

Stock Assessment of U.S. Atlantic wreckfish, *Polyprion americanus*

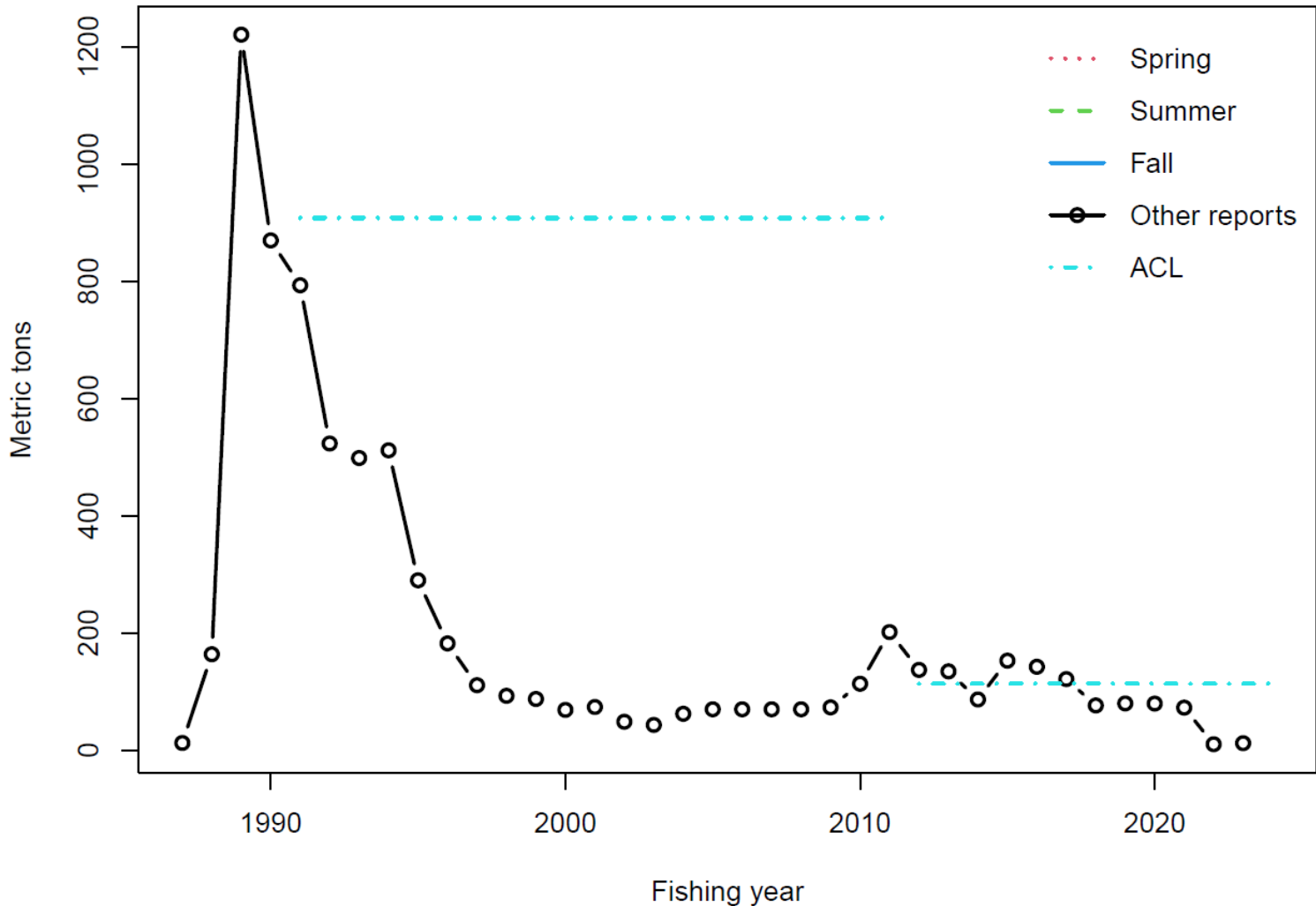


Jeremy Collie, Consultant for Lynker Corporation

4 December 2025

Data Sources

Commercial Landings



- Fishery started ~ 1986
- First fin fishery with ITQs
- No recreational catch data
- No discard estimates

Commercial wreckfish landings reported by Rademeyer & Butterworth and SAMFC Points from 2000 to 2008 are the average for that period due to low number of participating vessels.

Measures of Fishing Success (that reflect wreckfish relative abundance)

Catch per day (weight)

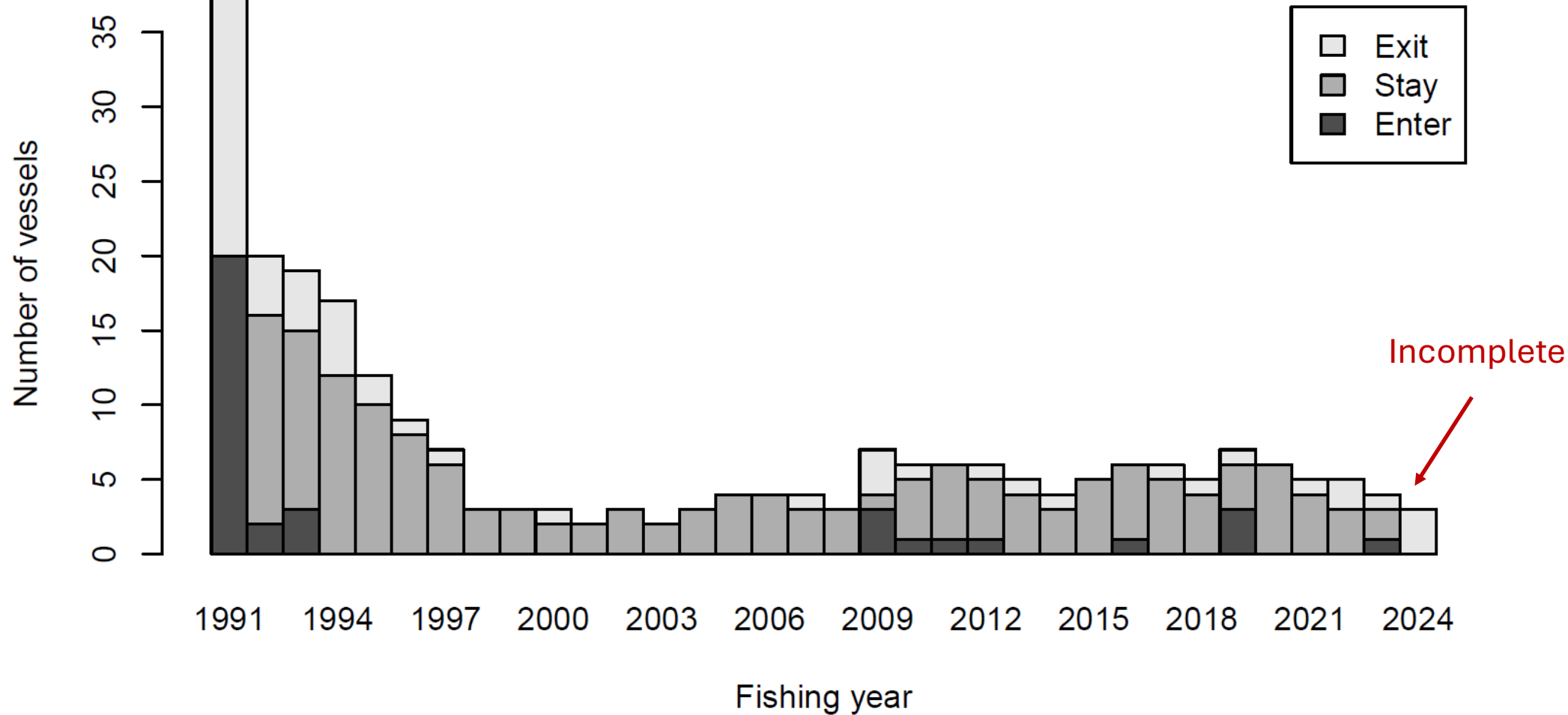
Catch per day (numbers)

Catch per hours fished

Catch per hook

Incomplete

Vessels Participating in the Wreckfish Fishery



Bars at the start and end of the series need special interpretation. Some of the “entrants” in 1991 likely participated in 1990. Data for 2024 are preliminary and don’t anticipate vessels that fished in 2025.

Factors that affect Fishing Success

Fishing location (state, area)

Depth

Season (month)

Gear (number of lines, hooks per line)

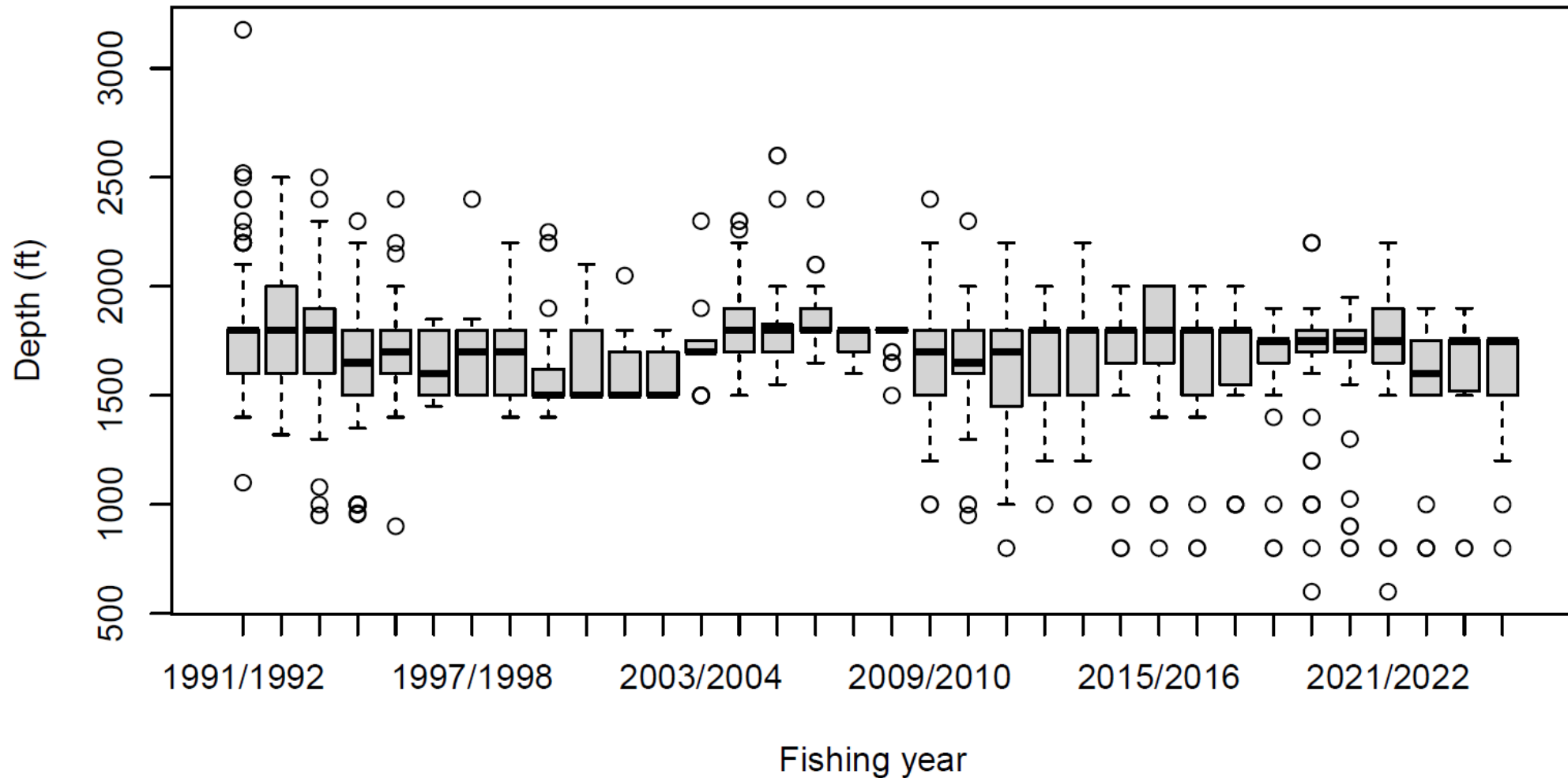
Vessel characteristics

Experience of captain

Externalities (climate change, other fisheries)

Average depth fished is fairly constant

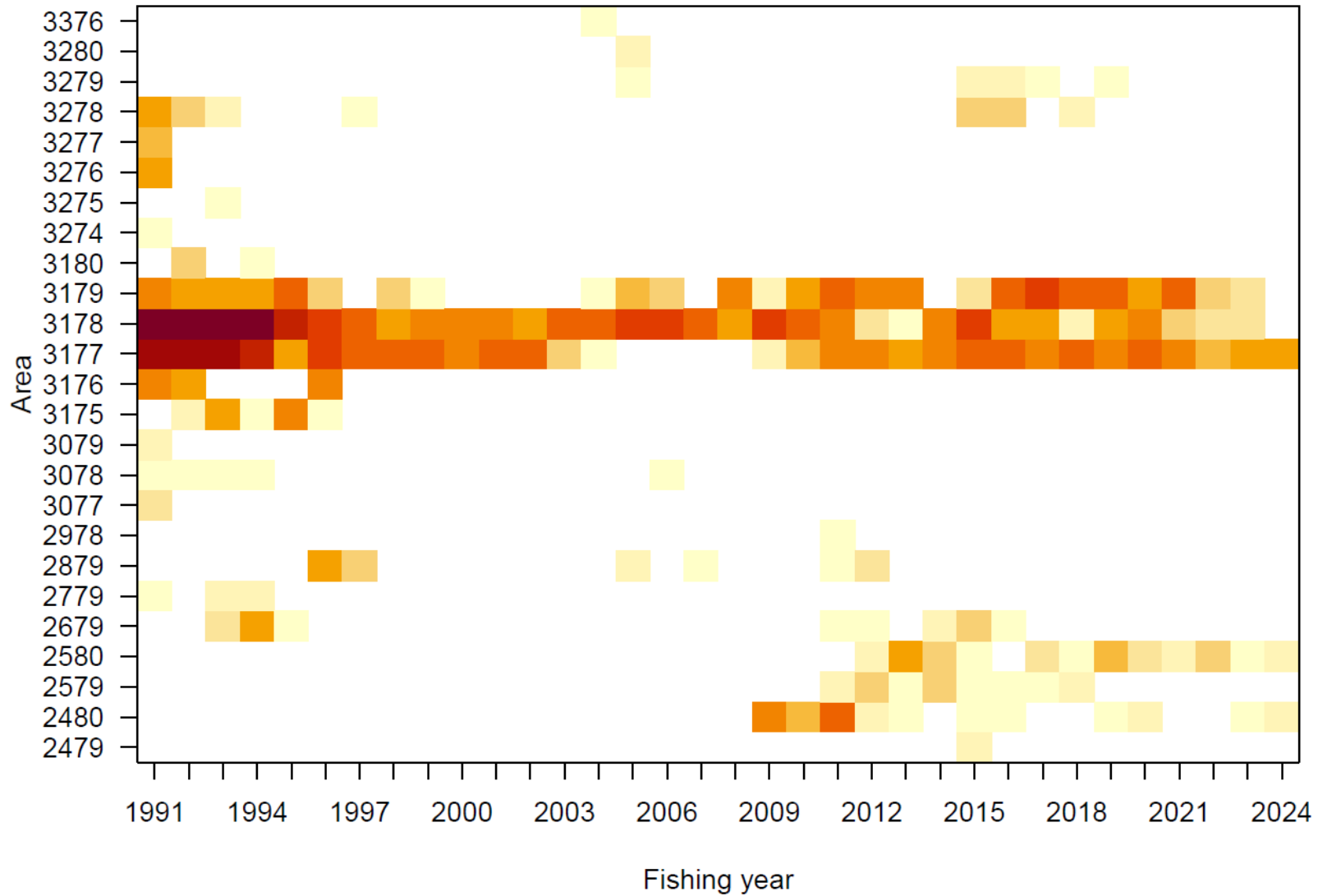
Average depth fished



What to do with the spatial distribution?

