2024 BSAI Pacific ocean perch Assessment

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Overall summary

- Minor tweaks to methodology (increased penalty for fishery selectivity, and prior on AI survey catchability)
- New procedures for model evaluation
- 2024 survey biomass is slightly lower than 2022 estimate, but recent have been large.
- 2025 ABC of 37,375 t (9% decrease from 2024 ABC).
- Assessment-related concerns noted in risk table.

BSAI POP Outline

1) SSC, Plan Team comments
2) Catch information
3) Survey and fishery data
4) Model description and evaluation
5) Model fits to data
6) Risk table
7) Management recommendations

SSC and Plan Team comments

(BSAI Plan Team, September 2022) *Of these CIE recommendations, the author recommended the following changes to be brought forward in November 1) fitting the model to survey abundance instead of biomass, 2) exploring stochastic initial age compositions, and 3) for equilibrium initial age composition, explore mortality rates other than that currently used in the model.*

Addressed in September report to the PT, which is included as an Appendix. Alternative methods for modeling the initial number at age did not improve the fits to the survey biomass index or the composition data.

SSC and Plan Team comments

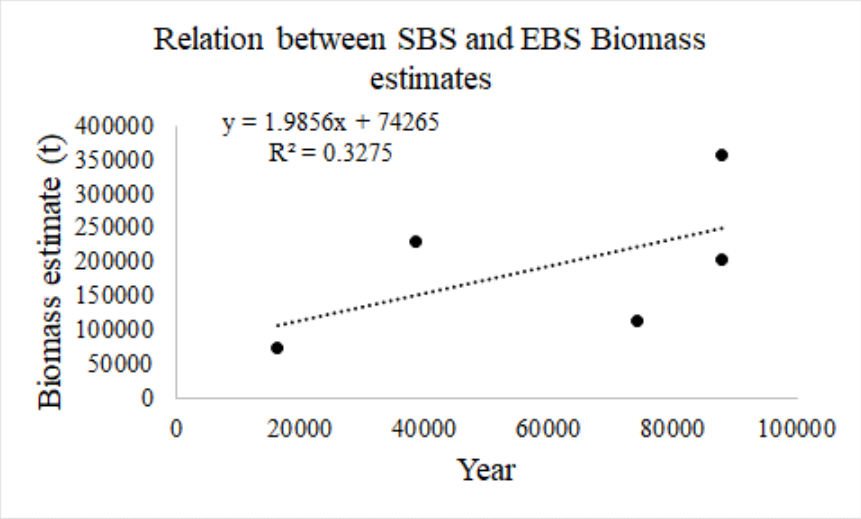
- (BSAI Plan Team, November 2022). *The Team discussed investigating the mortality rates by age particularly for the plus group as there were poor fits to this group in the eastern Bering Sea (EBS) slope survey. The Team noted that time blocks could be explored for the plus group or consider time-varying selectivity as there were younger fish in the AI BTS than the EBS slope survey.*
- (SSC, December 2022). *The SSC concurs with the BSAI GPT suggestion to pursue time-varying survey selectivity for the AI bottom trawl survey and supports the BSAI GPT's other suggestions for model improvements*

Also addressed in the September report to the PT. Dome-shape survey selectivity was not supported by the data, and a model with time-varying survey selectivity showed little variation in survey selectivity between years.

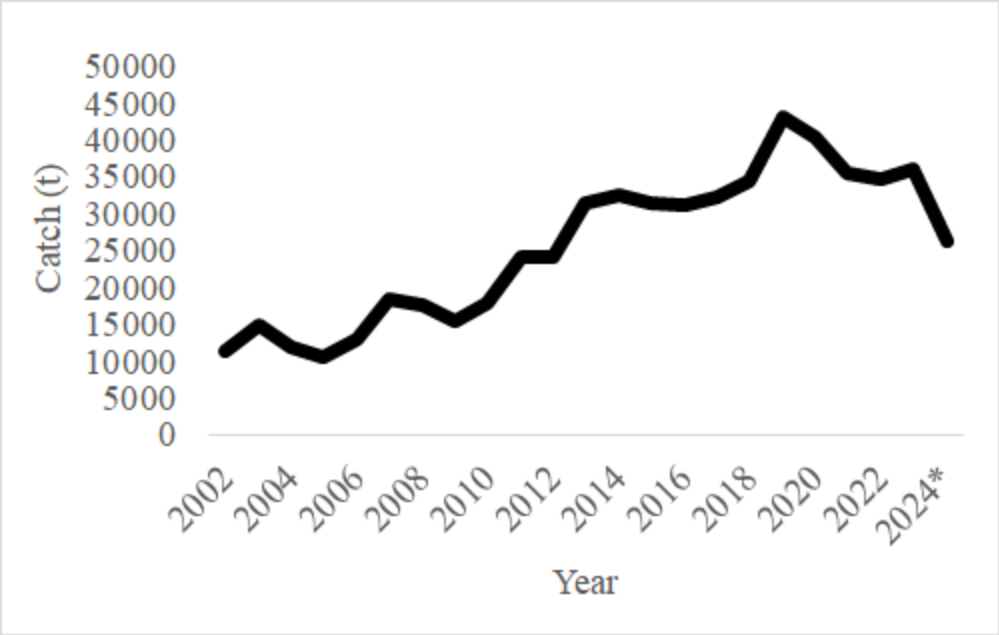
SSC and Plan Team comments

- (BSAI Plan Team, November 2022). *The Team also discussed the relative proportion of the EBS slope survey information into the future and encouraged the author to look at alternatives for estimating the apportionment on the EBS slope and comparing where the different surveys match up in the past for determining what the proportion should be moving forward.*

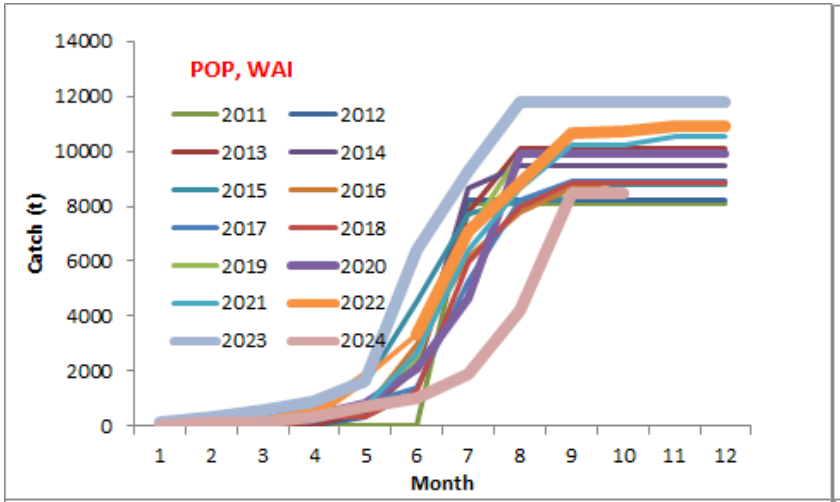
EBS slope survey has not been conducted since 2016, which impedes a data-based solution to this issue.

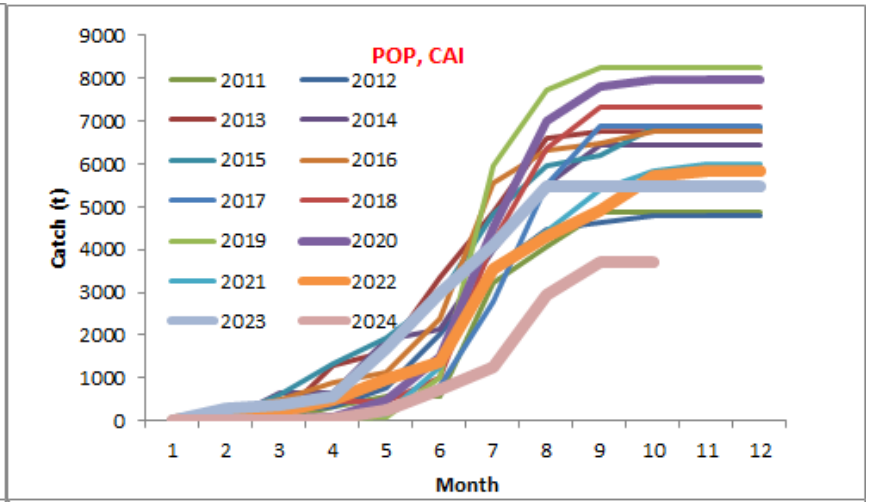


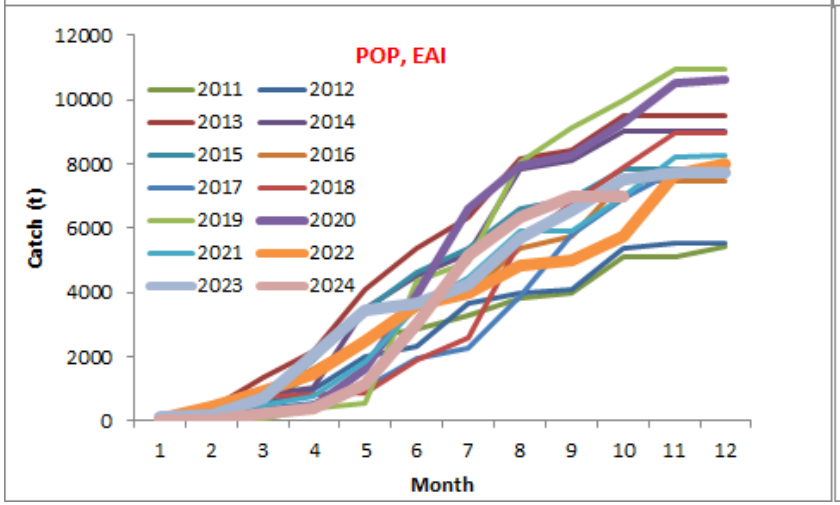
BSAI catch peaked in 2019, declined last few years (2024 through October 25)

