

Pacific Ocean Perch 2017 Assessment

Modeling and Results

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STAR Panel
June 26-30, 2017



Outline

Parameters

- Model Set-up

- Biology Parameters

- Selectivity & Retention

Fits to the Data

Population Estimates

Profiles & Uncertainties

Model Specifications

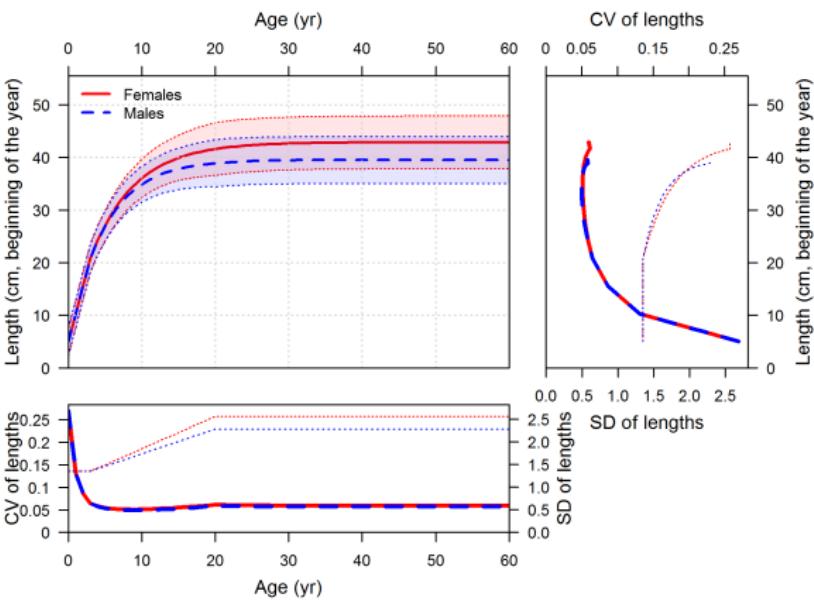
- Stock Synthesis version 3.30.03.05
 - Model starts in 1918, first year landings exceeded 1 metric ton
 - Steepness fixed at 0.50
 - Natural mortality fixed at 0.054 for females and males
 - Recruitment deviations start in 1900
 - Population age plus-group = 60 years (Data age plus-group = 40)
 - Length 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 (L_1)	20.8	20.8	Y-females
Length-at-age max (L_2)	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)	1.04E-5 (1.03E-5)	1.05E-5 (9.88E-6)	N
Weight-at-length (beta)	3.09 (3.10)	3.08 (3.10)	N

* Male parameters estimated as offsets from female parameters.

Estimated Length-at-Age

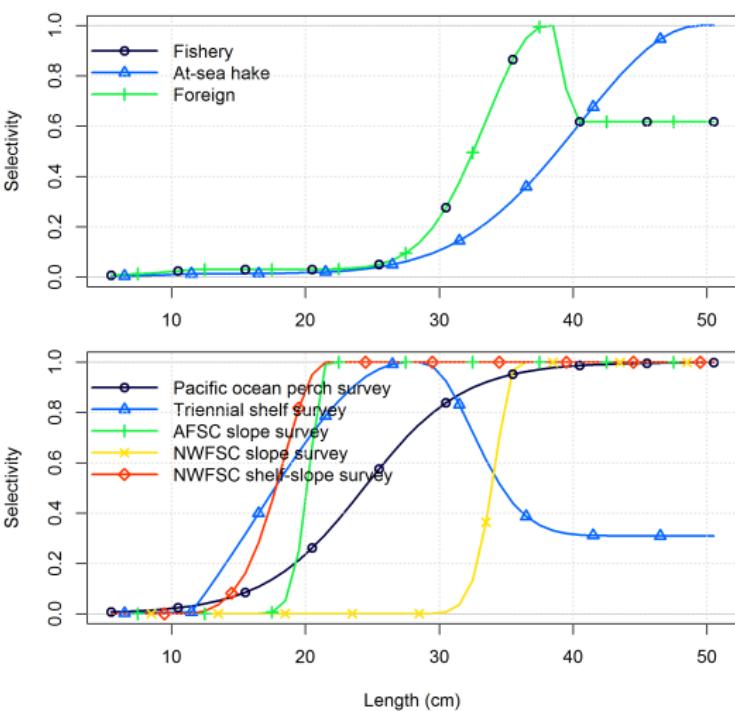




Fleet Structure, Retention, and Selectivity

- 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

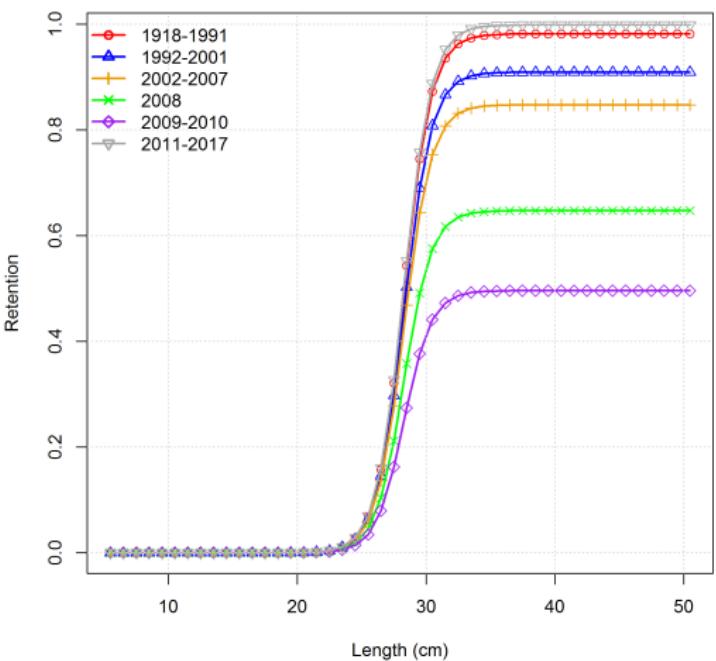
Selectivity



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



Outline

Parameters

Fits to the Data

Removals

Indices

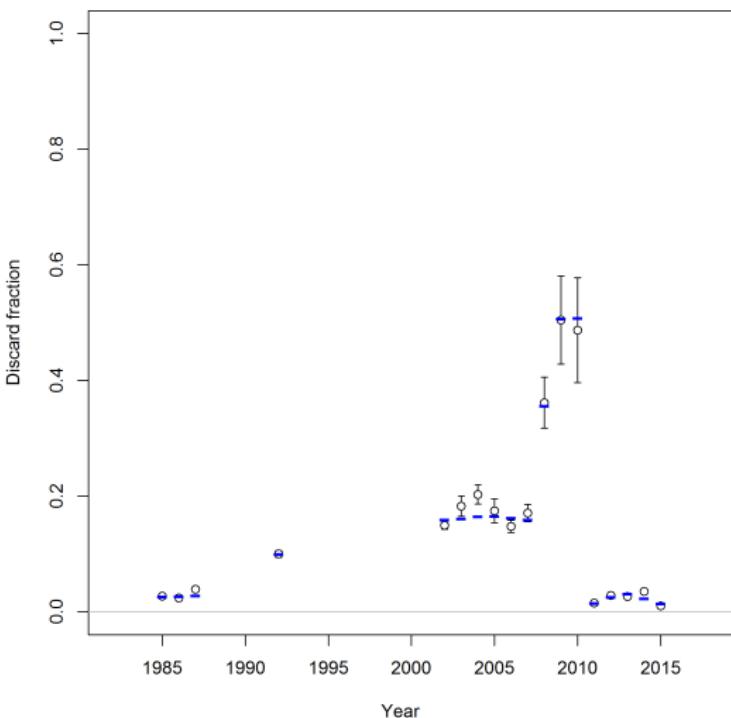
Data Weighting

Composition Data

Population Estimates

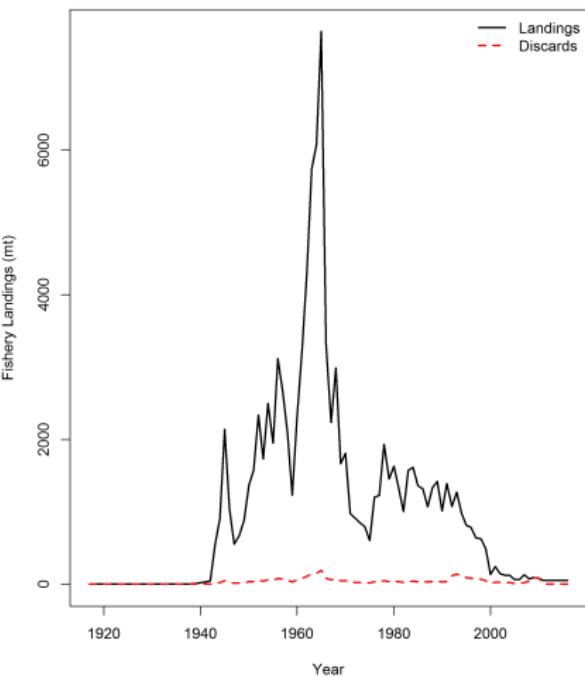
Profiles & Uncertainties

Fit to Fishery Discard Rates



Landings and Estimated Discards

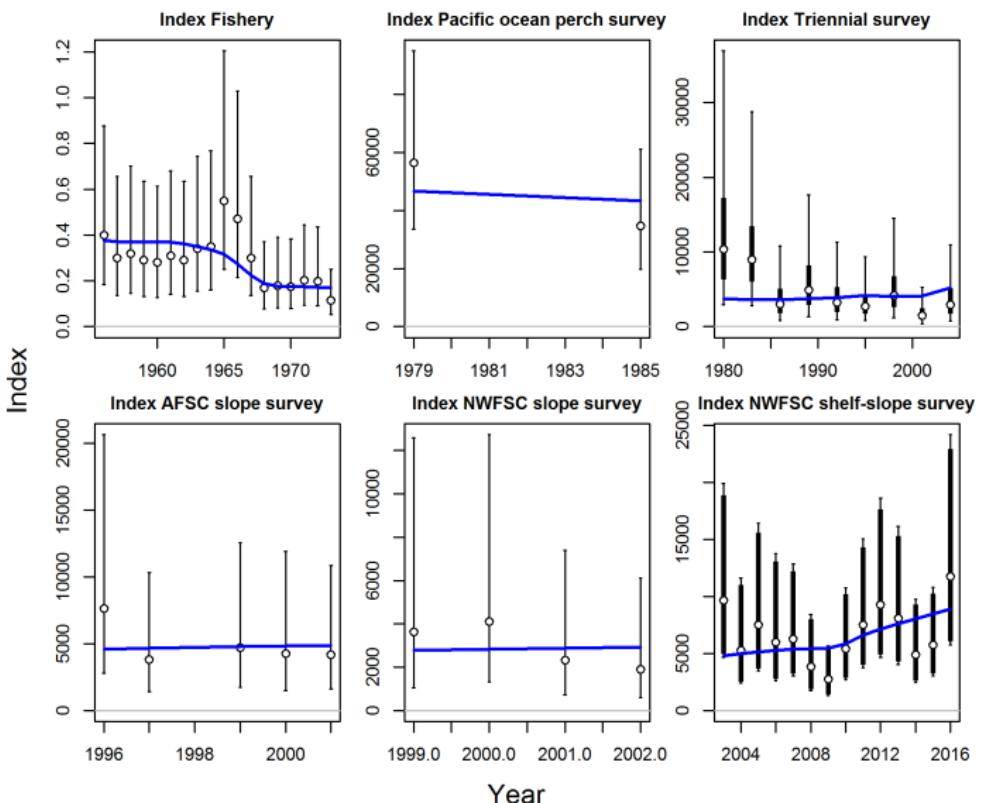
- Estimated discards contributes 3.3% of the total mortality across all years from the fishery.



