

Northern Rockfish GOA Groundfish Plan Team

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November, 2022



Teams or SSC Comments

- *“The Team recommends all GOA authors evaluate any bottom trawl survey information used in their assessment prior to 1990 including the 1984 and 1987 surveys and conduct sensitivity analyses to evaluate their usefulness to the assessment” (PT, November 2021)*
 - The 1980s survey data has been removed – iterative model evaluations were completed.
- *The Team recommends evaluating how the definition of the length composition plus group, and alternative data-weighting methods, affect model performance.” (Plan Team, November 2015)*
 - The length plus group has been increased and alternative data-weighting methods are explored
- *The SSC also agrees with the high priority placed on improving maturity-at-age information for northern rockfish.” (SSC, December 2018)*
 - A preliminary examination of skip spawning is presented

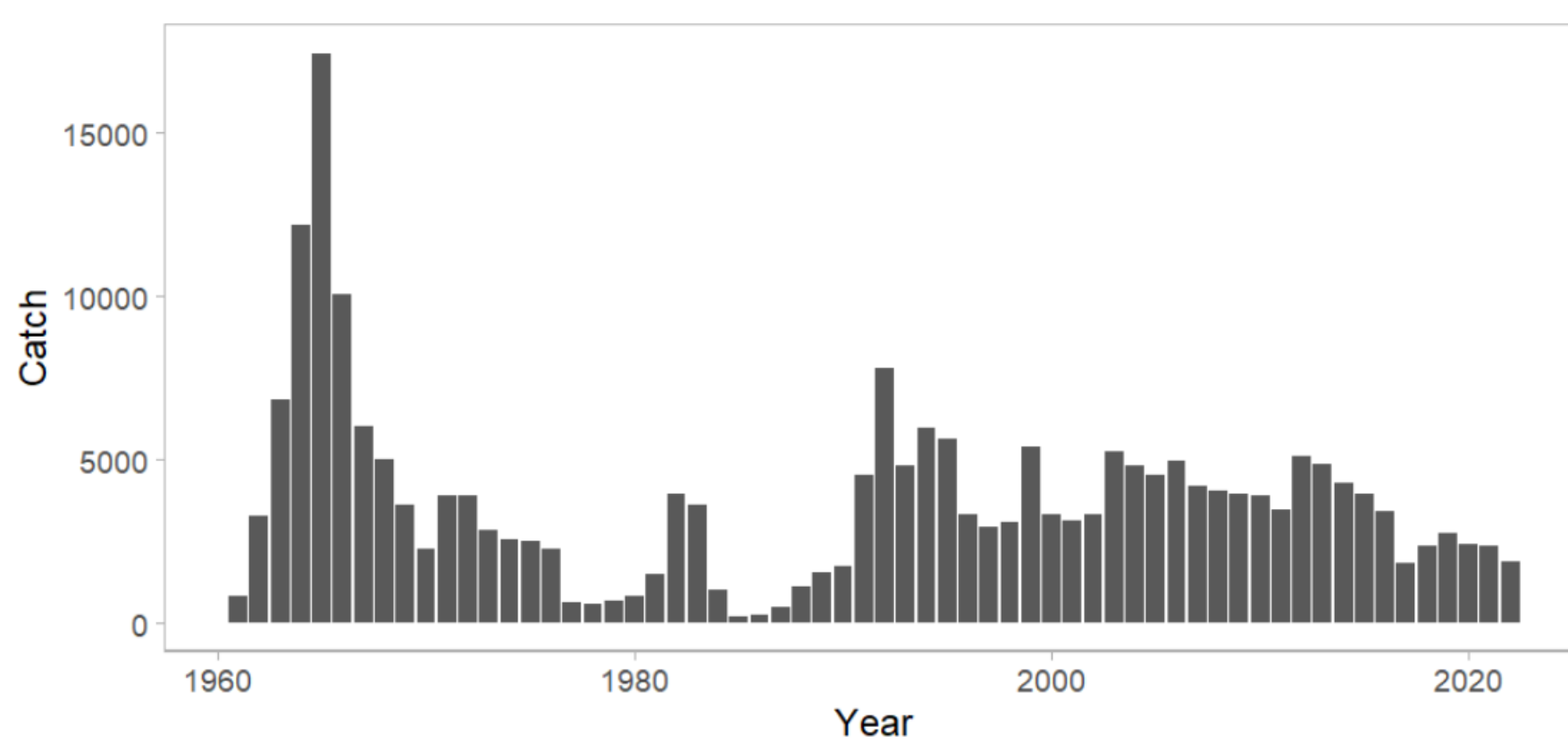
Data Summary

Source	Data	Years
NMFS Groundfish survey	Survey biomass	1990-1999 (triennial), 2001-2019 (biennial), 2021
	Age composition	1990-1999 (triennial), 2003-2019 (biennial), 2021
U.S. trawl fishery	Catch	1961-2020, 2021-2022
	Age composition	1998-2002, 2004-2006, 2008-2018 (biennial), 2020
	Length composition	1991-1997, 2003, 2007-2019 (biennial), 2021

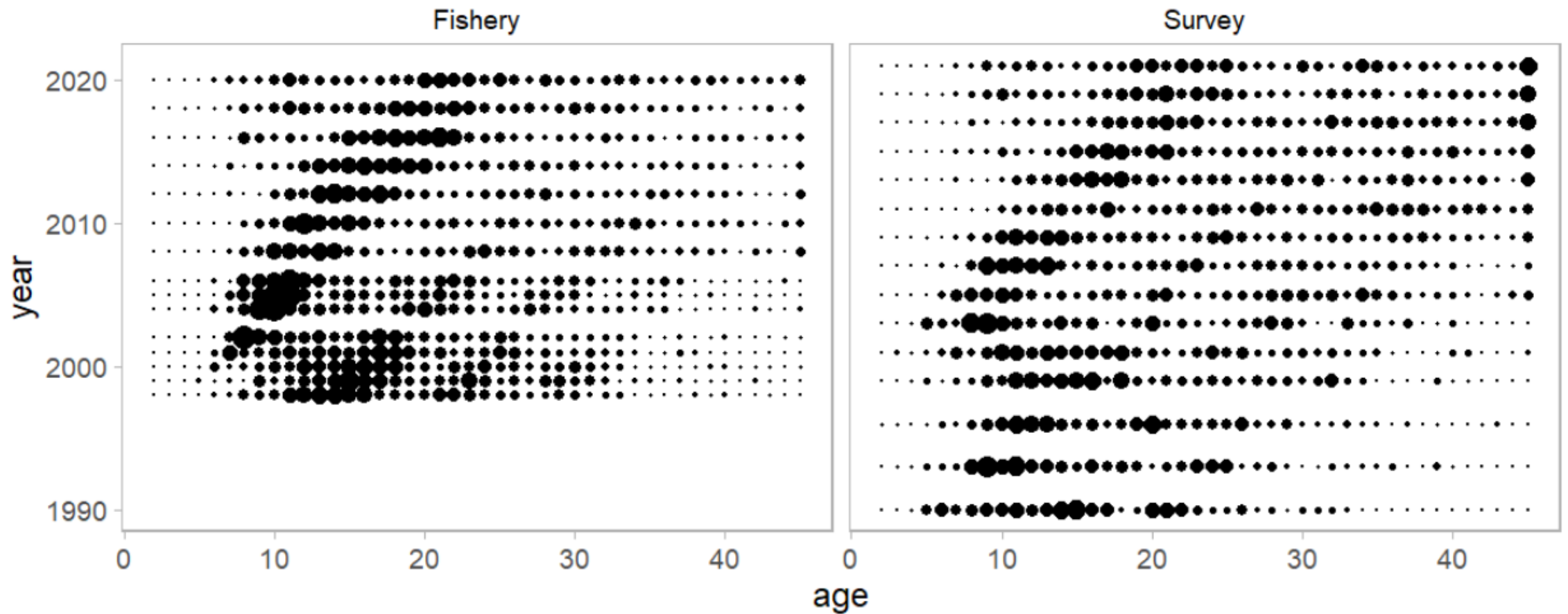
Model variants

Model	Description
base	2020 model (m18.2b) and results (includes 1980s survey data)
m18.2b	base model w/data updated through 2022, using GAP default VAST
m22	m18.2b using GAP default VAST (survey data 1990+)
m22.1	m22 w/increased length plus group
m22.1a	m22.1 w/Francis re-weighting
m22.1b	m22.1a w/survey biomass weight set to 1

