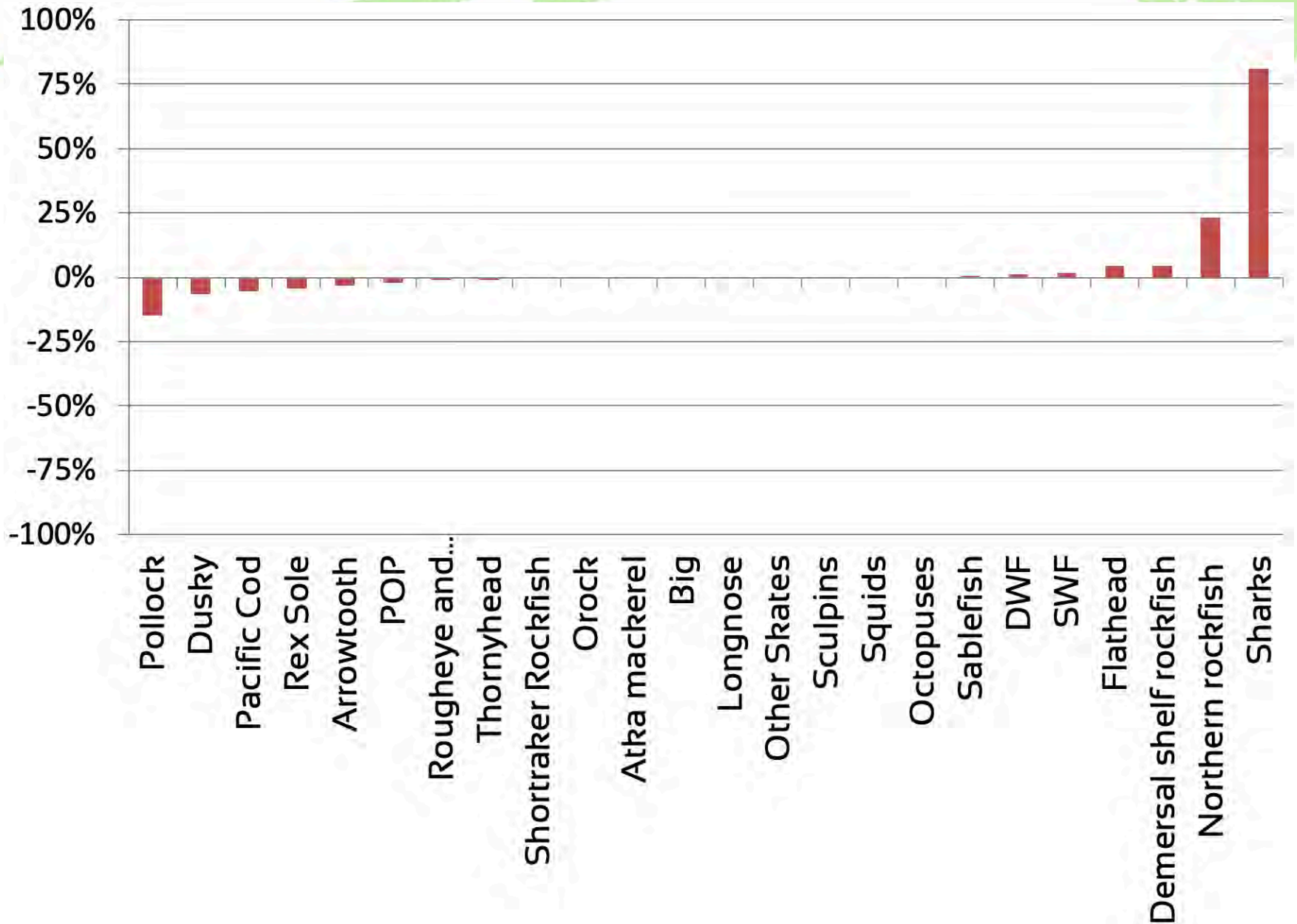
2018-2019 ABC change



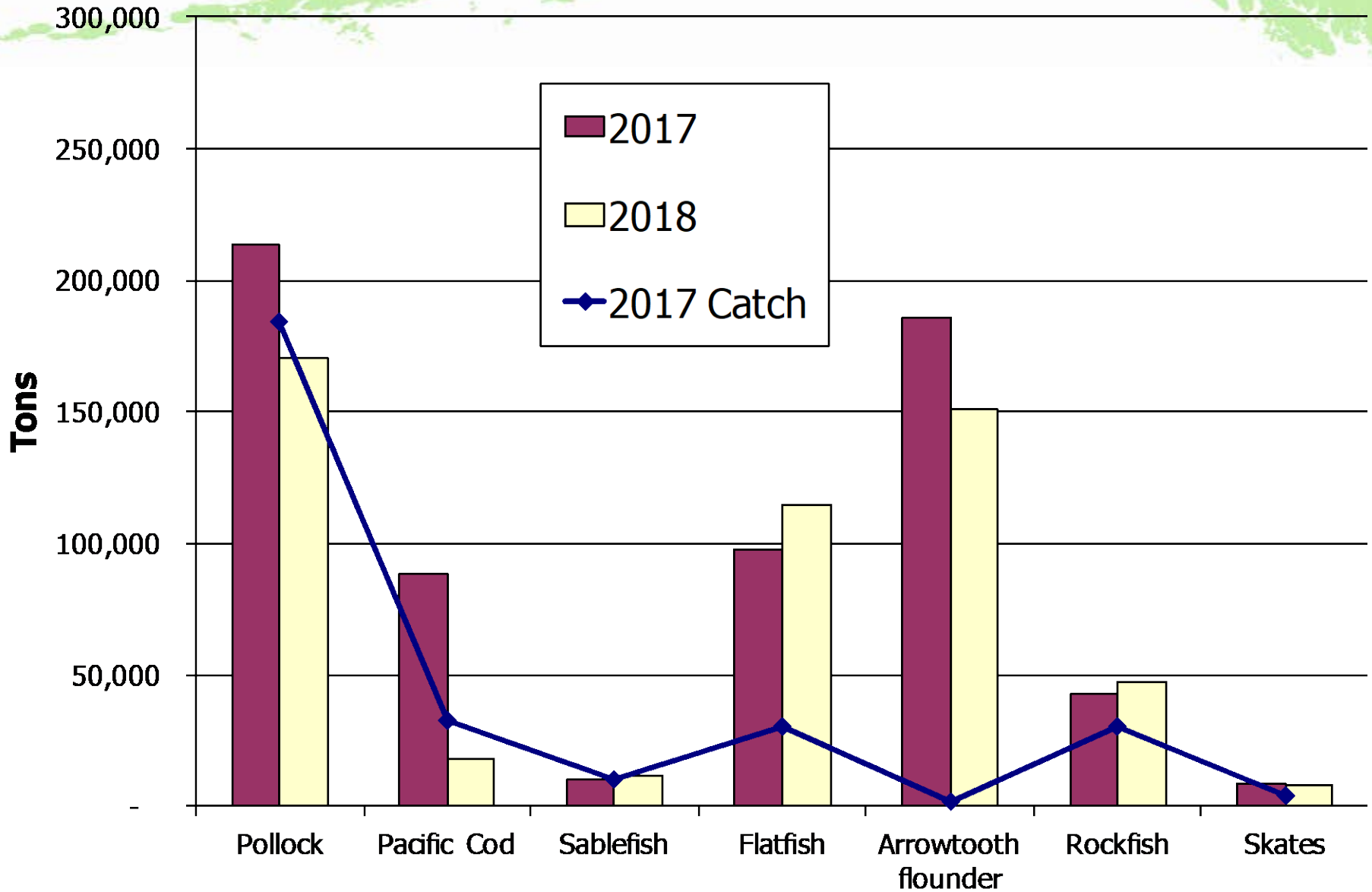
Percentage change in ABC, 2017-2018



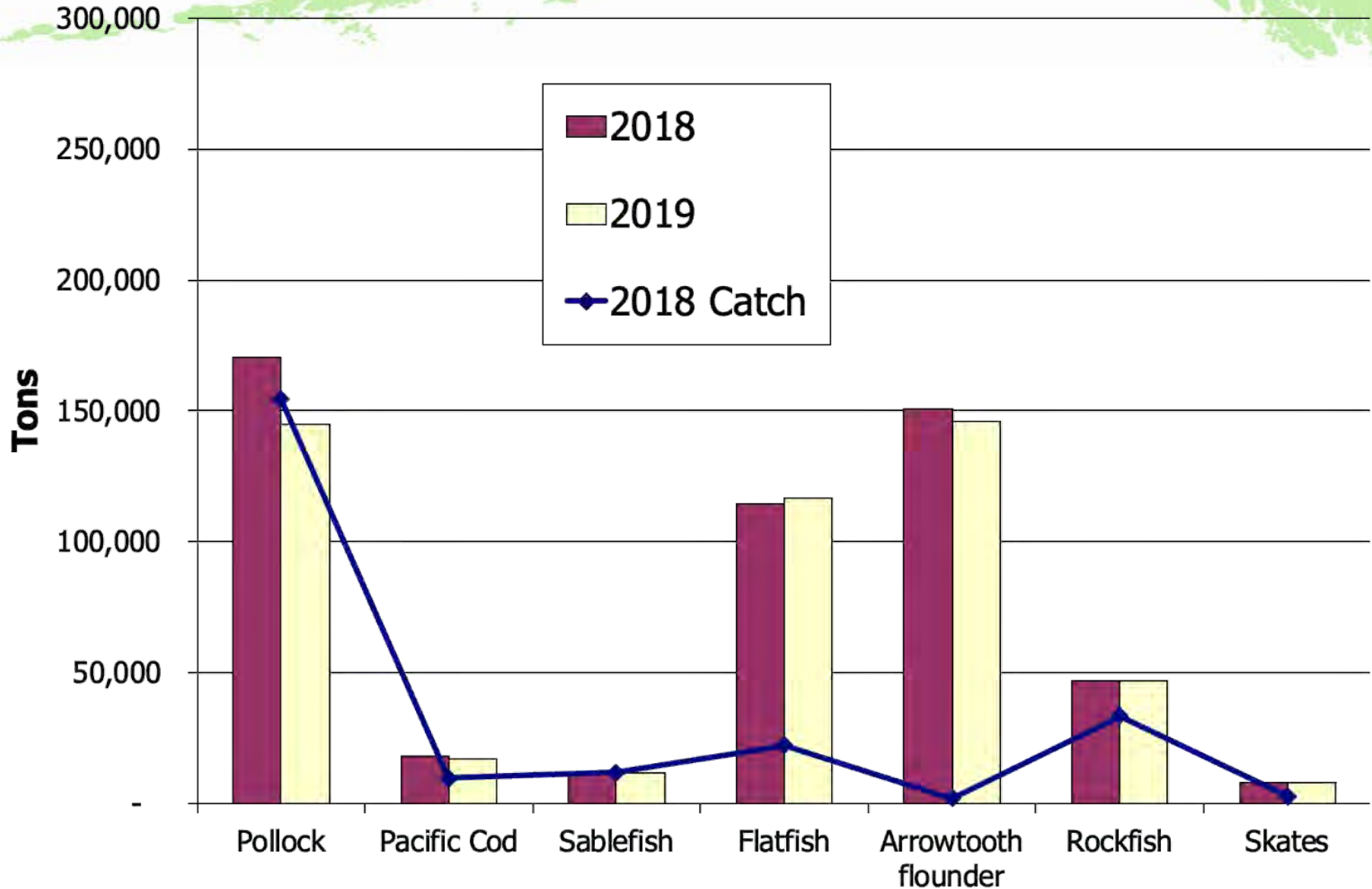
Percentage change in ABC, 2018-2019



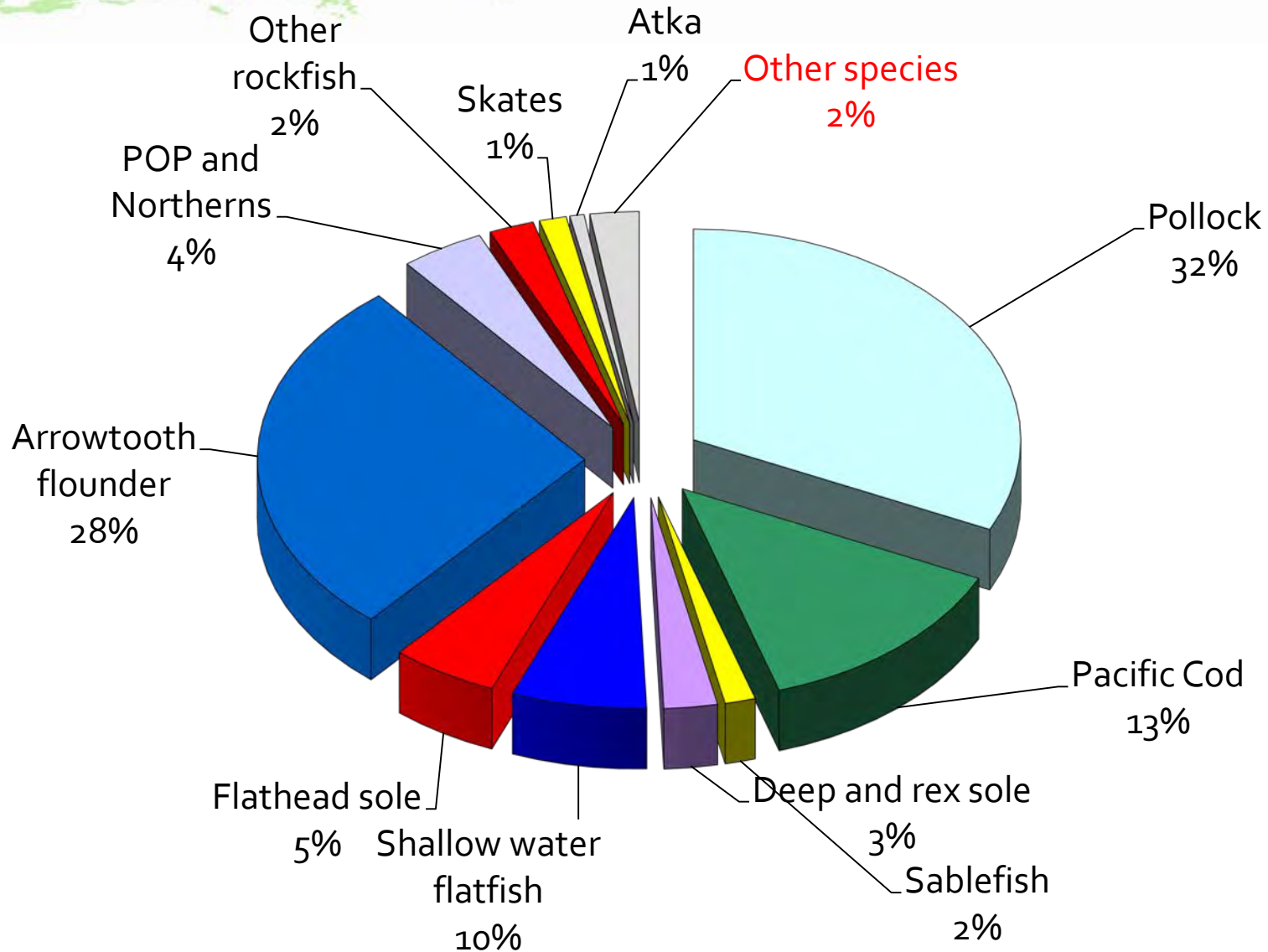
GOA Catch and ABC levels



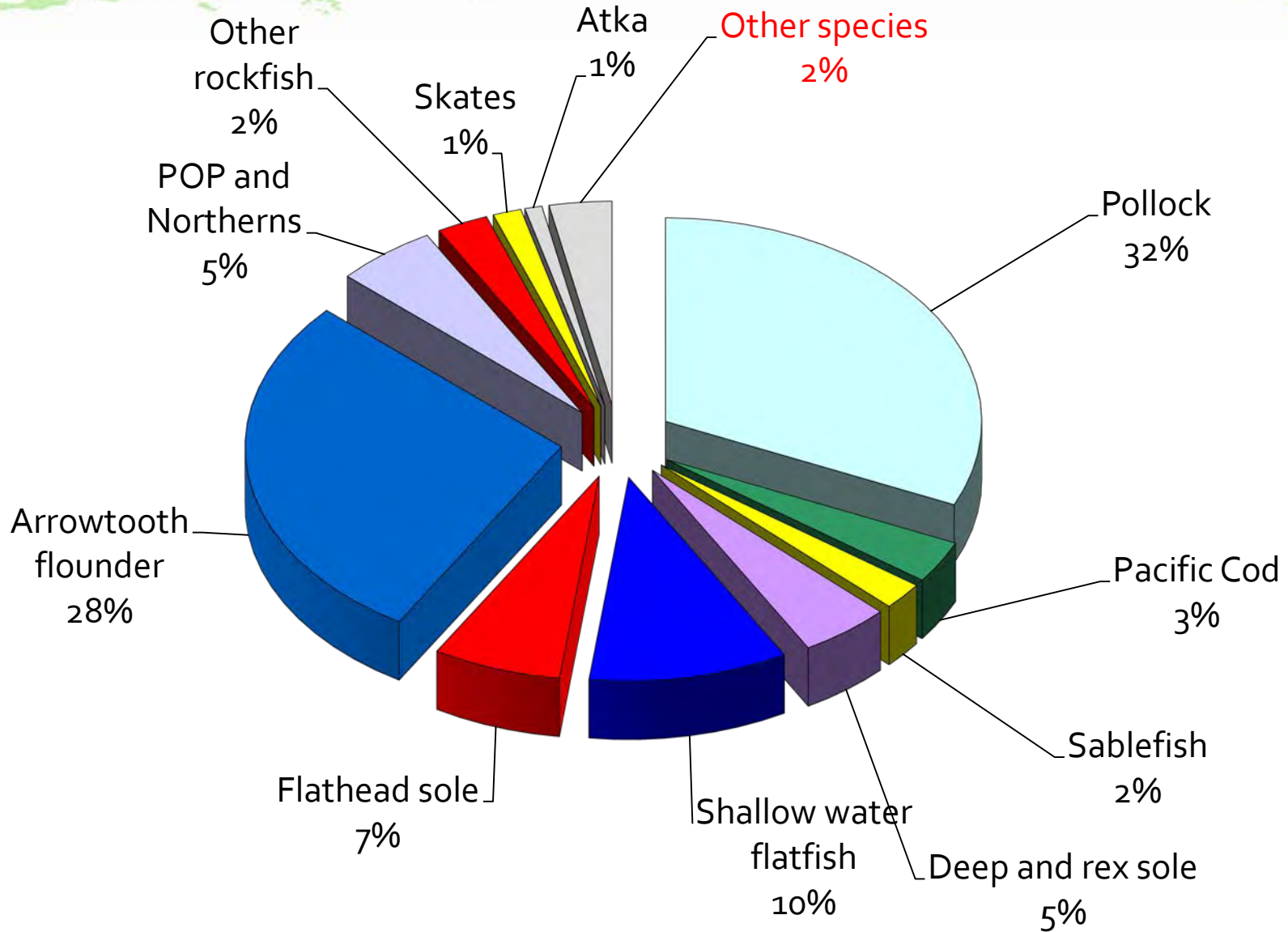
GOA Catch and ABC levels



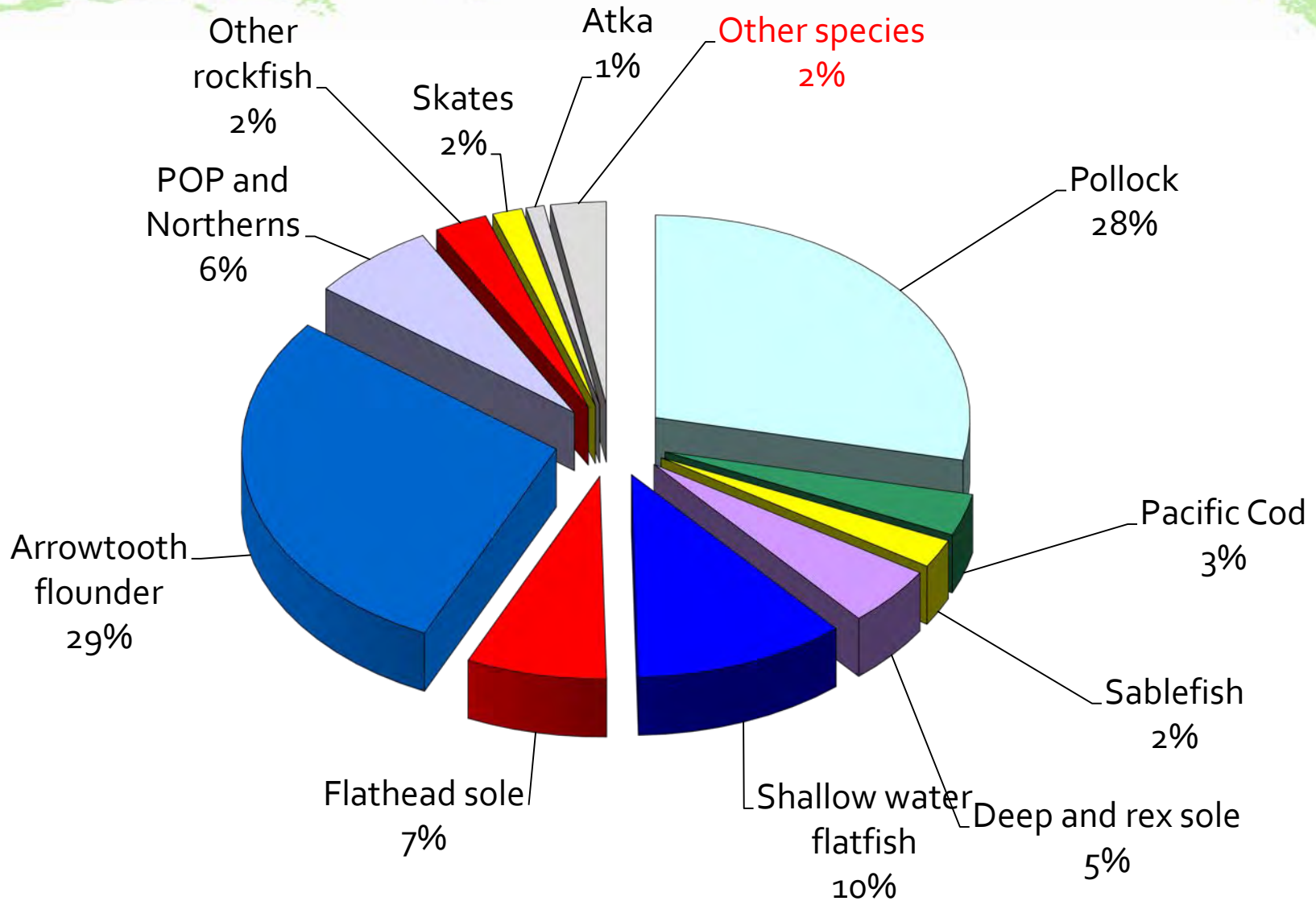
GOA 2017 ABC's: 667,877 t



GOA 2018 ABC's: 536,925 t



GOA 2019 ABC's: 509,507 t



Overall a 30% drop from 2016 aggregate ABC

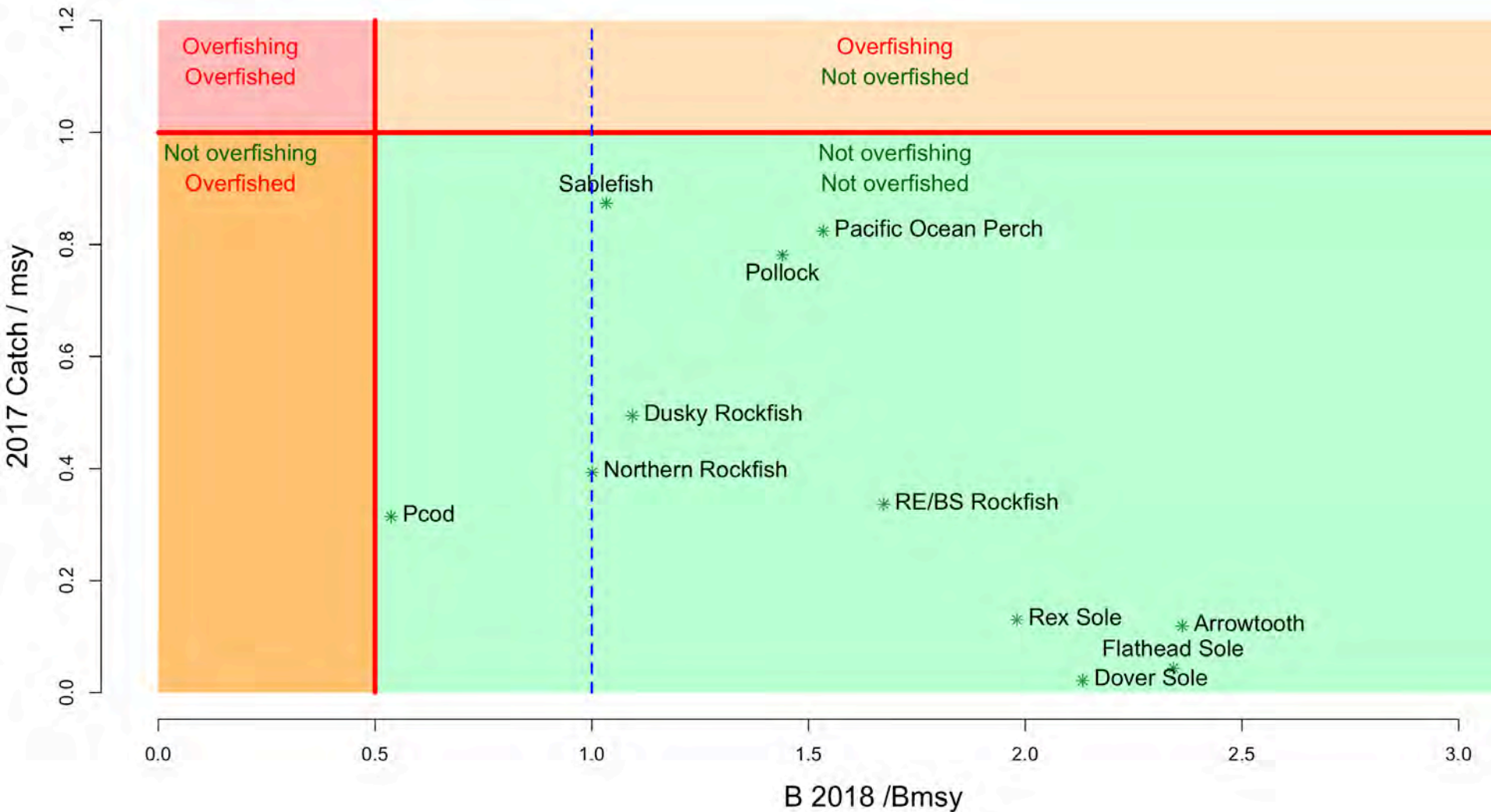
ABC / TAC

Team recommendations where
ABC < maximum permissible:

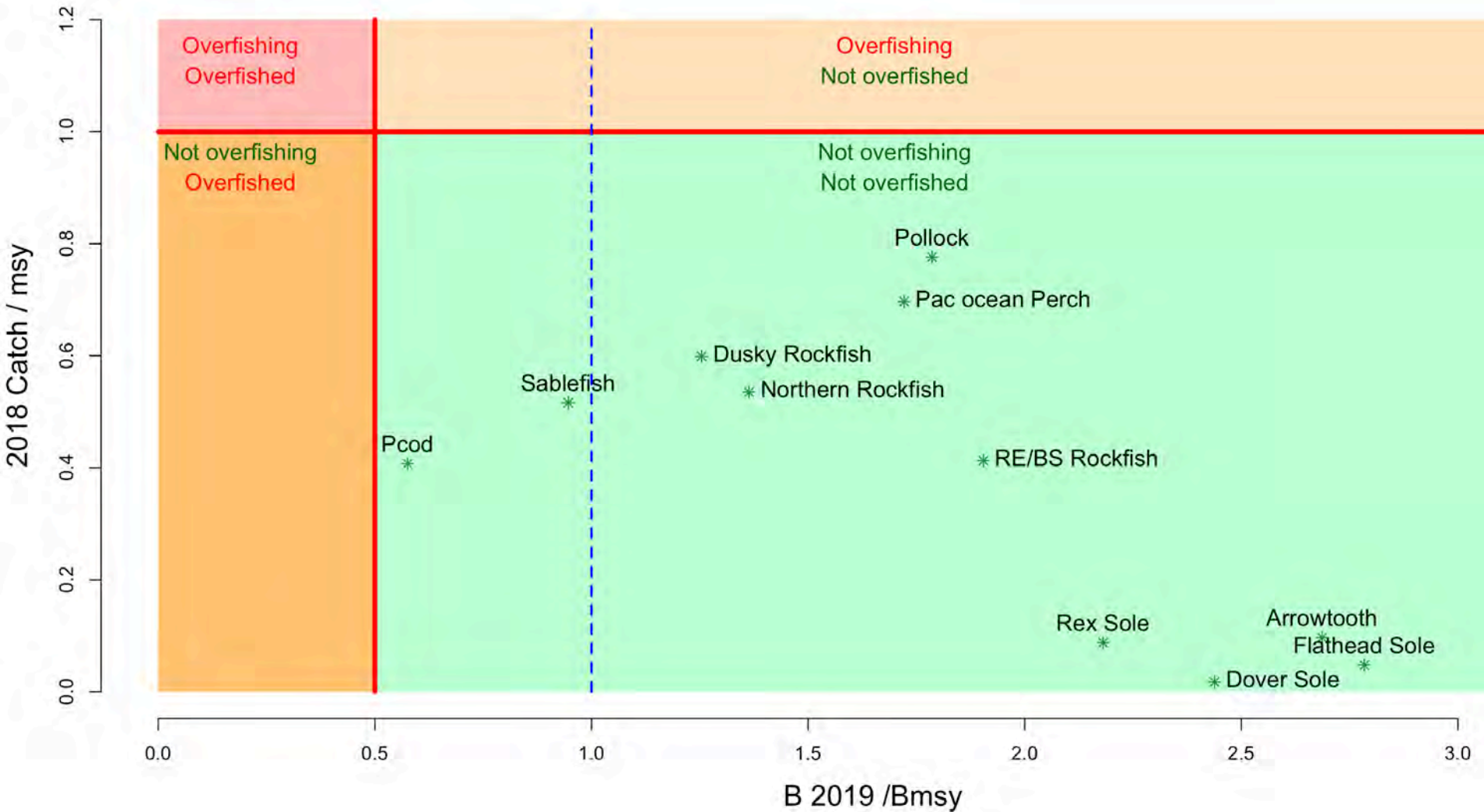
Table 3. Maximum permissible fishing mortality rates and ABCs as defined in Amendment 56 to the GOA and BSAI Groundfish FMPs, and the Plan Team's 2019 and 2020 recommended fishing mortality rates and ABCs, for those species whose recommendations were below the maximum permissible.

Species	Tier	$Max F_{ABC}$	2019		
			$Max ABC$	F_{ABC}	ABC
Pollock (W/C/WYK)	3a	0.27	158,518	0.22	135,850
Pacific cod	3b	0.29	19,655	0.25	17,000
Sablefish	3b	0.081	21,704	0.044	11,571
Demersal shelf rockfish	4, 6	0.026	333	0.02	261

Stock status summary last year

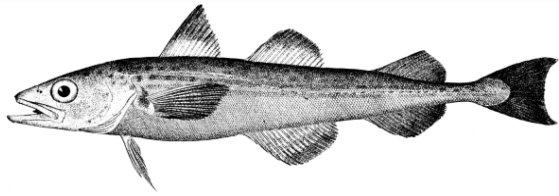


Stock status summary **this** year



Species overviews

1. 2018 ABC/Catch and recommended changes
2. Highlights
 - ◆ New data
 - ◆ Analytic approach (changes)
3. Stock status and trend
4. ABC/OFL
 - ◆ Tier history and recommendations
 - ◆ 2019, 2020 maxABC; recommended ABC



ABC

Species	2018 Catch	2018	2019	Change
Pollock	154,286	170,265	144,623	down 25,642 (15%)
Pacific Cod	9,595	18,000	17,000	down 1,000 (6%)
Sablefish	11,716	11,505	11,571	up 66 (1%)
Flatfish	22,053	114,712	116,562	up 1,850 (2%)
Arrowtooth flounder	2,045	150,945	145,841	down 5,104 (3%)
Rockfish	33,425	47,067	46,946	down 121 (0%)
Atka mackerel	1,431	4,700	4,700	same (0%)
Skates	2,786	7,804	7,804	same (0%)
Other Species	3,616	11,927	14,460	up 2,533 (21%)
Total	240,953	536,925	509,507	down 27,418 (5%)



1. GOA pollock overview

Changes to the assessment model

- ◆ Assessment is an update except...
- ◆ Net-selectivity corrected acoustic estimates

Author's 2019 ABC 134,740 t

- ◆ Decrease of 17% from the 2018 ABC
- ◆ 2020 ABC drops by 22% to 105,290 t

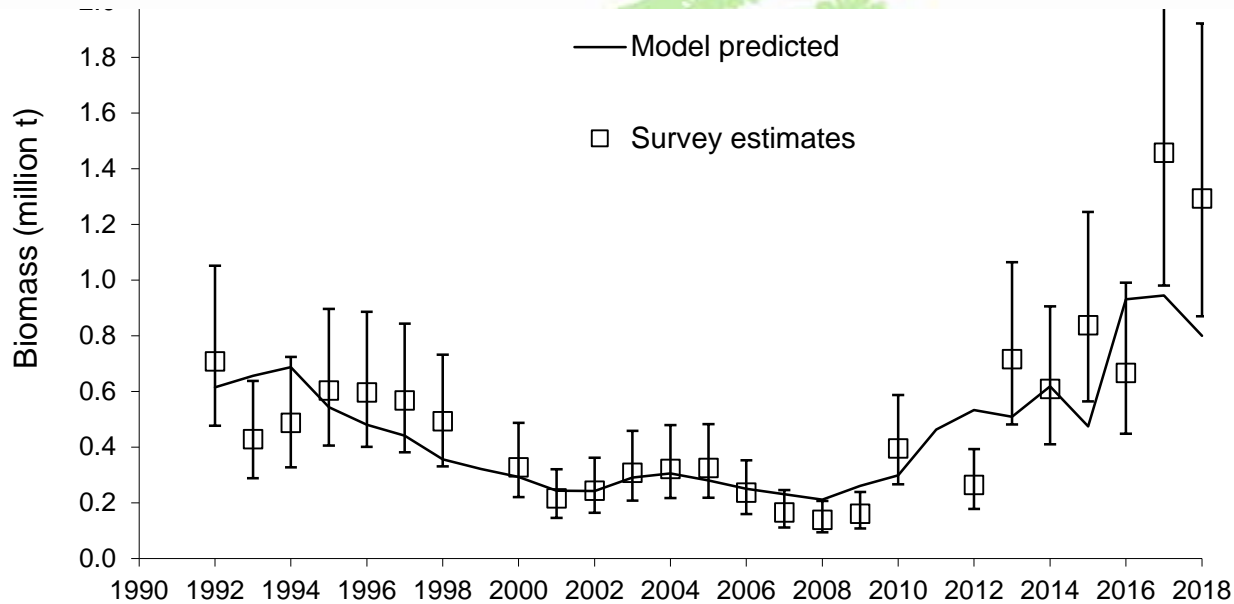
▪ Concerns:

- ◆ Poor model fit
- ◆ Population dominated by single year class
- ◆ Lack of recruitment
- ◆ Unfavorable environmental conditions

▪ Positives:

- ◆ Minimal retrospective pattern
- ◆ Evidence of 2017 year class (above average)
- ◆ Full suite of surveys will occur next year

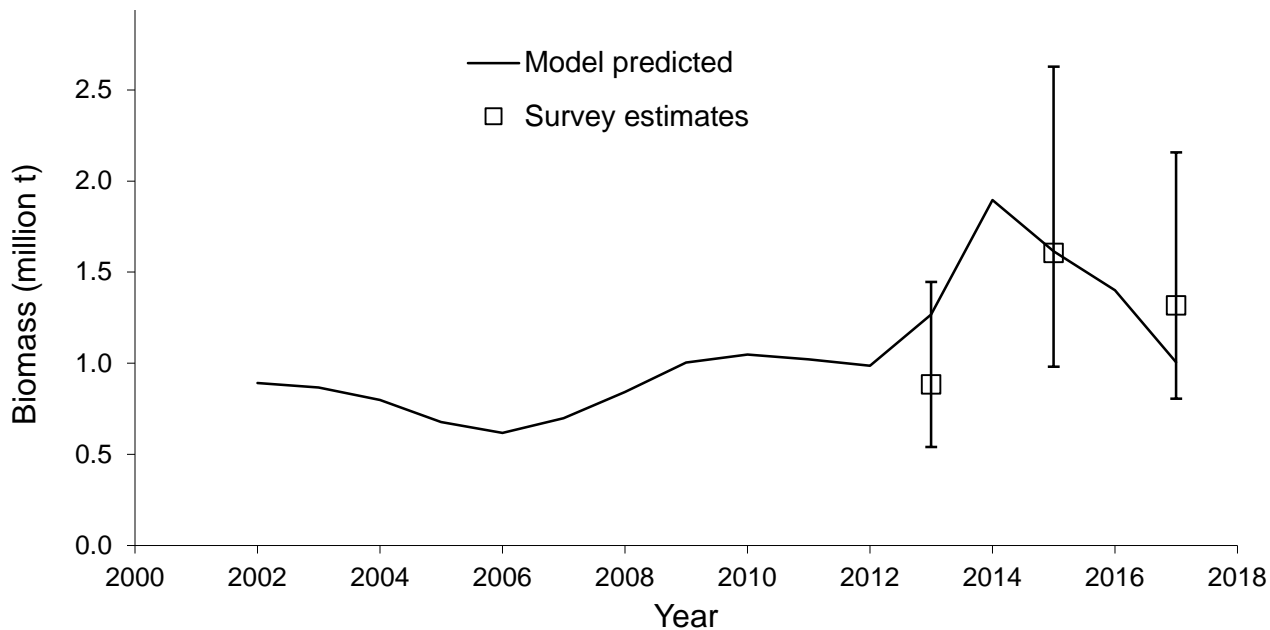
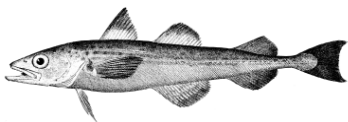
Shelikof Strait EIT survey, 1992-2018

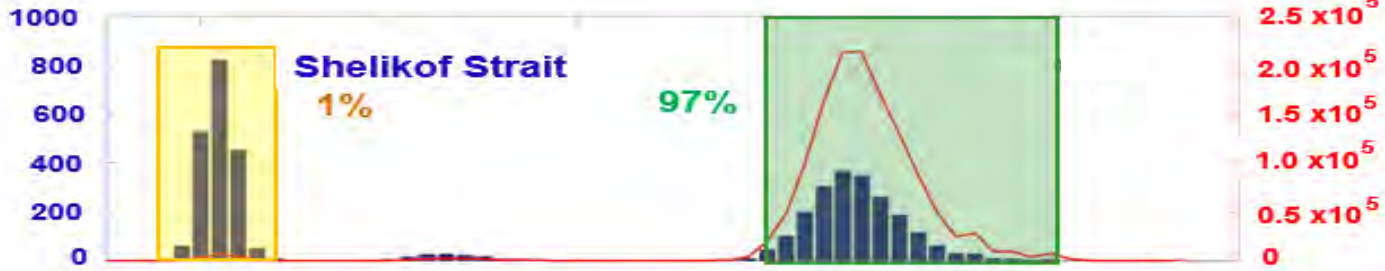


GOA pollock



Summer EIT survey
2013, 2015, 2017

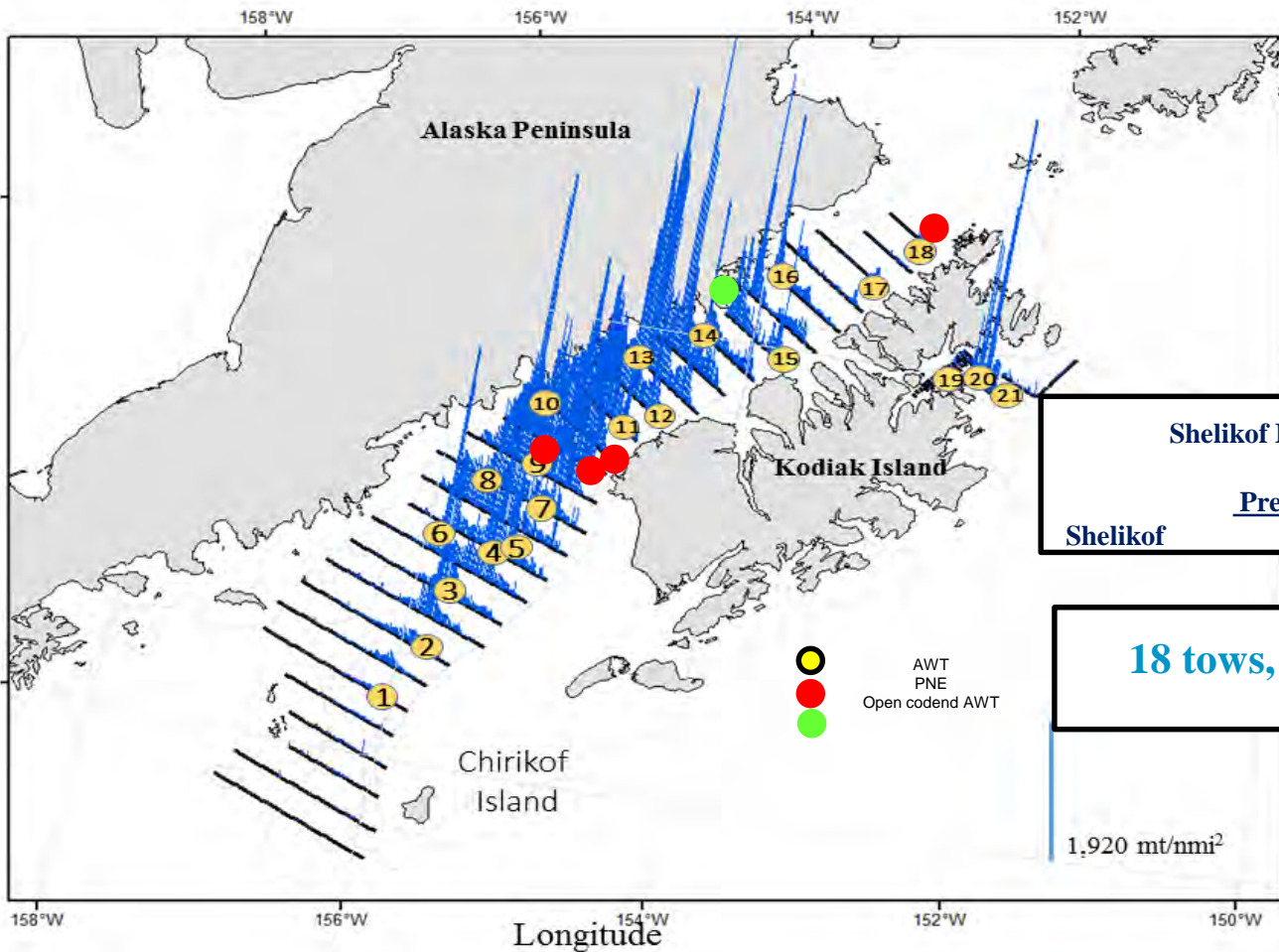




Shelikof Strait

March 15-21

1,320,867 t



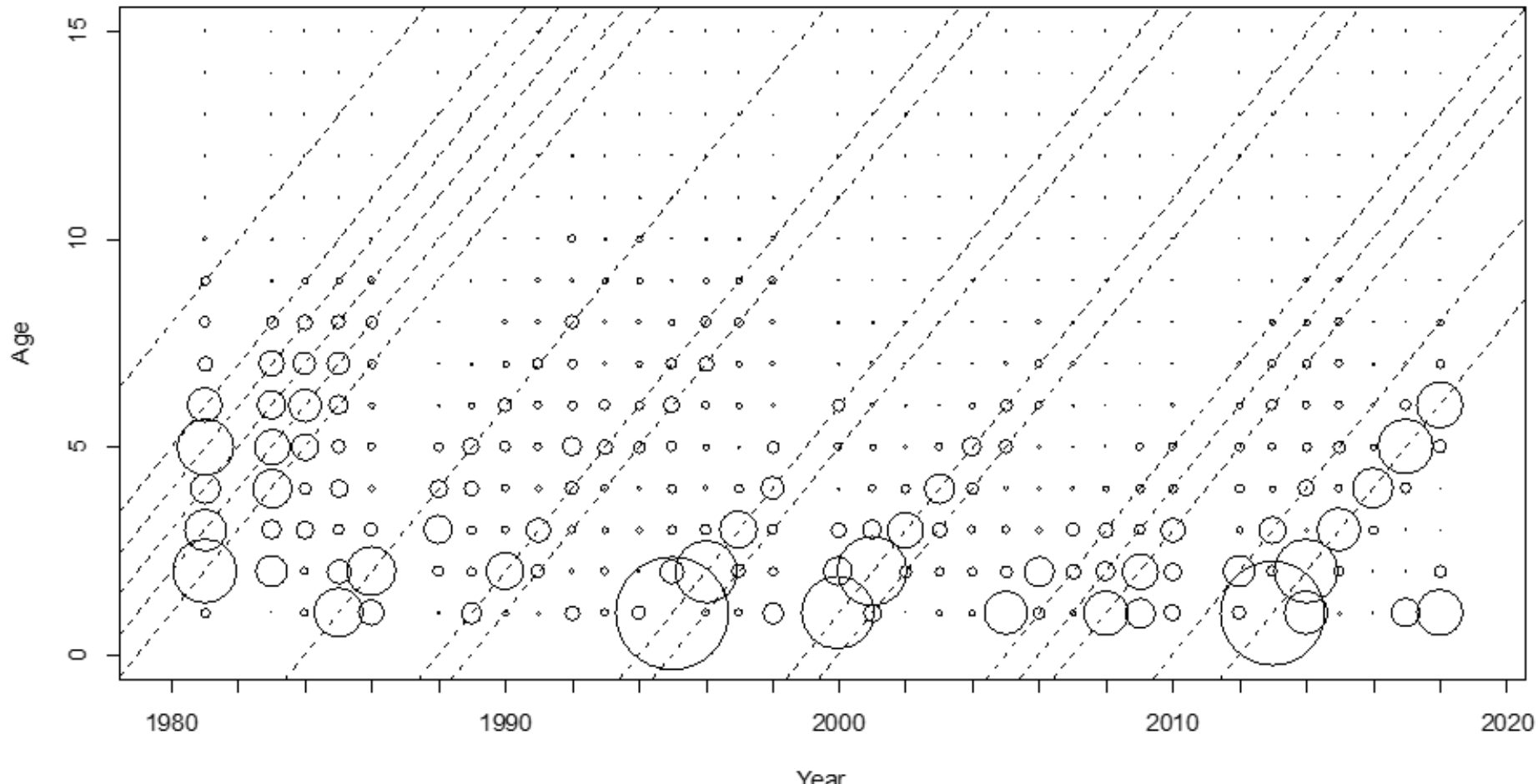
Shelikof Maturities (females > 40cm)

	<u>Prespawning</u>	<u>Spawning</u>	<u>Spent</u>	<u>n</u>
Shelikof	30%	24%	44%	383

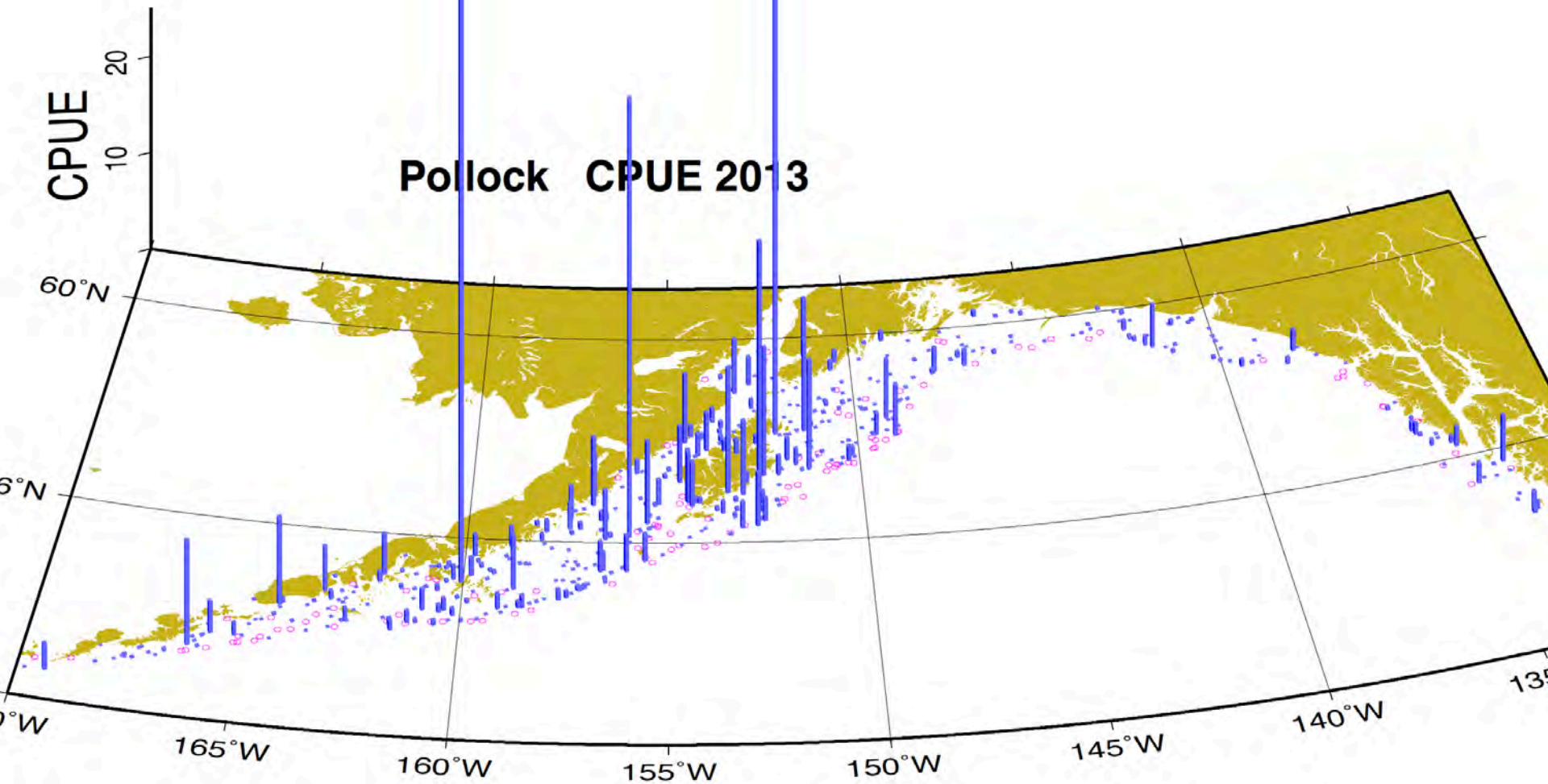
18 tows, 871 nmi of trackline

1,920 mt/nmi²

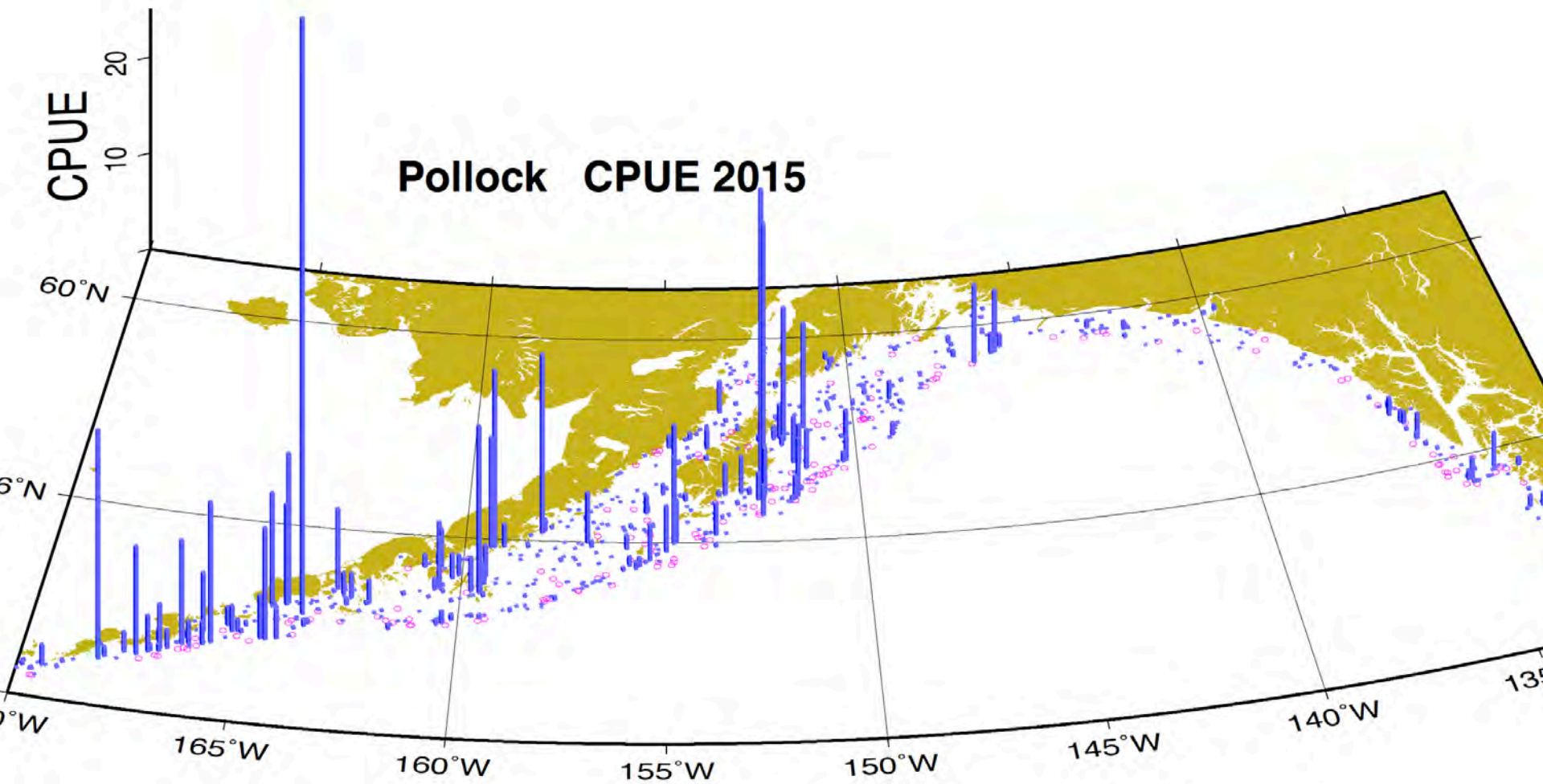
Shelikof Strait survey age compositions, 1981-2018; GOA Pollock



