BSAI Atka Mackerel

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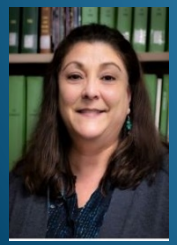
Alaska Fisheries Science Center



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Model 16.0b

Changes in the Input Data

- Fishery catch data updated (2019, 2020=TAC)
- **2019** fishery age composition data added
  - **2012 year class** ↑ 5% (above ave.)
  - **2013 year class** ↑ 7%
  - **2015 year class** ↑ 10%
- The est. average selectivity for **2015-2019** used for projections
- Assume 85% of the BSAI-wide ABC to be taken under revised SSL RPAs; % applied to 2021 (and 2022) maxABC for projections

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Key Results

- Tier 3b

- $B_{100\%}$, $B_{40\%}$, and $B_{35\%}$ ≈ last year's estimates
- 2021 spawning biomass (107,830 t) 2% lower, **below** $B_{40\%}$ ($B_{37\%}$),Tier 3b
- 2021 projections:

  Yield at $F_{40\%adj}$ = 0.43

  2021 ABC = 73,590 t **2021 OFL = 85,580 t**

  (5% higher than 2020 ABC & OFL)

Model 16.0b (last year's accepted model)

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From the Dec. 2019 SSC minutes:

"Continuing to develop appropriate apportionment methods for this stock in the future, with an emphasis on investigating the application and validation of the autoregressive spatio-temporal modeling approach developed in the VAST modeling framework for such purposes. As appropriate, this apportionment should consider use of both survey data and fishery CPUE."

"Taking into consideration that historical fishery evidence of linkages between the AI and GOA populations of Atka mackerel suggest source-sink population dynamics that may account for unexplained fluctuations in the AI population when modeled as a single unit, especially in the eastern region, and exploring the strength of these connections to evaluate changes in the assessment approach (e.g., modeling as two separate stocks versus one metapopulation)."

From the Nov. 2019 PT minutes: *"The Team recommended that an Ecosystem and Socioeconomic Profile (ESP) be developed for this stock in 2020."*

1 - 5
6 - 10
11 - 20
21 - 40
41 - 80
81 - 100
101 - 200
201 - 400
401 - 800
801 - 3000

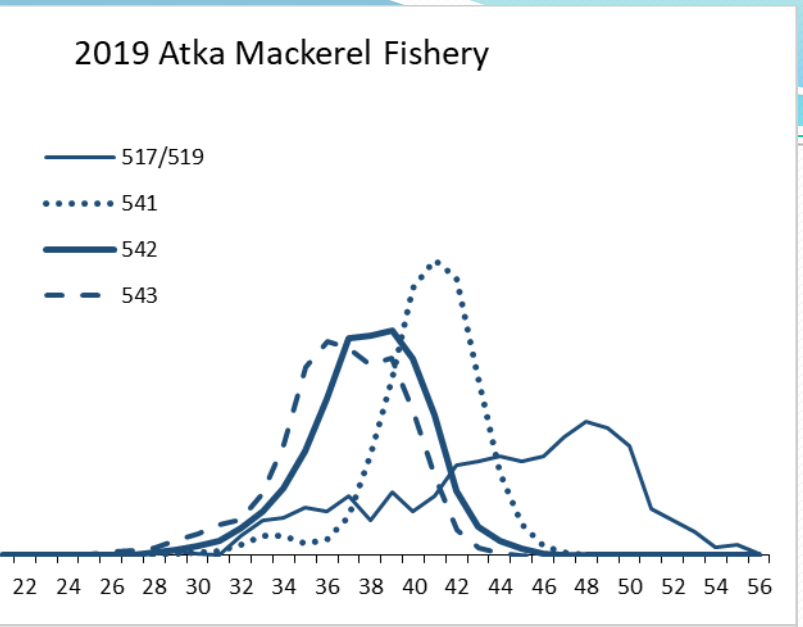
Observed catch (Tons)

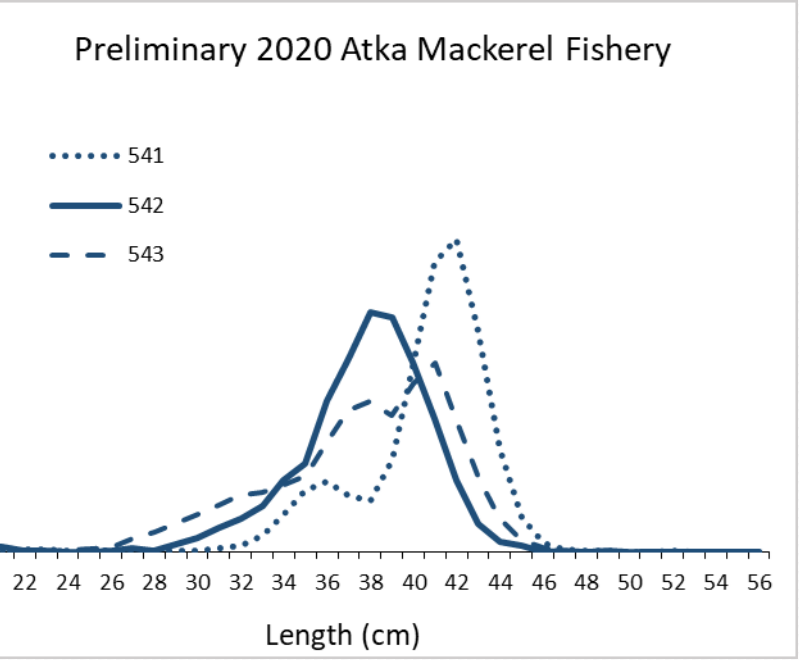
1 - 5
6 - 10
11 - 20
21 - 40
41 - 80
81 - 100
101 - 200
201 - 400
401 - 800
801 - 3000

Observed catch (Tons)

