

# **2023 Limited Assessment Update of U.S. West Coast Sablefish**

Assessment Modeling and Performance

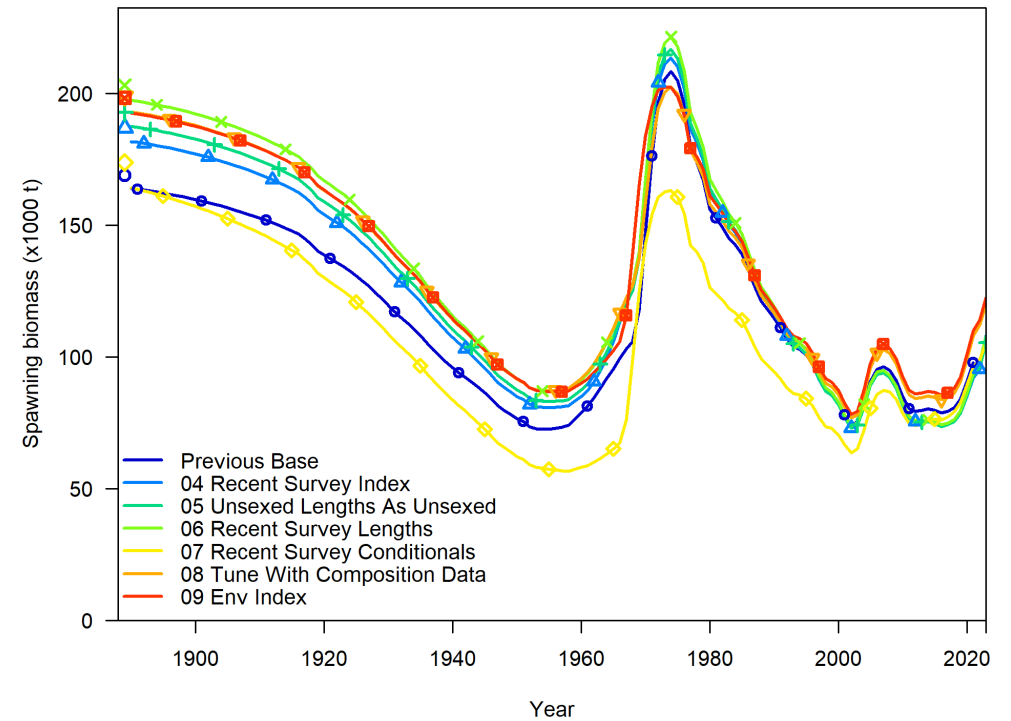
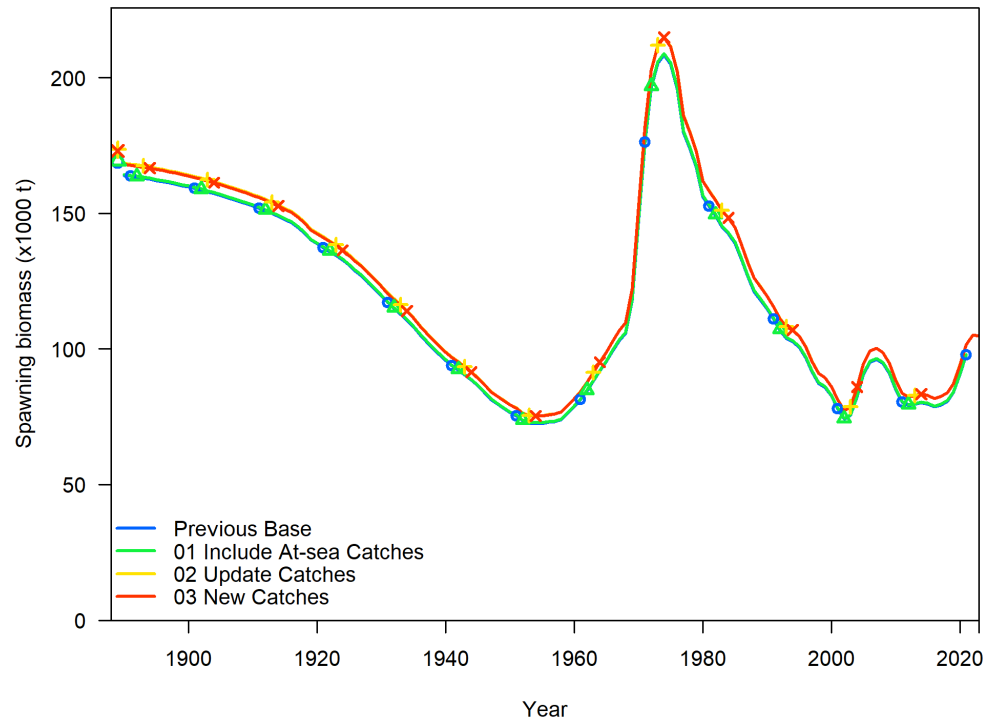
**Drs. Kelli F. Johnson, Chantel R. Wetzel, and Nick Tolimieri**

U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service

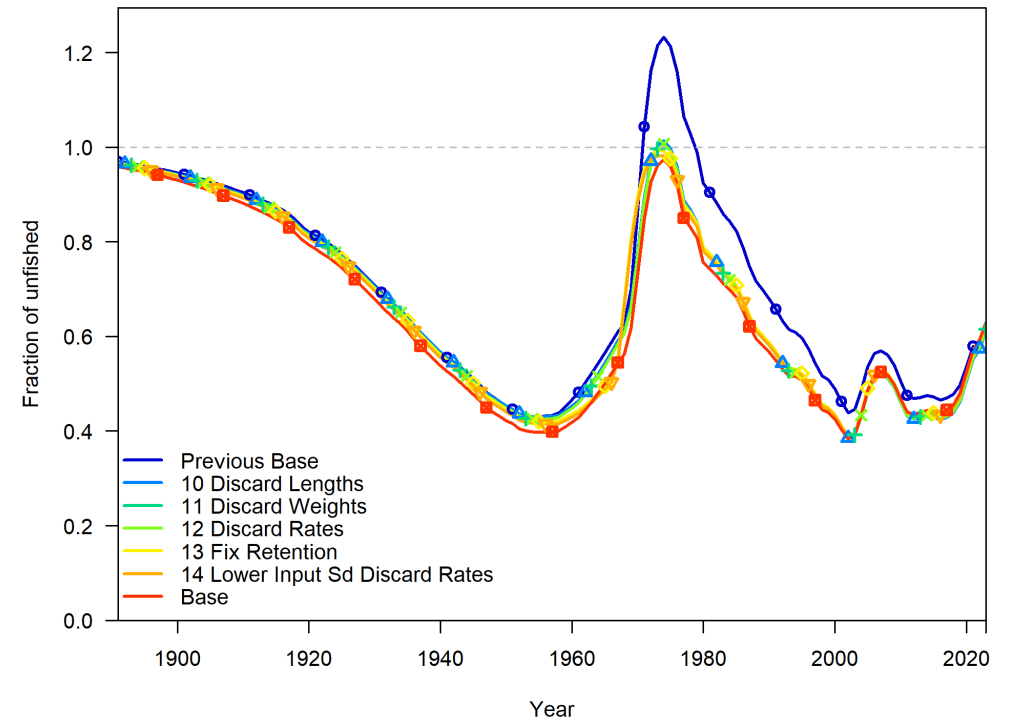
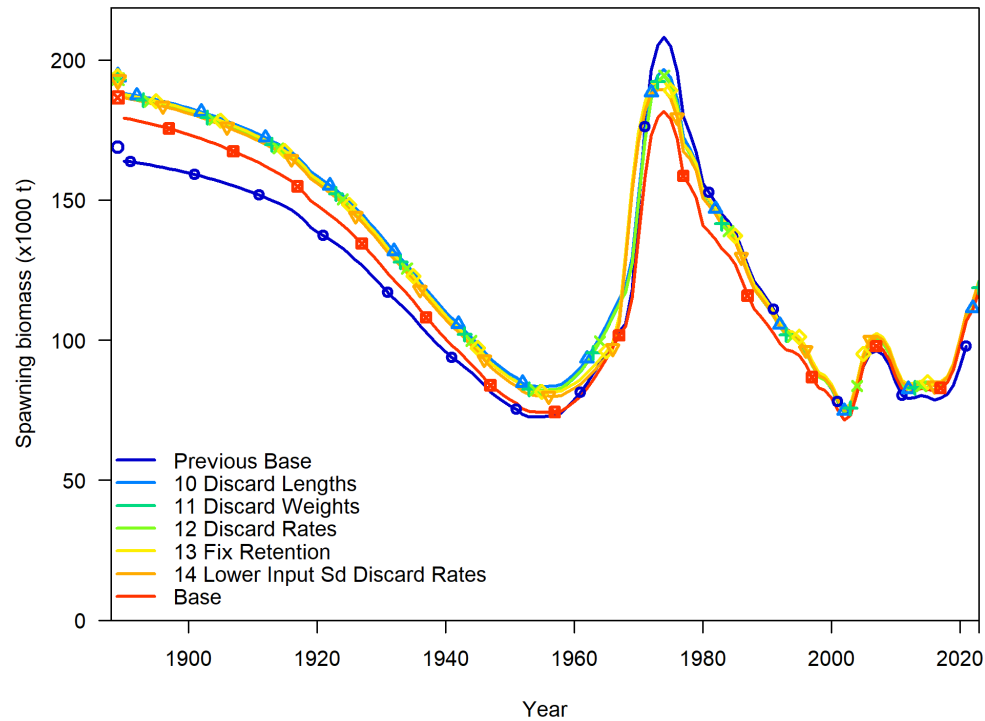
# Disclaimer

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# Bridging



# Base model



# Parameters

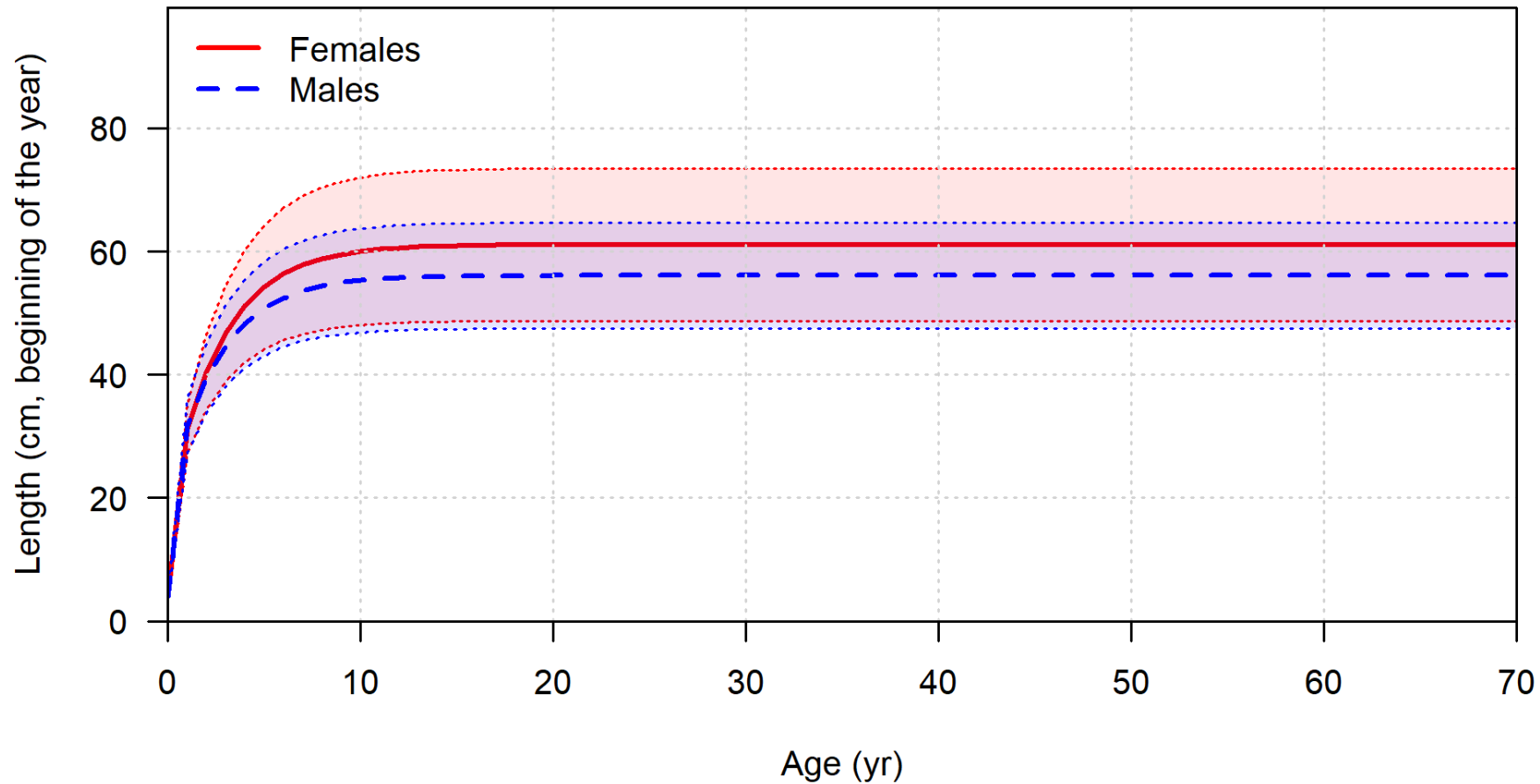
- Biology
- Growth
- Maturity
- Fecundity
- Selectivity
- Retention

# Parameters - Biology

Label	Value	SD	Gradient
CV old Female	0.10	0.004	-0.00188
CV old Male	0.08	0.003	-0.00102
CV young Female	0.06	0.009	-0.00044
CV young Male	0.07	0.008	0.00015
K Female	0.37	0.017	0.00664
K Male	0.38	0.017	0.00519
L at Amax Female	61.13	0.666	0.00339
L at Amax Male	56.11	0.380	0.00548

