

GOA Flathead sole

- **Summary of Changes in Assessment Inputs**

- 2016-2017 catch data were added to the model and 2015 catch was updated to include October to December catch in that year.
- 2016 and 2017 fishery length composition data were added to the model and 2015 fishery length composition data were updated to include October to December length data from that year.
- The 2017 bottom trawl survey biomass index and standard error was added to the model
- Survey length composition data for 2017 were added to the model
- Survey conditional age-at-length data for 2015 were added to the model
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- **Summary of Changes in Assessment Methodology**

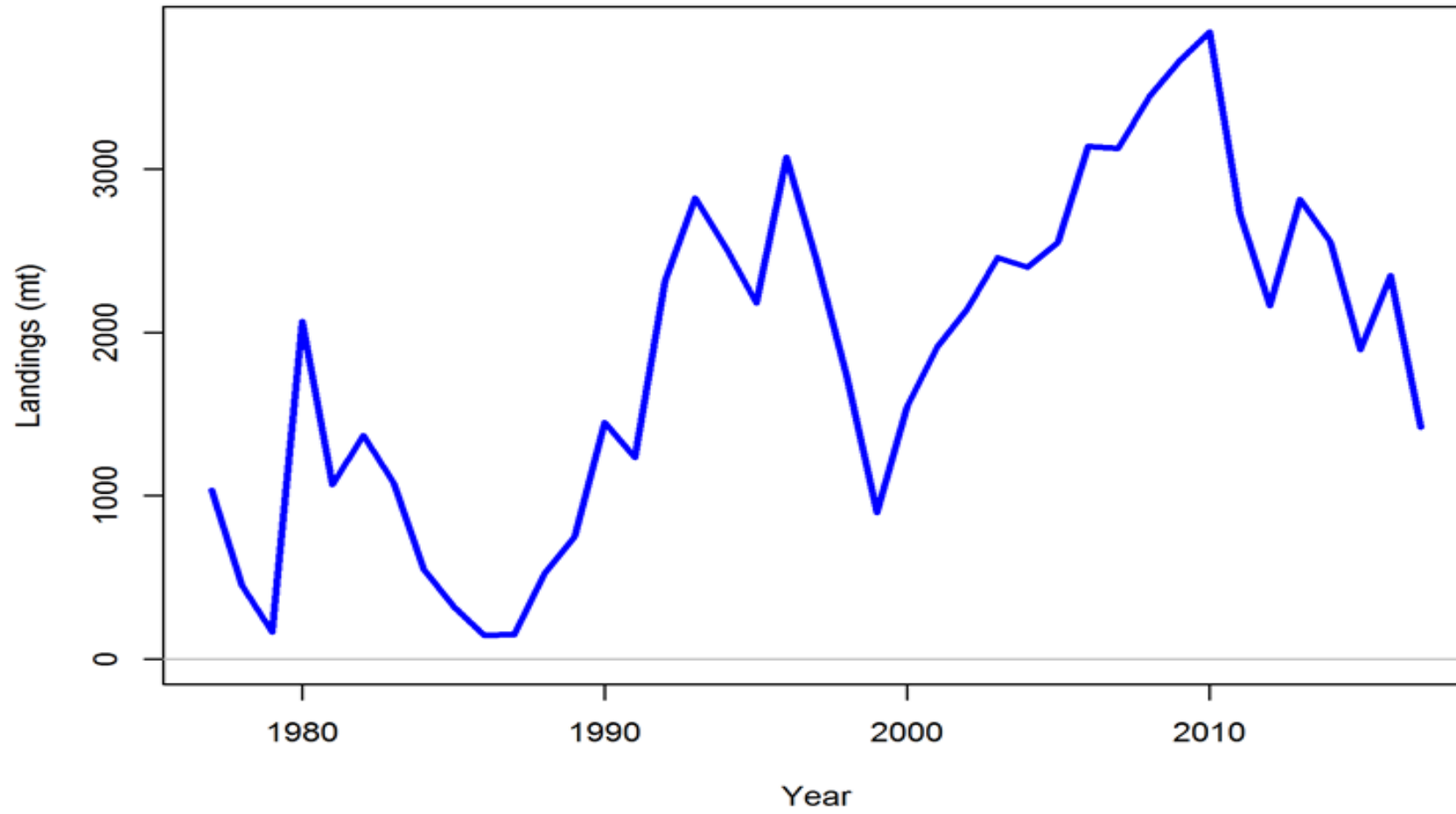
- No changes were made to the assessment methodology.

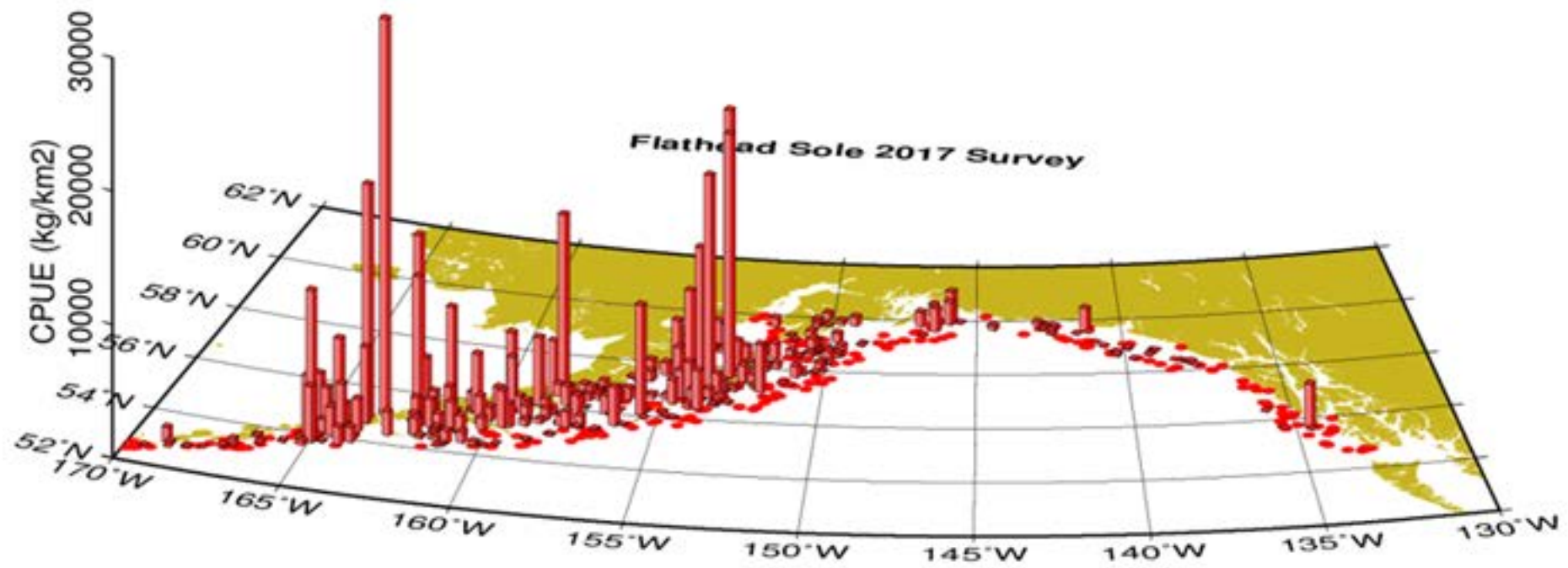
- **Responses to SSC and Plan Team Comments Specific to this Assessment**
- *The SSC concurs with the PT and author that a priority for future assessments is to analyze ageing error data for GOA flathead sole using methods described in Punt et al. (2008) and to incorporate a resulting ageing error matrix into the assessment. In addition, the SSC supports the PT and author's recommendations that future analyses should explore the relationship between natural mortality and catchability in the model, alternative parameter values, and the effects of these parameters on estimation of selectivity and other parameters. Finally, the SSC encourages the author to explore ways to better account for scientific uncertainty, especially uncertainty associated with parameters that are currently fixed in the model.*
- *Authors' response:* This assessment includes joint profiles likelihoods for survey Q and natural mortality. Ageing error estimation and scientific uncertainty will be explored in future assessments.

GOA Flathead Sole – Survey Biomass increased however, F35% decreased due to fishery selectivity shifting to younger fish, so OFL and ABC very similar to previous assessment.

Quantity	As estimated or <i>specified last year for:</i>		As estimated or <i>recommended this year for:</i>	
	2017	2018	2018*	2019*
<i>M</i> (natural mortality rate)	0.2	0.2	0.2	0.2
Tier	3a	3a	3a	3a
Projected total (3+) biomass (t)	269,638	272,323	281,635	283,107
Female spawning biomass (t)	82,819	84,273	85,765	89,118
<i>B</i> _{100%}	92,165	92,165	91,551	91,551
<i>B</i> _{40%}	36,866	36,866	36,620	36,620
<i>B</i> _{35%}	32,258	32,258	32,043	32,043
<i>F</i> _{OFL}	0.40	0.40	0.36	0.36
<i>maxF</i> _{ABC}	0.32	0.32	0.28	0.28
<i>F</i> _{ABC}	0.32	0.32	0.28	0.28
OFL (t)	43,128	43,872	43,011	44,822
maxABC (t)	35,243	35,829	35,266	36,746
ABC (t)	35,243	35,829	35,266	36,746
Status	As determined in 2016 for:		As determined in 2017 for:	
	2015	2016	2016	2017
Overfishing	no	n/a	no	n/a
Overfished	n/a	no	n/a	no
Approaching overfished	n/a	no	n/a	no

Flathead sole 2016 catch was 2,421 t (low compared to ABC)





