Southern Red Drum SS Model Results

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8/13/2024

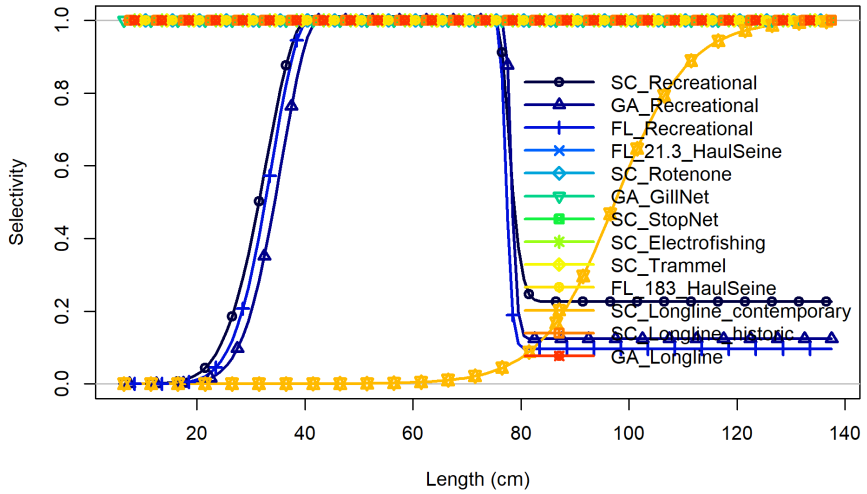
Fishing Fleets

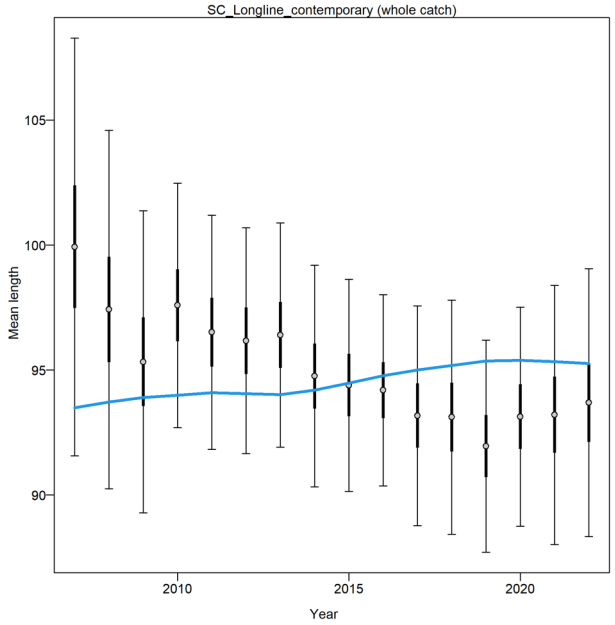
Fishing Fleet Name	Years	Discard Mortality	Catch Error Type	Selectivity	Retention Periods	Composition Error Type
SC_Recreational	1981-2022	0.08	Lognormal	Double Normal Length and Derived Age	1981-1989, 1990-1992, 1993-2000, 2001-2006, 2007-2017, 2018--2022	Multinomial
GA_Recreational	1981-2022	0.08	Lognormal	Double Normal Length and Derived Age	1981-1985, 1986-1992, 1993-2001, 2002-2022	Multinomial
FL_Recreational	1981-2022	0.08	Lognormal	Double Normal Length and Derived Age	1981-1984, 1985-1988, 1989-2022	Multinomial

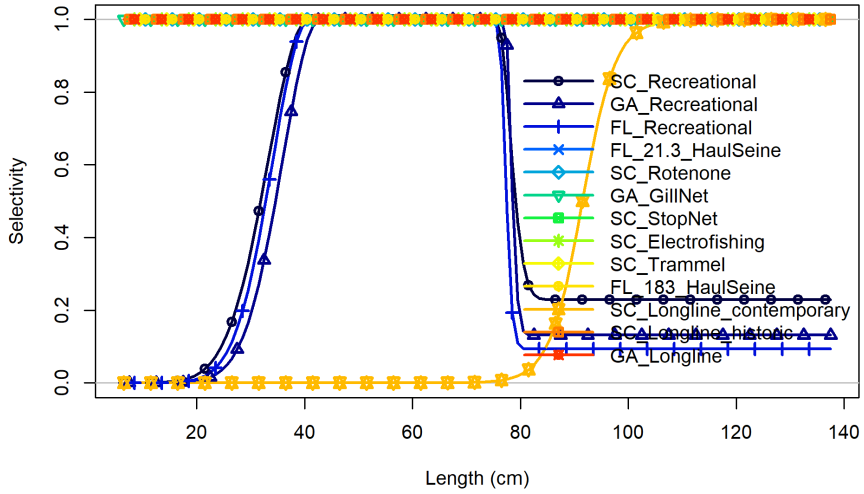
Fishery-Independent Surveys

Survey Name	Years	Timing	Catch Error Type	Selectivity	Composition Error Type
FL_21.3_HaulSeine	2001-2021	October 15	Lognormal	Age-0 Recruitment (SS special survey type 33)	NA
SC_Rotenone	1986-1993	October 15	Lognormal	Age-0 Recruitment (SS special survey type 33)	NA
GA_GillNet	2002-2022	July 15	Lognormal	Age-0 Only	NA
SC_StopNet	1987-1993	July 1	Lognormal	Double Normal Age	Multinomial
SC_Trammel	1991-2022	July 1	Lognormal	Double Normal Age	Multinomial
FL_183_HaulSeine	2001-2021	July 1	Lognormal	Double Normal Age	Multinomial
SC_Longline_contemporary	2007-2022	October 15	Lognormal	Double Normal Length and Derived Age	Multinomial

SC_Longline_contemporary Selectivity

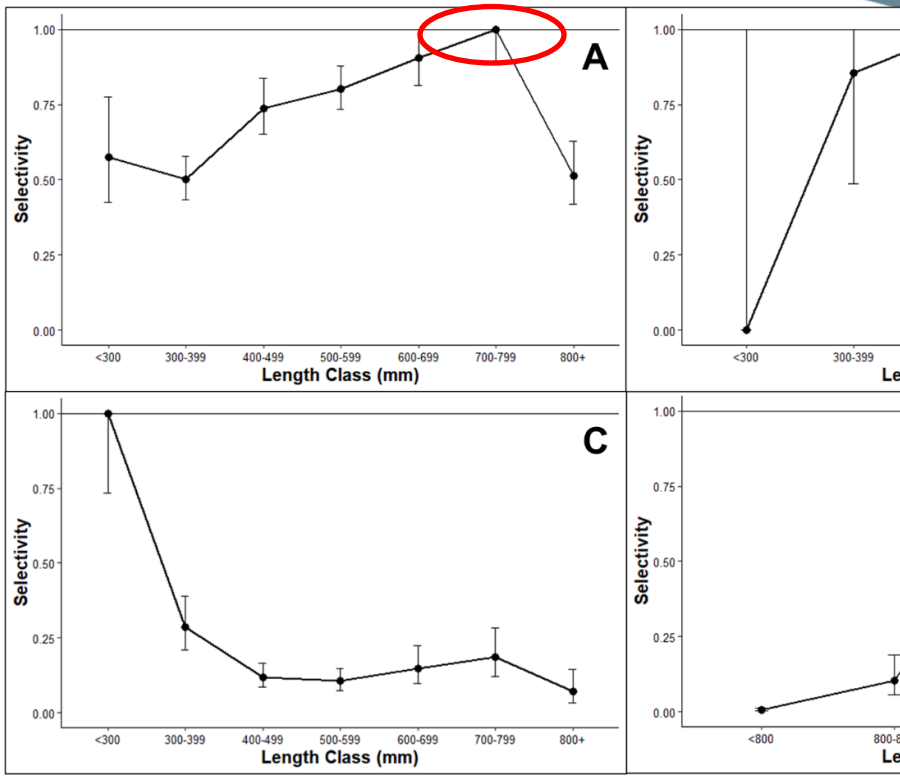






Fixed Top Selectivity Parameters

- Top parameter controlling width of full selectivity plateau
- With peak parameter estimate stable, prior on top parameter more straightforward to specify
  - Parameter value that allows for descending selectivity starting at 75cm when the peak is at 40cm
  - SC trammel net survey identified by SAS as appropriate proxy for sizes available inshore to recreational fisheries
  - 70-79cm bin largest size bin estimated to have full selectivity in SC trammel net survey by Troha (2023)



- Used as an informative prior first, but model continued to push to narrow selectivity patterns
- Fixed to address data deficiency (poor discard size data in quantity and quality) and model's inability to estimate parameter values aligning with other data/published information and expert opinion

End Selectivity Parameter Prior

- Model also struggles to estimate end parameter of SC fleet with no data to inform it

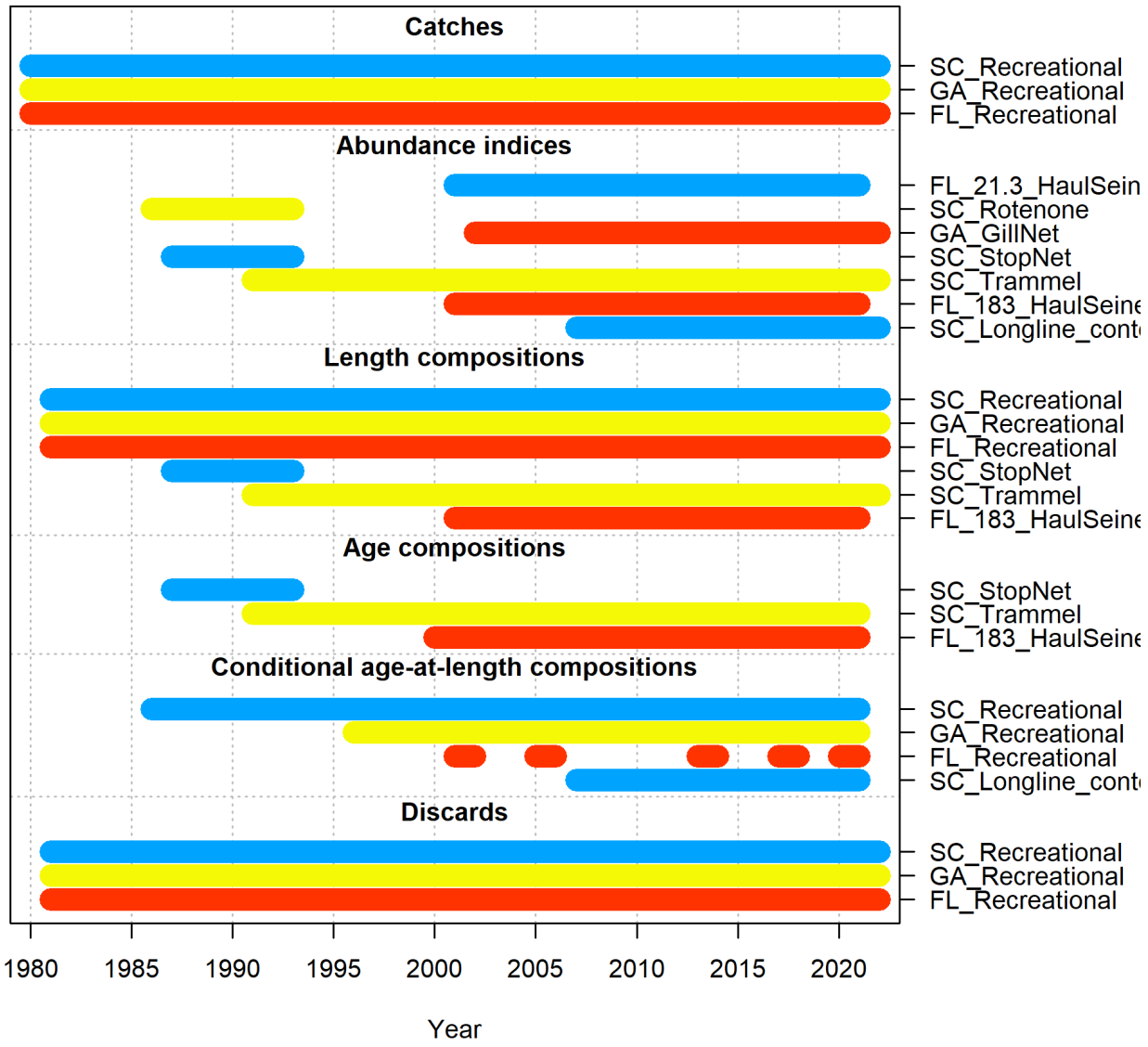
- Normal prior added for this parameter
  - Troha (2023) estimate for recreational release selectivity of largest regularly encountered size bin (90-99cm)
  - Mean = 0.27
  - sd= that needed to derive 95% CI of 0.2-0.37

Length Bin (mm)	Selectivity	Standard Error	Asymptotic Confidence Level
<300	1.00	0.07-0.08	0.86-1.00
300-399	0.72	0.04-0.05	0.63-0.81
400-499	0.62	0.04	0.54-0.71
500-599	0.64	0.04-0.05	0.56-0.74
600-699	0.71	0.04-0.05	0.62-0.81
700-799	0.77	0.04-0.05	0.67-0.88
800-899	0.70	0.05-0.06	0.59-0.84
900-999	0.27	0.04	0.20-0.37
1000-1099	0.14	0.04	0.08-0.24

Model Parameters

- 201 estimated parameters and 54 estimated deviations
  - 7 growth parameters
  - 1 stock-recruit parameter
  - 54 recruitment deviations
  - 129 F parameters
  - 64 selectivity/retention parameters

Data


Catches
SC_Recreational
GA_Recreational
FL_Recreational
Abundance indices
FL_21.3_HaulSein
SC_Rotenone
GA_GillNet
SC_StopNet
SC_Trammel
FL_183_HaulSeine
SC_Longline_cont
Length compositions
SC_Recreational
GA_Recreational
FL_Recreational
SC_StopNet
SC_Trammel
FL_183_HaulSeine
Age compositions
SC_StopNet
SC_Trammel
FL_183_HaulSeine
Conditional age-at-length compositions
SC_Recreational
GA_Recreational
FL_Recreational
SC_Longline_cont
Discards
SC_Recreational
GA_Recreational
FL_Recreational
1980
1985
1990
1995
2000
2005
2010
2015
2020
Year