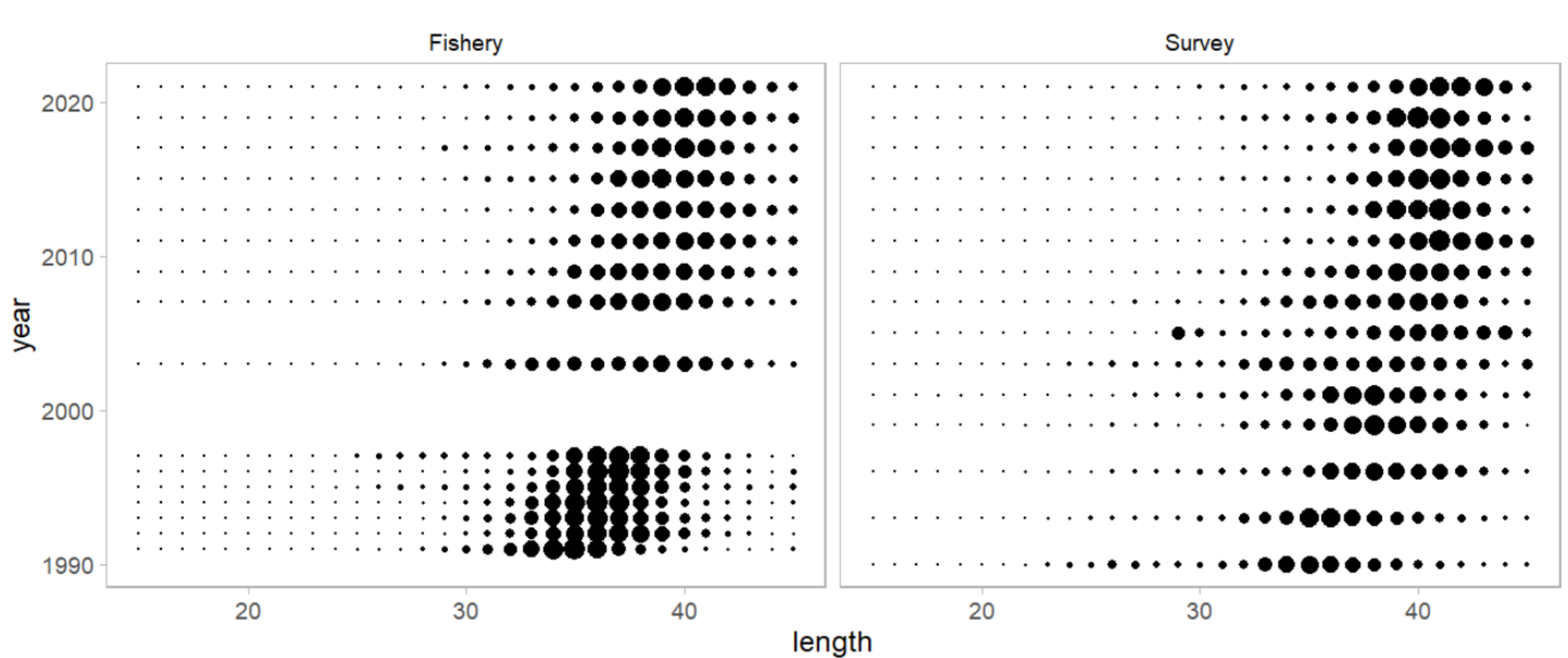
Catch



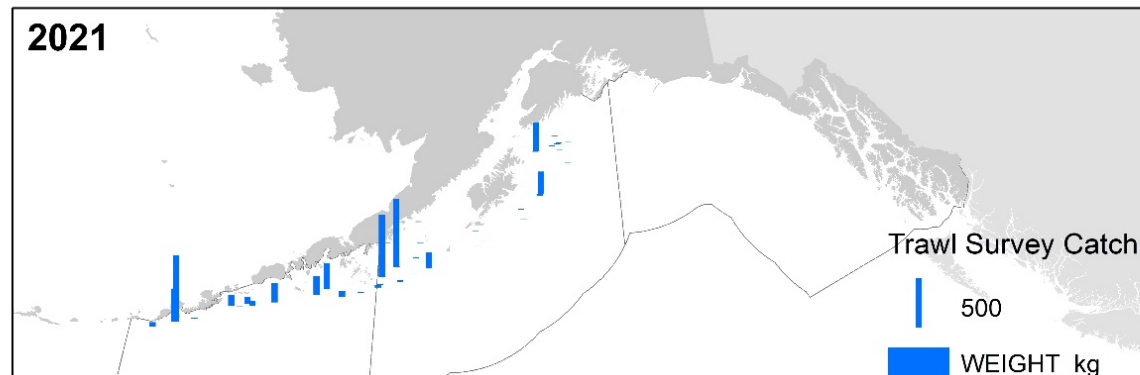
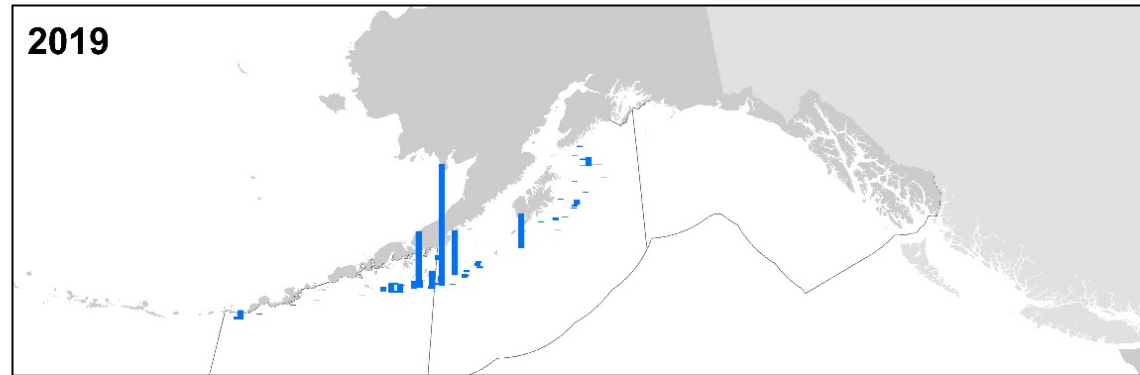
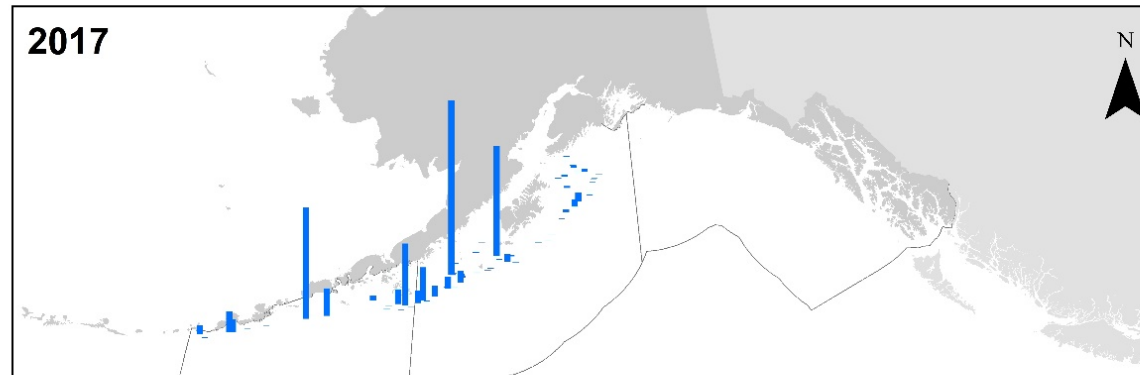
Inputs - age composition



