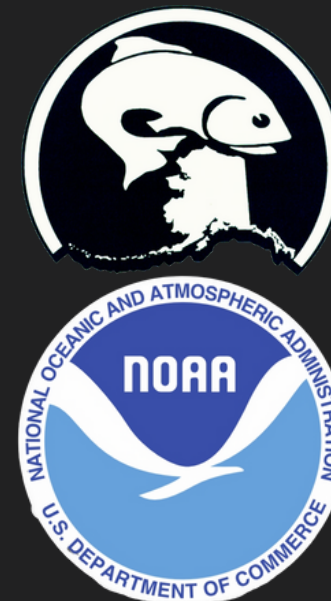


Flathead Sole GOA Plan Team



Nov 2022

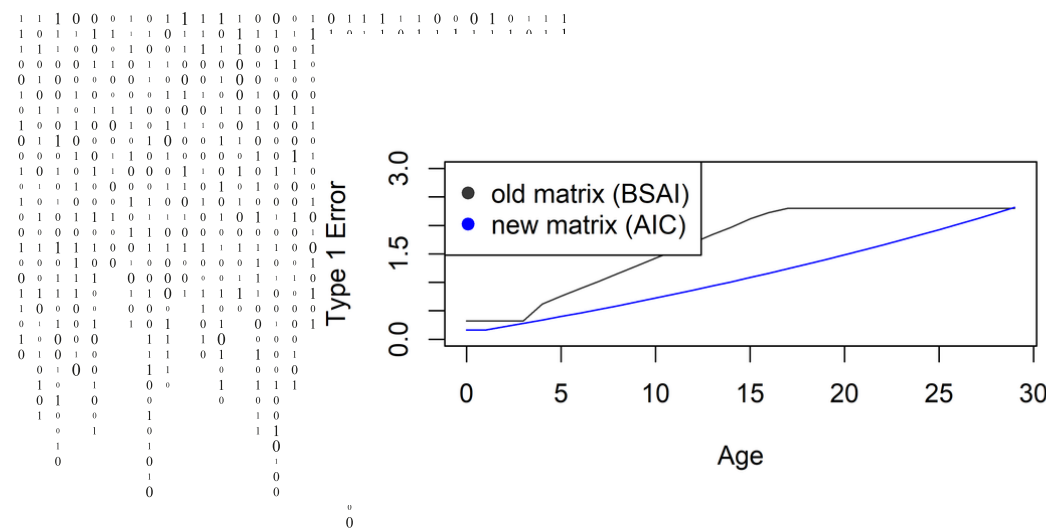
Maia Sosa Kapur
Cole Monnahan

Stock Overview

GOA
Flathead Sole
(*Hippoglossoides
elassodon*)

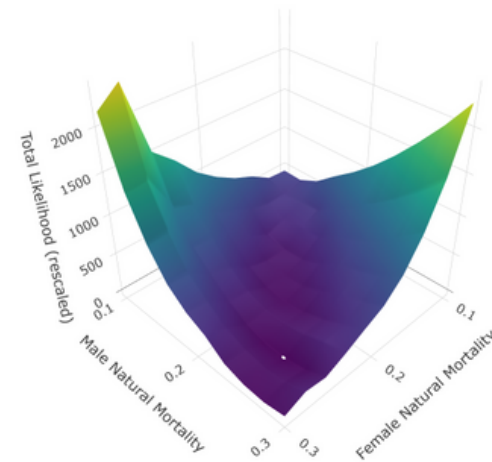
Tier	3a
Area	GOA (mostly Central and Western)
Status	Not overfished/no overfishing
Changes	Model structure: none Update: input data ageing error matrix software platform

SSC/CIE Comments



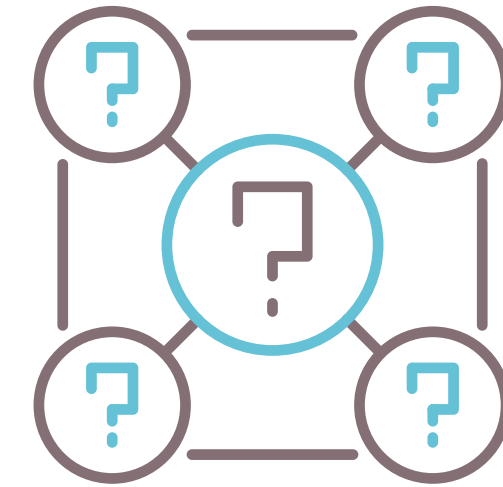
Update Ageing Error Matrix

Punt et al. (2008)



Explore M and q

2d likelihood profiles



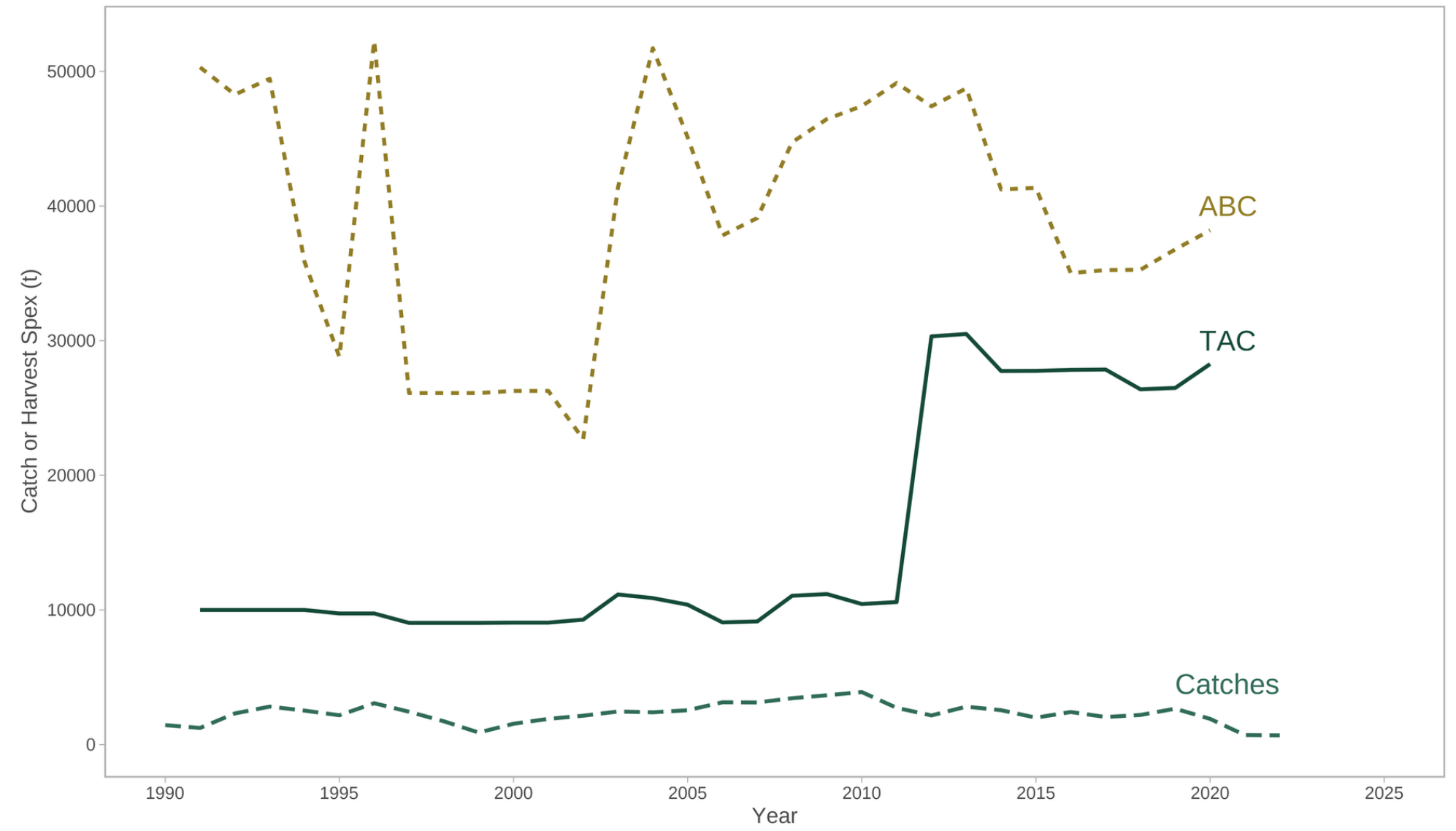
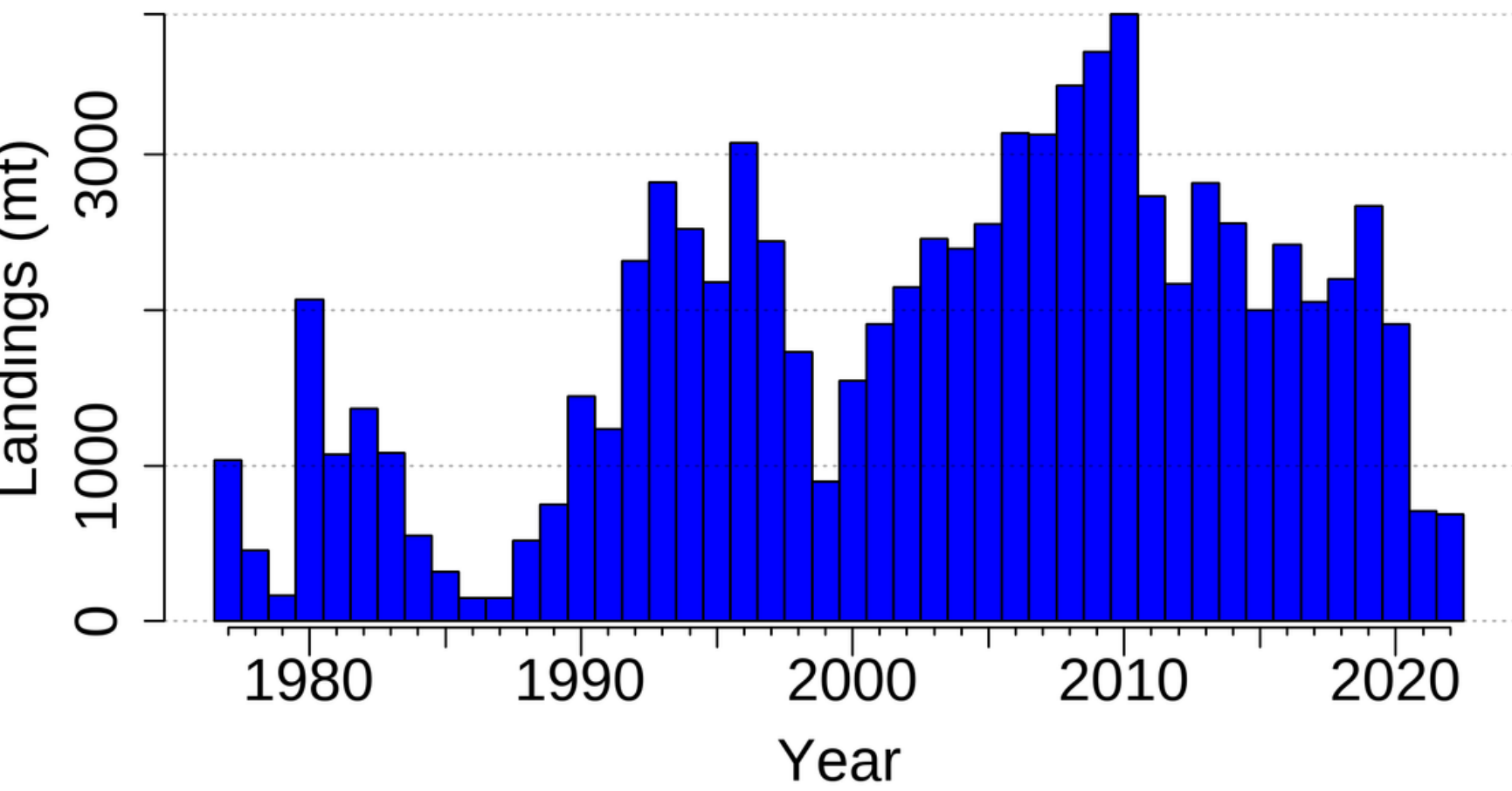
Explore/quantify scientific uncertainty

R0 profiles
Explore sensitivities and data weighting

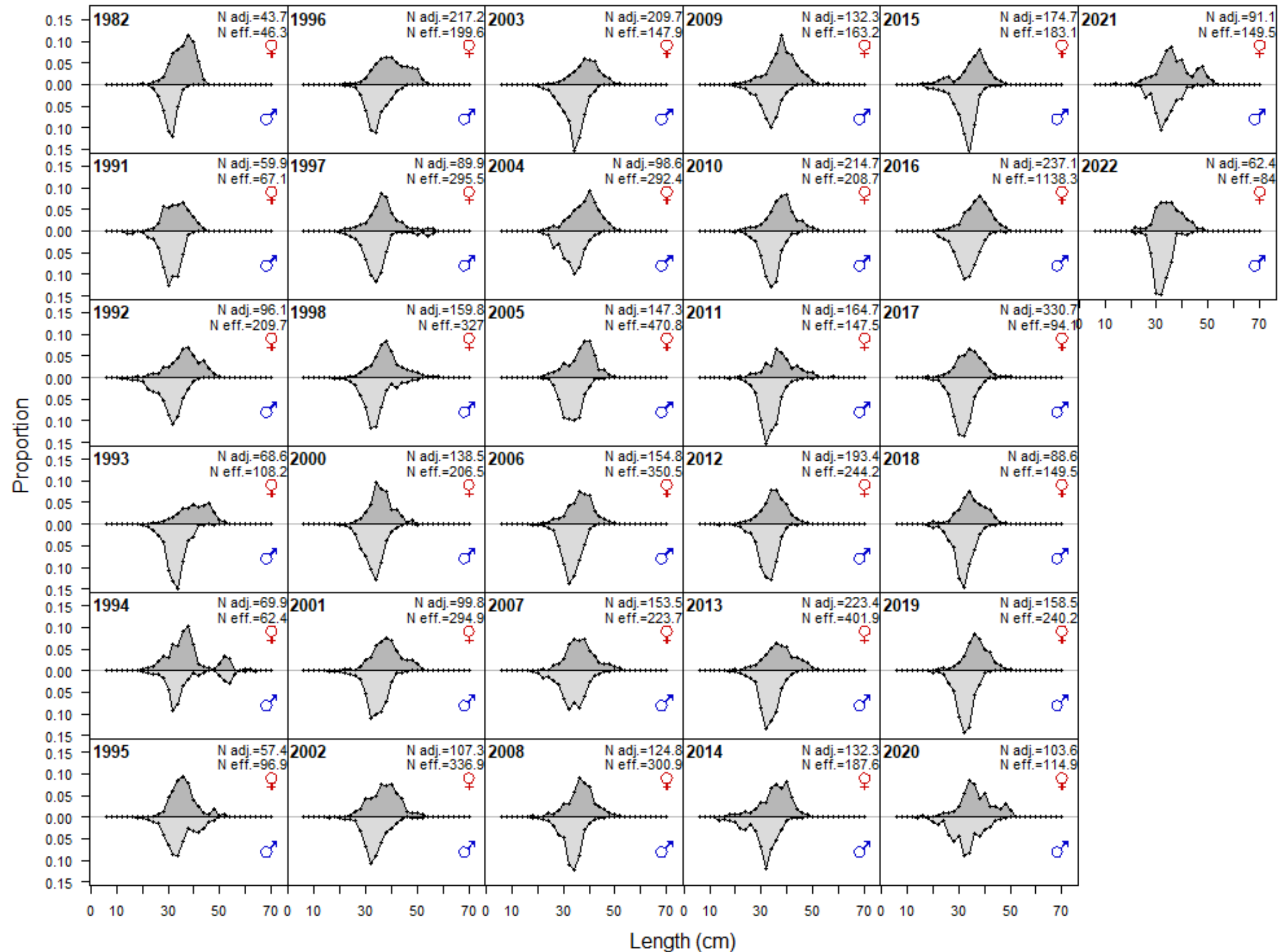
Data Summary

Source	Data	Years
U.S. trawl fishery	Catch biomass	1977-2022
	Catch length composition	1982, 1991, 1992, 1993, 1994, 1995, 1996, 1997, 1998, 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019, 2020, 2021, 2022
GOA bottom trawl survey	Survey biomass	1984-1999 (triennial), 2001-2021 (biennial)
	Survey length composition	1984-1999 (triennial), 2001-2021 (biennial)
	Survey age composition, conditioned on length	1990, 1993, 1996, 1999, 2001, 2003, 2005, 2007, 2009, 2011, 2013, 2015, 2017, 2019, 2021