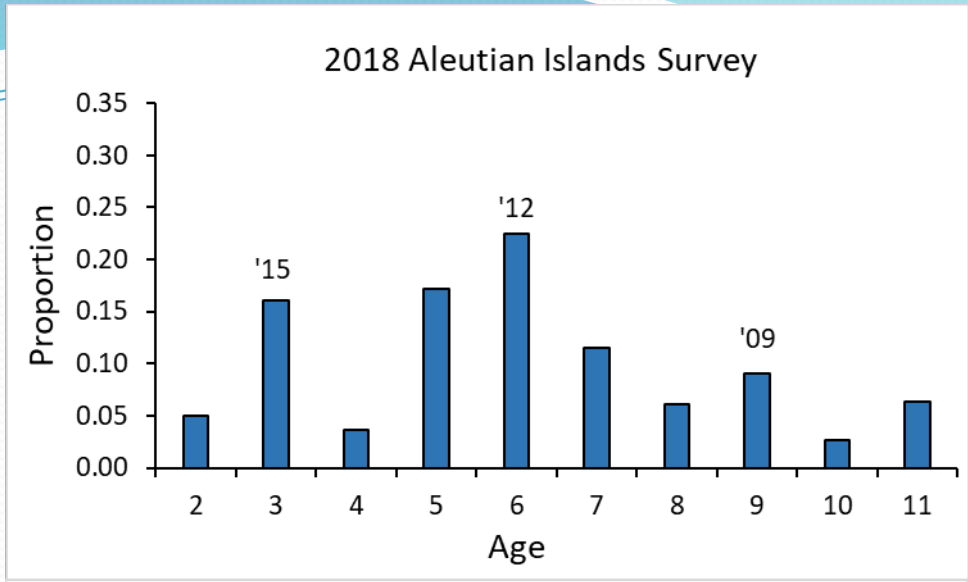
2019-2020

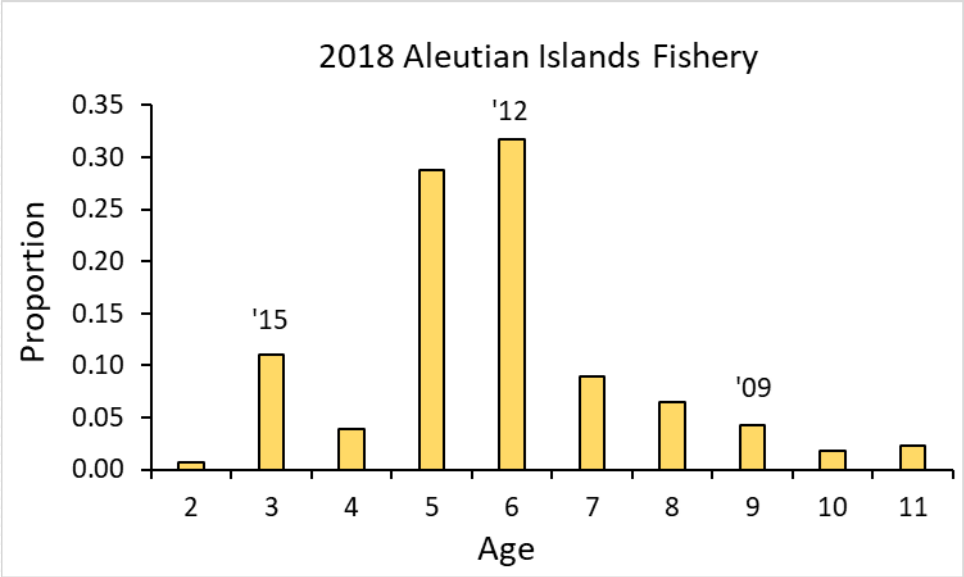
Atka mackerel fishery locations





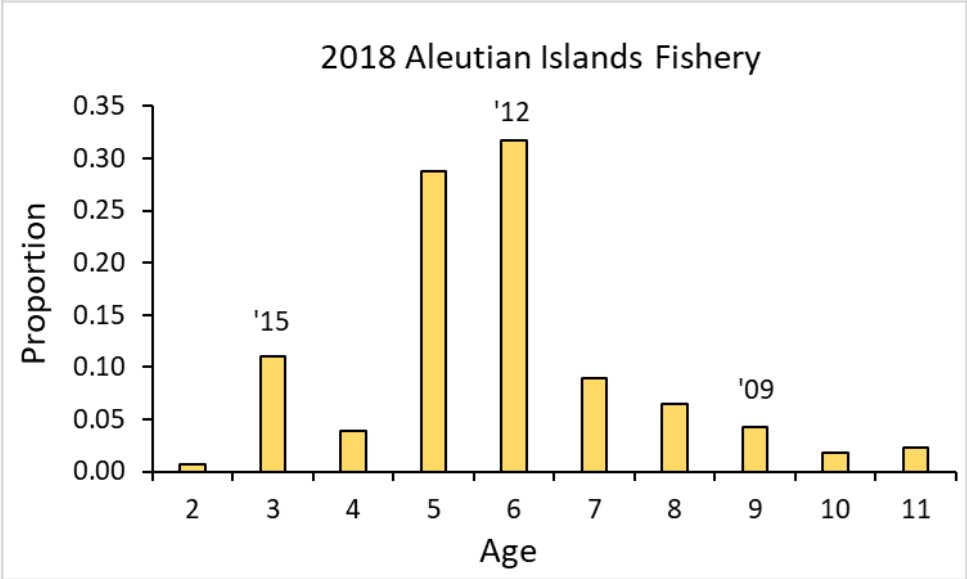
Atka mackerel fishery length-frequency data by area fished



