SEDAR 98: US Gulf of America Red Snapper (*Lutjanus campechanus*)

Review Workshop Assessment Model

September 22-25, 2026



SEFSC, Sustainable Fisheries Division

Gulf Fisheries Branch

Outline



- Data Review
  - Stock definition
  - Assessment history
  - Regulations
  - Life history
  - Removals
  - Size composition
  - Age composition
  - Indices of abundance & Composition
  - Key data differences from SEDAR 52
- Assessment model
  - Model building
  - AP Model configuration
  - AP Model results
  - AP Model diagnostics
  - AP Model sensitivities
  - AP Model projections

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SEDAR 74: Primary Review Conclusions

- Assessments should deliver management advice, therefore, the research track process has been discontinued.
- Bridging and continuity models are valued by the reviewers (both CIE and SSC).
  - A complete continuity/bridge from S52 to S98 is impossible with the change in stock ID; however, many comparisons can still be made.
- Complete diagnostics are **critical** for model interpretation.
- Incorporating age composition data should be prioritized.
  - CAAL data will hopefully allow integration of robust length and age comp.
- Characterization of the external survey data (GRSC) as an absolute index of abundance was inadequately supported.

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SEDAR 74: Advancements Carried Forward

Chance to critically review all data and modeling assumptions.

- 2 to 3 areas. Isolating West FL shelf (East) was a double-edged sword.
- Separated recreational fleets (CBT and PRIV previously combined).
- Incorporating FES based recreational statistics.
  - Continued point of interest. Likely source of sensitivity analyses.
- Moved the model start year from 1872 to 1950.
  - Removed long time-series of highly uncertain data without eliminating contrast.

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SEDAR 74: Advancements Carried Forward

- Incorporated length composition data (None in S52).
- Eliminated some indices of relative abundance (FD CPUE), added an observer index.
- Updated most life history parameters and added regional variability where appropriate.
  - Changes to fecundity estimates resulted in switch from a model in TEP to SSB.
- Re-evaluated and updated discard mortality rates for all fleets.
- **Many Major changes to data and model structure carried into S98**

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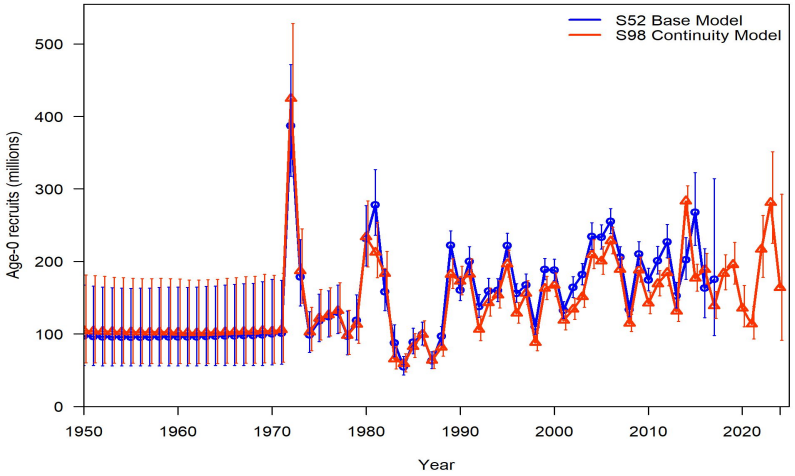


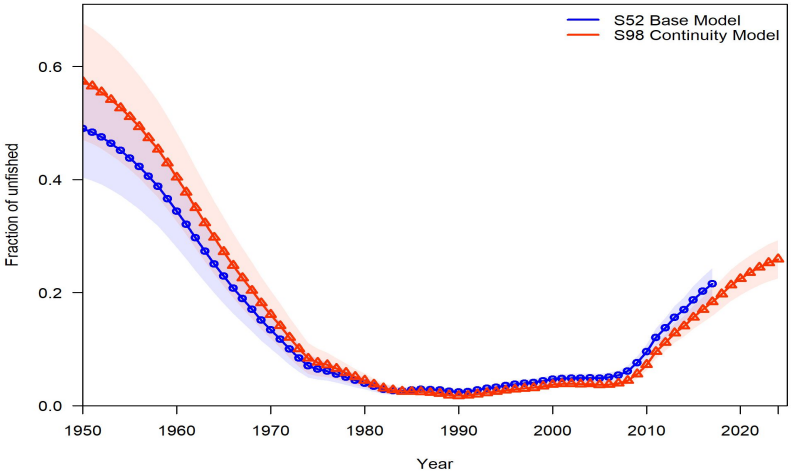
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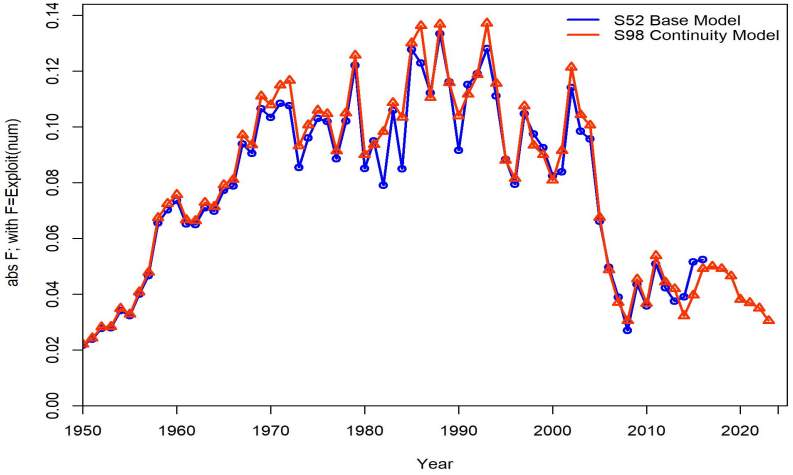
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Phase 1 Comparison

- "Continuity" from S52 not possible due to structural changes implemented in S74
- "Pseudo-Continuity" based on S52 model configuration with a number of necessary assumptions for changed (e.g., shrimp bycatch, comm. discards) and no longer supported data (e.g., 2-area indices).

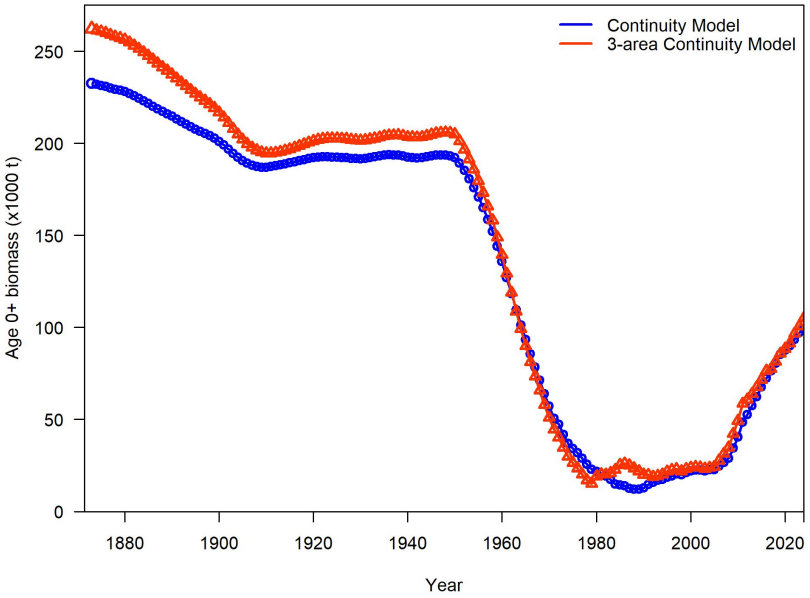






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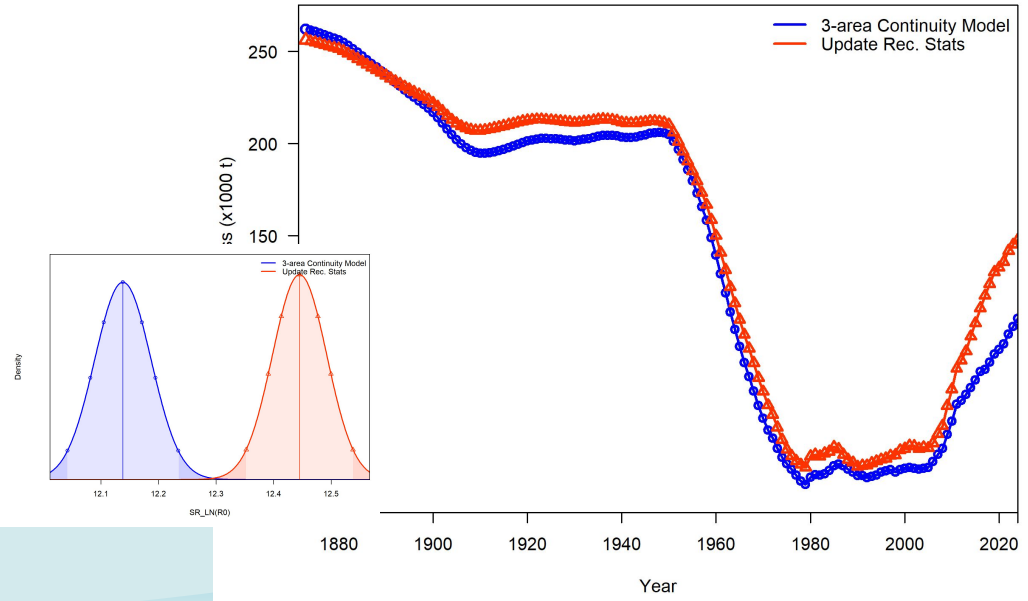
Phase 2 Bridging



- Updated all recreational statistics.
- Main difference is moving from S52 (CHTS) to S98 FES.

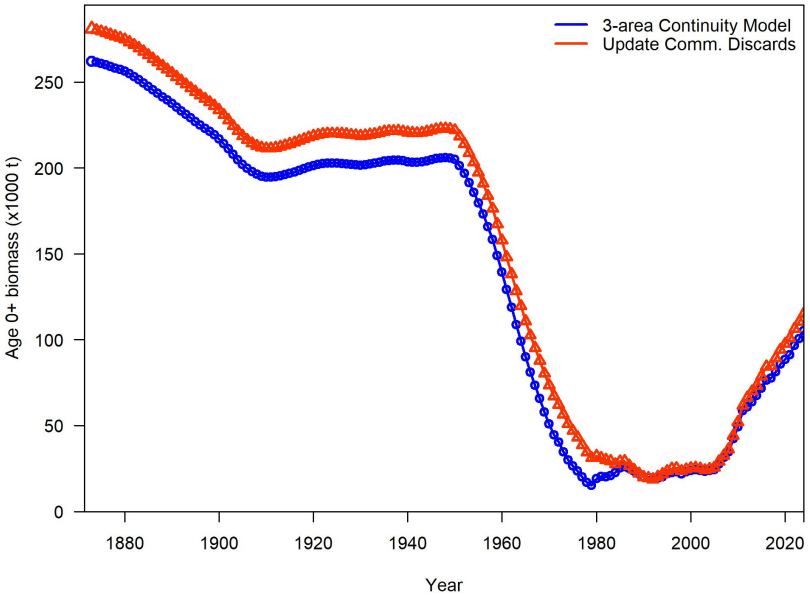
- FES estimates of removals are larger than CHTS based estimates

- Moved from the 2-area pseudo-continuity model to the 3-area structure. To the extent possible maintained all control file configurations and data preparations.
- Example, selectivity and retention for East and Central fleets mirrored.



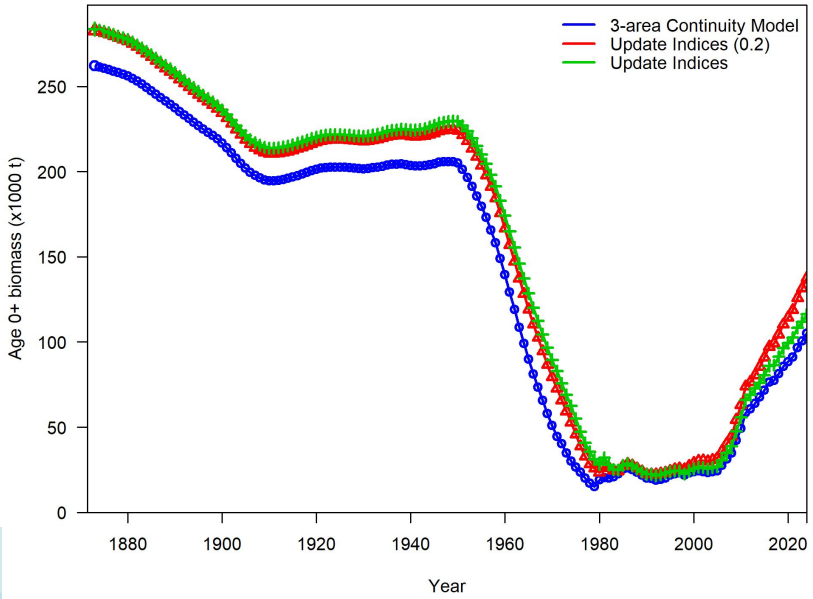
Phase 2 Bridging

- Isolates the impact of the methodological change to how time-series of commercial discards are constructed.

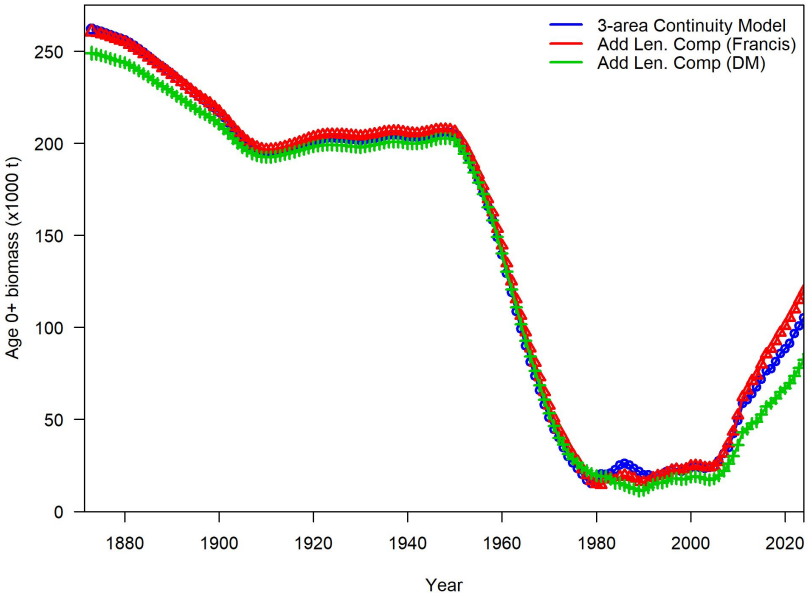


- Update the indices to the time-series provided for S98 and demonstrate the impact of the CV treatment.

- CV =0.2 essentially gives more weight to the index data



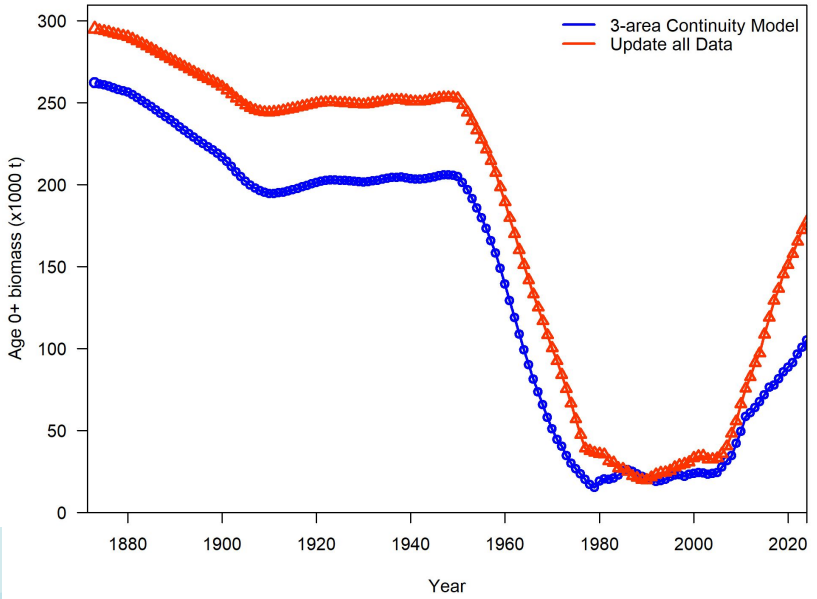
Phase 2 Bridging



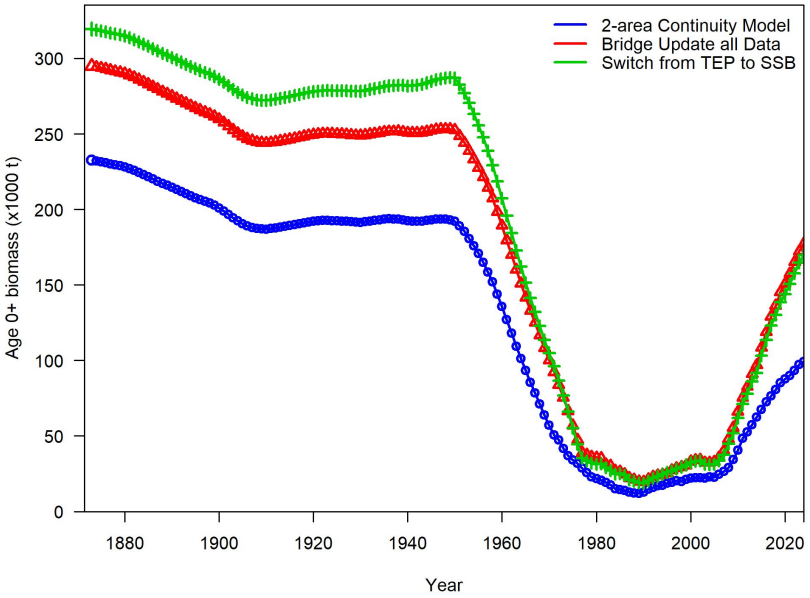
- Demonstrates the impact of adding length composition data (previously not included) under Francis and DM parameter weighting schemes.

- Update all sources of data to the values provided by the SEDAR 98 DW. New data sources not added yet (e.g., CAAL)

- Updated data suggests a more productive stock which has recovered quicker than previously estimated.

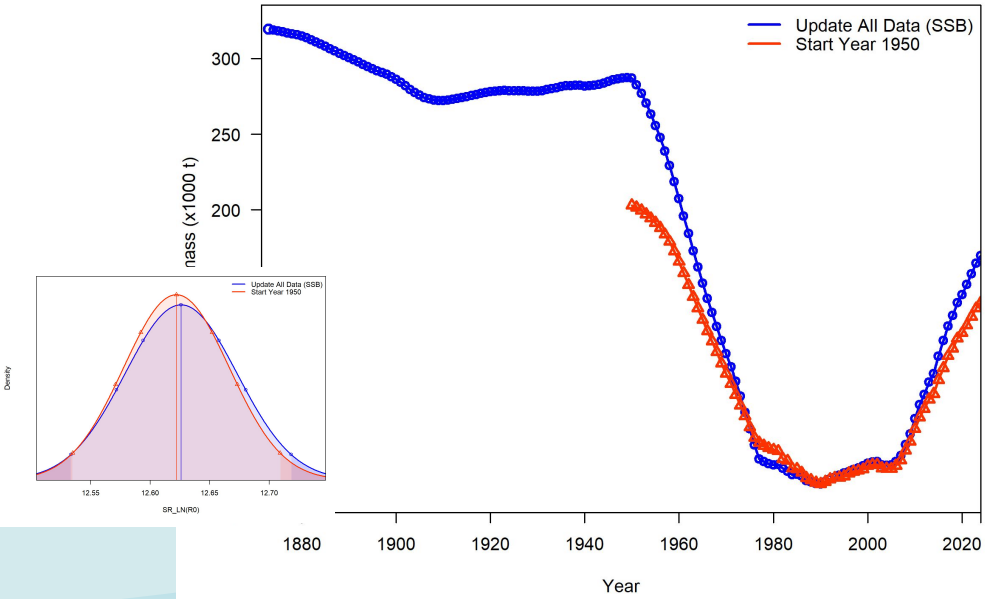


Phase 2 Bridging



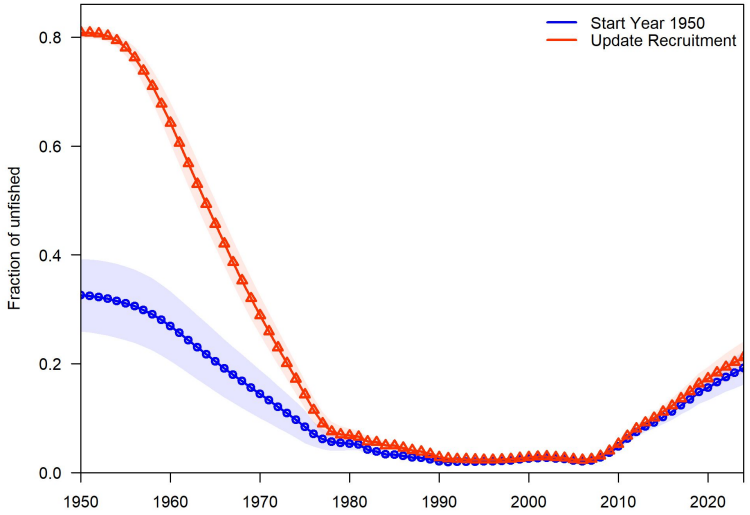
- Demonstrates the effect of moving start year from 1872 to 1950

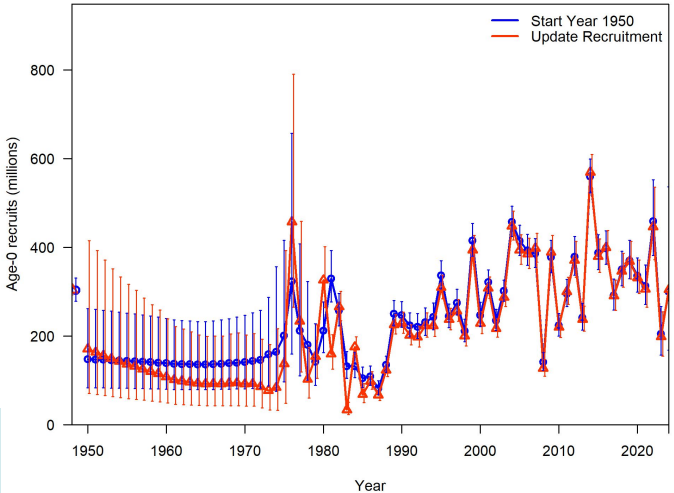
- Demonstrates the effect of switching from TEP to SSB based reference points. Similar analysis was done during SEDAR 74 and showed a similar minimal impact

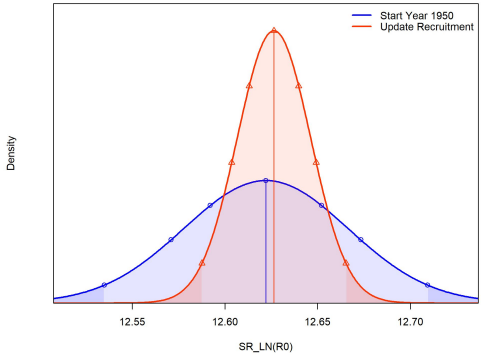


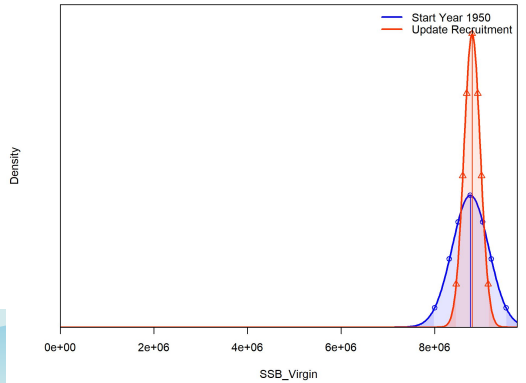
Update Recruitment

- Update recruitment parameterization.
  - Changed how deviations were specified
  - Removed R0 block
  - Updated SR bias ramp



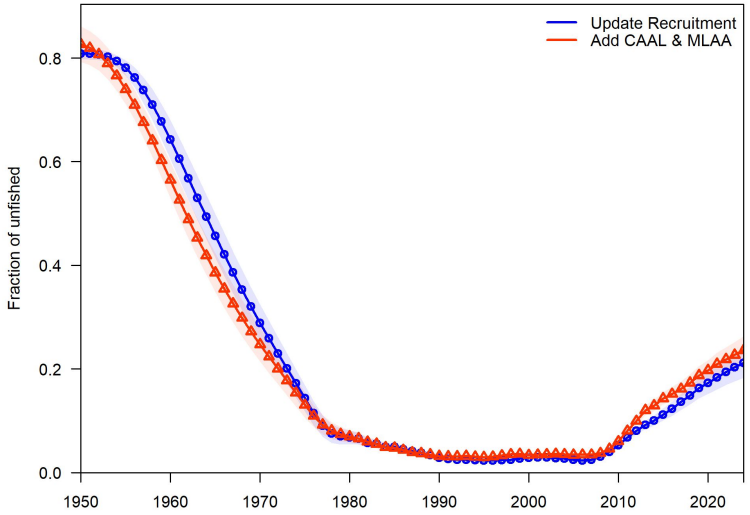


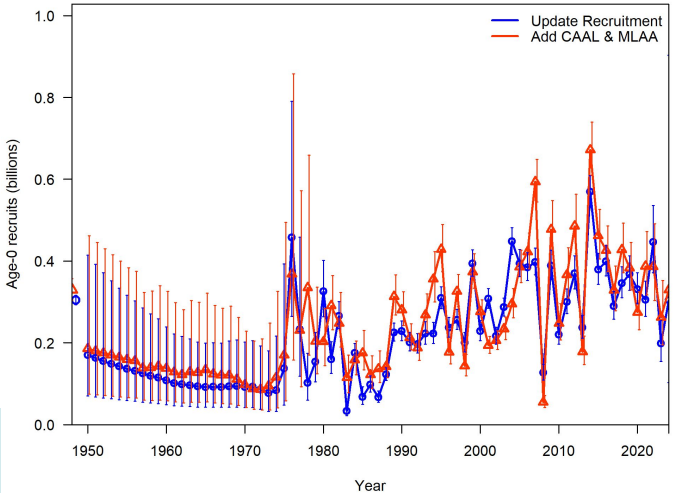


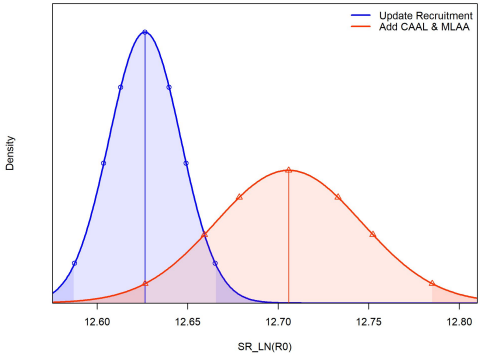


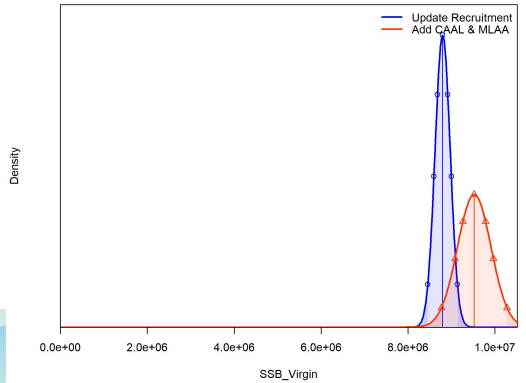
Add New Data Sources

- Added CAAL data and MLAA data. Selectivity and retention assumptions remain as they were in S52 (age based selectivity).
- CAAL data is fit while MLAA data is not fit directly.



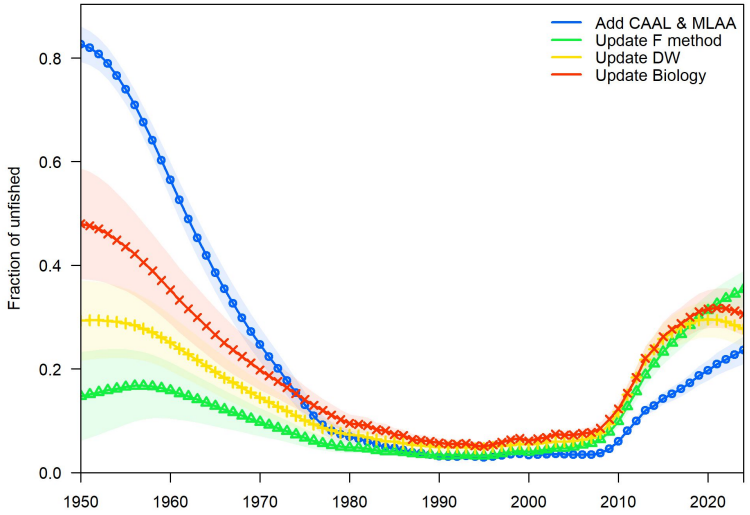


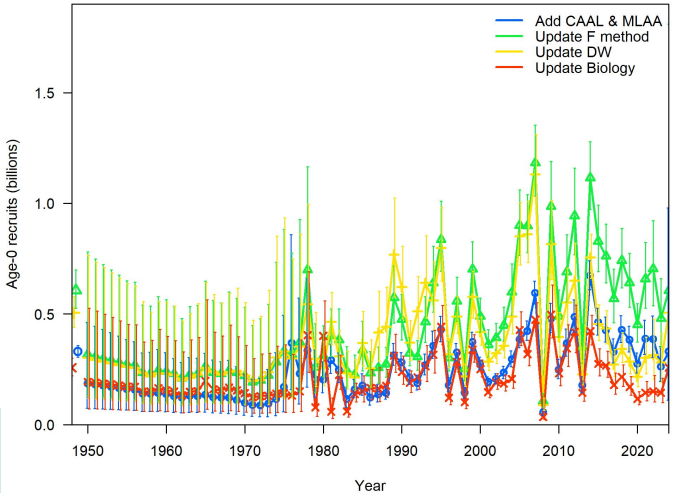


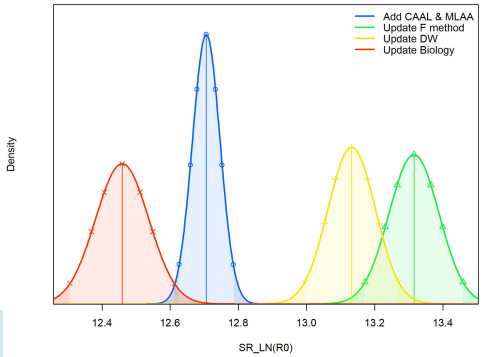


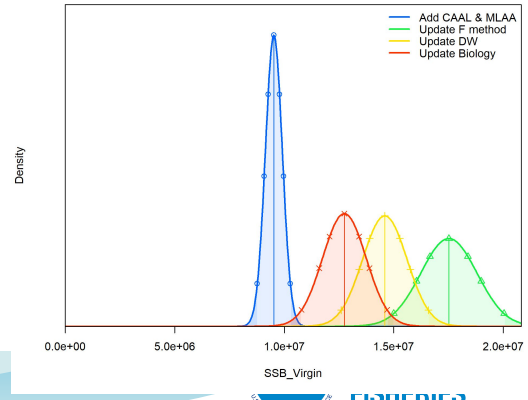
Update F, Data weights, and Biology

- Model was more sensitive to changes in initial F then anticipated. F max was increased from 2 to 4 and shrimp initial F's were estimated.
- Updating data weights effectively gave more weight to comps at the expense of indices.



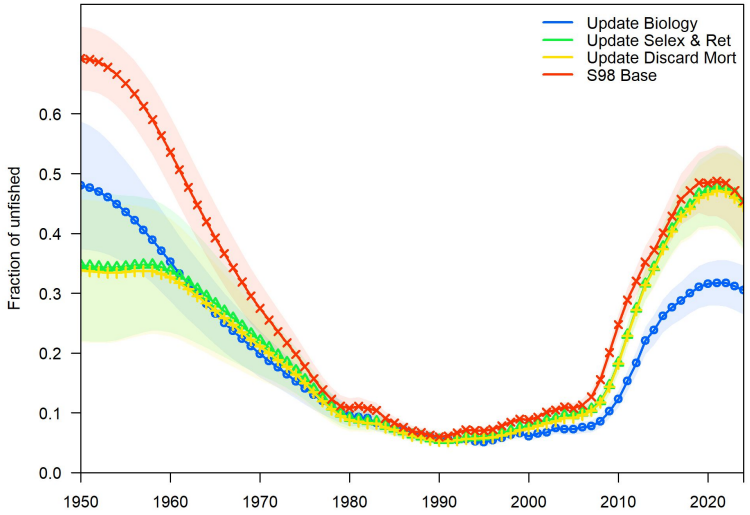


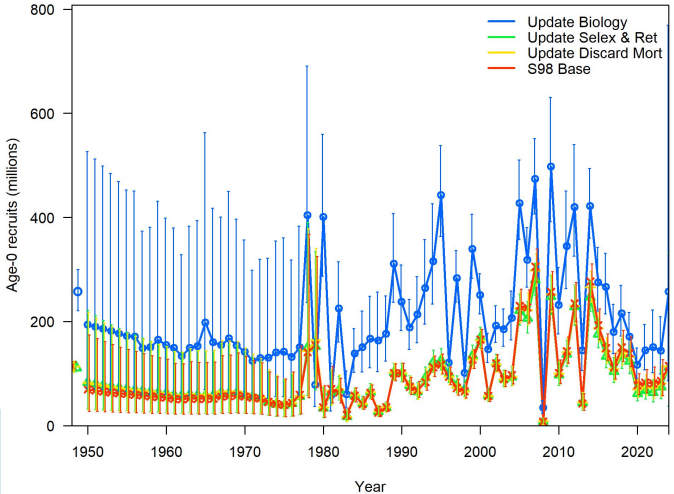


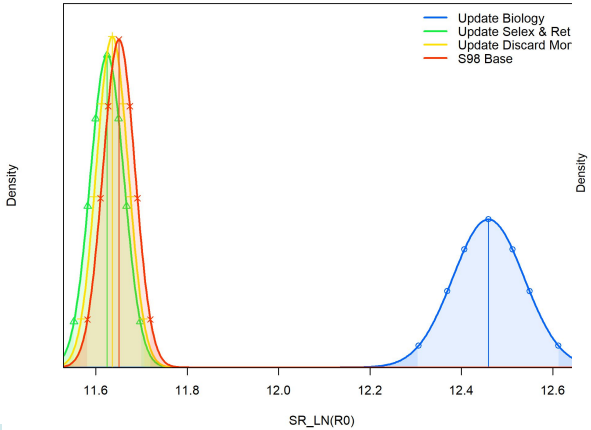


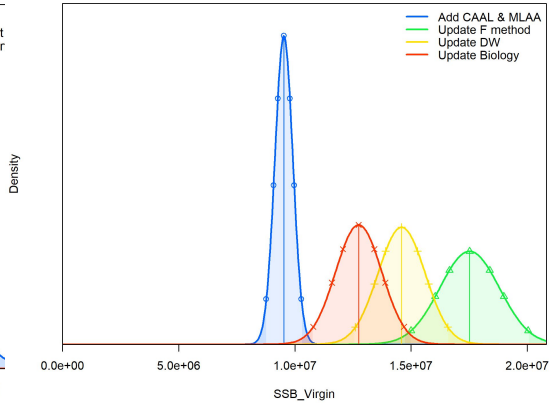
Update Selex, Discard Mortality, Model Tuning to Base

- Updating the way in which selectivity and retention are modeled resulted in an improved estimate of terminal depletion.









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Modeling Approach

- Using Stock Synthesis (Methot and Wetzel 2013), an integrated assessment modeling platform.
  - Statistical catch-at-age model
- Advantages
  - Allows a broad suite of data to be incorporated into the assessment model
  - Do not have to split time series
    - Time varying selectivity, retention, and catchability as appropriate.
  - Can use both length and age composition data simultaneously.
  - Explicitly incorporates uncertainty in observations.
  - Where appropriate can link parameters to environmental series or derived quantities like SSB.

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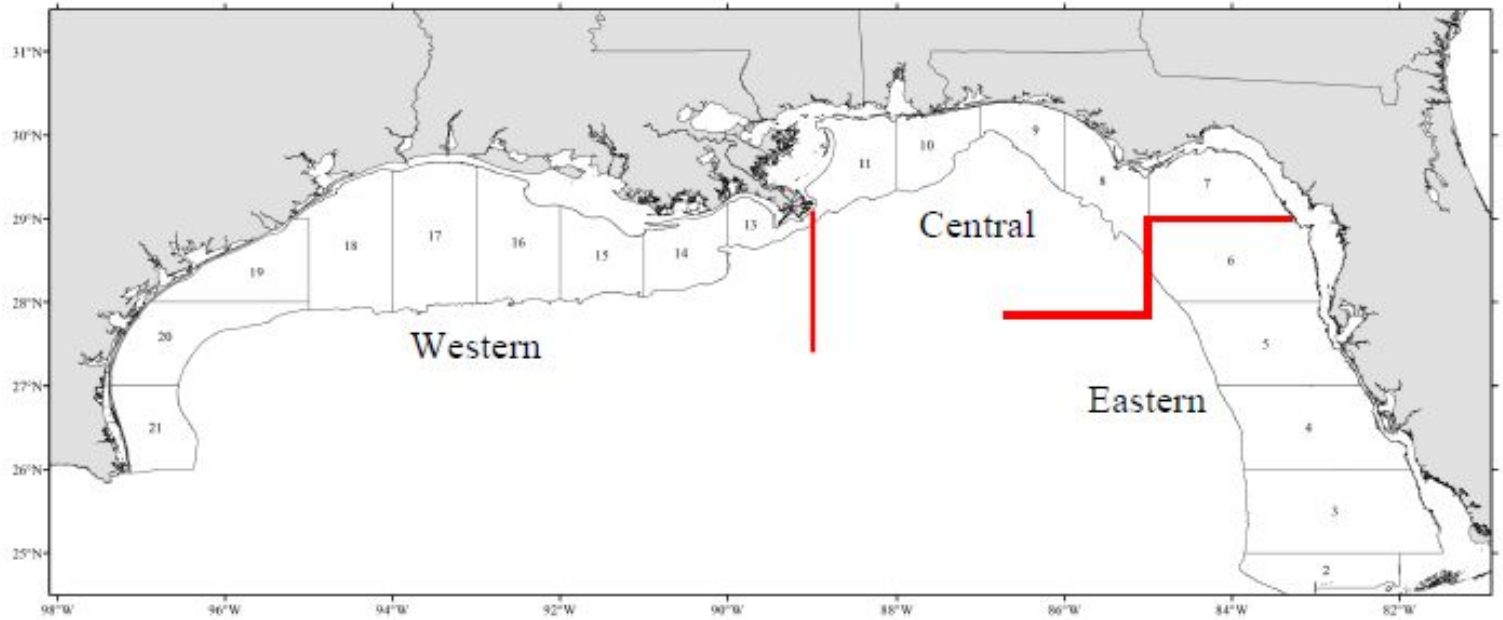
Modeling Configuration

- 1950 - 2023
  - Re-evaluated start year as part of SEDAR 74 which recommended moving from 1872 to 1950. Alternate start years not considered during model development.

- 3 area (West, Central, East), 1 season model (annual time-step)
  - Re-evaluating spatial structure was done in SEDAR 74 which recommended moving from the 2 area (West/East) model in SEDAR 52 to the current 3 area configuration.
- No explicitly modeled movement among areas

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Model Configuration: Stock Structure



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Modeling Configuration

- 1 sex model (combined sexes; 50:50 sex ratio at birth)
- Maturity a function of age (fixed)
- Reproductive potential based on female-only SSB
  - Switched from fecundity (S52) as a function of age due to **data limitations and lack of uncertainty**
- Decision to switch from TEP to SSB made in (SEDAR 74)

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Modeling Configuration

- Area-specific von Bertalanffy growth
    - Growth parameters fixed; however, sensitivities around estimating growth were completed.
- Lorenzen natural mortality for ages 2 - 20+
    - Updated with **Then et al. (2015)** Lutjanid-specific approach for specifying target *M.* Sensitivities done using Hamel & Cope (2022)
    - Age 0 and 1 natural mortality fixed at externally derived values with sensitivities around this assumption.
- Ageing error matrix implemented
    - Updated based on **revised age data during SEDAR 74. Not updated for S98**
- Ages 0 - 20 modeled, with plus group of 20+

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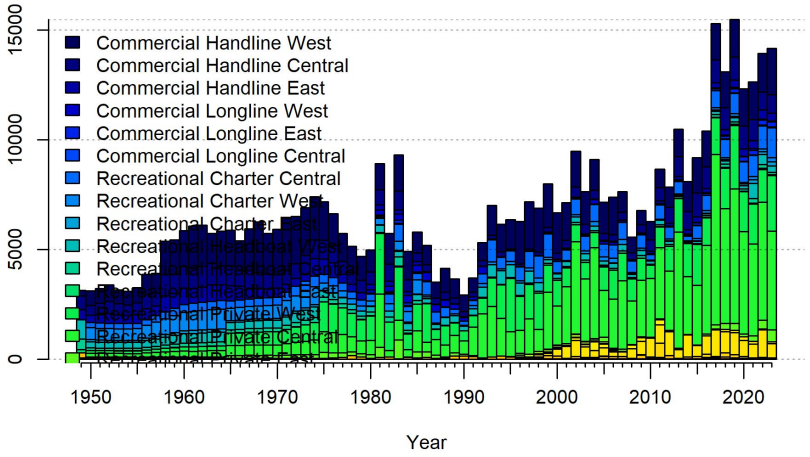
Modeling Configuration

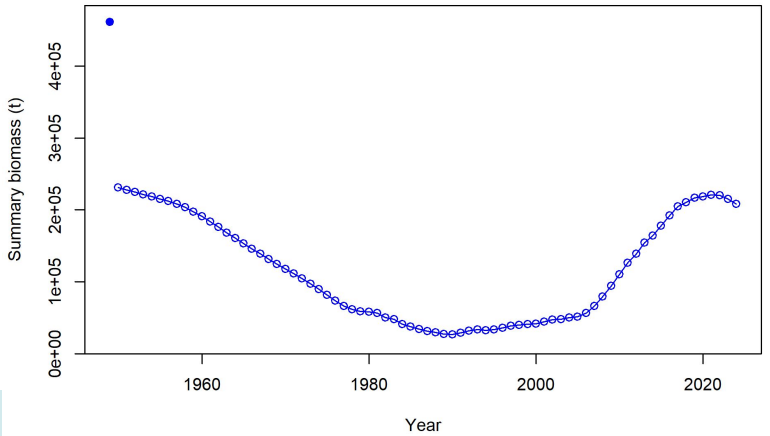
- Beverton-Holt stock-recruitment relationship
  - Estimated ln(R_0): unexploited equilibrium recruitment on log-scale.
  - Fixed steepness at upper bound. Attempts to estimate bounded and profile indicated high steepness, so fixed for computational convenience.
  - Fixed *SigmaR* at 0.6 to reflect realistic standard deviation in recruitment estimates.
  - Recruitment deviations estimated in main period (1985-2022), full bias adjustment from 1997-2023
  - Early deviations estimated from 1950 - 1984
  - 2023 deviation estimated as a simple dev constrained to be near zero.

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Modeling Configuration

- Deviation discussion
  - SEDAR 52 contained a time-varying R_0 parameter (St. yr - 1983, 1984 - end)
  - Block included to allow zero sum deviations (only option at the time) to accommodate what would otherwise be intractable data.





Modeling Configuration

- The R_0 block was removed during SEDAR 74 and the modeling approach was updated for SEDAR 98 based on SEDAR 74 reviewer feedback.
- Use simple deviations for the early data poor period and zero sum deviations for the main period to allow the model to:
    - Estimate R_0 using only years for which robust data exist.
    - Provide flexibility to allow removal history and indices/composition data to coexist without forcing a systematic bias in one or the other.
    - Fit the early removal data with small CVs increasing model stability.
    - Accomplish the above without making an explicit assumption about changes in stock productivity.
- Productivity still could have changed through time in the current setup and is allowed to change on a annual time-step instead of a block which is thought to be more realistic.

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Modeling Configuration

- Fishing mortality specified using fleet-specific continuous/hybrid approach (F method 4)
- Annual *F*s estimated as parameters for All directed, discard only, and bycatch fleets.
- Hybrid approach retained to speed up model convergence; however, given restrictions forced through discards, the legacy *F* as parameters (SS option 2) could have been retained.

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Model Configuration

- 5 fishing fleets per area with landings, discards and composition inputs (length, CAAL, MLAA)
  - Handline, Longline, Charter boat, Headboat, and Private
- Shrimp bycatch and Closed season discard fleets (HL, Priv, Hbt) for all areas
- G-FISHER video, BLL, Summer and Fall Trawl surveys for all areas
- Larval, commercial observer, early trawl survey as available
- Fishery Dependent indices of abundance removed during S74
- GRSC index not included in Base model configuration

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Modeling Configuration (Removal selectivity)

- Length-based selectivity for fishing fleets, closed season discard fleets.
- Data limitations necessitated use of mirroring for the Central LL, all HL and PRIV closed season, Central HBT closed season, and all East recreational fleets (PRIV, CBT, HBT).
- Mirrored fleets used the most similar fleet to inform selectivity behavior.
  - Central LL / West LL, Closed season HL and PRIV / open season counterparts. West Closed season HBT / Closed season Central HBT, and East recreational fleets / corresponding Central fleet.

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Modeling Configuration (Removal selectivity)

- Mirroring continued: mirrored fleet selectivity a copy of the assigned fleet selectivity if no composition data was available (e.g., HL Closed Season Discards).
- When composition data was available, mirrored selectivity was essentially a weighted average of the two areas compositions (e.g., East area recreational fleets).
- Time-varying selectivity for fishing fleets.
  - Rec. blocks accounted for the transition from essentially unmanaged to managed (1993) and the change from J-hooks to circle hooks (2007).
  - Comm. block accounted for the implementation of IFQ (2007).
- Applied as appropriate (i.e., early data availability limited the ability to estimate some blocks)

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Length-based Selectivity - fishing fleets

Pattern	Parameters	Fleet
Double normal	1*. Peak (beginning size for the plateau) 2. Top (width of plateau) 3*. Ascending width (parameter describing incline to plateau) 4*. Descending width (parameter describing decline from plateau to final size bin) 5**. Initial (selectivity of first size bin) 6**. Final (selectivity of final size bin)	All Recreational fleets, Commercial Handline, Closed season Discards ** Parameter not estimated. Selectivity of small and large fish determined by parameters 3 & 4
Logistic	1*. Size at inflection 2*. Width for 95% selection	Longline

* Time varying parameter

Shrimp Selectivity

- Age based selectivity
- Fixed at 100% selective for age 0 and 0% selective for all other ages.

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Model configuration (Survey)

- Catchability coefficient associated with each index estimated as a parameter
- Constant catchability assumed for all indices
- Extra Standard Deviation (SD) estimated for each index of relative abundance using a normal (0,0.2) prior to prevent the model from indiscriminately maximally upweighting or down weighting an index.

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Modeling Configuration (Survey selectivity)

- To the extent possible surveys used age based selectivity and did not include any time-varying components.

- The exceptions to this were the early summer and fall trawl survey which used length-based selectivity due to the absence of otolith age composition and robust ALKs for the early part of the data time-series.

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Pattern	Parameters	Fleet
Double normal	1. Peak (beginning size for the plateau) 2. Top (width of plateau) 3. Ascending width (parameter describing incline to plateau) 4. Descending width (parameter describing decline from plateau to final size bin) 5. Initial (selectivity of first size bin) 6. Final (selectivity of final size bin)	G-FISHER video (All) and Commercial Observer East, Early Summer and Fall Trawl (West) Estimated params. Survey specific
Logistic	1. Size at inflection 2. Width for 95% selection	Bottom Longline Survey (All)
Random Walk	Age specific parameters (0 - max age 6) Fleet dependent	Fall and Summer Trawl (all areas)

Length-based retention

- Modeled time-varying retention to account for changes in management regulations
  - Size limits, bag limits, trip limits, closed seasons
- Retention was modeled as a logistic relationship
  - P1 = ascending inflection
  - P2 = ascending slope
  - P3 = maximum retention
  - P4 = male offset to ascending; set to 0

$$\text{Retention} = \left(\frac{P3}{1 + e^{\frac{-(L-(P1+P4*male))}{P2}}} \right)$$

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Commercial retention

- All parameters estimated, but base (1950-1984) inflection point, width and asymptote parameters.

Time Block	Inflection	Width	Asymptote
pre-1985	Fixed at 8 inches TL	Fixed at 1	Fixed at 100%
1985-1994	Estimated; initially started at size limit of 13 inches TL (~30 cm FL)	Estimated prior LN(0,1)	Fixed at 100%
1995-2007	Estimated; initially started at size limit of 15 inches TL (~35 cm FL)	Estimated prior LN(0,1)	Fixed at 100%
2008-2023	Estimated; initially started at size limit of 13 inches TL (~30 cm FL)	Estimated prior LN(0,1)	Estimated (2007) (due to IFQ)

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Recreational retention

- Initial inflection block begins at 1985 for CBT and PRIV and at 1987 for HBT to reflect differing timing in implementation of minimum size management action.

Time Block	Inflection
pre-1985/1987	Fixed at 8 inches TL
1985/1987-1989	Estimated C & W; initially started at size limit of 12 inches FL (~30 cm FL)
1990-1994	Estimated C & W; initially started at size limit of 13 inches TL (30 cm FL)
1995-1999	Estimated C & W; initially started at size limit of 15 inches TL (~35 cm FL)
2000-2023	Estimated; initially started at size limit of 16 inches TL (37.5 cm FL)

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Recreational retention

- Recreational fleet width parameters based on changes in bag limit regulations. Asymptote block based on restricting to 2 fish bag

Time Block	Width	Asymptote
pre-1990	Fixed at 1	Fixed at 100%
1990-1994	Estimated (C&W)	Fixed at 100%
1995-1998	Estimated (C&W)	Fixed at 100%
1999-2006	Estimated (C&W)	Fixed at 100%
2007-2023	Estimated	Estimated For-hire, Fixed Private @ 100%

Discard Mortality

- P1 = descending inflection
- P2 = descending slope
- P3 = maximum discard mortality
- P4 = male offset to descending; set to 0

$$\text{Mortality} = \left(1 - \frac{1 - P3}{1 + e^{\frac{-(L-(P1+P4*male))}{P2}}}\right)$$

Fleet	West	Cen.	East
Commercial Handline/Closed	0.212	0.192	0.247
Commercial Longline	0.221	0.221	0.264
Recreational Charter Boat	0.412	0.169	0.268
Recreational Headboat/Closed	0.406	0.244	0.279
Recreational Private/Closed	0.355	0.297	0.315

P1 and P2 fixed to force discard mortality to apply equally to all lengths

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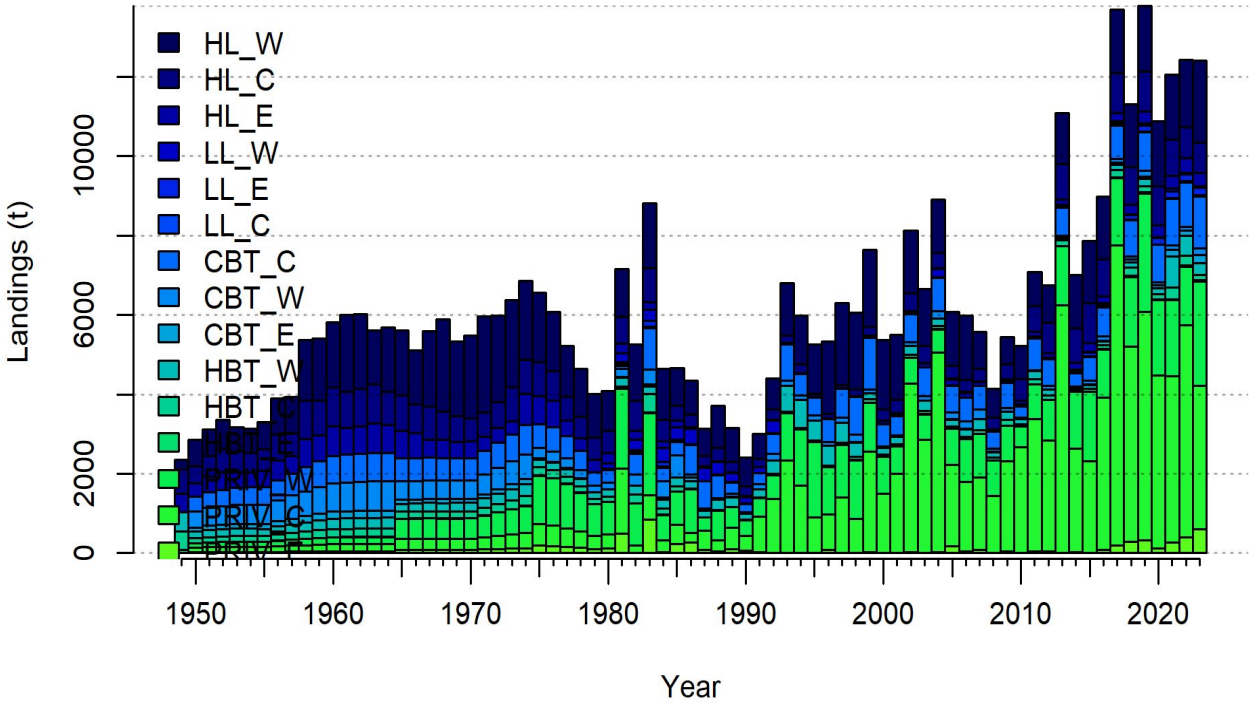
Outline

- Data Review
  - Stock definition
  - Assessment history
  - Regulations
  - Key data decisions
  - Life history
  - Removals
  - Size composition
  - Age composition
  - Indices of abundance
  - Survey composition



- Assessment model
  - Model building
  - AP Model configuration
  - **AP Model results**
  - AP Model diagnostics
  - AP Model sensitivities
  - AP Model projections

Landings (mt)

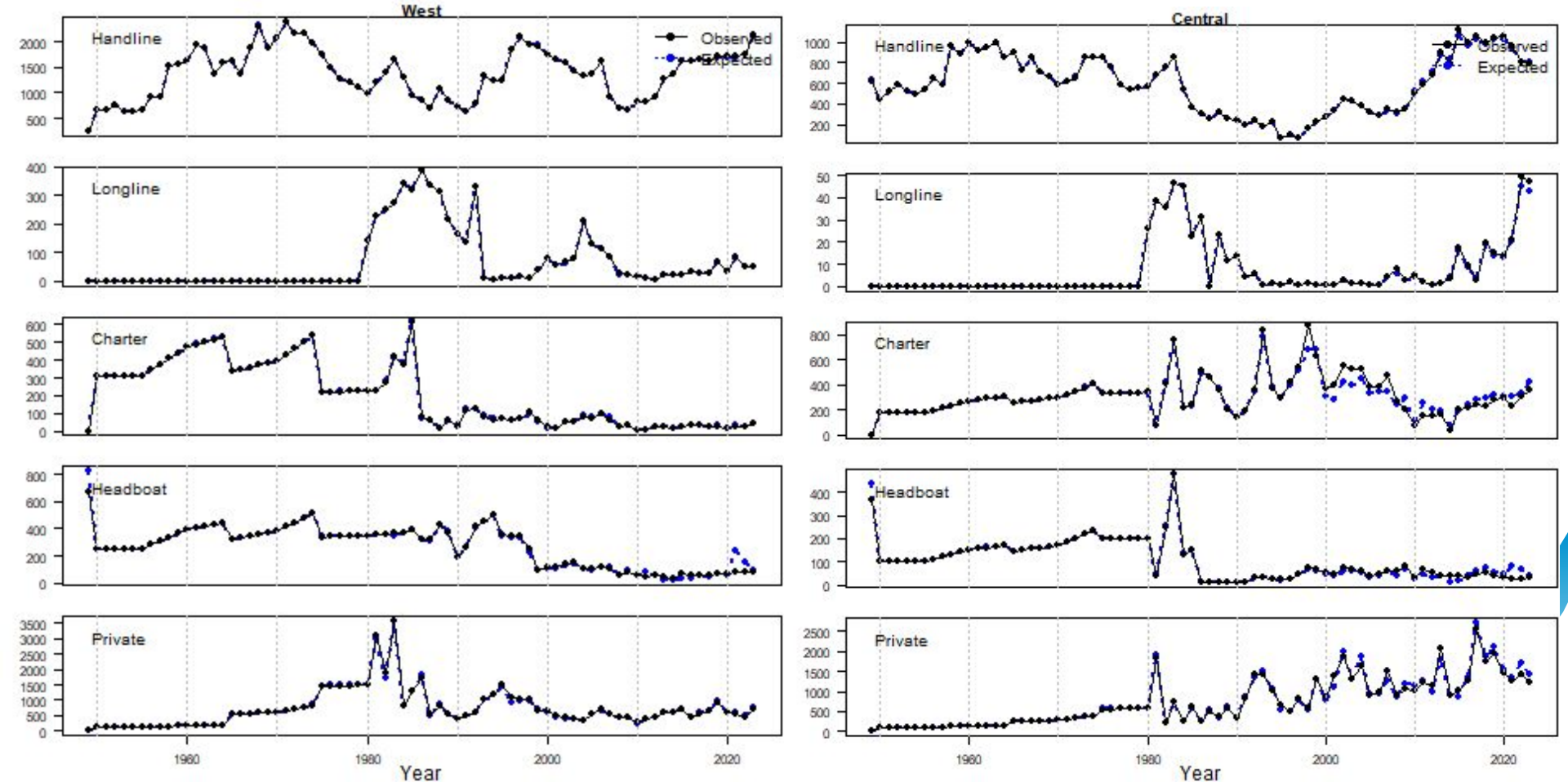


- Commercial fleets (black to dark blue)
- CBT (light blues)
- HBT (dark greens)
- PRIV (light greens)

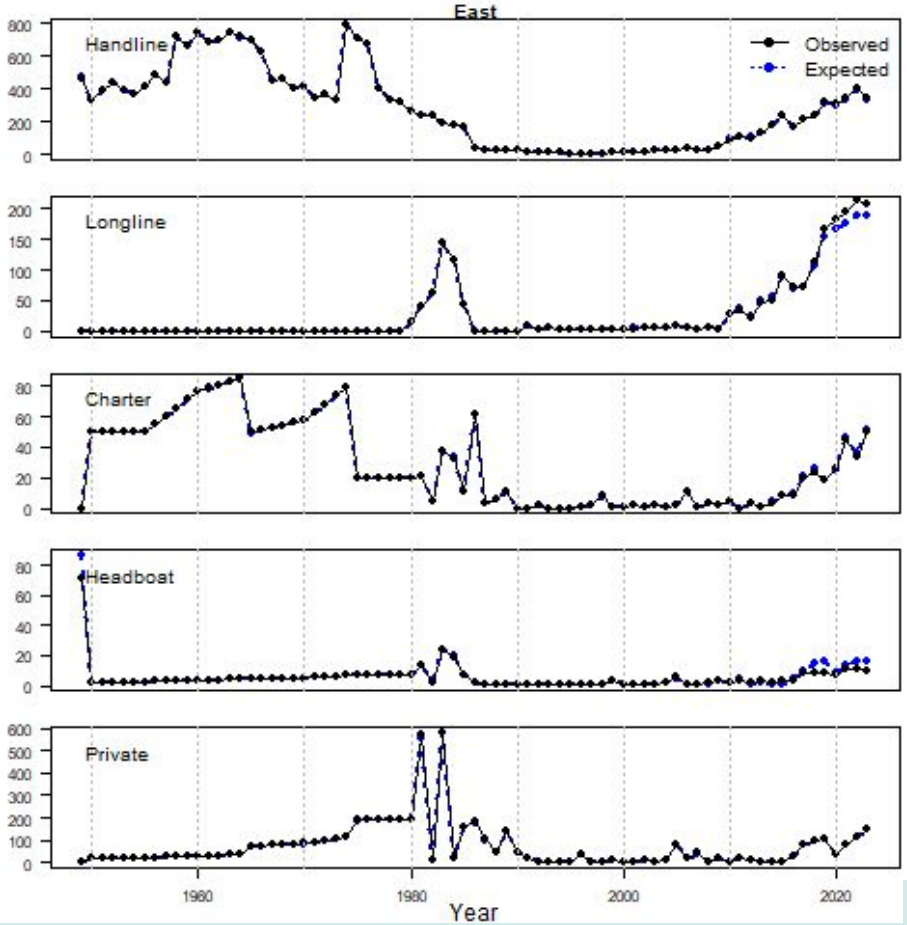
Notable increase in recreational landings over time. Mainly PRIV Central

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Log-scale SE fixed at 0.05 and 0.15 for comm. and rec., respectively



Log-scale SE fixed at 0.05 and 0.15 for comm. and rec., respectively



- Sensitivity run done exploring uncertainty assumptions.
- Model highly unstable if, at a minimum, early landings are not estimated as essentially known.

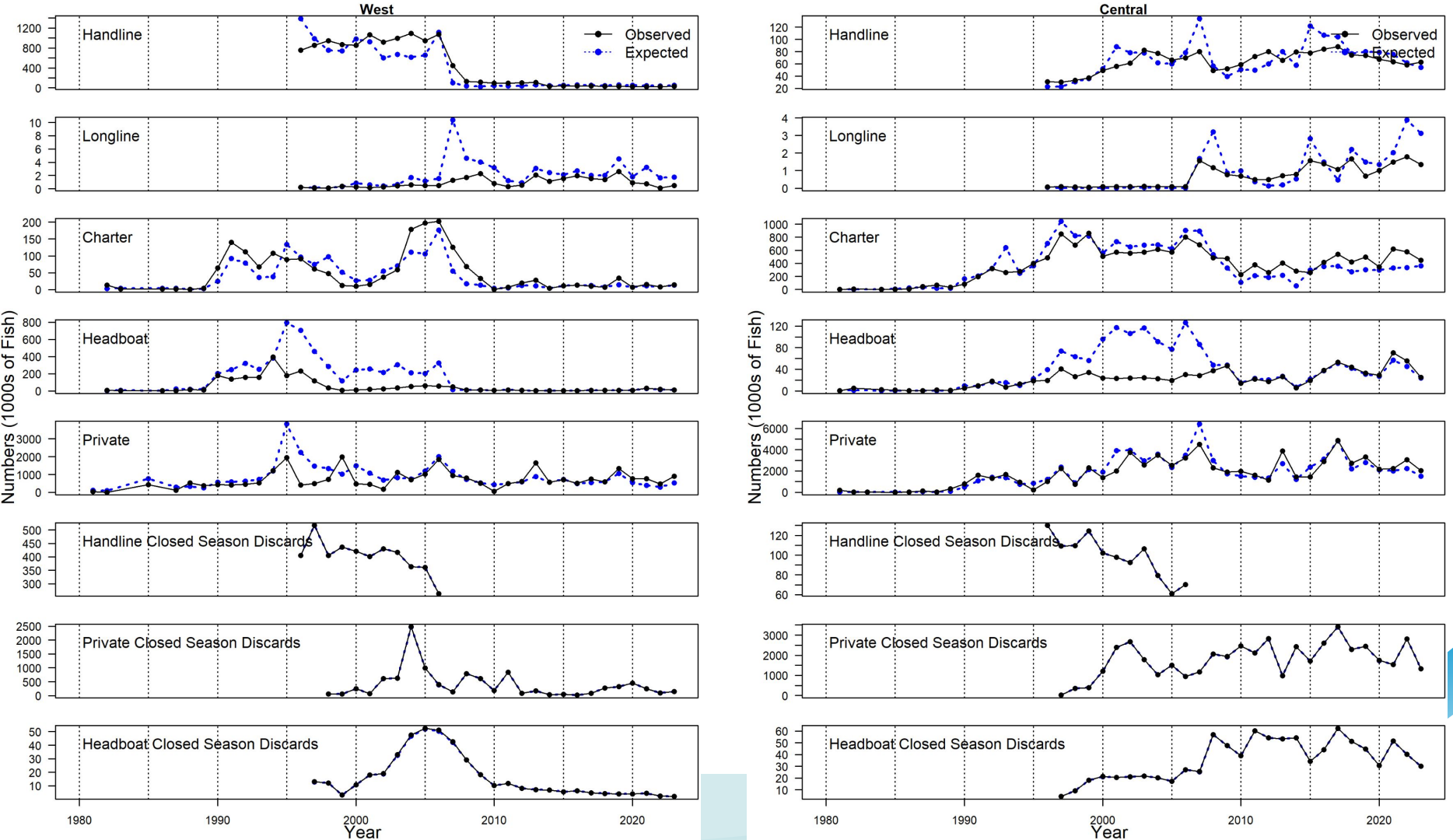
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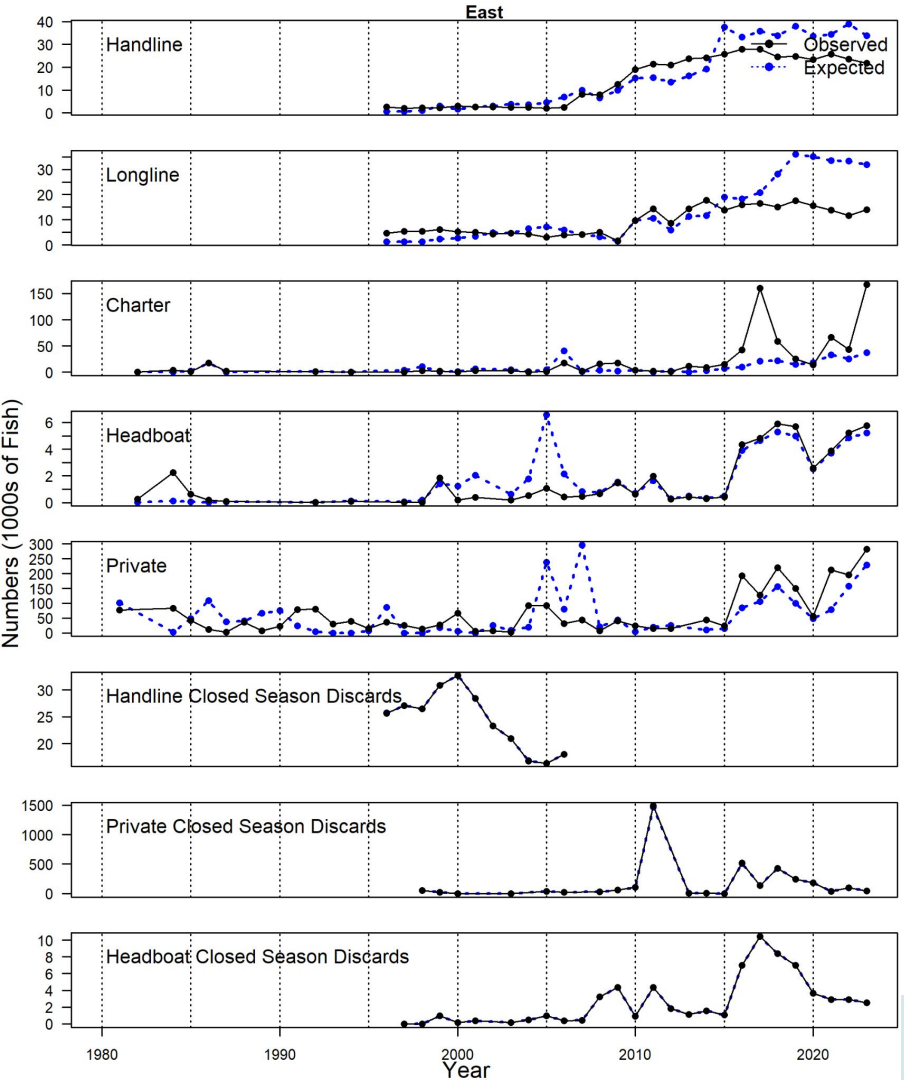
Discards (Open and Closed)

- Open Season - Modeled through length-based retention functions with DW provided CV's (large for most fleets).

- Closed Season - Modeled as 100% discard with selectivity either mirrored to open season fleet or estimated (HBT) when season-specific comp was available and robust.

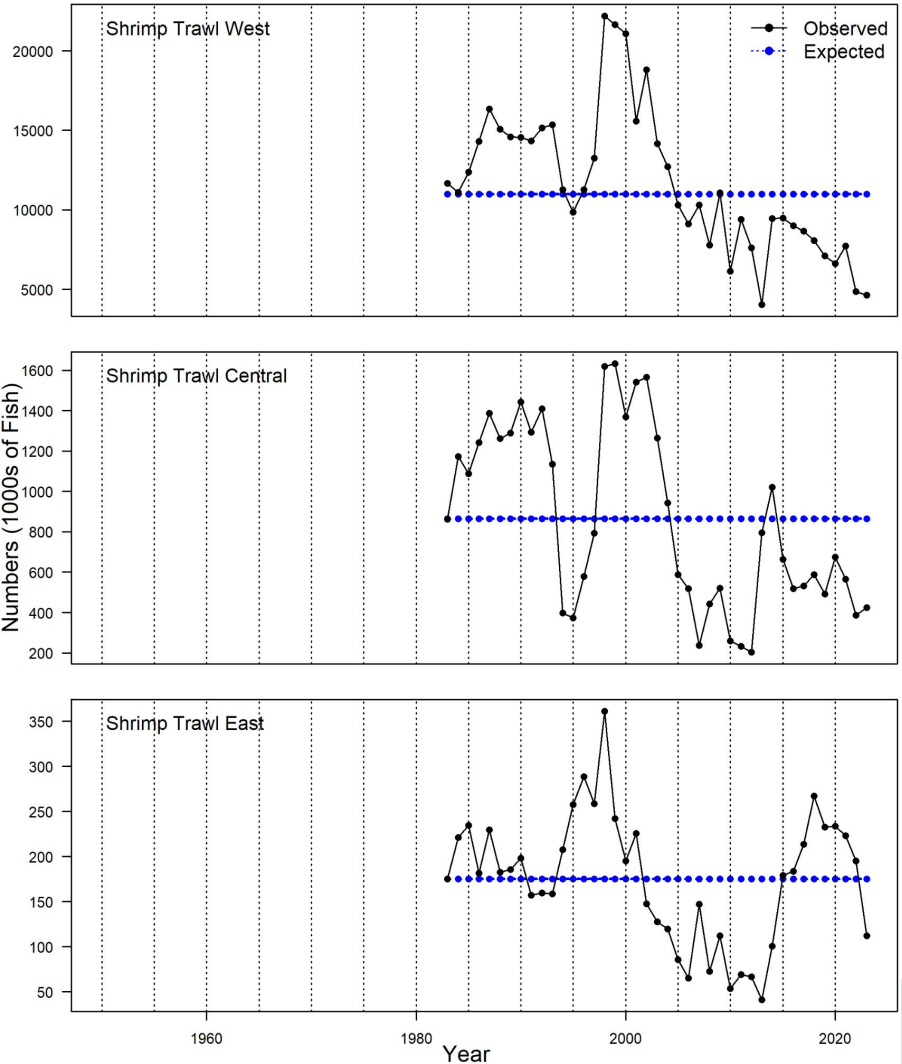
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West
Central
Handline
Longline
Charter
Headboat
Private
Handline Closed Season Discards
Private Closed Season Discards
Headboat Closed Season Discards
Observed
Expected
Numbers (1000s of Fish)
Year
1980
1990
2000
2010
2020



- Fits to the discards are in general much less precise then the fits to the catch which was expected given the modeling approach and large uncertainty around these data.

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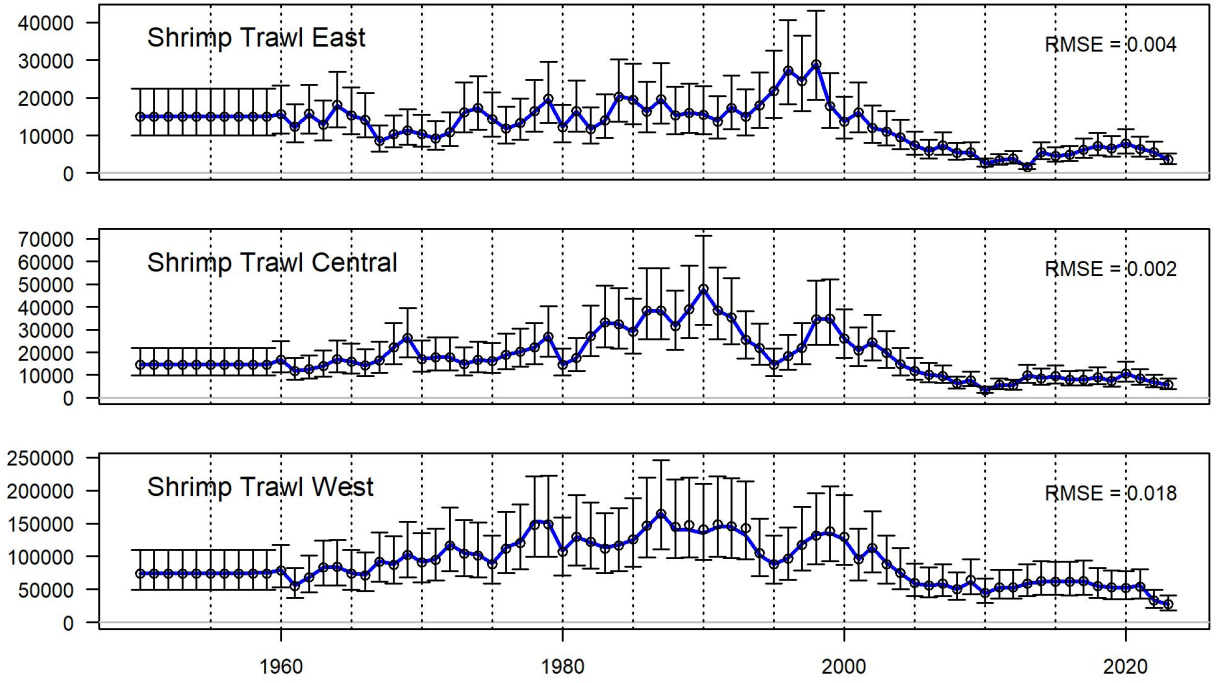
Shrimp Bycatch

- Fit to the median value of the time-series by region with annual *F*s scaled by region-specific time-series of shrimp effort.

