

Skate Stock Complex

BSAI Groundfish Plan Team Presentation
November 2023

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BSAI SKATE STOCK COMPLEX OVERVIEW

- Last presented in 2020
- Operational Update
- Two components:
 - Tier 3 Alaska skates
 - Tier 5 Other skates
- New author, no major changes
- Minor fixes to posted document



RELEVANT PT AND SSC COMMENTS

Paraphrased:

- **Move Tier 5 components to *rema* framework**
 - Completed for 2023 assessment
- **Concern over declining trend for leopard skate in AI survey**
 - We agree, and we will evaluate further for next operational full assessment. Leopard skate is a relatively new species, so it is unclear how representative the survey biomass trend is compared to long term. AI survey may have low reliability for skates due to habitat rugosity and gear type.
- **Detail catch projection methods**
 - Clarified in the document
 - Total catch for current year is estimated by the 5-yr mean of catch occurring after data pull date (in this case Oct 1)
 - Future catches for scenario 2 are set equal to estimated 2023 catch because catch is \ll ABC
- **Alaska skate stock structure**
 - We agree that this needs to be done, and have it prioritized for future efforts

FIXING ERRORS – DISCARDS

Table 18.3

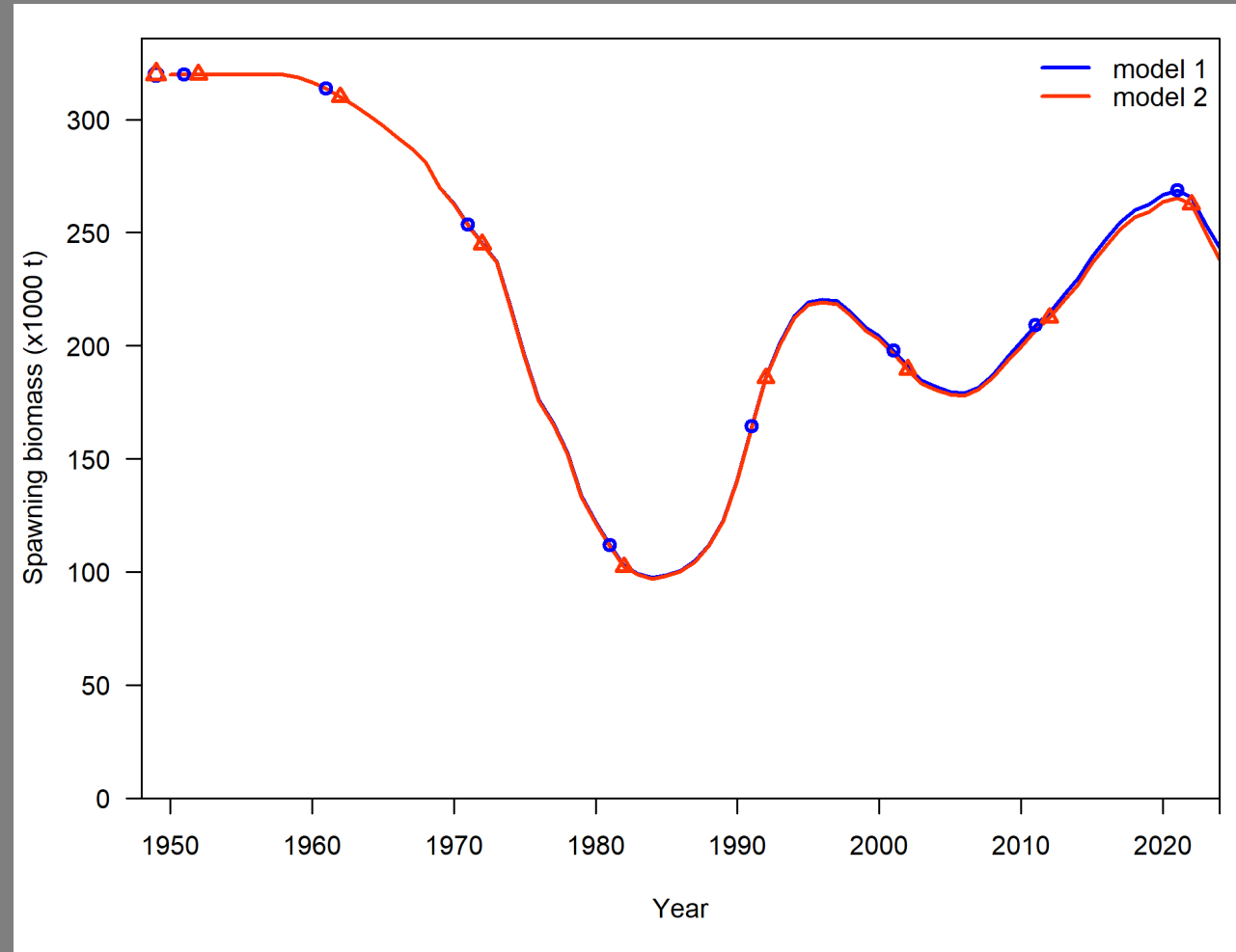
- Embarrassing filtering and mathematical errors in discard calculations
- Fixed
- No impact to assessment results
- Will be updated for the SSC

Year	Aleutian Islands		Eastern Bering Sea	
	Longline	Trawl	Longline	Trawl
2003	80%	85%	53%	55%
2004	74%	91%	73%	60%
2005	87%	88%	66%	64%
2006	77%	79%	71%	65%
2007	50%	89%	72%	66%
2008	82%	64%	68%	57%
2009	69%	67%	74%	59%
2010	80%	60%	69%	57%
2011	93%	70%	80%	60%
2012	80%	51%	72%	66%
2013	82%	59%	72%	64%
2014	95%	54%	70%	64%
2015	83%	45%	73%	65%
2016	95%	38%	80%	60%
2017	89%	43%	72%	64%
2018	82%	47%	62%	49%
2019	73%	46%	51%	52%
2020	67%	56%	51%	58%
2021	65%	60%	53%	59%
2022	58%	75%	54%	71%

FIXING ERRORS – CATCH

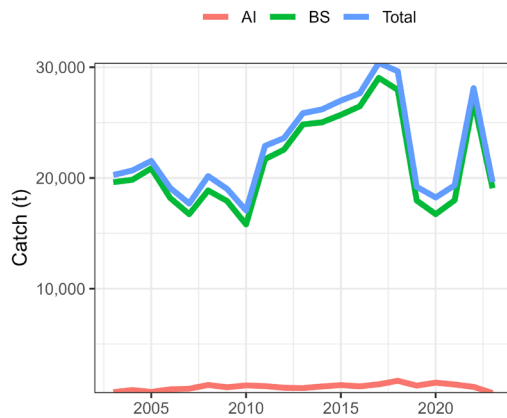
Table 18.1, 18.2 and Model 14.2d

- SQL query wasn't capturing all skate records
- 4-6% increase in catch since 2007 for Alaska and Other skates
- Updated catch going into Model 14.2d
- Minor changes to model results, generally <1% or no change
- ABC reduced by 150 t from posted document
- Will be updated in SSC version

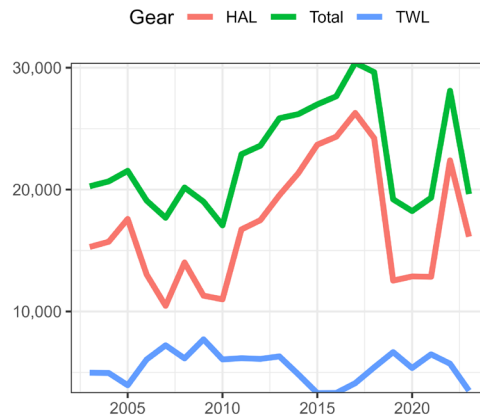


BSAI SKATE OVERVIEW

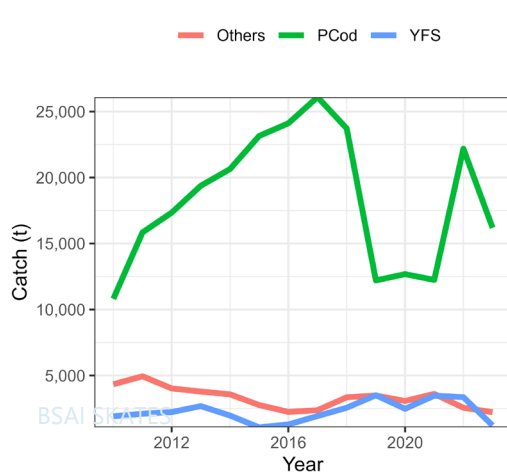
Catch by FMP Subarea



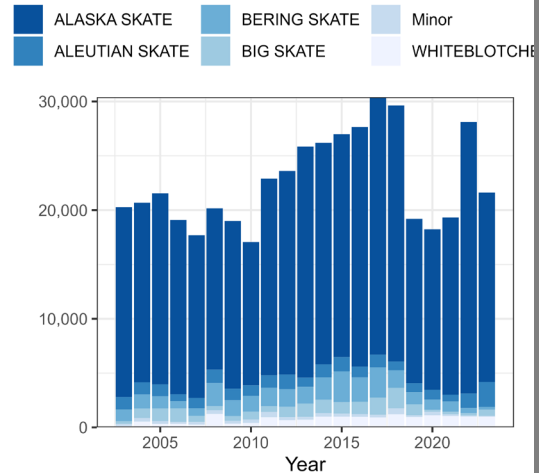
Catch by Gear Type



Catch by Target Fishery



Catch by Species



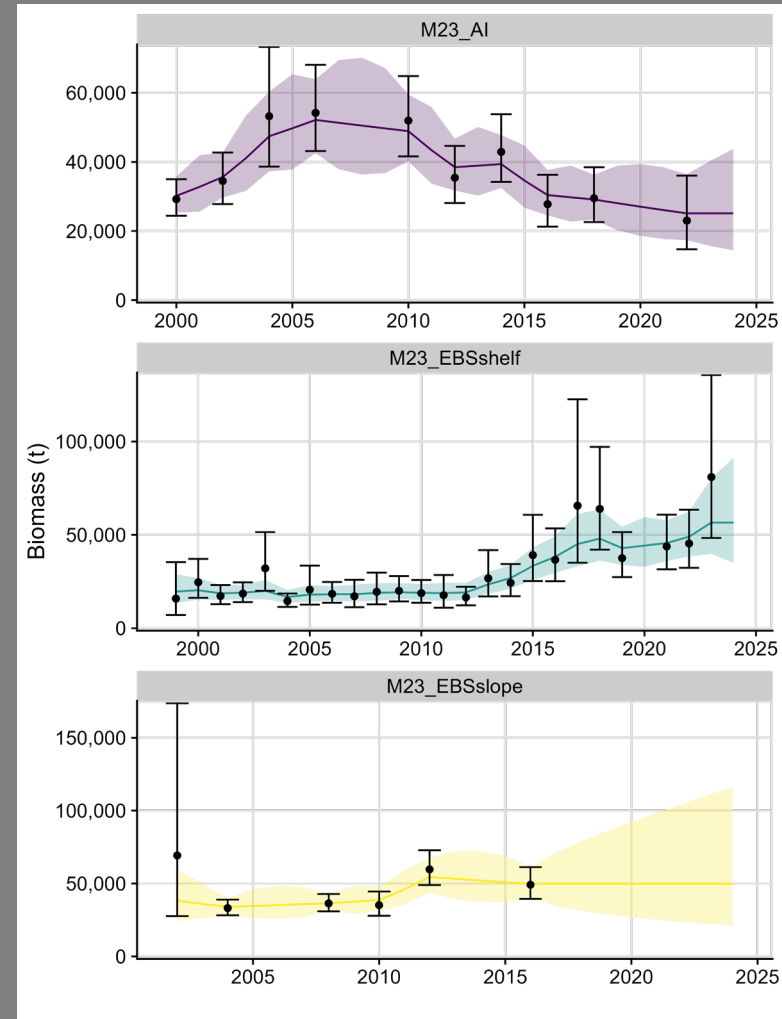
- Bering Sea catch >> Aleutian Islands catch
- Primarily in hook-and-line fisheries
- Bycatch in Pacific cod, yellowfin sole to a lesser extent
- Complex catch is dominated by Alaska skate

TIER 5 – OTHER SKATES

Model 23.0

- Everything but Alaska skates in the EBS shelf survey
- No previous model designation
- Updated survey data since 2020
- Moved to *rema* framework
- Each area modelled separately
- All species combined, same M

Figure 18.14

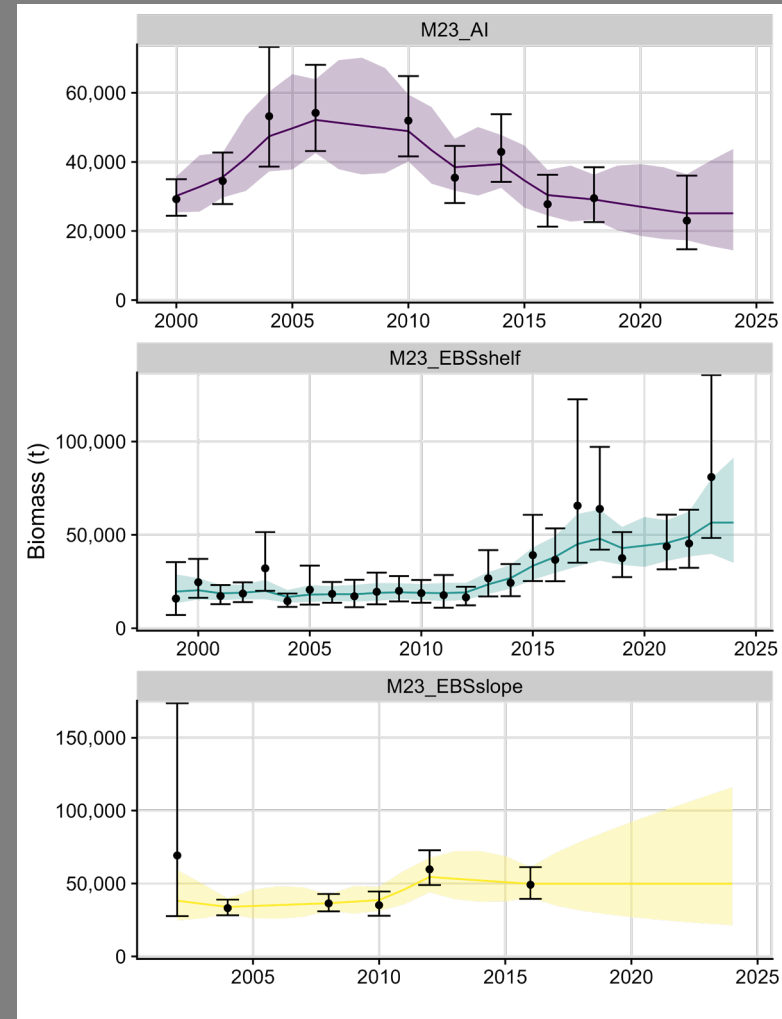


TIER 5 – OTHER SKATES

Model 23.0

- AI survey combined biomass continues declining trend
- EBS Shelf survey historic high
- No news is.....no news for the EBS slope survey

