

Responses to requests from the PFMC SSC Groundfish Subcommittee for supplementary review of the August 2025 widow rockfish stock assessment

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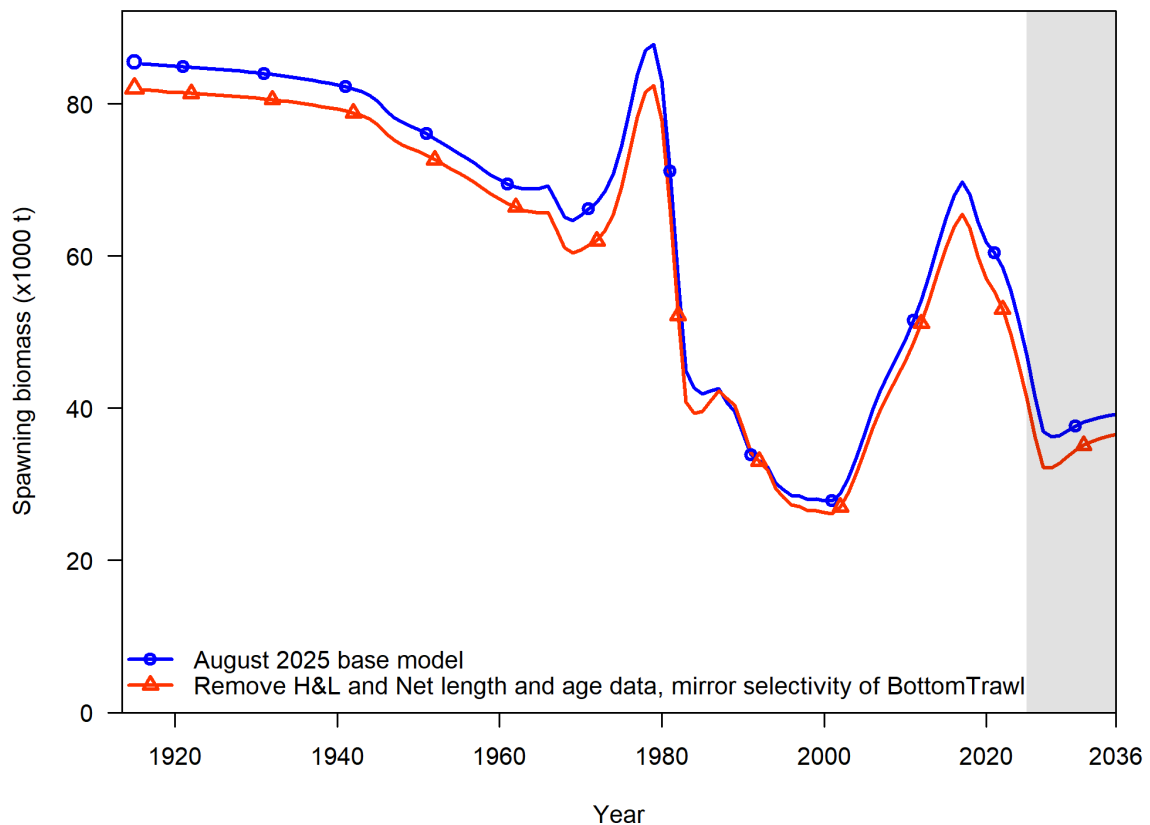
At the PFMC SSC groundfish subcommittee meeting (August 12-13, 2025), the groundfish subcommittee recommended additional review ([GFSC 2025](#)) with the following specific requests. The following explorations are all relative to the August 2025 base model which was the subject of the August review (simply termed “base model” throughout this document). Exploration of some of these changes led the widow stock assessment team (STAT) to propose a new base model. That new base model is described in a separate document (“Proposed new widow rockfish base model and changes from August 2025”).

- **Request 1:** Conduct a sensitivity that a) removes, b) combines (if practicable), and c) down-weights the hook-and-line (H&L) and other fixed gear compositional data (only if removal has a large influence, if removal has no influence, disregard).

Rationale 1: The H&L and net fisheries represent a very small fraction of the landings but appear to have had a greater influence on model results than might be expected. This sensitivity analysis would inform the degree of influence that these “minor” fisheries have on model results.

Response 1: Removing all length and age compositional data from both the hook-and-line and net fleets has only a small effect on the biomass time series (figure below). However the small reduction in estimated stock size combined with the observed recent catches results in a lower population status at the end of the time series and a 2027

ACL which is 11% lower than the value estimated in the August 2025 base model.



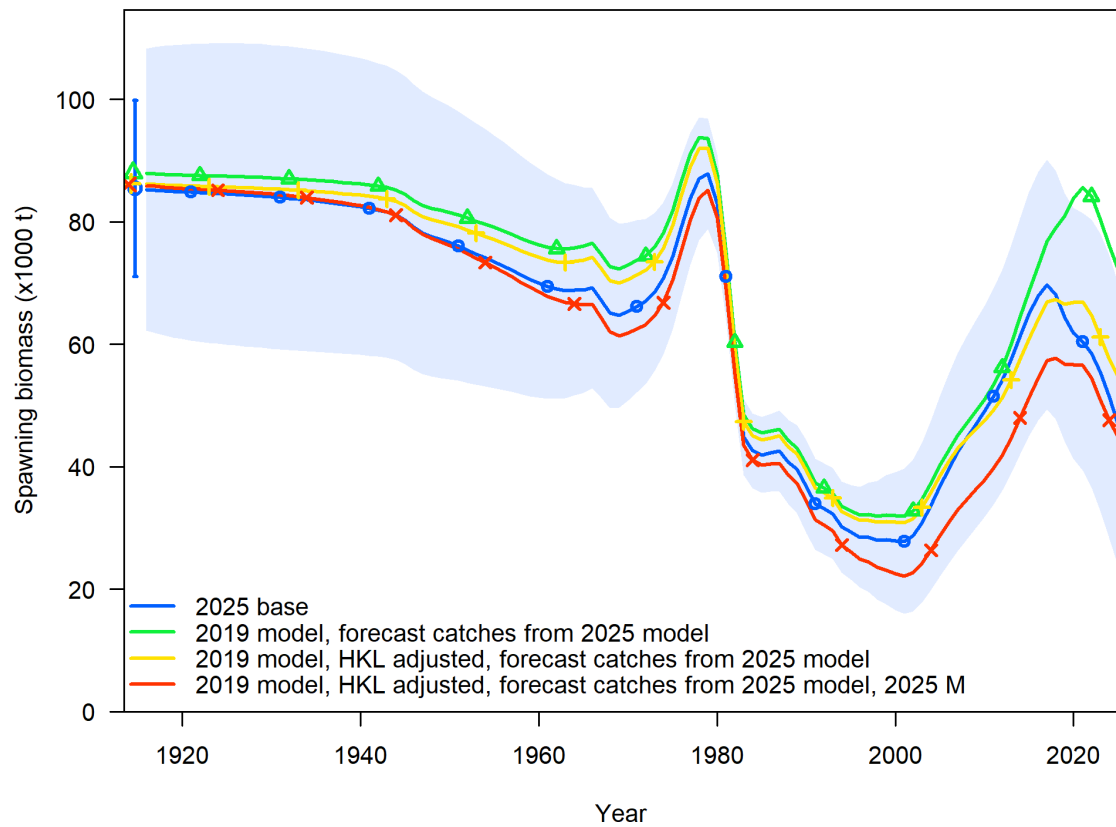
- Request 2:** Apply the changes and corrections to the H&L discard data made for the 2025 model to the 2019 model and compare revised 2019 model results to the original 2019 model results. Please provide a projection of the OFLs that would have arisen from the corrected 2019 model and actual and projected catches through 2026.

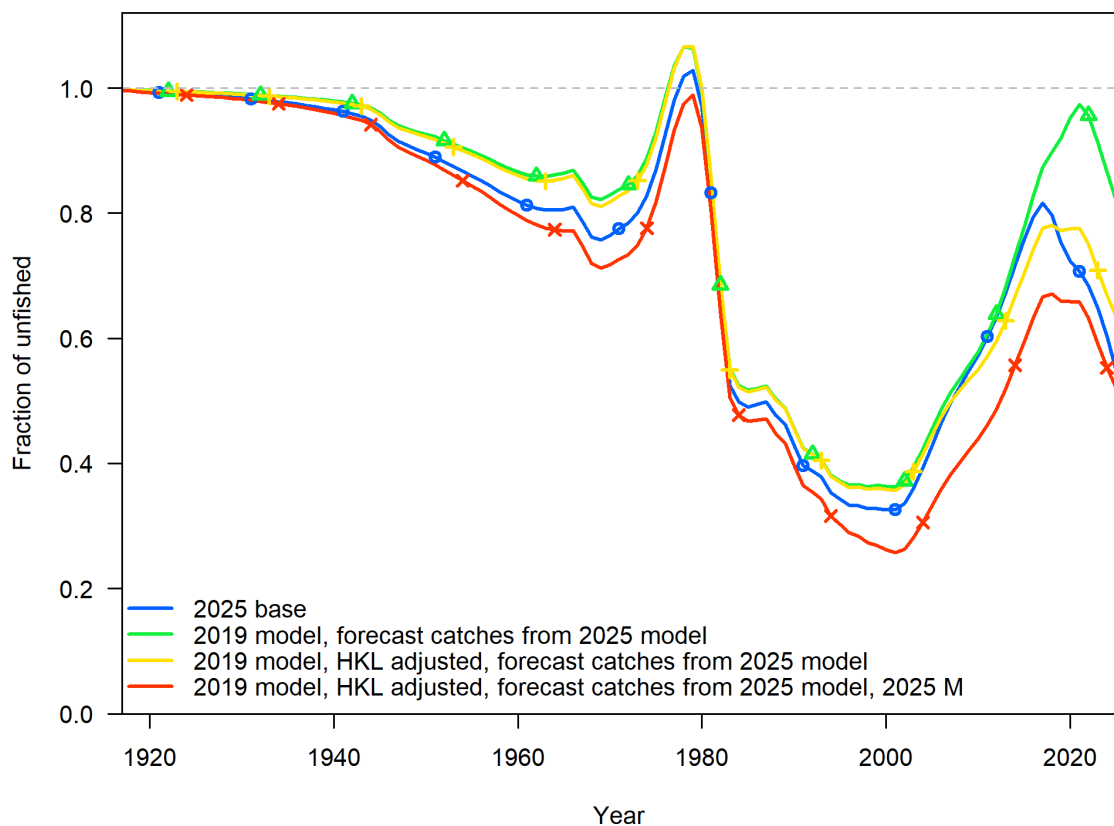
Rationale 2: This bridging analysis would improve our understanding about the relative influence of the discard data error relative to other differences between the current draft update assessment and the 2019 update assessment.

Response 2: We conducted three runs and compared them with the August 2025 model. Those runs included:

- 1) 2019 model as adopted, but forecast catches are set to actual catches for 2019-2024, and 2025-2026 catches as provided by GMT.
- 2) 2019 model with HKL discard added to HKL landings (as it was done in the August 2025 model). As in the first run, forecast catches are set to actual catches for 2019-2024, and 2025-2026 catches as provided by GMT.
- 3) 2019 model with HKL discard added to HKL landings, and natural mortality M fixed at 2025 estimated values for females and males. Forecast catches are set to actual catches for 2019-2024, and 2025-2026 catches provided by GMT.

Comparison of absolute and relative spawning biomass series among these runs are provided below.



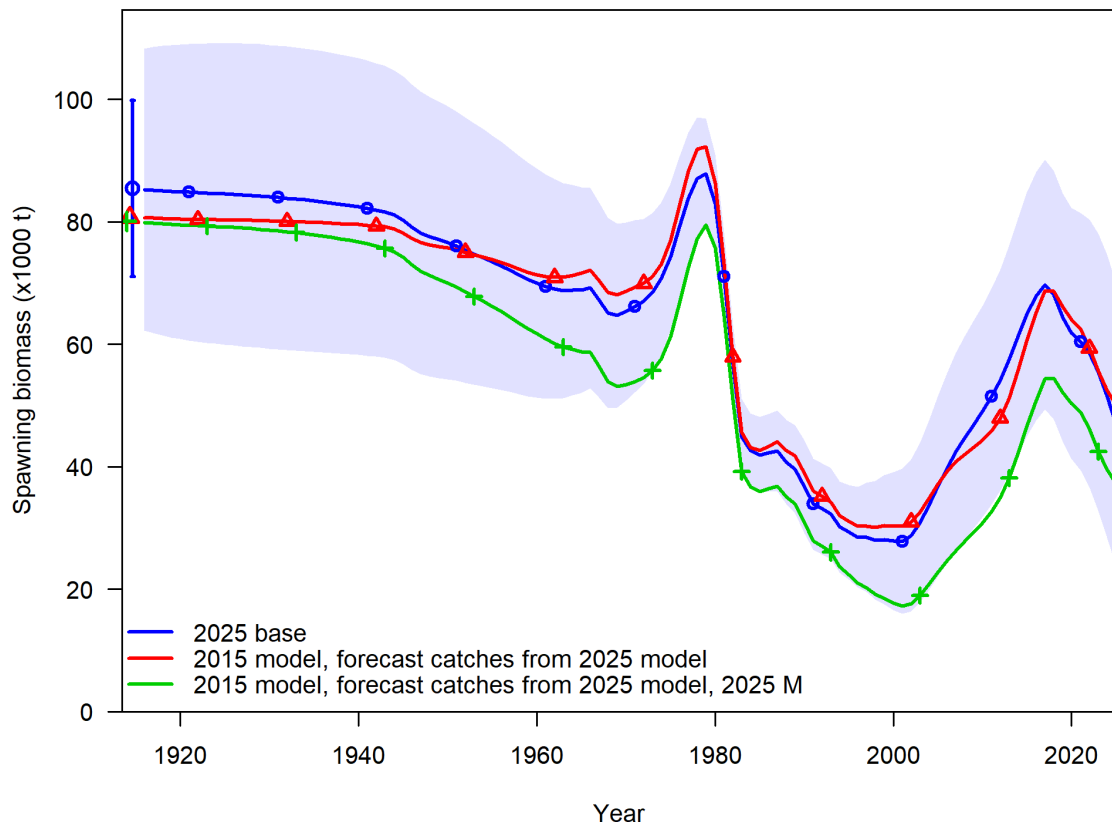


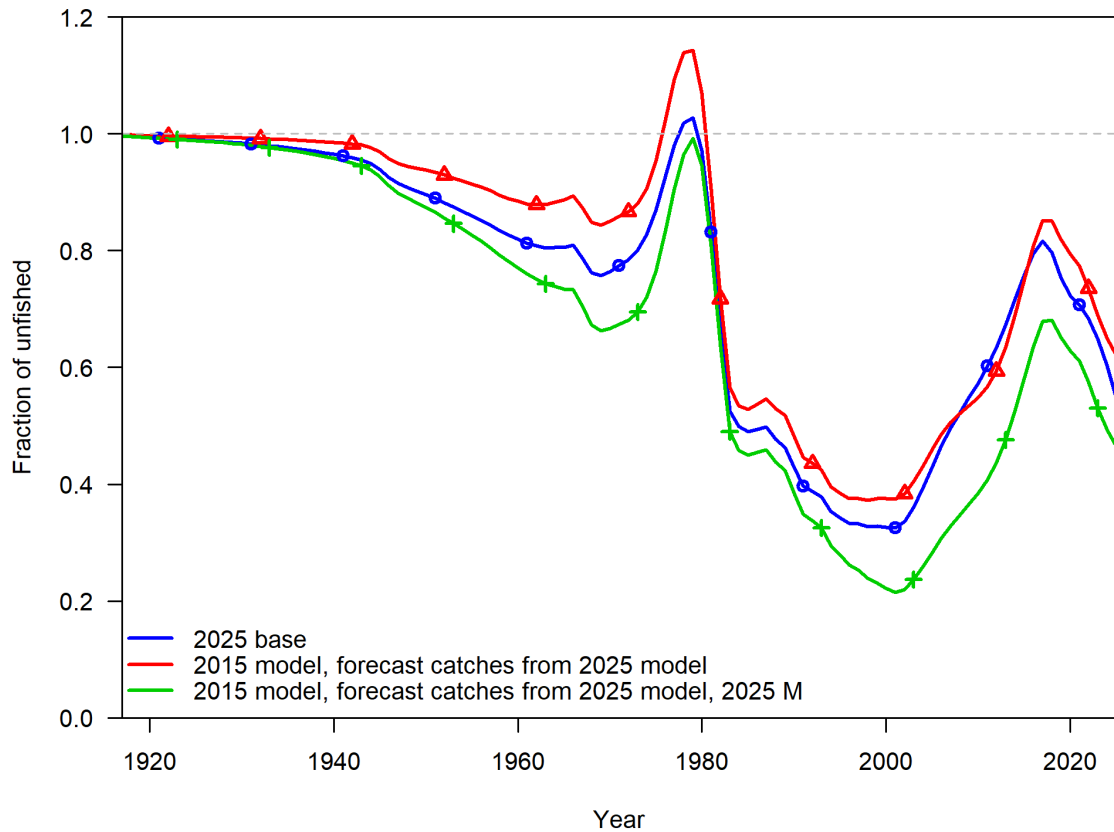
Estimated OFLs for the August 2025 model and requested 2019 model runs are in the Table below.

