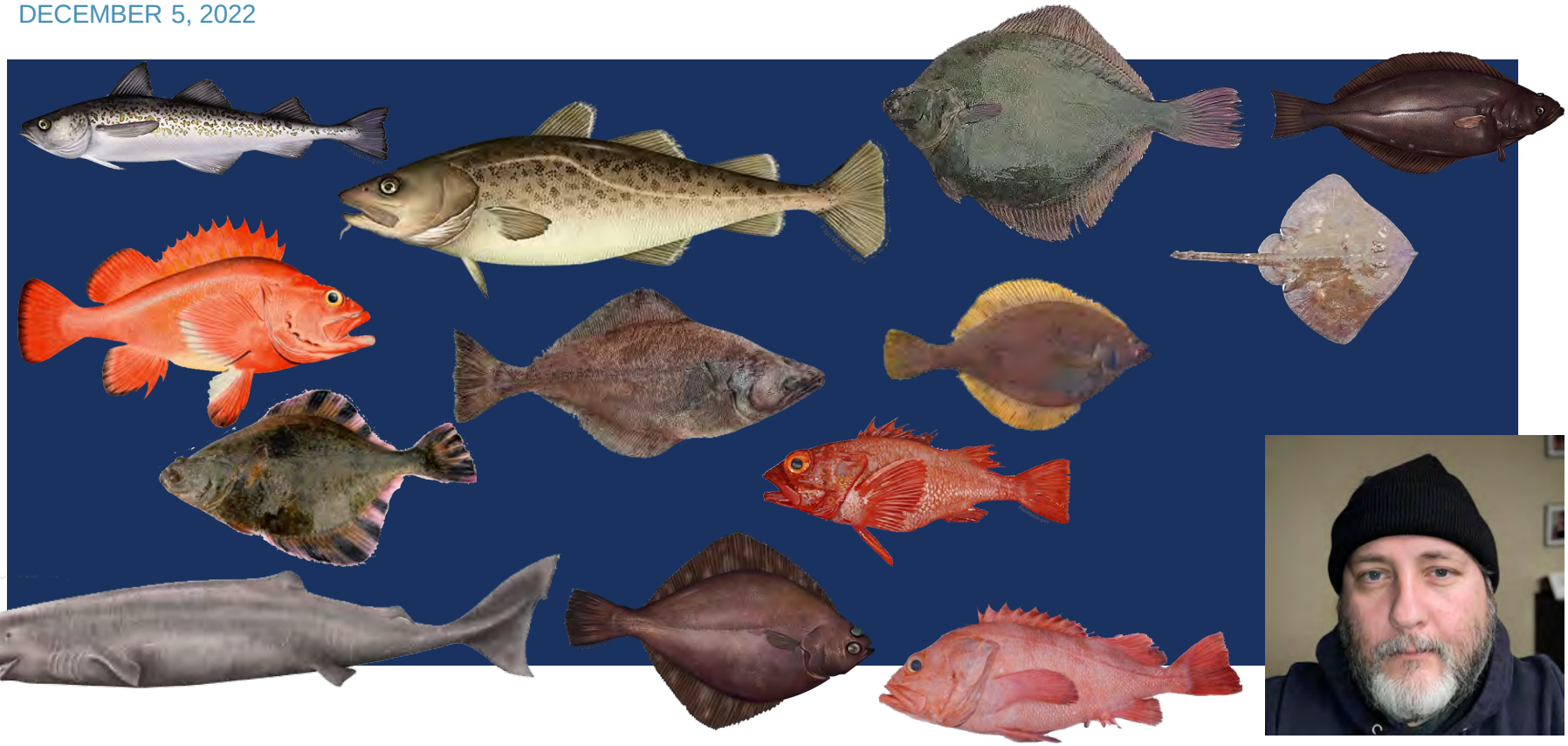
REPORT OF THE NOVEMBER 2022 BSAI GROUNDFISH PLAN TEAM MEETING

STEVE BARBEAUX (CO-CHAIR), KALEI SHOTWELL (CO-CHAIR), CINDY TRIBUZIO (VICE-CHAIR). DIANA STRAM (COORDINATOR)

DECEMBER 5, 2022



BSAI PLAN TEAM MEETING OVERVIEW

- Dates: November 14-18
- Place: Hybrid - AFSC in Seattle/Virtual
- Leaders: Steve Barbeaux, Kalei Shotwell (co-chairs); Cindy Tribuzio (vice-chair); Diana Stram (coordinator)
- Participation:
  - Caitlin Akeselrud (AFSC RACE)
  - Mary Furuness (NMFS AKRO)
  - Allan Hicks (IPHC)
  - Lisa Hillier (WDFW)
  - Kirstin Holsman (AFSC REFM)
  - Phil Joy (ADF&G)
  - Andy Kingham (AFSC FMA)
  - Beth Matta (AFSC REFM)
  - Andy Seitz (UAF)
  - Michael Smith (AFSC REFM)
  - Jane Sullivan (AFSC)
  - AFSC and AKRO staff and members of the public

BERING SEA AND ALEUTIAN ISLANDS BIG PICTURE

- Assessments of 22 stocks/complexes (17 **full**, 5 partial; 1 “none”)
  - Compared to 17 last year (8 full, 9 partial; 6 “none”)
- Total of 37 models, including Tier 5/6 methods (same as last year):
  - 20 base models/methods (down 5 from last year)
  - 17 additional models/methods
- The Team agreed with authors’ recommendations regarding preferred models/methods and harvest specifications in all but one stock (sharks)
- Reductions from maximum permissible ABC recommended in 5 stocks
- Of the 15 stocks/complexes in Tiers 1 or 3, only 2 are in sub-tier “b”
- No stocks/complexes were subjected to overfishing in 2021, and no Tier 1 or 3 stocks/complexes are overfished/approaching as of 2022
- 27 Team recommendations

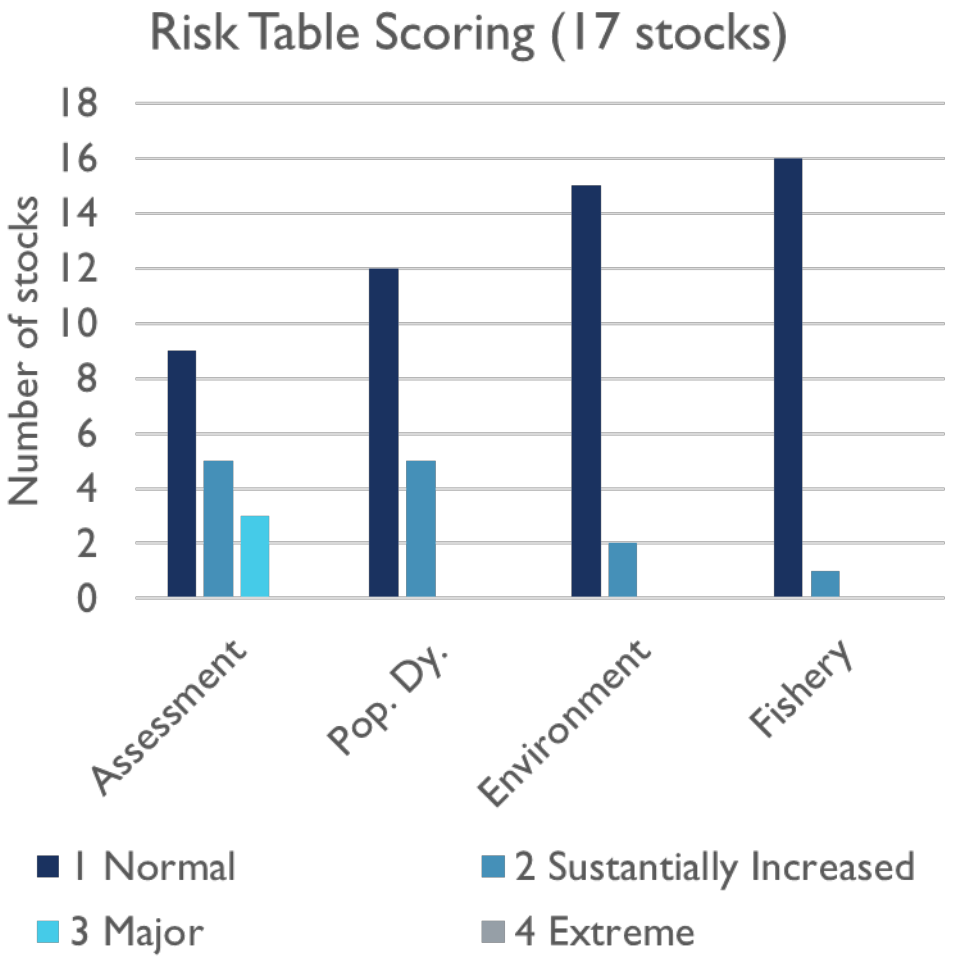
BERING SEA AND ALEUTIAN ISLANDS BIG PICTURE (TINY FONT)

Chapter	Assessment	Author	Tier	Type	Risk*	% Red.
1	Eastern Bering Sea pollock	Ianelli	1a	Full	2,2,1,1	**43%**
1B	Bogoslof Island Pollock	Ianelli	5	Full	1,1,1,NA	
1A	Aleutian Islands pollock	Barbeaux	3a	Full	1,1,1,1	
2	Eastern Bering Sea Pacific Cod	Barbeaux	**3b**	Full	1,1,1,1	
2A	Aleutian Islands Pacific cod	Spies	5	Full	1,2,2,1	
3	Sablefish	Goethel	3a	Full	1,1,1,1	
4	Yellowfin sole	Spies	1	Full	1,1,1,1	
5	Greenland Turbot	Bryan	3a	Full	2,2,1,1	**6%**
6	Arrowtooth flounder	Shotwell	3a	Full	1,1,1,1	
7	Kamchatka flounder	Bryan	3a	Full	2,1,1,1	
8	Northern Rock sole	McGilliard	1a	Full	3,1,1,1	**23%**
9	Flathead sole	Kapur	3a	Partial	NA	
10	Alaska plaice	Monnahan/Sullivan	3a	Partial	NA	
11	Other flatfish	NA	5	None	NA	
12	Pacific ocean perch	Spencer	3a	Full	2,1,1,1	
13	Northern rockfish	Spencer	3a	Partial	NA	
14	Blackspotted & rougheye rockfish	Spencer	**3b**/5	Full	3,2,1,2	**12%**
15	Shortraker rockfish	Shotwell	5	Full	1,1,1,1	
16	Other rockfish	Sullivan	5	Full	1,1,1,1	
17	Atka mackerel	Lowe	3	Full	2,1,2,1	
18	Skates	Ianelli/Tribuzio	3a/5	Partial	NA	
19	Sharks	Tribuzio	6	Full	3,2,1,1	**13%**
22	Octopus	Rodgveller/Lowe	6	Partial	NA	

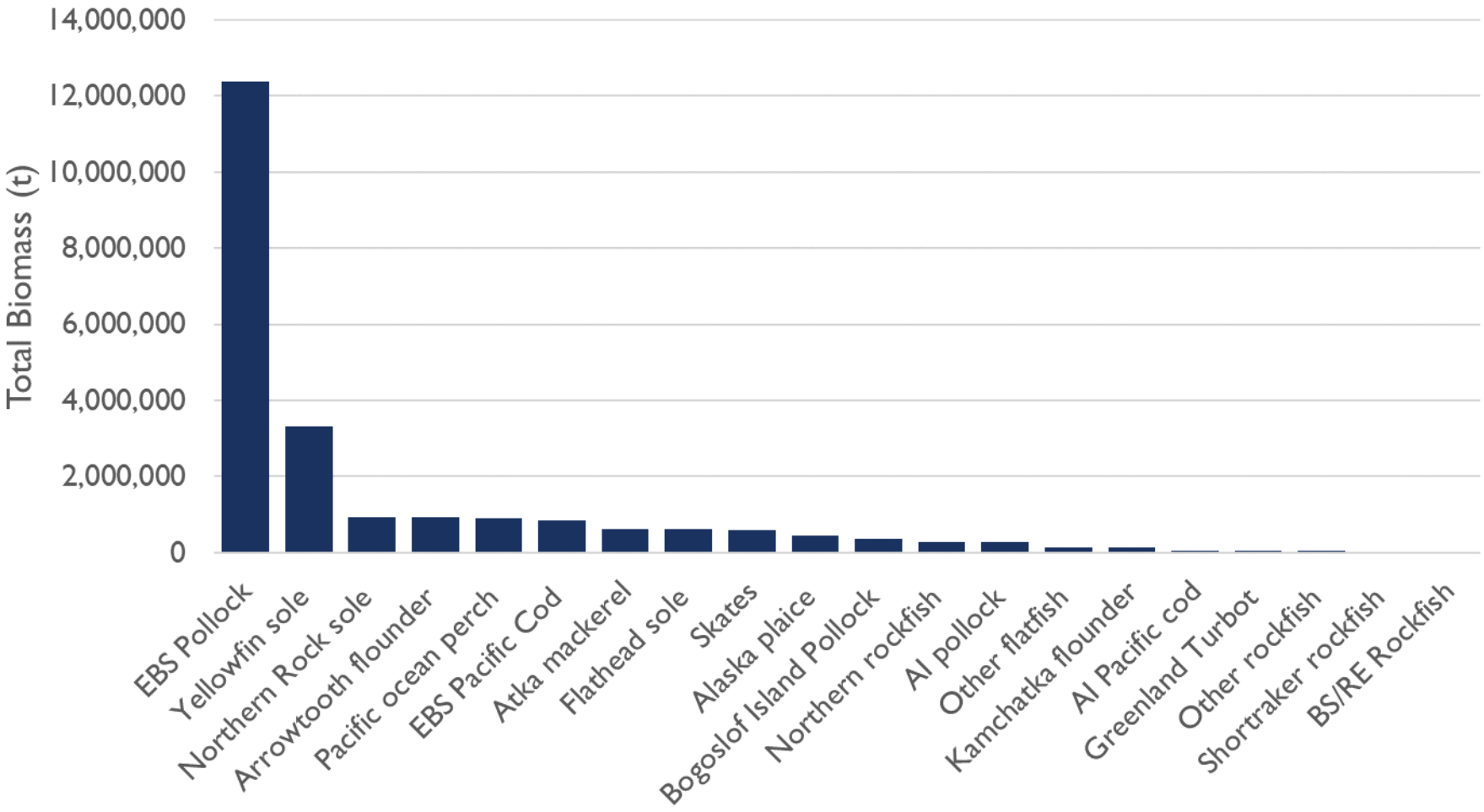
* Assessment, Pop Dy., Environment, Fishery

BERING SEA AND ALEUTIAN ISLANDS RISK TABLE AND REDUCTIONS

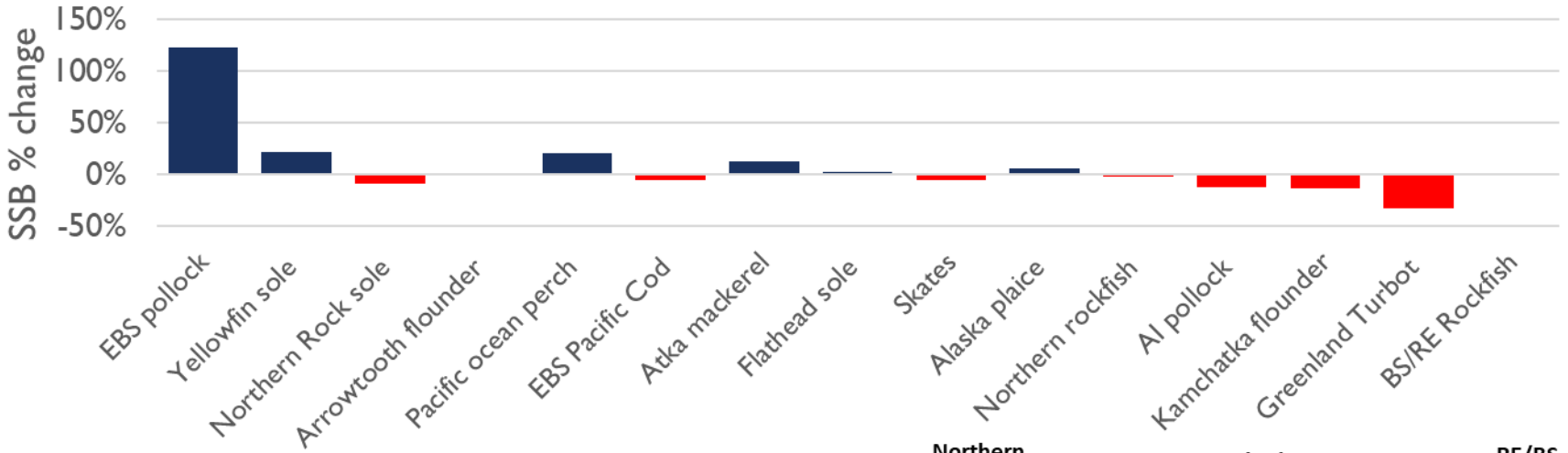
- All 5 recommendations for reduction from maximum permissible ABC were in response to elevated assessment concerns
- 4 of the 5 reductions were in agreement with recommendations from the authors
- 1 reduction was recommended as the author's choice of models was not accepted (shark) which elevated assessment concerns

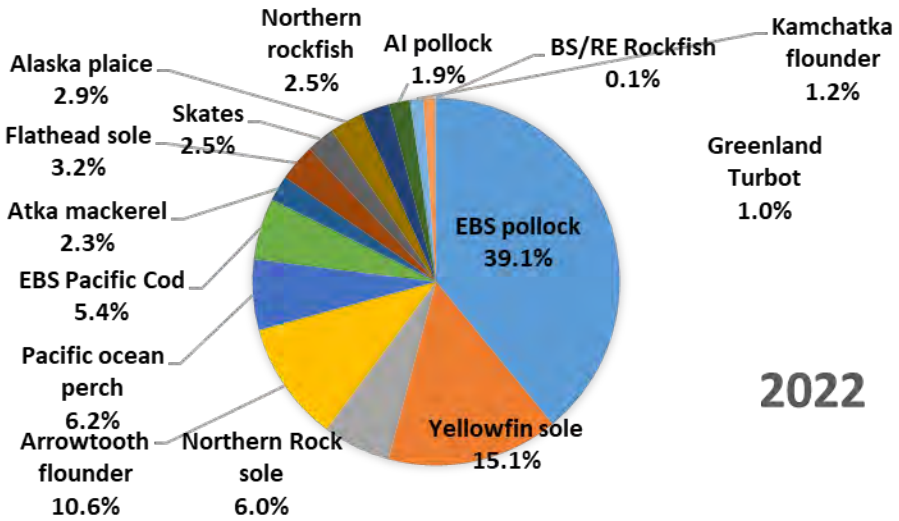


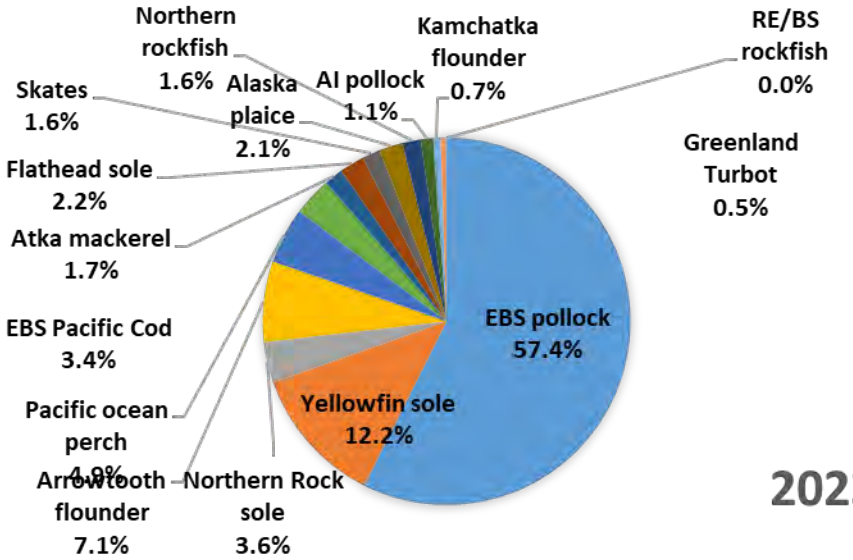
BERING SEA AND ALEUTIAN ISLANDS TOTAL BIOMASS (TIER 1, 3, AND 5)



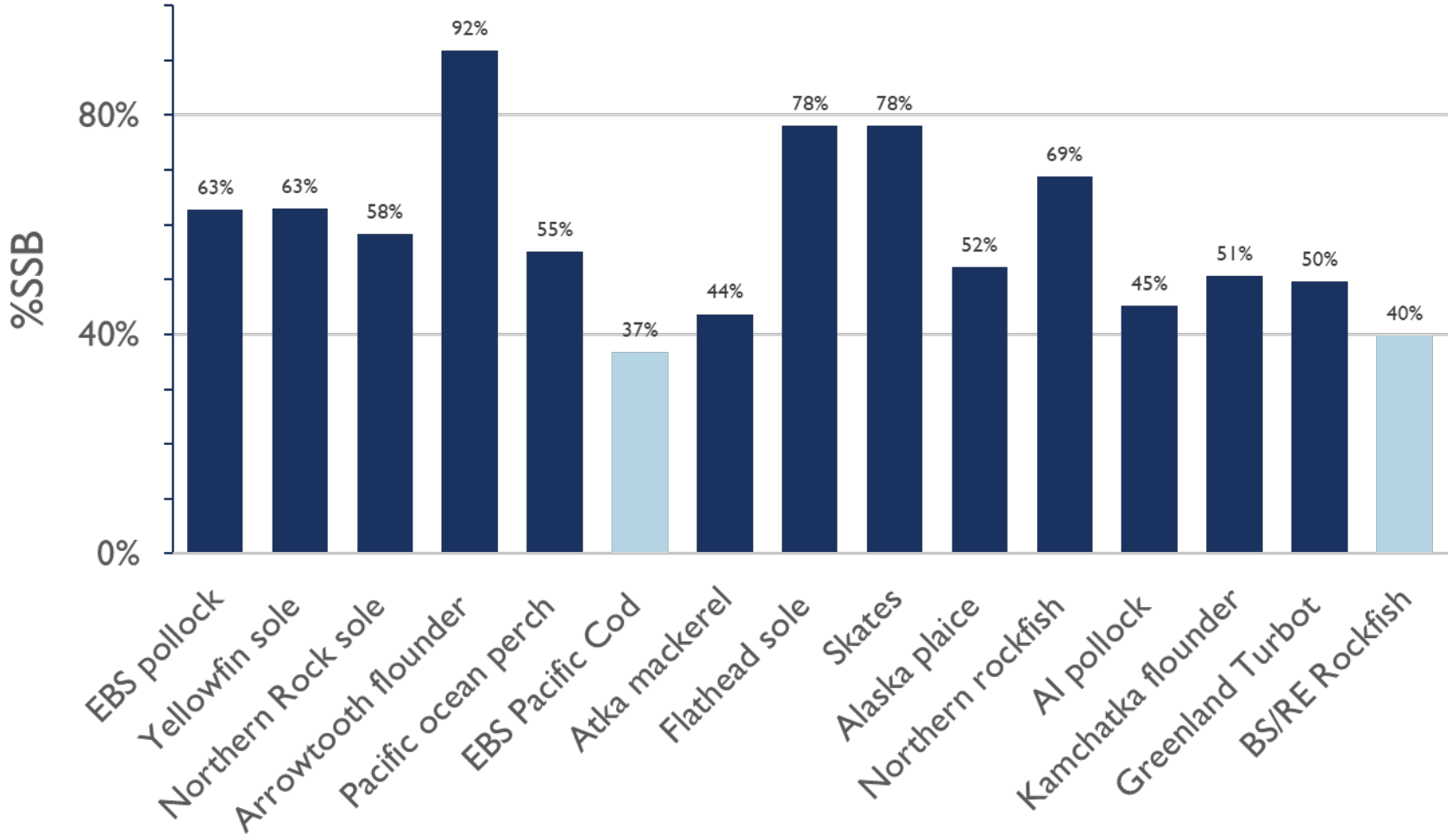
BERING SEA AND ALEUTIAN ISLANDS SPAWNING BIOMASS (TIERS 1 AND 3)



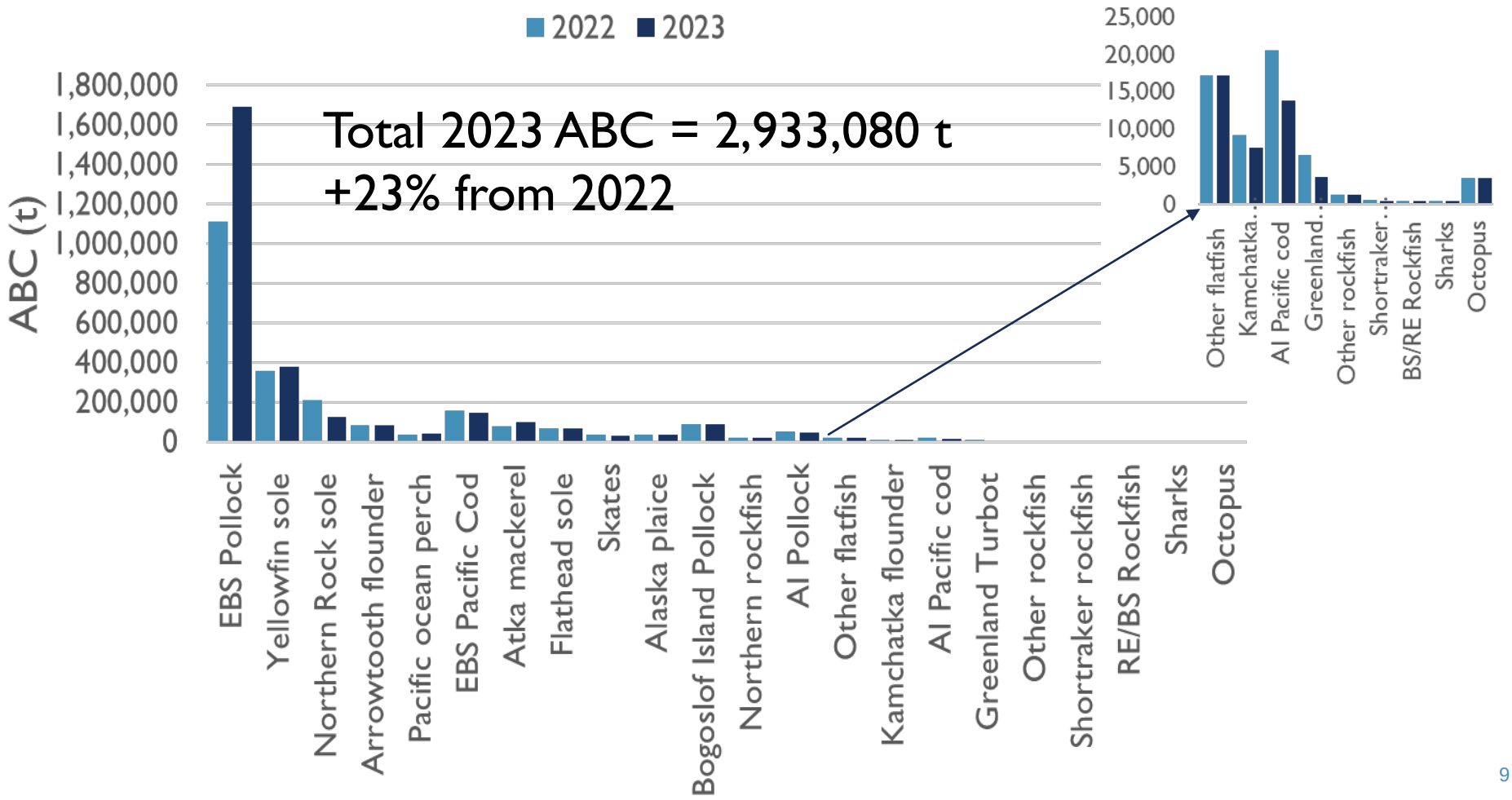




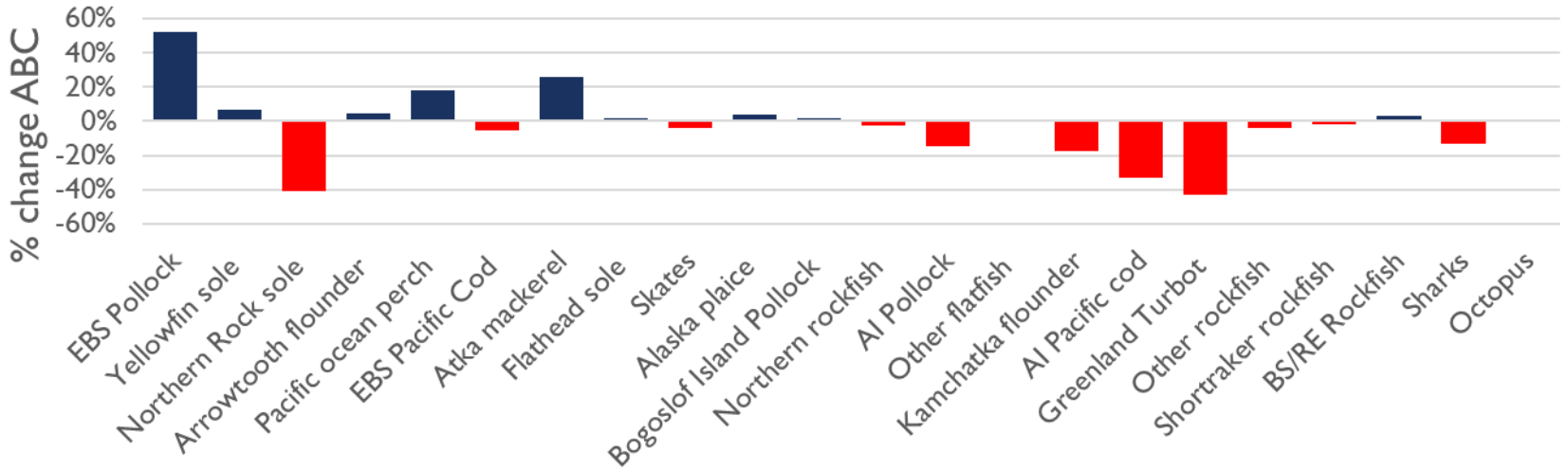
BERING SEA AND ALEUTIAN ISLANDS SPAWNING BIOMASS (TIERS 1 AND 3)

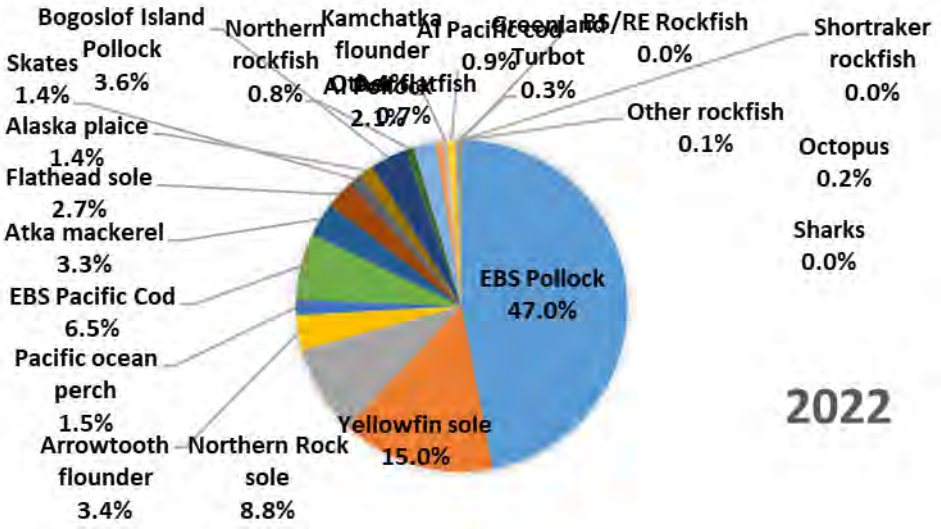


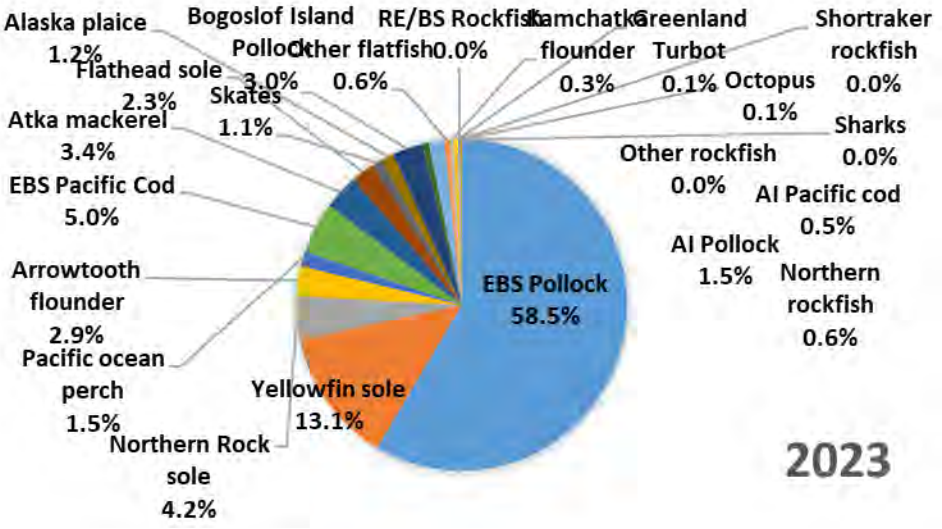
BERING SEA AND ALEUTIAN ISLANDS ALLOWABLE BIOLOGICAL CATCH (ABC)



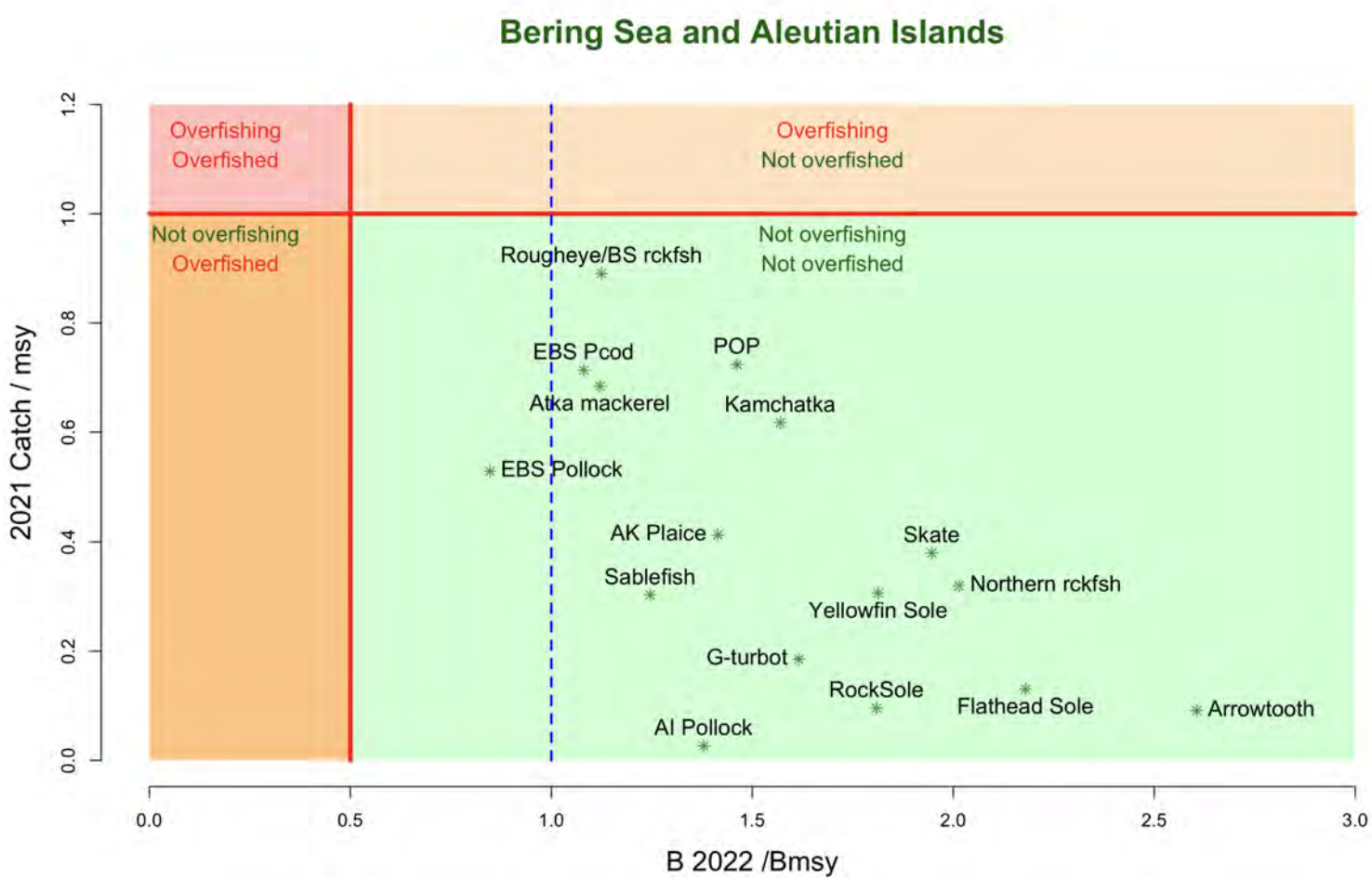
BERING SEA AND ALEUTIAN ISLANDS CHANGE IN 2023 ABC *PROJECTION*



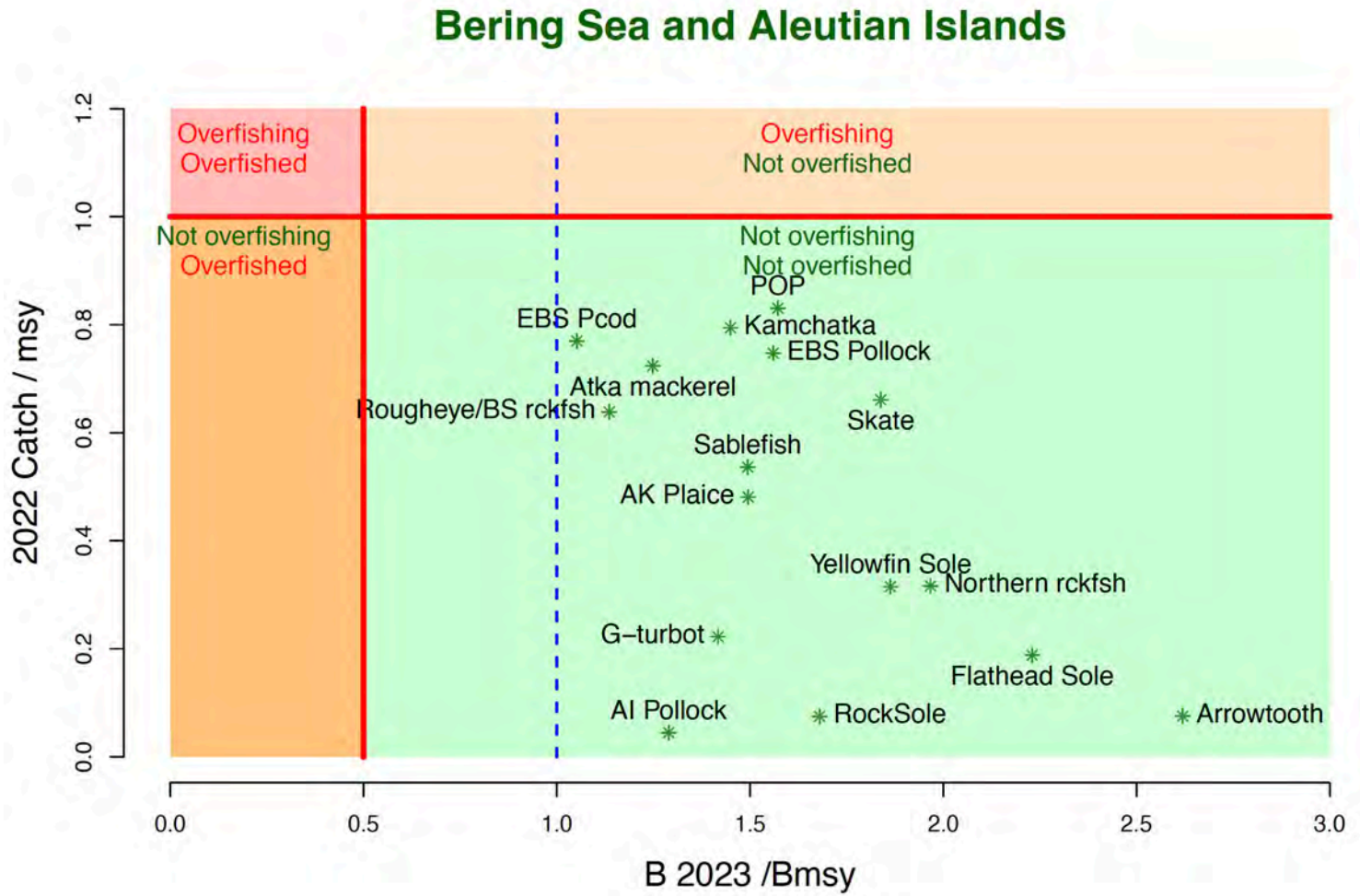




BERING SEA AND ALEUTIAN ISLANDS BIG PICTURE – STOCK STATUS



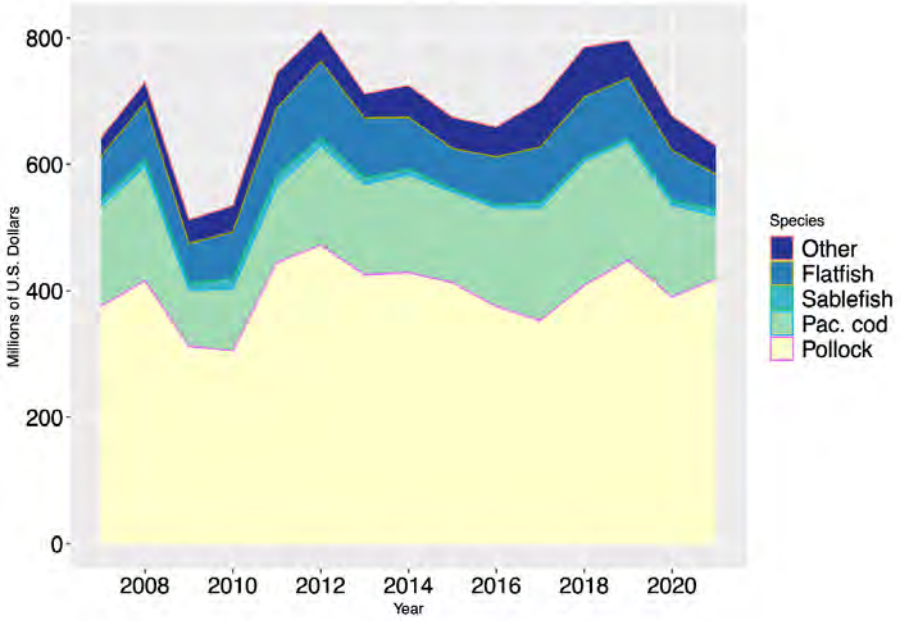
BERING SEA AND ALEUTIAN ISLANDS BIG PICTURE – STOCK STATUS

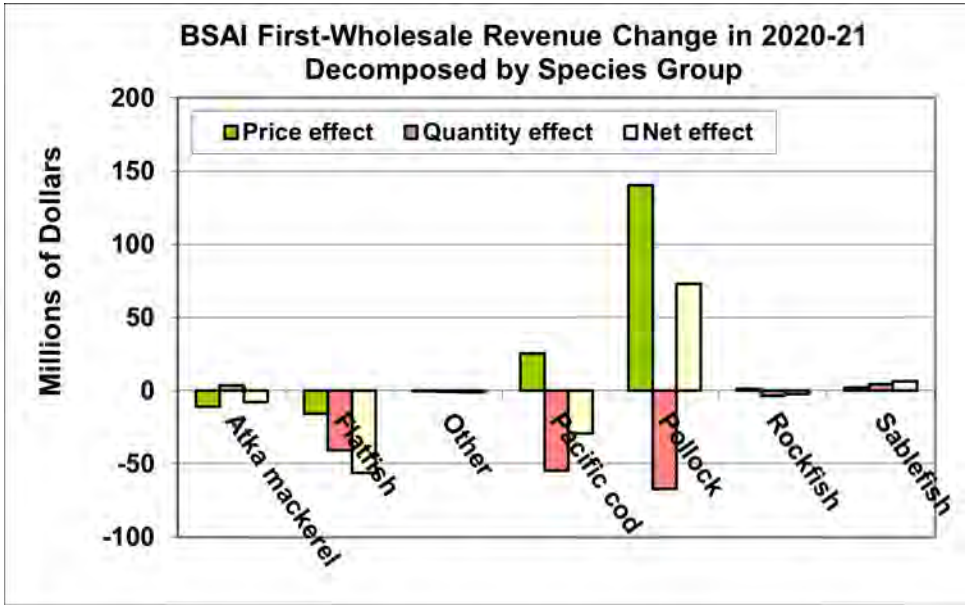


BERING SEA AND ALEUTIAN ISLANDS BIG PICTURE – ECONOMICS

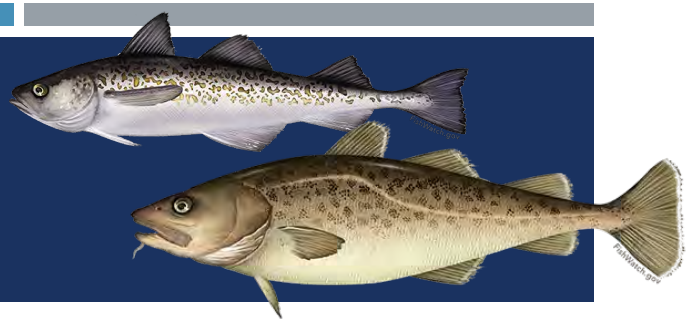
- Continued overall decrease in value of BSAI harvested species from 2020 to 2021

Real ex-vessel value





POLLOCK AND PACIFIC COD SUMMARY



Stock	Tier	2023 ABC (t)	2023 OFL (t)	Change from 2022 ABC
EBS Pollock	1a	**1,688,000*(43%)**	3,381,000	52%
AI pollock	3a	43,413	52,383	-14%
Bogoslof poll.	5	86,360	115,1460	1%
EBS Pacific cod	3b	144,834	172,495	-6%
AI Pacific cod	5	13,812	18,416	-33%

***xx% Reduced from maximum permissible ABC**

CHAPTER 1
EBS WALLEYE POLLOCK

- New model(s): yes; change from base: yes; risk table (2,1,1,1)
- Switch to authors' presentation (Team comments will follow)

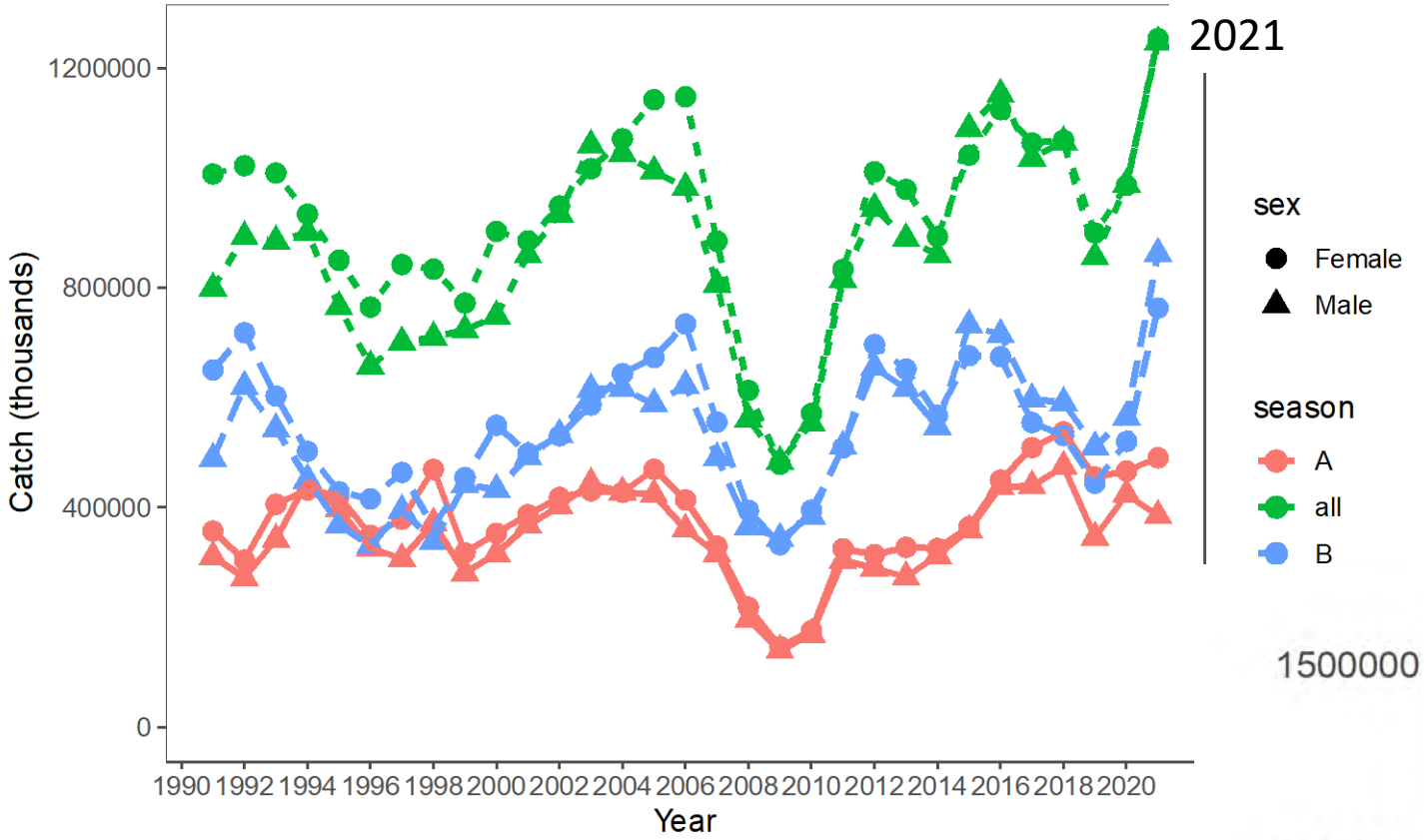
Stock assessment work for Alaska pollock in the Eastern Bering Sea

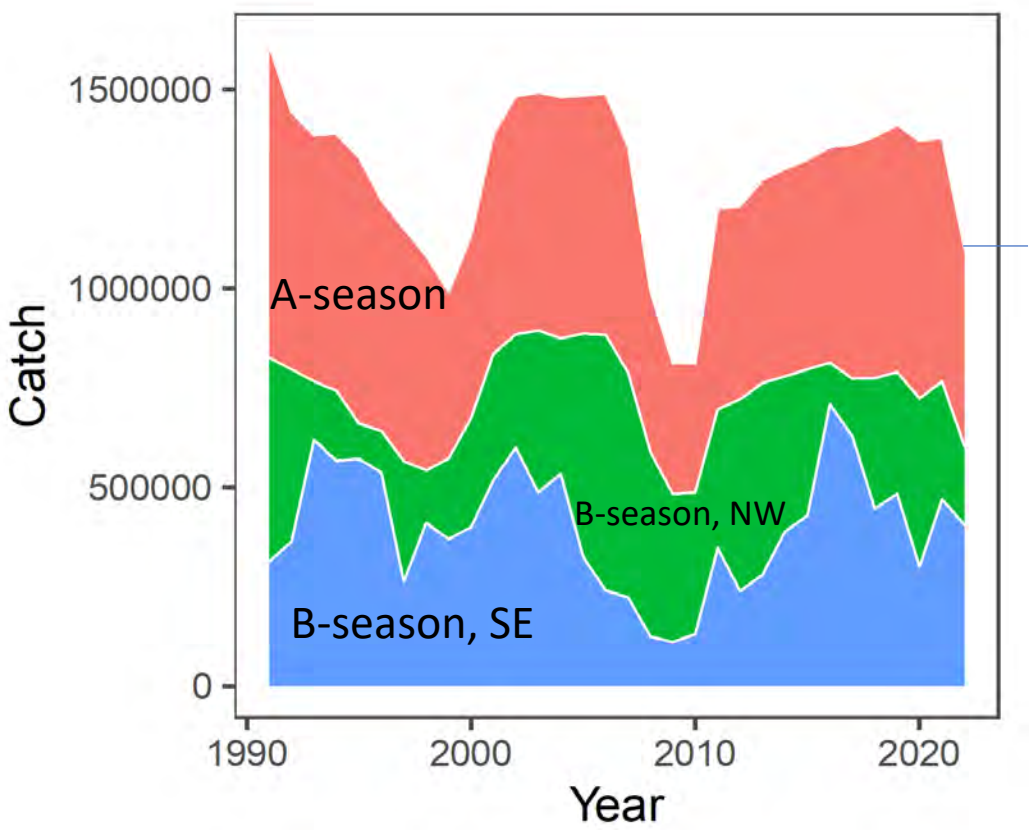
Jim Ianelli, Taina Honkalehto, Sarah Stienessen, E. Siddon, Caitlin Allen-Akselrud