Figure 18.14



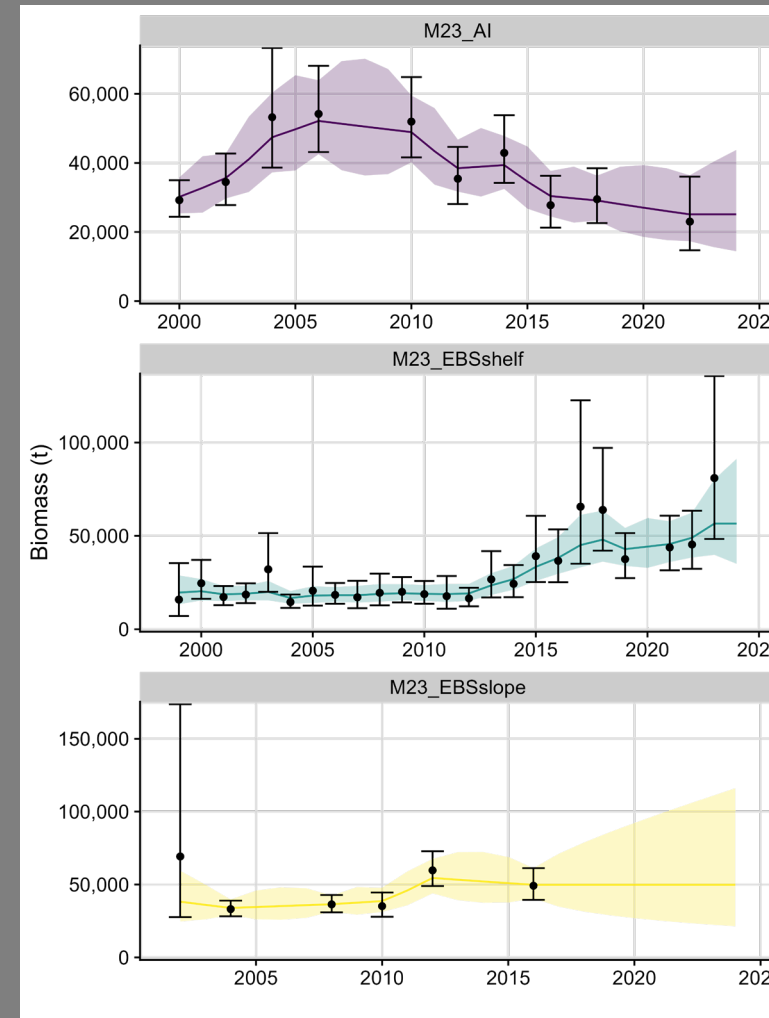
TIER 5 – OTHER SKATES

Figure 18.14

Model 23.0

Other skate harvest recommendations

Quantity	2022 Results		2023 Results	
	2023	2024	2024	2025
M	0.10	0.10	0.10	0.10
Tier	5	5	5	5
Biomass (t)	107,174	107,174	131,446	131,446
F_{OFL}	0.10	0.10	0.10	0.10
$\max F_{ABC}$	0.075	0.075	0.075	0.075
F_{ABC}	0.075	0.075	0.075	0.075
OFL (t)	10,717	10,717	13,145	13,145
$\max ABC$ (t)	8,038	8,038	9,858	9,858
ABC (t)	8,038	8,308	9,858	9,858



Declines in Aleutian and leopard

Mostly due to big skates

Highest diversity region

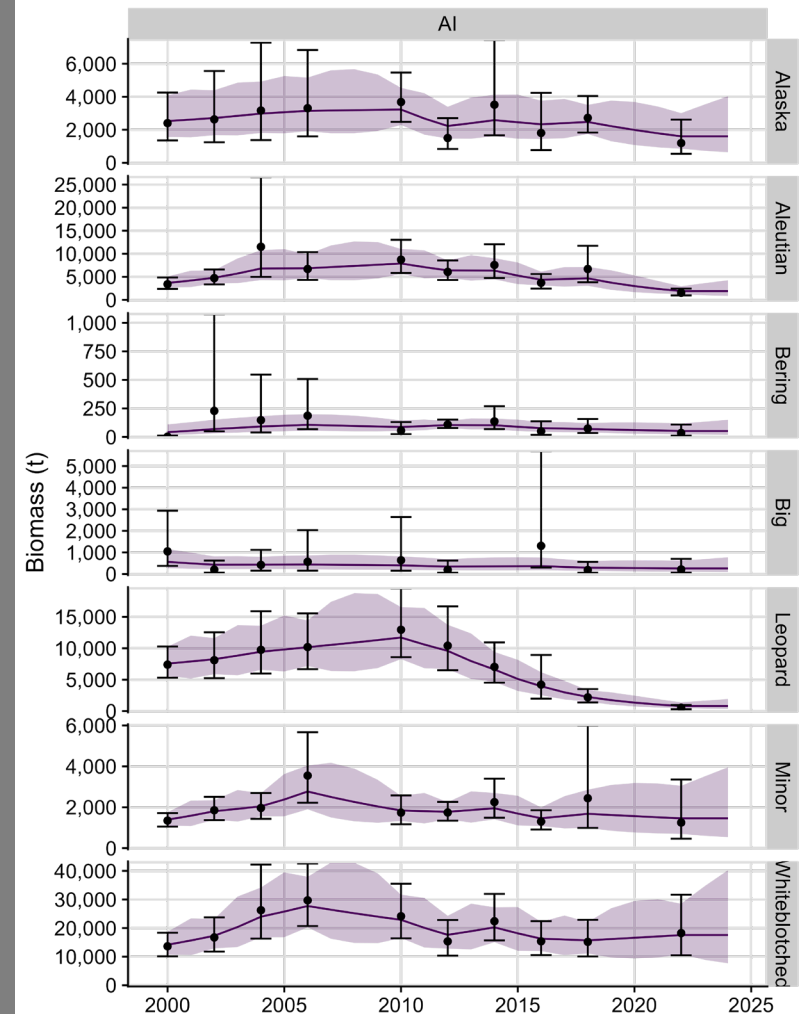


TIER 5 – OTHER SKATES (APPENDIX 18.B)

Figure 18.B1

Aleutian Islands Survey

Dominant	Minor
Alaska	Butterfly
Aleutian	Commander
Bering	Longnose
Big	Mud
Leopard	Roughtail
Whiteblotched	Whitebrow
	Skate Unid

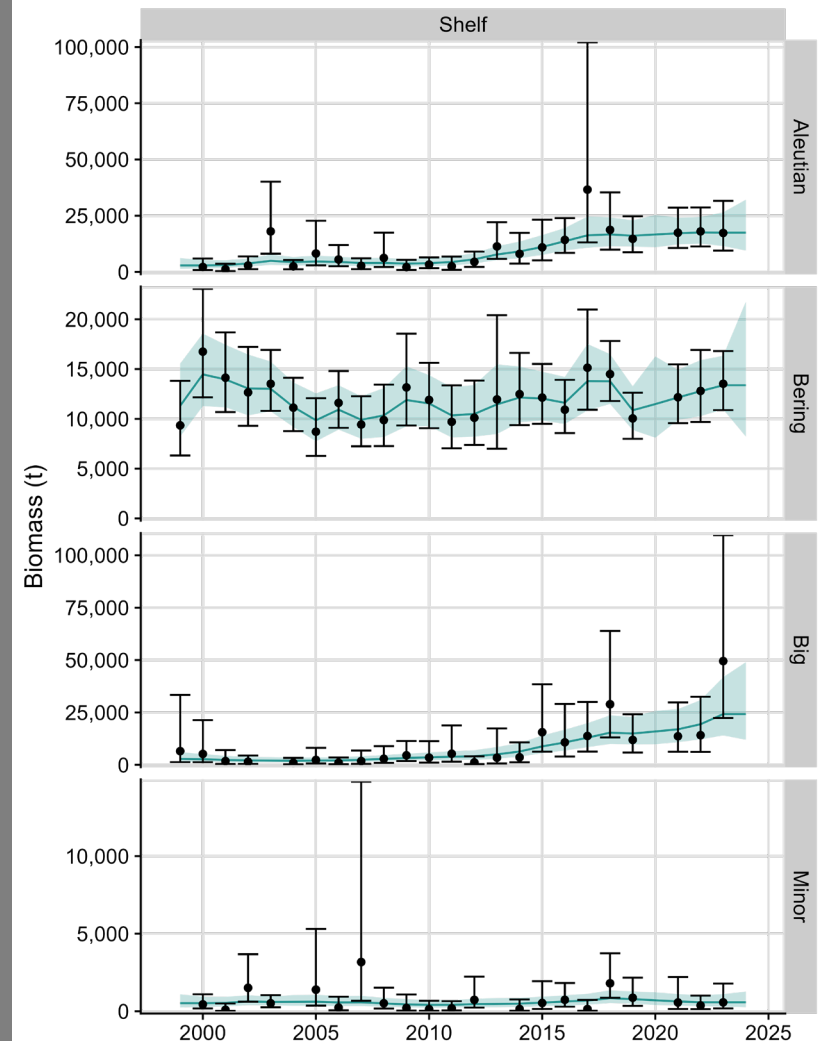


TIER 5 – OTHER SKATES (APPENDIX 18.B)

EBS Shelf Survey

Dominant	Minor
Aleutian	Longnose
Bering	Mud
Big	Okhotsk
	Whiteblotched

Figure 18.B2

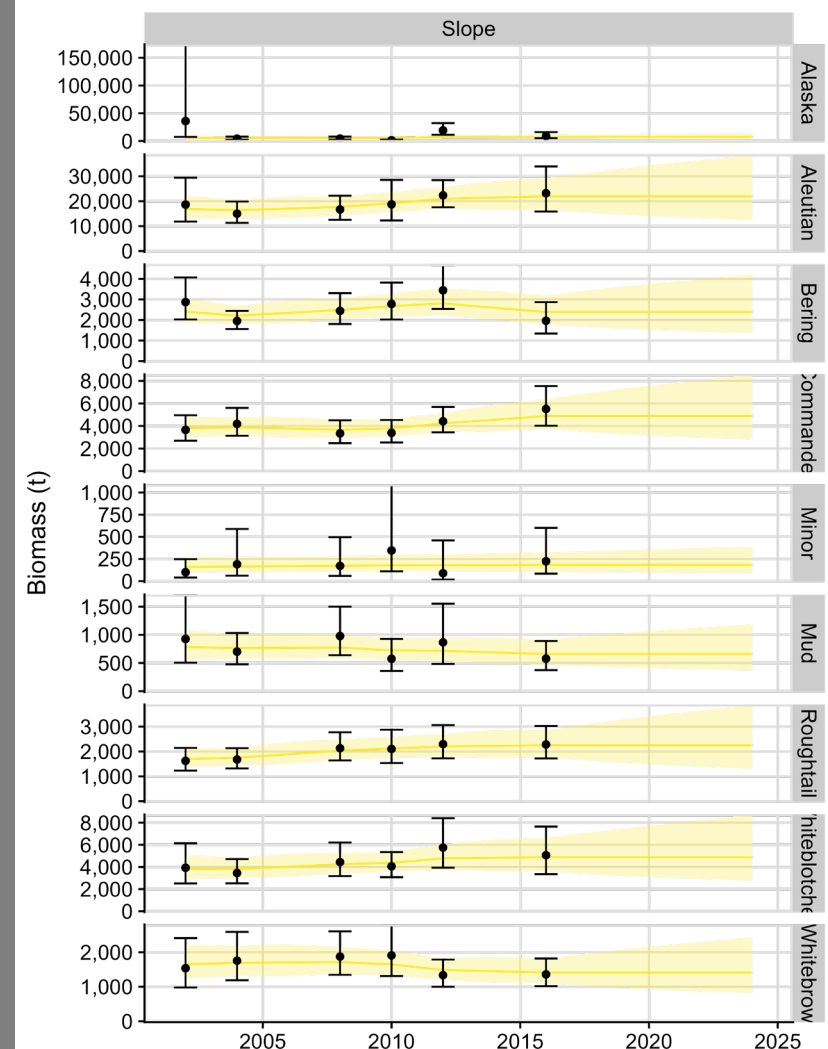


TIER 5 – OTHER SKATES (APPENDIX 18.B)

EBS Slope Survey

Dominant	Minor
Alaska	Deepsea
Aleutian	Longnose
Bering	Okhotsk
Commander	Skate Unid
Mud	
Roughtail	
Whiteblotched	
Whitebrow	