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



Base Model Data Weights

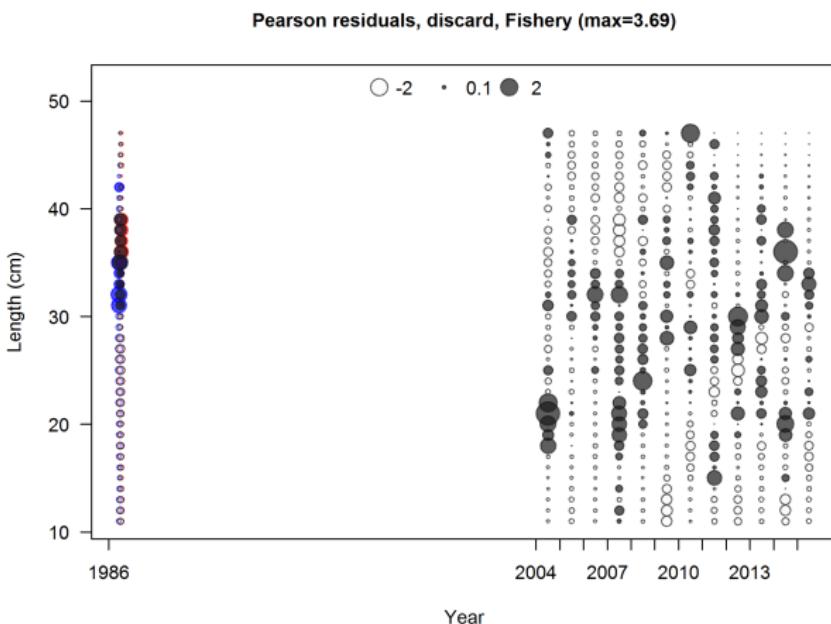
- Base model weighted according to Francis weighting approach

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

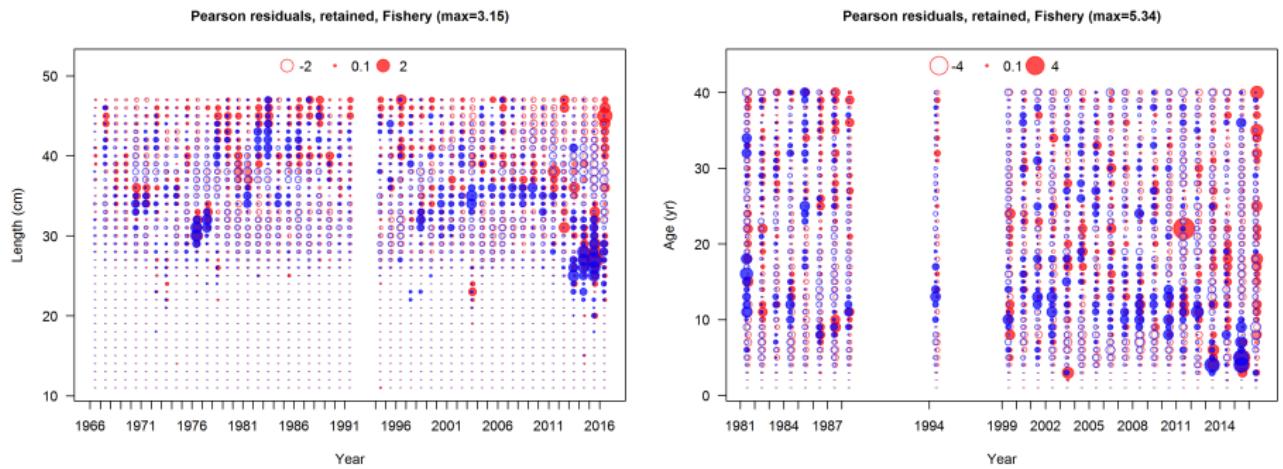
* The Francis method suggested up-weighting data from the Pacific ocean perch survey to values > 1.



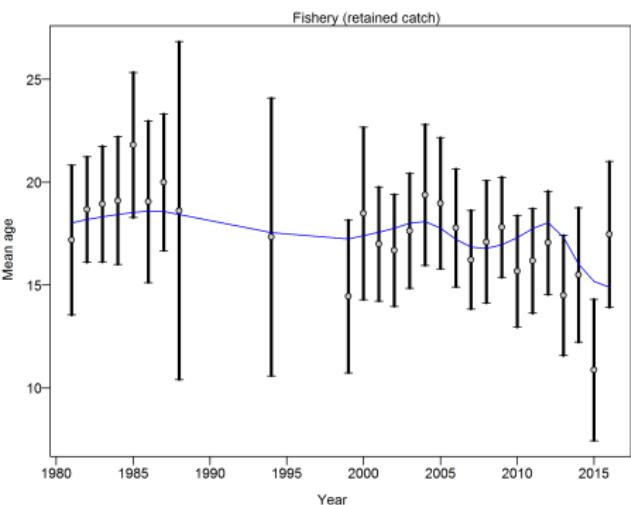
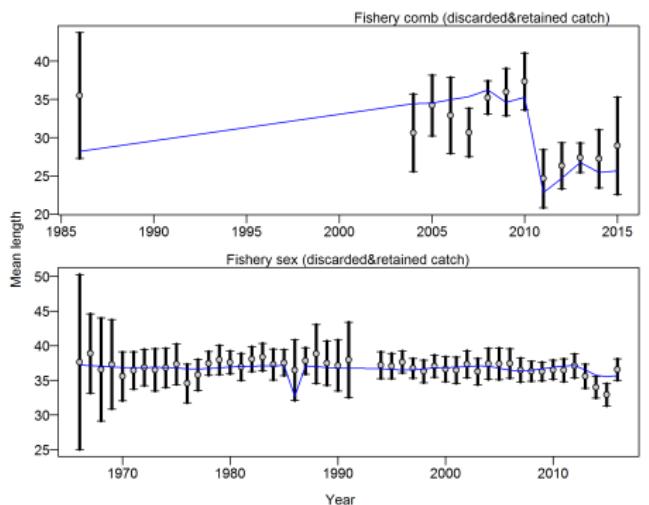
Fishery: Length and Age Composition



Fishery: Length and Age Composition

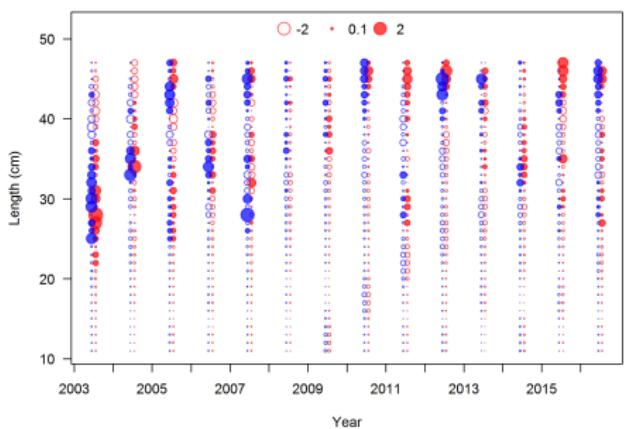


Fishery: Mean Length and Age

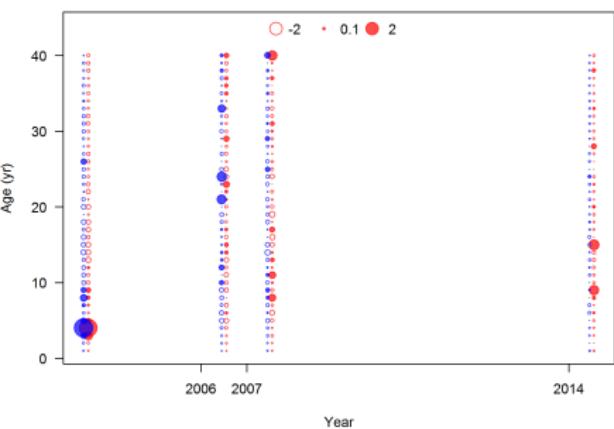


At-sea hake: Length and Age Composition

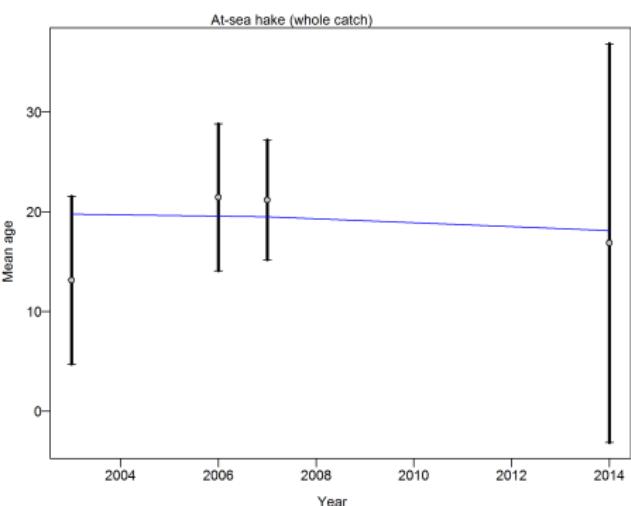
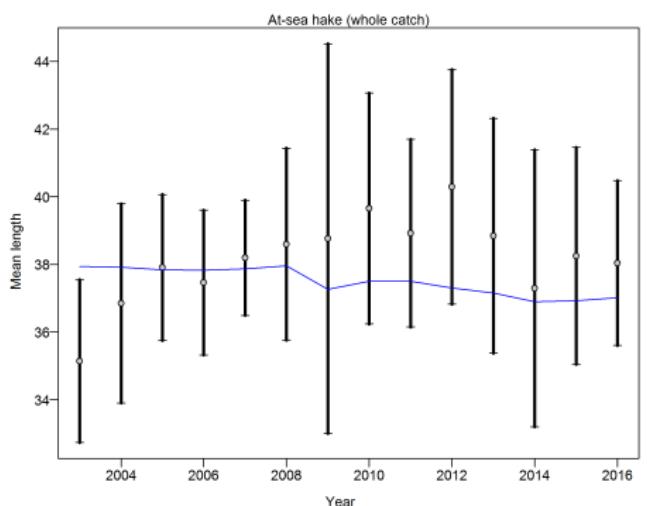
Pearson residuals, whole catch, At-sea hake (max=2.37)



Pearson residuals, whole catch, At-sea hake (max=4.03)