Alaska Fisheries Science Center

Eastern Bering Sea pollock

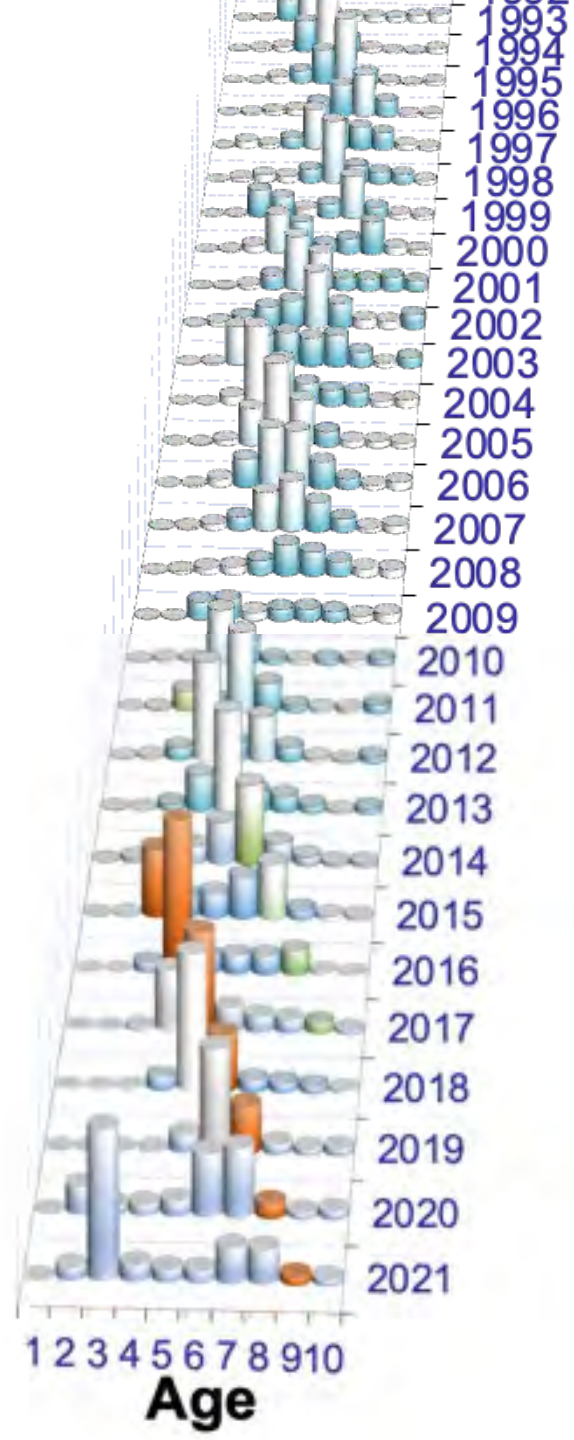
Fishery catches

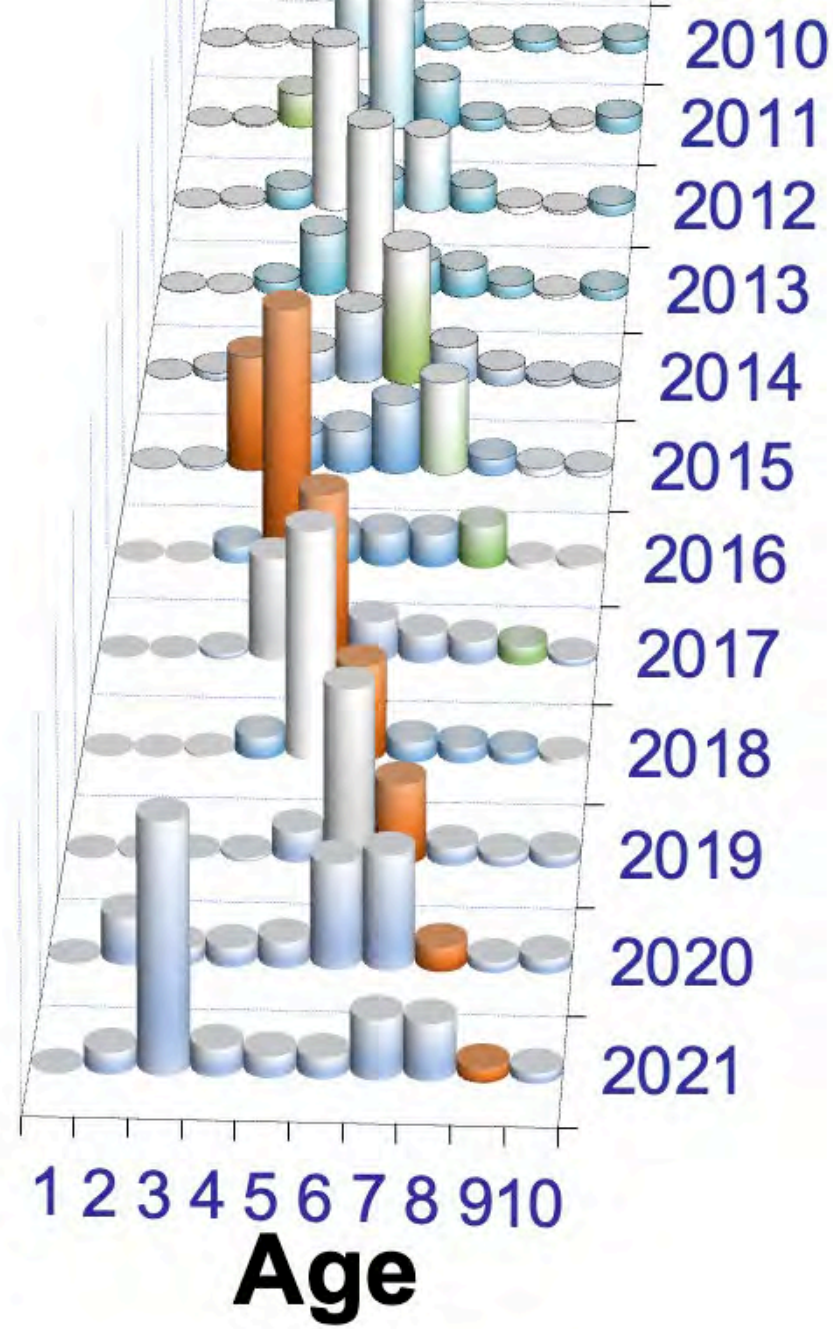




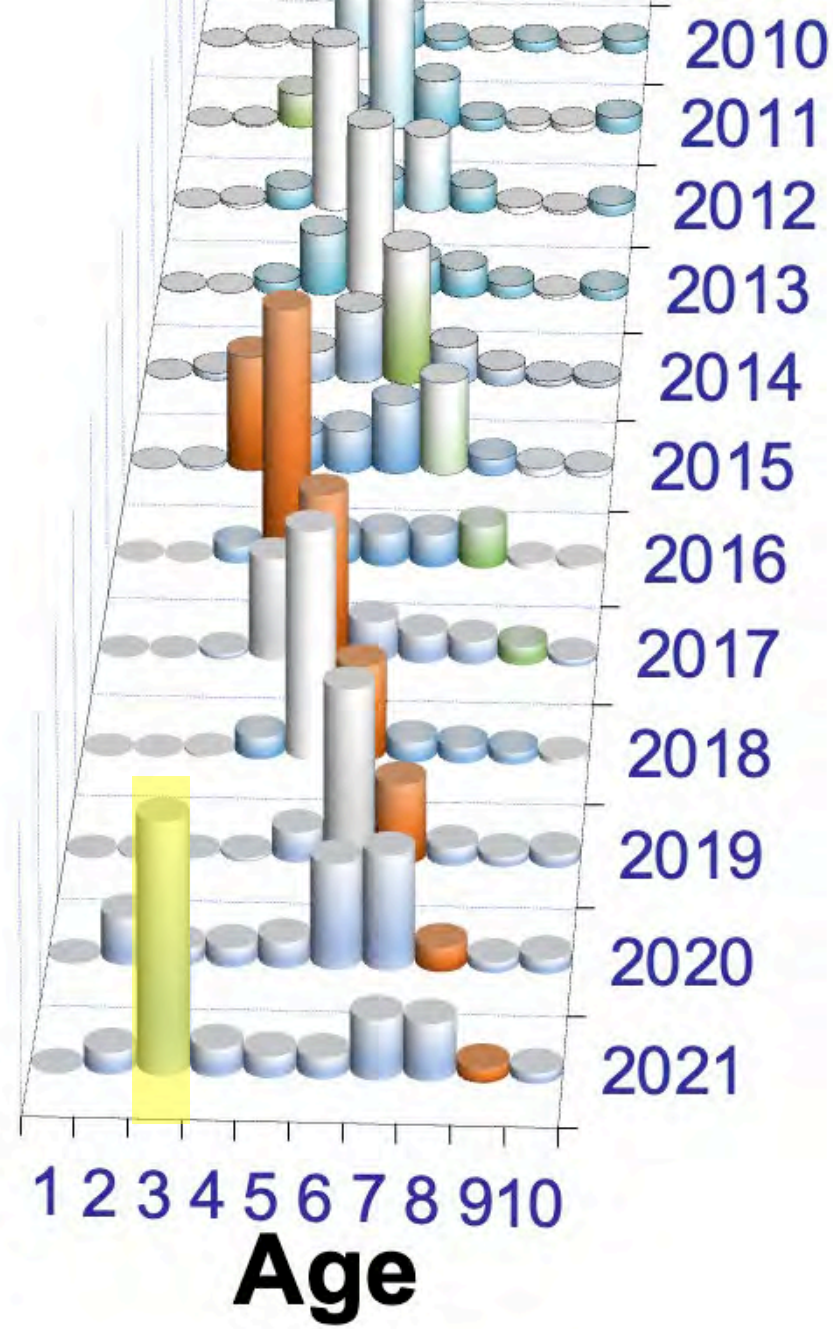
2022
(1.11 million t)

Fishery catch-at-age




2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
1 2 3 4 5 6 7 8 9 10
Age

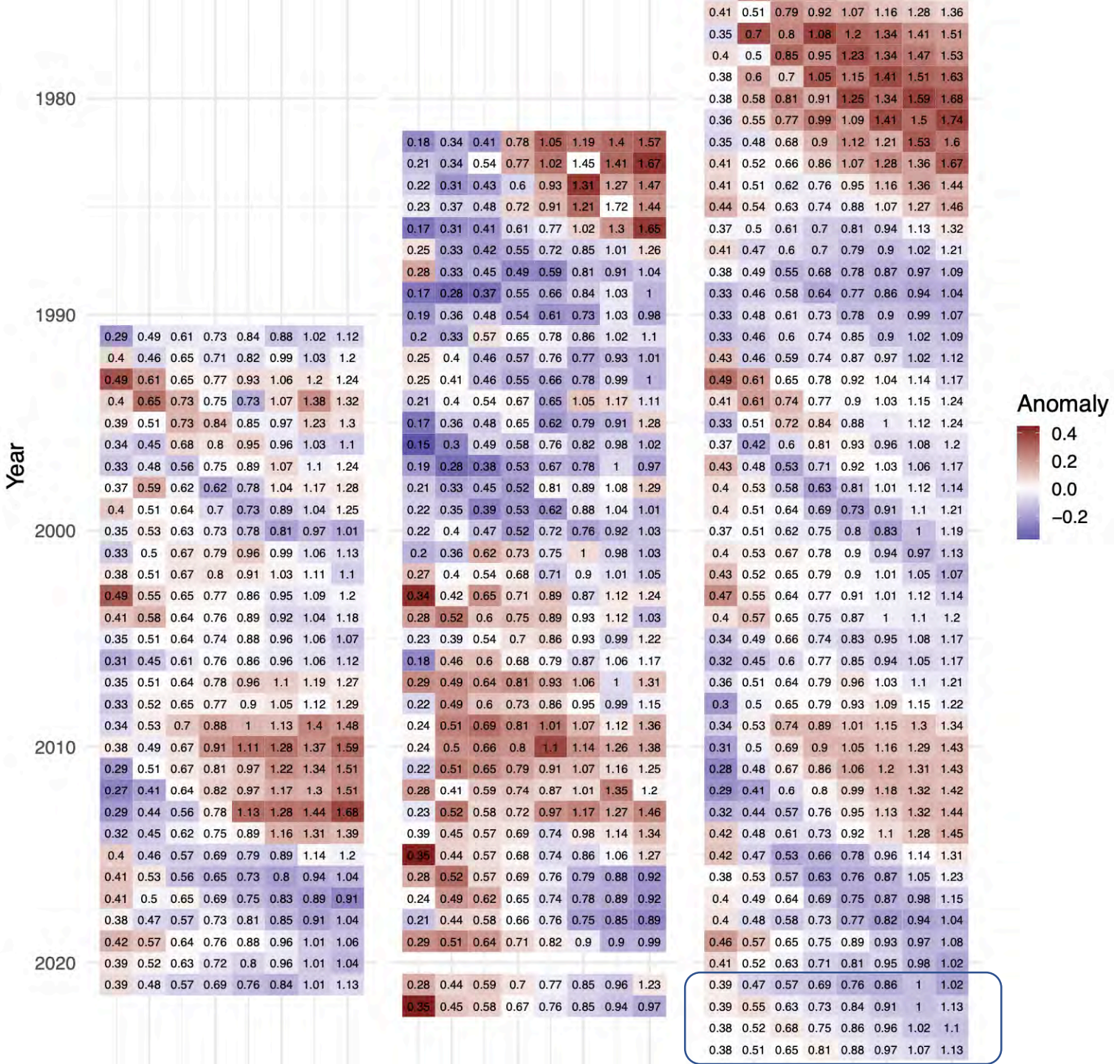
2021 New information



Eastern Bering Sea pollock

Historical wt-age

- And projected…

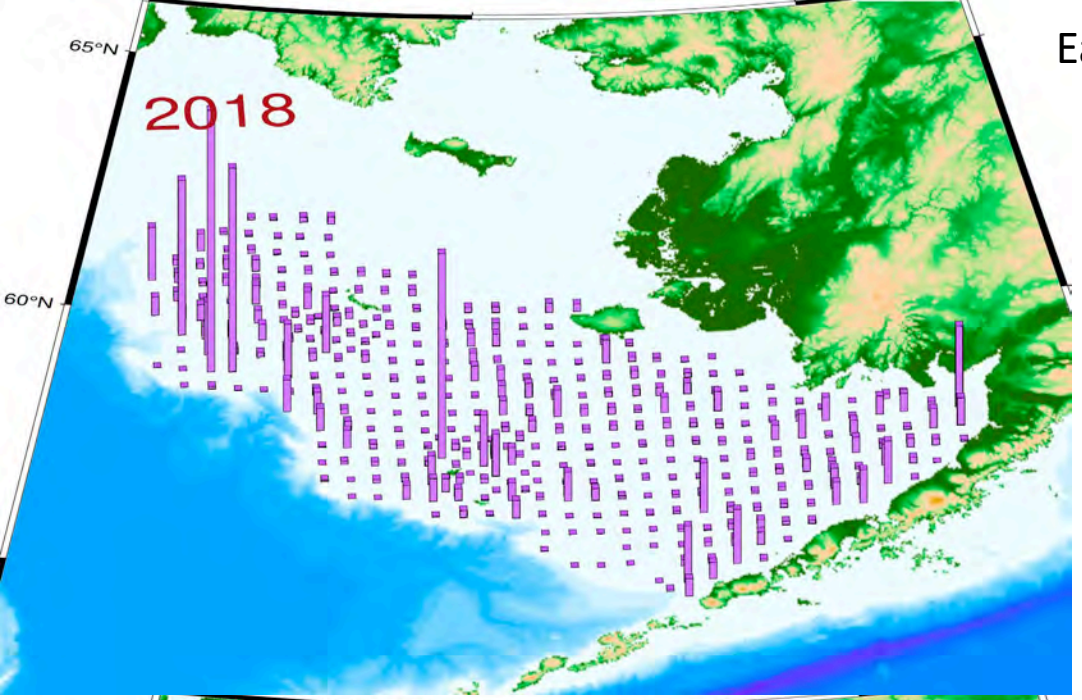


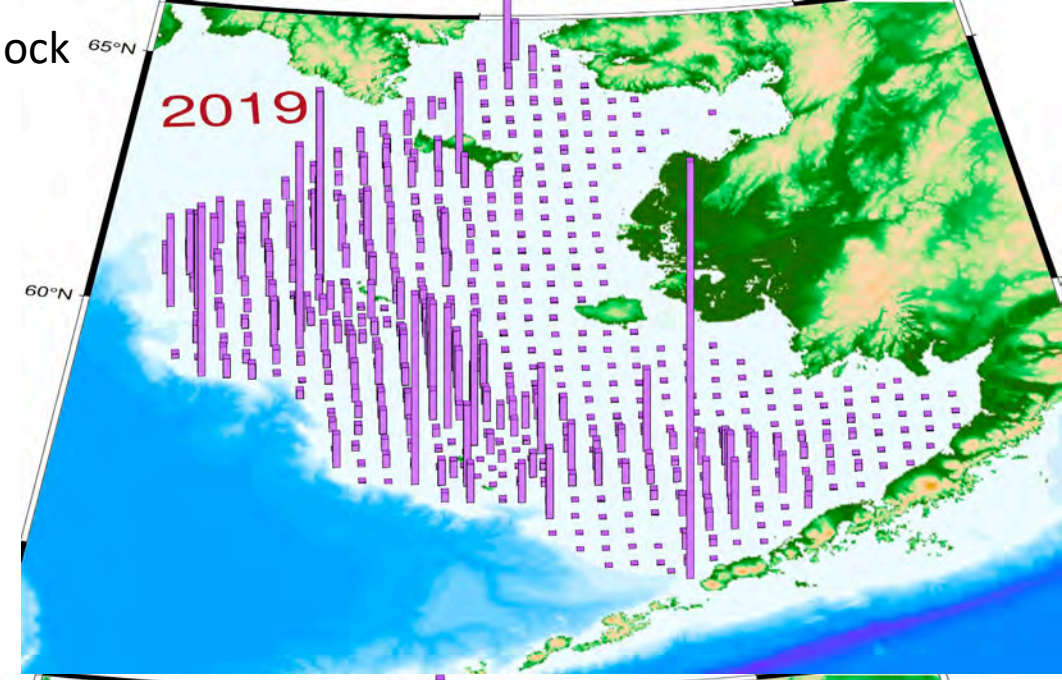
Survey work

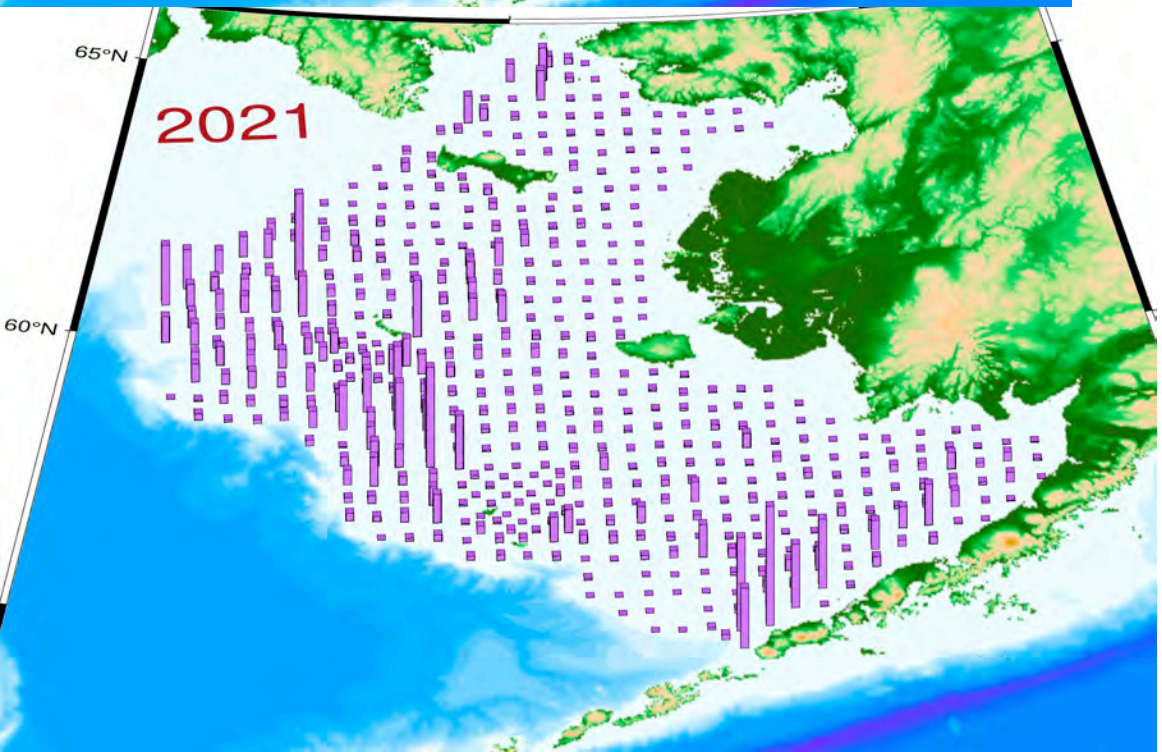
FV *Vesteraalen*
2014-present
8th year

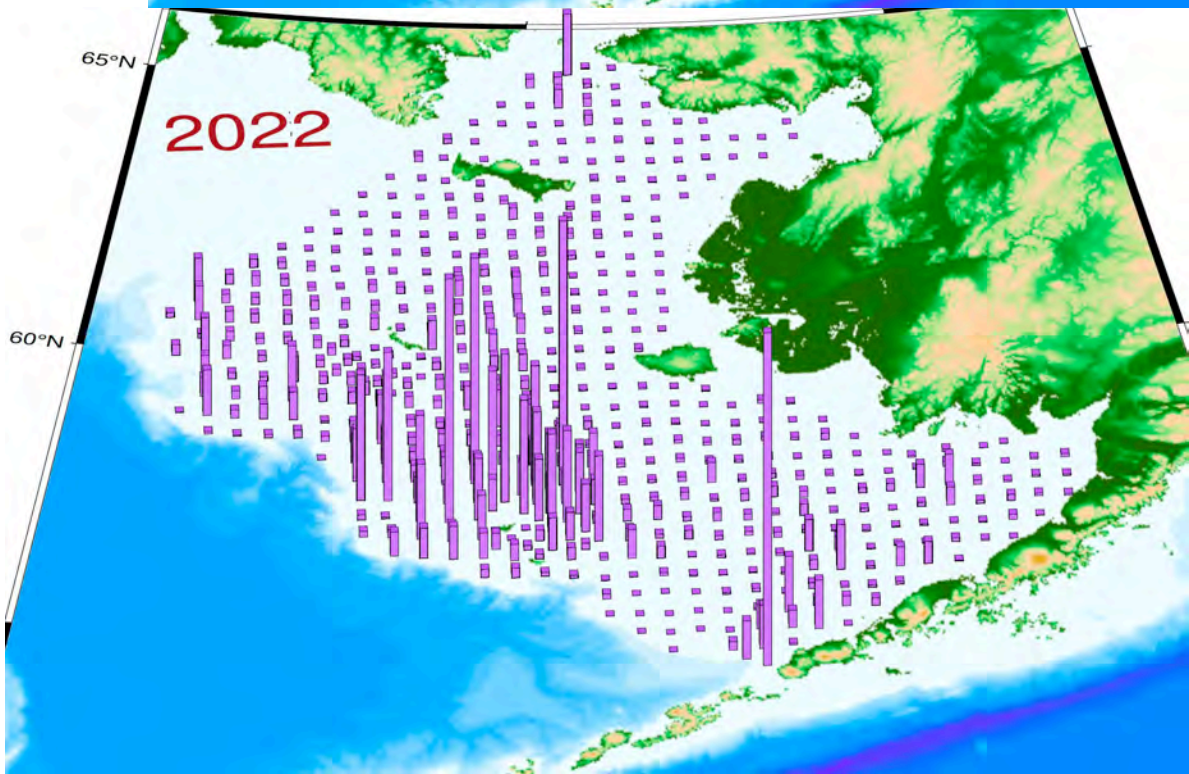
FV *Alaska Knight*
2010-present
11th year

Eastern Bering Sea pollock

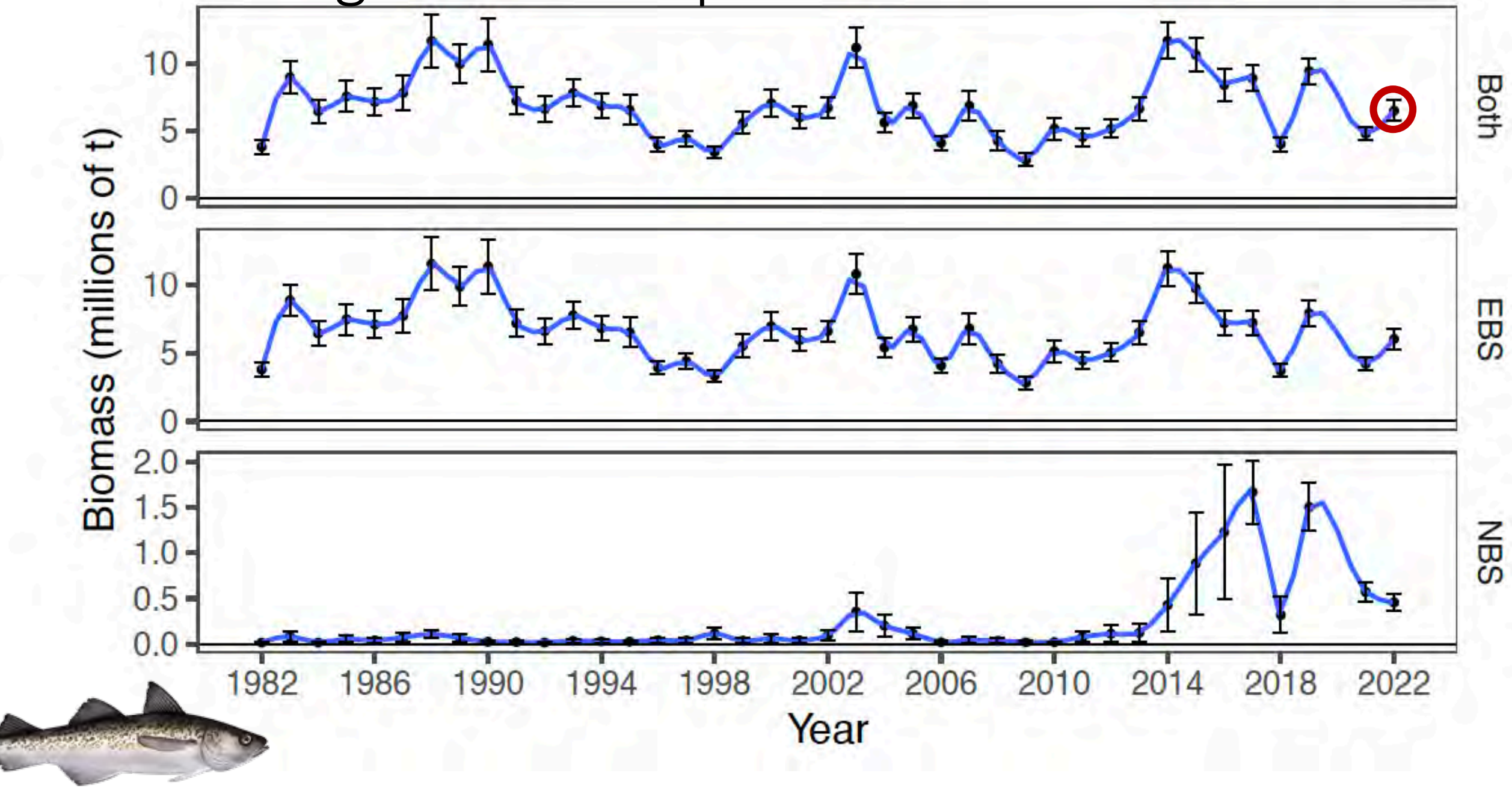






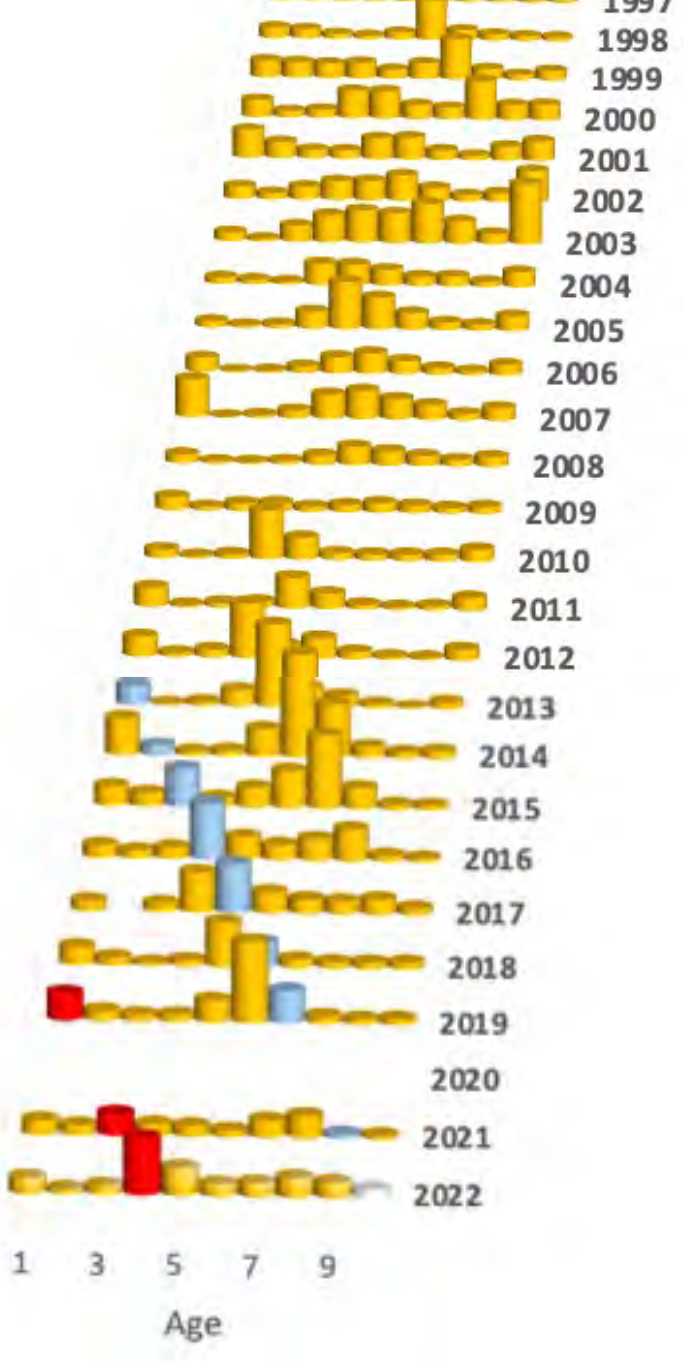


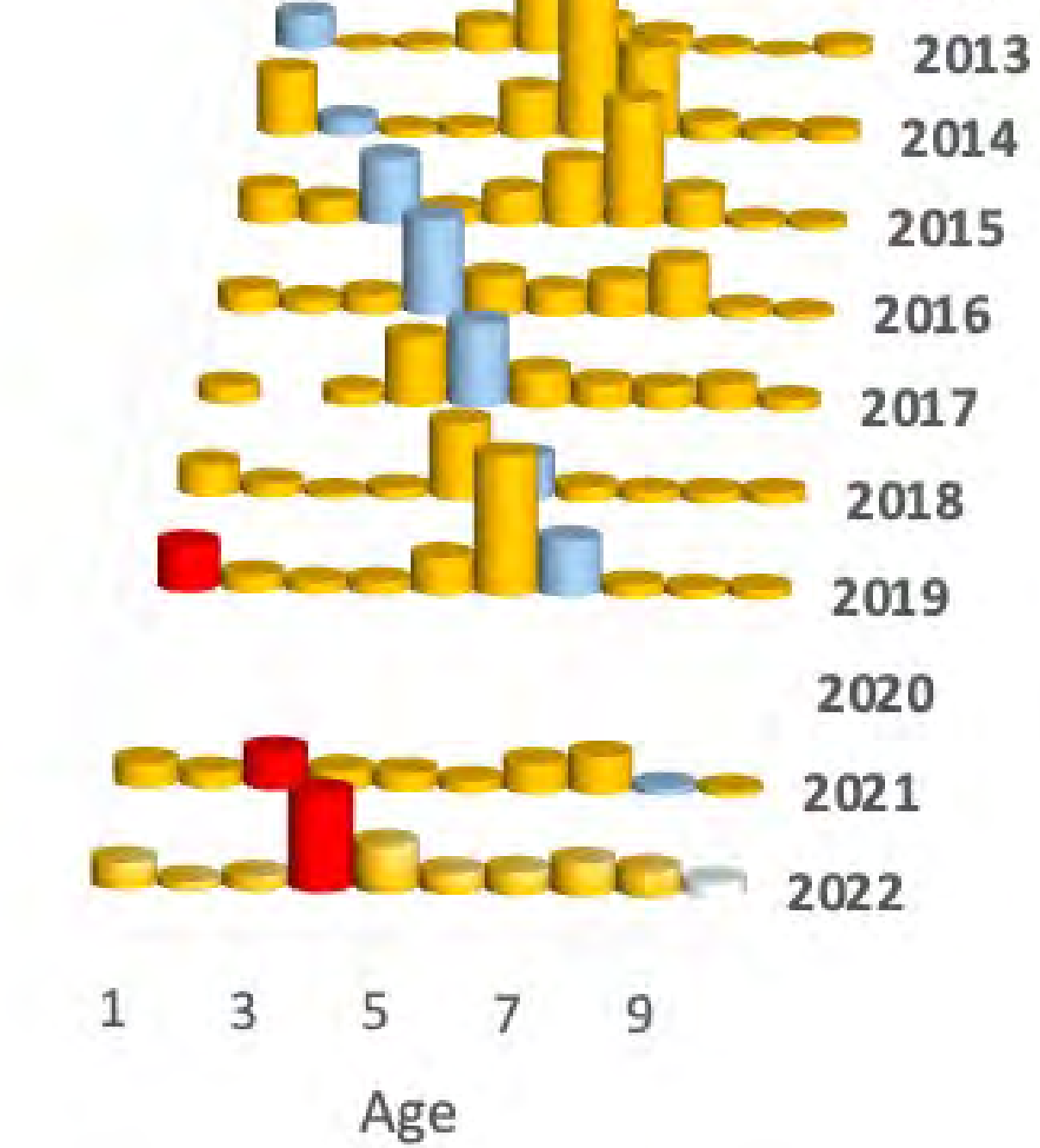
E. Bering Sea Alaska pollock



Survey abundance-at-age

- Eastern Bering Sea pollock




2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
1
3
5
7
9
Age

New VAST age-comps

- Bottom trawl survey

Eastern Bering Sea pollock

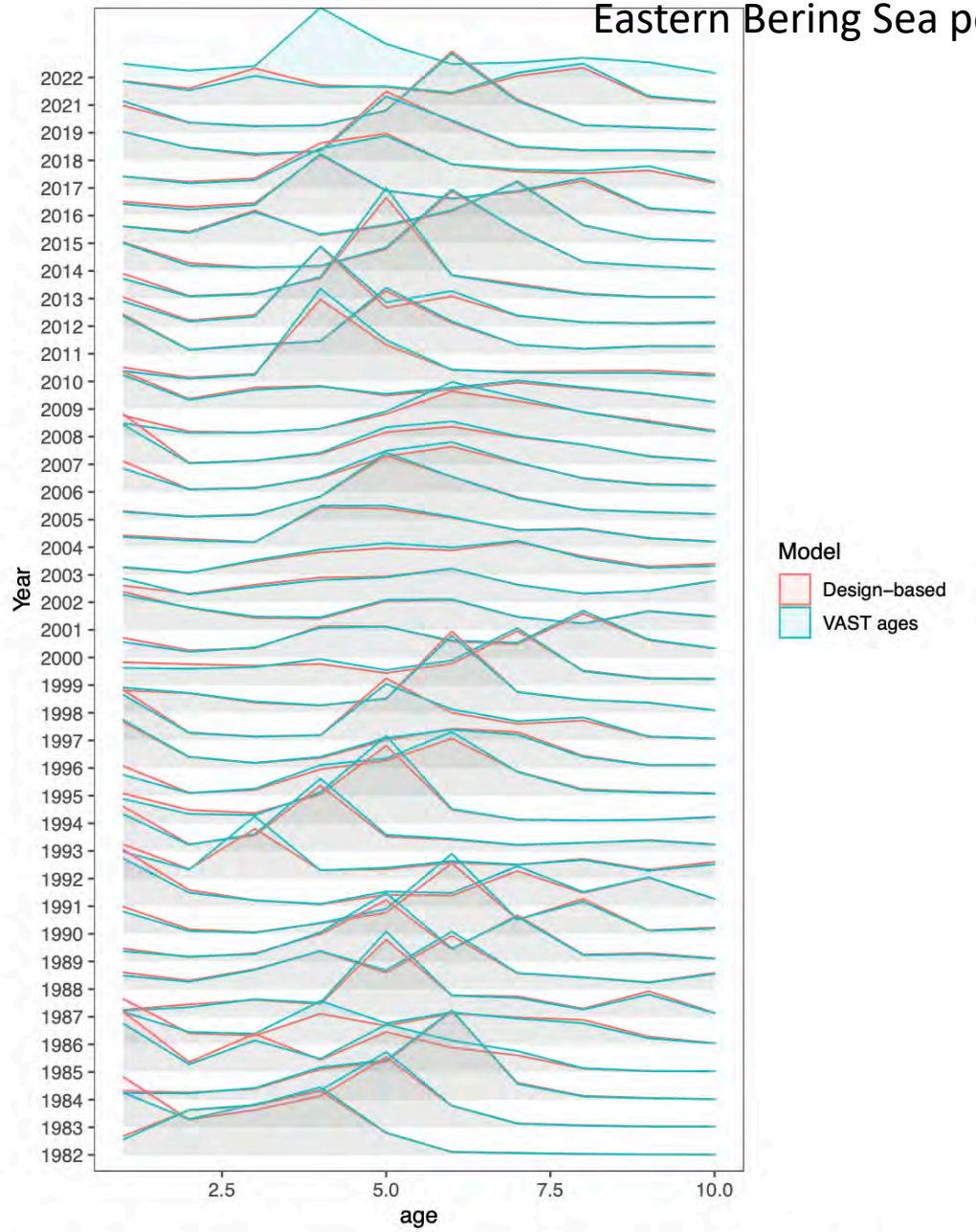


Figure 1-20. Comparison of EBS pollock estimated proportions-at-age from the bottom trawl surveys using the standard design-based estimates and those using the VAST spatio-temporal model, 1982-2022 (no data from 2020).

Eastern Bering Sea pollock

Noted update in bottom-trawl survey weight-at-age

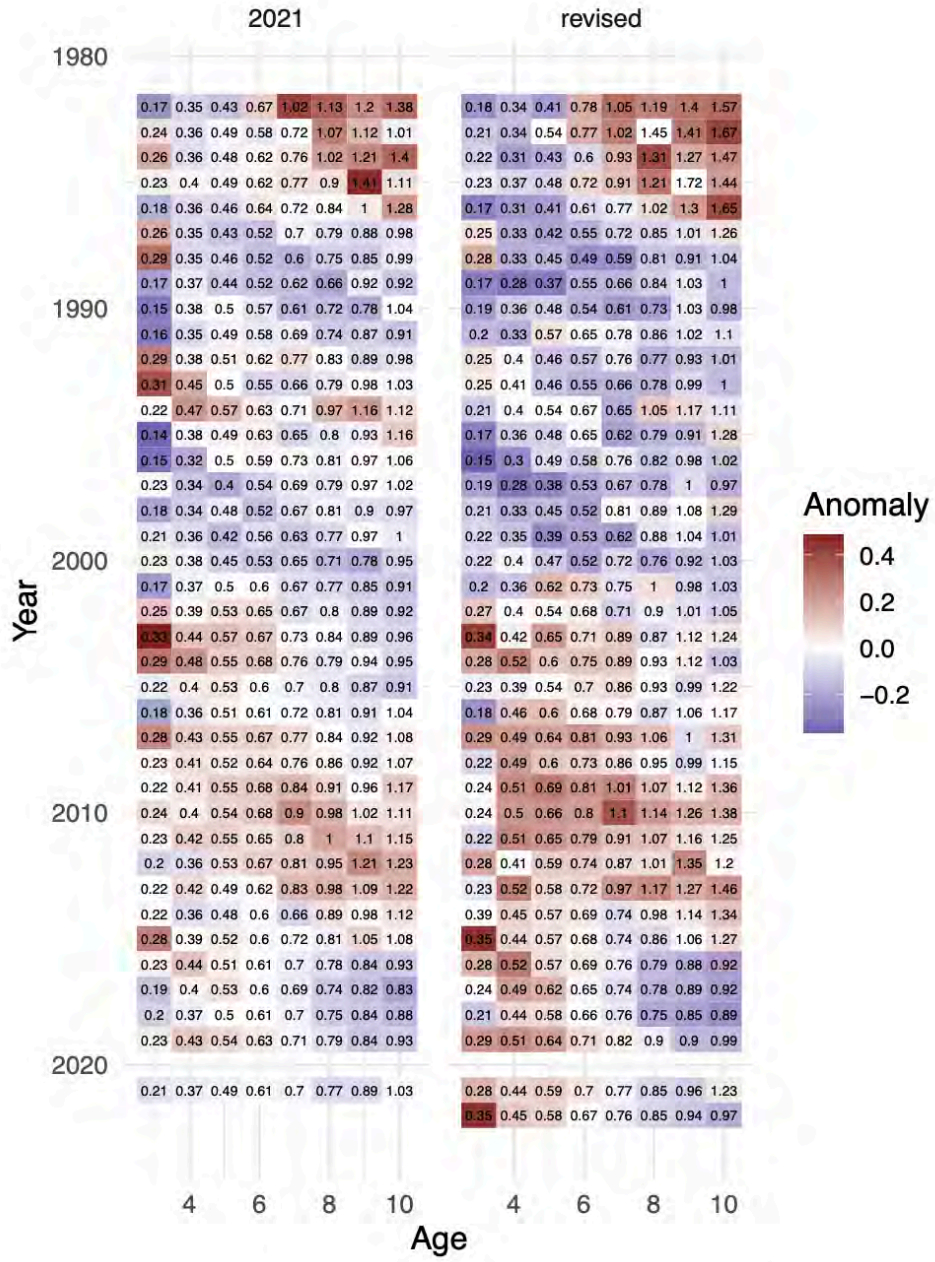
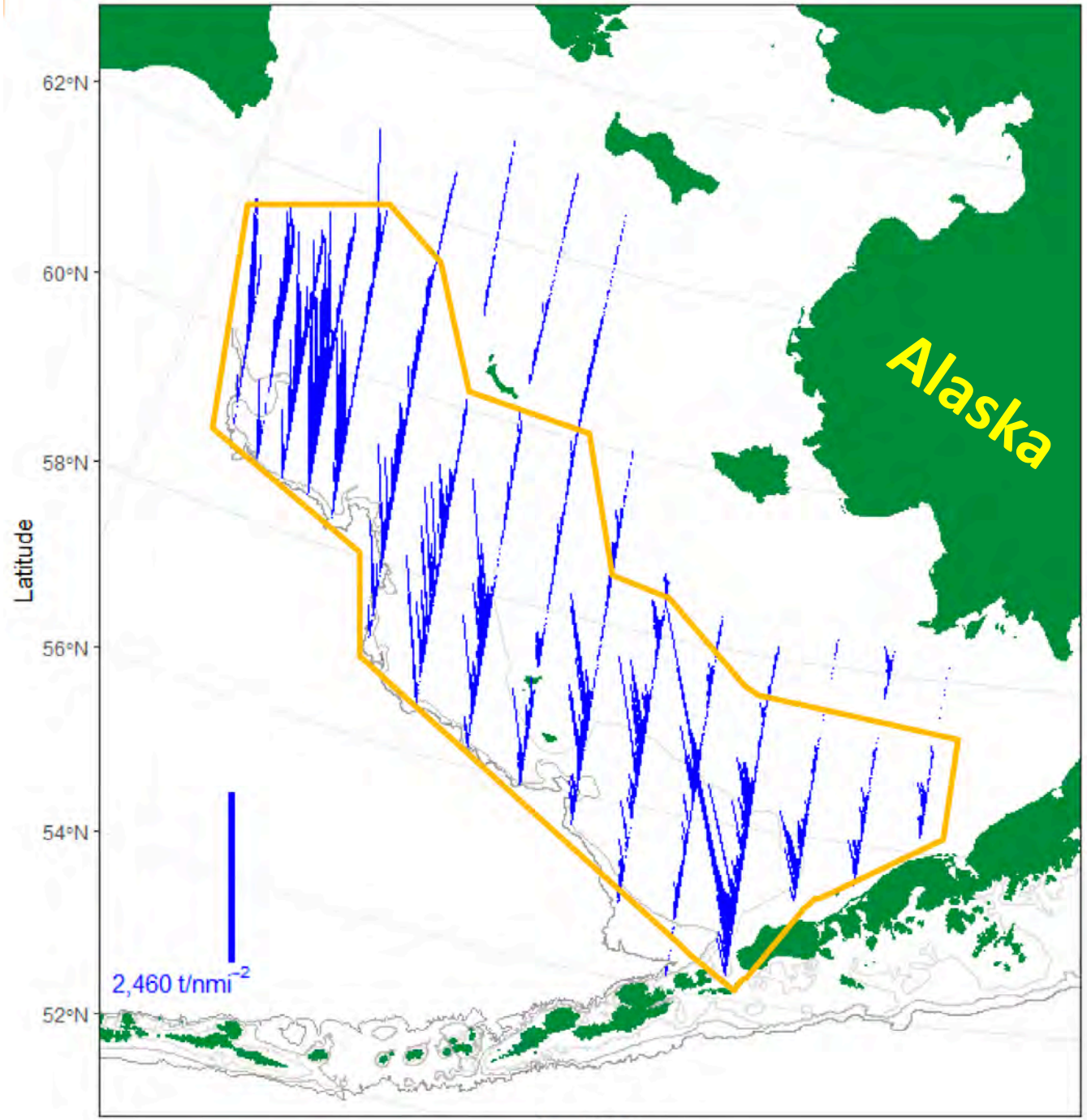
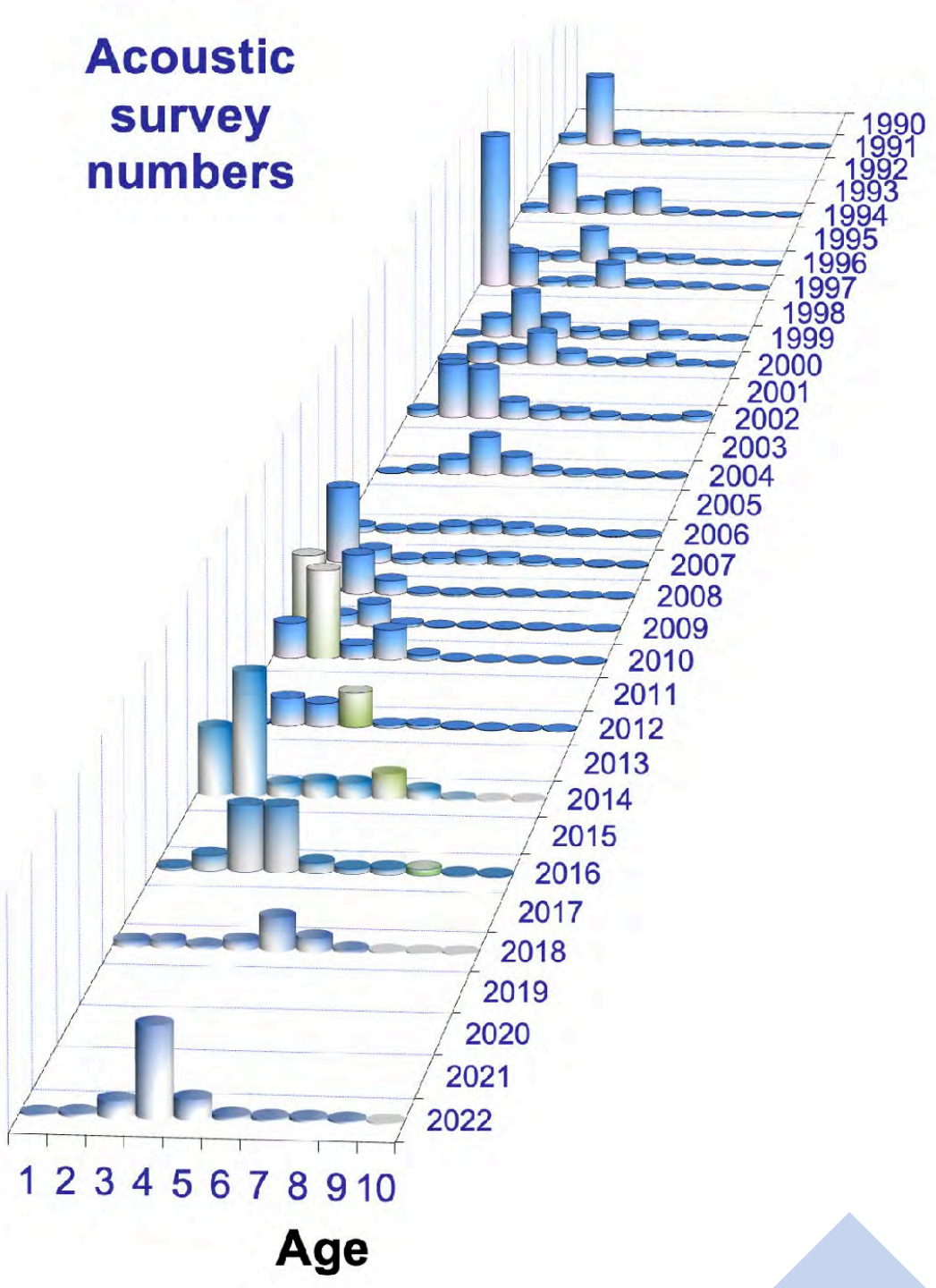


Figure 1-21. Panels showing the values for mean pollock weight-at-age used in the previous assess
ment (left panel) and the values revised for this assessment as based on more data and appropriat
CPUE weighting (right panel). the shadings indicate anomalies over time within ages (columns).

