BSAI Atka Mackerel

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BSAI Atka Mackerel

Tier 3a

***Data and Model*:**

- **2016** fishery and survey age composition data added
  - **2011 year class** increased 14% relative to last year's assessment
  - **2012 year** class increased 32%
- **2016 survey biomass: ↓ 38%**, decreases in all areas of the Aleutian Islands

Key Results

- $B_{100\%}$, $B_{40\%}$, and $B_{35\%}$ are 2% lower
- 2018 spawning biomass (139,300 t) 4% lower, **above** $B_{40\%}$ ($B_{45\%}$), Tier 3a
- 2018 age 1+ biomass ≈ last year's projection for 2017
- 2018 projections:

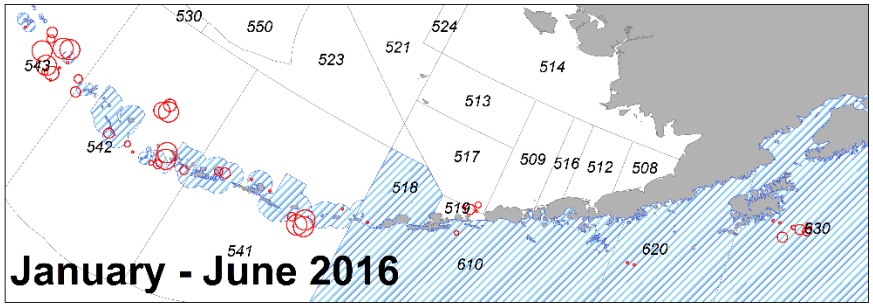
Yield at $F_{40\%}$ up 6% from 2017 ABC

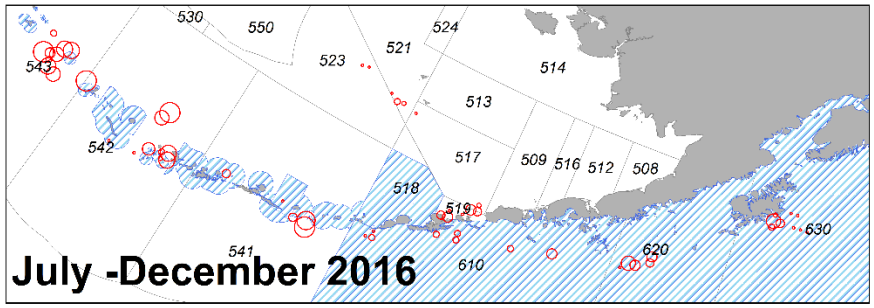
2018 ABC = 92,000 t **2018 OFL = 108,600 t**

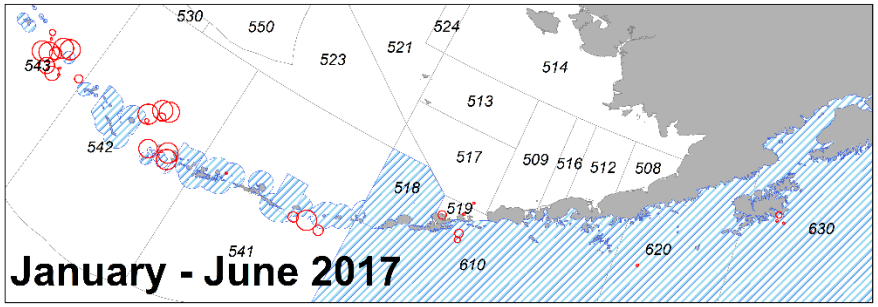
Changes in the Input Data

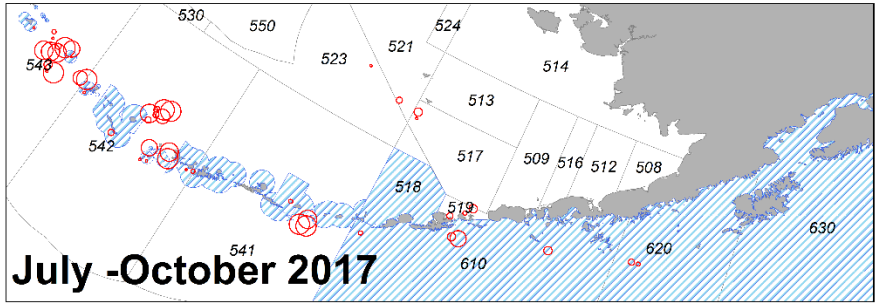
- Fishery catch data updated
- 2016 fishery and survey age composition added
- The est. average selectivity for 2012-2016 used for projections
- Sample sizes for fishery age comp rescaled with 2016 data (varied relative to # hauls)
- Survey age comp data tuned Francis (2011) method, 2016 data added
- Refinements to time-varying fishery selectivity inputs, Francis method used for time-varying sel. variance term
- Assume 75% of the BSAI-wide ABC to be taken under revised SSL RPAs; % applied to 2018 maxABC for projections

16.0 model configuration used, conducted sensitivity evaluations with alt. fishery and selectivity patterns









Observed catch (Tons)

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

Observed catch (Tons)

- 1 - 5
- 6 - 10
- 11 - 20
- 21 - 40
- 41 - 80
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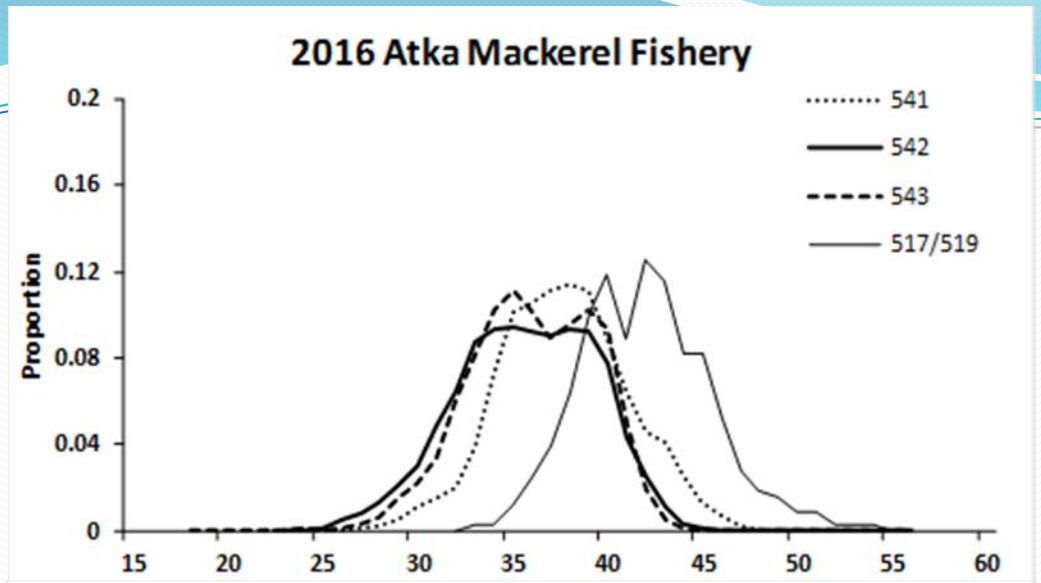
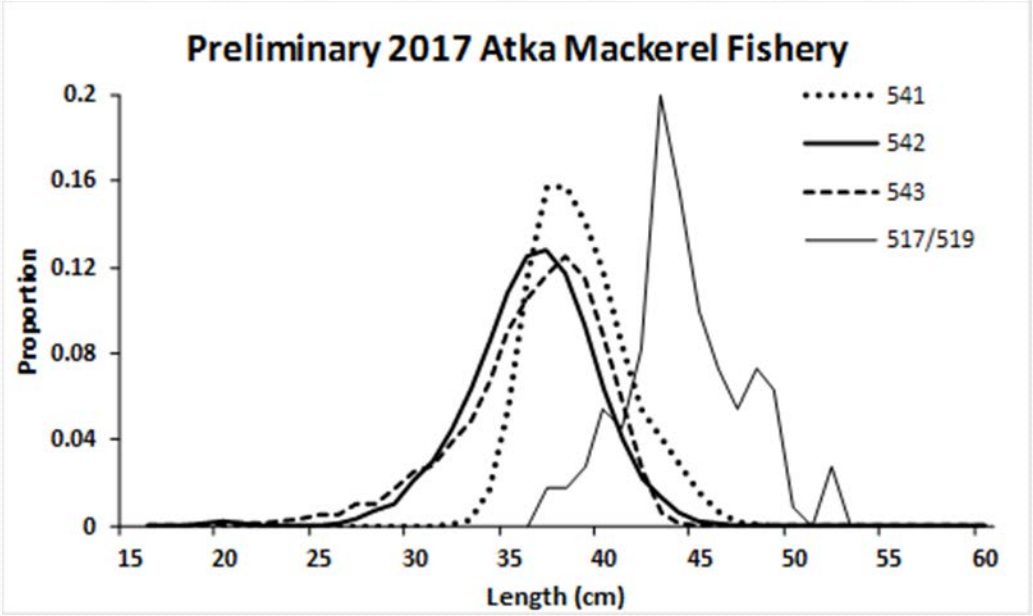
- 201 - 400
- 401 - 800
- > 800