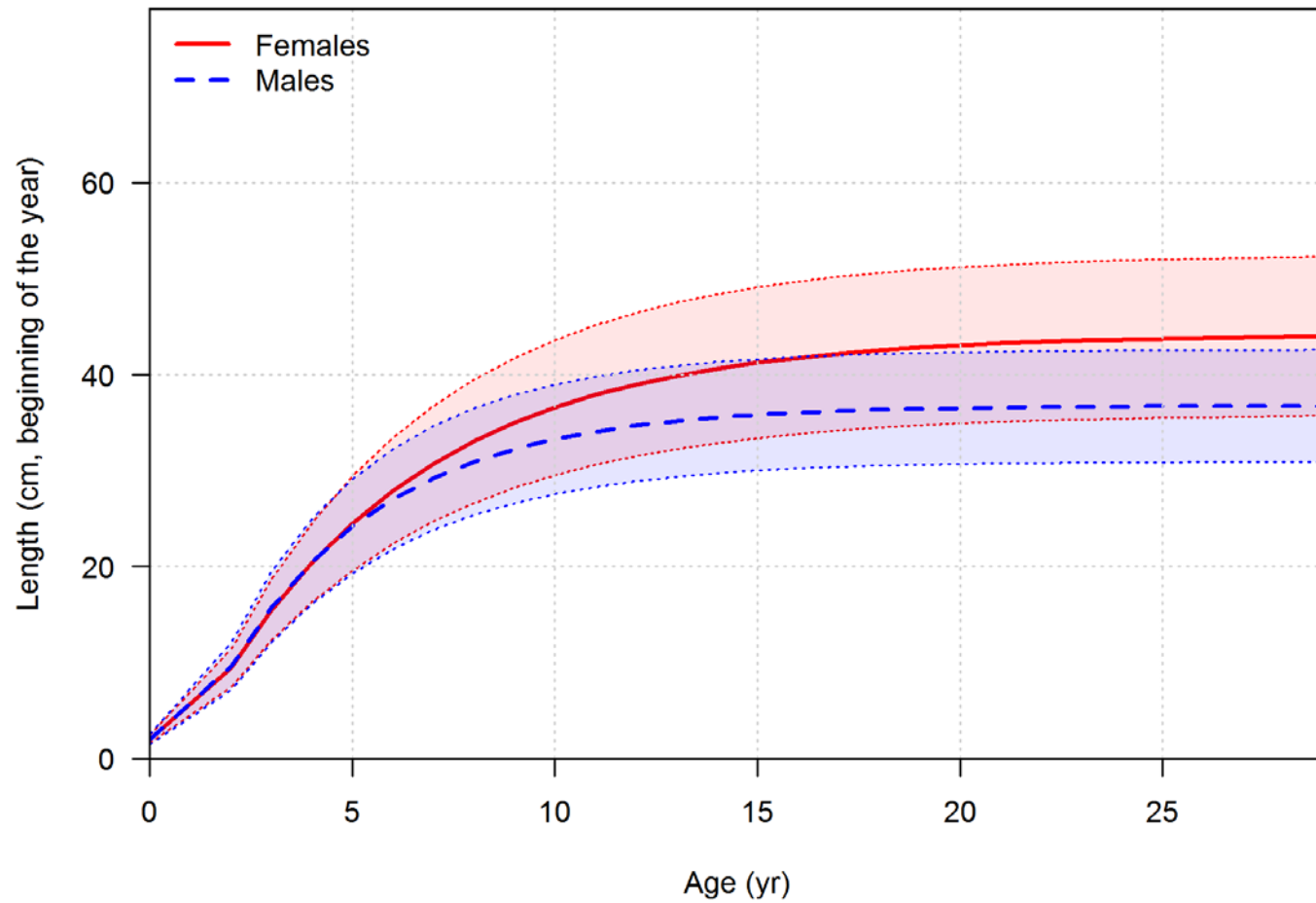


Figure 9. Estimated length-at-age relationship with 95% asymptotic confidence intervals for males (blue) and females (red). The blue dashed line and red solid line show the mean relationship and dotted lines show confidence intervals.

Length comps, aggregated across time by fleet

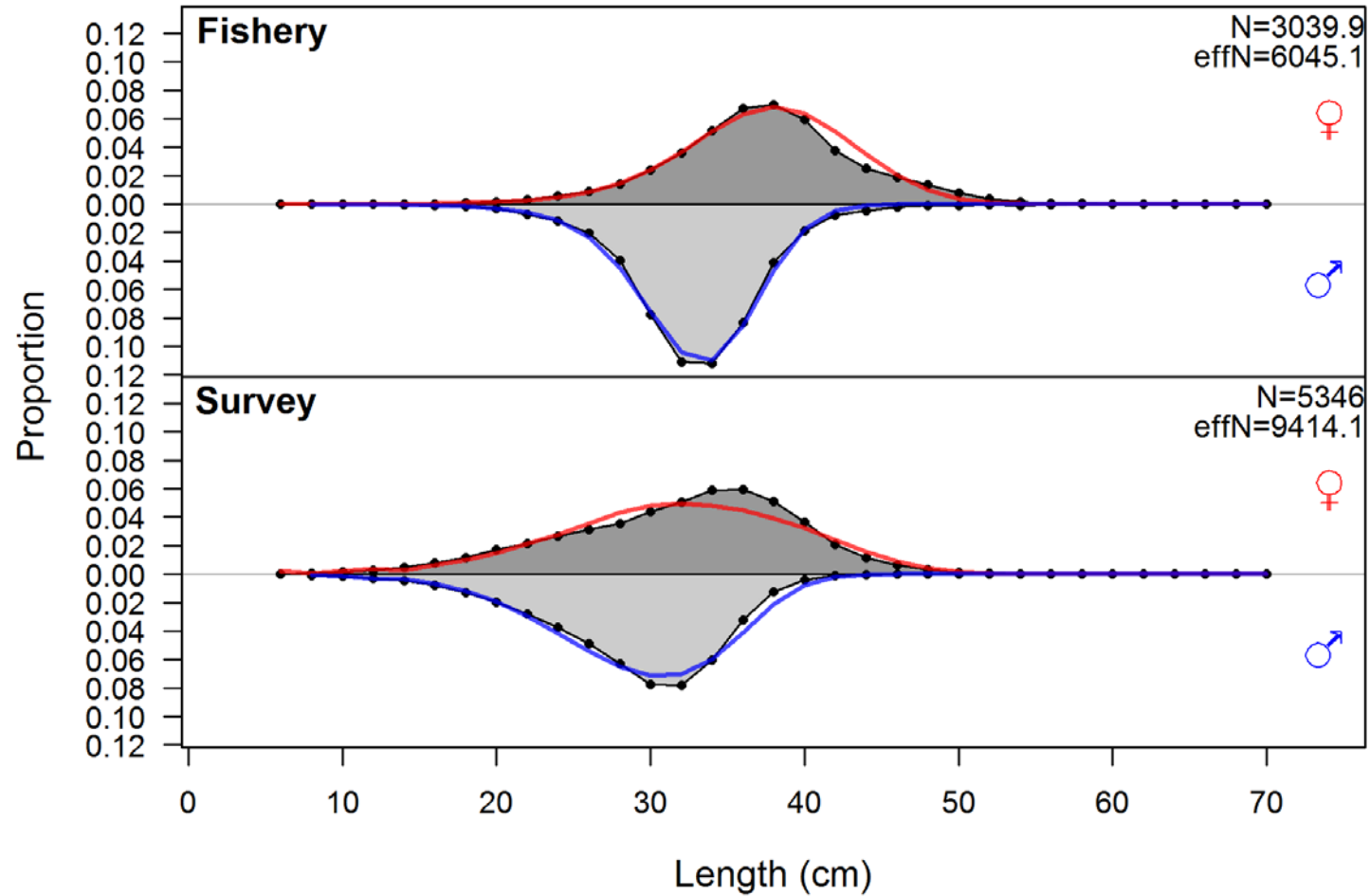
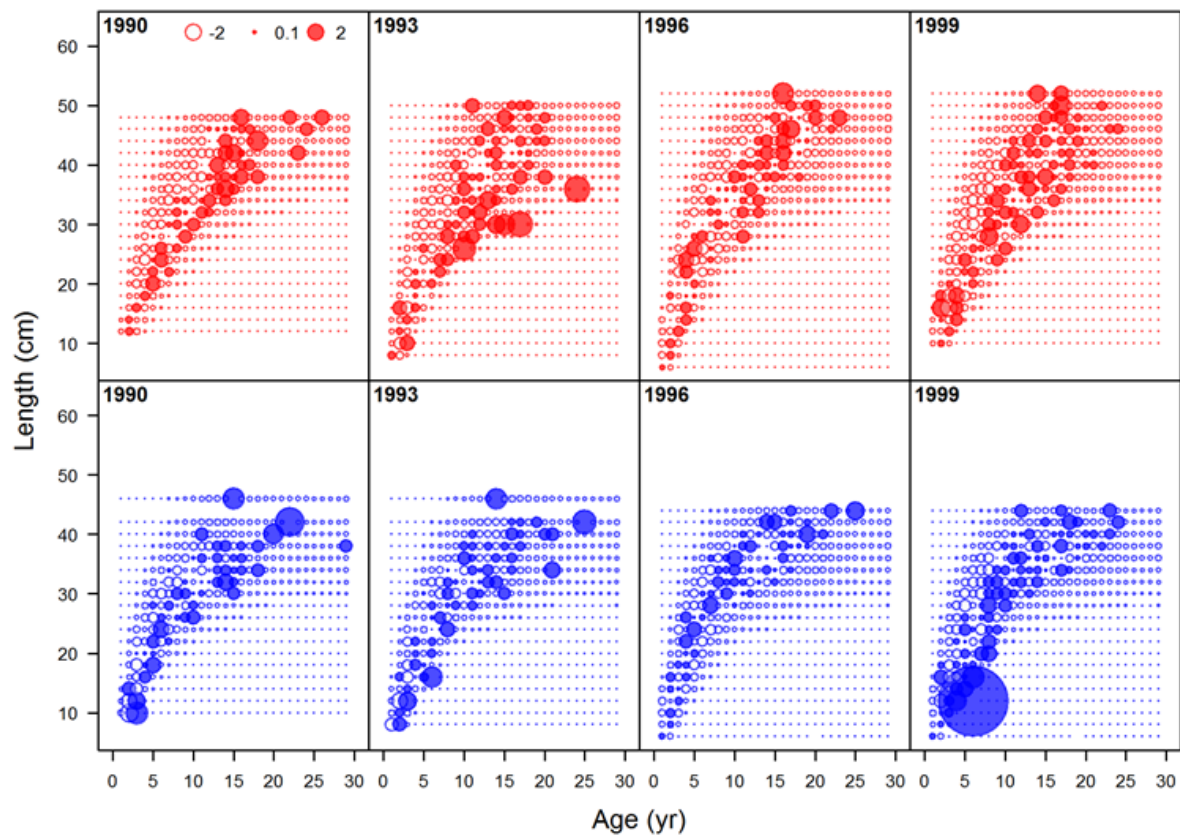