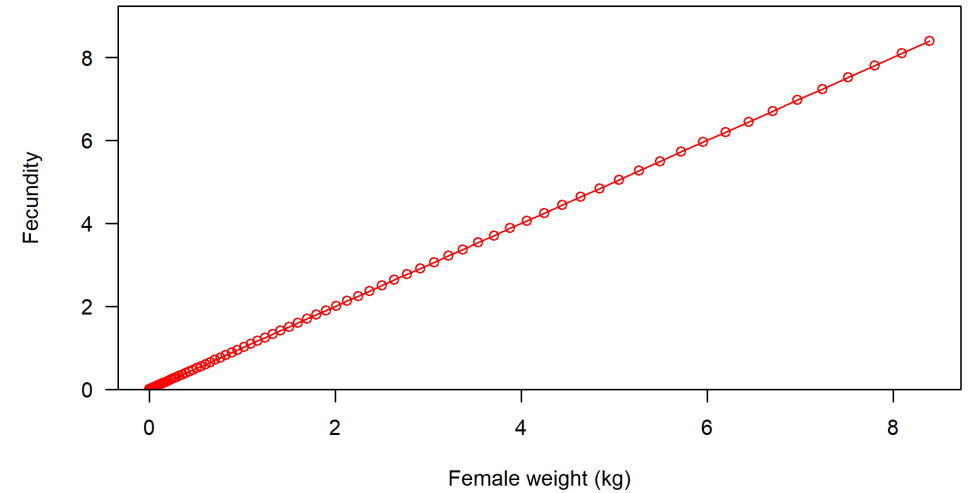
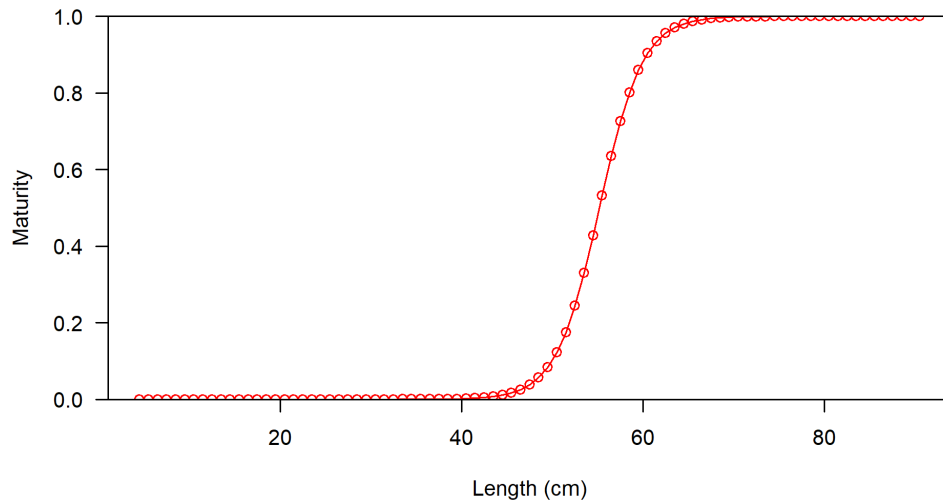
Label	Value	SD	Gradient
L at Amin Female	25.26	0.500	0.00213
L at Amin Male	26.62	0.605	0.00457
M Female	0.07	0.008	-0.00787
M Male	0.06	0.005	-0.00862

# Parameters - Growth

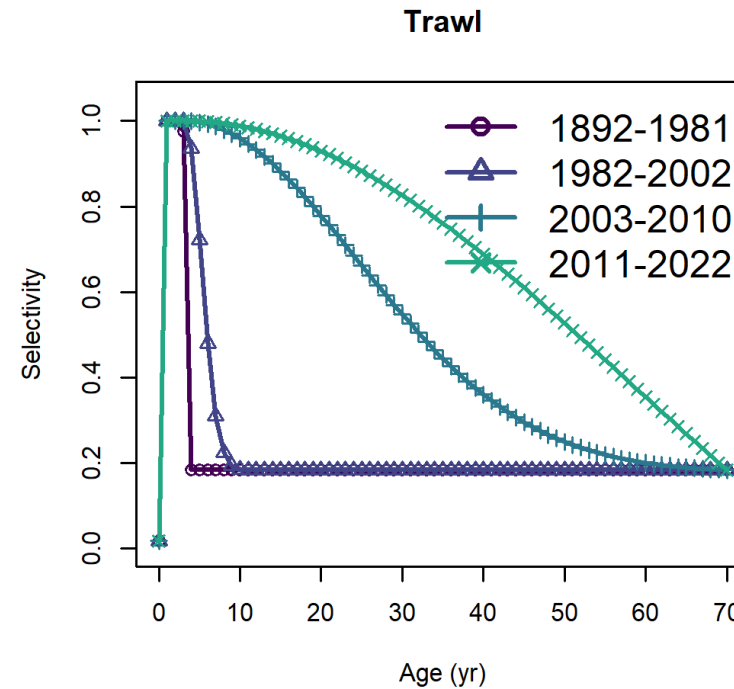
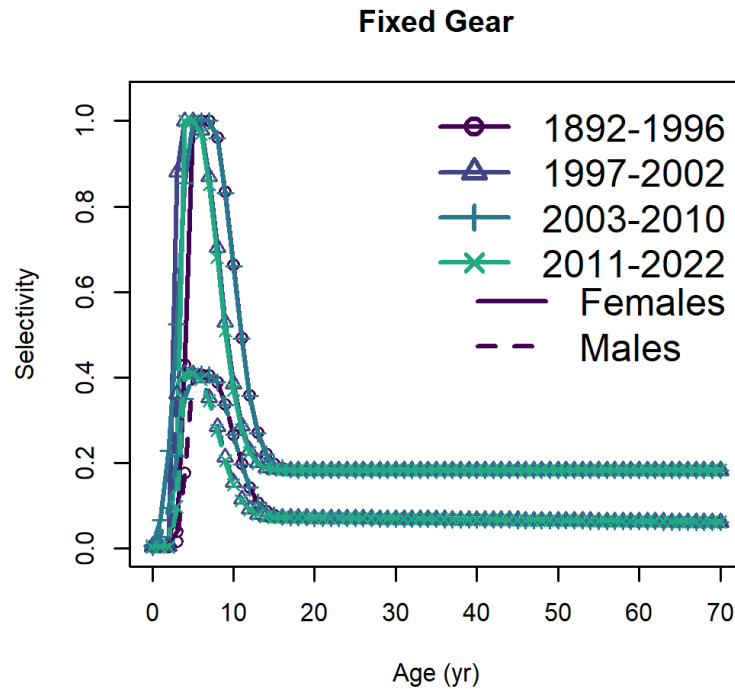




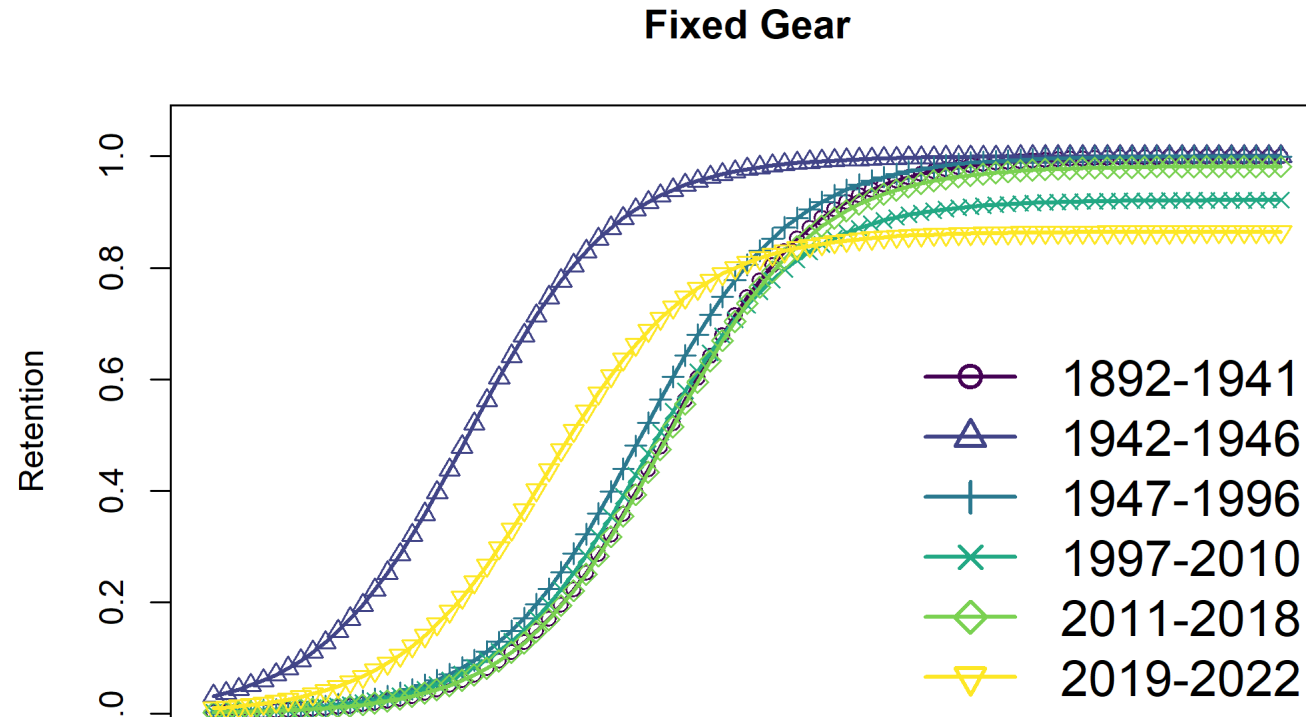
# Parameters - Maturity & Fecundity



# Parameters - Selectivity



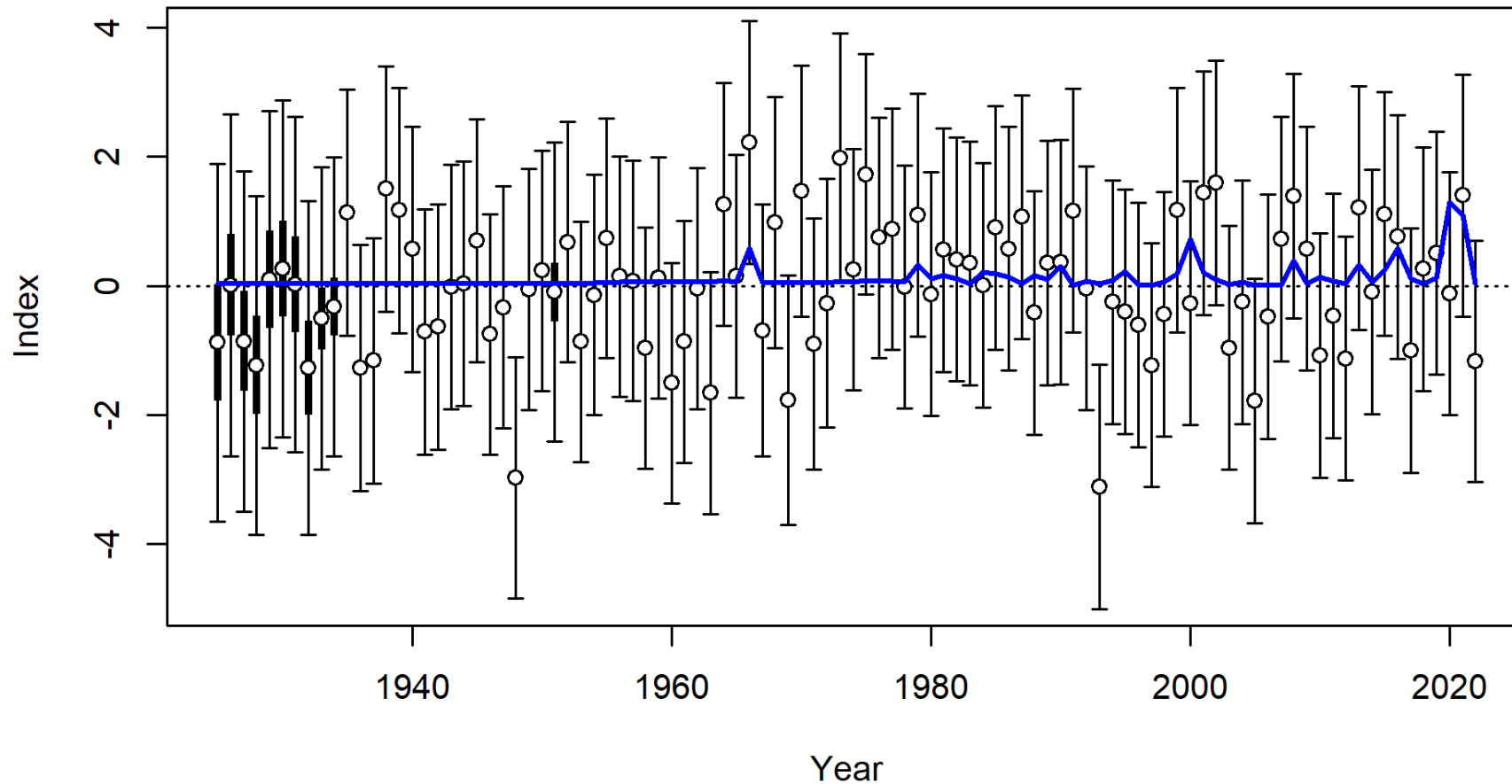
# Parameters - Retention



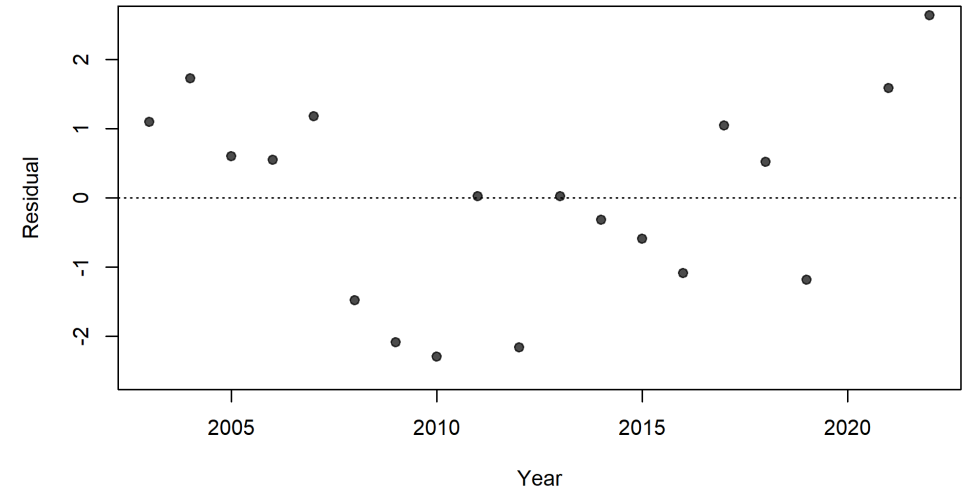
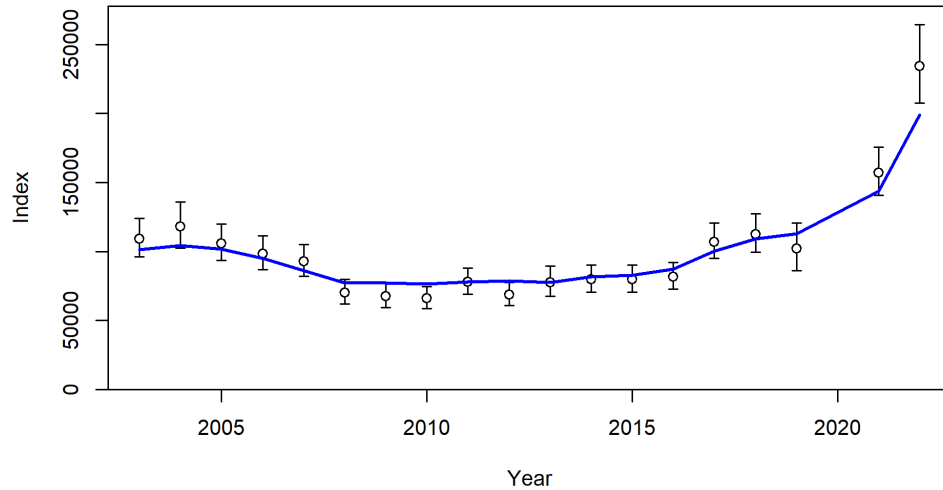
# Fits to the Data

