



**NOAA
FISHERIES**

Alaska Fisheries
Science Center

BSAI Plan Team report

Grant Thompson, co-chair
Dana Hanselman, co-chair
Diana Stram, coordinator

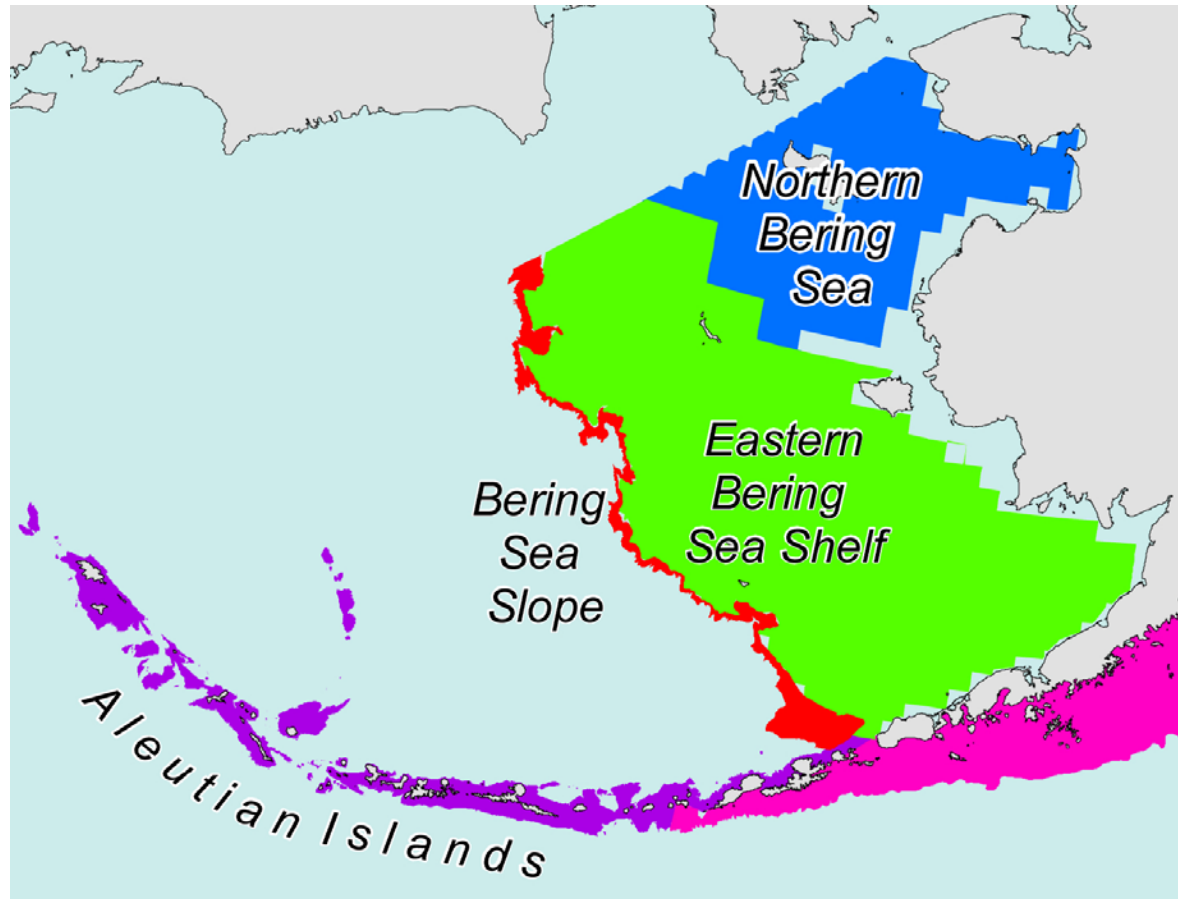
December 8, 2017

Team members

- Grant Thompson, co-chair (AFSC REFM)
- Dana Hanselman, co-chair (AFSC ABL)
- Diana Stram, coordinator (NPFMC)
- Jennifer Cahalan (PSMFC) – replacing Chilton
- Mary Furuness (NMFS AKRO)
- Alan Haynie (AFSC REFM)
- Allan Hicks (IPHC)
- Kirstin Holsman (AFSC REFM)
- Brenda Norcross (UAF)
- Chris Siddon (ADF&G)
- Jane Sullivan (ADF&G) – replacing Barnard
- Cindy Tribuzio (AFSC ABL)

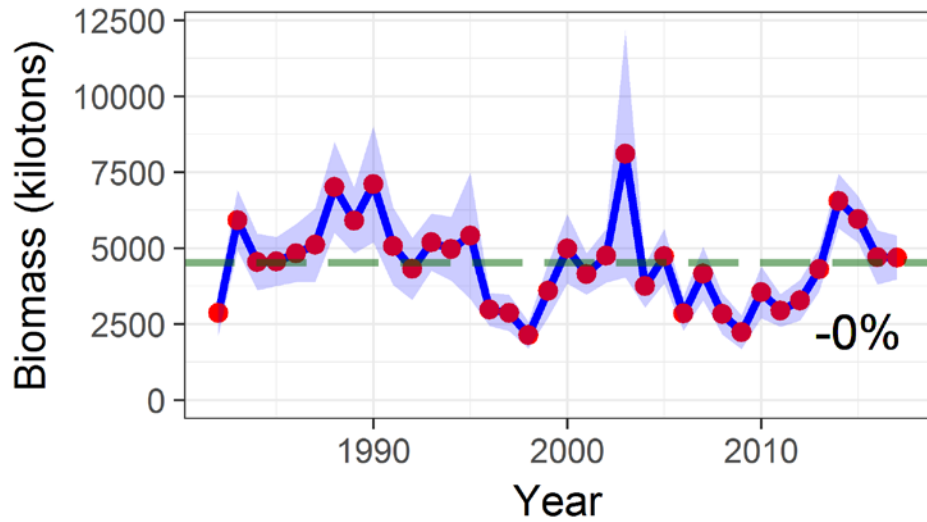
“Big picture” overview

BSAI bottom trawl survey areas

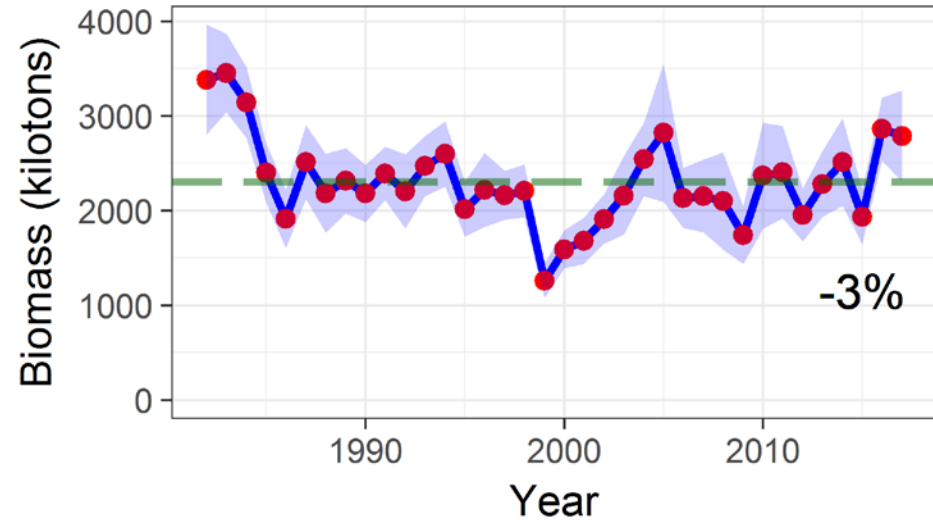


EBS Shelf Survey w/ 95% CIs

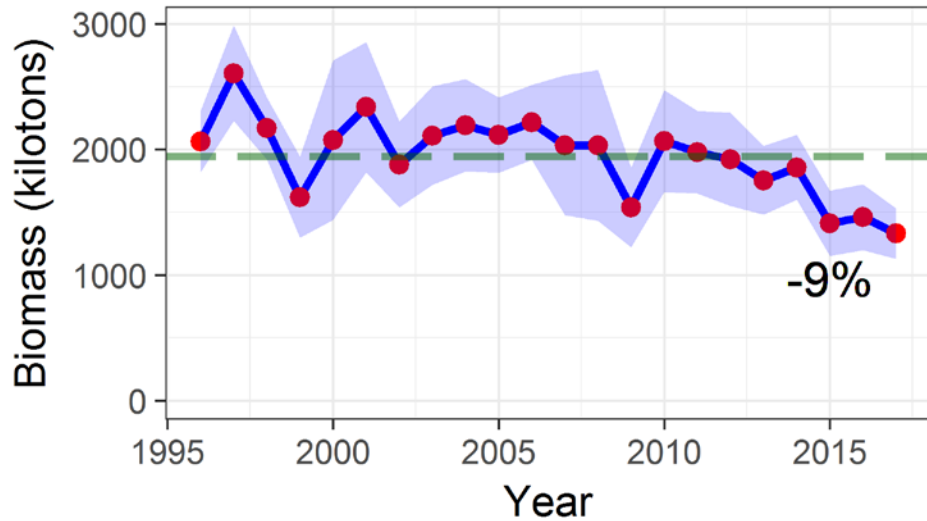
Walleye Pollock



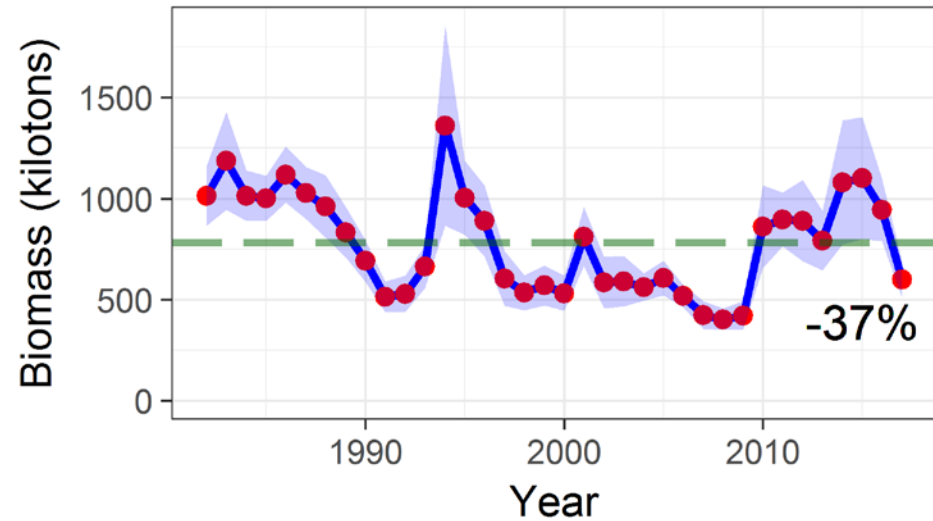
Yellowfin Sole



Northern Rock Sole

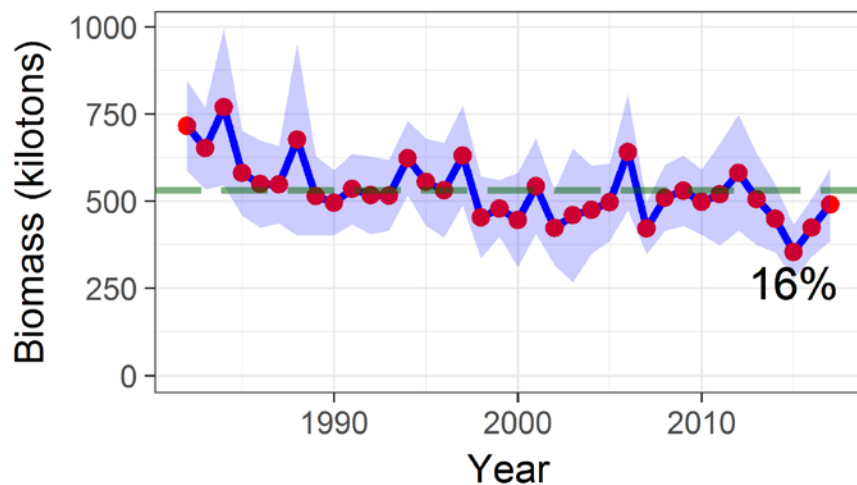


Pacific Cod

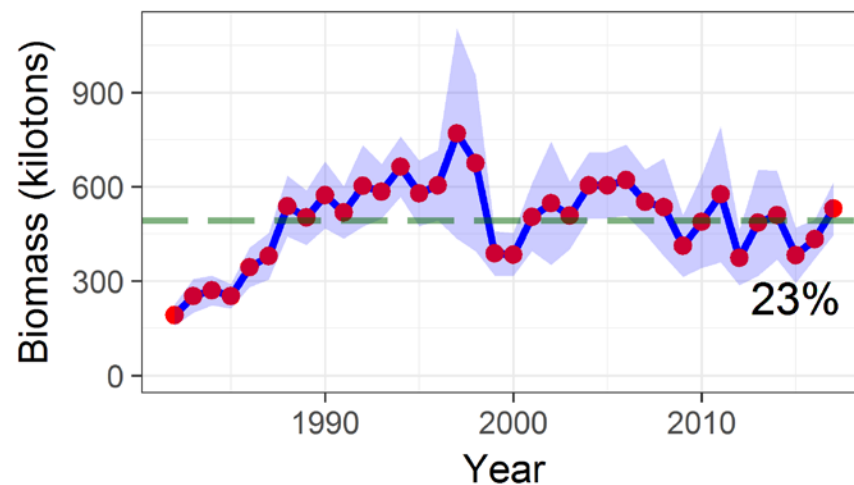


EBS Shelf Survey w/ 95% CIs

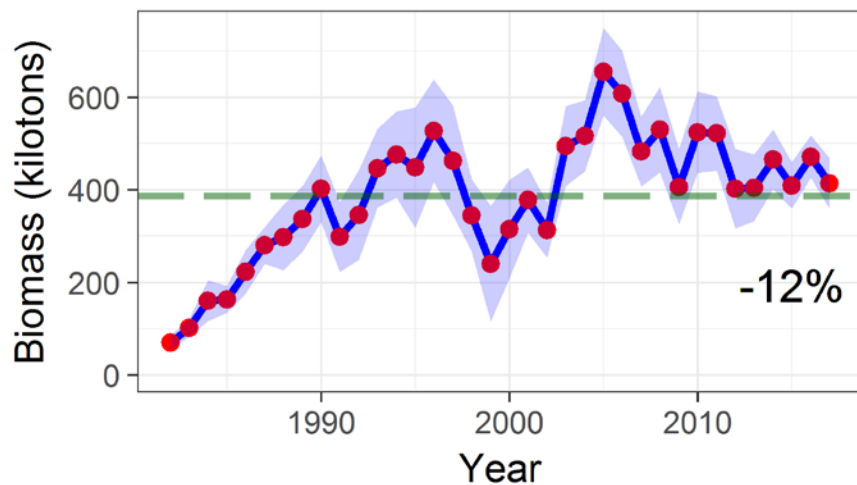
Alaska Plaice



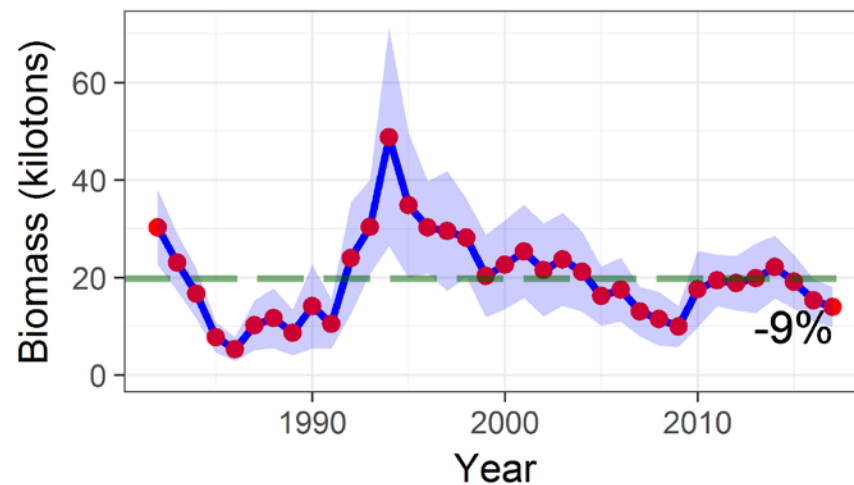
Flathead Sole



Arrowtooth Flounder



Greenland Turbot



Assessment schedule (1 of 2)

Stock/complex	Type	Tier(s)	Frequency	Next full
Eastern Bering Sea pollock	Full	1	1	2018
Bogoslof Island Pollock	None	5	2	2018
Aleutian Islands pollock	Partial	3	2	2018
Eastern Bering Sea Pacific Cod	Full	3	1	2018
Aleutian Islands Pacific cod	Full	5	1	2018
Sablefish	Full	3	1	2018
Yellowfin sole	Full	1	1	2018
Greenland Turbot	Partial	3	2	2018
Arrowtooth flounder	Partial	3	2	2018
Kamchatka flounder	Partial	3	2	2018
Northern Rock sole	Partial	1	2	2018
Flathead sole	Partial	3	2	2018
Alaska plaice	Full	3	2	2019
Other flatfish	None	5	4	2020

Assessment schedule (2 of 2)

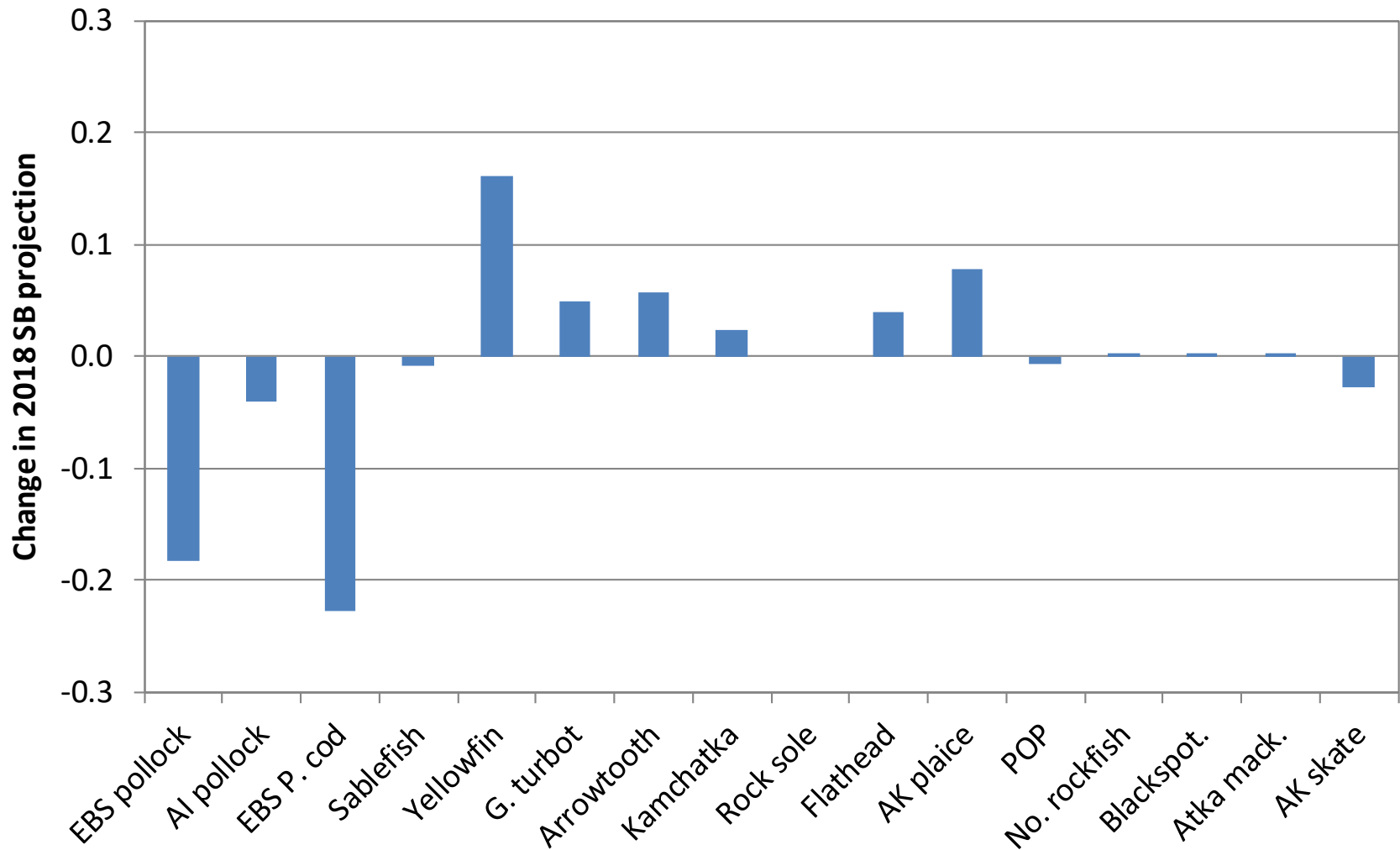
Stock/complex	Type	Tier(s)	Frequency	Next full
Pacific ocean perch	Partial	3	2	2018
Northern rockfish	Partial	3	2	2019
Rougeye & blackspotted rockfish	Partial	3	2	2018
Shortraker rockfish	None	5	2	2018
Other rockfish	None	5	2	2018
Atka mackerel	Full	3	1	2018
Squid	None	6	2	2018
Skates	Partial	3/5	2	2018
Sharks	None	5	2	2018
Octopus	None	6	2	2018
Sculpins	Partial	5	4	2019
Forage Species	Report	Eco	2	2019
Grenadiers (BSAI/GOA)	None	Eco	4	2020

Changes in models

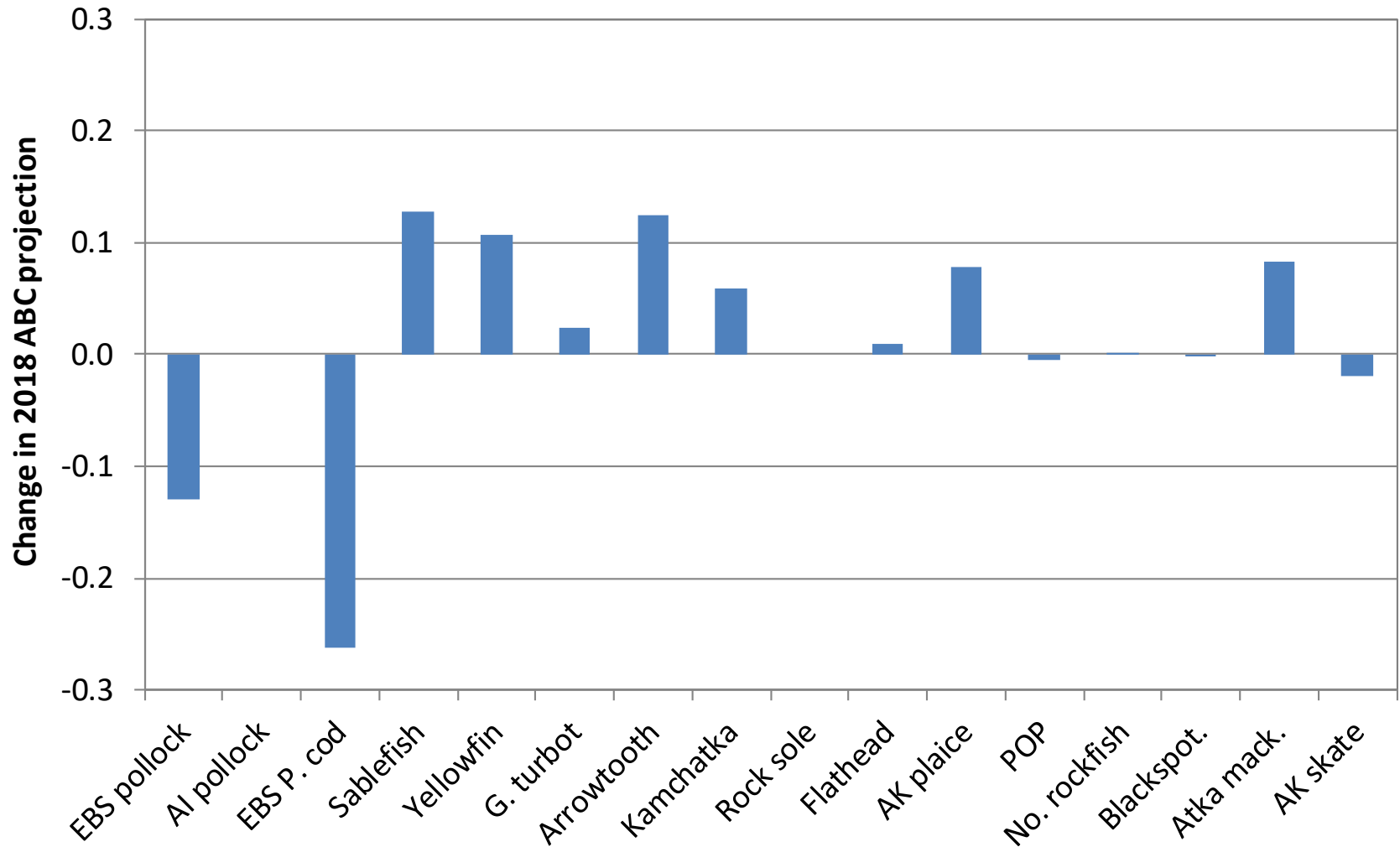
- Only two assessments contained multiple models this year

Ch.	Assessment	Models	Comments
1	EBS pollock	16.0a	ATS data from 0.5-3 m added
2	EBS Pacific cod	16.6, 17.1, 17.2, 17.3, 17.6, 17.7	Author chose 17.2, Team 16.6
2.1	AI Pacific cod	13.4	
3	Sablefish	16.5	
4	Yellowfin sole	14.1	
10	Alaska plaice	11.1	
17	Atka mackerel	16.0, 16.0a, 16.0b, 16.0c	Authors and Team chose 16.0b

