Pacific ocean perch 2017 Assessment

Biology and Data

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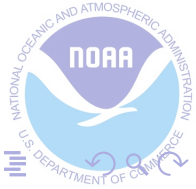
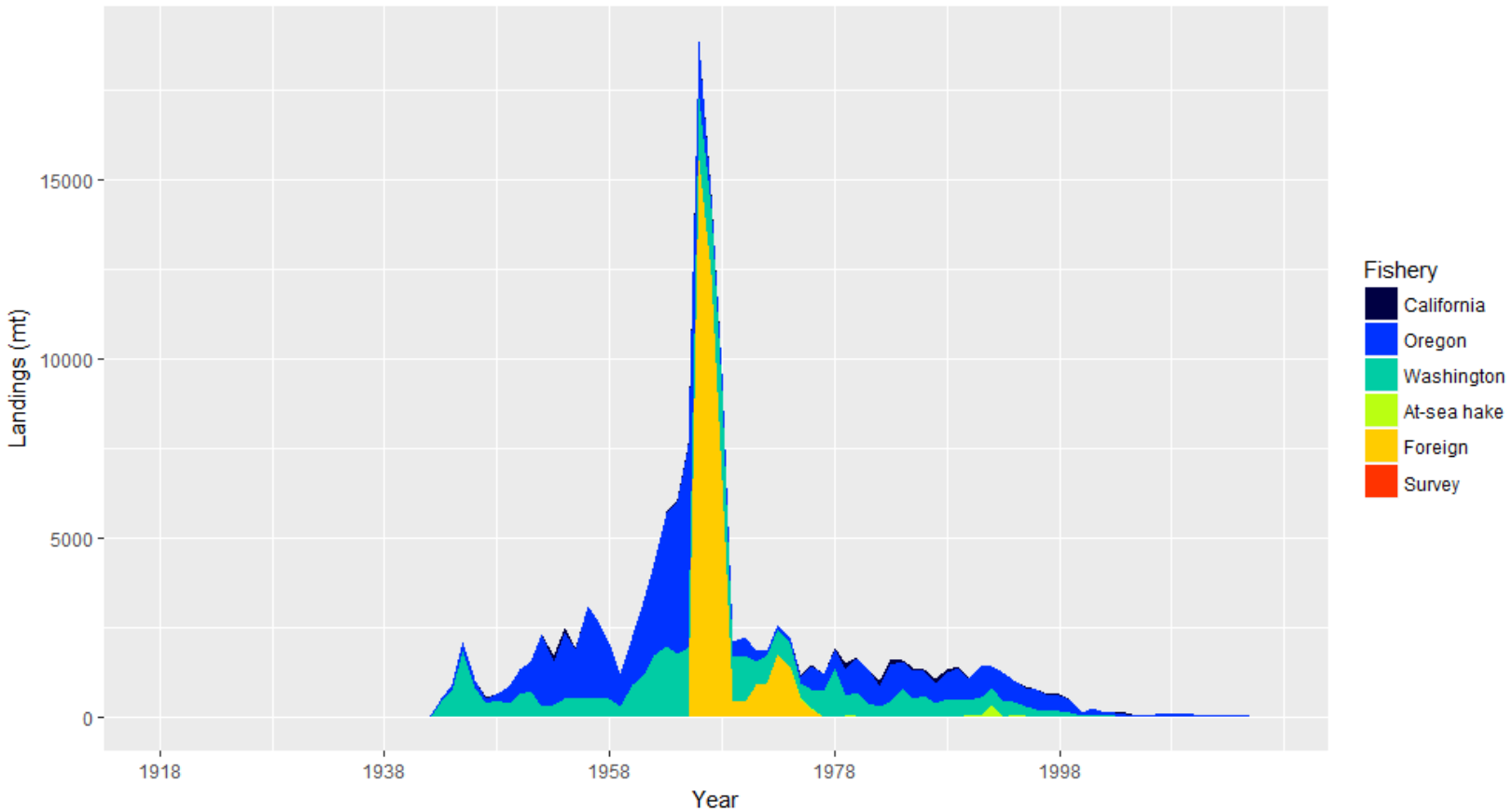
STAR Panel

June 26-30, 2017

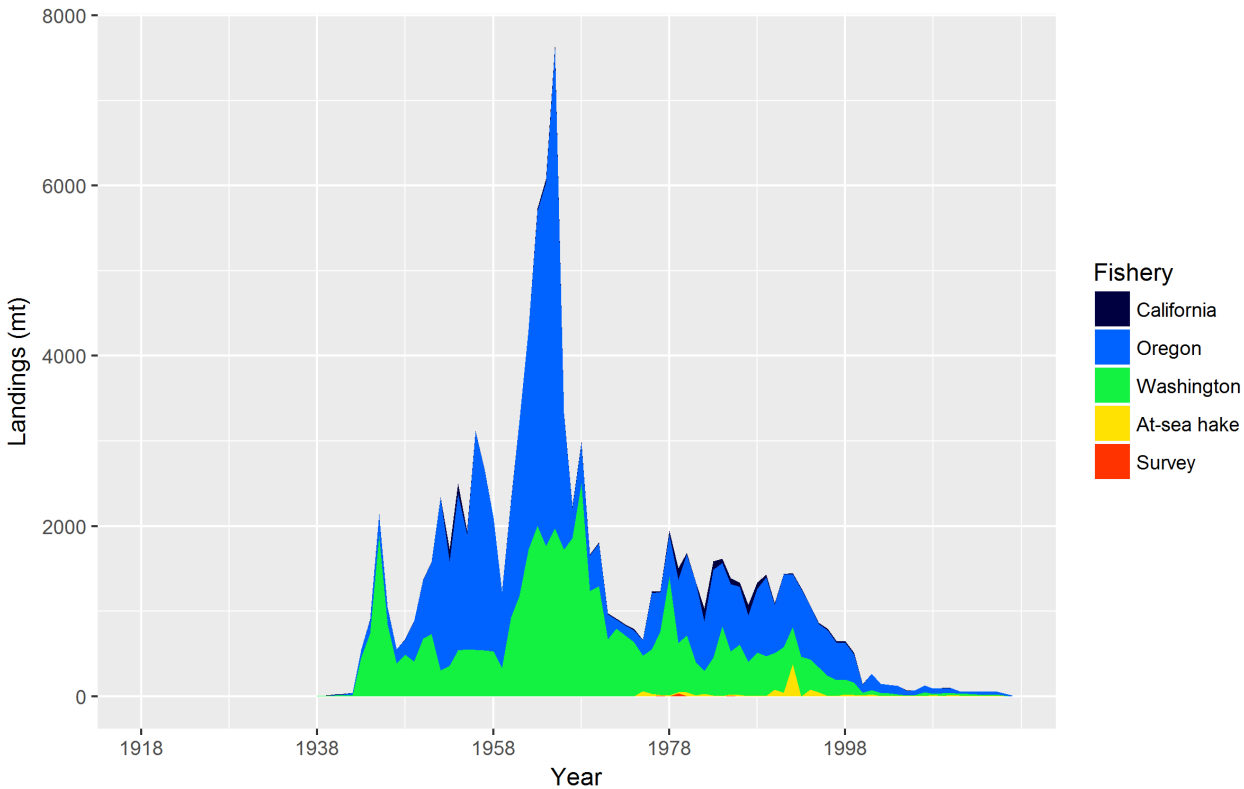


Outline

Landings


Landings (mt)
15000
10000
5000
0
1918
1938
1958
1978
1998
Year
Fishery
California
Oregon
Washington
At-sea hake
Foreign
Survey

Landings without the Foreign Catches

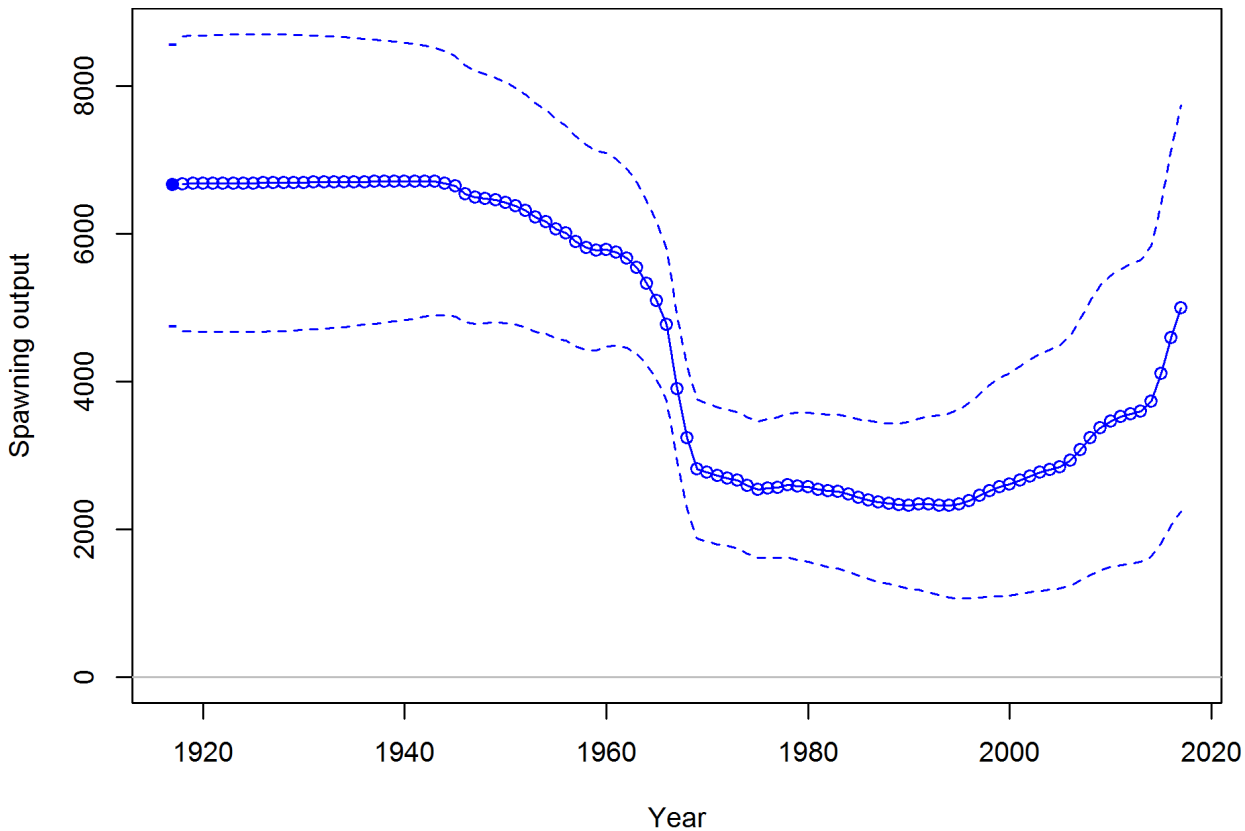


Landings over the Last 10-years

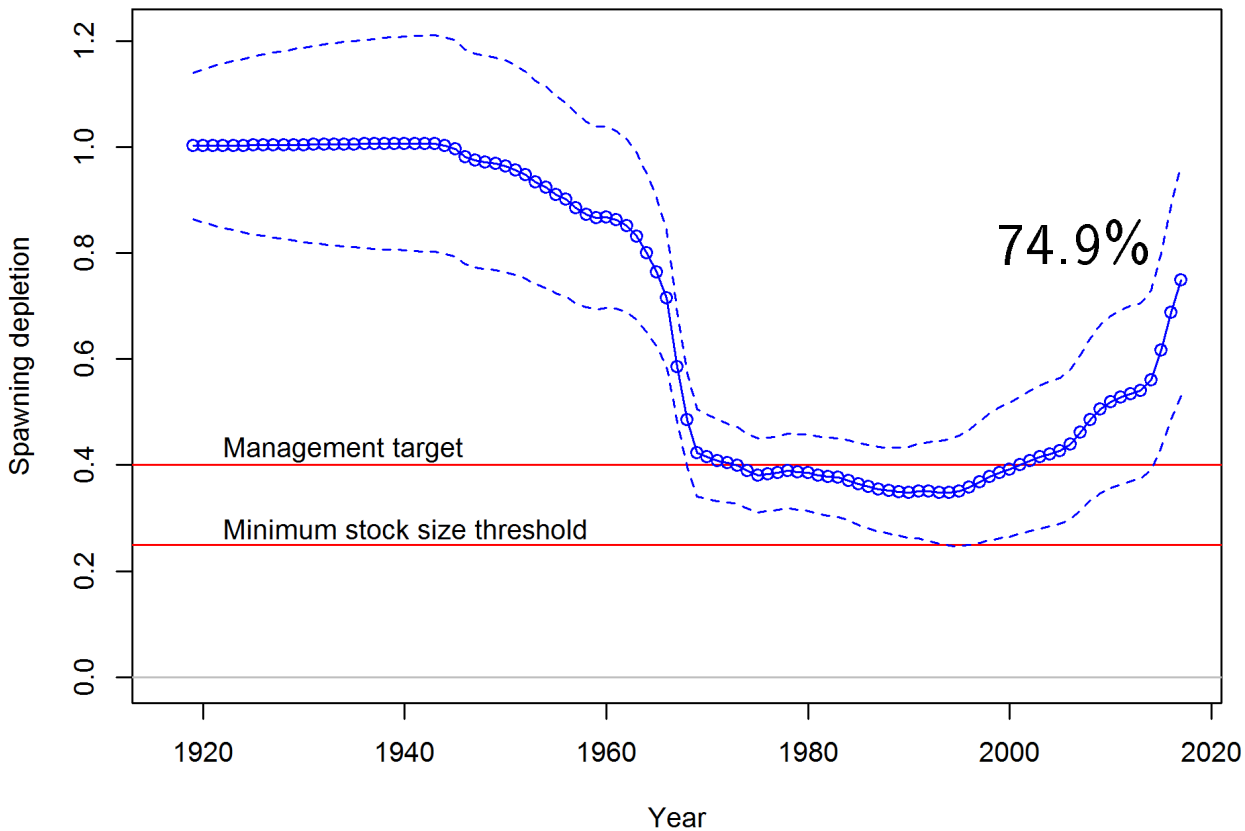
Year	CA	OR	WA	At-sea hake	Survey	Total Landings
2007	0.15	83.65	45.12	4.05	0.58	133.55
2008	0.39	58.64	16.61	15.93	0.80	92.36
2009	0.92	58.74	33.22	1.56	2.72	97.17
2010	0.14	58.00	22.29	16.87	1.68	98.98
2011	0.12	30.26	19.66	9.17	1.94	61.14
2012	0.18	30.41	21.79	4.52	1.62	58.51
2013	0.08	34.86	14.83	5.41	1.71	56.89
2014	0.18	33.91	15.82	3.92	0.57	54.40
2015	0.12	38.05	11.41	8.71	1.59	59.88
2016	0.23	40.81	13.12	10.30	3.10	67.56

Approximately 70% of the landings are from Oregon.
Vast majority of landings are from bottom-trawl gear.

