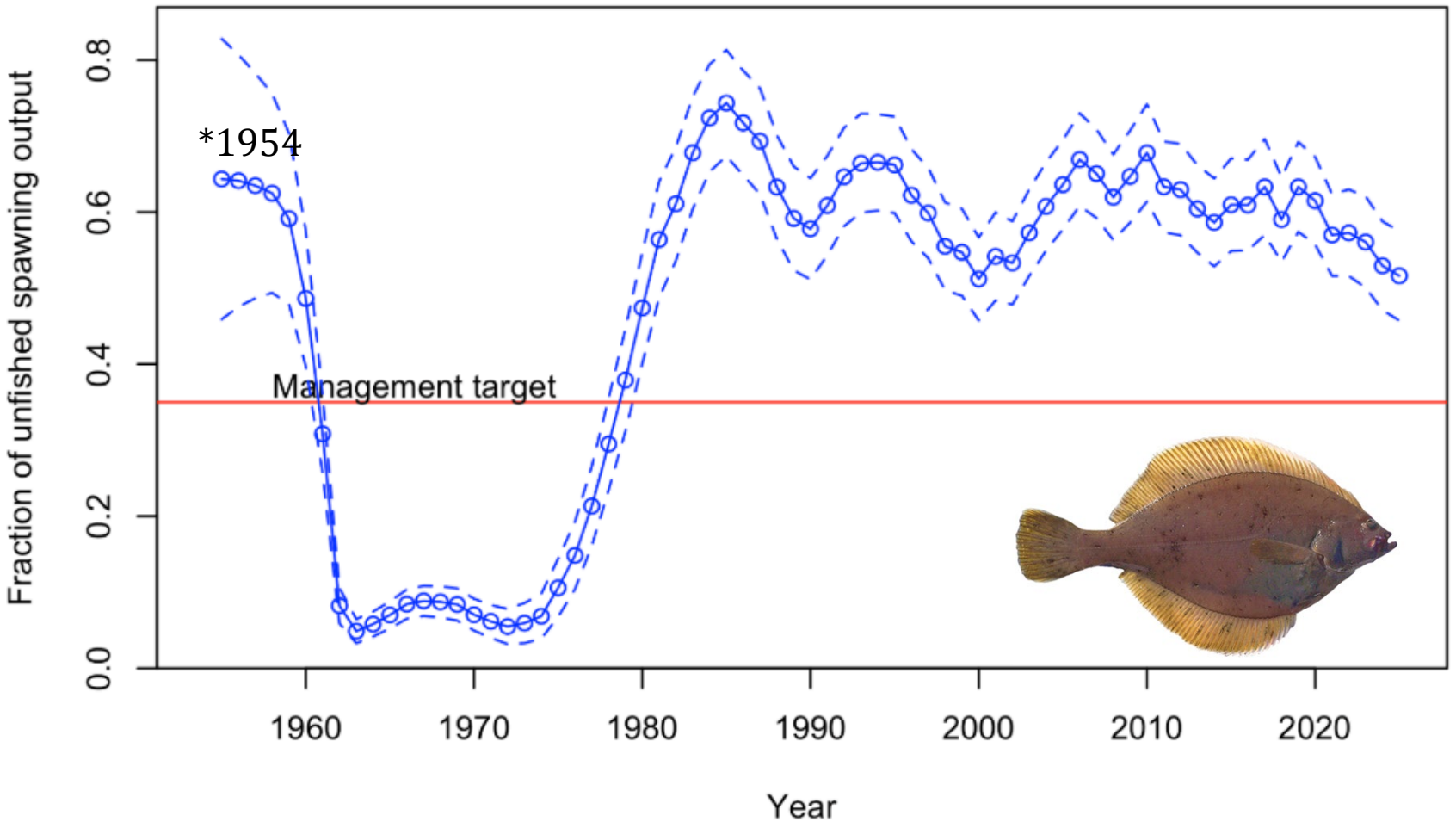
BSAI Yellowfin sole September 2026

Ingrid Spies and Meaghan Bryan

Yellowfin sole assessment model



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Yellowfin sole assessment model – Distinguishing attributes

- Long time series
- Tier 1*
- Empirical weight at age (survey)
- Fishery weight at age estimated using catch-at-age methodology (bootstrapping "Sampler").
- Survey catchability modeled as a function of 100m EBS bottom temperature and survey start date anomalies.*

$$q_t = e^{-\alpha + \beta T + \gamma S + \mu T:S}$$

* Indicates changes proposed.

2026 CIE Review

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Reviewer #1 - Issues

1. Issue with growth in the model: "…population model is scientifically invalid because growth is not really modelled (instead observations are used as biological parameters)."

2. Issue with data: EBS trawl series contains vessel effects which are structural rather than random.

- Vessel is confounded with year; vessels used from 1982-1992 were different from vessels 1993-2024.
- Recommended estimating vessel effects, but this must be done within the two periods separately.

Reviewer #1 – Further comments

- The use of bottom temperature in VAST is not an issue because it is not used there to address annual variation in availability.
- Mean bottom temperature used as a “density covariate”.
- VAST distinguishes between “density” and “catchability” covariates (Thorson 2023).
- Low temperature:
  - Affects mobility of the fish, and therefore herding is reduced.
  - Delays the migration of the fish returning from spawning (availability);
  - Inhibits growth.

Reviewer #1 – Further comments

- Recommended moving the assessment from Tier 1 to Tier 3; "The stock-recruitment relationship is not well estimated due to a lack of contrast. Therefore, this stock should reside in Tier 3 rather than Tier 1."
- He supported the bridging analysis from the bespoke ADMB assessment to SS3.

Responses - Reviewer #1:

1. Issue with growth in the model: "…population model is scientifically invalid because growth is not really modelled (instead observations are used as biological parameters)."

An empirical weight-at-age approach reduces estimation bias compared to modeling parametric growth in integrated, statistical stock assessment models when growth is time varying

Peter T. Kuriyama[a,*], Kotaro Ono[a], Felipe Hurtado-Ferro[a], Allan C. Hicks[b], Ian G. Taylor[b], Roberto R. Licandeo[c], Kelli F. Johnson[a], Sean C. Anderson[d], Cole C. Monnahan[e], Merrill B. Rudd[a], Christine C. Stawitz[e], Juan L. Valero[f]

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Responses - Reviewer #1:

2. Issue with data: EBS trawl series contains vessel effects which are structural rather than random.

- [RACE] used vessel effect correction prior to 2006 and decided to abandon it due to the evidence provided in Munro 1998 and Weinberg, K.L. and Kotwicki, S., 2008.
- Conclusion was that the differences between the vessels are often happening by chance and there is no consistency in vessel effect between years.

Reviewer #2:

- SS3 assessment m25.0a for BSAI yellowfin sole is technically competent, draws on an appropriate and rich data set, and is broadly consistent with survey and fishery evidence.
- Tier 1 is adequate as long as reference points are treated as model-dependent and interpreted alongside Tier 3 proxies and appropriate sensitivities.
- The transition from the bespoke ADMB model to SS3 has been carefully implemented and verified,
- The use of VAST/sdmTMB and tinyVAST for survey standardization and composition pre-processing is technically sound.

Reviewer #3:

- Transitioning to SS3 in that it provides consistency and flexibility.
- This stock should be assigned to a Tier 3 control rule. The current Ricker stock-recruitment function is not appropriate for benchmarks.
- The candidate assessment model 25a is adequate for providing management advice.

Yellowfin sole assessment model – 2026 (following CIE)

- Tier 1 → Tier 3.*
- Empirical weight at age (survey).
- Fishery weight at age estimated using catch at age methodology (bootstrapping "Sampler").
- Survey catchability modeled as a function of 100m EBS bottom temperature OR survey start date anomalies. *

Models 25.0 and 25.0a

$$q_t = e^{-\alpha + \beta S}$$

Models 25.0b

$$q_t = e^{-\alpha + \beta T}$$

- ADMB → SS3.*

* Indicates changes proposed.

Yellowfin sole stock assessment model - 2026

Model 25.0:

- This model is the same as Model 25.0_2025, but with updated data.

Model 25.0a: This model builds on Model 25.0, with:

- Data weighting for survey age composition is based on the input sample size (ISS) methodology R package *sampleISS* (Hulson et al. 2024).

Model 25.0b:

- This is the same as Model 25.0a but EBS survey catchability q incorporates EBS bottom temperature as an additive log-space environmental link (details below).

Models 25.0 and 25.0a

$$q_t = e^{-\alpha + \beta S}$$

Models 25.0b

$$q_t = e^{-\alpha + \beta T}$$

Data

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September models include data added through 2025

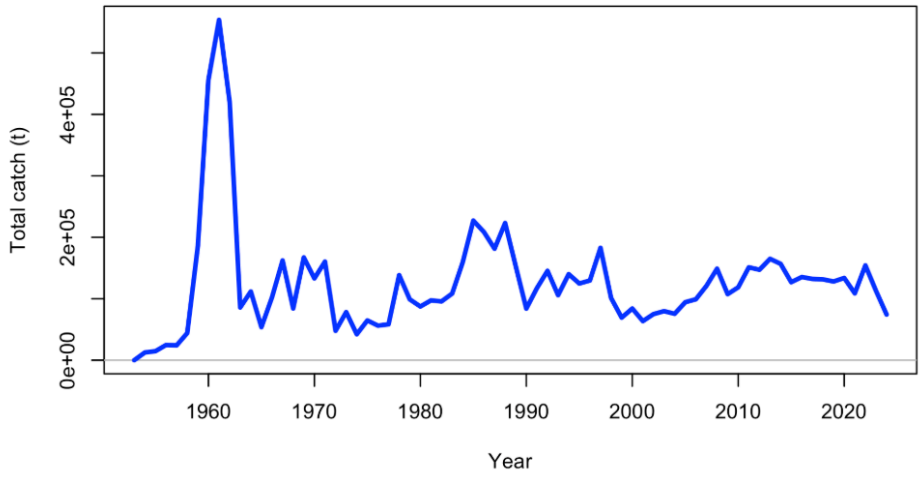
	Model 25.0 (2025)	Model 25.0, 25.0a, 25.0b
Data source	Years	Years
Fishery catch	1954-2025*	1954-2025
Fishery age composition	1975-2023	1975-2024
Fishery weight at age	1975-2023	1975-2024
Survey biomass and standard error	1982-2024	1982-2025 (not 2020)
Bottom temperature	1982-2024	1982-2025 (not 2020)
Survey age composition	1979-2024	1979-2025 (not 2020)
Survey weight at age	1979-2024	1979-2025 (not 2020)
Age at maturity	combined 1992 and 2012 samples	

*Incomplete

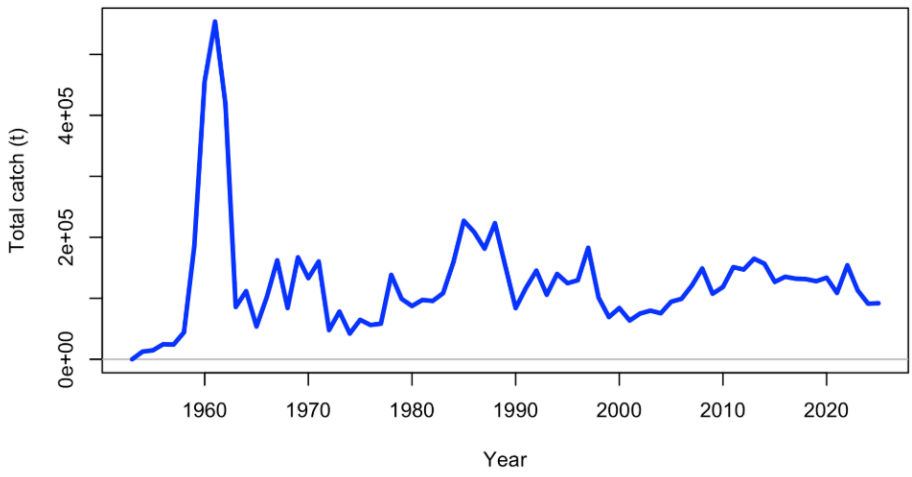
Note: survey age comps for 1982 – 2025 used tinyVAST (previously VAST).

