Atka mackerel
BSAI Groundfish Plan Team

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With contributions from Ivonne Ortiz, Russel Dame, Megsie Siple, Steve Barbeaux, and many others

NOAA FISHERIES

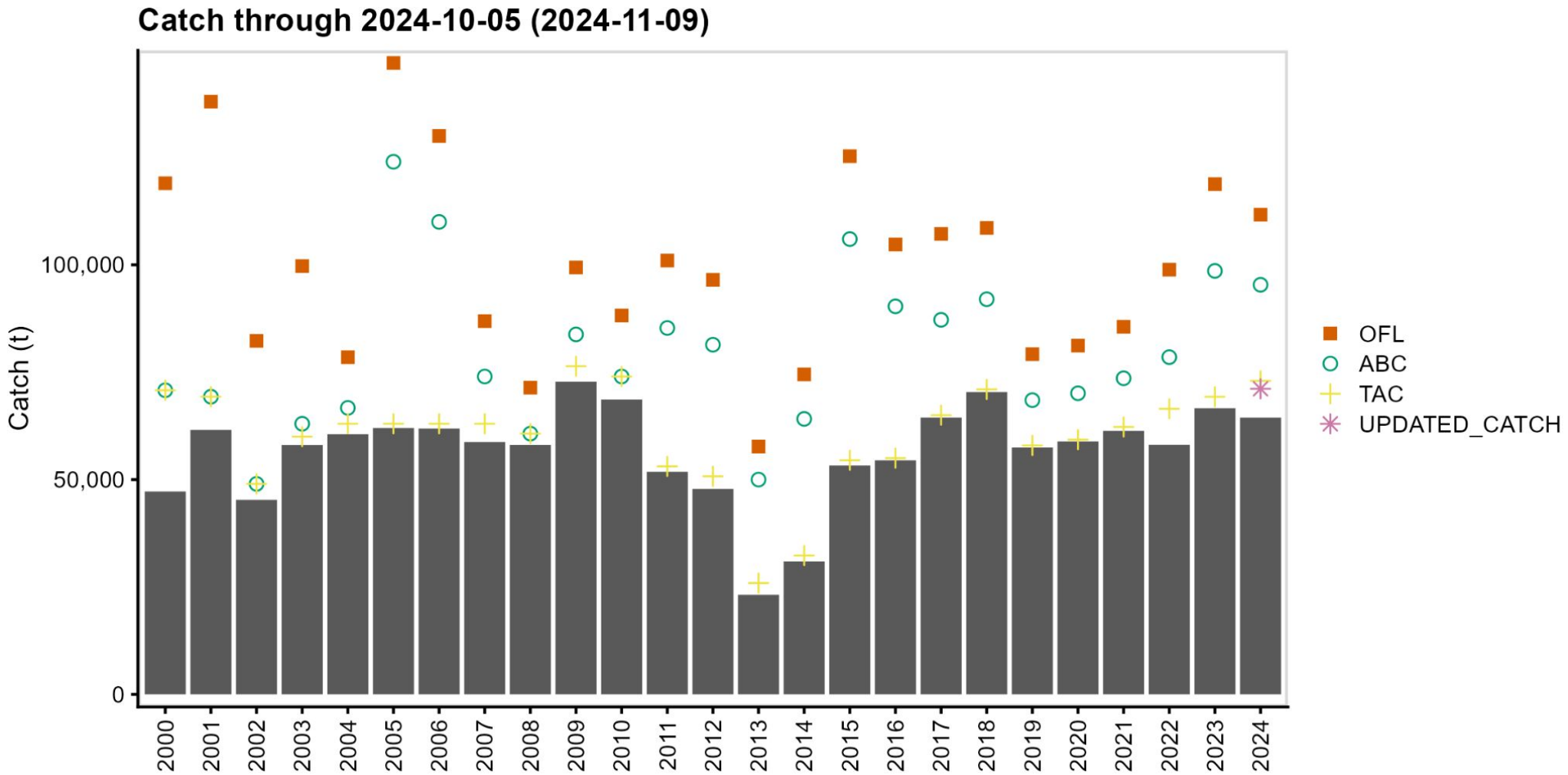
Stock Overview

New: Annual to biennial assessment in even years
"Update" in 2024 (Model 16.0b; no new models considered)

Quantity	As estimated or *specified last* year for:		As estimated or *recommended this* year for:	
	2024	2025	2025*	2026*
M (natural mortality rate)	0.30	0.30	0.30	0.30
Tier	3a	3b	3a	3a
Projected Female SSB	116,618	110,694	119,853	106,274
$B_{40\%}$	112,182	112,182	105,894	105,894
OFL (t)	111,684	99,723	**122,622**	107,889
maxABC (t) (recommended)	95,358	84,676	**103,247**	92,361

+8% in ABC from 2024

Catch, TAC, ABC, and OFL



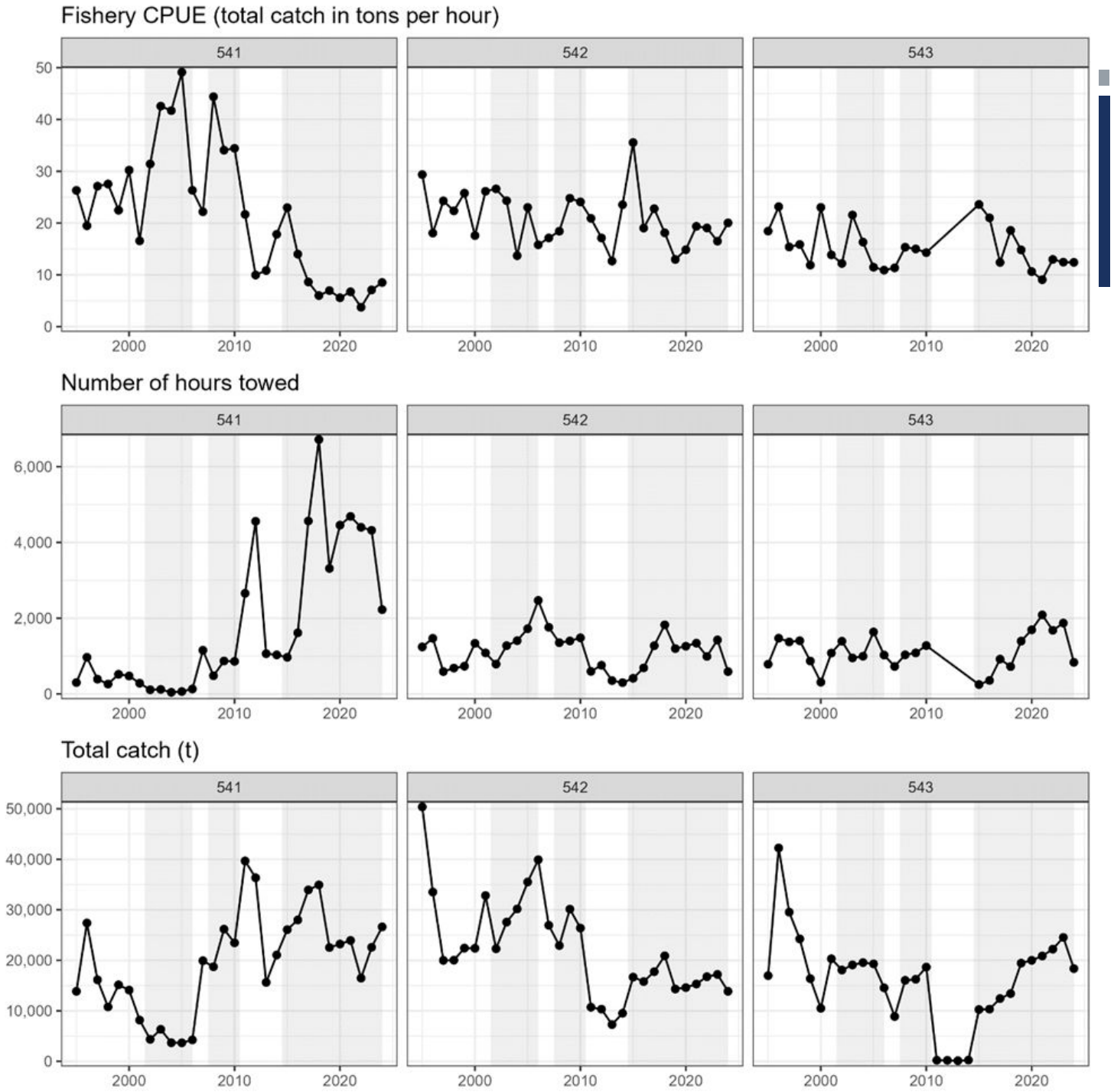
Fishery trends

CPUE most variable in 541

- increased effort, decreased CPUE

CPUE is more stable in 542/543, though some evidence of long-term/slow declines in CPUE

Interannual changes often explained by management actions (shaded regions)



Markets (Dame, Appendix 17B)

Head & Gut product exported to Japan, S Korea, and N China, where it it undergoes secondary processing

Image source: Oiso Co., Ltd. via https://www.shimanebuyers.com/product/cat05/184/

COVID…

2023: $90.3 million first wholesale value, a 17% increase since 2022; attributed to increase in production and price

2024: early indicators suggest decline from 2023 in export volume and value but still above the 2014-2018 average

Data Summary

New data in bold

Source	Data component	Years of data
Fishery	Catch biomass	1977-**2024**
	Age composition	1977-**2023** (except 1989)
NMFS Aleutian Islands bottom trawl survey	Survey biomass	1991, 1994, 1997, 2000, 2002, 2004, 2006, 2010, 2012, 2014, 2016, 2018, 2022, **2024**
	Survey age composition	1991, 1994, 1997, 2000, 2002, 2004, 2006, 2010, 2012, 2014, 2016, 2018, **2022**

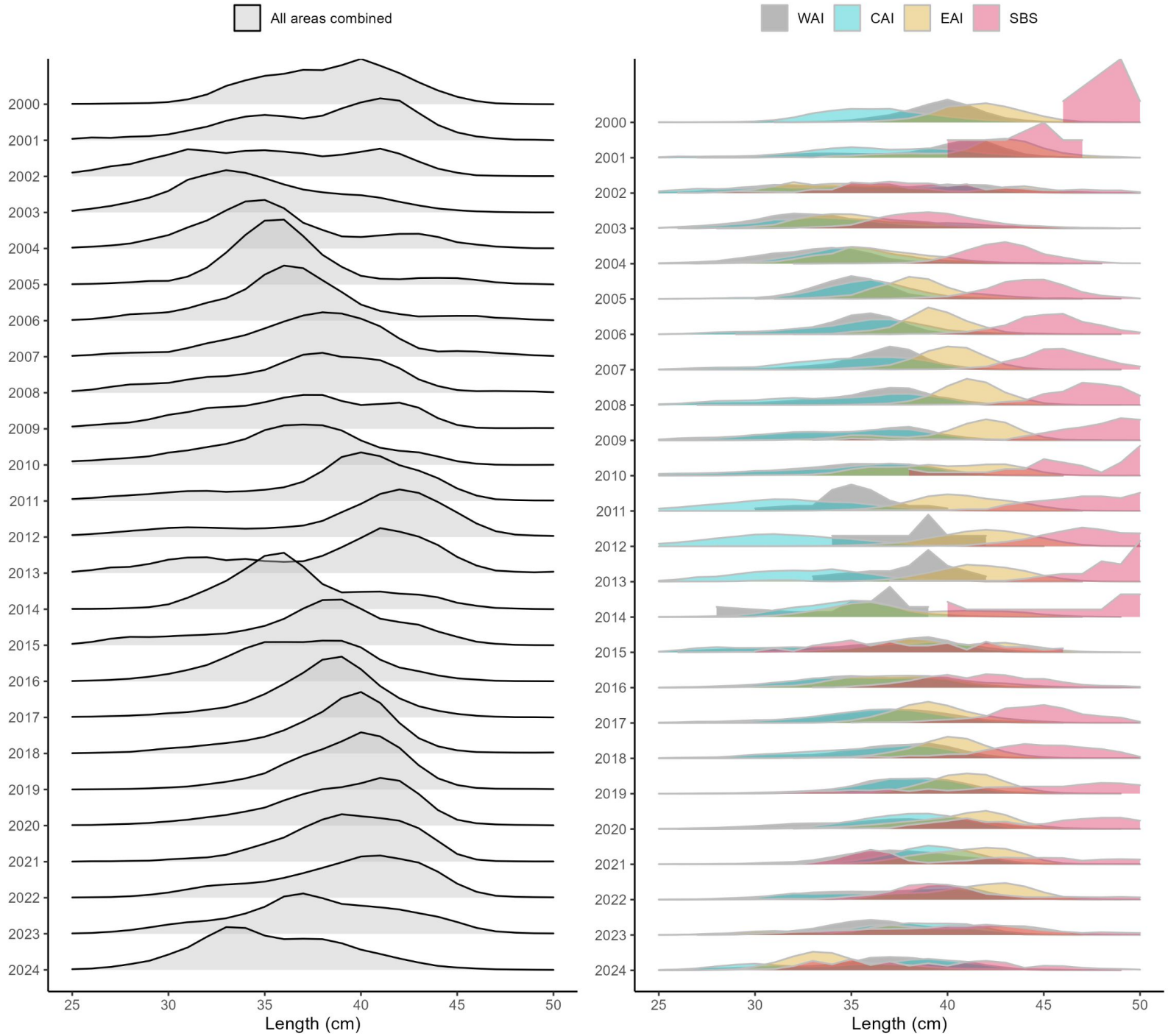
Fishery Age Composition

Fishery Length Compositions

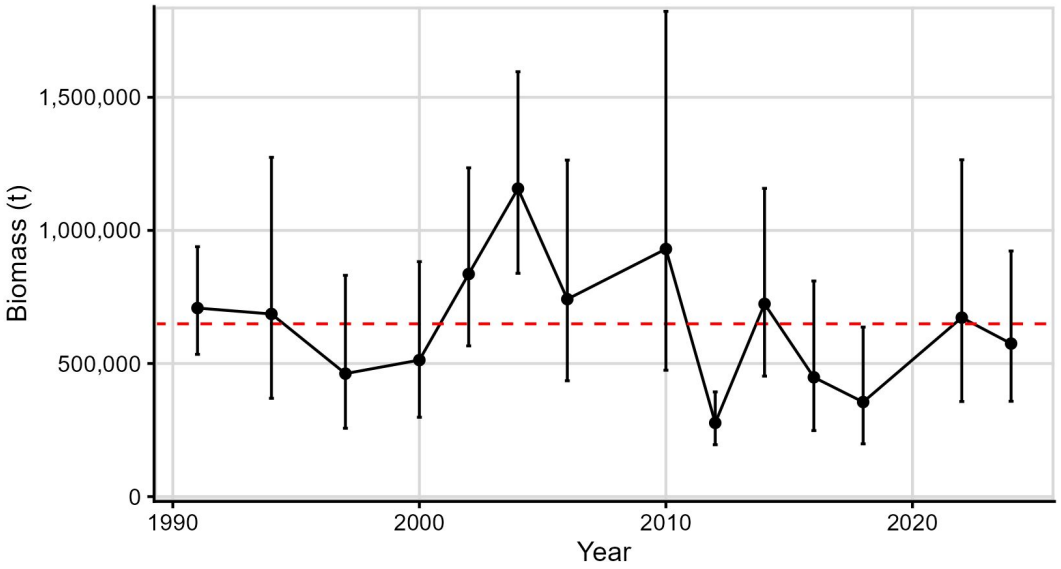
General west-east gradient in size comps (small to large)