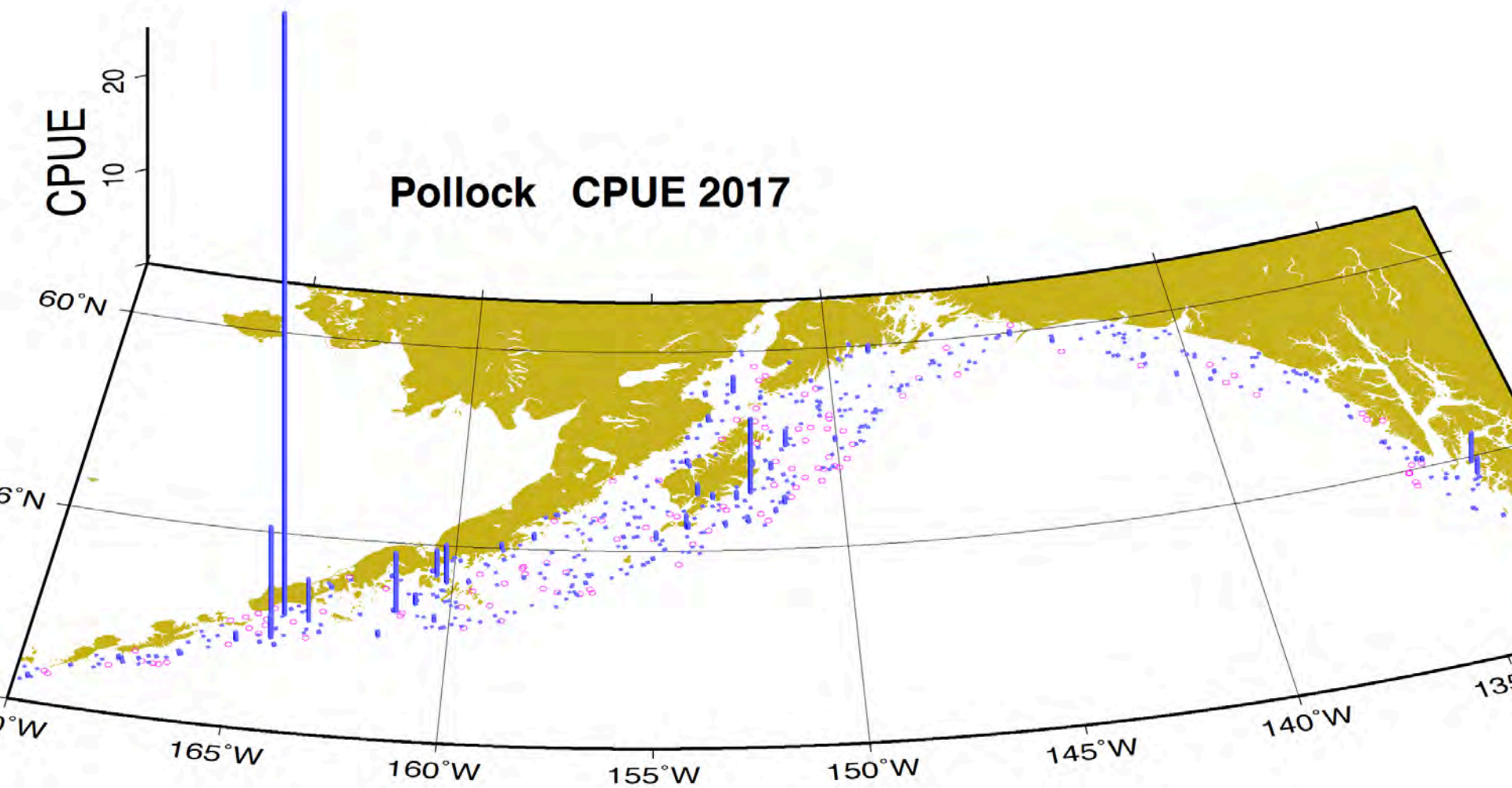
NMFS GOA trawl survey, pollock



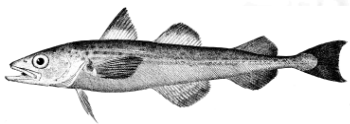
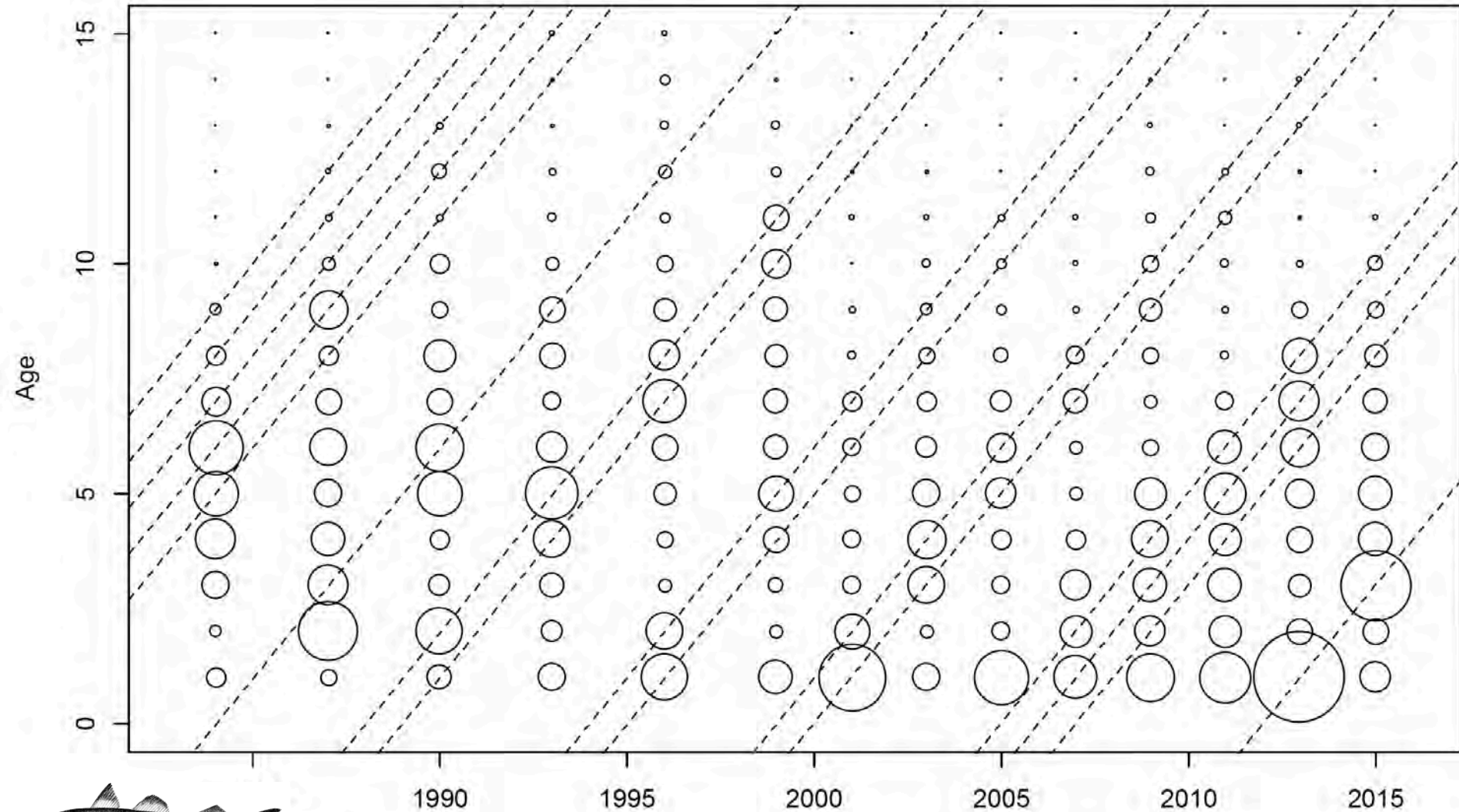
NMFS GOA trawl survey, pollock



NMFS GOA trawl survey, pollock



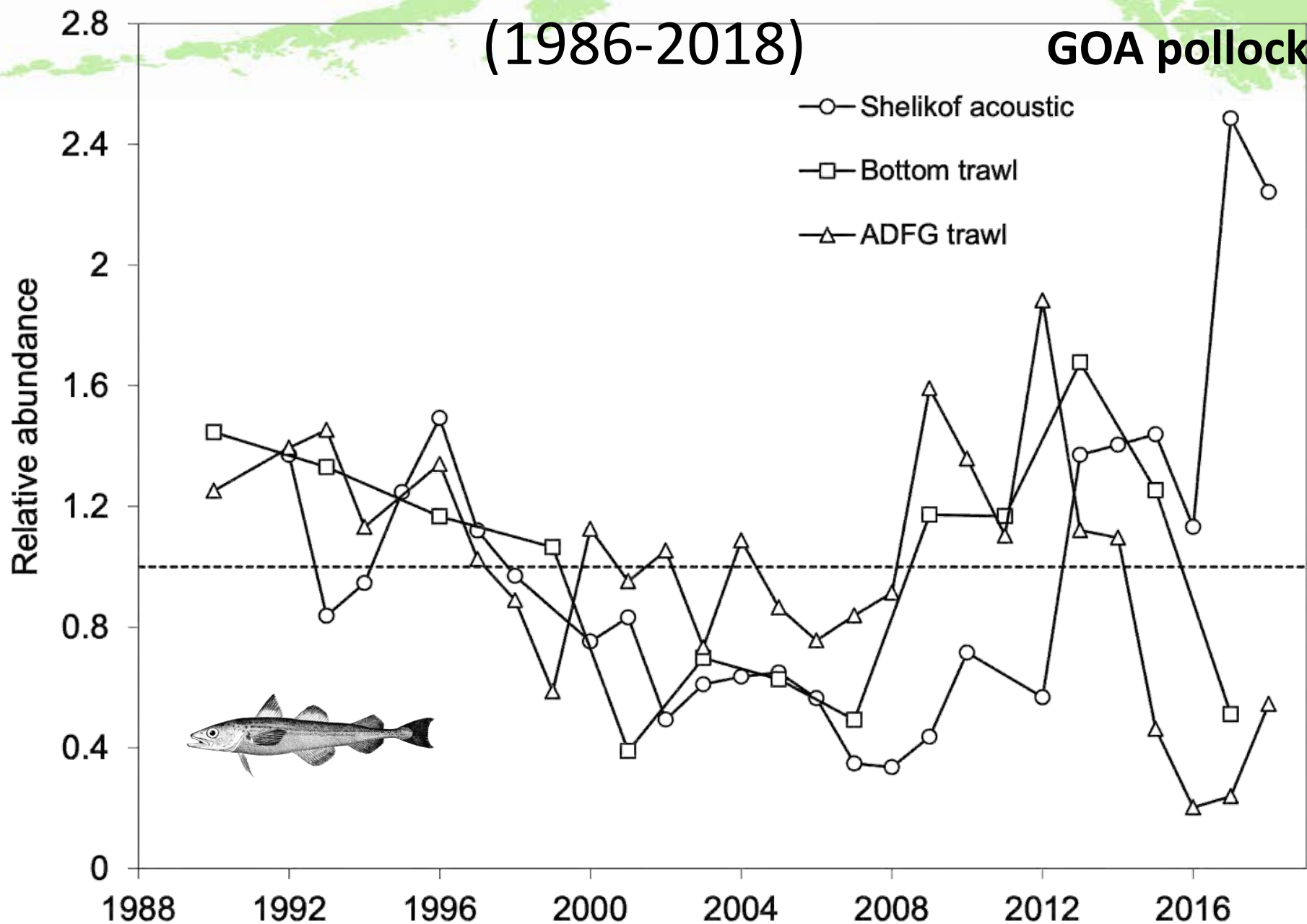
GOA pollock bottom-trawl survey age compositions



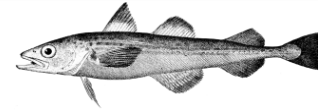
Relative trends in abundance indices

(1986-2018)

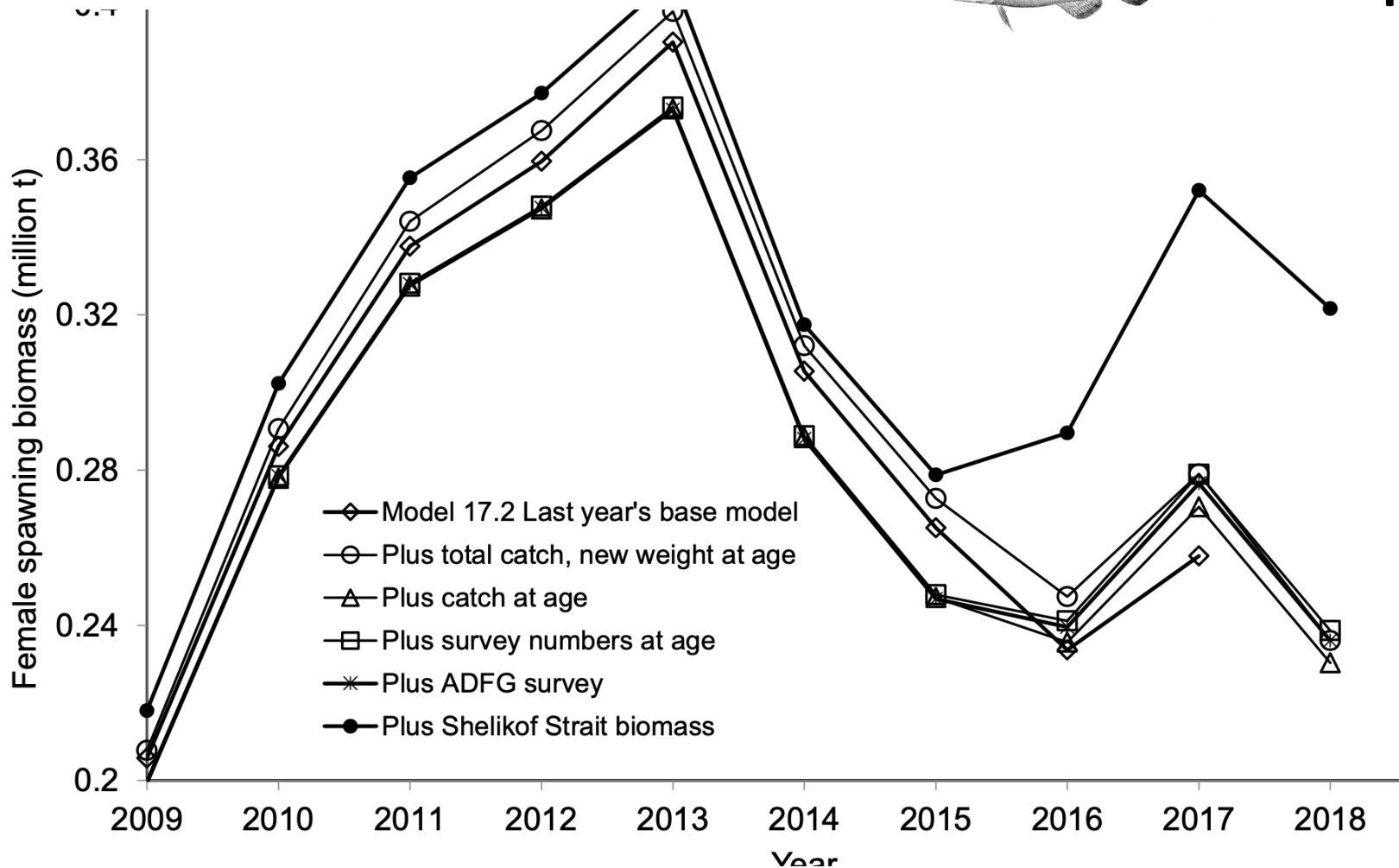
GOA pollock



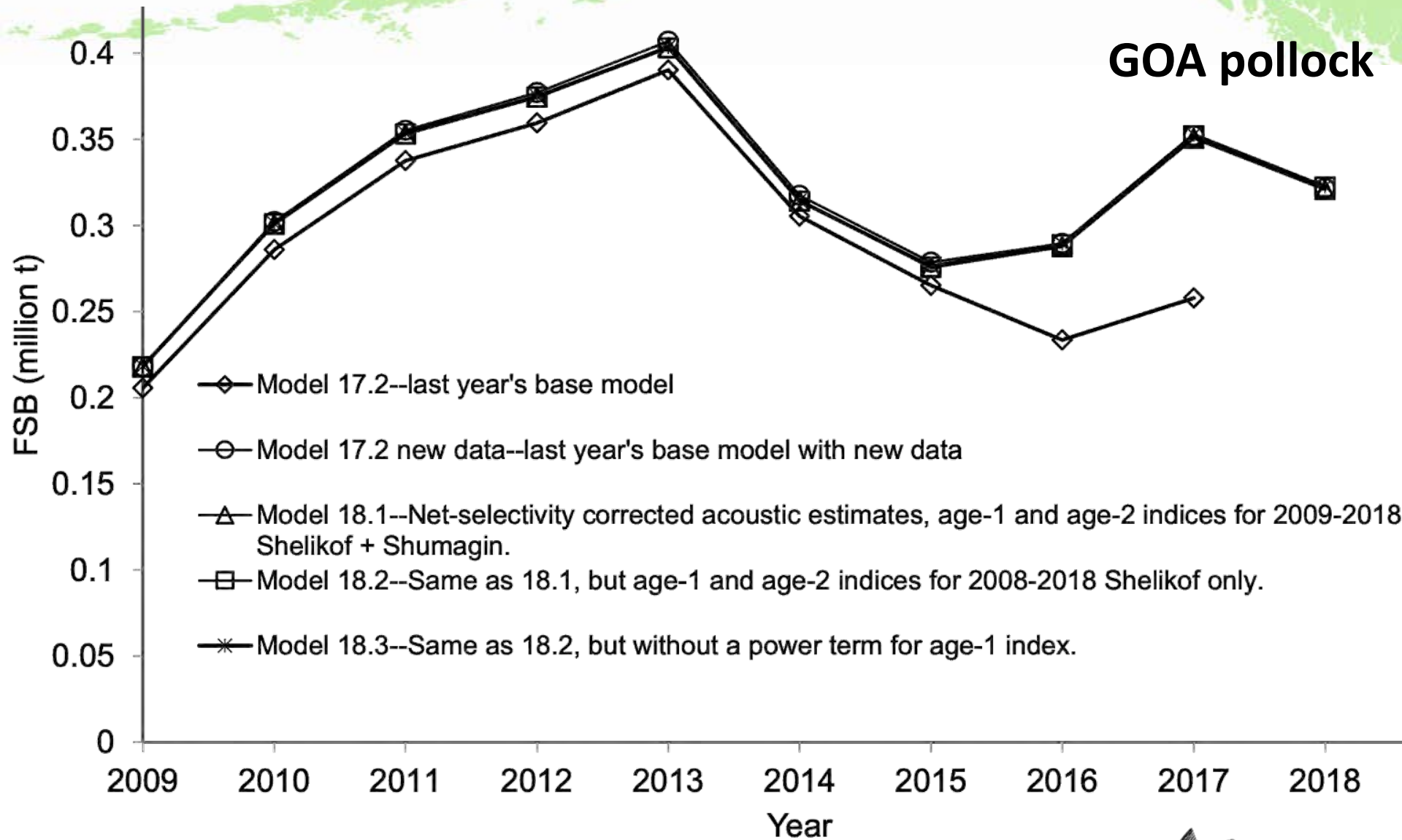
Sensitivity to new survey data...

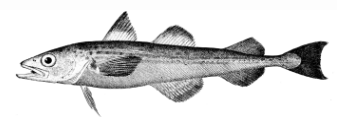


GOA pollock

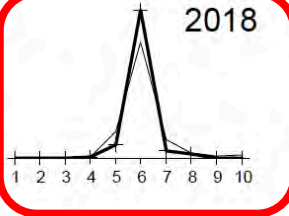
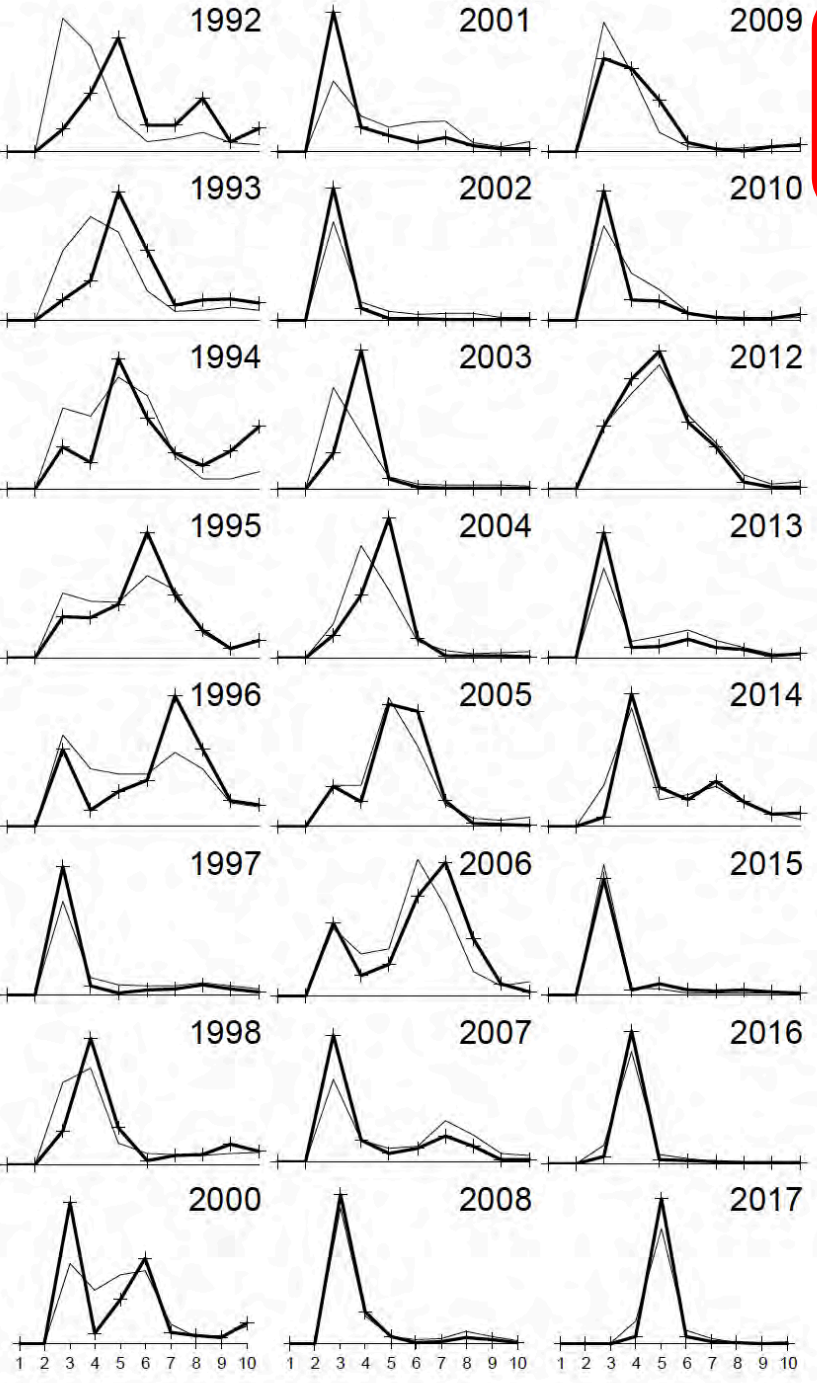


GOA pollock model evaluations





GOA pollock

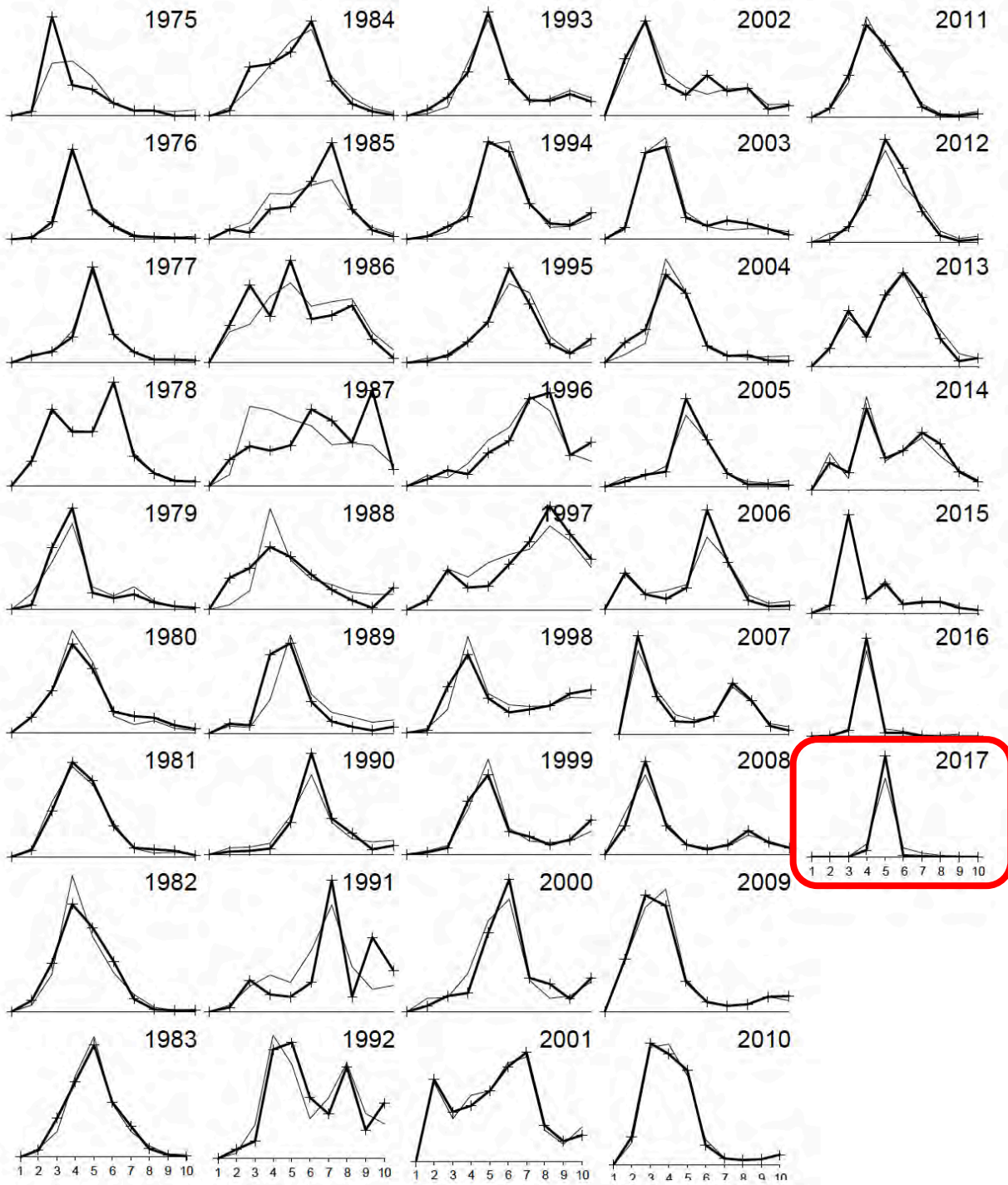


**Shelikof Strait
survey age
composition
(predicted vs
observed)**

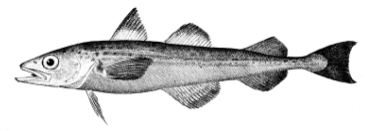
Age



GOA pollock



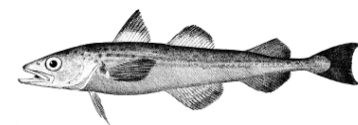
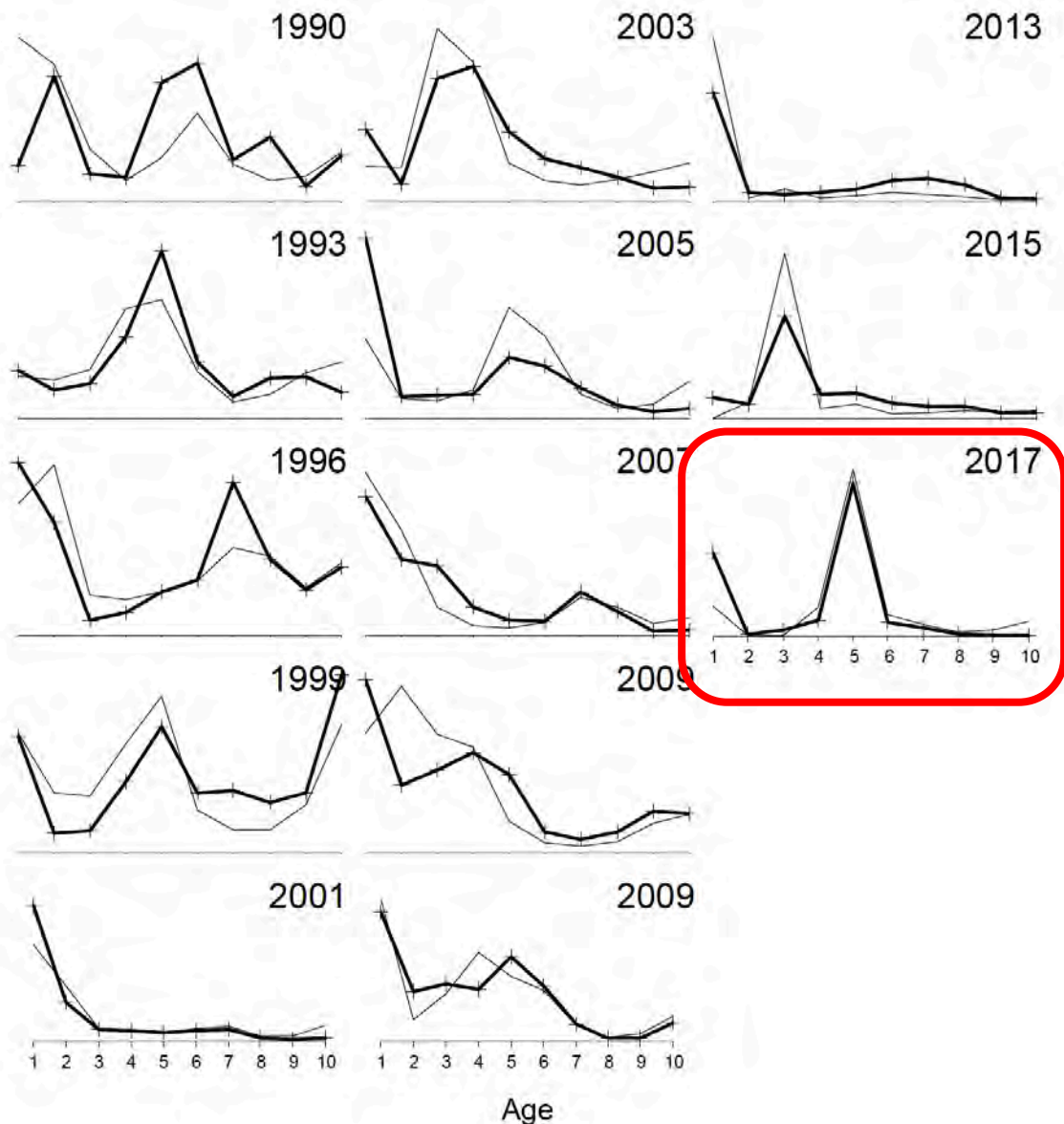
GOA pollock age composition (predicted vs observed)



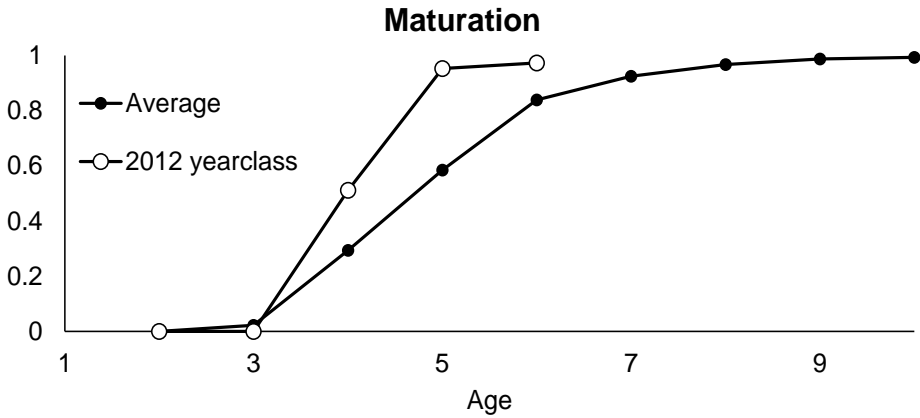
NMFS bottom trawl age composition (predicted

vs observed)

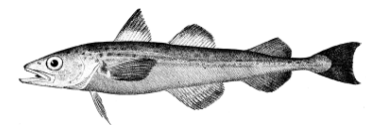
GOA pollock



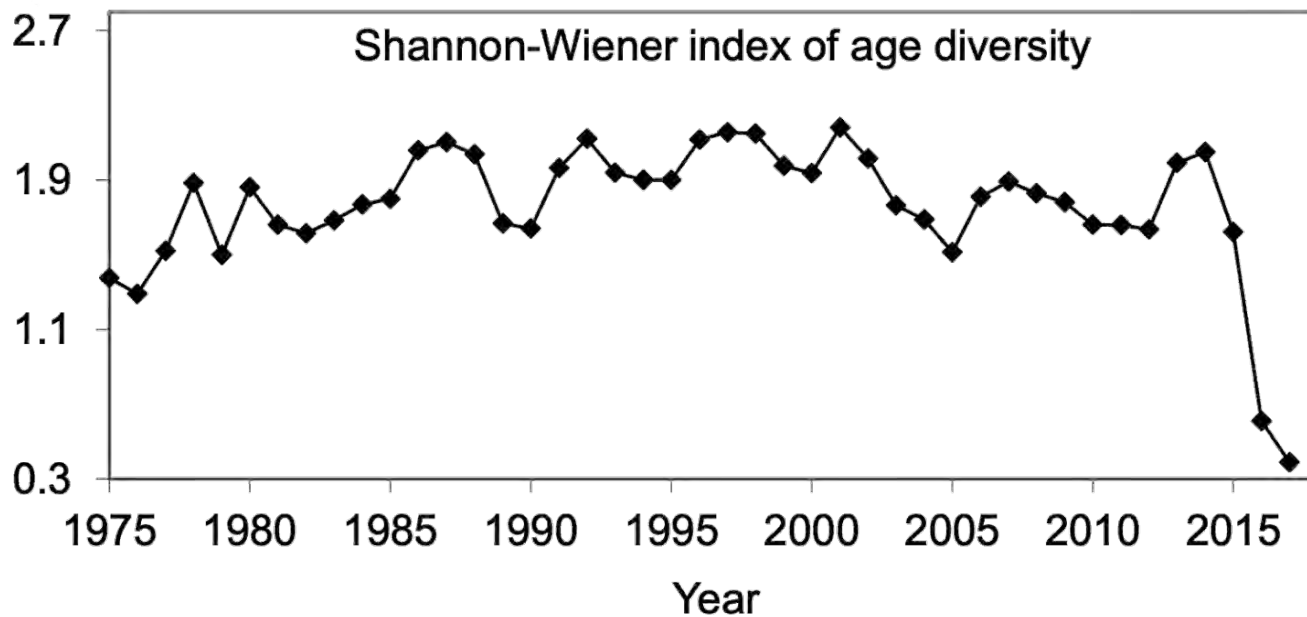
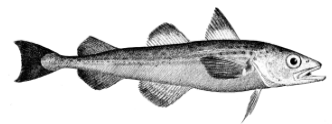
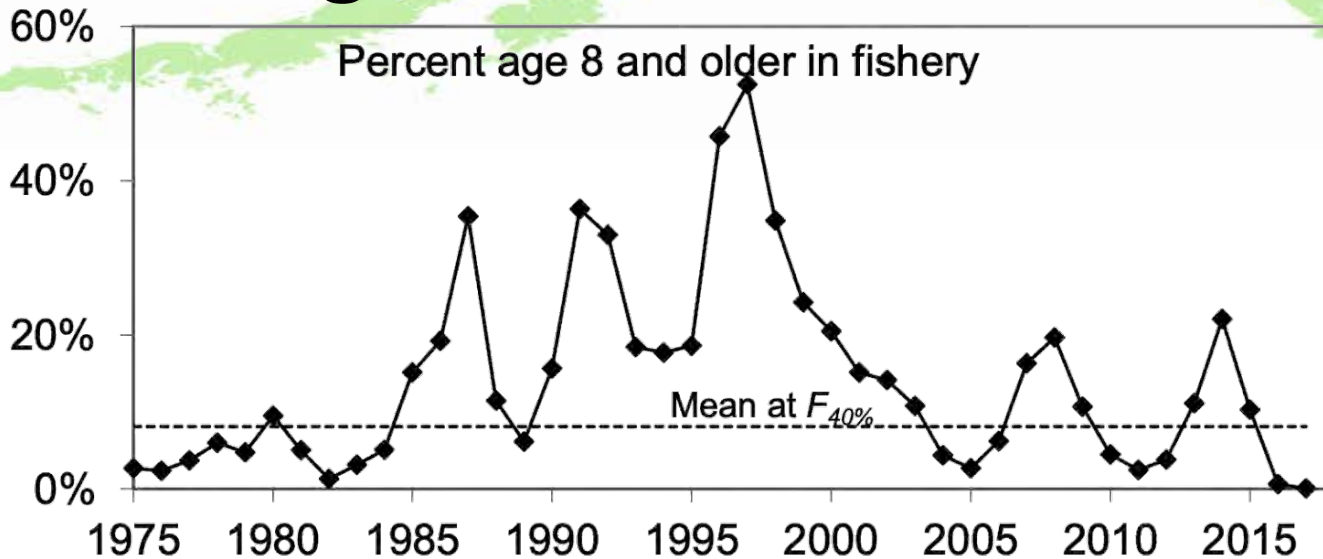
GOA pollock



2012 Year class characteristics

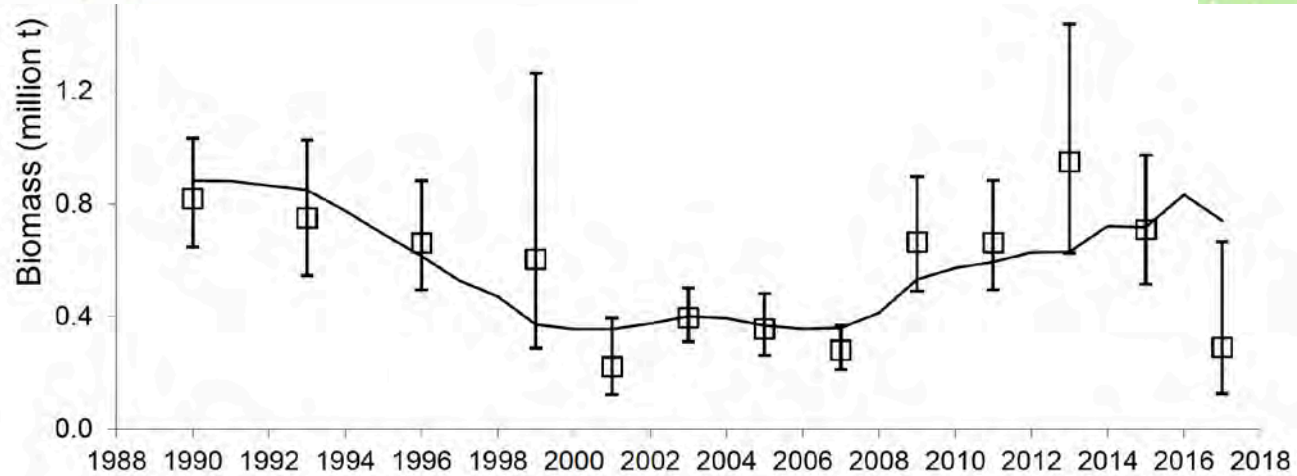


GOA Pollock age structure issues

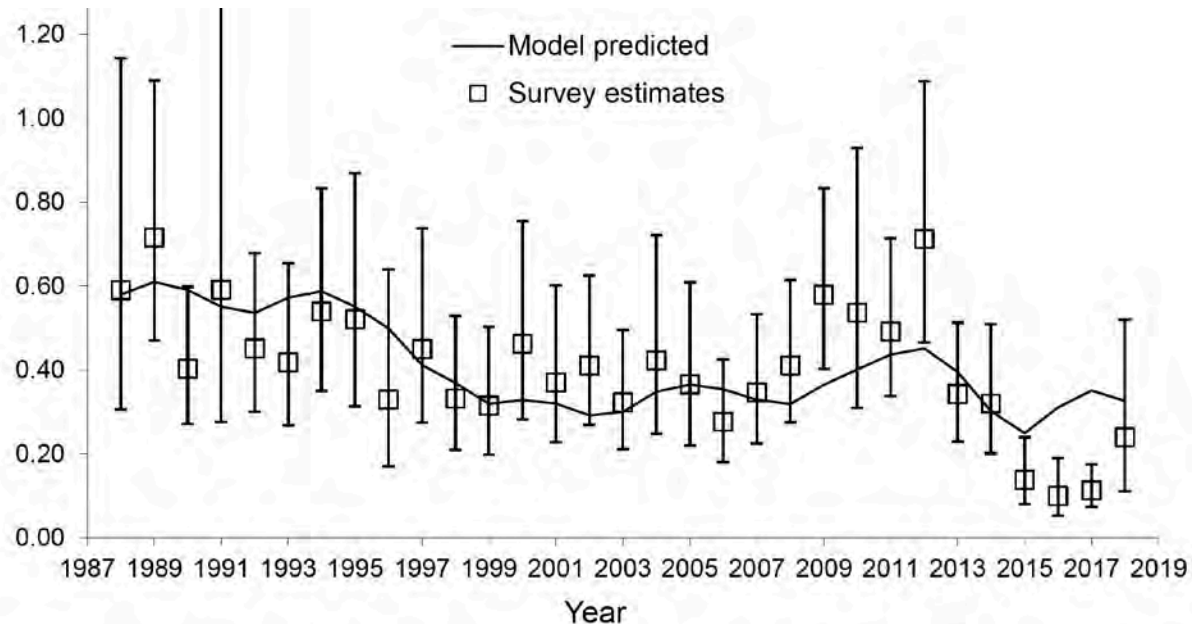


GOA pollock

Fit to NMFS
bottom
trawl
survey

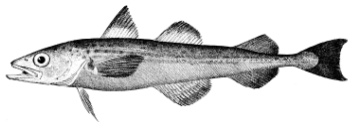
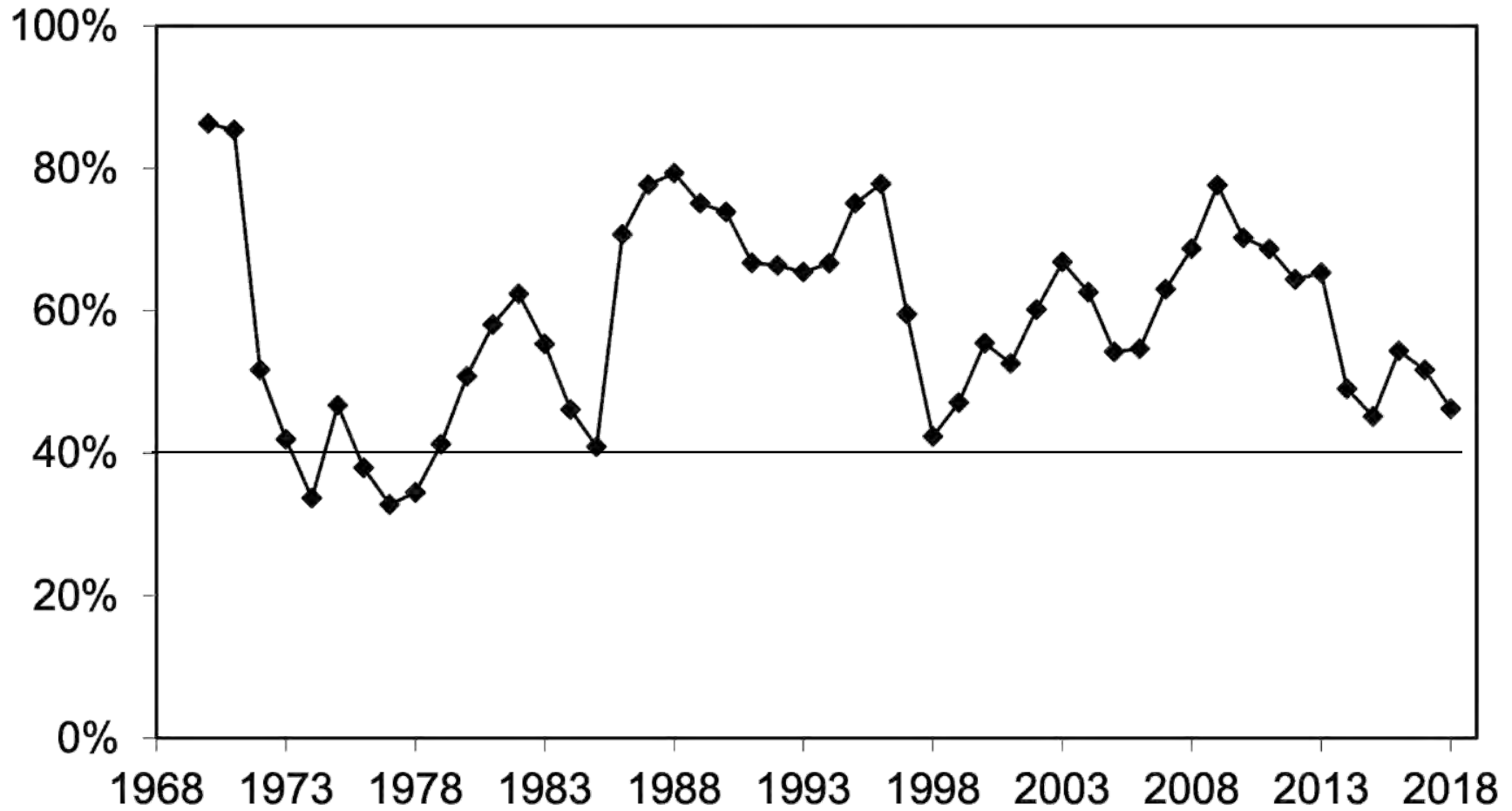


Fit to ADFG
survey

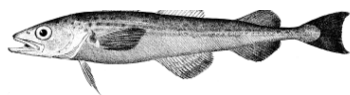
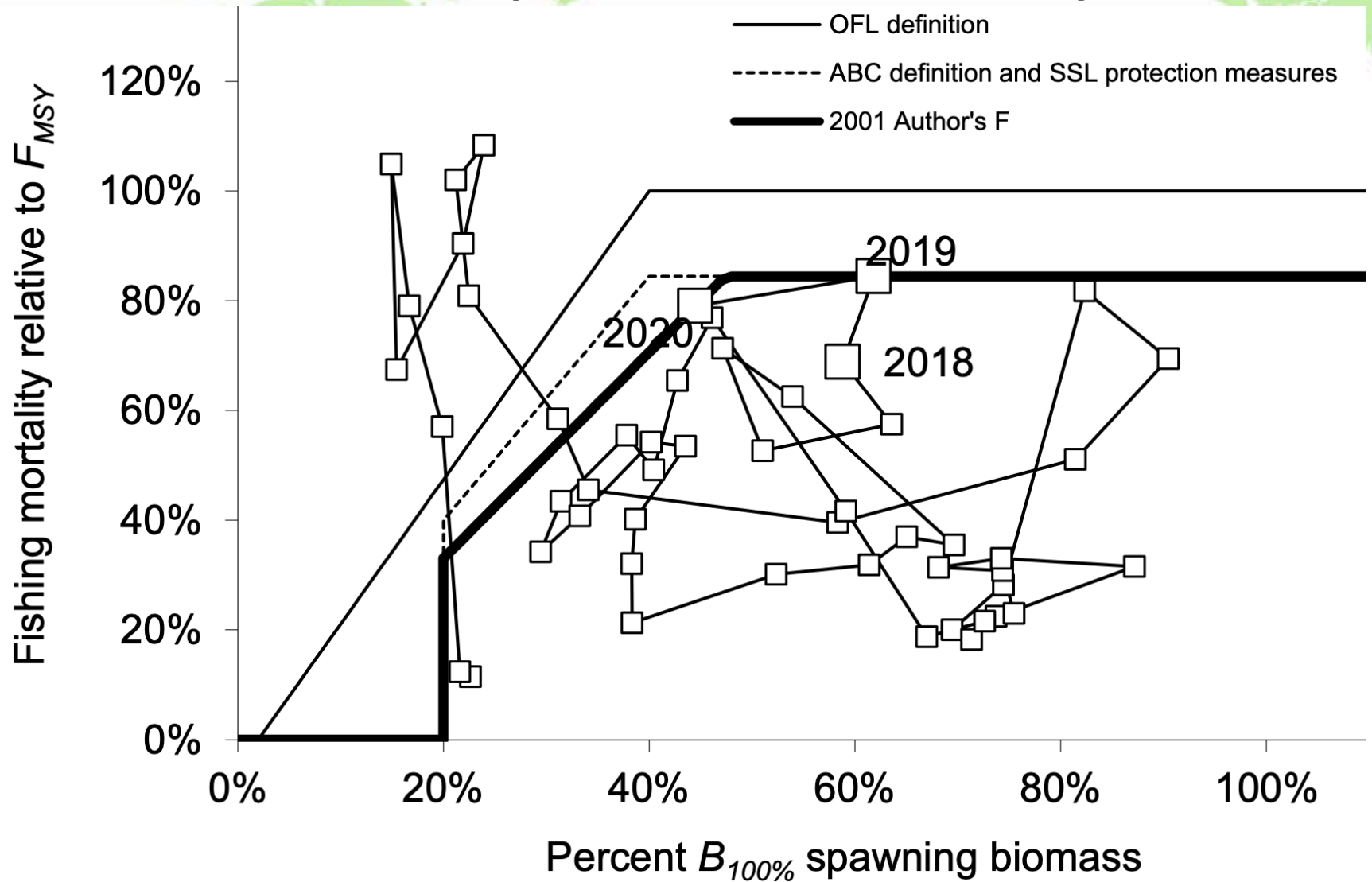


GOA pollock SPR history

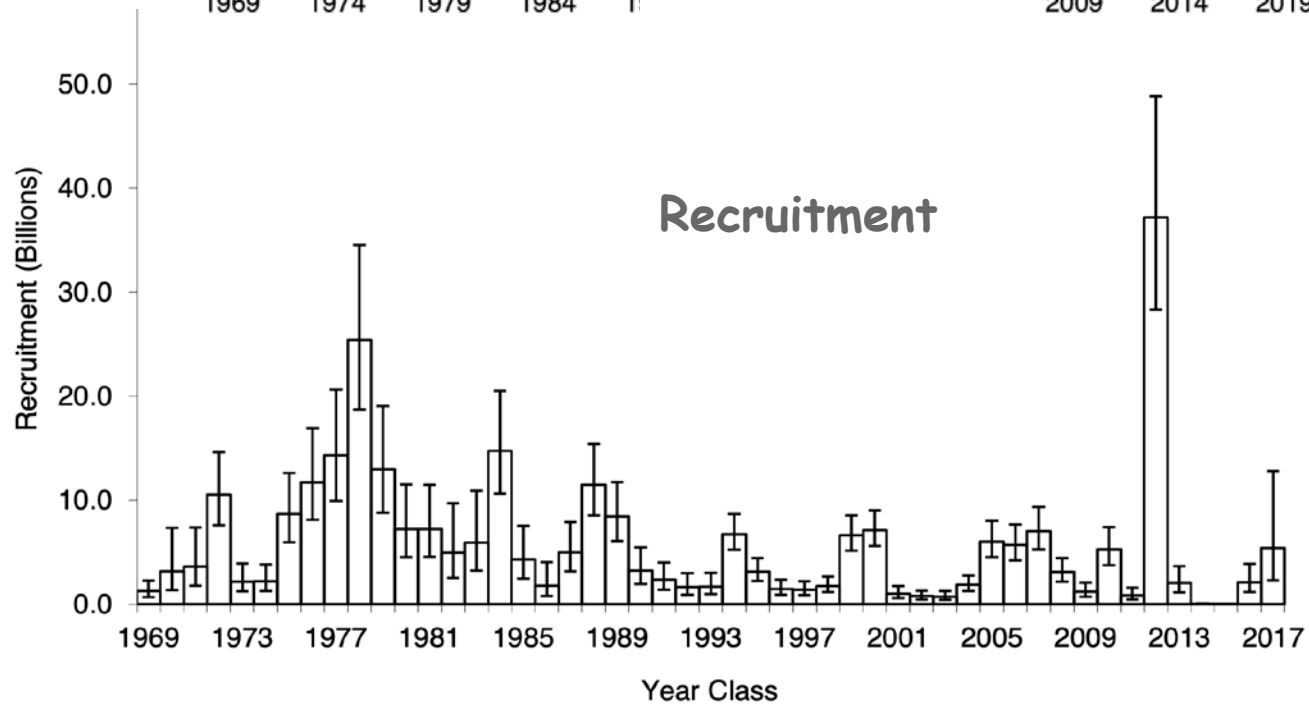
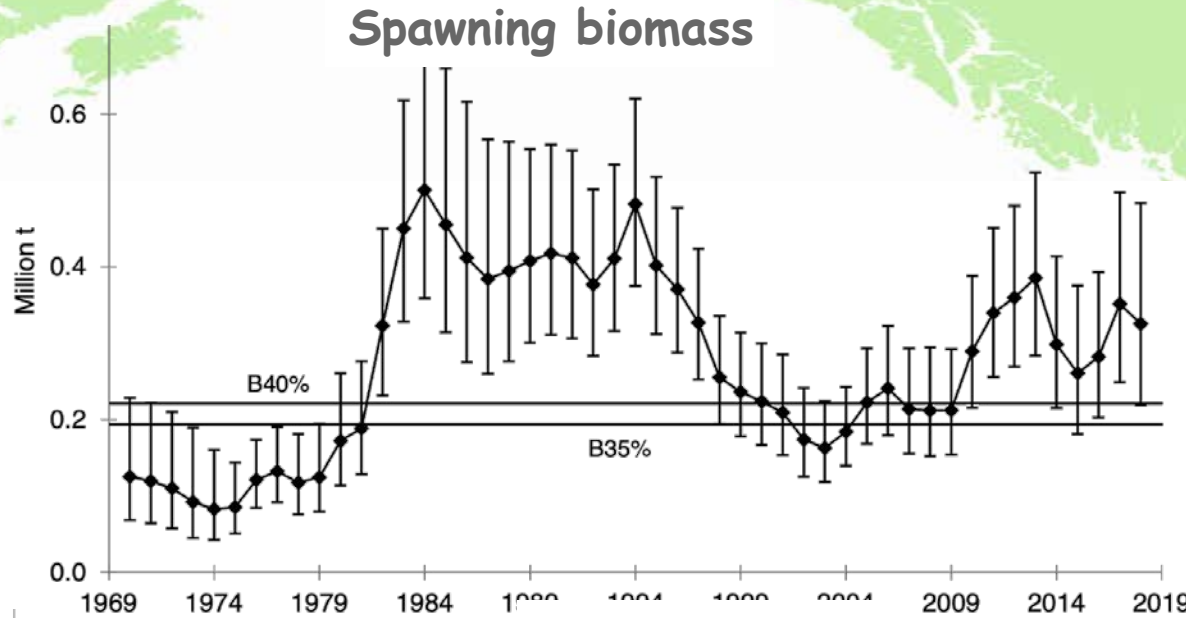
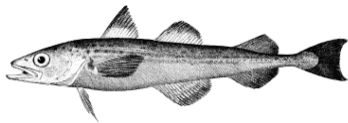
Annual SPR rate