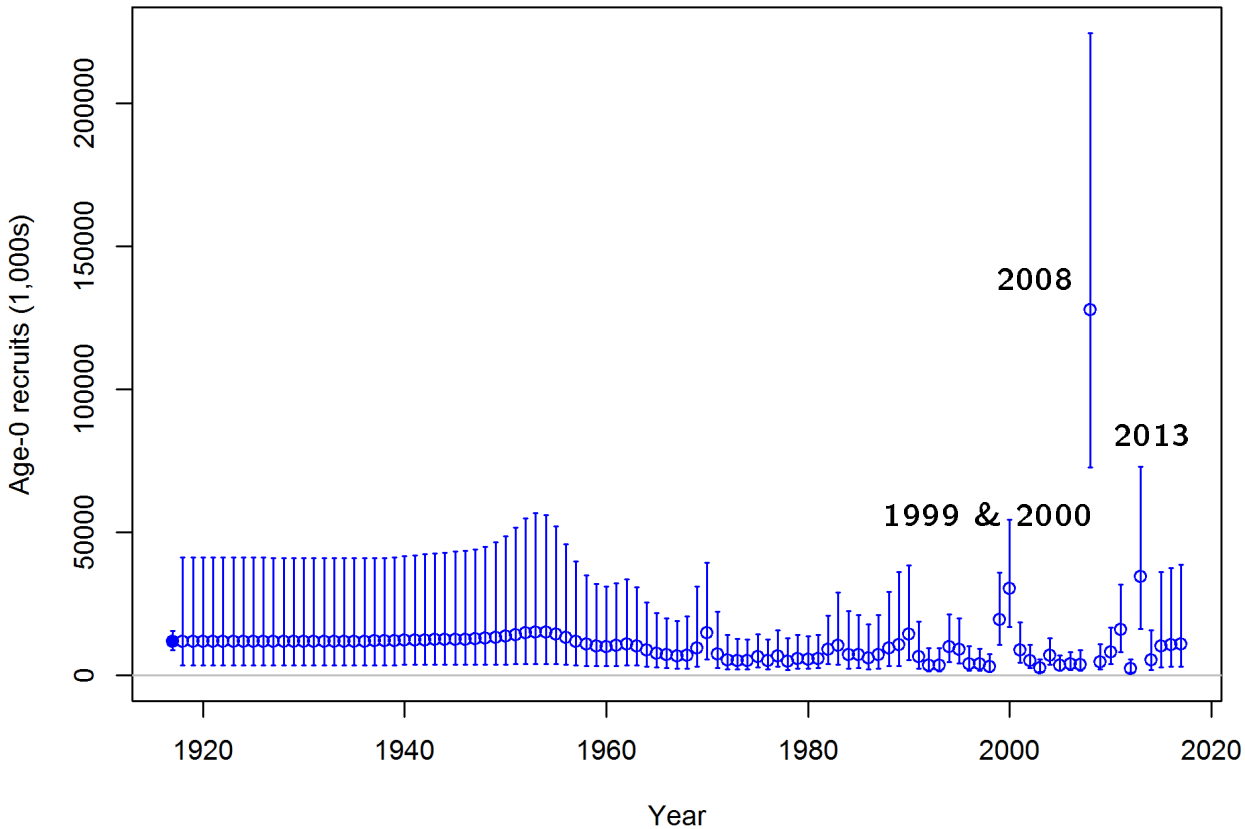
Spawning Output



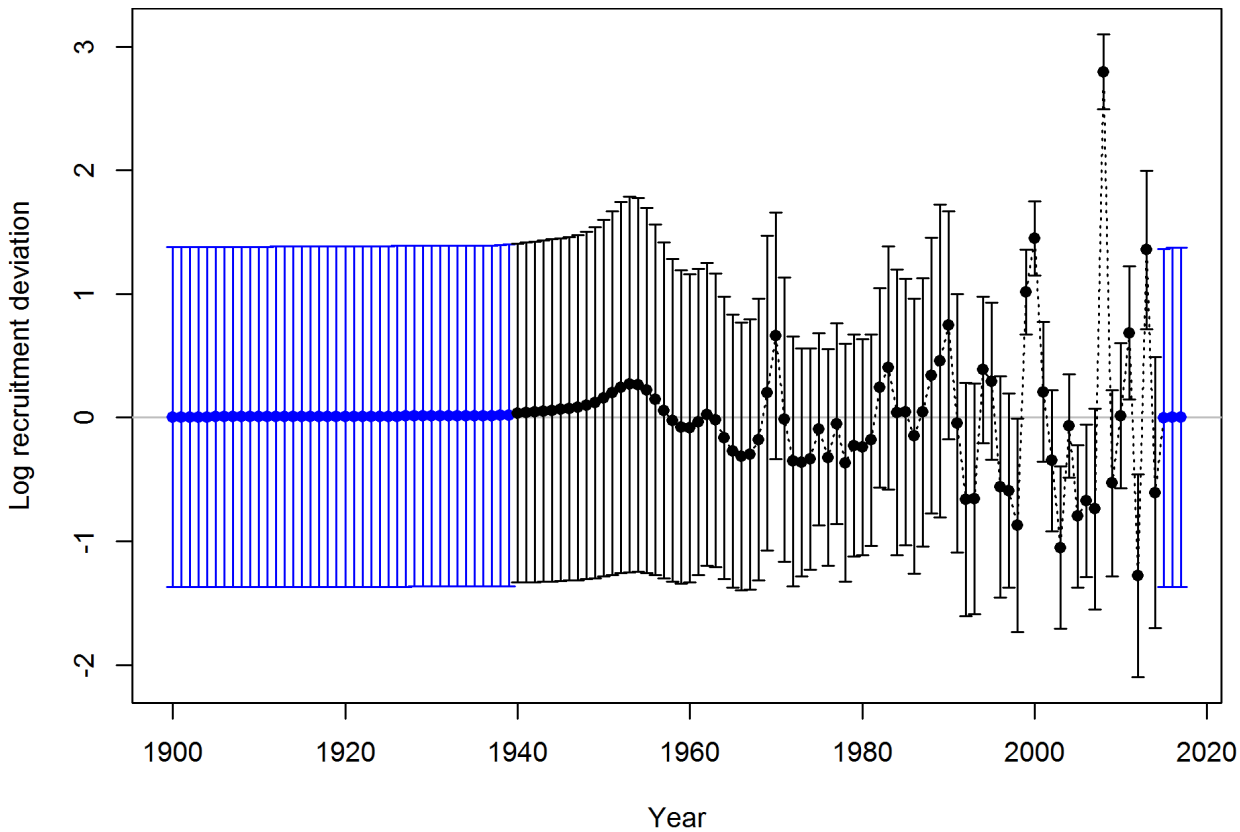
Relative Depletion



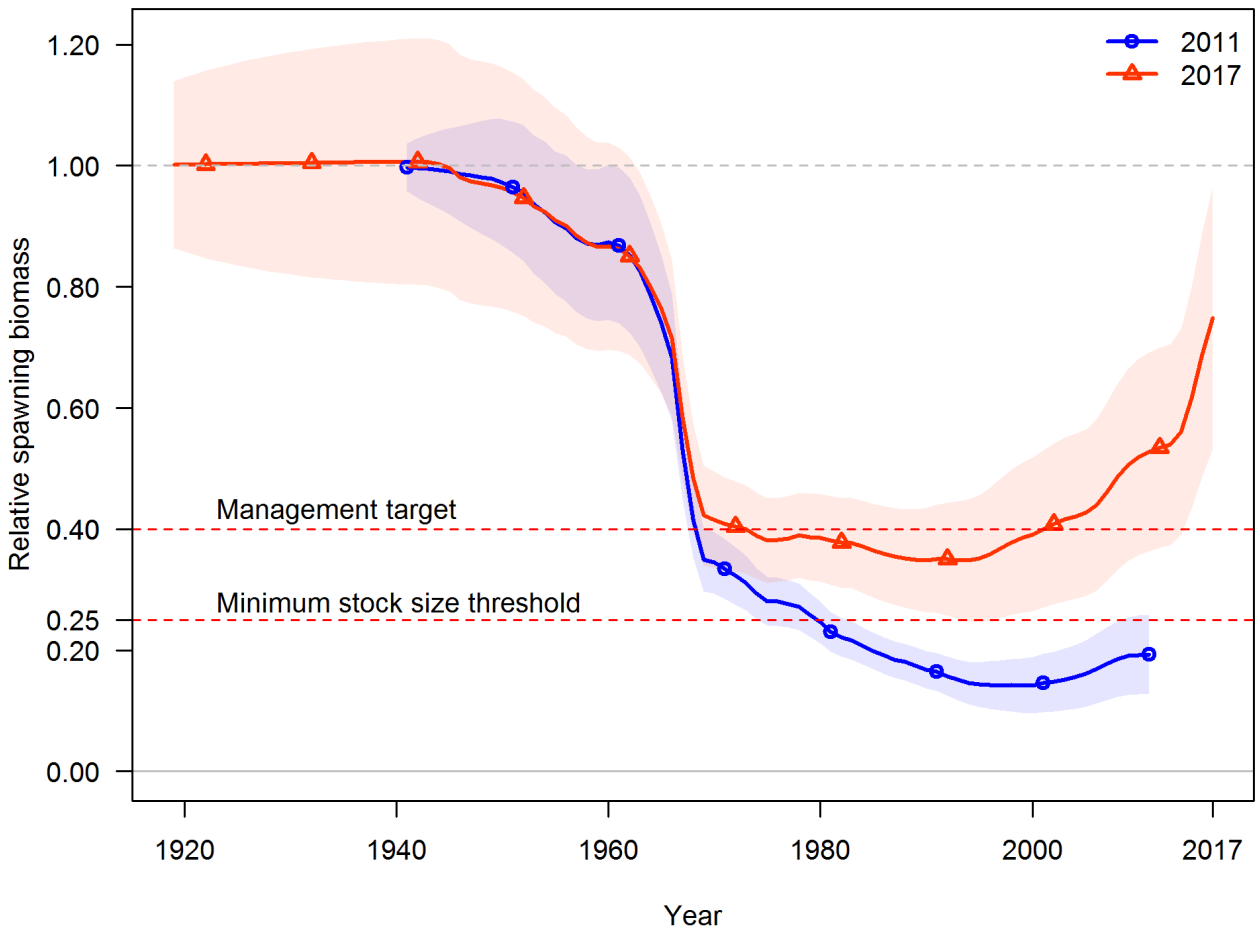
Estimated Annual Recruitment



Estimated Annual Recruitment Deviations



Comparison between 2011 and 2017

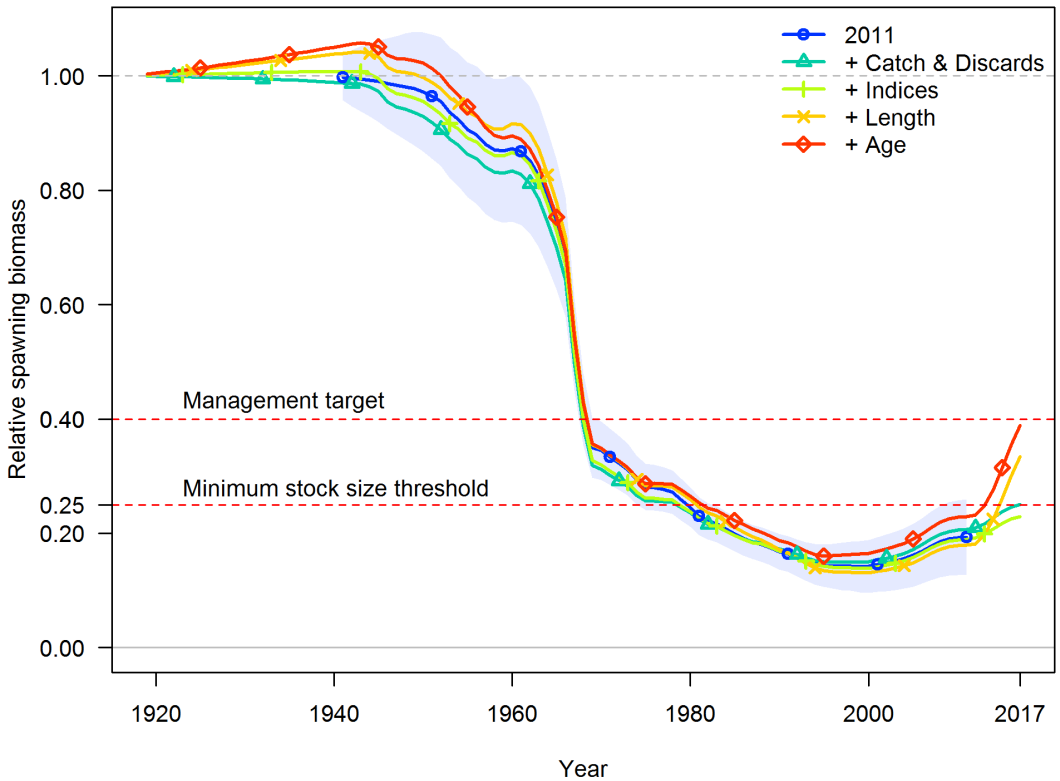


Major Changes Between the Previous and Current Assessment

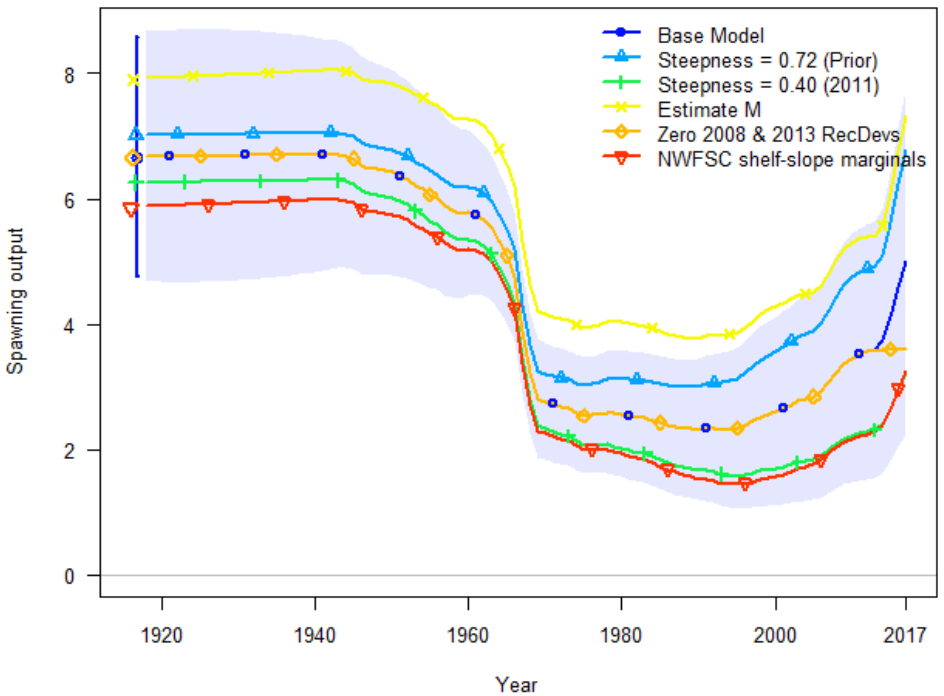
- Steepness
- Natural Mortality
- Landing History
- Maturity and Fecundity
- Fleet and Survey Selectivities

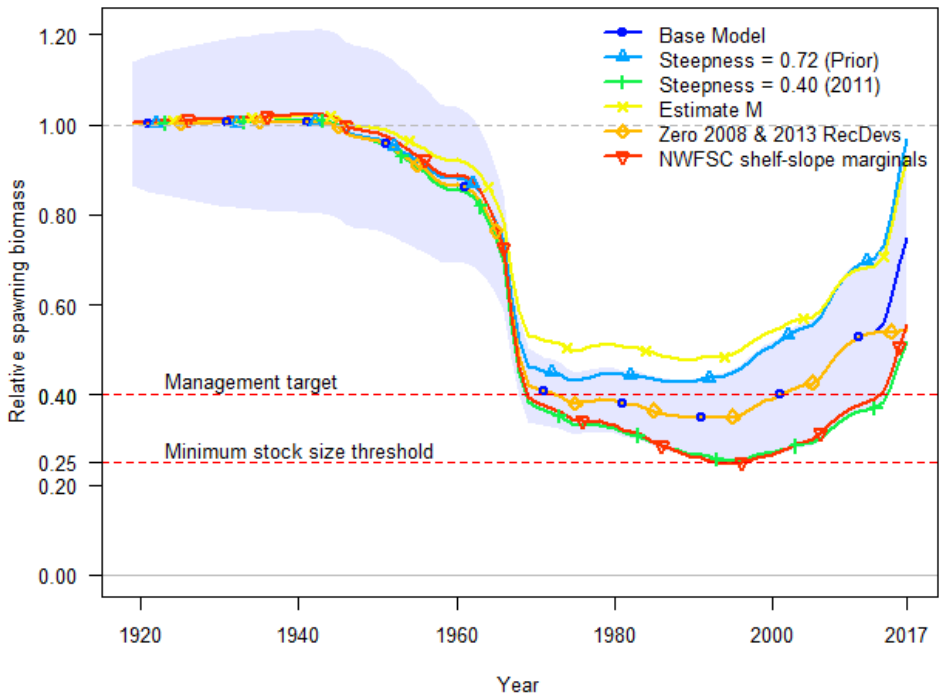
2011 Model Data "Update"

- Added layers of new data cumulatively while retaining 2011 modeling assumptions



2017 Base Model Sensitivities





Key Sources of Uncertainty

- Steepness
  - Fixed at 0.50 within the base model. Likelihood profile over steepness indicates no information in data concerning steepness. Fixing the value at the steepness prior value of 0.72 results in stock status 97% of unfished.
- Natural Mortality
  - Fixed at 0.054 for males and females, the mean of the prior when maximum age is 100. Likelihood profile relatively flat around the prior.
- Recruitment
  - Estimated large recruitments in 2008 and 2013.
  - Setting these recruitments equal to the stock-recruitment curve results in a decline in stock status to 54%.
- NWFSC shelf-slope age data
  - Treating these data as either conditional age-at-length or as marginals results in differing estimates of R_0 and final stock status.

Outline

Pacific ocean perch (*Sebastes alutus*)

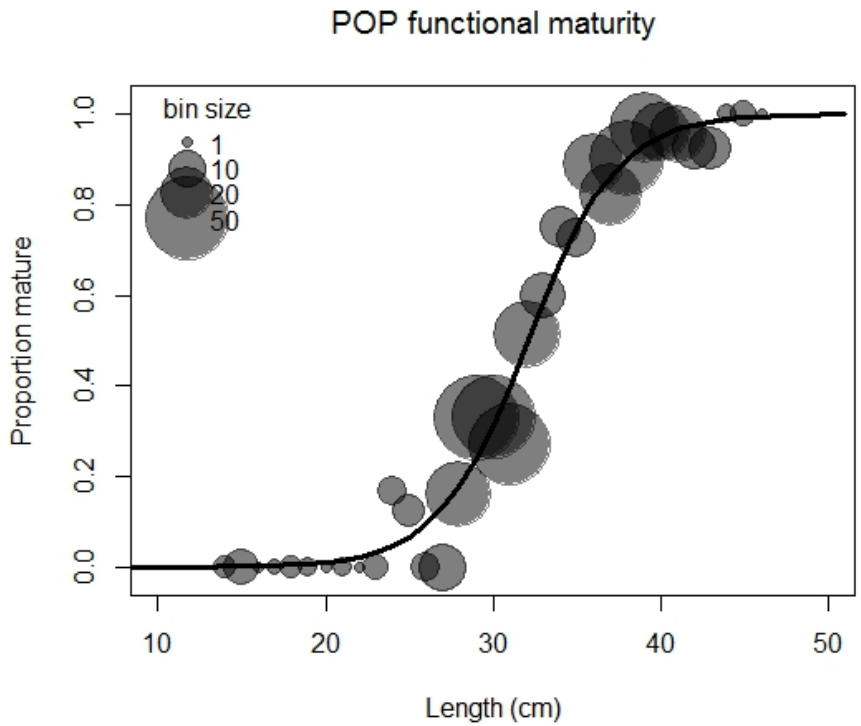
- Distributed from Alaska Aleutian Islands to Northern California
- Typically disctributed between 200 - 400 meters during summer months
- Semi-demersal and can be pelagic
- Both sexes move to deeper water with age

- Females move to deeper waters post-spawning during winter months and return inshore in spring.

