Pacific Ocean Perch 2017 Assessment

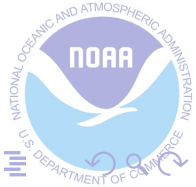
Modeling and Results

Chantel Wetzel[1]
Lee Cronin-Fine[2]

Northwest Fisheries Science Center[1]
University of Washington[2]

STAR Panel

June 26-30, 2017



Outline

Model Specifications

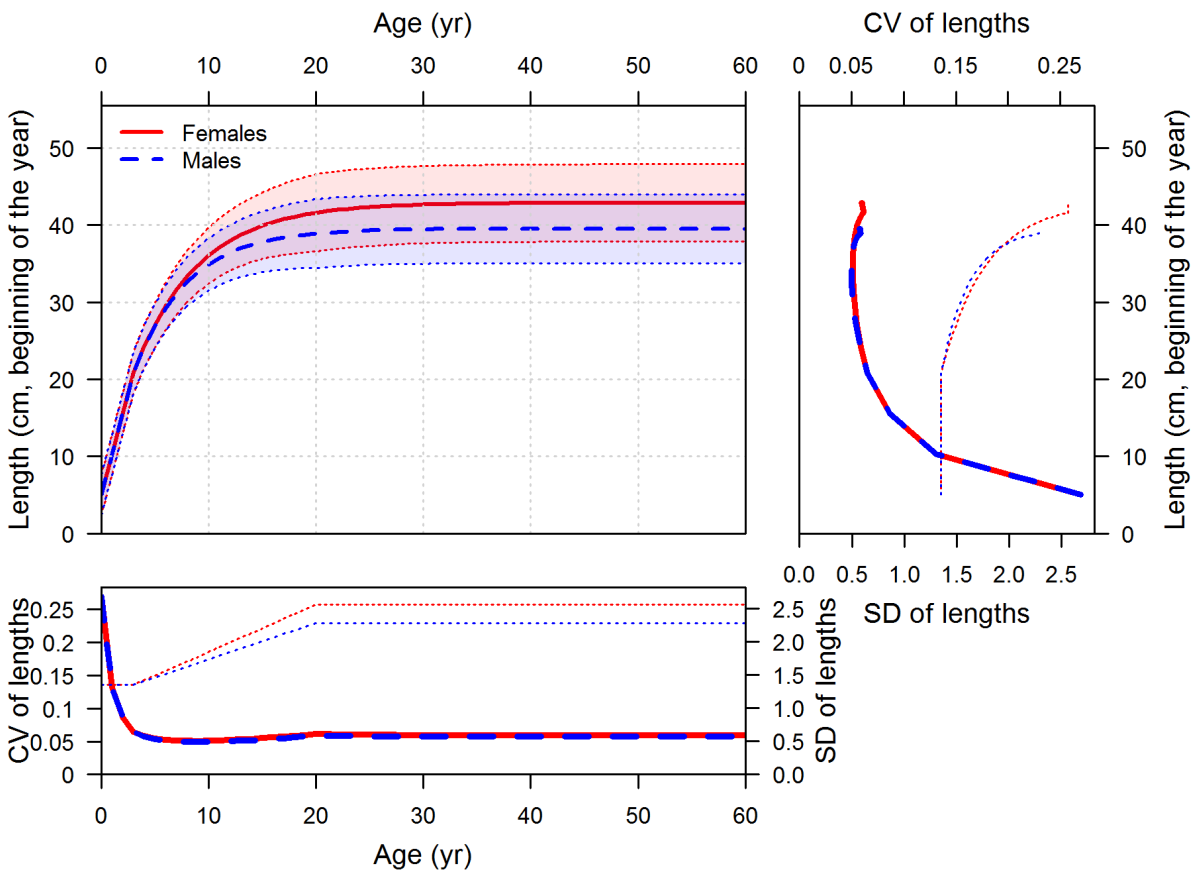
- Stock Synthesis version 3.30.03.05
- Model starts in 1918, first year landings exceeded 1 metric ton
- Steepness fixed at 0.50
- Natural mortality fixed at 0.054 for females and males
- Recruitment deviations start in 1900
- Population age plus-group = 60 years (Data age plus-group = 40)
- Length data bins from 11-47 cm by 1 cm intervals

Growth Parameters

Parameter	Females	Males	Estimated
Natural mortality	0.054	0.054	N
Length-at-age min ($L1$)	20.8	20.8	Y-females
Length-at-age max ($L2$)	41.6	38.9	Y
Growth coefficient (k)	0.167	0.199	Y
SD young	1.35	1.35	Y-females
SD old	2.56	2.28	Y
Weight-at-length (alpha)	1.044E-5	1.05E-5	N
Weight-at-length (beta)	3.088	3.083	N

* Male parameters estimated as offsets from female parameters.

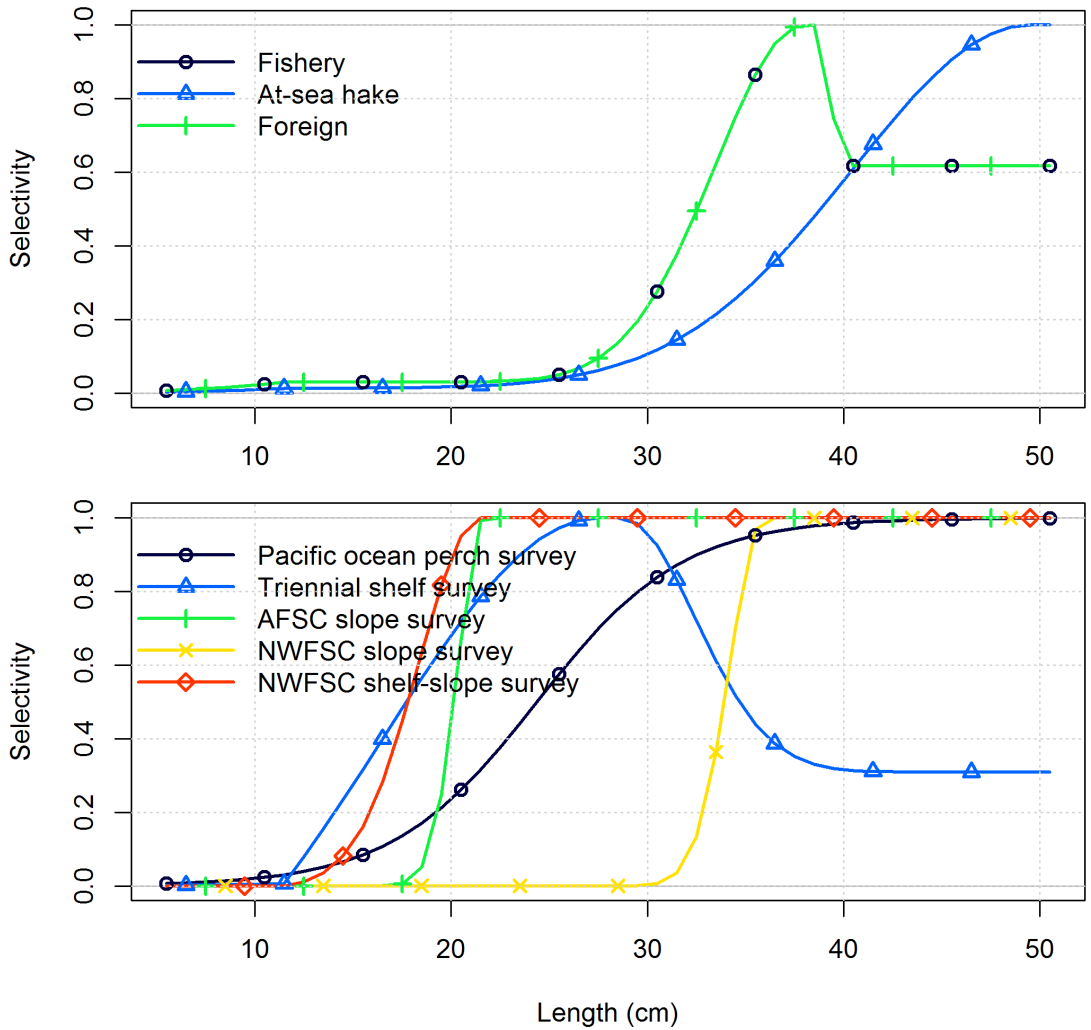
Estimated Length-at-Age



Fleet structure, Retention, and Selectivity

- Fishery fleet - includes bottom, mid-water trawls, and fixed gears
  - Estimated retention, double-normal selectivity, asymptotic retention
- At-sea hake fishery
  - Double-normal selectivity
- Foreign fleet
  - Double-normal selectivity - mirrored to the fishery fleet
- Pacific ocean perch survey
  - Logistic selectivity
- Triennial shelf survey
  - Double normal selectivity
- AFSC slope survey
  - Double normal selectivity
- NWFSC slope survey
  - Double normal selectivity
- NWFSC shelf-slope survey
  - Double normal selectivity

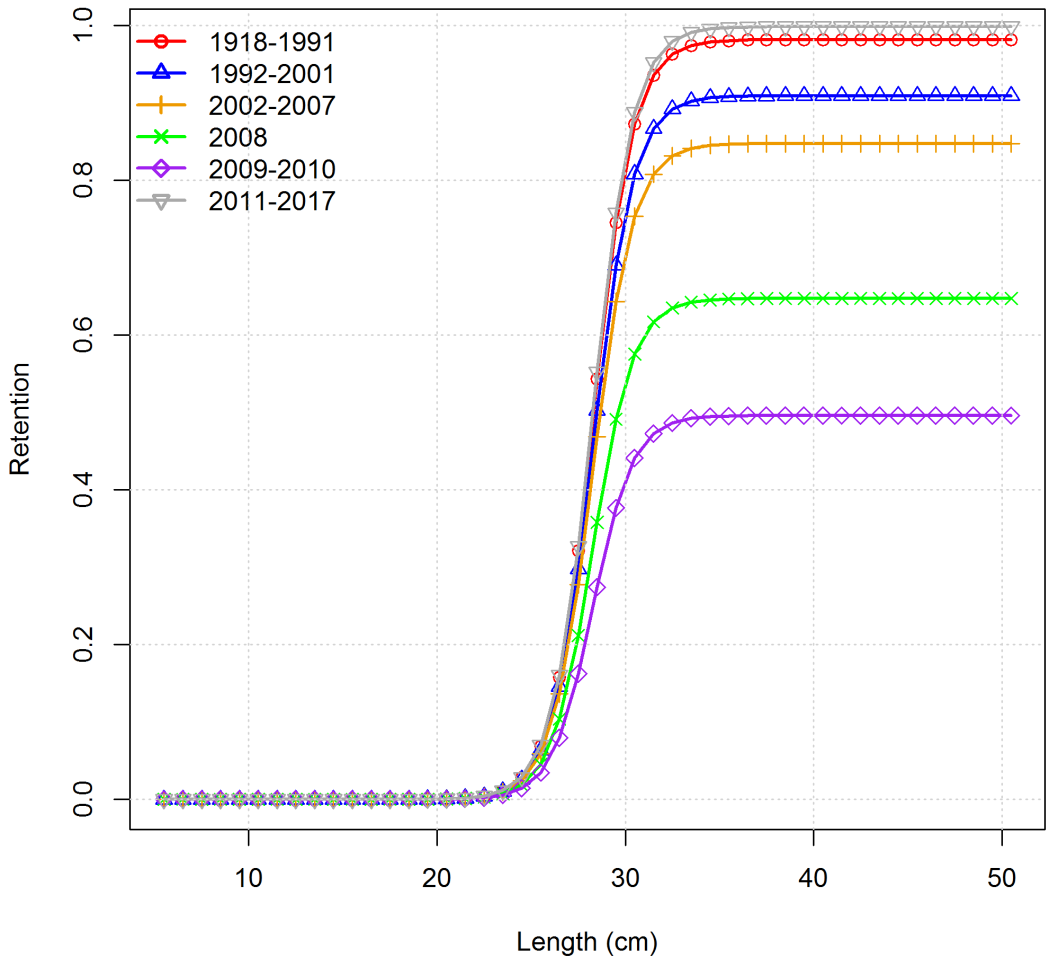
Selectivity



Fishery Retention

Sensitivities to 1992 discard rate

- Low - Removed block
  - $< 0.5\%$ increase in 2017 stock status
- High - Assumed average discard based on 2003-2007
  - $< 0.5\%$ decrease in 2017 stock status



Base Model Data Weights

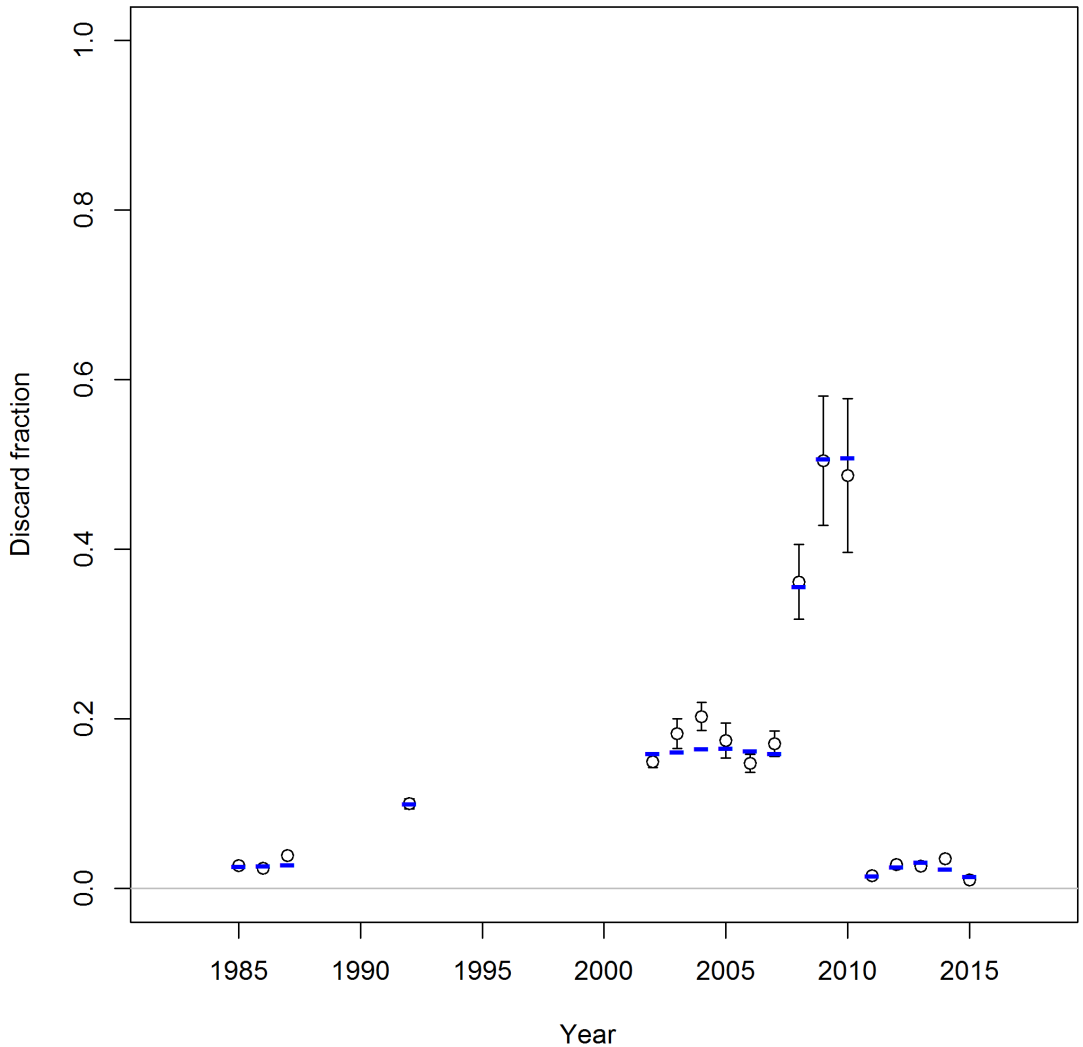
- Base model weighted according to Francis weighting approach

Fleet	Data	Weight	Data	Weight
Fishery	Length	0.09	Age	0.22
At-sea hake	Length	0.09	Age	0.03
POP survey	Length	1.00*	Age	1.00*
Triennial	Length	0.02	Age	0.23
AFSC slope	Length	0.08	Age	-
NWFSC slope	Length	0.59	Age	0.32
NWFSC shelf-slope	Length	0.03	Age	0.41

* The Francis method suggested upweighting data from the Pacific ocean perch survey to values > 1.

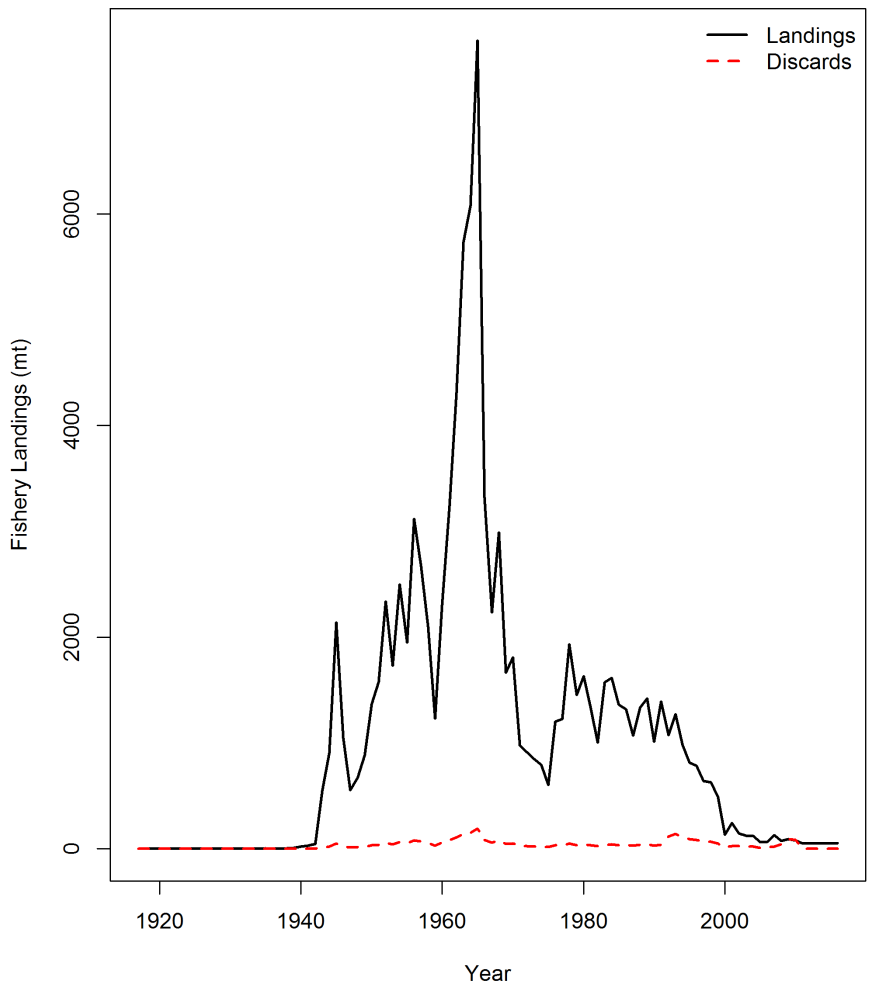
Outline

Fit to Discard Rates



Landings and Estimated Discards

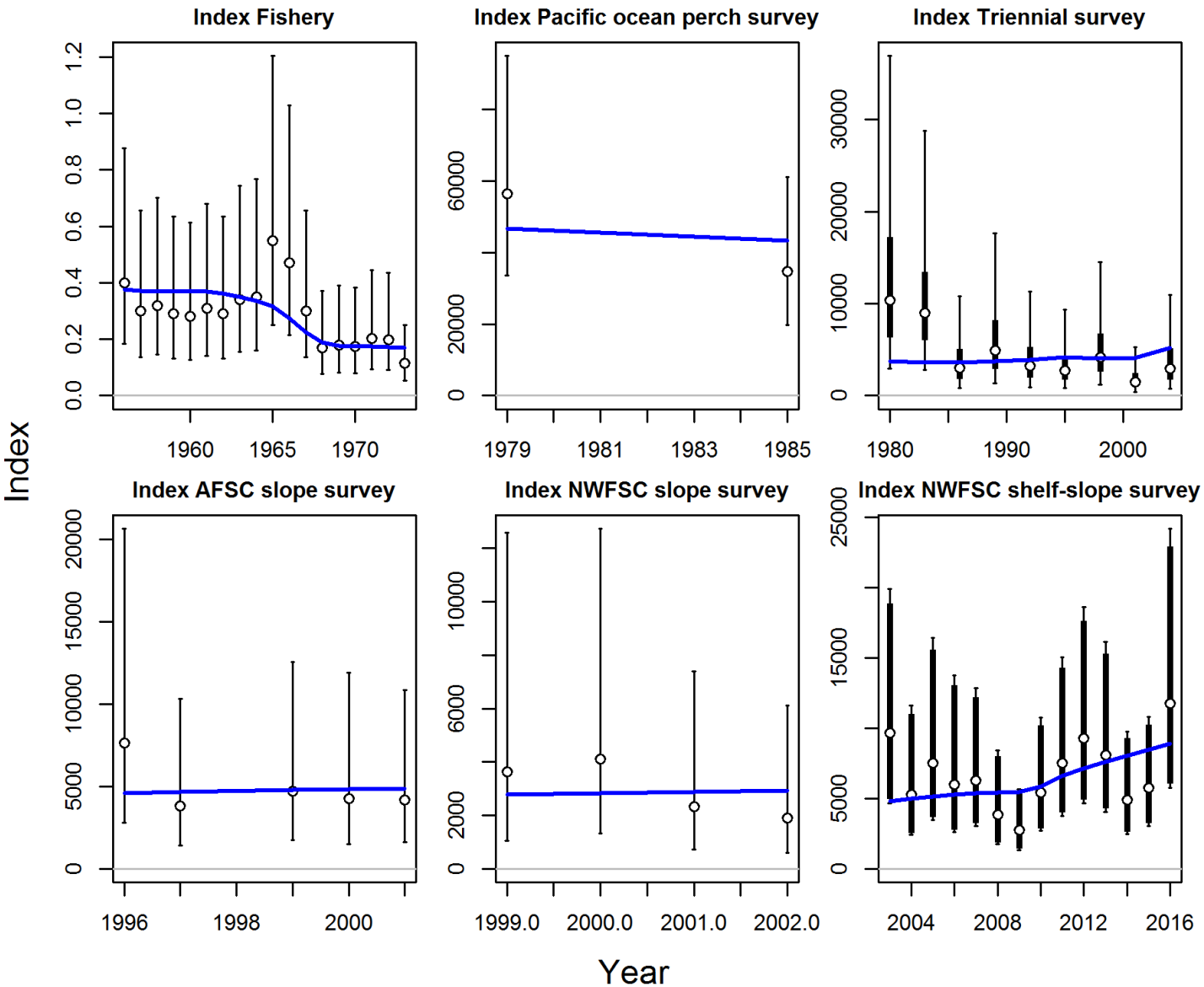
- Estimated discards contributes 3.3% of the total mortality across all years from the fishery.