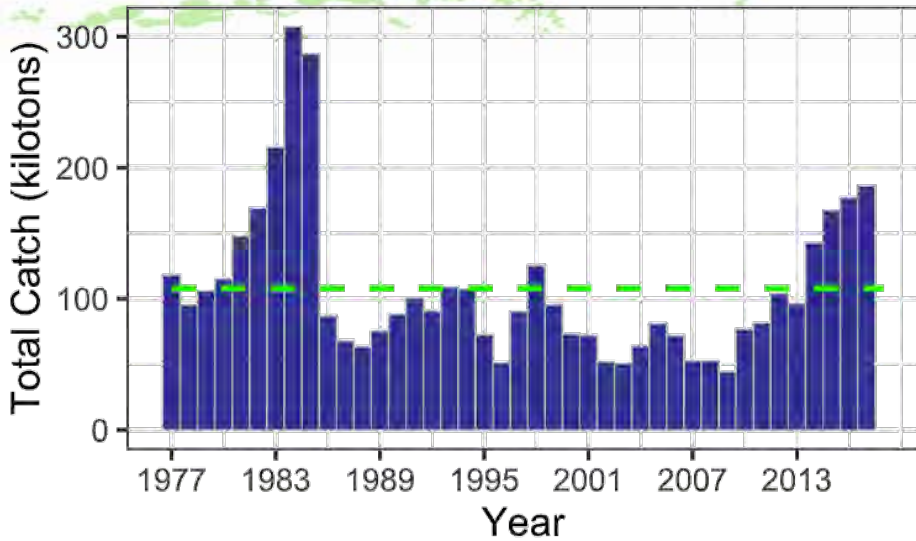
GOA pollock history



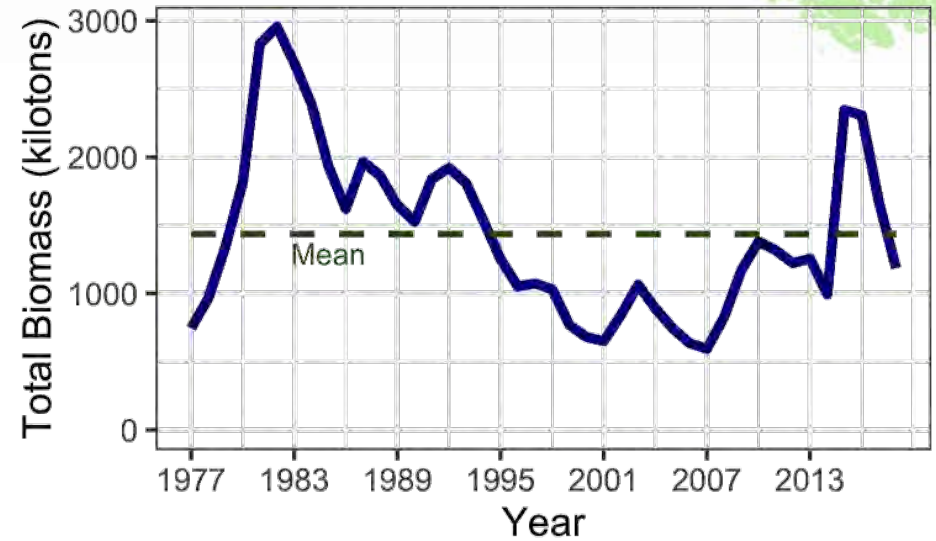
GOA pollock model results



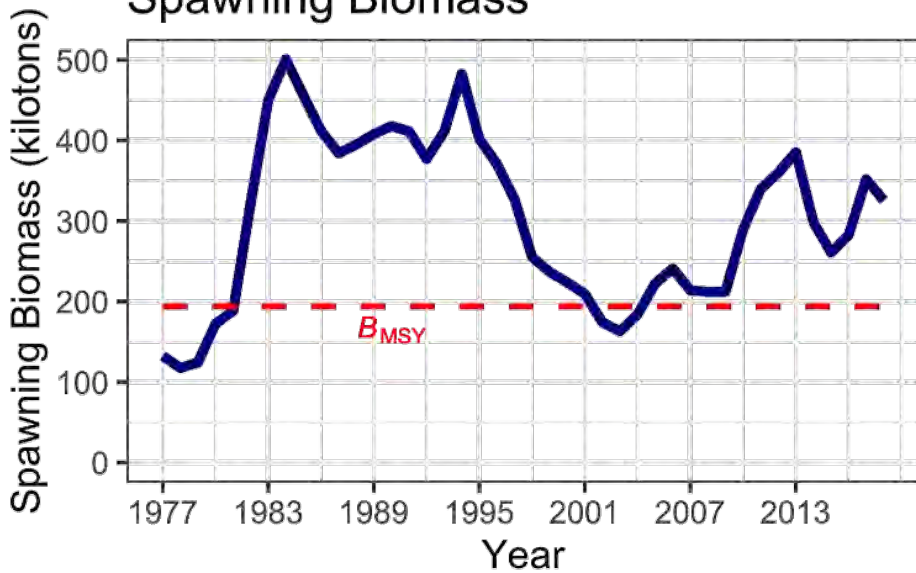
Total Catch



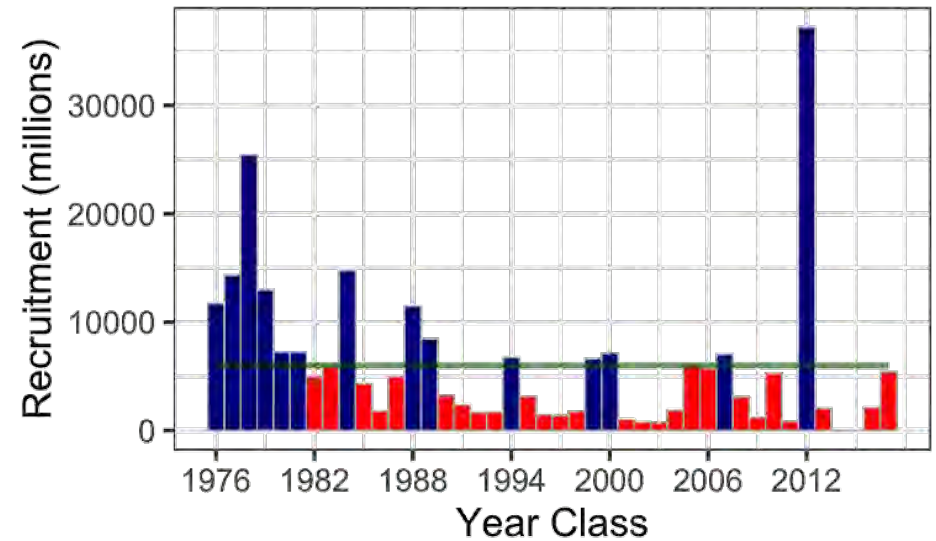
Total Biomass



Spawning Biomass

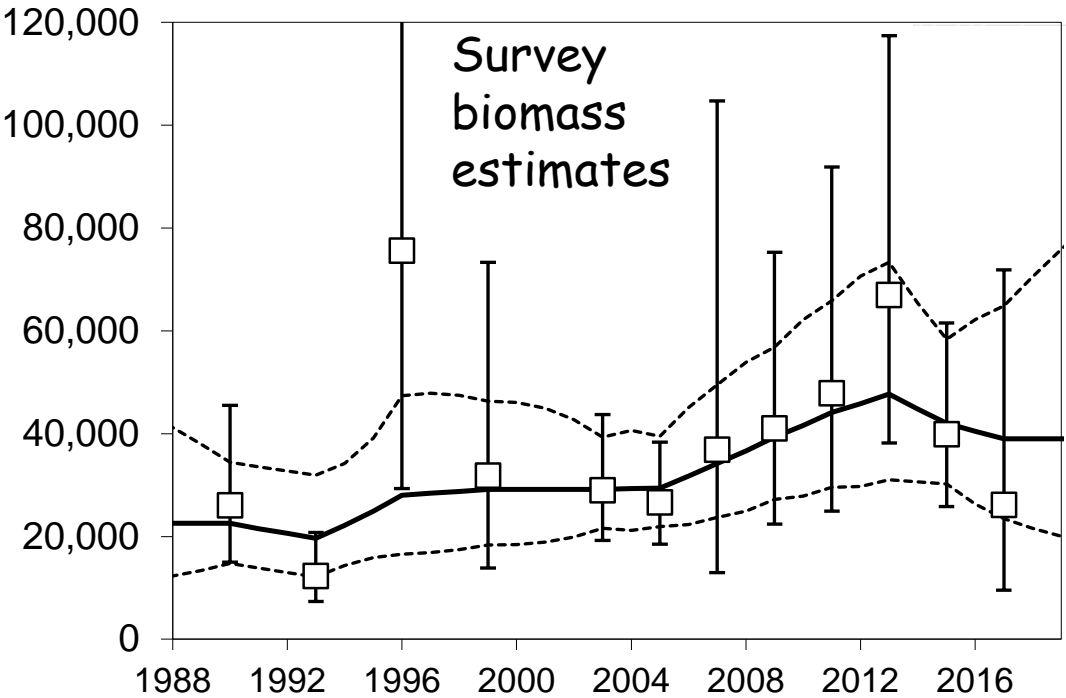
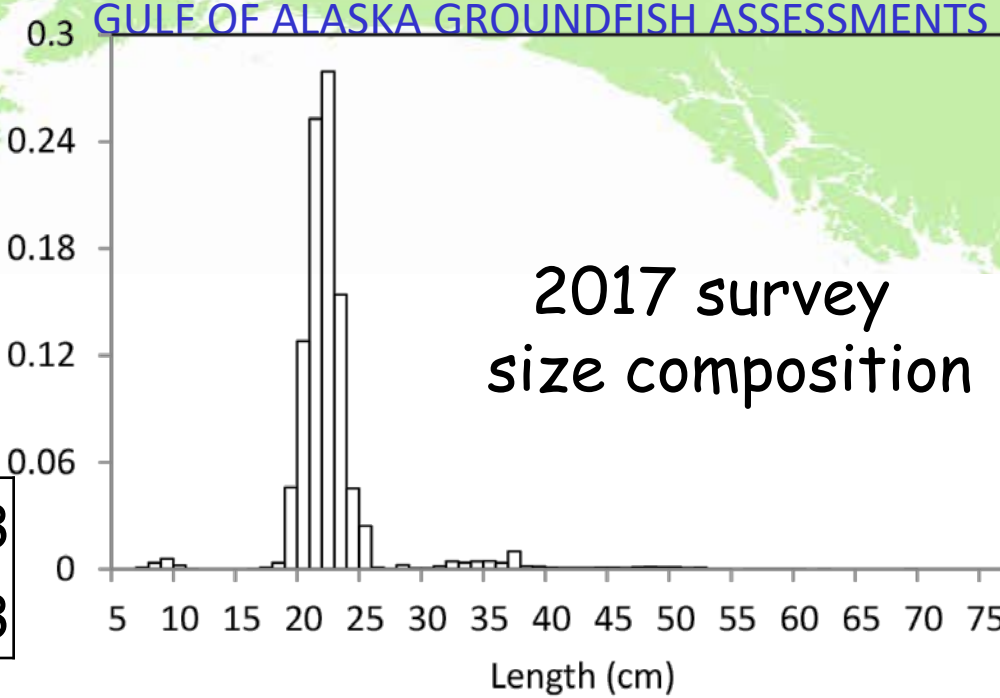


Age 1 Recruitment

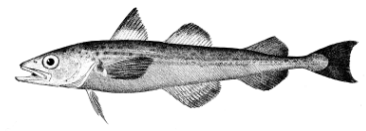


EGOA pollock (Tier 5)

EGOA Pollock	Biomass	OFL	ABC
2018	38,989	11,697	8,773
2019		11,697	8,773

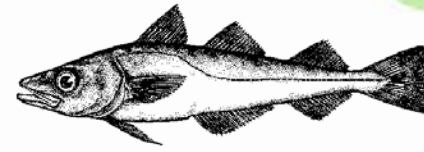


Random effects model



Gulf of Alaska pollock

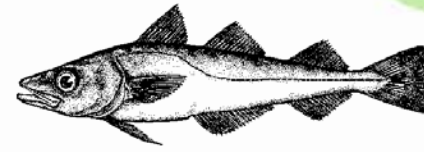
Risk table Criteria



	Assessment-related	Population dynamics	Environmental / ecosystem
Level 1: Normal	Typical to moderately increased uncertainty / minor unresolved issues in assessment	Stock trends are typical for the stock; recent recruitment is within normal range.	No apparent environmental/ecosystem concerns
Level 2: Substantially increased concerns	Substantially increased assessment uncertainty/unresolved issues.	Stock trends are unusual; abundance increasing or decreasing faster than has been seen recently, or recruitment pattern is atypical.	Some indicators showing an adverse signals but the pattern is not consistent across all indicators.
Level 3: Major Concern	Major problems with the stock assessment, very poor fits to data, high level of uncertainty, strong retrospective bias.	Stock trends are highly unusual; very rapid changes in stock abundance, or highly atypical recruitment patterns.	Multiple indicators showing consistent adverse signals a) across the same trophic level, and/or b) up or down trophic levels (i.e., predators and prey of stock)
Level 4: Extreme concern	Severe problems with the stock assessment, severe retrospective bias. Assessment considered unreliable.	Stock trends are unprecedented. More rapid changes in stock abundance than have ever been seen previously, or a very long stretch of poor recruitment compared to previous patterns.	Extreme anomalies in multiple ecosystem indicators that are highly likely to impact the stock. Potential for cascading effects on other ecosystem components

Gulf of Alaska pollock

Authors' risk table evaluation



Assessment	Population dynamics	Environmental / ecosystem
<p>Contradictory data, very poor model fits to recent survey indices. But model seems robust, no retrospective pattern.</p>	<p>Stock dominated by a single year class, Four years of very weak recruitment. There have been similar patterns in the past, but never this extreme.</p>	<p>Onset of a marine heatwave and projections of a weak El Niño are not conducive for winter survival for age-0 pollock. Zooplankton prey for adult pollock has increased, but planktivorous parakeet auklets in the central GOA had poor reproductive success in 2018</p>
<p>Conclusion: Level 2</p>	<p>Conclusion: Level 2</p>	<p>Conclusion: Level 2</p>

Overall score is Level 2: Substantially increased concerns.

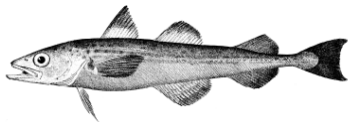
Author's recommended ABC = 85% of maximum permissible (15% buffer)

- based on mode of historical buffers.

GOA Pollock Team discussions

- Relative to reductions from maximum permissible:

The Team recommends using the incremental method (14.3%) but would appreciate guidance from the SSC on appropriate level(s) of reduction in response to substantial concerns of how to implement the risk matrix.



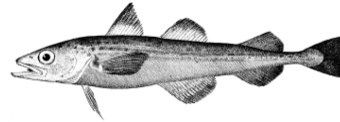
GOA Pollock Team discussions

- Relative to natural mortality:

The Team recommends the author investigate the use of maturity at age estimation procedure.

- Others: The Team recommends

- ♦ investigating model behavior sensitivity to abundance indices by incrementally dropping survey indexes to clarify how the data affect the model(s)
- ♦ Check recent year estimates of fishery selectivity, specifically the rising edge of the selectivity curves, which appear overly static given the single cohort state of the population.

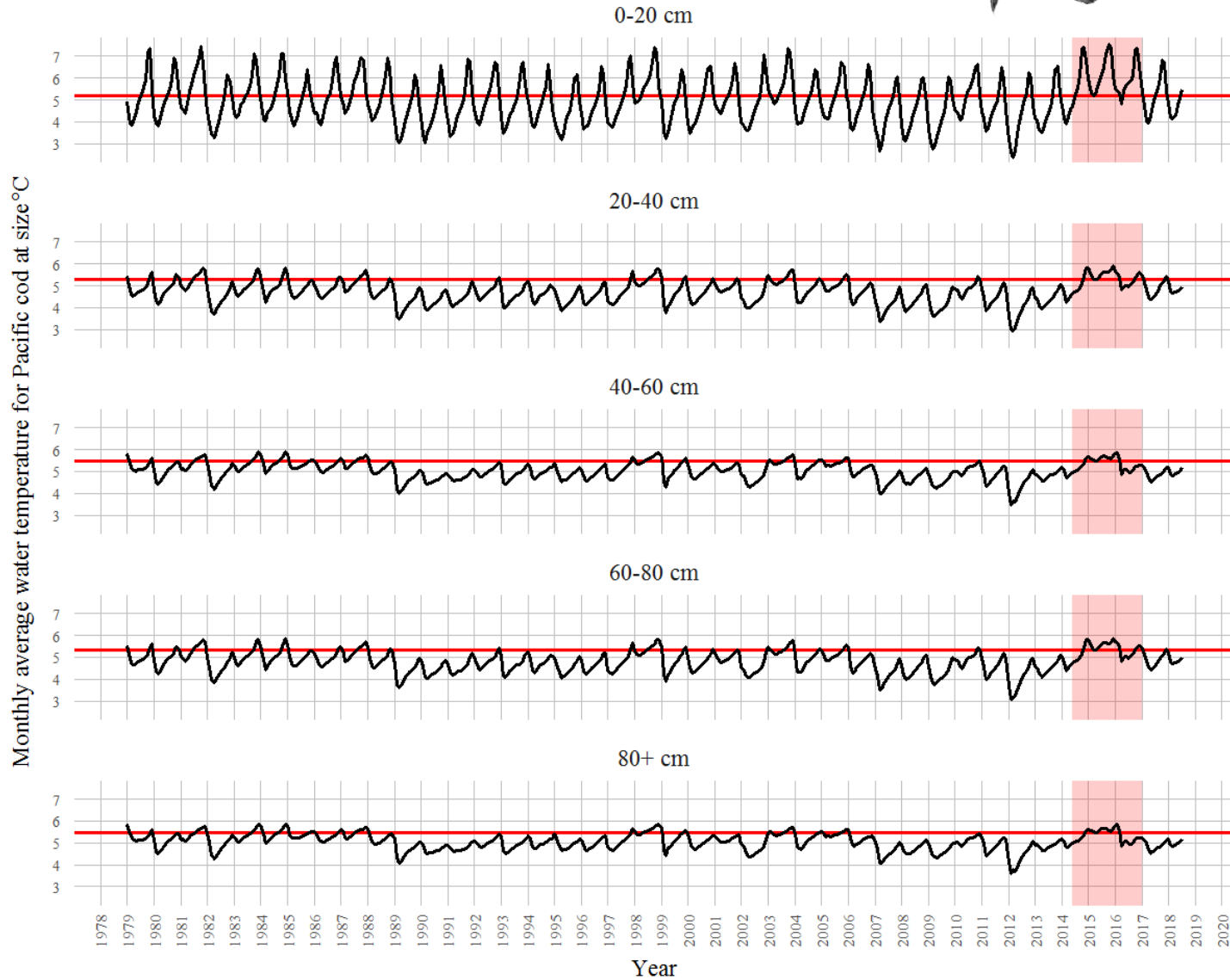


2. GOA Pacific cod



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Other Species	3,616	11,927	14,460	up 2,533 (21%)
Total	240,953	536,925	509,507	down 27,418 (5%)

Anomalously warm waters 2014-2016

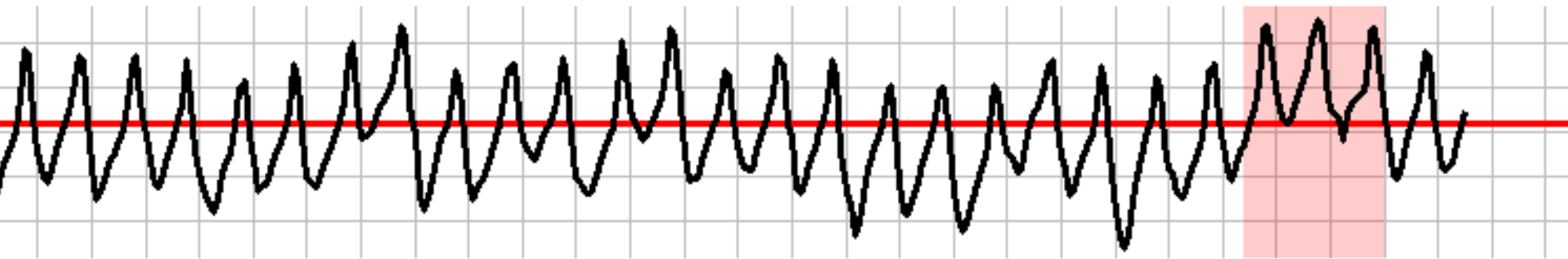


Cooler in 2017
and first half
of 2018

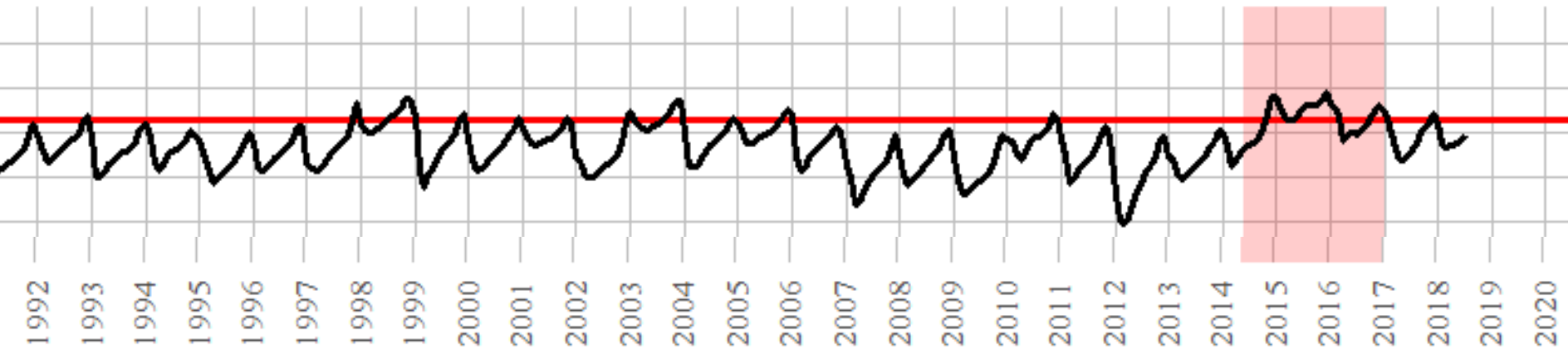
Anomalously warm waters 2014-2016



0-20 cm



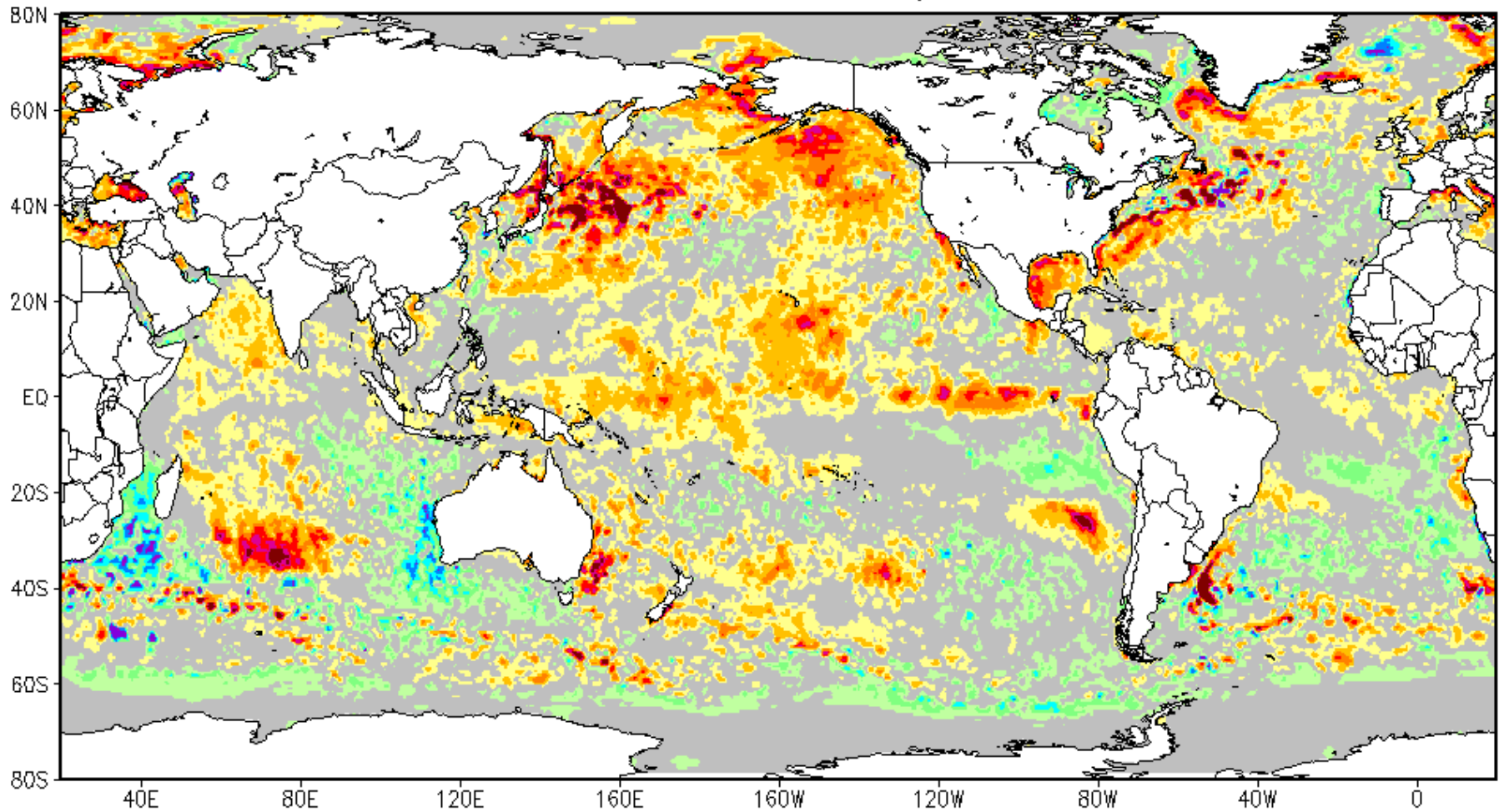
20-40 cm



Year

Daily OISST Anomaly intv2: 08NOV2018

AVHRR - only

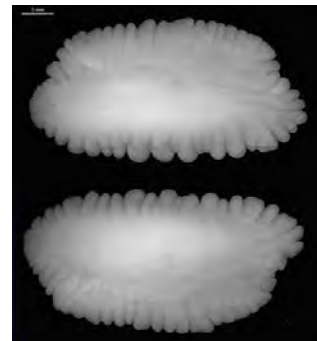


- Heatwave in central GOA since September 10, 2018
- 70-75% chance of El Niño in winter 2018-2019



New data

- 2018 AFSC longline survey
 - ◆ RPN Index 1990-2018
 - ◆ Length composition
- 2012-2017 Fishery age composition and length at age
- 2017-2018 Fishery catch and length composition
- 2017 AFSC bottom trawl survey age composition and length at age

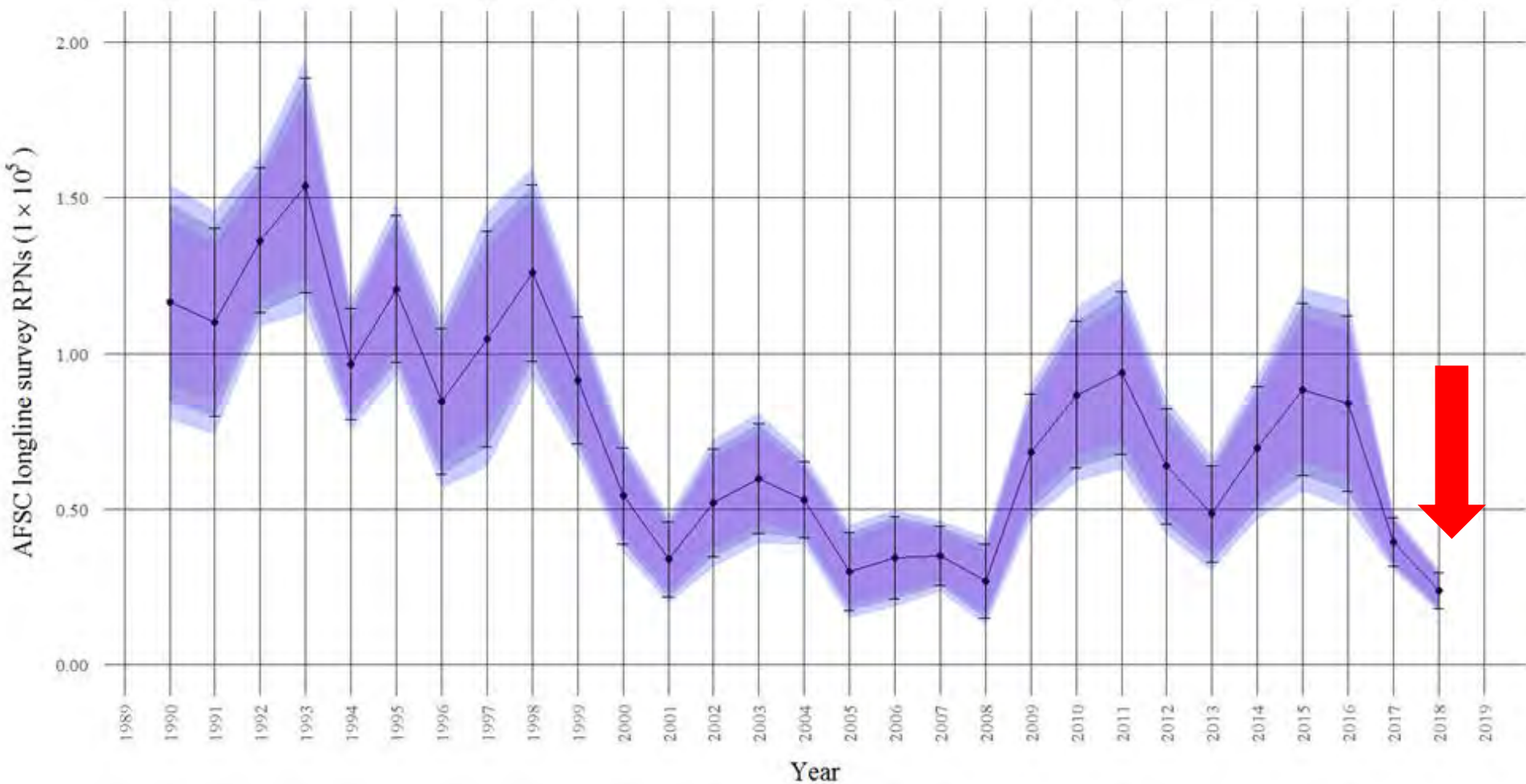


AFSC longline survey

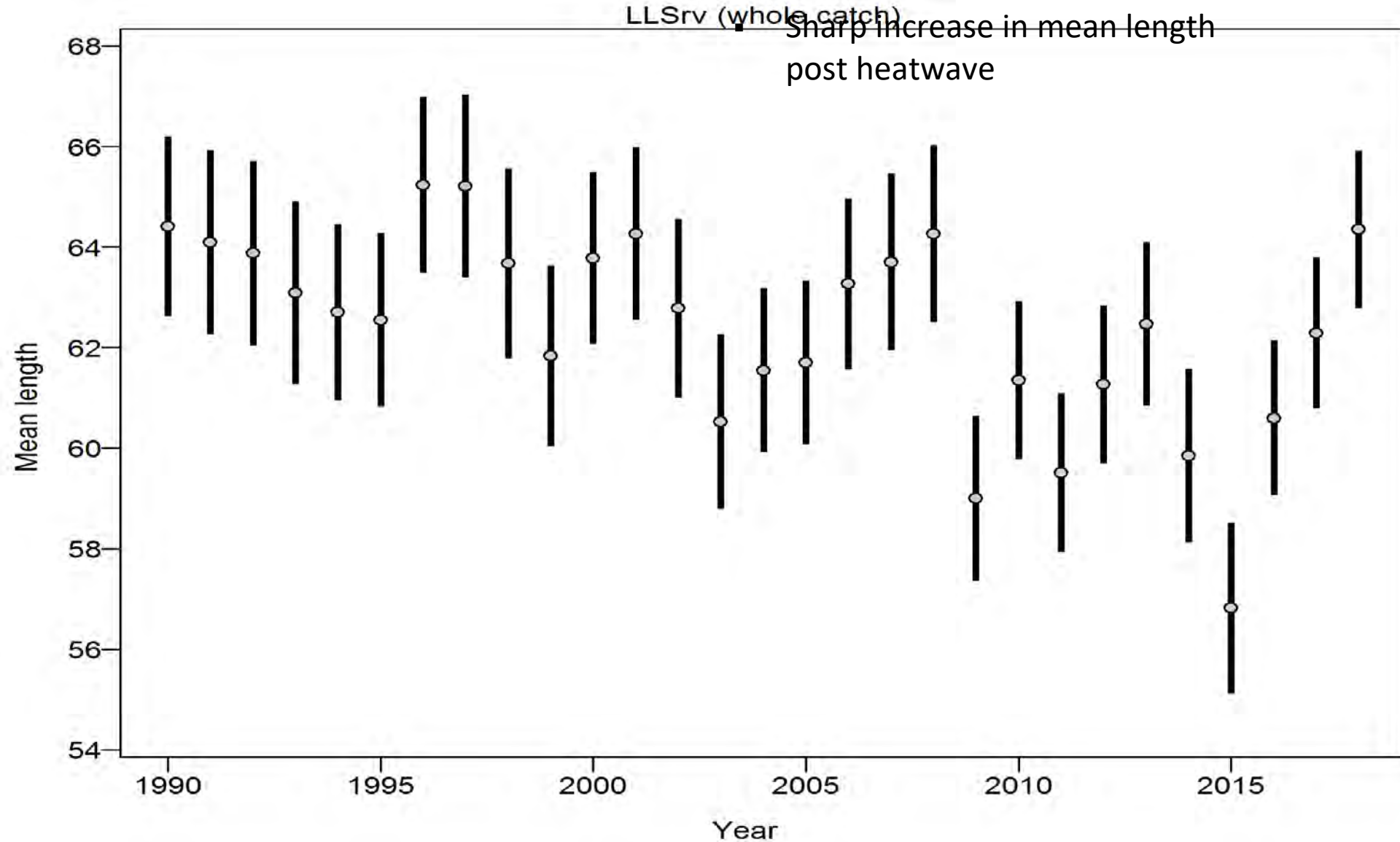


2018 lowest on record

- ◆ Down 40% from 2017

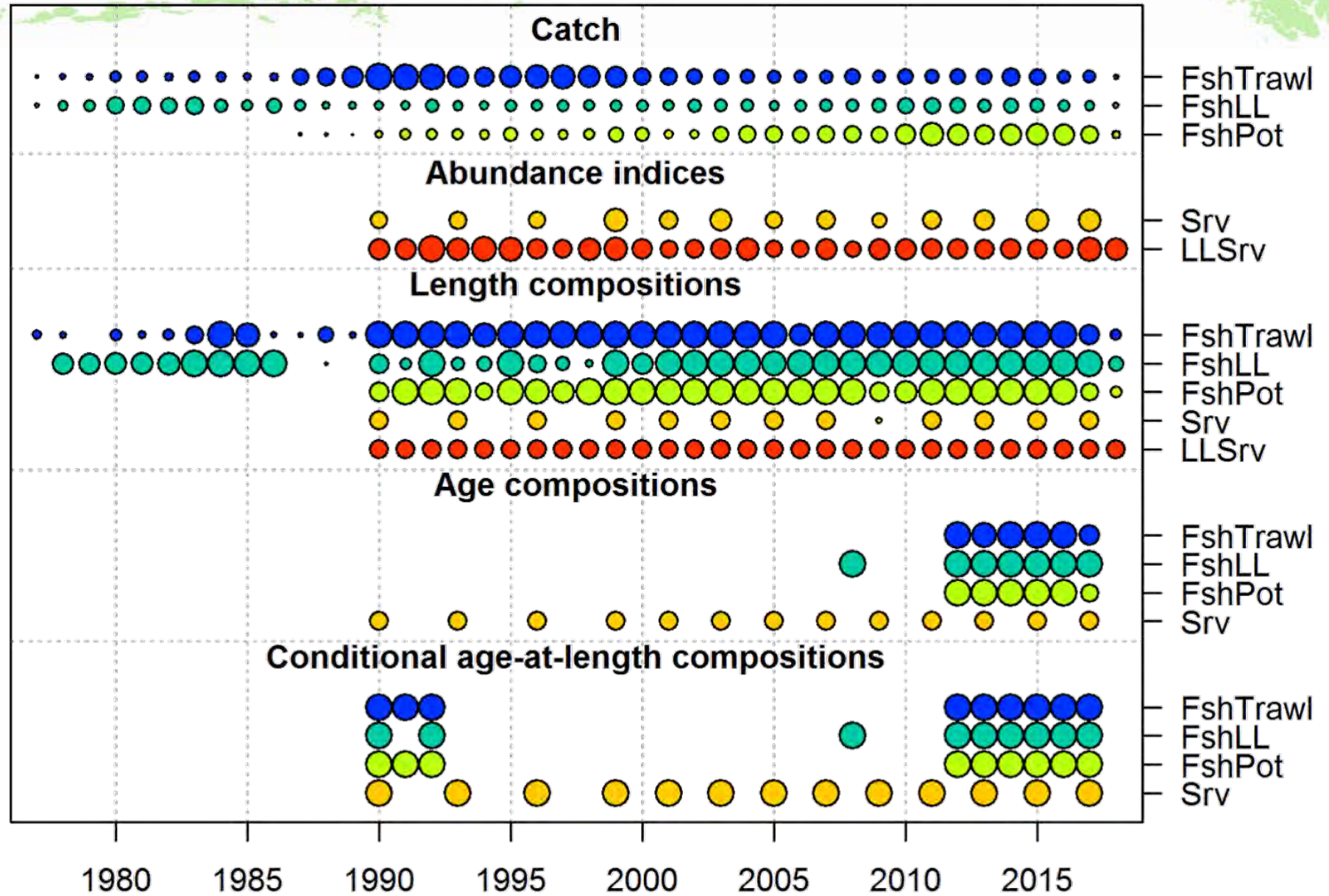


AFSC longline survey mean size

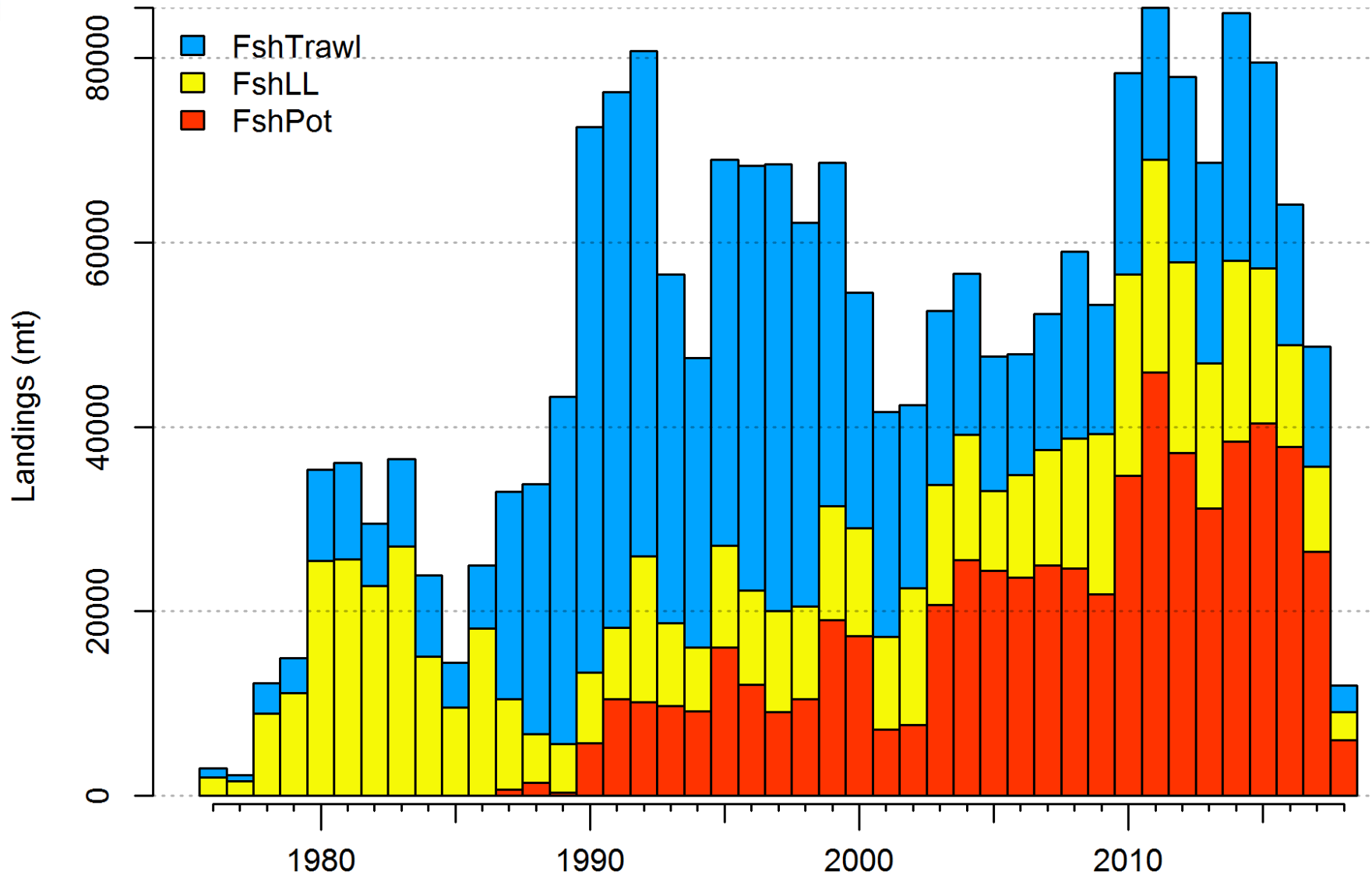




Data extent



Catch

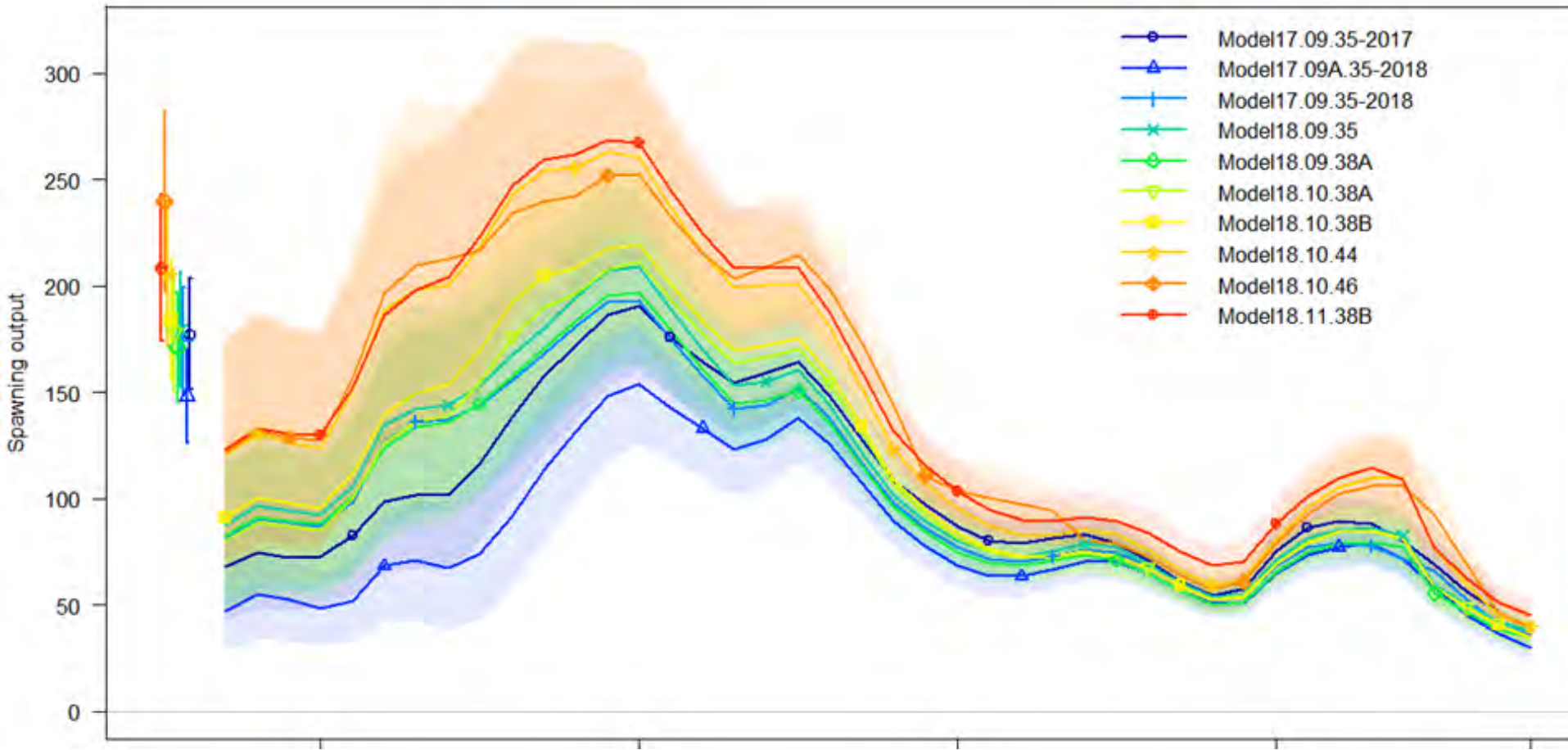




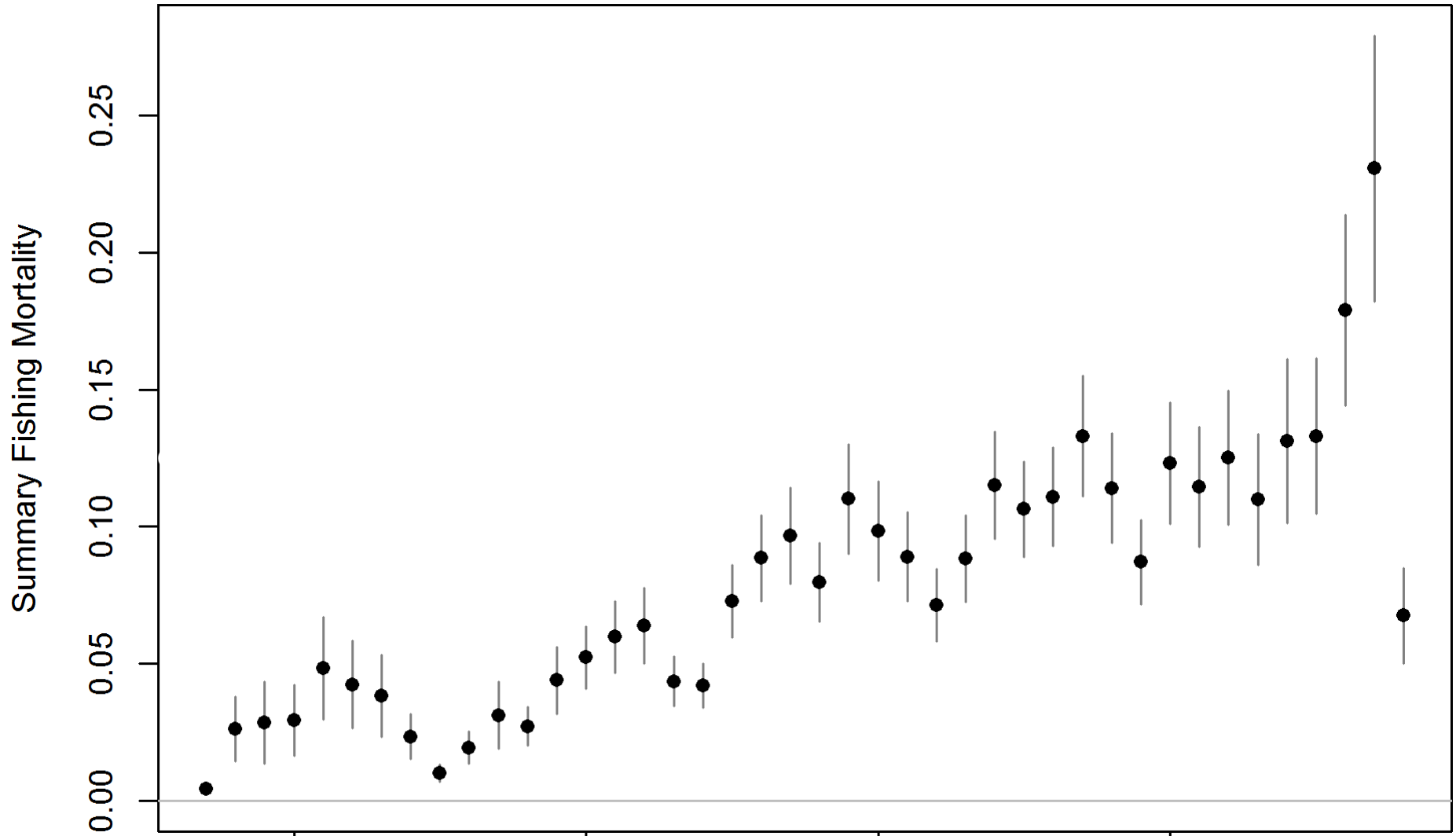
Models configurations

Model	Data	SS version	M- block	Maturity	Marine heatwave index	Selectivity	Prior CV on M	VB prior (l _{inf} /K)
17.09.35	Same as 2017	2.24	15-16	Age-based		Length-based	0.10	Uniform
18.09.35	Same as 2017	3.30	14-16	Age-based		Length-based	0.10	Uniform
18.09.38A	Same as 2017	3.30	14-16	Length-based		Length-based	0.10	Uniform
18.10.38A	No age data pre-2007	3.30	14-16	Length-based		Length-based	0.10	Uniform
18.10.38B	No age data pre-2007	3.30	14-16	Length-based		Length-based	0.10	Normal 99.46/0.197
18.10.44	No age data pre-2007	3.30	14-16	Length-based		Length-based	0.41	Normal 99.46/0.197
18.10.46	No age data pre-2007	3.30	NA	Length-based	✓	Length-based	0.41	Normal 99.46/0.197
18.11.38B	No age data	3.30	14-16	Length-based		Length-based	0.10	Normal 99.46/0.197

Spawning biomass



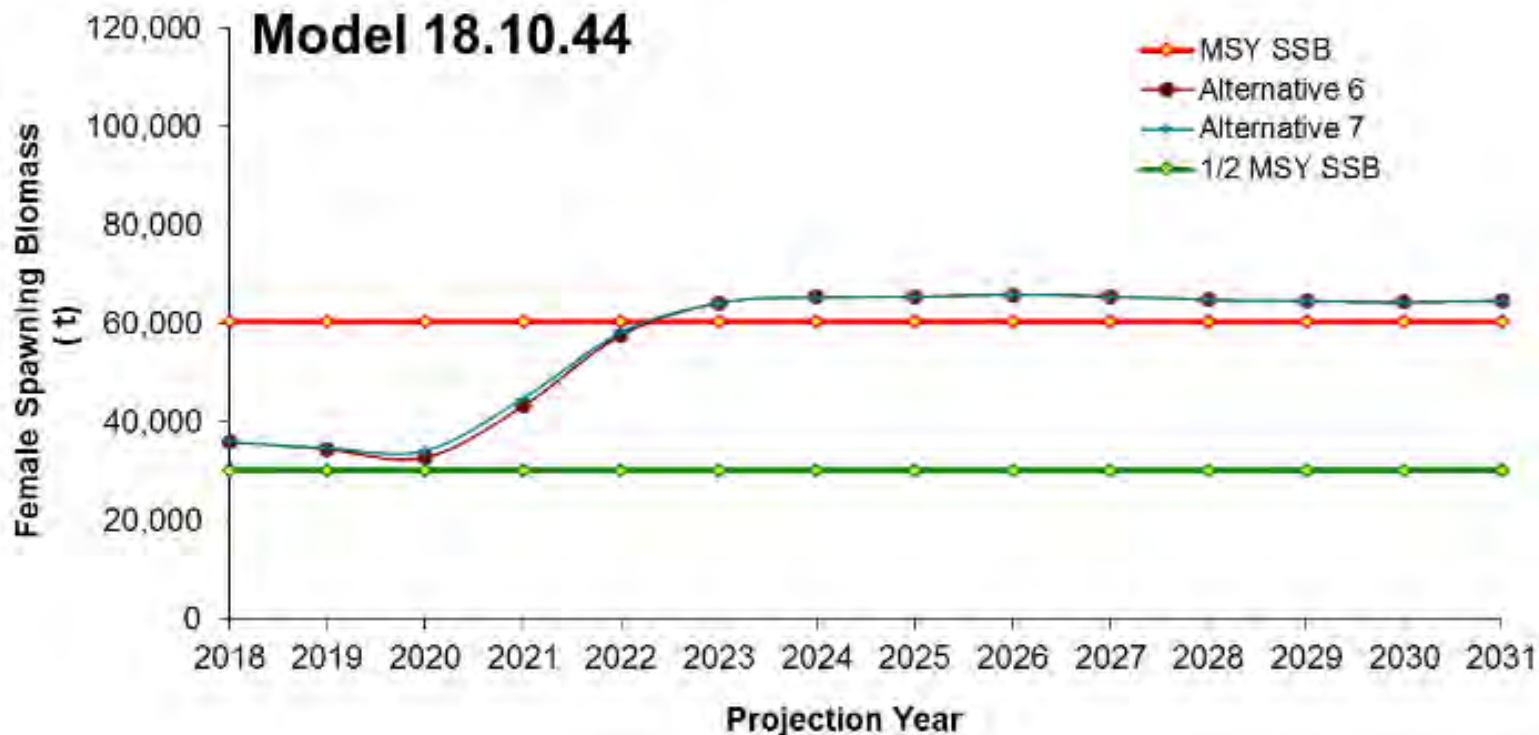
Fishing mortality



Projections



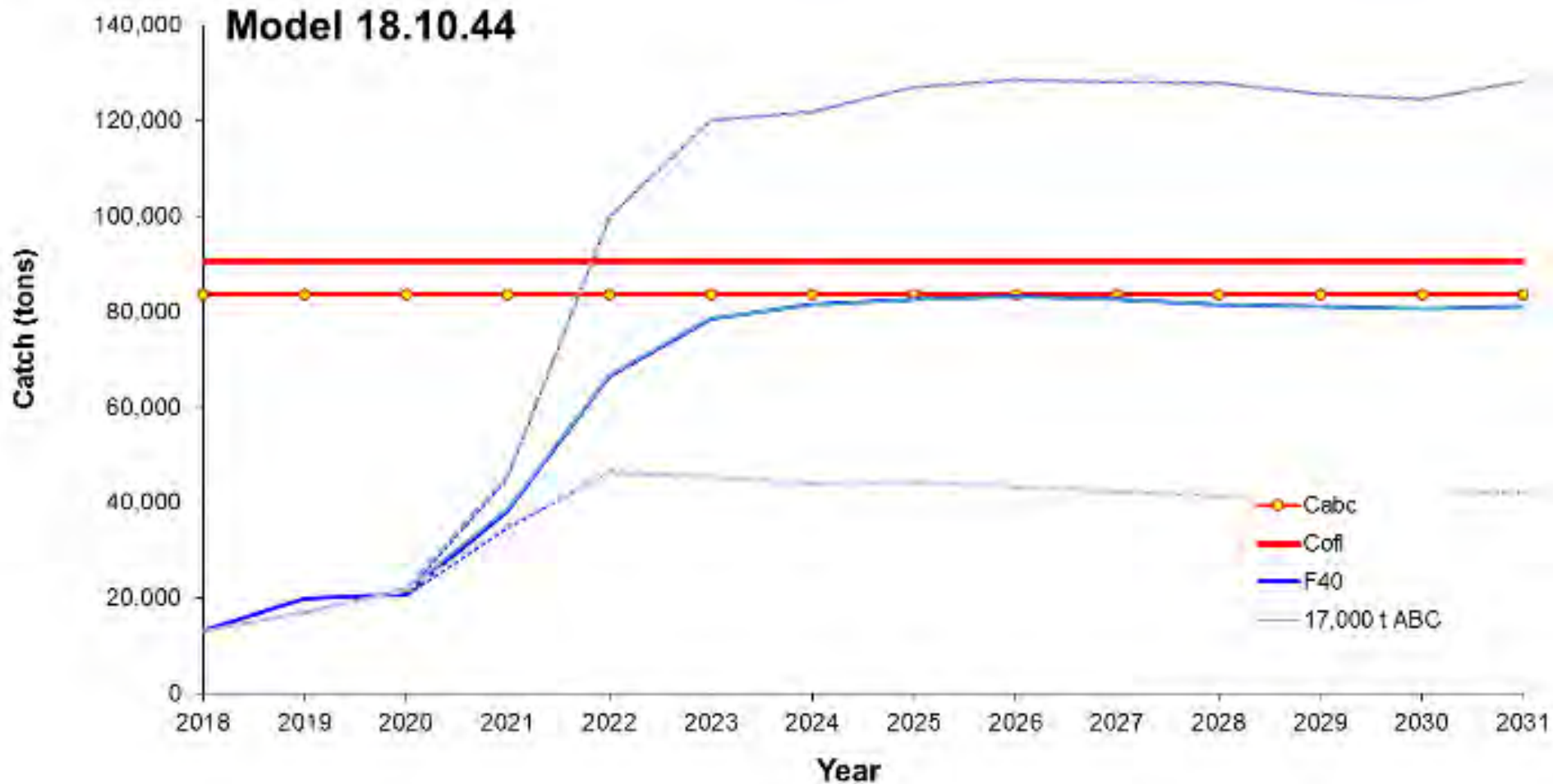
- Above $B_{17.5\%}$ in 2018 and 2020
- Above $B_{35\%}$ by 2028 and 2030
- Not overfished, not overfishing...