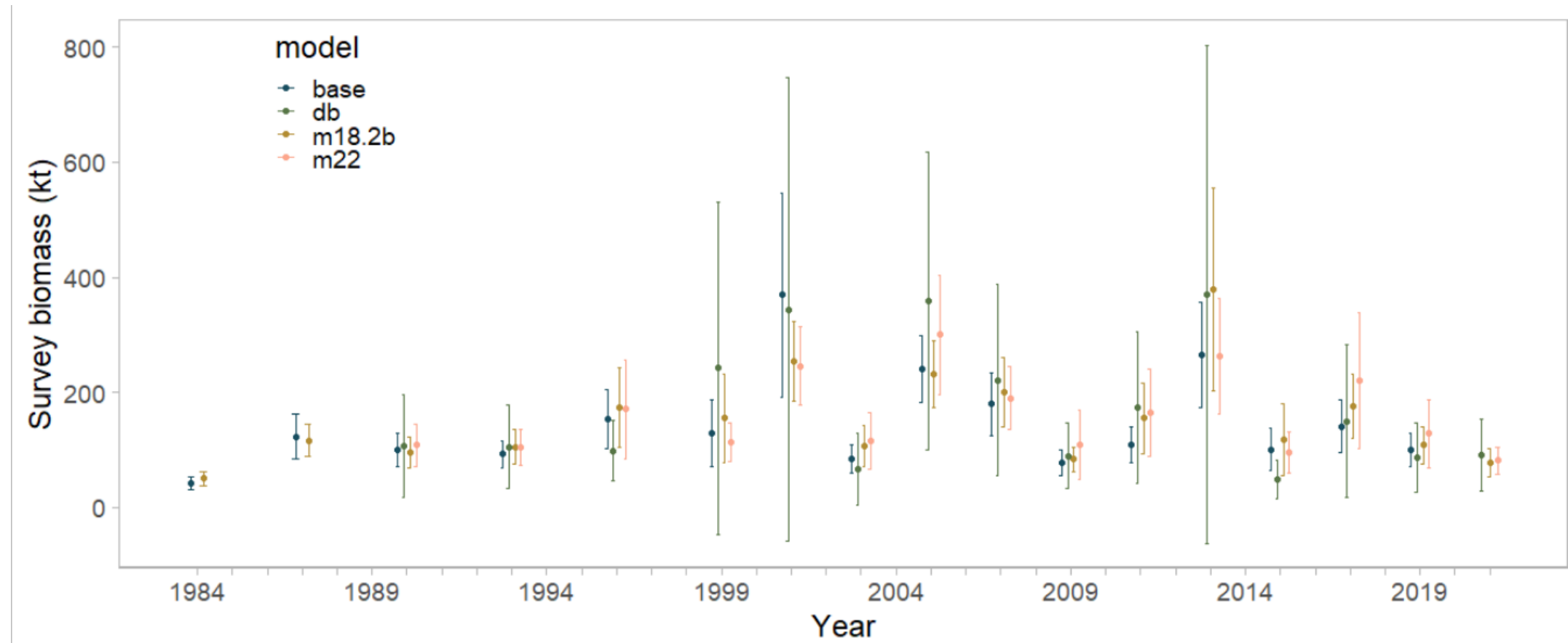
Inputs – size composition



Survey - biomass



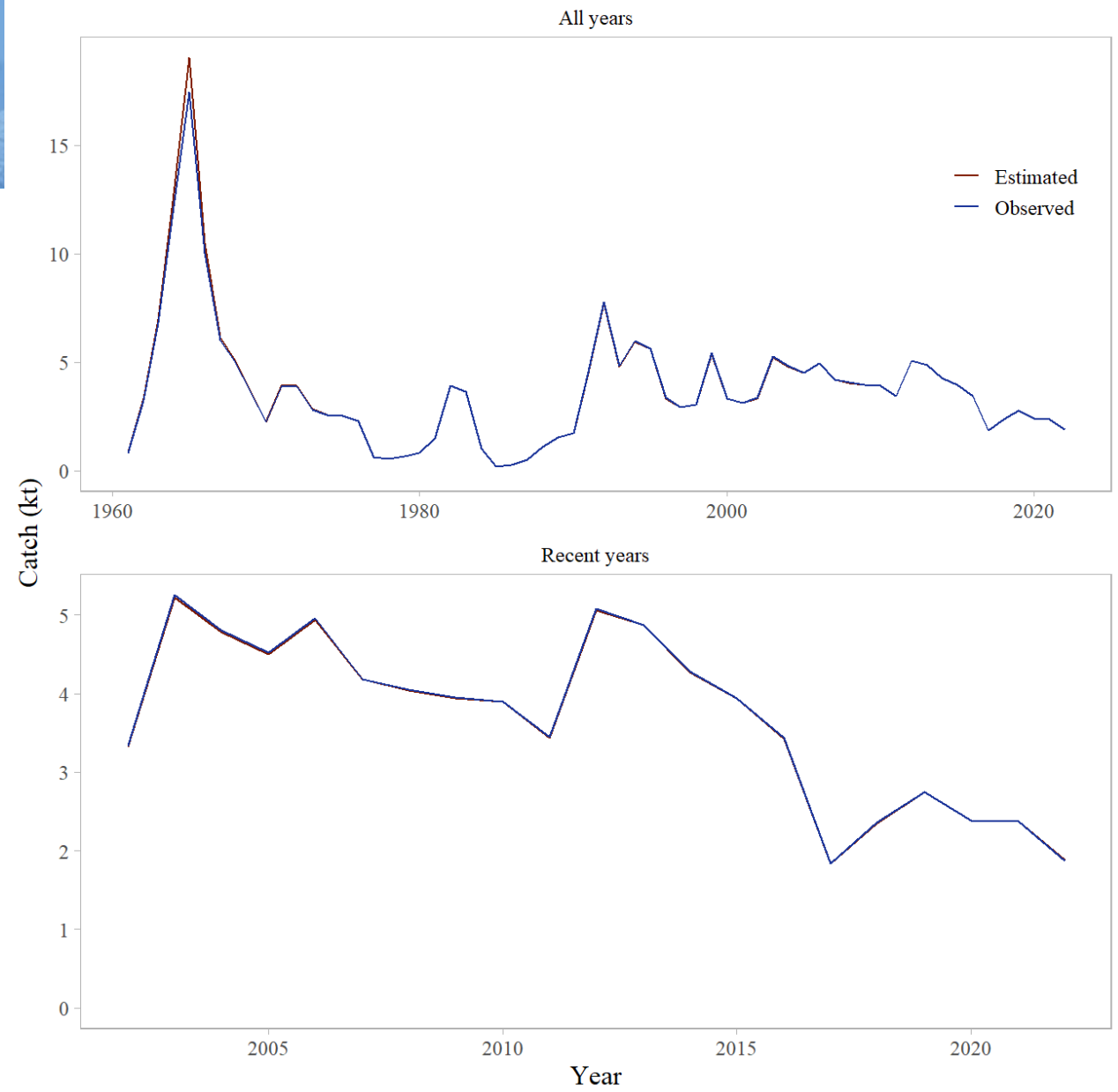
Survey - biomass



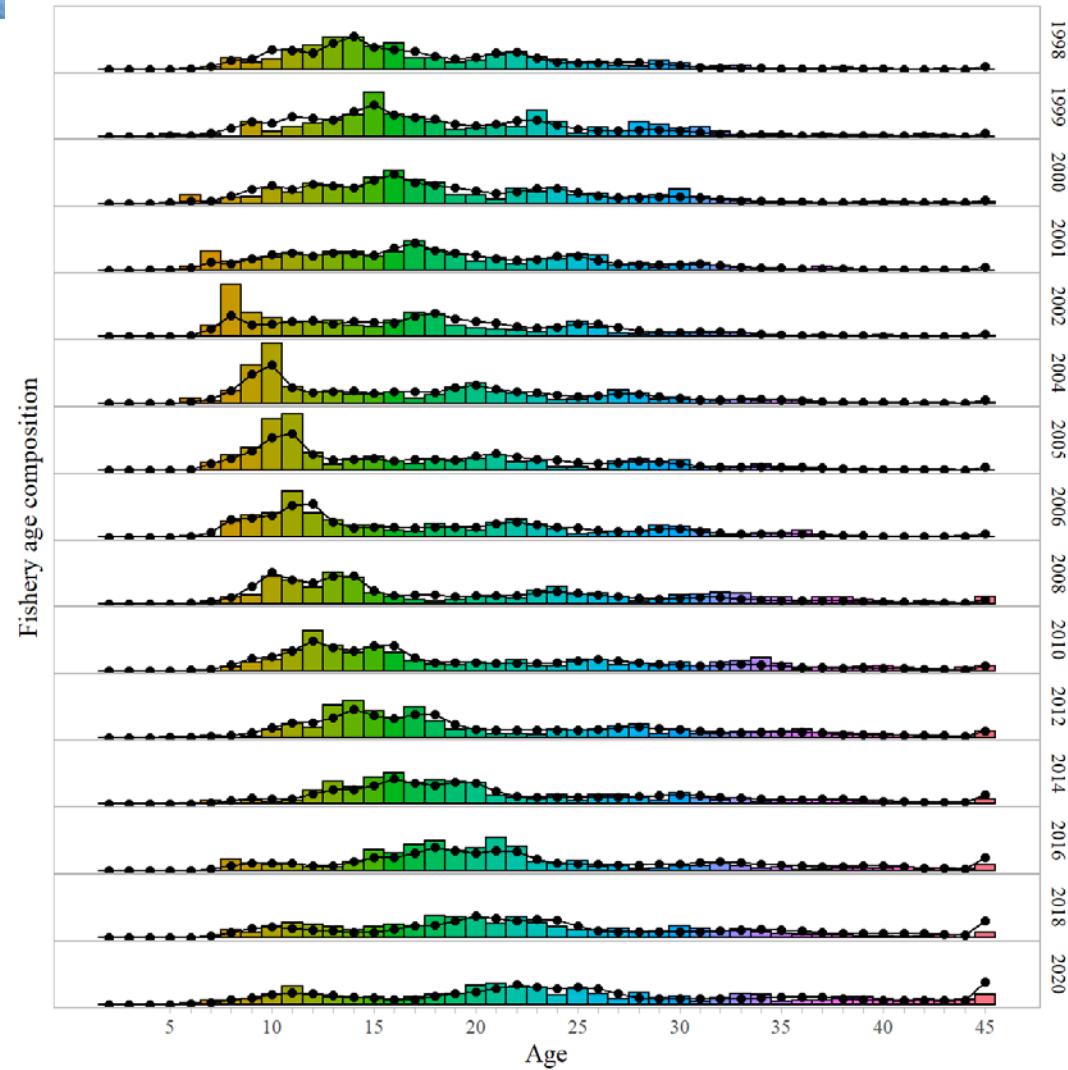
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m22.1a	m22.1 re-weighted
m22.1b	m22.1 re-weighted, with survey weight = 1

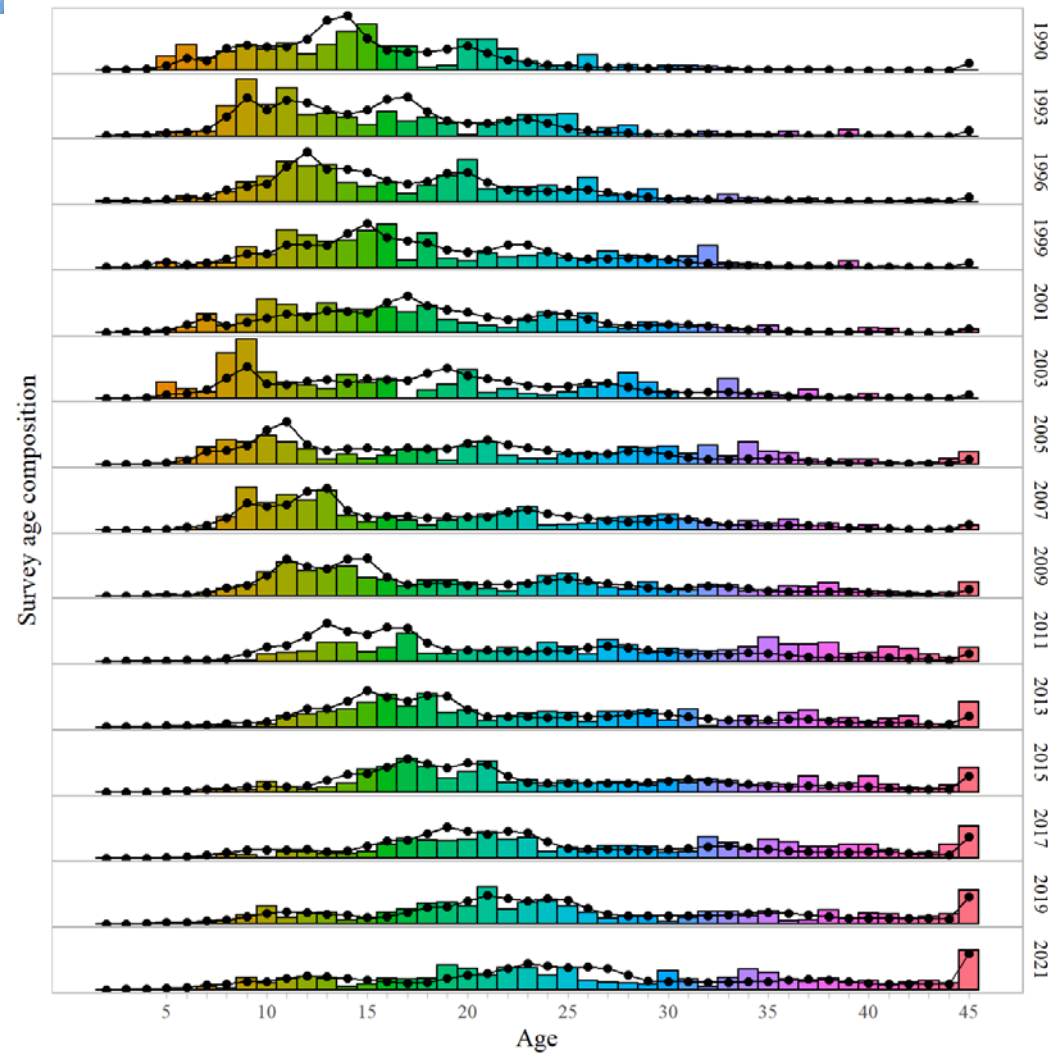
Model Fit - Catch



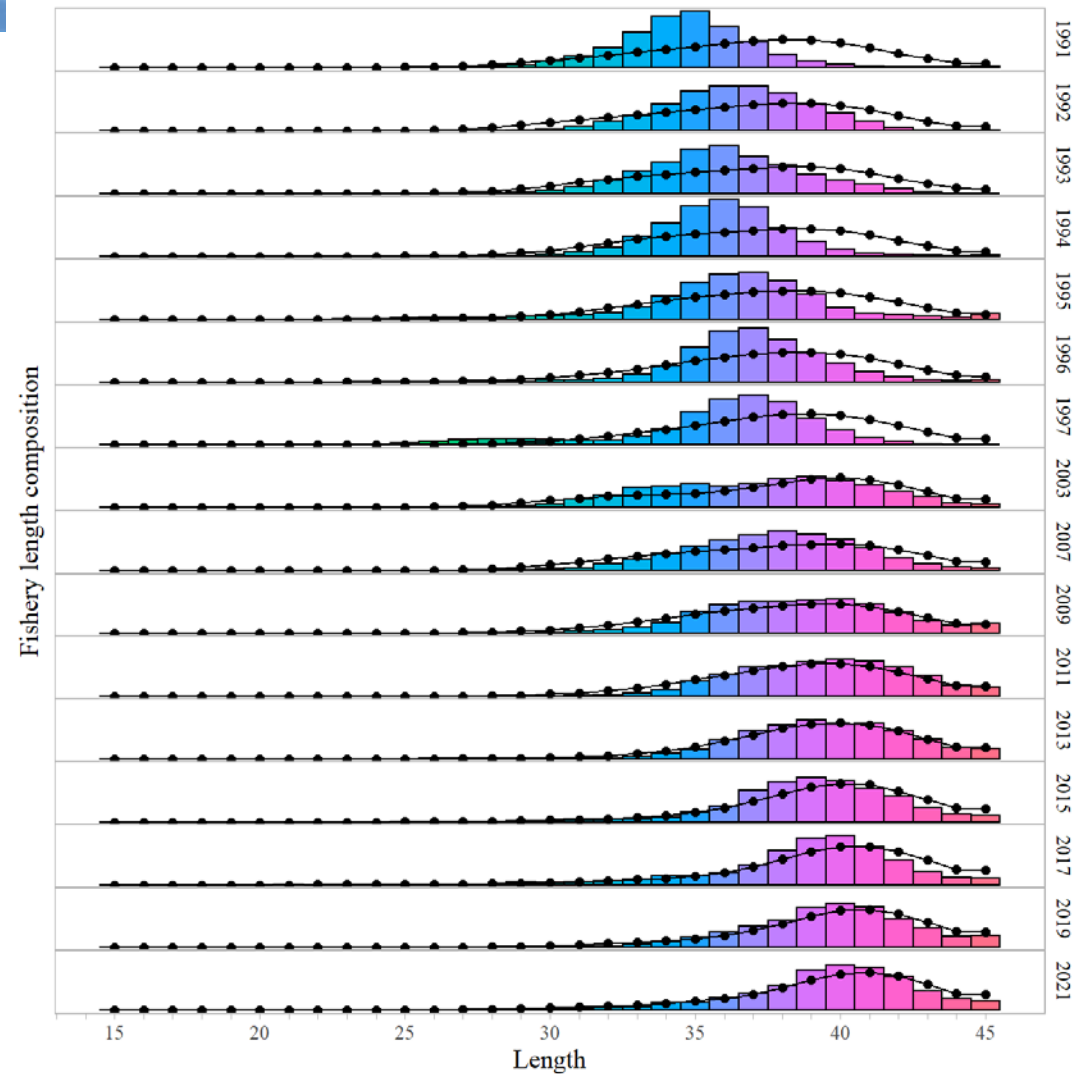
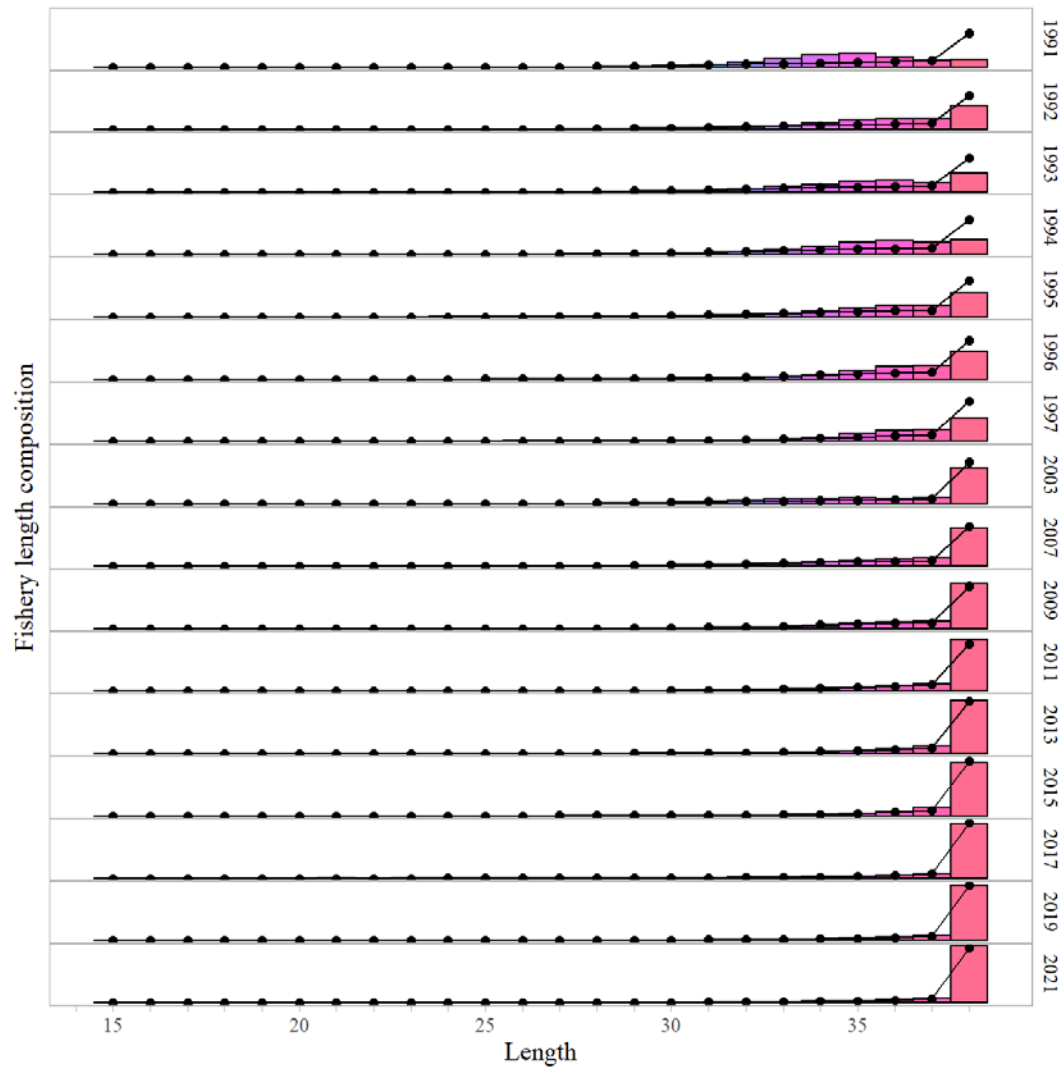
Model Fit – Fishery age comp