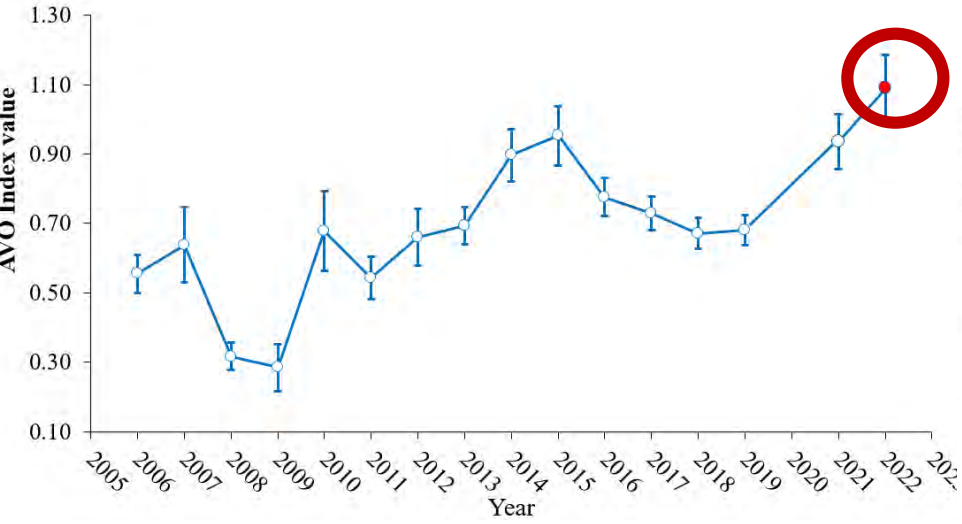

62°N
60°N
58°N
56°N
54°N
52°N
Latitude
Alaska
2,460 t/nmi^{-2}
Longitude

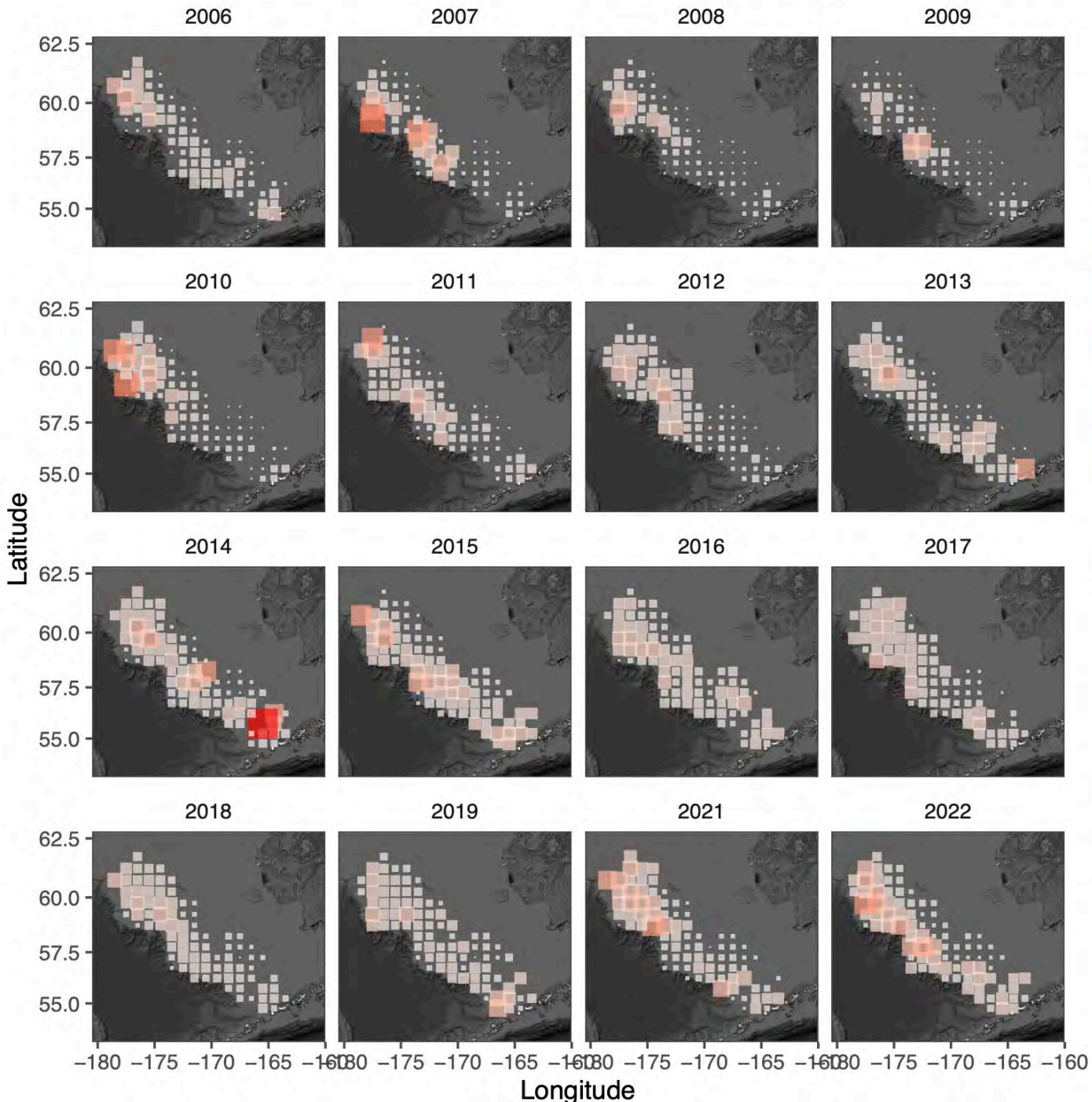

OSCAR DYSON
NOAA


Acoustic survey numbers
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
1 2 3 4 5 6 7 8 9 10
Age

Other acoustic data

AVO time series





Model fits

NMFS Bottom trawl survey…

Bottom trawl survey biomass

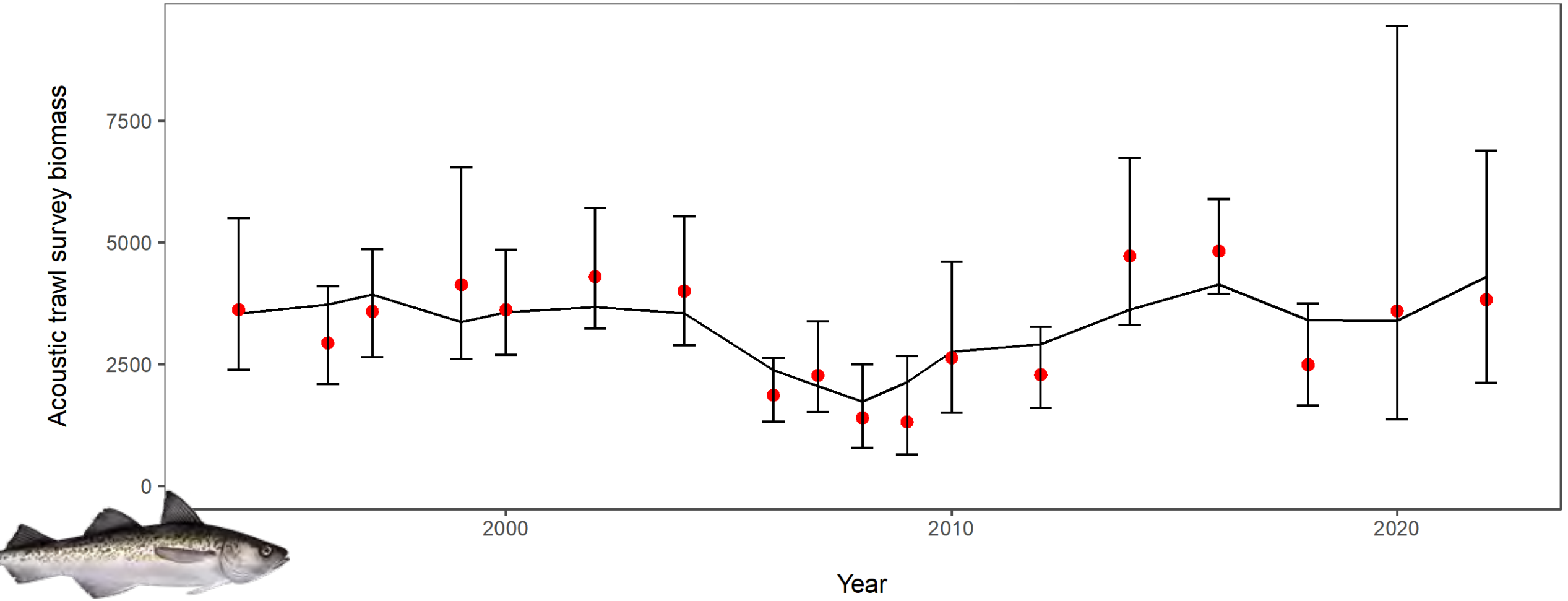
15000
10000
5000
0

1980
1990
2000
2010
2020

Year

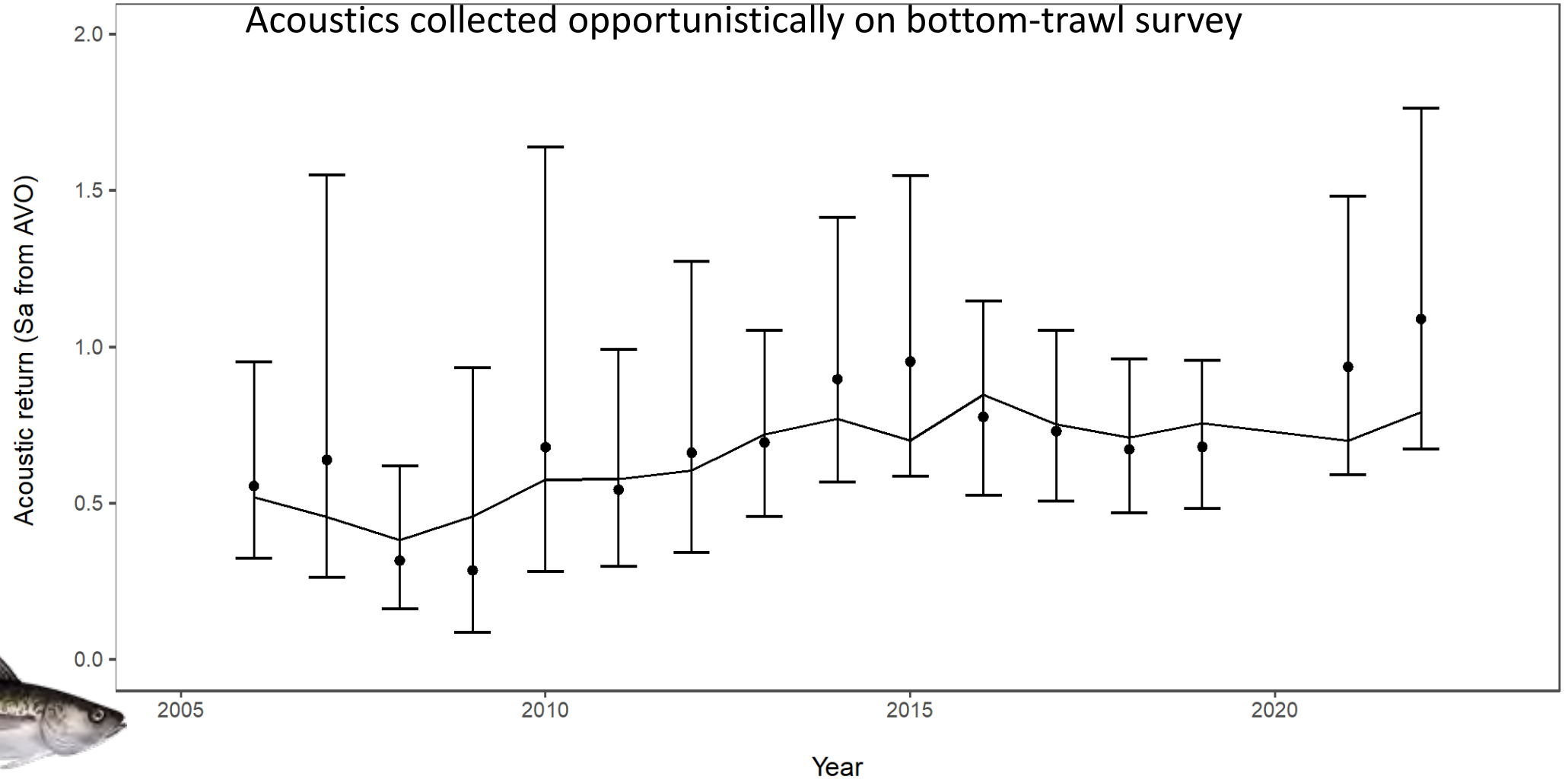
NMFS Bottom trawl survey…

Fit to acoustic-trawl index

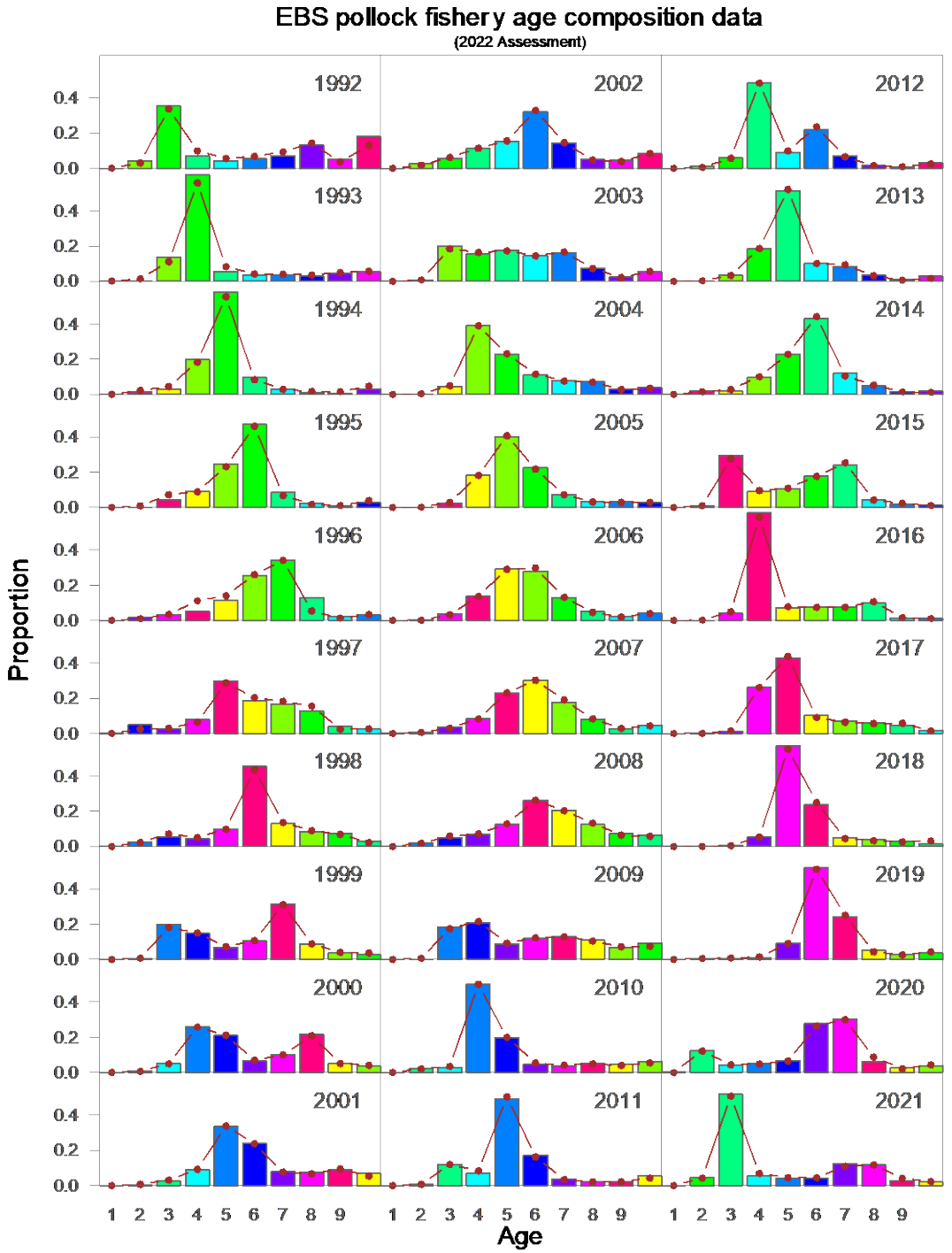


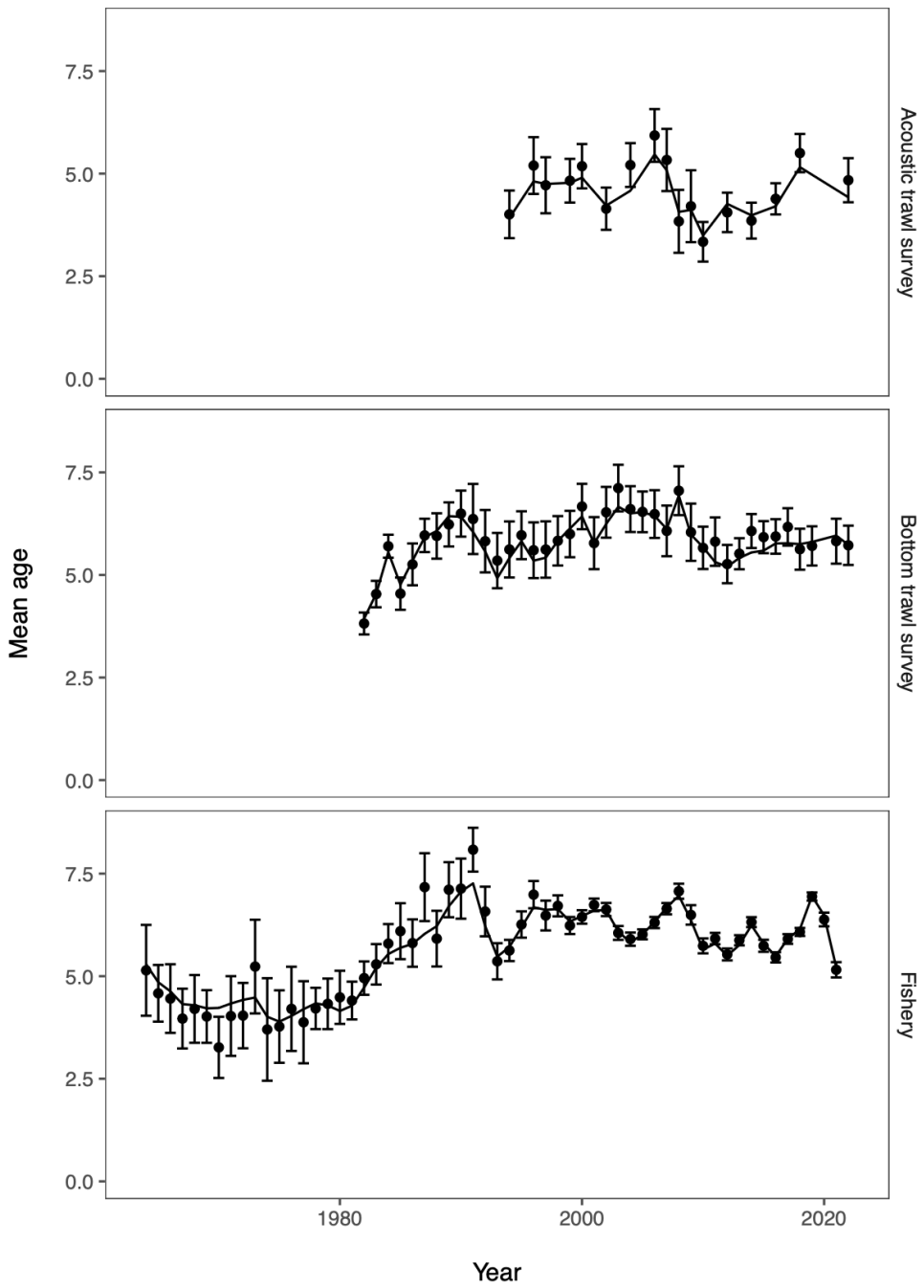
AVO Index

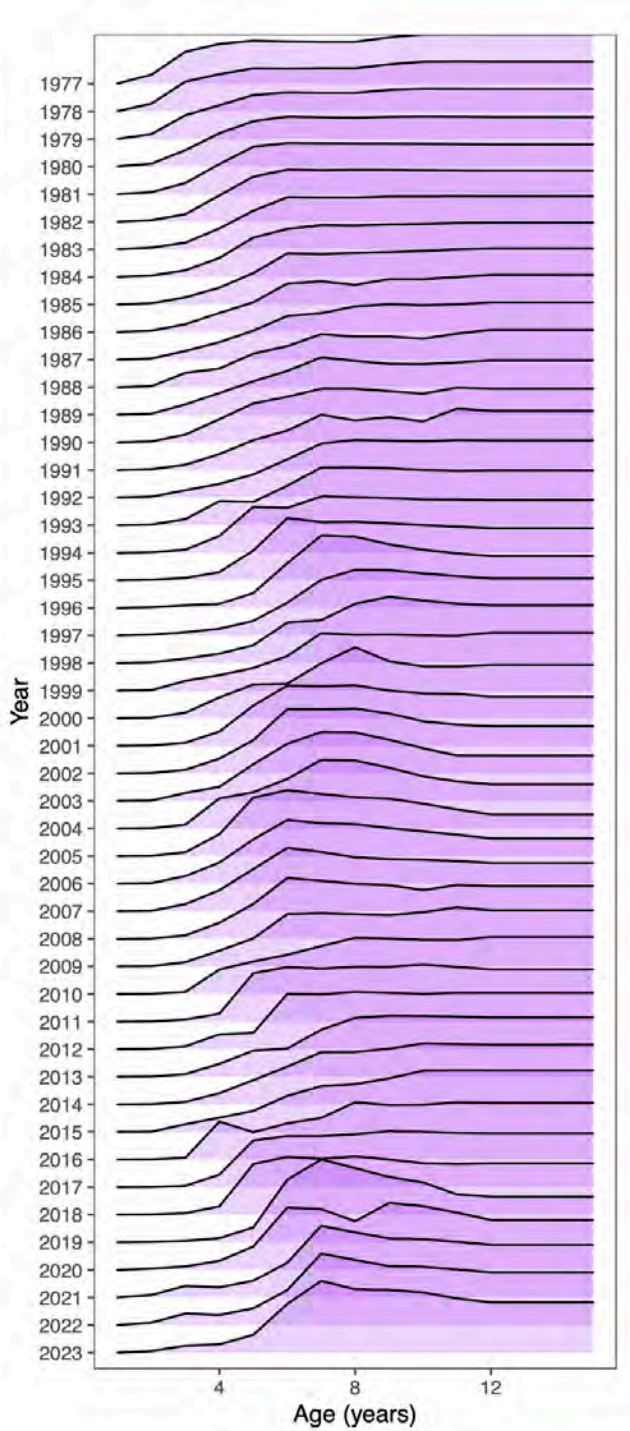

ALASKA KNIGHT


Acoustics collected opportunistically on bottom-trawl survey
Acoustic return (Sa from AVO)
2.0
1.5
1.0
0.5
0.0
2005
2010
2015
2020
Year

Fishery age composition fits







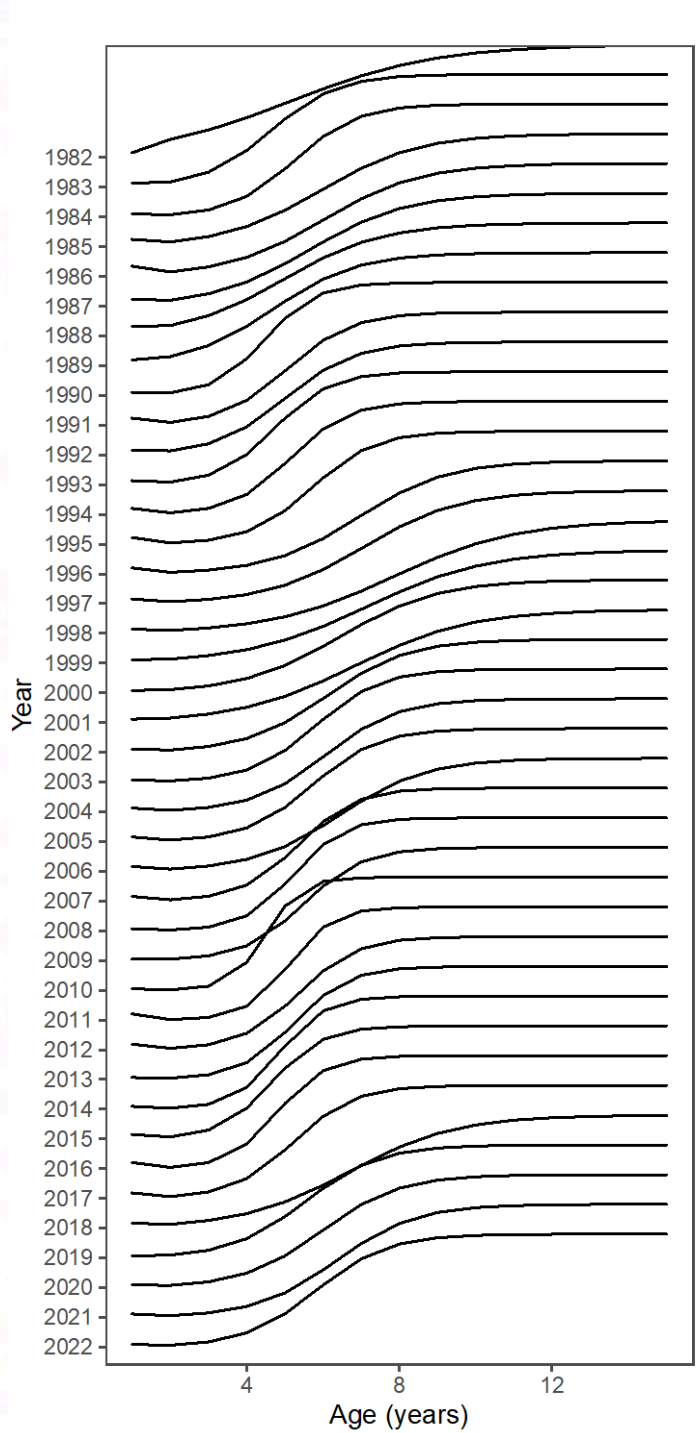
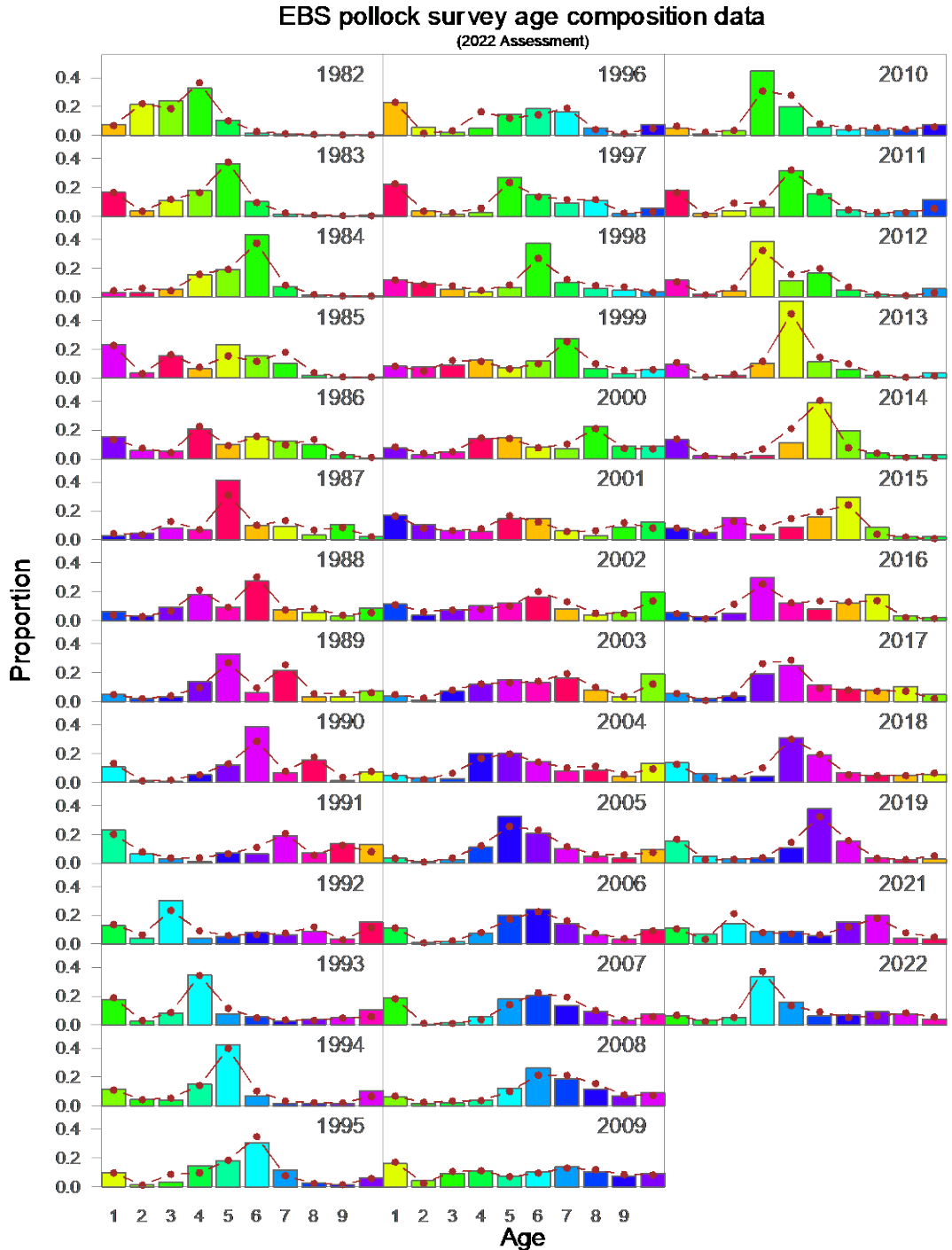


Figure 1-36. EBS pollock model fits to observed mean age for the Acoustic trawl survey (top), the bottom trawl survey (middle) and fishery (bottom)

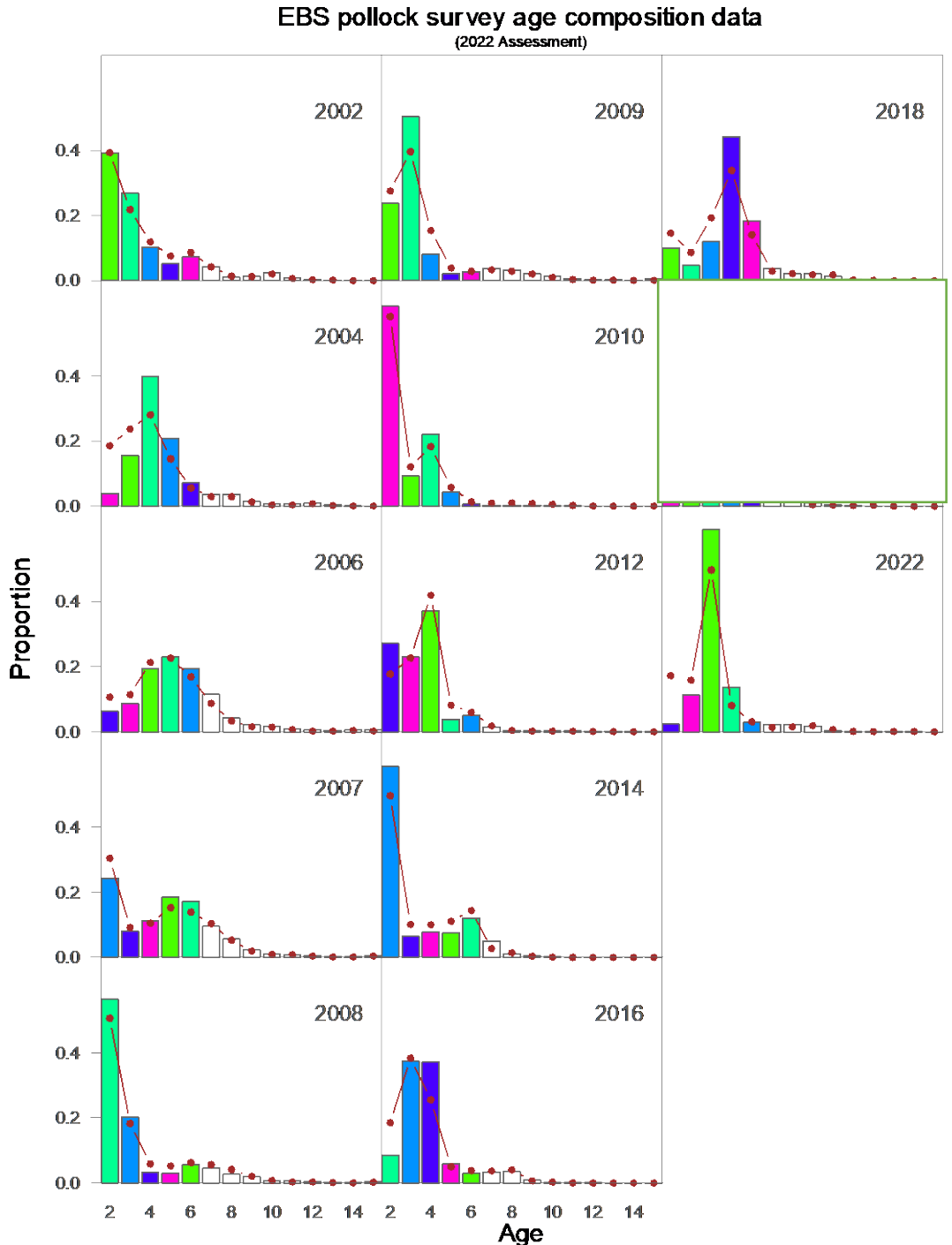
Bottom-trawl survey age composition fits



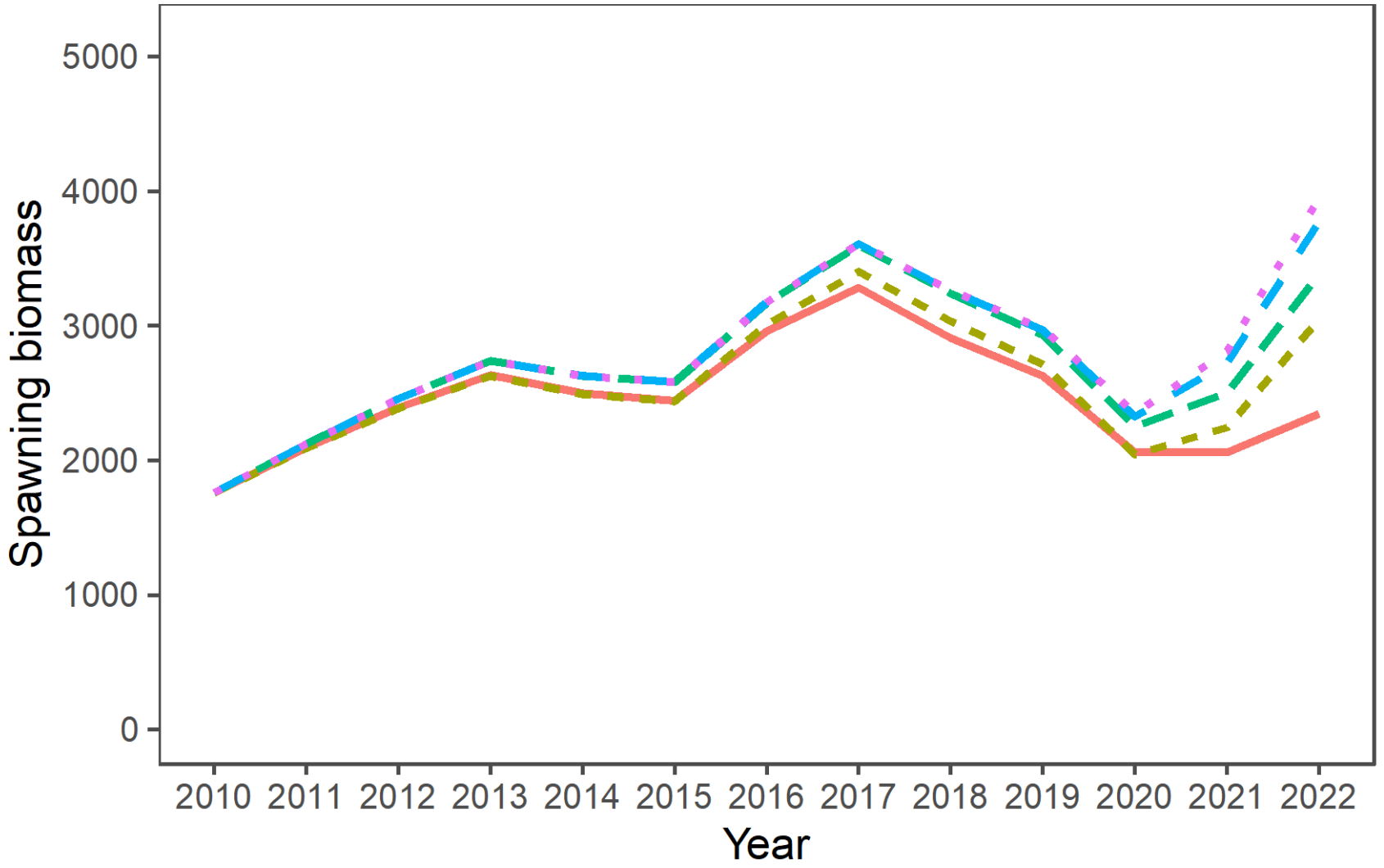
Acoustic-trawl survey age composition fits

NOTE: No age data in 2020

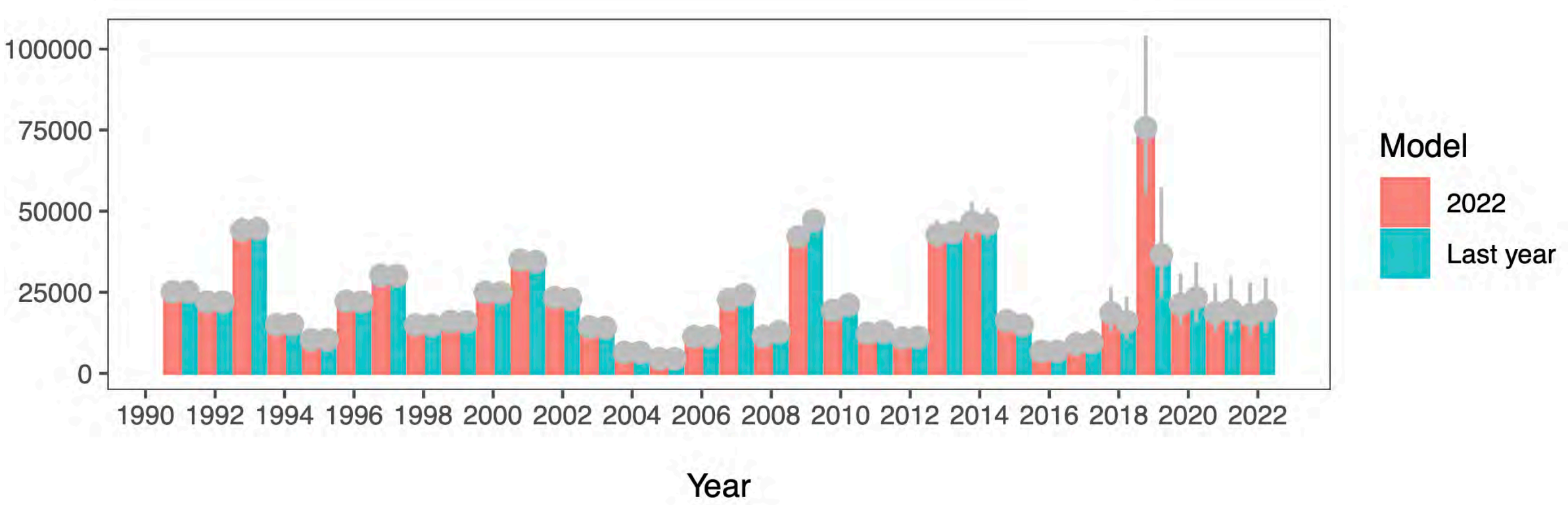
Figure panel gets no weight

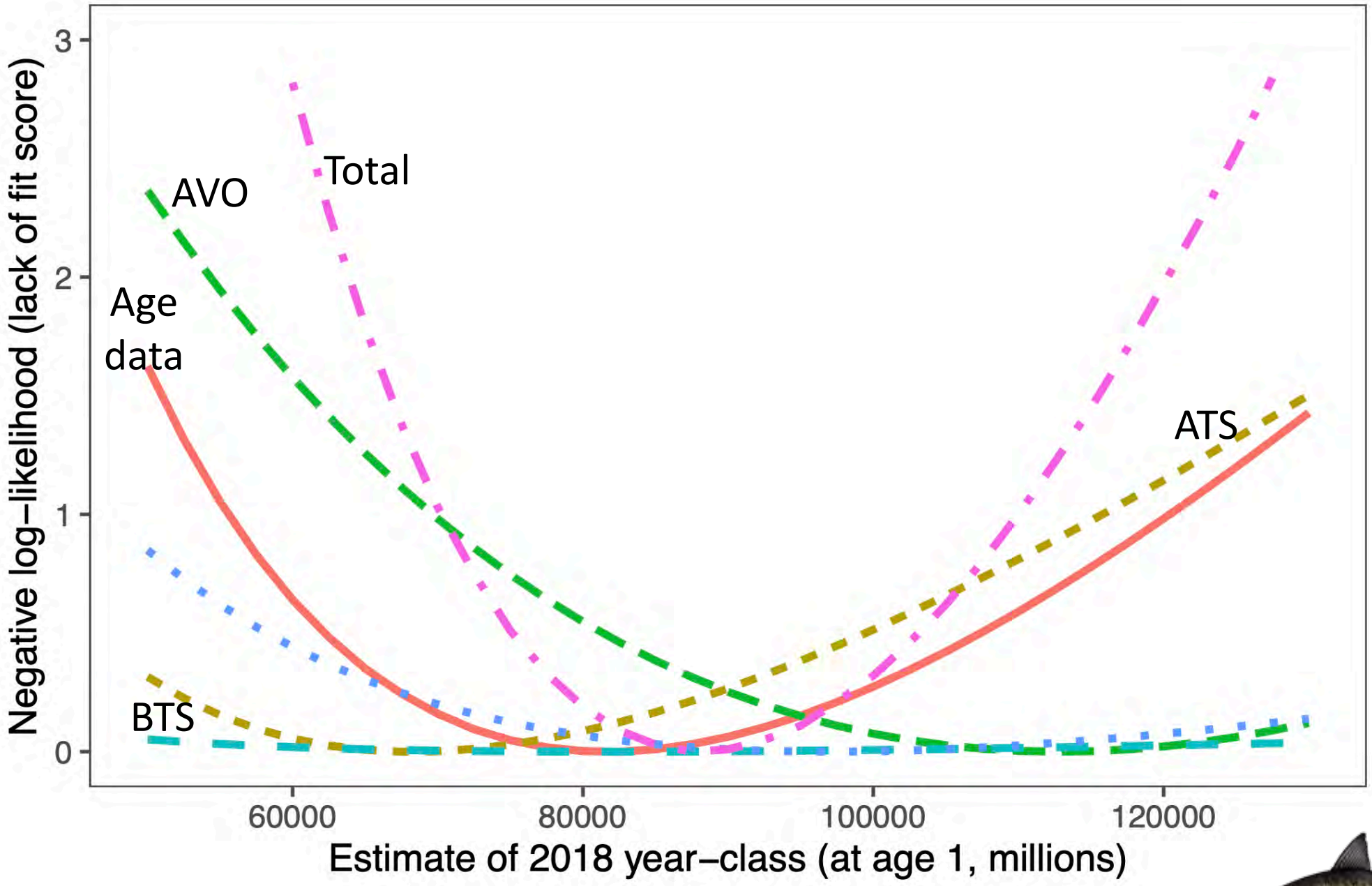


Incremental effect of new data



Recruitment estimates revised from last year

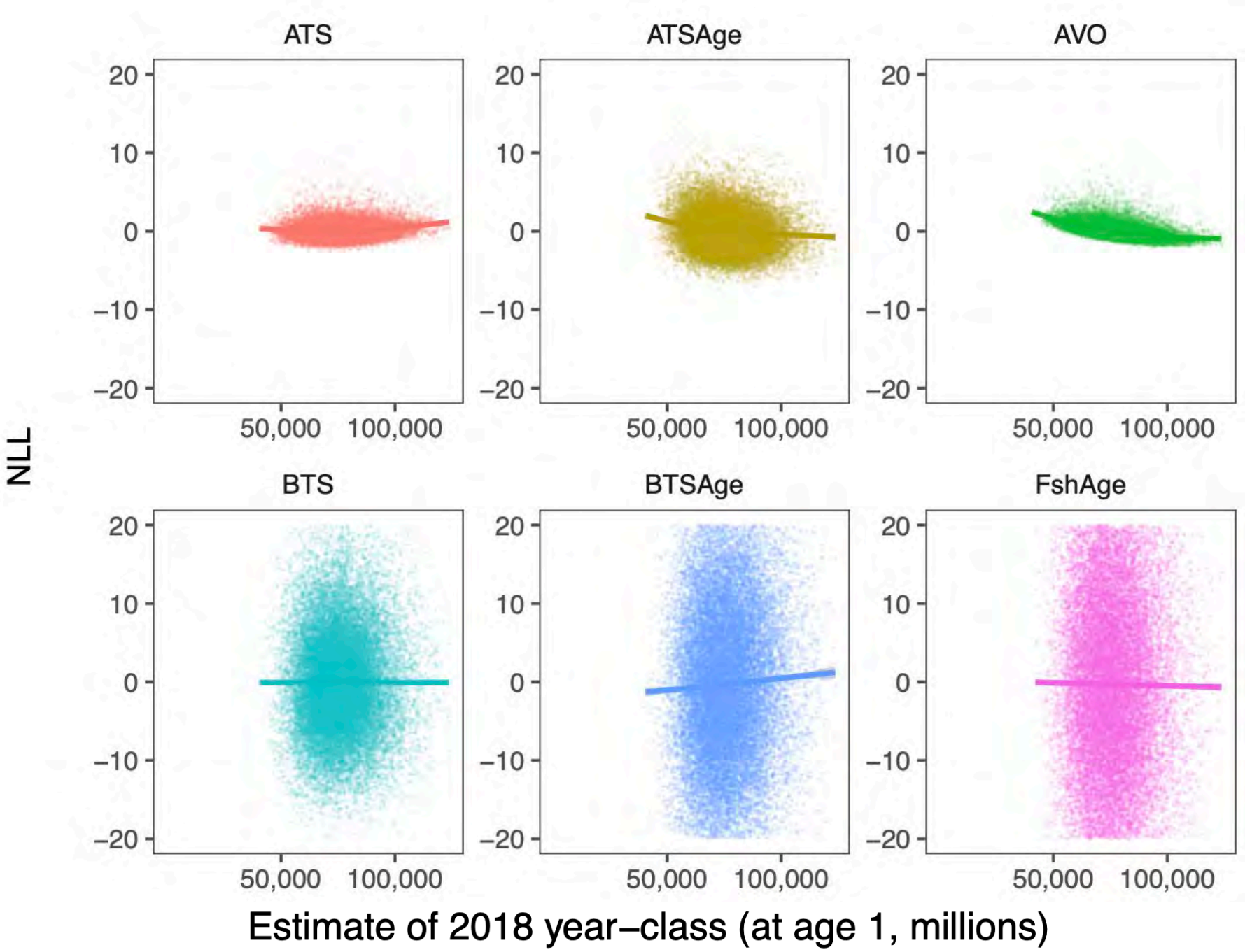



Negative log−likelihood (lack of fit score)
3
2
1
0
AVO
Total
Age
data
ATS
BTS
60000
80000
100000
120000
Estimate of 2018 year−class (at age 1, millions)

Eastern Bering Sea pollock

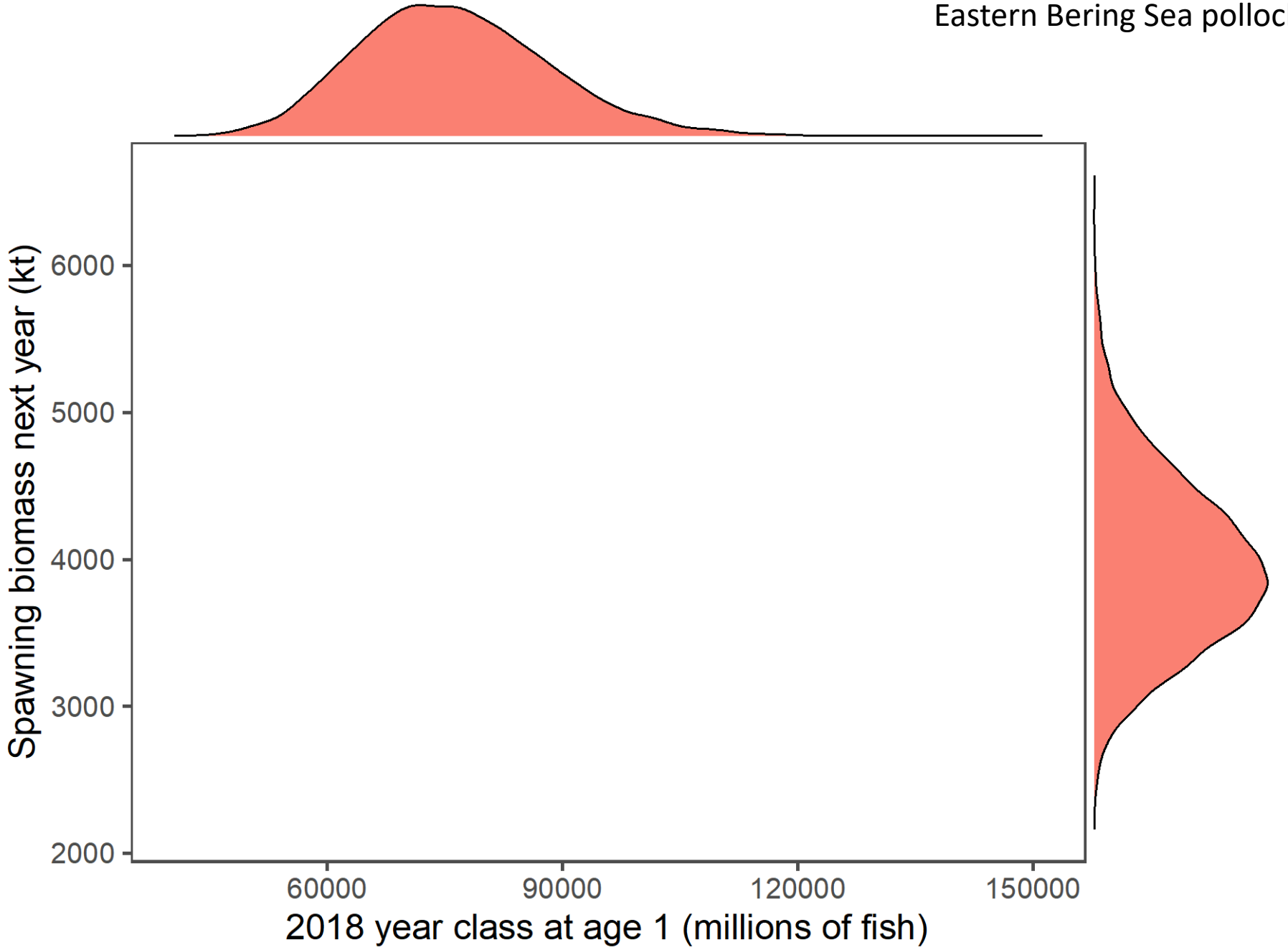
“profiles”

- From posterior components



Joint posterior distribution

How much does the 2018 year class estimate affect spawning biomass?



Uncertainty evaluation treatments

Improvements in posterior integration thanks to Monnahan's 2019 work on ADMB no-U-turn sampler

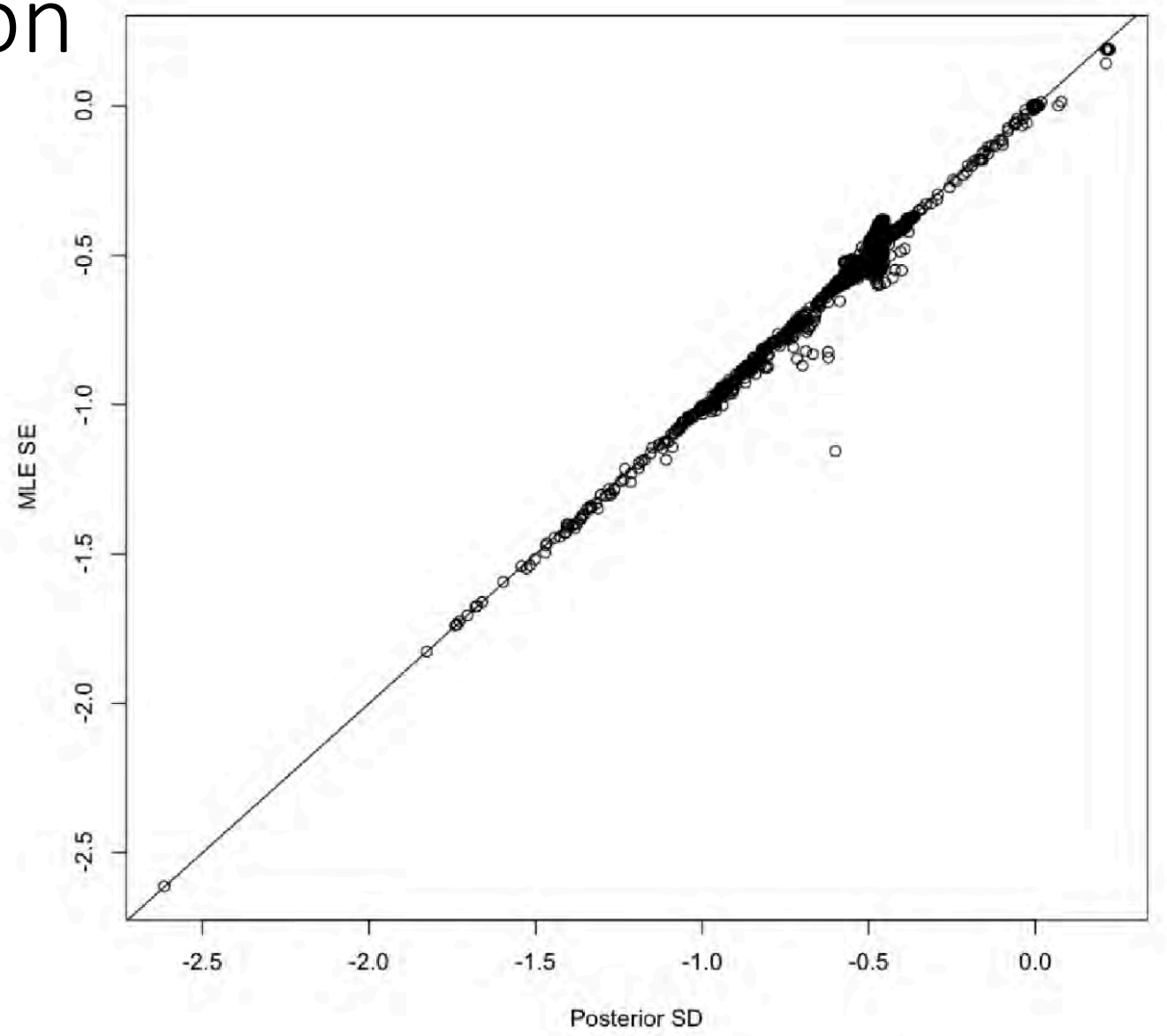


Figure 1-42. Comparison of the asymptotic parameter standard errors (from inverting the Hessian; vertical axis) with the marginals from the MCMC draws (horizontal axis).