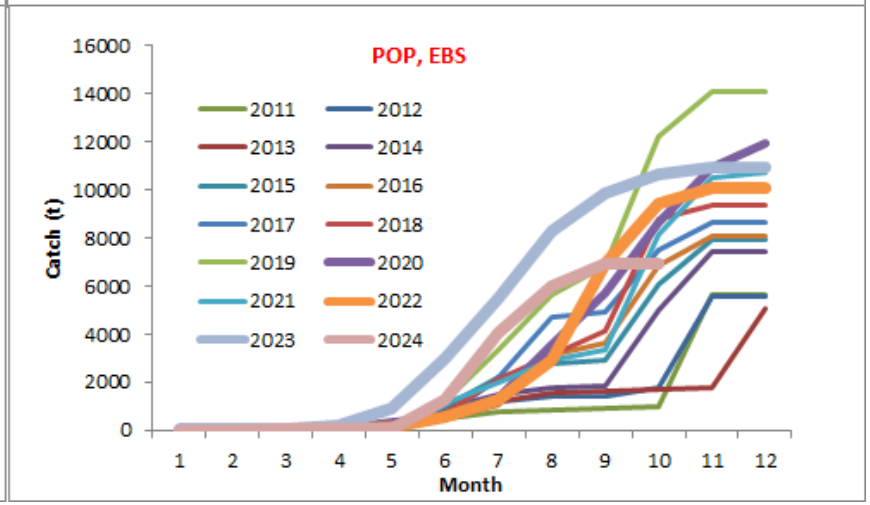


BSAI POP catch by month and area, 2011-2024





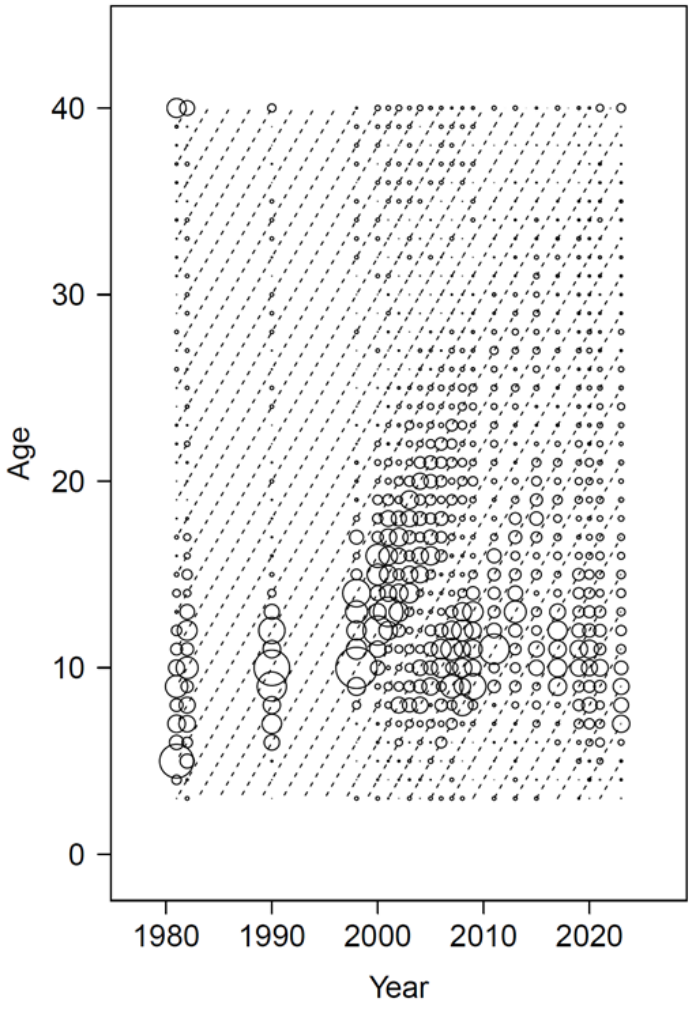




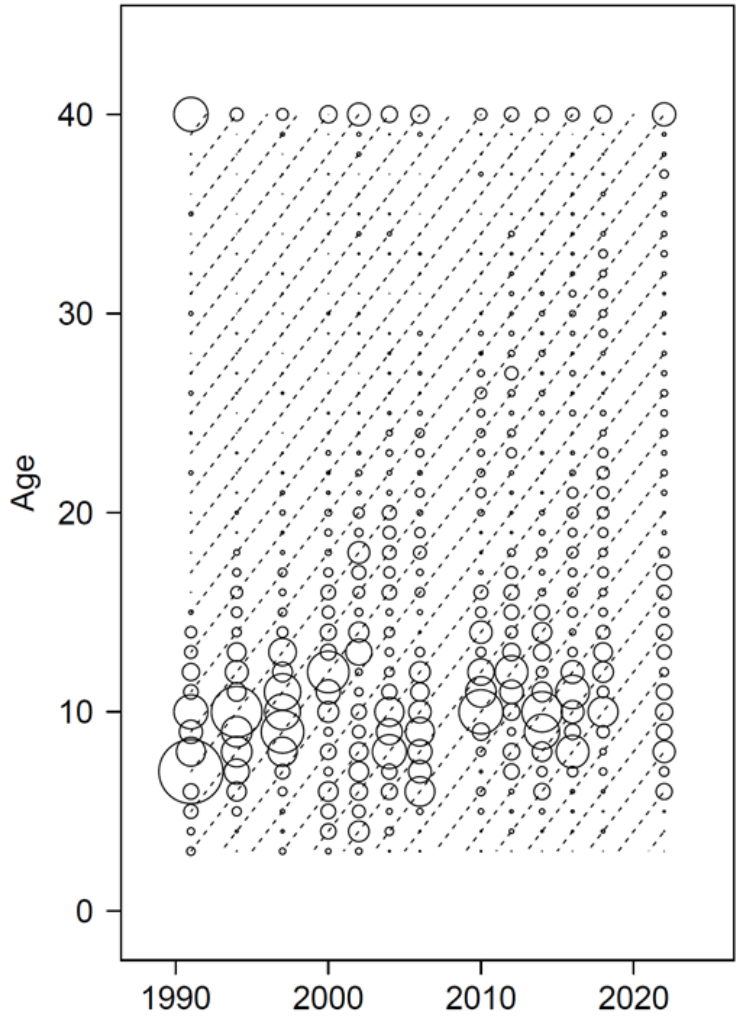
Data in assessment model

Component	BSAI
Fishery catch	1960-**2024**
Fishery age composition	1981-82, 1990, 1998, 2000-2009, 2011, 2013, 2015, 2017, 2019, 2020, 2021, **2023**
Fishery size composition	1964-72, 1983-1984, 1987-1989, 1991-1997, 1999, 2010, 2012, 2014, 2016, 2018, **2022**
AI Survey age composition	1991, 1994, 1997, 2000, 2002, 2004, 2006, 2010, 2012, 2014, 2016, 2018, **2022**
AI Survey length composition	**2024**
AI Survey biomass estimates	1991, 1994, 1997, 2000, 2002, 2004, 2006, 2010, 2012, 2014, 2016, 2018, 2022, **2024**
EBS Survey age composition	2002, 2004, 2008, 2010, 2012, 2016
EBS Survey biomass estimates	2002, 2004, 2008, 2010, 2012, 2016

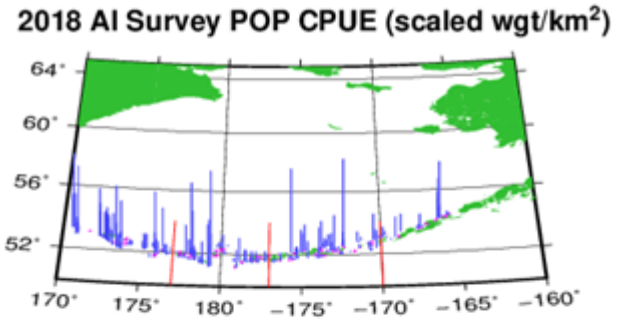
POP fishery age composition data

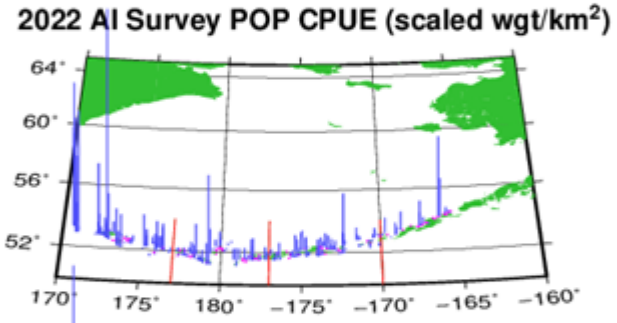


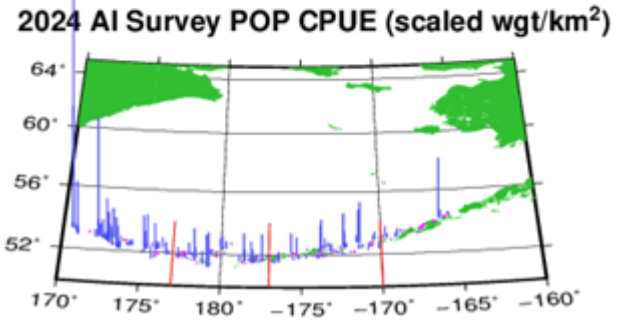
POP AI survey age composition data



Survey CPUE, 2018 – 2024 AI surveys

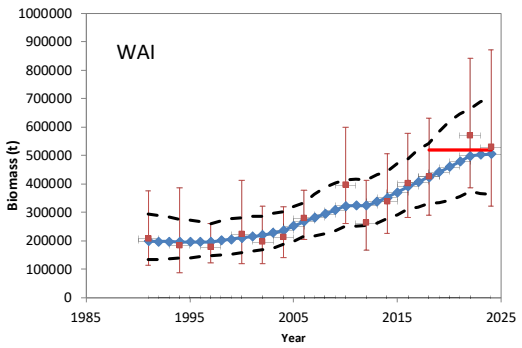


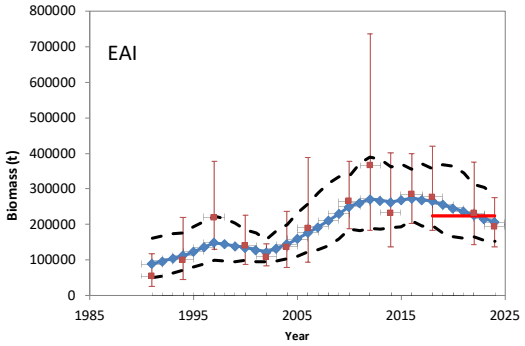


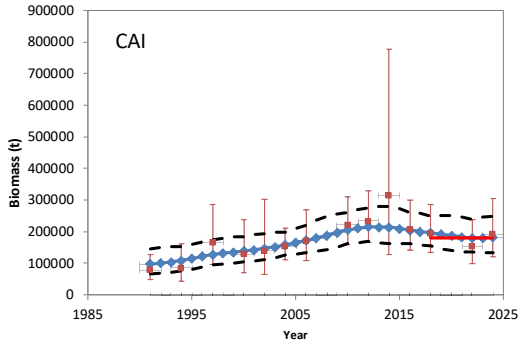


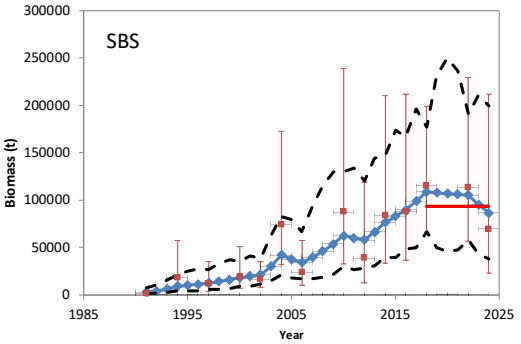
Year	Western	Central	Eastern	southern BS	Total AI survey
2018	427,440 (0.20)	195,497 (0.19)	278,326 (0.21)	115,046 (0.29)	1,016,309 (0.11)
2022	570,272 (0.20)	153,147 (0.23)	232,021 (0.25)	113,738 (0.37)	1,063,030 (0.13)
2024	529,334 (0.26)	191,364 (0.24)	193,387 (0.18)	69,550 (0.62)	983,636 (0.16)