Catch – minor differences

Data partial through 2025



Data updated through 2025



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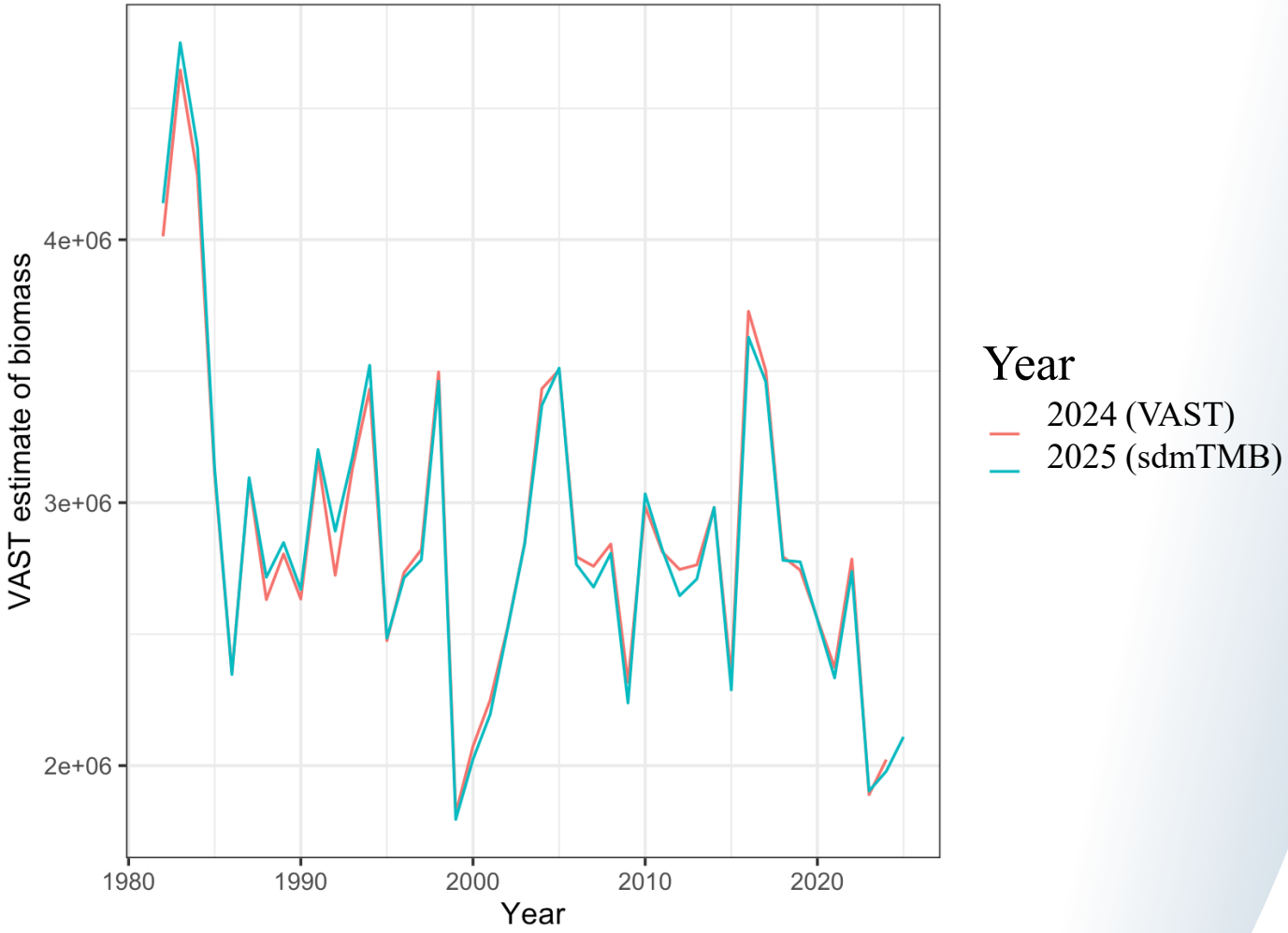
Minor difference in survey biomass index (EBS+NBS)



Bridging plots available.

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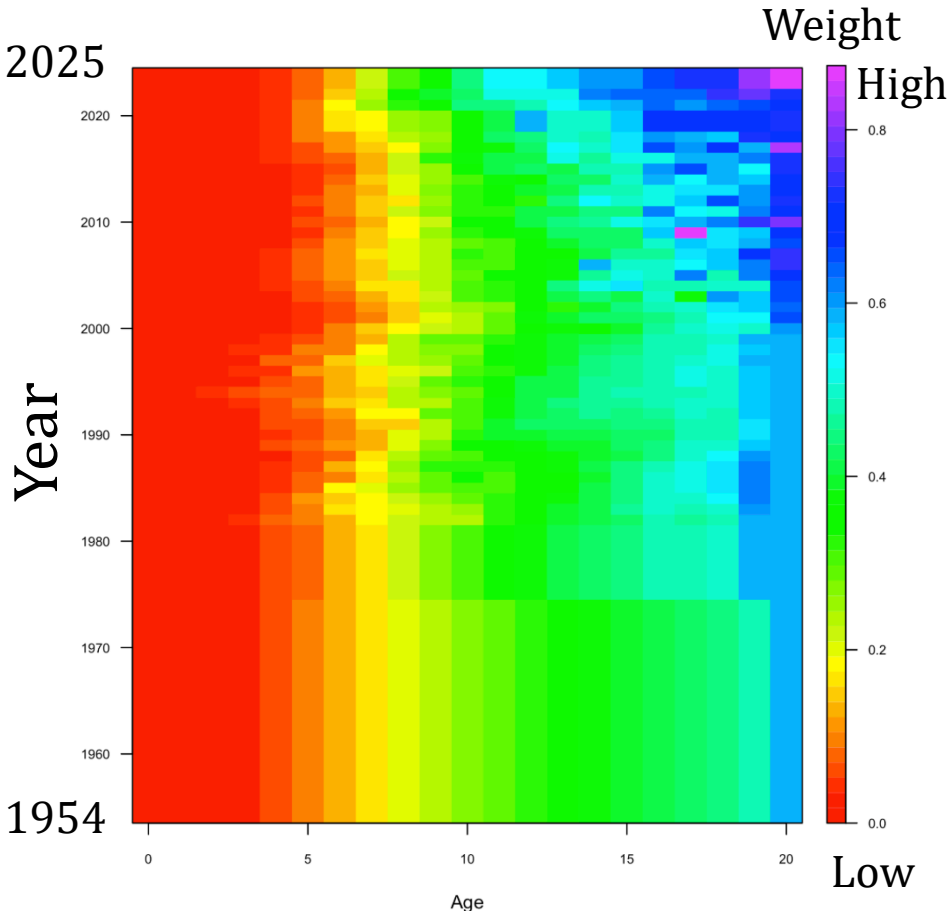
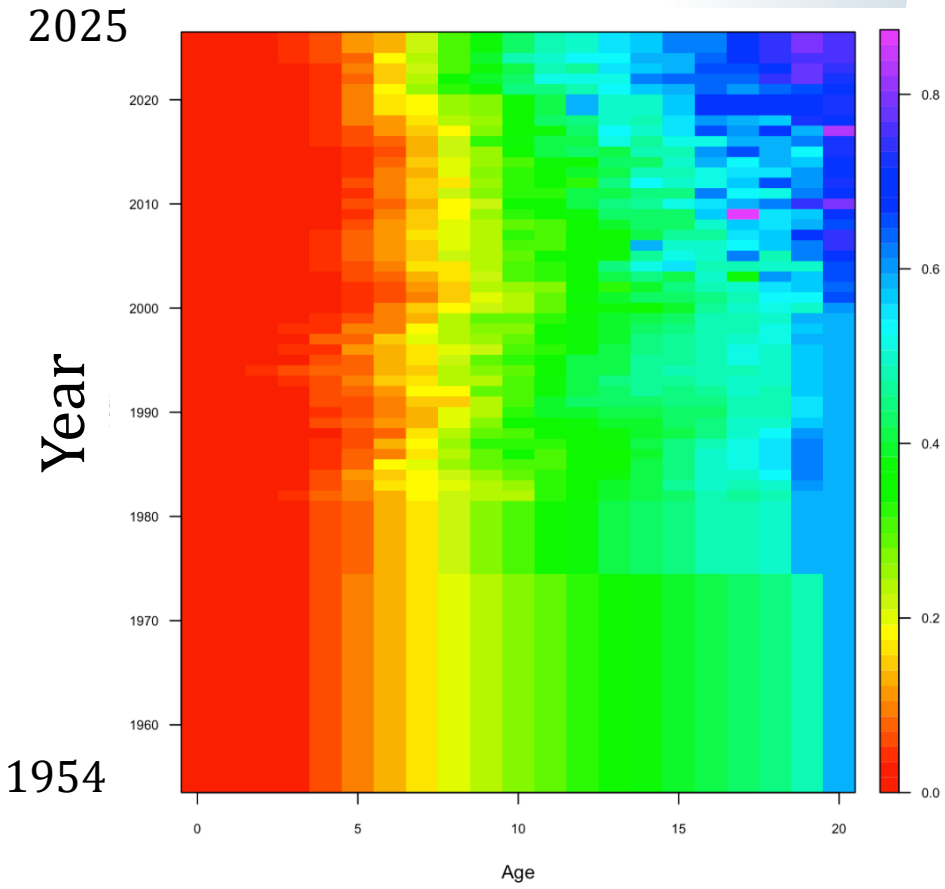
Female weight at age