Eastern Bering Sea pollock

Uncertainty evaluation treatments

Improvements in posterior integration thanks to Monnahan's 2019 work on ADMB no-U-turn sampler

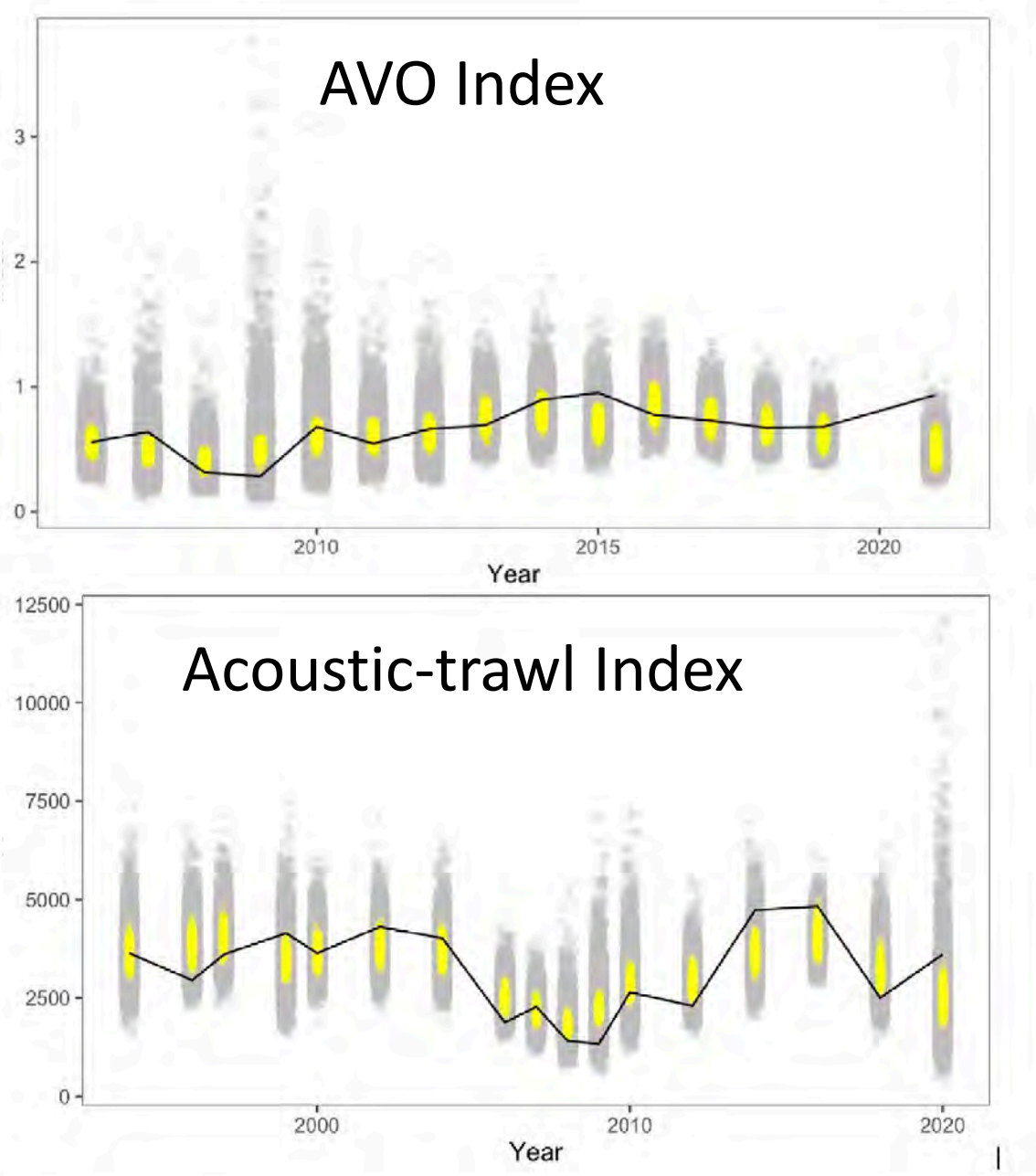
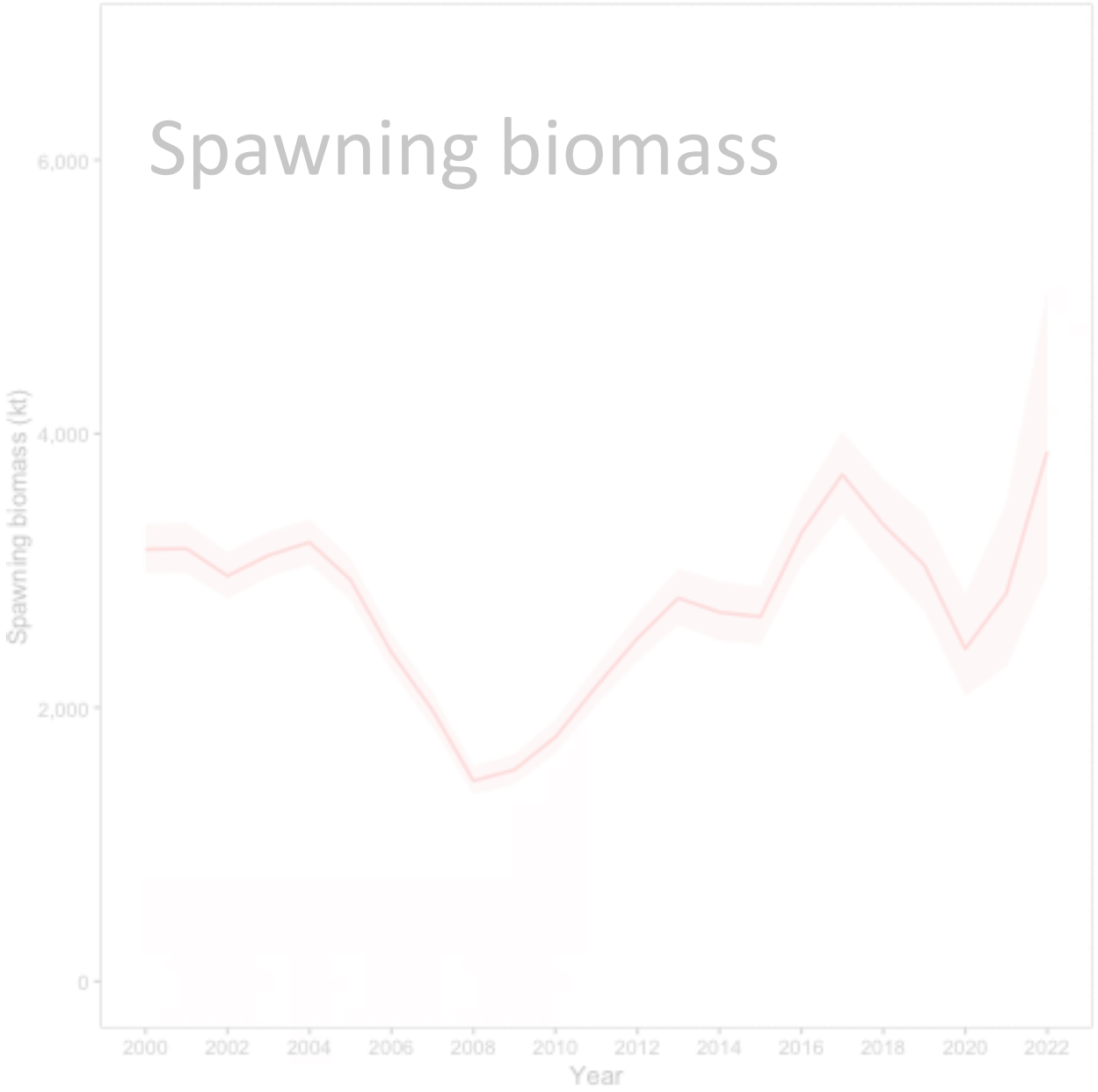
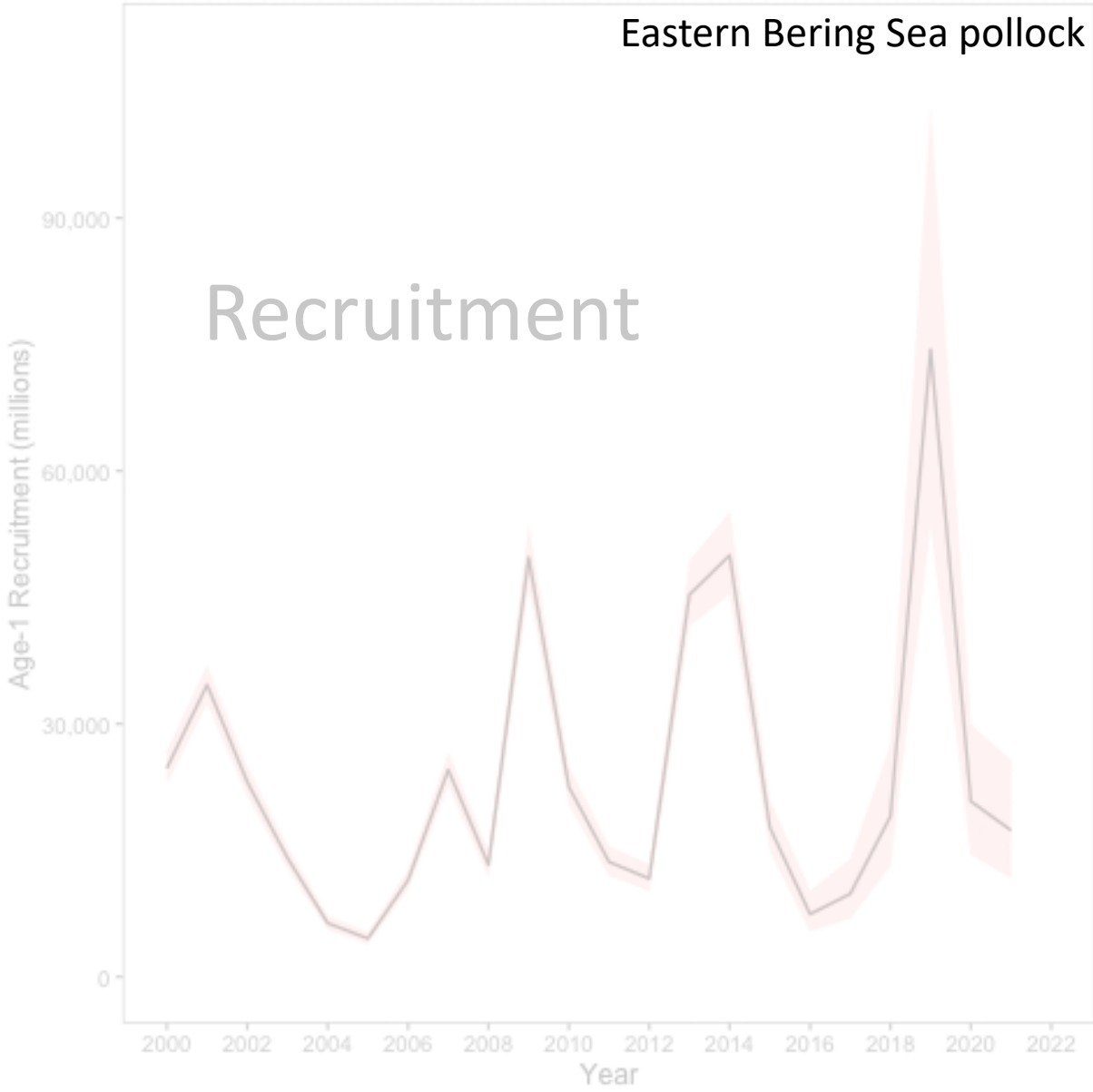


Figure 1-46. Plot of the model prediction (solid line), the distribution of the expected value (yellow dots) and the posterior predictive distribution (grey points).

Retrospectives

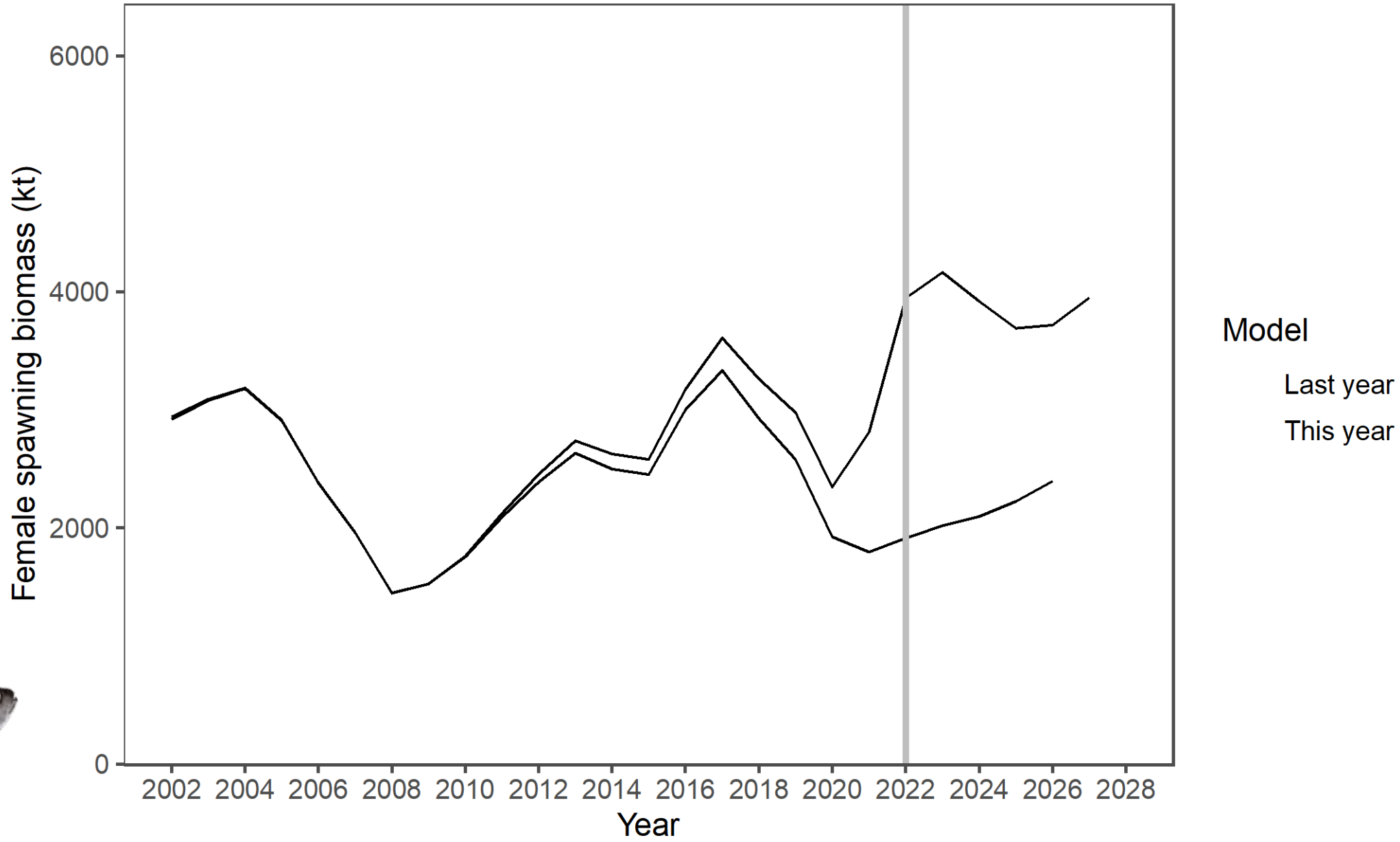
Eastern Bering Sea pollock





Eastern Bering Sea pollock

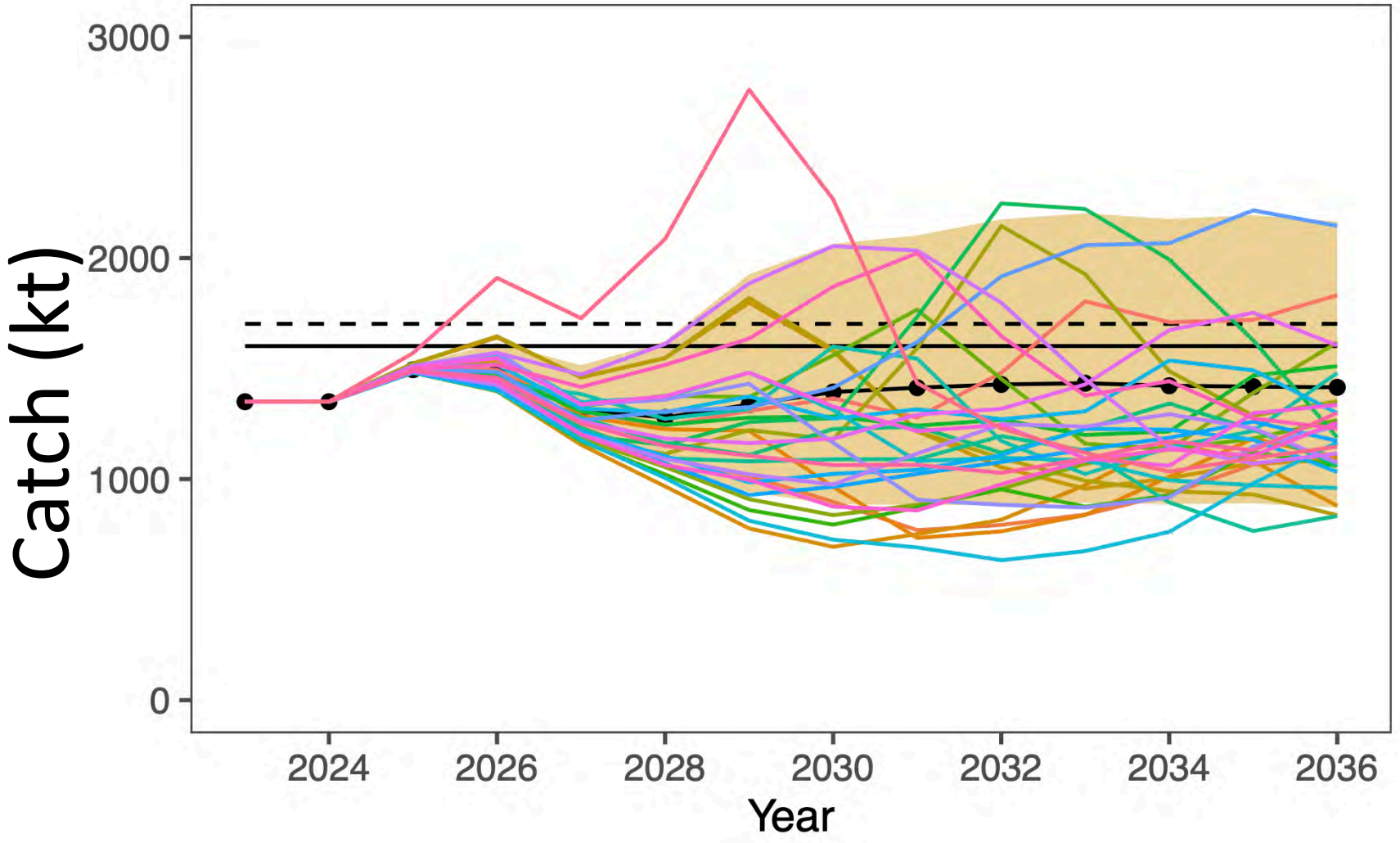
Result, new data and update on spawning biomass



Quantity	As estimated or *specified* *last* year for: 2022	2023	As estimated or *recommended* *this* year for: 2023	2024
M (natural mortality rate, ages 3+)	0.3	0.3	0.3	0.3
Tier	1b	1b	1a	1a
Projected total (age 3+) biomass (t)	6,839,000 t	6,969,000 t	12,389,000 t	11,445,000 t
Projected female spawning biomass (t)	1,881,000 t	1,905,000 t	4,171,000 t	3,944,000 t
B_0	5,575,000 t	5,575,000 t	6,653,000 t	6,653,000 t
B_{msy}	2,220,000 t	2,220,000 t	2,674,000 t	2,674,000 t
F_{OFL}	0.392	0.415	0.491	0.491
$maxF_{ABC}$	0.334	0.353	0.434	0.434
F_{ABC}	0.296	0.314	0.365	0.365
OFL	1,469,000 t	1,704,000 t	3,381,000 t	4,639,000 t
$maxABC$	1,251,000 t	1,451,000 t	2,987,000 t	4,099,000 t
ABC	1,111,000 t	1,289,000 t	1,688,000 t	1,815,000 t
Status	2020	2021	2021	2022
Overfishing	No	n/a	No	n/a
Overfished	n/a	No	n/a	No
Approaching overfished	n/a	No	n/a	No

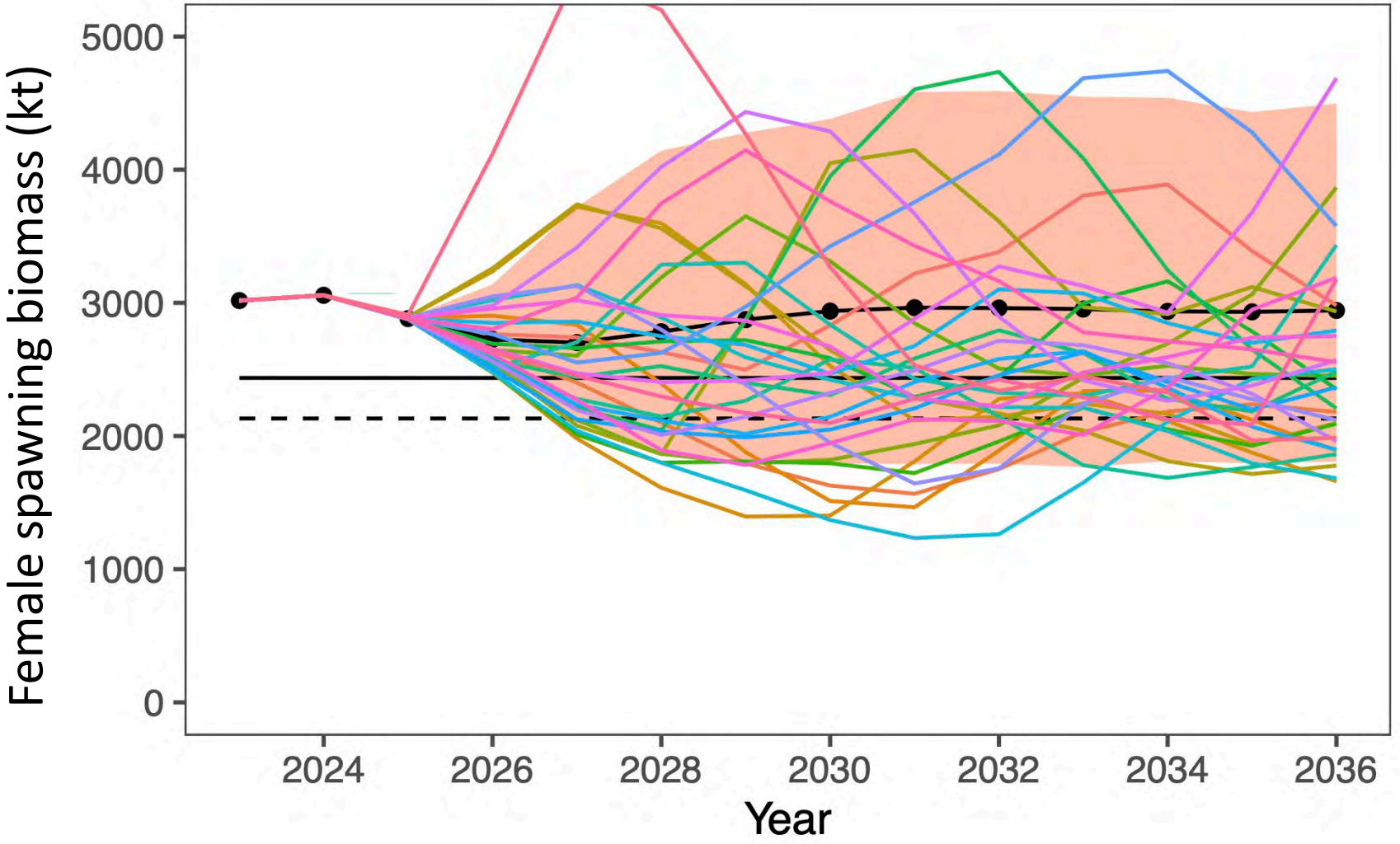
Projections

Effort equal to recent 5-years



Projections

Effort equal to recent 5-years



Decision variables (?)

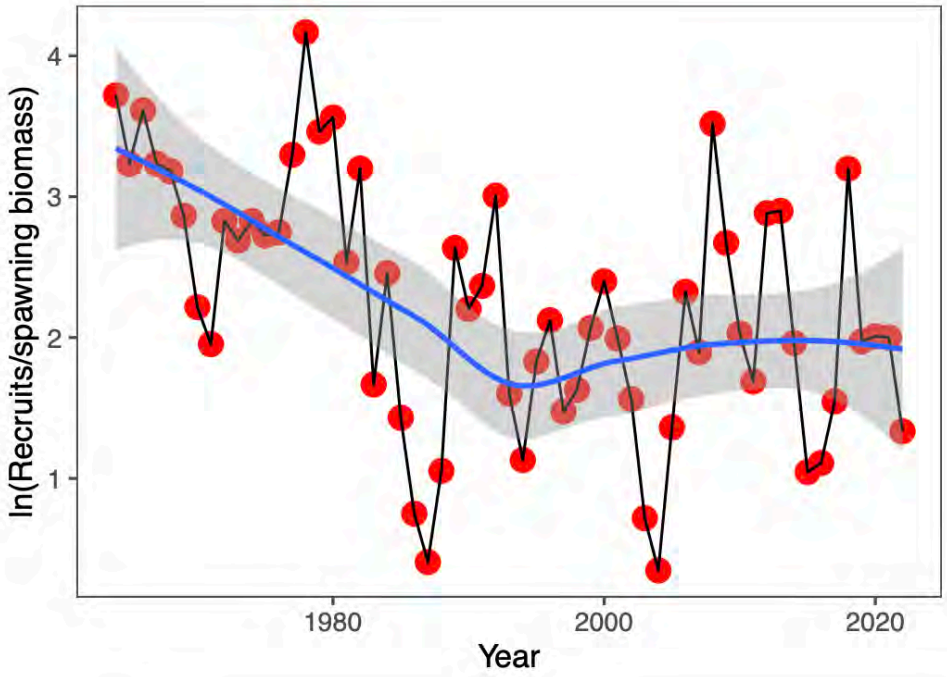
Table 1-34. Outcomes of decision (expressed as chances out of 100) given different 2023 catches (first row, in kt). Note that for the 2020 and later year-classes average values were assumed. Constant Fs based on the 2023 catches were used for subsequent years.

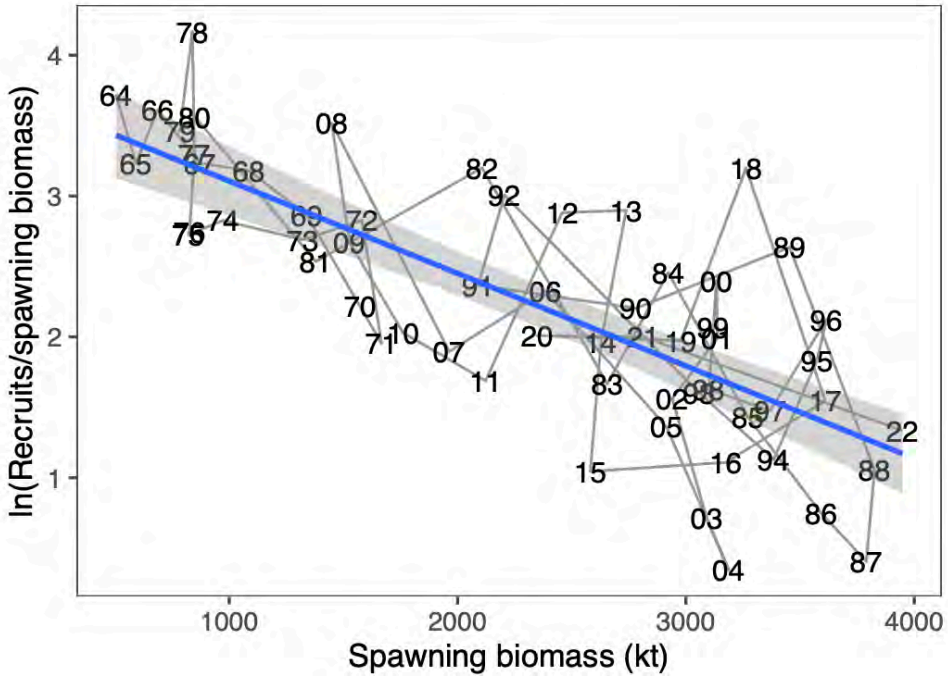
	10	850	1000	1110	1150	1300	1450	1600
$P\left[F_{2023} > F_{MSY}\right]$	0	0	0	0	0	0	0	0
$P\left[B_{2024} < B_{MSY}\right]$	4	7	8	9	9	10	12	14
$P\left[B_{2025} < B_{MSY}\right]$	2	8	10	12	12	15	19	23
$P\left[B_{2024} < \bar{B}\right]$	0	1	1	1	1	2	3	4
$P\left[B_{2027} < \bar{B}\right]$	0	7	9	12	12	15	19	22
$P\left[B_{2027} < B_{2023}\right]$	9	45	52	56	58	63	68	72
$P\left[B_{2025} < B_{20\%}\right]$	0	0	0	0	0	0	0	0
$P\left[p_{a_5,2024} > \bar{p}_{a_5}\right]$	1	36	44	50	52	58	64	69
$P\left[D_{2024} < D_{1994}\right]$	53	71	74	76	77	80	83	85
$P\left[D_{2027} < D_{1994}\right]$	0	2	3	5	5	8	11	15
$P\left[E_{2023} > E_{2022}\right]$	0	0	3	18	27	62	85	95

Table 1-33. Details and explanation of the decision table factors selected in response to the Plan Team requests (as originally proposed in the 2012 assessment).

Term	Description	Rationale
$P\left[F_{2023} > F_{MSY}\right]$	Probability that the fishing mortality in 2023 exceeds F_{MSY}	OFL definition is based on F_{MSY}
$P\left[B_{2024} < B_{MSY}\right]$	Probability that the spawning biomass in 2024 is less than B_{MSY}	B_{MSY} is a reference point target and biomass in 2021 provides an indication of the impact of 2023 fishing
$P\left[B_{2025} < B_{MSY}\right]$	Probability that the spawning biomass in 2025 is less than B_{MSY}	B_{MSY} is a reference point target and biomass in 2023 provides an indication of the impact of fishing in 2023 and 2024
$P\left[B_{2025} < \bar{B}\right]$	Probability that the spawning biomass in 2024 is less than the 1978–2022 mean	To provide some perspective of what the stock condition might be relative to historical estimates after fishing in 2023.
$P\left[B_{2027} < \bar{B}\right]$	Probability that the spawning biomass in 2027 is less than the long term mean	To provide some perspective of what the stock condition might be relative to historical estimates after fishing in 2023.
$P\left[B_{2027} < B_{2023}\right]$	Probability that the spawning biomass in 2027 is less than that estimated for 2023	To provide a medium term expectation of stock status relative to 2023 levels
$P\left[B_{2025} < B_{20\%}\right]$	Probability that the spawning biomass in 2025 is less than $B_{20\%}$	$B_{20\%}$ had been selected as a Steller Sea Lion lower limit for allowing directed fishing
$P\left[p_{a_5,2025} > \bar{p}_{a_5}\right]$	Probability that in 2025 the proportion of age 1–5 pollock in the population exceeds the long-term mean	To provide some relative indication of the age composition of the population relative to the long term mean.
$P\left[D_{2024} < D_{1994}\right]$	Probability that the diversity of ages represented in the spawning biomass (by weight) in 2024 is less than the value estimated for 1994	To provide a relative index on the abundance of different age classes in the 2024 population relative to 1994 (a year identified as having low age composition diversity)
$P\left[D_{2027} < D_{1994}\right]$	Probability that the diversity of ages represented in the spawning biomass (by weight) in 2027 is less than the value estimated for 1994	To provide a medium-term relative index on the abundance of different age classes in the population relative to 1994 (a year identified as having low age composition diversity)
$P\left[E_{2023} > E_{2022}\right]$	Probability that the theoretical fishing effort in 2023 will be greater than that estimated in 2022.	To provide the relative effort that is expected (and hence some idea of costs).

Stock-recruit relationship





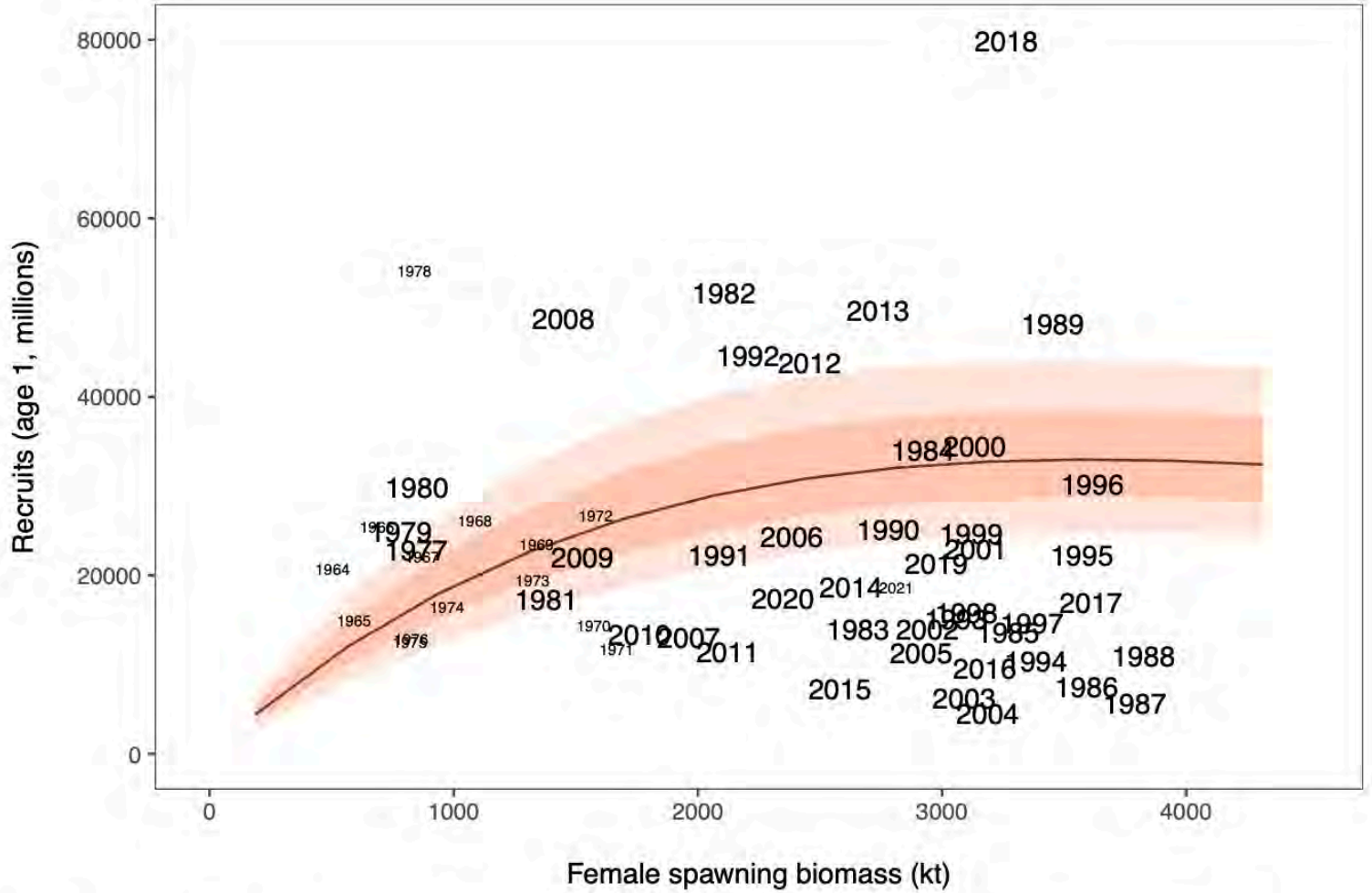


Figure 1-60. Stock-recruitment estimates (shaded represents structural uncertainty) and age-1 EBS pollock estimates labeled by year-classes

CHAPTER 1
EBS WALLEYE POLLOCK

- New model(s): yes; change from base: yes; risk table (2,2,1,1)

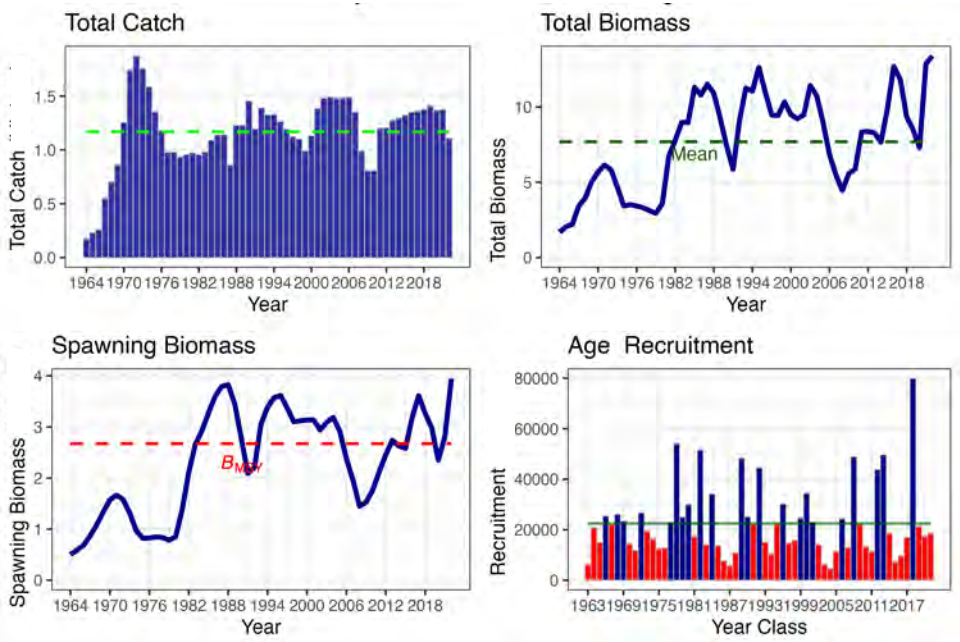
- Team agreed with author's recommendation on assessment model and reduction from maximum permissible ABC

- ABCs to be reduced by 43% from Tier 1 maximum permissible ABC

Quantity	Last asmt.	This asmt.	Change
M	0.3	0.3	0%
2022 Tier	1b		
2023 Tier	1b	1a	
2022 age+ biomass	6,839,000		81%
2023 age+ biomass	6,969,000	12,389,000	78%
2022 spawning biomass	1,881,000		122%
2023 spawning biomass	1,905,000	4,171,000	119%
B_0	5,575,000	6,653,000	16%
B_{msy}	2,220,000	2,674,000	20%
2023 F_{OFL}	0.392	0.491	25%
2023 F_{ABC}	0.314	0.365	16%
2022 OFL	1,469,000		130%
2023 OFL	1,704,000	3,381,000	98%
2022 ABC	1,111,000		52%
2023 ABC	1,289,000	1,688,000	31%

CHAPTER 1
EBS WALLEYE POLLOCK

- New model(s): yes; change from base: yes; risk table (2,2,1,1)



Quantity	Last asmt.	This asmt.	Change
M	0.3	0.3	0%
2022 Tier	1b		
2023 Tier	1b	1a	
2022 age+ biomass	6,839,000		81%
2023 age+ biomass	6,969,000	12,389,000	78%
2022 spawning biomass	1,881,000		122%
2023 spawning biomass	1,905,000	4,171,000	119%
B_0	5,575,000	6,653,000	16%
B_{msy}	2,220,000	2,674,000	20%
2023 F_{OFL}	0.392	0.491	25%
2023 F_{ABC}	0.314	0.365	16%
2022 OFL	1,469,000		130%
2023 OFL	1,704,000	3,381,000	98%
2022 ABC	1,111,000		52%
2023 ABC	1,289,000	1,688,000	31%

CHAPTER 1
EBS POLLOCK RECOMMENDATIONS

EBS Pollock

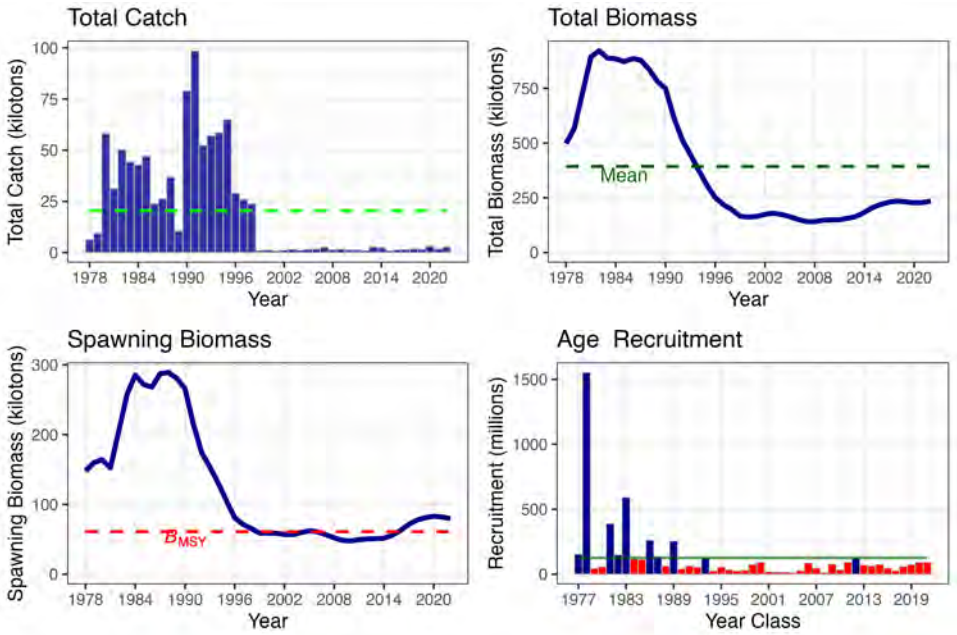
- The Team recommended that the EBS pollock stock be included in any working group developed to investigate appropriate means of dealing with irregular recruitment and alternative harvest control rules.

Multispecies models

- The Team recommended that the contributions of the CEATTLE model align with the timing of the risk table evaluation to inform those discussions in the future.
- The Team recommended that the methodologies described for providing climate advice be included in the climate change working group.
- The Team recommended continued work to align the CEATTLE results with the single species models and to transfer to the Rceattle version when possible.

CHAPTER 1A
AI WALLEYE POLLOCK

- New model(s): no; change from base: no; risk table (1,1,1,1)



Quantity	Last asmt.	This asmt.	Change
M	0.21	0.21	0%
2022 Tier	3a		
2023 Tier	3a	3a	
2022 age+ biomass	308,525		-14%
2023 age+ biomass	330,375	264,173	-20%
2022 spawning biomass	89,516		-12%
2023 spawning biomass	87,650	78,628	-10%
B_0	185,475	174,218	-6%
2023 F_{OFL}	0.390	0.380	-3%
2023 F_{ABC}	0.313	0.305	-3%
2022 OFL	61,264		-14%
2023 OFL	61,379	52,383	-15%
2022 ABC	50,752		-14%
2023 ABC	50,825	43,413	-15%

CHAPTER 1A
AI POLLOCK RECOMMENDATIONS

- The Team recommended reevaluation of the assessment considerations category risk table score in the next assessment.

CHAPTER 1B
BOGOSLOF WALLEYE POLLOCK

- New model(s): no; change from base: no; risk table (1,1,1,NA)

- Tier 5 with M derived from age structured model and biomass from a random effects model

- Team agreed with author's recommendation

Quantity	Last asmt.	This asmt.	Change
M	0.3	0.313	4%
2022 tier	5		
2023 tier	5	5	
Biomass	378,262	367,880	-3%
2023 F_{OFL}	0.300	0.313	4%
2023 F_{ABC}	0.225	0.235	4%
2022 OFL	113,479		1%
2023 OFL	113,479	115,146	1%
2022 ABC	85,109		1%
2023 ABC	85,109	86,360	1%

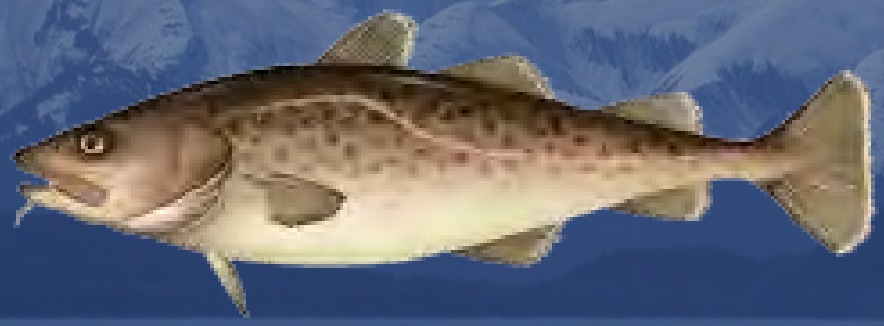
CHAPTER 2
EBS PACIFIC COD

- New model(s): yes; change from base: yes; risk table (1,1,1,1)
- Switch to authors' presentation (Team comments will follow)

EBS PACIFIC COD

Steven J. Barbeaux, Lewis Barnett, Jason Connor, Julie Nielson, S. Kalei Shotwell, Elizabeth Siddon, and Ingrid Spies

December, 2022



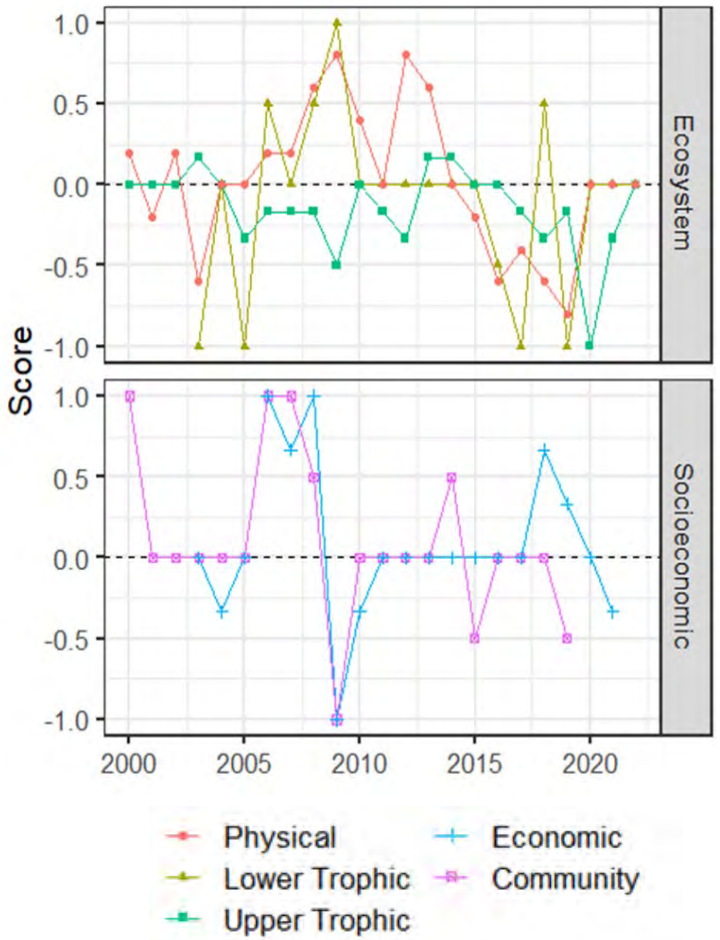
NOAA FISHERIES

THANKS TO THE MANY CONTRIBUTORS TO THIS ASSESSMENT

Caitlin Allen-Akselrud, Kerim Aydin, Mathew Callahan, Curry Cunningham, Lucas DeFilippo, Bridget Ferriss, Ben Fissel, Madison Hall, Kirstin Holsman, Tom Hurst, Kelly Kearney, Ben Laurel, Cecilia A. O'Leary, Beth Matta, Susanne McDermott, Sandi Neidetcher, Jens Nielsen, Kimberly Rand, Patrick Ressler, Heather Renner, Sean Rohan, Katie Sweeney, Grant Thompson, James Thorson, Muyin Wang, Jordan Watson, Sarah Wise, and Stephani Zador

ECOSYSTEM AND SOCIOECONOMIC PROFILE (ESP)

- Management Summary
  - Temperatures generally at a more average state, calmer conditions and sea ice extent average
  - Spring bloom timing earlier but match depends on spawning and movement of Pacific cod
  - Condition of juveniles and adults were both above average, suggesting sufficient prey, spatial estimates suggest the population is more east and south, and more spread out
  - Arrowtooth biomass has steadily increased over time, near time series peak
  - Ex-vessel value decreased to below average, price and revenue/effort decreased in 2021
- Modeling Summary
  - One potential covariate for recruitment (spring SST), consistent with last few years
  - CEATTLE model update and discussion on how to use in future ESPs



TEAMS OR SSC COMMENTS

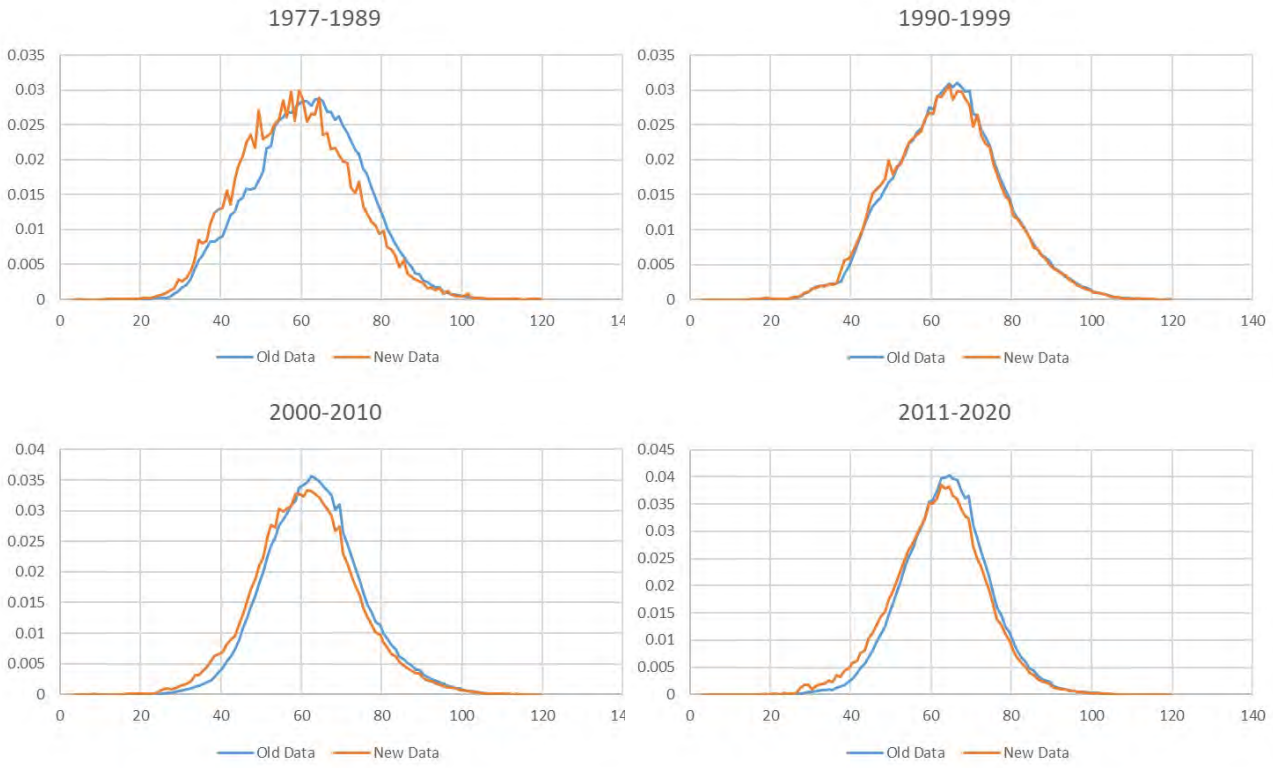
- *Given that an ensemble model structure has been endorsed by the SSC in 2021, representing a fairly large change in the assessment process, if the new authors choose to propose an ensemble in the future it may be prudent to minimize changes to the suite of models comprising the ensemble so that the potential benefits of a stable ensemble can be realized*.
  - **The authors presented a series of minor changes to the model this year. The Plan Team and SSC endorsed removing of the weight-at-length adjustments and the aging bias for post-2007. These model changes resulted in very minimal changes to the resulting model and are described below.**