- Environmental Index
- NWFSC WCGBTS Index
- Length Compositions
- Marginal Age Compositions (unchanged)
- Conditional Age-at-Length

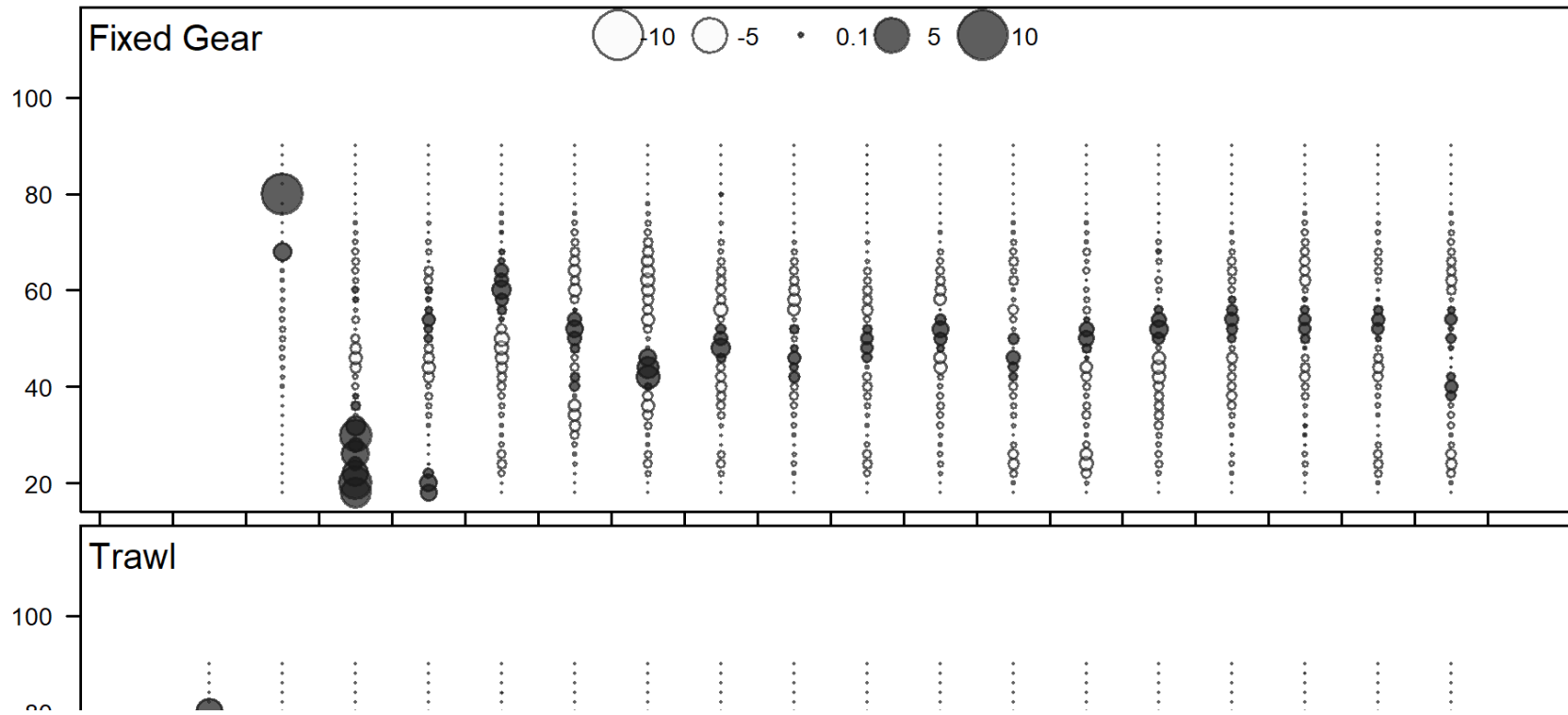
# Fits to the Data - Environmental Index