Added Standard Error for Indices

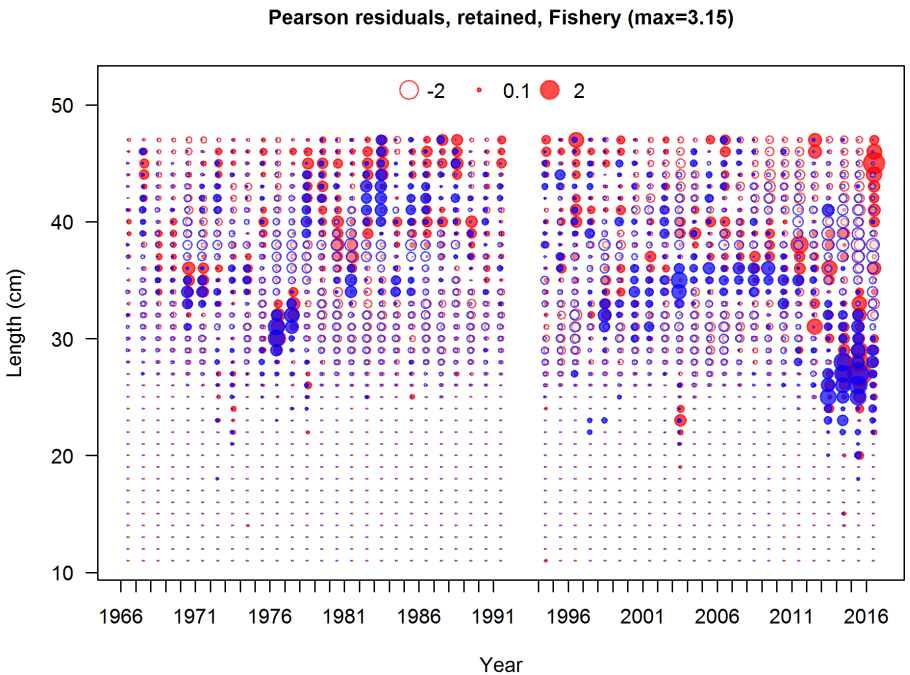
- Additional variance was explored for each index of abundance and the CPUE time-series.
- Only the Triennial shelf and the NWFSC shelf-slope indices required added variance to allow for model fitting.
  - Triennial shelf = 0.390
  - NWFSC shelf-slope = 0.027

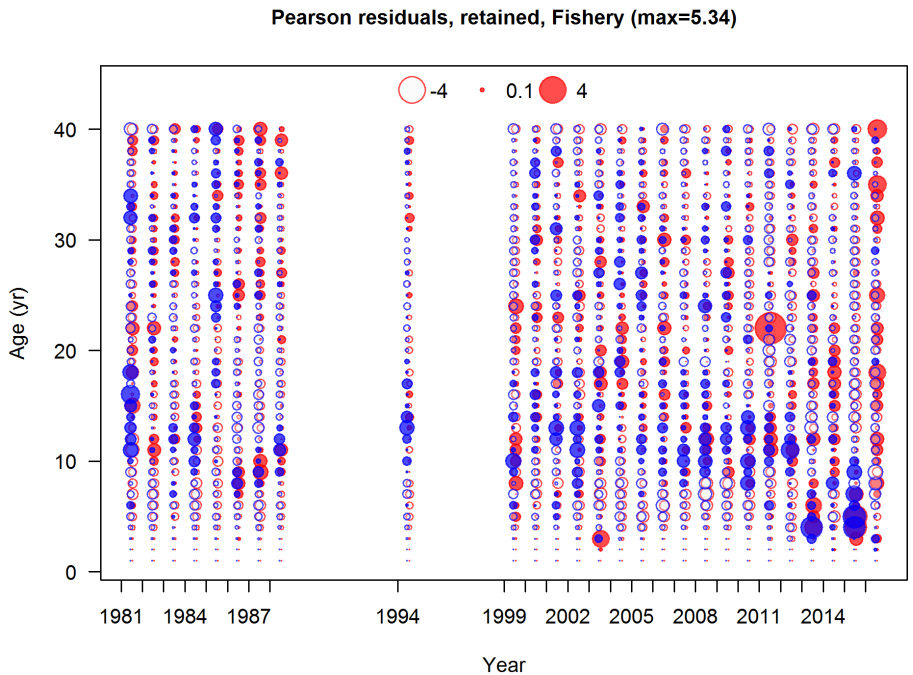
Fit to the Indices



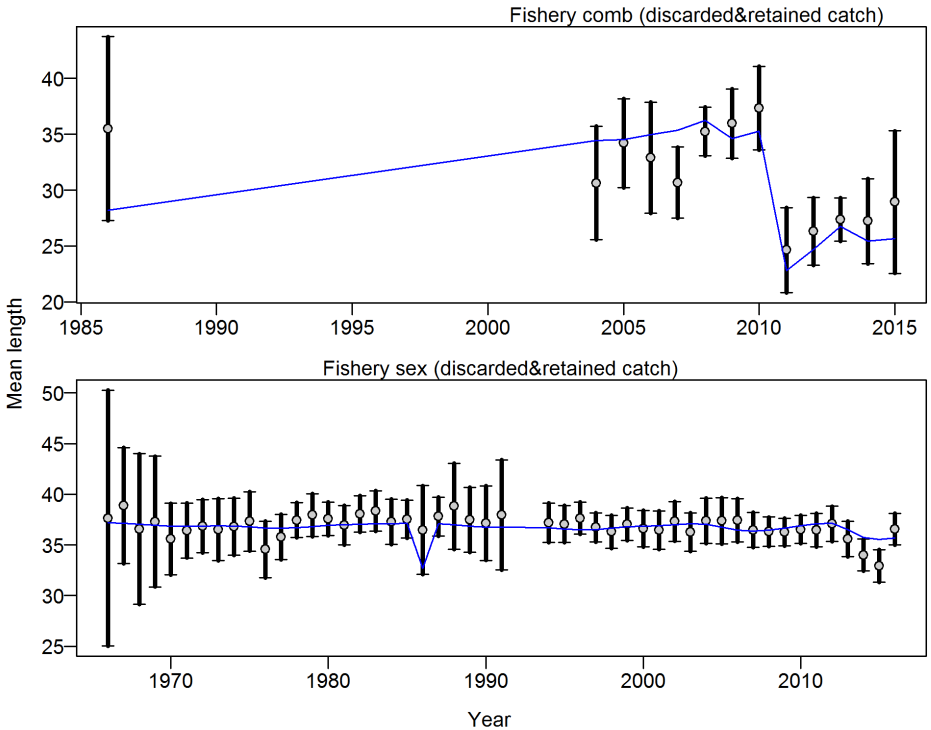
Fishery: Length and Age Composition

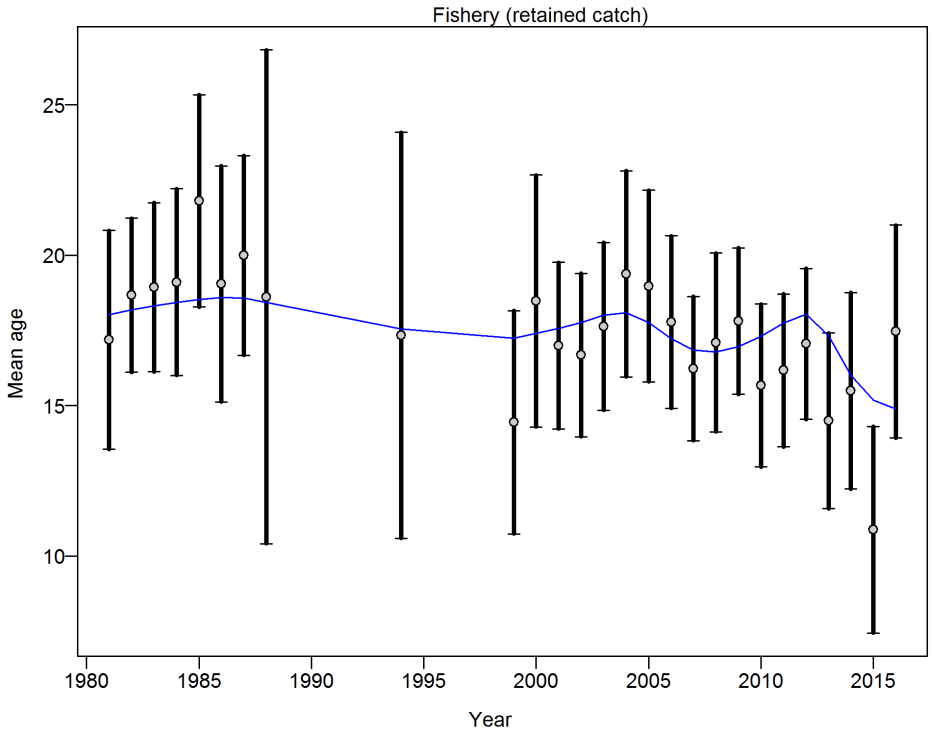
Fishery: Length and Age Composition



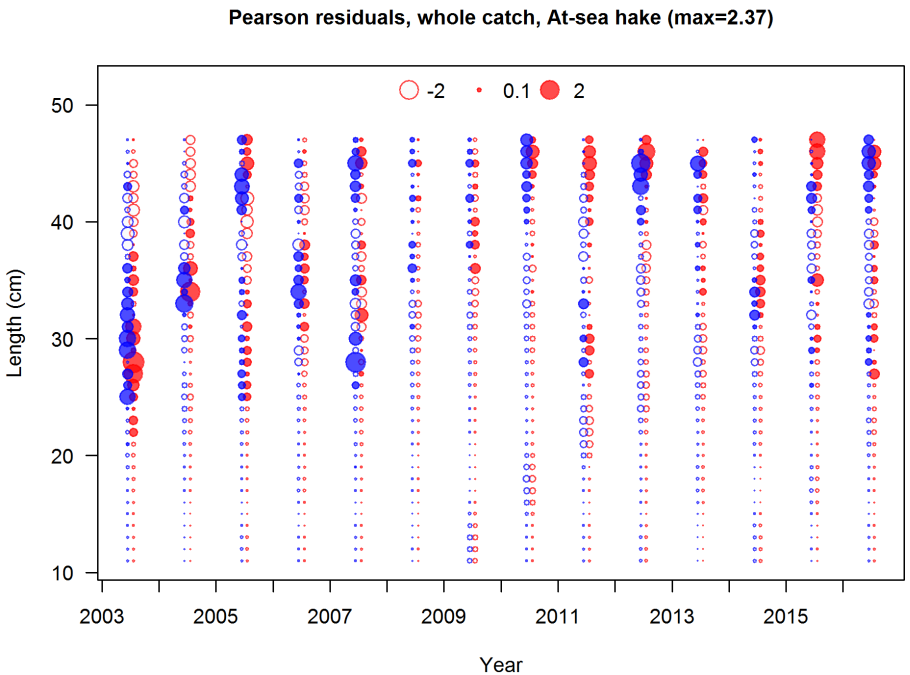


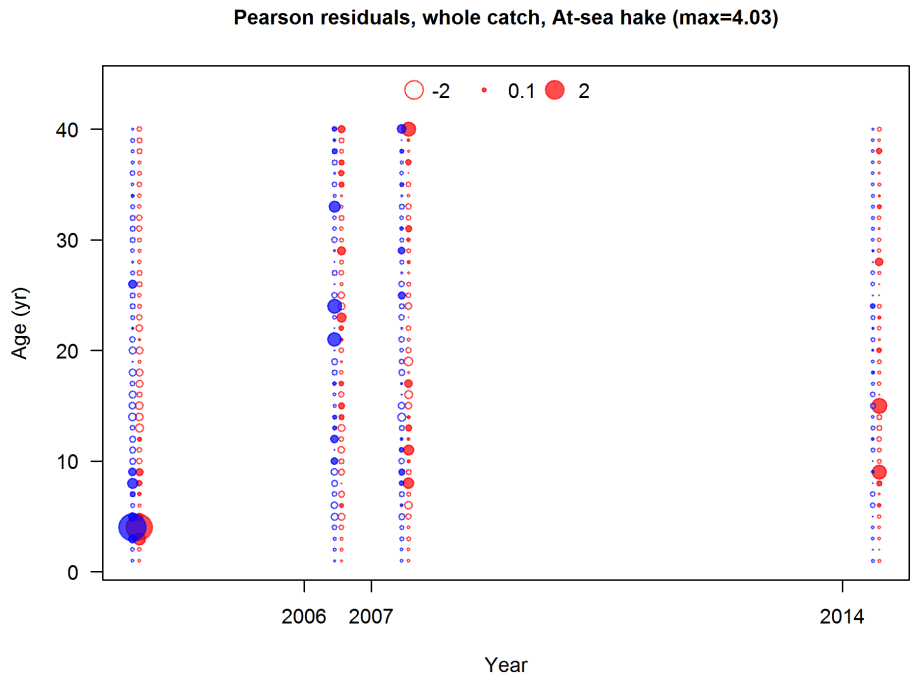
Fishery: Mean Length and Age



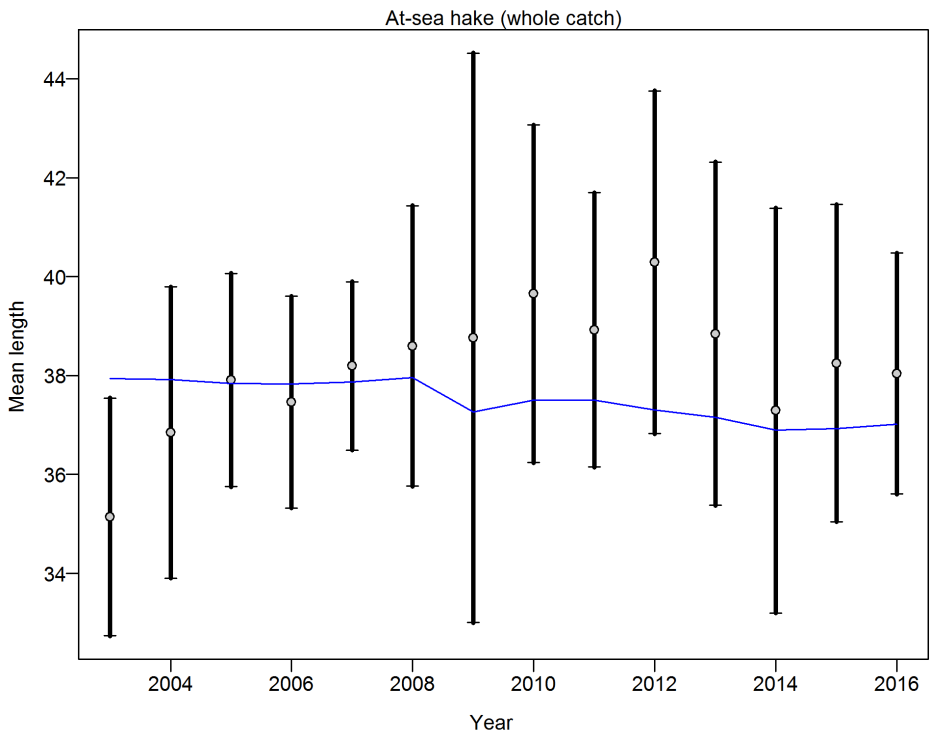


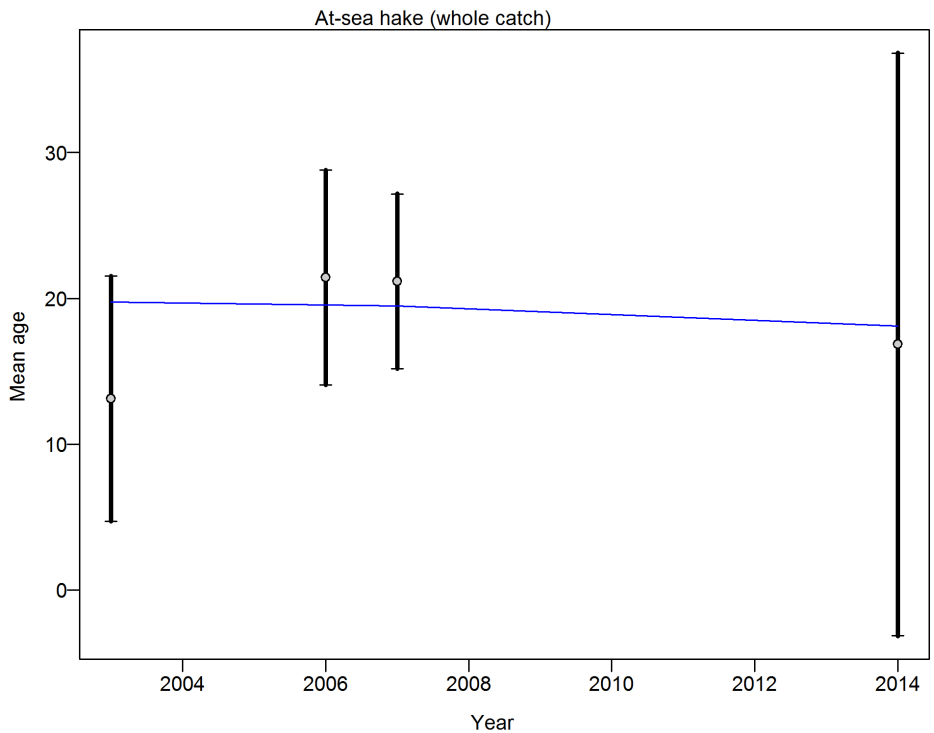
At-sea hake: Length and Age Composition



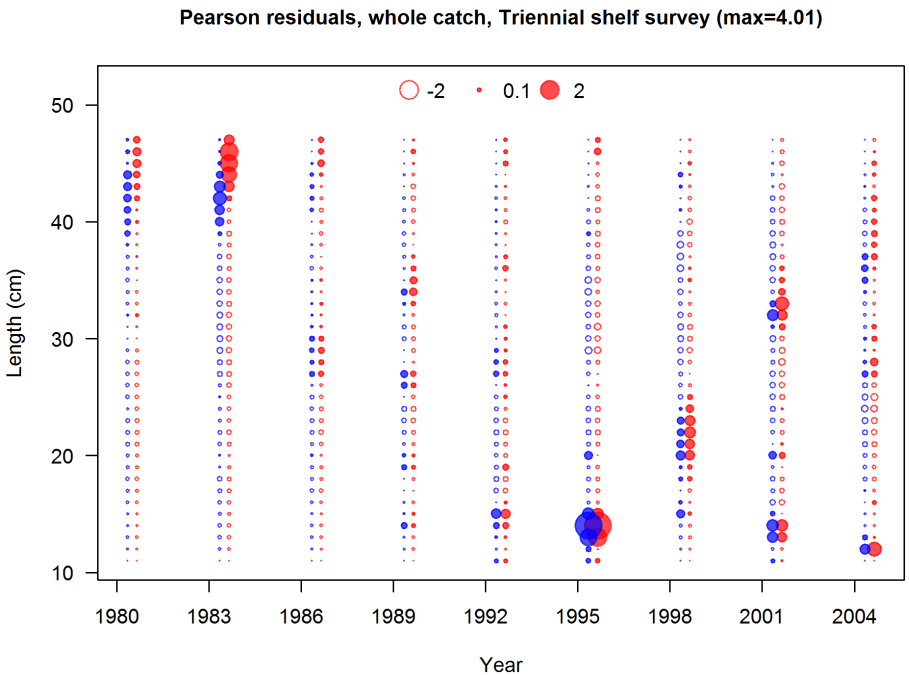


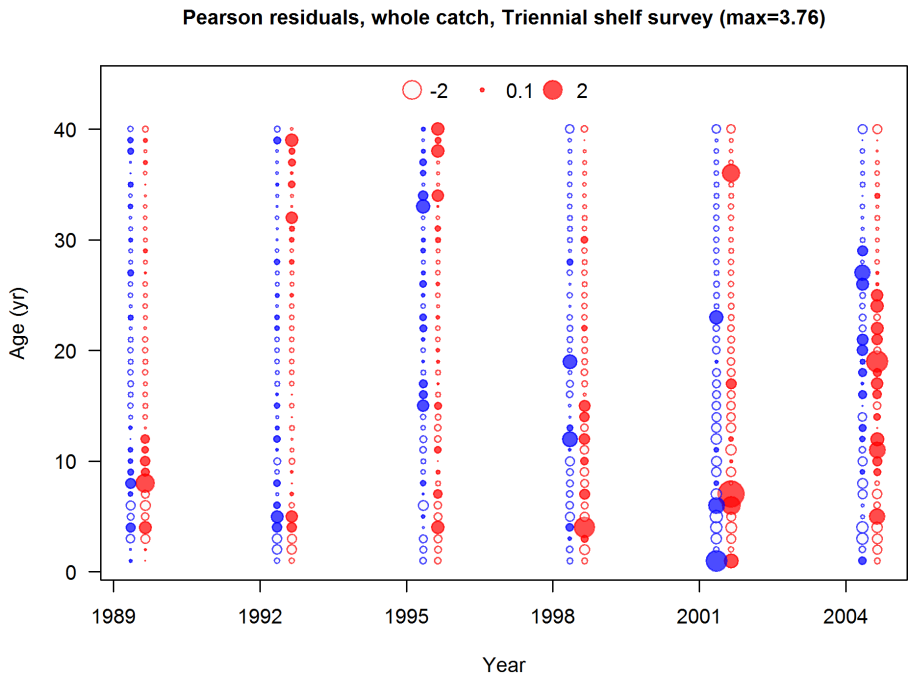
At-sea hake: Mean Length and Age



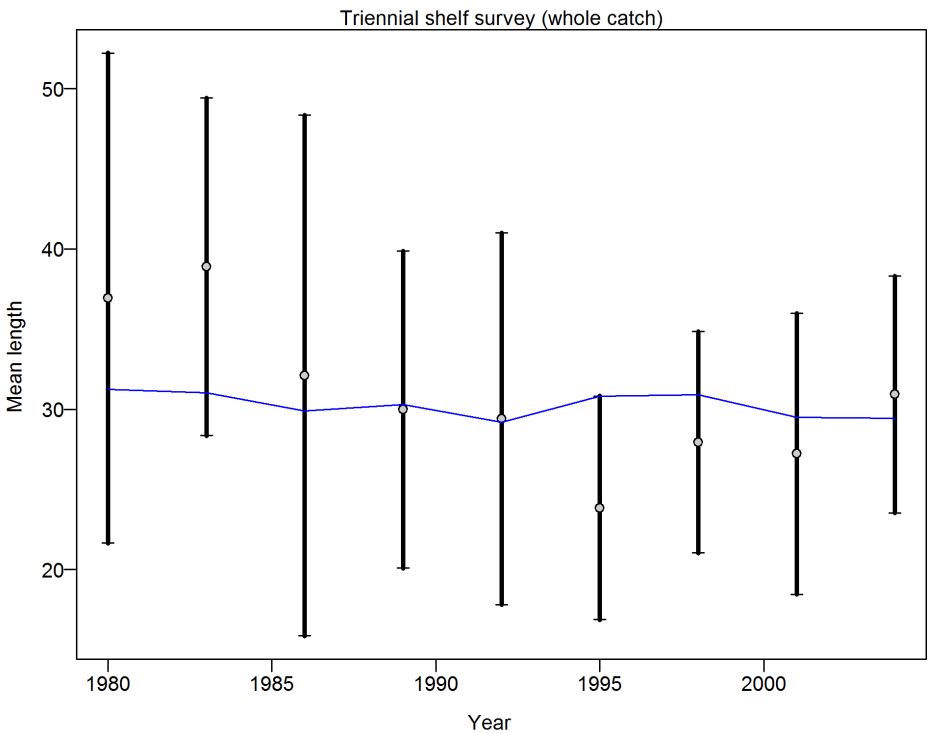


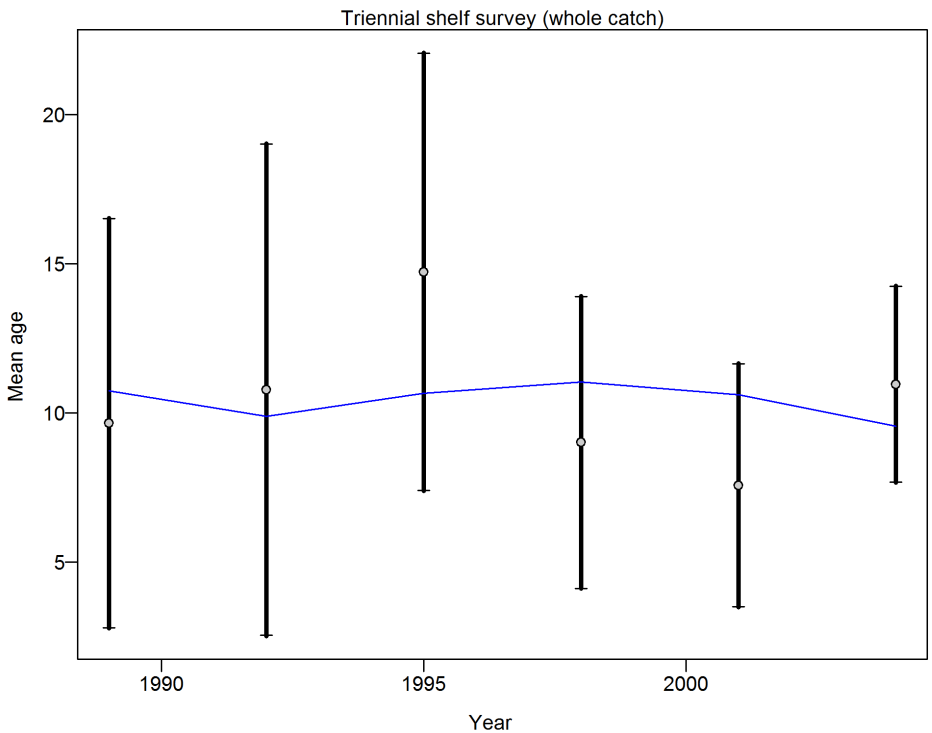
Triennial shelf survey: Length and Age Composition