- *If model ensembles are brought forward in the future, the authors should work with the BSAI GPT to define a process whereby GPT members themselves assign model scores based on the same, or an updated set, of scoring criteria. This would allow for future development of ensemble member weightings based upon independent review, and the SSC believes this would address one of the concerns highlighted in public comment.*
  - **In light of the above recommendation, model changes were kept to a minimum and the weighting criteria used for this year's ensemble were judged to rate the same as the weights generated by the CIE and endorsed by the SSC in 2021.**

- *The SSC recommends that inclusion of [fishery age composition data] be fully explored in a later assessment cycle, either within a single model or multiple ensemble members, highlighting that it views this as a top priority for future research.*
  - **Given the already monumental task of taking this stock over from Dr. Thompson, the authors chose not to investigate the use of fishery age composition data. This also in light of the SSCs recommendation to minimize changes to the suite of models comprising the ensemble. The authors intend to investigate the use of fishery age composition data in the future.**

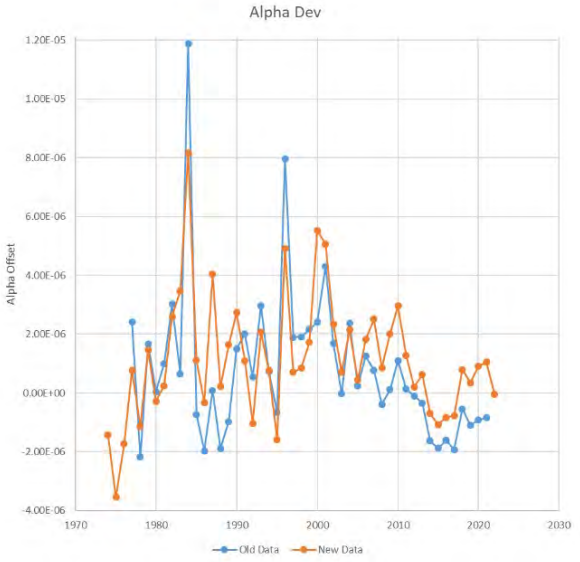
DATA CHANGES
FISHERY LENGTH COMPOSITION

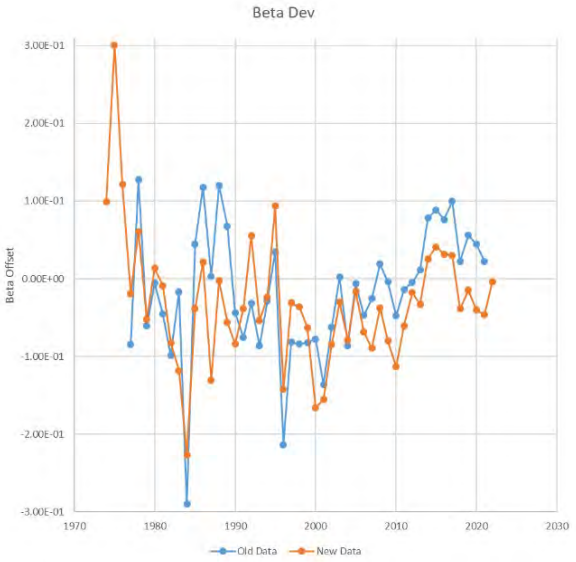
- New algorithm for constructing fishery length composition (described in September)
- Data weighted by haul, vessel, gear, month, NMFS area, and year
- Resulted in shift to more small fish in distribution

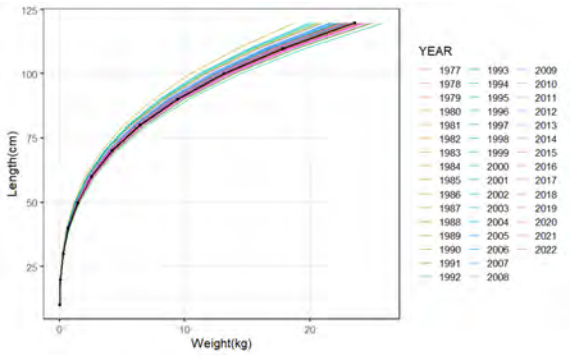


DATA CHANGES – ANNUAL WEIGHT-AT-LENGTH ADJUSTMENTS

- Switch from linear Mathcad algorithm to GAM in R mgcv library (described in September)
- Similar resulting trend in adjustments

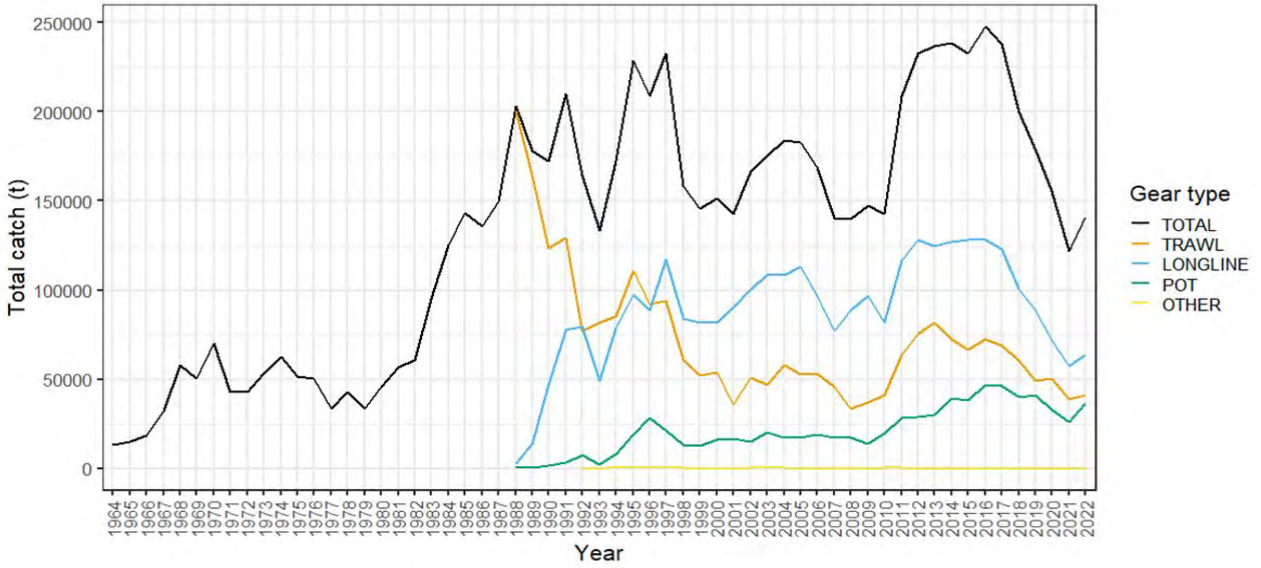


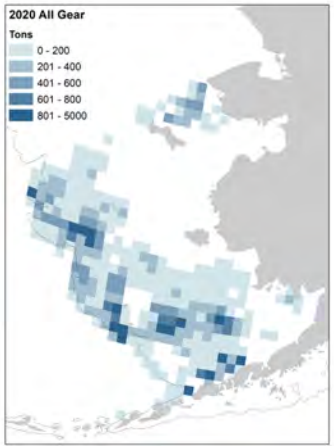


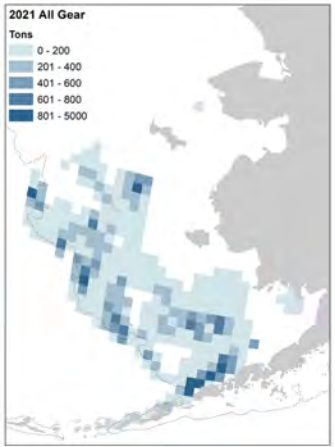


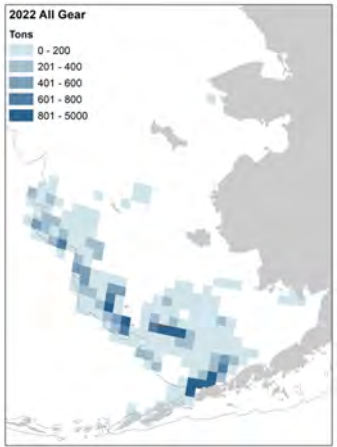
CATCH – FISHERY SECTOR

- Increase in catch from 2021 but lower than 10-year average
- Longline remains dominant
- Continued increasing trend in pot proportion and decreasing trend in trawl proportion





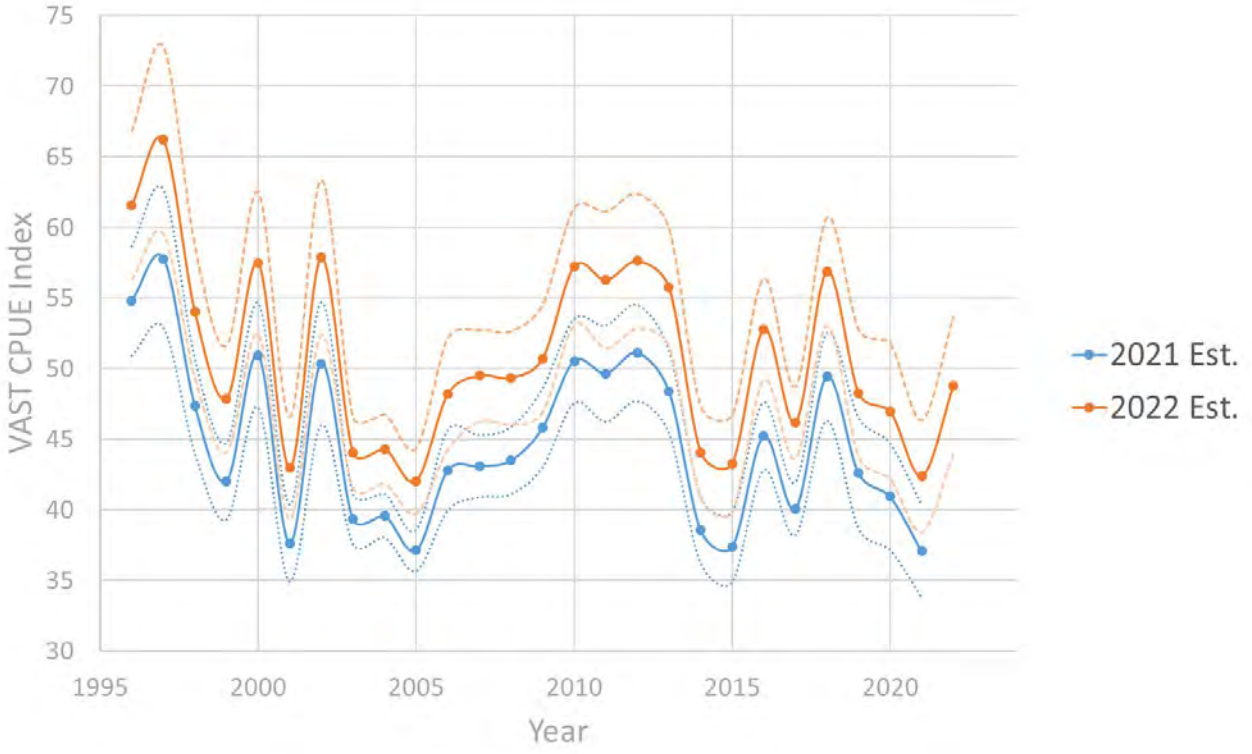




- Southwestward shift in center of gravity
- Low level of fishing in NBS

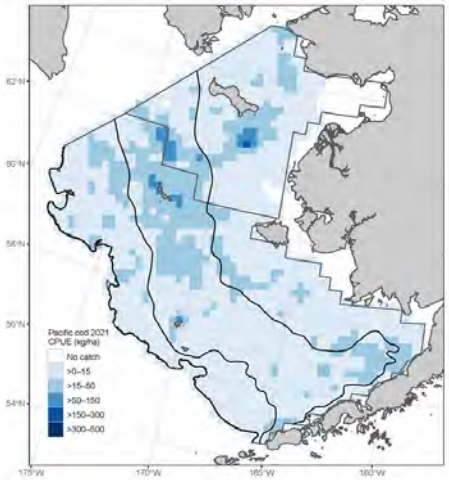
VAST CPUE INDEX – JAN.-FEB. LONGLINE FISHERY

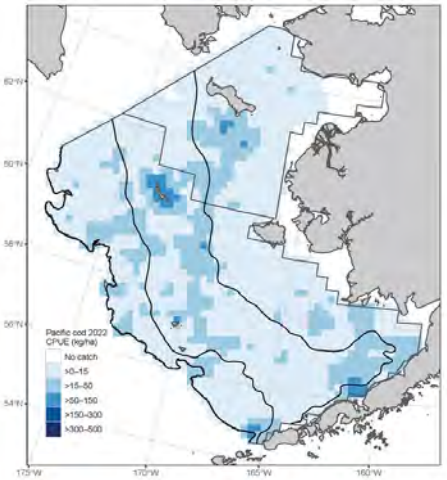
- Difference in spatial extent resulted in overall inflation of index
- Trend remains the same with high correlation between indices
- 15% Increase in 2022 from 2021

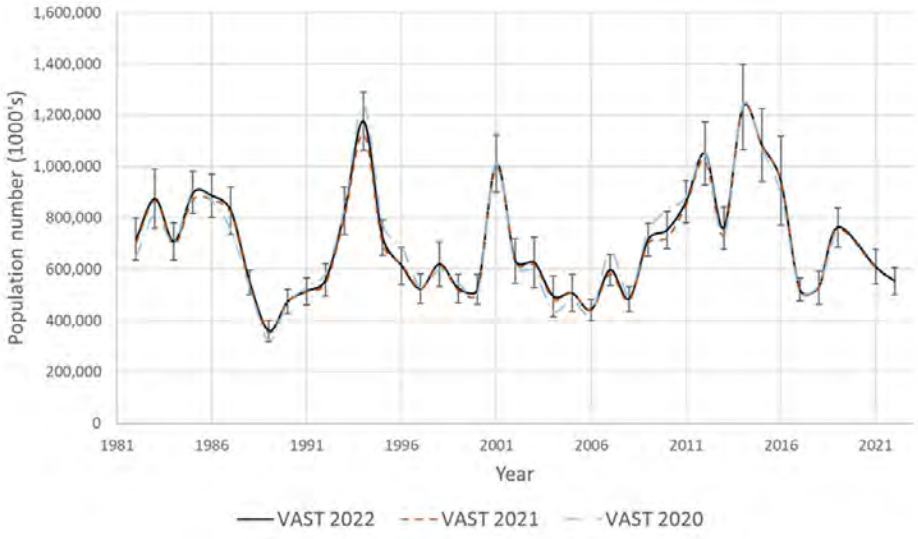


VAST SURVEY INDEX – BERING SEA SHELF BOTTOM TRAWL

- Southeastward shift in center of gravity
- Small changes in time series from previous years
- Overall drop in abundance (VAST -8.9% from 2021)

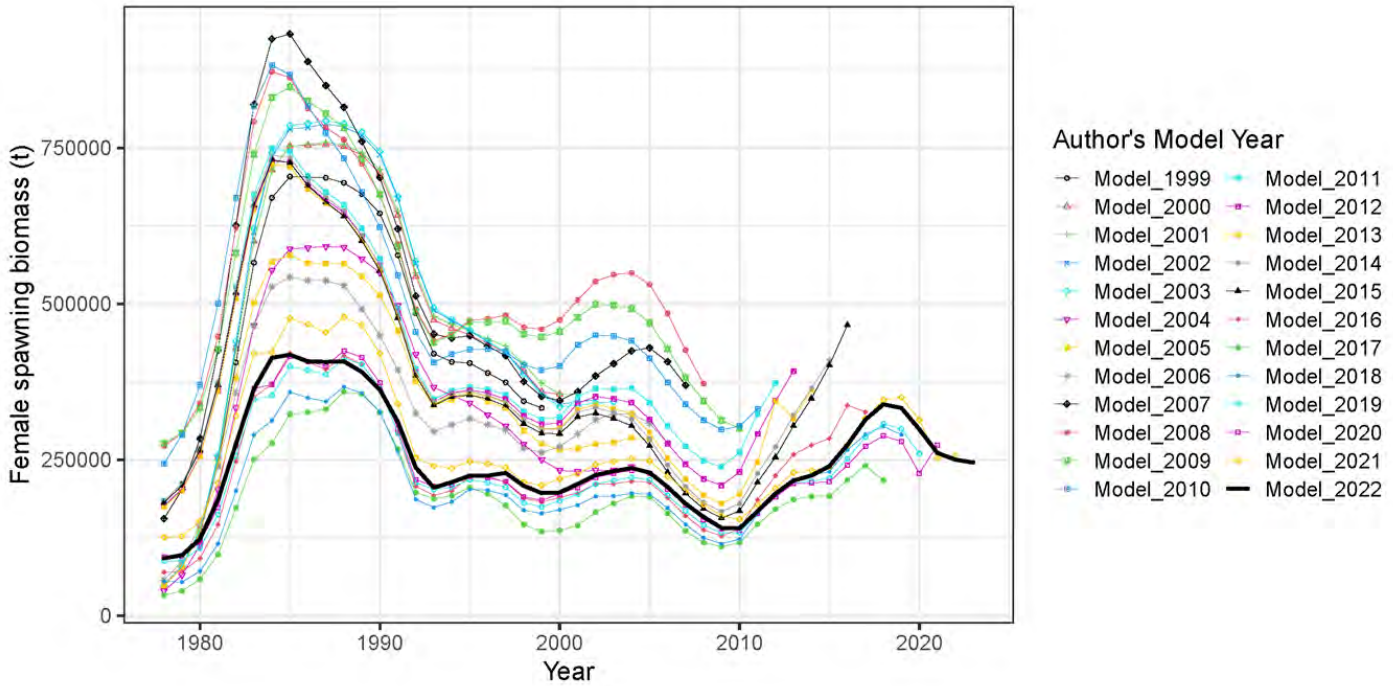






STOCK ASSESSMENT MODELS

- Diverse set of models over the past 22 years
- Current base model is an ensemble of 4 models



MODEL CONFIGURATIONS

Thompson Series models	M 19.12	M 19.12A	M 21.1	M 21.2
New Series models	**M 22.1**	**M 22.2**	**M 22.3**	**M 22.4**
Feature 1: Allow catchability to vary?	**YES**	NO	NO	NO
Feature 2: Allow domed survey selectivity?	NO	NO	**YES**	NO
Feature 3: Use fishery CPUE?	NO	NO	NO	**YES**

New Series models - Same as Thompson Series models except

- Seasonally corrected annual weight-at-length adjustments removed
- Post-2007 aging bias block removed
- Although minor model changes, substantial changes in data processing resulting in model name changes for this year.

MODEL WEIGHTING (SAME AS LAST YEAR)

Feature		M 19.12 M 22.1	M 19.12A M 22.2	M 21.1 M 22.3	M 21.2 M 22.4
Feature 1: Allow catchability to vary?		yes	no	no	no
Feature 2: Allow domed survey selectivity?		no	no	yes	no
Feature 3: Use fishery CPUE?		no	no	no	yes
Criterion	Emph.	M 19.12 M 22.1	M 19.12A M 22.2	M 21.1 M 22.3	M 21.2 M 22.4
General plausibility of the model	3	1	2	0.6667	1
Acceptable retrospective bias	3	2	2	1.3333	1
Uses properly vetted data	3	2	2	2	0
Acceptable residual patterns	3	2	2	2	2
Comparable complexity	2	1	2	1	2
Fits consistent with variances	2	2	1	1	0
Average emphasis:		1.6875	1.875	1.375	1
Model weight:		0.2842	0.3158	0.2316	0.1684

MODEL FITS

- Exploration of individual models and their fits can be found at the link provided

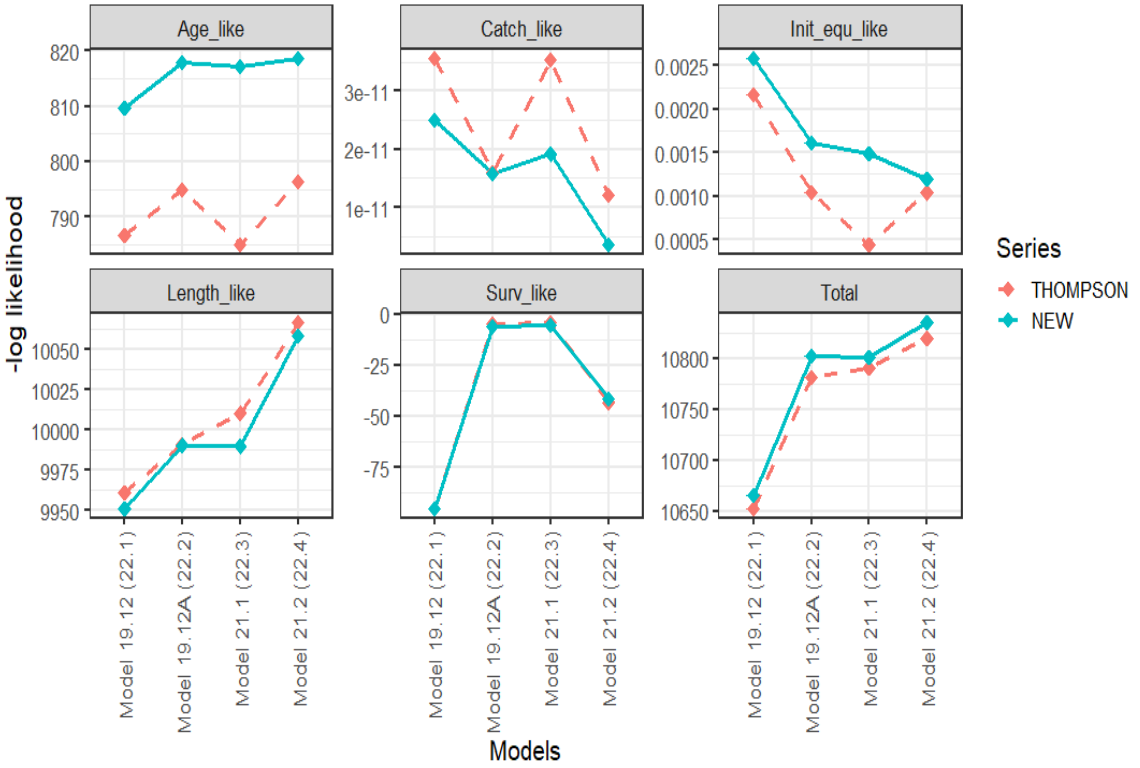
- Model fits and results were nearly identical between the Thompson and New Series models

- Largest difference was the fit to the age composition data with a degraded fit due to the removal of the post-2007 aging bias

https://afsc-assessments.github.io/EBS_PCOD/2022_ASSESSMENT/NOVEMBER_MODELS/

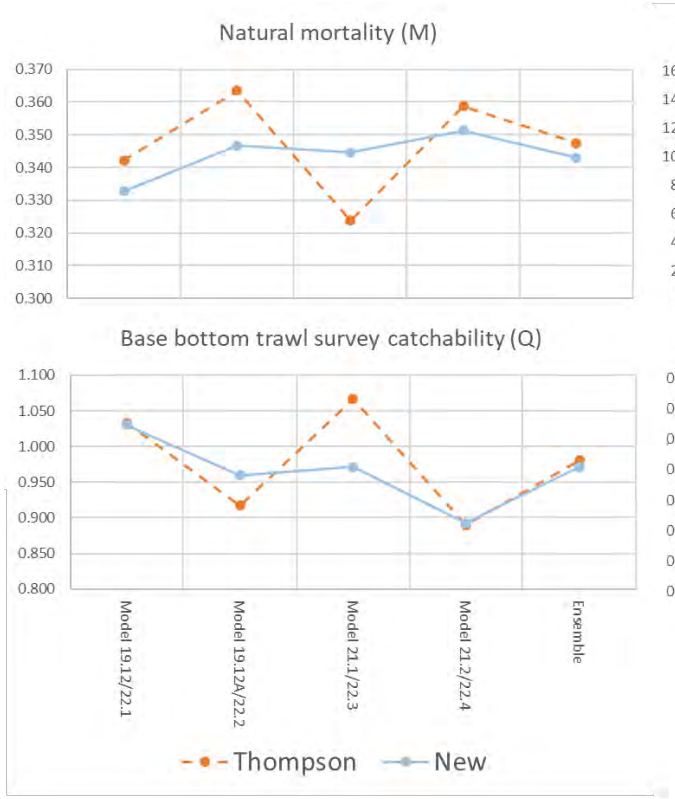
MODELS – OBJECTIVE FUNCTION

- Can not compare across models in a series, but can look at between models across series
- Largest difference between series is the fit to the age composition



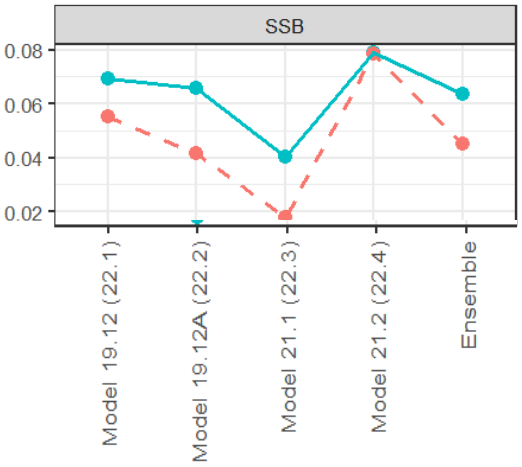
MODELS – PARAMETERS

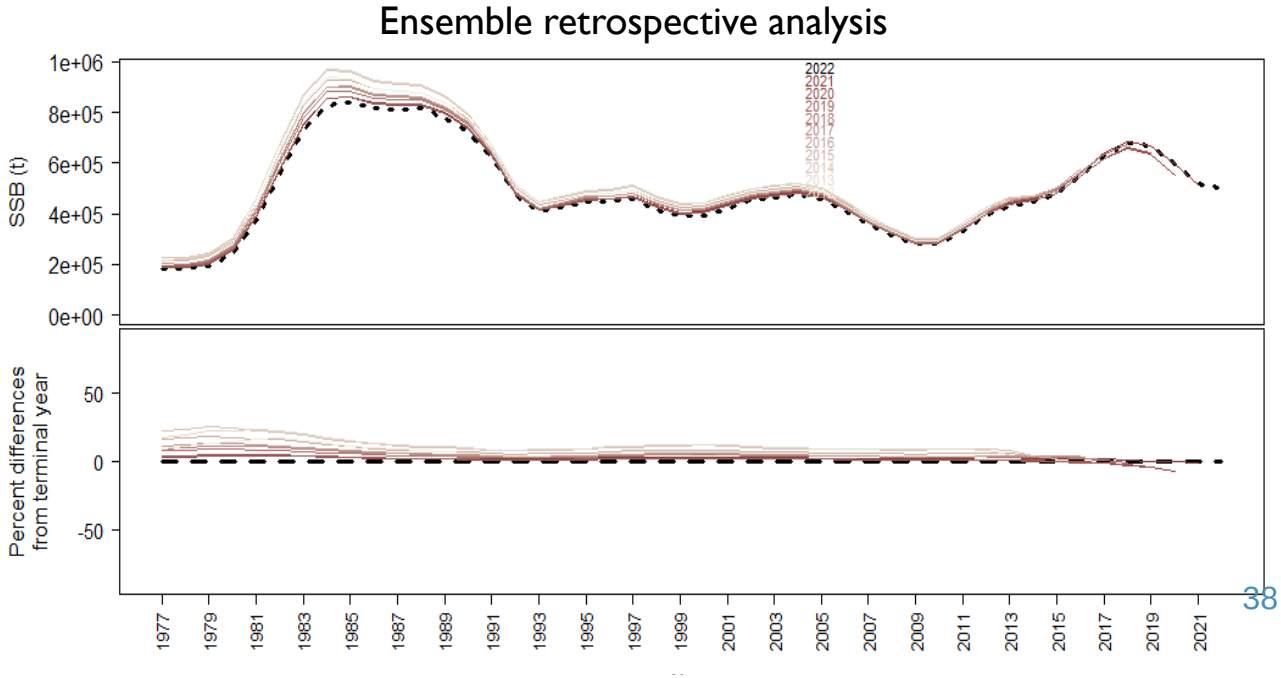
- Similar values between the ensembles
- Higher variability in parameters from the individual Thompson Series models



MODELS – RETROSPECTIVE ANALYSIS

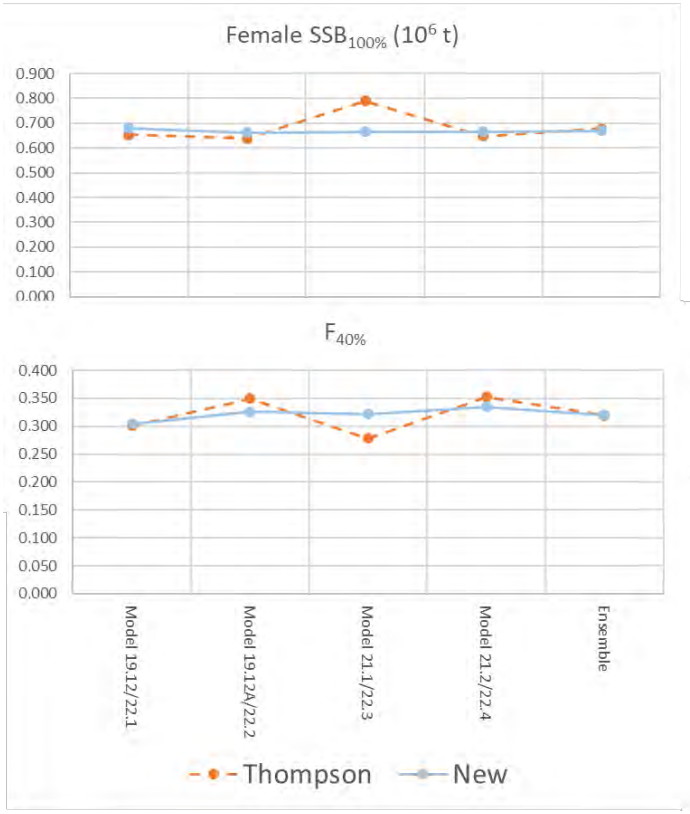
- Consistently low positive bias on Mohn's ρ for SSB from both series





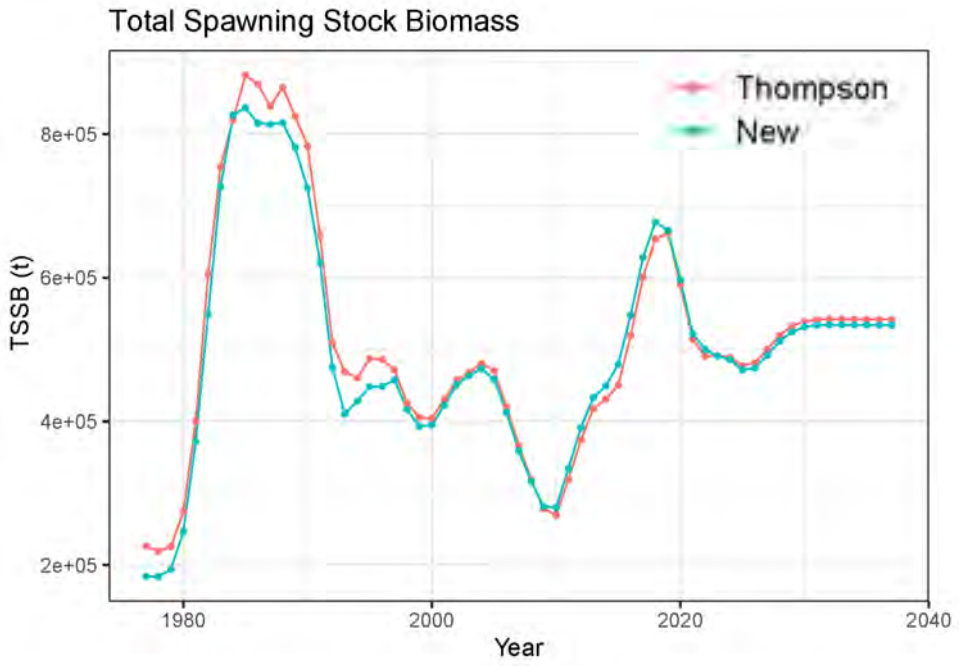
MODELS – DERIVED QUANTITIES

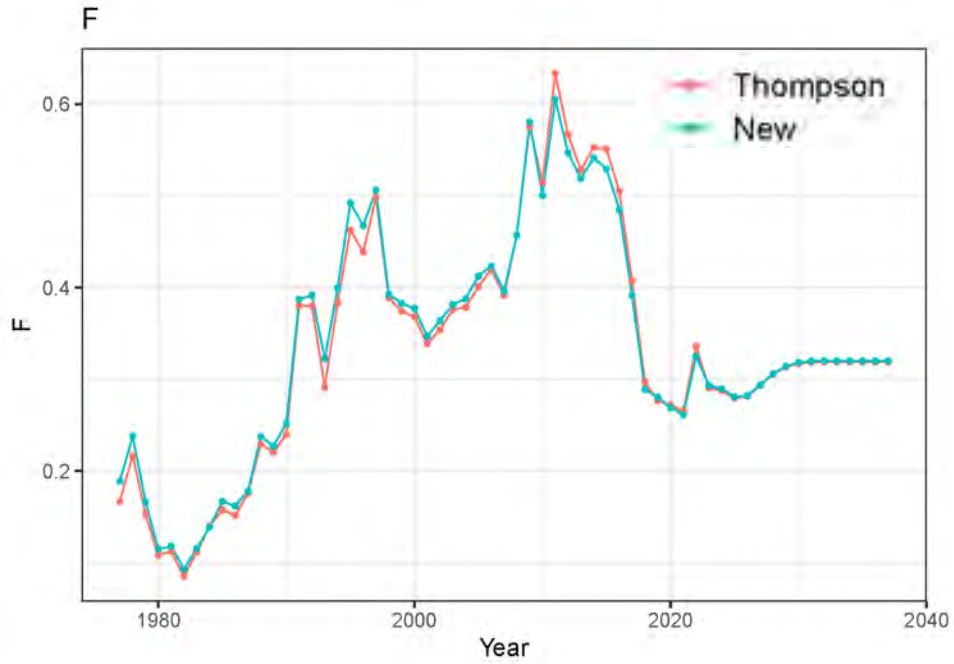
- As with the parameters the derived quantities are similar, but less variable for the New Series.
- Ensemble values are very similar.



MODELS – DERIVED QUANTITIES

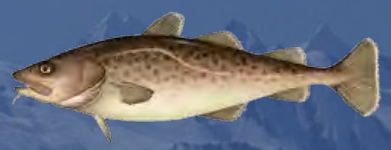
- Spawning biomass slightly higher in early part for Thompson Series



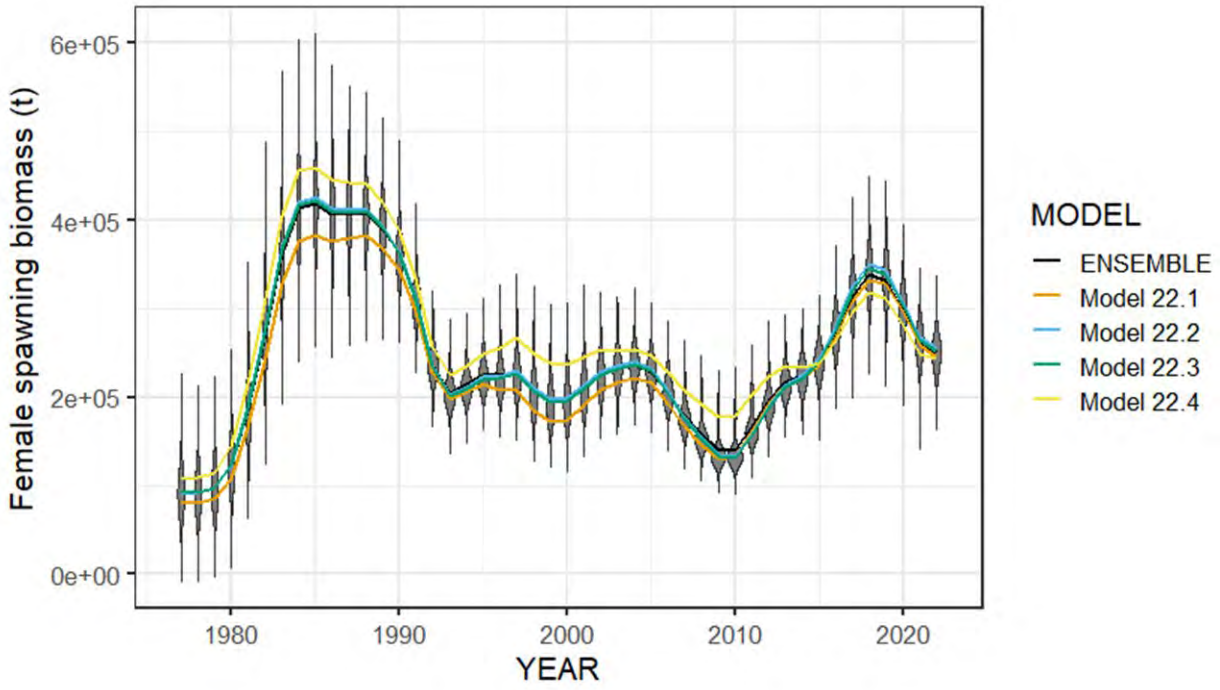


- Higher variability in fishing mortality in Thompson Series

NEW SERIES RESULTS – FEMALE SPAWNING BIOMASS

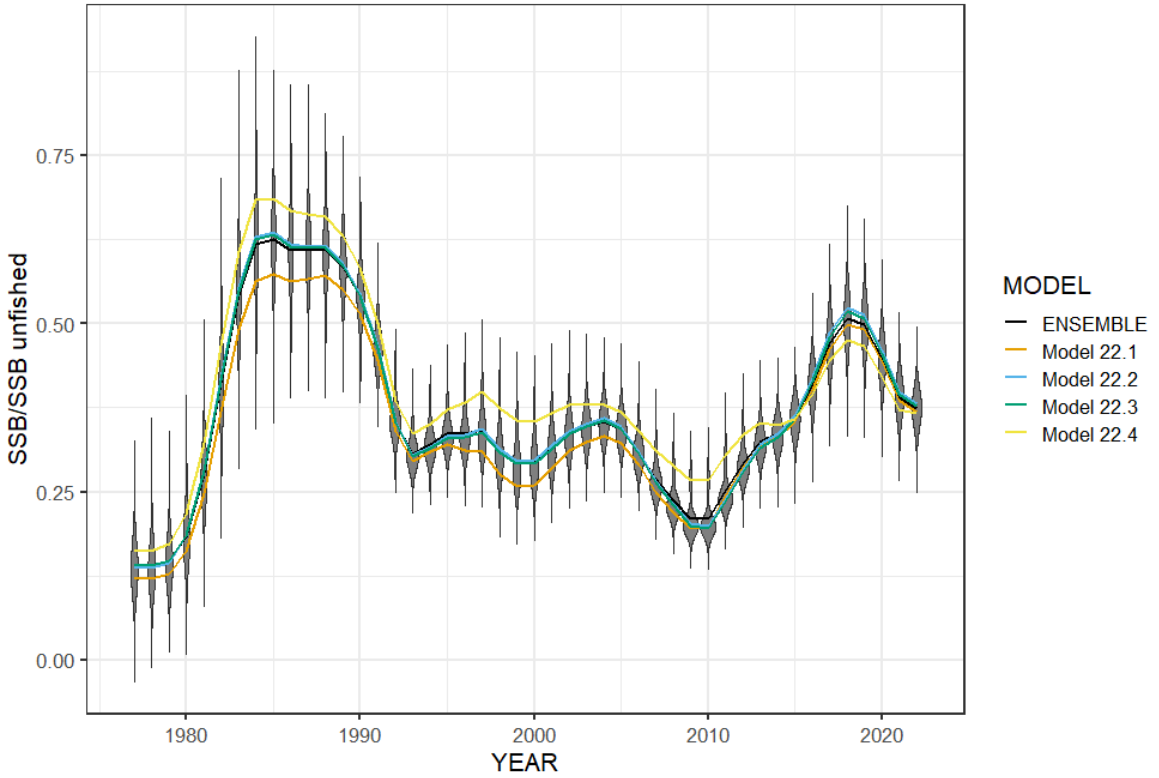


- All four models show reduction from 2018 high point.
- Model 22.4 with CPUE index indicates higher SSB earlier in the time series and lower in most recent



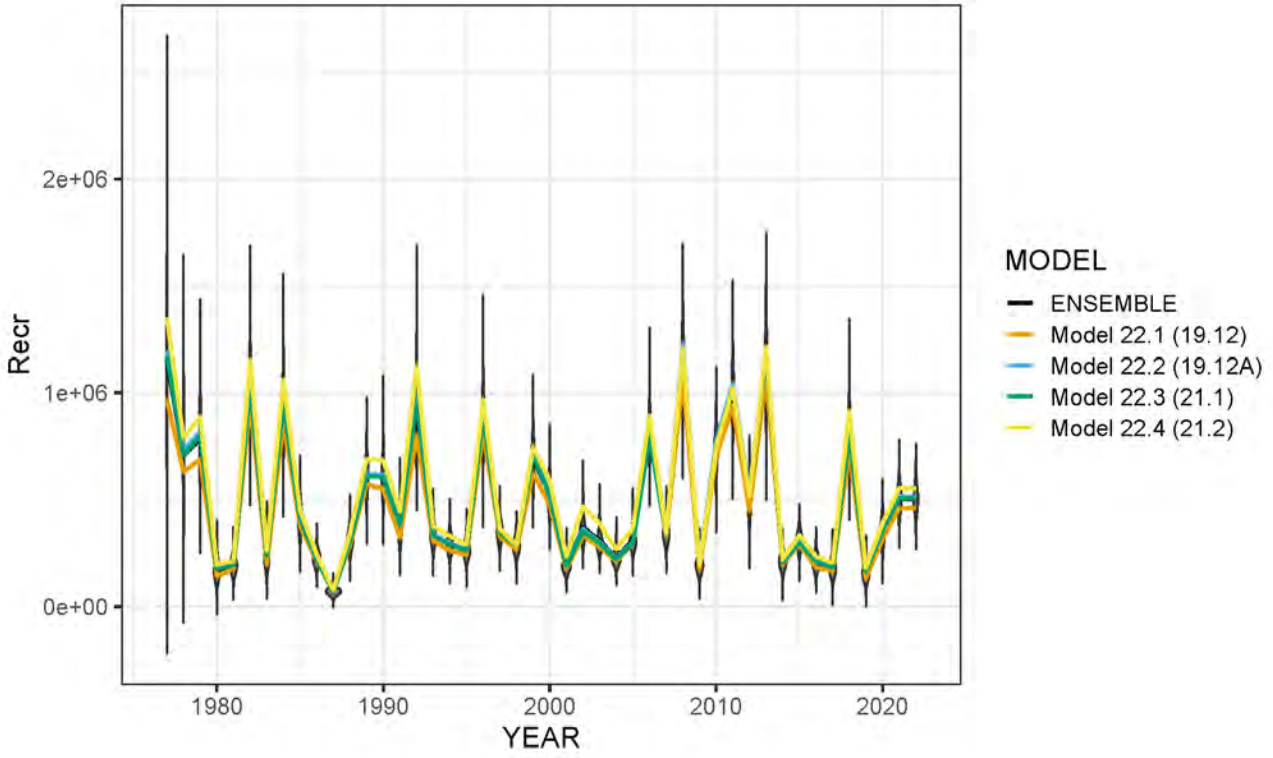
NEW SERIES RESULTS – FEMALE SPAWNING BIOMASS

- High point in the mid to late 1980s
- Low point in 2010 at $B_{21\%}$
- Currently below $B_{40\%}$



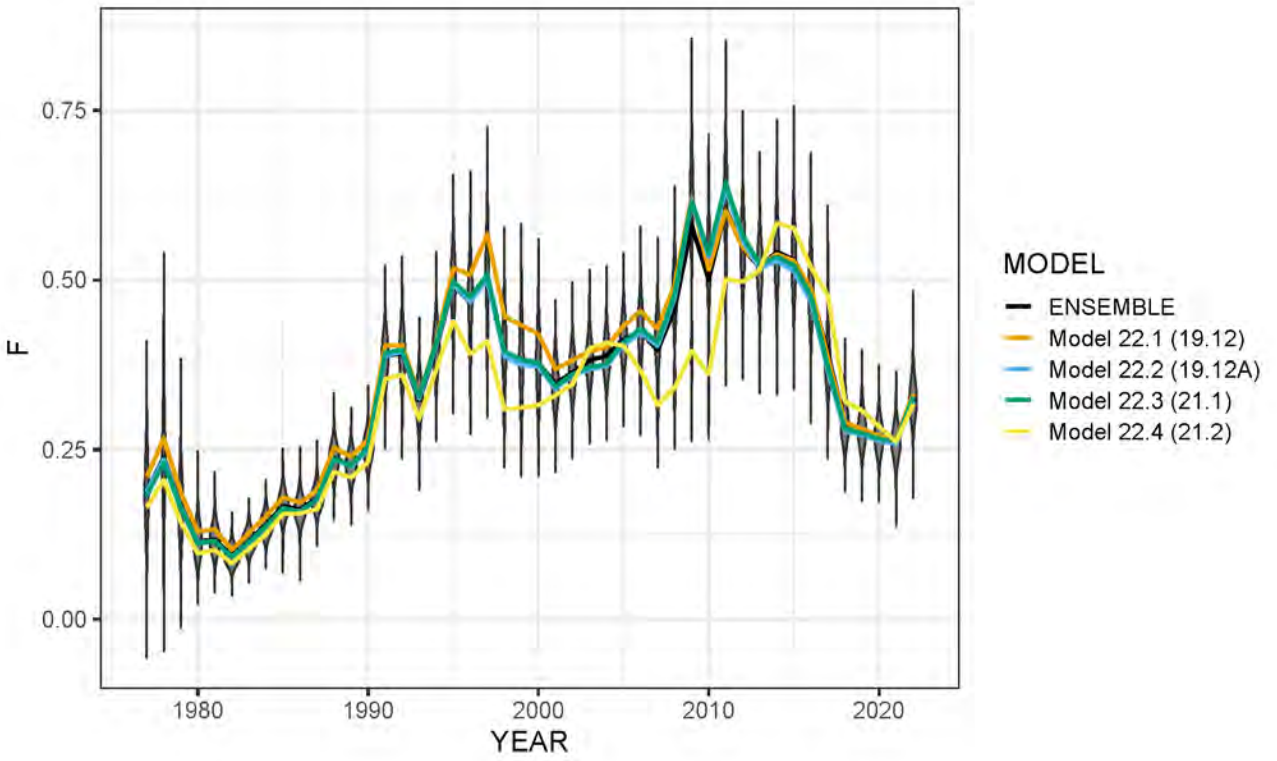
NEW SERIES RESULTS – AGE-0 RECRUITMENT

- Large 2018 year class
- 2014-2017, 2019, and 2020 estimated to be below average
- 2021 and 2022 set at ~R_0 as not yet well defined in the data.



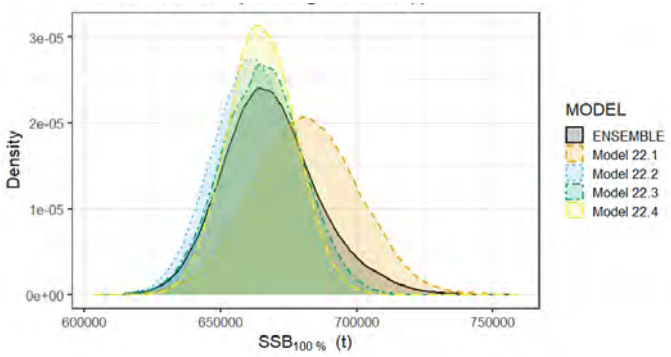
NEW SERIES RESULTS – APICAL FISHING MORTALITY

- High fishing mortality from 2008-2016 with dome-shaped survey selectivity
- Drop in F 2017-2021 change to asymptotic survey selectivity.
- Increase in 2022 due again to change in model with ensemble



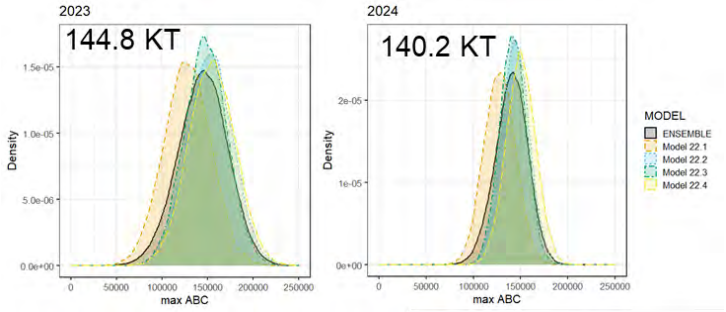
HARVEST RECOMMENDATION – NEW SERIES ENSEMBLE

Unfished SSB (t)

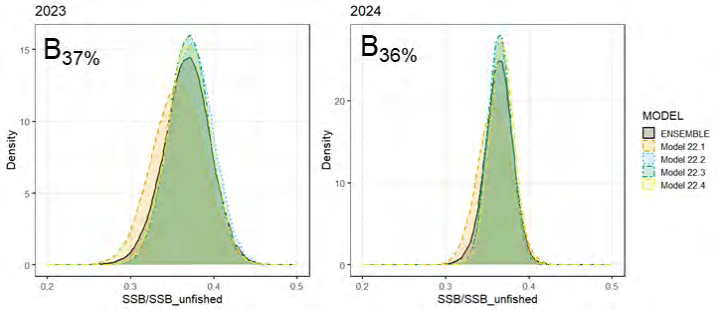


Year	Quantity	Last Year	New Series	Change
	$B_{100\%}$	686,761	668,477	-2.70%
2023	Tot Biom Age 0+	848,615	844,578	-0.50%
2023	B_{2023}	254,585	245,594	-3.50%
2023	$B_{\%}$	0.370	0.367	-0.80%
2023	$maxF_{ABC}$	0.310	0.293	-5.50%
2023	maxABC	151,709	144,834	-4.50%
2024	Tot biom Age 0+		831,566	
2024	B_{2024}		242,911	
2024	$B_{\%}$		0.364	
2024	$maxF_{ABC}$		0.29	
2024	maxABC		140,159	

ABC

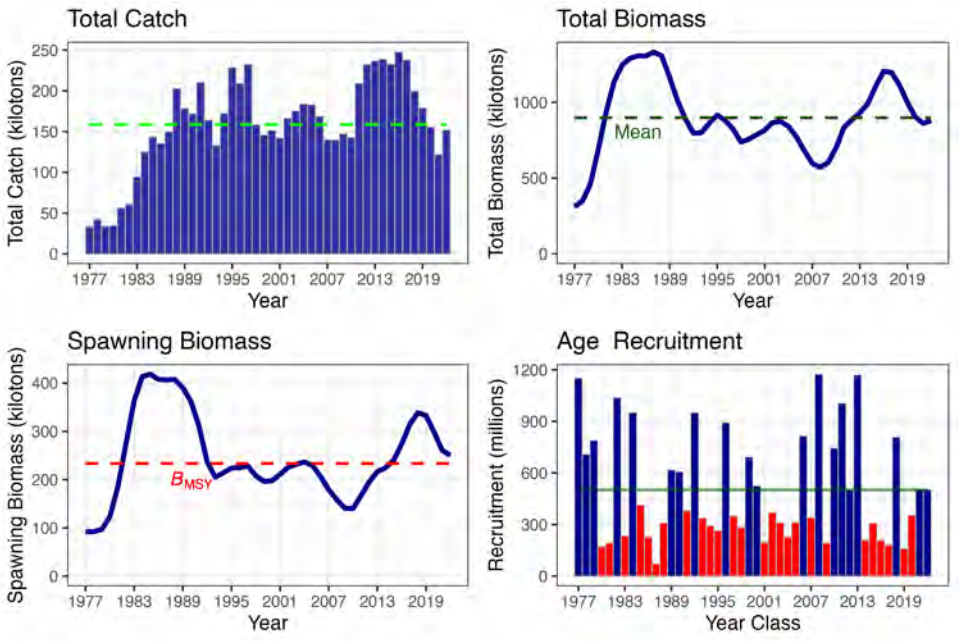


Bratio



CHAPTER 2
EBS PACIFIC COD

- New model(s): yes; change from base: yes; risk table (1,1,1,1)
- Team agreed with author's recommendation of using the New Series ensemble



Quantity	Last asmt.	This asmt.	Change
M	0.34	0.34	0%
2022 Tier	3b		
2023 Tier	3b	3b	
2022 age+ biomass	879,978		-4%
2023 age+ biomass	848,615	844,578	-0.5%
2022 spawning biomass	259,789		-5%
2023 spawning biomass	254,585	245,594	-4%
B_0	686,761	668,477	-3%
2023 F_{OFL}	0.380	0.360	-5%
2023 F_{ABC}	0.310	0.290	-6%
2022 OFL	183,012		-6%
2023 OFL	180,909	172,495	-5%
2022 ABC	153,383		-6%
2023 ABC	151,709	144,834	-5%

CHAPTER 2
EBS PACIFIC COD RECOMMENDATIONS

Pacific cod- EBS Ecosystem and Socioeconomic Profile (ESP)

- The Team recommended the ESP team investigate options for cooperative research and communication with the fleet and observer program to collect Pacific cod stomachs in the fishery.