Projections



Adjustment of 2019 catch from 19,665 t to 17,000 t to stabilize biomass





GOA Pacific cod

Team discussions

Further ABC reductions?

- Consistent with last year's recommendation as adopted by the SSC
- Assurance that spawning biomass above 20% of unfished

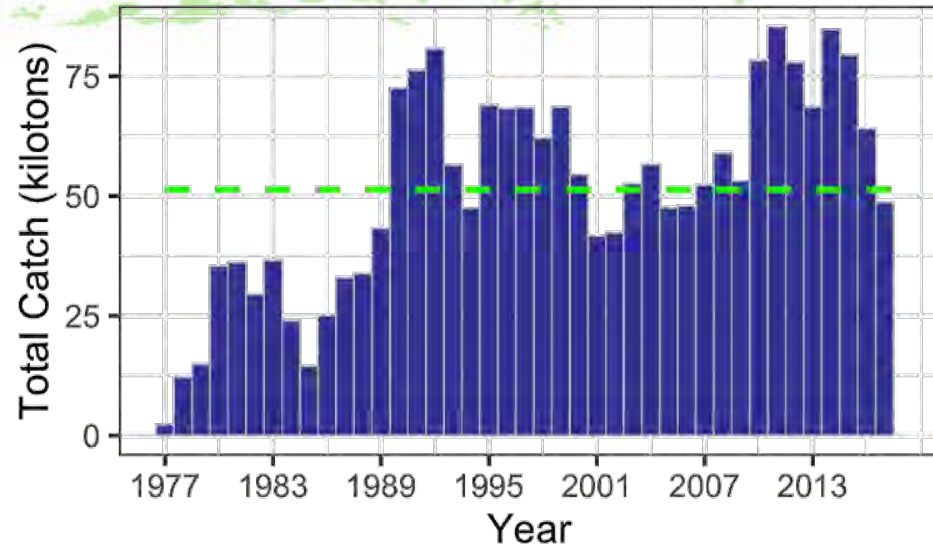
The Team recommended that the author investigate the role that fishery catch has had on the decline in abundance. That is, project estimated historical recruits forward without fishing mortality.

- This should help discern the extent that the stock declines are the result of environmental conditions versus the impact of fishing.

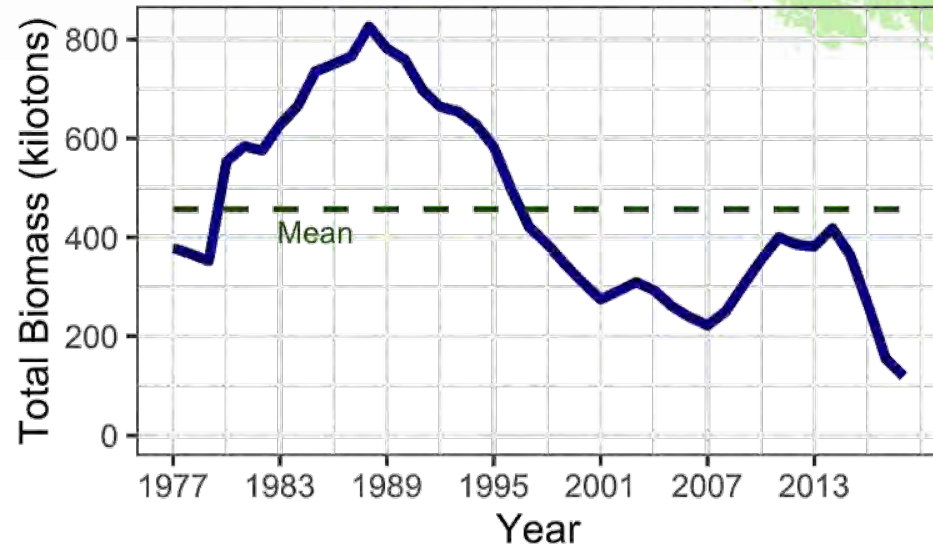
GOA Pacific cod



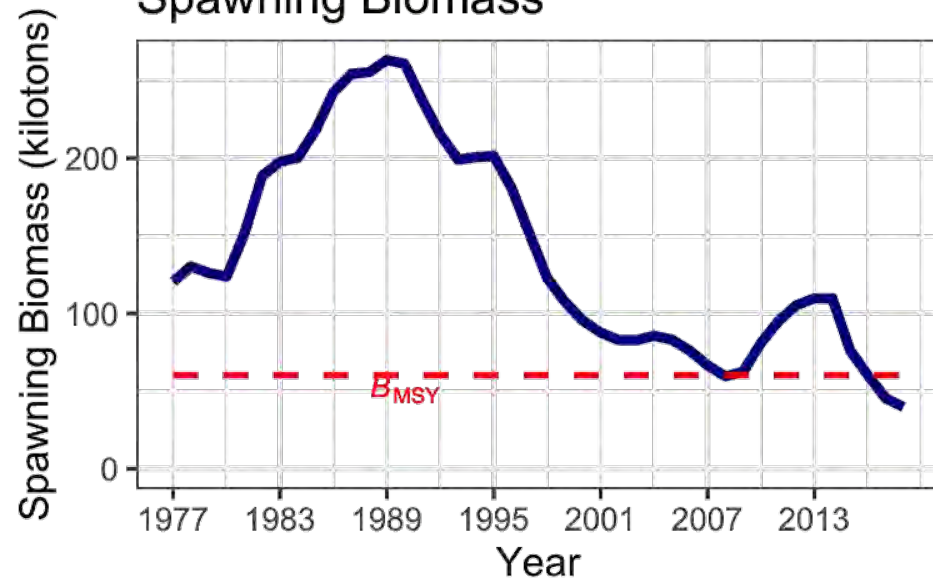
Total Catch



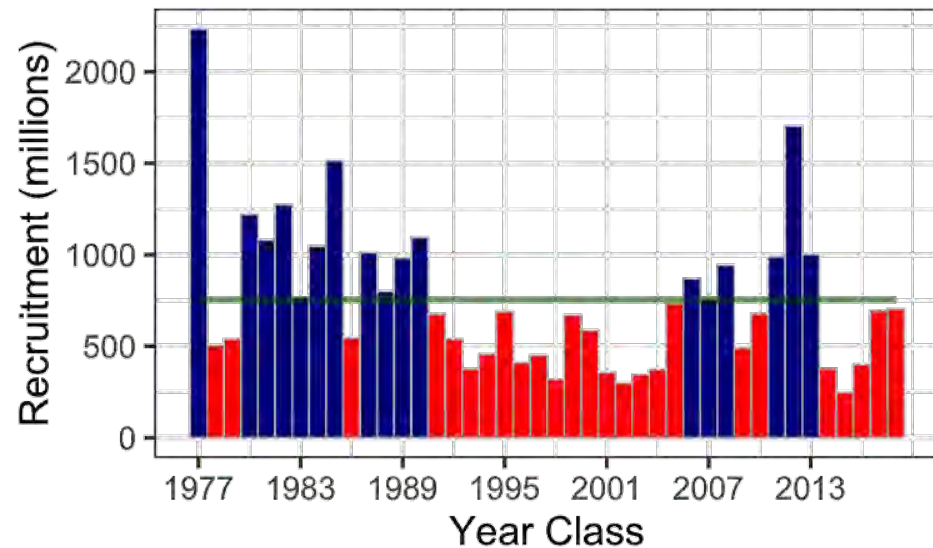
Total Biomass



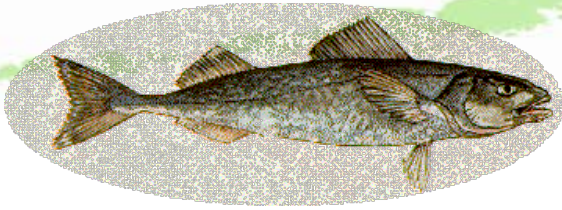
Spawning Biomass



Age 0 Recruitment



3. Sablefish



Species	2018 Catch	2018	2019	Change
Pollock	154,286	170,265	144,623	down 25,642 (15%)
Pacific Cod	9,595	18,000	17,000	down 1,000 (6%)
Sablefish	11,716	11,505	11,571	up 66 (1%)
Flatfish	22,053	114,712	116,562	up 1,850 (2%)
Arrowtooth flounder	2,045	150,945	145,841	down 5,104 (3%)
Rockfish	33,425	47,067	46,946	down 121 (0%)
Atka mackerel	1,431	4,700	4,700	same (0%)
Skates	2,786	7,804	7,804	same (0%)
Other Species	3,616	11,927	14,460	up 2,533 (21%)
Total	240,953	536,925	509,507	down 27,418 (5%)

2018 sablefish assessment overview

Sablefish



- Maximum permissible ABC way up
- Author's ABC 2019 = ABC 2018 (-45%)
 - ♦ Provides 12 reasons to rationalize
- Risk-table applied
- Also Ecosystem and Socioeconomic Profile (ESP)

New data

Catch:

- ◆ Updated catch for 2017
- ◆ New 2018-2020 estimates

Relative abundance:

- ◆ 2018 Longline **survey**
- ◆ 2017 Longline **fishery**

Ages:

- ◆ 2017 longline survey, 2017 fixed gear fishery

Lengths:

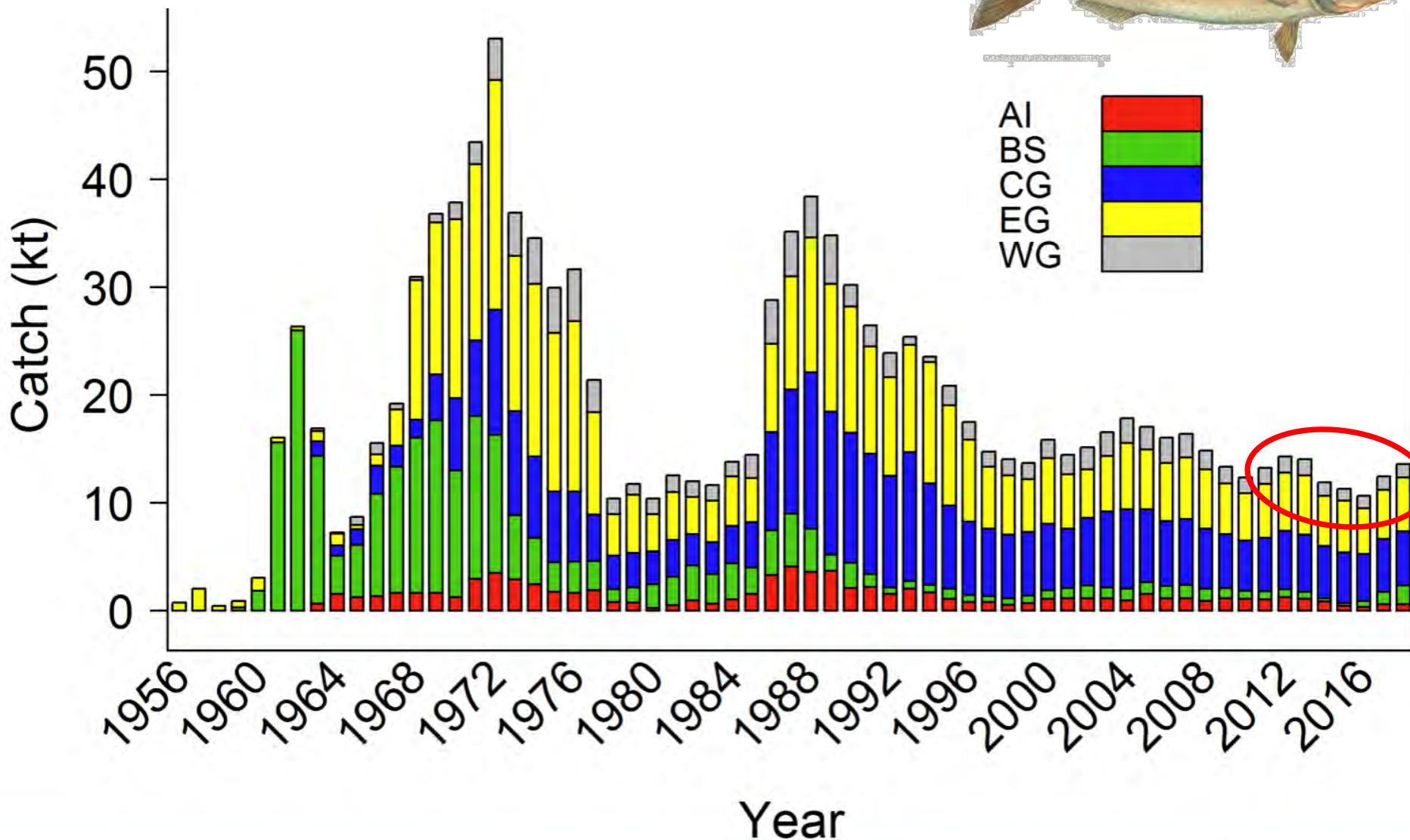
- ◆ 2018 longline survey,
- ◆ 2017 fixed gear fishery, and
- ◆ 2017 trawl fishery

Sablefish



Sablefish Catch by Area

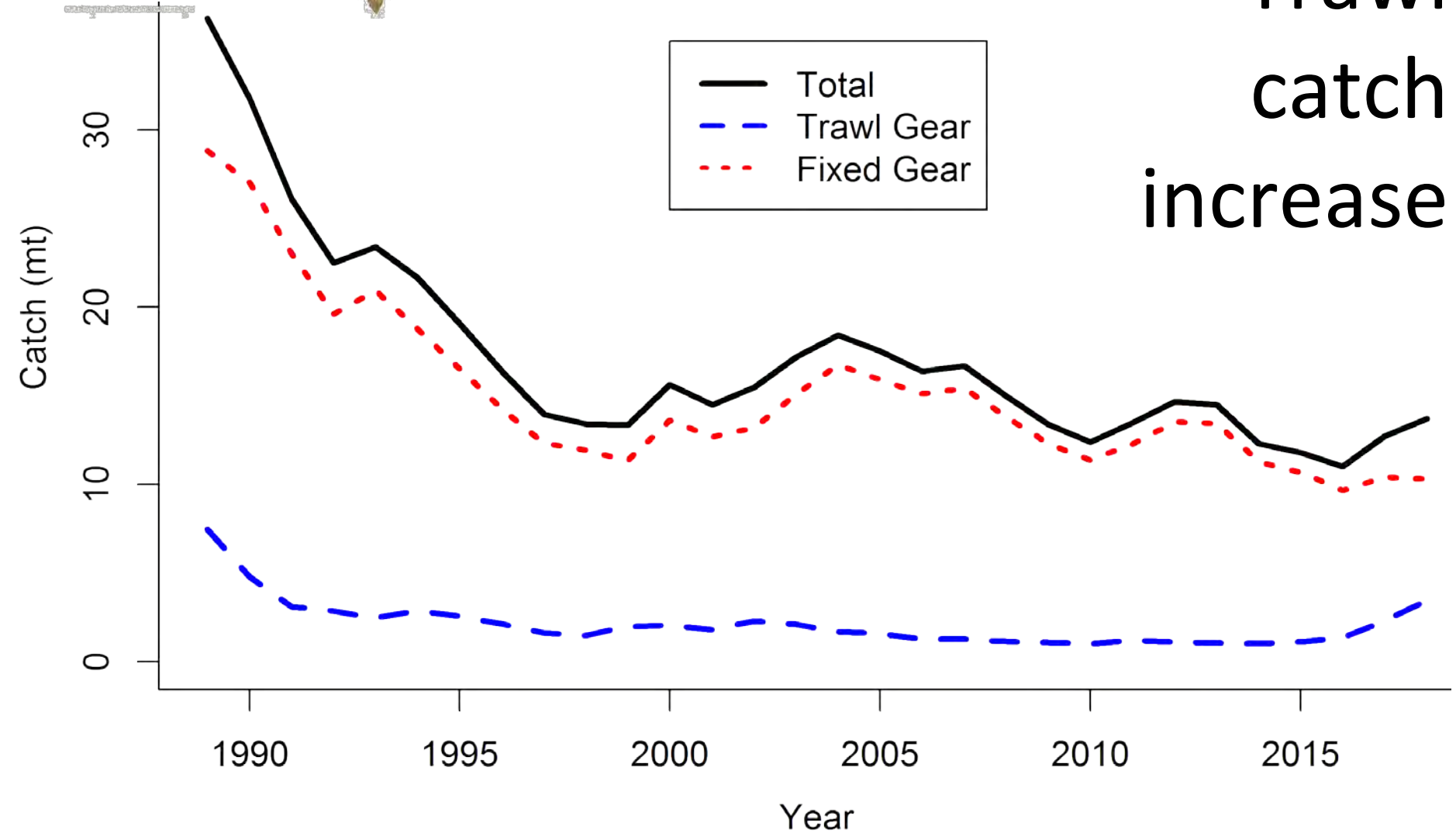
Sablefish



Sablefish



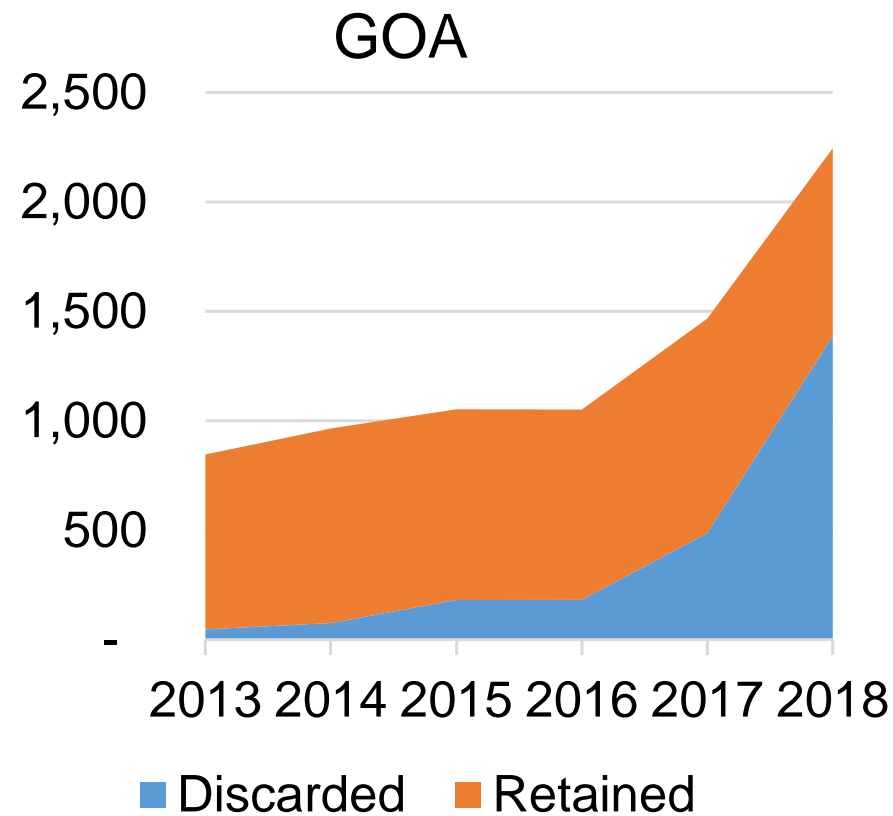
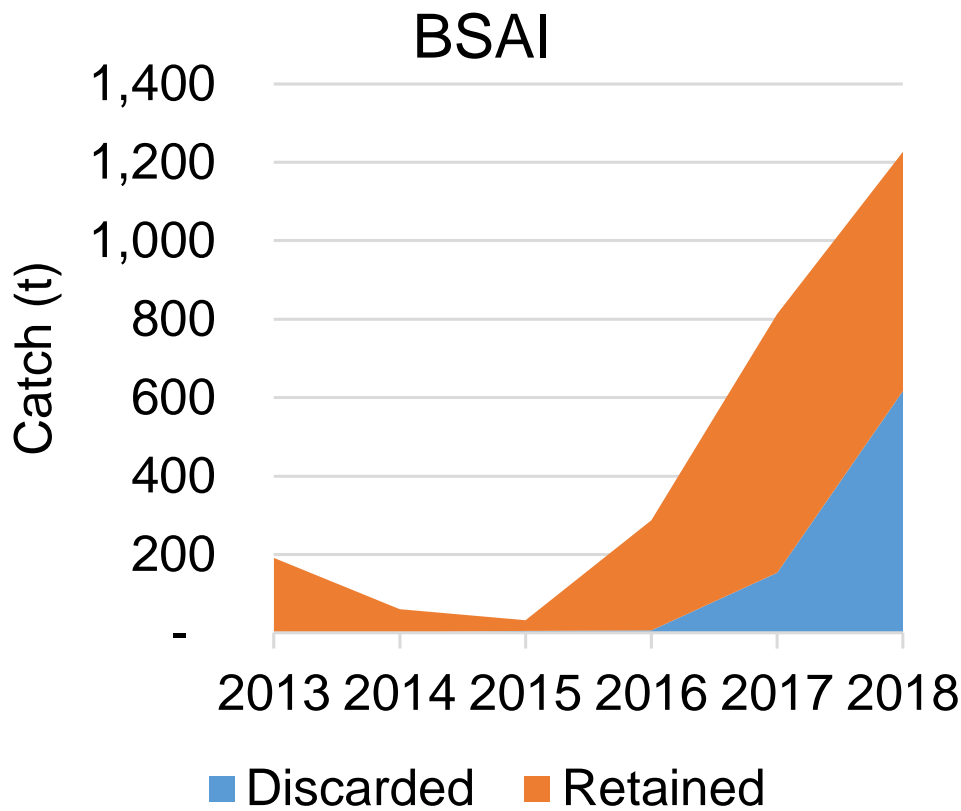
Sablefish Trawl catch increase



Sablefish

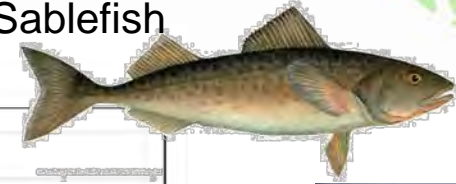


Bycatch in trawl fishery

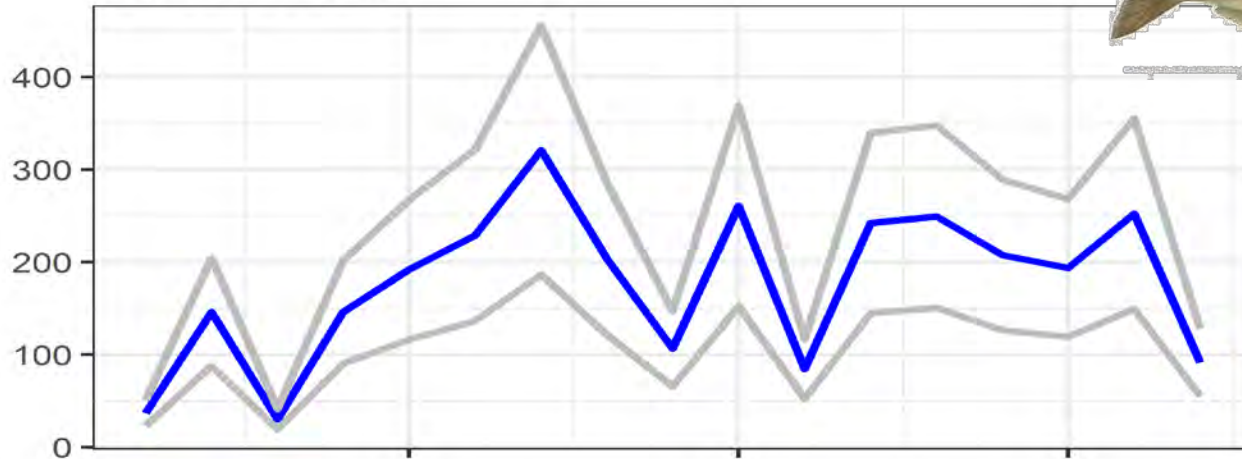


Depredation by whales in fishery

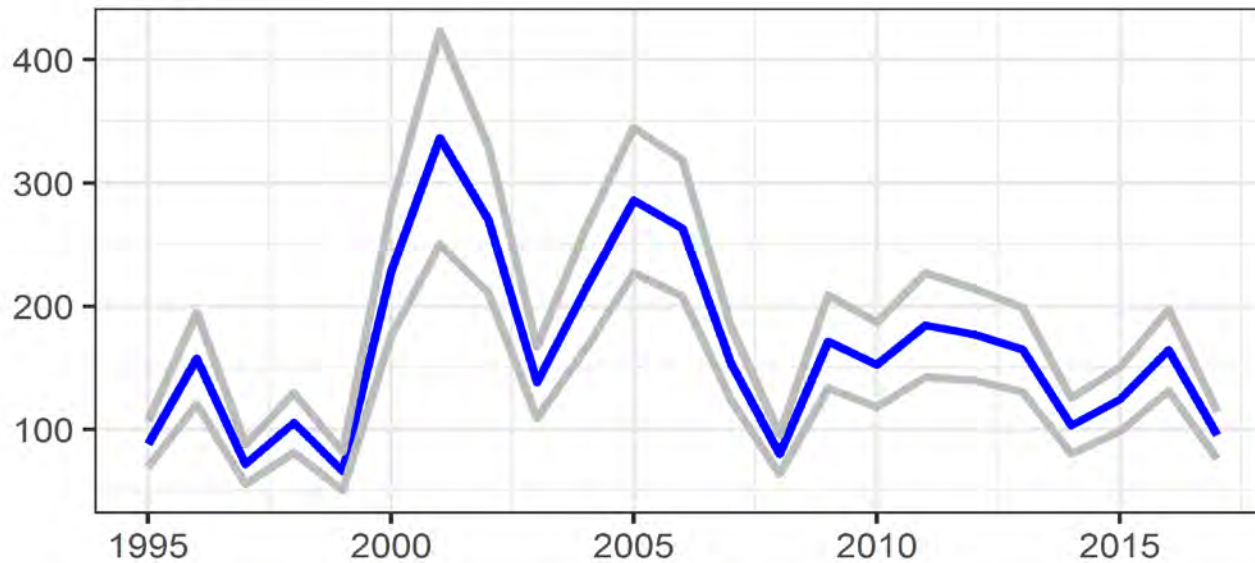
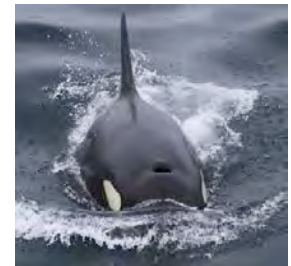
Sablefish



Sperm whale



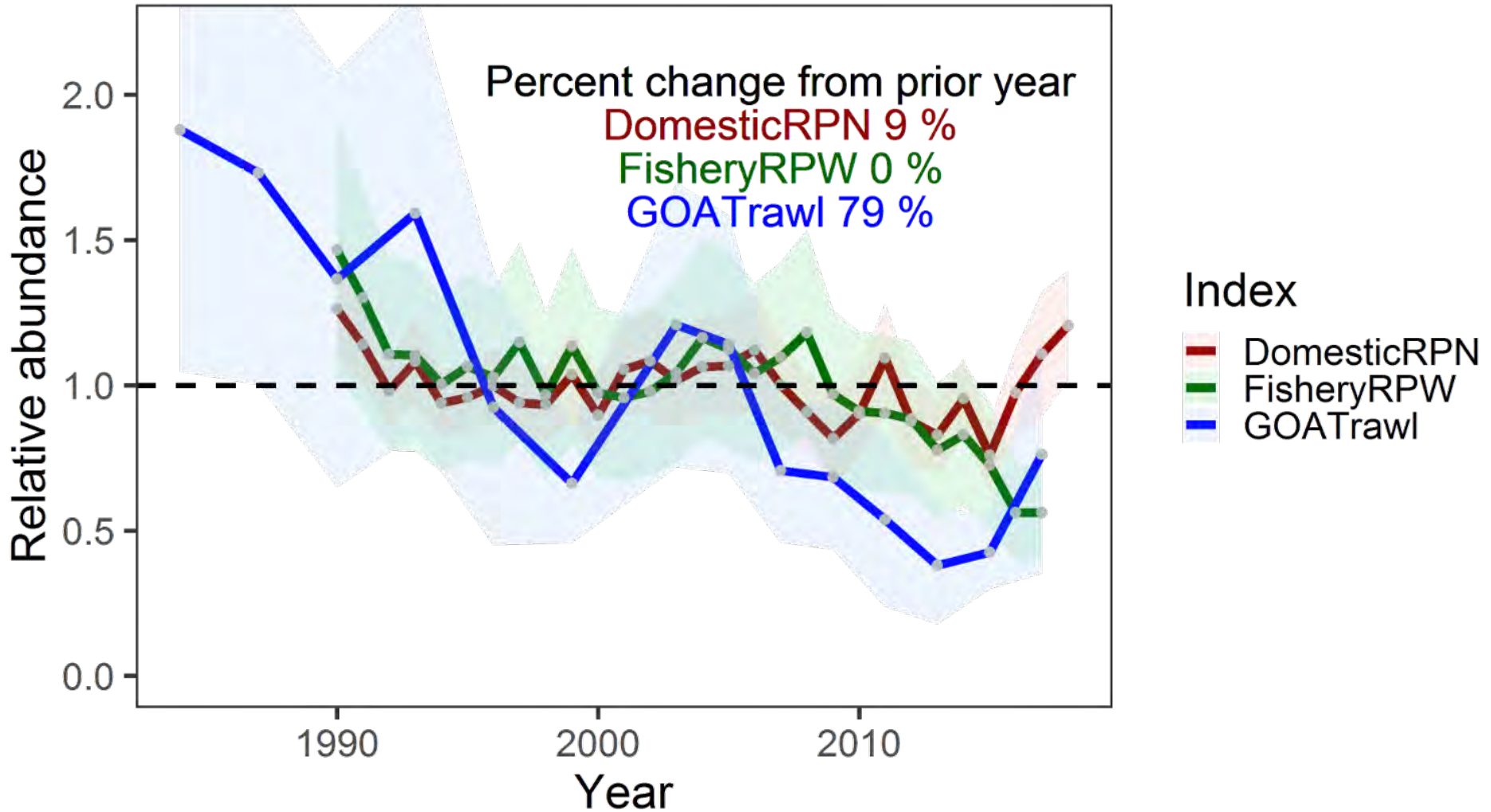
Orca



Sablefish



Sablefish abundance indices

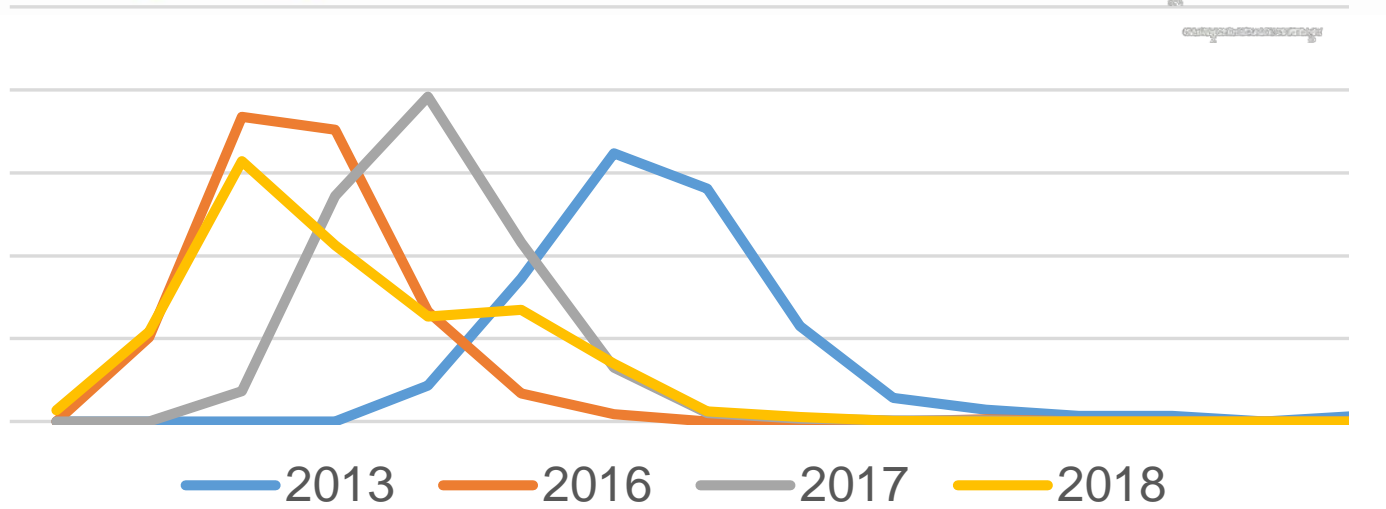


Bycatch in trawl fishery

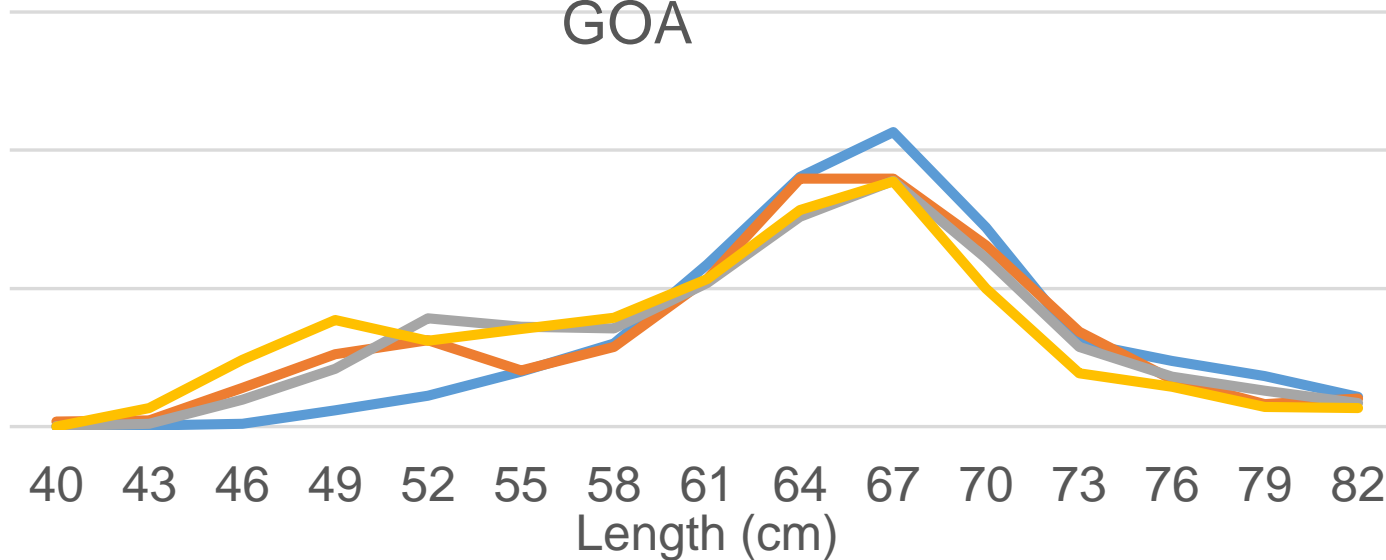
Sablefish



BSAI

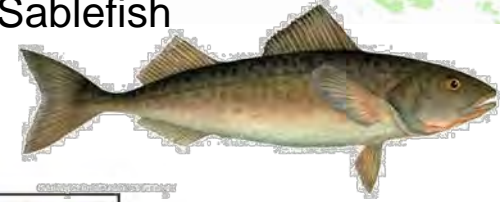


GOA

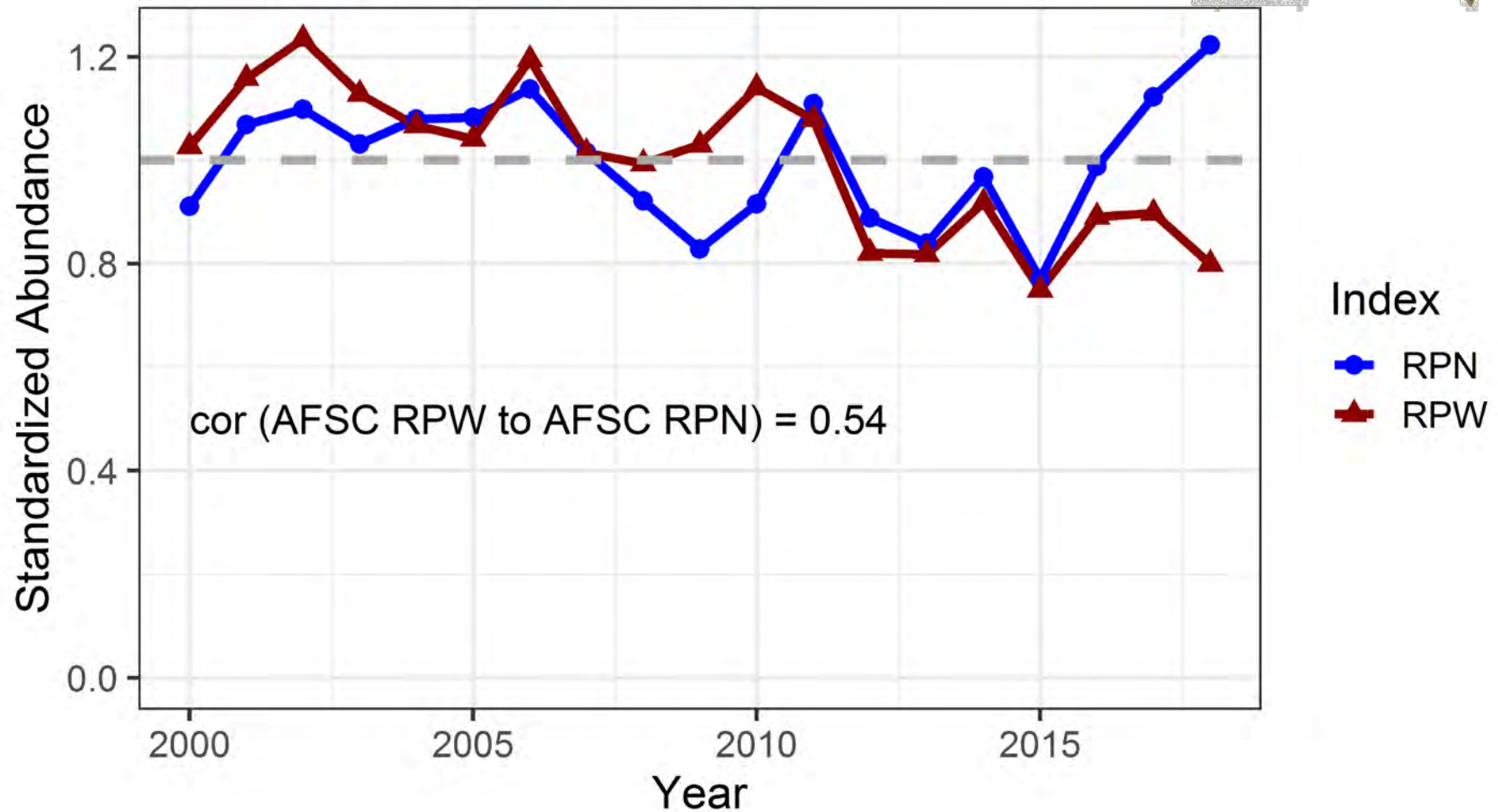


Sablefish survey CPUE (wt vs number)

Sablefish

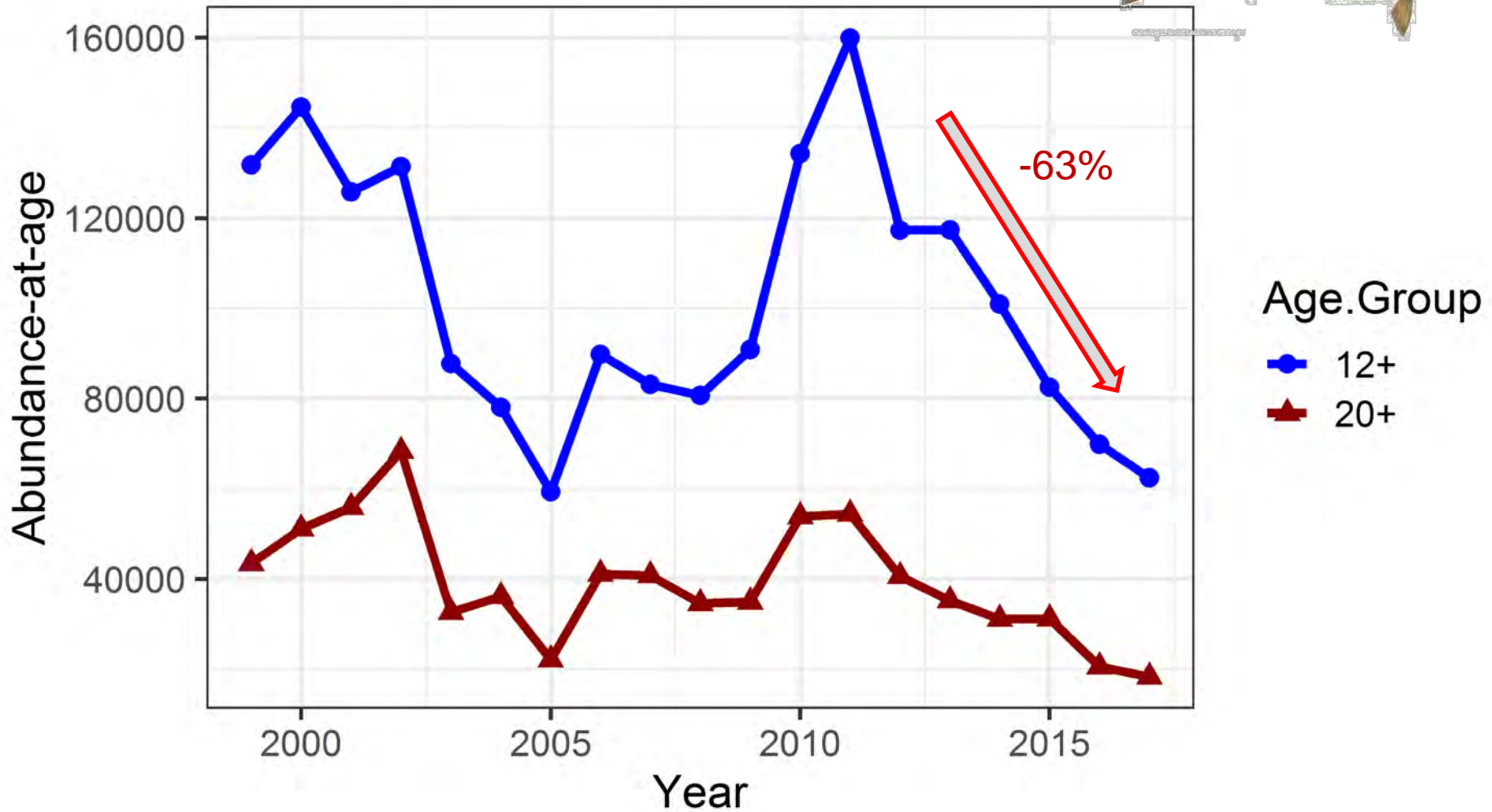


RPN and RPW comparison



Apparent abundance of older fish

Sablefish

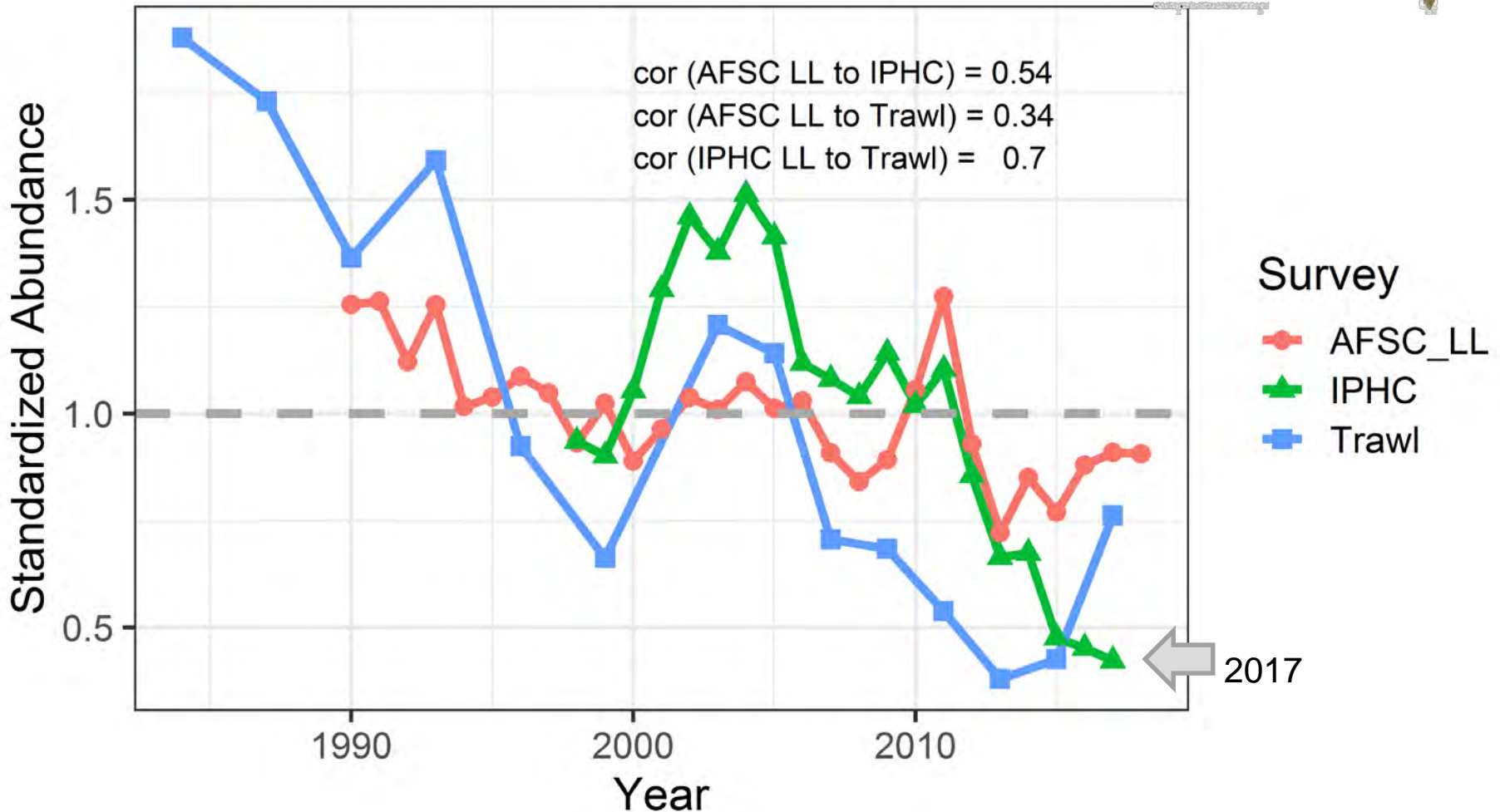


Survey not in the model (IPHC)