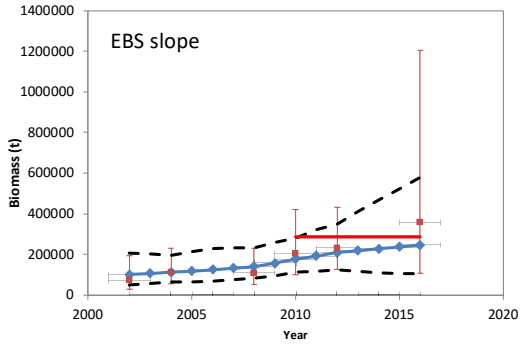
Smoothed survey time series by subarea







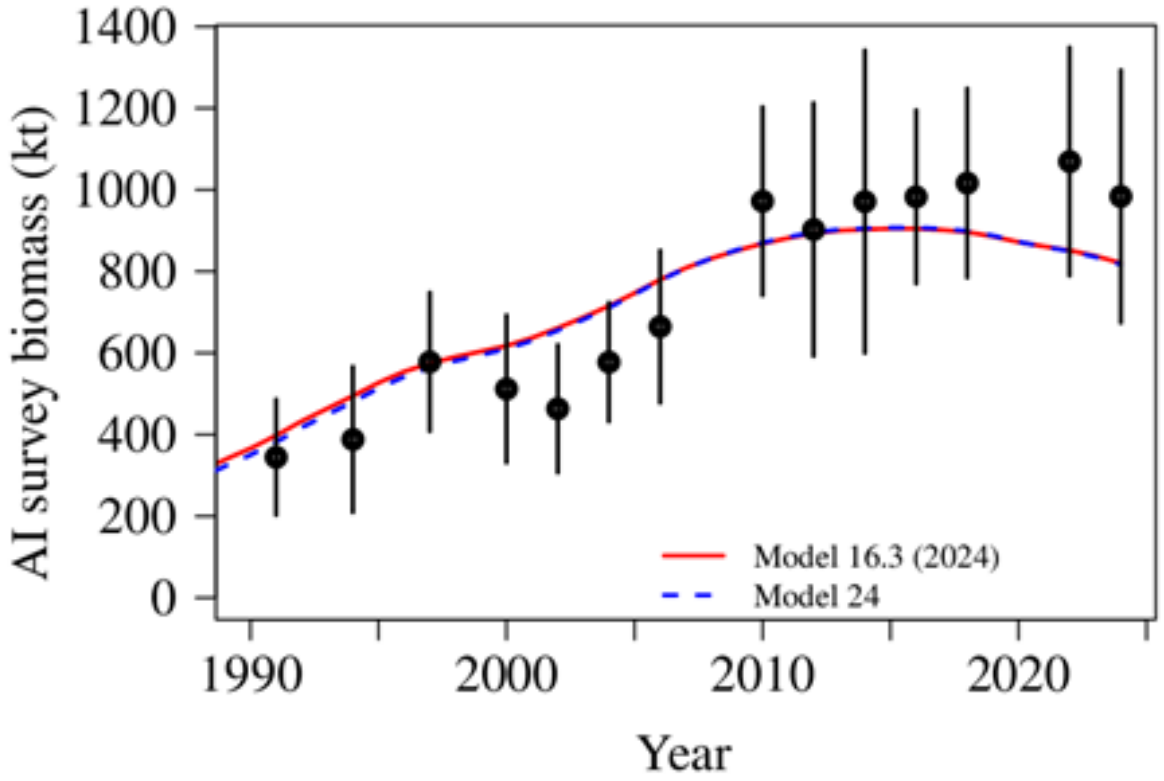




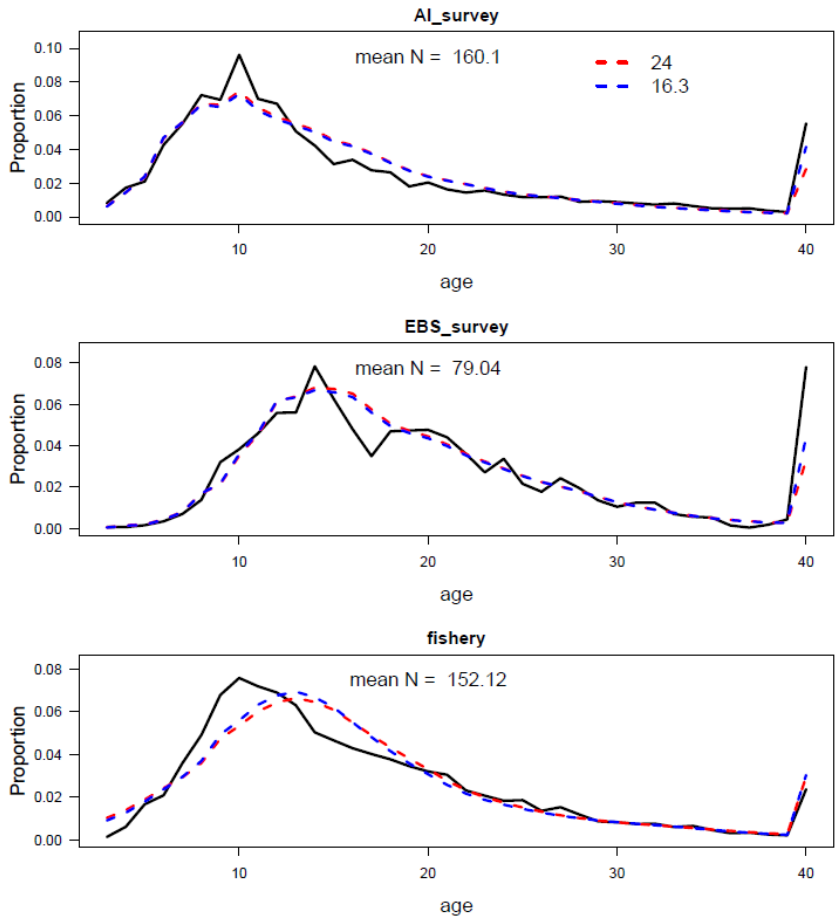
Model description

Model	Differences from 2022 model
Model 16.3 (2024)	No modeling differences. Freely estimates the AI and EBS survey catchability coefficients without prior distributions
Model 24	Model 16.3, but with the penalty for the dome-shapedness in the bicubic spline used for fishery selectivity increased from 10 to 30, and a lognormal prior on the AI survey catchability (mean=1, CV=0.15)