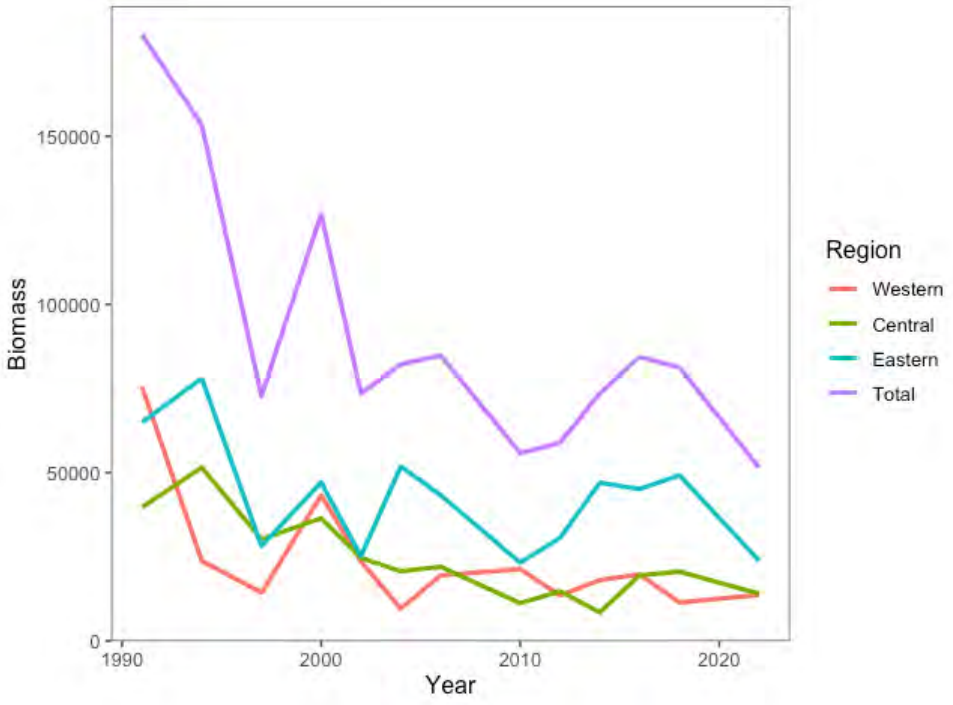
Pacific cod- EBS

- The Team recommended the authors explore the sensitivity of the terminal year fishery size composition data that have not been debriefed or may not be representative of a full year of data.

CHAPTER 2A: AI PACIFIC COD

- New model(s): yes; change from base: no; risk table (1,2,2,1)

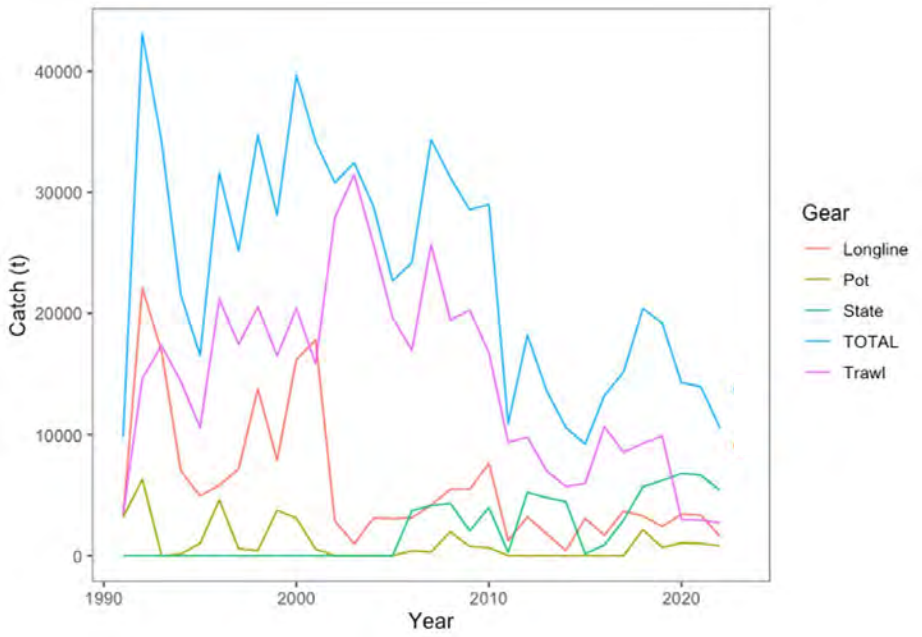
- 2022 AI bottom trawl survey
  - -37% from 2018
  - lowest in time series
- Development of two new age-structured models
  - Not recommended for management by author due to positive retrospective bias
    - Lack of survey in 2020 and potential change in productivity in AI may be cause of bias



CHAPTER 2A:
AI PACIFIC COD

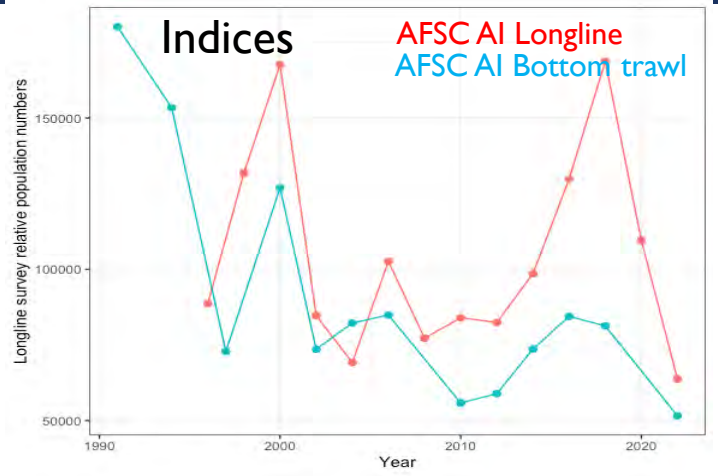
- New model(s): yes; change from base: no; risk table (1,2,2,1)

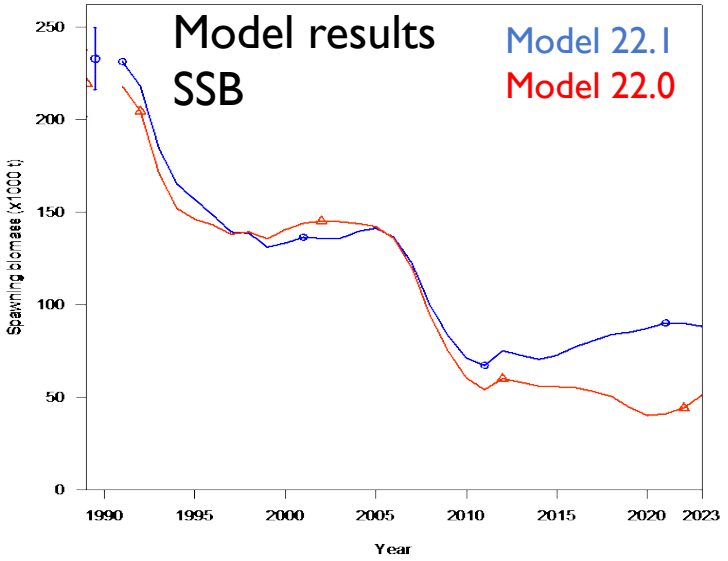
- 2022 AI bottom trawl survey
  - -37% from 2018
  - lowest in time series
- Development of two new age-structured models
  - Not recommended for management by author due to positive retrospective bias
    - Lack of survey in 2020 and potential change in productivity in AI may be cause of bias



CHAPTER 2A:
AI PACIFIC COD

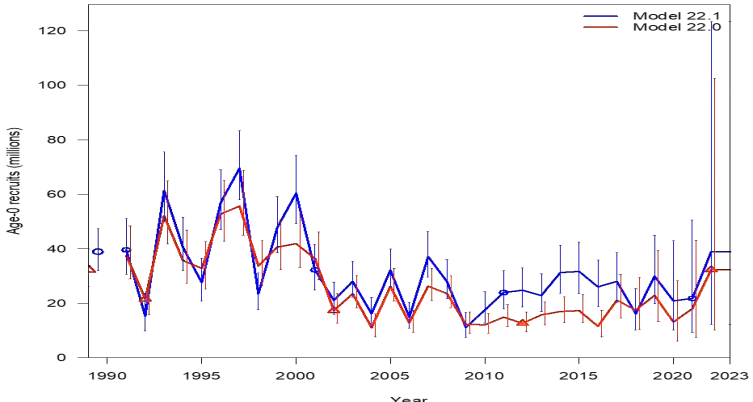
- Model 22.0 (Simple)
  - Single fishery
  - AFSC AI bottom trawl index
- Model 22.1 (Complex)
  - 3 fisheries (longline, pot, trawl)
  - 2 surveys
    - AFSC AI bottom trawl index
    - AFSC AI longline index

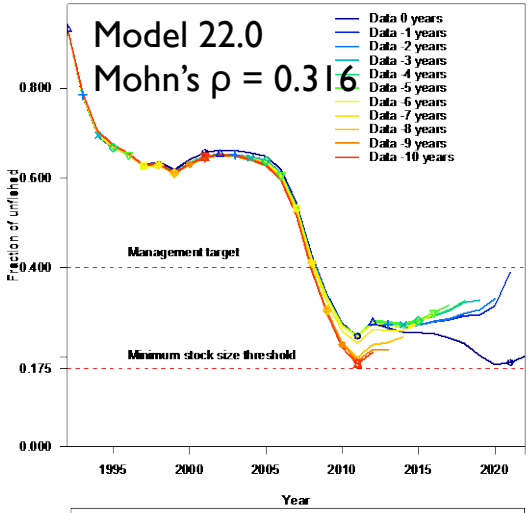


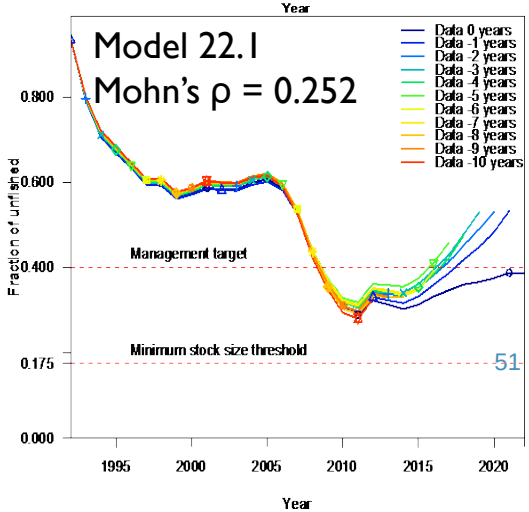


CHAPTER 2A: AI PACIFIC COD

- Both age-structured models have high positive retrospective bias leading to optimistic projections with lack of data
  - Bias is due to overly optimistic estimates of R_0
- Neither model shows the stock reaching R_0 in over 20 years.



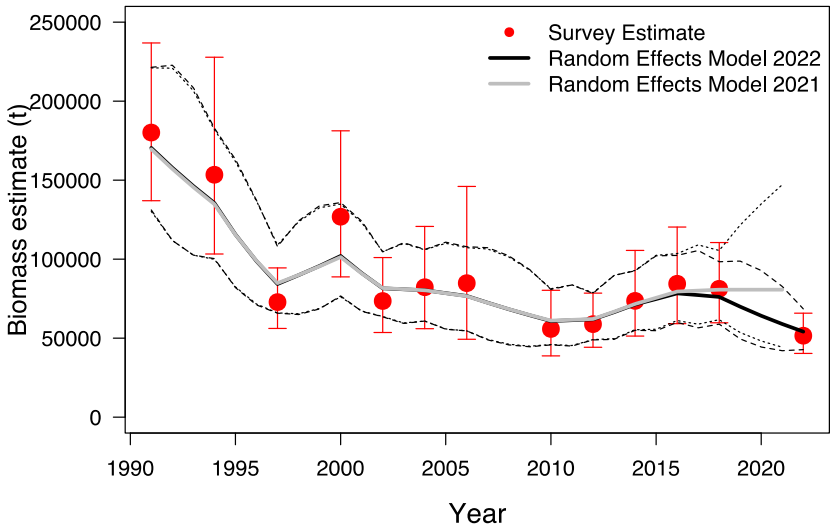




CHAPTER 2A: AI PACIFIC COD

- New model(s): yes; change from base: no; risk table (1,2,2,1)

- Team agreed with authors' recommendation of using Tier 5 random effects model



Quantity	Last asmt.	This asmt.	Change
M	0.34	0.34	0
2022 tier	5		
2023 tier	5	5	
Biomass	80,700	54,165	-49%
2023 F_{OFL}	0.340	0.340	0%
2023 F_{ABC}	0.255	0.255	0%
2022 OFL	27,400		-33%
2023 OFL	27,400	18,416	-33%
2022 ABC	20,600		-33%
2023 ABC	20,600	13,812	-33%

CHAPTER 2A
AI PACIFIC COD RECOMMENDATIONS

- The Team recommended the author continue to present the age-structured models shown this year for future consideration.
- The Team recommended that this stock remain on an annual cycle and not be considered for reduction in assessment frequency when the Teams considers stock prioritization.
- The Team recognized the importance of the survey to the assessment of this stock and recommended that an Aleutian Islands trawl survey be completed as part of its biennial schedule in 2024.

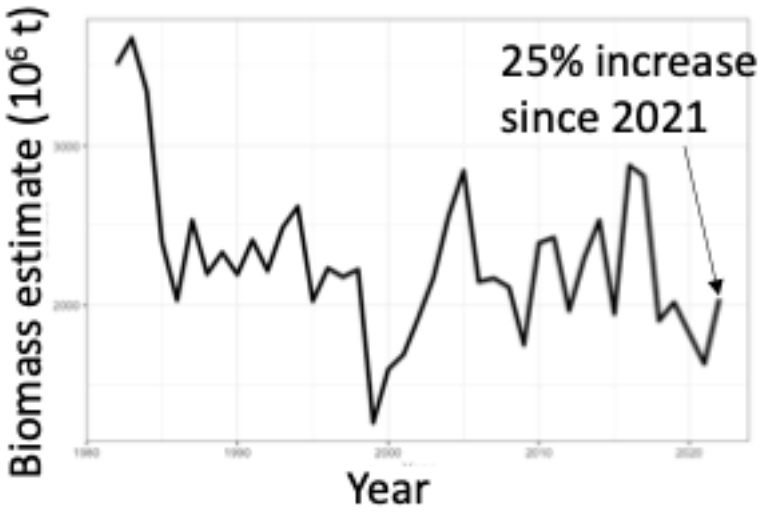
FLATFISH SUMMARY

Stock	Tier	2023 ABC (t)	2023 OFL (t)	Change from 2022 ABC
Yellowfin sole	1a	378,499	404,882	7%
Greenland turbot	3a	**3,722*(6%)**	4,645	-43%
Arrowtooth flounder	3a	83,852	98,787	4%
Kamchatka flounder	3a	7,579	8,946	-18%
Northern rock sole	1a	**121,719*(23%)**	166,034	-41%
Flathead sole (partial)	3a	65,244	79,256	2%
Alaska plaice (partial)	3a	33,946	40,823	4%
Other flatfish (none)	5	17,189	22,919	0%

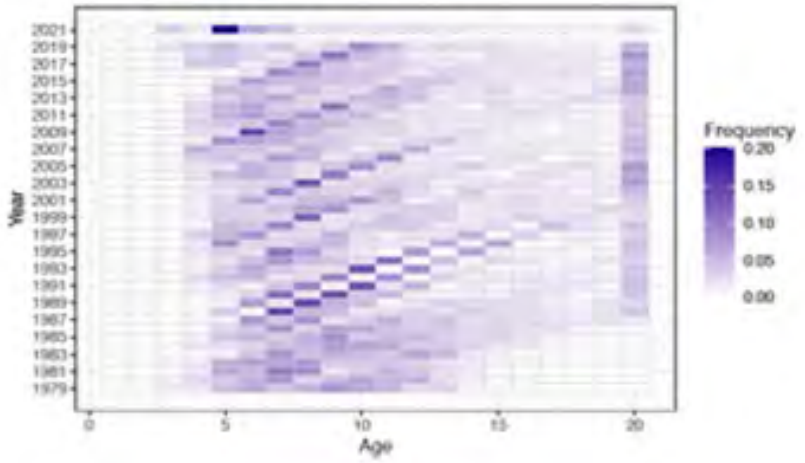
***xx% Reduced from maximum permissible ABC**

CHAPTER 4
YELLOWFIN SOLE

- New model(s): yes; change from base: yes; risk table (1,1,1,1)
  - Increase in survey biomass from 2021
  - Large 2017 year class

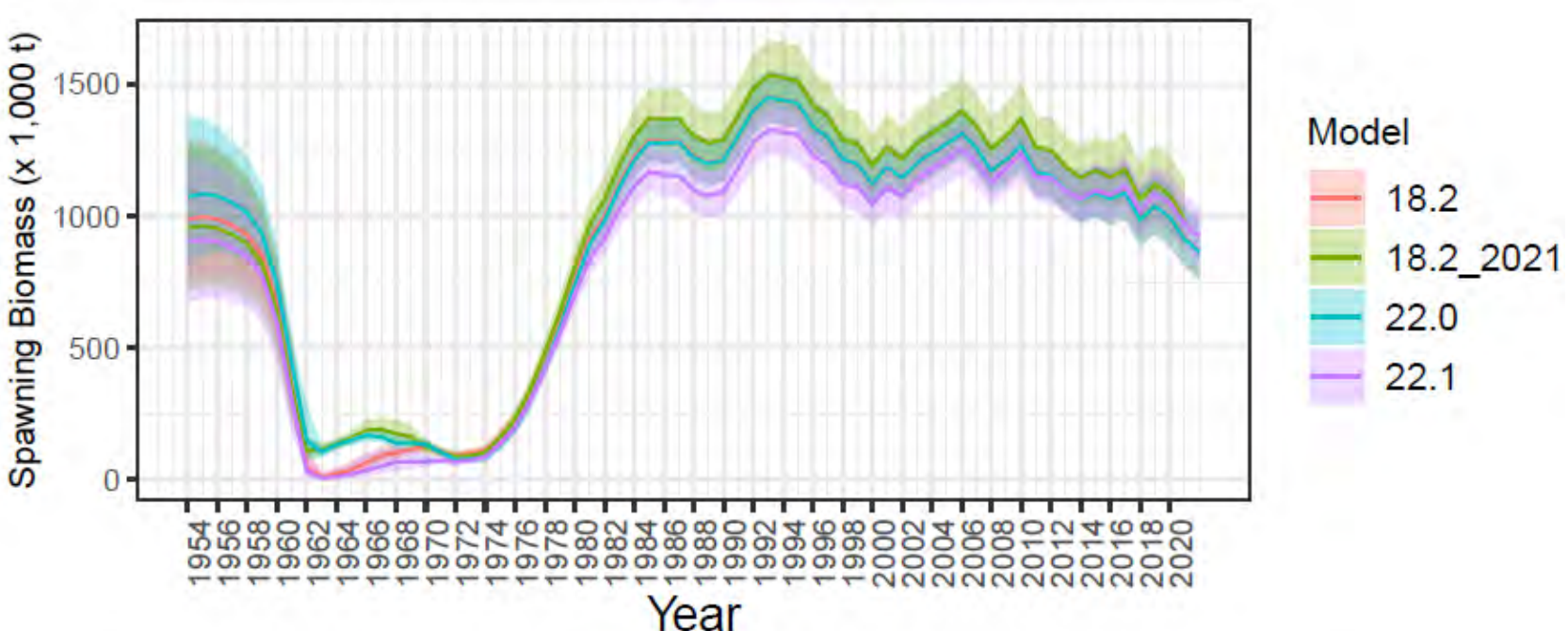


Survey age comps indicate very strong 2017 year class.



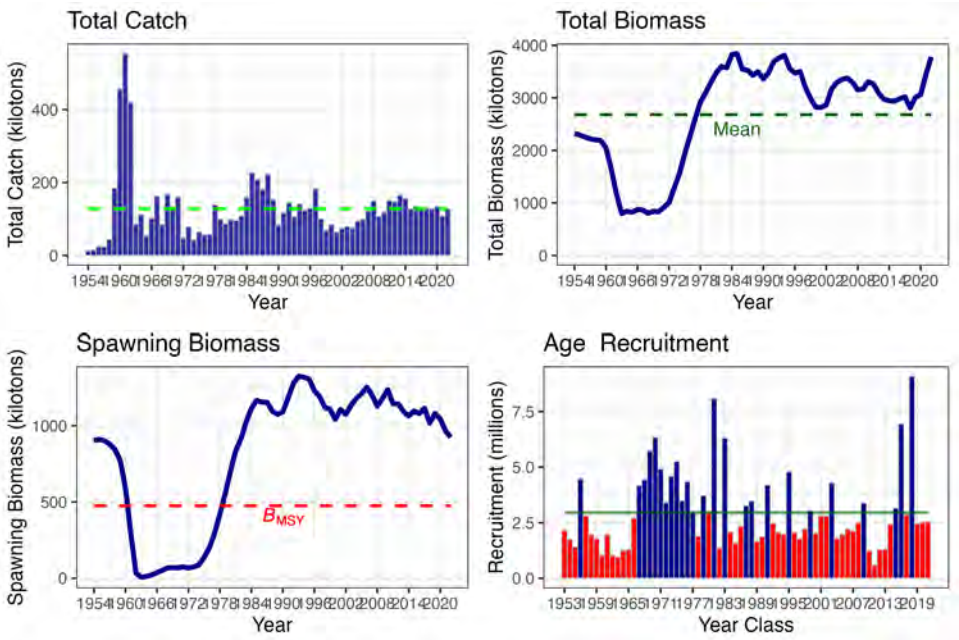
CHAPTER 4
YELLOWFIN SOLE

- New model(s): yes; change from base: yes; risk table (1,1,1,1)
- Two new models
  - **22.0** Single sex selectivity (nearly identical to 18.2)
  - **22.1** 22.0 W/ VAST EBS & NBS survey index



CHAPTER 4
YELLOWFIN SOLE

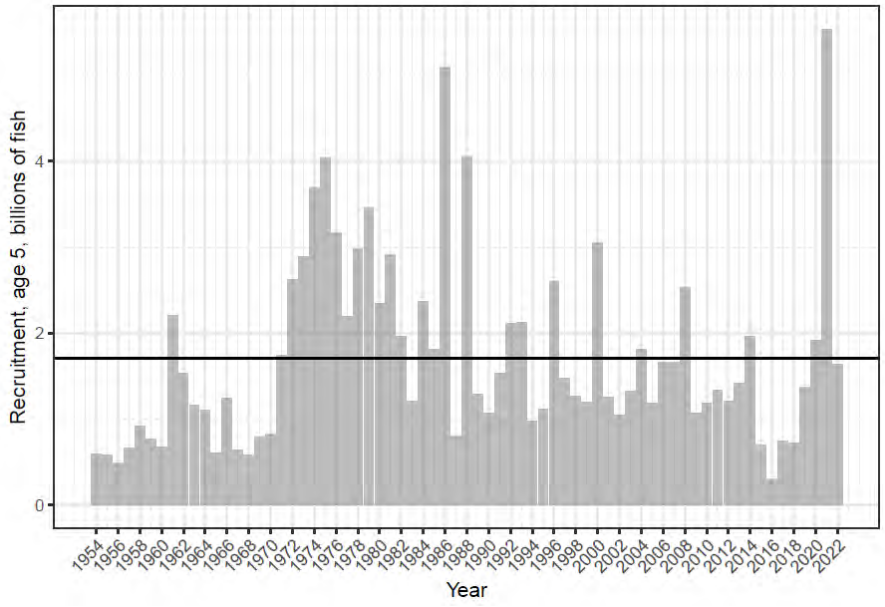
- New model(s): yes; change from base: yes; risk table (1,1,1,1)
- Sharp increase in total biomass
- Gradual projected increase in SSB

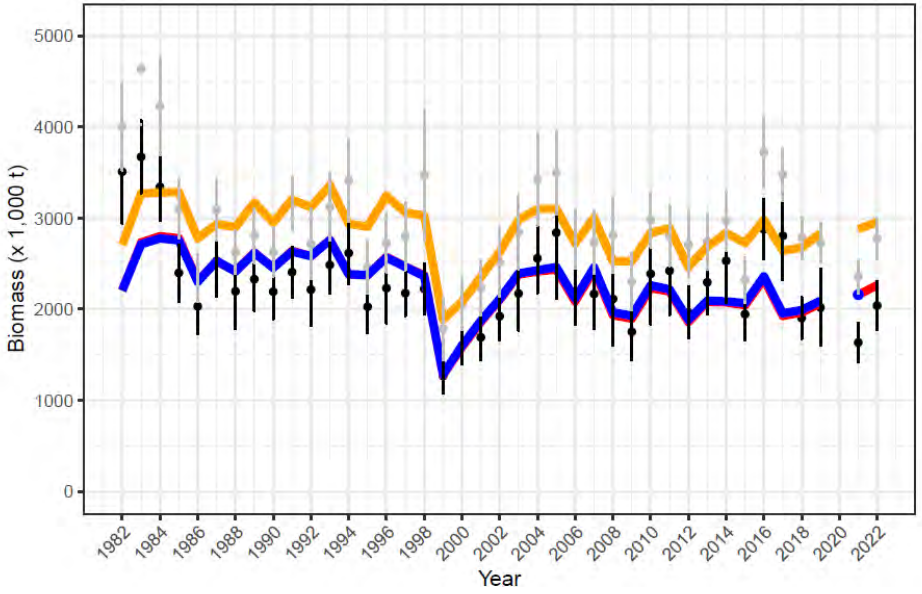


Quantity	Last asmt.	This asmt.	Change
M	0.12/0.135	0.12/0.125	
2022 Tier	1a		
2023 Tier	1a	1a	
2022 age+ biomass	2,479,370		34%
2023 age+ biomass	2,284,820	3,321,640	45%
2022 spawning biomass	857,101		3%
2023 spawning biomass	727,101	885,444	22%
B_0	1,489,190	1,407,000	-6%
B_{msy}	495,904	475,199	-4%
2023 F_{OFL}	0.152	0.122	-20%
2023 F_{ABC}	0.143	0.114	-20%
2022 OFL	377,071		7%
2023 OFL	347,483	404,882	17%
2022 ABC	354,014		7%
2023 ABC	326,235	378,499	16%

CHAPTER 4
YELLOWFIN SOLE RECOMMENDATIONS

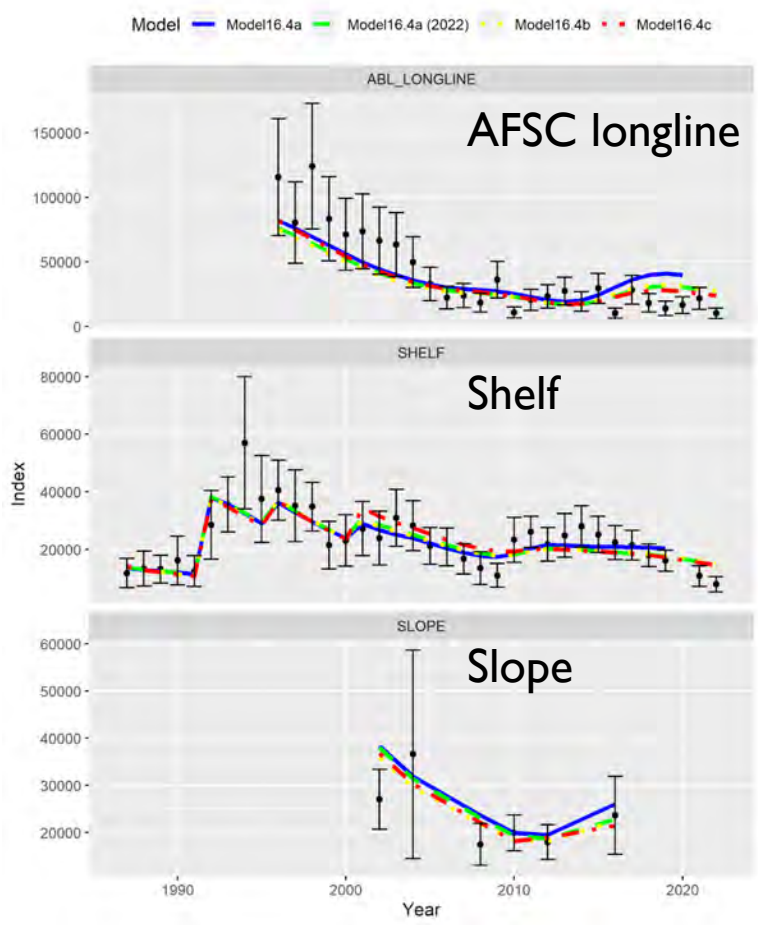
- The Team recommended to include the recruitment retrospective analysis in the next full assessment.
- The Team recommended a comparison of the EBS only and the combined EBS+NBS model-based estimates to determine if the inflation of the estimates was due to the VAST method or the addition of the NBS.





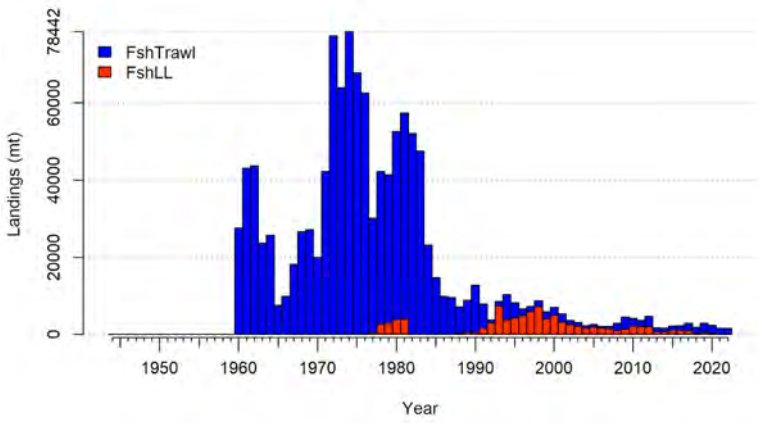
CHAPTER 5
GREENLAND TURBOT

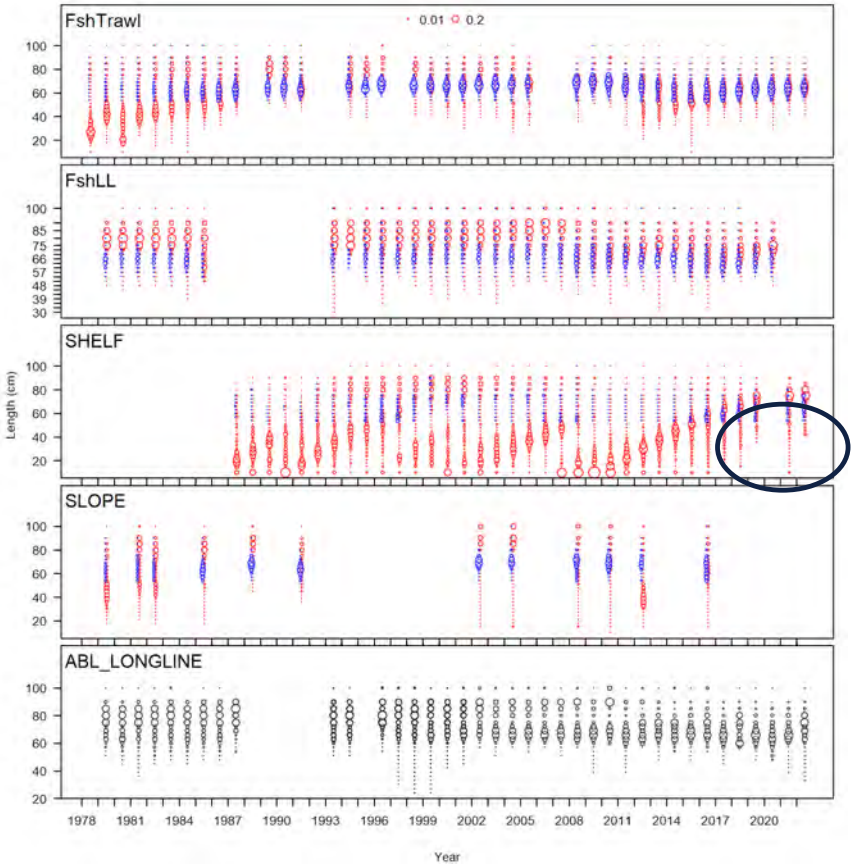
- New model(s): yes; change from base: yes; risk table (2,2,1,1)
- AFSC longline has been relatively flat in recent years with small decline in 2022
- EBS shelf survey biomass declined by 33% in 2021 and 26% in 2022
- Minor changes made in assessment model
  - Included AFSC LL length data and estimated selectivity
  - EBS slope mean length at age data to inform growth



CHAPTER 5
GREENLAND TURBOT

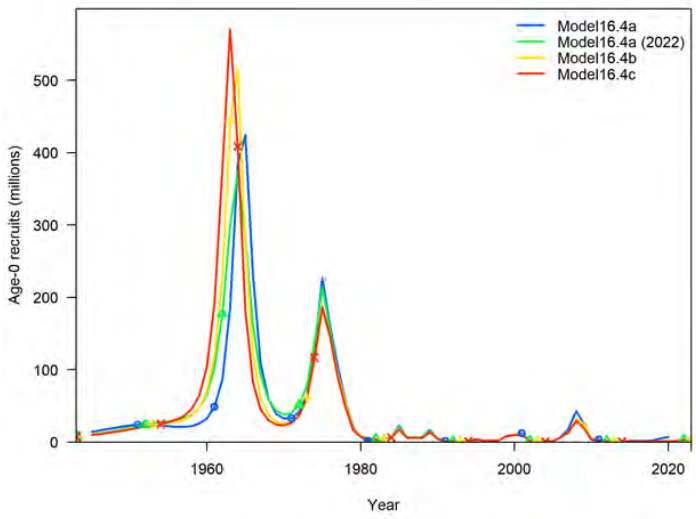
- New model(s): yes; change from base: yes; risk table (2,2,1,1)
- EBS shelf survey is an indicator for young Greenland turbot
- Less smaller, younger fish in recent years
- Longline fishery not actively fishing for GT - no length data in 2021 and 2022





CHAPTER 5
GREENLAND TURBOT RISK TABLE

- Population dynamics – Level 2
  - “Stock is characterized by infrequent recruitment events. The last relatively strong cohorts in the population are from 2007-2009. Given the frequency of past recruitment events, we would have expected another in recent years. However, recruitment has been below average since 2012 and fish younger than 4 years old have not been observed in the EBS shelf bottom trawl survey data since 2018. We score this category as Level 2 given the uncertainty in future recruitment levels.”

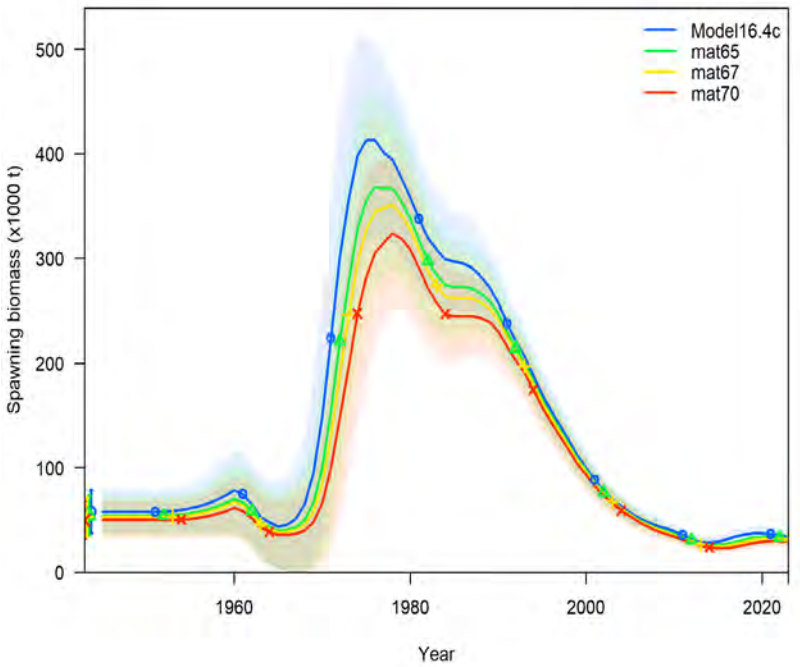


CHAPTER 5
GREENLAND TURBOT RISK TABLE

- Assessment considerations – Level 2
  - The EBS slope survey has not been conducted since 2016
    - Was the main biomass index of the adult population, some uncertainty about the portion of the adult population on the slope
  - Uncertainty about the length at 50% maturity is unresolved
    - Greenland turbot develop 2 cohorts of oocytes (Rideout et al. 2012)
    - Developing cohort: Used for spawning the next year
    - Leading cohort: Larger, advanced cohort used for within year spawning
    - Kennedy et al. (2014) revised estimates of length at 50% maturity for east Greenland Greenland halibut
    - Assumed individuals with only developing cohorts were “functionally immature”
    - Estimate of length at 50% maturity increased

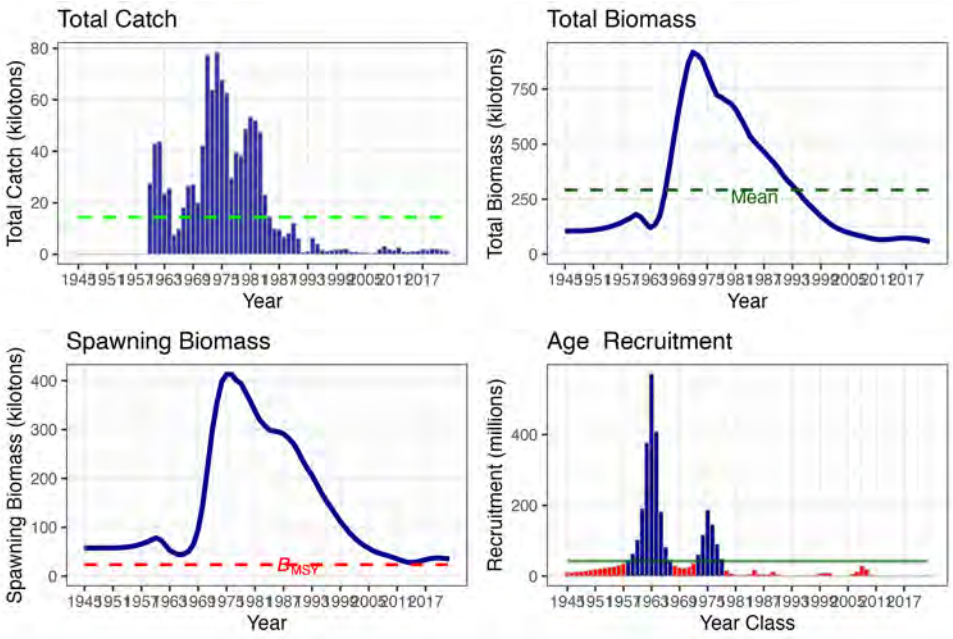
CHAPTER 5
GREENLAND TURBOT RISK TABLE

- Uncertainty about the length at 50% maturity is unresolved
  - Conducted a maturity sensitivity analysis
    - Used estimates from Cooper et al. (2007): 65cm, 67cm, and 70cm
  - Results:
    - SSB reduced by 6% - 13% on average
- Author suggested reduction from maximum permissible ABC was warranted, but did not suggest a specific value



CHAPTER 5
GREENLAND TURBOT

- New model(s): yes; change from base: yes; risk table (2,2,1,1)



Quantity	Last asmt.	This asmt.	Change
M	0.112	0.112	0%
2022 Tier	3a		
2023 Tier	3a	3a	
2022 age+ biomass	84,341		-36%
2023 age+ biomass	80,404	53,907	-33%
2022 spawning biomass	50,361		-33%
2023 spawning biomass	47,376	33,554	-29%
B_0	89,054	67,647	-32%
2023 F_{OFL}	0.220	0.200	-9%
2023 F_{ABC}	0.180	0.170	-6%
2022 OFL	7,687		-40%
2023 OFL	6,698	4,645	-31%
2022 ABC	6,572		-43%
2023 ABC	5,724	3,722	-35%

CHAPTER 5
GREENLAND TURBOT

- New model(s): yes; change from base: yes; risk table (2,2,1,1)
- Team agreed with author's recommendations
- Team recommended 6% reduction from maximum permissible ABC due to assessment concerns.

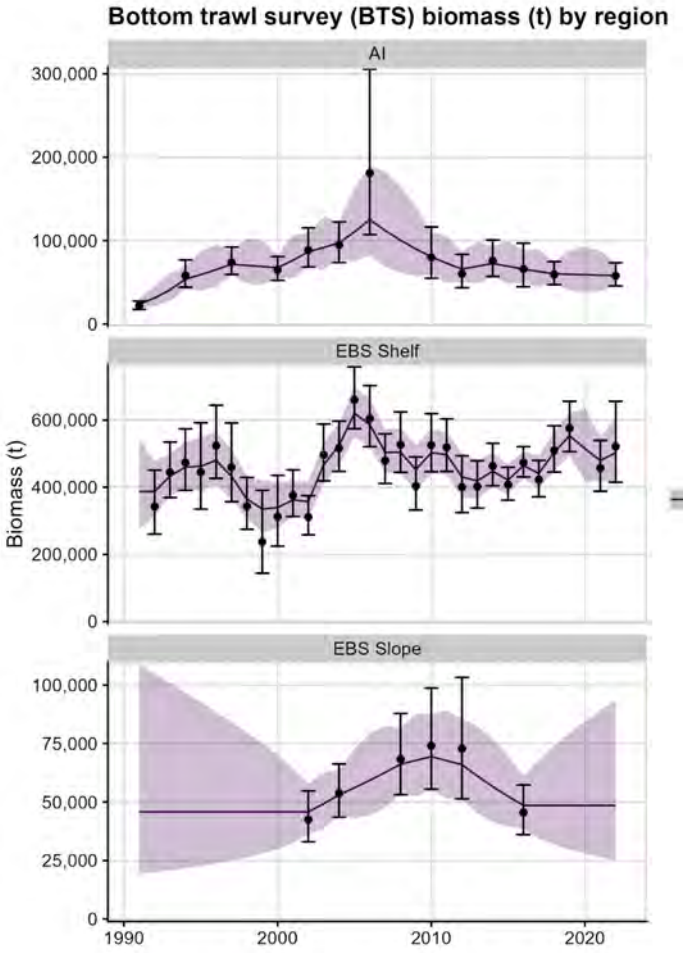
Apportionment:

Area	%	ABC
Bering Sea	84.3%	3772
Aleutian Islands	15.7%	584

Quantity	Last asmt.	This asmt.	Change
M	0.112	0.112	0%
2022 Tier	3a		
2023 Tier	3a	3a	
2022 age+ biomass	84,341		-36%
2023 age+ biomass	80,404	53,907	-33%
2022 spawning biomass	50,361		-33%
2023 spawning biomass	47,376	33,554	-29%
B_0	89,054	67,647	-32%
2023 F_{OFL}	0.220	0.200	-9%
2023 F_{ABC}	0.180	0.170	-6%
2022 OFL	7,687		-40%
2023 OFL	6,698	4,645	-31%
2022 ABC	6,572		-43%
2023 ABC	5,724	3,722	-35%

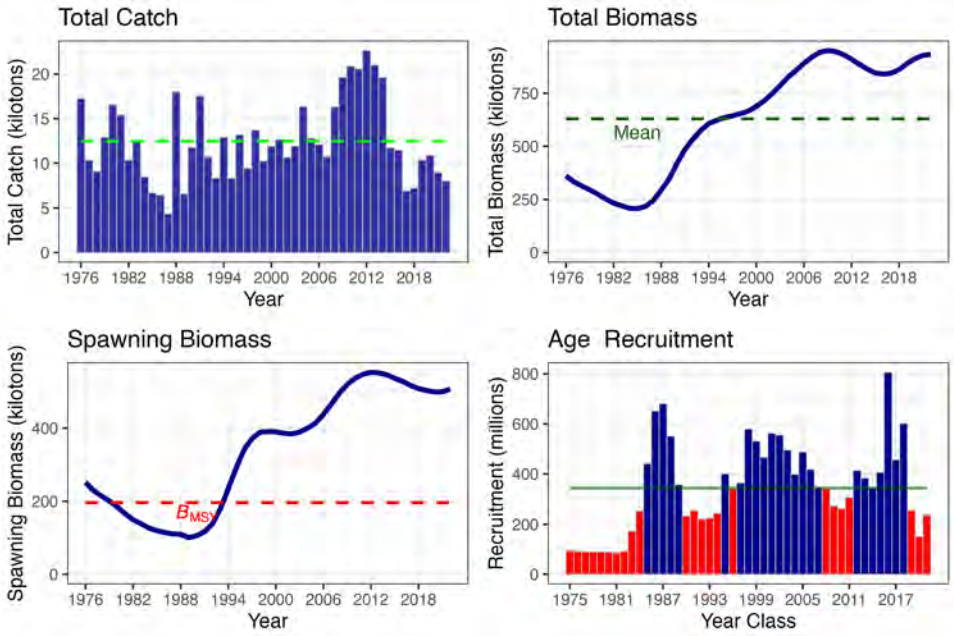
CHAPTER 6
ARROWTOOTH FLOUNDER

- New model(s): no; change from base: no; risk table (1,1,1,1)
- 2021 catch was 11% of ABC, in recent years has been ~10-15%
- 2022 EBS bottom trawl survey up 14% from 2021
- 2022 AI bottom trawl survey slightly down 3% from 2018
- 2022 Longline survey down from 2020 in AI (not used in model)
- Overall, surveys mixed, population levels are stable



CHAPTER 6
ARROWTOOTH FLOUNDER

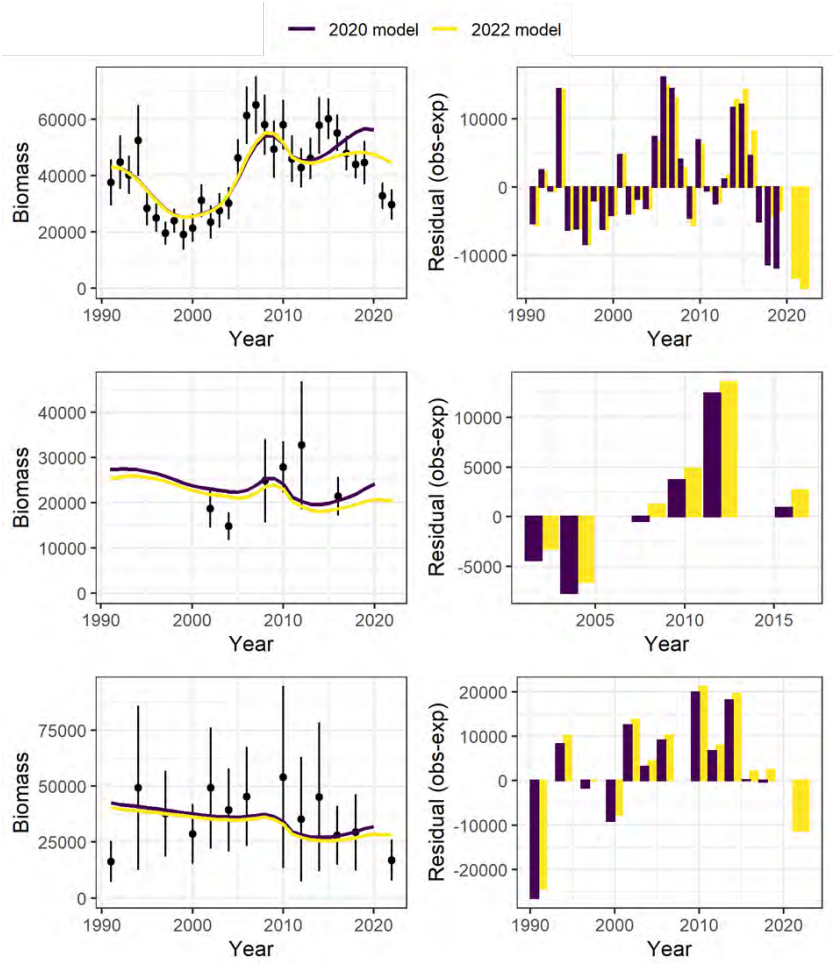
- New model(s): no; change from base: no; risk table (1,1,1,1)
- Team accepted authors recommended model



Quantity	Last asmt.	This asmt.	Change
M	0.2/0.35	0.2/0.35	0%
2022 Tier	3a		
2023 Tier	3a	3a	
2022 age+ biomass	921,690		1%
2023 age+ biomass	914,915	929,274	2%
2022 spawning biomass	509,672		1%
2023 spawning biomass	528,725	514,577	-3%
B_0	558,826	561,219	0%
2023 F_{OFL}	0.160	0.174	9%
2023 F_{ABC}	0.135	0.146	8%
2022 OFL	94,445		5%
2023 OFL	97,944	98,787	1%
2022 ABC	80,389		4%
2023 ABC	83,389	83,852	1%

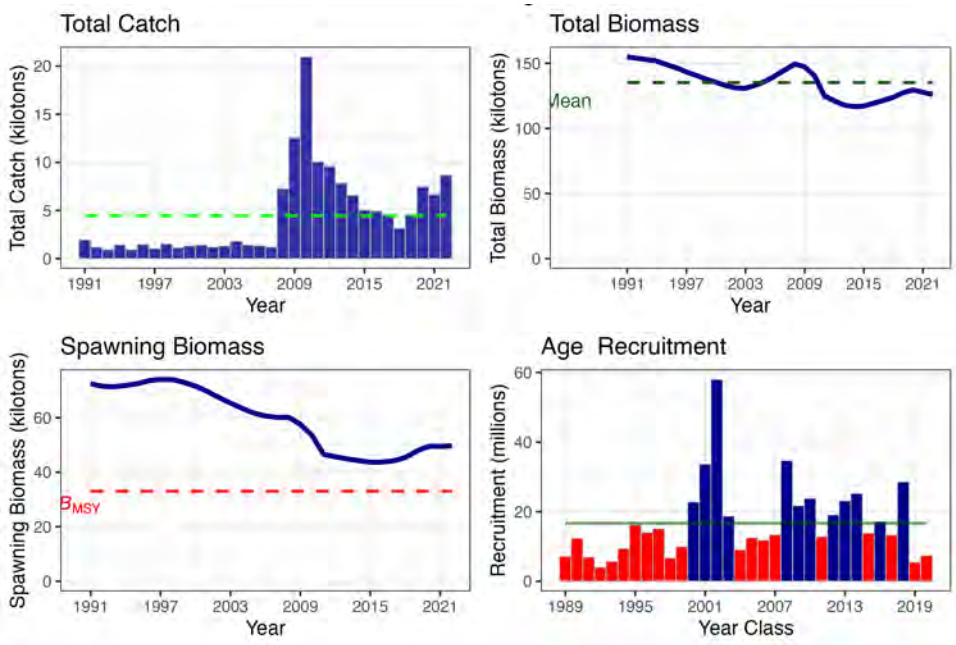
CHAPTER 7
KAMCHATKA FLOUNDER

- New model(s): no; change from base: no; risk table (2,1,1,1)
- EBS shelf survey declined by 26% in 2021 and 10% in 2022
  - Overestimating most recent 2 years
  - Changing catchability?
- AI survey declined by 42% in 2022 from 2018
  - Fit scaled down from last assessment. Drawn down by most recent data point



CHAPTER 7
KAMCHATKA FLOUNDER

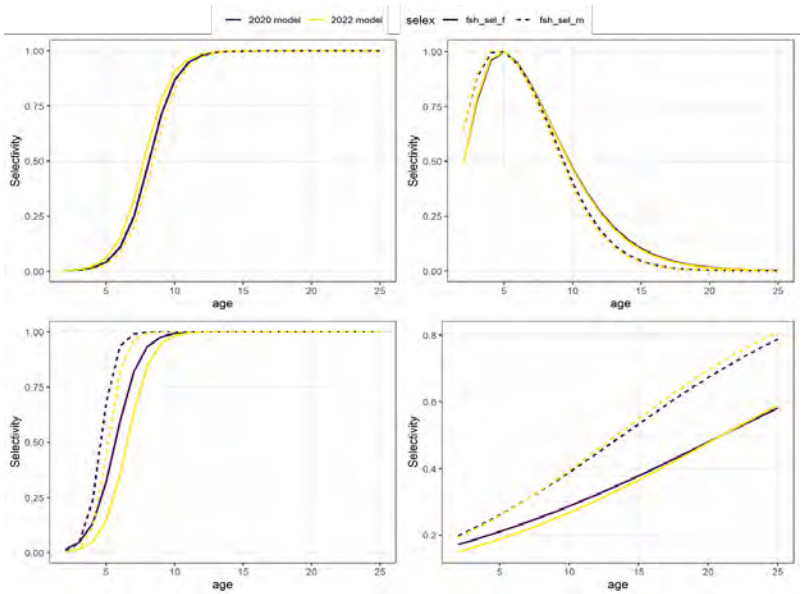
- New model(s): no; change from base: no; risk table (2,1,1,1)
- Team agreed with author's recommendation

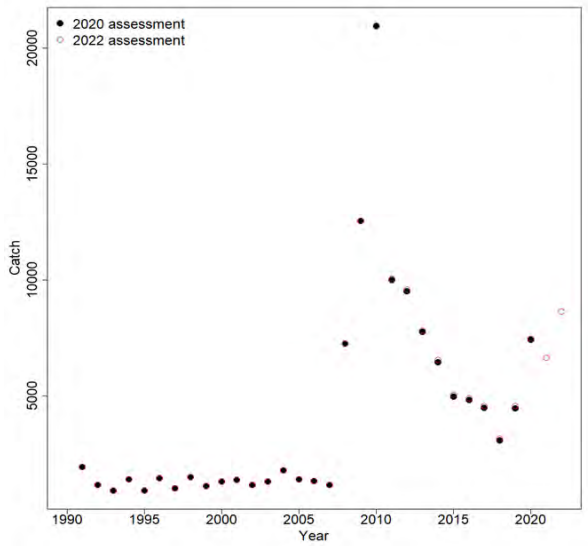


Quantity	Last asmt.	This asmt.	Change
M	0.11	0.11	0%
2022 Tier	3a		
2023 Tier	3a	3a	
2022 age+ biomass	143,983		-15%
2023 age+ biomass	142,762	121,977	-15%
2022 spawning biomass	55,701		-14%
2023 spawning biomass	57,082	47,877	-16%
B_0	101,376	94,370	-7%
2023 F_{OFL}	0.108	0.103	-5%
2023 F_{ABC}	0.090	0.086	-4%
2022 OFL	10,903		-18%
2023 OFL	11,115	8,946	-20%
2022 ABC	9,214		-18%
2023 ABC	9,393	7,579	-19%

CHAPTER 7
KAMCHATKA FLOUNDER RECOMMENDATIONS

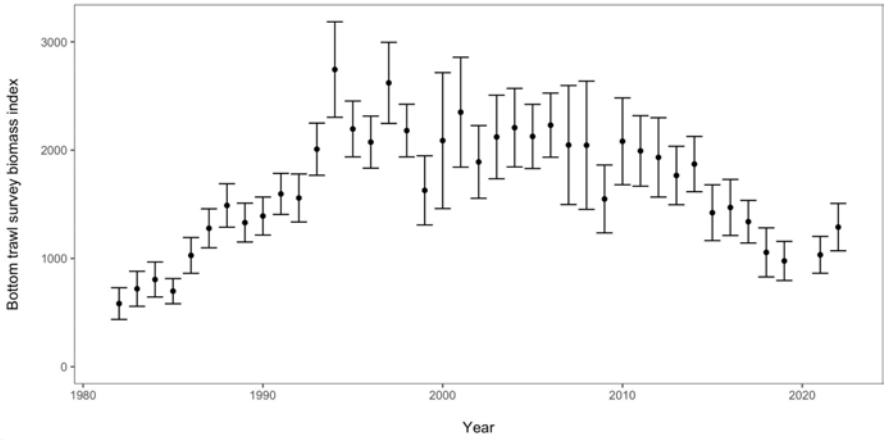
- Residual patterns: The Team recommended examining a single length-based selectivity curve in the next assessment cycle.
- Catch estimation: The Team recommended exploring the model sensitivity to the proportion of arrowtooth assigned to Kamchatka prior to 2008.