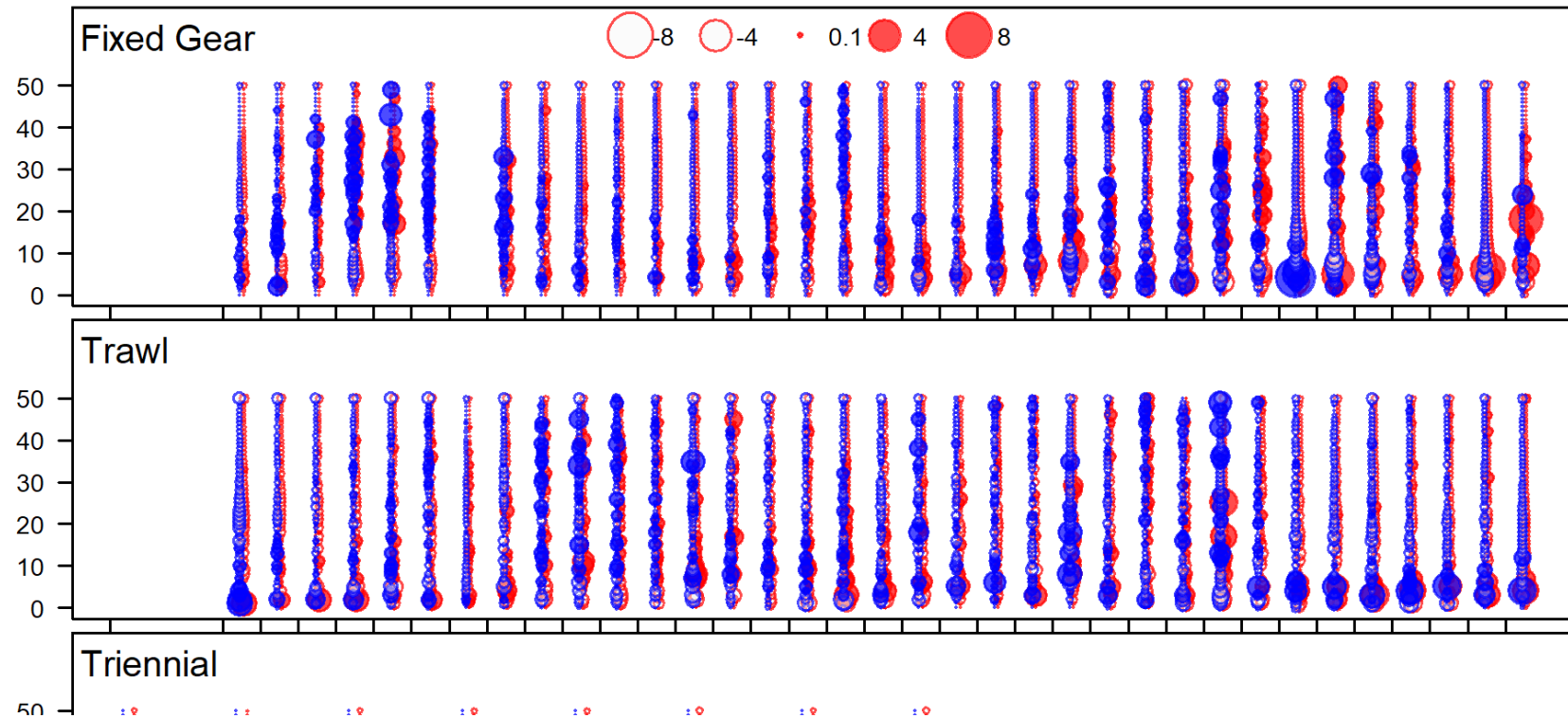
# Fits to the Data - WCGBTS Index



# Fits to the Data - Length

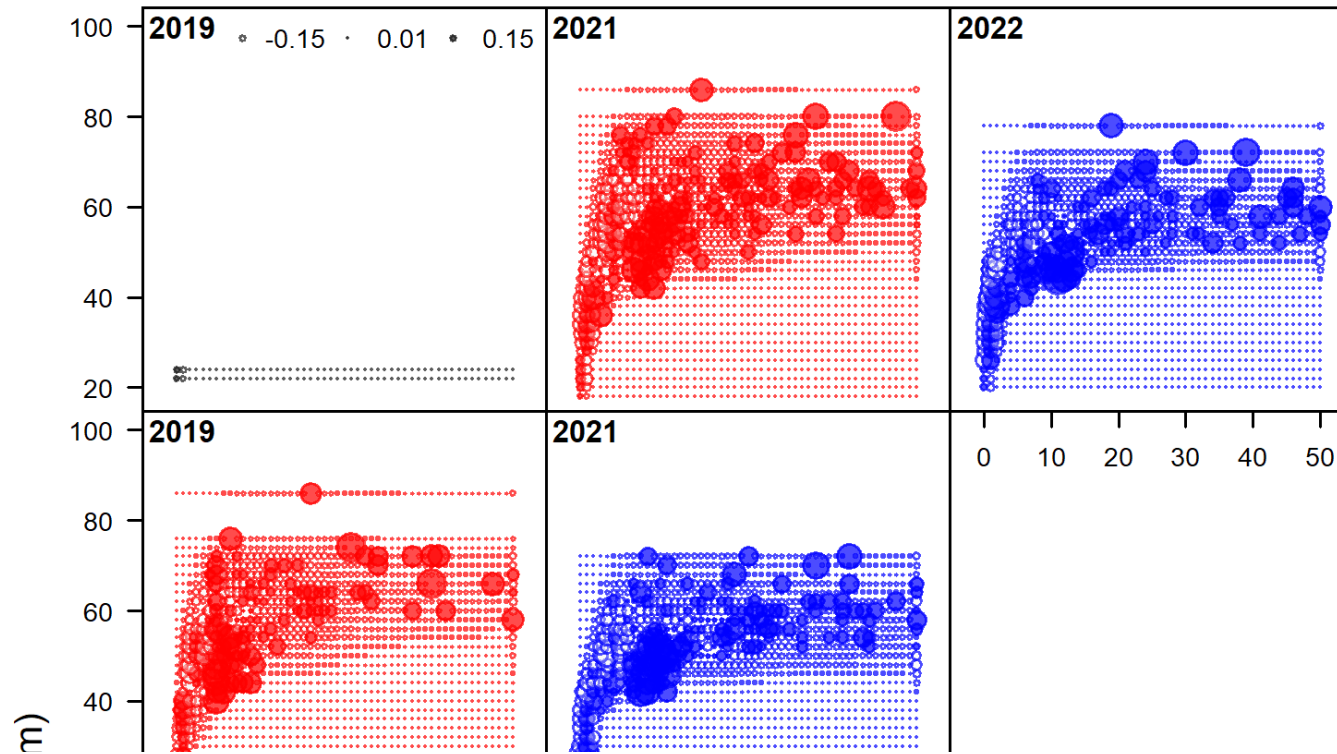


# Fits to the Data - Age

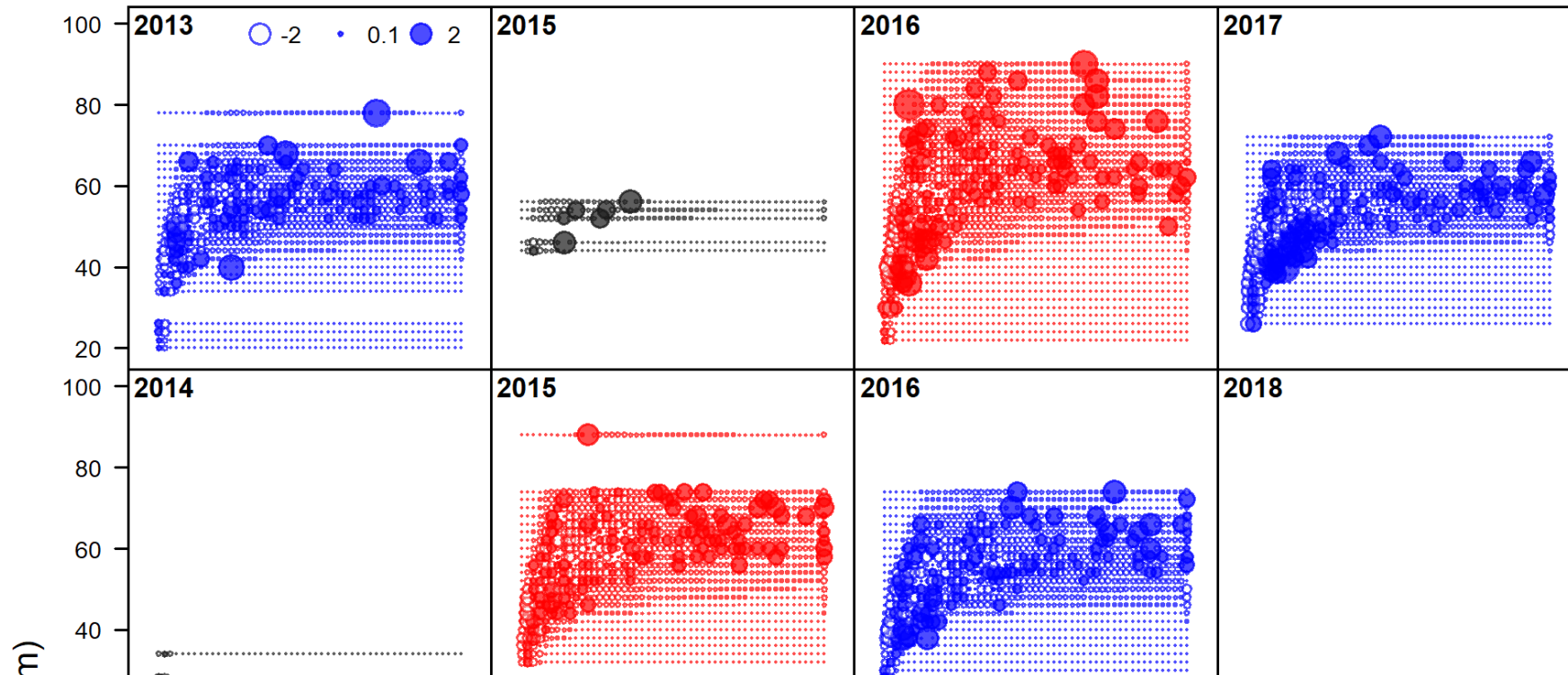




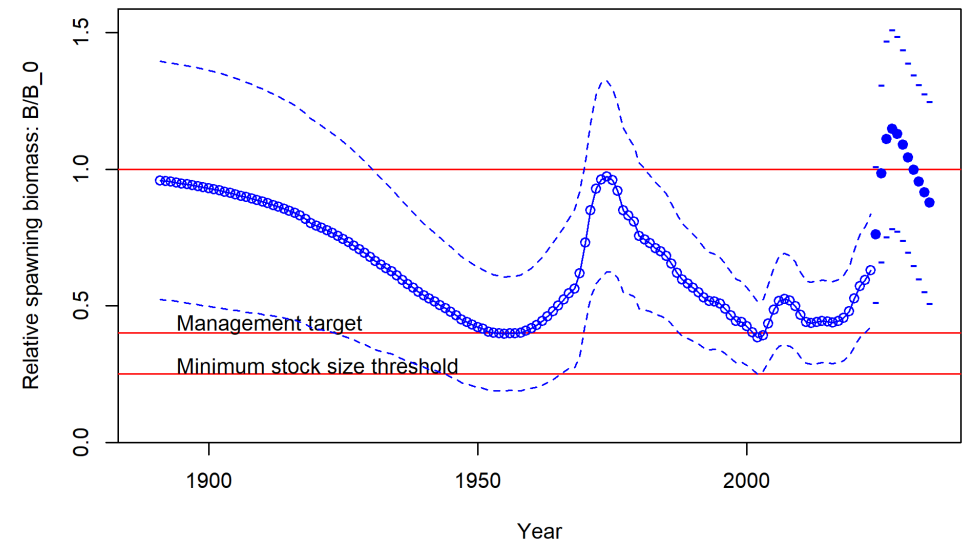
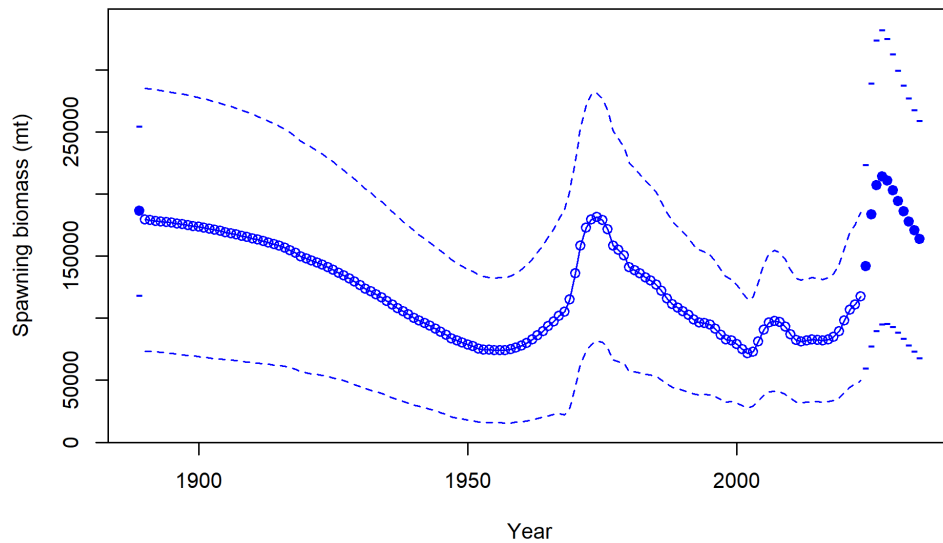
# Fits to the Data - Conditional Age



# Fits to the Data - Conditional Age



# Population Estimates - Spawning Biomass



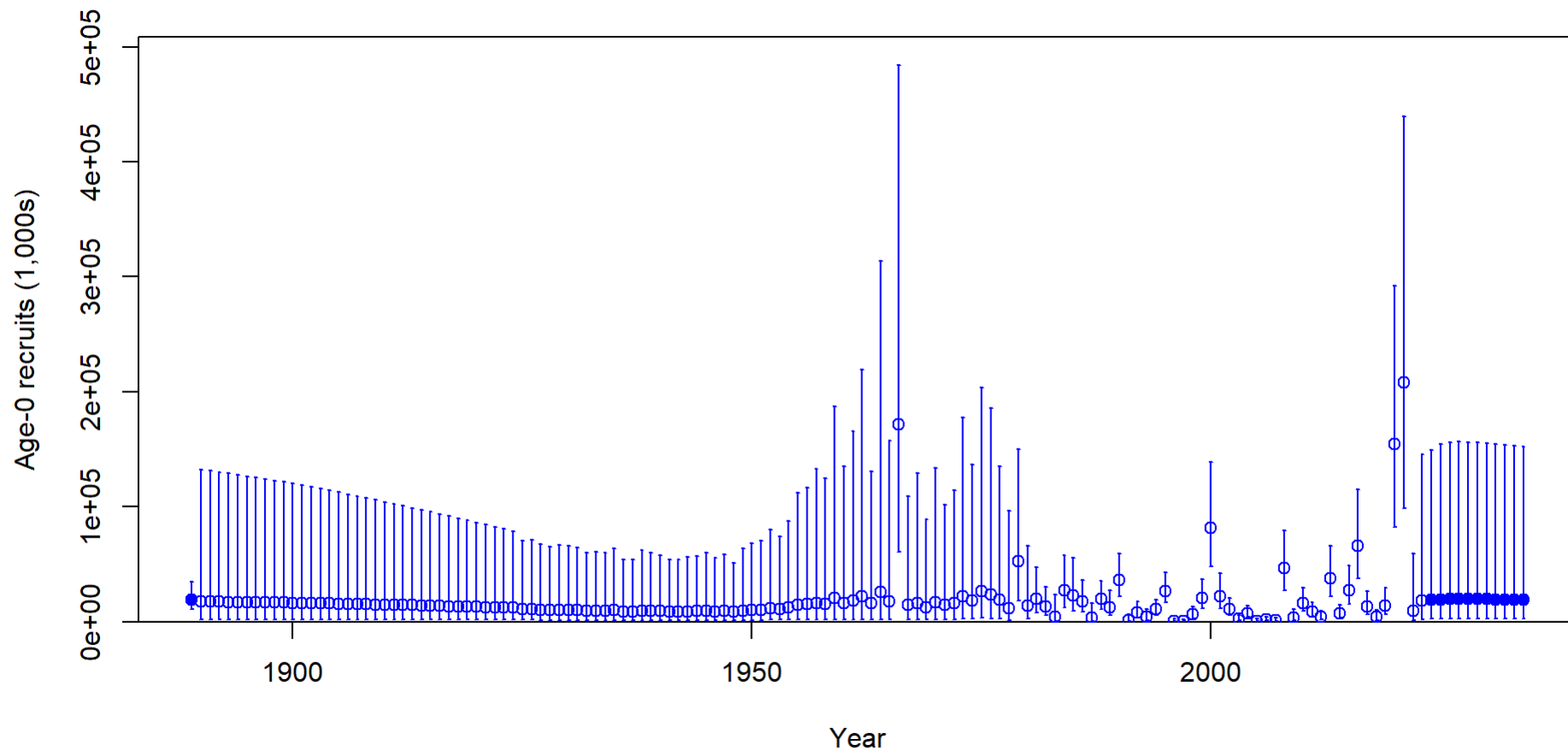
# Population Estimates - Recruitment

Age-0

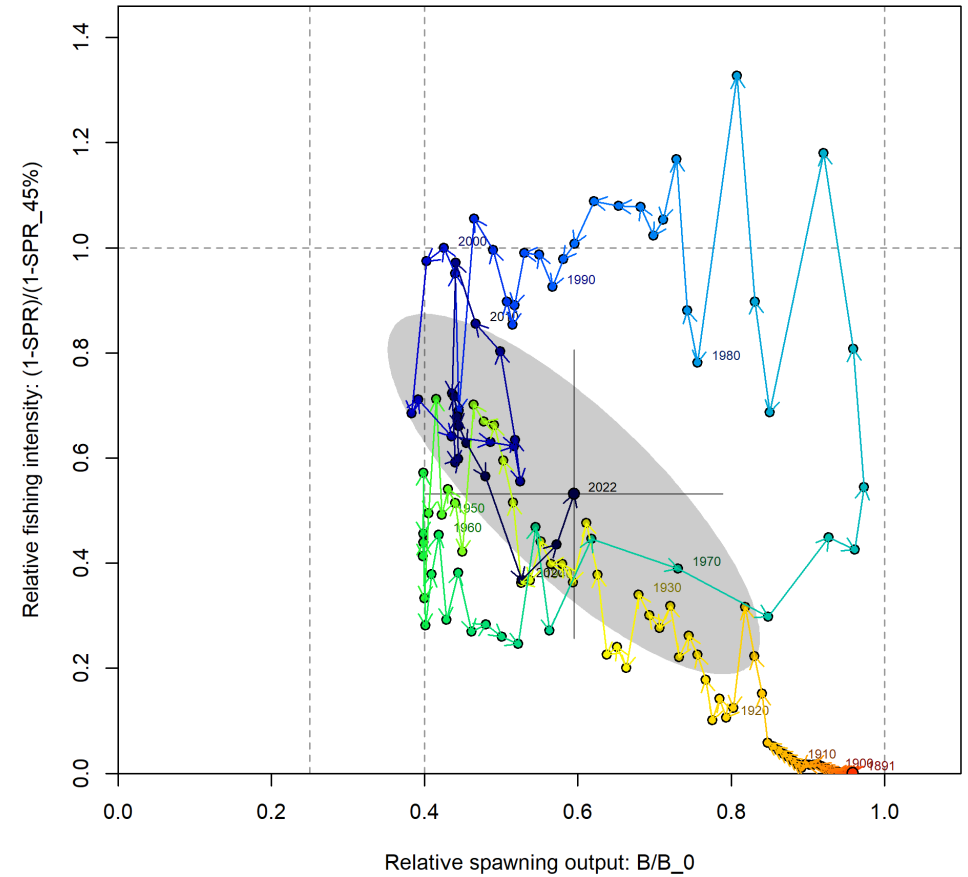
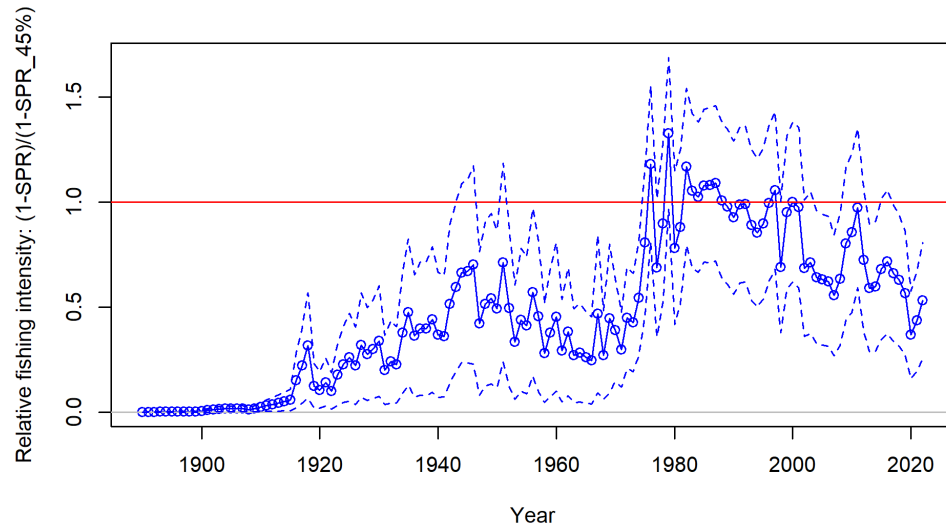
Top/Bottom

Deviations

Top/Bottom



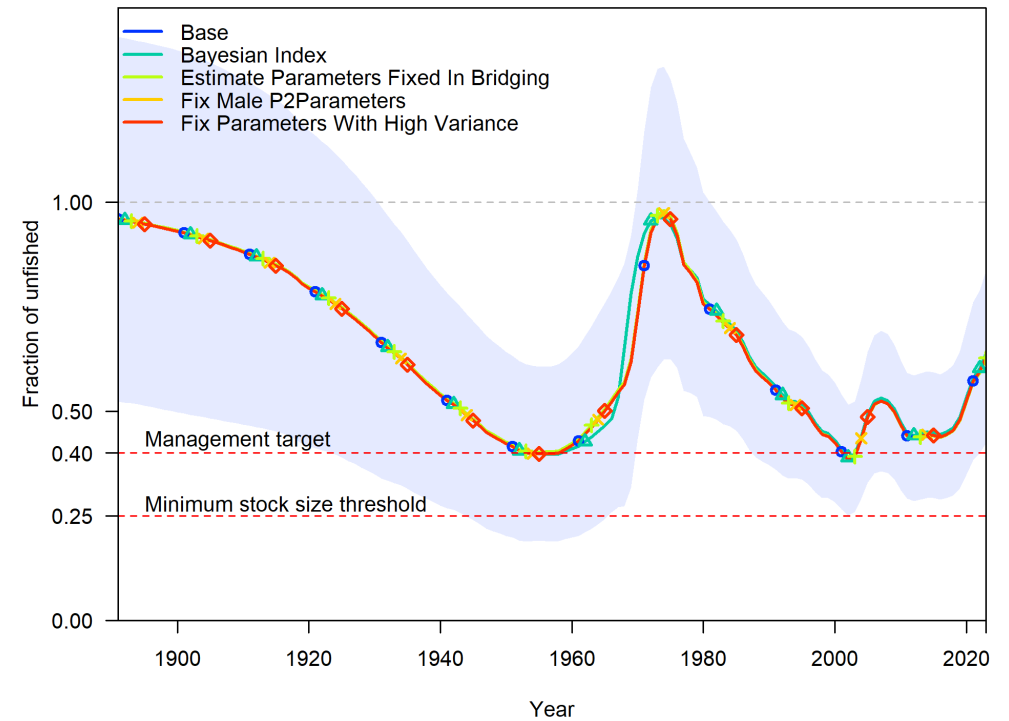
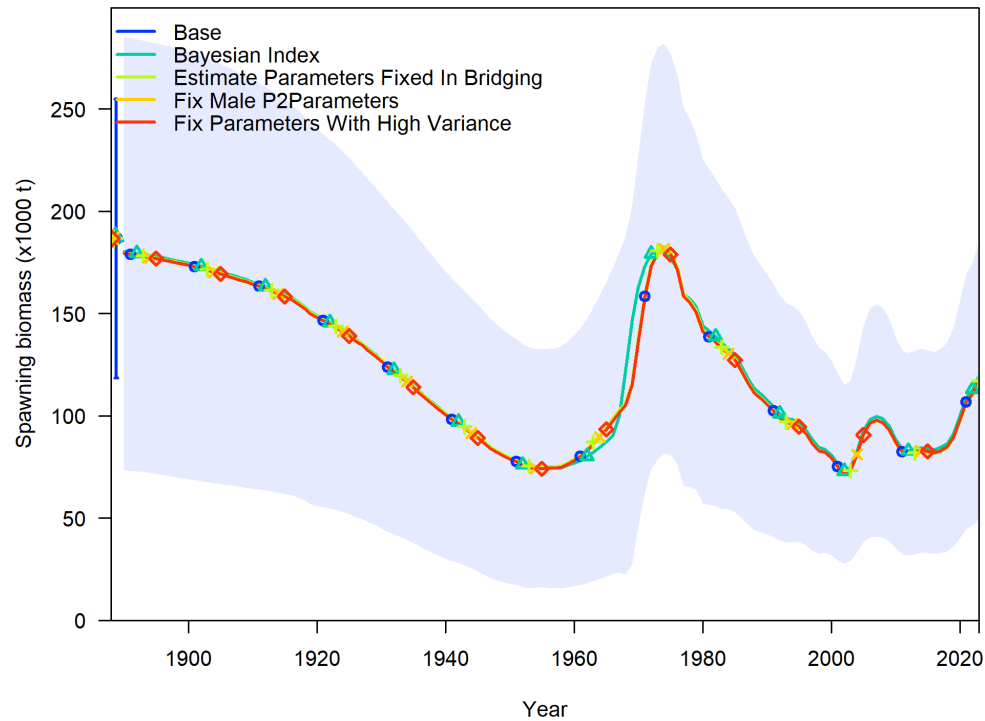
# Population Estimates - $F$