Sablefish

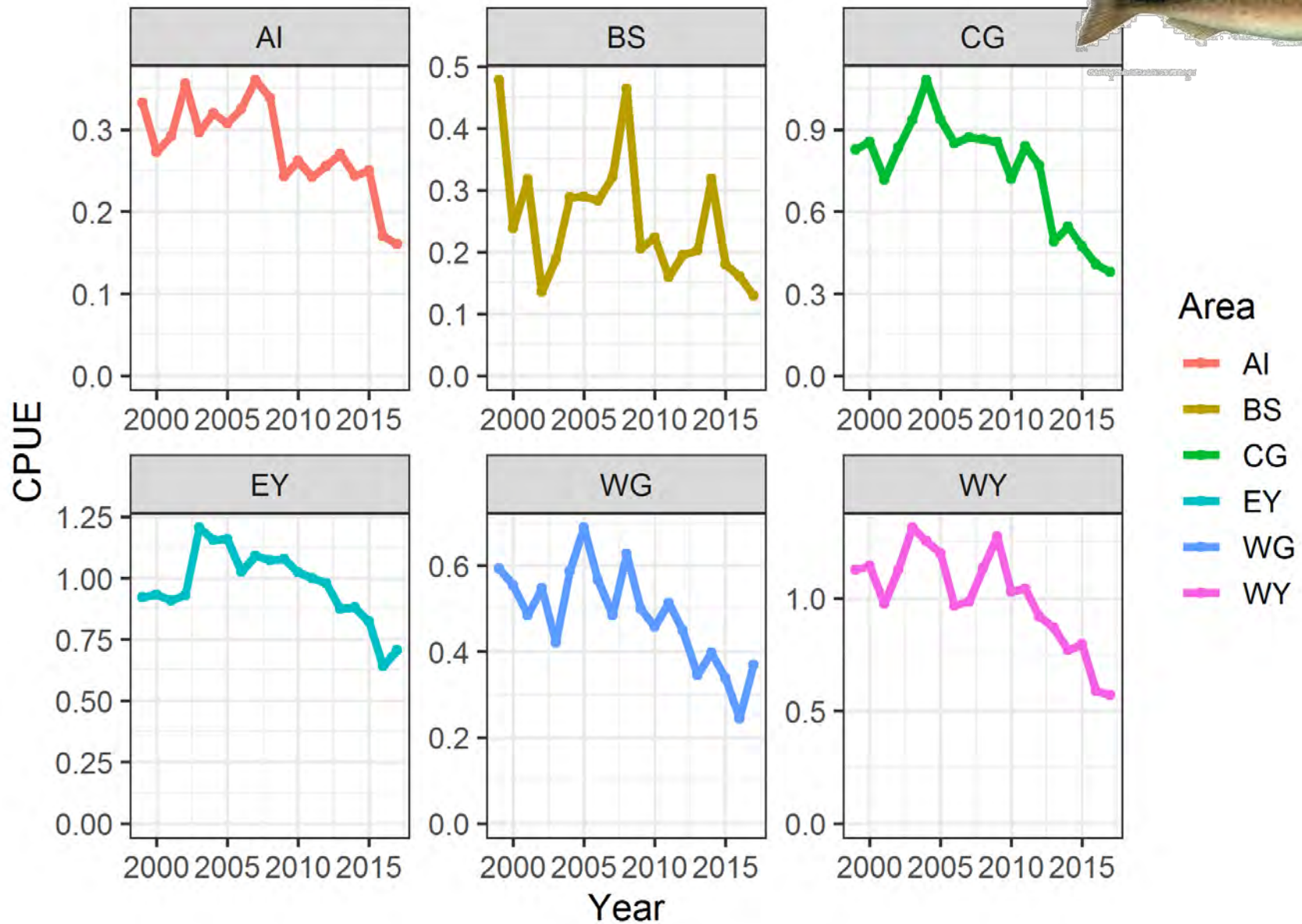


Gulf of Alaska survey comparison



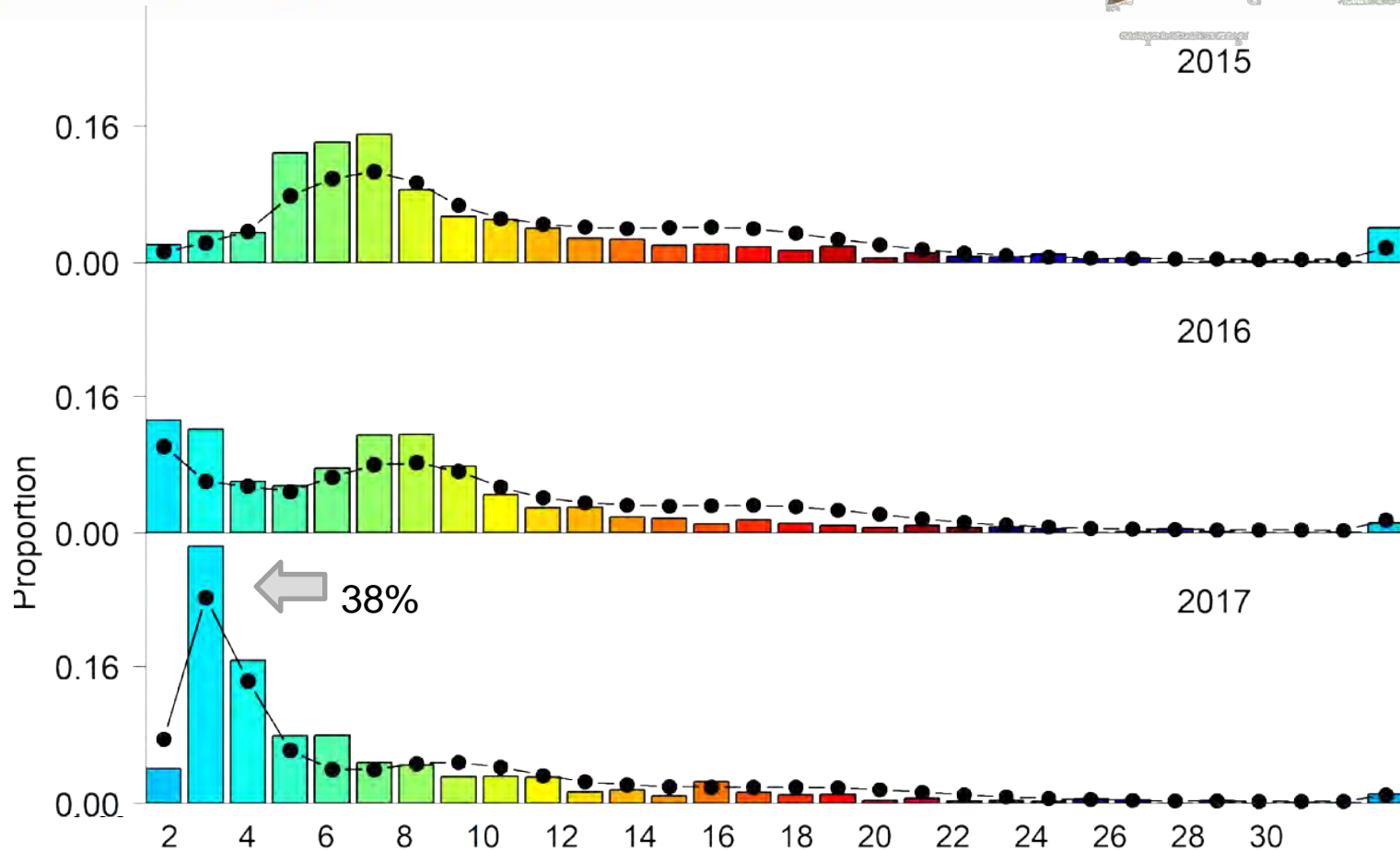
Fishery cpue by area

Sablefish



Longline survey ages

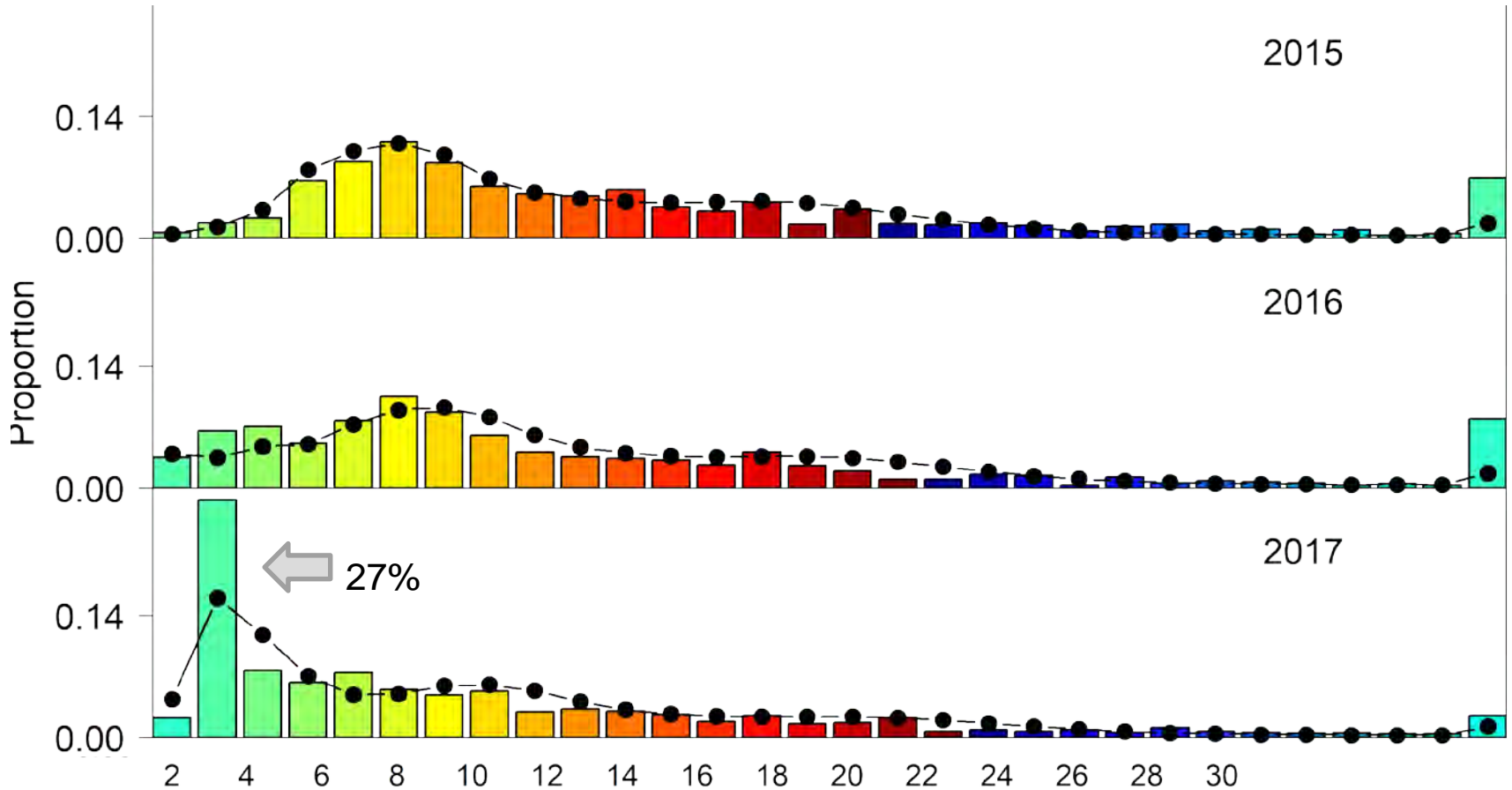
Sablefish



Sablefish



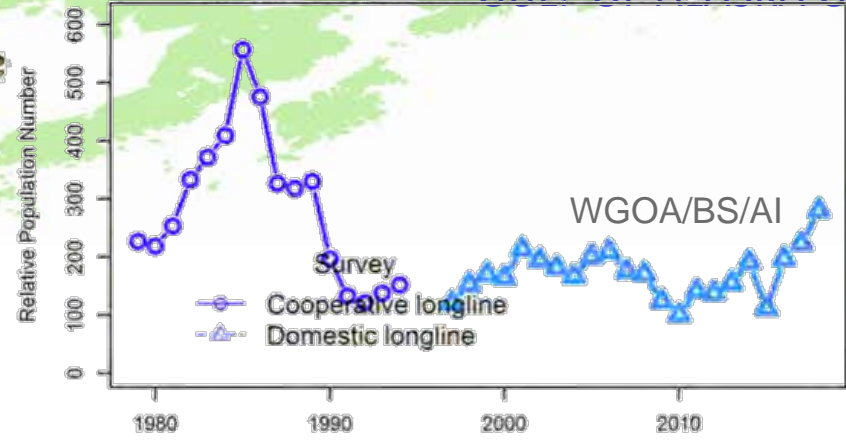
Fixed gear fishery ages



Sablefish

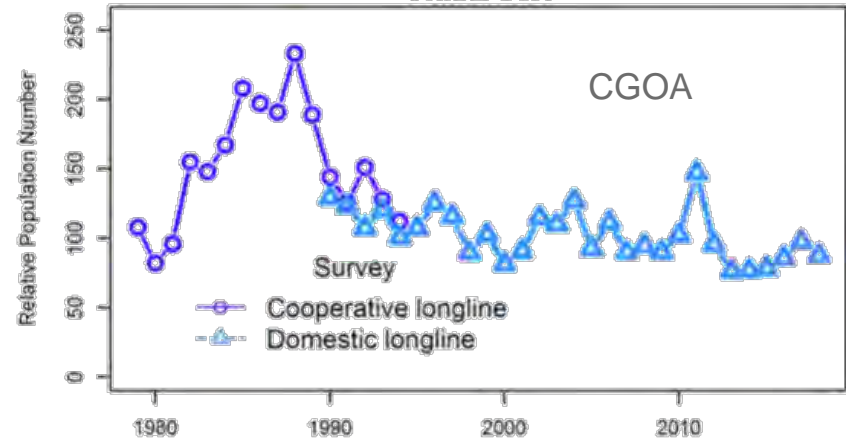


Western GOA, Aleutian Islands, and Bering Sea

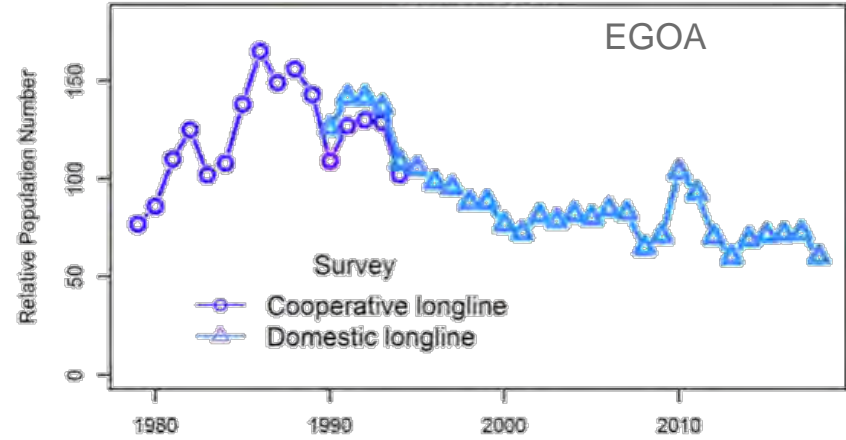


LL Survey RPNs

Central GOA



Eastern GOA

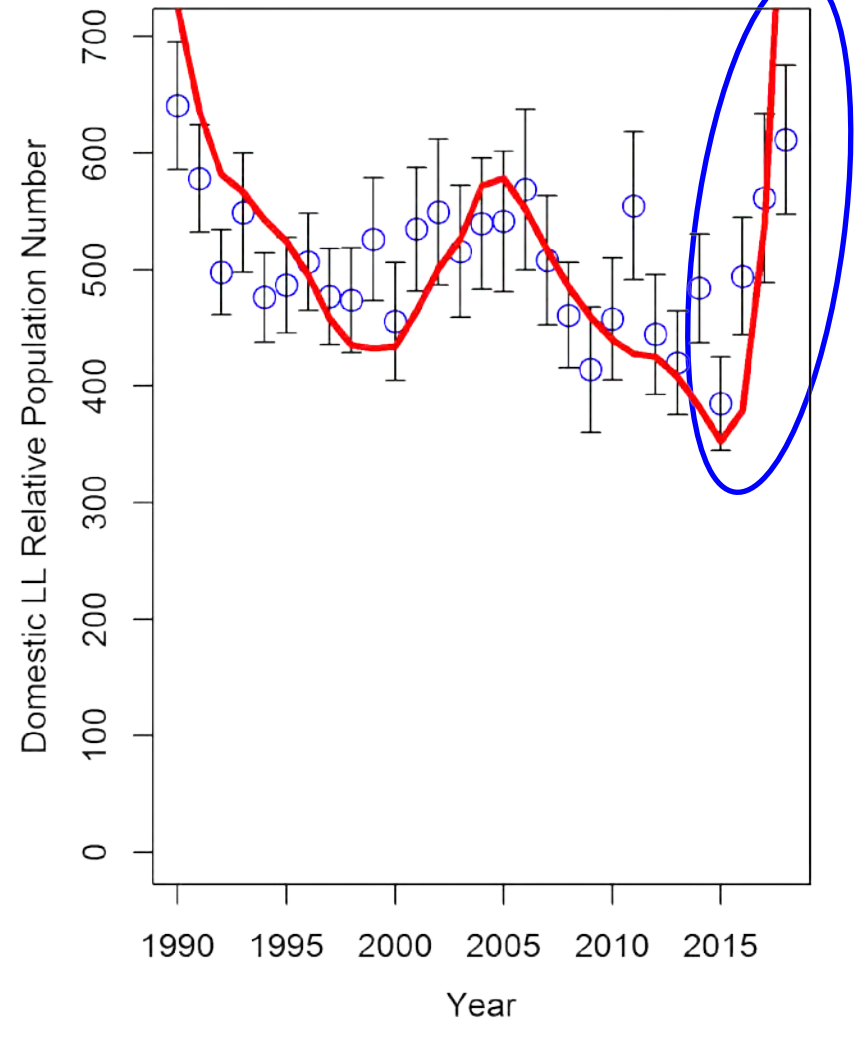
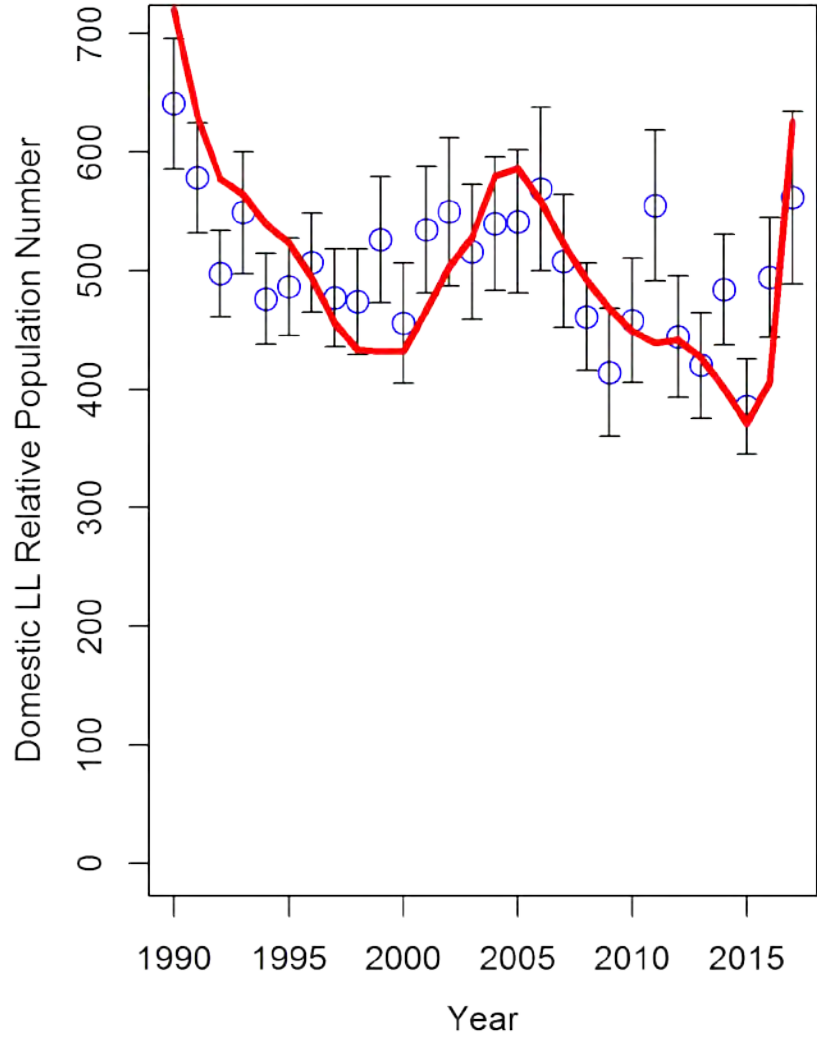




Sablefish survey fit, last yr vs this yr

2017

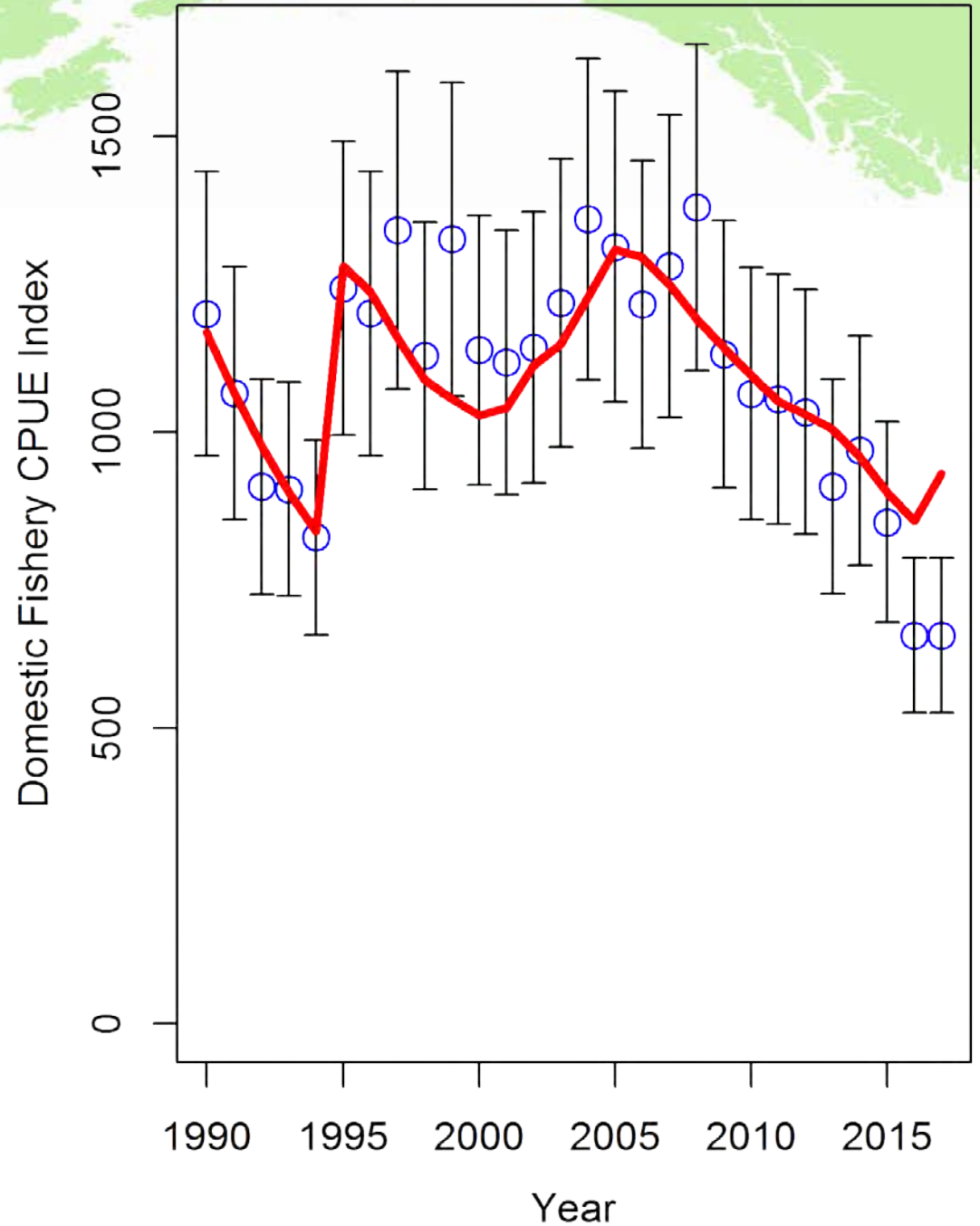
2018



Sablefish

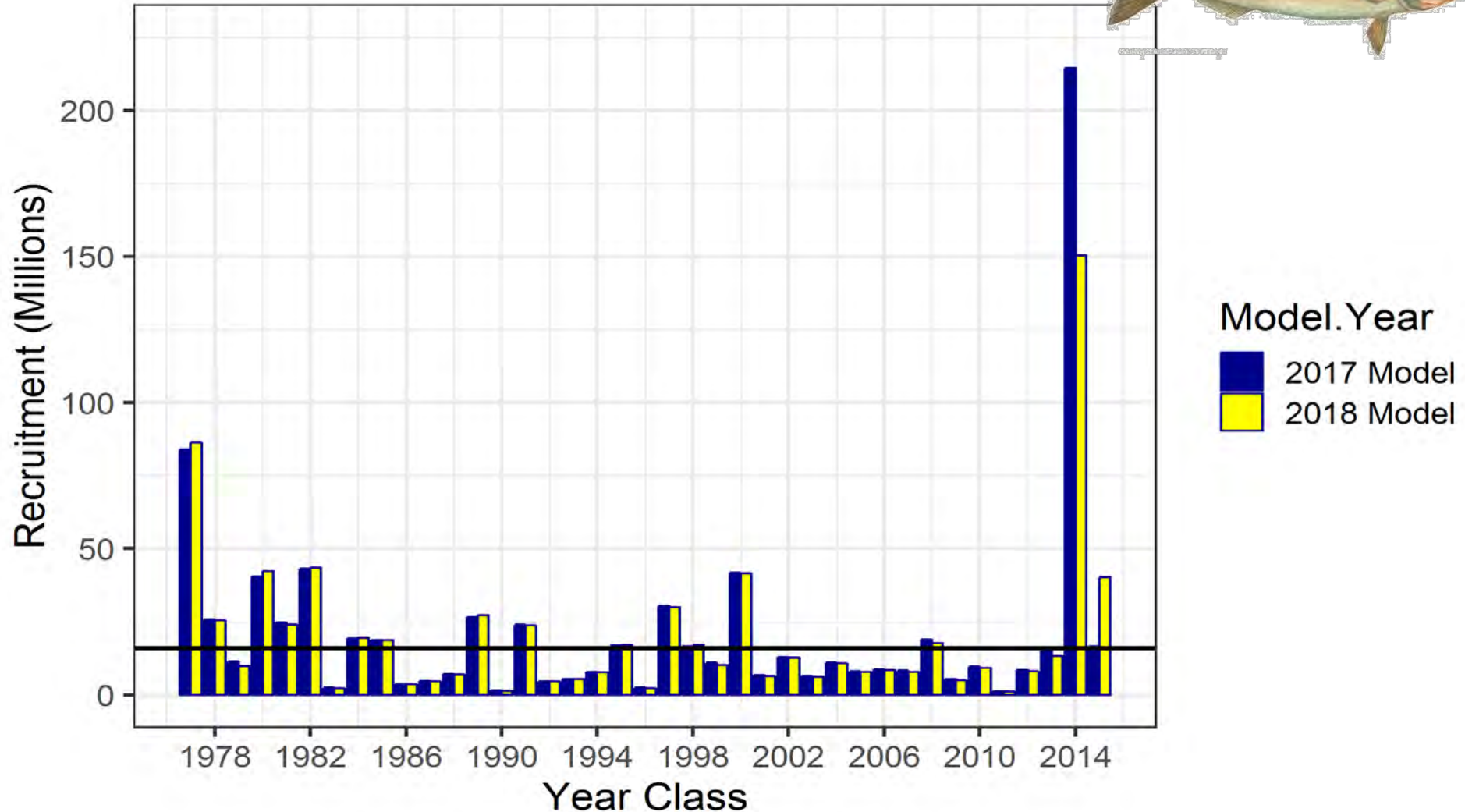


Fit to fishery
CPUE



Model recruitment estimates

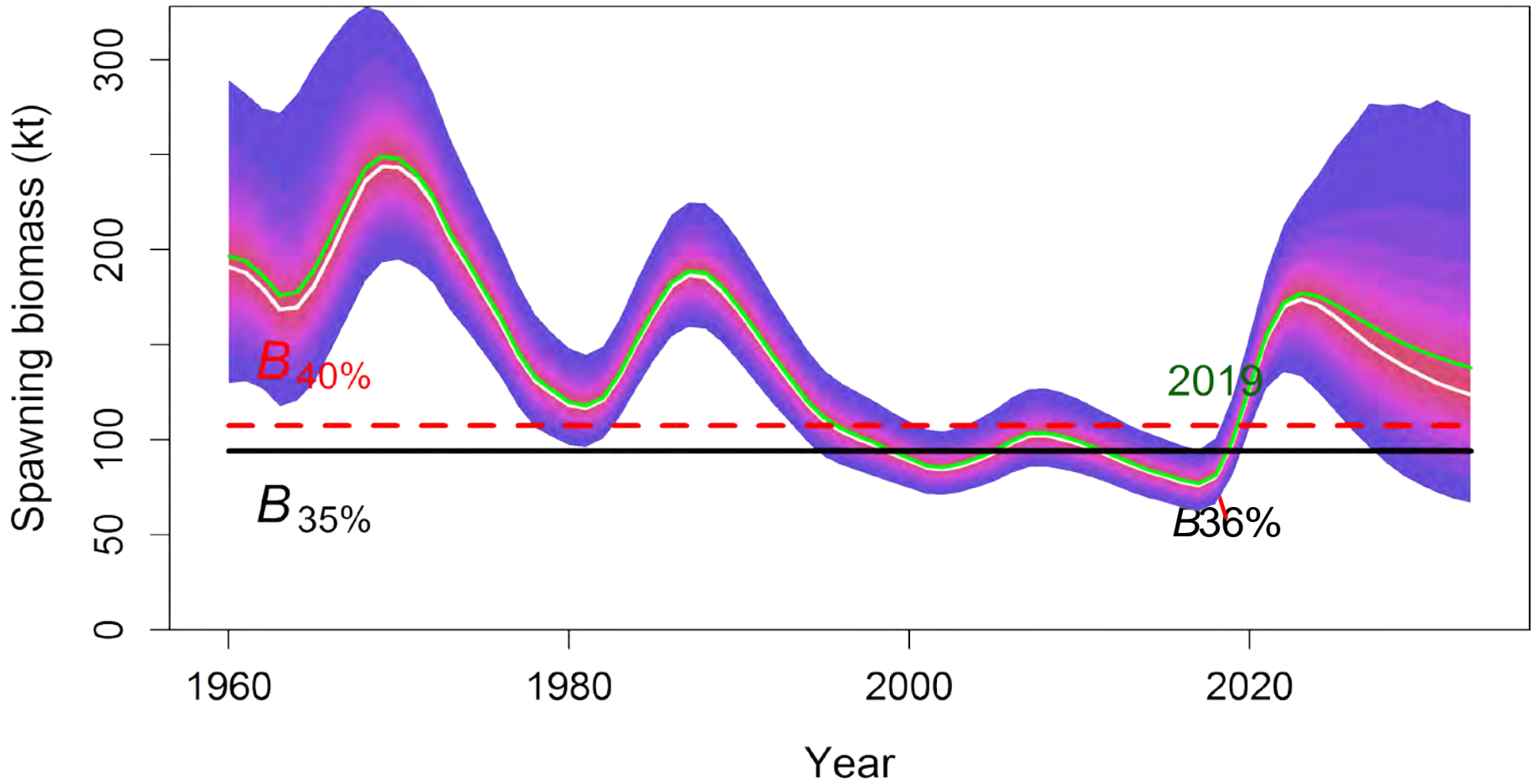
Sablefish



Sablefish



2018 Projection





Risk-table framework **4**

- Reducing ABC from maximum
- Assessment model: **2** (increased concern)
- Population dynamics: **4** (extreme concern)
- Ecosystem: **2** (increased concern)

ABC summary

Sablefish



LL survey RPN up substantially from low in 2015

Fishery CPUE index at time series low in 2016/2017

33% unfished spawning biomass (lower than in 2017)

- Author's ABC 2019 = ABC 2018
- Rebuilding spawning biomass above target is primary goal



Apportionment recommendation

- Continuing with the fixed apportionment

Apportionment Table (before whale depredation adjustments)

Area	2018 ABC	Standard apportionment for 2019 ABC	Recommended fixed apportionment for 2019 ABC*	Difference from 2018
Total	15,380	15,380	15,380	0%
Bering Sea	1,501	3,085	1,501	0%
Aleutians	2,030	2,064	2,030	0%
Gulf of Alaska (subtotal)	11,849	10,231	11,849	0%
Western	1,659	1,877	1,659	0%
Central	5,246	3,978	5,246	0%
W. Yakutat**	1,765	1,506	1,765	0%
E. Yak. / Southeast**	3,179	2,870	3,179	0%

* Fixed at the 2013 assessment apportionment proportions (Hanselman et al. 2012b). ** Before 95:5 hook and line: trawl split shown below.



Discussion in Joint minutes (p. 3)

Teams agreed with the authors' recommendation

- ◆ Keep ABC constant at the 2018 level.
- ◆ Apply updated depredation adjustment
- ◆ Stock appears to remain in Tier 3b in 2018

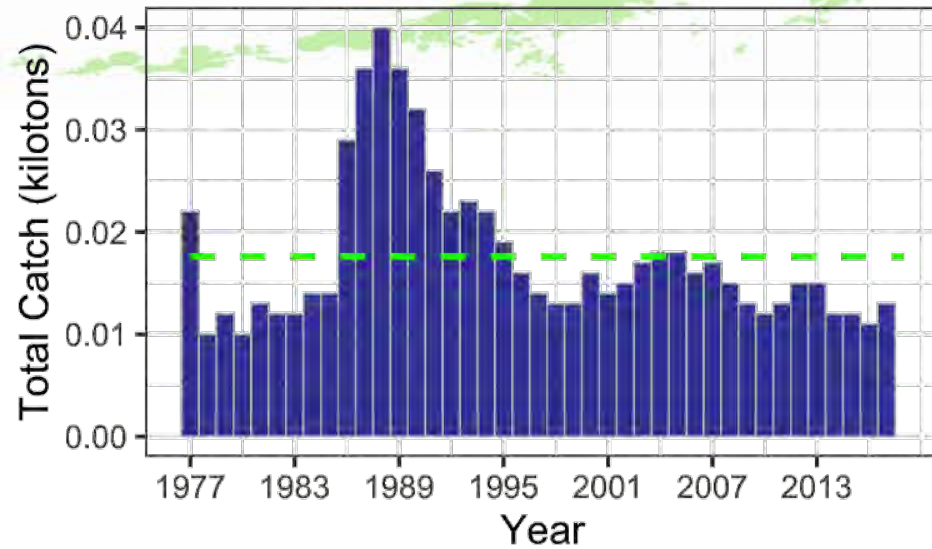
The Teams recommend exploring model fit to the survey RPN and the alternative survey index, RPW,

- ◆ Specifically related to changes in size-at-age or length-weight relationships

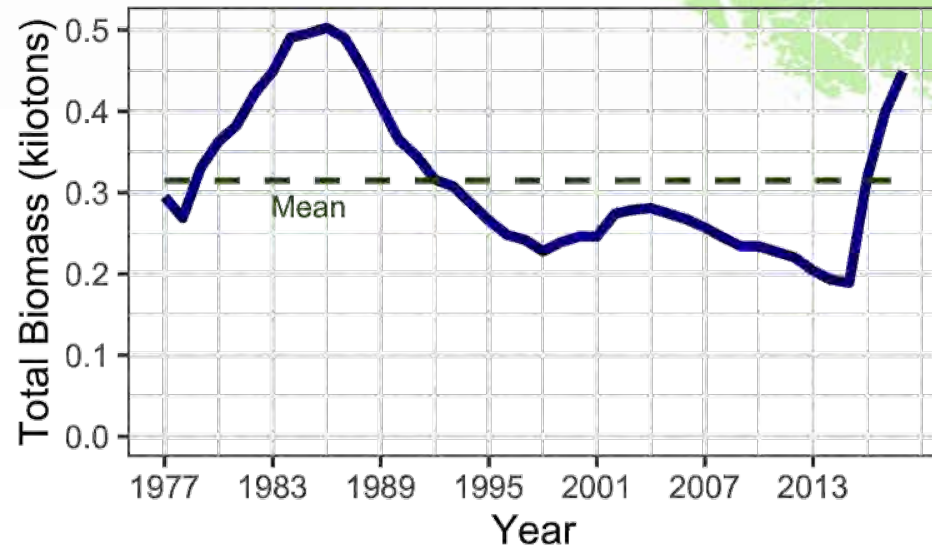
The Teams look forward to seeing the spatial apportionment analysis next year

2018

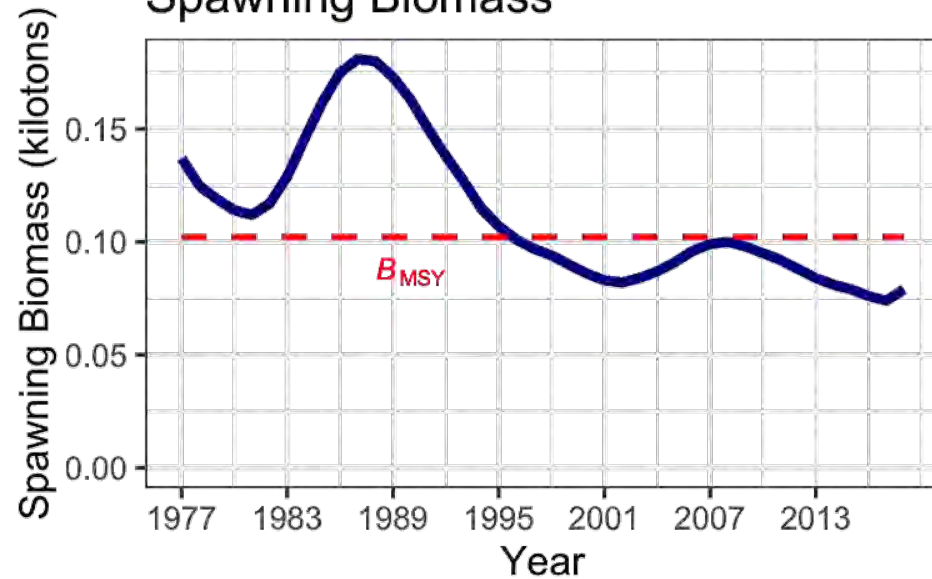
Total Catch



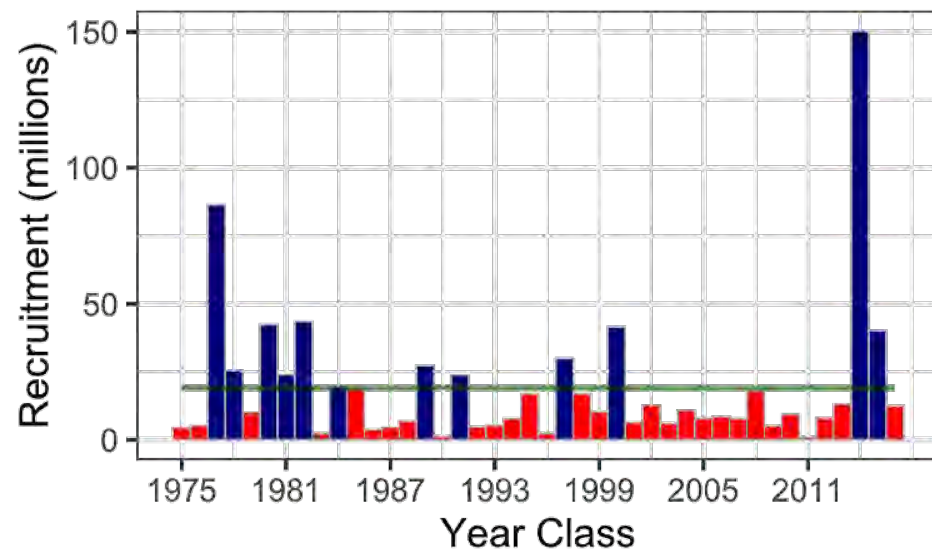
Total Biomass



Spawning Biomass



Age 2 Recruitment



Flatfish ABC Summary



Species	2018 Catch	2018	2019	Change
Pollock	154,286	170,265	144,623	down 25,642 (15%)
Pacific Cod	9,595	18,000	17,000	down 1,000 (6%)
Sablefish	11,716	11,505	11,571	up 66 (1%)
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Flatfish ABC's

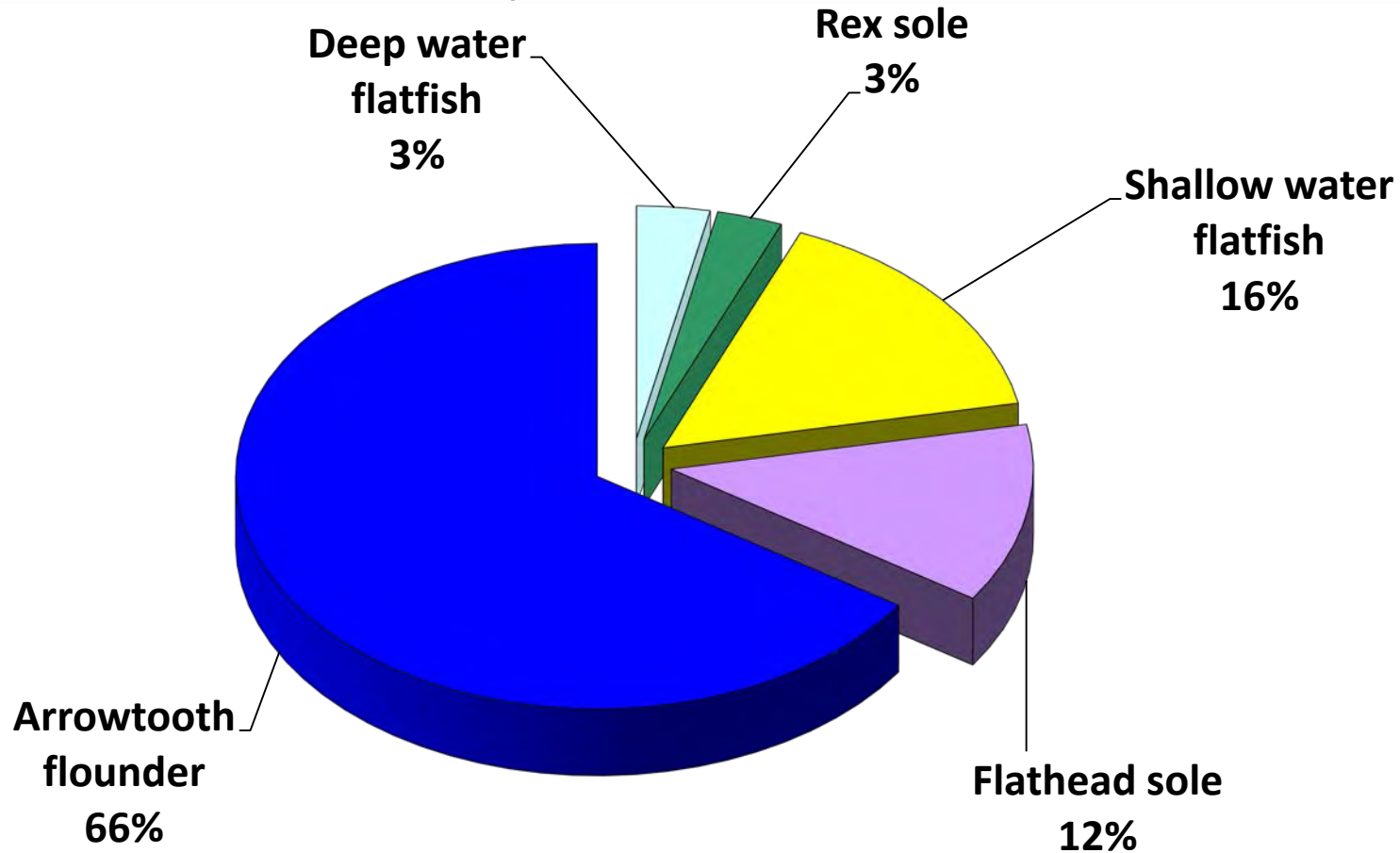
Species	2018 ABC	2019 ABC	Change
Shallow water flatfish	54,688	55,587	up 899 (2%)
Rex sole	15,373	14,692	down 681 (4%)
Deep water flatfish	9,385	9,501	up 116 (1%)
Flathead sole	35,266	36,782	up 1,516 (4%)
Arrowtooth flounder	150,945	145,841	down 5,104 (3%)
Subtotal	265,657	262,403	down 3,254 (1%)
Subtotal (without ATF)	114,712	116,562	up 1,850 (2%)

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

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

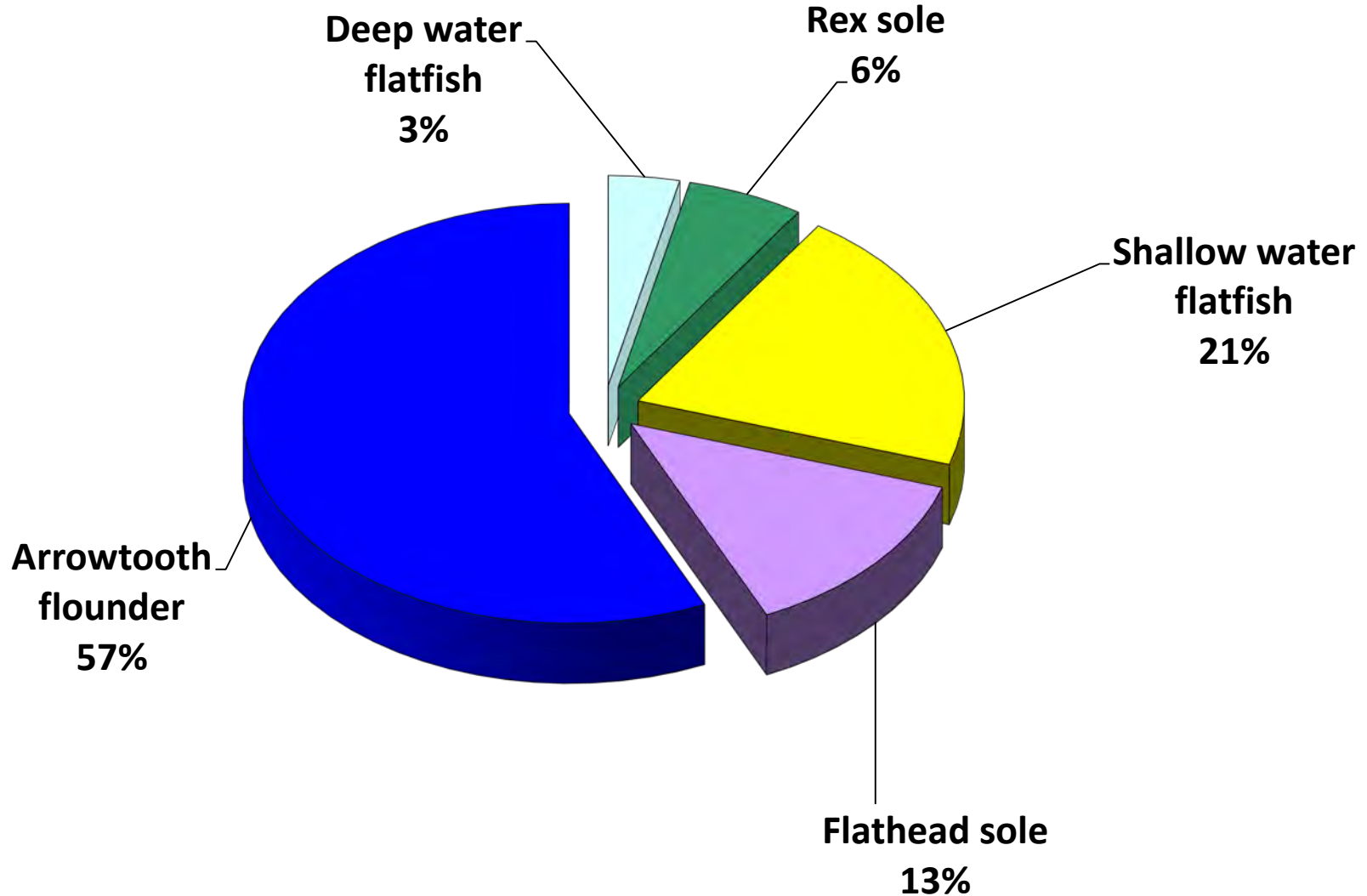
Flatfish 2017 ABC's

283,453 t combined



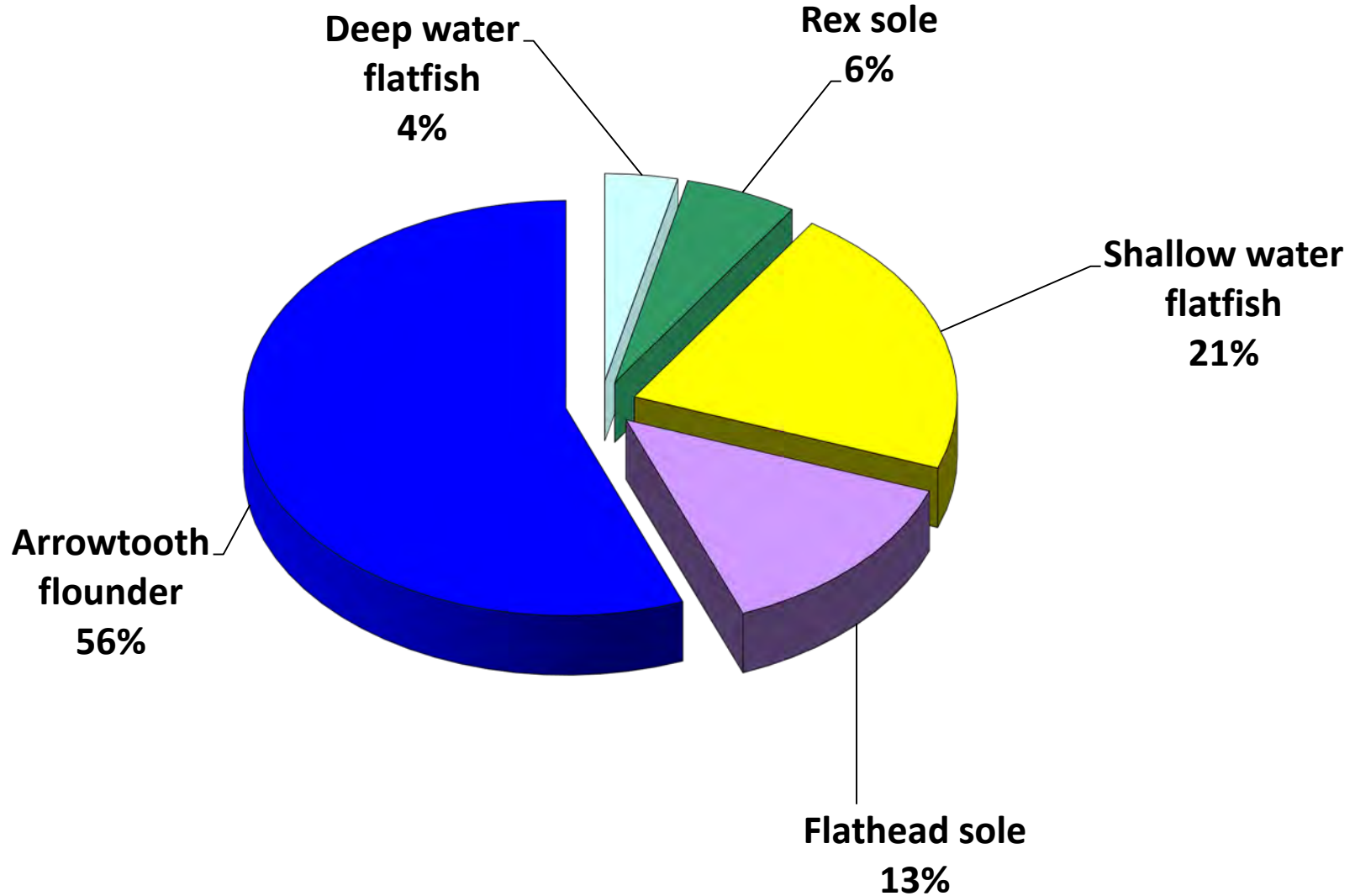
Flatfish 2018 ABC's

265,657 t combined



Flatfish 2019 ABC's

260,887 t combined



General comments on flatfish assessments

- Lightly exploited
- Analytical developments:
 - ♦ N & S rock sole models
 - ♦ Dover and flathead sole models full in 2015
 - Stock Synthesis modeling platform (SS3) application
 - Models accepted from 2014
 - ◆ Rex sole assessment conversion completed to SS3
 - Full assessment this year

Flatfish ABC's

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

4. Shallow-water flatfish

Tier 5 (except rock soles)

Random effects model:

- ◆ Applied to sum of survey biomass over species (excluding rock sole)
- ◆ Also by area (including rock soles)
- ◆ Also by species separately (excluding rock sole)

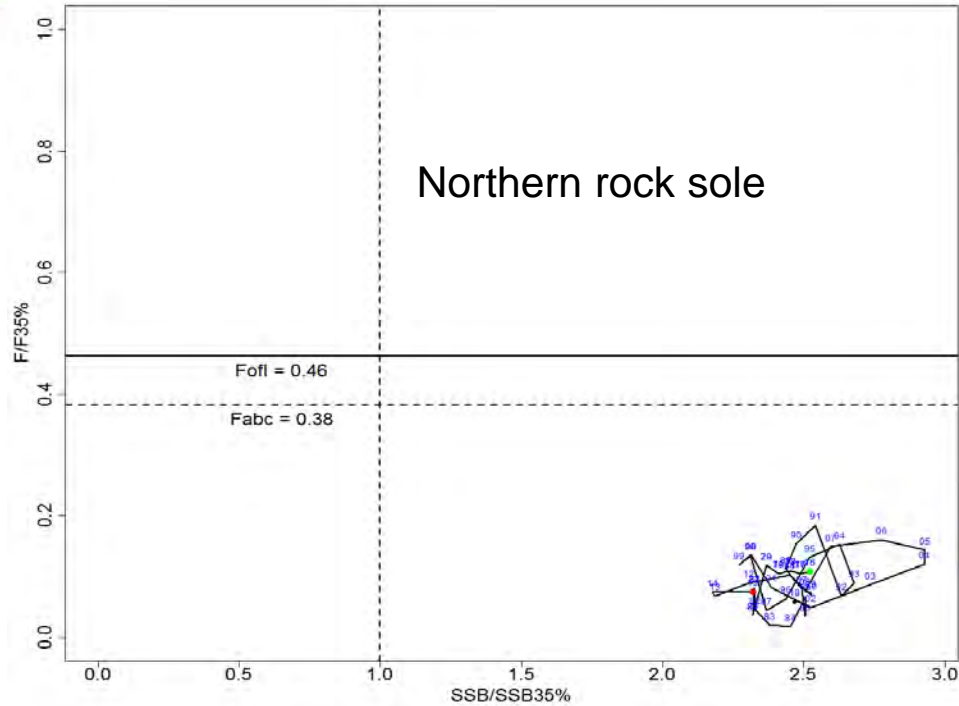
4. Shallow-water flatfish

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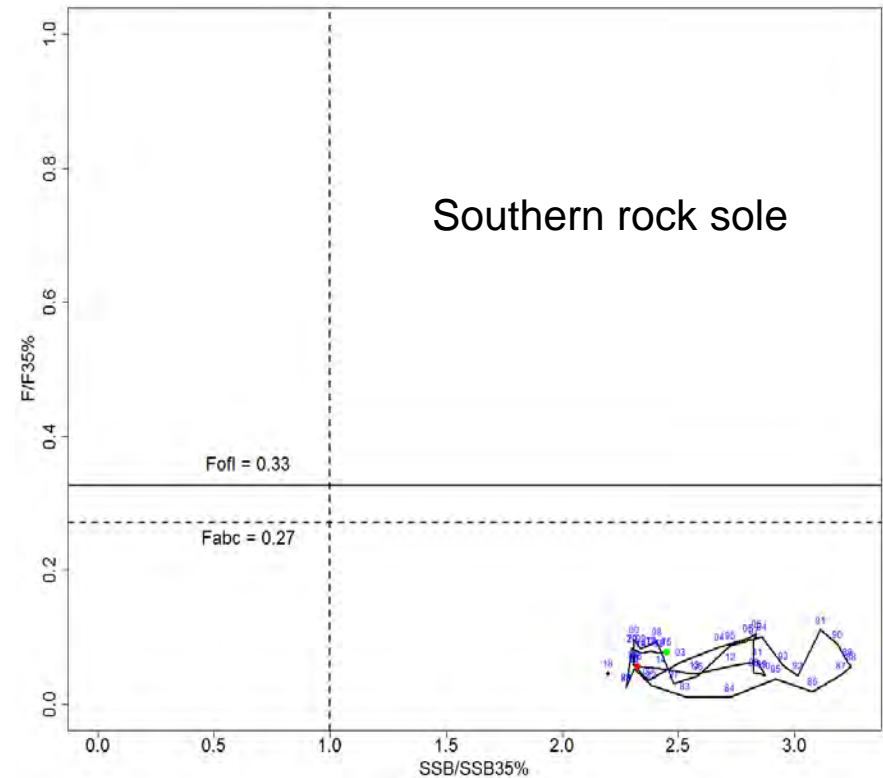
4. Shallow-water flatfish

Species						2018		2019	
Shallow-water flatfish	Tier	FABC	FOFL	2019 Biomass ¹	2020 Biomass ¹	ABC	OFL	ABC	OFL
Northern rock sole	3a	0.242	0.287	93,748	94,029	16,802	19,960	17,331	20,582
Southern rock sole	3a	0.271	0.326	140,270	141,538	21,424	25,333	21,794	25,779
Yellowfin sole	5	0.15	0.2	35,284	35,284	5,293	7,057	5,293	7,057
Butter sole	5	0.15	0.2	16,368	16,368	2,455	3,274	2,455	3,274
Starry flounder	5	0.15	0.2	29,474	29,474	4,421	5,895	4,421	5,895
English sole	5	0.15	0.2	16,210	16,210	2,432	3,242	2,432	3,242
Sand sole	5	0.15	0.2	1,511	1,511	227	302	227	302
Alaska plaice	5	0.15	0.2	10,890	10,890	1,634	2,178	1,634	2,178
Total				343,755	345,304	54,688	67,241	55,587	68,309