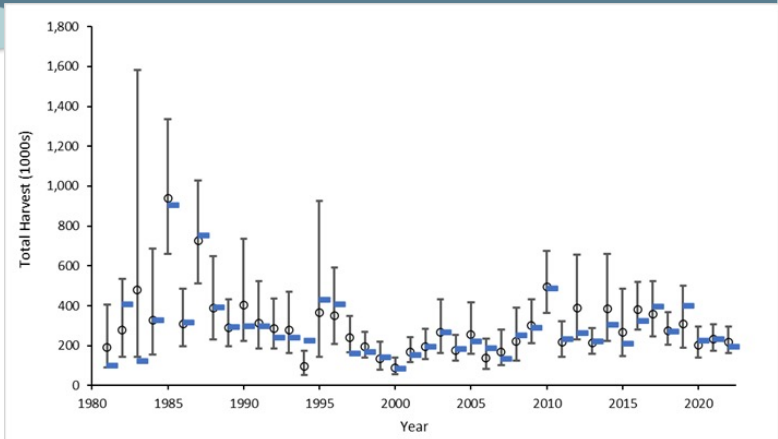
Convergence/Stability

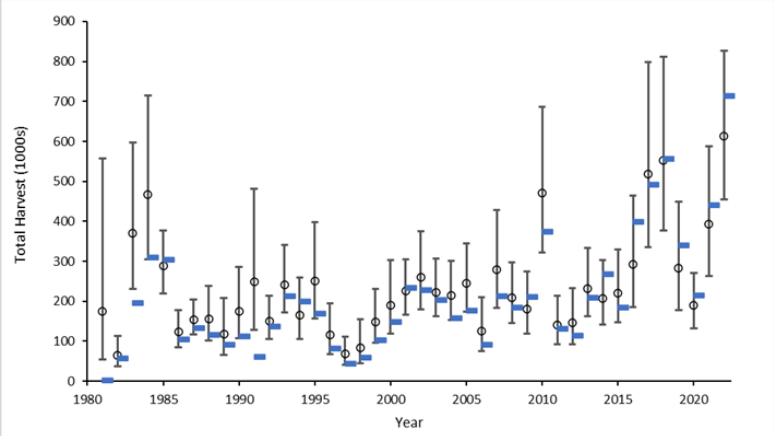
- Hessian matrix positive definite
- Maximum gradient component=5.76014e-05
- No parameters at bounds
- No highly correlated (>+0.95) parameter pairs
- No parameters had low correlations (<0.01) with all other parameters

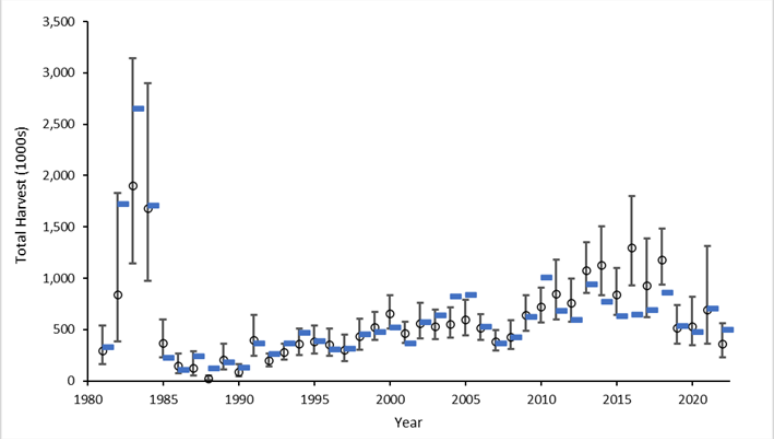
Jitter Analysis

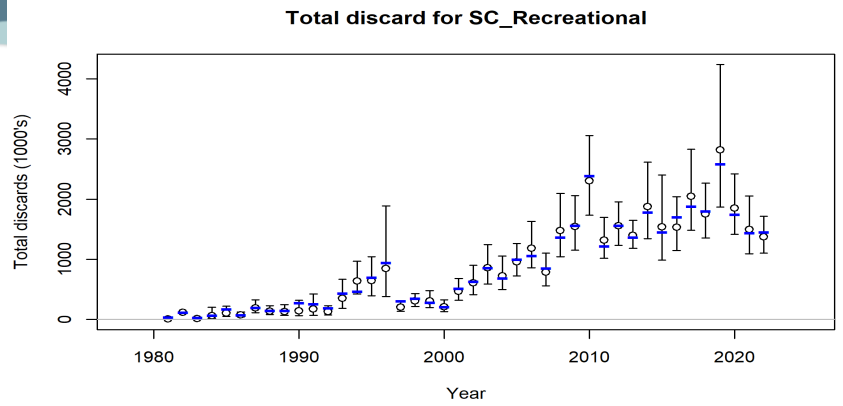
-LL	Δ -LL	Frequency	Converged?
7,345	0	192	Yes
7,352	7	1	Yes
7,352	7	1	Yes
7,366	22	1	Yes
9,093	1,748	1	No
9,698	2,353	1	No
9,925	2,580	1	No
13,533	6,188	1	No
22,632	15,287	1	No