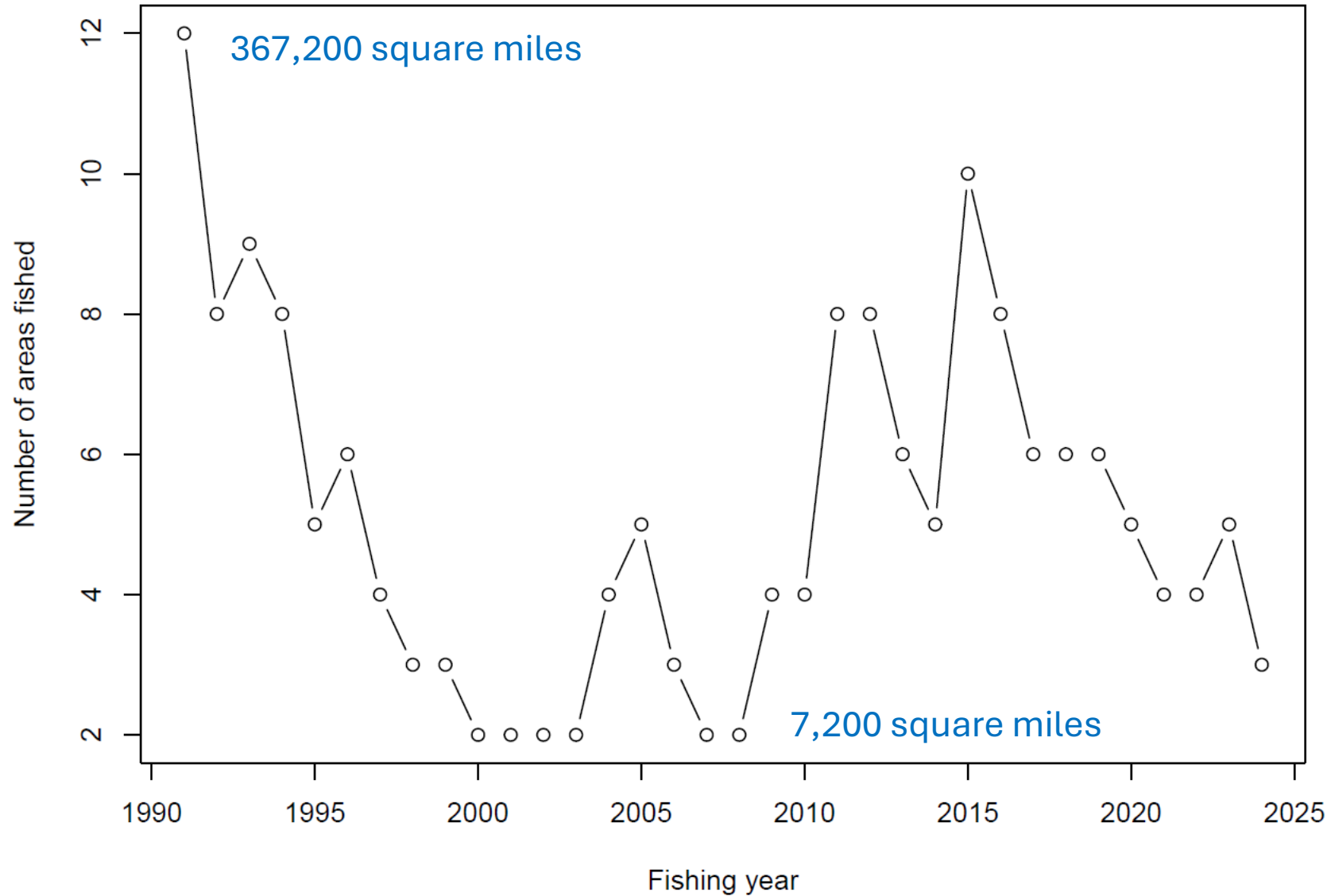
1. Use the areas as they are reported;
2. **Attempt to correct the area designation;**
3. Omit records with incorrect area;
4. **Don't include area as a factor in the model**

Which areas were fished each year?



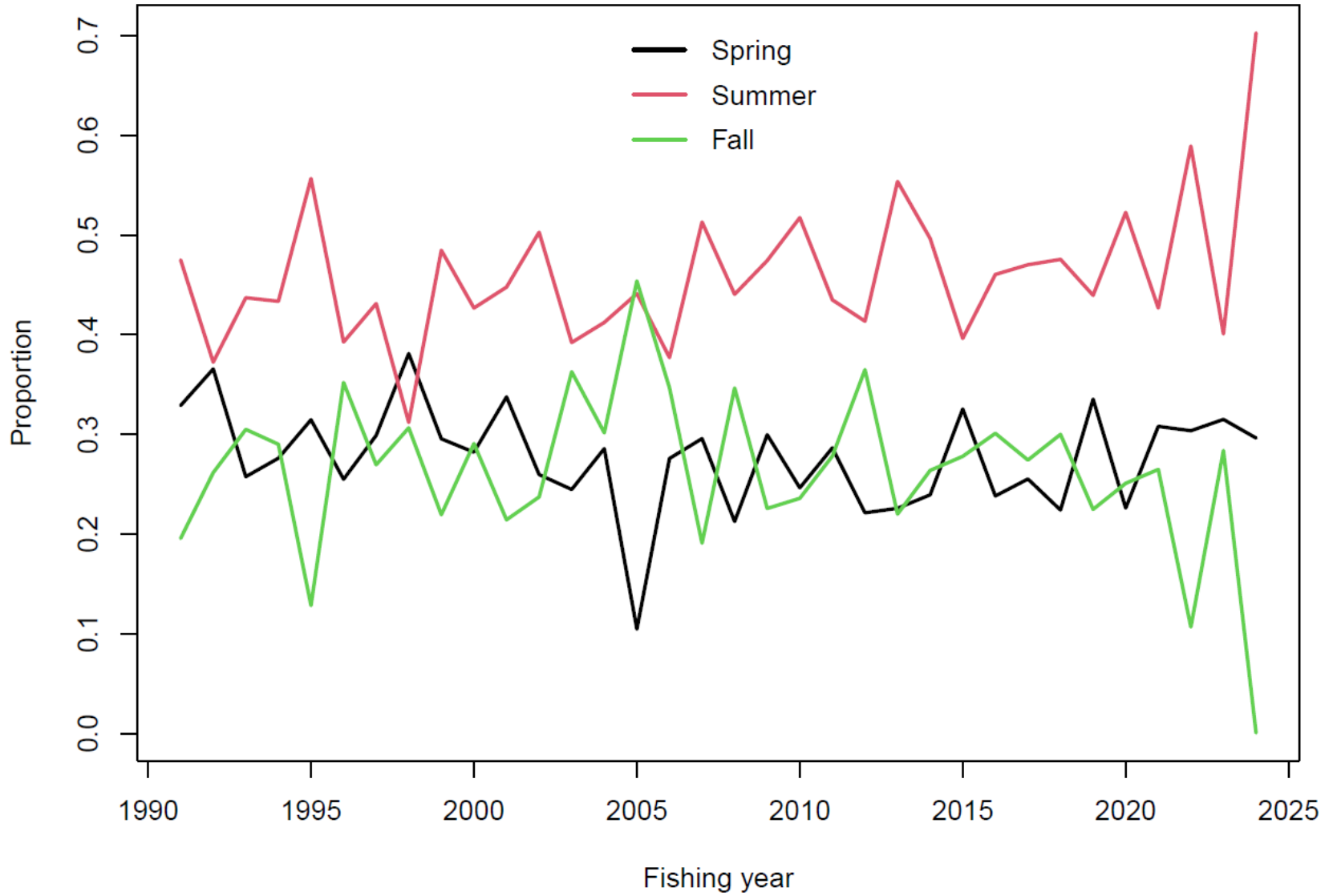
Fishing locations reported in vessel trip reports. Frequency of occurrence of each 1° by 1° area on a log scale. The color scheme runs from red (high) to yellow (low).

Fishing Footprint

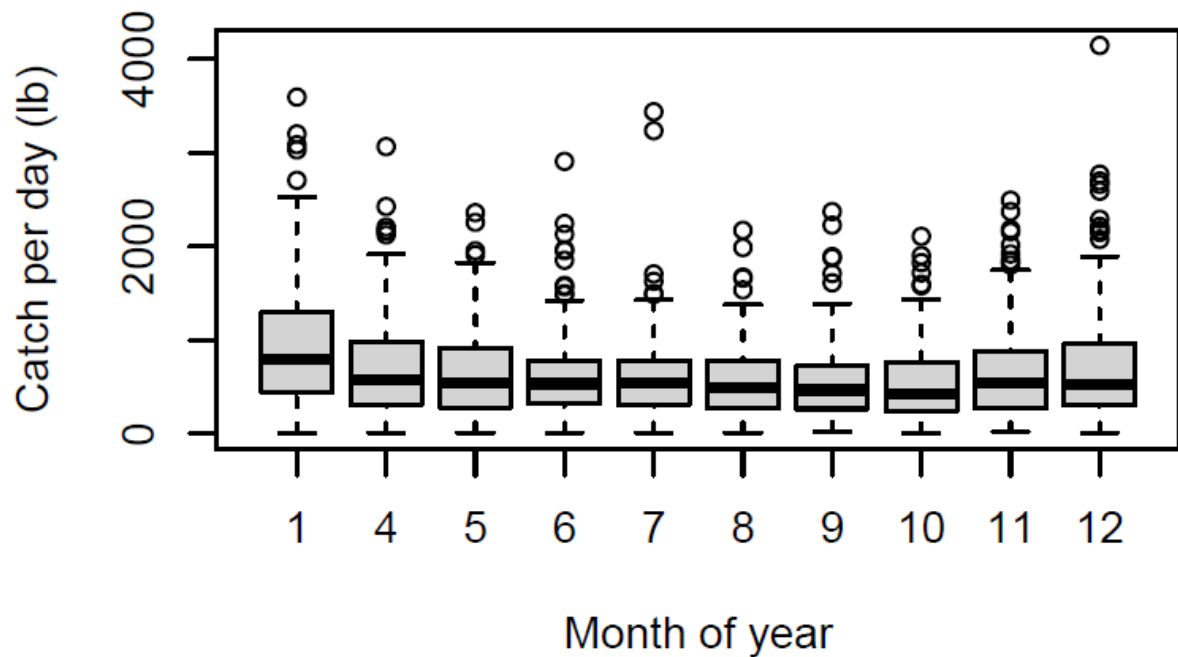
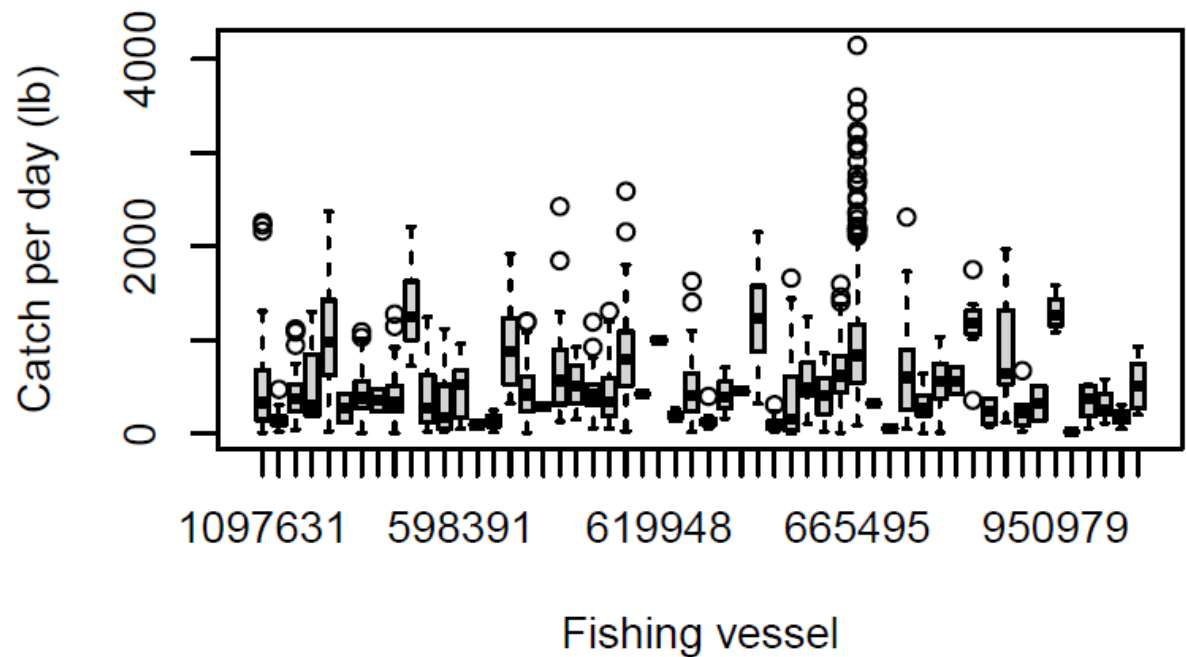
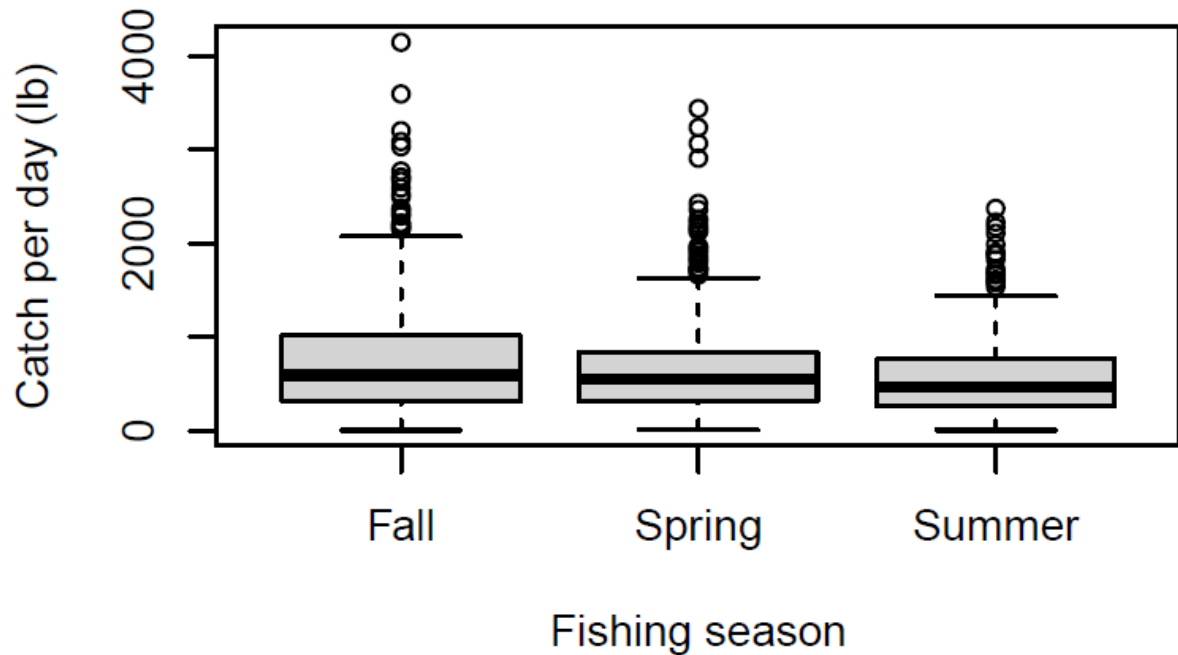
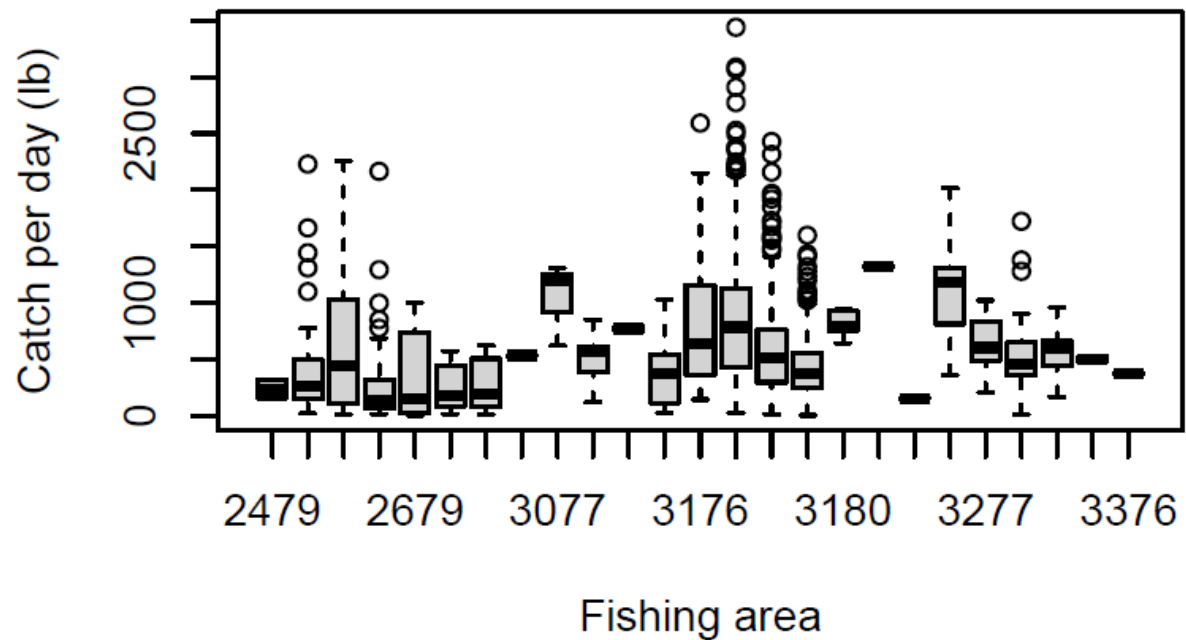


Number of 1° by 1° areas fished each year.