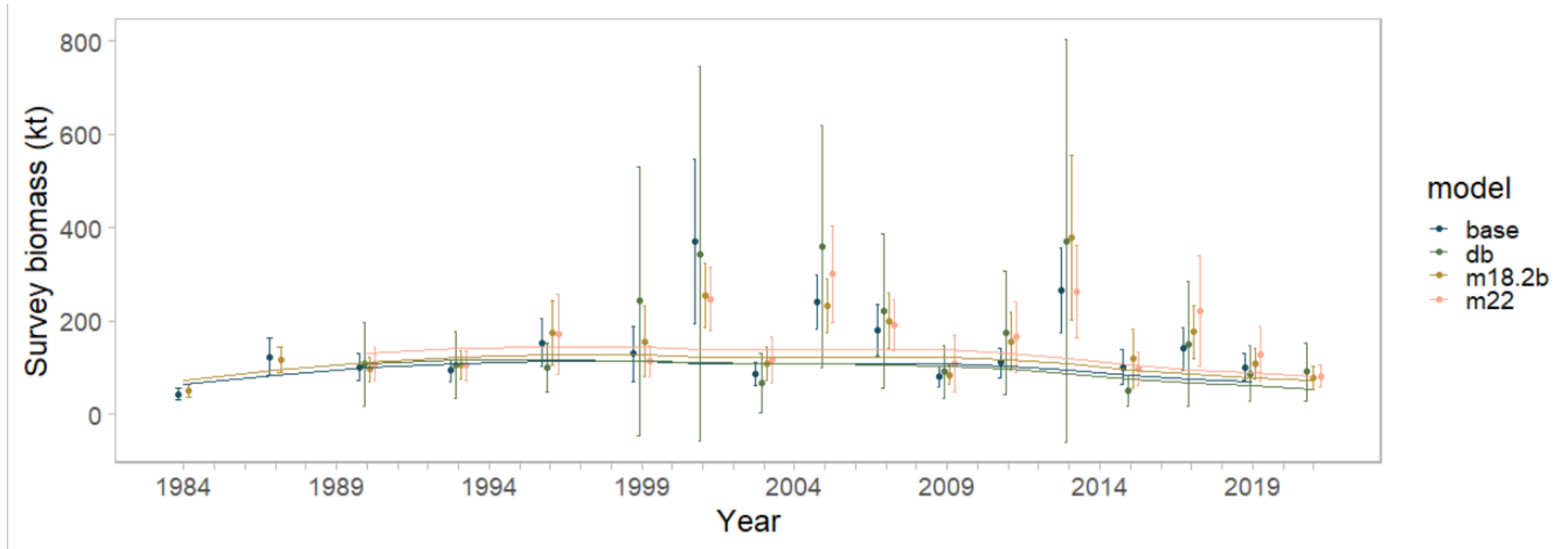
Model Fit – Survey age comp



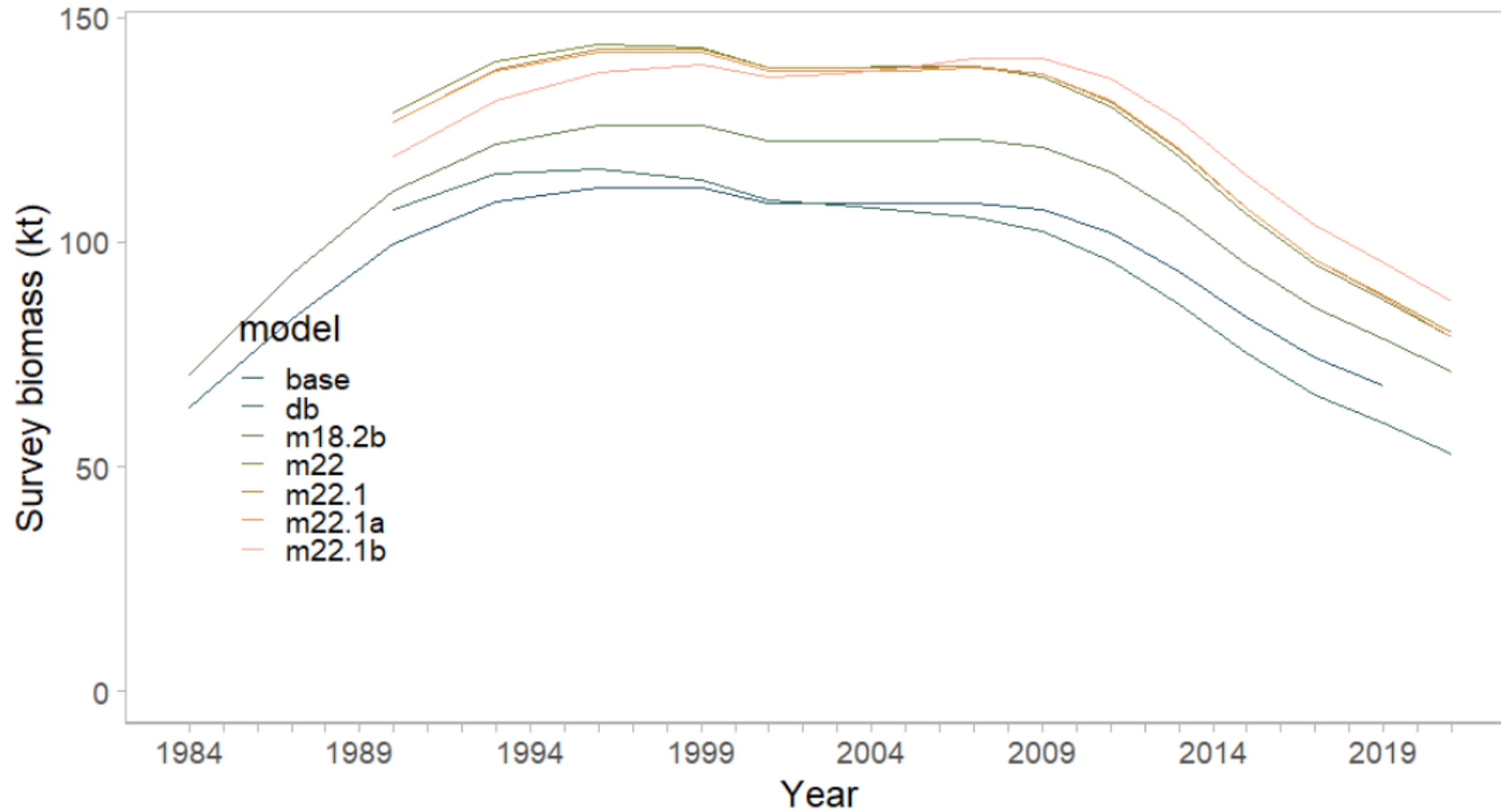
Model Fit – Fishery length comp



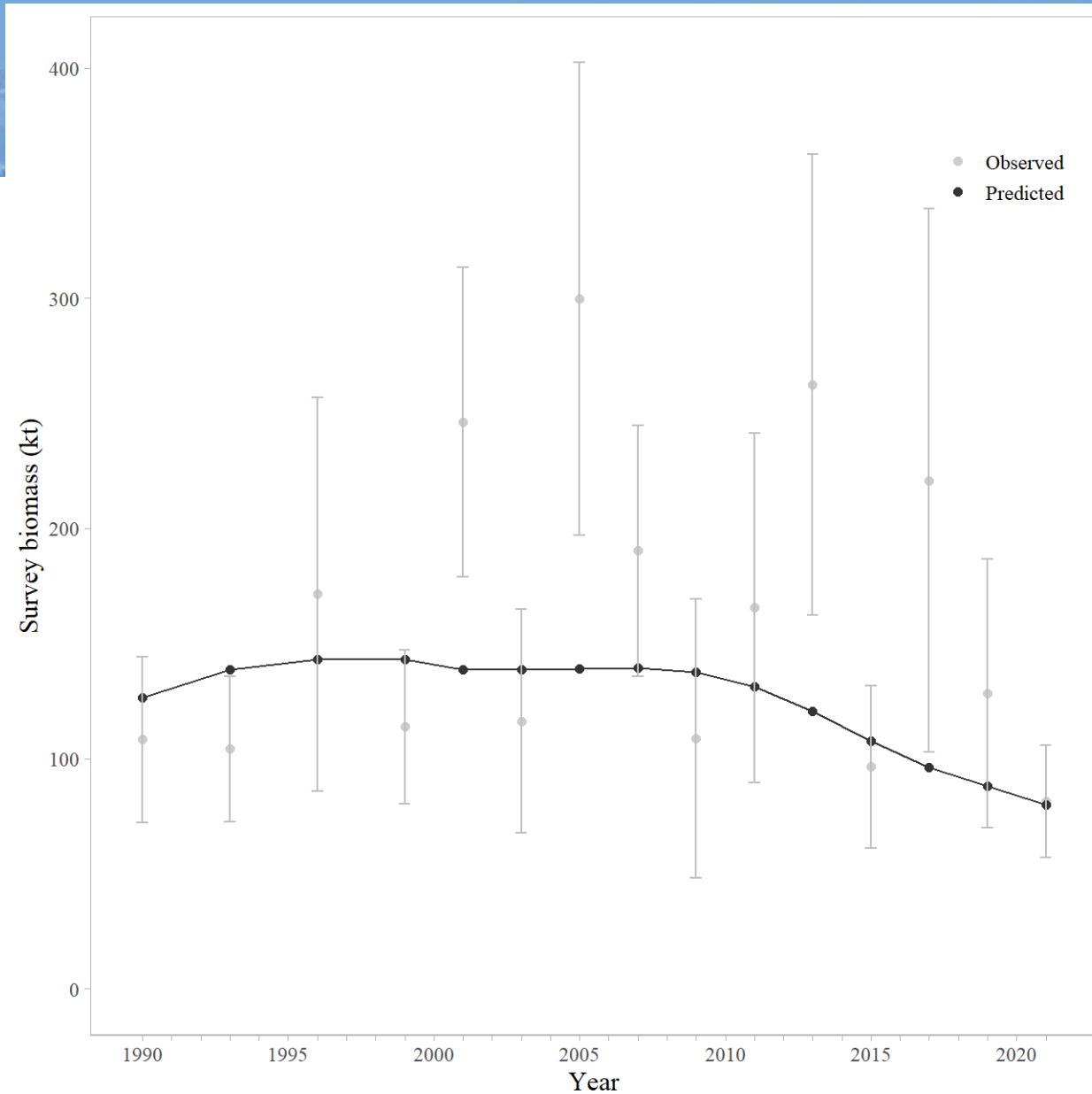
Survey - biomass



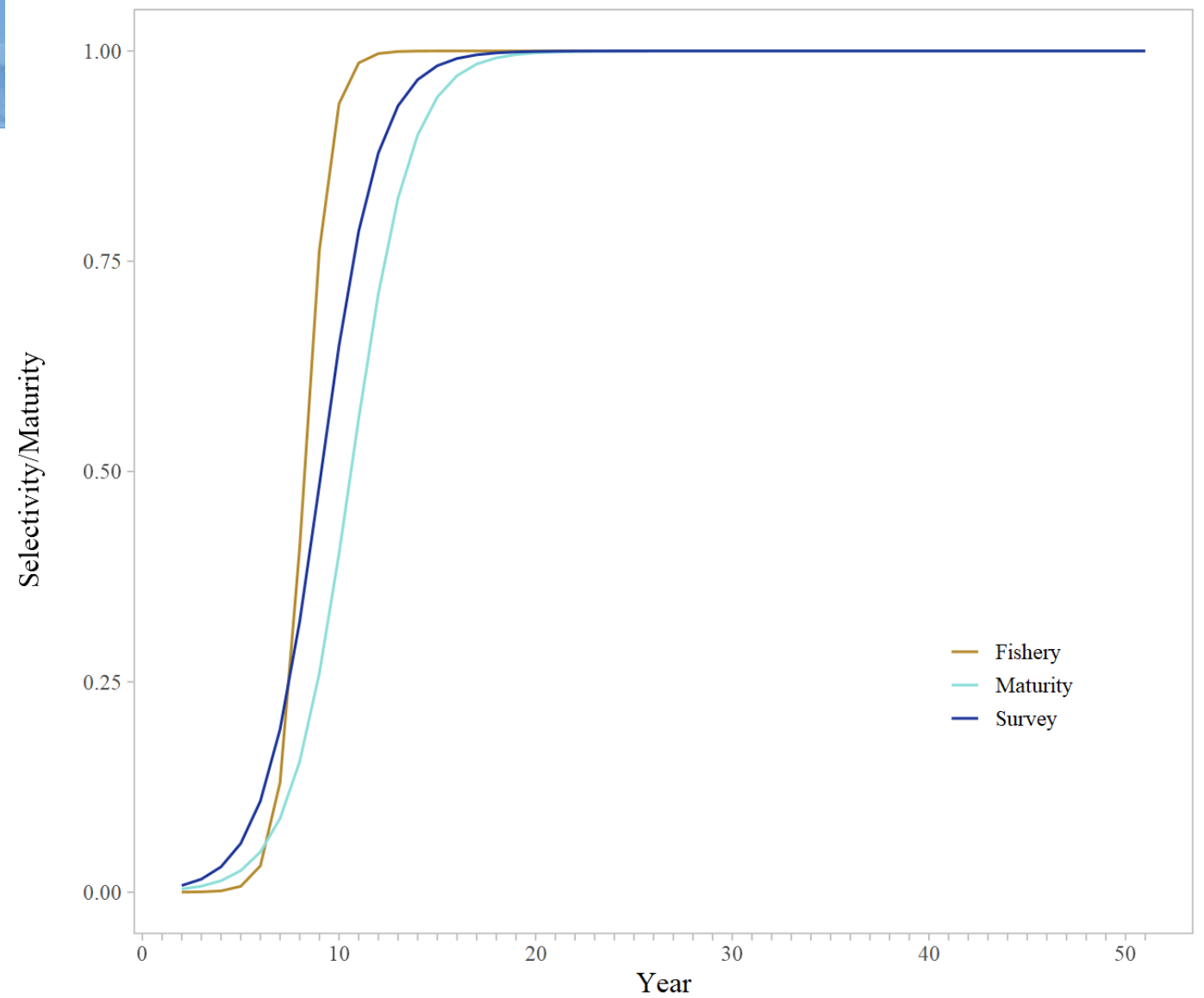
Survey - biomass