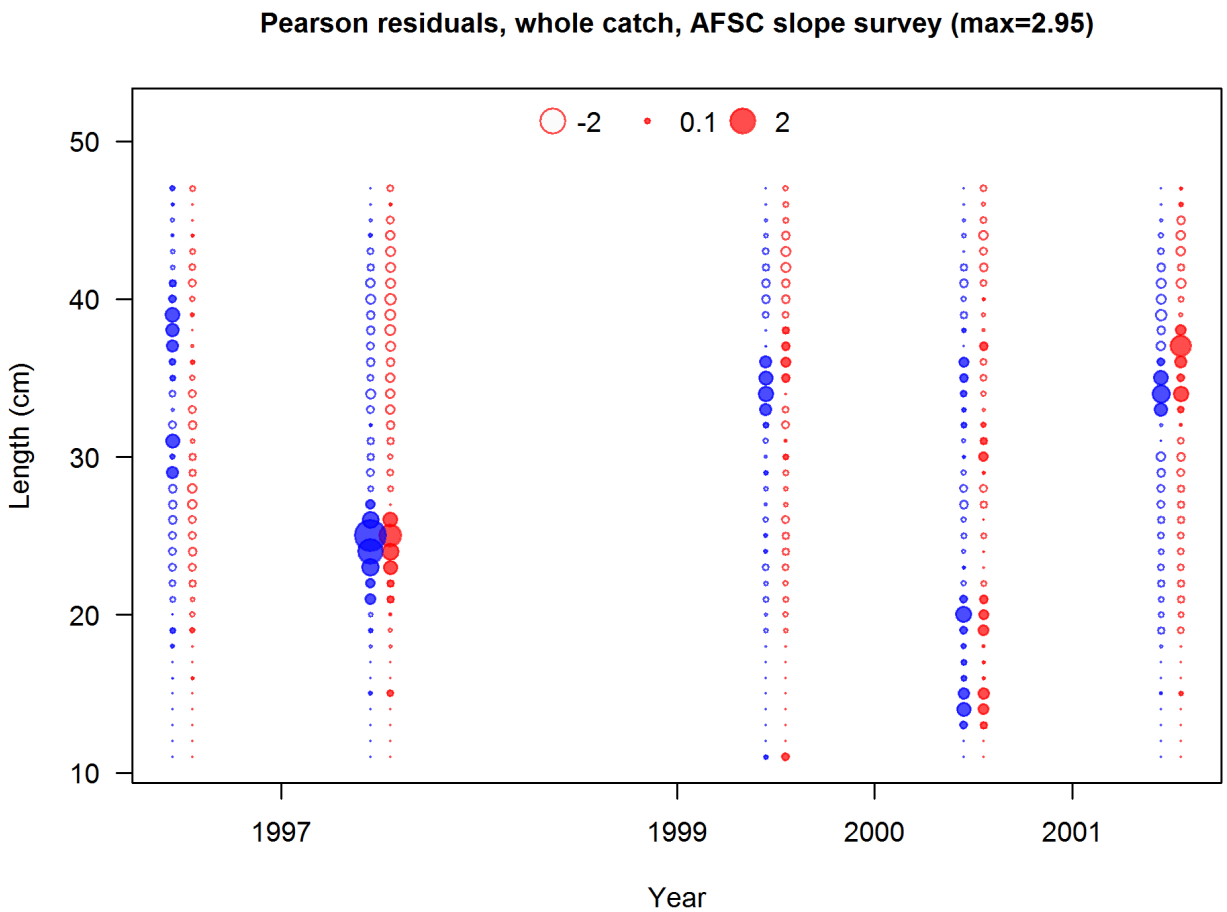


Triennial shelf survey: Mean Length and Age

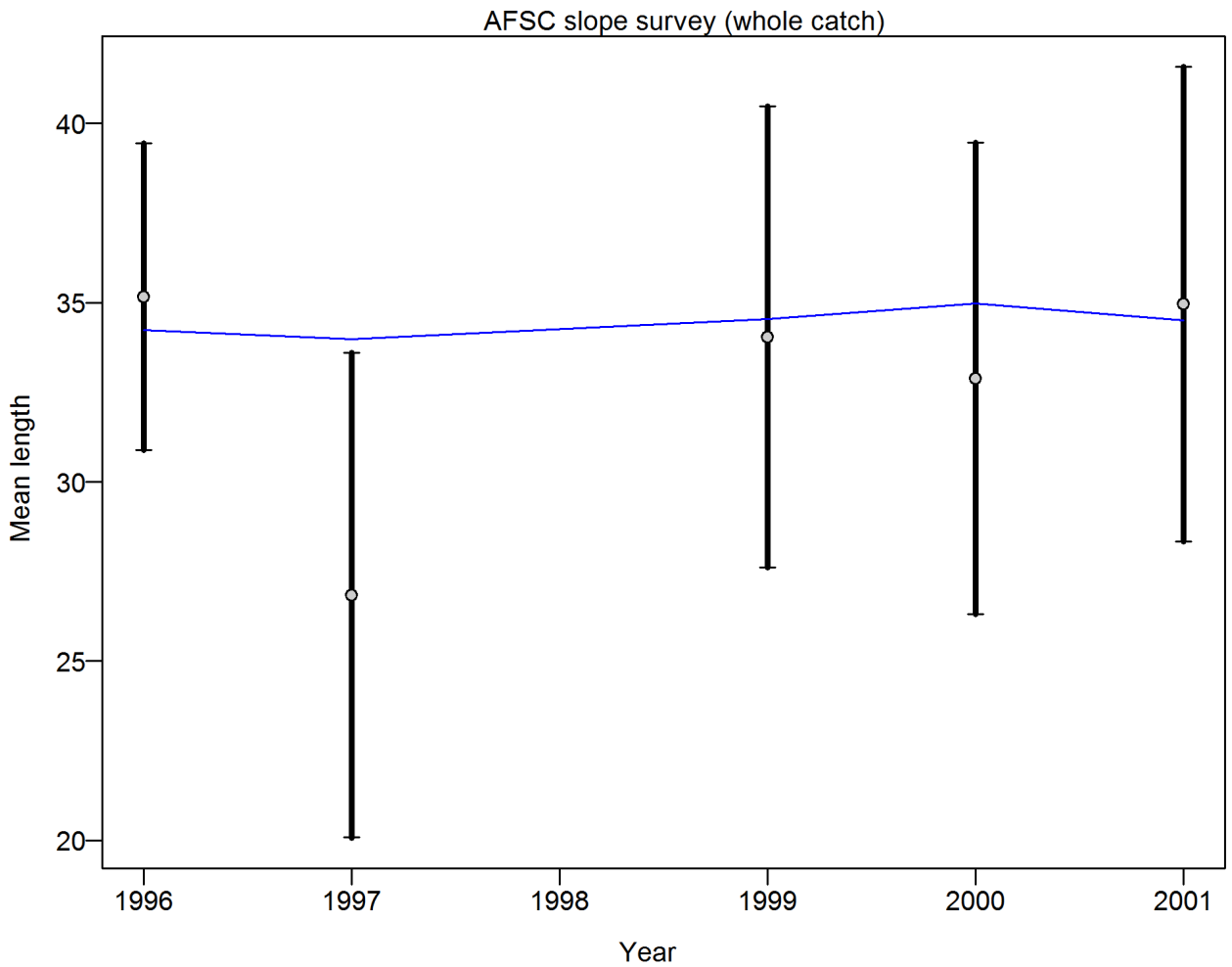




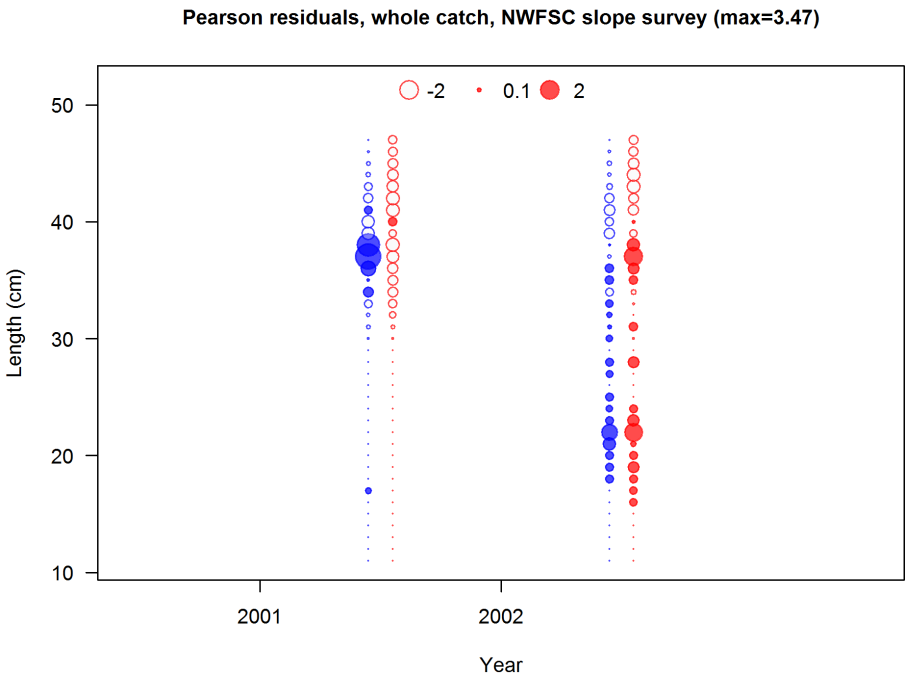
AFSC slope survey: Length Composition

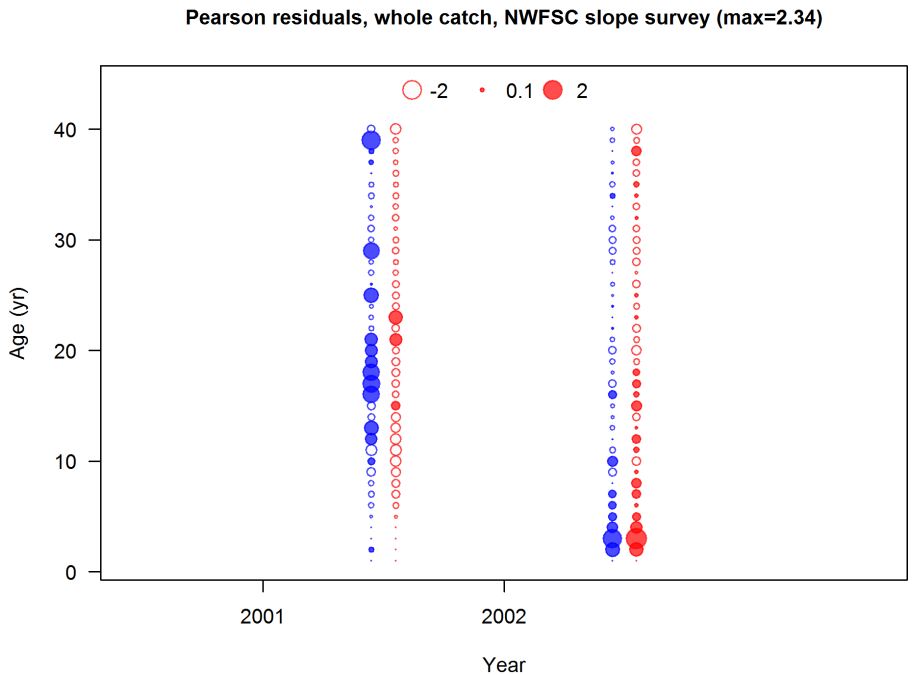


AFSC slope survey: Mean Length and Age

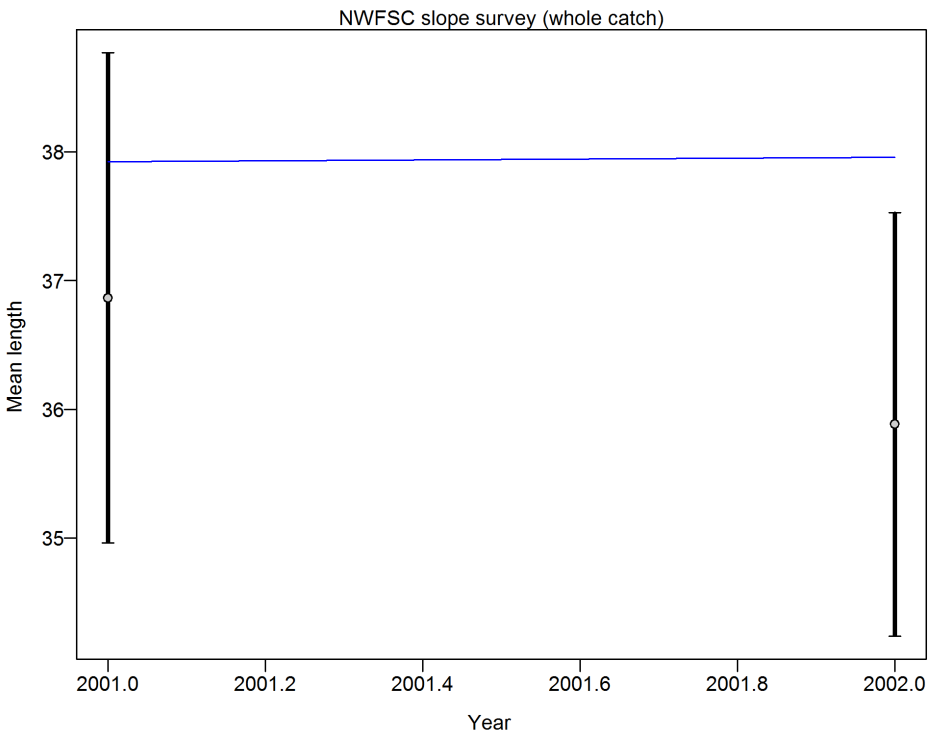


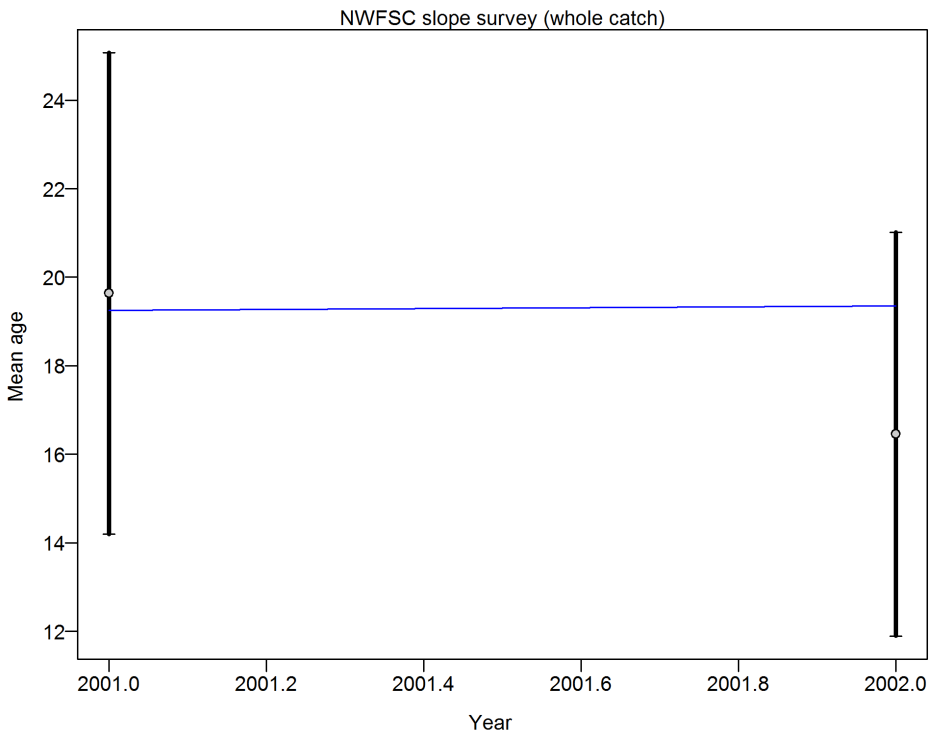
NWFSC slope survey: Length and Age Composition