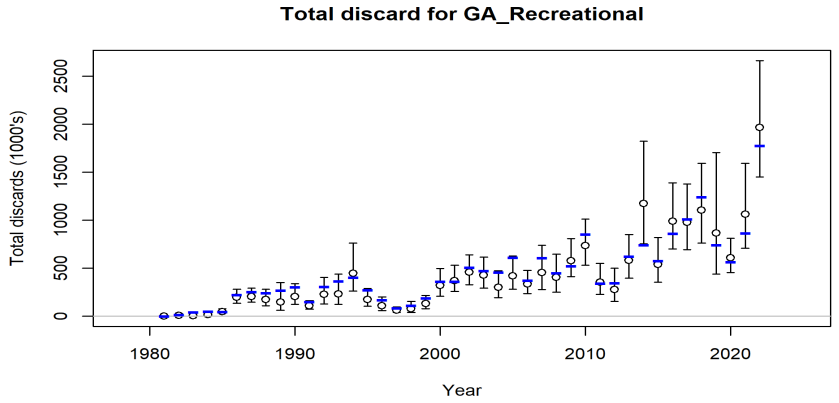
Fishing Fleet Catch

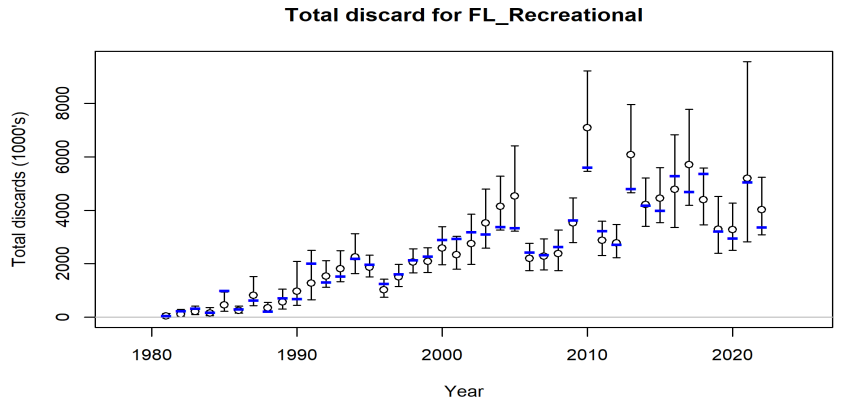




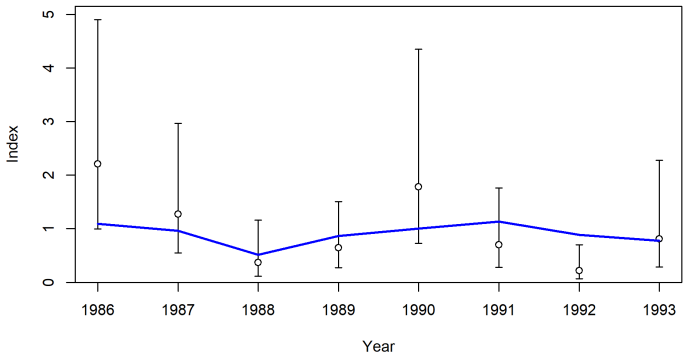


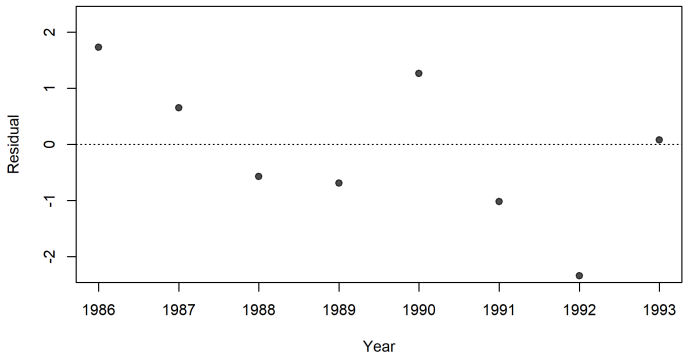


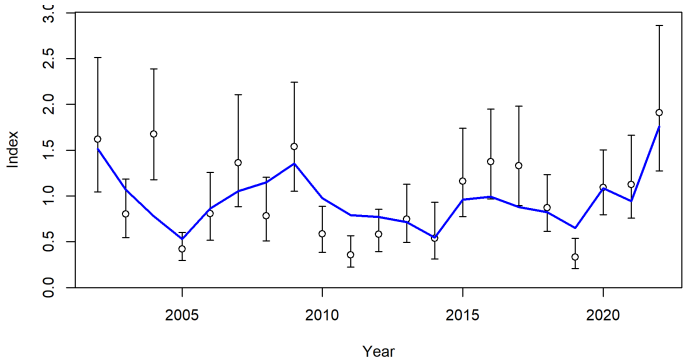


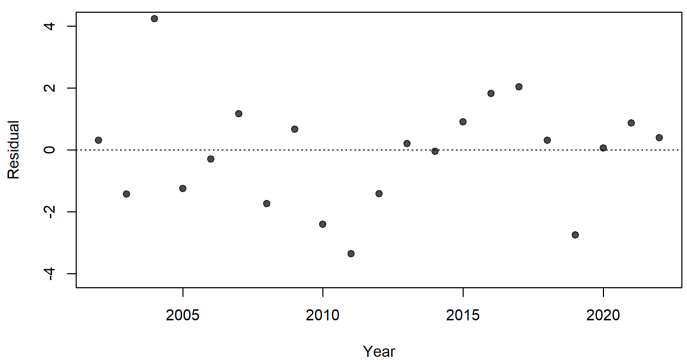


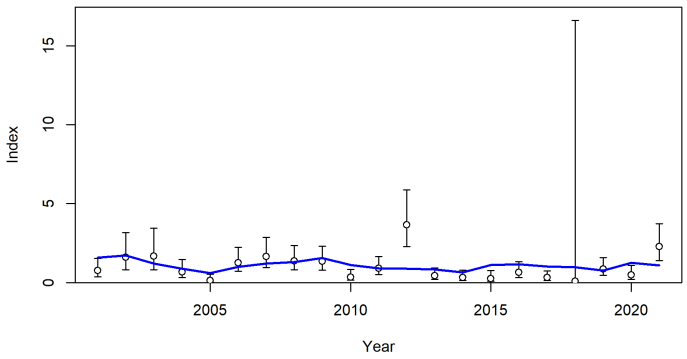
Age-0 Recruitment Indices

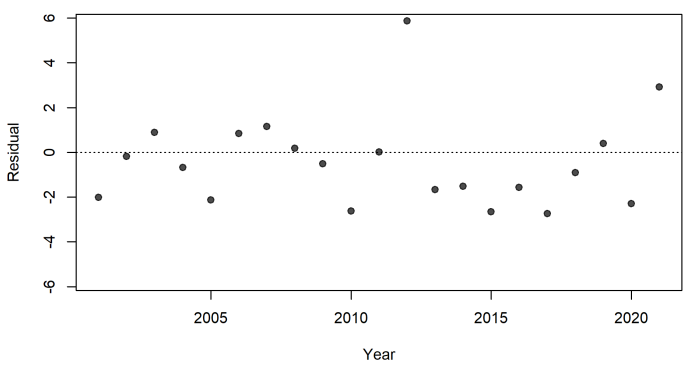




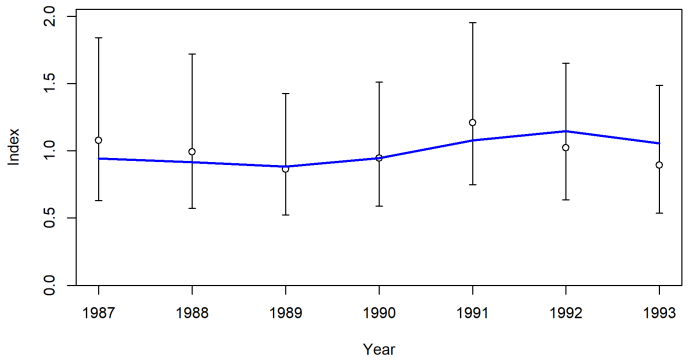


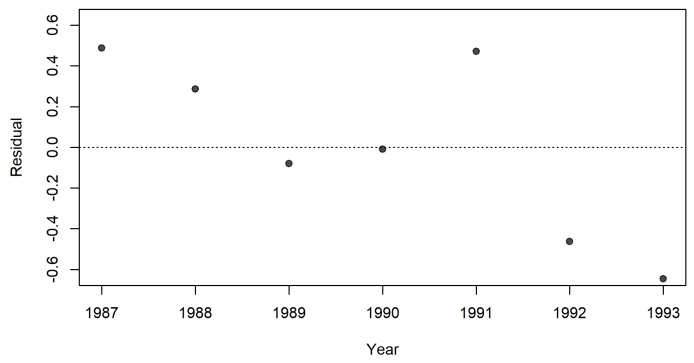


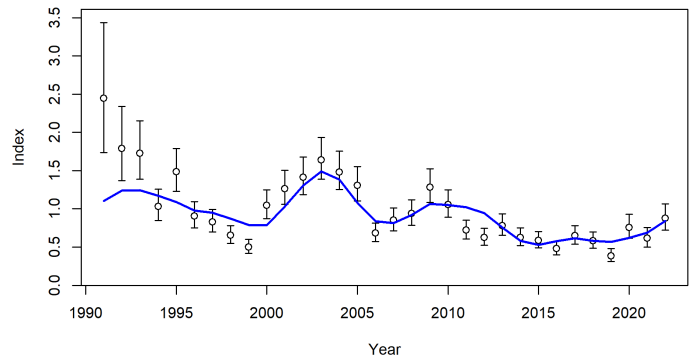


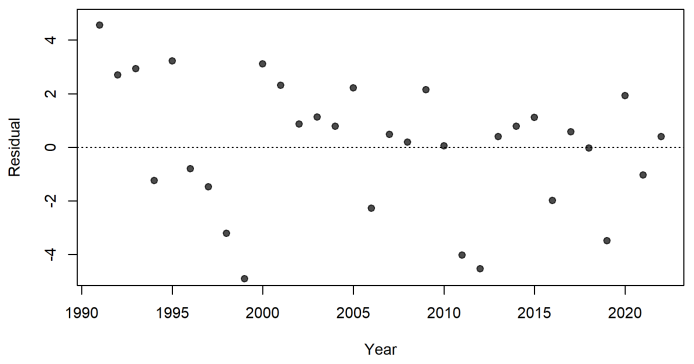


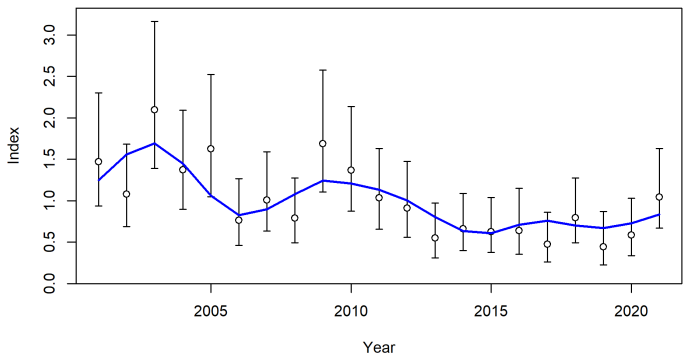
Sub-Adult Indices

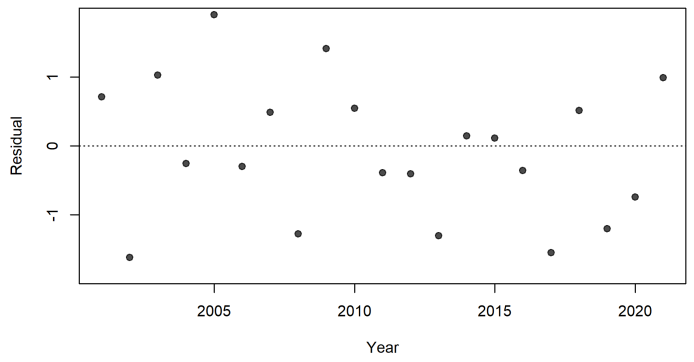