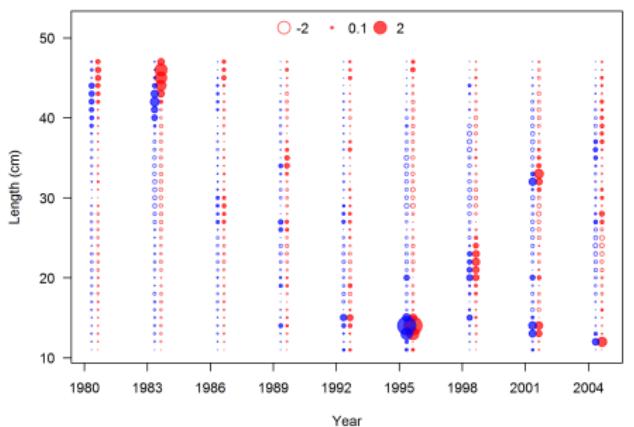


At-sea hake: Mean Length and Age

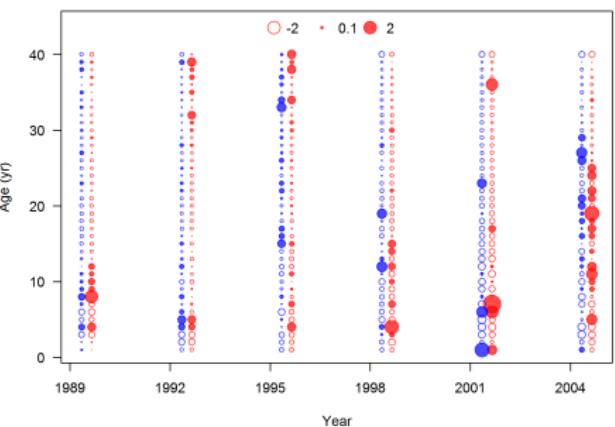


Triennial shelf survey: Length and Age Composition

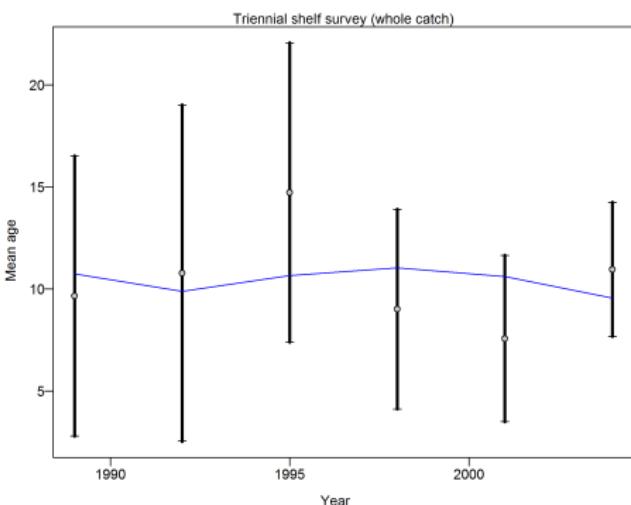
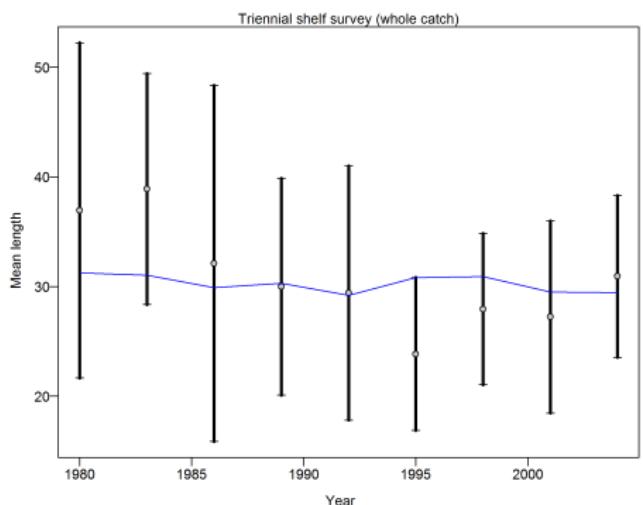
Pearson residuals, whole catch, Triennial shelf survey (max=4.01)



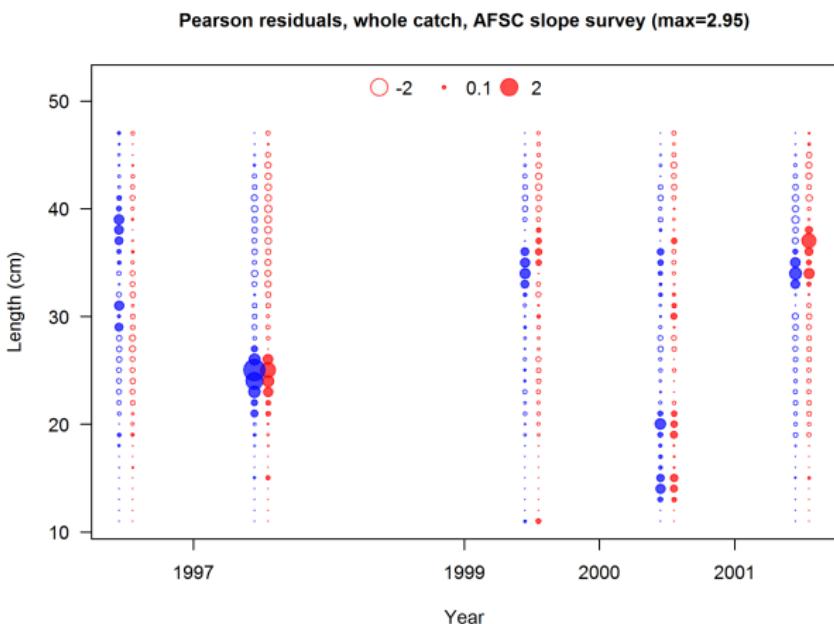
Pearson residuals, whole catch, Triennial shelf survey (max=3.76)



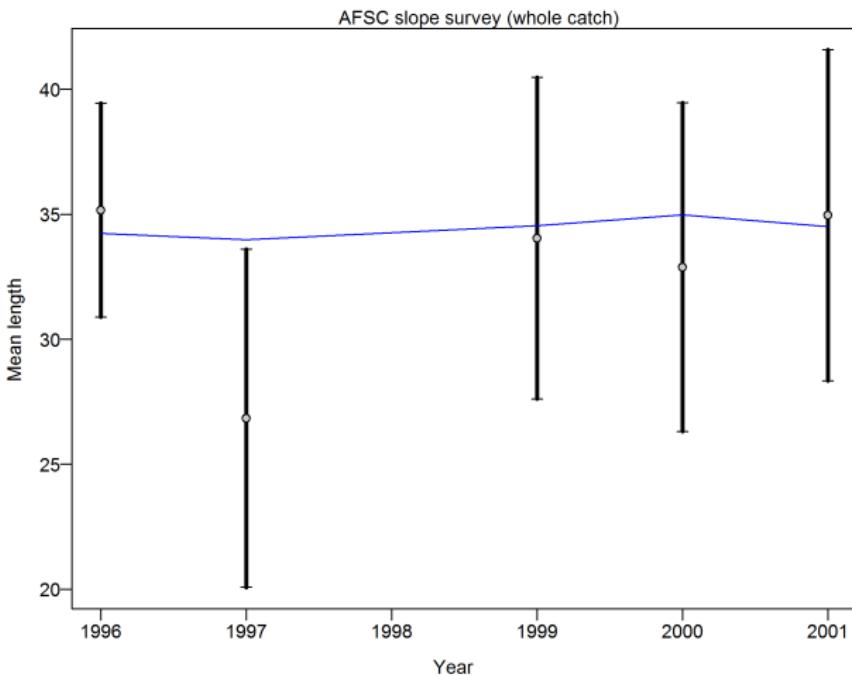
Triennial shelf survey: Mean Length and Age



AFSC slope survey: Length Composition

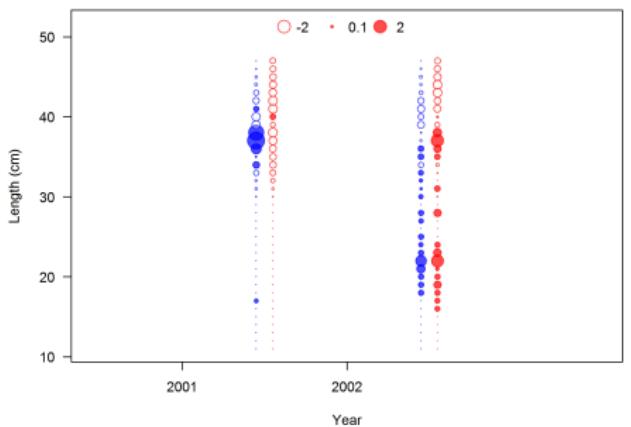


AFSC slope survey: Mean Length and Age

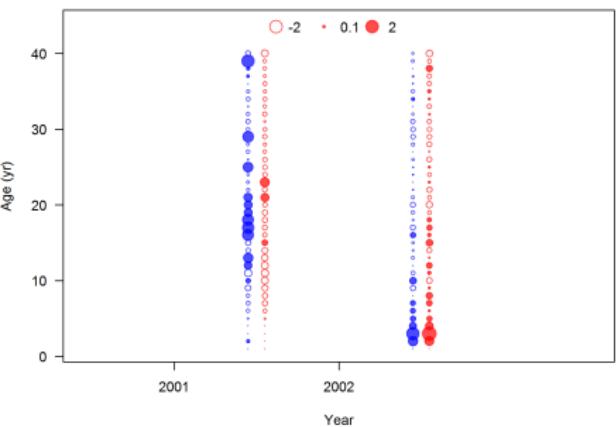


NWFSC slope survey: Length and Age Composition

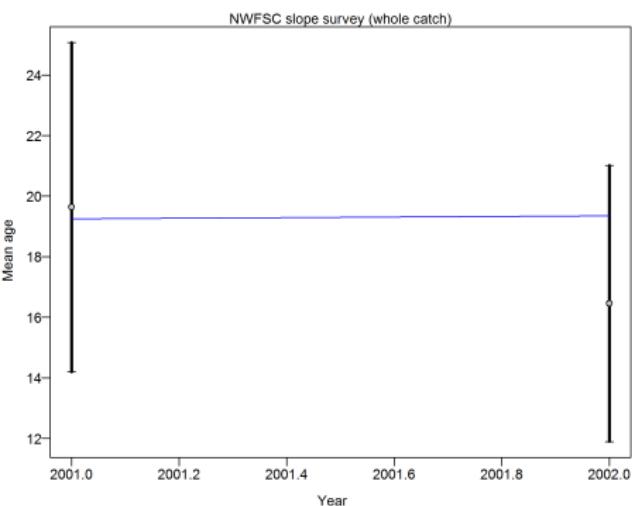
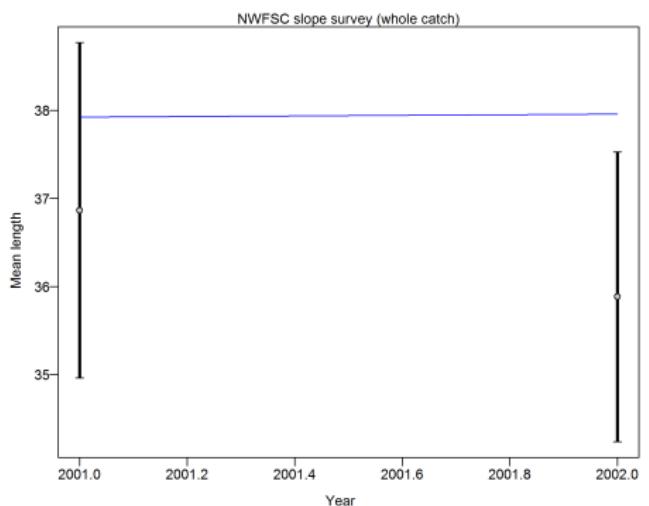
Pearson residuals, whole catch, NWFSC slope survey (max=3.47)



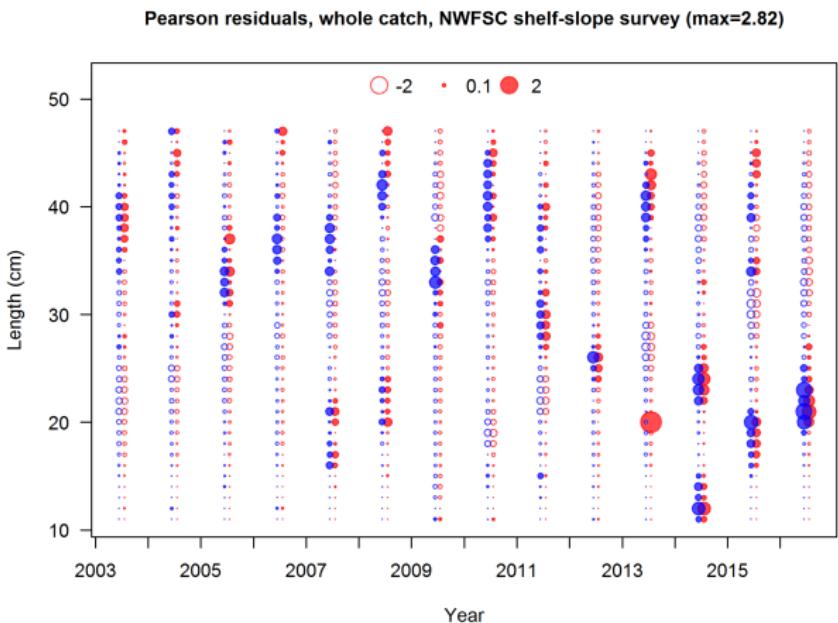
Pearson residuals, whole catch, NWFSC slope survey (max=2.34)