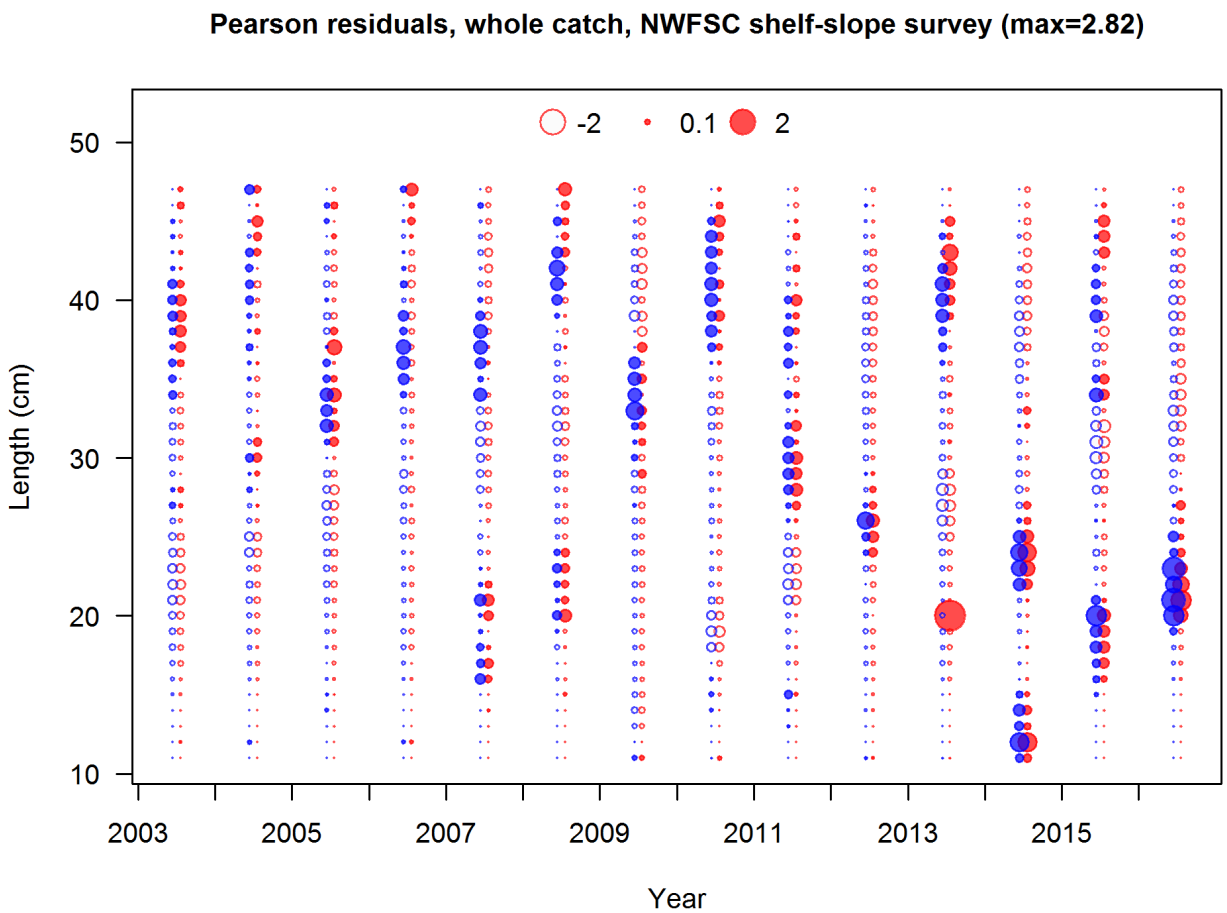


NWFSC slope survey: Mean Length and Age

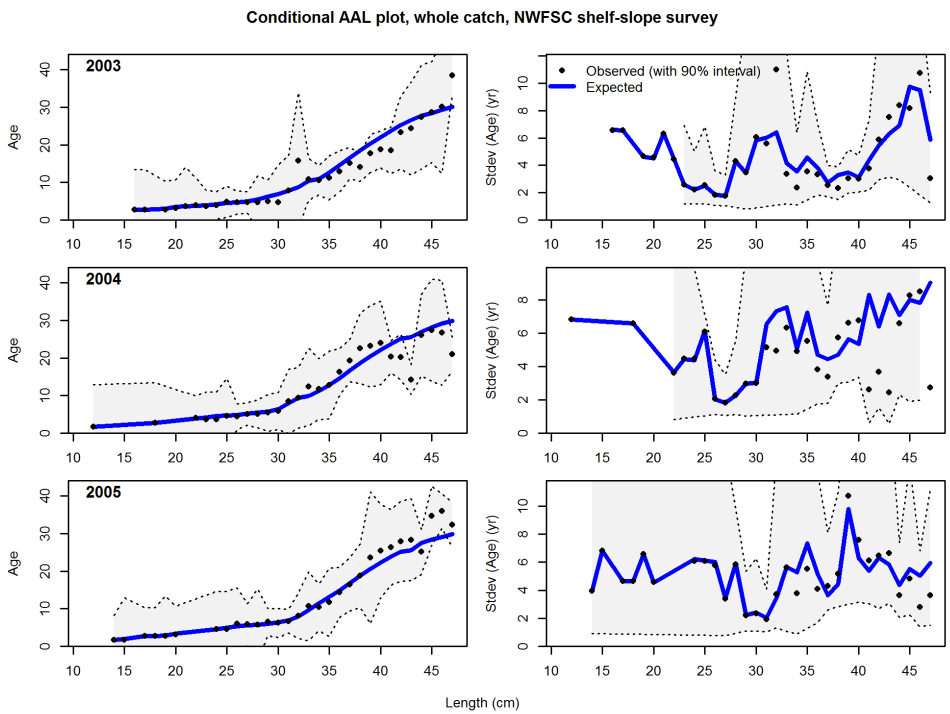


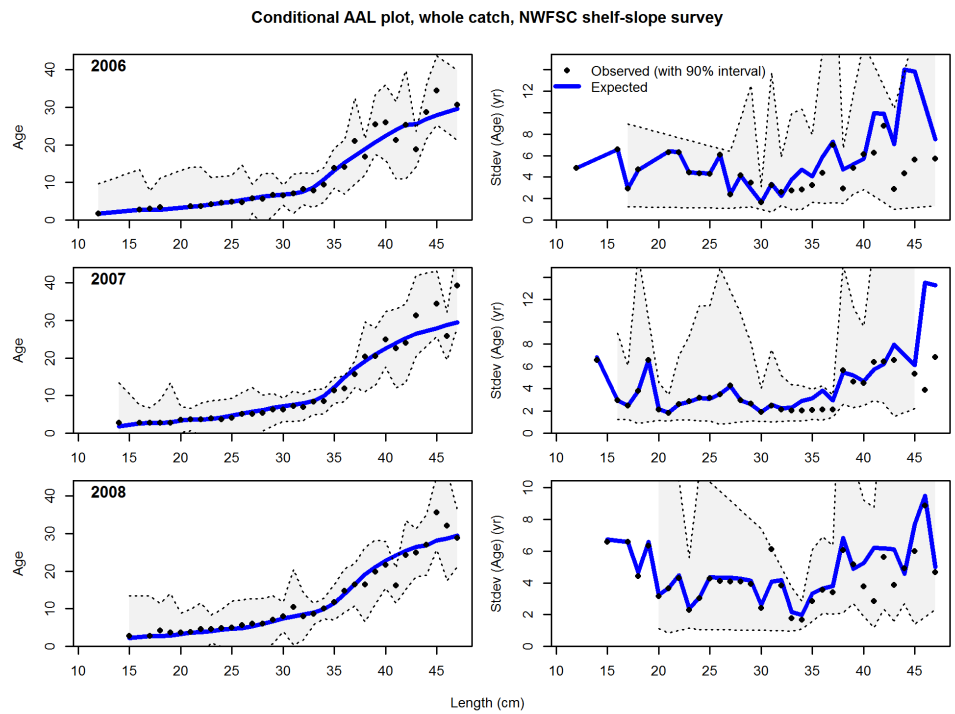


NWFSC shelf-slope survey: Length Composition

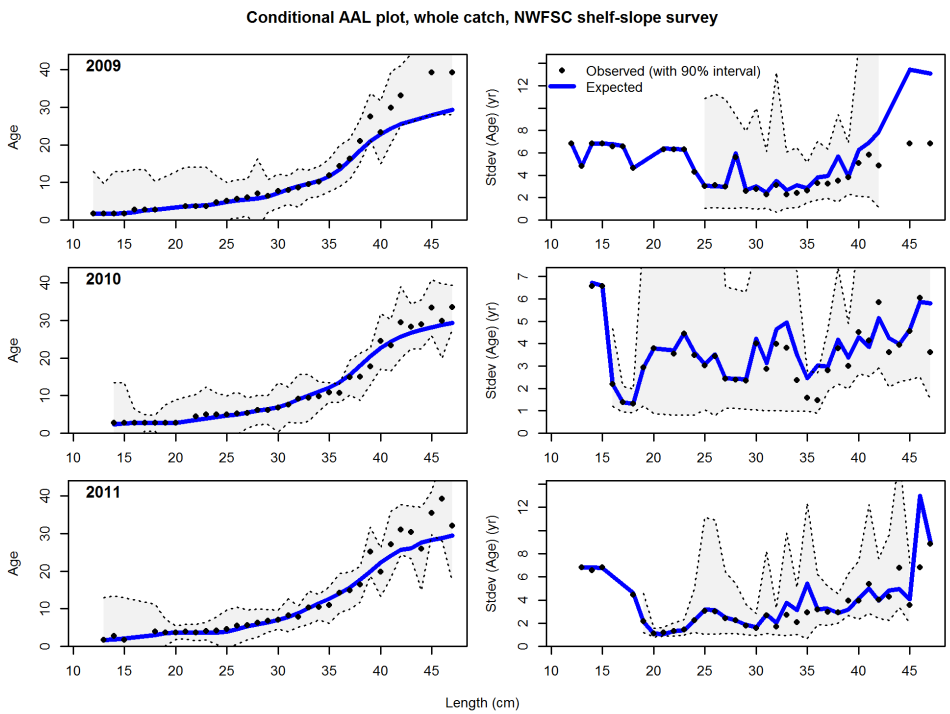


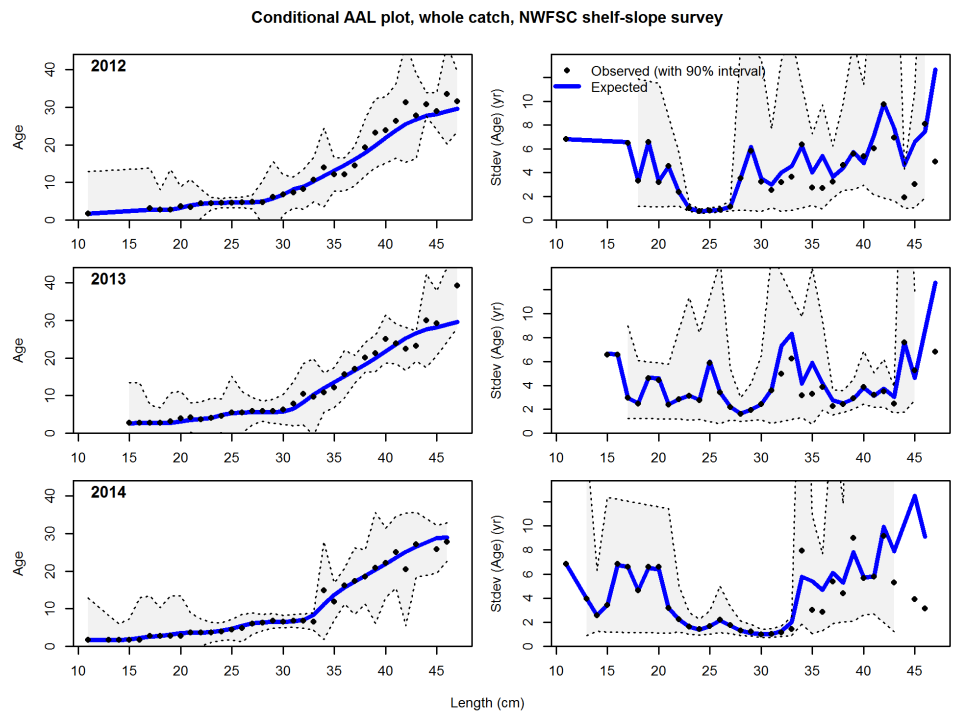
NWFSC shelf-slope survey: Conditional Age-at-Length Composition



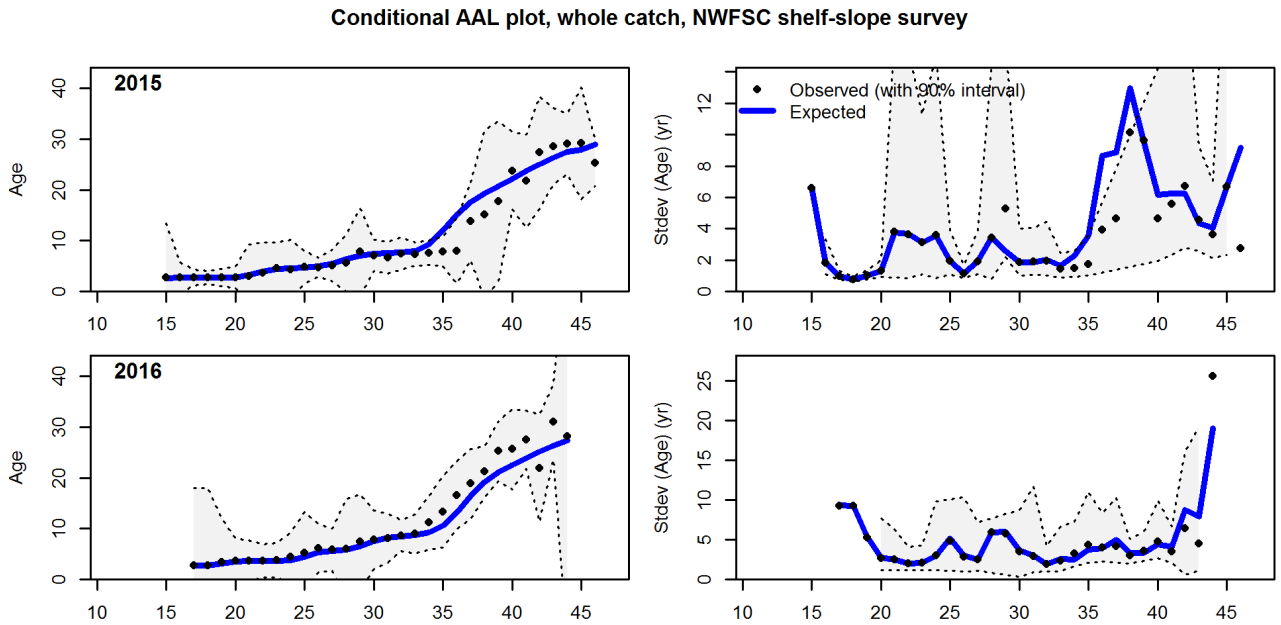


NWFSC shelf-slope survey: Conditional Age-at-Length Composition

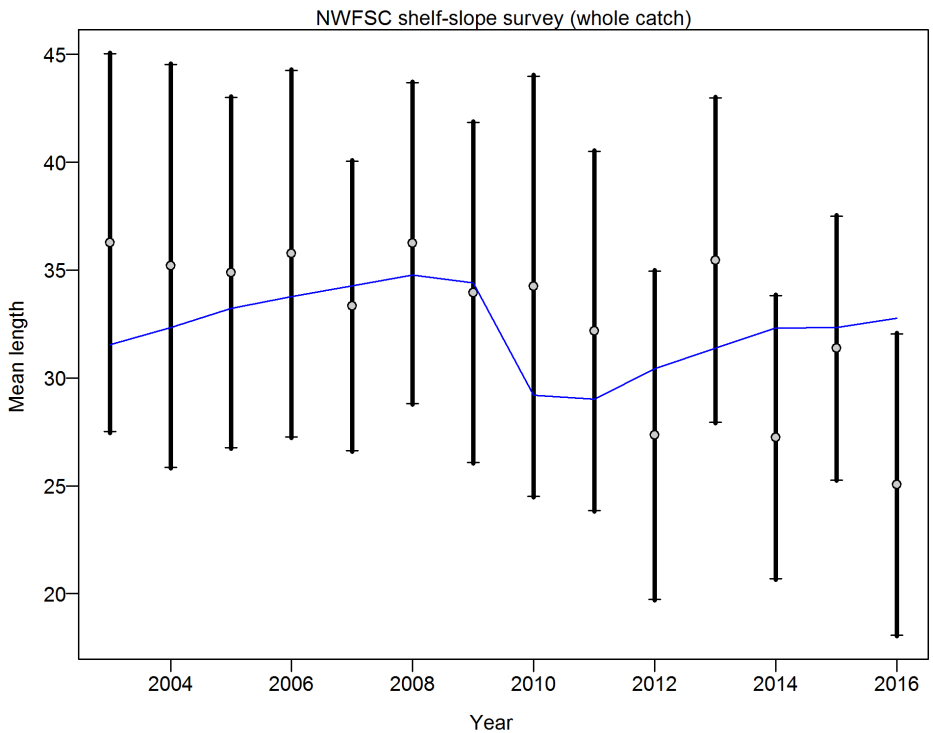


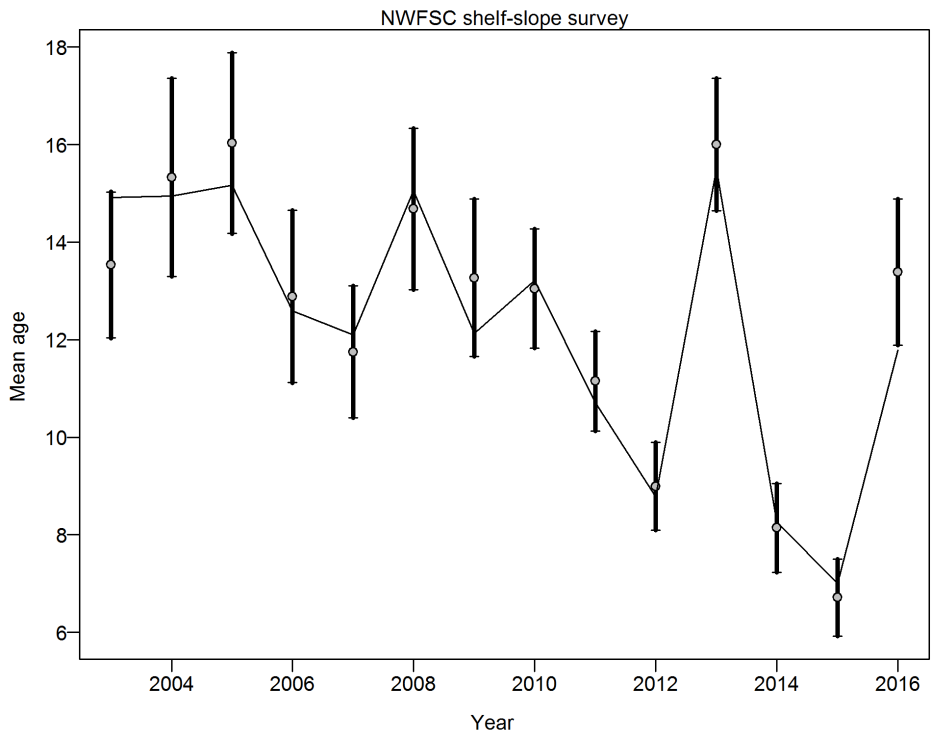


NWFSC shelf-slope survey: Conditional Age-at-Length Composition

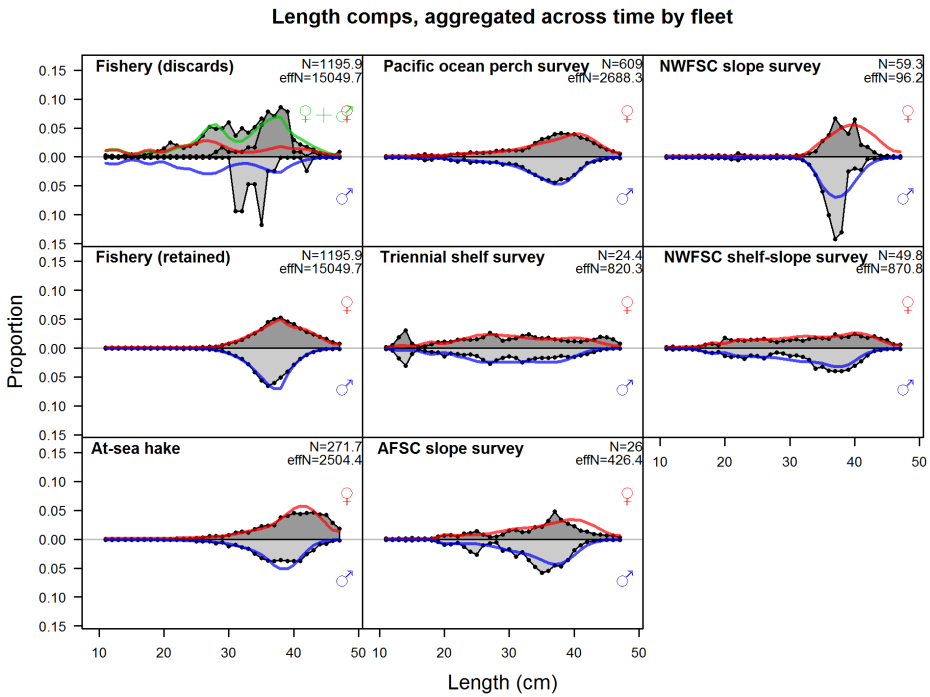


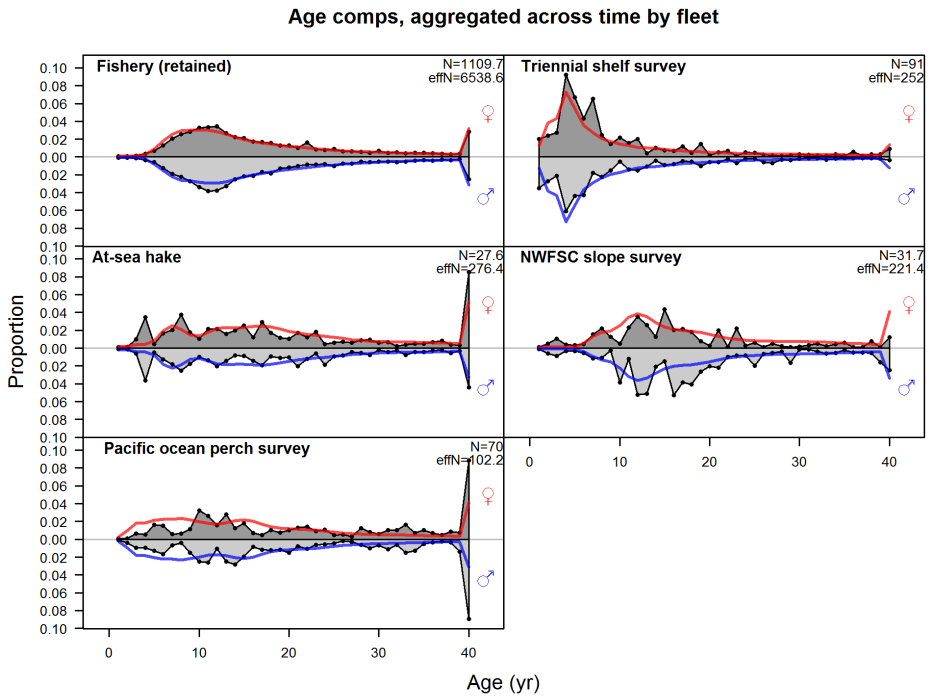
NWFSC shelf-slope survey: Mean Length and Age





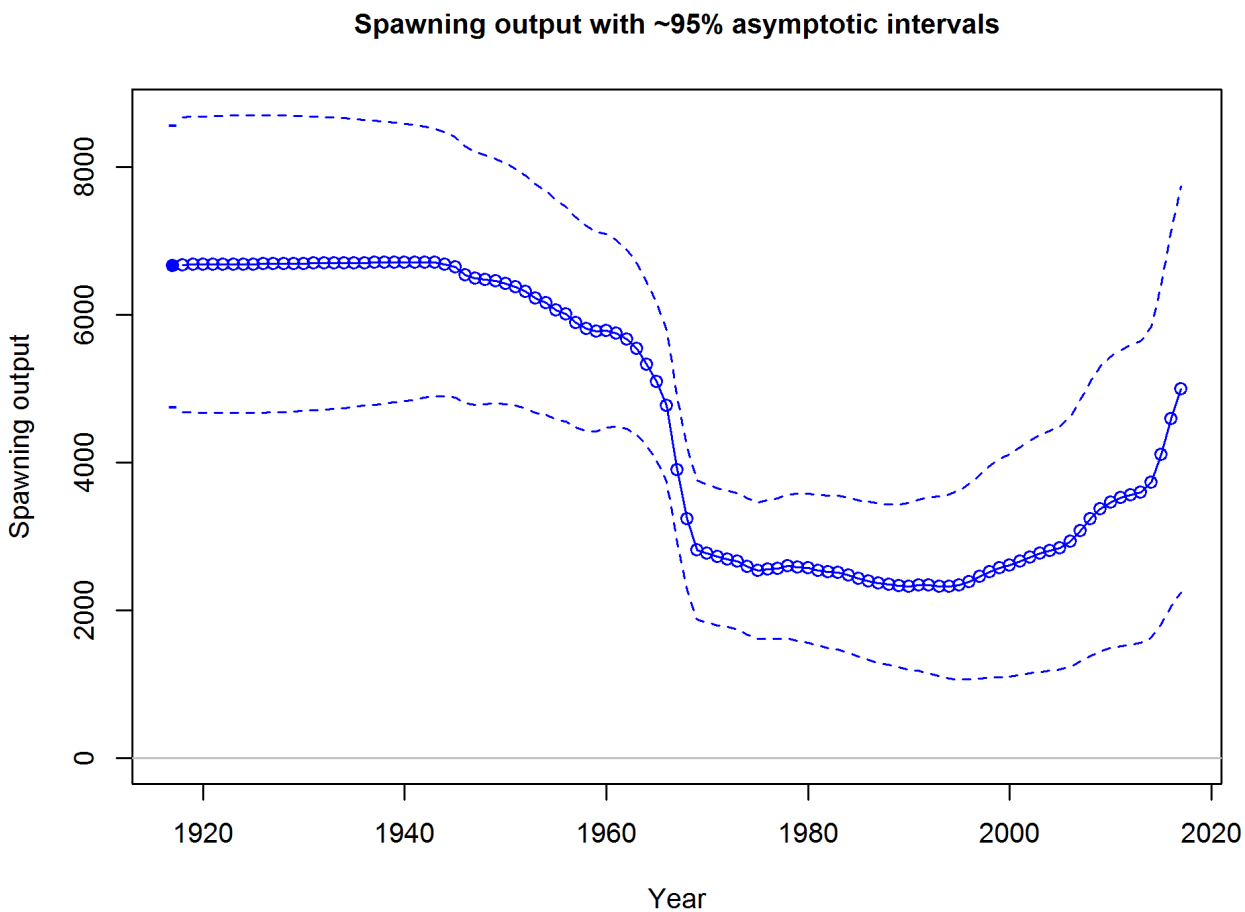
Aggregated Length and Age Composition Fits