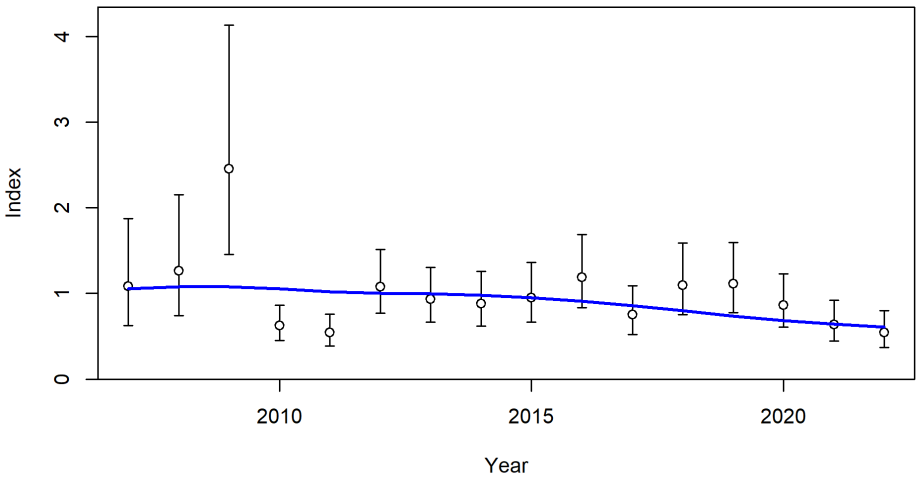


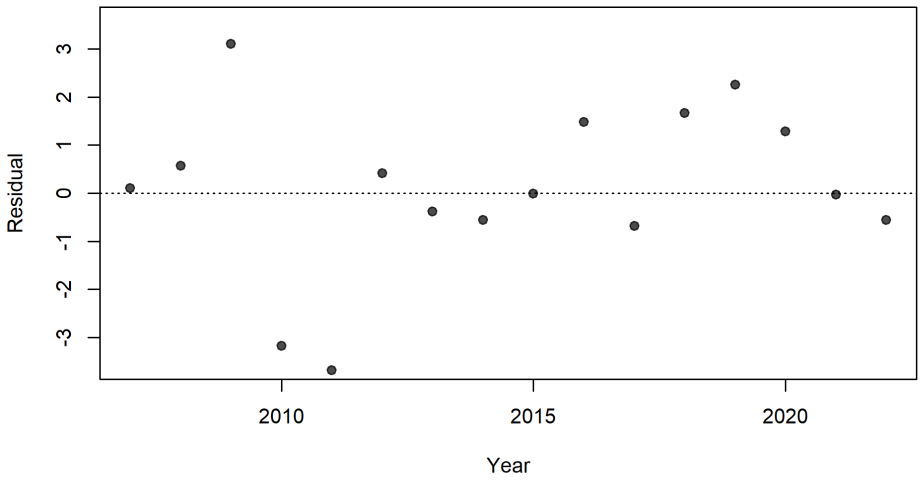




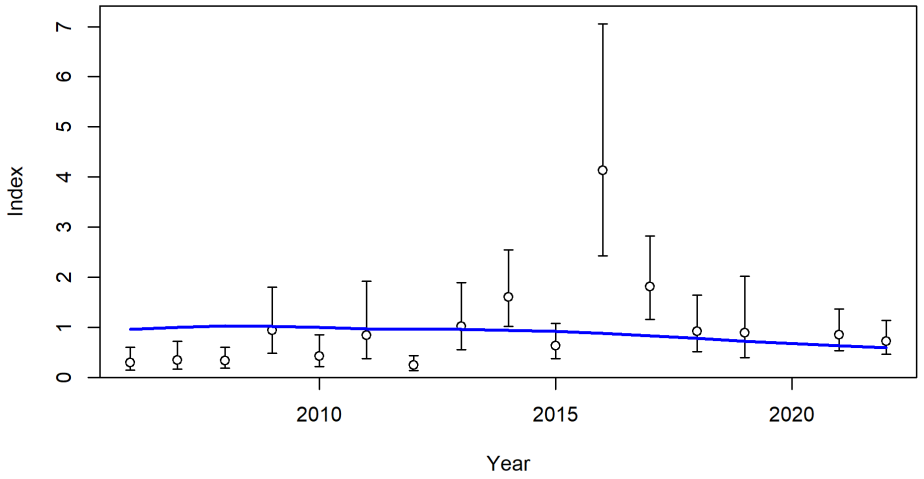


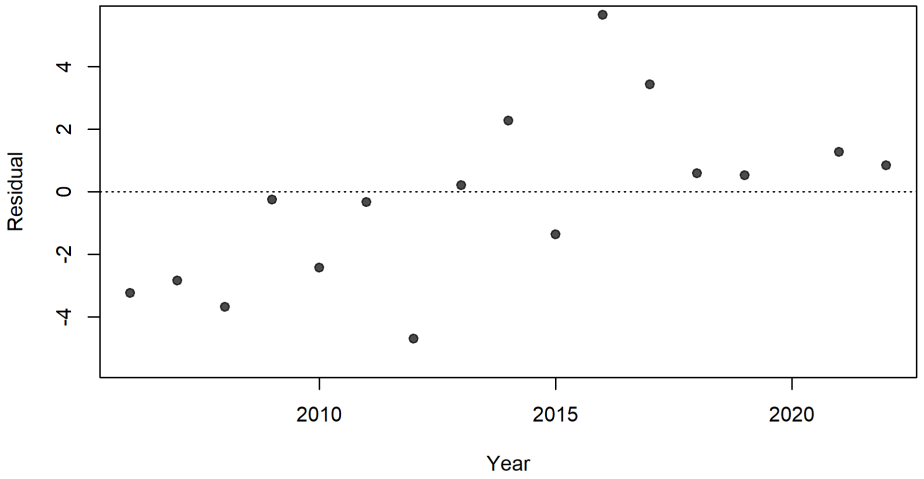
Adult Index

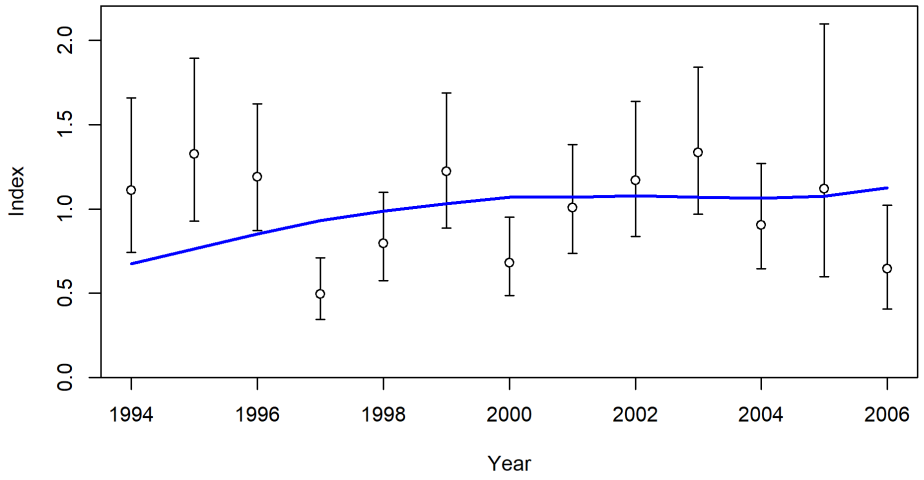

Index
0
1
2
3
4
2010
2015
2020
Year

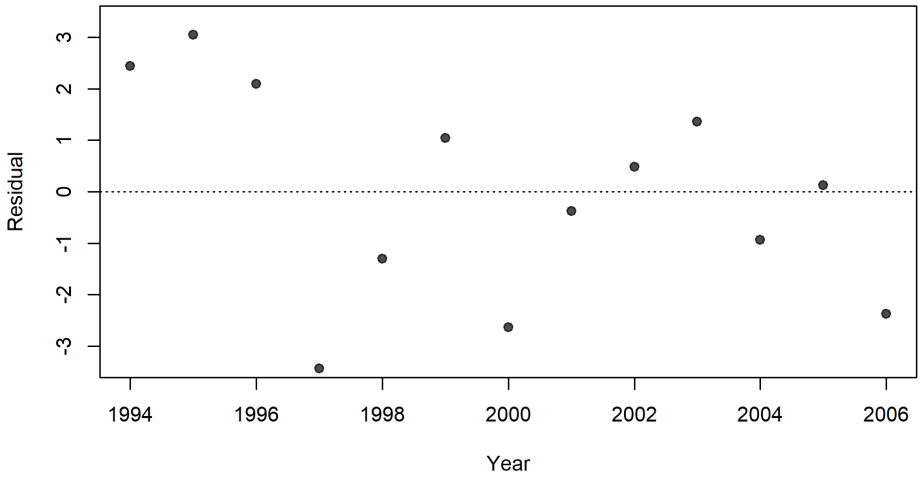

Residual
-3
-2
-1
0
1
2
3
2010
2015
2020
Year

Longline Survey Selection

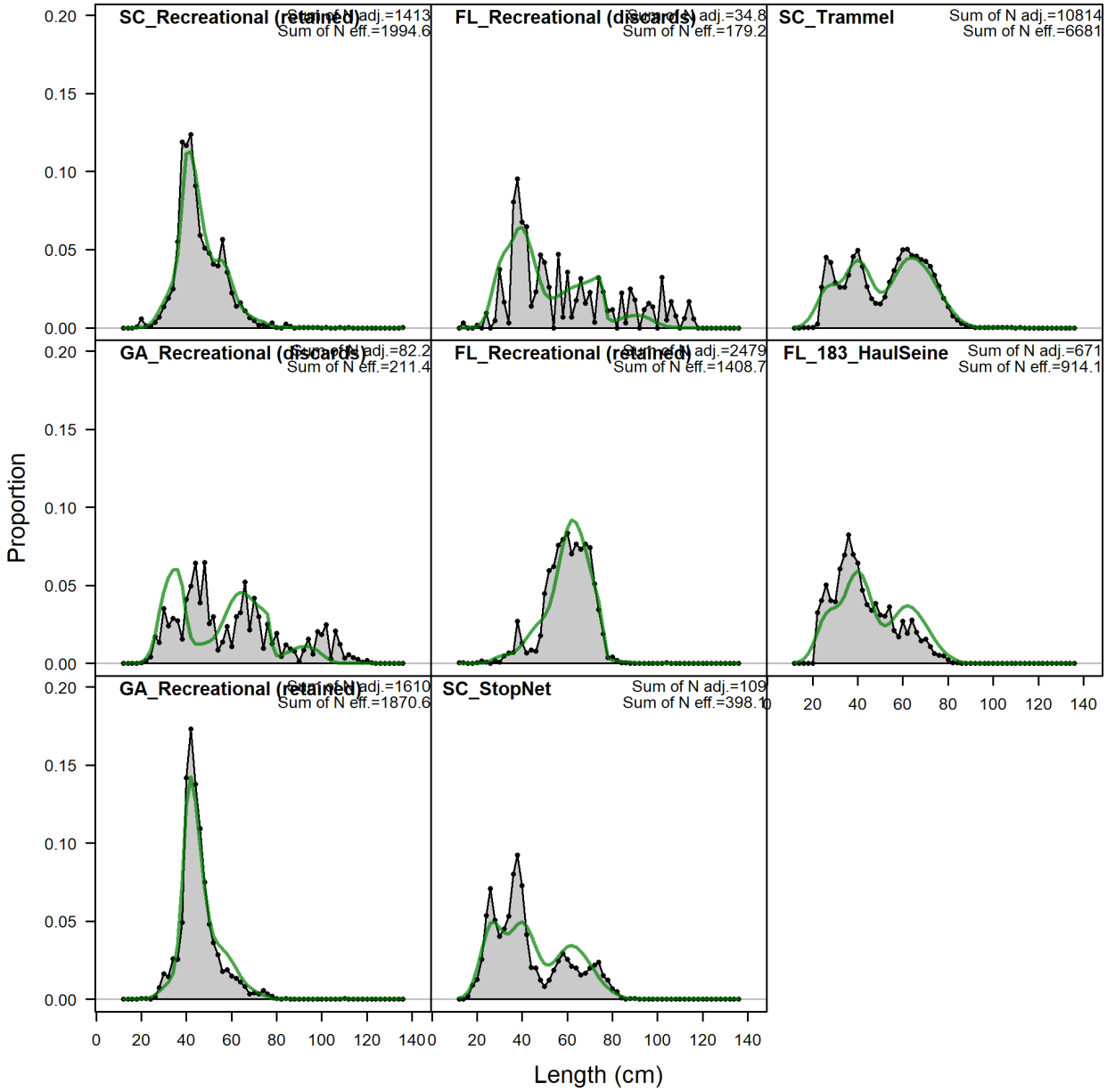




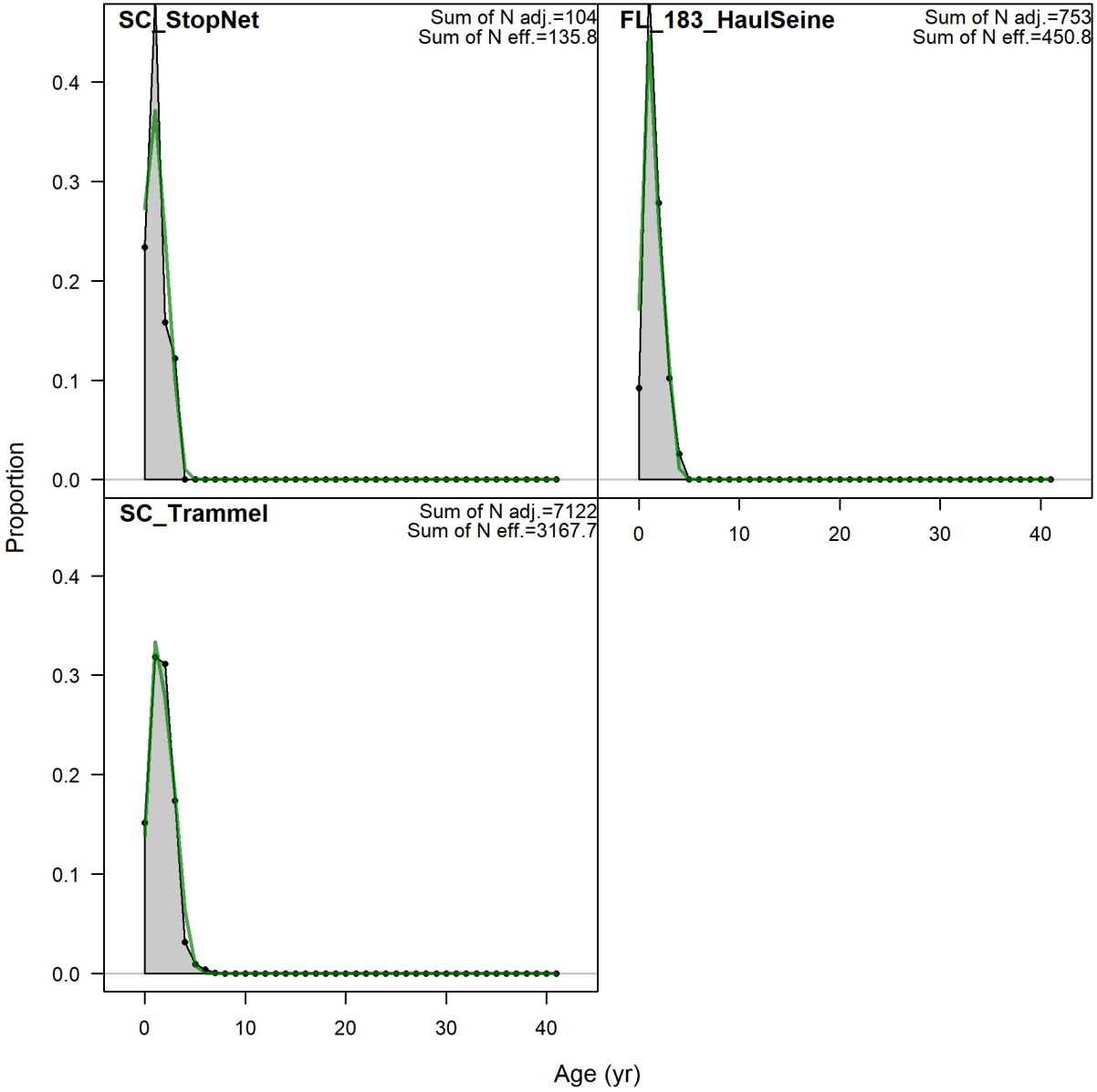




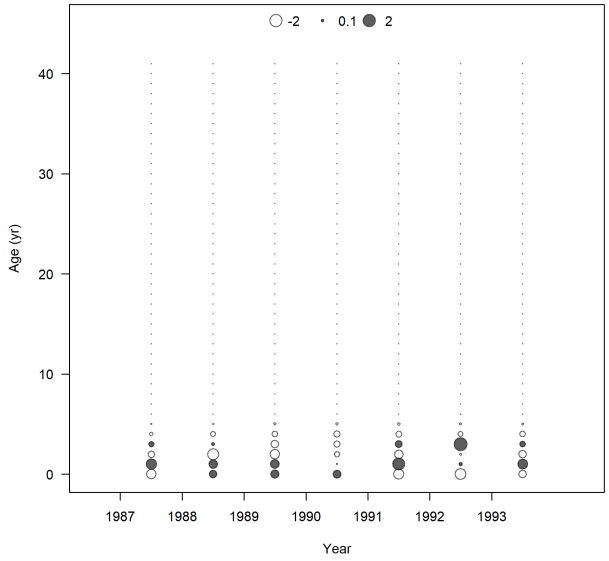
Length Compositions

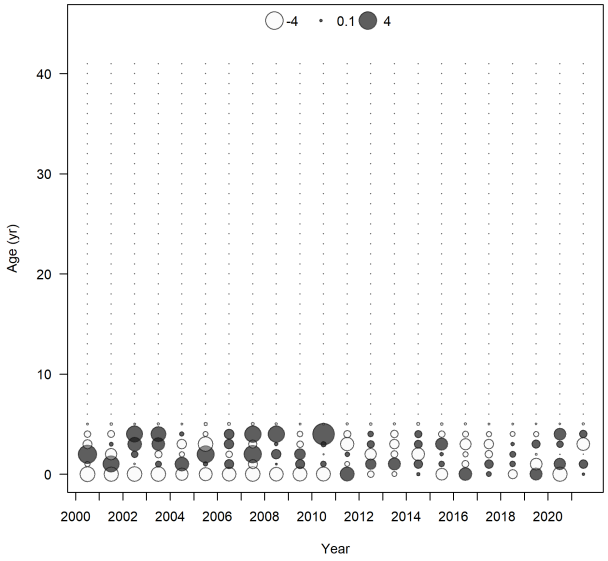


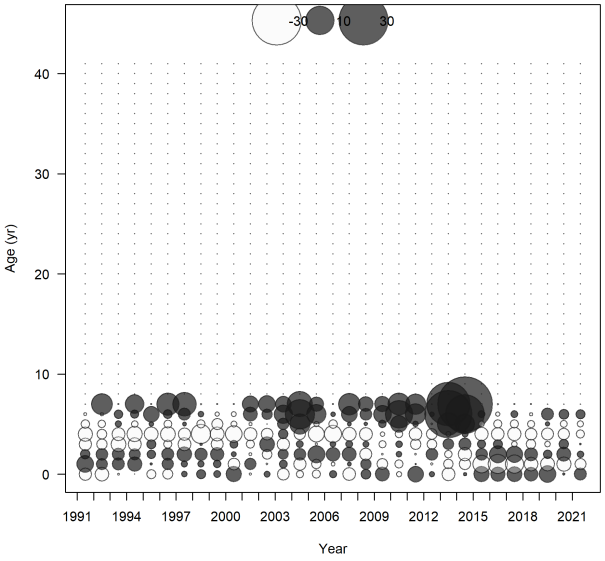
Marginal Age Compositions



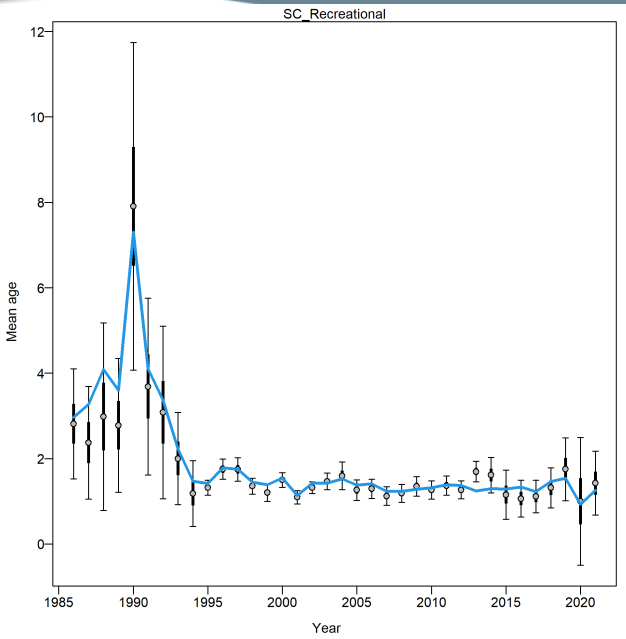