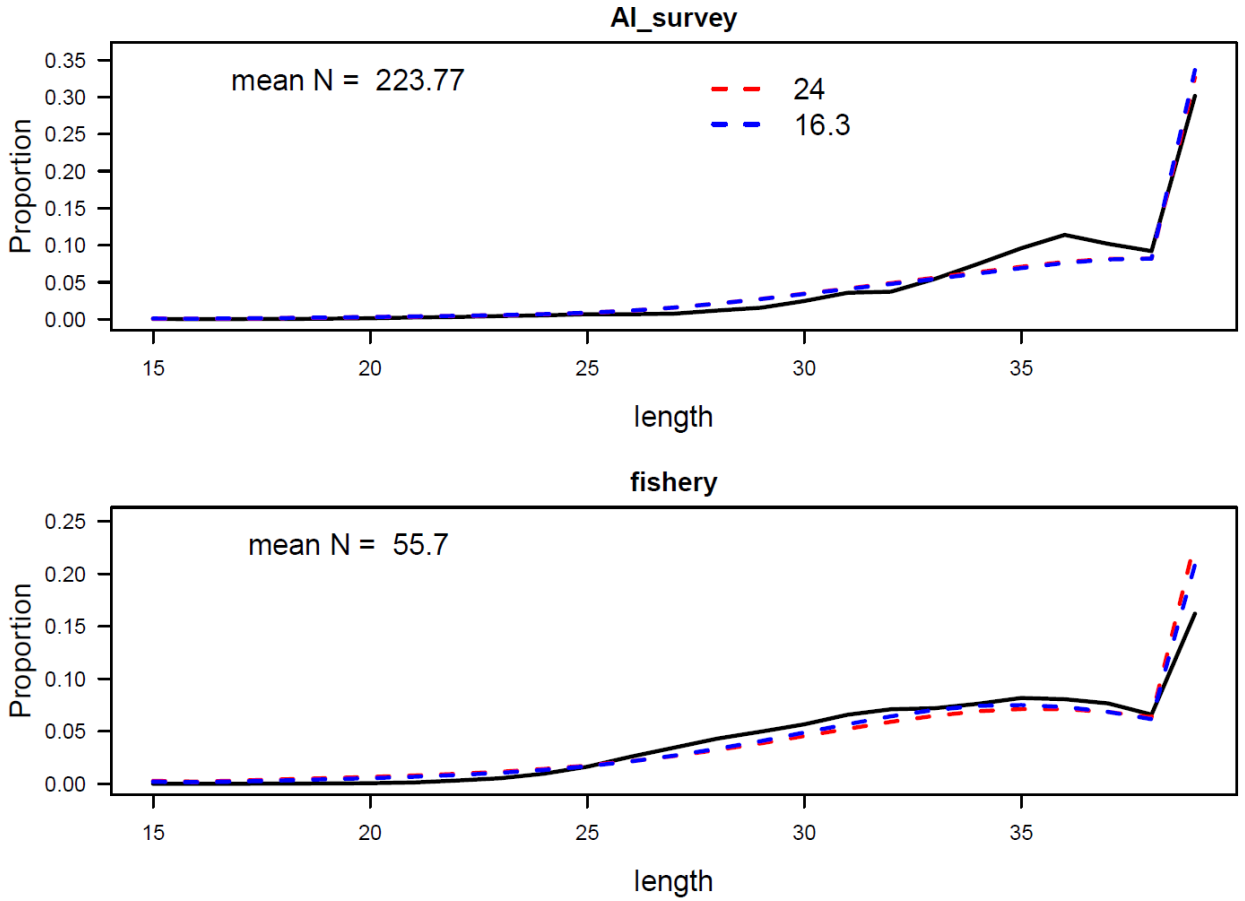
Fit to the AI survey



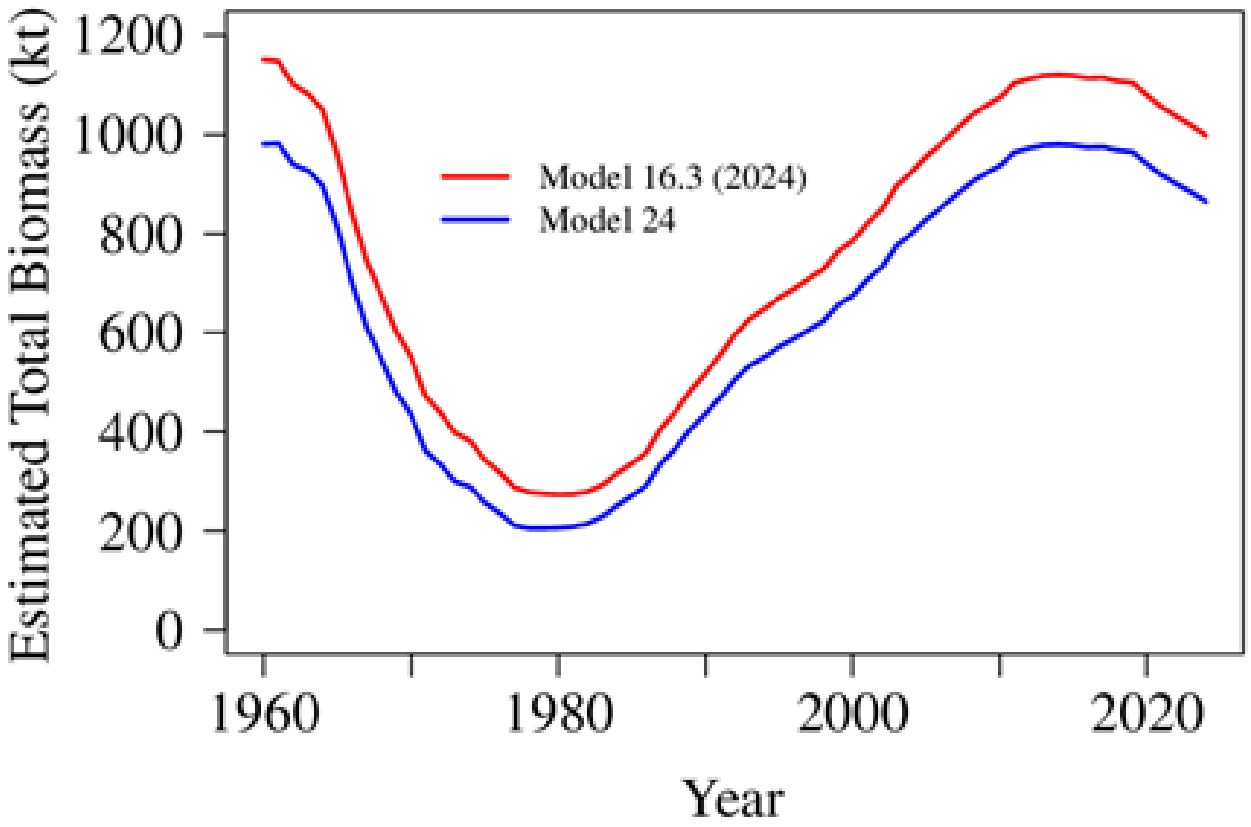
Aggregate fits to age comps, two models



Aggregate fits to length comps, two models



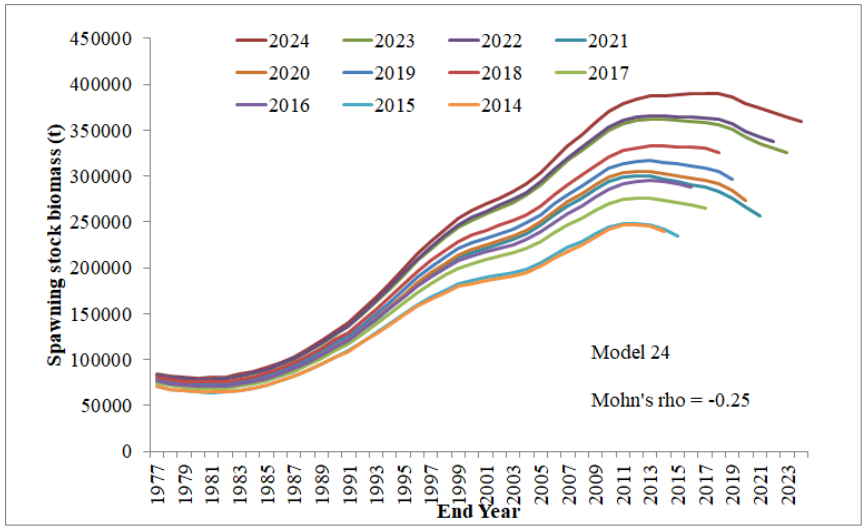
Estimated total biomass, two models

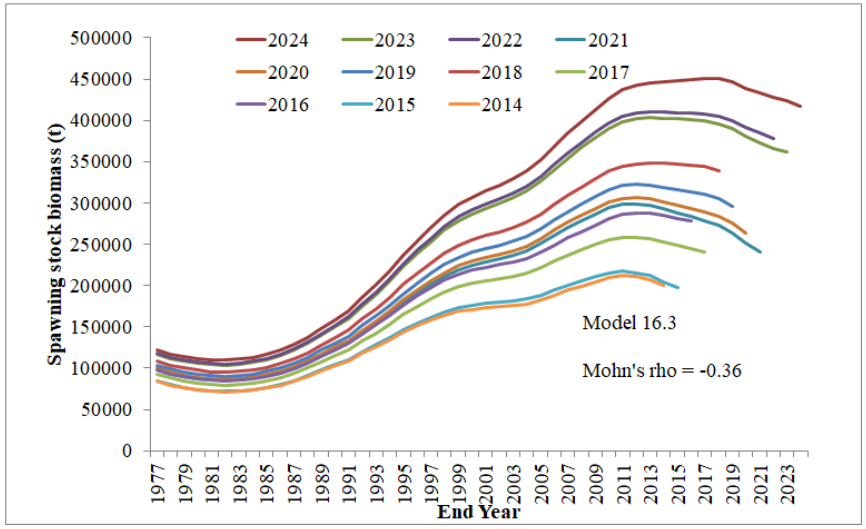


Likelihood table

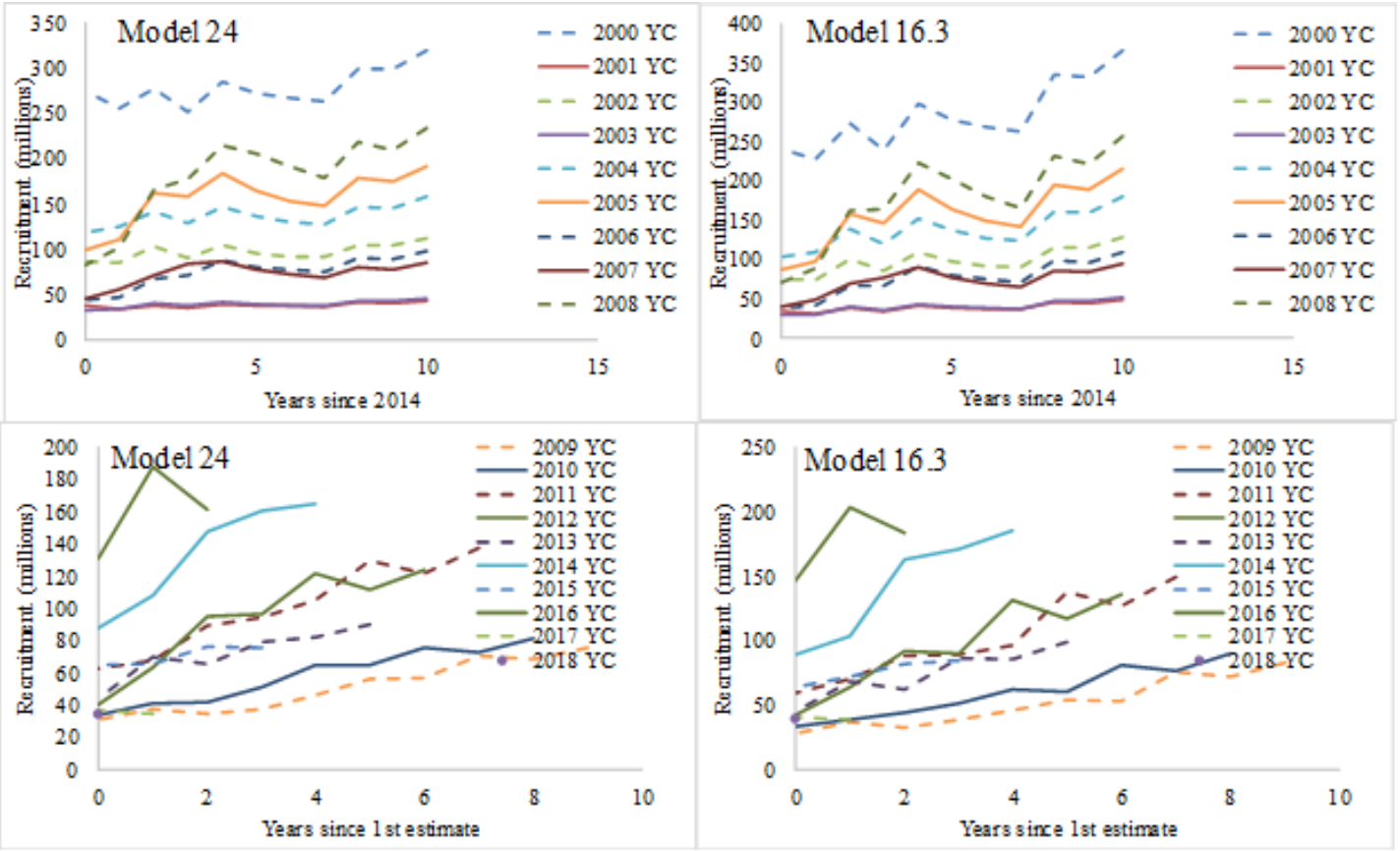
	Model 16.3 (2024)	Model 24
Negative log-likelihood		
Data components		
AI survey biomass	9.30	8.77
EBS survey biomass	2.08	2.05
Catch biomass	0.00	0.00
Fishery age comp	276.50	298.19
Fishery length comp	166.05	213.05
AI survey age comp	160.25	176.07
AI survey length comp	8.01	7.50
EBS survey age comp	67.29	73.91
Maturity	2.71	2.71
Priors and penalties		
Recruitment	12.15	11.98
Prior on AI survey q	0.00	0.11
Prior on M	0.47	0.03
Fishery selectivity	97.07	108.12
Total negative log-likelihood	809.57	910.07
Parameters	164	164

Retrospective pattern in SSB

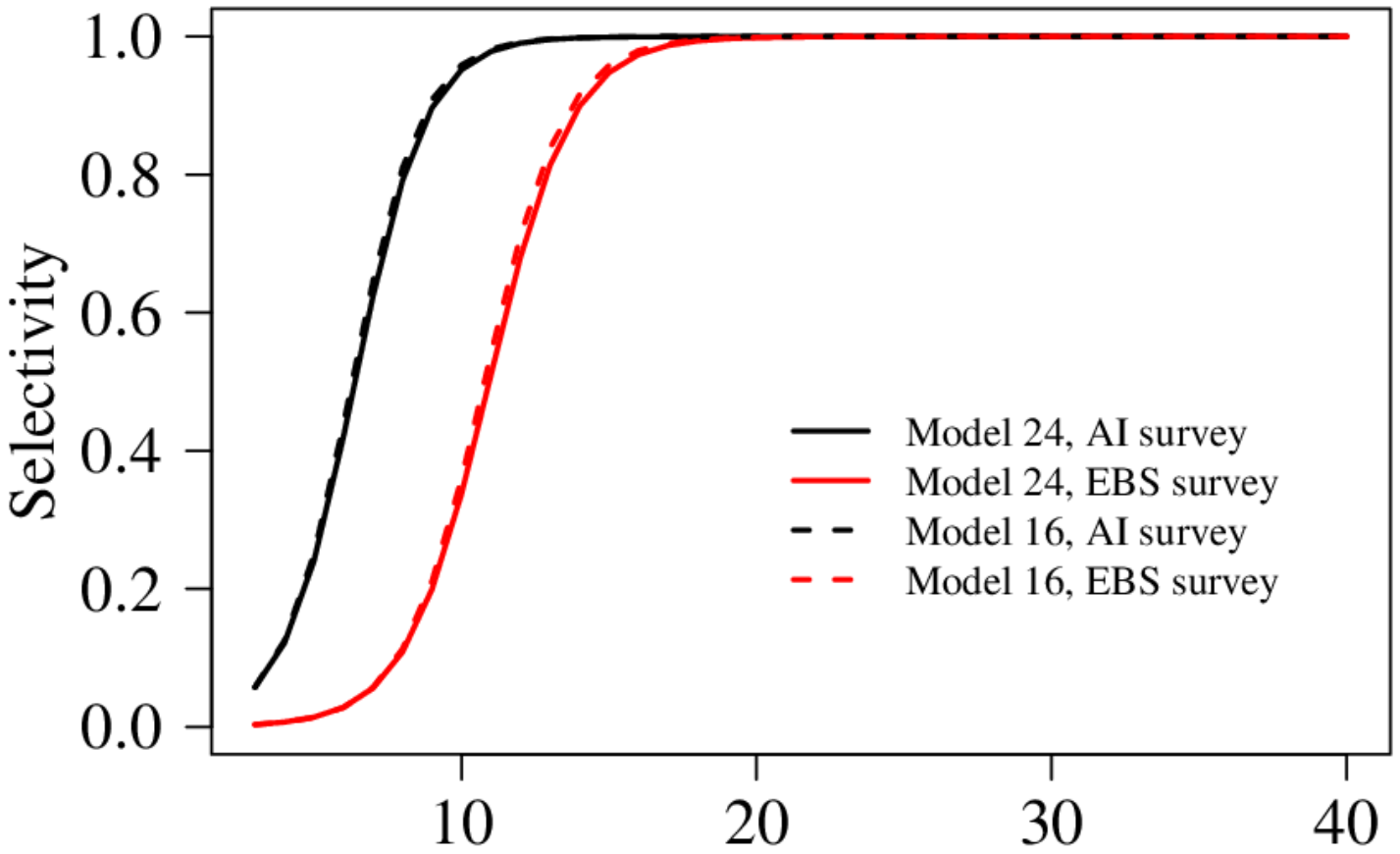




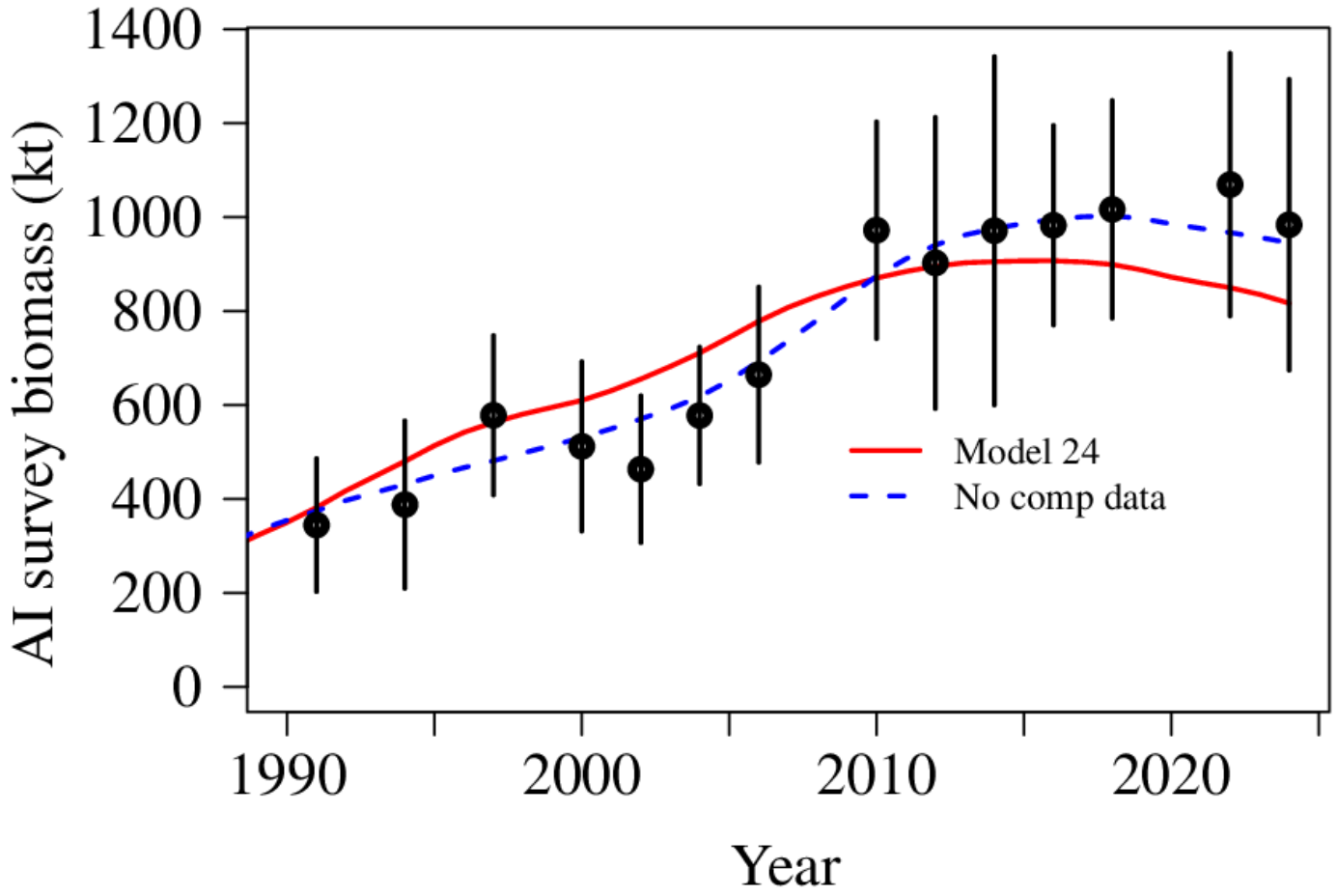
Retrospective pattern in estimated recruitments