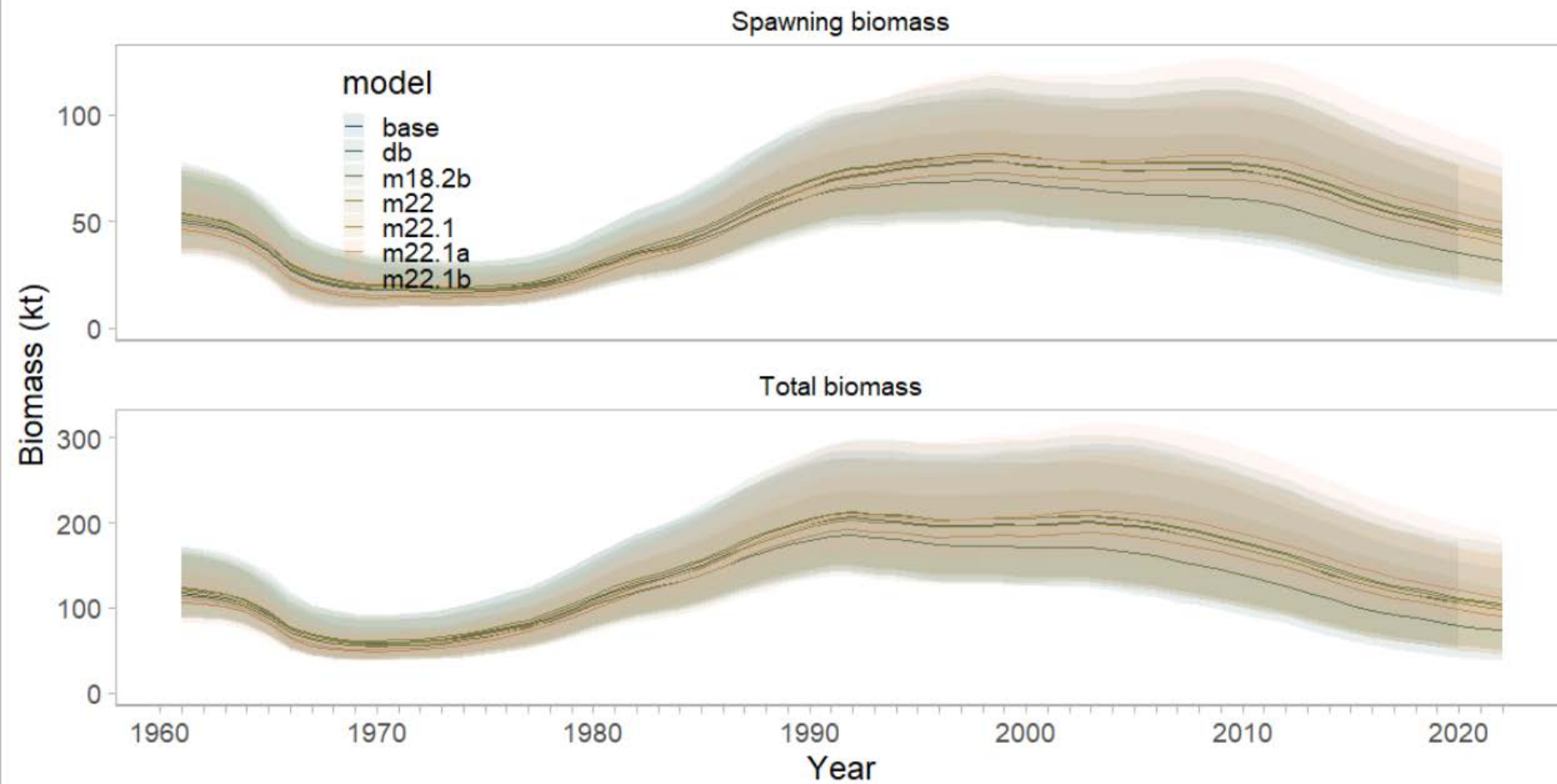
Survey - biomass



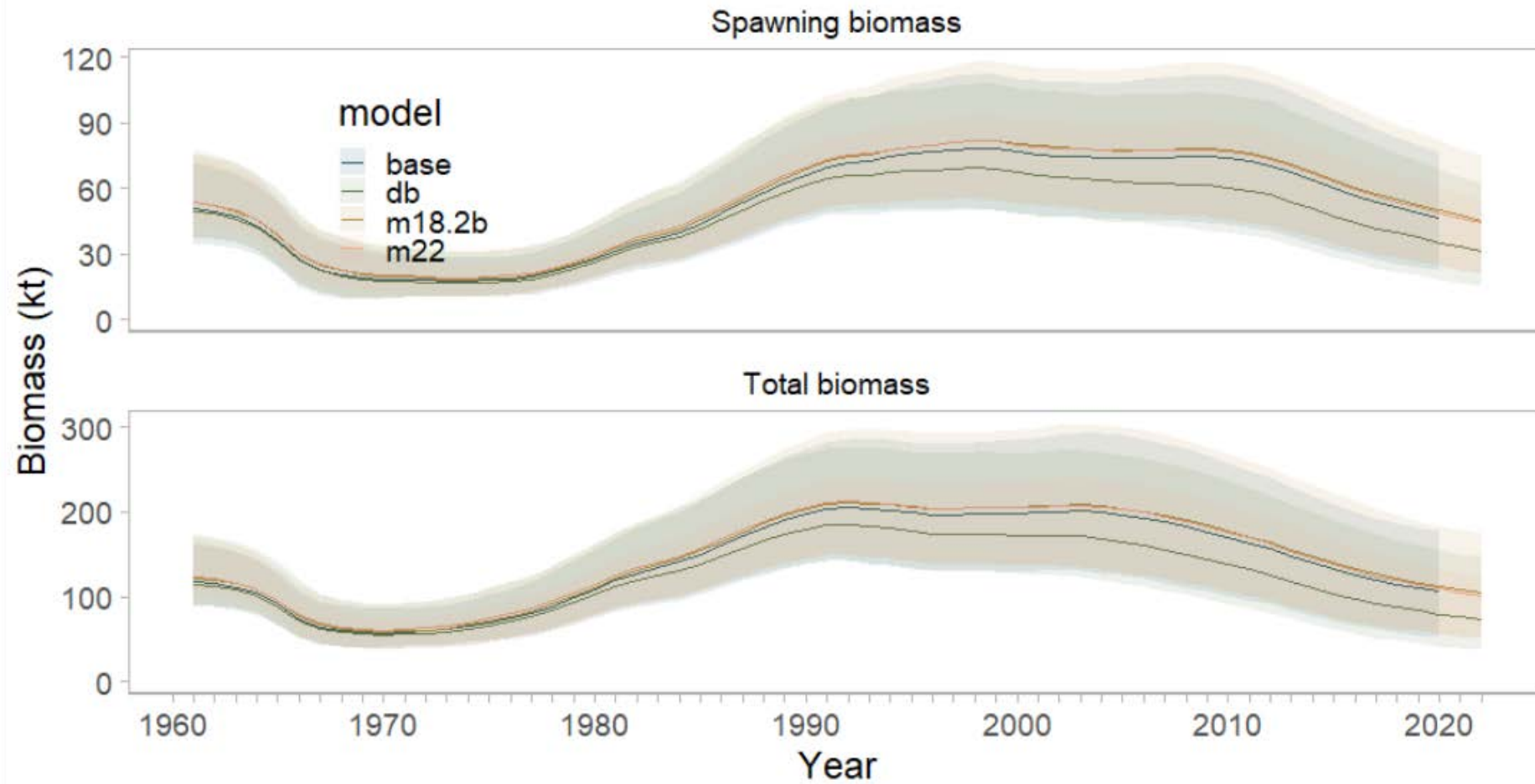
Model Fit - Selectivity



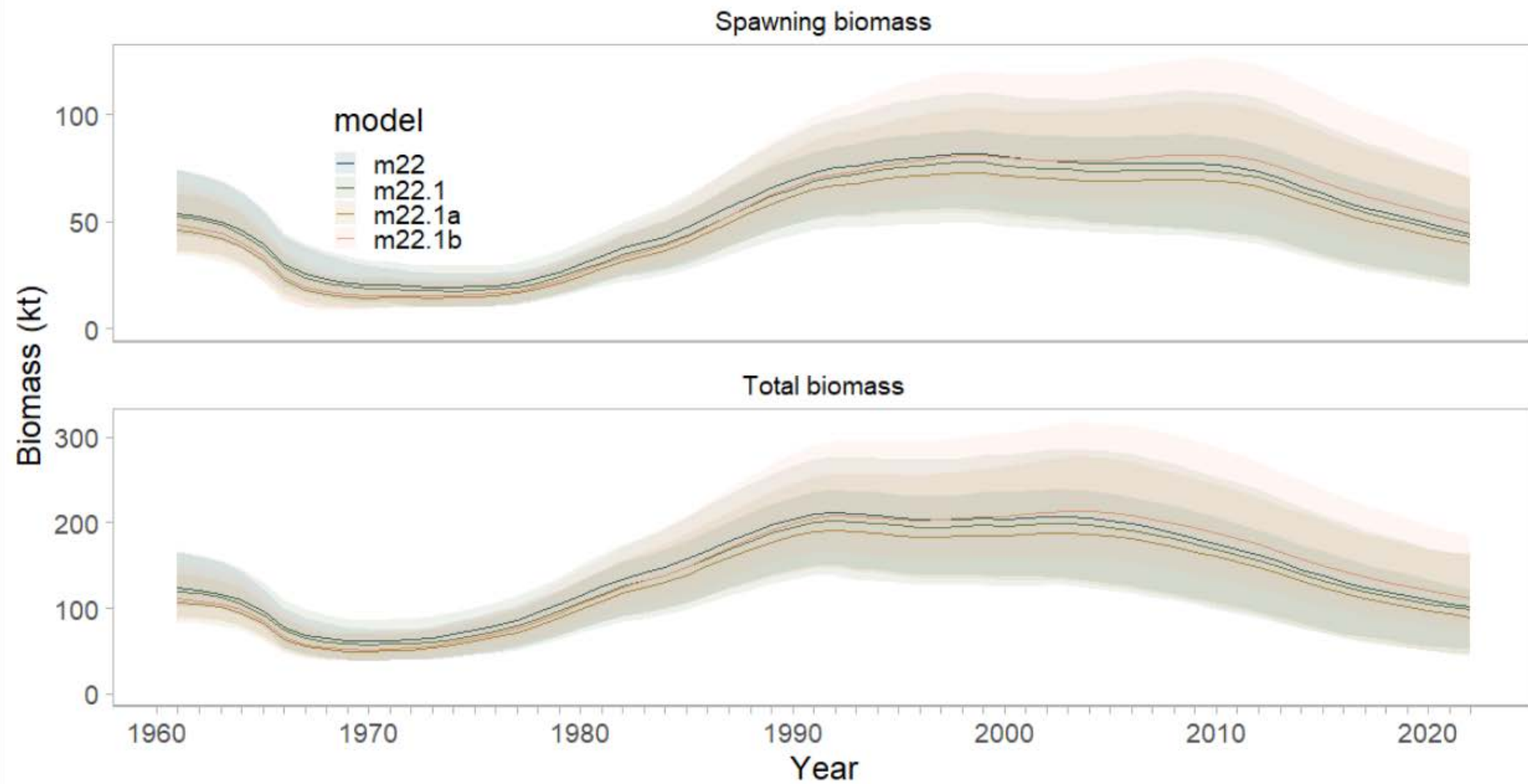
Biomass



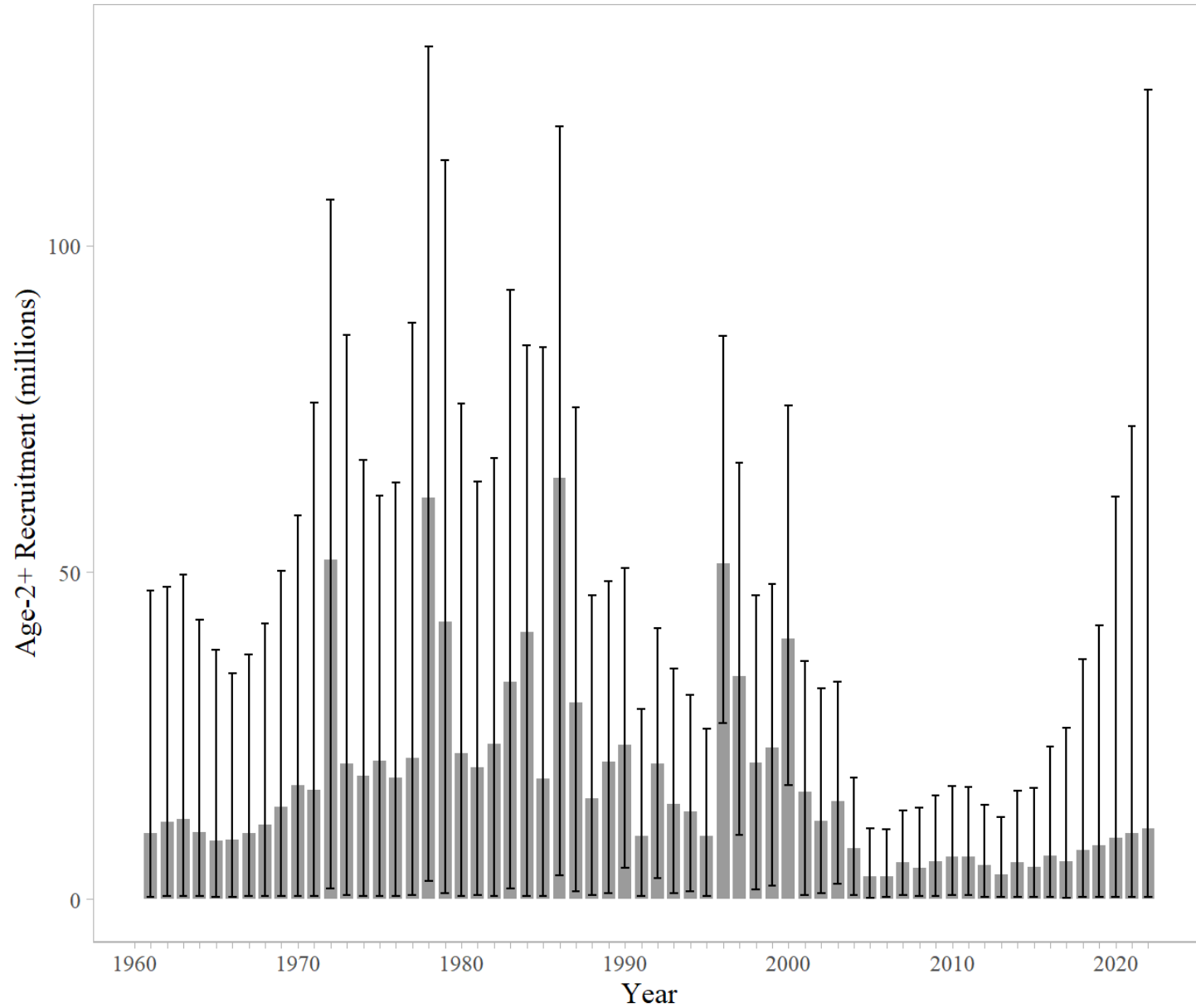
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