Marginal Age Compositions

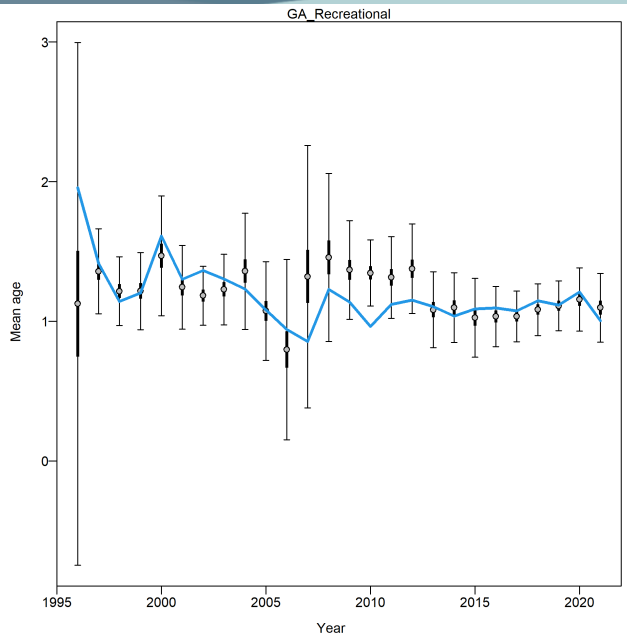


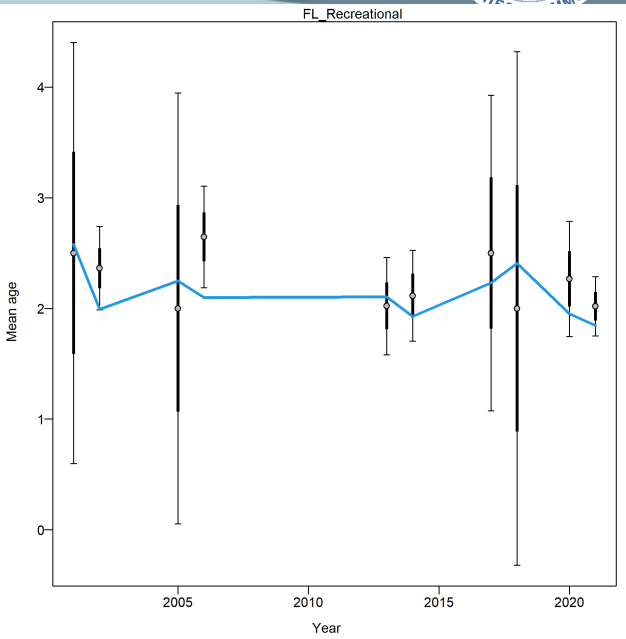


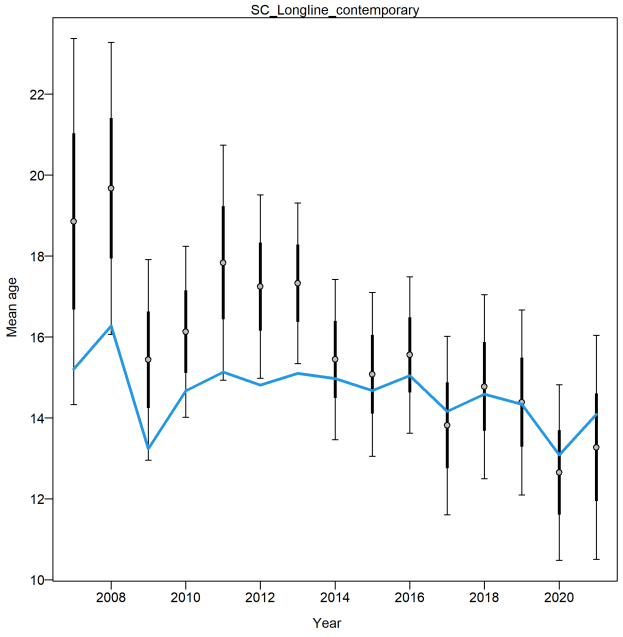


Conditional Age-At-Length

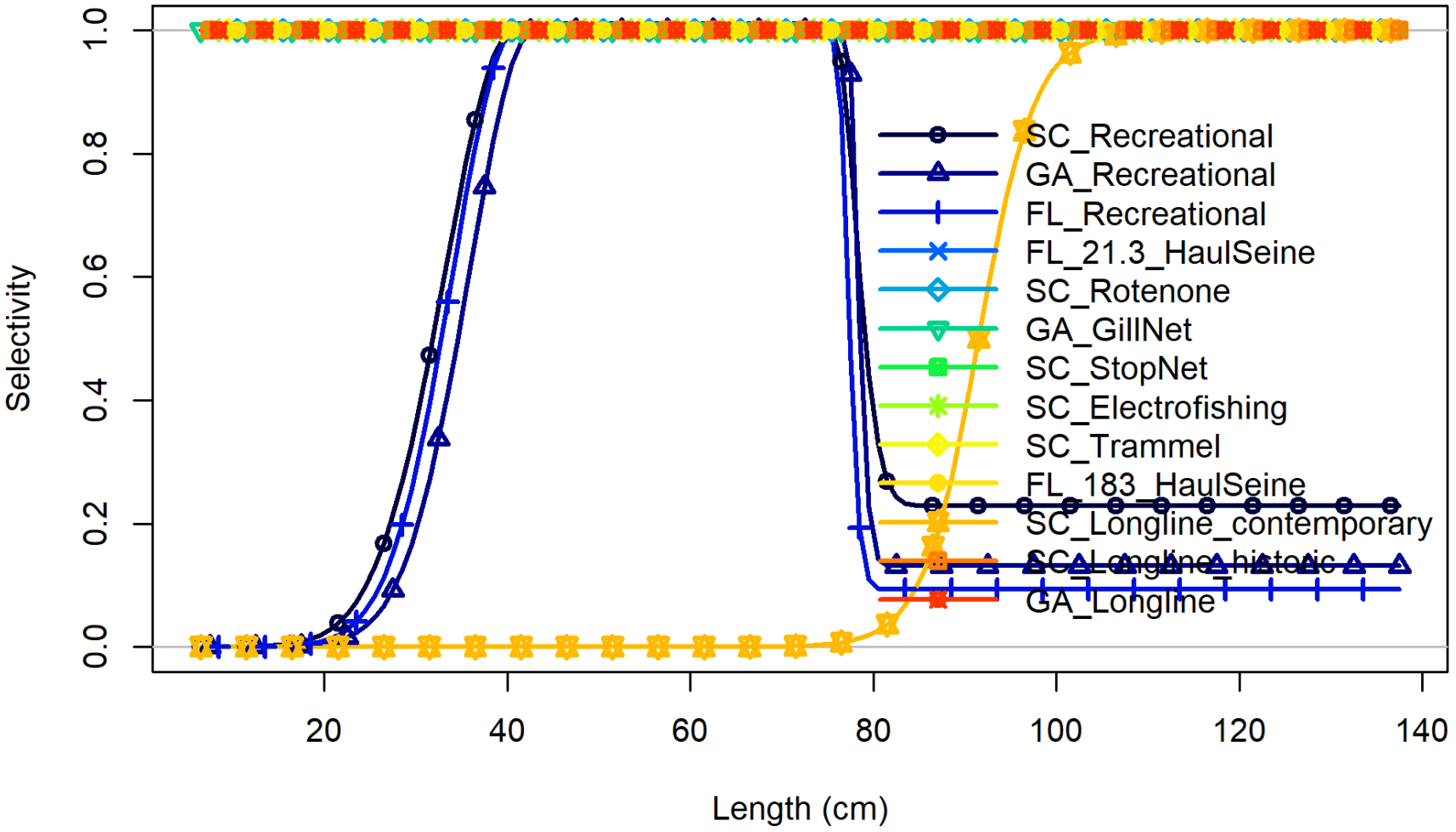




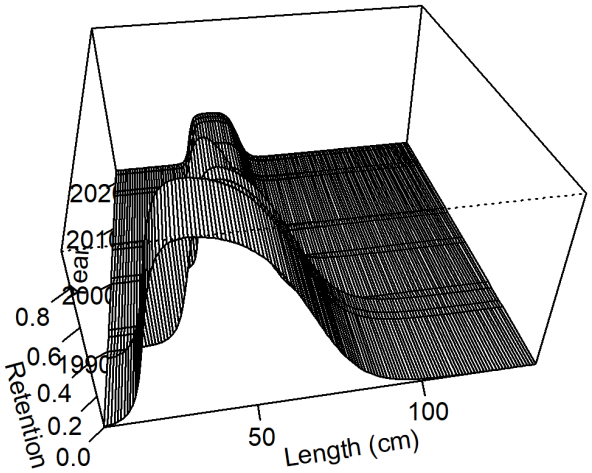


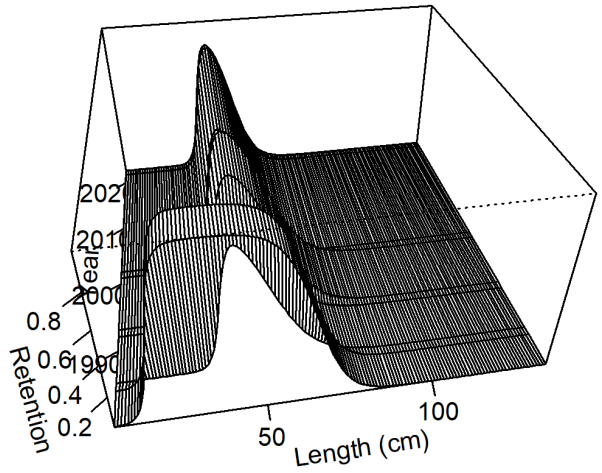


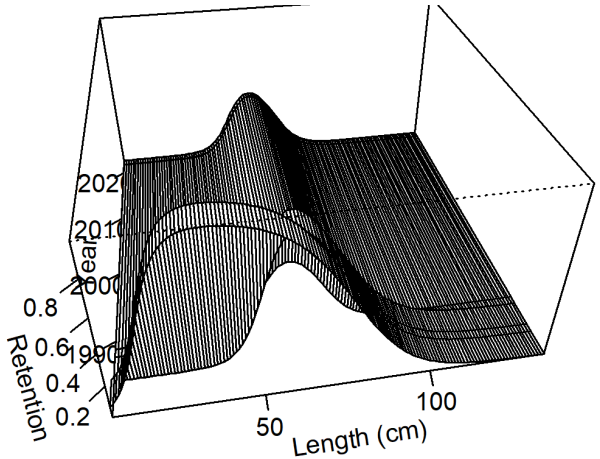
Length-Based Selectivity



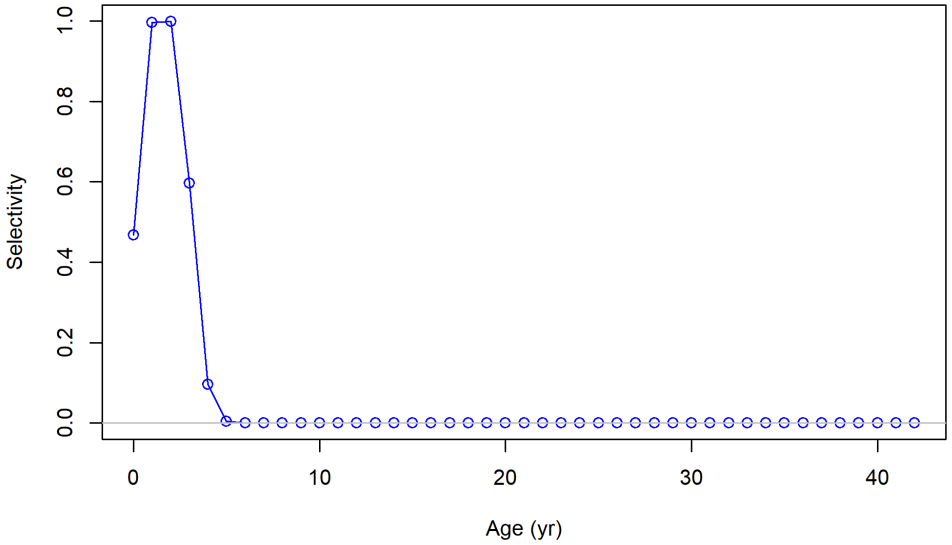
Retention

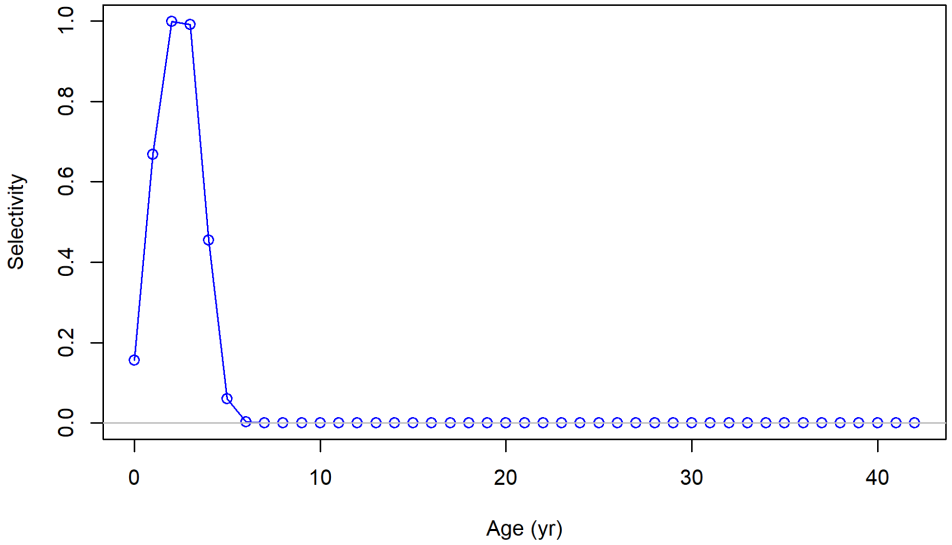

Retention
0.0
0.2
0.4
0.6
0.8
50
100
Length (cm)

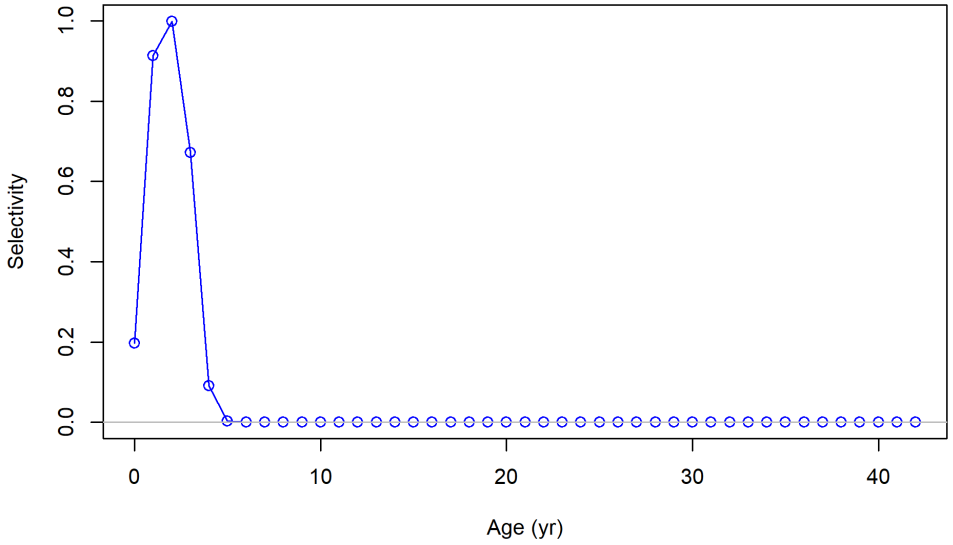

Retention
0.2
0.4
0.6
0.8
50
100
Length (cm)


Retention
0.2
0.4
0.6
0.8
50
100
Length (cm)