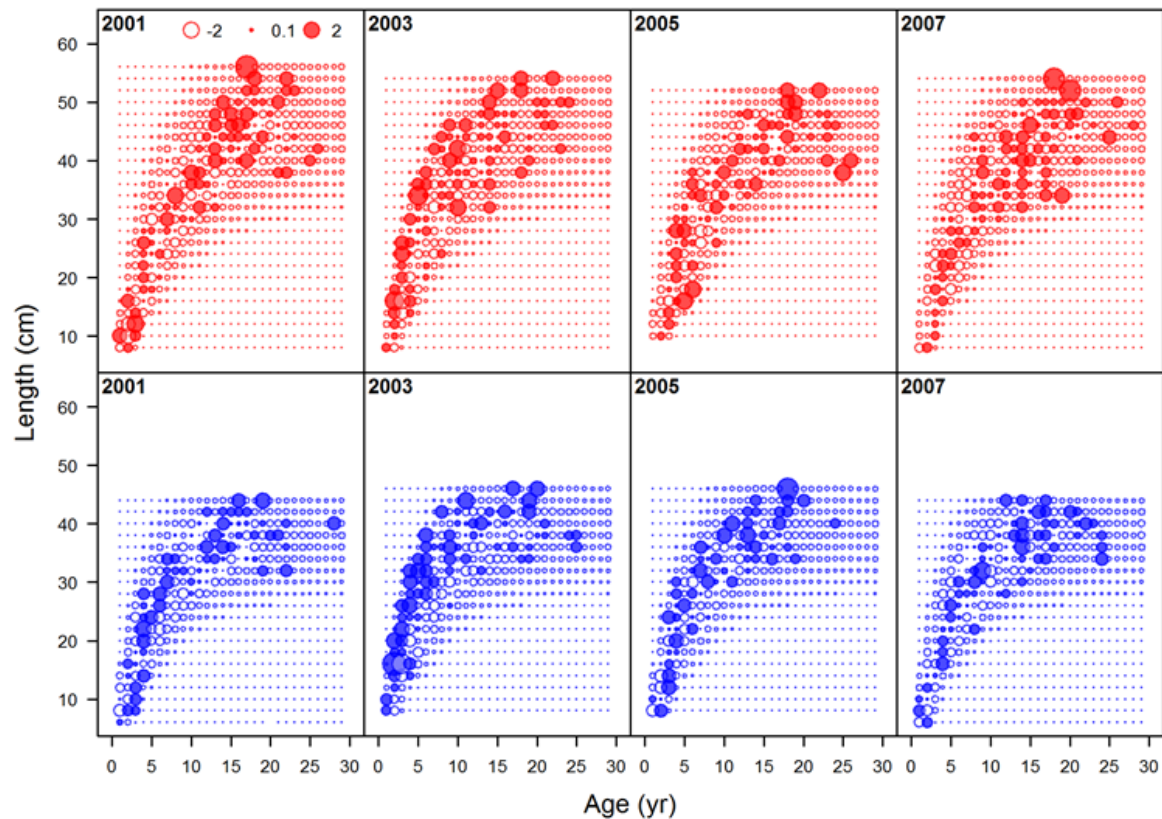
Figure 10. Observed (grey shaded area, black lines) and expected (red lines) proportions-at-length, aggregated over years for the fishery and survey and for females (upper half of plots) and males (lower half of plots) for the proposed 2017 model.

Females red Males blue

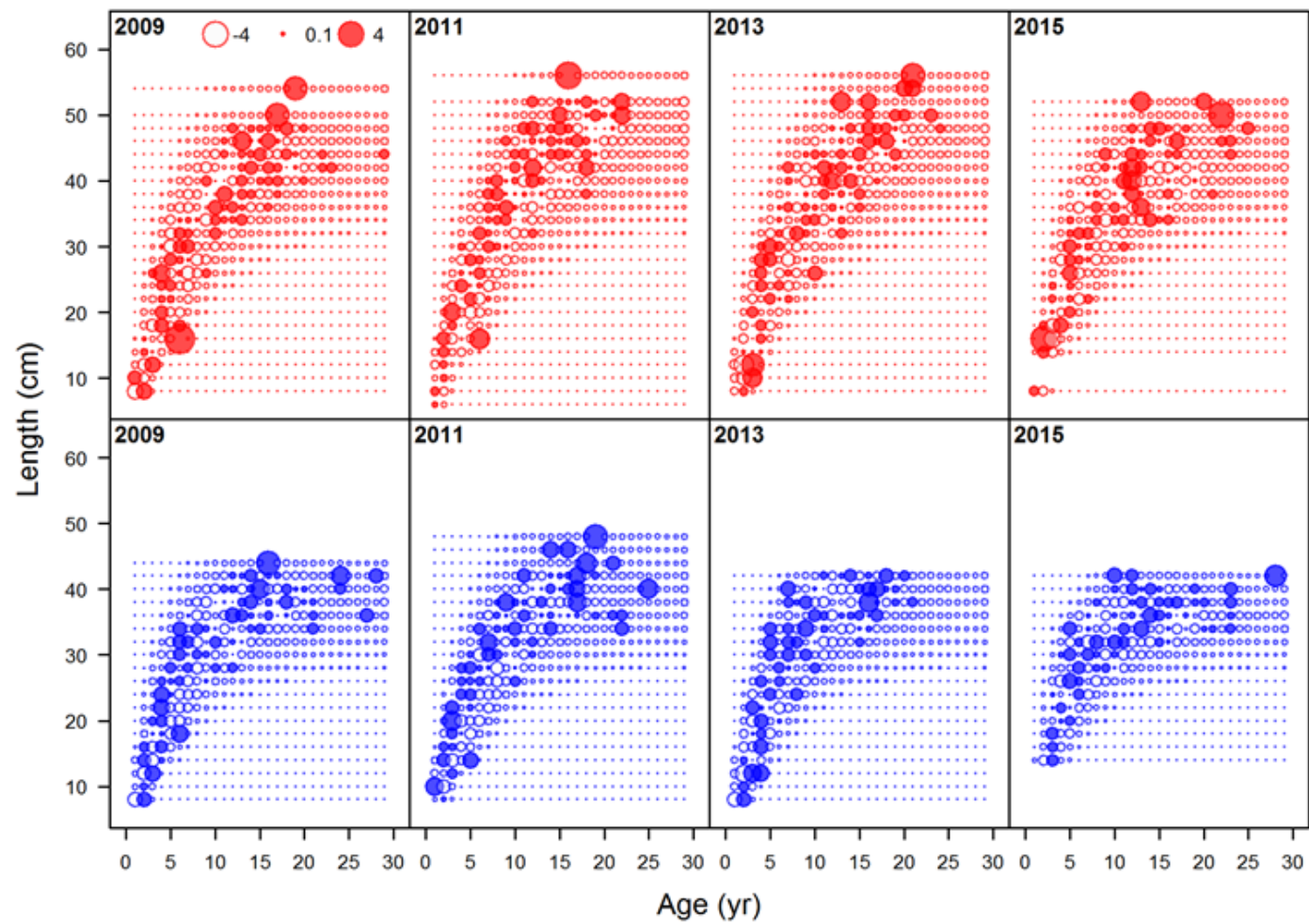
Pearson residuals, whole catch, Survey (max=37.18)



Pearson residuals, whole catch, Survey (max=37.18)



Pearson residuals, whole catch, Survey (max=37.18)



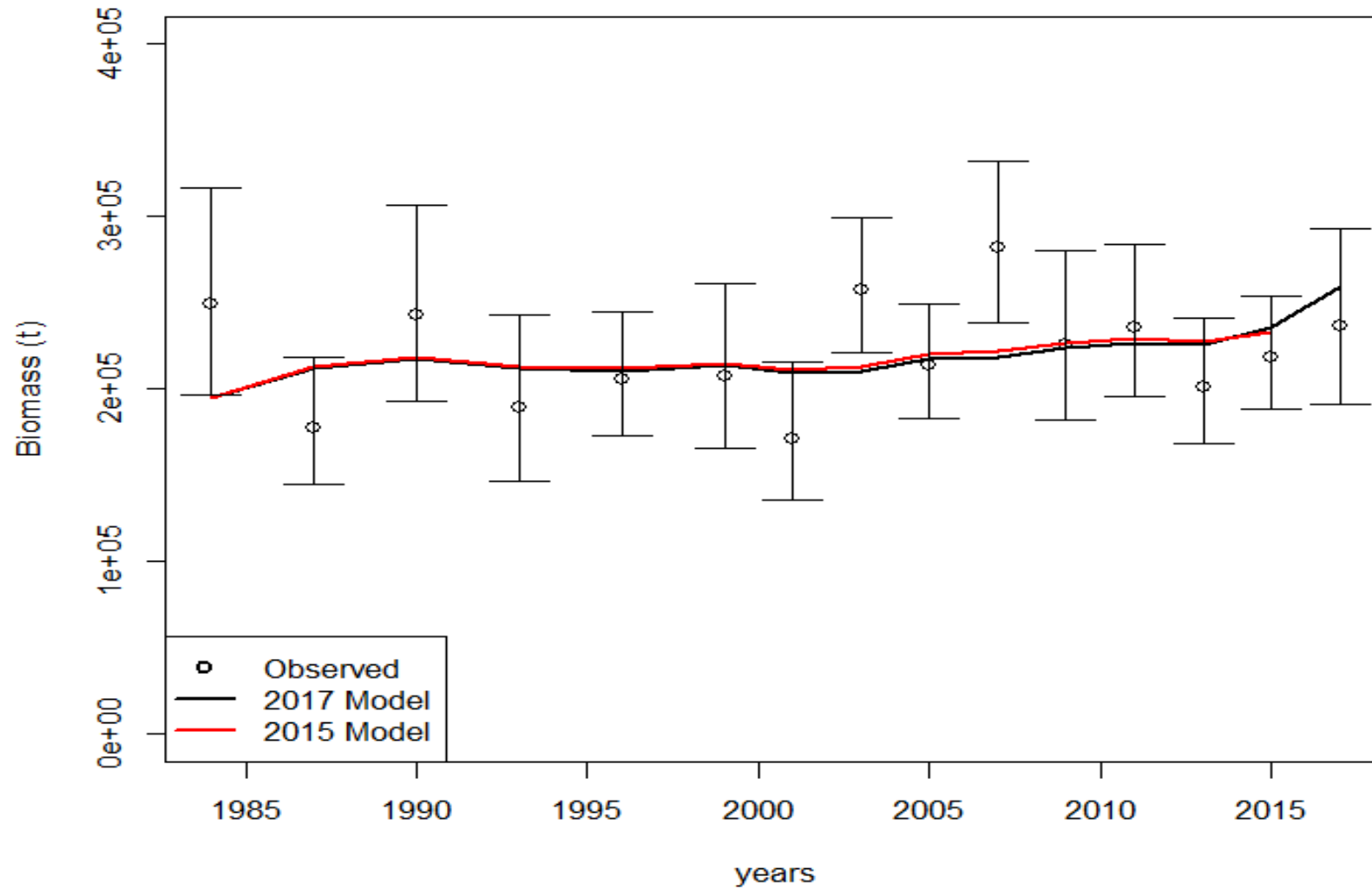


Figure 1. Survey biomass index (circles), asymptotic 95% confidence intervals (vertical black lines), and estimated survey biomass for the proposed 2017 model and the accepted 2015 model (the same as the 2017 Model without 2016-2017 data).