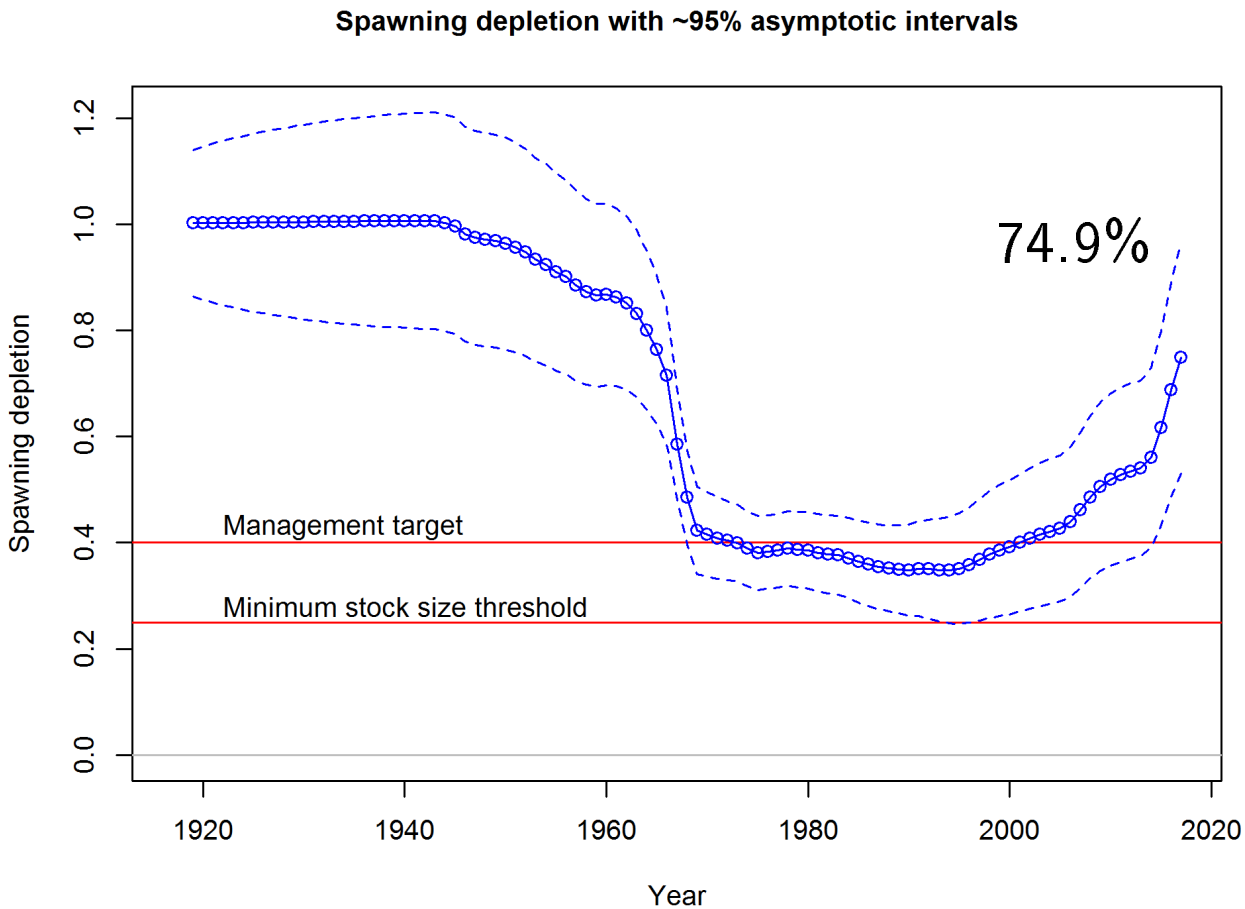


Outline

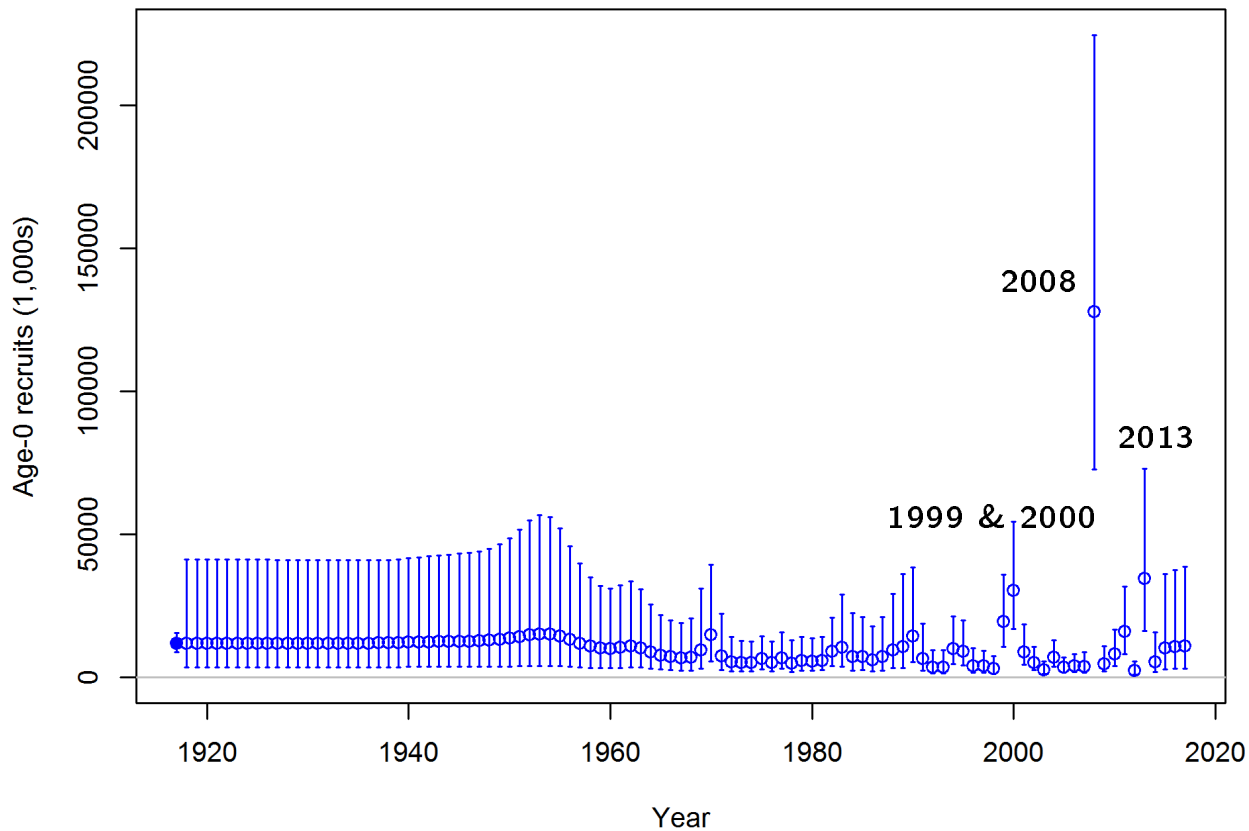
Spawning Output



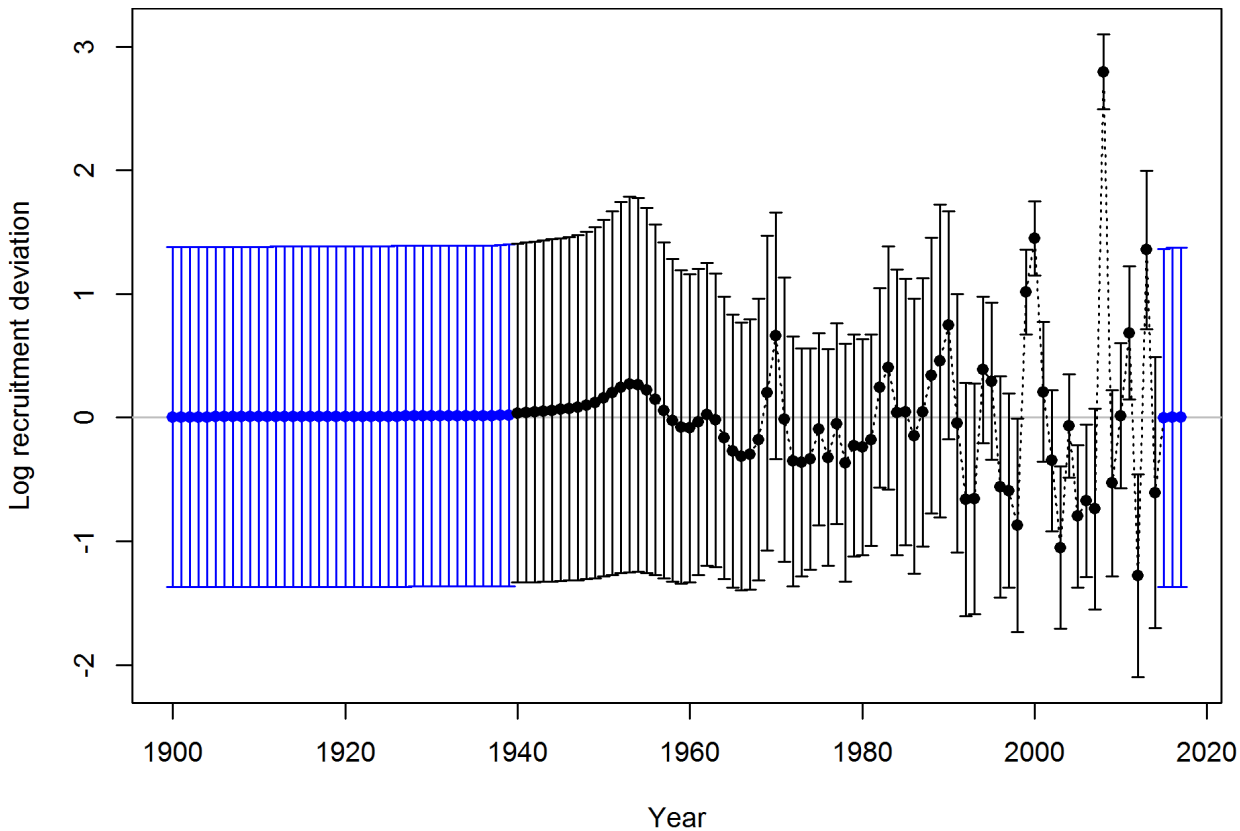
Relative Spawning Output (Depletion)



Estimated Annual Recruitment

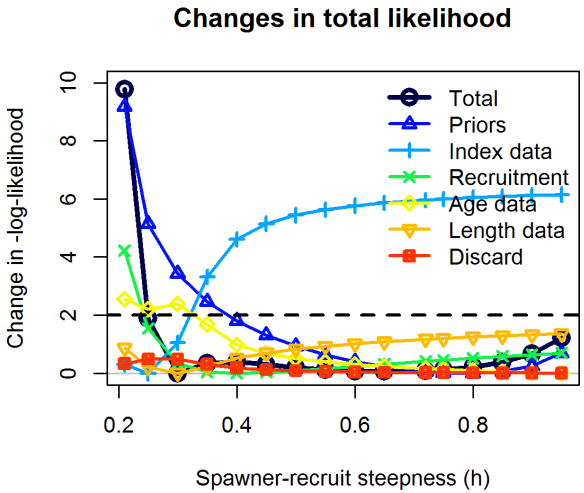


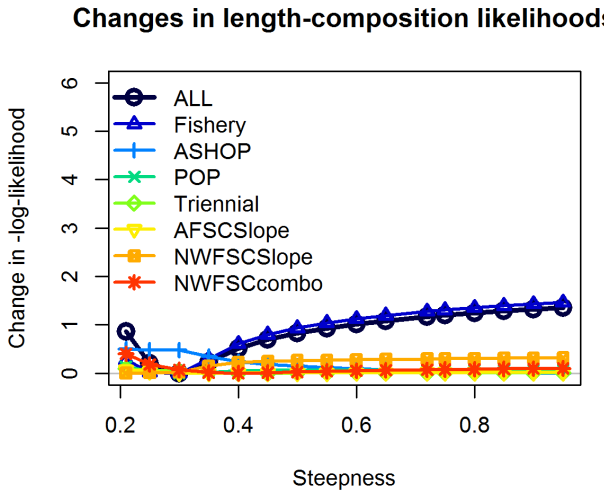
Estimated Annual Recruitment Deviations

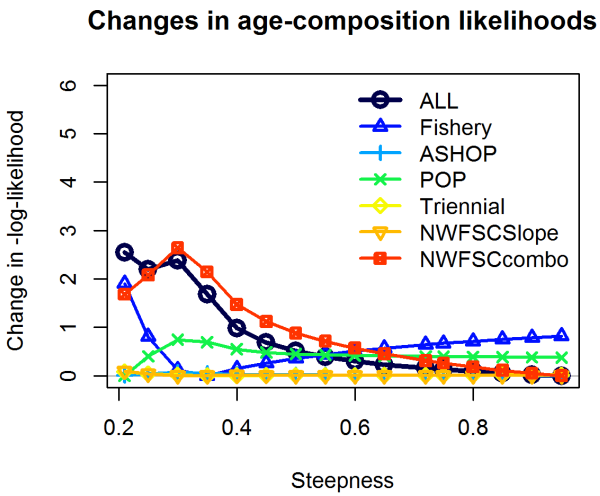


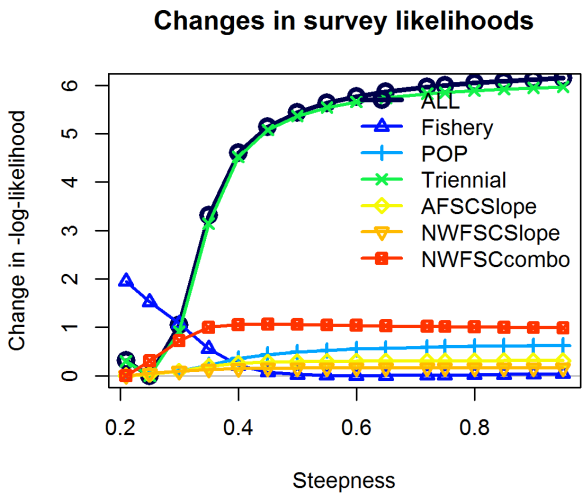
Outline

Steepness Profile

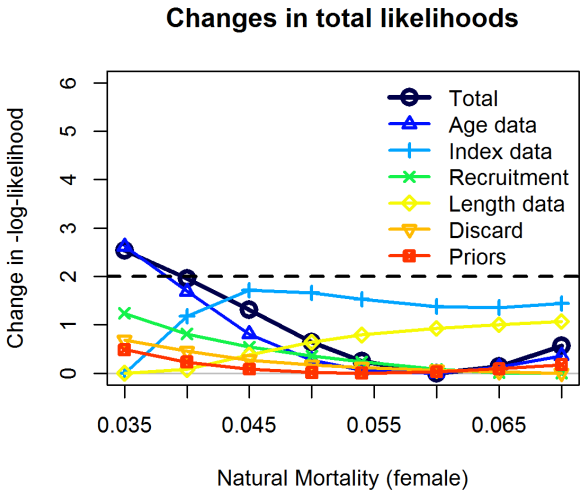


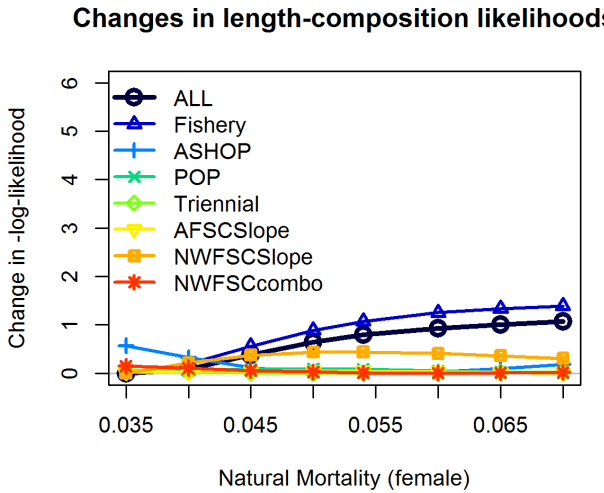


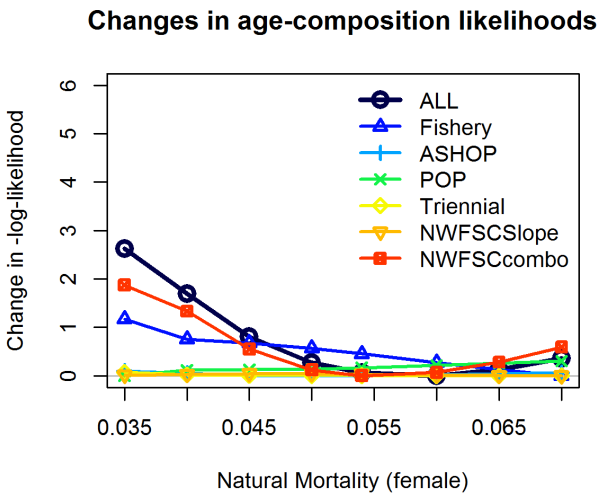


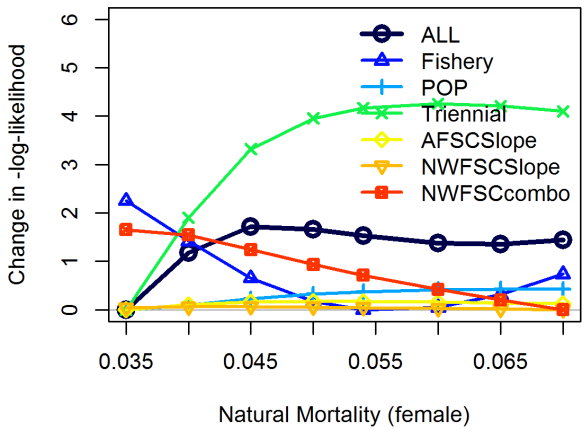


Natural Mortality Profile

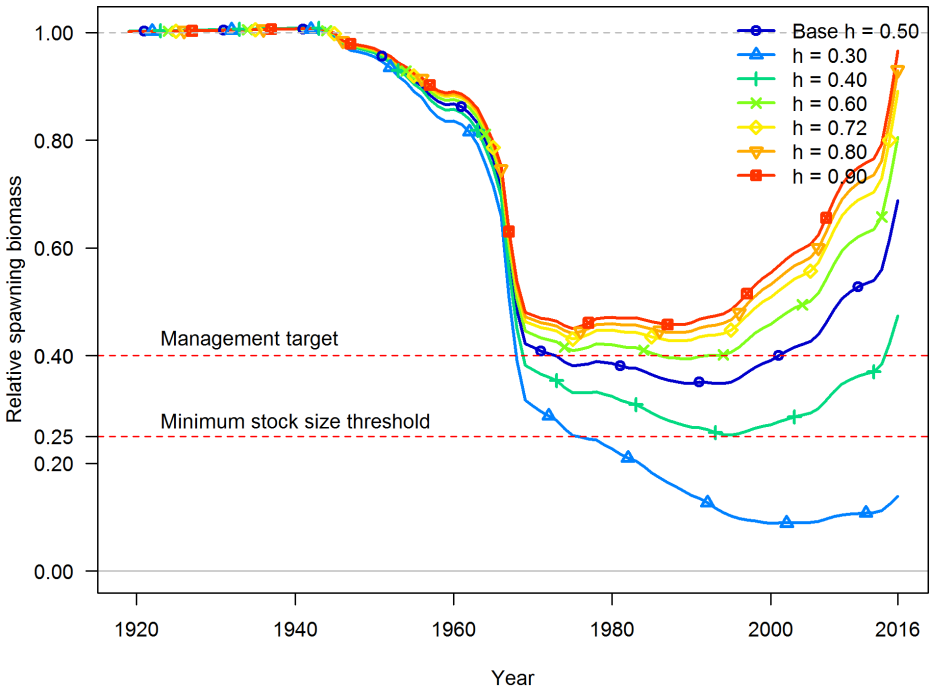


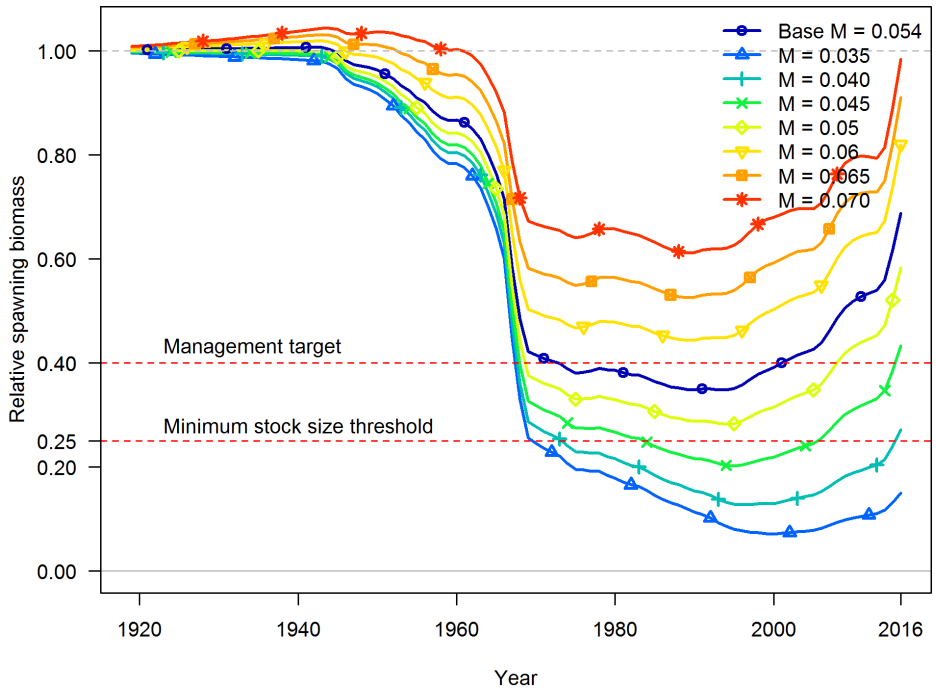




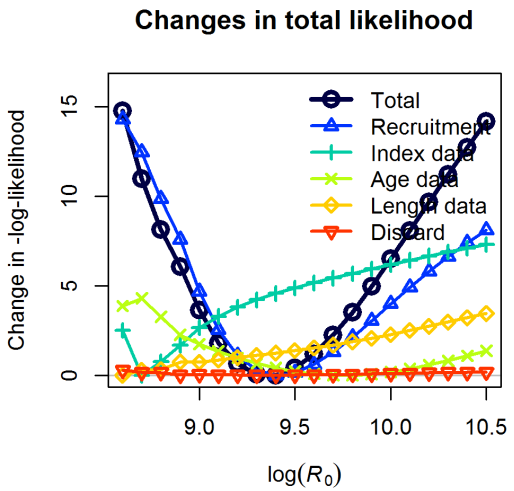


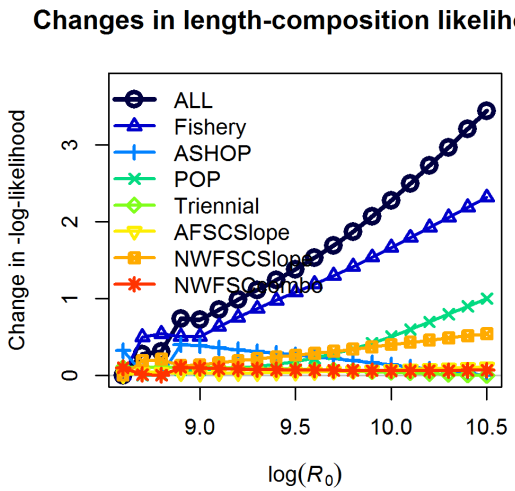
Population Trajectories

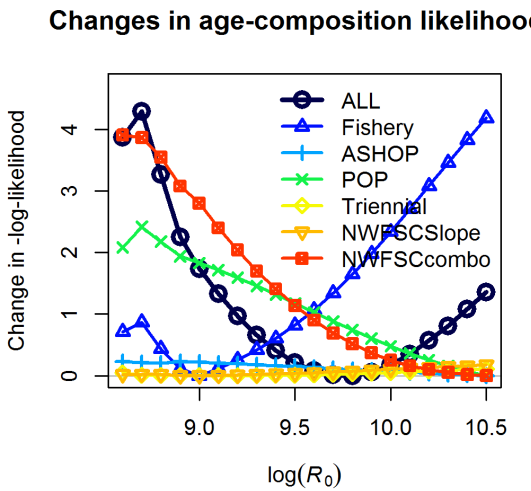


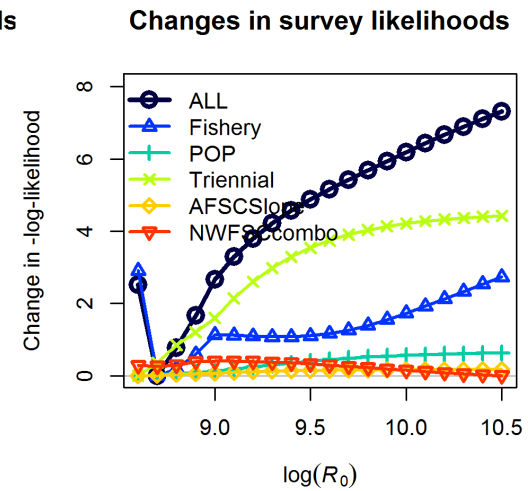


R_0 Profile

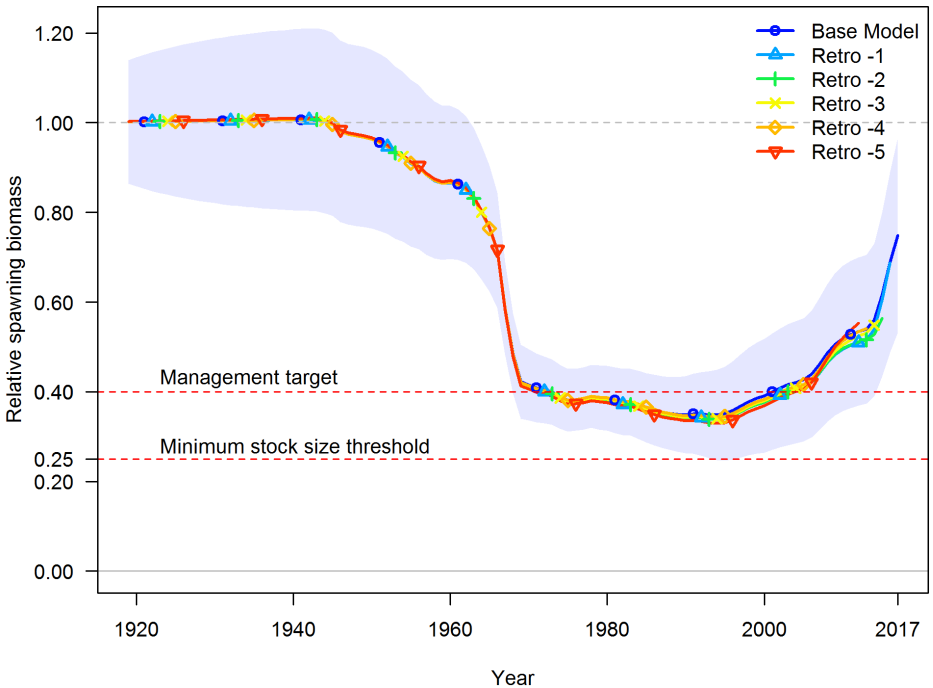

Changes in total likelihood
Change in -log-likelihood
log(R_0)
Total
Recruitment
Index data
Age data
Length data
Discard