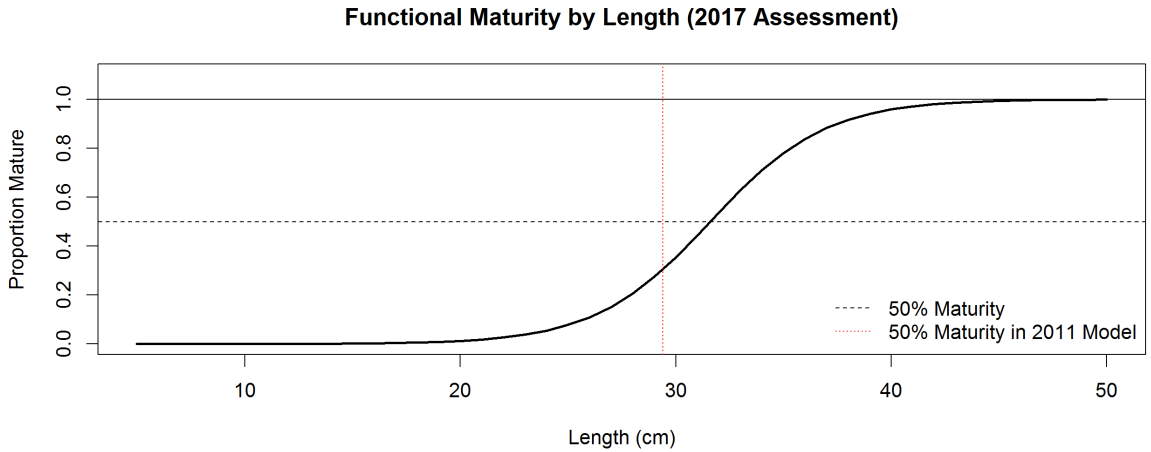
Maturity

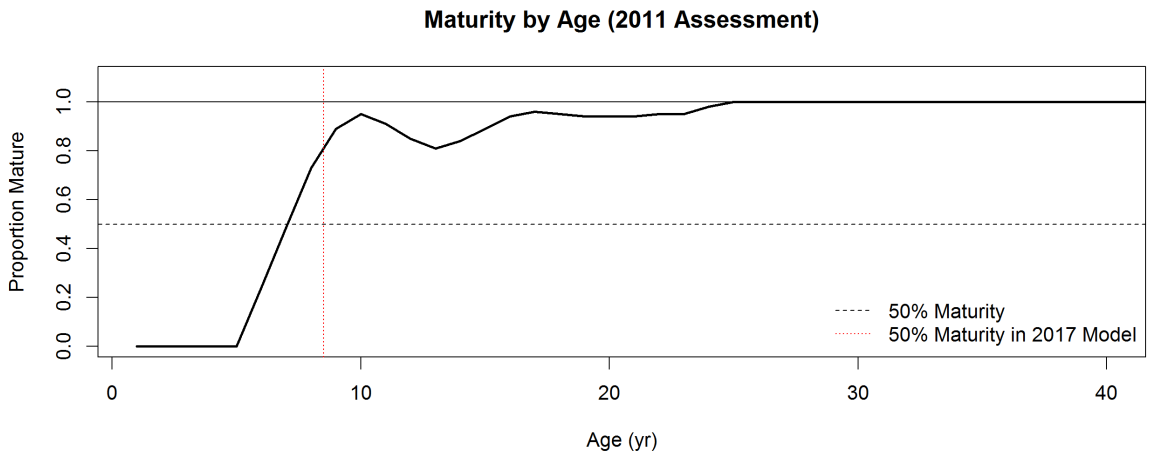
Functional maturity-at-length

- Categorized mature and immature fish based on the proportion of vitellogenin in the cytoplasm and atretic cells
- 50% maturity is at larger lengths vs. biological maturity
- functional 50% = 32.1 cm vs. biological 50% = 30.1 cm



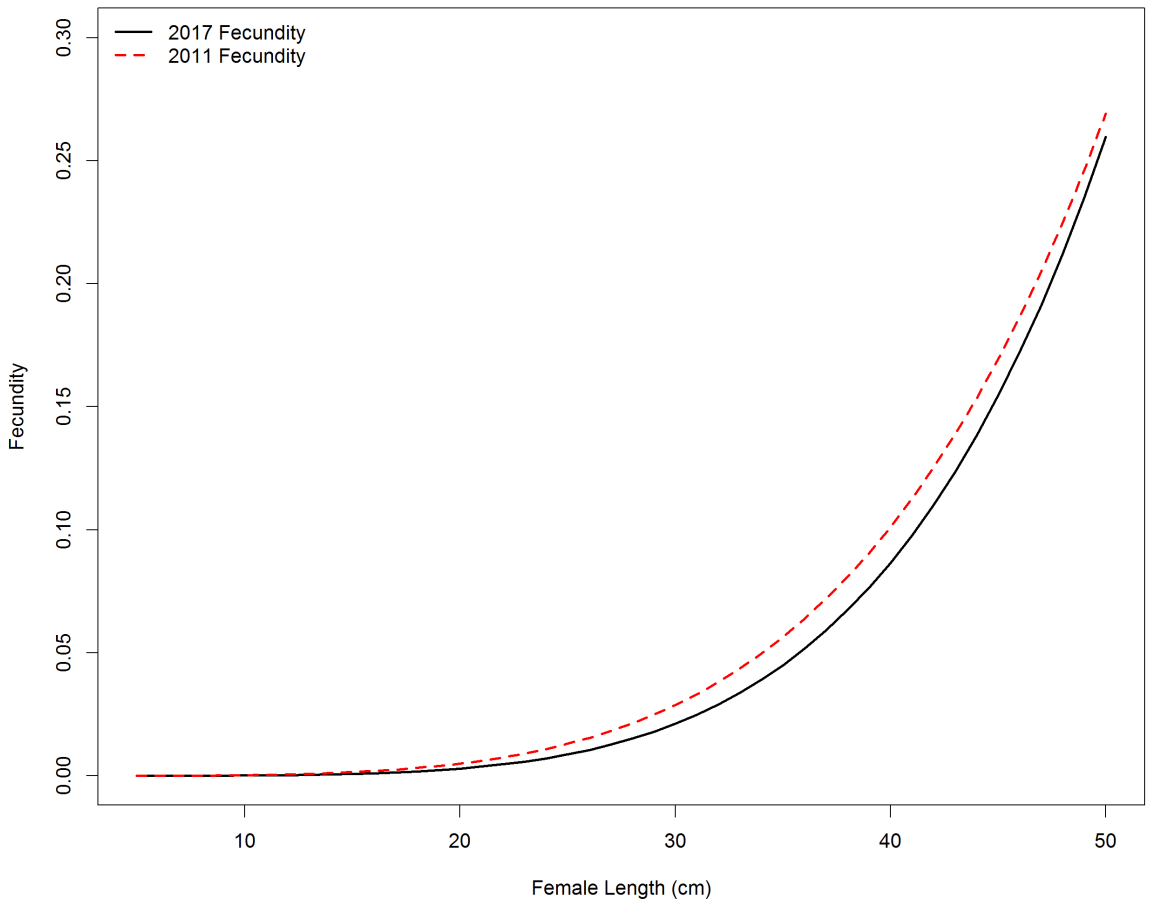
Maturity Comparison





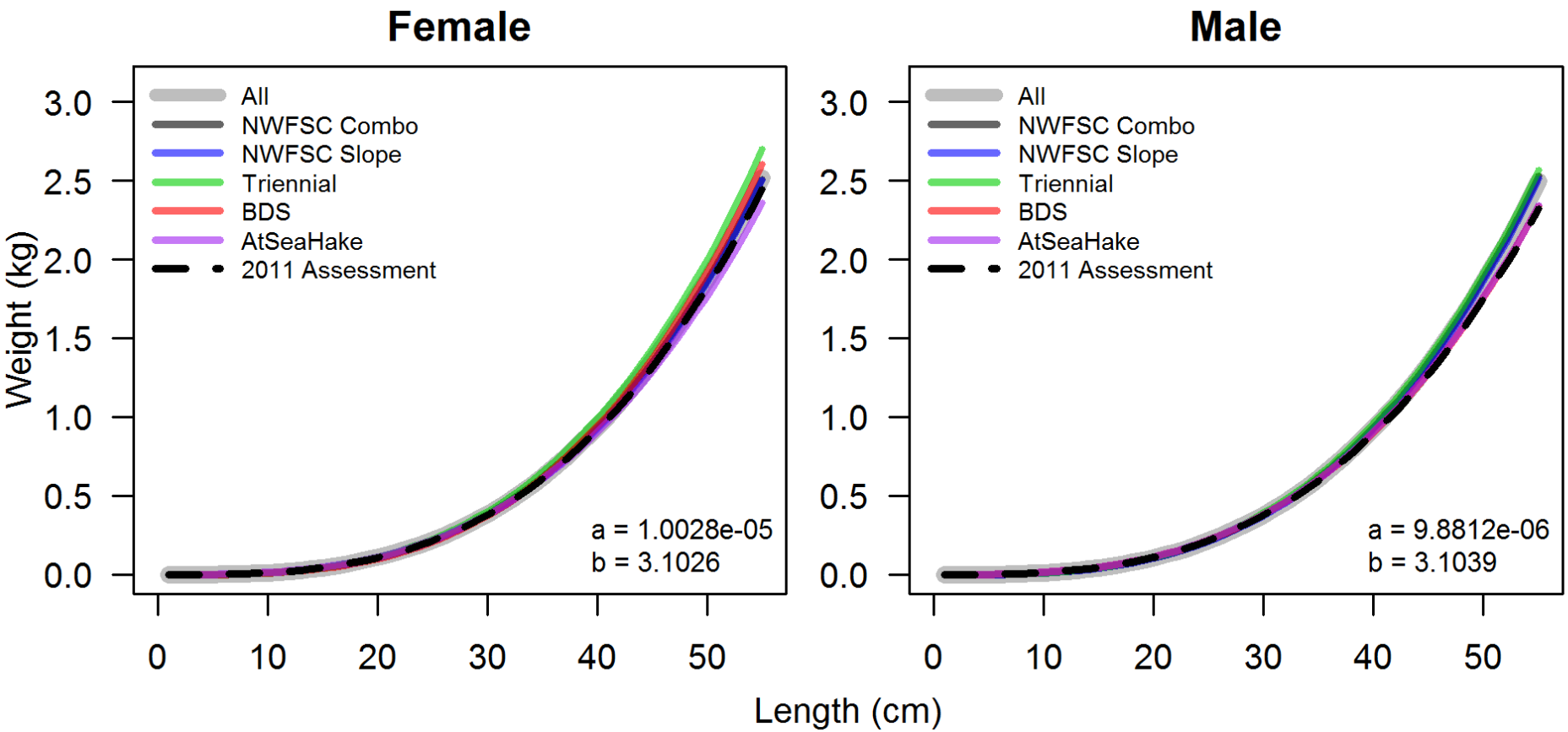
*Sensitivity to assumed maturity shown to not have a large impact on results