NWFSC slope survey: Mean Length and Age

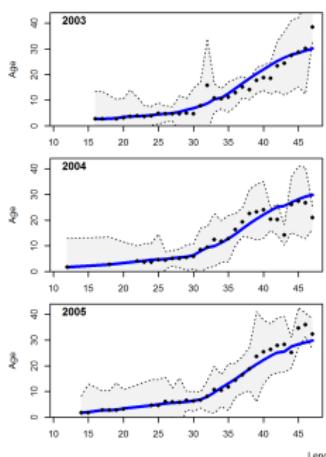


NWFSC shelf-slope survey: Length Composition

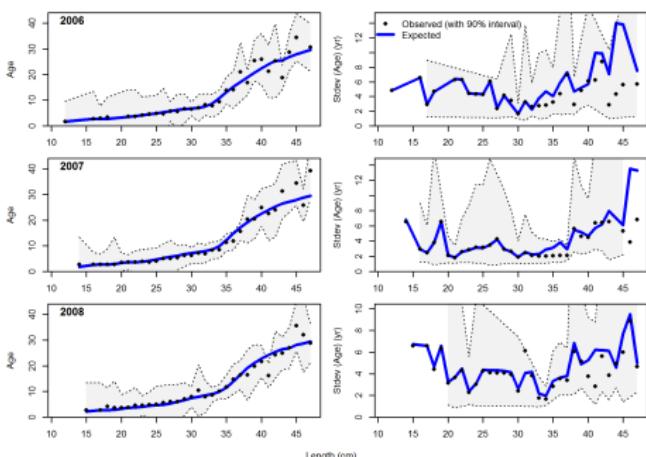


NWFSC shelf-slope survey: Conditional Age-at-Length Composition

Conditional AAI plot, whole catch, NMFS shelf-slope survey

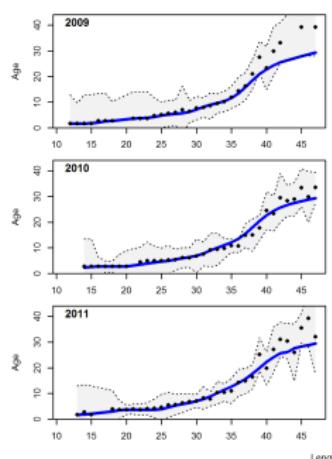


Conditional AAI plot, whole catch, NWESCS shelf-slope survey

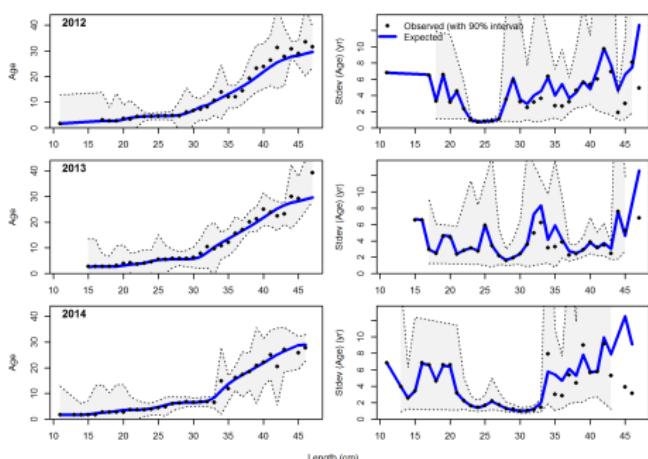


NWFSC shelf-slope survey: Conditional Age-at-Length Composition

Conditional AAI plot: whole catch, NMFS shelf-slope survey

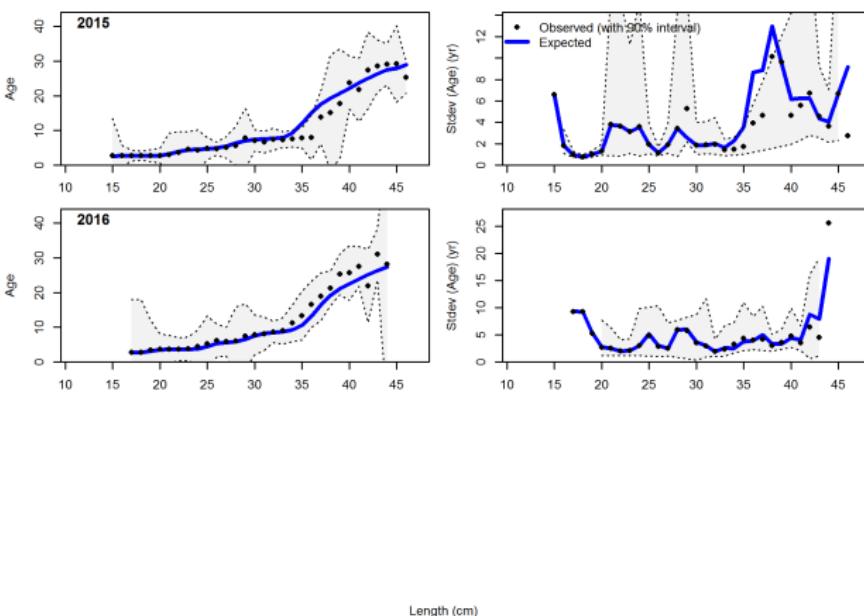


Conditional AAI plot, whole catch, NWESCS shelf-slope survey

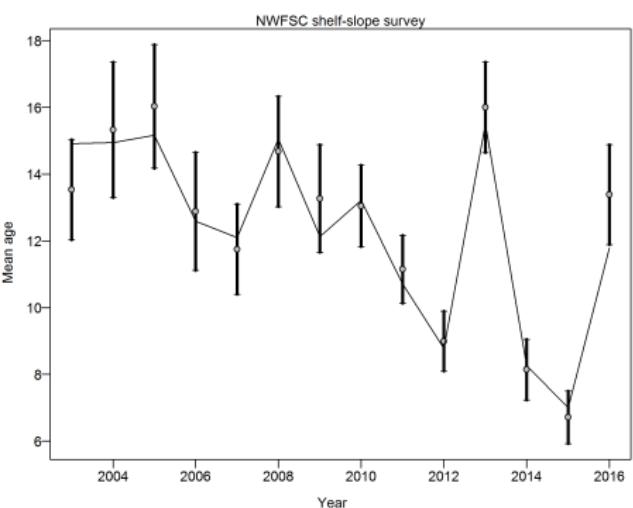
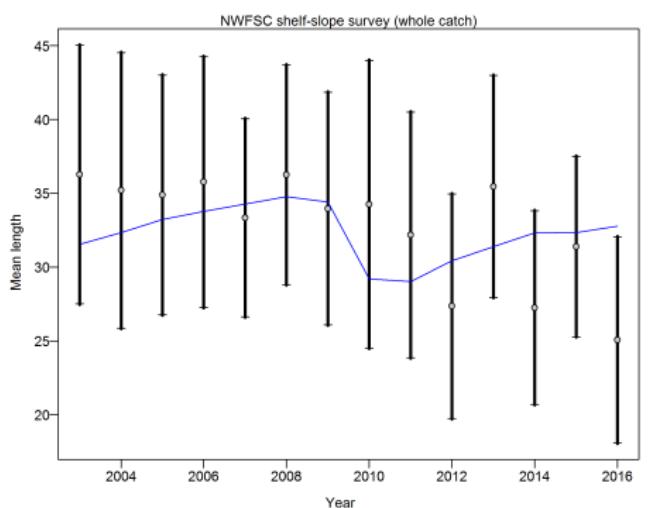