Proportional Landings By Season

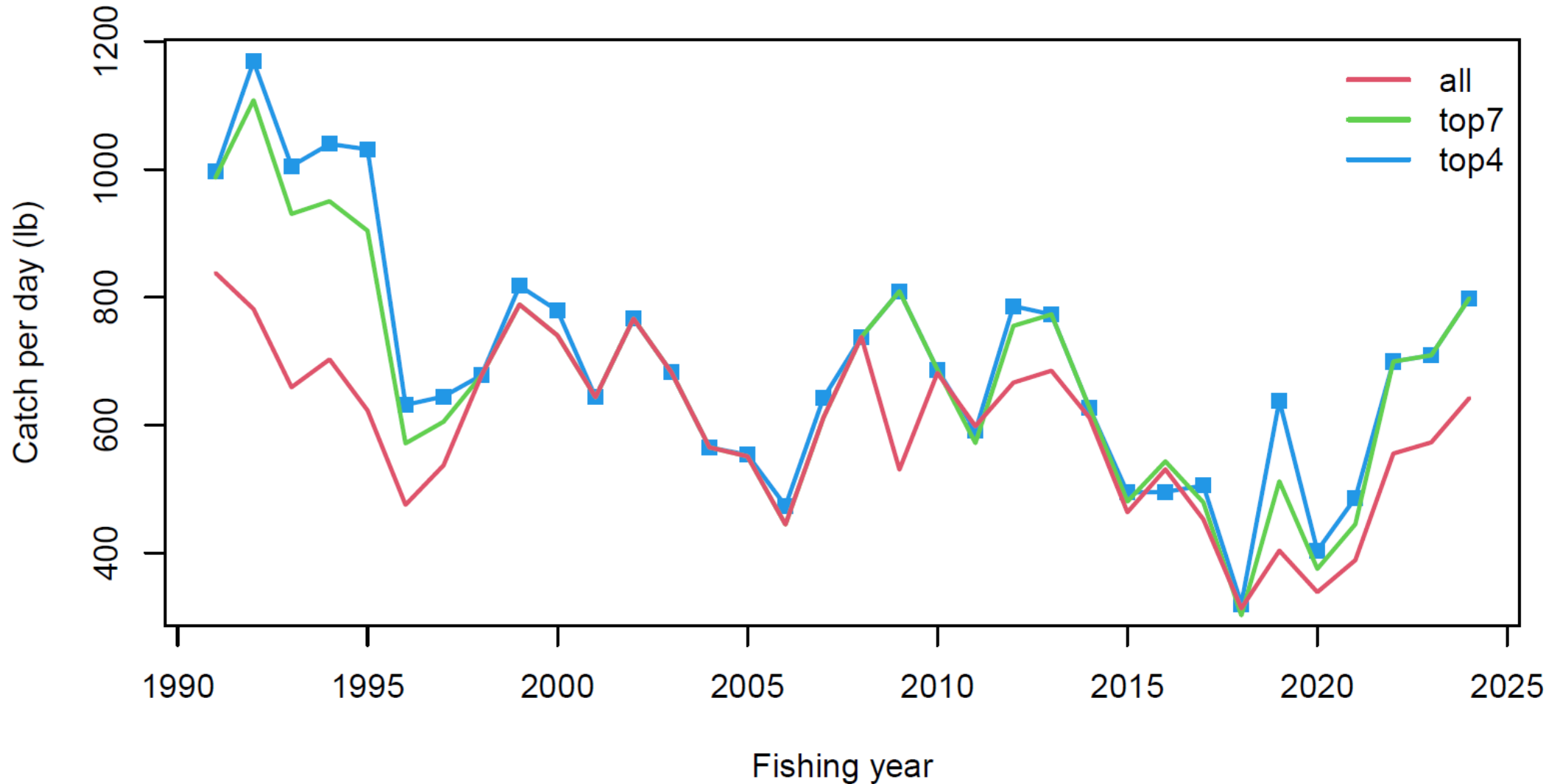


No clear trend in the seasonality of the fishery



Fishery-dependent Abundance Index

Nominal Catch Per Unit Effort



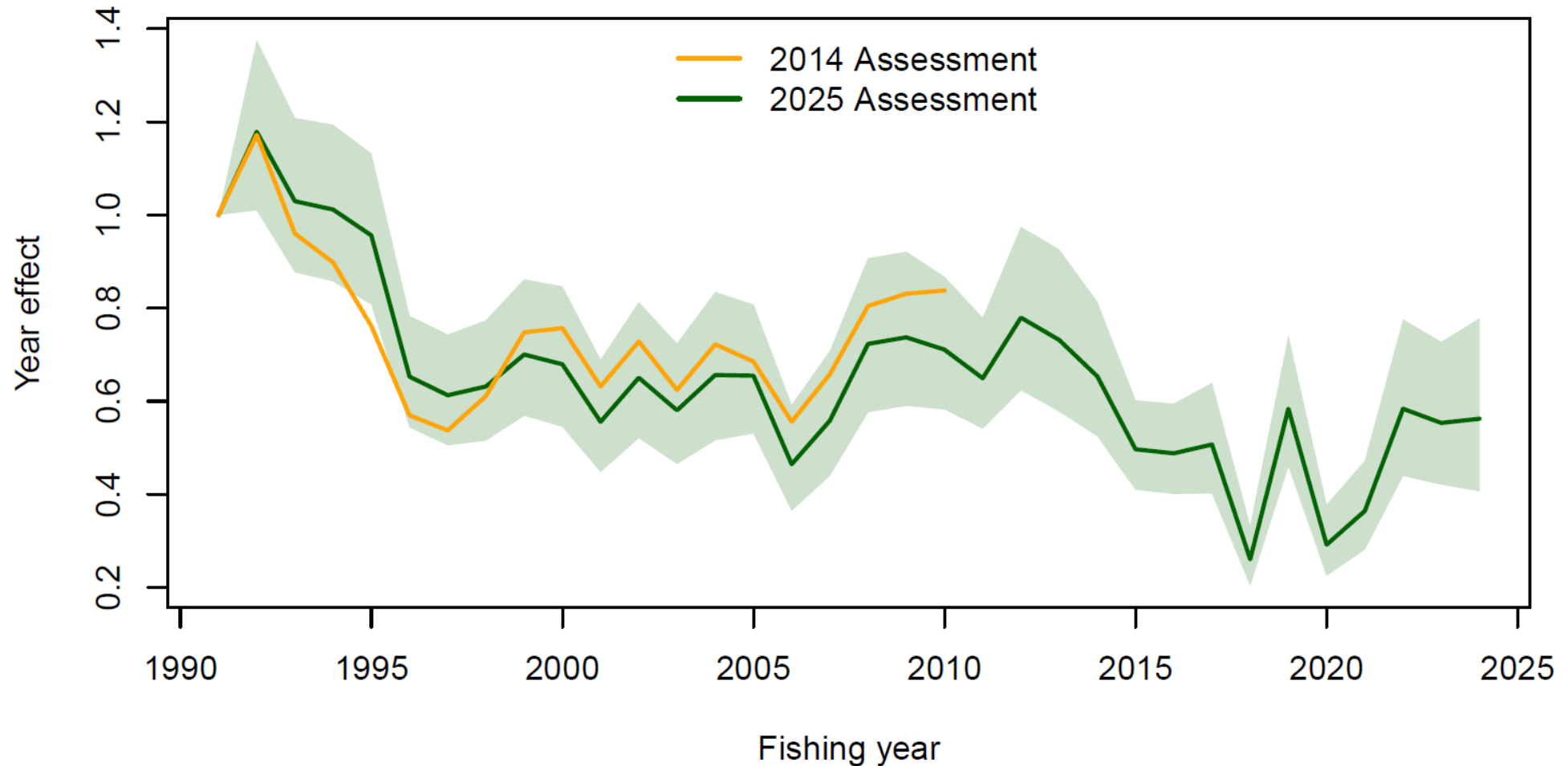
Fishery-dependent Abundance Index

Model of fishing success with covariates:

catch per day \sim **function**(**year** + vessel + month)

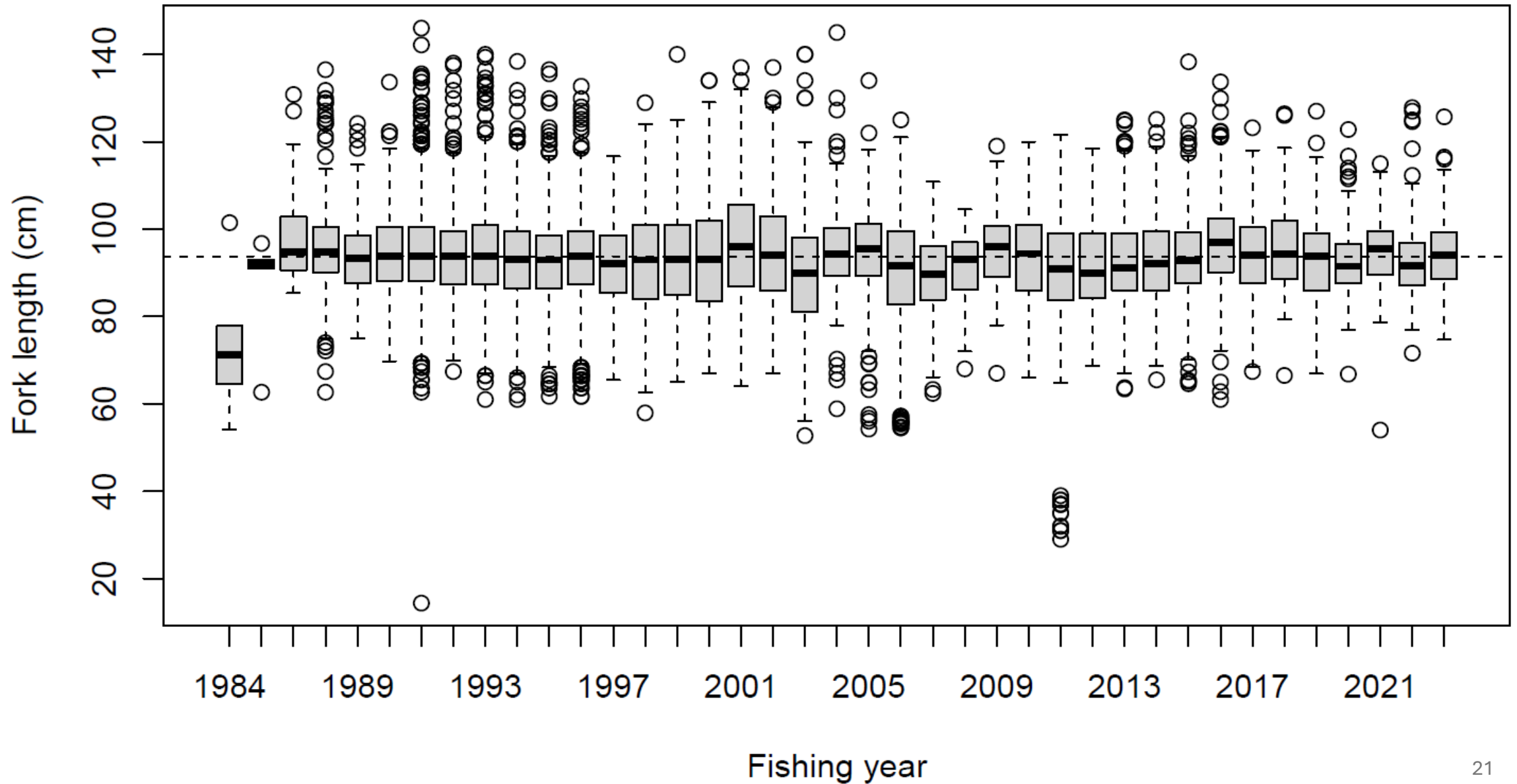
where CPD is calculated for the top4 vessels and the Tweedie distribution is used for the residual error.

CPD YRFI + VESSEL_ID + as.factor(MOLA)



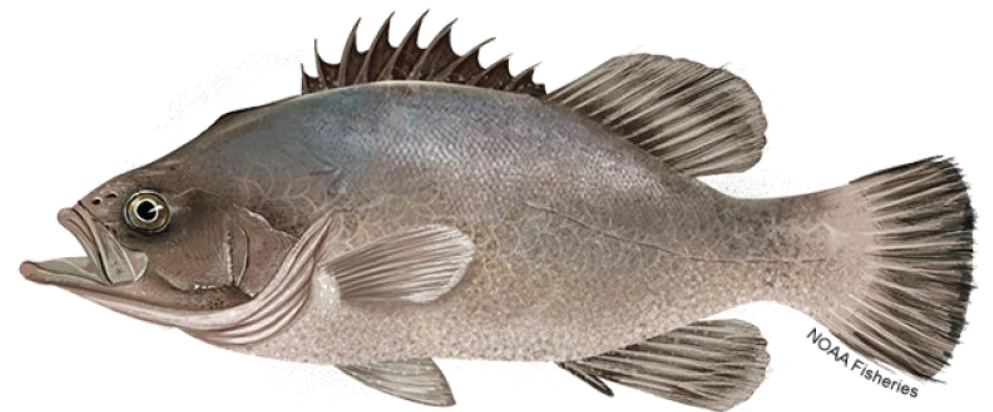
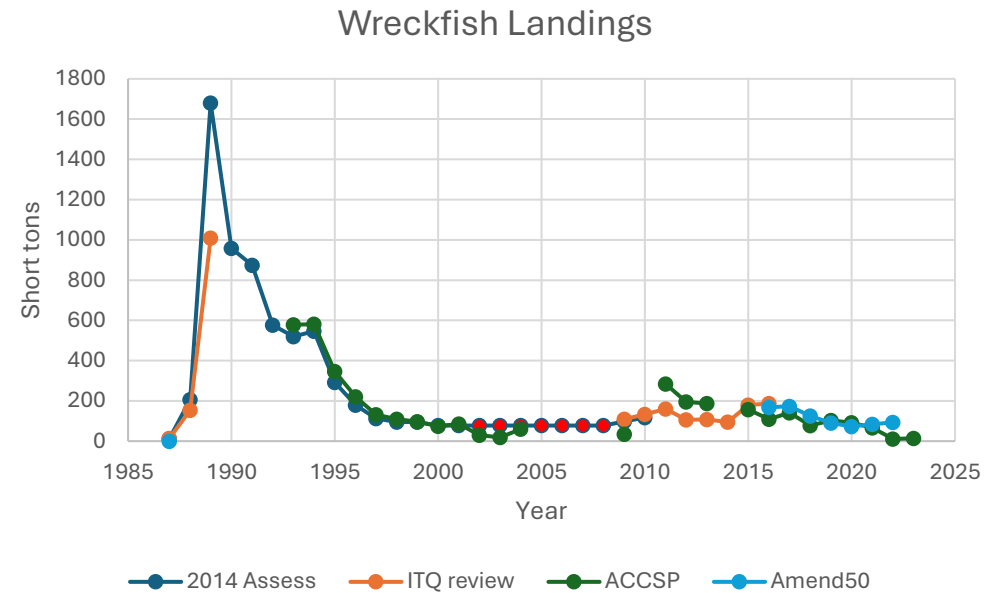
Year effect on catch per day estimated with the GAM. Solid green line is the estimated effect and the shaded area is ± 2 times the standard error of the estimates. For comparison, the orange line is the CPUE index used by Rademeyer & Butterworth (2014) standardized to 1 in 1991.