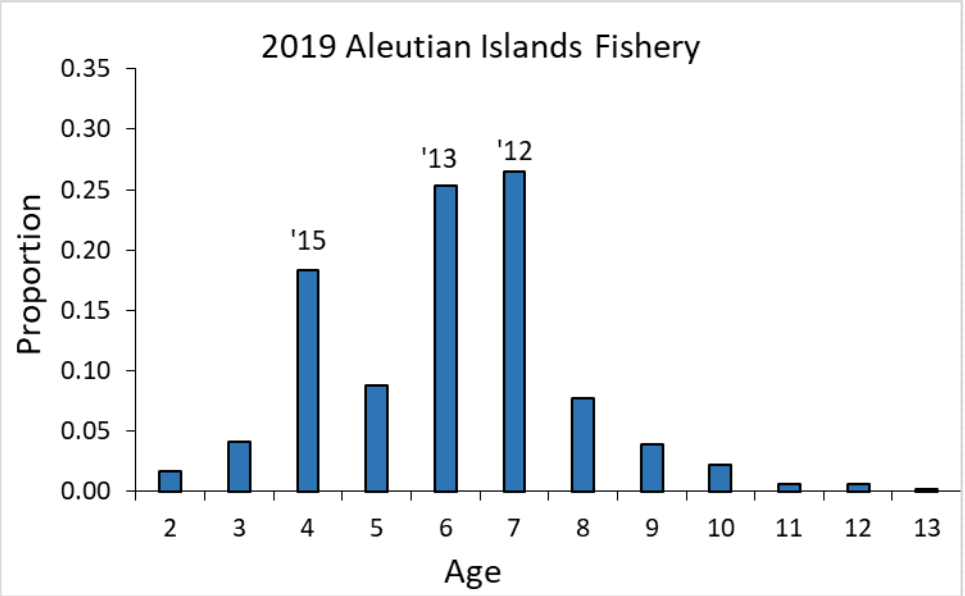


A total of 1,052 otoliths were aged from 2018 survey; mean age is 6 years

A total of 1,581 otoliths were aged from 2018 fishery; mean age is 5.8 years

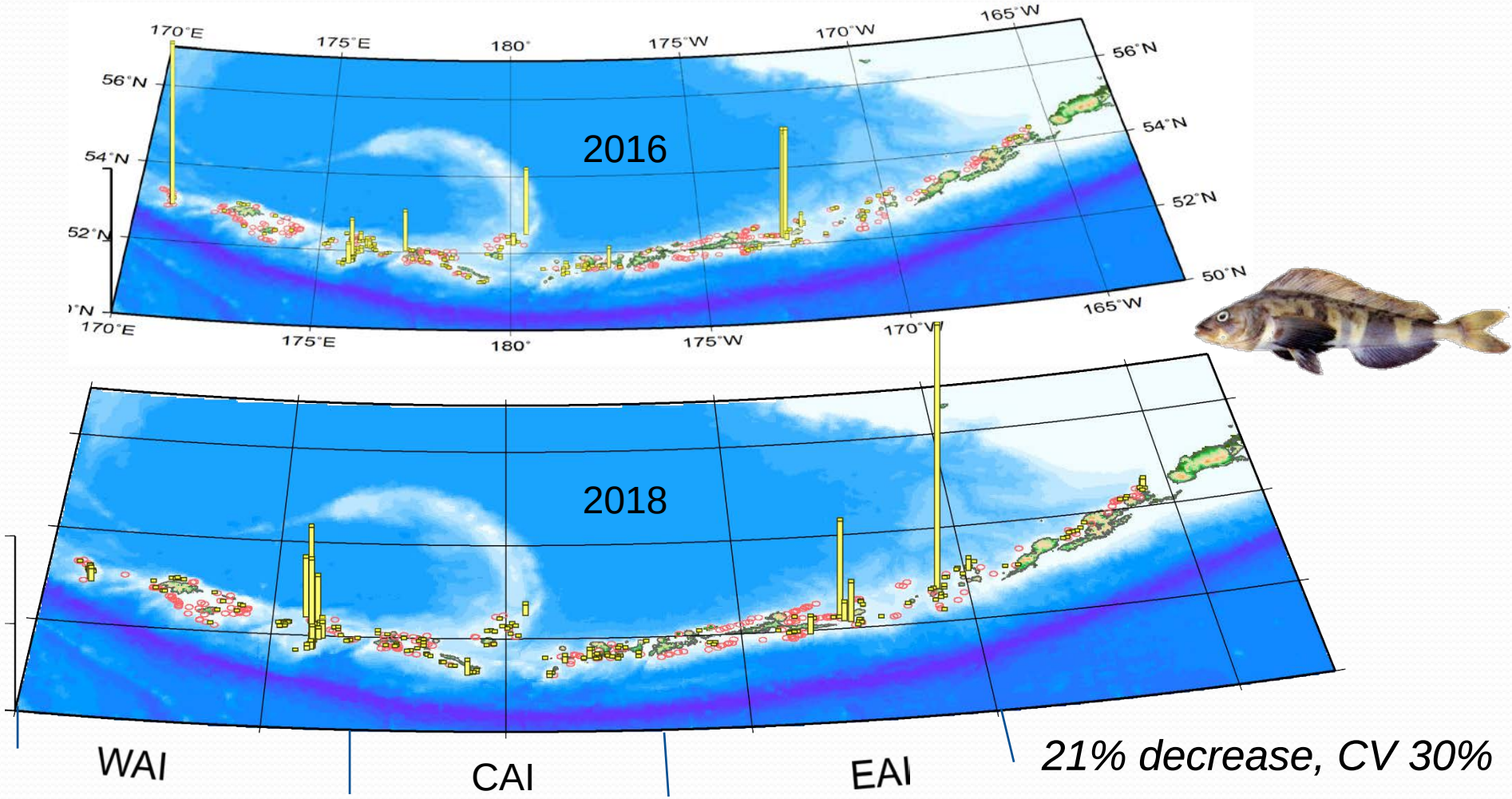


1,581 otoliths aged
Mean age = 5.8 yrs

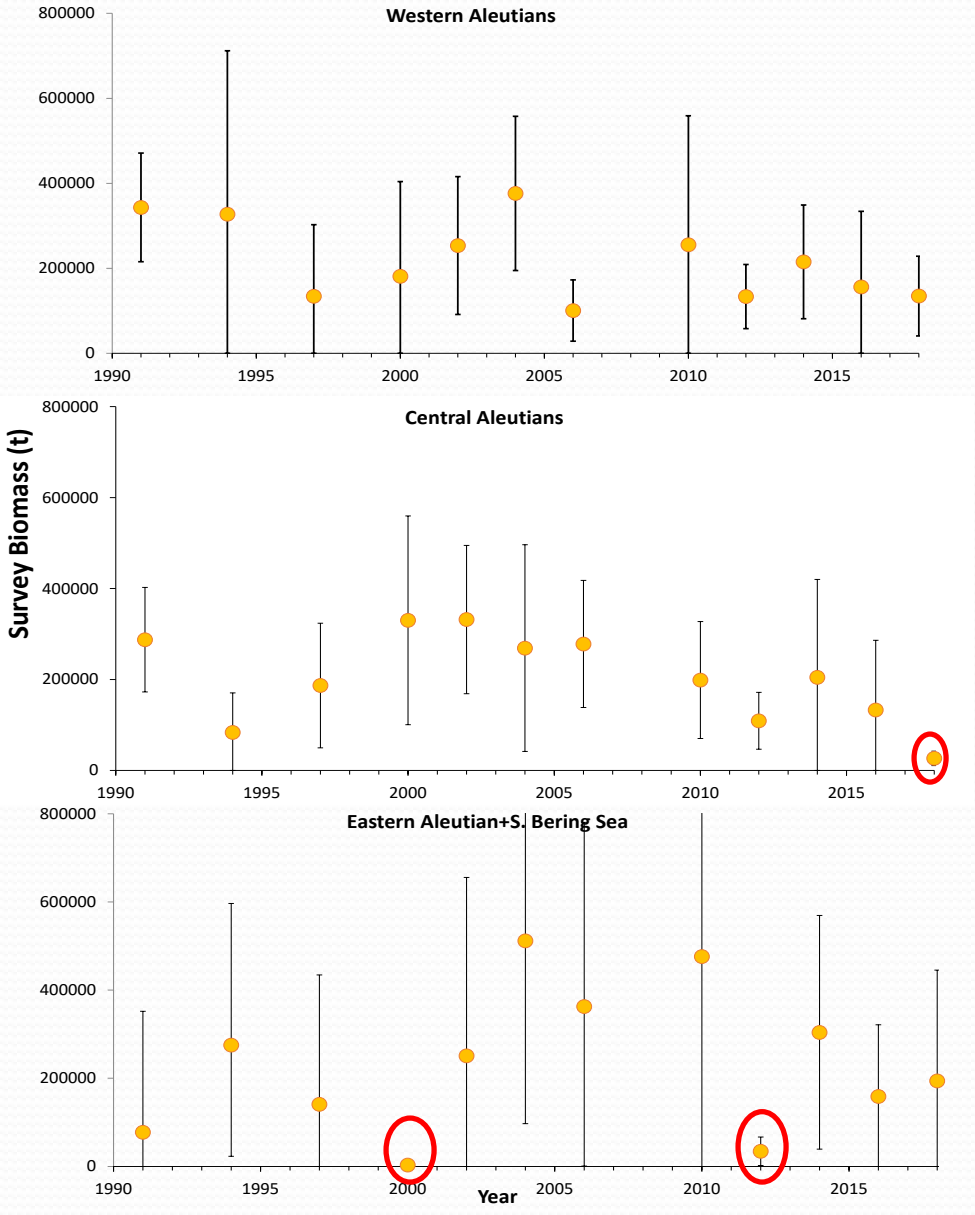


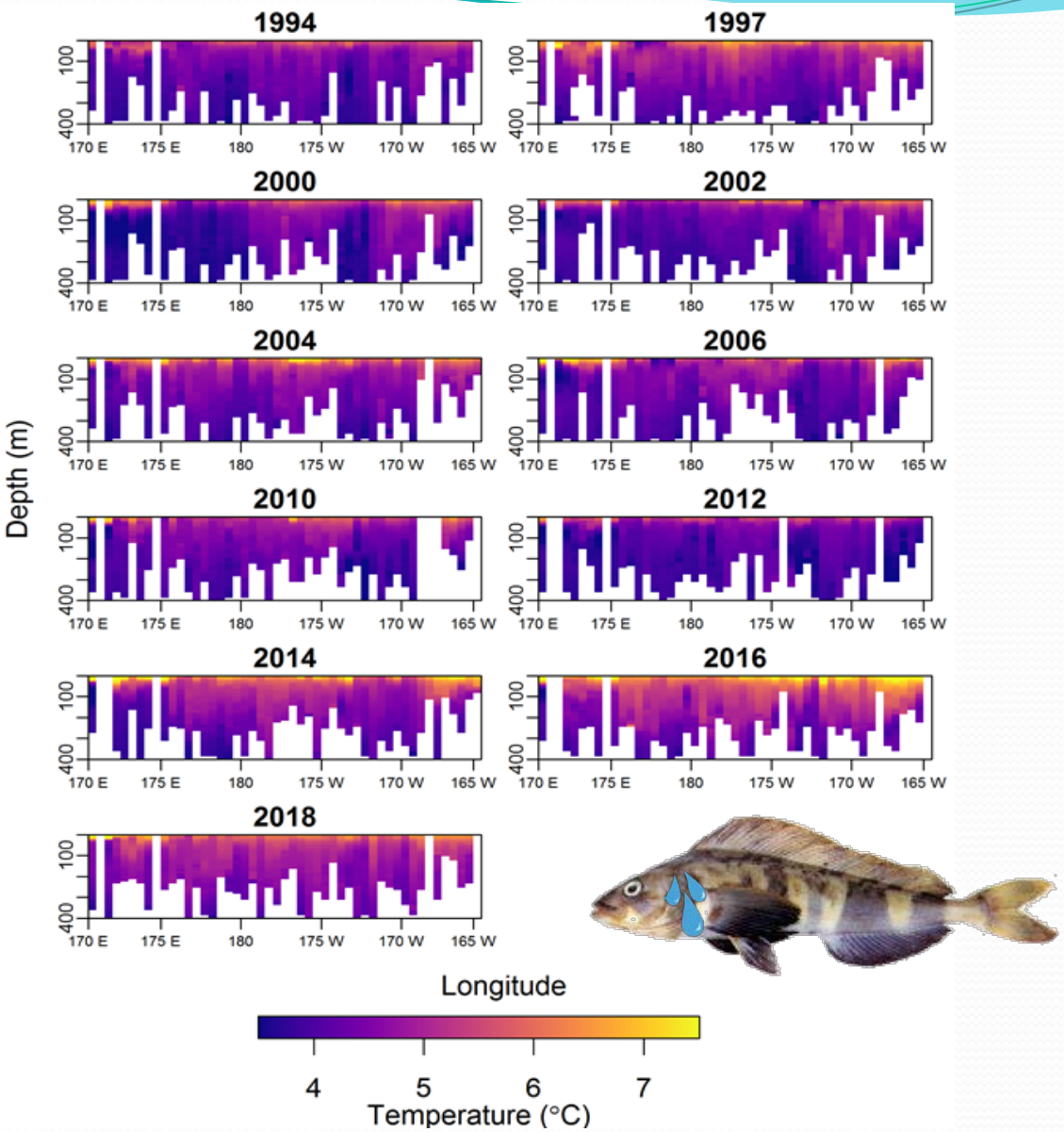
1,510 otoliths aged
Mean age = 6.1 yrs