Data partial through 2025



Data updated through 2025



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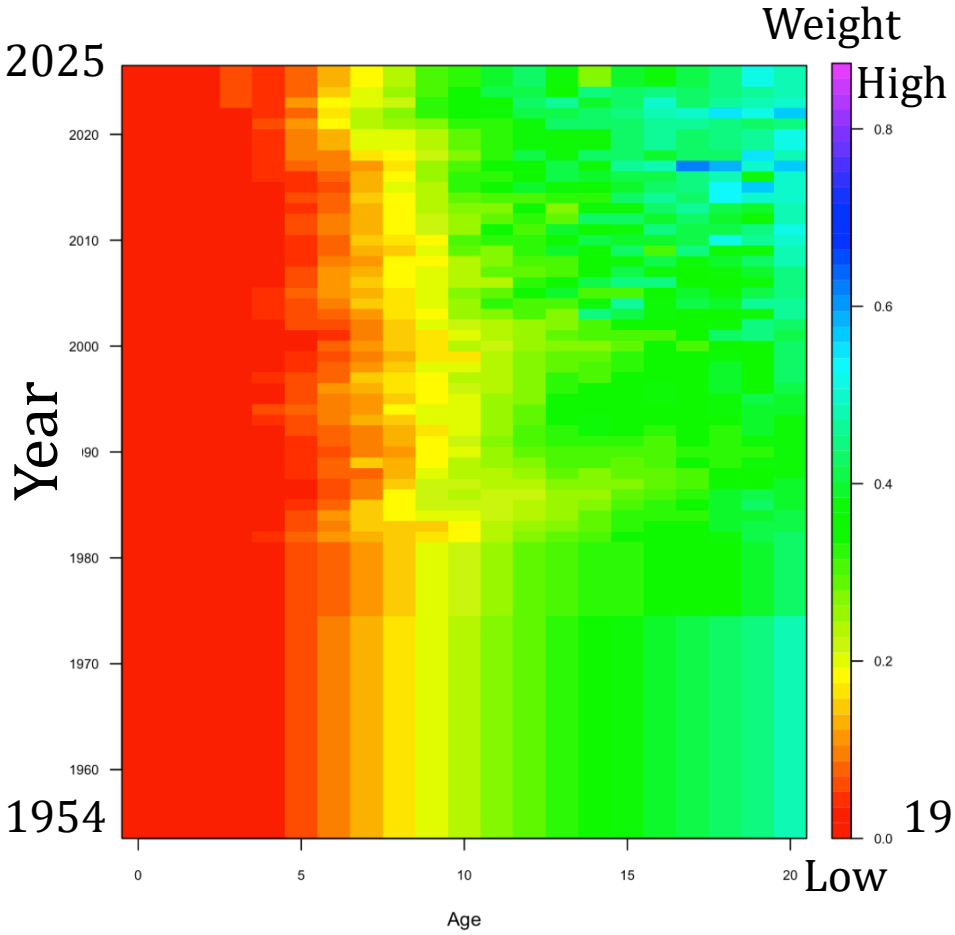
Male weight at age

Data partial through 2025



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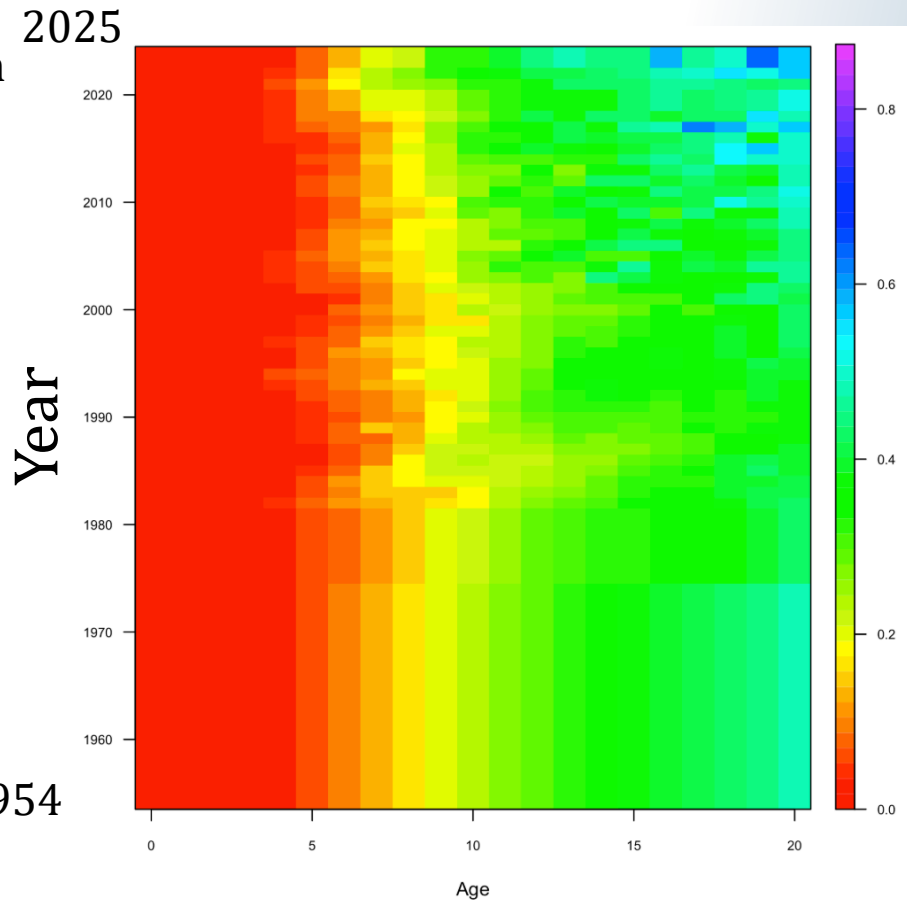

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Results

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Proposed model – Likelihoods and selected parameter estimates

Label	M25.0 (2025)	M25.0	M25.0a	M25.0b
Data	Partial 2025	----------Complete 2025----------		
Catchability	Start date	Start date	Start date	Temperature
N. samples for agecomp	Nhauls	Nhauls	SurveyISS	SurveyISS
Number of parameters	235	235	235	235
Survey_like	4.55	-5.36	-10.37	-20.97
Age_comp_like	197.97	319.81	393.19	389.60
Parm_priors_like	0.09	0.04	0.02	0.04
Recr_Virgin_billions	2.39	2.67	2.73	2.61
SR_LN(R0)	14.69	14.80	14.82	14.78
R0_for_SRR_bench	2,385,820	2,669,580	2,734,870	2,612,490
SR_BH_steep	1.00	1.00	1.00	1.00
NatM_uniform_Fem_GP_1	0.120	0.120	0.120	0.120
NatM_uniform_Mal_GP_1	0.123	0.132	0.132	0.132
L_at_Amax_Fem_GP_1	38.034	38.034	38.034	38.034
L_at_Amax_Mal_GP_1	34.030	34.030	34.030	34.030
VonBert_K_Fem_GP_1	0.137	0.137	0.137	0.137
VonBert_K_Mal_GP_1	0.161	0.161	0.161	0.161
SSB_Virgin	1,372,200	1,535,410	1,572,960	1,502,580
Bratio_2025	NA	0.77	0.78	0.71
$SDNR_{survey}$		0.82/0.80	0.82/0.80	0.75/0.74
$SDNR_{fishery}$		0.83/0.86	0.83/0.86	0.86/0.90