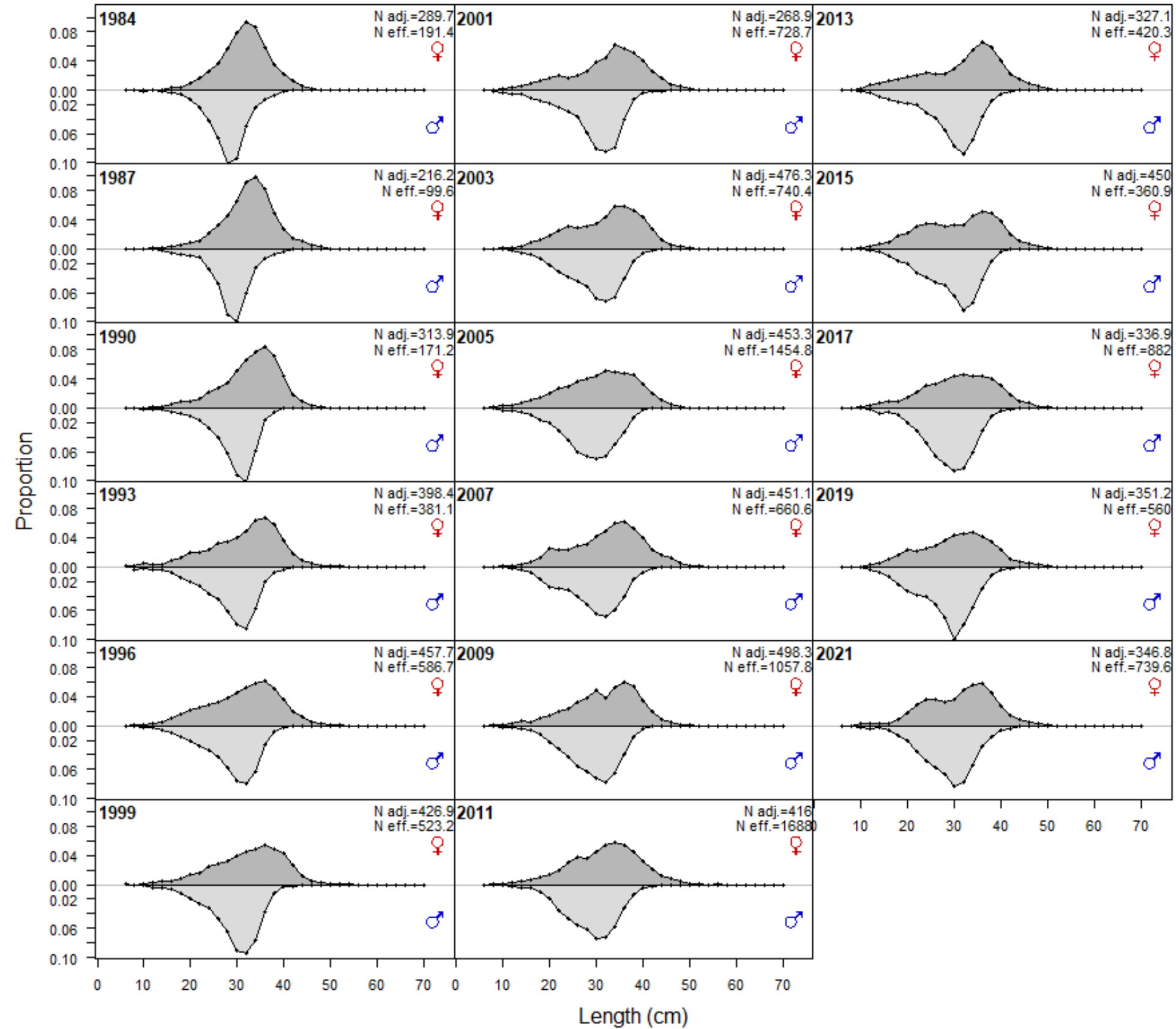
Catches



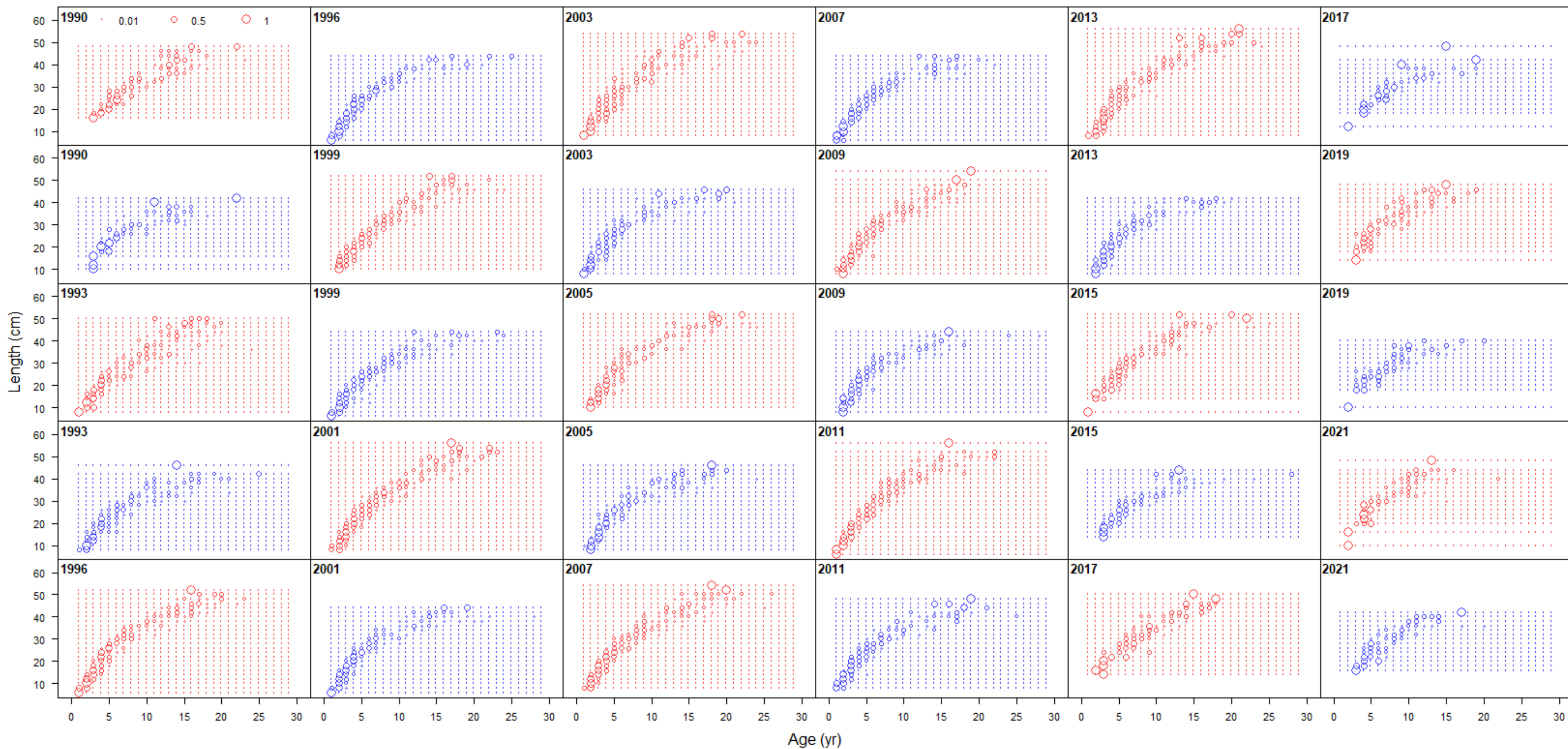
Fishery Length Composition Data



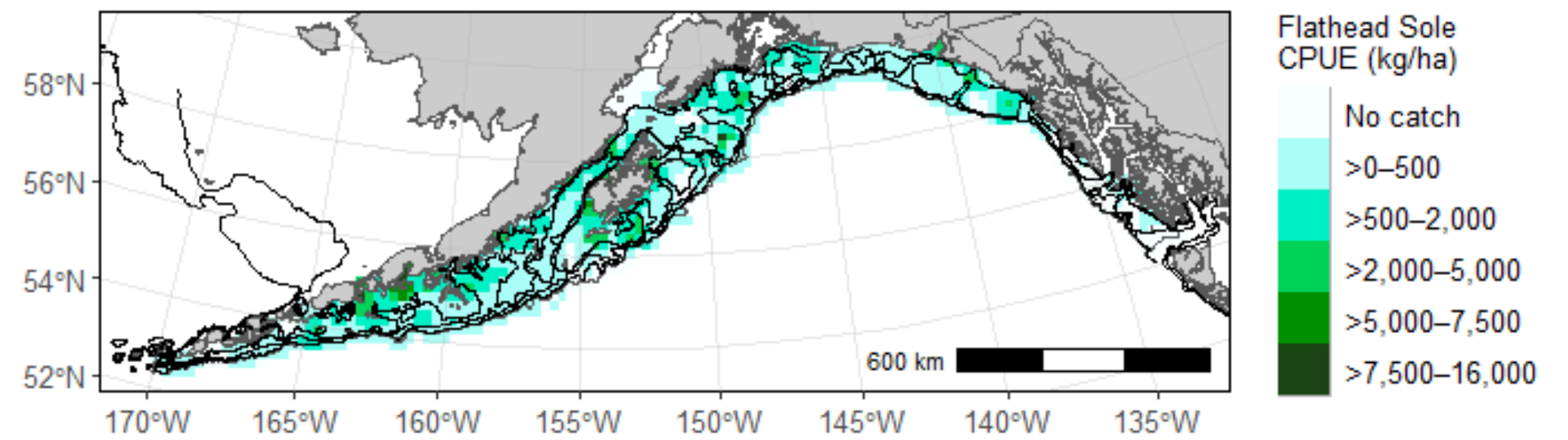
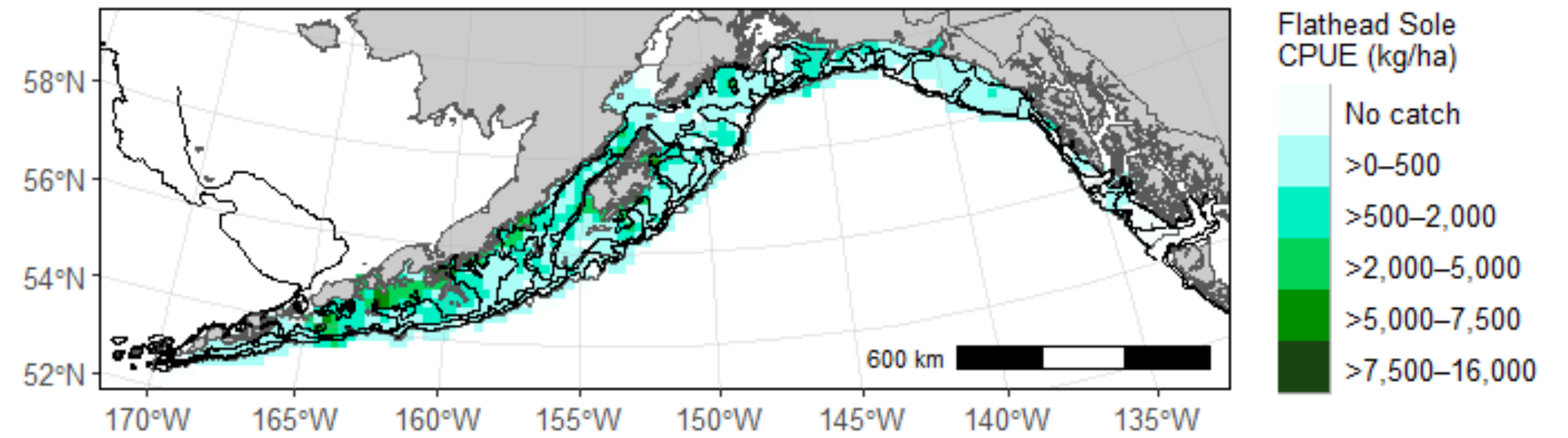
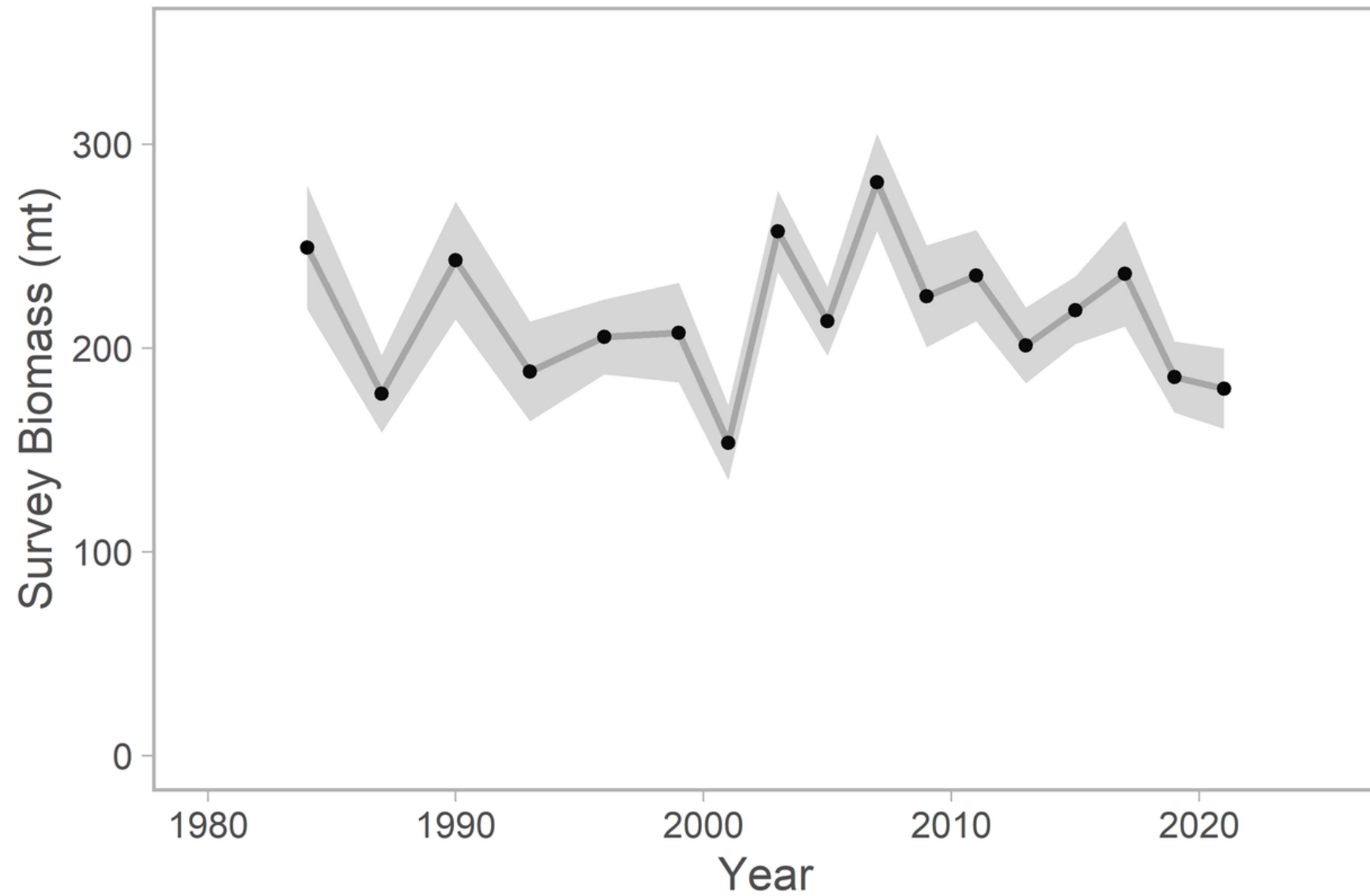
Survey Length Composition Data



Survey CAAAL data



GOA Trawl Survey Data



Model Summary

No changes
from 2017
(Turnock et. al.)

Software Bridged from SSv3.24 to SSv3.30.17

General Split-sex, age structured (29+)
Logistic age selex
Logistic maturity

Approach Bridge to new SS version
Add in new data & ageing error matrix
Update M-I weights
Profiles
Sensitivities
Projections