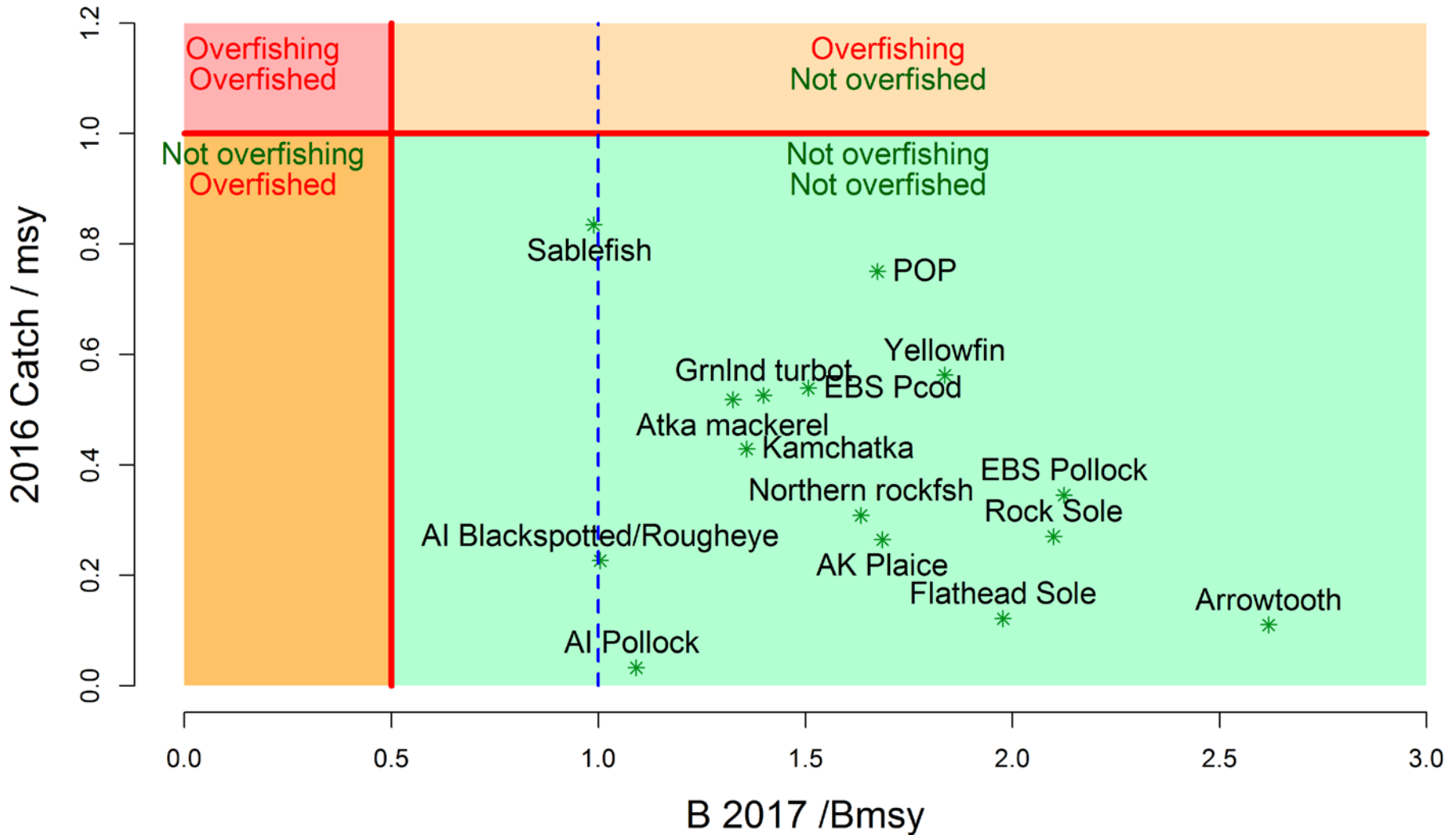
Change in 2018 spawning biomass projection



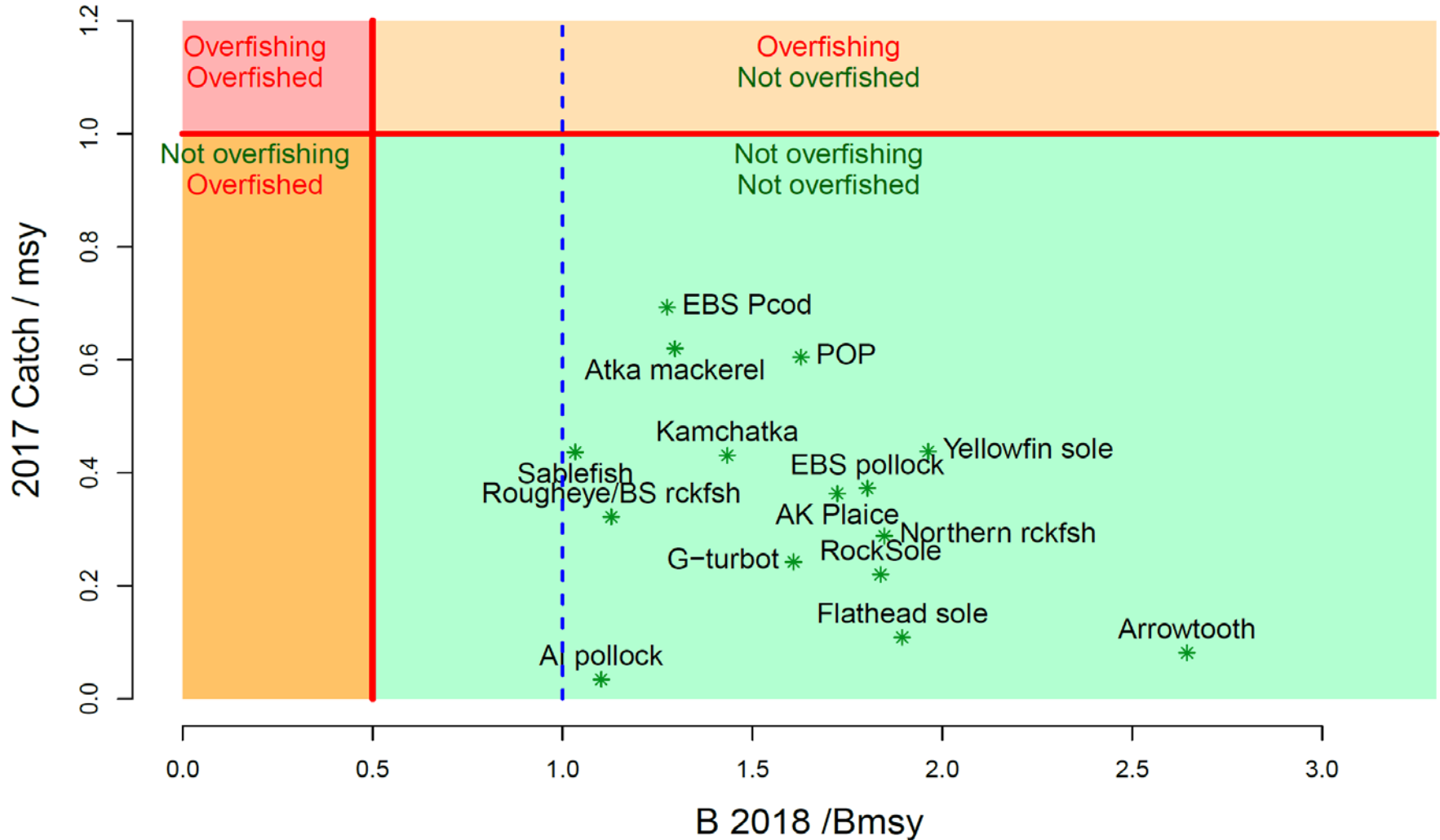
Change in 2018 ABC projection



Quad plot (Tiers 1-3): 2016

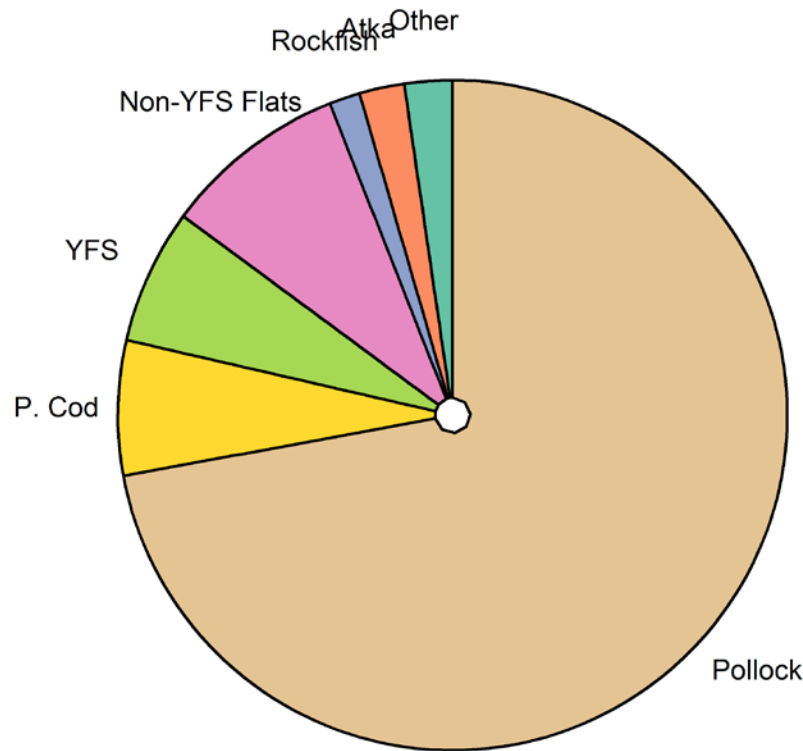


Quad plot (Tiers 1-3): 2017



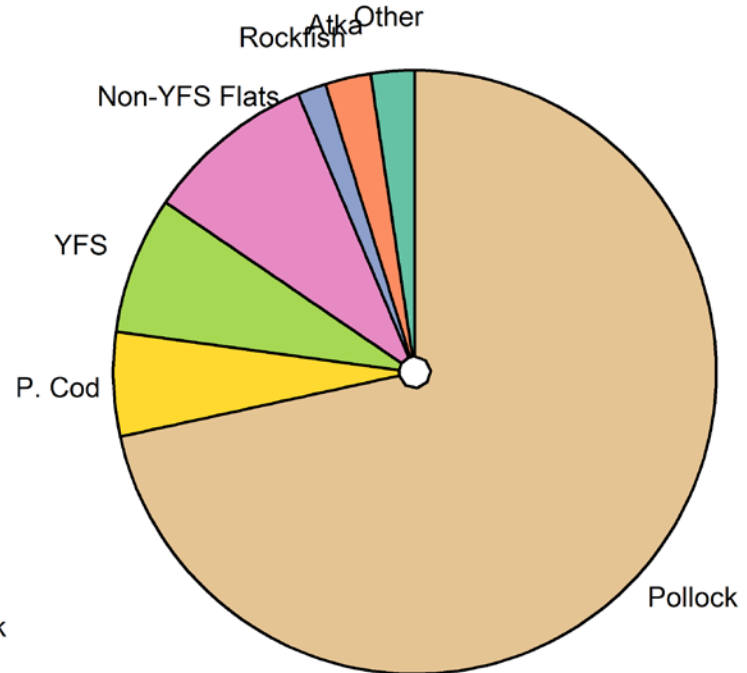
Group ABCs for 2017 and 2018

2017



Total = 4.01 mmt

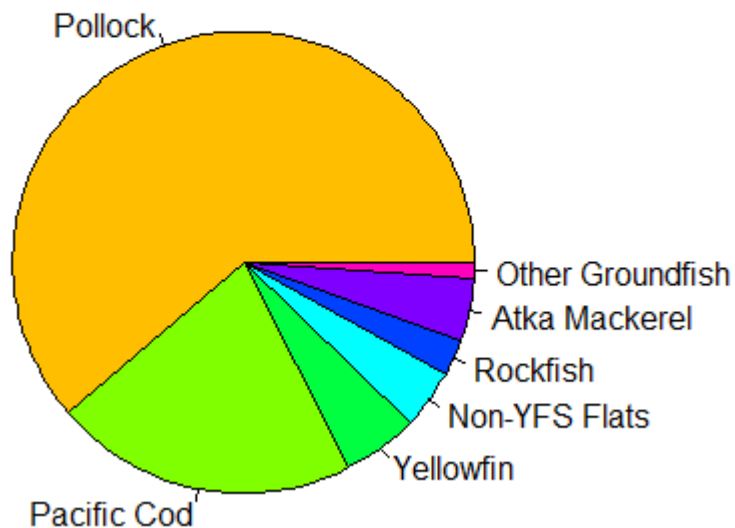
2018



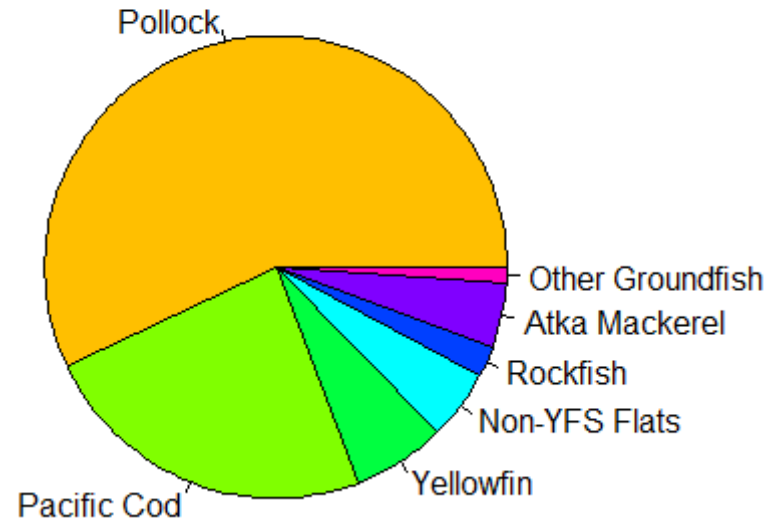
Total = 3.76 mmt

Ex-vessel value by year and species/group

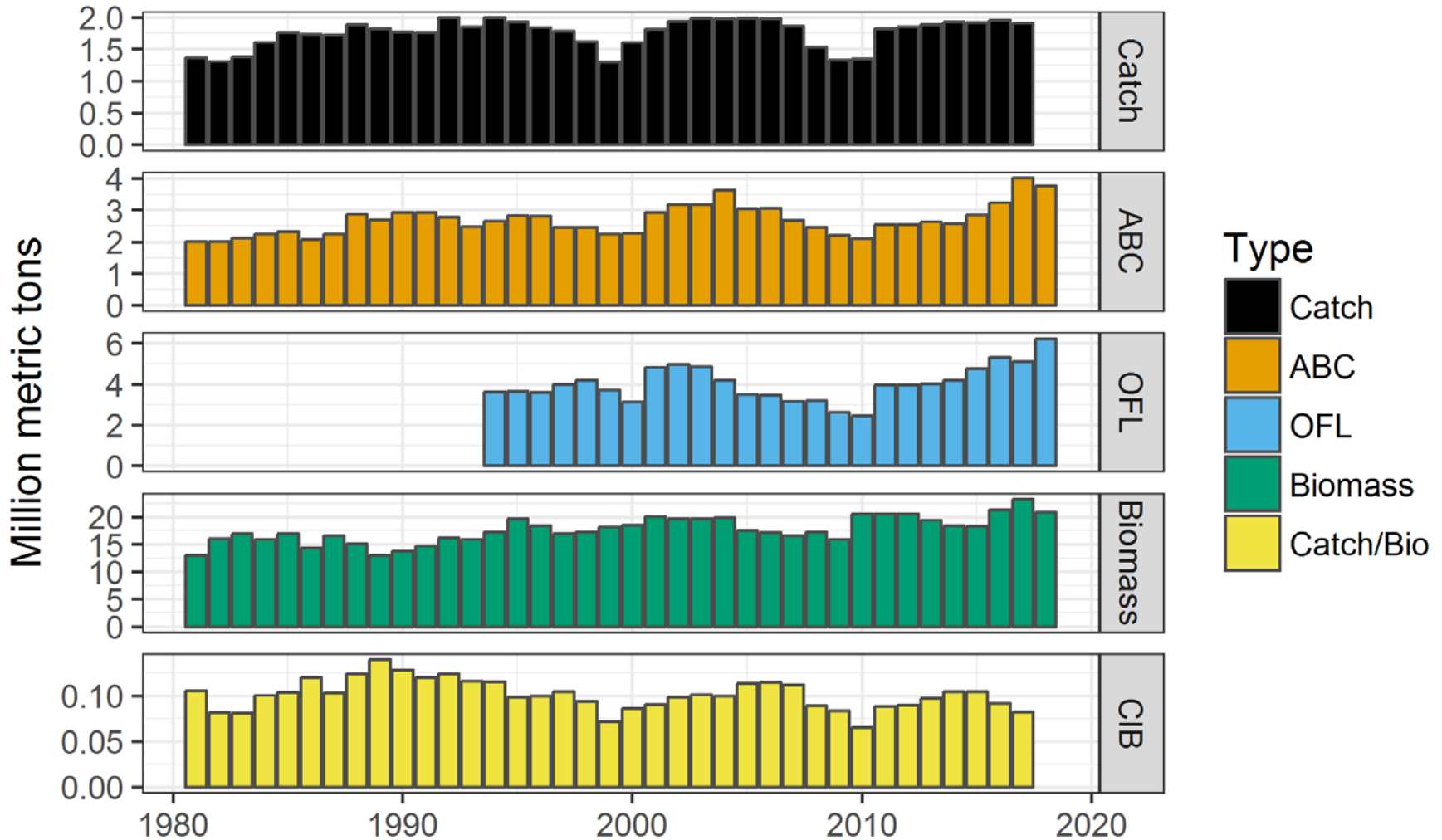
**BSAI Ex-vessel Value 2015,
Total = \$674**



**BSAI Ex-vessel Value 2016,
Total = \$657**



Aggregating across species/groups



A few final “big picture” items

- Team agreed with authors’ ABC recommendations in all cases except EBS Pcod, AI Pcod, and Greenland turbot
- ABC recommendations correspond to maximum permissible values in all cases except EBS pollock, Bogoslof pollock, EBS Pcod, and sablefish
- Of the 16 stocks/complexes in Tiers 1-3, none are in Tier 1b and only 3 (AI pollock, sablefish, and blackspotted/rougheye) are in Tier 3b
- No stocks/complexes were subjected to overfishing in 2016, and no stocks/complexes are overfished or approaching a condition of being overfished as of 2017

General Team recommendations

Northern Bering Sea

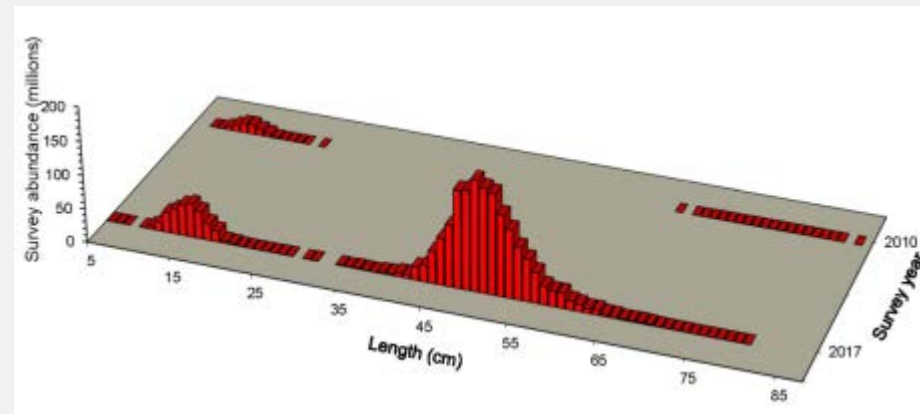
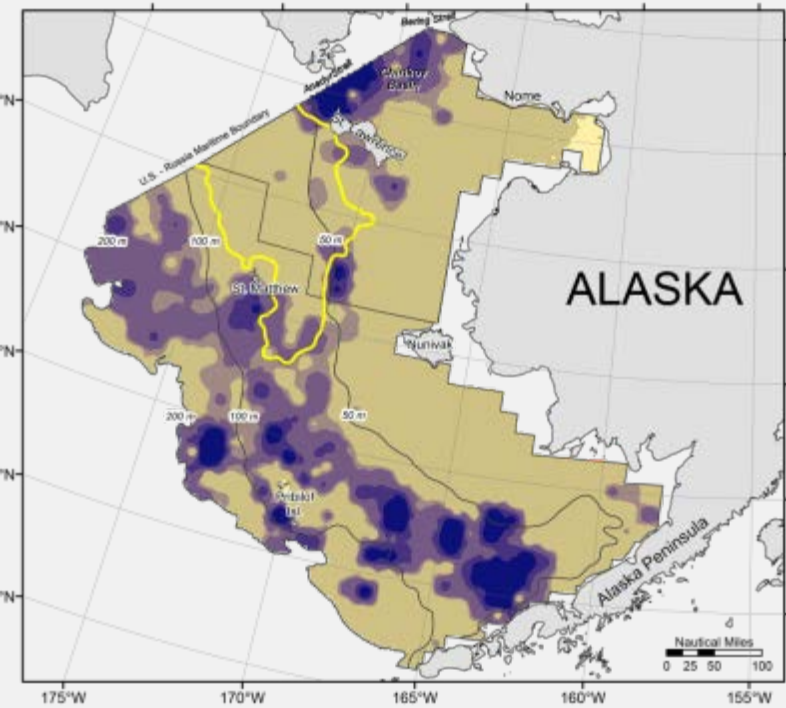
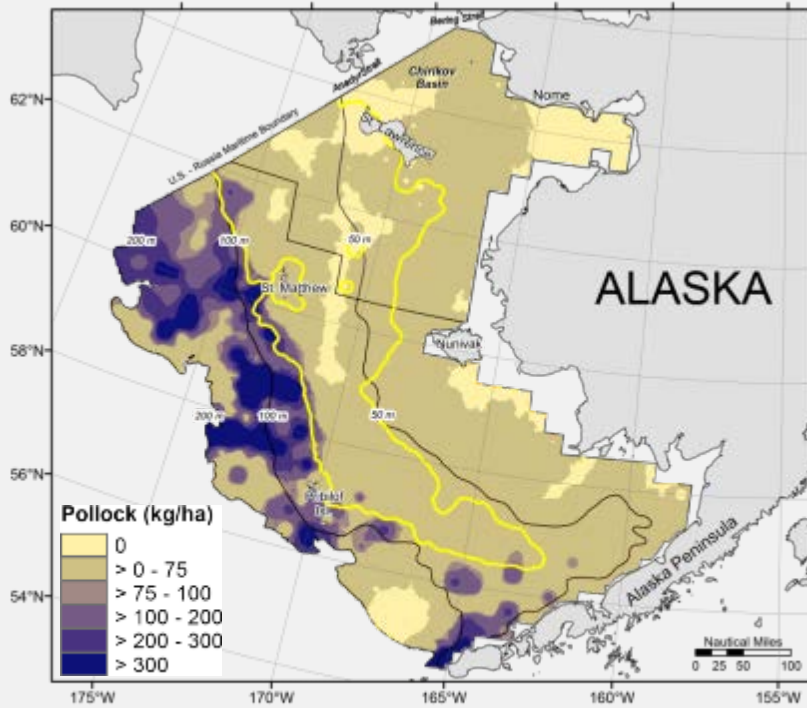
- Survey conducted in 2010
- Survey repeated in 2017
- Interpreting the results was a big topic in the BSAI Plan Team
- Kotwicki and Lauth showed info at SSC

Examples of Percent Biomass Change 2010 to 2017

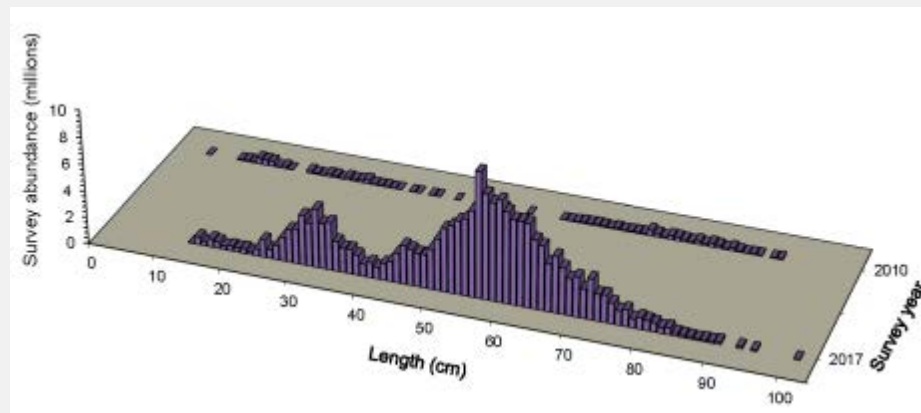
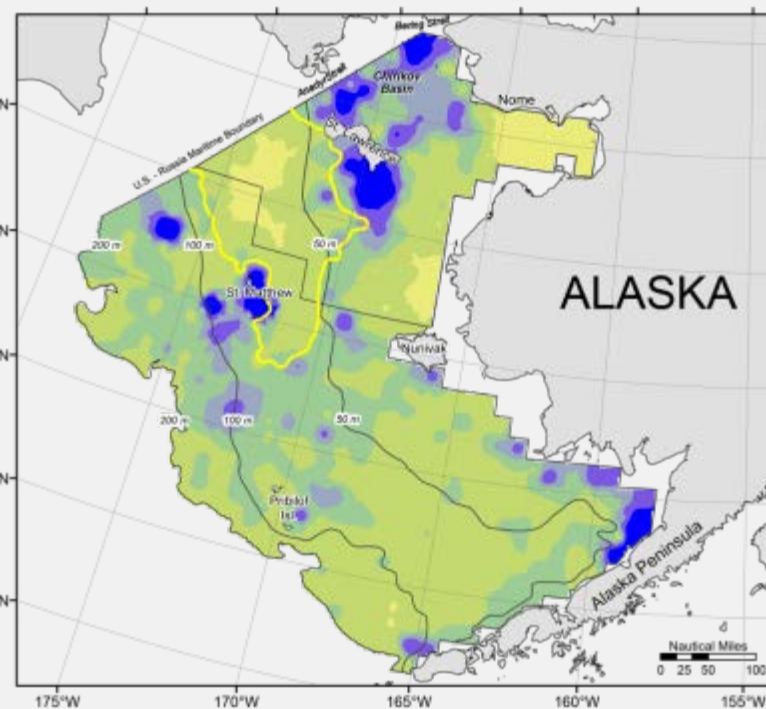
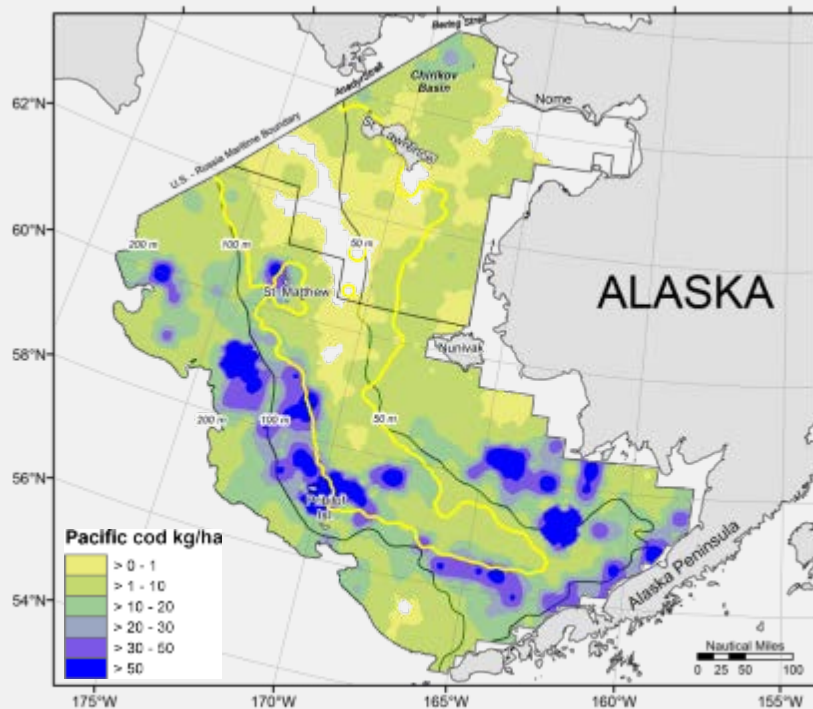
Invertebrate taxon	Biomass (mt)		% change
	2010	2017	
jellfishes	13,112	66,166	405%
green sea urchin	49,263	164,277	233%
blue king crab	1,940	5,795	199%
bryozoans	2,747	7,463	172%
sea anenomes	9,381	21,330	127%
clams	2,531	5,374	112%
other snails	27,102	54,963	103%
neptune whelk	115,325	178,443	55%
hermit crabs	134,417	162,475	21%
purple-orange sea star	298,087	353,314	19%
all shrimps	3,777	4,462	18%
segmented worms	124	130	5%
red king crab	2,453	2,254	(8%)
snow crab	324,549	227,948	(30%)
corals	12,343	8,429	(32%)
brittle stars	69,653	40,697	(42%)
basket starfish	68,662	39,878	(42%)
Other crabs	60,972	33,575	(45%)
tunicates	358,440	101,083	(72%)