Proposed model – Likelihoods and selected parameter estimates

Label	M25.0 (2025)	M25.0	M25.0a	M25.0b
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NatM_uniform_Fem_GP_1	0.120	0.120	0.120	0.120
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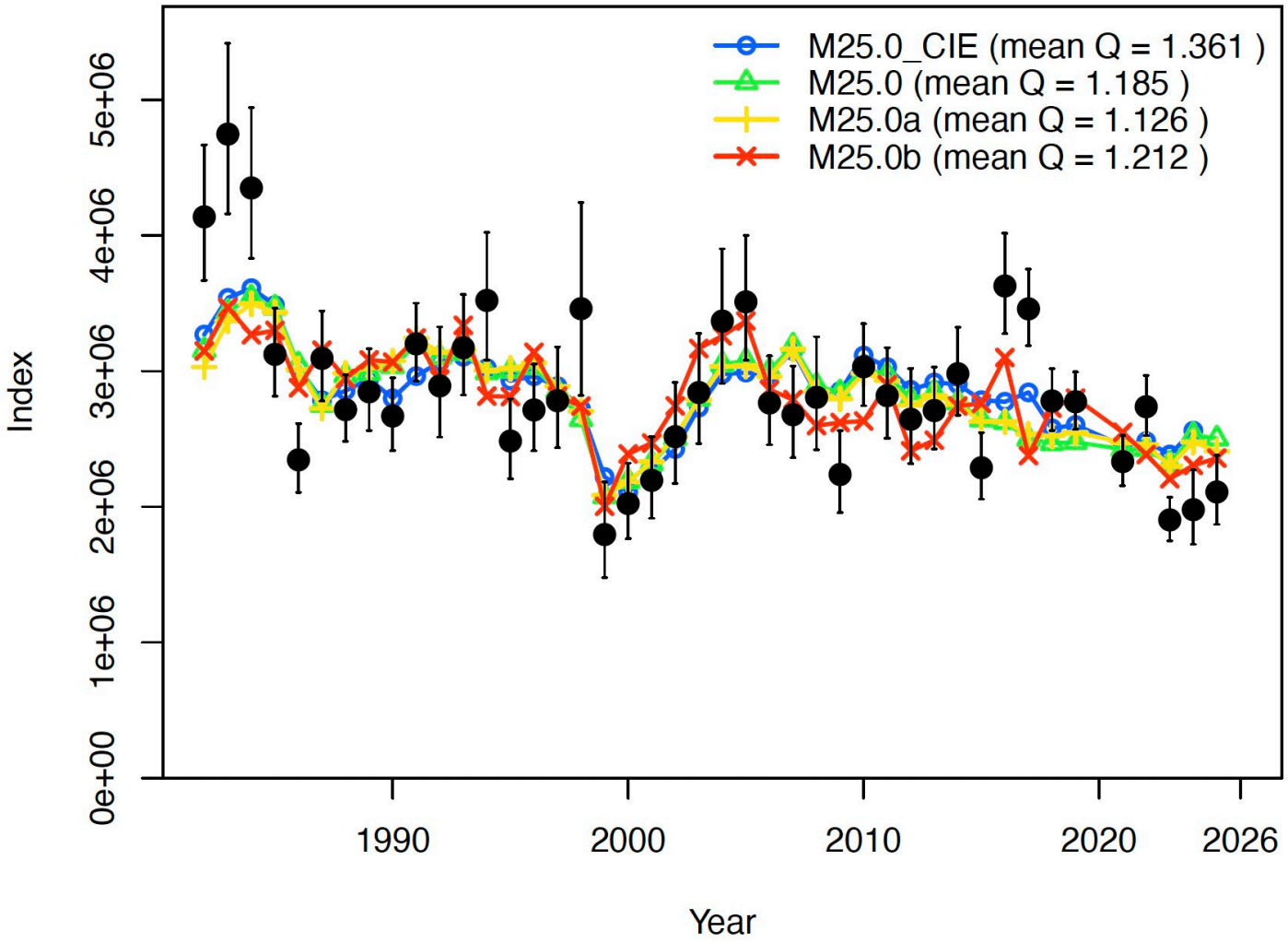
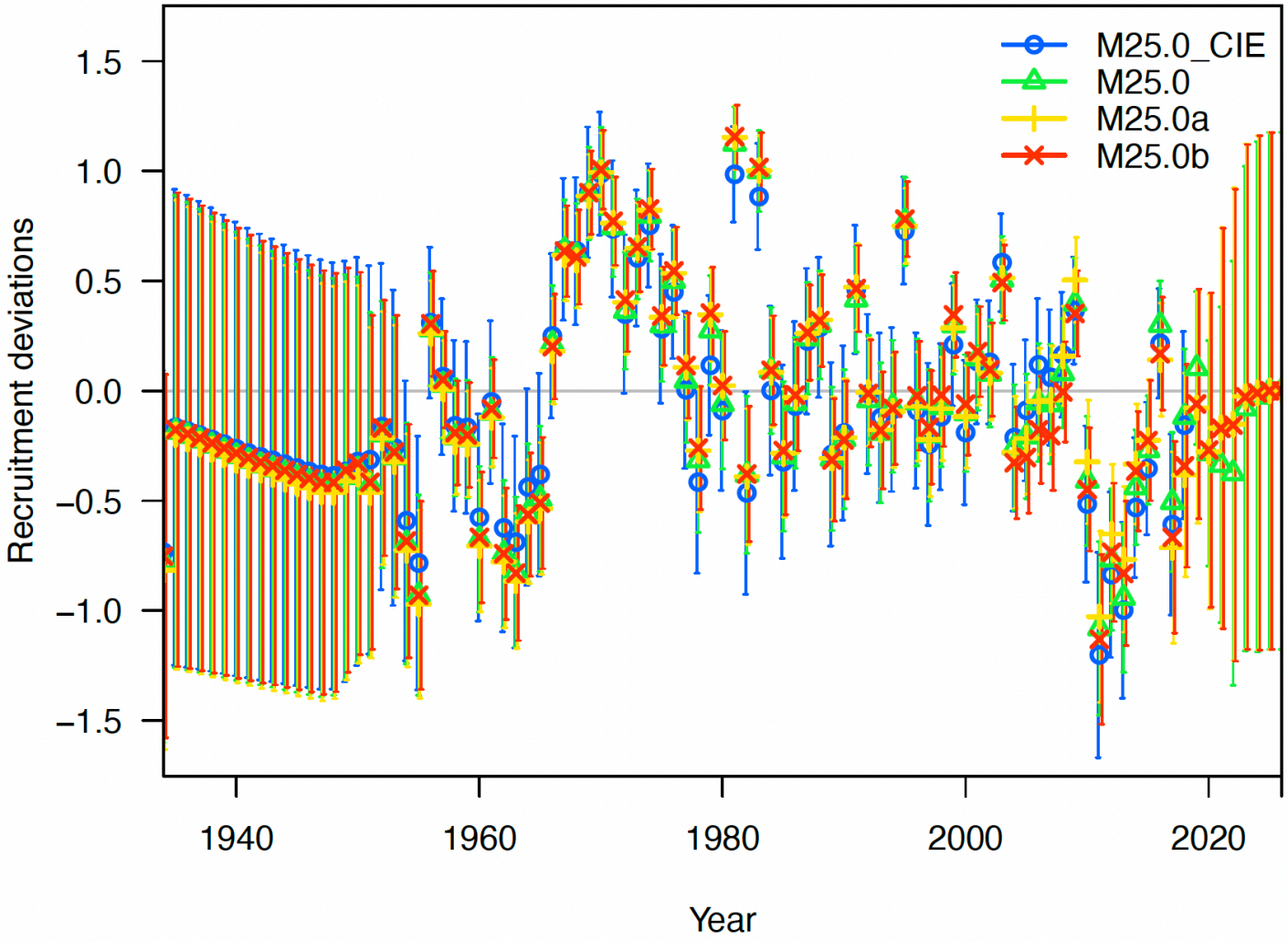
Proposed models fit to survey index



Recruitment deviations track between models.



Diagnostics

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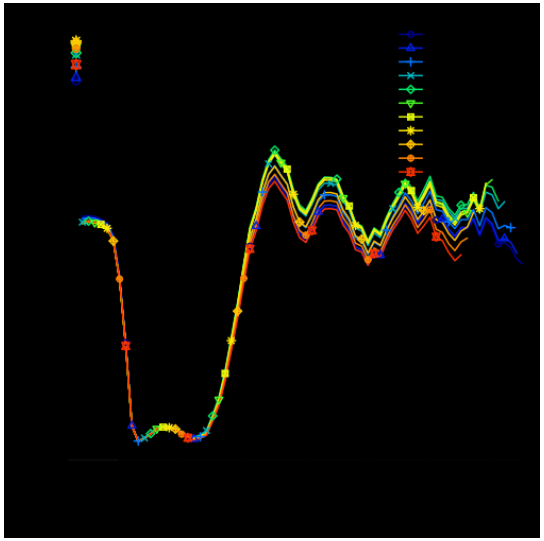
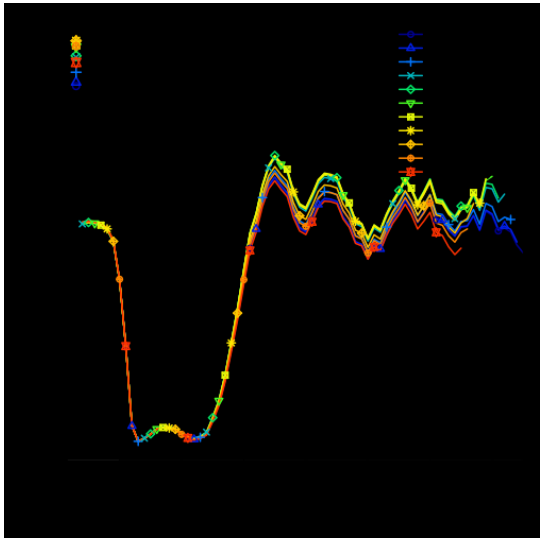
Retrospectives - overall systemic bias is minimal.

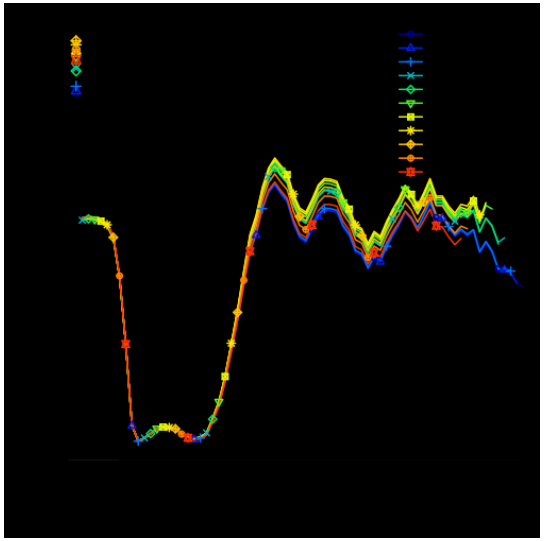
Model 25.0
Rho = 0.087



Model 25.0a
Rho = 0.072

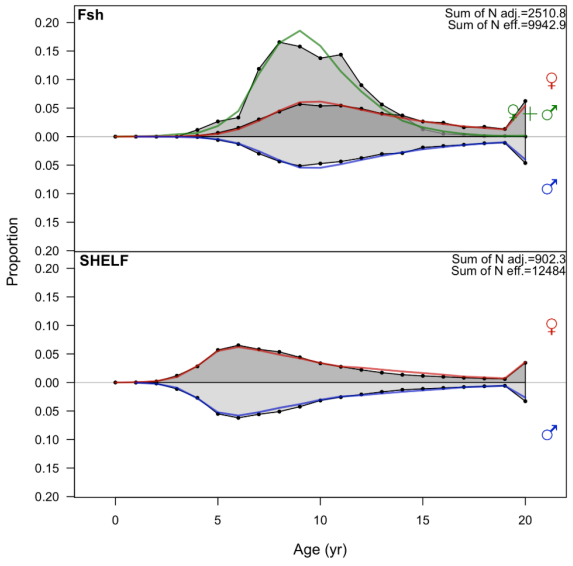


Model 25.0b
Rho = 0.095



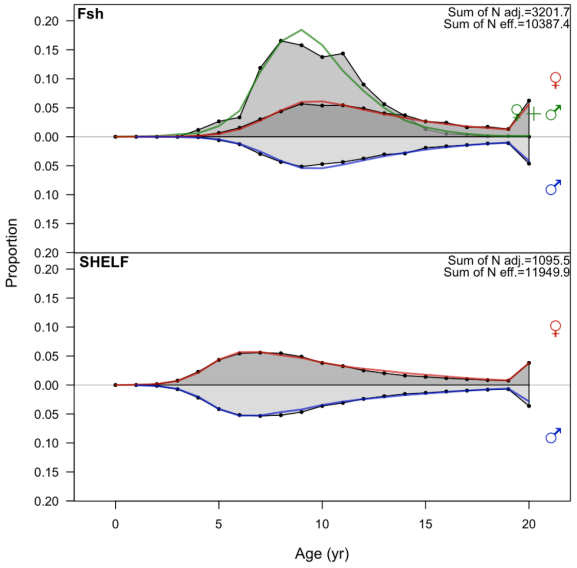
Age composition distribution – similar fit between models.