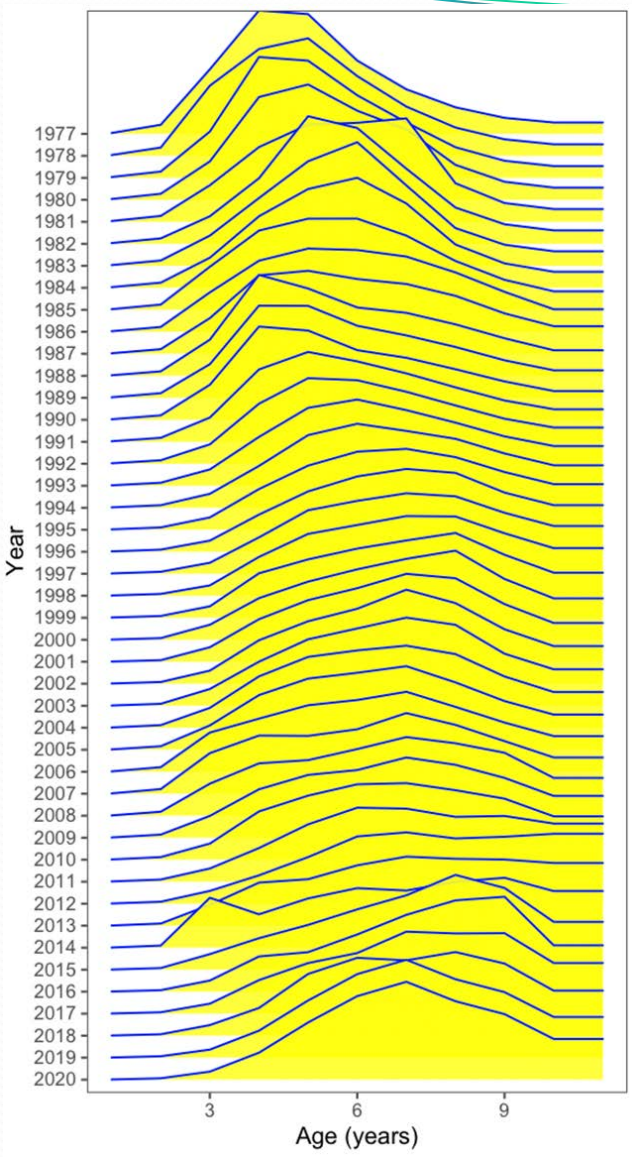
Bottom trawl survey CPUE distributions of Atka mackerel catches



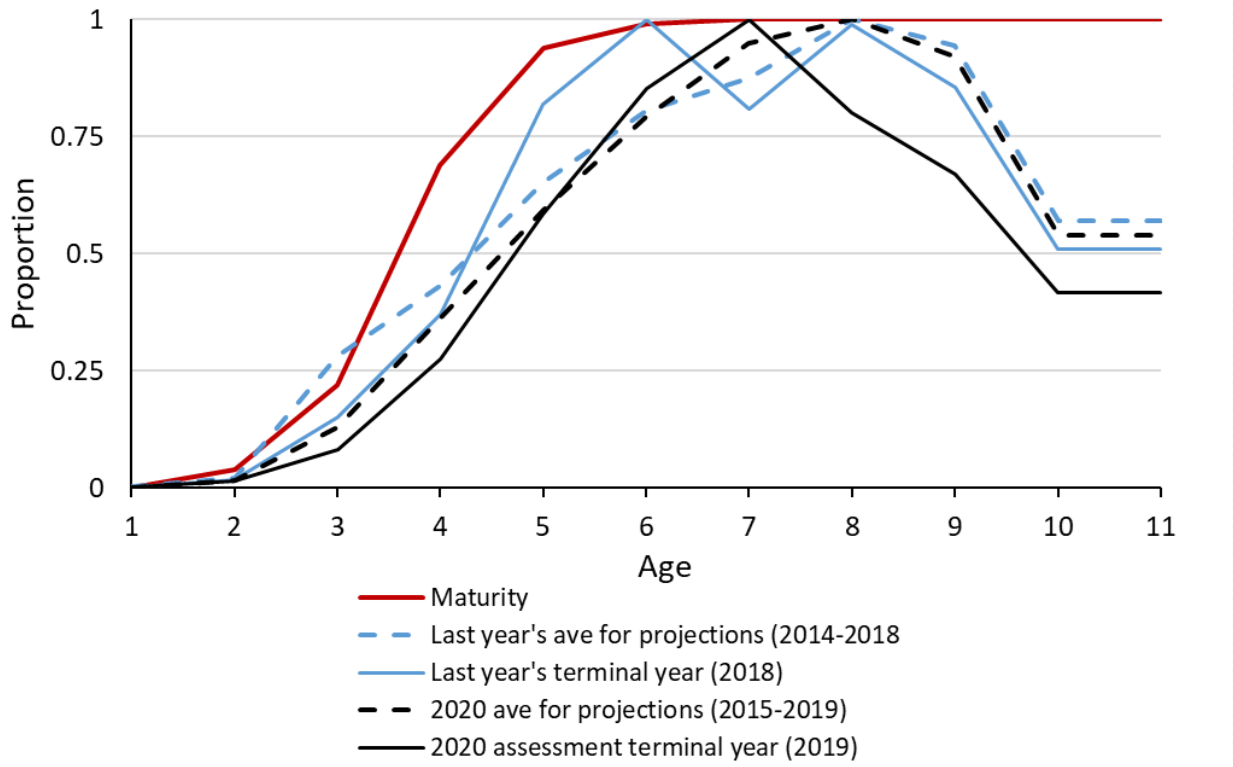
21% decrease, CV 30%


Western Aleutians
800000
600000
400000
200000
0
1990
1995
2000
2005
2010
2015
Central Aleutians
Survey Biomass (t)
800000
600000
400000
200000
0
1990
1995
2000
2005
2010
2015
Eastern Aleutian+S. Bering Sea
800000
600000
400000
200000
0
1990
1995
2000
2005
2010
2015
Year