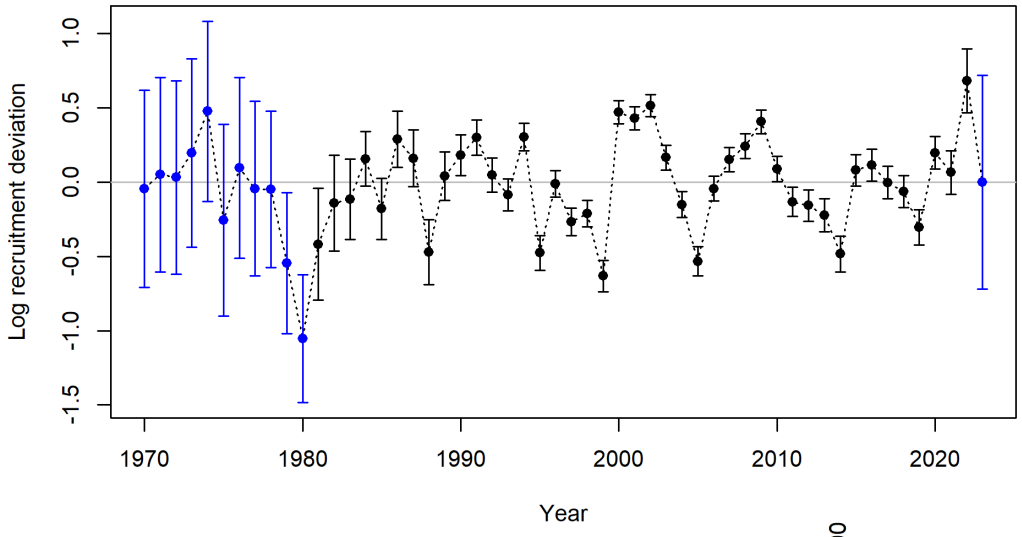
Age-Based Selectivity

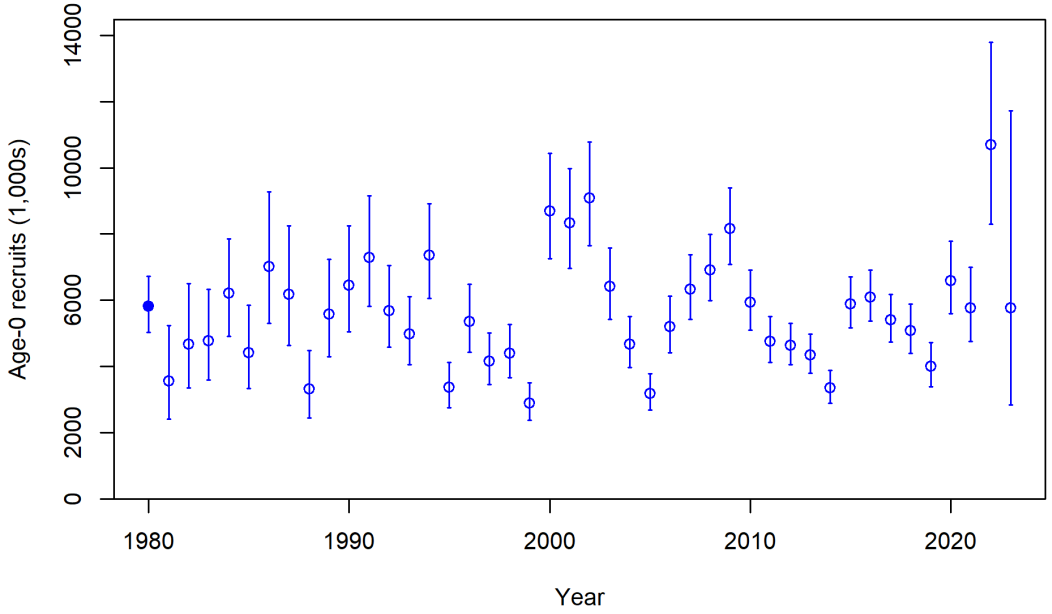




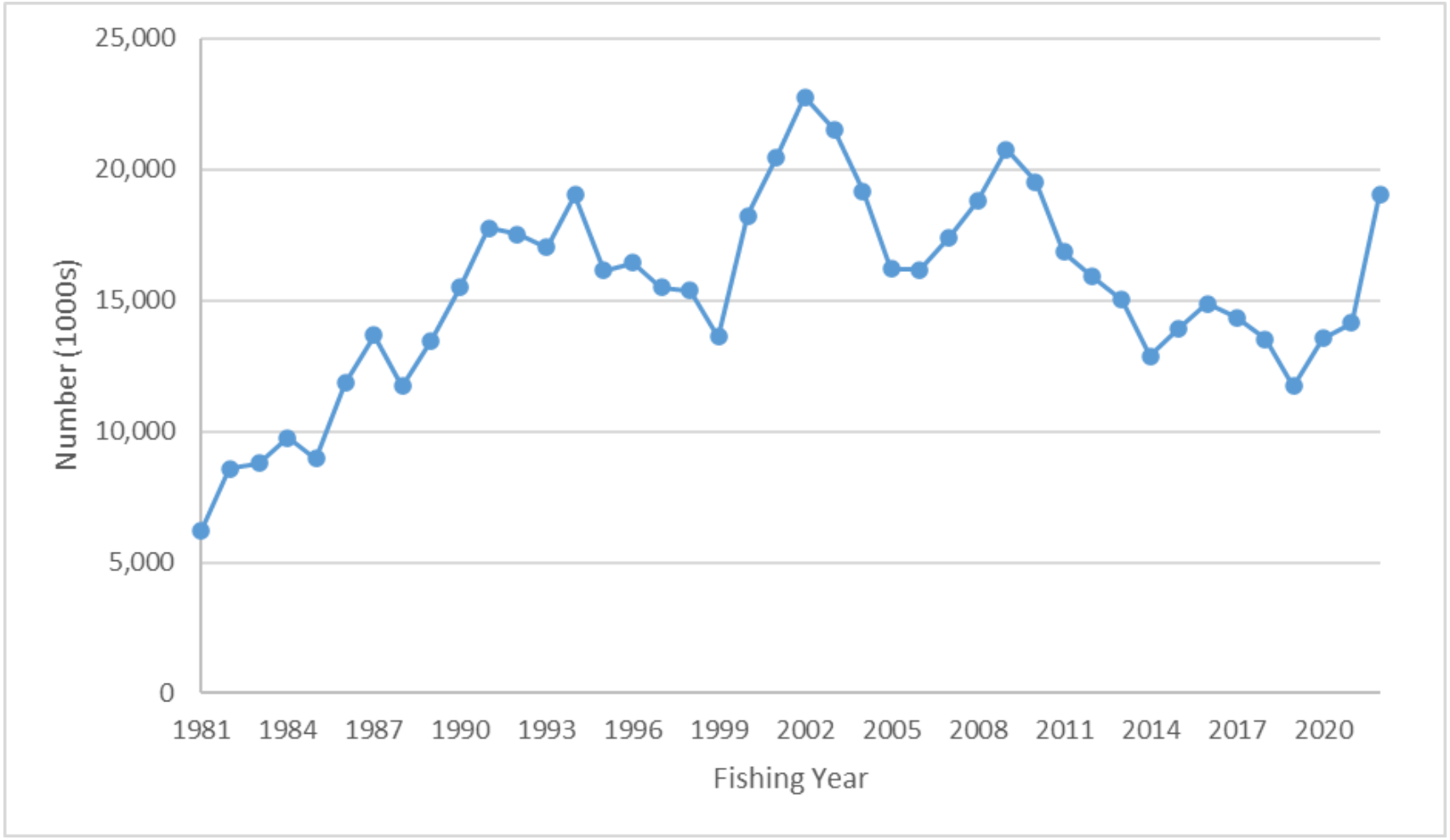


Recruitment

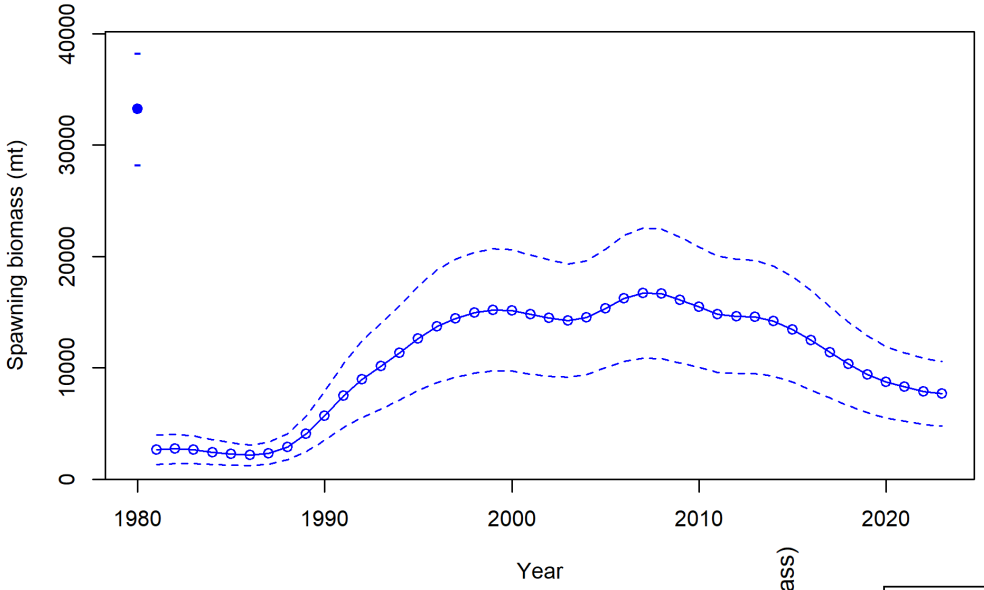


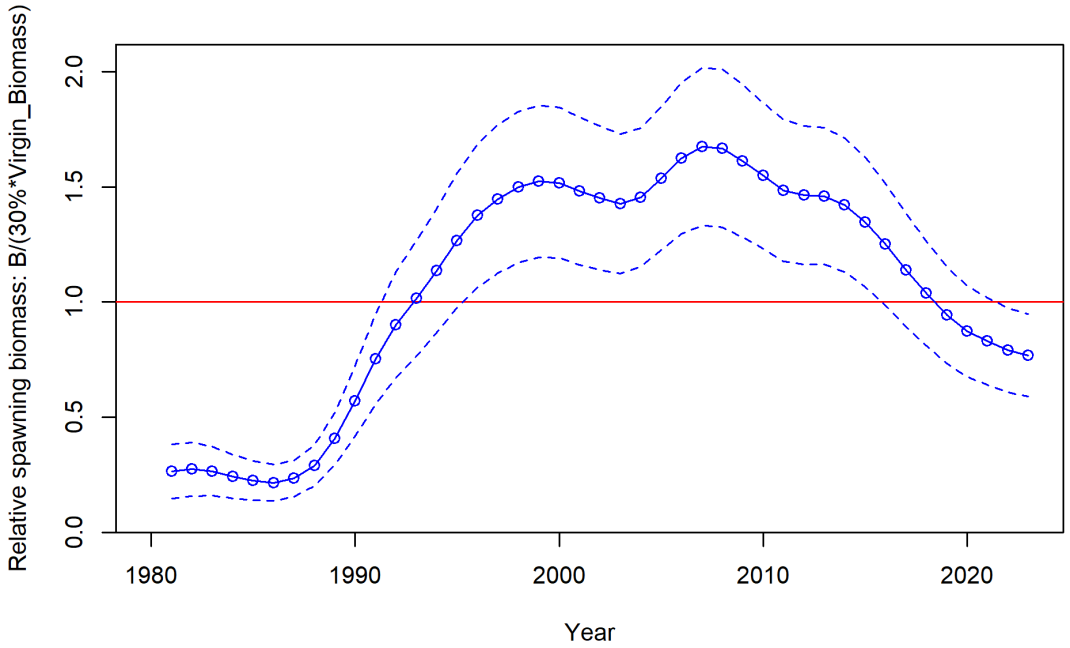


Abundance

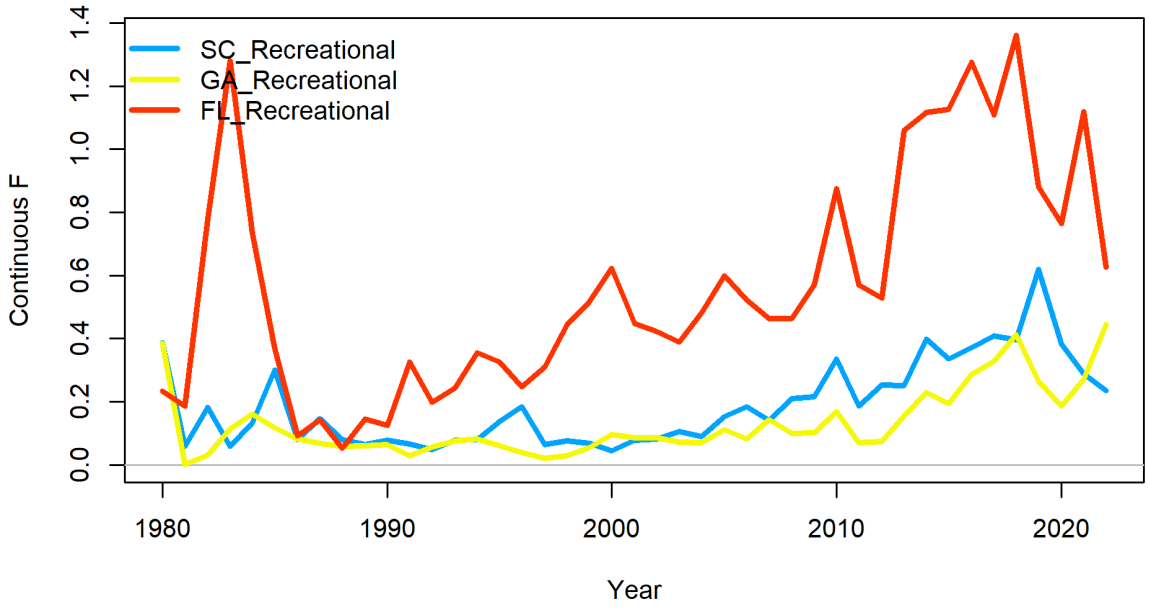

25,000
20,000
15,000
10,000
5,000
0
Number (1000s)
1981
1984
1987
1990
1993
1996
1999
2002
2005
2008
2011
2014
2017
2020
Fishing Year

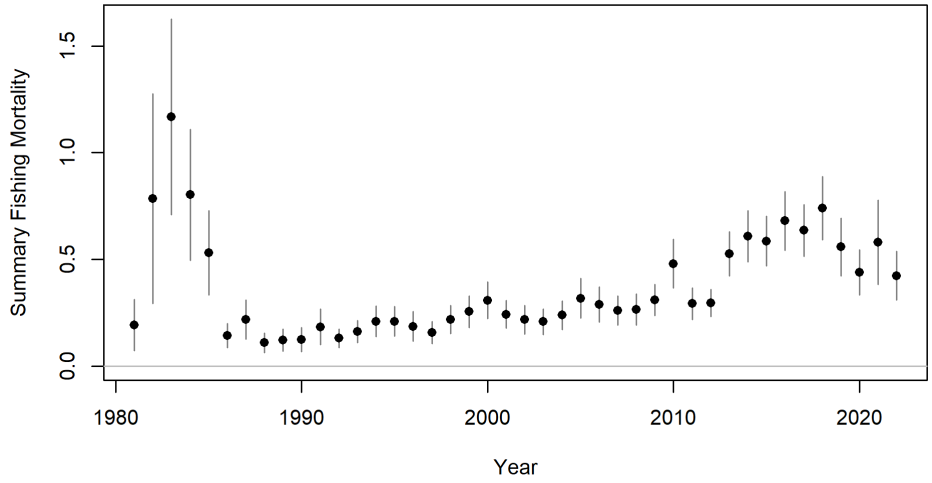
Spawning Stock Biomass



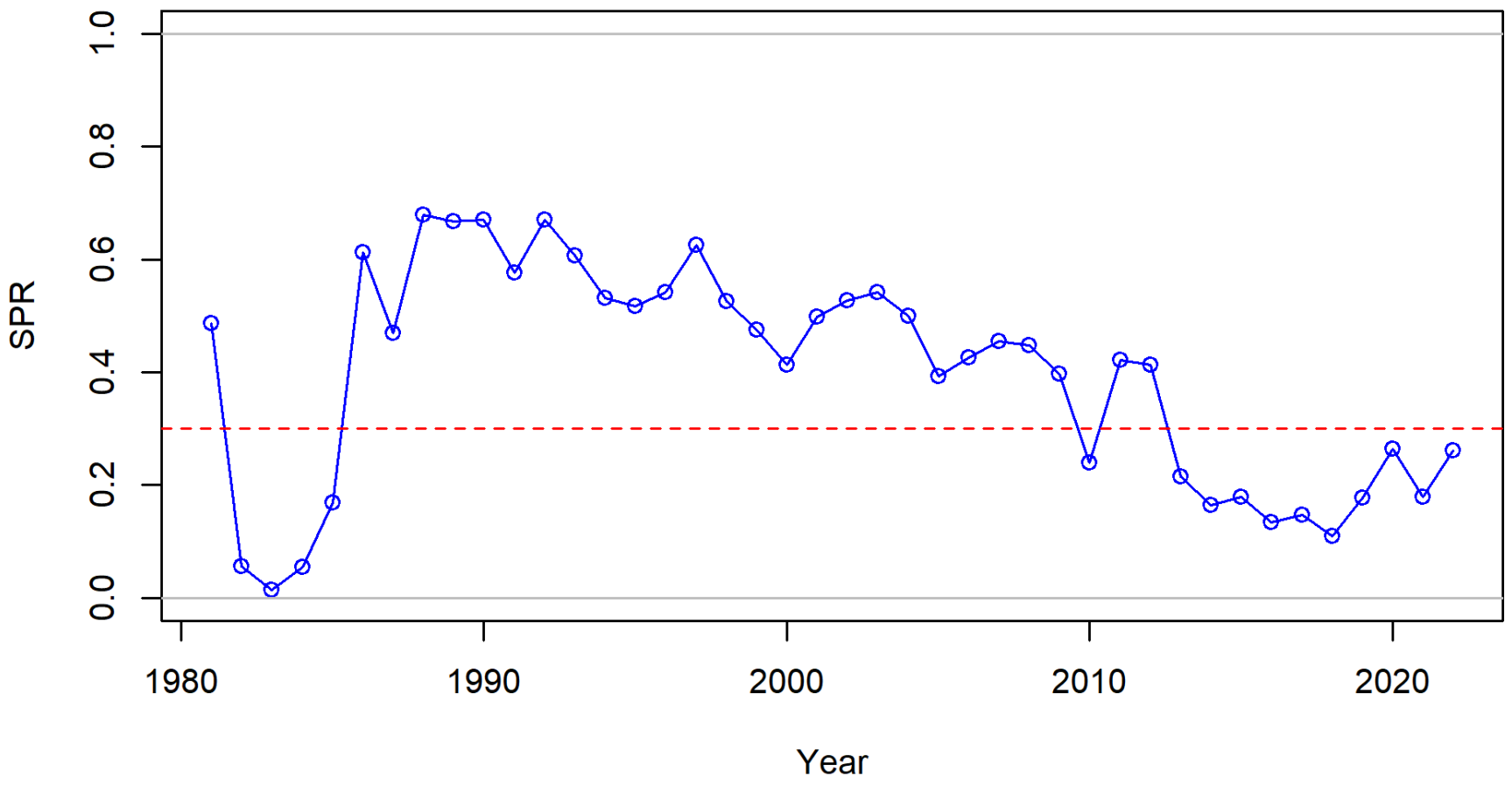


Fishing Mortality





Spawning Potential Ratio

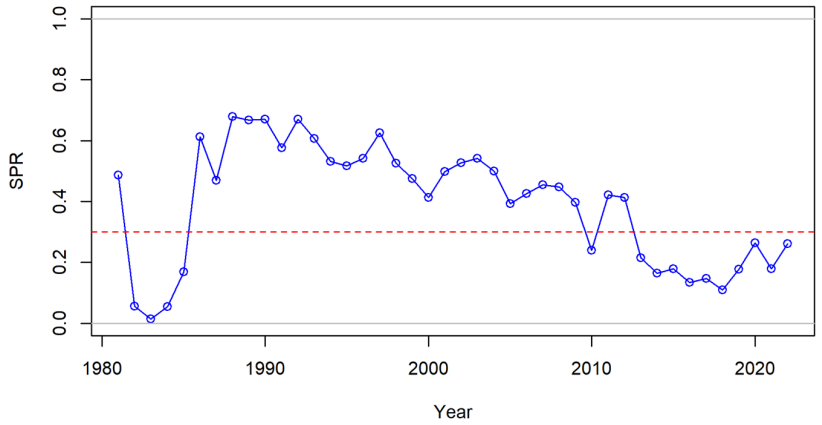


Reference Points

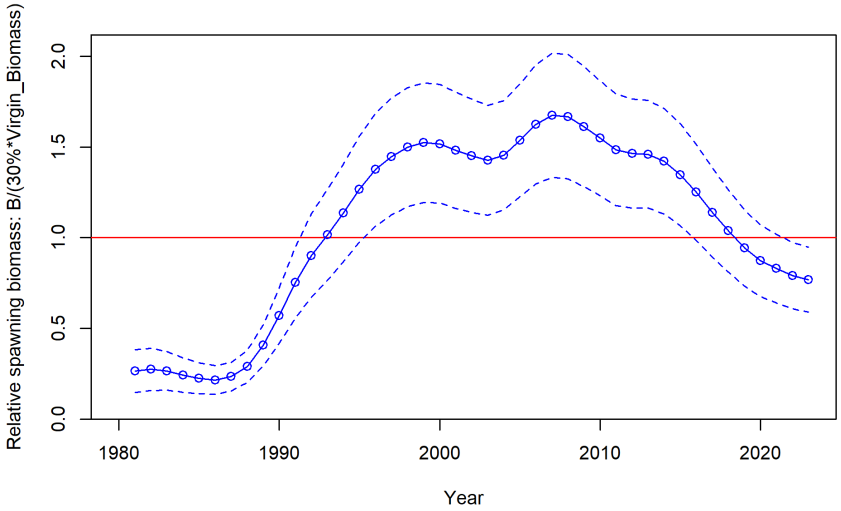
- Thresholds
  - SPR 30% (adopted in FMP)
  - $F_{30\%}$ = 0.396 (age-2)
  - $SSB_{30\%}$ = 9,917 metric tons
- Targets
  - SPR 40% (adopted in FMP)
  - $F_{30\%}$ = 0.301
  - $SSB_{40\%}$ = 13,250 metric tons