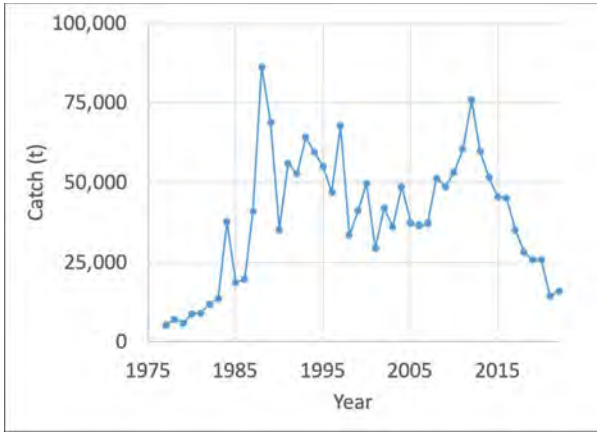




CHAPTER 8
NORTHERN ROCKSOLE

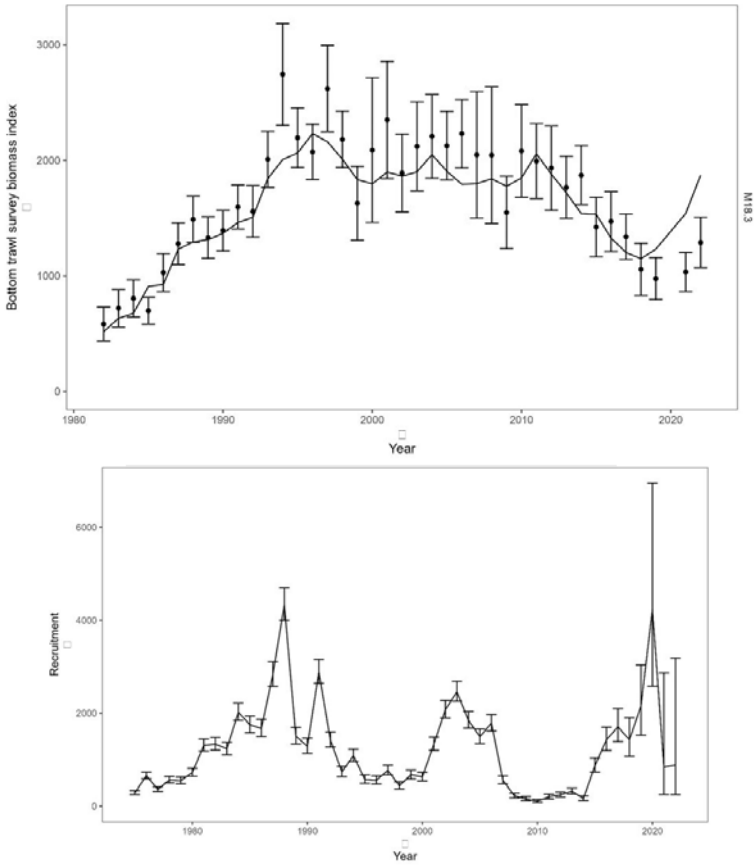
- New model(s): yes; change from base: no - but ; risk table (3,1,1,1)
- Declining biomass 2011 - 2019
- Seeing increases in recent years:
  - 6% increase in 2021
  - 25% increase in 2022
- Low catches in recent years
  - 16k t 2022; 40k t = 10 yr avg





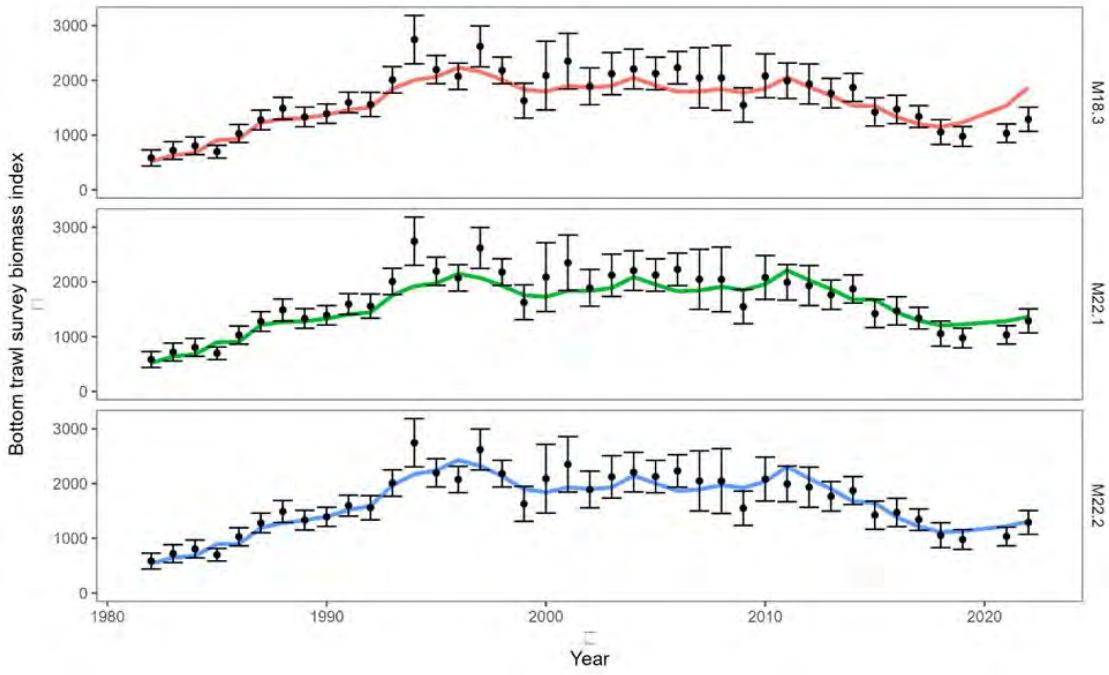
CHAPTER 8
NORTHERN ROCKSOLE

- New model(s): yes; change from base: no - but; risk table (3,1,1,1)
- Base Model
  - Spawning biomass down
  - Big recent recruitment not seen at same extent in survey biomass index
- Issues
  - No formal data weighting – conflict between survey biomass and age composition
    - Poor fit to recent survey indices
    - 2018 recruitment potentially driving biomass estimates



CHAPTER 8
NORTHERN ROCKSOLE

- Alternative models provided in Appendices
  - Model 22.1 - Francis weighting
  - Model 22.2 – Model 22.1 with estimation of both make and female M
- Both alternative models provide improved fits to the survey indices
- Both alternative models recommend much lower ABCs with OFLs below base model ABC.



CHAPTER 8
NORTHERN ROCKSOLE RISK TABLE

- Assessment considerations – Level 3
  - The new, large 2020 recruitment estimated by the model has only been observed once and is a mismatch with the survey biomass index
  - The models with Francis data weighting have much improved fits to survey biomass data and much improved retrospective patterns
  - It appears from the comparison of retrospective patterns across models that it is a feature of the base model to consistently overestimate recent recruitments and spawning biomass
  - The SSC recommended evaluating the probability that ABC > true, but unknown OFL
  - The models using Francis data weighting estimate OFL's that are lower than the ABC estimated by the base model
  - Therefore ABC was reduced to the OFL for Model 22.1

CHAPTER 8
NORTHERN ROCKSOLE

- New model(s): yes; change from base: no - but ; risk table (3,1,1,1)

- Author developed alternative models after October review
- Recommended reduction in maximum permissible ABC to reduce probability of exceeding the 'True OFL'

Quantity	Last asmt.	This asmt.	Change
M	0.15/0.17	0.15/0.19	0%
2022 Tier	1a		
2023 Tier	1a	1a	
2022 age+ biomass	1,363,592		-31%
2023 age+ biomass	1,787,395	941,359	-47%
2022 spawning biomass	287,600		-9%
2023 spawning biomass	320,399	260,887	-19%
B_0	476,820	447,795	-6%
B_{msy}	158,972	155,293	-2%
2023 F_{OFL}	0.157	0.152	-3%
2023 F_{ABC}	0.152	0.129	-15%
2022 OFL	214,084		-22%
2023 OFL	280,621	166,034	-41%
2022 ABC	206,896		-41%
2023 ABC	271,199	121,719	-55%

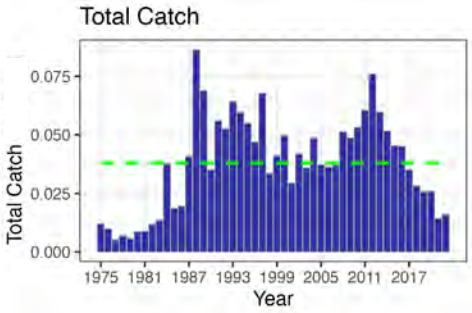
CHAPTER 8
NORTHERN ROCKSOLE

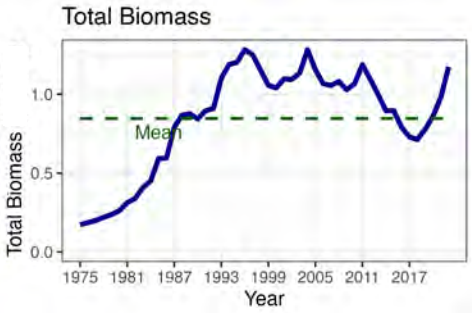
- New model(s): yes; change from base: no - but; risk table (3,1,1,1)
- Team commended the author on this innovative approach to incorporating new information into the assessment
- Team agreed with the authors recommended approach of using the base model but reducing the ABC to the lowest alternative OFL to reduce the risk of the ABC exceeding the 'true' but unkown OFL.

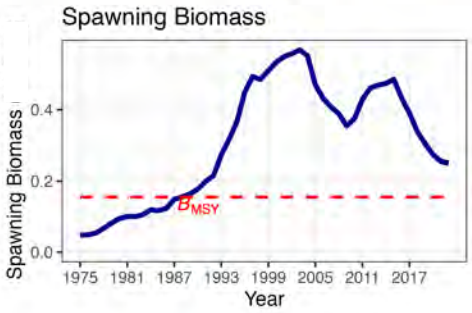
Quantity	Last asmt.	This asmt.	Change
M	0.15/0.17	0.15/0.19	0%
2022 Tier	1a		
2023 Tier	1a	1a	
2022 age+ biomass	1,363,592		-31%
2023 age+ biomass	1,787,395	941,359	-47%
2022 spawning biomass	287,600		-9%
2023 spawning biomass	320,399	260,887	-19%
B_0	476,820	447,795	-6%
B_{msy}	158,972	155,293	-2%
2023 F_{OFL}	0.157	0.152	-3%
2023 F_{ABC}	0.152	0.129	-15%
2022 OFL	214,084		-22%
2023 OFL	280,621	166,034	-41%
2022 ABC	206,896		-41%
2023 ABC	271,199	121,719	-55%

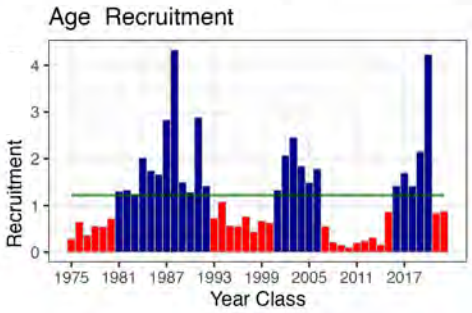
CHAPTER 8
NORTHERN ROCKSOLE

- New model(s): yes; change from base: no - but ; risk table (3,1,1,1)







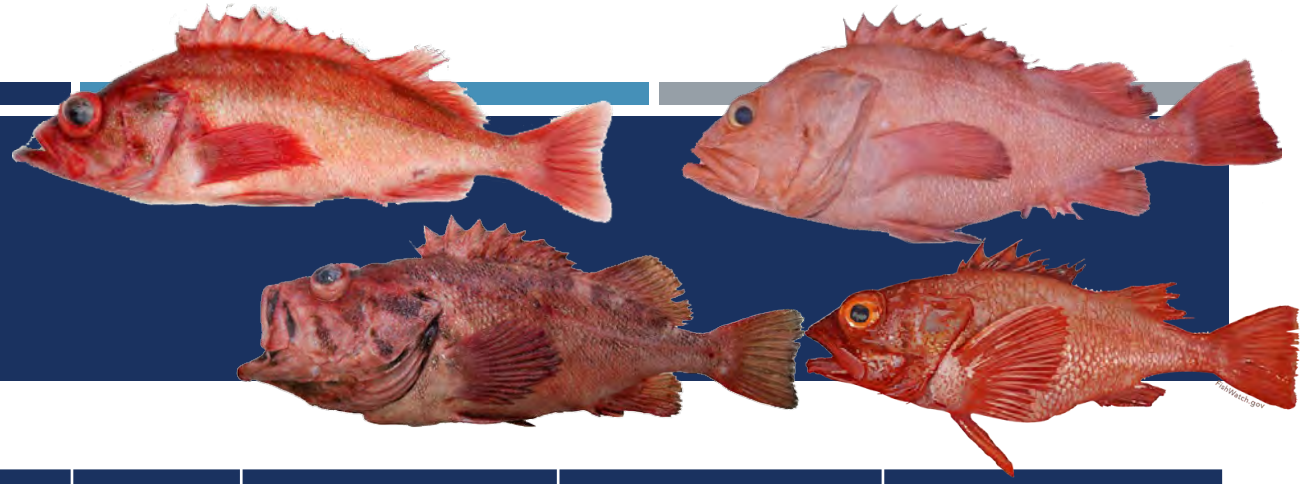


Quantity	Last asmt.	This asmt.	Change
M	0.15/0.17	0.15/0.19	0%
2022 Tier	1a		
2023 Tier	1a	1a	
2022 age+ biomass	1,363,592		-31%
2023 age+ biomass	1,787,395	941,359	-47%
2022 spawning biomass	287,600		-9%
2023 spawning biomass	320,399	260,887	-19%
B_0	476,820	447,795	-6%
B_{msy}	158,972	155,293	-2%
2023 F_{OFL}	0.157	0.152	-3%
2023 F_{ABC}	0.152	0.129	-15%
2022 OFL	214,084		-22%
2023 OFL	280,621	166,034	-41%
2022 ABC	206,896		-41%
2023 ABC	271,199	121,719	-55%

CHAPTER 8
NORTHERN ROCKSOLE RECOMMENDATION

- The Team recommended the authors put Models 22.1 and 22.2 forward - with likelihood profiles and an evaluation of performance - as alternative models to the base model in the 2024 assessment cycle, to be presented in September 2024.

ROCKFISH SUMMARY

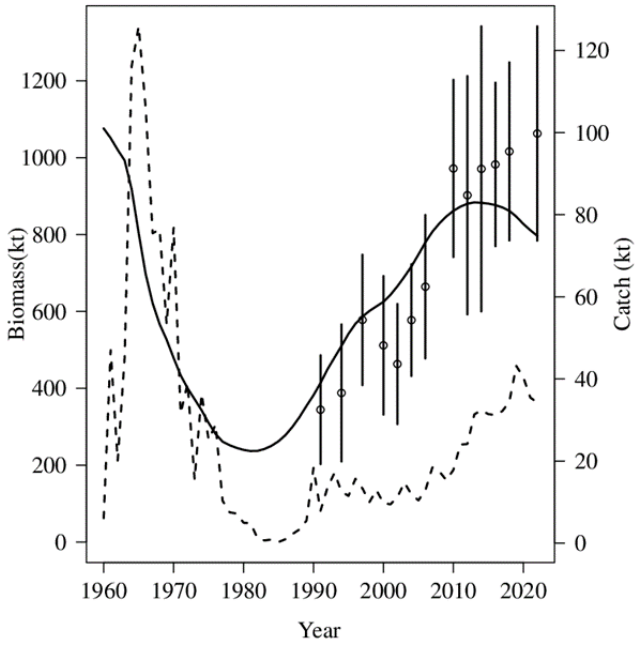


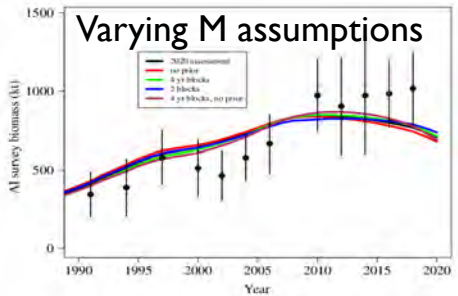
Stock	Tier	2023 ABC (t)	2023 OFL (t)	Change from 2022 ABC
Pacific ocean perch	3a	42,038	50,133	18%
Northern rockfish (Partial)	3a	18,687	22,776	-3%
Blackspotted/rougheye	**3b**/5	**467*(12%)**	703	3%
Shortraker rockfish	5	530	706	-2%
Other rockfish	5	1,260	1,680	-4%

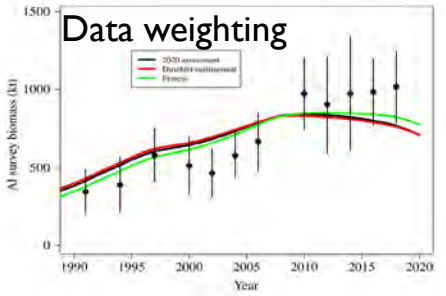
***xx% Reduced from maximum permissible ABC**

CHAPTER 12
PACIFIC OCEAN PERCH

- New model(s): yes; change from base: no; risk table (2,1,1,1)
- 2022 AI survey abundance estimate is largest on record (again)
- Still tension between survey biomass estimates and age/length composition data
  - Focus of discussion during 2022 CIE review, but no obvious answers
    - Explored models with various assumptions on M
    - Explored alternative data weighting

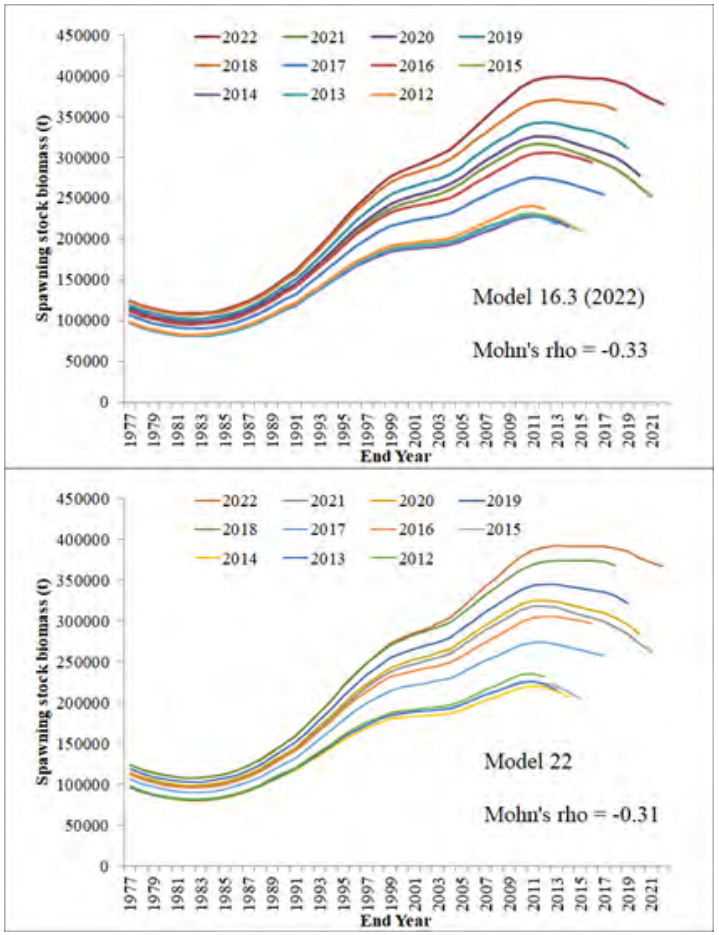


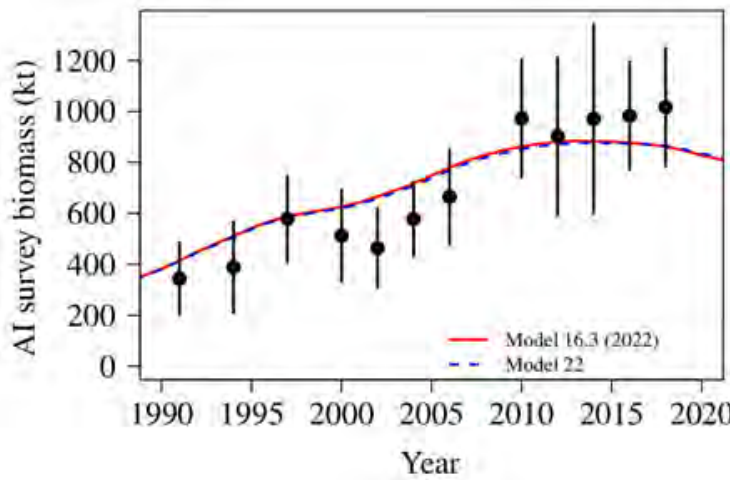




CHAPTER 12
PACIFIC OCEAN PERCH

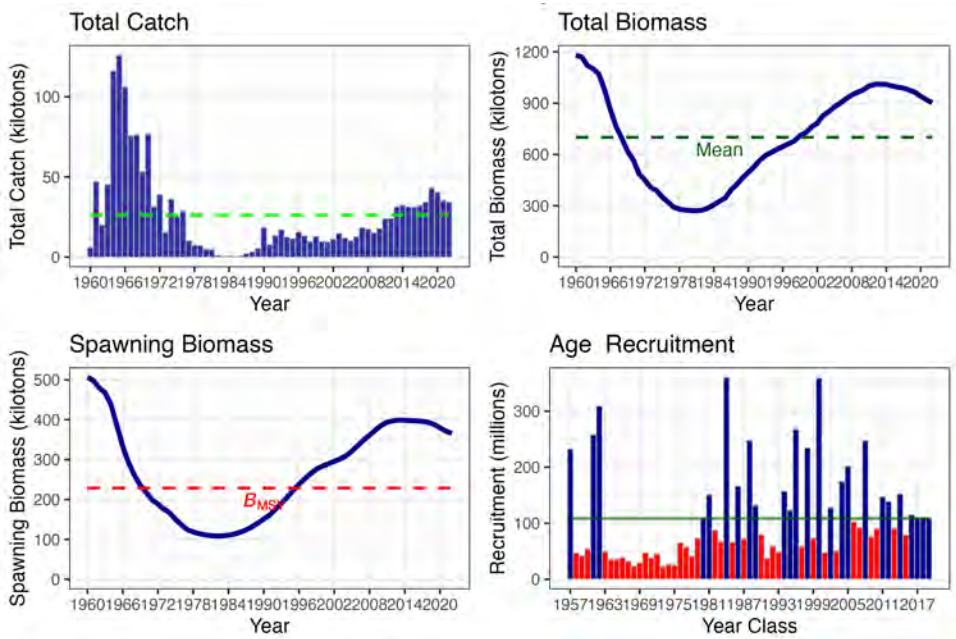
- Alternative model explored in assessment using AI survey abundance instead of biomass
  - Retrospective pattern remains biased negative
  - No model improvement





CHAPTER 12
PACIFIC OCEAN PERCH

- New model(s): yes; change from base: no; risk (2,1,1,1)
- Team agreed with author's recommendation and stayed with base model



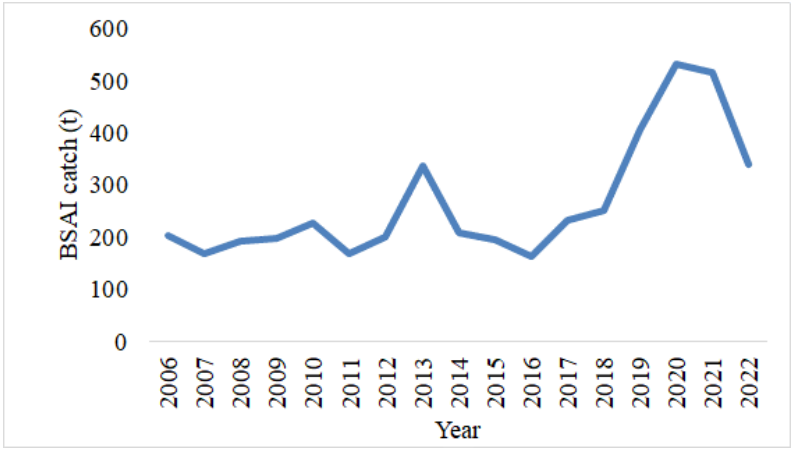
Quantity	Last asmt.	This asmt.	Change
M	0.056	0.056	0%
2022 Tier	3a		
2023 Tier	3a	3a	
2022 age+ biomass	738,710		20%
2023 age+ biomass	724,085	888,722	23%
2022 spawning biomass	299,232		20%
2023 spawning biomass	288,437	359,074	24%
B_0	584,747	652,626	10%
2023 F_{OFL}	0.089	0.089	0%
2023 F_{ABC}	0.073	0.074	1%
2022 OFL	42,605		18%
2023 OFL	40,977	50,133	22%
2022 ABC	35,688		18%
2023 ABC	34,322	42,038	22%

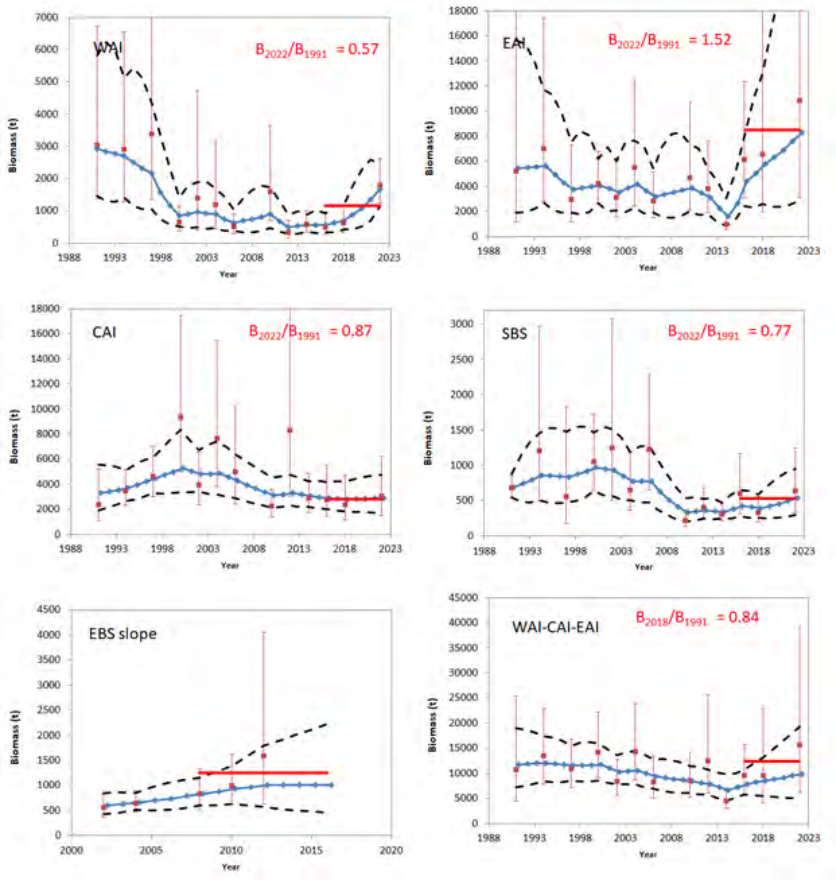
CHAPTER 14
BLACKSPOTTED & ROUGHEYE ROCKFISH

- Aleutian Islands and Bering Sea component split
  - Tier 3 model for Aleutian Islands section
  - Tier 5 RE model for Eastern Bering Sea section
- Issues of concern:
  - In AI model 2010 year class >6 times larger than largest than next largest cohort
  - Reduction from maximum permissible ABC
  - Spatial management concerns (presentation by Diana Stram)

CHAPTER 14
AI BLACKSPOTTED & ROUGHEYE ROCKFISH

- New model(s): yes; change from base: no - but; risk table (3,2,1,2)
- Stable or increasing recent trend in survey biomass, but high degree of uncertainty
- Decrease in recent catch

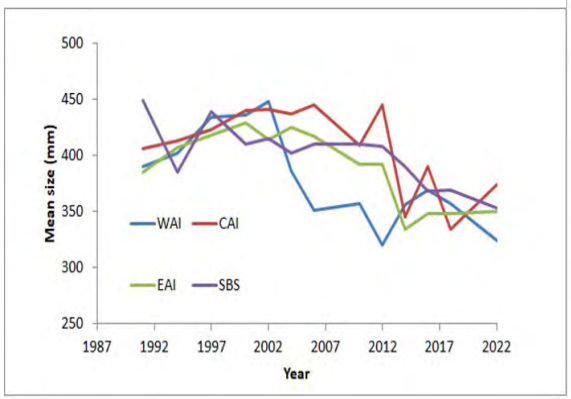


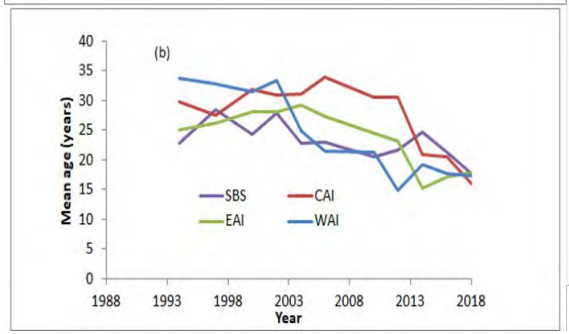


CHAPTER 14
AI BLACKSPOTTED & ROUGHEYE ROCKFISH

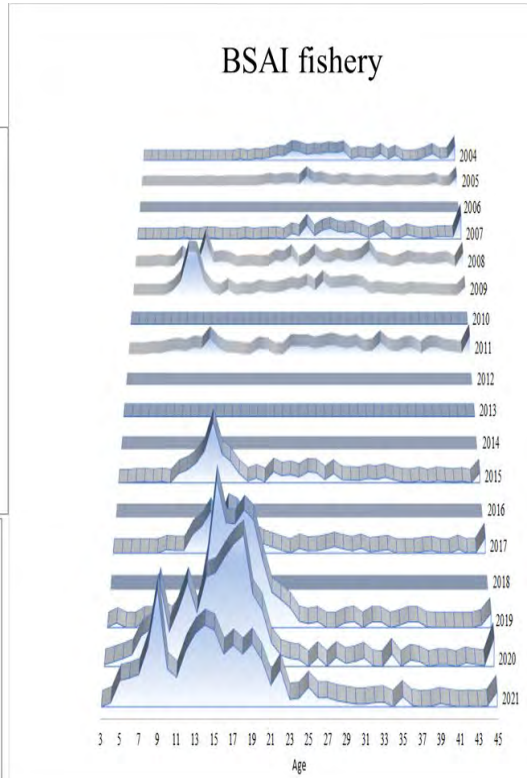
- New model(s): yes; change from base: no - but; risk table (3,2,1,2)
- New age/length composition data show continued recent catch of young/small fish (2019 – 2021 fishery ages, 2022 survey lengths)

AI survey



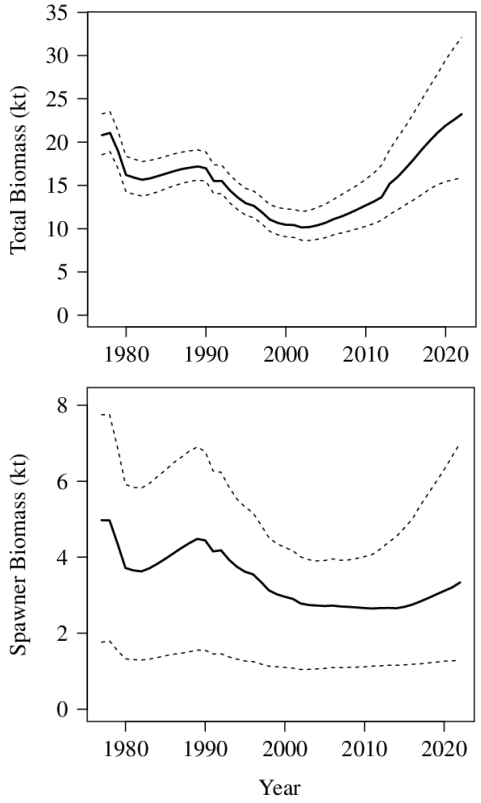


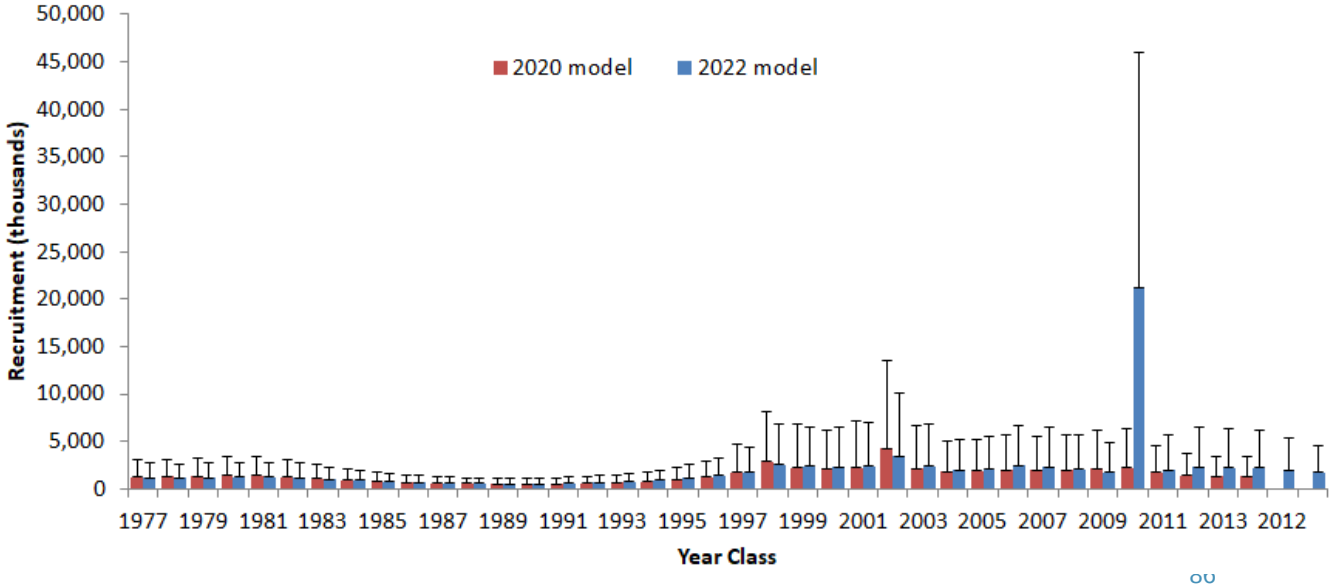
BSAI fishery



CHAPTER 14
AI BLACKSPOTTED & ROUGHEYE ROCKFISH

- The 2010 year class is 21.25 million (CV of 0.58), which is > 6 times the next largest year class
- This year class contributes 25% of the beginning year 2022 total biomass





CHAPTER 14
BLACKSPOTTED & ROUGHEYE ROCKFISH

- In standard procedures, $B_{40\%}$ increases sharply (+32%), and F_{ABC} decreases sharply (-24%), despite little change in estimated SSB
- If the 2010 year class is adjusted when computing mean recruitment to a more likely value, the $B_{40\%}$ is stabilized, but the ABC would increase sharply (based on fishing a stock in which a large portion of the biomass is composed of a large and uncertain year class).
- **Proposed middle ground:** set the value of the 2010 year class to the next largest (3.43 million, 2002 year class) for the purpose of stabilizing $B_{40\%}$ and computing maximum permissible ABC, then recommend a lower ABC so as to not substantially raise the ABC until more certainty in this year class and overall stock size can be obtained.

CHAPTER 14
BLACKSPOTTED & ROUGHEYE ROCKFISH
RISK TABLE

- Assessment considerations: Level 3: Major Concern
  - Very poor fits to data; high level of uncertainty; strong retrospective bias.
- Population dynamics considerations: Level 2: Substantially increased concerns.
  - Stock trends are unusual; abundance increasing or decreasing faster than has been seen recently, or recruitment pattern is atypical.
- Fishery performance considerations: Level 2: Substantially increased concerns.
  - Fishery CPUE in the WAI subarea are larger than would be expected based on the spatial distribution of survey biomass estimates. Also, the WAI catches have consistently exceeded the MSSC, and these overages have increased over time. The catches in the WAI/CAI subarea have also exceeded the subarea ABC from 2019 – 2022, and the BSAI ABC in 2021.

CHAPTER 14
AI BLACKSPOTTED & ROUGHEYE ROCKFISH

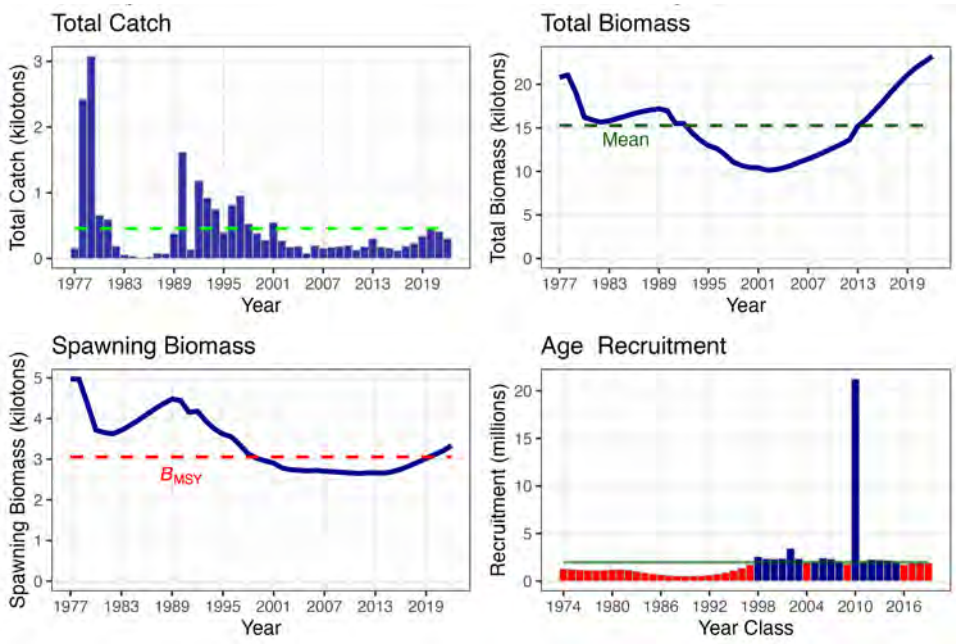
- New model(s): yes; change from base: no - but; risk table (3,2,1,2)

- Team accepted the authors' recommendation
  - Adjusted 2010 recruitment to 2002 value for calculating reference points.
  - Reduction from maximum permissible ABC to 2022 ABC to stabilize ABC until there is more certainty on the 2010 year class.

Quantity	Last asmt.	This asmt.	Change
M	0.049	0.05	0%
2022 Tier	3b		
2023 Tier	3a	3b	
2022 age+ biomass	17,774		34%
2023 age+ biomass	17,862	23,856	34%
2022 spawning biomass	3,468		0%
2023 spawning biomass	3,568	3,471	-3%
B_0	8,811	8,733	-1%
2023 F_{OFL}	0.039	0.040	3%
2023 F_{ABC}	0.033	0.030	-9%
2022 OFL	531		18%
2023 OFL	548	626	14%
2022 ABC	453		3%
2023 ABC	467	467	0%

CHAPTER 14
AI BLACKSPOTTED & ROUGHEYE ROCKFISH

- New model(s): yes; change from base: no - but; risk table (3,2,1,2)



Quantity	Last asmt.	This asmt.	Change
M	0.049	0.05	0%
2022 Tier	3b		
2023 Tier	3a	3b	
2022 age+ biomass	17,774		34%
2023 age+ biomass	17,862	23,856	34%
2022 spawning biomass	3,468		0%
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B_0	8,811	8,733	-1%
2023 F_{OFL}	0.039	0.040	3%
2023 F_{ABC}	0.033	0.030	-9%
2022 OFL	531		18%
2023 OFL	548	626	14%
2022 ABC	453		3%
2023 ABC	467	467	0%

CHAPTER 14
EBS BLACKSPOTTED & ROUGHEYE ROCKFISH

- Team accepted the authors' recommendation

Quantity	Last asmt.	This asmt.	Change
M	0.049	0.05	2%
2022 tier	5		
2023 tier	5	5	
Biomass	1,371	1,544	11%
2023 F_{OFL}	0.049	0.050	2%
2023 F_{ABC}	0.037	0.037	0%
2022 OFL	67		15%
2023 OFL	67	77	15%
2022 ABC	50		16%
2023 ABC	50	58	16%

CHAPTER 14
BLACKSPOTTED & ROUGHEYE ROCKFISH

Spatial apportionment

	Area				
	WAI	CAI	EAI	SBS	EBS slope
Smoothed biomass	1,671	2,887	8,282	534	1,010
percentage (within AI subarea)	13.0%	22.5%	64.5%		

MSSCs

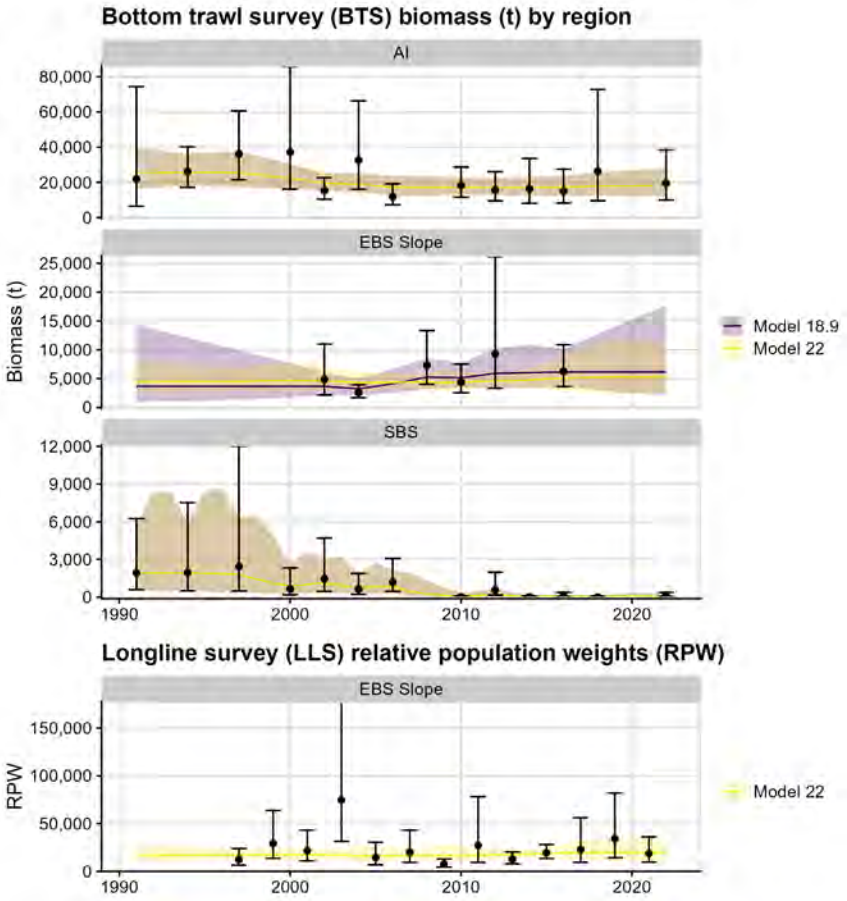
	Area				
	WAI	CAI	WAI/CAI	EAI/EBS	Total
Year	MSSC	MSSC	ABC	ABC	ABC
2023	61	105	166	359	525
2024	67	115	182	388	570

CHAPTER 14
BLACKSPOTTED & ROUGHEYE ROCKFISH RECOMMENDATIONS

- The Team discussed the lack of larger fish in fishery composition data and recommended examining the NMFS and IPHC longline survey data to determine if larger fish may be in the population and not showing up in the fishery.
- The Team also recommended looking at the rate of blackspotted/rougheye to Pacific ocean perch in the survey tows over the time series.