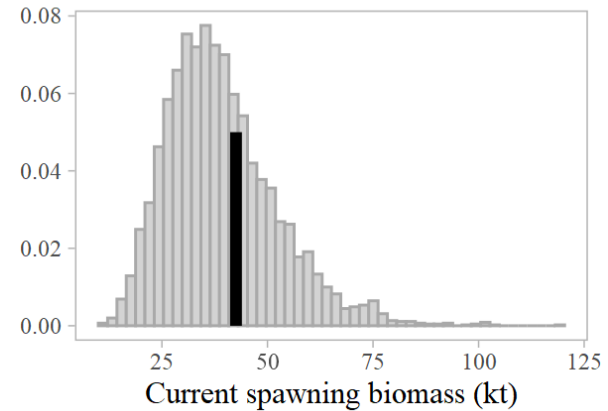
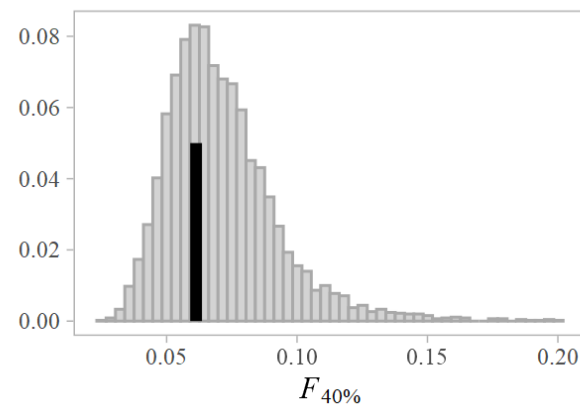
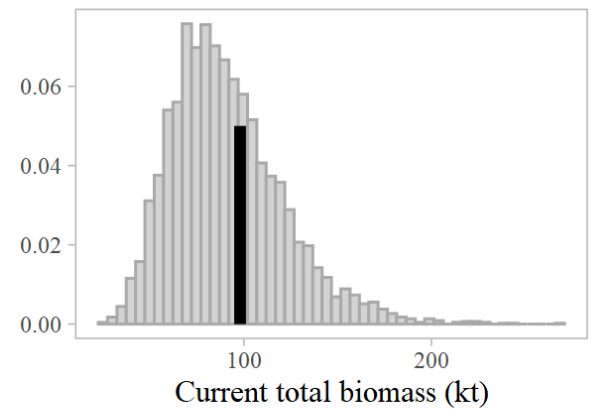
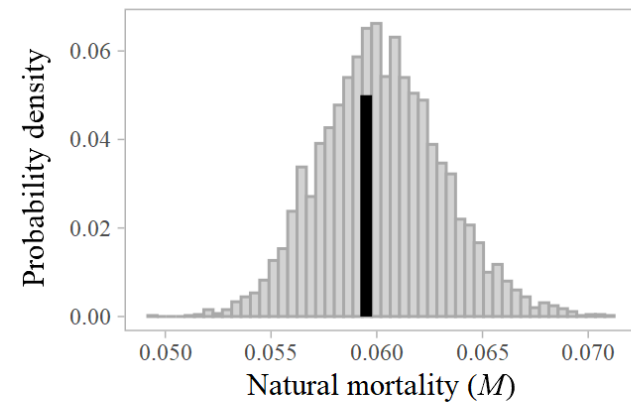
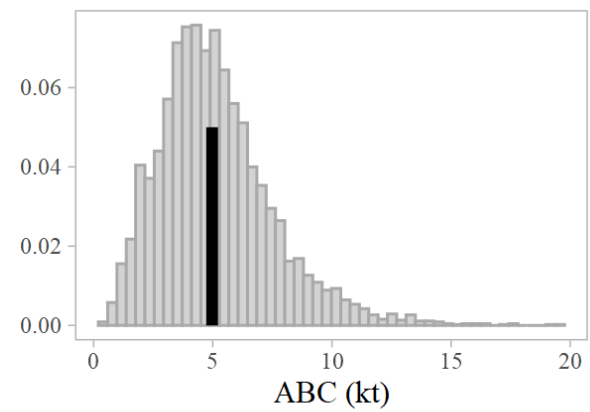
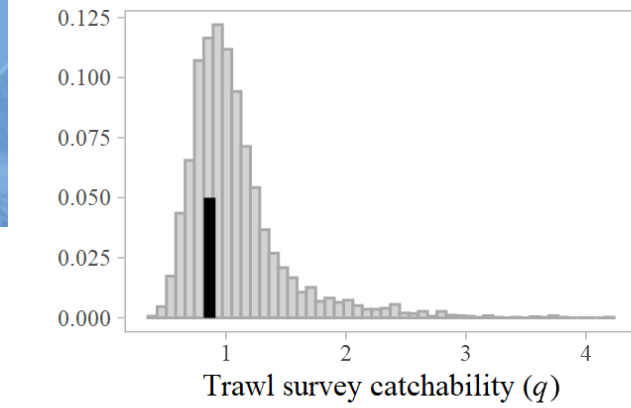
Biomass