Base model, data thru 2025
StartdateQ, nhauls



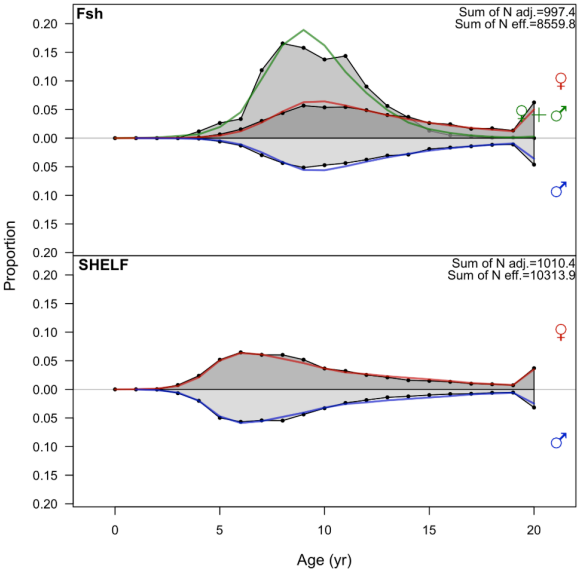
m25.0

Same model, data thru 2025
StartdateQ, sampleISS



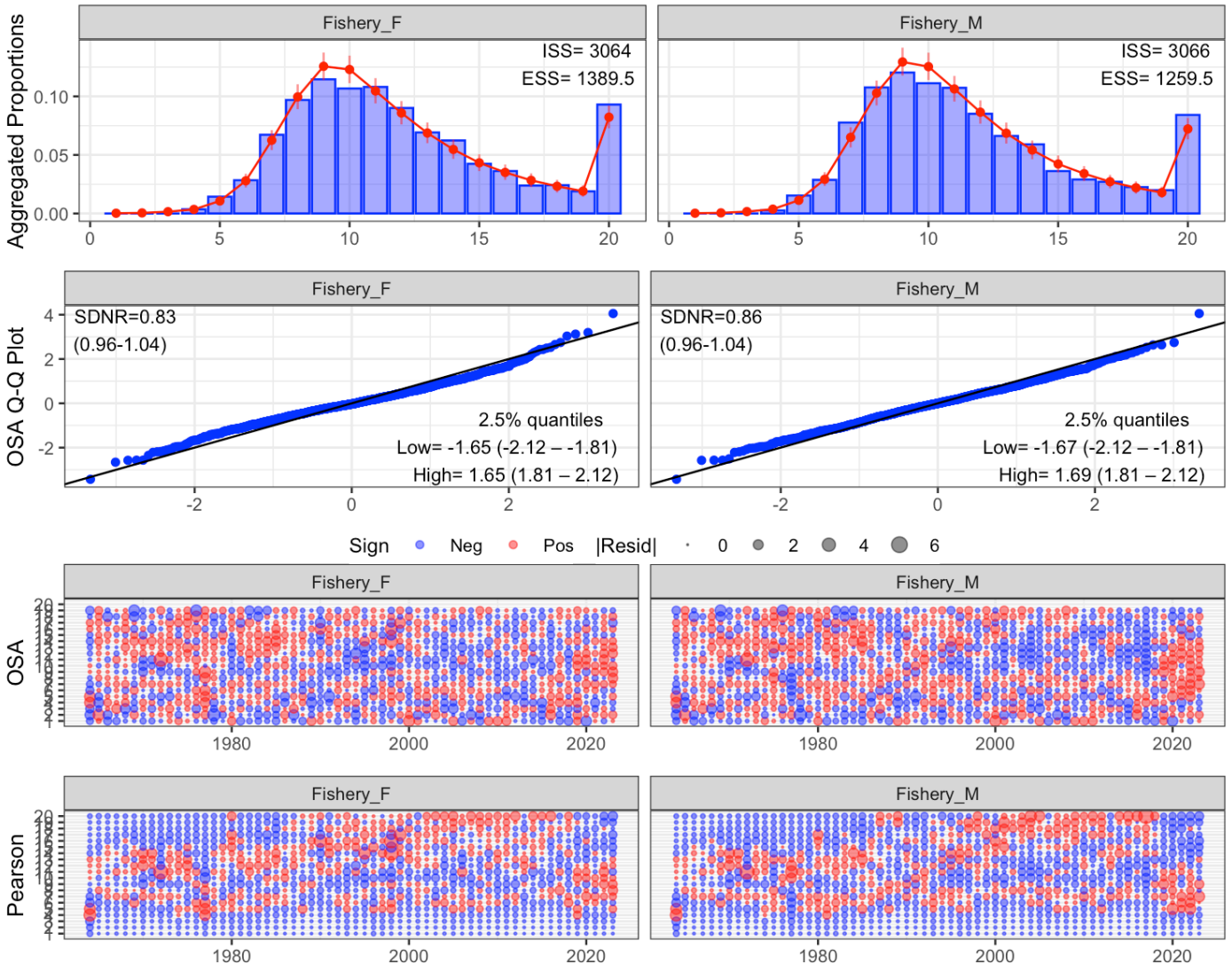
m25.0a

Data thru 2025
TemperatureQ, sampleISS

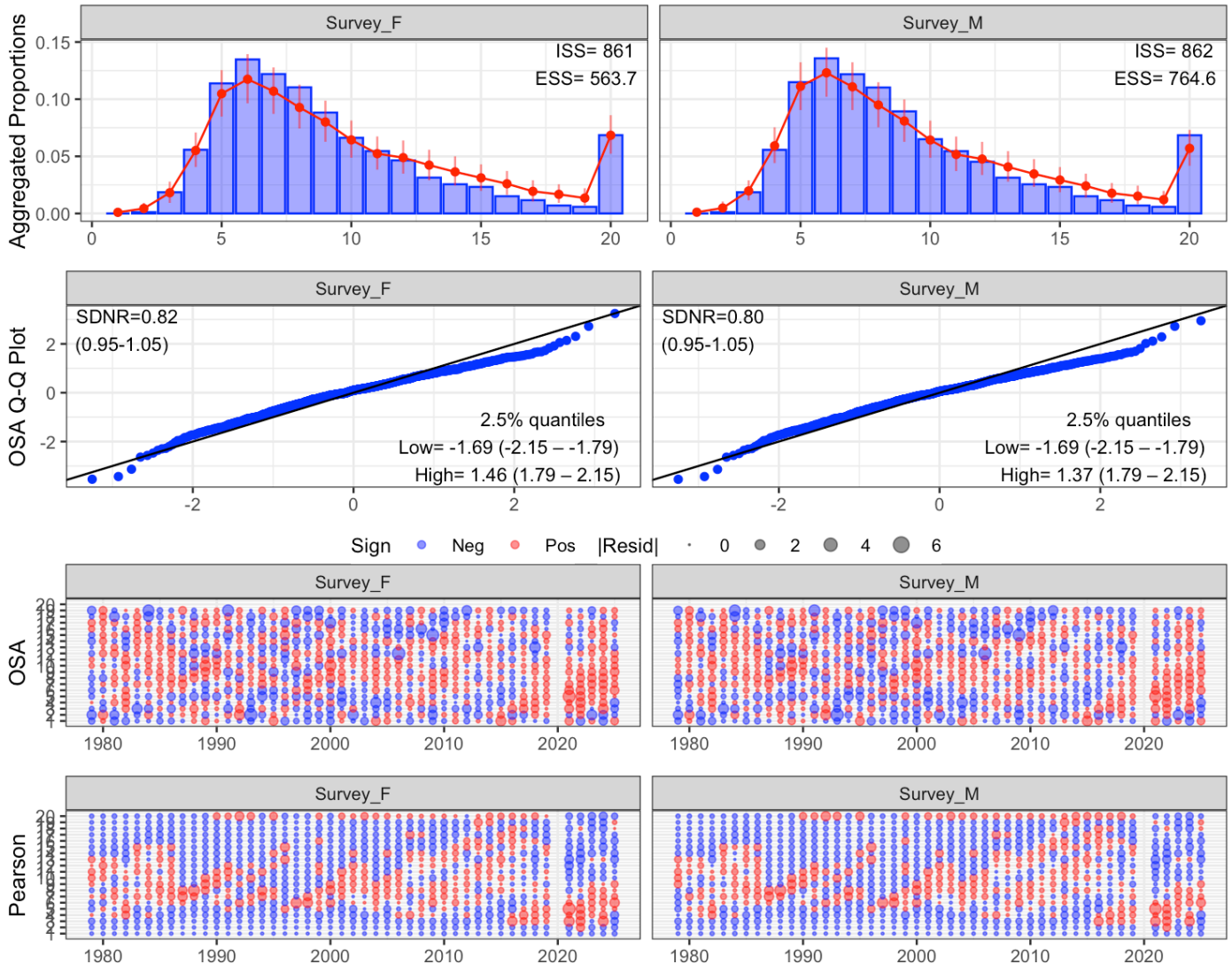


m25.0b

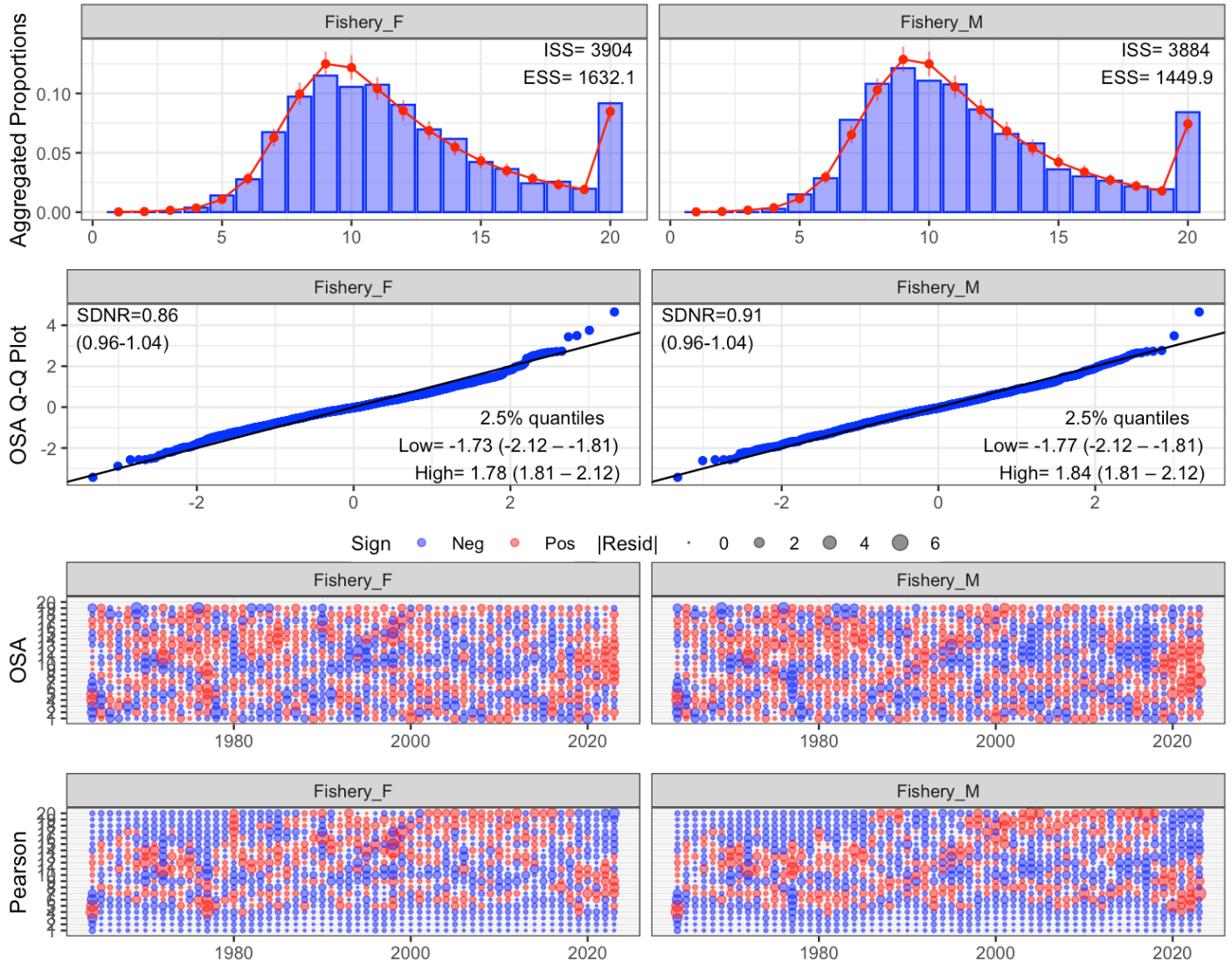
Model 25.0 Fishery OSA Residuals



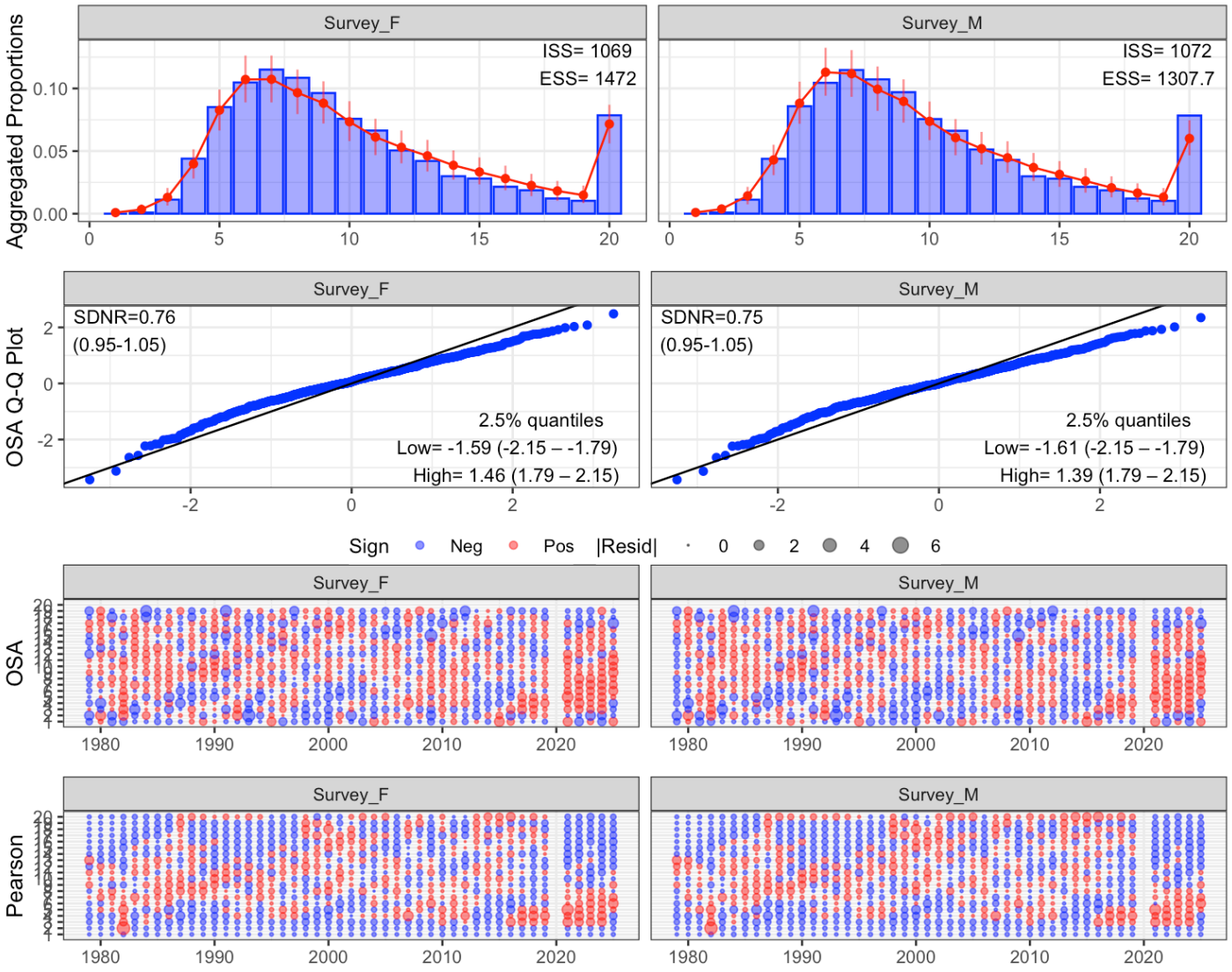
Model 25.0 Survey OSA Residuals



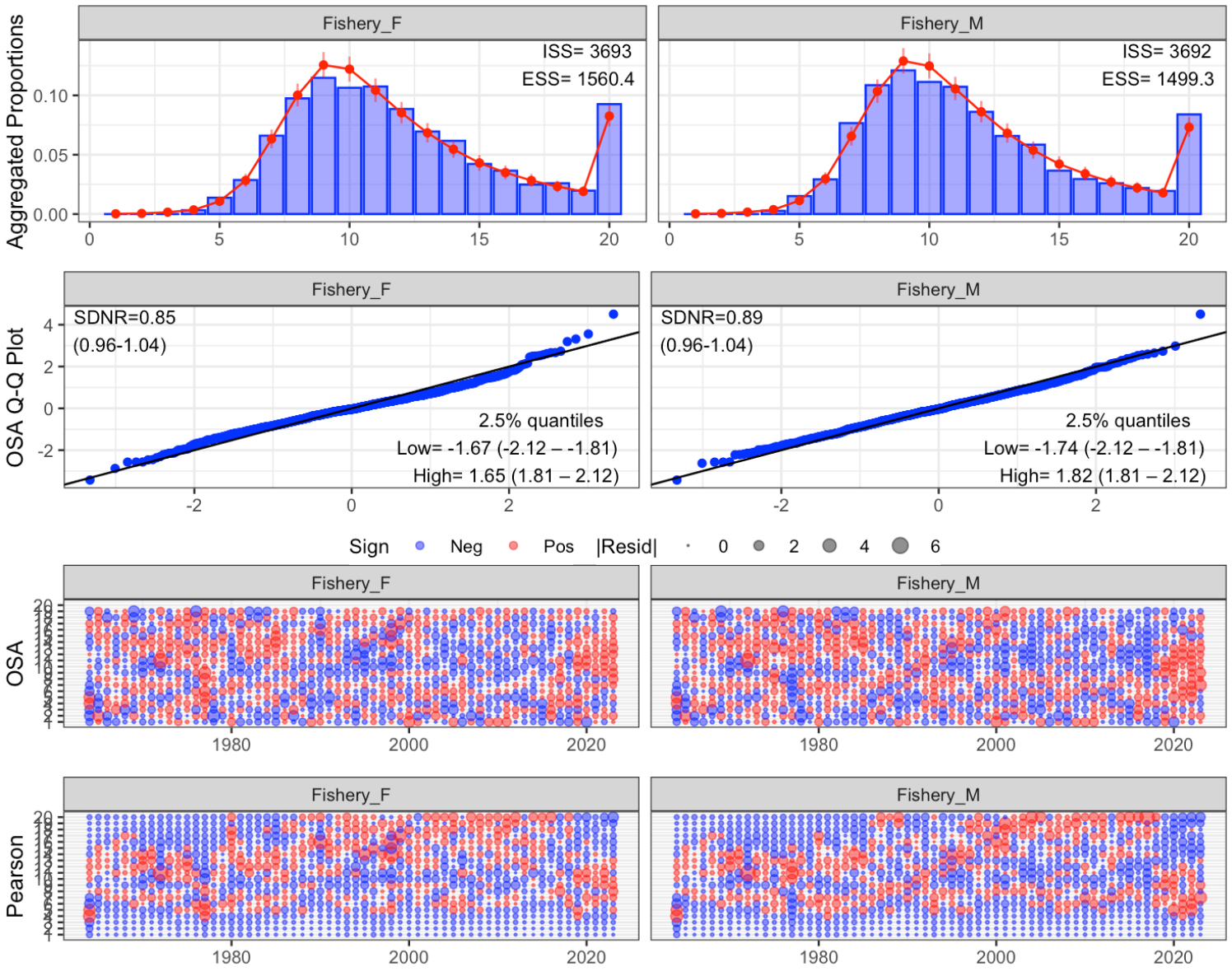