4. Shallow-water flatfish

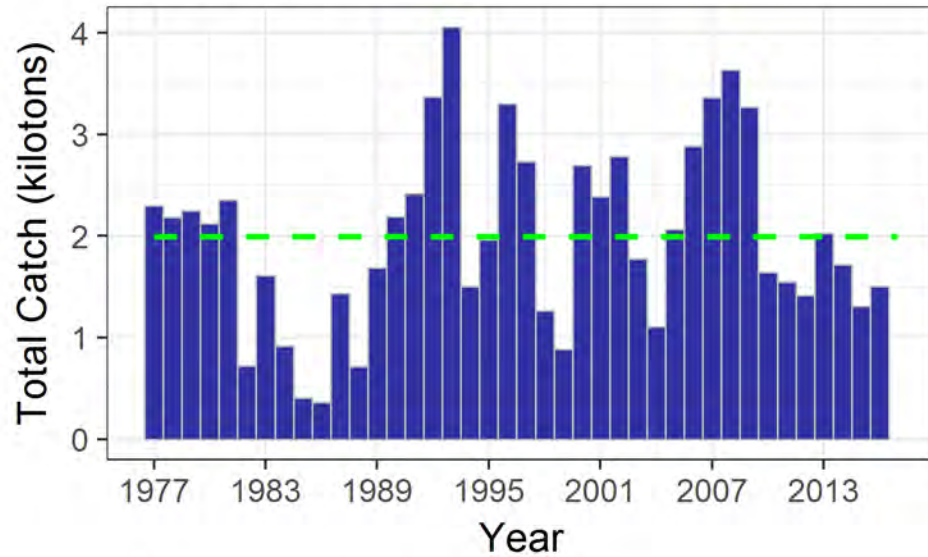


Rock soles phase plots

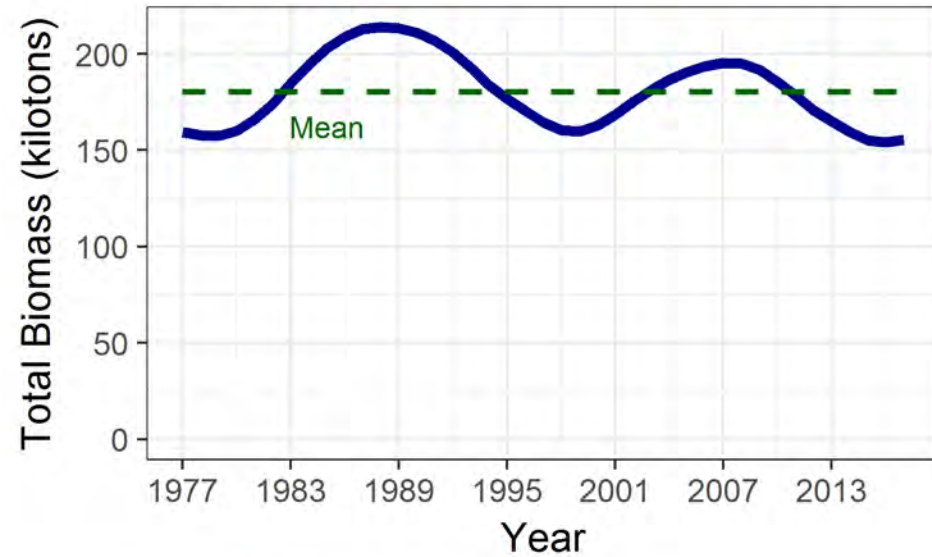


GOA Southern Rock Sole

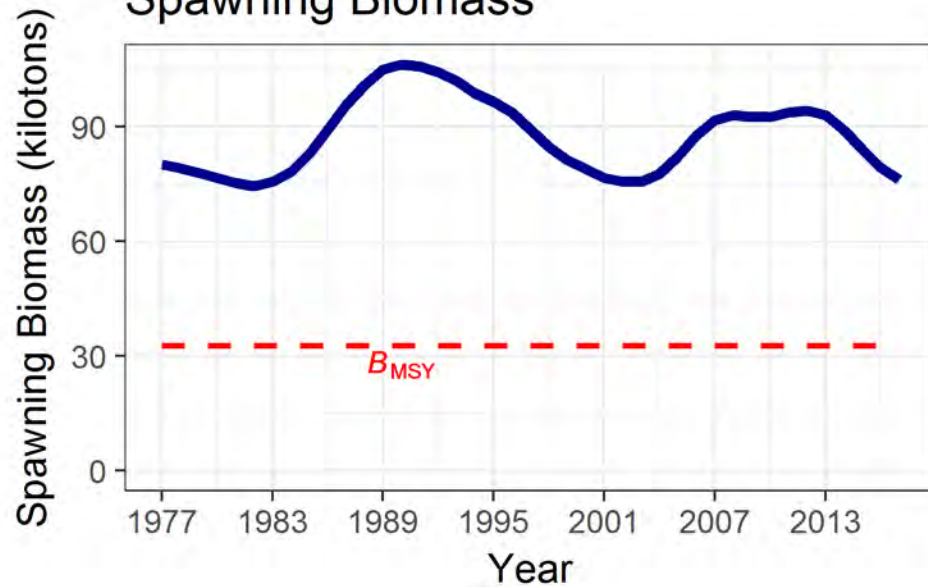
Total Catch



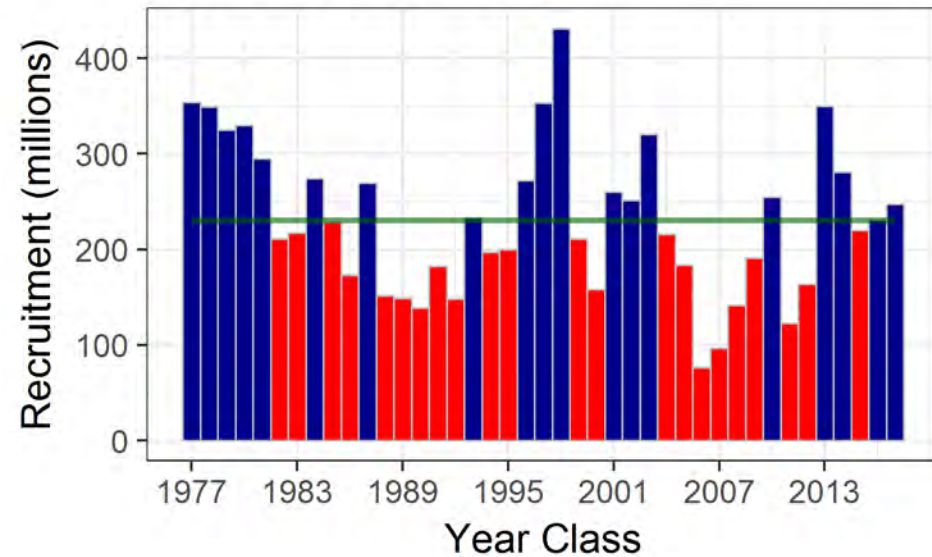
Total Biomass



Spawning Biomass

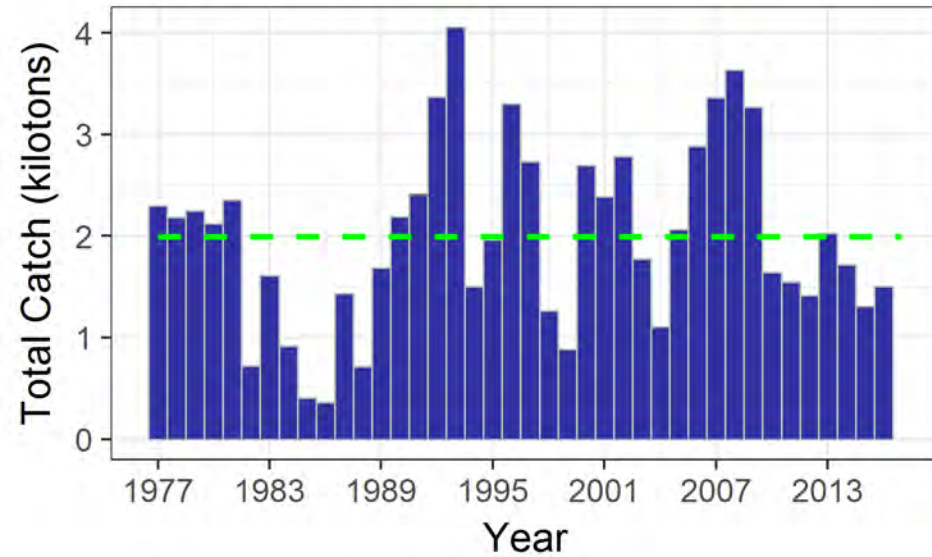


Age 0 Recruitment

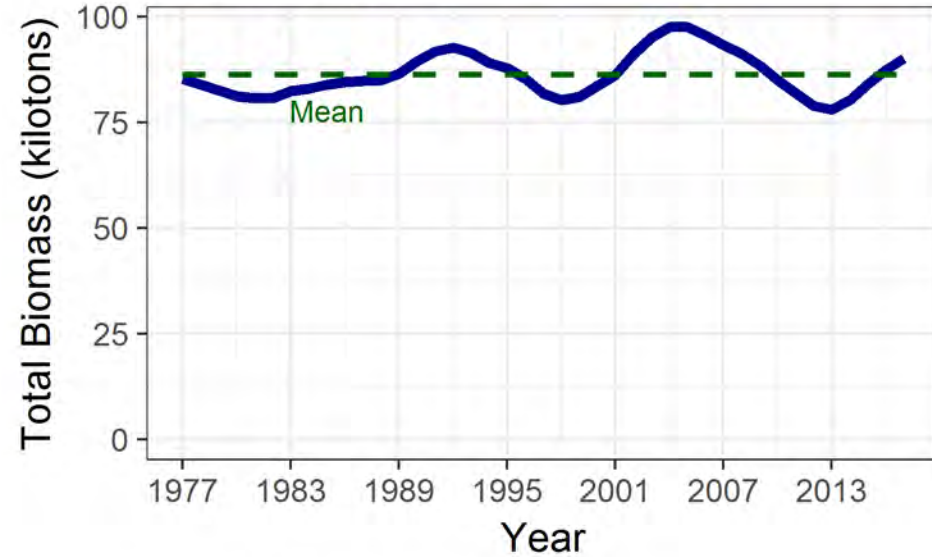


GOA Northern Rock Sole

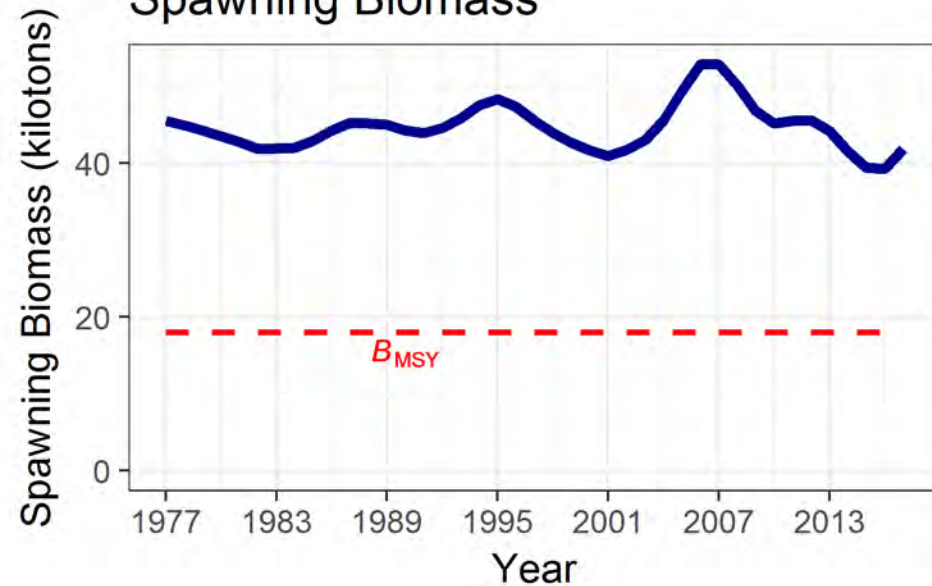
Total Catch



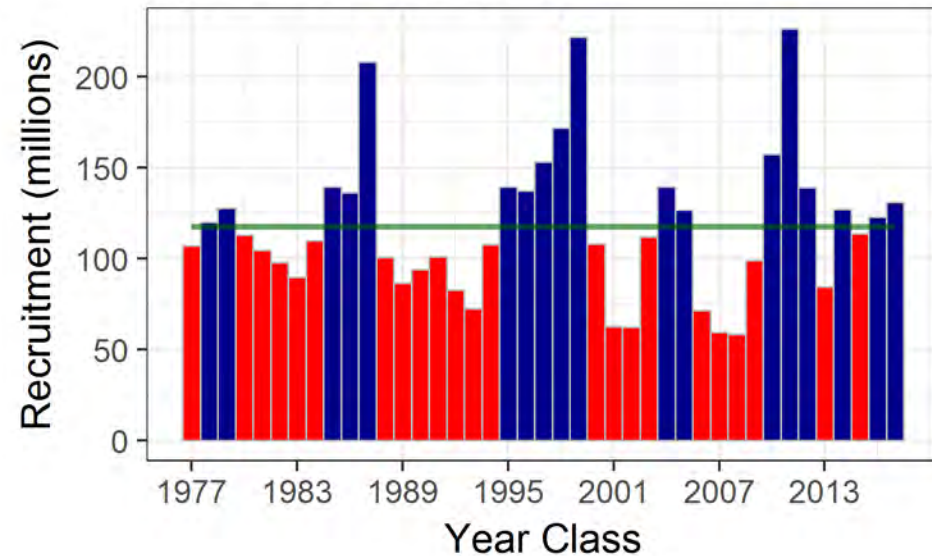
Total Biomass



Spawning Biomass



Age 0 Recruitment



5. Deepwater flatfish

Species	2018 ABC	2019 ABC	Change
Shallow water flatfish	54,688	55,587	up 899 (2%)
Rex sole	15,373	14,692	down 681 (4%)
Deep water flatfish	9,385	9,501	up 116 (1%)
Flathead sole	35,266	36,782	up 1,516 (4%)
Arrowtooth flounder	150,945	145,841	down 5,104 (3%)
Subtotal	265,657	262,403	down 3,254 (1%)
Subtotal (without ATF)	114,712	116,562	up 1,850 (2%)

Partial assessment

Updated 2017 and estimated 2018 catch

- ◆ 2019 and 2020 catch projected from 2013-2017 average
- ◆ Species estimated from observer data

6. Rex sole

Species	2018 ABC	2019 ABC	Change
Shallow water flatfish	54,688	55,587	up 899 (2%)
Rex sole	15,373	14,692	down 681 (4%)
Deep water flatfish	9,385	9,501	up 116 (1%)
Flathead sole	35,266	36,782	up 1,516 (4%)
Arrowtooth flounder	150,945	145,841	down 5,104 (3%)
Subtotal	265,657	262,403	down 3,254 (1%)
Subtotal (without ATF)	114,712	116,562	up 1,850 (2%)

Partial assessment,

- Updated catch through 2018
 - ♦ Apportionment via random effects model
 - stock areas separately

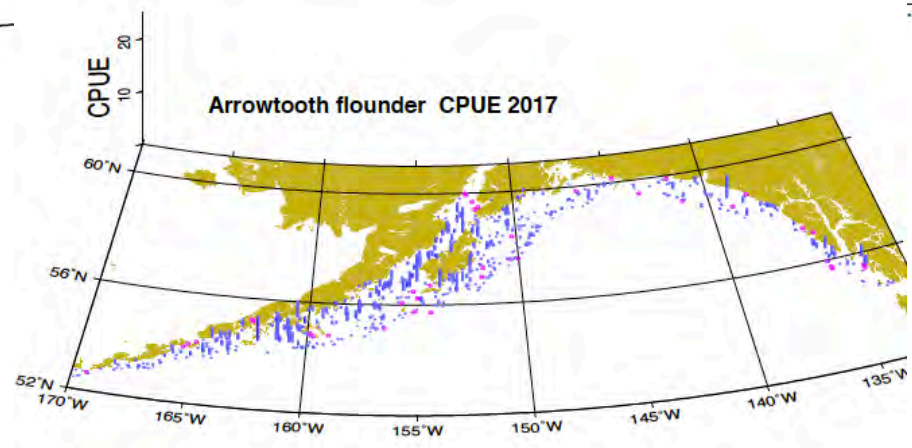
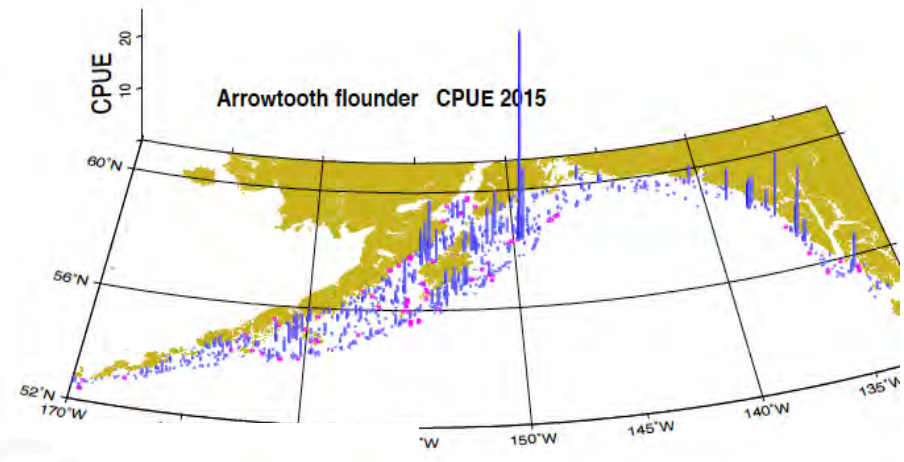
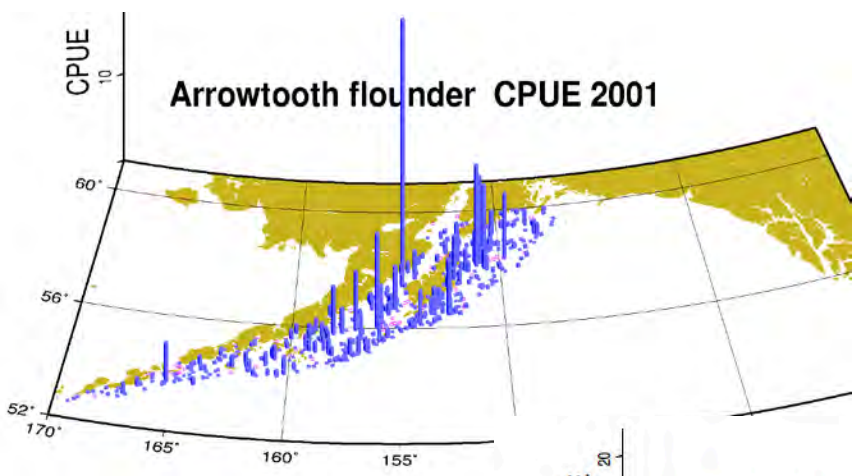
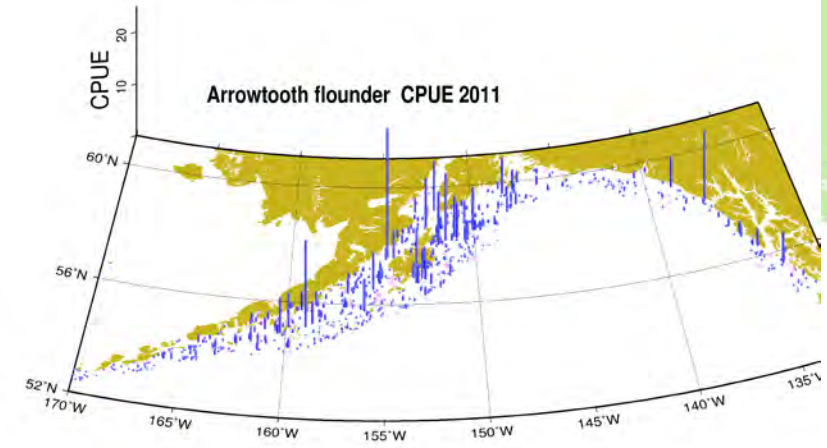
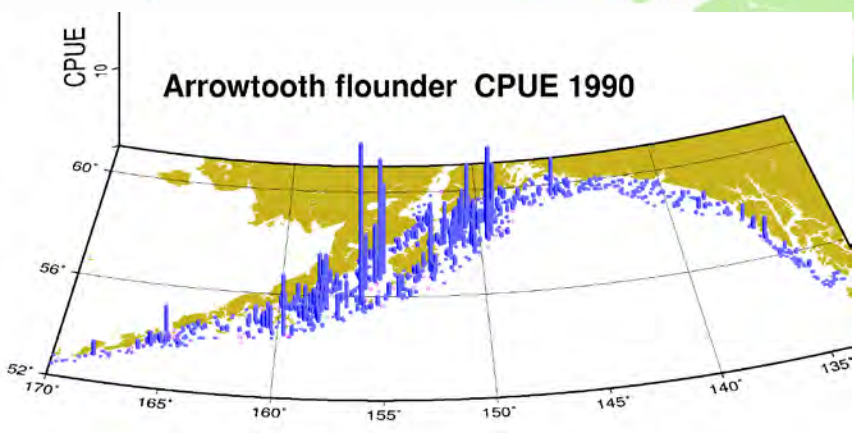
Flatfish ABC's

Species	2018 ABC	2019 ABC	Change
Shallow water flatfish	54,688	55,587	up 899 (2%)
Rex sole	15,373	14,692	down 681 (4%)
Deep water flatfish	9,385	9,501	up 116 (1%)
Flathead sole	35,266	36,782	up 1,516 (4%)
Arrowtooth flounder	150,945	145,841	down 5,104 (3%)
Subtotal	265,657	262,403	down 3,254 (1%)
Subtotal (without ATF)	114,712	116,562	up 1,850 (2%)

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

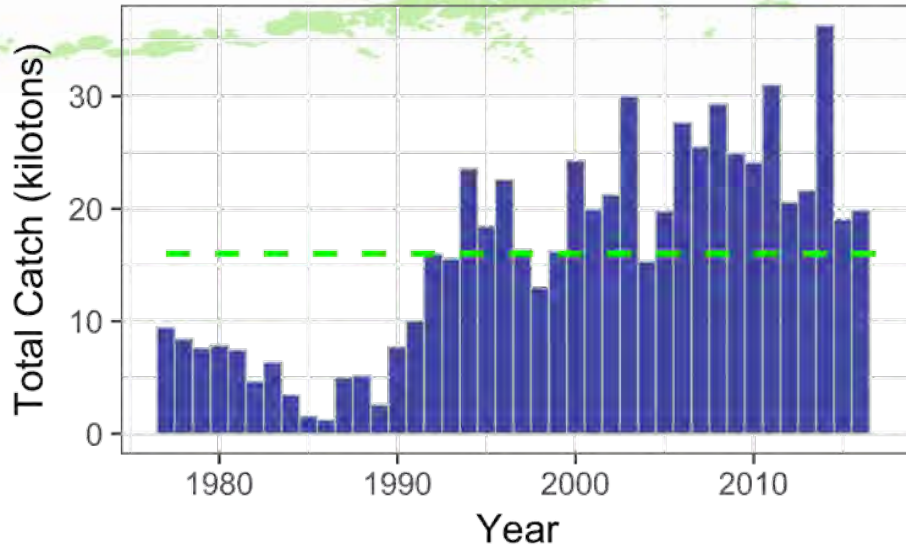
Shallow water flats: N and S rock sole Tier 3, others Tier 5

7. Arrowtooth flounder

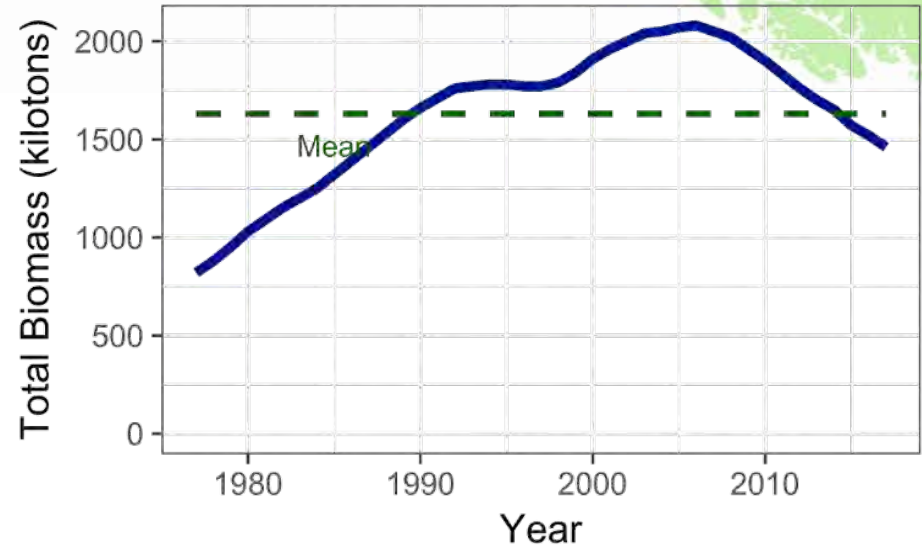


GOA Arrowtooth Flounder

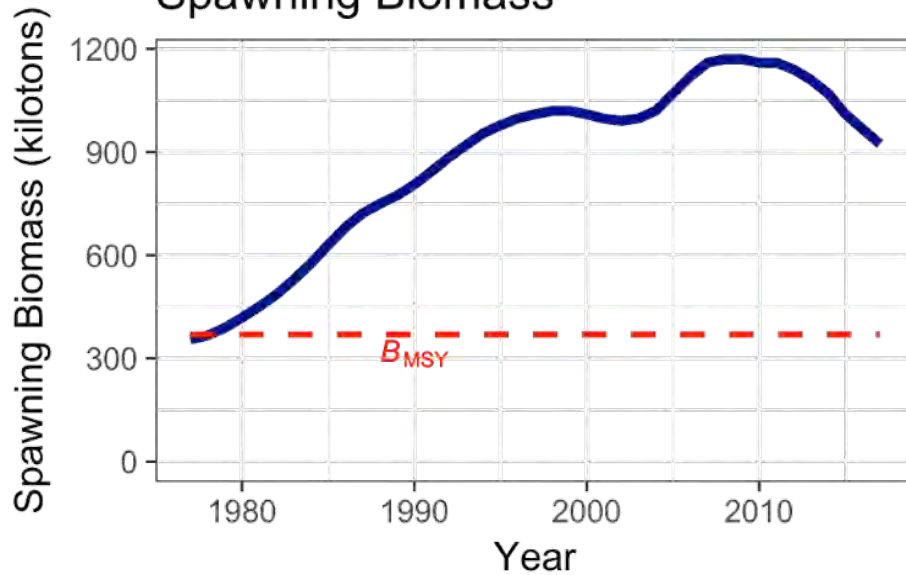
Total Catch



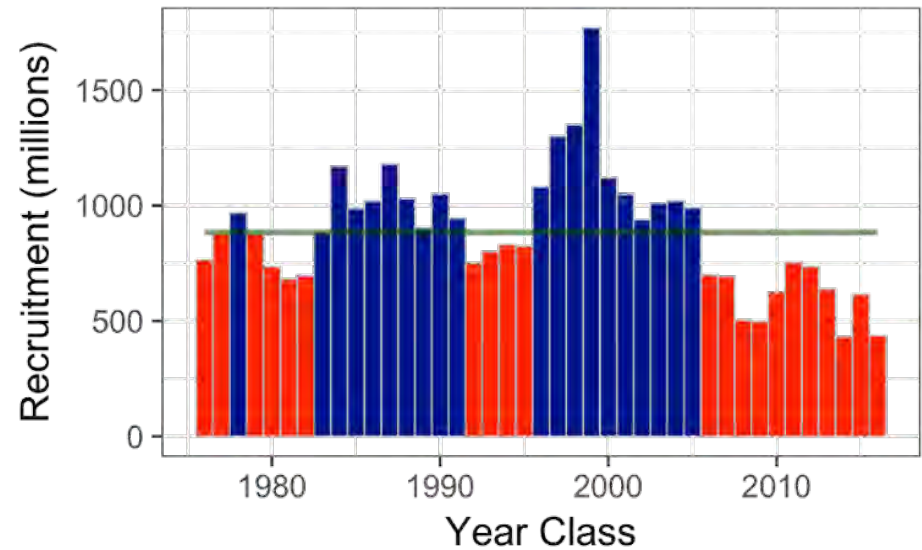
Total Biomass



Spawning Biomass



Age 1 Recruitment



Flatfish ABC's

Species	2018 ABC	2019 ABC	Change
Shallow water flatfish	54,688	55,587	up 899 (2%)
Rex sole	15,373	14,692	down 681 (4%)
Deep water flatfish	9,385	9,501	up 116 (1%)
Flathead sole	35,266	36,782	up 1,516 (4%)
Arrowtooth flounder	150,945	145,841	down 5,104 (3%)
Subtotal	265,657	262,403	down 3,254 (1%)
Subtotal (without ATF)	114,712	116,562	up 1,850 (2%)

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

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

8. Flathead sole

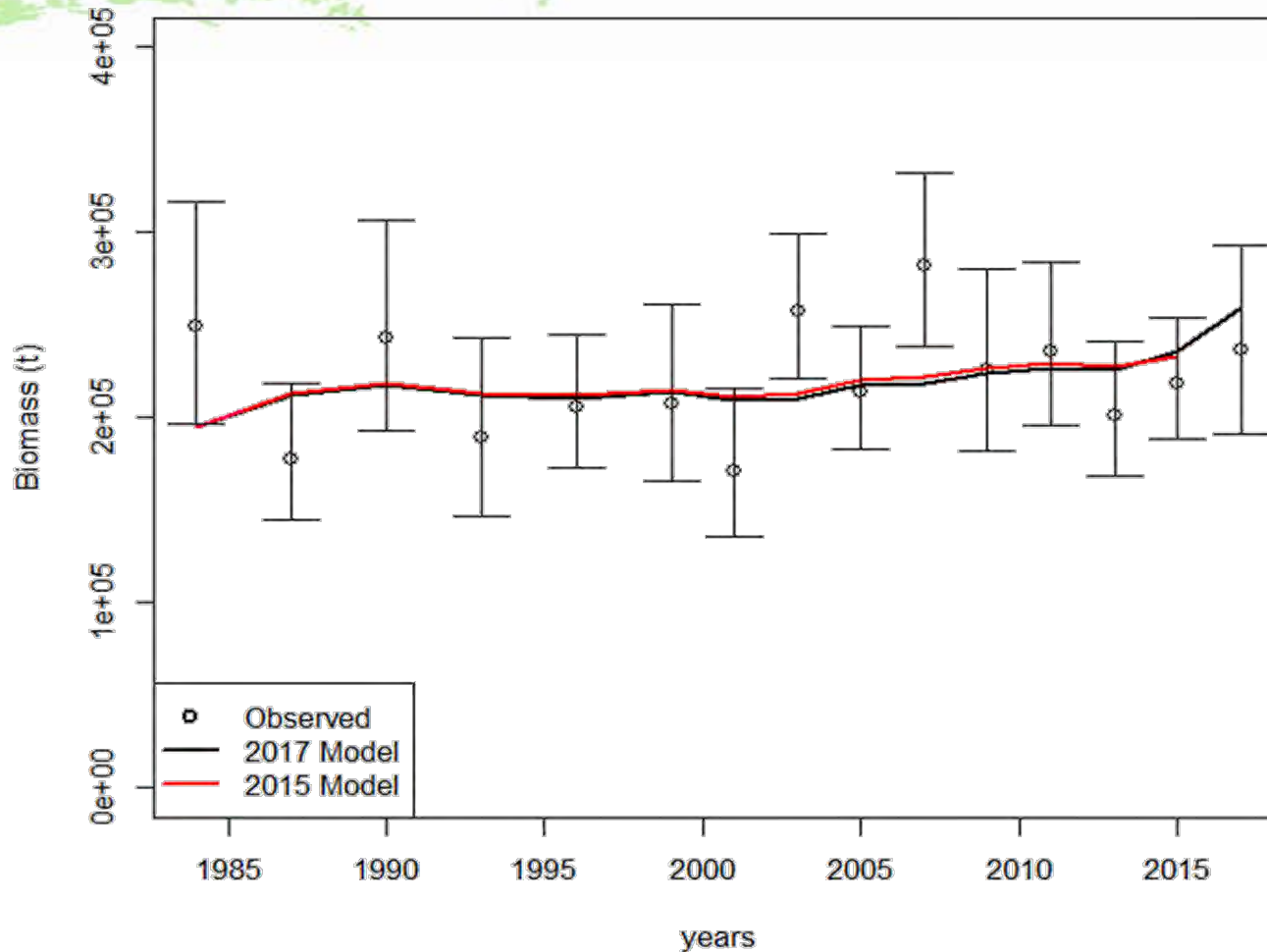
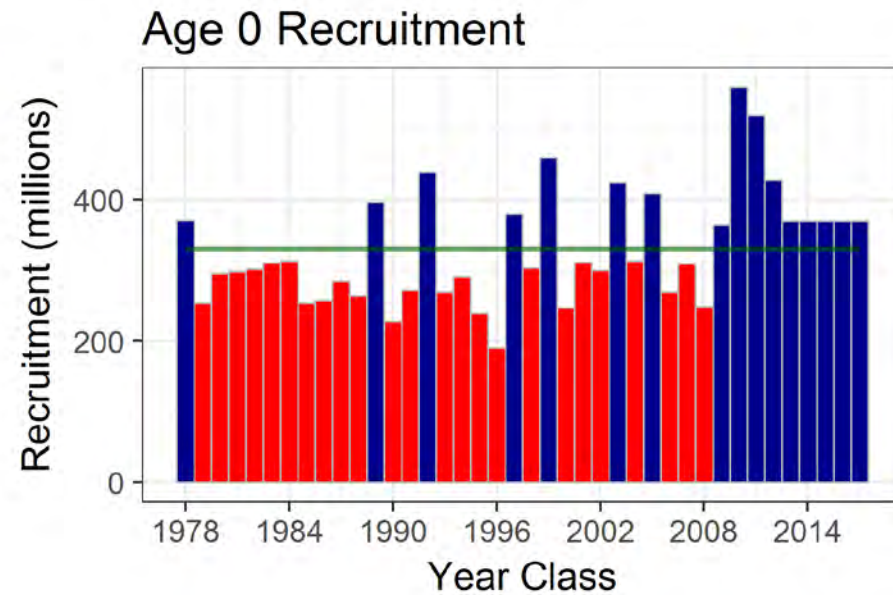
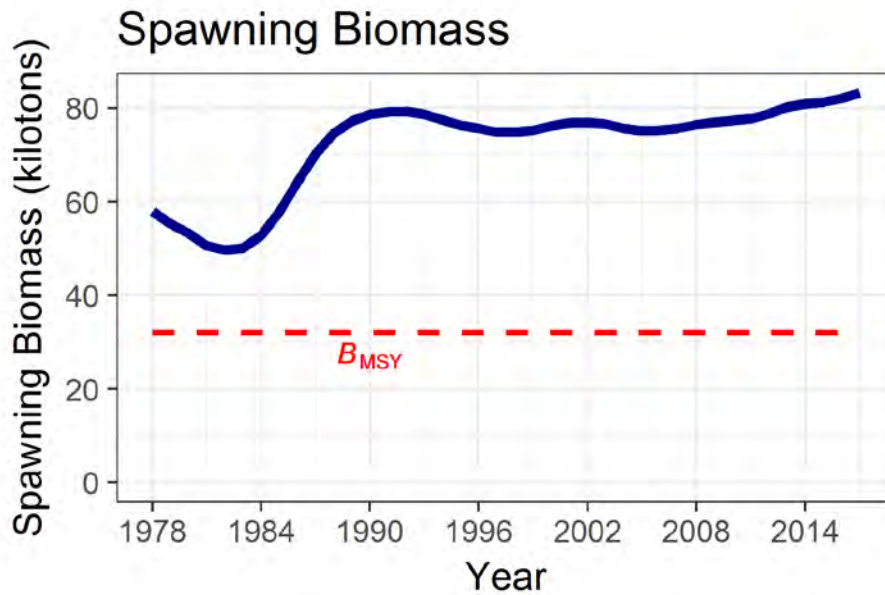
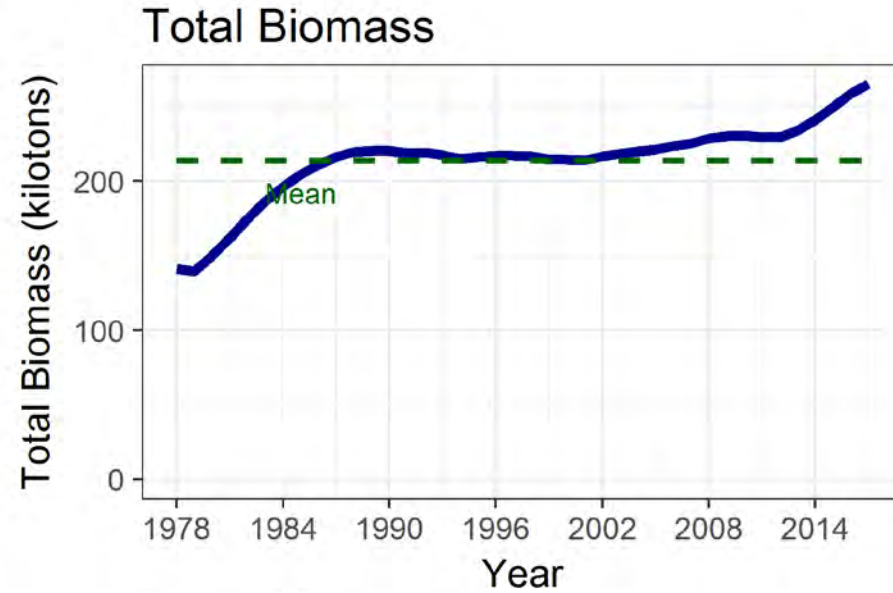
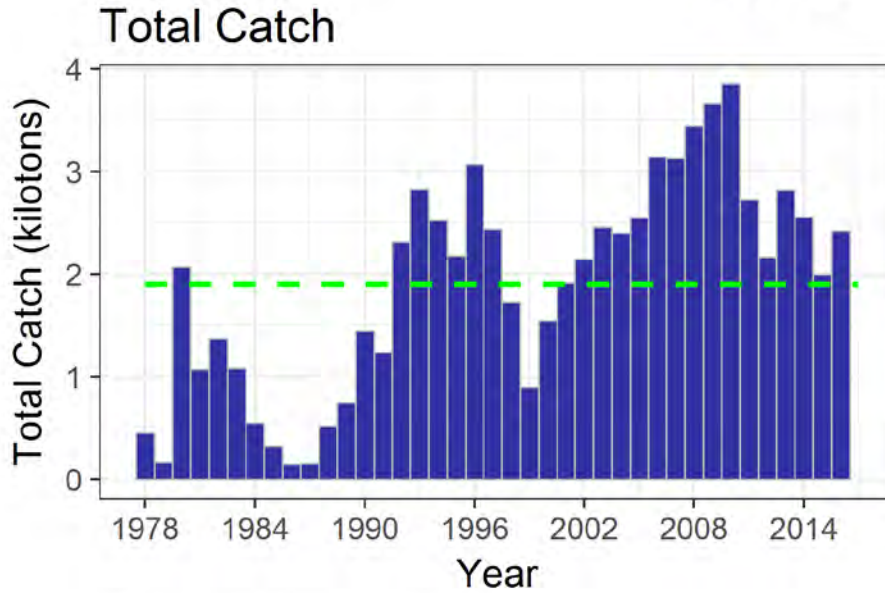


Figure 1. Survey biomass index (circles), asymptotic 95% confidence intervals (vertical black lines), and estimated survey biomass for the proposed 2017 model and the accepted 2015 model (the same as the 2017 Model without 2016-2017 data).

8. Flathead sole

GOA Flathead Sole

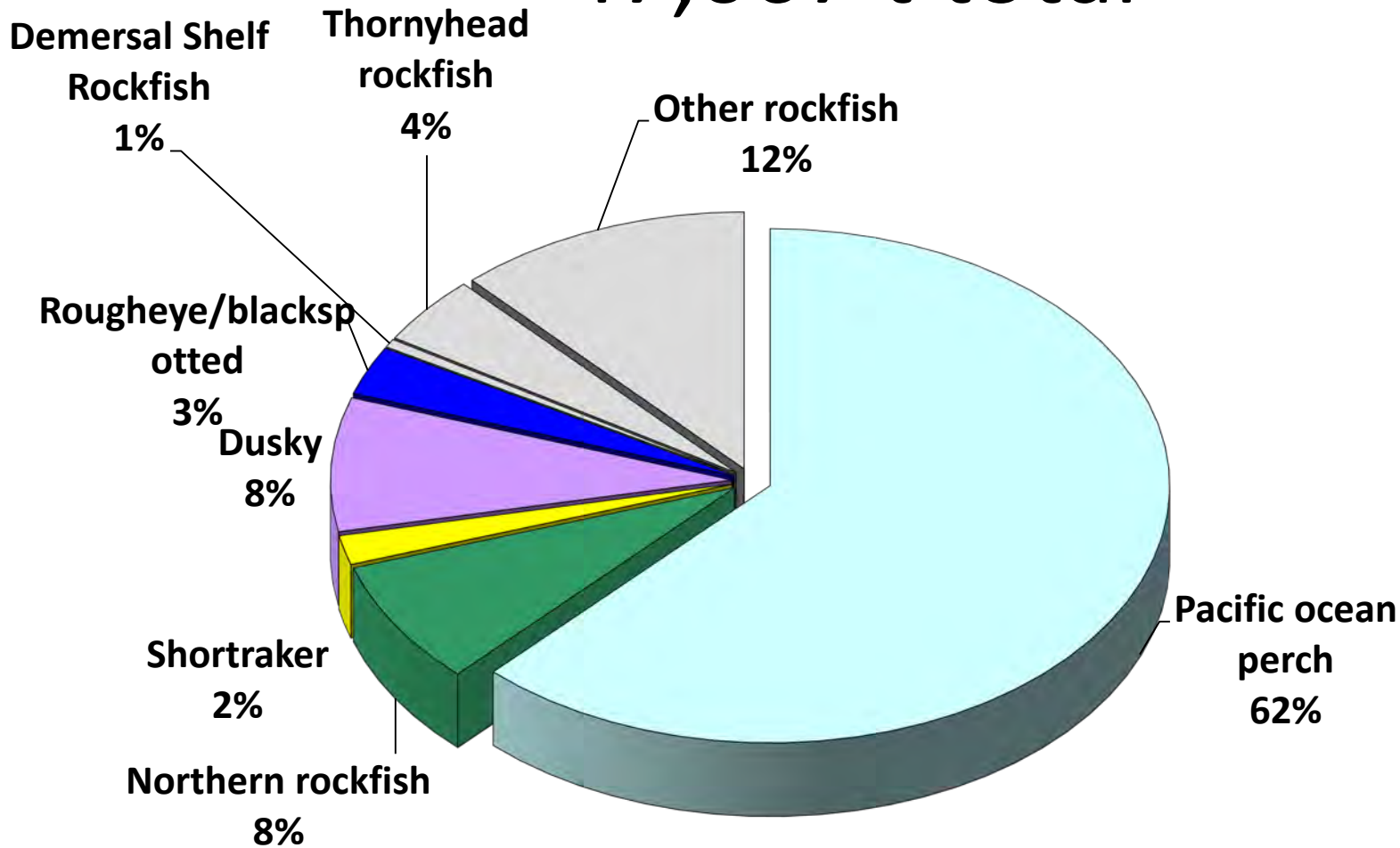


GOA Rockfish

Species	2018 Catch	2018	2019	Change
Pollock	154,286	170,265	144,623	down 25,642 (15%)
Pacific Cod	9,595	18,000	17,000	down 1,000 (6%)
Sablefish	11,716	11,505	11,571	up 66 (1%)
Flatfish	22,053	114,712	116,562	up 1,850 (2%)
Arrowtooth flounder	2,045	150,945	145,841	down 5,104 (3%)
Rockfish	33,425	47,067	46,946	down 121 (0%)
Atka mackerel	1,431	4,700	4,700	same (0%)
Skates	2,786	7,804	7,804	same (0%)
Other Species	3,616	11,927	14,460	up 2,533 (21%)
Total	240,953	536,925	509,507	down 27,418 (5%)

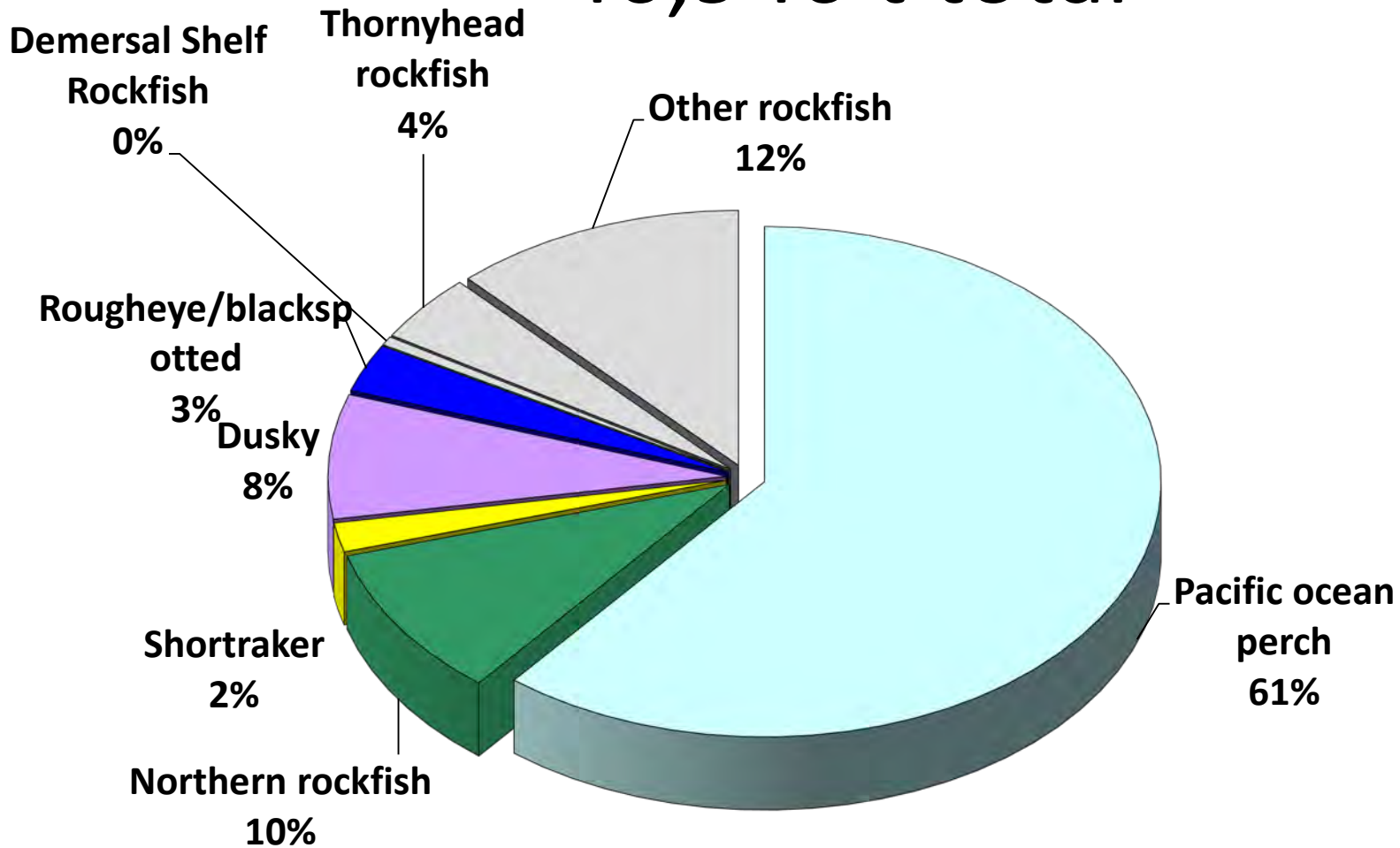
Rockfish 2018 ABC's

47,067 t total



Rockfish 2019 ABC's

46,946 t total



Rockfish ABC Summary

Species	2018	2019	Change
POP	29,236	28,555	down 681 (2%)
northern rockfish	3,685	4,529	up 844 (23%)
Shortraker Rockfish	863	863	same (0%)
Dusky	3,957	3,700	down 257 (6%)
Rougeye and Blackspotted Rockfish	1,444	1,428	down 16 (1%)
Demersal shelf rockfish	250	261	up 11 (4%)
Thornyhead	2,038	2,016	down 22 (1%)
Other rock	5,594	5,594	same (0%)
Sub Total	47,067	46,946	down 121 (0%)

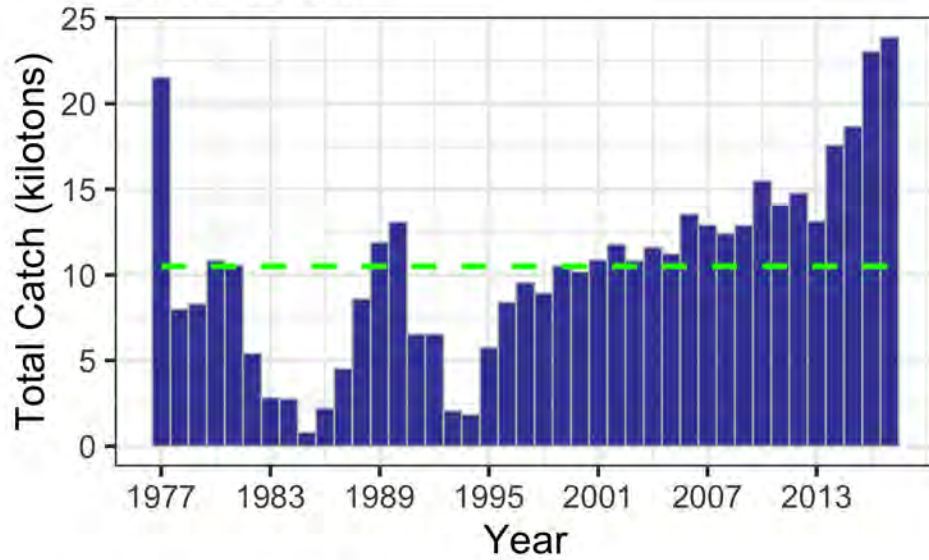
9. Pacific ocean perch

- Partial assessment
- CIE review for GOA rockfish scheduled for spring 2019
 1. Use hydroacoustic info
 2. Examine fishery-dependent info, e.g., age sampling
 3. Catchability manuscript is in prep to inform priors...

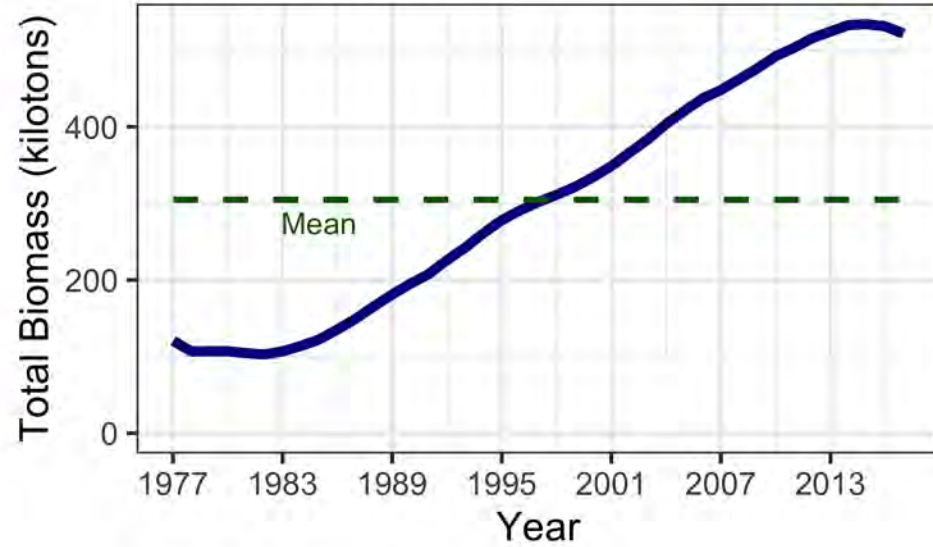
The Plan Team supports the review CIE review topics, and additionally recommends the assessment authors incorporate an examination of the VAST model during the CIE review.