Figure 4.

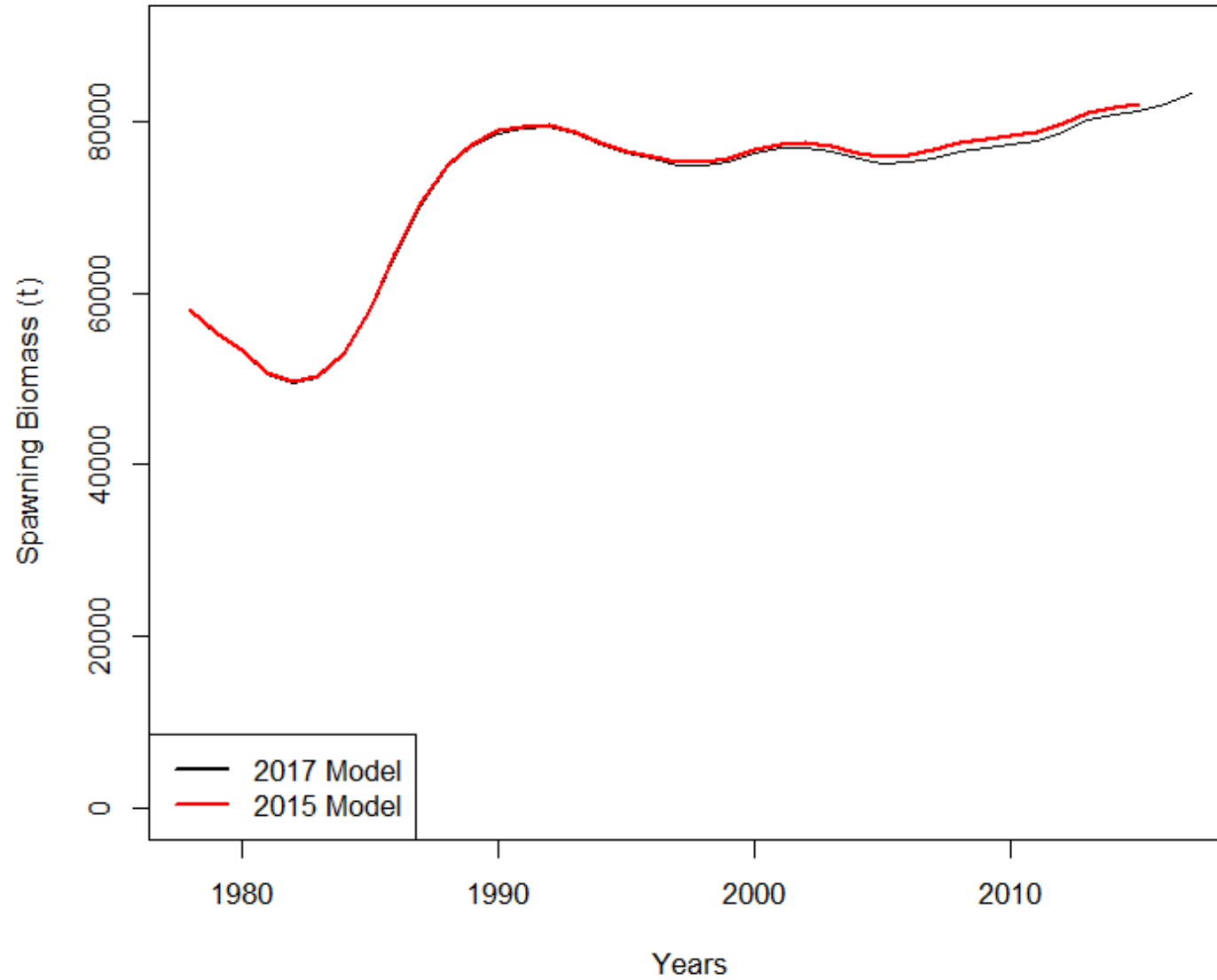
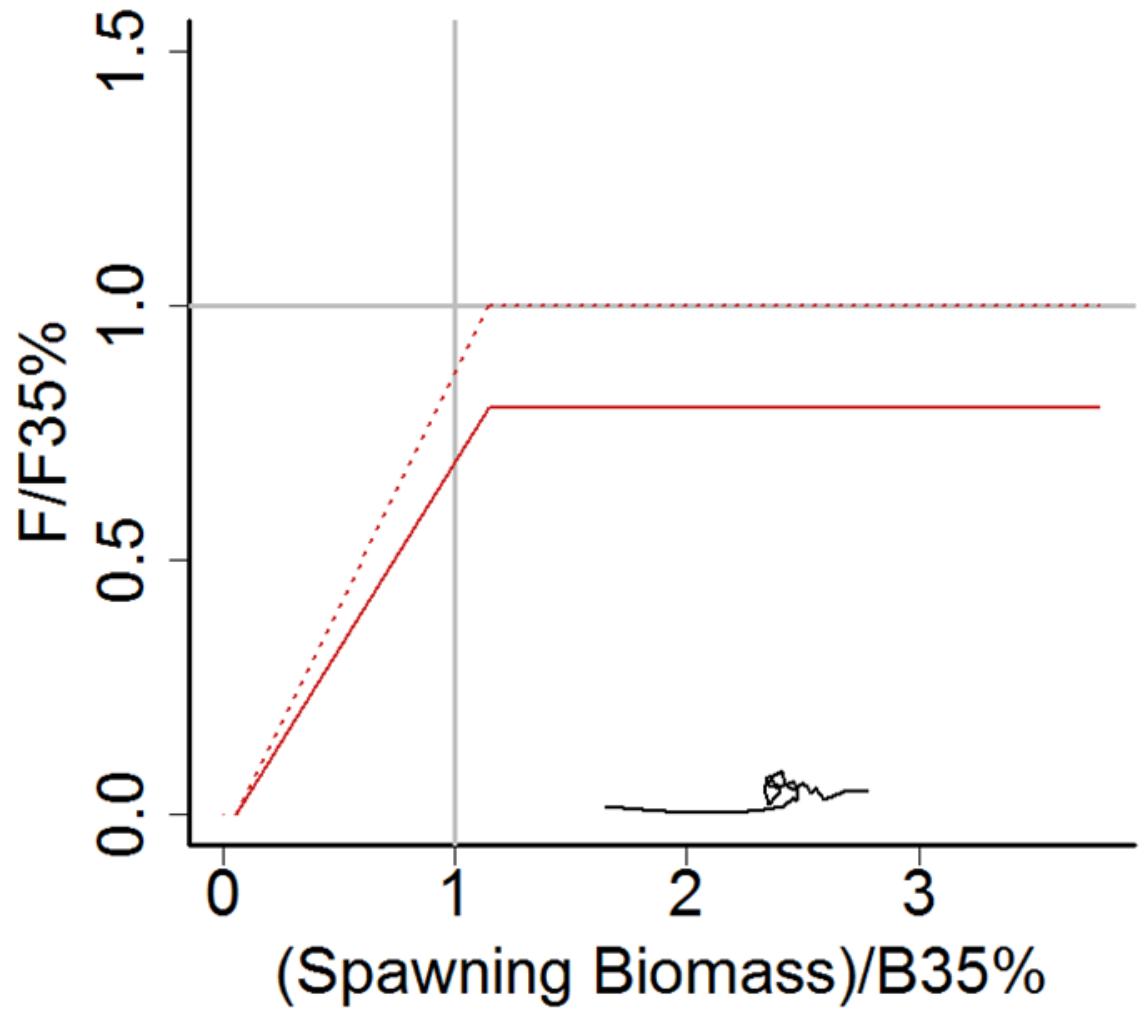


Figure 1. Time series of spawning biomass for the proposed 2017 model and the accepted 2015 model (the same as the 2017 Model without 2016-2017 data).



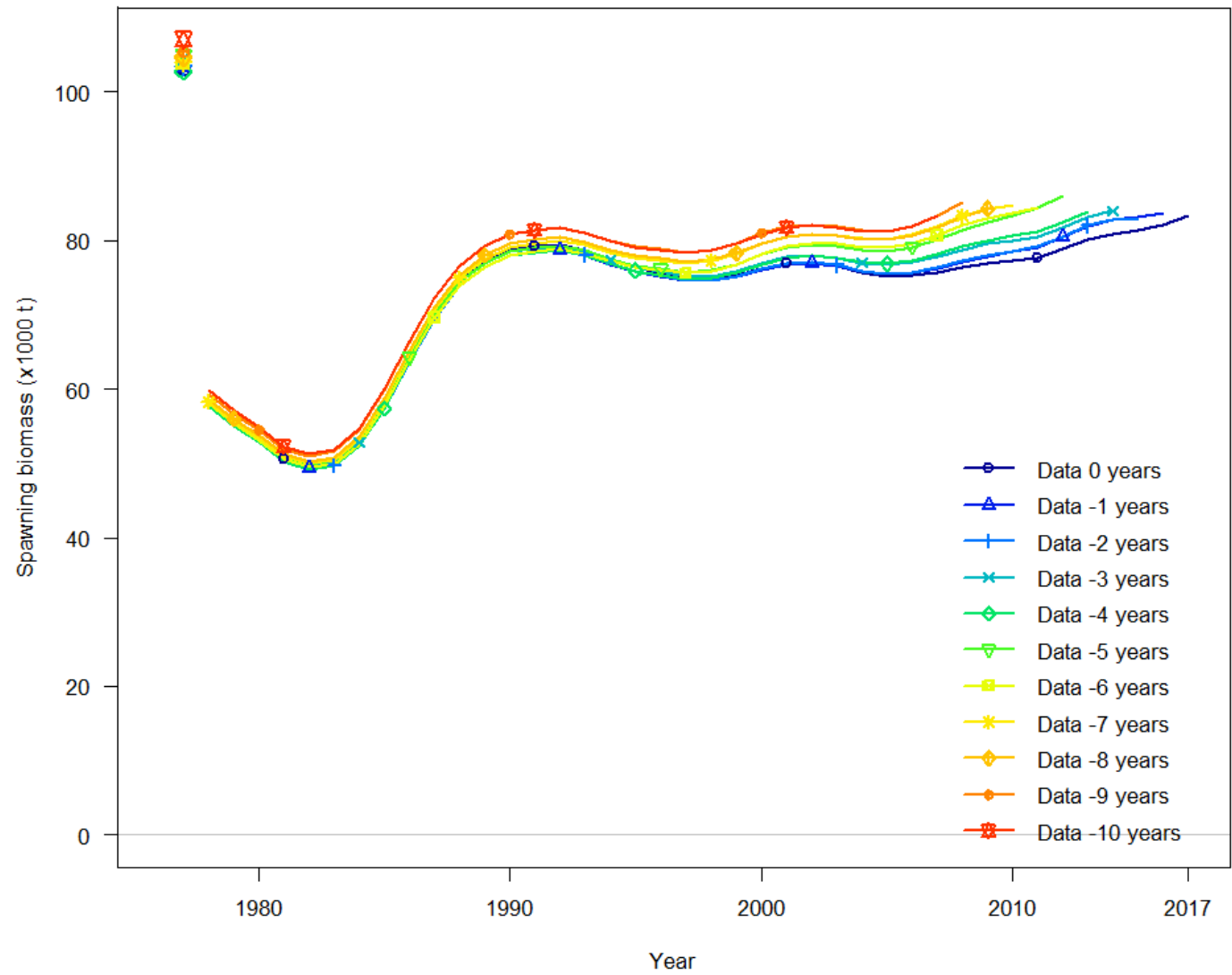


Figure 23. Spawning stock biomass for base case model runs with 0 to 10 years of the most recent data removed. Points at first year are virgin biomass.