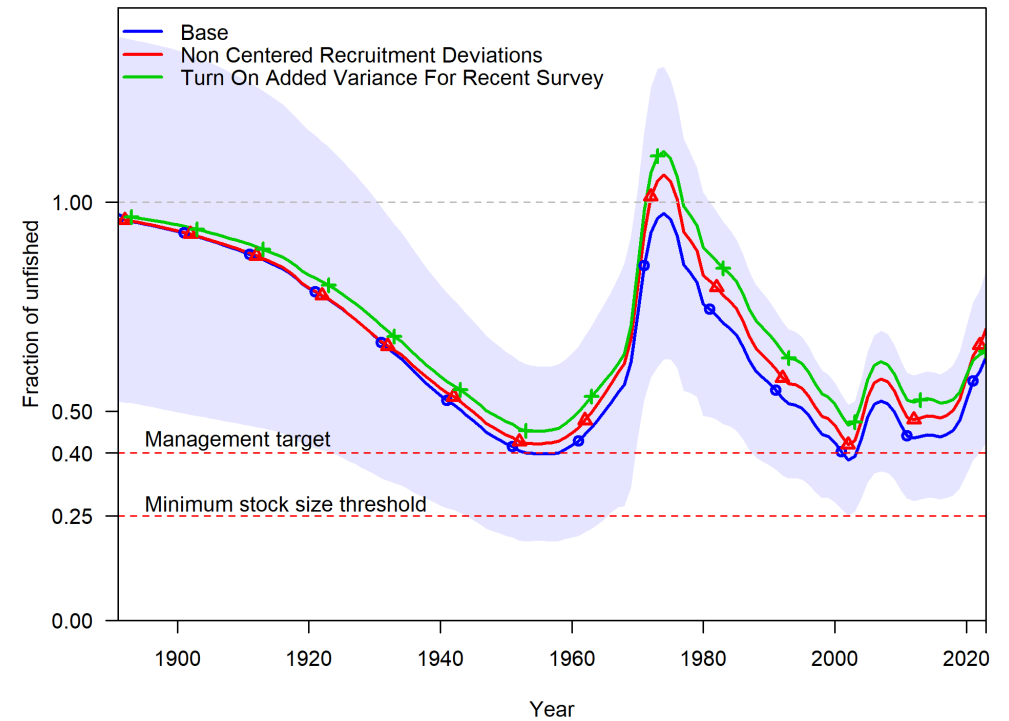
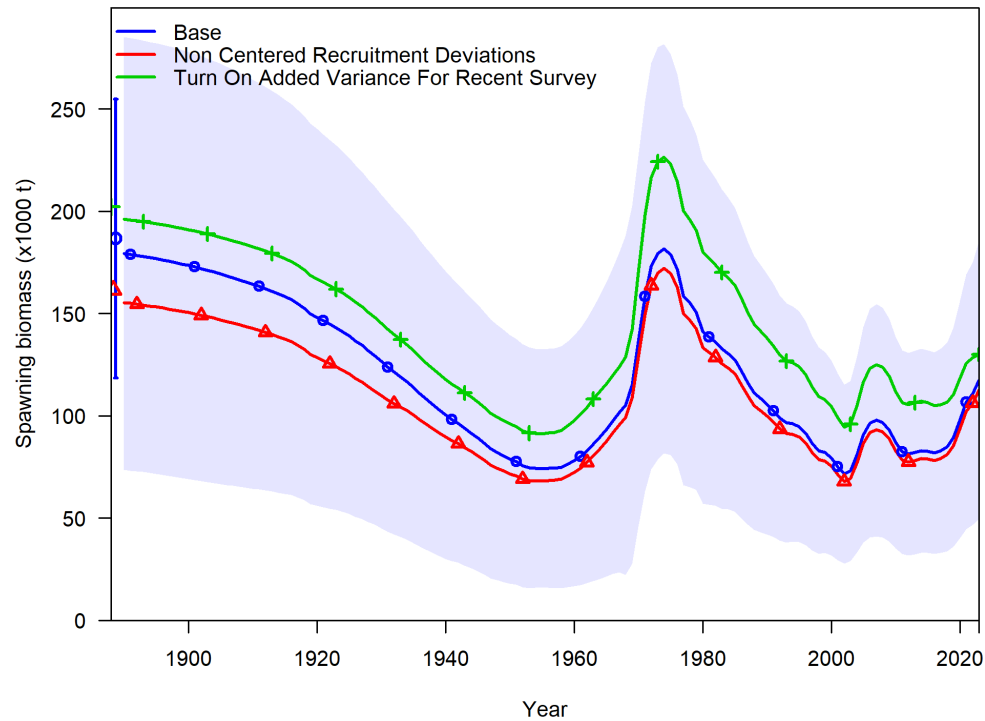
# Model Diagnostics

- Sensitivities - Exploration
- Sensitivities - Structural Changes
- Sensitivities - Standard Set
- Likelihood Profile  $M$
- Likelihood Profile  $h$
- Likelihood Profile  $R_0$
- Retrospective

# Sensitivities - Exploration

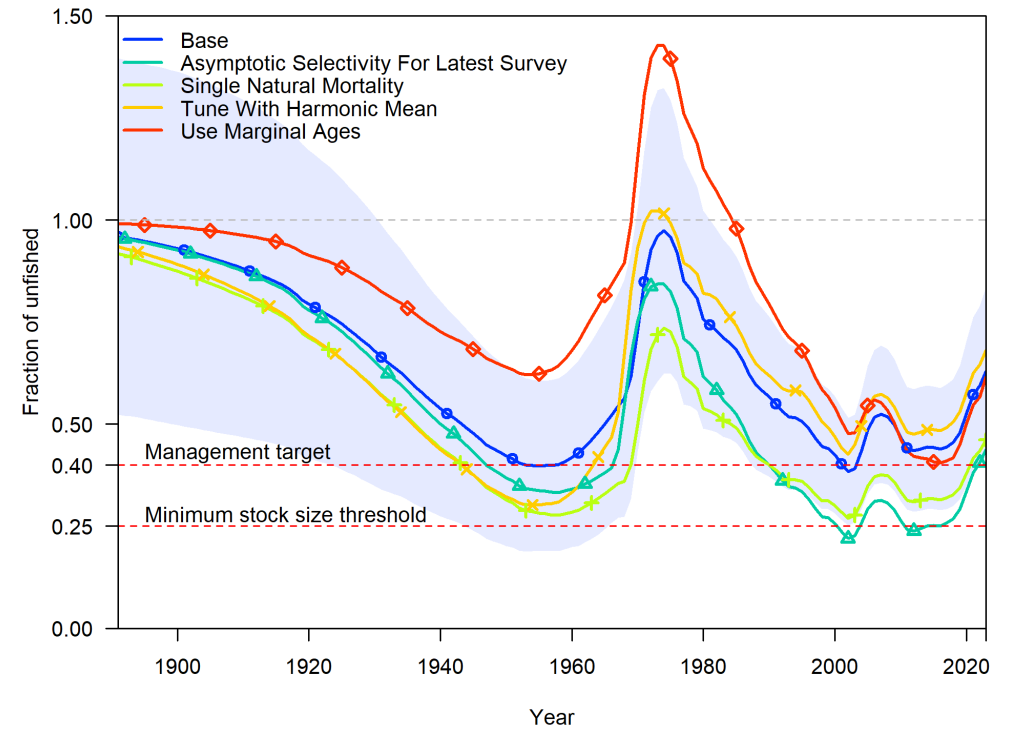
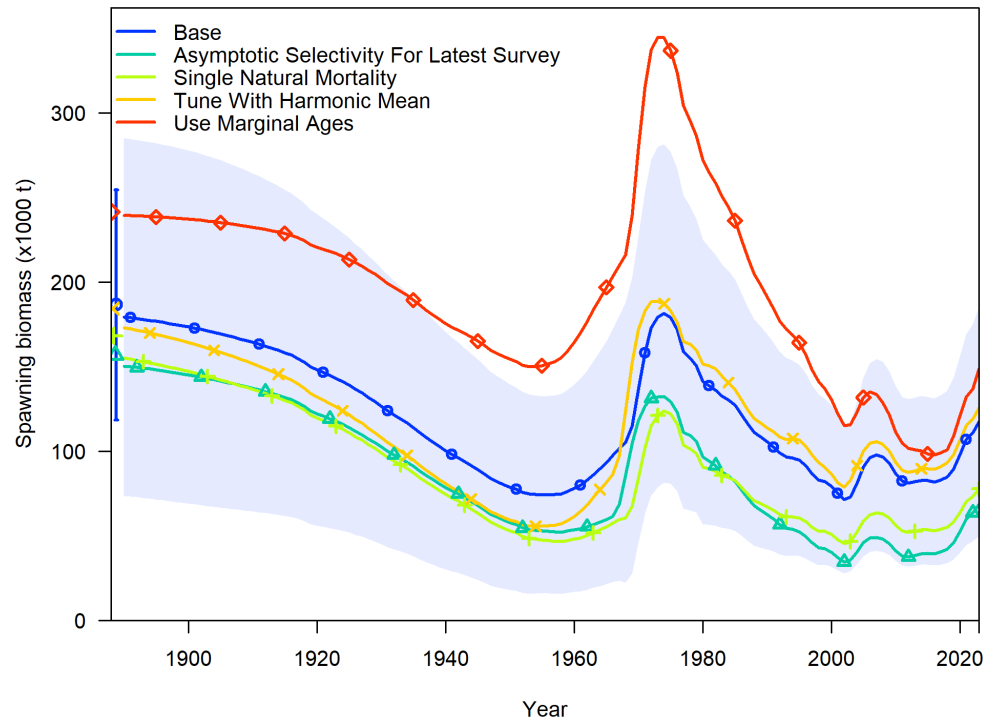


# Sensitivities - Structural Changes

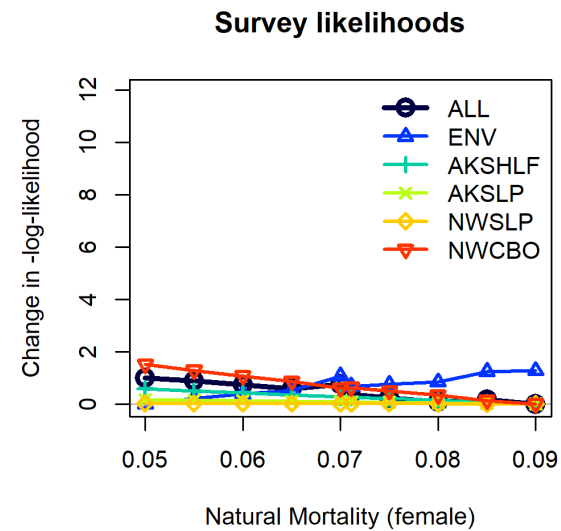
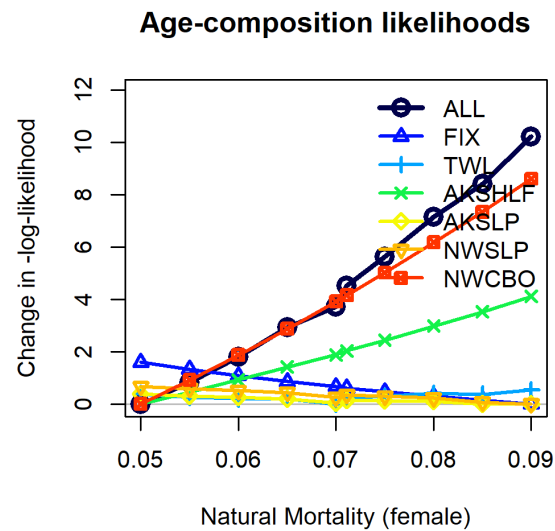
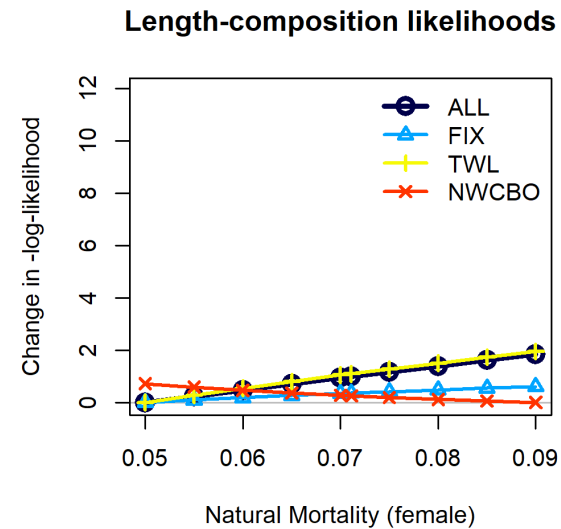
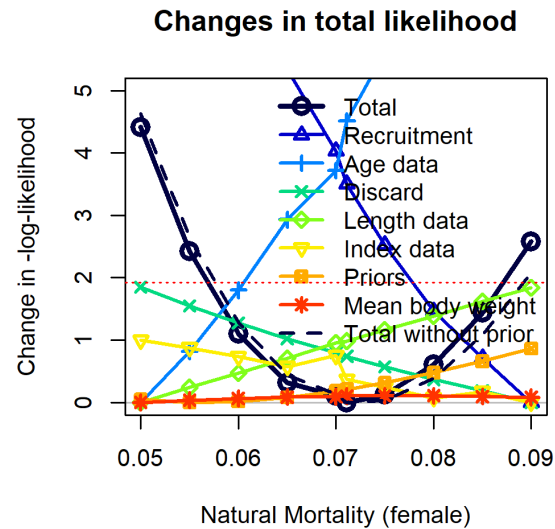