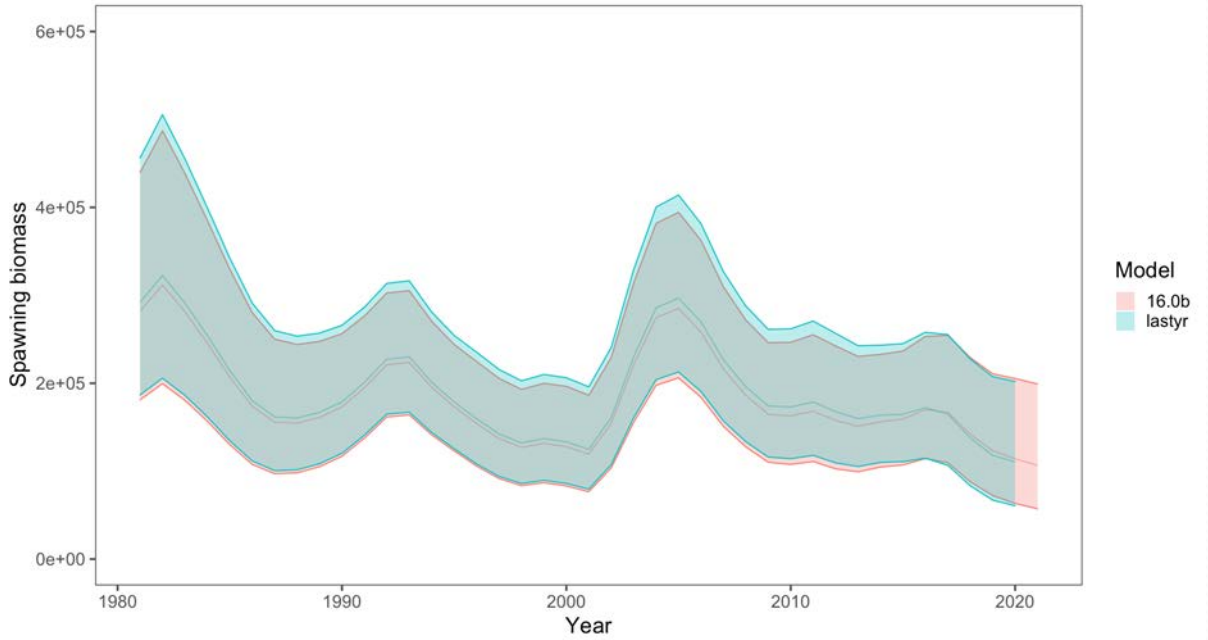

1994
1997
2000
2002
2004
2006
2010
2012
2014
2016
2018
Depth (m)
100
400
170 E
175 E
180
175 W
170 W
165 W
Longitude
4
5
6
7
Temperature (°C)



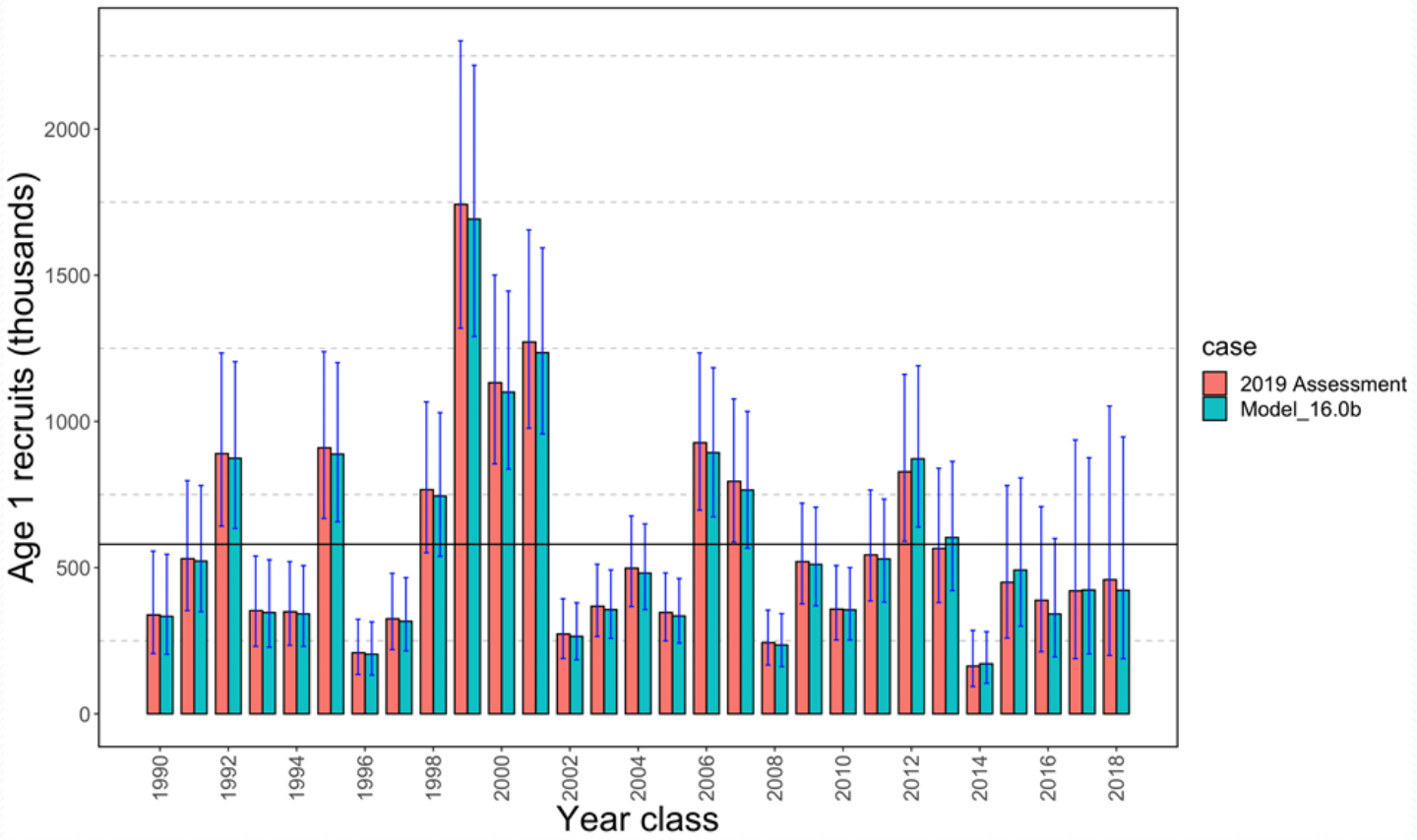
Fishery selectivity pattern from the BSAI Atka mackerel assessment Model 16.0b