Fish taxon	Biomass (mt)		% change
	2010	2017	
walleye pollock	20,977	1,312,620	6,157%
Pacific cod	28,425	286,310	907%
poachers	422	2,040	384%
warty sculpin	38,172	108,753	185%
northern rock sole	21,379	56,093	162%
sticklebacks/blennies	1,553	3,609	132%
starry flounder	15,319	31,103	103%
Pacific herring	22,289	35,365	59%
Bering flounder	12,661	20,022	58%
snailfishes	3,316	4,842	46%
plain sculpin	28,338	36,819	30%
Alaska plaice	309,523	333,947	8%
Alaska skate	78,972	84,267	7%
other sculpins	10,219	10,422	2%
yellowfin sole	438,548	439,801	0%
eelpouts	11,313	9,842	(13%)
saffron cod	91,593	76,455	(17%)
Pacific halibut	23,806	18,538	(22%)
smelts	16,745	5,273	(69%)
Arctic cod	37,981	3,963	(90%)

Pollock distribution, abundance & size



Pacific cod distribution, abundance & size



Northern Bering Sea surveys

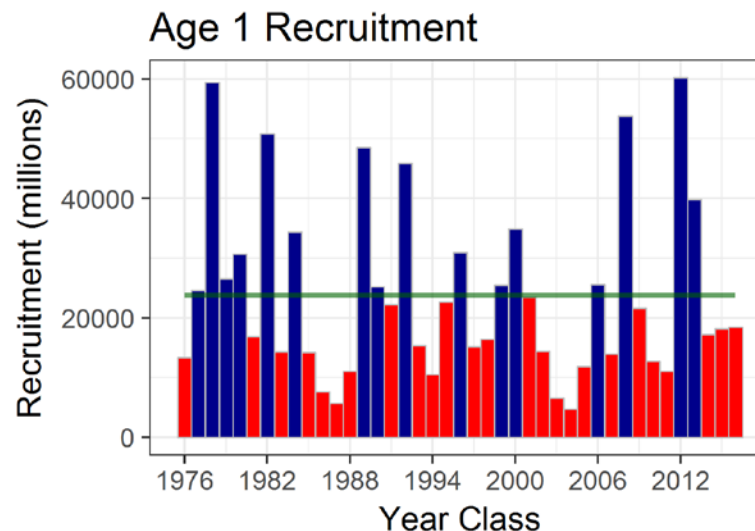
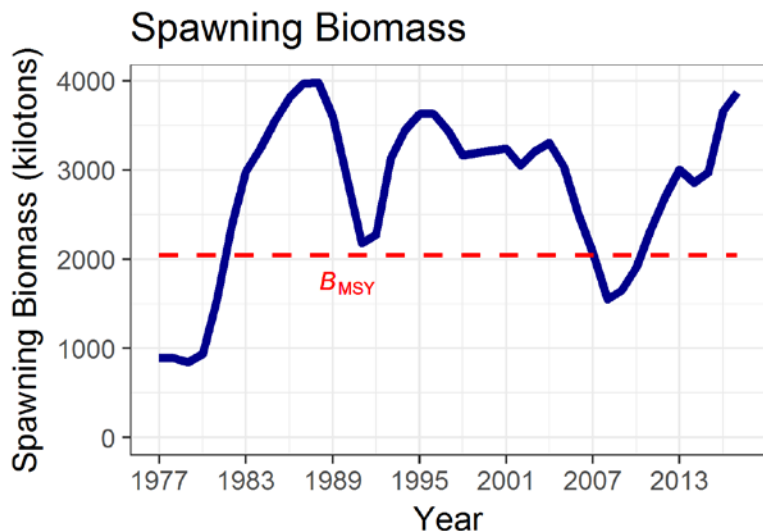
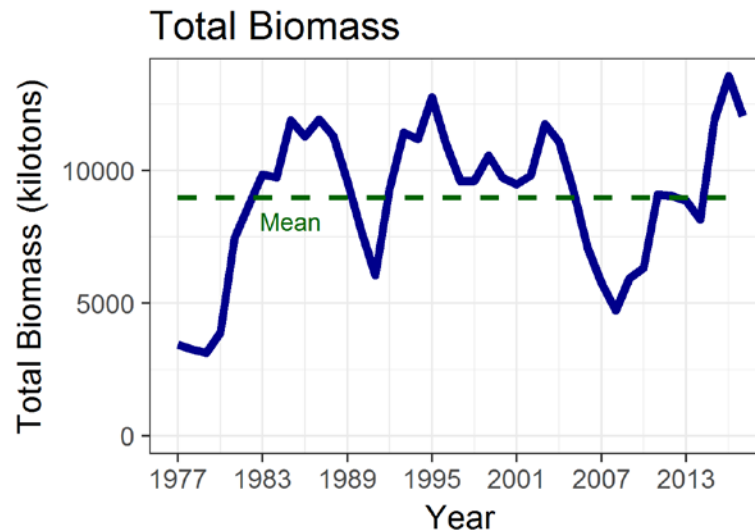
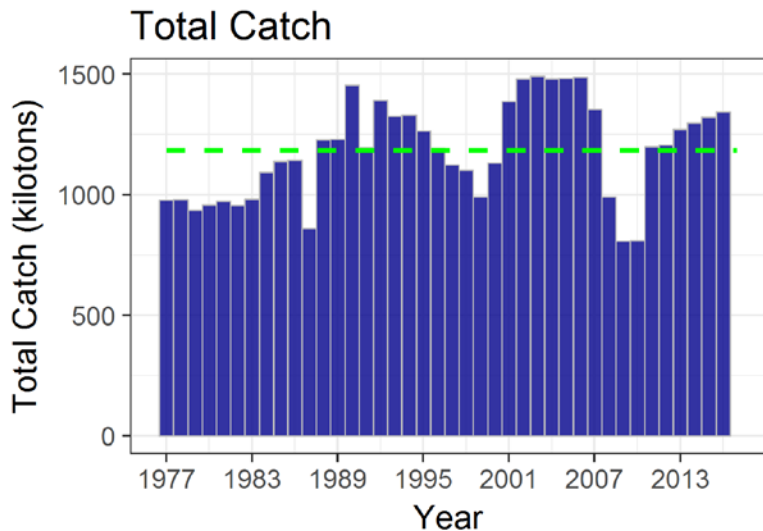
- The Team recommends that more NBS surveys be conducted in the near future, as a time series of such data may be essential for understanding changes in the abundance of some individuals stocks as well as the overall ecosystem
- Some species, such as pollock and Pacific cod, exhibited enormous changes in NBS survey biomass between 2010 and 2017, both in absolute terms and relative to the NBS+EBS total, while others, such as Alaska plaice, exhibited very little change
- The Team also recommends that assessment authors evaluate data from the NBS survey to determine if they should be included in their respective assessment models, particularly if more surveys are conducted, recognizing that it may be appropriate to include these data in some assessments but not others, and that the methods used to include these data may vary between assessments

Ecosystem status report

- The Team recommends continued evaluation of approaches to incorporating local ecological knowledge into the ESR, particularly for helping to understand patterns in the Northern Bering Sea ecosystem
- The Team supports continued refinement and development of ecosystem indicators across physical, biological, and socio-economic categories
- The Team recommends that assessment authors be more fully integrated into the prioritization of AFSC ecosystem research, in order to: 1) develop methods and approaches (where appropriate) of linking ecosystem indicators to individual species; 2) identify species-specific ecosystem “red-flags;” and 3) track indicator performance retrospectively, as is done for some of the pollock recruitment indicators

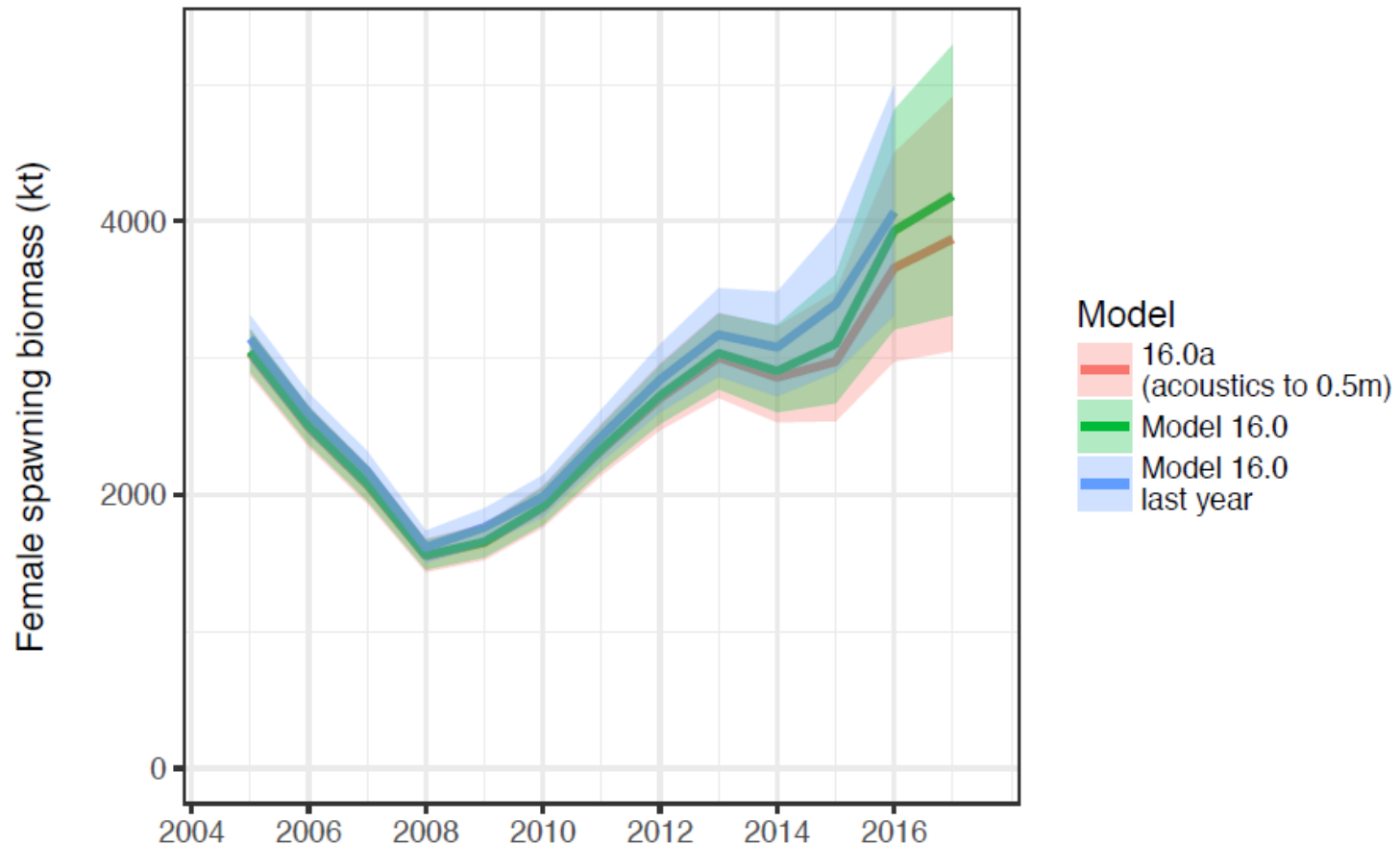
Chapter summaries

Chapter 1: EBS walleye pollock (full)

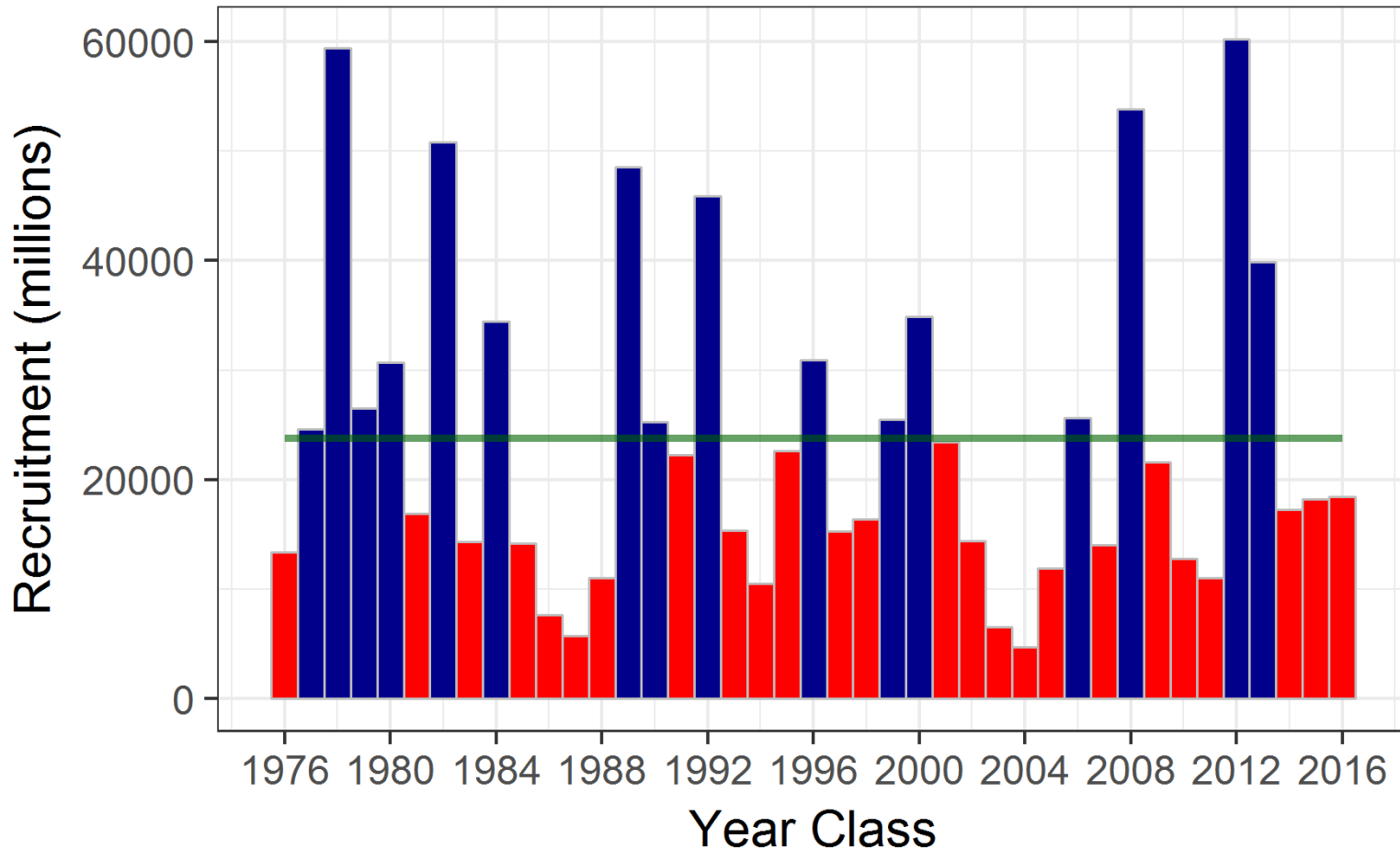


EBS walleye pollock, continued

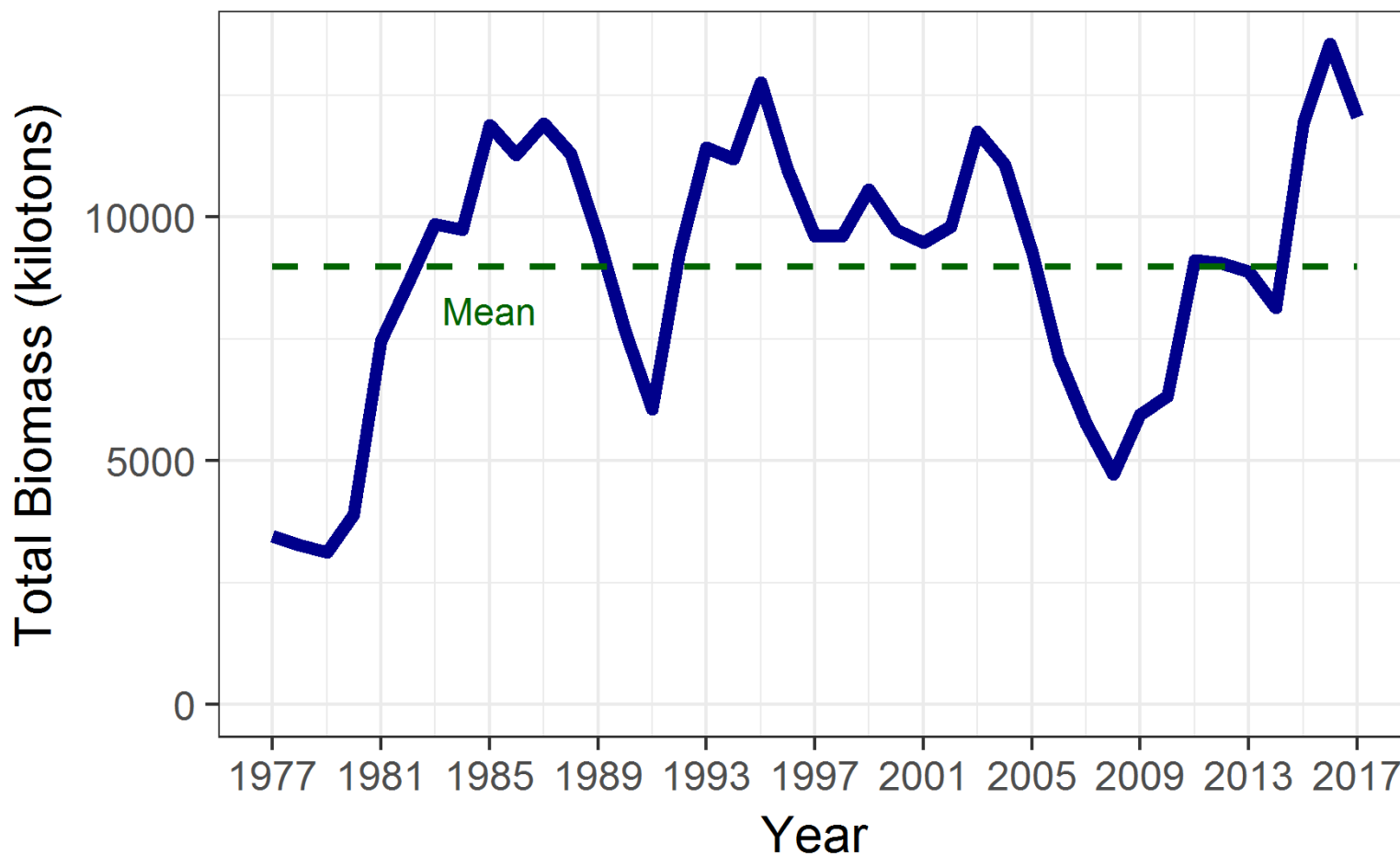
- Only change in *type* of data used was addition of 0.5-3 m ATS data



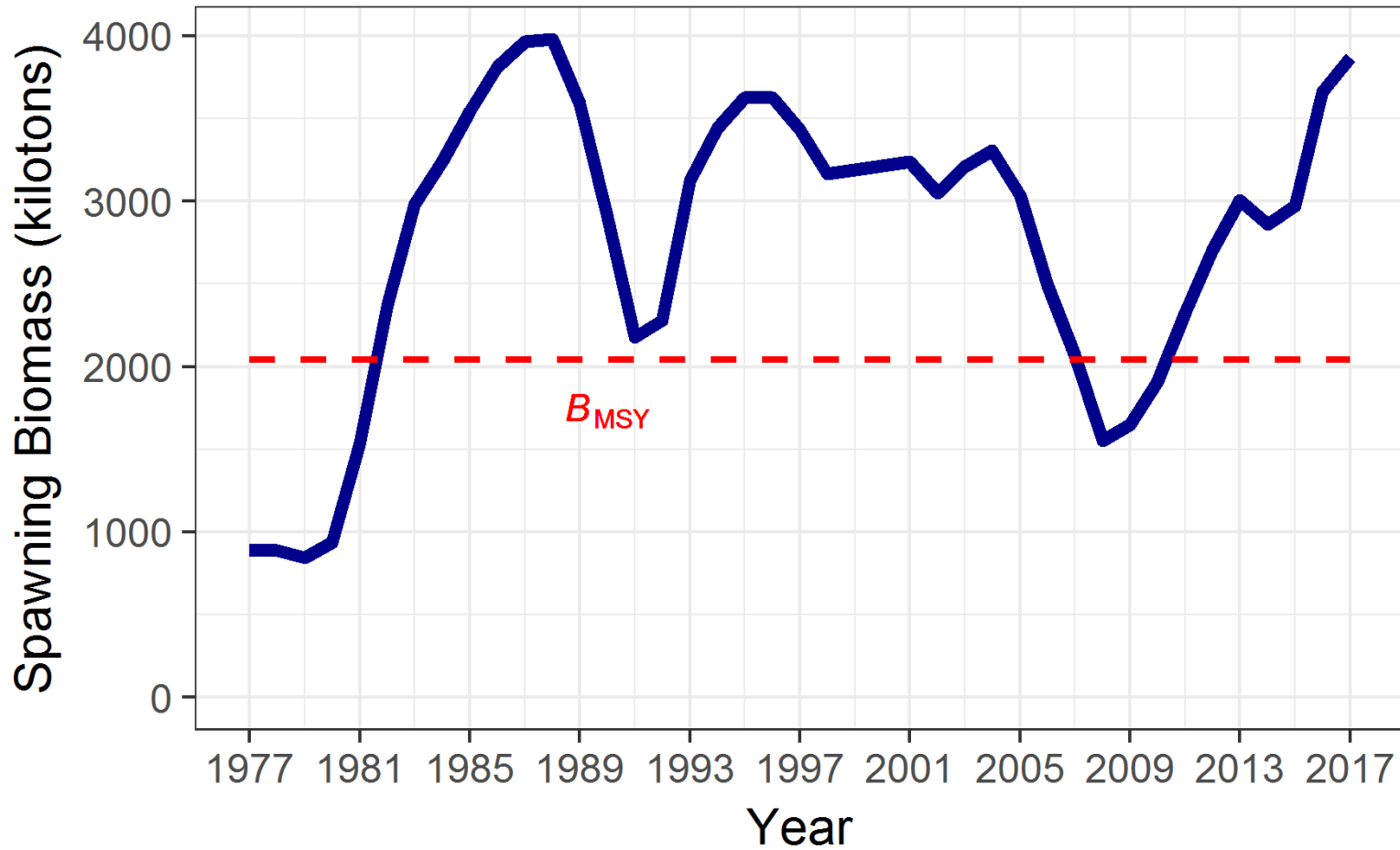
EBS Walleye Pollock Age 1 Recruitment



EBS Walleye Pollock Total Biomass



EBS Walleye Pollock Spawning Biomass



EBS walleye pollock, continued

- Although this stock has been determined to qualify for management under Tier 1a, the authors recommend setting ABC at the Tier 3a level, as has been done for the last three years
 - Seven reasons for doing so are listed in the chapter
 - Multi-species model ("CEATTLE") gives slightly higher maxABC values than the assessment, authors also suggest setting ABC significantly below the maximum
- Team accepted authors' choice of model and harvest specifications
 - Not a change in Tier classification; just borrowing the control rule

EBS walleye pollock, continued

Quantity	Last year	This year	Change
M	0.30	0.30	0.00
2017 tier	1a	n/a	none
2018 tier	1a	1a	none
2017 age+ biomass	13,000,000	n/a	-0.16
2018 age+ biomass	12,100,000	10,965,000	-0.09
2017 spawning biomass	4,600,000	n/a	-0.20
2018 spawning biomass	4,500,000	3,678,000	-0.18
B0	5,700,000	5,394,000	-0.05
Bmsy	2,165,000	2,042,000	-0.06
2018 FOFL	0.465	0.621	0.34
2018 FABC	0.370	0.336	-0.09
2017 OFL	3,640,000	n/a	0.32
2018 OFL	4,360,000	4,795,000	0.10
2017 ABC	2,800,000	n/a	-0.07
2018 ABC	2,979,000	2,592,000	-0.13