NWFSC shelf-slope survey: Conditional Age-at-Length Composition

Conditional AAI plot, whole catch, NWESC shelf-slope survey

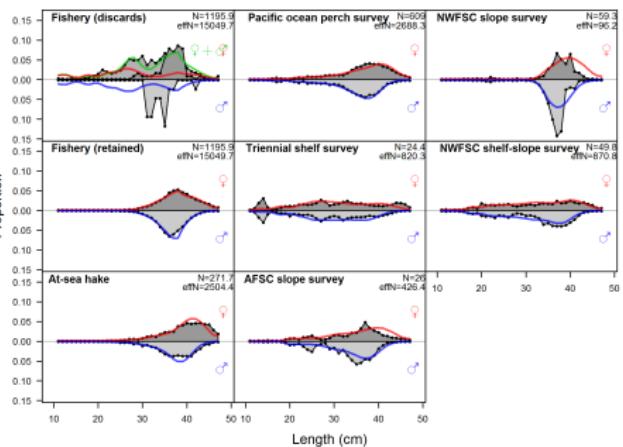


NWFSC shelf-slope survey: Mean Length and Age

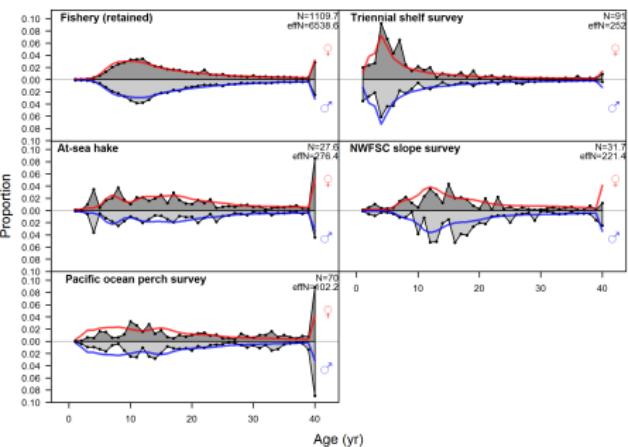


Aggregated Length and Age Composition Fits

Length comps. aggregated across time by fleet



Age comps. aggregated across time by fleet



Outline

Parameters

Fits to the Data

Population Estimates

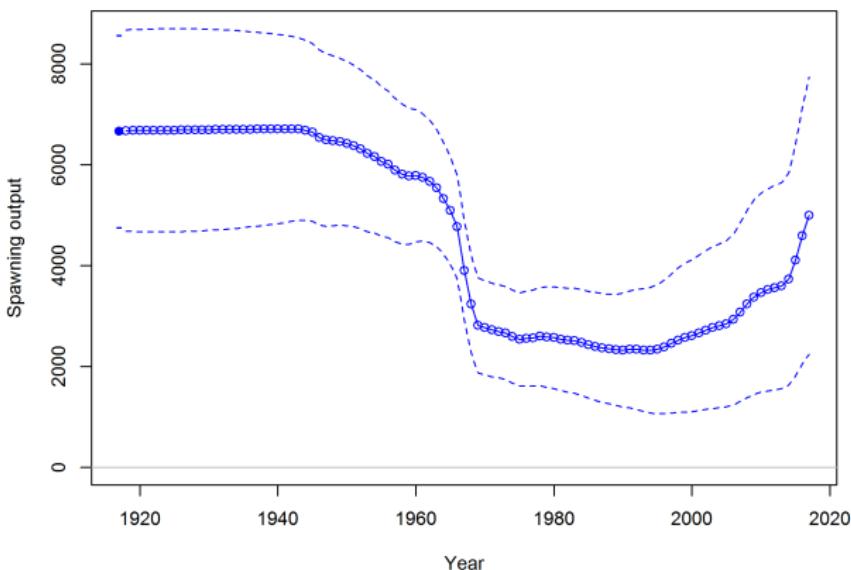
Size and Scale

Recruitment

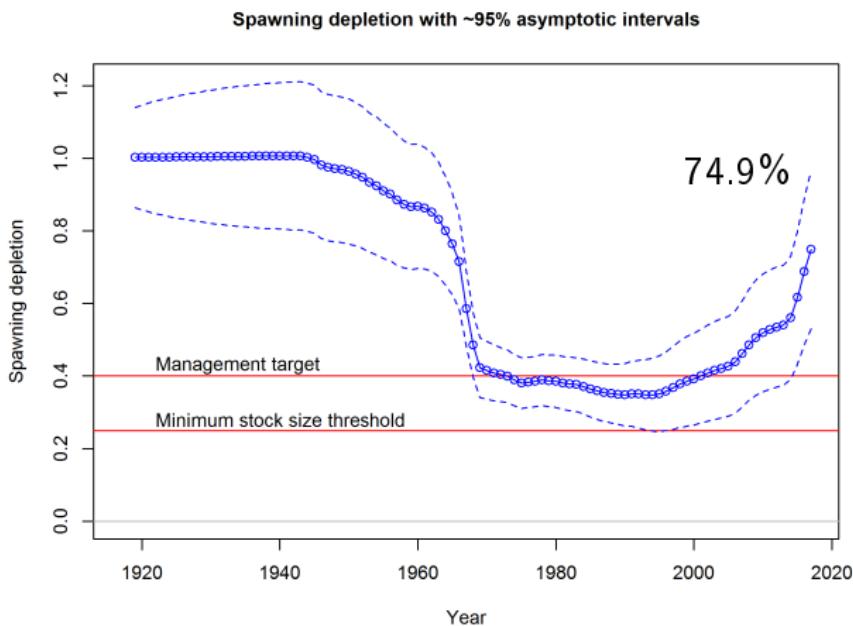
Profiles & Uncertainties

Spawning Output

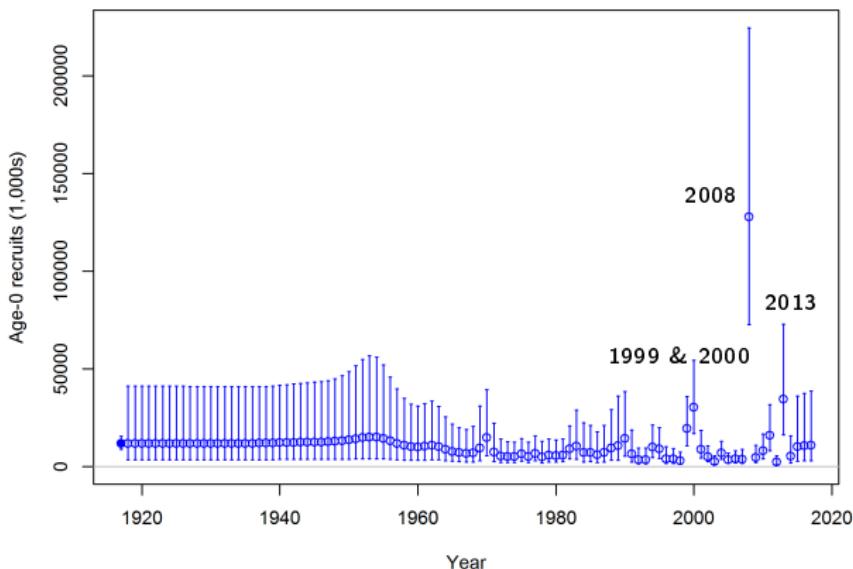
Spawning output with ~95% asymptotic intervals



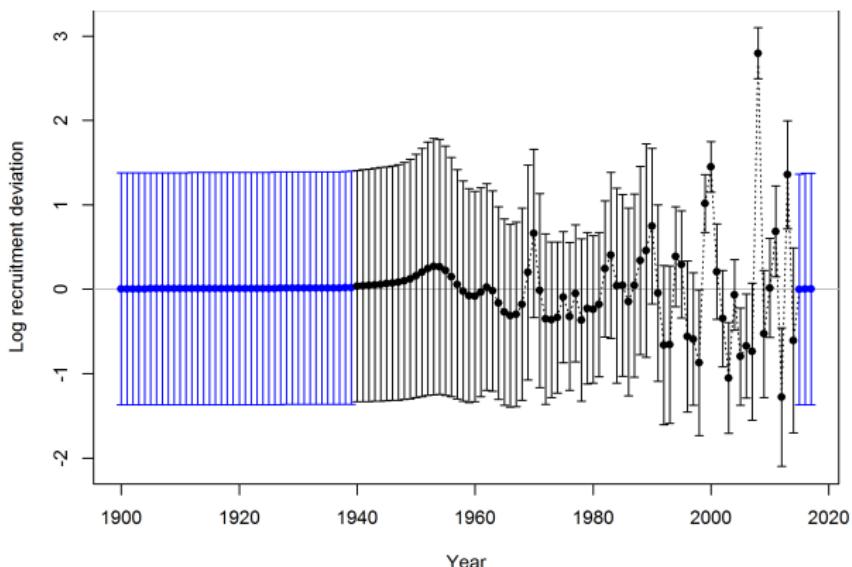
Relative Spawning Output (Depletion)



Estimated Annual Recruitment



Estimated Annual Recruitment Deviations



Parameters
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Fits to the Data
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Population Estimates
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Profiles & Uncertainties
oooooooooooo

Appendix
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Outline

Parameters

Fits to the Data

Population Estimates

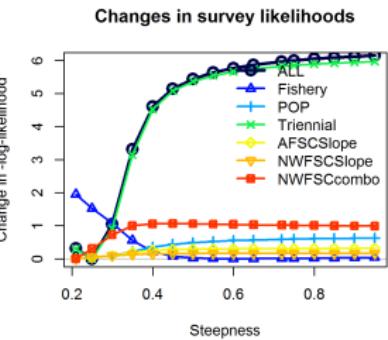
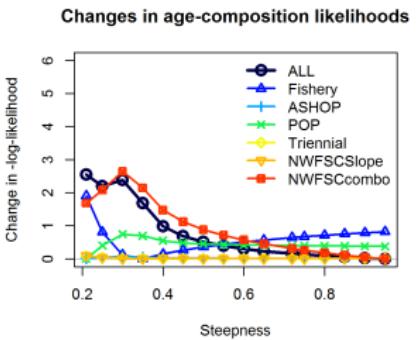
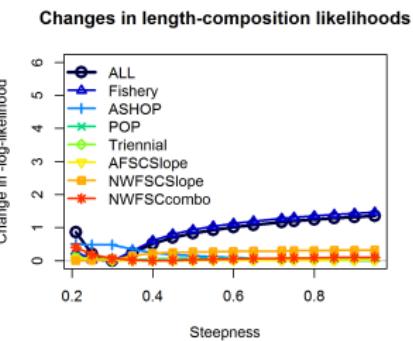
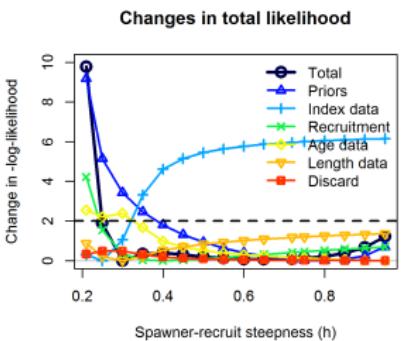
Profiles & Uncertainties

Profiles

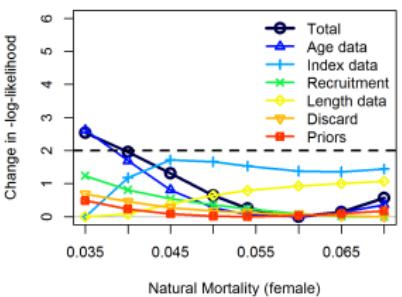
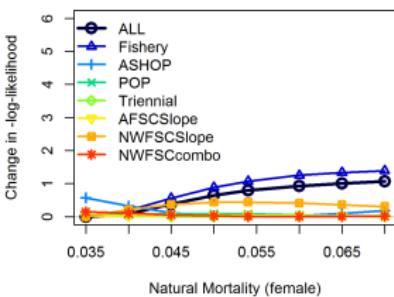
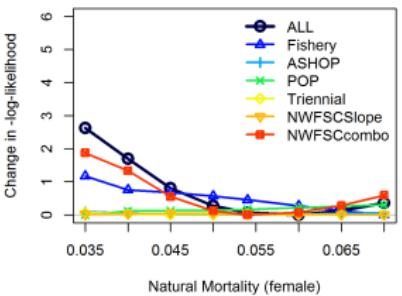
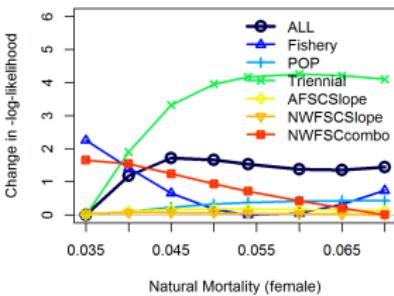
Retrospectives

Sensitivities

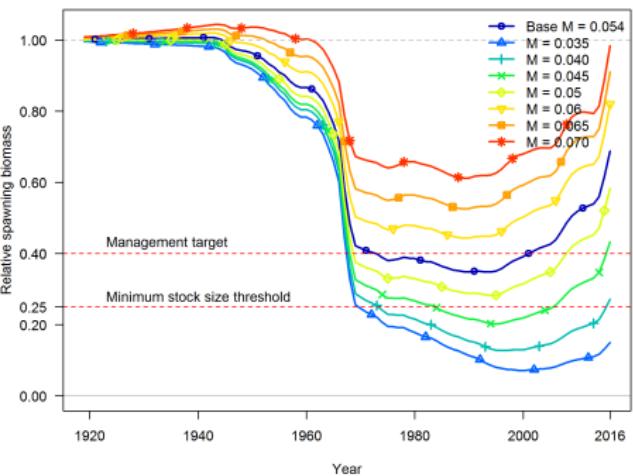
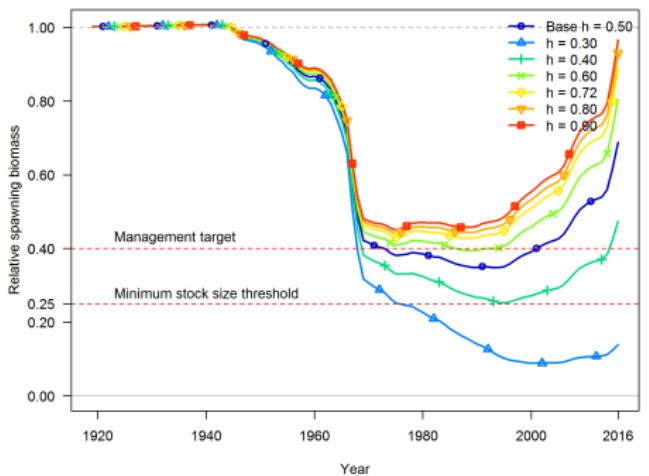
Steepness Profile



Natural Mortality Profile

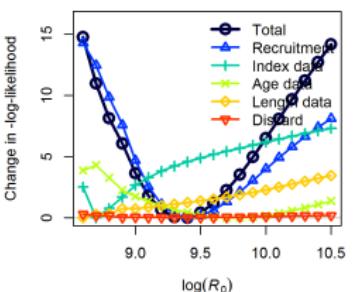
Changes in total likelihoods**Changes in length-composition likelihoods****Changes in age-composition likelihoods****Changes in survey likelihoods**

Population Trajectories

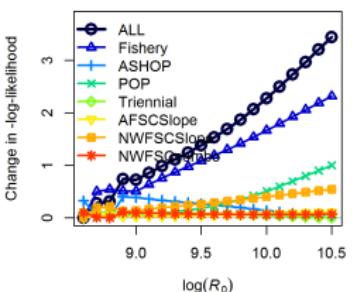


R_0 Profile

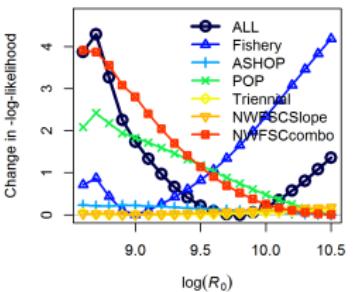
Changes in total likelihood



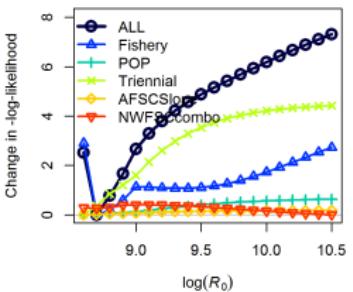
Changes in length-composition likelihood