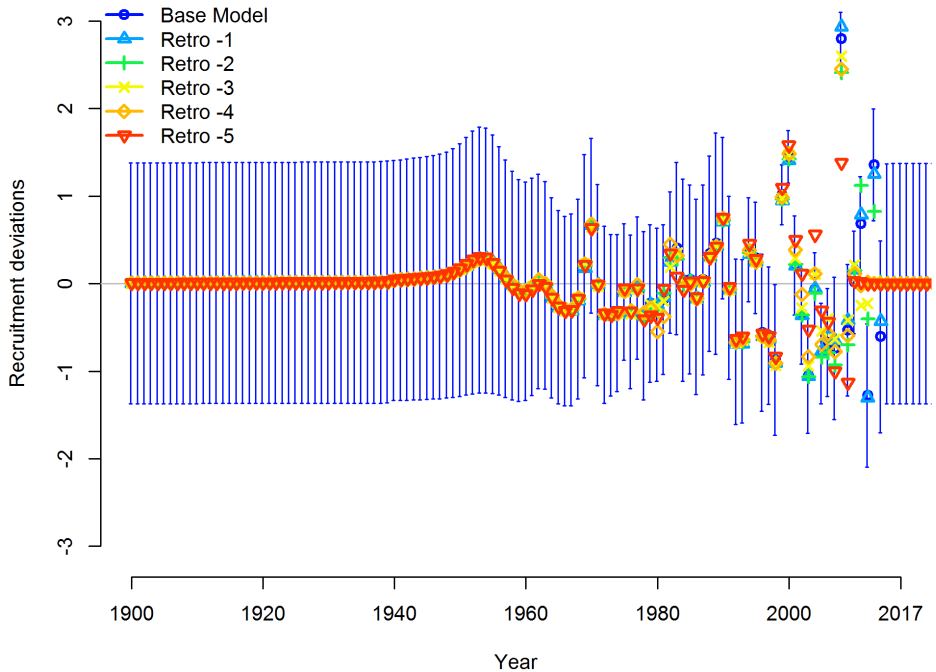

Changes in length-composition likelihood
Change in -log-likelihood
log(R_0)
ALL
Fishery
ASHOP
POP
Triennial
AFSCSlope
NWFSCSlope
NWFSCcombo


Changes in age-composition likelihoods
Change in -log-likelihood
log(R_0)
ALL
Fishery
ASHOP
POP
Triennial
NWFSCSlope
NWFSCcombo

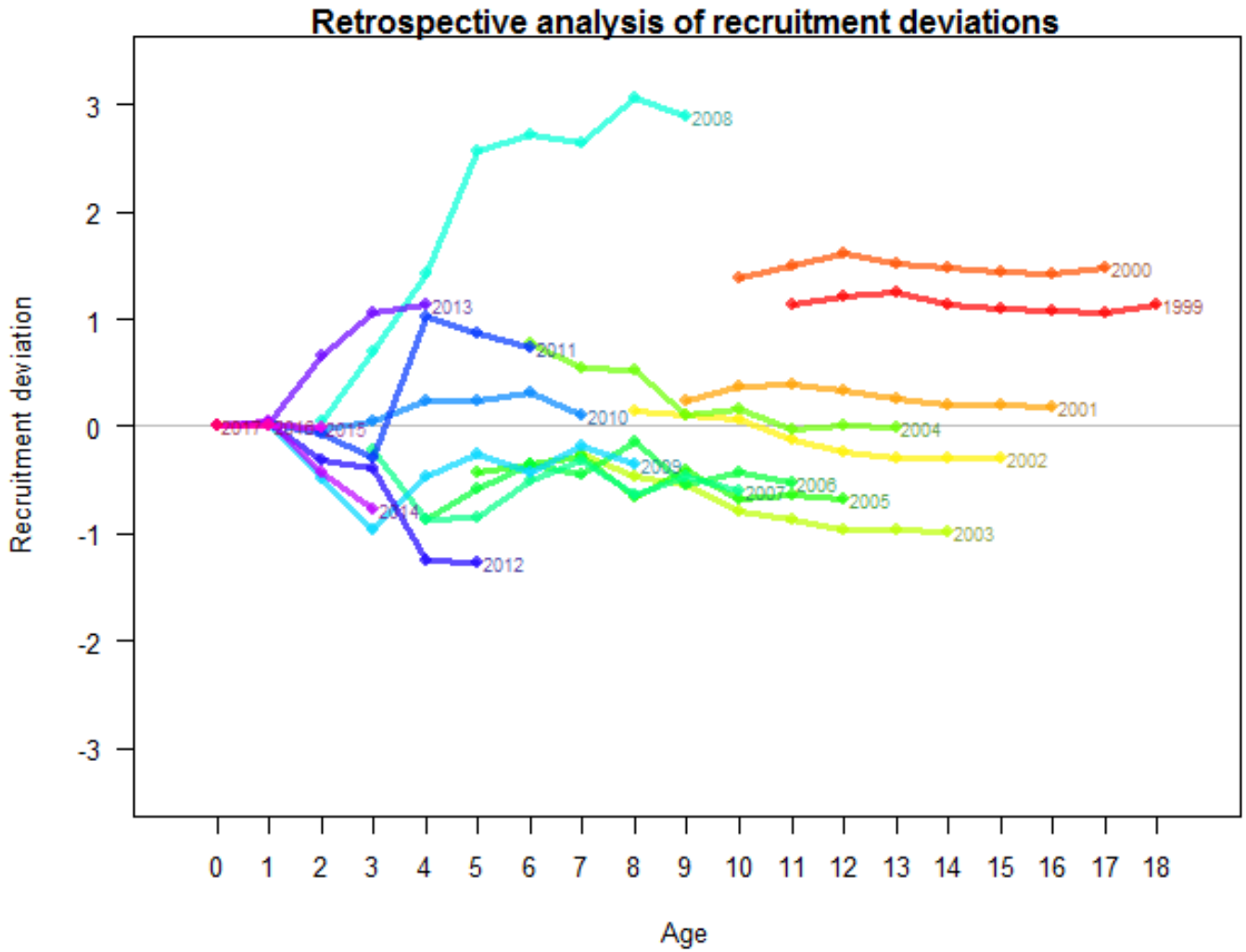

Changes in survey likelihoods
Change in -log-likelihood
log(R_0)
ALL
Fishery
POP
Triennial
AFSCSlope
NWFSCcombo