- First data point represents the estimated median bycatch value.

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Shrimp Effort



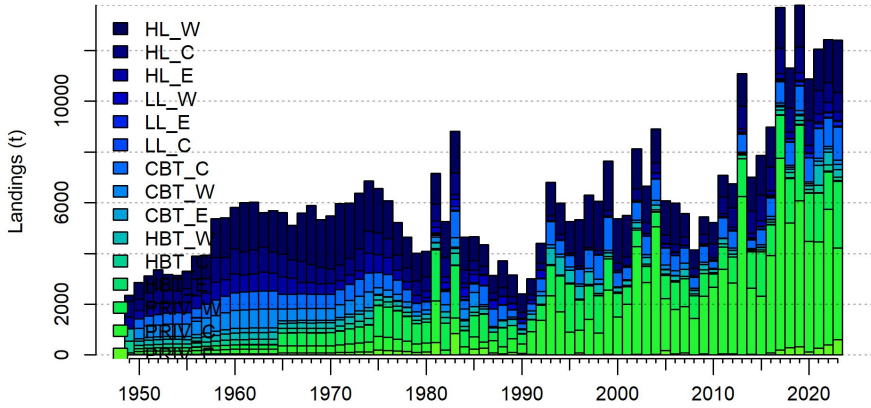
- Shrimp effort indices are used to scale annual *F*s.
- Time-series of effort fit well and therefore dictating annual shrimp bycatch *F* as intended.

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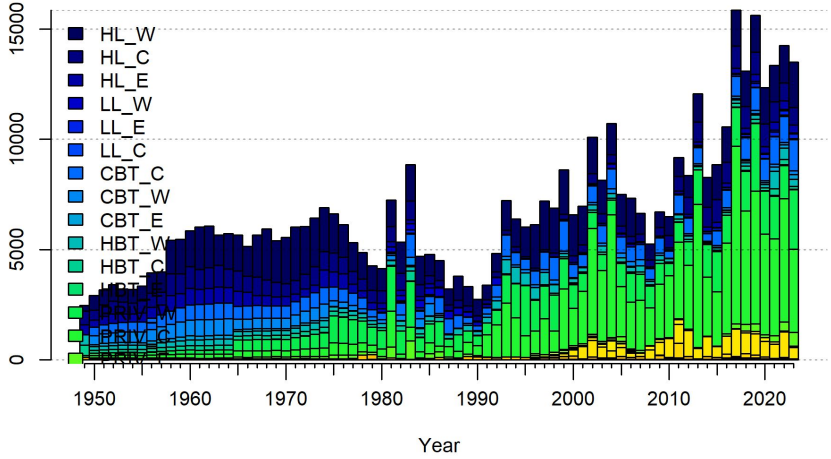
Total Removals

- Recreational fisheries, especially private, are the dominant source of catch and total removals since the mid 1990s.
- Closed season discards (yellow) contribute significant mortality
- Shrimp bycatch (orange) removes large numbers but little biomass since it impacts age-0 fish.

Total Catch

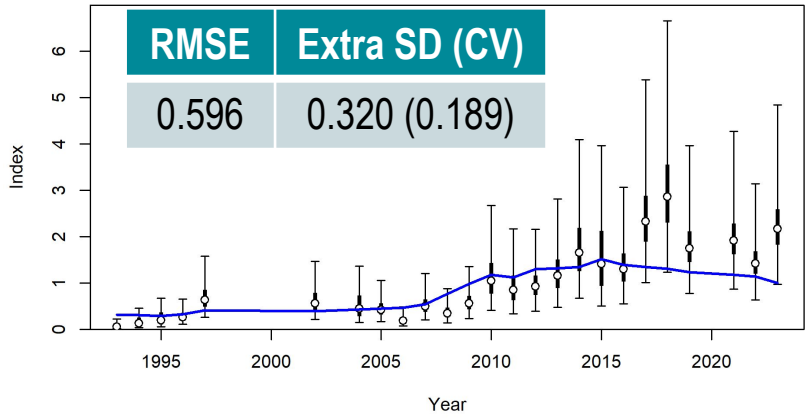


Total Removals

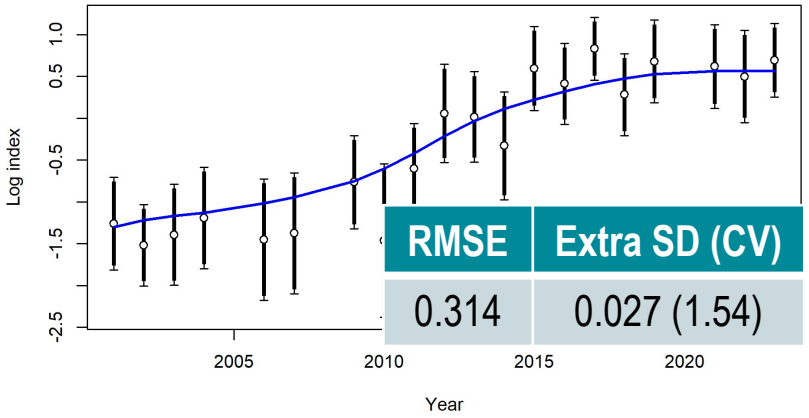


Indices of Relative Abundance (West)

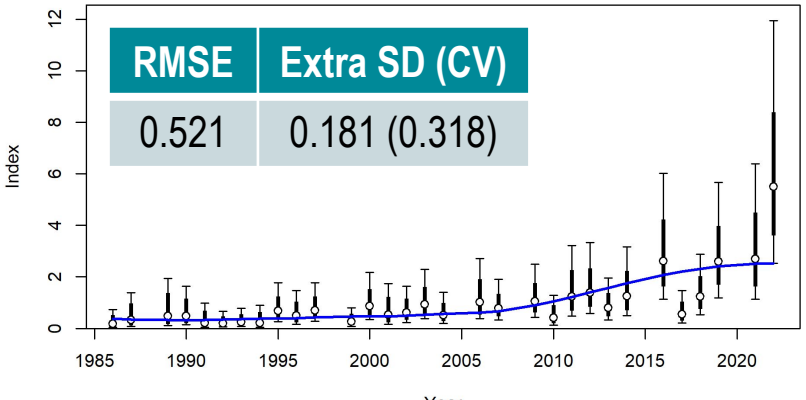
G-FISHER video



BLL



Fall Plankton (SSB)

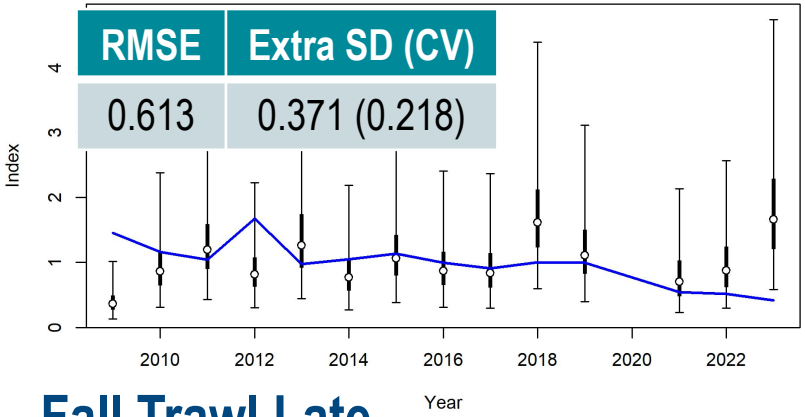


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Indices of Relative Abundance (West)

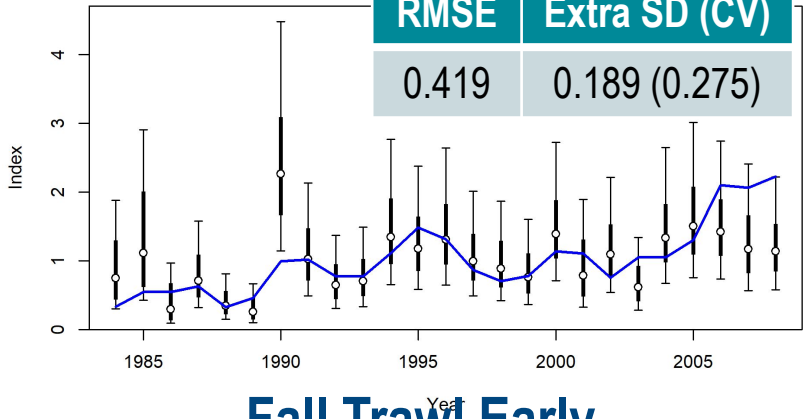
Summer Trawl Late

RMSE	Extra SD (CV)
0.613	0.371 (0.218)



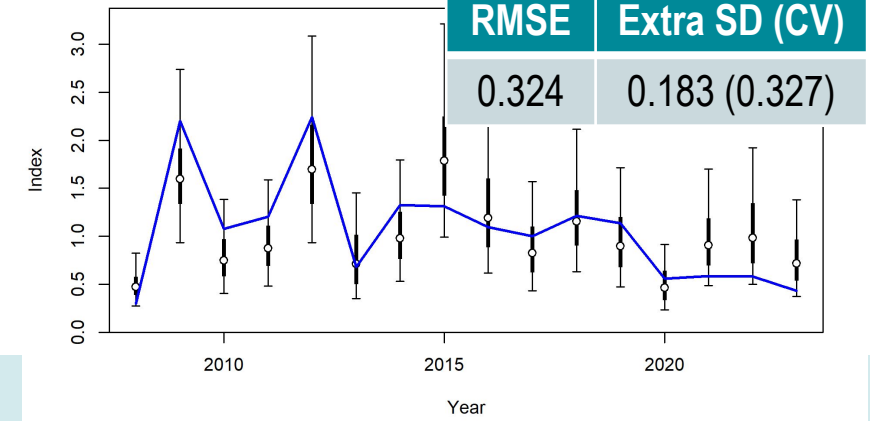
Summer Trawl Early

RMSE	Extra SD (CV)
0.419	0.189 (0.275)



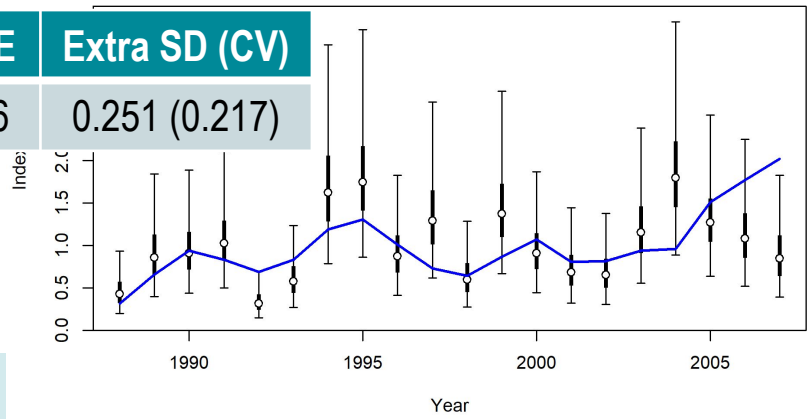
Fall Trawl Late

RMSE	Extra SD (CV)
0.324	0.183 (0.327)



Fall Trawl Early

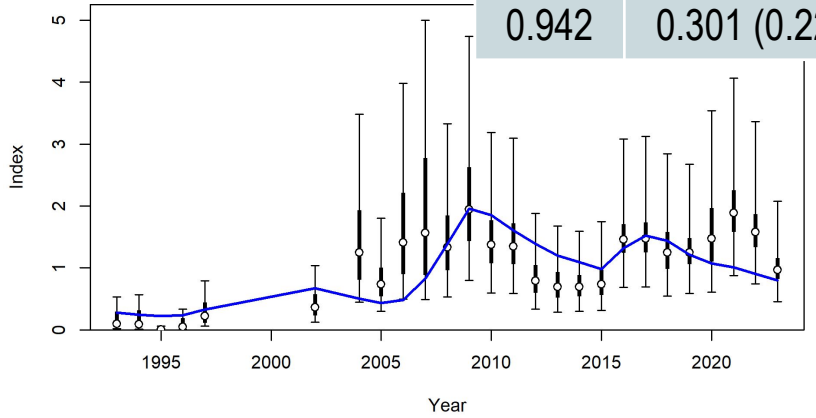
RMSE	Extra SD (CV)
0.406	0.251 (0.217)



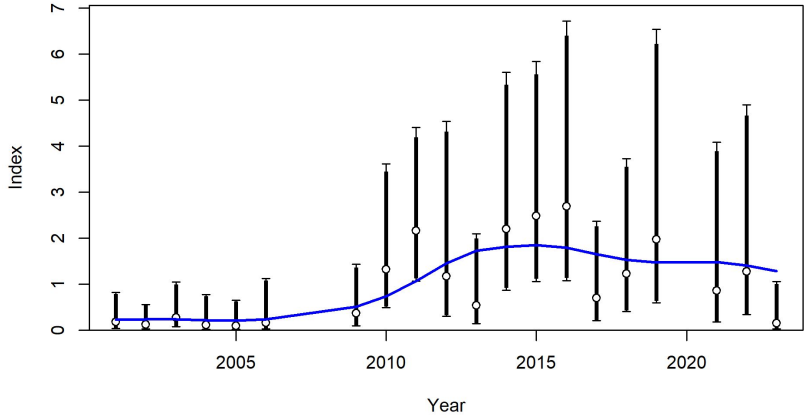
Indices of Relative Abundance (Central)

G-FISHER video

RMSE	Extra SD (CV)
0.942	0.301 (0.224)



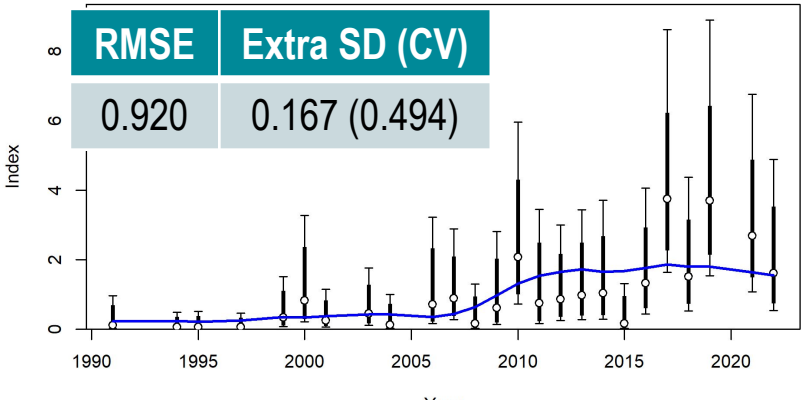
BLL



RMSE	Extra SD (CV)
0.714	0.025 (3.431)

Fall Plankton (SSB)

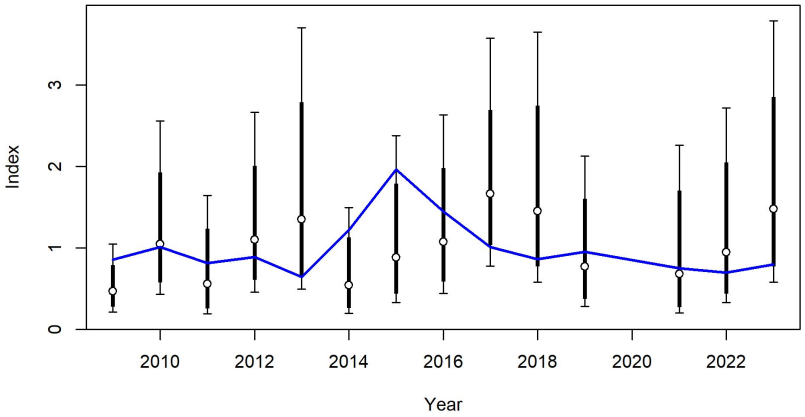
RMSE	Extra SD (CV)
0.920	0.167 (0.494)



NOAA FISHERIES

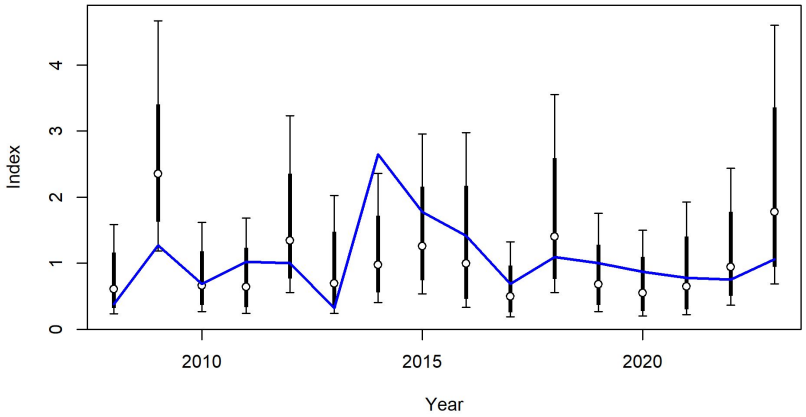
Indices of Relative Abundance (Central)

Summer Trawl Late



RMSE	Extra SD (CV)
0.504	0.145 (0.571)

Fall Trawl Late



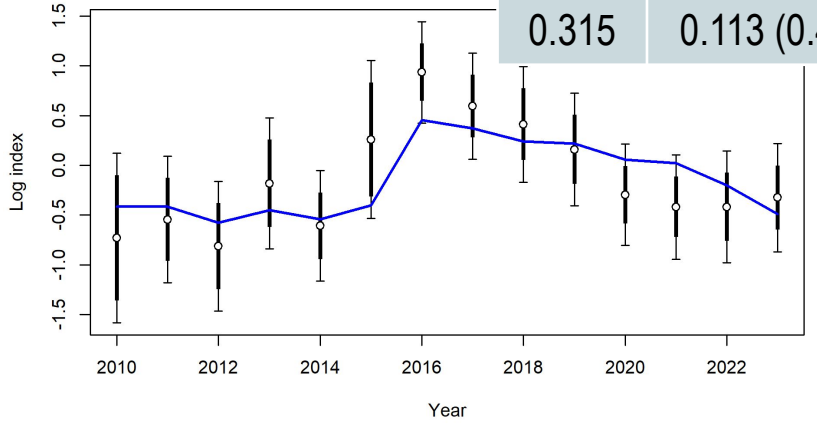
RMSE	Extra SD (CV)
0.477	0.161 (0.445)

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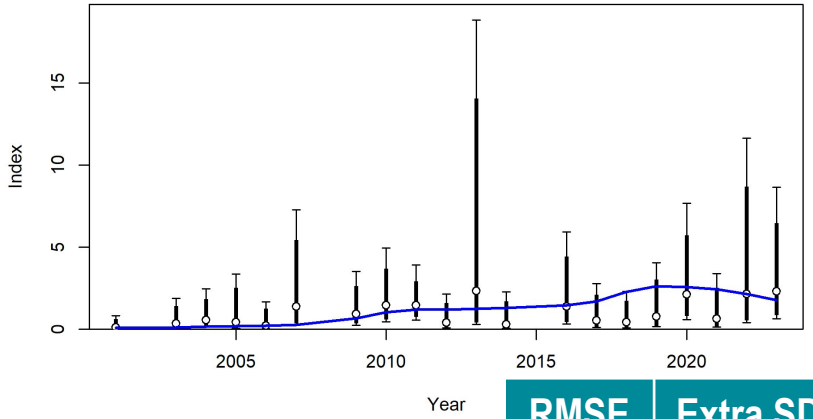
Indices of Relative Abundance (East)

G-FISHER video

RMSE	Extra SD (CV)
0.315	0.113 (0.464)

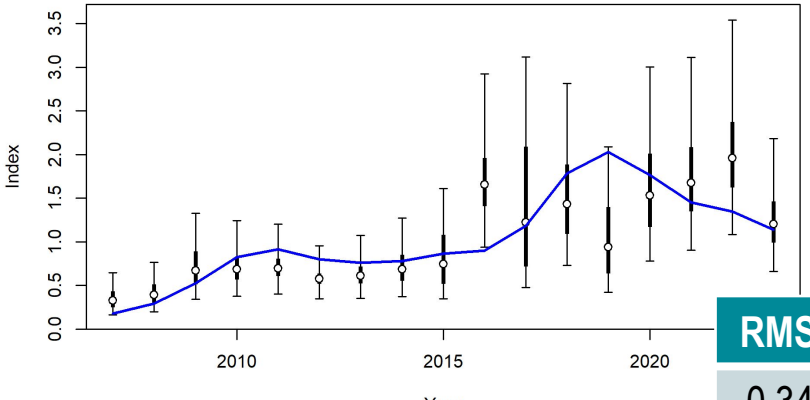


BLL



RMSE	Extra SD (CV)
0.964	0.150 (0.716)

Commercial Observer

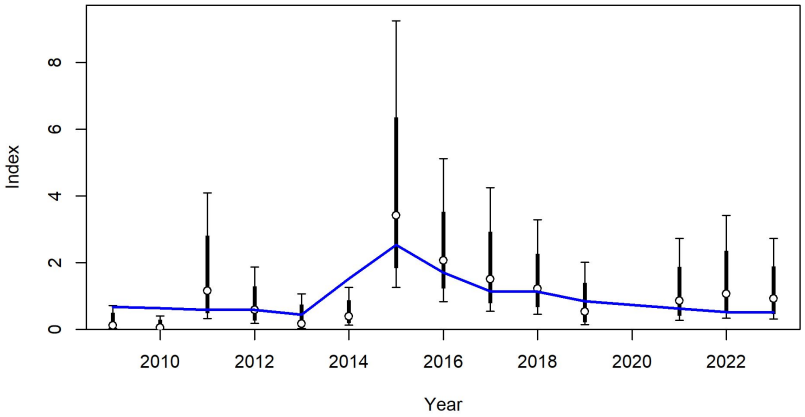


RMSE	Extra SD (CV)
0.343	0.205 (0.248)

NOAA FISHERIES

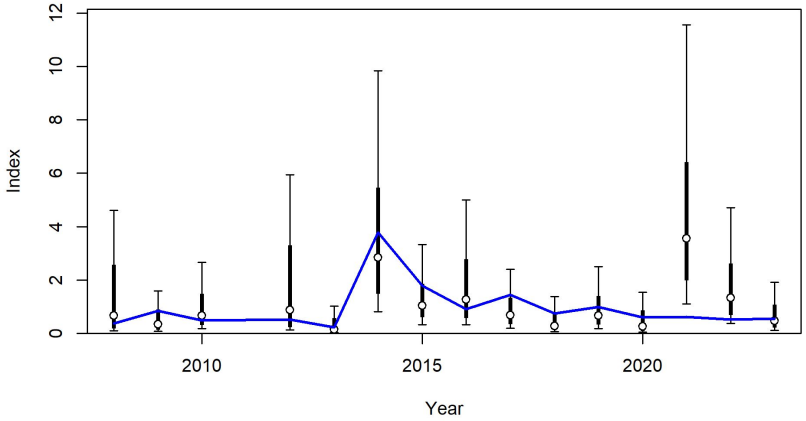
Indices of Relative Abundance (East)

Summer Trawl Late



RMSE	Extra SD (CV)
1.043	0.192 (0.560)

Fall Trawl Late

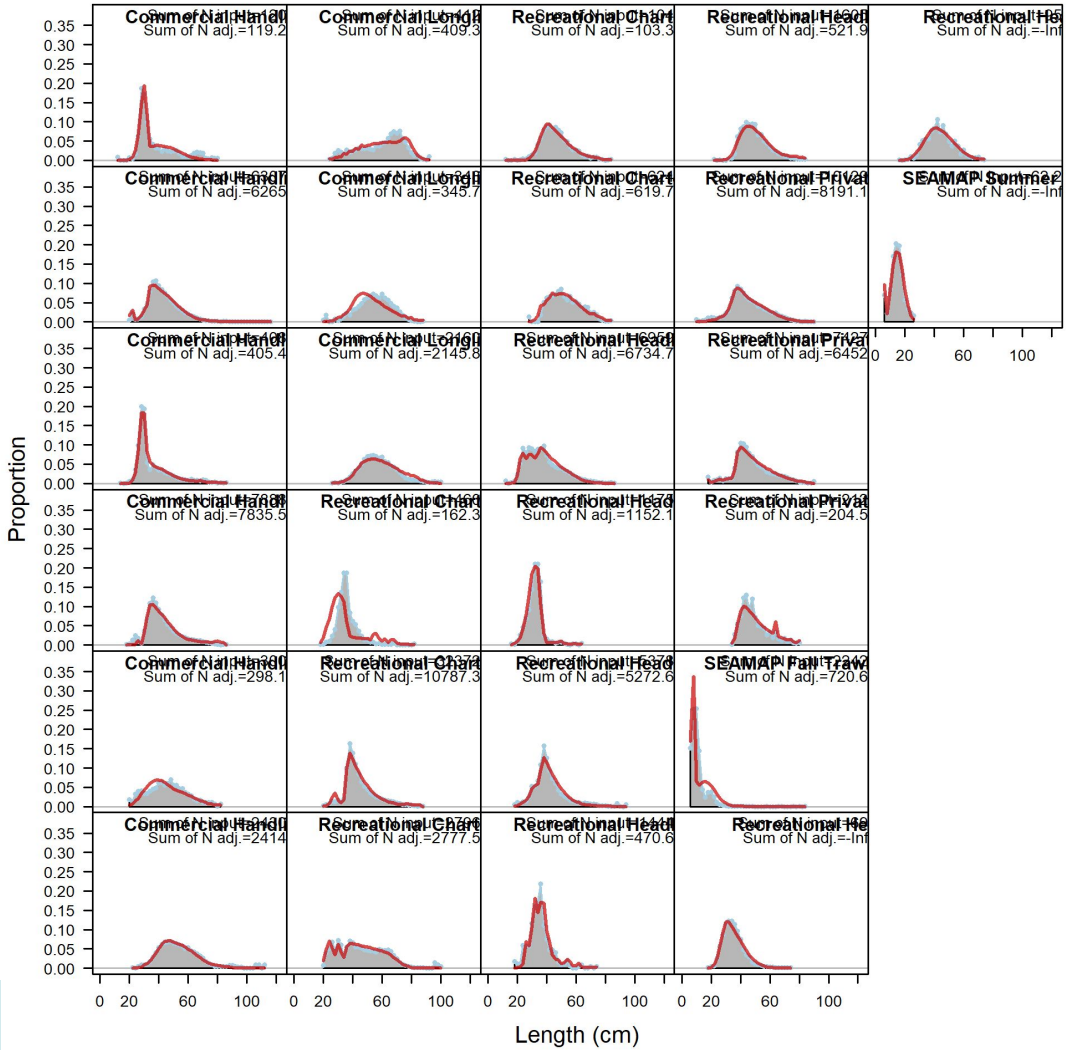


RMSE	Extra SD (CV)
0.761	0.301 (0.306)

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Composition - Length

Aggregate fits to length composition data for landings, discards, and surveys.



Estimated Dirichlet parameters (length)

- To reduce total parameters, Dirichlet parameters were shared across groups of fleets when appropriate.

ln(DM_theta)	Value (CV)
Commercial HL and LL (all areas)	5 (Fixed)
Charter Boat - Central	-0.54 (0.13)
Charter Boat - West & East	4.99 (Fixed)
Headboat - West & Central	4.86 (0.14)
Headboat - East	-0.62 (0.17)
Private (all areas)	3.11 (0.13)
Early Fall Trawl - West	-0.80 (0.16)

- Generally, the model increased the relative weight of the length composition. Fixed DM parameters done after model bounded

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Estimated Dirichlet parameters (Age)

- To reduce total parameters, Dirichlet parameters were shared across groups of fleets when appropriate.

ln(DM_theta)	Value (CV)
Commercial Handline (all areas)	-1.93 (0.01)
G-FISHER Video (all areas)	4.99 (Fixed)
Commercial Longline (West)	4.99 (Fixed)
Commercial Longline (East)	-0.54 (0.09)
Bottom Longline Survey (all areas)	4.48 (0.17)
Charter Boat, Headboat, and Private (Central and West)	-1.16 (0.01)
Charter Boat, Headboat, and Private (East)	3.54 (0.16)
Fall Trawl survey (all areas)	5 (Fixed)
Commercial Observer Survey (East)	-2.64 (0.04)
Summer Trawl survey (all areas)	5 (Fixed)

G-FISHER and longline were fixed at bound after model estimate. Trawl survey fixed to force fit

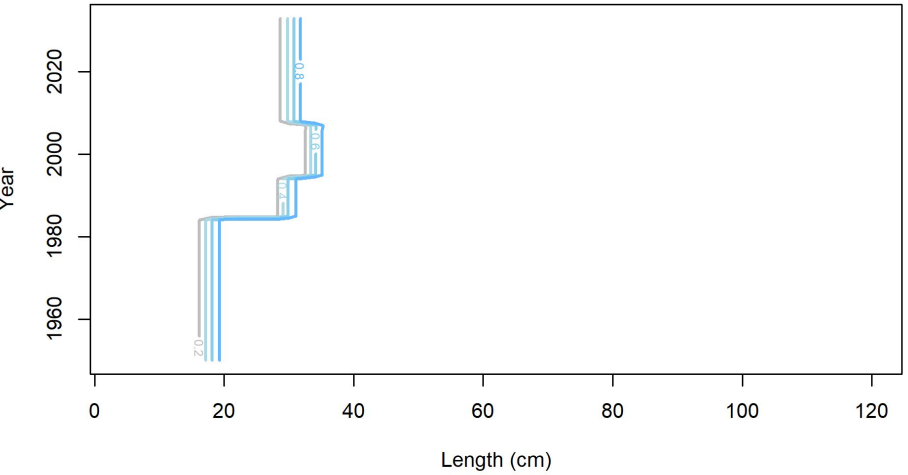
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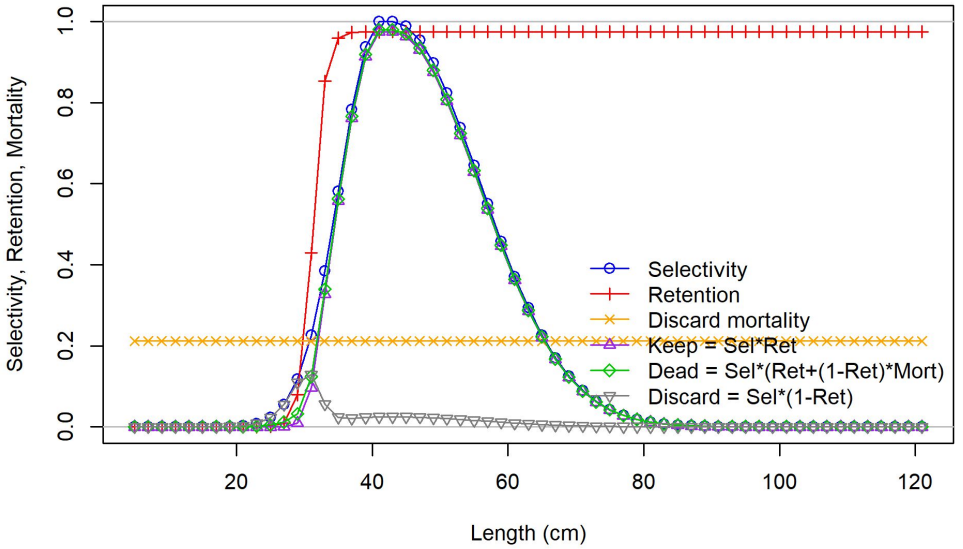
Commercial Fleets:

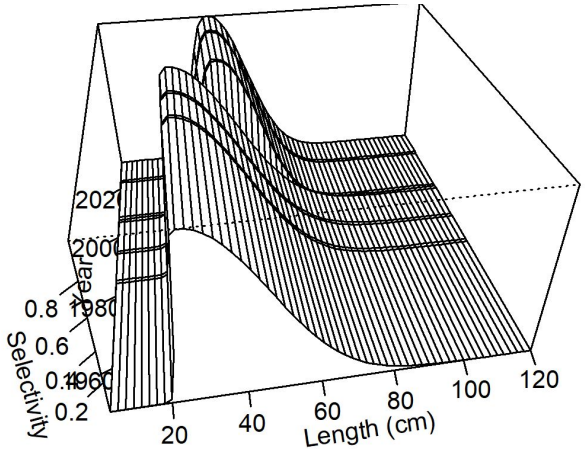
Selectivity, Retention, and Fits to Composition Data

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Commercial Handline (West)





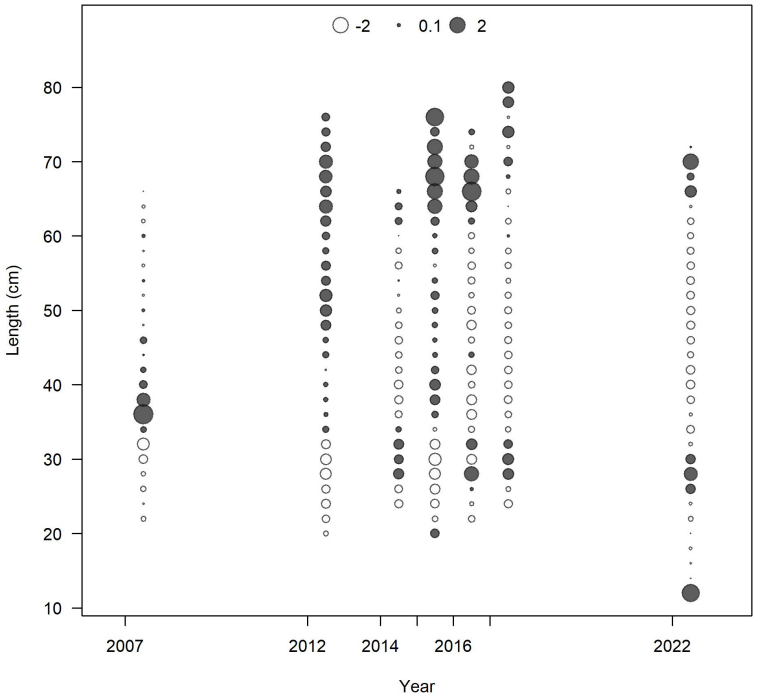


Commercial Handline (West)

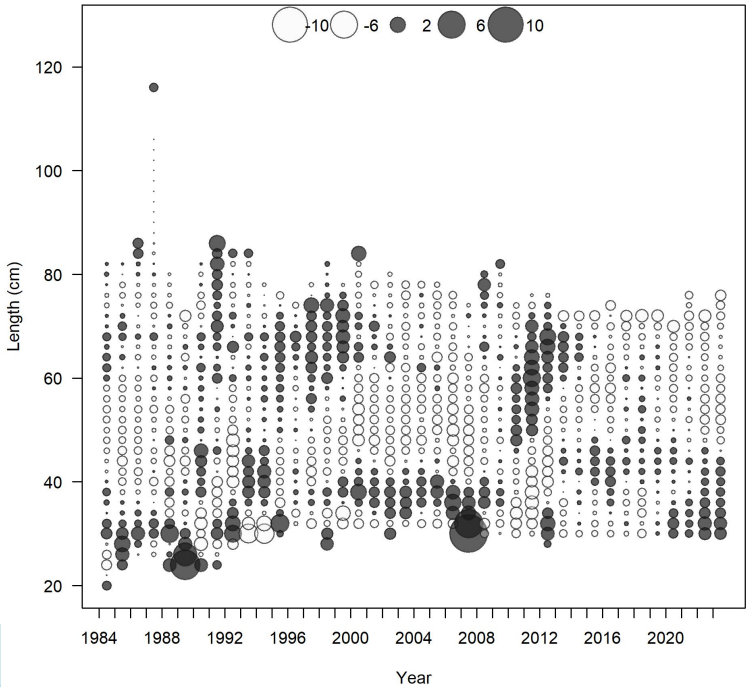
Closed = + (observed > expected)
Open = - (observed < expected)

- Legal sized discards observed and asymptotic retention estimated

Discards



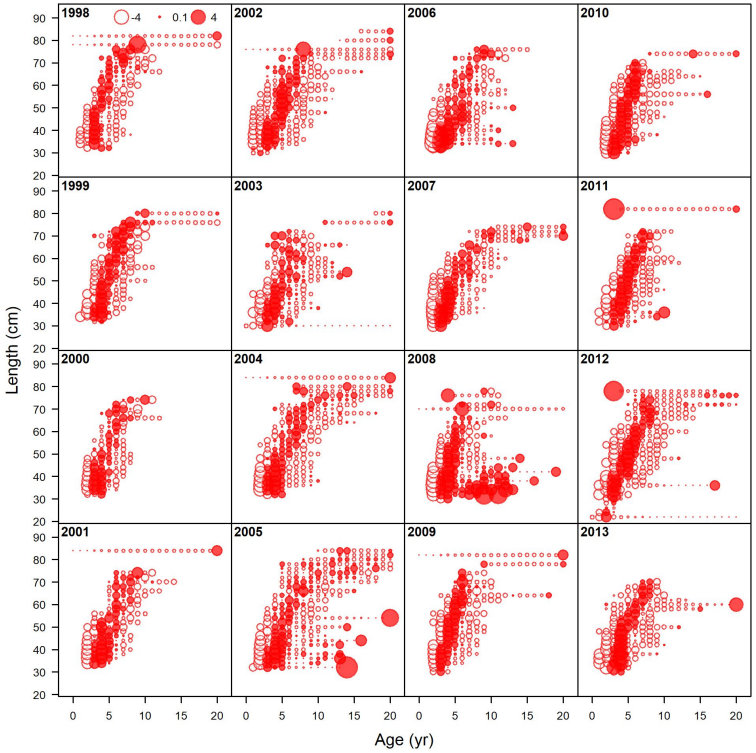
Retained Catch

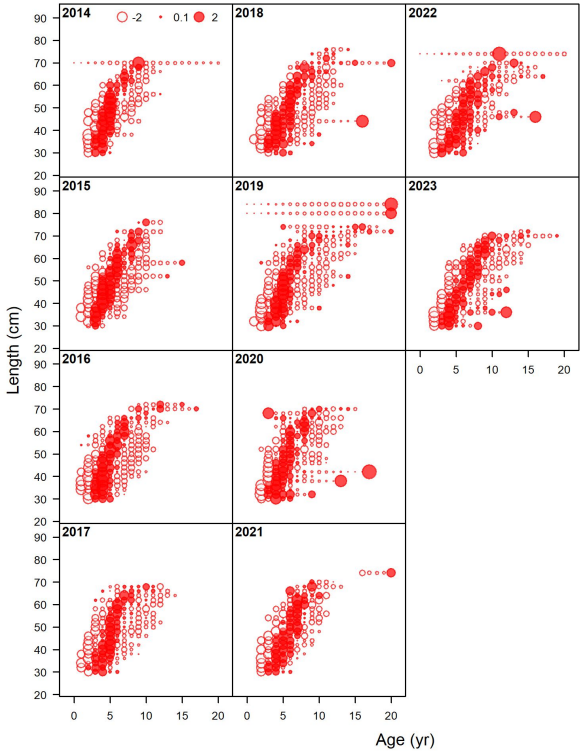


Commercial Handline (West)

Closed = + (observed > expected)
Open = - (observed < expected)

- Conditional age-at-length residuals up to 8.6

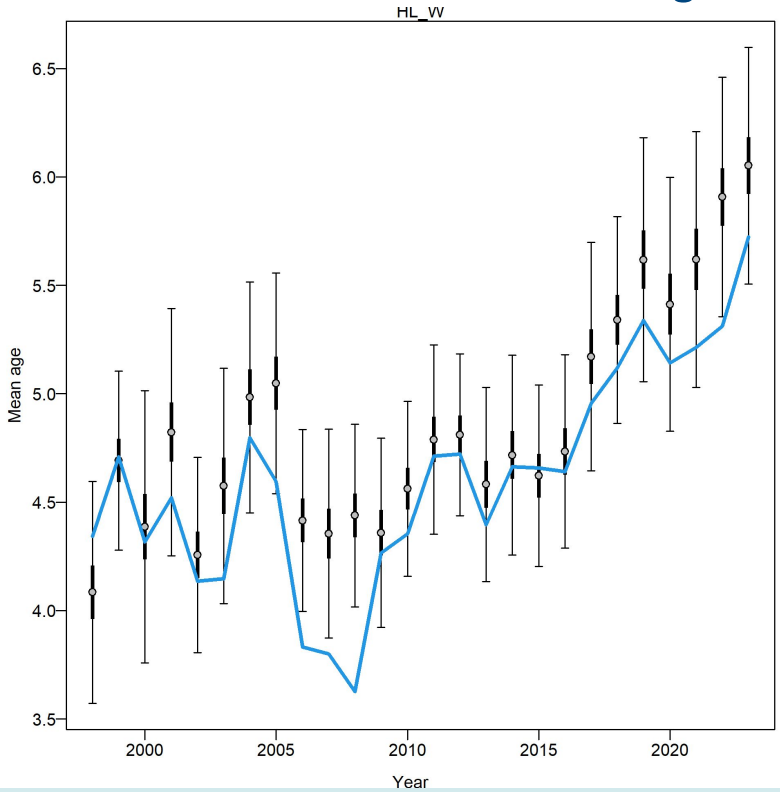




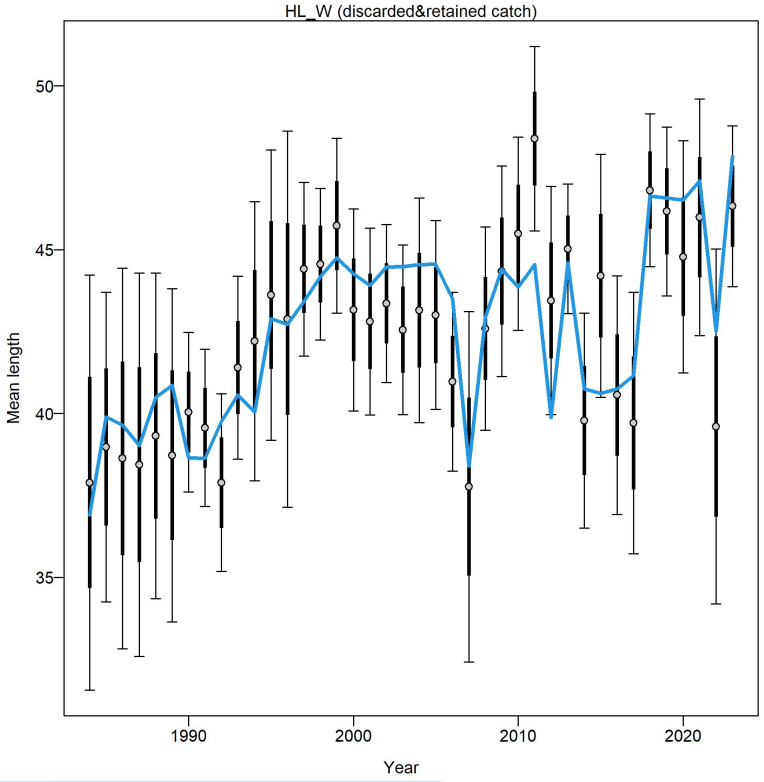
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Commercial Handline (West)

Fit to Mean Retained Age

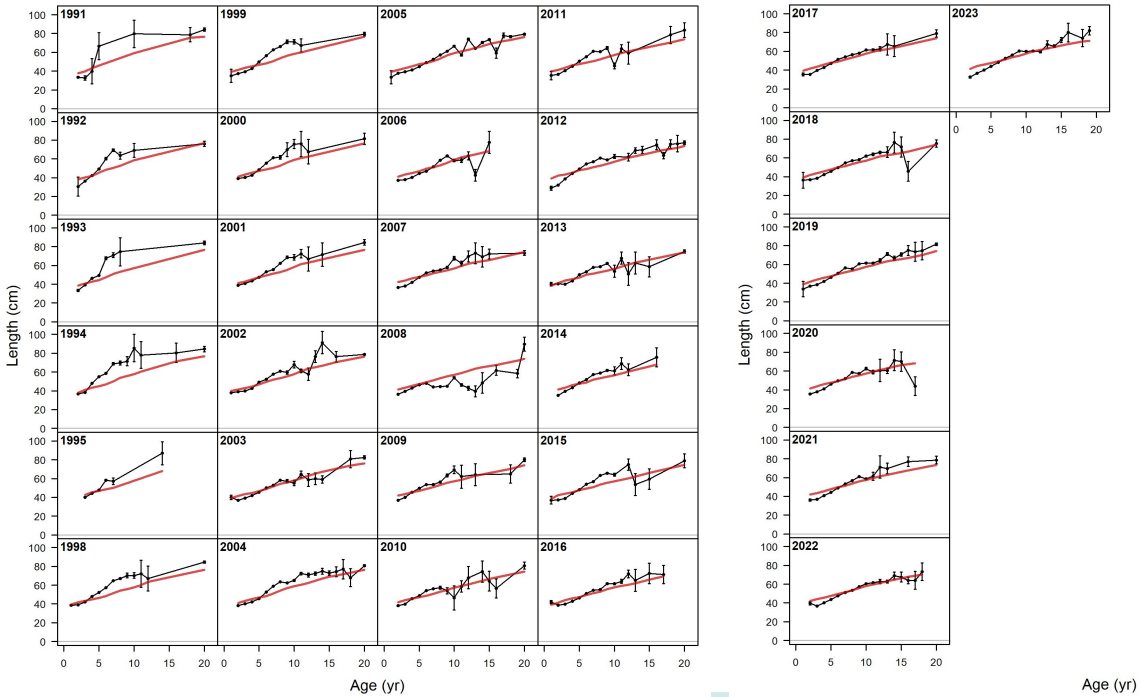


Fit to Mean Length



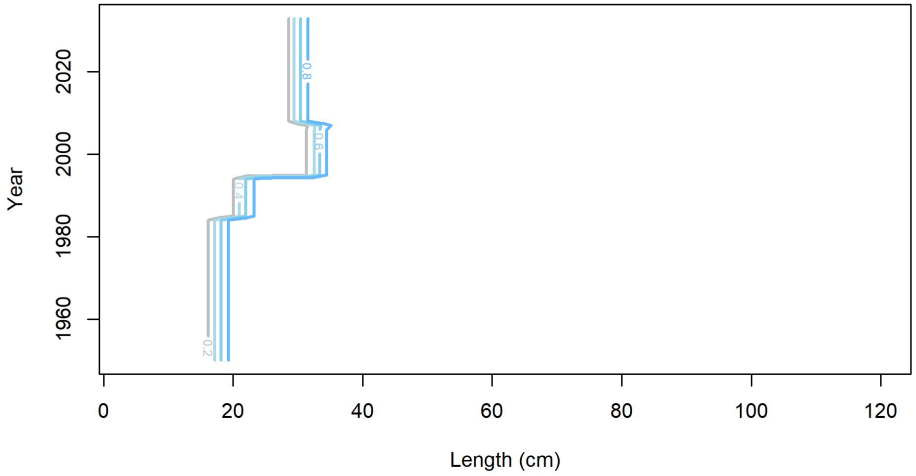
Commercial Handline (West)

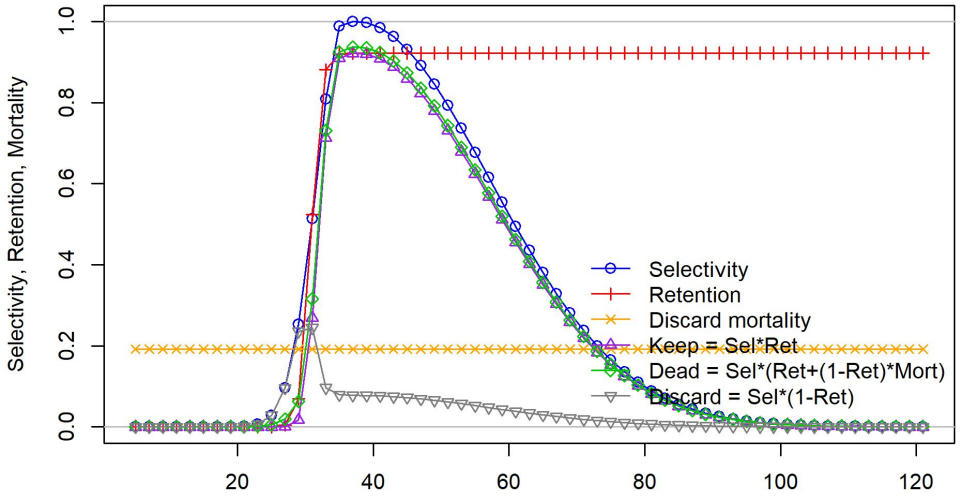
- Expected mean length-at-age* similar to observed data

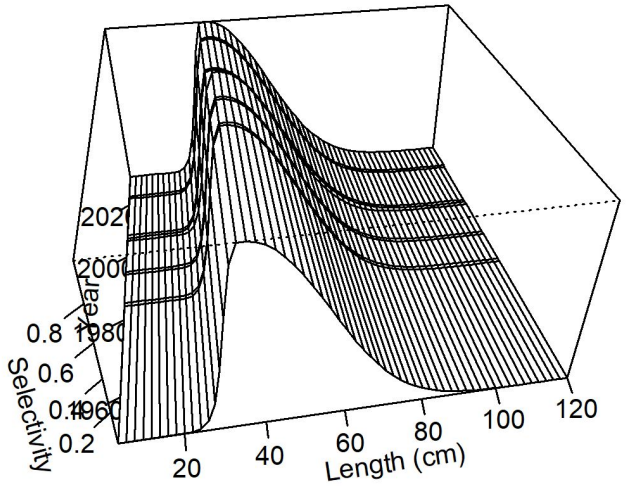


*Not included in likelihood

Commercial Handline (Central)





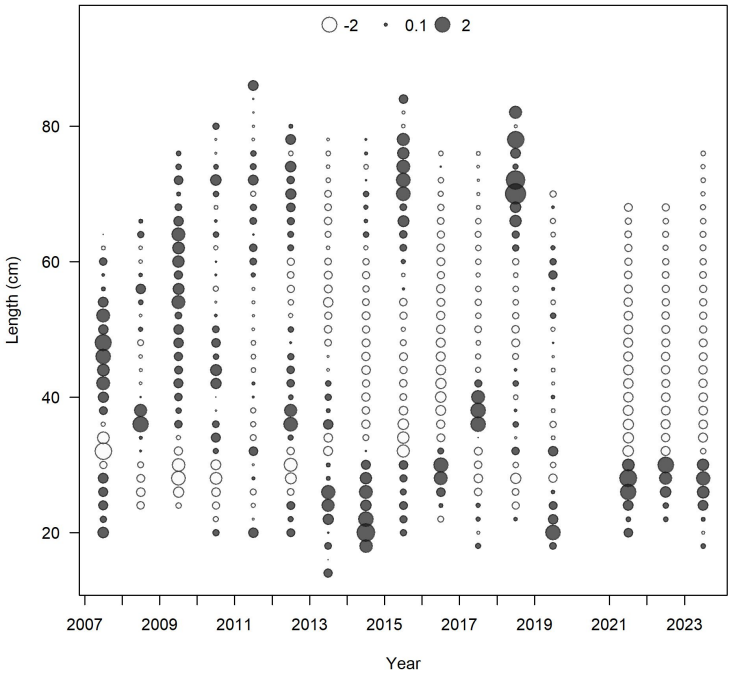


Commercial Handline (Central)

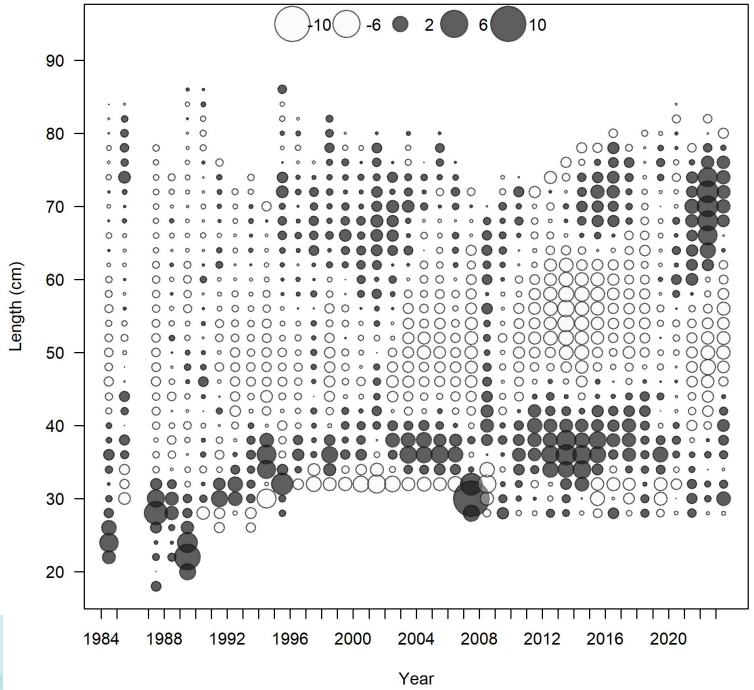
Closed = + (observed > expected)
Open = - (observed < expected)

- Legal sized discards observed and asymptotic retention estimated

Discards



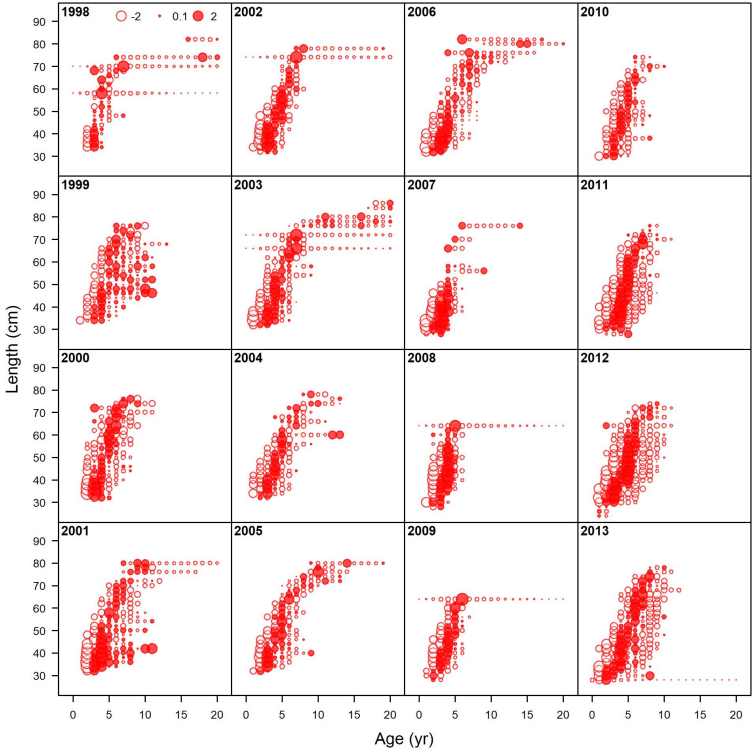
Retained Catch

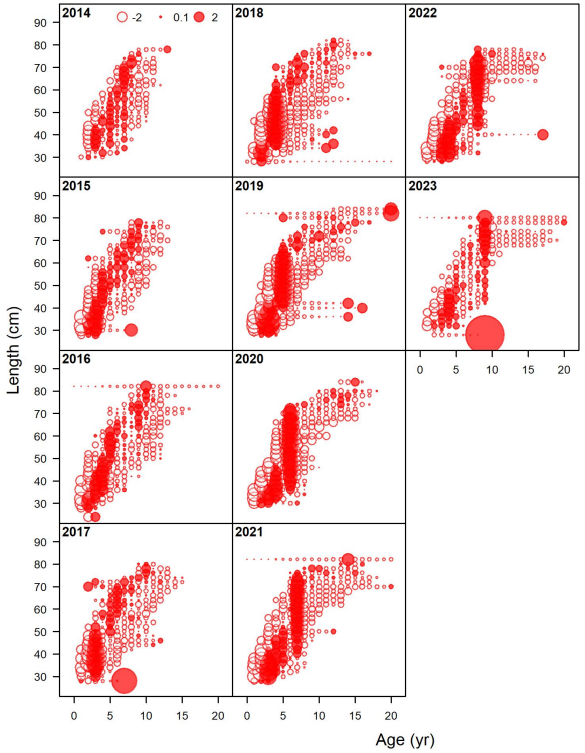


Commercial Handline (Central)

Closed = + (observed > expected)
Open = - (observed < expected)

- Conditional age-at-length residuals up to 28.82

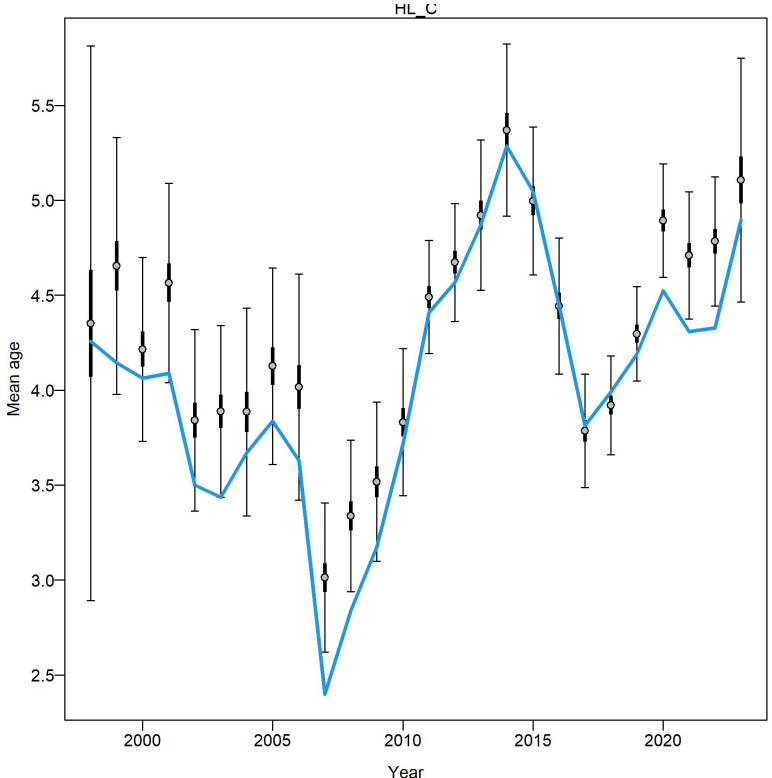




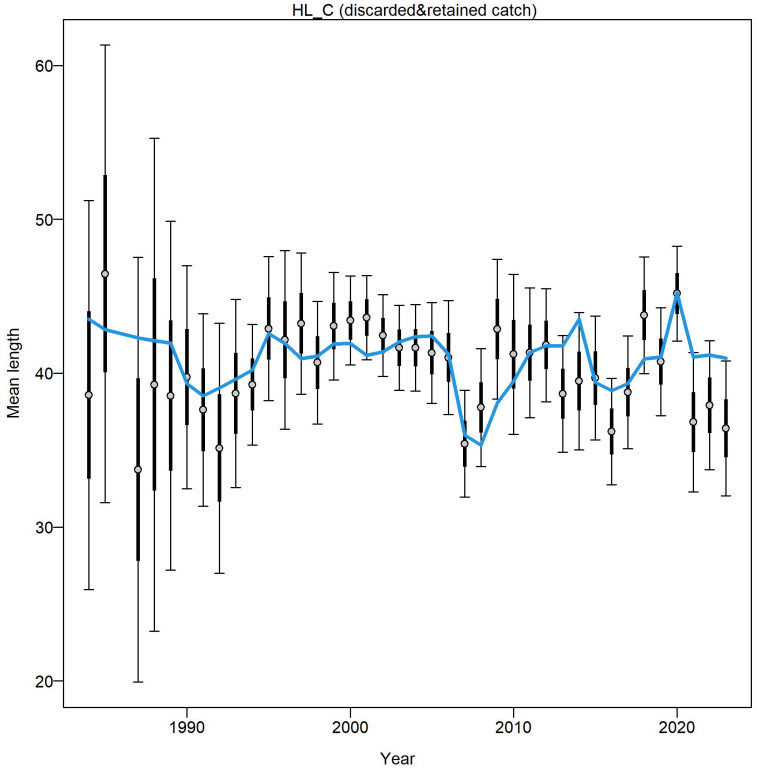
NOAA FISHERIES

Commercial Handline (Central)

Fit to Mean Retained Age

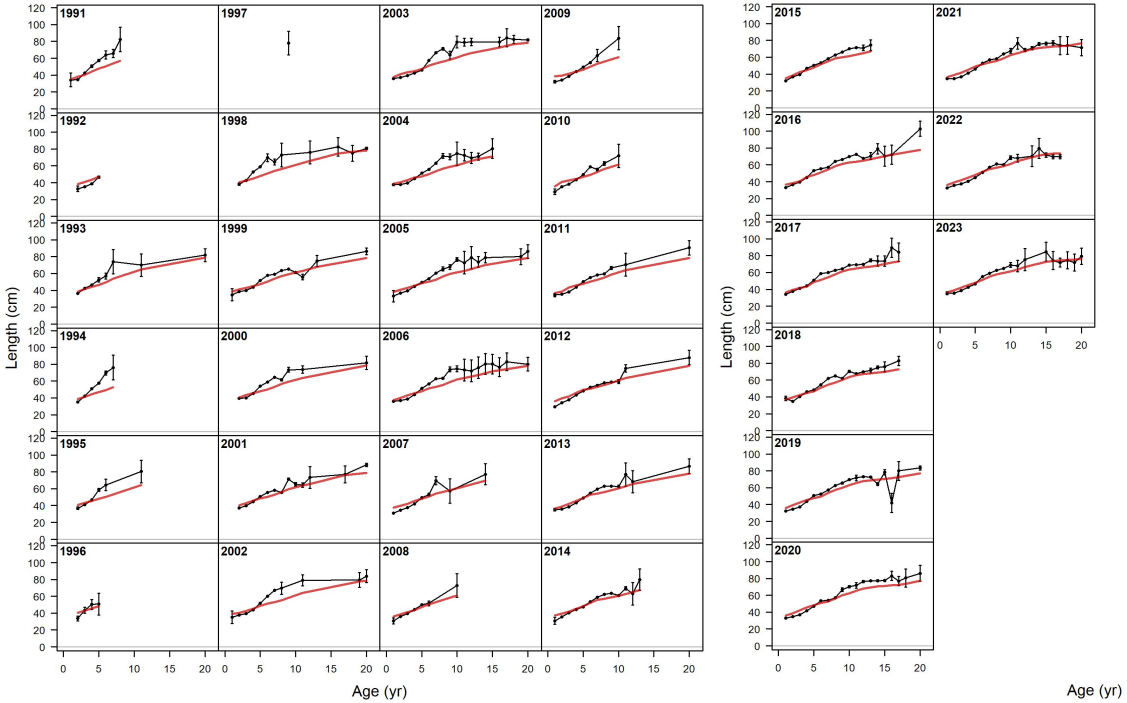


Fit to Mean Length



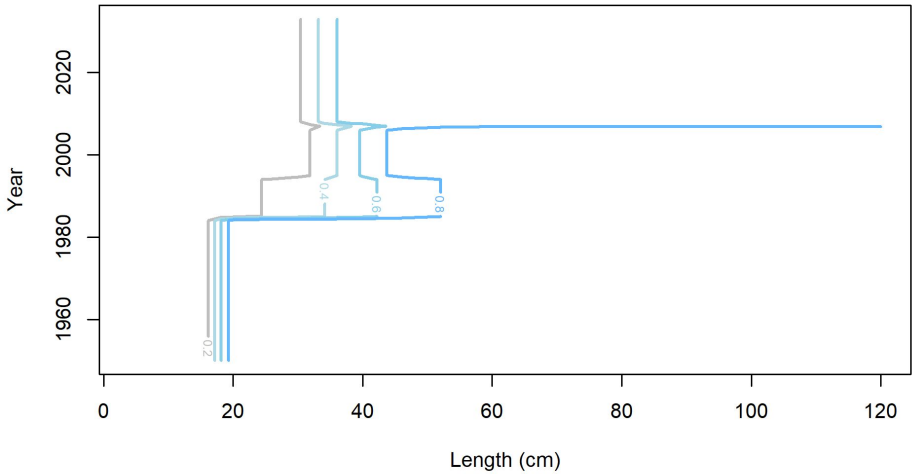
Commercial Handline (Central)

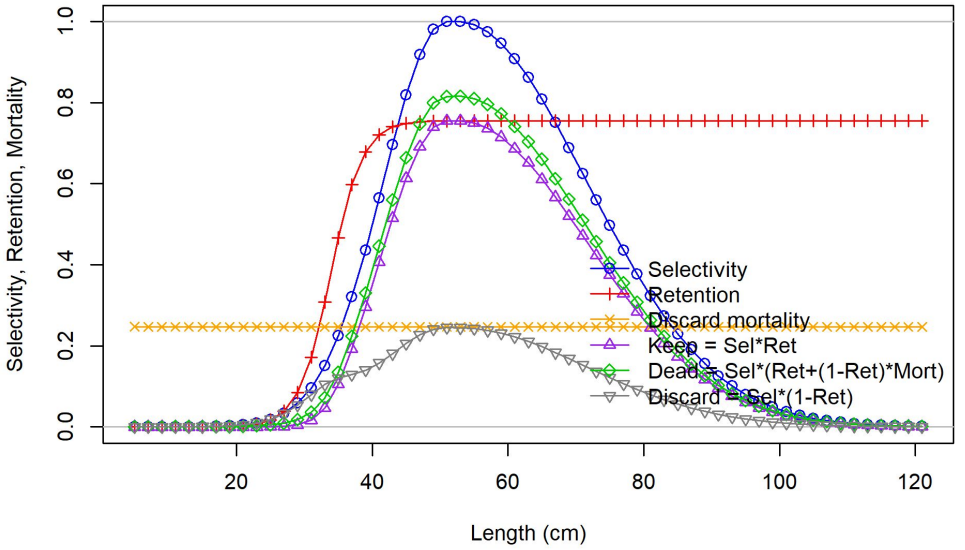
- Expected mean length-at-age* similar to observed data

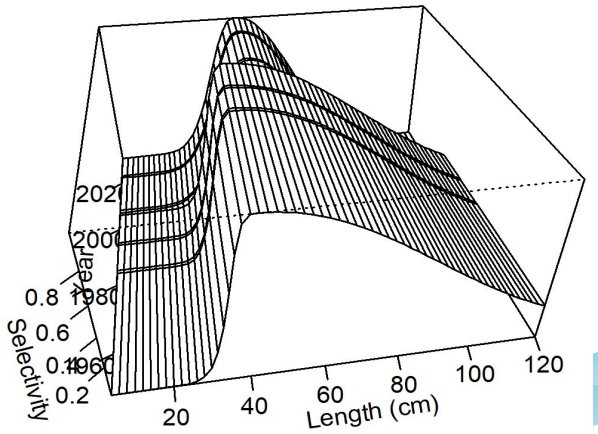


*Not included in likelihood

Commercial Handline (East)





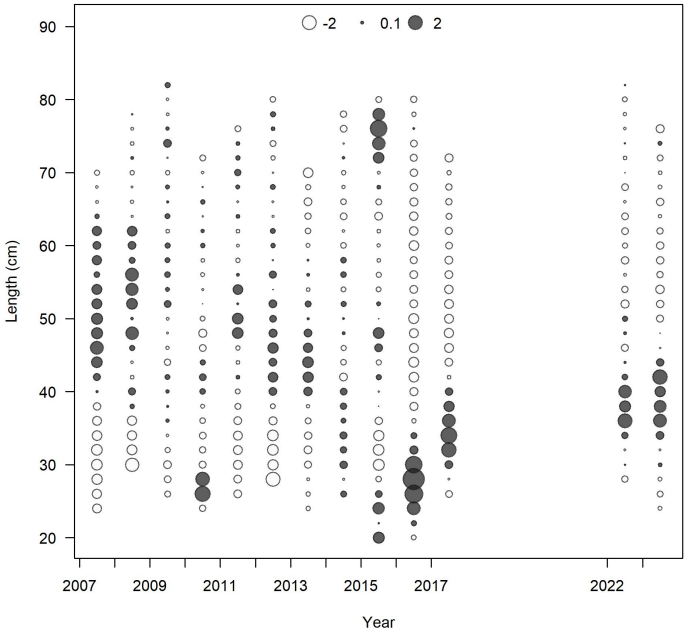


Commercial Handline (East)

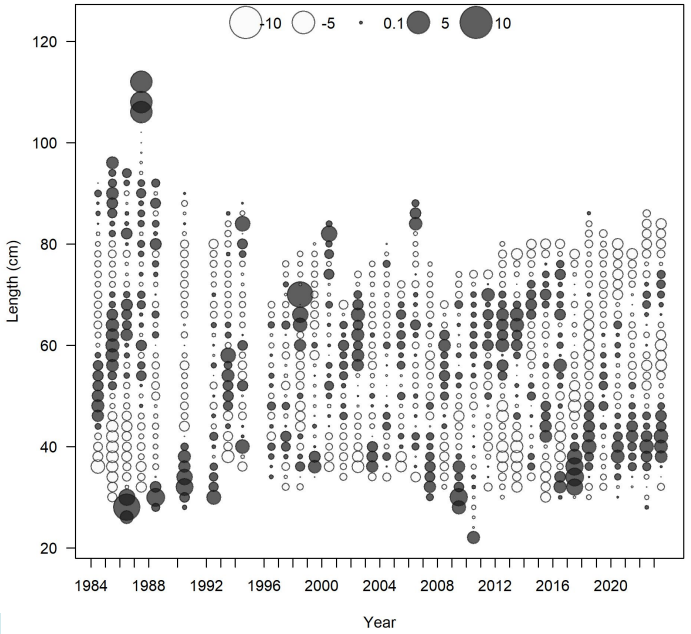
Closed = + (observed > expected)
Open = - (observed < expected)

- Legal sized discards observed and asymptotic retention estimated

Discards



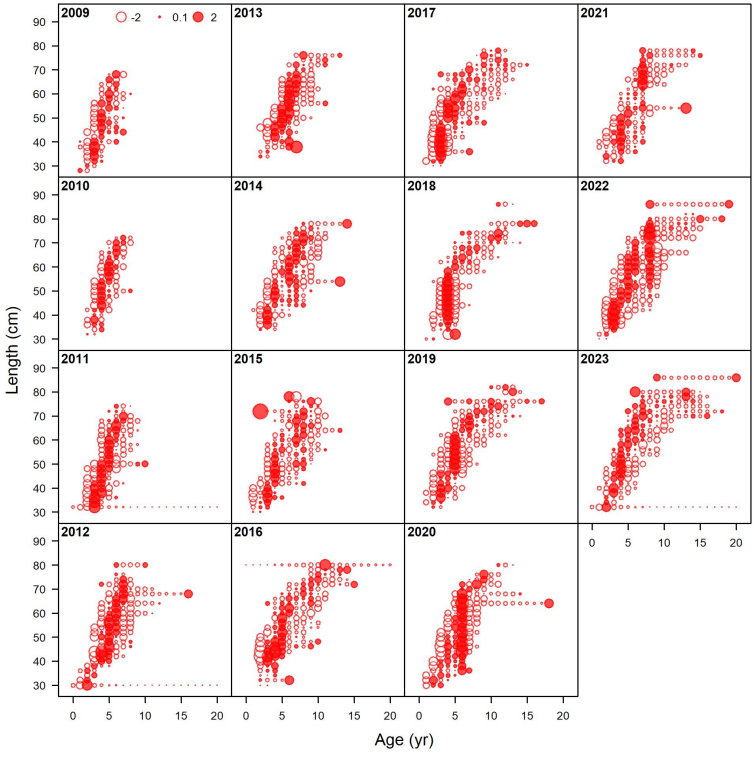
Retained Catch



Commercial Handline (East)

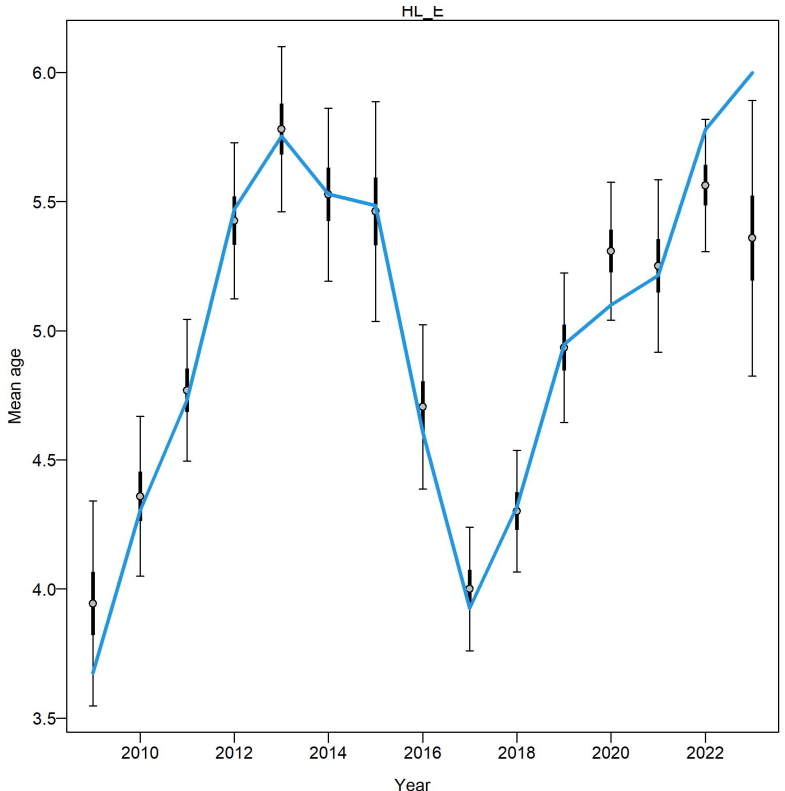
Closed = + (observed > expected)
Open = - (observed < expected)