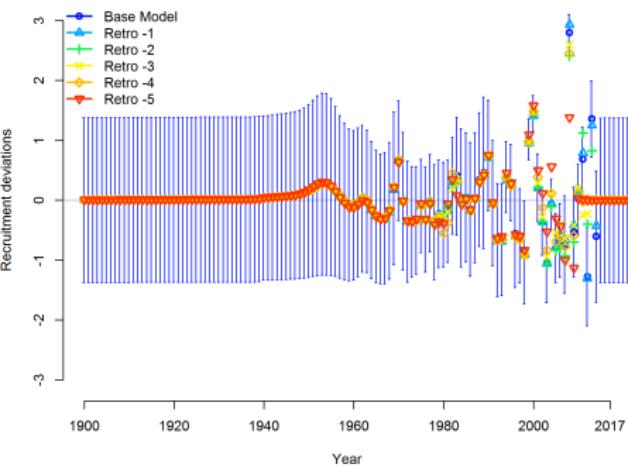
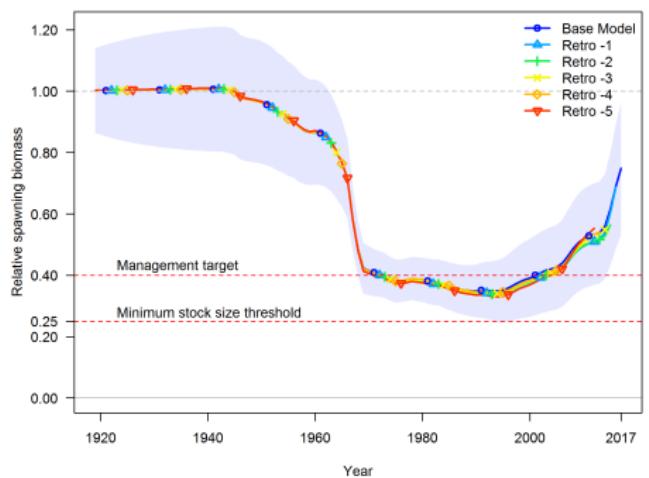
Changes in age-composition likelihoods



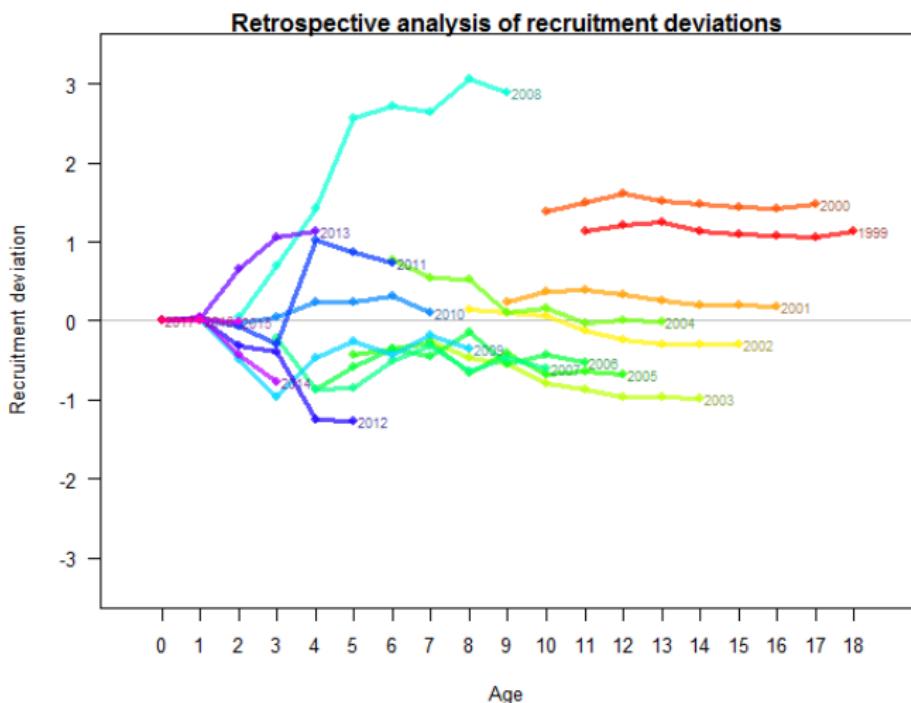
Changes in survey likelihoods



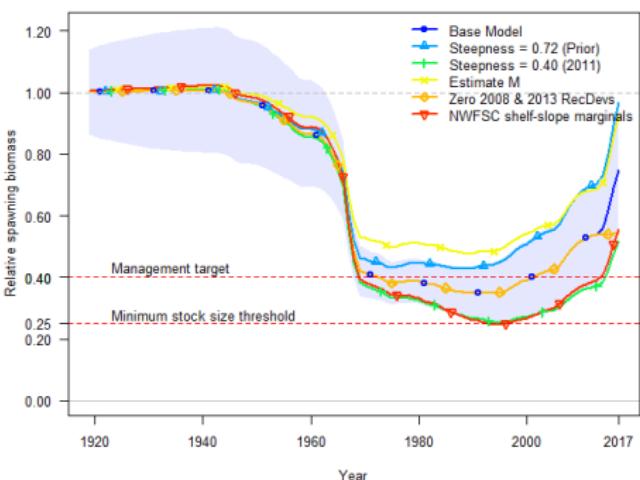
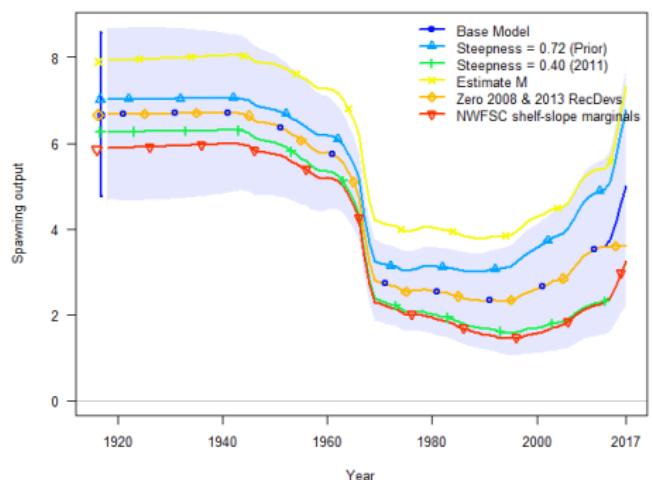
Retrospective Pattern



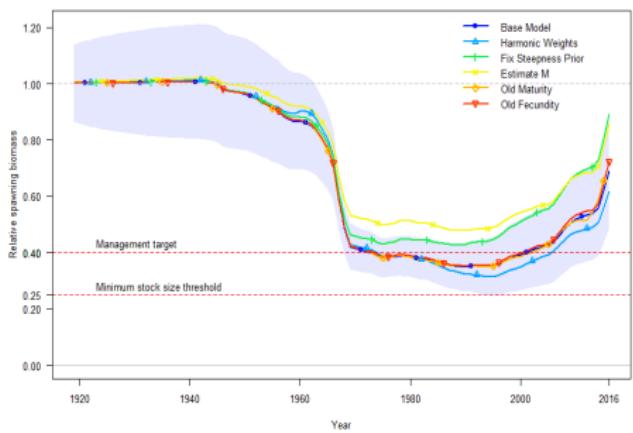
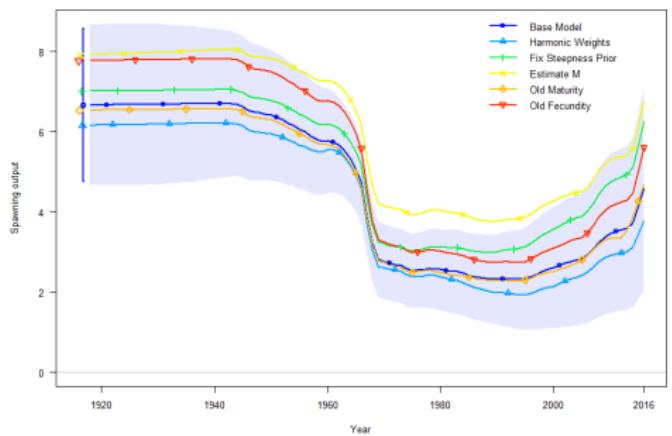
Retrospective in Recruitment Strength



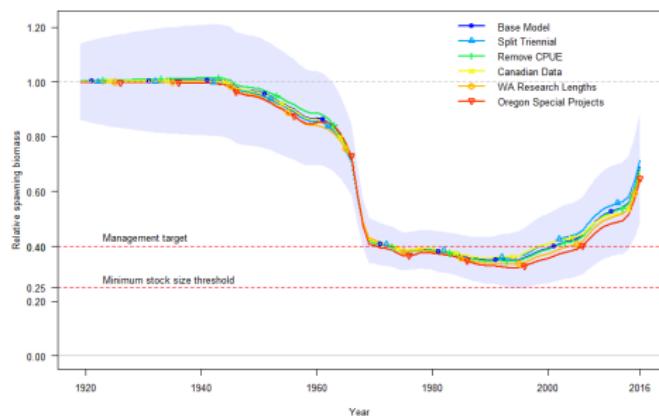
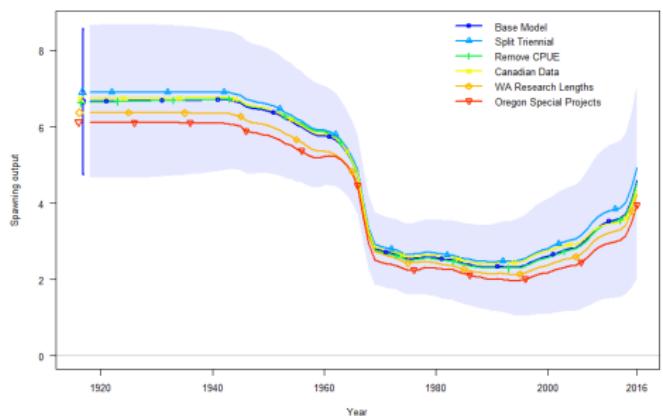
Model Sensitivities