Spatial growth explained by food quality rather than food quantity or temperature (Rand et al., 2010), e.g., Atka in the EAI eating more euphausiids compared to copepods

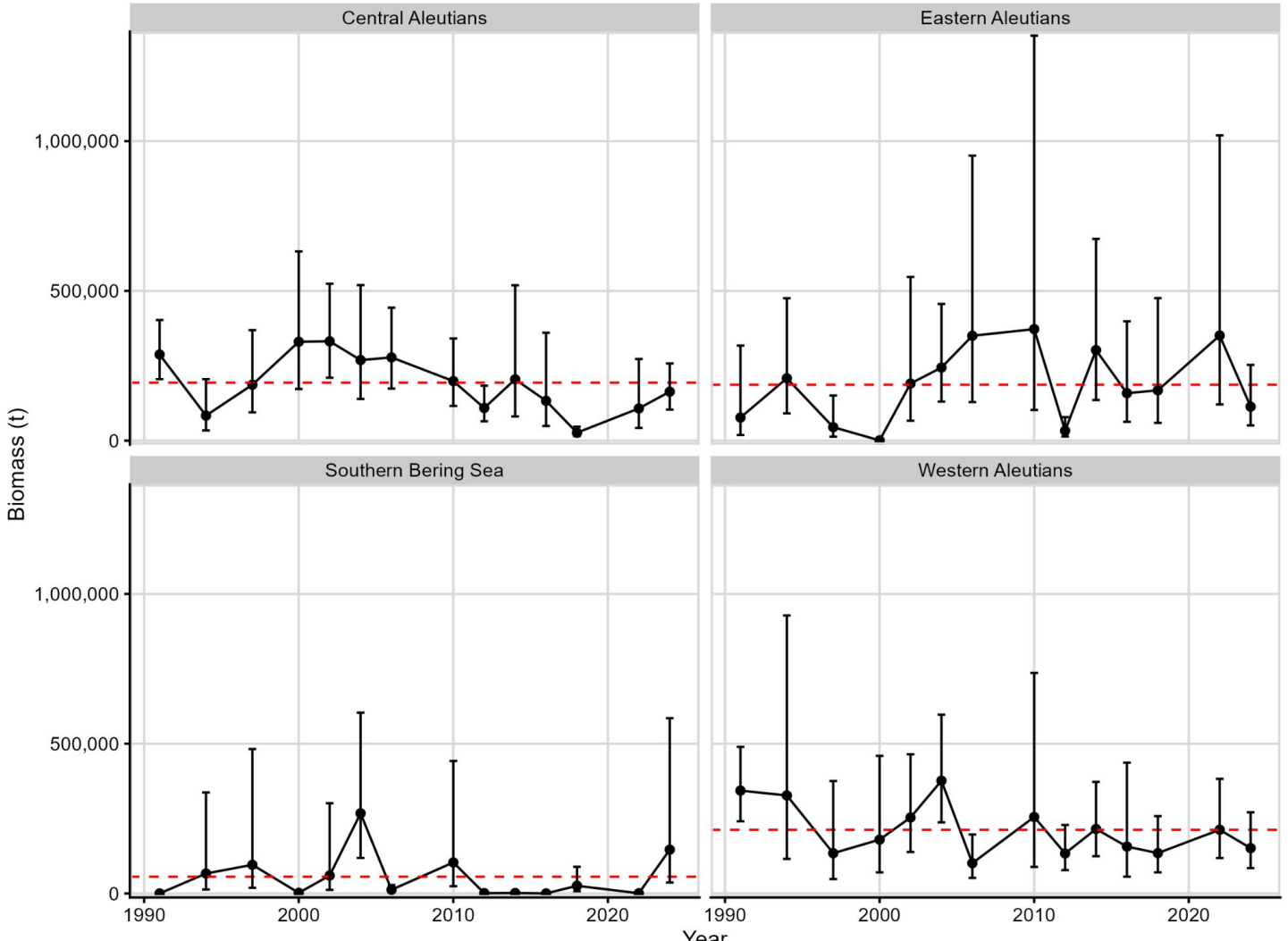
Evidence of new 2021/22 yc in 2024 comps

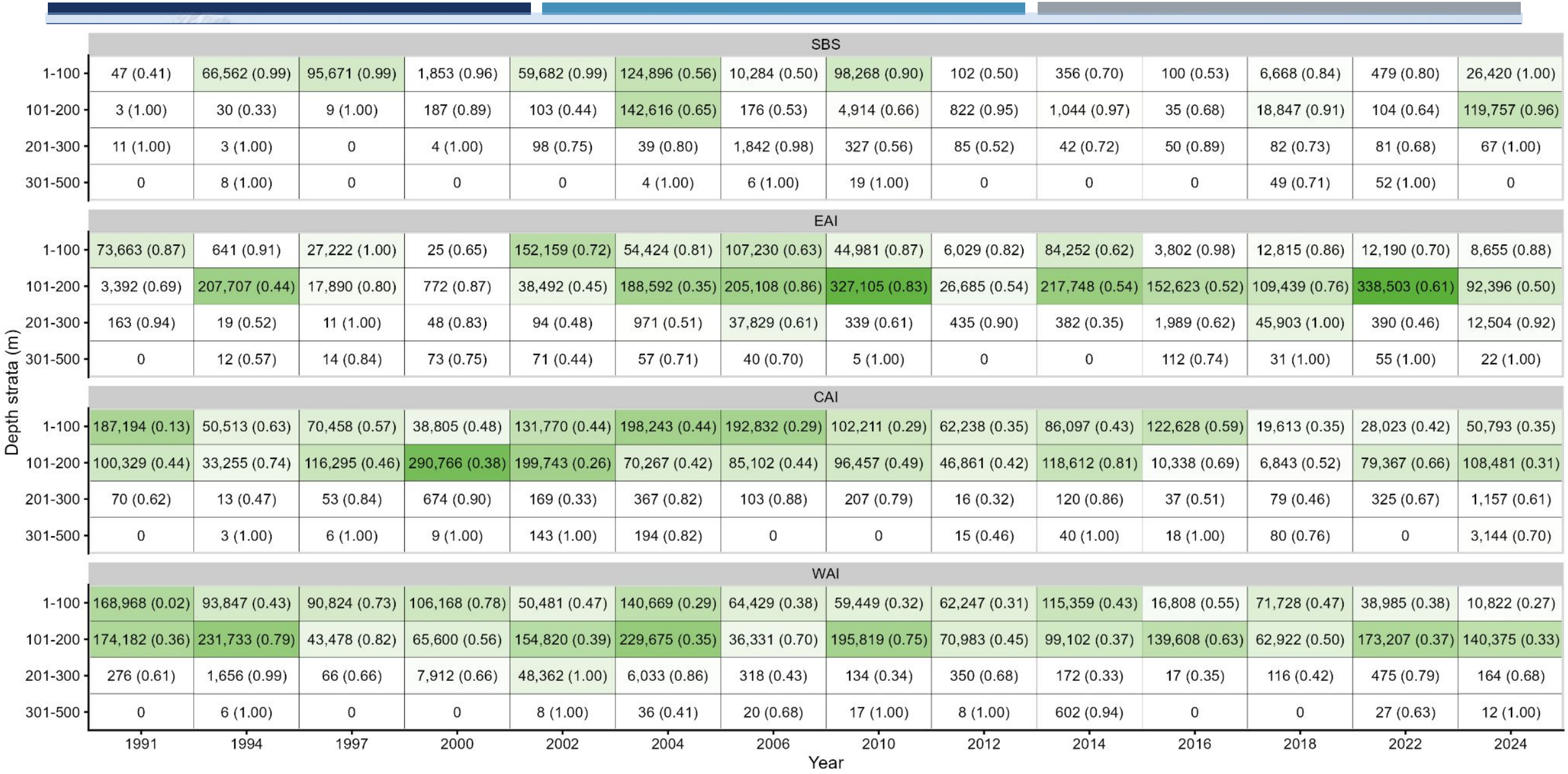


Survey - Aleutian Islands Bottom Trawl



14.5% decrease in biomass from 2022 to 2024



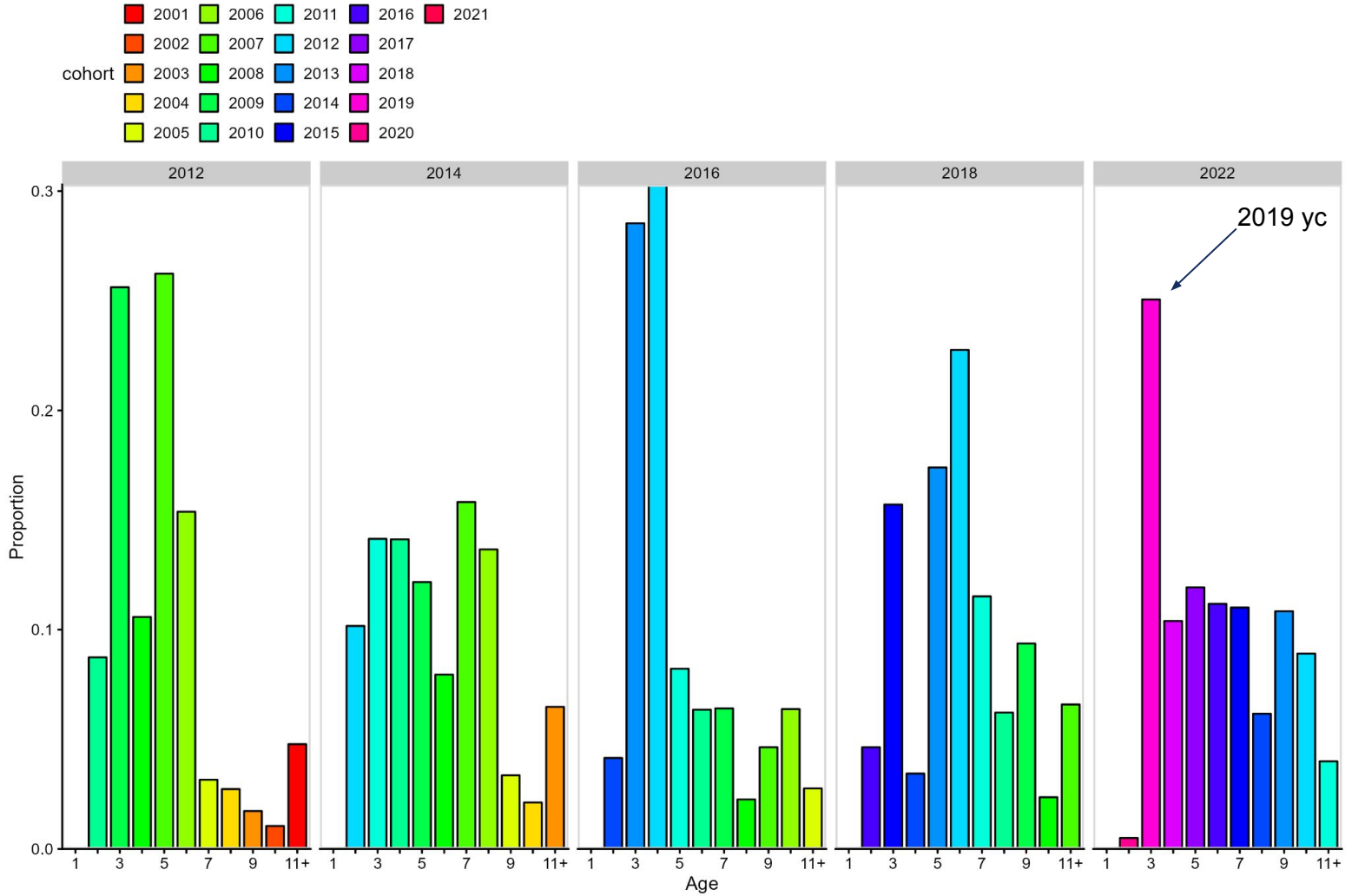

SBS
1-100 47 (0.41) 66,562 (0.99) 95,671 (0.99) 1,853 (0.96) 59,682 (0.99) 124,896 (0.56) 10,284 (0.50) 98,268 (0.90) 102 (0.50) 356 (0.70) 100 (0.53) 6,668 (0.84) 479 (0.80) 26,420 (1.00)
101-200 3 (1.00) 30 (0.33) 9 (1.00) 187 (0.89) 103 (0.44) 142,616 (0.65) 176 (0.53) 4,914 (0.66) 822 (0.95) 1,044 (0.97) 35 (0.68) 18,847 (0.91) 104 (0.64) 119,757 (0.96)
201-300 11 (1.00) 3 (1.00) 0 4 (1.00) 98 (0.75) 39 (0.80) 1,842 (0.98) 327 (0.56) 85 (0.52) 42 (0.72) 50 (0.89) 82 (0.73) 81 (0.68) 67 (1.00)
301-500 0 8 (1.00) 0 0 0 4 (1.00) 6 (1.00) 19 (1.00) 0 0 0 49 (0.71) 52 (1.00) 0
EAI
1-100 73,663 (0.87) 641 (0.91) 27,222 (1.00) 25 (0.65) 152,159 (0.72) 54,424 (0.81) 107,230 (0.63) 44,981 (0.87) 6,029 (0.82) 84,252 (0.62) 3,802 (0.98) 12,815 (0.86) 12,190 (0.70) 8,655 (0.88)
101-200 3,392 (0.69) 207,707 (0.44) 17,890 (0.80) 772 (0.87) 38,492 (0.45) 188,592 (0.35) 205,108 (0.86) 327,105 (0.83) 26,685 (0.54) 217,748 (0.54) 152,623 (0.52) 109,439 (0.76) 338,503 (0.61) 92,396 (0.50)
201-300 163 (0.94) 19 (0.52) 11 (1.00) 48 (0.83) 94 (0.48) 971 (0.51) 37,829 (0.61) 339 (0.61) 435 (0.90) 382 (0.35) 1,989 (0.62) 45,903 (1.00) 390 (0.46) 12,504 (0.92)
301-500 0 12 (0.57) 14 (0.84) 73 (0.75) 71 (0.44) 57 (0.71) 40 (0.70) 5 (1.00) 0 0 112 (0.74) 31 (1.00) 55 (1.00) 22 (1.00)
CAI
1-100 187,194 (0.13) 50,513 (0.63) 70,458 (0.57) 38,805 (0.48) 131,770 (0.44) 198,243 (0.44) 192,832 (0.29) 102,211 (0.29) 62,238 (0.35) 86,097 (0.43) 122,628 (0.59) 19,613 (0.35) 28,023 (0.42) 50,793 (0.35)
101-200 100,329 (0.44) 33,255 (0.74) 116,295 (0.46) 290,766 (0.38) 199,743 (0.26) 70,267 (0.42) 85,102 (0.44) 96,457 (0.49) 46,861 (0.42) 118,612 (0.81) 10,338 (0.69) 6,843 (0.52) 79,367 (0.66) 108,481 (0.31)
201-300 70 (0.62) 13 (0.47) 53 (0.84) 674 (0.90) 169 (0.33) 367 (0.82) 103 (0.88) 207 (0.79) 16 (0.32) 120 (0.86) 37 (0.51) 79 (0.46) 325 (0.67) 1,157 (0.61)
301-500 0 3 (1.00) 6 (1.00) 9 (1.00) 143 (1.00) 194 (0.82) 0 0 15 (0.46) 40 (1.00) 18 (1.00) 80 (0.76) 0 3,144 (0.70)
WAI
1-100 168,968 (0.02) 93,847 (0.43) 90,824 (0.73) 106,168 (0.78) 50,481 (0.47) 140,669 (0.29) 64,429 (0.38) 59,449 (0.32) 62,247 (0.31) 115,359 (0.43) 16,808 (0.55) 71,728 (0.47) 38,985 (0.38) 10,822 (0.27)
101-200 174,182 (0.36) 231,733 (0.79) 43,478 (0.82) 65,600 (0.56) 154,820 (0.39) 229,675 (0.35) 36,331 (0.70) 195,819 (0.75) 70,983 (0.45) 99,102 (0.37) 139,608 (0.63) 62,922 (0.50) 173,207 (0.37) 140,375 (0.33)
201-300 276 (0.61) 1,656 (0.99) 66 (0.66) 7,912 (0.66) 48,362 (1.00) 6,033 (0.86) 318 (0.43) 134 (0.34) 350 (0.68) 172 (0.33) 17 (0.35) 116 (0.42) 475 (0.79) 164 (0.68)
301-500 0 6 (1.00) 0 0 8 (1.00) 36 (0.41) 20 (0.68) 17 (1.00) 8 (1.00) 602 (0.94) 0 0 27 (0.63) 12 (1.00)
Depth strata (m)
1991 1994 1997 2000 2002 2004 2006 2010 2012 2014 2016 2018 2022 2024
Year