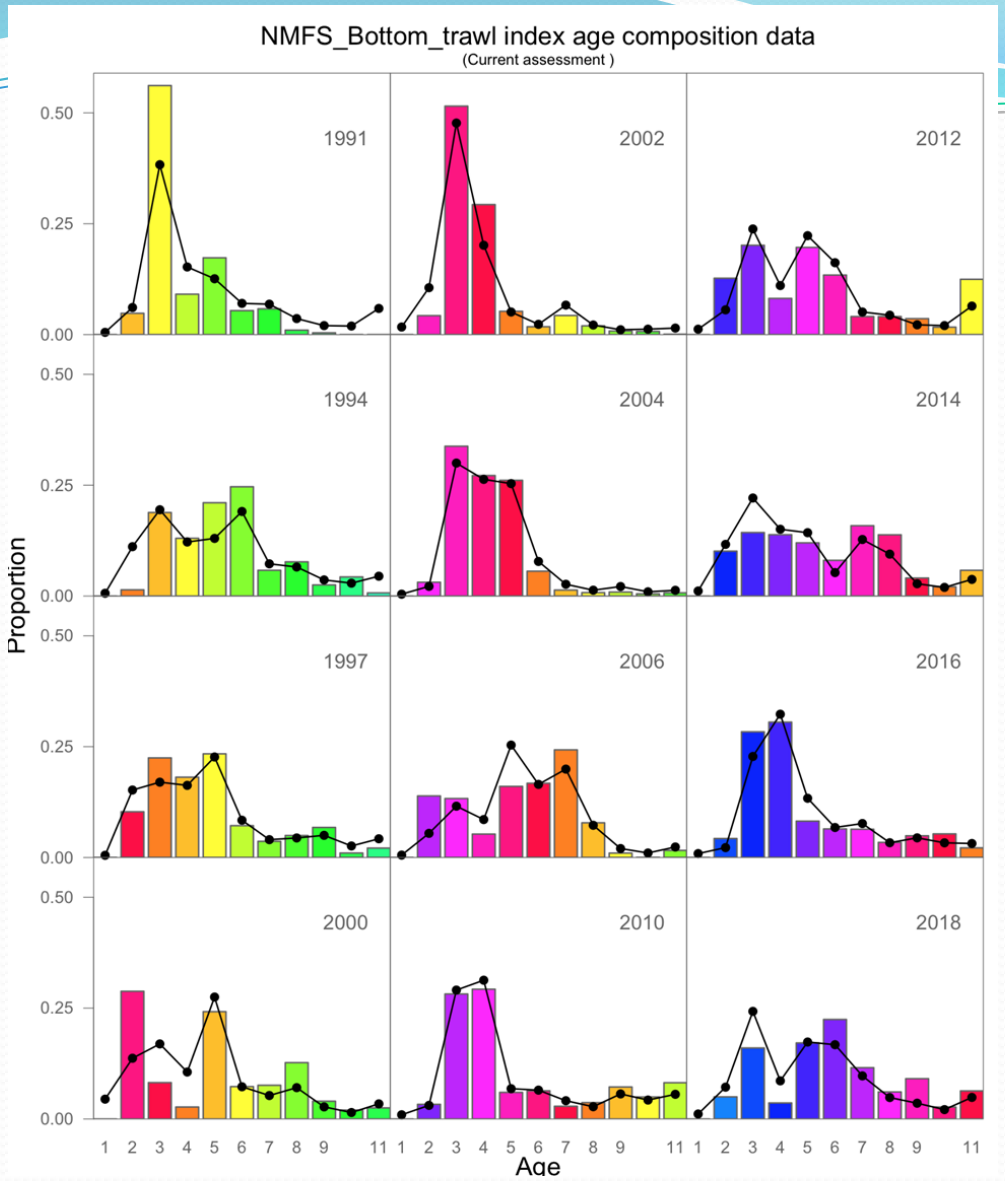
Estimated fishery selectivity patterns in the current assessment with a) last year's average for projections (2014-2018), b) the 2020 assessment average selectivity used for projections (2015-2019), c) last year's assessment terminal year (2018), and d) the 2020 assessment terminal year (2019) compared with the maturity-at-age estimates for BSAI Atka mackerel.



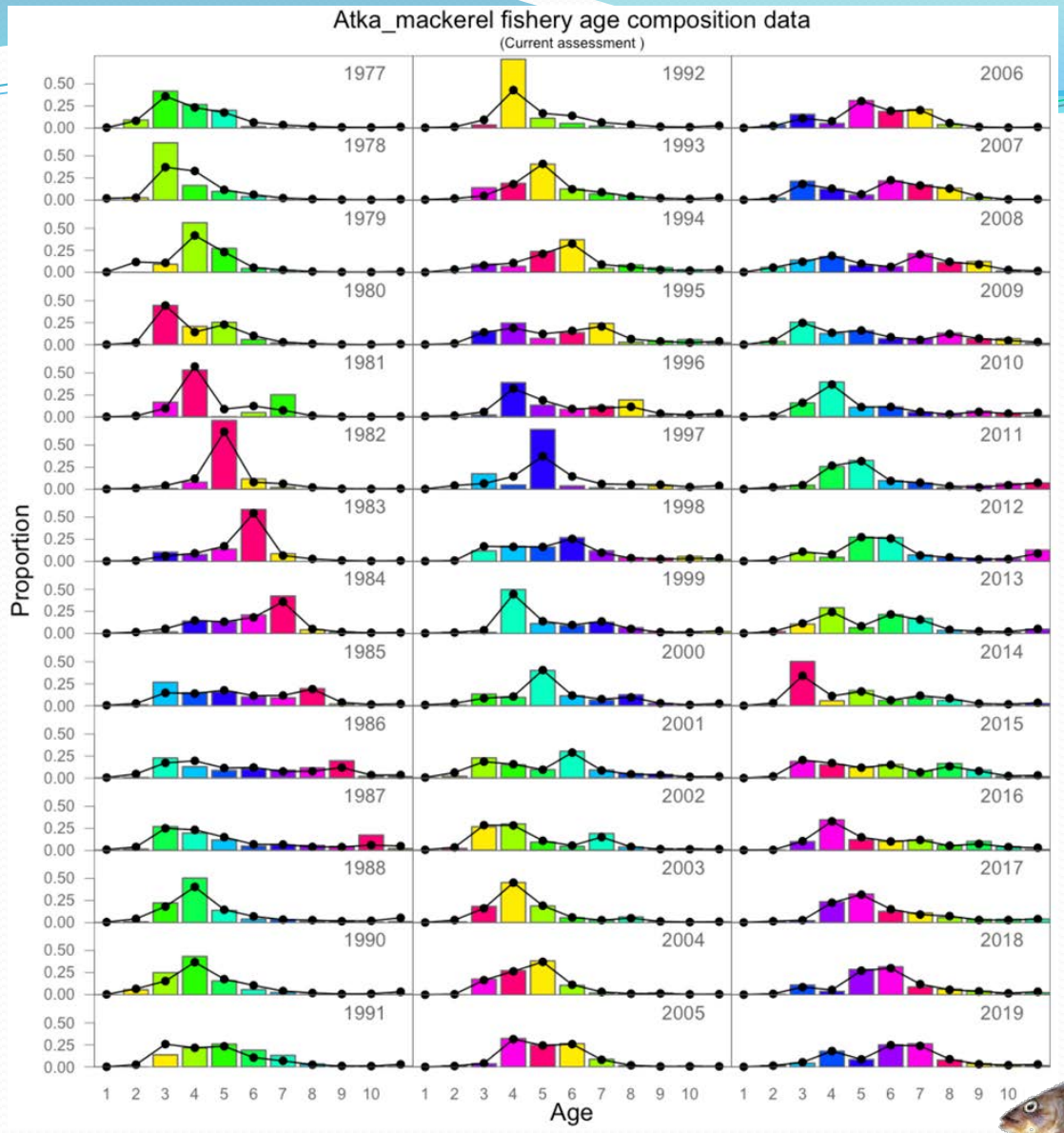
Time series of the current assessment (Model 16.0b) estimated AI Atka mackerel spawning biomass (t) with approximate 95% confidence bounds, compared to last year's Model 16.0b estimates (2019 assessment). Changes include 2019 fishery age composition data in the current assessment.