OFL catch	2025 model	2019 model, actual catches	2019 model, HKL adjusted, actual catches	2019 model, HKL adjusted, 2025 M, actual catches
2015				
2016				
2017				
2018				
2019		14,670	11,701	8,775
2020		15,774	11,970	8,918
2021		16,116	11,983	8,879
2022		15,533	11,451	8,404
2023		14,439	10,601	7,687
2024		13,326	9,806	7,039
2025	6,271	12,421	9,219	6,573
2026	5,200	11,582	8,669	6,125
2027	4,533	10,957	8,290	5,815

The HKL catches contribute less than half of a percent to the total removals. With HKL discard added to HKL landings in the 2019 model, the estimated OFLs dropped substantially, and with the 2019 model using M as estimated in the 2025 model, the estimated OFLs decreased even further, to the level close to the OFLs estimated in the 2025 model.

We also calculated projections using the 2015 assessment with 2015-2024 catches set to actual catches. We conducted two runs, one with the 2015 model as is, and the other one with the 2015 model but M values fixed at the 2025 estimates. The results are shown below.





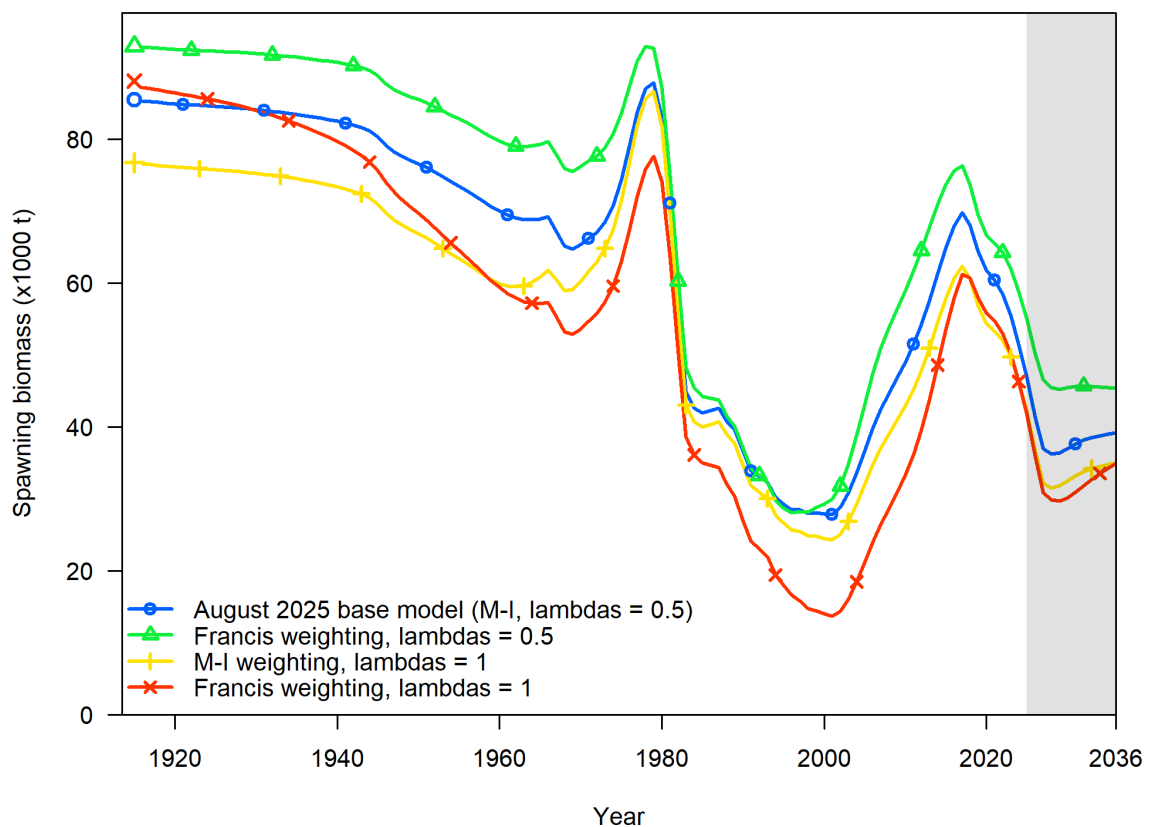
The estimated OFLs for these runs added to the Table shown above are below.

OFL catch	2025 model	2019 model, actual catches	2019 model, HKL adjusted, actual catches	2019 model, HKL adjusted, 2025 M, actual catches	2015 model, actual catches	2015 model, 2025 M, actual catches
2015					12,259	7,424
2016					13,487	8,260
2017					14,346	8,876
2018					14,221	8,796
2019		14,670	11,701	8,775	13,499	8,272
2020		15,774	11,970	8,918	12,983	7,901
2021		16,116	11,983	8,879	12,600	7,633
2022		15,533	11,451	8,404	11,904	7,127
2023		14,439	10,601	7,687	11,061	6,508
2024		13,326	9,806	7,039	10,379	6,007
2025	6,271	12,421	9,219	6,573	9,893	5,649
2026	5,200	11,582	8,669	6,125	9,365	5,245
2027	4,533	10,957	8,290	5,815	8,983	4,943

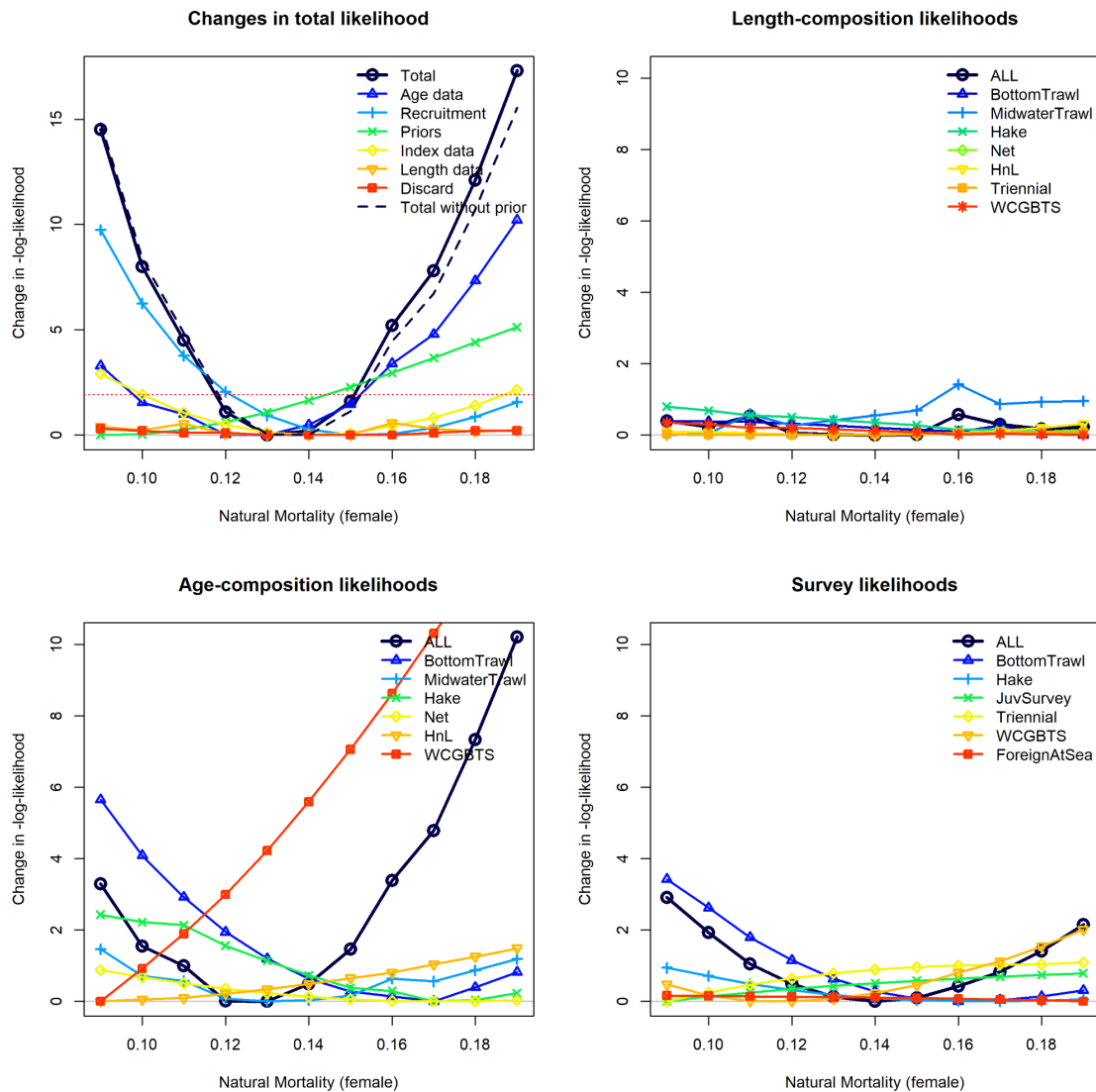
- **Request 3:** Reweight the compositional data using Francis methods (as was done in the sensitivity analysis for the draft document) and provide a profile across M with Francis weighting.

Rationale 3: Most assessments in the past several cycles have used Francis weighting methods rather than McAllister-Ianelli methods for weighting for compositional data. Consideration of Francis weighting methods was outside the TOR for an update assessment but can be considered for a revised base model during the Supplemental Review.

Response 3: The widow model has two elements of data weighting which were common when the benchmark assessment was conducted in 2015, but have been less commonly applied in recent years: use of the McAllister-Ianelli (M-I) weighting method for compositional data, and the use of a likelihood multiplier (lambda) of 0.5 on both the age and length compositions. We explore the four combinations of Francis vs. M-I weighting and lambda = 0.5 vs 1.0, results of which are shown in the figure below.



Profiling over female natural mortality for the model with Francis weighting and lambdas = 0.5 (figure below) provides similar results to the August 2025 base model (Figure 58 in the assessment report reviewed in August), with the biggest change in the magnitude of the change in age data likelihood in general (top-left panel), and WCG BTS ages specifically (bottom-left panel). Note that the bump associated with the model at $M = 0.16$ may indicate lack of convergence for that one step in the profile.



Finally, we note that (unlike what was stated in a public comment) the August 2025 model uses the same weighting approach as in the 2015 benchmark and 2019 update assessments. The method of *specifying* these weights changed, but they remain mathematically identical. The total weights in the model are a combination of input variance factors (informed by the McAllister-Ianelli method in the case of the August 2025 base model) and likelihood multipliers (lambdas) that further reduce the influence of marginal age and length data. The product of input variance factors and lambdas can be calculated outside of the model and then that product entered directly into the model control file (as was done in 2015 and 2019 assessments), or input variance factors and lambdas can be entered in corresponding sections in the control file, with the multiplication done within the model (as was done in August 2025 model).

We updated the specification because the options available in stock synthesis have expanded since 2015, and the new approach is more transparent and less prone to errors.

The runs conducted in response to this request demonstrate that both the data weighting methods and the use of additional down-weighting are influential.

- **Request 4:** Consider alternative selectivity curves for WCBTS index.

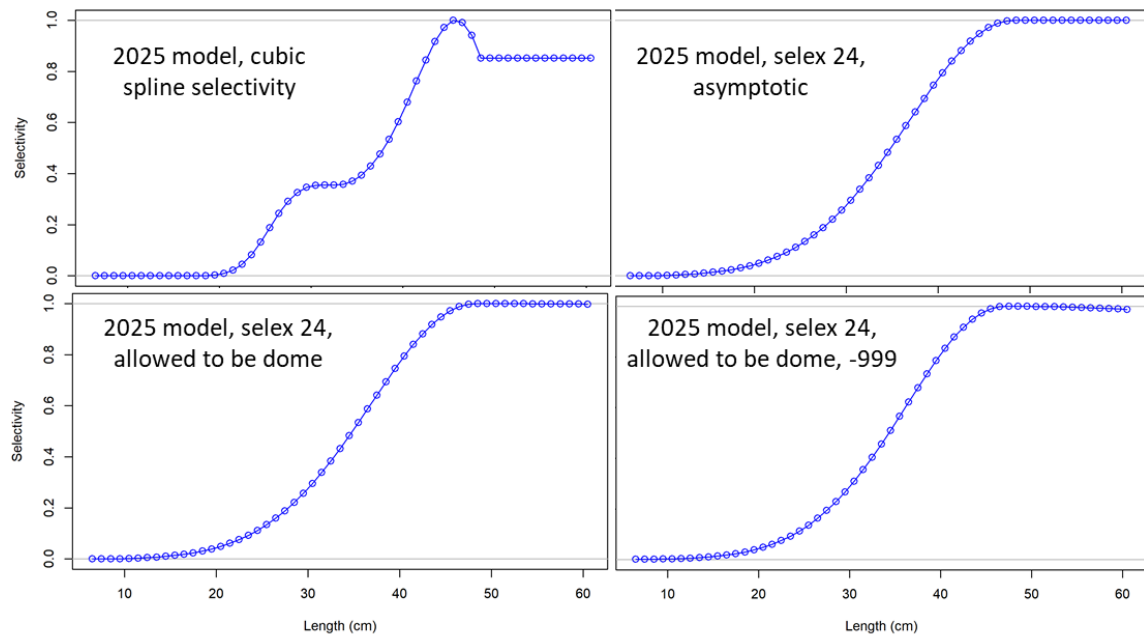
Rationale 4: The 2015 assessment used a spline to estimate WCBTS selectivity. Few assessments since then have used the spline option for selectivity, and the time series is now twice as long. Revisiting selectivity using dome-shaped and asymptotic curves would coincide with current practices and enable an evaluation of how sensitive the model is to the shape of this curve.