Model Results

From Model 17.1a (2022) - Links to extra sensitivity runs are in document

Model fits

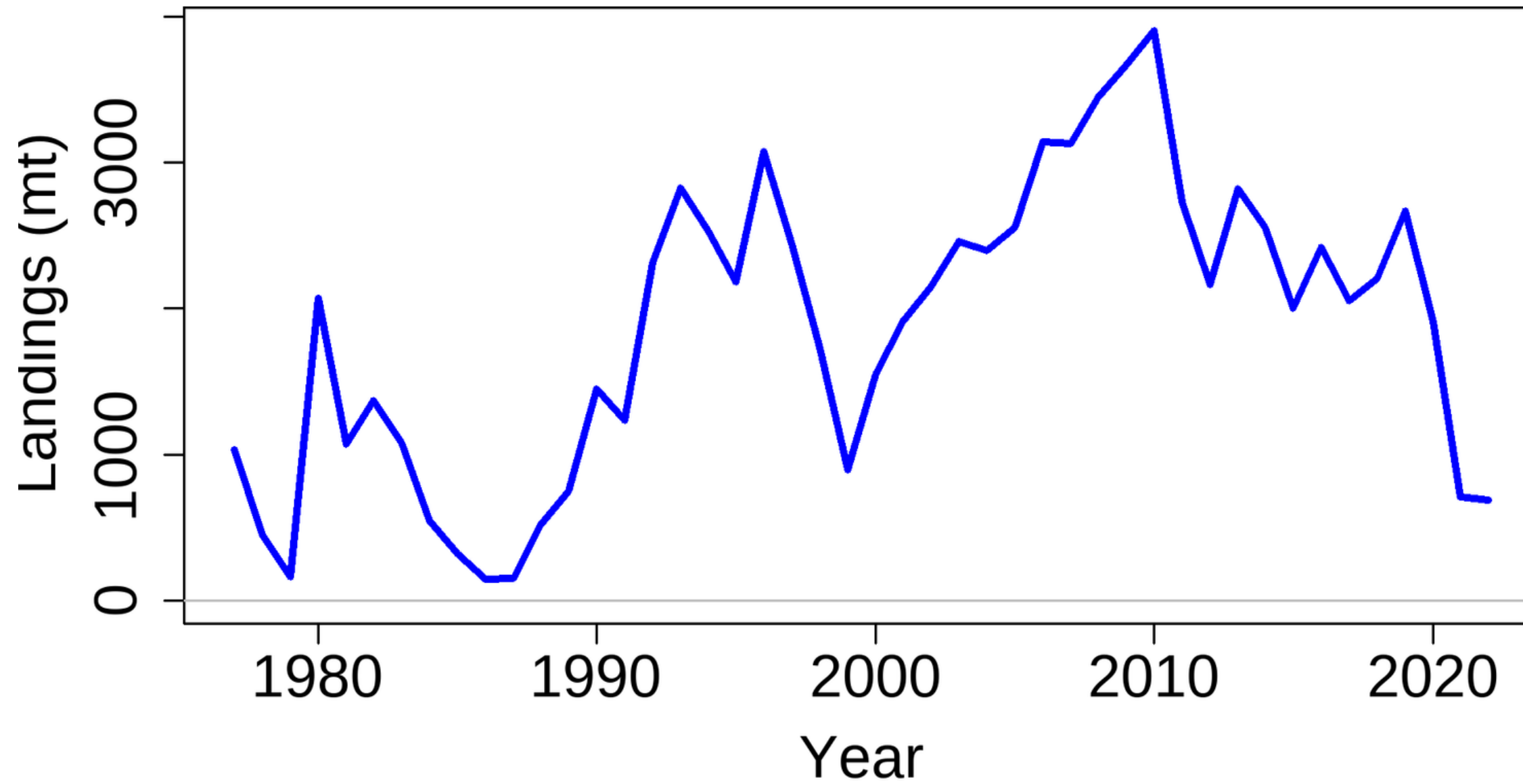
Parameters & Derived Quants

Retrospectives, sensitivities

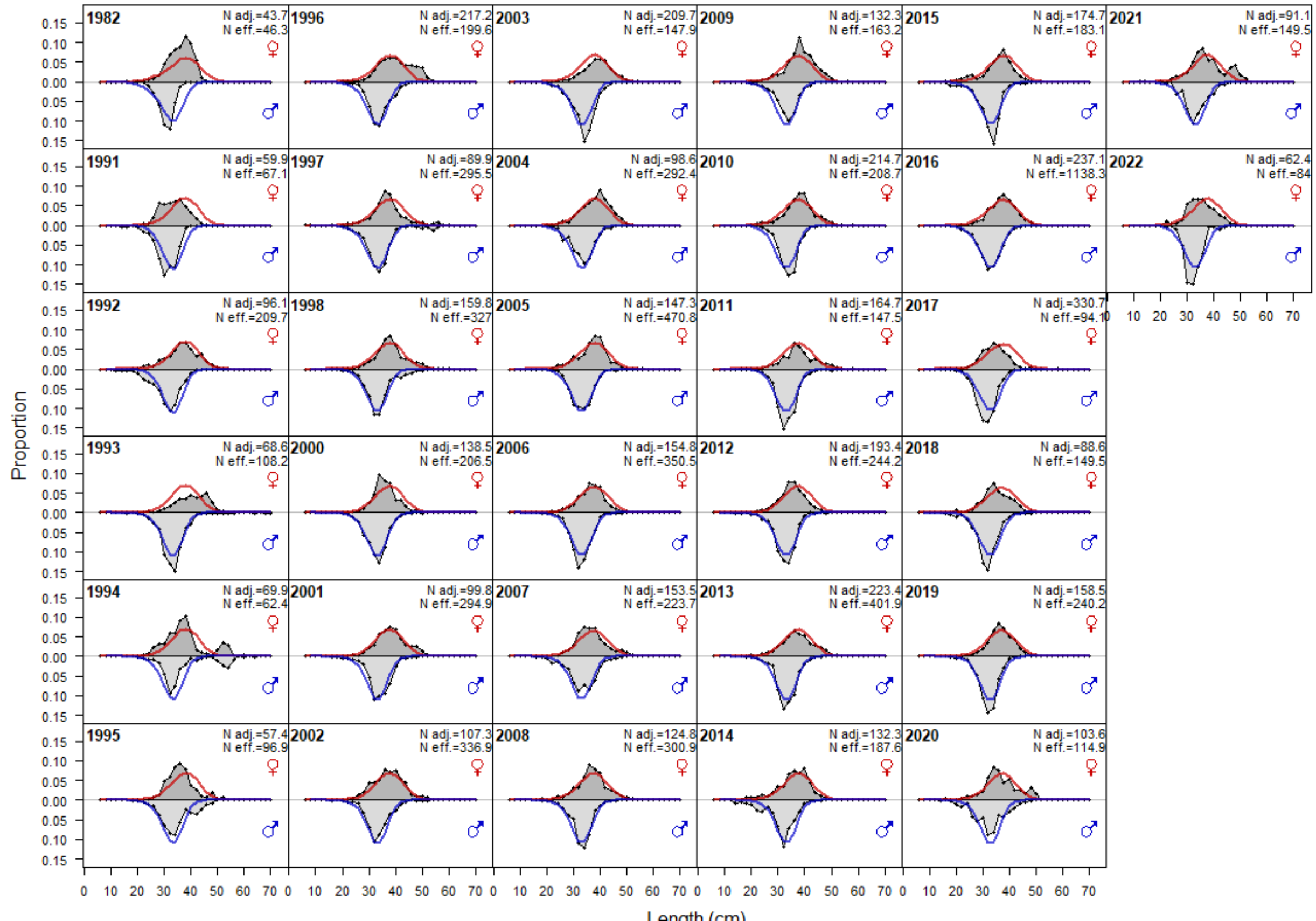
**Projections,
Apportionment,
Risk Table**