Figure 18.B3



Questions on Tier 5 Other Skates

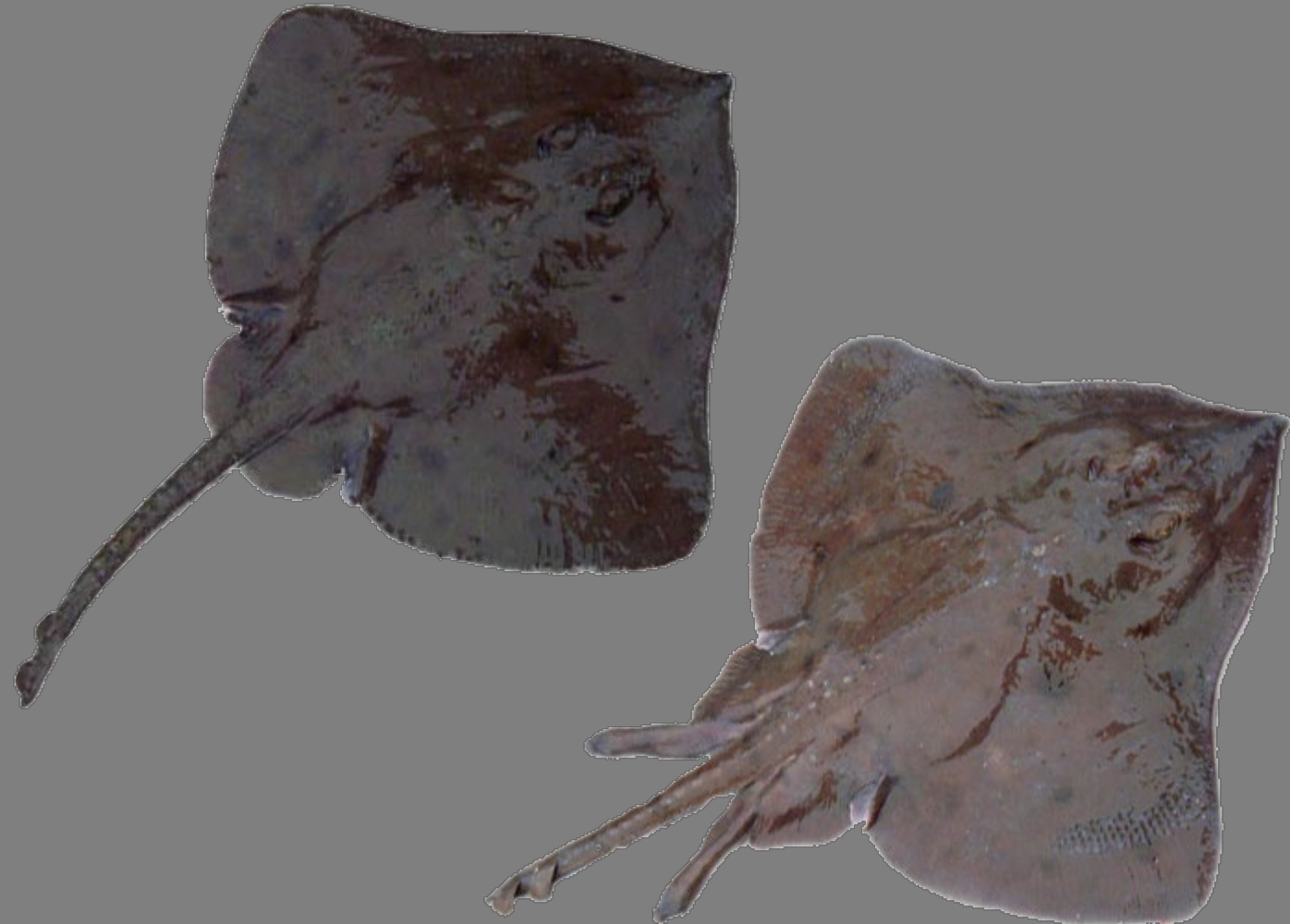
Up next: Tier 3 Alaska Skates



TIER 3 – ALASKA SKATE

Model 14.2

- Statistical Catch at Age
- SS3
- Single sex



TIER 3 – ALASKA SKATE

Model 14.2

- Statistical Catch at Age
- SS3
- Single sex
- Two fleets
- One survey

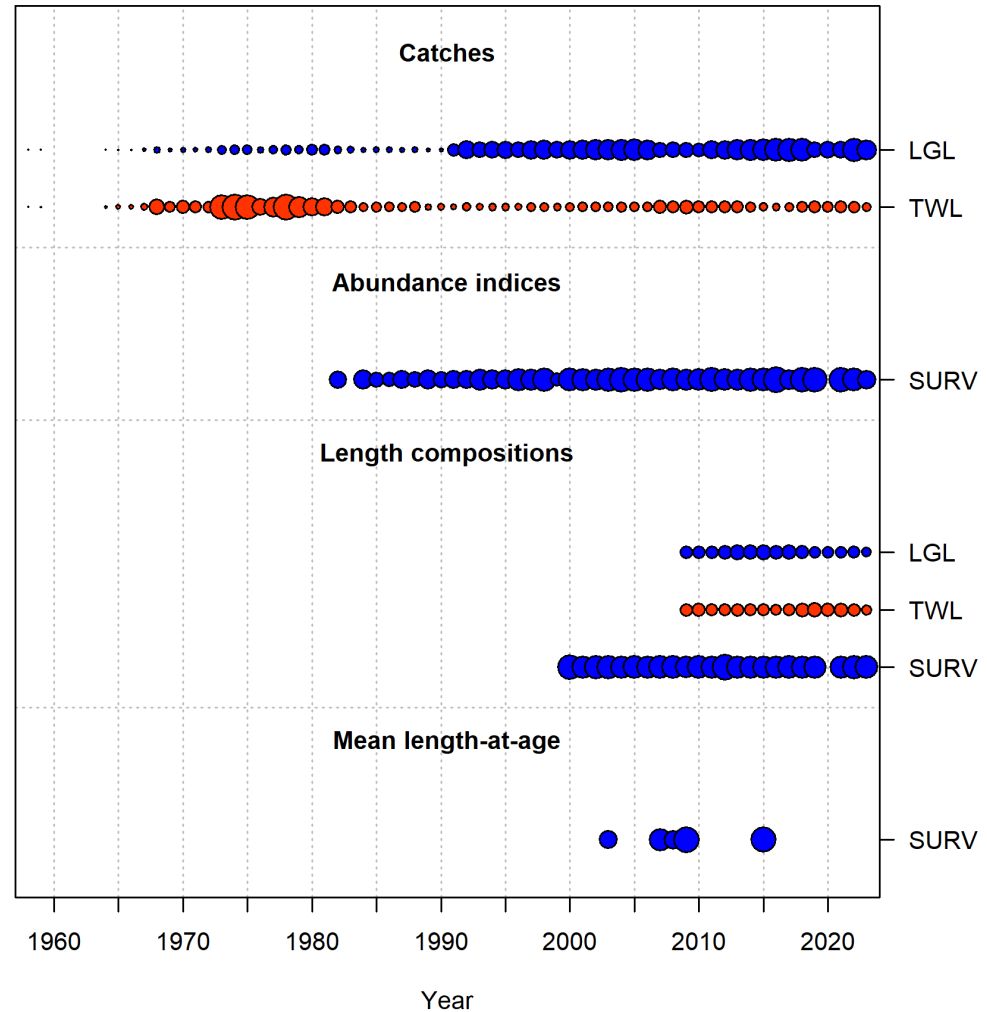


Figure 18.3

TIER 3 – ALASKA SKATE

Model 14.2

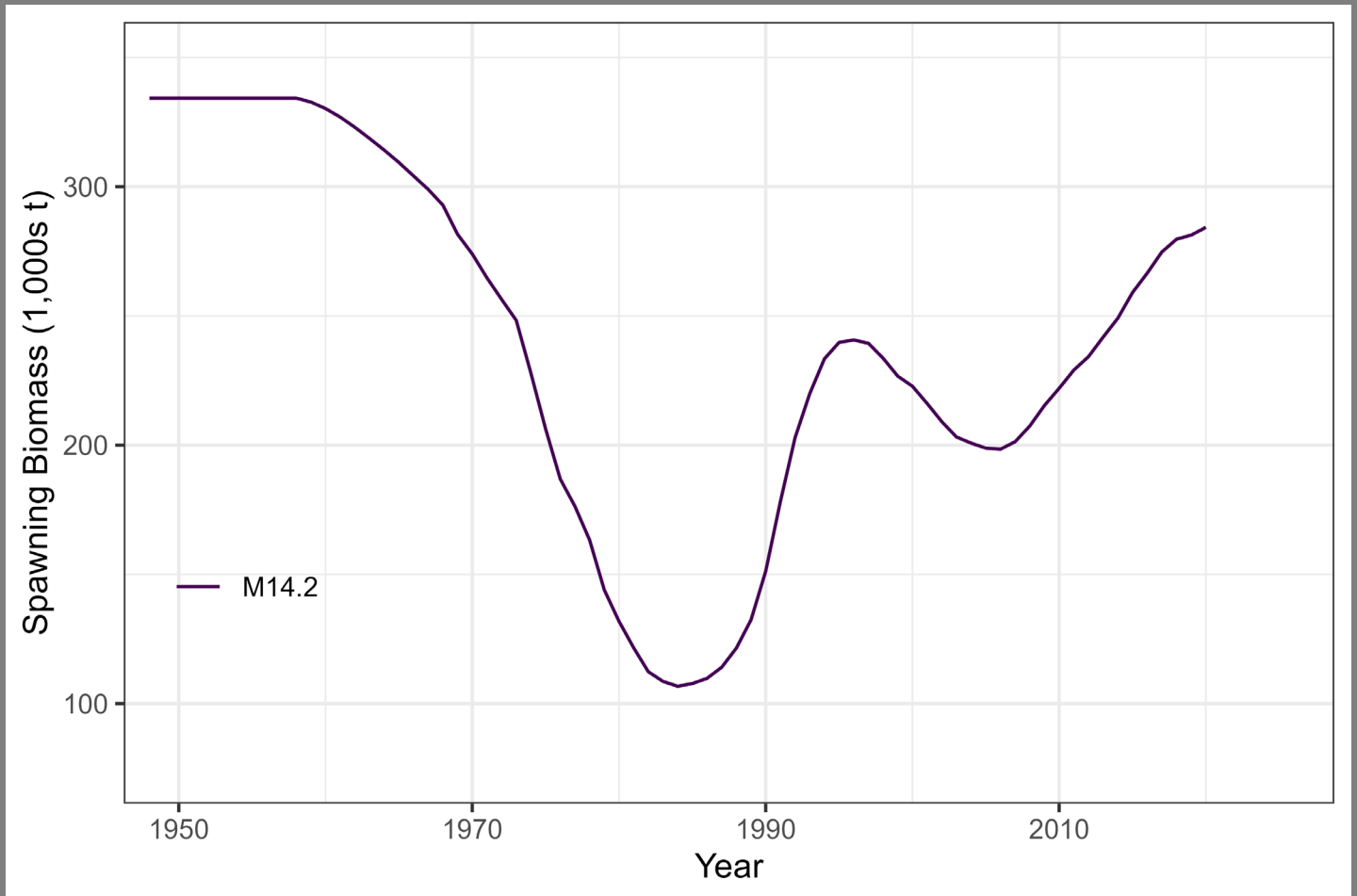
- Statistical Catch at Age
- SS3
- Single sex
- Two fleets
- One survey
- Parameters – fixed
 - See Table 18.6 for estimated parameters

Parameter	Value
natural mortality (M)	0.13
coefficient (a)	9.00×10^{-6}
exponent (b)	2.962
length at 50% maturity (a)	93.28
slope (b)	-0.548
Steepness	1
σ_R	0.4
ln catchability (q)	0
Initial longline fishery F	0
Initial trawl fishery F	0