- Conditional age-at-length residuals up to 4.59

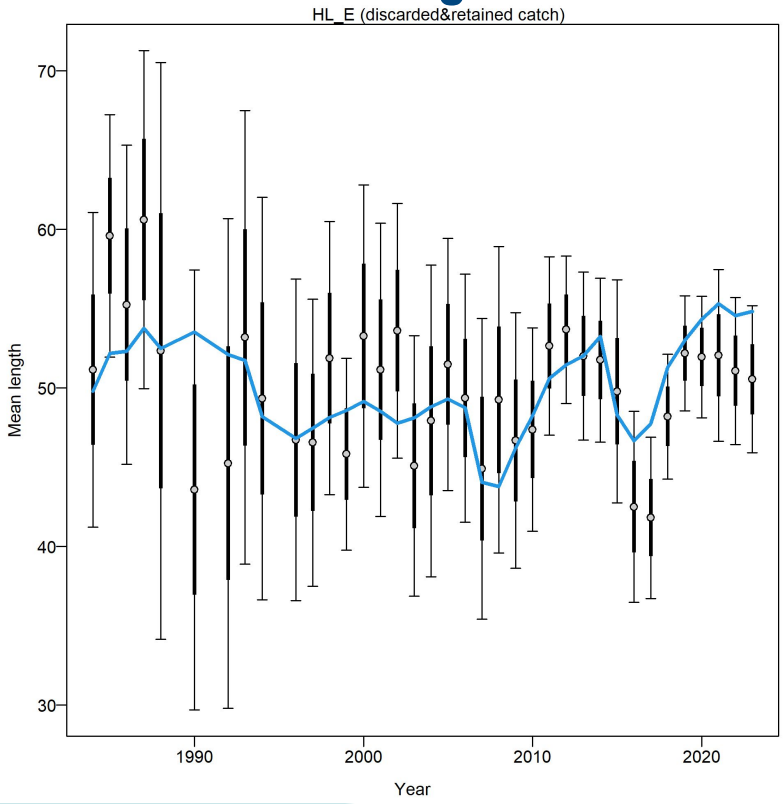


Commercial Handline (East)

Fit to Mean Retained Age

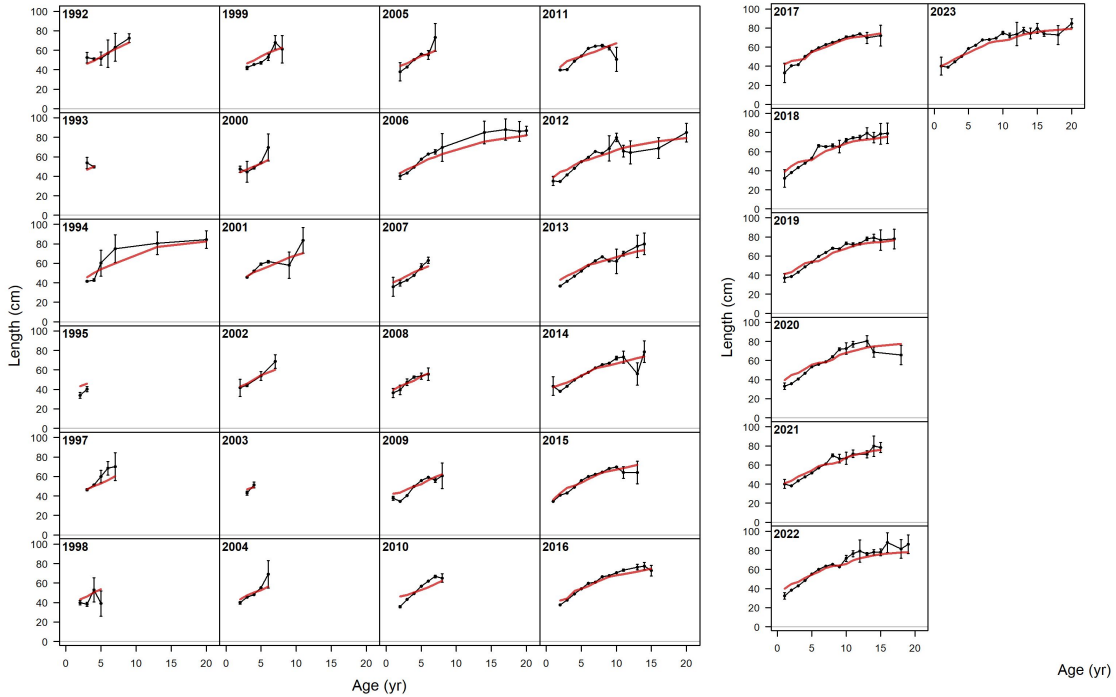


Fit to Mean Length



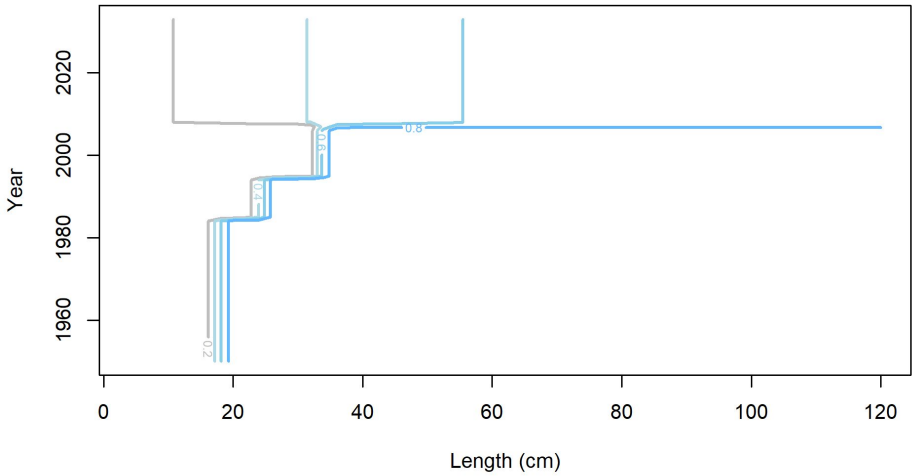
Commercial Handline (East)

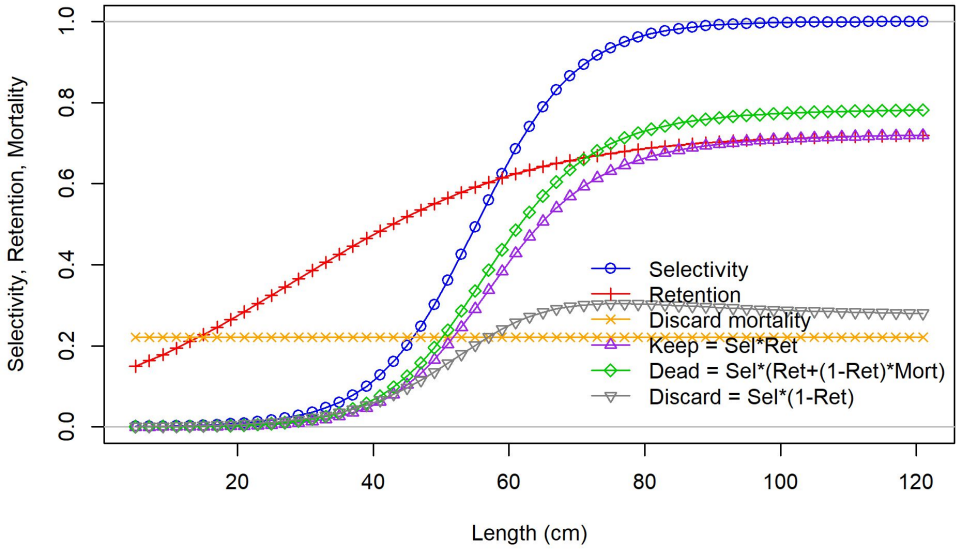
- Expected mean length-at-age* similar to observed data



*Not included in likelihood

Commercial Longline (West)





Not Time-varying

NOAA FISHERIES

Commercial Longline (West)

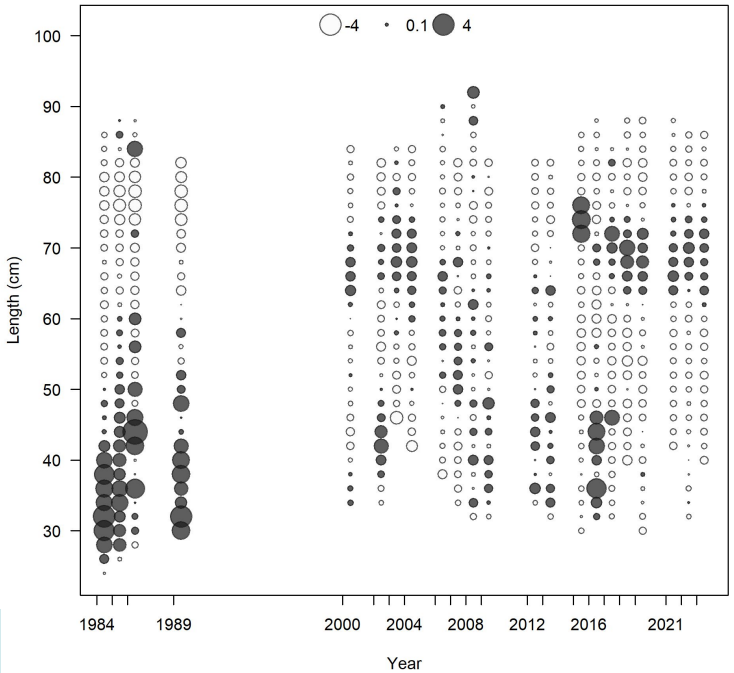
Closed = + (observed > expected)
Open = - (observed < expected)

- No discard composition available but legal sized discarding estimated based on LL_E observations

Discards

No length composition included

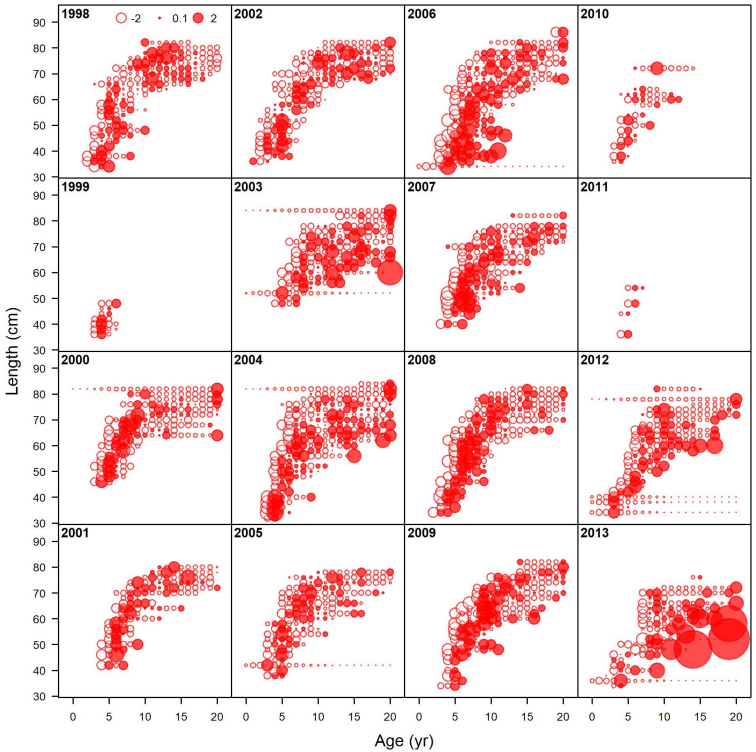
Retained Catch

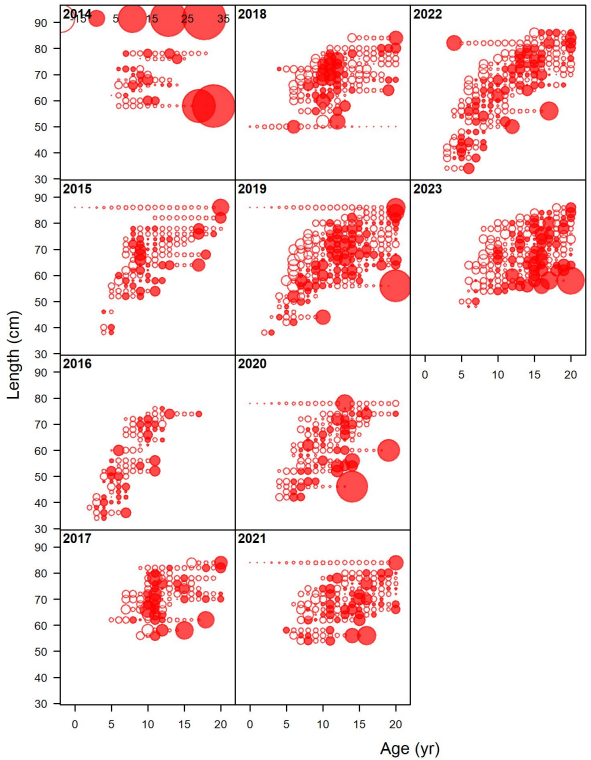


Commercial Longline (West)

Closed = + (observed > expected)
Open = - (observed < expected)

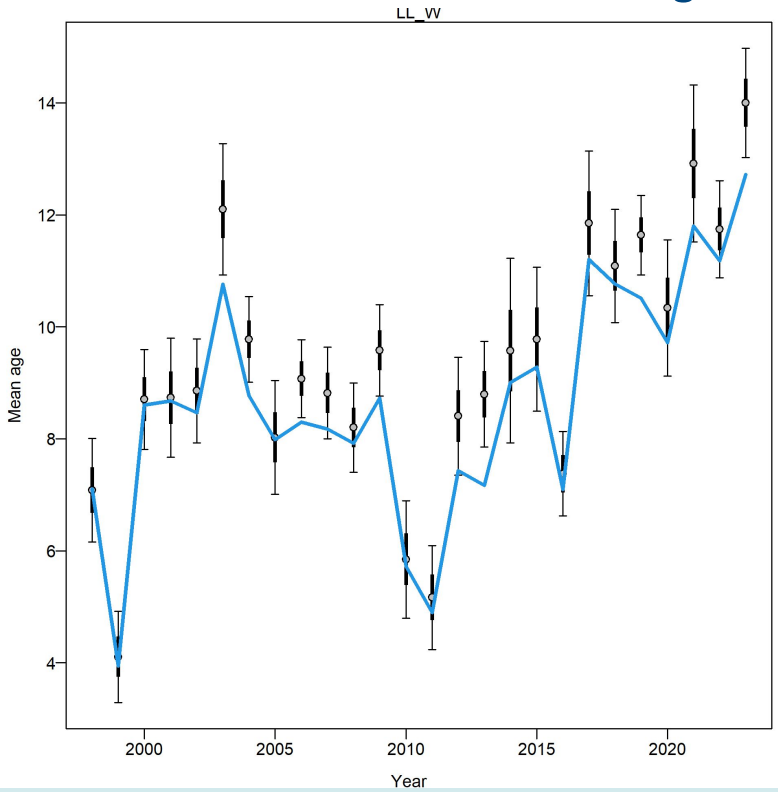
- Conditional age-at-length residuals up to 34.15



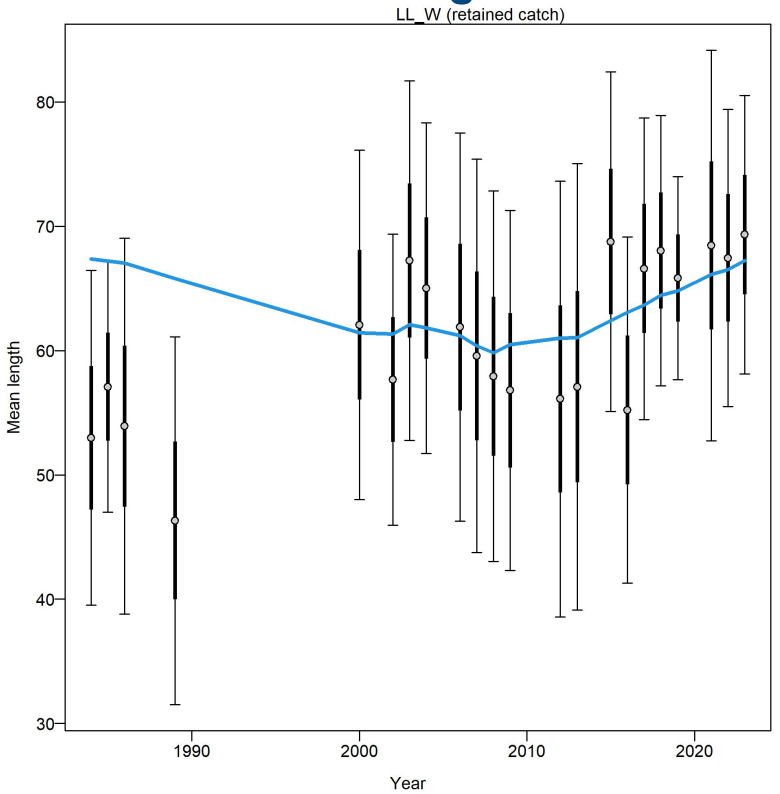


Commercial Longline (West)

Fit to Mean Retained Age

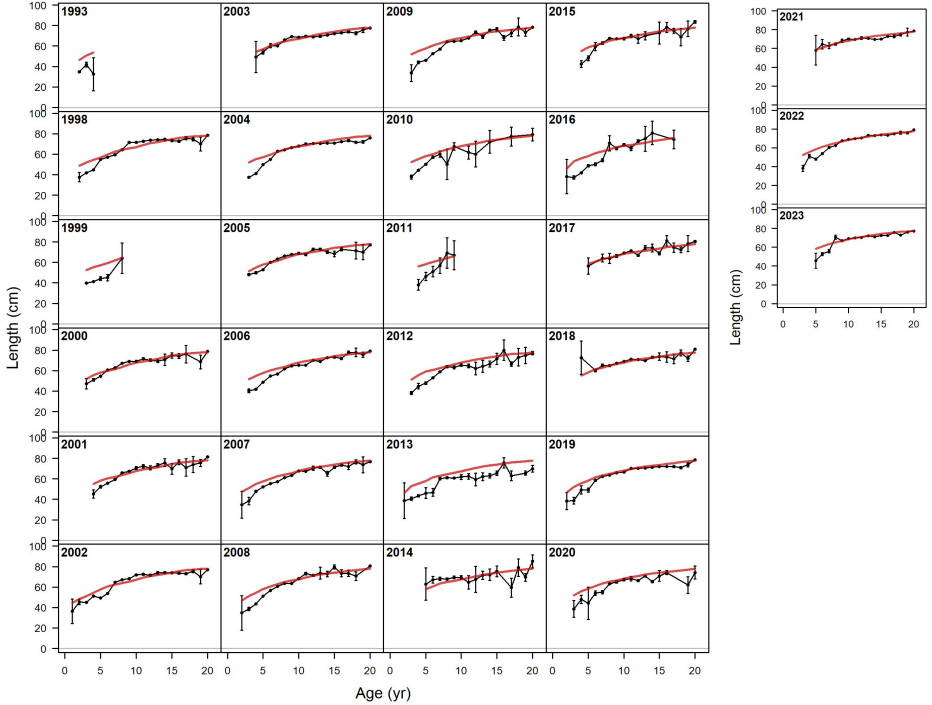


Fit to Mean Length



Commercial Longline (West)

- Expected mean length-at-age* similar to observed data



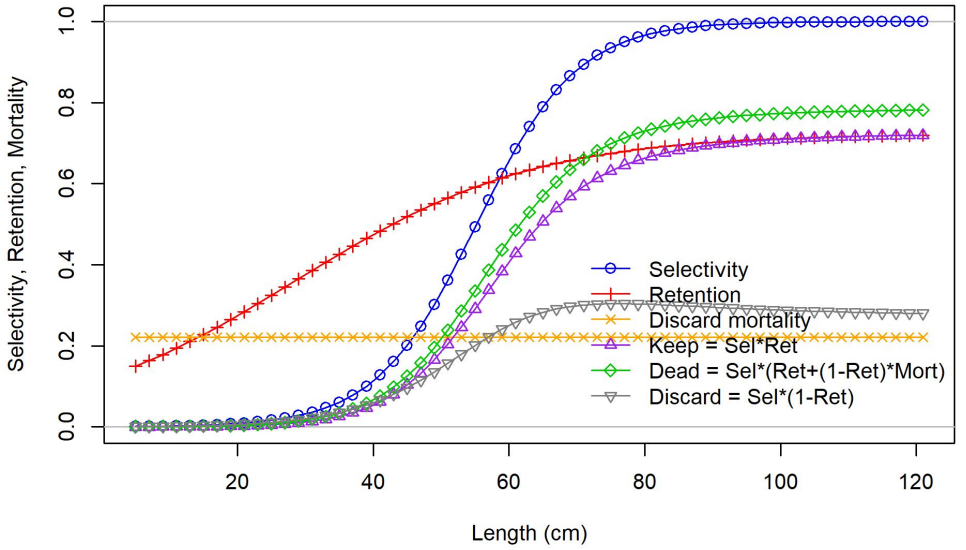
Age (yr)

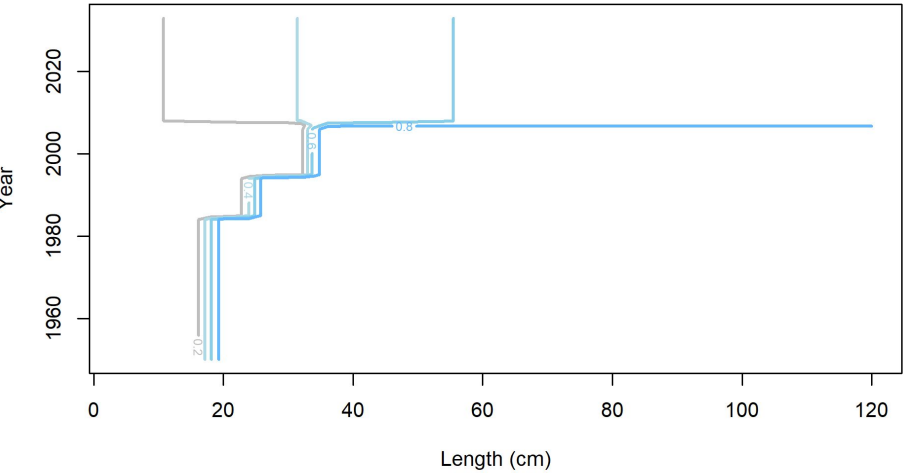
*Not included in likelihood

NOAA FISHERIES

Commercial Longline (Central)

Selectivity and retention mirrored to west LL fleet





Not Time-varying

NOAA FISHERIES

Commercial Longline (Central)

Closed = + (observed > expected)
Open = - (observed < expected)

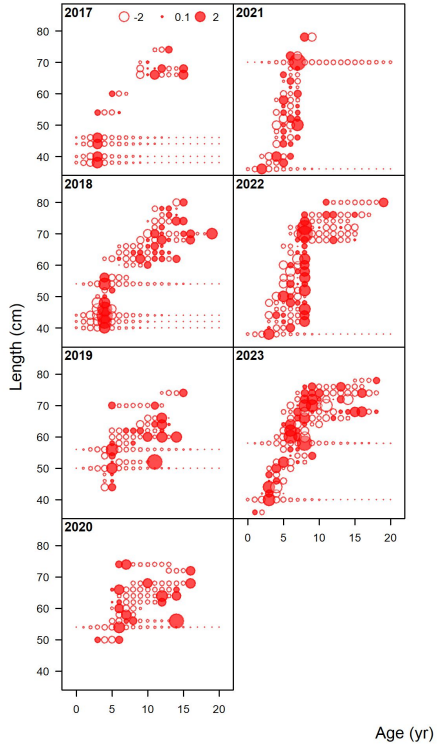
- No length composition included in the model. Most years did not meet minimum sample size requirements and few remaining years dropped.

NOAA FISHERIES

Commercial Longline (Central)

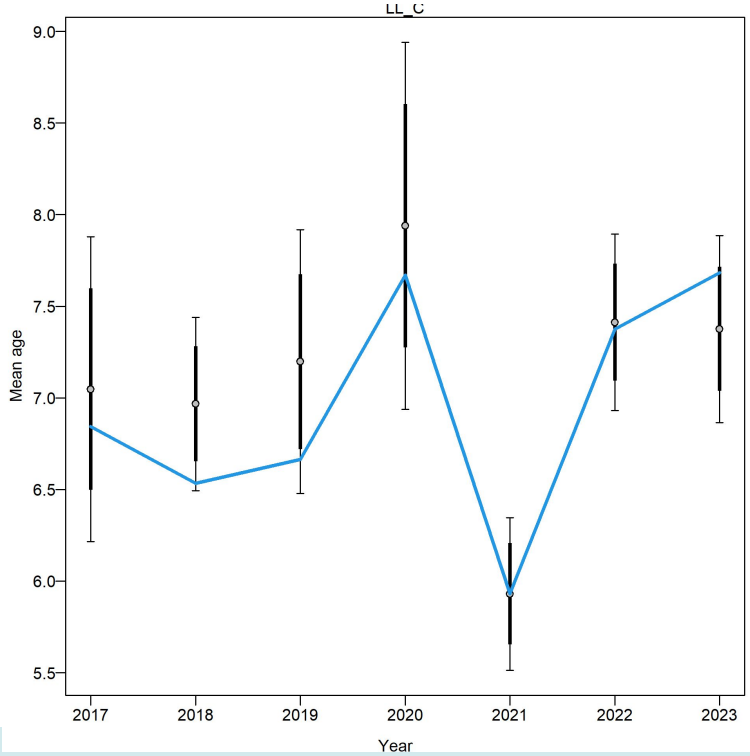
Closed = + (observed > expected)
Open = - (observed < expected)

- Conditional age-at-length residuals up to 5.31



Commercial Longline (Central)

Fit to Mean Retained Age

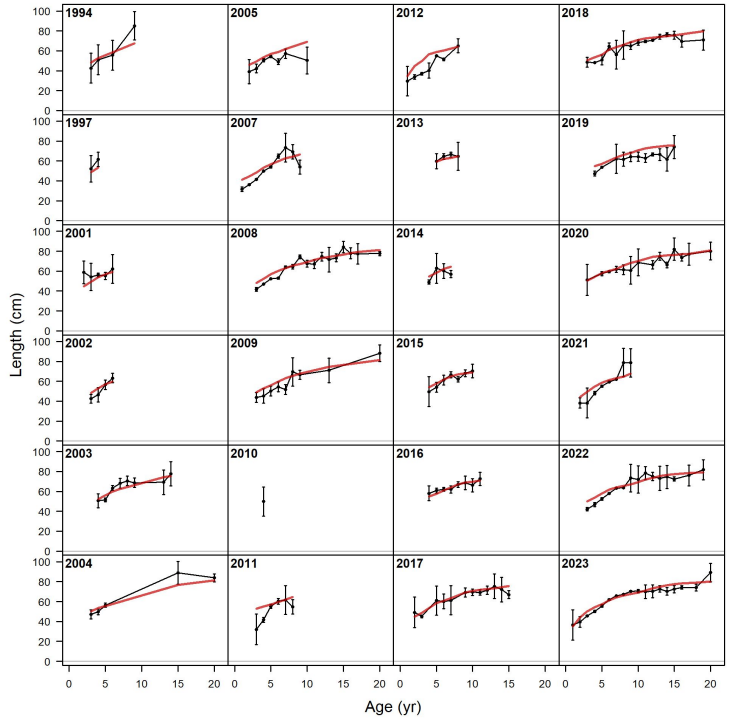


Fit to Mean Length

No length composition included

Commercial Longline (Central)

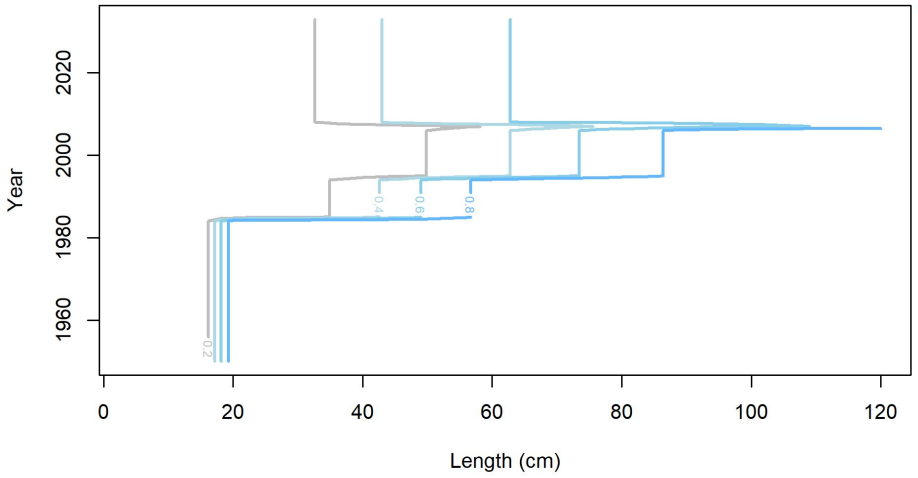
- Expected mean length-at-age* similar to observed data

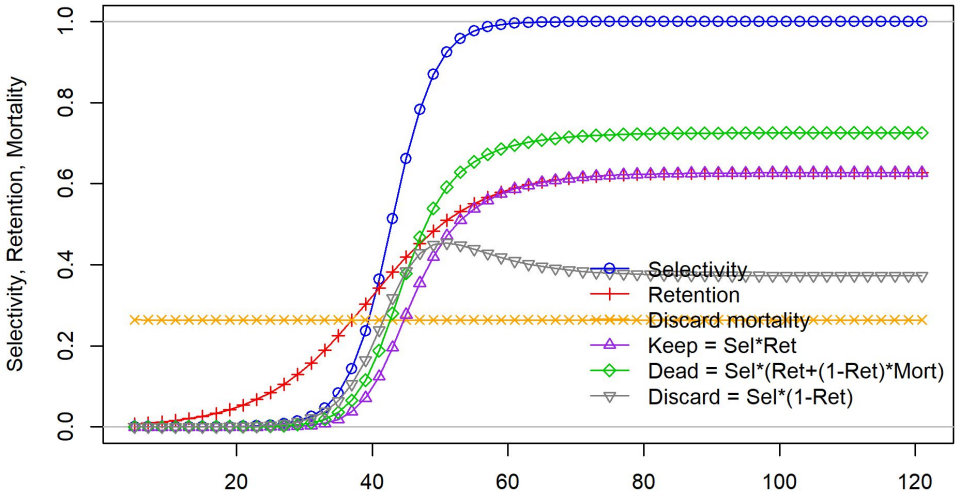


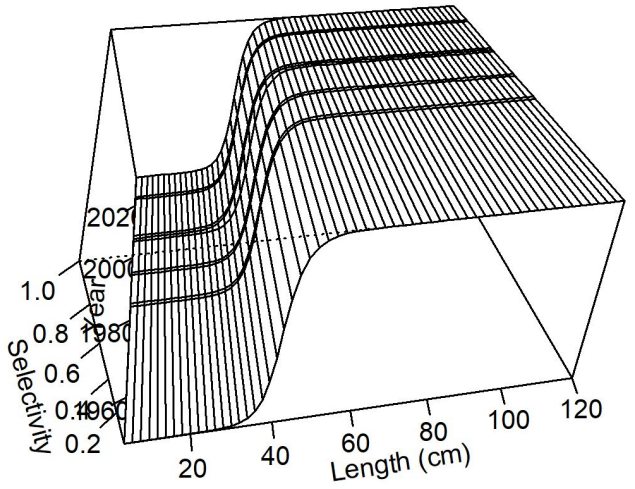
*Not included in likelihood

NOAA FISHERIES

Commercial Longline (East)





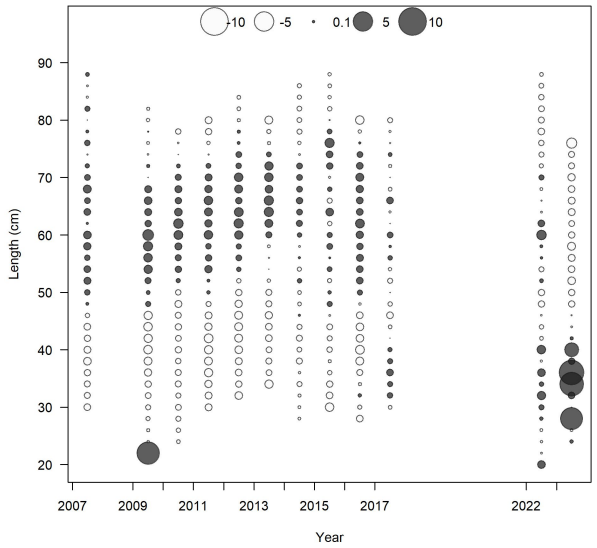


Commercial Longline (East)

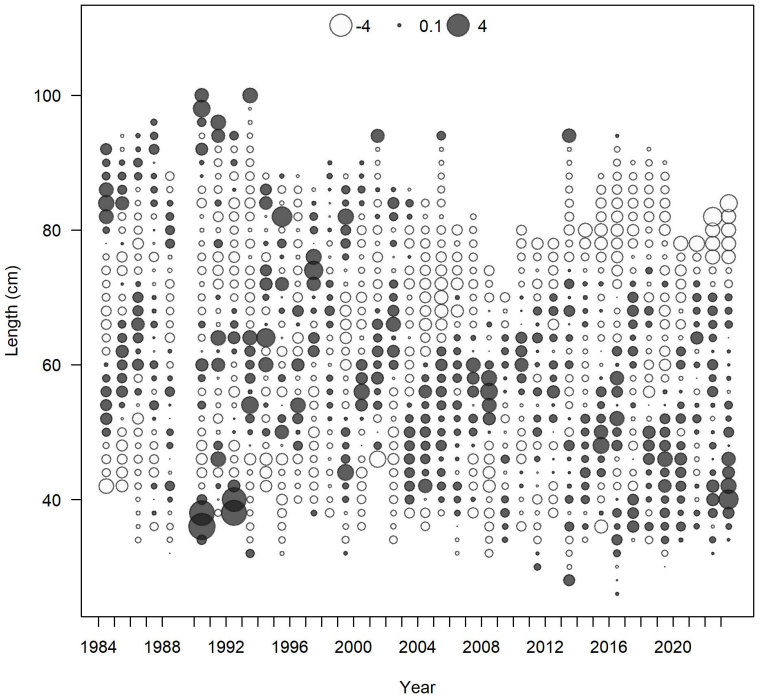
Closed = + (observed > expected)
Open = - (observed < expected)

- Legal sized discards observed and asymptotic retention estimated

Discards



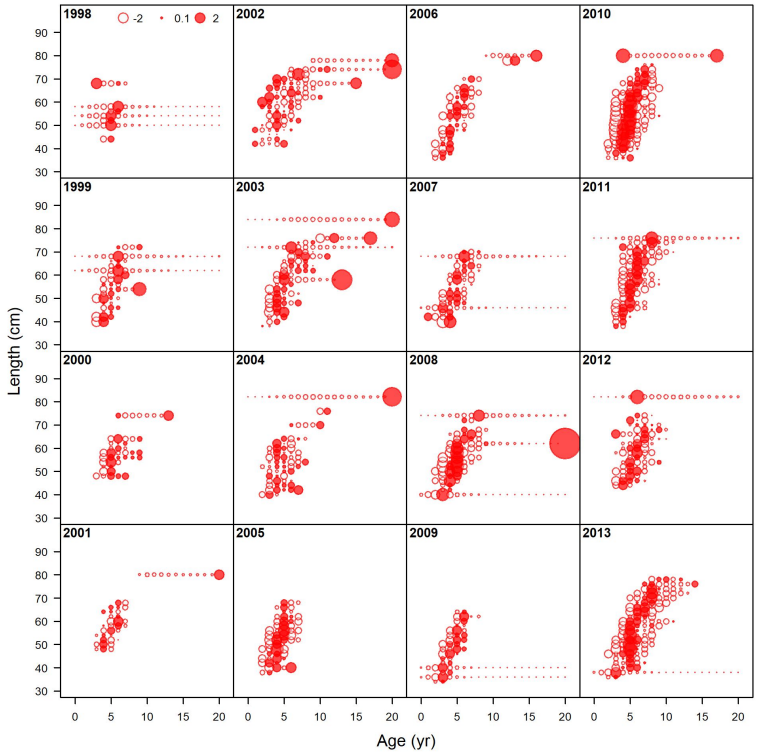
Retained Catch

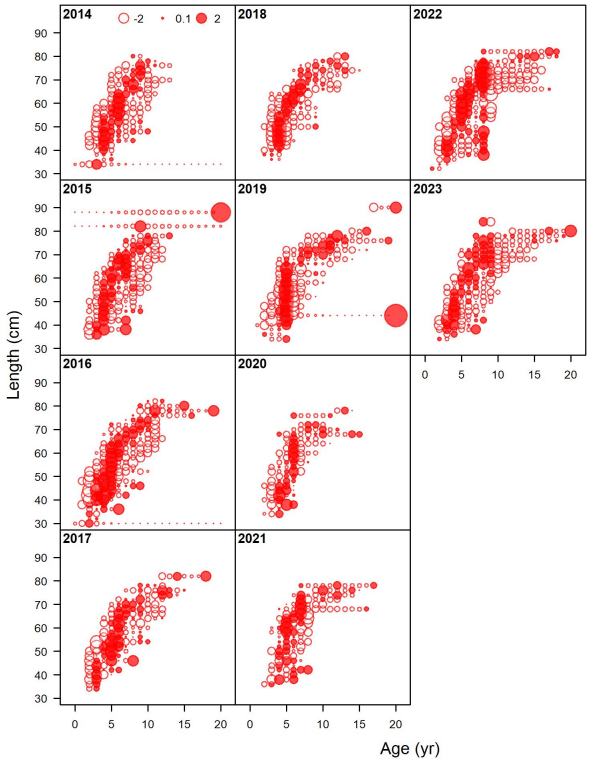


Commercial Longline (East)

Closed = + (observed > expected)
Open = - (observed < expected)

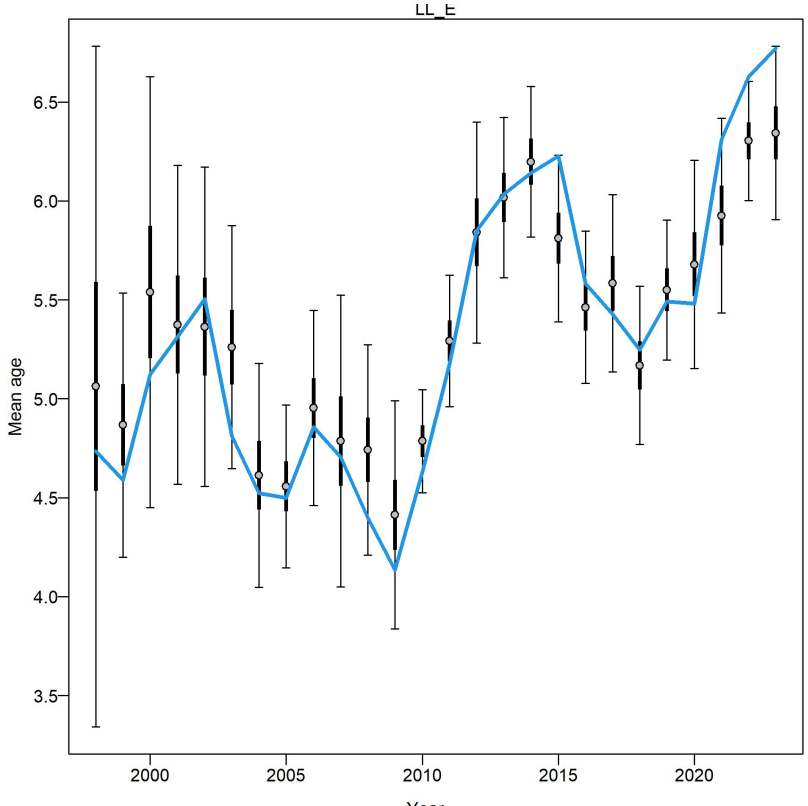
- Conditional age-at-length residuals up to 18.42



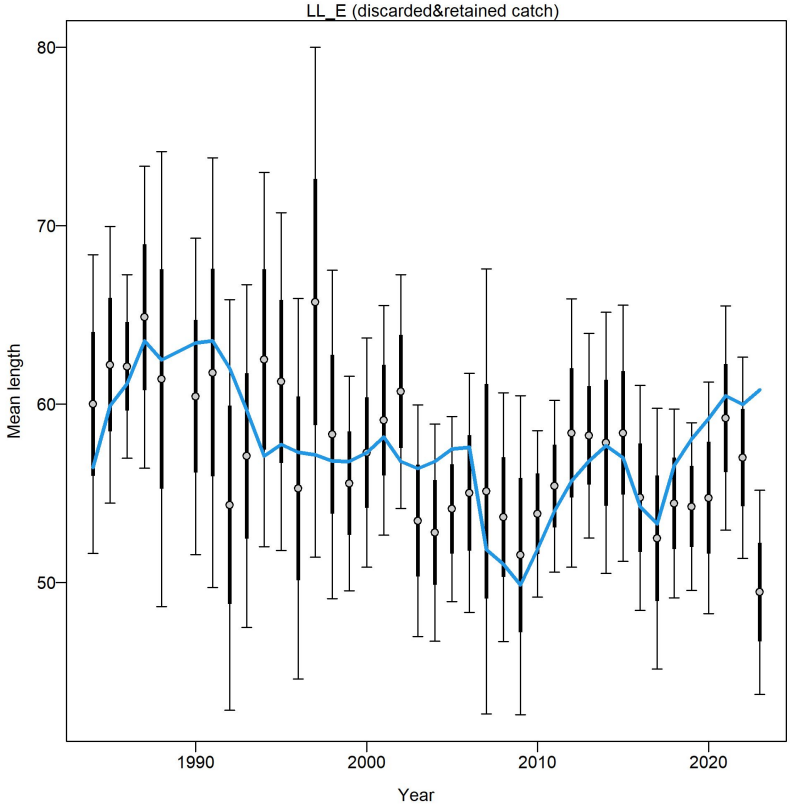


Commercial Longline (East)

Fit to Mean Retained Age

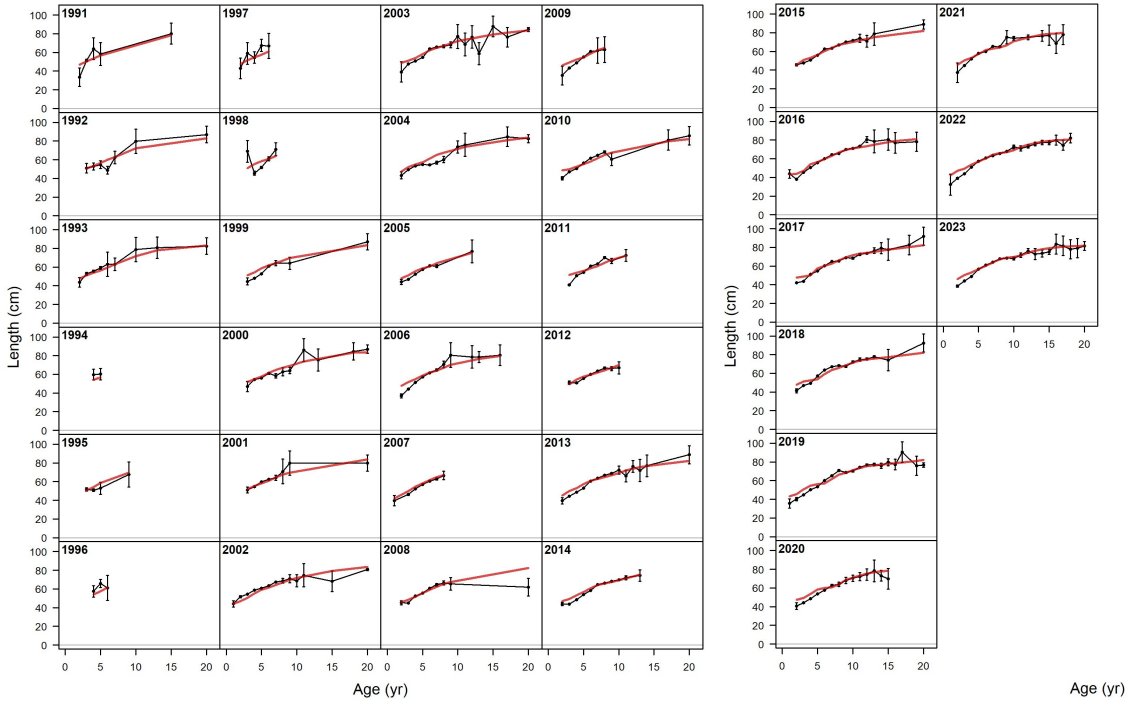


Fit to Mean Length



Commercial Longline (East)

- Expected mean length-at-age* similar to observed data



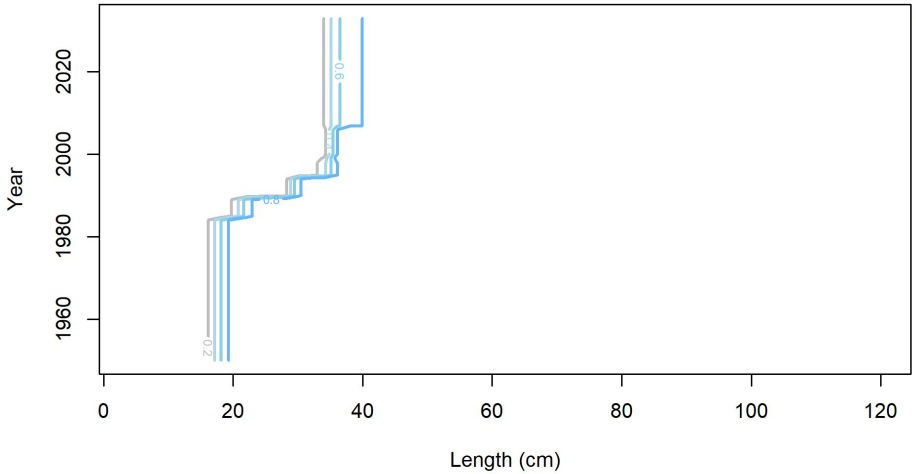
*Not included in likelihood

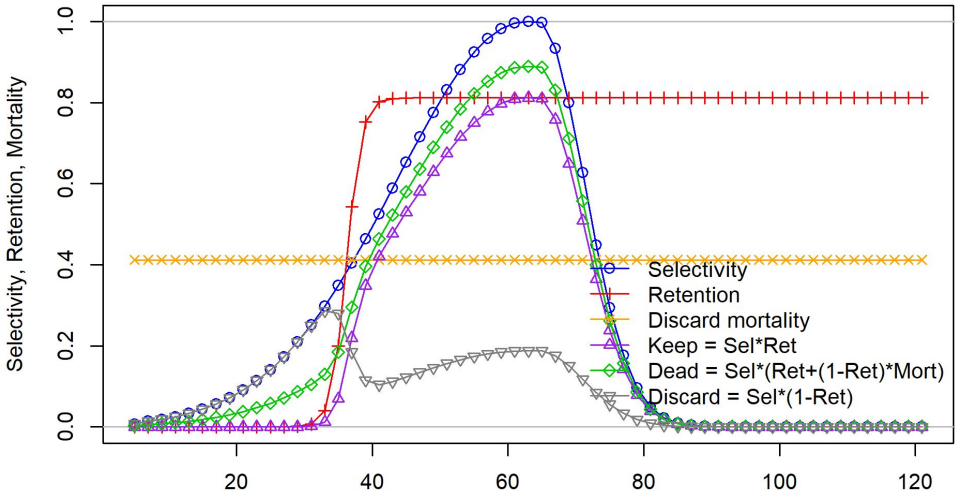
Recreational Fleets:

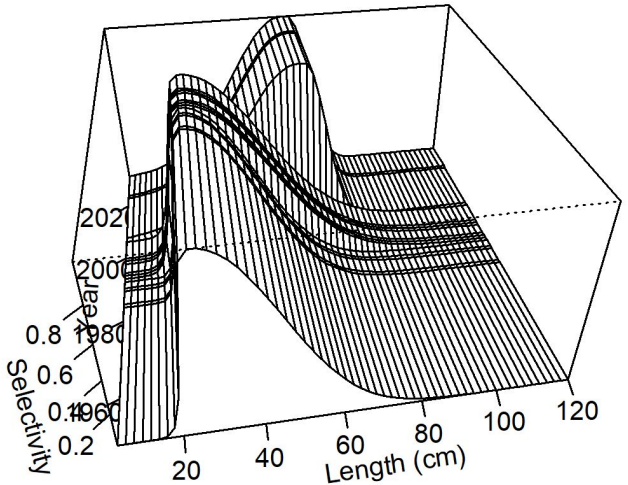
Selectivity, Retention, and Fits to Composition Data

NOAA FISHERIES

Recreational Charter Boat (West)







Recreational Charter Boat (West)

- Asymptotic retention estimated with bounds then fixed

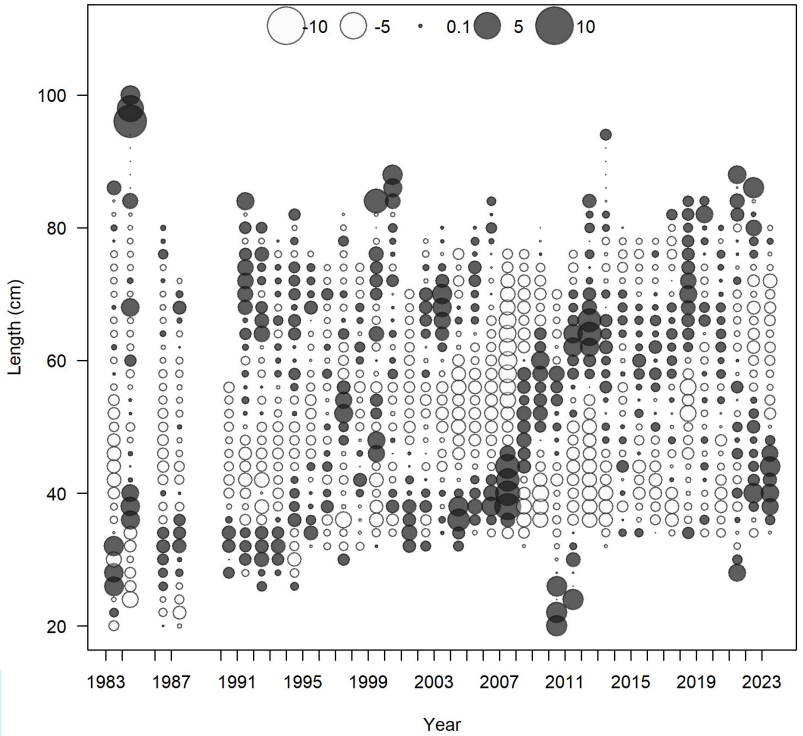
Discards

No length composition included

Closed = + (observed > expected)

Open = - (observed < expected)

Retained Catch

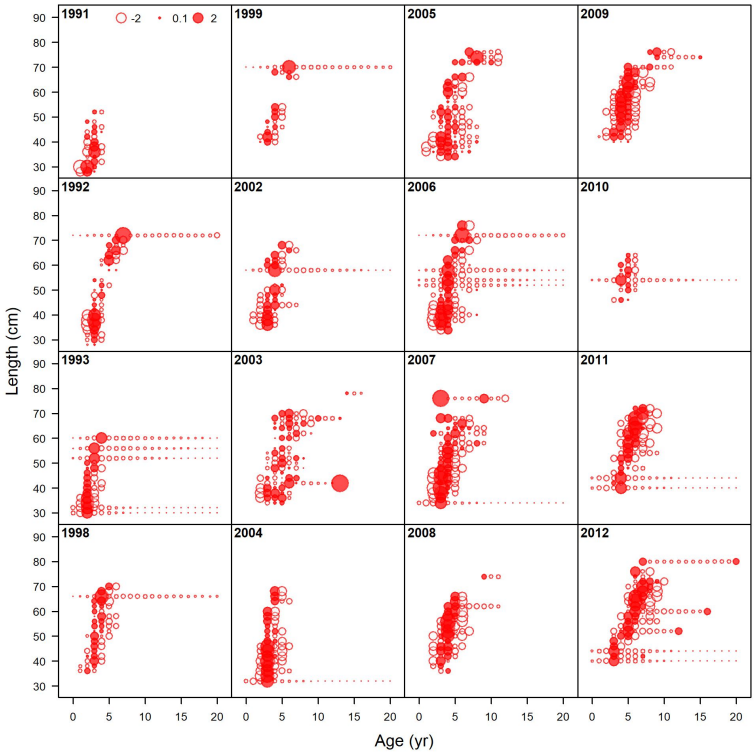


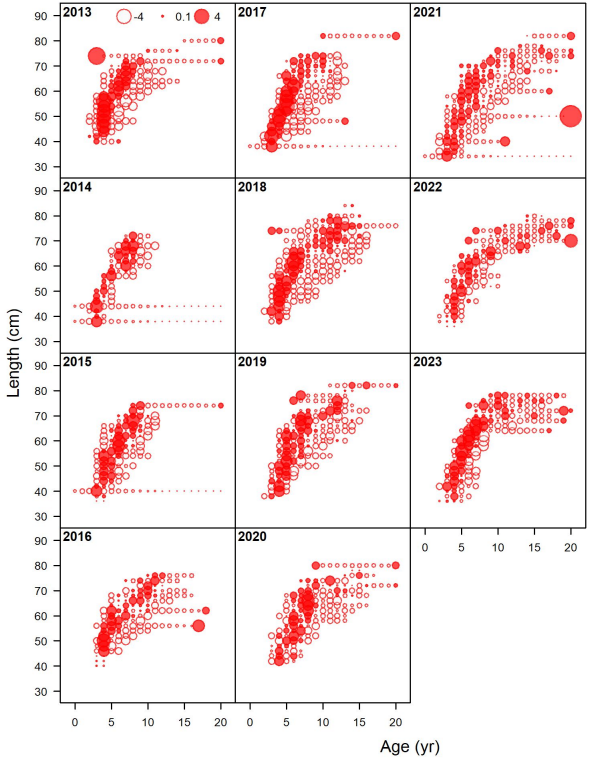
Recreational Charter Boat (West)

Closed = + (observed > expected)

Open = - (observed < expected)

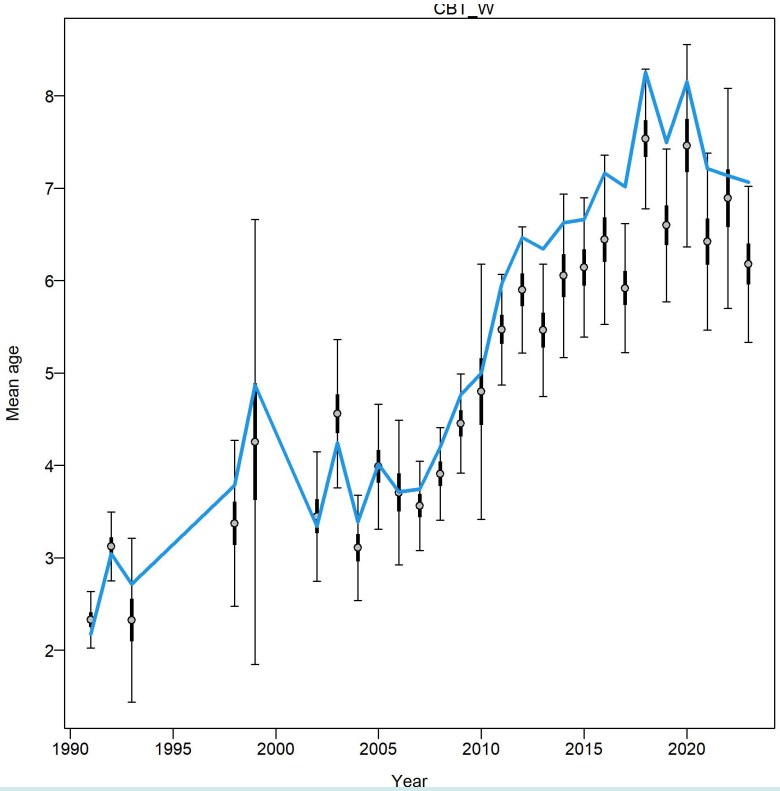
- Conditional age-at-length residuals up to 8.72



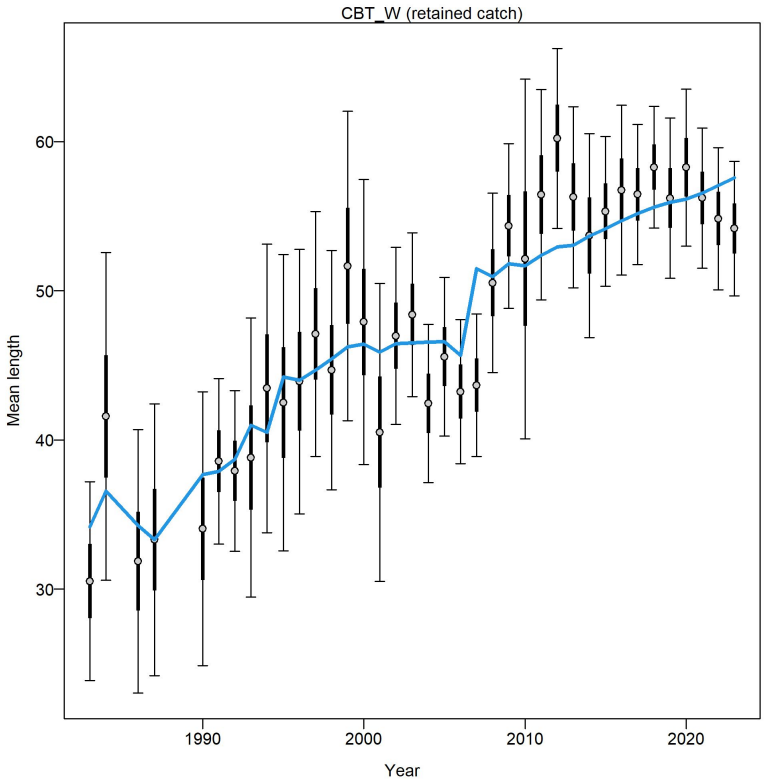


Recreational Charter Boat (West)

Fit to Mean Retained Age

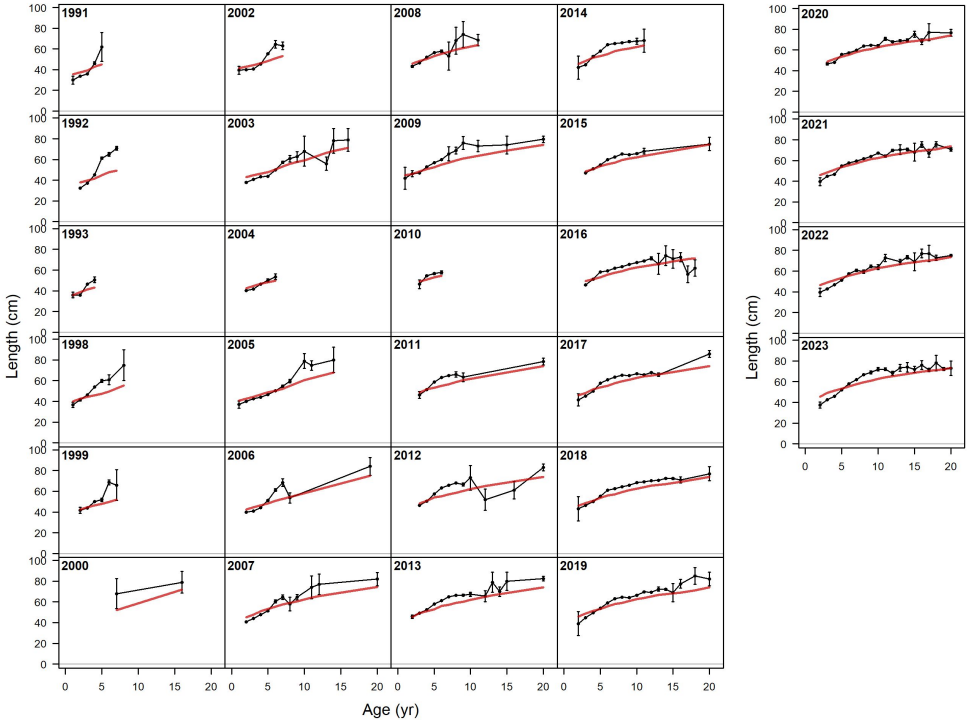


Fit to Mean Length



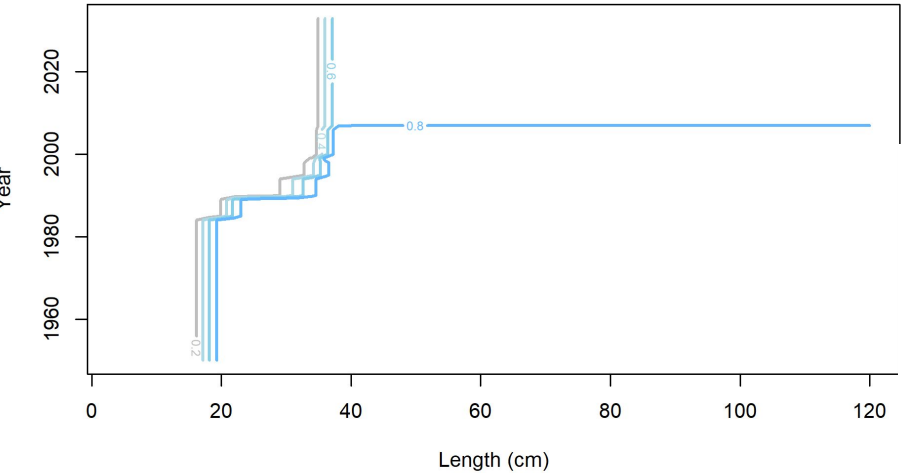
Recreational Charter Boat (West)

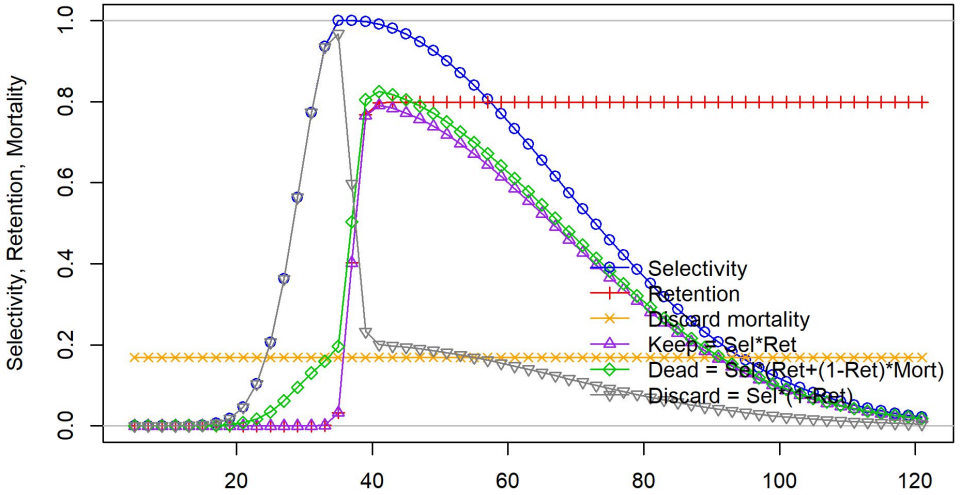
- Expected mean length-at-age* similar to observed data

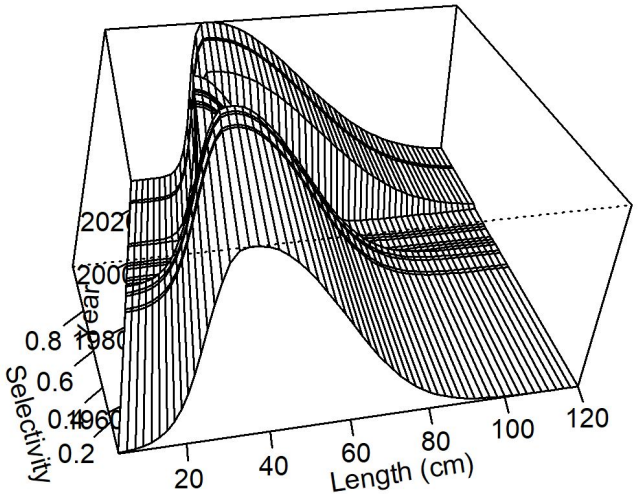


*Not included in likelihood

Recreational Charter Boat (Central)







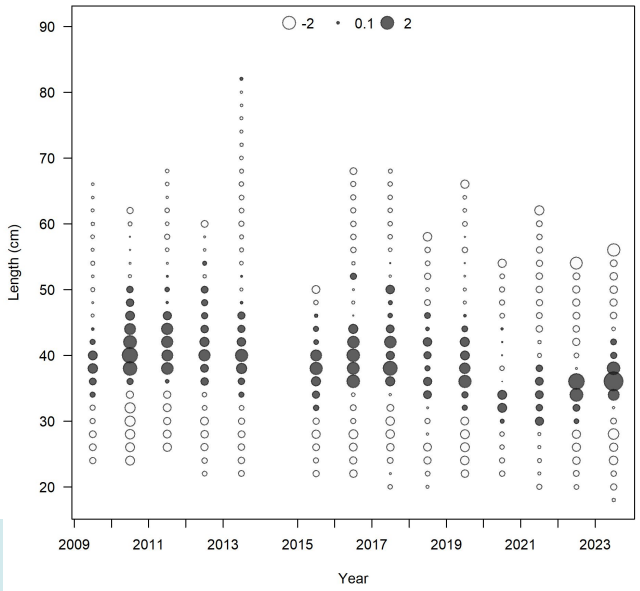
NOAA FISHERIES

Recreational Charter Boat (Central)

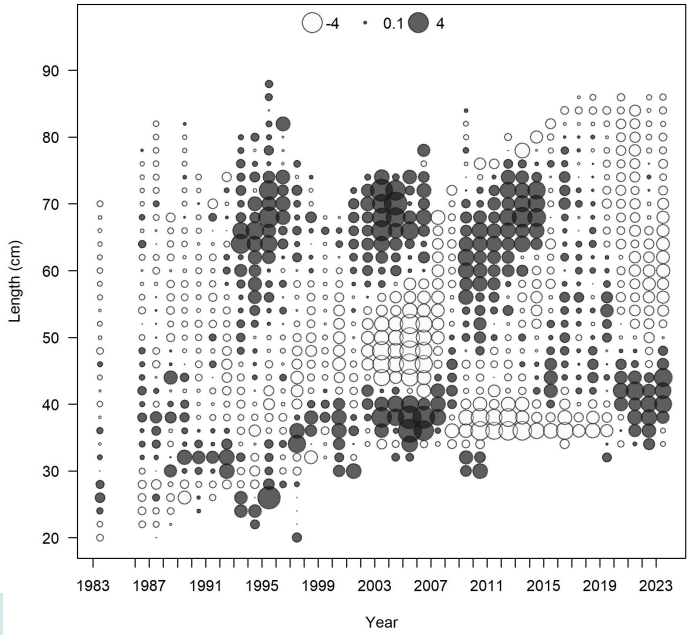
Closed = + (observed > expected)
Open = - (observed < expected)

- Legal sized discards observed and asymptotic retention estimated then fixed at lower bound

Discards



Retained Catch

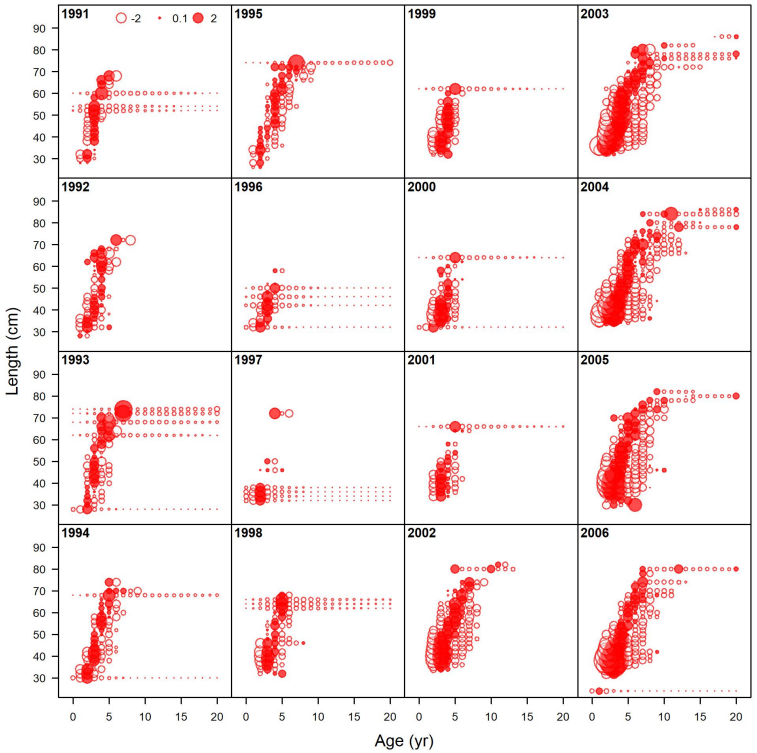


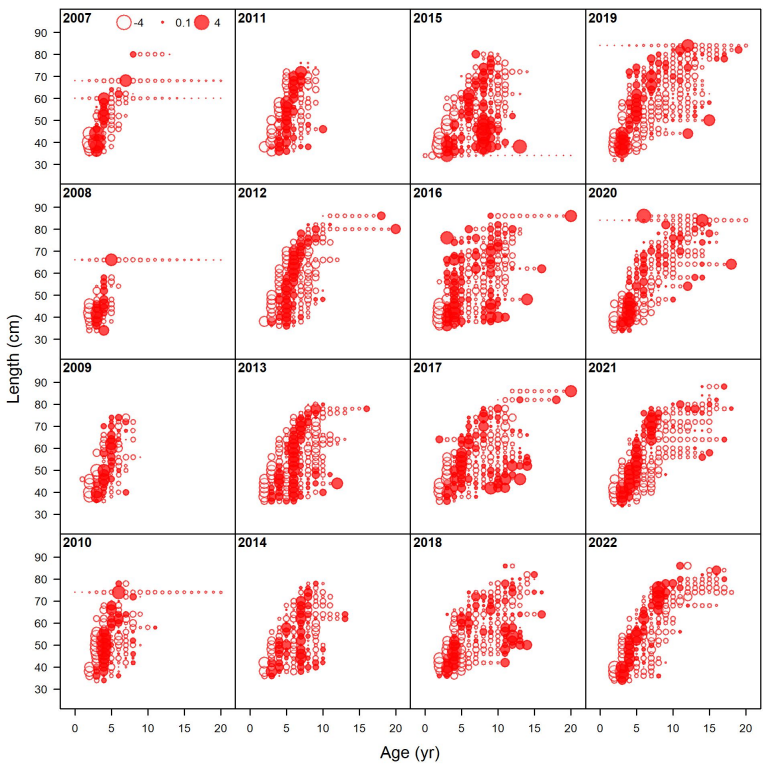
Recreational Charter Boat (Central)

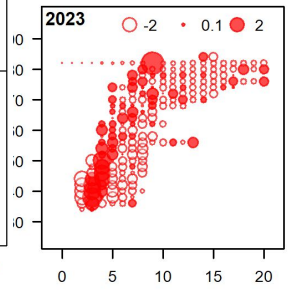
Closed = + (observed > expected)

Open = - (observed < expected)

- Conditional age-at-length residuals up to 16.82

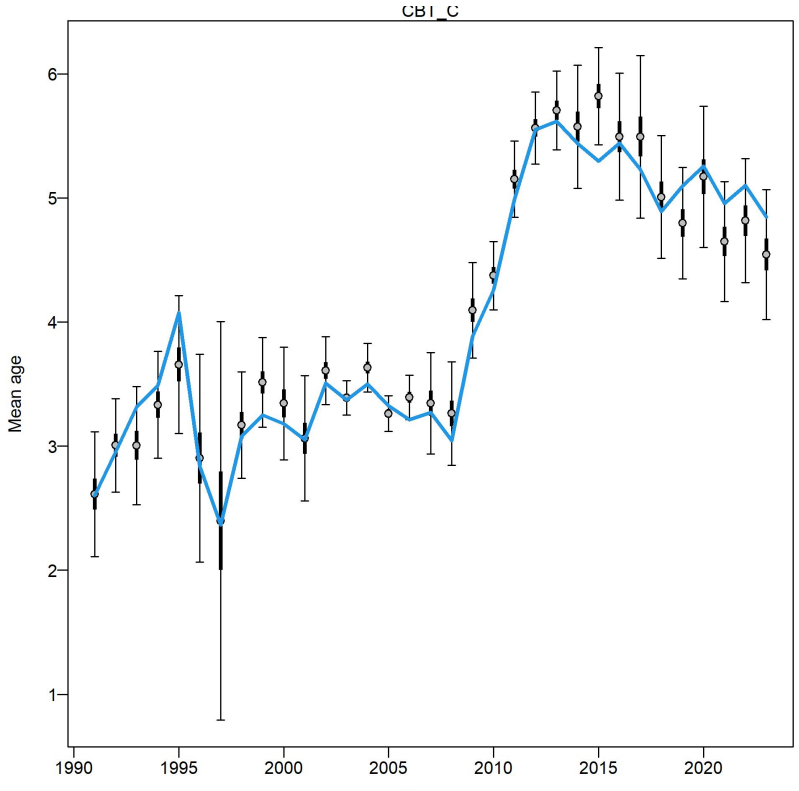




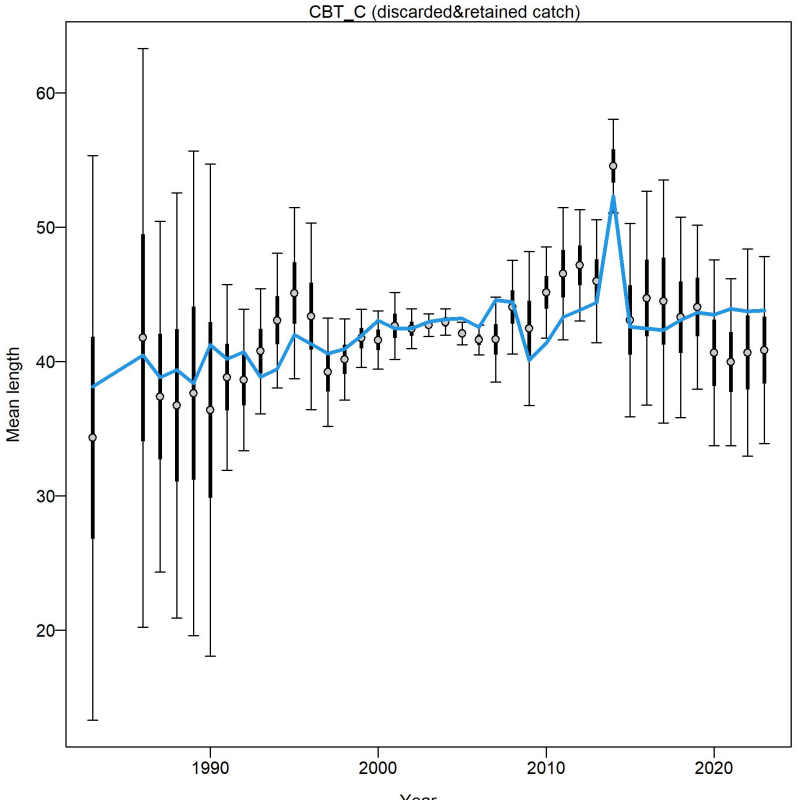


Recreational Charter Boat (Central)