Gaps/Research

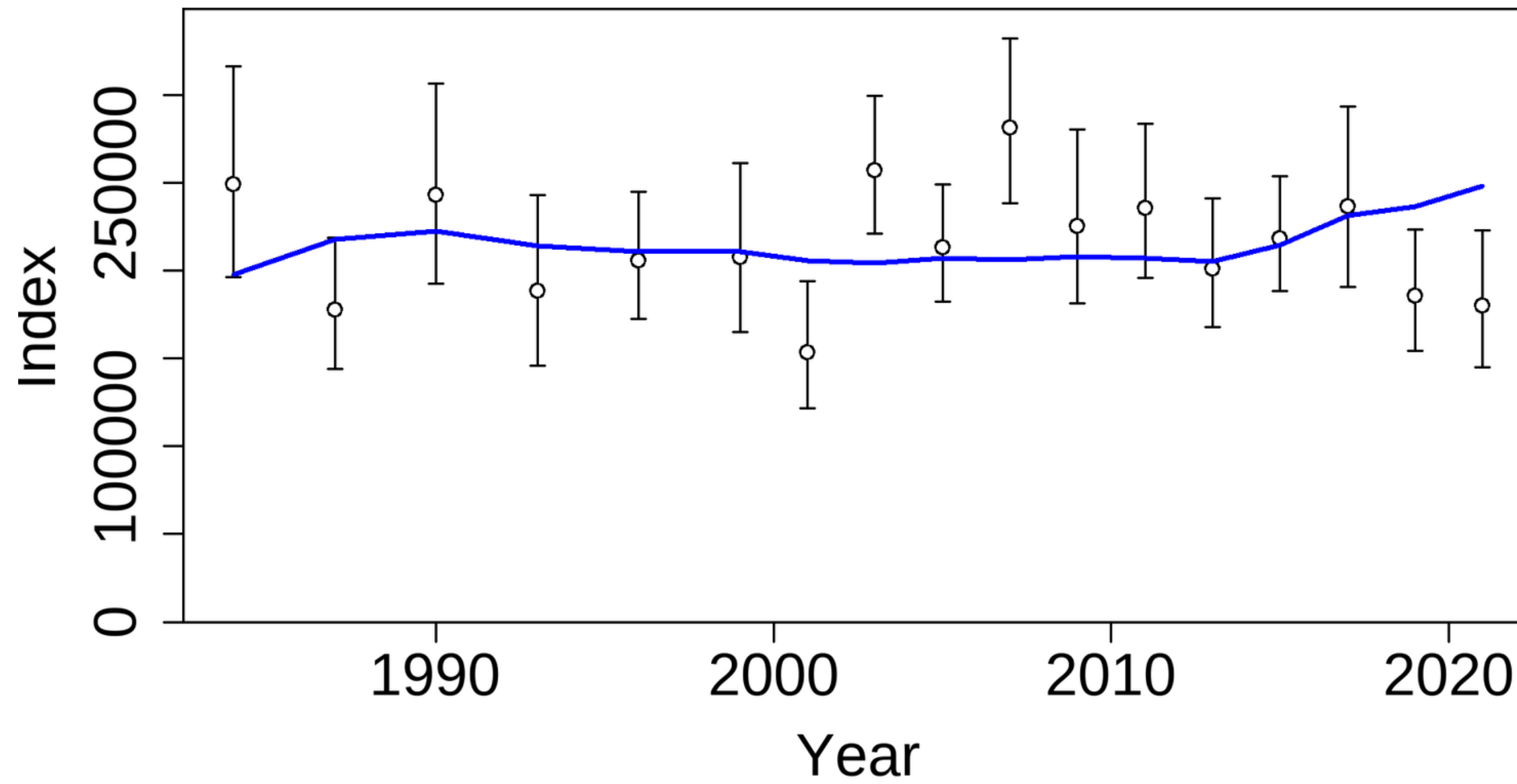
Model Fit: Catches



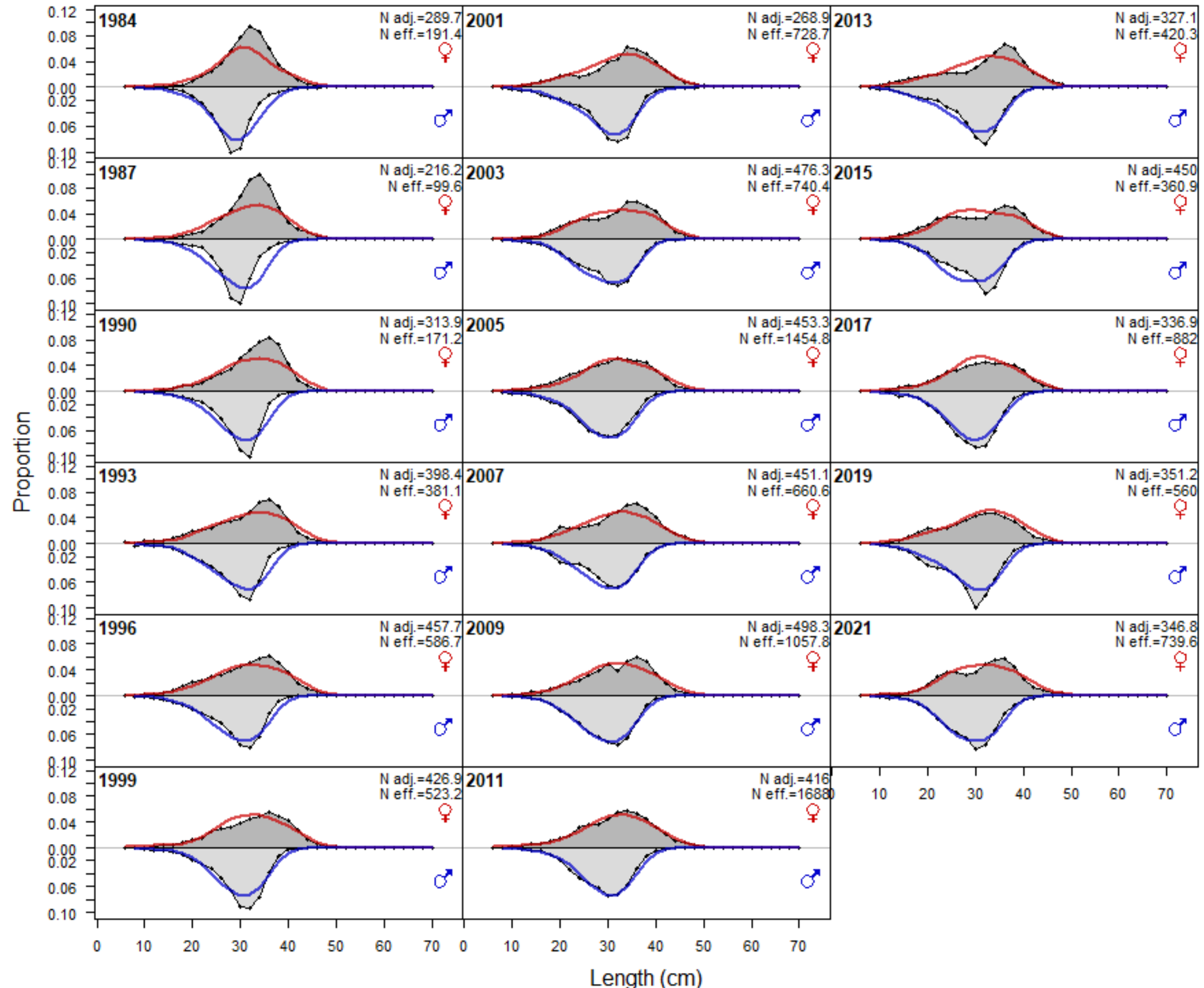
Model Fit: Fishery Lengths



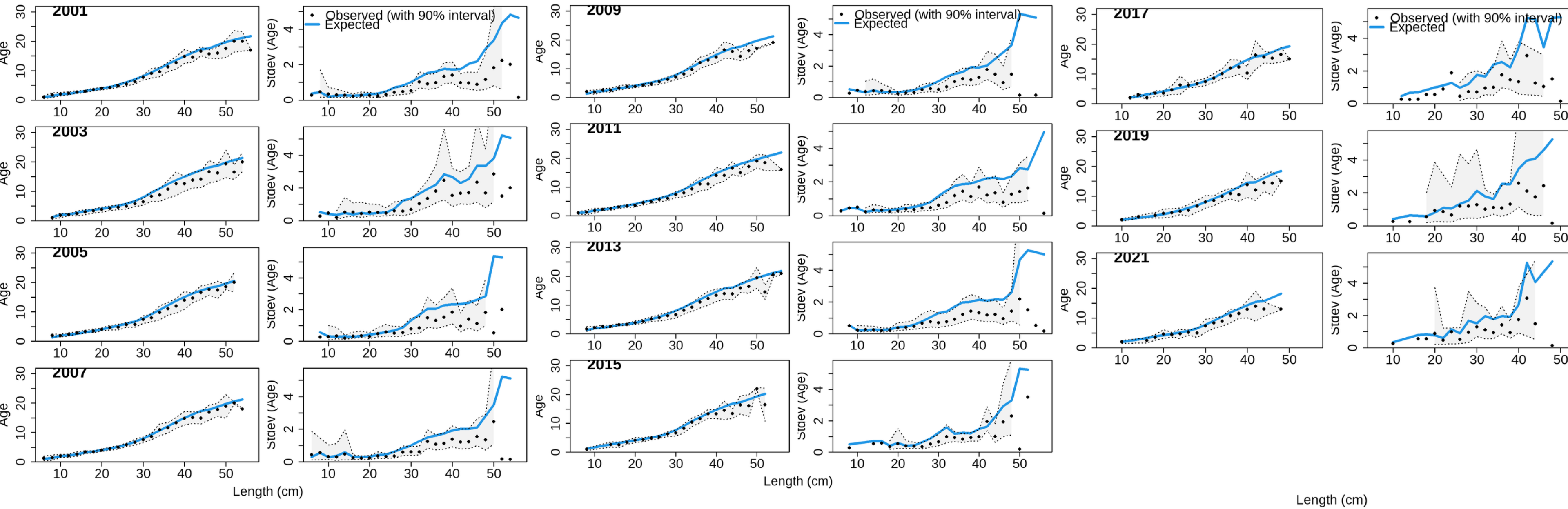
Model Fit: Survey Biomass



Model Fit: Survey Lengths



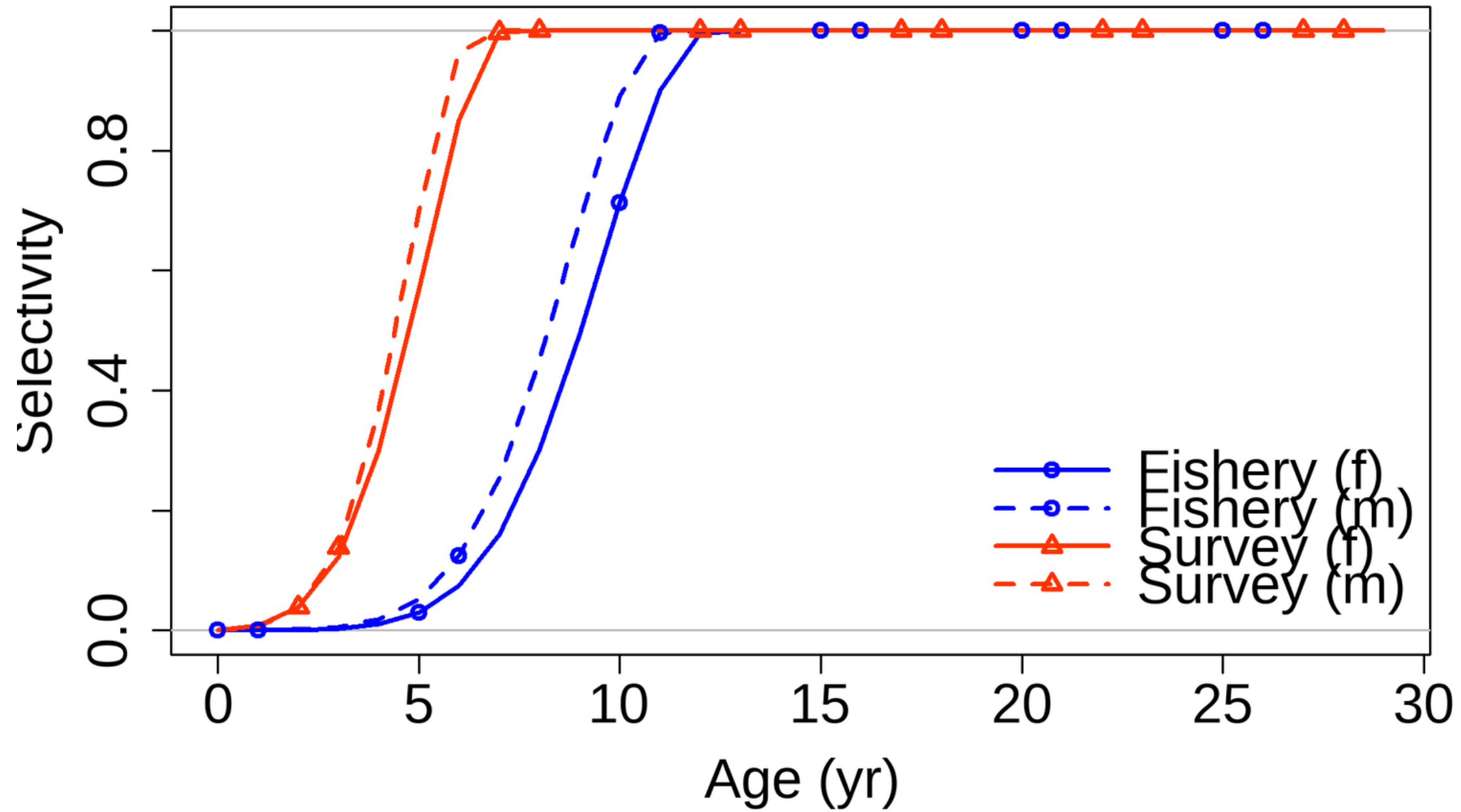
Model Fit: Survey CAAL



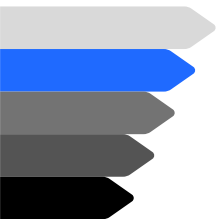
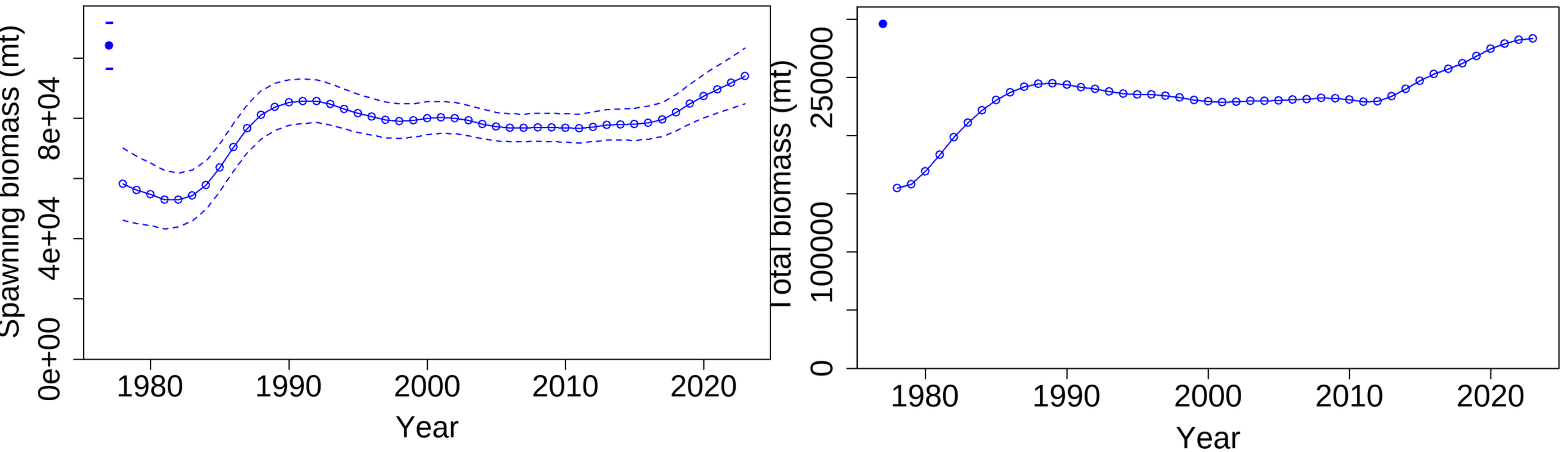
Parameters

Parameter	Model 17.1a (2022)	Model 17.0 (2017)
Natural Mortality (both sexes)	0.200	0.200
Length at age 2 (females, cm)	10.129	9.473
Linf (females, cm)	43.648	44.398
von Bertalanffy k (females, cm/yr)	0.192	0.188
CV in length-at-age 2 (females)	0.141	0.107
CV in length-at-age 59 (females)	0.099	0.095
Length at age 2 (males, cm)	0.200	9.543
Linf (males, cm)	36.501	36.860
von Bertalanffy k (males, cm/yr)	0.260	0.256
CV in length-at-age 2 (males)	0.156	0.128
CV in length-at-age 59 (males)	0.085	0.081
Unfished Recruitment (millions)	383.528	370.248