Length distributions of the wreckfish catch



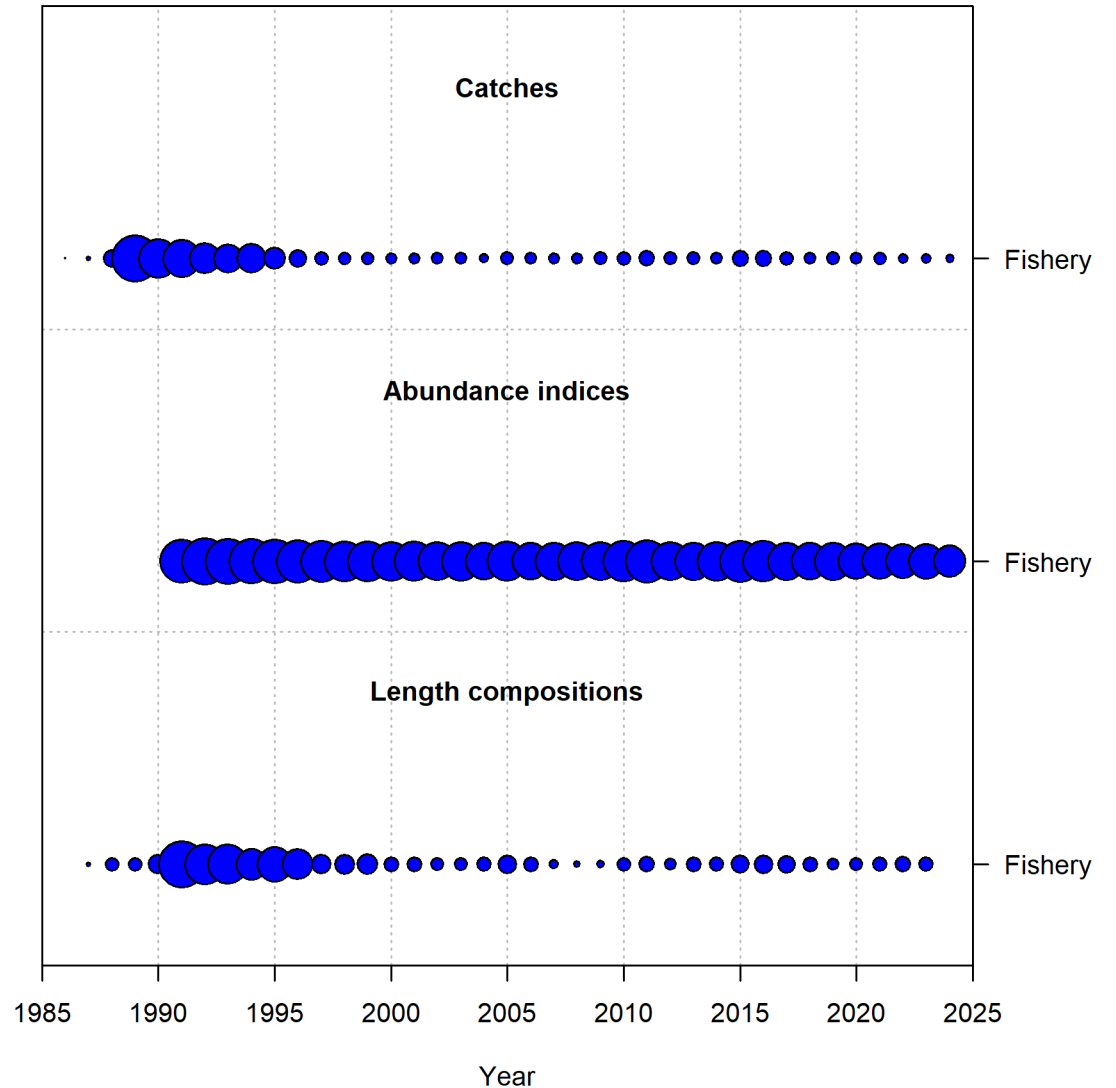
Wreckfish Assessment – Model Platform

- Cope, J. (2024). Stock Assessment Continuum Tool (Version 1.1.0). <https://github.com/shcaba/SS-DL-tool>;
- The Stock Synthesis Catch Length (SS-CL) module is appropriate for a data-moderate stock such as Wreckfish;
- A relative abundance index (i.e. LPUE) has been incorporated;
- What is the level of stock depletion since the fishery started in the late 1980s?
- What is the Optimum Yield of wreckfish?

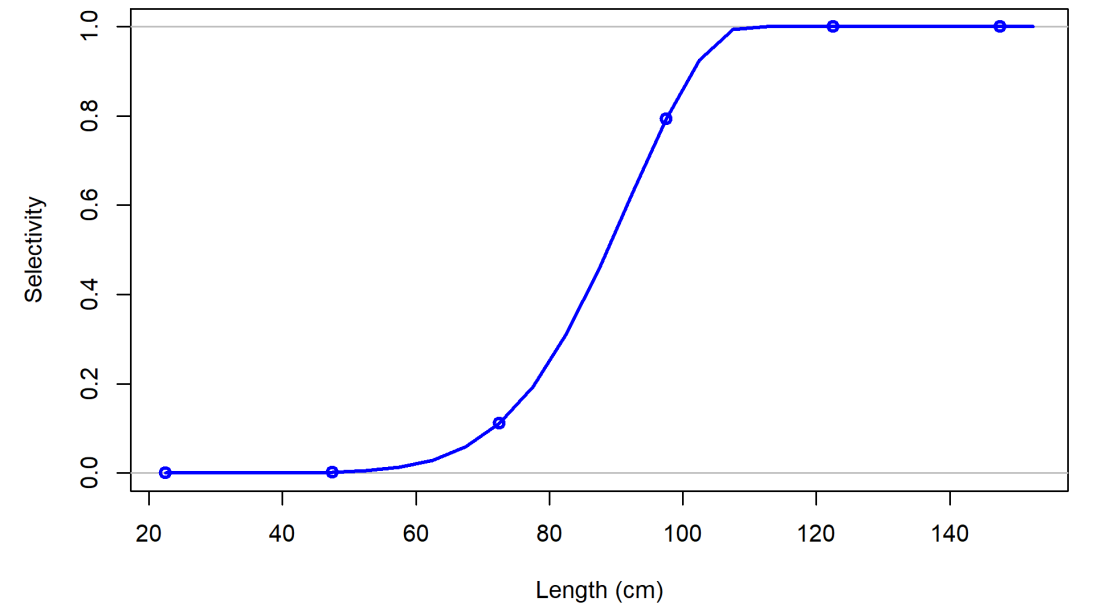
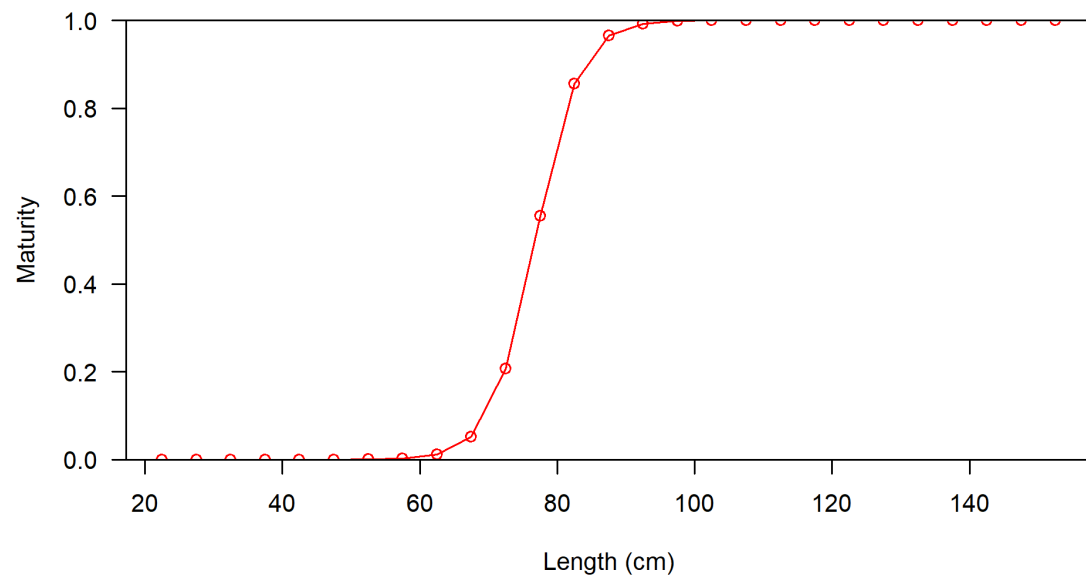
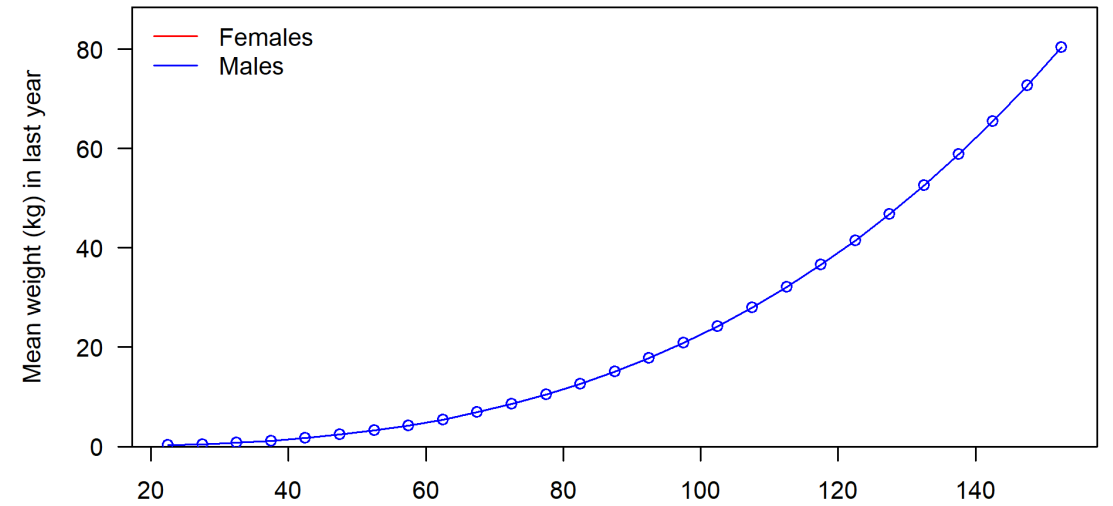
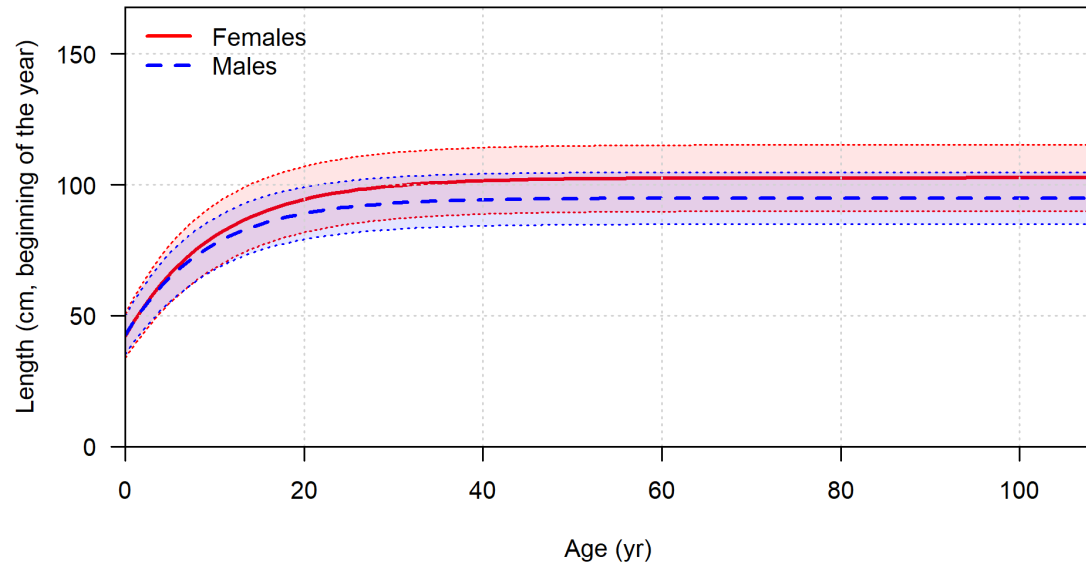


Wreckfish Assessment – Input data availability

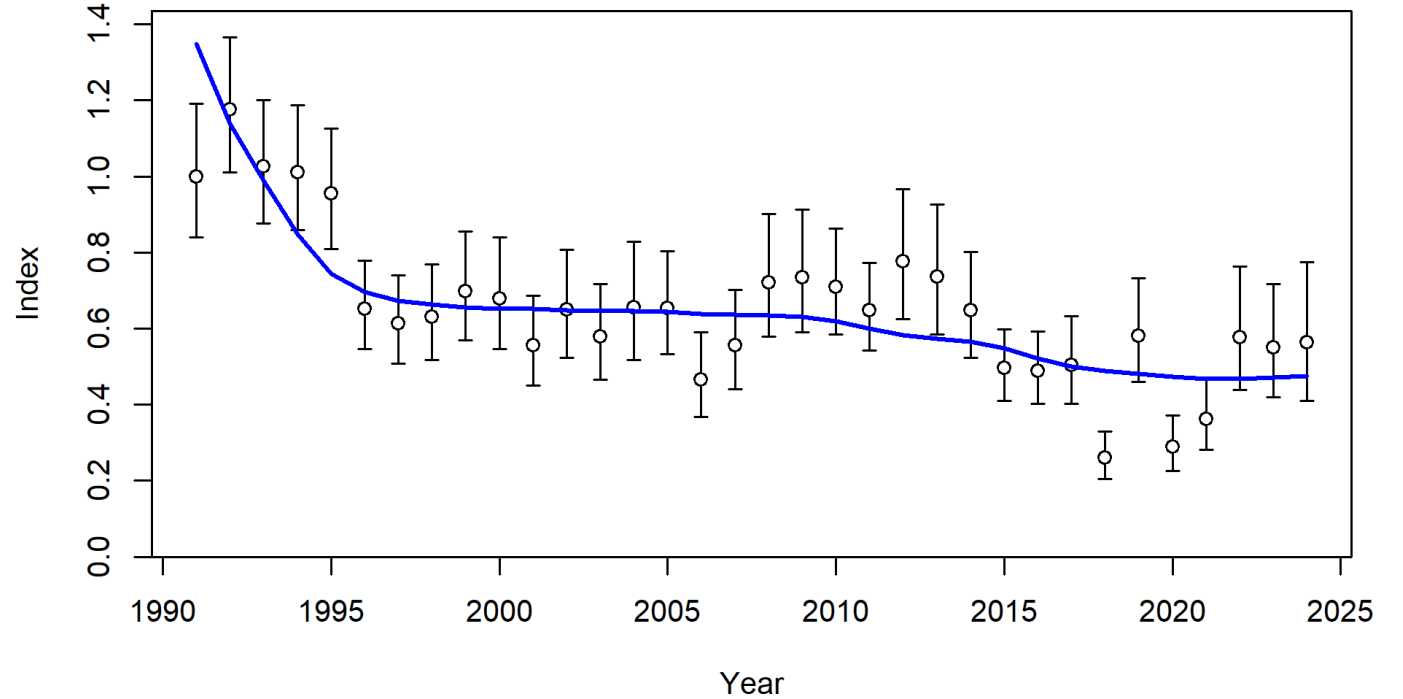
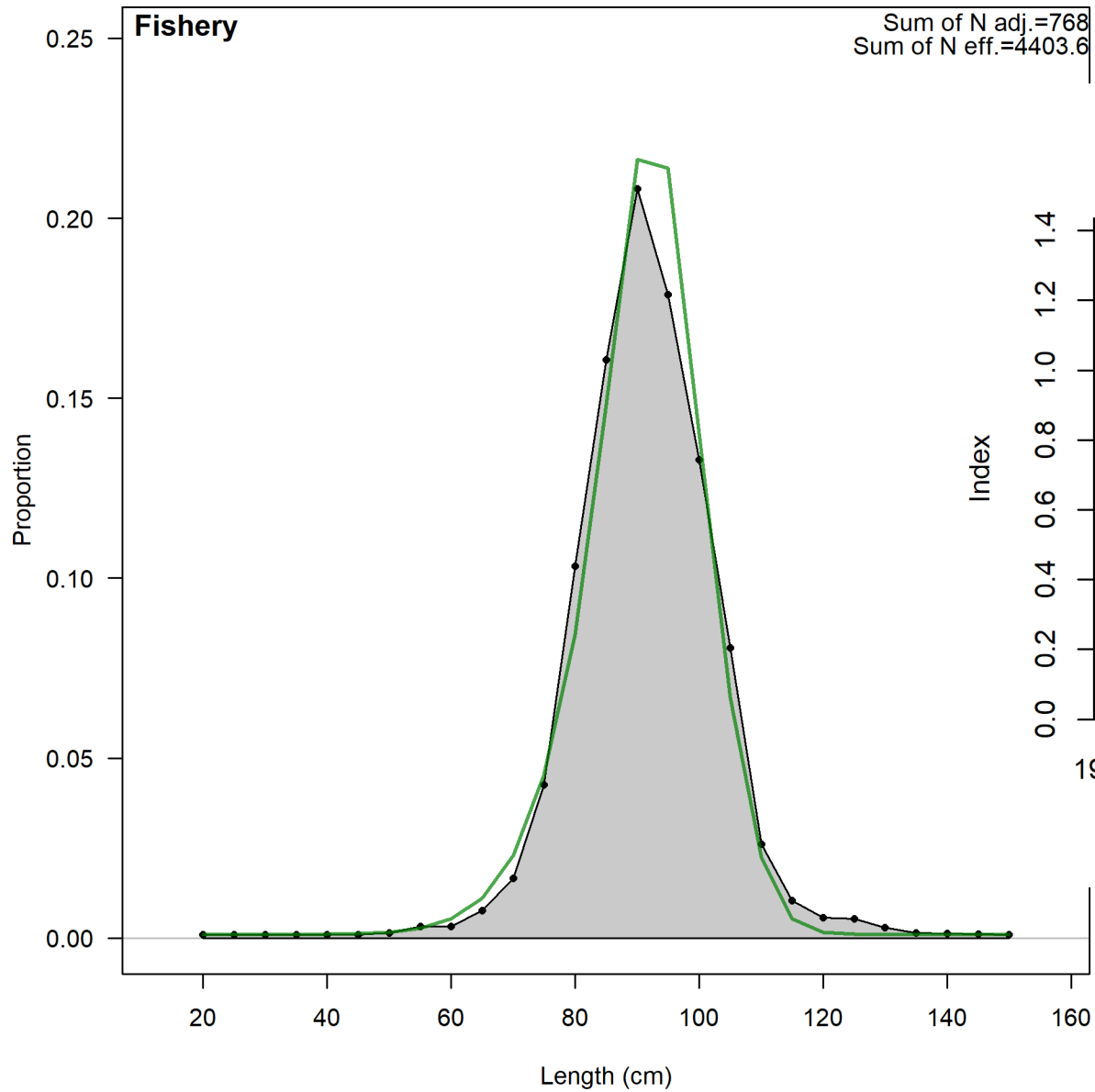
1. Life-history information: length at age, maturity at age, length-weight conversions (Bublely et al. 2025);
2. Length composition of catches from 1987 to 2023;
3. Commercial landings from 1987 to 2024 (SAFIS);
4. Commercial LPUE from 1991 to 2024 (catch per days fished).
5. Some age composition data have been collected by SC DNR...