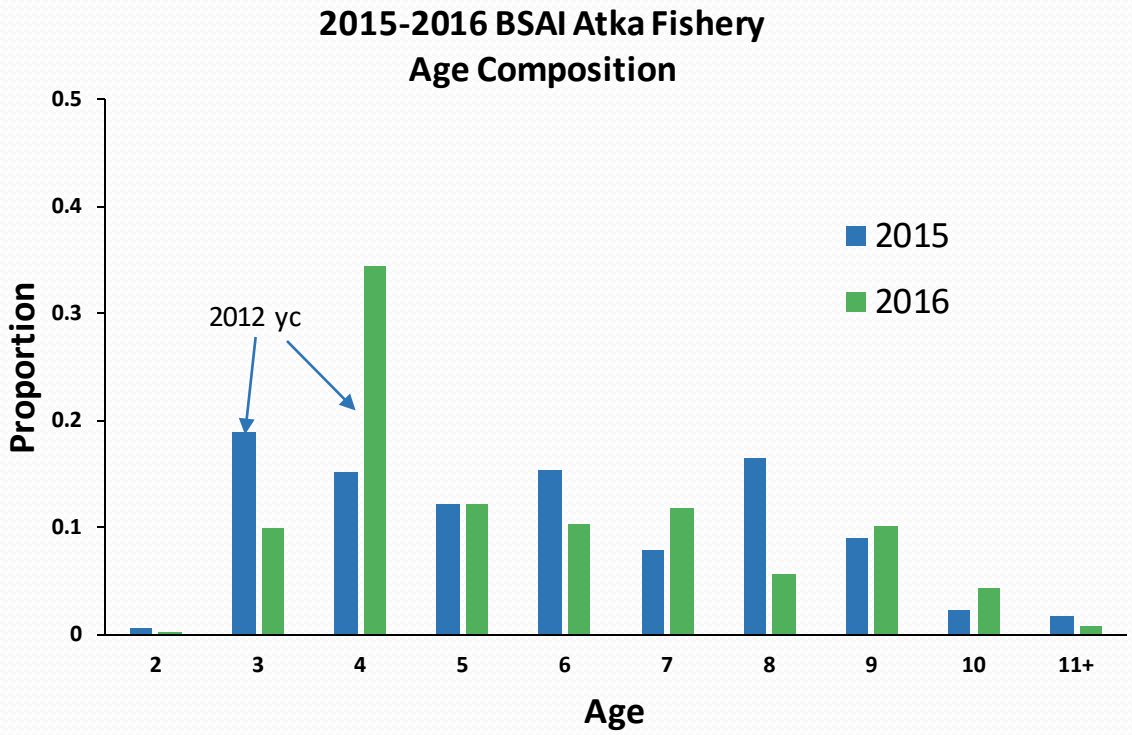
2016-2017

Atka mackerel fishery locations



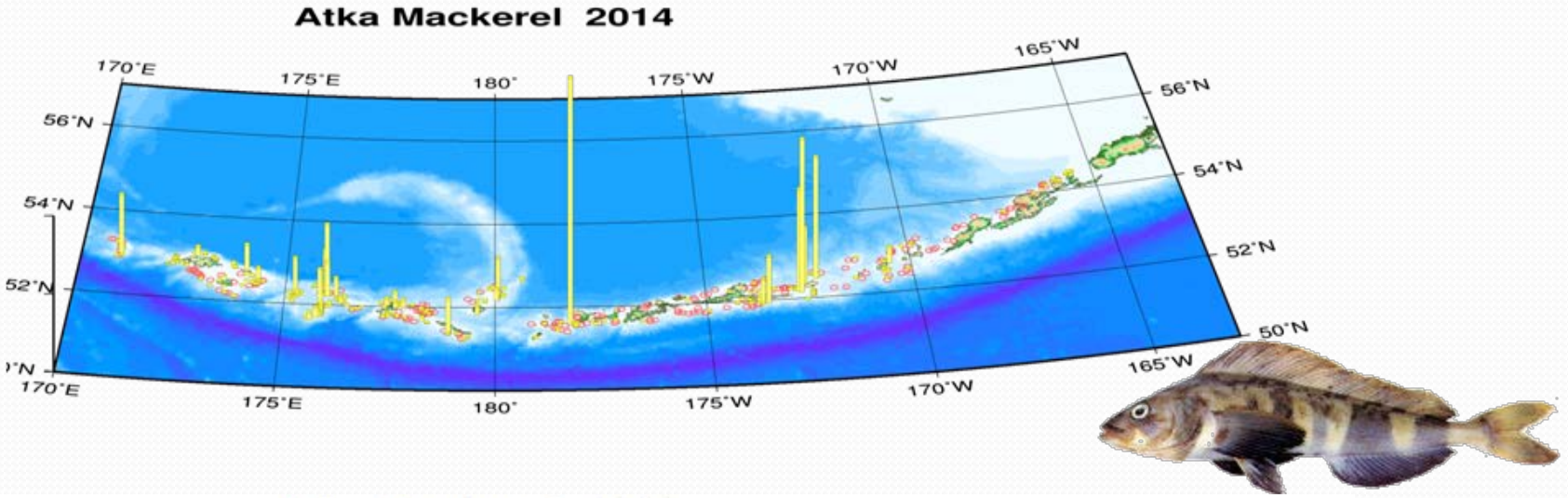


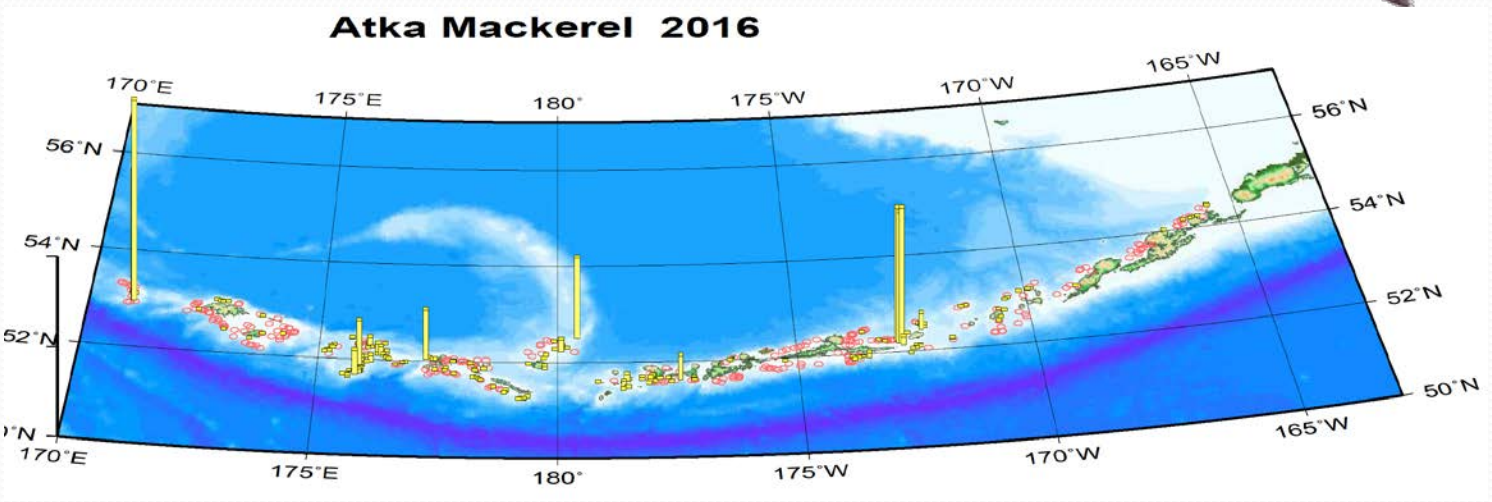
Atka mackerel fishery length-frequency data by area fished