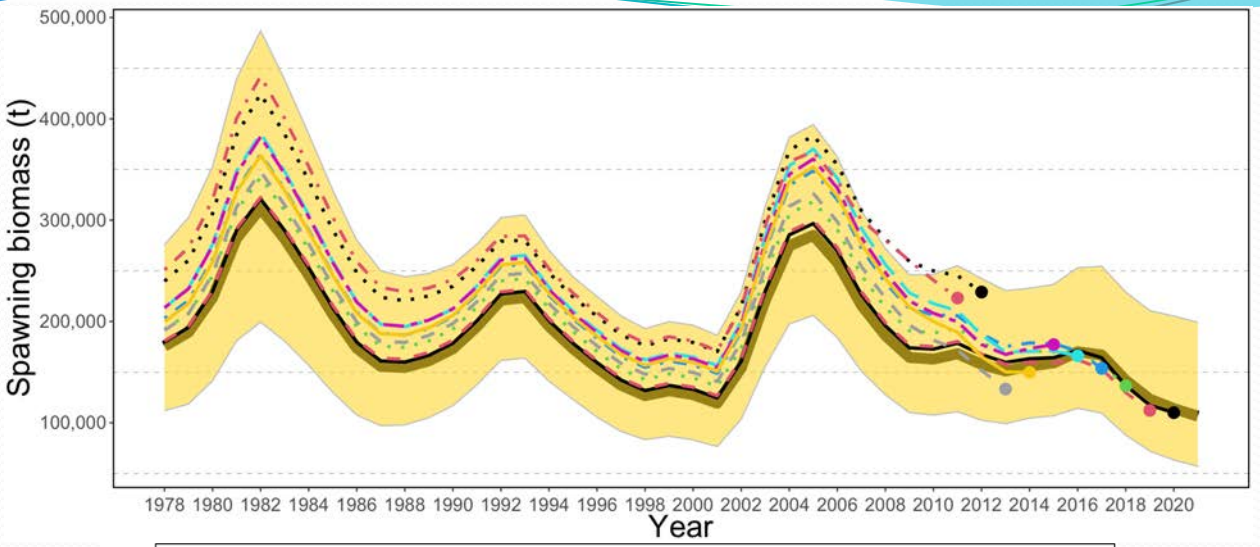
Age 1 recruitment from the current assessment (2020) with the solid line indicating average recruitment (580 million) from the 1977-2018 year classes, and age 1 recruitment as estimated from the 2020 assessment

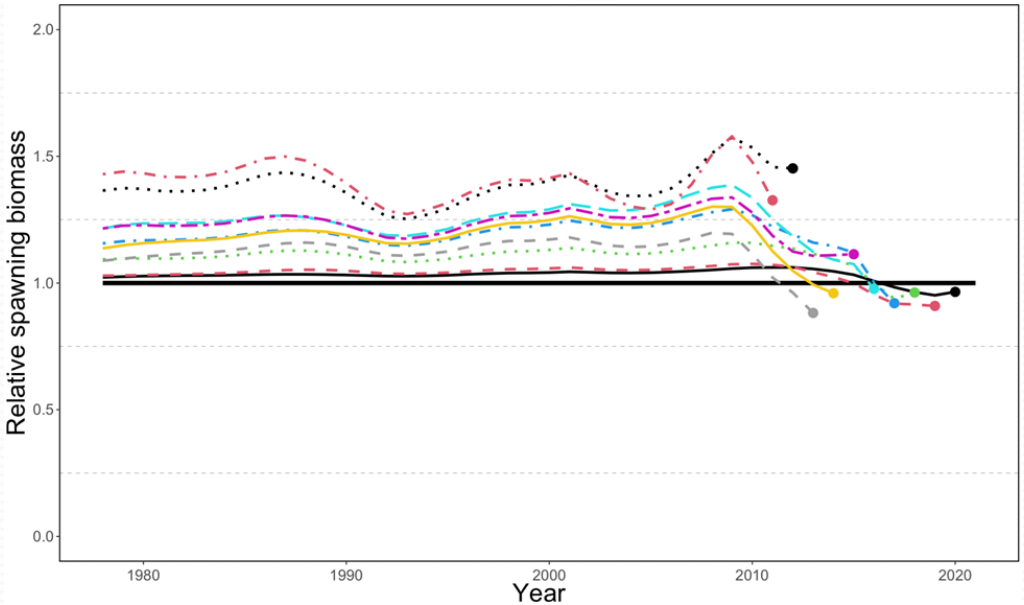


Observed and predicted **survey** proportions-at-age for BSAI Atka mackerel. Lines with "●" symbol are the model predictions and columns are the observed proportions at age

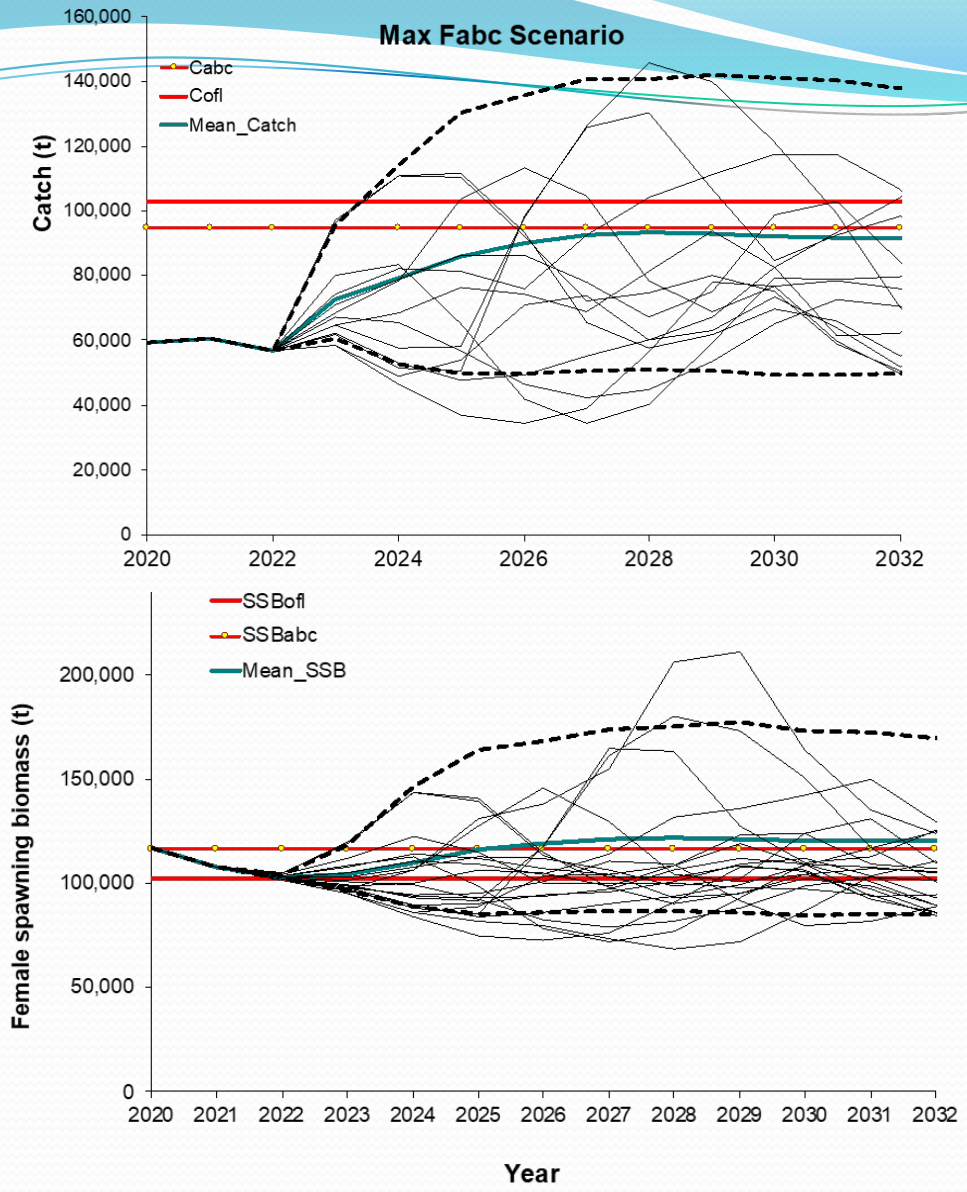


Observed and predicted Atka mackerel **fishery** proportions-at-age for BSAI Atka mackerel. Lines with "•" symbol are the model predictions and columns are the observed proportions at age (with colors corresponding to cohorts)