Fecundity

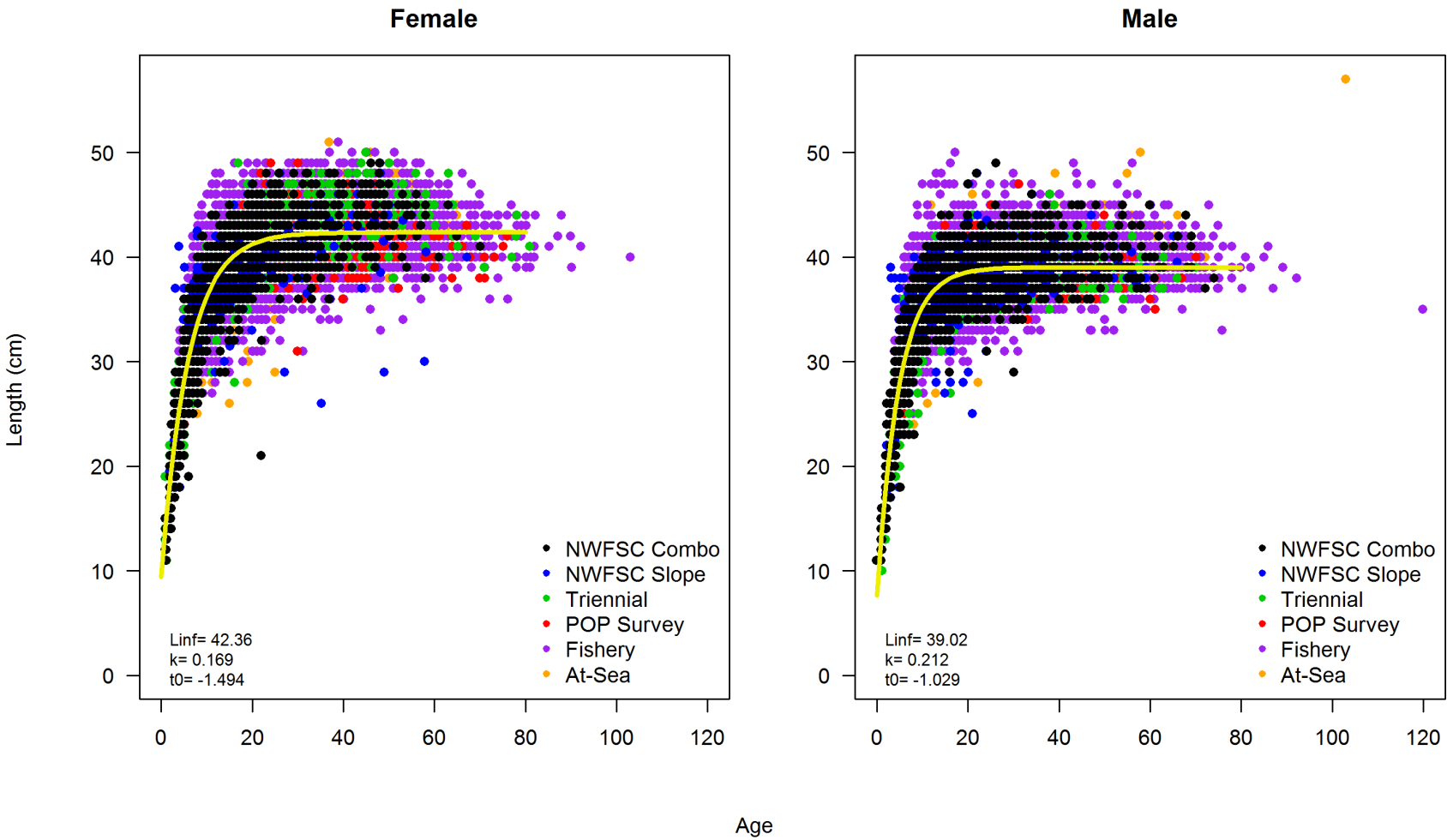


*Sensitivity to assumed fecundity shown to not have a large impact on results

Weight-at-length

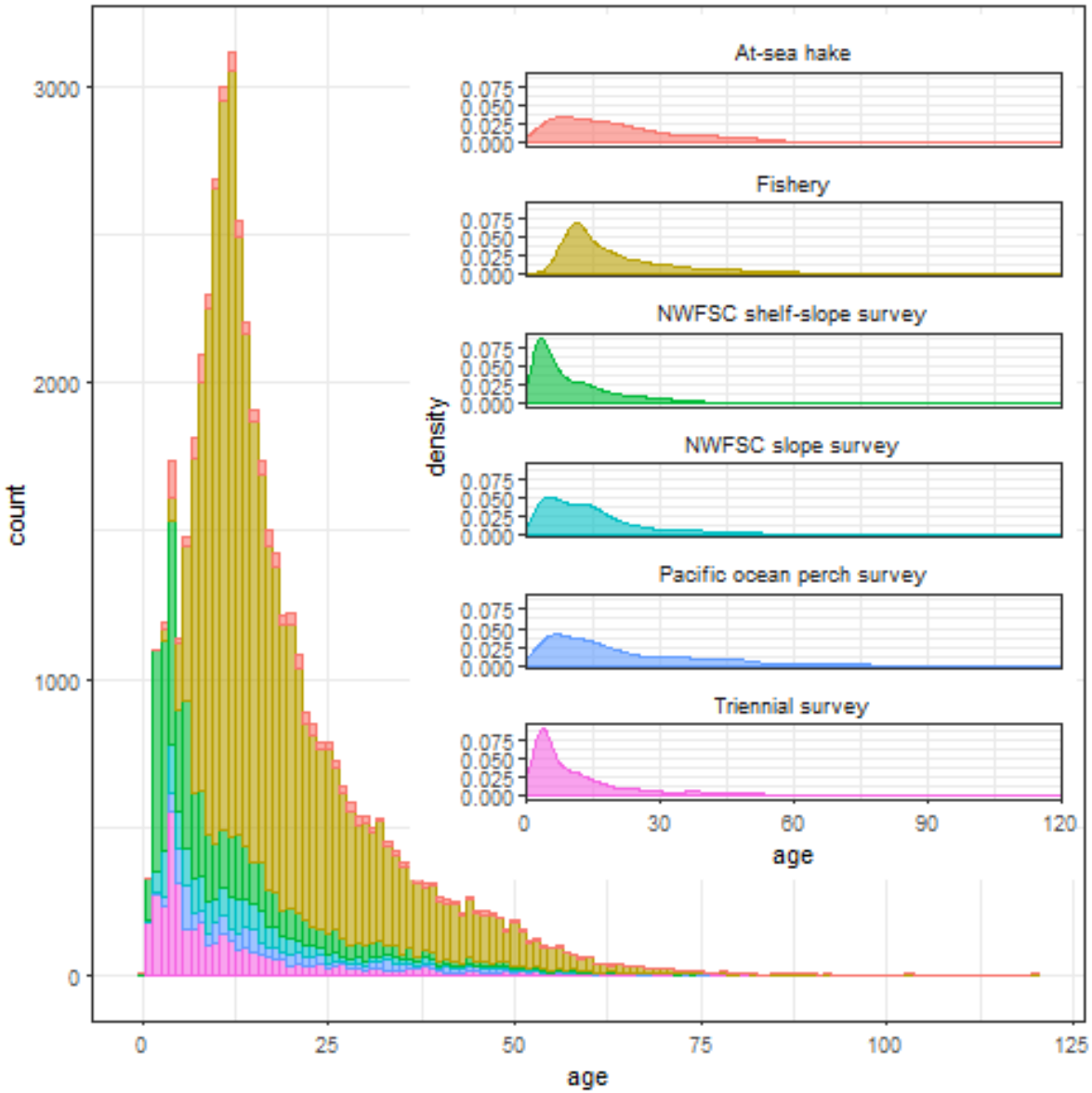


Length-at-age

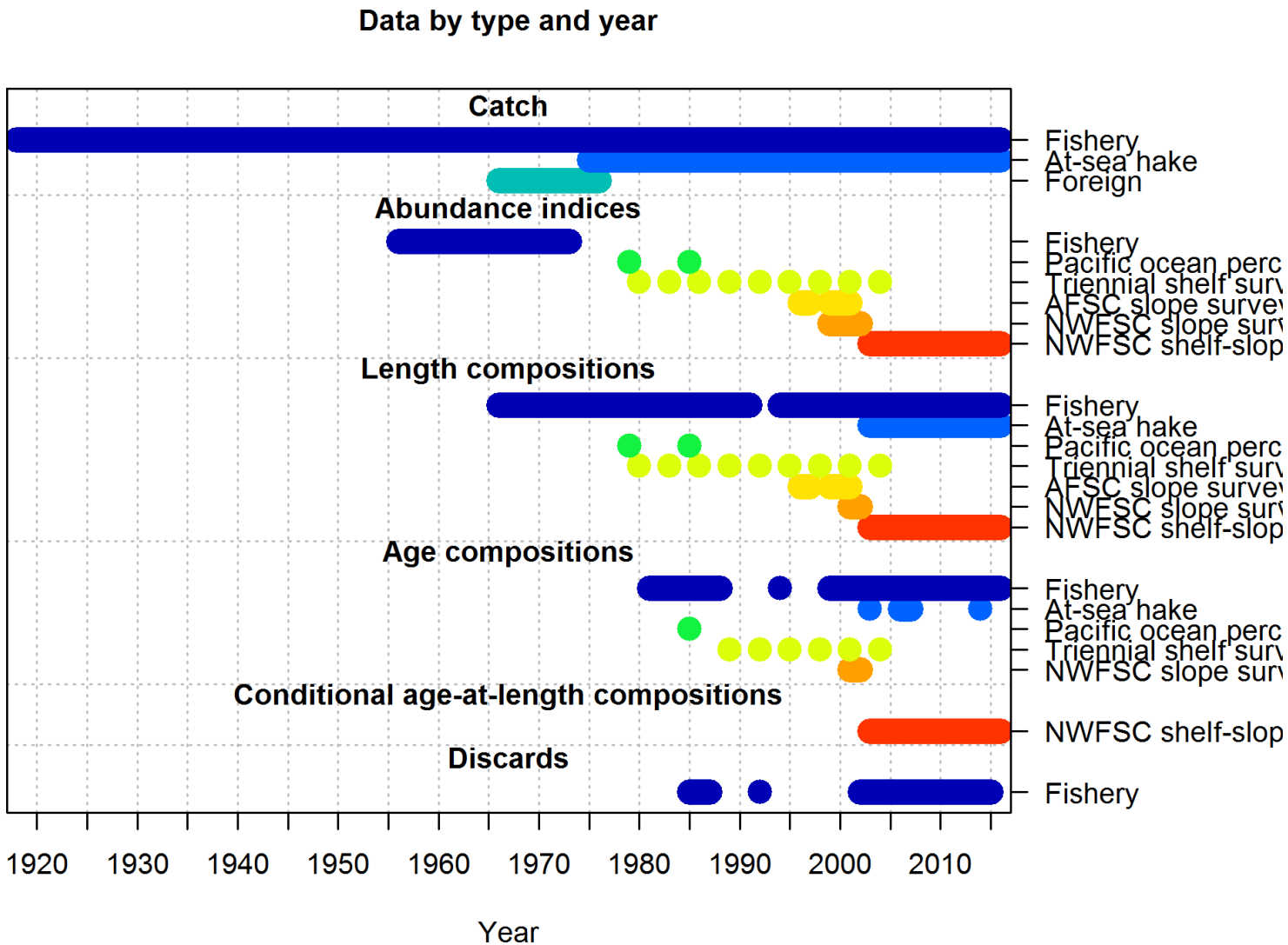


Observed Ages

- Oldest age: 120 by the fishery (2007)
- Next oldest fish range from 90-103 collected by the fishery or the at-sea hake fishery between 1981-2010