Table 18.6

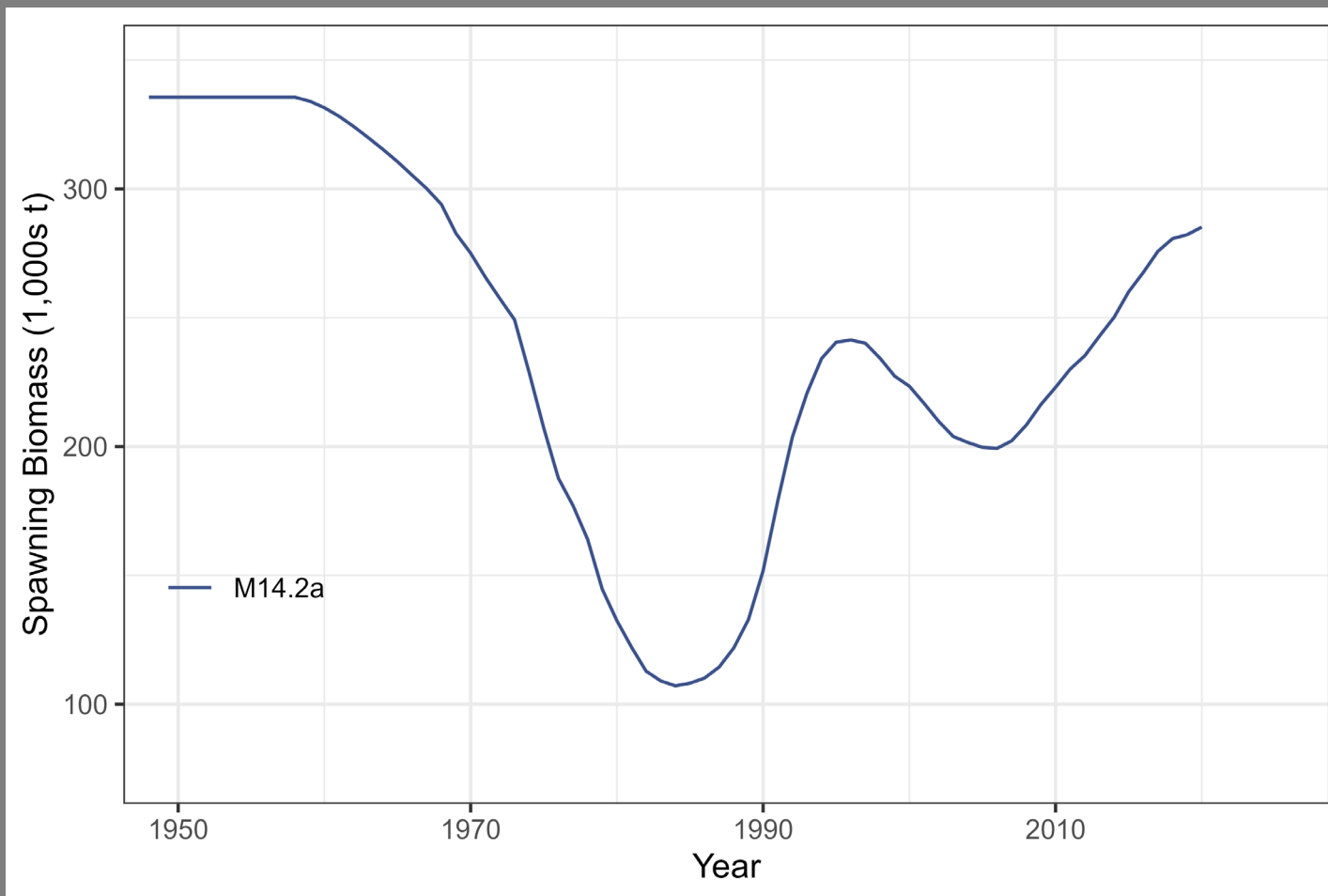
TIER 3 – MODEL BRIDGE

- Model 14.2 – 2020 model run



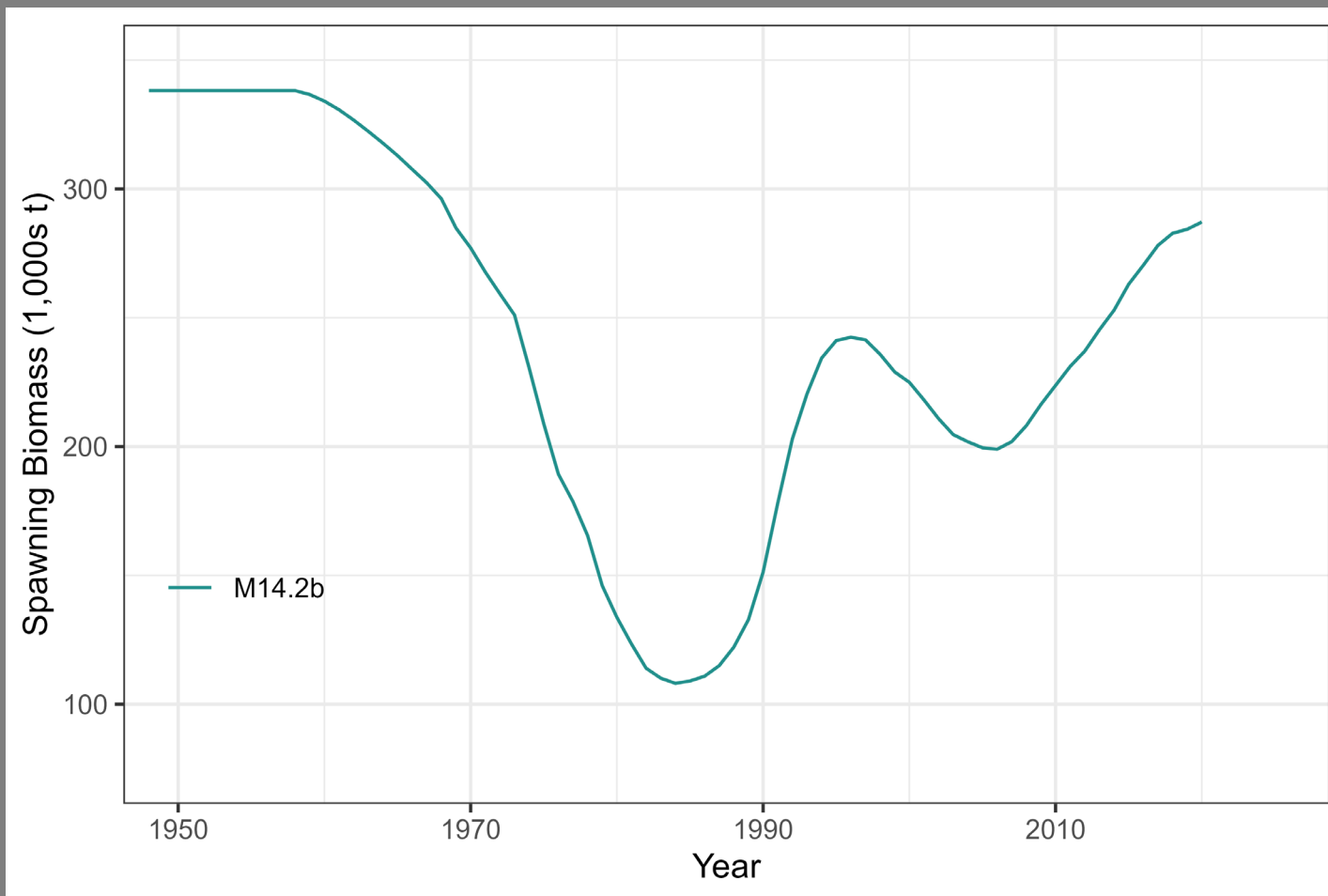
TIER 3 – MODEL BRIDGE

- Model 14.2 – 2020 model run
- Model 14.2a – migrate from SS3 3.23 to 3.30.21



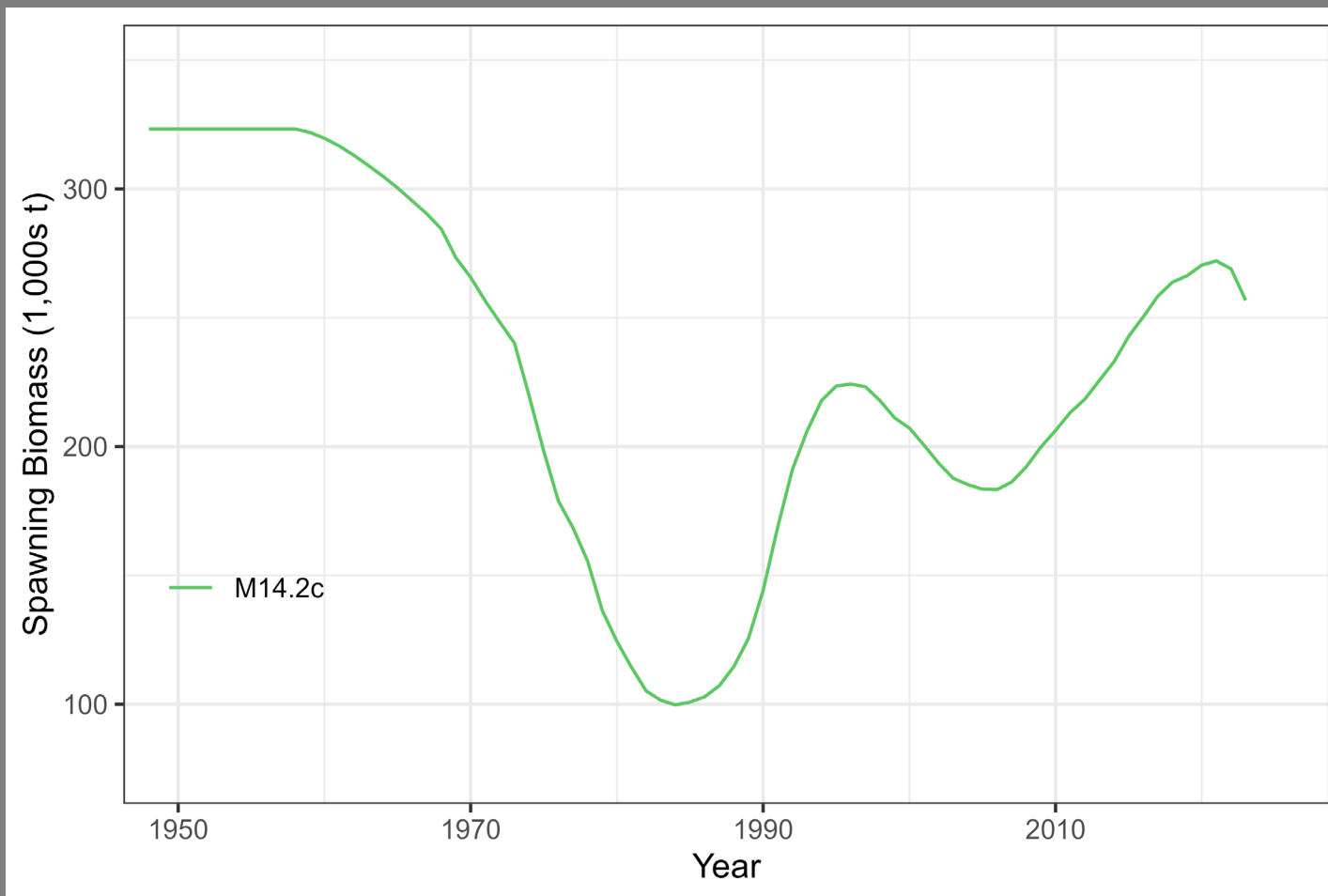
TIER 3 – MODEL BRIDGE

- Model 14.2 – 2020 model run
- Model 14.2a – migrate from SS3 3.23 to 3.30.21
- Model 14.2b – 14.2a with fixed historical data



TIER 3 – MODEL BRIDGE

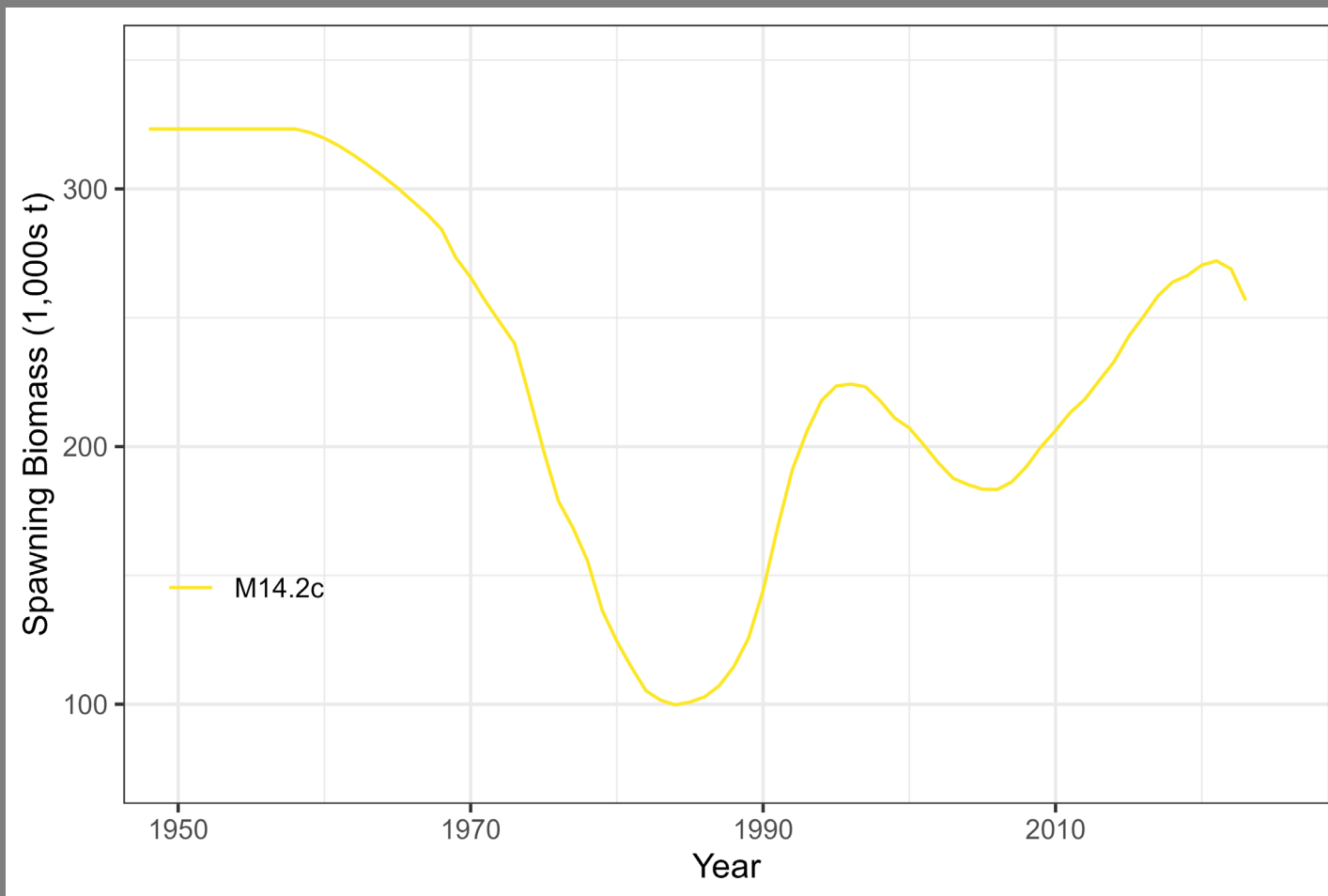
- Model 14.2 – 2020 model run
- Model 14.2a – migrate from SS3 3.23 to 3.30.21
- Model 14.2b – 14.2a with fixed historical data
- Model 14.2c – 14.2a with added data since 2020



TIER 3 – MODEL BRIDGE

- Model 14.2 – 2020 model run
- Model 14.2a – migrate from SS3 3.23 to 3.30.21
- Model 14.2b – 14.2a with fixed historical data
- Model 14.2c – 14.2a with added data since 2020
- Model 14.2d – all of the above