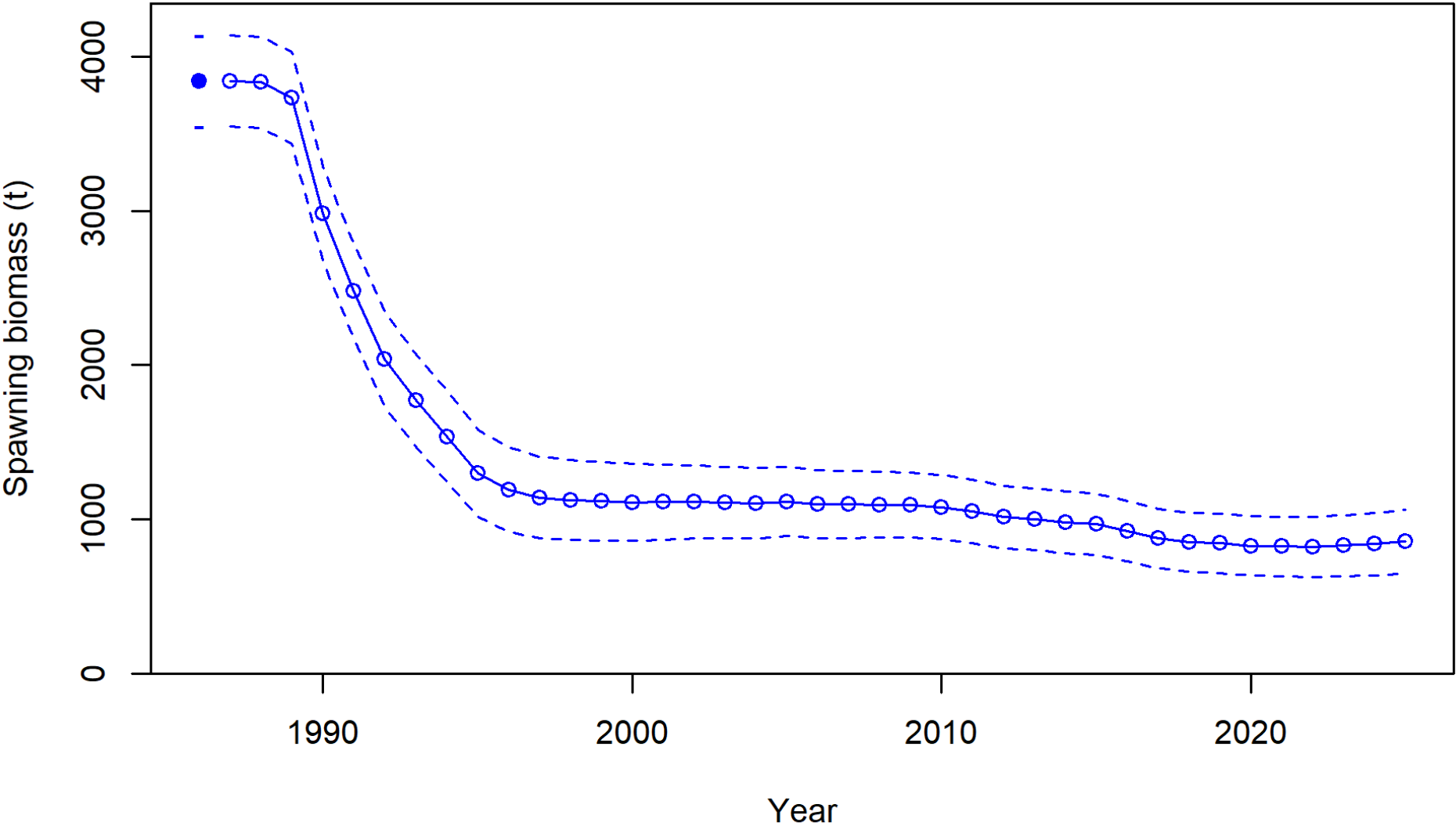
Wreckfish Life-history Information (Bublely et al. 2025)



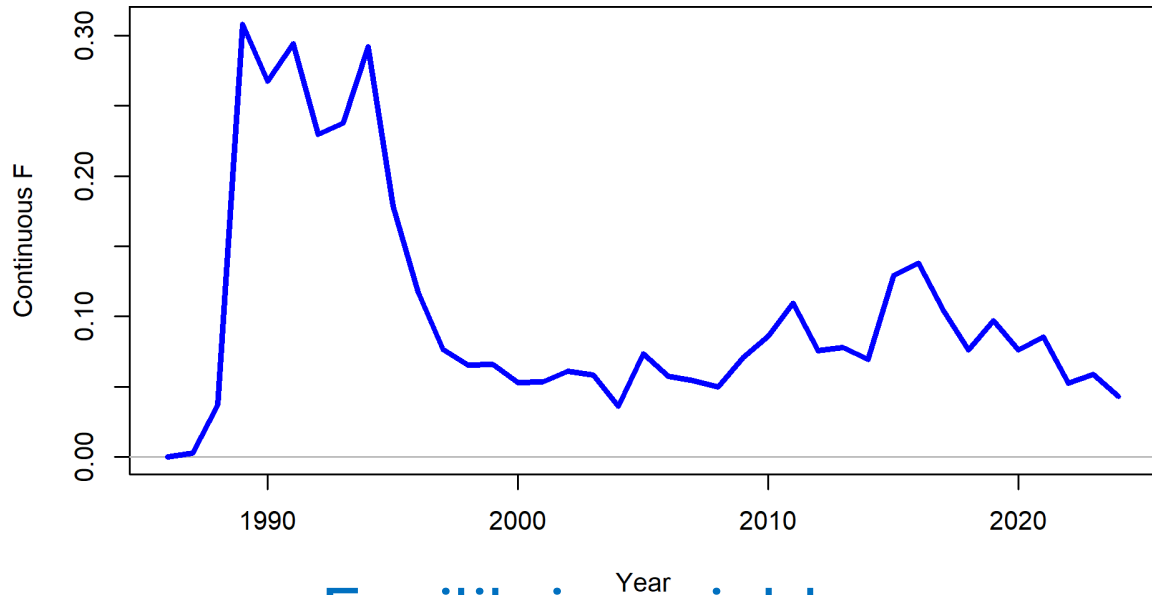
Fit to aggregated length composition and LPUE Index