Stock Status

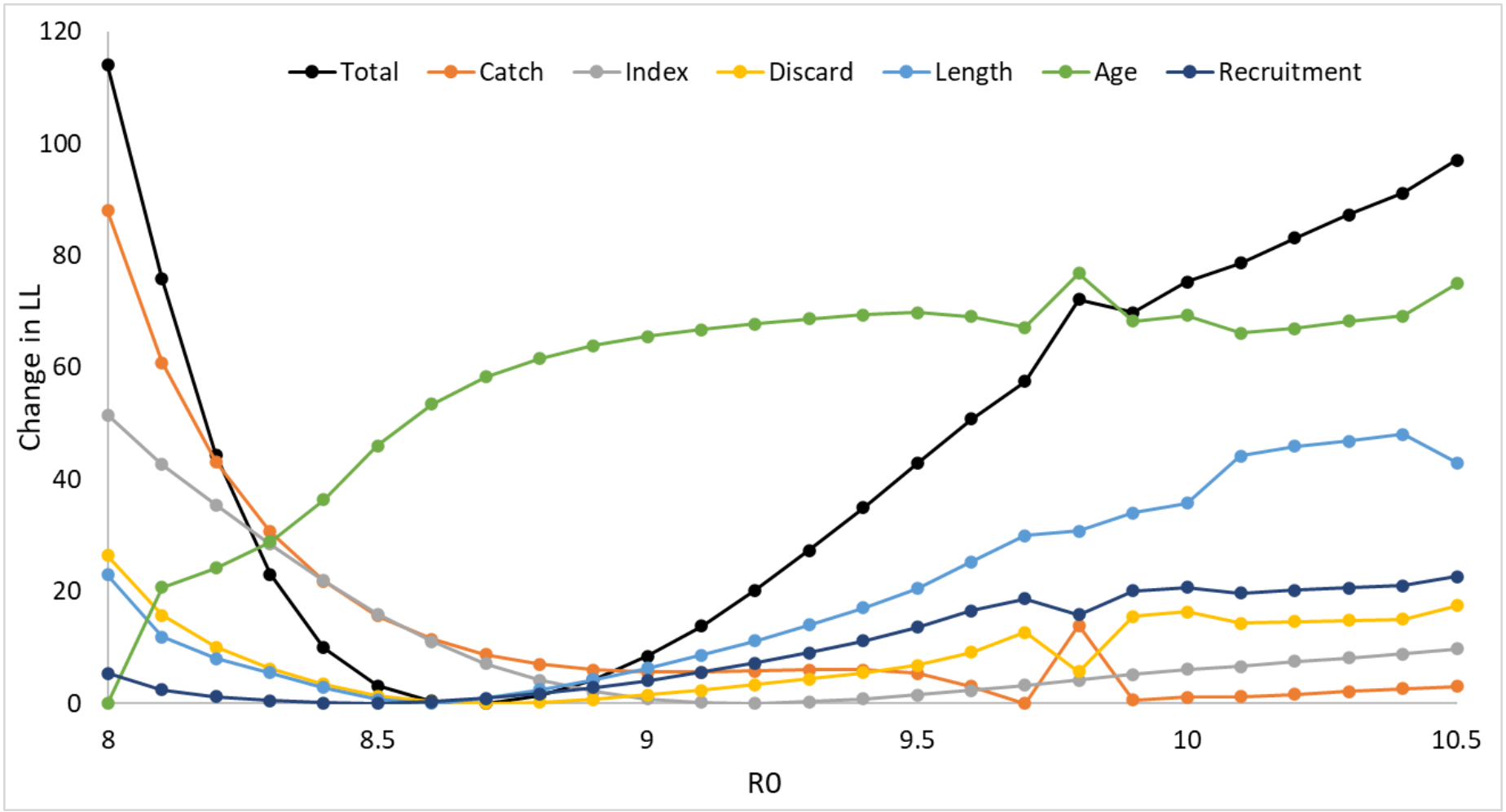
Year	Annual SPR			Three-Year Average SPR
	LCI	Estimate	UCI	
2019	0.103	0.178	0.252	0.145
2020	0.179	0.264	0.348	0.184
2021	0.079	0.179	0.279	0.207
2022	*0.168*	*0.262*	*0.356*	*0.235*



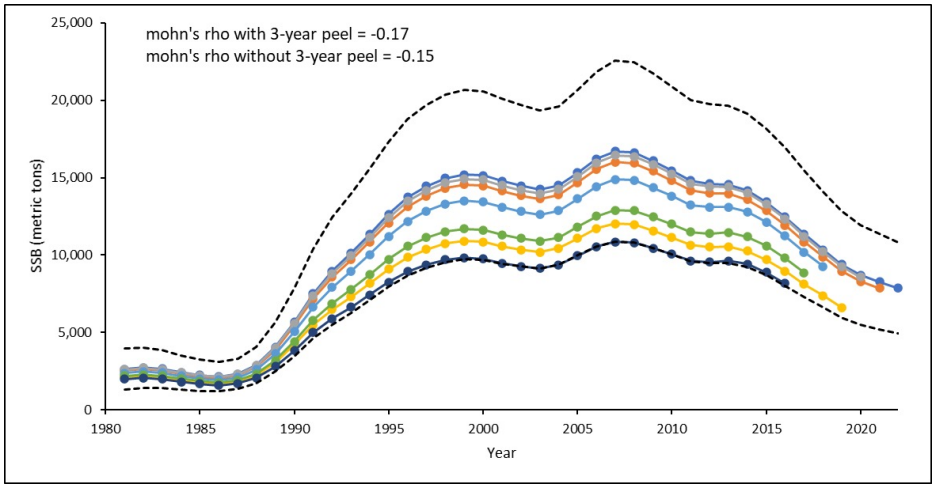
Year	Annual Relative SSB			Three-Year Average Relative SSB
	LCI	Estimate	UCI	
2019	0.732	0.942	1.152	1.040
2020	0.675	0.873	1.070	0.951
2021	0.641	0.830	1.019	0.881
2022	*0.607*	*0.790*	*0.973*	*0.831*

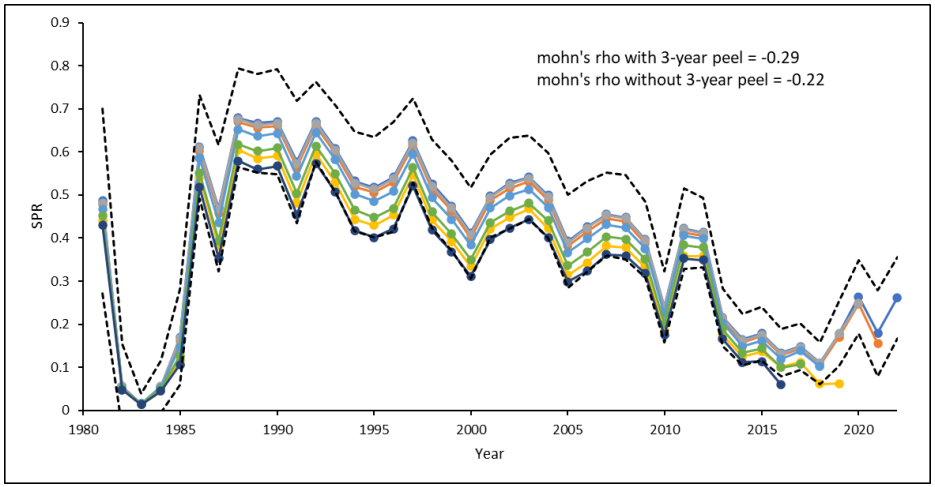


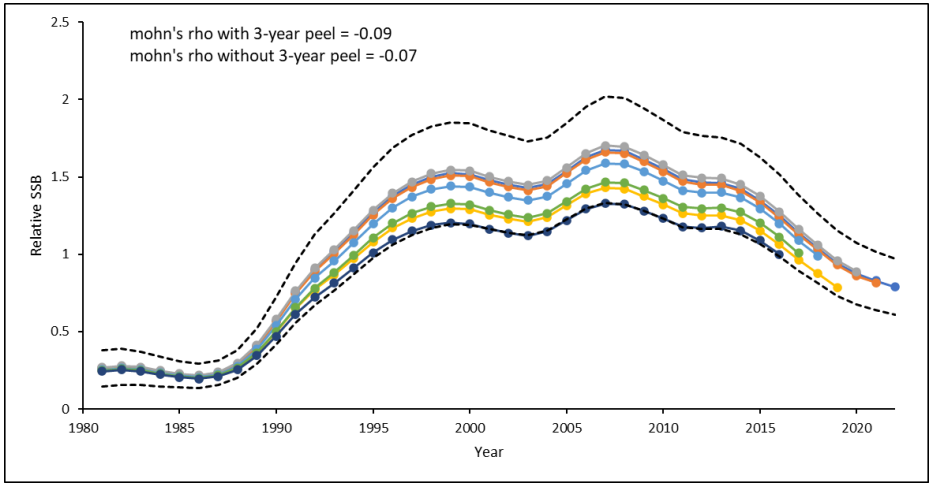
R0 Likelihood Profile

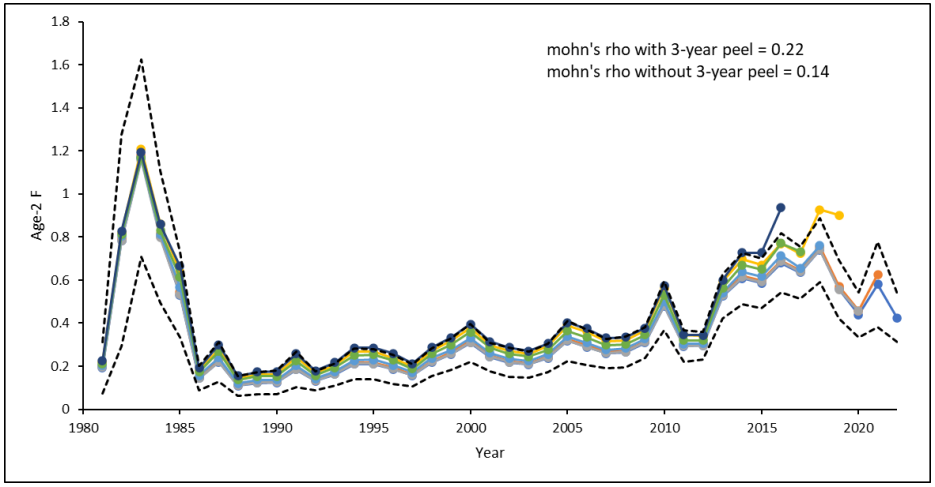


Retrospective Analysis



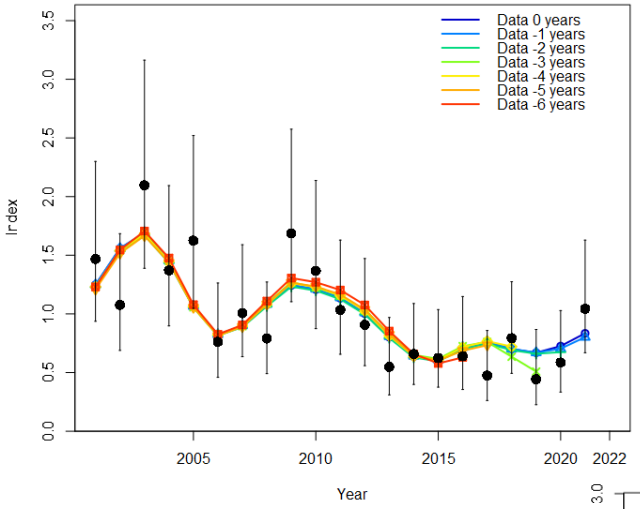


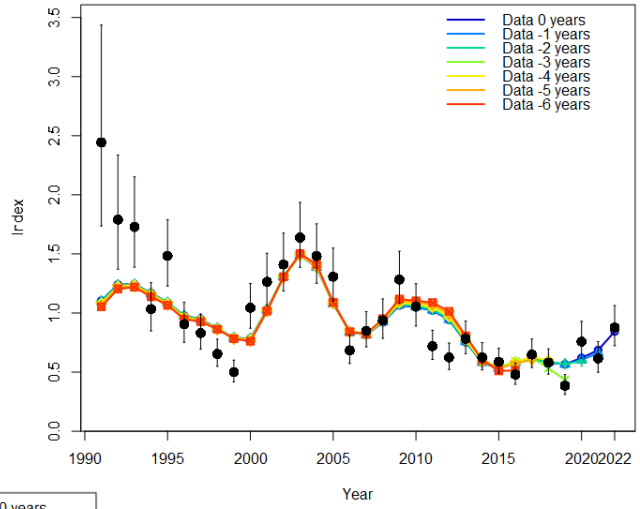


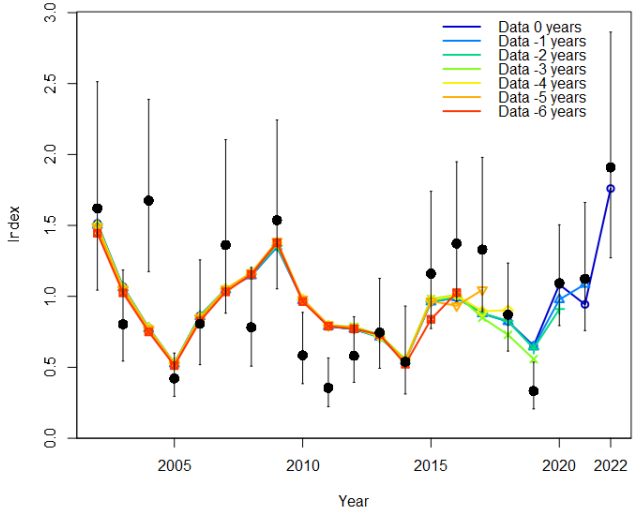


Retrospective Analysis

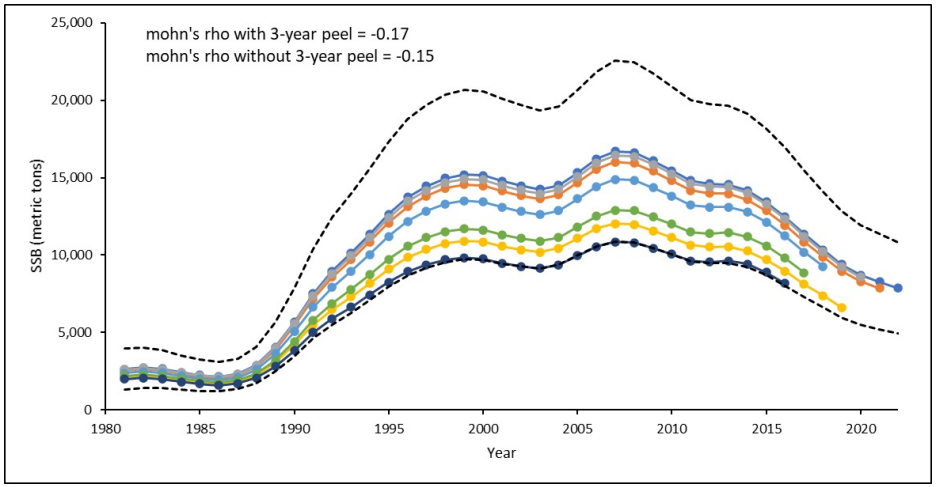
- Three year peel divergence due to low 2019 index values other peels overestimate