AI survey reduction in 2024

Exceptional work by the survey team following loss of >20 vessel days in 2024)

Year	Quantity	WAI	CAI	EAI	SBS	Total
1991	*CV*	18%	17%	83%	37%	14%
1994		57%	48%	44%	99%	32%
1997		56%	36%	68%	99%	31%
2000		51%	34%	74%	88%	28%
2002		32%	24%	58%	99%	20%
2004		24%	35%	33%	43%	17%
2006		35%	24%	55%	44%	28%
2010		58%	28%	74%	86%	35%
2012		28%	27%	46%	77%	18%
2014		29%	50%	43%	73%	24%
2016		56%	54%	50%	39%	31%
2018		34%	29%	57%	70%	30%
2022		31%	50%	59%	55%	33%
2024		30%	24%	43%	81%	25%
1991	*Number of hauls*	56	91	129	55	331
1994		69	114	133	64	380
1997		92	116	136	52	396
2000		113	110	138	58	419
2002		107	114	132	61	414
2004		124	130	112	53	419
2006		112	110	91	44	357
2010		118	128	121	51	418
2012		120	113	132	55	420
2014		134	110	122	44	410
2016		135	114	127	43	419
2018		129	120	126	45	420
2022		108	112	131	47	398
2024		88	80	104	35	307

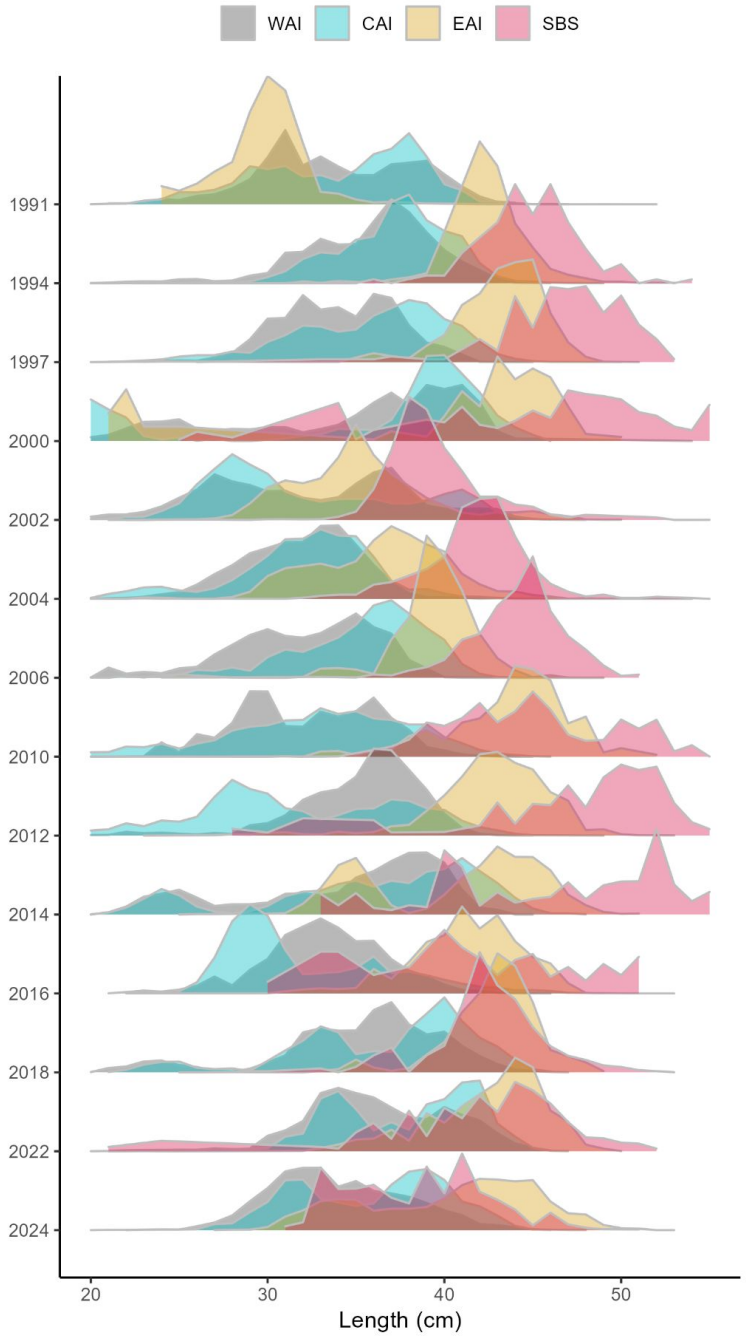
Survey Age Composition - AI Bottom Trawl

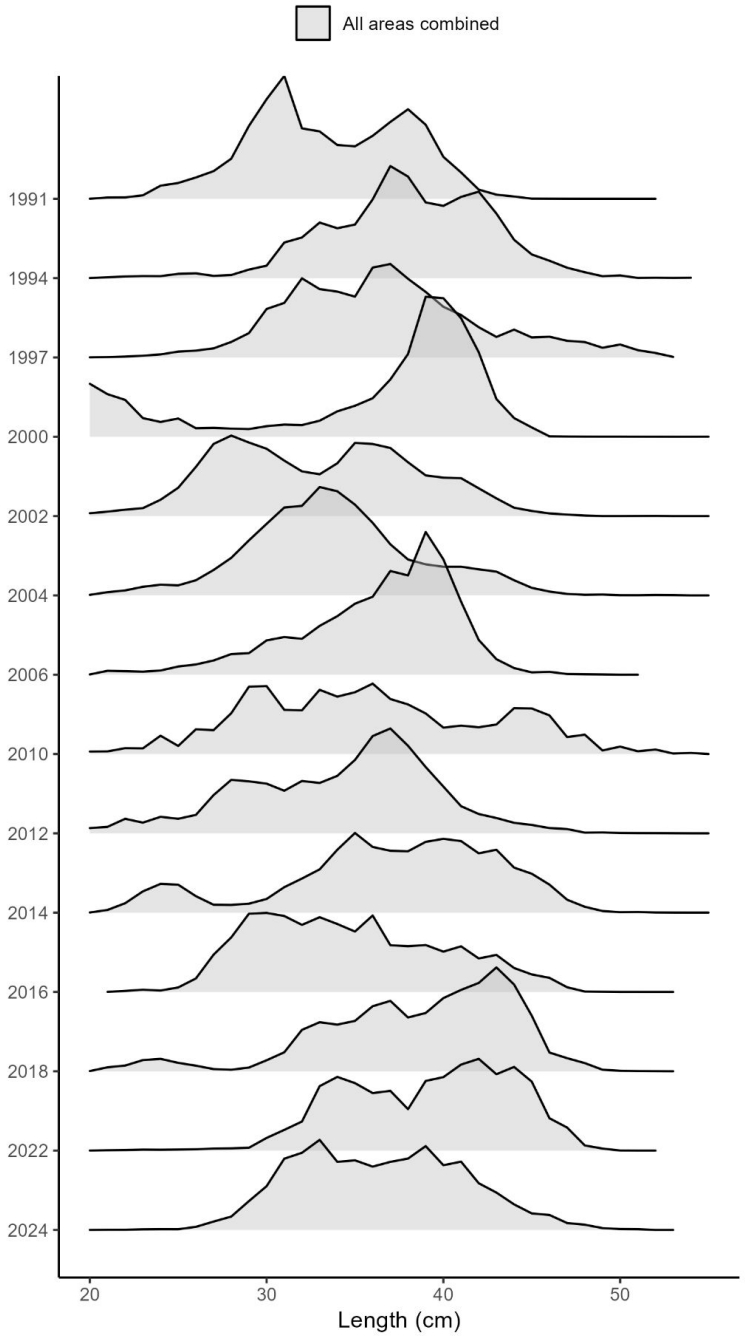


Agreement in the data:

new 2022 survey, 2022 fishery, and 2023 fishery ages all show indication of an above average 2019 yc

Survey Length Composition



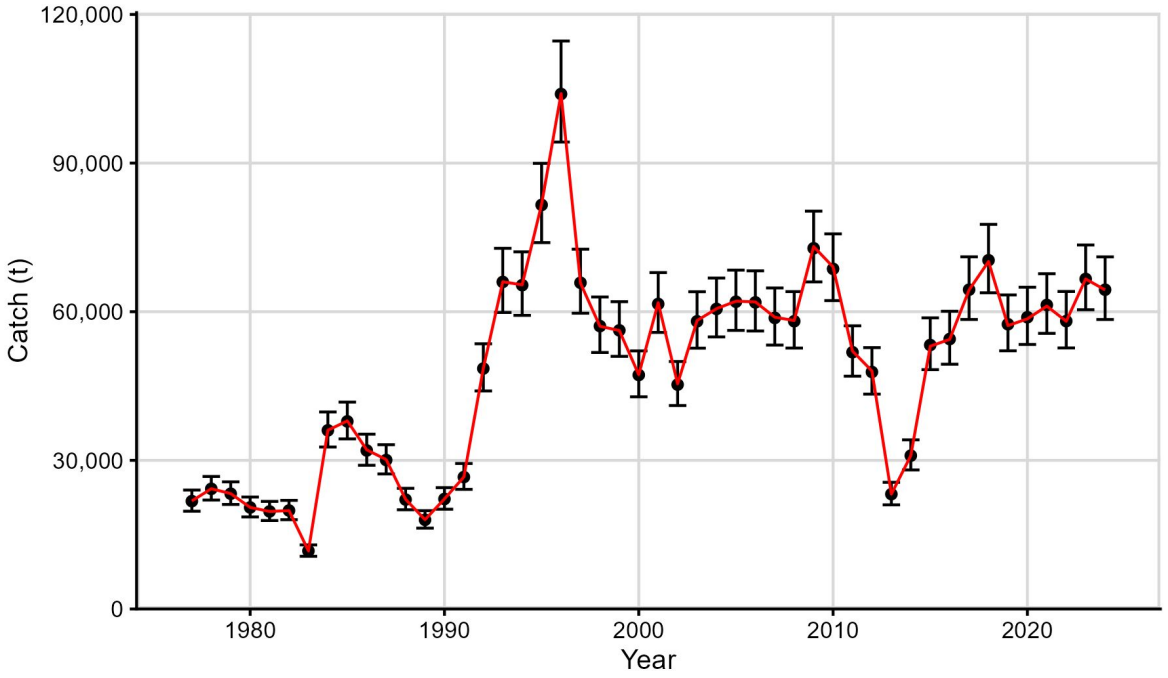


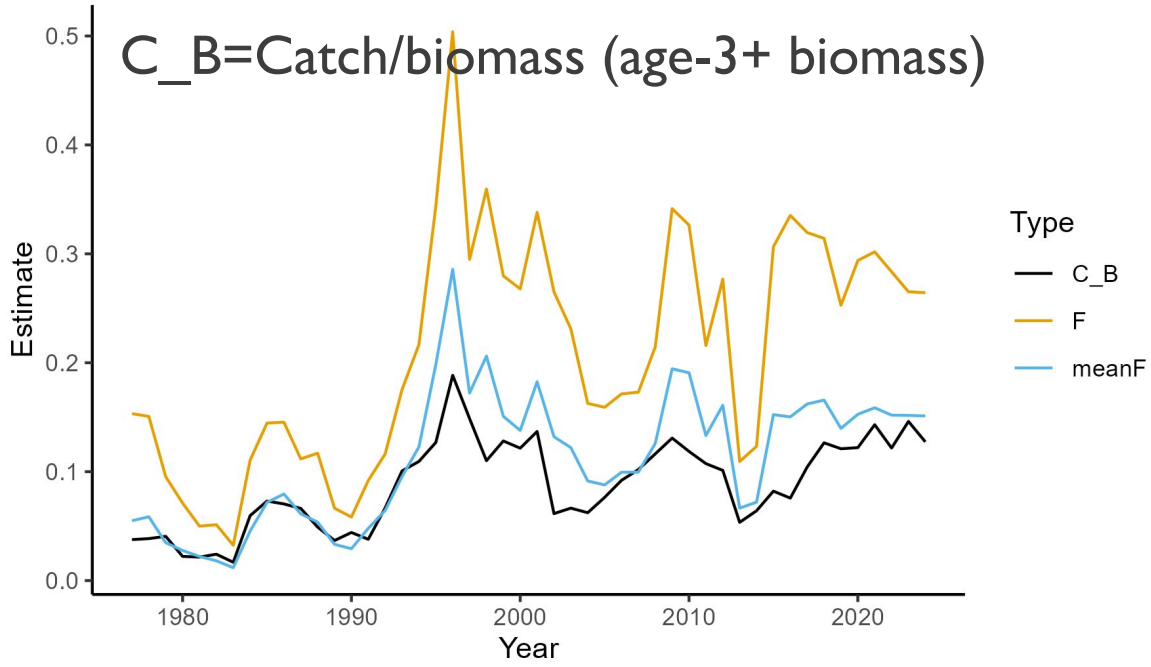
Model 16.0b

- Single sex, ages 1-11+
- M=0.35 fixed
- Single fishery (Directed A80 trawl, high resolution data)
  - Age comps (multinomial, mean ISS = 100)
  - Annually-varying age-based nonparametric selectivity (σ_{f_sel} tuned using Francis method)
  - Annually-varying empirical weight-at-age
- Single index (AI bottom trawl survey)
  - Age comps (multinomial with Francis weighting)
  - Constant age-based nonparametric selectivity
  - Annually-varying empirical weight-at-age
- Catchability prior with (mean = 1.0, $\sigma^2 = 0.2^2$)
- Beverton-Holt h=0.8, σ_R estimated (mean = 0.6, $\sigma^2 = 15^2$)