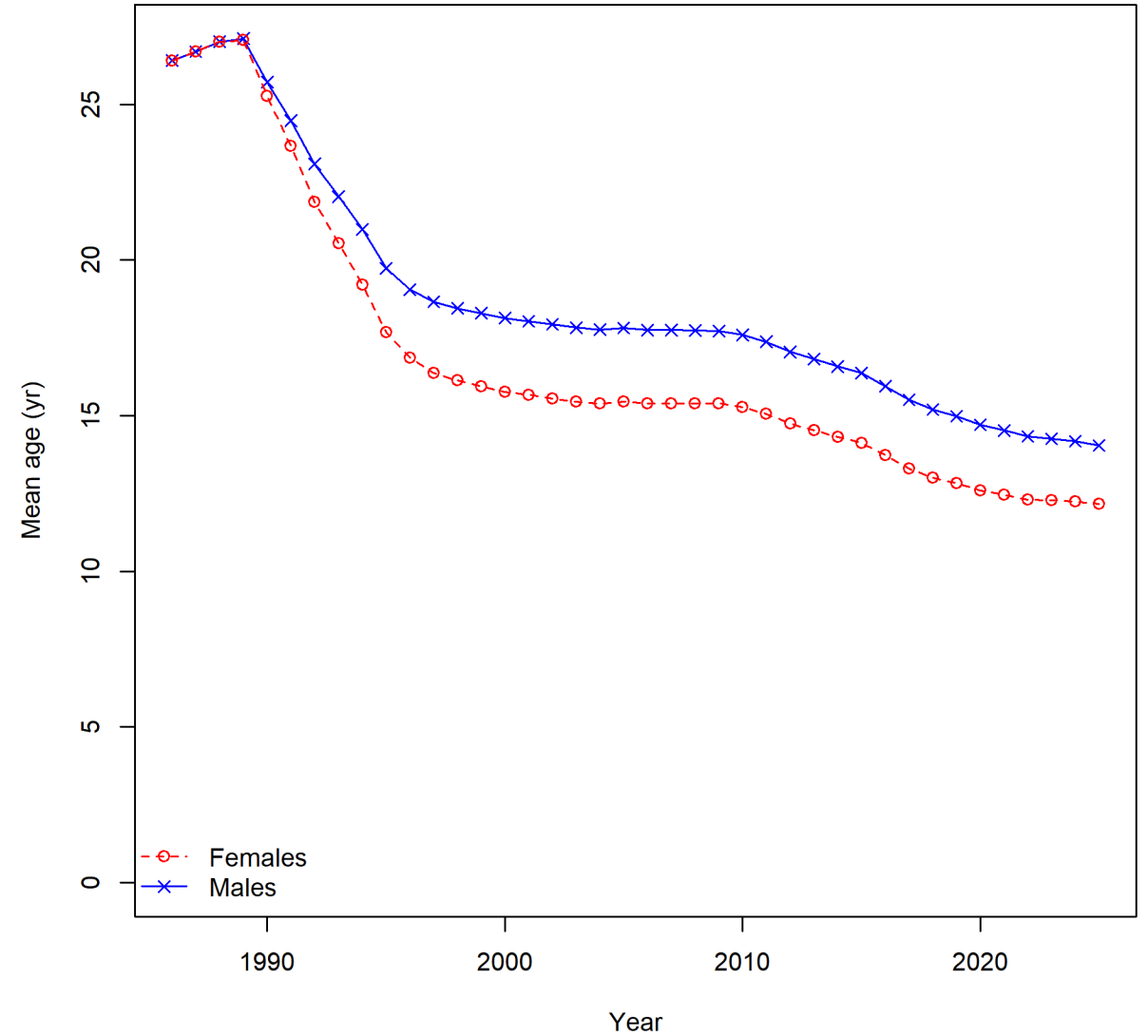
Estimated spawning biomass with 95% CI



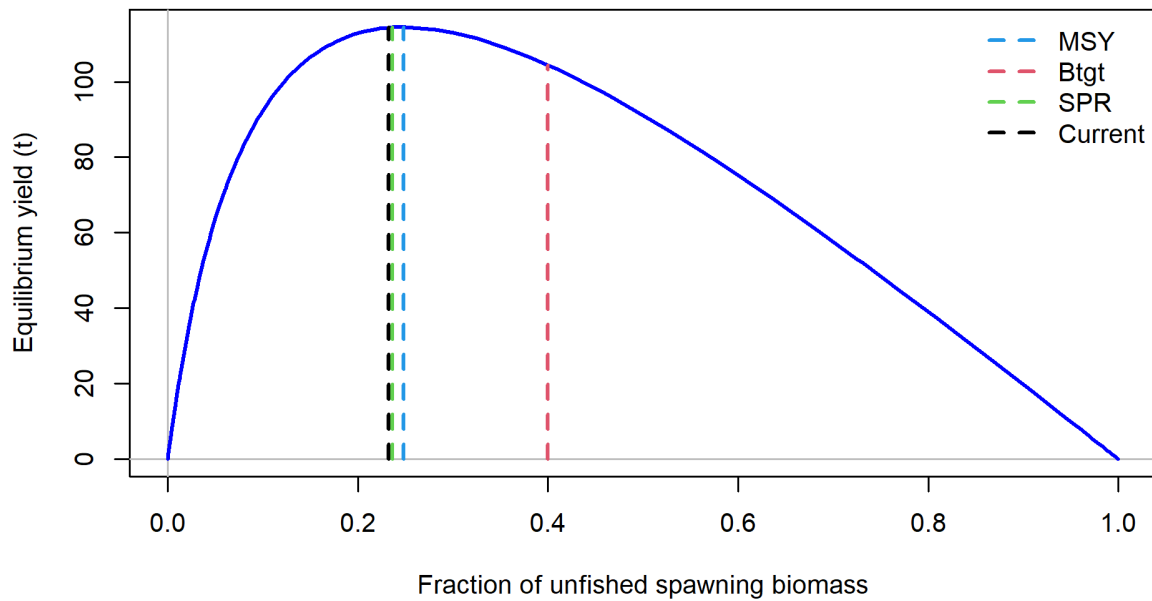
Fishing mortality rate



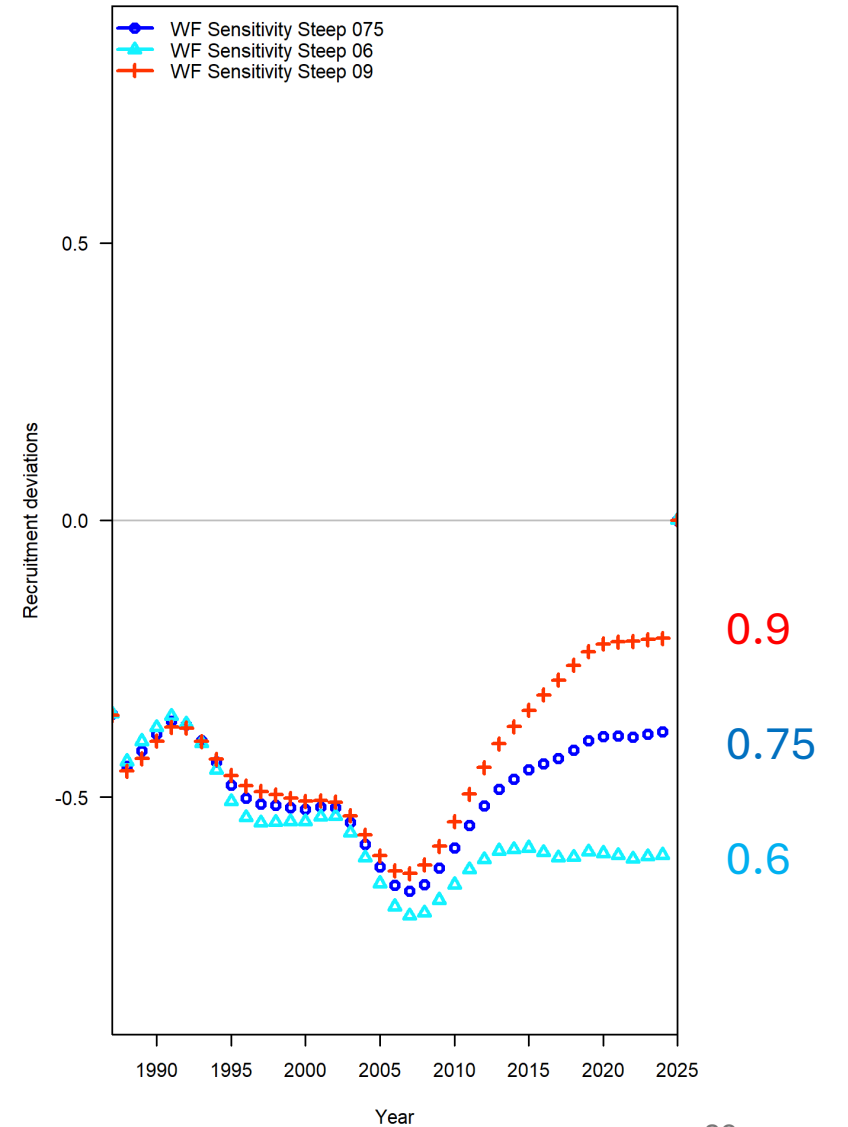
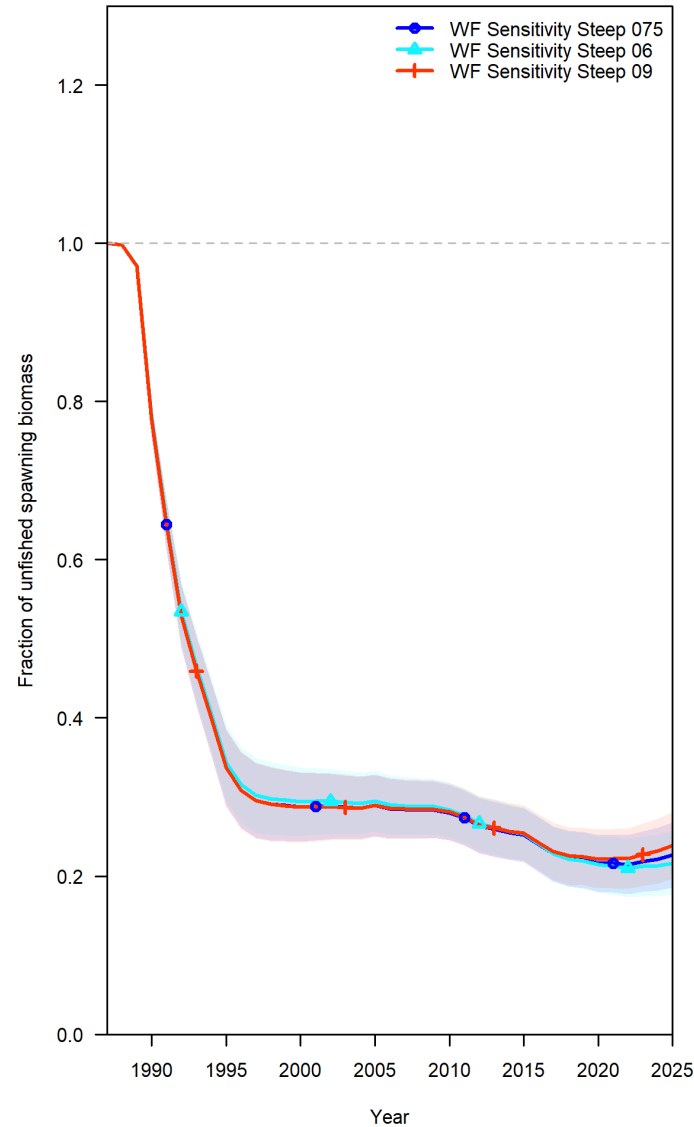
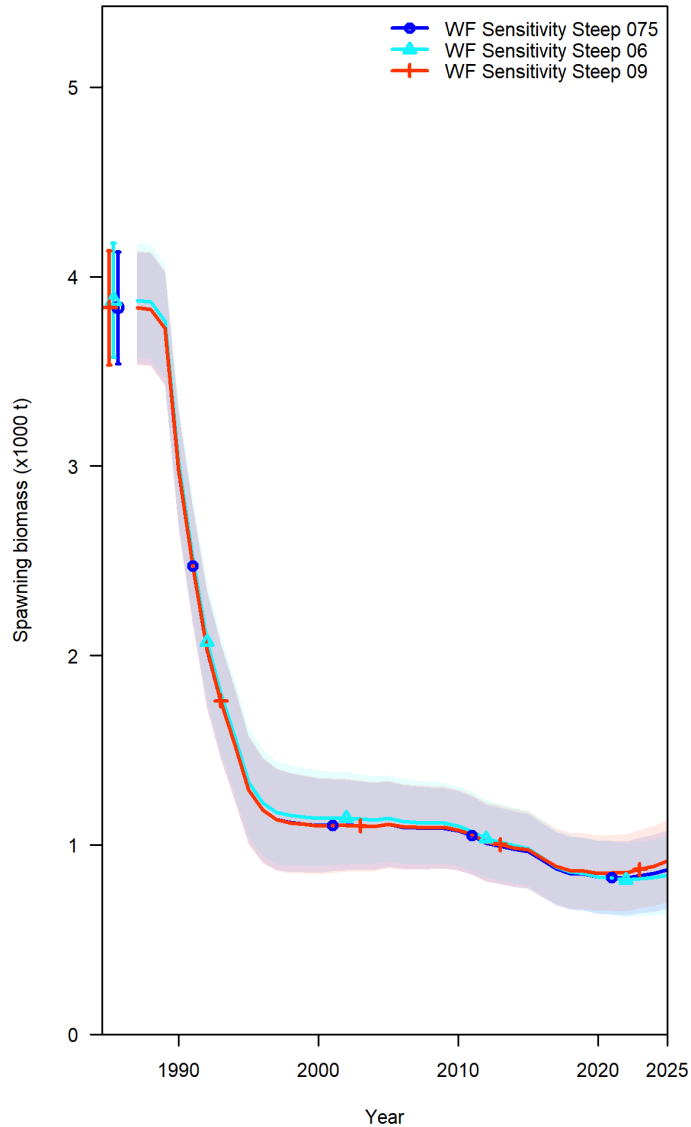
Mean age in the population



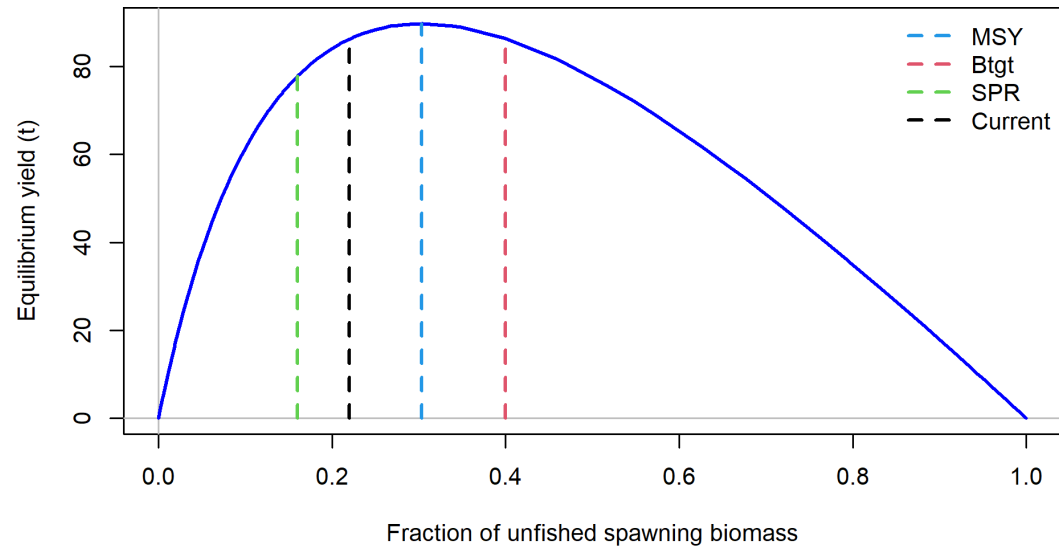
Equilibrium yield curve



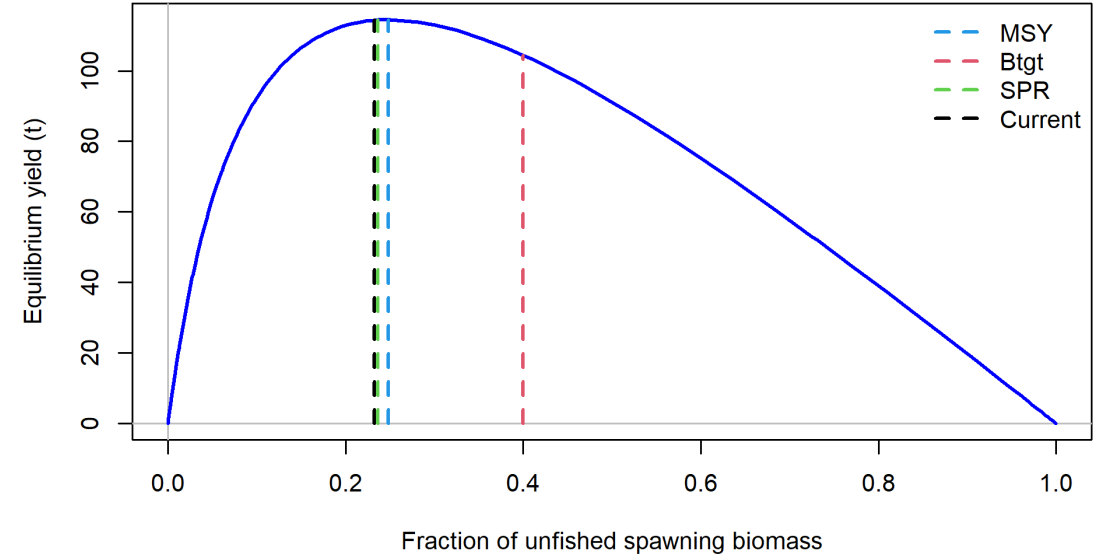
Sensitivity Analysis for Stock-recruitment Steepness