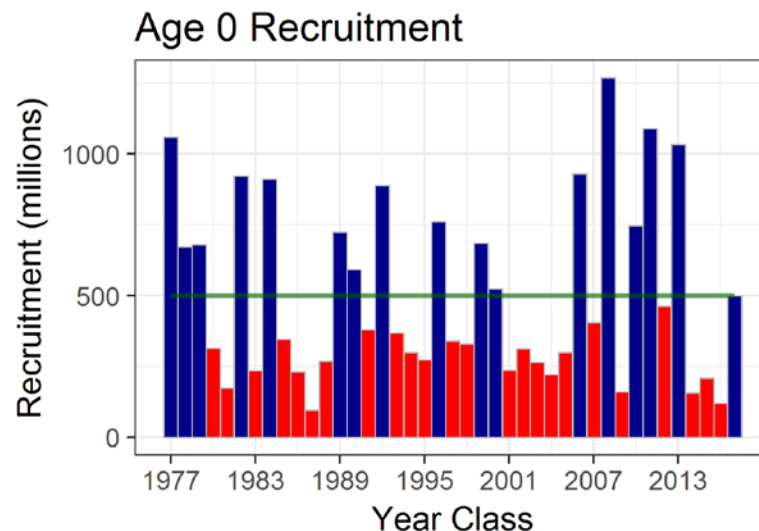
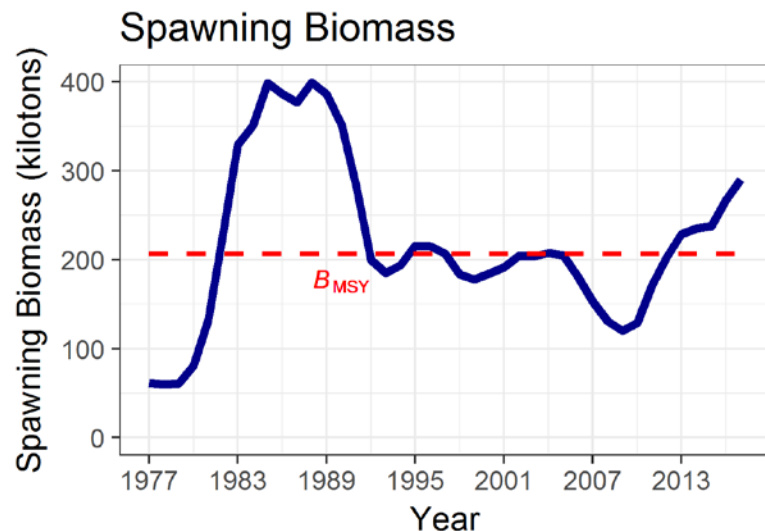
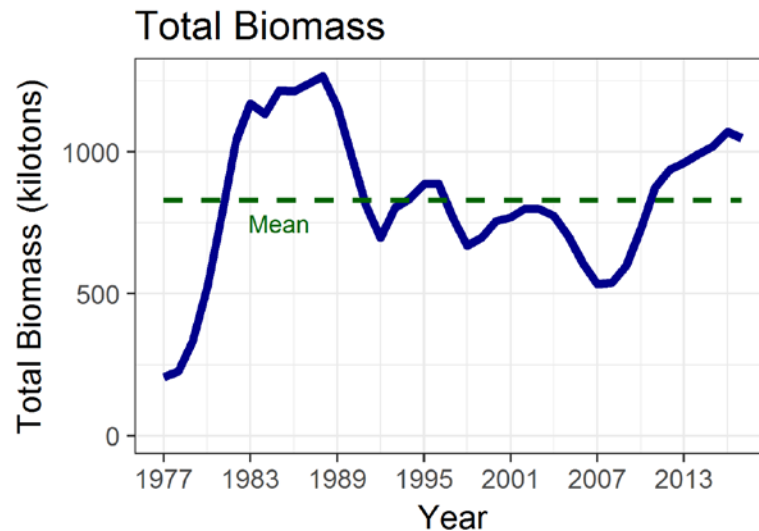
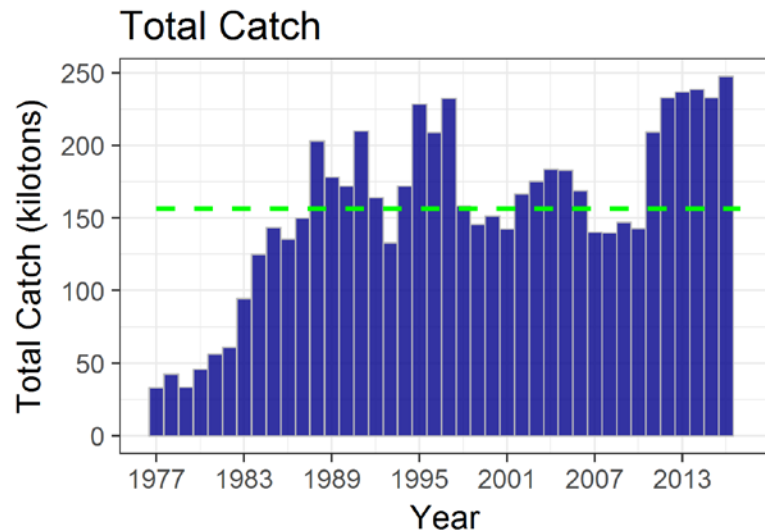
Chapter 1A: AI walleye pollock (partial)

Quantity	Last year	This year	Change
M	0.19	0.19	0.00
2017 tier	3b	n/a	none
2018 tier	3b	3b	none
2017 age+ biomass	250,221	n/a	0.09
2018 age+ biomass	271,831	272,675	0.00
2017 spawning biomass	77,579	n/a	0.01
2018 spawning biomass	81,545	78,305	-0.04
B100%	203,100	203,100	0.00
B40%	81,240	81,240	0.00
B35%	71,085	71,085	0.00
2018 FOFL	0.397	0.397	0.00
2018 FABC	0.319	0.319	0.00
2017 OFL	43,650	n/a	0.13
2018 OFL	49,291	49,291	0.00
2017 ABC	36,061	n/a	0.13
2018 ABC	40,788	40,788	0.00

Chapter 1B: Bogoslof walleye pollock (none)

Quantity	Last year	This year	Change
M	0.30	0.30	0.00
2017 tier	5	n/a	none
2018 tier	5	5	none
Biomass	434,760	434,760	0.00
2018 FOFL	0.30	0.30	0.00
2018 FABC	0.225	0.225	0.00
2017 OFL	130,428	n/a	0.00
2018 OFL	130,428	130,428	0.00
2017 ABC	51,300	n/a	0.00
2018 ABC	51,300	51,300	0.00

Chapter 2: EBS Pacific cod (full)



EBS Pacific cod, continued

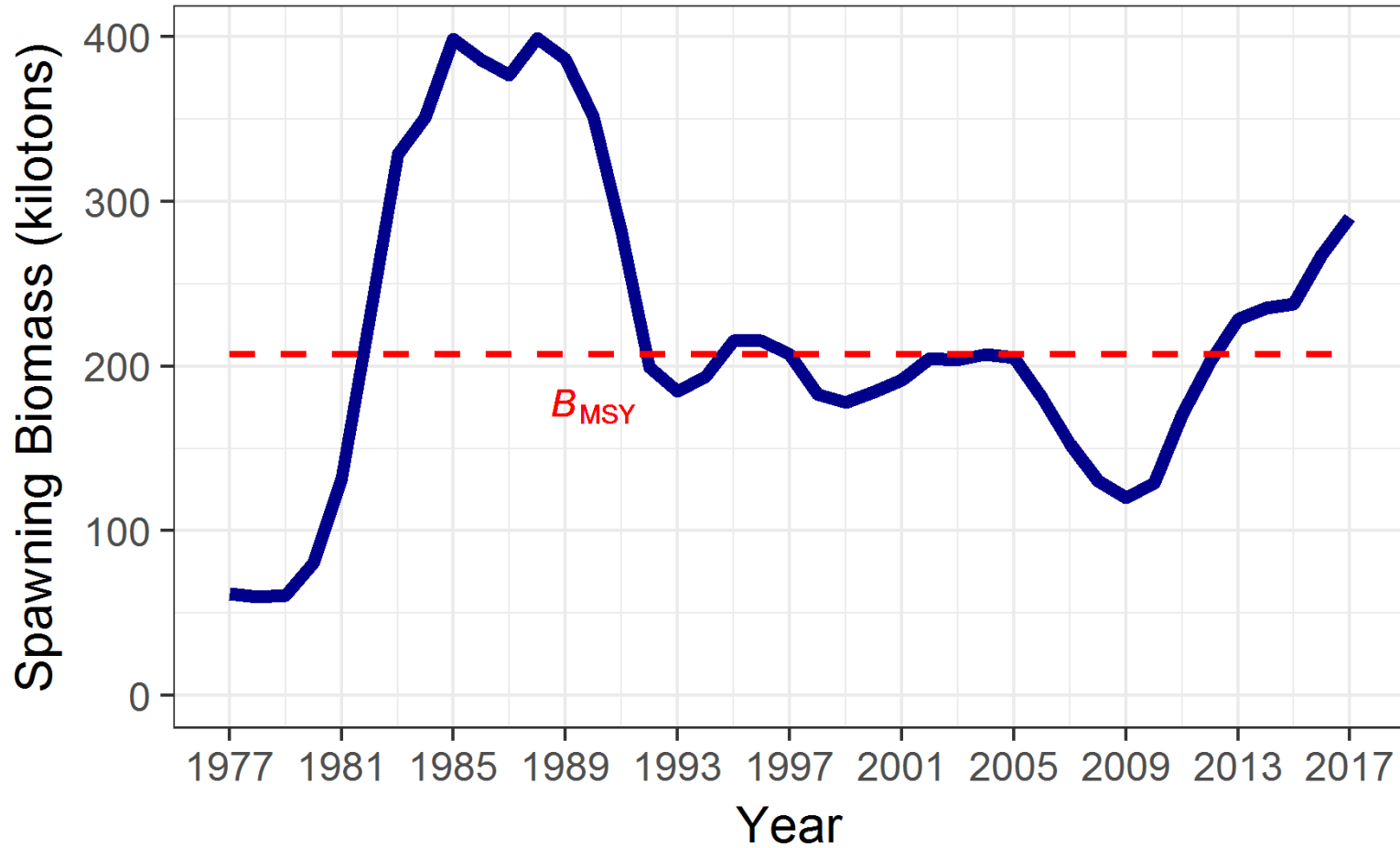
- Six models provided a wide range of results

Quantity	M16.6	M17.1	M17.2	M17.3	M17.6	M17.7
B100%	593,000	644,000	548,000	622,000	633,000	644,000
B40%	237,000	258,000	219,000	249,000	253,000	258,000
B35%	207,000	226,000	192,000	218,000	221,000	225,000
B(2018)	264,000	173,000	217,000	146,000	142,000	145,000
B(2019)	248,000	200,000	211,000	179,000	177,000	181,000
B(2018)/B100%	0.45	0.27	0.40	0.24	0.22	0.23
B(2019)/B100%	0.42	0.31	0.39	0.29	0.28	0.28
F40%	0.31	0.25	0.32	0.26	0.26	0.26
F35%	0.38	0.31	0.38	0.31	0.32	0.31
maxFABC(2018)	0.31	0.16	0.31	0.15	0.14	0.14
maxFABC(2019)	0.31	0.19	0.30	0.18	0.18	0.18
maxABC(2018)	201,000	75,500	172,000	59,100	57,300	57,600
maxABC(2019)	170,000	92,400	148,000	79,900	79,200	80,300
FOFL(2018)	0.38	0.20	0.38	0.18	0.17	0.17
FOFL(2019)	0.38	0.23	0.37	0.22	0.22	0.21
OFL(2018)	238,000	89,600	202,000	70,300	68,400	68,700
OFL(2019)	201,000	109,000	173,000	94,500	93,900	95,100
Pr(maxABC(2018)>truOFL(2018))	0.03	0.11	0.05	0.21	0.14	0.17
Pr(maxABC(2019)>truOFL(2019))	0.09	0.12	0.23	0.22	0.13	0.15
Pr(B(2018)<B20%)	0.00	0.00	0.00	0.13	0.09	0.11
Pr(B(2019)<B20%)	0.00	0.00	0.00	0.00	0.00	0.00
Pr(B(2020)<B20%)	0.00	0.00	0.00	0.00	0.00	0.00
Pr(B(2021)<B20%)	0.00	0.00	0.00	0.00	0.00	0.00

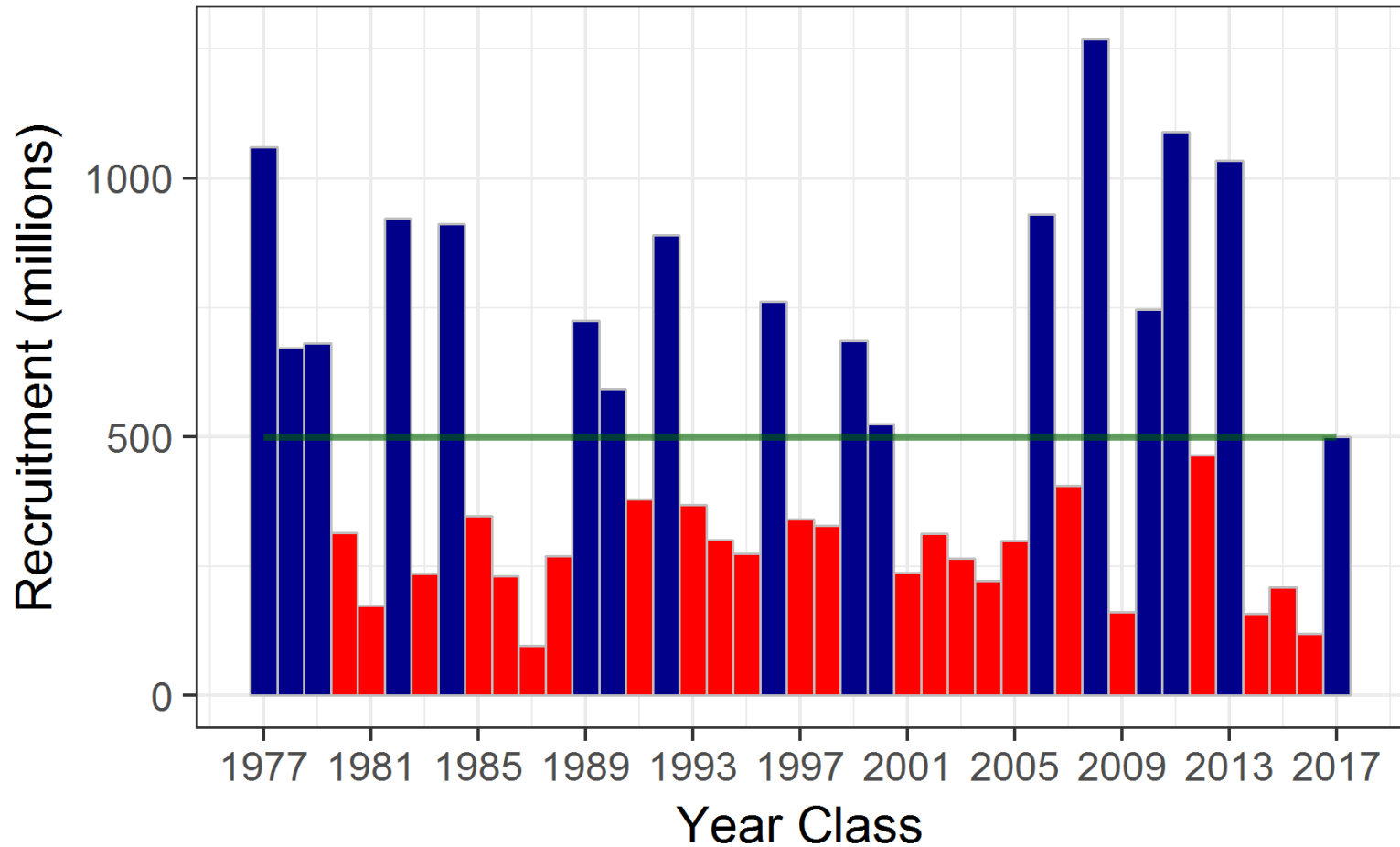
EBS Pacific cod, continued

- Differences in predicted ABC between models were a big concern
- Model 17.2 was seen as an improvement in some aspects
 - It included more specific data weighting and fishery time-varying selectivity, which may or may not improve the model
- However, 16.6 is the status quo model, is more parsimonious, is structurally simpler than the 17.X series, and provides stability to the choice of the assessment model
- None of the 17.x series of models were a clear and obvious improvement over Model 16.6
- **The Team recommends that Model 16.6 be used for determining stock status and setting management quantities**

EBS Pacific Cod Spawning Biomass



EBS Pacific Cod Age 0 Recruitment



EBS Pacific cod, continued

- The Team recommends that the ABC should be below the maximum permissible because of many concerns related to the dramatic declines in the EBS shelf survey index, recent poor environmental conditions, lack of incoming recruitment, and recent small size-at-age of young fish
- Some of the options considered included a 10% reduction, the ABC from model 17.2, or some version of the averages given in the appendix on model averaging
- Ultimately, the Team's 2018 ABC recommendation was closely tied to the average of the maximum permissible values from Model 16.6 and Model 17.2
- The Team's recommended 2018 ABC is 188,000 t
- The Team recommends a 2019 ABC equal to the maximum 2019 ABC from Model 16.6 (170,000 t)

EBS Pacific cod, continued

- The Team discussed whether the NBS Pacific cod are the same stock as the EBS or if they are distinct stocks, and the resulting implications for the assessment
- Ingrid Spies (AFSC) has put together a research proposal to conduct a genetic analysis of samples already collected from the EBS and NBS
 - If funding is available right away, she may be able to complete the analysis in time for next year's assessment
- The Team recommends funding the genetics proposal presented by Ingrid Spies as soon as possible

EBS Pacific cod, continued

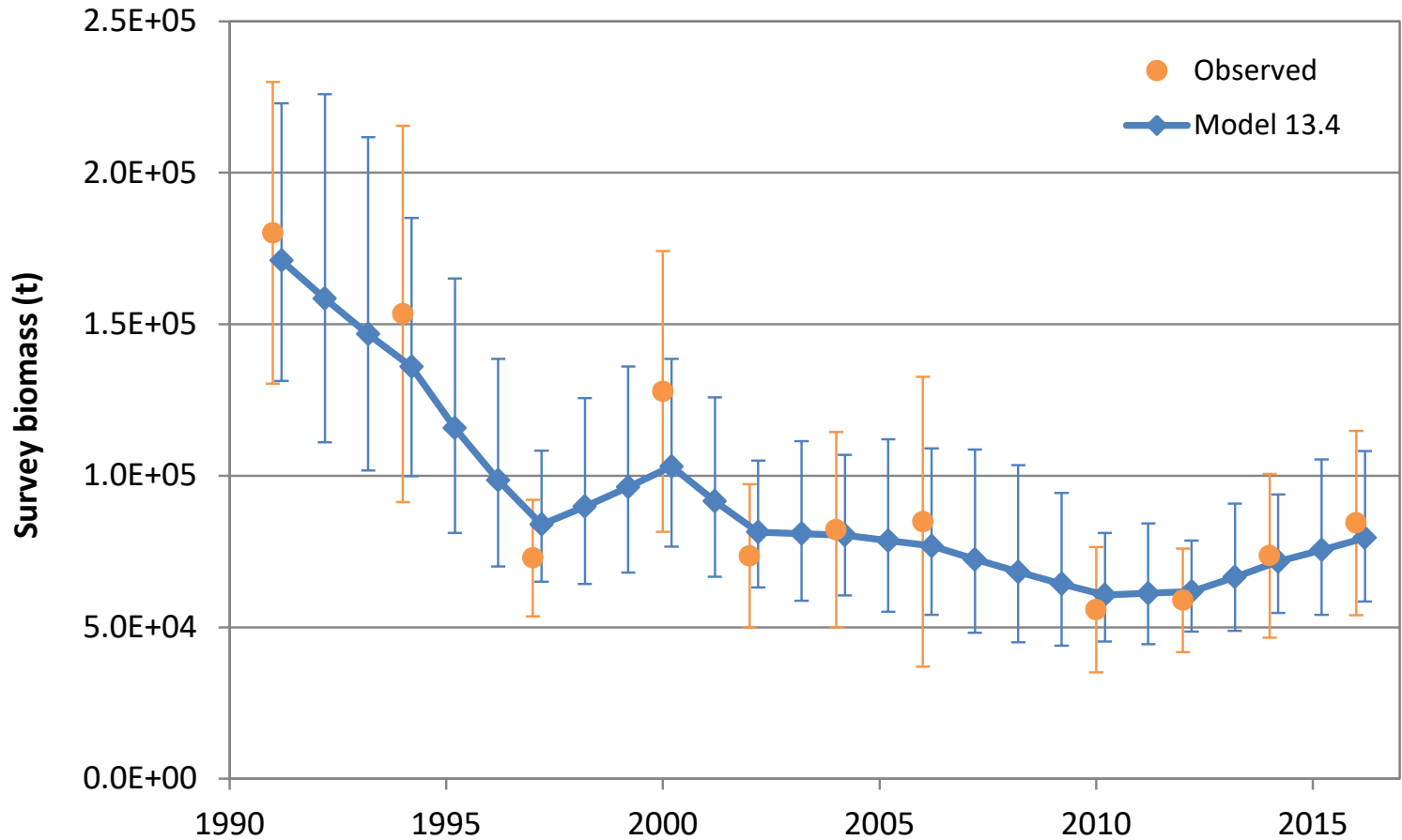
- Instead of the usual spring meeting to discuss Pcod models, the Team recommends a meeting with a broader focus (both species and topics):
 - What ecological hypotheses should be considered (drawing on other models such as CEATTLE and FEAST)?
 - How to choose models for inclusion in the ensemble (statistics, goodness of fit, plausibility, etc.)?
 - Which first principles and standard practices of assessment models should be considered, identifying models for the ensemble as opposed to models that are merely sensitivity analyses?
 - Which models are useful for management?
 - How to link the ESR to the assessment (potentially involving other ecosystem researchers within the AFSC)?
 - When should ABC be reduced from the maximum, and by how much?

EBS Pacific cod, continued

Quantity	Last year	This year	Change
M	0.36	0.36	0.00
2017 tier	3a	n/a	none
2018 tier	3a	3a	none
2017 age+ biomass	1,260,000	n/a	-0.27
2018 age+ biomass	1,110,000	918,000	-0.17
2017 spawning biomass	327,000	n/a	-0.20
2018 spawning biomass	340,000	263,000	-0.23
B100%	620,000	593,000	-0.04
B40%	248,000	237,000	-0.04
B35%	217,000	207,000	-0.05
2018 FOFL	0.38	0.38	0.00
2018 FABC	0.31	0.31	0.00
2017 OFL	284,000	n/a	-0.16
2018 OFL	302,000	238,000	-0.21
2017 ABC	239,000	n/a	-0.21
2018 ABC	255,000	188,000	-0.26

Chapter 2A: AI Pacific cod (full)

- Survey biomass



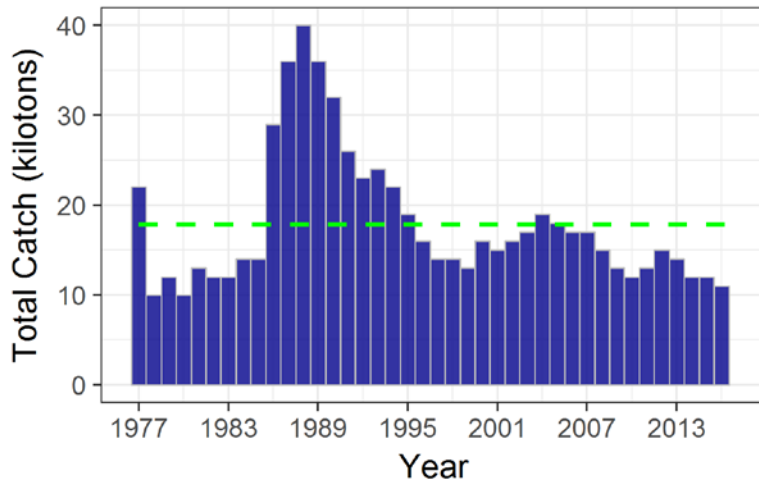
AI Pacific cod, continued

- Following past practice, the author recommended changes based on the M (=0.38) from his recommended EBS model, but the Team's recommended EBS model keeps M at last year's value (0.36)

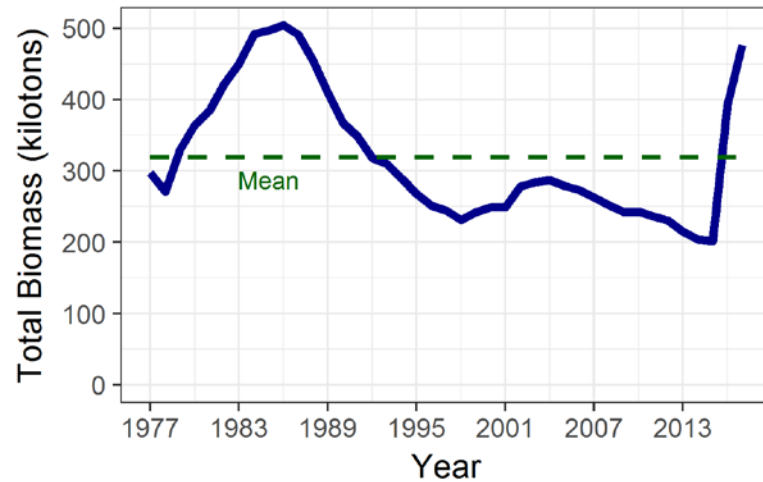
Quantity	Last year	This year	Change
M	0.36	0.36	0.00
2017 tier	5	n/a	none
2018 tier	5	5	none
Biomass	79,600	79,600	0.00
2018 FOFL	0.36	0.36	0.00
2018 FABC	0.27	0.27	0.00
2017 OFL	28,700	n/a	0.00
2018 OFL	28,700	28,700	0.00
2017 ABC	21,500	n/a	0.00
2018 ABC	21,500	21,500	0.00

Chapter 3: sablefish (full)