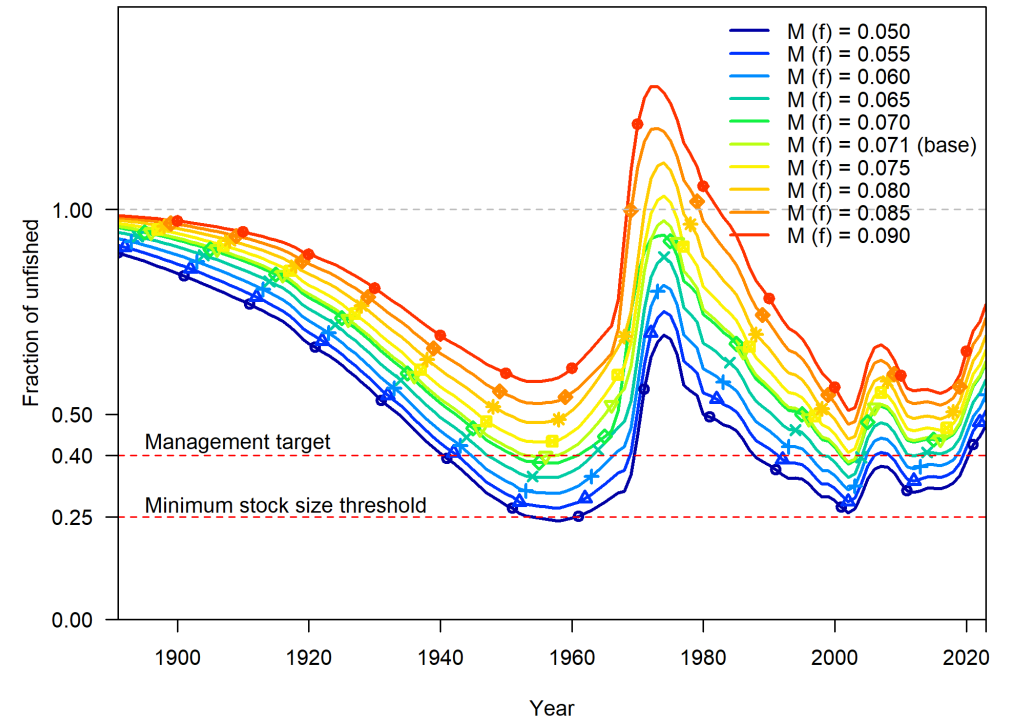
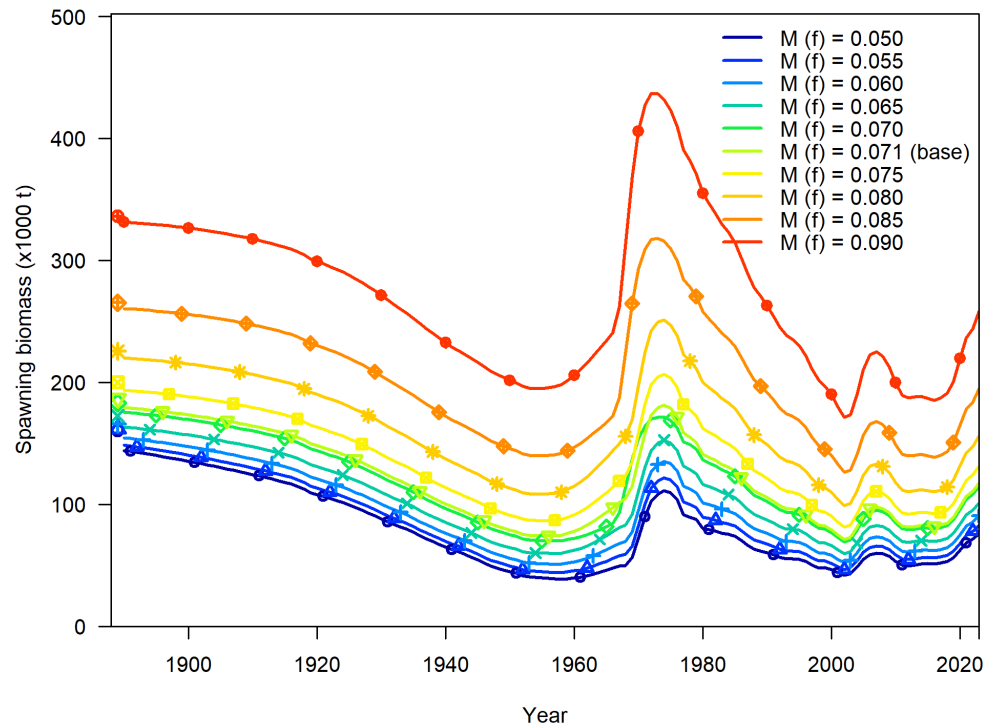
# Sensitivities - Standard Set



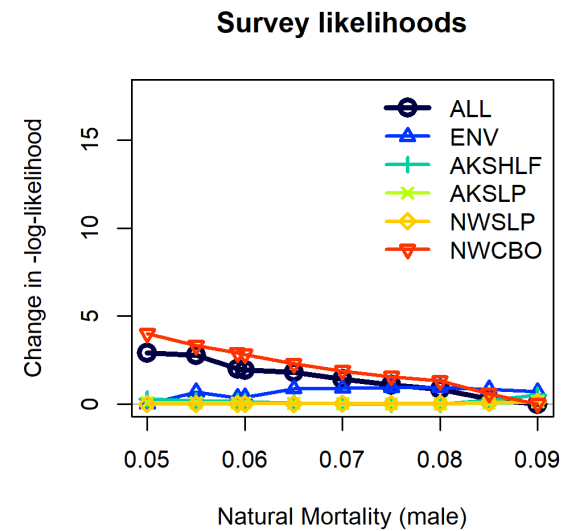
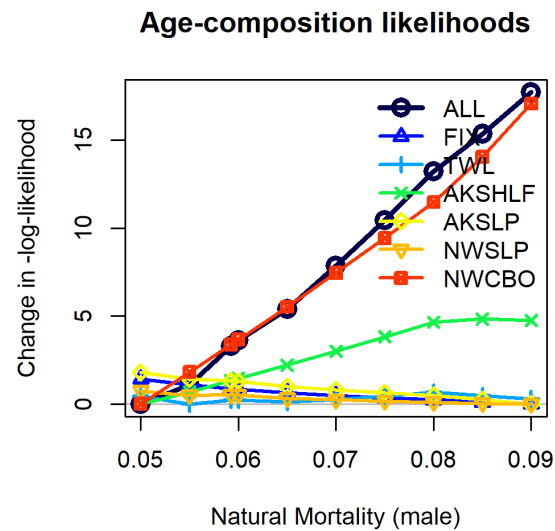
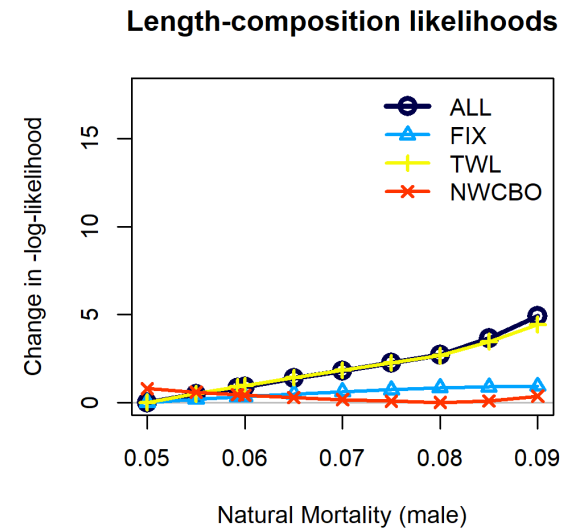
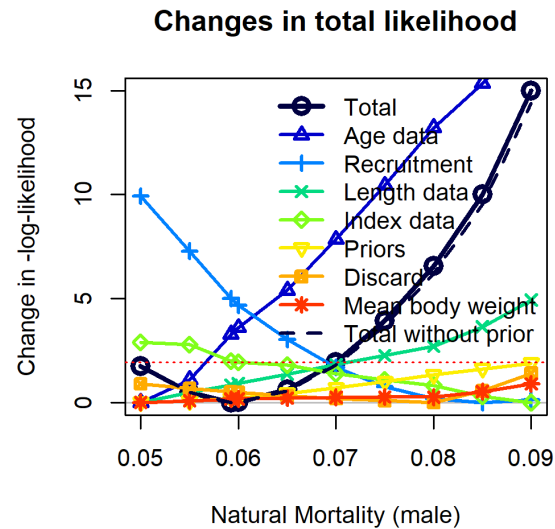
# Profile Female $M$



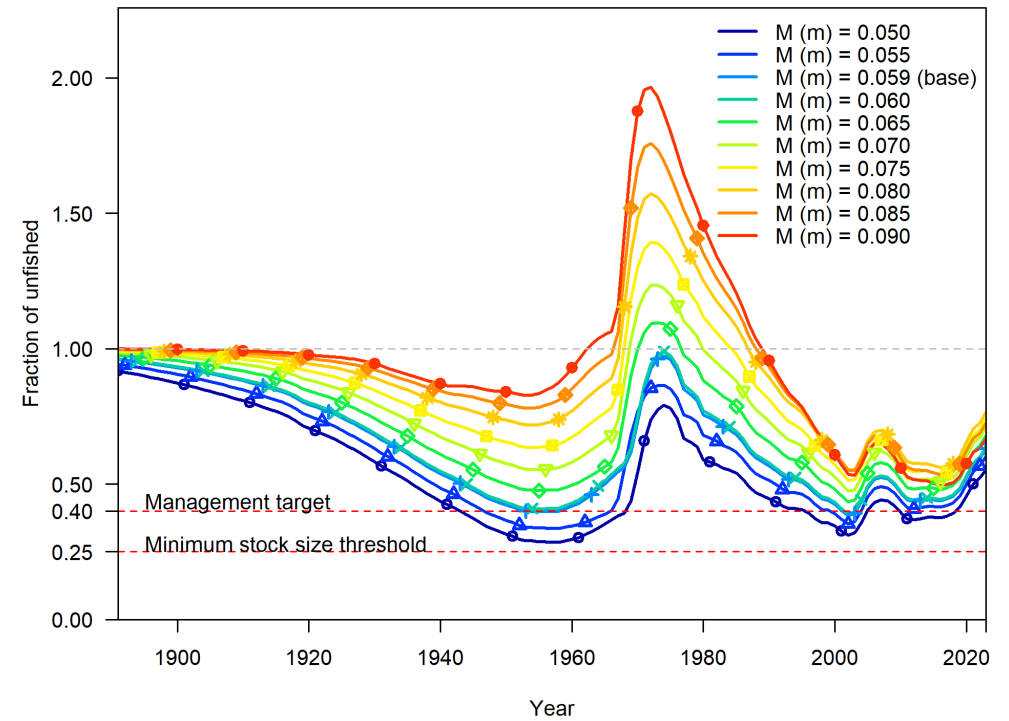
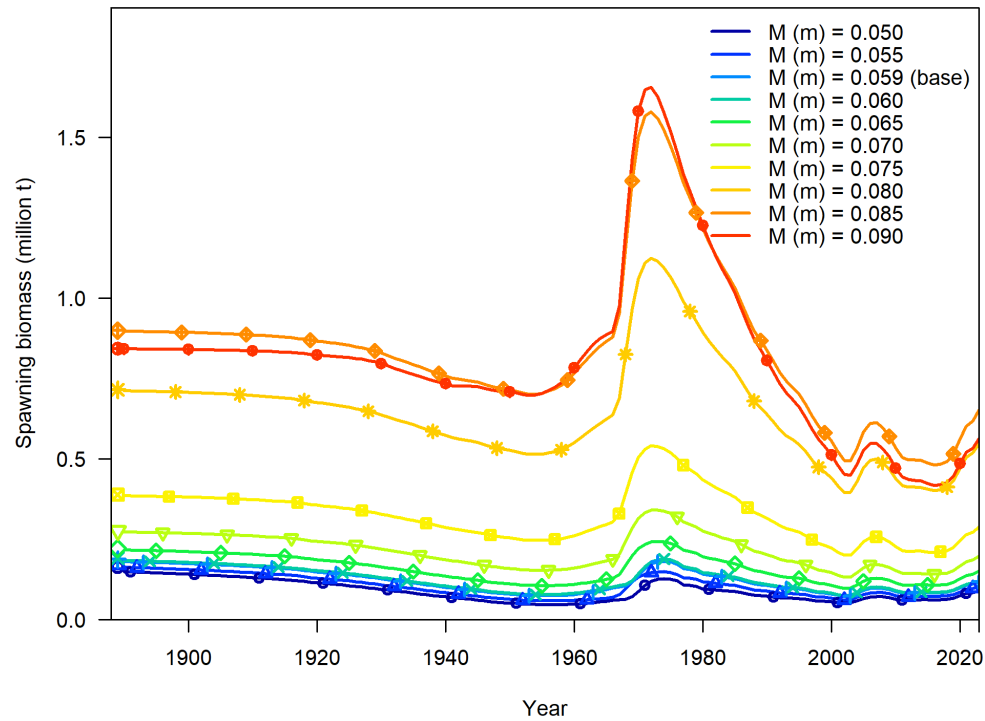
# Profile Female $M$ - Spawning Biomass