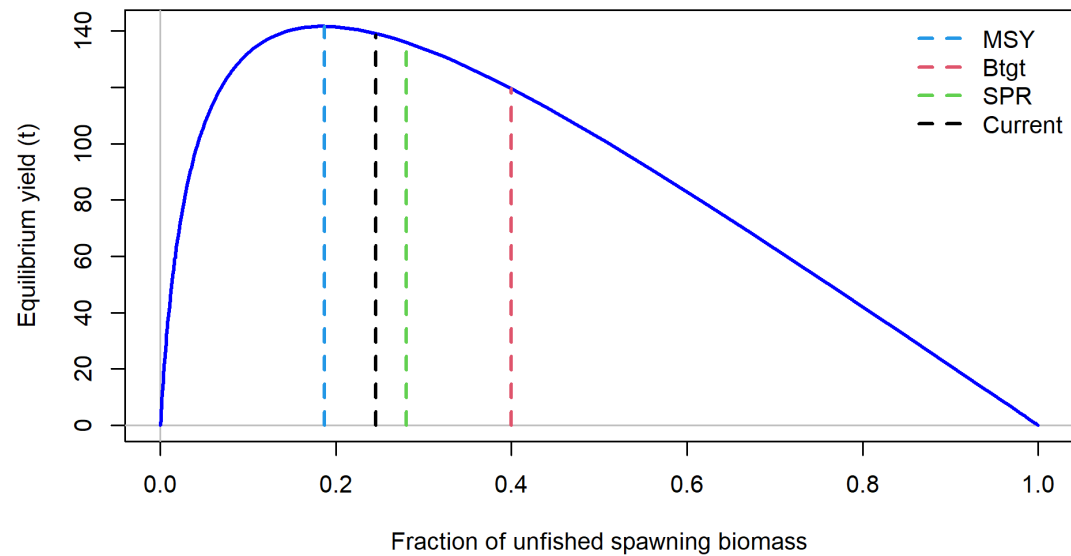
Steepness=0.6



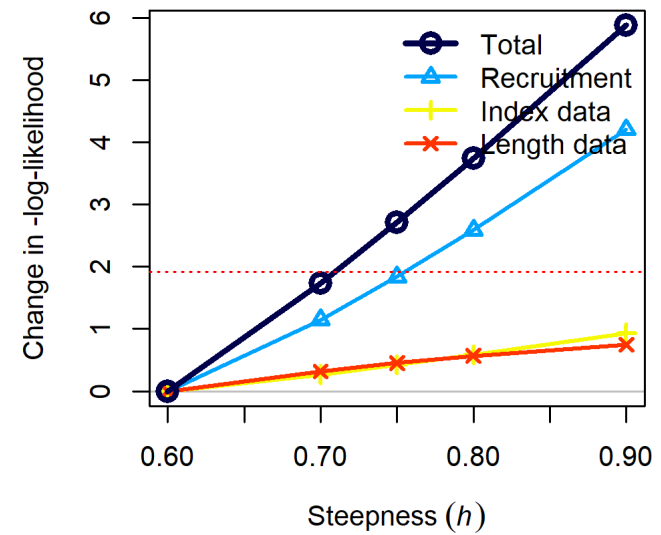
Steepness=0.75



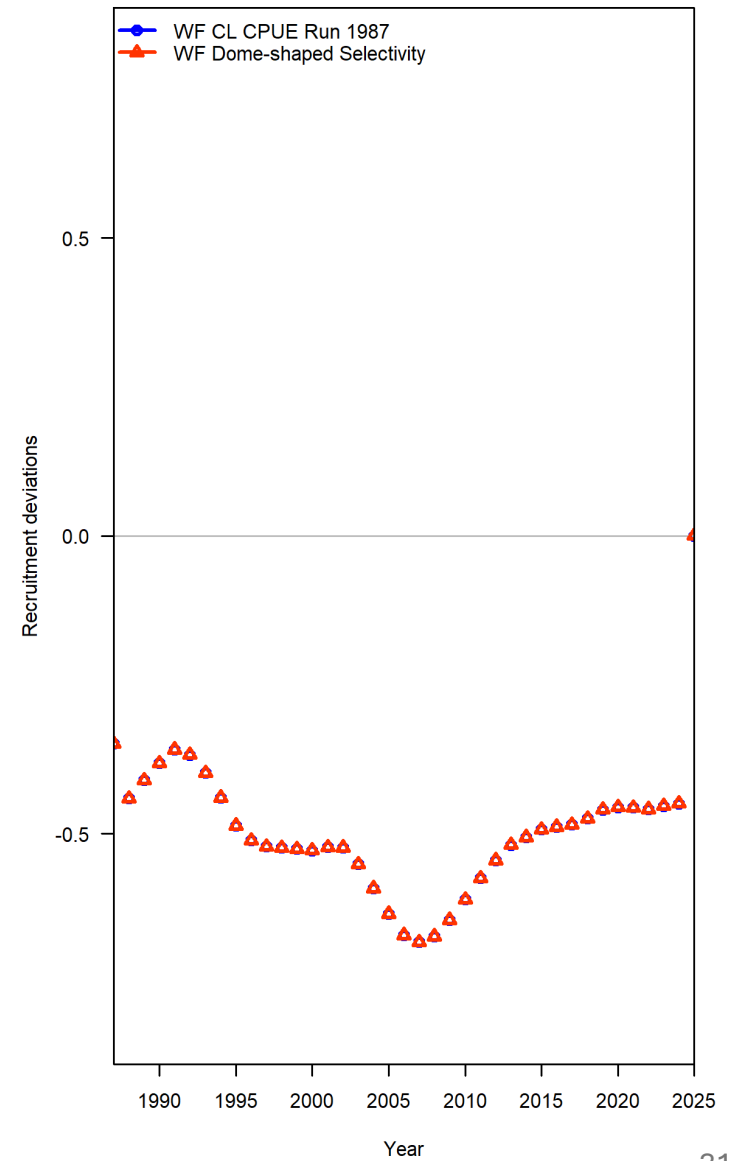
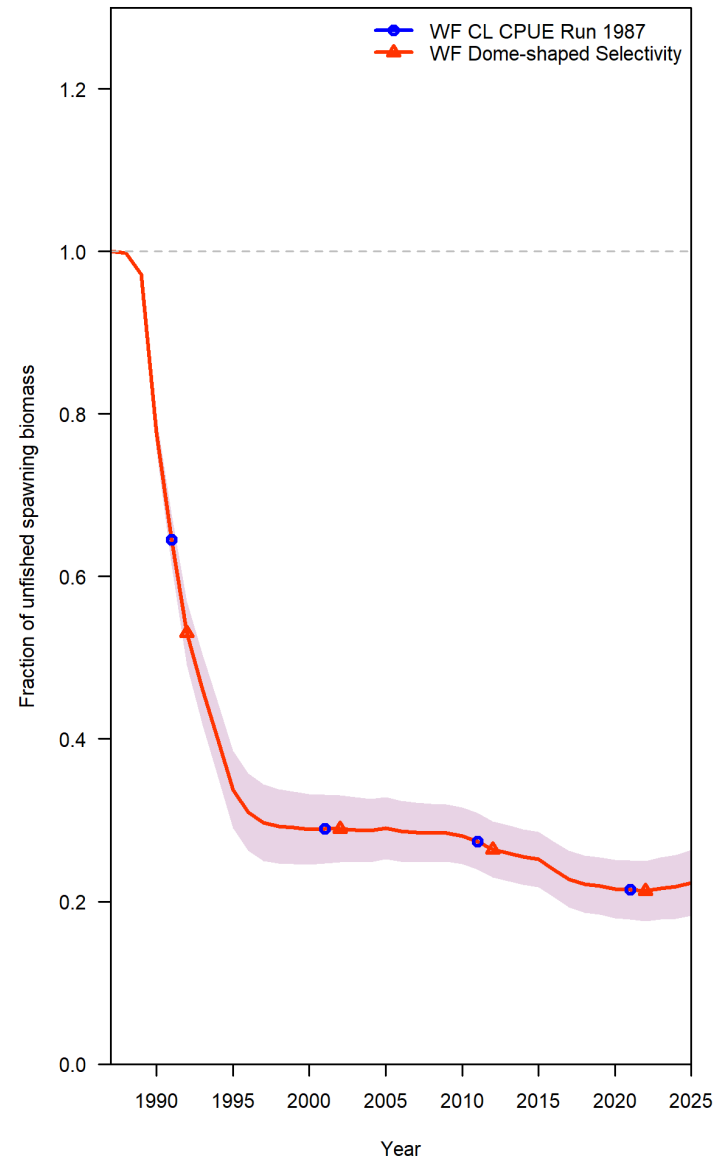
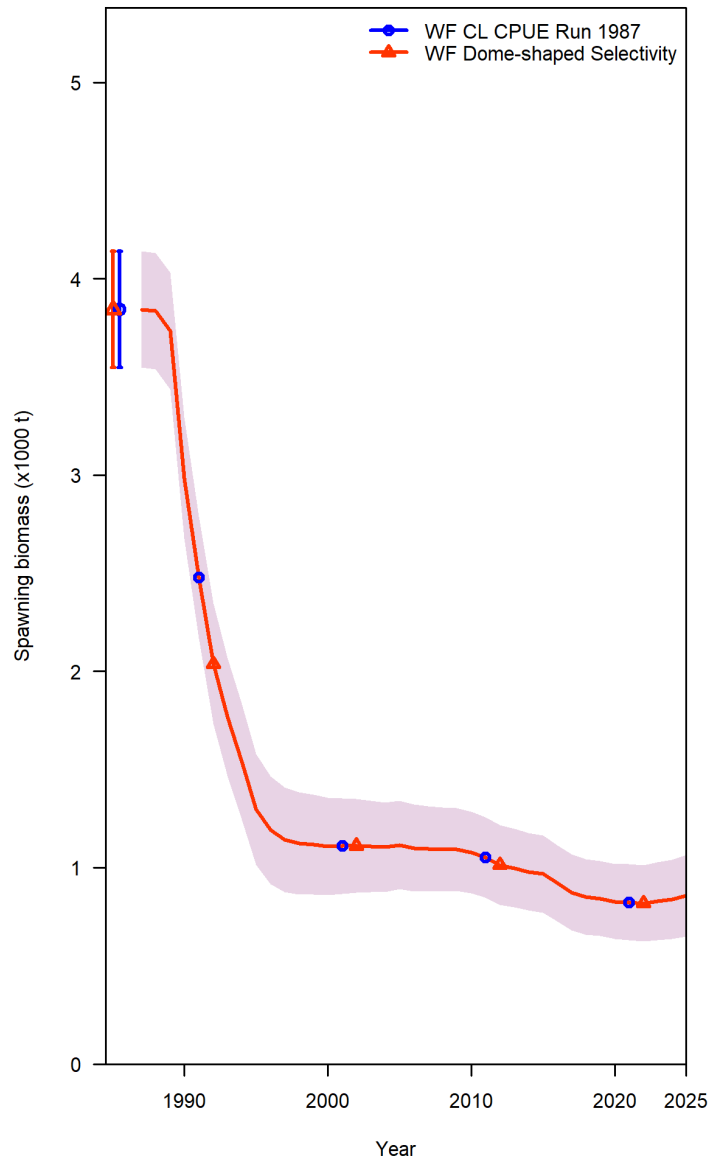
Steepness=0.9



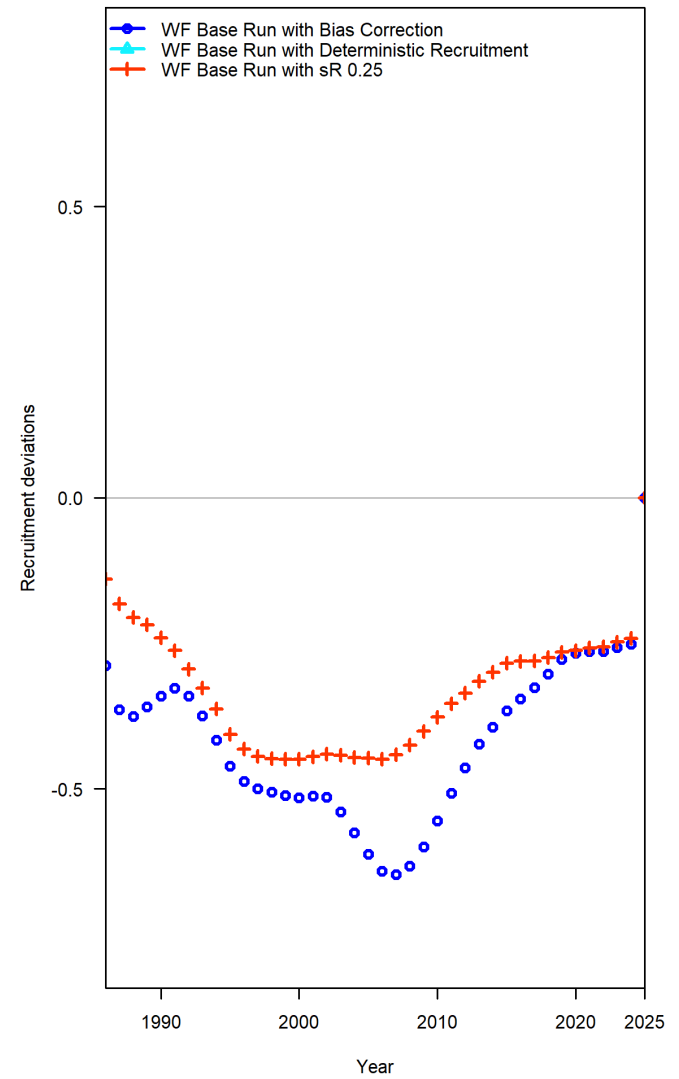
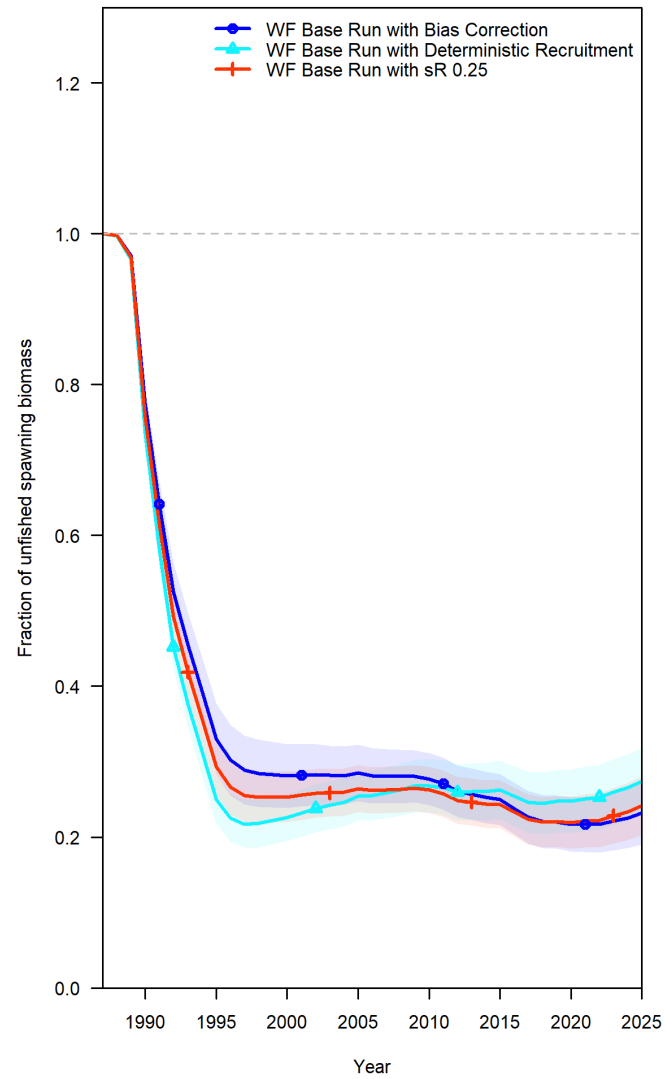
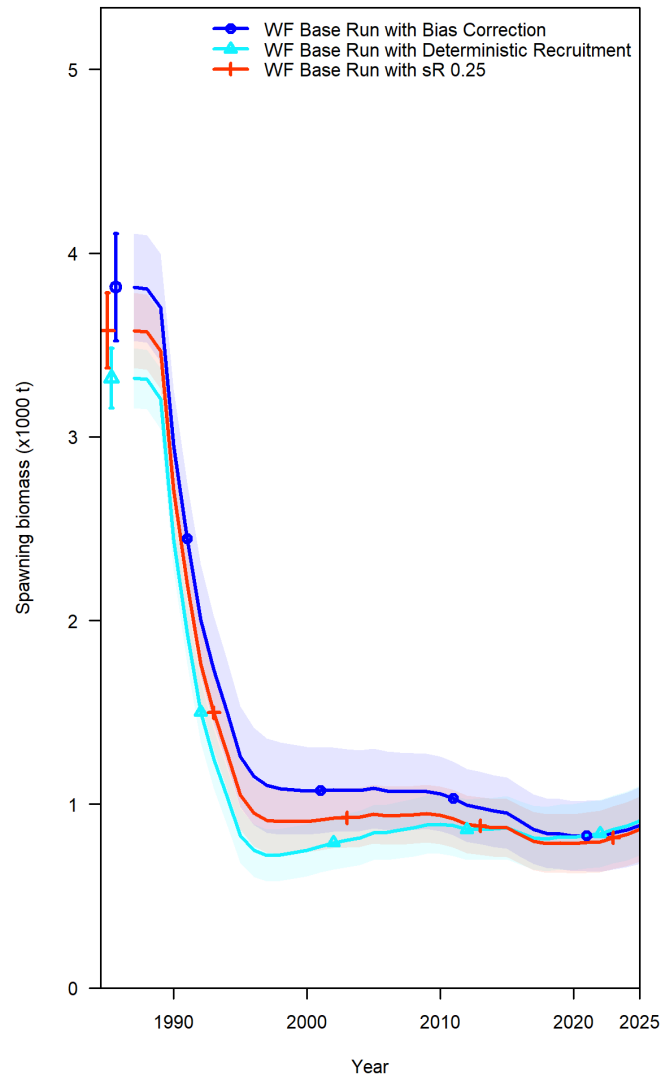
Changes in total likelihood



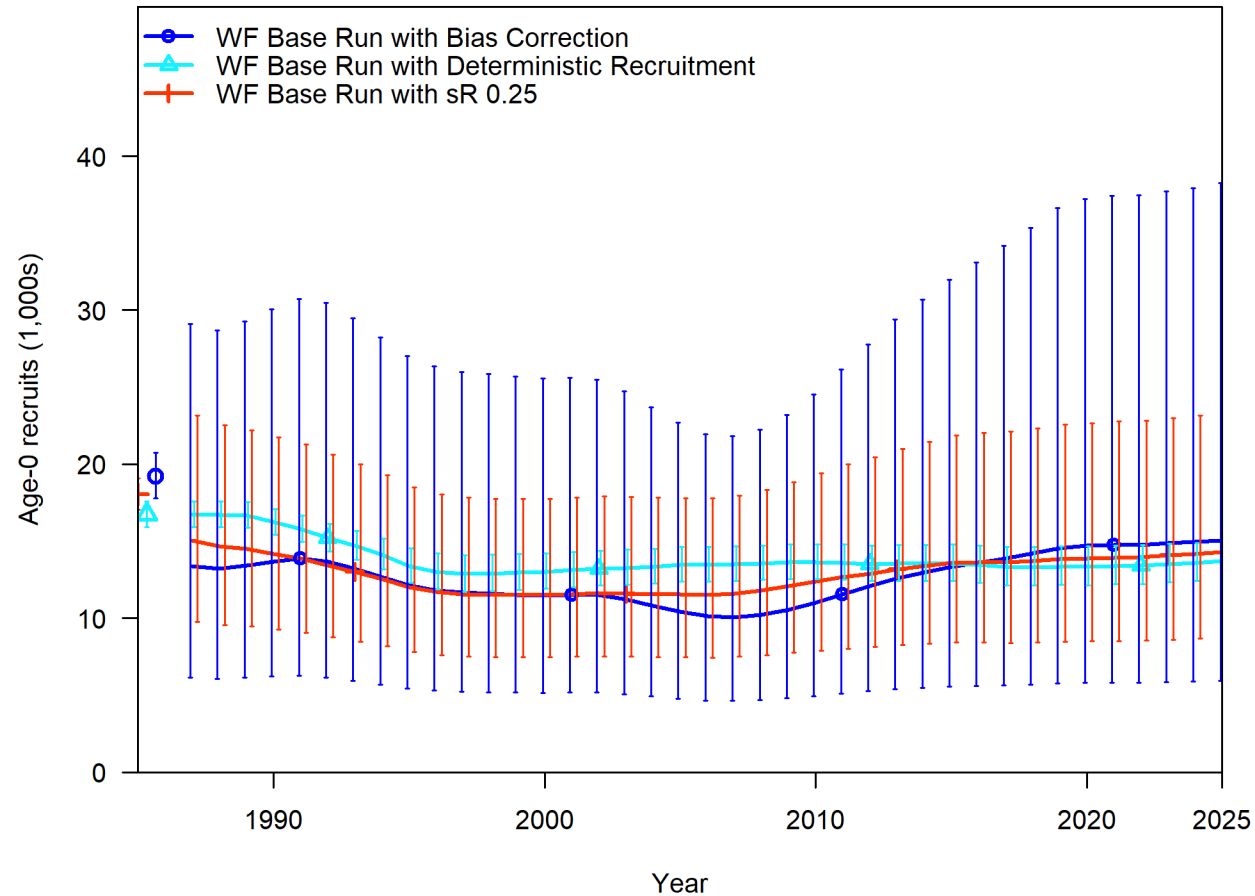
Sensitivity Analysis for Size Selectivity to the Fishery



Sensitivity Analysis for Recruitment Variability

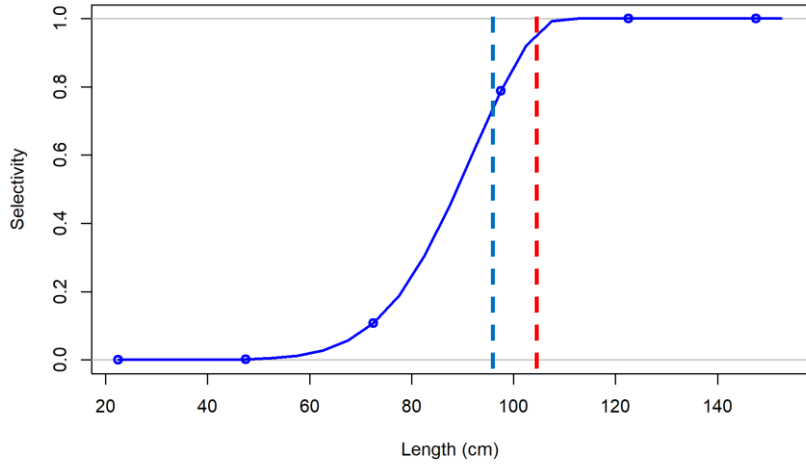


Sensitivity Analysis for Recruitment Variability

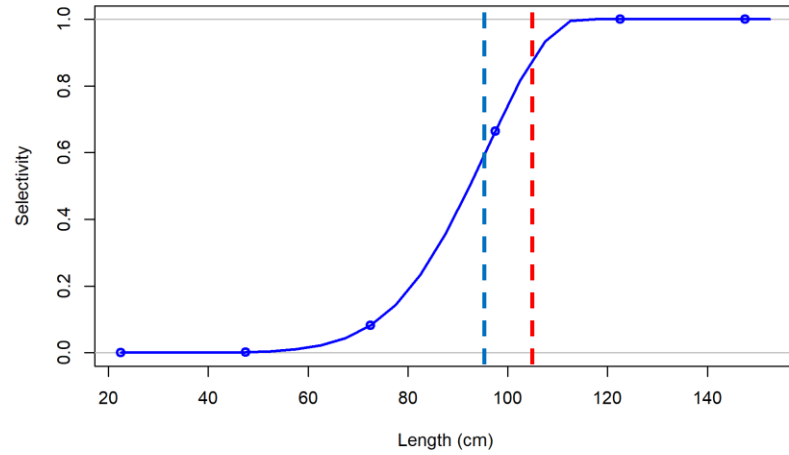


σ_R is the deviation of recruitment from the stock-recruitment curve (log scale)