Recruitment

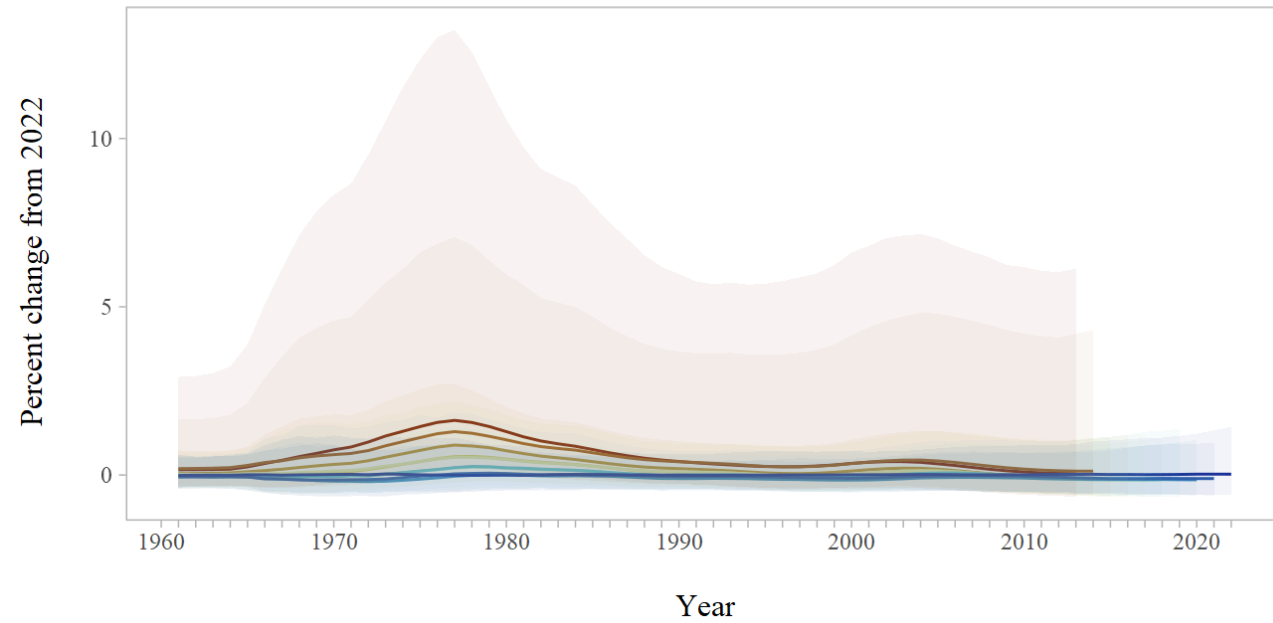
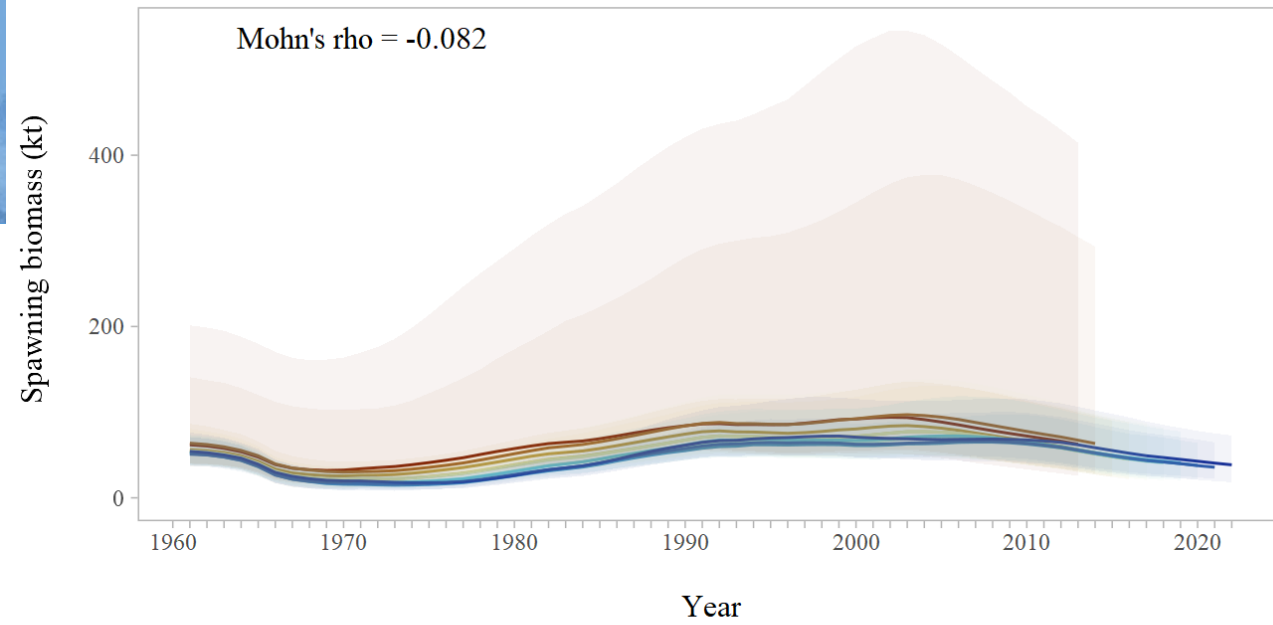


Parameters

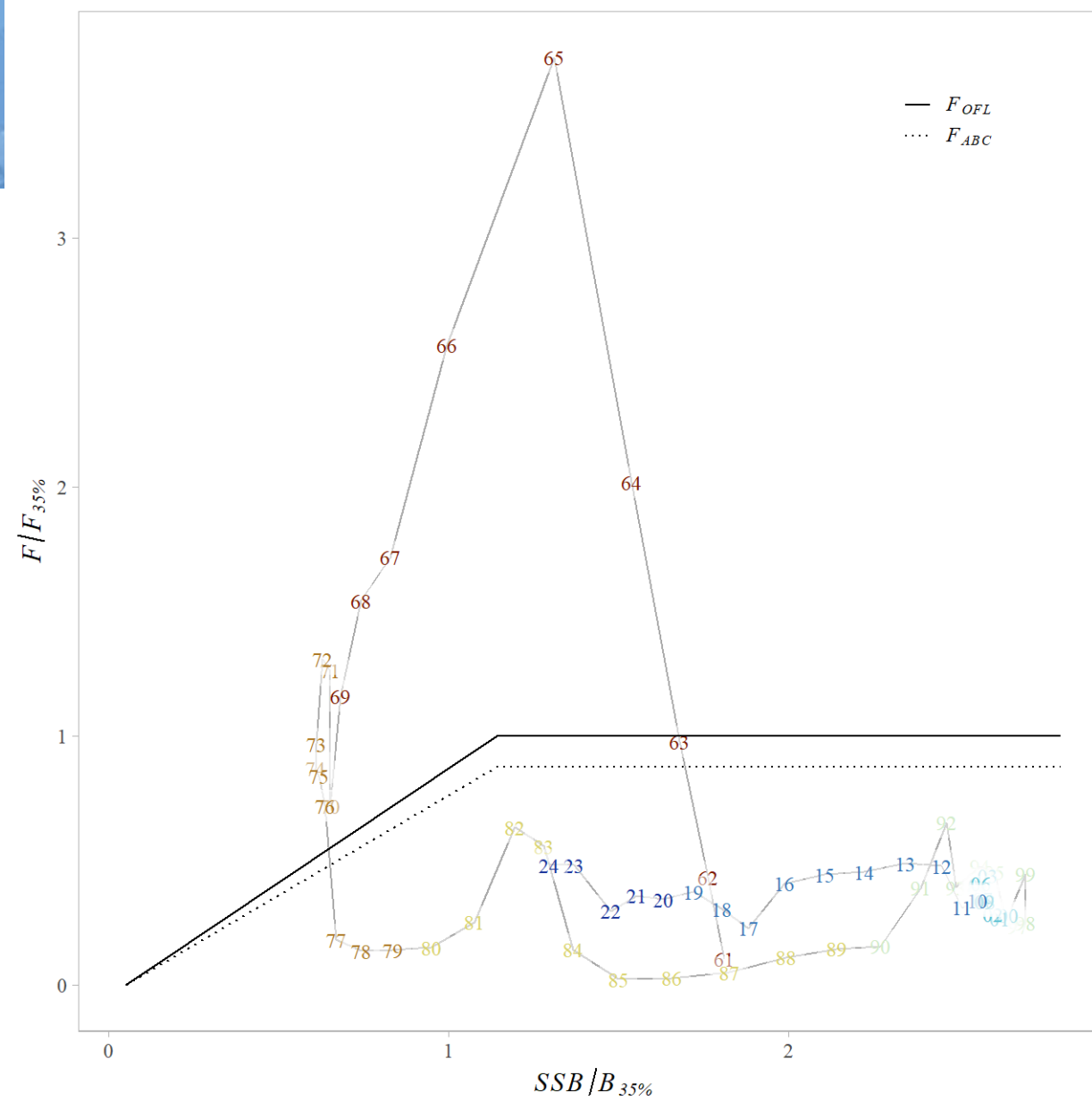


Likelihoods	base	m18.2b	m22	m22.1	m22.1a	m22.1b	db
Catch	0.126	0.098	0.083	0.091	0.173	0.246	0.0549
Survey biomass	11.504	11.041	6.148	6.022	6.023	22.268	2.399
Fishery ages	37.429	40.917	41.078	40.177	100.979	99.894	41.198
Survey ages	68.741	67.118	66.057	69.160	119.246	119.669	65.404
Fishery lengths	46.267	49.996	50.704	67.907	131.253	131.536	50.906
Maturity	23.501	23.501	23.501	23.501	23.501	23.501	23.501
Data	164.067	169.171	164.070	183.356	357.674	373.612	159.962
Penalties/Priors							
Recruitment devs	8.931	8.780	8.757	8.640	9.847	10.024	8.936
F regularity	5.601	5.499	5.471	5.457	5.942	6.074	5.435
M prior	0.067	0.062	0.020	0.014	0.012	0.048	0.011
q prior	0.374	0.255	0.099	0.052	0.015	0.096	0.171
Objective function	249.270	253.990	248.650	267.750	443.720	460.080	244.743
Parameter estimates							
# parameters	181	185	185	185	185	185	185
M	0.059	0.059	0.059	0.059	0.060	0.059	0.059
q	0.678	0.725	0.819	0.865	0.926	0.821	0.768
rec	3.487	3.515	3.530	3.504	3.409	3.465	3.42
F40	0.061	0.061	0.061	0.061	0.061	0.061	0.06
Projected total biomass	102,661	101,479	99,365	95,559	86,908	108,108	71,504
Projected spawning biomass	42,774	42,135	41,102	39,463	36,402	45,876	28,871
B100	84,832	85,282	83,815	82,350	78,318	89,078	69,952
B40	33,933	34,113	33,526	32,940	31,327	35,631	27,981
ABC	5,357	5,251	5,147	4,972	4,573	5,726	3,632

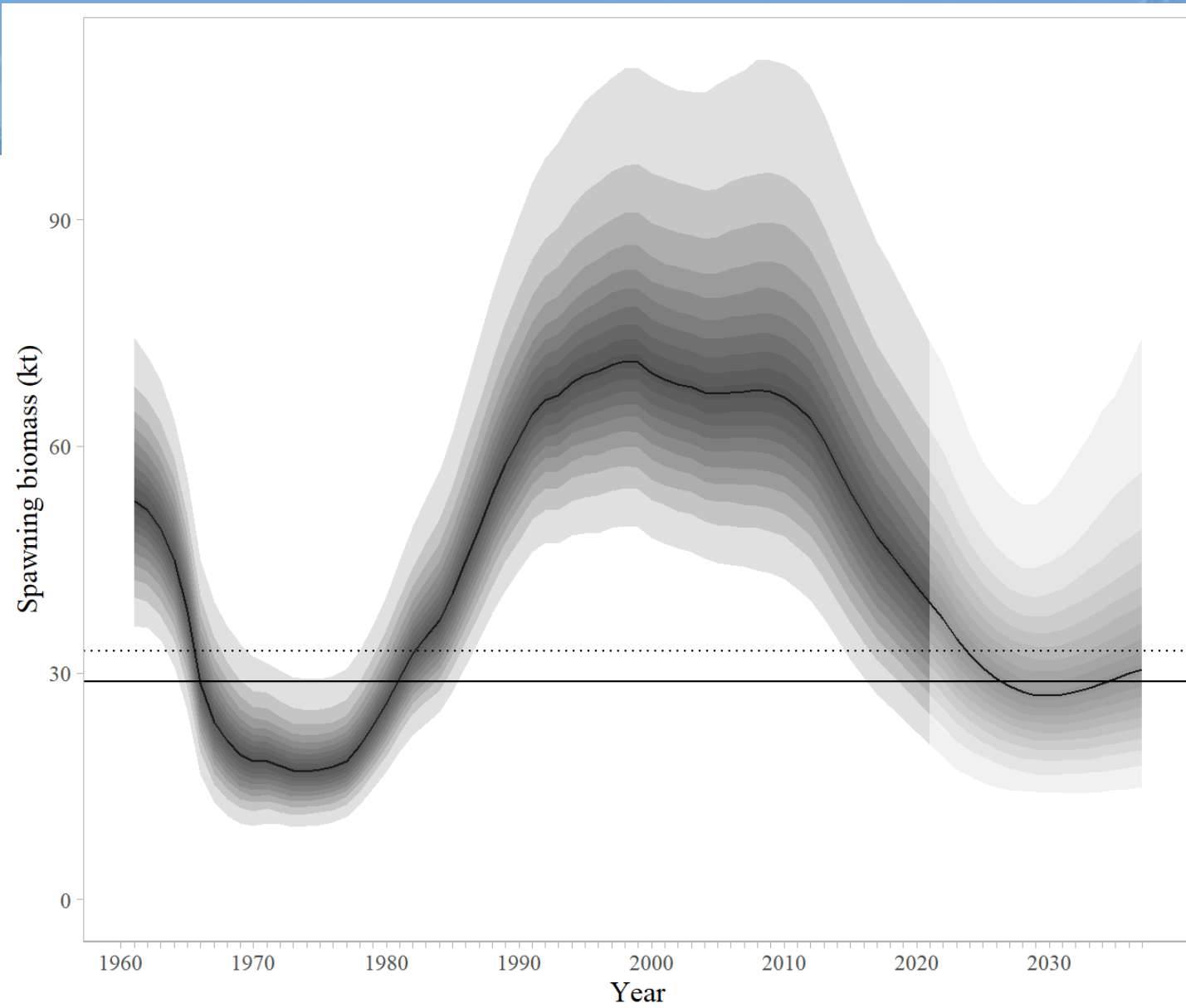
Retrospective



Phase Plane



Projection



Risk Table

Assessment-related considerations	Population dynamics considerations	Environmental/ ecosystem considerations	Fishery Performance
Level 1: No increased concerns	Level 2: Substantially increased concerns	Level 1: No increased concerns	Level 1: No increased concerns

Assessment – Changing from a design-based model to a VAST-based estimate has made the survey biomass estimates more realistic (less overall fluctuation) though the model continues to fit these data poorly.