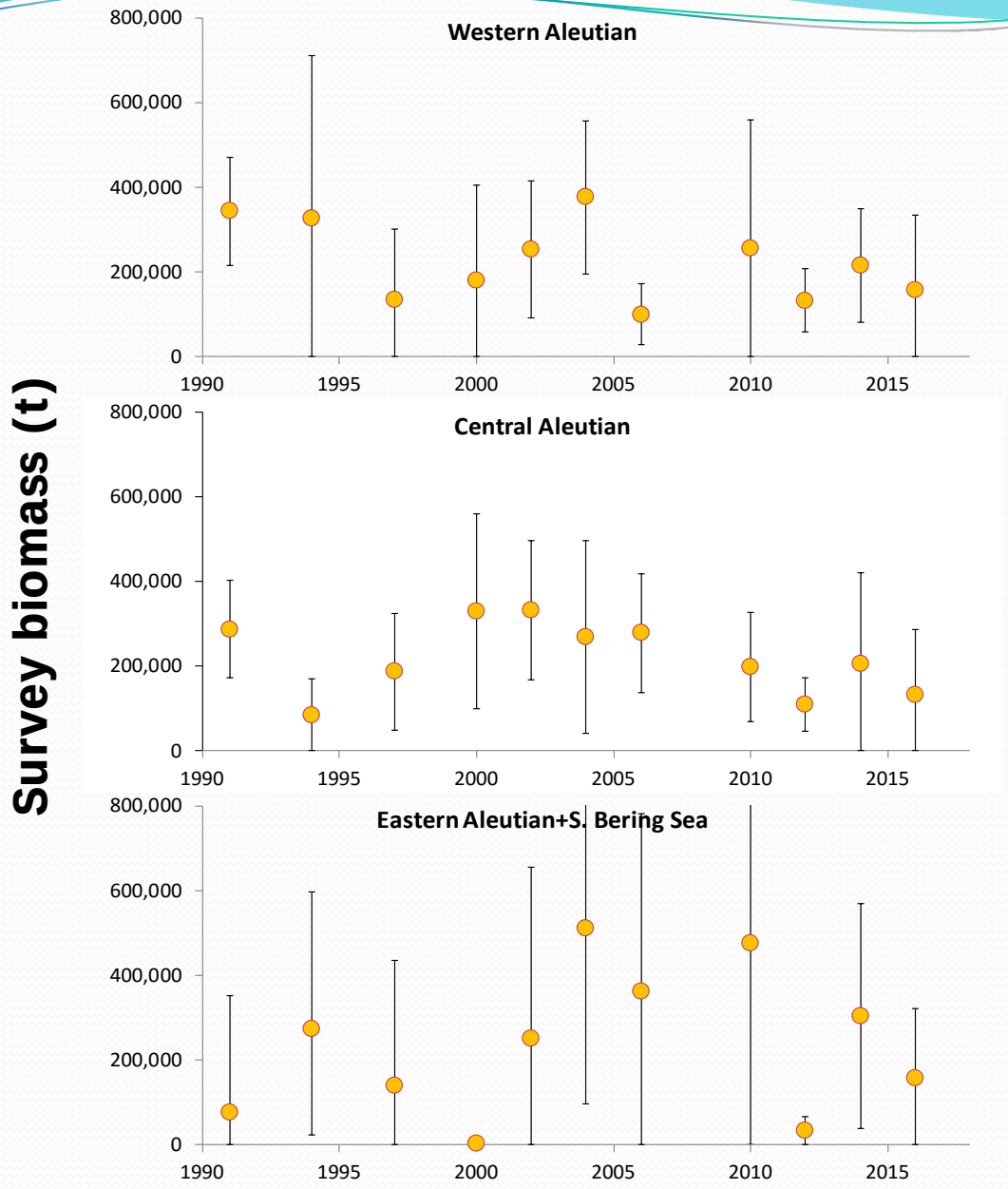
A total of 1,868 otoliths were aged in 2016; mean age from the 2016 fishery is 5.6 years

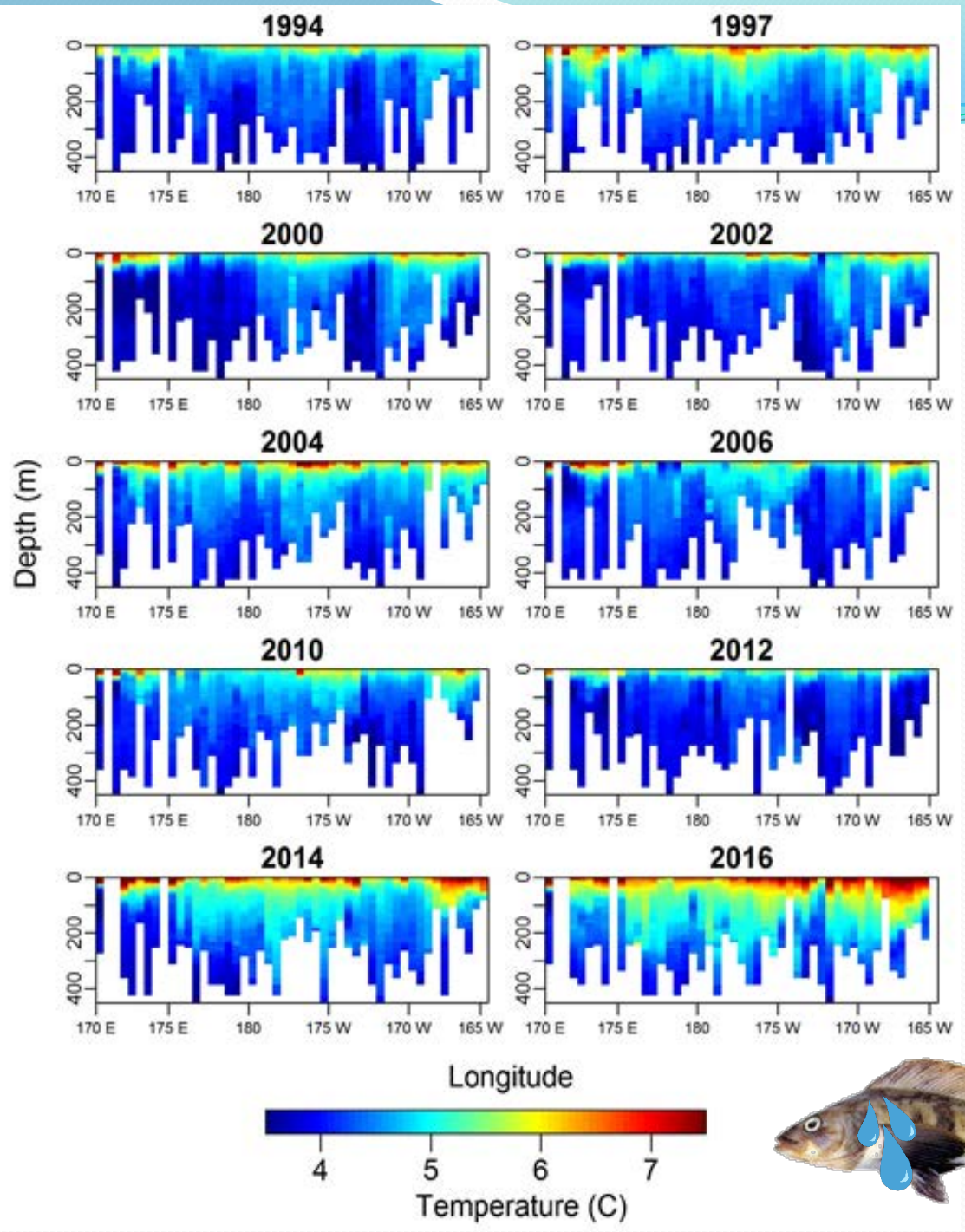
Bottom trawl survey CPUE distributions of Atka mackerel catches