Fit to Mean Retained Age

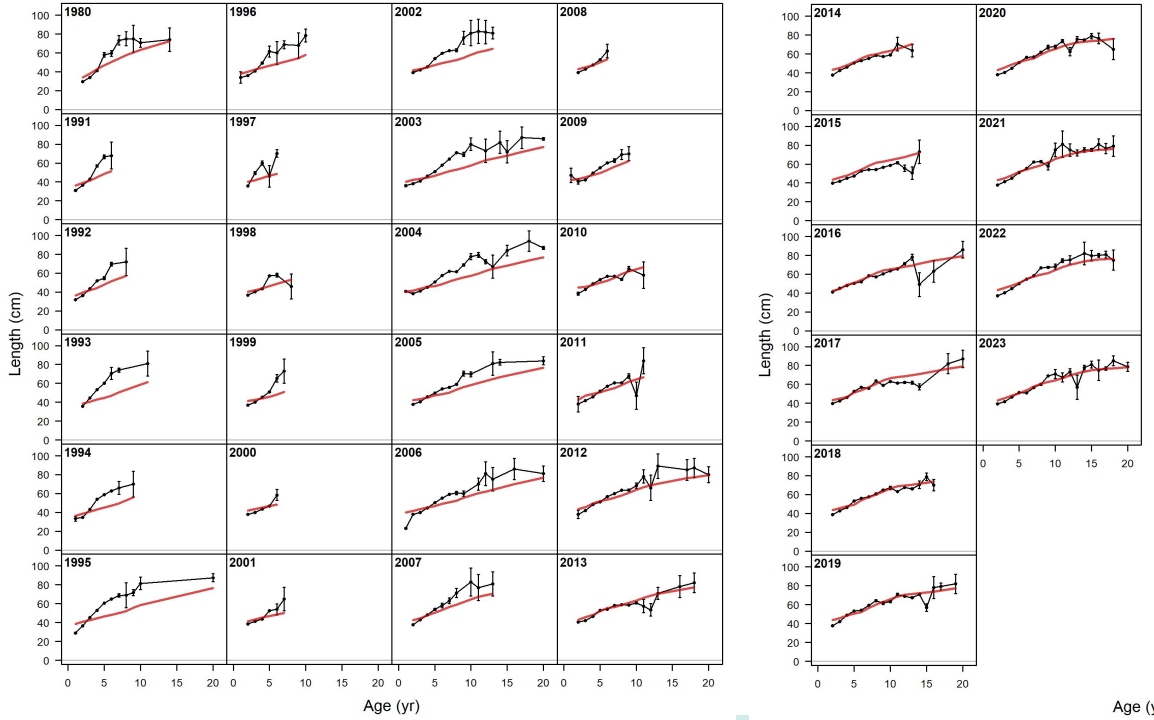


Fit to Mean Length



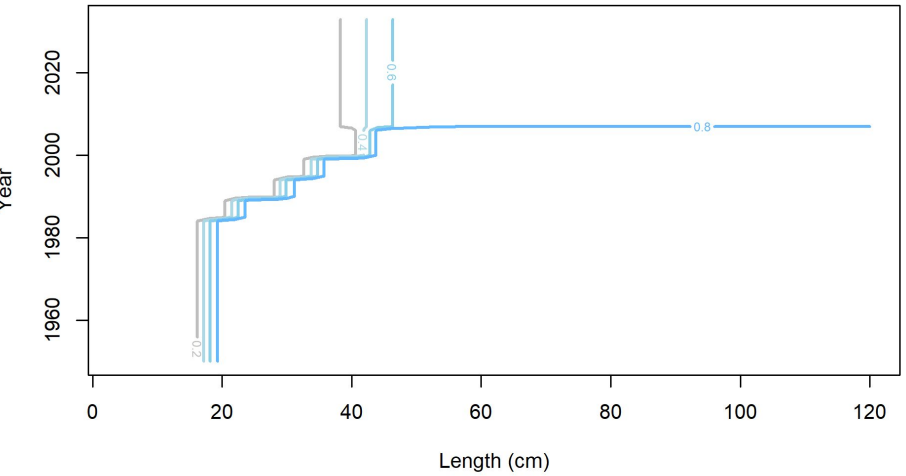
Recreational Charter Boat (Central)

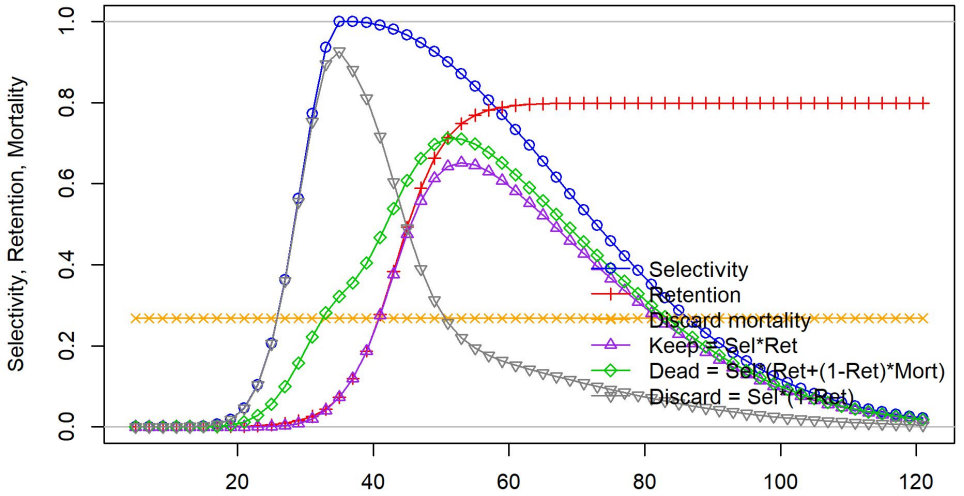
- Expected mean length-at-age* similar to observed data

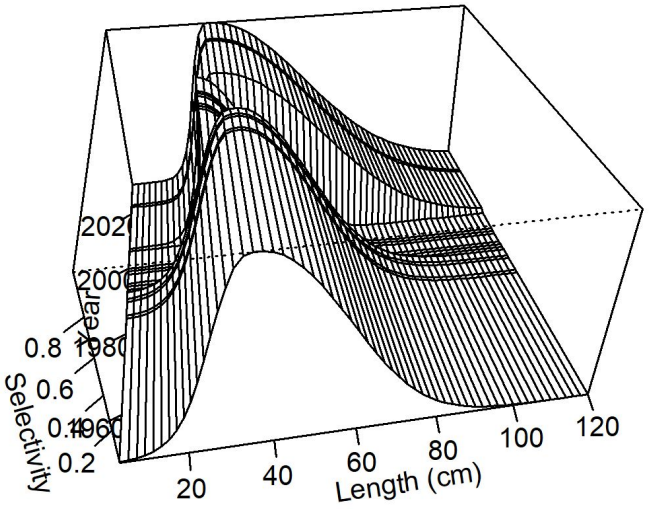


*Not included in likelihood

Recreational Charter Boat (East)







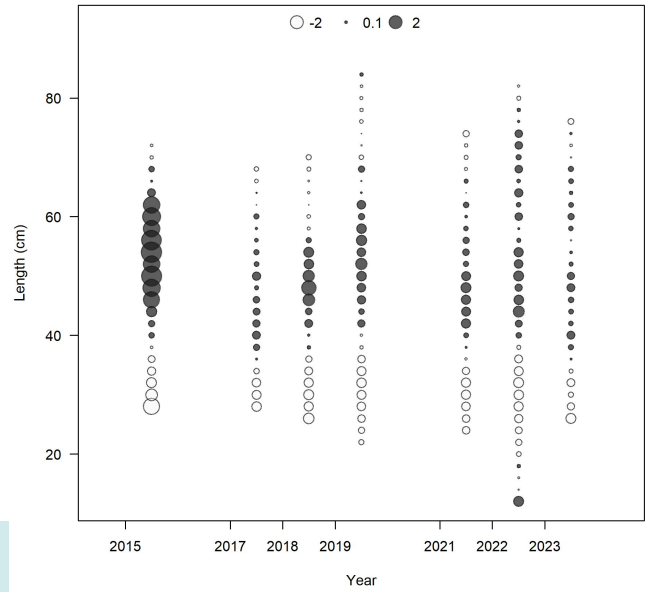
NOAA FISHERIES

Recreational Charter Boat (East)

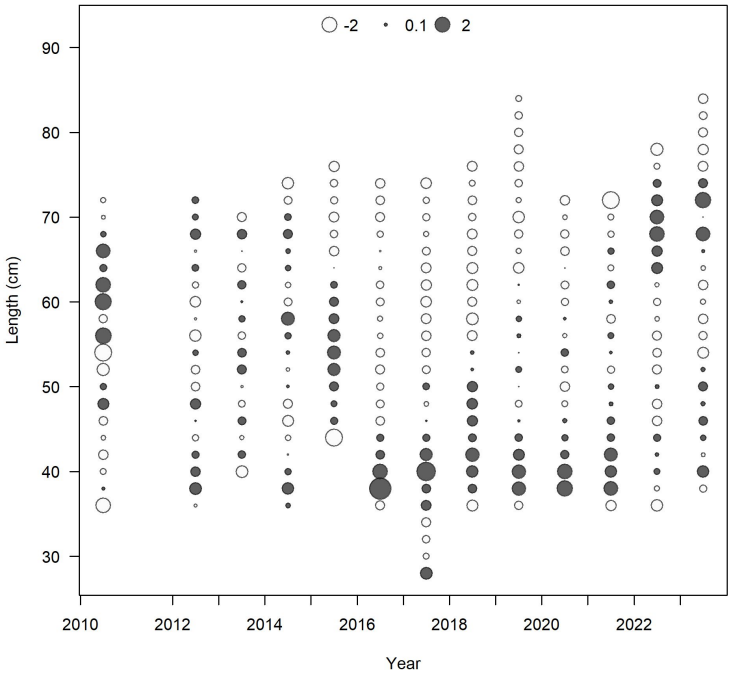
Closed = + (observed > expected)
Open = - (observed < expected)

- Legal sized discards observed and asymptotic retention estimated then fixed at lower bound

Discards



Retained Catch



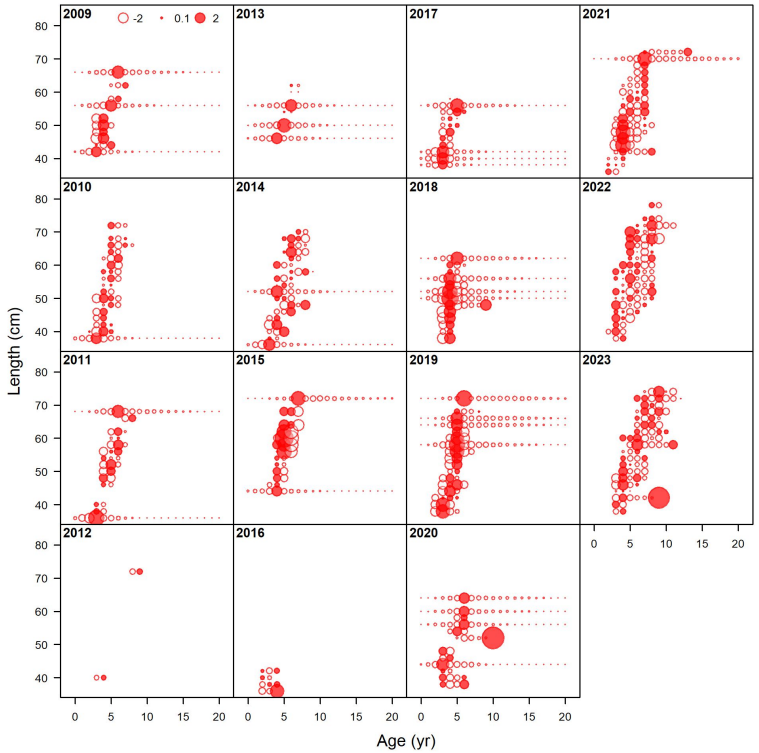
NOAA FISHERIES

Recreational Charter Boat (East)

Closed = + (observed > expected)

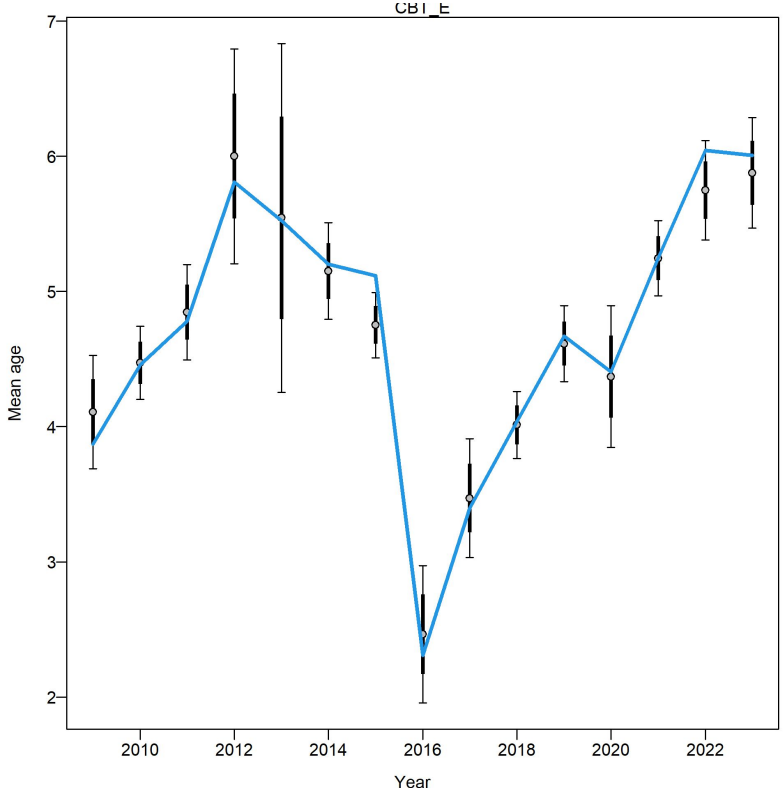
Open = - (observed < expected)

- Conditional age-at-length residuals up to 9.48

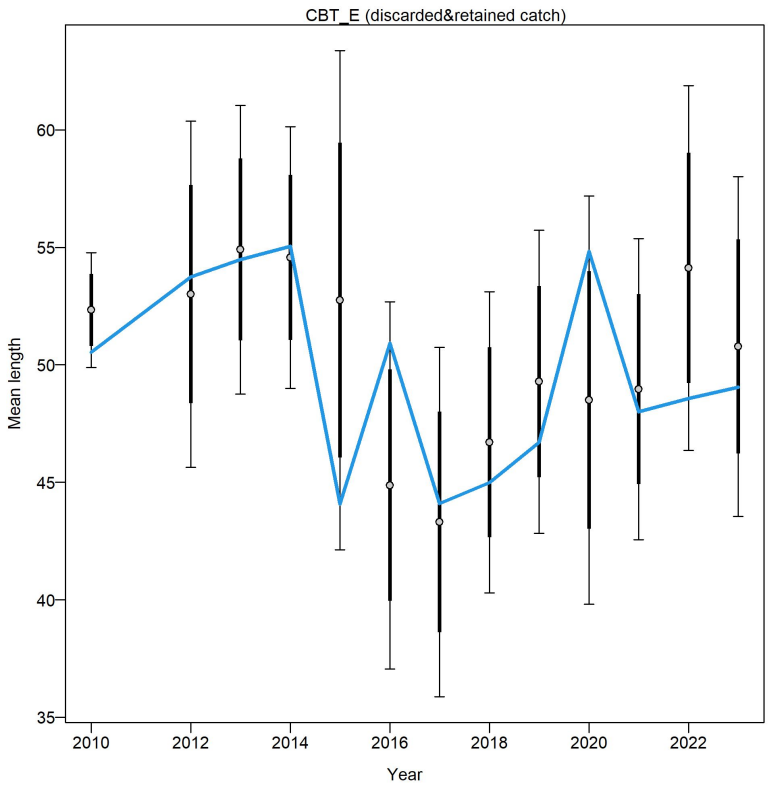


Recreational Charter Boat (East)

Fit to Mean Retained Age



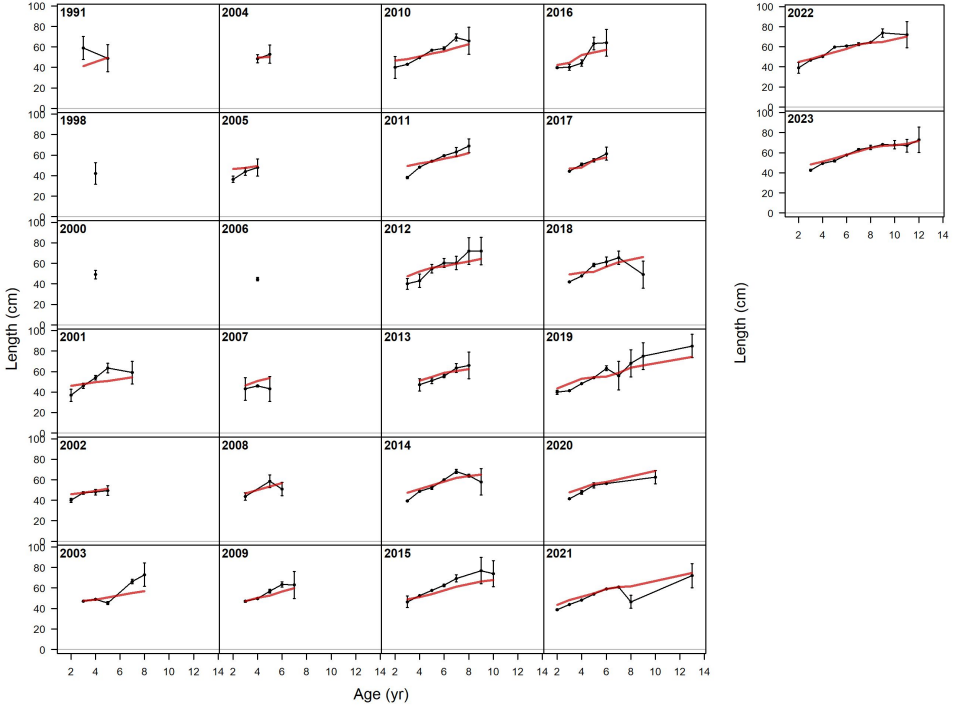
Fit to Mean Length



NOAA FISHERIES

Recreational Charter Boat (East)

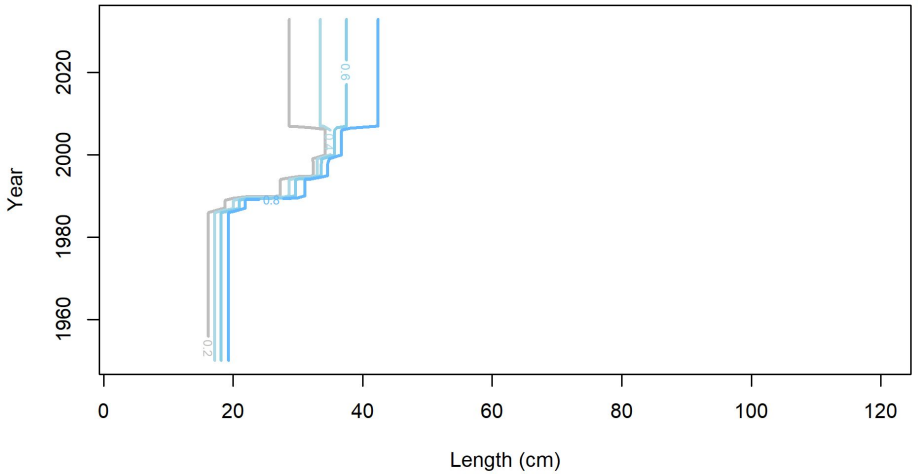
- Expected mean length-at-age* similar to observed data

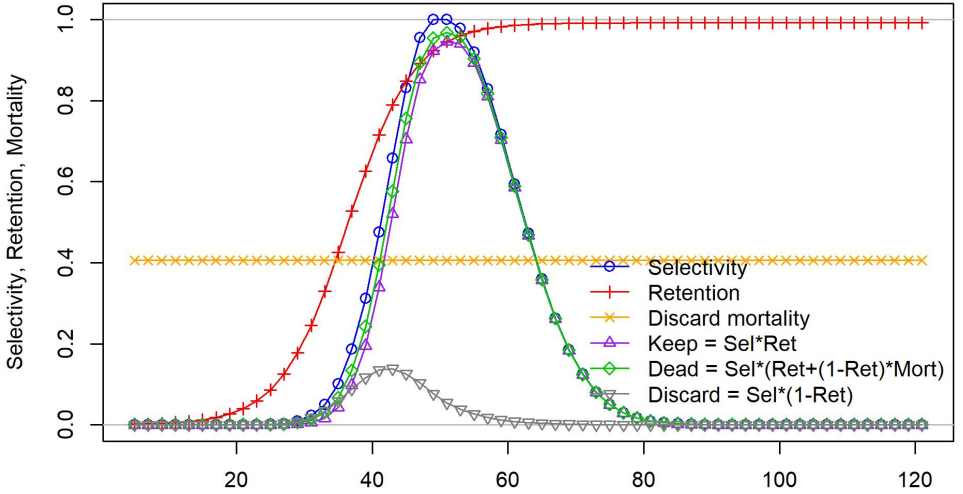


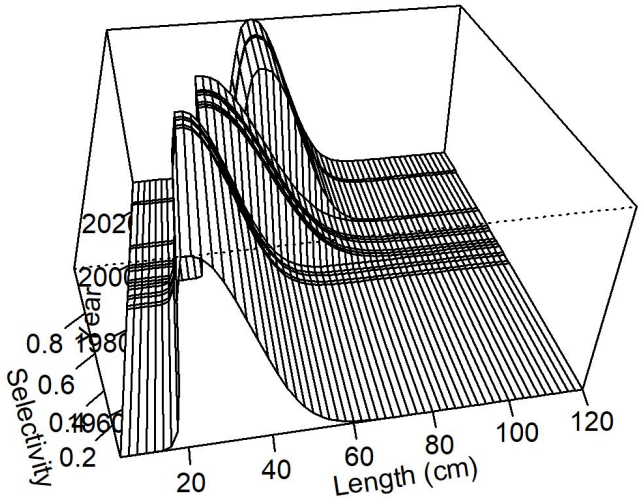
*Not included in likelihood

NOAA FISHERIES

Recreational Headboat (West)







Recreational Headboat (West)

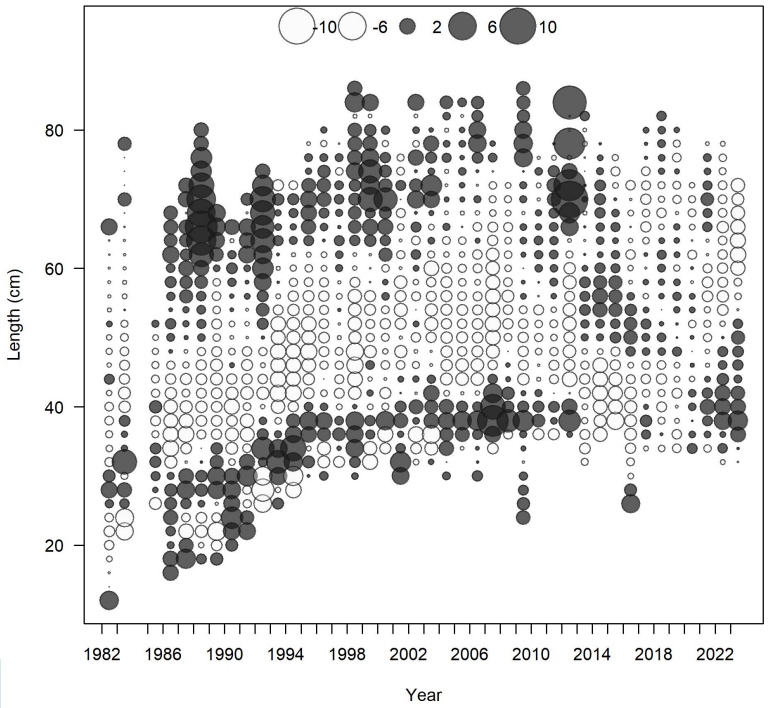
Closed = + (observed > expected)
Open = - (observed < expected)

- Asymptotic retention Fixed

Discards

No length composition included

Retained Catch

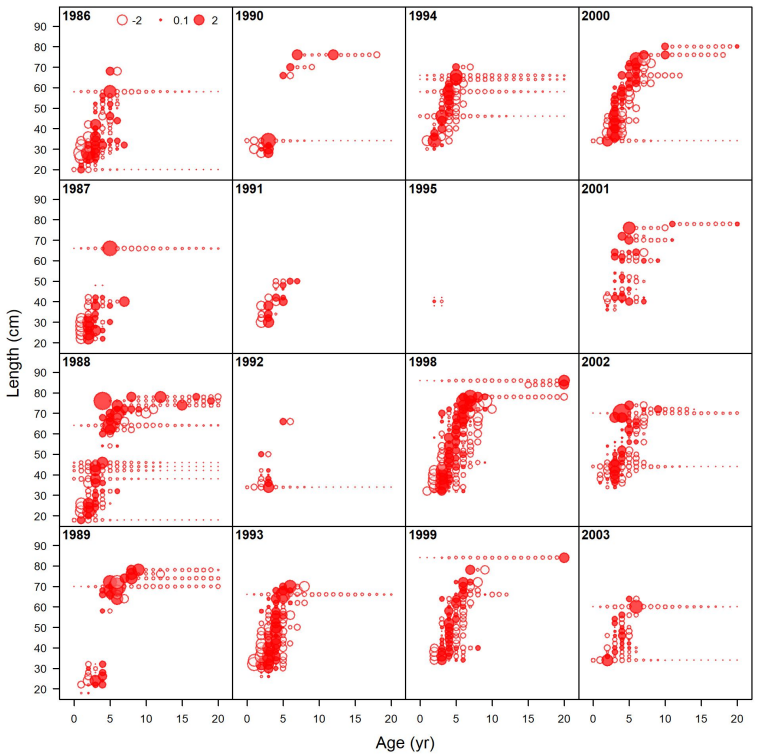


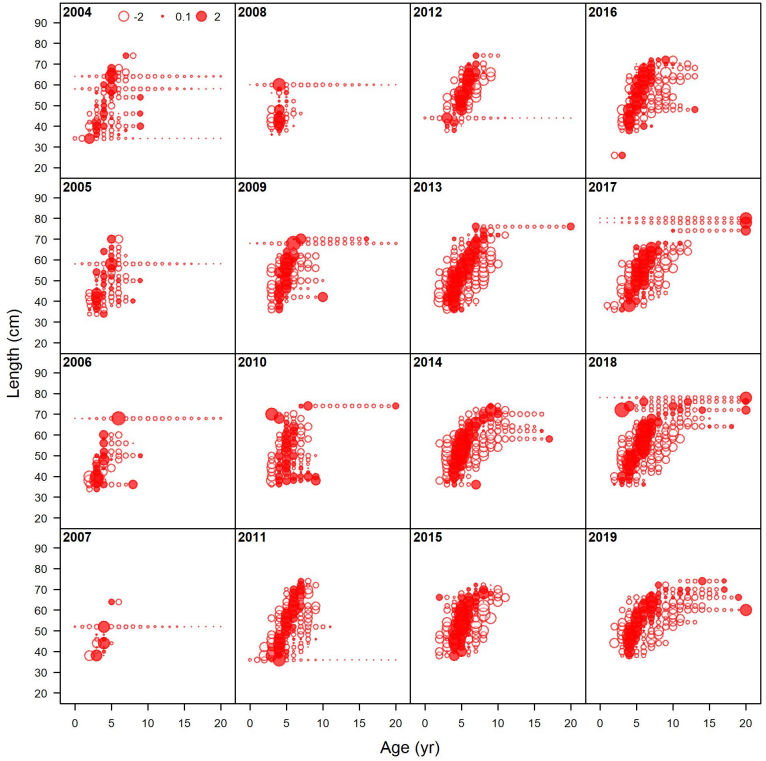
NOAA FISHERIES

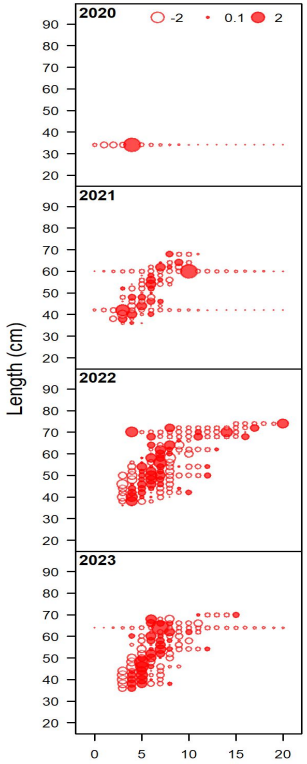
Recreational Headboat (West)

Closed = + (observed > expected)
Open = - (observed < expected)

- Conditional age-at-length residuals up to 6.45

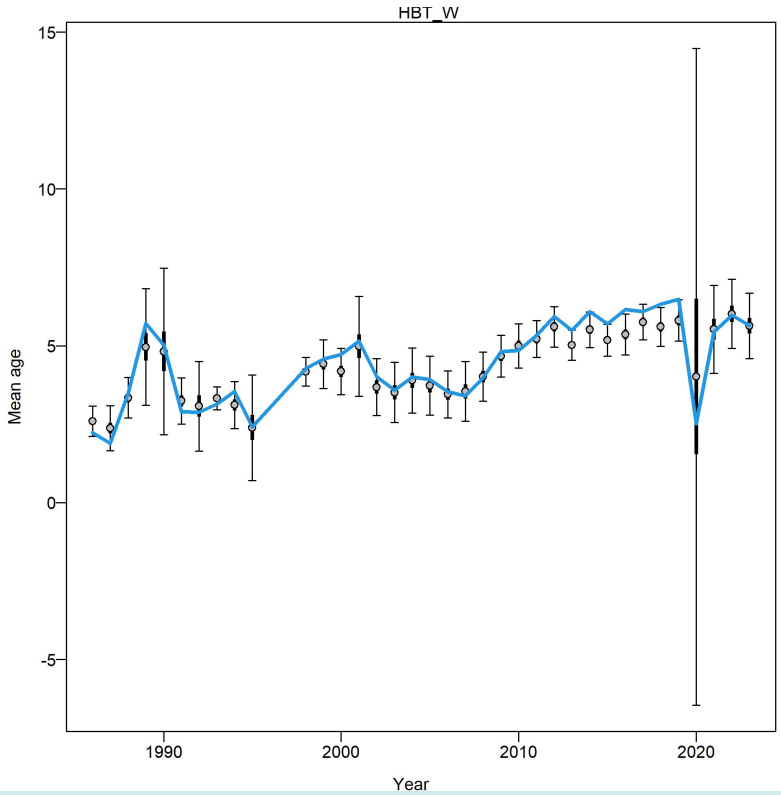




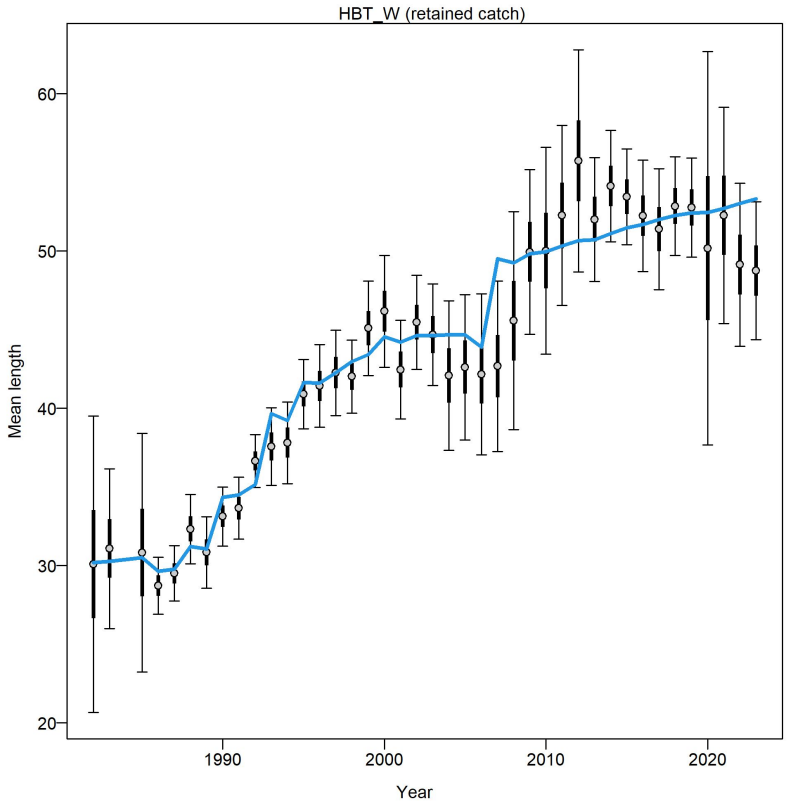


Recreational Headboat (West)

Fit to Mean Retained Age

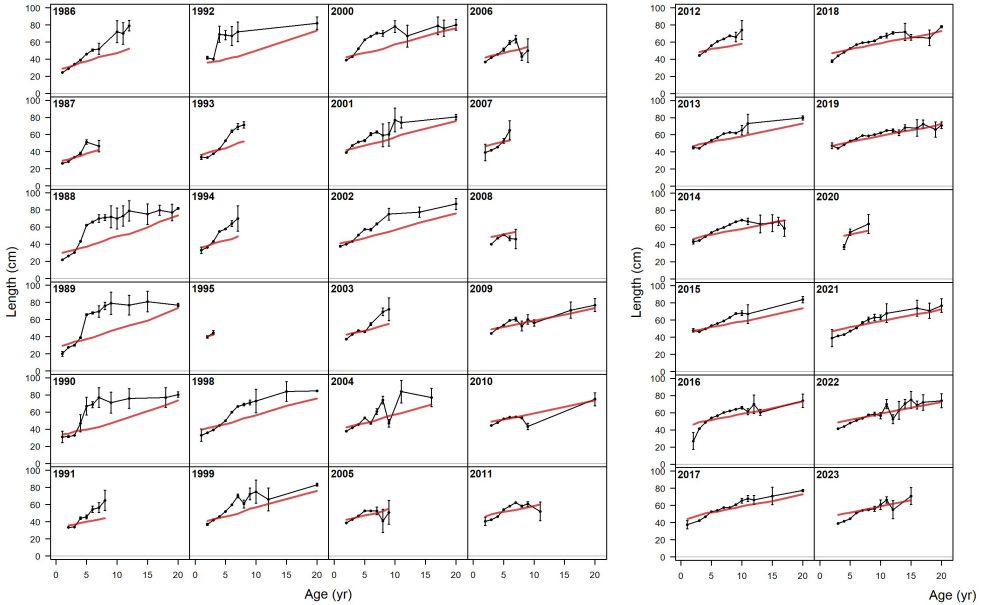


Fit to Mean Length



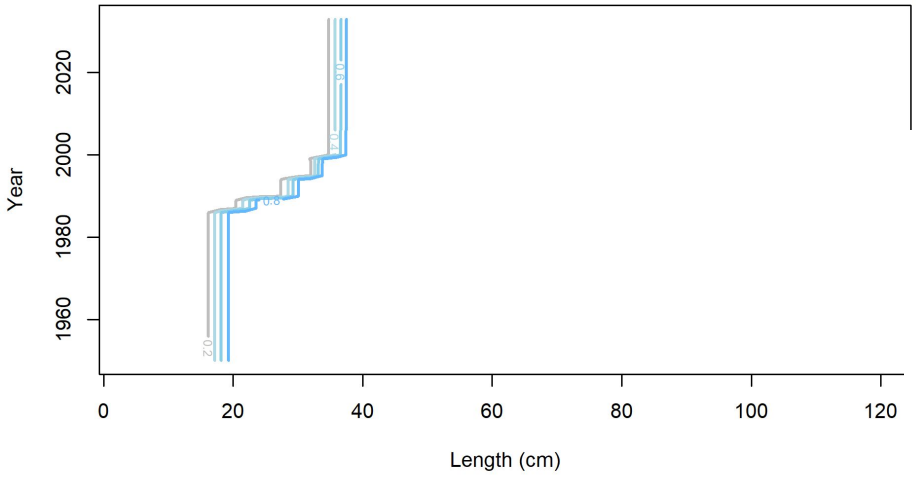
Recreational Headboat (West)

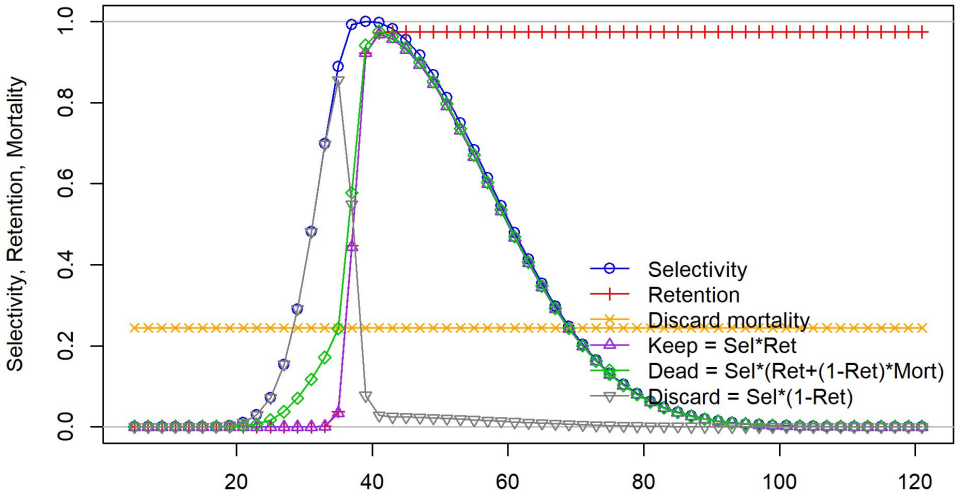
- Expected mean length-at-age* underestimates observed data

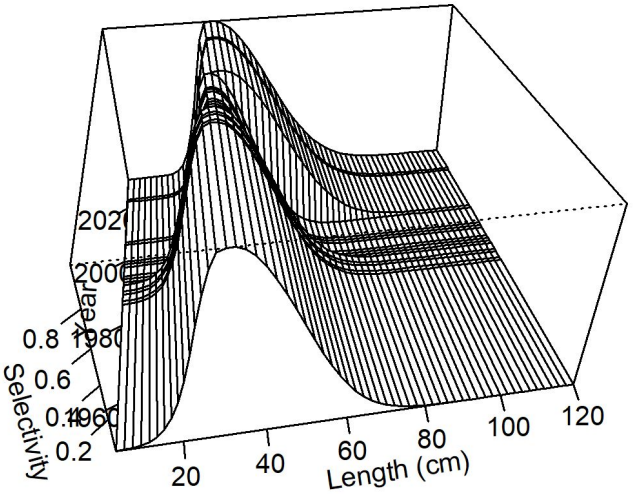


*Not included in likelihood

Recreational Headboat (Central)







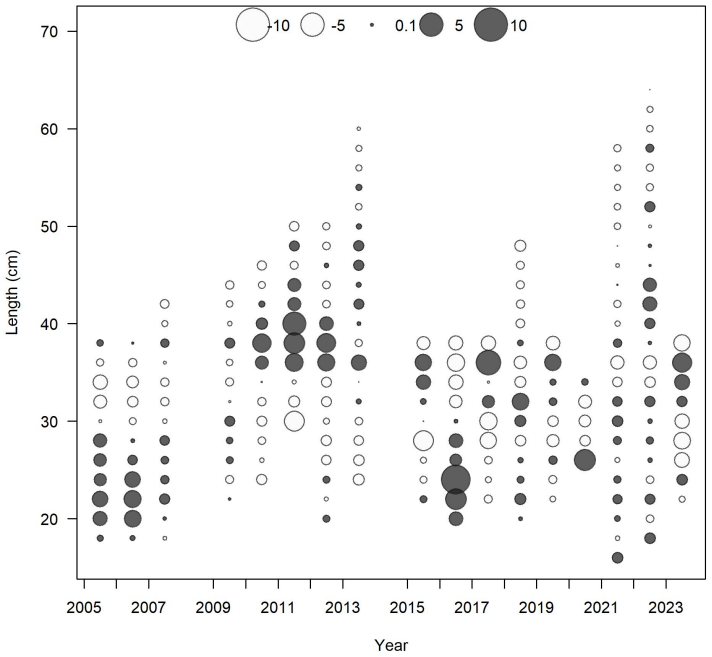
NOAA FISHERIES

Recreational Headboat (Central)

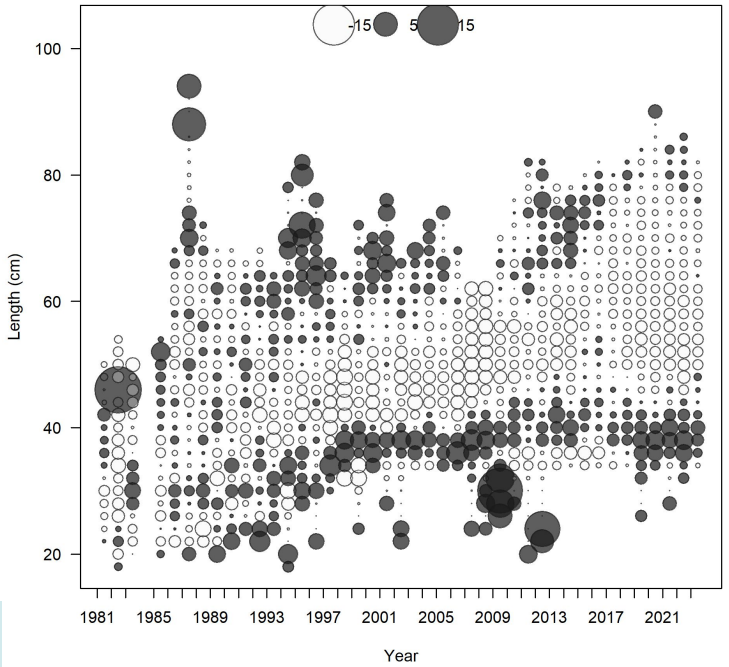
Closed = + (observed > expected)
Open = - (observed < expected)

- Legal sized discards observed and asymptotic retention estimated

Discards



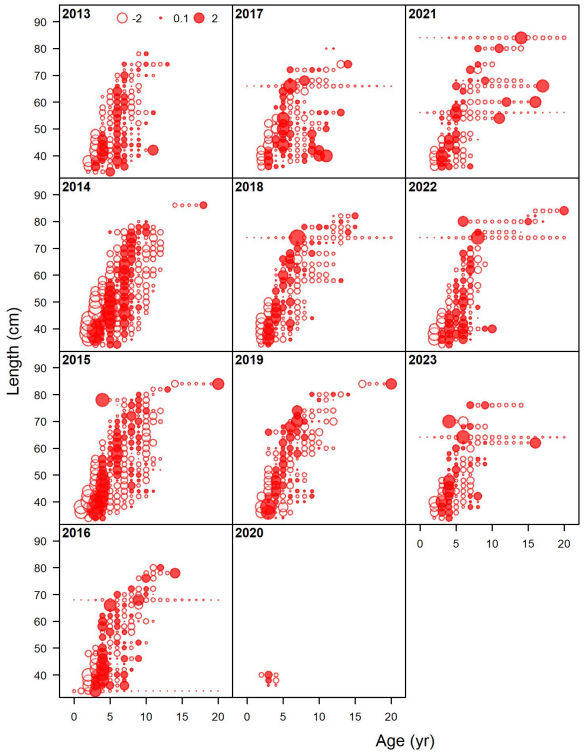
Retained Catch



Recreational Headboat (Central)

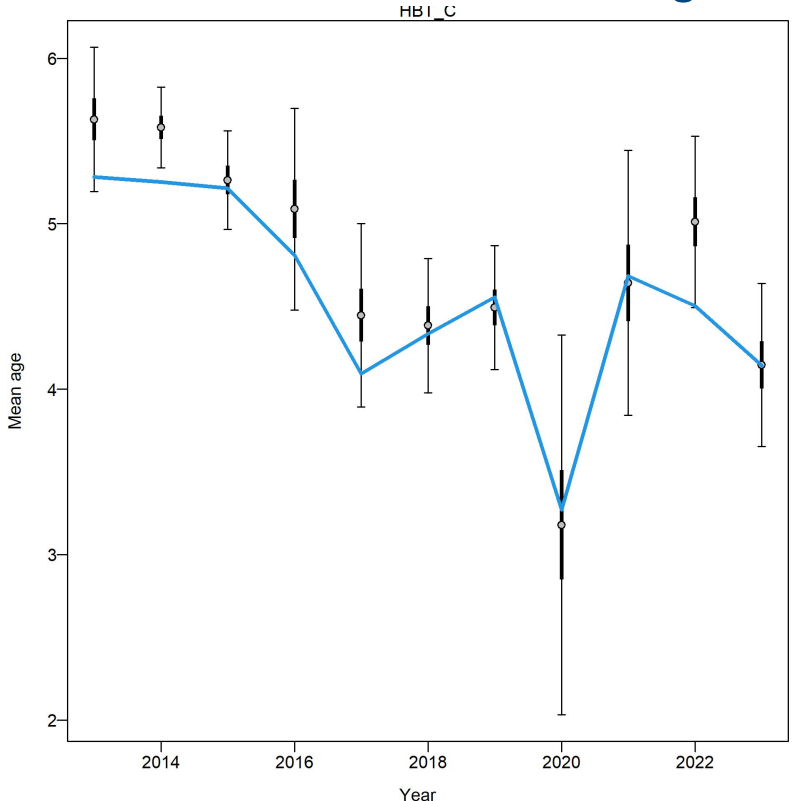
Closed = + (observed > expected)
Open = - (observed < expected)

- Conditional age-at-length residuals up to 6.11

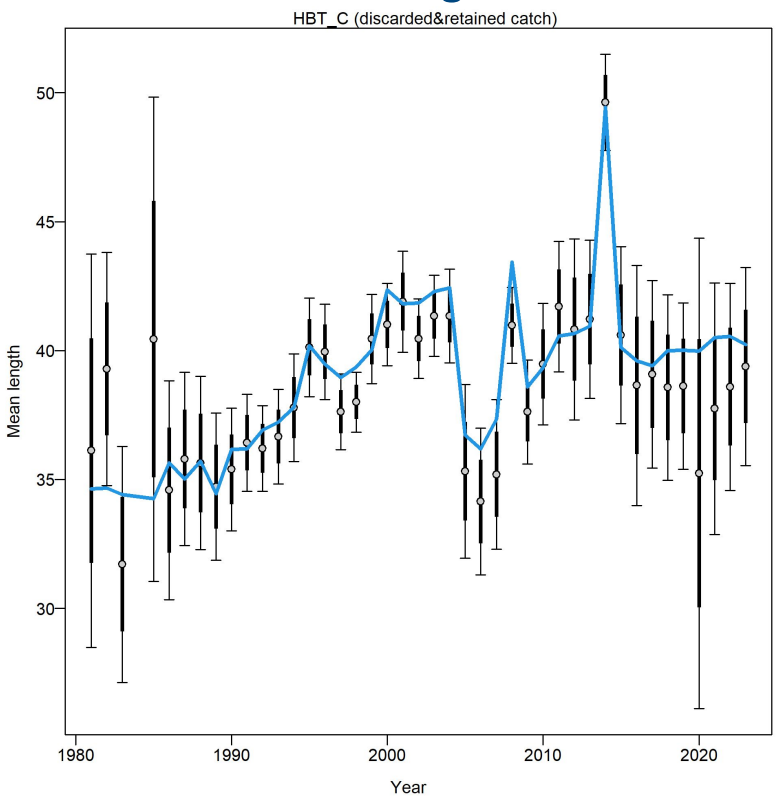


Recreational Headboat (Central)

Fit to Mean Retained Age

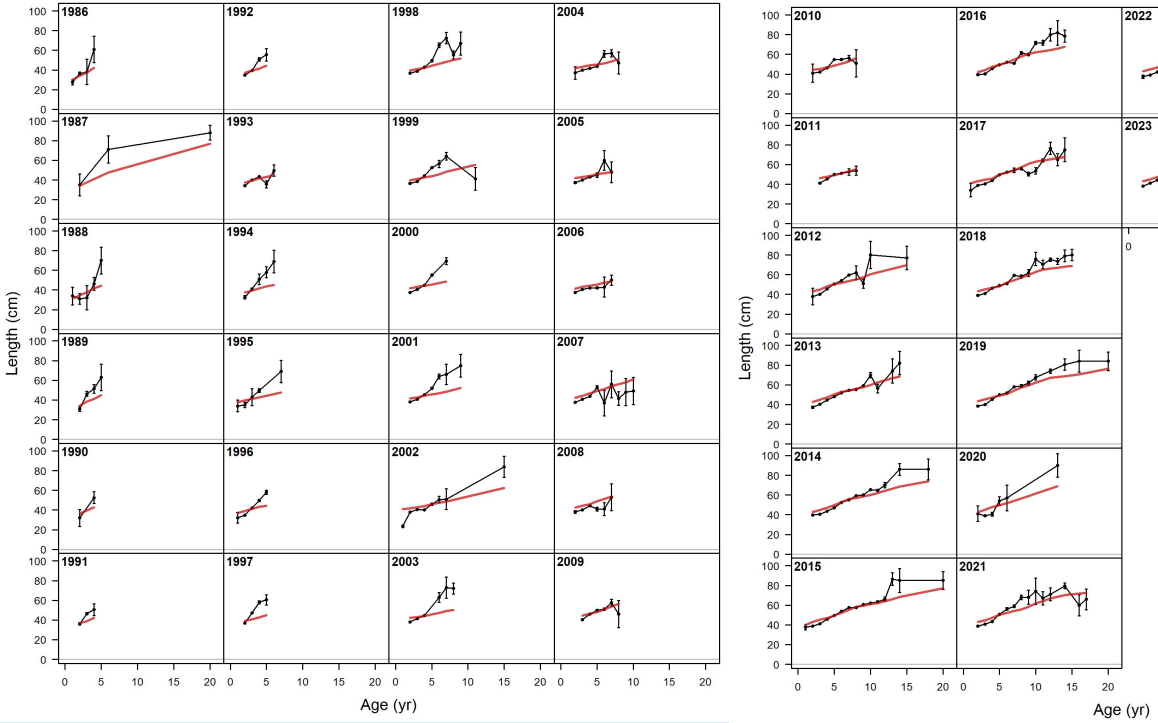


Fit to Mean Length



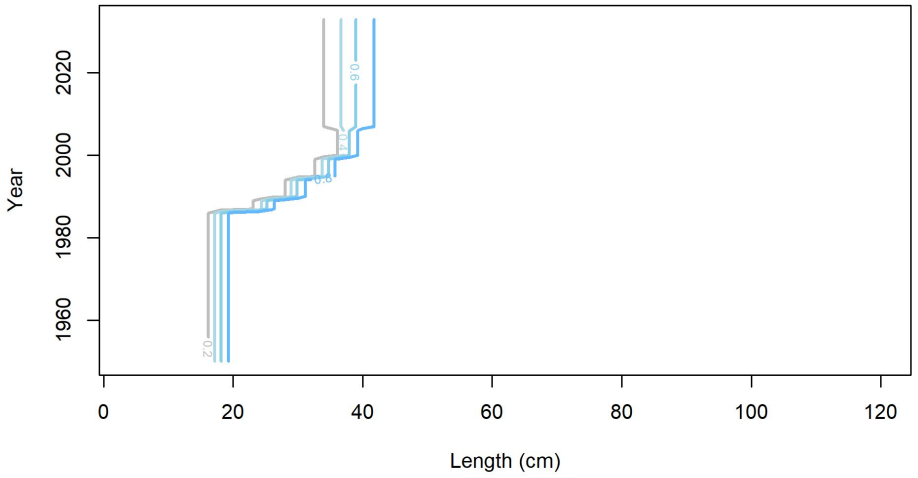
Recreational Headboat (Central)

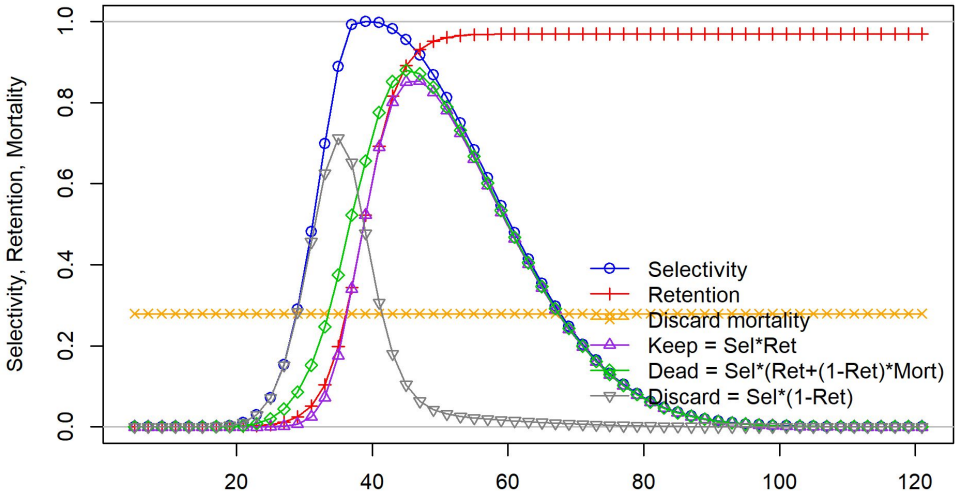
- Expected mean length-at-age* similar to observed data

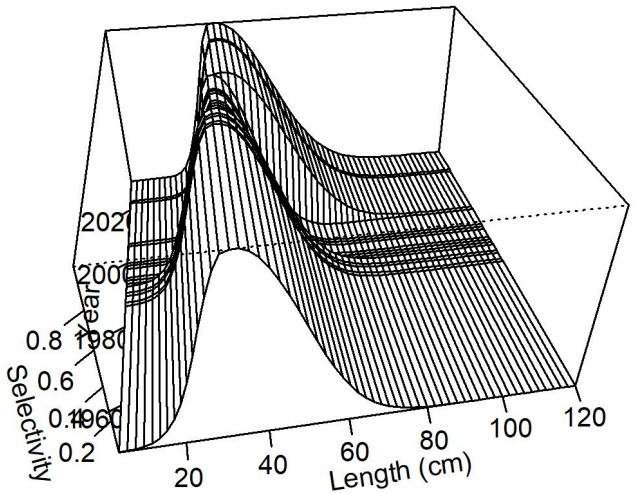


*Not included in likelihood

Recreational Headboat (East)





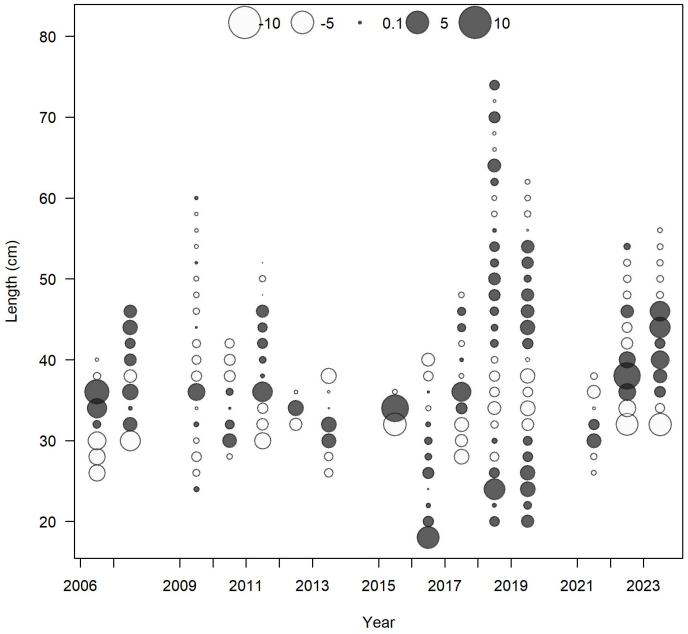


Recreational Headboat (East)

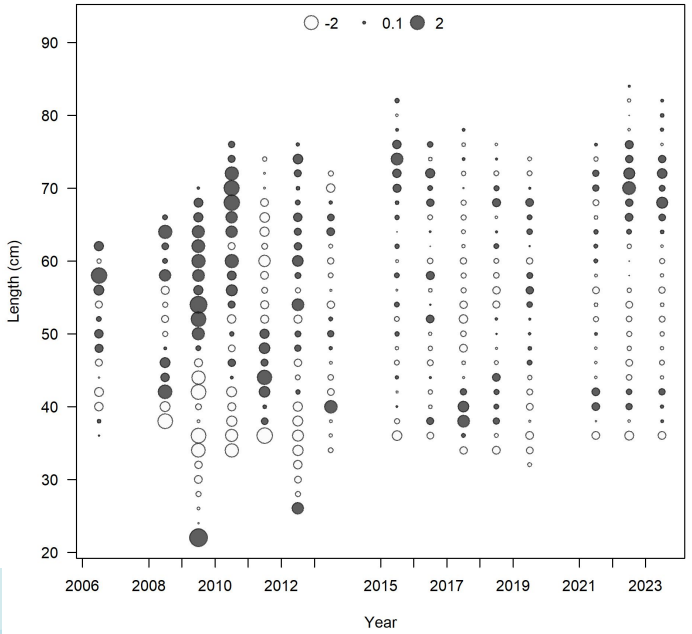
Closed = + (observed > expected)
Open = - (observed < expected)

- Legal sized discards observed and asymptotic retention estimated

Discards



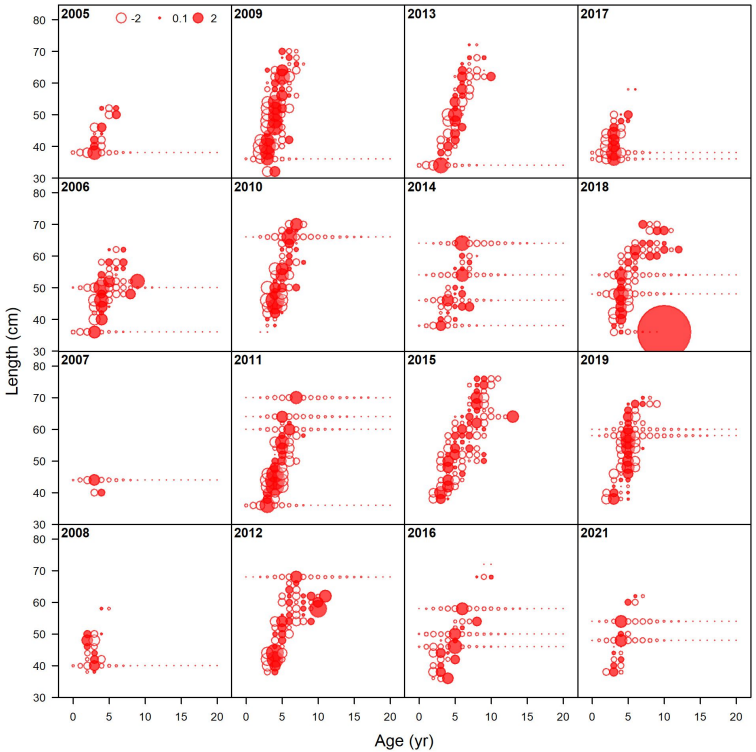
Retained Catch

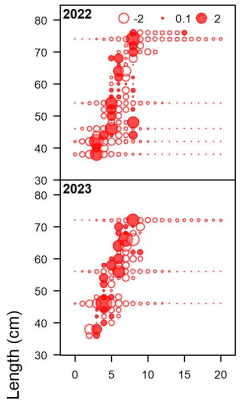


Recreational Headboat (East)

Closed = + (observed > expected)
Open = - (observed < expected)

- Conditional age-at-length residuals up to 54.96

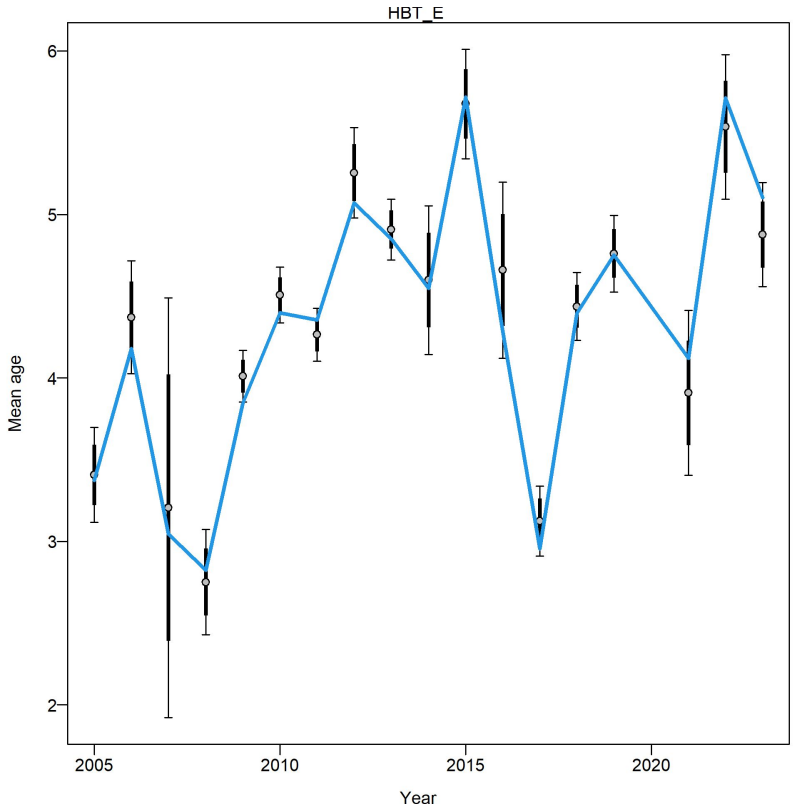




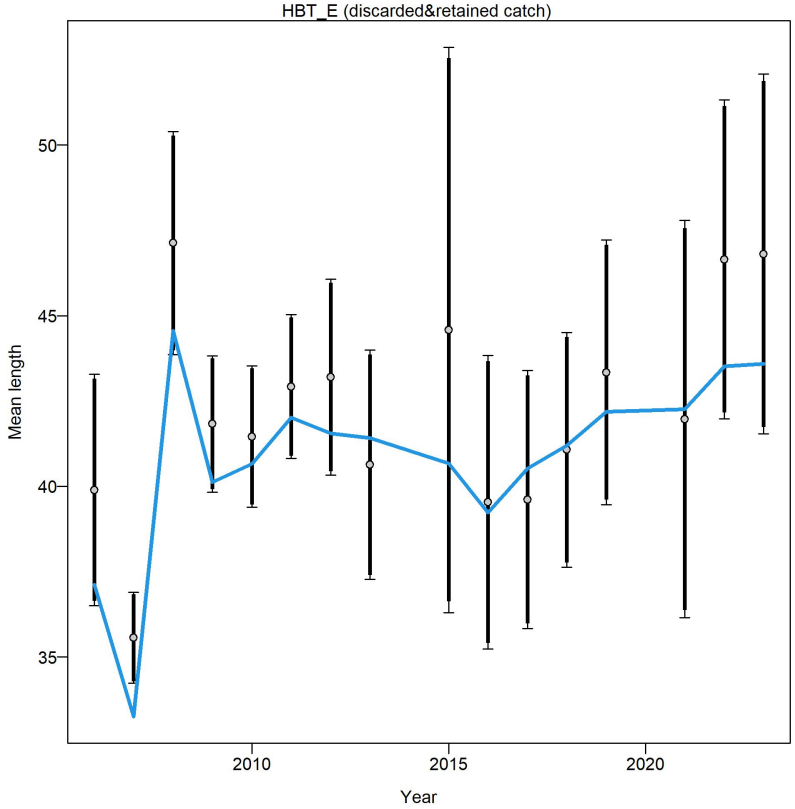
Age (yr)

Recreational Headboat (East)

Fit to Mean Retained Age

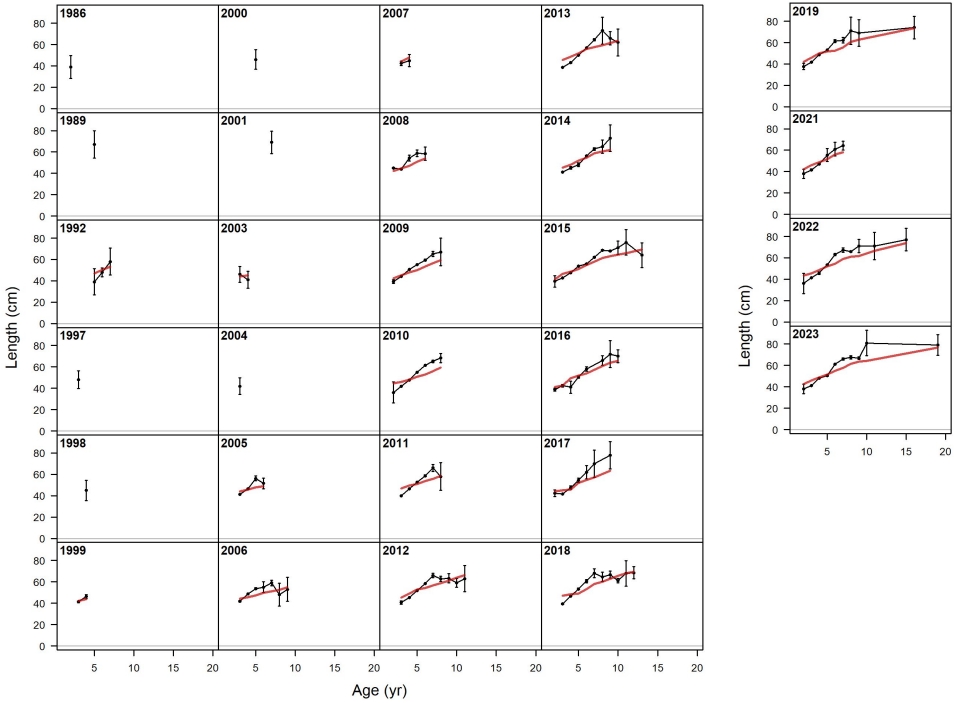


Fit to Mean Length



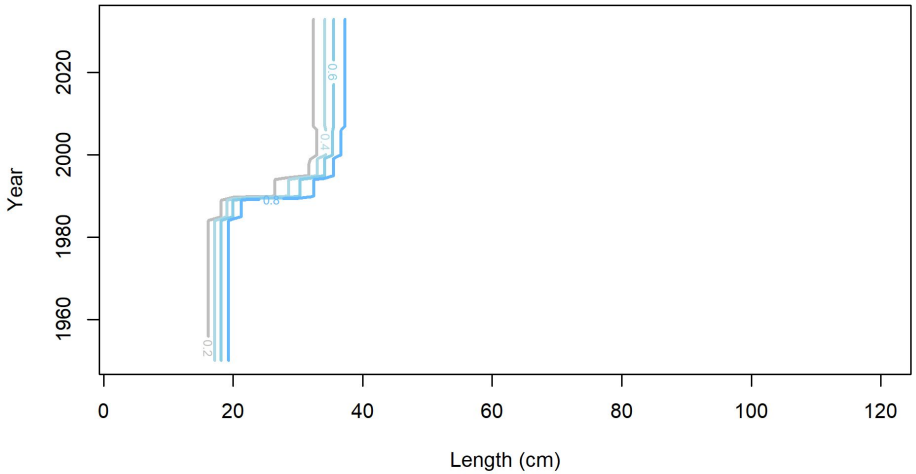
Recreational Headboat (East)

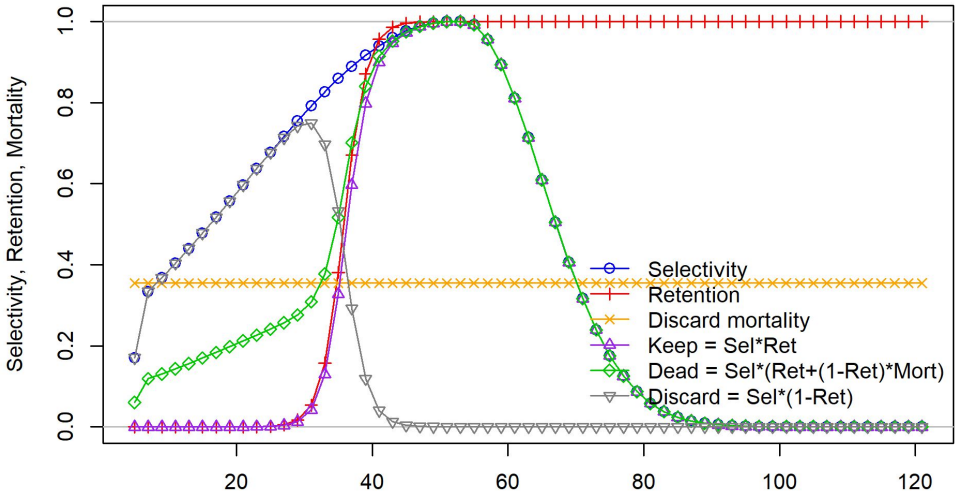
- Expected mean length-at-age* similar to observed data

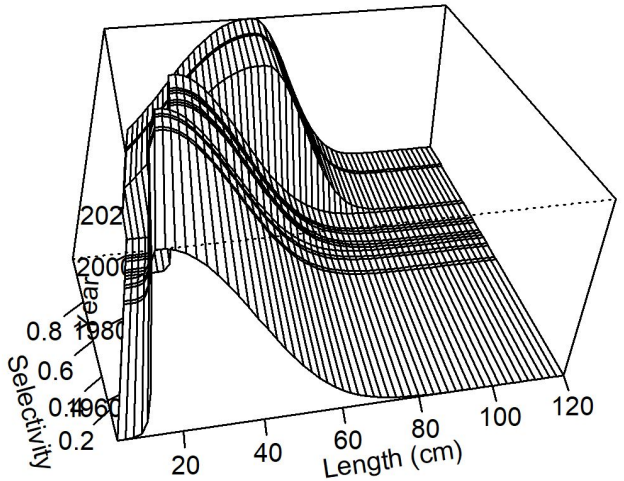


*Not included in likelihood

Recreational Private (West)







Recreational Private (West)

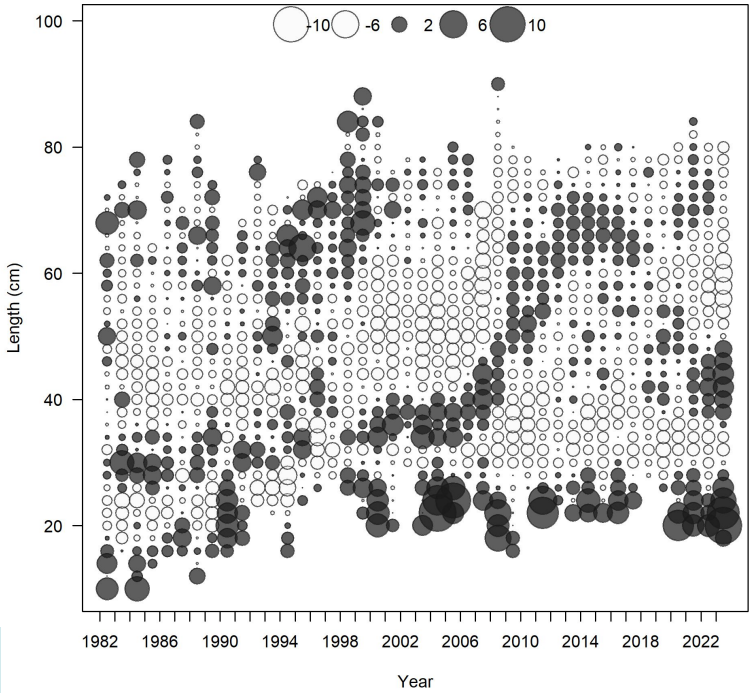
Closed = + (observed > expected)
Open = - (observed < expected)

- Asymptotic retention Fixed (100% retention)