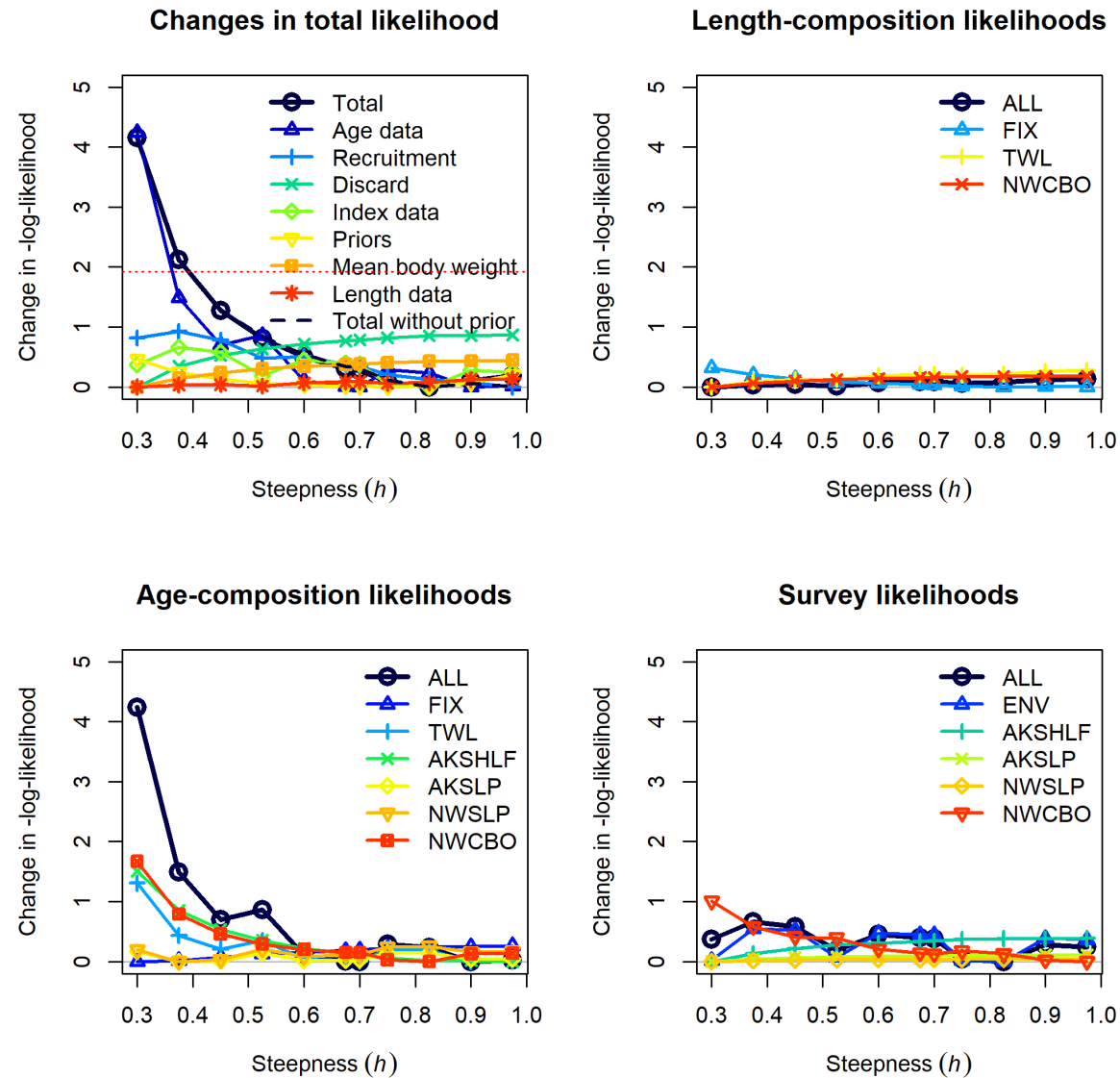
# Profile Male $M$



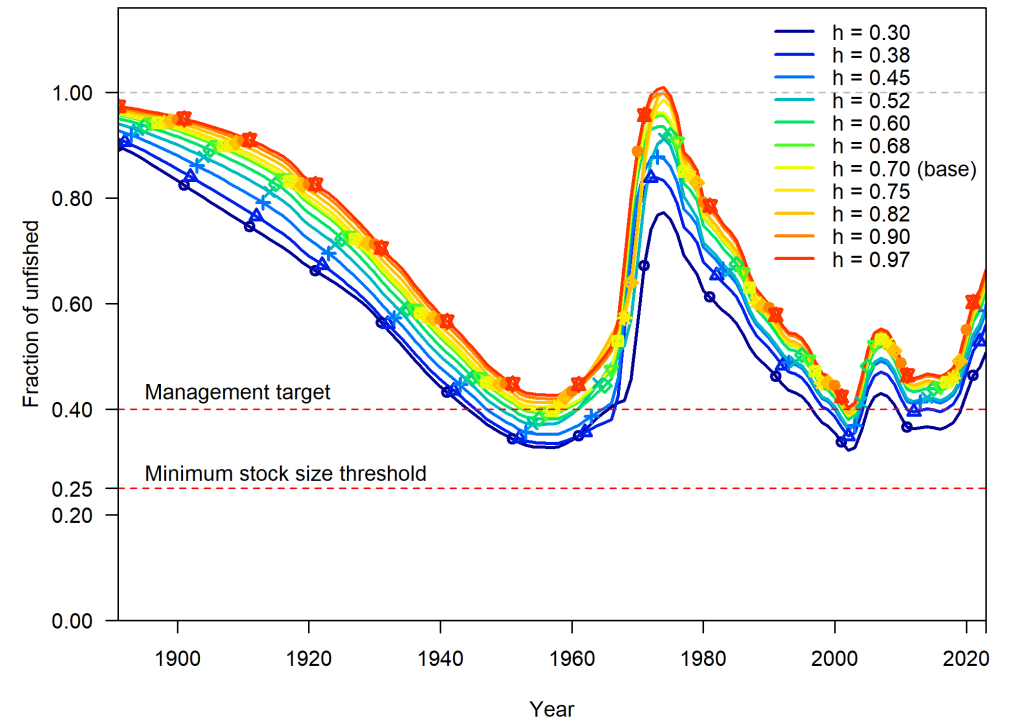
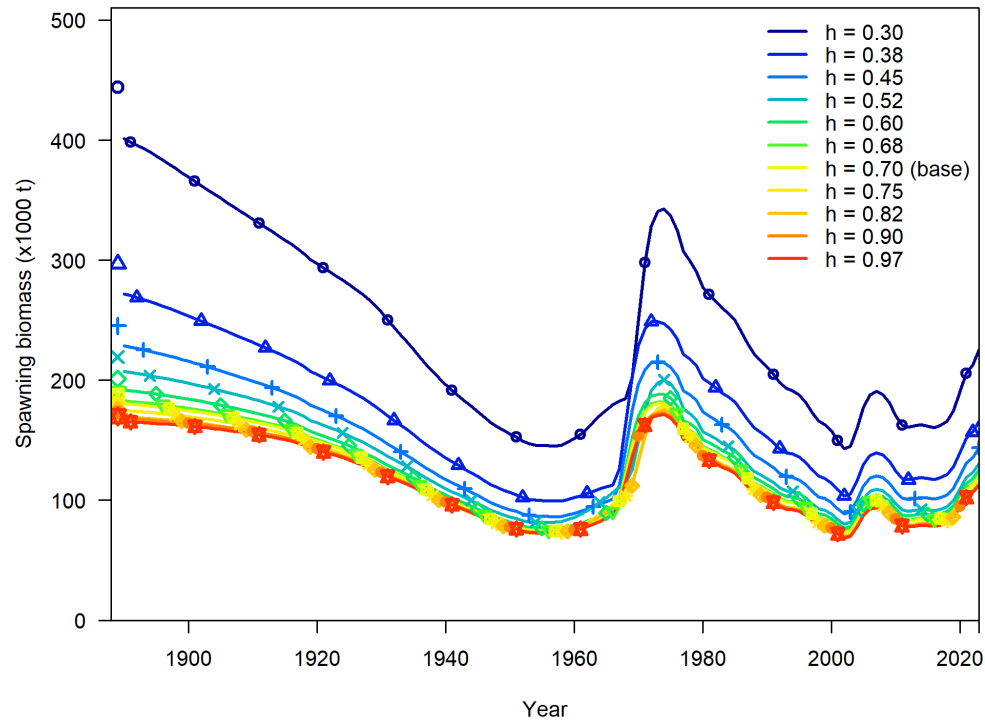
# Profile Male $M$ - Spawning Biomass



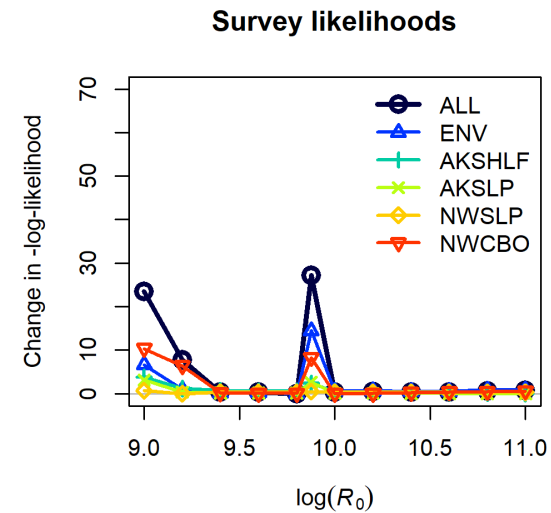
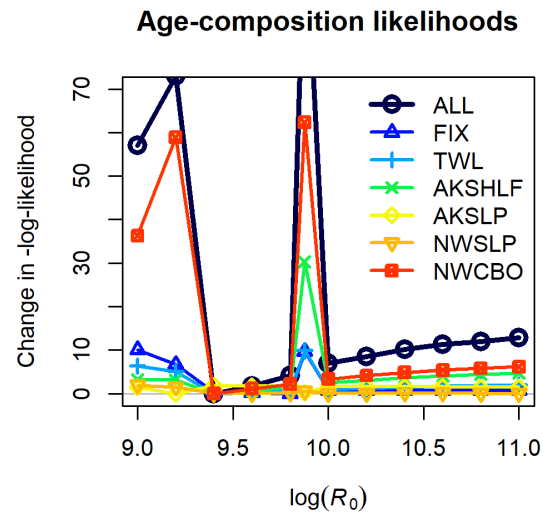
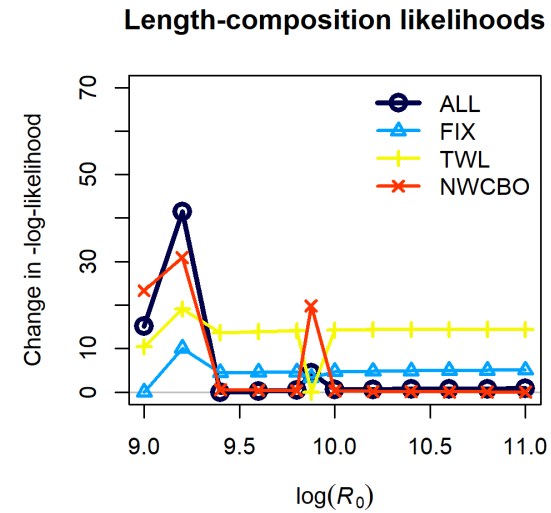
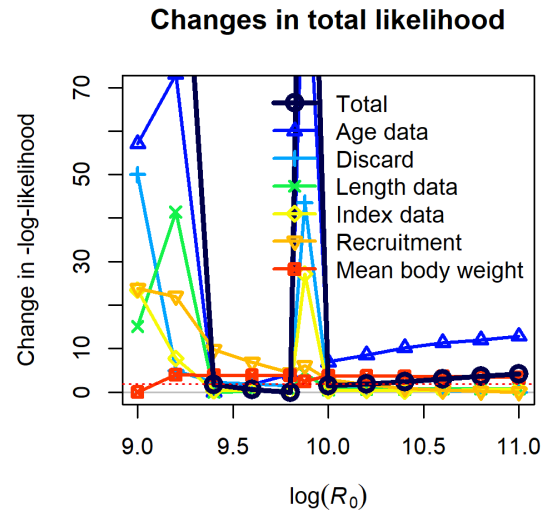
# Profile $h$



# Profile $h$ - Spawning Biomass

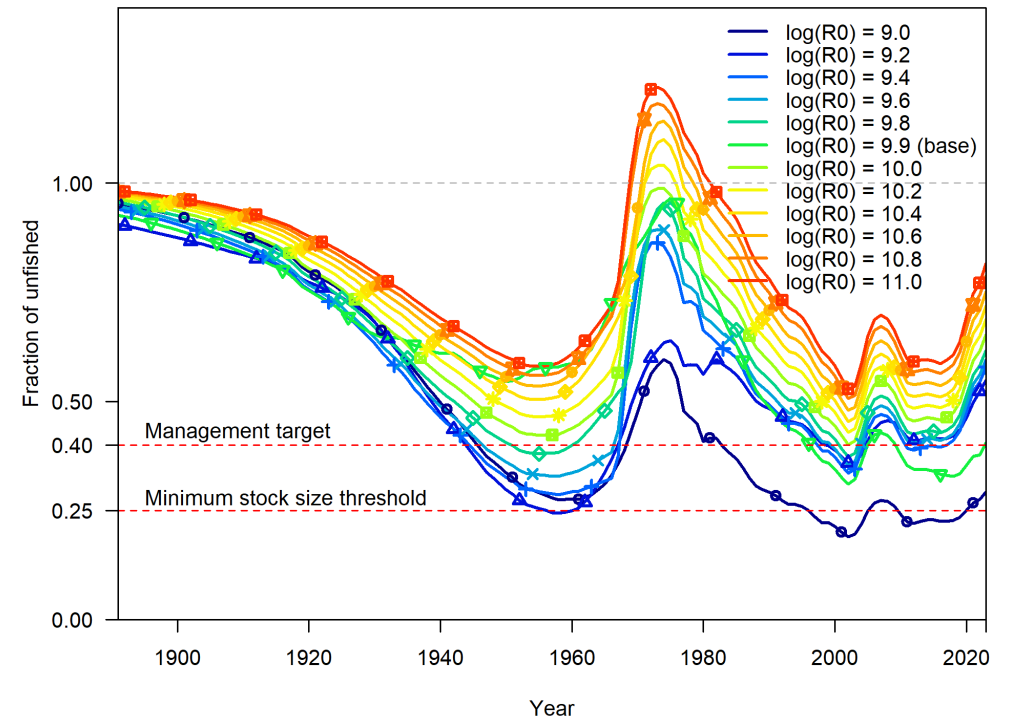
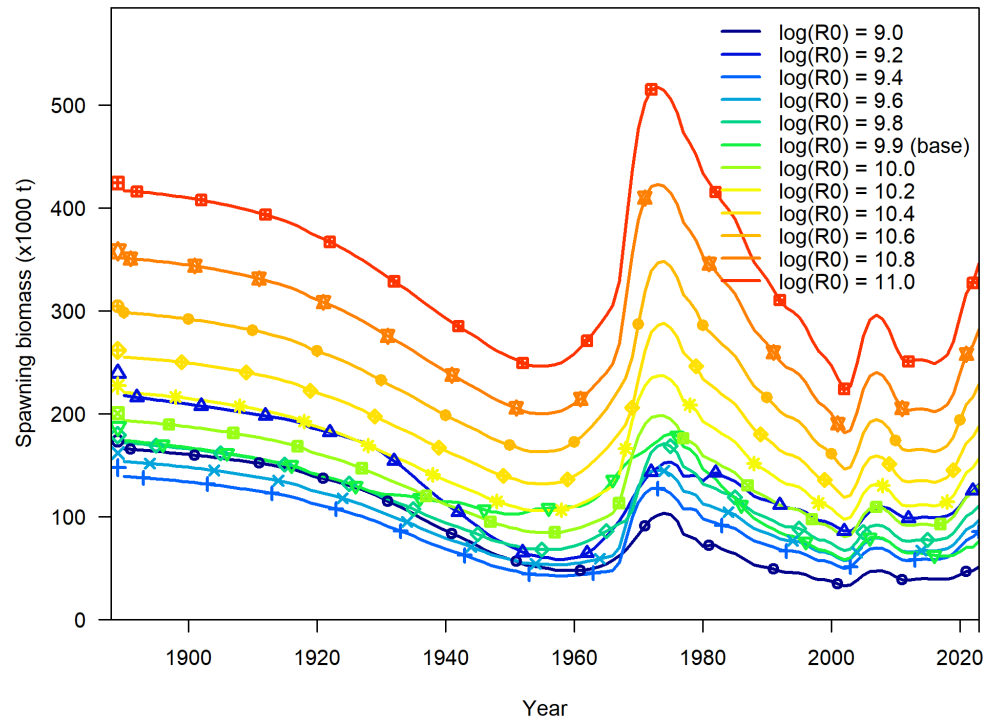