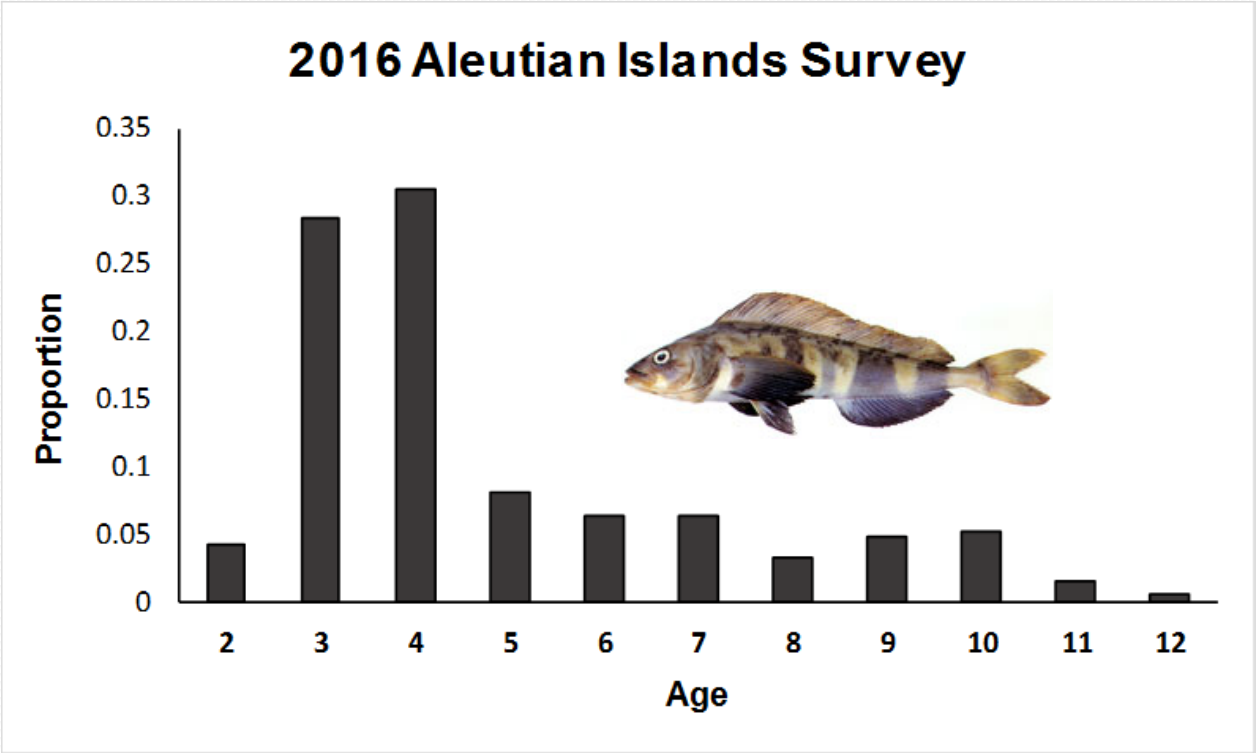




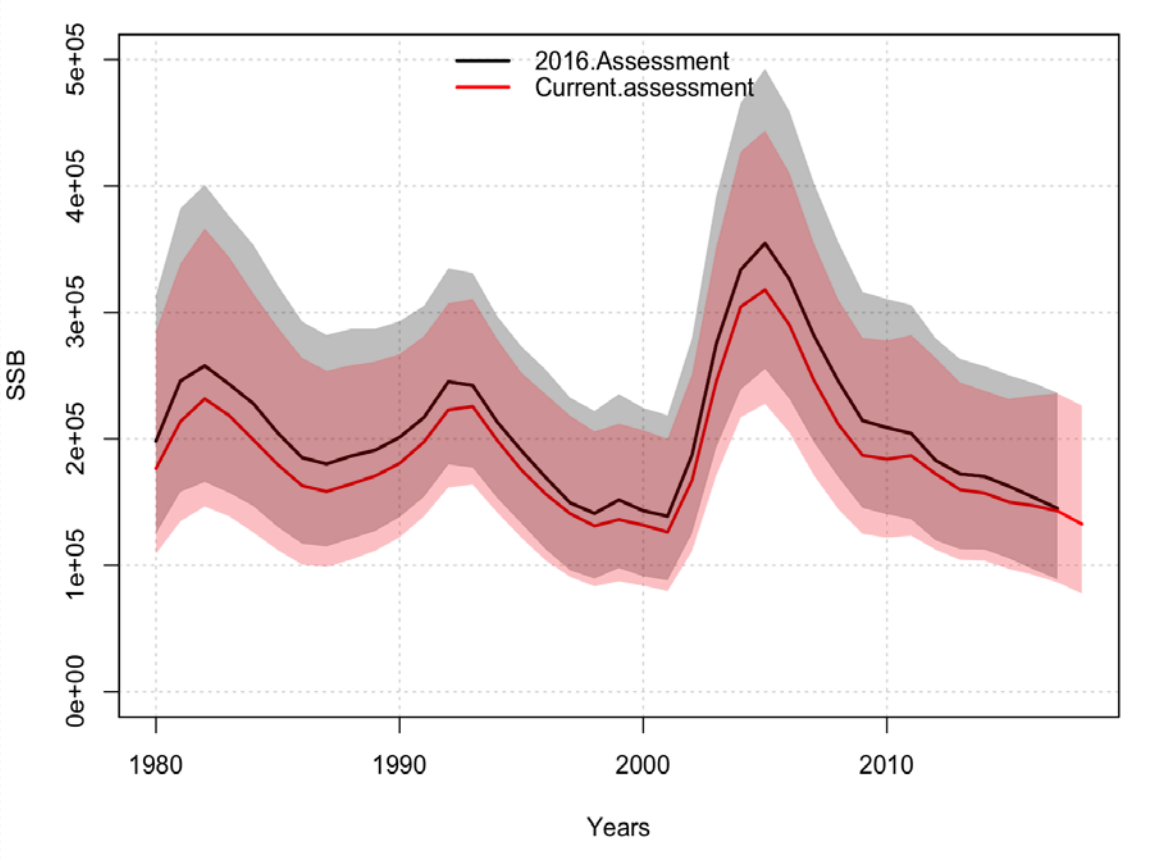
38% decrease, *CV* 31%


Survey biomass (t)
Western Aleutian
Central Aleutian
Eastern Aleutian+S. Bering Sea
800,000
600,000
400,000
200,000
0
1990
1995
2000
2005
2010
2015


1994
1997
2000
2002
2004
2006
2010
2012
2014
2016
Depth (m)
0
200
400
170 E
175 E
180
175 W
170 W
165 W
Longitude
4
5
6
7
Temperature (C)



A total of 300 otoliths were aged; mean age from the 2016 survey is 4.9 years



Time series of the current assessment (Model 16.0) estimated AI Atka mackerel spawning biomass (t) with approximate 95% confidence bounds, compared to last year's Model 16.0 estimates (2016 assessment). The only change is the new data available in 2017.

	Fishery selectivity	Variance of fishery selectivity σ_{f_sel}	Fishery sample sizes	Survey Sample sizes
Model 16.0	Time - varying	Varies as in 2016 assessment	Varied with # hauls	Varied with # hauls
Model 16.0a	Time - varying	Tuned using Francis weights	Varied with # hauls	Varied with # hauls
Model 16.0b	Time - varying	Tuned using Francis weights	Varied with # hauls	Tuned using Francis weights
Model 16.0c	Time blocks	NA	Tuned using Francis weights	Tuned using Francis weights

1977-1983 Foreign fishery
1984-1991 Joint venture fishery
1992-1998 Domestic fishery and 3-subarea split
1999-2010 Steller sea lion regulations
2011-2014 Steller sea lion RPAs
2015-2016 revised Steller sea lion RPAs

Survey Selectivity

- Parameterization similar to fishery, no time-varying aspect
- 2011 random walk for catchability, time periods for survey selectivity
- 2 time periods coinciding with break pt in lack of fit (2012-2013)
- Single survey selectivity-at-age vector (2014-2017)

Conducted explorations of time-varying survey selectivity as suggested by the BSAI Plan Team. Initial explorations allowed for a separate selectivity pattern for 1986

-- failed to improve the model fit to the survey biomass and also had minimal impact on results

Will continue to explore time-varying fishery and survey selectivity, and interactions with *M* and *q*