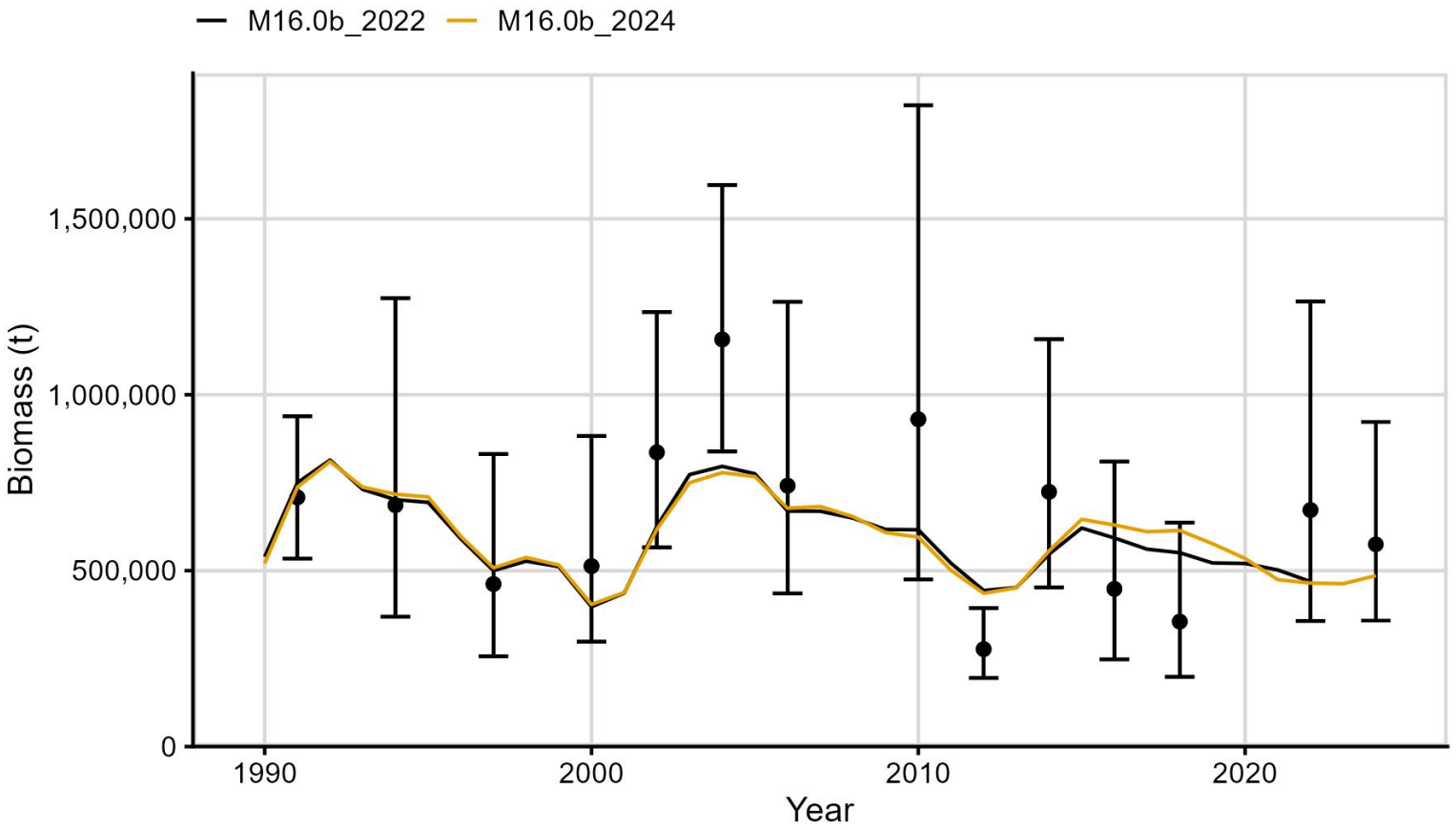
Catch & Fishing Mortality

Year	Current *F*	2022 *F*	Current Catch/Biomass	2022 Catch/Biomass
2015	0.307	0.293	0.082	0.085
2016	0.335	0.301	0.076	0.081
2017	0.32	0.3	0.104	0.114
2018	0.314	0.315	0.127	0.133
2019	0.253	0.263	0.121	0.126
2020	0.294	0.34	0.122	0.113
2021	0.302	0.386	0.143	0.123
2022	0.284	0.45	0.122	0.138
2023	0.265	-	0.146	-
2024	0.264	-	0.127	-