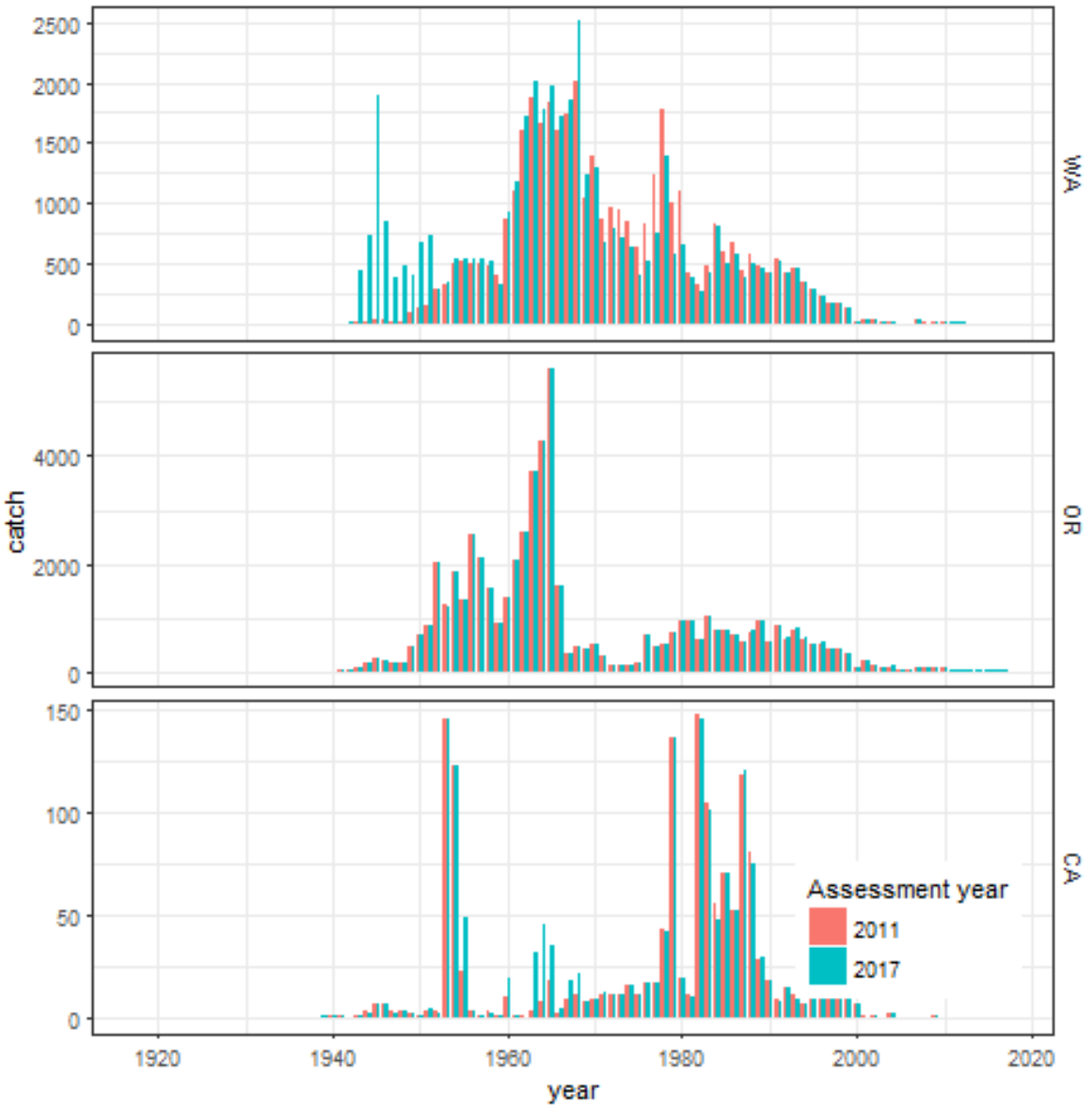


Data Summary Used in the 2017 Assessment

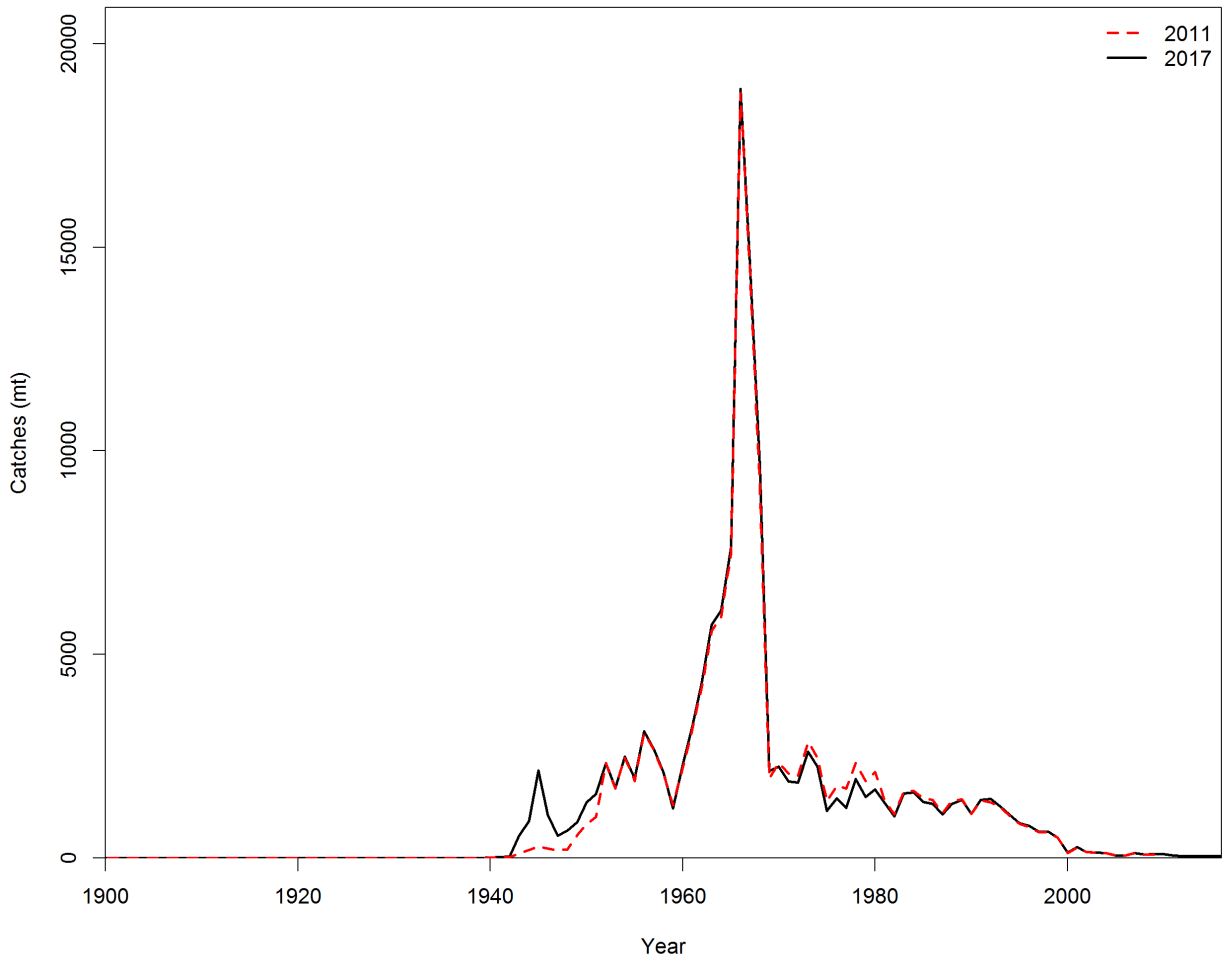


Outline

Landings Data: 2017 vs. 2011

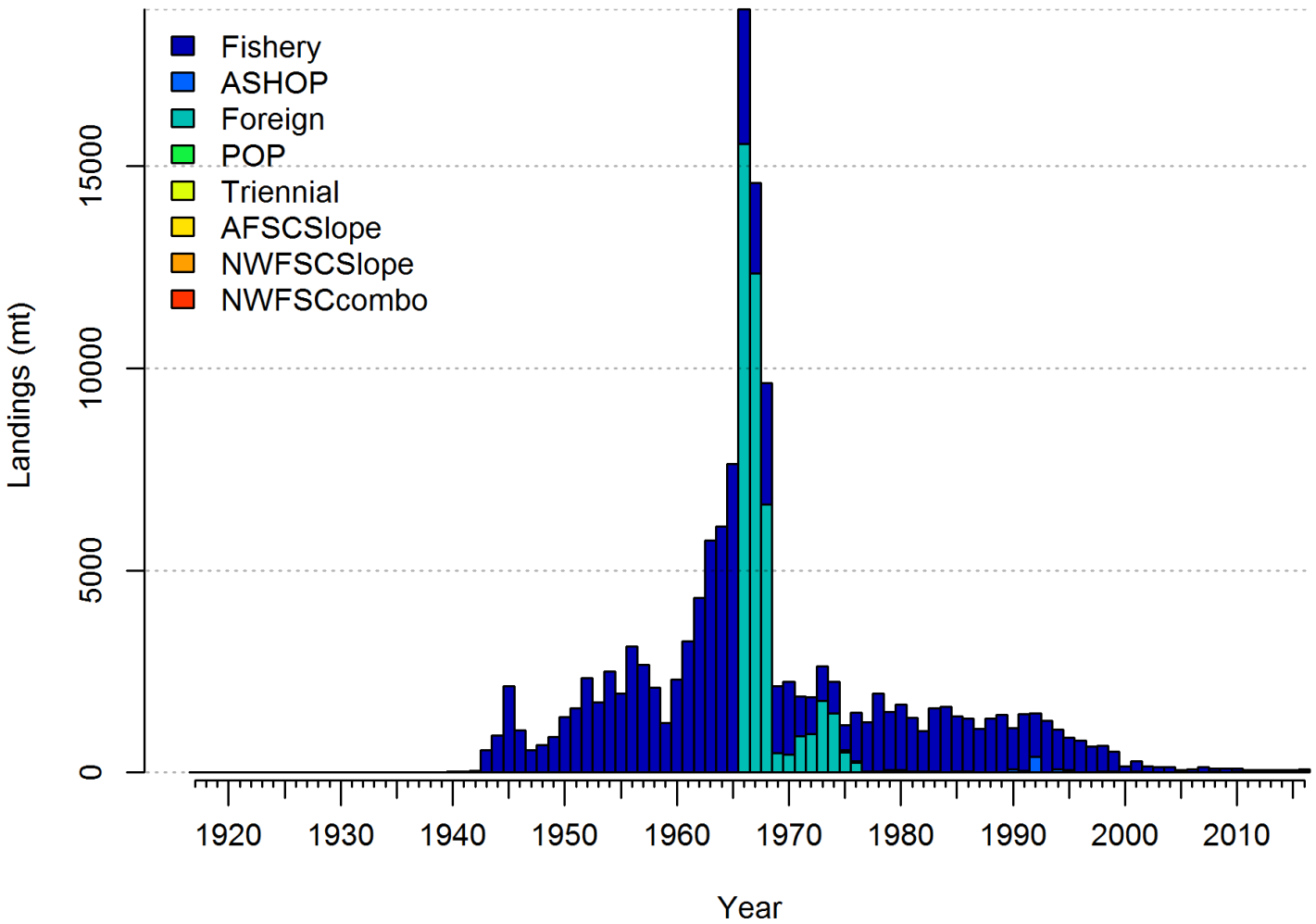


Cummalative Catch Difference

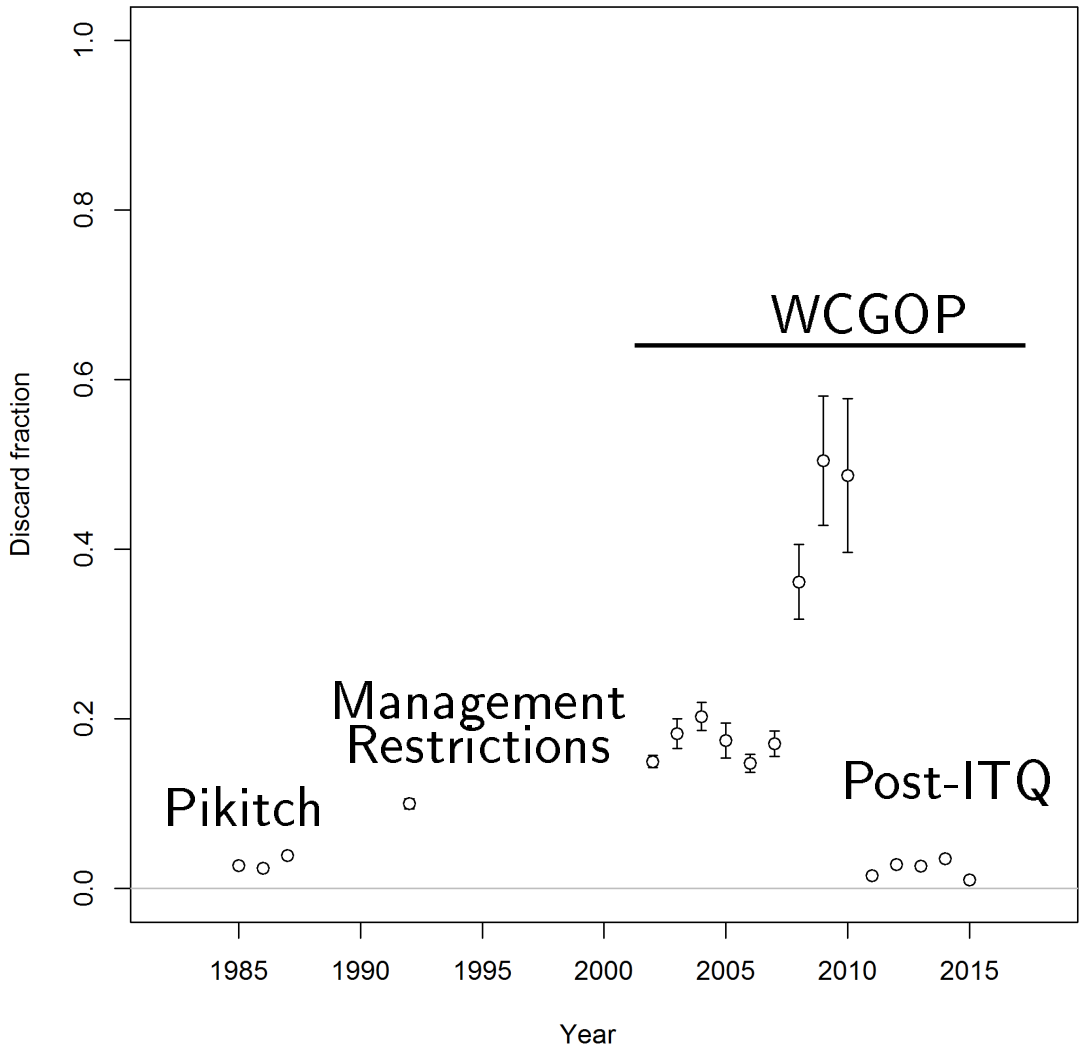


*Resulted in $<$ 1% change in $R0$

Landings by Fleet and Survey



Fishery Discard Data



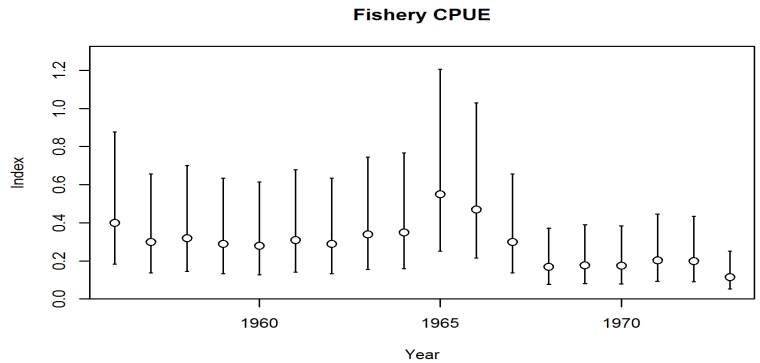
* Sensitivities done on the 1992 data point (high vs. low) results $\pm$ 0.5% in status.

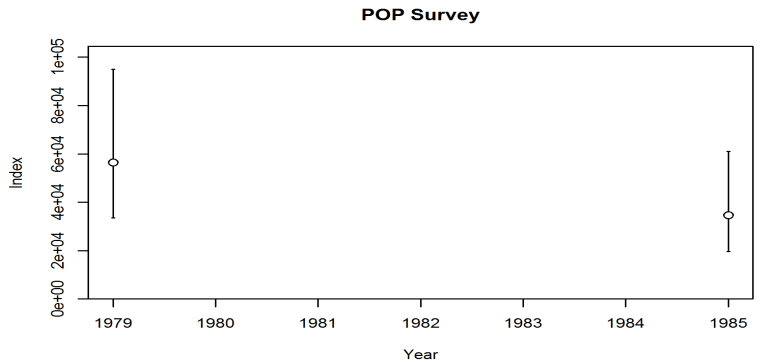
Outline

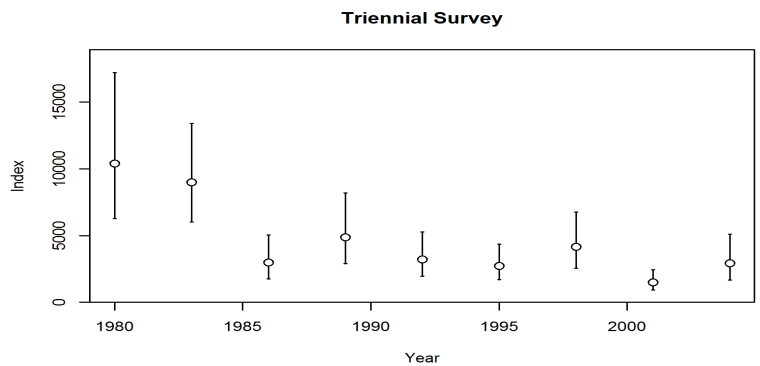
CPUE

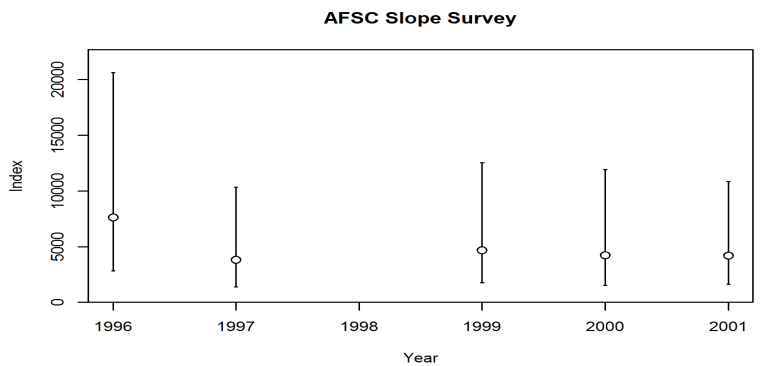
Gunderson (1977) CPUE from the INPFC Columbia area
*Sensitivity shows little effect on model results when removed.

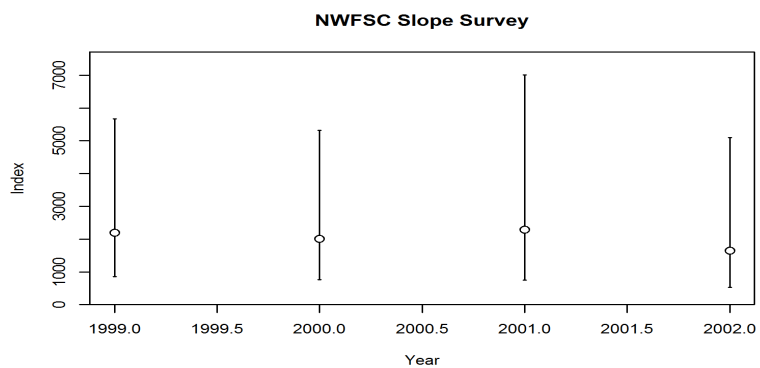
Survey Indices

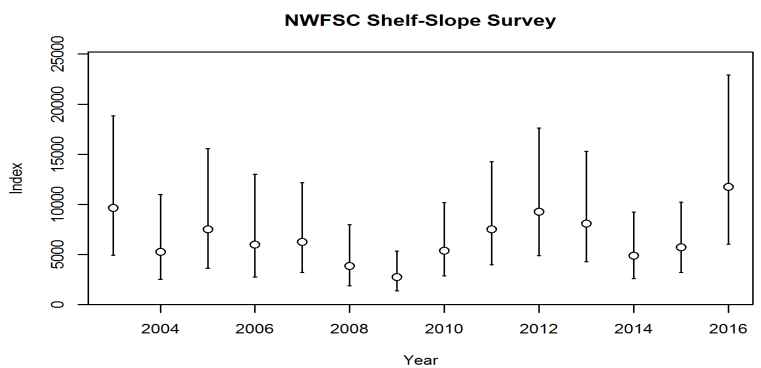




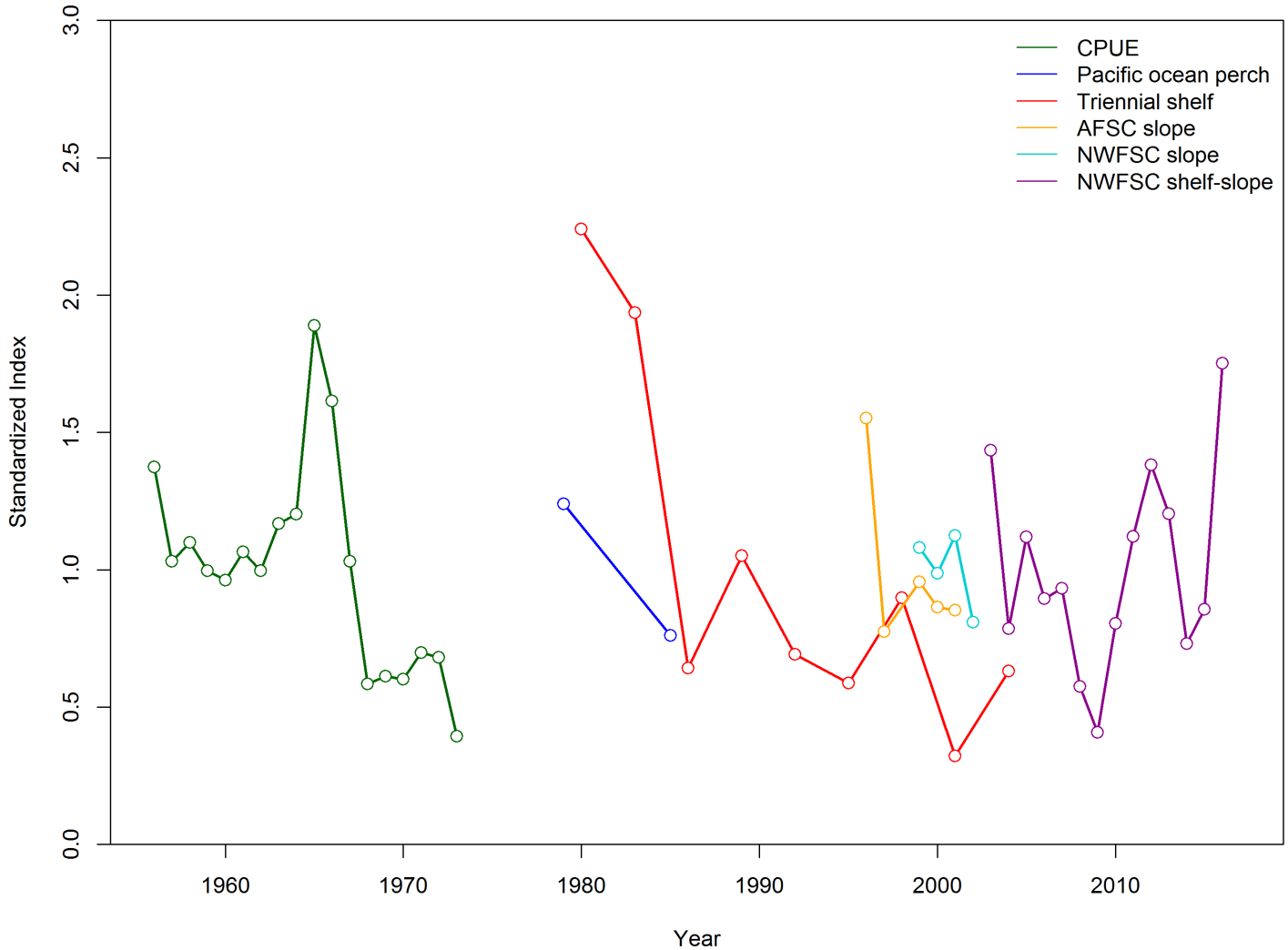








All: Standardized



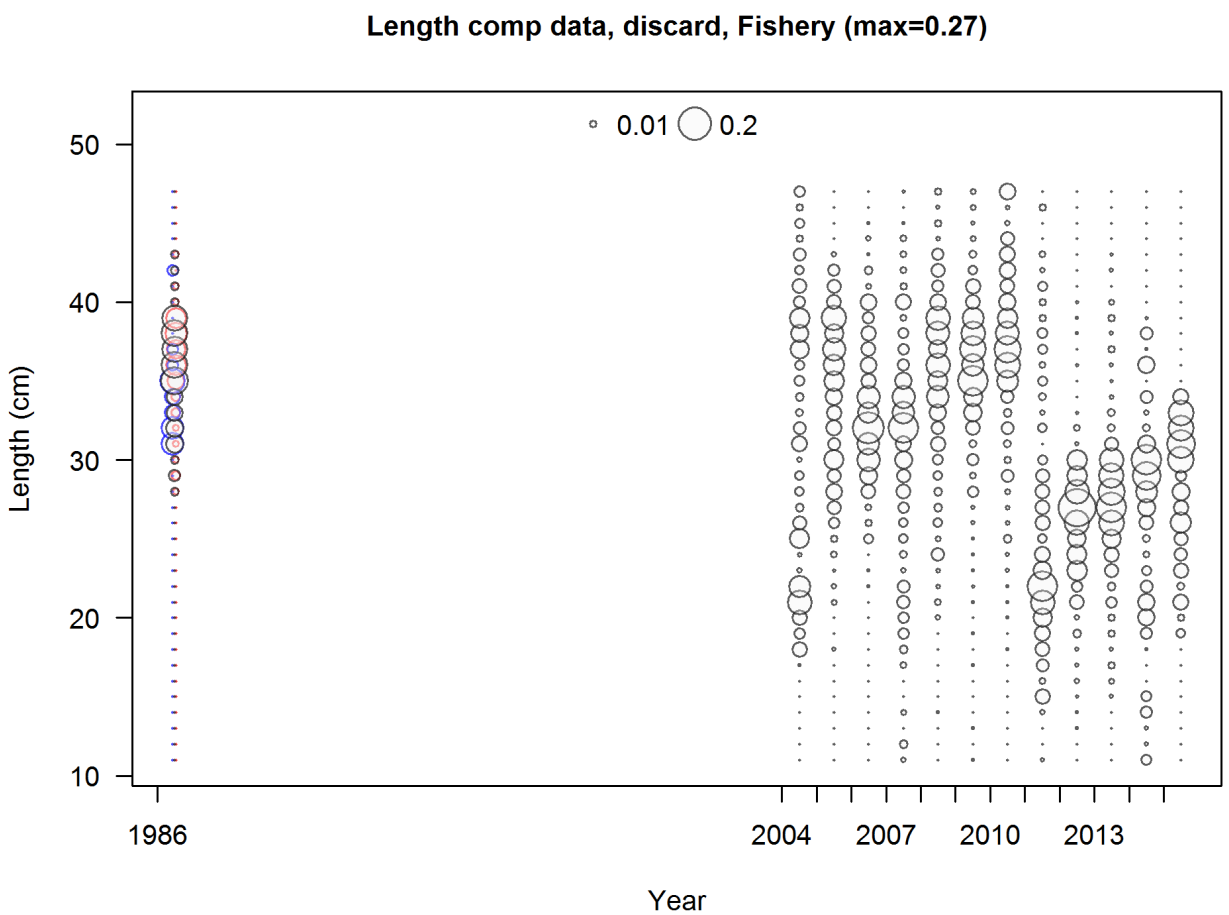
Outline

Fishery Length and Age Data

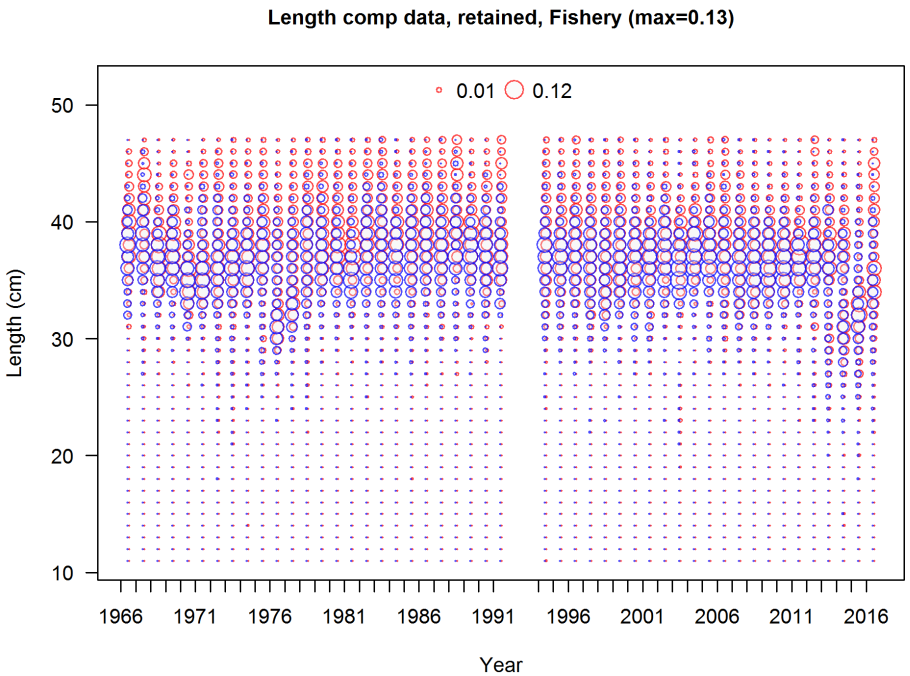
Fishery length data used in the 2017 assessment:

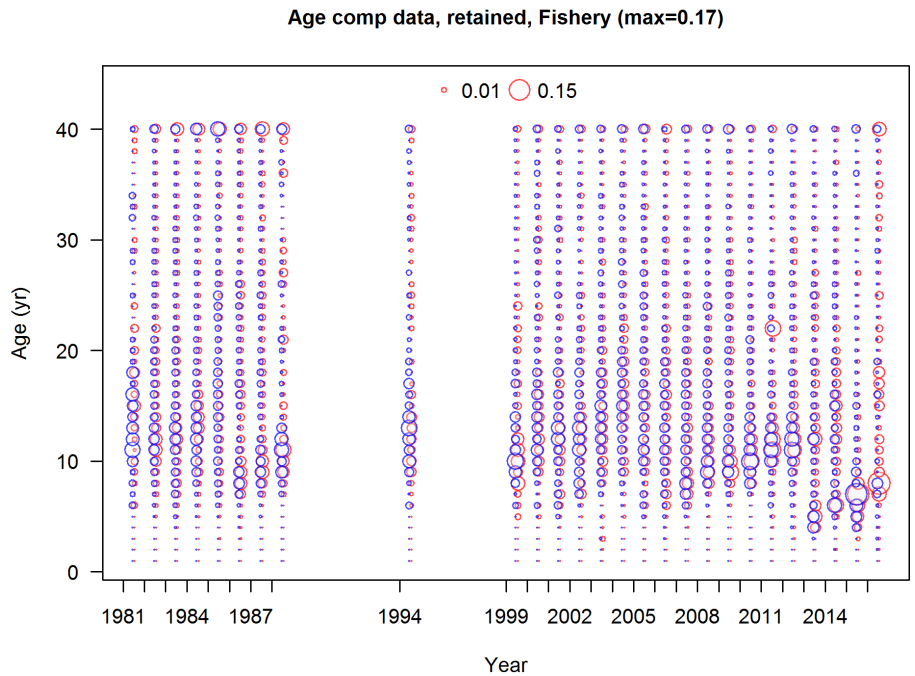
- Fishery: bottom trawl, mid-water trawl, fixed gear
  - Retained Lengths: 1966-2016
  - Discarded Lengths: 1986 (Pikitch), 2004-2015
  - Ages: 1981-1988, 1994, 1999-2016
- At-sea hake fishery
  - All (Retained and Discarded) Lengths: 2003-2016
  - Ages: 2003, 2006, 2007, 2014

Fishery Lengths: Discarded

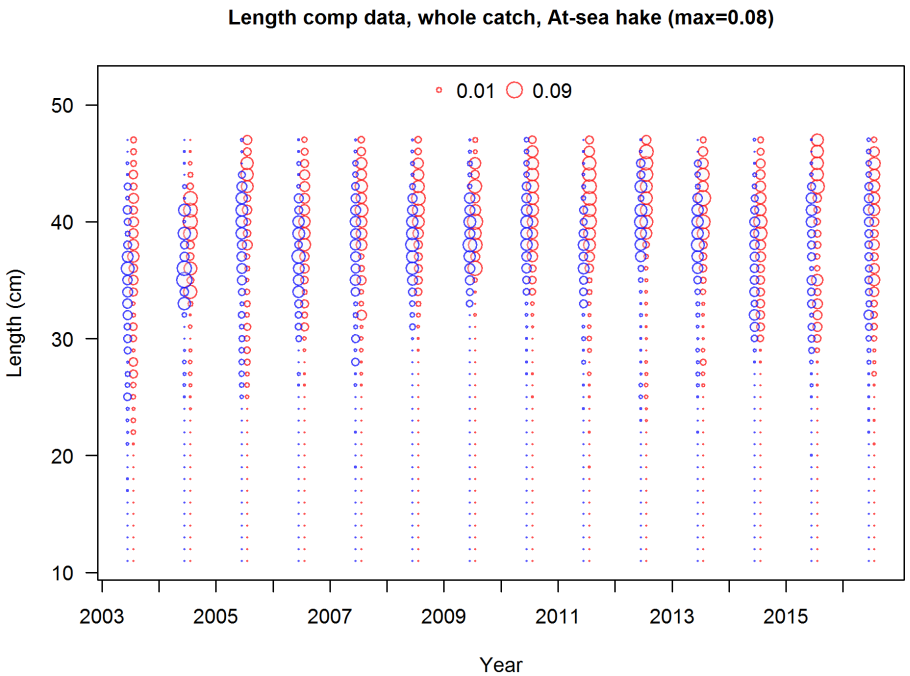


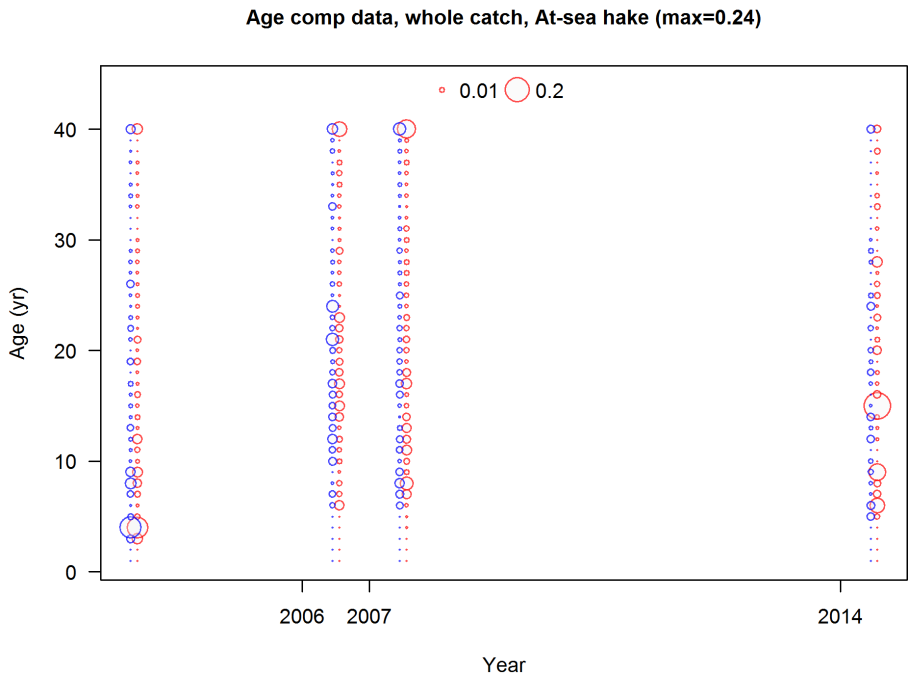
Fishery Lengths and Ages: Retained





At-sea hake


Length comp data, whole catch, At-sea hake (max=0.08)
0.01
0.09
Length (cm)
Year
10
20
30
40
50
2003
2005
2007
2009
2011
2013
2015

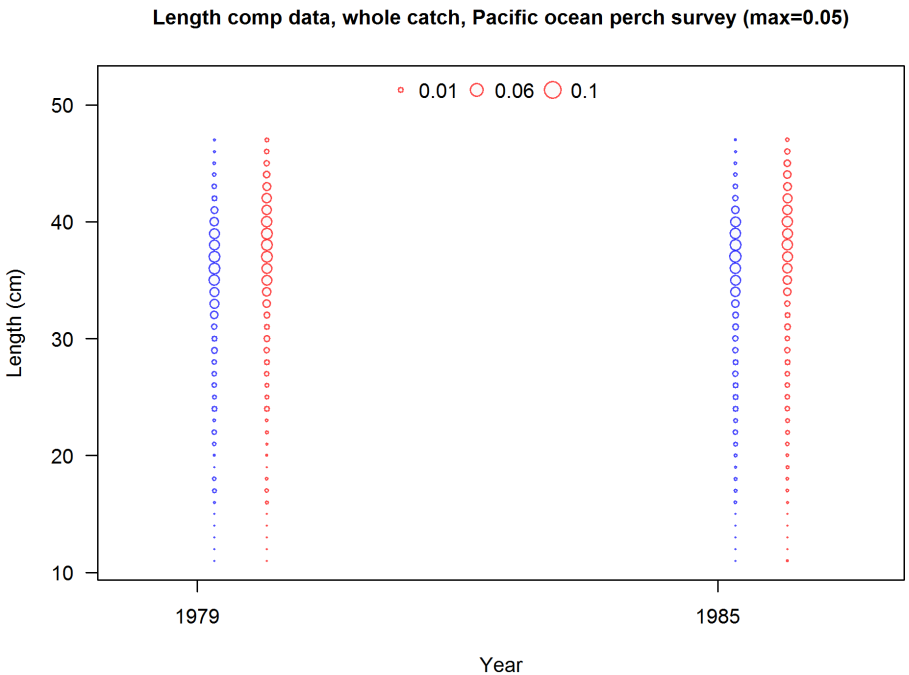

Age comp data, whole catch, At-sea hake (max=0.24)
0.01
0.2
Age (yr)
Year
0
10
20
30
40
2006
2007
2014

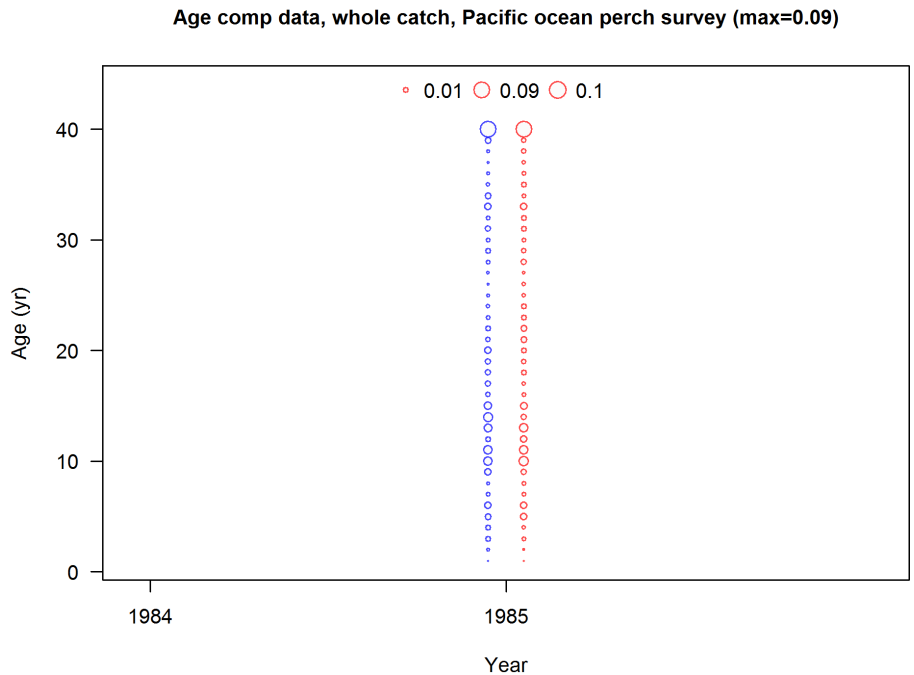
Survey Length Data

Survey length data used in the 2017 assessment:

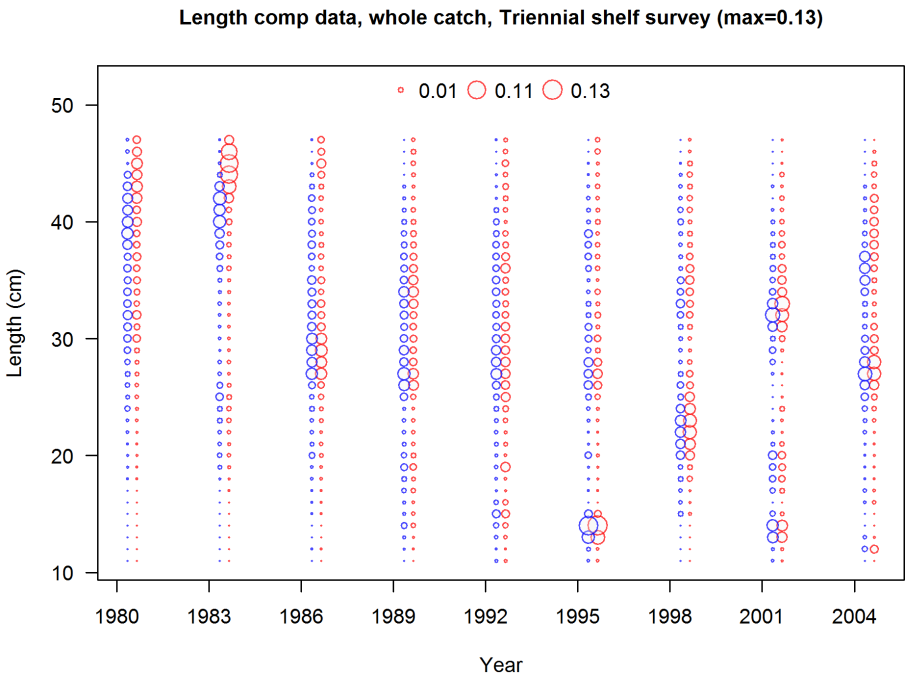
- Pacific ocean perch survey
  - Lengths: 1979 and 1985
  - Ages: 1985
- Triennial shelf survey
  - Lengths: 1980, 1983, 1986, 1989, 1992, 1995, 1998, 2001, 2004
  - Ages: 1989, 1992, 1995, 1998, 2001, 2004
- AFSC slope survey
  - Lengths: 1996, 1997, 1999-2001
- NWFSC slope survey
  - Lengths: 2001 and 2002
  - Ages: 2001 and 2002
- NWFSC shelf-slope survey
  - Lengths: 2003-2016
  - Ages: 2003-2016