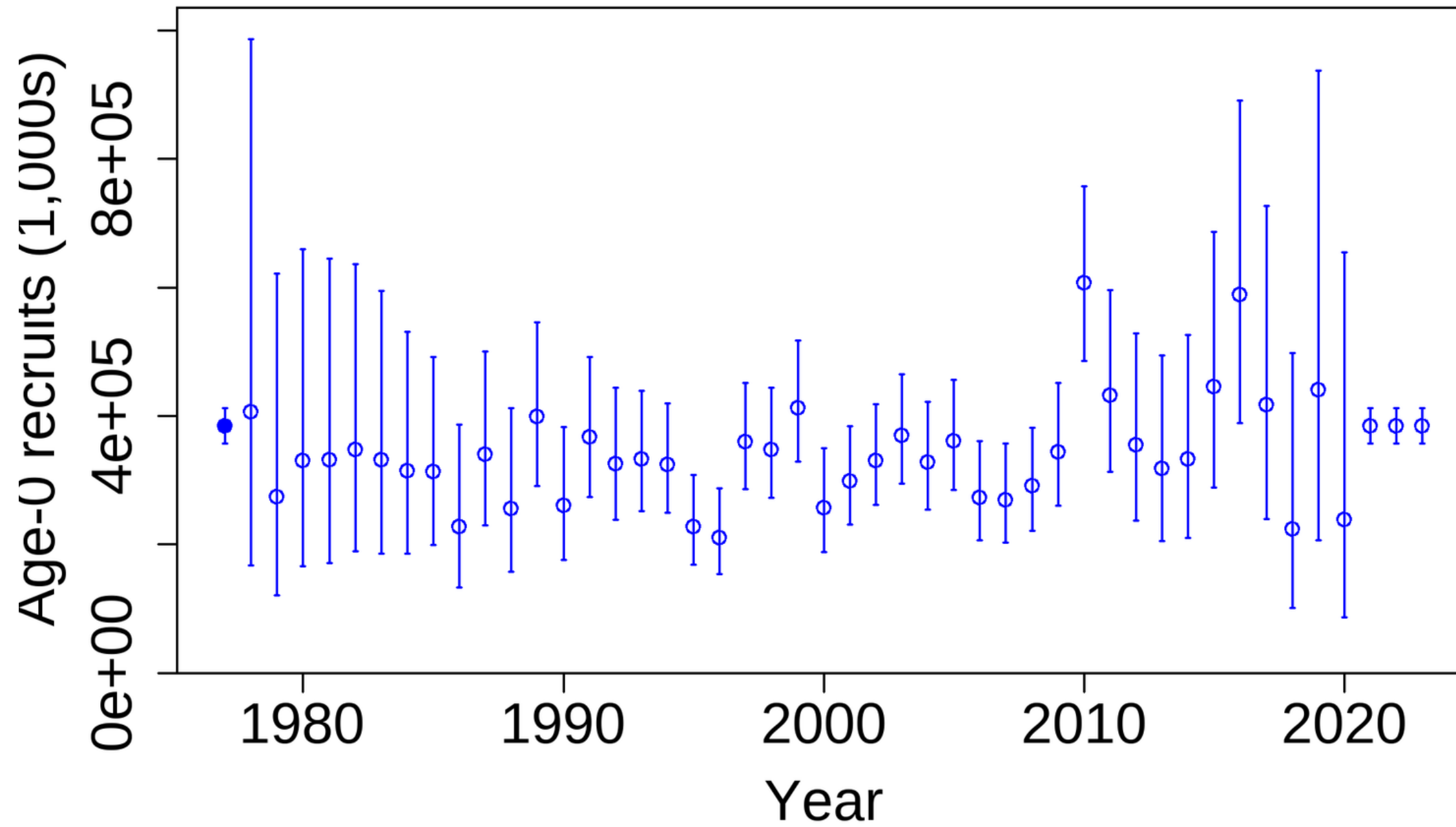
Selectivity Curves



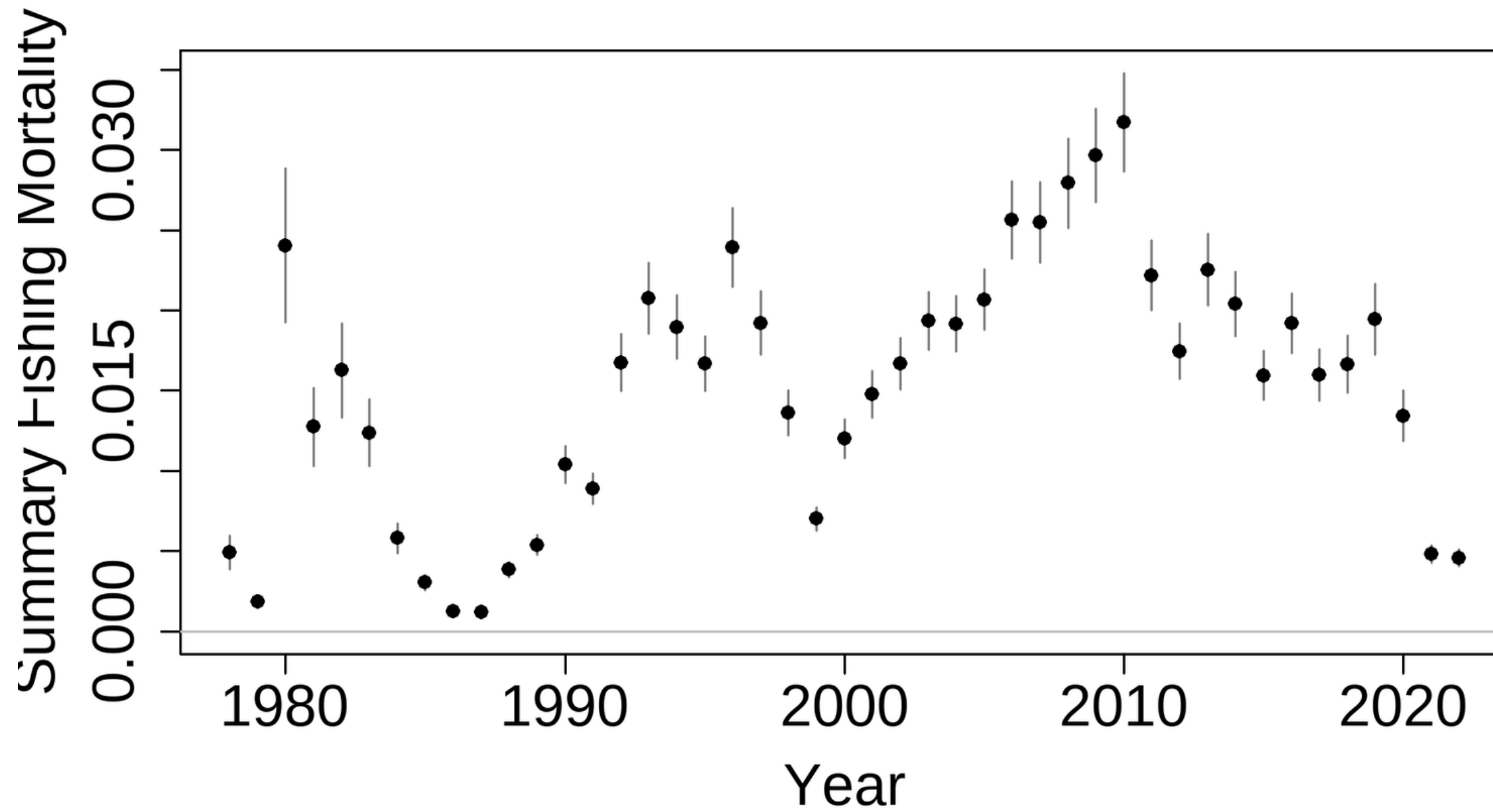
Time Series: SSB & Total Biomass



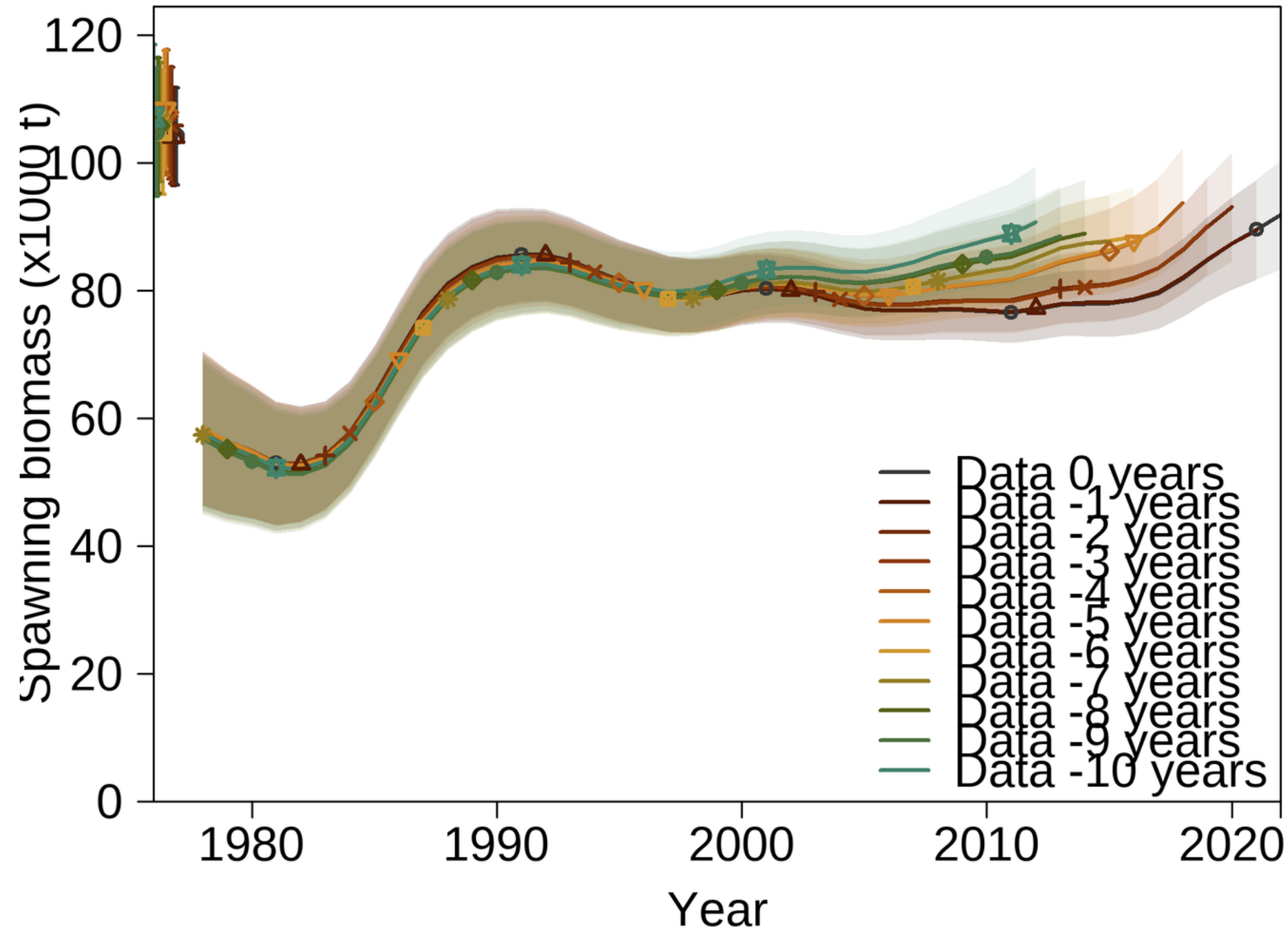
Time Series: Recruitment



Time Series: Fishing Mortality



10-year Retrospectives

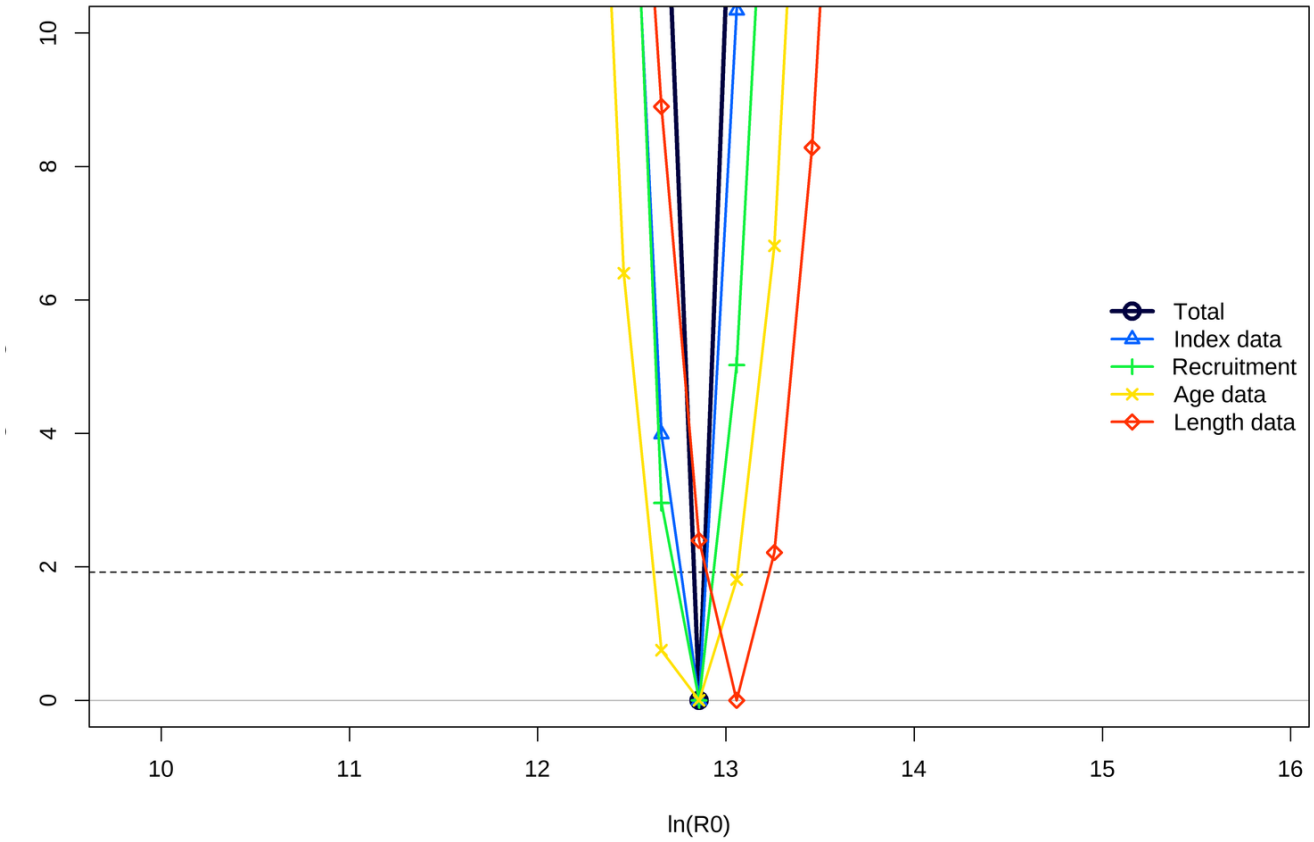
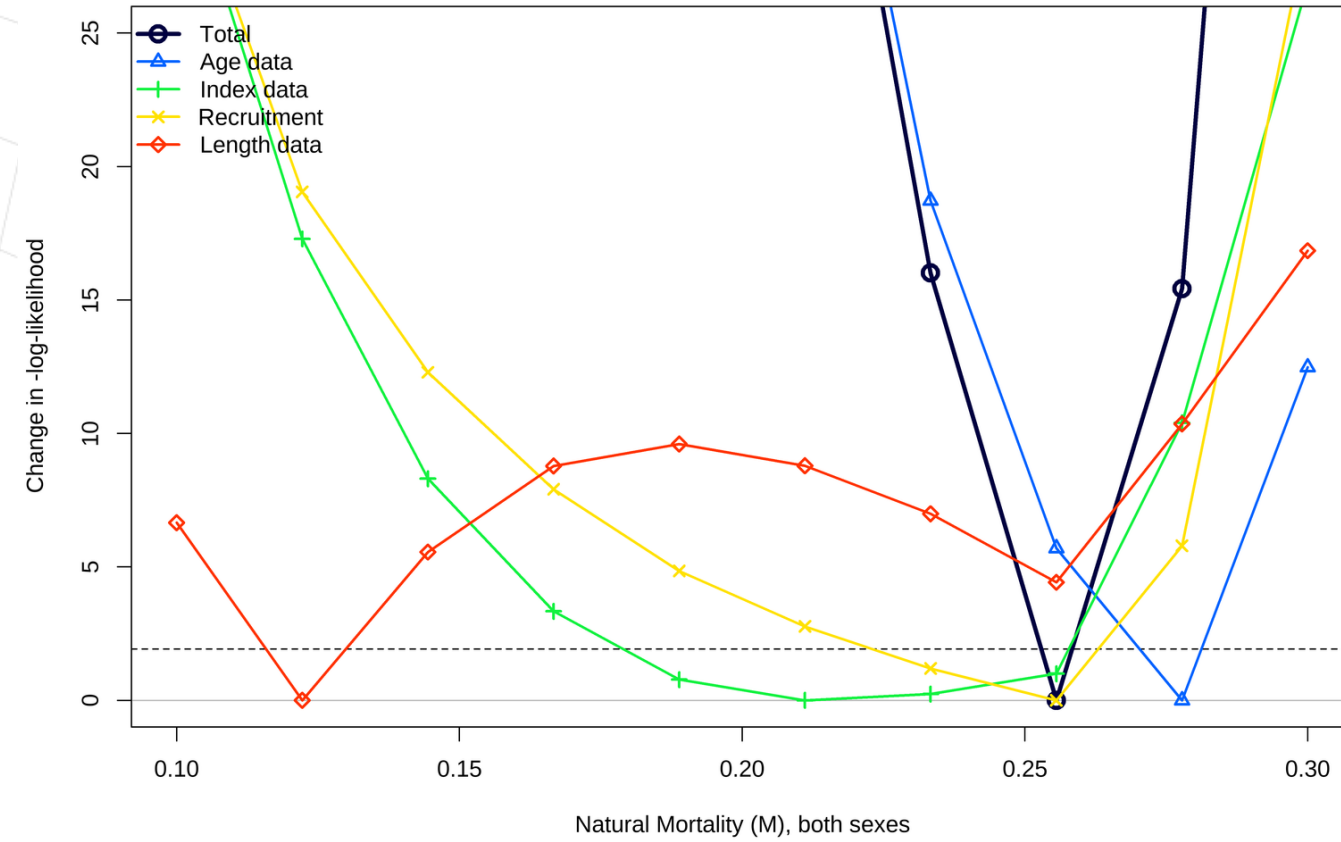
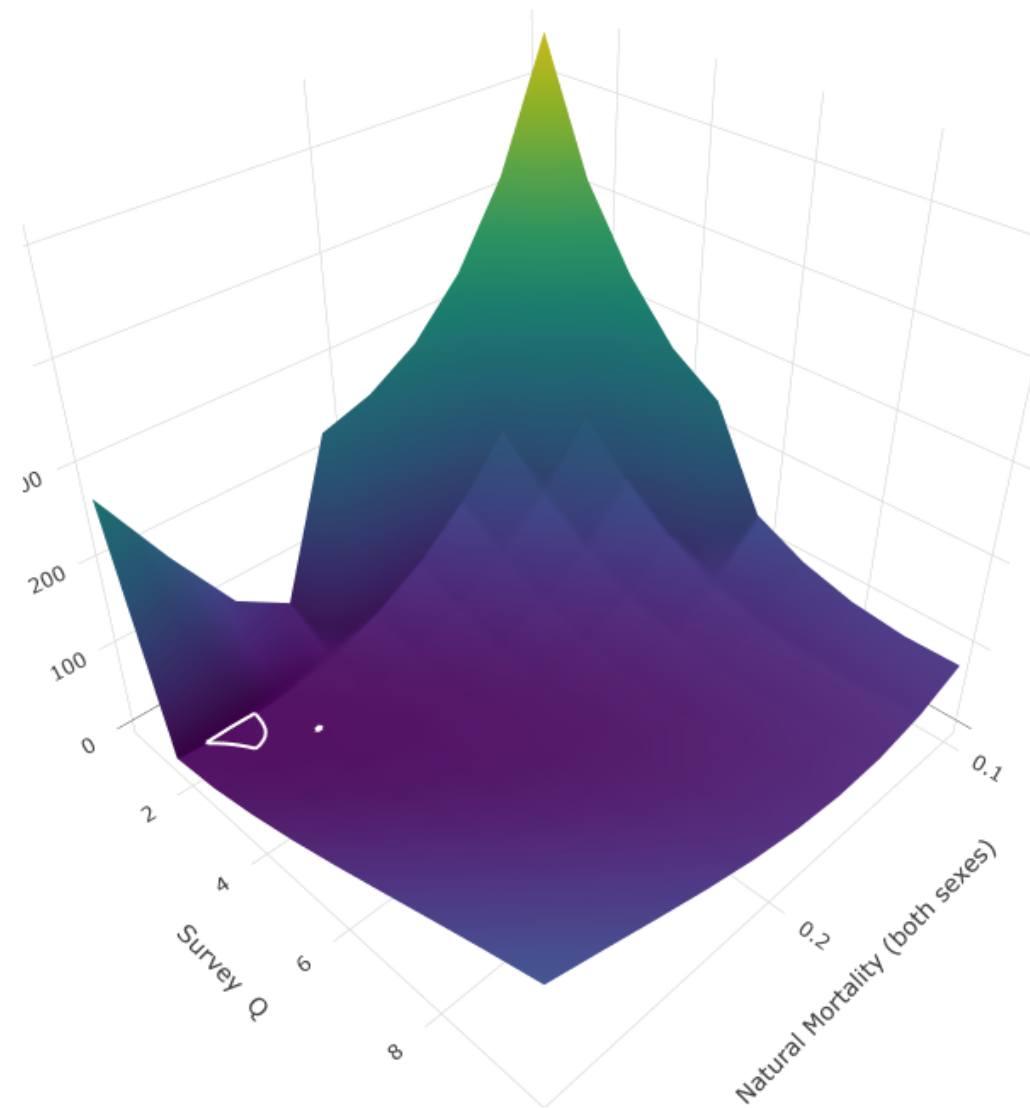


Quant	Mohn's Rho
SSB	0.1107
Rec	-0.2704
Bratio	0.0895
F	-0.0493

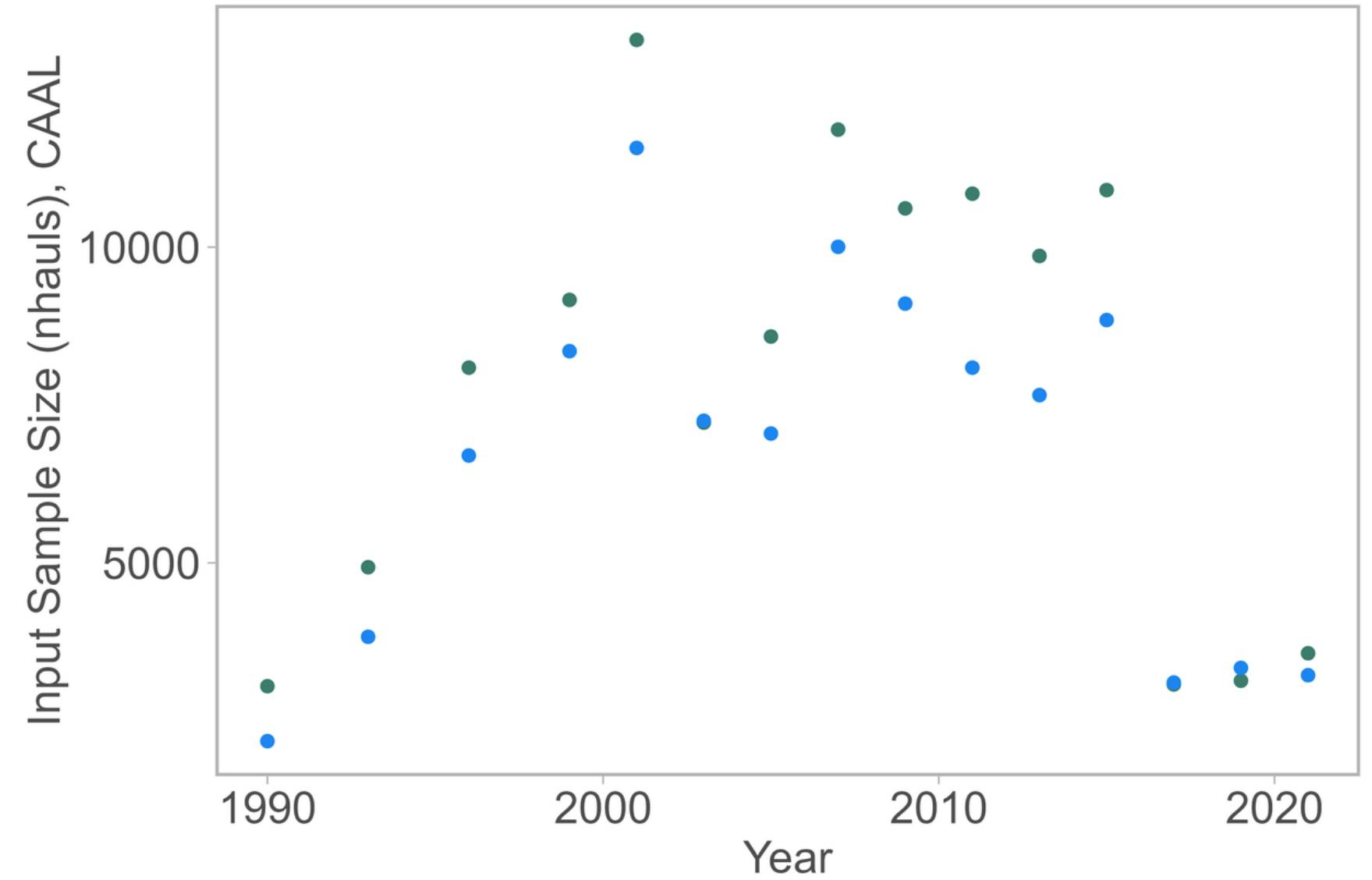
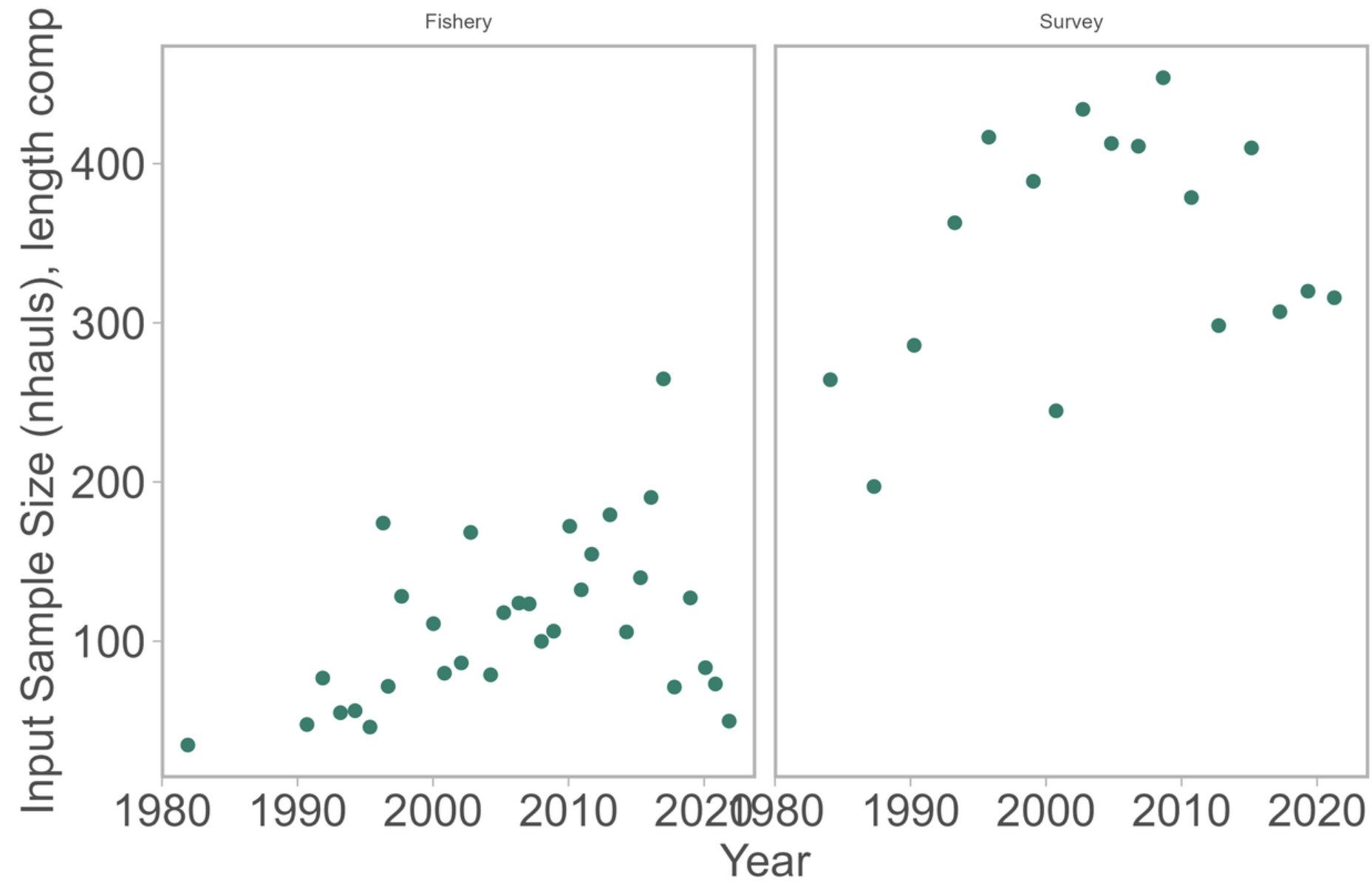
Likelihood Profiles/Sensitivities



Likelihood Profiles - data conflict!