Discards

No length composition included

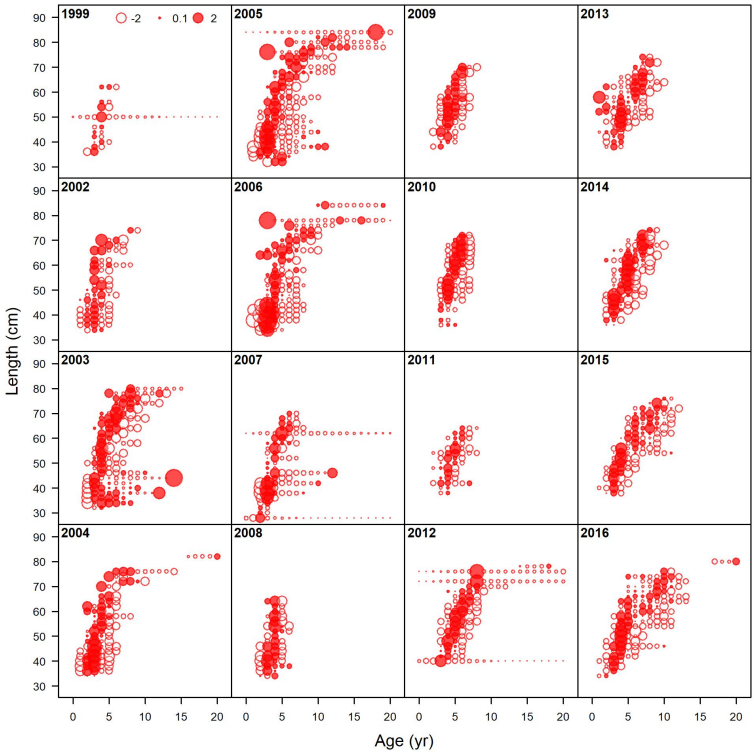
Retained Catch

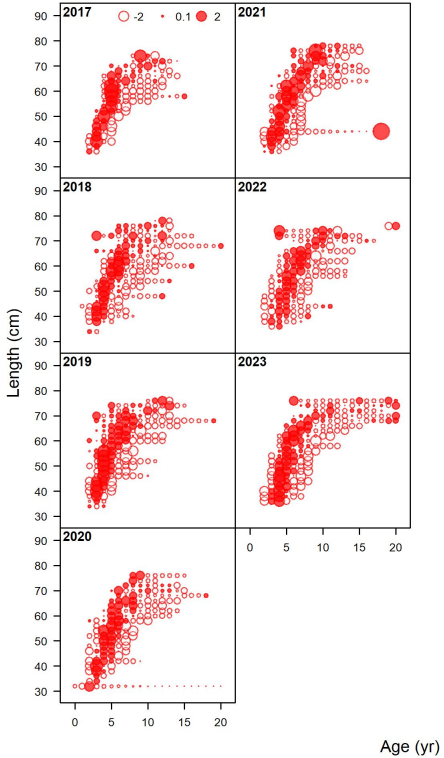


Recreational Private (West)

Closed = + (observed > expected)
Open = - (observed < expected)

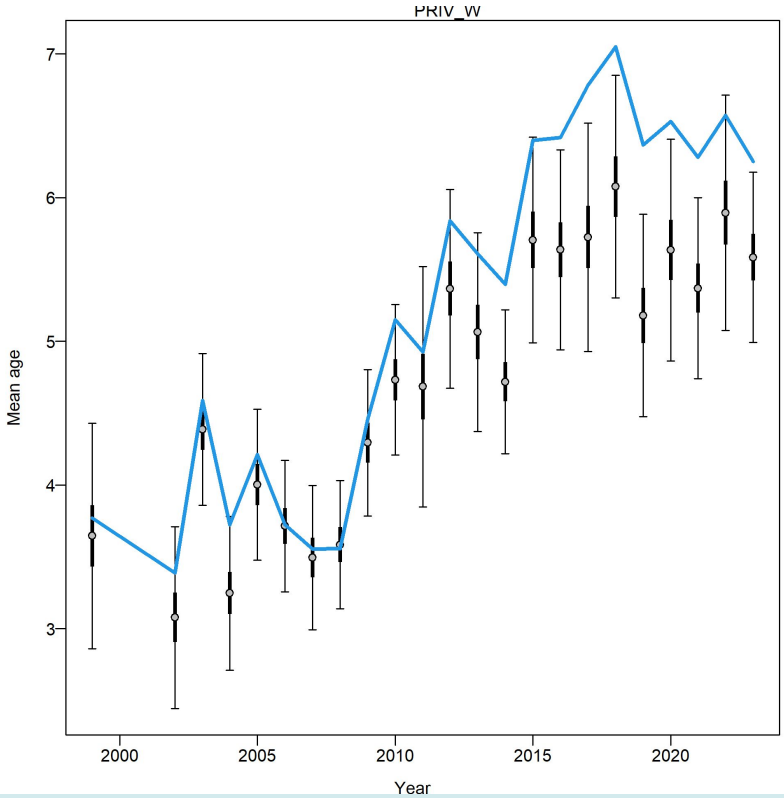
- Conditional age-at-length residuals up to 7.21



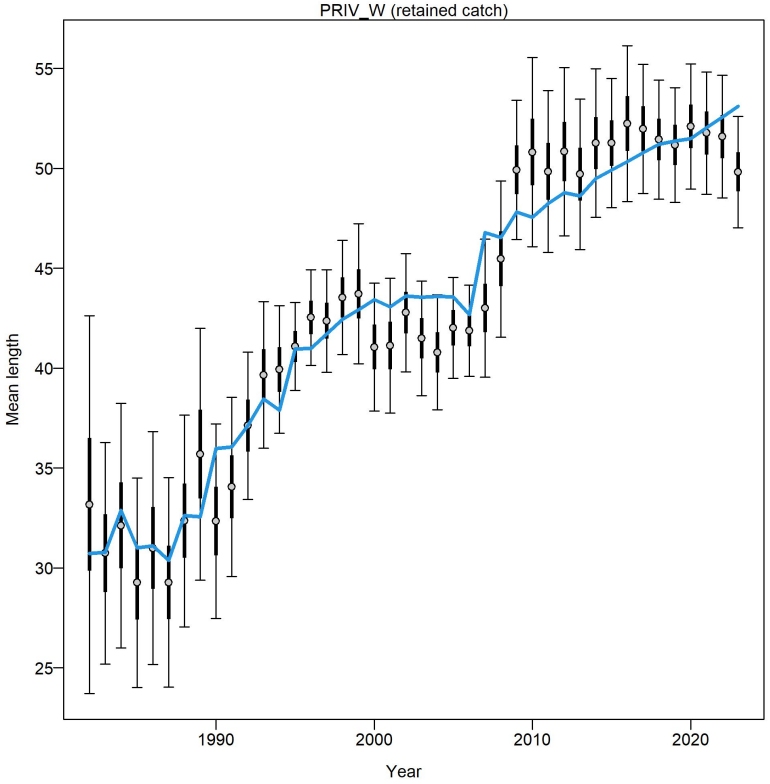


Recreational Private (West)

Fit to Mean Retained Age



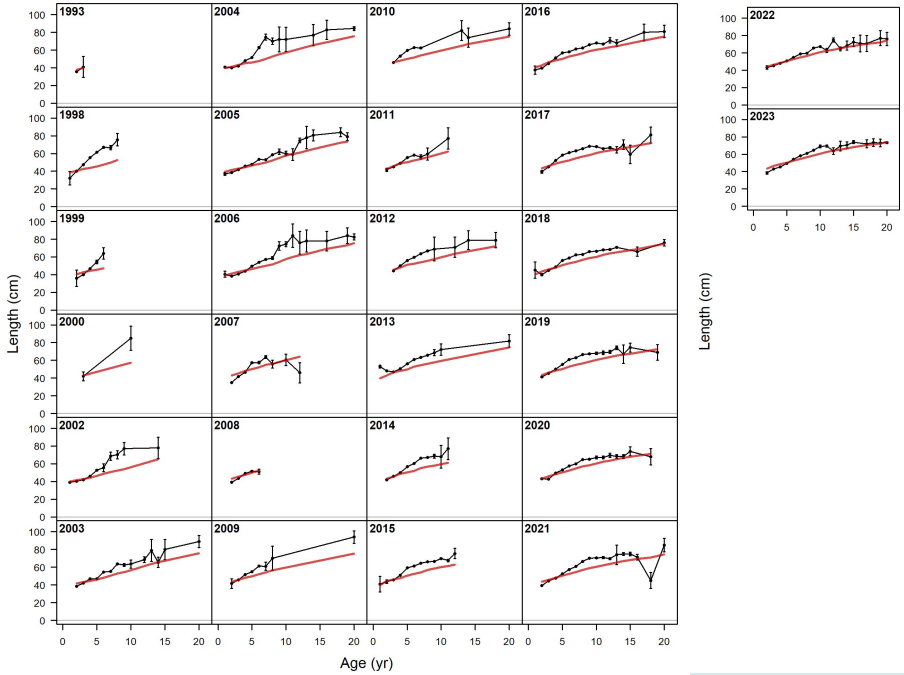
Fit to Mean Length



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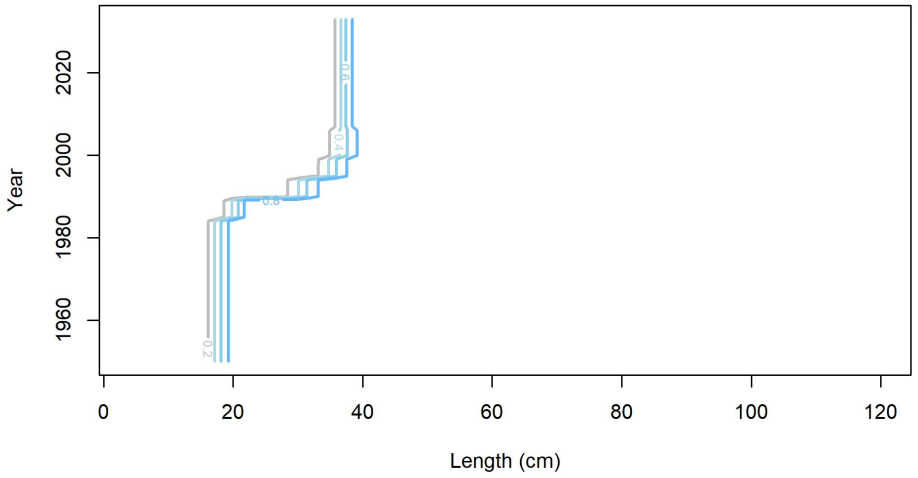
Recreational Private (West)

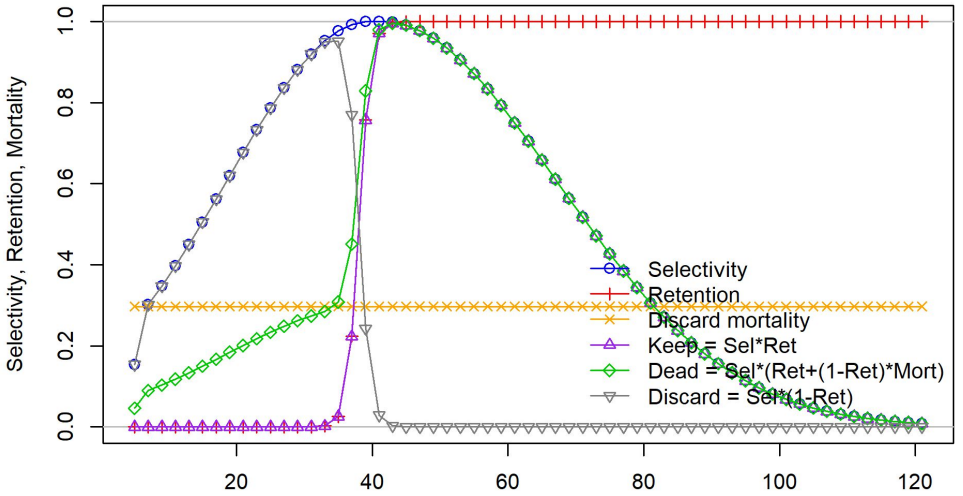
- Expected mean length-at-age* underestimates observed data

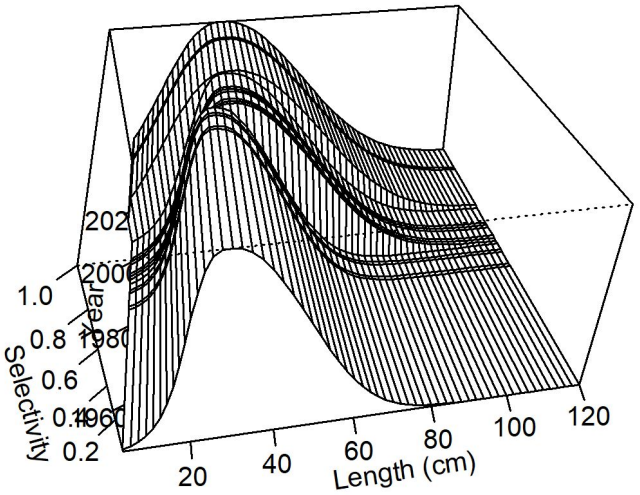


*Not included in likelihood

Recreational Private (Central)







Recreational Private (Central)

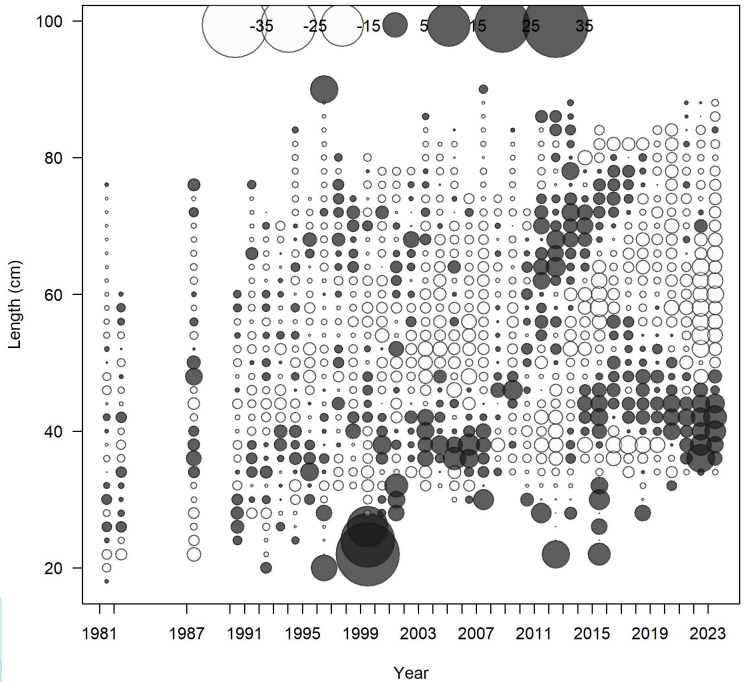
Closed = + (observed > expected)
Open = - (observed < expected)

- Asymptotic retention Fixed (100% retention)

Discards

No length composition included

Retained Catch

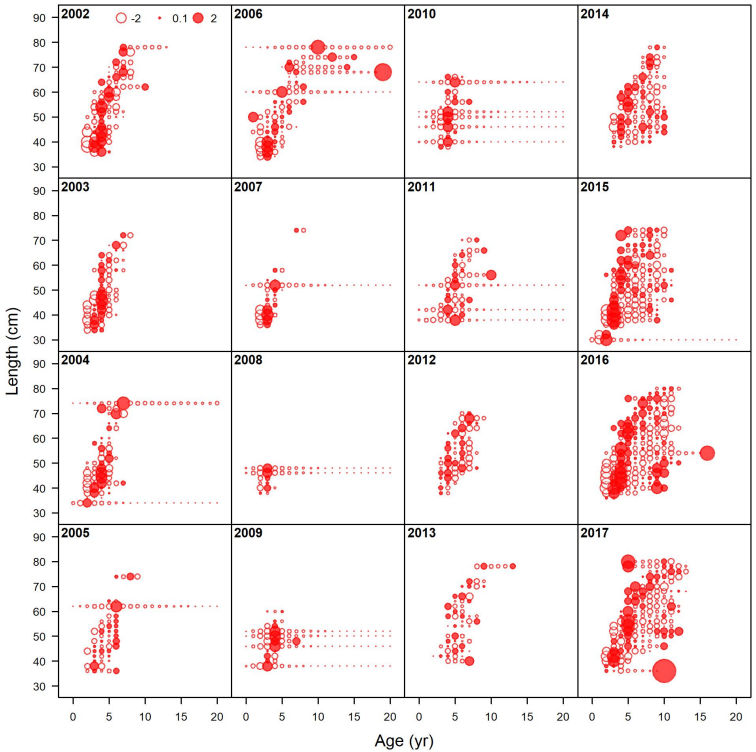


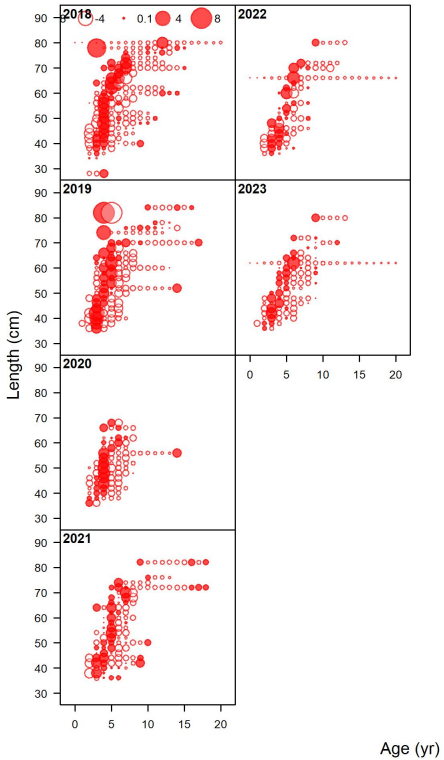
Recreational Private (Central)

Closed = + (observed > expected)

Open = - (observed < expected)

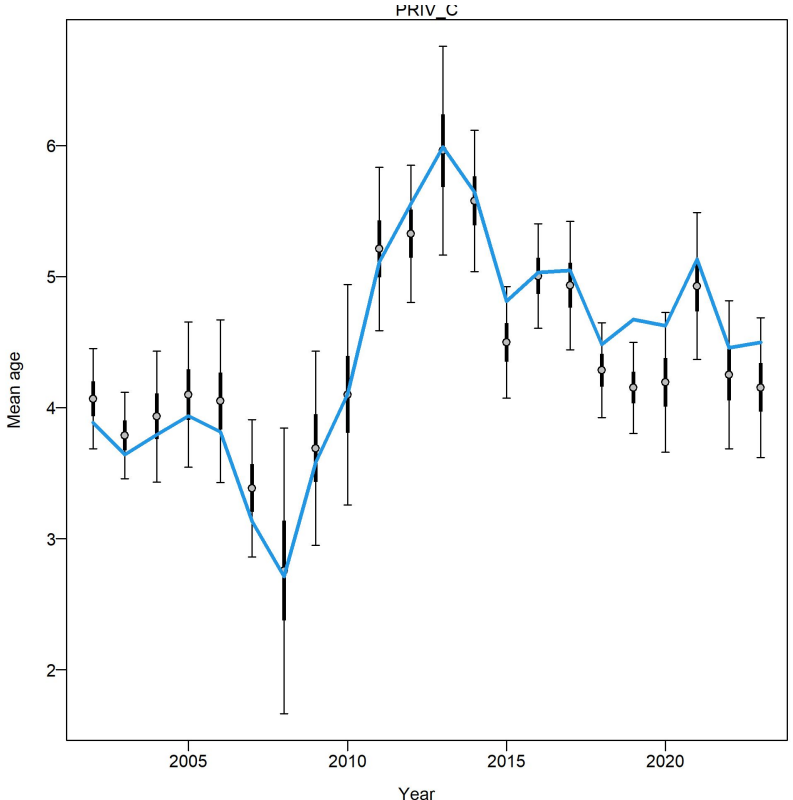
- Conditional age-at-length residuals up to 10.28



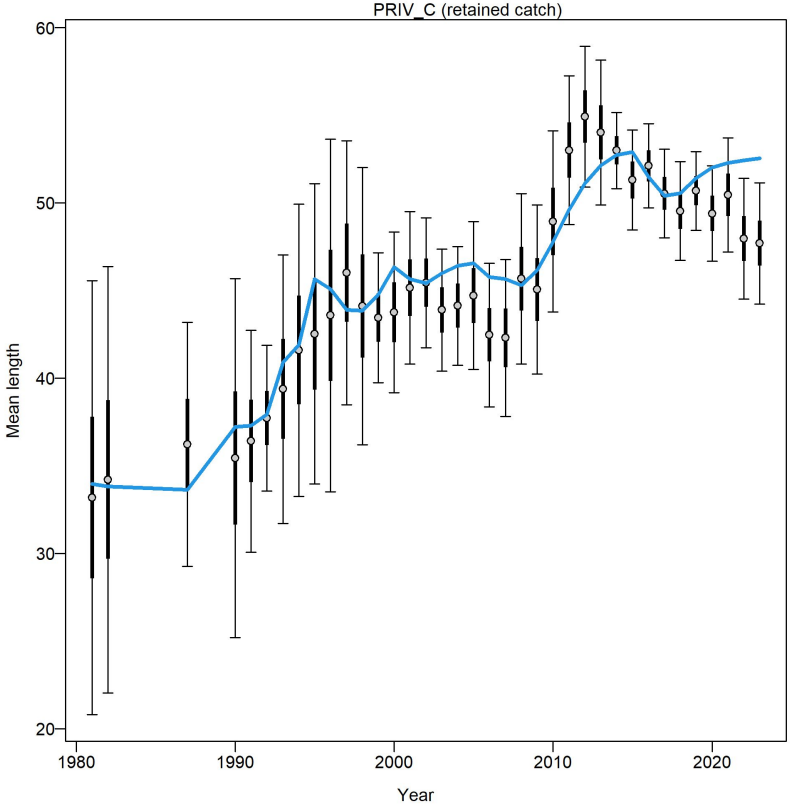


Recreational Private (Central)

Fit to Mean Retained Age

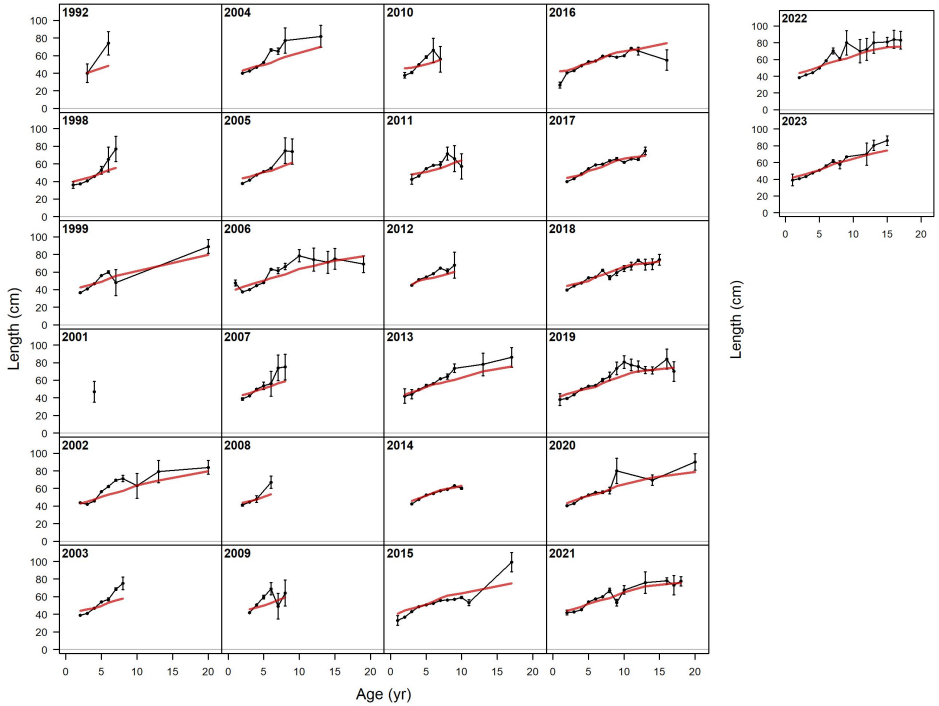


Fit to Mean Length



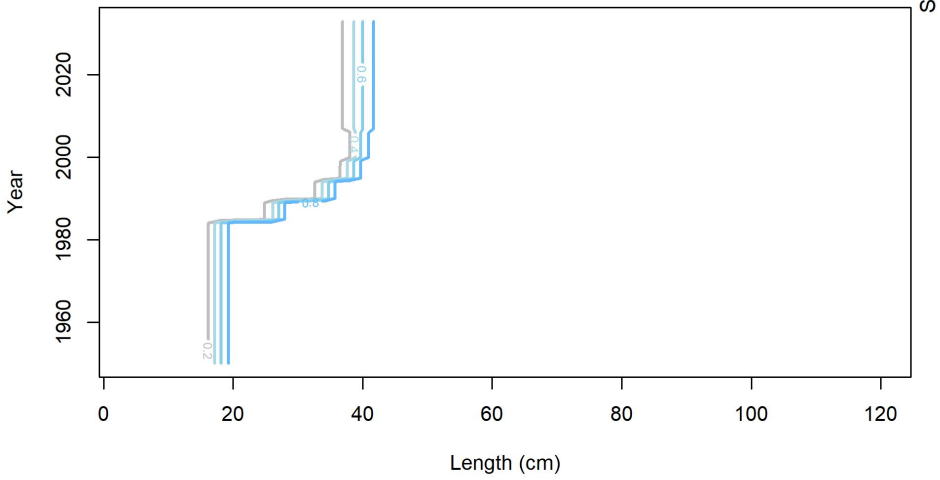
Recreational Private (Central)

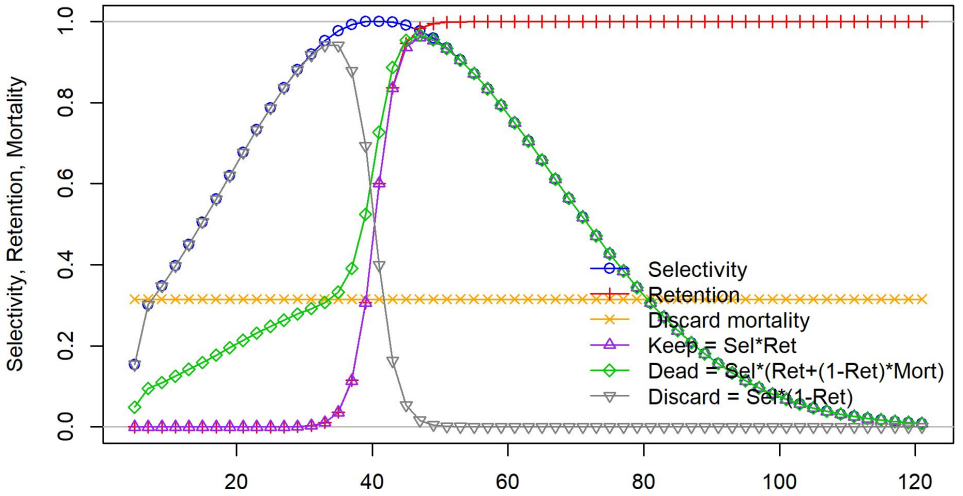
- Expected mean length-at-age* similar to observed data

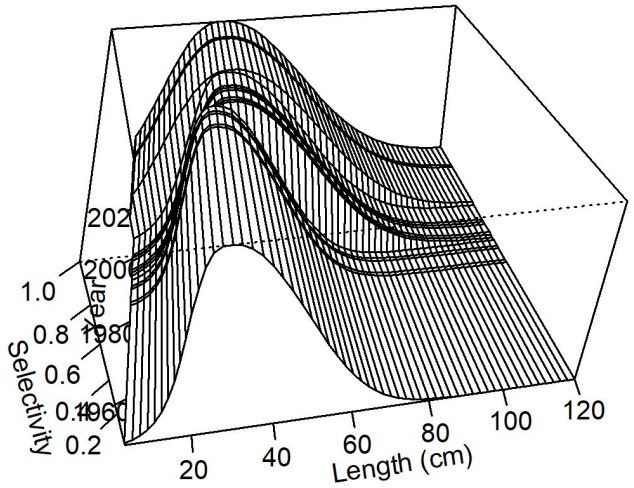


*Not included in likelihood

Recreational Private (East)







NOAA FISHERIES

Recreational Private (East)

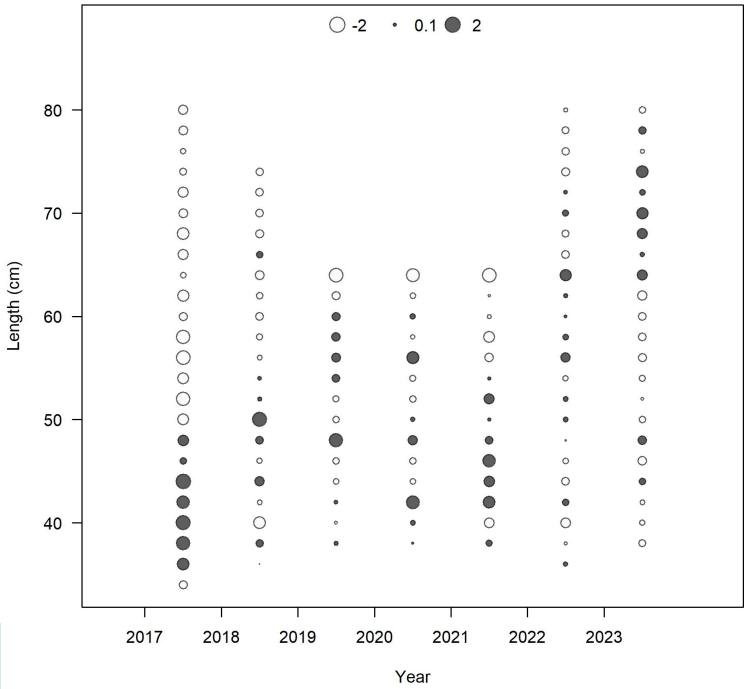
Closed = + (observed > expected)
Open = - (observed < expected)

- Asymptotic retention Fixed (100% retention)

Discards

No length composition included

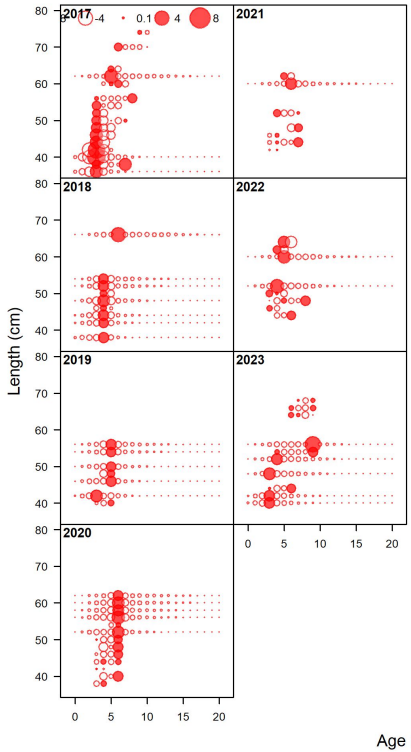
Retained Catch



Recreational Private (East)

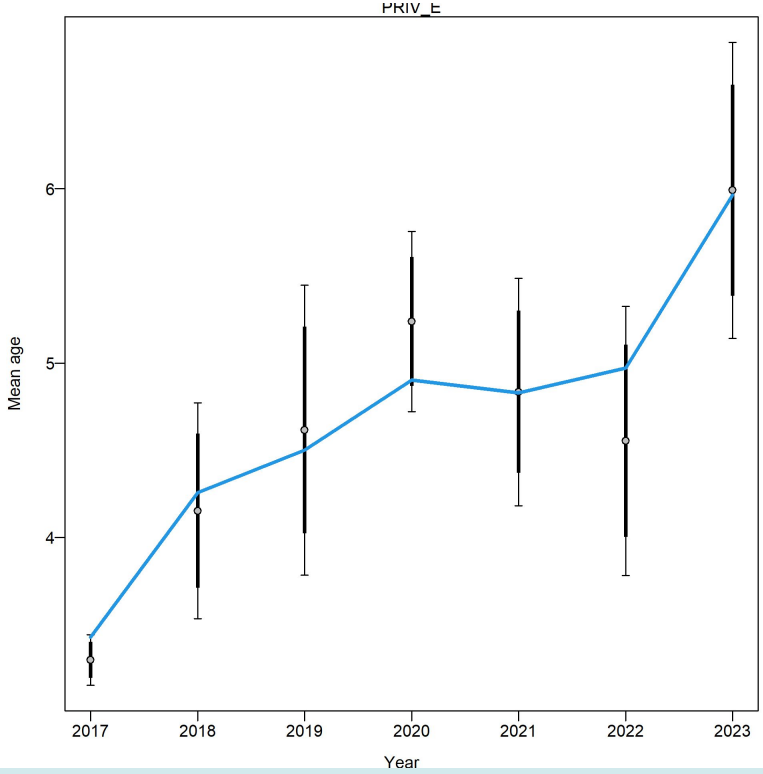
Closed = + (observed > expected)
Open = - (observed < expected)

- Conditional age-at-length residuals up to 6.21

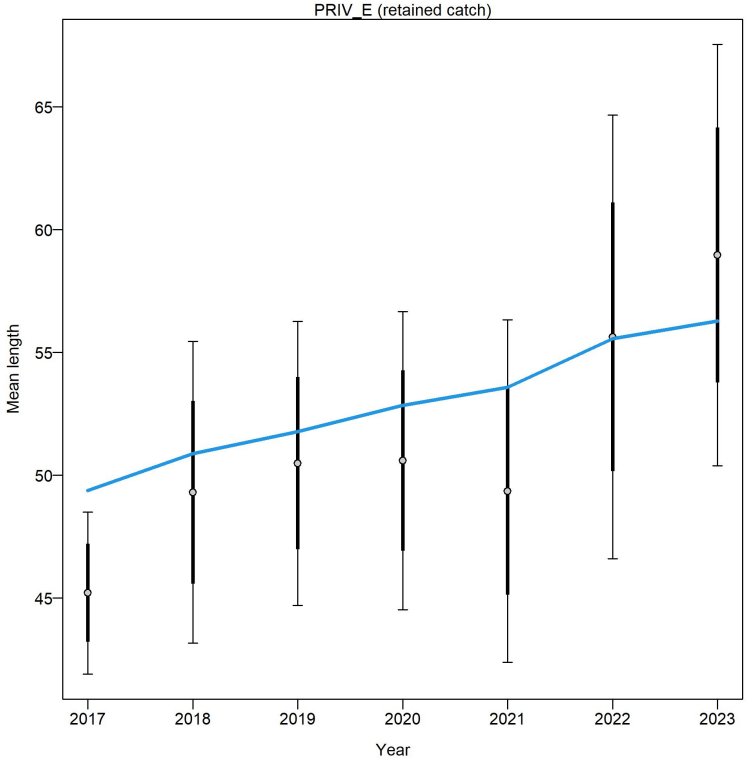


Recreational Private (East)

Fit to Mean Retained Age

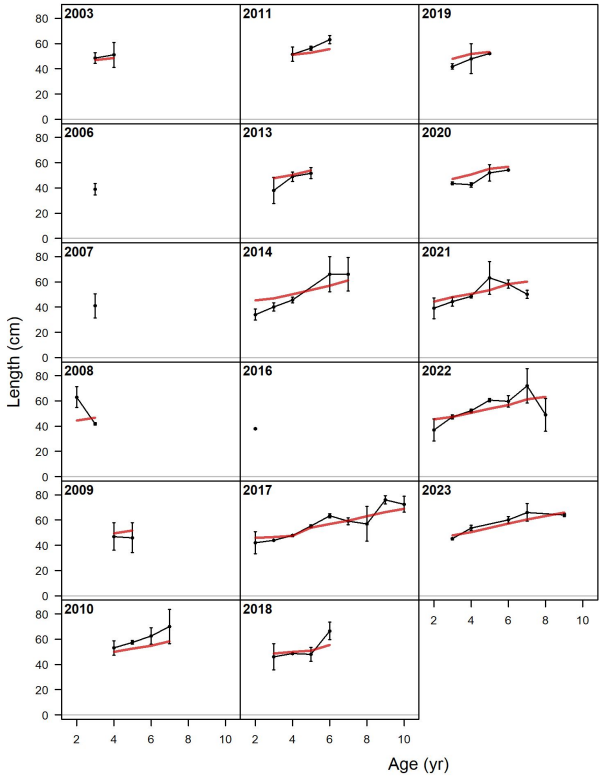


Fit to Mean Length



Recreational Private (East)

- Expected mean length-at-age* similar to observed data



*Not included in likelihood

Discard Only & Bycatch Fleets:

Selectivity, Retention, and Fits to Composition Data

NOAA FISHERIES

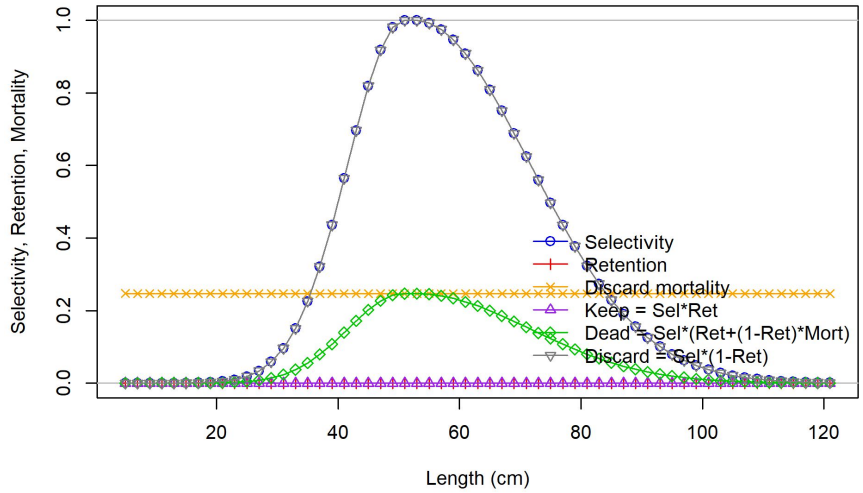
Discard Only Fleets

- Selectivity for the Handline and Private Discard only fleets was mirrored to the open season fleets for all areas due to a lack of composition data.
- Headboat fleet had discard only composition data available so selectivity was estimated using the double normal parameterization
- In all cases retention was set at 100% discards and discard mortality was applied equally across all length bins

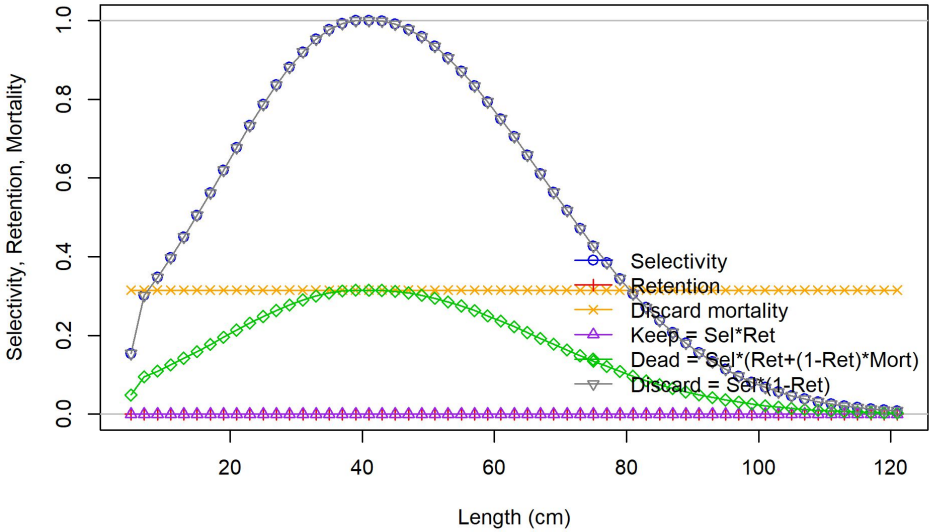
NOAA FISHERIES

Examples

HL closed east

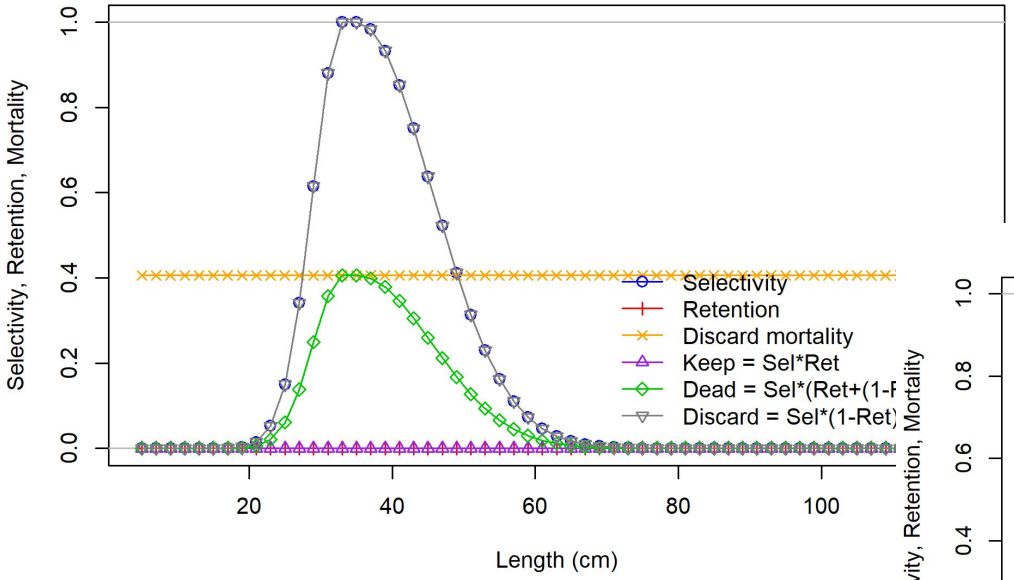


Private closed east

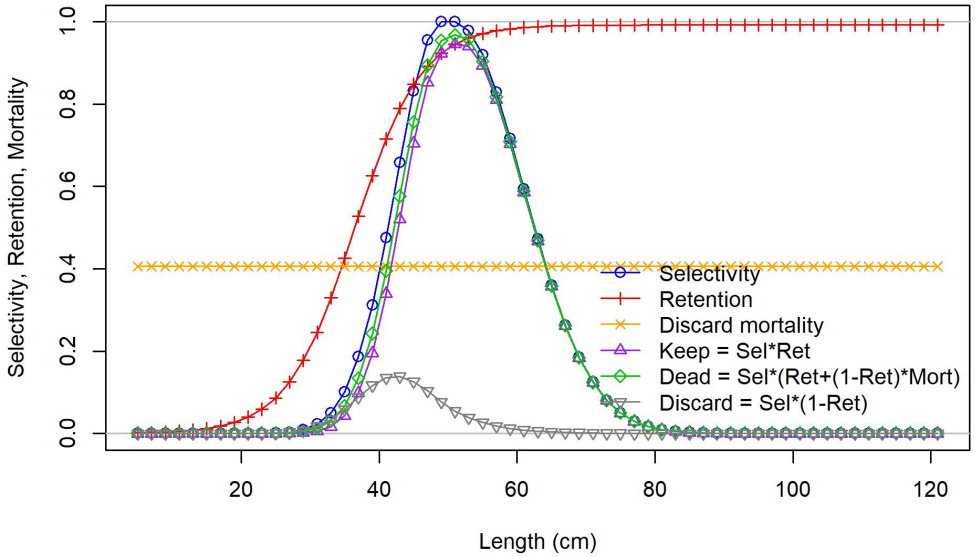


NOAA FISHERIES

Closed Season Discard Headboat West

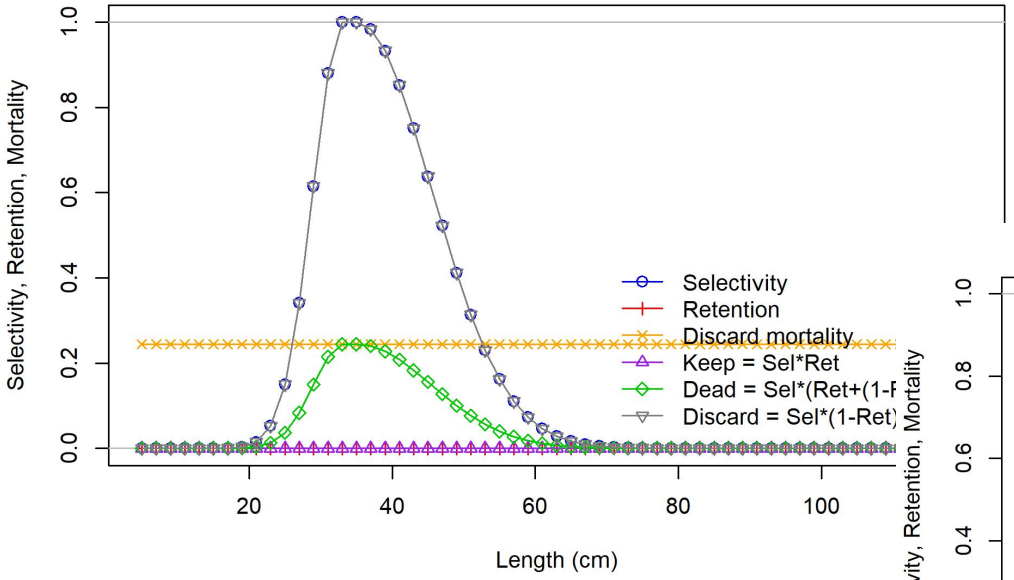


Open



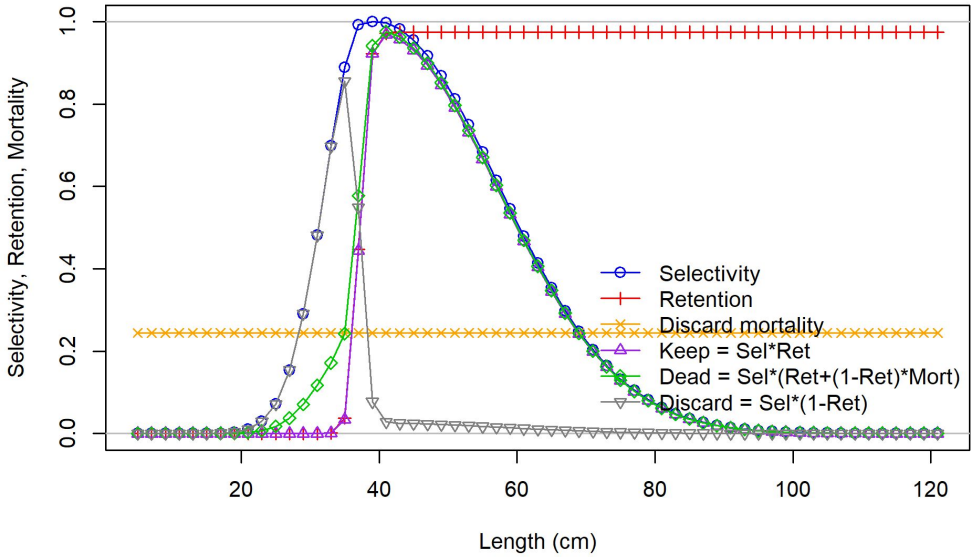
Closed: No Comp mirrored to Central

Closed Season Discard Headboat Central

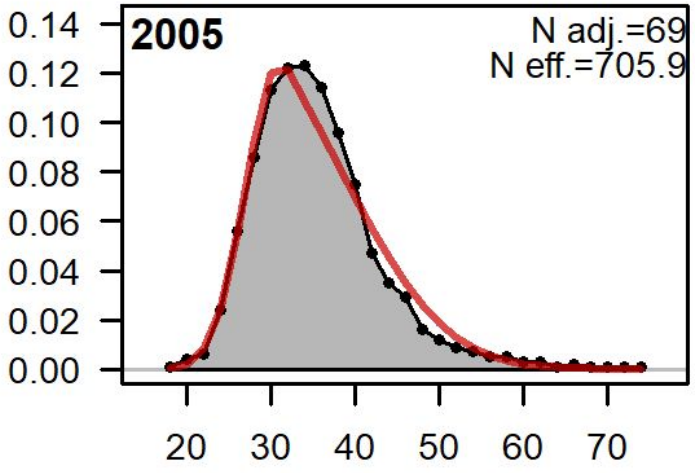


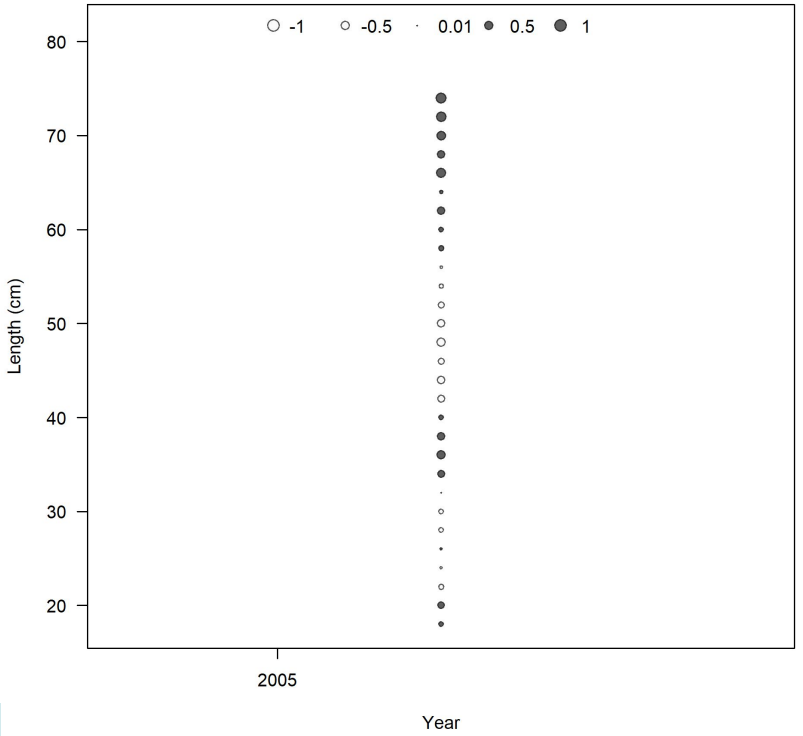
Closed

Open

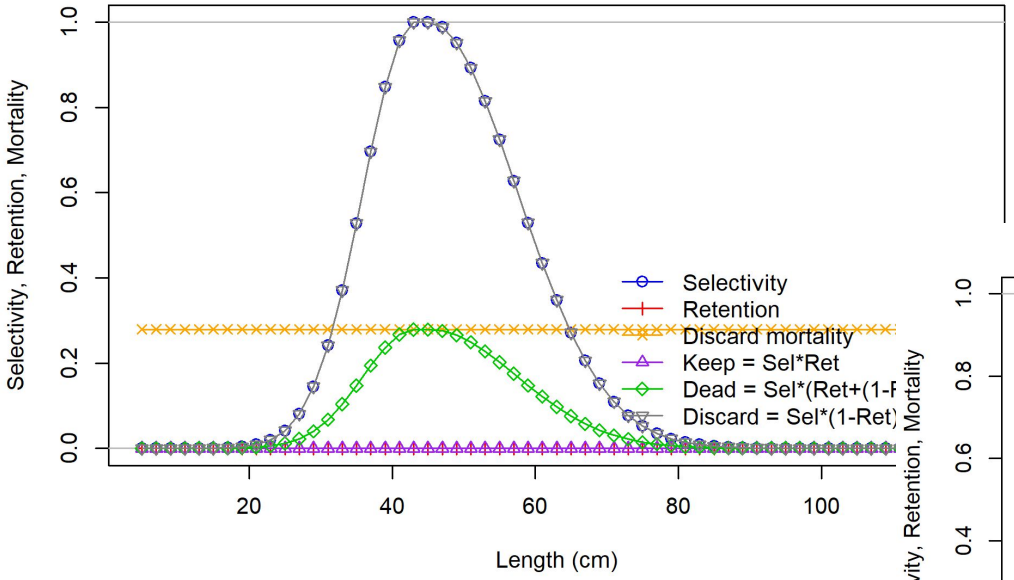


Closed Season Discard Headboat Central



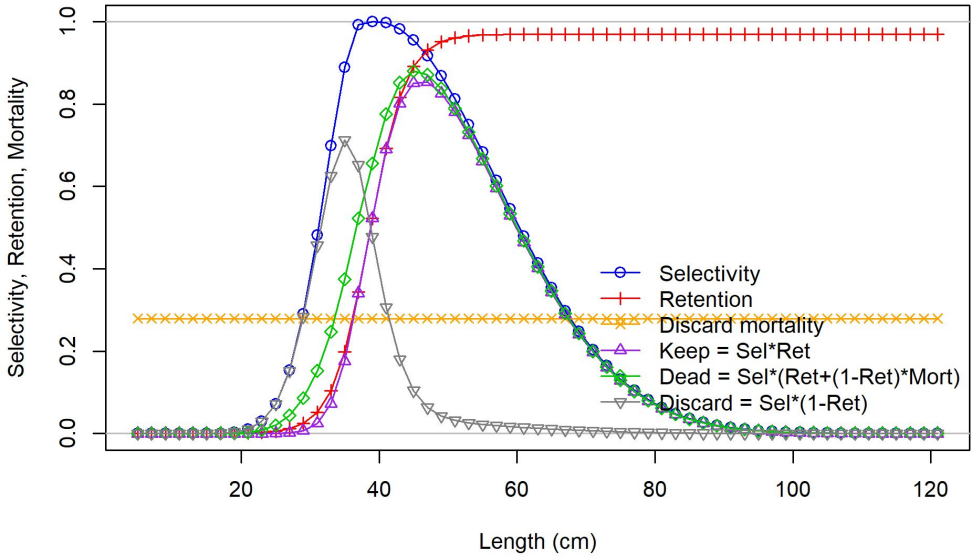


Closed Season Discard Headboat East

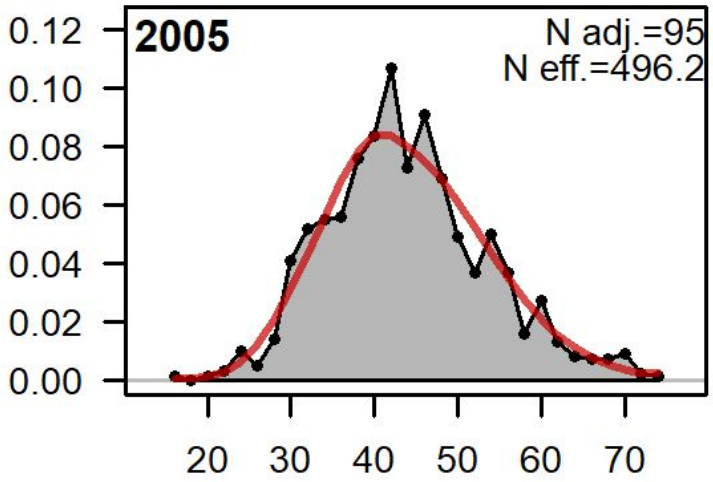


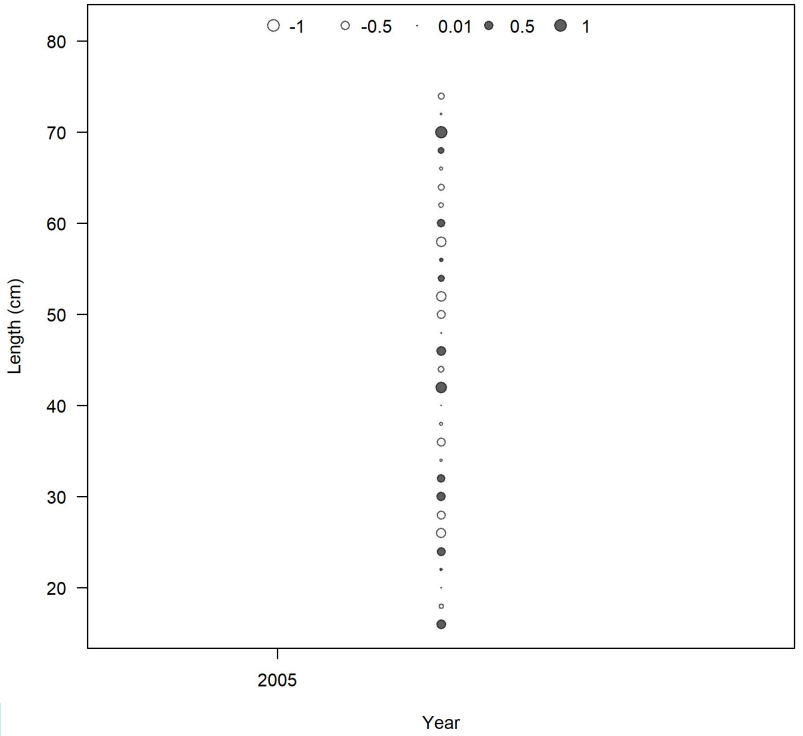
Closed

Open



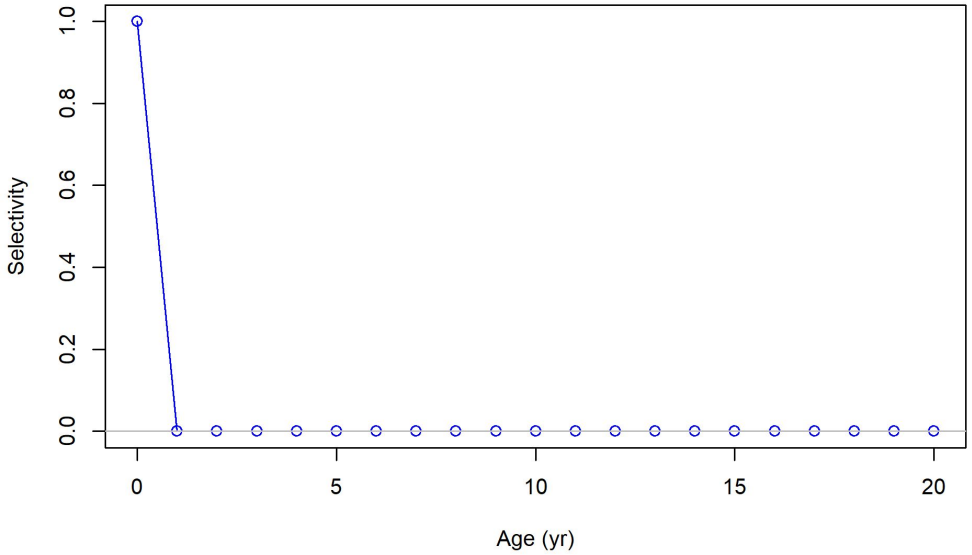
Closed Season Discard Headboat East





Shrimp Bycatch

Selectivity fixed at 100% age 0 and 0% all other ages. 100% dead discards



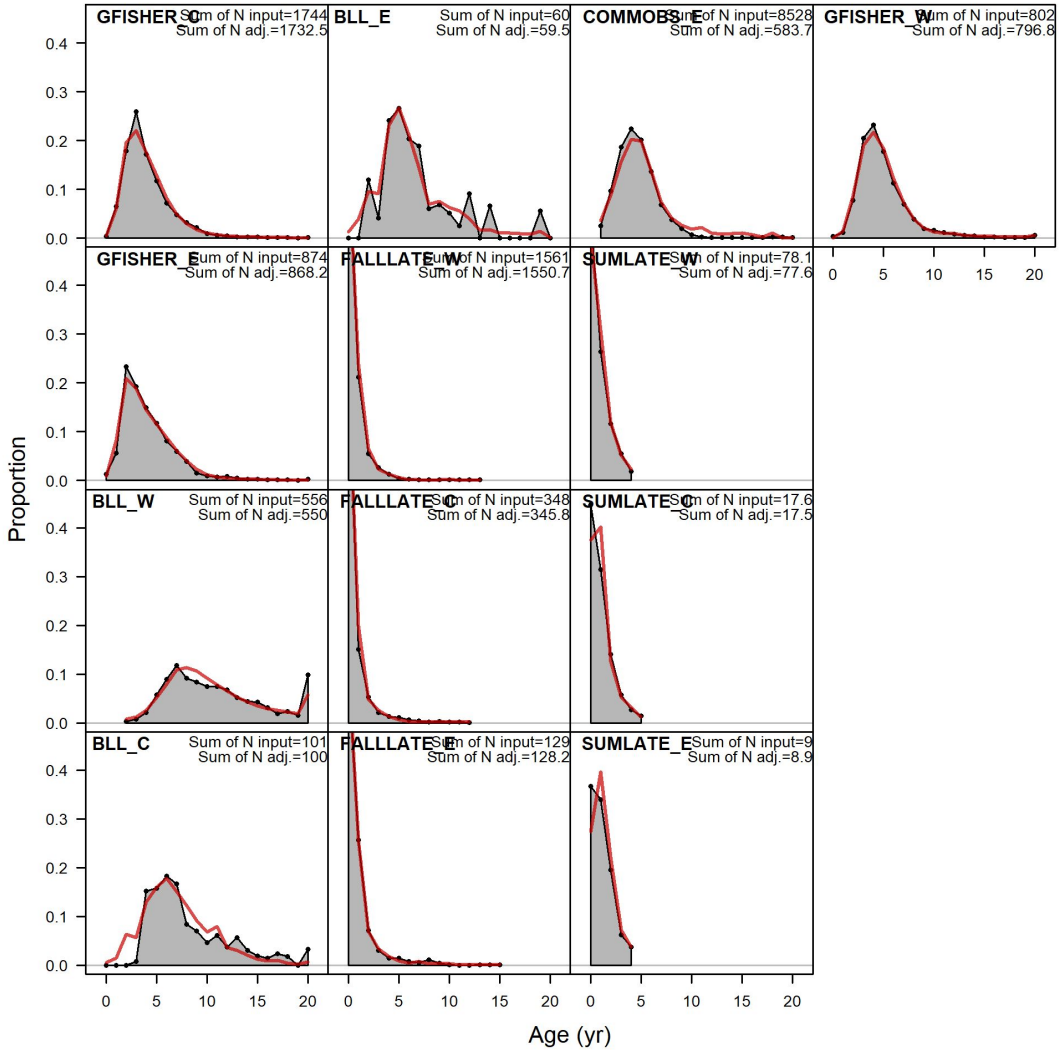
Survey Fleets:

Selectivity, Retention, and Fits to Composition Data

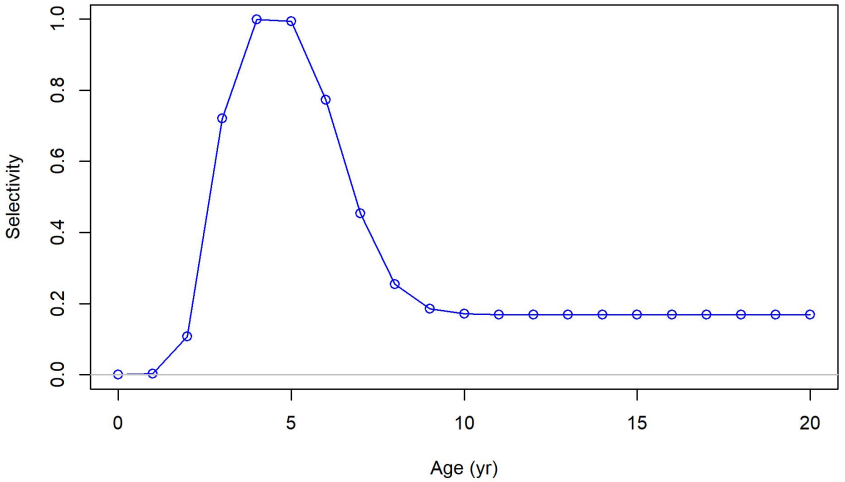
NOAA FISHERIES

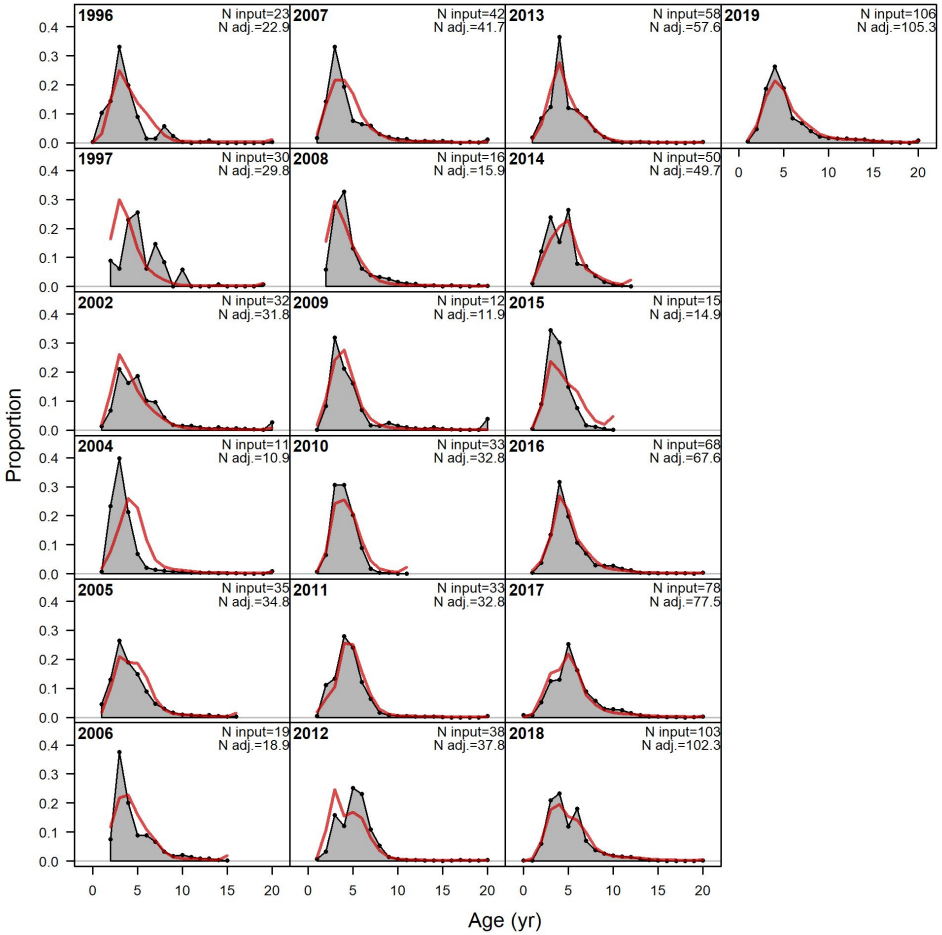
Survey age composition

Aggregate fits to age composition data for surveys.