Sensitivities-2



Sensitivities-3

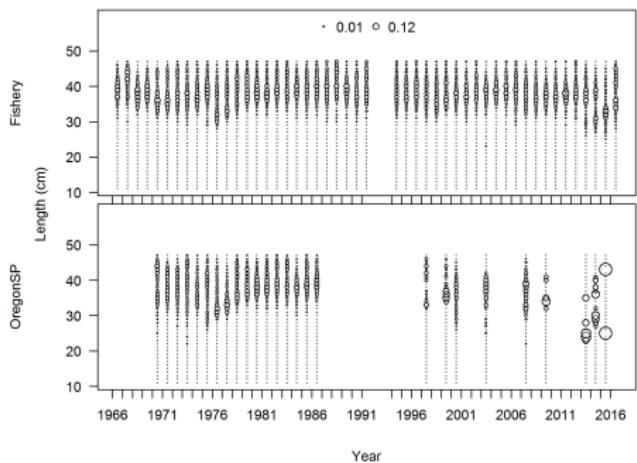


Conclusion of Modeling & Results

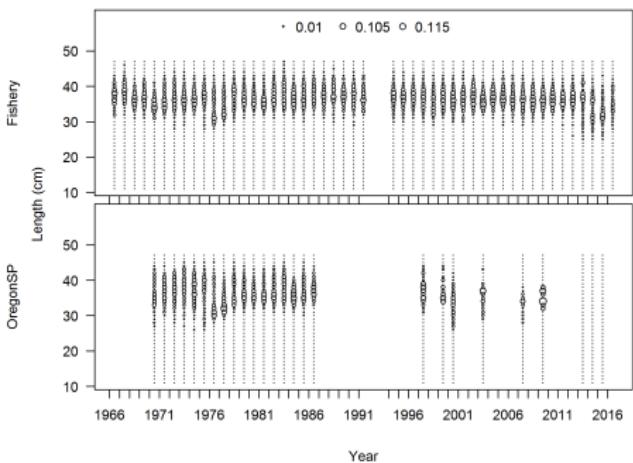
Additional data slides

Oregon Special Projects - Length Data

Length comp data, female, retained, comparing across fleets

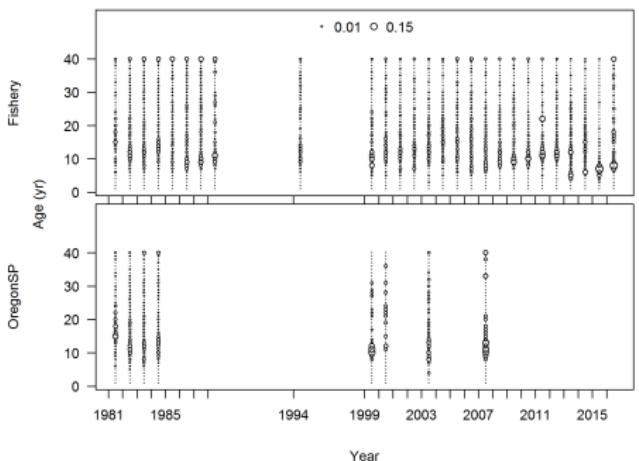


Length comp data, male, retained, comparing across fleets

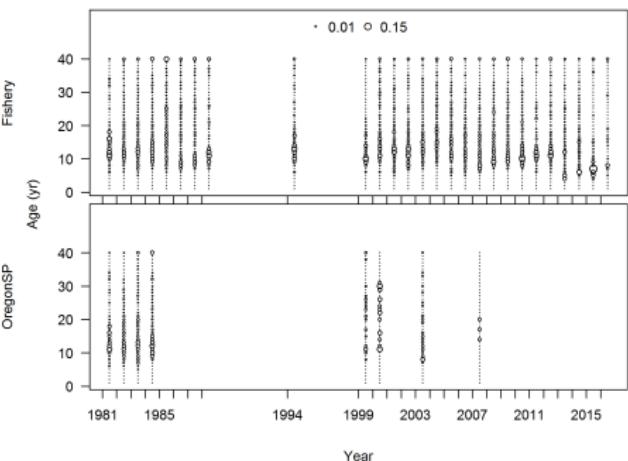


Oregon Special Projects - Age Data

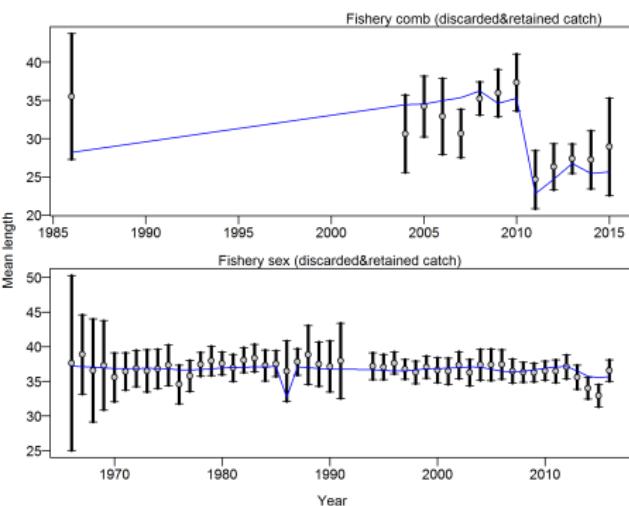
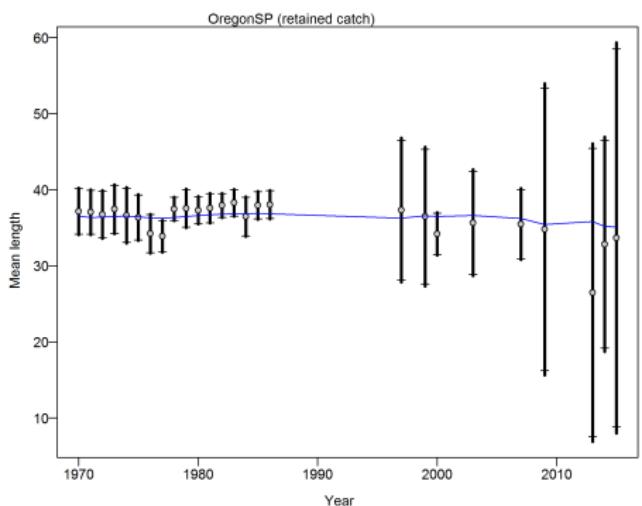
Age comp data, female, retained, comparing across fleets



Age comp data, male, retained, comparing across fleets

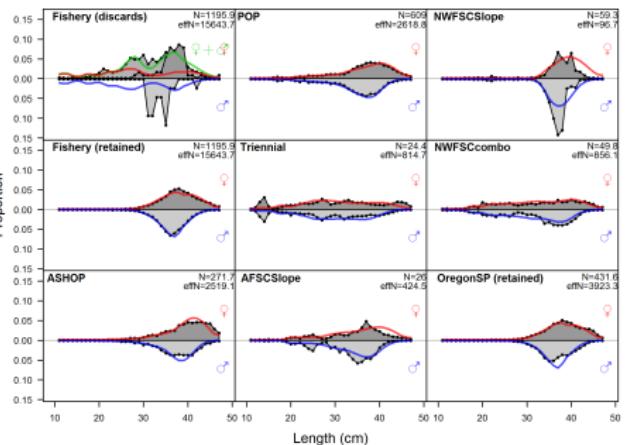


Oregon Special Projects - Mean Length Comparison

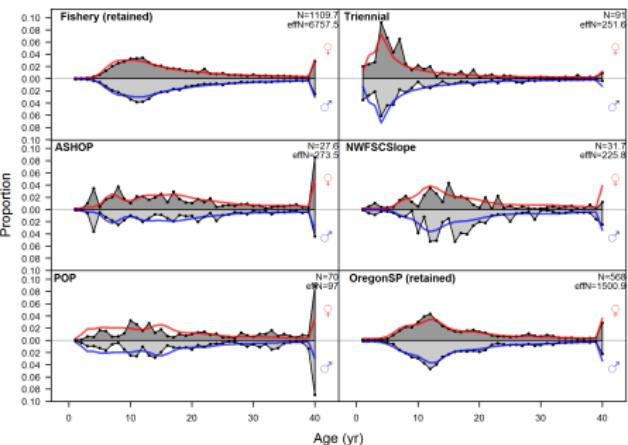


Oregon Special Projects - Aggregated Fits

Length comps. aggregated across time by fleet

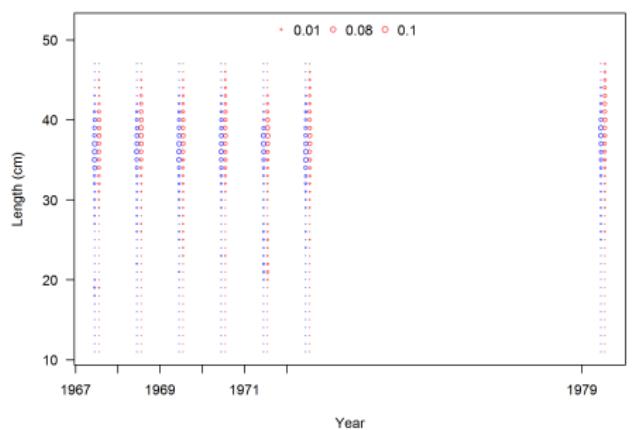


Age comps. aggregated across time by fleet

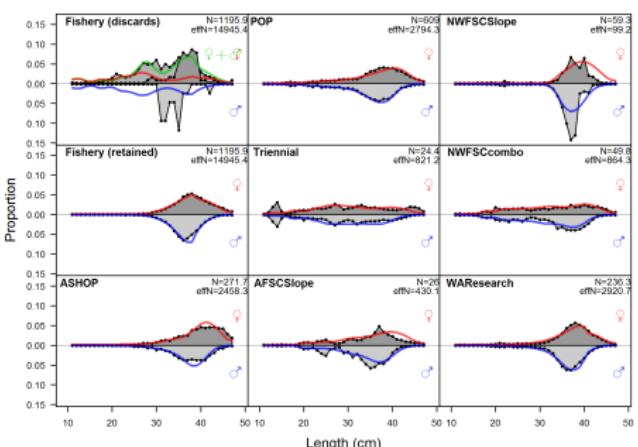


Washington Research Lengths

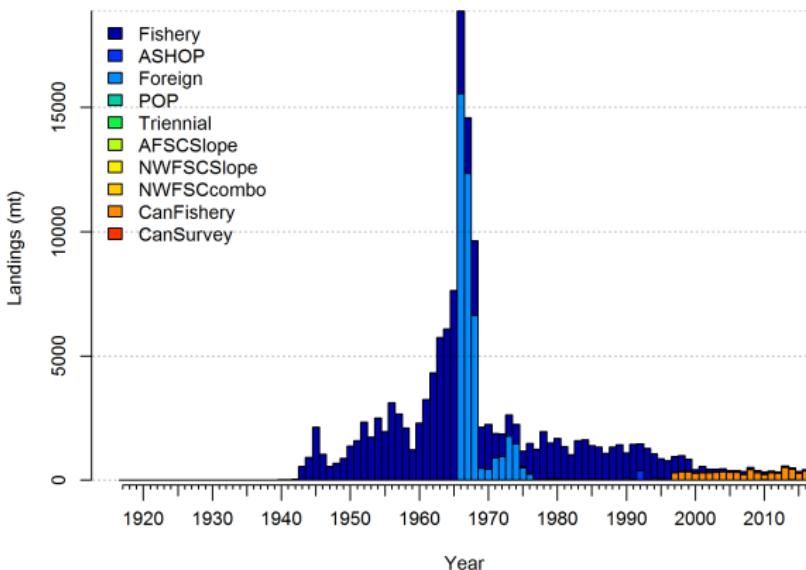
Length comp data, whole catch, WAResearch (max=0.07)



Length comps, aggregated across time by fleet

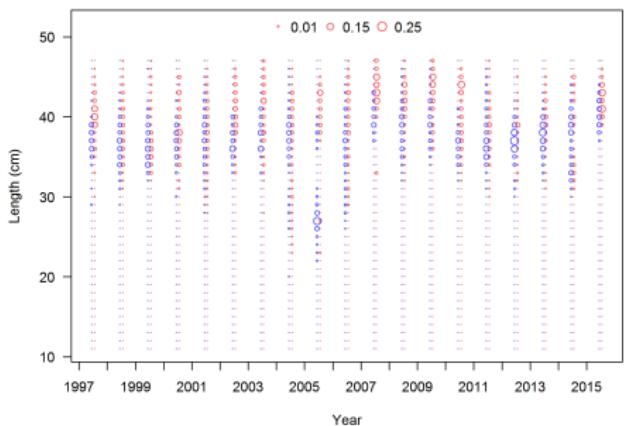


Landings with Canada

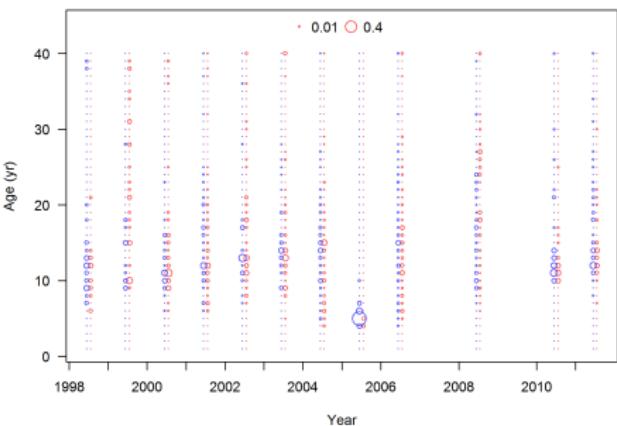


Canadian Fishery Data

Length comp data, whole catch, CanFishery (max=0.2)

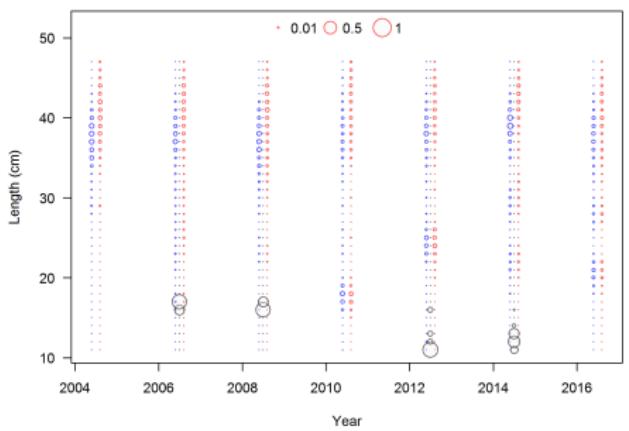


Age comp data, whole catch, CanFishery (max=0.58)