Response 4: As an alternative to cubic spline selectivity used in the model for surveys, double normal selectivity (pattern 24) was explored with different formulations for WCBTS, including 1) fixing selectivity asymptotic, 2) allowing for a dome-shaped curve through estimating both parameters defining descending part of the curve, 3) allowing for a dome-shaped curve estimating a parameter controlling descending width and fixing the final parameter (parameter 6) to -999 (current common practice), which allows the curve to decay the large fish selectivity according to the descending width parameter.

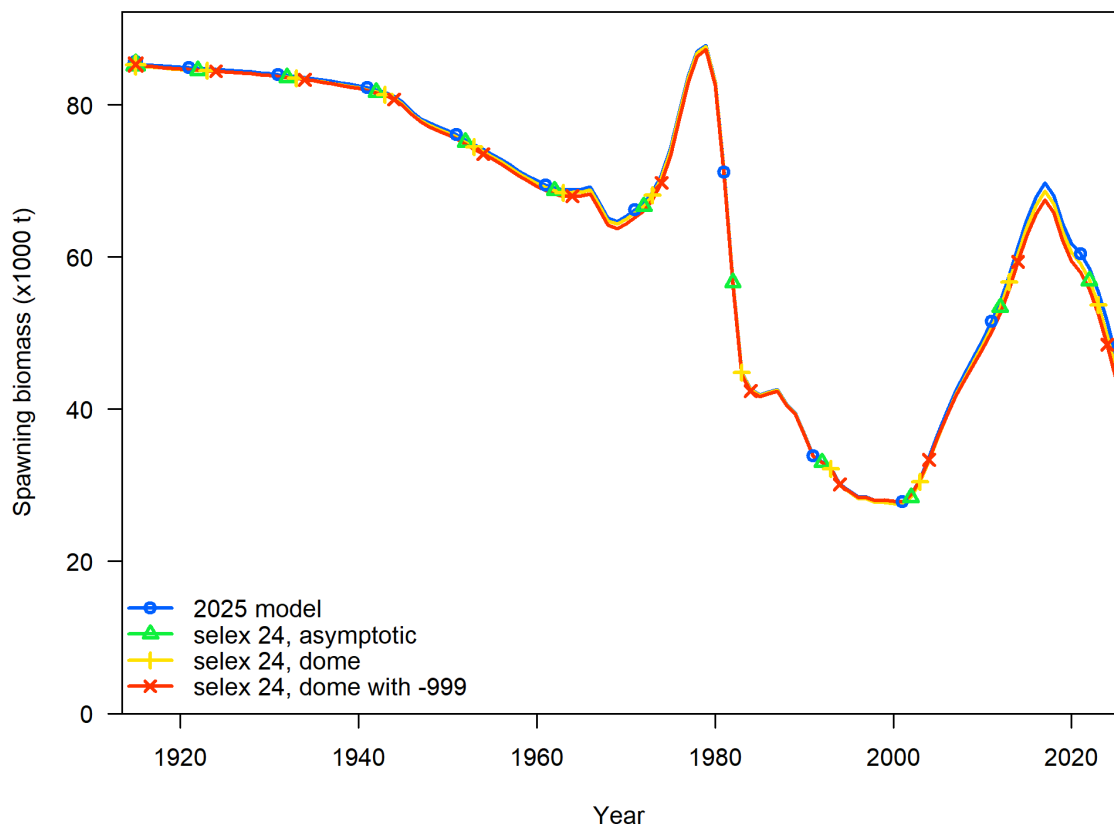
The change in selectivity functional form reduced the fit to the data, with an increase in total likelihood of 12 to 22 units. The estimates of natural mortality were slightly lower in spite of the removal of the dome-shape in the spline selectivity.

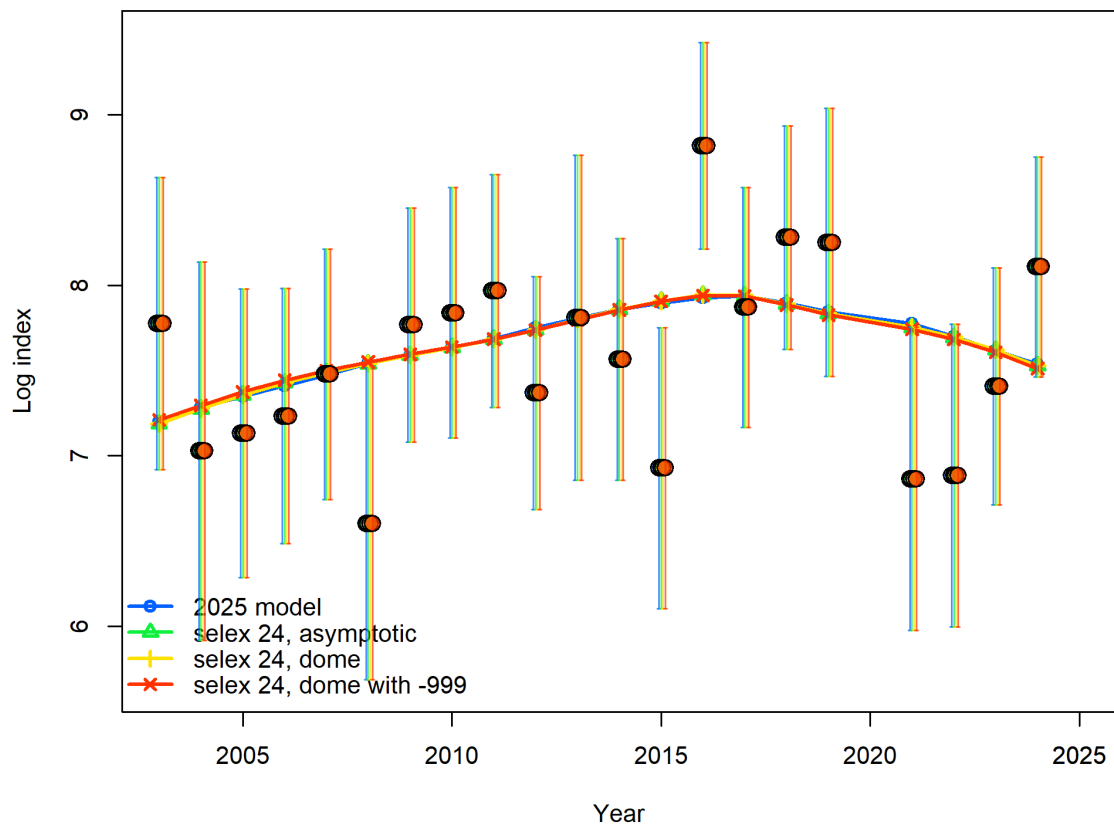
Label	August 2025 base: spline with 3rd knot = 48cm (4 pars)	double normal asymptotic (2 pars)	double normal allowed to be dome (4 pars)	double normal allowed to be dome, -999 (3 pars)
Diff. in likelihood from base model				
Total	0	11.9	11.9	22.3
Index	0	0.058	0.058	0.092
Length comp	0	13.38	13.38	18.713
Age comp	0	-1	-1	3.87
Parm priors	0	-0.028	-0.028	-0.074
Estimates of key parameters				
M Female	0.122	0.122	0.122	0.12
M Male	0.14	0.139	0.139	0.137
log(R0)	10.457	10.444	10.444	10.42
Estimates of derived quantities				
B0 1000 mt thousand mt	85.46	85.22	85.22	85.29
B2025 1000 mt thousand mt	46.93	45.11	45.11	43.92
Fraction unfished 2025	0.549	0.529	0.529	0.515
2027 ACL mt	4238	4009	4009	3823
Equil. catch at SPR targ. mt	5822	5765	5765	5693

The estimated selectivity curves in each scenario are presented below:

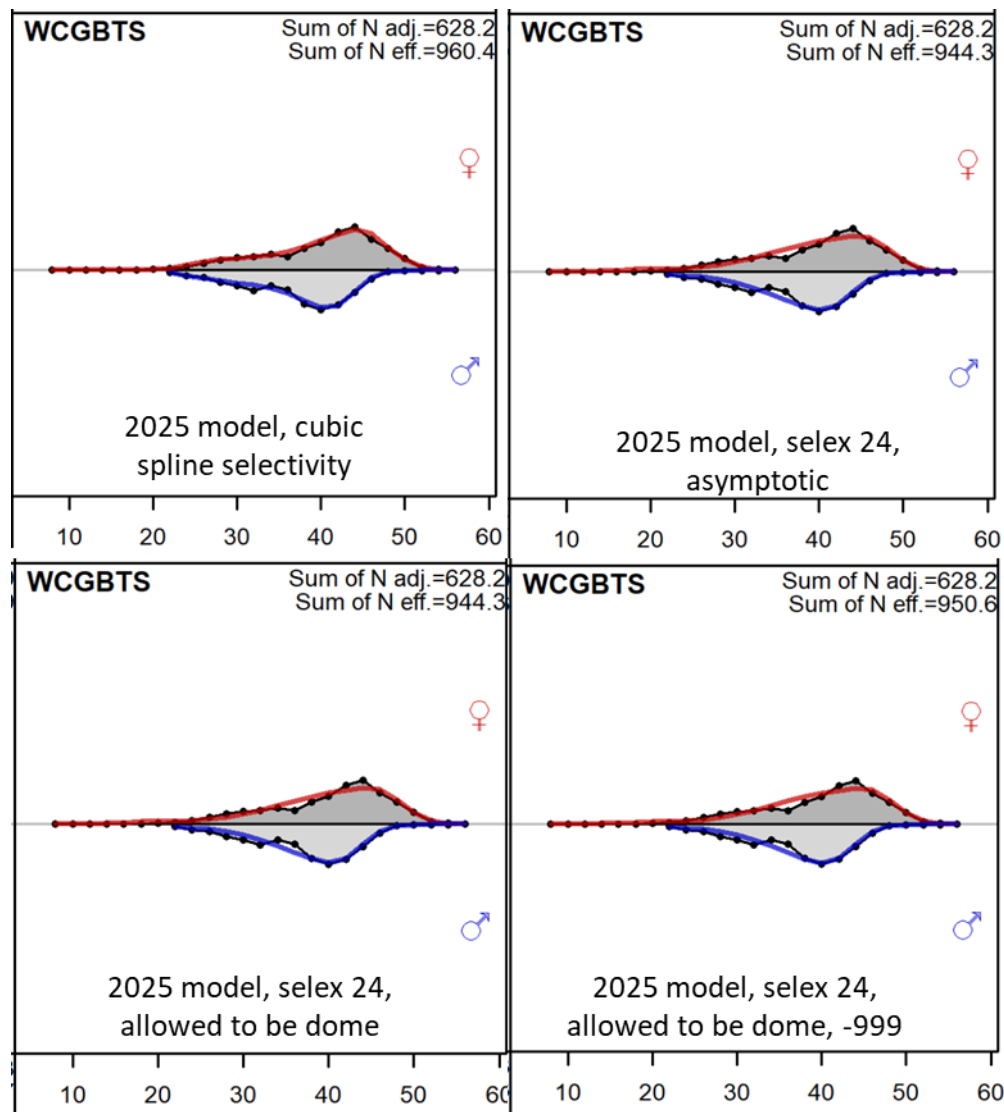


The alternative WCG BTS selectivity assumptions did not have much impact on model output and fit to the survey index:





However, the fit to length composition data deteriorated when switched to double-normal selectivity option. The cubic spline approach provides for a better fit to a somewhat bimodal length distribution in the length composition data.



- **Request 5:** Explore alternative start years for the bias adjustment ramp used to estimate recruitment deviations.

Rationale 5: The 2015 benchmark assessment used 1974 as the starting year for bias adjustment. The 2019 update assessment shifted the start date to 1971, which inadvertently started the ramp between two year classes that are among the strongest estimated in the assessment (1970 and 1971). These year classes were likely well sampled during the rapid development of the fishery in the 1980s. Adjusting the bias ramp to start before 1970 would inform how sensitive model results are to this decision point.

Response 5: Changing the first year of the maximum bias adjustment ramp from 1977 to 1970 resulted in small differences in estimated recruitment. These changes led to: 1.3

units of improvement in the negative log-likelihood, a 2% increase in spawning biomass in 2025 and a 3% increase in 2027 ACL.

- **Request 6:** Conduct a “leave-one-out” sensitivity analysis, where survey indices and composition data are sequentially removed from the proposed base model. Provide a table that reports associated likelihood values by the remaining fleets and components, as well as key parameter estimates (including M), along the lines of Tables 29-31 in the draft yellowtail rockfish assessment or Tables 14-16 in the draft chilipepper assessment.

Rationale 6: This sensitivity will inform the relative influence of each index and composition dataset on model results, particularly the estimated natural mortality rate. This was done for some but not all of the datasets in the draft update assessment.

Response 6: The largest impacts of data removal occurred for age data. In particular, with the removal of WCGBTS age data the estimate of female natural mortality increased from 0.122 yr^{-1} to 0.153 yr^{-1} and the estimate of unfished recruitment increased from 34.8 million to 52.0 million. With the removal of midwater trawl age data and the estimate of unfished recruitment increased from 34.8 million to 41.8 million. Both of these lead to large ($>2000 \text{ mt}$) increases in the 2027 OFL. Full results are below. Length composition data for a fleet was only removed if age composition data was available for that fleet to inform estimation of selectivity. Total likelihoods are not included because likelihoods from models with different data are not comparable.

Results from removing each index of abundance are shown in the Table below.

Label	BottomTrawl	ForeignAtSea	Hake	JuvSurvey	Triennial	WCGBTS	Base
Length_comp_like	829.500	829.501	829.473	829.738	829.745	829.938	829.491
Age_comp_like	1366.490	1367.150	1367.090	1367.220	1367.170	1366.640	1367.200
Recr_Virgin_millions	32.368	34.634	34.503	35.239	36.165	35.086	34.800
SR_LN(R0)	10.385	10.453	10.449	10.470	10.496	10.466	10.457
NatM_uniform_Fem_GP_1	0.120	0.122	0.122	0.123	0.124	0.123	0.122
NatM_uniform_Mal_GP_1	0.132	0.135	0.134	0.135	0.136	0.136	0.135
L_at_Amax_Fem_GP_1	49.488	49.493	49.487	49.496	49.495	49.484	49.492
L_at_Amax_Mal_GP_1	43.614	43.607	43.612	43.607	43.603	43.609	43.608
VonBert_K_Fem_GP_1	0.181	0.181	0.181	0.181	0.181	0.181	0.181
VonBert_K_Mal_GP_1	0.245	0.245	0.245	0.245	0.245	0.245	0.245
SSB_Virgin_thousand_mt	83.033	85.220	85.302	85.799	86.952	85.041	85.458
SSB_2025_thousand_mt	42.559	46.670	46.290	47.396	49.773	46.282	46.932
Bratio_2025	0.513	0.548	0.543	0.552	0.572	0.544	0.549
SPRratio_2024	1.243	1.179	1.185	1.168	1.136	1.182	1.175
OFLCatch_2027	3933.810	4499.630	4440.380	4579.870	4914.960	4449.880	4532.510

Results from removing each source of age data are presented in the next Table.