Retrospective Pattern

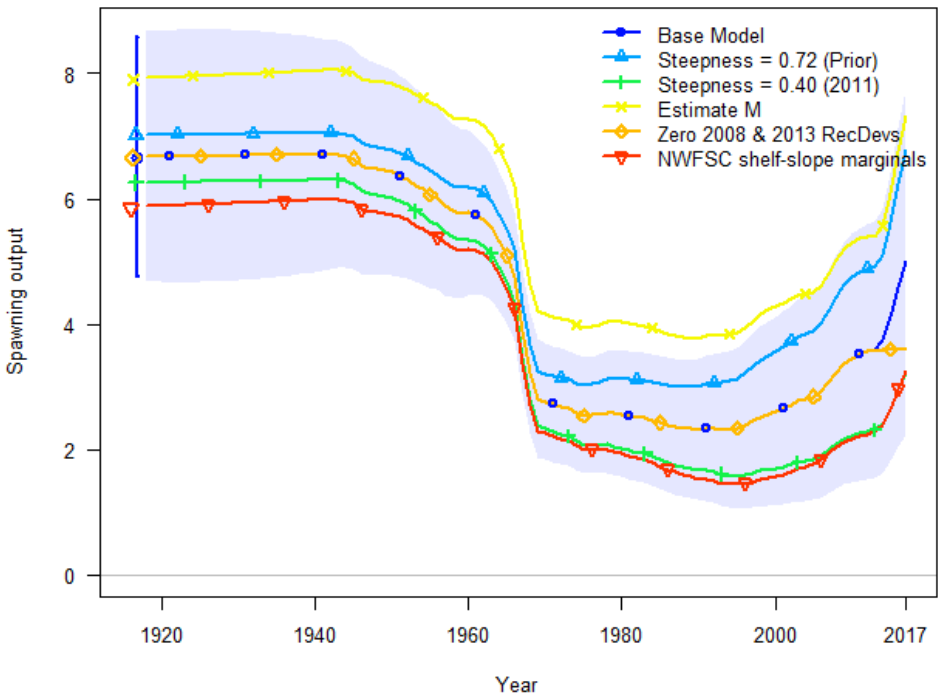


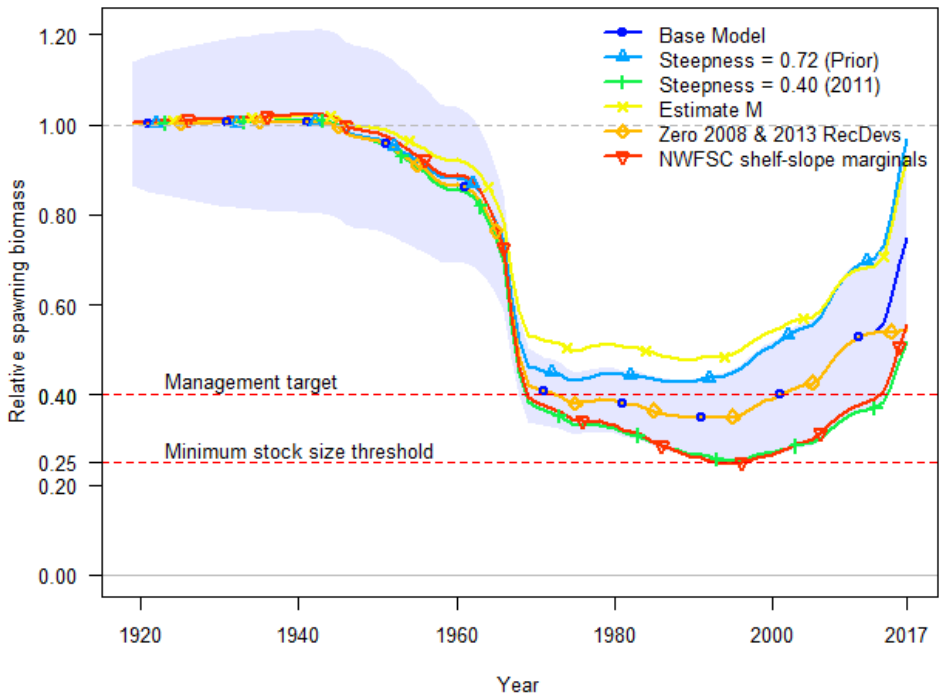


Retrospective in Recruitment Strength

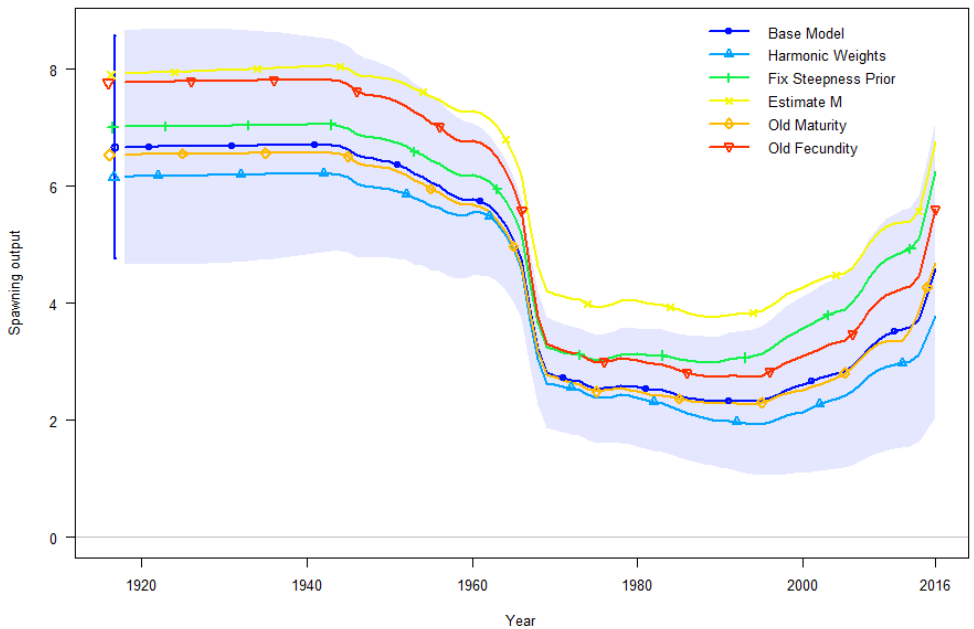


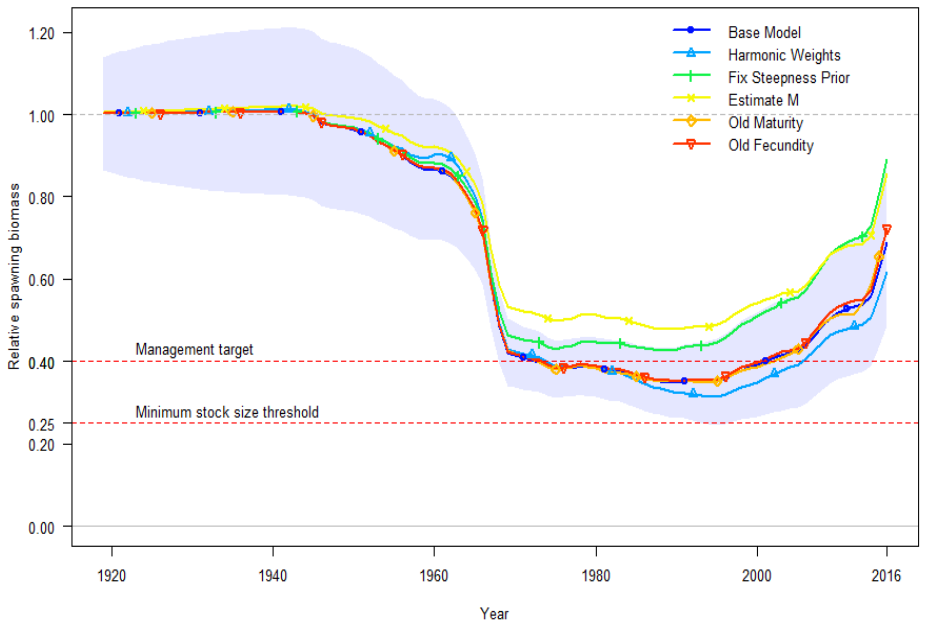
Model Sensitivities



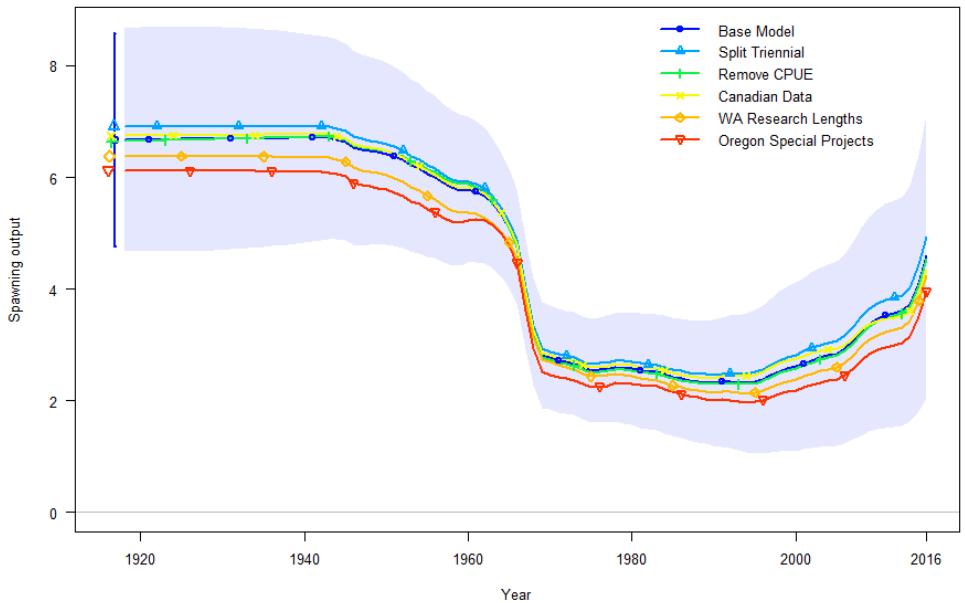


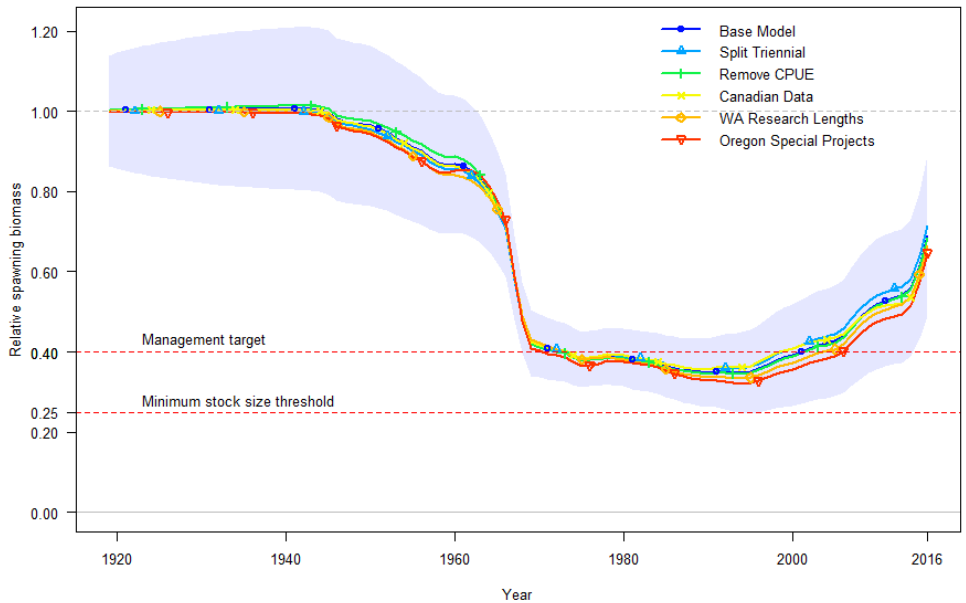
Sensitivities-2





Sensitivities-3

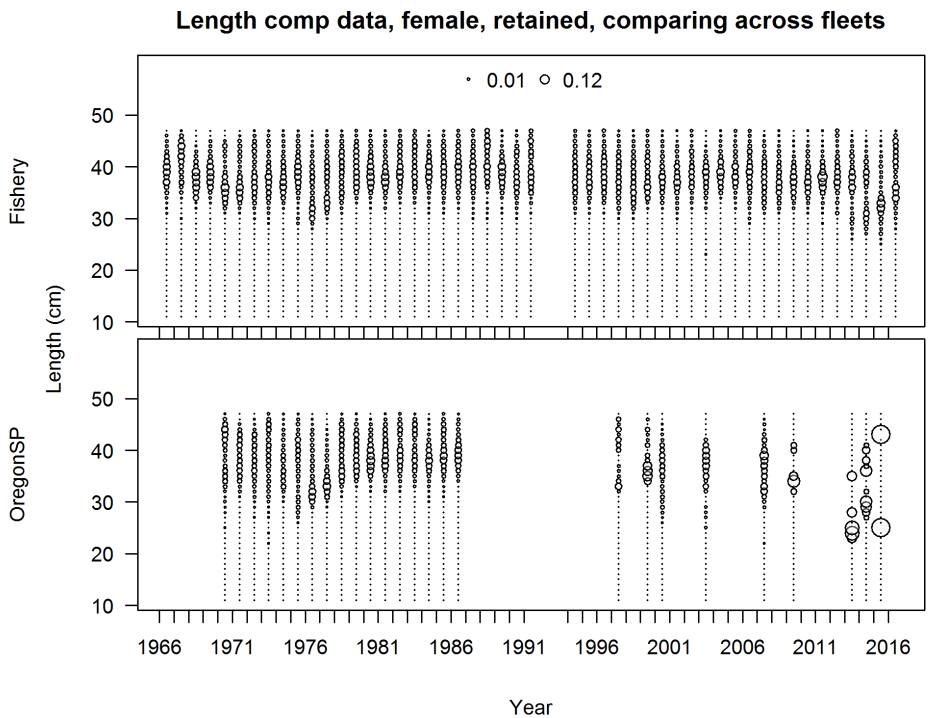


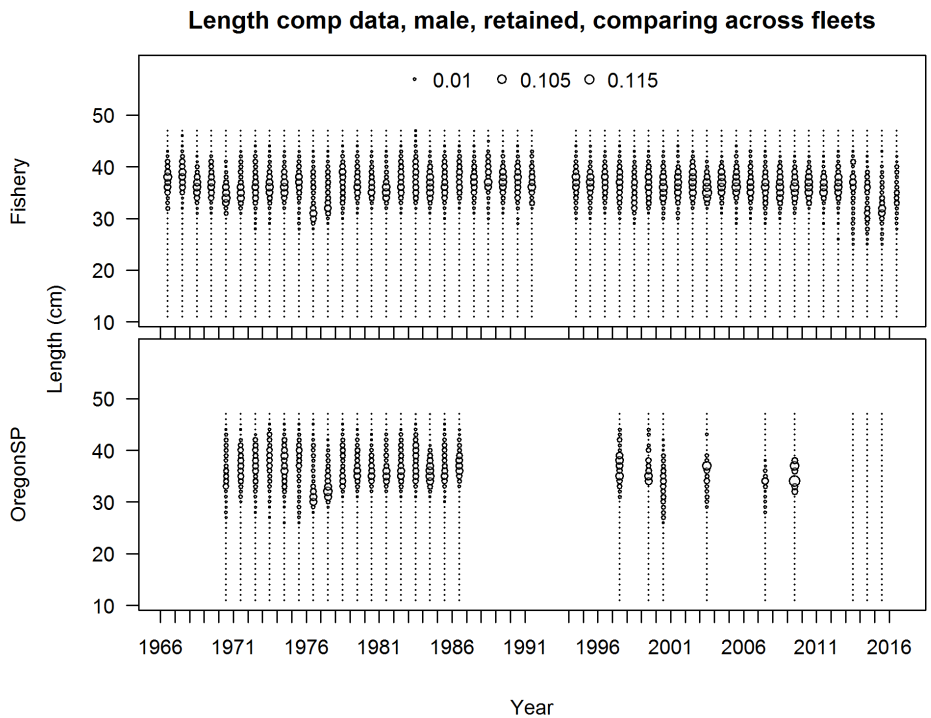


Conclusion of Modeling & Results

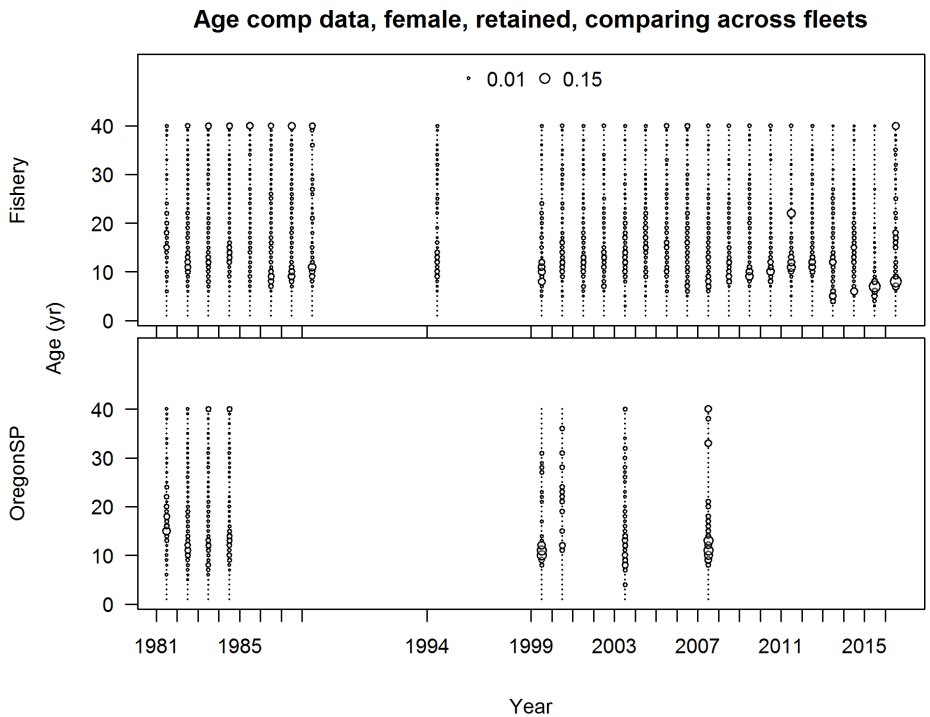
Additional data slides

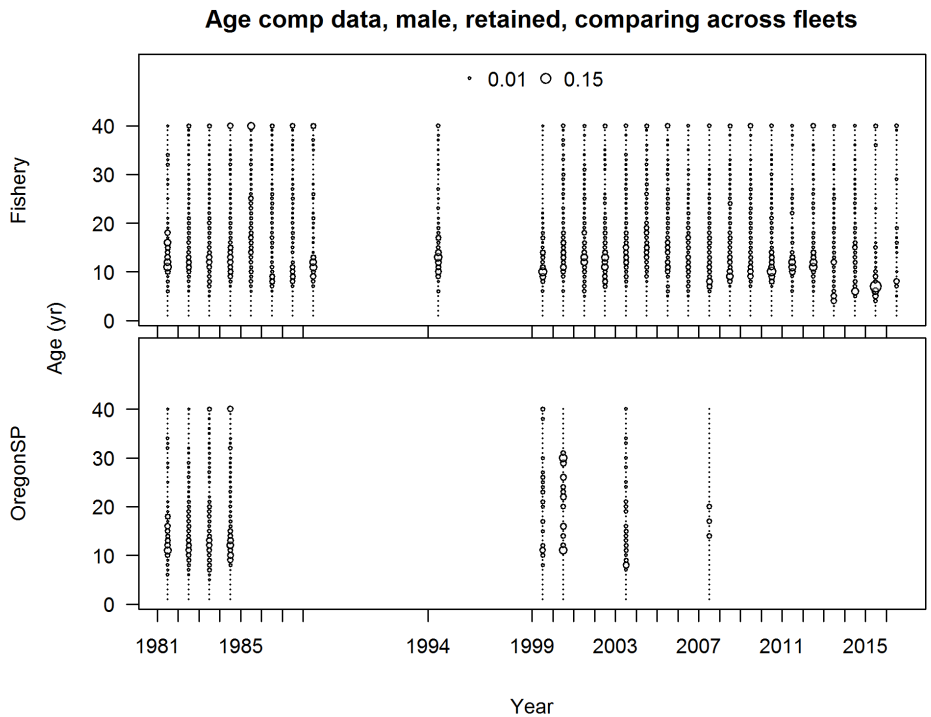
Oregon Special Projects - Length Data



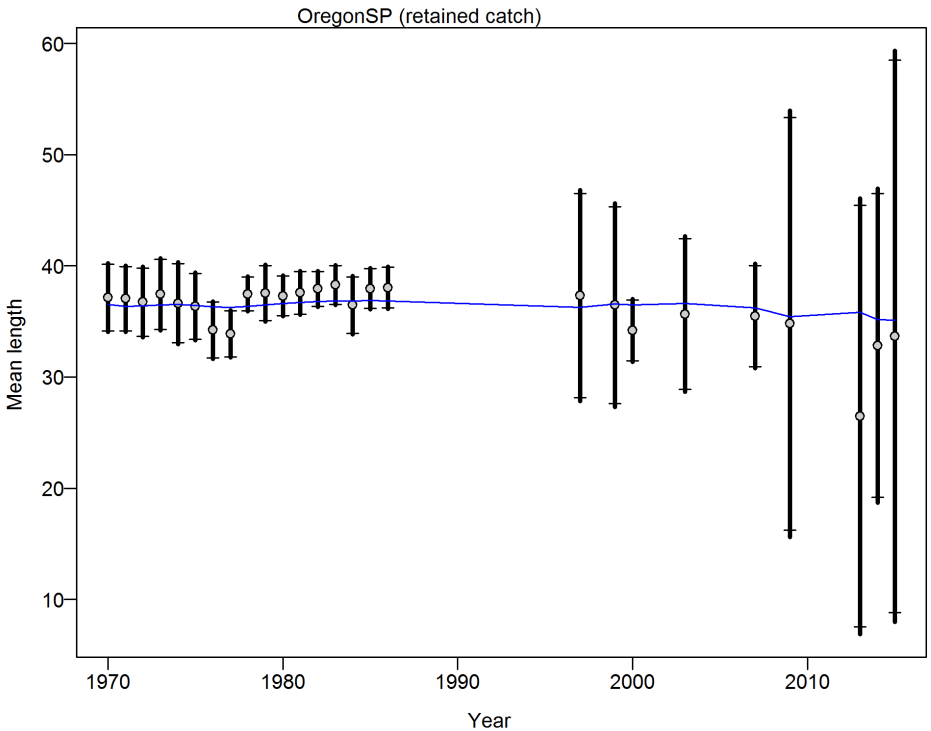


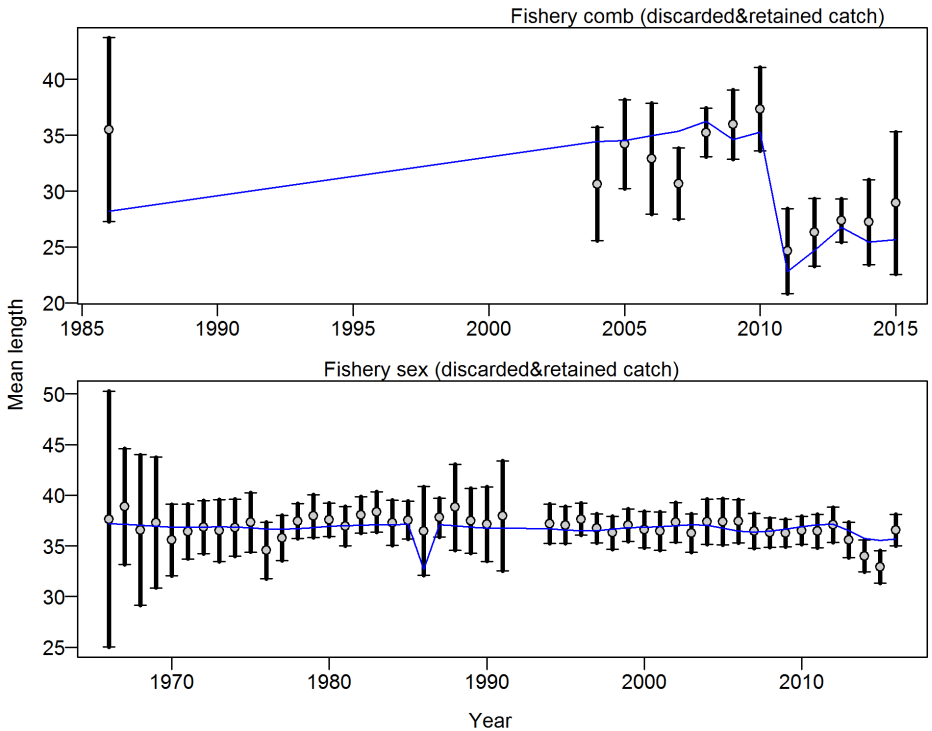
Oregon Special Projects - Age Data



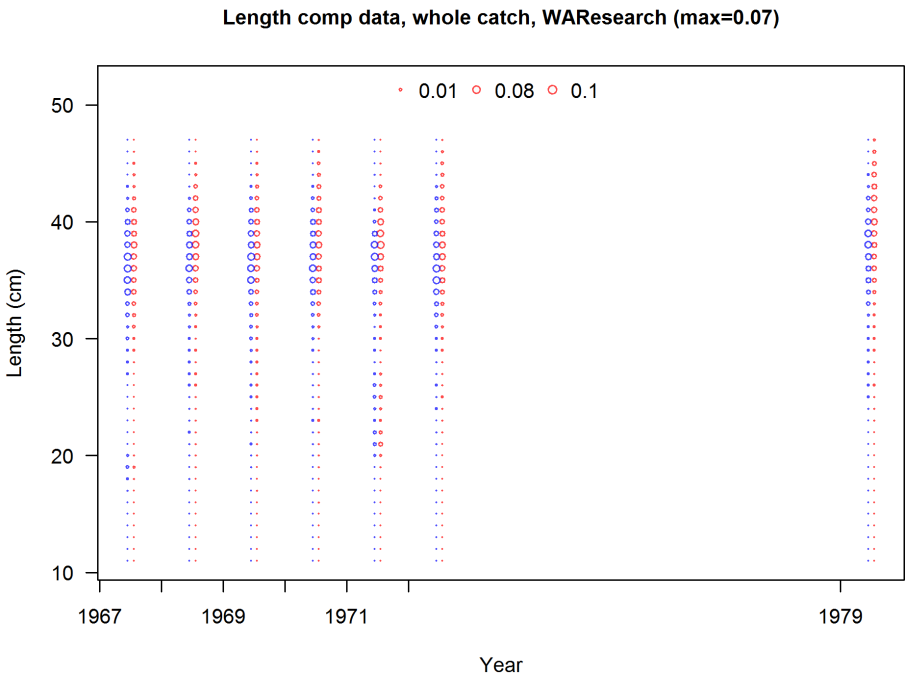


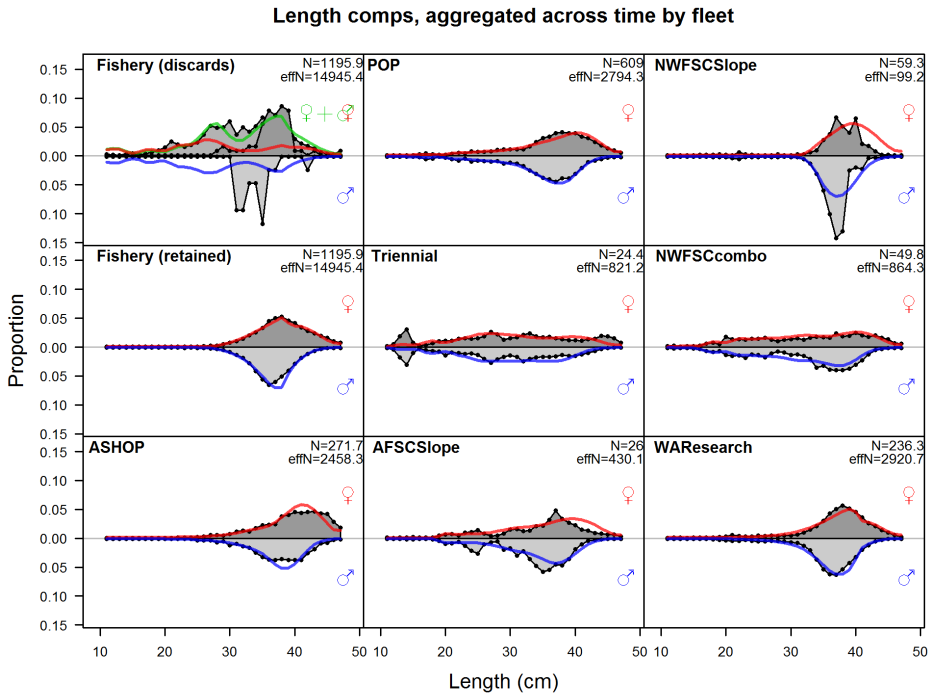
Oregon Special Projects - Mean Length Comparison