Data Weights i



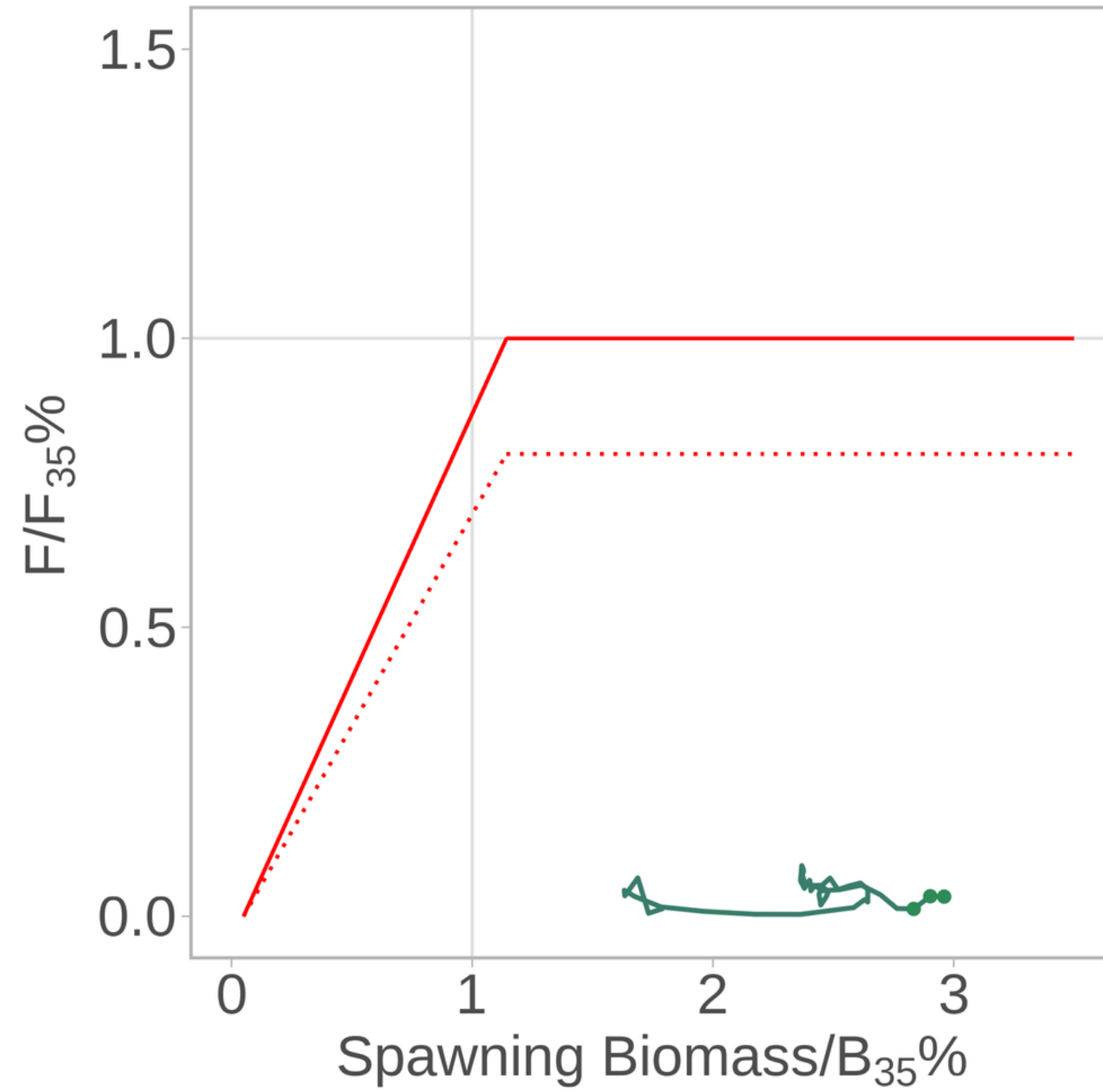
Data Weights ii

Data Type	2017 M-I Weight	2022 M-I Weight	2022 Francis weight (not used)
Fishery Length	1.190	1.248	0.215
Survey Length	1.017	1.097	0.470
Survey CAAL	0.345	0.327	0.216

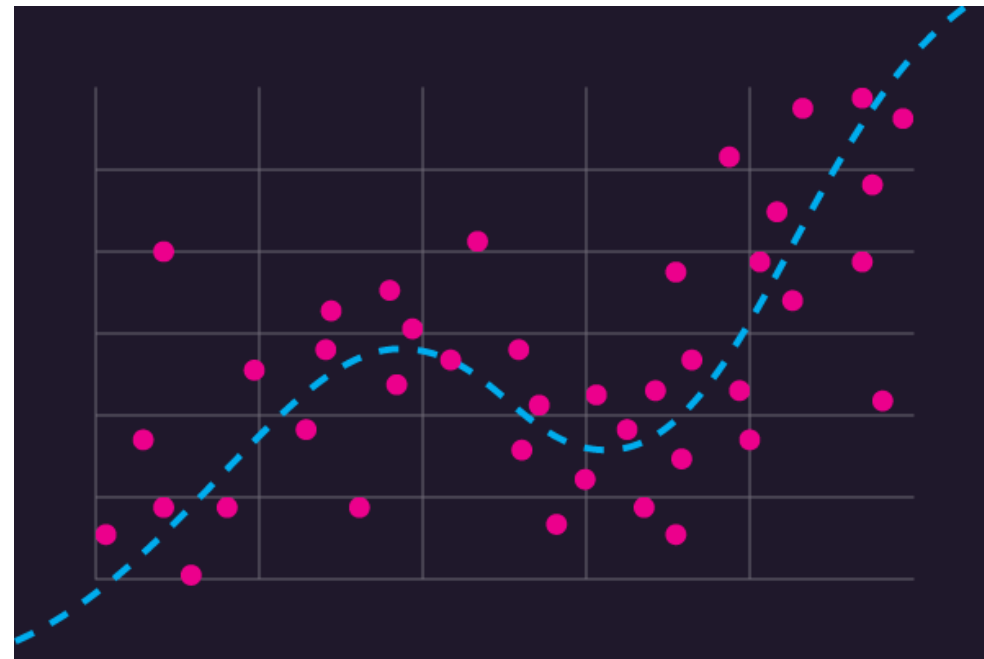
Both methods downweight CAALs

Recall Francis TA1.8 is based on Pearson residuals
No large trajectory differences between methods

Phase Plane



Risk Table (Level 1, all categories)



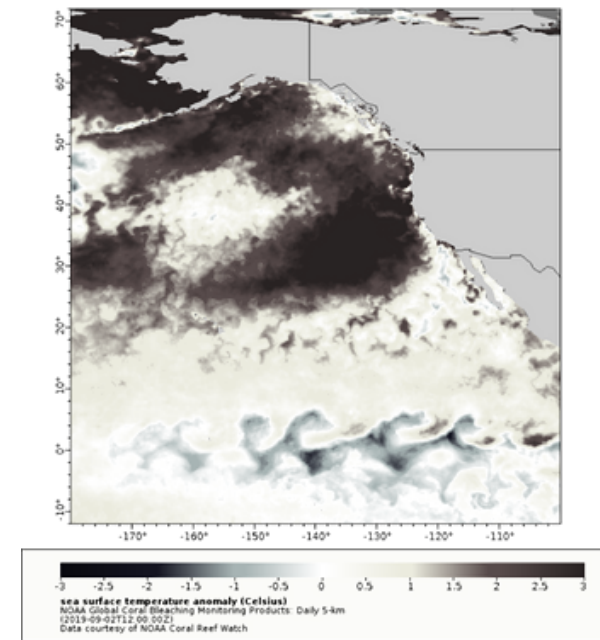
Assessment

Model estimated with convergence.
New data minimally influential



PopDy/Fishery

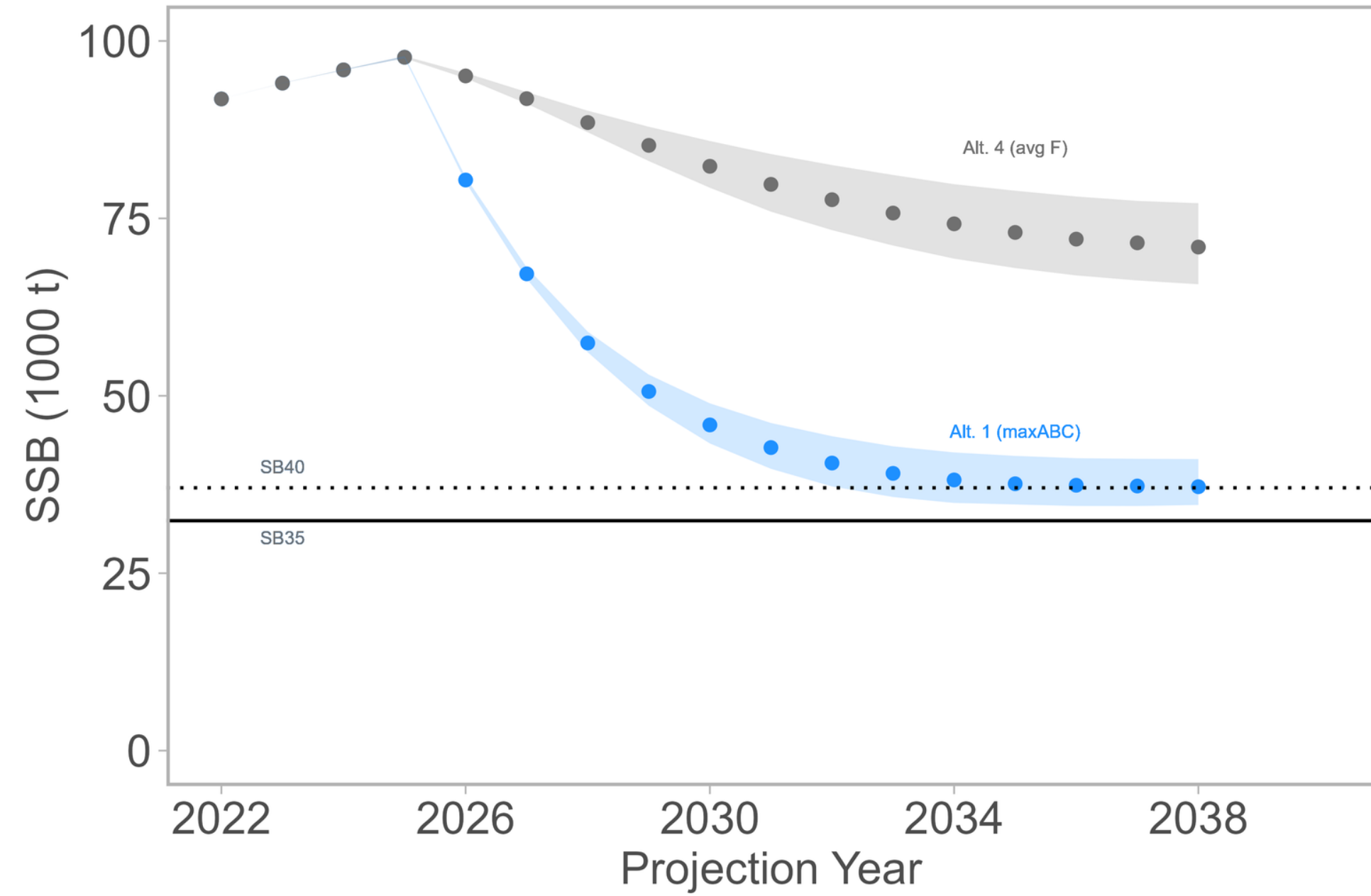
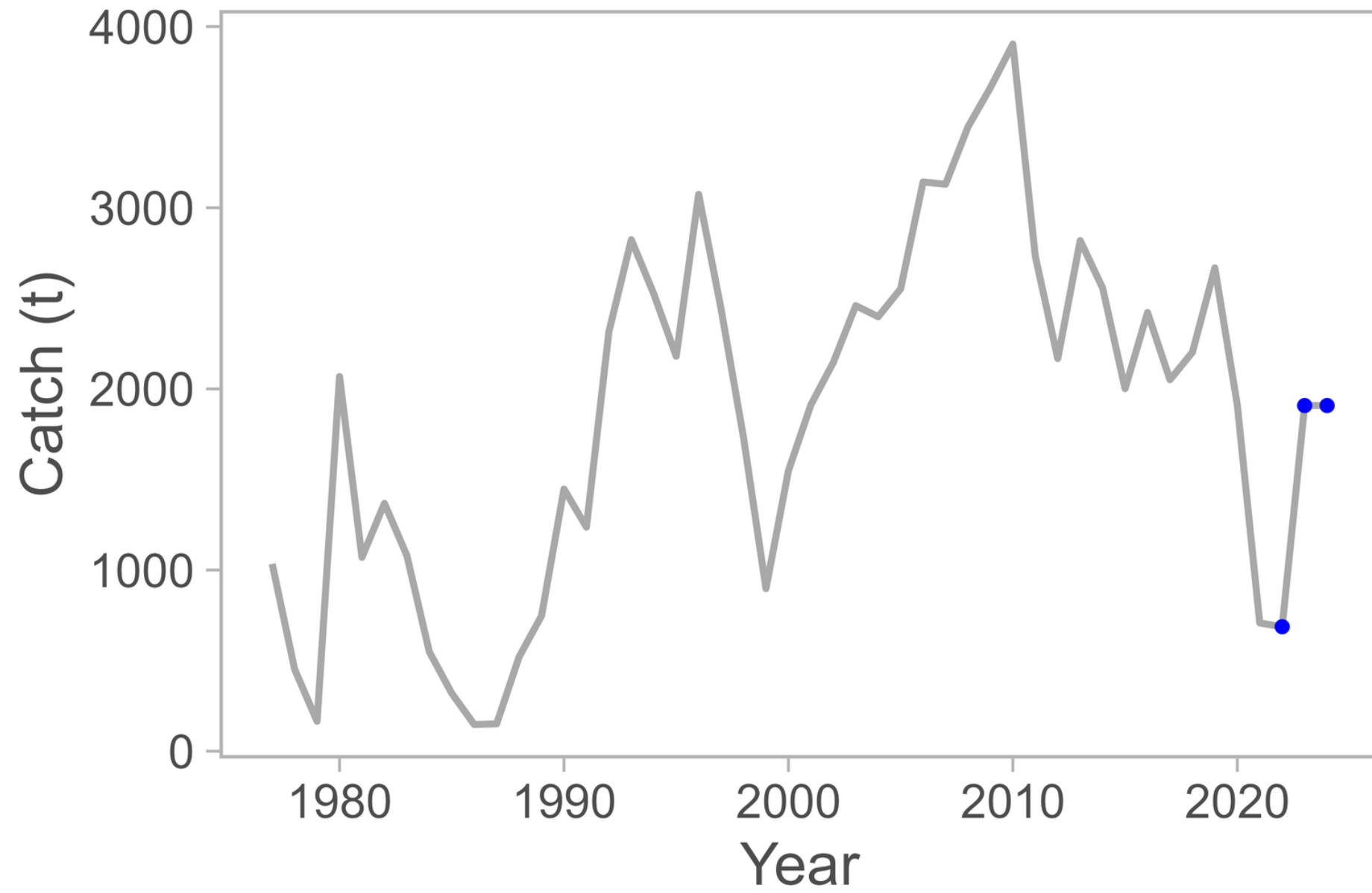
Thermal conditions average to good at present.
Prey dynamics unknown.
Very lightly exploited



Environment

MHW likely impacting prey availability and mean length

Projection

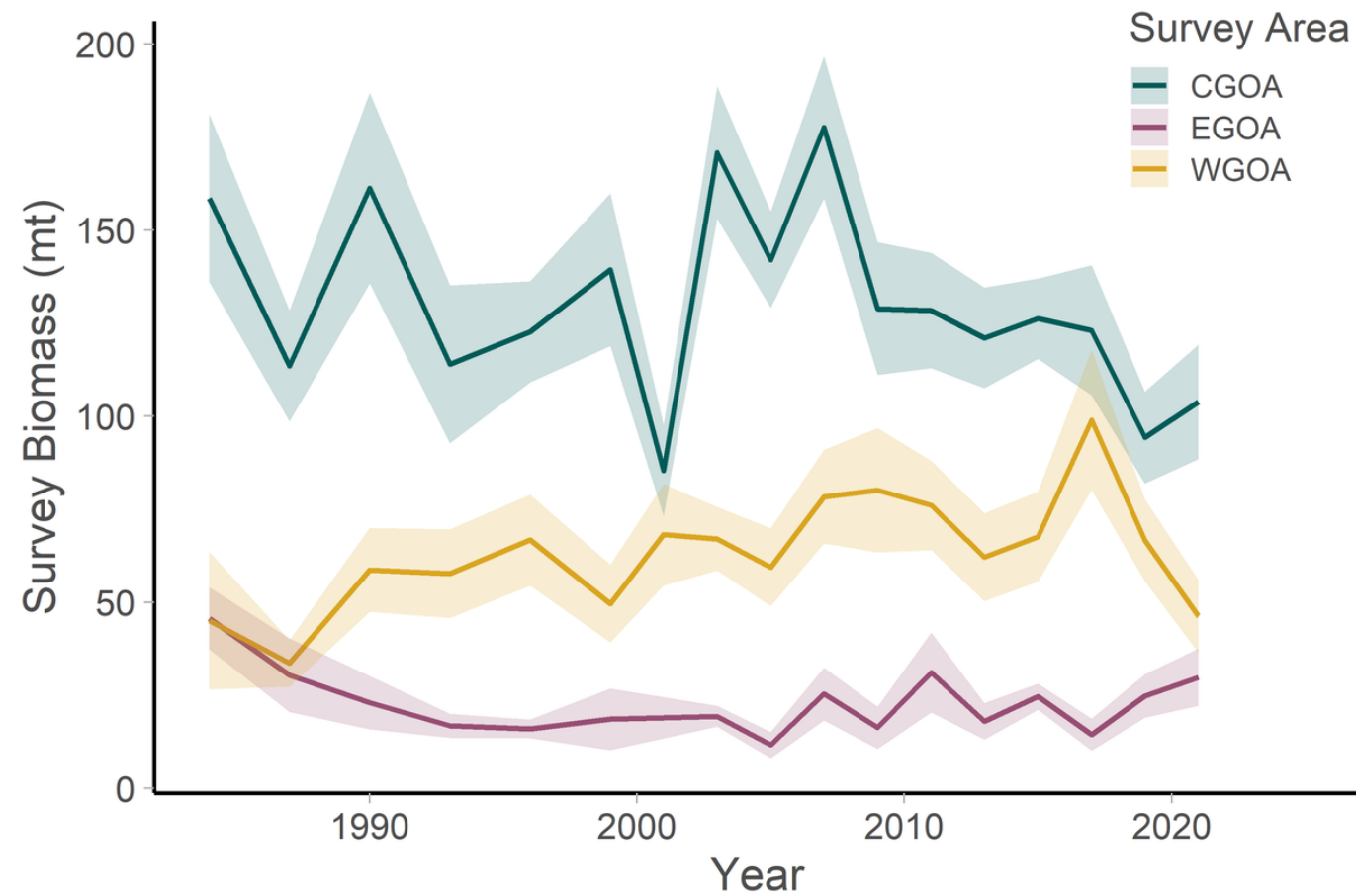


Harvest Recommendation

Quantity	As estimated or <i>specified last</i> year for:		As estimated or <i>recommended this</i> year for:	
	2022	2023	2023*	2024*
<i>M</i> (natural mortality rate)	0.2	0.2	0.2	0.2
Tier	3a	3a	3a	3a
Projected total (3+) biomass (t)	279,975	276,796	294,188	293,277
Projected Female spawning biomass (t)	97,614	97,876	94,059	95,932
<i>B</i> _{100%}	91,551	91,551	92,582	92,582
<i>B</i> _{40%}	36,620	36,620	37,033	37,033
<i>B</i> _{35%}	32,043	32,043	32,404	32,404
<i>F</i> _{OFL}	0.36	0.36	0.36	0.36
<i>maxF</i> _{ABC}	0.28	0.28	0.29	0.29
<i>F</i> _{ABC}	0.28	0.28	0.29	0.29
OFL (t)	48,928	48,757	48,161	49,073
<i>maxABC</i> (t)	40,175	40,046	39,480	40,222
ABC (t)	40,175	40,046	39,480	40,222
Status	As determined <i>last year</i> for:		As determined <i>this year</i> for:	
	2020	2021	2021	2022
Overfishing	no	NA	no	NA
Overfished	NA	no	NA	no
Approaching Overfished	NA	no	NA	no