# Profile $R_0$

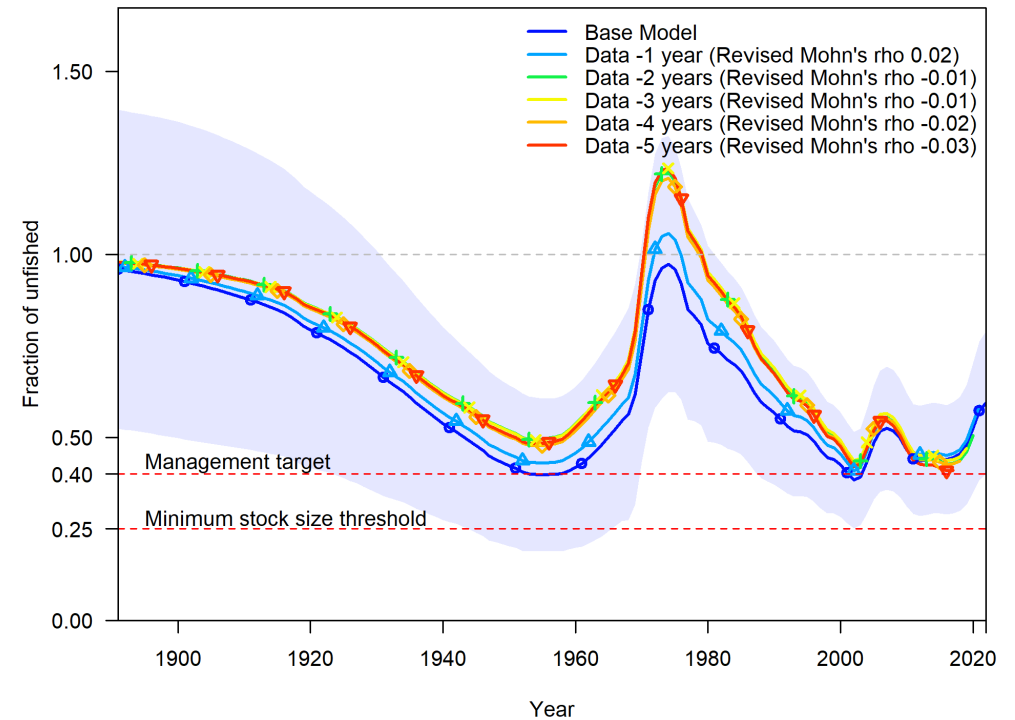
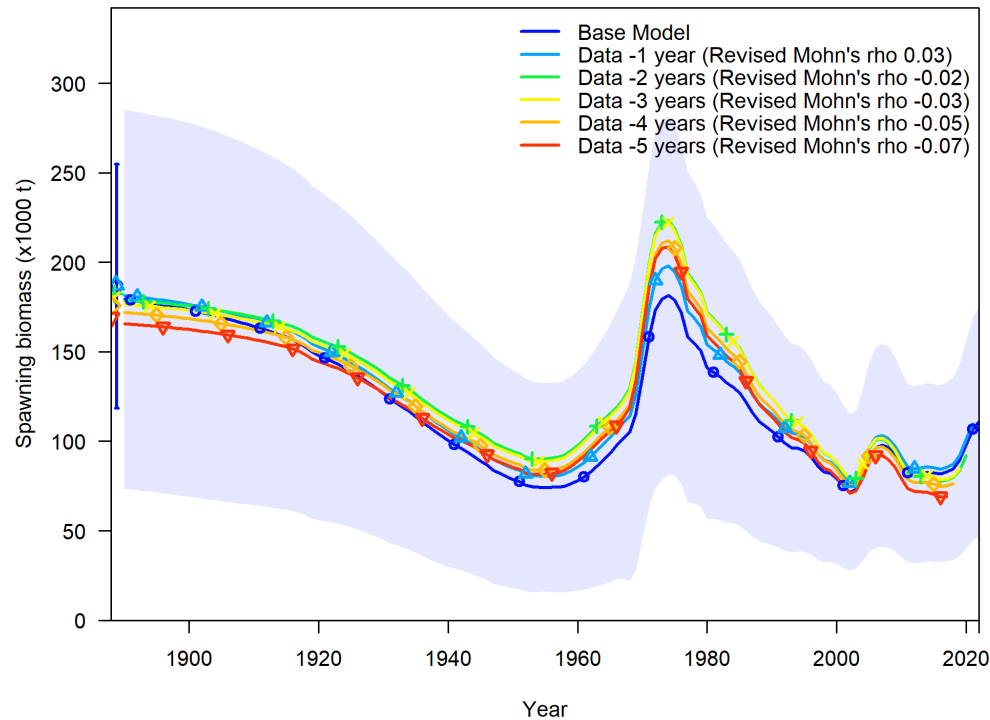




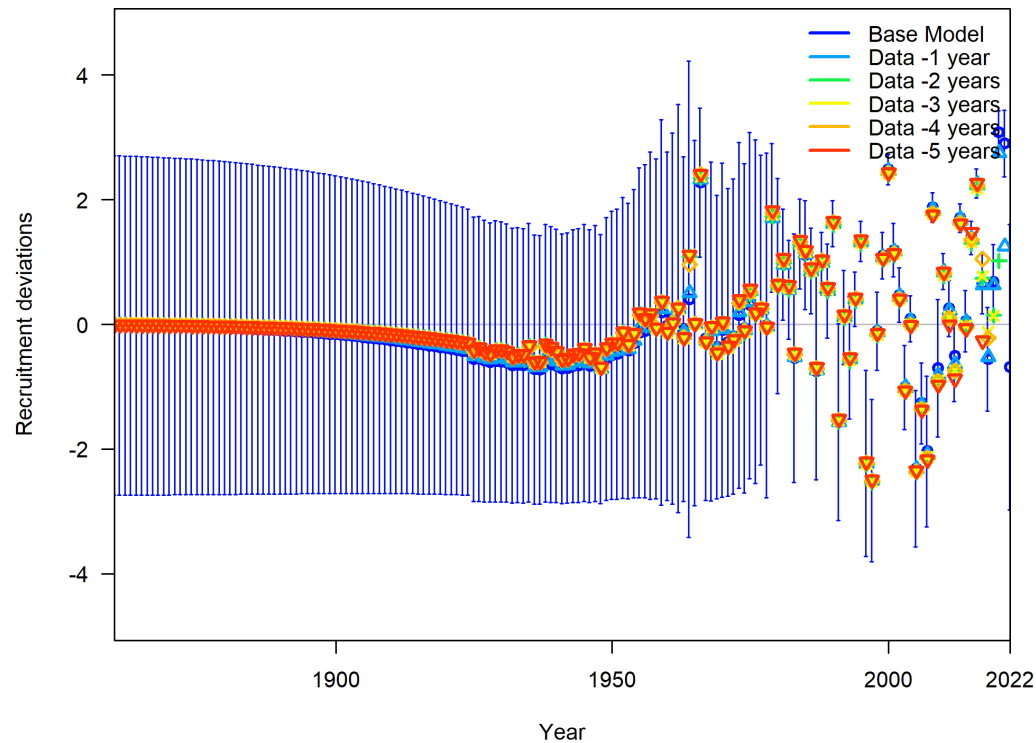
# Profile $R_0$ - Spawning Biomass



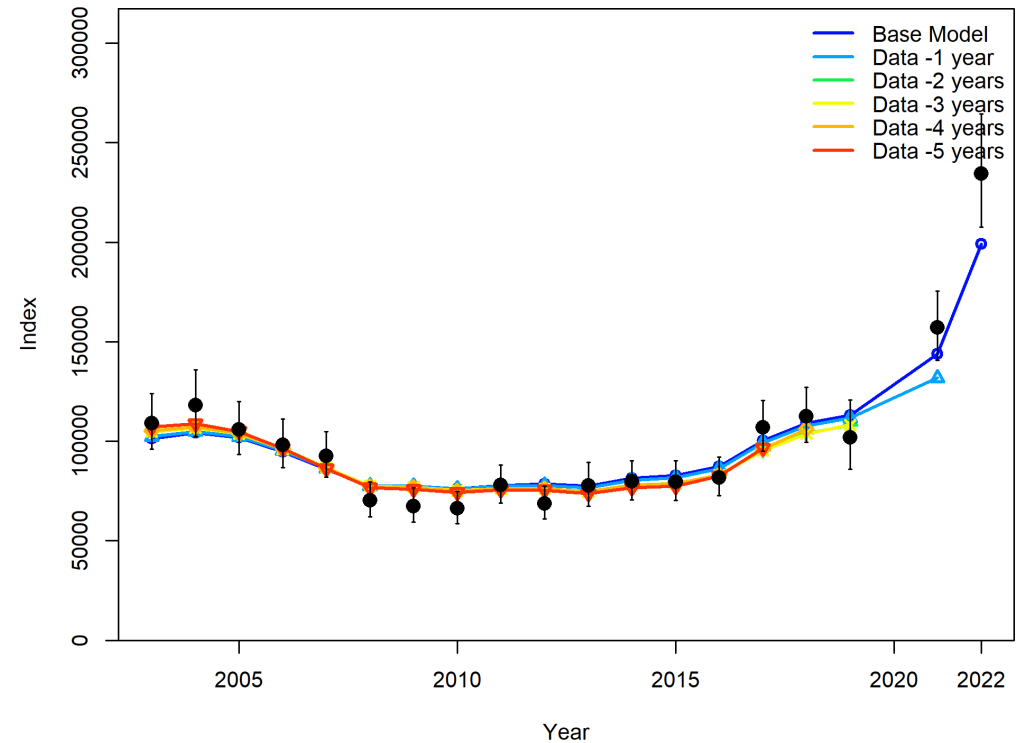
# Retrospective - Spawning Biomass



# Retrospective - Deviations & WCGBTS



Log of recruitment deviations.



WCGBTS index.

# Population Projections

- Total catches in 2023 = 9,118 mt.
- Total catches in 2024 = 8,359 mt.
- ABC values use category 1 time-varying  $\sigma_y$  starting at 0.50 combined with a  $P^*$  value of 0.45.
- 2025–2034 catches were set equal to the year-specific ABC
- SB increased sharply during 2025–2034 due to the estimated large 2020 and 2021 recruitments.
- Future OFLs and ABCs are substantially higher than those set for 2023–2024.

# Population Projections

Year	Adopted OFL	Adopted ACL	Assumed Removals	OFL	ABC	Spawning Biomass	Fraction Unfished
2023	11,577	10,824	9,118	-	-	117,519	0.630
2024	10,670	9,923	8,359	-	-	141,875	0.761
2025	-	-	-	39,085	36,545	183,592	0.984
2026	-	-	-	37,310	34,699	207,142	1.110
2027	-	-	-	34,160	31,632	214,059	1.148
2028	-	-	-	29,701	27,385	210,719	1.130
2029	-	-	-	25,318	23,217	203,091	1.089
2030	-	-	-	21,812	19,914	194,403	1.042
2031	-	-	-	19,380	17,616	185,924	0.997
2032	-	-	-	17,843	16,130	177,993	0.954
2033	-	-	-	16,898	15,208	170,621	0.915

# Reference Points

Quantity	Estimate	Lower Interval	Upper Interval
Unfished Spawning Biomass (mt)	186,534.000	118,407.808	254,660.192
Unfished Age 4+ Biomass (mt)	458,971.000	280,172.306	637,769.694
Unfished Recruitment (R0)	19,453.900	7,838.526	31,069.274
Spawning Biomass (mt) (2023)	117,519.000	49,642.507	185,395.493
Fraction Unfished (2023)	0.630	0.424	0.836
Reference Points Based SB40%	NA	NA	NA
Proxy Spawning Biomass (mt) SB40%	74,613.600	47,363.045	101,864.155
SPR Resulting in SB40%	0.464	0.464	0.464
Exploitation Rate Resulting in SB40%	0.043	0.035	0.050
Yield with SPR Based On SB40% (mt)	9,477.830	4,432.471	14,523.189

Quantity	Estimate	Lower Interval	Upper Interval
Reference Points Based on SPR Proxy for MSY	NA	NA	NA
Proxy Spawning Biomass (mt) (SPR45)	71,629.000	45,468.577	97,789.423
SPR45	0.450	NA	NA
Exploitation Rate Corresponding to SPR45	0.045	0.037	0.053
Yield with SPR45 at SB SPR (mt)	9,641.130	4,509.219	14,773.041
Reference Points Based on Estimated MSY Values	NA	NA	NA
Spawning Biomass (mt) at MSY (SB MSY)	45,903.500	29,025.251	62,781.749
SPR MSY	0.327	0.324	0.330
Exploitation Rate Corresponding to SPR MSY	0.069	0.057	0.082
MSY (mt)	10,431.200	4,881.895	15,980.505

# Thank you

- To all that made this limited update happen within a very limited amount of time. Particularly the age readers at the Cooperative Ageing Program and the staff in charge of the discard data within the West Coast Groundfish Observer Program.
- To the members of the Population Ecology at the NWFSC for providing helpful tools that allow for rapid, reproducible research.
- To Drs. Owen Hamel and Jim Hastie for reviewing the draft assessment.