Model 25.0a Fishery OSA Residuals



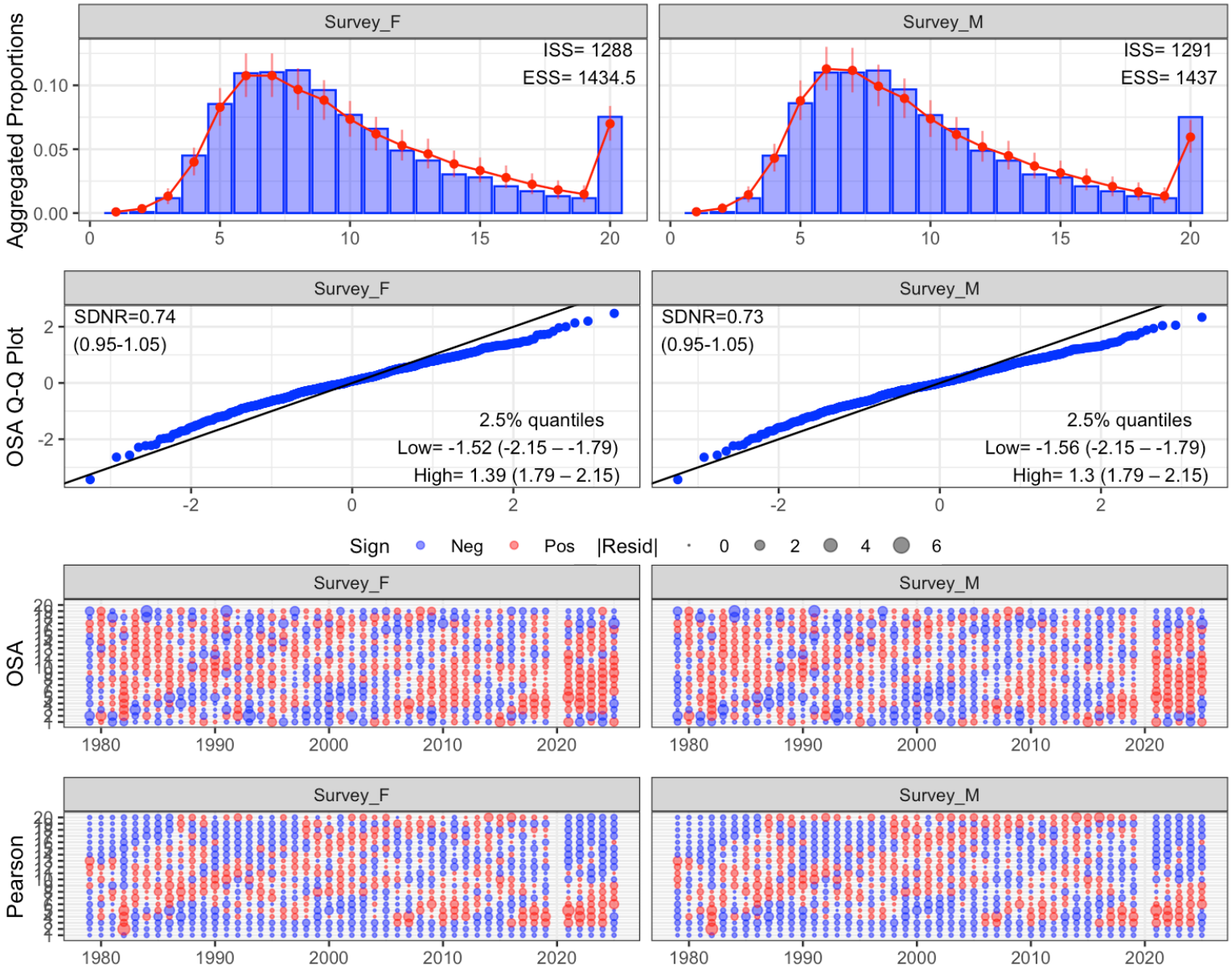
Model 25.0a Survey OSA Residuals



Model 25.0b Fishery OSA Residuals



Model 25.0b Survey OSA Residuals



Proposed model – Likelihoods and selected parameter estimates

YFS Summary Table 2024

Quantity	As estimated or *specified* *last* year for: 2024	2025	As estimated or *recommended* *this* year for: 2025	2026
M (natural mortality rate)	0.12, 0.125	0.12, 0.125	0.12, 0.128	0.12, 0.128
Tier	1a	1a	1a	1a