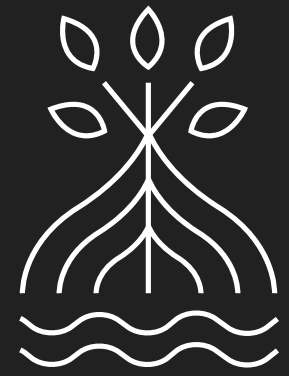
1% change in ABC from last year

Apportionment



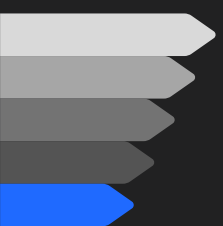
Quantity	Year	Western	Central	West Yakutat	Southeast	Total (t)
Area Apportionment %		32.4	54.43	5.88	7.29	
ABC (t)	2023	12,793	21,488	2,320	2,880	39,480
ABC (t)	2024	13,033	21,892	2,363	2,934	40,222

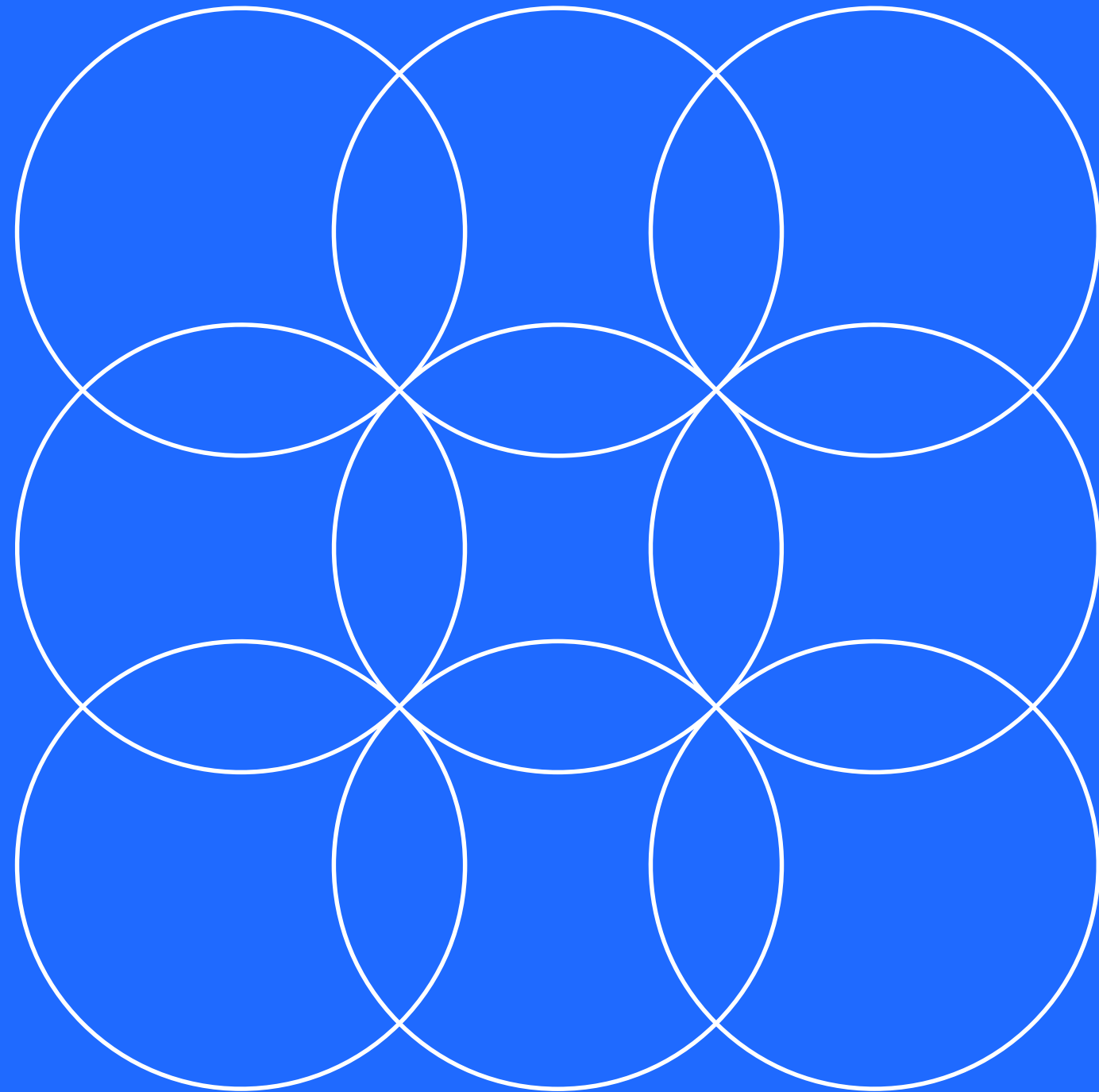
Check out <https://github.com/afsc-assessments/rema>



Data Gaps & Future Research

- Examine interaction between data weights and catchability
- Consider priors for M/q
- Revisit selex





Thank you!

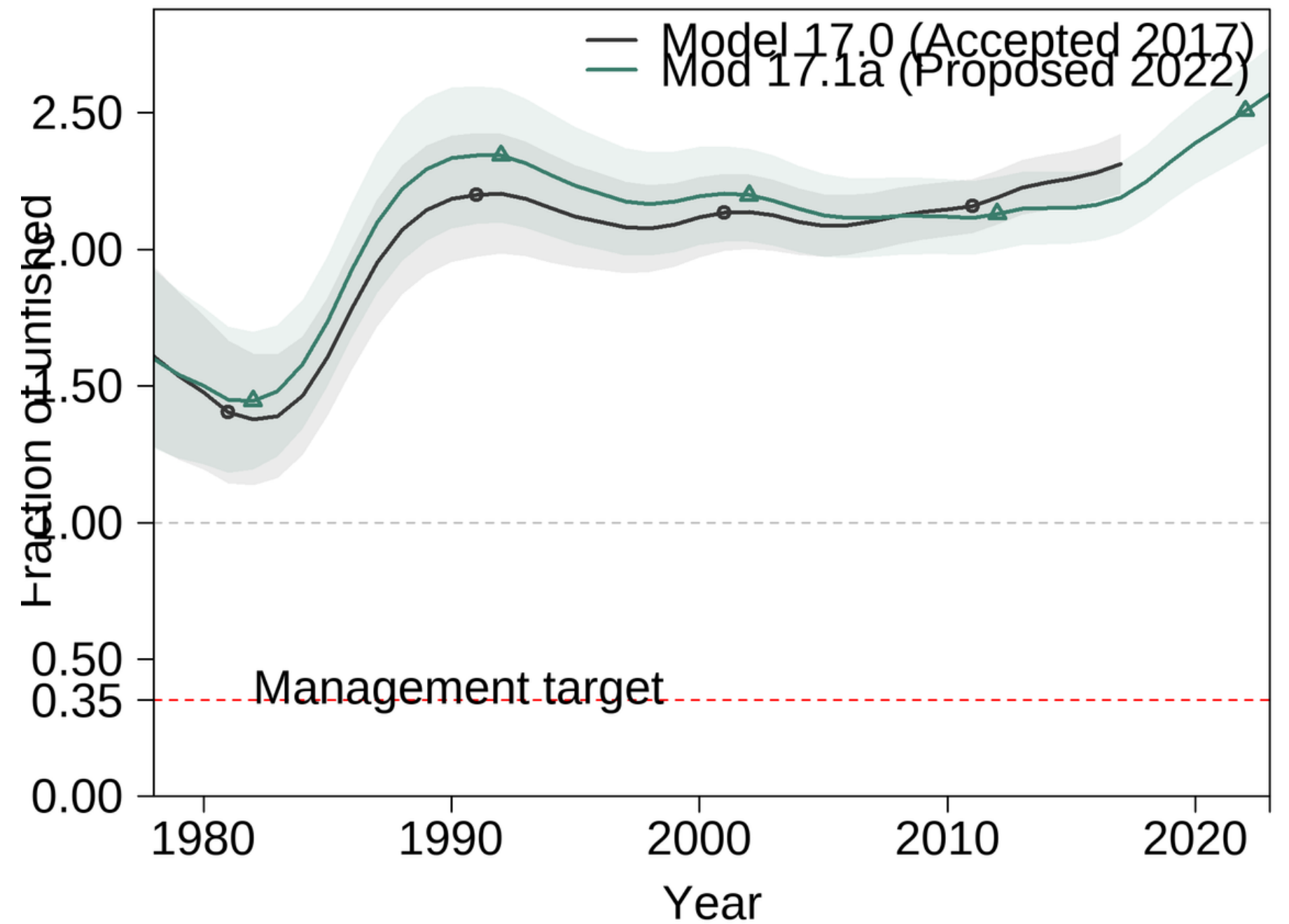
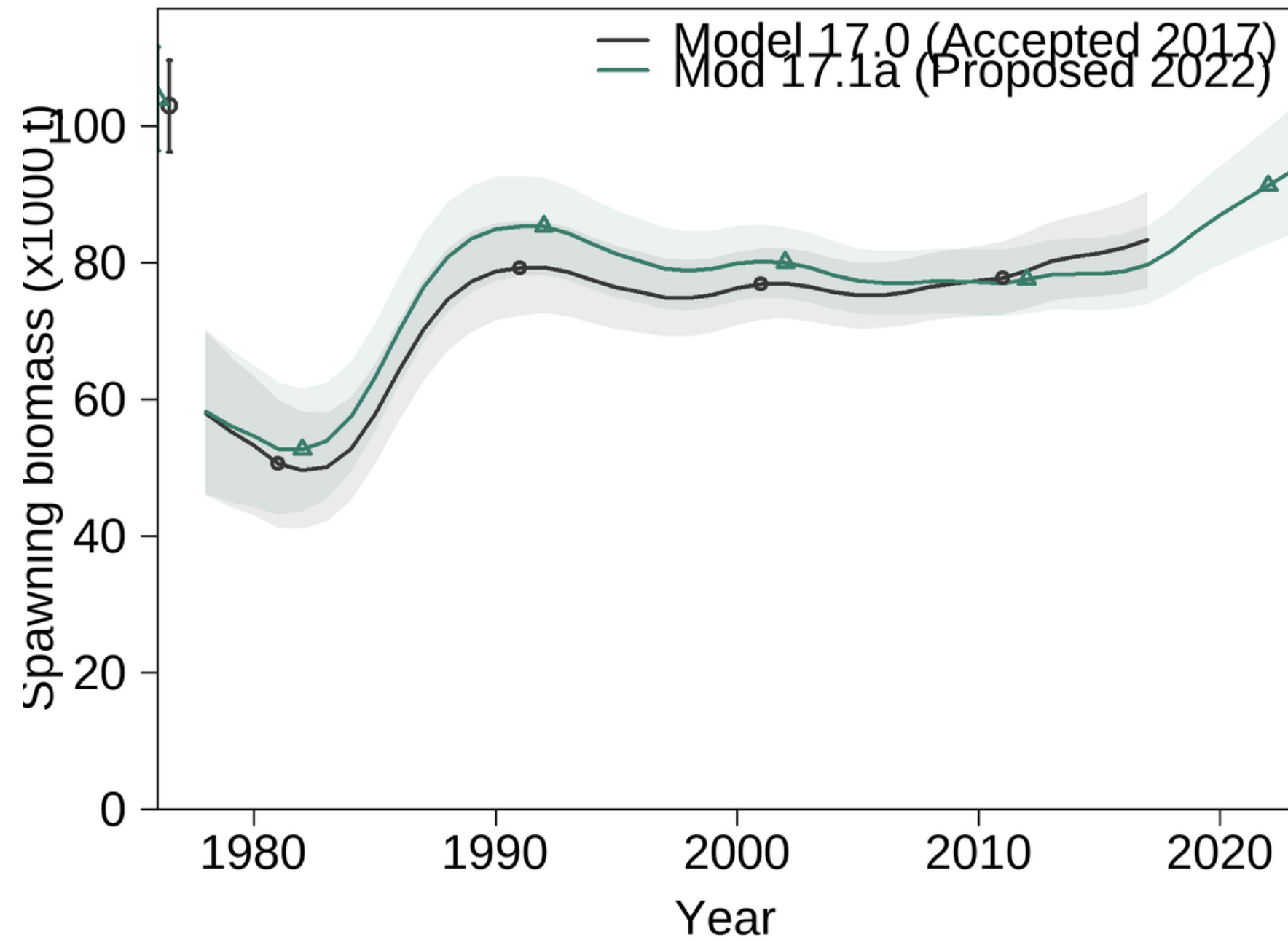
maia.kapur@noaa.gov

Extra Links (Sensitivity Runs)

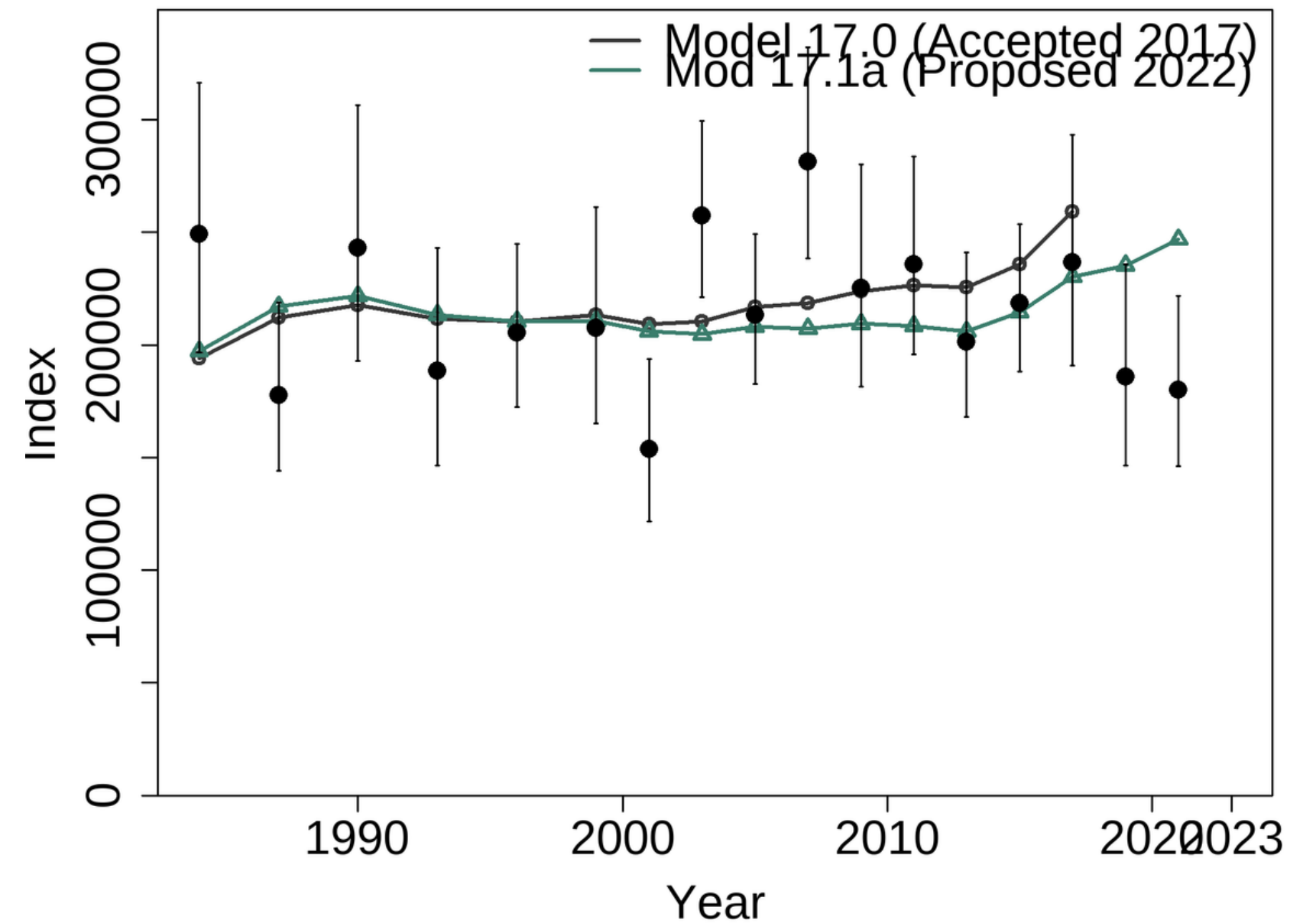
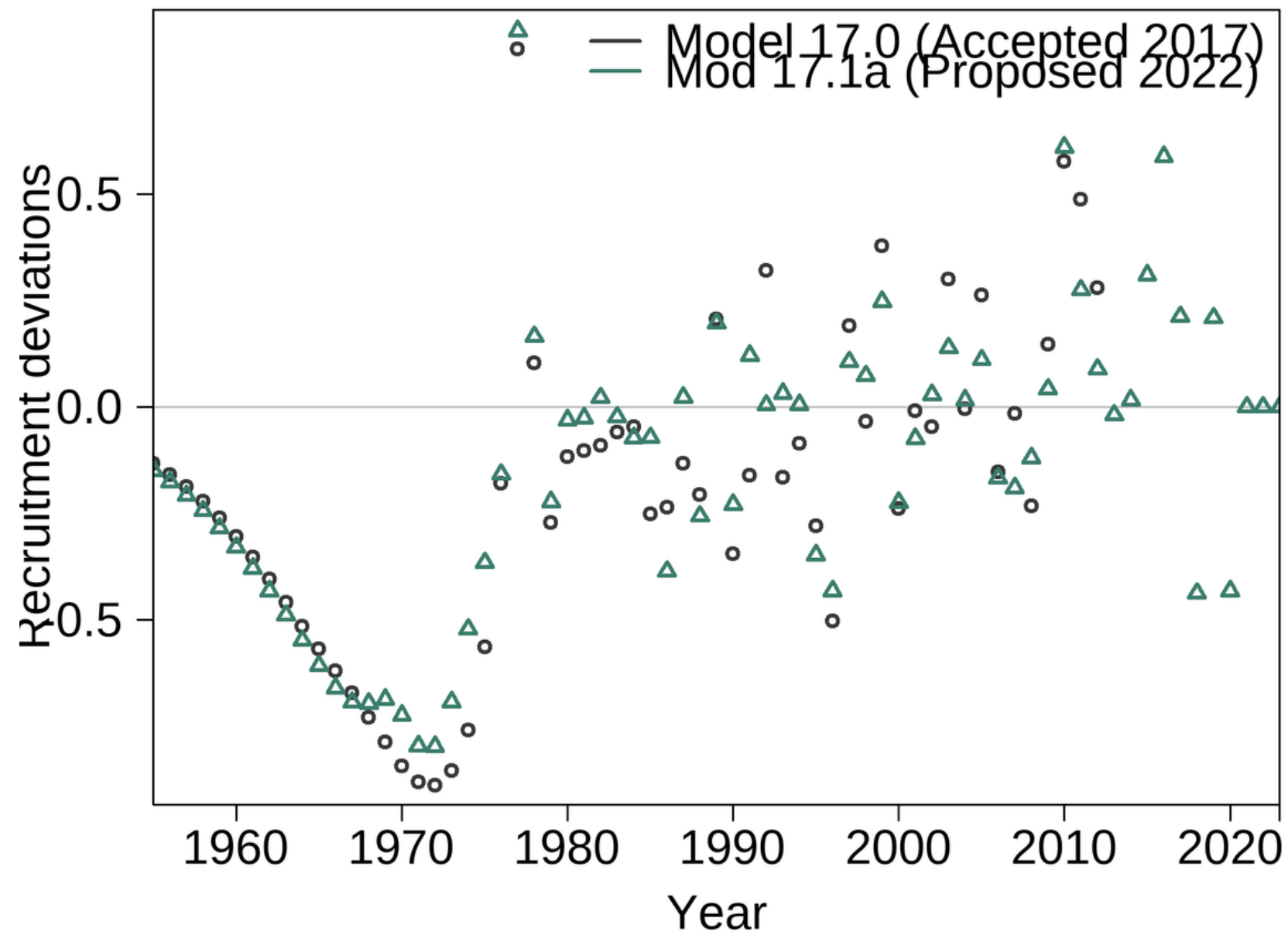
https://mkapur-noaa.github.io/goa-fhs-2022/sensitivities_goa_fhs_2022.html