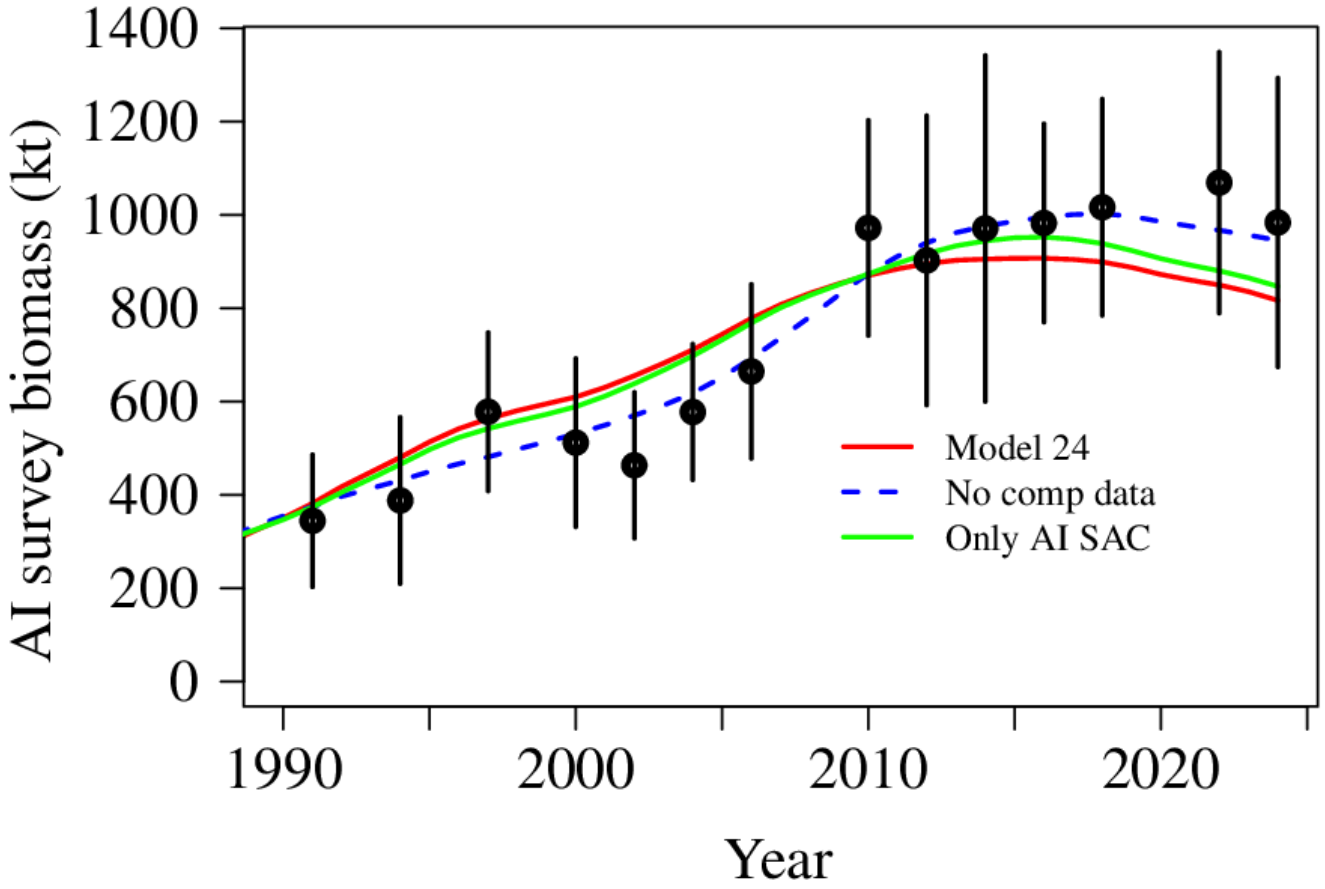
EBS and AI survey selectivity



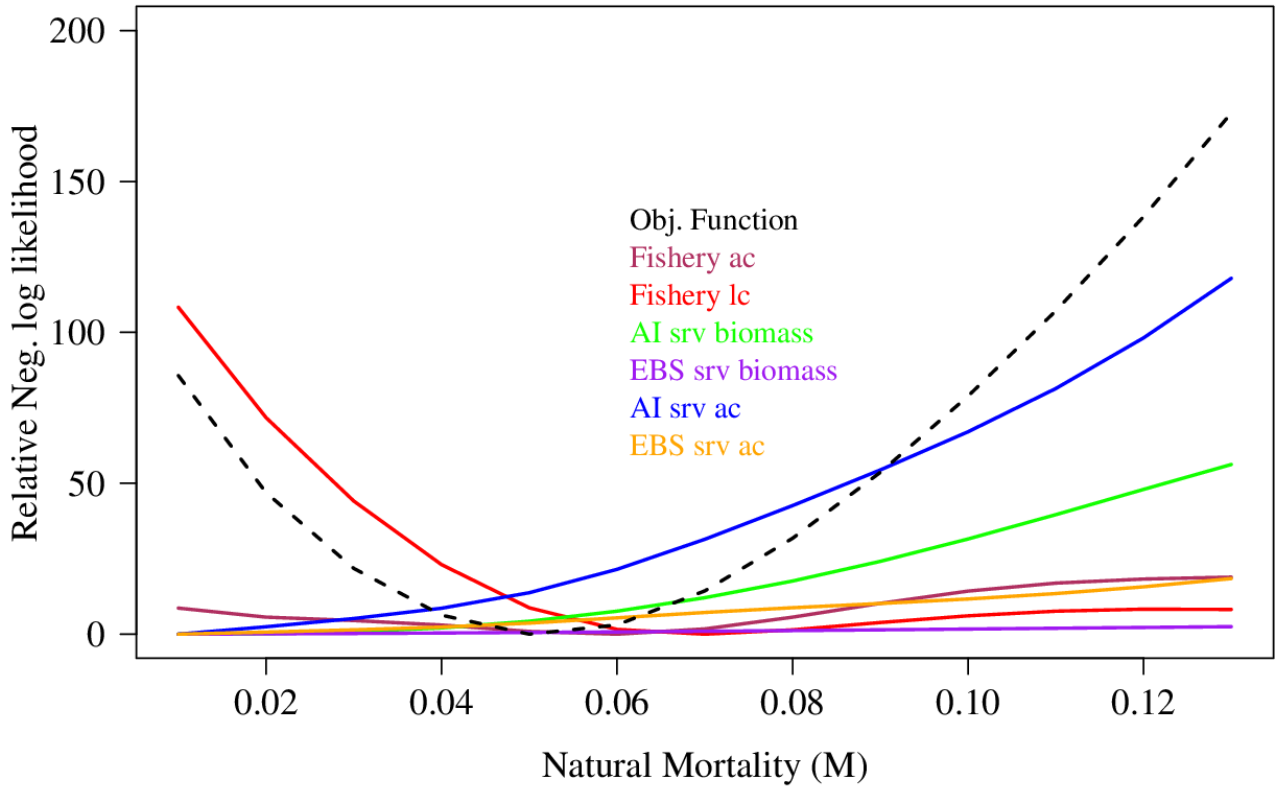
Sensitivity analyses – drop data sets



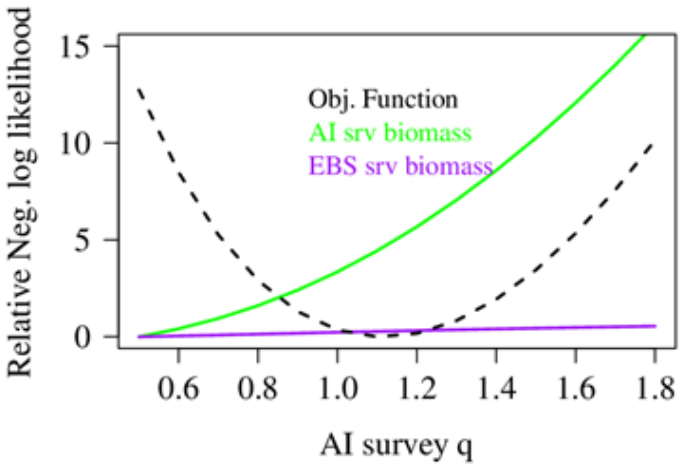
Sensitivity analyses – drop data sets

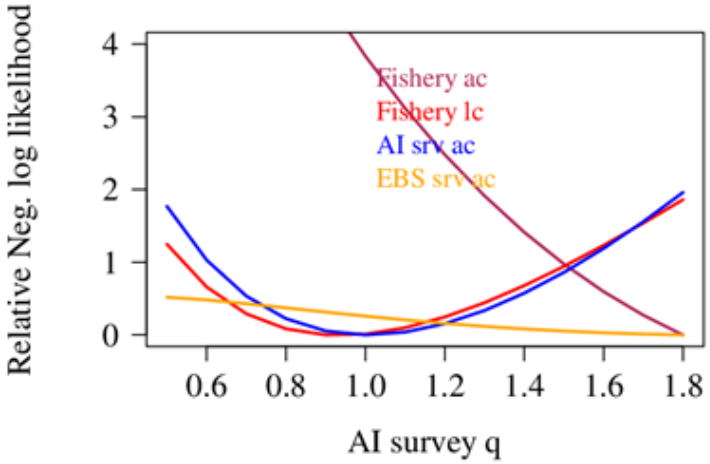


Likelihood profile – natural mortality

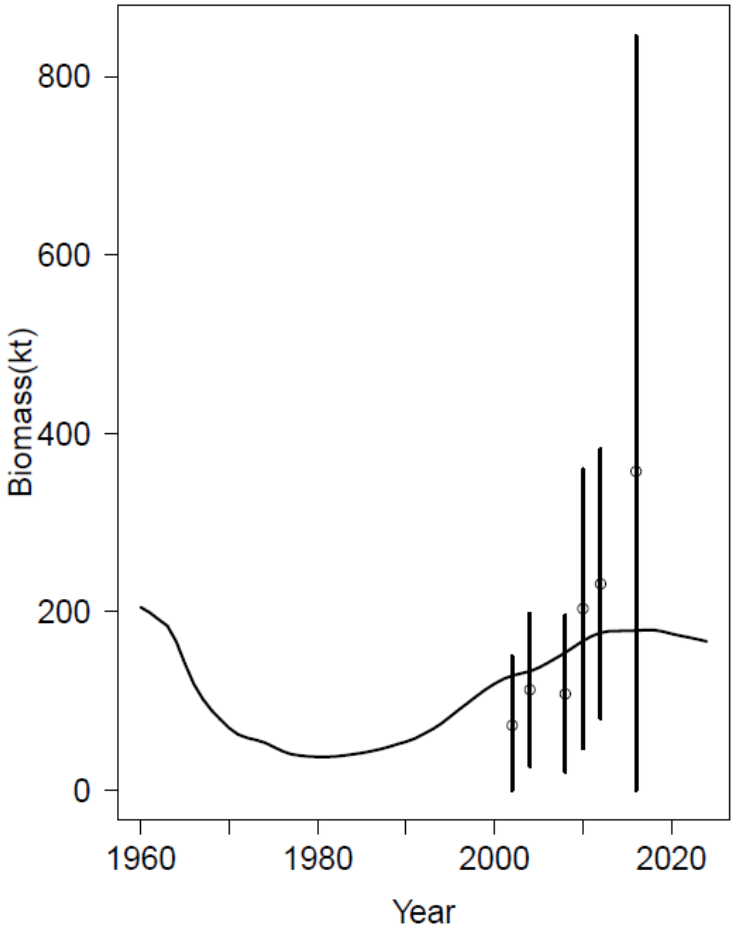


Likelihood profile – AI survey catchability

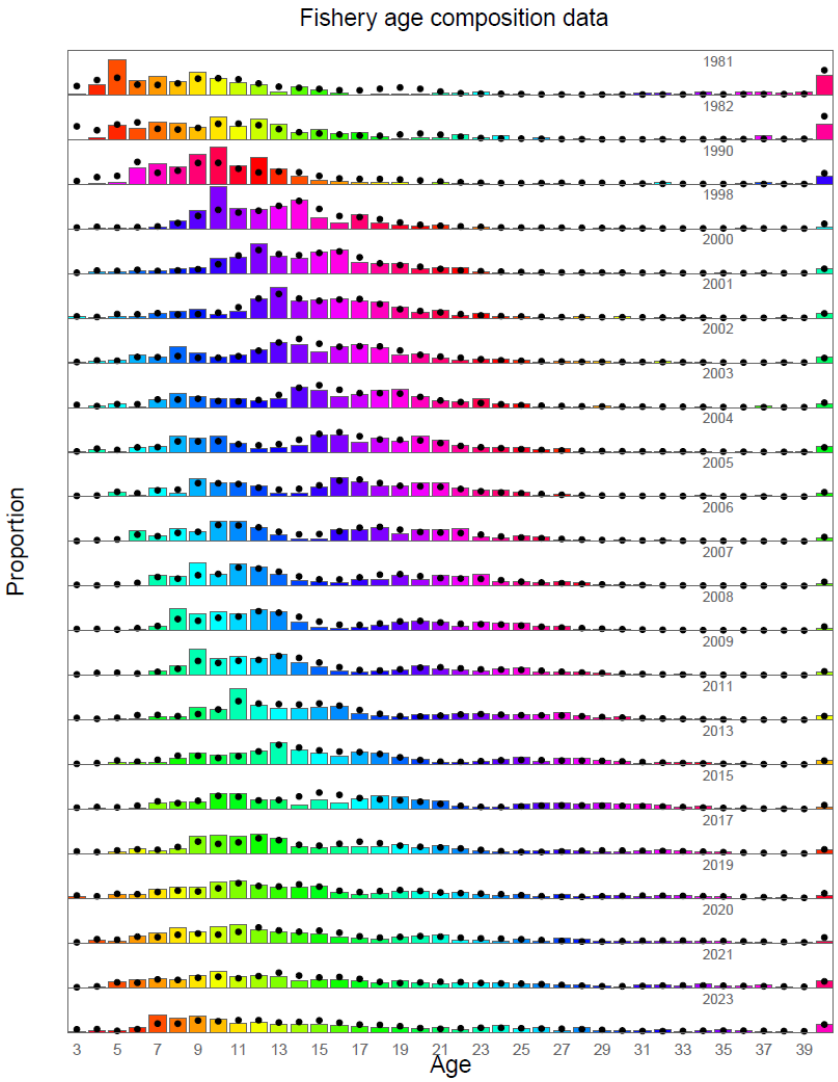