BSAI SKATES



TIER 3 – MODEL BRIDGE

Model Bridge

- Model 14.2d for harvest recommendations

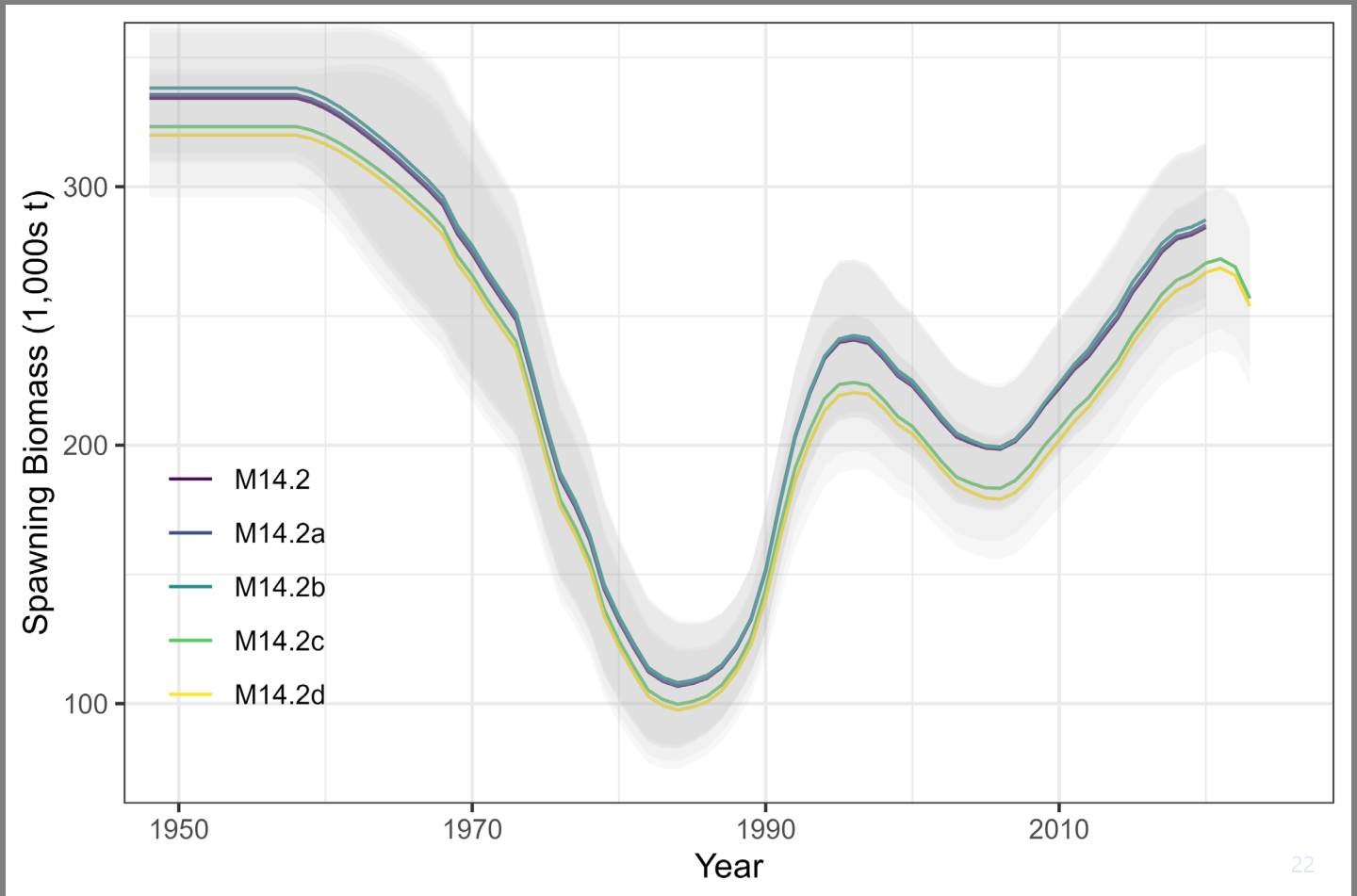


Figure 18.5

TIER 3 – MODEL DIAGNOSTIC

Table 18.7

Model number	14.2 (2020)	14.2d (2023)	Model number	14.2 (2020)	14.2d (2023)
likelihood components			# of params	94	104
Survey	-5.59	-13.34	L_amin	13.98	14.94
length comps	132.11	176.19	SD	0.419	0.904
LAA	161.00	167.25	L_amax	101.96	102.11
Recruitment	-40.96	-43.45	SD	0.230	0.396
Total	246.58	288.34	K	0.38	0.37
			SD	.017	.012
			CV young	0.35	0.33
			SD	0.00008	0.035
			CV old	0.05	0.05
			SD	0.00031	0.0000033
			ln (Rzero)	10.12	10.09
			SD	0.036	0.037

TIER 3 – MODEL DIAGNOSTIC

Table 18.7

Model number	14.2 (2020)	14.2d (2023)
RMSE_survey	0.146	0.143
% within survey CI	75.7%	57.5%
correlation obs-pred	0.782	0.792
mean longline input N	78.1	67.1
mean longline eff N	738.9	662.3
mean longline effN/N	9.46	9.9
mean trawl input N	53.3	57.9
mean trawl eff N	851.9	667.5
mean trawl effN/N	16.0	11.5
mean survey input N	200.0	200.0
mean survey eff N	841.0	718
mean survey effN/N	4.2	3.4

TIER 3 - GROWTH

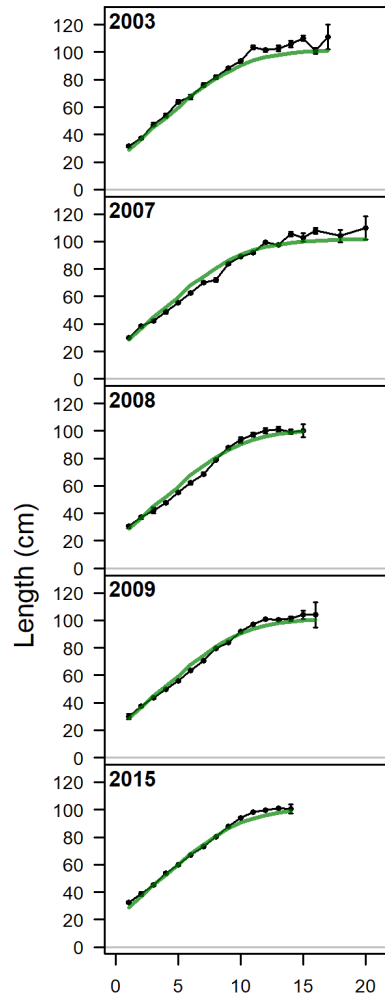
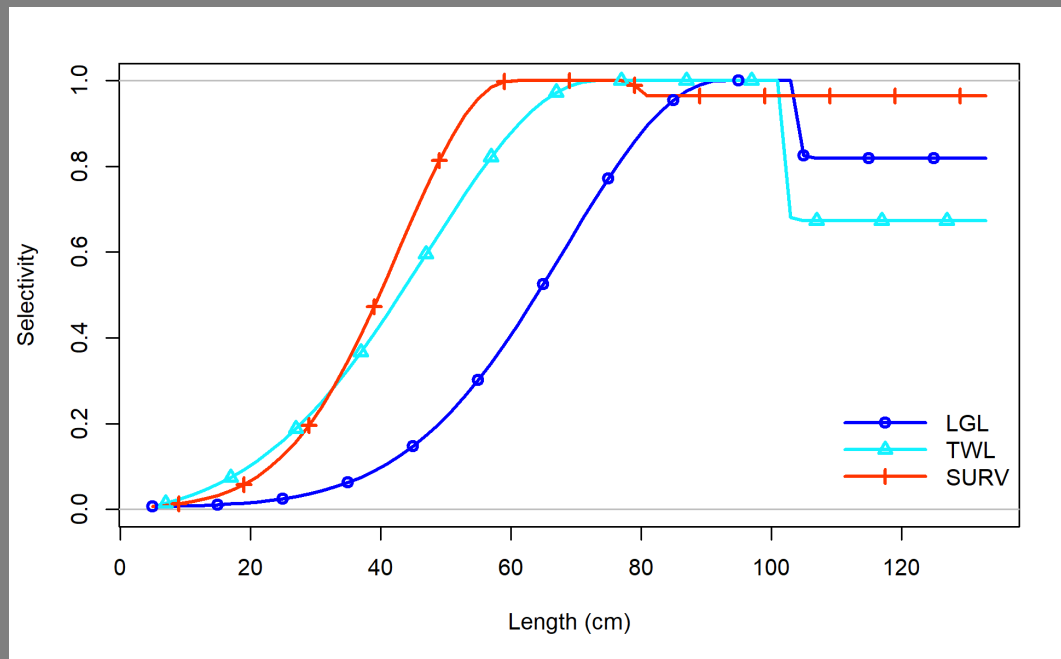


Figure 18.6

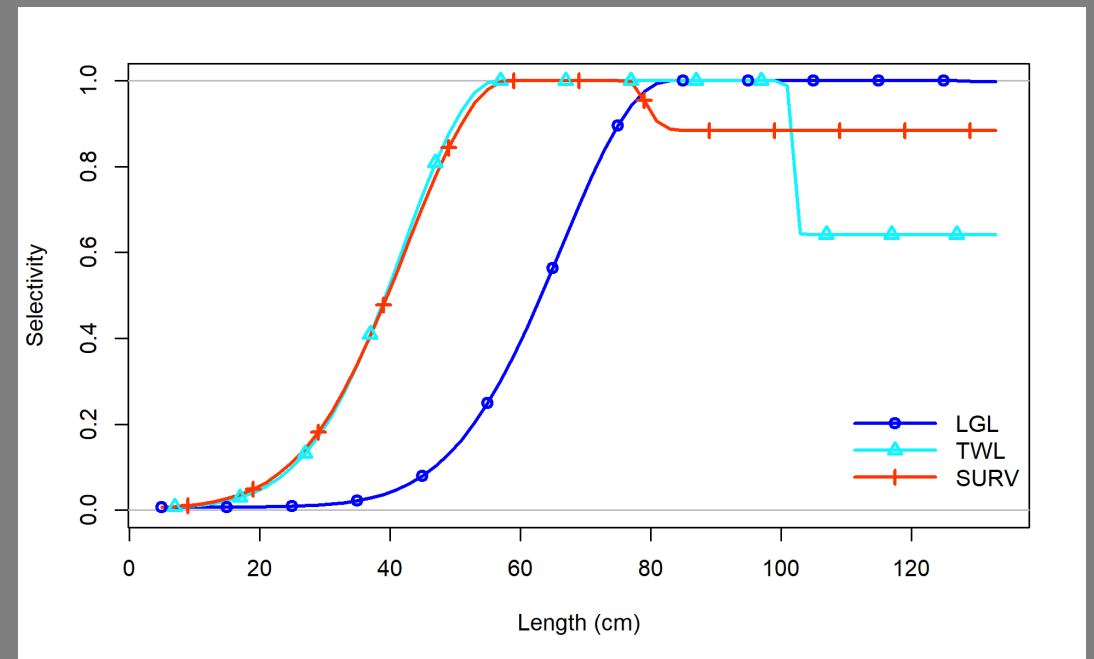
- No new age data since 2015
- Model tends to underestimate length of oldest fish in early years

TIER 3 - SELECTIVITY

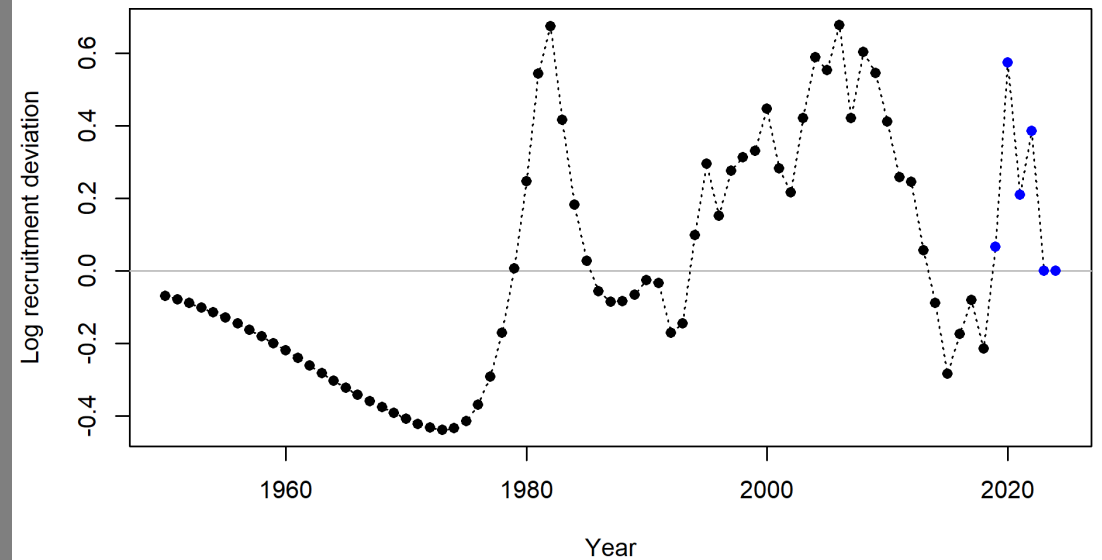
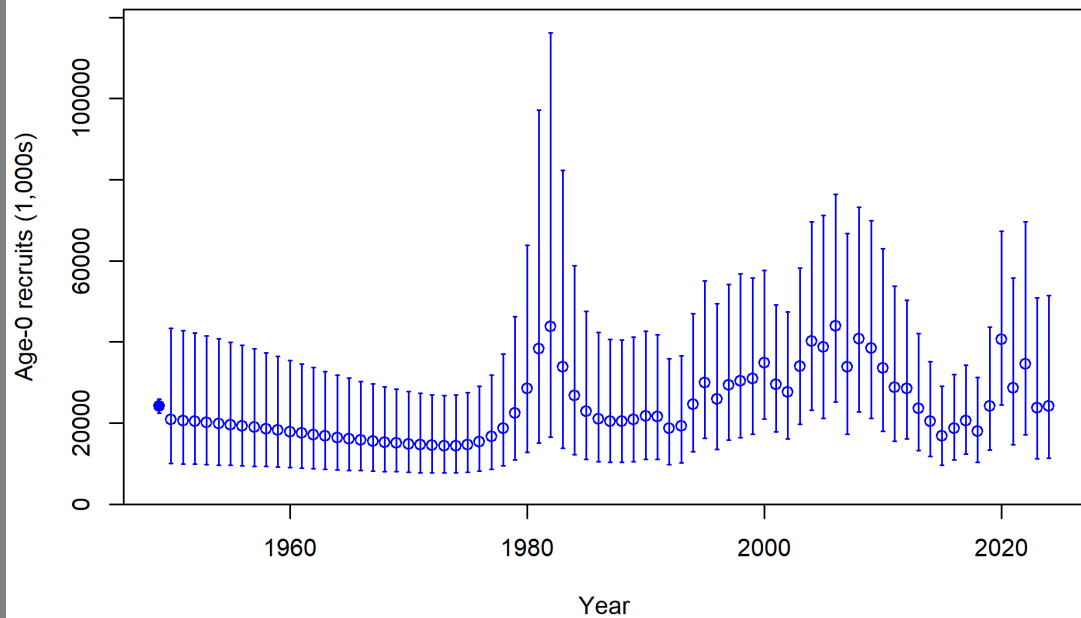
Model 14.2d (2023 Figure 18.11)