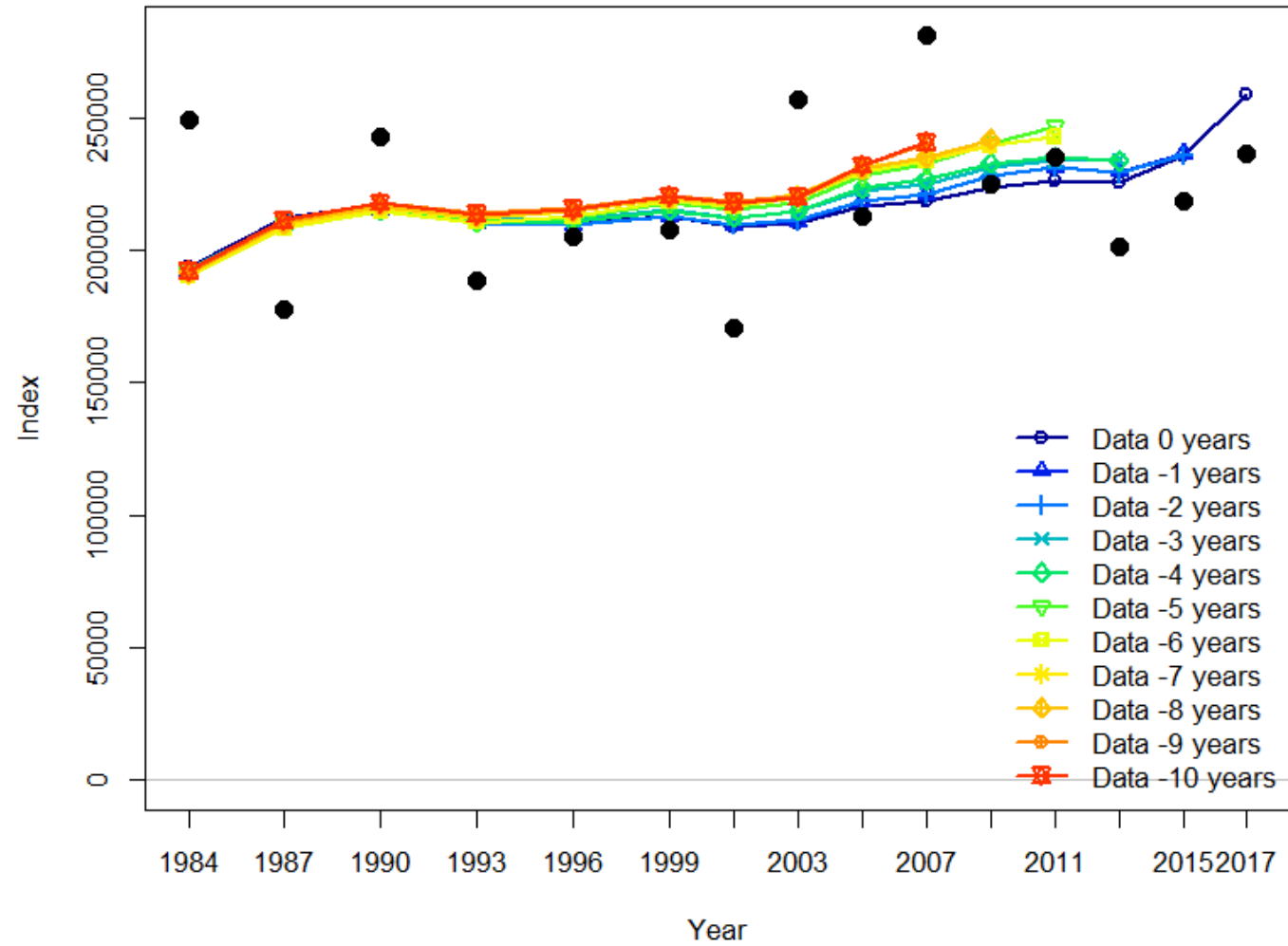


Figure 25. Model fit to survey biomass for the base case model with 0 to 10 years of the most recent data removed. Biomass in years where no survey occurred are not plotted.

Fishery selectivities 2017 and 2015

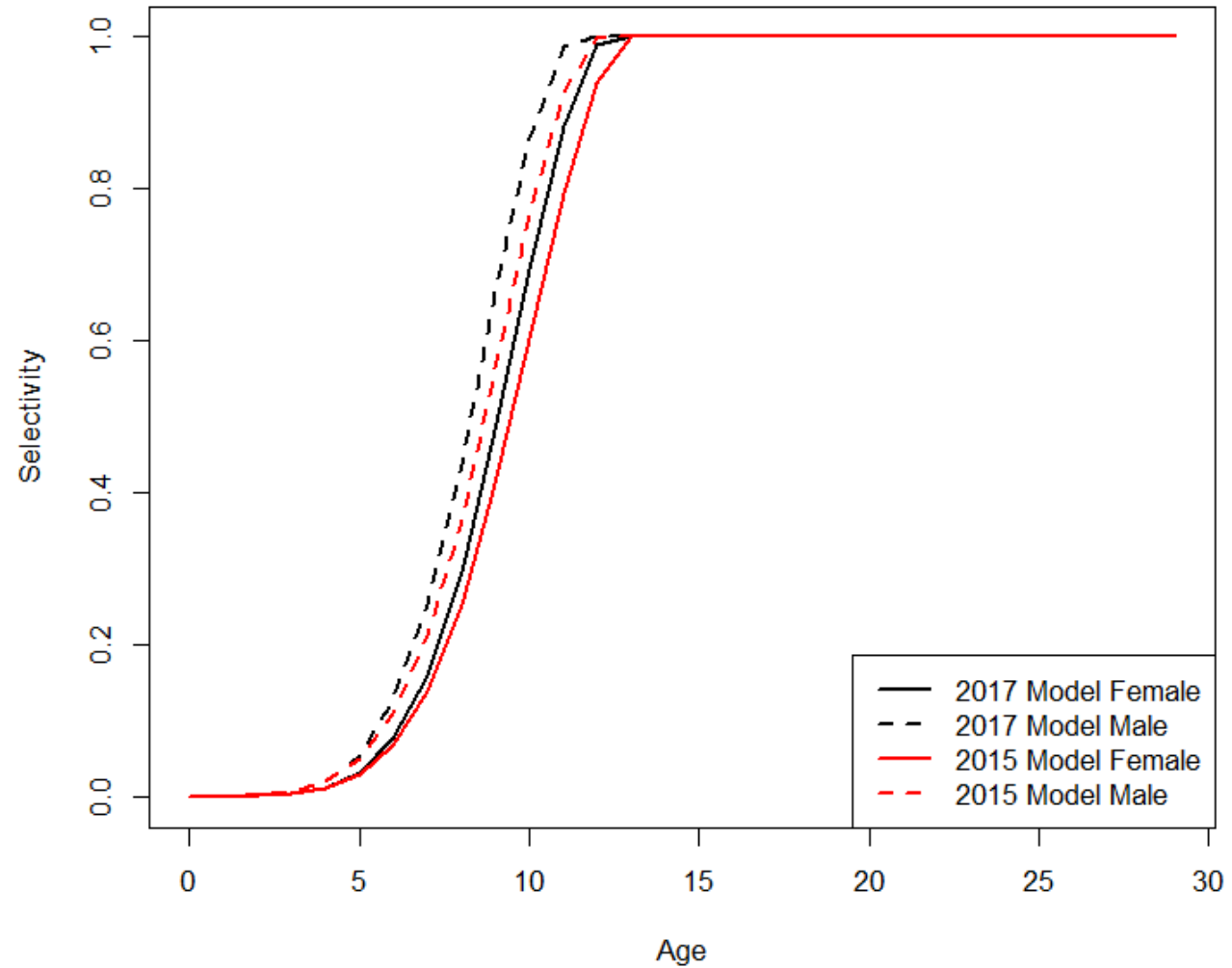


Figure 8. Fishery selectivities for males and females for Model 2015 and Model 2017.