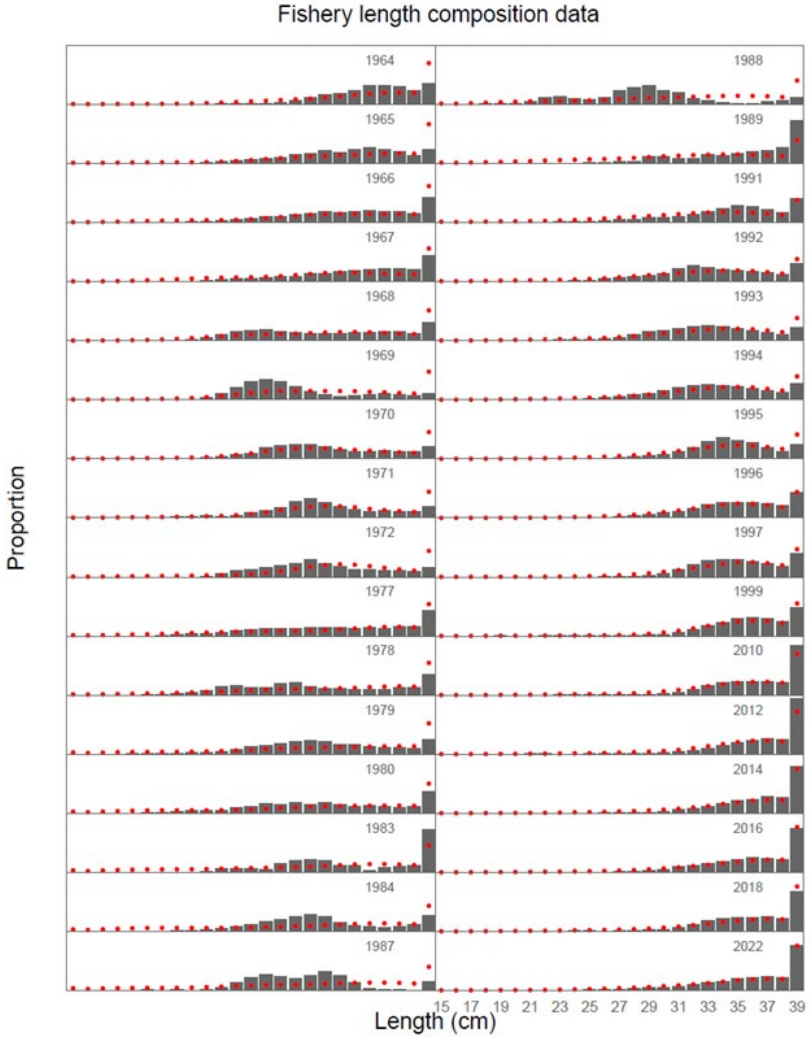
Fit to the EBS survey index



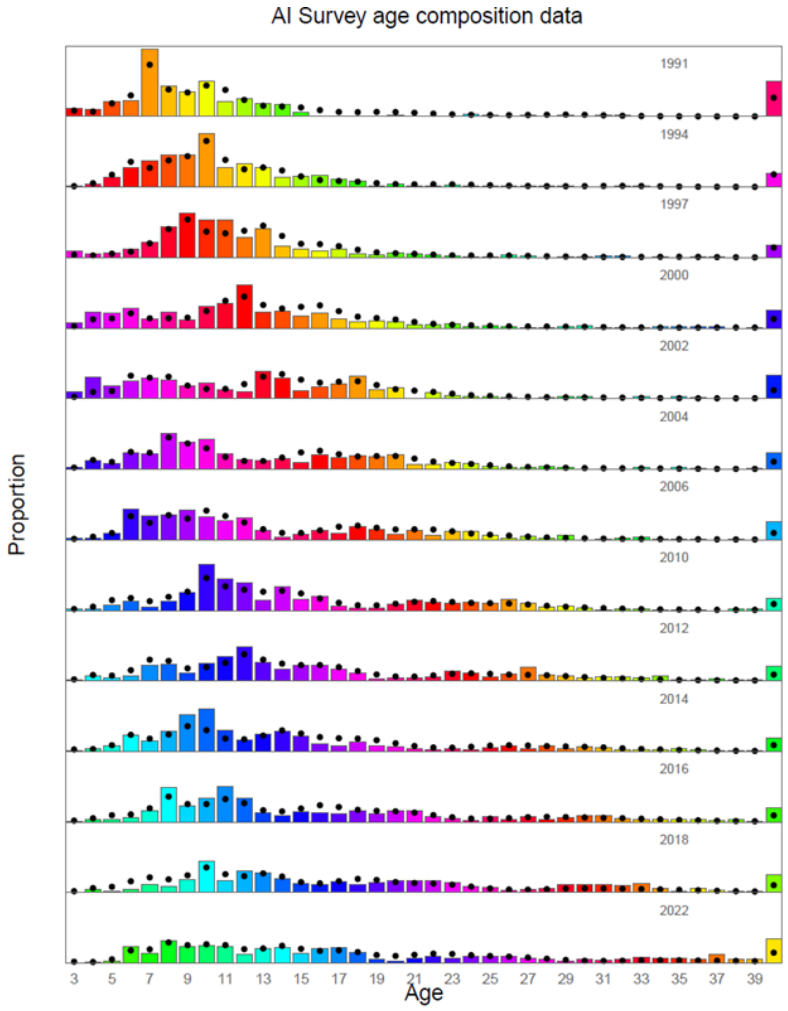
BSAI fishery age composition



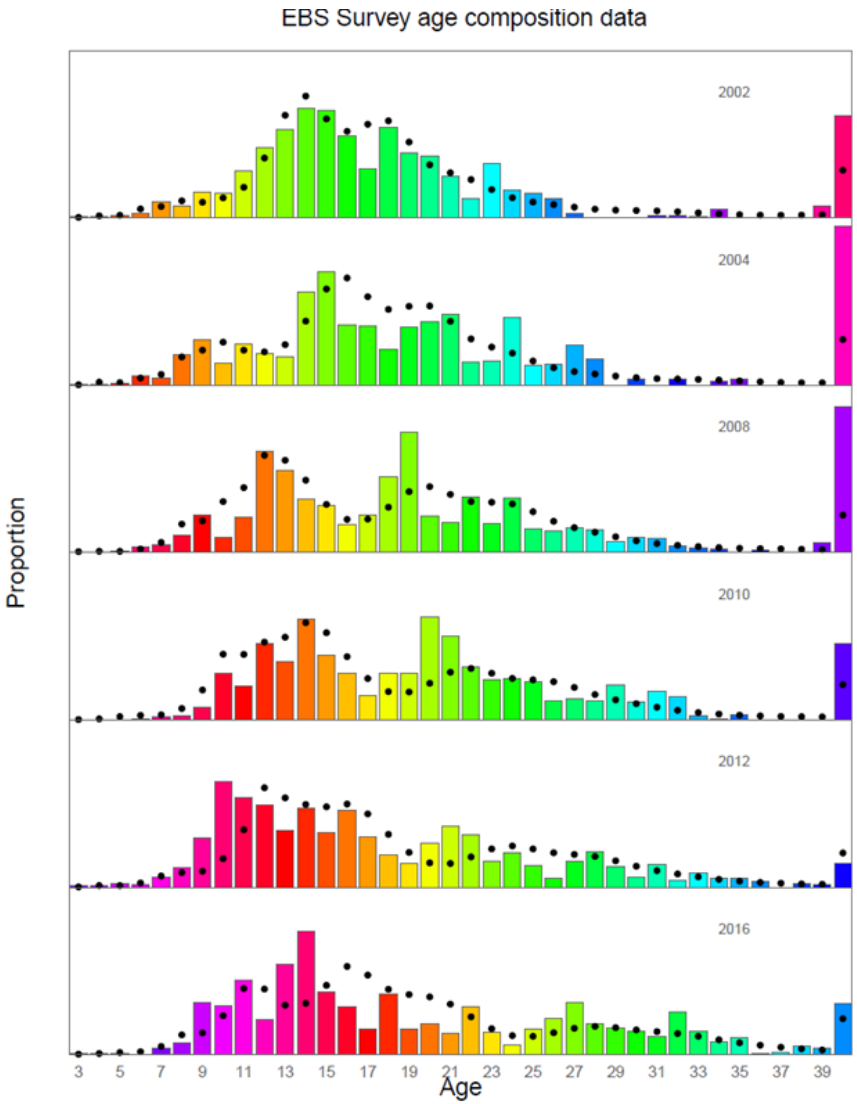
Fishery length composition



AI survey age composition



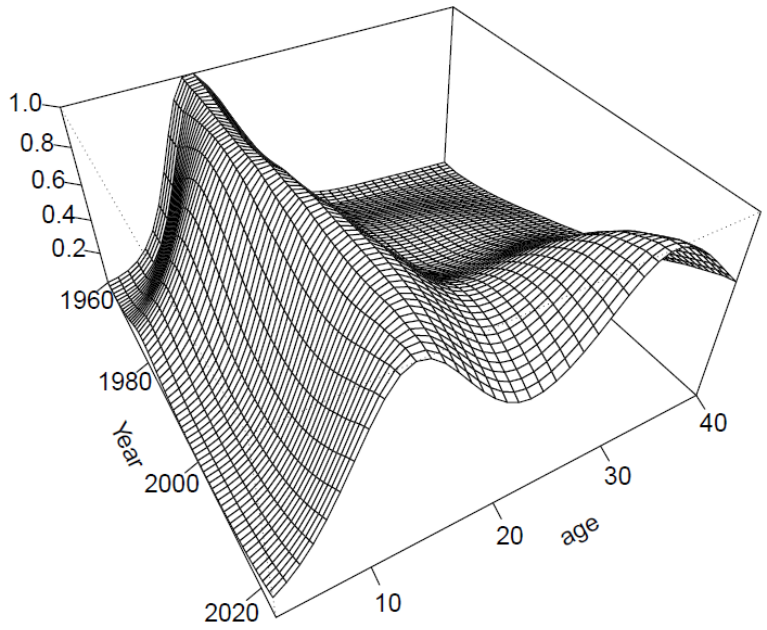
EBS survey age composition



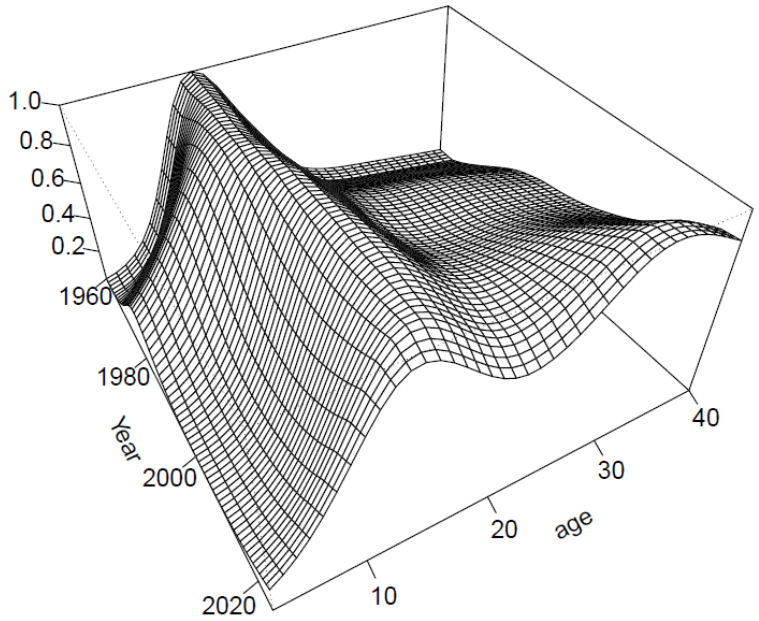
Not a great fit to the EBS survey age compositions