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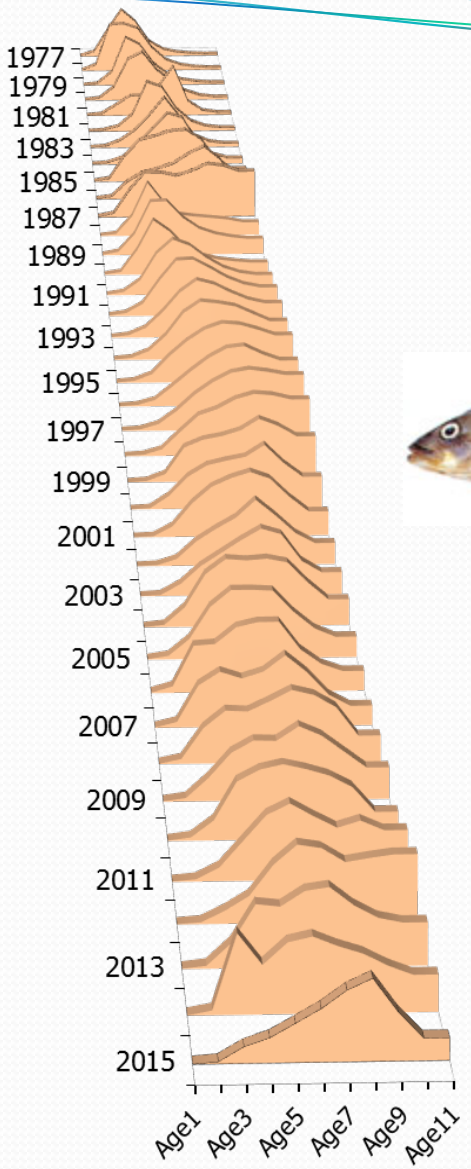
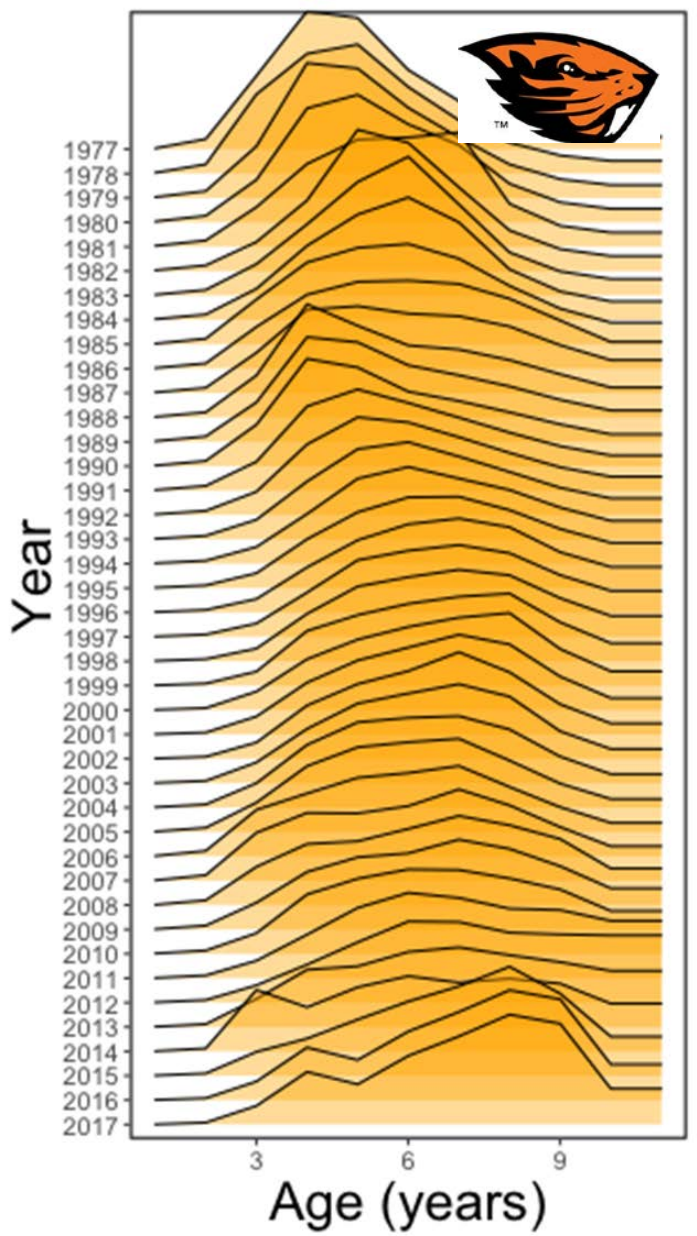
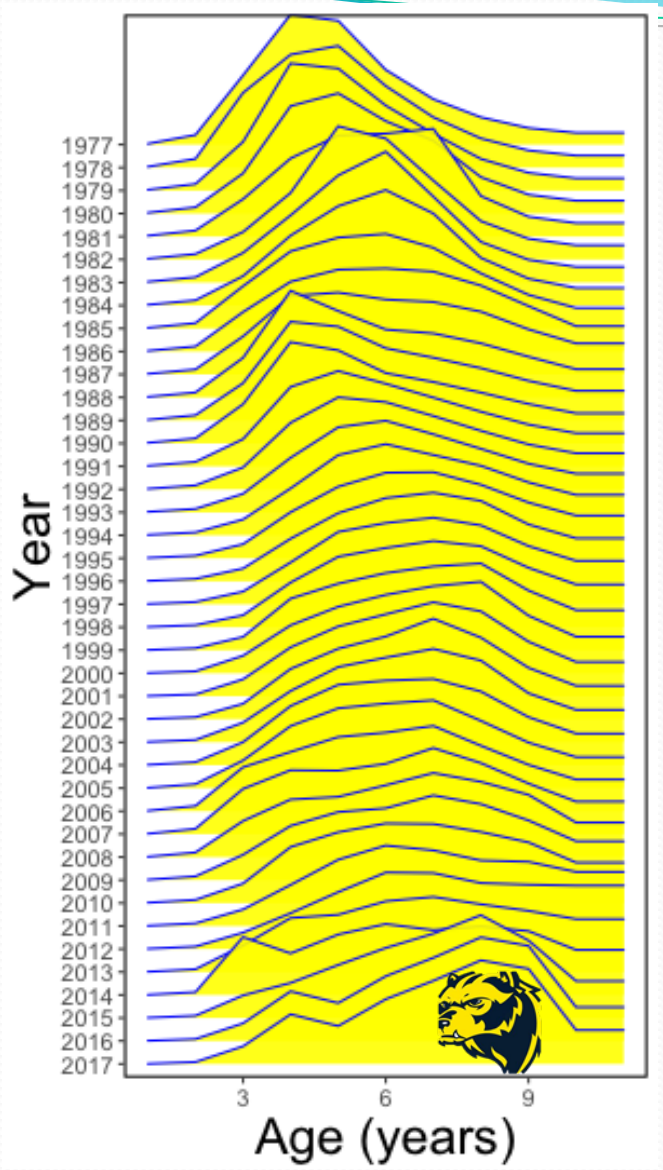


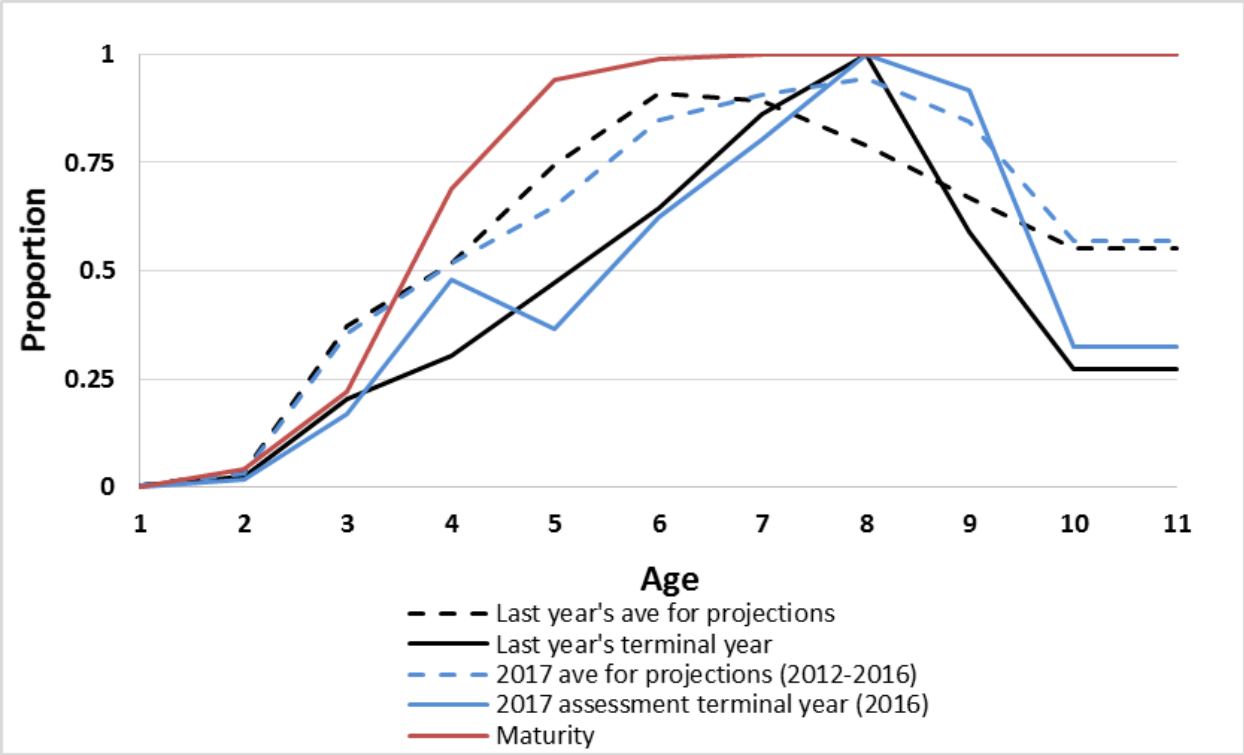
Fishery selectivity pattern from the 2016 BSAI Atka mackerel assessment model 16.0



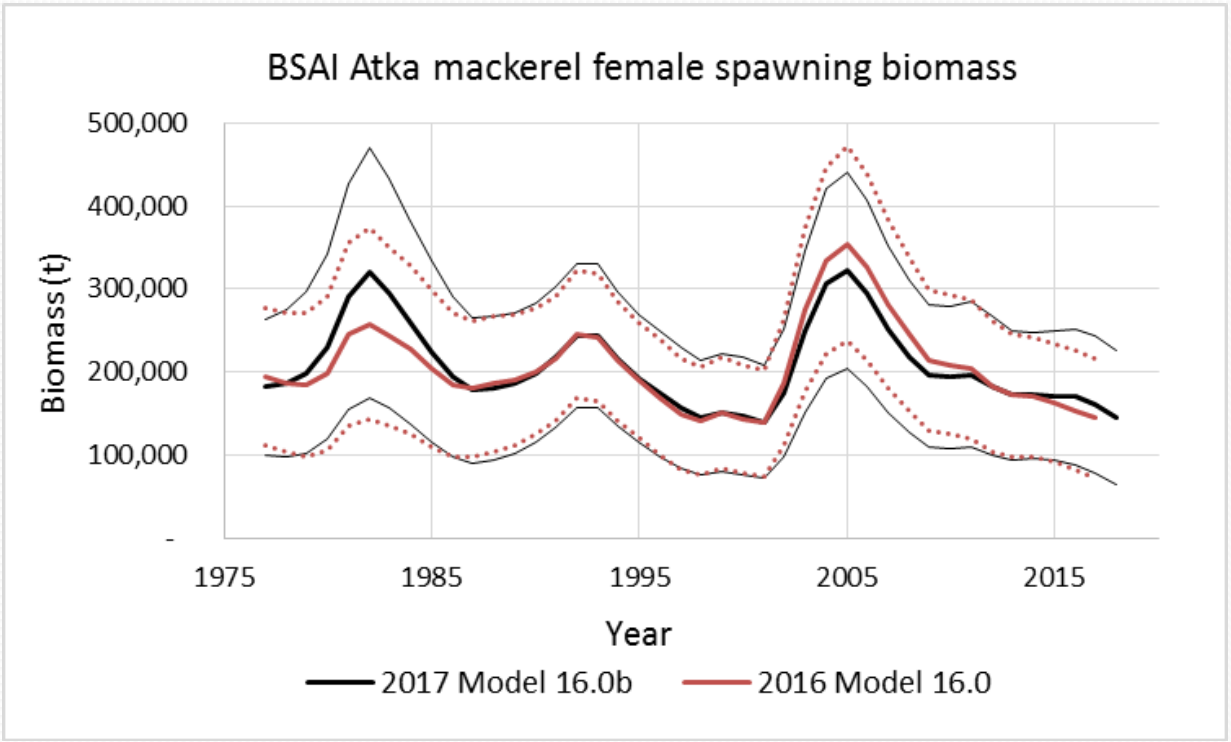
Fishery selectivity pattern from the BSAI Atka mackerel assessment model 16.0b