Population dynamics – consistent low recruitment, skip spawning has been observed for this stock, levels unknown

Environmental - environmental mechanisms for changes in survival and productivity of dusky rockfish remain unknown, though indication that structural epifauna habitat may be decreasing

Fishery performance - catches are well below ABC

Harvest Recommendation

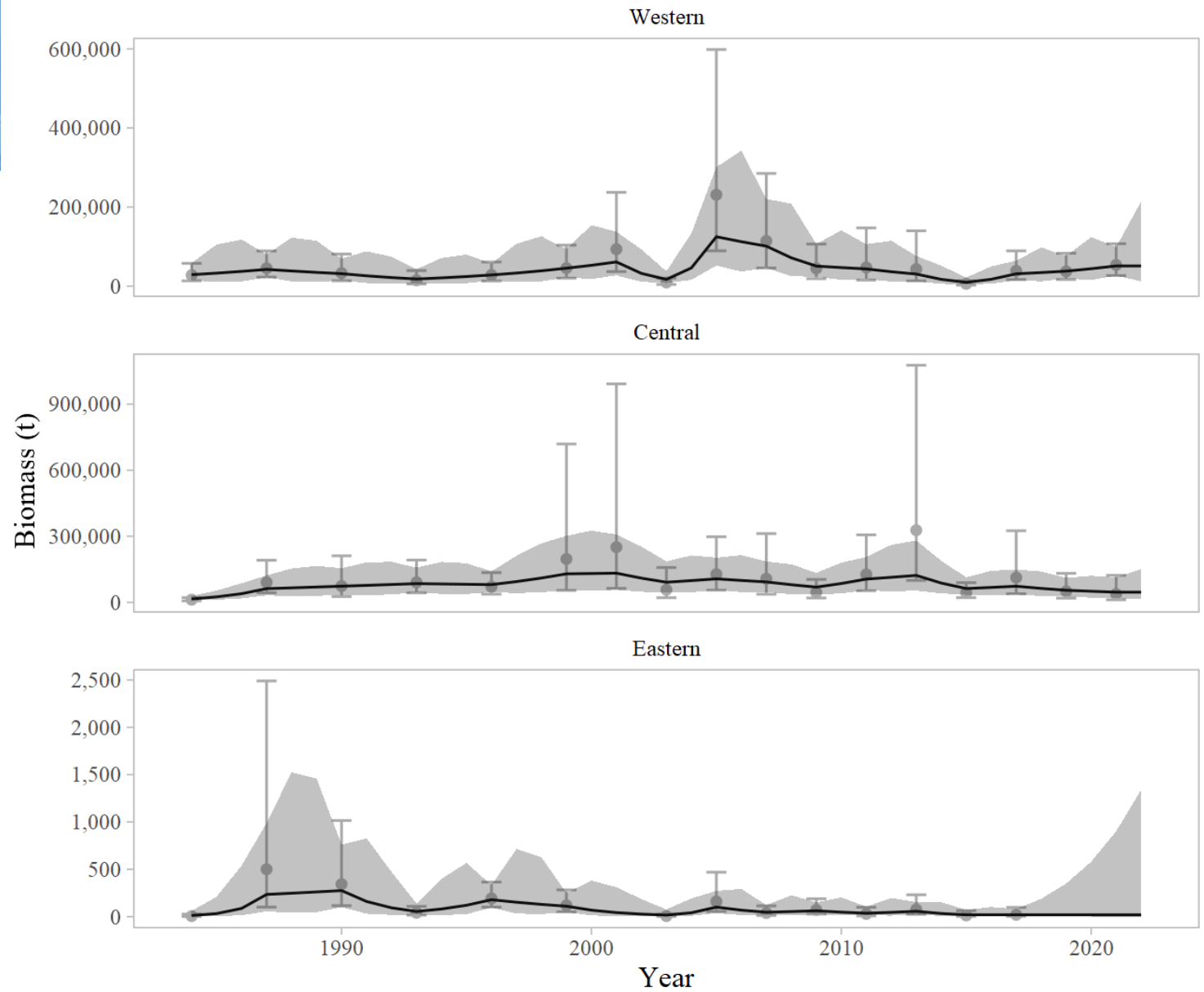
	As estimated or specified last year for:		As estimated or recommended this year for:	
	2022	2023	2023*	2024*
Quantity/Status				
M (natural mortality)	0.059	0.059	0.059	0.059
Tier	3a	3a	3a	3a
Projected total (age 2+) biomass (t)	100,371	96,045	95,452	93,022
Projected female spawning biomass (t)	40,474	37,408	39,445	37,470
$B_{100\%}$	84,832	84,832	82,350	82,350
$B_{40\%}$	33,933	33,933	32,940	32,940
$B_{35\%}$	29,691	29,691	28,822	28,822
F_{OFL}	0.073	0.073	0.074	0.074
$\max F_{ABC}$	0.061	0.061	0.061	0.061
F_{ABC}	0.061	0.061	0.061	0.061
OFL (t)	6,143	5,874	5,927	5,661
$\max ABC$ (t)	5,147	4,921	4,965	4,742
ABC (t)	5,147	4,921	4,965	4,742
	As determined last year for:		As determined this year for:	
Status	2021	2022	2022	2023
Overfishing	No	n/a	No	n/a
Overfished	n/a	No	n/a	No
Approaching overfished	n/a	No	n/a	No

Apportionment

Western 37.76% → 52.65%

Central 62.22% → 47.33%

Eastern 0.02% → 0.02%



Apportionment

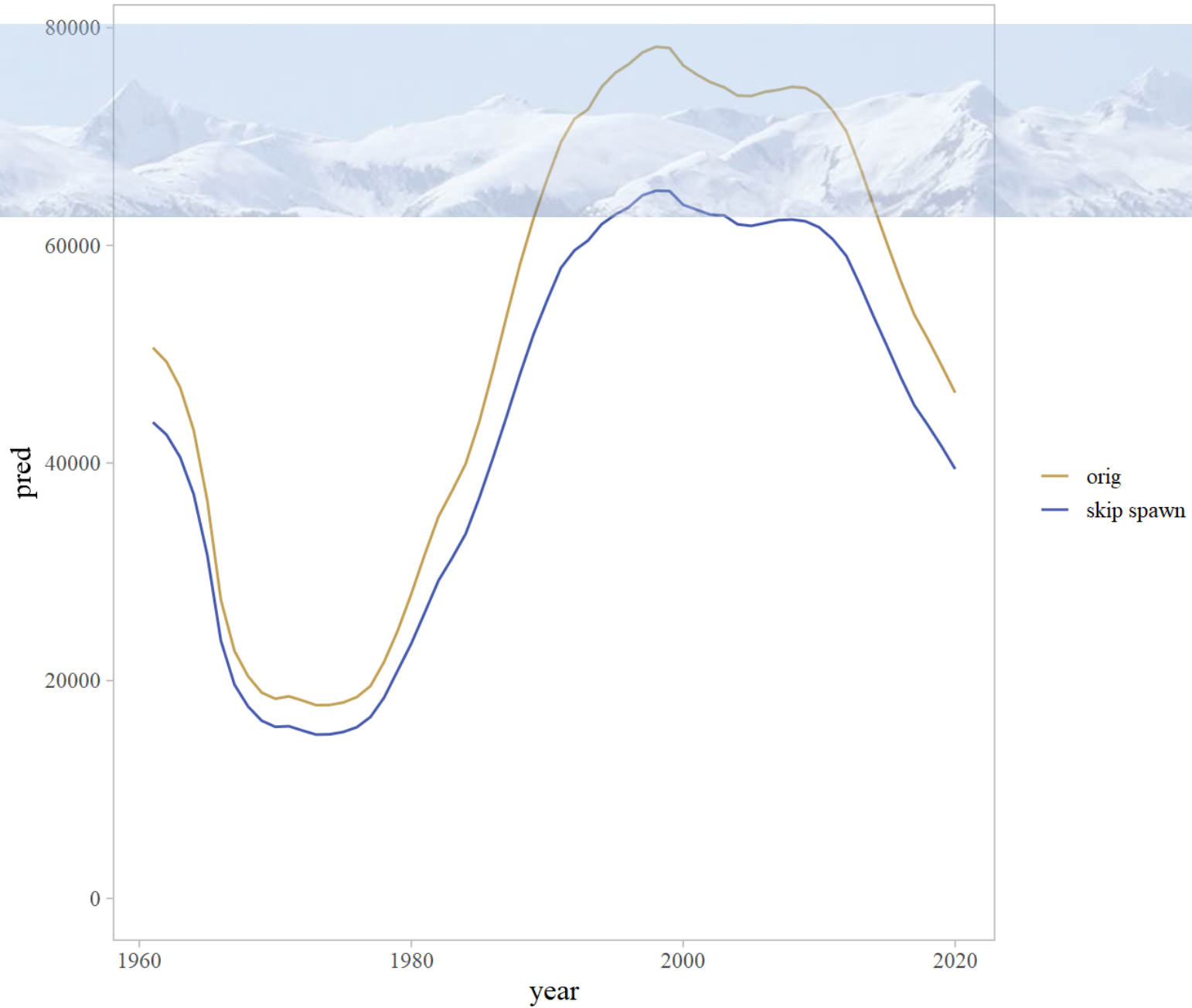
		Western	Central	Eastern ¹	Total
Area	Apportionment	52.65%	47.33%	0.02%	100%
2023	ABC (t)	2,614	2,350	1	4,965
2023	OFL (t)				5,927
2024	ABC (t)	2,497	2,244	1	4,742
2024	OFL (t)				5,661

¹For management purposes the small ABC in the Eastern area is combined with the Other Rockfish complex.

Conclusions

- Recommendation
 - Increase length plus group (model 22.1)
- Data Gaps and Future Research Priorities
 - We have no information on larval, post-larval, or early-stage juvenile northern rockfish
 - Habitat requirements are either unknown or anecdotal – research to identify HAPC
 - Aging is a continual issue (challenging to age well)
 - Reproductive biology is poorly understood, though skip spawning has been observed – the spatial and temporal extent of skip spawning should be a research priority
 - Exploration of data weighting, possibly the inclusion of a variance inflation parameter to increase the variance on VAST estimated trawl surveys

Maturity



Of note - PSC

Species Group	2018	2019	2020	2021	2022
Bairdi Tanner Crab	321	64	1,146	2,279	180
Blue King Crab	0	0	0	0	0
Chinook Salmon	336	410	655	1,042	1,116
Golden (Brown) King Crab	324	223	60	114	136
Halibut	100	115	111	179	128
Herring	0	2	0	0	1
Non-Chinook Salmon	325	380	723	1,628	4,002
Opilio Tanner (Snow) Crab	0	0	0	0	0
Red King Crab	0	0	0	0	0

A photograph of a harbor at sunset. The sun is low on the horizon, casting a bright orange glow across the sky and reflecting on the water. Several boats are docked along a pier on the left, and a large building is visible in the background. The sky is filled with wispy clouds.

QUESTIONS?

CONTACT:

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