Label	BottomTrawl	Hake	HnL	MidwaterTrawl	Net	WCGBTS	Base
Survey_like	8.226	7.612	8.101	6.132	8.915	8.792	8.045
Length_comp_like	824.064	815.621	828.651	820.578	828.089	787.994	829.491
Recr_Virgin_millions	33.329	33.419	35.204	41.799	33.569	51.953	34.800
SR_LN(R0)	10.414	10.417	10.469	10.641	10.421	10.858	10.457
NatM_uniform_Fem_GP_1	0.119	0.117	0.123	0.126	0.121	0.153	0.122
NatM_uniform_Mal_GP_1	0.131	0.130	0.135	0.135	0.133	0.167	0.135
L_at_Amax_Fem_GP_1	49.467	49.466	49.501	49.542	49.529	49.083	49.492
L_at_Amax_Mal_GP_1	43.668	43.538	43.598	43.348	43.578	43.770	43.608
VonBert_K_Fem_GP_1	0.181	0.177	0.181	0.174	0.181	0.235	0.181
VonBert_K_Mal_GP_1	0.241	0.240	0.245	0.240	0.247	0.274	0.245
SSB_Virgin_thousand_mt	86.776	88.290	85.365	97.001	84.272	82.781	85.458
SSB_2025_thousand_mt	47.023	45.804	47.305	66.393	45.112	55.019	46.932
Bratio_2025	0.542	0.519	0.554	0.684	0.535	0.665	0.549
SPRratio_2024	1.194	1.219	1.165	0.959	1.204	0.906	1.175
OFLCatch_2027	4408.980	4211.250	4632.530	7024.150	4270.320	7875.550	4532.510

Results from removing each source of length data are below. Length data for a fleet was only removed if age data also existed to inform selectivity for that fleet.

Label	BottomTrawl	Hake	HnL	MidwaterTrawl	Net	WCGBTS	Base
Survey_like	7.932	9.050	8.371	7.140	8.534	5.831	8.045
Age_comp_like	1359.760	1331.980	1368.220	1326.330	1365.170	1352.550	1367.200
Recr_Virgin_millions	34.621	36.660	33.515	39.260	34.760	35.593	34.800
SR_LN(R0)	10.452	10.509	10.420	10.578	10.456	10.480	10.457
NatM_uniform_Fem_GP_1	0.122	0.122	0.121	0.129	0.123	0.122	0.122
NatM_uniform_Mal_GP_1	0.134	0.136	0.133	0.140	0.135	0.136	0.135
L_at_Amax_Fem_GP_1	49.613	49.263	49.450	49.816	49.573	49.496	49.492
L_at_Amax_Mal_GP_1	43.731	43.300	43.618	43.603	43.690	43.566	43.608
VonBert_K_Fem_GP_1	0.177	0.178	0.182	0.161	0.181	0.181	0.181
VonBert_K_Mal_GP_1	0.239	0.248	0.246	0.245	0.244	0.248	0.245
SSB_Virgin_thousand_mt	84.930	89.446	83.767	85.365	84.521	87.507	85.458
SSB_2025_thousand_mt	45.582	49.590	42.520	48.304	45.978	47.824	46.932
Bratio_2025	0.537	0.554	0.508	0.566	0.544	0.547	0.549
SPRratio_2024	1.194	1.163	1.243	1.118	1.184	1.153	1.175
OFLCatch_2027	4350.900	4700.620	4135.980	4792.270	4430.610	4814.060	4532.510

We then looked more carefully at the WCGBTS and midwater trawl ages, which exerted the greatest influence on catch advice. We removed these data sources one year at a time back to the set of years that were available in the 2019 assessment, essentially doing a 6-year retrospective, but only for one particular data source. This data-specific retrospective analysis showed that while the midwater trawl ages are influential to the model, they do not explain the changes in perception of the stock between 2019 and 2025. Rather, it is the full time series of midwater trawl age data that is important. Removing survey ages one year at a time, on the other hand, led to a year-by-year increase in the estimate of natural mortality and unfished recruitment, and associated increases in catch advice.

Results from removing one year at a time of midwater trawl age data are shown in the Table below. For each column, all midwater trawl ages are removed from the model from that year to present.

Label	2019	2020	2021	2022	2023	2024	Base
Recr_Virgin_millions	35.510	35.901	35.995	36.012	35.626	35.394	34.800
SR_LN(R0)	10.478	10.488	10.491	10.492	10.481	10.474	10.457
NatM_uniform_Fem_GP_1	0.123	0.123	0.123	0.123	0.122	0.123	0.122
NatM_uniform_Mal_GP_1	0.135	0.136	0.135	0.135	0.135	0.135	0.135
SSB_Virgin_thousand_mt	86.265	86.821	87.109	87.259	87.262	86.463	85.458
SSB_2025_thousand_mt	49.124	50.003	50.345	50.360	49.958	49.103	46.932
Bratio_2025	0.569	0.576	0.578	0.577	0.573	0.568	0.549
SPRratio_2024	1.150	1.135	1.132	1.132	1.140	1.148	1.175
OFLCatch_2027	4733.360	4898.930	4956.270	4969.890	4896.370	4799.450	4532.510

Results from consecutively removing one year at a time of WCGBTS age data are presented below. For each column, all WCGBTS ages are removed from the model from that year to present. 2020 is not included because there was no survey due to the COVID-19 pandemic.

Label	2019	2021	2022	2023	2024	Base
Recr_Virgin_millions	43.692	42.472	41.650	40.650	38.484	34.800
SR_LN(R0)	10.685	10.657	10.637	10.613	10.558	10.457
NatM_uniform_Fem_GP_1	0.138	0.136	0.135	0.133	0.129	0.122
NatM_uniform_Mal_GP_1	0.151	0.149	0.148	0.145	0.142	0.135
SSB_Virgin_thousand_mt	84.934	85.256	85.185	85.832	85.652	85.458
SSB_2025_thousand_mt	58.169	56.544	55.512	55.106	51.976	46.932
Bratio_2025	0.685	0.663	0.652	0.642	0.607	0.549
SPRratio_2024	0.944	0.971	0.988	1.006	1.063	1.175
OFLCatch_2027	7445.640	7058.730	6812.490	6530.830	5799.380	4532.510

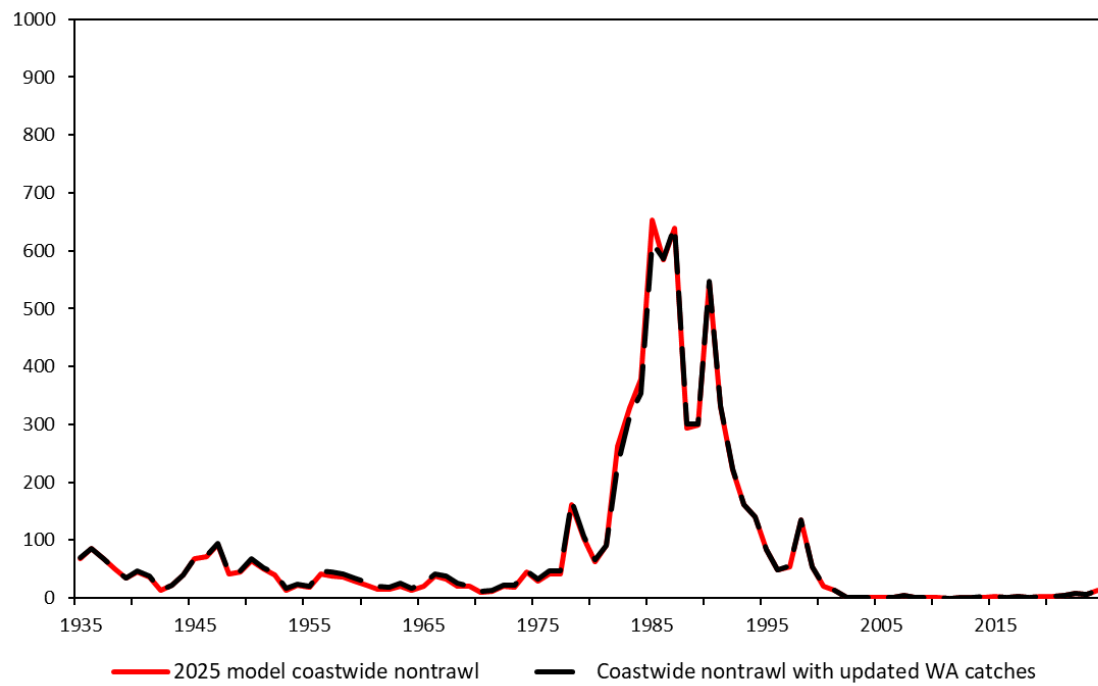
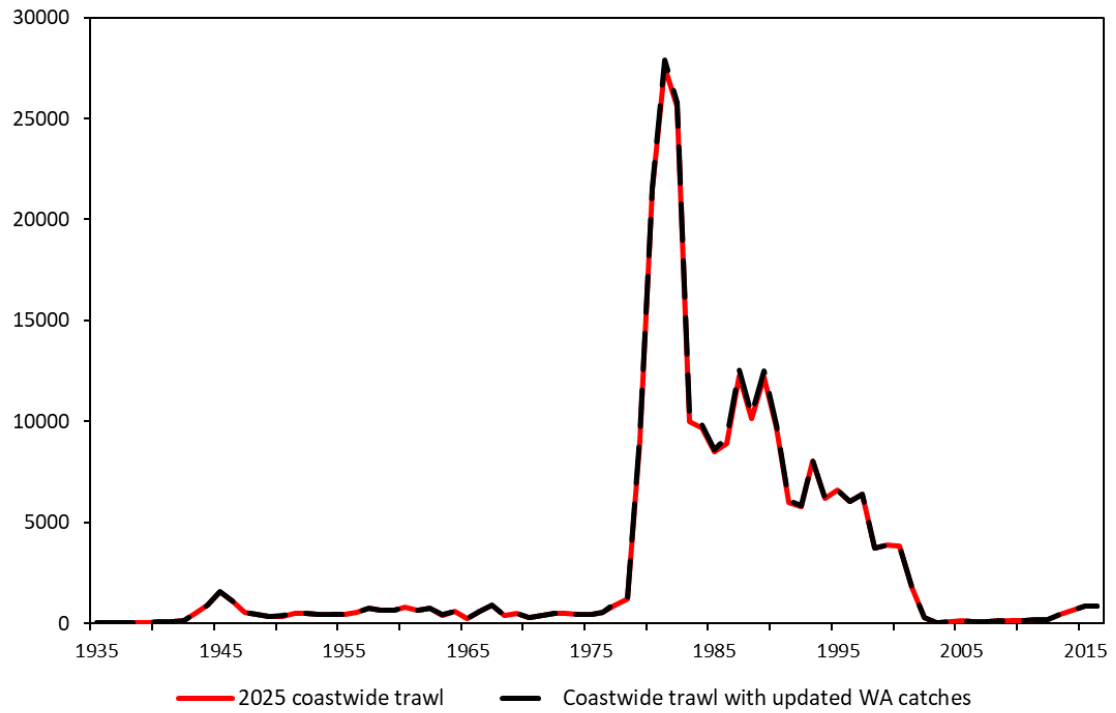
- **Request 7:** Include an updated historical catch reconstruction for Washington (WA) into the base model.

Rationale 7: Although these data were provided after the data deadline, they were used in a sensitivity analysis. Including updated catch data in the base model represents an improvement over the data used in previous assessments. It was noted that across all states, recreational catches were comparable in volume to some of the commercial fleets, and should be accounted for in future models. There is likely not sufficient time to accomplish this task prior to the supplemental review.

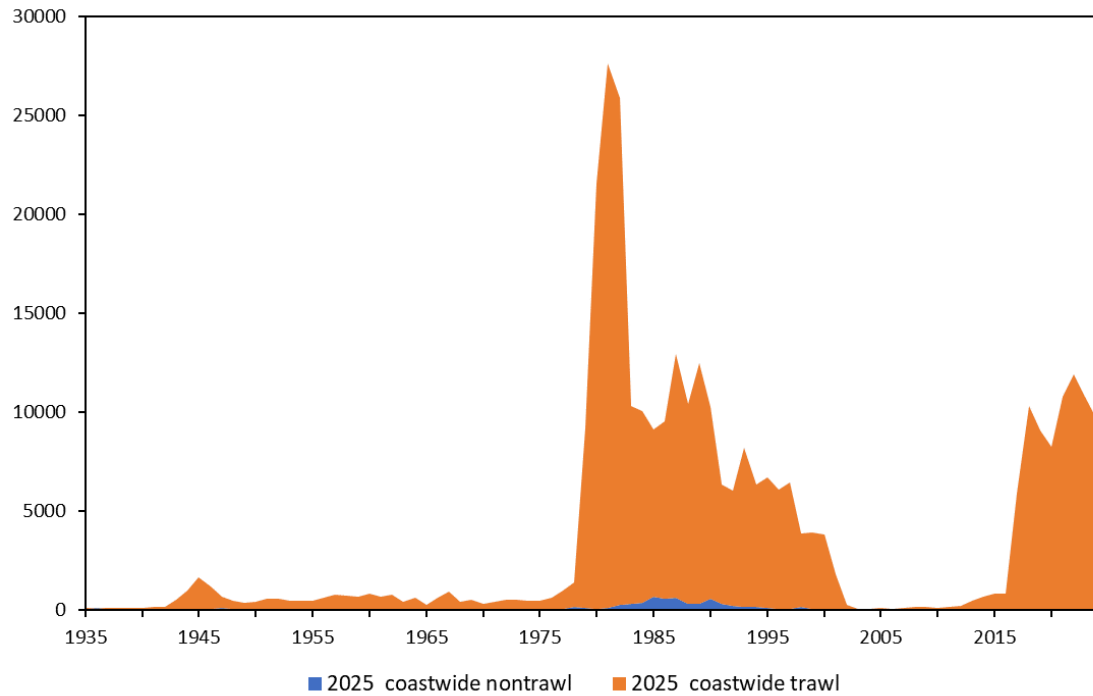
Response 7:

The recent Washington historical reconstruction provides catches for trawl and non-trawl groups. In the 2025 widow rockfish model, following the 2015 and 2019 models, shoreside trawl catches are divided among three fleets - bottom trawl, shoreside midwater trawl targeting rockfish, and shoreside midwater trawl targeting hake. Non-trawl landings are divided between hook and line and net gear groups. In the 2015 assessment, total trawl and non-trawl catches were divided among the modeled fleets based on multiple sources, including logbook data. The recent Washington reconstruction does not divide catches into the fine-scale categories needed for this assessment. For this sensitivity run, we used the same proportions among gear groups as in the 2015 assessment.