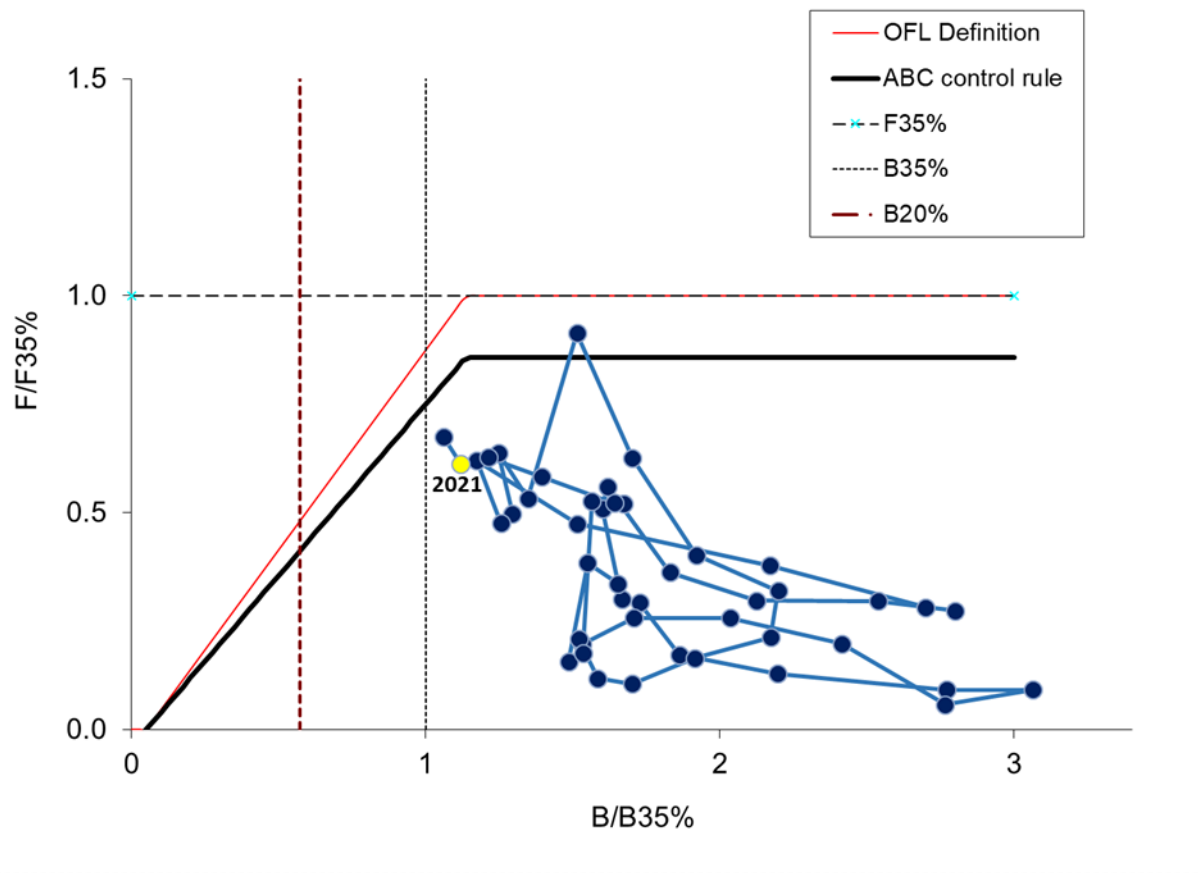




Retrospective plots showing the spawning biomass over time (top) and the relative difference (bottom) over 10 different “peels”



Projected Atka mackerel catch (assuming TAC taken in 2020 and reduced 2021 and 2022 catches; top) and spawning biomass (bottom) in thousands of metric tons under maximum permissible harvest control rule specifications after 2022



BSAI Atka mackerel spawning biomass relative to $B_{35\%}$ and fishing mortality relative to F_{OFL} (1977-2022)

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Overfishing Level and Maximum Permissible ABC

Catch assumptions:

- Total 2020 year end catch set = to TAC (59,305 t) for ABC/OFL specification purposes
- For 2021 & 2022 assume that 85% of the BSAI-wide ABC would be taken
  - Due to revised SSL RPAs
  - Affects ABC and OFL values

Selectivity assumption for projections:

- Estimated ave. selectivity for 2015-2019

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Quantity	As estimated or *specified last* year for: 2020	2021	As estimated or *recommended this* year for: **2021***	2022*
Tier	3b	3b	**3b**	3b
Projected total (age 1+) biomass (t)	515,890	534,220	**560,360**	599,690
Projected Female spawning biomass	109,900	104,700	**107,830**	102,950
$B_{40\%}$	116,600	116,600	**116,330**	116,330
$B_{35\%}$	102,020	99,320	**101,790**	101,790
F_{OFL}	0.48	0.46	**0.51**	0.49
$maxF_{ABC}$	0.41	0.39	**0.43**	0.41
F_{ABC}	0.41	0.39	**0.43**	0.41
OFL (t)	81,200	74,800	**85,580**	79,660
maxABC (t)	70,100	64,400	**73,590**	68,220
ABC (t)	70,100	64,400	**73,590**	68,220

*Projections are based on estimated total catch of 60,400 t and 56,925 t in place of maximum permissible ABC for 2021 and 2022, respectively.

BSAI Atka Mackerel Apportionment

	2018 Random Effects Model
541[1]	**50%**
542	**10%**
543	**40%**

[1]Includes eastern Aleutian Islands and southern Bering Sea areas.

4-Survey Weighted Average (Recommended)

	Survey Year				2021 & 2022 Apportionment	**2021 ABC**	**2022 ABC**
	2012	2014	2016	2018			
541+SBS	12%	42%	35%	38%	0.35	25,760	23,880
542	39%	28%	30%	7%	0.21	15,450	14,330
543	48%	30%	35%	55%	0.44	32,380	30,010
Weights	8	12	18	27	1.00		
Total ABC						73,590	68,220

Should the ABC be reduced below the maximum permissible ABC?

Assessment-related considerations	*Population dynamics considerations*	*Environmental/ecosystem considerations*	*Fishery Performance considerations*
Level 1: Typical to moderately increased concerns	Level 1: Stock trends are typical for the stock; recent recruitment is within normal range.	Level 1: No apparent environmental/ ecosystem concerns	Level 1: No apparent fishery/resource-use performance and/or behavior concerns

There are no changes to the risk table scores relative to last year, and the scores suggests that setting the ABC below the maximum permissible is not warranted.

Questions?