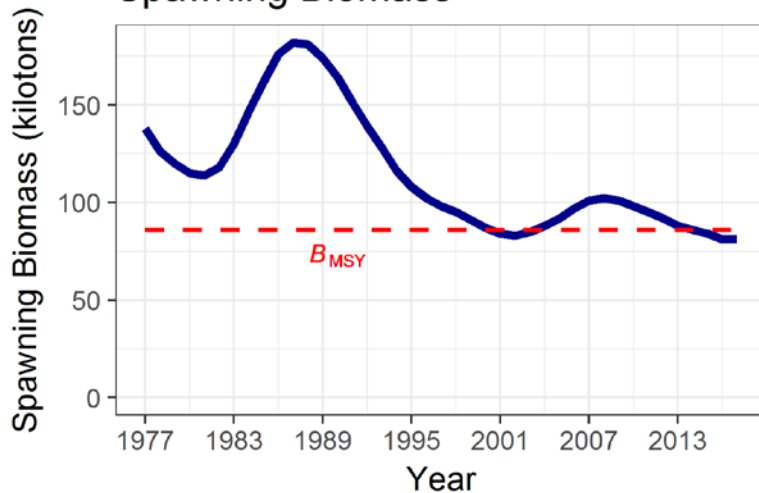
Total Catch



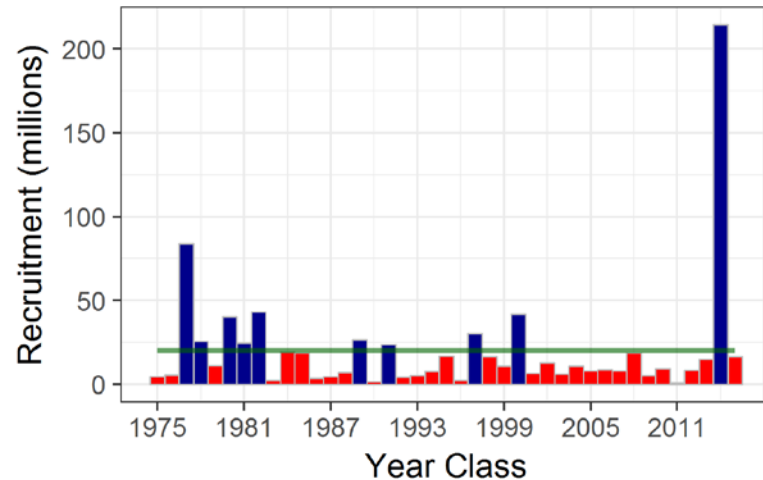
Total Biomass



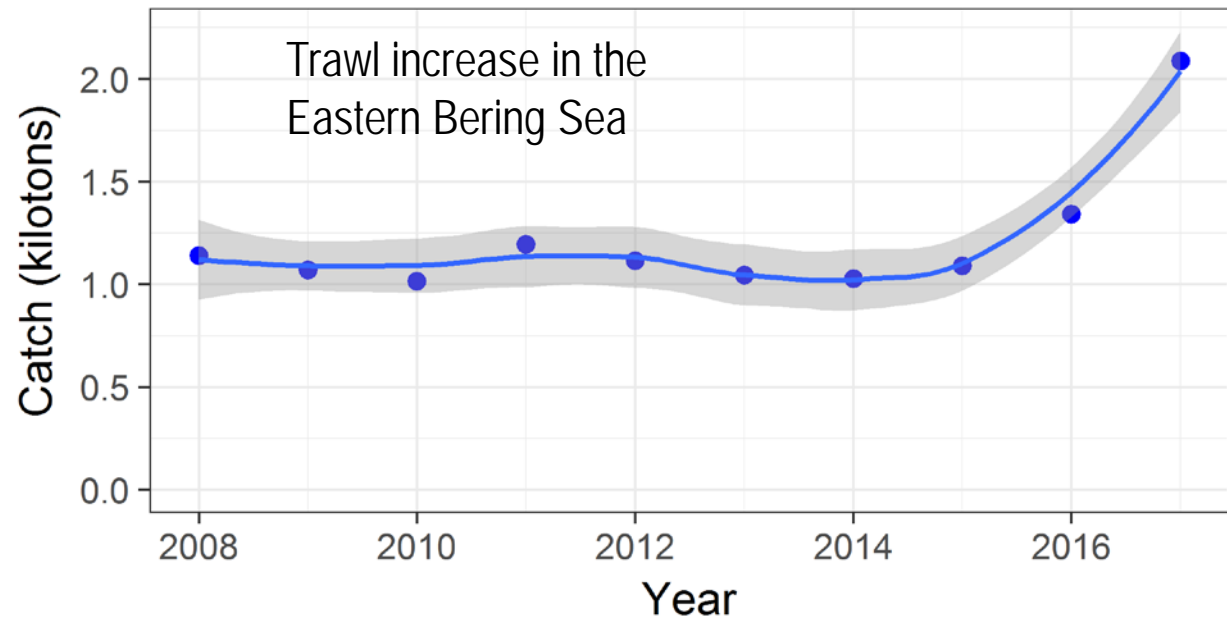
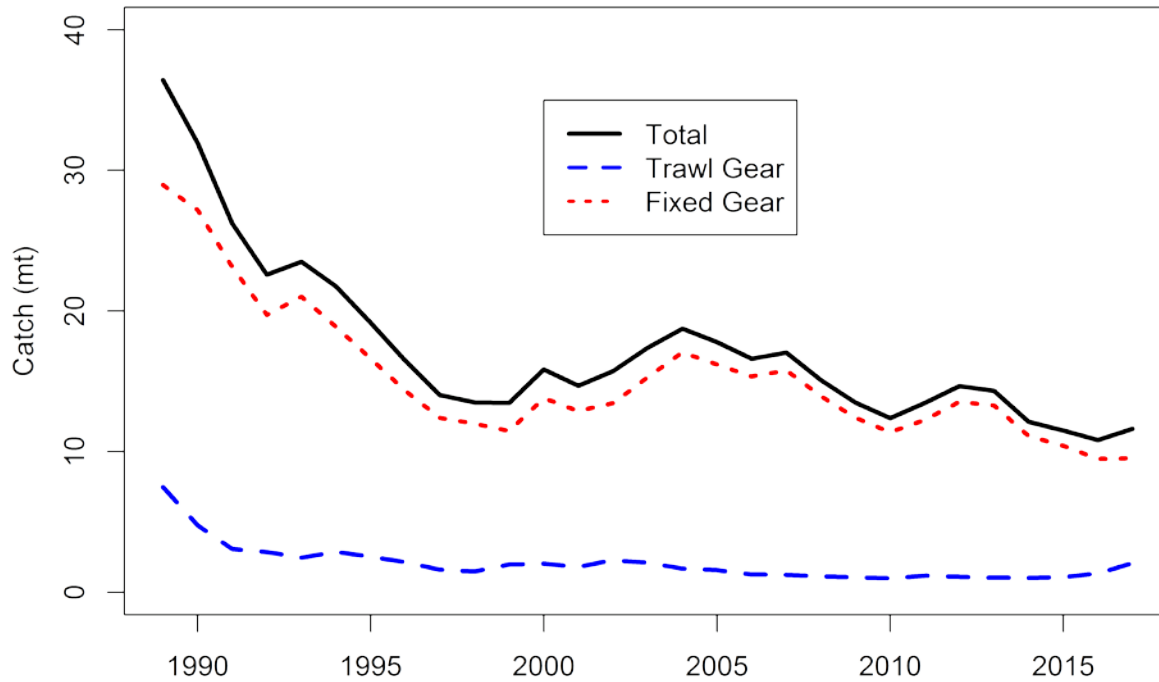
Spawning Biomass



Age 2 Recruitment

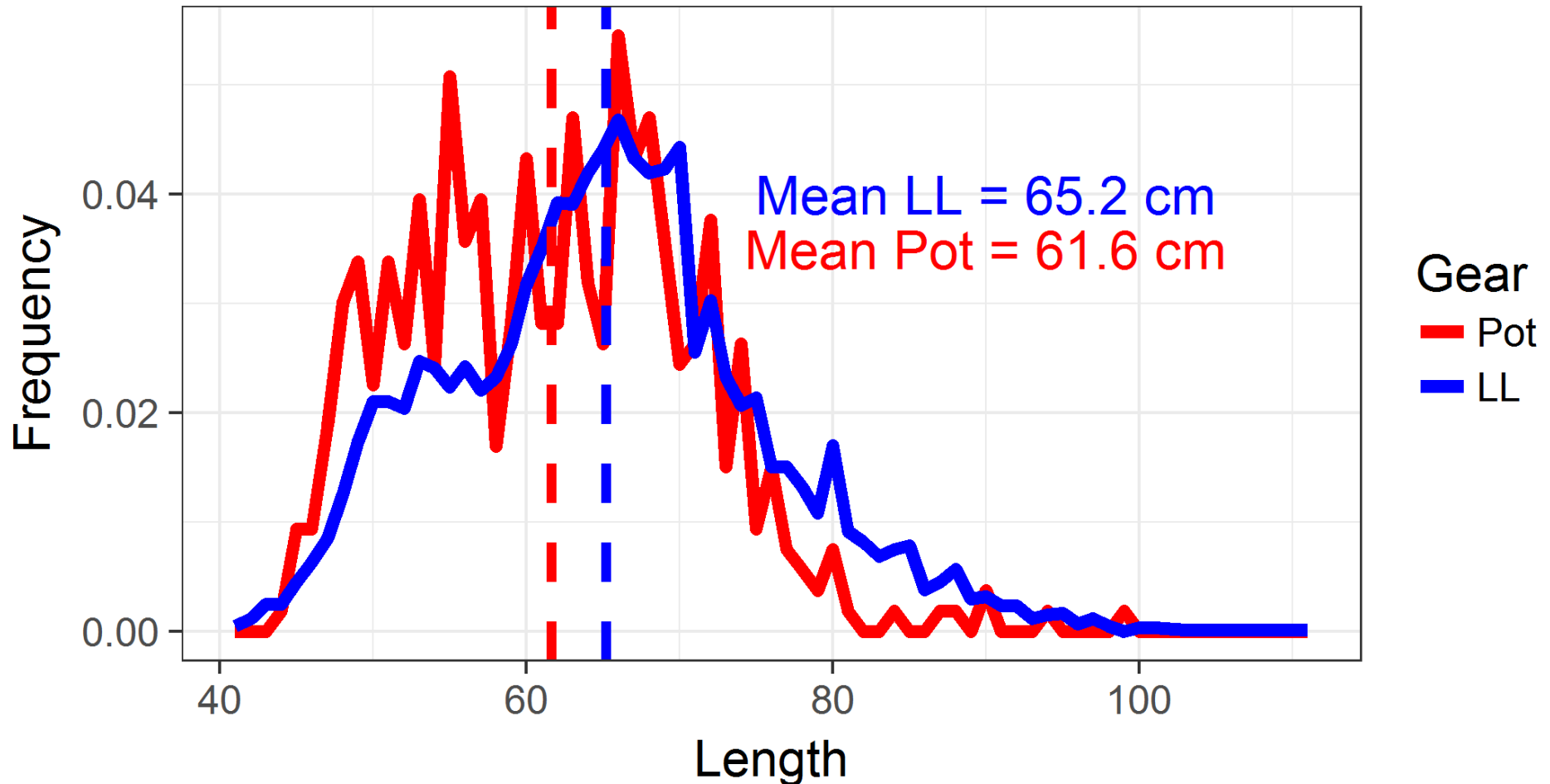


Sablefish Trawl catch increase



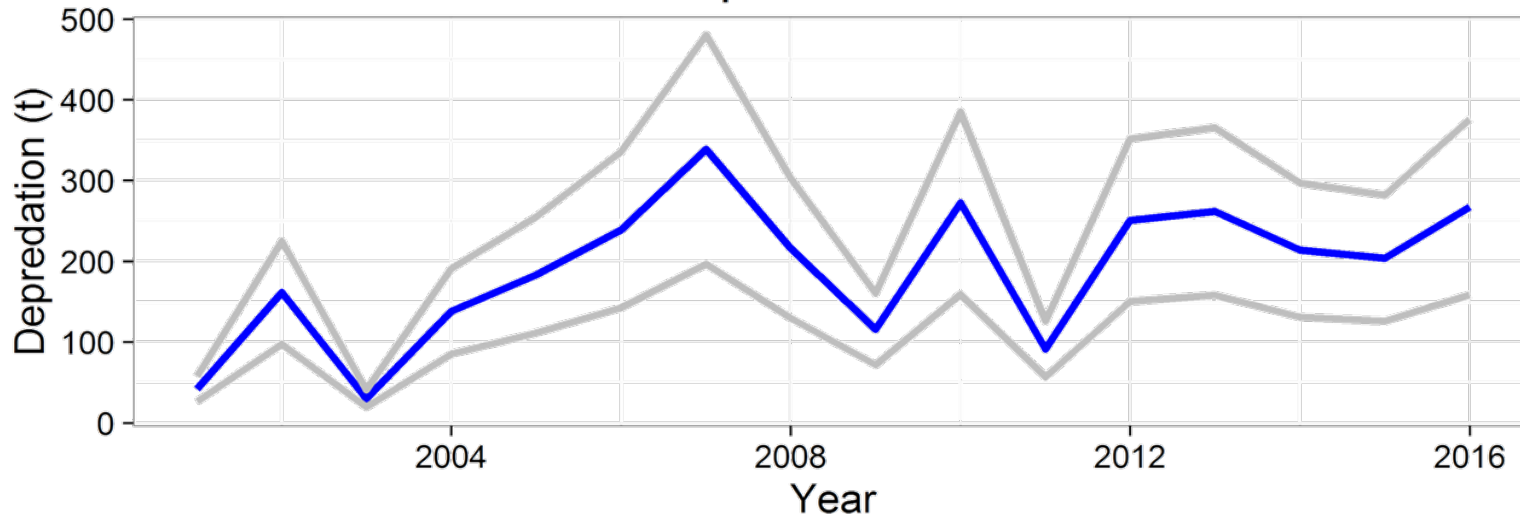
Longline vs pot sablefish fishery lengths

2017 Length Frequencies GOA sablefish

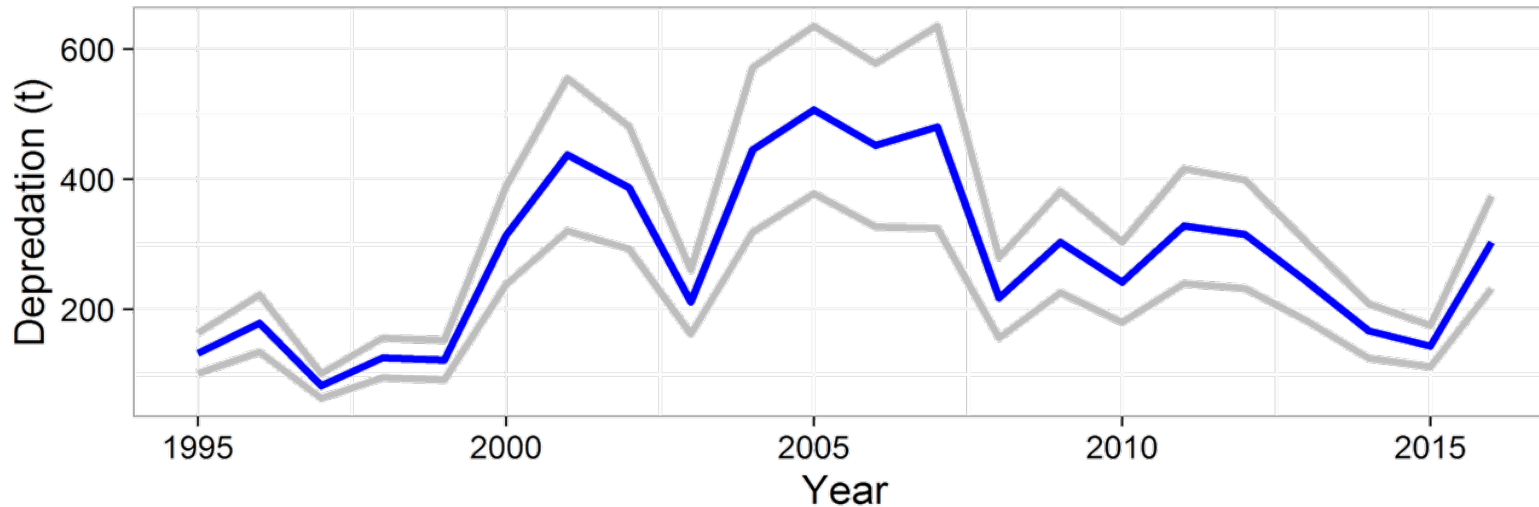


Depredation by whales in fishery

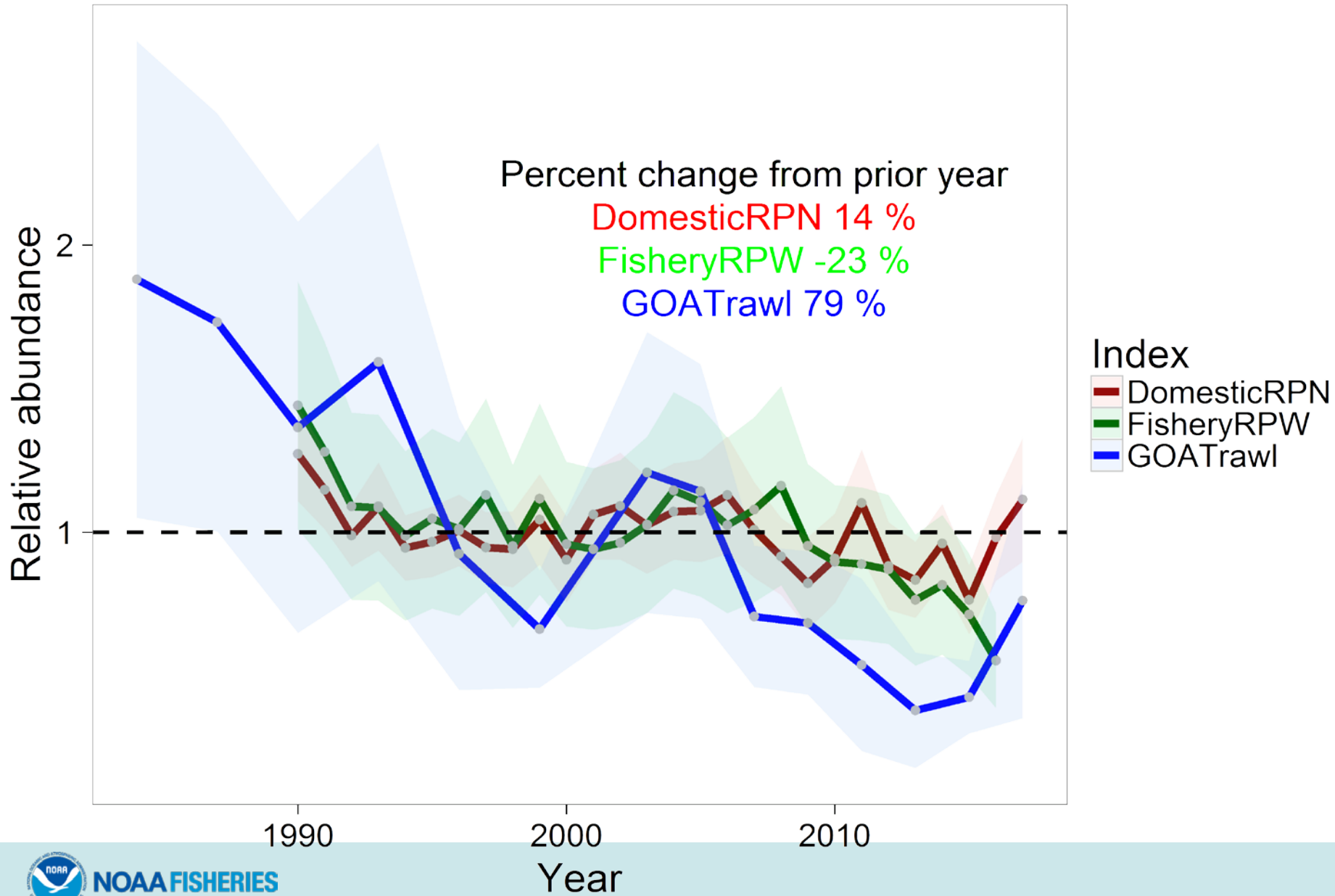
Sperm whale



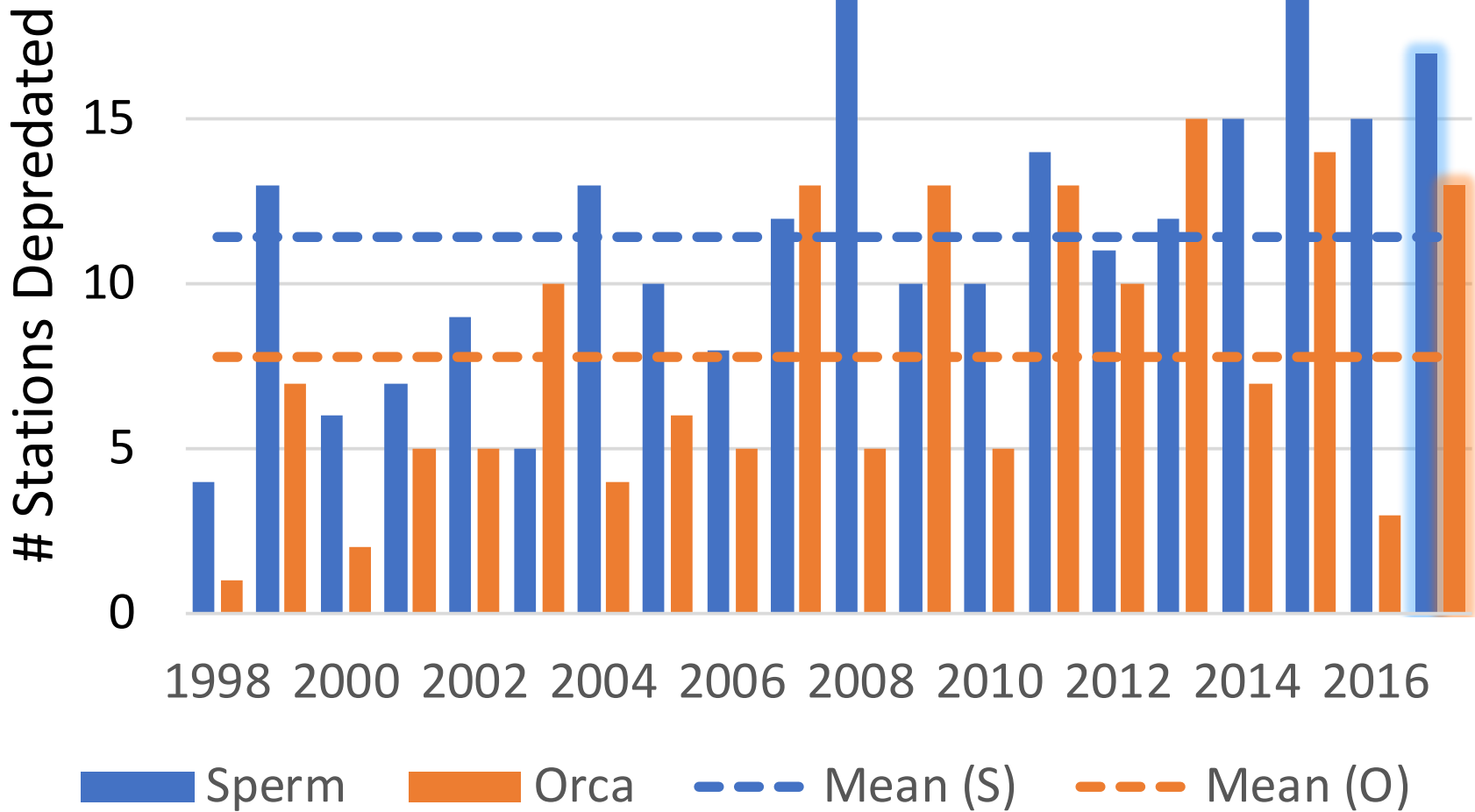
Orca



Sablefish abundance indices



Sablefish whale depredation in survey



Summary of sablefish observations

2014

Abundant YOYs in surface trawl survey

Reports of YOY in coho salmon

2015

One year olds reported by sport fishermen

YOYs found in coho and pomfret stomachs

Confirmed by fisherman

2016

YOY abundant in new EGOA surface trawl survey

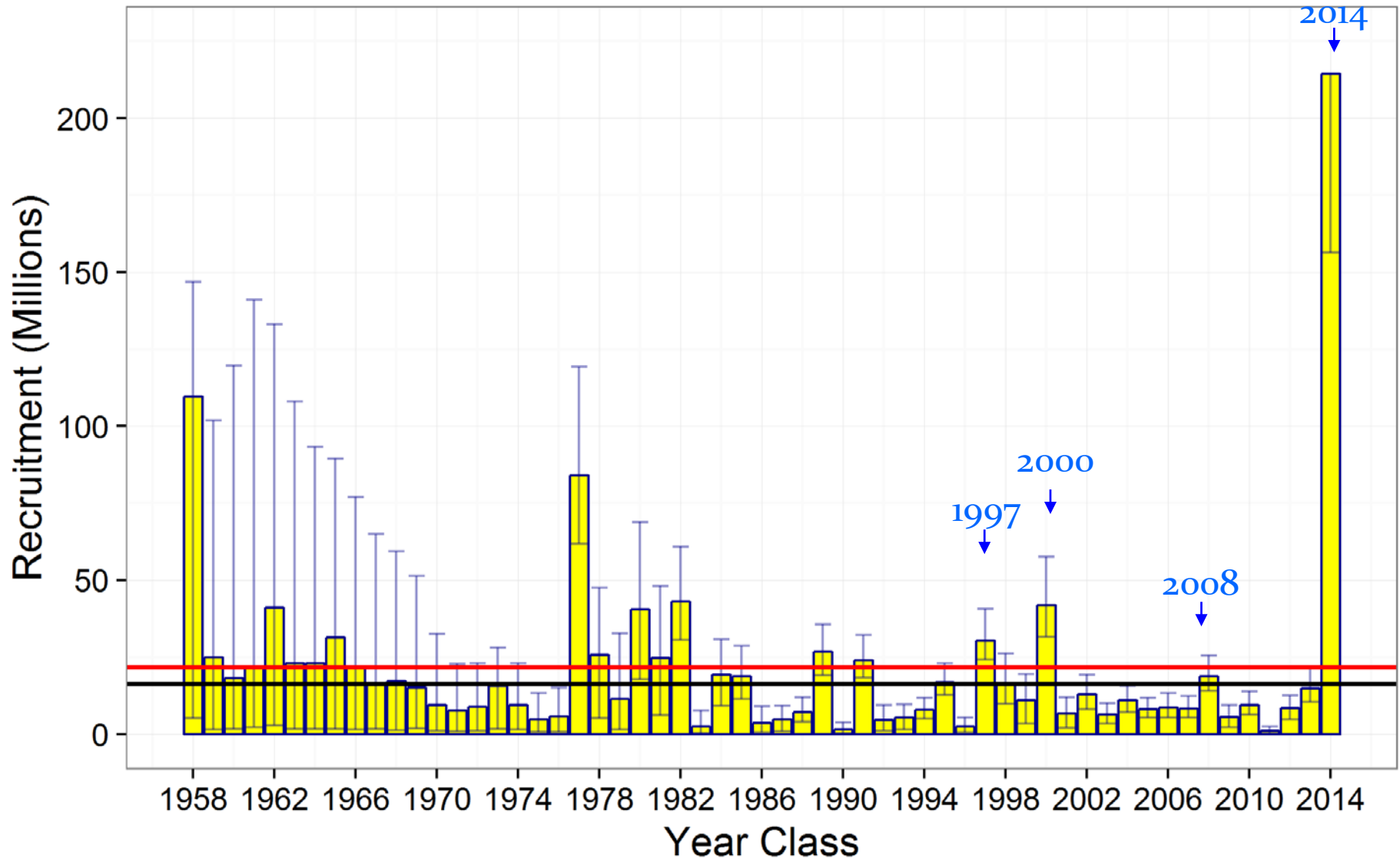
Fisherman reporting YOY in coho salmon stomachs