Model 14.2 (2020)



TIER 3 - RECRUITMENT



- Recruitment tend to be protracted for elasmobranchs
- Incubation influenced by temperature

- Lots of above average recruitment
- Currently at average

TIER 3 - RECRUITMENT

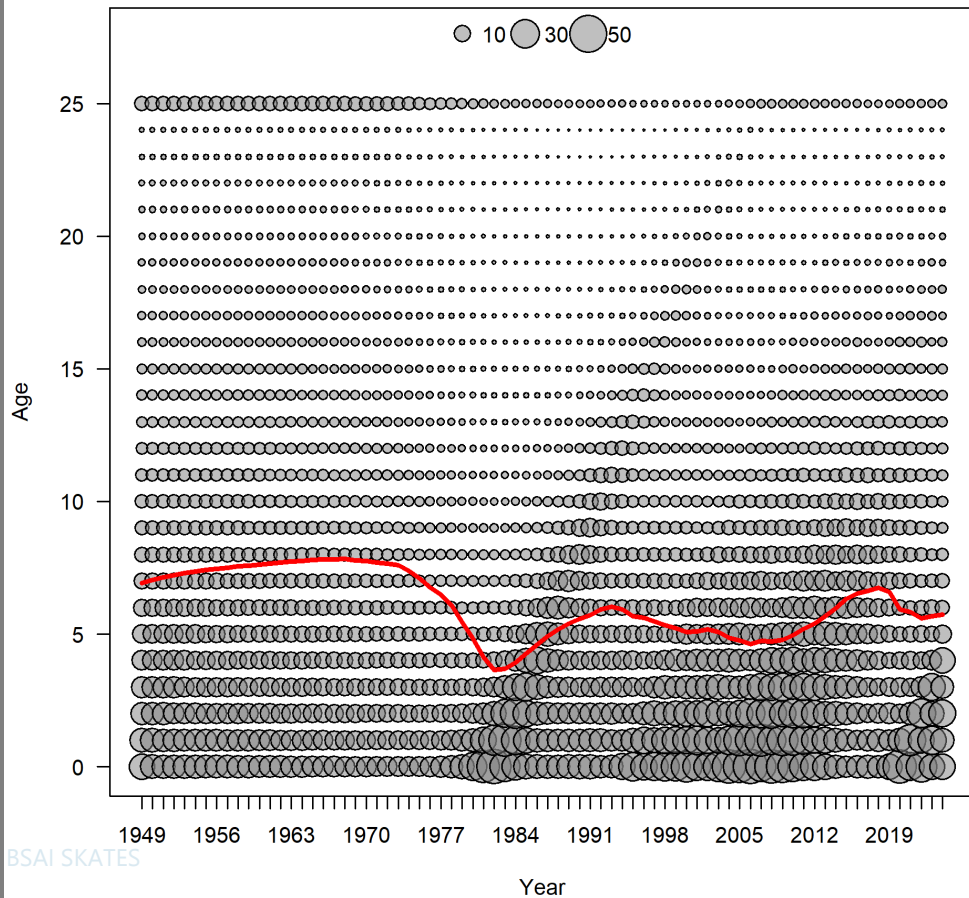
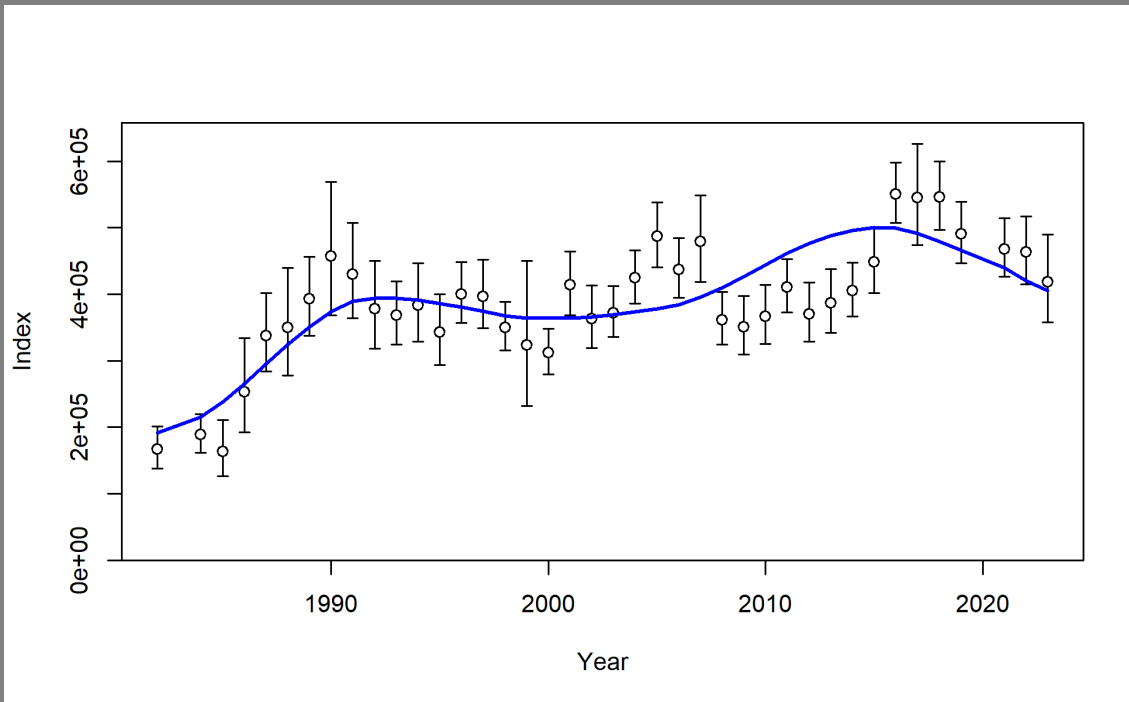


Figure 18.18

- Cohorts generally span multiple years
- Indication of developing cohort

TIER 3 - INDEX

Figure 18.12



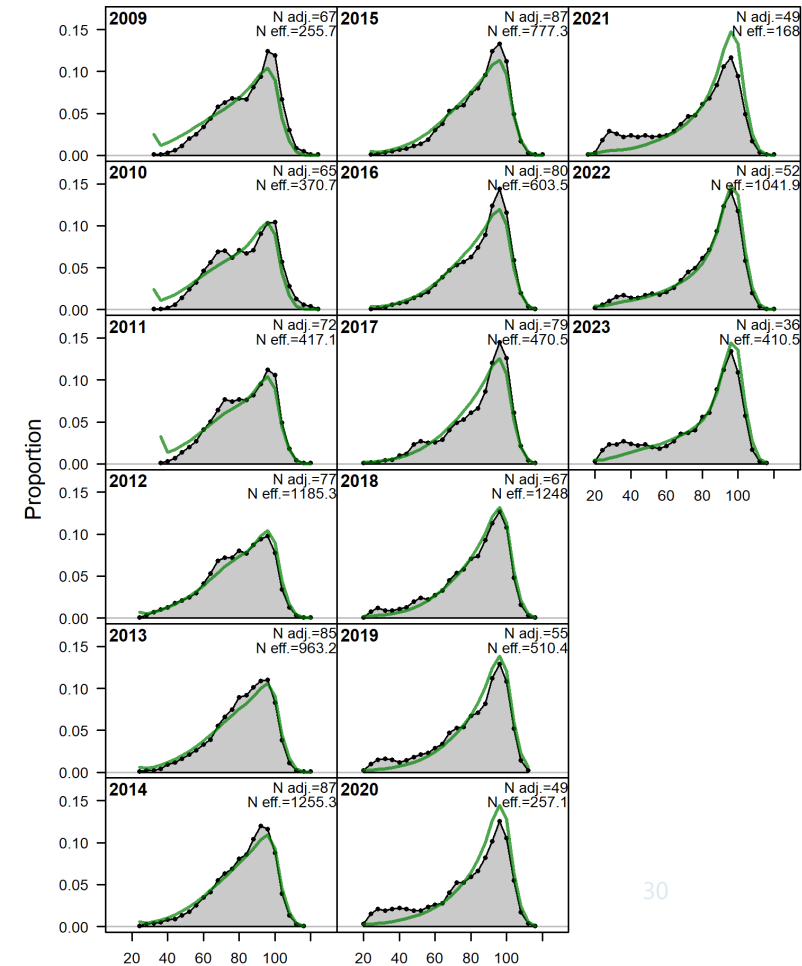
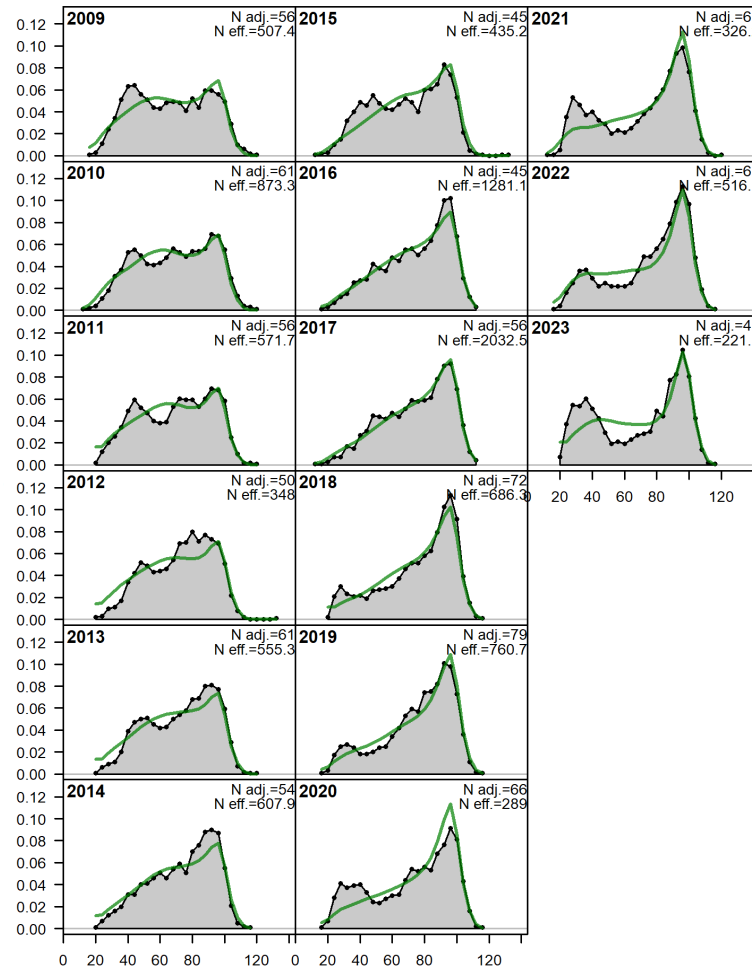
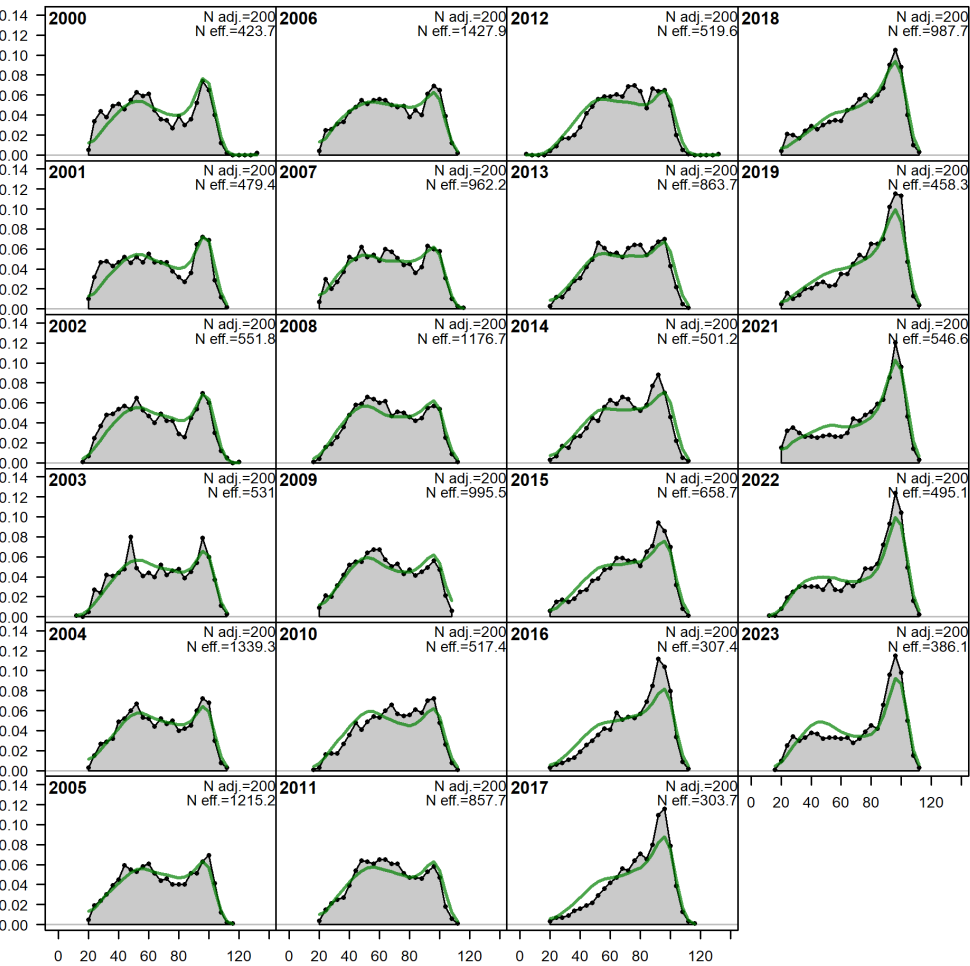
- Periods of under/over estimation since 2004
- Within CIs recently, but near the lower bounds
- Spot on in 2023