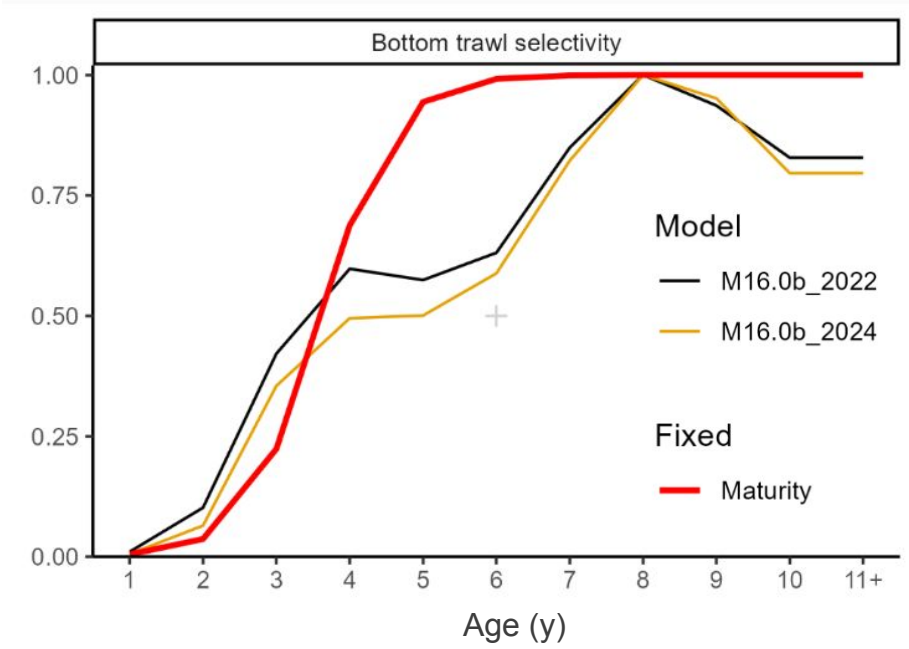


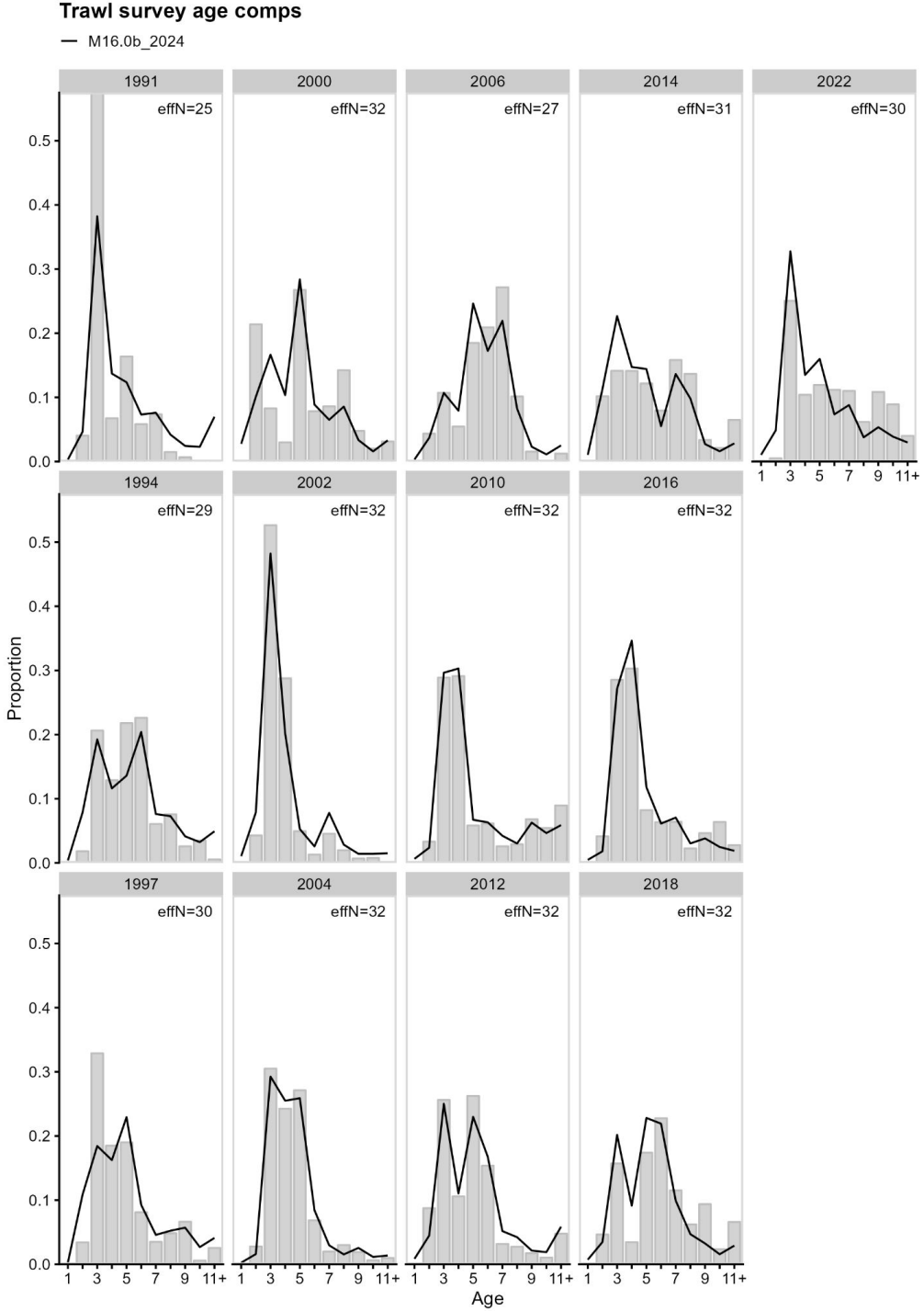


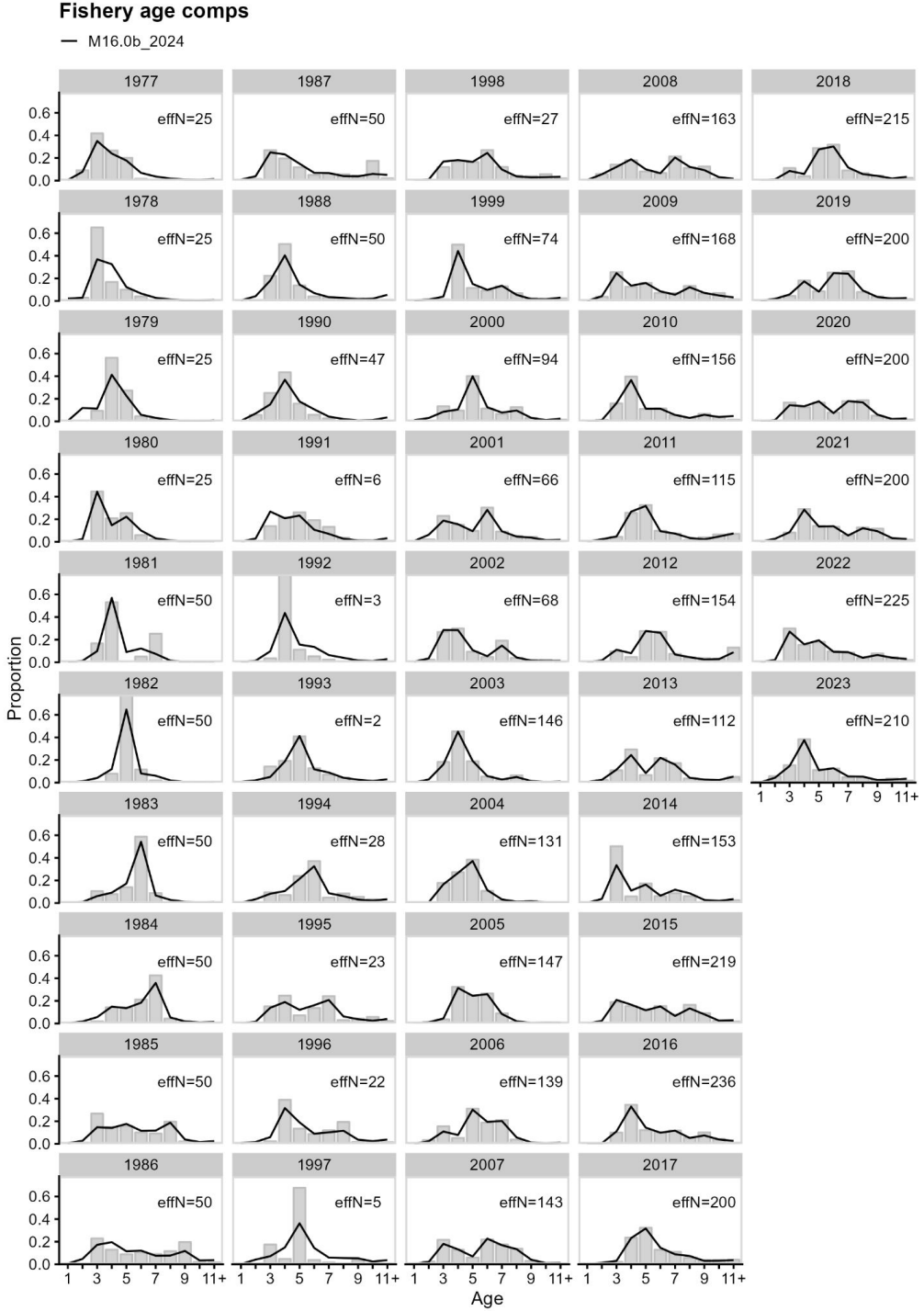
Model Fit – Survey Biomass

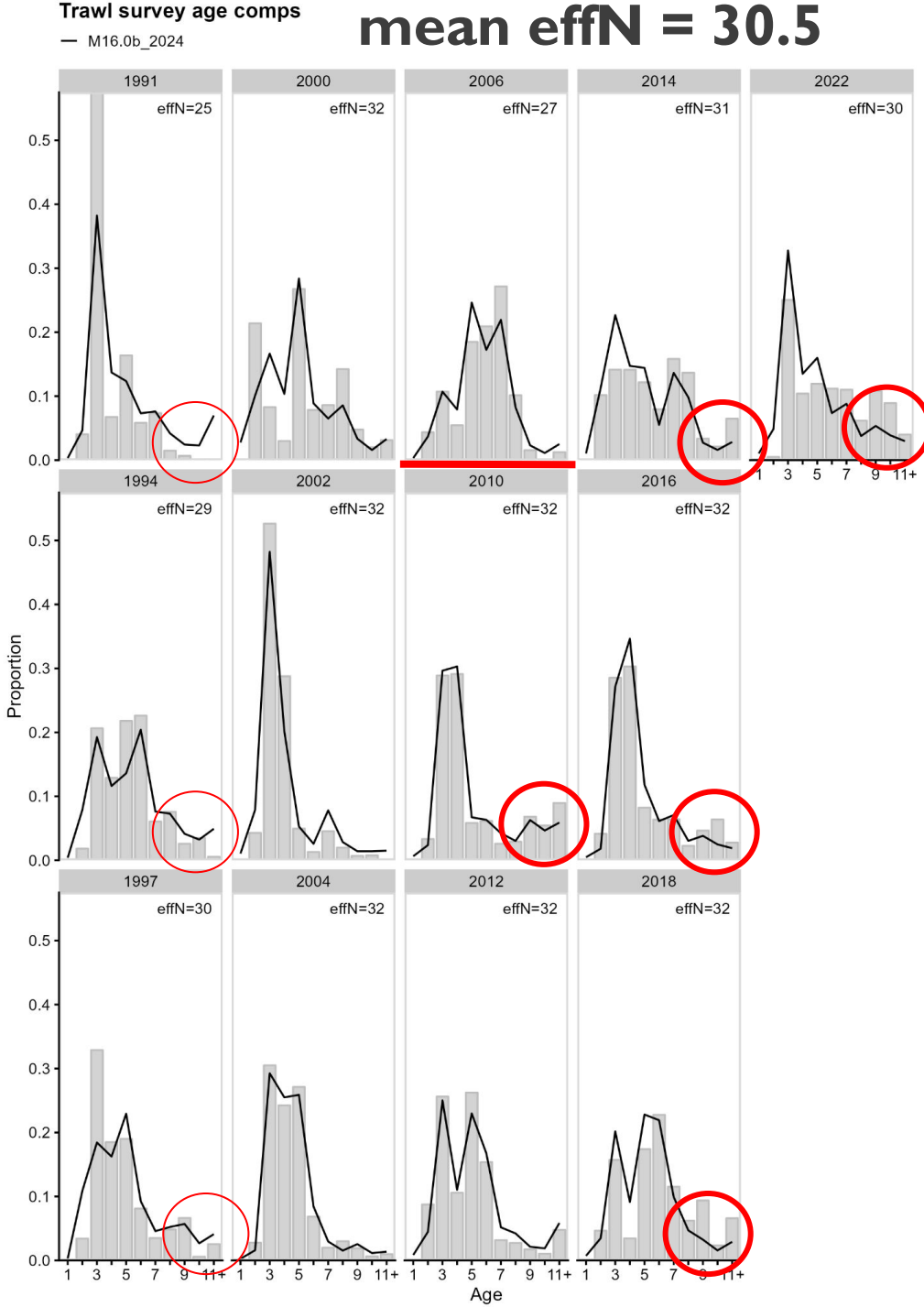


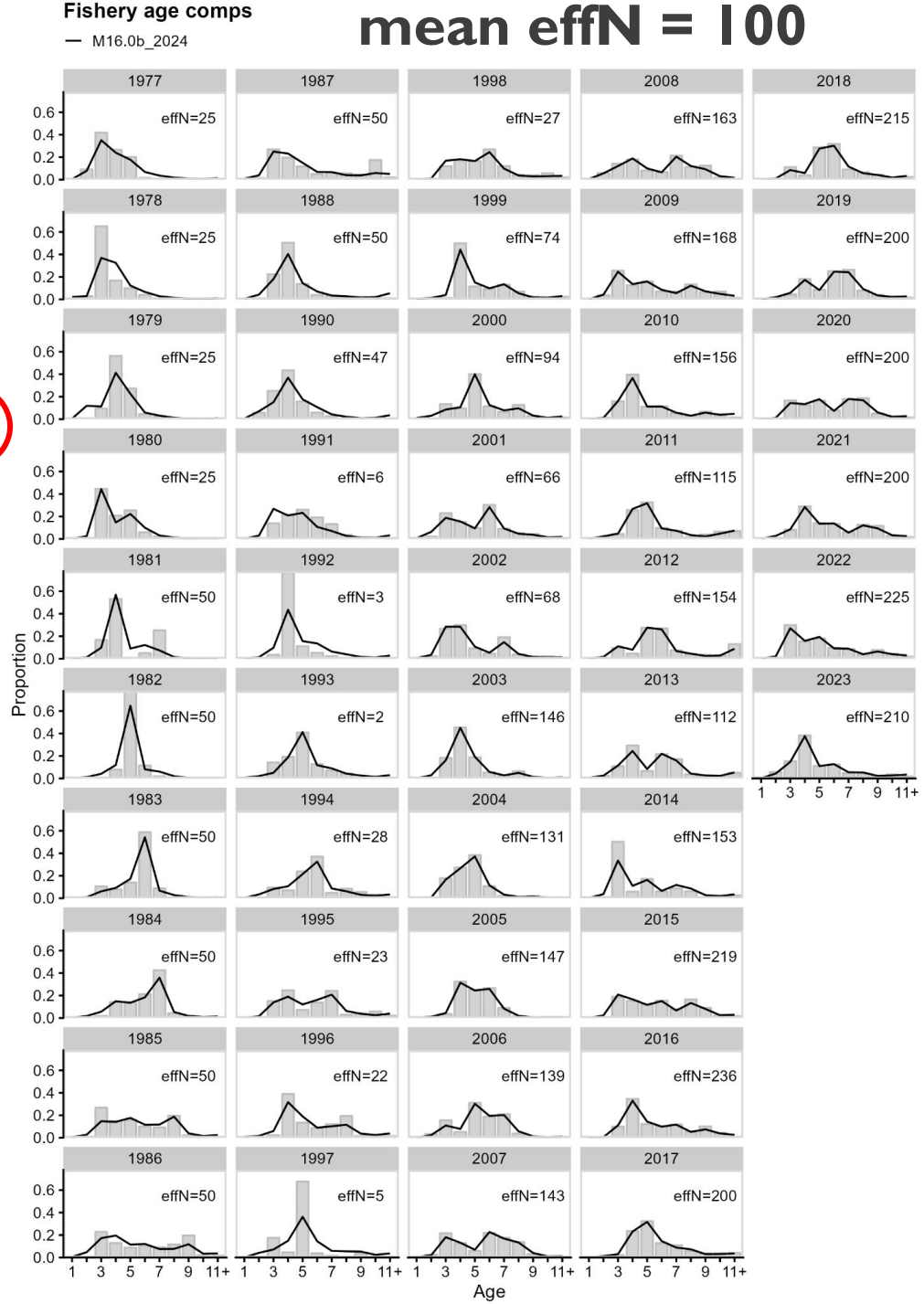
Survey Q=1.8 (1.6 in 2022)




Trawl survey age comps
M16.0b_2024
1991 effN=25
2000 effN=32
2006 effN=27
2014 effN=31
2022 effN=30
1994 effN=29
2002 effN=32
2010 effN=32
2016 effN=32
1997 effN=30
2004 effN=32
2012 effN=32
2018 effN=32
Proportion
Age

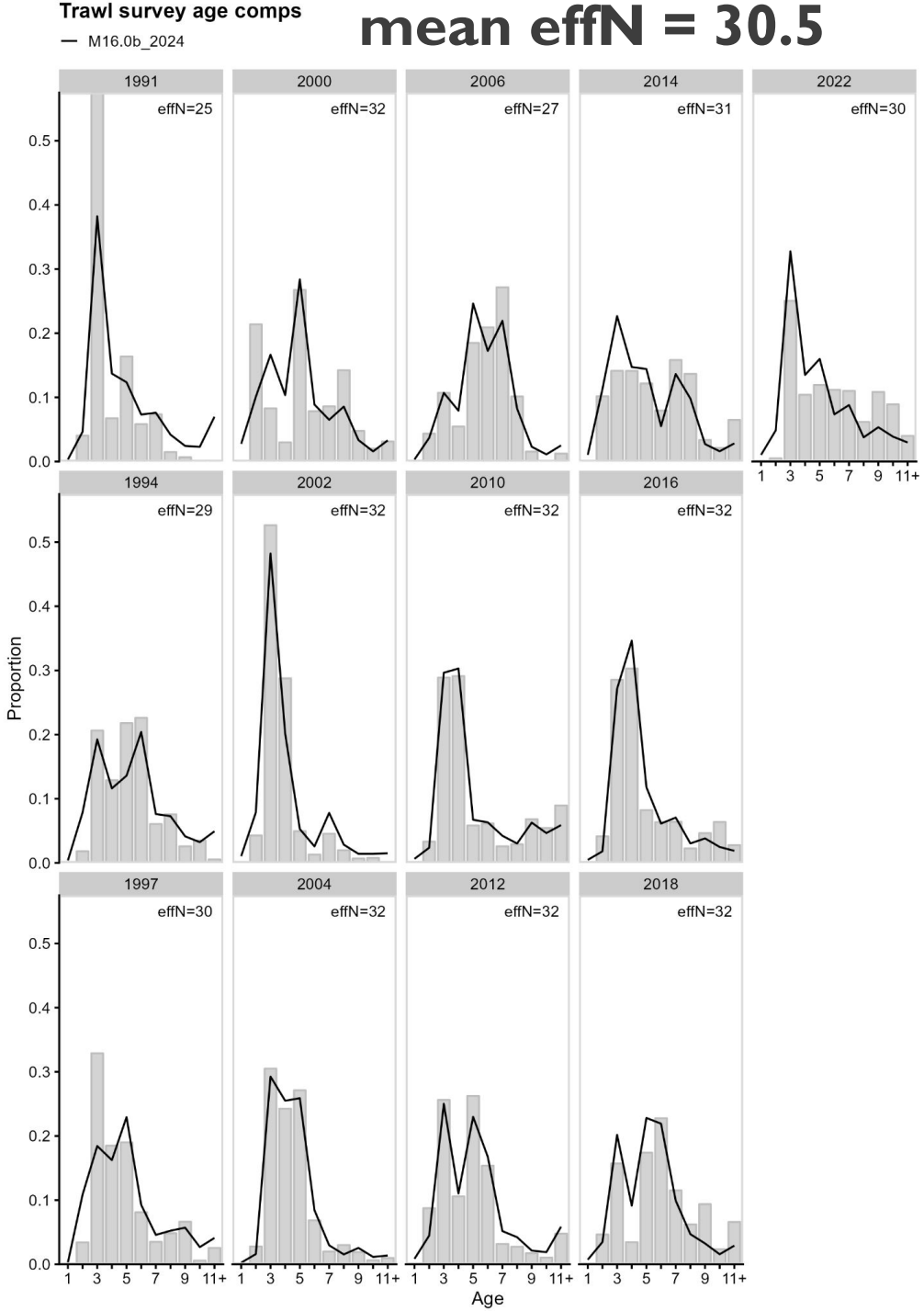

Fishery age comps
M16.0b_2024
1977 effN=25
1987 effN=50
1998 effN=27
2008 effN=163
2018 effN=215
1978 effN=25
1988 effN=50
1999 effN=74
2009 effN=168
2019 effN=200
1979 effN=25
1990 effN=47
2000 effN=94
2010 effN=156
2020 effN=200
1980 effN=25
1991 effN=6
2001 effN=66
2011 effN=115
2021 effN=200
1981 effN=50
1992 effN=3
2002 effN=68
2012 effN=154
2022 effN=225
1982 effN=50
1993 effN=2
2003 effN=146
2013 effN=112
2023 effN=210
1983 effN=50
1994 effN=28
2004 effN=131
2014 effN=153
1984 effN=50
1995 effN=23
2005 effN=147
2015 effN=219
1985 effN=50
1996 effN=22
2006 effN=139
2016 effN=236
1986 effN=50
1997 effN=5
2007 effN=143
2017 effN=200
Proportion
Age

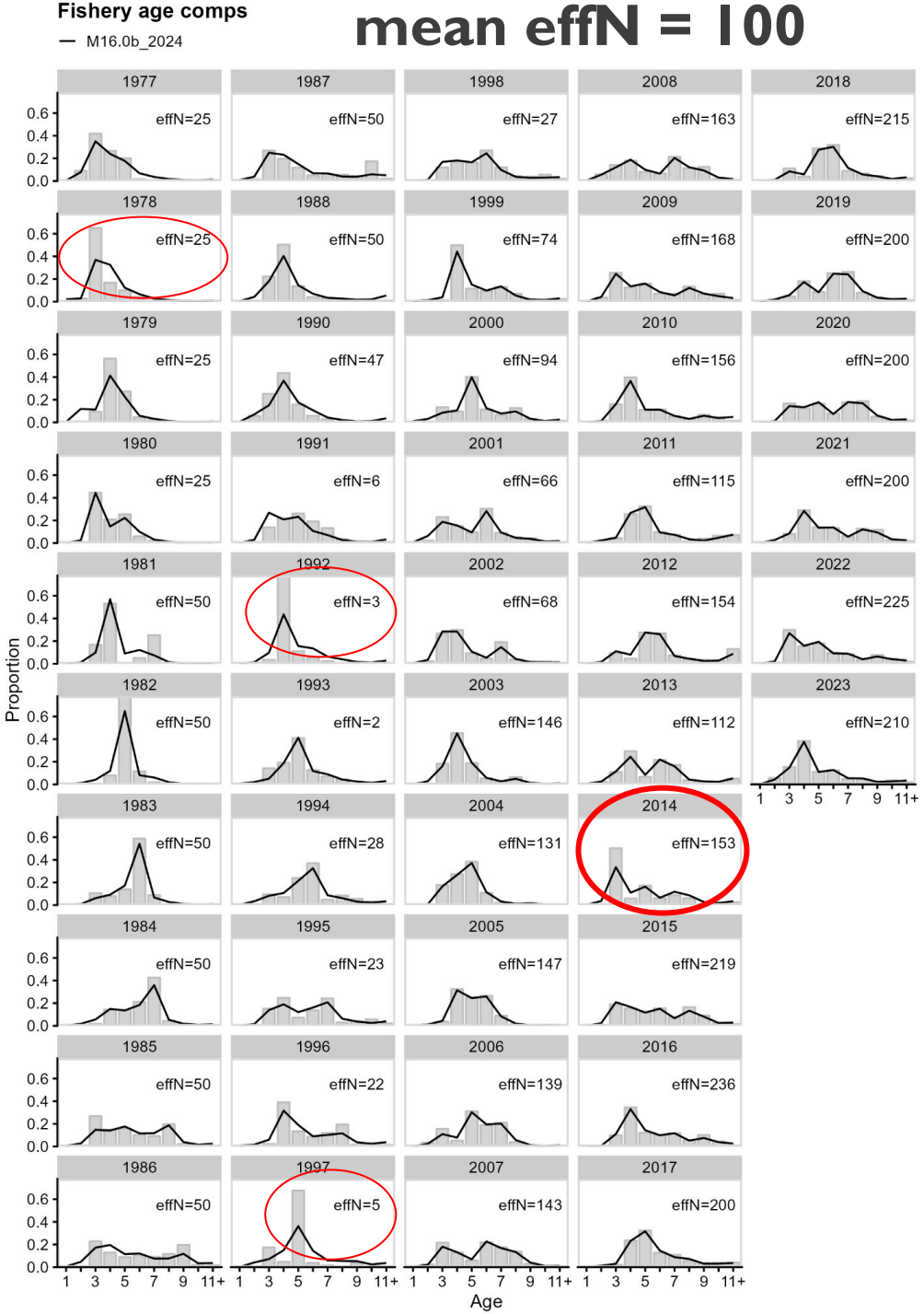




Misfit in survey comps attributed to lower overall effective N (Francis wt)

Change in availability of older fish in the survey (after 2010?)