https://mkapur-noaa.github.io/goa-fhs-2022/AgeingError_Writeup_Static.html

Comparison with 2017 i



Comparison with 2017 ii

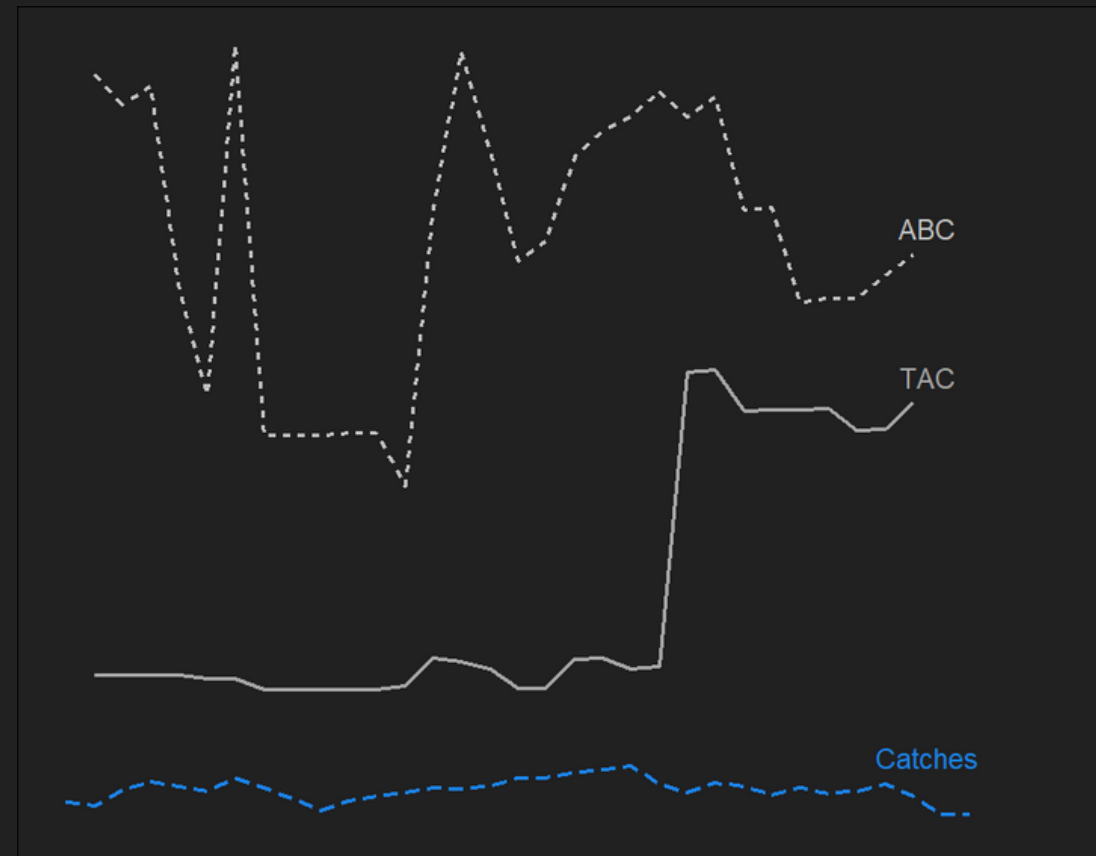


Comparison with 2017 iii

component	Model 17.0 (2017)	Model 17.1a (2022) with 2017 data	Model 17.1a (2022)
TOTAL	1,534.88000	1,536.27000	1,780.16000
Survey	-19.01160	-18.74870	-11.60820
<u>Length comp</u>	539.11800	538.99700	687.64100
<u>Age comp</u>	1,019.12000	1,020.45000	1,113.70000
Recruitment	-4.34713	-4.42665	-9.57505

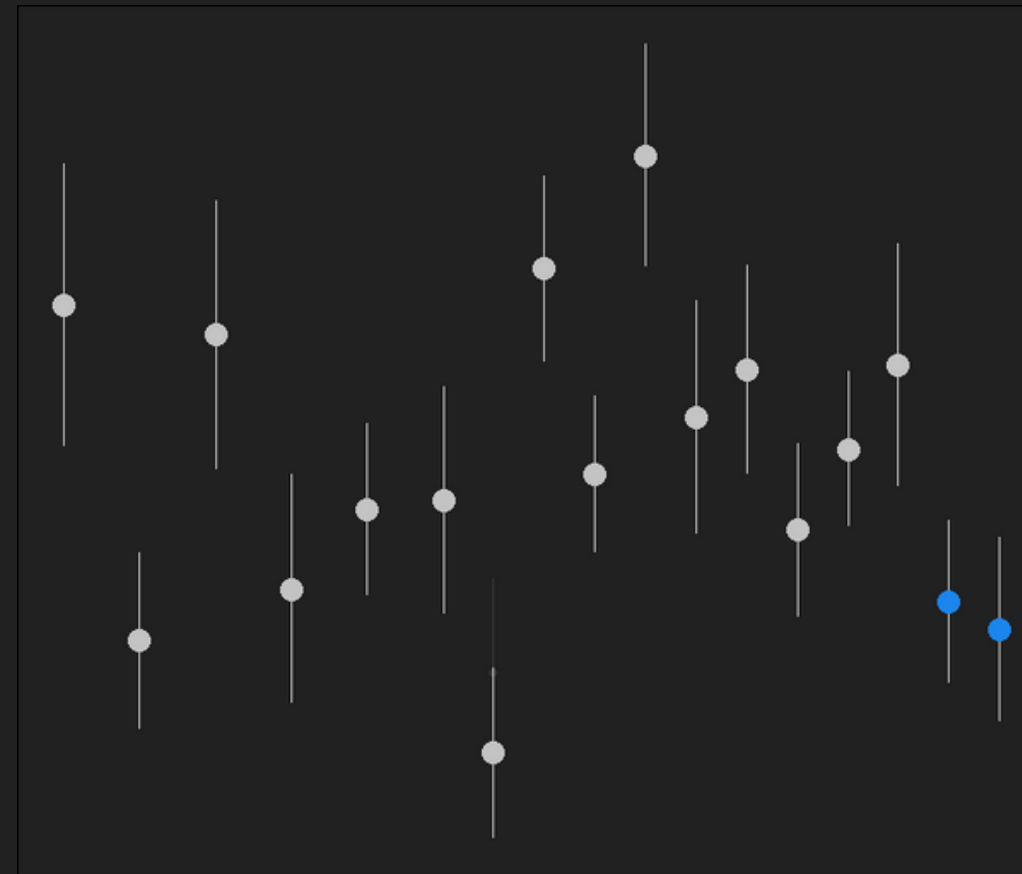
slides for Director's Briefing, 02 Nov 2022

GOA Flathead Sole: Data



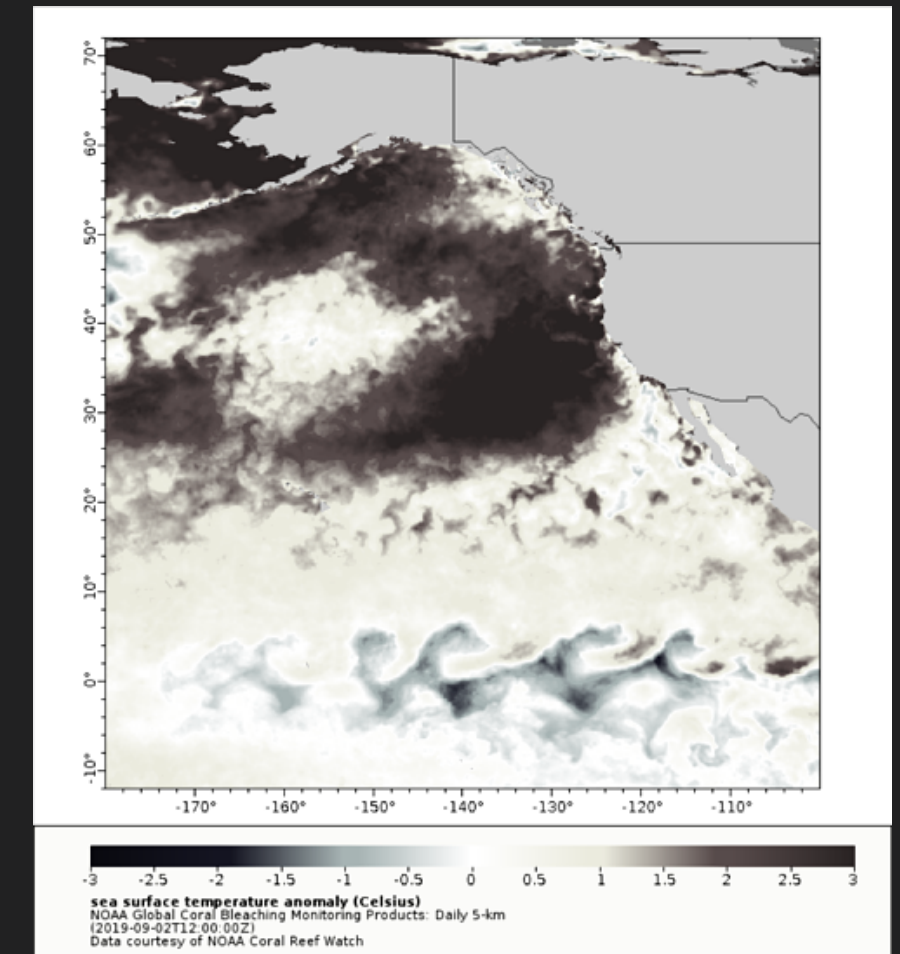
Catch is <10% ABC

Approaching bycatch status



Last two years of survey down

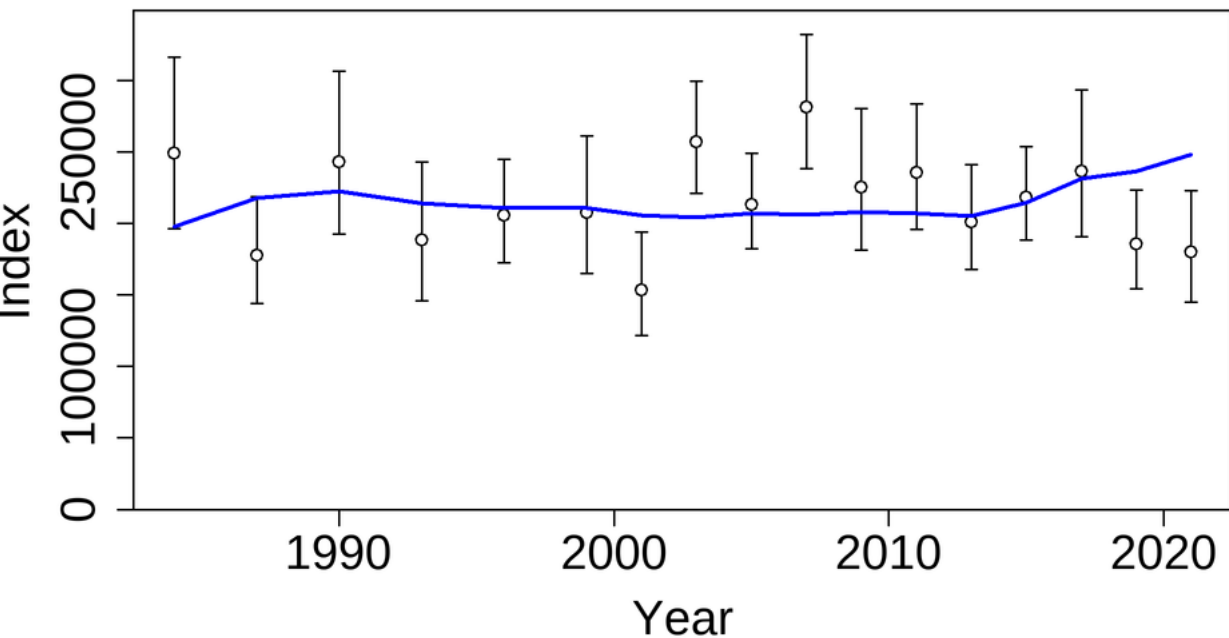
Still highest in Central GOA
Not out of historical range



2016 MHW likely catching up with data

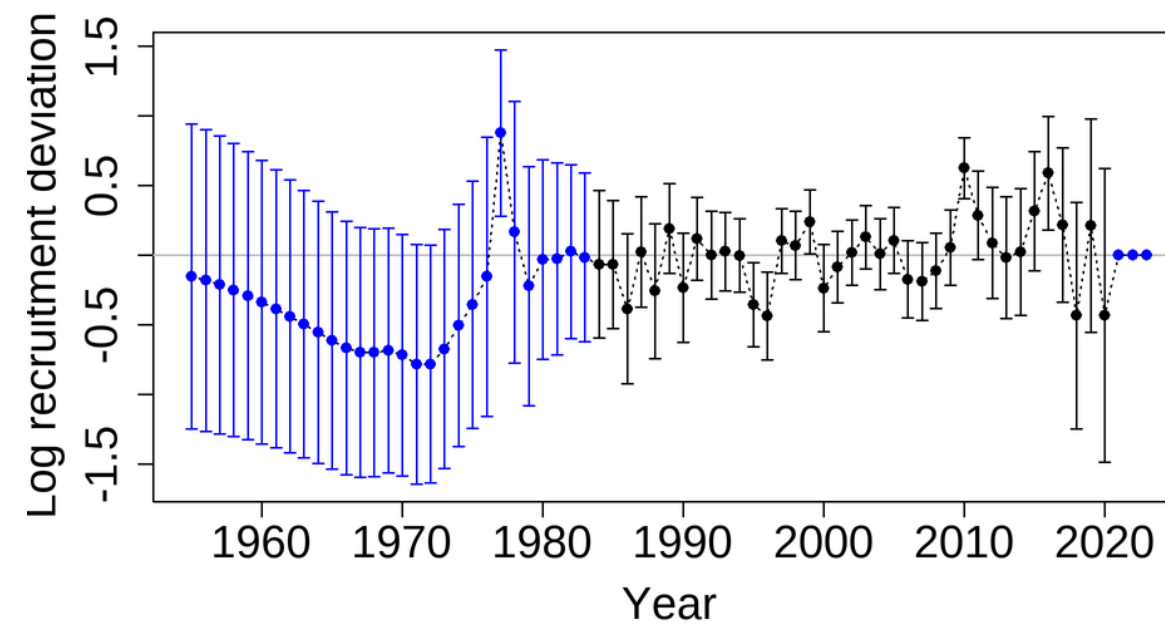
Reduced prey availability
Lower recruitment devs and mean lengths

GOA Flathead Sole: Model



No Changes to Model

Slight overfit last two years of survey data with q , M , weighting constraints



Recruitment

Keep an eye on response to climactic conditions



ABC

in 2023 is **48,161** t, ~1% difference from last year
Model is structurally stable and robust to new data

