

Pacific ocean perch 2017 Assessment

Biology and Data

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STAR Panel
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Outline

Model Summary

Landings

Estimated Stock Size and Status

Uncertainties

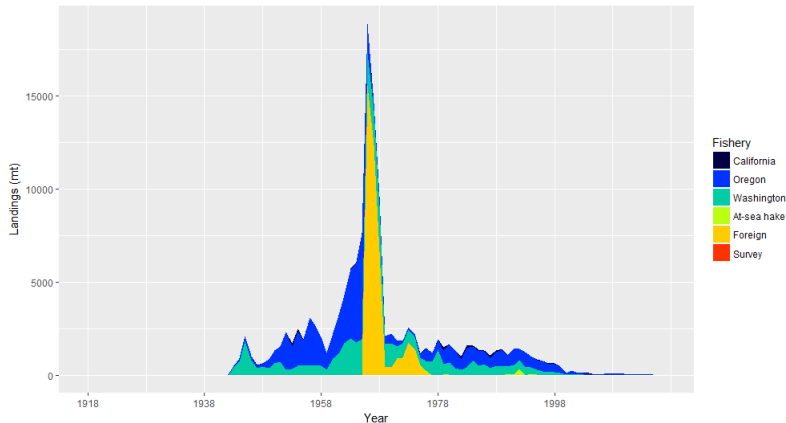
Biology

Removals

Indices of Abundance

Composition Data

Landings

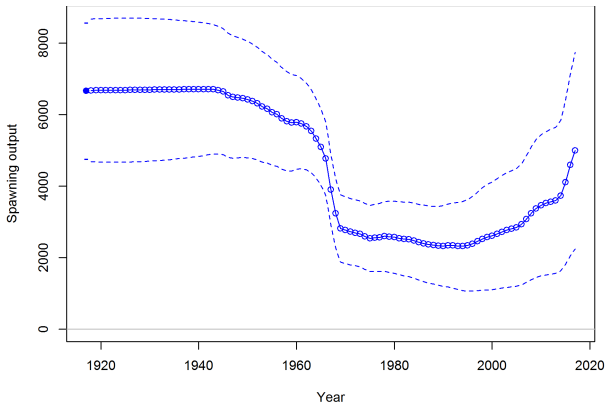


Year	CA	OR	WA	At-sea hake	Survey	Total Landings
2007	0.15	83.65	45.12	4.05	0.58	133.55
2008	0.39	58.64	16.61	15.93	0.80	92.36
2009	0.92	58.74	33.22	1.56	2.72	97.17
2010	0.14	58.00	22.29	16.87	1.68	98.98
2011	0.12	30.26	19.66	9.17	1.94	61.14
2012	0.18	30.41	21.79	4.52	1.62	58.51
2013	0.08	34.86	14.83	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

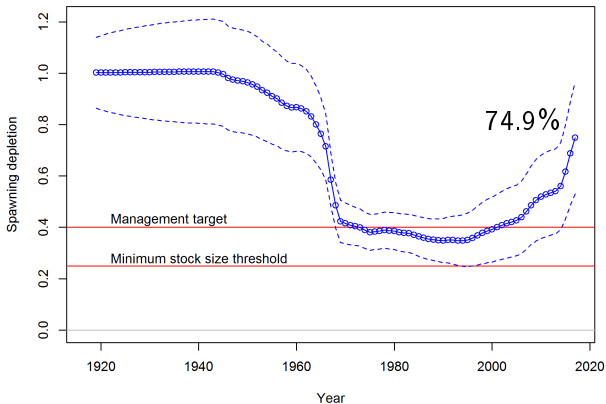
Approximately 70% of the landings are from Oregon.

Vast majority of landings are from bottom-trawl gear.