YFS Summary Table 2023

Quantity	As estimated or *specified* *last* year for: 2023	2024	As estimated or *recommended* *this* year for: 2024	2025
M (natural mortality rate)	0.12, 0.125	0.12, 0.125	0.12, 0.137	0.12, 0.137
Tier	1a	1a	1a	1a

Label	M25.0 (2025)	M25.0	M25.0a	M25.0b
Data	Partial 2025	----------Complete 2025----------		
Catchability	Start date	Start date	Start date	Temperature
N. samples for agecomp	Nhauls	Nhauls	SurveyISS	SurveyISS
Number of parameters	235	235	235	235
Survey_like	4.55	-5.36	-10.37	-20.97
Age_comp_like	197.97	319.81	393.19	389.60
Parm_priors_like	0.09	0.04	0.02	0.04
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SR_LN(R0)	14.69	14.80	14.82	14.78
R0_for_SRR_bench	2,385,820	2,669,580	2,734,870	2,612,490
SR_BH_steep	1.00	1.00	1.00	1.00
NatM_uniform_Fem_GP_1	0.120	0.120	0.120	0.120
NatM_uniform_Mal_GP_1	0.123	0.132	0.132	0.132
L_at_Amax_Fem_GP_1	38.034	38.034	38.034	38.034
L_at_Amax_Mal_GP_1	34.030	34.030	34.030	34.030

Proposed model – Likelihoods and selected parameter estimates

YFS Summary Table 2024

Quantity	As estimated or *specified last* year for: 2024	2025	As estimated or *recommended this* year for: 2025	2026
M (natural mortality rate)	0.12, 0.125	0.12, 0.125	0.12, 0.128	0.12, 0.128
Tier	1a	1a	1a	1a
Projected total (age 6+) biomass (t)	2,512,810 t	2,616,800 t	2,308,550 t	2,353,240 t
Projected female spawning biomass (t)	881,648 t	857,354 t	748,076 t	758,695 t
B_0	1,516,980 t	1,516,980 t	1,383,020 t	1,383,020 t
B_{MSY}	539,657 t	539,657 t	479,711 t	479,711 t
F_{OFL}	0.121	0.121	0.13	0.13
$maxF_{ABC}$	0.106	0.106	0.114	0.114
F_{ABC}	0.106	0.106	0.114	0.114
OFL (t)	305,298 t	317,932 t	299,247 t	305,039 t
$maxABC$	265,913 t	276,917 t	262,557 t	267,639 t
	265,913 t	276,917 t	262,557 t	267,639 t
	2022	2023	2023	2024
	No	n/a	No	n/a
	n/a	No	n/a	No
	n/a	No	n/a	No

ed on estimated catches of 74,288 t in 2024 and 116,803 t used in place of
is estimate was based on the mean catch over the past 5 years, 2020 - 2024,
includes the extrapolated catch of 74,288 t for 2024.

Label	M25.0 (2025)	M25.0	M25.0a	M25.0b
Data	Partial 2025	----------Complete 2025----------		
Catchability	Start date	Start date	Start date	Temperature
N. samples for agecomp	Nhauls	Nhauls	SurveyISS	SurveyISS
Number of parameters	235	235	235	235
Survey_like	4.55	-5.36	-10.37	-20.97
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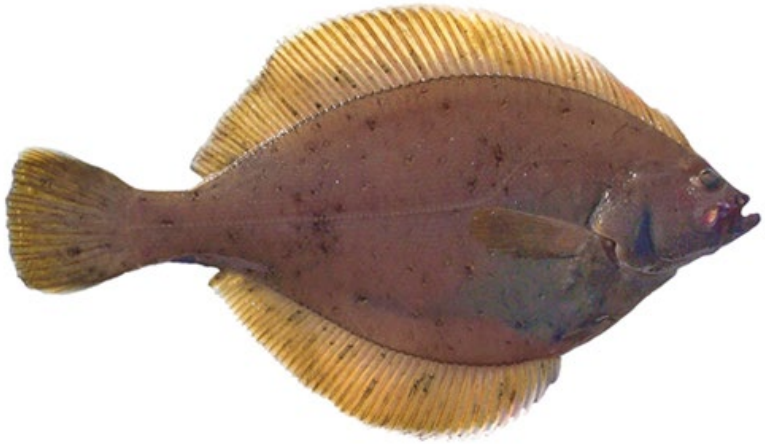
Questions?



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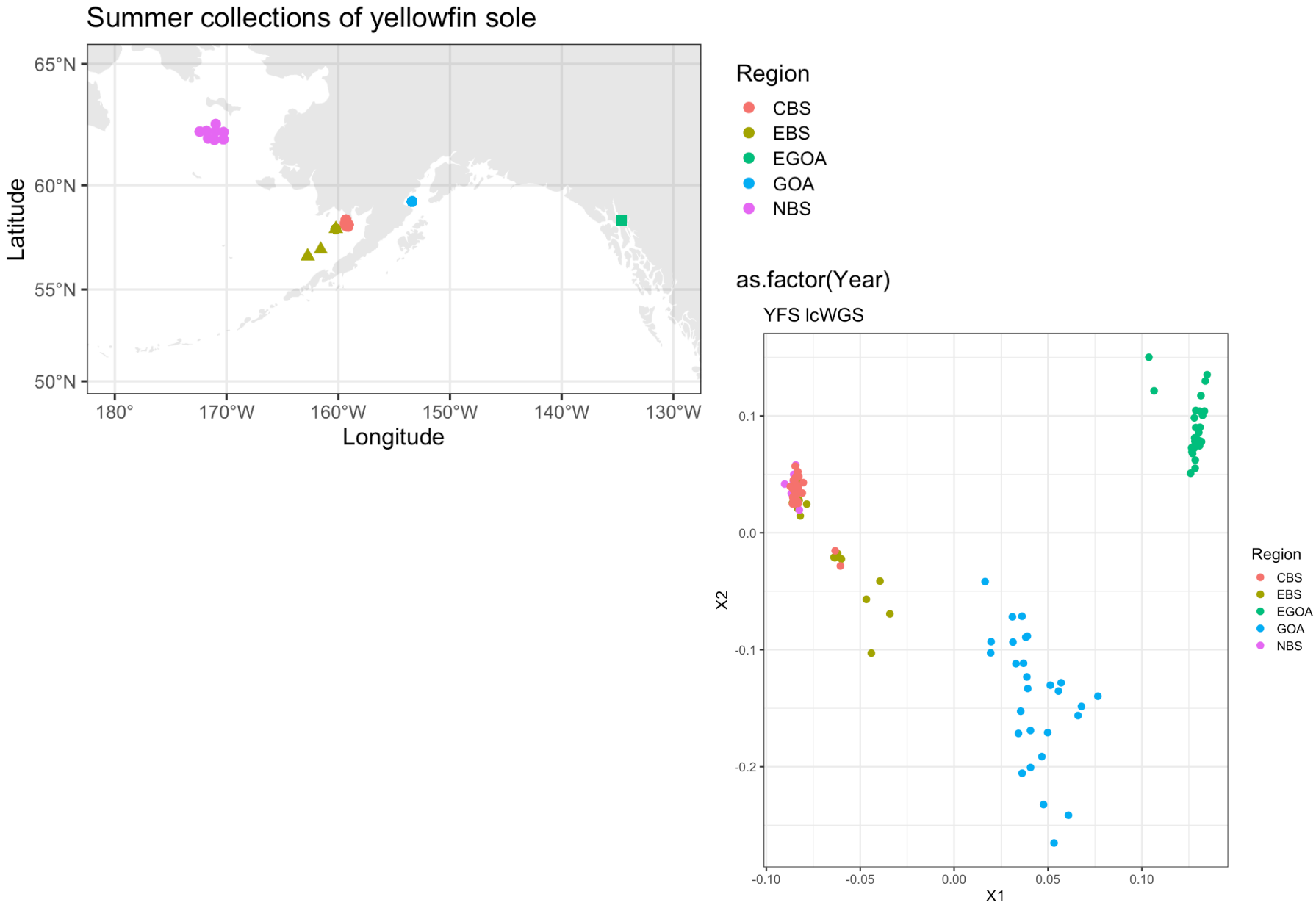
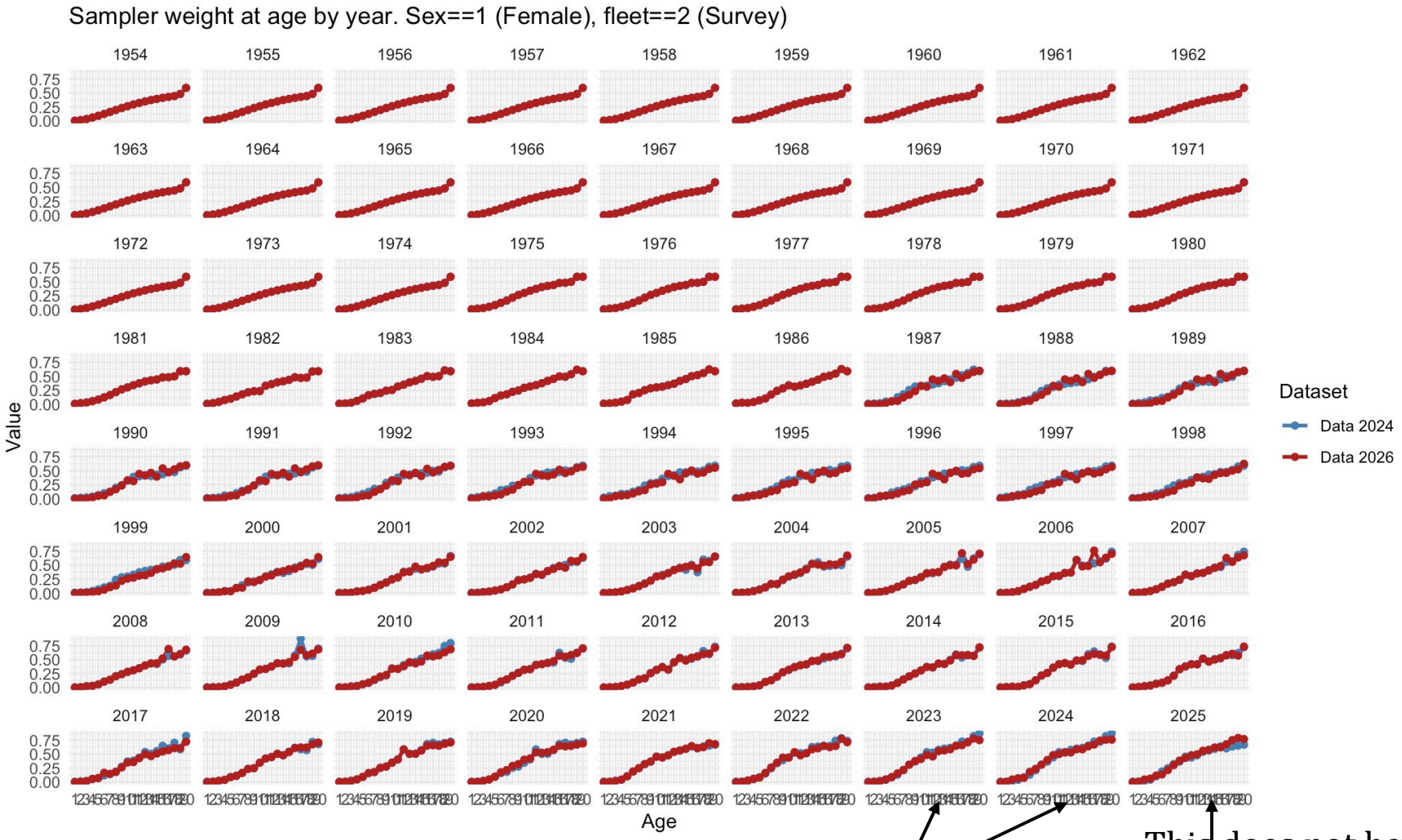