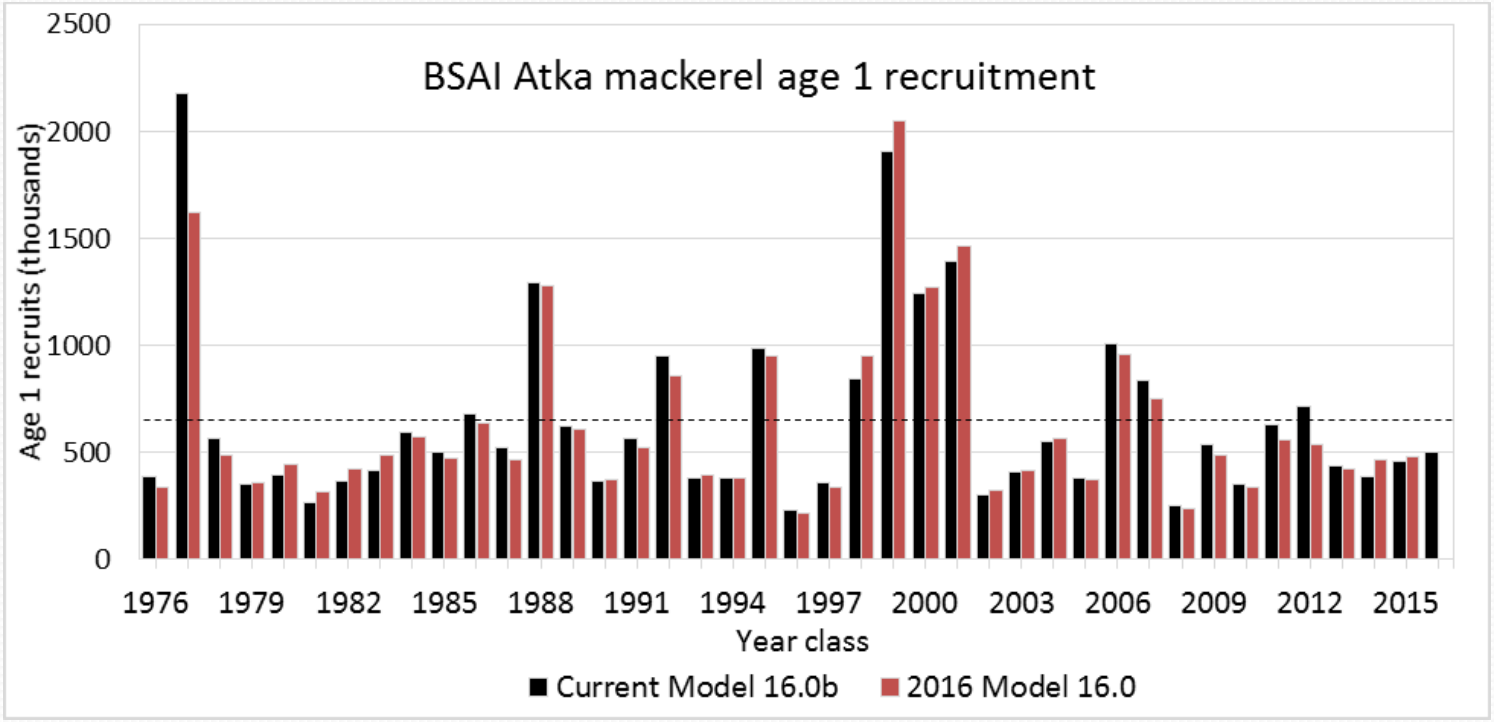
Fishery selectivity pattern from the BSAI Atka mackerel assessment model 16.0b



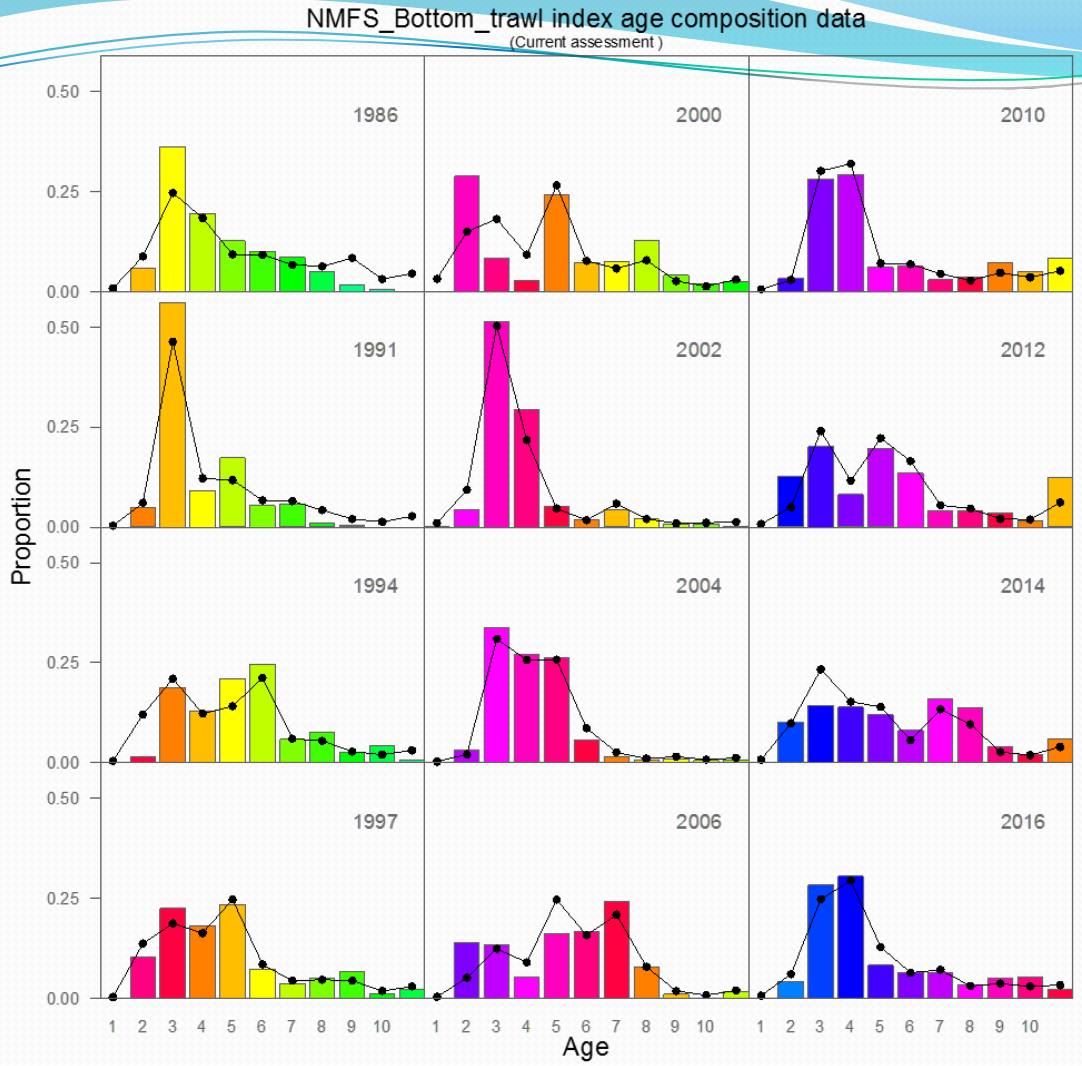
Estimated fishery selectivity patterns in the current assessment with a) last year's average for projections, b) the 2017 assessment average selectivity used for projections (2012-2016), c) last year's assessment terminal year, and d) the 2017 assessment terminal year (2016) compared with the maturity-at-age estimates for BSAI Atka mackerel.