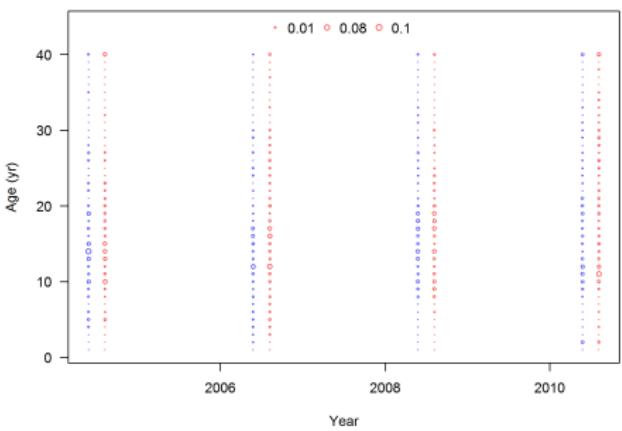


Canadian Survey Data

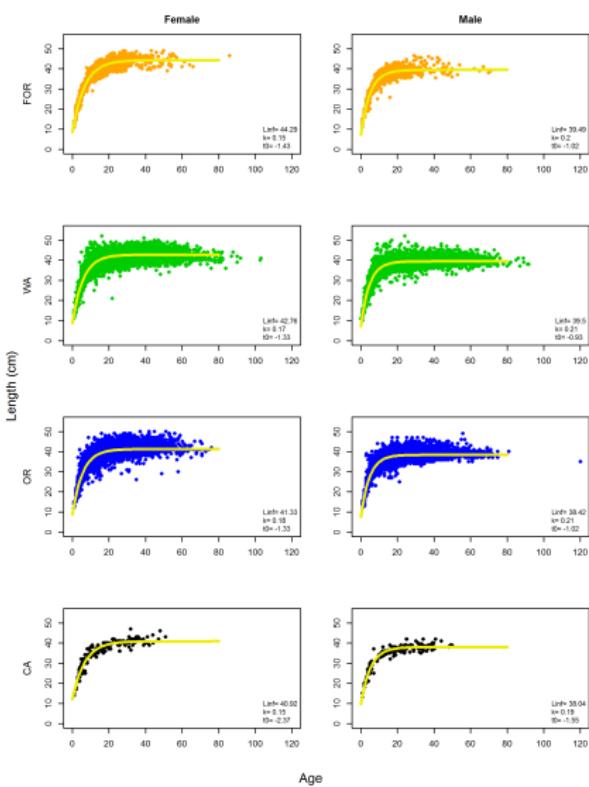
Length comp data, whole catch, CanSurvey (max=0.7)



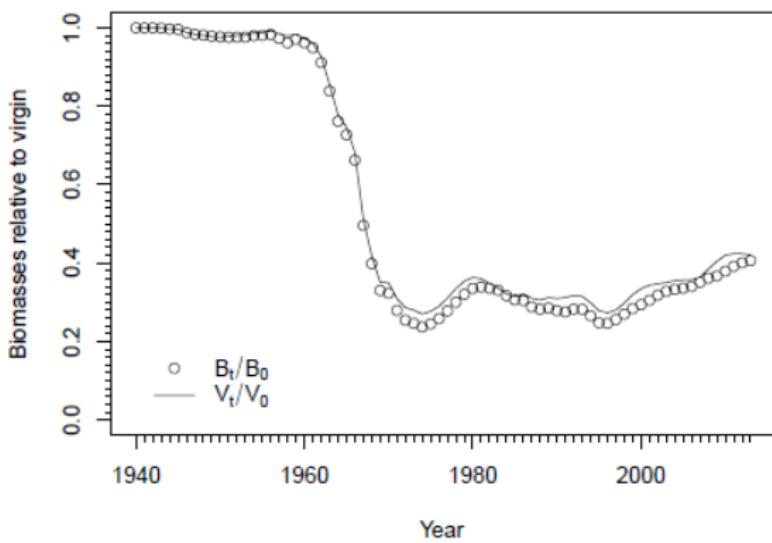
Age comp data, whole catch, CanSurvey (max=0.08)

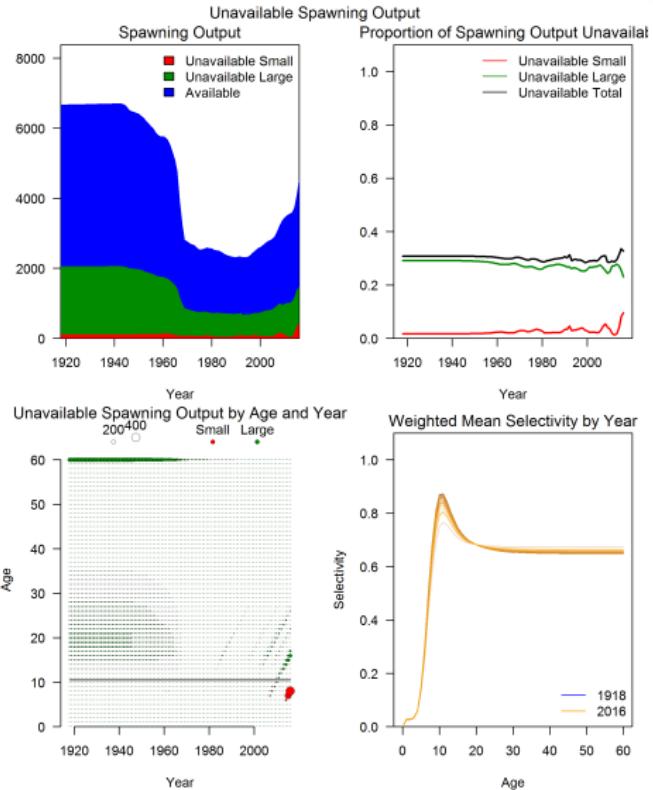


Length-at-Age by Area



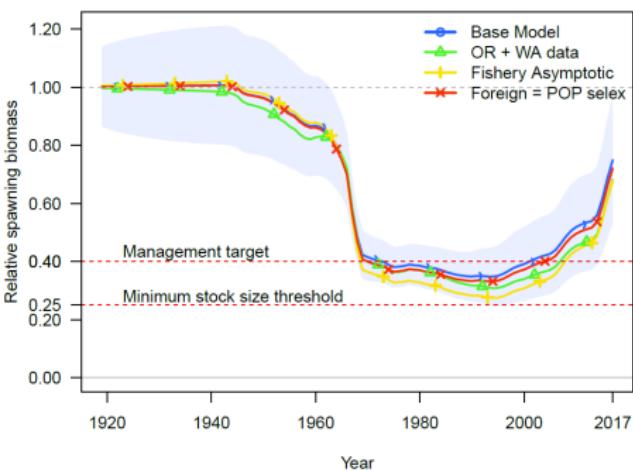
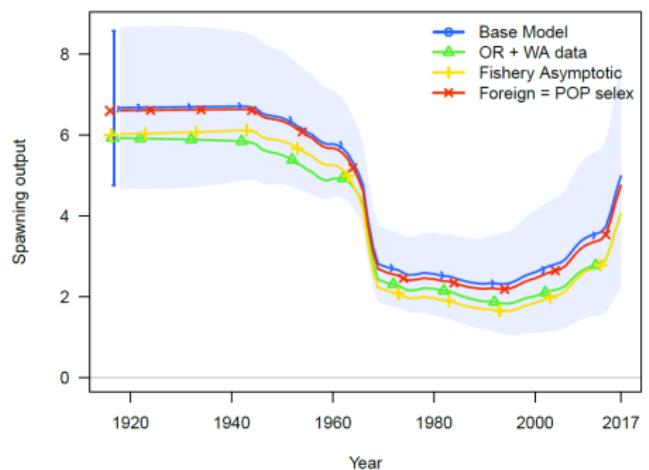
Depletion of Canadian British Columbia Stock





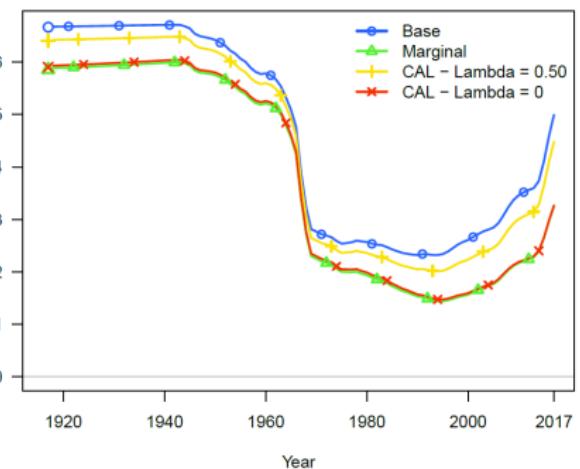
Additional model sensitivity slides

Additional Sensitivities

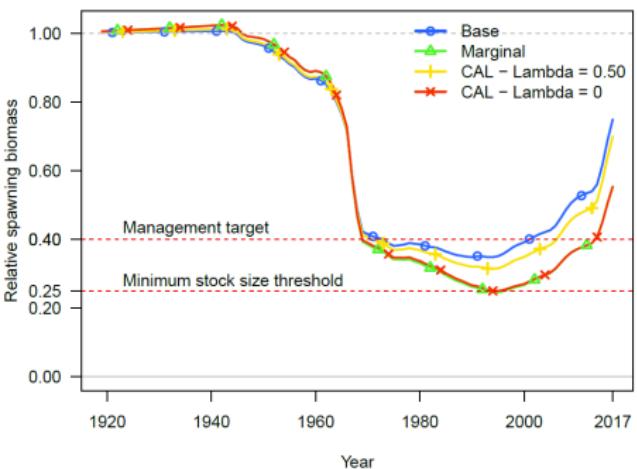


Conditional Age-at-Length vs. Marginal Ages

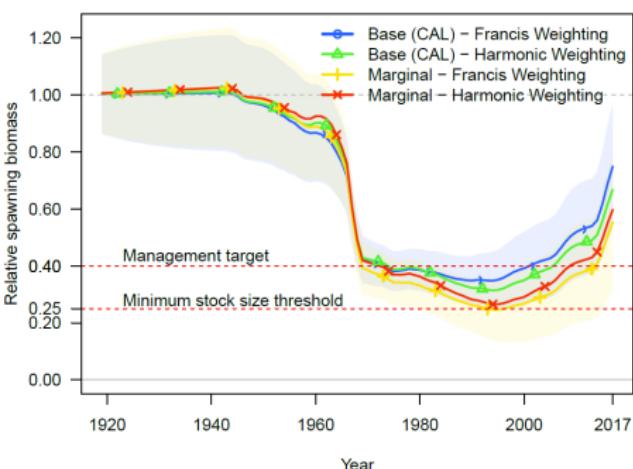
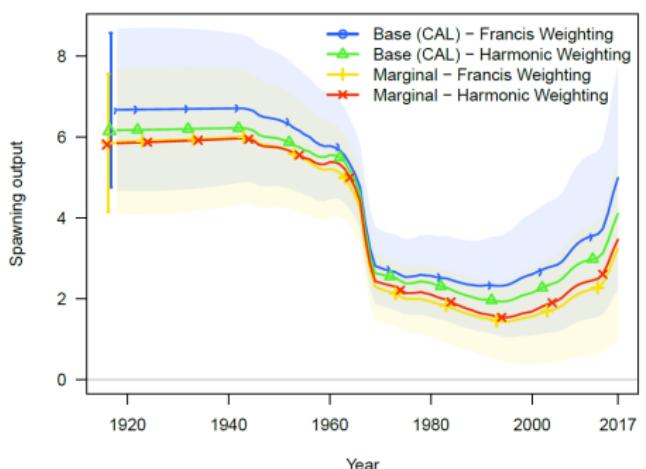
Spawning output



Relative spawning biomass



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