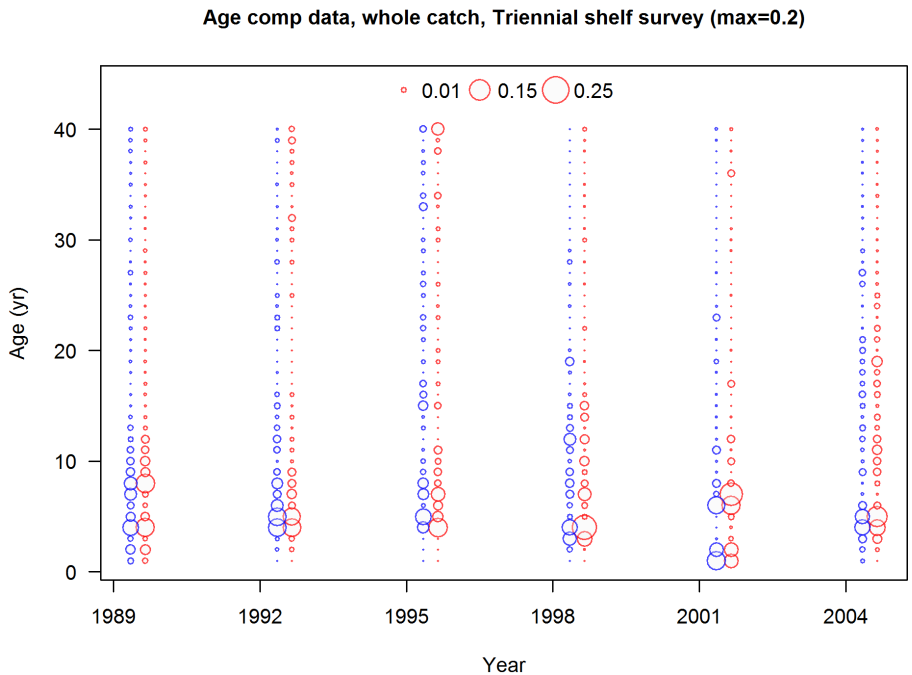
Pacific ocean perch survey lengths



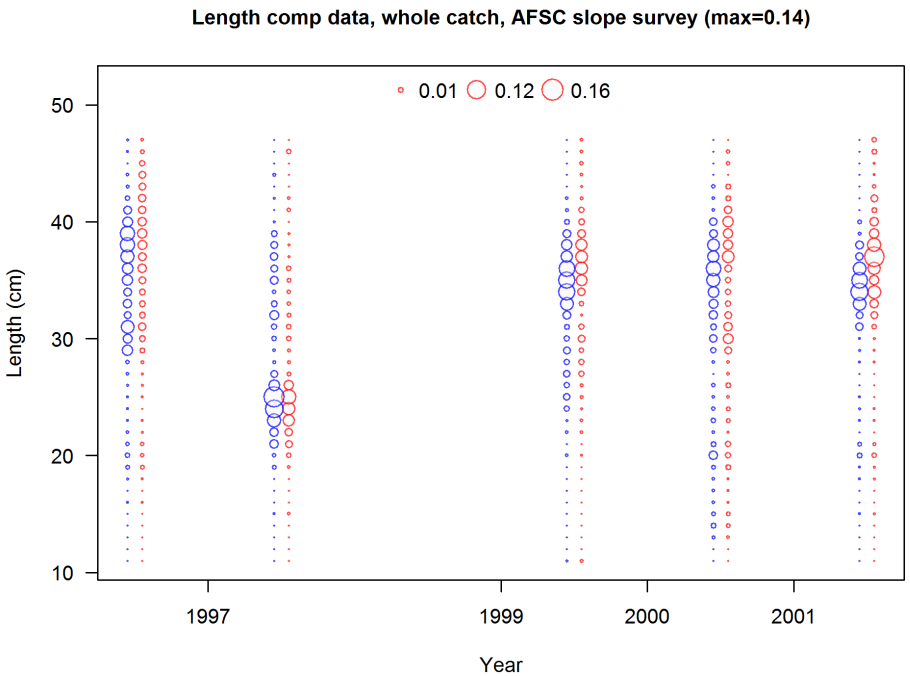


Triennial shelf survey

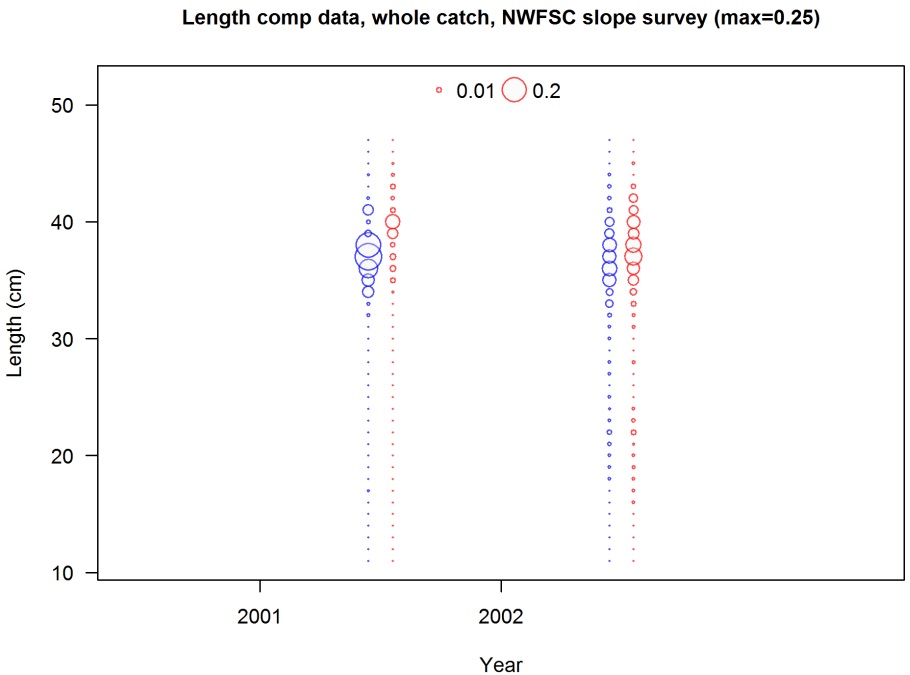


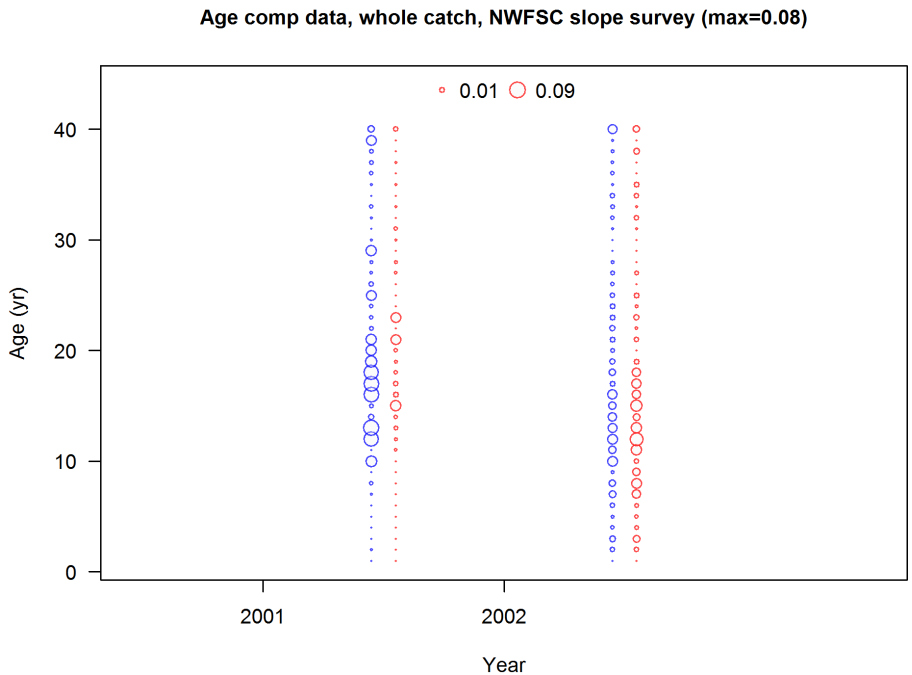


AFSC slope survey

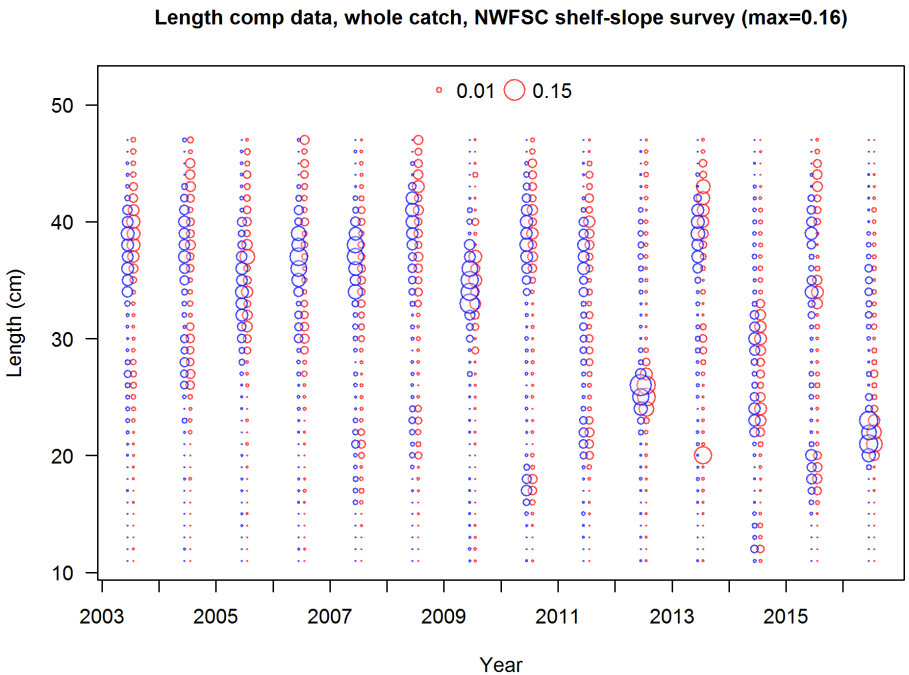


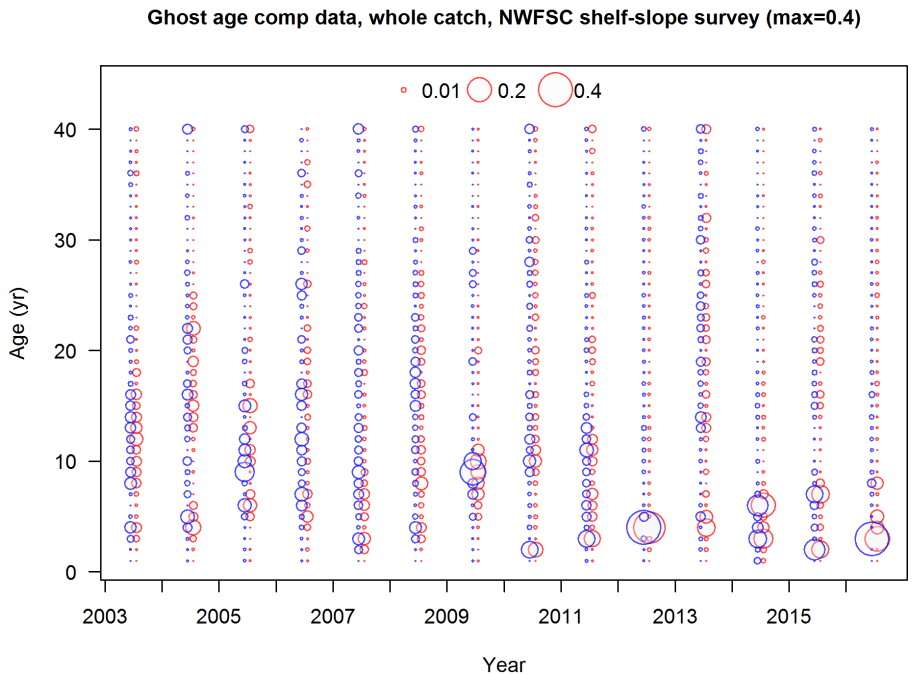
NWFSC slope survey



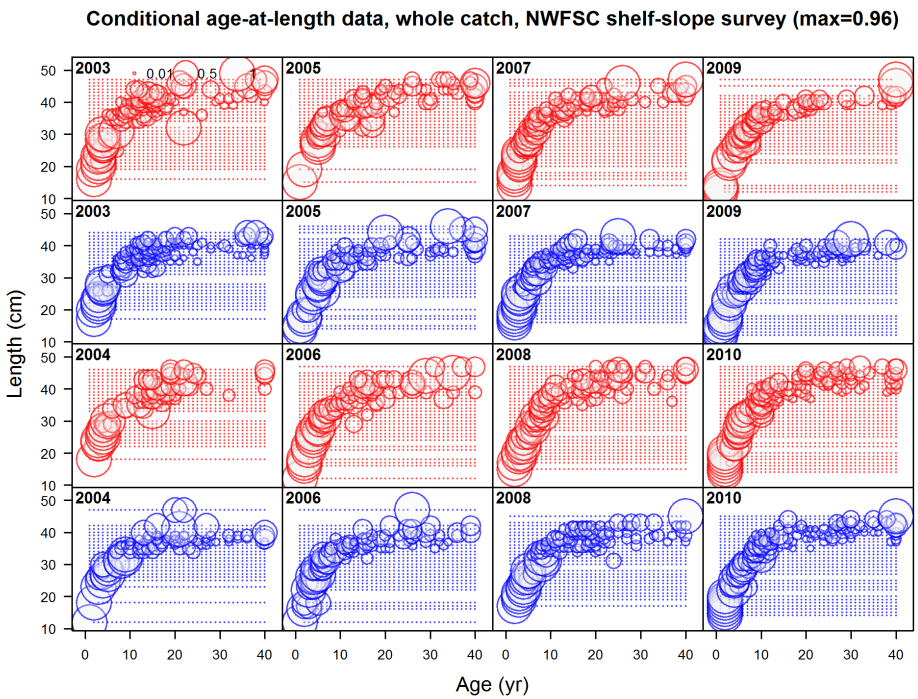


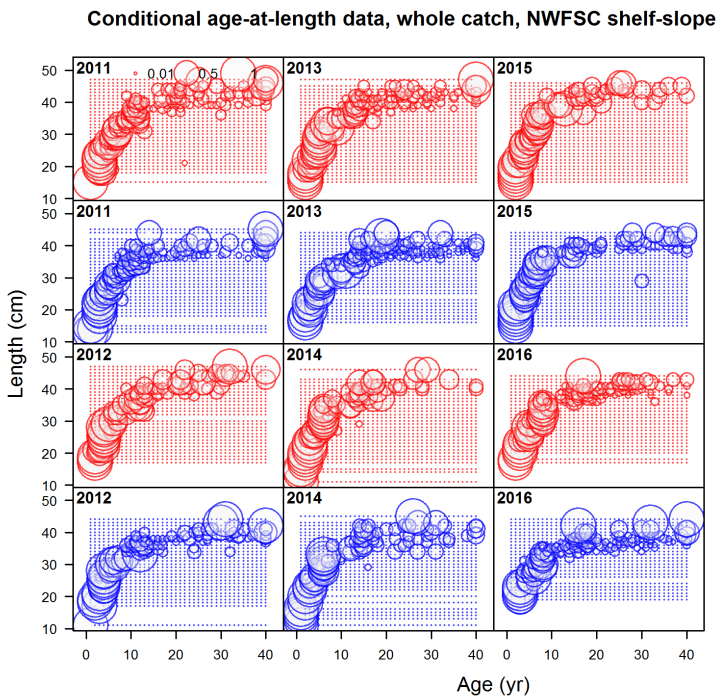
NWFSC shelf-slope survey



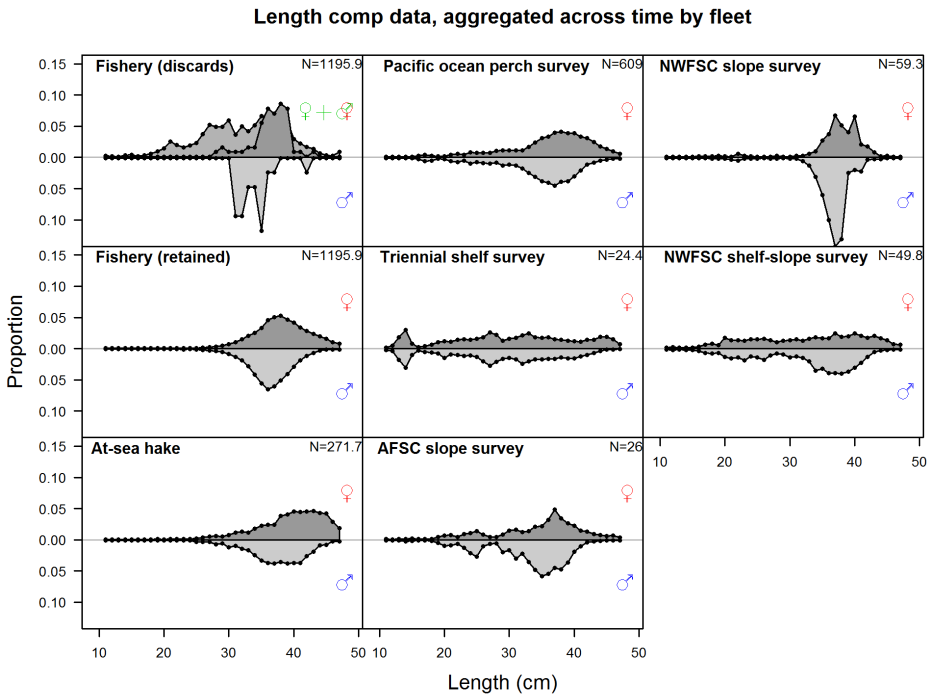


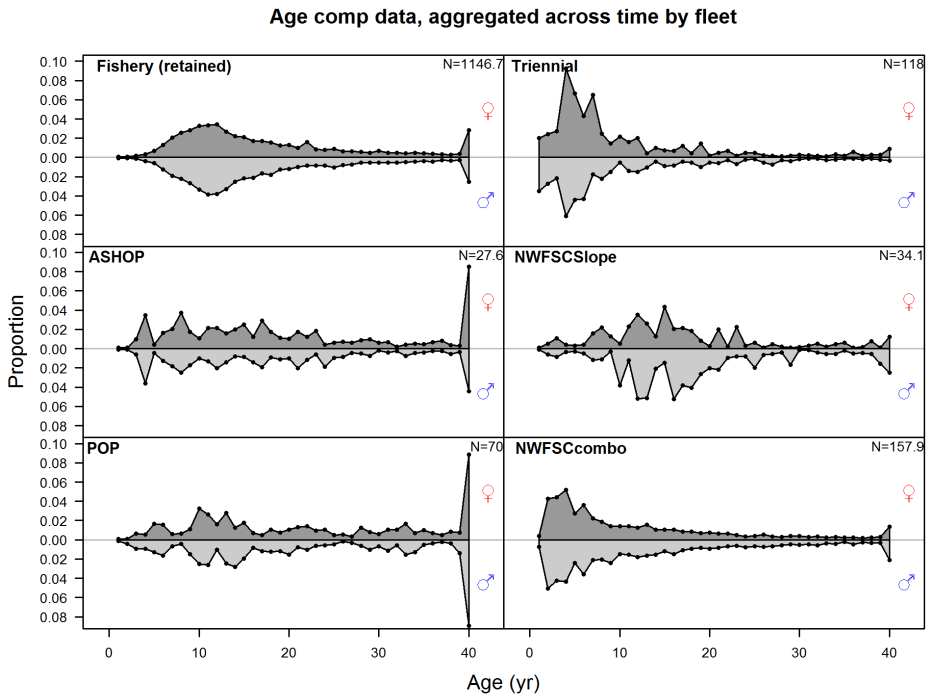
NWFSC shelf-slope conditional age-at-length