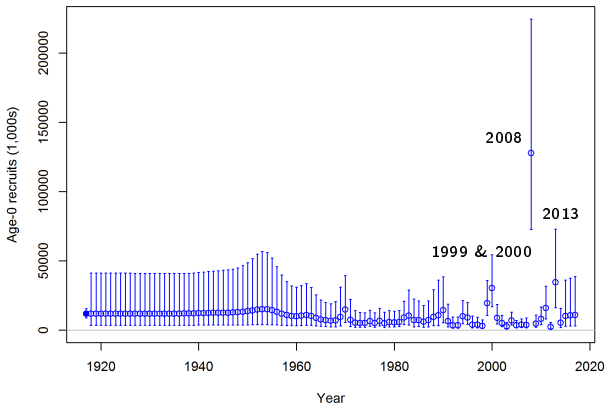
Spawning Output



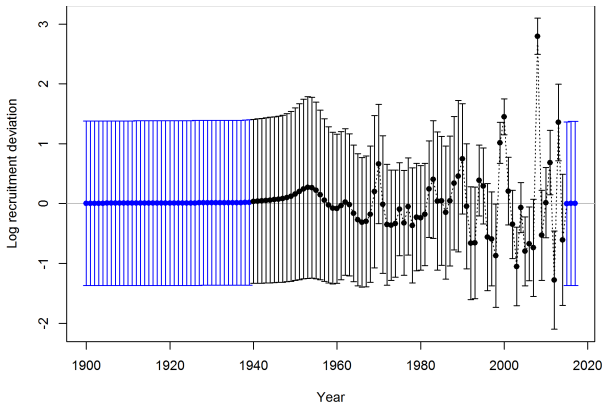
Relative Depletion



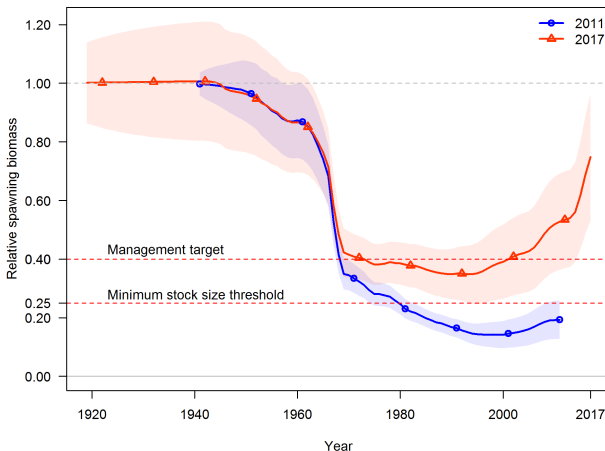
Estimated Annual Recruitment



Estimated Annual Recruitment Deviations



Comparison between 2011 and 2017

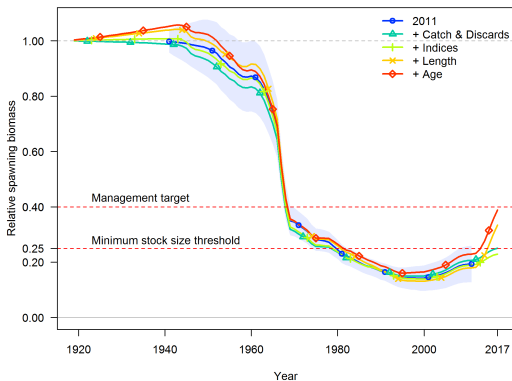


Major Changes Between the Previous and Current Assessment

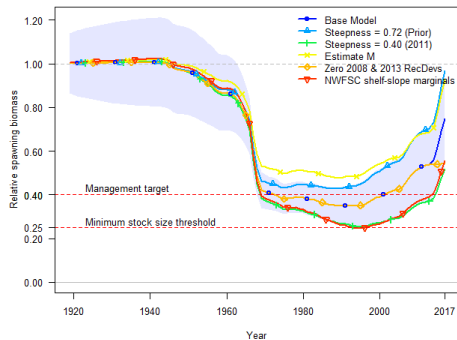
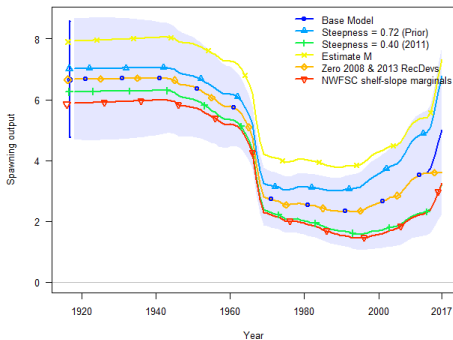
- Steepness
- Natural Mortality
- Landing History
- Maturity and Fecundity
- Fleet and Survey Selectivities

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

Growth

Model Summary

Removals

Biology

Indices of Abundance


Overview

Maturity

Fecundity

Composition Data

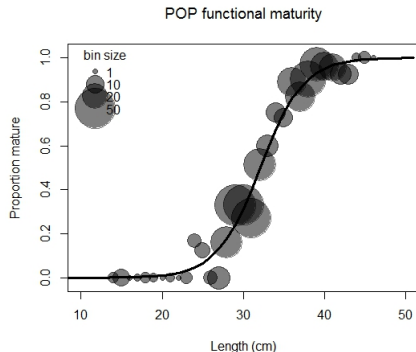
Pacific ocean perch (*Sebastes alutus*)