2017

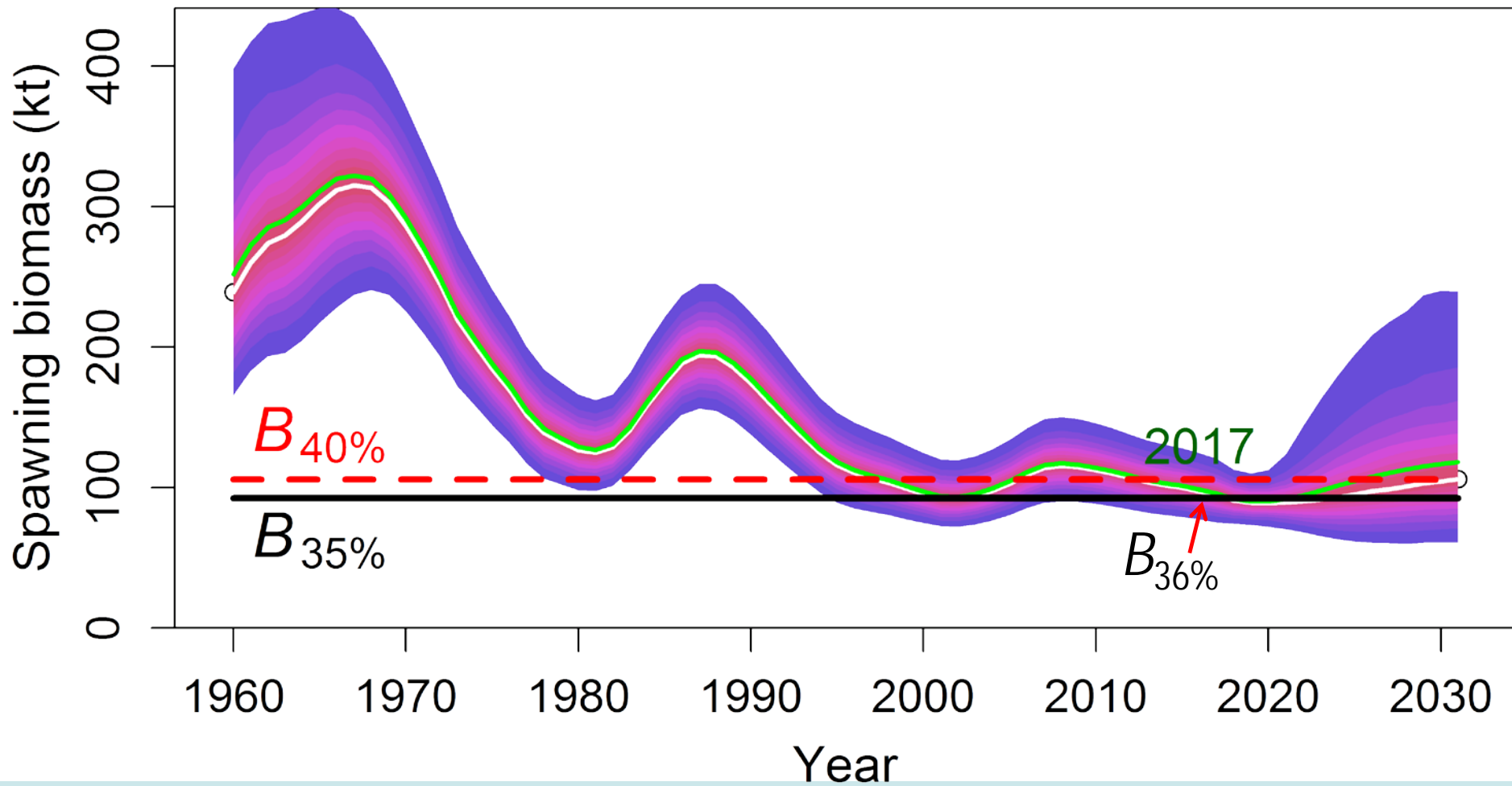
Widespread reporting of small fish in the fishery



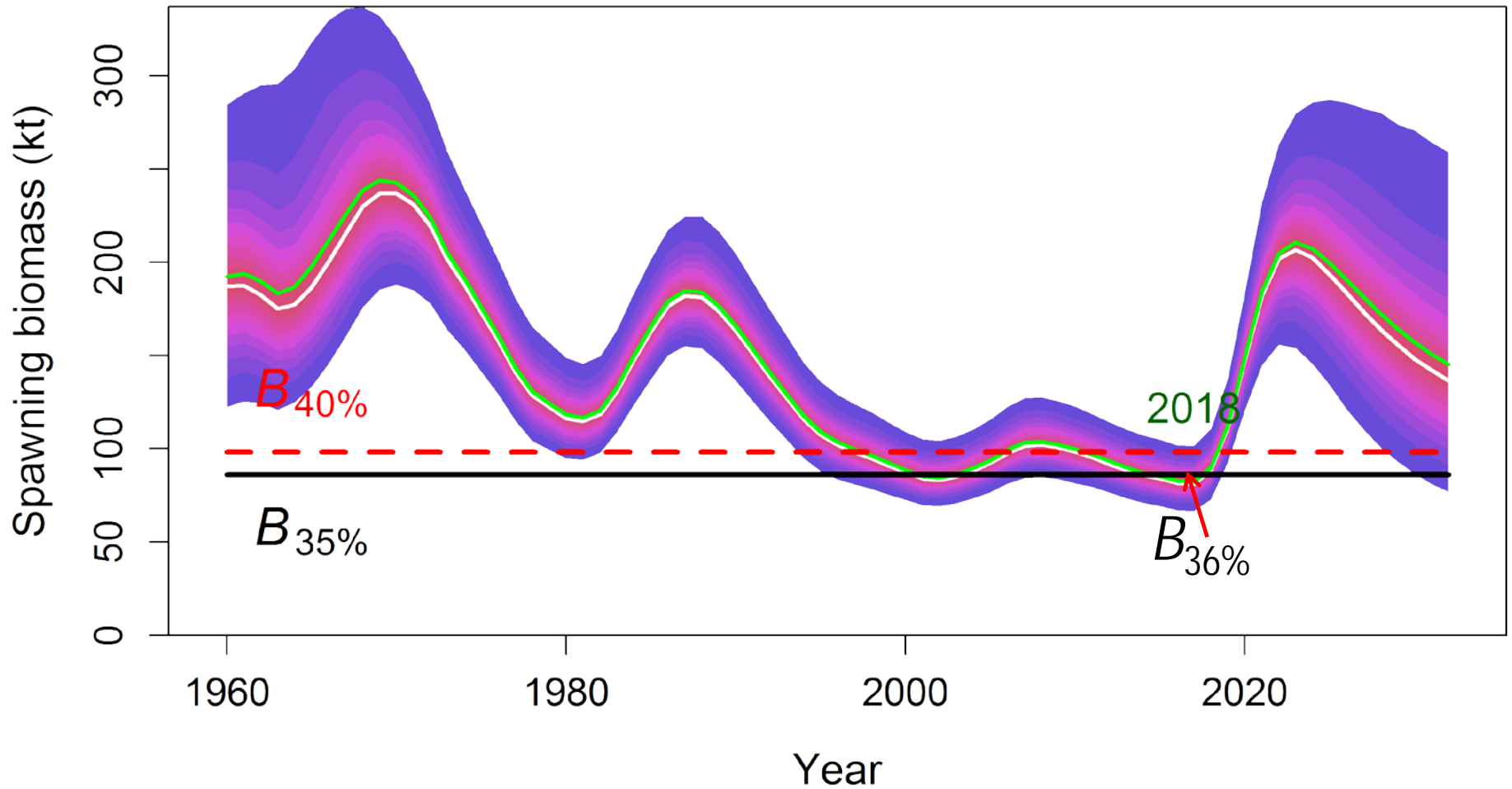
Model recruitment estimates



2016 Projection...



2017 Projection

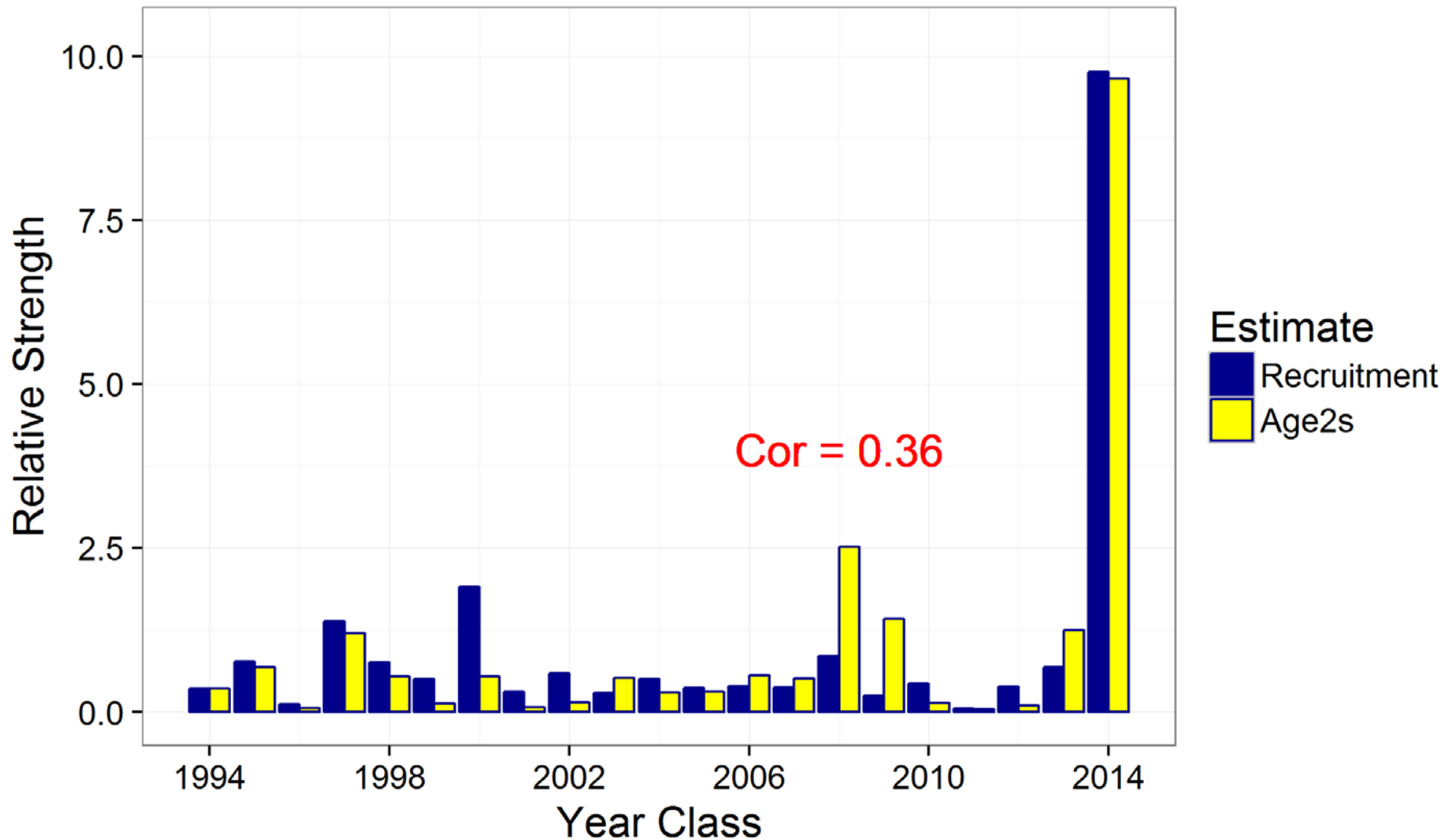


ABC summary

- Despite low SSB, the projected maxABC is an increase of 87% from 2017
- Most of that increase is based on the estimate of one really large year class (based on one year of age compositions)
- Consider some other factors when recommending an ABC

Recruitment

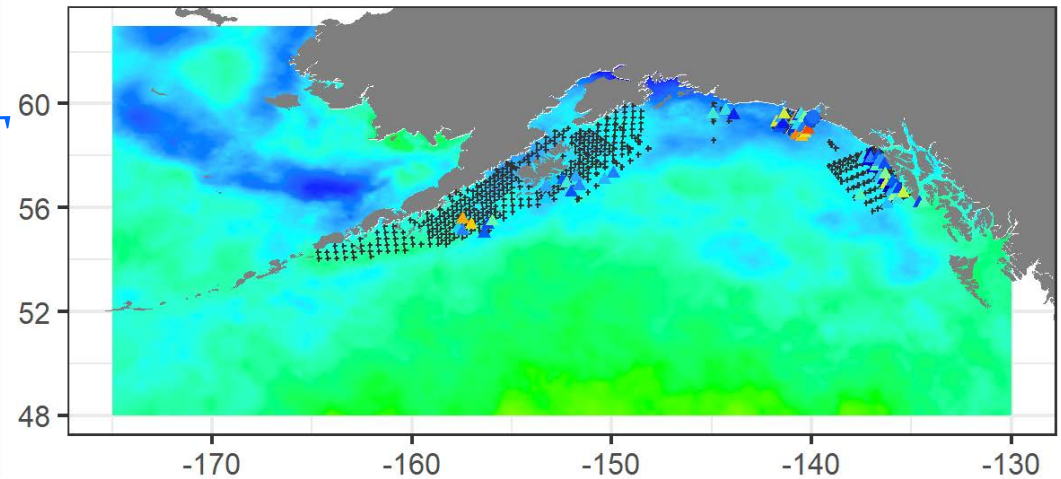
Alaska-wide



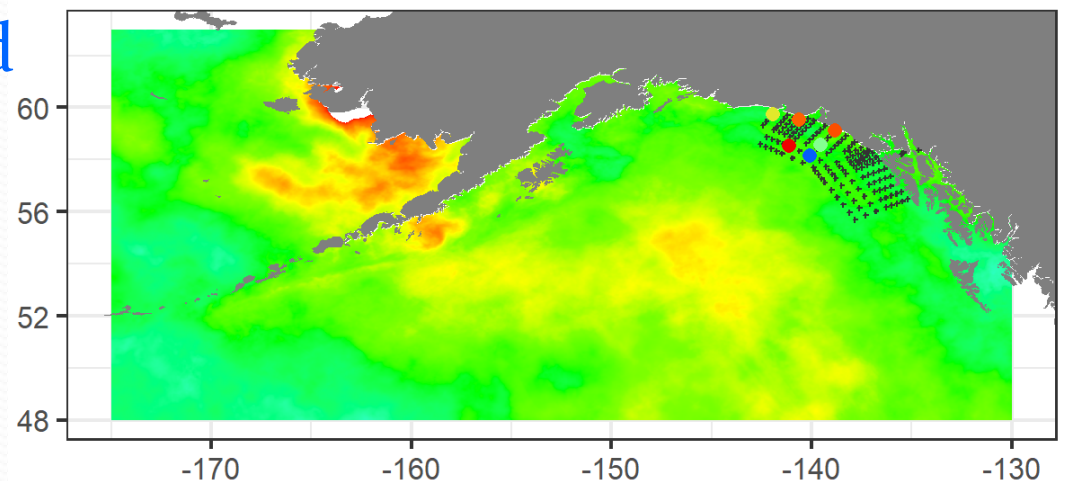
Ecosystem and Socioeconomic Profile (ESP)

- Big change in GOA SST
- Very warm offshore in the GOA in 2014 (and 2015)
- These conditions seemed to have favored sablefish larvae

2013

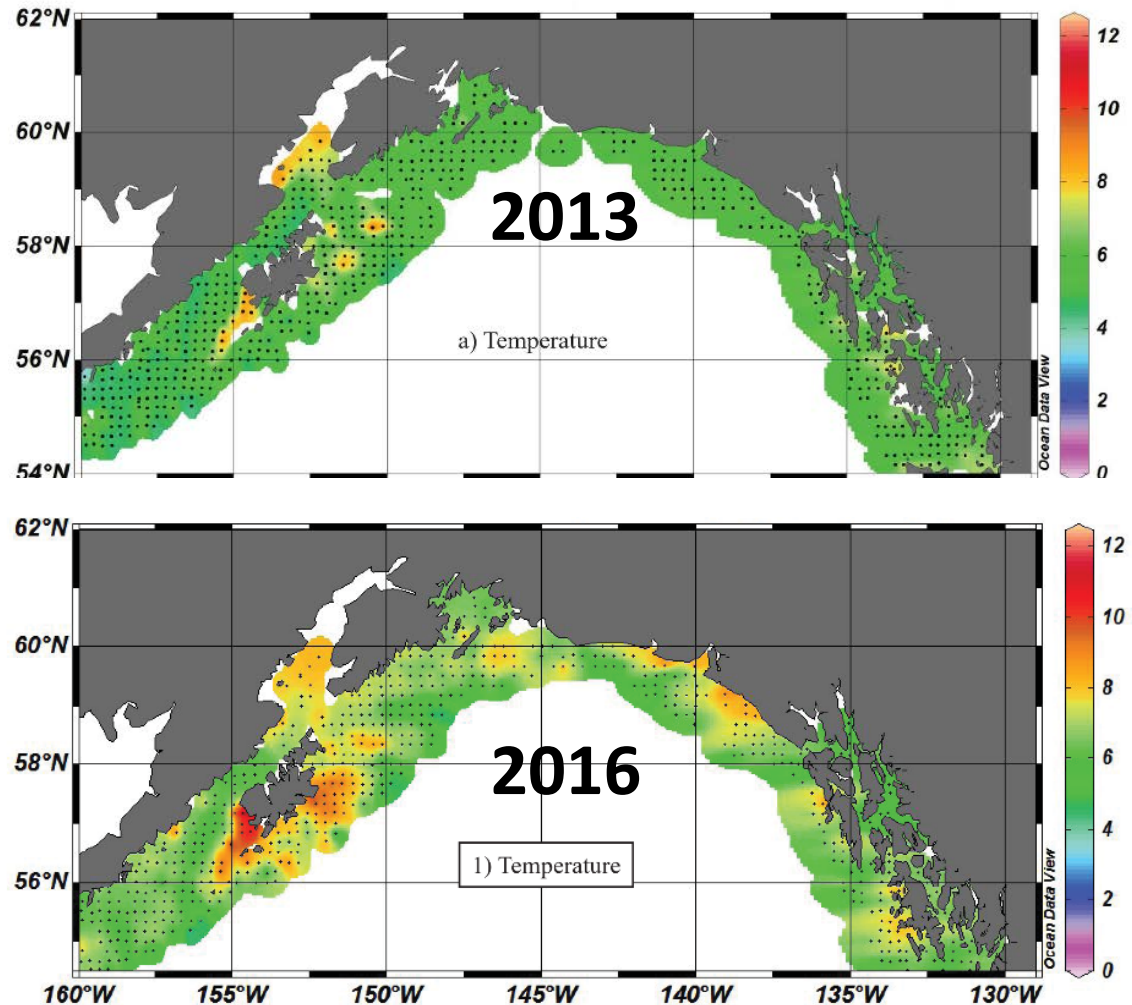


2014



Ecosystem and Socioeconomic Profile (ESP)

- I'm not an oceanographer
- But warm SST seems to translate to warm bottom temperature later
- Could influence selectivity
- Moving out earlier because of food or preference

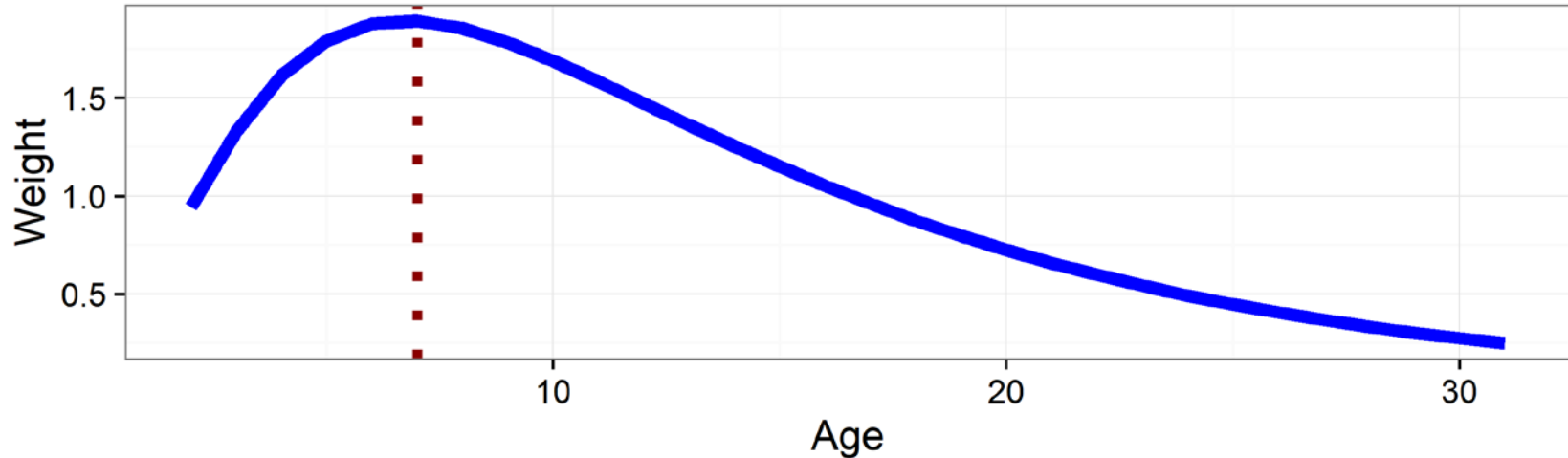


Ecosystem and Socioeconomic Profile (ESP)

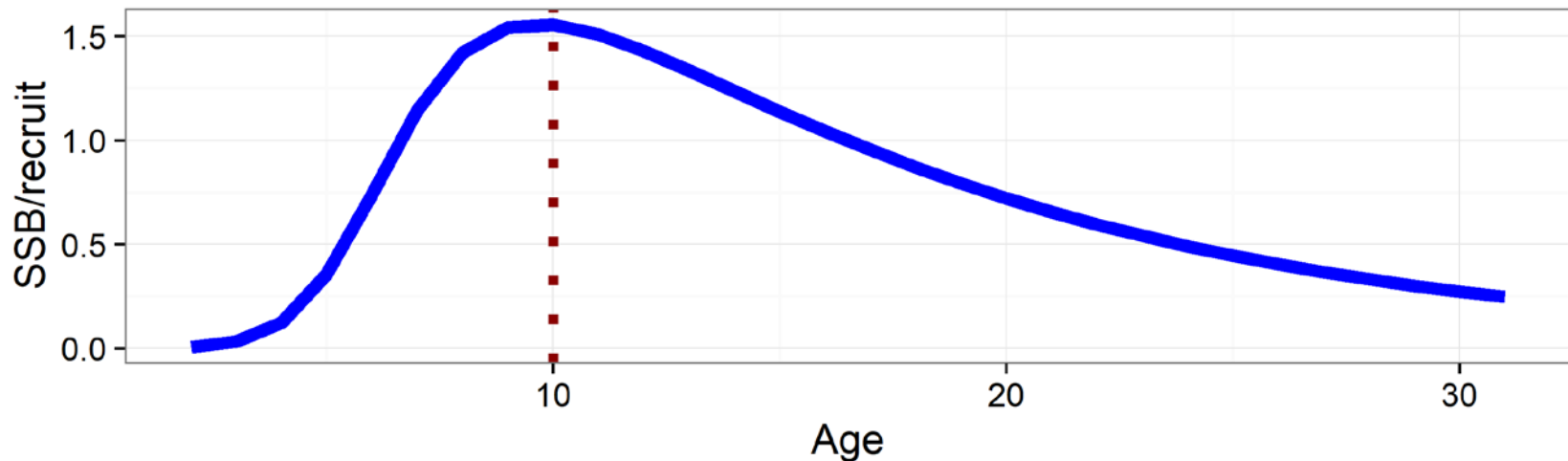
	2003-2012 Average	2013	2014	2015	2016
Quantity K mt	8.59	7.83	6.70	6.06	5.86
Value M US\$	\$101.5	\$96.2	\$99.0	\$91.0	\$99.7
Price/lb US\$	\$5.36	\$5.57	\$6.70	\$6.81	\$7.72
H&G share	95%	97%	97%	98%	97%