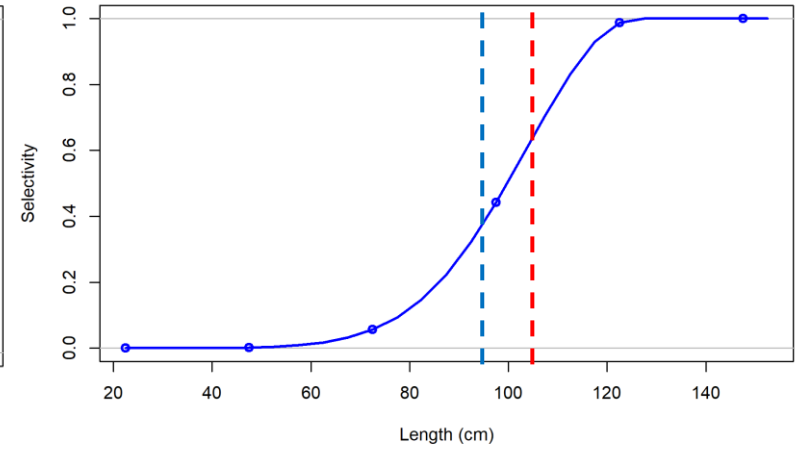
sigmaR=0.5 (default)



sigmaR=0.25

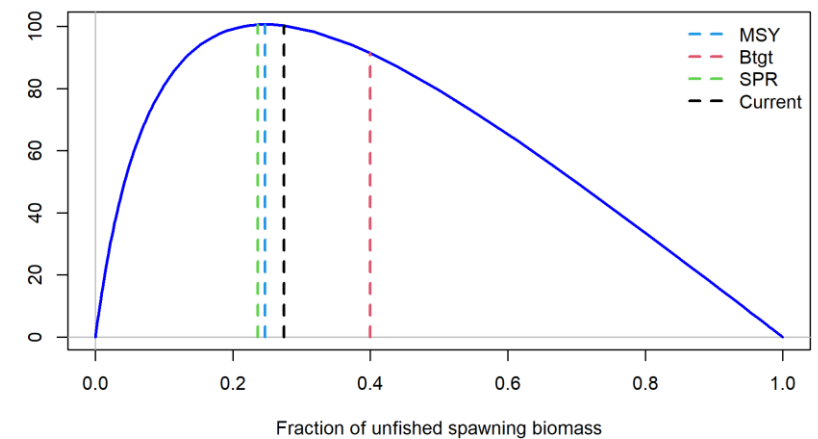
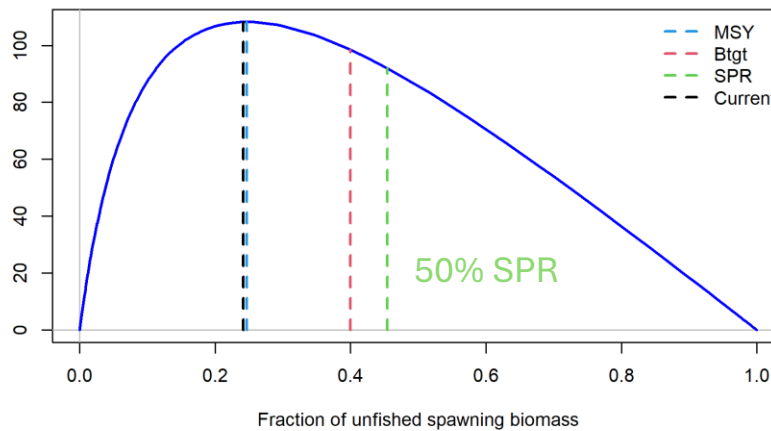
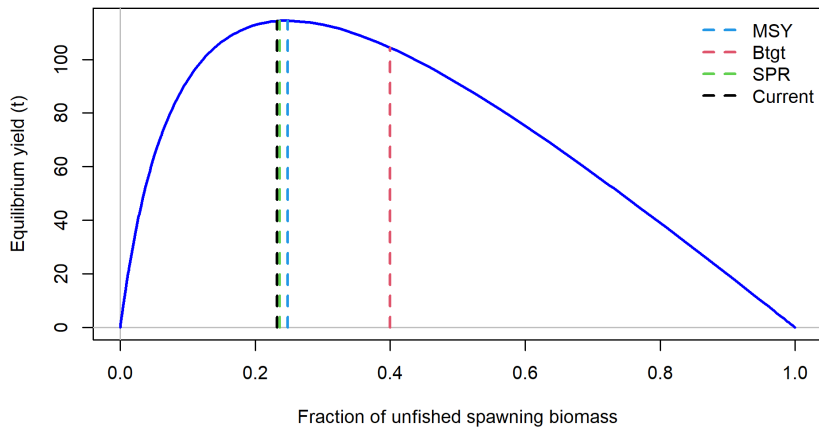


sigmaR=0 (deterministic)



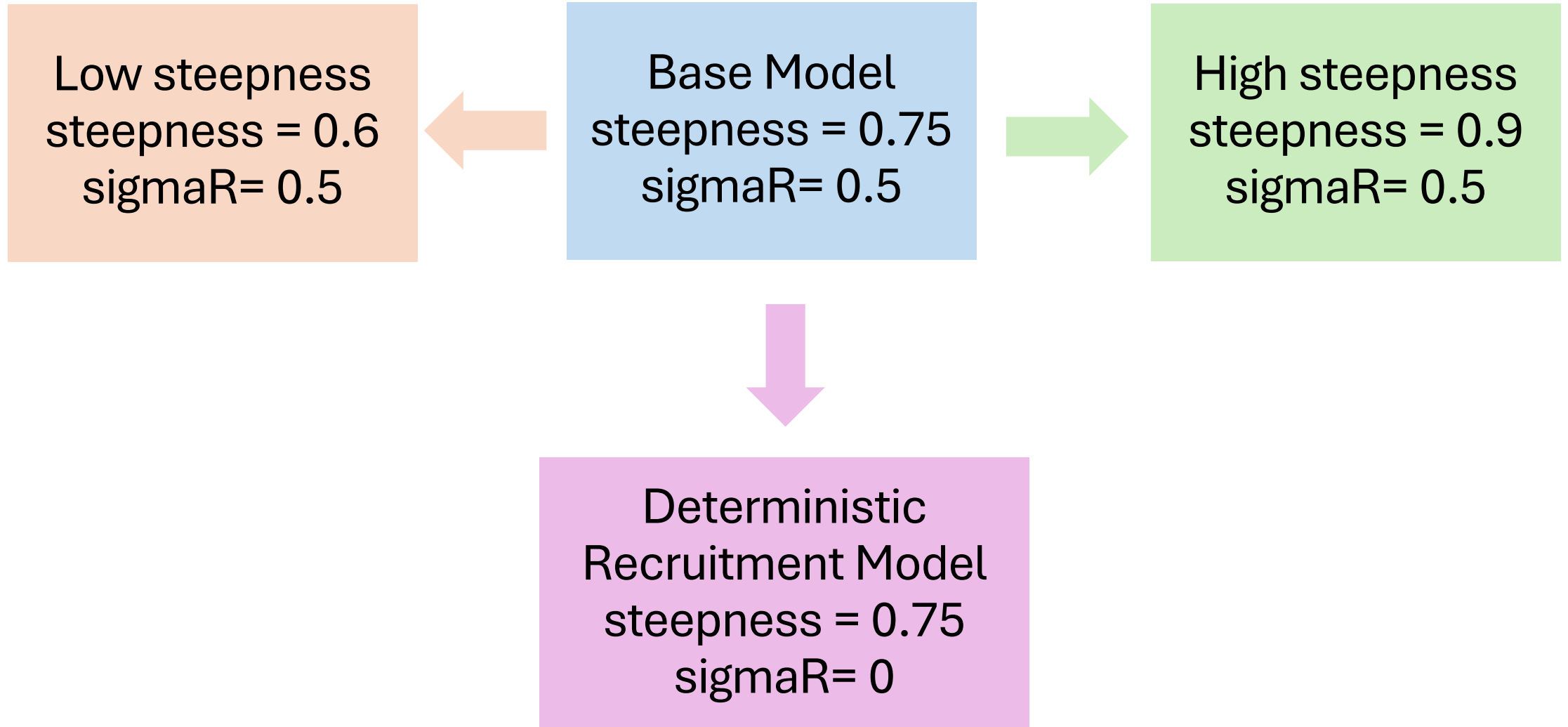
Selectivity by length

--- Linf Female
--- Linf Male



Equilibrium yield

Candidate Operating Models



Candidate Operating Models

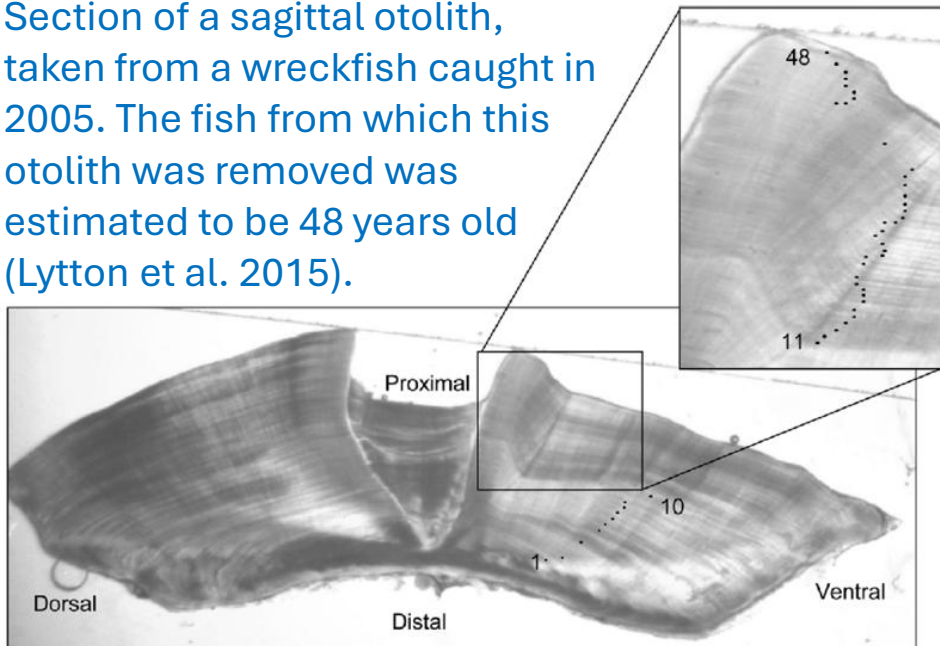
	Low Steepness	Base model	High Steepness	Deterministic
Steepness	0.6	0.75	0.9	0.75
Sigma R	0.5	0.5	0.5	0
# parameters	75	75	75	30
-log(likelihood)	33.6	36.1	38.8	80.0
Full selectivity (cm)	109.5	109.6	109.4	126.0
Ro (thousands)	19.3	19.2	19.3	16.7
SBo (mt)	3836.7	3813.2	3827.0	3319.8
SB25/SBo	0.22	0.23	0.19	0.25
MSY (mt)	89.8	114.5	141.7	100.7
U(MSY)	0.0312	0.0453	0.0658	0.0452
U(2025)	0.0375	0.0375	0.0380	0.0418

R = Recruitment, SB = Spawning Biomass, U = Exploitation rate

Wreckfish Assessment – Next Steps

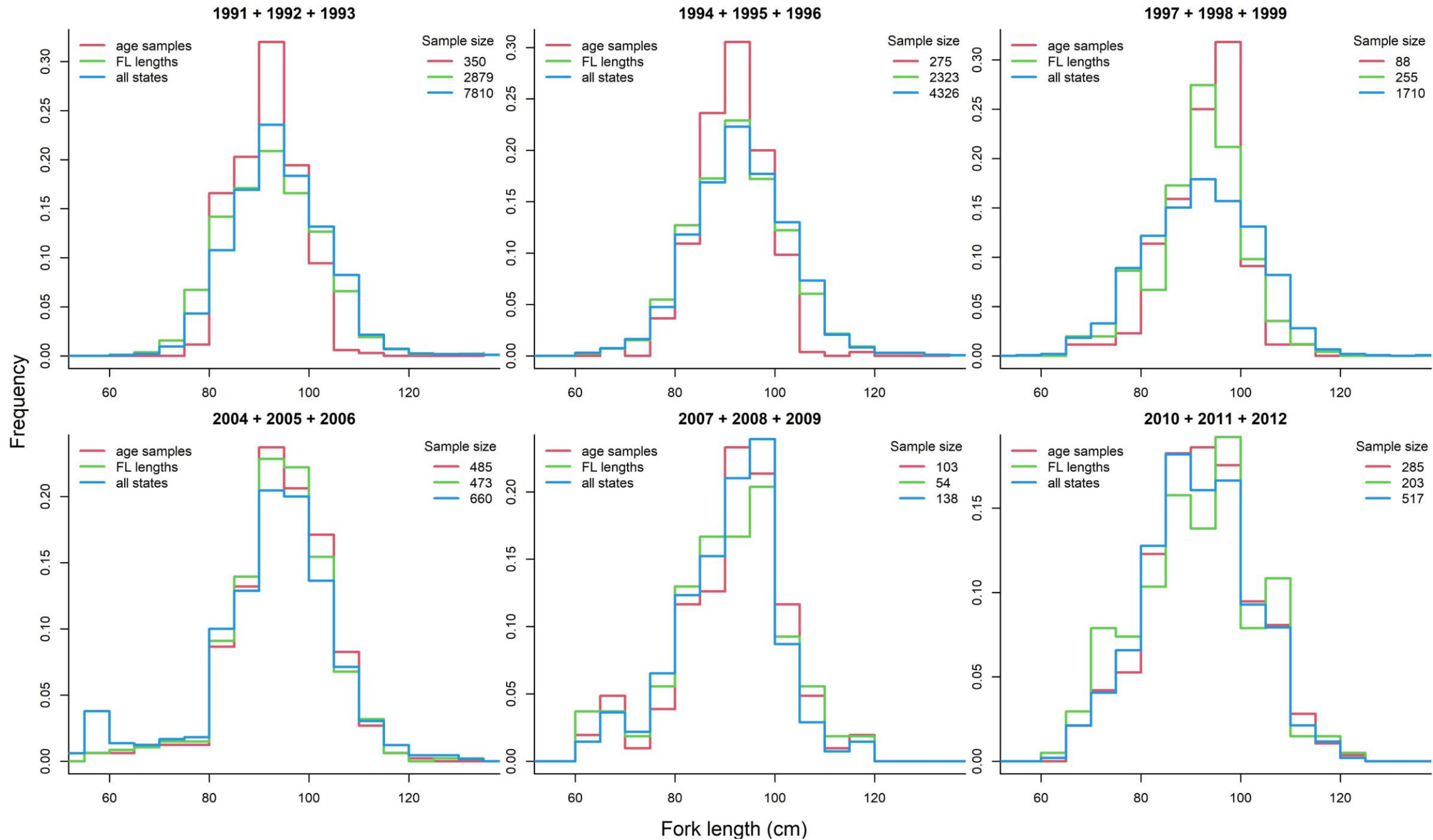
1. Conduct sensitivity analyses for key parameters (natural mortality, stock-recruitment steepness, selectivity, recruitment deviations);
2. Consider the incorporation of age-composition data;

Section of a sagittal otolith, taken from a wreckfish caught in 2005. The fish from which this otolith was removed was estimated to be 48 years old (Lytton et al. 2015).



Year	FL	SC	Unknown	Total
1991	154		69	223
1992	61			61
1993	18		48	66
1994	57		9	66
1995	1		67	68
1996	141			141
1997	54		1	55
1998	14			14
1999	19			19
2004	120			120
2005	220	7		227
2006	115	23		138
2007	37	8		45
2008	8	18		26
2009	8	24		32
2010	64	33		97
2011	24	132		156
2012		34		34
GrandTotal	1115	279	194	1588

Otoliths that have been aged by SCDNR



Incorporation of Age-composition Data

1. Enter age-composition as marginal data, which means they don't contribute to the likelihood (goodness of fit). However, this allows comparison of the observed and estimated age compositions.
2. Determine whether the age compositions are representative of the wreckfish population.
3. If yes, enter age-composition as conditional on the length distribution, in which case they would be included in the model likelihood.