- Distributed from Alaska Aleutian Islands to Northern California
 - Typically distributed 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

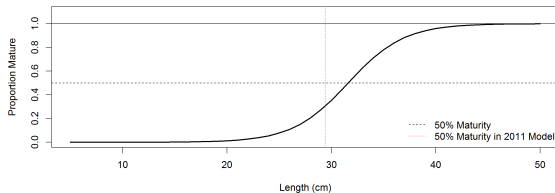
Functional maturity-at-length

- 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

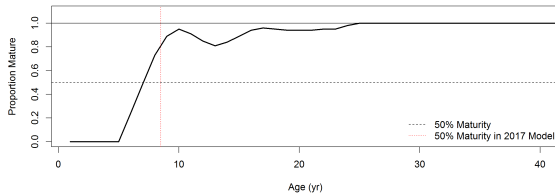


Maturity Comparison

Functional Maturity by Length (2017 Assessment)

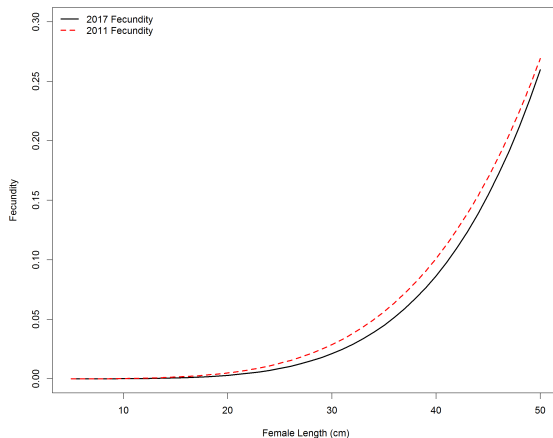


Maturity by Age (2011 Assessment)



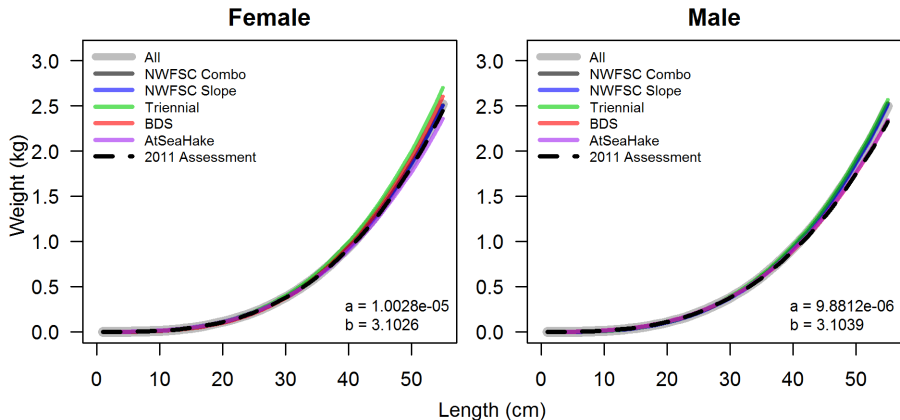
*Sensitivity to assumed maturity shown to not have a large impact on results

Fecundity

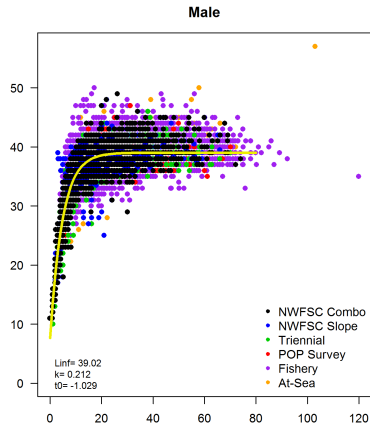
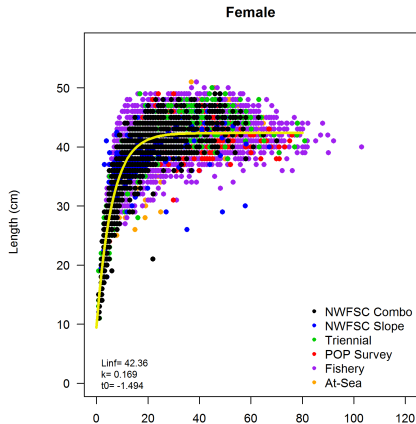