The comparison of coastwide trawl and nontrawl catches between those used in August 2025 model and those that incorporate updated Washington historical catches are shown below for trawl and nontrawl gear groups separately:

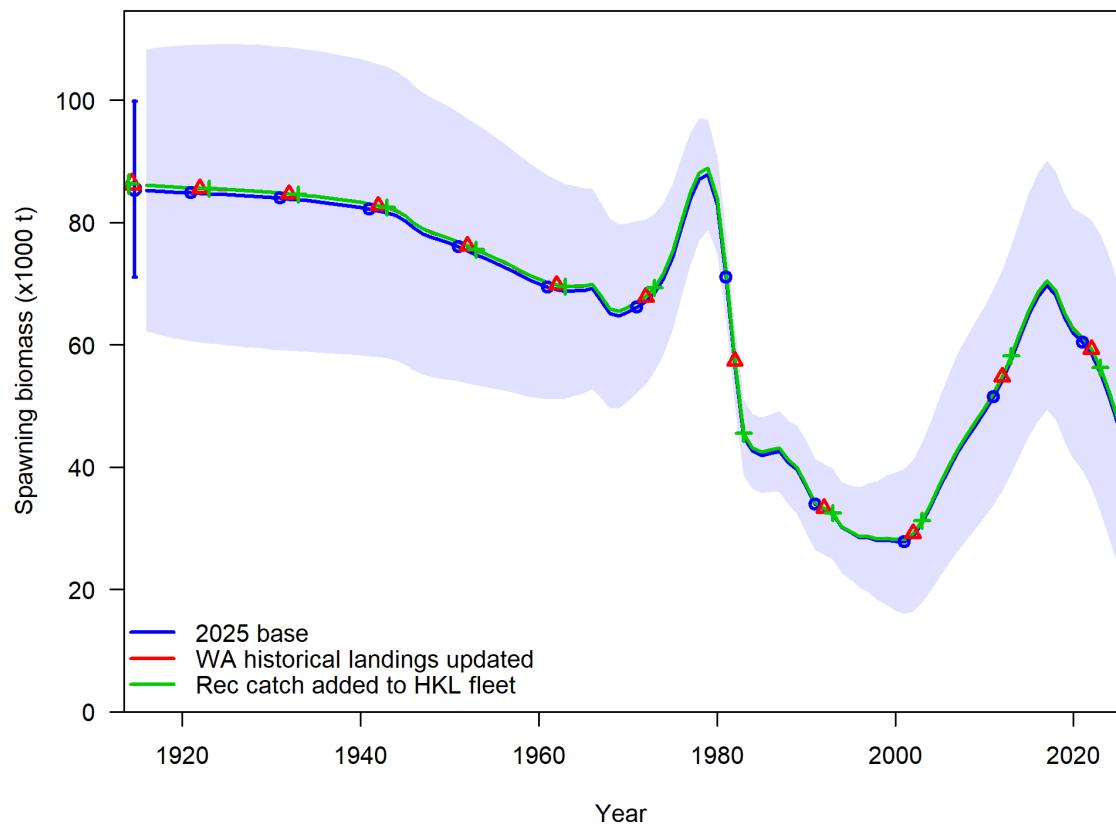


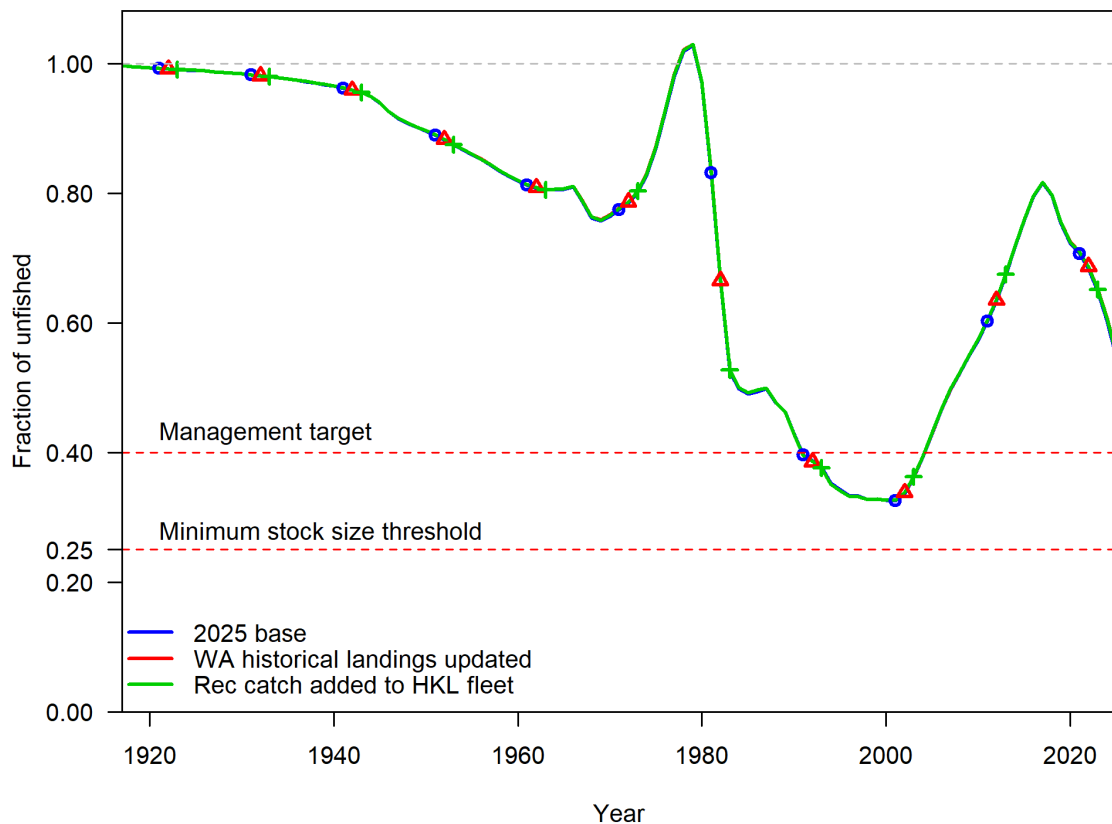
The contribution of nontrawl landings to total catches is extremely minimal; the majority of catches are removed by trawl gears.



We also conducted a run with widow rockfish recreational catches since 2002 added to the hook and line (HKL) fleet. The recreational catches were obtained from GEMM; between 2002 and 2023, recreational catches ranged between 0.9 and 30 metric tons with an average of just under 10 metric tons per year.

Adding recreational catches did not have any impact on the model results:





- Request 8:** Provide two 10-year retrospective analyses, one using both McAllister-Ianelli and the other using Francis weighting of the compositional data. Include a table that reports key model parameters and outputs (e.g., the model estimate of M , depletion, $SPR_{50\%}$ the MSY proxy) along the lines of Tables 29-31 in the draft yellowtail rockfish assessment or Tables 14-16 in the draft chilipepper assessment.

Rationale 8: The change in perception of stock status is substantial between the current and previous assessments. The method of weighting compositional data also seems to have a substantial influence on model results. A 10-year retrospective would improve our understanding about the effects of data and weighting methods on the shift in stock status.

Response 8: The 10-year retrospective from the August 2025 base model produces results that were consistent with the leave-one-out analysis in request 6, namely that the estimates of natural mortality were strongly influenced by the recent data, and removing the last 10 years of data produces results that are much more similar to the 2015 base model in terms of estimates of M and equilibrium catch at the SPR target (see Table and Figure below).

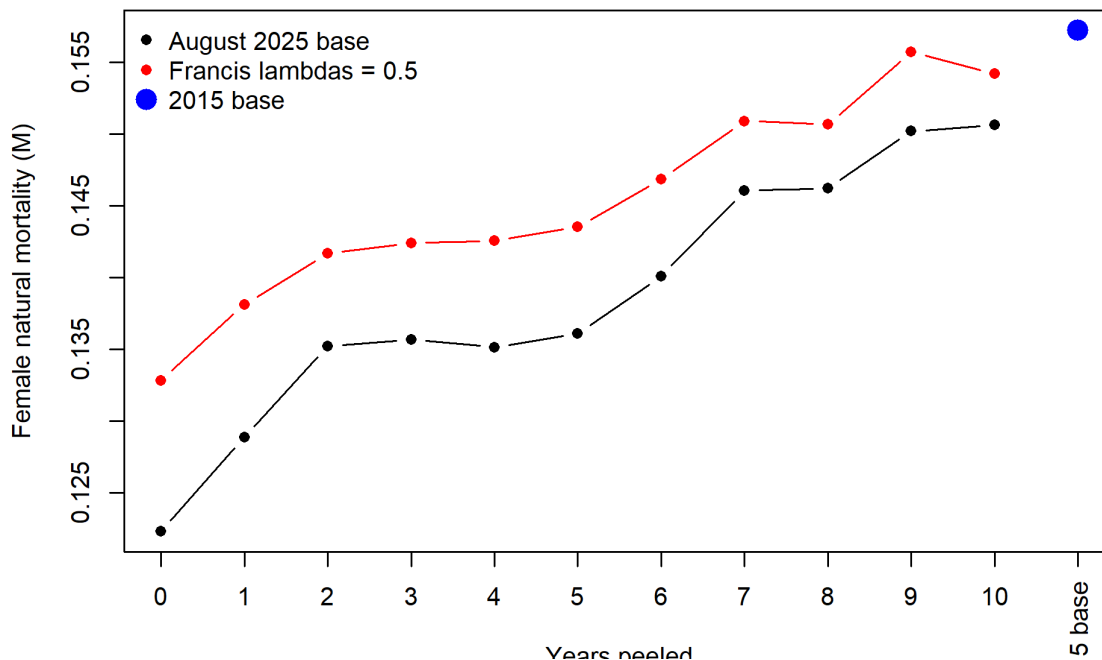
In the table below, quantities of interest for the 10-year retrospective for the base model (with default McAllister-Ianelli weighting and $\lambda = 0.5$) along with the 2015 base model.

Label	Aug 2025 base	Data -1 years	Data -2 years	Data -3 years	Data -4 years	Data -5 years	Data -6 years	Data -7 years	Data -8 years	Data -9 years	Data -10 years	2015 base model
M Female	0.122	0.129	0.135	0.136	0.135	0.136	0.140	0.146	0.146	0.150	0.151	0.157
M Male	0.135	0.142	0.147	0.148	0.147	0.148	0.152	0.158	0.159	0.164	0.164	0.170
B0 1000 mt	85.5	82.2	84.0	86.1	88.3	88.0	85.4	83.3	82.8	82.5	82.5	80.7
Equil. catch at SPR targ. mt	5822	5910	6377	6539	6659	6691	6686	6833	6880	7107	7177	7776

The table below shows the same quantities for the model with Francis weighting and $\lambda = 0.5$.

Label	Aug 2025 with Francis weights	Data -1 years	Data -2 years	Data -3 years	Data -4 years	Data -5 years	Data -6 years	Data -7 years	Data -8 years	Data -9 years	Data -10 years
M Female	0.133	0.138	0.142	0.142	0.143	0.144	0.147	0.151	0.151	0.156	0.154
M Male	0.154	0.161	0.165	0.166	0.167	0.168	0.172	0.178	0.178	0.185	0.183
B0 1000 mt	93.0	88.9	89.8	92.3	94.1	93.9	92.4	91.5	91.0	90.9	90.5
Equil. catch at SPR targ. mt	6977	6963	7240	7488	7661	7705	7750	7824	7821	8148	8038

Values of female natural mortality across retrospective runs, with the 2015 base model included for comparison, are shown in the figure below for each of the data weighting methods (the August 2025 base uses the McAllister-Ianelli method and also has λ set to 0.5).



- Request 9:** Explore other potential issues and/or provide other sensitivities that the Stock Assessment Team (STAT) deems helpful or informative. As with the above explorations, any such changes or improvements need not adhere to the terms of reference for update assessments.

Rationale 9: Responses to these requests and other STAT investigations may lead to additional improvements or insights that would help inform the reason for substantial changes in stock status or productivity between the current and previous assessments, or (more importantly) to improvements in the proposed base model for Supplemental Review.

Response 9:

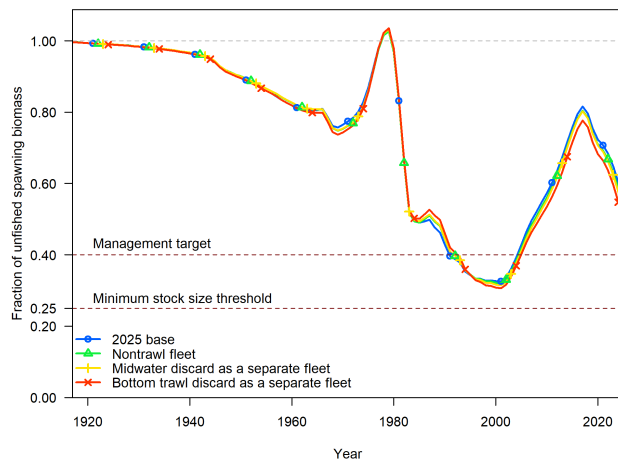
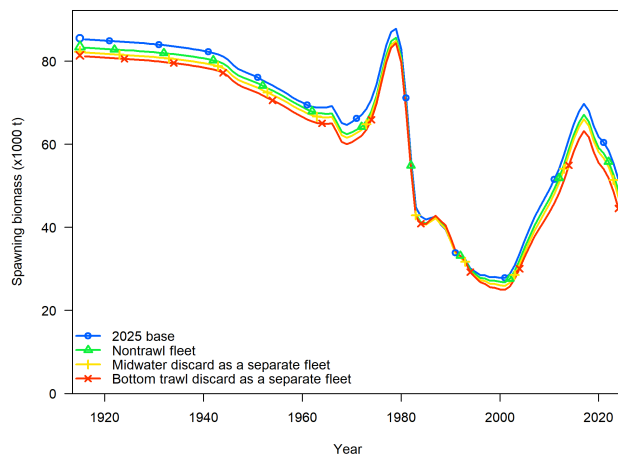
A) Simplification of fleet structure

The 2015 benchmark assessment model (and subsequent 2019 and 2025 updated assessment models) has a complex fleet structure, with two fleets (net and hook-and-line) contributing minimal amounts of catch, primarily in historical periods, they also have limited amount of composition data to estimate selectivity parameters. Also, for several fleets, discard is estimated within the model, with retention curves estimated based on minimal data. While constructing the 2025 update assessment, we found that limited discard length data for the hook-and-line fleet (which contributes less than one tenth of one percent of recent landed catches) had a disproportionately high influence on estimates of recruitment (not supported by any other sources).