TIER 3 – LENGTH FITS

Survey Figure 18.7

Longline Figure 18.8

Trawl Figure 18.9



TIER 3 - RESIDUALS

- Pearson's residuals
- Need to investigate OSA
- Some very large residuals in largest sizes

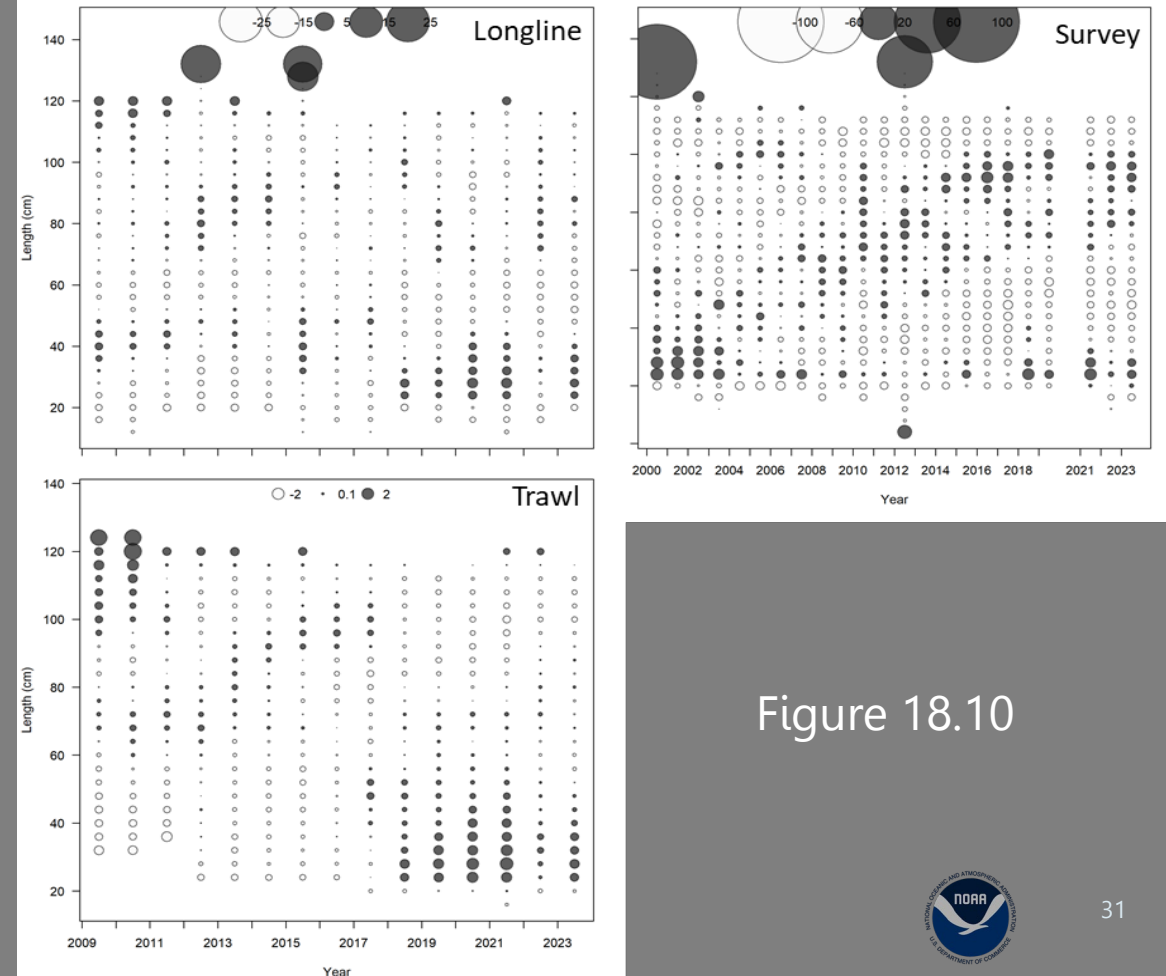
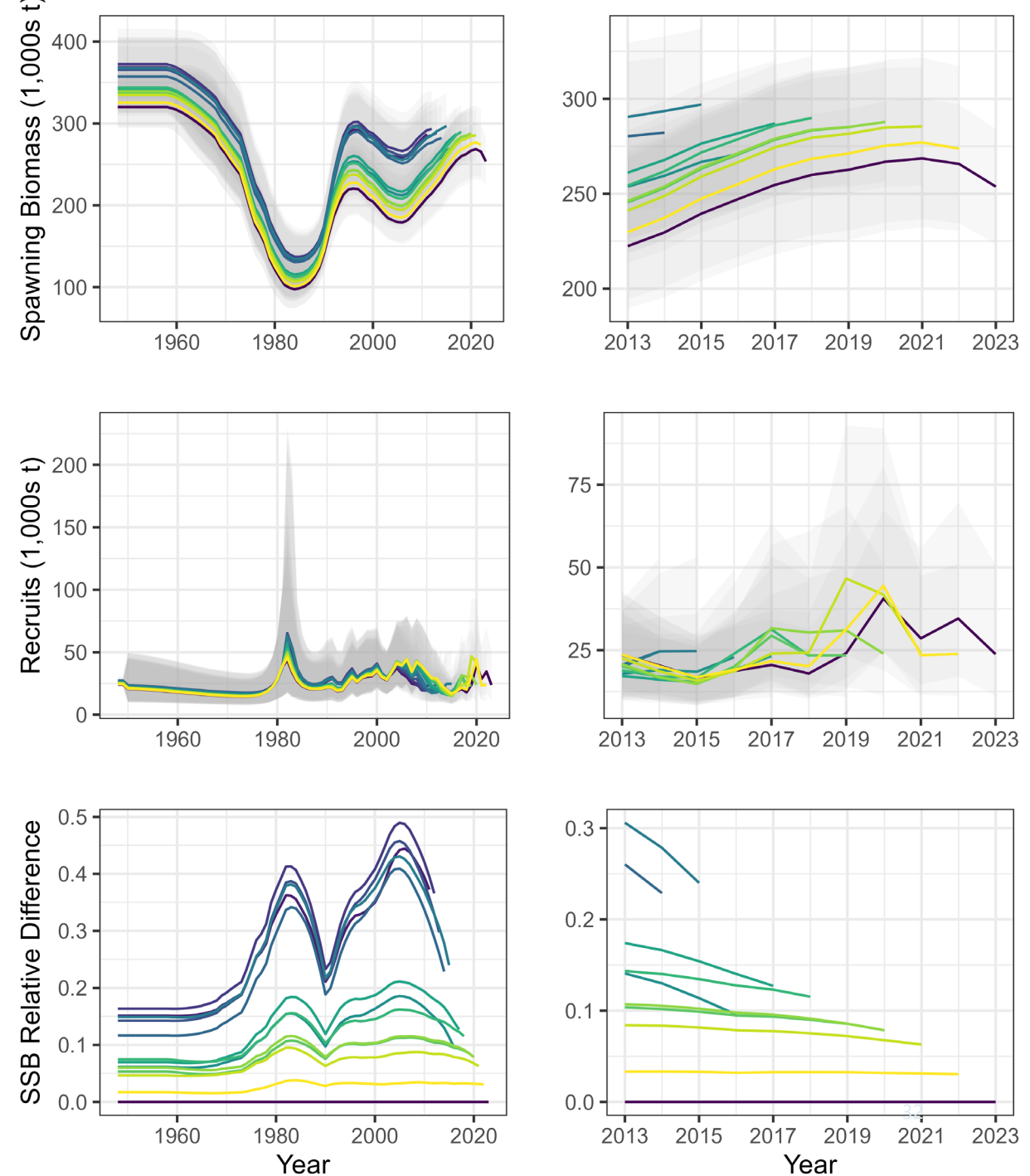


Figure 18.10

TIER 3 - RETROSPECTIVE

- Mohn's rho = 0.154
- Model likely overestimates SSB
- if the recommended ABCs were fully harvested, the realized fishing mortality could have actually been higher than the maximum permissible fishing mortality (Hanselman et al. 2013)
- Other potential issues
 - Lack of contrast in reconstructed catch history
 - Low average F

Figure 18.13



TIER 3 – STATUS

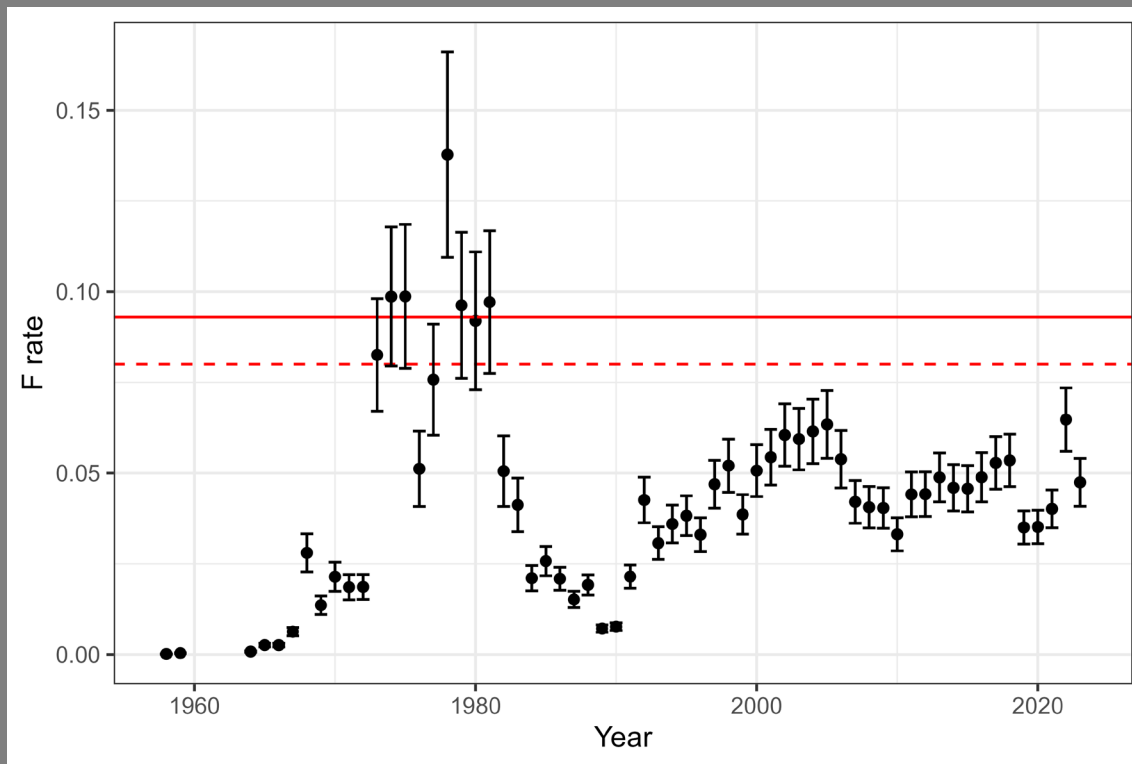
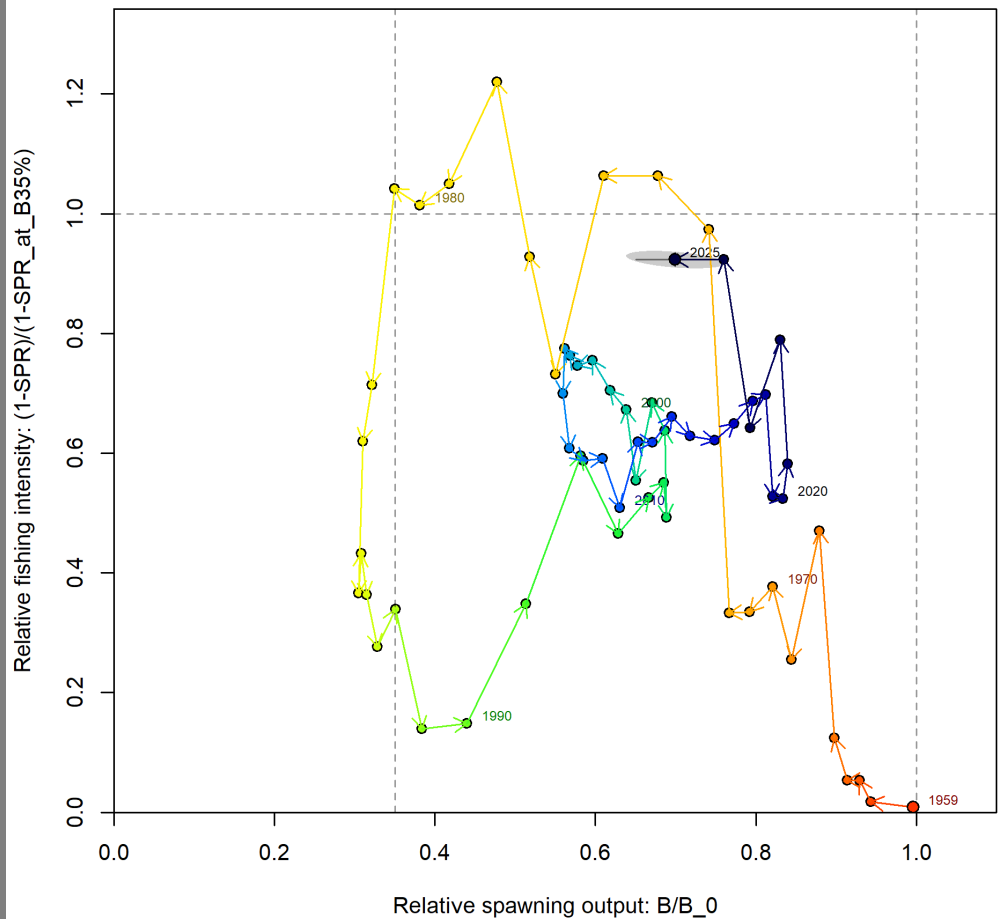


Figure 18.17

- Catch is generally well below ABC
- $F_{2022} = 0.06$
- $F_{ABC} = F_{40\%} = 0.08$
- $F_{OFL} = F_{35\%} = 0.093$
- **Not overfishing**