Summer collections of yellowfin sole
65°N
60°N
55°N
50°N
Latitude
180°
170°W
160°W
150°W
140°W
130°W
Longitude
Region
CBS
EBS
EGOA
GOA
NBS
as.factor(Year)
YFS lcWGS
0.1
0.0
-0.1
-0.2
X2
-0.10
-0.05
0.00
0.05
0.10
X1
Region
CBS
EBS
EGOA
GOA
NBS

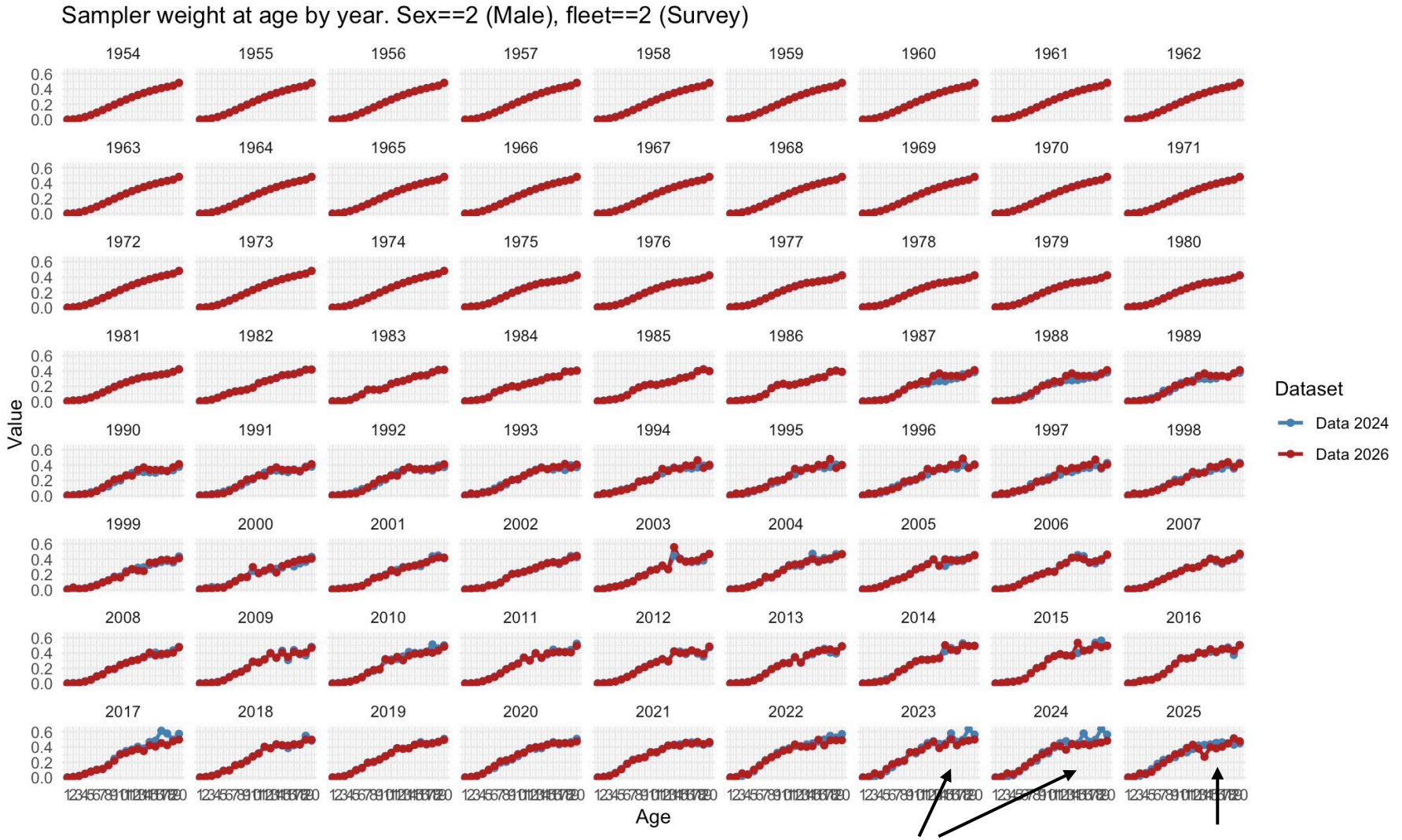
Sampler survey weight at age females.



Last two survey years in 2024 are identical because we do not have data.

This does not have 2024 data. Where did this come from?

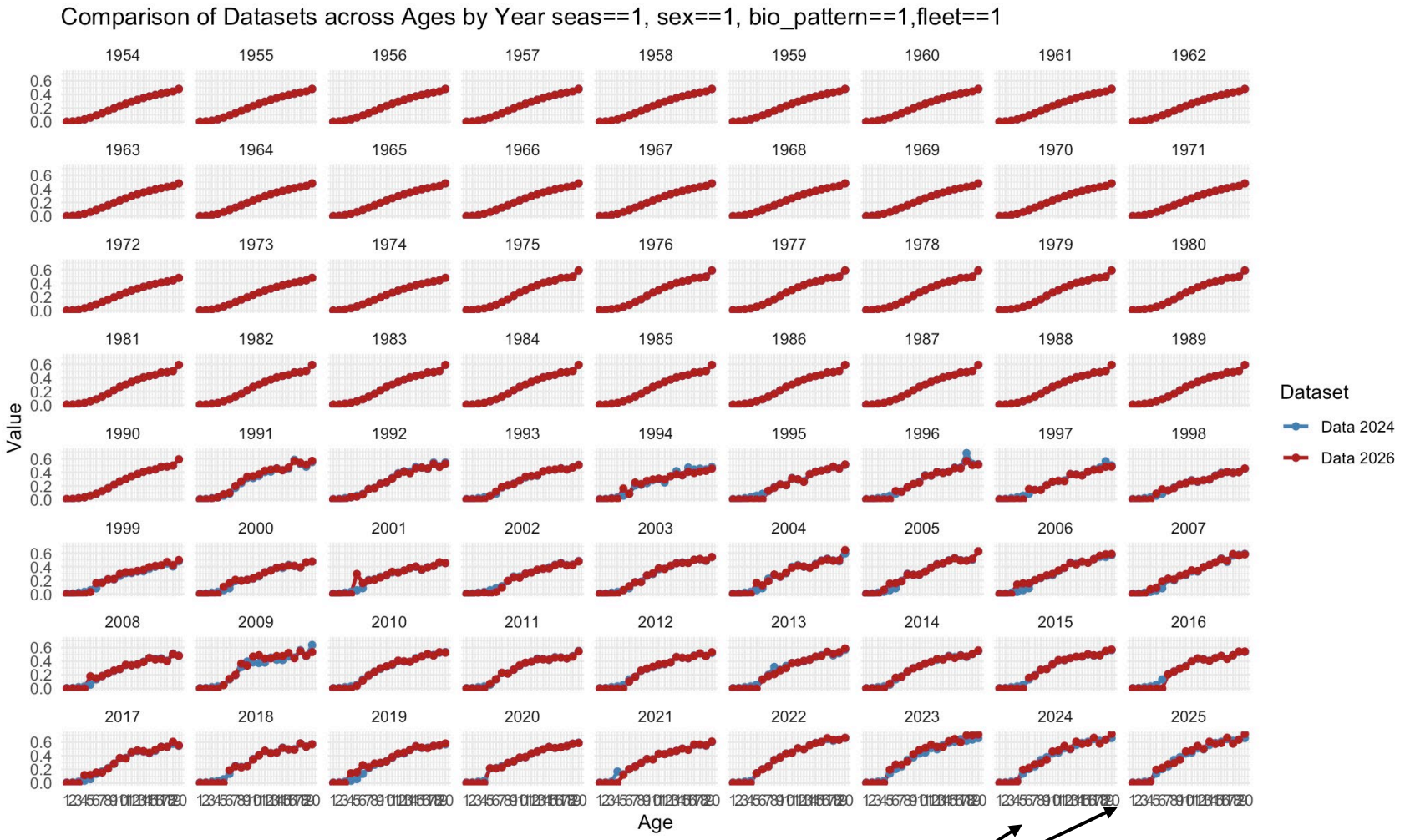
Sampler survey weight at age males.



Last two survey years in 2024 are identical because we do not have data.

This does not have 2024 data. ggplot error.

Fishery females



Last 2 years duplicated in this dataset

Fishery males