*Sensitivity to assumed fecundity shown to not have a large impact on results

Weight-at-length



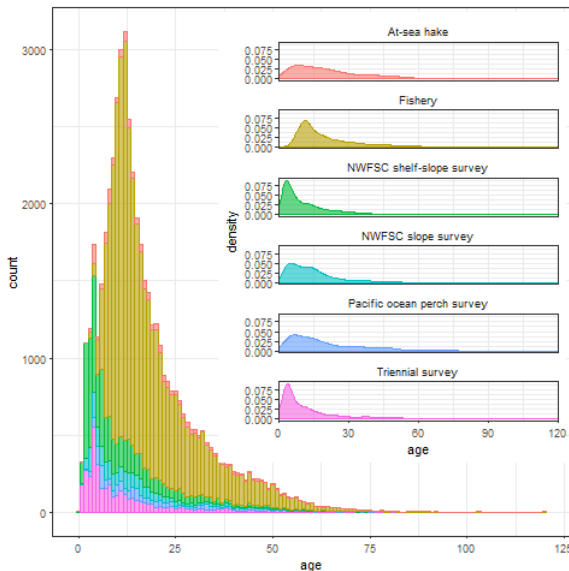
Length-at-age



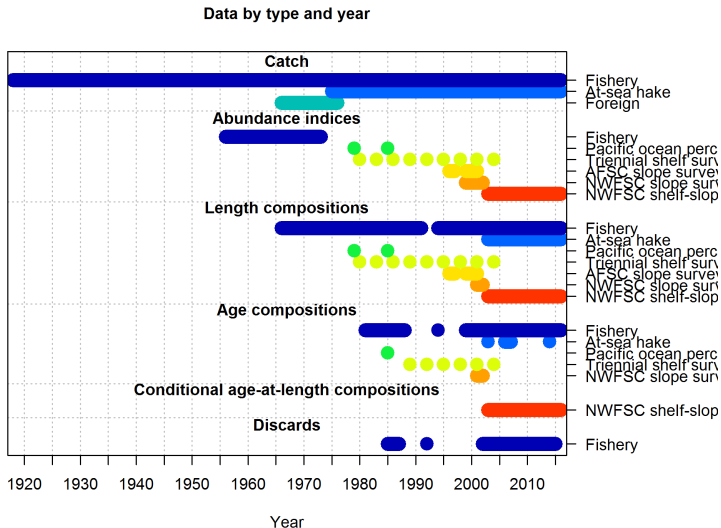
Age

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

Model Summary

Biology

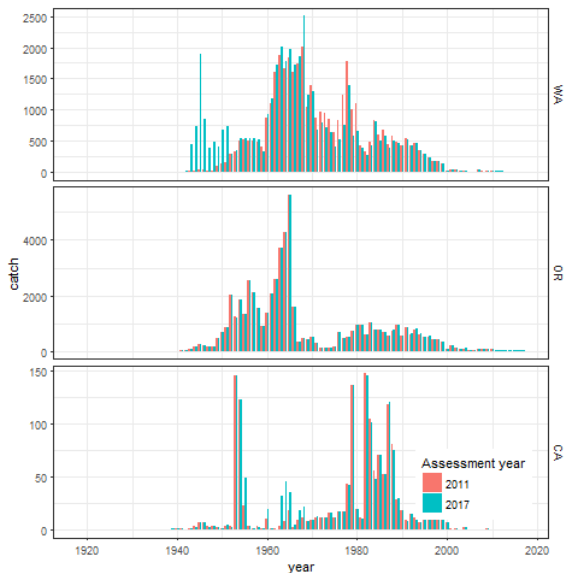
Removals

Landing history by state
Discarding practices

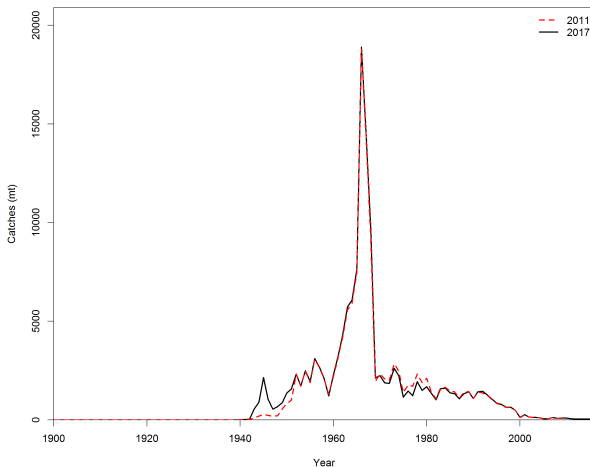
Indices of Abundance

Composition Data

Landings Data: 2017 vs. 2011

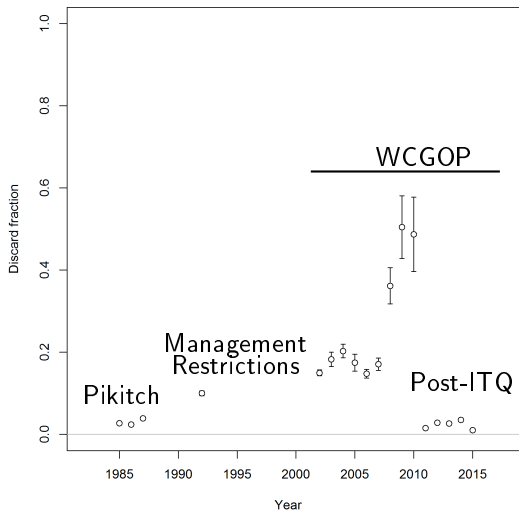


Cummalative catch difference



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

Fishery Discard Data



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

Outline

Model Summary

Biology

Removals

Indices of Abundance