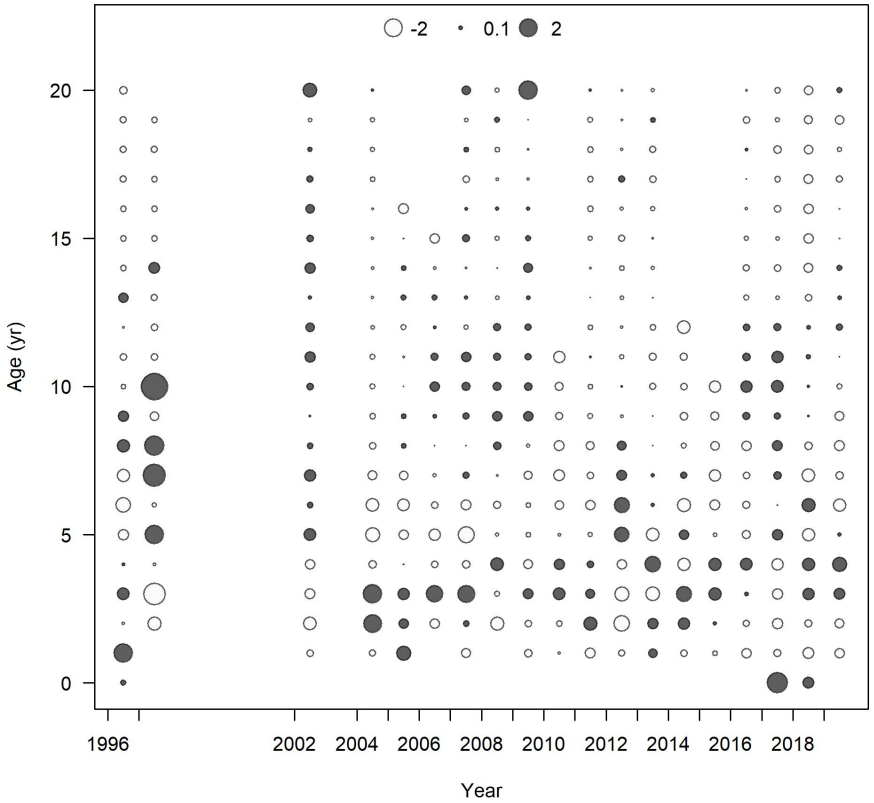
G-FISHER West

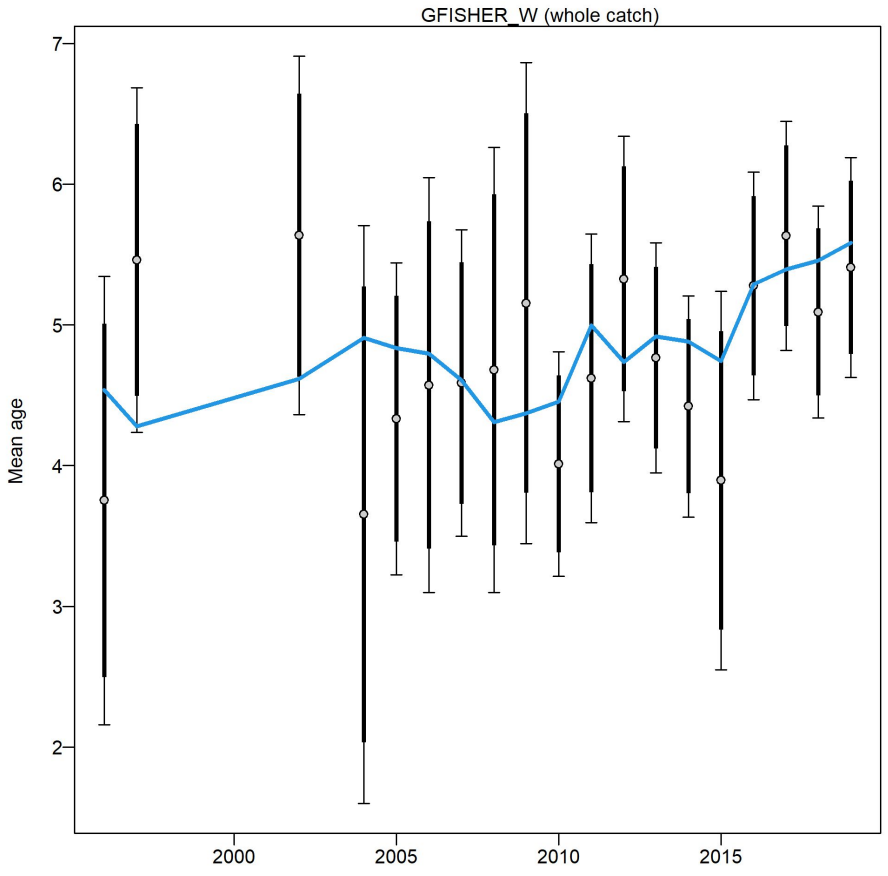




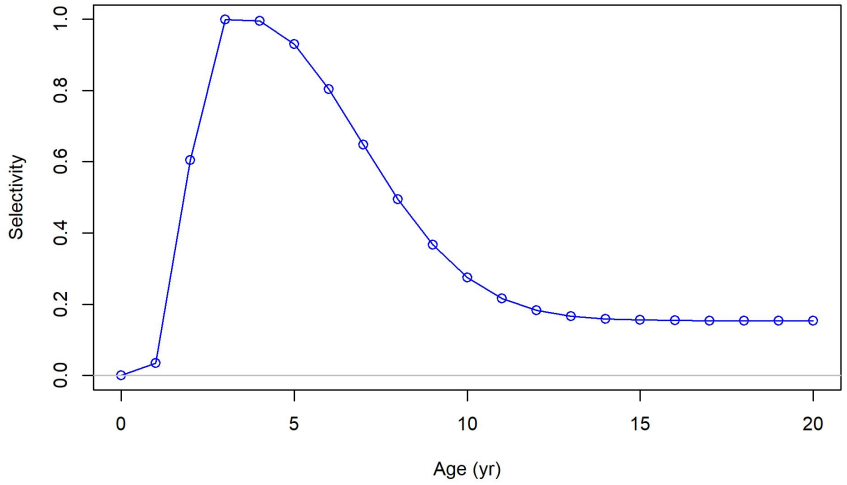
FISHERIES

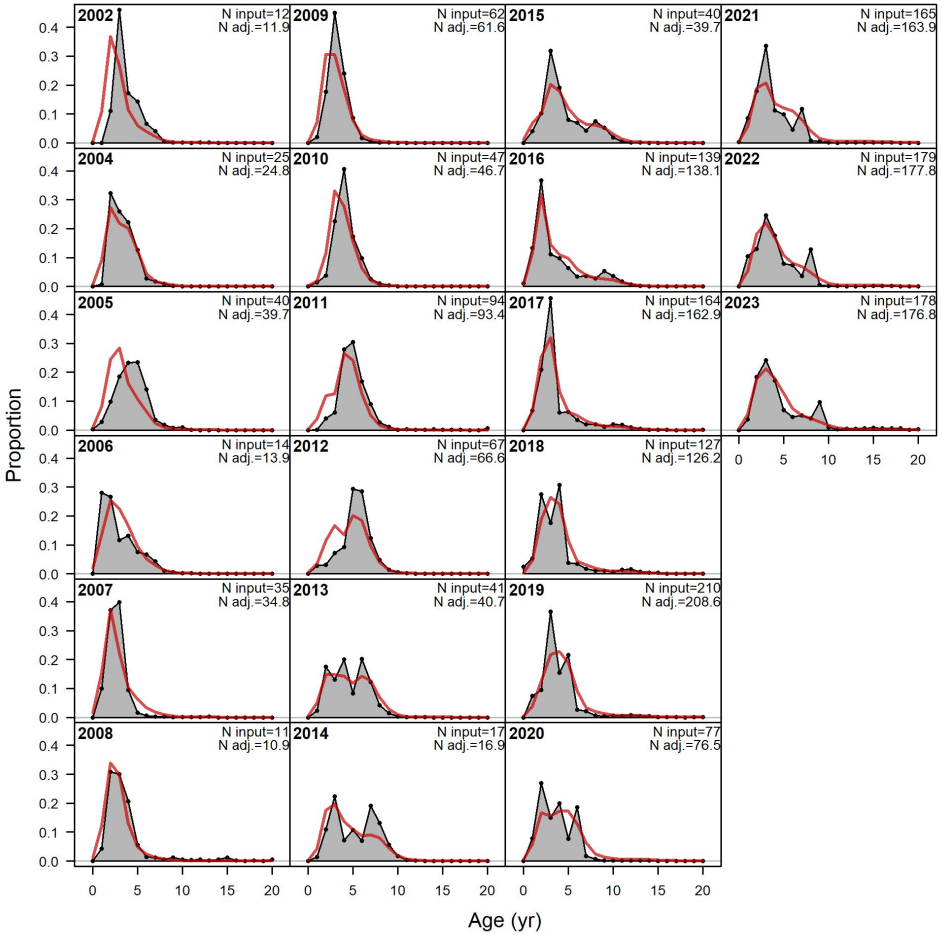
G-FISHER West





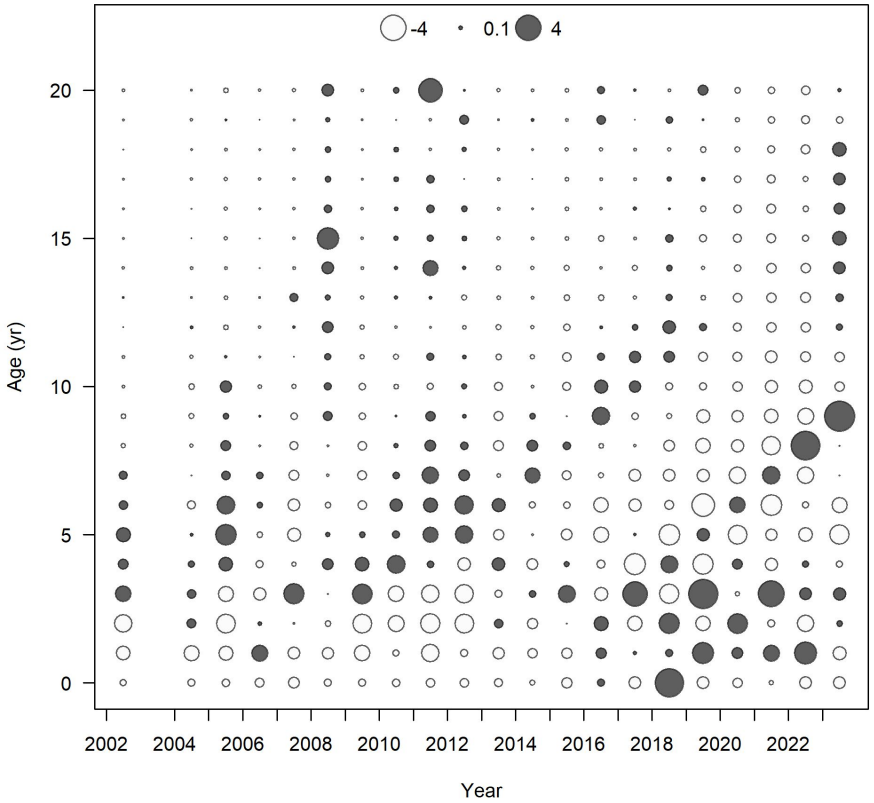
G-FISHER Central

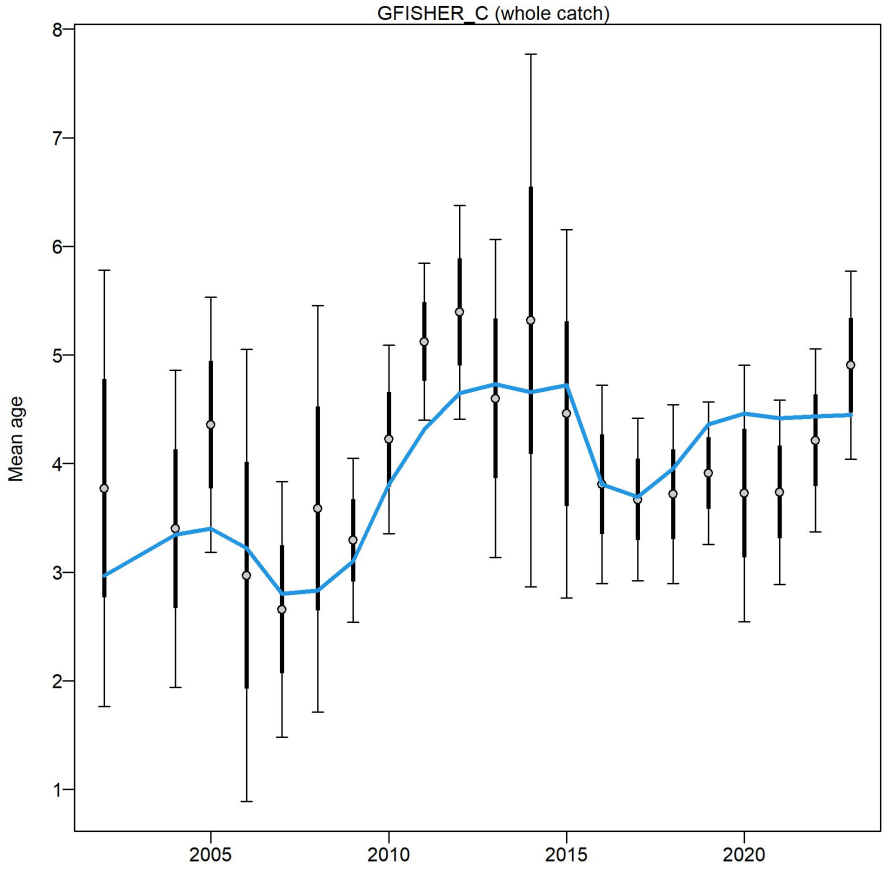




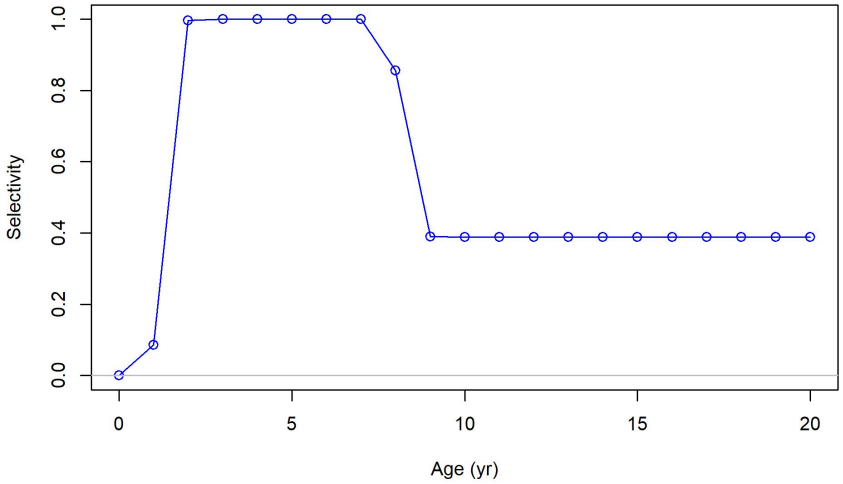
FISHERIES

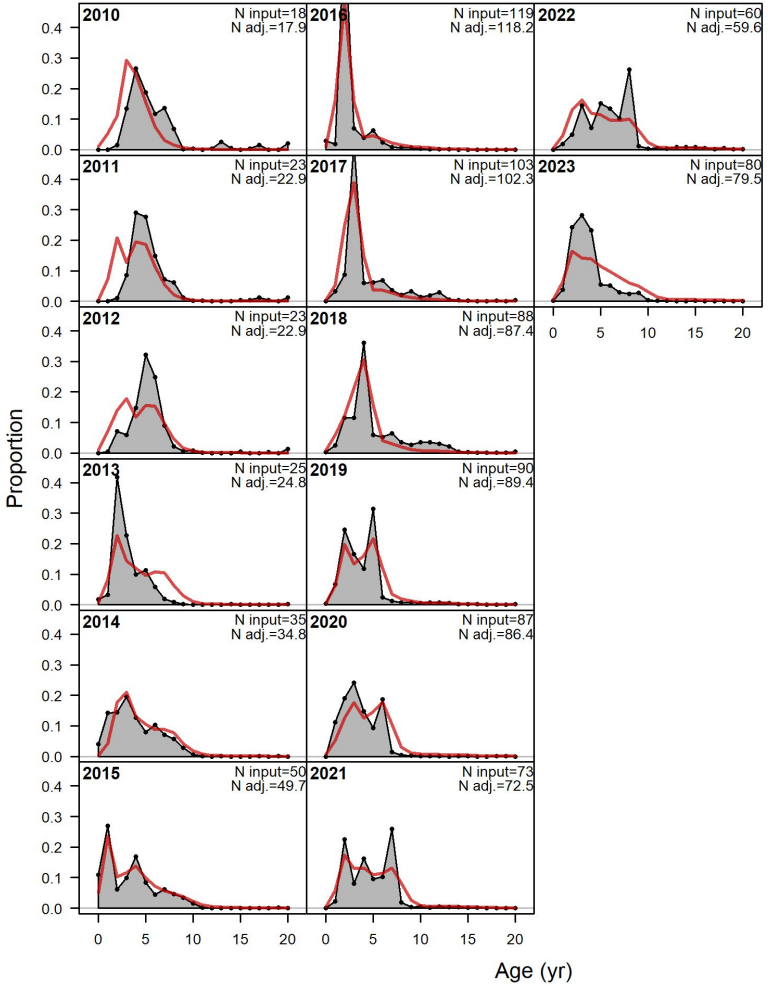
G-FISHER Central



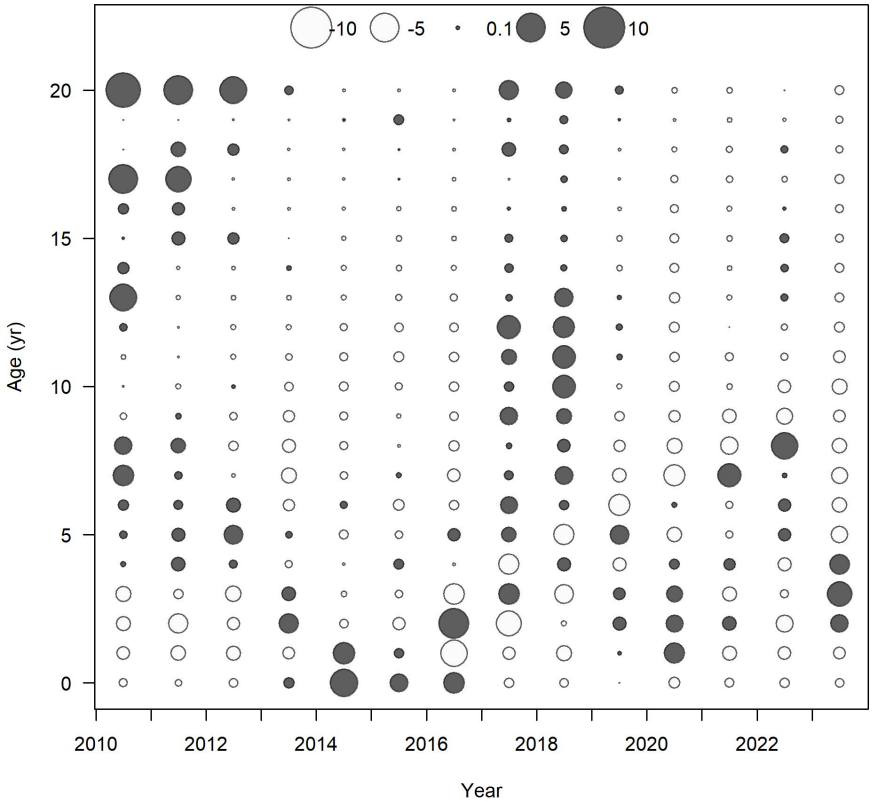


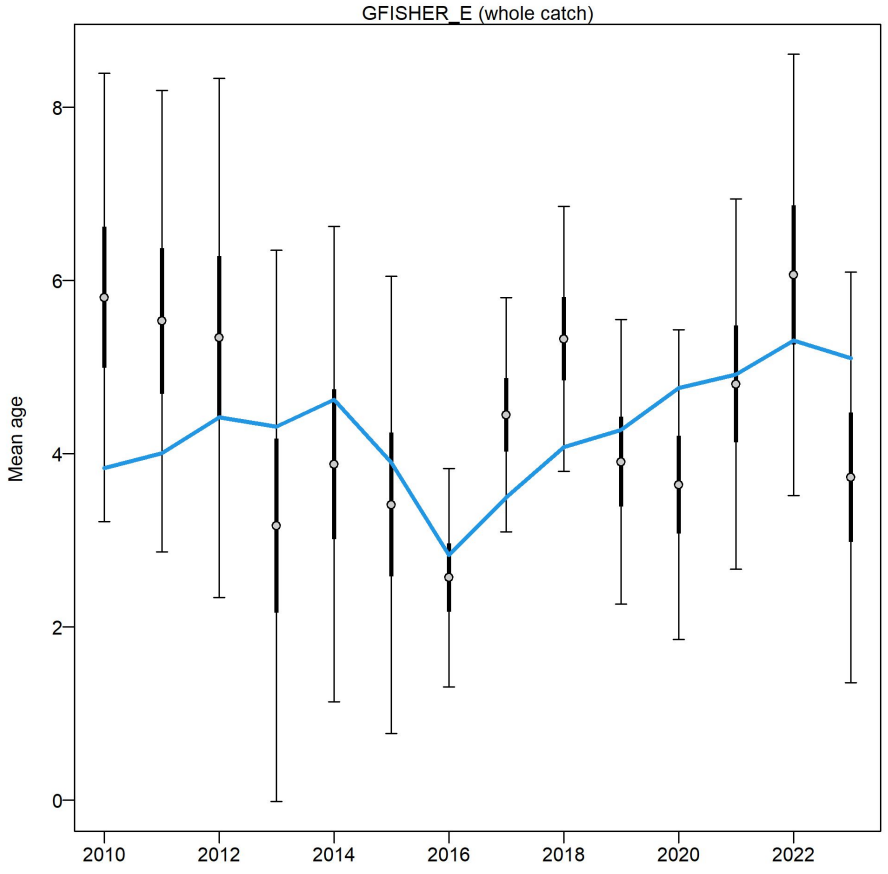
G-FISHER East



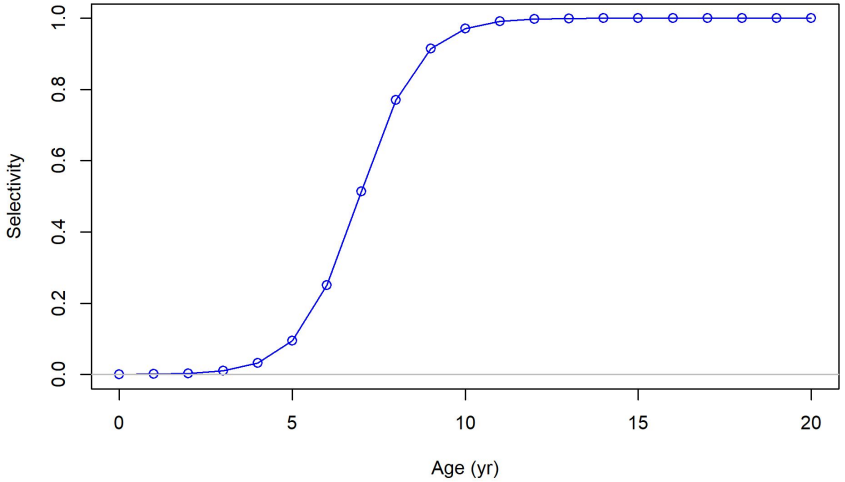


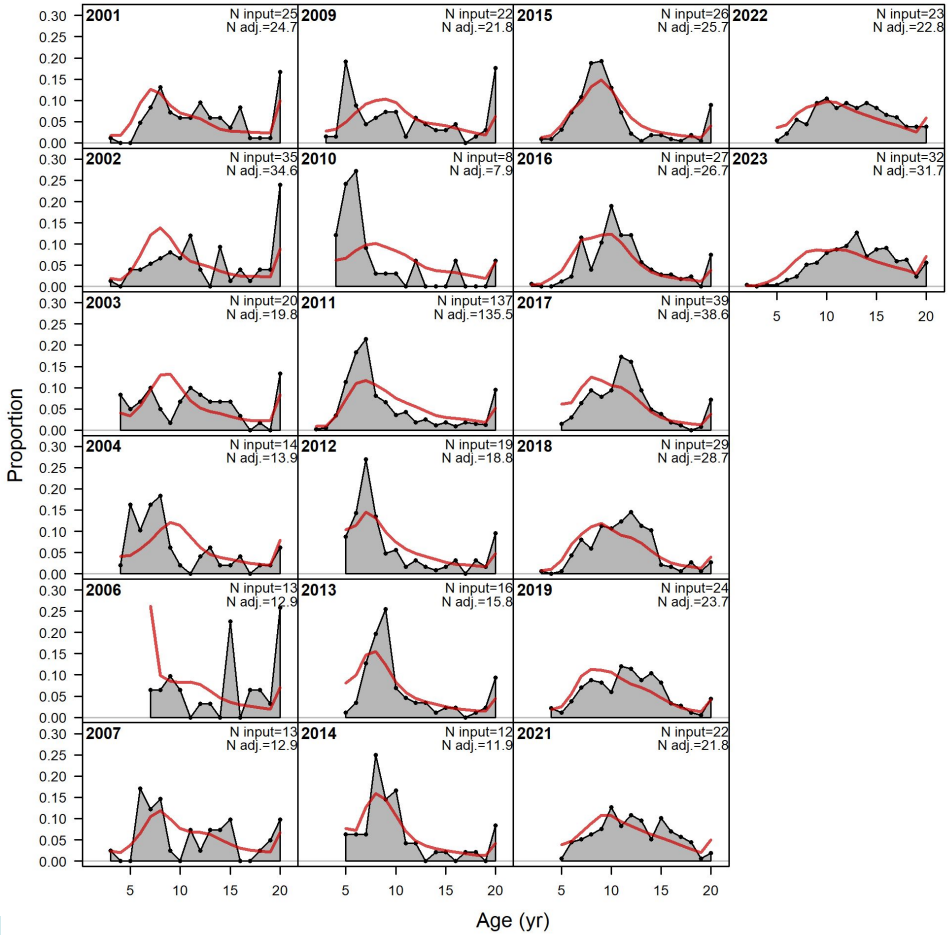
G-FISHER East





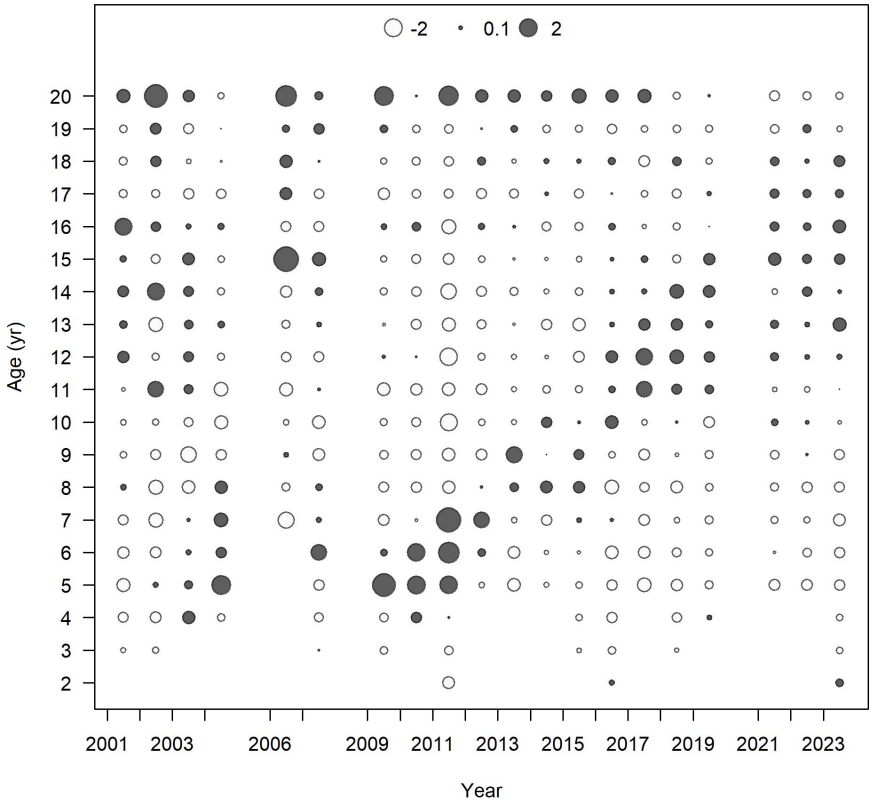
BLL West

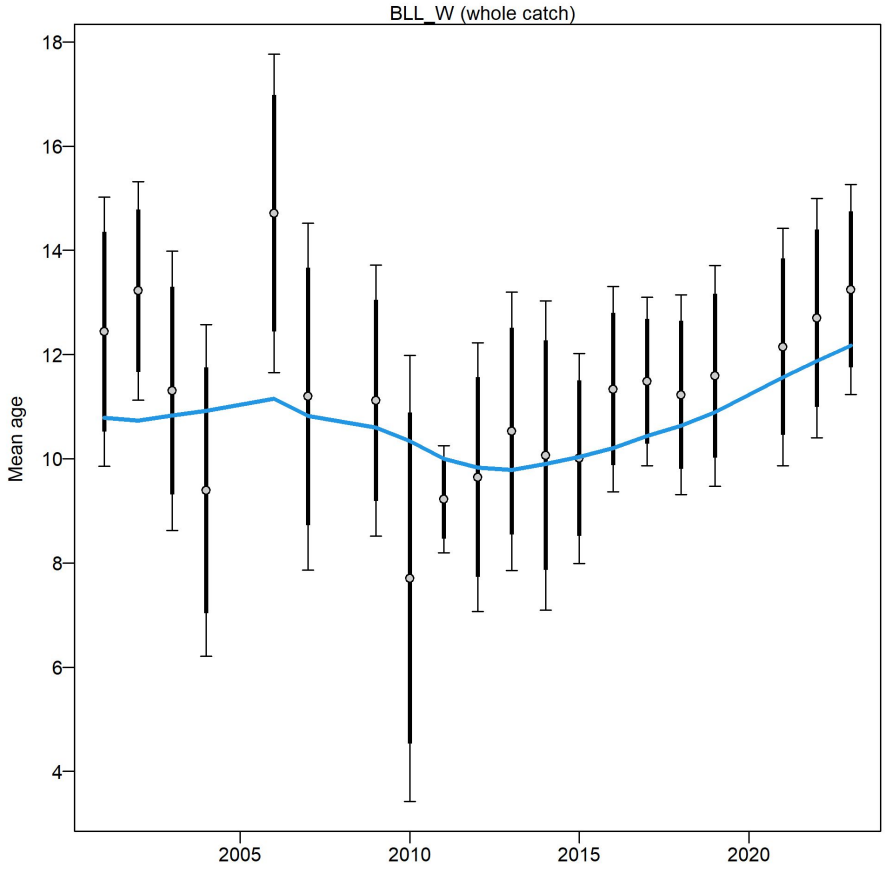




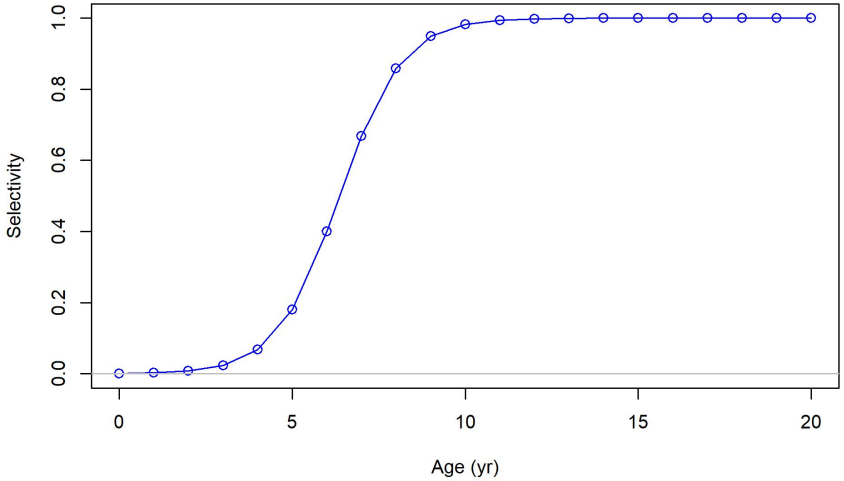
FISHERIES

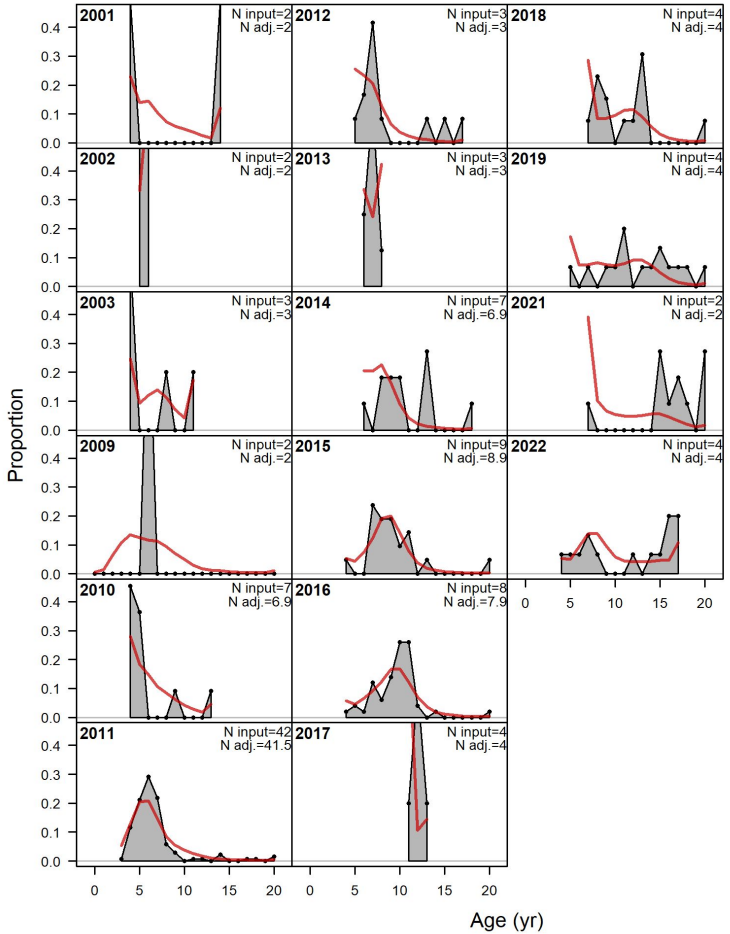
BLL West


-2
0.1
2
Age (yr)
Year
2001
2003
2006
2009
2011
2013
2015
2017
2019
2021
2023


BLL_W (whole catch)
Mean age
2005
2010
2015
2020

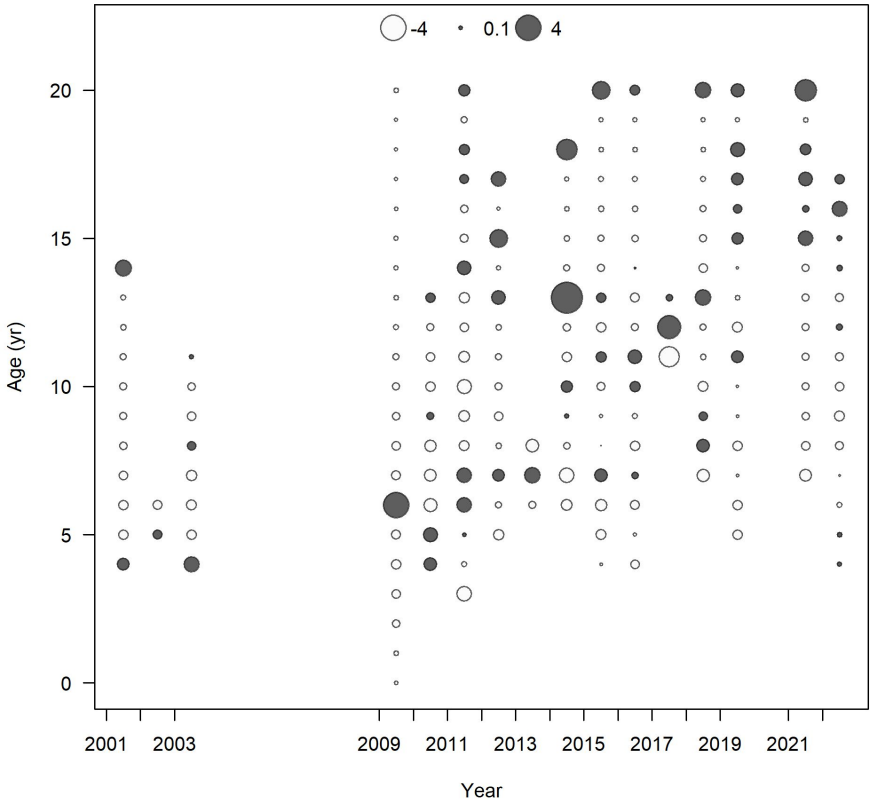
BLL Central

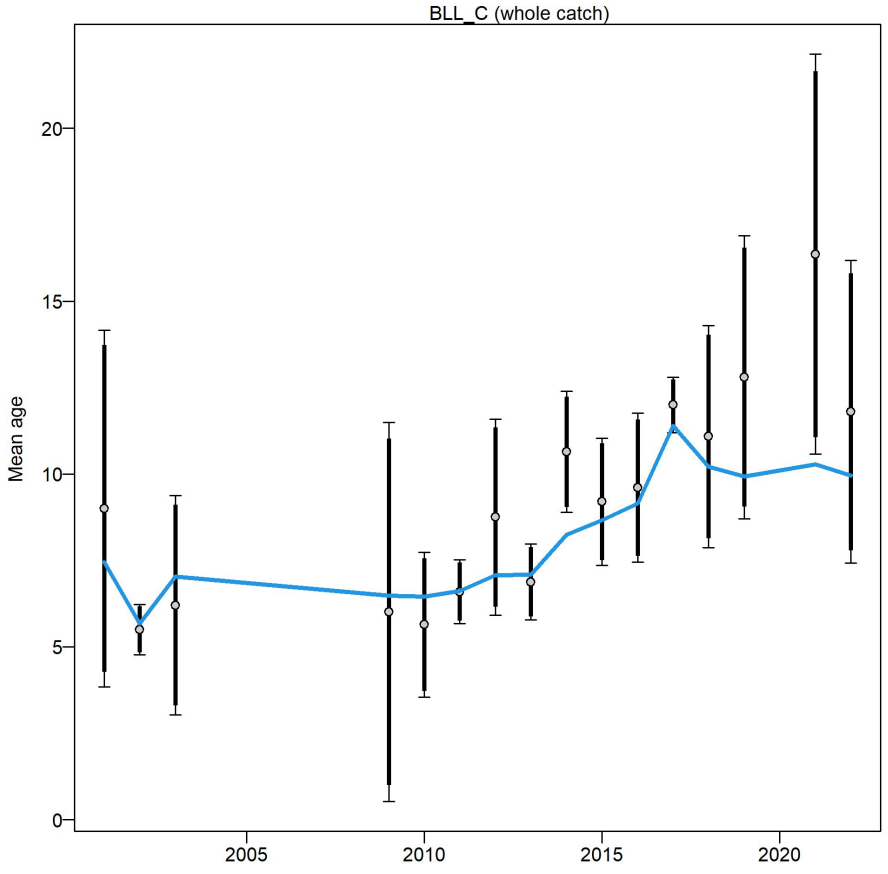




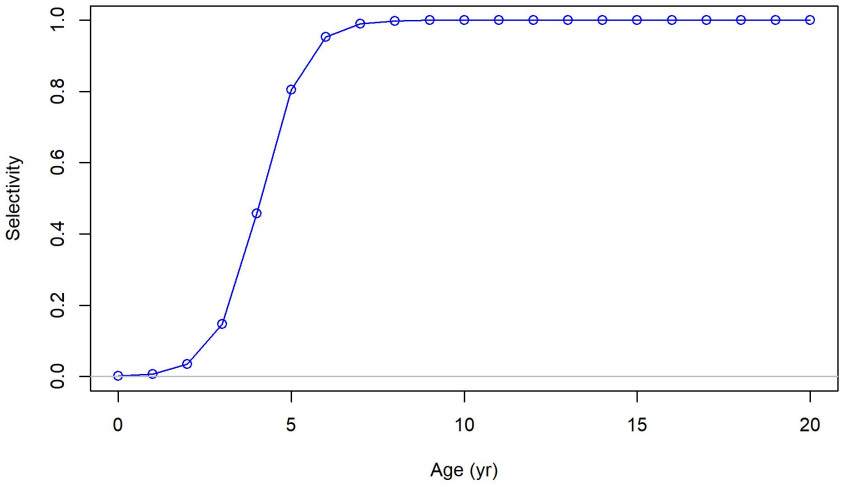
FISHERIES

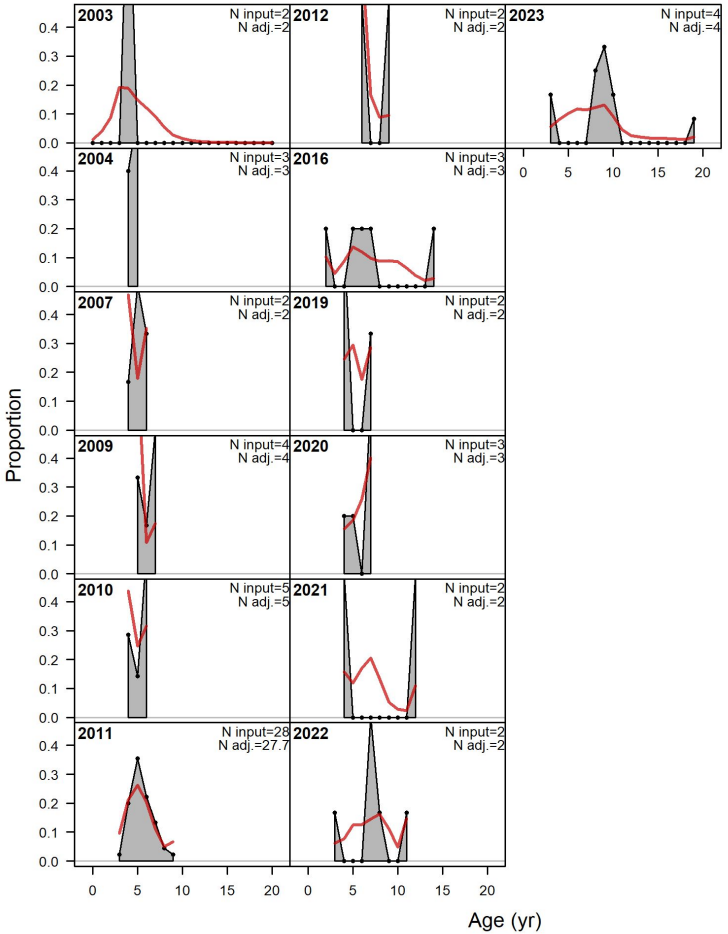
BLL Central


-4
0.1
4
Age (yr)
0
5
10
15
20
2001
2003
2009
2011
2013
2015
2017
2019
2021
Year


BLL_C (whole catch)
Mean age
0
5
10
15
20
2005
2010
2015
2020

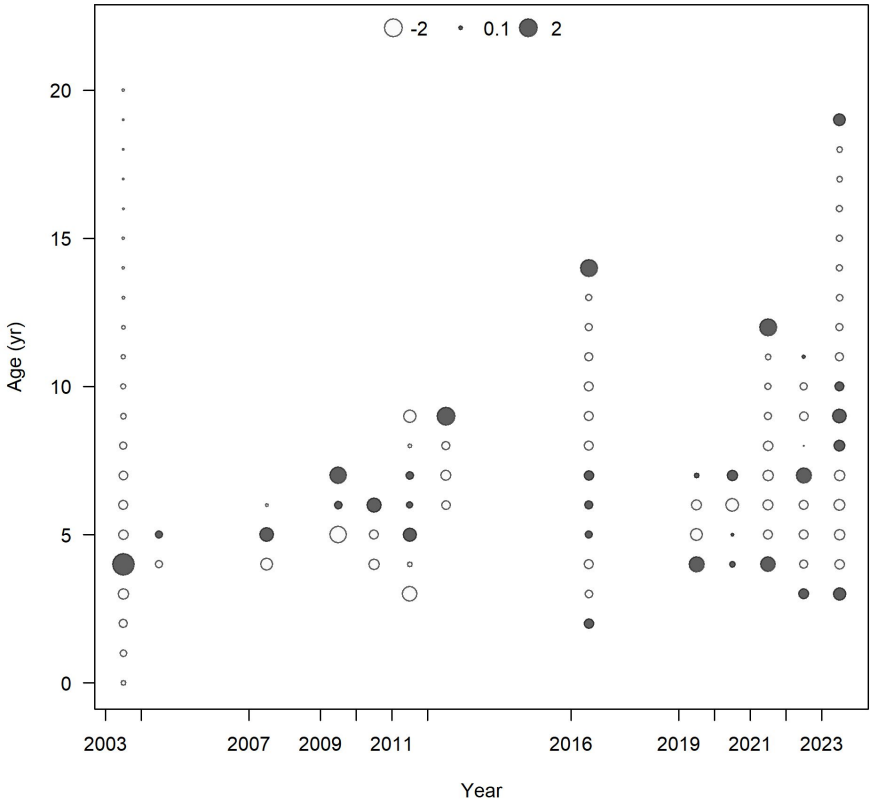
BLL East

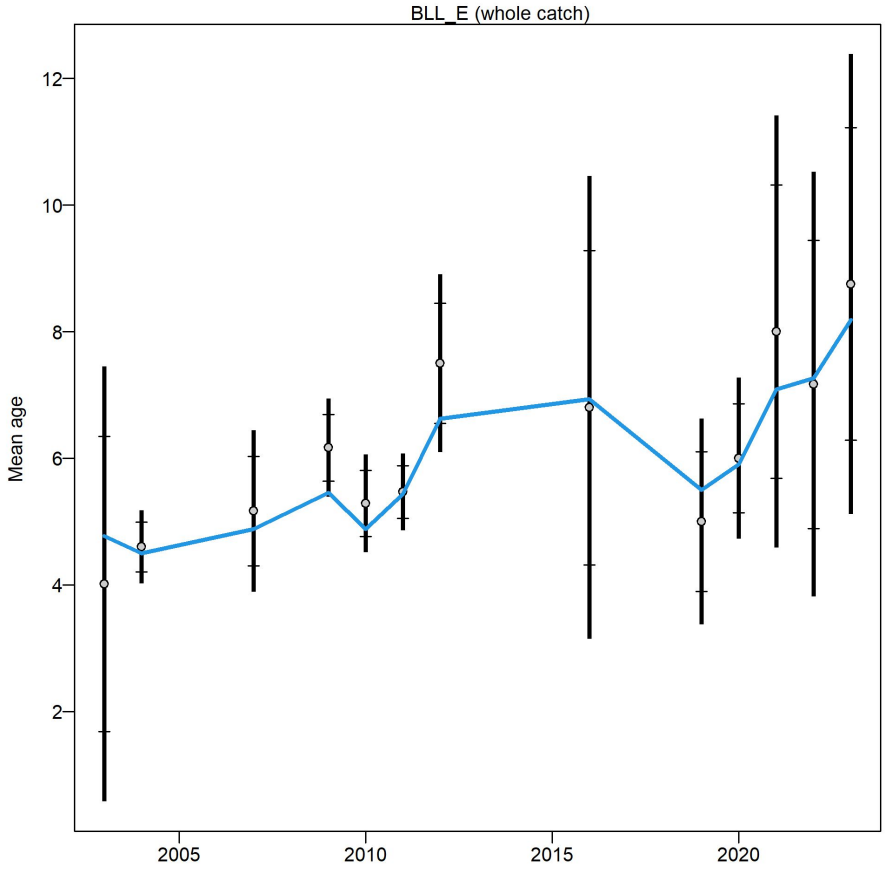




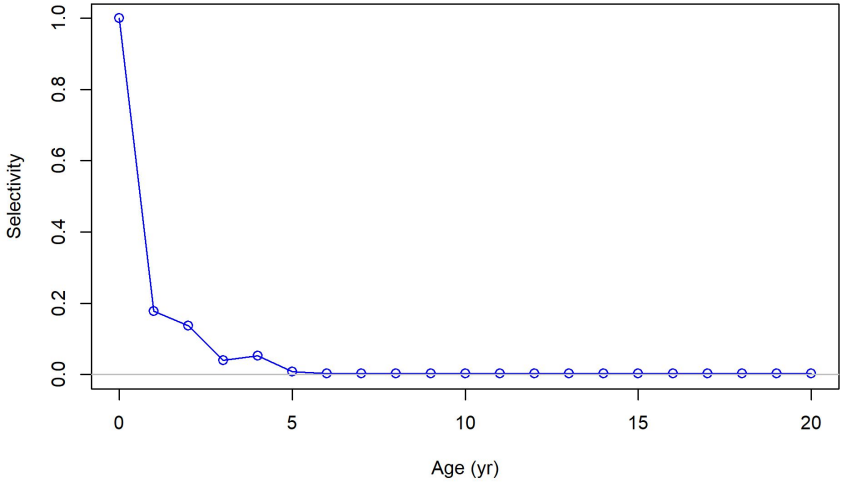
FISHERIES

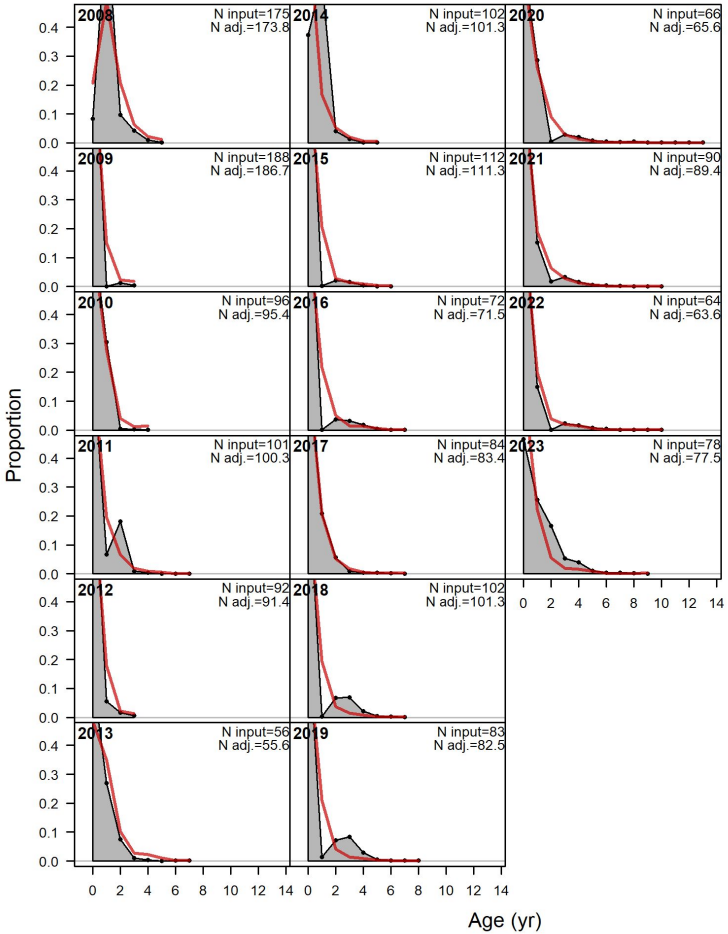
BLL East


-2
0.1
2
Age (yr)
0
5
10
15
20
2003
2007
2009
2011
2016
2019
2021
2023
Year


BLL_E (whole catch)
Mean age
2
4
6
8
10
12
2005
2010
2015
2020

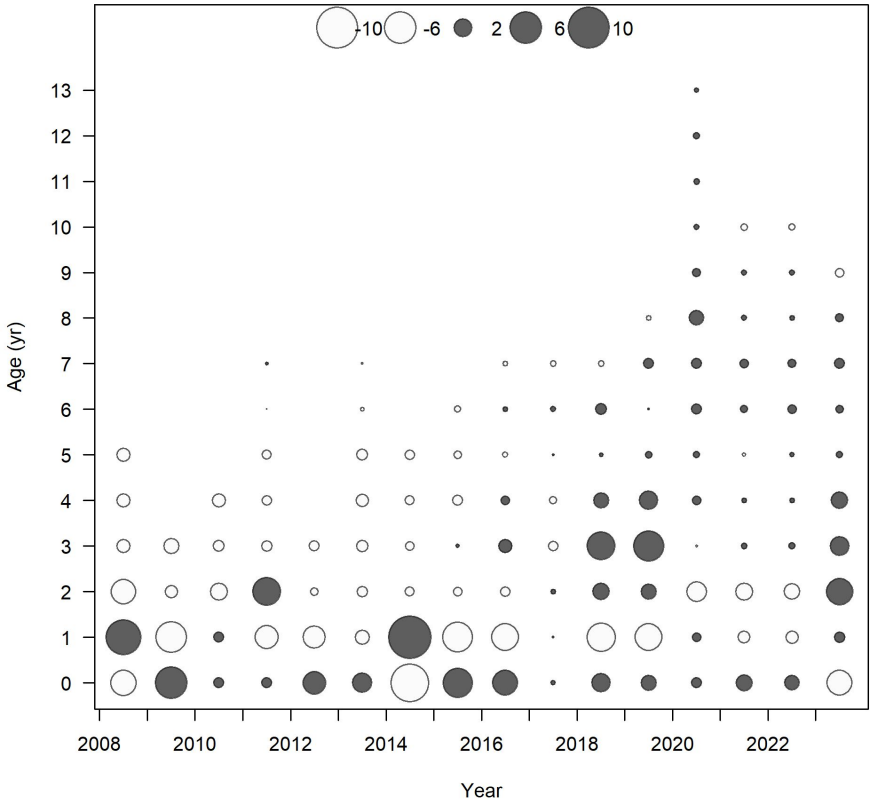
Fall Trawl West (Late)

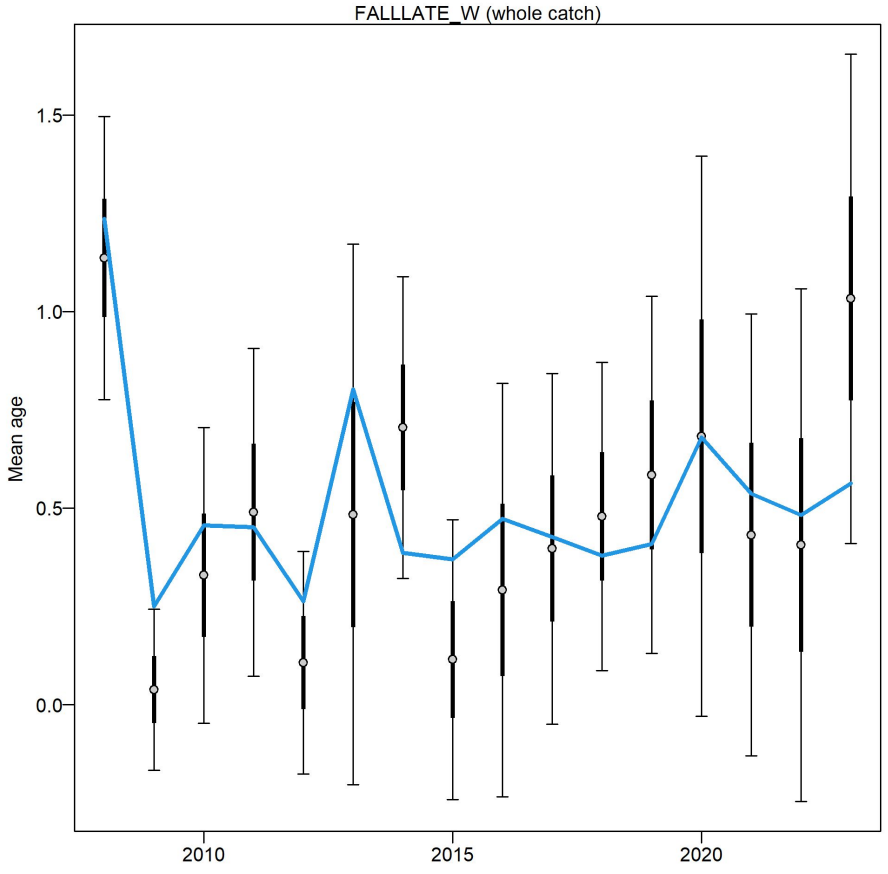




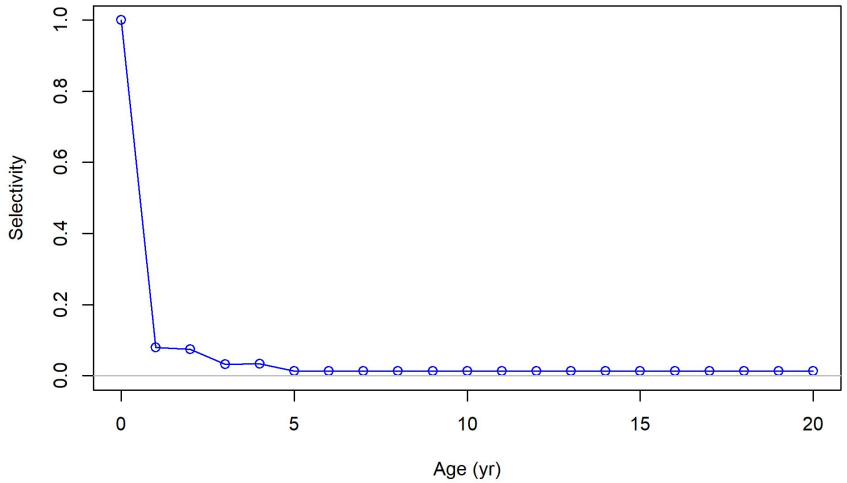
FISHERIES

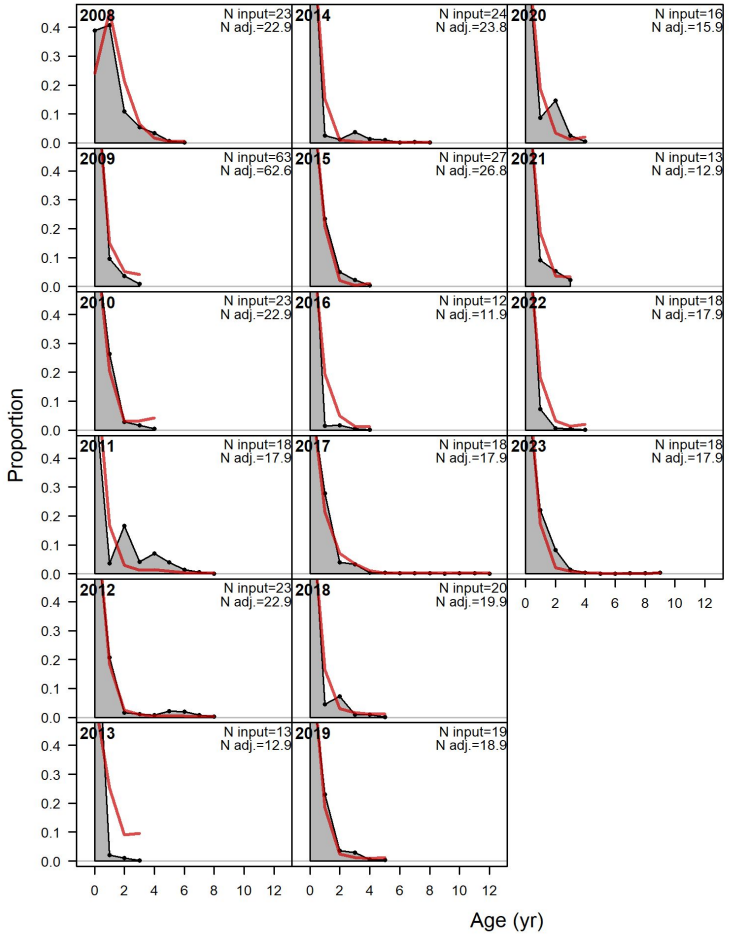
Fall Trawl West (Late)





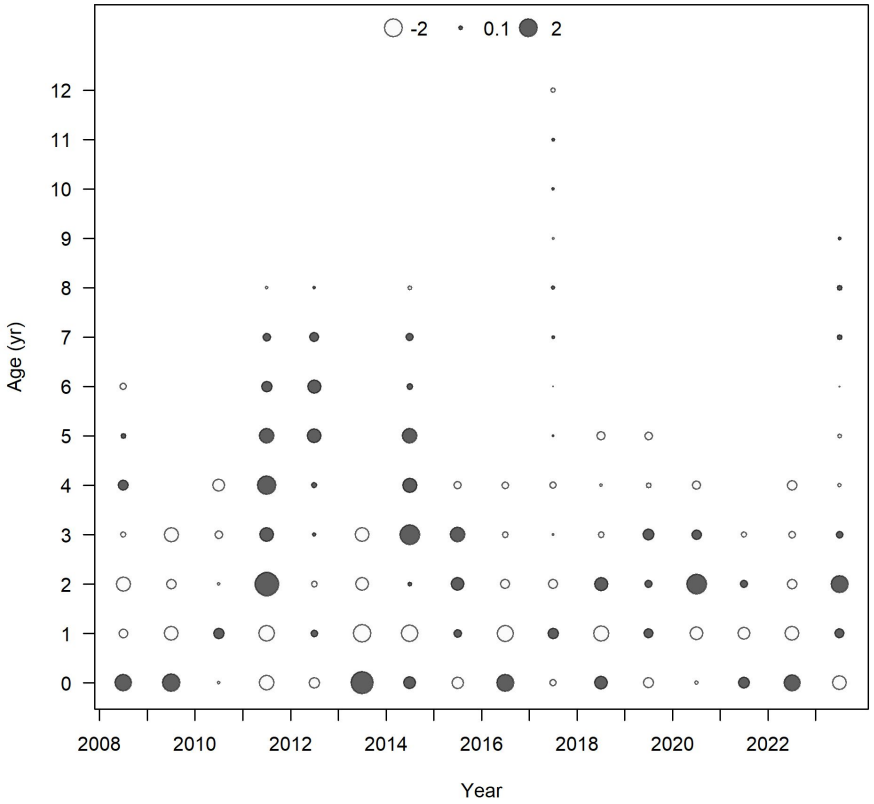
Fall Trawl Central (Late)

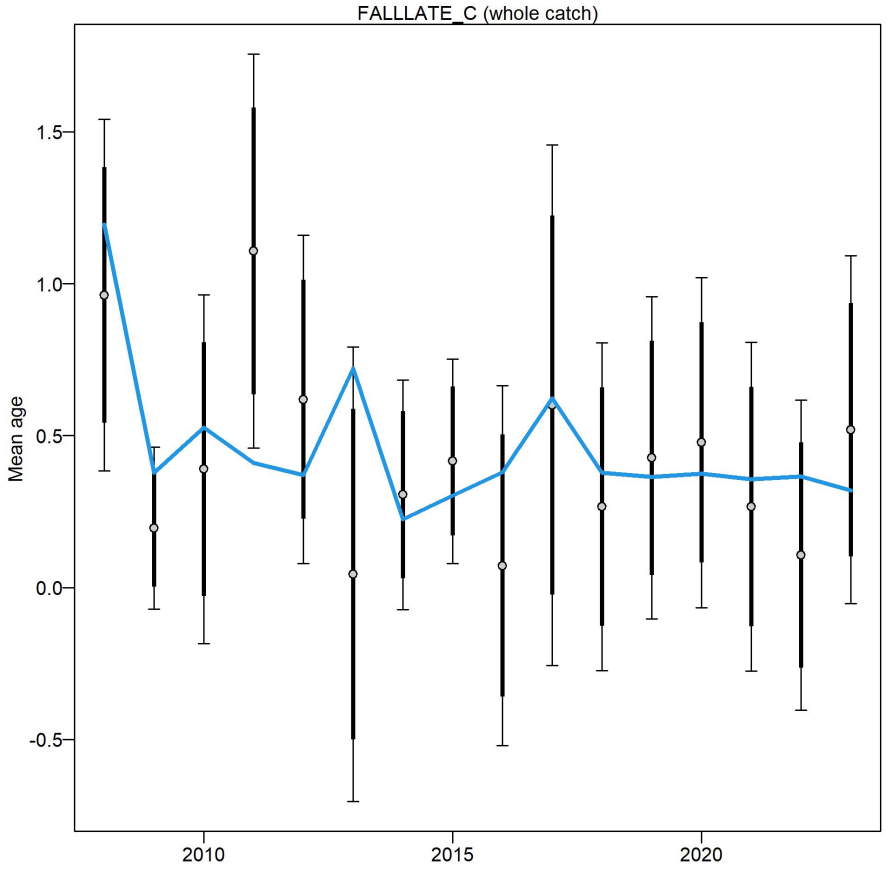




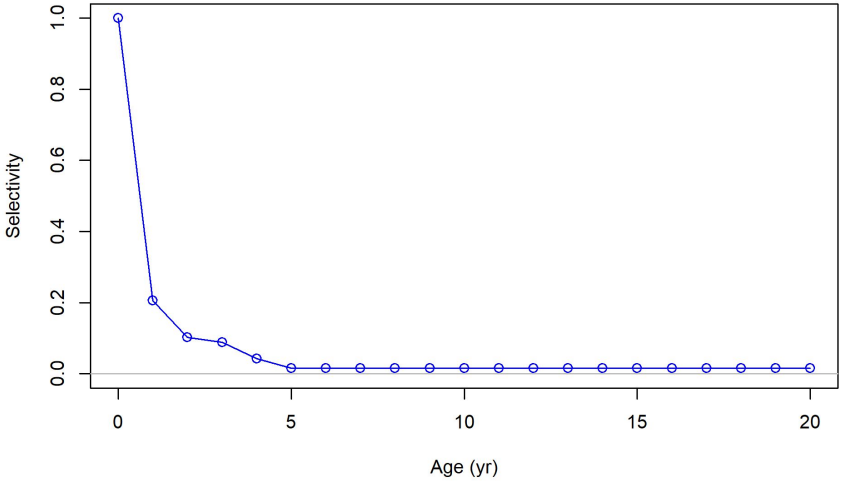
FISHERIES

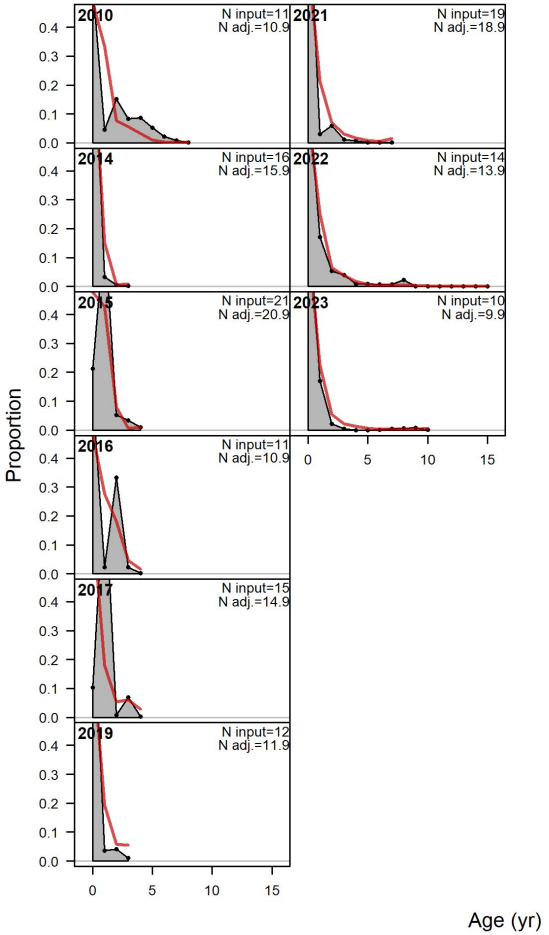
Fall Trawl Central (Late)



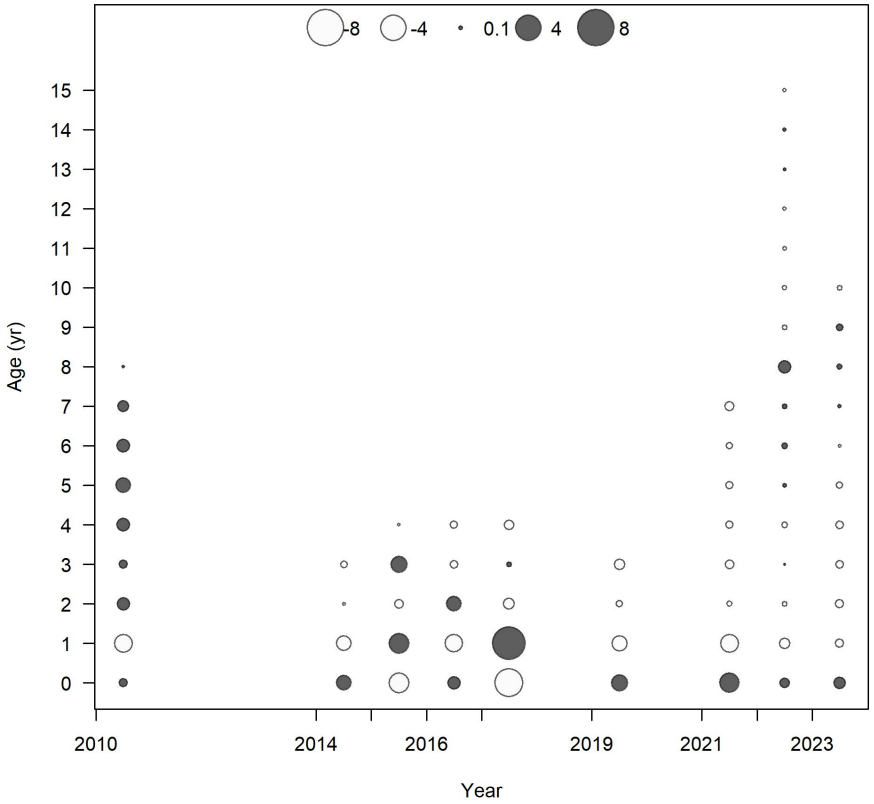


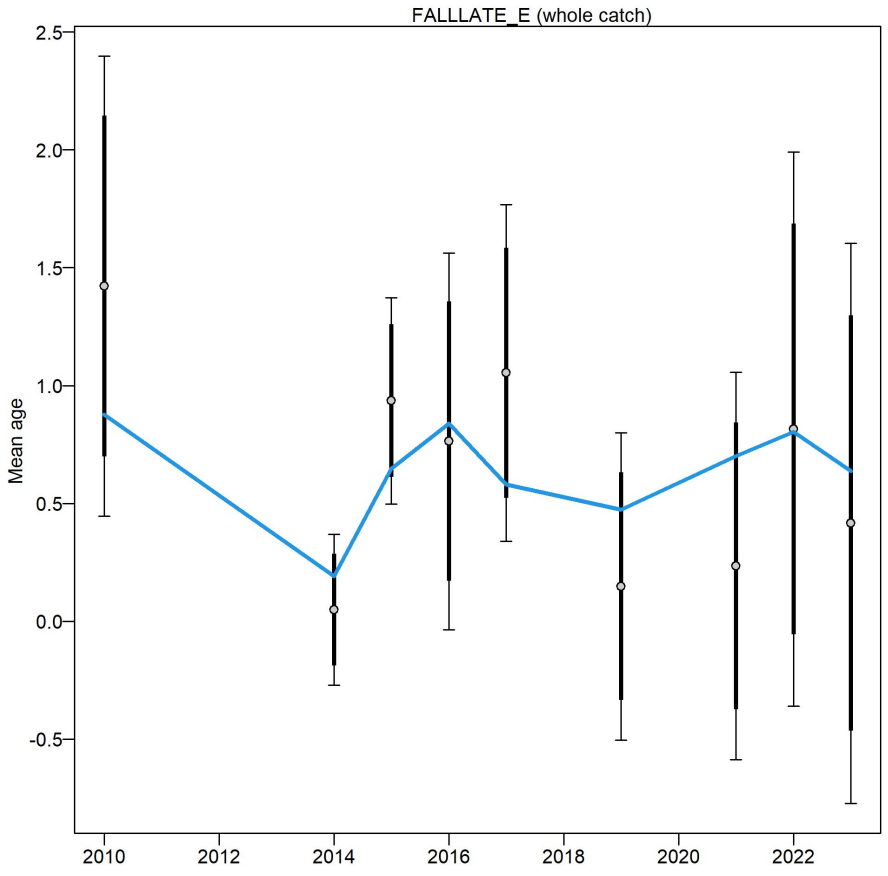
Fall Trawl East (Late)



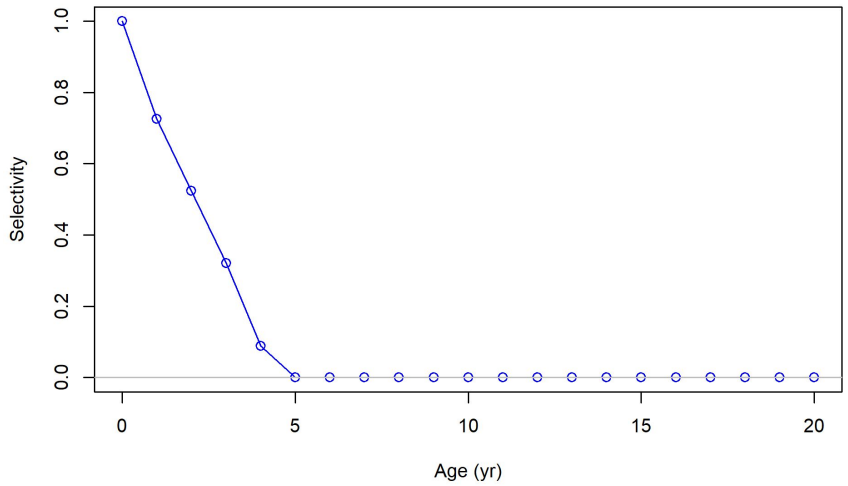


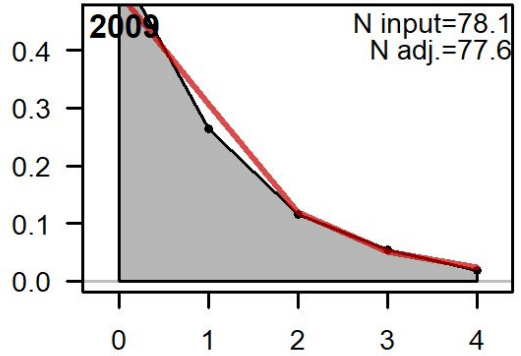
Fall Trawl East (Late)





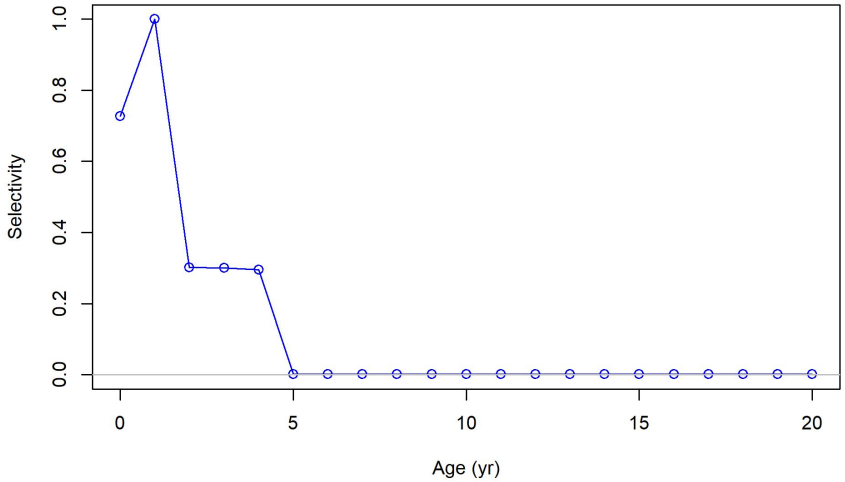
SummerTrawl West (Late)

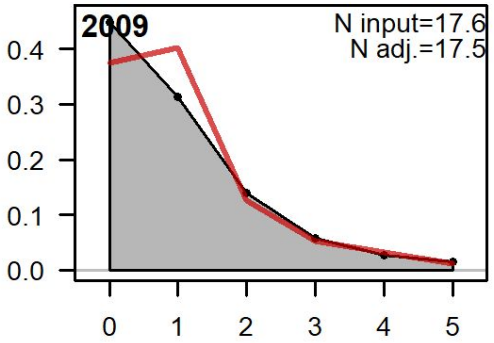




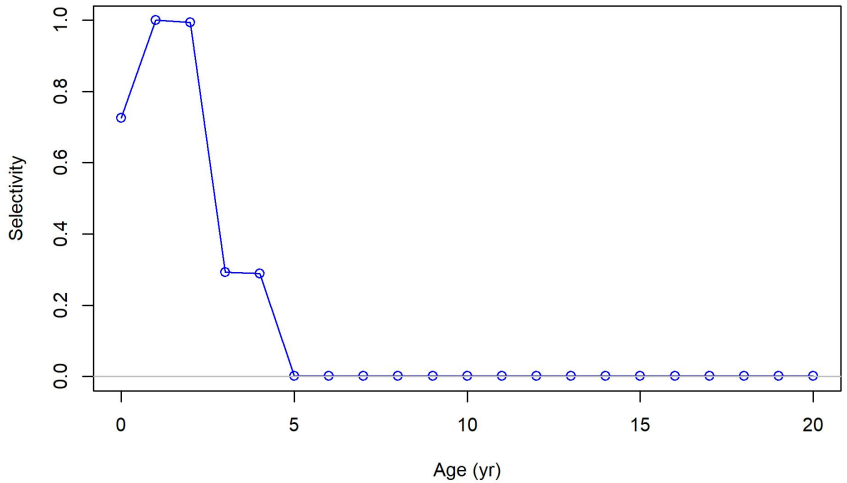
NOAA FISHERIES

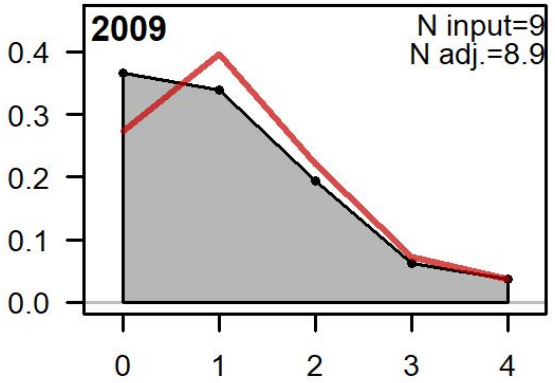
Summer Trawl Central (Late)



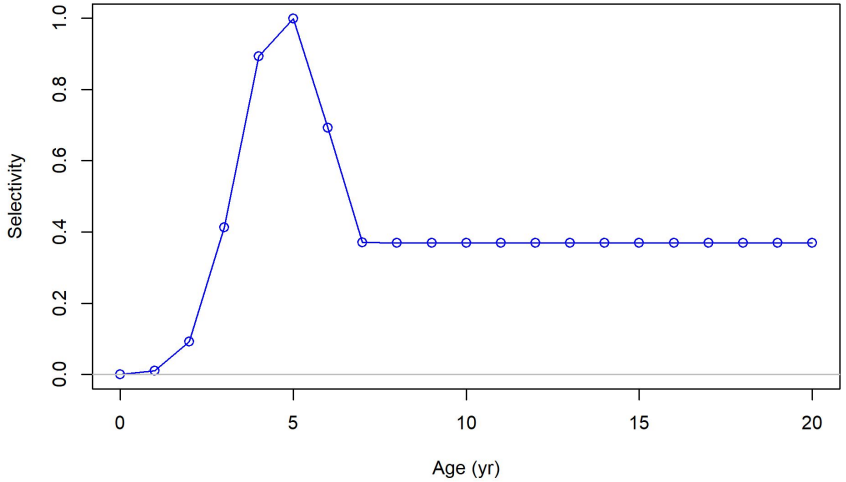


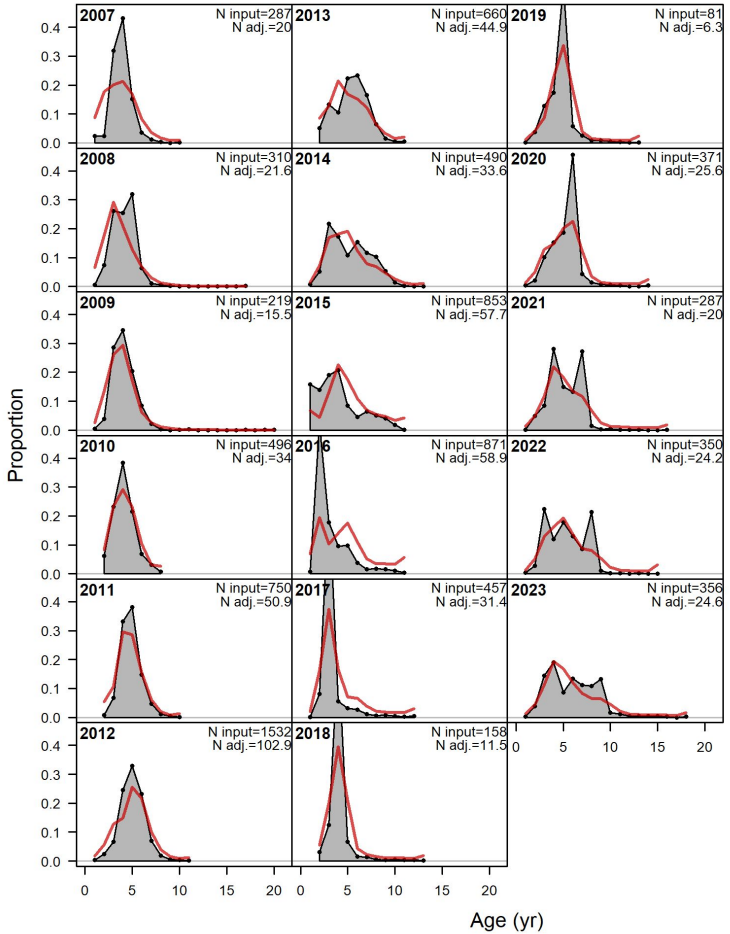
Summer Trawl East (Late)