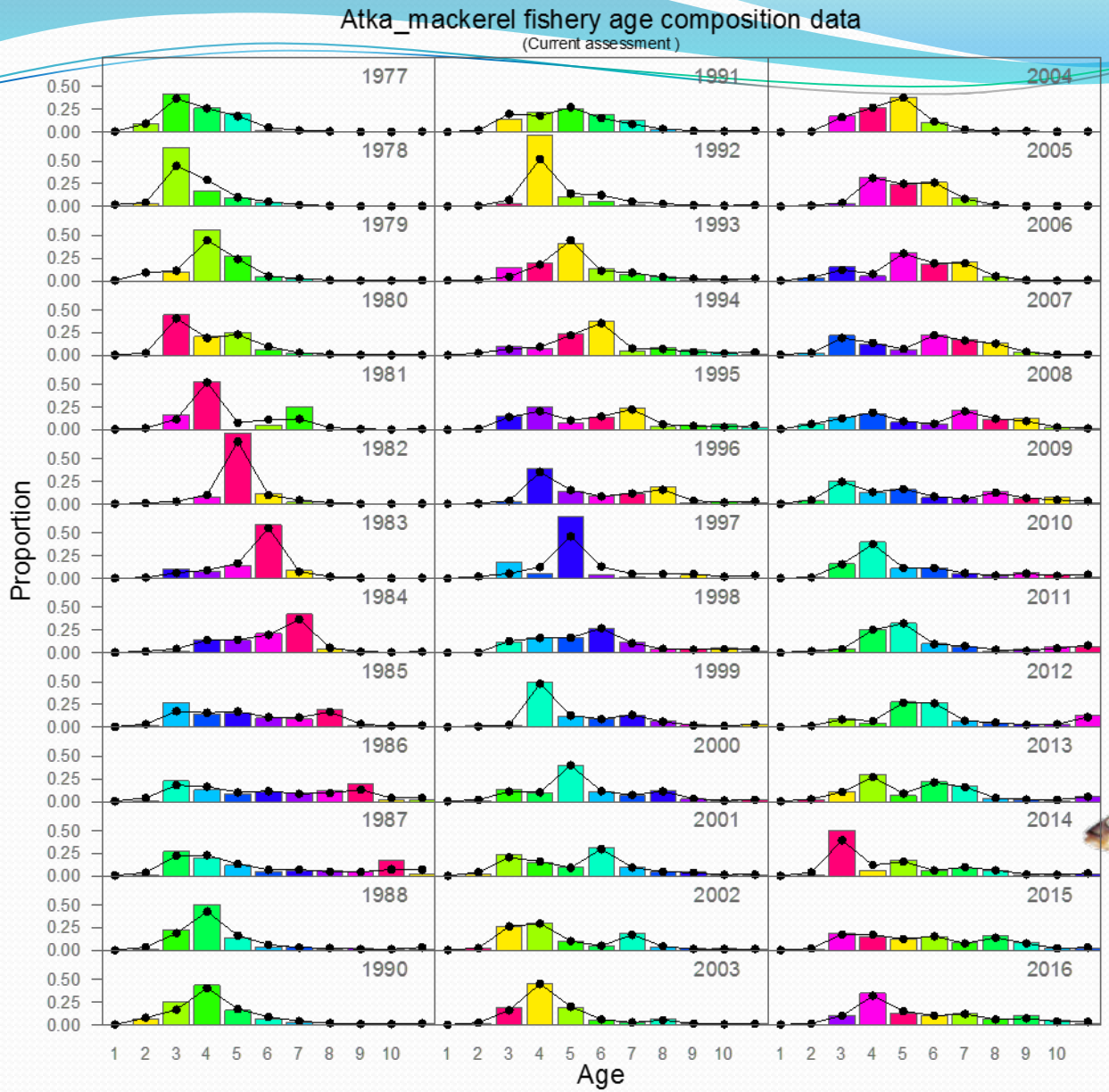
Time series of estimated Aleutian Islands Atka mackerel spawning biomass with approximate 95% confidence bounds compared to last year's (2016 assessment) selected model



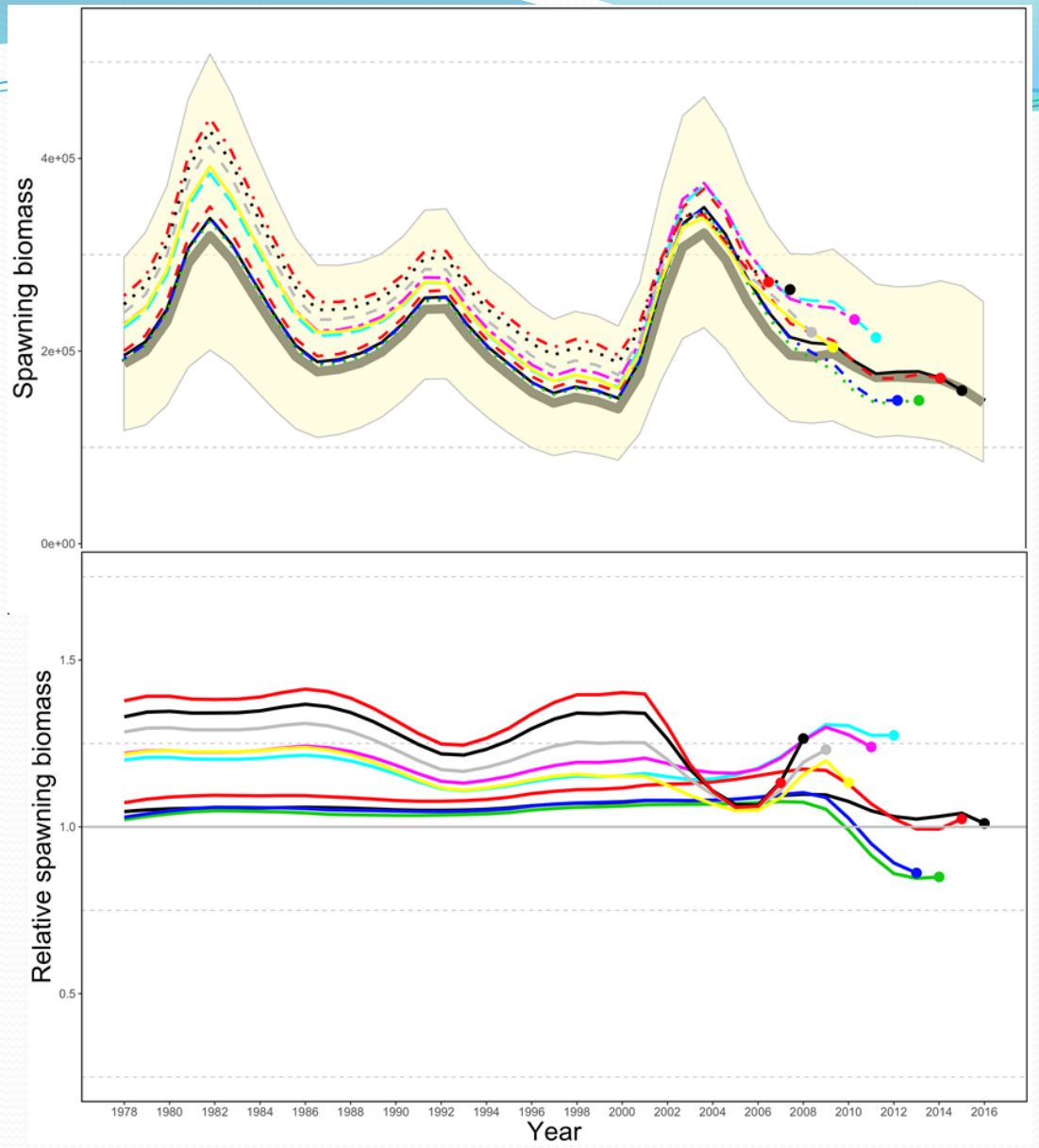
Age 1 recruitment from the current assessment (2017) with the dashed line indicating average recruitment (658 million) over 1978-2015 year classes, and age 1 recruitment as estimated from the 2016 assessment