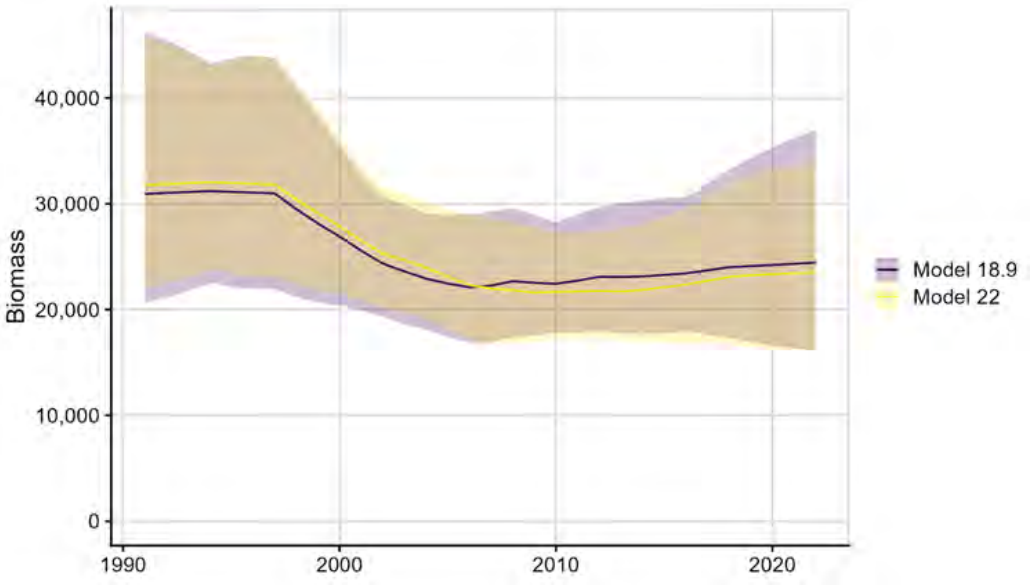
CHAPTER 15
SHORTRAKER ROCKFISH

- New model(s): yes; change from base: yes; risk table (1,1,1,1)
- Model change:
  - REMA
  - Added NMFS longline survey abundance index for shortraker in the EBS slope (no trawl survey since 2016)
- 2021 Catch: 380 t
  - 70% of ABC
- 2022 Biomass: 23,547 t
  - 2% decrease from 2020



CHAPTER 15
SHORTRAKER ROCKFISH

- New model(s): yes; change from base: yes; risk table (1,1,1,1)
- Team agreed with author's recommendations

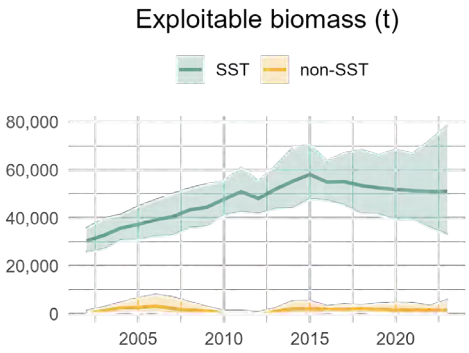


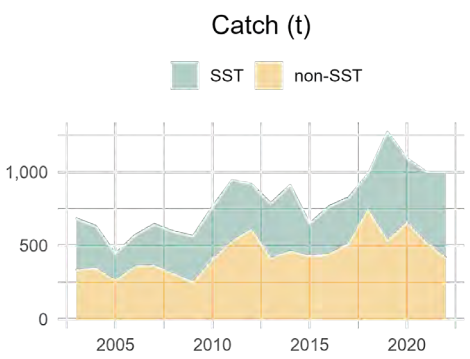
Quantity	Last asmt.	This asmt.	Change
M	0.03	0.03	0
2022 tier	5		
2023 tier	5	5	
Biomass	24,055	23,547	-2%
2023 F_{OFL}	0.030	0.030	0%
2023 F_{ABC}	0.023	0.023	0%
2022 OFL	722		-2%
2023 OFL	722	706	-2%
2022 ABC	541		-2%
2023 ABC	541	530	-2%

CHAPTER 16
OTHER ROCKFISH

- New model(s): yes; change from base: yes; risk table (1,1,1,1)
- SST: shortspine thornyhead (95% of complex)
- non-SST: dusky rockfish and ≥ 11 other species (5% of complex)
- Model change: Added NMFS longline survey abundance index for SST in the EBS slope (no trawl survey since 2016)

Quantity	Last asmt.	This asmt.	Change
M	0.03/0.09	0.03/0.09	0
2022 tier	5		
2023 tier	5	5	
Biomass	53,248	52,733	-1%
2023 F_{OFL}	0.03/0.09	0.03/0.09	0%
2023 F_{ABC}	0.0225/0.0675	0.0225/0.0675	0%
2022 OFL	1,751		-4%
2023 OFL	1,751	1,680	-4%
2022 ABC	1,313		-4%
2023 ABC	1,313	1,260	-4%





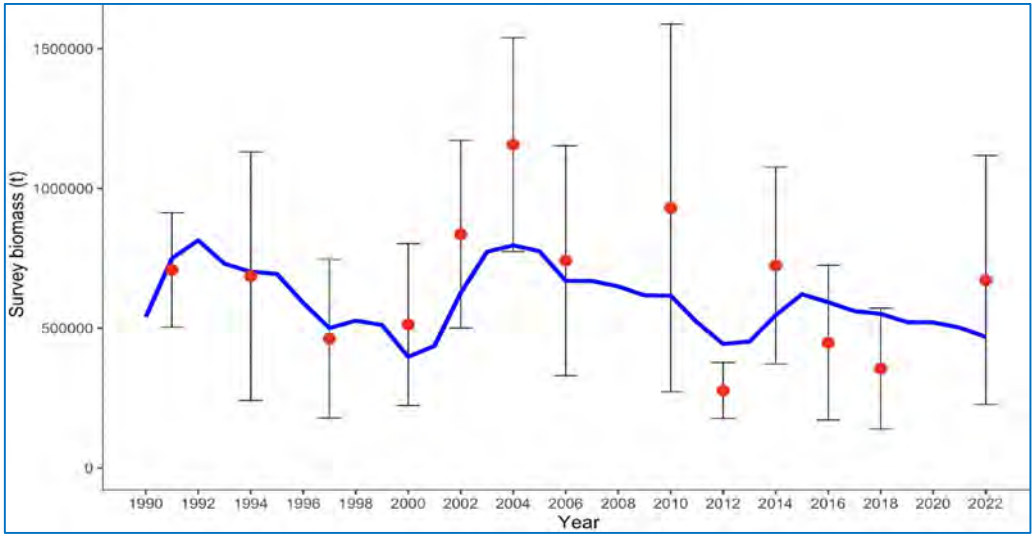
OTHER SUMMARY

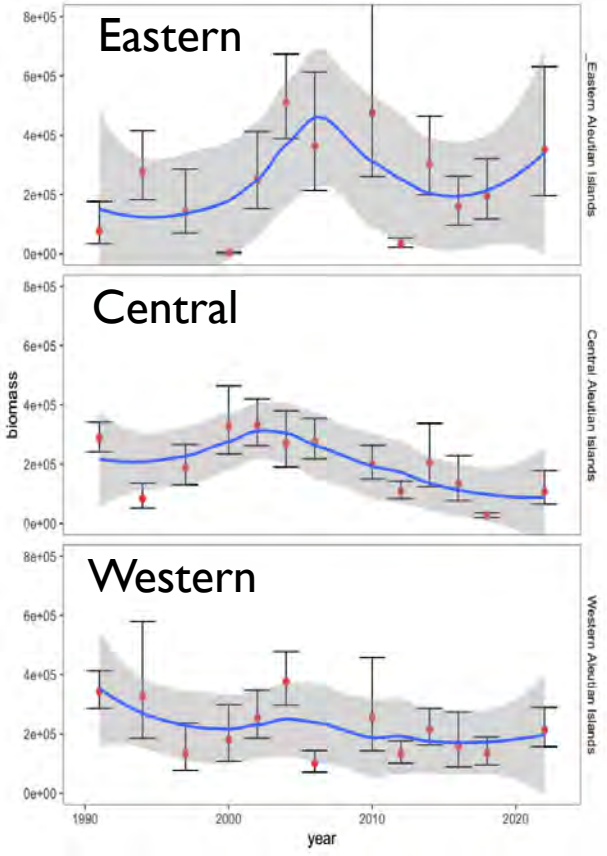
Stock	Tier	2023 ABC (t)	2023 OFL (t)	Change from 2022 ABC
Atka mackerel	3a	98,588	118,787	26%
Skates (Partial)	3a/5	38,605	46,220	-4%
Sharks	6	**450*(13%)**	689	-13%
Octopus (Partial)	6	3,576	4,769	0%

***xx% Reduced from maximum permissible ABC**

CHAPTER 17
ATKA MACKEREL

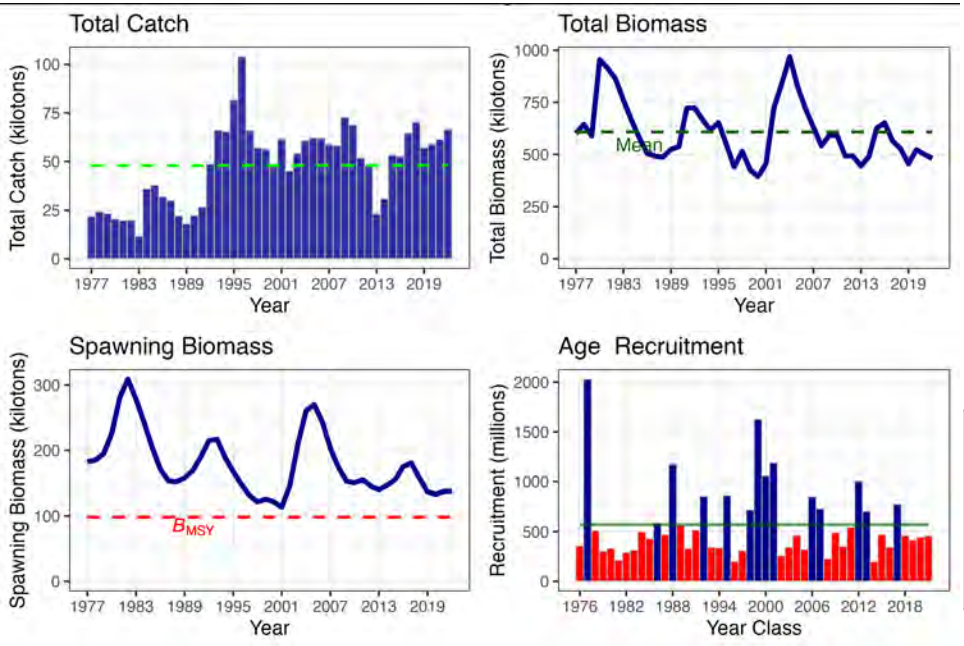
- New model(s): no; change from base: no; risk table (2,1,2,1)
- 89% increase in AI bottom trawl survey biomass
  - Increase across all AI regions





CHAPTER 17
ATKA MACKEREL

- New model(s): no; change from base: no; risk table (2,1,2,1)
- Team accepted the authors' recommendation



Quantity	Last asmt.	This asmt.	Change
M	0.3	0.3	0%
2022 Tier	3a		
2023 Tier	3a	3a	
2022 age+ biomass	554,490		11%
2023 age+ biomass	570,080	615,027	8%
2022 spawning biomass	109,360		12%
2023 spawning biomass	103,330	122,541	19%
B_0	278,670	280,456	1%
2023 F_{OFL}	0.650	0.760	17%
2023 F_{ABC}	0.540	0.610	13%
2022 OFL	91,870		29%
2023 OFL	84,440	118,787	41%
2022 ABC	78,510		26%
2023 ABC	71,990	98,588	37%

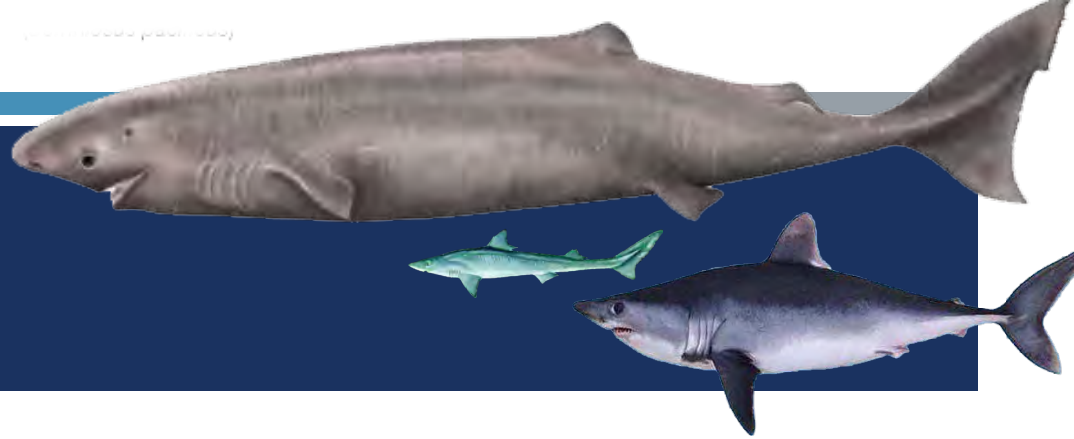
CHAPTER 17
ATKA MACKEREL RECOMMENDATIONS

- Area apportionment:
  - Except for the 2016 and 2017 assessments, when apportionments were based on the Tier 5 RE model, apportionments of Atka mackerel since the 2001 assessment have been based on a 4-survey weighted average, with weights of 8:12:18:27

Weighted Average (Recommended)

	Survey Year				2023 & 2024 Apportionment	**2023**	**2024**
	2014	2016	2018	2022		**ABC**	**ABC**
541	42%	35%	38%	52%	0.44	43,280	37,958
542	28%	30%	7%	16%	0.18	17,351	15,218
543	30%	35%	55%	39%	0.8	38,956	33,289
Weights	8	12	18	27	1.00		
Total ABC						98,588	86,464

CHAPTER 19
SHARKS

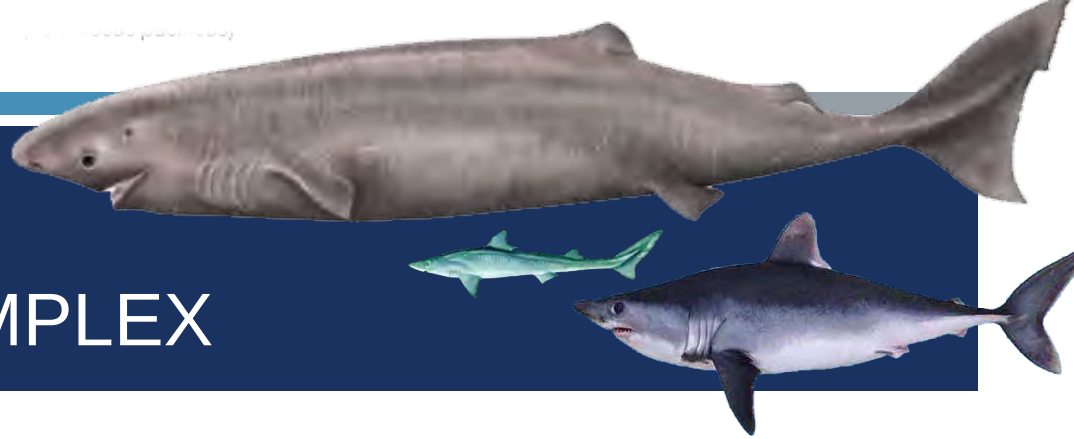


- New model(s): yes; change from base: no - but; risk table (3*,2,1,1)
- Switch to authors' presentation (Team comments will follow)

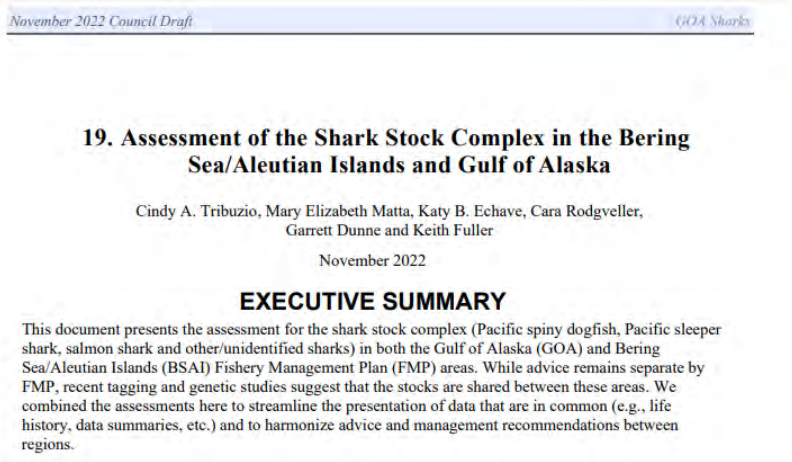
SHARK STOCK COMPLEX

SSC Presentation
December 2022
Cindy Tribuzio*, Mary Elizabeth Matta, Katy B Echave, Cara Rodgveller, Garrett Dunne and Keith Fuller

SHARK STOCK COMPLEX



- Combined SAFE document
- Separate FMP management advice
- Responses to comments



November 2022 Council Draft GOA Sharks

19. Assessment of the Shark Stock Complex in the Bering Sea/Aleutian Islands and Gulf of Alaska

Cindy A. Tribuzio, Mary Elizabeth Matta, Katy B. Echave, Cara Rodgveller, Garrett Dunne and Keith Fuller

November 2022

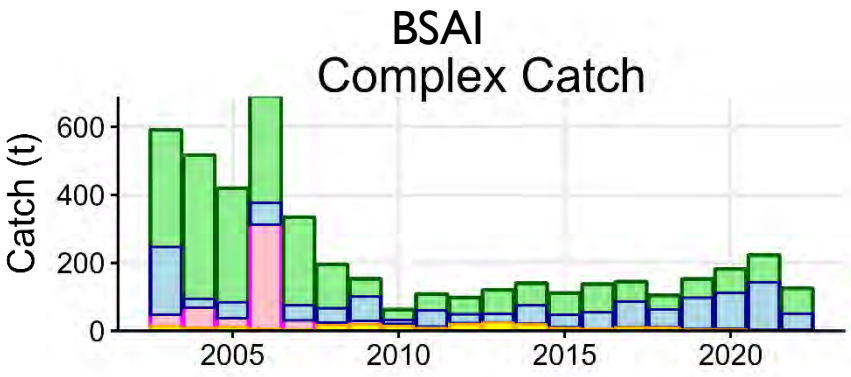
EXECUTIVE SUMMARY

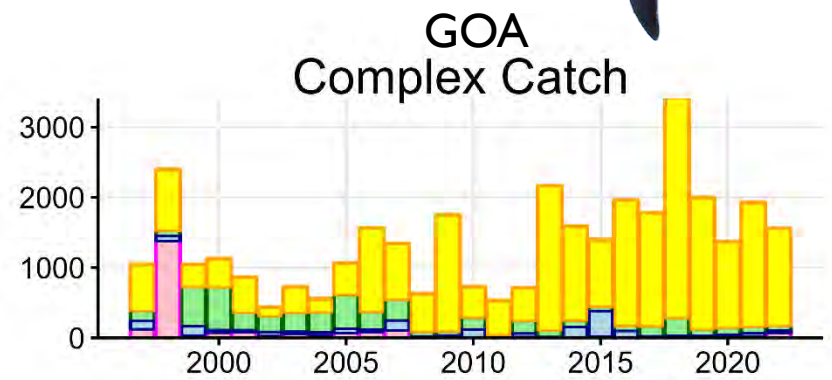
This document presents the assessment for the shark stock complex (Pacific spiny dogfish, Pacific sleeper shark, salmon shark and other/unidentified sharks) in both the Gulf of Alaska (GOA) and Bering Sea/Aleutian Islands (BSAI) Fishery Management Plan (FMP) areas. While advice remains separate by FMP, recent tagging and genetic studies suggest that the stocks are shared between these areas. We combined the assessments here to streamline the presentation of data that are in common (e.g., life history, data summaries, etc.) and to harmonize advice and management recommendations between regions.

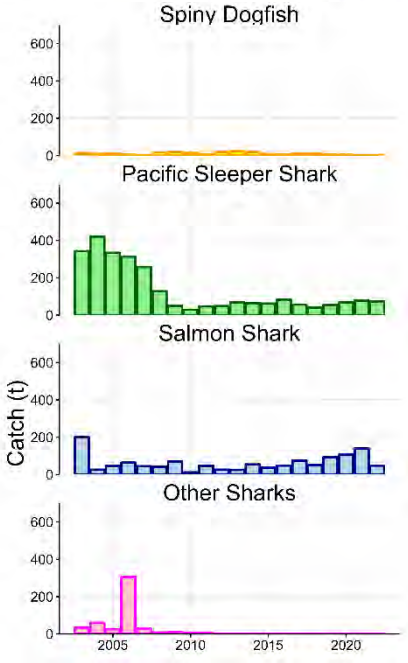
Two Primary Issues

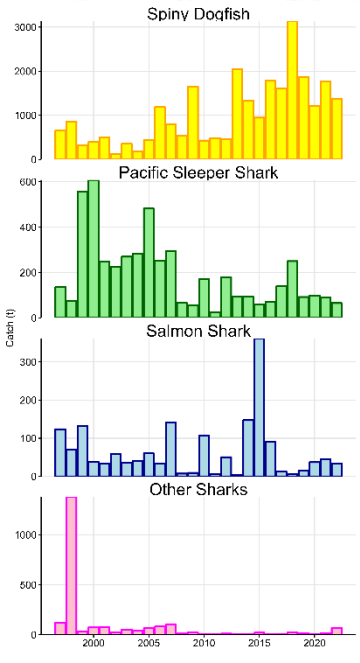
1. Rare species with likely erroneous catch estimates
2. Improving assessment of Pacific sleeper shark

SLIDE ORIENTATION



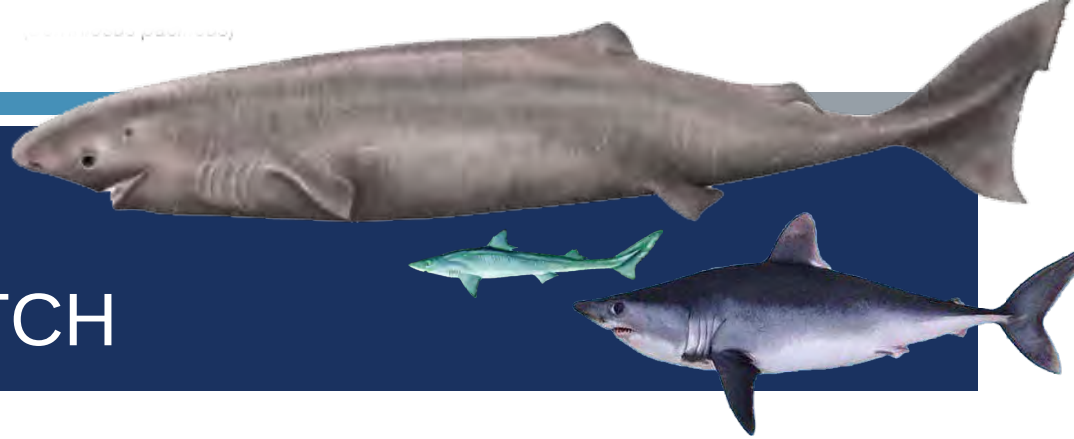




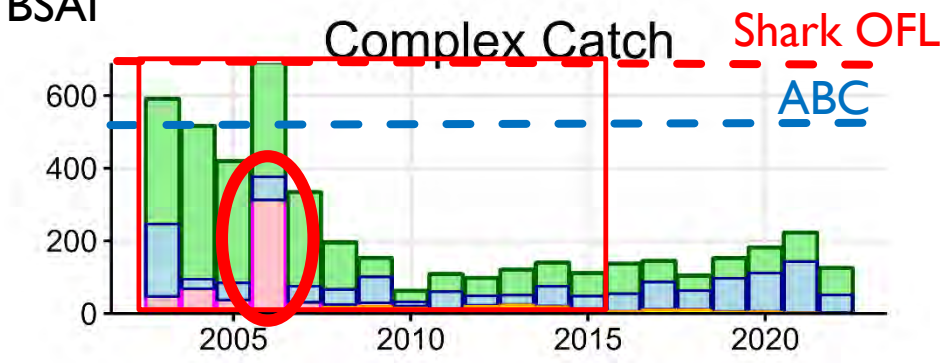


- Species colors consistent
- BSAI always on top
- Scale changes

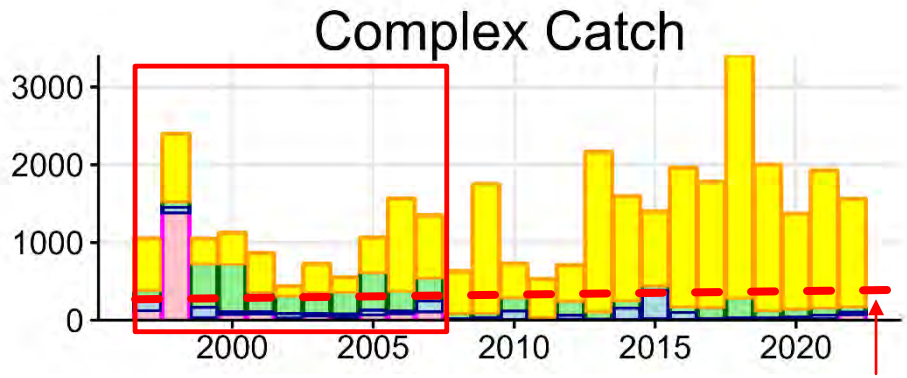
RARE SPECIES CATCH



BSAI



GOA

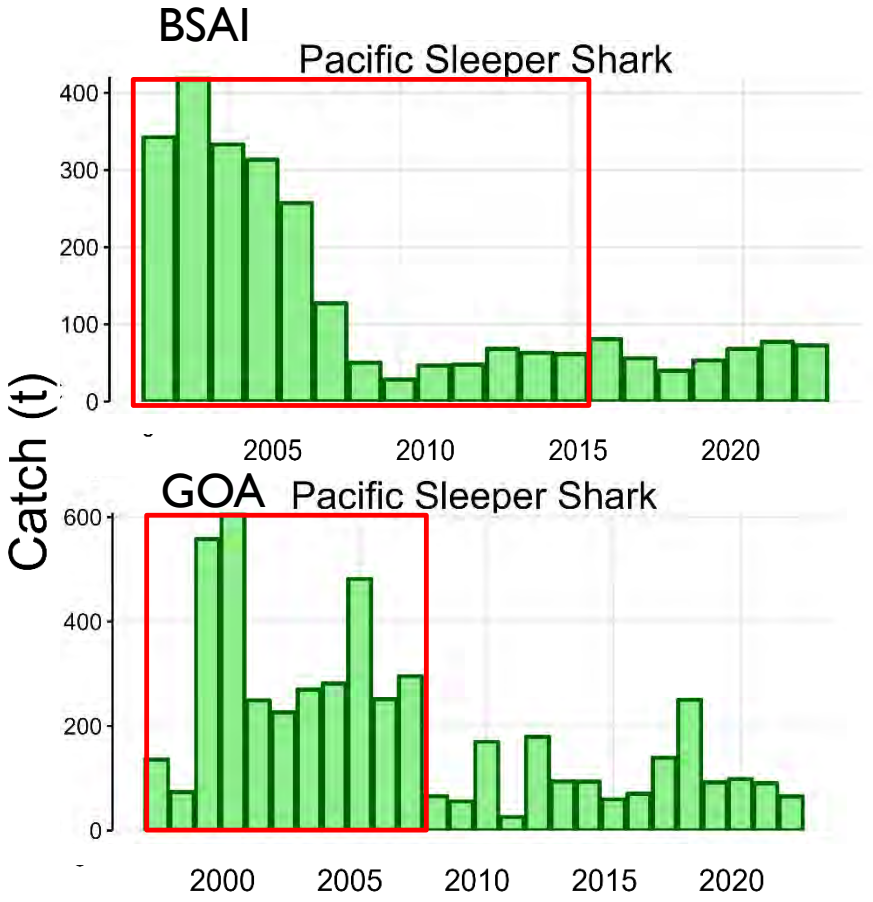


- Due to extrapolation procedure, rare hauls with “large” shark catches can extrapolate to likely erroneous catch estimates
- BSAI issue: status quo is max COMPLEX catch
- Proposed 90th percentile of time series to reduce impact of large extrapolations
- BSAI Other/Unid and spiny dogfish
- GOA Other/Unid

PACIFIC SLEEPER SHARK

PSS Status Quo Concerns:

- Time series needs to be based on period of stable catch
- Maximum or Mean catch scalars have high risk of overfishing
- Does not allow for inclusion of other information

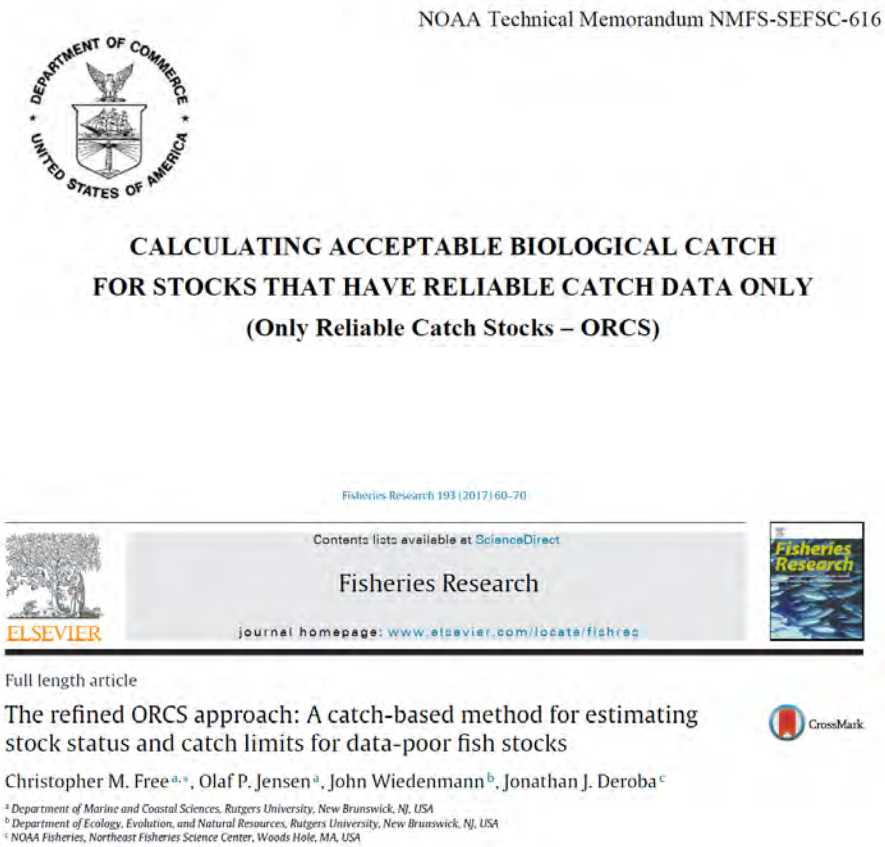


PACIFIC SLEEPER SHARK

Explored many data-limited approaches

Only Reliable Catch Series (ORCS)

- Expert judgment used to qualitatively score attributes (Table 19.7)
- Flexible to additional attributes
- Robust to assumptions of stock status
- Allows for incorporation of uncertainty of input information



NOAA Technical Memorandum NMFS-SEFSC-616

DEPARTMENT OF COMMERCE · UNITED STATES OF AMERICA

CALCULATING ACCEPTABLE BIOLOGICAL CATCH FOR STOCKS THAT HAVE RELIABLE CATCH DATA ONLY

(Only Reliable Catch Stocks – ORCS)

Fisheries Research 193 (2017) 60–70

Contents lists available at ScienceDirect

Fisheries Research

journal homepage: www.elsevier.com/locate/fishres

ELSEVIER

Full length article

The refined ORCS approach: A catch-based method for estimating stock status and catch limits for data-poor fish stocks

Christopher M. Free[a,*], Olaf P. Jensen[a], John Wiedenmann[b], Jonathan J. Deroba[c]

[a] Department of Marine and Coastal Sciences, Rutgers University, New Brunswick, NJ, USA
[b] Department of Ecology, Evolution, and Natural Resources, Rutgers University, New Brunswick, NJ, USA
[c] NOAA Fisheries, Northeast Fisheries Science Center, Woods Hole, MA, USA

PACIFIC SLEEPER SHARK

	Attribute	BSAI	GOA	Justification
1	Status of assessed stocks in fishery	1	1	0% of fishery stocks are overfished
2	Behavior affecting capture	2	2	Species does not exhibit significant aggregating behaviors
3	Discard rate	3	3	Discard rates are 88% (BSAI) and 99% (GOA)
4	Targeting intensity	1	1	All sharks are non-targeted
5	M compared to dominant species	3	3	M is >20% than dominant species in BSAI, likely 20% lower that the dominant species in the GOA
6	Occurrence in catch	1	1	Occurs in <2% of observed hauls

- Table 19.9 and described in detail in model results section

PACIFIC SLEEPER SHARK

	Attribute	BSAI	GOA	Justification
1	Status of assessed stocks in fishery	1	1	0% of fishery stocks are overfished
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6	Occurrence in catch	1	1	Occurs in <2% of observed hauls

- Table 19.9 and described in detail in model results section
- ORCS is designed to encompass both discarded and retained stocks, Free et al. (2017) included both in analyses

PACIFIC SLEEPER SHARK

	Attribute	BSAI	GOA	Justification
7	Value	1	1	Little to no market value
8	Recent trend in catch	2	2	No significant trends
9	Habitat loss	1	1	Species does not occupy identified threatened habitats
10	Recent trend in effort	2	2	No significant trends
11	Recent trend in abundance index	NA	2	No data in BSAI, No recent trend in GOA IPHC survey
12	Proportion of population protected	3	3	No specific protection measures
13	Life history considerations	3	3	Low productivity and large proportion of catch is immature

- Table 19.9 and described in detail in model results section

PACIFIC SLEEPER SHARK

	Attribute	BSAI	GOA	Justification
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- Table 19.9 and described in detail in model results section
- IPHC is best GOA indicator, unable to use IPHC survey since 2019 – future work may change this

PACIFIC SLEEPER SHARK

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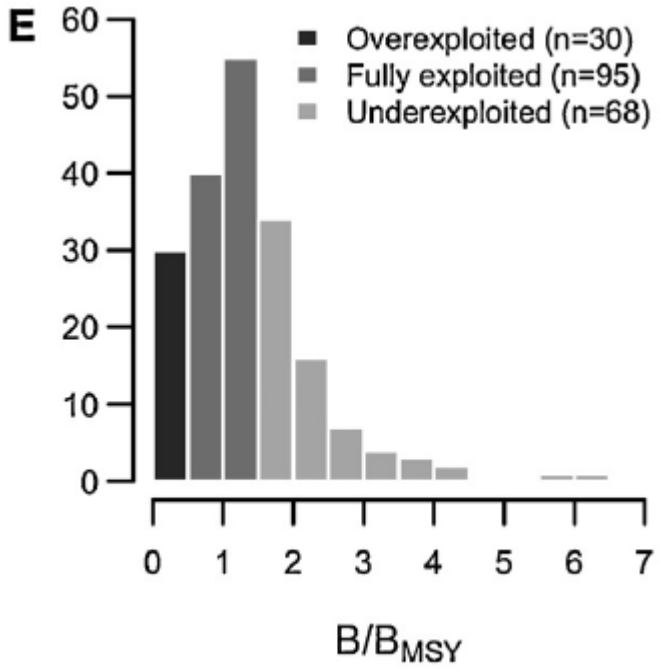
- Table 19.9 and described in detail in model results section
- IPHC is best GOA indicator, unable to use IPHC survey since 2019 – future work may change this
- Added to incorporate maturity of catch and species productivity

PACIFIC SLEEPER SHARK

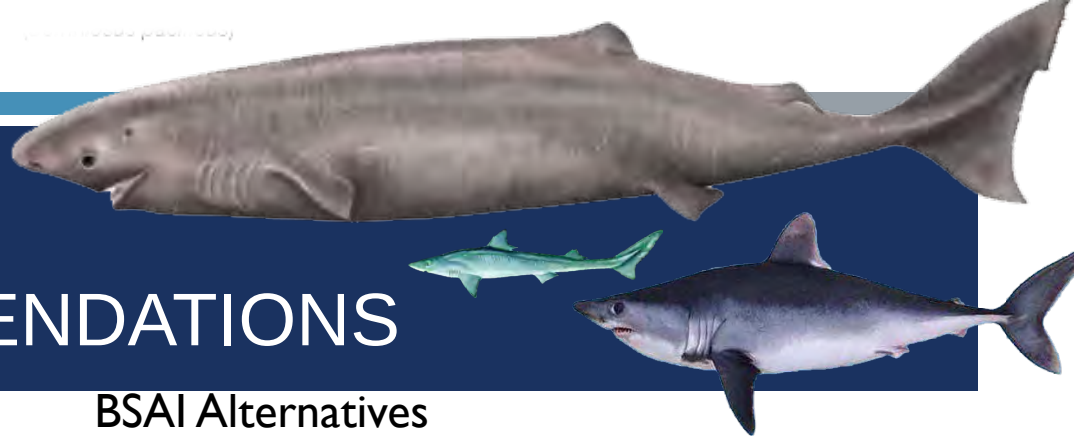
From Free et al. 2017



Mean attribute score determines

(Table 19.8, adapted from Free et al. 2017)

Mean Score	Stock status	Catch statistic	
<1.5	Underexploited	90th percentile, whole time series	1.90
1.5 – 2.5	Fully exploited	25th percentile, previous 10 years	2.16
> 2.5	Overexploited	10th percentile, whole time series	1.56



AUTHOR RECOMMENDATIONS

BSAI Status Quo

Species	Model	OFL (t)	ABC (t)
Pacific Sleeper			
Salmon			
Other/Unid			
Spiny Dogfish			
Shark Stock Complex	16.0	689	517

BSAI Alternatives

Species	Model	OFL (t)	ABC (t)
Pacific Sleeper	PSS22.0	117	88
Salmon	SS22.0	199	149
Other/Unid	OU22.0	55	41
Spiny Dogfish	SD22.0	20	15
Shark Stock Complex		391	293

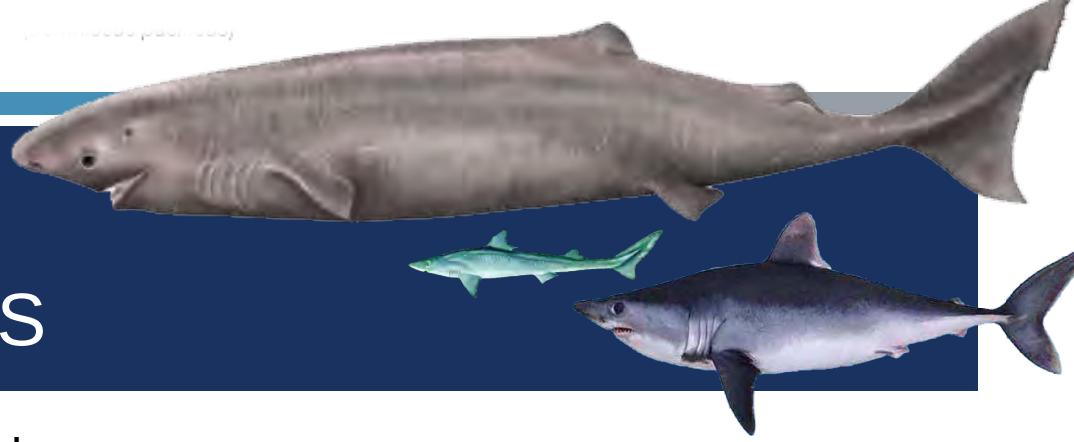
GOA Status Quo

Species	Model	OFL (t)	ABC (t)
Pacific Sleeper	11.0	312	234
Salmon	11.0	70	53
Other/Unid	11.0	188	141
Spiny Dogfish (T5)	SD15.3A	5,951	4,463
Shark Stock Complex		6,521	4,891

GOA Alternatives

Species	Model	OFL (t)	ABC (t)
Pacific Sleeper	PSS22.0	197	148
Salmon	SS11.0	70	53
Other/Unid	OU22.0	123	92
Spiny Dogfish (T5)	SD15.3A	5,951	4,463
Shark Stock Complex		6,341	4,756

SHARK RISK TABLES



Author recommended models risk table

Assessment-related	Population dynamics	Enviro/ ecosystem	Fishery Performance
Level 1: no increased concerns	Level 2: Substantially increased concerns	Level 1: no increased concerns	Level 1: no increased concerns

If alternative models selected, no recommended reductions from maximum permissible ABC

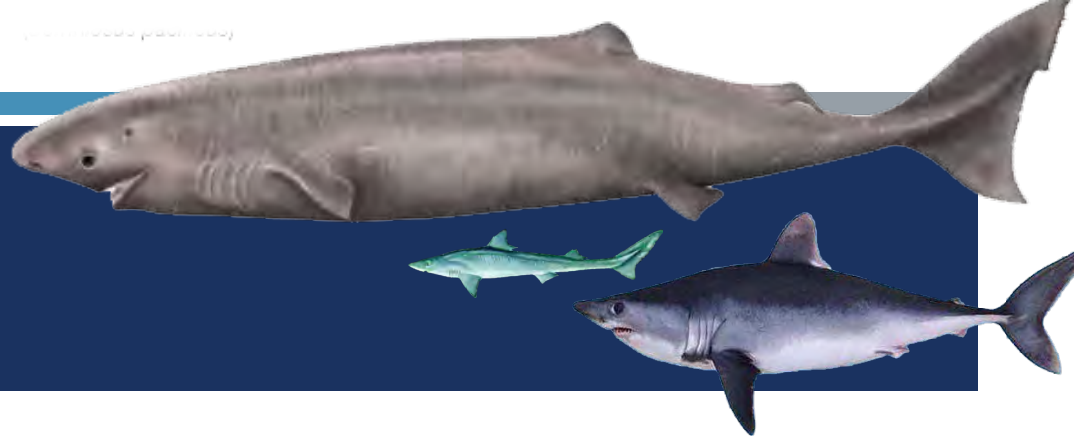
Status quo risk table

Assessment-related	Population dynamics	Enviro/ ecosystem	Fishery Performance
Level 3: major problems with the stock assessment	Level 2: Substantially increased concerns	Level 1: no increased concerns	Level 1: no increased concerns

If status quo, author recommended a reduction from maximum permissible ABC.

Suggest using ORCS output for reduction

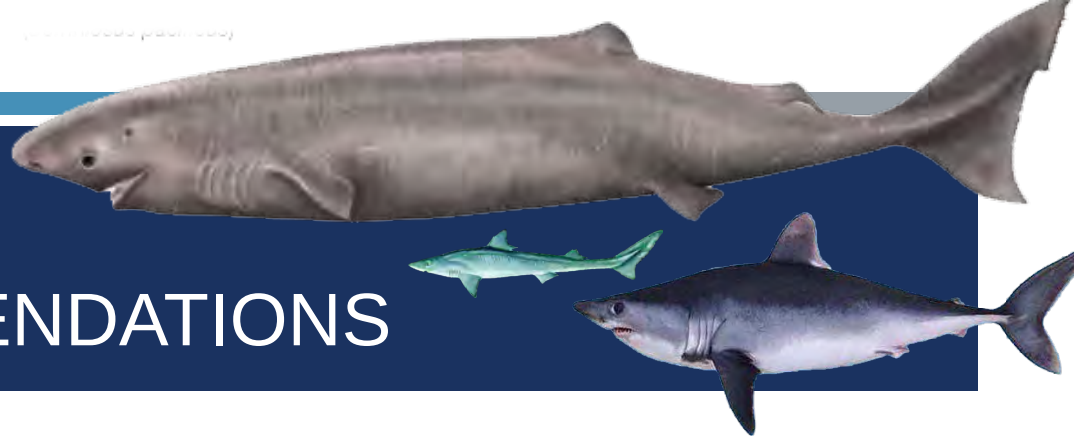
CHAPTER 19 SHARKS



- New model(s): yes; change from base: no - but; risk table (3*,2,1,1)
- The Team recommended the status-quo management approach (Tier 6) with a risk table reduction from maximum permissible ABC to accommodate for the high risk to the Pacific sleeper shark (PSS) component of the complex.
  - OFL = Tier 6 OFL
  - ABC = Tier 6 maxABC × 0.7 + ORCS PSS ABC
    - 0.7 was the proportion of Tier 6 maxABC that was not PSS

	OFL	MaxABC	ABC
BSAI Sharks	689 t	517 t	517×0.7+88 = 450 t

CHAPTER 19
SHARKS RECOMMENDATIONS

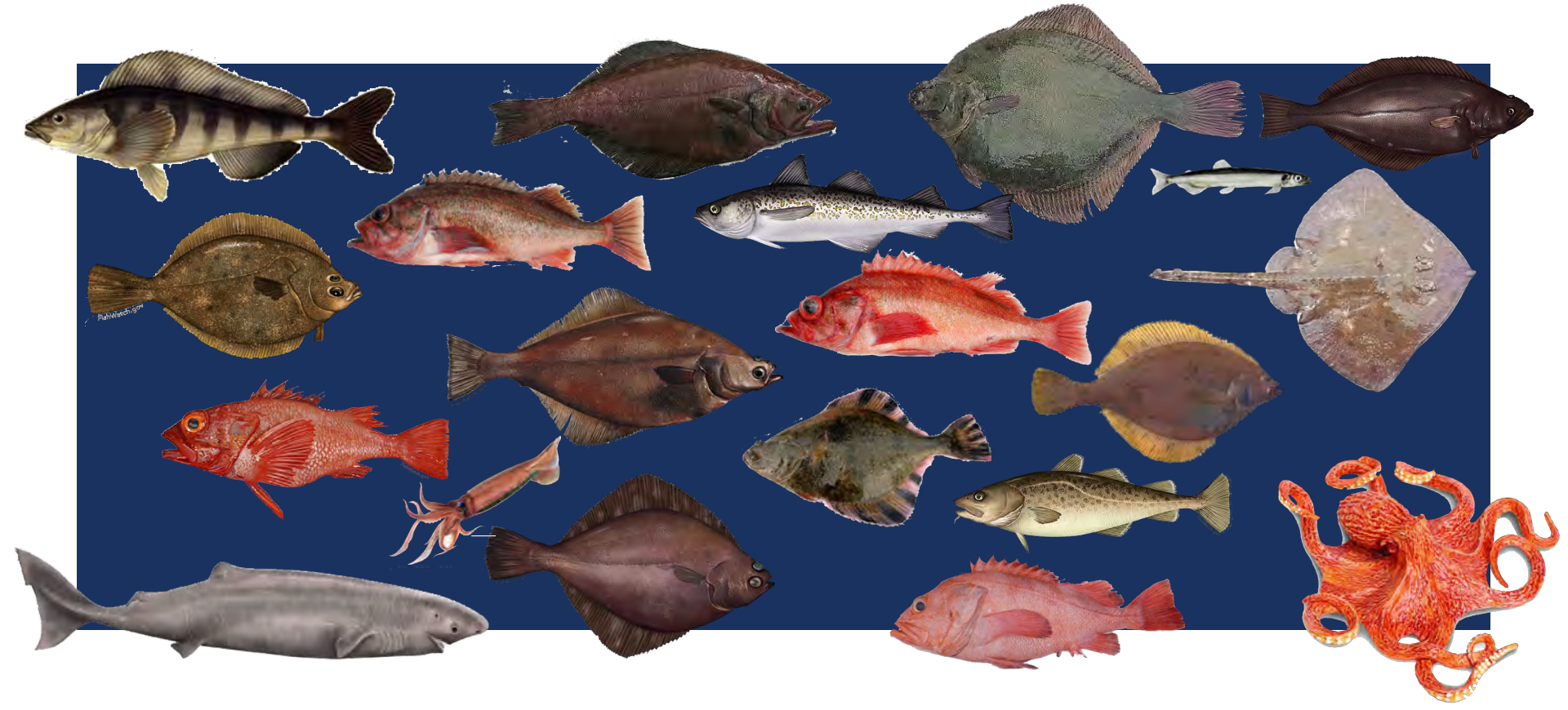


- The Team recommended that the authors continue to explore the ORCS approach and to determine customization and weighting methods for the attribute table that are appropriate for the BSAI shark complex.

RECOMMENDED HARVEST SPECIFICATIONS

Species	Area	2021 OFL	2021 ABC	2021 TAC	Catch as of 12/31/2021	2022 OFL	2022 ABC	2022 TAC	Catch as of 11/5/2022	2023 OFL	2023 ABC	2023 TAC	2024 OFL	2024 ABC	2024 TAC
Pollock	EBS	2,594,000	1,626,000	1,375,000	1,376,258	1,469,000	1,111,000	1,111,000	1,103,996	3,381,000	1,688,000		4,639,000	1,815,000	
	AI	61,856	51,241	19,000	1,840	61,264	50,752	19,000	2,895	52,383	43,413		52,043	43,092	
	Bogoslof	113,479	85,109	250	8	113,479	85,109	250	256	115,146	86,360		115,146	86,360	
Pacific cod	BS	147,949	123,805	111,380	109,202	183,012	153,383	136,466	127,885	172,495	144,834		166,814	140,159	
	AI	27,400	20,600	13,796	7,298	27,400	20,600	13,796	6,178	18,416	13,812		18,416	13,812	
	BSAI/GO	60,426	29,558	n/a		40,432	34,521	n/a		47,390	40,502		48,561	41,539	
Sablefish	BS	n/a	3,396	3,396	4,169	n/a	5,264	5,264	5,205	n/a	8,417		n/a	10,145	
	AI	n/a	4,717	4,717	1,578	n/a	6,463	6,463	2,193	n/a	8,884		n/a	10,299	
Yellowfin sole	BSAI	341,571	313,477	200,000	108,788	377,071	354,014	250,000	149,869	404,882	378,499		495,155	462,890	
Greenland turbot	BSAI	8,568	7,326	6,025	1,597	7,687	6,572	6,572	1,477	4,645	3,722		3,947	3,162	
	BS	n/a	6,176	5,125	1,130	n/a	5,540	5,540	1,038	n/a	3,180		n/a	2,666	
	AI	n/a	1,150	900	467	n/a	1,032	1,032	439	n/a	592		n/a	496	
Arrowtooth flounder	BSAI	90,873	77,349	15,000	9,014	94,445	80,389	20,000	7,626	98,787	83,852		103,070	87,511	
Kamchatka flounder	BSAI	10,630	8,982	8,982	6,667	10,903	9,214	9,214	8,349	8,946	7,579		8,776	7,435	
Northern rock sole	BSAI	145,180	140,306	54,500	14,393	214,084	206,896	66,000	18,242	166,034	121,719		196,011	119,969	
Flathead sole	BSAI	75,863	62,567	25,000	10,259	77,967	64,288	35,500	14,559	79,256	65,344		81,167	66,927	
Alaska plaice	BSAI	37,924	31,657	24,500	15,862	39,305	32,697	29,221	11,006	40,823	33,946		43,328	36,021	
Other flatfish	BSAI	22,919	17,189	6,500	2,638	22,919	17,189	10,000	2,550	22,919	17,189		22,919	17,189	
Pacific Ocean perch	BSAI	44,376	37,173	35,899	35,479	42,605	35,688	35,385	22,629	50,133	42,038		49,279	41,322	
	BS	n/a	10,782	10,782	10,693	n/a	10,352	10,352	9,665	n/a	11,903		n/a	11,700	
	EAI	n/a	8,419	8,419	8,288	n/a	8,083	8,083	5,924	n/a	8,152		n/a	8,013	
	CAI	n/a	6,198	6,198	5,993	n/a	5,950	5,950	5,823	n/a	5,648		n/a	5,551	
	WAI	n/a	11,774	10,500	10,505	n/a	11,303	11,000	10,882	n/a	16,335		n/a	16,058	
Northern rockfish	BSAI	18,917	15,557	13,000	6,212	23,420	19,217	17,000	7,801	22,776	18,687		22,105	18,135	
Blackspotted/Rougheye Rockfish	BSAI	576	482	482	515	598	503	503	386	703	525		763	570	
	EBS/EAI	n/a	313	313	196	n/a	326	326	137		359			388	
	CAI/WAI	n/a	169	169	319	n/a	177	177	249		166			182	
Shortraker rockfish	BSAI	722	541	500	496	722	541	541	284	706	530		706	530	
Other rockfish	BSAI	1,751	1,313	916	1,002	1,751	1,313	1,144	1,224	1,680	1,260		1,680	1,260	
	BS	n/a	919	522	392	n/a	919	750	647		880			880	
	AI	n/a	394	394	610	n/a	394	394	577		380			380	
Atka mackerel	BSAI	85,580	73,590	62,257	61,354	91,870	78,510	66,481	54,311	118,787	98,588		101,188	86,464	
	EAI/BS	n/a	25,760	25,760	25,183	n/a	27,260	27,260	15,504	n/a	43,281		n/a	37,958	
	CAI	n/a	15,450	15,450	15,308	n/a	16,880	16,880	16,599	n/a	17,351		n/a	15,218	
	WAI	n/a	32,380	21,047	20,863	n/a	34,370	22,341	22,208	n/a	37,956		n/a	33,288	
Skates	BSAI	49,297	41,257	18,000	20,029	47,790	39,958	30,000	27,799	46,220	38,605		44,168	36,837	
Sharks	BSAI	689	517	200	221	689	517	500	125	689	450		689	450	
Octopuses	BSAI	4,769	3,576	700	170	4,769	3,576	700	254	4,769	3,576		4,769	3,576	
Total	BSAI	3,945,315	2,747,727	2,000,000	1,795,049	2,953,182	2,383,653	1,871,000	1,586,764	4,859,585	2,933,080		6,219,700	3,130,210	

THANK YOU



BSAI TEAM
ESR RECOMMENDATIONS

- **Bering Sea ESR**
  - The Team recommended that pH data be aligned with “survey replicated” dates and locations in the model to further skill evaluations.
  - The Team recommended continuation of display of NBS and EBS data separately and encouraged the addition of composite indices (i.e., EBS, NBS, and EBS+NBS). The Team encouraged authors to include EBS and NBS (where appropriate) as well as EBS+NBS combined for all indices when available, and for authors to clearly label each index domain to facilitate sub-regional assessments.
- **Combined AI and EBS ESR Discussion and recommendations**
  - The Team recommended collection of sablefish diets across groundfish survey regions in the next year(s) in order to help understand mechanisms for, and implications of, increasing abundance of sablefish in response to recent warm conditions.
  - The Team recommended adding the zooplankton time series back into the Report Card.
  - The Team recommended a short presentation next September to the Team to review the methods and tradeoffs in approaches.
  - The Team recommended continuing to identify a common baseline for index or indicator averages and in particular to work with the contributors and the ESR team to establish some guidance for fixed baselines (rather than annually adjusting means).

BSAI TEAM POLLOCK RECOMMENDATIONS

- **EBS Pollock**
  - The Team recommended that the EBS pollock stock be included in any working group developed to investigate appropriate means of dealing with irregular recruitment and alternative harvest control rules.
- **EBS Multi-species Model**
  - The Team recommended that the contributions of the CEATTLE model align with the timing of the risk table evaluation to inform those discussions in the future.
  - The Team also recommended that the methodologies described for providing climate advice be included in the climate change working group.
  - Finally, the Team recommended continued work to align the CEATTLE results with the single species models and to transfer to the Rceattle version when possible.
- **Aleutian Islands pollock**
  - The Team recommended reevaluation of the assessment considerations category risk table score in the next assessment.

BSAI TEAM
PACIFIC COD RECOMMENDATIONS

- **Pacific cod - EBS Ecosystem and Socioeconomic Profile (ESP)**
  - The Team recommended the ESP team investigate options for cooperative research and communication with the fleet and observer program to collect Pacific cod stomachs in the fishery.
- **Pacific cod - EBS**
  - The Team recommended the authors explore the sensitivity of the terminal year fishery size composition data that have not been debriefed or may not be representative of a full year of data.
- **Pacific cod - Aleutian Islands**
  - The Team recommended the author continue to present the age-structured models shown this year for future consideration.
  - The Team recommended that this stock remain on an annual cycle and not be considered for reduction in assessment frequency when the Teams considers stock prioritization.
  - The Team recognized the importance of the survey to the assessment of this stock and recommended that an Aleutian Islands trawl survey be completed as part of its biennial schedule in 2024.

BSAI TEAM
FLATFISH RECOMMENDATIONS

- **Yellowfin sole**
  - The Team recommended to include the recruitment retrospective analysis in the next full assessment.
  - The Team recommended a comparison of the EBS only and the combined EBS+NBS model-based estimates to determine if the inflation of the estimates was due to the VAST method or the addition of the NBS.
- **Greenland turbot**
  - The Team recommended a 6% reduction from maximum permissible ABC, based on the lower range determined by a sensitivity analysis of maturity.
  - The Team recommended the authors revise the interpolation method used to combine the BS and AI longline survey relative population numbers, either based on linear interpolation or new methods under development at the University of Alaska Fairbanks**.**
- **Kamchatka flounder**
  - The Team recommended examining a single length-based selectivity curve in the next assessment cycle. The Team recommended exploring the model sensitivity to the proportion of arrowtooth assigned to Kamchatka prior to 2008.
- **Northern rock sole**
  - The Team recommended the authors put Models 22.1 and 22.2 forward - with likelihood profiles and an evaluation of performance - as alternative models to the base model in the 2024 assessment cycle, to be presented in September 2024.

BSAI TEAM
ROCKFISH RECOMMENDATIONS

- **Blackspotted and rougheye rockfish**
  - The Team discussed the lack of larger fish in fishery composition data and recommended examining the NMFS and IPHC longline survey data to determine if larger fish may be in the population and not showing up in the fishery.
  - The Team also recommended looking at the rate of blackspotted/rougheye to Pacific ocean perch in the survey tows over the time series.

BSAI TEAM
OTHER FISHES RECOMMENDATIONS

- **Sharks**
  - The Team recommended the status-quo management approach with a risk table reduction from maximum permissible ABC to accommodate for the high risk to the Pacific sleeper shark component of the complex.
  - The Team recommended that the authors continue to explore the ORCS approach and to determine customization and weighting methods for the attribute table that are appropriate for the BSAI shark complex.
- **Octopus**
  - The Team recommended that the next author review the consumption model to determine if it is still relevant and applicable.