Fishery CPUE

Survey Indices

Composition Data

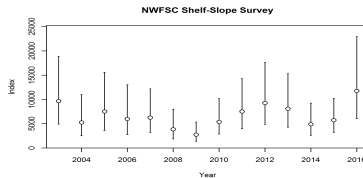
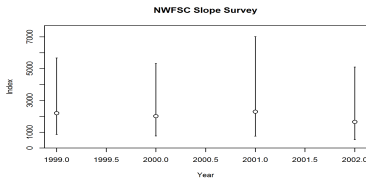
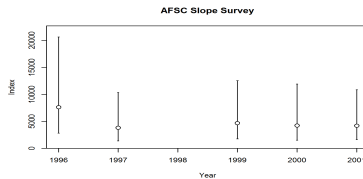
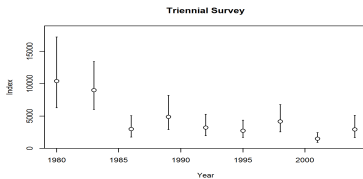
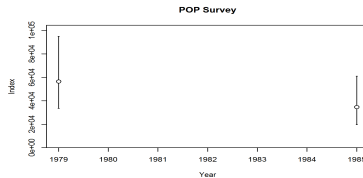
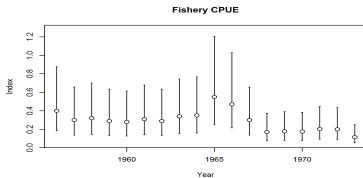
CPUE



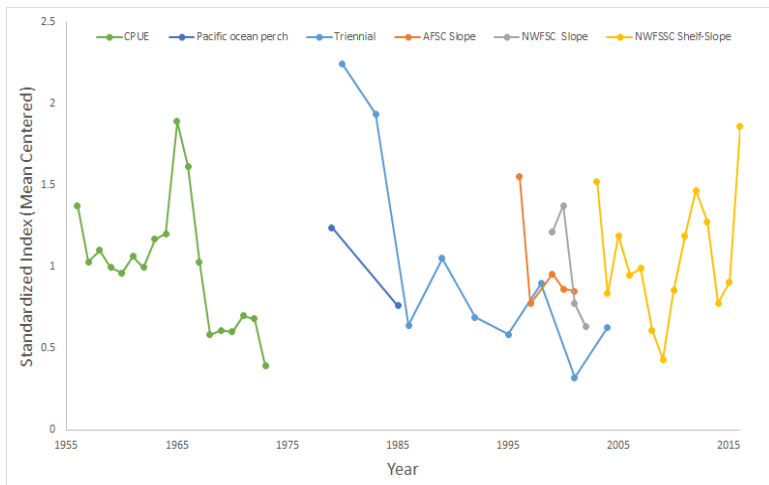
Gunderson (1977) CPUE from the INPFC Columbia area

*Sensitivity shows little effect on model results when removed.

Survey Indices



All: standardized



Outline

Indices of Abundance

Composition Data

Fishery Data

Survey Length and Age Data

Ageing Error

Model Summary

Biology

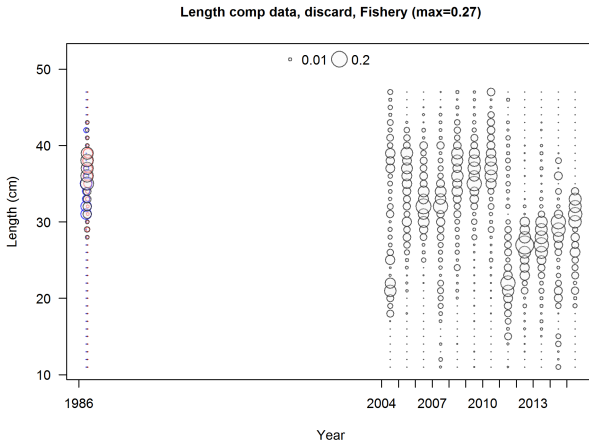
Removals

Fishery Length and Age Data

Fishery length data used in the 2017 assessment:

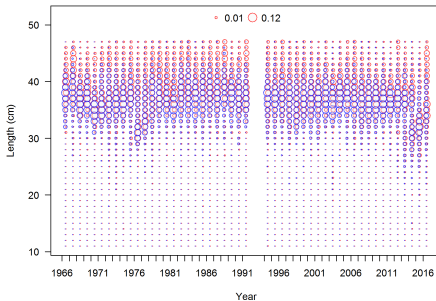
- Fishery: bottom trawl, mid-water trawl, fixed gear
 - Retained Lengths: 1966-2016
 - Discarded Lengths: 1986 (Pikitch), 2004-2015
 - Ages: 1981-1988, 1994, 1999-2016
- At-sea hake fishery
 - All (Retained and Discarded) Lengths: 2003-2016
 - Ages: 2003, 2006, 2007, 2014

Fishery Lengths: Discarded

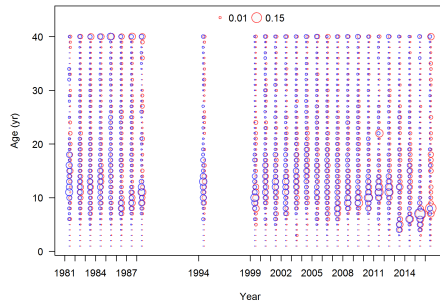


Fishery Lengths and Ages: Retained

Length comp data, retained, Fishery (max=0.13)

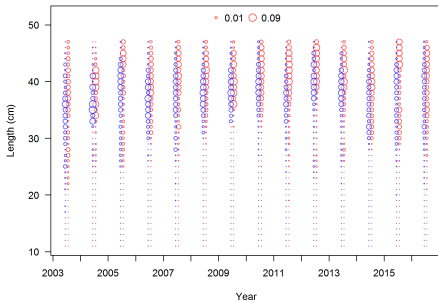


Age comp data, retained, Fishery (max=0.17)

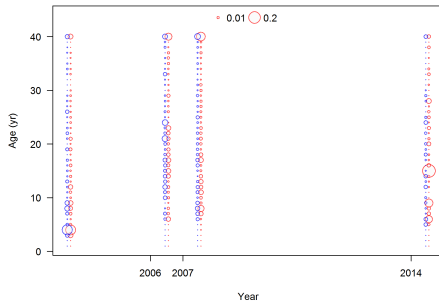


At-sea hake

Length comp data, whole catch, At-sea hake (max=0.08)



Age comp data, whole catch, At-sea hake (max=0.24)



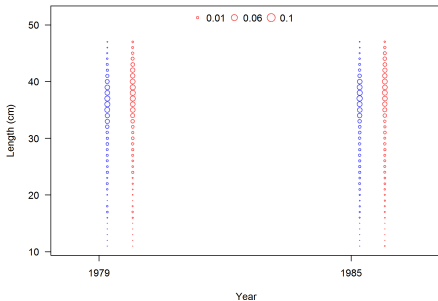
Survey Length Data

Survey length data used in the 2017 assessment:

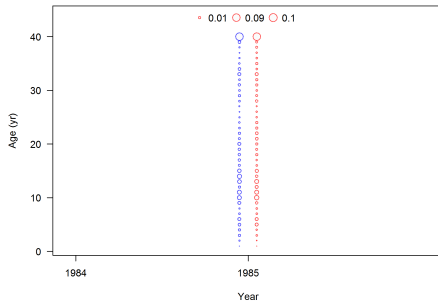
- Pacific ocean perch survey
 - Lengths: 1979 and 1985
 - Ages: 1985
- Triennial shelf survey
 - Lengths: 1980, 1983, 1986, 1989, 1992, 1995, 1998, 2001, 2004
 - Ages: 1989, 1992, 1995, 1998, 2001, 2004
- AFSC slope survey
 - Lengths: 1996, 1997, 1999-2001
- NWFSC slope survey
 - Lengths: 2001 and 2002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

Pacific ocean perch survey lengths

Length comp data, whole catch, Pacific ocean perch survey (max=0.05)