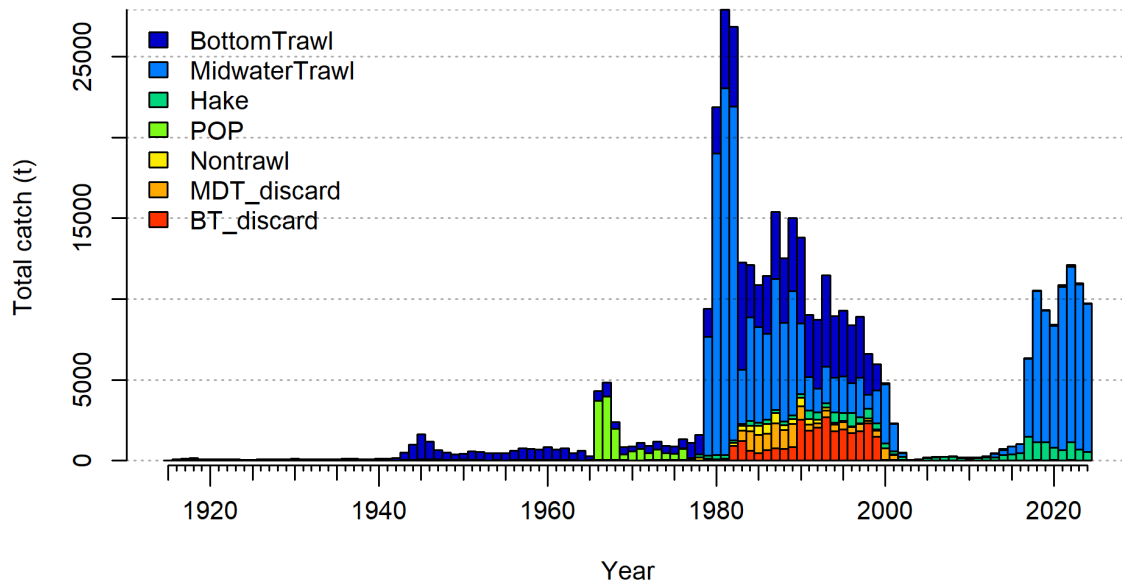
For the supplemental review, we therefore explored multiple model configurations with simplified fleet structures.

As a first step, we ran the model (1) combining net and hook-and-line fleets into a single Nontrawl fleet, (2) including Midwater trawl discards as a separate fleet with selectivity mirrored to Midwater trawl landings, and (3) including Bottom trawl discards as a separate fleet, with selectivity being informed by discard length composition data collected by the Pikitch study and WCGOP. For these initial runs, we used discard amounts as estimated in the 2025 base model for the period prior to 2002, and GEMM estimated discard amounts from 2002 forward.

The trajectories among these initial runs were very similar. No unexpected or unreasonable dynamics were discovered.



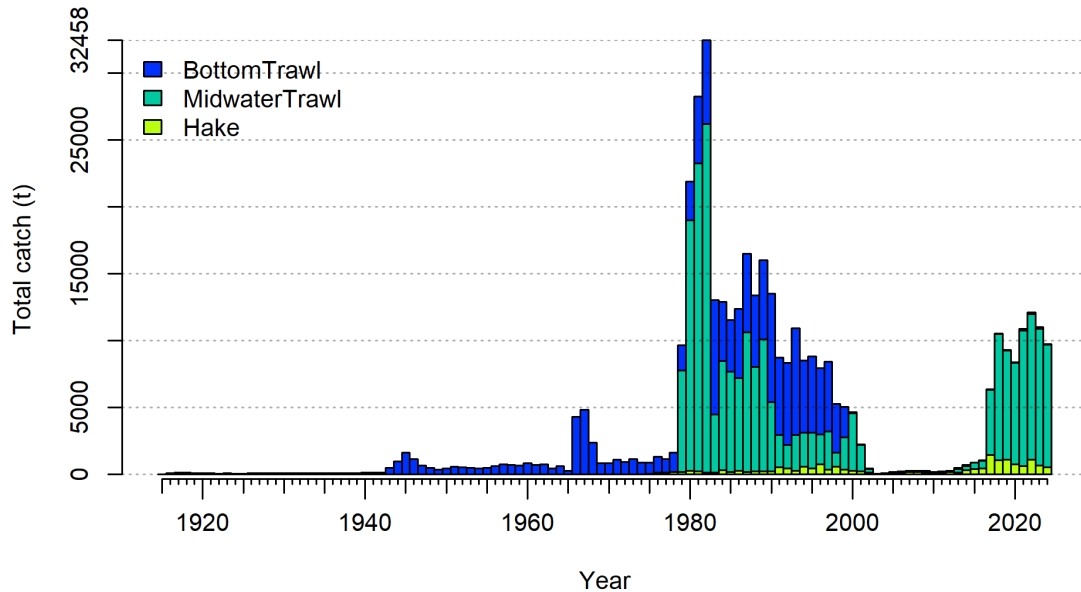
Contributions of different sources of catch (by simplified fleet, and landings vs discards) to total removals are summarized in the plot below.



Nontrawl fleet contribution has been very limited. Since 2002 discards in the bottom trawl and midwater trawl fleets were also extremely small (not visible on the plot). Bottom trawl discard length data composition data are scarce and primarily come from the recent period of low discarding sampled by WGCOP, which is likely not representative of the composition of discarded fish during the 1980s and 1990s when discarding was much more prevalent. There were non-existing midwater trawl discard biological data (only a few fish were sampled during the modern WCGOP years).

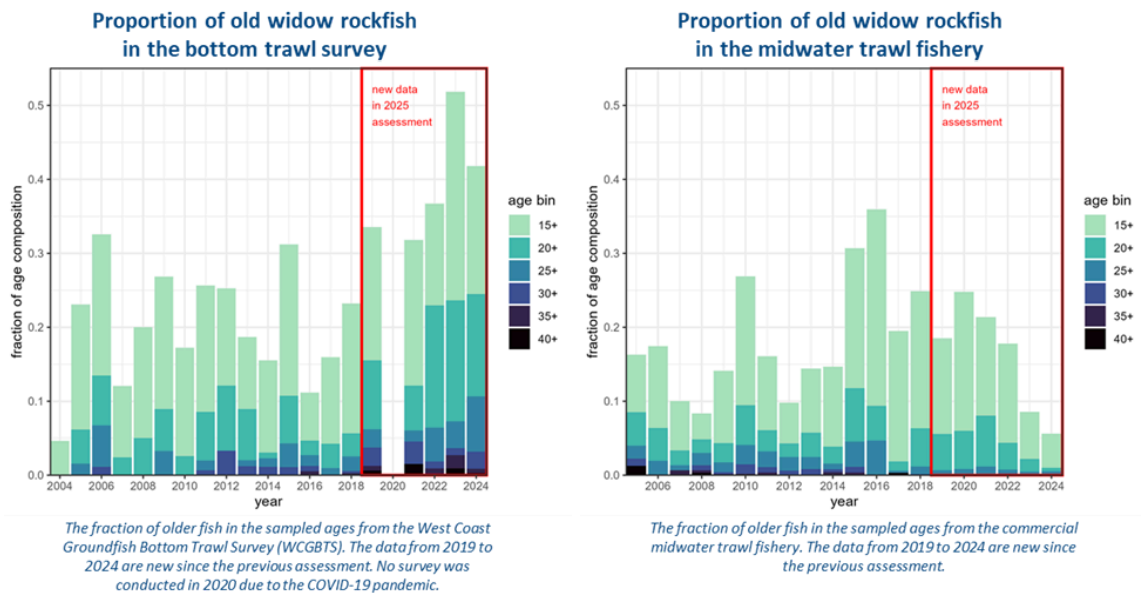
Therefore, we explored even further simplification, calculating the discards outside the model and adding them to the retained catch within just three fleets: bottom trawl, midwater trawl, and hake. The catch from non-trawl gear groups (hook-and-line and net) was added to the bottom trawl fleet. Bottom trawl discard and midwater trawl discards were added to landings of each fleet respectively (bottom trawl and midwater trawl). This additional simplification produces similar results to the first simplification step (fixing discards in separate fleets rather than modeling retention within the model).

The catch of widow rockfish in these three fleets is shown below:



B) Opposing trends in midwater trawl fishery and bottom trawl survey age compositions

There are apparent opposing trends in age composition observed in the midwater trawl fishery catches versus those of the bottom trawl survey, as shown below. The proportion of older fish has decreased since the 2019 assessment in the midwater trawl fishery, but has increased in the bottom trawl survey over the same years.

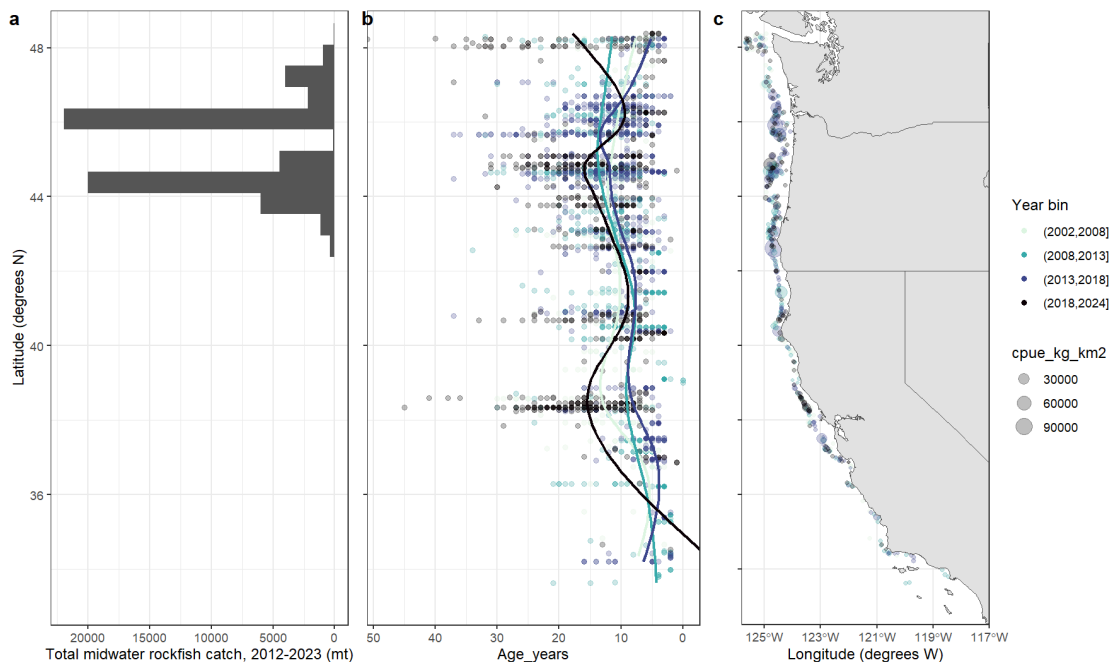


The increase in older ages in the bottom trawl survey is the major driver of the decrease in the estimate of natural mortality in the 2025 assessment compared to previous assessments. Fishery participants have emphasized that they only fish in a very restricted

set of locations relative to where the population is found, so we explored possible spatial explanations for this conflict in the data.

The age data from the fishing fleets, as extracted from the PacFIN database, are only associated with port of landing, not fishing location, so it is not possible to analyze the precise spatial distribution of fishery ages. Instead, we compared spatial patterns of fishery catches with the spatial distribution of survey ages, for which precise locations are readily available. From 2017 onward, 34% of the age samples used and 11% of catch-weighted ages were from landings in Westport, Washington; 26% of age samples and 38% of catch-weighted ages from Astoria, Oregon; 24% of age samples and 51% of catch-weighted ages from Newport, Oregon; and 16% of age samples and <1% of catch-weighted ages from all other ports combined.

In the figure below, we plotted 2012-2023 catches made by the midwater rockfish trawl fleet by latitude (panel a), alongside age data from the WCGBTS by latitude and 5-year bin (panel b) and WCGBTS CPUE by latitude and 5-year bin (panel c). The WCGBTS CPUE figure includes a map to orient data to the coastline. In the middle panel (panel b), we also show smoothed trend lines that represent average age by latitude associated with each 5-year bin. In panel (a), latitudinal bins with < 3 vessels operating over the time period are not shown due to confidentiality.



The figure shows several notable patterns in fishery and survey data. Consistent with reports from fishery participants, there are two major latitudinal bands where widow rockfish are currently caught; one is offshore of the Columbia River, and one is in Central Oregon. In recent years, the average age in the survey has been lowest offshore of the

Columbia River, which is one of the major areas of widow rockfish catch. Off Central Oregon, the other main fishery location, the survey ages are slightly older in recent years. However, the survey ages in central Oregon are not as old as clusters of samples off of northern Washington or near San Francisco Bay, where less fishing is occurring. The largest density of fish in the survey appears to be in the two main locations where the fishery operates, although there are other clusters of high survey catches near San Francisco Bay, near Cape Mendocino, off Southern Oregon, and off Northern Washington where the fishery either does not operate or catches have been very low over the last decade.

One potential explanation for the discrepancy in average age trends between the survey and the fishery is that the high rate of fishery removals over a small portion of the population's habitat removes old fish and does not allow younger fish to grow old and replace them. Over the past eight years, these consistently high removals have caused the age structure to become increasingly skewed to younger ages (truncated), particularly offshore of the Columbia River.

The WCGBTS samples widow rockfish very patchily, which means these trends should be interpreted cautiously, as they may be spurious or driven by multiple factors. Widow rockfish are encountered in about 4% of the hauls in the WCGBTS (an average of 26 out of about 635 successful hauls per year). Even though otoliths are collected in every haul where they occur, sampling variability may contribute to the observed patterns. Lastly, little is known regarding the movement of widow rockfish, so it is not clear how long local changes in age structure or density would persist.

Numerous additional factors may impact the opposing trends in fishery and survey ages, including differences between fish in the midwater and those available to bottom trawl gear, or different depth ranges where the fishery and survey are operating paired with ontogenetic movement or changes in diel distribution with age.

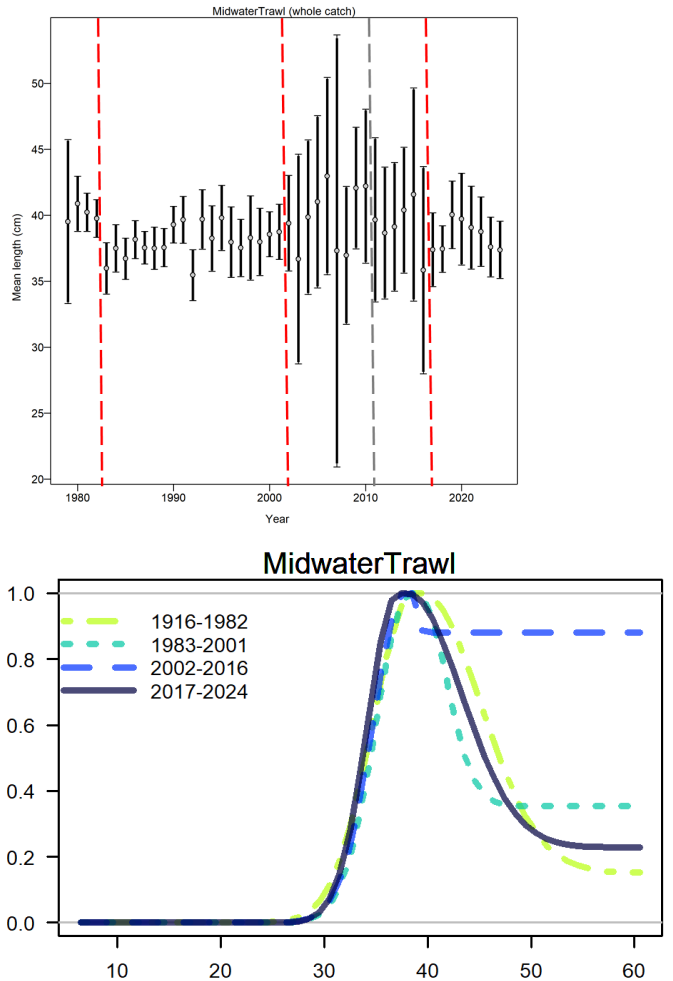
Further research on all these topics would improve our understanding of these patterns, and benefit future assessments of the species.