2000 year class is strong in the AI age data, not so much in the EBS data

Fishery selectivity

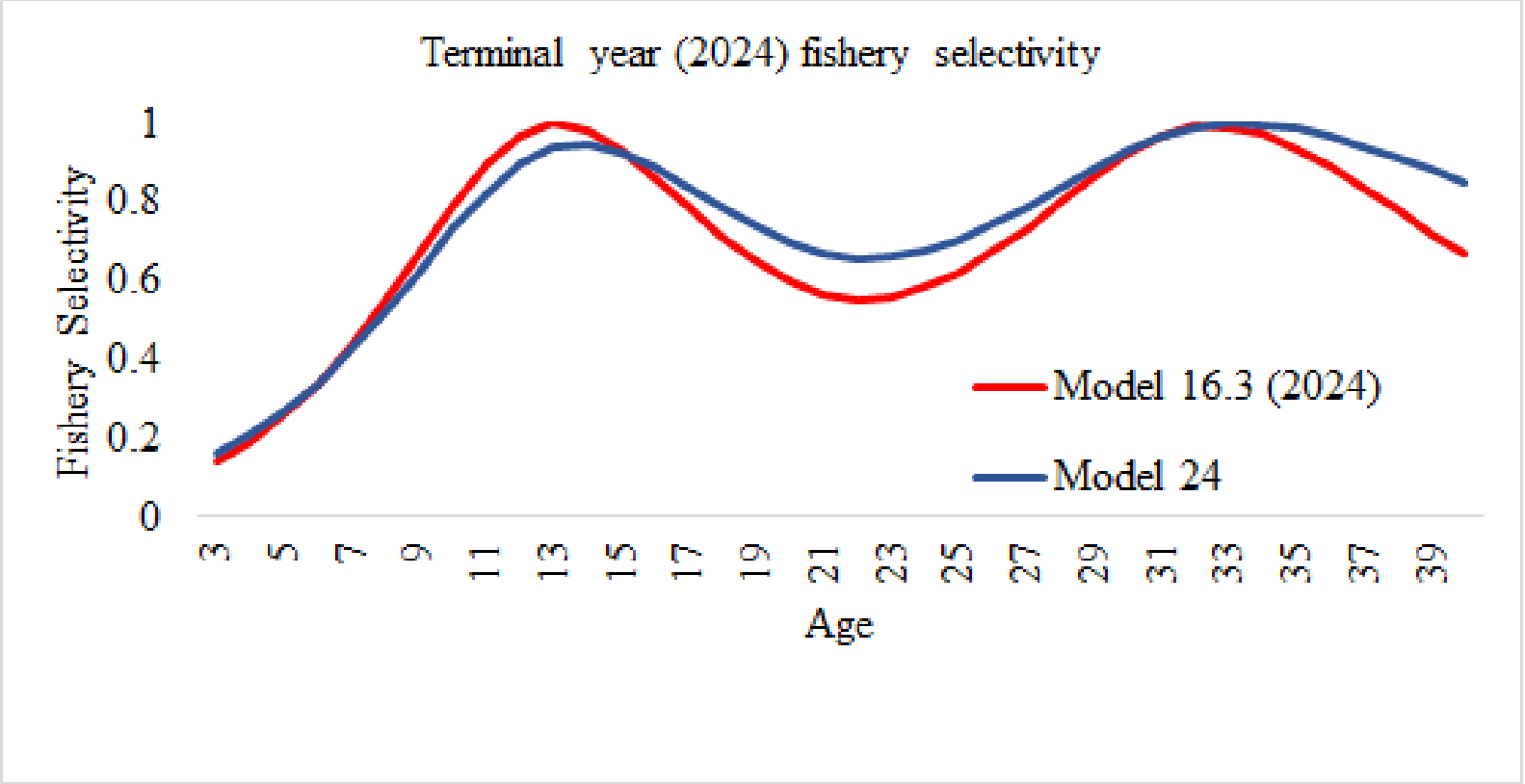


Model 16.3 (2024)

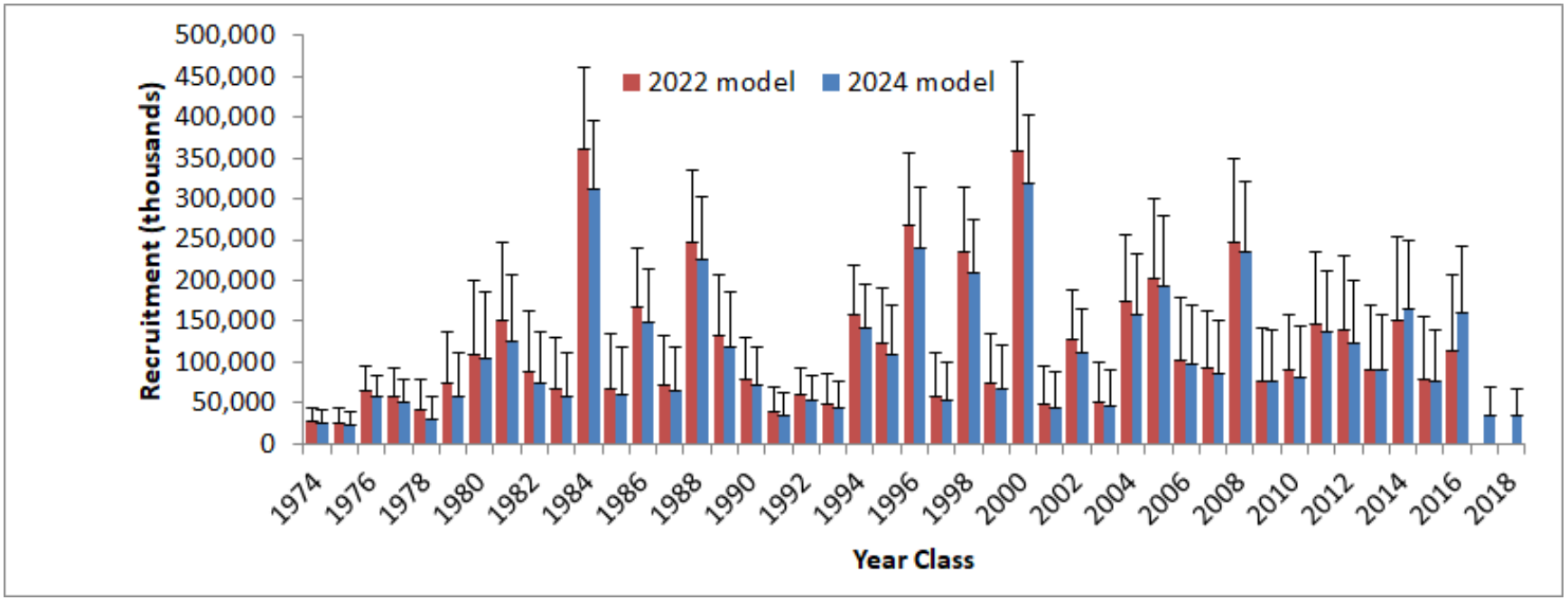


Model 24

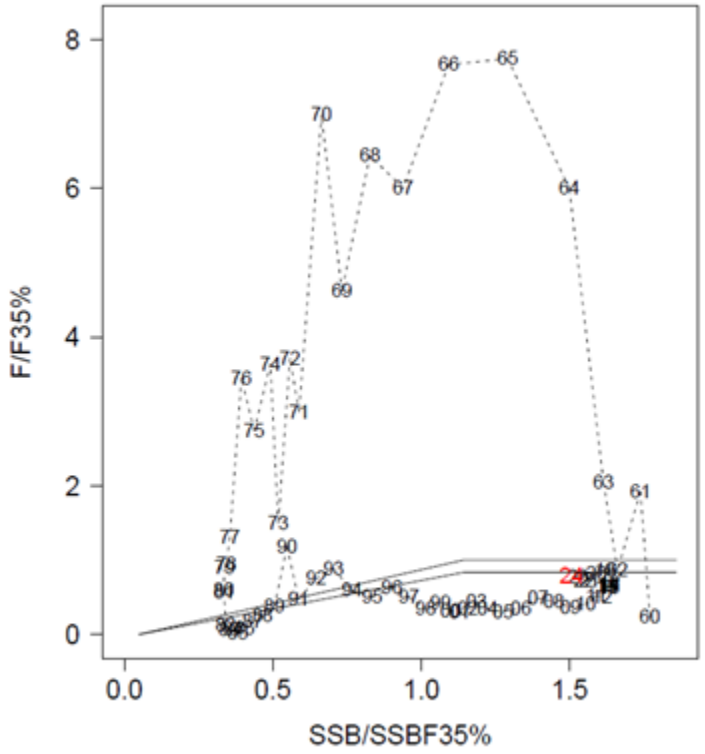
Terminal year fishery selectivity

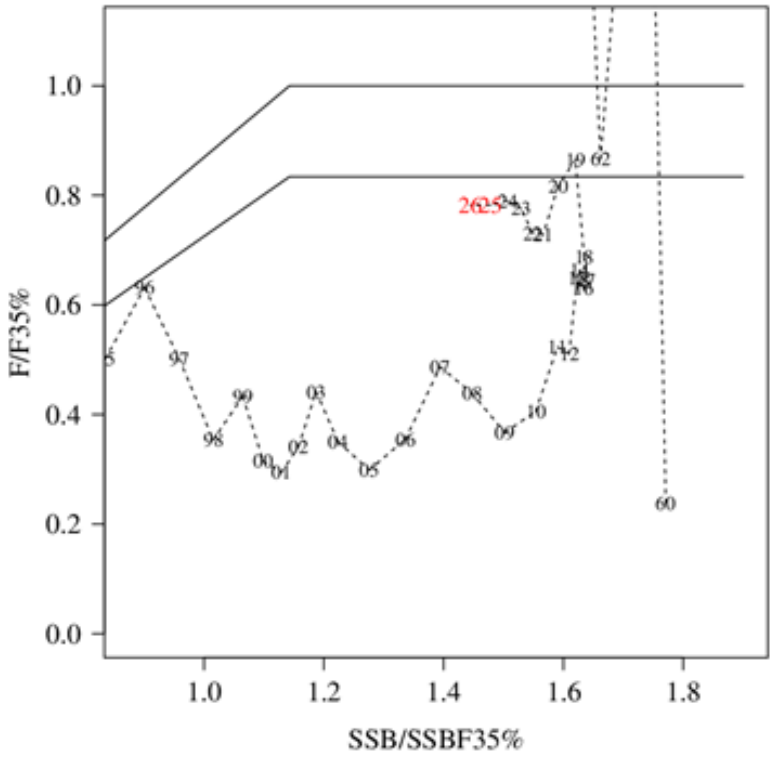


BSAI POP recruitment



Phase plane plot





Risk table considerations

- Assessment considerations: “data-inputs: biased ages, skipped surveys, lack of fishery-independent trend data; model fits: poor fits to fits to fishery or survey data, inability to simultaneously fit multiple data inputs; model performance: poor model convergence, multiple minima in the likelihood surface, parameters hitting bounds; estimation uncertainty: poorly-estimated but influential year classes; retrospective bias in biomass estimates.