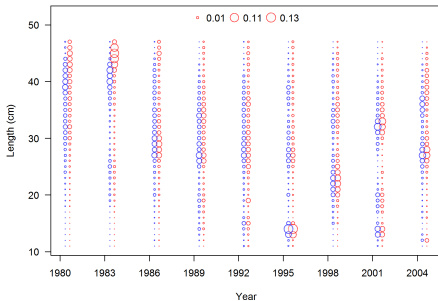


Age comp data, whole catch, Pacific ocean perch survey (max=0.09)

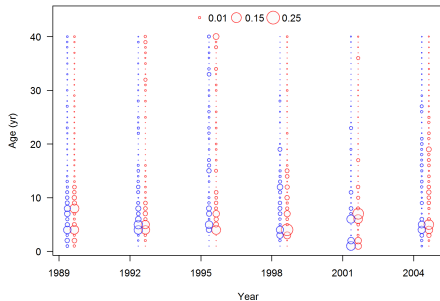


Triennial shelf survey

Length comp data, whole catch, Triennial shelf survey (max=0.13)

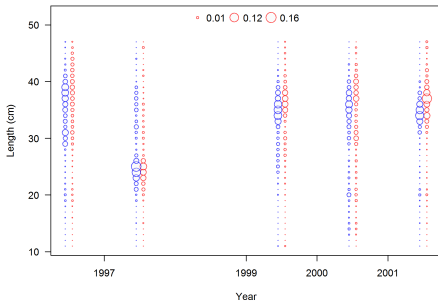


Age comp data, whole catch, Triennial shelf survey (max=0.2)



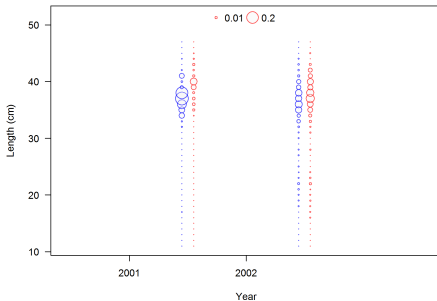
AFSC slope survey

Length comp data, whole catch, AFSC slope survey (max=0.14)

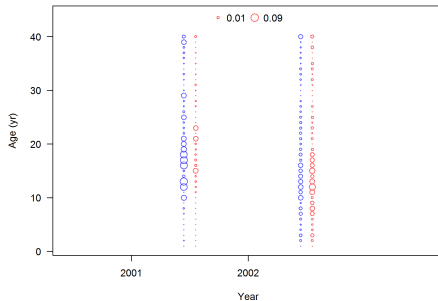


NWFSC slope survey

Length comp data, whole catch, NWFSC slope survey (max=0.25)

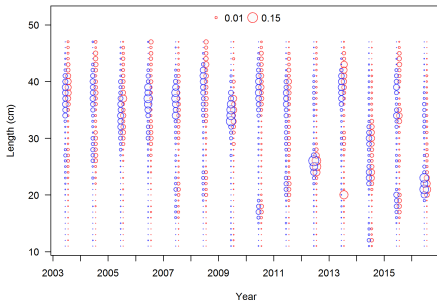


Age comp data, whole catch, NWFSC slope survey (max=0.08)

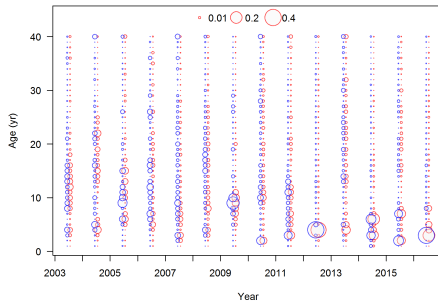


NWFSC shelf-slope survey

Length comp data, whole catch, NWFSC shelf-slope survey (max=0.16)

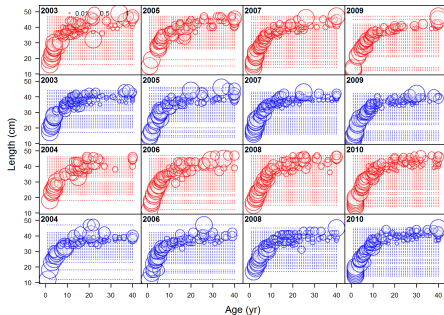


Ghost age comp data, whole catch, NWFSC shelf-slope survey (max=0.4)

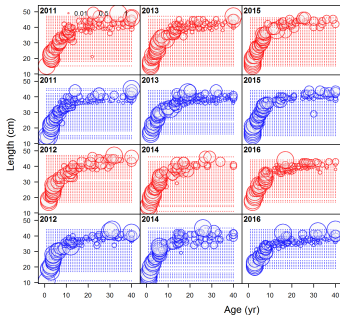


NWFSC shelf-slope conditional age-at-length

Conditional age-at-length data, whole catch, NWFSC shelf-slope survey (max=0.96)