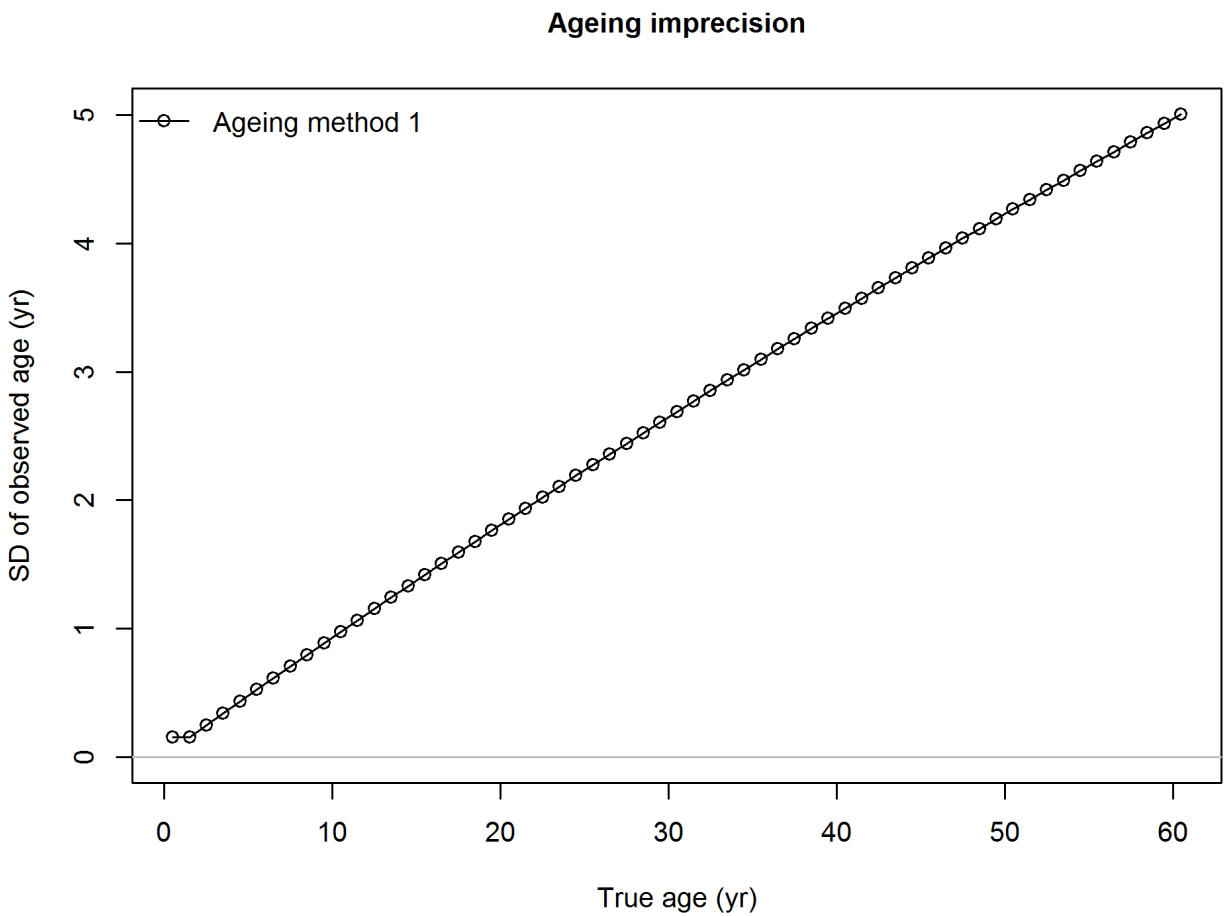


Aggregated data by source



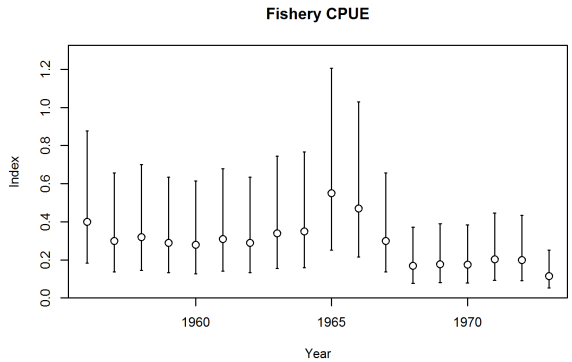


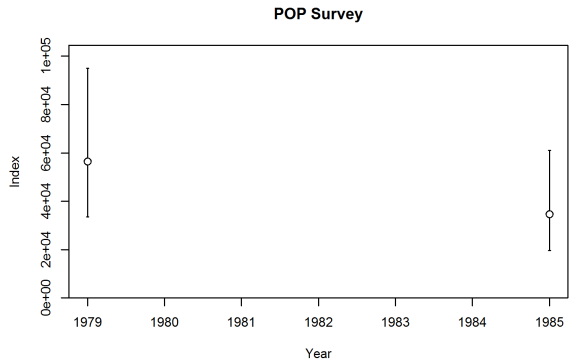
Estimated Ageing Error: Curvilinear without bias

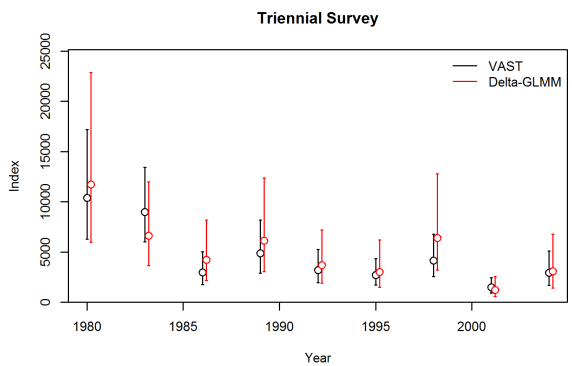


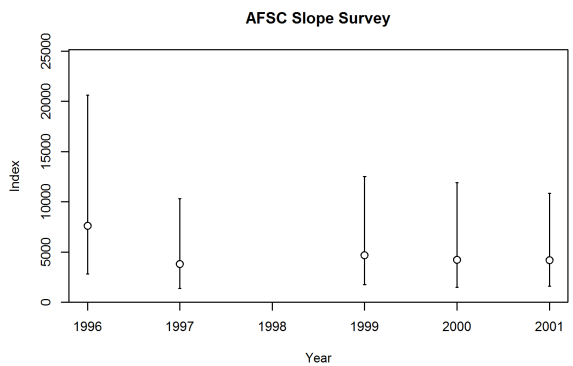
Conclusion of Biology & Data

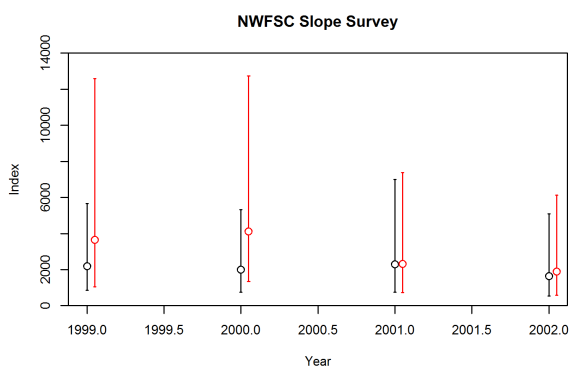
VAST vs. Bayesian Delta-GLMM Indices

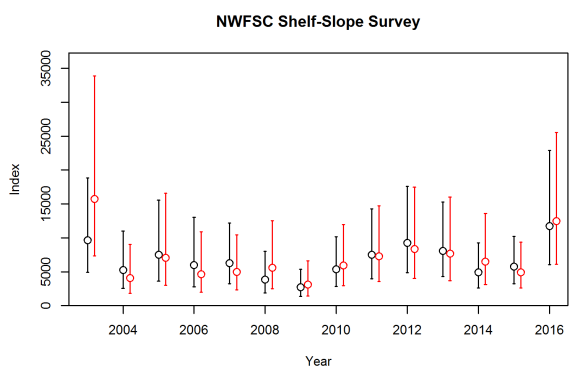




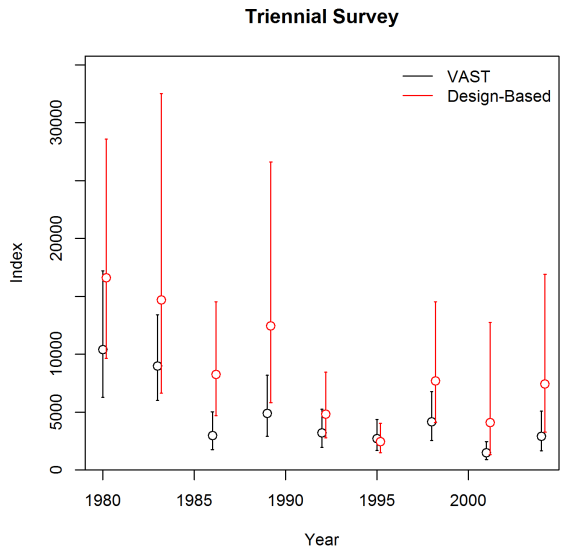


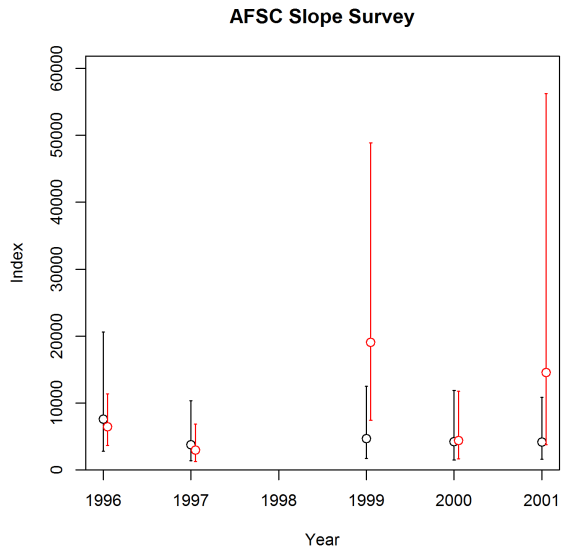


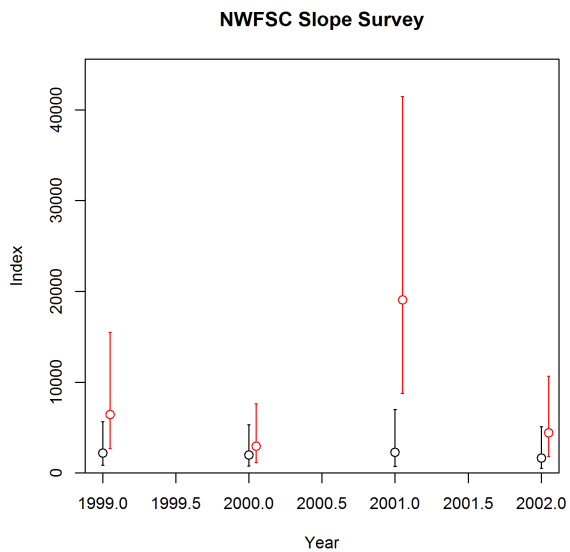


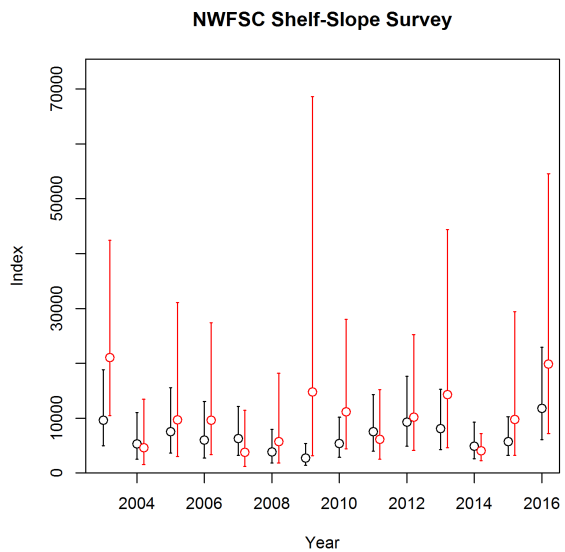


Designed Based vs. VAST Indices

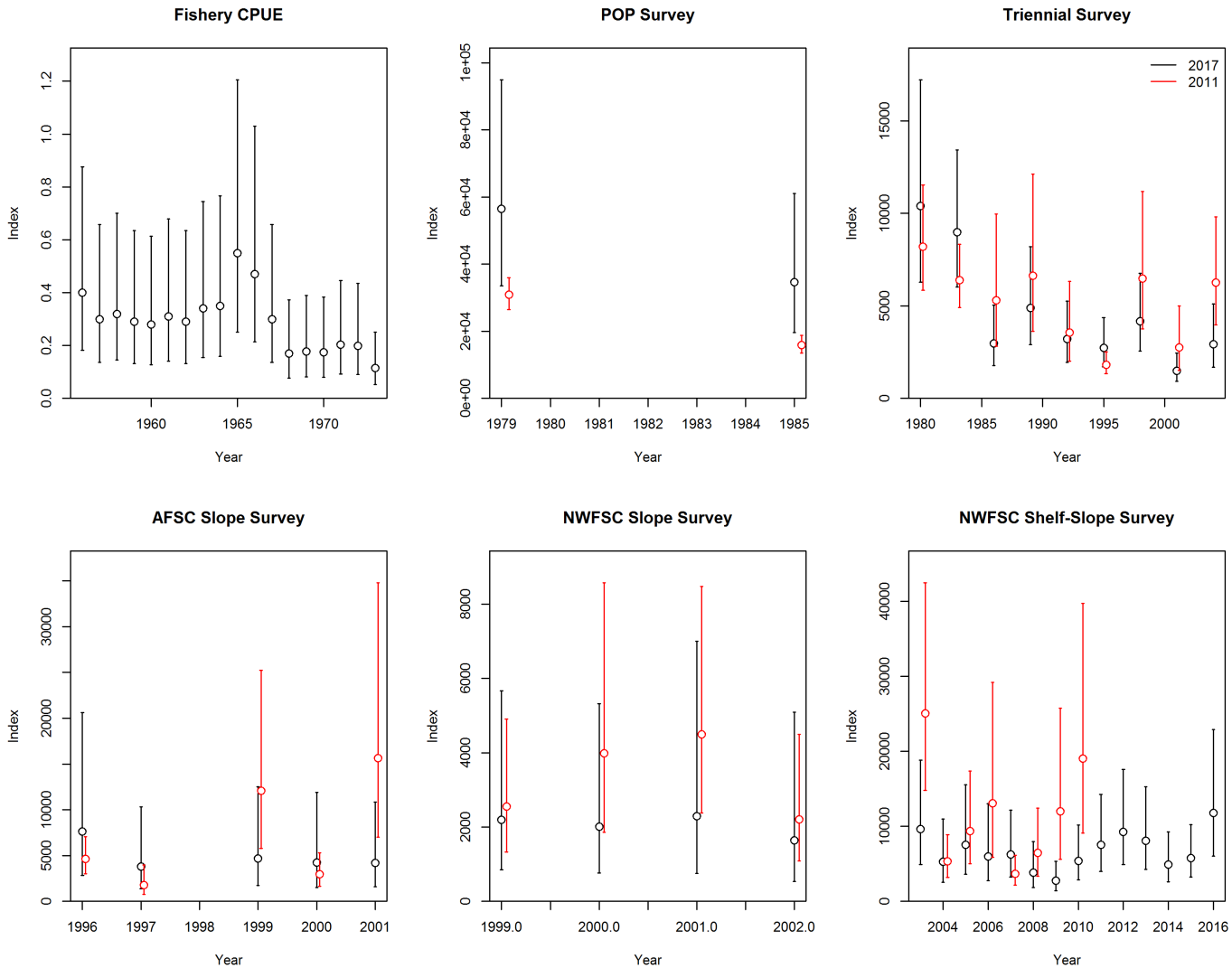




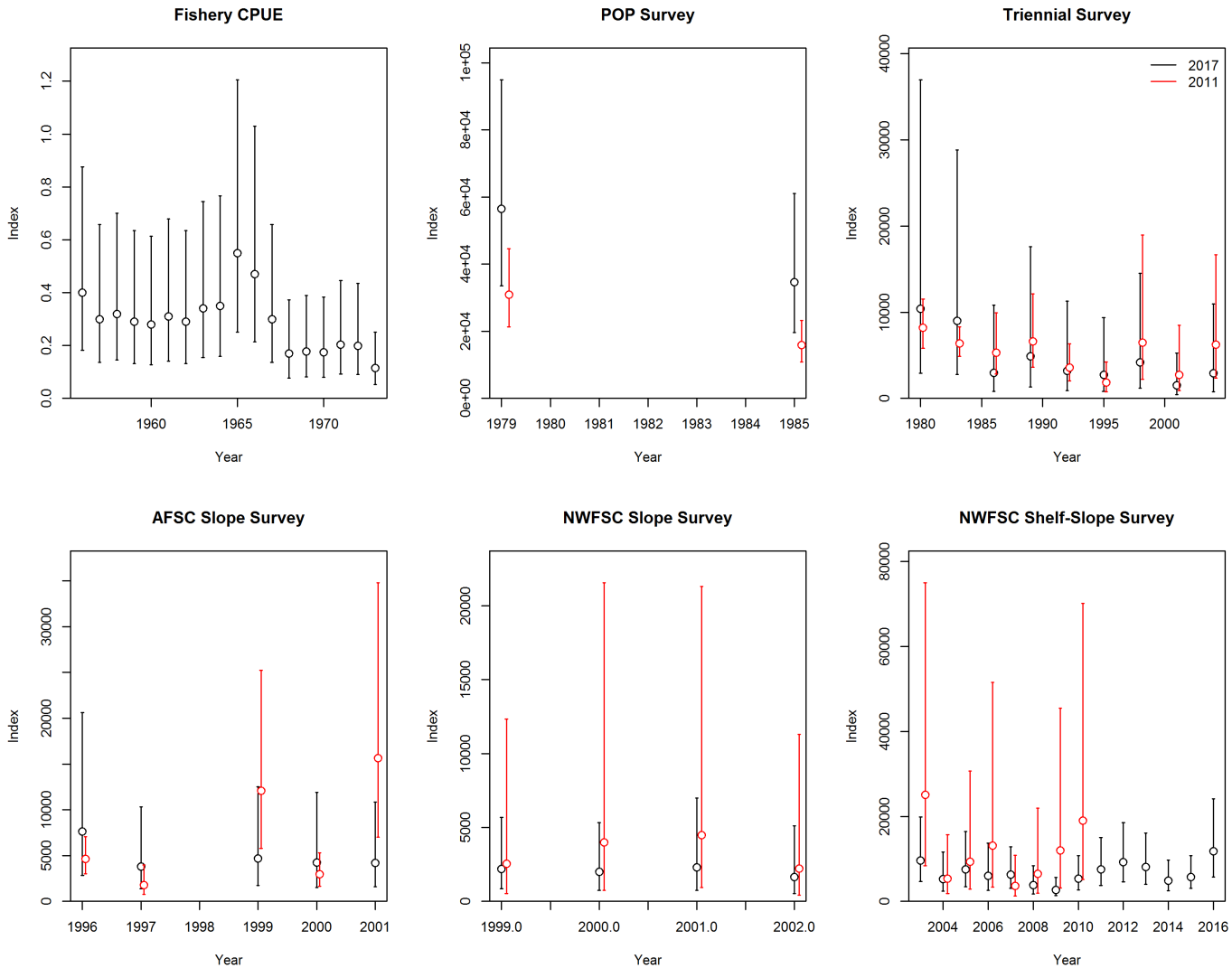




Pre-Model 2011 Indices vs. 2017 Indices



Post Model 2011 Indices vs. 2017 Indices



Catchability Comparison

Index	2011	2017
Fishery CPUE	5.25E-06	4.48E-06
Pacific ocean perch survey	0.8126	0.8741
Triennial shelf survey (early)	0.2423	0.161
Triennial shelf survey (late)	0.1793	-
AFSC slope survey	0.2708	0.0822
NWFSC slope survey	0.1717	0.0571
NWFSC shelf-slope survey	0.4797	0.0728

2011 vs. 2017 NWFSC shelf-slope index