- Level 2: Substantially increased uncertainty/unresolved issues. Strong retrospective bias that could represent model misspecification, but population dynamics and/or observational processes have not been identified. Poor residual pattern in fitting recent AI survey biomass estimates.

Risk table considerations

- Population dynamics considerations: “decreasing biomass trend, poor recent recruitment, inability of the stock to rebuild, abrupt increase or decrease in stock abundance.

- Level 1: Stock trends are typical for the stock; recent recruitment is in the normal range.

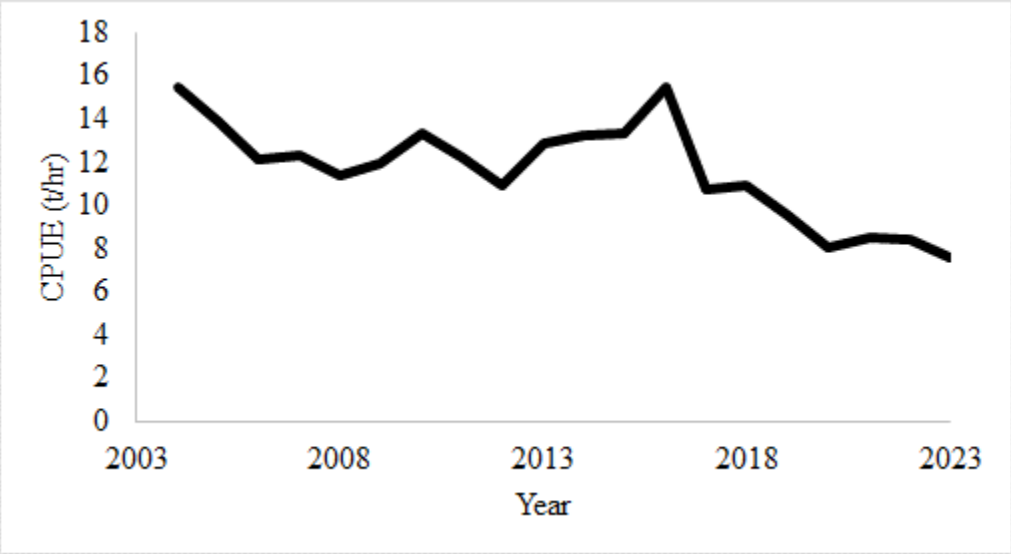
Rapid increase in the stock between 2006-2010 is somewhat unusual, although there is precedence for the stock rebuilding quickly from periods with strong recruitments. Recruitments for several recent year classes have been lower.

Risk table considerations

- Environmental/ecosystem considerations: "*adverse trends in environmental/ecosystem indicators, ecosystem model results, decreases in ecosystem productivity, decreases in prey abundance or availability, increases or increases in predator abundance or productivity.*"

- Level 1: Normal. "*The recent stretch of increased temperatures could potentially have negative effects, but the recent increasing trend in the POP stock suggests that the temperature impacts have not been limiting.*"

Fishery CPUE



Tons/hr, from tows targeting POP based on haul species composition. Source: North Pacific Groundfish Observer Program.

Risk table considerations

- Fishery performance considerations: “fishery CPUE is showing a contrasting pattern from the stock biomass trend, unusual spatial pattern of fishing, changes in the percent of TAC taken, changes in the duration of fishery openings.”

- Level 1: No apparent fishery/resource-use performance and/or behavior concerns.

  Fishery CPUE was relatively stable from 2004-2016. A decline in CPUE has occurred since 2017, which might be related to change in fishing practices in order to better avoid bycatch stocks.

Reference points and ABCs

Quantity	As estimated or specified last year for: 2024	2025	As estimated or recommended this year for: 2025	2026
M (natural mortality rate)	0.056	0.056	0.051	0.051
Tier	3a	3a		
Projected total (age 3+) biomass (t)	871,892	858,751	847,803	832,388
Female spawning biomass (t)				
Projected	350,439	342,980	352,503	344,463
$B_{100\%}$	652,626	652,626	681,381	681,381
$B_{40\%}$	261,050	261,050	272,552	272,552
$B_{35\%}$	228,419	228,419	238,483	238,483
F_{OFL}	0.089	0.089	0.072	0.072
$maxF_{ABC}$	0.074	0.074	0.060	0.060
F_{ABC}	0.074	0.074	0.060	0.060
OFL (t)	49,010	48,139	44,594	43,084
maxABC (t)	41,096	40,366	37,375	36,578
ABC (t)	41,096	40,366	37,375	36,578
Status	As determined last year for: 2022	2023	As determined this year for: 2023	2024
Overfishing	No	n/a	No	n/a
Overfished	n/a	No	n/a	No
Approaching overfished	n/a	No	n/a	No

Recommended 2025 BSAI ABCs and OFLs

BSAI ABC: 37,375 t (decrease from 2024 ABC of 41,096 t)

BSAI OFL: 44,594 t (decrease from 2024 OFL of 49,010 t)

Spatial apportionments

Spatial apportionment from 2022 assessment)

ABC apportionments

	Area				
	WAI	CAI	EAI	SBS	EBS slope
2022 smoothed biomass estimate	492,623	170,314	245,831	113,052	245,905
percentage	38.9%	13.4%	19.4%	8.9%	19.4%

Spatial apportionment from 2024 assessment)

ABC apportionments

	Area				
	WAI	CAI	EAI	SBS	EBS slope
2024 smoothed biomass estimate	506,358	182,590	206,200	86,457	245,954
percentage	41.2%	14.9%	16.8%	7.0%	20.0%

Subarea ABCs

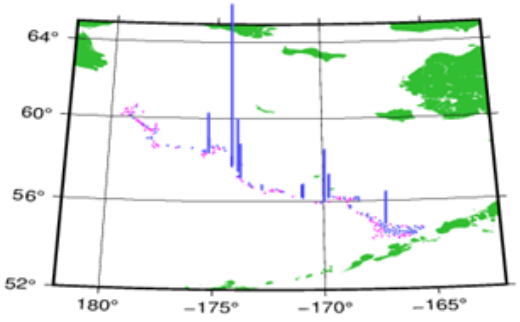
Area	Year	Age 3 Bio (t)	OFL	ABC	TAC	Catch[1]
BSAI	2023	888,722	50,133	42,038	37,703	35,951
	2024	871,892	49,010	41,096	37,626	26,124
	2025	847,803	44,594	37,375	n/a	n/a
	2026	832,388	43,084	36,578	n/a	n/a
Eastern Bering Sea	2023			11,903	11,903	10,892
	2024			11,636	11,636	6,946
	2025			10,121	n/a	n/a
	2026			9,905	n/a	n/a
Eastern Aleutian Islands	2023			8,152	8,152	7,791
	2024			7,969	7,969	6,969
	2025			6,278	n/a	n/a
	2026			6,144	n/a	n/a
Central Aleutian Islands	2023			5,648	5,648	5,461
	2024			5,521	5,521	3,724
	2025			5,559	n/a	n/a
	2026			5,441	n/a	n/a
Western Aleutian Islands	2023			16,335	12,000	11,807
	2024			15,970	12,500	8,485
	2025			15,417	n/a	n/a
	2026			16,058	n/a	n/a

Conclusions

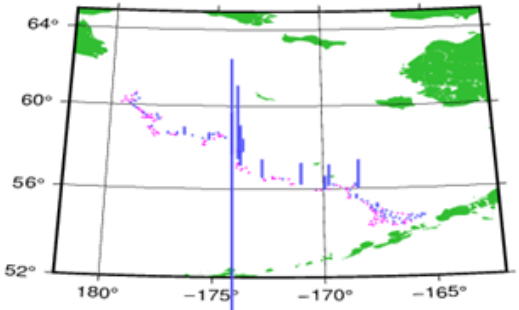
- Continued high abundance of POP
- High survey biomass estimates have been keeping the estimated biomass in the assessment at a high level.
- Additional diagnostics have contributed to our understanding of the conflicts between the data sets
- Statistical estimation of ageing error (i.e., Punt method) would be useful

Survey CPUE, 2010 – 2016 EBS surveys

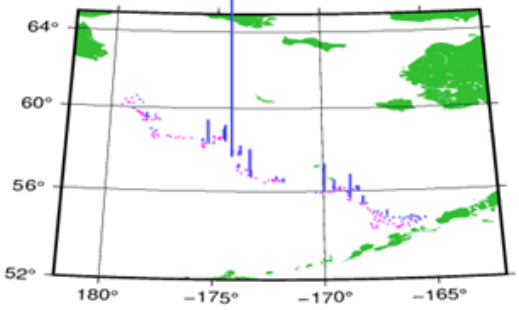
2010 EBS Survey POP CPUE (scaled wgt/km^2)



2012 EBS Survey POP CPUE (scaled wgt/km^2)

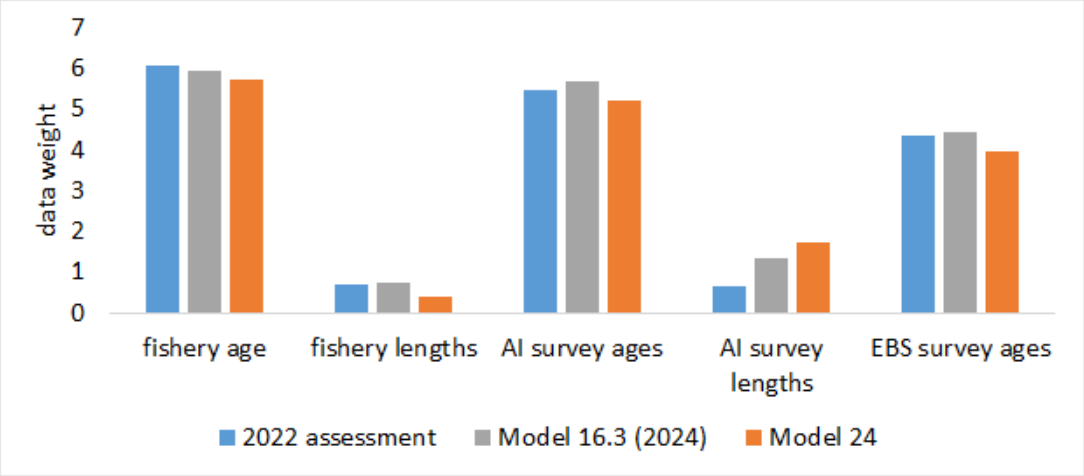


2016 EBS Survey POP CPUE (scaled wgt/km^2)

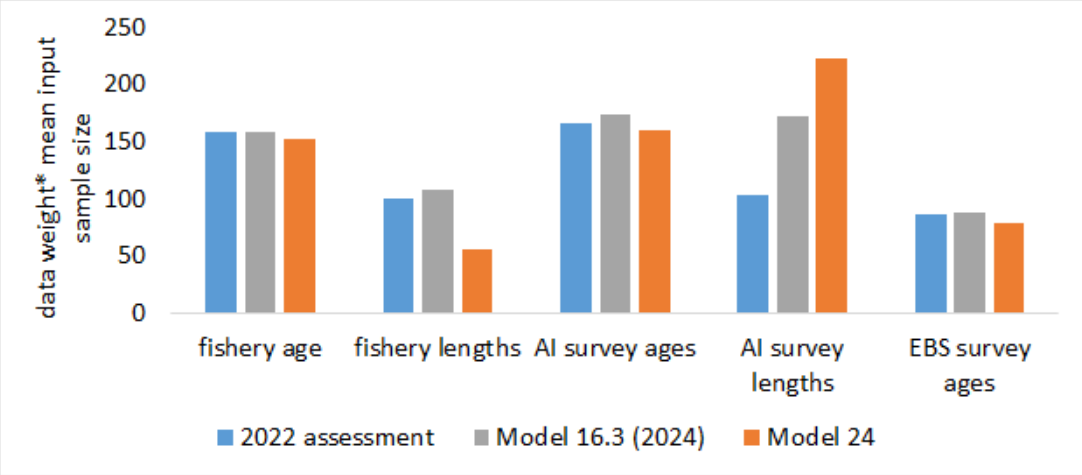


Year	EBS slope survey
2002	72,676 (0.53)
2004	112,582 (0.38)
2008	107,891 (0.41)
2010	203,460 (0.38)
2012	231,220 (0.33)
2016	357,379 (0.68)

Age/length composition weights



Data weights



(Data weights) *
(mean input sample size)