Likelihood profile for M

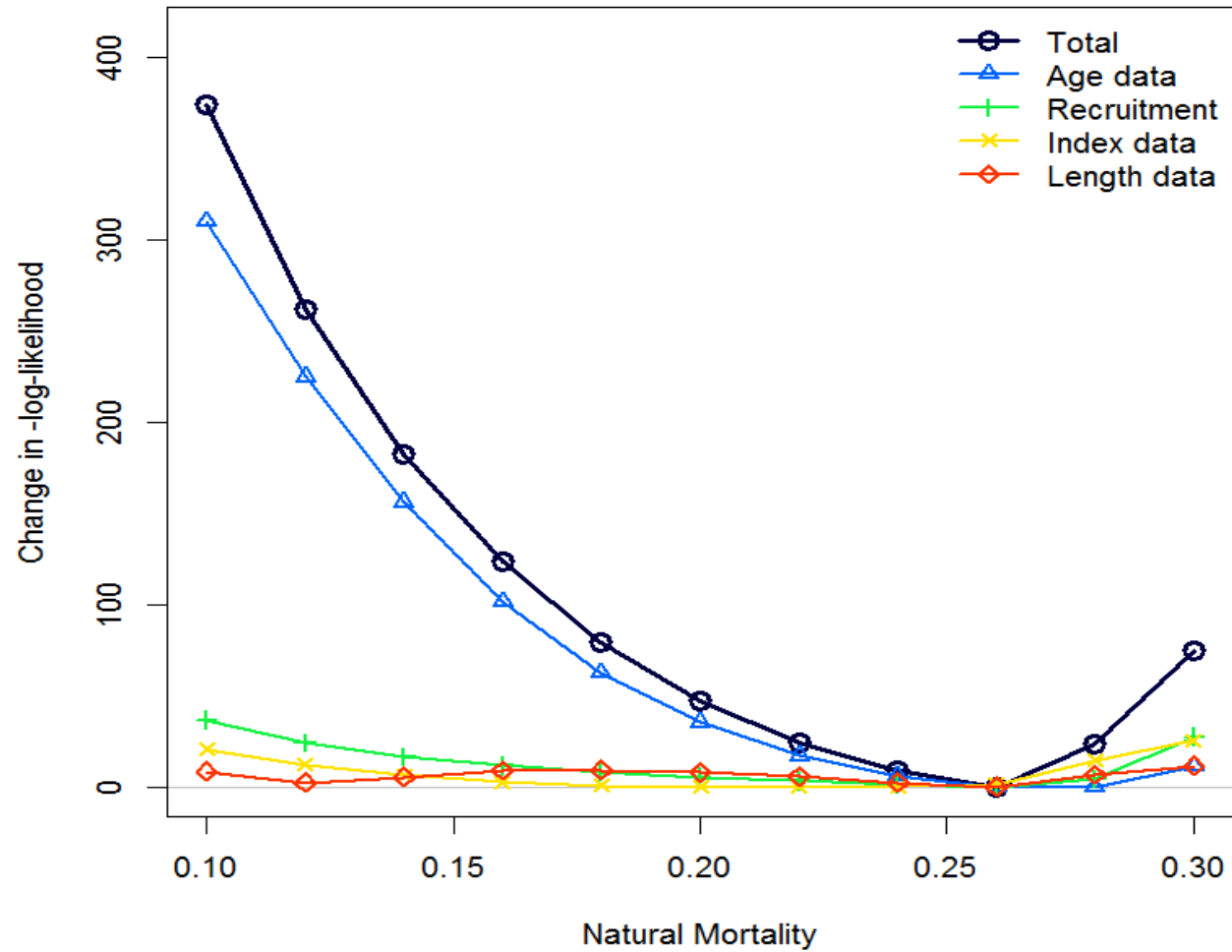


Figure 26. Likelihood profile on Male and Female M 2017 model.

Likelihood profile on survey Q

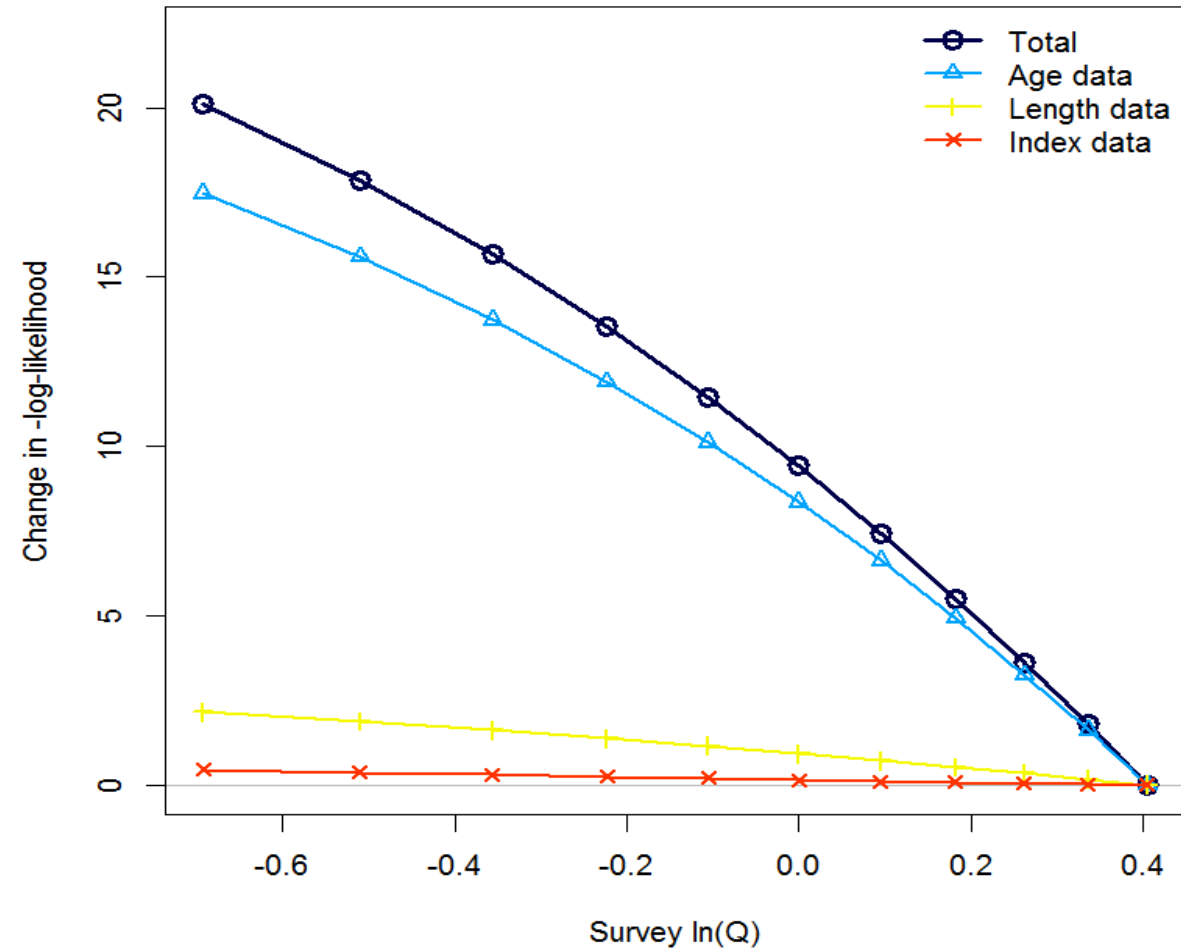


Figure 27. Likelihood profile for $\ln(Q)$. Q from 0.5 ($\ln(Q) = -0.69$) to 1.5 ($\ln(Q) = 0.4$).

Joint likelihood profile for M and Q

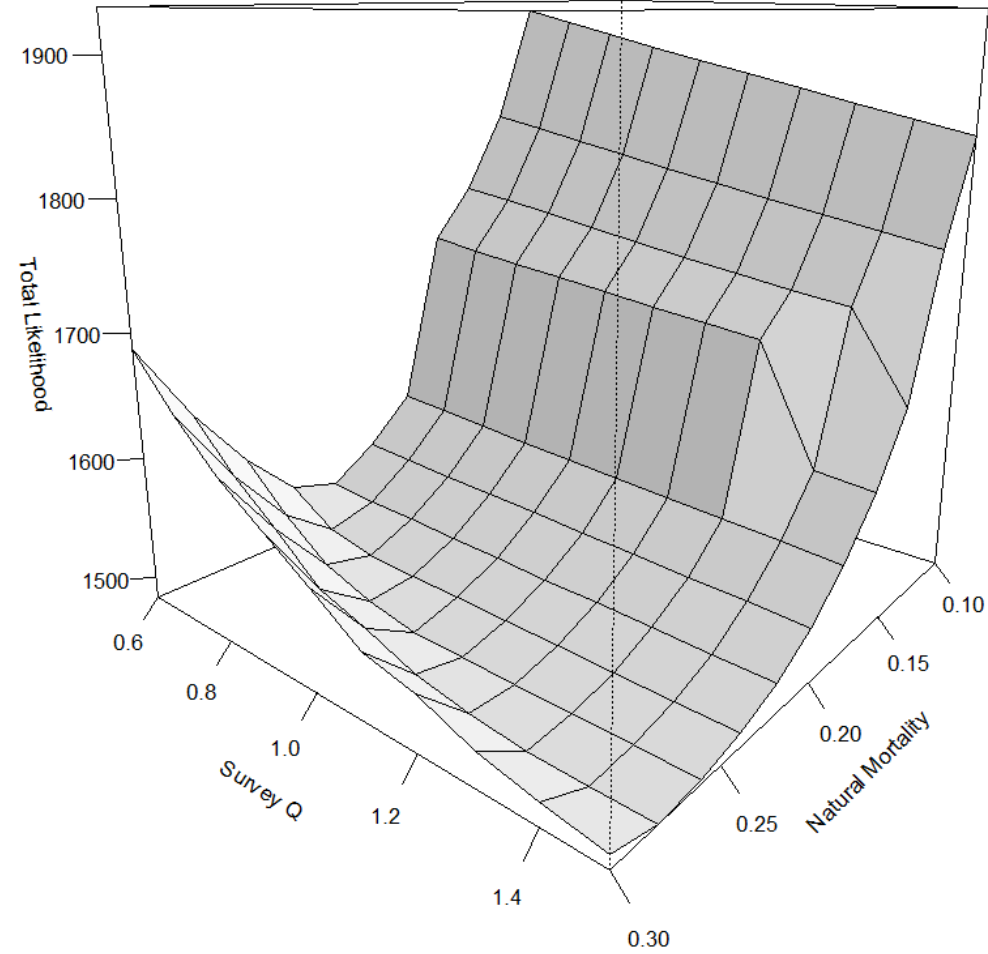


Figure 28. Total Likelihood surface for Natural mortality (0.1 to 0.3) vs Survey Q (0.6 to 1.5).