TIER 3 – STATUS



- 2024 $B/B_{40\%} = 1.55$
- **Sub Tier 3a**
- $B_{2024} > B_{35\%}$
- **Not overfished**

Figure 18.19

TIER 3 – STATUS

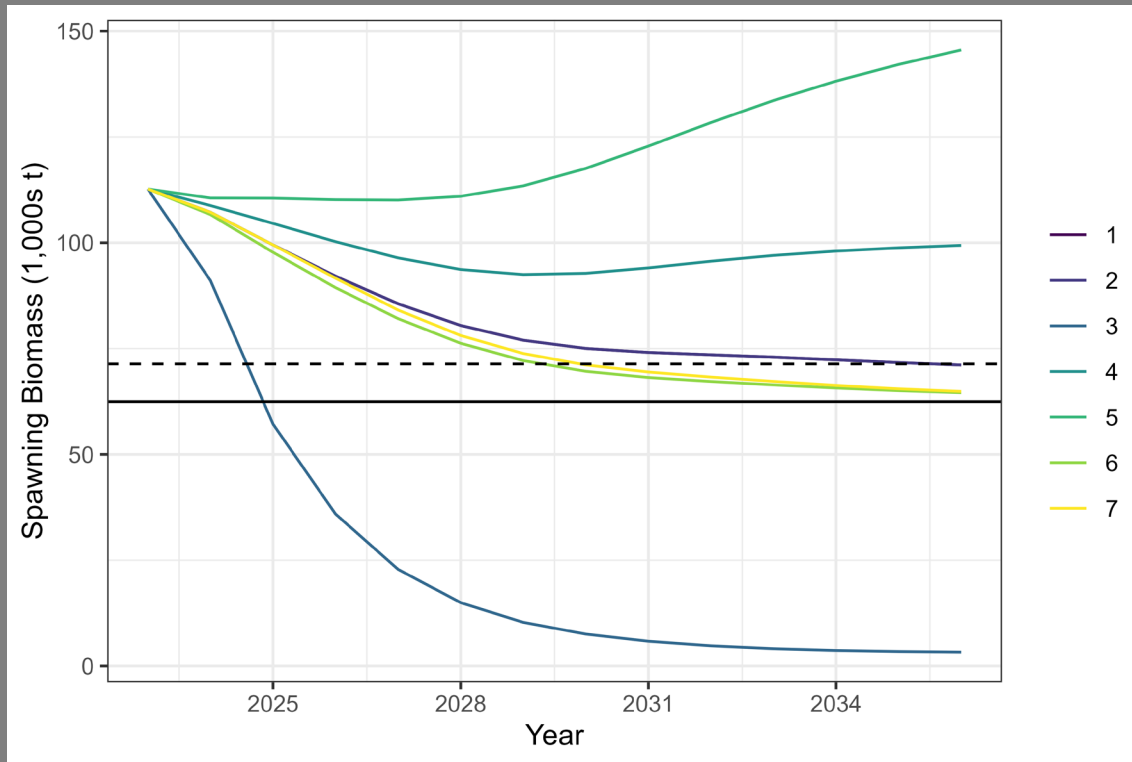


Figure 18.20

- 2024 $B/B_{40\%} = 1.55$
- **Sub Tier 3a**
- $B_{2024} > B_{35\%}$
- **Not overfished**
- $B_{2036} > B_{35\%}$
- **Not approaching overfished**

TIER 3 – HARVEST RECOMMENDATIONS

Quantity	2023	2024	2024*	2025*
M (natural mortality rate)	0.13	0.13	0.13	0.13
Tier	3a	3a	3a	3a
Projected total (age 0+) biomass (t)	473,527	450,679	453,053	437,751
Projected Female spawning biomass (t)	114,804	105,595	106,549	98,884
$B_{100\%}$	178,425	178,425	172,881	172,881
$B_{40\%}$	71,370	71,370	69,152	69,152
$B_{35\%}$	62,449	62,449	60,508	60,508
F_{OFL}	0.092	0.092	0.093	0.093
$\max F_{ABC}$	0.079	0.079	0.080	0.080
F_{ABC}	0.079	0.079	0.080	0.080
OFL (t)	35,503	33,451	32,429	31,058
$\max ABC$ (t)	30,567	28,799	27,950	26,767
ABC (t)	30,567	28,799	27,950	26,767

Questions on Tier 3 Alaska Skates

Up next: Harvest Recommendations



HARVEST RECOMMENDATIONS

Risk Tables

Assessment-related	Population dynamics	Enviro/ ecosystem	Fishery Performance
Level 2 for Alaska skates Level 1 for Other skates	Level 1: no increased concerns	Level 1: no increased concerns	Level 1: no increased concerns

Assessment

- Alaska skate model
 - Retrospective bias concerns
 - Many areas for model improvement
- Lack of EBS slope data a continuing concern for Tier 5

HARVEST RECOMMENDATIONS

Risk Tables

Assessment-related	Population dynamics	Enviro/ ecosystem	Fishery Performance
Level 2 for Alaska skates Level 1 for Other skates	Level 1: no increased concerns	Level 1: no increased concerns	Level 1: no increased concerns

Population Dynamics

- Alaska skate model
 - Current declining trend
 - Catch well below ABC, not at risk of becoming overfished
 - Suggestion of developing cohort
- Monitoring Tier 5 species trends, elevated concern not yet warranted

HARVEST RECOMMENDATIONS

Risk Tables

Assessment-related	Population dynamics	Enviro/ ecosystem	Fishery Performance
Level 2 for Alaska skates Level 1 for Other skates	Level 1: no increased concerns	Level 1: no increased concerns	Level 1: no increased concerns

Ecosystem/Fishery

- Data-limited
- No apparent ecosystem concerns
- Bycatch species

No reduction from max ABC
recommended at this time

HARVEST RECOMMENDATIONS

aggregate harvest recommendations for the BSAI skate complex

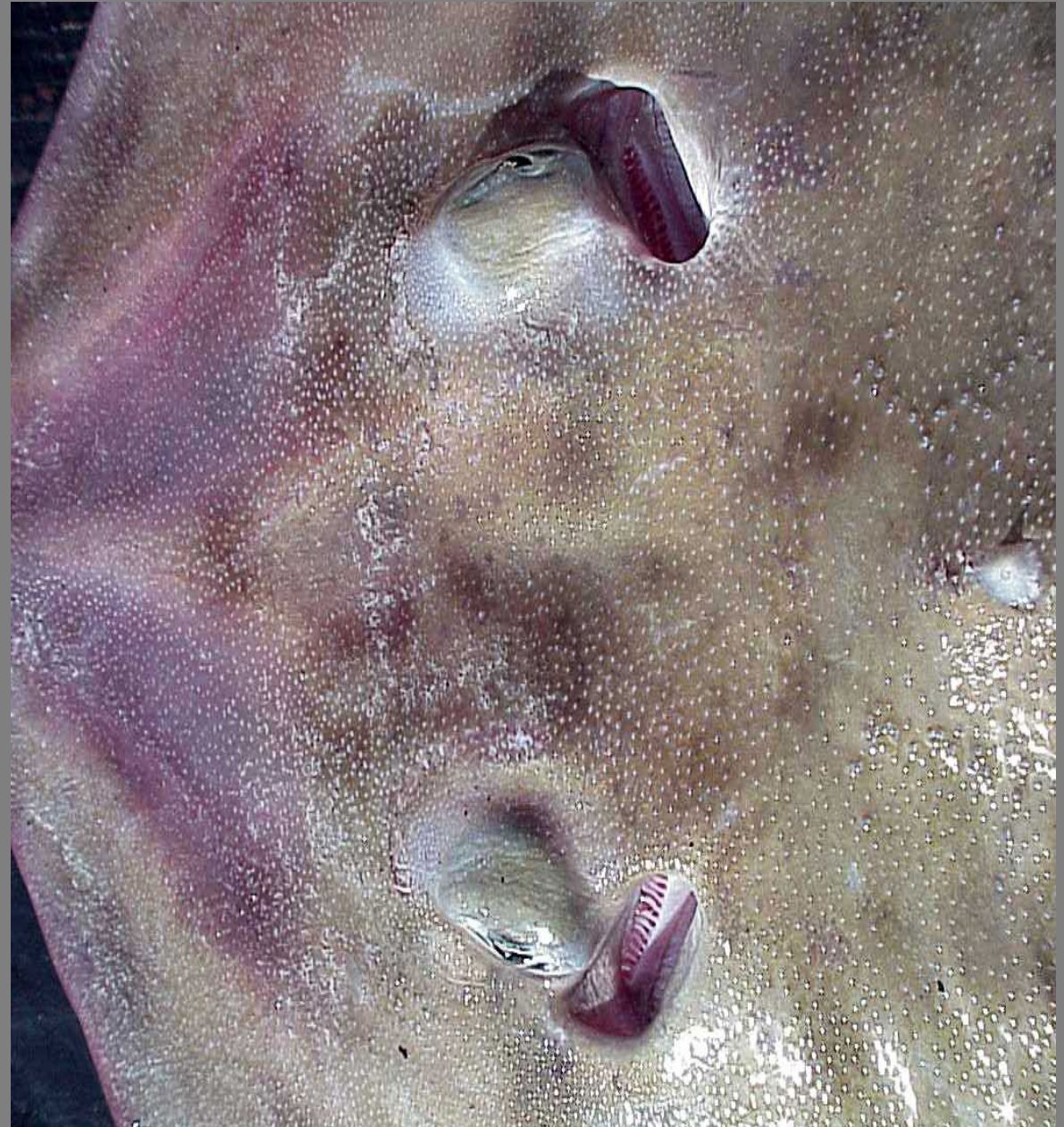
Quantity	As estimated or specified last year for:		As estimated or recommended this year for:	
	2023	2024	2024	2025
OFL (t)	46,220	44,168	45,574	44,203
maxABC (t)	38,605	36,837	37,808	36,625
ABC (t)	38,605	36,837	37,808	36,625

Questions, comments or feedback

Contact: cindy.tribuzio@noaa.gov

With contributions from:

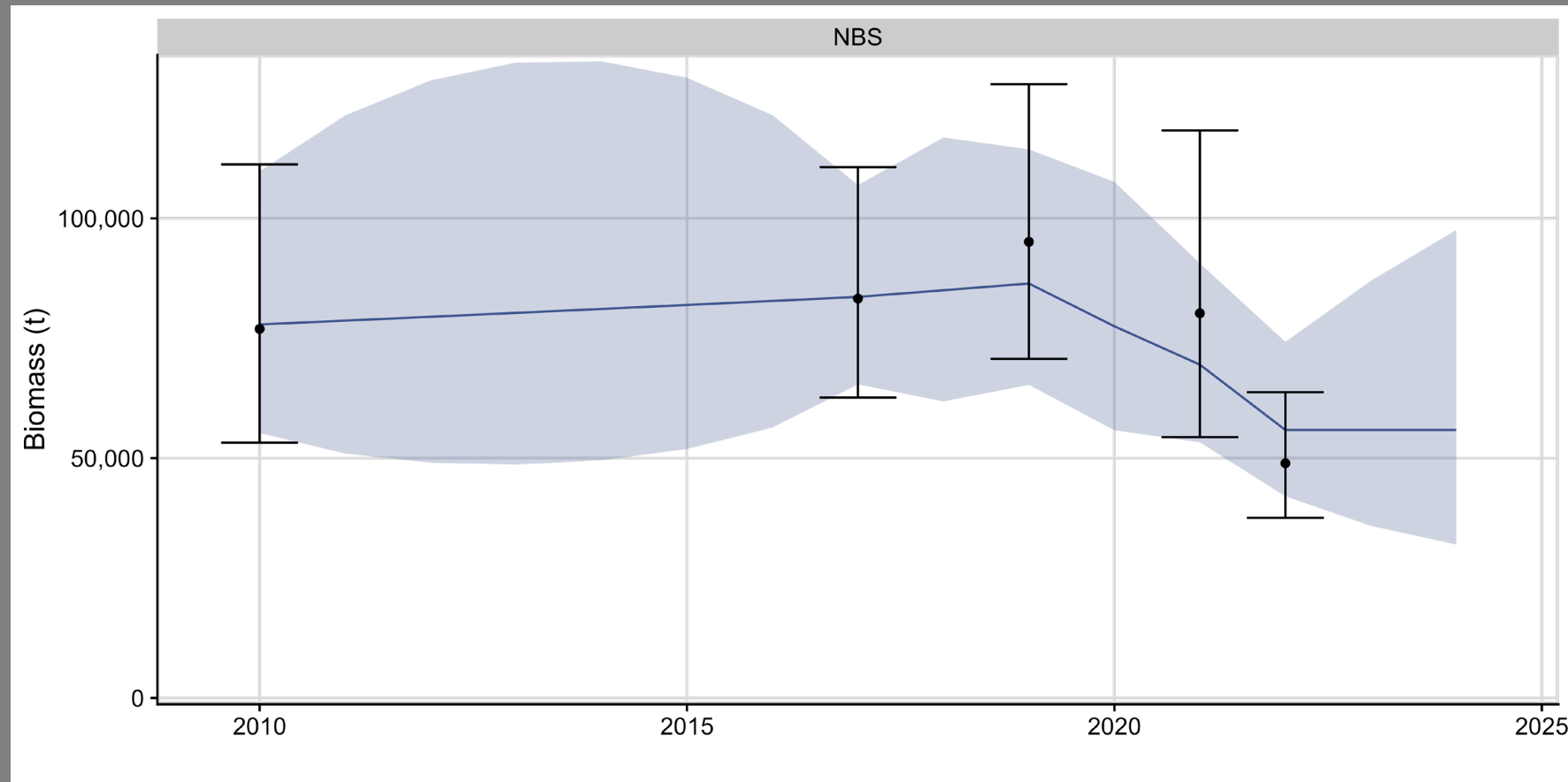
- Ivonne Ortiz and Ebett Siddon (AFSC) for the Ecosystem Considerations sections.
- Jerry Hoff and Duane Stevenson (AFSC) for survey and skate expertise.



ALASKA SKATES - NBS

Figure 18.B4

- Not in Model 14.2d
- Only species identified in NBS (so far)





ALASKA SKATE CATCH