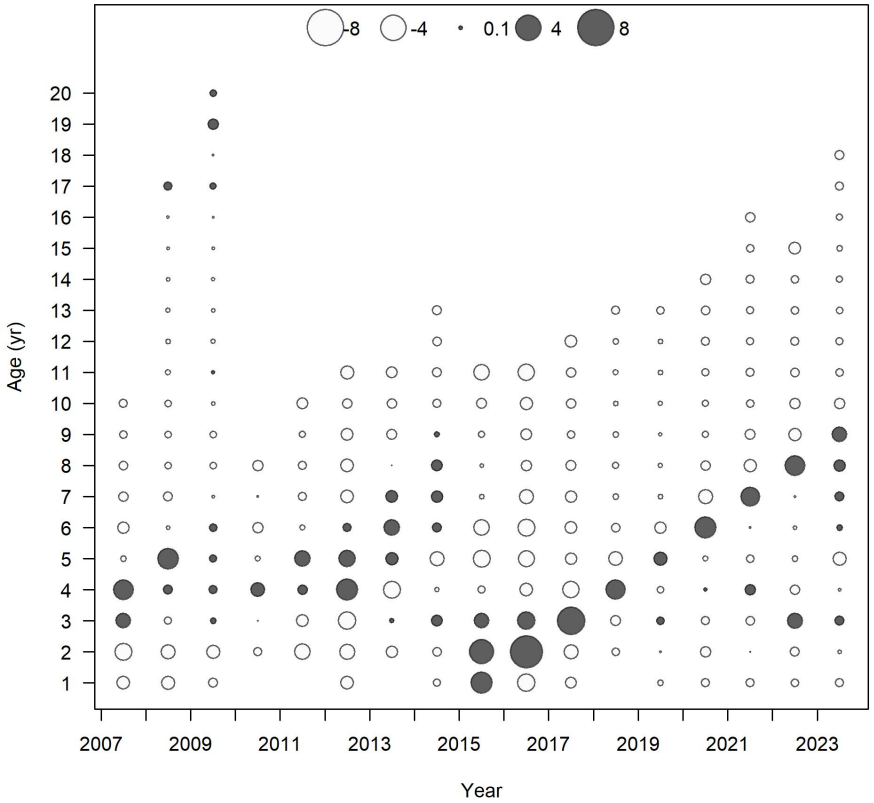


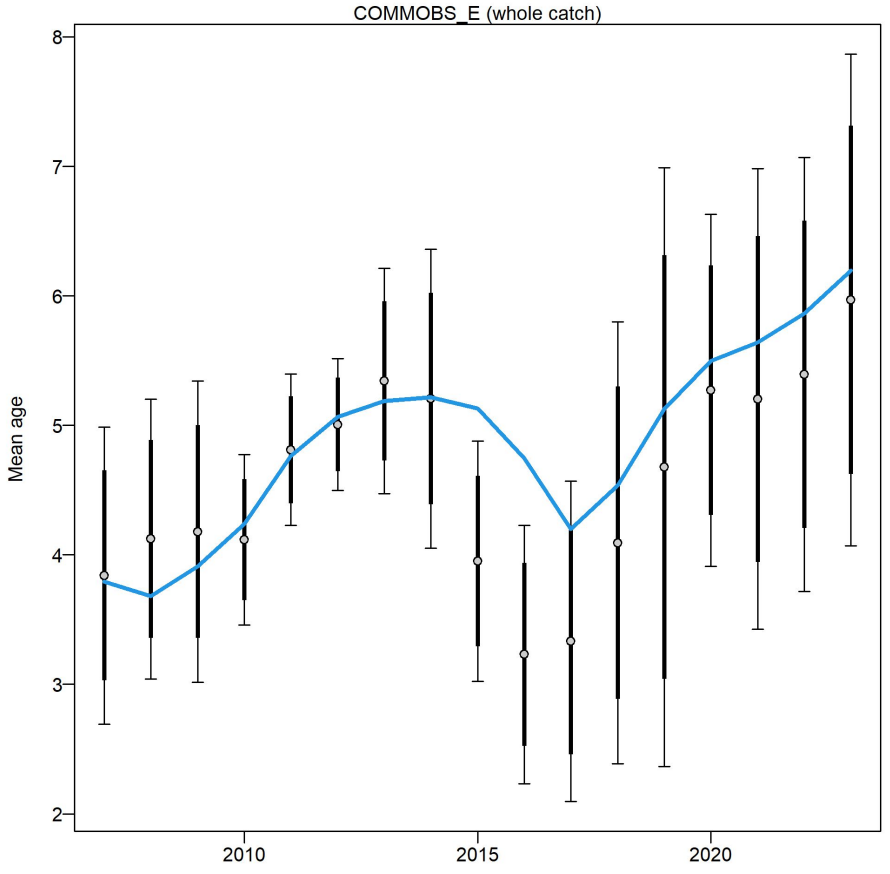
Commercial Observer (East)



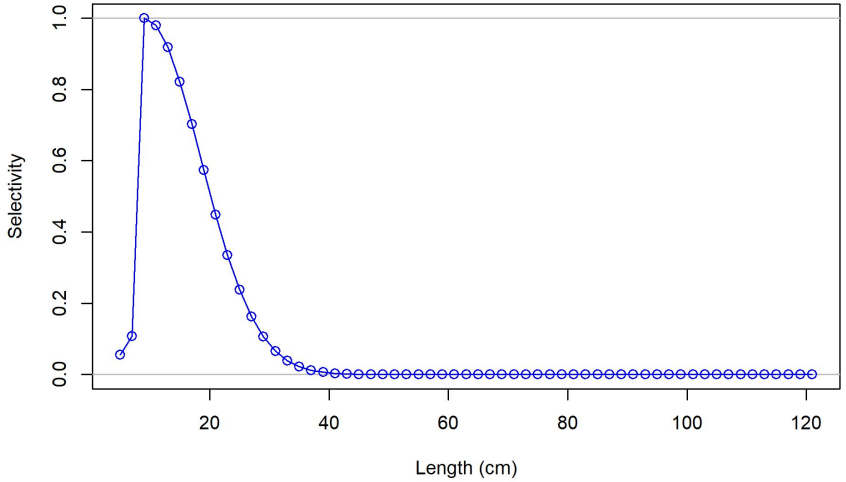


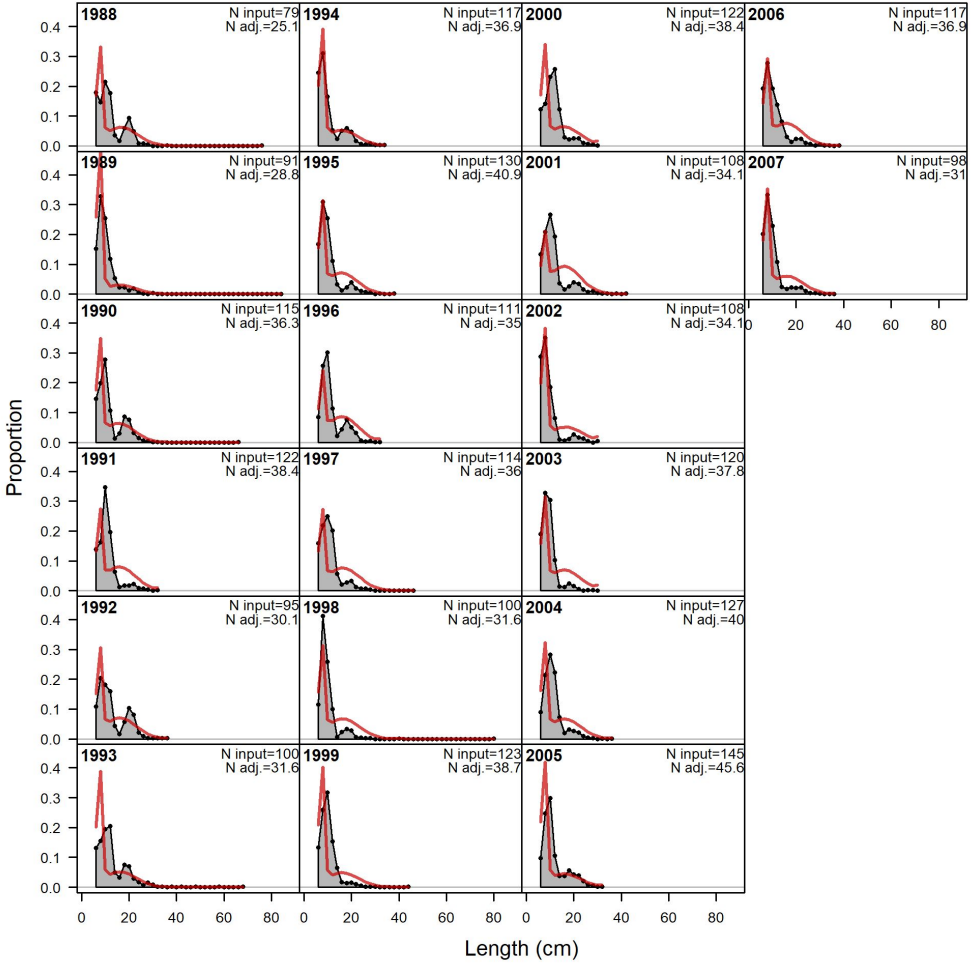
Commercial Observer (East)



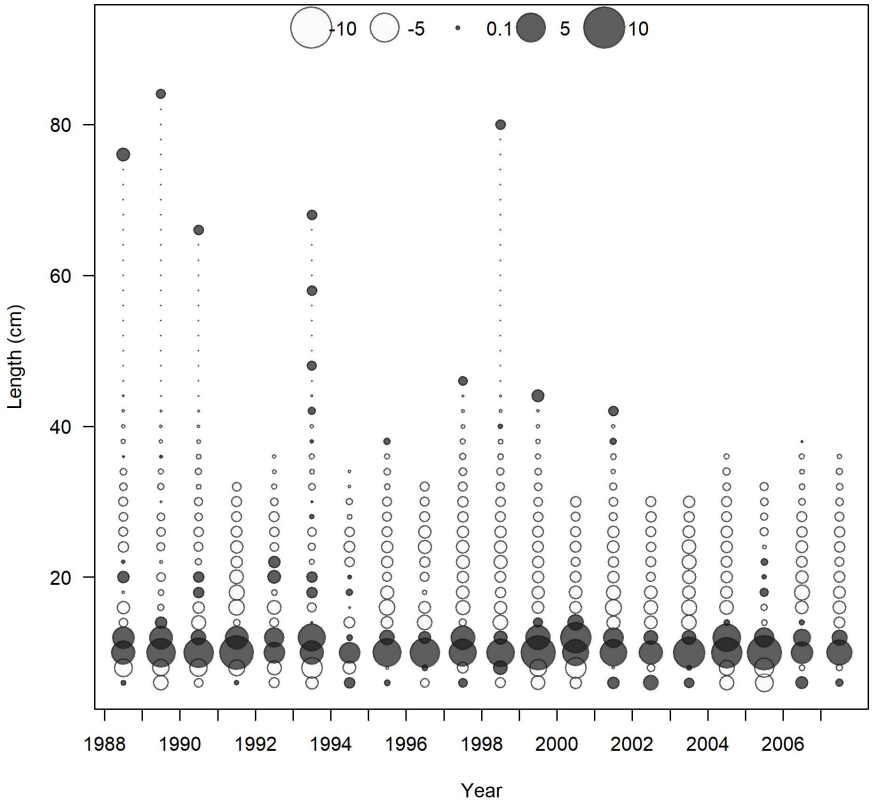


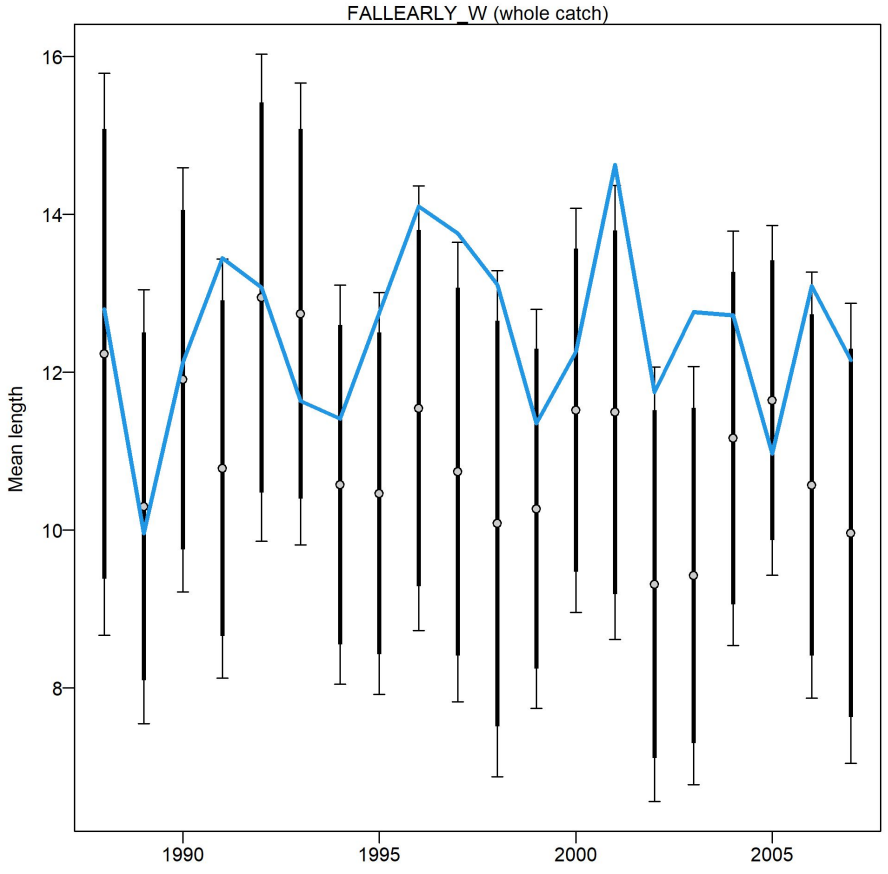
Fall Trawl Early (West)



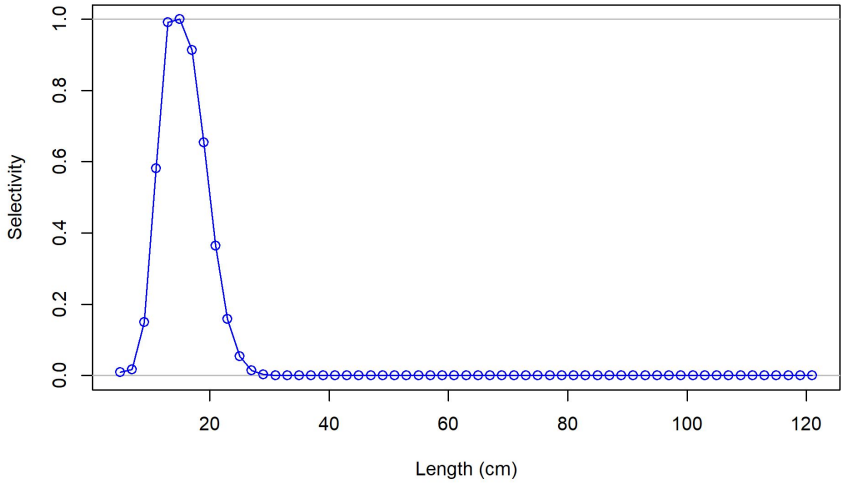


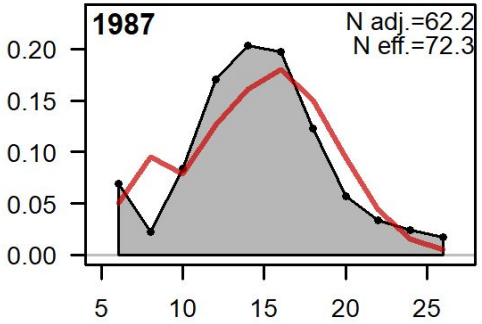
Fall Trawl Early (West)



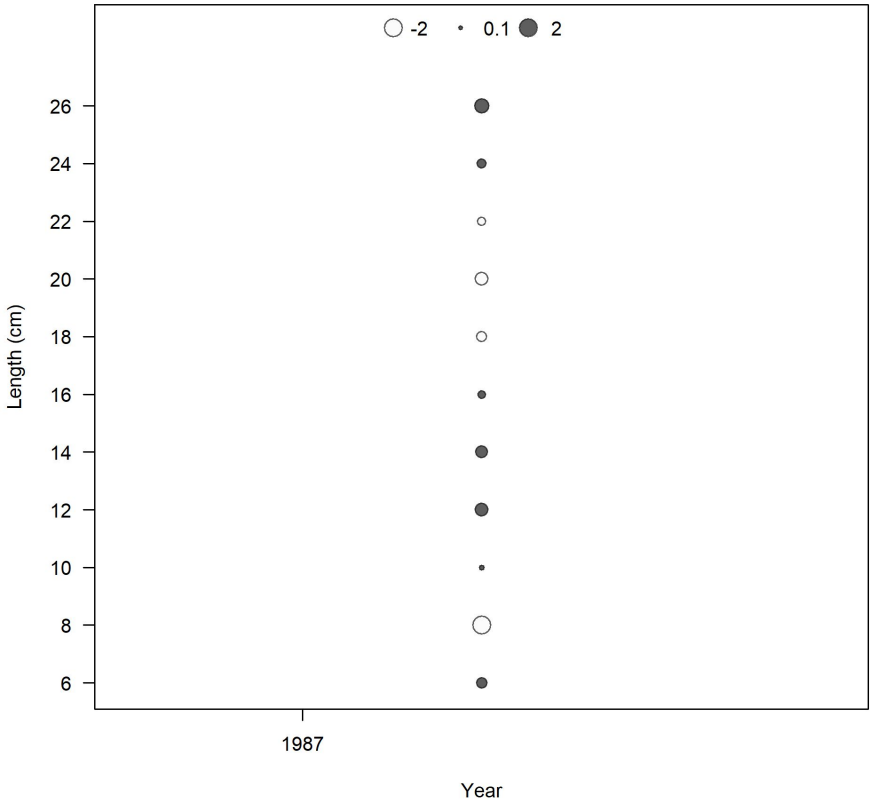


Summer Trawl Early (West)





Summer Trawl Early (West)

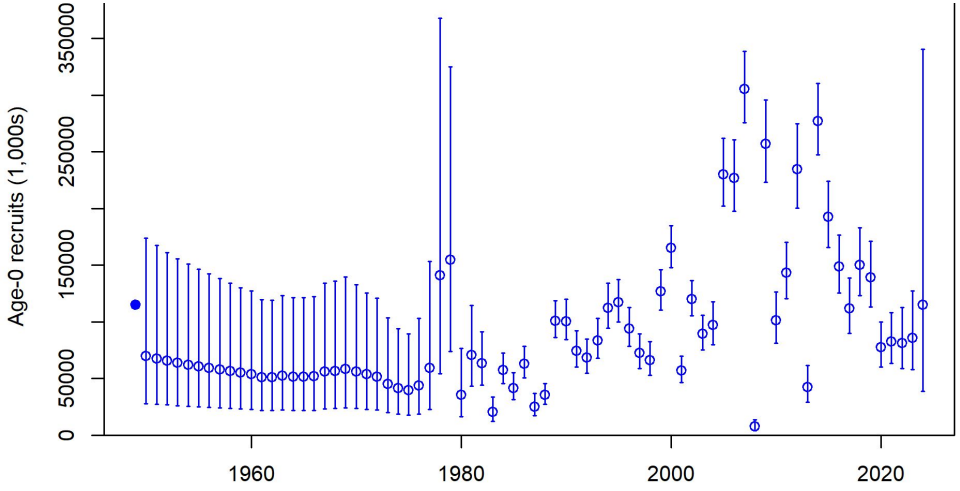


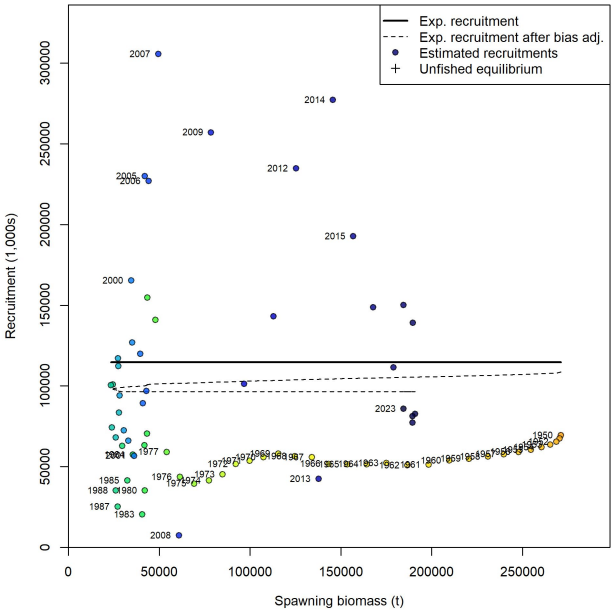
Derived Population Quantities

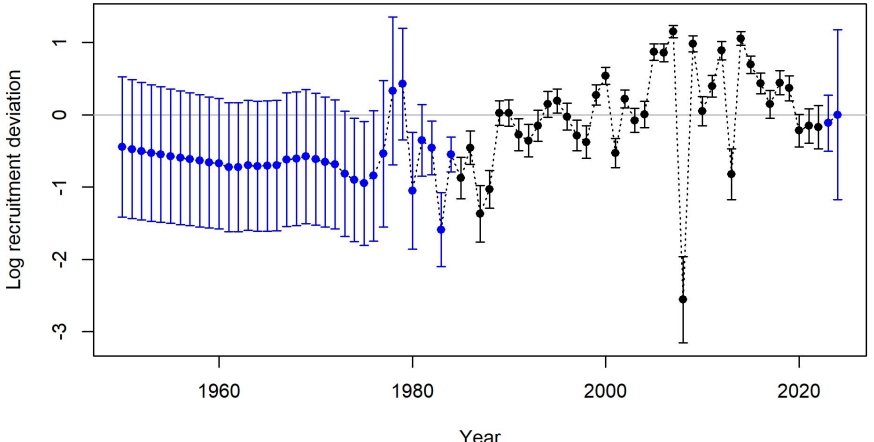
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Recruitment

Parameter	Value (CV)
$\ln(R_0)$	11.6505 (0.003)
R_0	95,740,000
Steepness	1.0 (NA)
SigmaR	0.6 (NA)

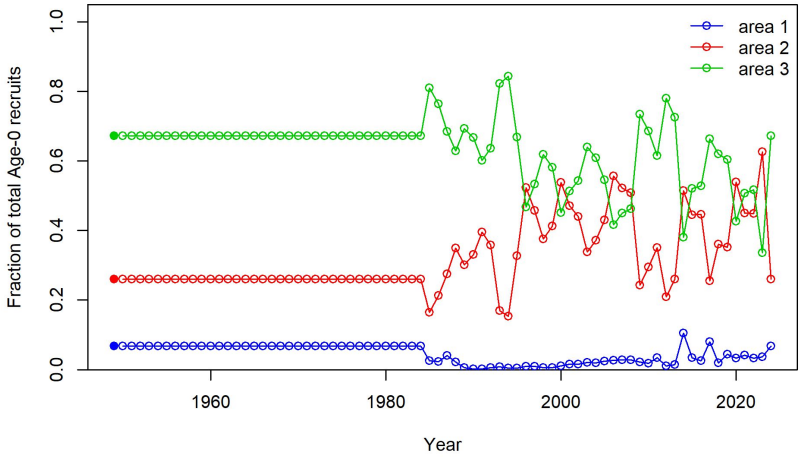


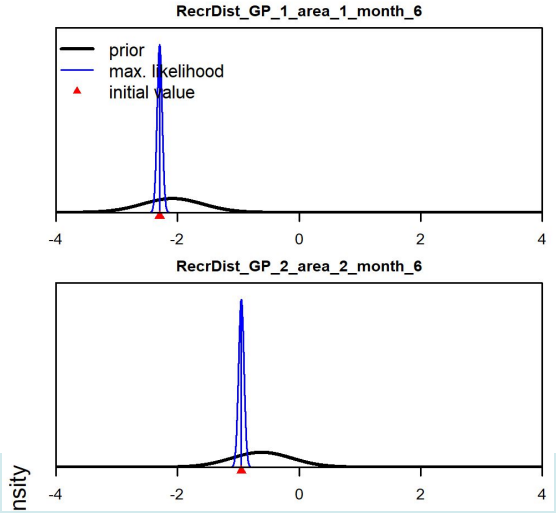


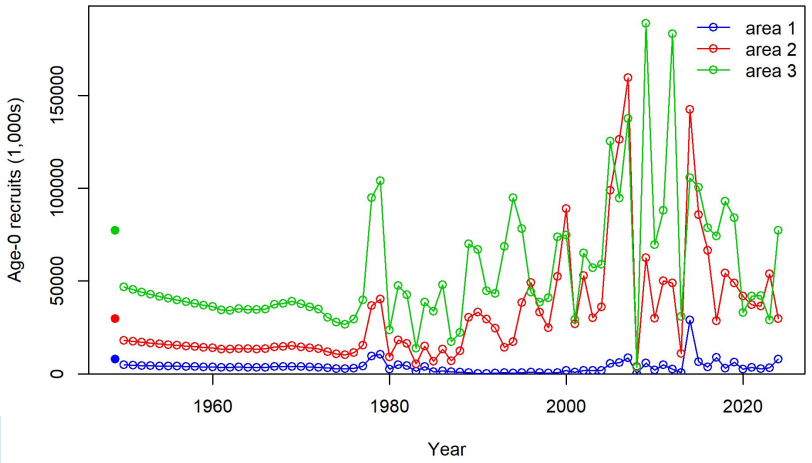


Apportionment

Parameter	Value (CV)
Base Area 1	0.068 (0.018)
Base Area 2	0.260 (0.046)
Base Area 3	0.673 (NA)
Dev. Standard Error	0.5 (NA)
Dev. Autocorrelation	0 (NA)

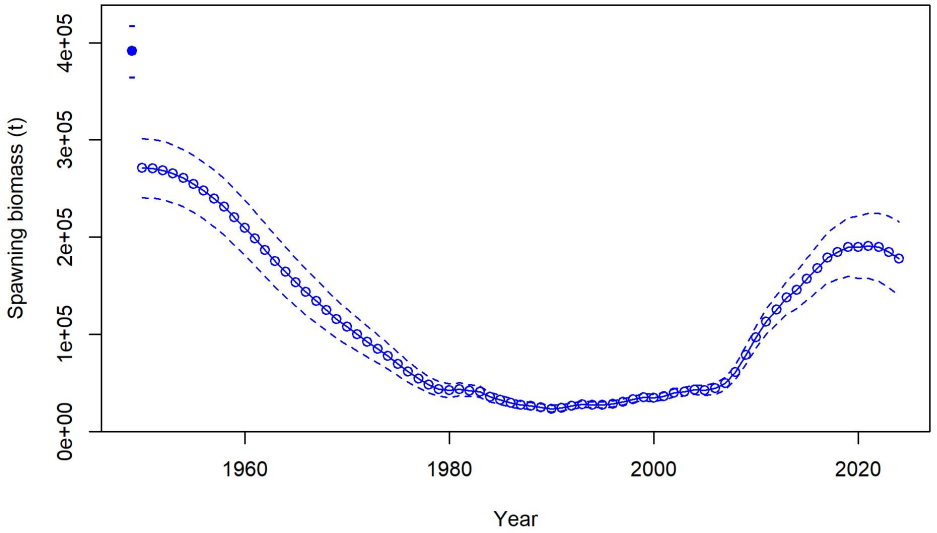






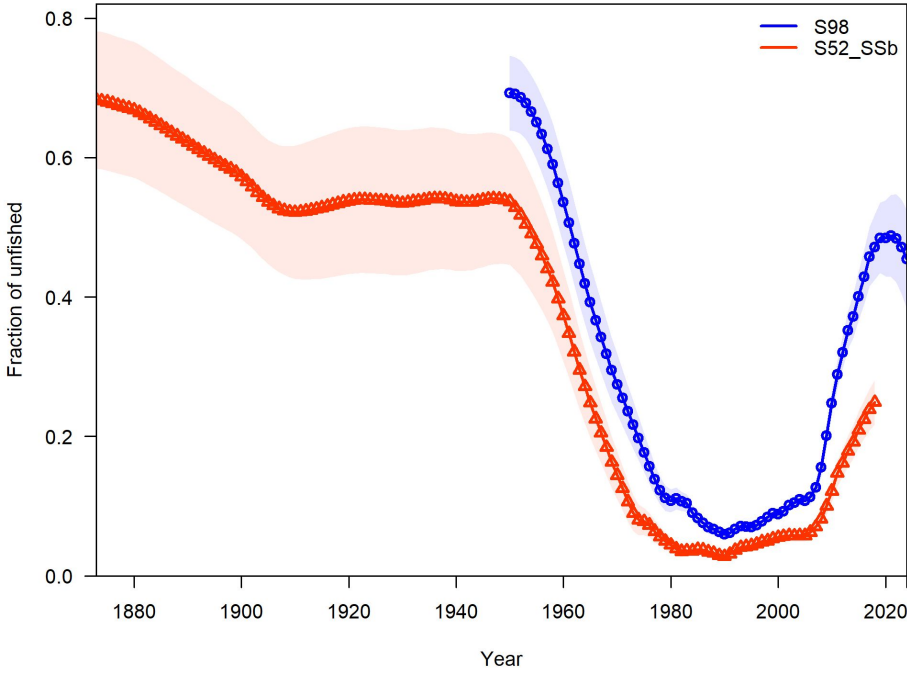
Biomass (Gulf Wide)

- Steady decline until early 1980s, then remained low until series of large recruitment events in early 2000's spurred recovery.



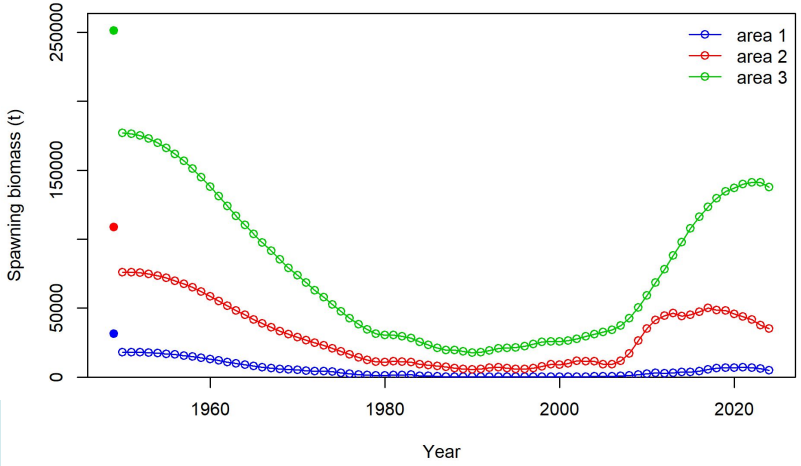
SEDAR 52 (SSB) vs SEDAR 98

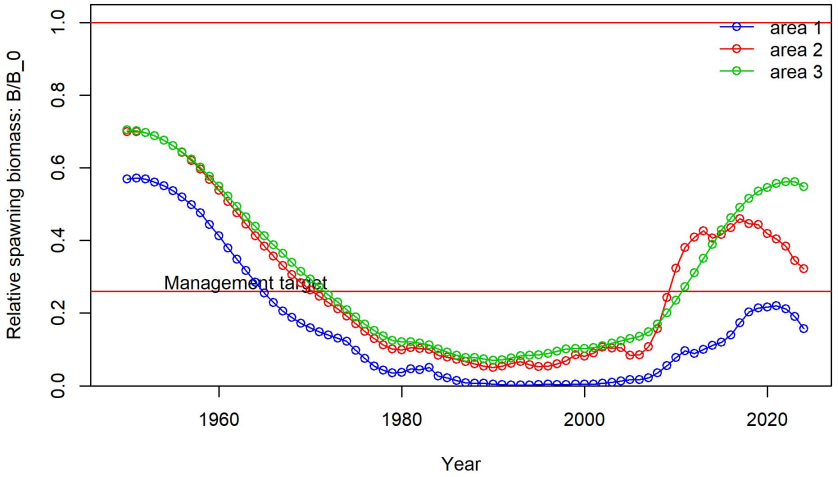
Fraction of unfished biomass



Biomass (Area-specific)

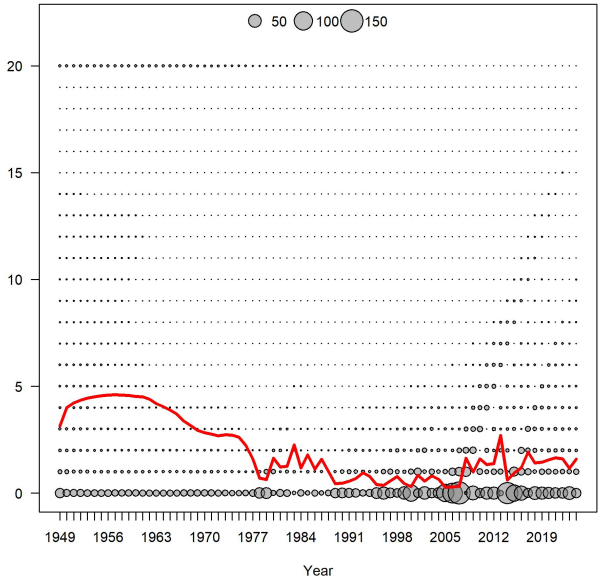
- West area has been consistently estimated to contain the most biomass since regional estimates were obtained.
- Model indicates that Gulf wide stock recovery may be at an inflection point.



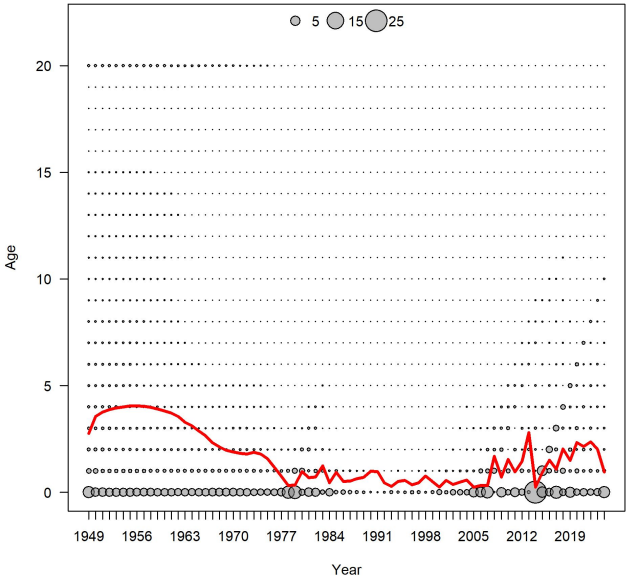


Expected Numbers-at-age

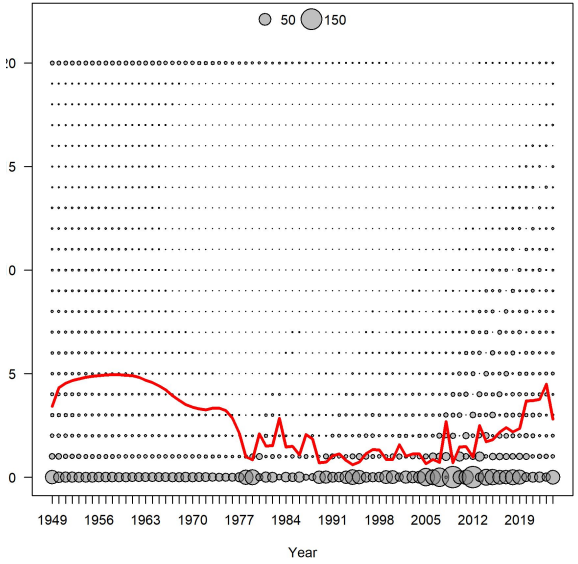
Central



East



West



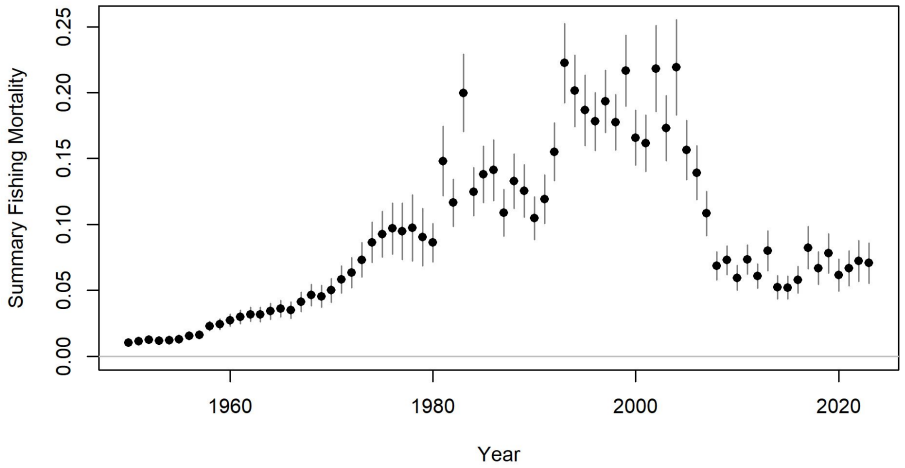
Legend:
1000s of fish

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Fishing Mortality

- Exploitation highest during periods when biomass was estimated to be low Gulf wide.

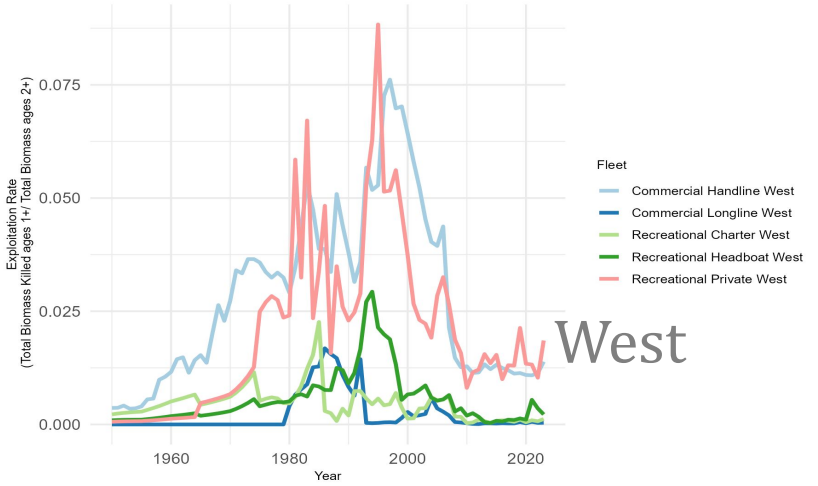
- Sudden drop in exploitation rate tied to management changes and rapid increase in biomass associated with several large year classes.

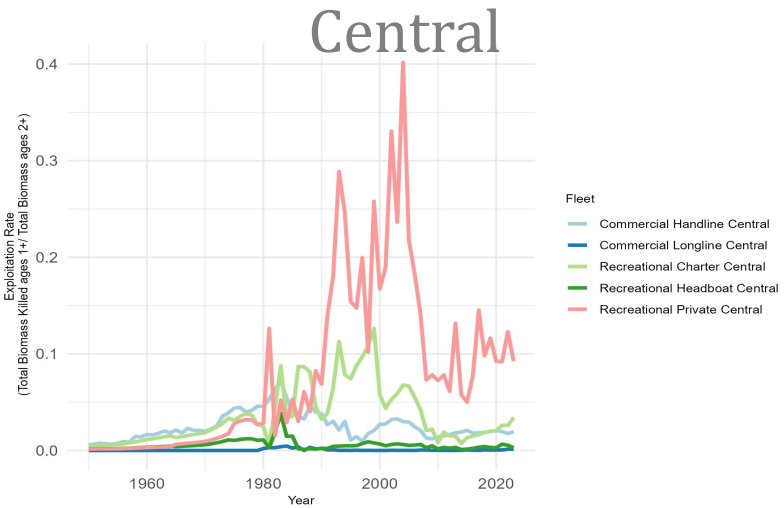


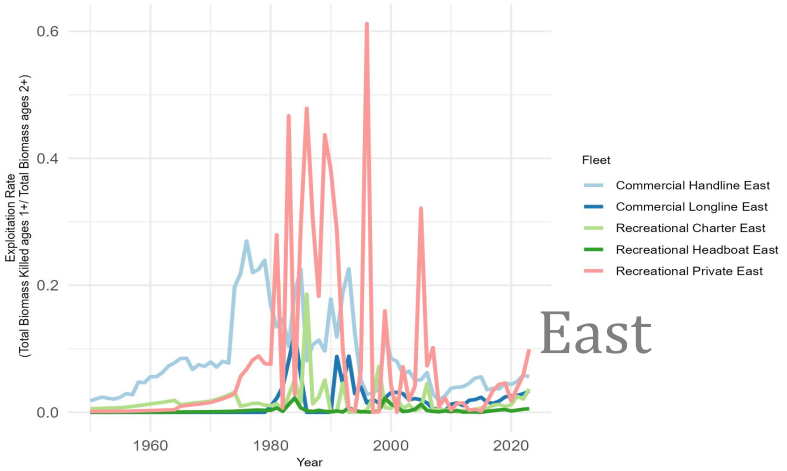
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Fishing Mortality (fleet/area)

- Estimates of fleet-specific F highly variable in East due to very low biomass estimates and variable catch statistics.

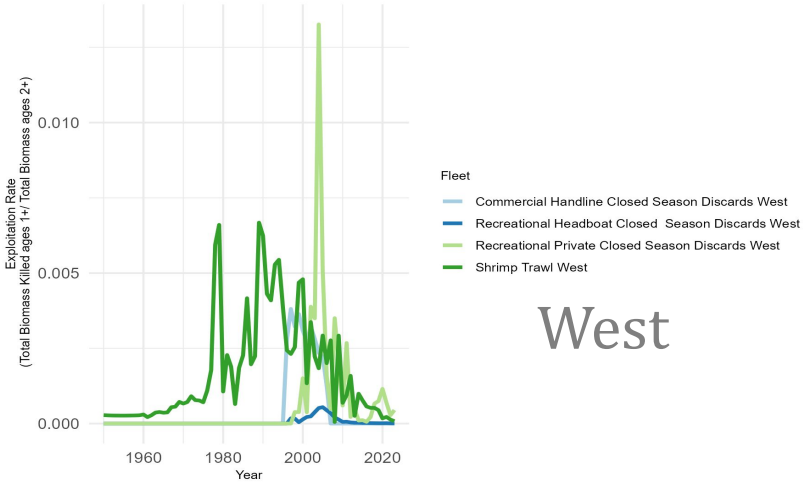






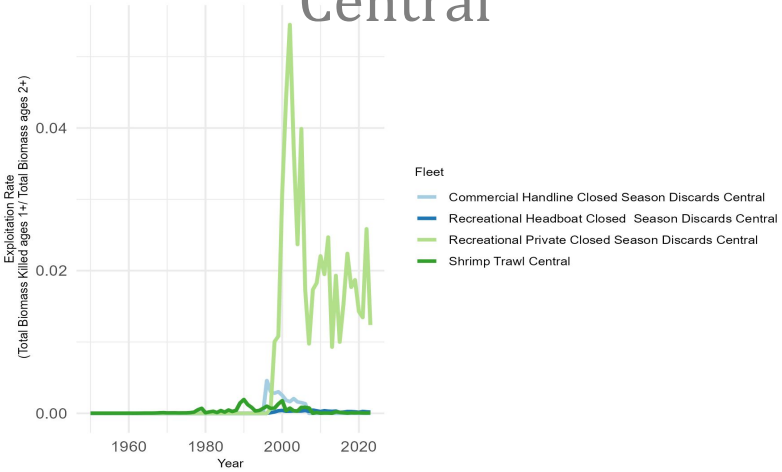
Fishing Mortality (fleet/area)

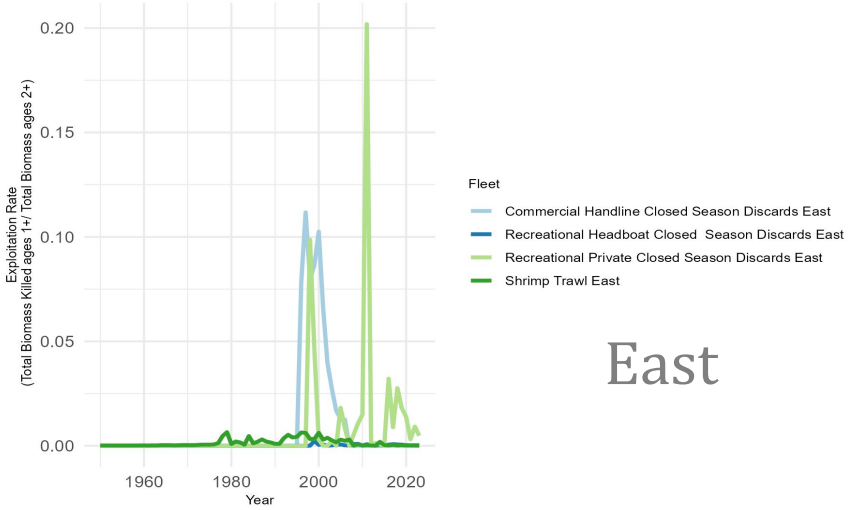
- Discard only and bycatch fleets generally estimated to have low exploitation rates.
- Central Private consistently higher



West

Central





East

Outline

- Data Review
  - Stock definition
  - Assessment history
  - Regulations
  - Key data decisions
  - Life history
  - Removals
  - Size composition
  - Age composition
  - Indices of abundance
  - Survey composition



- Assessment model
  - Model building
  - AP Model configuration
  - AP Model results
  - **AP Model diagnostics**
  - AP Model sensitivities
  - AP Model projections

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Model Reminders

- 2.1K estimated parameters in total
- 3 regions all with separate fleets
  - Most parameters are F's which are estimated annually per fleet per region
- Attempted to stabilize model by fixing growth, natural mortality, and steepness
  - Growth uses LHG recs one pattern for East/Central and one for west
  - Natural mortality is a fixed vector at age
  - Steepness fixed @ 1
- Model uses length and CAAL data were available

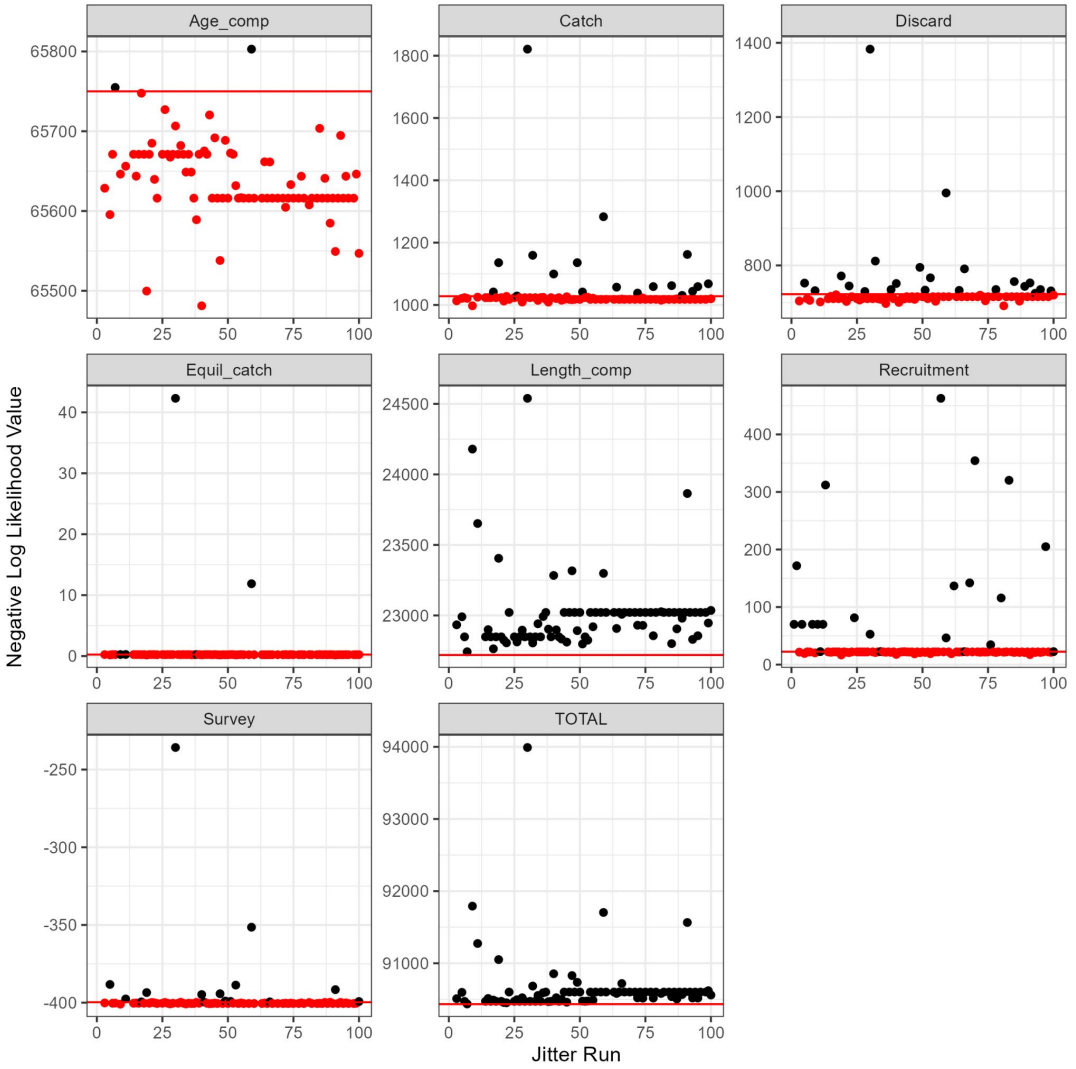
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Jitter - Model Stability

- 100 replicates with initial parameters changed by 0.1
- Of the 100, 83 runs converged and 17 failed to converge.
- Roughly 87% of converged runs were within 200 Likelihood points of the lowest NLL run.

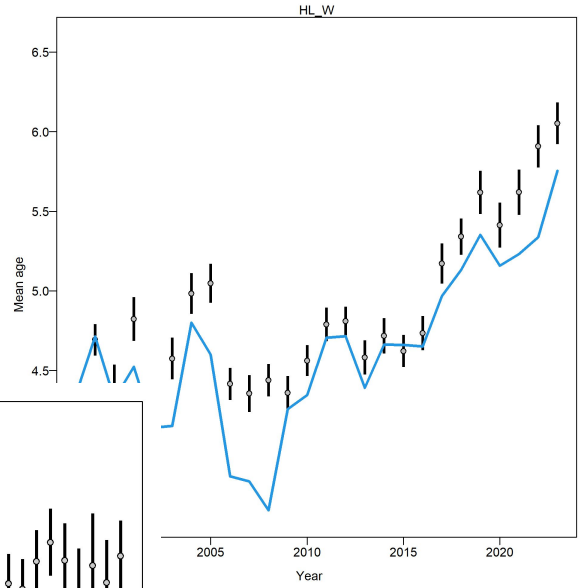
Jitter - Model Stability

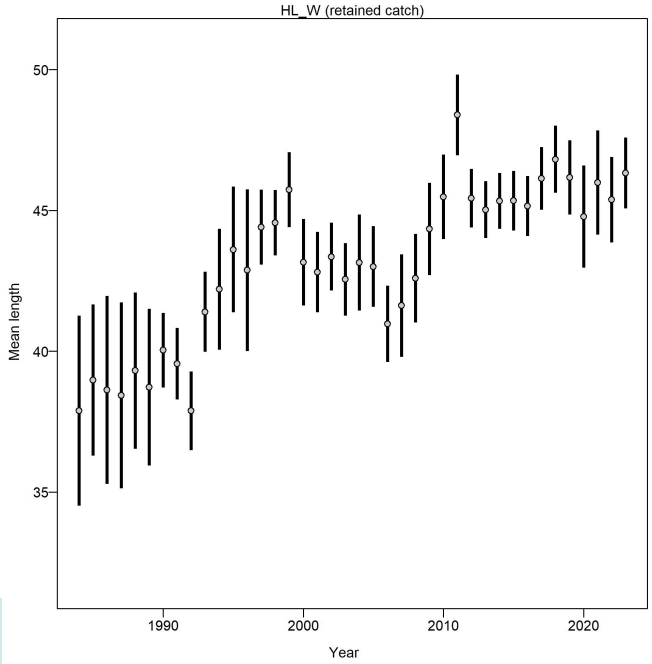
- Primary source of variability in Jitter analysis due to trade off between fit to age and length comp.
- May be linked to inability to estimate growth internally. May be data conflicts



Jitter - Model Stability

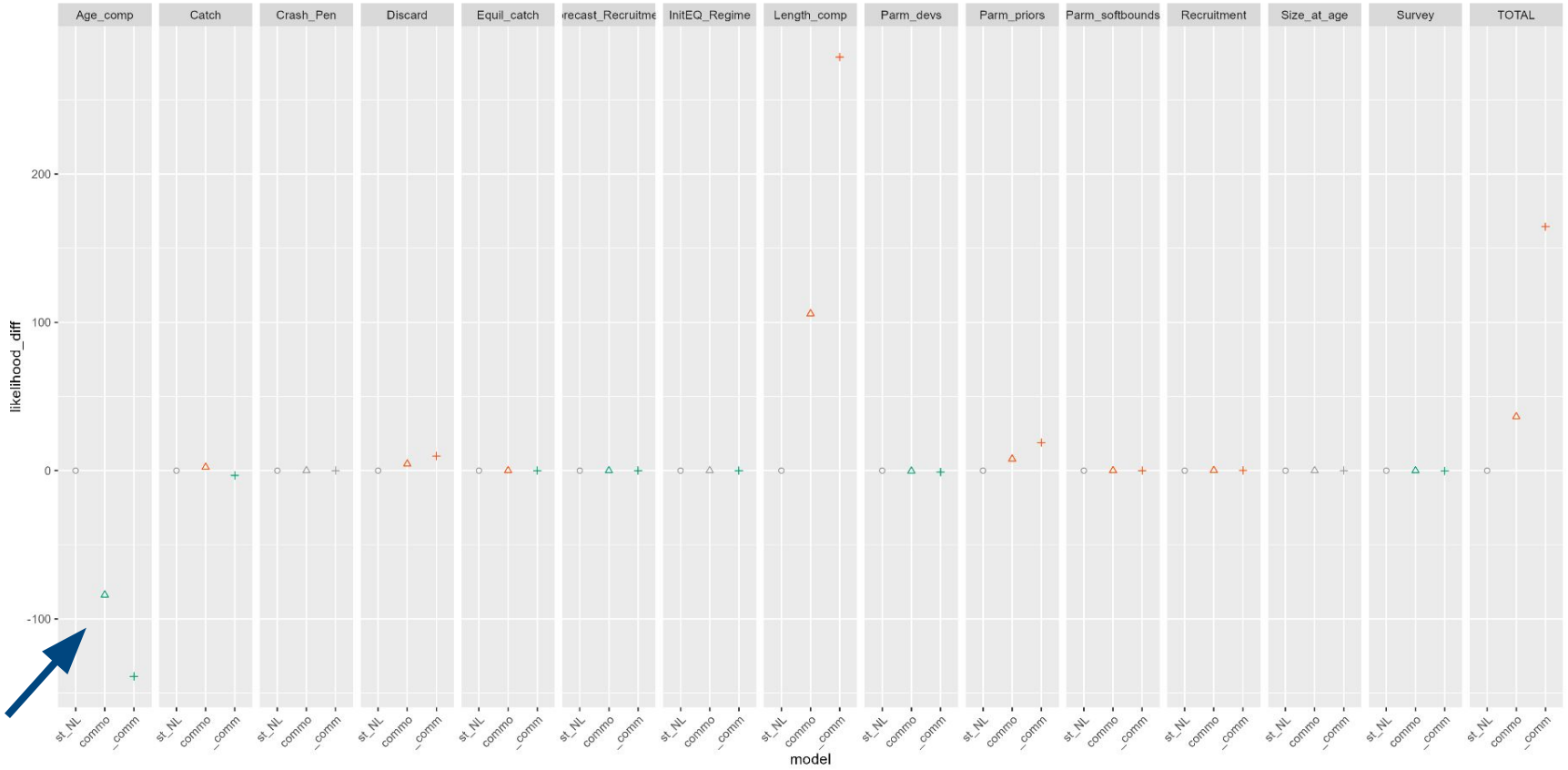
- Example of what potential data conflict looks like. No trend in mean length over last five years vs. strong positive trend in mean age over same time period in the same fleet.





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Jitter - Model Stability



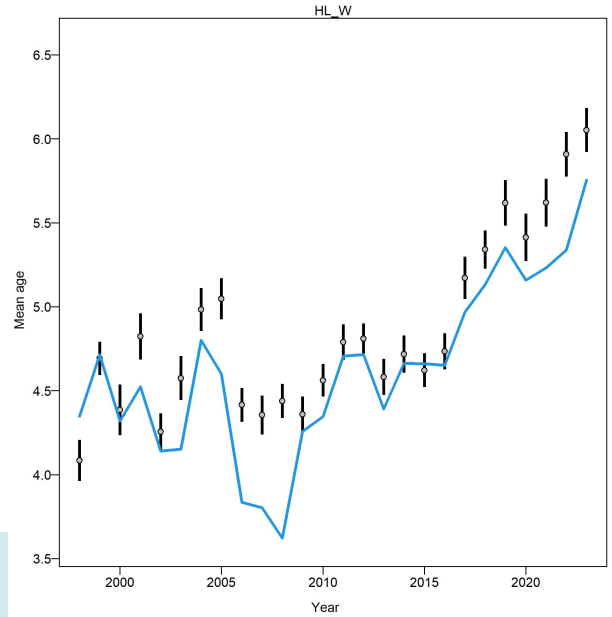
Jitter - Model Stability

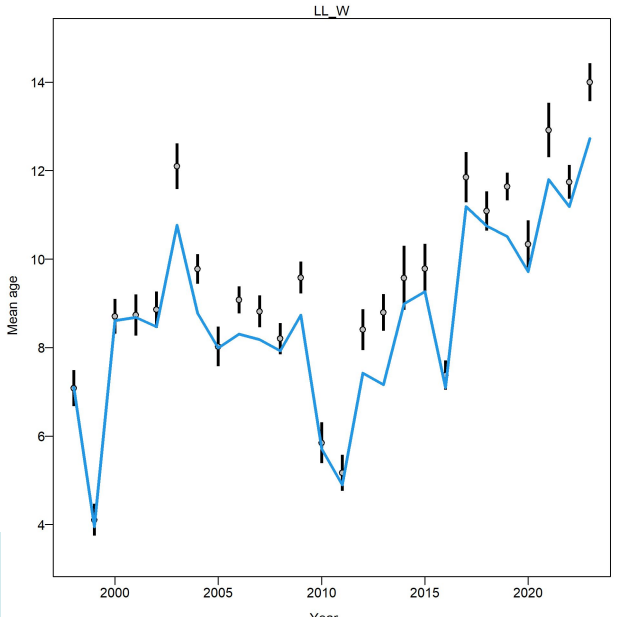
- Looking at the fleet level - All fleets with composition data show some differences in fit between the lowest and high-common run.
- West handline, longline, charter boat fleets and early trawl survey along with central charter boat contribute most to difference in NLL.

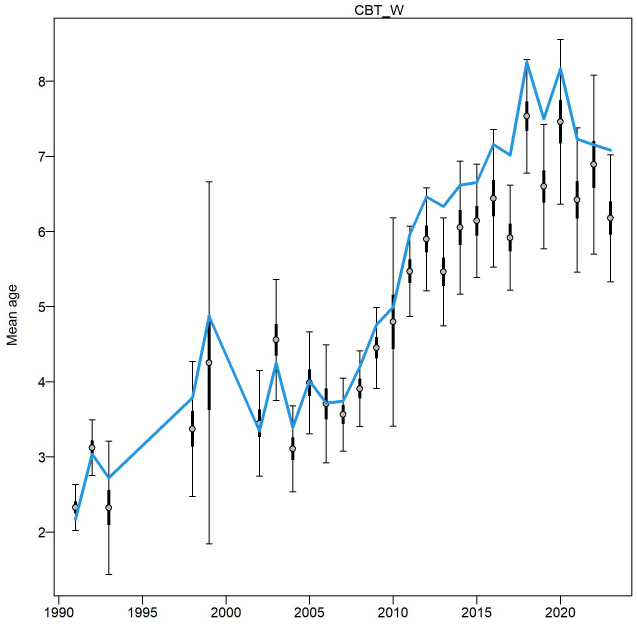
NOAA FISHERIES

Jitter - Model Stability

- Model tension in the west may be linked to the apparent non-equilibrium state of the west over the last 5-10 data years.

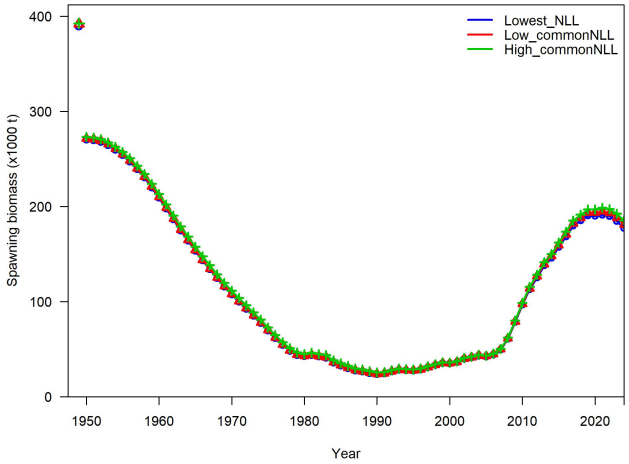


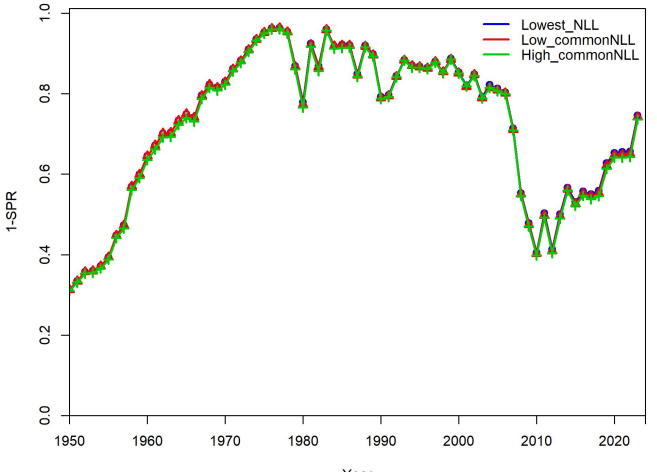


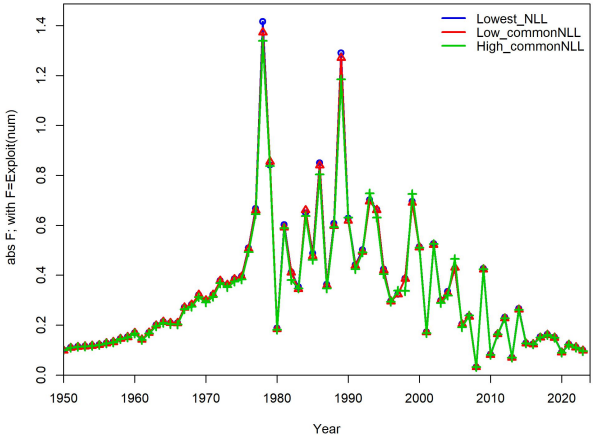


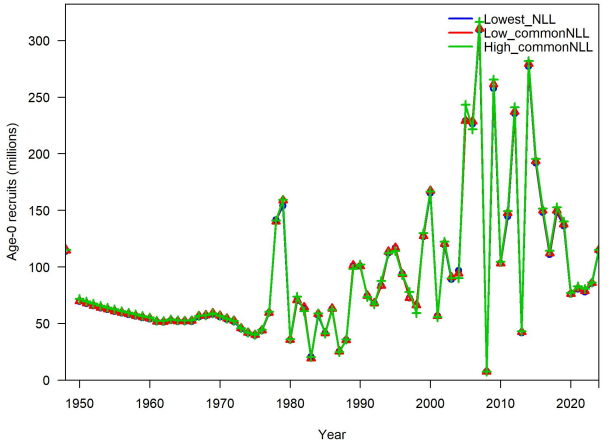
Jitter - Model Stability

Minimal difference in derived quantities among jitter runs.









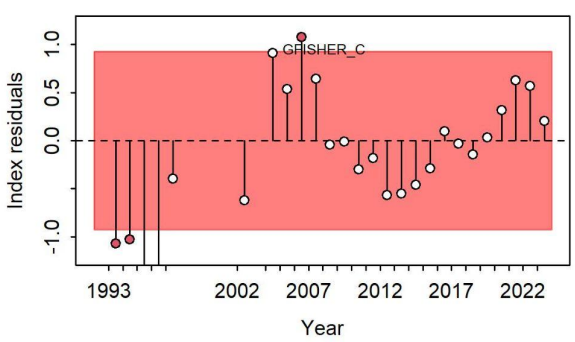
Runs Tests

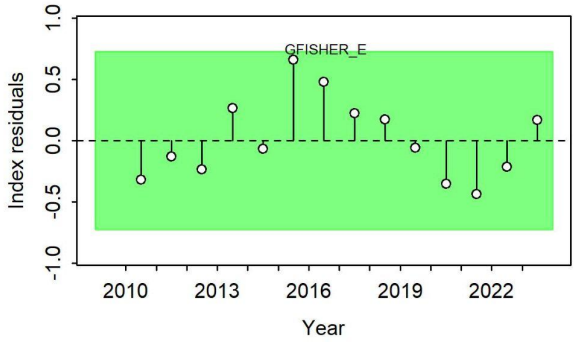
- Test to identify whether residuals for a given data set randomly fluctuate around zero or display signs of protracted autocorrelation.
- In the following plots, datasets highlighted in green pass the runs test (random residuals), those highlighted in red fail the runs test.

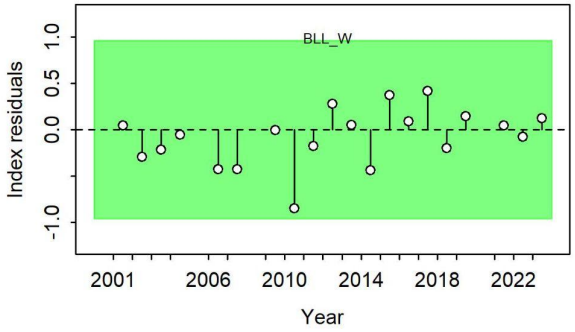
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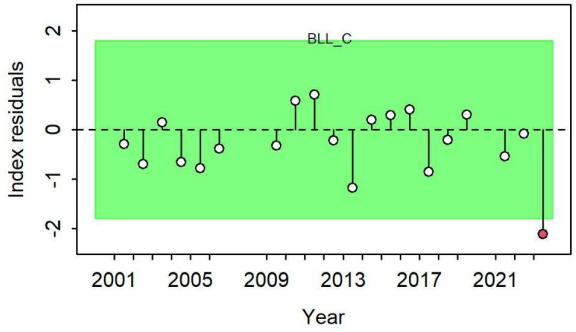
Runs Tests (Indices - 1)

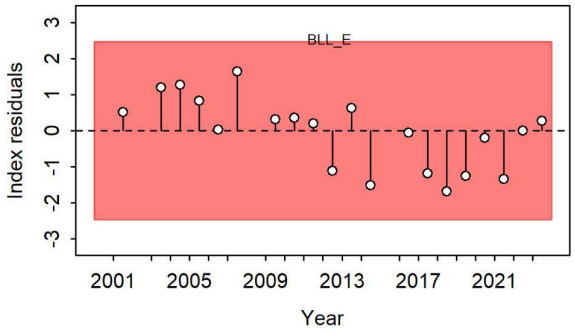
- BLL_E survey has high CV (avg 0.7) as do other East surveys. Pop dy driven by comp.
- Residual pattern in central video potentially due to survey design.
- Video west potentially not capturing full regional dynamics.

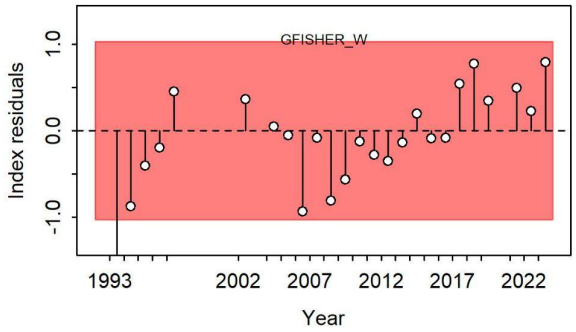






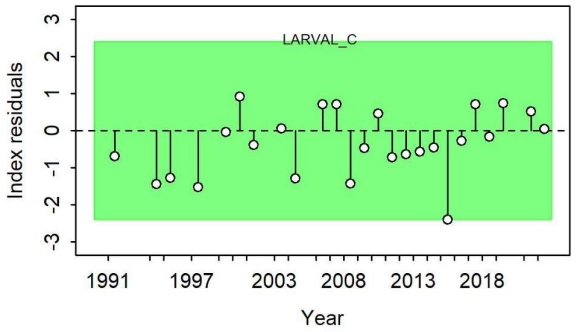


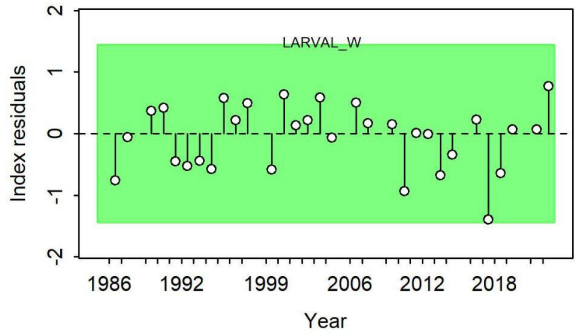


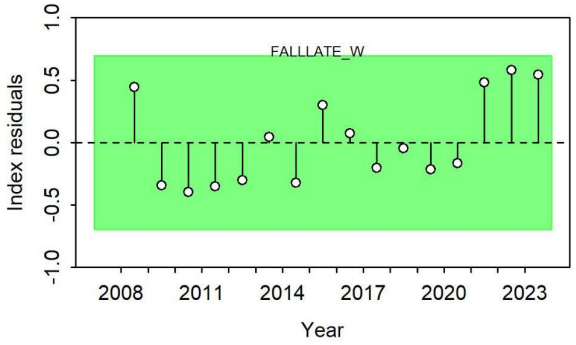


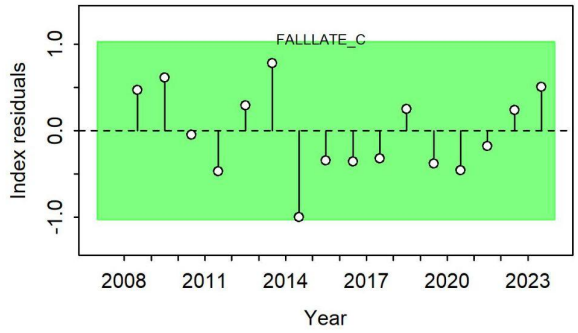
Runs Tests (Indices - 2)

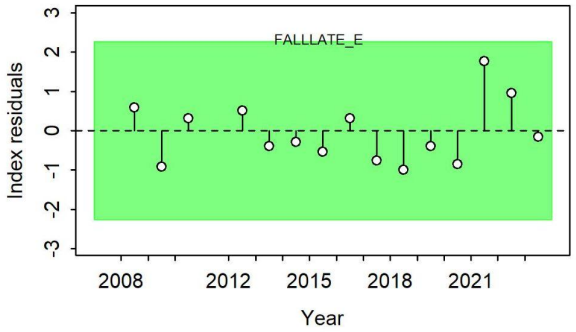
- No issues with fit to Larval survey (SSB) or fall survey (Recruits)

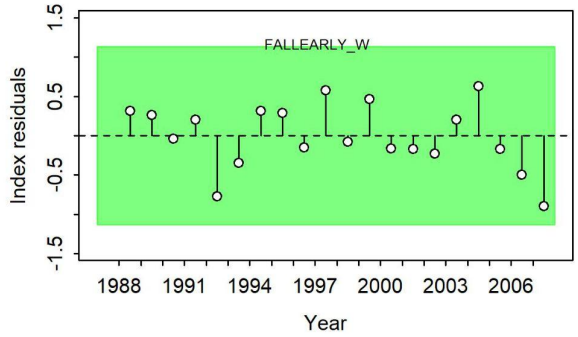






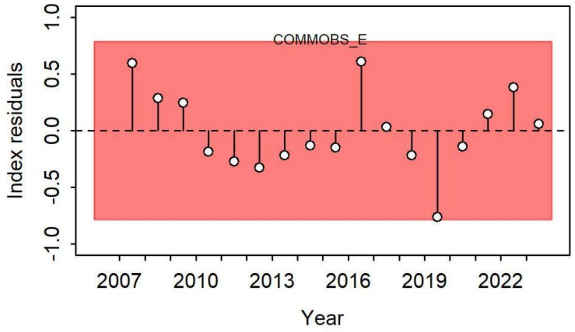


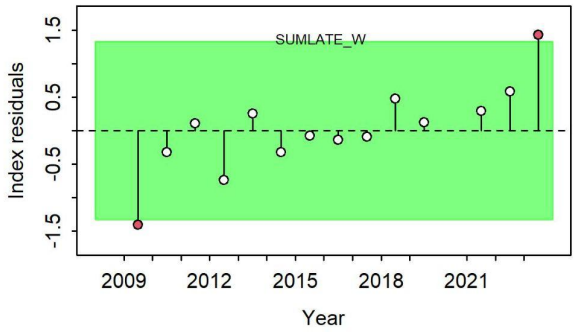


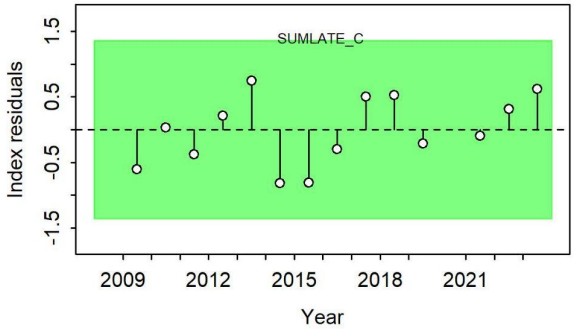


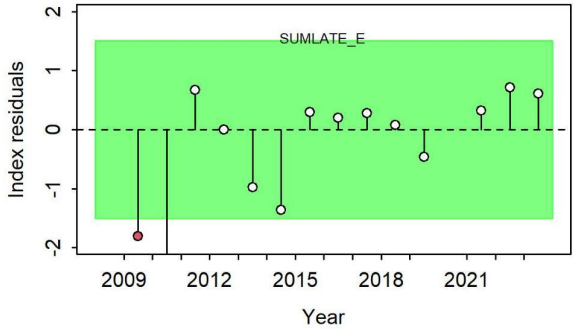
Runs Tests (Indices - 3)

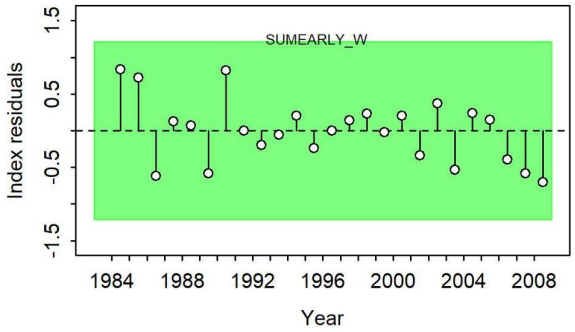
- Observer CPUE index fails the test; however, model expectation generally matches observed trend.