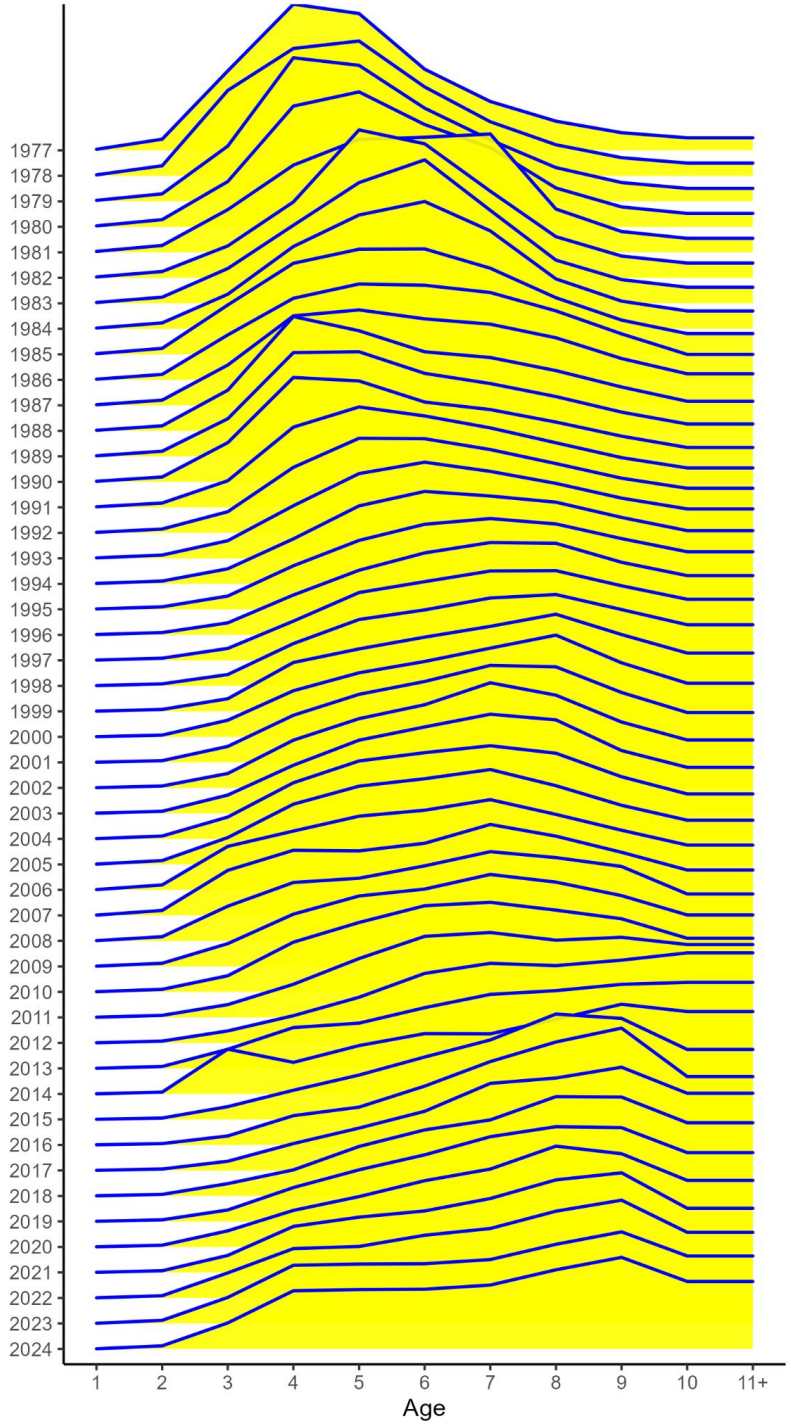


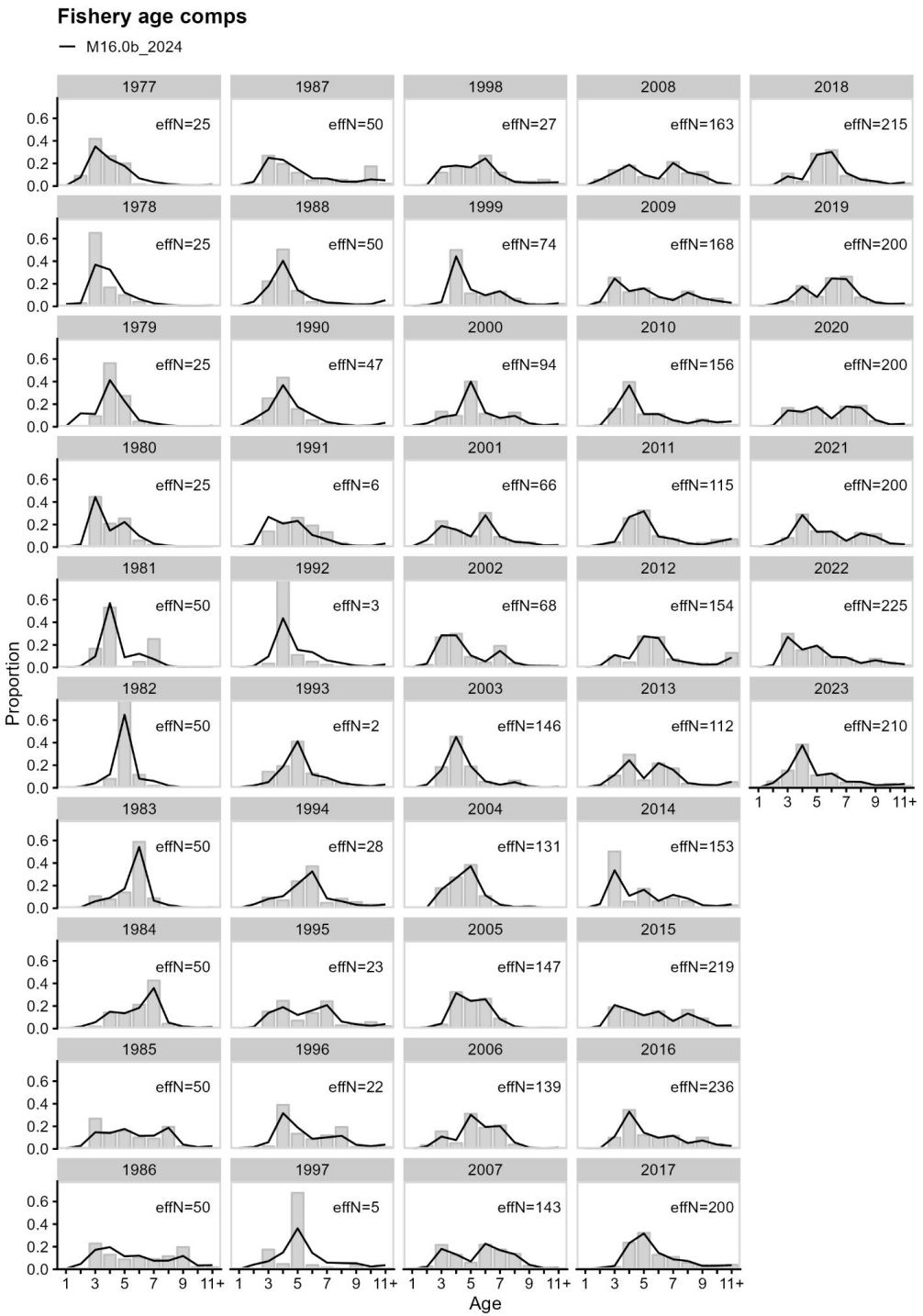
Misfit in fishery comps attributed to low effective N in early years.

Notable exception is age-3 in 2014 (2011 yc that never materialized)

Fishery selectivity

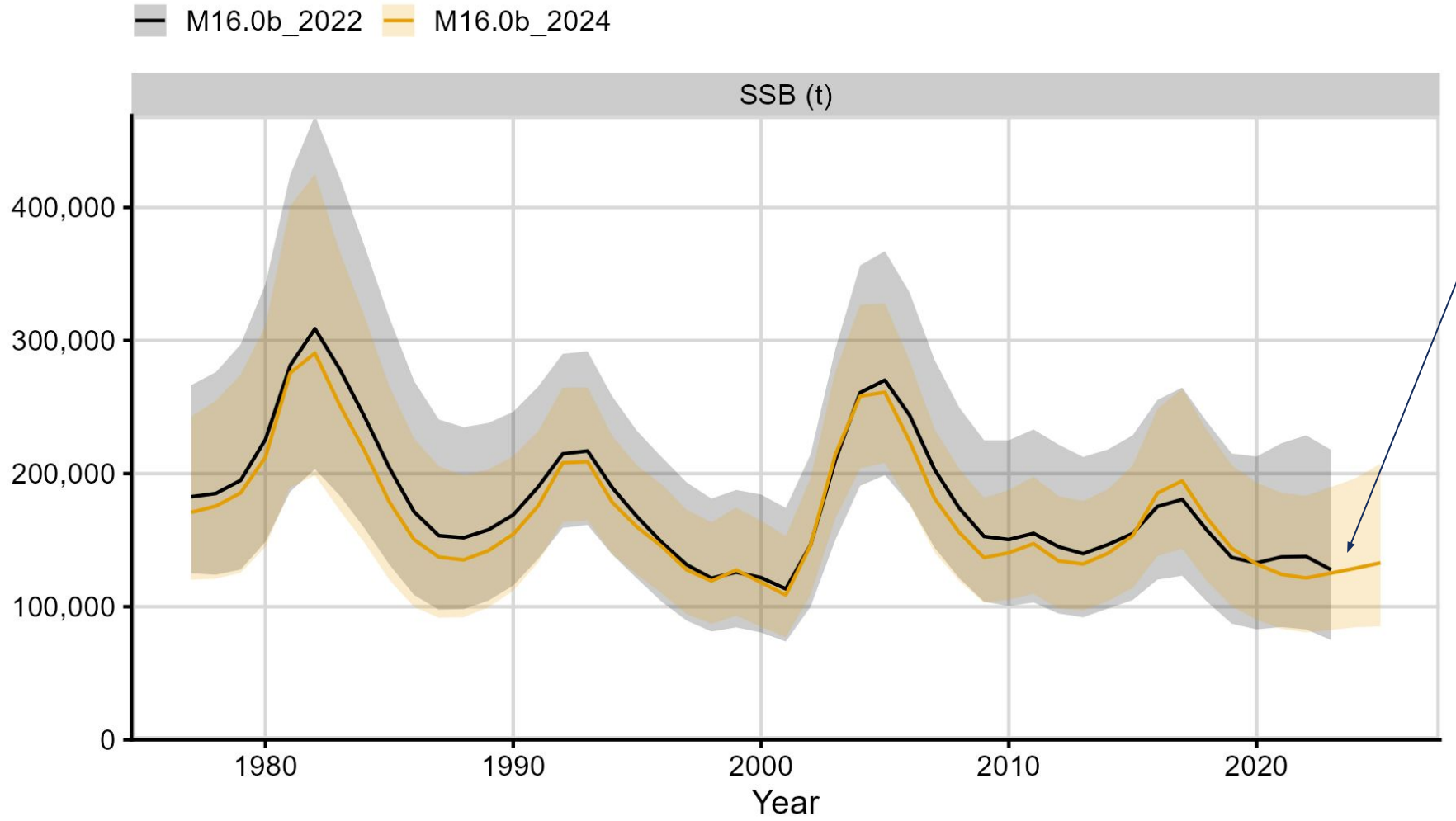
Dome to logistic





Deviation from standard normal likely indicates model misspecification (e.g., time-varying survey selectivity that is not accounted for)