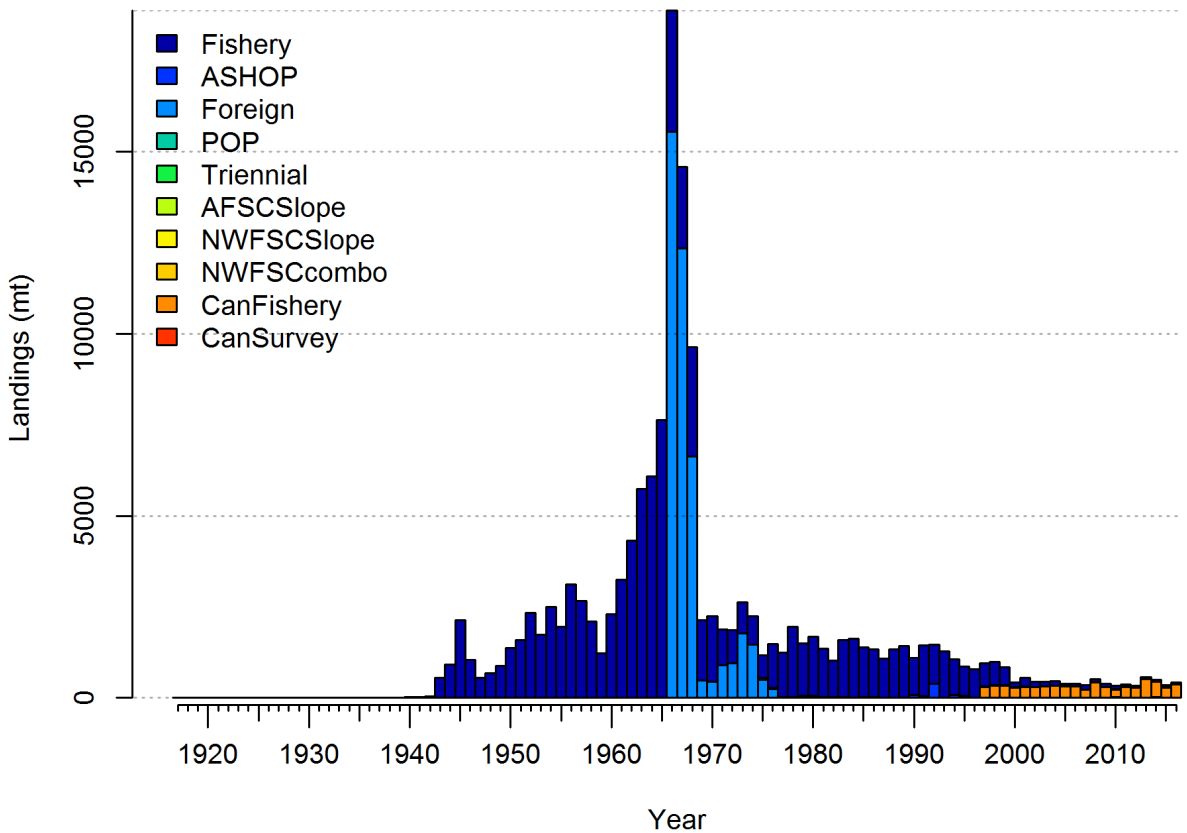


Washington Research Lengths

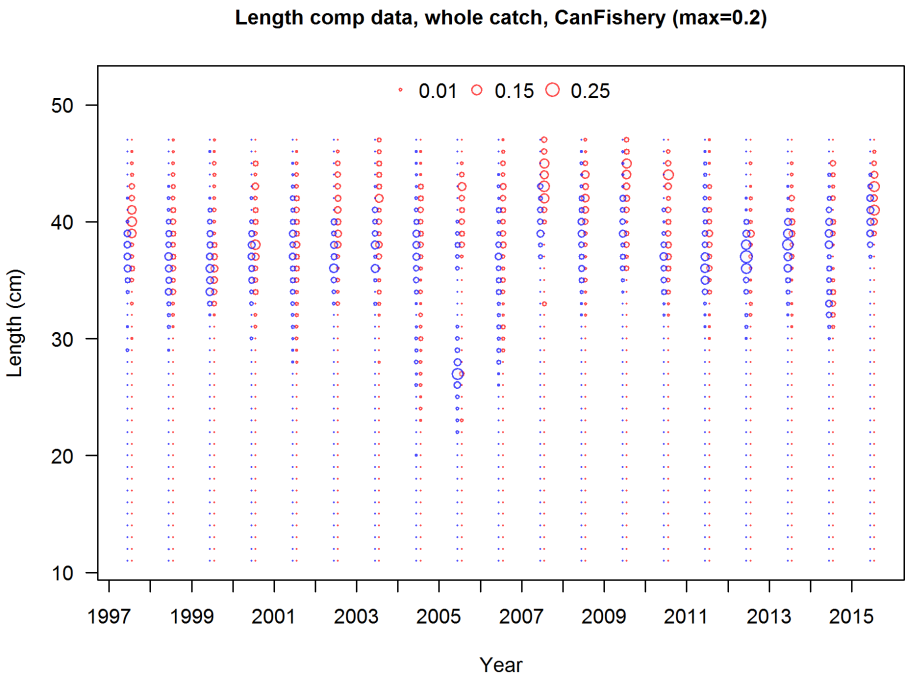


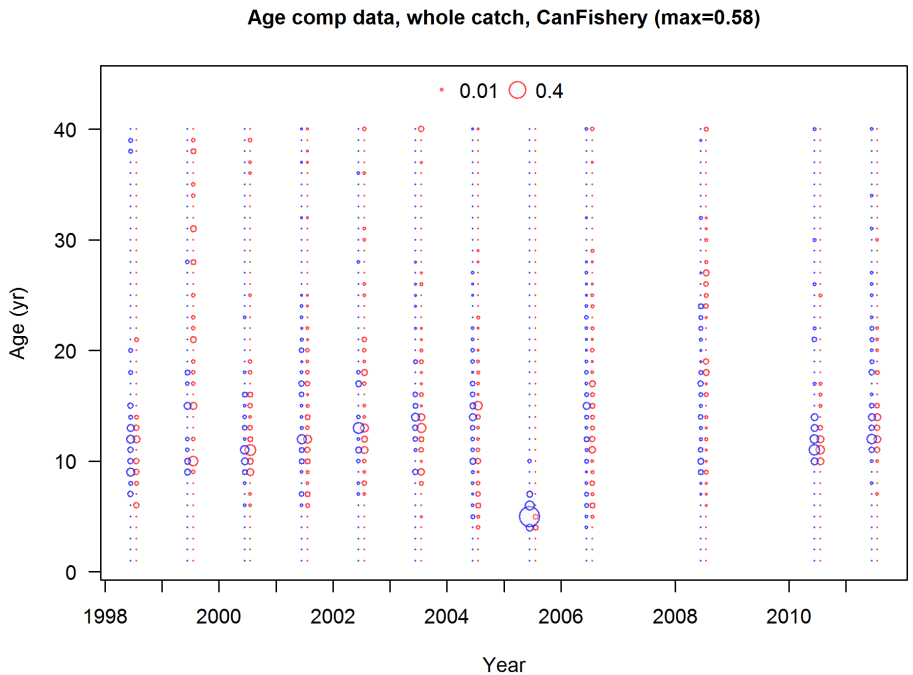


Landings with Canada

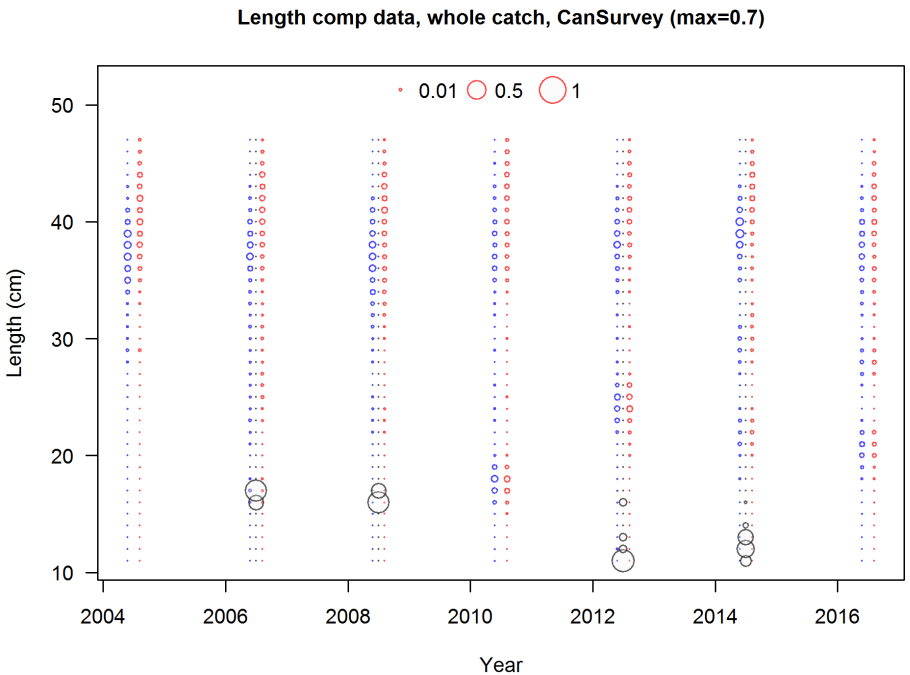


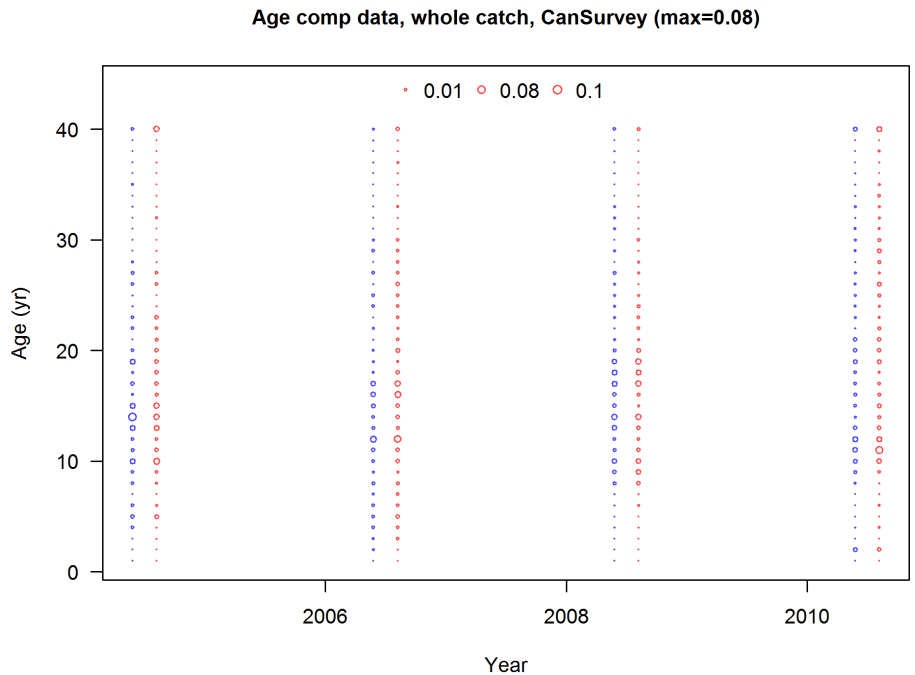
Canadian Fishery Data



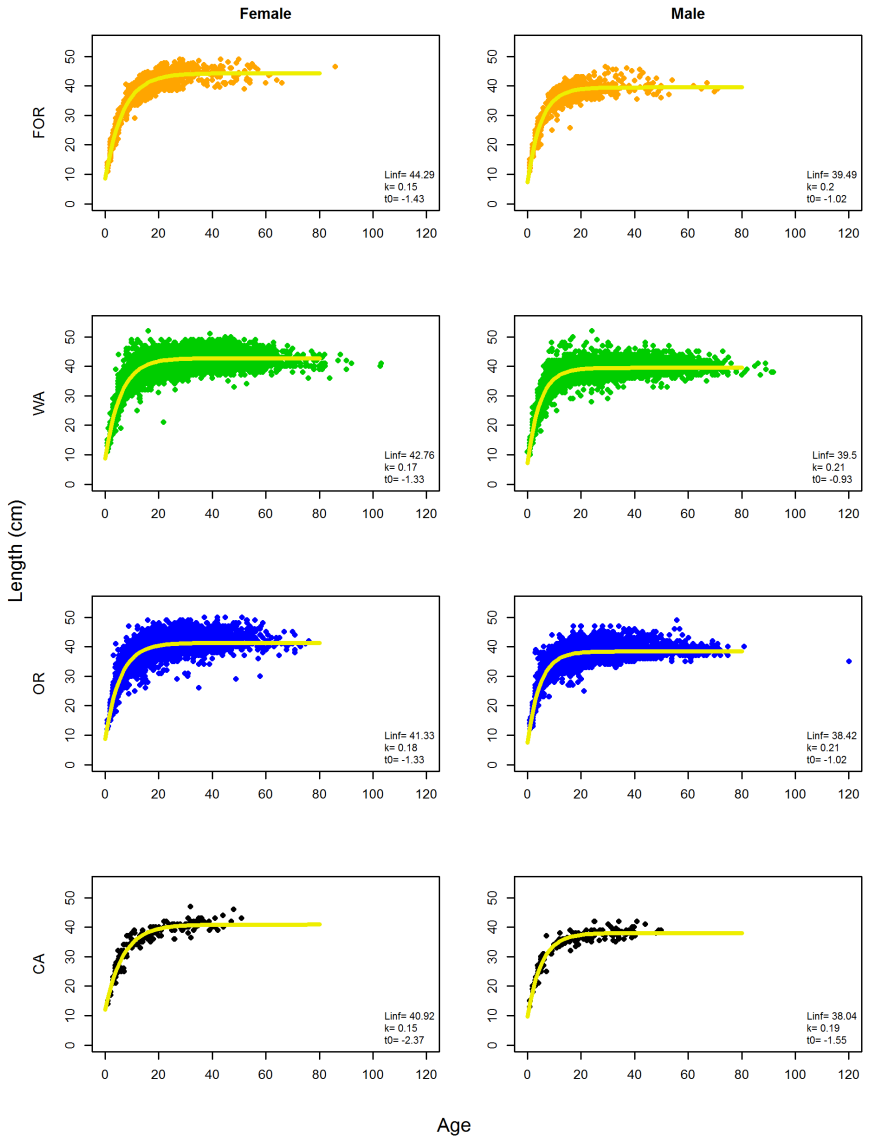


Canadian Survey Data

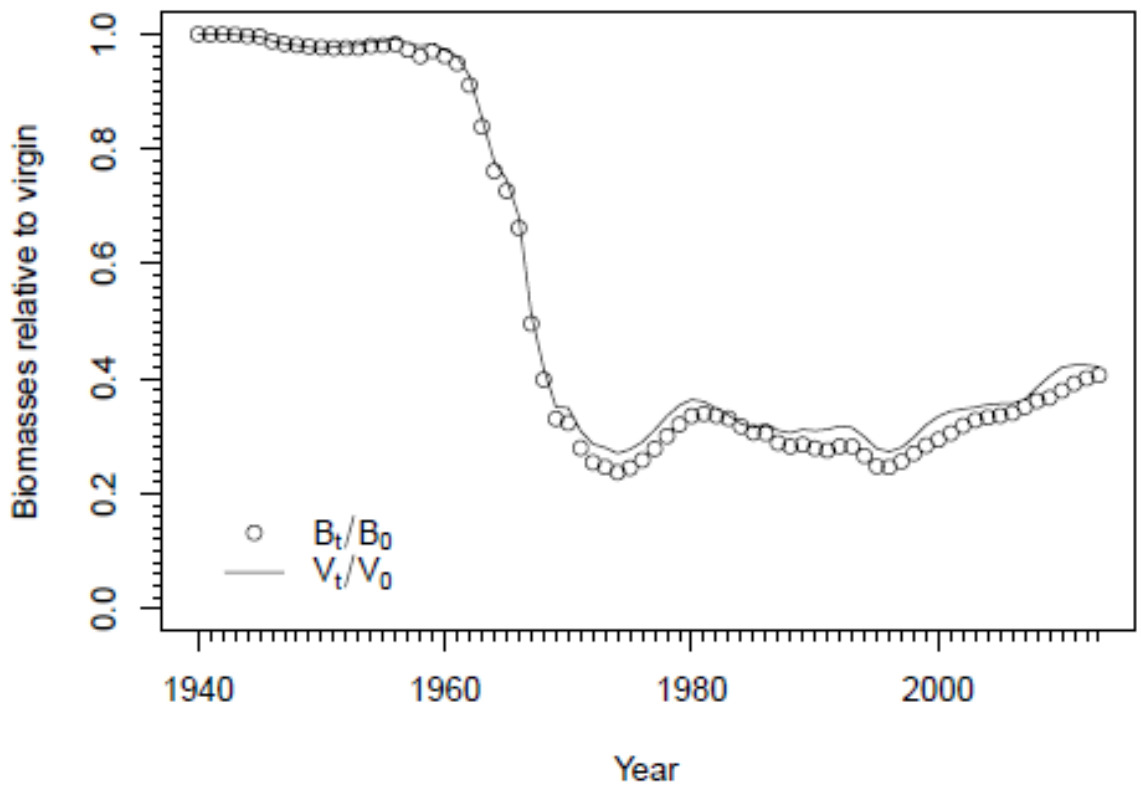


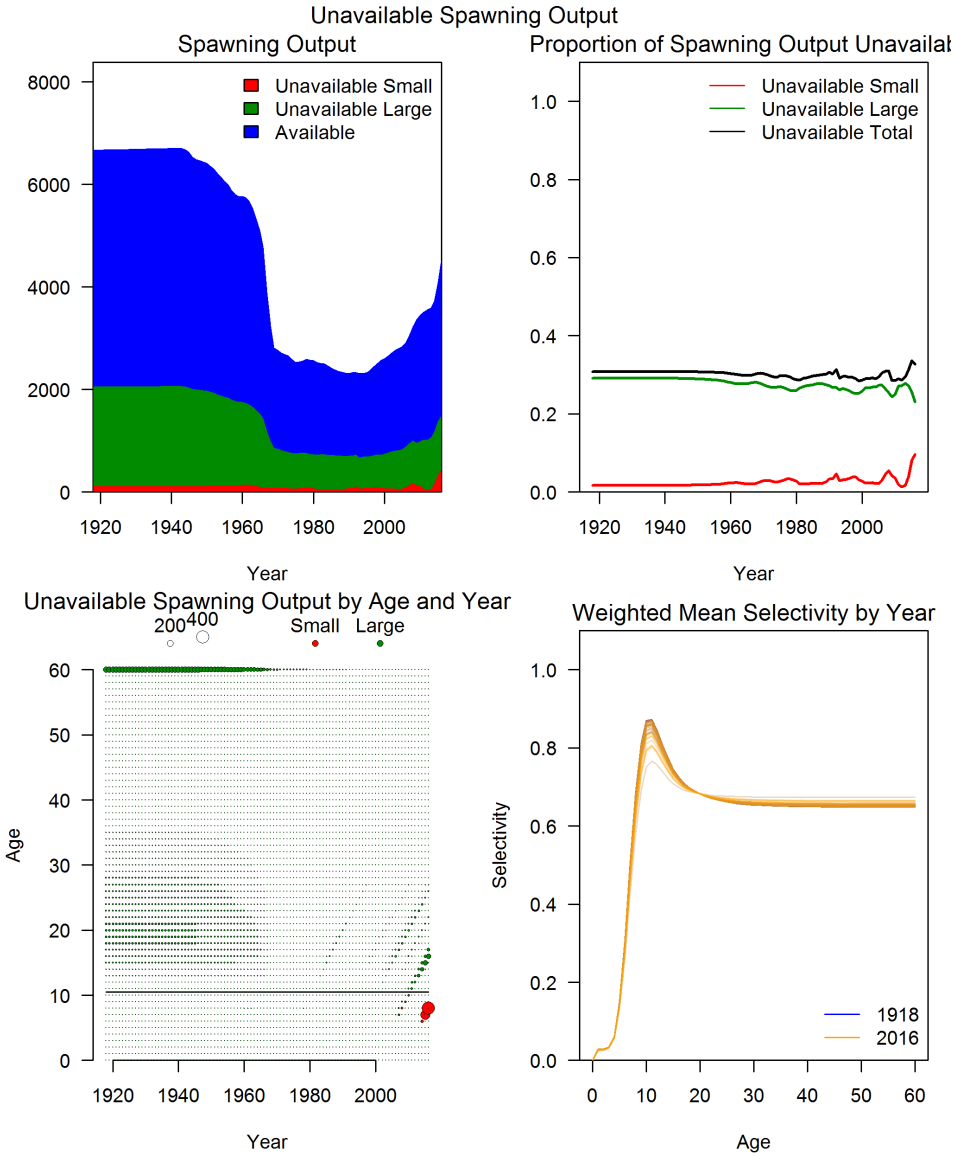


Length-at-Age by Area



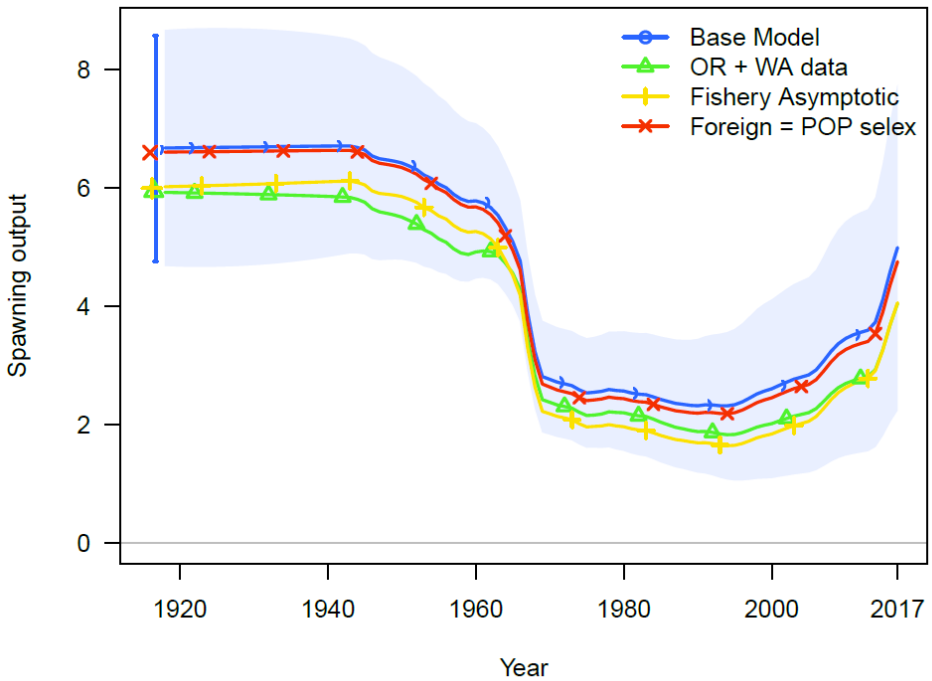
Depletion of Canadian British Columbia Stock

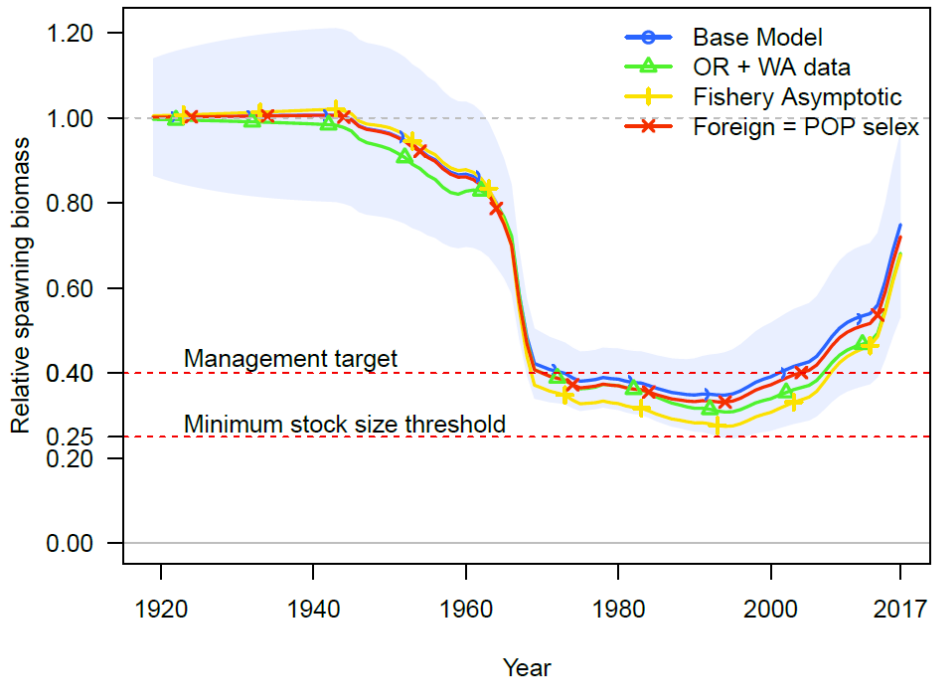



Unavailable Spawning Output
Spawning Output
Unavailable Small
Unavailable Large
Available
8000
6000
4000
2000
0
1920
1940
1960
1980
2000
Year
Proportion of Spawning Output Unavailat
Unavailable Small
Unavailable Large
Unavailable Total
1.0
0.8
0.6
0.4
0.2
0.0
1920
1940
1960
1980
2000
Year
Unavailable Spawning Output by Age and Year
200
400
Small
Large
60
50
40
30
20
10
0
Age
1920
1940
1960
1980
2000
Year
Weighted Mean Selectivity by Year
1.0
0.8
0.6
0.4
0.2
0.0
Selectivity
1918
2016
0
10
20
30
40
50
60
Age

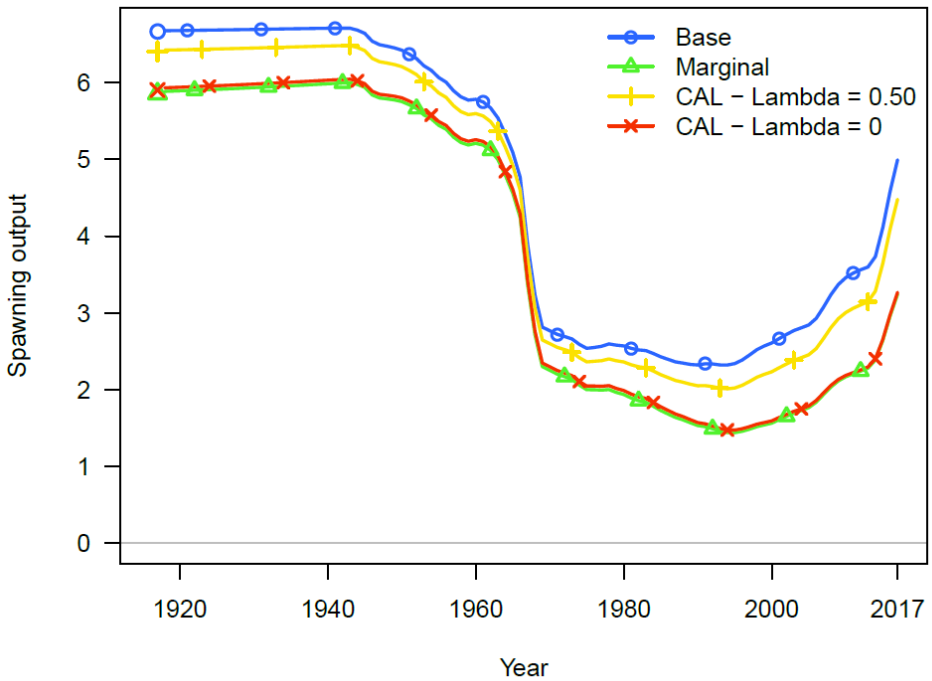
Additional model sensitivity slides

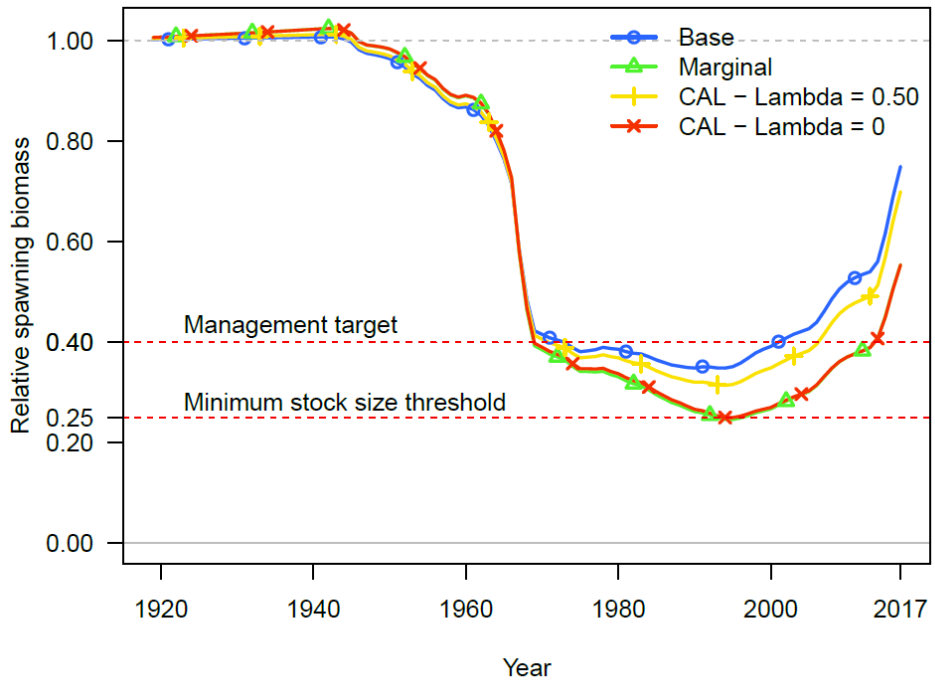
Additional Sensitivities



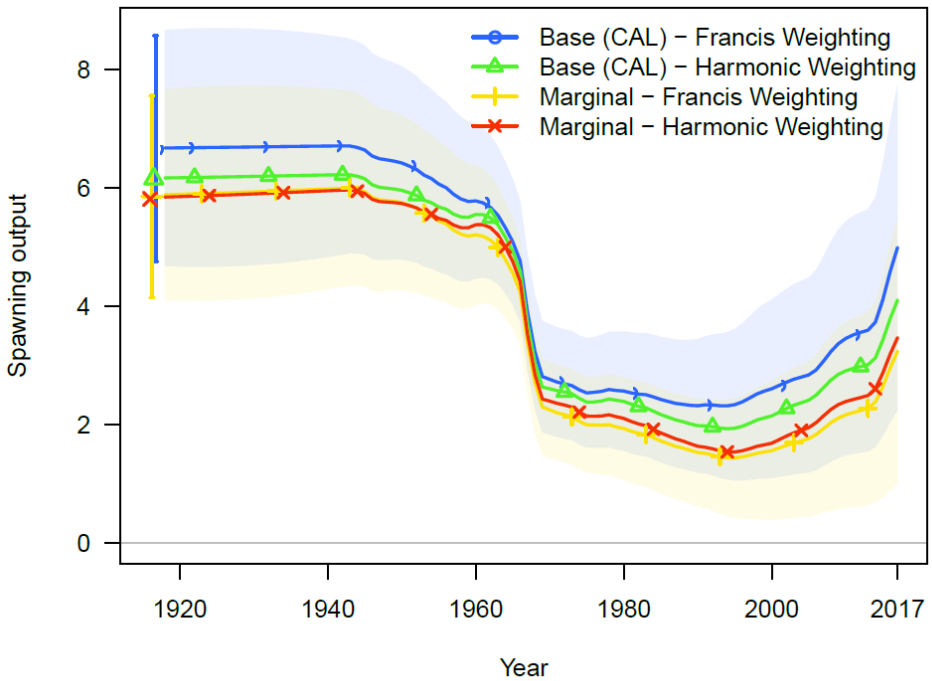


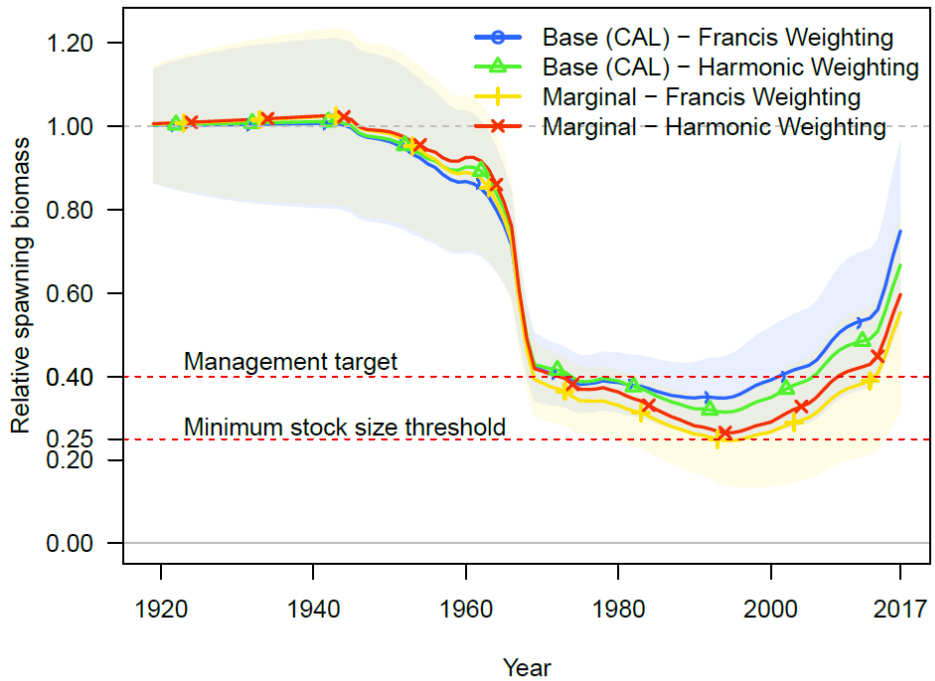
Conditional Age-at-Length vs. Marginal Ages





Weighting Approaches vs. Treatment of Age Data





Comparison of model weight based on using conditional age-at-length vs. marginal ages.

Base model with CAL:

Fleet	Data	Francis Weights	Harmonic Weights
Fishery	Lengths	0.089	0.381
NWFSC shelf-slope	Lengths	0.031	0.471
Fishery	Ages	0.221	0.777
NWFSC shelf-slope	Ages	0.411	0.354

Model with marginal ages:

Fishery	Lengths	0.091	0.379
NWFSC shelf-slope	Lengths	0.032	0.498
Fishery	Ages	0.228	0.743
NWFSC shelf-slope	Ages	0.076	0.262