GOA Pacific Ocean Perch

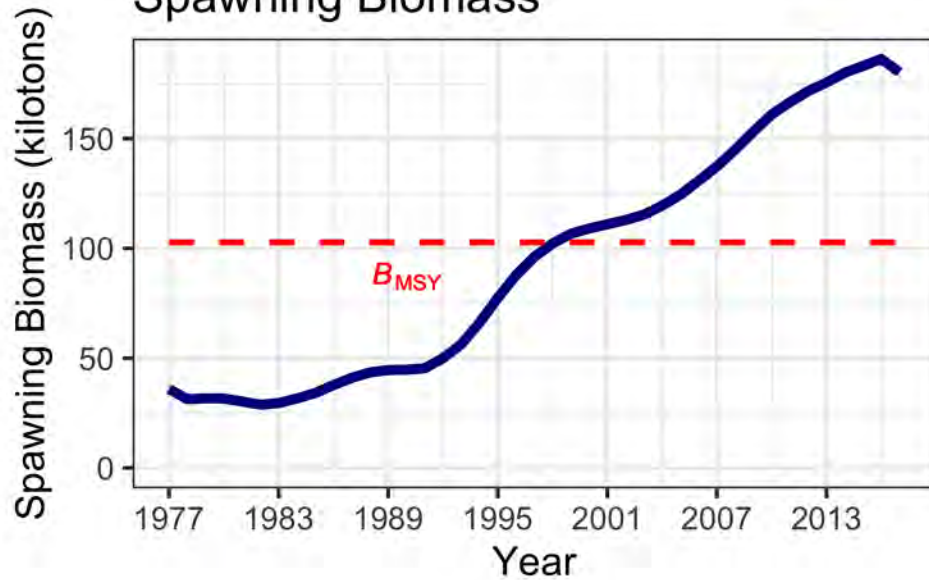
Total Catch



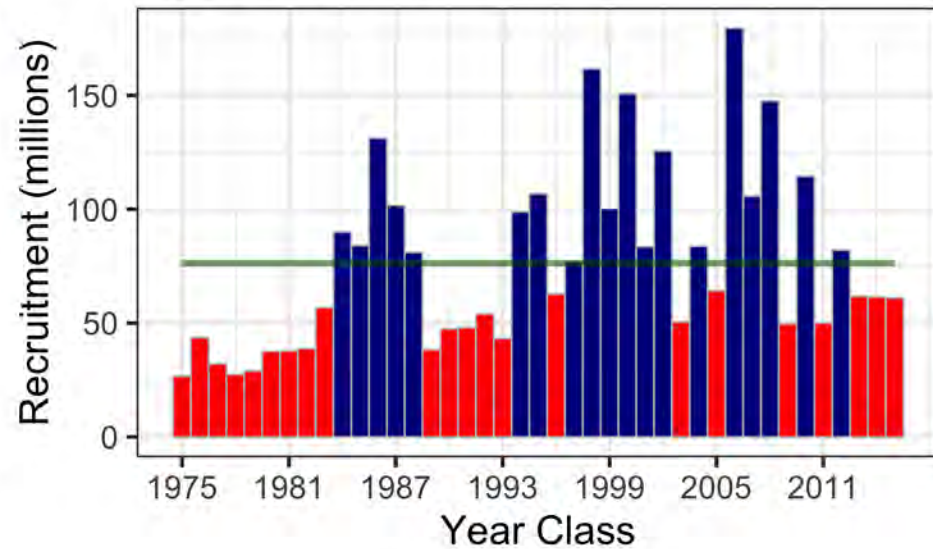
Total Biomass



Spawning Biomass



Age 2 Recruitment



Rockfish ABC Summary

Species	2018	2019	Change
POP	29,236	28,555	down 681 (2%)
northern rockfish	3,685	4,529	up 844 (23%)
Shortraker Rockfish	863	863	same (0%)
Dusky	3,957	3,700	down 257 (6%)
Rougeye and Blackspotted Rockfish	1,444	1,428	down 16 (1%)
Demersal shelf rockfish	250	261	up 11 (4%)
Thornyhead	2,038	2,016	down 22 (1%)
Other rock	5,594	5,594	same (0%)
Sub Total	47,067	46,946	down 121 (0%)



10. Northern rockfish

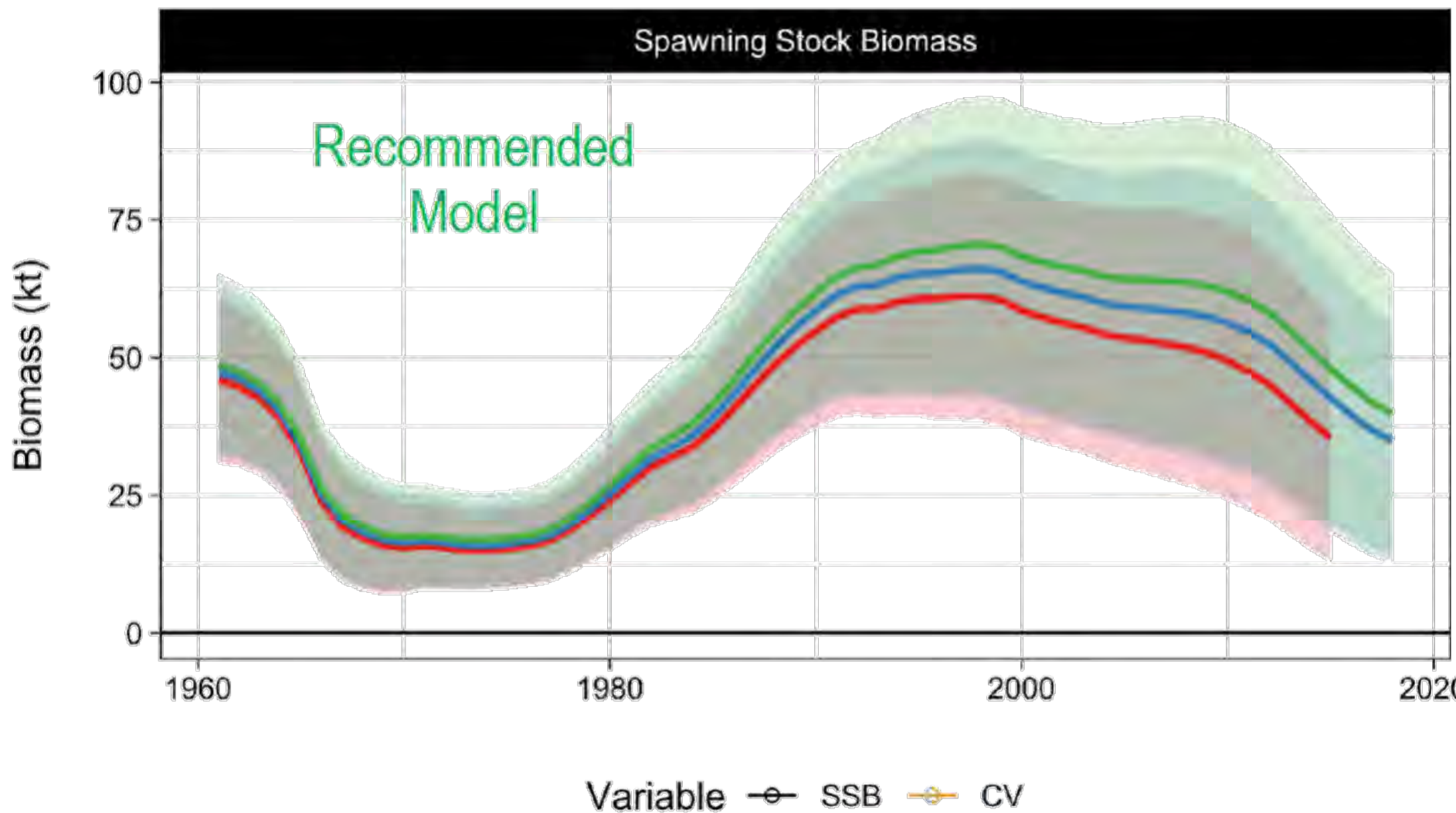
New Data for 2018 Assessment

Source	Data	Years
Fisheries	Catch	1961-2018 (2015, 2016, 2017, prelim 2018)
NMFS bottom trawl surveys	Biomass index	1984, 1987, 1990, 1993, 1996, 1999, 2001, 2003, 2005, 2007, 2009, 2011, 2013, 2015, 2017
NMFS bottom trawl surveys	Age	1984, 1987, 1990, 1993, 1996, 1999, 2001, 2003, 2005, 2007, 2009, 2011, 2013, 2015, 2017
U.S. trawl fisheries	Age	1998, 1999, 2000, 2001, 2002, 2004, 2005, 2006, 2008, 2010, 2012, 2014, 2016
U.S. trawl fisheries	Length	1990, 1991, 1992, 1993, 1994, 1995, 1996, 1997, 2003, 2007, 2009, 2011, 2013, 2015, 2017



GOA Northern rockfish

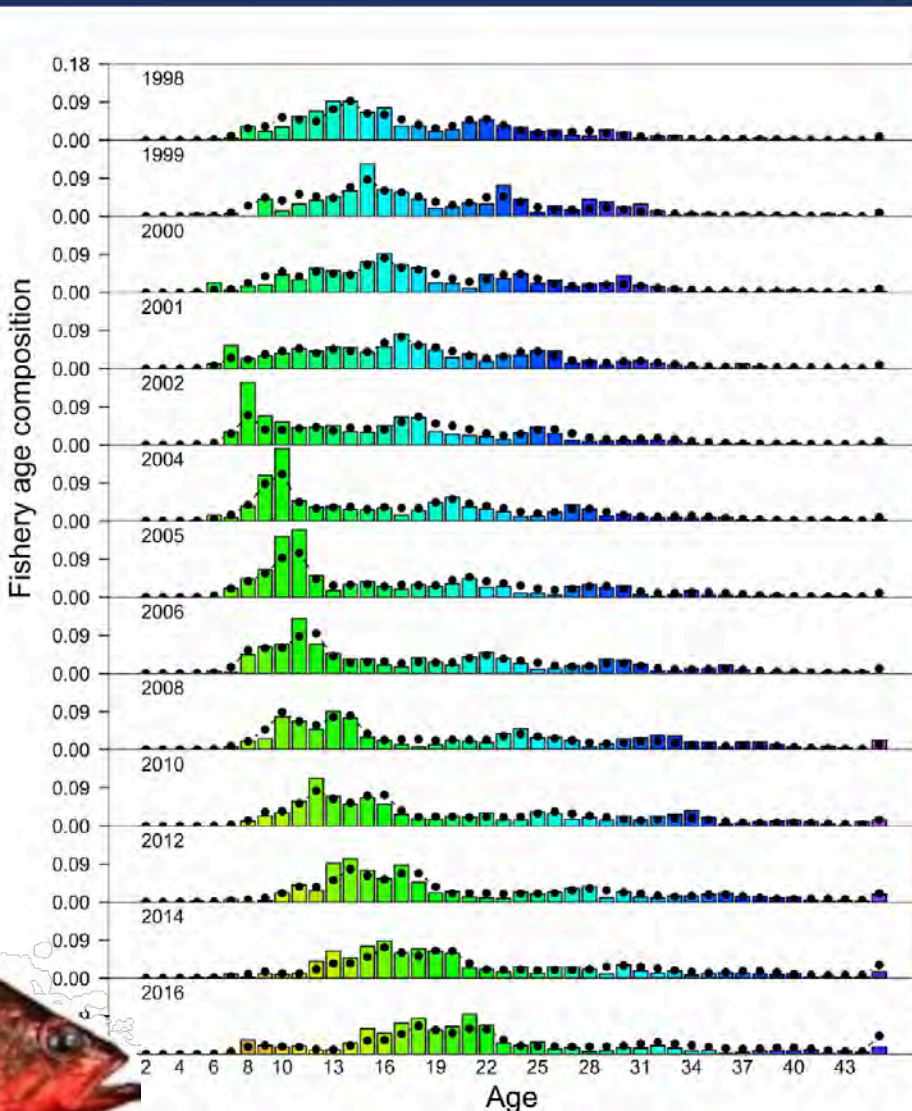
Model — M15.4 (2015) — M15.4 (2018) — M18.2 (2018)



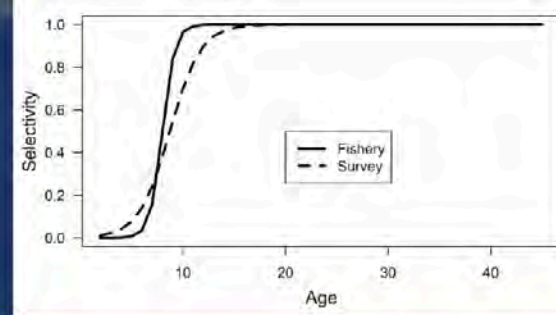
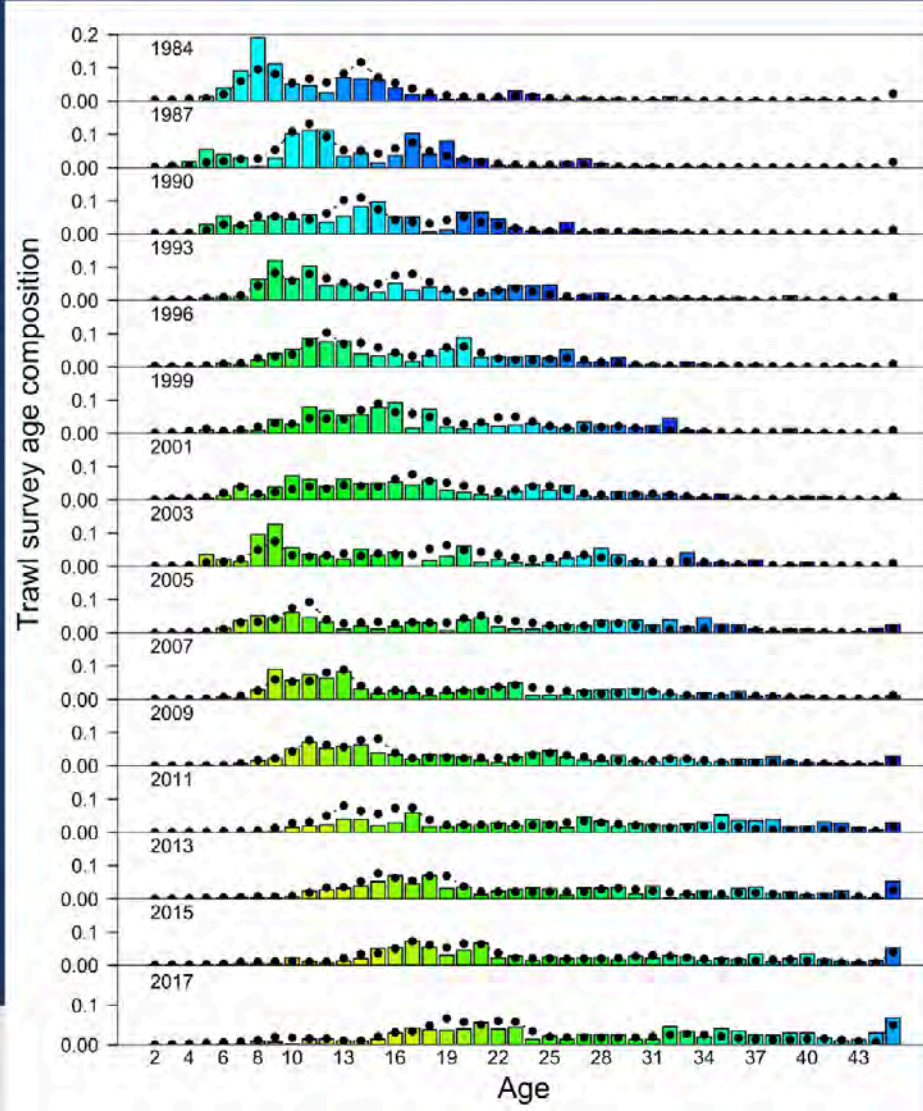
GOA Northern rockfish

Age Compositions

Fishery



Survey



Northern rockfish: Team discussions

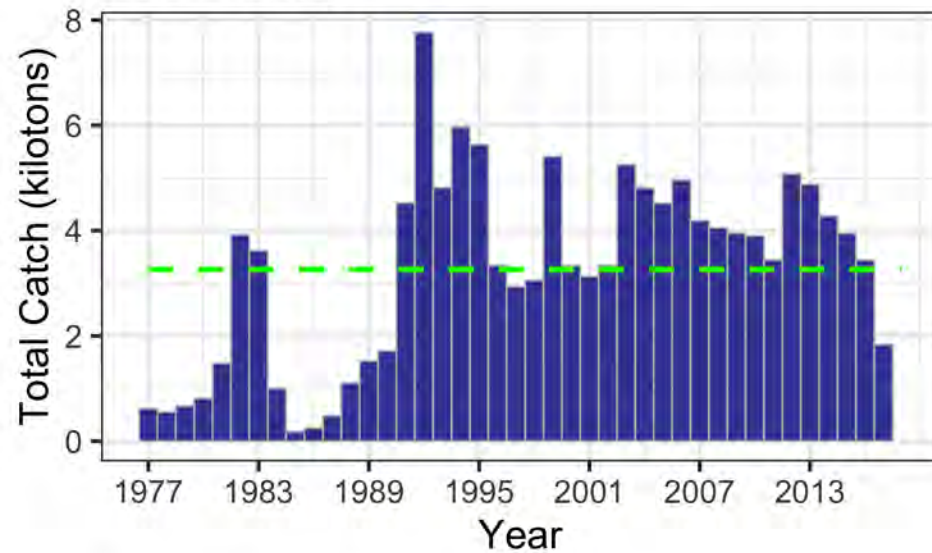
The Team recommended

- ♦ **Examining the delta-GLM approach by survey strata to see if the stratum-specific estimates are affecting the differences in approaches (compared to the results from a GOA-wide model).**
- ♦ **Exploring using the covariance matrix from VAST in the stock assessment likelihood (i.e., to avoid using some variance inflation outside of the assessment).**

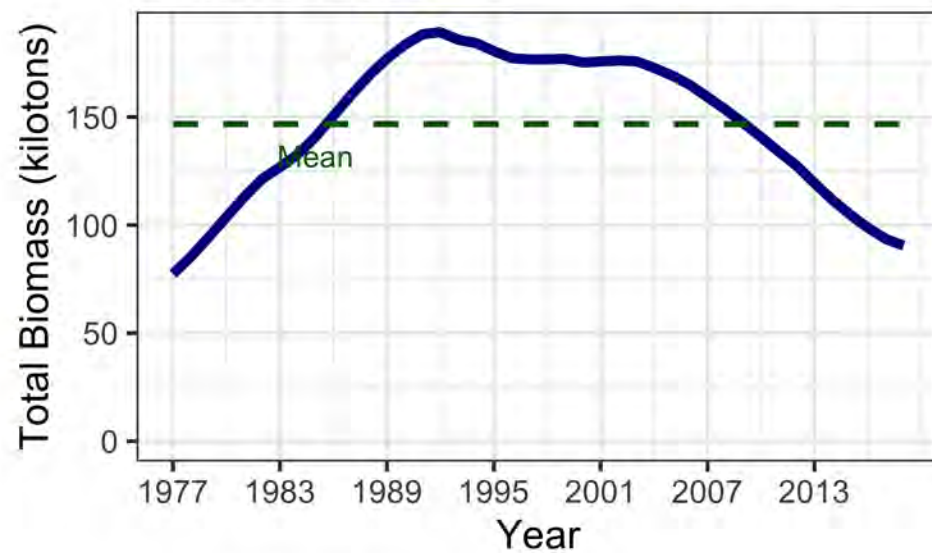


GOA Northern Rockfish

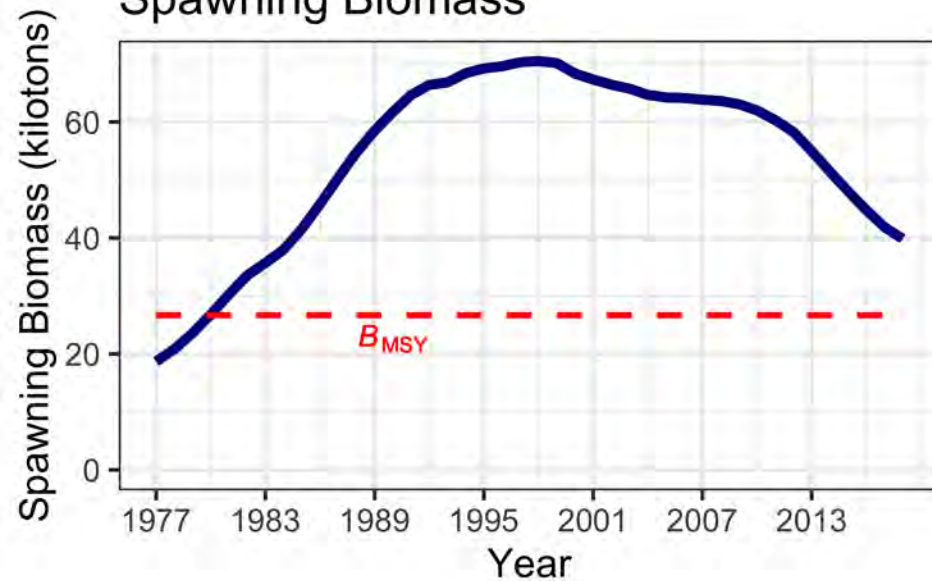
Total Catch



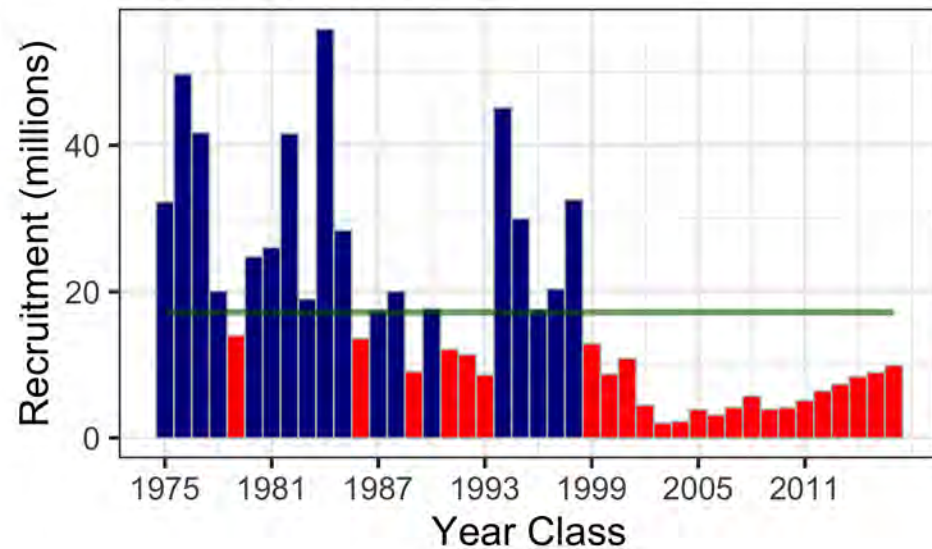
Total Biomass



Spawning Biomass



Age 2 Recruitment

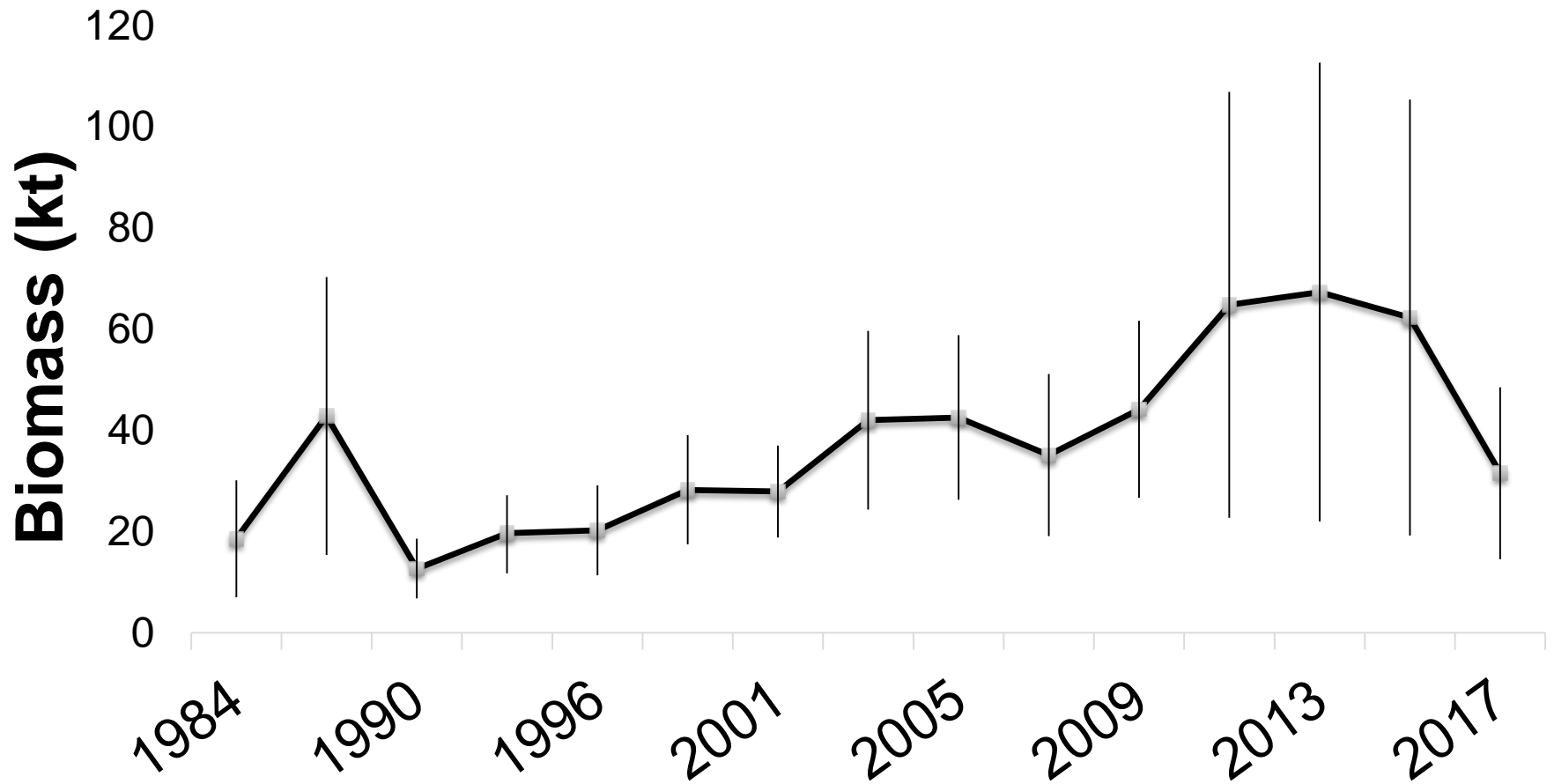


Rockfish ABC Summary

Species	2018	2019	Change
POP	29,236	28,555	down 681 (2%)
northern rockfish	3,685	4,529	up 844 (23%)
Shortraker Rockfish	863	863	same (0%)
Dusky	3,957	3,700	down 257 (6%)
Rougeye and Blackspotted Rockfish	1,444	1,428	down 16 (1%)
Demersal shelf rockfish	250	261	up 11 (4%)
Thornyhead	2,038	2,016	down 22 (1%)
Other rock	5,594	5,594	same (0%)
Sub Total	47,067	46,946	down 121 (0%)

11. GOA Shortraker

No assessment



Rockfish ABC Summary

Species	2018	2019	Change
POP	29,236	28,555	down 681 (2%)
northern rockfish	3,685	4,529	up 844 (23%)
Shortraker Rockfish	863	863	same (0%)
Dusky	3,957	3,700	down 257 (6%)
Rougheye and Blackspotted Rockfish	1,444	1,428	down 16 (1%)
Demersal shelf rockfish	250	261	up 11 (4%)
Thornyhead	2,038	2,016	down 22 (1%)
Other rock	5,594	5,594	same (0%)
Sub Total	47,067	46,946	down 121 (0%)

12. GOA Dusky Rockfish

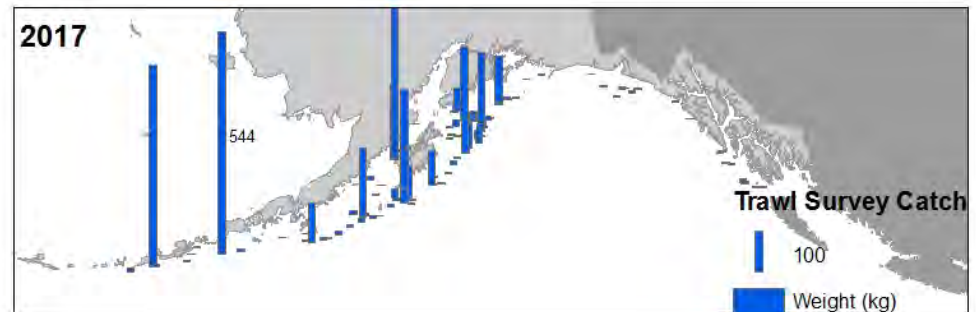
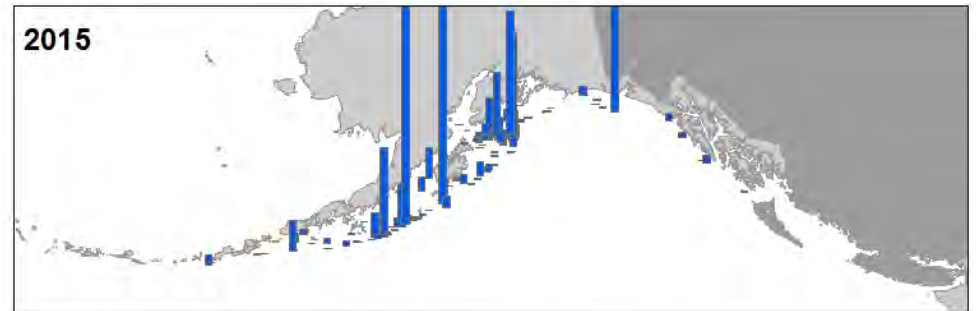
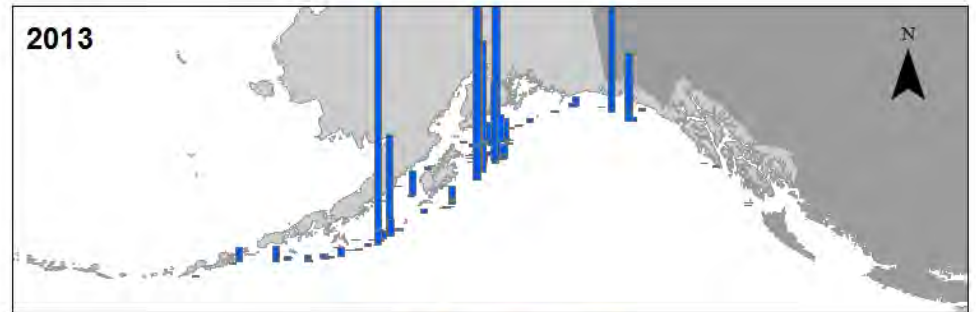


- New data
 - ♦ 2016, 2017, 2018* catch (*projected)
 - ♦ 2017 trawl survey biomass
 - ♦ 2015, 2017 survey age comps
 - ♦ 2014, 2016 fishery age comps
 - ♦ 2015, 2017 fishery length comps

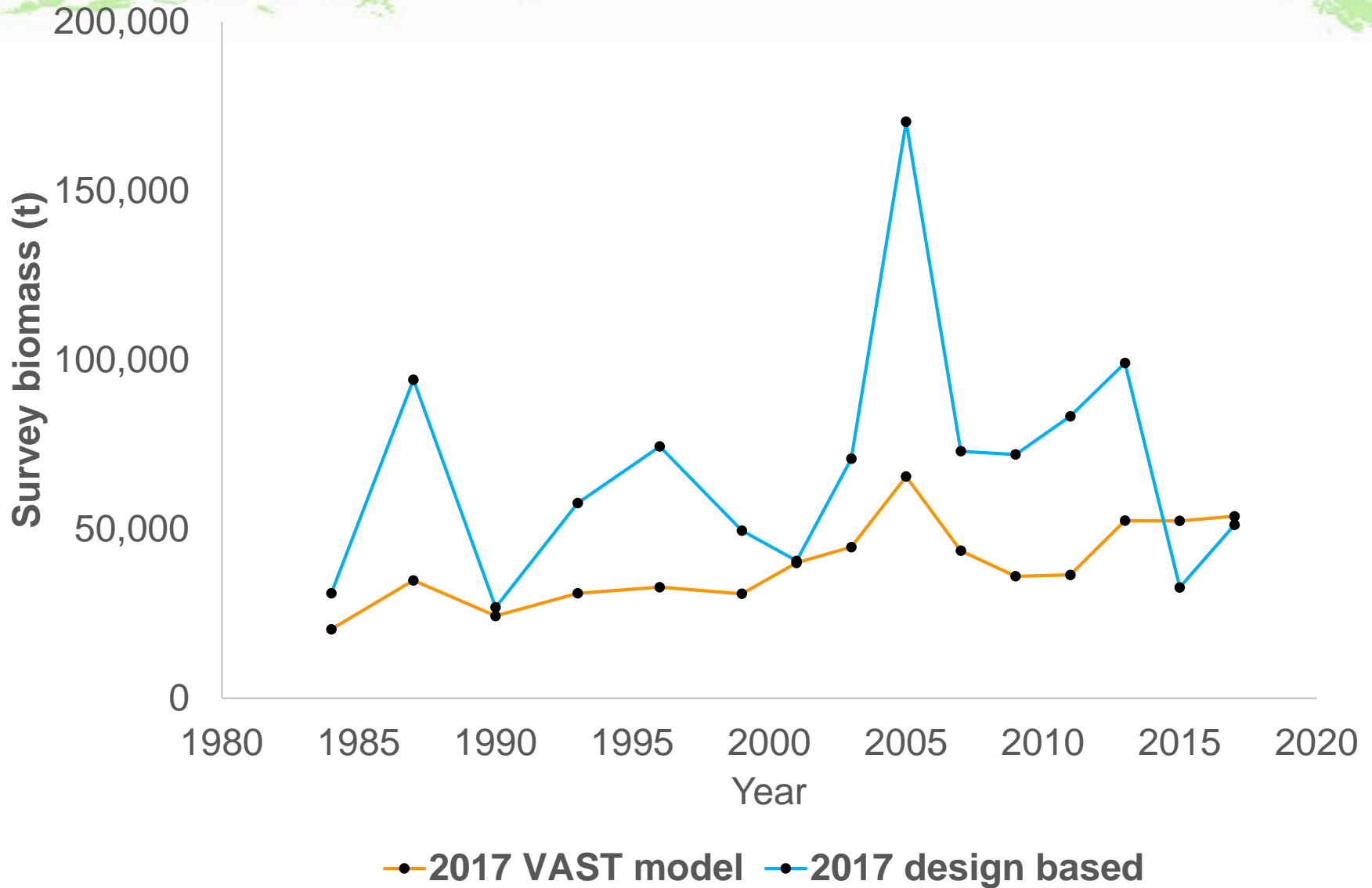
Dusky catches in recent Trawl Surveys

2017 trawl survey

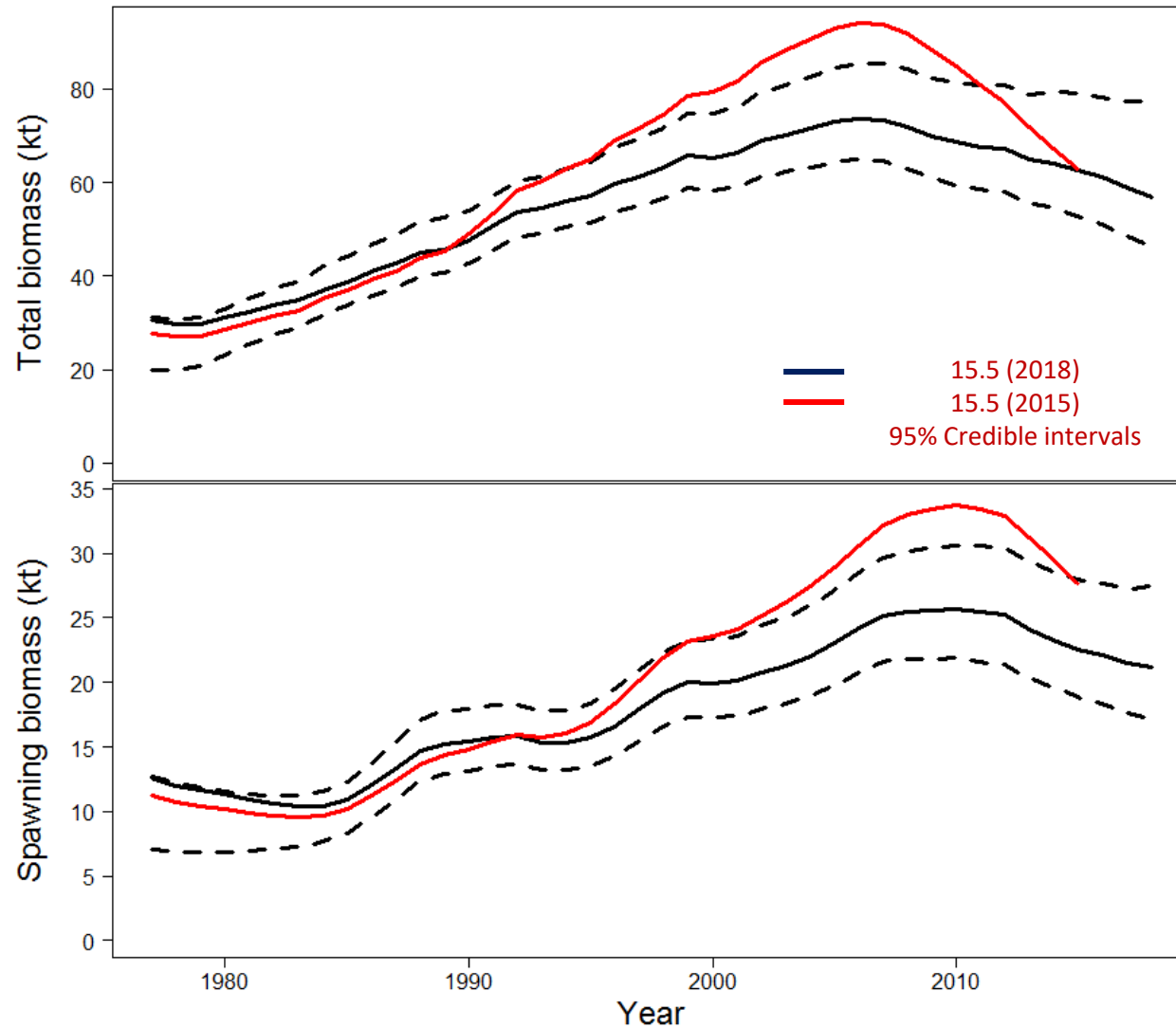
- sampled to 700m
- still covers dusky depth range well



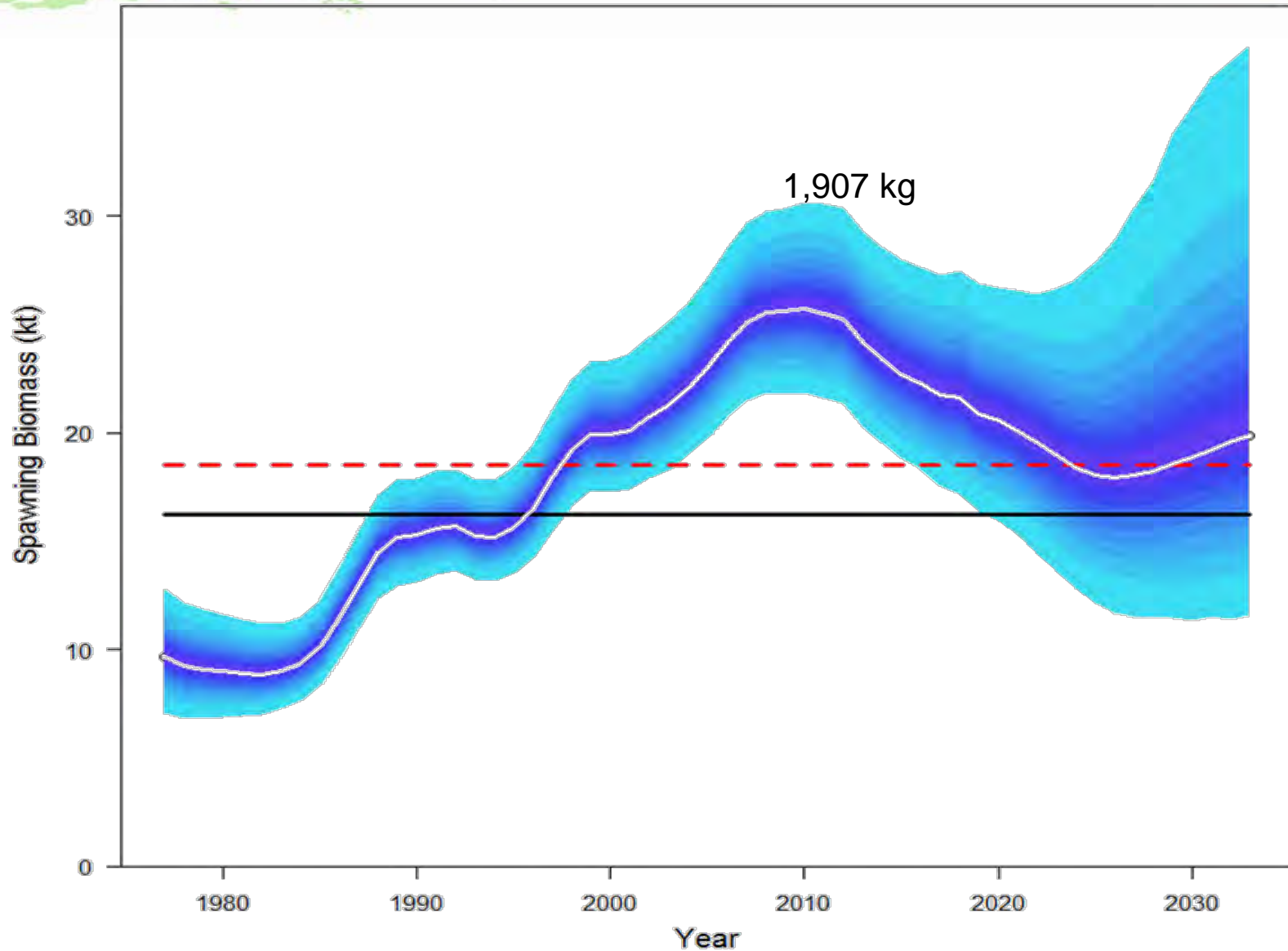
Dusky Trawl Survey Biomass



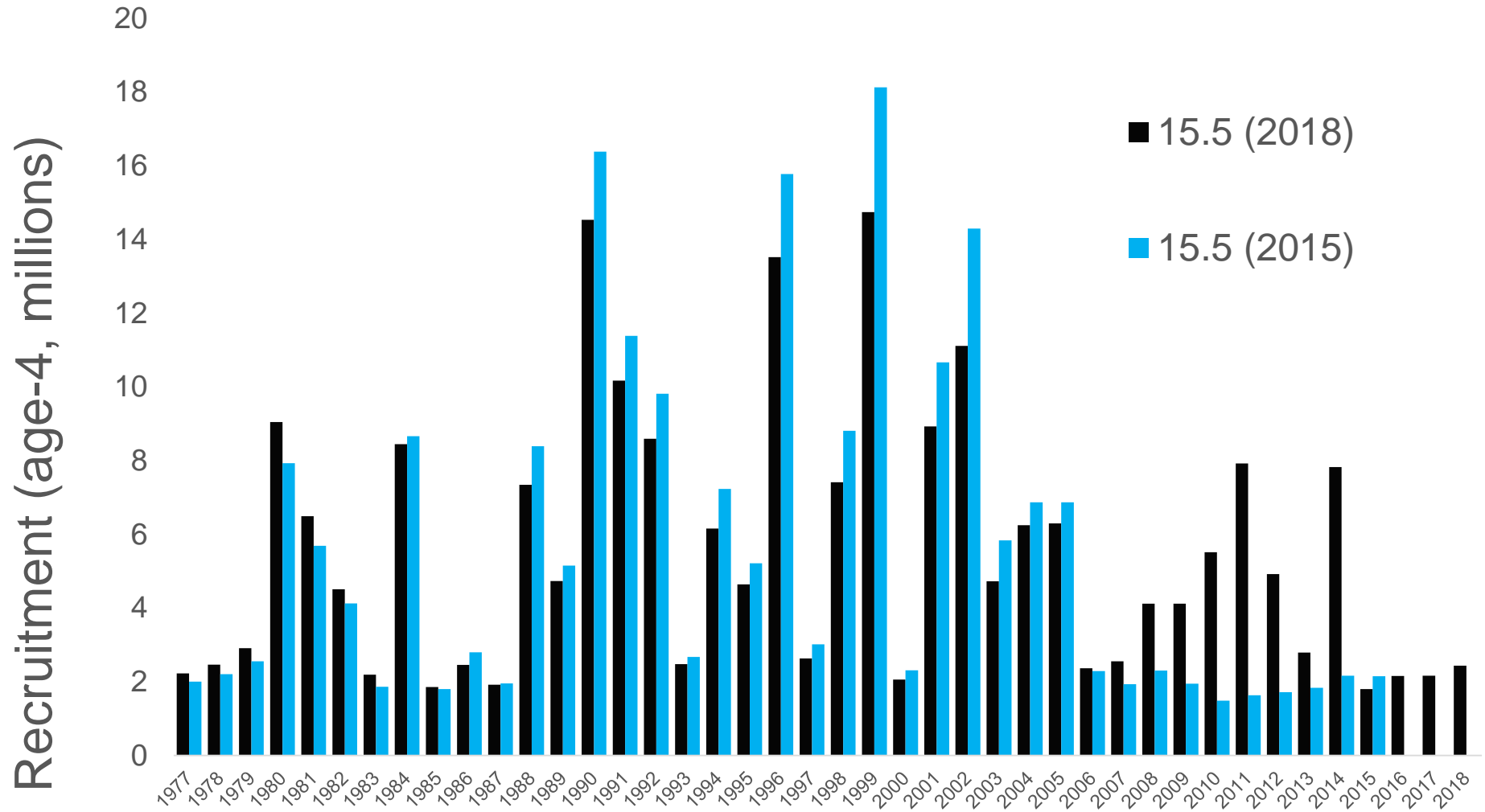
Dusky rockfish biomass



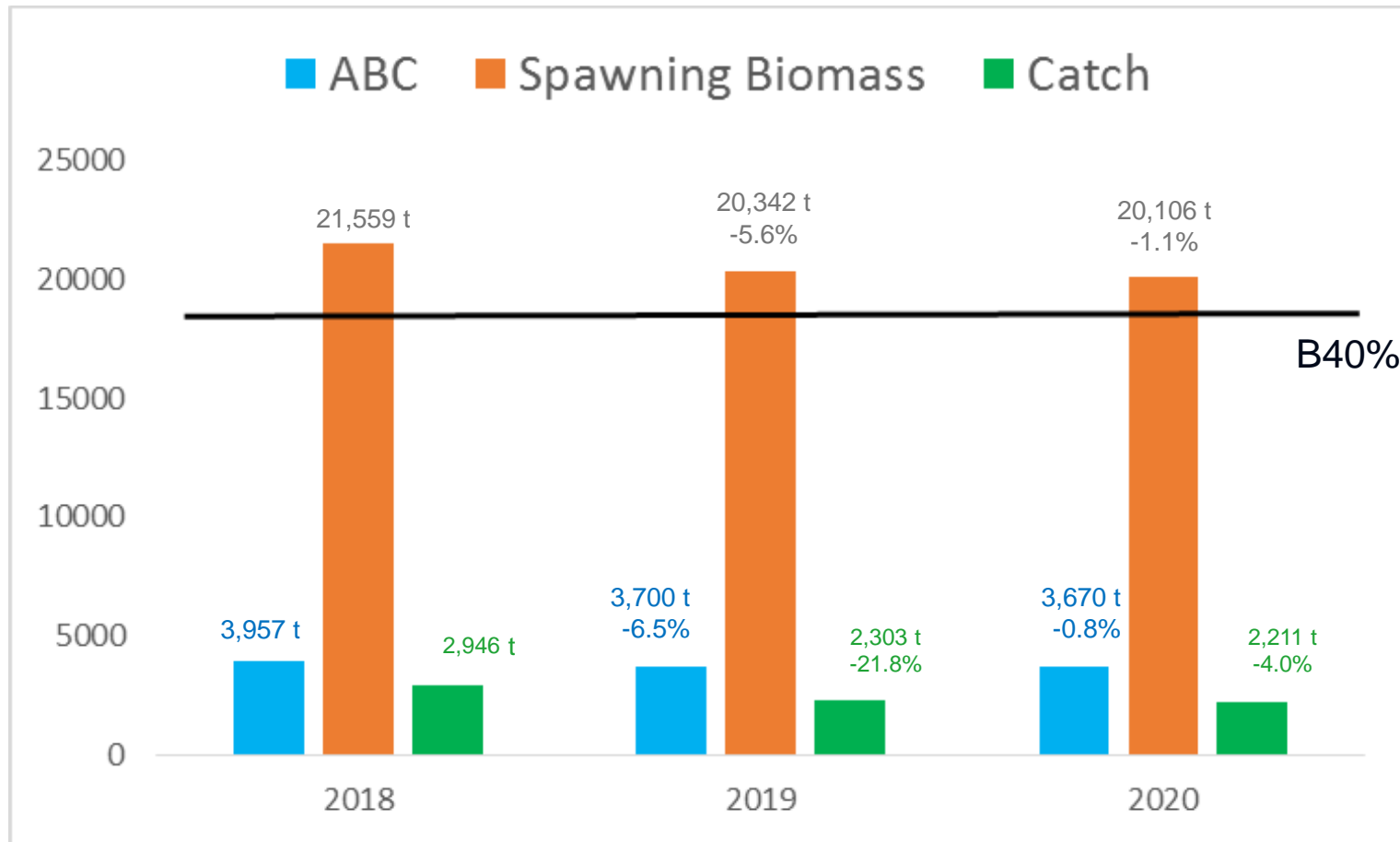
Dusky rockfish spawning biomass



Dusky rockfish recruitment



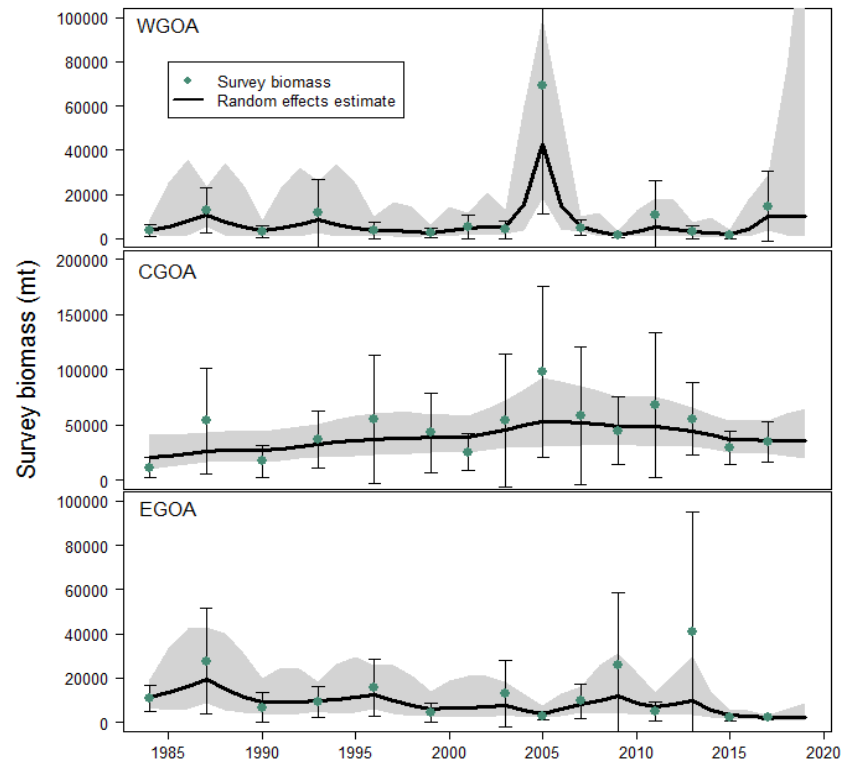
Dusky rockfish 3 year summary



*Estimated catch of 2,946 t for 2018, and estimates of 2,303 t and 2,211 t used in place of maximum permissible ABC for 2019 and 2020

Dusky Apportionment

	Western	Central	Eastern	[Eastern sub-areas]		Total
Area Apportionment	21.1%	74.7%	4.2%	W.Yak	EY/SE	100%
2019 ABC (t)	781	2,764	155	95	60	3,700
2020 ABC (t)	774	2,742	154	94	60	3,670



Dusky summary & research priorities

- CIE coming for rockfish
- Geostatistical model-for apportionment
 - ♦ Replace RE model applied on design-based estimates
- Track VAST discussions and test any recommended changes, as needed

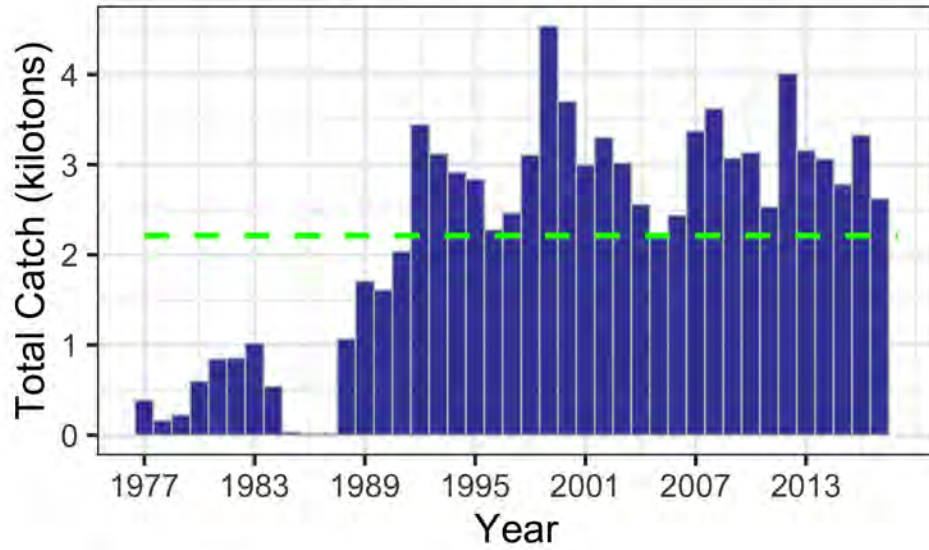
Dusky rockfish - Summary

Team recommended:

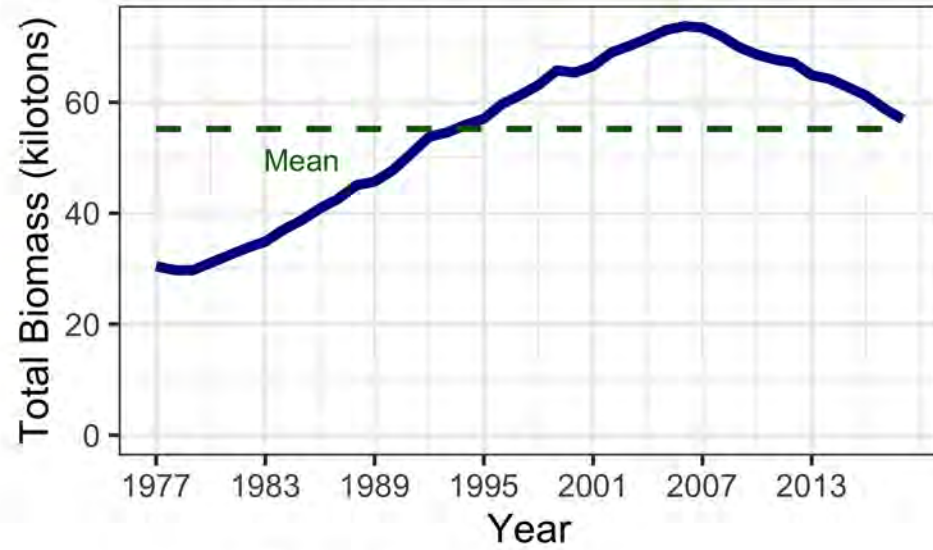
- **That the authors examine the impact of including the 1984 and 1987 survey data, and**
- **That the use of the VAST approach for spatial apportionment and for projections (similar to the one-dimensional random effects model) be investigated.**

GOA Dusky Rockfish

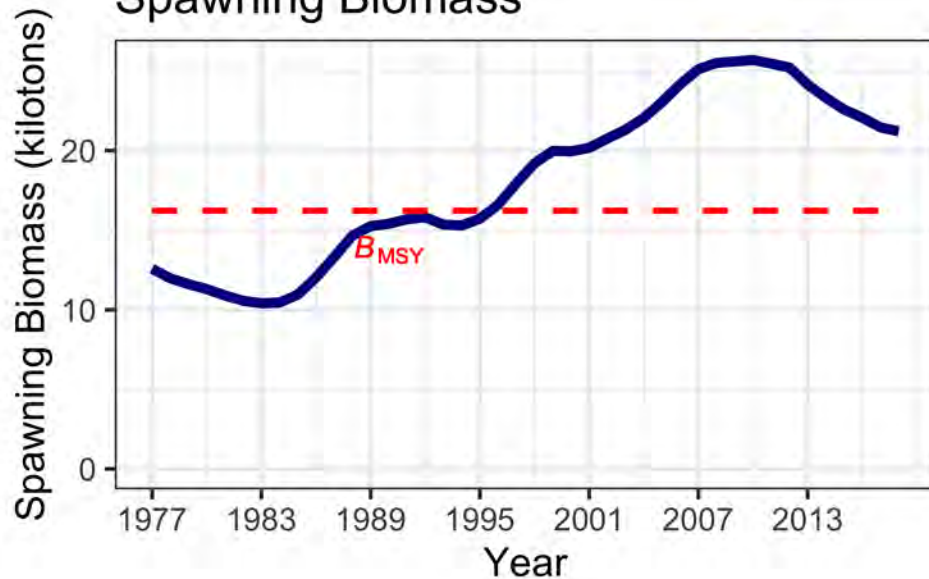
Total Catch



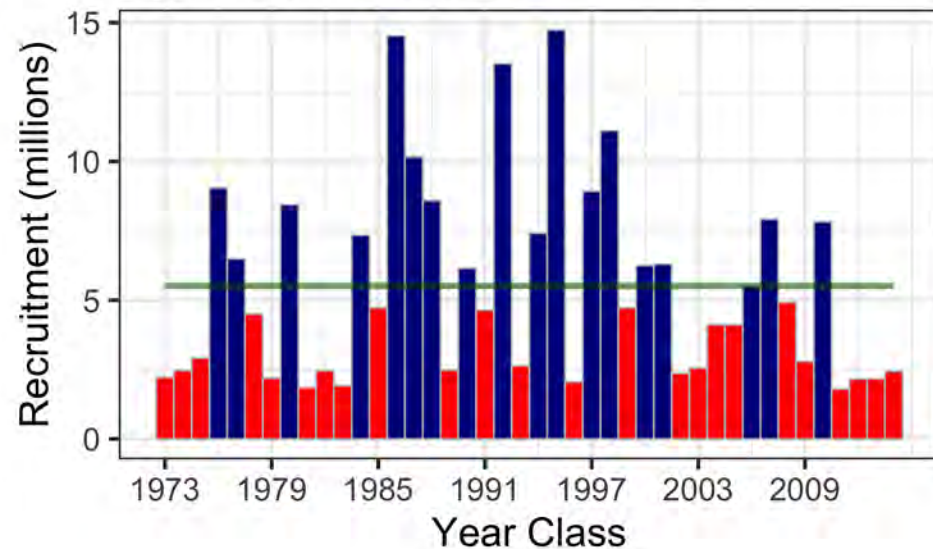
Total Biomass



Spawning Biomass



Age 4 Recruitment



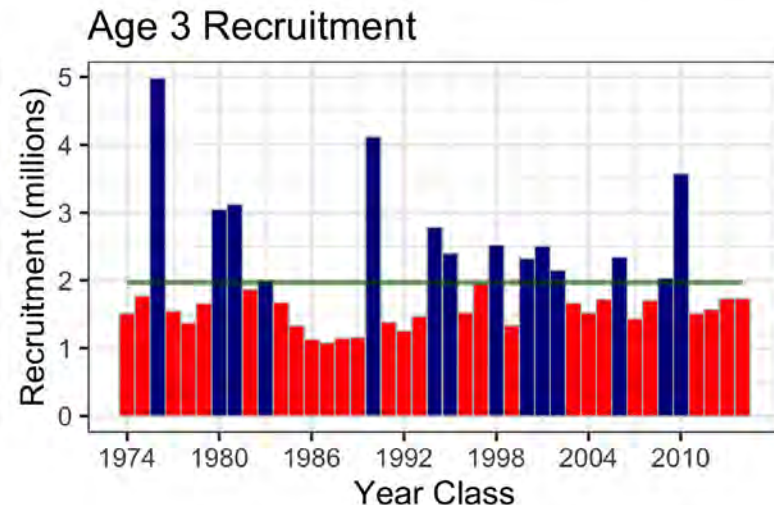
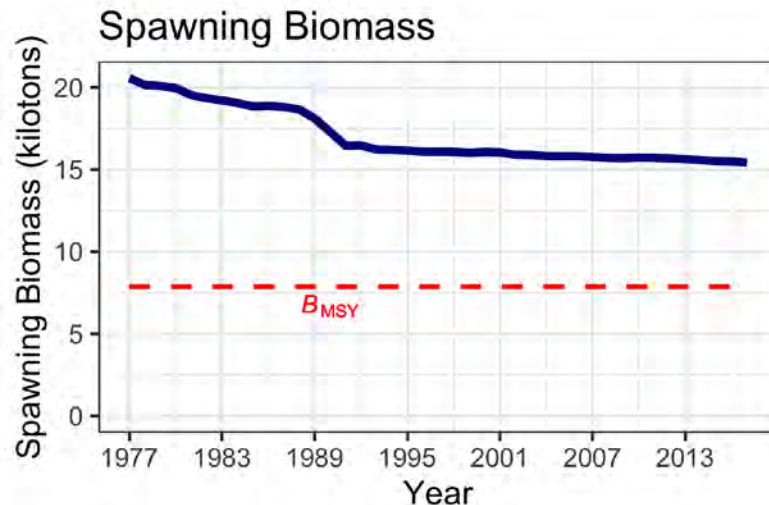
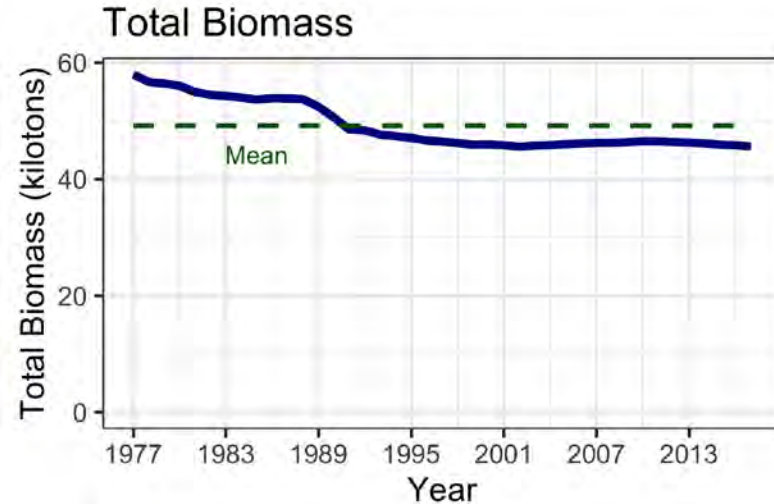
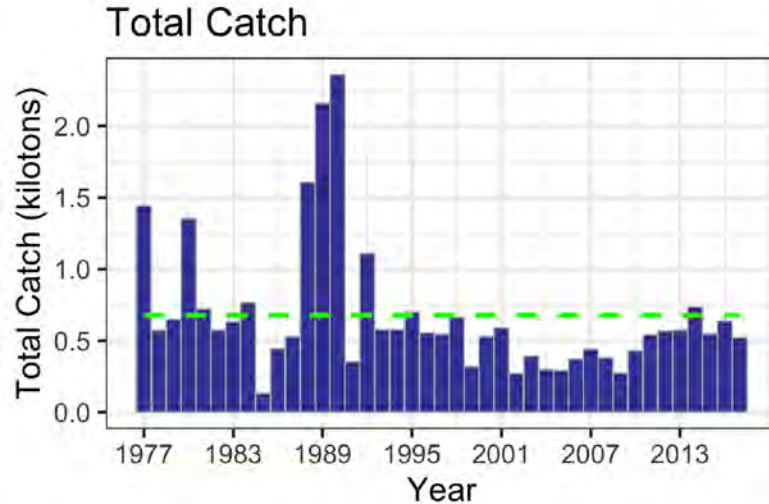
Rockfish ABC Summary