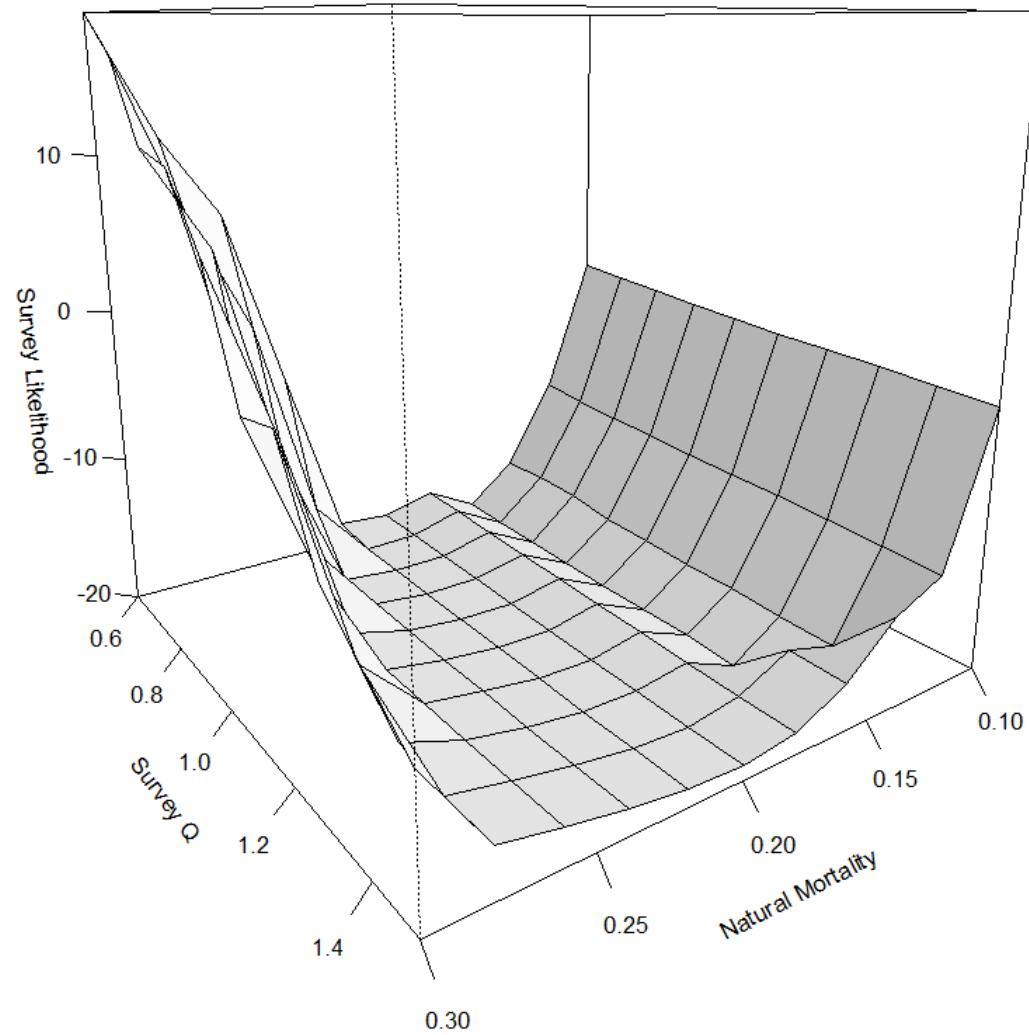


Figure 29. Survey Likelihood surface for Natural mortality (0.1 to 0.3) vs Survey Q (0.6 to 1.5).

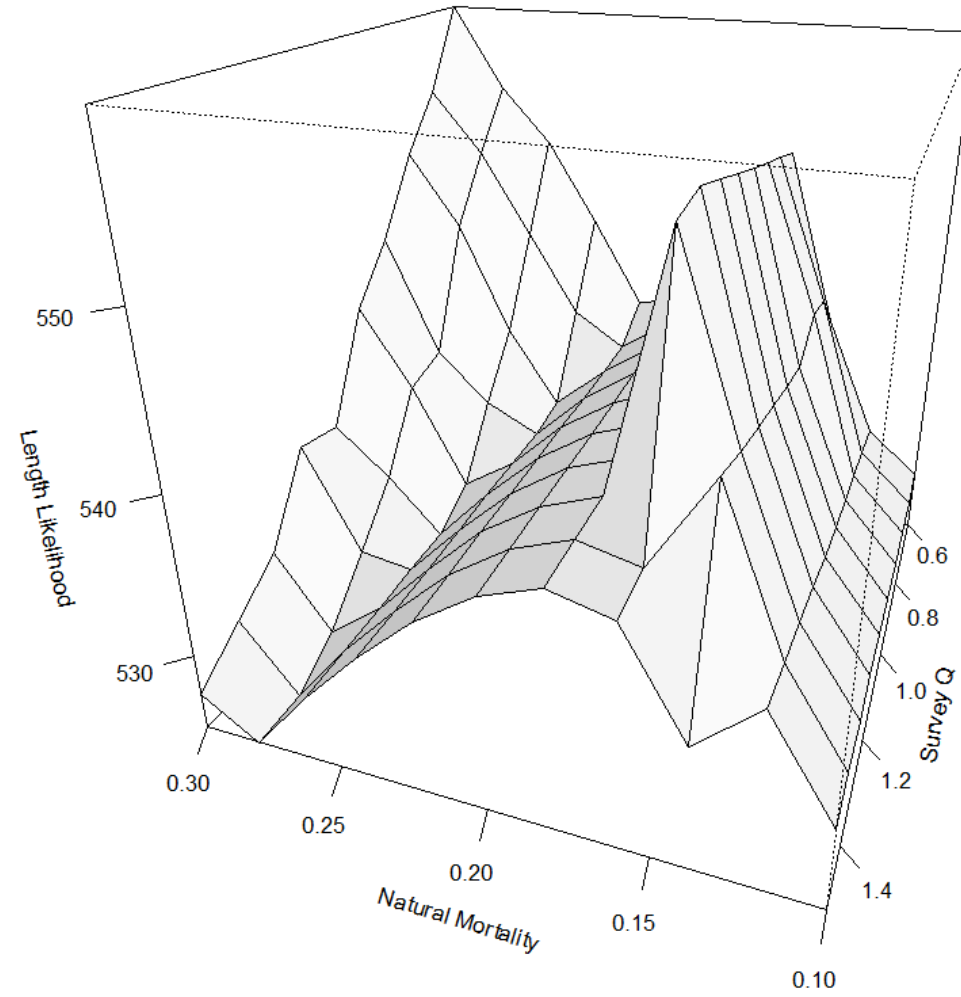


Figure 30. Length Likelihood surface for Natural mortality (0.1 to 0.3) vs Survey Q (0.6 to 1.5).

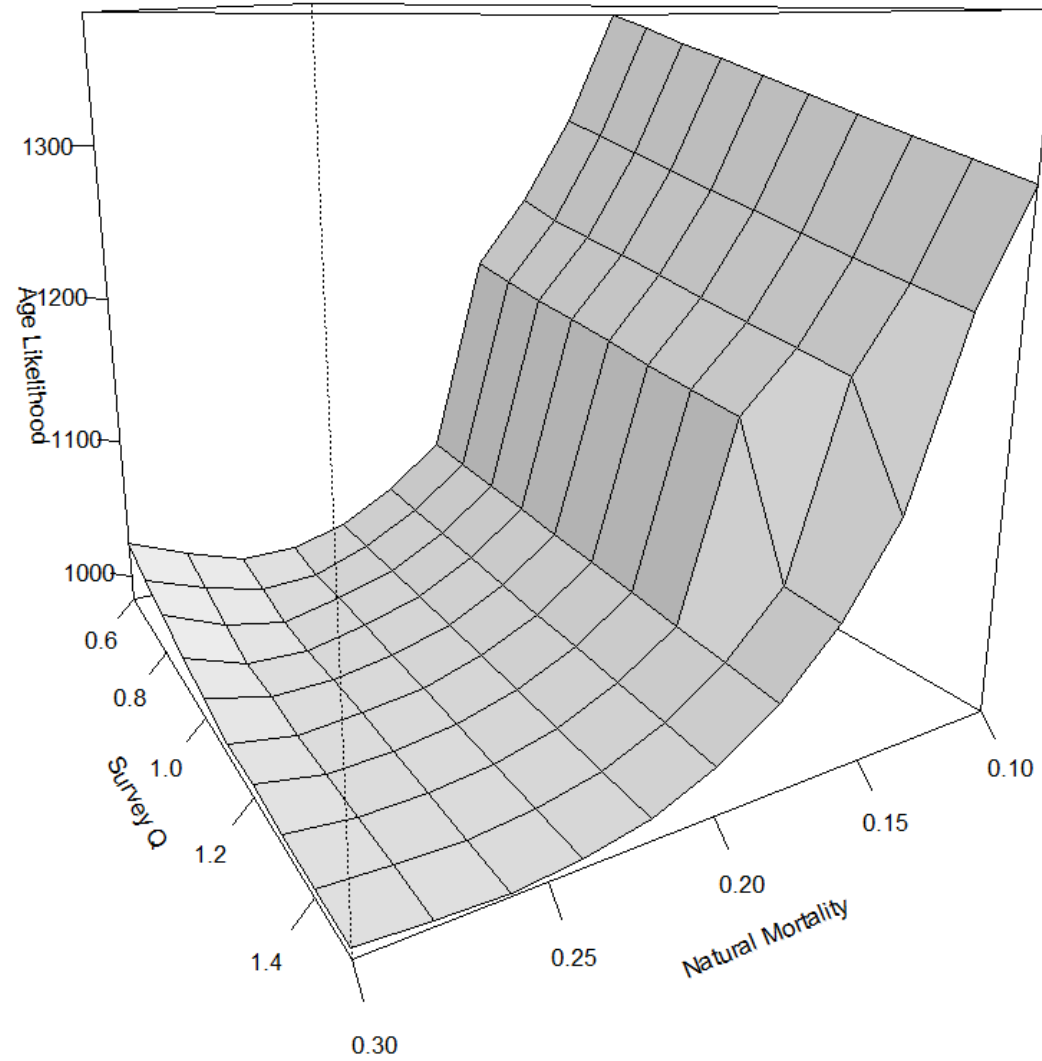


Figure 31. Age Likelihood surface for Natural mortality (0.1 to 0.3) vs Survey Q (0.6 to 1.5).