C) Exploring time-varying selectivity in the midwater trawl fleet.

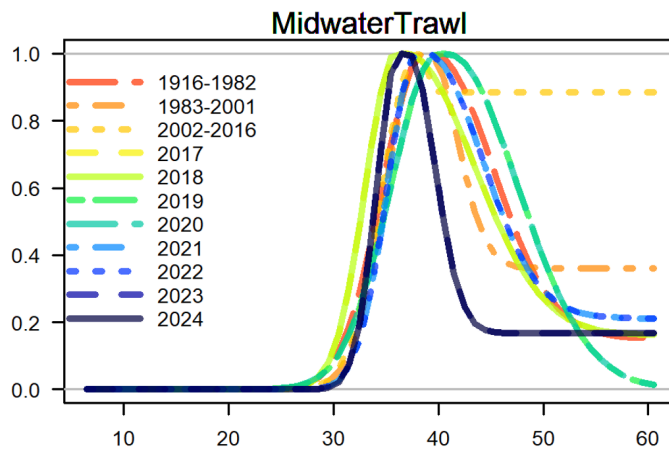
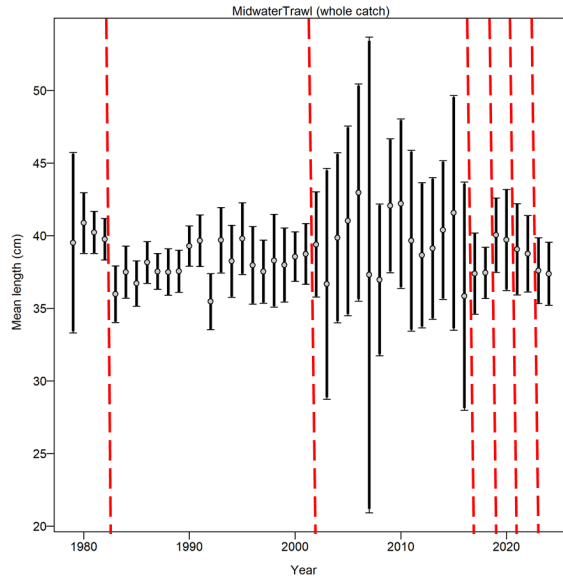
The most recent removals of widow rockfish are primarily made by the midwater trawl fleet targeting rockfish. The increased catches are observed since 2017, a few years after widow rockfish was declared rebuilt. The August 2025 model (following the 2015 and 2019 models) has several blocks set for the Midwater trawl fleet. These blocks were placed to account for changes in selectivity in 1983, when trip limits were introduced, in 2002, when the stock was declared overfished, and in 2011, when the IFQ program started.

We explored multiple assumptions regarding blocks in the period of the recent fishery. First, we added a block for the period from 2017 forward. With that, we found that estimated selectivity curves for the 2002-2010 and 2011-2016 periods were virtually

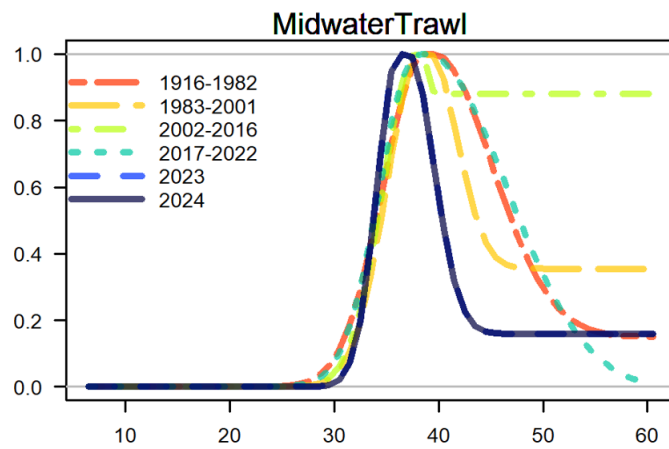
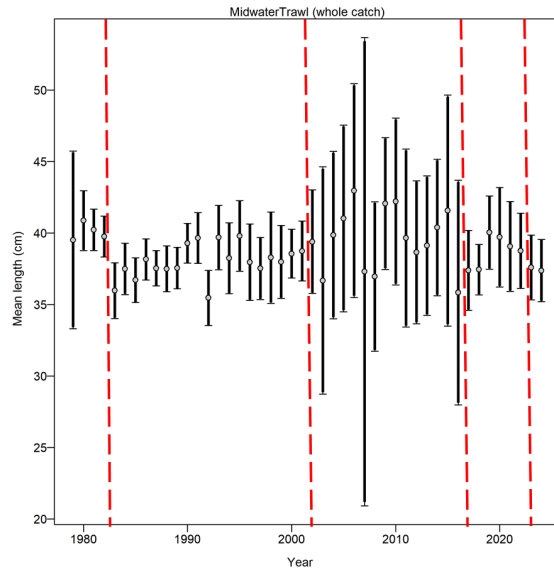
identical. Therefore we extended the 2002-2010 block to end in 2016, removing a break associated with the start of the IFQ program.



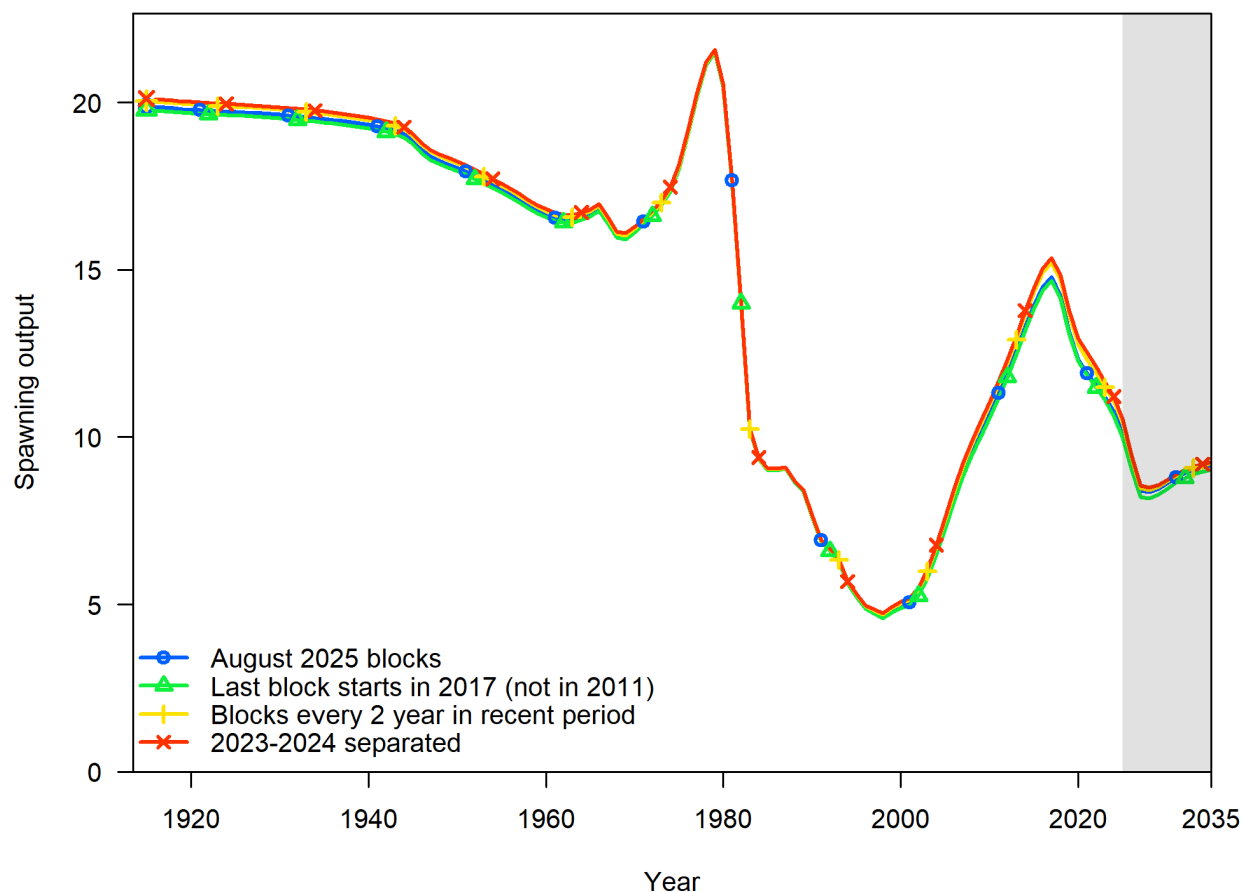
We also tried adding blocks every two years in the most recent years to allow flexibility for the model to track local changes in age/length structure and/or targeting within the primary fishing areas during the recent fishery period. In particular, if widow rockfish remain in the same general latitudes from year to year, with fishing pressure primarily in a few latitudinal areas, that could lead to truncated age structures in those areas relative to the entire population. In addition, and/or alternatively, if the fishery is targeting the large 2016 year class in the most recent years, that would also lead to a change in selectivity and in the observed age and length composition of catch in the fishery.



Finally, we tried separating only the two most recent years (2023-2024).



None of the runs with different blocking scenarios had much impact on the model output, which is shown below with the forecast period included (forecast years shaded in gray).



Models with no blocks after 2017 do not show changes in estimated OFLs as a function of the forecast selectivity assumptions. However, in the model with an additional block in 2023-2024, 2027 OFL estimates vary depending on the range of years used as the basis for selectivity in the forecast, since selectivity parameters change within the most recent 5 year period. When the forecast period is informed by the selectivity parameters in the five most recent years (2020-2024), the 2027 OFL is estimated to be 4,119 mt. When selectivity in the most recent two years (2023-2024) informs the forecast, the estimated 2027 OFL drops to 2,671 mt, while it increases to 5,053 mt when the 2020-2022 period is used to inform the forecast.

Lower Priority Requests

- **Request 10:** Update the fishery description section to reflect changes since the 2015 benchmark assessment (Groundfish Advisory Panel [GAP] recommendation).

Rationale 10: Fisheries have changed considerably since 2015 (e.g., with changing ecological conditions, other stock dynamics, and varied management actions). It would be helpful to update the description of the fisheries for the 2025 assessment, even though this is not required for an update assessment.

Response 10:

Key points:

- The current fishery is primarily composed of a midwater trawl fleet and bycatch by the hake fleet, with efforts focused off the shelf in central Oregon.
- Changes in spatial distribution of fishing efforts are primarily due to bycatch avoidance in WA and CA, avoidance of small fish (driven by increased observer coverage / introduction of IFQ system) and proximity to processing infrastructure in central Oregon.
- Where vessels have 'leftover' yellowtail quota at the end of a season, they may be more inclined to target WA- on shelf areas where mixed catches of yellowtail and widow occur.
- The bottom trawl fleet has declined due reduced ex-vessel value, regulatory changes (8 " footrope, closed areas) and fleet consolidation.
- Discarding has been minimal in recent years due to changes in fleet behaviour and introduction of the IFQ system.

Historical and current fishery

Widow rockfish were lightly exploited by bottom trawl and hook-and-line gears prior to the 1980s. After many attempts to start trawl fisheries off the west coast of the United States in the late 1800s, the availability of otter trawl nets and the diesel engine in the mid-1920s helped trawl fisheries expand (Douglas 1998). The trawl fisheries really became established during World War II when demand increased for shark livers and bottomfish. A mink food fishery also developed during World War II (Jones and Harry 1960). Foreign fleets began fishing for rockfish in the mid-1960s until the EEZ was implemented in 1977 (Rogers 2003). Longline catches of widow rockfish are present from the turn of the century and continue in recent years, mainly from fisheries targeting sablefish and halibut.

In the late 1960s and early 1970s, it is reported that foreign fishing vessels caught large numbers of widow rockfish (Rogers 2003). In the late 1970s a domestic midwater trawl fishery began developing off of Oregon when it was realized that widow rockfish form dense aggregations at night (Gunderson 1984). The fishery expanded very quickly, with landings from trawl, net, and hook-and-line gears increasing more than 20 times by the early 1980s (Table 1). As early as 1982, trip limits were imposed to keep catches below recommended annual levels (Table 3). Trip limits became more restrictive over the years until widow rockfish was declared overfished in 2001. In 2002, harvest guidelines were greatly reduced resulting in decreased catch.

Since 2011, catches have steadily increased to levels approximately equal to those in the late 1980's and early 1990's. The majority of current catches are taken by the midwater trawl fleet, though a significant portion is caught as bycatch by the pacific whiting / Hake fleet. While historically a major fleet, the catches from the bottom trawl fleet have

declined due to a combination of regulatory changes, fleet consolidation and reduced ex-vessel value (pers. comm. J.Lackey). The distribution of the midwater trawl fleet has also shifted significantly in recent years. This change in distribution is largely due to the fleet attempting to avoid bycatch, reduce catches of undersized fish and minimize distance from processing facilities. If midwater vessels have a remaining yellowtail quota later in the season, they may be more inclined to target some of the Washington grounds where a mix of widow and yellowtail is highly likely. The industry has also noted that the fleet is dynamic throughout the season, with fishers responding to changes in oceanographic conditions, feed distribution and target species distribution (pers. comm., J. Lackey).