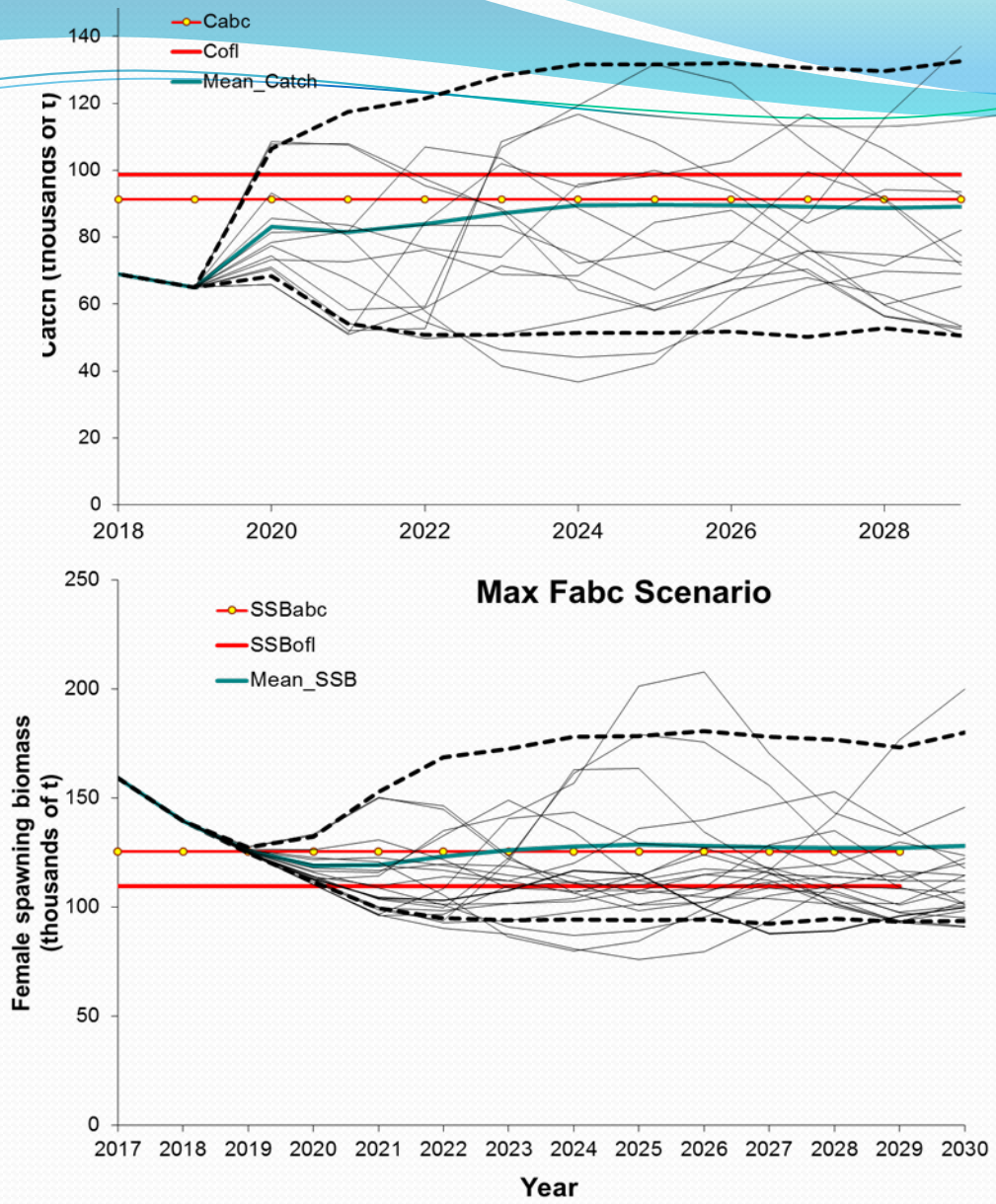
Observed and predicted **survey** proportions-at-age for BSAI Atka mackerel. Lines with "•" symbol are the model predictions and columns are the observed proportions at age



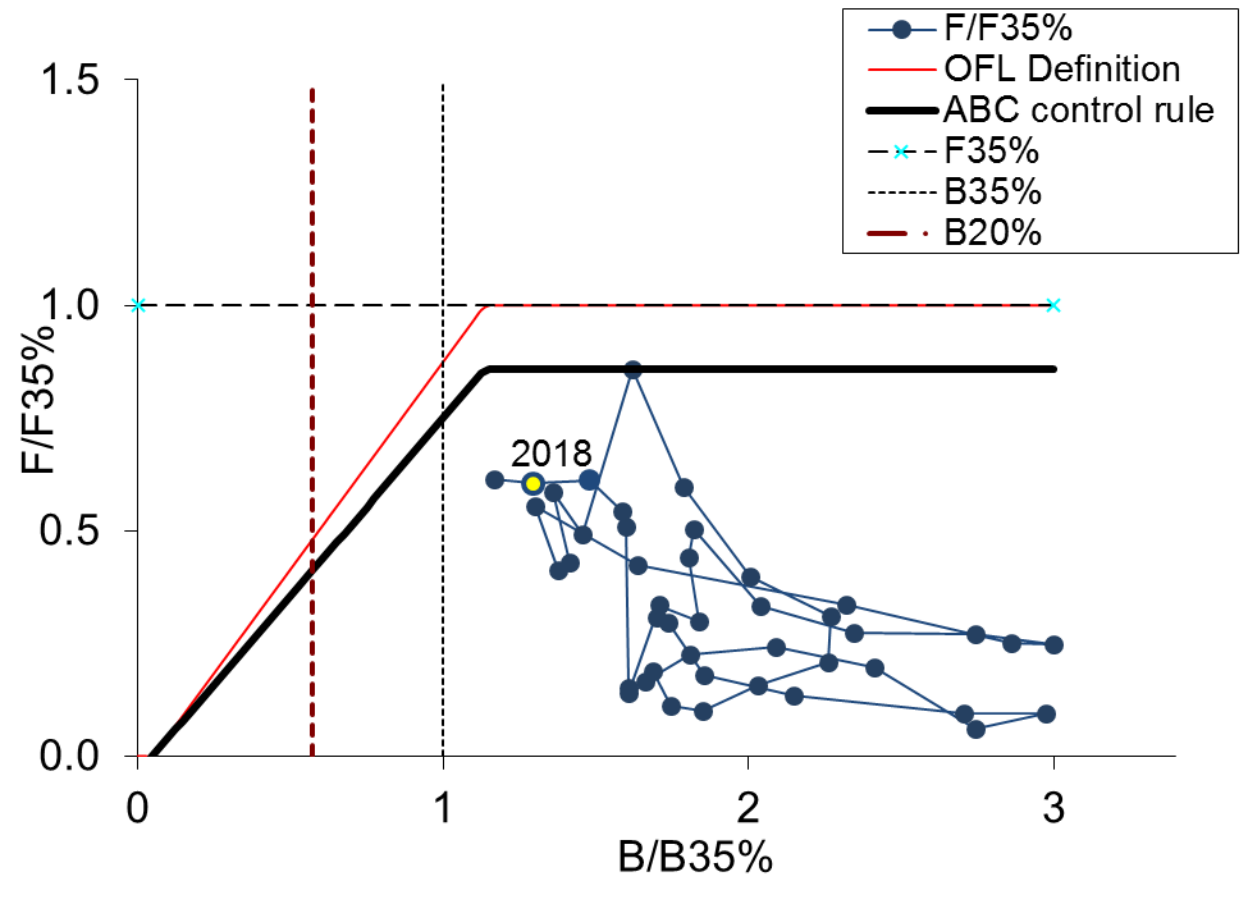
Observed and predicted Atka mackerel **fishery** proportions-at-age for BSAI Atka mackerel. Lines with "•" symbol are the model predictions and columns are the observed proportions at age (with colors corresponding to cohorts)



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 2017 and reduced 2018 and 2019 catches; top) and spawning biomass (bottom) in thousands of metric tons under maximum permissible Tier 3a harvest specification



BSAI Atka mackerel spawning biomass relative to $B_{35\%}$ and fishing mortality relative to F_{OFL} (1977-2019)

BSAI Atka Mackerel

Overfishing Level and Maximum Permissible ABC

Catch assumptions:

- Total 2017 year end catch set ≈ to TAC (64,500 t) for ABC/OFL specification purposes
- For 2018 & 2019 assume that 75% of the BSAI-wide ABC would be taken
  - Due to revised SSL RPAs
  - Affects ABC and OFL values

Selectivity assumption:

- Estimated ave. selectivity for 2012-2016

BSAI Atka Mackerel

Quantity	As estimated or *specified last* year for: 2017	2018	As estimated or *recommended this* year for: 2018*	2019*
Tier	3a	3a	3a	3a
Projected total (age 1+) biomass (t)	598,791	611,442	599,000	600,440
Projected Female spawning biomass				
Projected	145,258	138,791	139,300	125,600
$B_{40\%}$	125,288	125,288	122,860	122,860
$B_{35\%}$	109,627	109,627	107,500	107,500
F_{OFL}	0.40	0.40	0.46	0.46
$maxF_{ABC}$	0.34	0.34	0.38	0.38
F_{ABC}	0.34	0.34	0.38	0.38
OFL (t)	102,700	99,900	108,600	97,200
maxABC (t)	87,200	85,000	92,000	84,400
ABC (t)	87,200	85,000	92,000	84,400

*Projections are based on estimated total catch of 69,000 t and 65,000 t in place of maximum permissible ABC for 2018 and 2019, respectively.

BSAI Atka Mackerel Apportionment

	Random Effects Model
541[1]	**40.01%**
542	**34.78%**
543	**25.20%**

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

Apportionment of the recommended 2018 and 2019 ABCs based on RE model

	2018 (t)	2019 (t)
Eastern (541+S.BSea)	36,820	33,780
Central (542)	32,000	29,350
Western (543)	23,180	21,270
Total	92,000	84,400