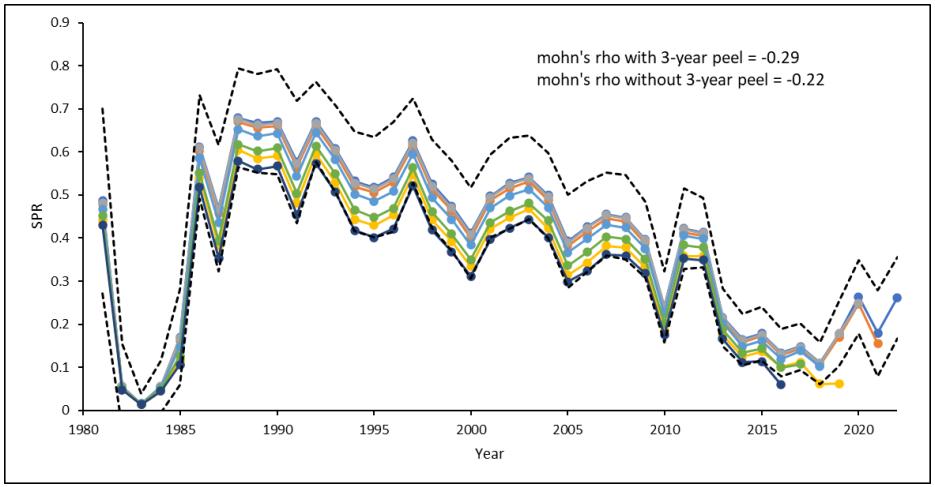


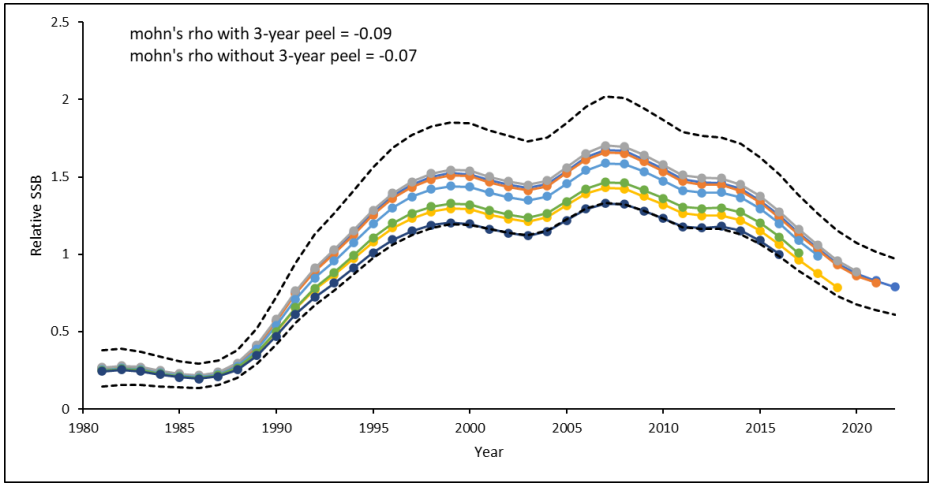


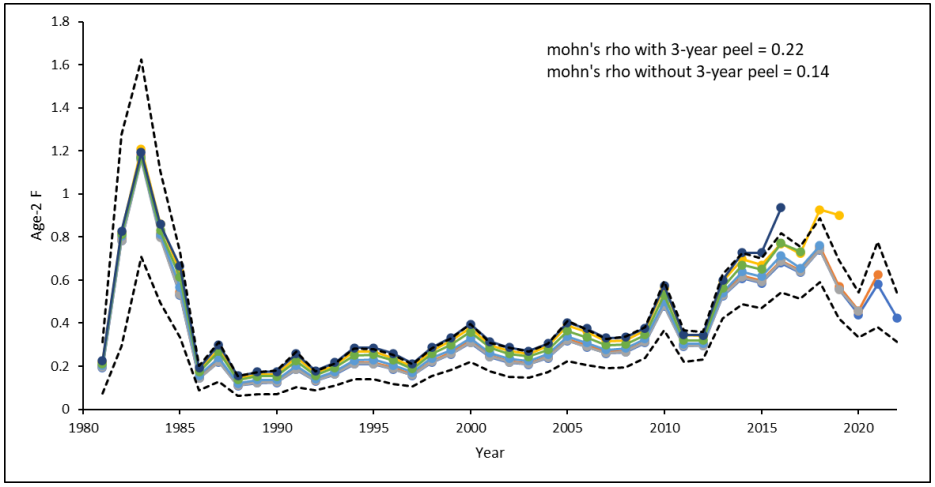


Retrospective Analysis

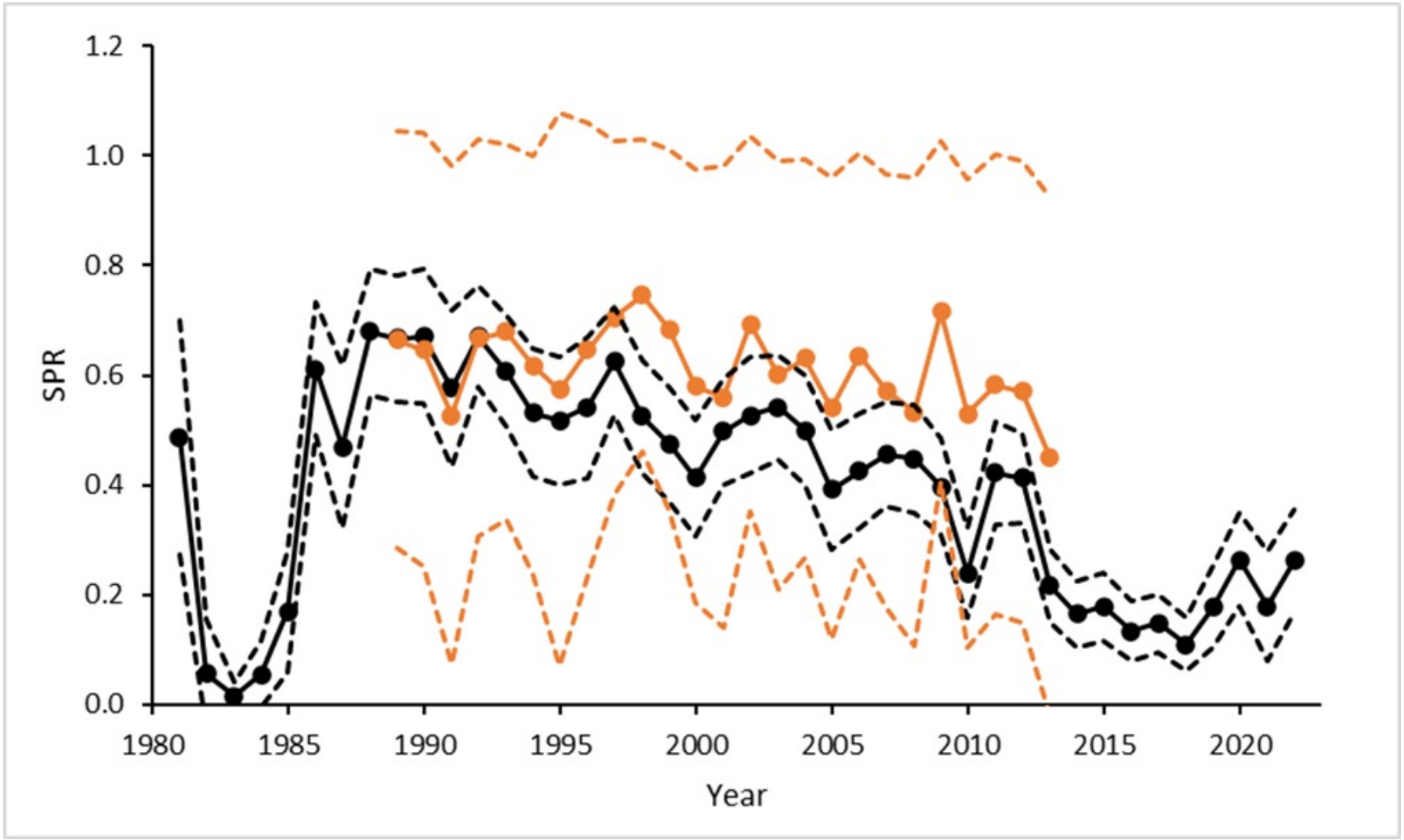








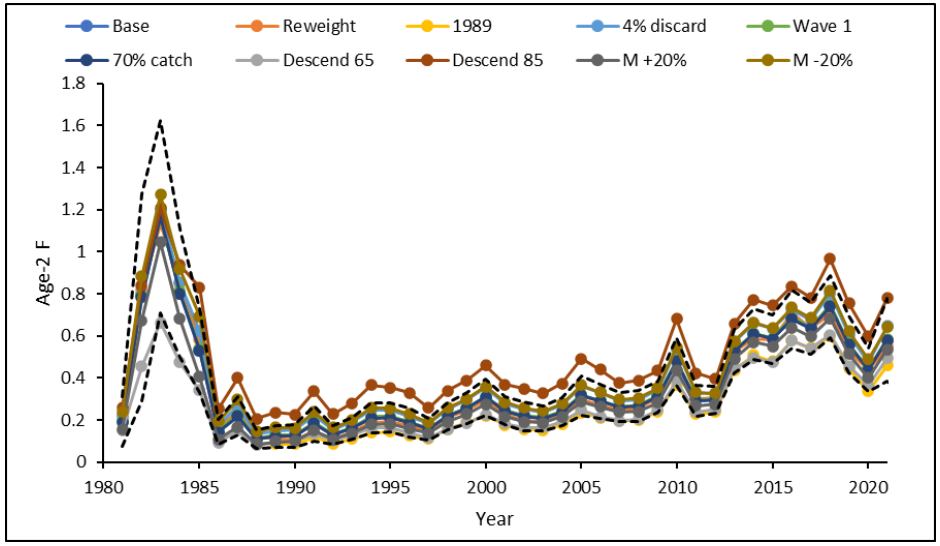
Historical Retrospective

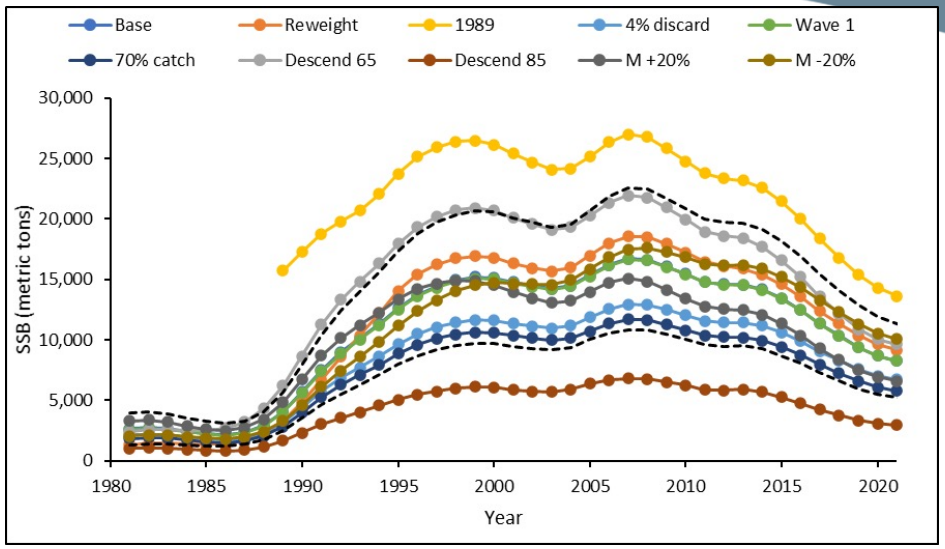


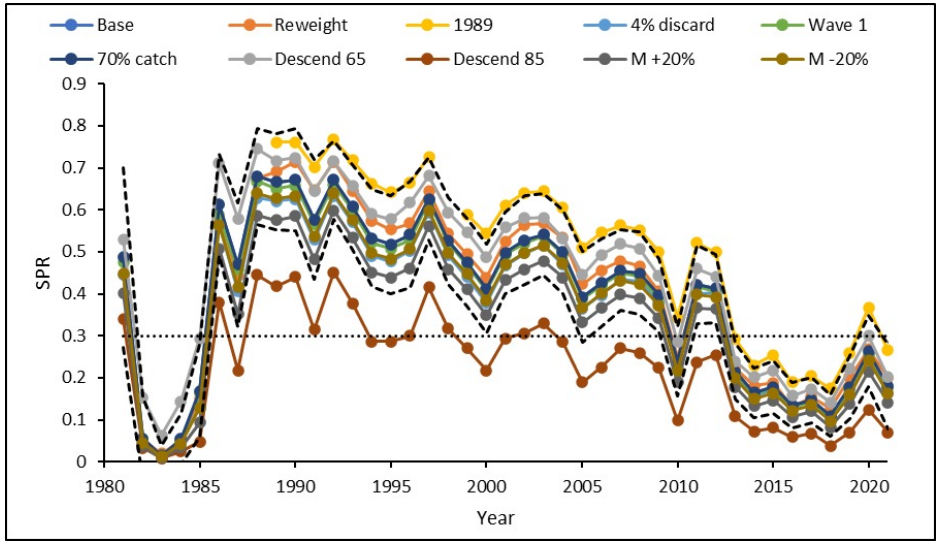
Sensitivities

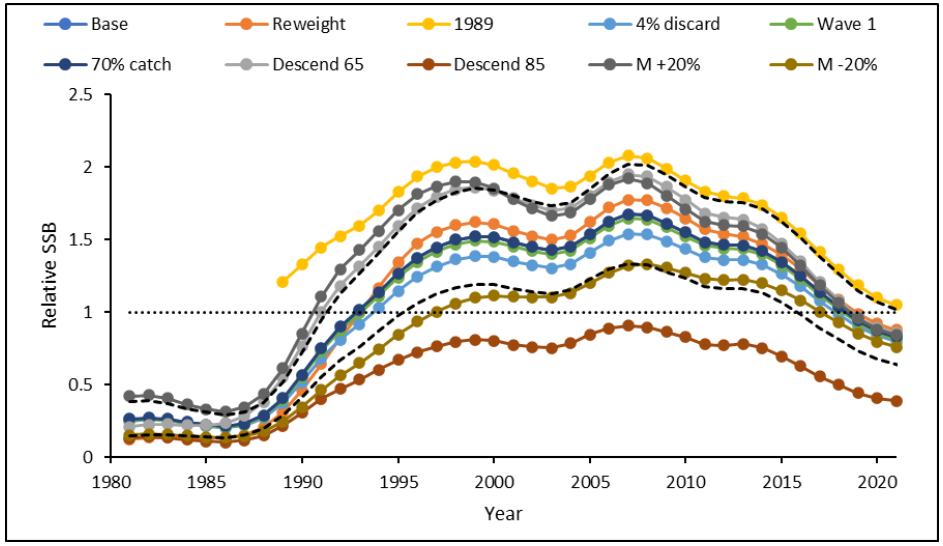
- Francis reweight of composition data (Reweight)
- 1989 start year (1989)
- 4% discard mortality (4% discard)
- Wave 1 imputed catch data for GA and SC (Wave 1)
- 30% reduction of MRIP catch estimates (70% catch)
- 20% decrease of age-2 fixed M (M -20%)
- 20% increase of age-2 fixed M (M +20%)
- Start of descending rec selec at 65cm (Descend 65)
- Start of descending rec selec at 85cm (Descend 85)

Sensitivity Analysis









Questions?