Species	2018	2019	Change
POP	29,236	28,555	down 681 (2%)
northern rockfish	3,685	4,529	up 844 (23%)
Shortraker Rockfish	863	863	same (0%)
Dusky	3,957	3,700	down 257 (6%)
Rougeye and Blackspotted Rockfish	1,444	1,428	down 16 (1%)
Demersal shelf rockfish	250	261	up 11 (4%)
Thornyhead	2,038	2,016	down 22 (1%)
Other rock	5,594	5,594	same (0%)
Sub Total	47,067	46,946	down 121 (0%)

13. GOA Blackspotted/Rougheye Rockfish

Partial assessment

Catches low relative to total biomass



Rockfish ABC Summary

Species	2018	2019	Change
POP	29,236	28,555	down 681 (2%)
northern rockfish	3,685	4,529	up 844 (23%)
Shortraker Rockfish	863	863	same (0%)
Dusky	3,957	3,700	down 257 (6%)
Rougeye and Blackspotted Rockfish	1,444	1,428	down 16 (1%)
Demersal shelf rockfish	250	261	up 11 (4%)
Thornyhead	2,038	2,016	down 22 (1%)
Other rock	5,594	5,594	same (0%)
Sub Total	47,067	46,946	down 121 (0%)

14. Demersal shelf rockfish

Stock Assessment

DSR Complex:

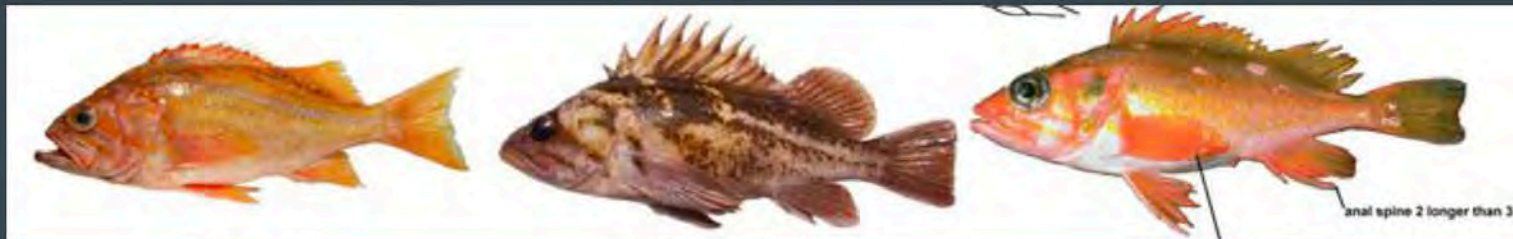


Yelloweye
(*S. ruberrimus*)

Quillback
(*S. maliger*)

Tiger
(*S. nigrocinctus*)

China
(*S. nebulosus*)



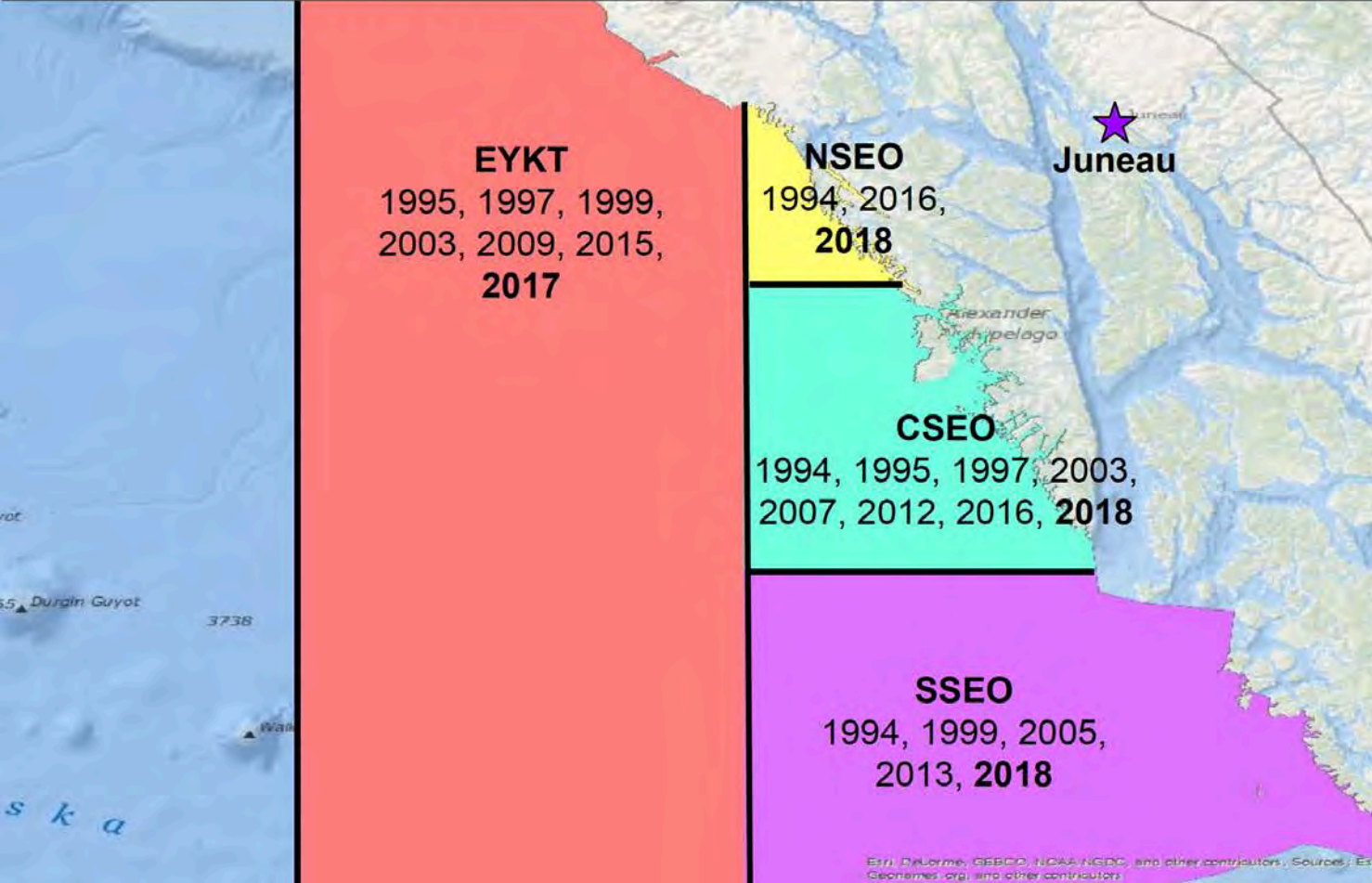
Canary
(*S. pinniger*)

Copper
(*S. caurinus*)

Rosethorn
(*S. helvomaculatus*)

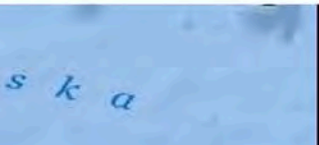
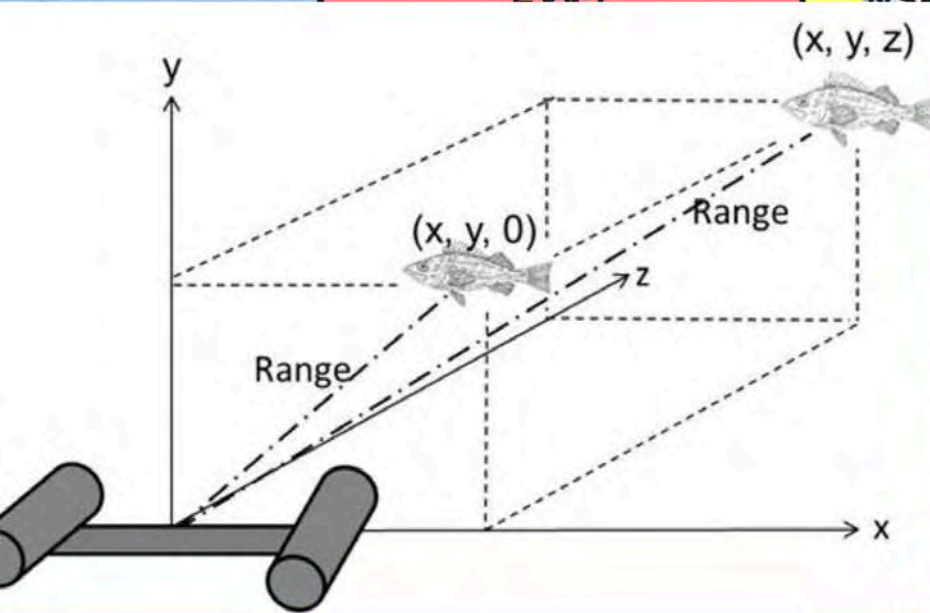
14. Demersal shelf rockfish

Stock Assessment



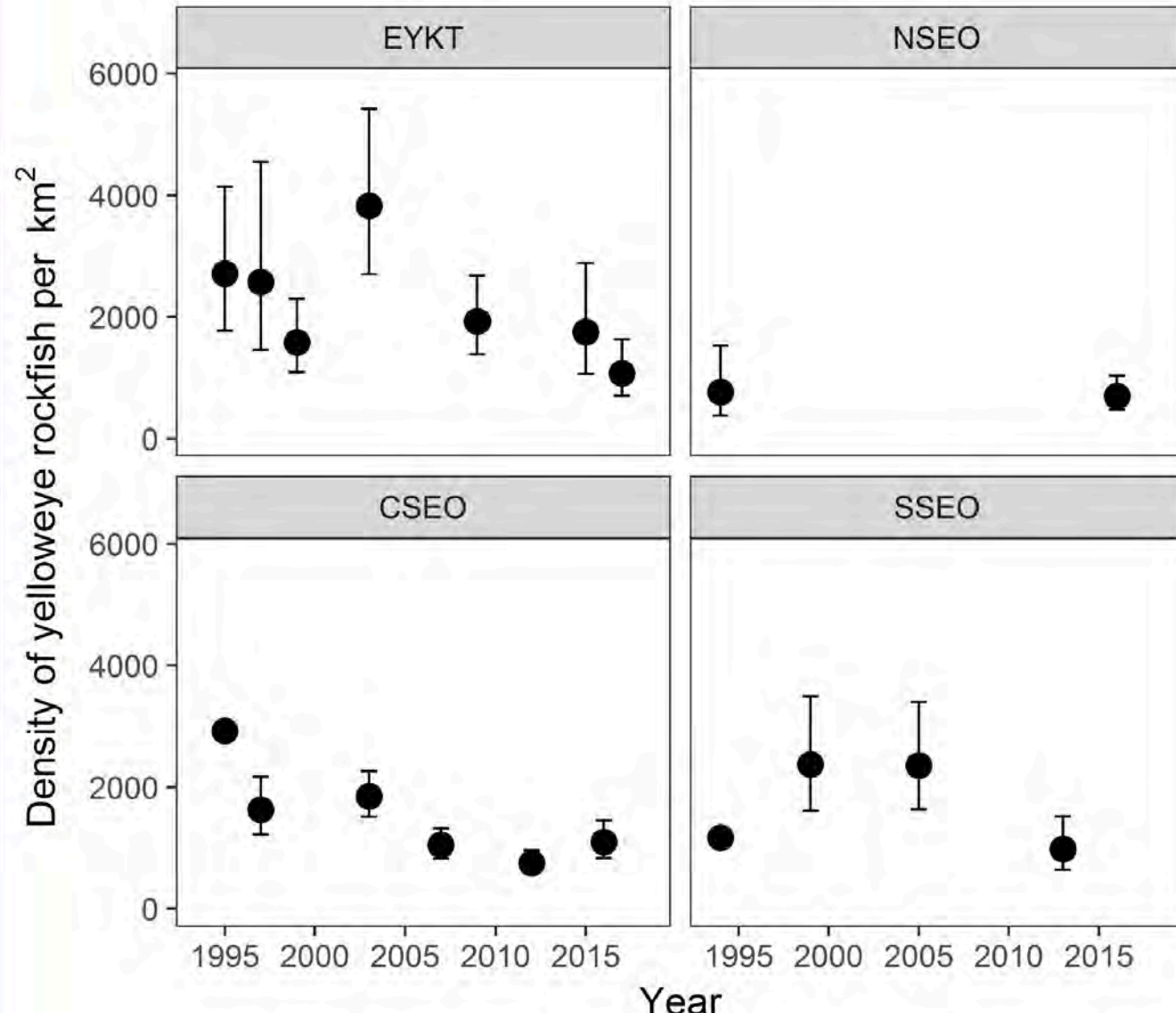
14. Demersal shelf rockfish

Stock Assessment



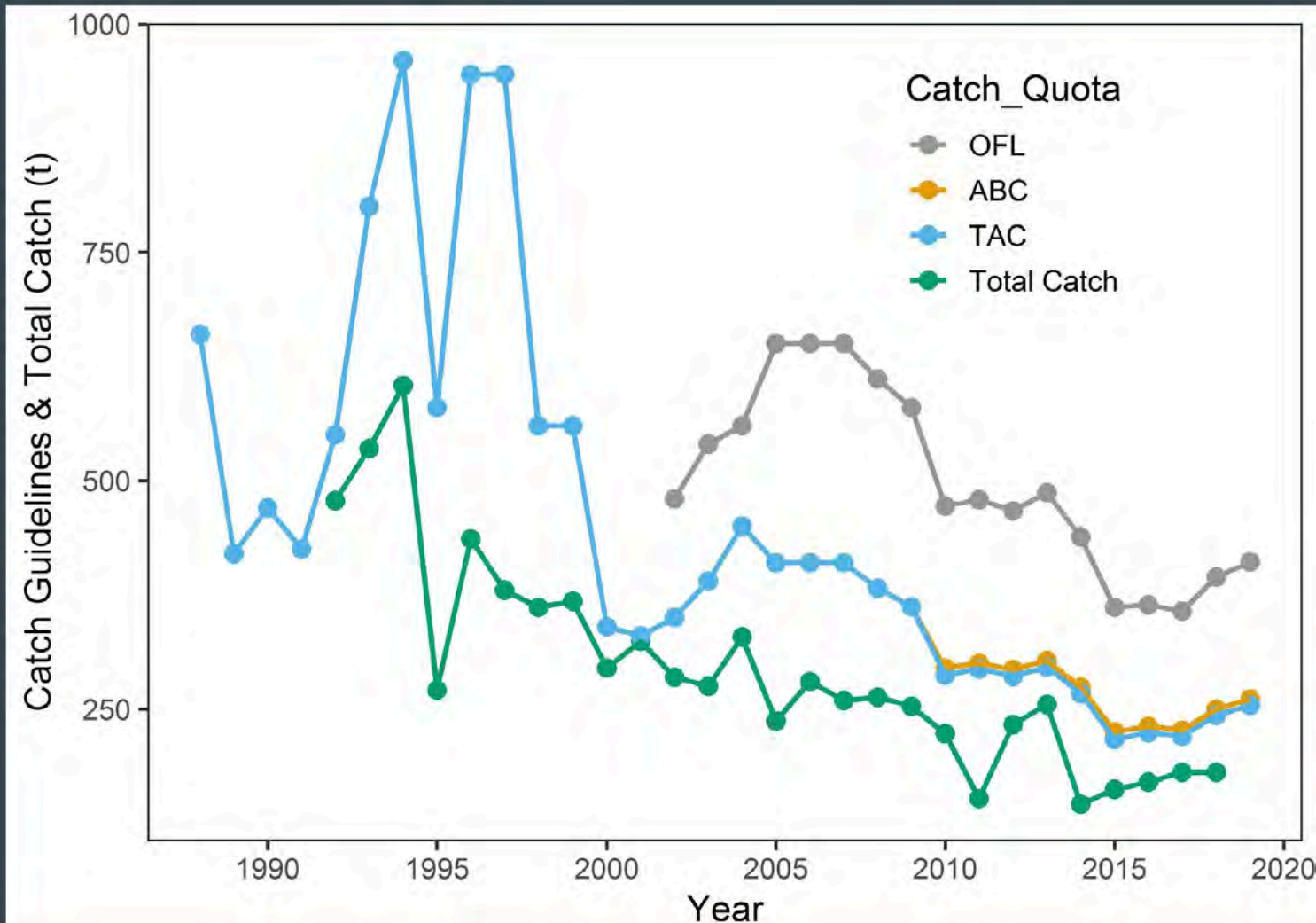
14. Demersal shelf rockfish

Sub & ROV
Density
Estimates
(95% CI)



14. Demersal shelf rockfish

Catch Guidelines vs Total Catch



14. Demersal shelf rockfish

Recommended Allocation

2019 recommended ABC = 261 mt

261 t – 7 t (subsistence catch) = 254 t

Allocation: 84% Commercial / 16% Sport

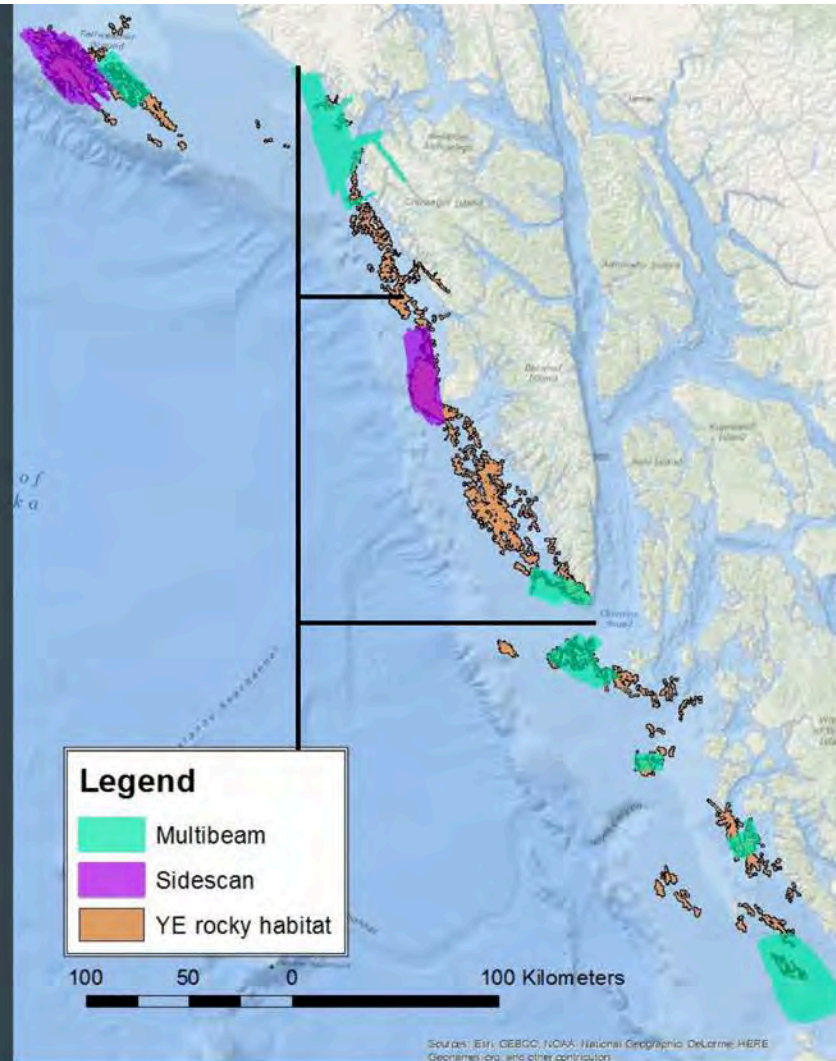
213 t to Commercial / 41 t to Sport



14. Demersal shelf rockfish

Future Research

- Age Structured Assessment in 2020
- Increase survey consistency for mgt areas
- Density estimates in 2019
 - SSEO, NSEO, & CSEO
- Survey EYKT in 2019
- Updating habitat maps using available information from NOAA, USGS, and Alaska Longliners Fisheries Association (ALFA)
- Develop YE habitat suitability model for survey area stratification



GOA Demersal shelf rockfish

- **The GOA Plan Team recommends**
 - ♦ **The Team recommends that the authors provide rationale in the assessment of why M is being used instead of $F_{40\%}$ and why the lower 90% CI for biomass is used rather than the point estimate.**
 - ♦ **The Team recommends the authors examine the risk table for the next assessment.**

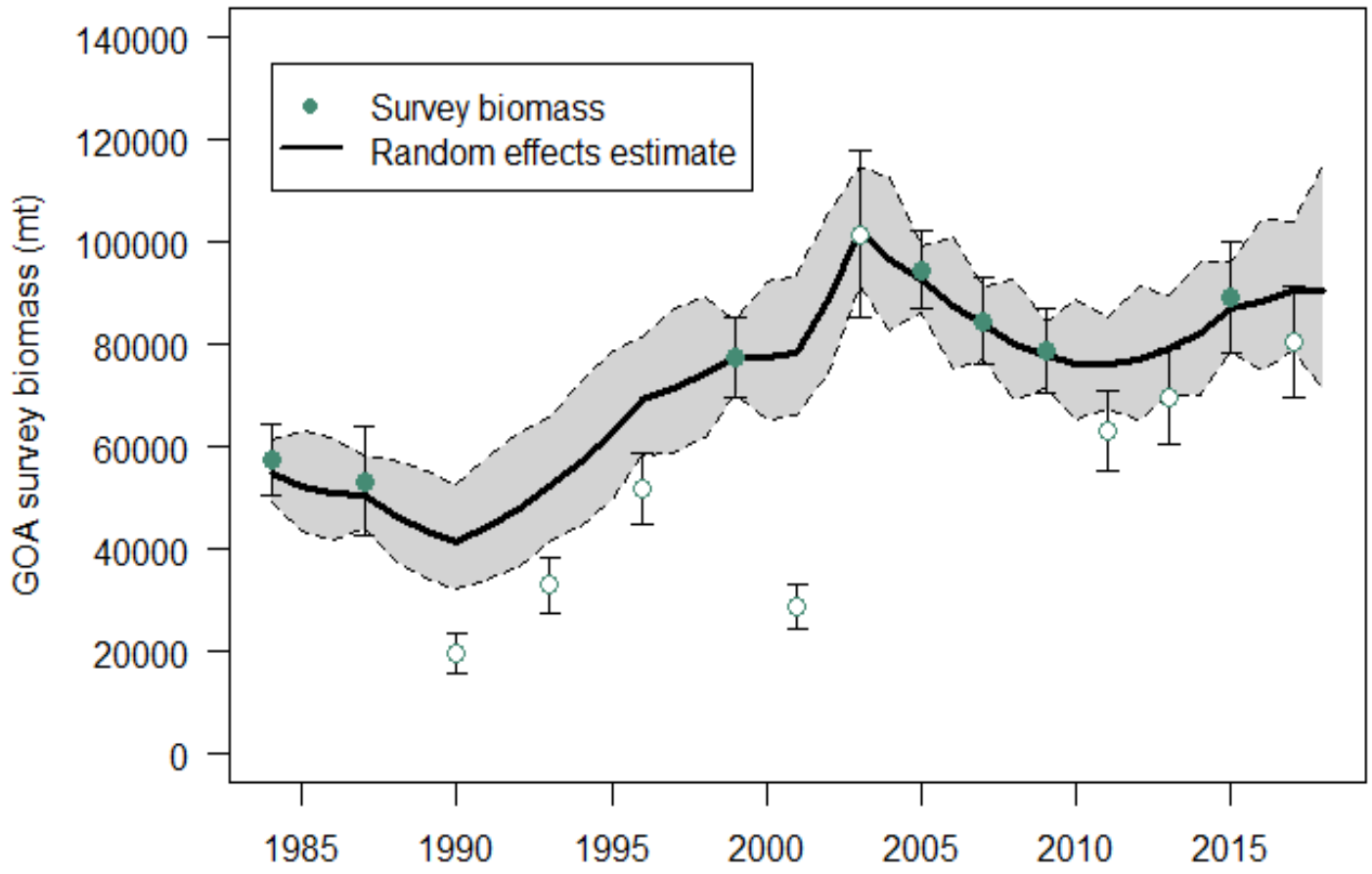
Rockfish ABC Summary

Species	2018	2019	Change
POP	29,236	28,555	down 681 (2%)
northern rockfish	3,685	4,529	up 844 (23%)
Shortraker Rockfish	863	863	same (0%)
Dusky	3,957	3,700	down 257 (6%)
Rougeye and Blackspotted Rockfish	1,444	1,428	down 16 (1%)
Demersal shelf rockfish	250	261	up 11 (4%)
Thornyhead	2,038	2,016	down 22 (1%)
Other rock	5,594	5,594	same (0%)
Sub Total	47,067	46,946	down 121 (0%)

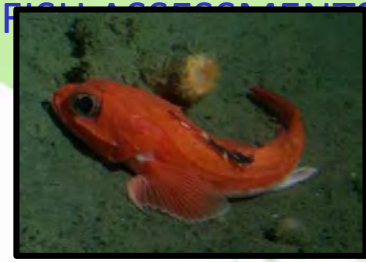
15. Shortspine thornyheads



Tier 5

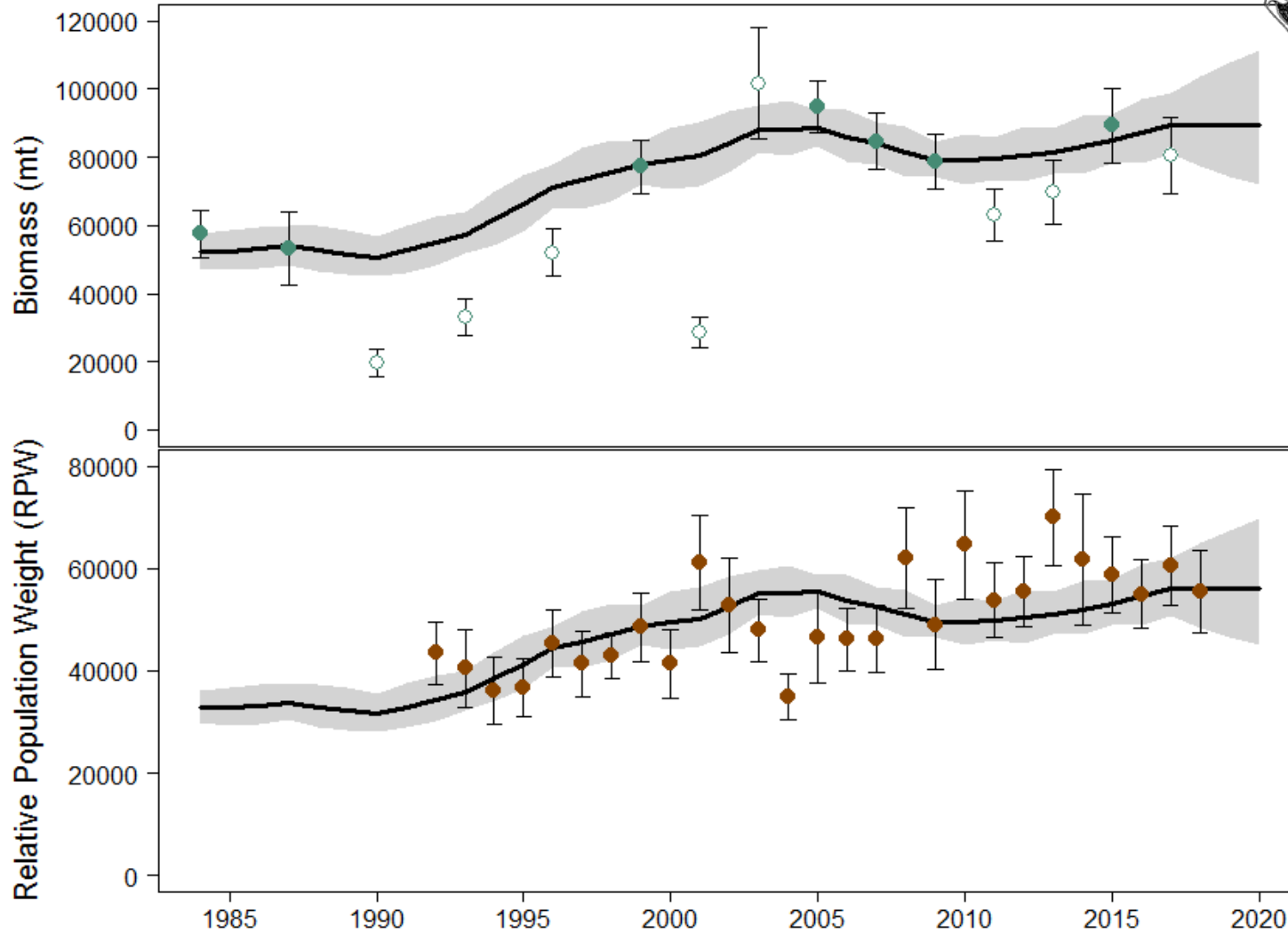


GOA Thornyhead Rockfish



- Tier 5 species new data
 - ◆ 2017 trawl survey biomass
 - ◆ 1992 – 2018 longline survey RPWs
- Exploitable biomass: 89,609 t
(1% decrease from 2017 estimate)
- Changes in Methodology:
 - ◆ Exploitable biomass estimation and harvest allocation
 - random effects model fit to the AFSC LL survey RPW index (1992-2018) **AND** the AFSC bottom trawl survey biomass index (1984-2017)
- Catch Update (October 10, 2018)
 - ◆ 2018 catch up 9% from 2017
 - ~54% of gulfwide ABC

Estimated Exploitable Biomass via Random Effects Model



Trawl survey biomass
10%



LL Survey RPW
13%



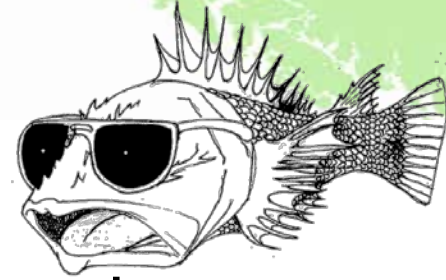
GOA Thornyhead Summary



- GOA thornyhead recommendations for 2019 (tier 5):
 - $F_{OFL} = M = 0.03$
 - ♦ B (exploitable biom.) = 89,609 t
 - ♦ **OFL** = $89,609 \times 0.03 = \mathbf{2,688\ t}$
 - ♦ $F_{ABC} = 0.75 * M = 0.0225$
 - ♦ **ABC** = $89,609 \times 0.0225 = \mathbf{2,016\ t}$
(↓ 1.1% from 2,038 t in 2018)

Thornyhead

Apportionment of ABC for 2019



Apportionment based on random effects by region

Uses

1984-2017 trawl survey AND

1992-2018 LL survey RPW estimates

- Western: 326 t (↓5%)
- Central: 911 t (↓1%)
- Eastern: 779 t (↑1%)

ABCs for remaining GOA species

Species	2018 Catch	2018	2019	Change
Pollock	154,286	170,265	144,623	down 25,642 (15%)
Pacific Cod	9,595	18,000	17,000	down 1,000 (6%)
Sablefish	11,716	11,505	11,571	up 66 (1%)
Flatfish	22,053	114,712	116,562	up 1,850 (2%)
Arrowtooth flounder	2,045	150,945	145,841	down 5,104 (3%)
Rockfish	33,425	47,067	46,946	down 121 (0%)
Atka mackerel	1,431	4,700	4,700	same (0%)
Skates	2,786	7,804	7,804	same (0%)
Other Species	3,616	11,927	14,460	up 2,533 (21%)
Total	240,953	536,925	509,507	down 27,418 (5%)

Other species...

Species	2018 Catch	2018	2019	Change
Atka mackerel	1,431	4,700	4,700	same(0%)
Big skate	1,262	2,848	2,848	same(0%)
Longnose skate	843	3,572	3,572	same(0%)
Other skates	681	1,384	1,384	same(0%)
Sculpins	550	5,301	5,301	same(0%)
Sharks	2,886	4,514	8,184	up 3,670(81%)
Squid	41	1,137	-	down 1,137(100%)
Octopus	139	975	975	same(0%)

20. GOA Sharks



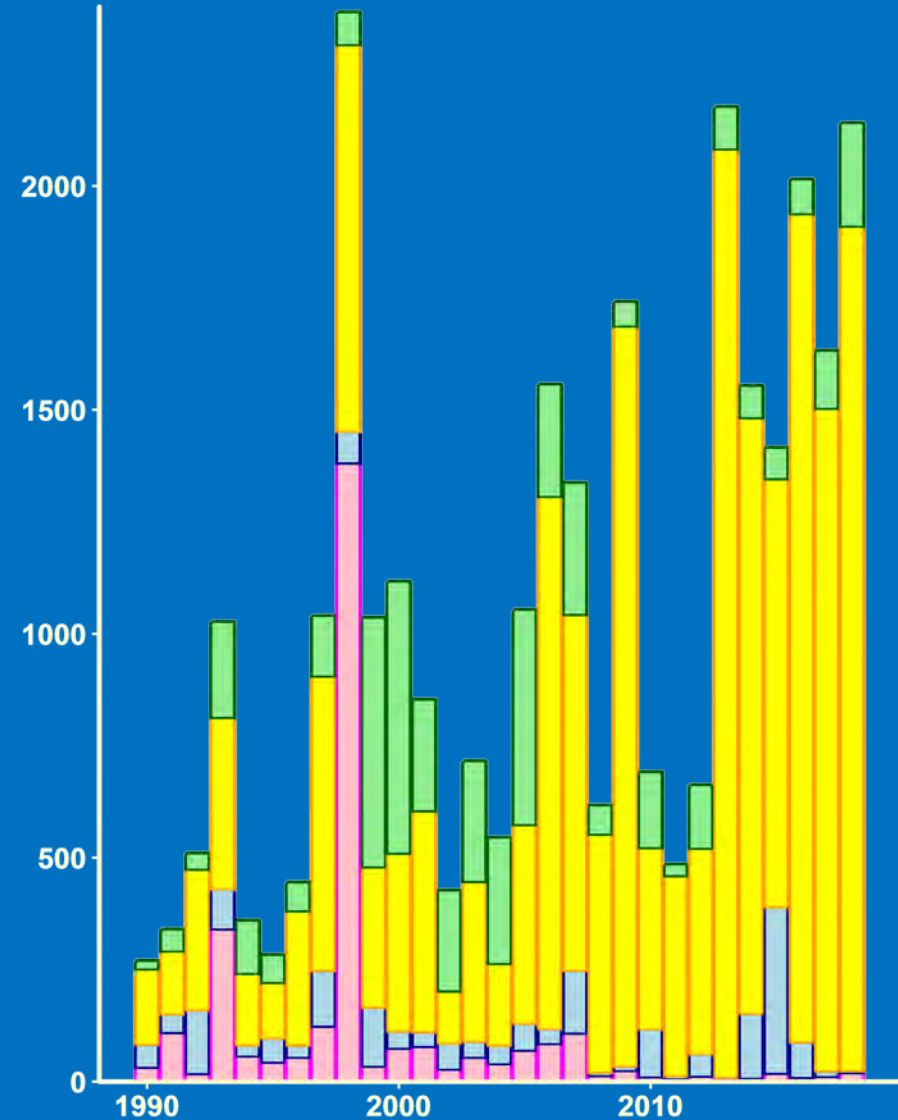
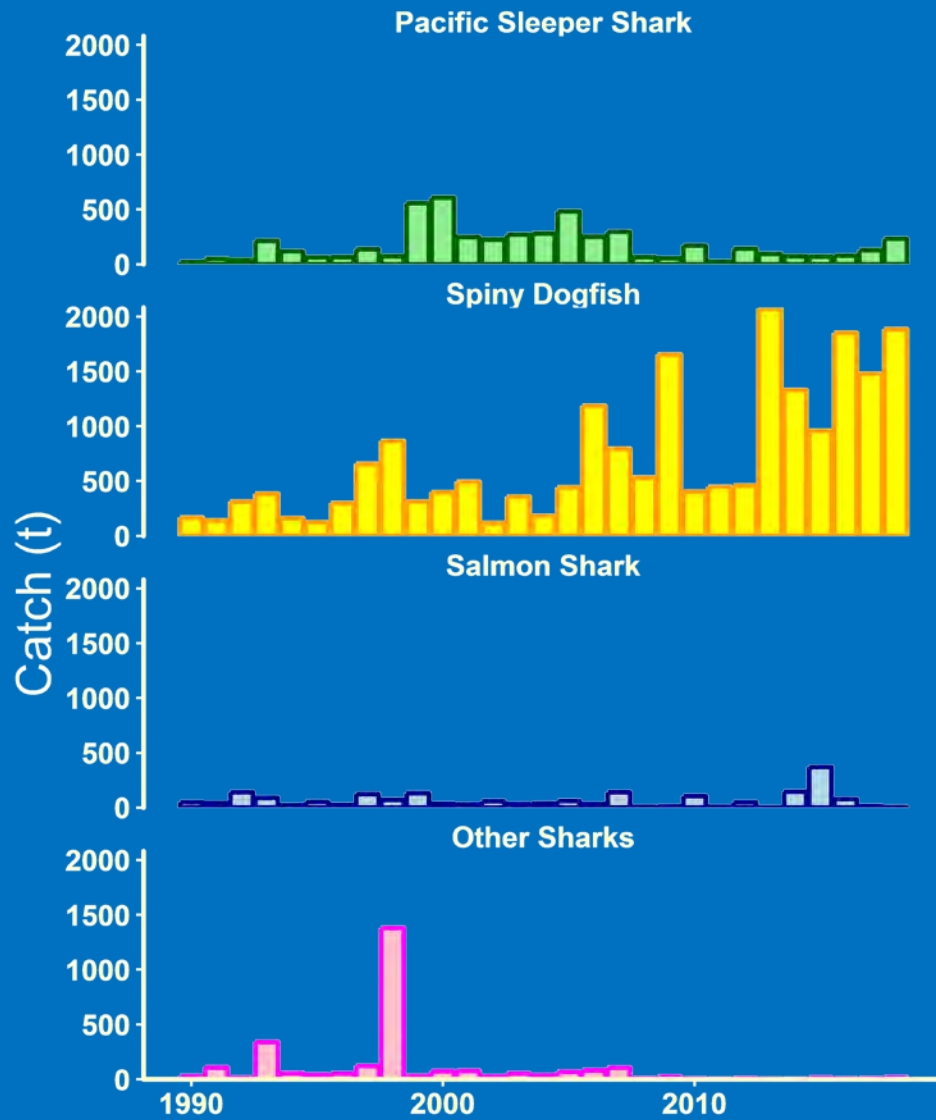
- Changes to input data:
 - ◆ Updated catch data through 2018 (as of Oct 9, 2018)
 - ◆ Updated data from AFSC trawl, AFSC longline, IPHC longline and ADF&G surveys
 - ◆ Updated random effects biomass
 - ◆ Estimate of catchability (q)

GOA Sharks



- Changes to assessment methodology:
 - ◆ Tier 6 species: none
 - ◆ Spiny dogfish (Model 15.3A)
 - Minimum biomass (B_{RFX}) adjusted by $q = 0.21$
 - $F_{OFL} = F_{max} = 0.04$
 - Model 15.1 (status quo) assumes $q = 1$ and $F_{OFL} = M = 0.097$

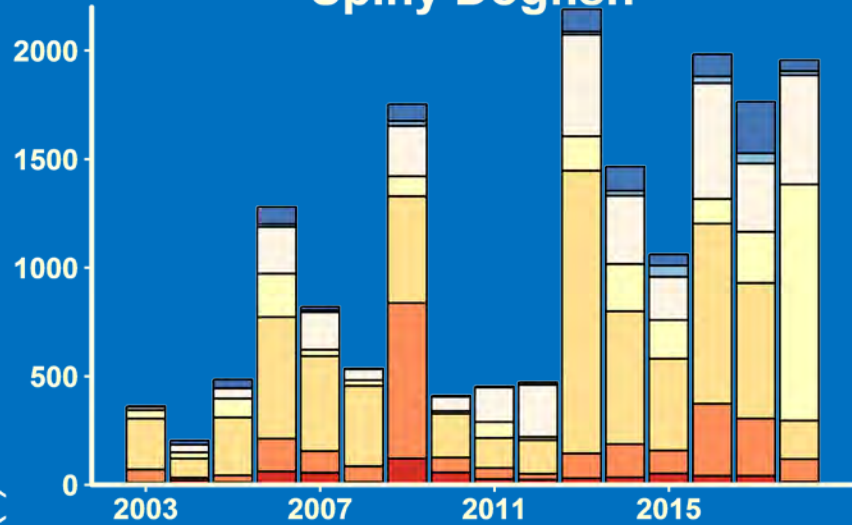
Species Specific Catch



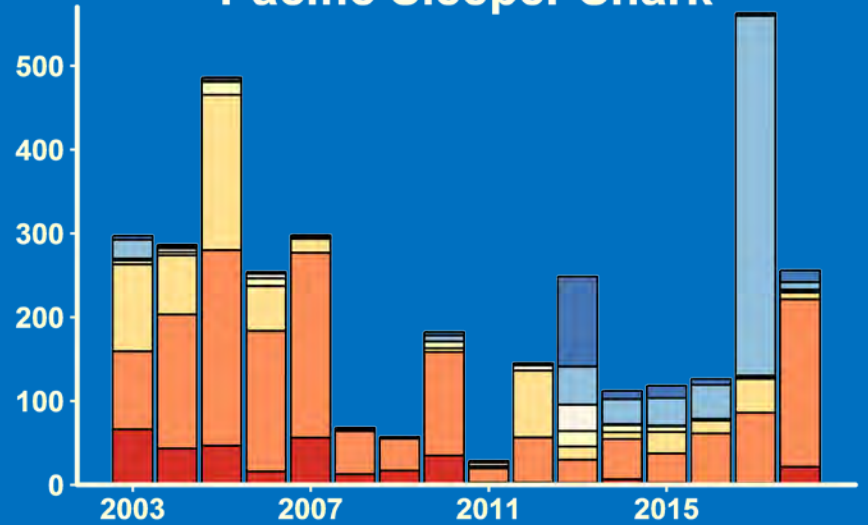
Year

Catch by Area

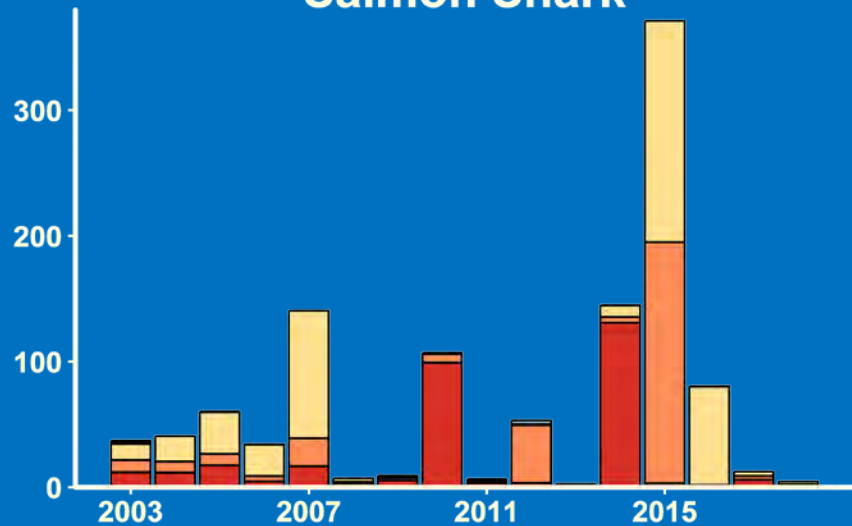
Spiny Dogfish



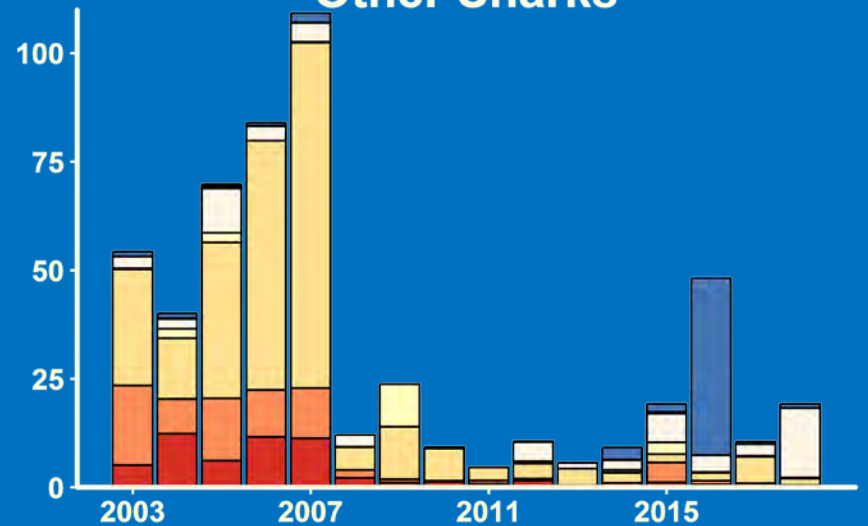
Pacific Sleeper Shark



Salmon Shark

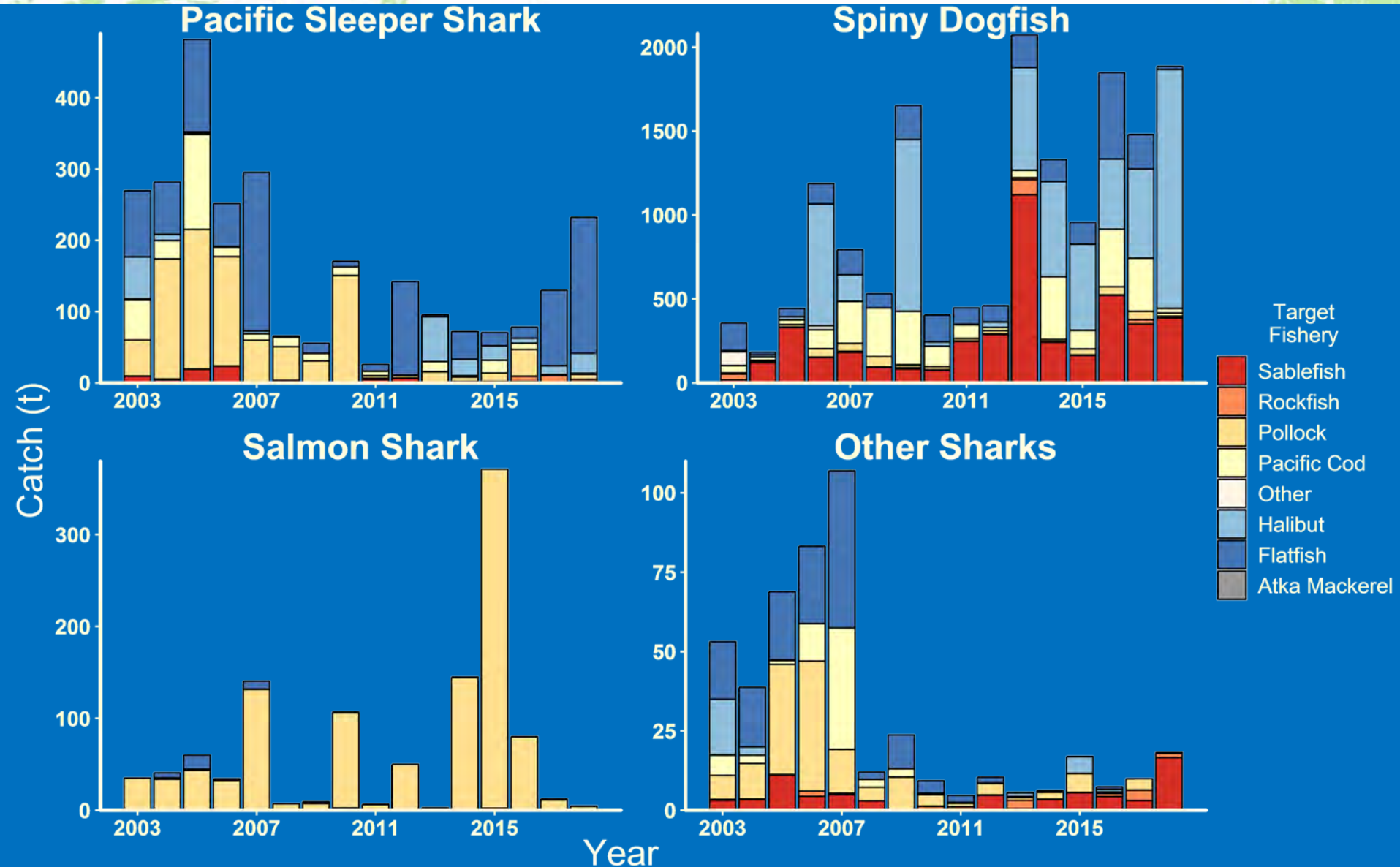


Other Sharks



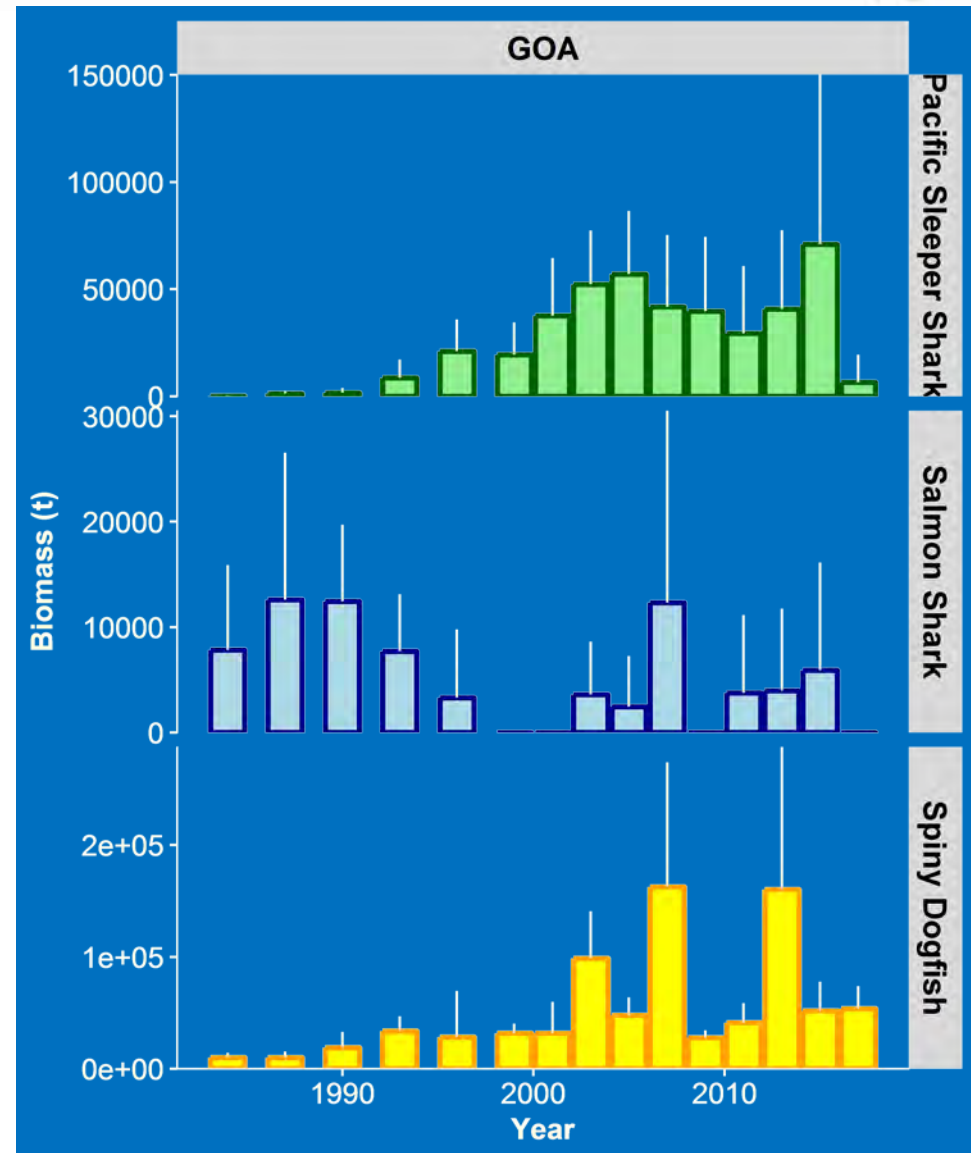
Year

Catch by Target Group



AFSC Trawl Survey

- Pacific Sleeper shark one of lowest of time series
- Spiny dogfish flat
- Only used for spiny dogfish



20. Sharks

Team recommended the author continue with efforts to estimate biomass in NMFS areas 649 and 659

- ♦ **small workgroup form to examine estimation approaches for 649/659 catches**

Forage species

- Author recommended title change
- **The Plan Team supported the author recommendation to include squid in the forage species category in the Ecosystem Chapter.**