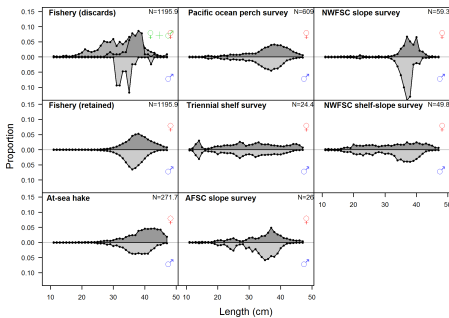


Conditional age-at-length data, whole catch, NWFSC shelf-slope survey (max=0.96)

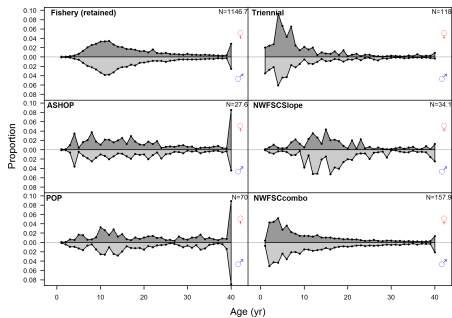


Aggregated data by source

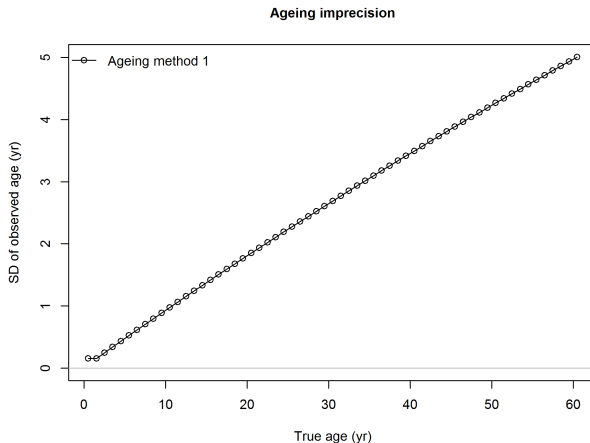
Length comp data, aggregated across time by fleet



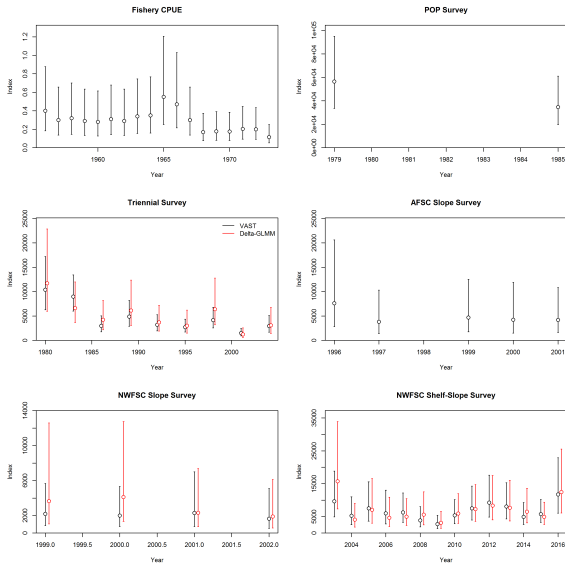
Age comp data, aggregated across time by fleet



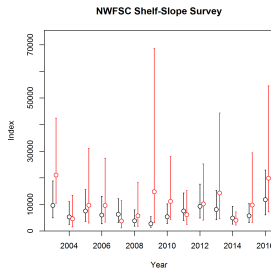
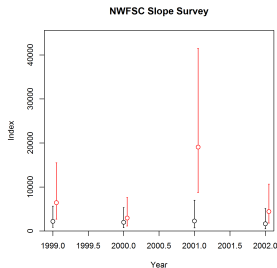
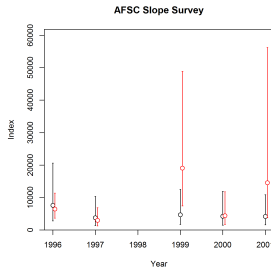
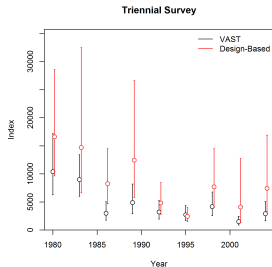
Estimated Ageing Error: Curvilinear without bias



VAST vs. Bayesian Delta-GLMM Indices



Designed Based vs. VAST Indices



2011 vs. 2017 NWFSC shelf-slope index