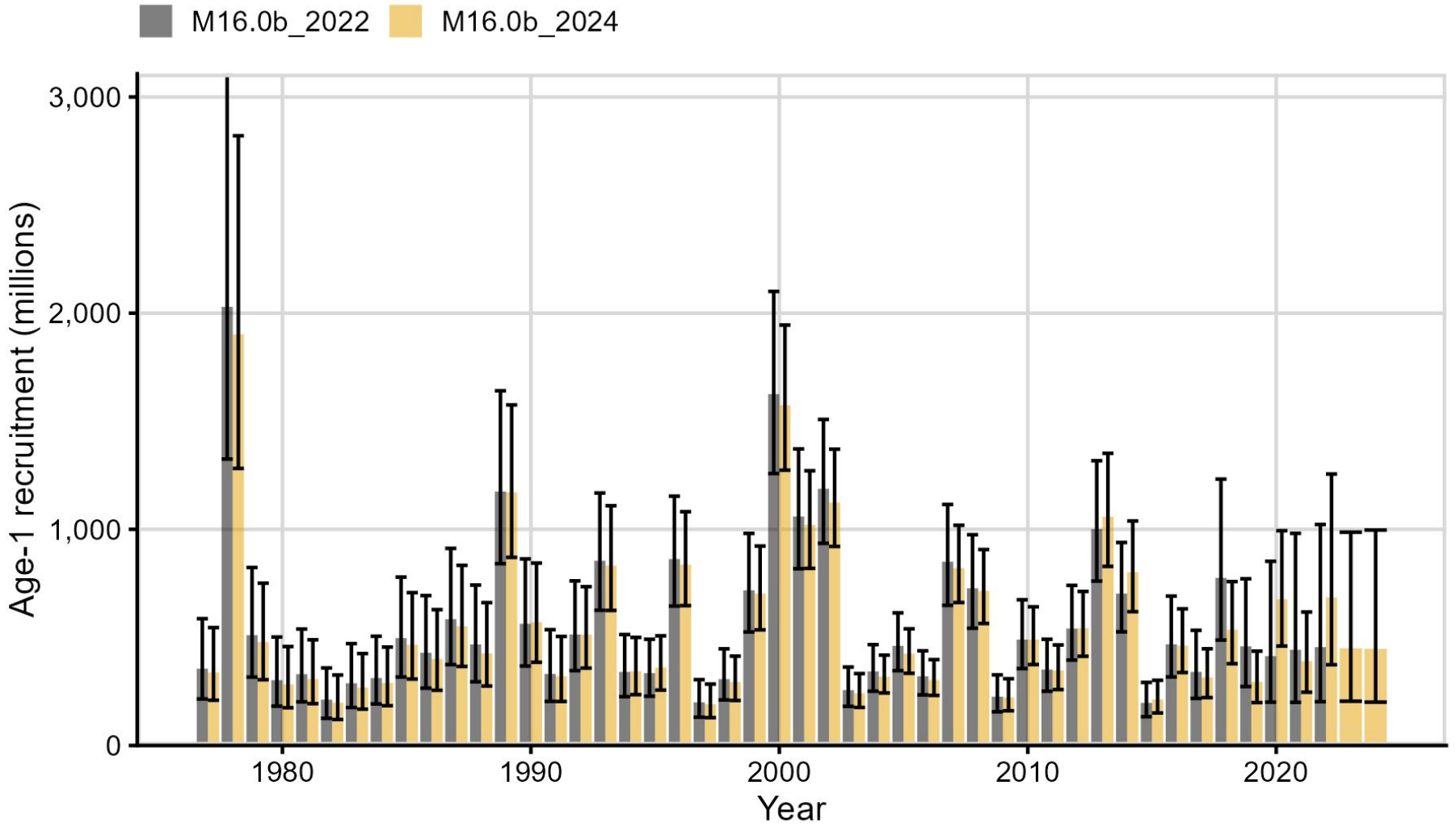
Time Series - Spawning Stock Biomass



Increasing trend attributed to 2019 yc

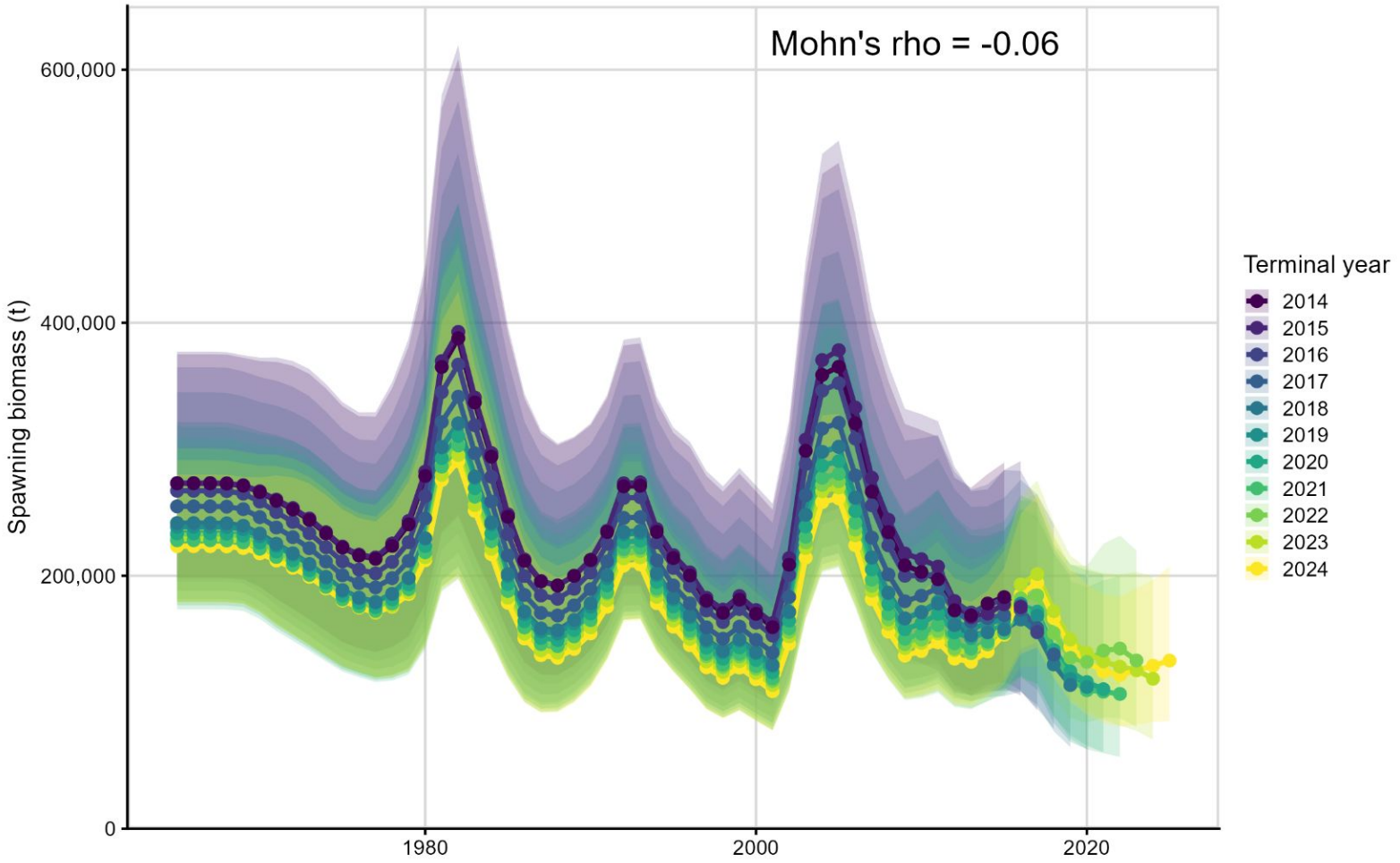
Age at 50% maturity = 3.6 years

Time Series – Age 1 Recruitment



- Magnitude of the 2017 and 2018 year classes decreased 31% and 36%, respectively
- 2019 year class increased 64% and is now estimated to be 20% above average
- sigR estimate increased from 0.47 to 0.48

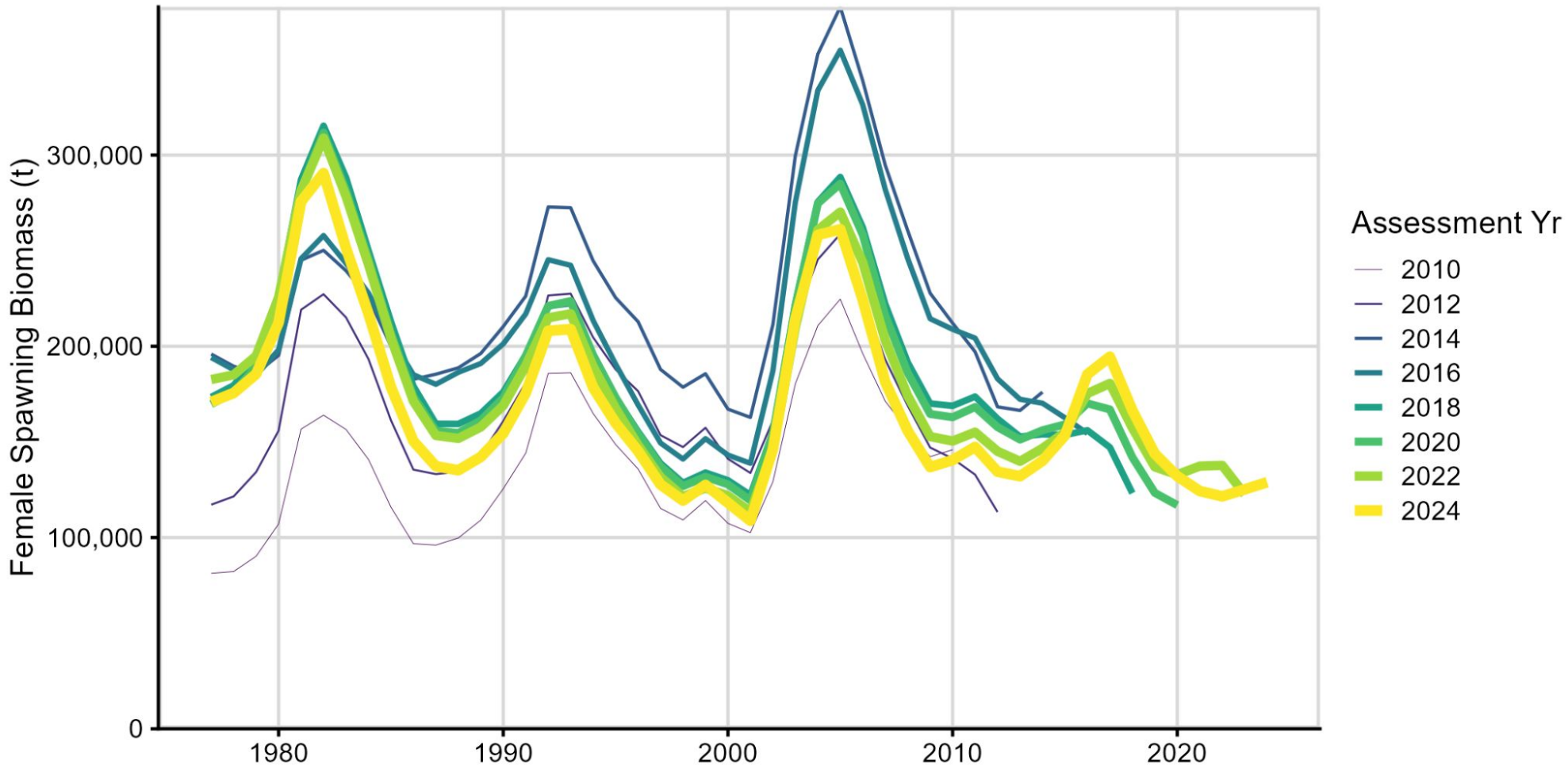
Retrospective



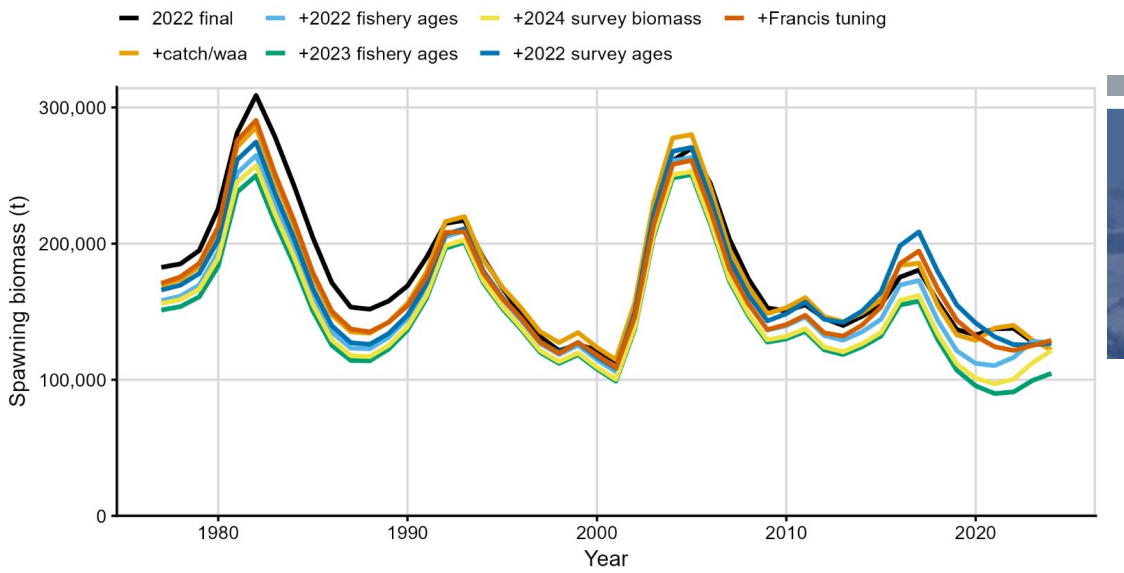
Recent 12 peels are reasonable

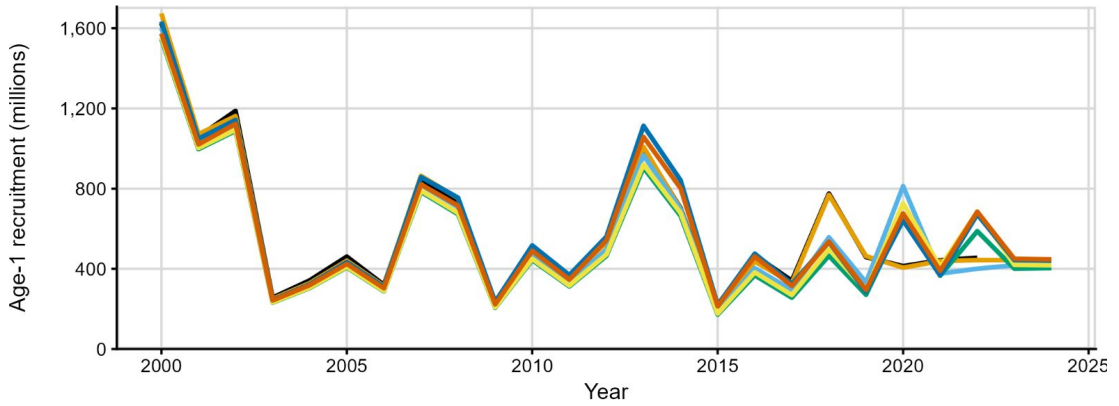
2012-2014 start to see moderate to strong positive bias (lack of old fish in survey results in more dome-shaped survey selectivity, smaller Q, larger population scales)