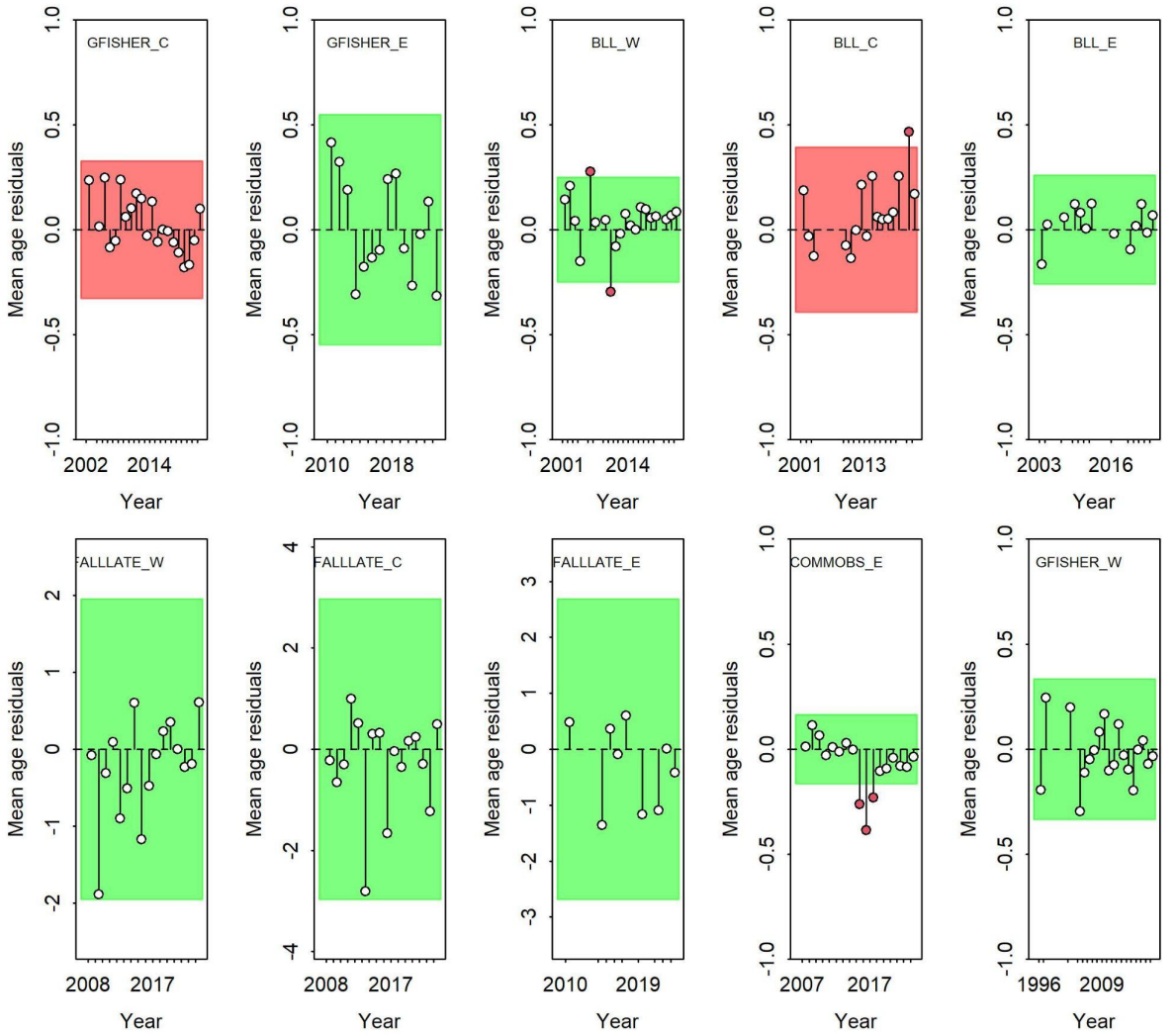






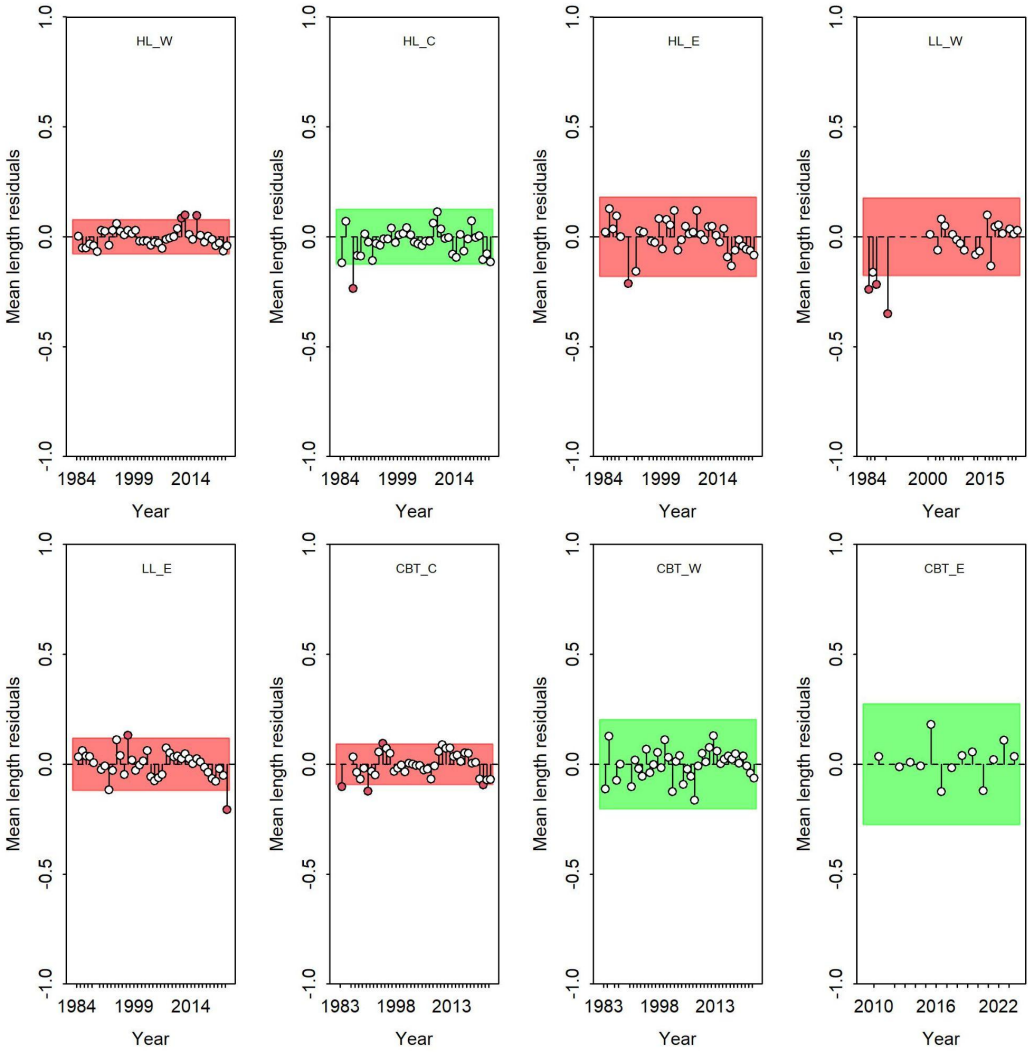
Runs Tests (Age)

- No results for CAAL data
- Generally positive results indicating model is tracking cohorts well.
- Failures in the Central area may be linked to video survey expansion.



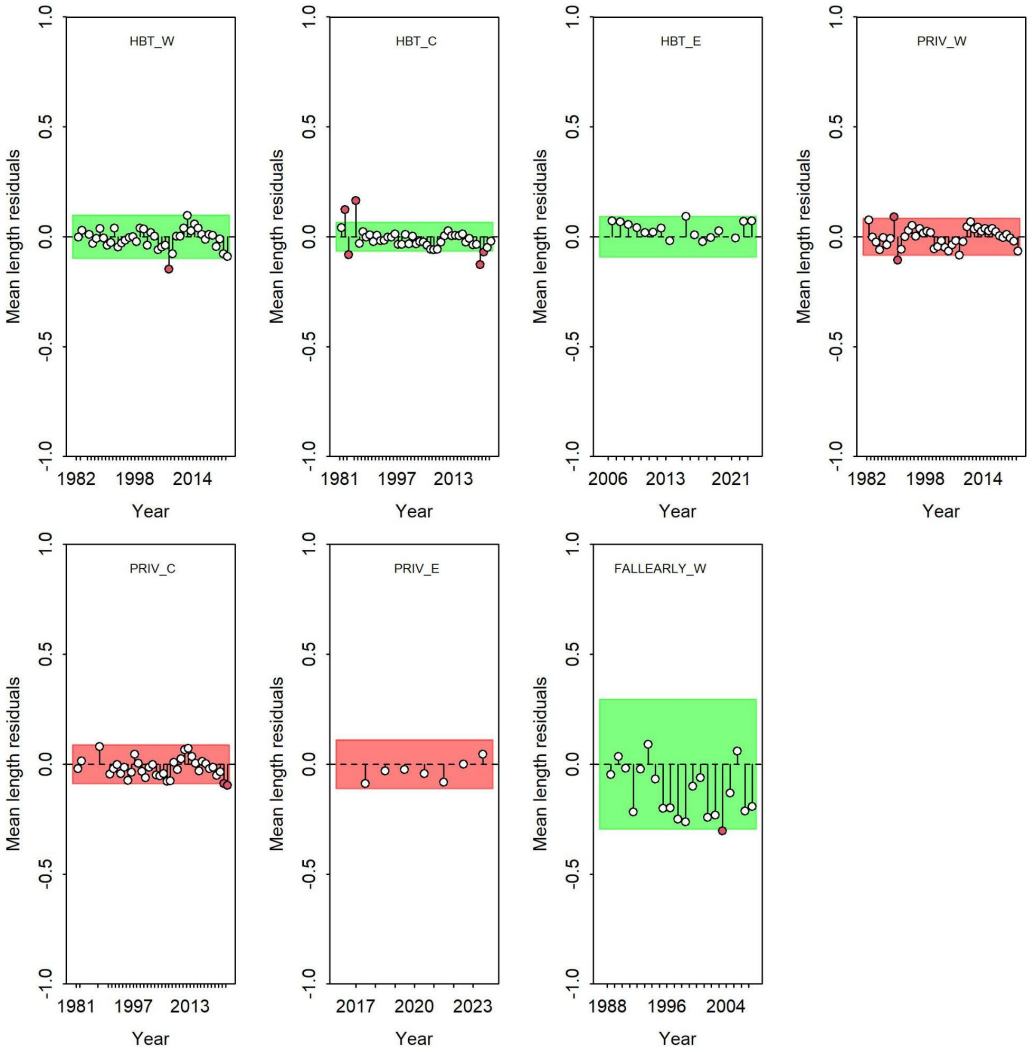
Runs Tests (Length - 1)

- Autocorrelation in residuals apparent in several fleets.
- In general the magnitude of the residuals is small and mean length captured well



Runs Tests (Length - 2)

- Failure in all three private fleets indicates a potential fleet specific misspecification.
- EFP/state management blocking not incorporated in this assessment



Runs Tests (Length)

Evidence of correlated residuals in the length composition data likely caused by inflexible or misspecified selectivity and/or retention functions.

- Intentional effort was made to reduce estimated selectivity parameters in the base model which may contribute.
- Fixed parameters around retention, due to lack of discard composition, likely also contributes.
- Uncertainty around extent of high grading and regulatory discards also resulted in parameters being fixed or range bound.

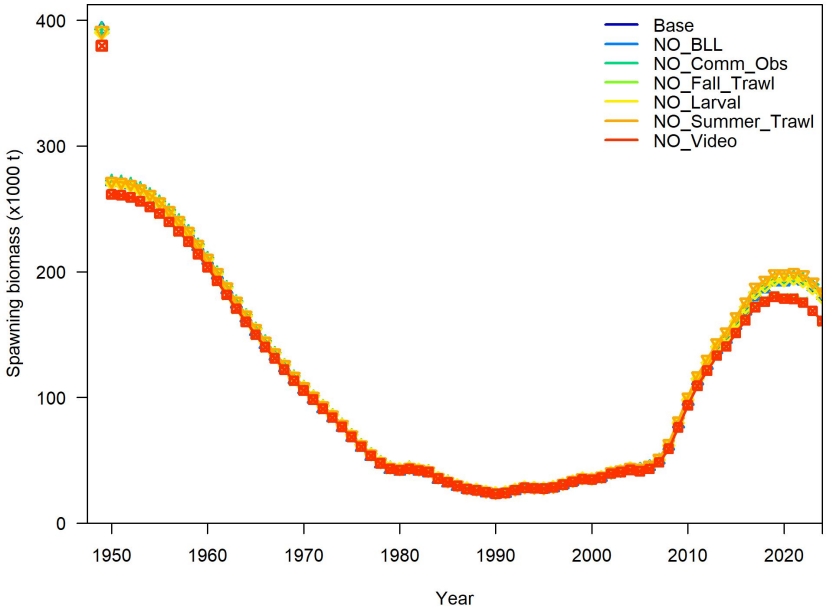
NOAA FISHERIES

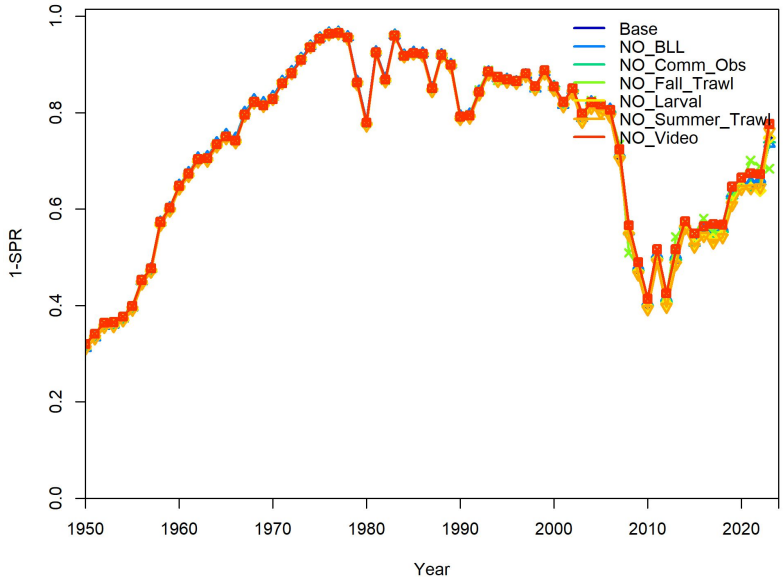
Index Jackknife

- Remove each index (across all regions) in turn.
- Analysis done to determine if model results are overly sensitive to any one index.
- Model shows some sensitivity to the removal of the video survey and the fall trawl survey.

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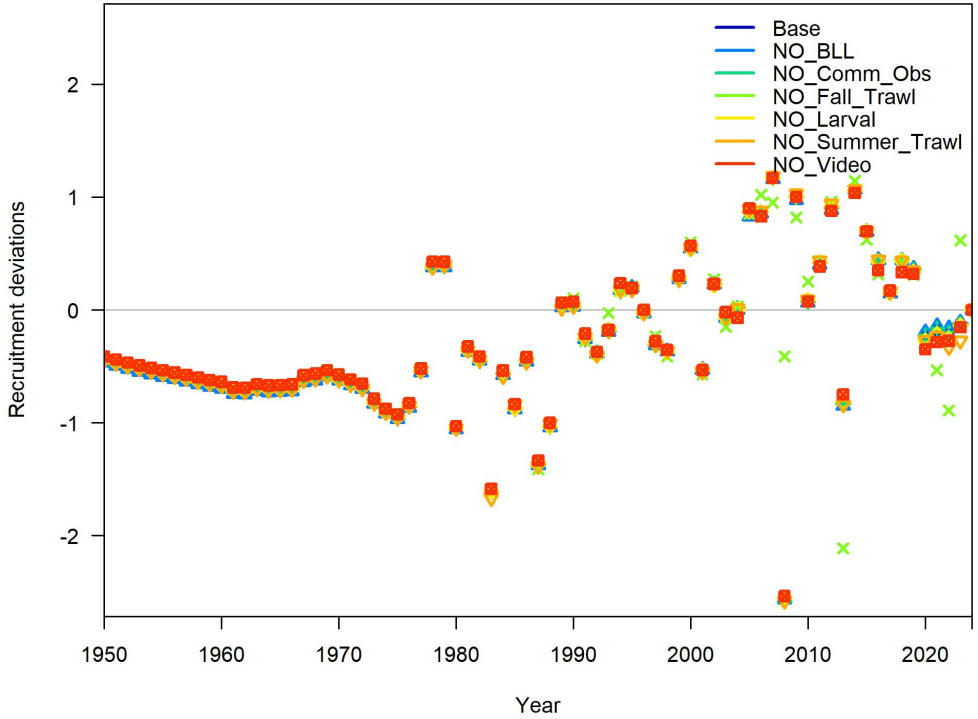
Index Jackknife





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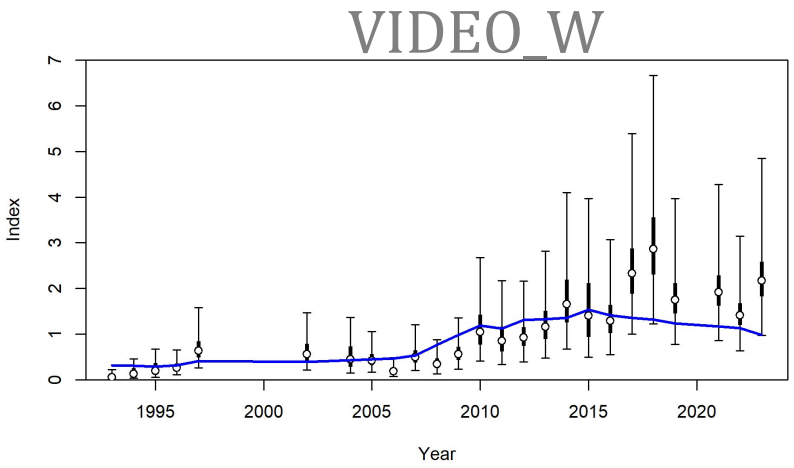
Index Jackknife



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Index Jackknife (VIDEO)

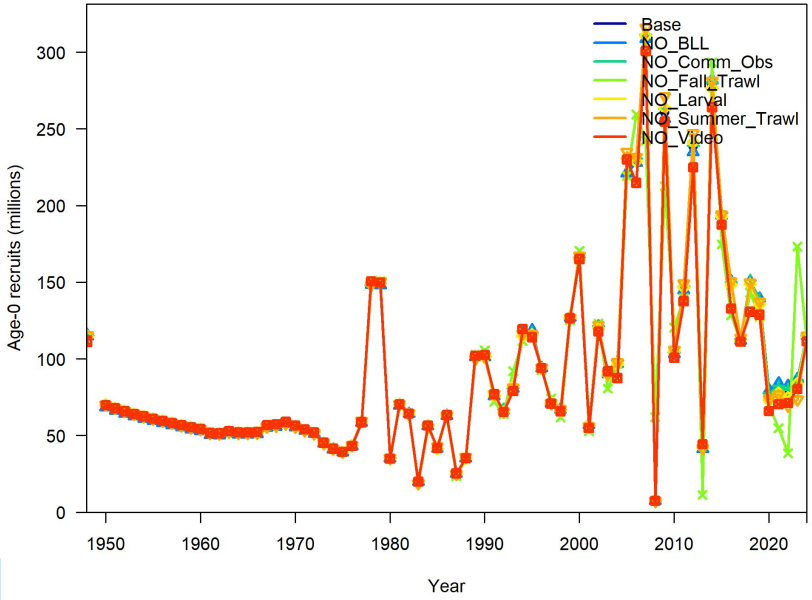
- Sensitivity to VIDEO survey was expected.
- E.g., West video (shown). Model wants to trend biomass lower than the observed video survey data in recent years.
- Removing the observed data allows it to trend even lower.



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Index Jackknife (Fall Trawl)

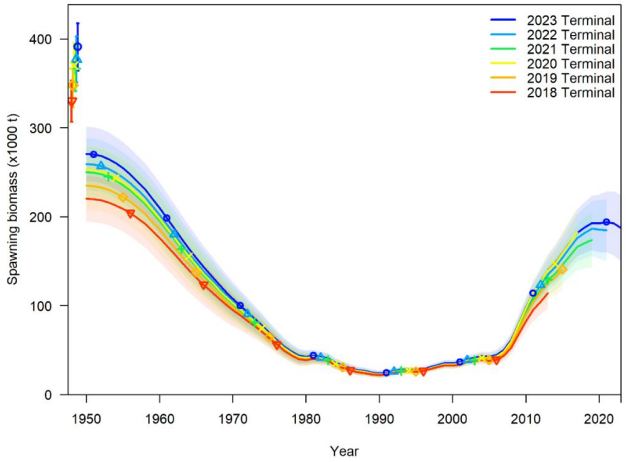
- Fall trawl was specifically included to help inform year class strength, so sensitivity of the rec. devs. to its removal was expected.
- Sensitivity of the model to the fall trawl survey should be considered during forecasts as recent mean average recruitment is being heavily influenced by the survey.

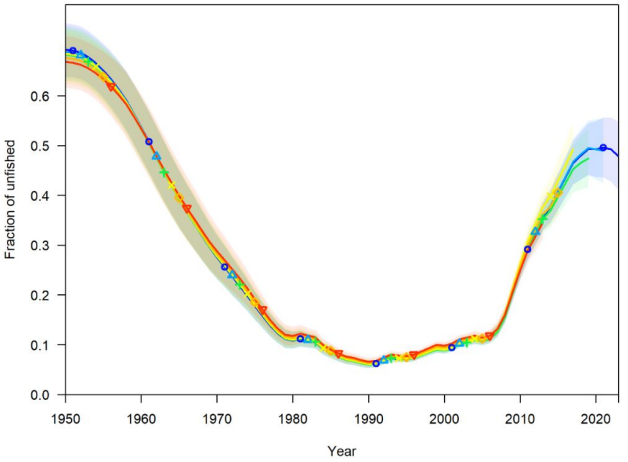


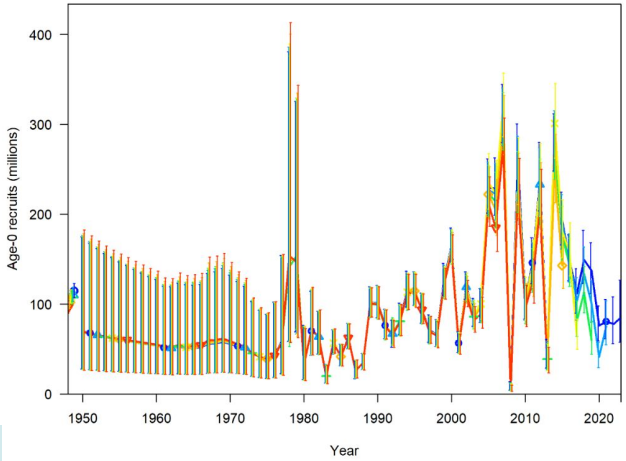
Retrospectives

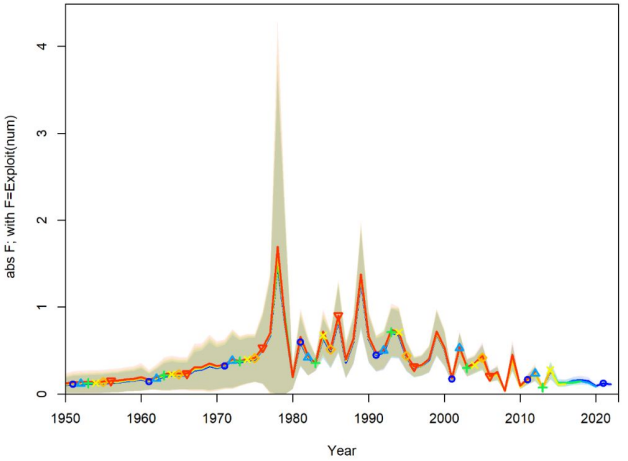
Component	Mohn's rho
SSB	-0.089
Recruitment	-0.297
Bratio	-0.059
F	-0.006

Values greater than -0.15 do not exhibit severe retrospective pattern









Retrospectives

- All rho values were negative indicating that adding an additional year of data increased the previous years estimate.
- More extreme rho value for recruitment is not viewed as a critical failure as terminal year recruitment is consistently one of the least informed parameters in an assessment model.
- Increased estimates of recruitment deviations with additional years of data indicative of consistent recruitment above R0 in recent years. Expected given how recruitment deviations are being handled.

Retrospective Analysis

- Retrospective analysis indicates that the model, in its current configuration, does not possess a severe retrospective bias.

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Hindcasting / cross validation

- Measures models predictive ability to forecast observed data (CPUE, mean age, and mean length) by fleet/survey over terminal 5 years.

- Results evaluated using the MASE statistic and ss3diags R package.
  - MASE <1: The model has predictive skill
  - MASE = 1: The model performs as well as simply assuming next years value equals this years value.
  - MASE >1: The model lacks predictive skill.

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Hindcasting (Index)

- Taken collectively the indices have high predictive value (joint MASE = 0.553).
- Of note: in general the indices in the west have the least predictive power with the summer trawl and Video survey providing less predictive skill than the naive baseline.

INDEX	MASE	REGION
GFISHER_W	1.756	West
GFISHER_C	0.929	Central
GFISHER_E	0.619	East
BLL_W	0.815	West
BLL_C	0.189	Central
BLL_E	0.546	East
LARVAL_W	0.523	West
LARVAL_C	0.276	Central
FALLLATE_W	0.744	West
FALLLATE_C	0.894	Central
FALLLATE_E	0.382	East
COMMOBS_E	0.795	East
Shr_W	0.201	West
Shr_C	0.008	Central
Shr_E	0.046	East
SUMLATE_W	1.347	West
SUMLATE_C	0.757	Central
SUMLATE_E	0.577	East
joint	0.553	

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Hindcasting (Age)

- Taken collectively the indices have acceptable predictive value (joint MASE = 0.84).
- However, many individual sources of age data across all regions indicate that the current model configuration provides little predictive skill in estimating future age structure/year class strength.

INDEX	MASE	REGION
GFISHER_W	1.31	West
GFISHER_C	1.87	Central
GFISHER_E	0.58	East
BLL_W	0.71	West
BLL_C	1.10	Central
BLL_E	0.35	East
FALLLATE_W	1.39	West
FALLLATE_C	0.48	Central
FALLLATE_E	0.74	East
COMMOBS_E	1.28	East
joint	0.84	

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Hindcasting (Length)

- Taken collectively, the model is capable of predicting the next years mean length (joint MASE = 0.575).
- In general, results indicate that length-based selectivity and retention functions are configured appropriately for capturing near term dynamics.

INDEX	MASE	REGION
HL_W	0.599	West
HL_C	0.708	Central
HL_E	0.710	East
LL_W	0.541	West
LL_E	0.716	East
CBT_W	0.263	West
CBT_C	0.787	Central
CBT_E	0.665	East
HBT_W	0.472	West
HBT_C	0.773	Central
HBT_E	0.261	East
PRIV_W	0.334	West
PRIV_C	0.658	Central
PRIV_E	0.500	East
joint	0.575	

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Hindcasting (Summary)

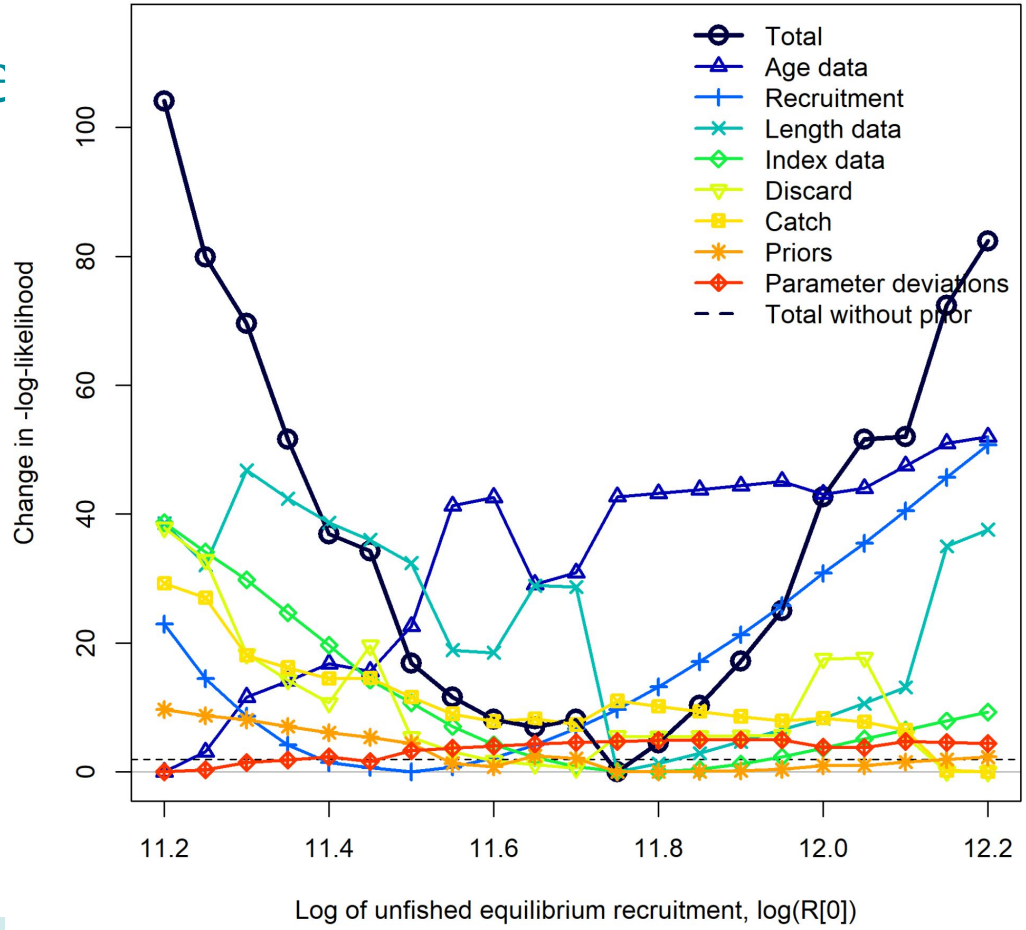
- Indices
  - Poor results with the trawl surveys are understandable given their sensitivity to recruitment deviations which can't be predicted well.
  - Lack of predictive ability of the GFISHER_W survey is intriguing given known concerns with index.
- Age
  - Models lack of predictive skill for mean age is troubling and may indicate, among other things, a mis-specification in the growth function, which remains an area of model development focus.

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SR parameter Profile

R0

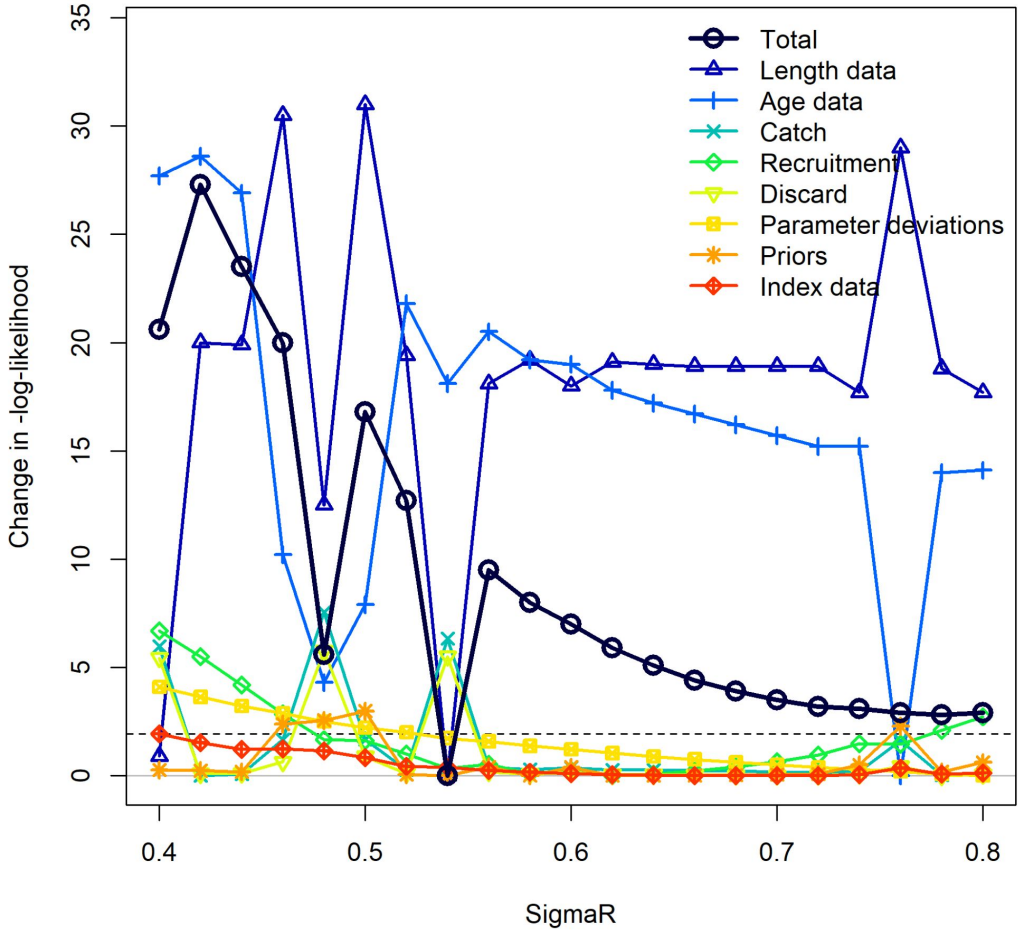
- Model total likelihood appears to find a minimum at approx. 11.7
- Min supported by the length (green x's), and index (green diamonds) data
- There is slight conflict between length and age - age appears to settle at a higher R0



SR parameter Profiles

SigmaR

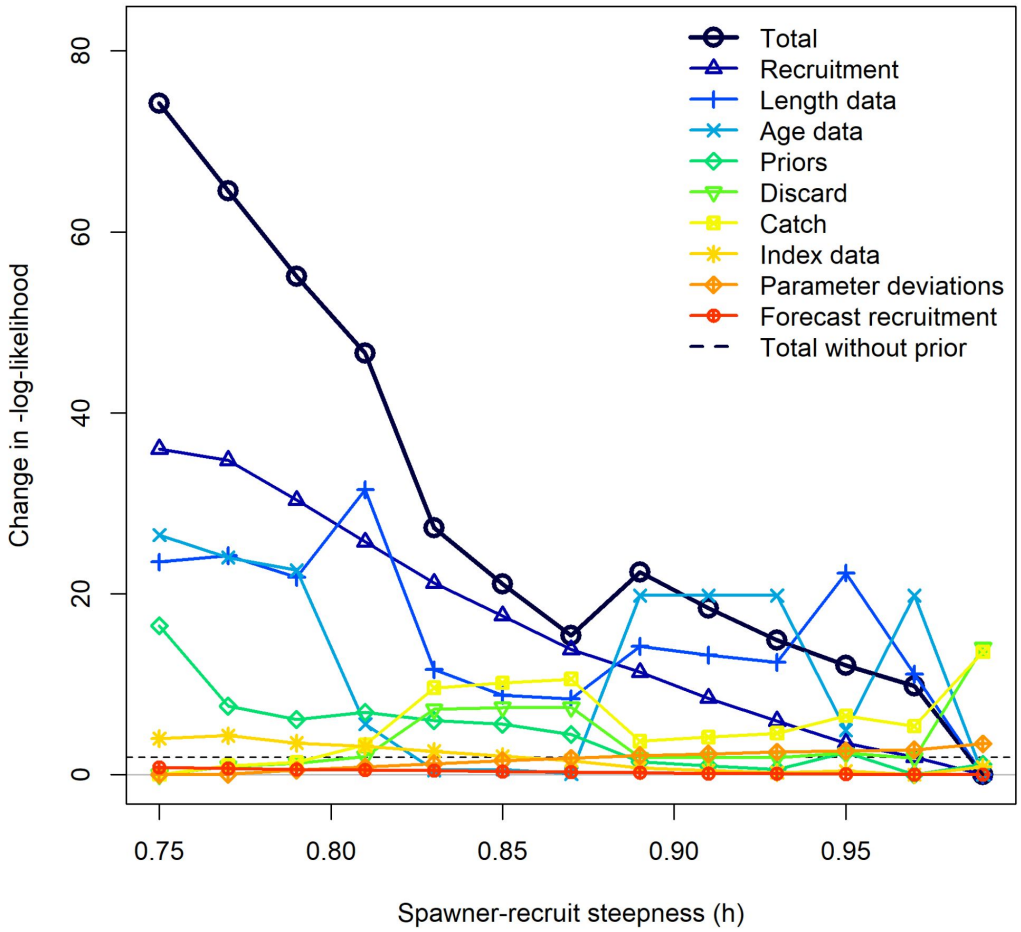
- A difficult parameter to pinpoint
- Set at 0.6 in model
- Conflict between length and age data
- Profile indicates that a higher Sigma R value may be more appropriate.



SR parameter Profiles

Steepness (h)

- Most data streams suggest a steepness close to 1
- Length and age data support a similar steepness



Model Behavior Conclusions

- In general the model diagnostics indicate no strong retrospective bias, reasonably stable convergence, and broad predictive skill.
- Some areas of concern identified
  - Poor fits (runs test) to a number of indices suggested that data weights may be to strongly favoring the composition data.
  - Poor predictive skill in mean age combined with the length comp & age comp tradeoff apparent in the jitter analysis suggests that underlying dynamics responsible for the shifting age and size structure of the population over the last 5-10 years may not be adequately captured in the current model configuration.

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Model Behavior Conclusions

- We conclude that the diagnostic analysis supports the current base model configuration.
- However, further evaluations are warranted around:
  - Selectivity/retention blocking schemes, especially recent (EFP).
  - Internal growth estimation and natural mortality modeling.
  - Balance of data weights in a model that currently favors fitting composition data over indices.
  - The utility of indices of relative abundance that lack predictive skill, especially if this remains an issue following data weight evaluations.

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Outline

- Data Review
  - Stock definition
  - Assessment history
  - Regulations
  - Key data decisions
  - Life history
  - Removals
  - Size composition
  - Age composition
  - Indices of abundance
  - Survey composition



- Assessment model
  - Model building
  - AP Model configuration
  - AP Model results
  - AP Model diagnostics
  - **AP Model sensitivities**
  - AP Model projections

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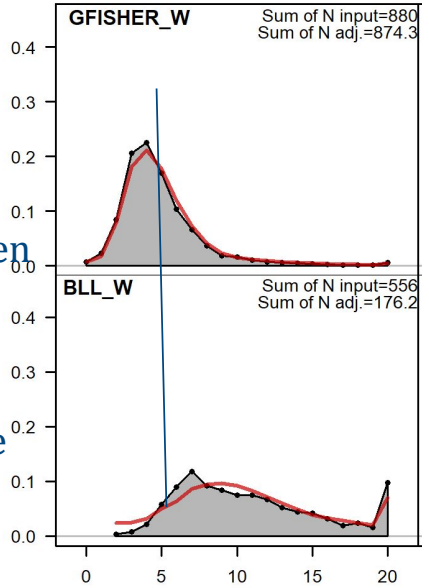
Sensitivities to Assumptions and Configurations

- G-FISHER Index and composition
- Uncertainty in landings
- Natural mortality Age 0 & 1
- Estimating Growth parameters
- MRIP FES adjustment
- Great Red Snapper Count
- Hamel and Cope natural mortality

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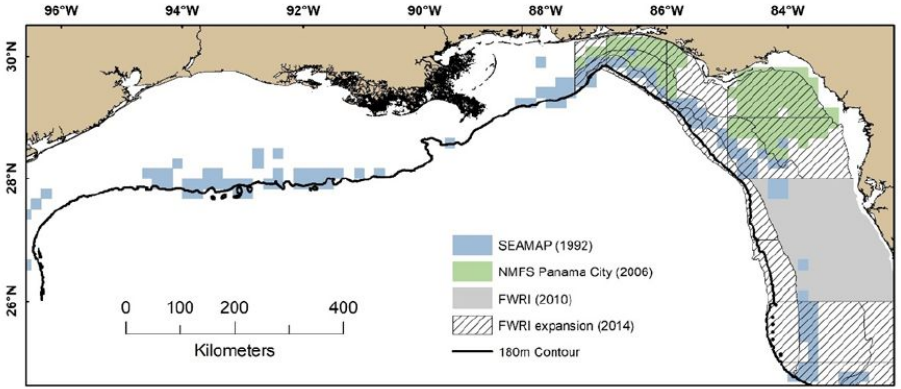
G-FISHER Index and Comp. Exploration

- Lack of large fish in FISHER comp is likely habitat sampling bias given the wide Western shelf compared to the narrow East and Central
- Older larger RS make the ontogenetic shift from reefs to mud/uncharacterized bottom
- Use Great Red Snapper Count (GRSC) data to provide some evidence (only central and west since there was no UCB/ mud in East)

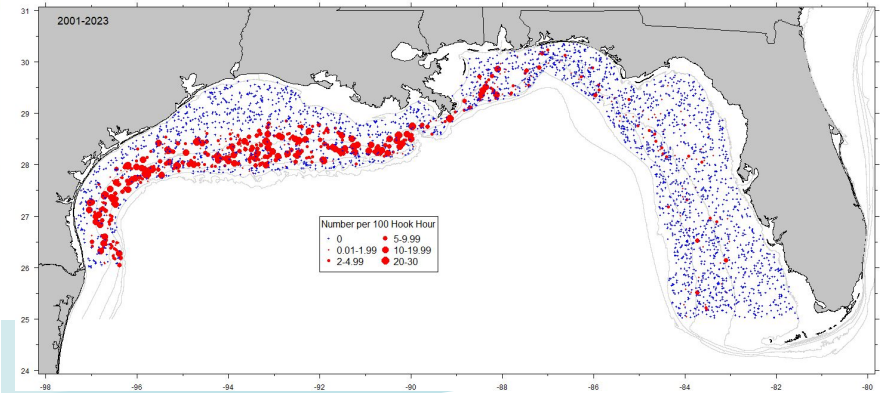


BLL has a wider distribution of ages

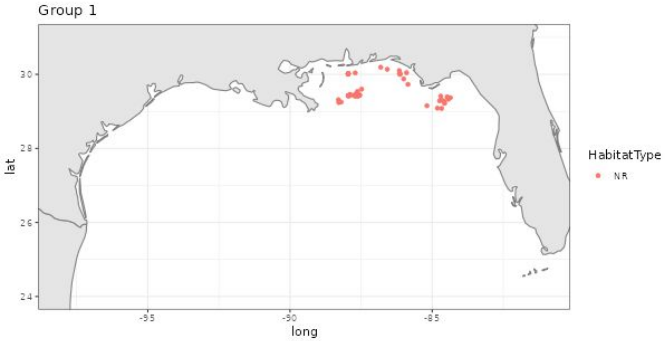
G-FISHER - samples are from natural reef

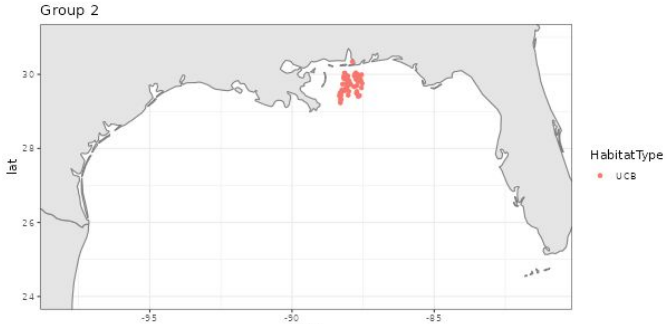


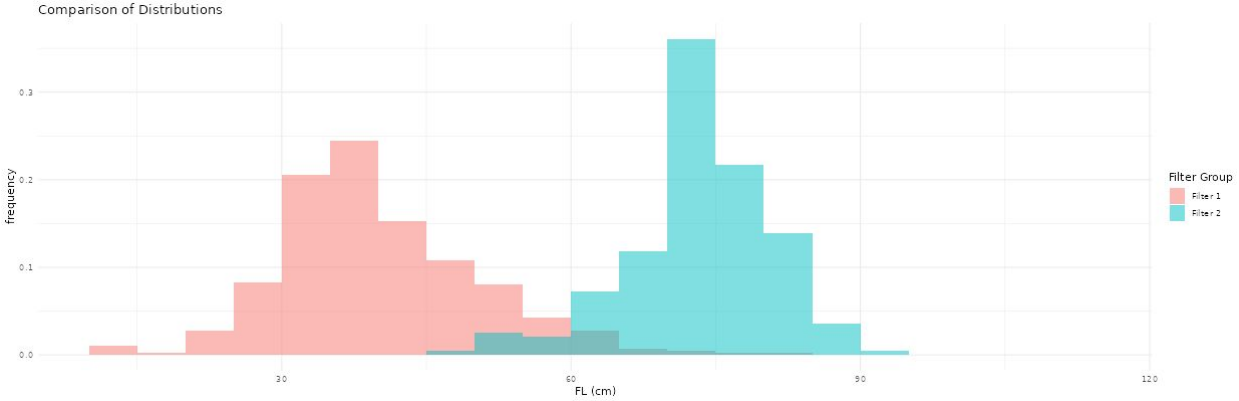
BLL - samples include mud/uncharacterized bottom



Central - GRSC Length Comps NR vs UCB



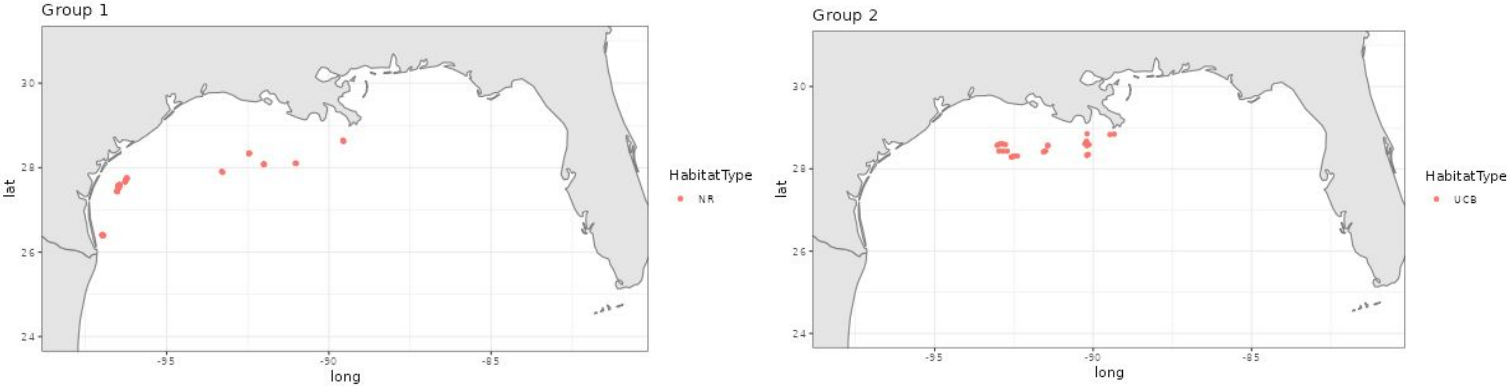


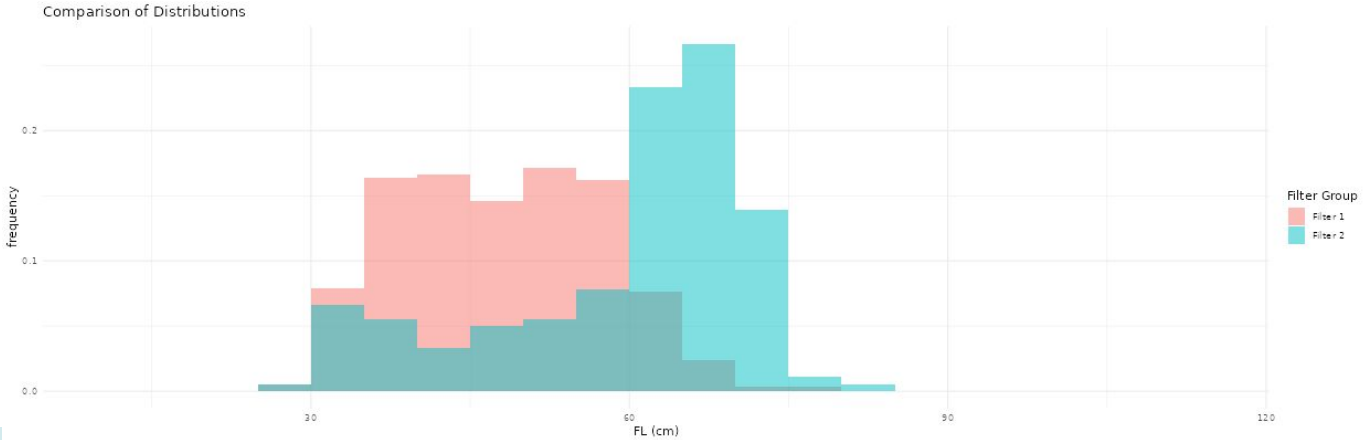


Compact shelf allows video to measure fish on both habitats, expanding the length distribution

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West - GRSC Length Comps NR vs UCB



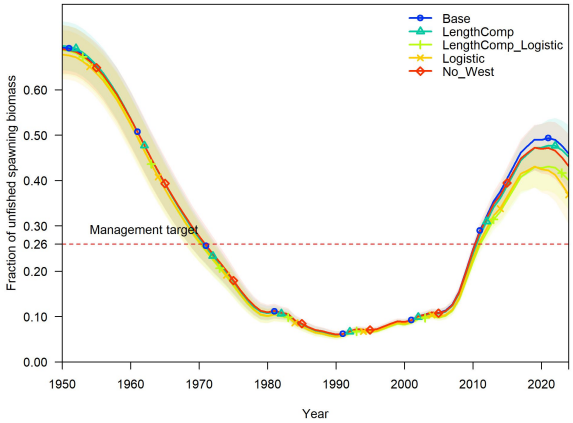


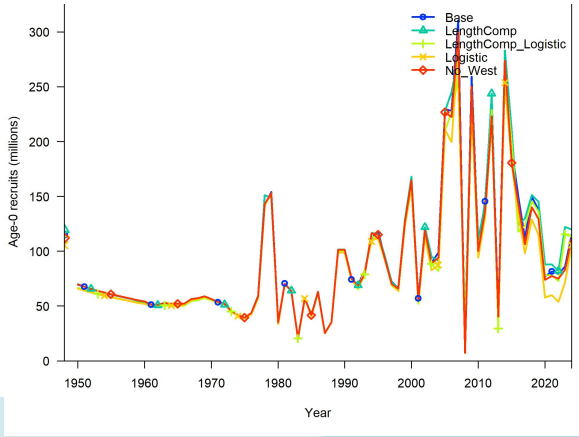
Extended shelf, possibly a greater distance between sampled NR and UCB where larger fish reside and are not caught on camera

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G-FISHER Index and Composition

- Switching from ALK converted age comp. to length comp has little to no impact on terminal ratio
- Switching selectivity form (i.e., Logistic and LengthComp_Logistic) further reduces terminal SB and recruitment but not enough to change stock status.

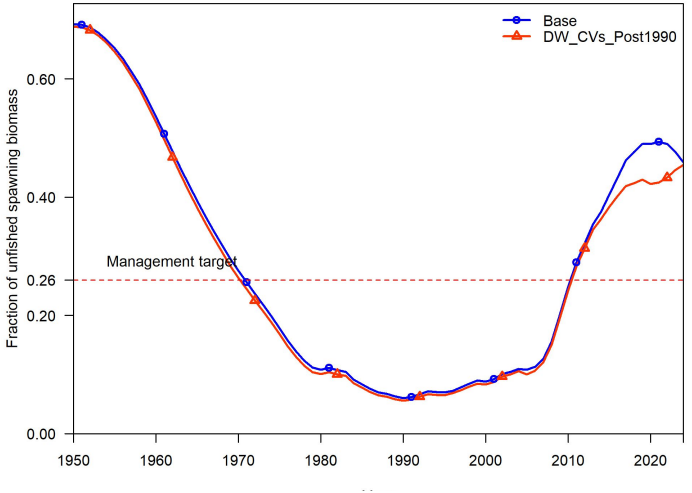


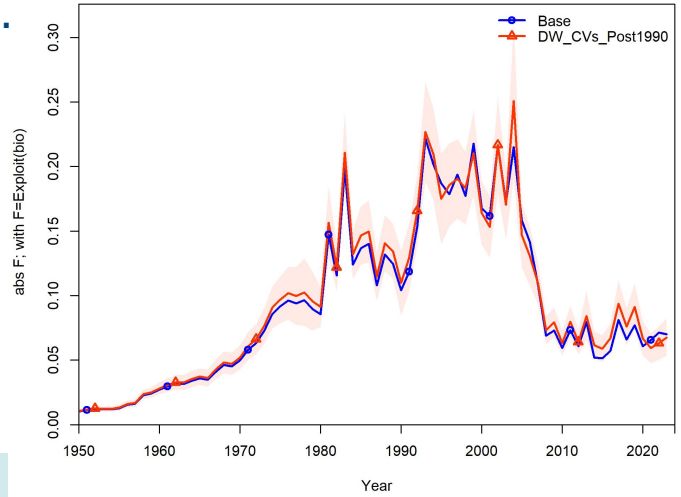


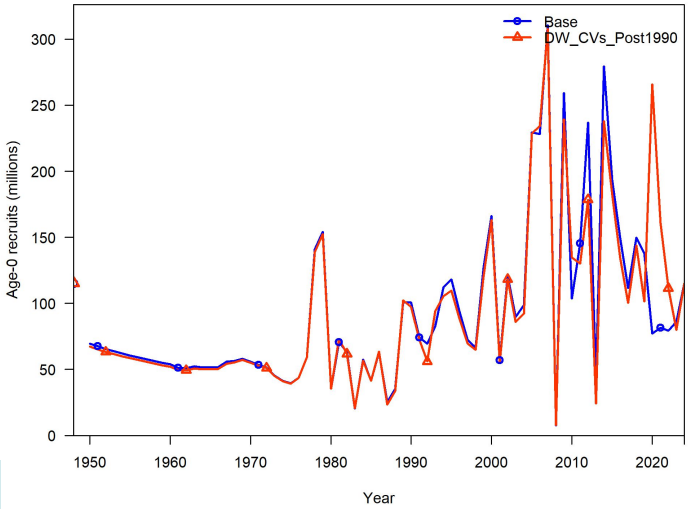
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Uncertainty in Landings

- Using DW provided uncertainty values as high as 0.6 and 0.25 for commercial and recreational fleets would not allow the model to converge.
- Keeping CVs tight early on and using DW provided CVs from 1990's on allowed the model to converge with no differences in the initial or terminal Bratio.

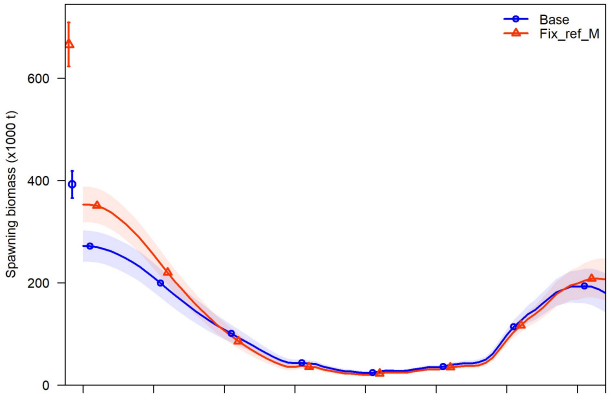


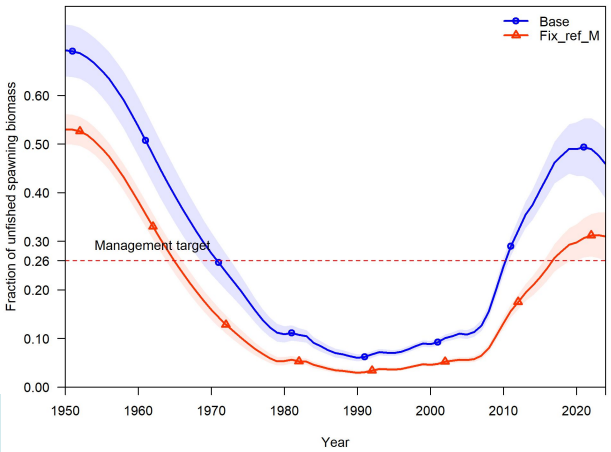


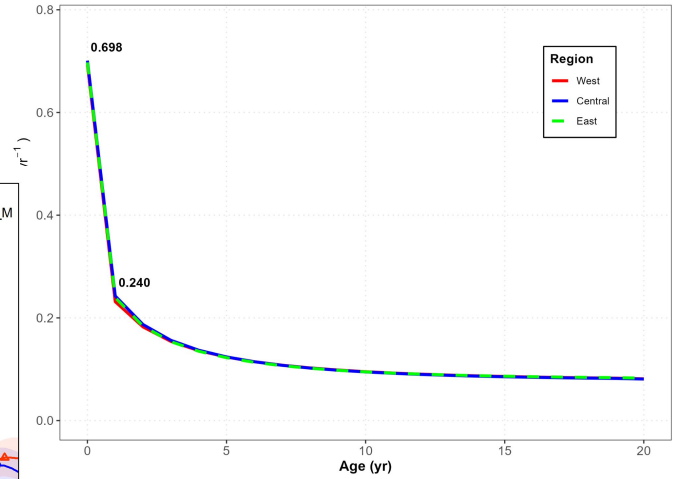


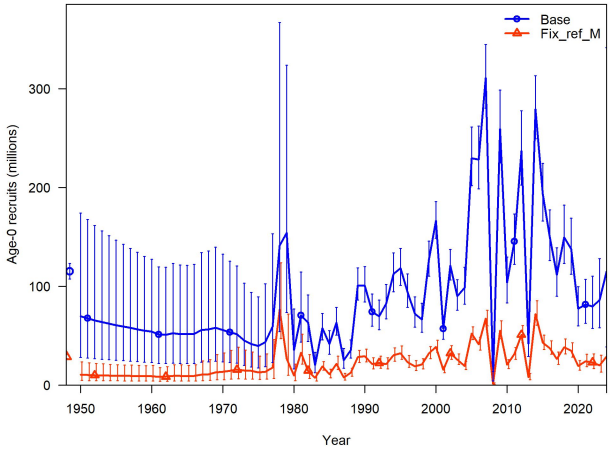
Natural Mortality age 0 and 1

- The model cannot estimate a target M
- When you allow the model to internally scale the age 0 and 1 mortality they are high but not 2 and 1.2
- The assumed productivity of the stock changes to match the removals



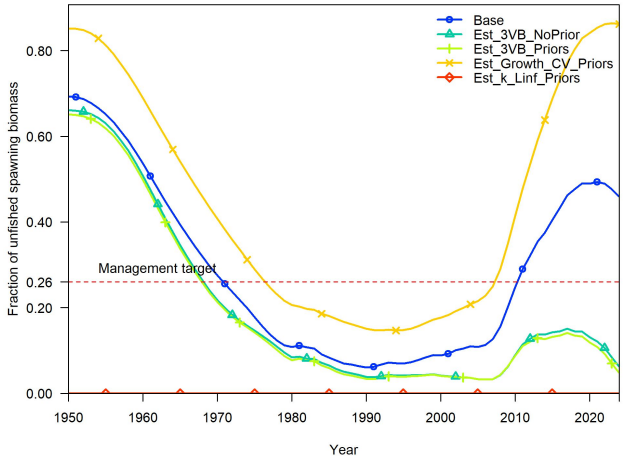


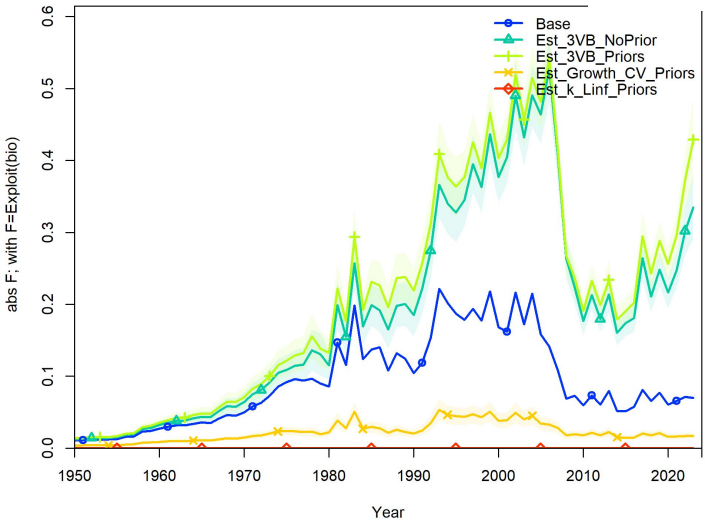




Estimating Growth Parameters

- When attempting to estimate growth the model estimates a range of values drastically changing the trajectory of the stock

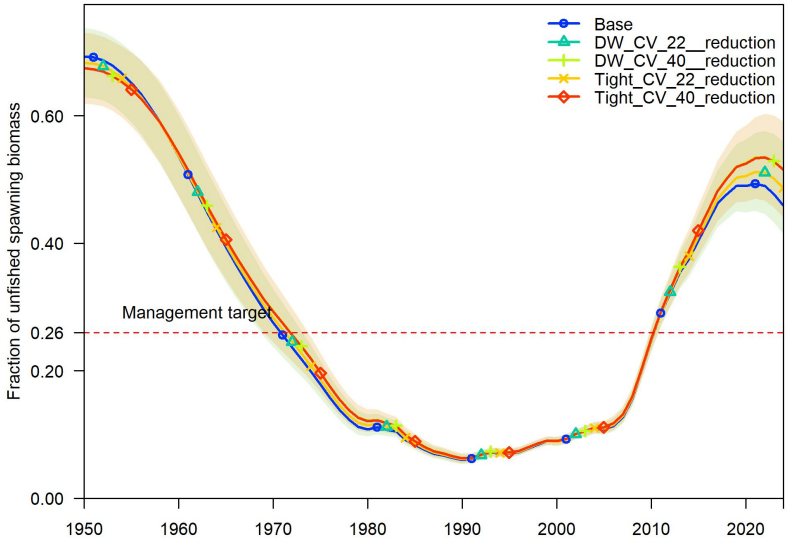


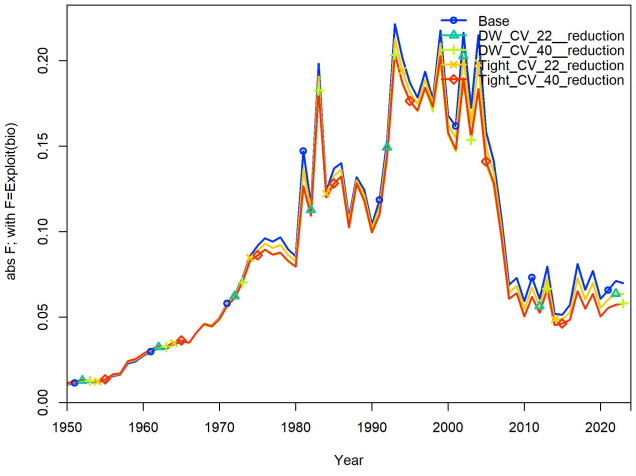


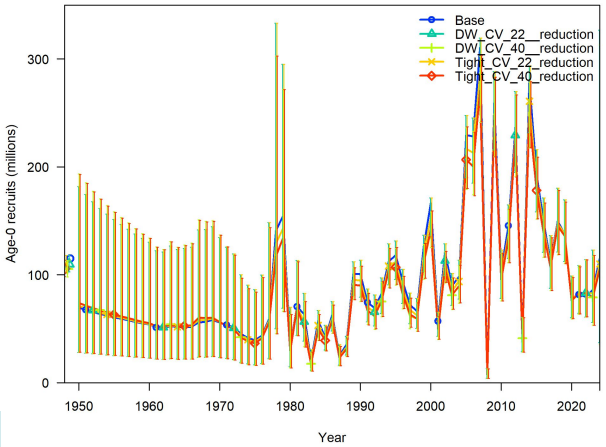
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MRIP- FES adjustment

- The 20% -40% reduction in private landings does not significantly impact stock status as all runs are within the same confidence band
- Not much movement in recruitment; slight movement in Fs



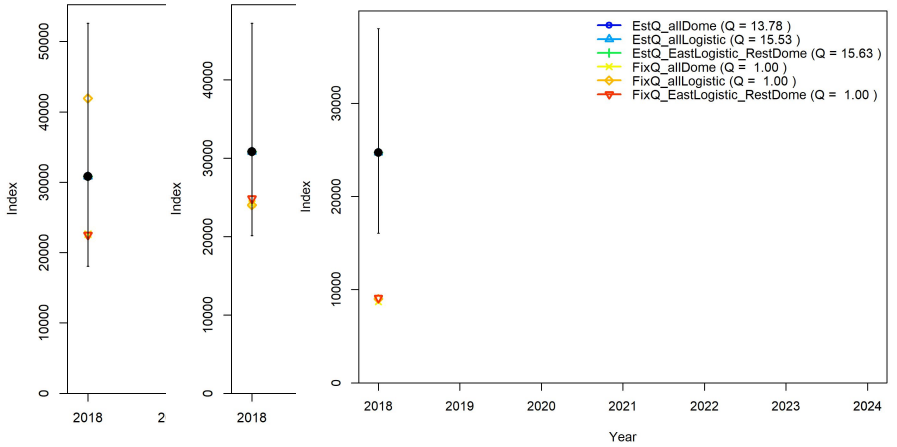


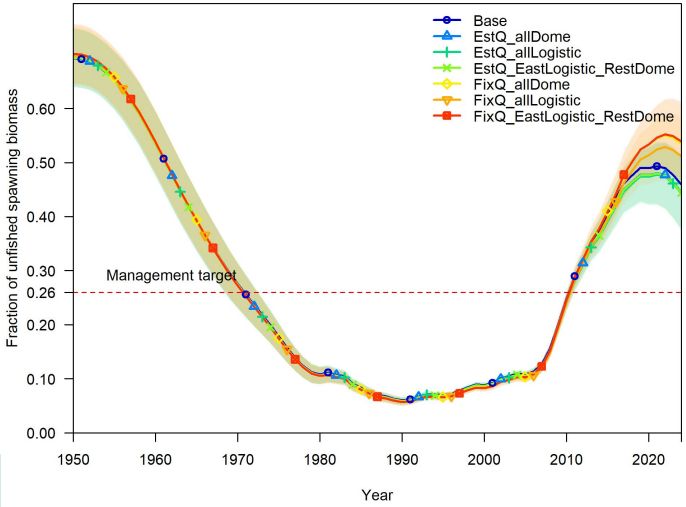


GRSC - Composition Update

West Central East

- SEDAR 74 showed that if we do not have a calculated catchability the model will ignore the GRSC data (Estimated Q runs are behind the observed data). We never received the calculated Q.



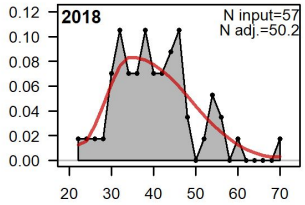


- Having a year of composition data or a change in selectivity assumptions does not impact model estimates the bigger issue is having the correct Q.

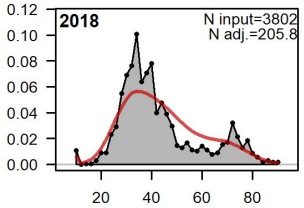
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GRSC - Composition Update

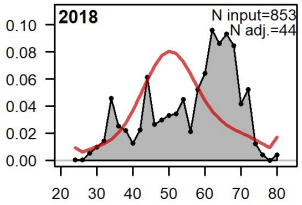
Run: Estimate Q & All areas dome shaped selectivity



West

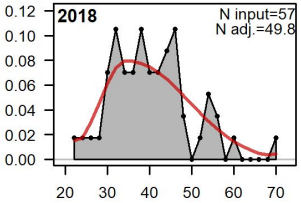


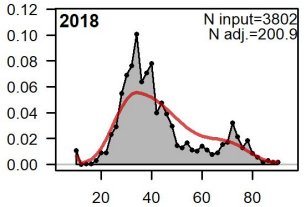
Central

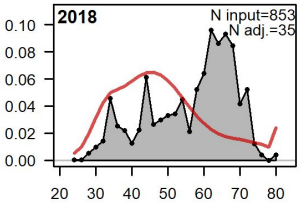


East

Run: Fixed Q & All areas dome shaped selectivity





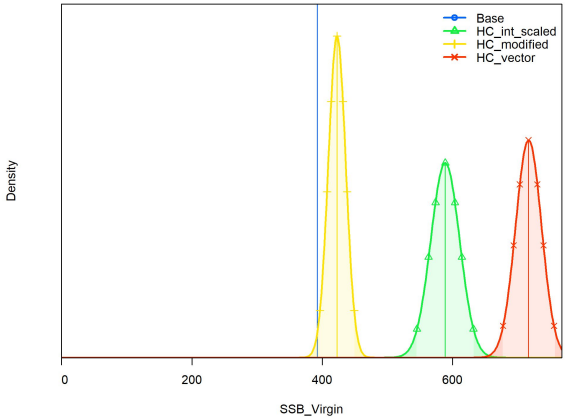


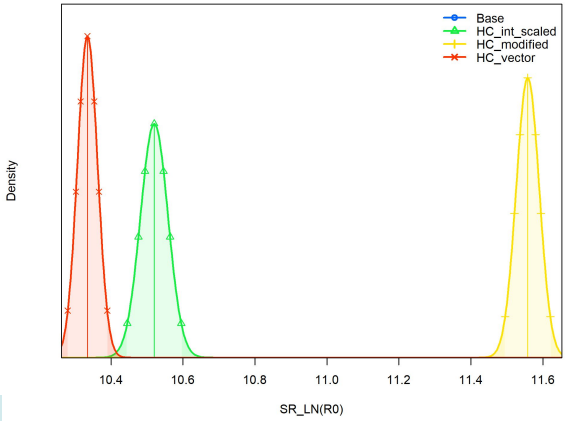
Any signal from GRSC is overshadowed by the numerous other data sources with longer time series

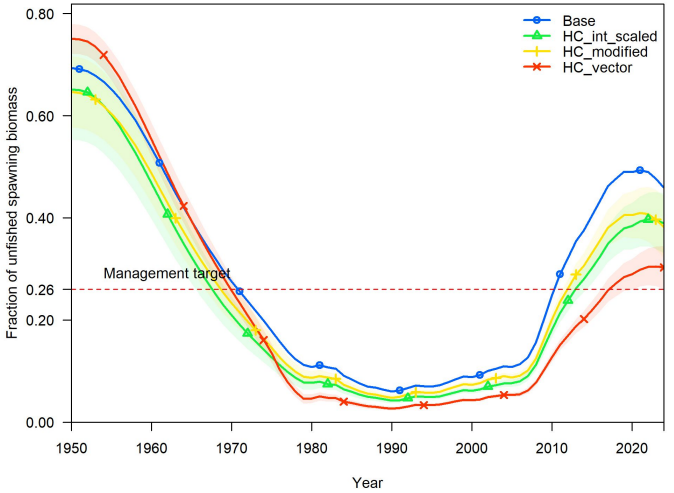
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Hamel and Cope - Natural Mortality

- Hamel and Cope M result in lower estimates of R0 andhifher estimates of viring stock biomass
- Stock status is not significantly impacted.







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Questions and Comments

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