Per-recruit considerations

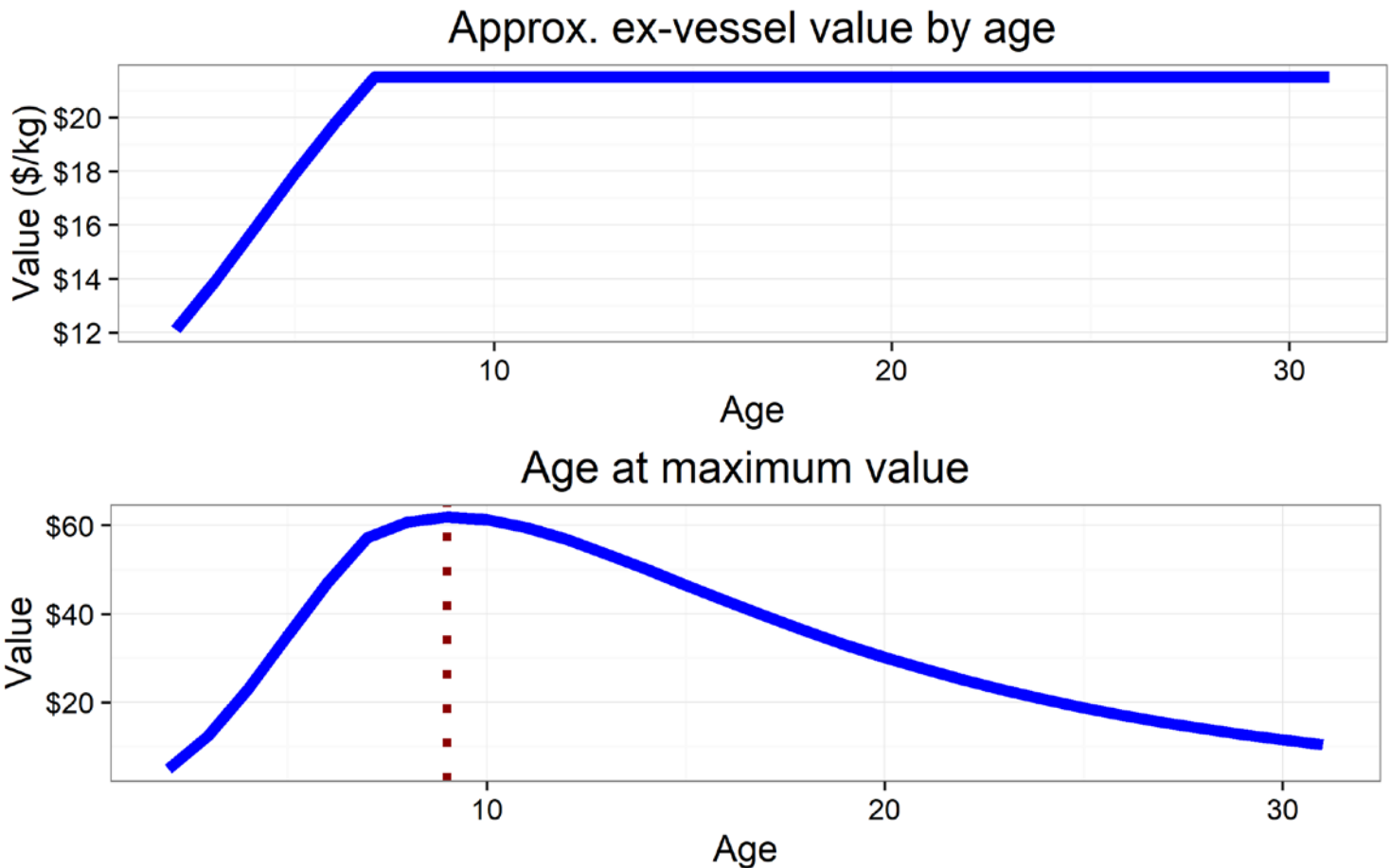
Age at maximum production



Age at maximum SSB/contribution



Ecosystem and Socioeconomic Profile (ESP)



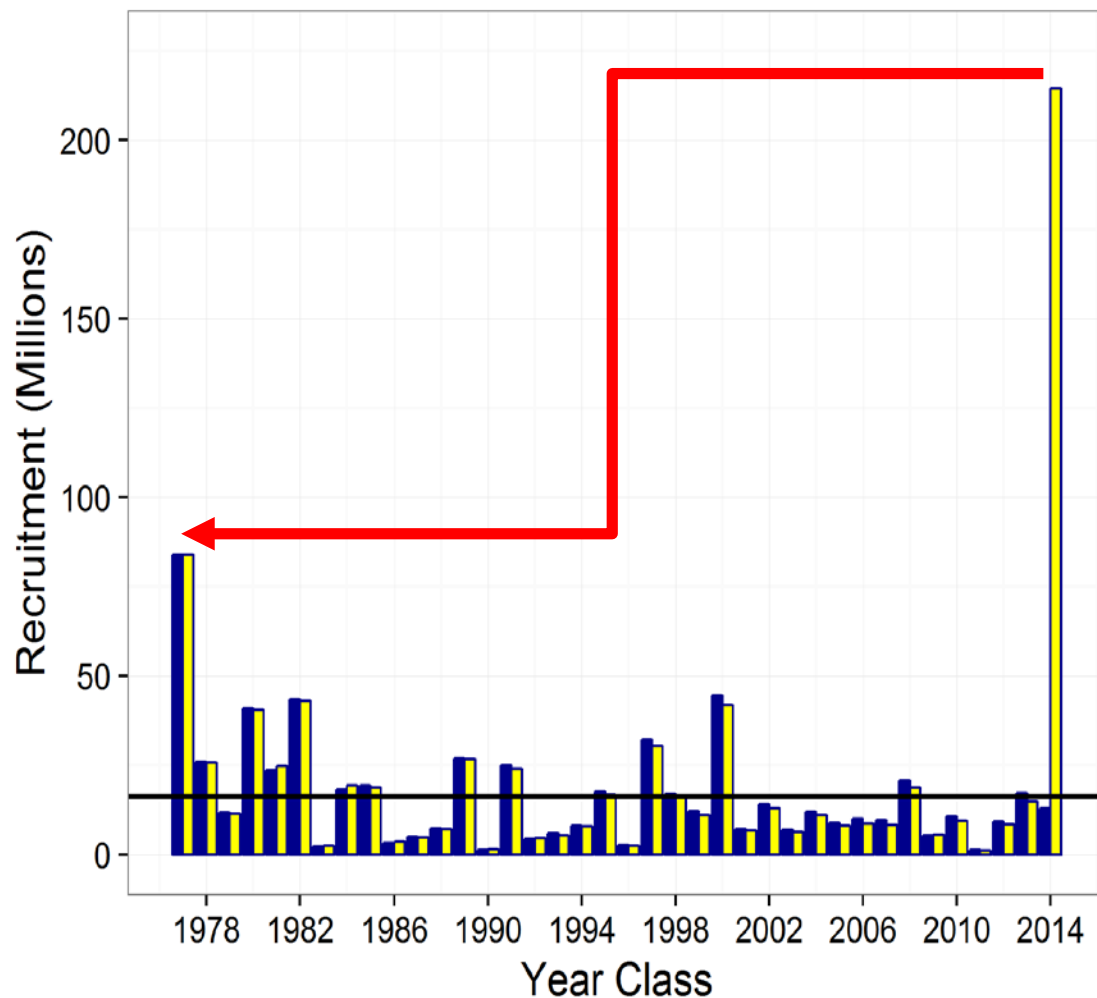
Alternative ABC/ACL

2014 year class set to
1977 estimate

- ~4 x avg
- 40% of est

maxABC:

- Reduced from 25 kt to 15 kt



2018 ABC corrected for depredation

Area	<u>AI</u>	<u>BS</u>	<u>WG</u>	<u>CG</u>	<u>WY*</u>	<u>EY*</u>	<u>Total</u>
2017 ABC	1,783	1,318	1,457	4,608	1,550	2,793	13,509
2018 ABC	2,030	1,501	1,659	5,246	1,765	3,179	15,380
Run with whale corrections for survey and fishery							
3 year average depredation	37	33	101	77	81	43	371
Ratio of 2017 ABC/2016 ABC = 1.139							
Deduct 3 year average * 1.139							
Deduct 3 year adjusted average	-42	-37	-115	-88	-92	-49	-423
2018 ABC_{WC}	1,988	1,464	1,544	5,158	1,672	3,131	14,957
Change from 2017	15%	15%	14%	14%	14%	14%	14%

ABC summary

LL survey up substantially from low in 2015

Fishery CPUE index at time series low in 2016

Trawl survey almost double from 2015

2018 SSB at 36% of unfished

maxABC 2018: 25,583 t (vs. 13,688 t projected)

- 87 % **increase** from 2017 (versus 1% projected)

Author recommended ABC_w 14,957 (+14%)

AK Sablefish

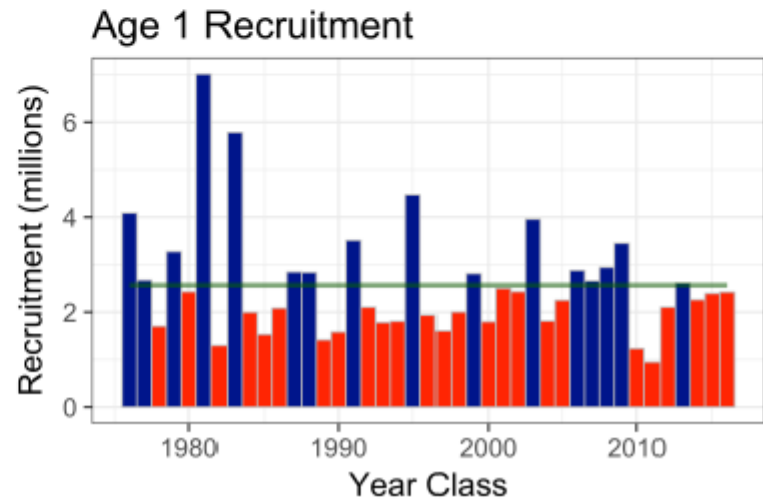
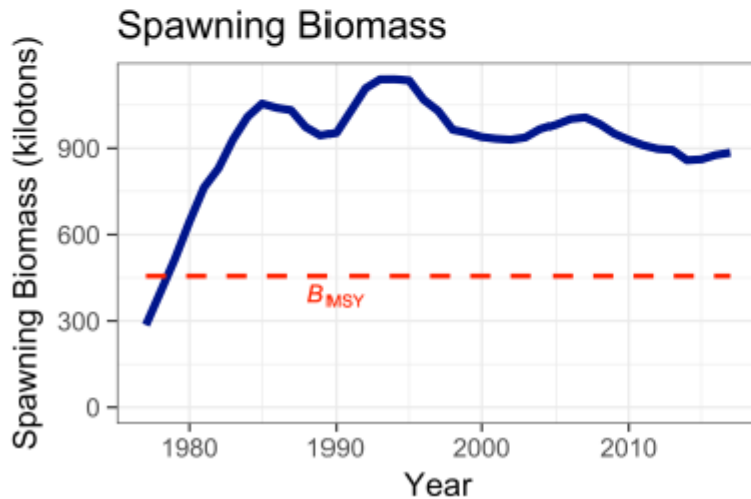
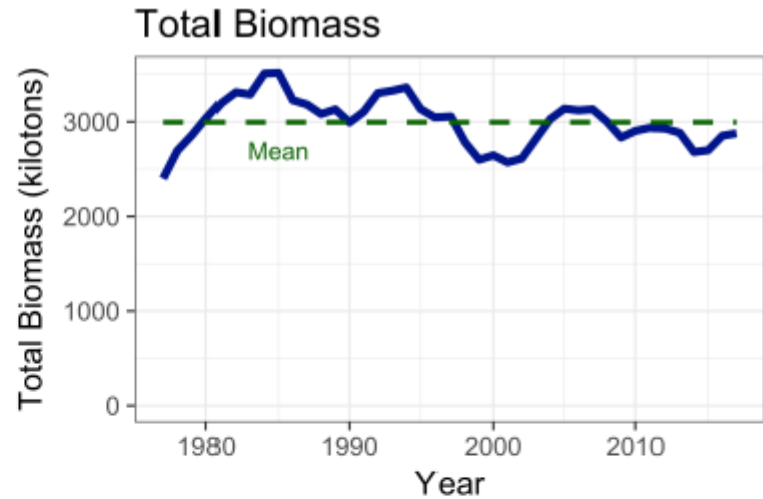
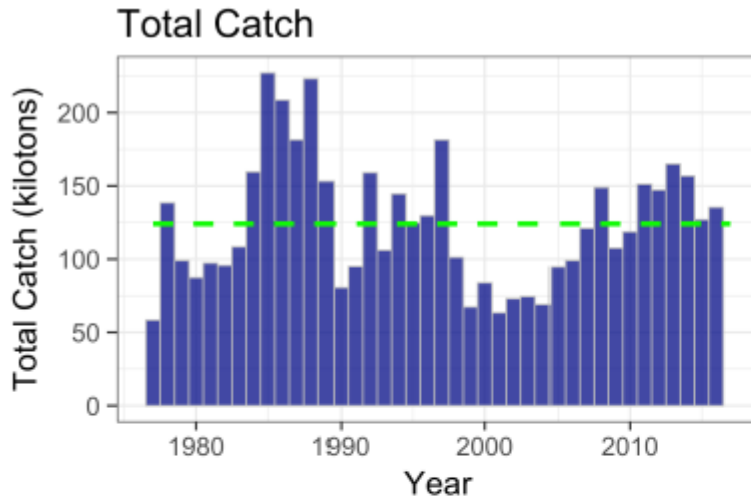
Teams' discussions

- Model selection and the whale depredation adjustment
- 3-yr average of area-specific depredation for killer and sperm whales appropriate (behavior of fishers may change)

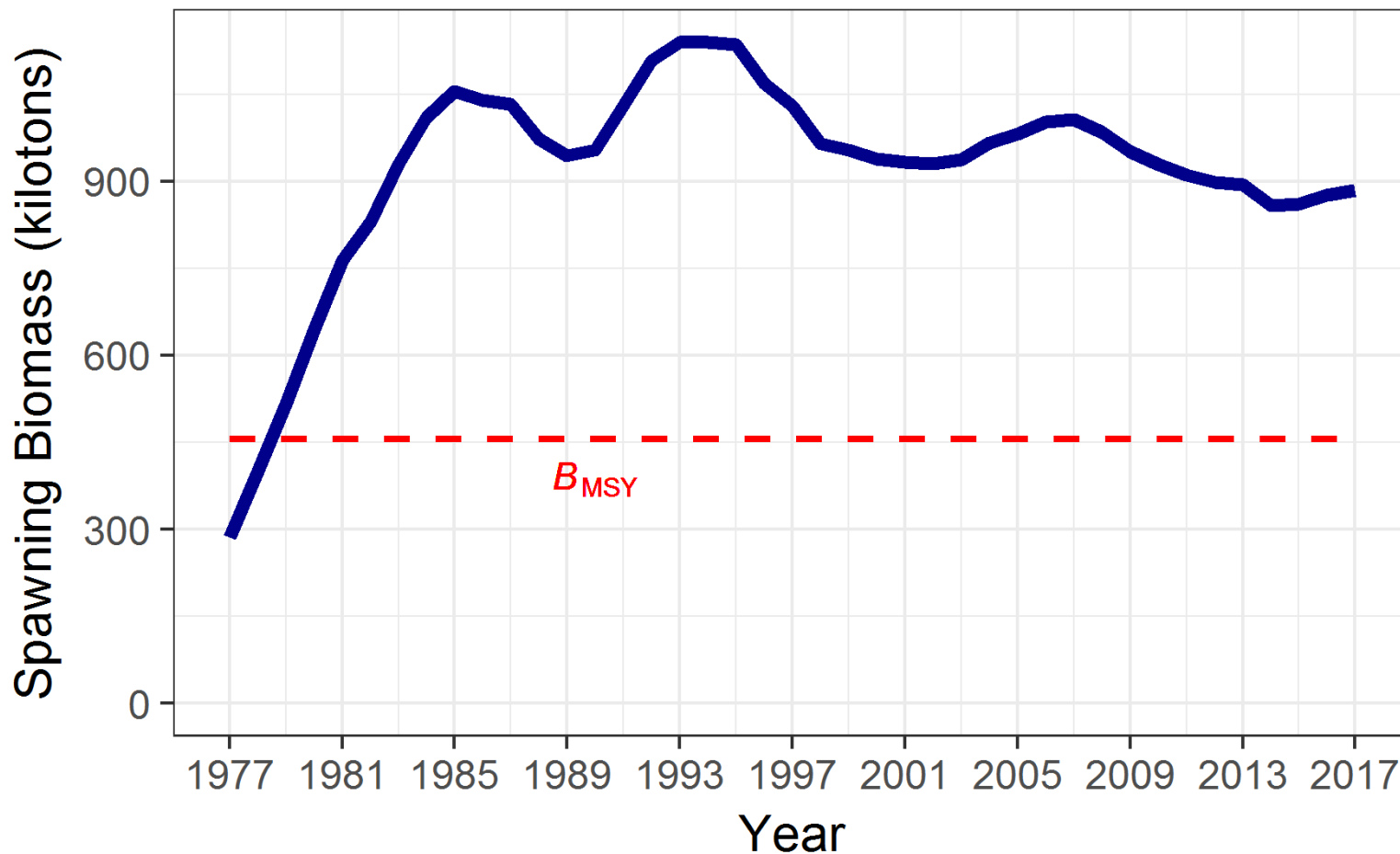
Teams' concurred with conservative ABC/OFL approach

- Balance between economics, ecosystem, and standard population dynamics

Chapter 4: yellowfin sole (full)



BSAI Yellowfin Sole Spawning Biomass



Yellowfin sole, continued

Quantity	Last year	This year	Change
M	0.12	0.12	0.00
2017 tier	1a	n/a	none
2018 tier	1a	1a	none
2017 age+ biomass	2,290,100	n/a	0.11
2018 age+ biomass	2,202,300	2,553,100	0.16
2017 spawning biomass	778,600	n/a	0.15
2018 spawning biomass	770,900	895,000	0.16
B0	1,202,700	1,204,000	0.00
Bmsy	424,000	456,000	0.08
2018 FOFL	0.125	0.120	-0.04
2018 FABC	0.114	0.109	-0.04
2017 OFL	287,000	n/a	0.07
2018 OFL	276,000	306,700	0.11
2017 ABC	260,800	n/a	0.06
2018 ABC	250,800	277,500	0.11

Chapter 5: Greenland turbot (partial)

- The authors' recommended an ABC of 7,000 t for the next two years, a value that the authors had also recommended last year
- Last year, the Team agreed that capping harvests at the 7,000 t level would likely result in less variable future harvests and keep the stock above $B_{35\%}$, but the Team felt that these were more appropriately viewed as TAC considerations than ABC considerations, and so proposed setting ABC at the maximum permissible level instead
- Last year, the SSC embarked on a 2-year stair-step for ABC, putting the SSC on track to recommend the maximum permissible this year
- The Team proposes setting ABC at the maximum permissible level for 2018 and 2019

Greenland turbot, continued

Quantity	Last year	This year	Change
M	0.112	0.112	0.00
2017 tier	3a	n/a	none
2018 tier	3a	3a	none
2017 age+ biomass	121,804	n/a	0.04
2018 age+ biomass	122,032	126,417	0.04
2017 spawning biomass	50,461	n/a	0.15
2018 spawning biomass	55,347	58,035	0.05
B100%	103,097	103,097	0.00
B40%	41,239	41,239	0.00
B35%	36,084	36,084	0.00
2018 FOFL	0.22	0.22	0.00
2018 FABC	0.18	0.18	0.00
2017 OFL	11,615	n/a	0.13
2018 OFL	12,831	13,148	0.02
2017 ABC	9,825	n/a	0.13
2018 ABC	10,864	11,132	0.02

Chapter 6: arrowtooth flounder (partial)

Quantity	Last year	This year	Change
M	0.35/0.20	0.35/0.20	0.00
2017 tier	3a	n/a	none
2018 tier	3a	3a	none
2017 age+ biomass	779,195	n/a	0.01
2018 age+ biomass	772,153	785,141	0.02
2017 spawning biomass	485,802	n/a	0.01
2018 spawning biomass	464,066	490,663	0.06
B100%	530,135	530,135	0.00
B40%	212,054	212,054	0.00
B35%	185,547	185,547	0.00
2018 FOFL	0.151	0.151	0.00
2018 FABC	0.129	0.129	0.00
2017 OFL	76,100	n/a	0.01
2018 OFL	67,023	76,757	0.15
2017 ABC	65,371	n/a	0.01
2018 ABC	58,633	65,932	0.12

Chapter 7: Kamchatka flounder (partial)

Quantity	Last year	This year	Change
M	0.11	0.11	0.00
2017 tier	3a	n/a	none
2018 tier	3a	3a	none
2017 age+ biomass	170,300	n/a	0.11
2018 age+ biomass	181,000	189,868	0.05
2017 spawning biomass	60,300	n/a	0.06
2018 spawning biomass	62,200	63,718	0.02
B100%	126,954	126,954	0.00
B40%	50,782	50,782	0.00
B35%	44,434	44,434	0.00
2018 FOFL	0.078	0.075	-0.04
2018 FABC	0.066	0.064	-0.03
2017 OFL	10,360	n/a	0.10
2018 OFL	10,700	11,347	0.06
2017 ABC	8,880	n/a	0.10
2018 ABC	9,200	9,737	0.06

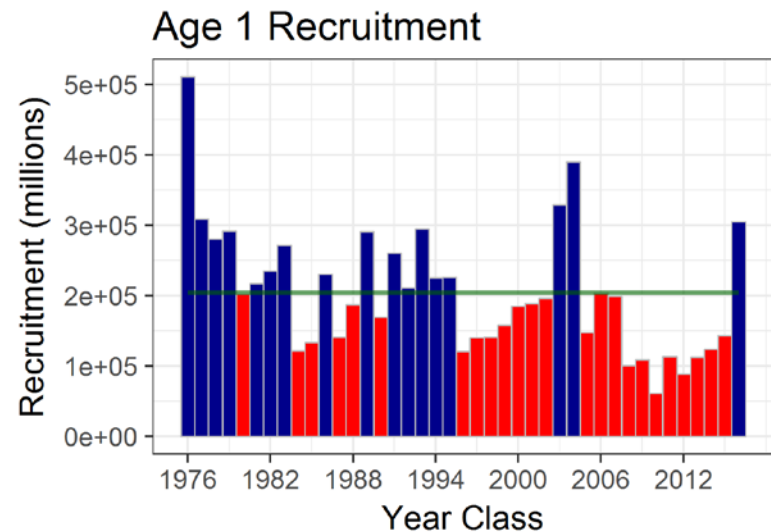
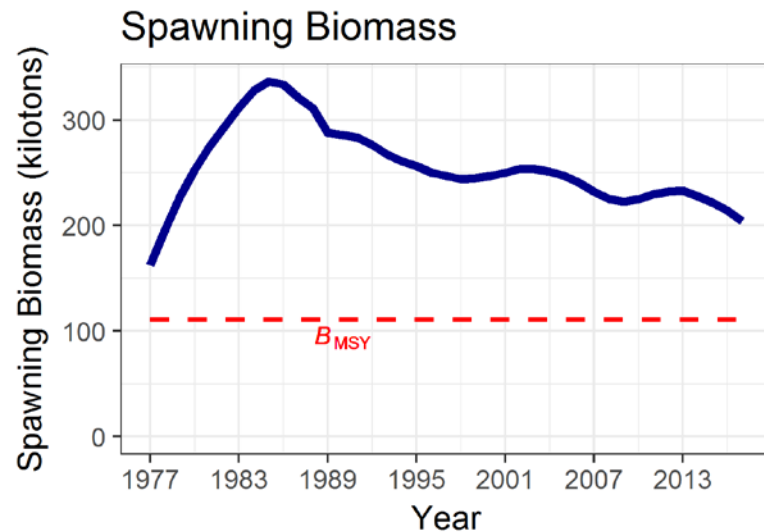
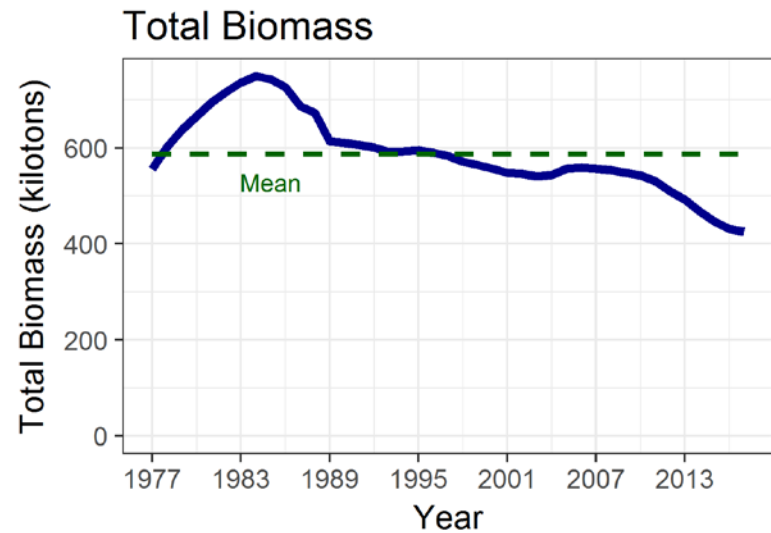
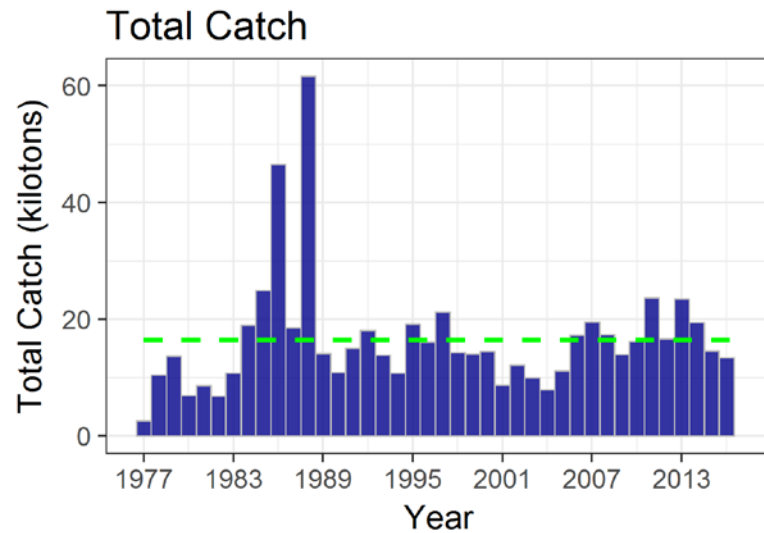
Northern rock sole, continued

Quantity	Last year	This year	Change
M	0.15	0.15	0.00
2017 tier	1a	n/a	none
2018 tier	1a	1a	none
2017 age+ biomass	1,000,600	n/a	-0.08
2018 age+ biomass	923,200	923,200	0.00
2017 spawning biomass	539,500	n/a	-0.12
2018 spawning biomass	472,200	472,200	0.00
B0	678,310	678,310	0.00
Bmsy	257,000	257,000	0.00
2018 FOFL	0.16	0.16	0.00
2018 FABC	0.155	0.155	0.00
2017 OFL	159,700	n/a	-0.08
2018 OFL	147,300	147,300	0.00
2017 ABC	155,100	n/a	-0.08
2018 ABC	143,100	143,100	0.00