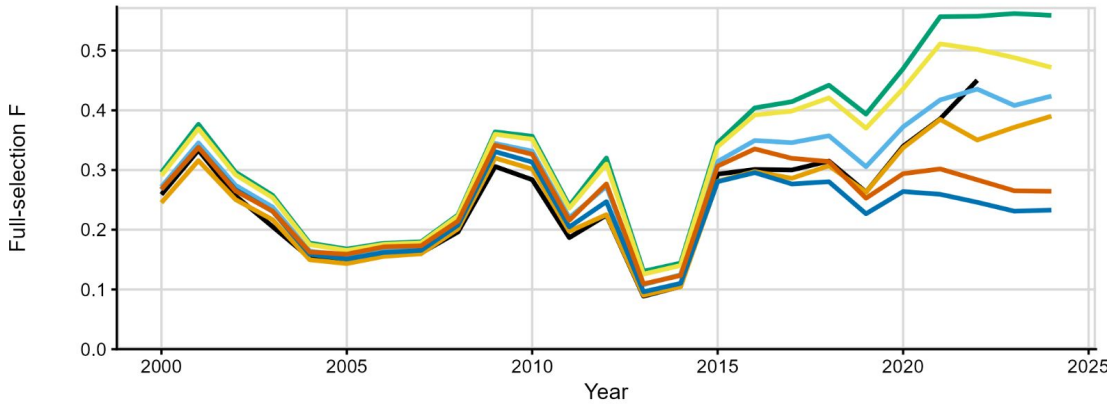
Assessment retrospective



Impact of new data

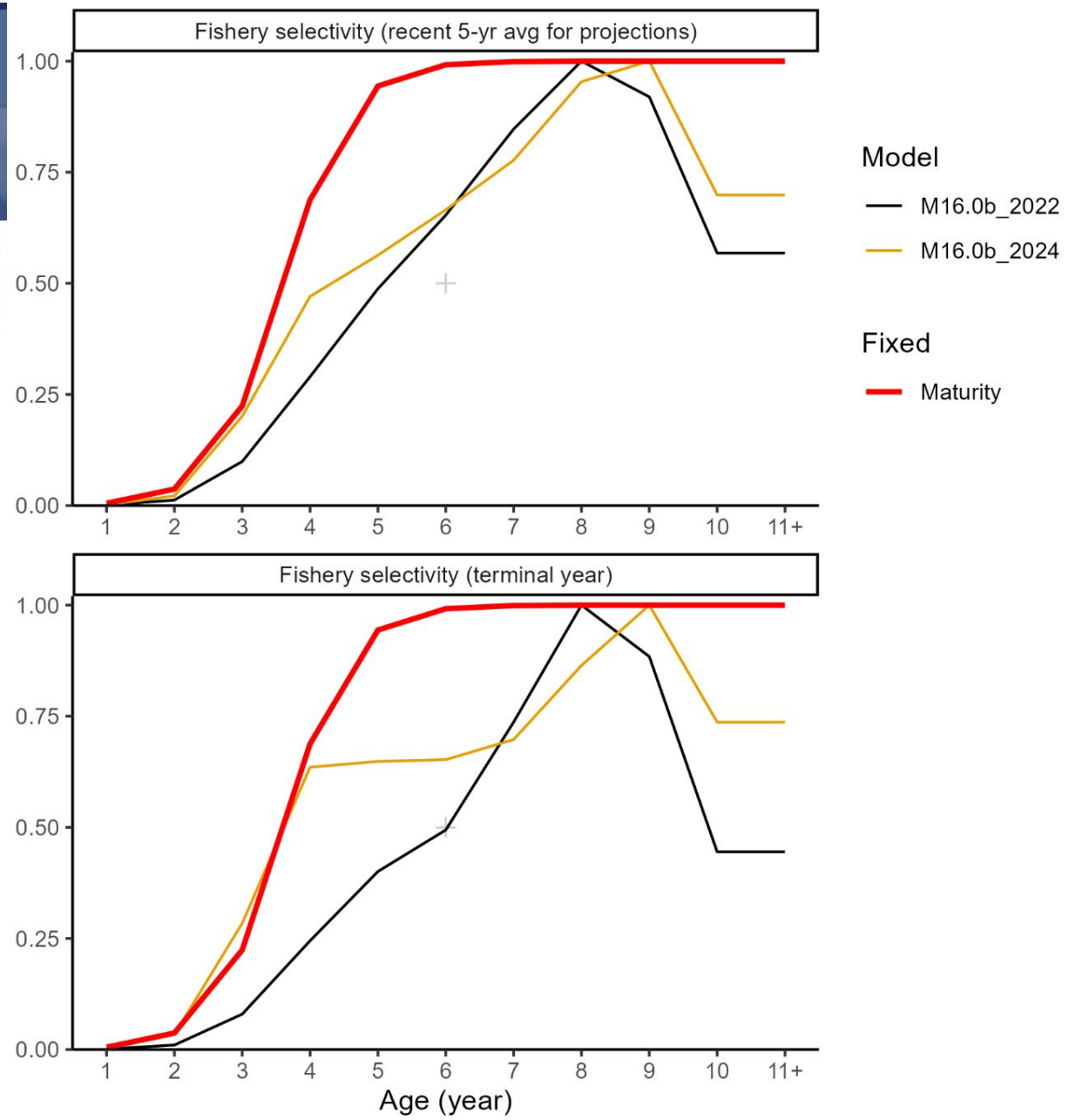






Survey selectivity and projection assumptions

- The recent estimated 5-yr average fishery selectivity (2019-2023) used for projections
- Population weight-at-age set equal to the average of the most recent three surveys with age data (2016, 2018, 2022)
- We assume projected 2025 and 2026 catch is 85% of maxABC (SSL regulations)



Harvest Recommendations

- **Level 2** for Environmental & Ecosystem Considerations of Risk Table
- Level 1 for all other considerations

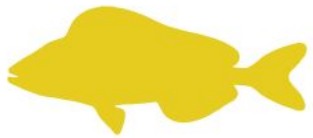
Quantity	As estimated or *specified last* year for:		As estimated or *recommended this* year for:	
	2024	2025	2025*	2026*
M (natural mortality rate)	0.30	0.30	0.30	0.30
Tier	3a	3b	3a	3a
Projected total (age 1+) biomass (t)	625,578	631,261	627,115	605,644
Projected Female spawning biomass	116,618	110,694	119,853	106,274
$B_{100\%}$	280,456	280,456	264,734	264,734
$B_{40\%}$	112,182	112,182	105,894	105,894
$B_{35\%}$	98,160	98,160	92,657	92,657
F_{OFL}	0.76	0.75	0.64	0.64
$maxF_{ABC}$	0.61	0.60	0.53	0.53
F_{ABC}	0.61	0.60	0.53	0.53
OFL (t)	111,684	99,723	**122,622**	107,889
maxABC (t)	95,358	84,676	**103,247**	92,361
ABC (t)	95,358	84,676	**103,247**	92,361
Status	As determined *this* year for:		As determined *this* year for:	
	2022	2023	2024	2025
Overfishing	No	n/a	No	n/a
Overfished	n/a	No	n/a	No
Approaching overfished	n/a	No	n/a	No

+8% in ABC from 2024

Risk Table - Environmental/ecosystem considerations

Sustained Level 2

Atka mackerel



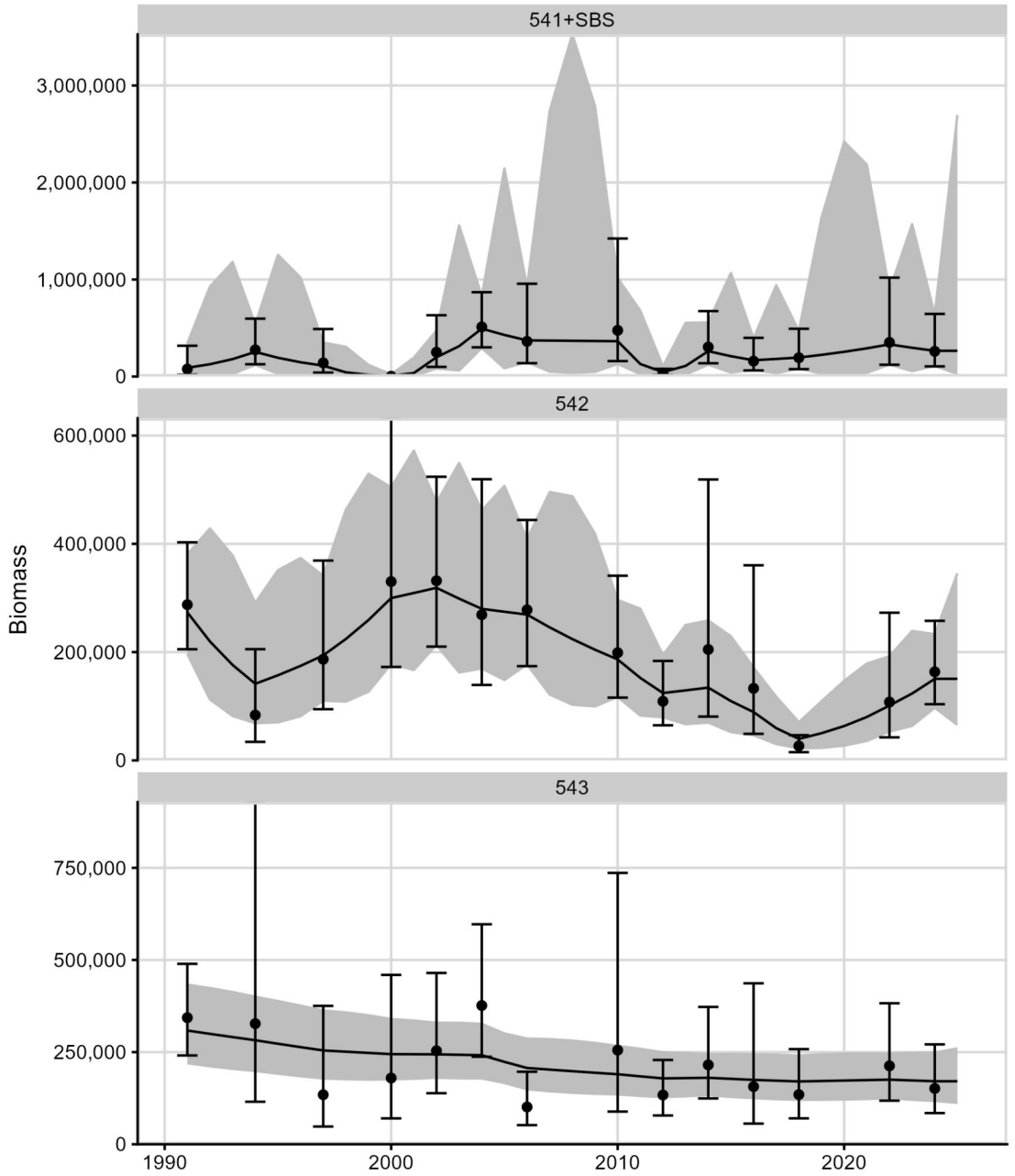
- Warm winter conditions
- Smaller species in copepod communities
- Deeper mixed layer: potential impact on availability of prey in water column
- Lower than average fish condition across the entire chain
- Increased competition for prey (high rockfish abundance)

Apportionment

Apportionment Method	Area	Proportion	2025 ABC	2026 ABC
Random effects model (recommended)	541+SBS	0.452	**46,650**	**41,731**
	542	0.257	**26,511**	**23,716**
	543	0.291	**30,087**	**26,914**
	BSAI Total		**103,247**	**92,361**
Four-survey weighted average	541+SBS	0.477	49,253	44,060
	542	0.213	21,986	19,668
	543	0.310	32,008	28,633
	BSAI Total		103,247	92,361

Recommend using random effects model instead of current weighted average approach.

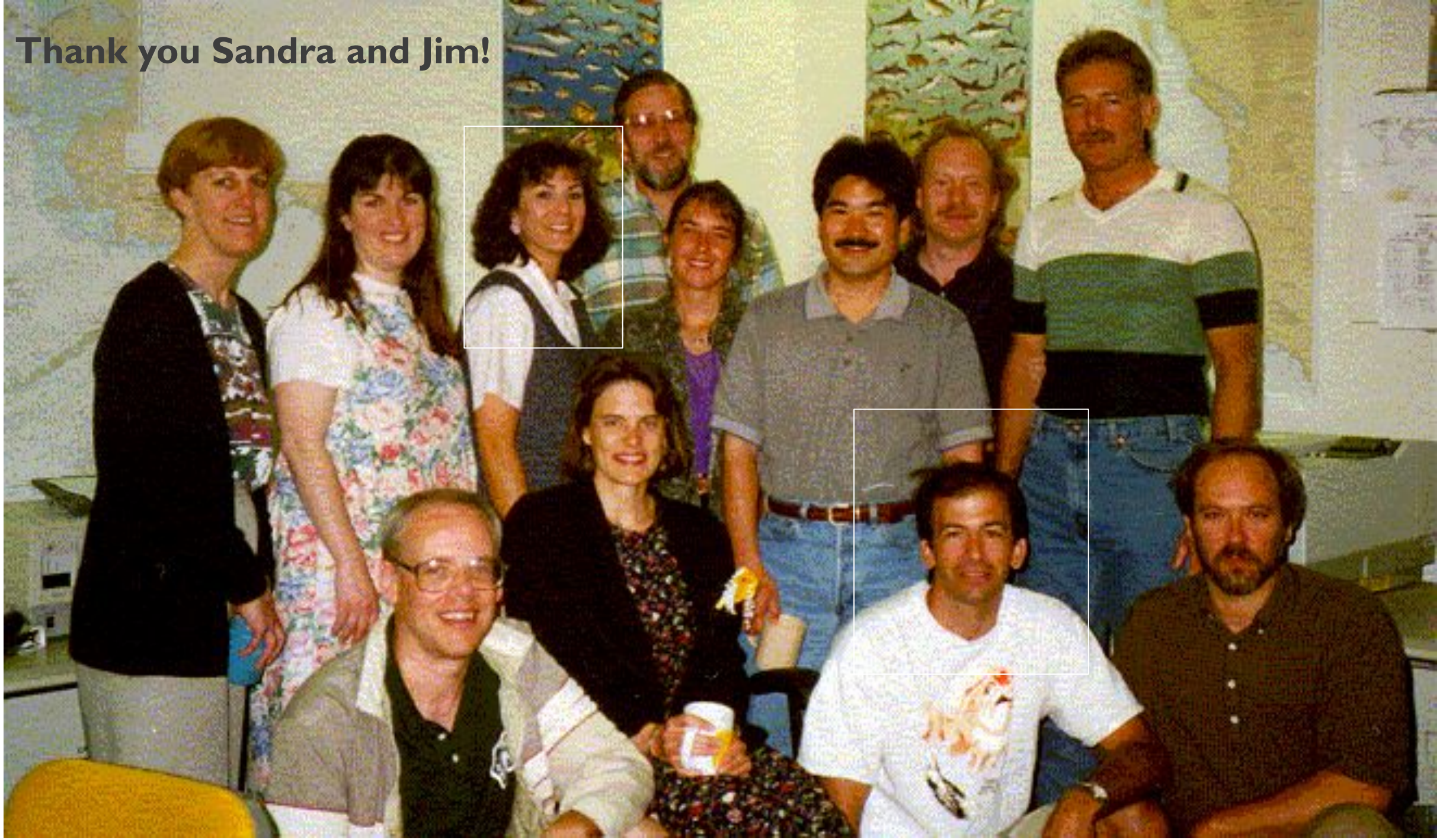
Apportionment



Next steps

- 2026 CIE
- Selectivity and scale
- Diagnostics (profiles, jitter, MASE, etc.)
- afscISS, sampler (with spatial growth considerations)
- ESP development
- Convert platforms (RTMB

Thank you Sandra and Jim!



QUESTIONS?

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