Fishery age at 50% selected

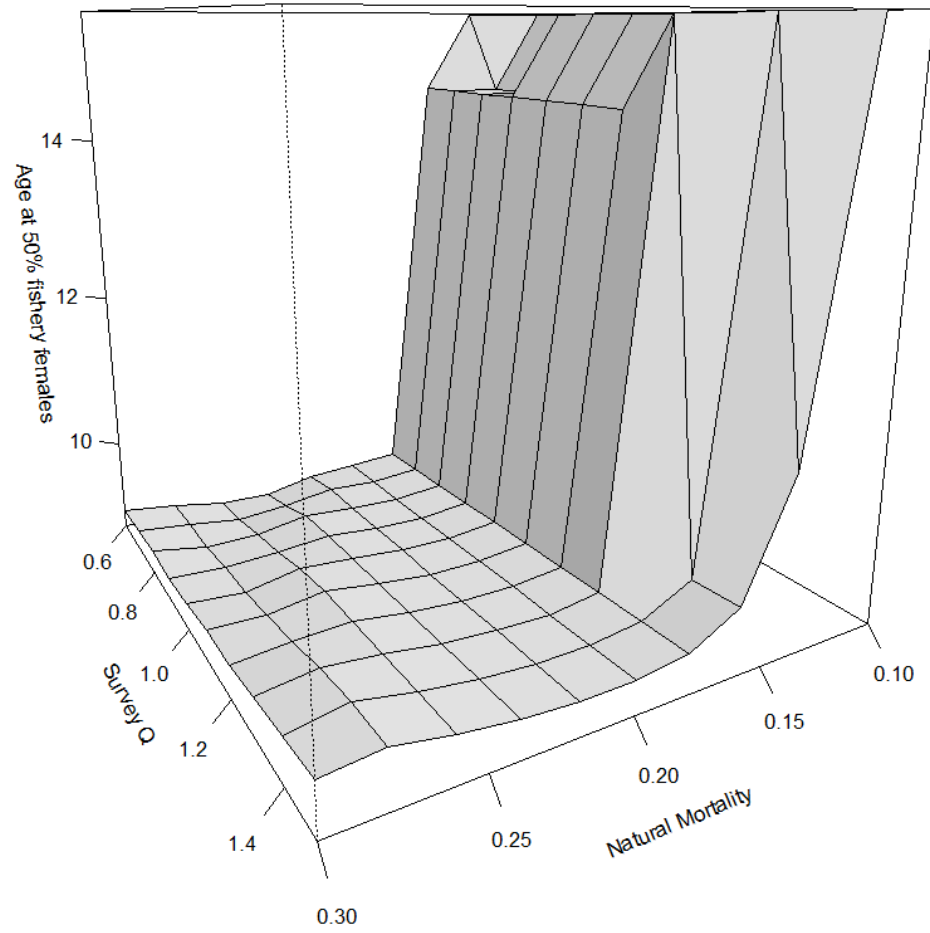


Figure 32. Age at 50% selected for females in the fishery.

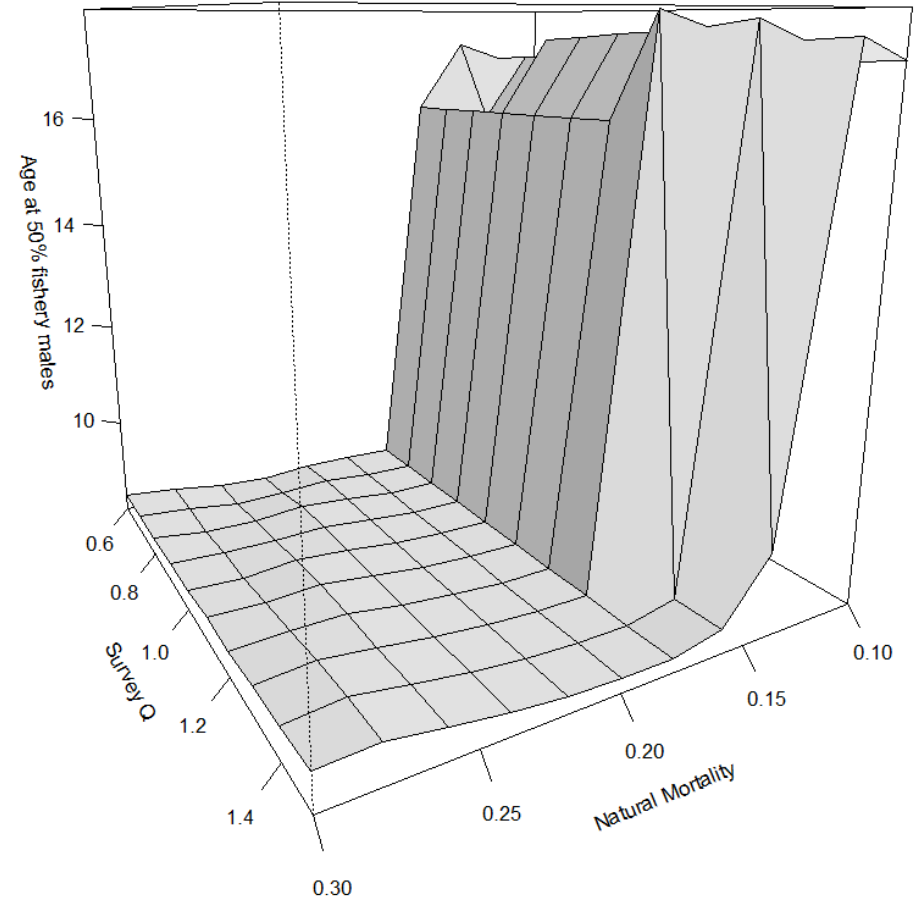


Figure 33. Age at 50% selected for males in the fishery.

Survey age at 50% selected

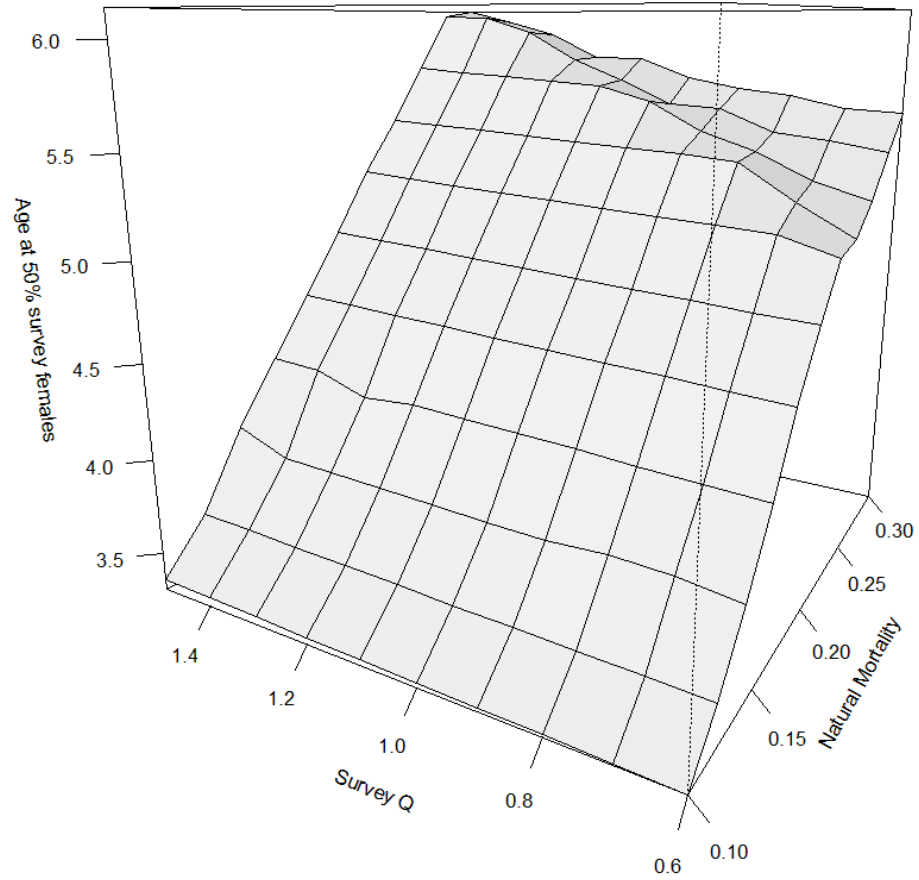


Figure 34. Age at 50% selected for females in the survey

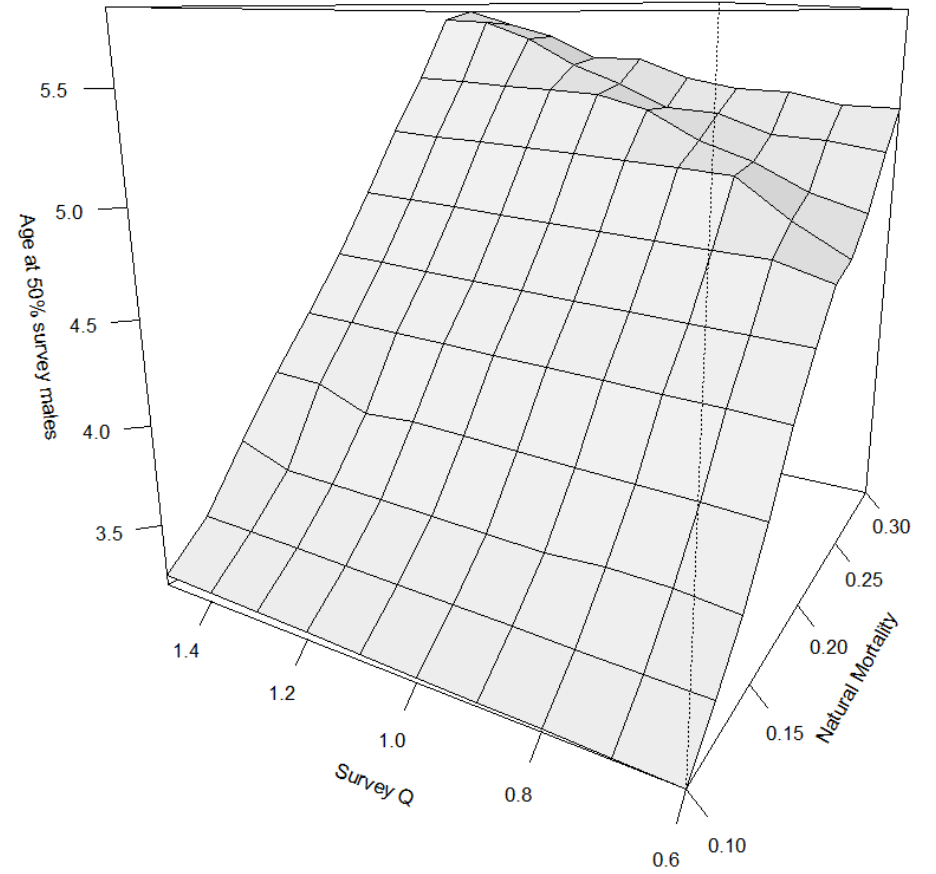


Figure 35. Age at 50% selected for males in the survey.

ABC Apportionments estimated using the random effects model fit to survey biomass by area.

Quantity	Western	Central	West Yakutat	Southeast	Total
Area Apportionment	35.98%	57.39%	5.48%	1.15%	100.00%
2018 ABC (t)	12,690	20,238	1,932	406	35,266
2019 ABC (t)	13,222	21,087	2,013	424	36,746

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