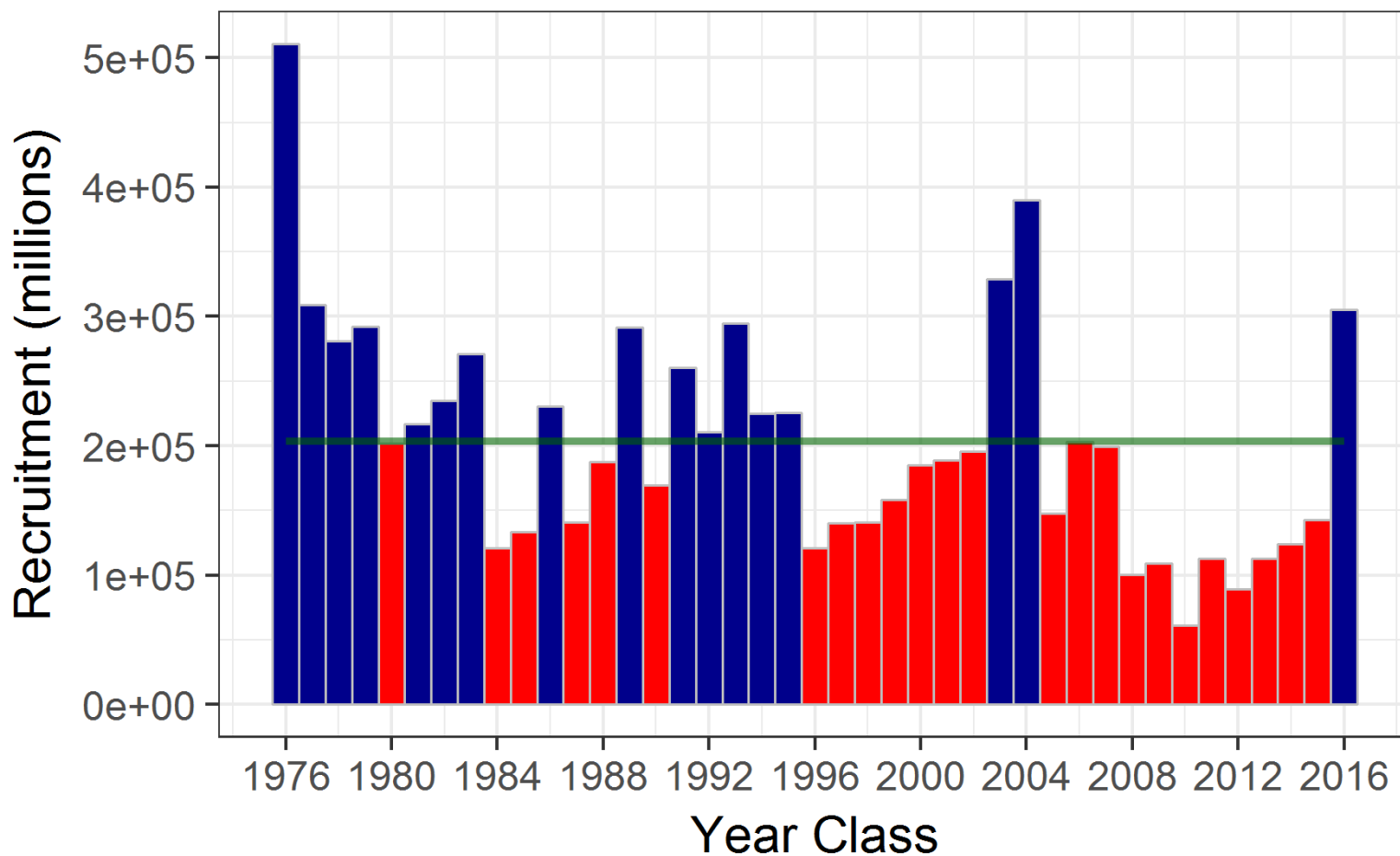
Chapter 9: flathead sole (partial)

Quantity	Last year	This year	Change
M	0.20	0.20	0.00
2017 tier	3a	n/a	none
2018 tier	3a	3a	none
2017 age+ biomass	747,557	n/a	0.02
2018 age+ biomass	758,543	762,513	0.01
2017 spawning biomass	223,469	n/a	-0.04
2018 spawning biomass	206,029	214,124	0.04
B100%	322,938	322,938	0.00
B40%	129,175	129,175	0.00
B35%	113,028	113,028	0.00
2018 FOFL	0.41	0.41	0.00
2018 FABC	0.34	0.34	0.00
2017 OFL	81,654	n/a	-0.02
2018 OFL	79,136	79,862	0.01
2017 ABC	68,278	n/a	-0.02
2018 ABC	66,164	66,773	0.01

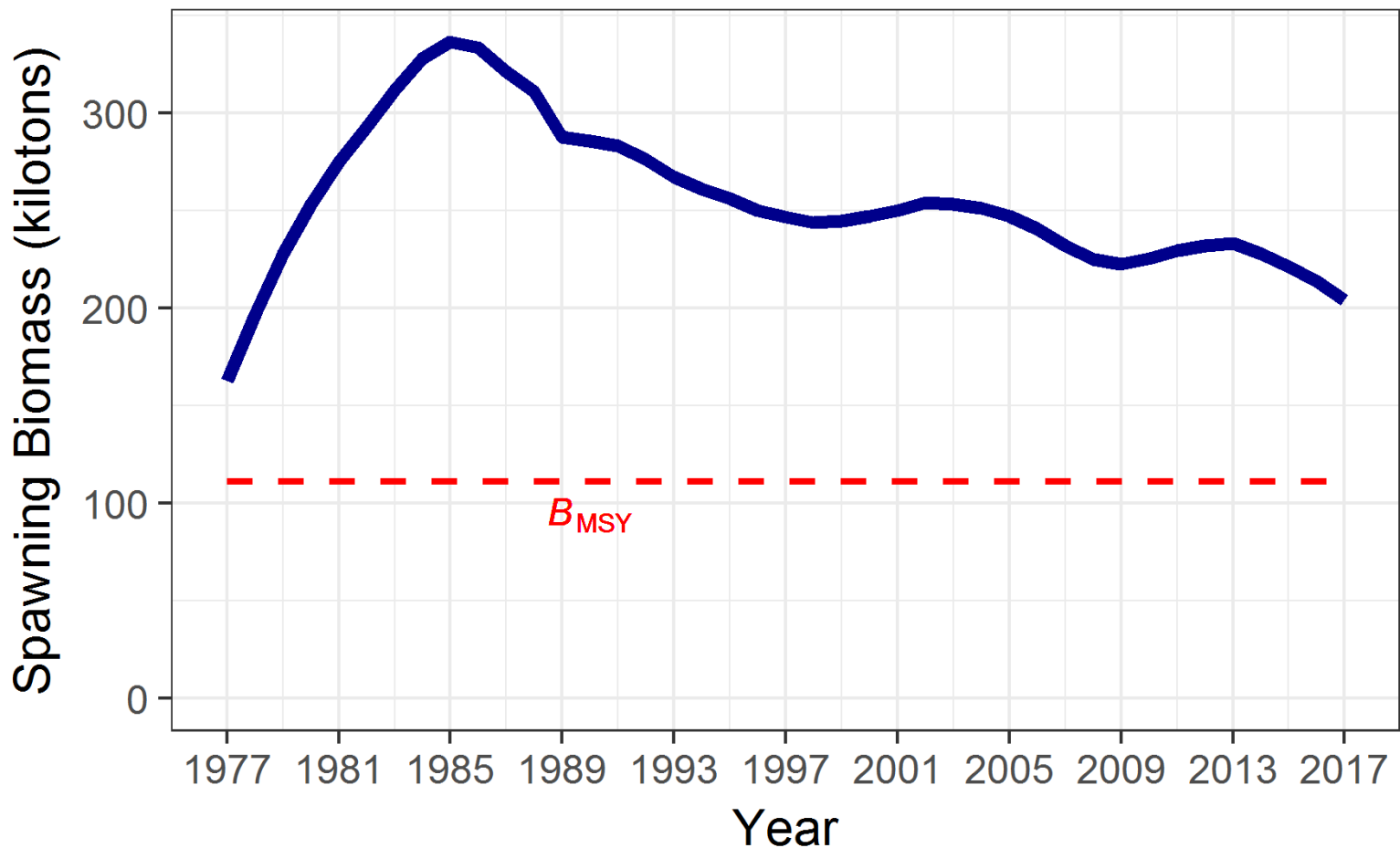
Chapter 10: Alaska plaice (full)



BSAI Alaska Plaice Age 1 Recruitment



BSAI Alaska Plaice Spawning Biomass



Alaska plaice, continued

- Discussion centered around the NBS survey
- In 2017, 40% of the Alaska plaice were caught in the NBS survey, which is comparable to the 38% there in 2010, unlike the dramatic increases seen in Pacific cod and walleye pollock
- A Team Member said it appears that Alaska plaice is moving northward because of recent presence of young plaice north of the NBS; its abundance is inversely related to bottom water temperature
- It is unknown if Alaska plaice is all one stock throughout the Bering Sea and northward into the Chukchi Sea; however, it is likely, as plaice has antifreeze proteins and cold water is not a deterrent
- At present this is not a problem because the biomass is above $B_{40\%}$, but it could be a problem in the future if migration out of the EBS survey area is mistakenly interpreted as implying a large reduction in stock size

Alaska plaice, continued

Quantity	Last year	This year	Change
M	0.13	0.13	0.00
2017 tier	3a	n/a	none
2018 tier	3a	3a	none
2017 age+ biomass	412,600	n/a	0.01
2018 age+ biomass	407,300	417,300	0.02
2017 spawning biomass	186,300	n/a	0.03
2018 spawning biomass	177,500	191,460	0.08
B100%	276,250	317,360	0.15
B40%	110,500	126,900	0.15
B35%	96,700	111,100	0.15
2018 FOFL	0.154	0.149	-0.03
2018 FABC	0.128	0.124	-0.03
2017 OFL	42,800	n/a	-0.04
2018 OFL	36,900	41,170	0.12
2017 ABC	36,000	n/a	-0.04
2018 ABC	32,100	34,590	0.08

Chapter 11: other flatfish (none)

Quantity*	Last year	This year	Change
M	0.155	0.155	0.00
2017 tier	5	n/a	none
2018 tier	5	5	none
Biomass	113,450	113,450	0.00
2018 FOFL	0.155	0.155	0.00
2018 FABC	0.116	0.116	0.00
2017 OFL	17,591	n/a	0.00
2018 OFL	17,591	17,591	0.00
2017 ABC	13,193	n/a	0.00
2018 ABC	13,193	13,193	0.00

*Instantaneous rates are biomass-weighted averages

Chapter 12: Pacific ocean perch (partial)

Quantity	Last year	This year	Change
M	0.058	0.058	0.00
2017 tier	3a	n/a	none
2018 tier	3a	3a	none
2017 age+ biomass	767,767	n/a	-0.02
2018 age+ biomass	753,302	749,925	0.00
2017 spawning biomass	314,489	n/a	-0.03
2018 spawning biomass	307,808	305,804	-0.01
B100%	536,713	536,713	0.00
B40%	214,685	214,685	0.00
B35%	187,849	187,849	0.00
2018 FOFL	0.101	0.101	0.00
2018 FABC	0.082	0.082	0.00
2017 OFL	53,152	n/a	-0.03
2018 OFL	51,950	51,675	-0.01
2017 ABC	43,723	n/a	-0.03
2018 ABC	42,735	42,509	-0.01

Chapter 13: northern rockfish (partial)

Quantity	Last year	This year	Change
M	0.046	0.046	0.00
2017 tier	3a	n/a	none
2018 tier	3a	3a	none
2017 age+ biomass	248,160	n/a	-0.01
2018 age+ biomass	245,693	246,160	0.00
2017 spawning biomass	107,660	n/a	-0.01
2018 spawning biomass	106,184	106,486	0.00
B100%	164,674	164,674	0.00
B40%	65,870	65,870	0.00
B35%	57,636	57,636	0.00
2018 FOFL	0.08	0.08	0.00
2018 FABC	0.065	0.065	0.00
2017 OFL	16,242	n/a	-0.02
2018 OFL	15,854	15,888	0.00
2017 ABC	13,264	n/a	-0.02
2018 ABC	12,947	12,975	0.00

Chapter 14: blackspotted/rougheye (partial)

Quantity	Last year	This year	Change
M	0.033	0.033	0.00
2017 tier	3b	n/a	none
2018 tier	3b	3b	none
2017 age+ biomass	35,669	n/a	0.05
2018 age+ biomass	37,474	37,453	0.00
2017 spawning biomass	7,305	n/a	0.12
2018 spawning biomass	8,188	8,208	0.00
B100%	20,777	20,777	0.00
B40%	8,311	8,311	0.00
B35%	7,272	7,272	0.00
2018 FOFL	0.054	0.054	0.00
2018 FABC	0.044	0.044	0.00
2017 OFL	612	n/a	0.22
2018 OFL	750	749	0.00
2017 ABC	501	n/a	0.22
2018 ABC	614	613	0.00

Chapter 15: shortraker rockfish (none)

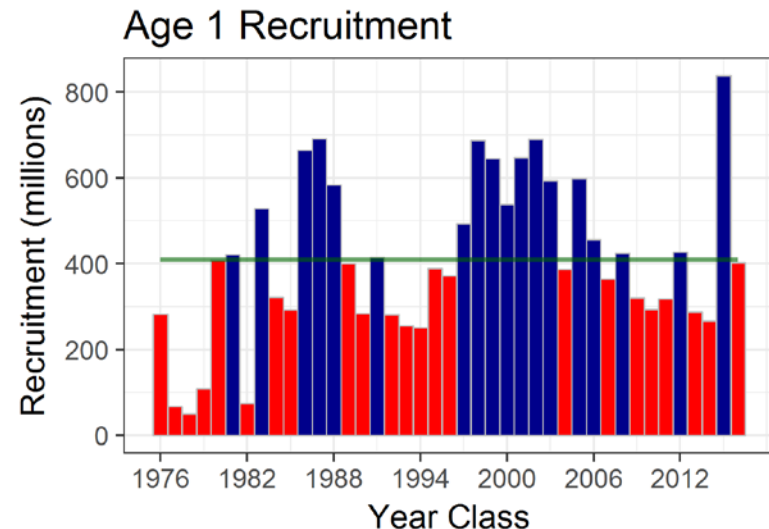
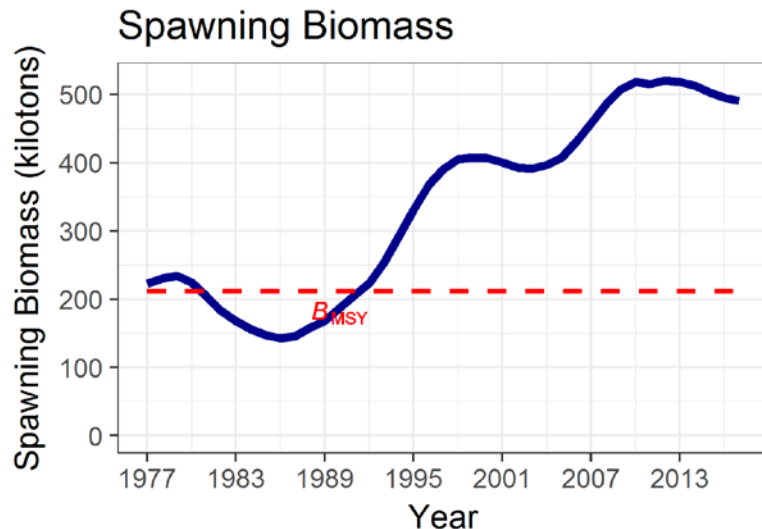
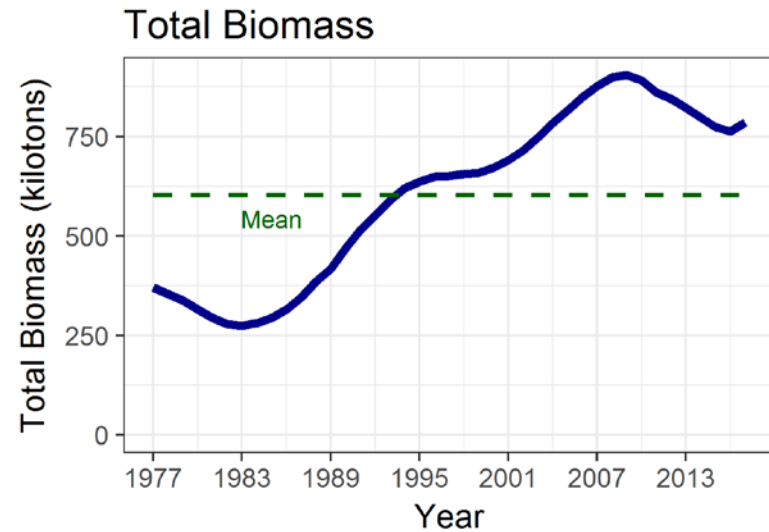
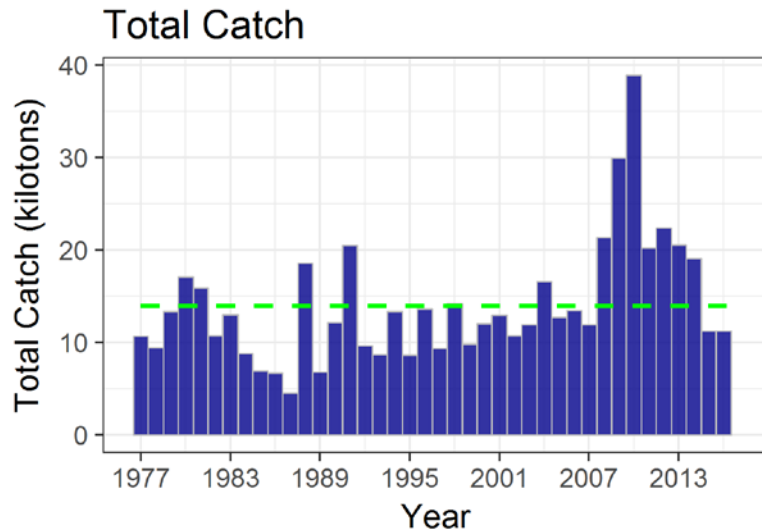
Quantity	Last year	This year	Change
M	0.030	0.030	0.00
2017 tier	5	n/a	none
2018 tier	5	5	none
Biomass	22,191	22,191	0.00
2018 FOFL	0.030	0.030	0.00
2018 FABC	0.0225	0.0225	0.00
2017 OFL	666	n/a	0.00
2018 OFL	666	666	0.00
2017 ABC	499	n/a	0.00
2018 ABC	499	499	0.00

Chapter 16: other rockfish (none)

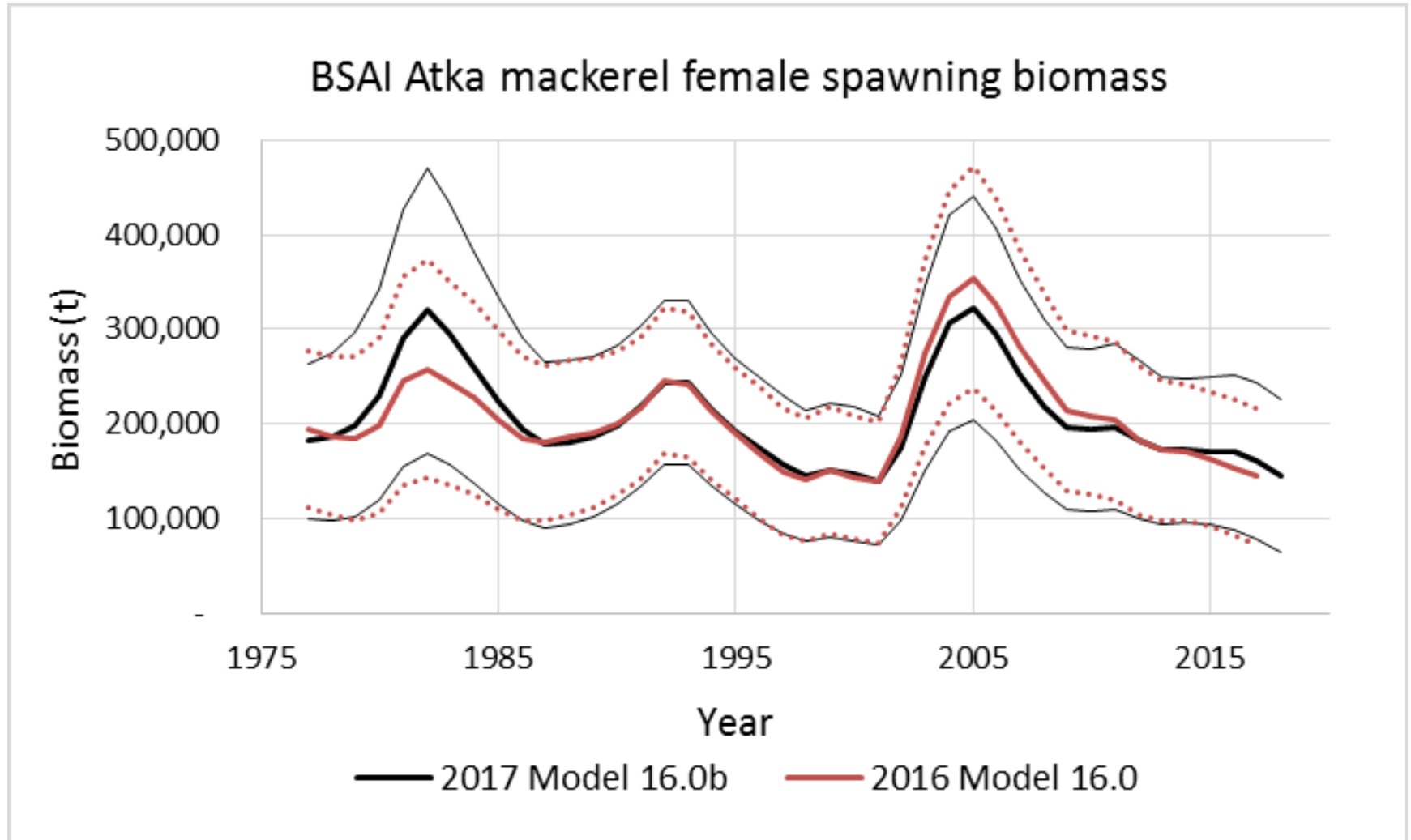
Quantity*	Last year	This year	Change
M	0.033	0.033	0.00
2017 tier	5	n/a	none
2018 tier	5	5	none
Biomass	55,312	55,312	0.00
2018 FOFL	0.033	0.033	0.00
2018 FABC	0.025	0.025	0.00
2017 OFL	1,816	n/a	0.00
2018 OFL	1,816	1,816	0.00
2017 ABC	1,362	n/a	0.00
2018 ABC	1,362	1,362	0.00

*Instantaneous rates are biomass-weighted averages

Chapter 17: Atka mackerel (full)



Atka mackerel, continued



Atka mackerel, continued

Quantity	Last year	This year	Change
M	0.30	0.30	0.00
2017 tier	3a	n/a	none
2018 tier	3a	3a	none
2017 age+ biomass	598,791	n/a	0.00
2018 age+ biomass	611,442	599,000	-0.02
2017 spawning biomass	145,258	n/a	-0.04
2018 spawning biomass	138,791	139,300	0.00
B100%	313,220	307,150	-0.02
B40%	125,288	122,860	-0.02
B35%	109,627	107,500	-0.02
2018 FOFL	0.40	0.46	0.15
2018 FABC	0.34	0.38	0.12
2017 OFL	102,700	n/a	0.06
2018 OFL	99,900	108,600	0.09
2017 ABC	87,200	n/a	0.06
2018 ABC	85,000	92,000	0.08

Chapter 18: skates (partial)

- Alaska skate:

Quantity	Last year	This year	Change
M	0.13	0.13	0.00
2017 tier	3a	n/a	none
2018 tier	3a	3a	none
2017 age+ biomass	506,921	n/a	-0.06
2018 age+ biomass	487,035	478,306	-0.02
2017 spawning biomass	110,180	n/a	-0.03
2018 spawning biomass	110,159	107,136	-0.03
B100%	180,556	180,556	0.00
B40%	72,222	72,222	0.00
B35%	63,195	63,195	0.00
2018 FOFL	0.092	0.092	0.00
2018 FABC	0.079	0.079	0.00
2017 OFL	39,162	n/a	-0.06
2018 OFL	37,365	36,655	-0.02
2017 ABC	33,731	n/a	-0.06
2018 ABC	32,183	31,572	-0.02

Skates, continued

- Other skates, continued

Quantity	Last year	This year	Change
M	0.10	0.10	0.00
2017 tier	5	n/a	none
2018 tier	5	5	none
Biomass	100,130	100,130	0.00
2018 FOFL	0.10	0.10	0.00
2018 FABC	0.075	0.075	0.00
2017 OFL	10,013	n/a	0.00
2018 OFL	10,013	10,013	0.00
2017 ABC	7,510	n/a	0.00
2018 ABC	7,510	7,510	0.00

Chapter 19: sculpins (partial)

- EBS shelf biomass estimate for 2017 down 9% from high in 2016
- Tier 5 random effects model *was* re-run

Quantity*	Last year	This year	Change
M	0.283	0.282	0.00
2017 tier	5	n/a	none
2018 tier	5	5	none
Biomass	199,937	188,656	-0.06
2018 FOFL	0.283	0.282	0.00
2018 FABC	0.212	0.212	0.00
2017 OFL	56,582	n/a	-0.06
2018 OFL	56,582	53,201	-0.06
2017 ABC	42,387	n/a	-0.06
2018 ABC	42,387	39,995	-0.06

*Instantaneous rates are biomass-weighted averages

Chapter 20: sharks (none)

Quantity	Last year	This year	Change
2017 tier	6	n/a	none
2018 tier	6	6	none
2017 OFL	689	n/a	0.00
2018 OFL	689	689	0.00
2017 ABC	517	n/a	0.00
2018 ABC	517	517	0.00

Chapter 21: squids (none)

Quantity	Last year	This year	Change
2017 tier	6	n/a	none
2018 tier	6	6	none
2017 OFL	6,912	n/a	0.00
2018 OFL	6,912	6,912	0.00
2017 ABC	5,184	n/a	0.00
2018 ABC	5,184	5,184	0.00

Chapter 22: octopus (none)

Quantity	Last year	This year	Change
2017 tier	6	n/a	none
2018 tier	6	6	none
2017 OFL	4,769	n/a	0.00
2018 OFL	4,769	4,769	0.00
2017 ABC	3,576	n/a	0.00
2018 ABC	3,576	3,576	0.00

Forage fish

- Per SSC request, this report will continue to be produced inside the SAFE report on a biennial cycle instead of inside the ESR
- The Team discussed the utility of reporting the bycatch of these species in either this chapter or the ESR instead of in the individual species-specific chapters
 - There seemed to be some benefit to consolidating all discussions of bycatch of non-target species in the ESR as more applicable to a broader audience than within the species-specific chapters as per present practice

Forage fish (continued)

- The Team discussed the herring savings area closures and potential mis-specificity of their application and locations
- The Team noted that the assessment author may wish to examine catch inside and outside of the current herring areas in the next report
- The Team also noted that the assessment author may wish to evaluate spatial population considerations to consider aspects such as herring migration or whether some core areas of abundance for herring and broader forage species locations have shifted over time
 - This could help to elucidate reasons for corollary issues such as broad scale seabird die-offs

Questions?