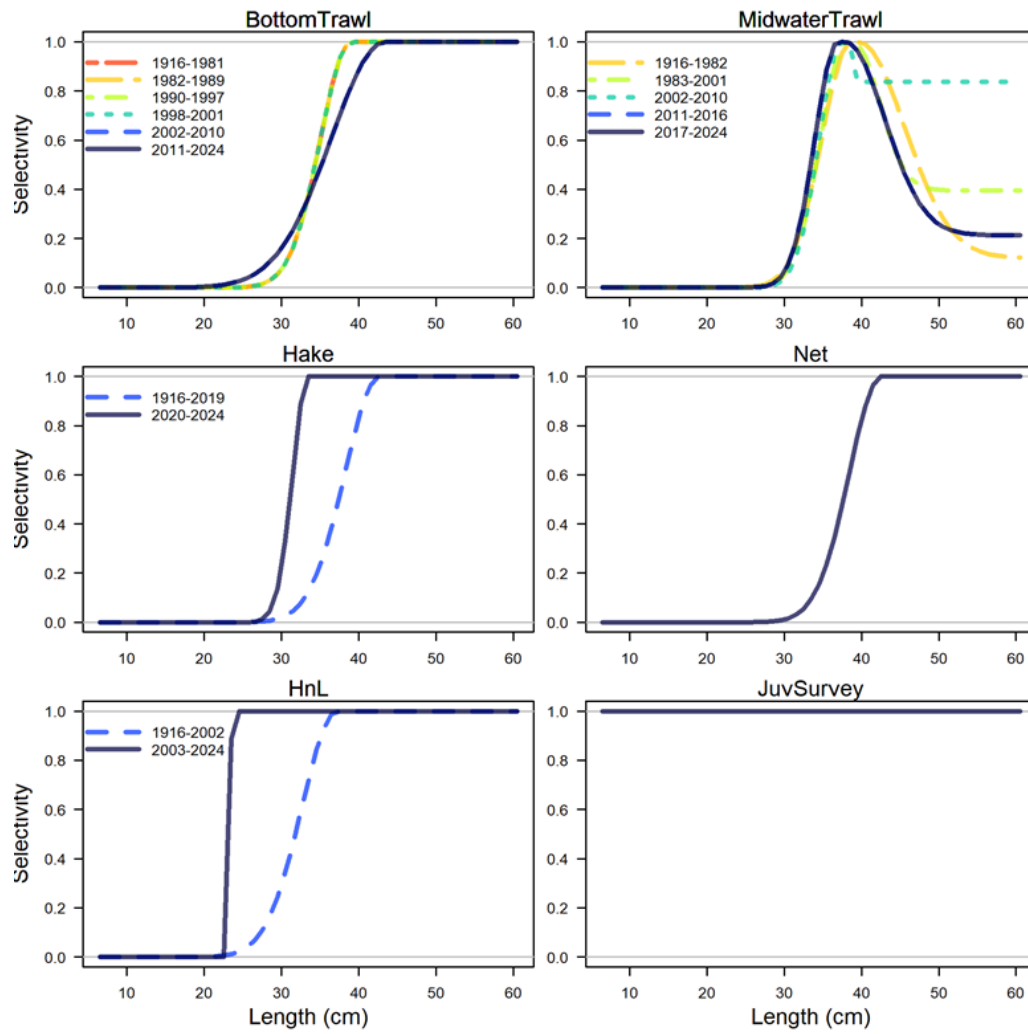
Historical discarding practices are not well known, but it is believed that little discarding occurred prior to management restrictions. With the introduction of trip limits, limited data from the mid-1980s show occasional very high discard rates of widow rockfish from tows that occurred near the end of a trip. In recent years, discards from all fleets have been low, likely due to a combination of changes in fleet behavior, increased observer coverage and the introduction of the IFQ system in 2011.

- **Request 11:** Compare selectivity curves for the fisheries and surveys from the 2015, 2019, and 2025 assessments.

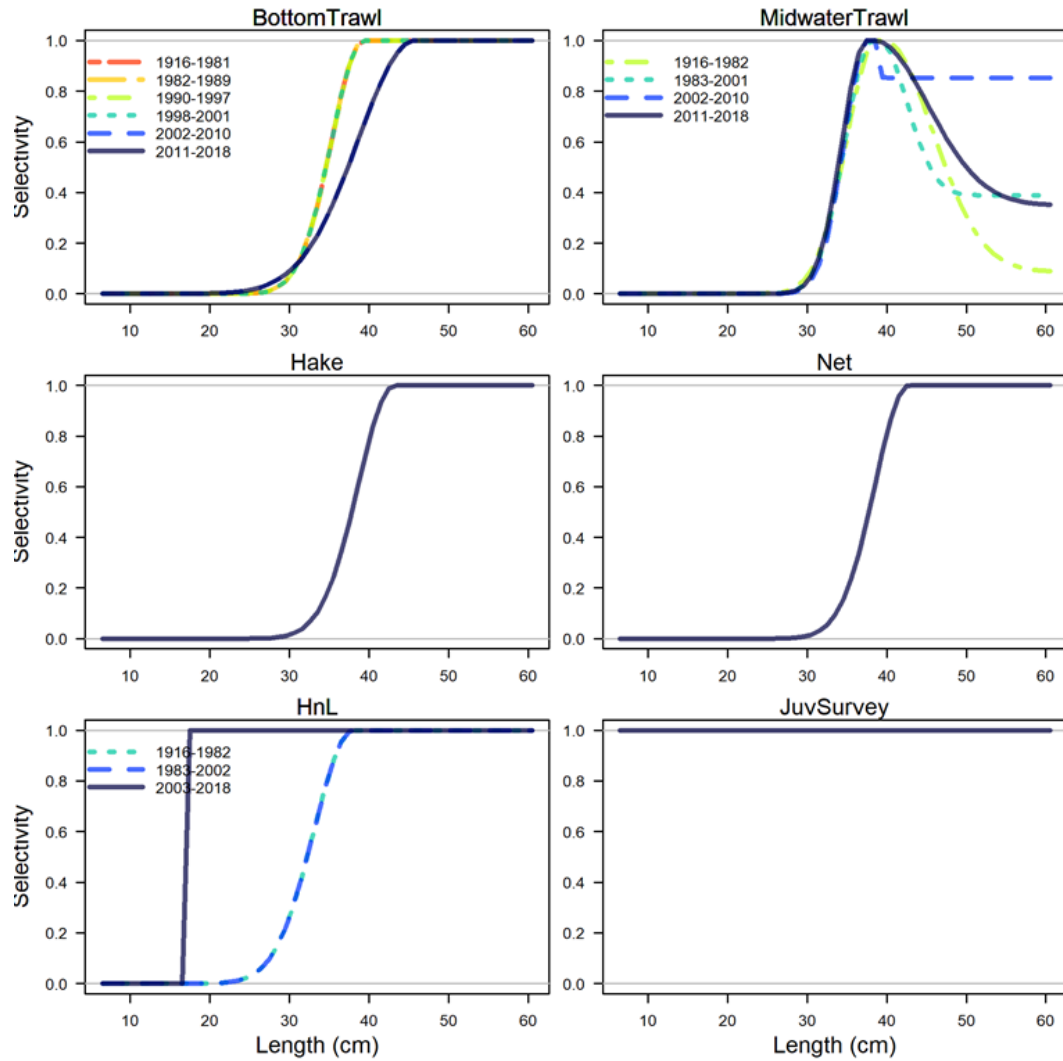
Rationale 11: A direct comparison will illustrate how the shapes of the selectivity curves have changed across recent assessments.

Fisheries selectivity curves from 2025, 2019 and 2015 assessments are provided below:

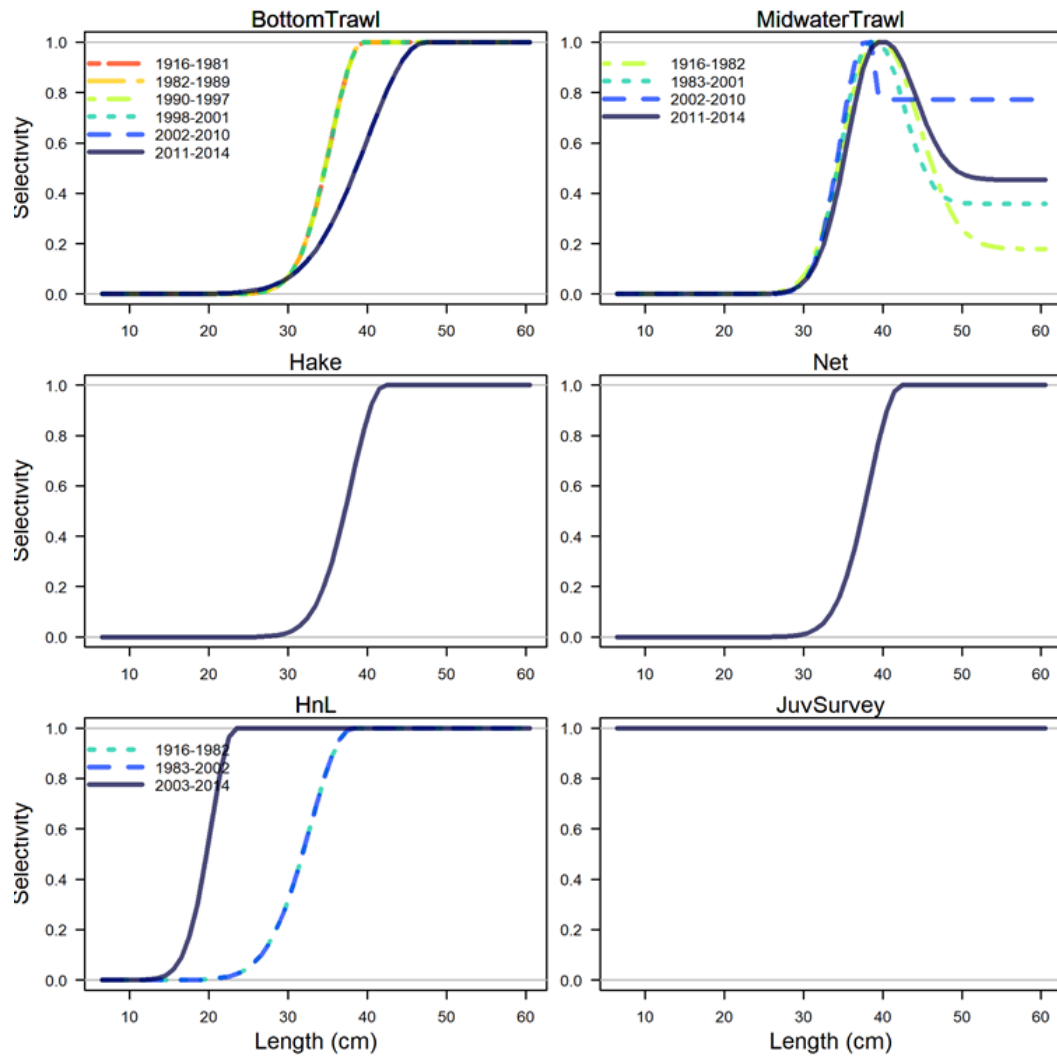
2025 model



2019 model

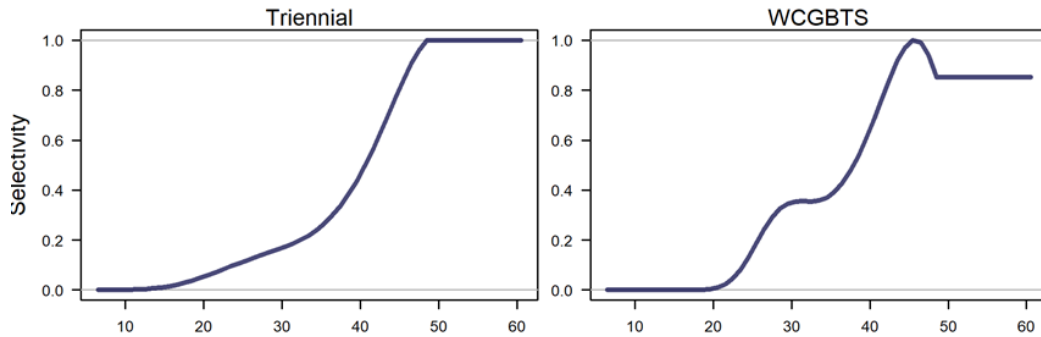


2015 model

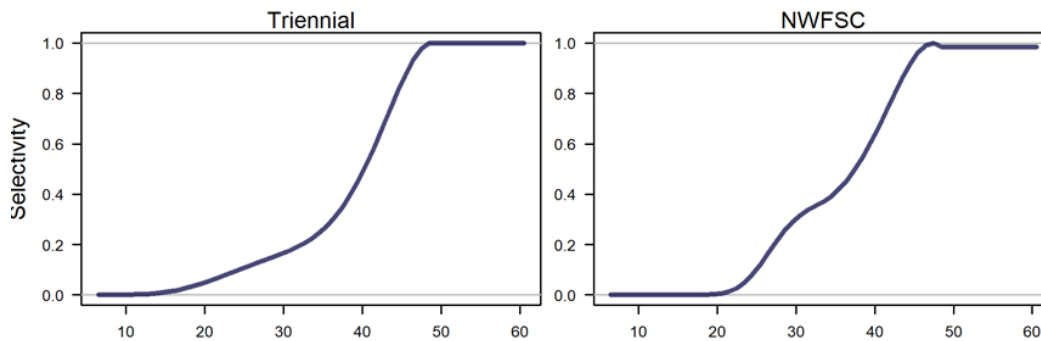


Survey selectivity curves for August 2025, 2019 and 2015 assessments are below:

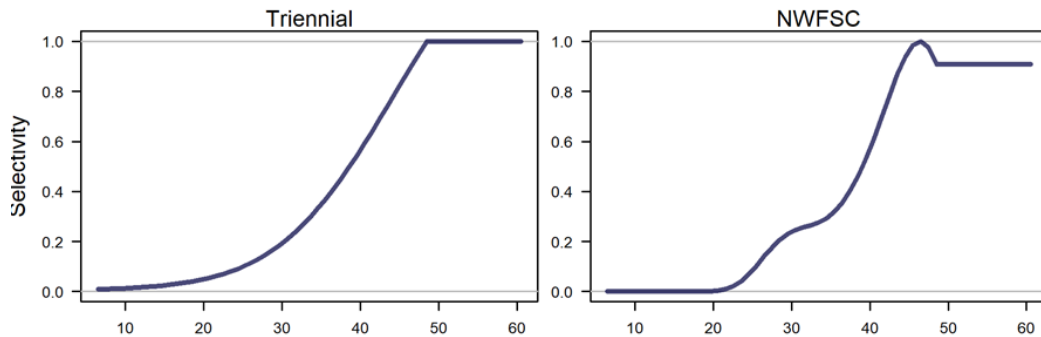
2025 model



2019 model



2015 model



- Request 12:** Provide a sensitivity analysis in which the pelagic juvenile survey index (age-0 abundance) is retuned and the total coefficient of variation (CV) does not exceed sigma-R.

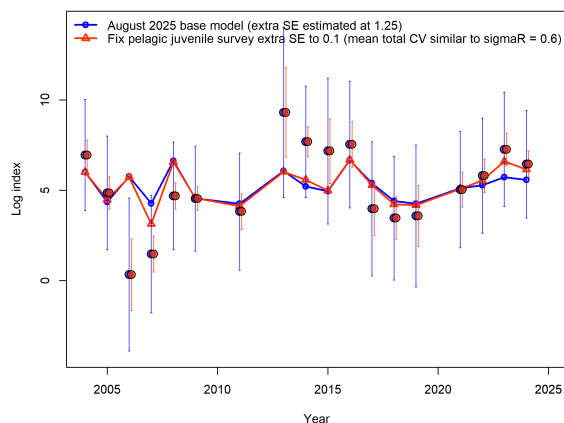
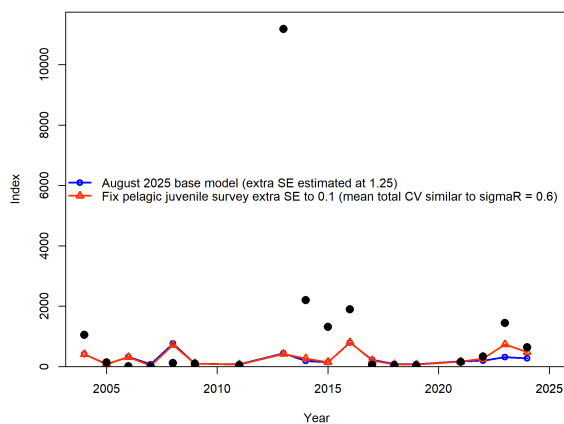
Rationale 12: With conventional tuning practices, the influence of the index is often “tuned out” of the assessment entirely (particularly when CV with additive variance greatly exceeds sigma-R). This practice was adopted for the 2025 chilipepper assessment and allows the recruitment index to be more influential for the most recent years of data.

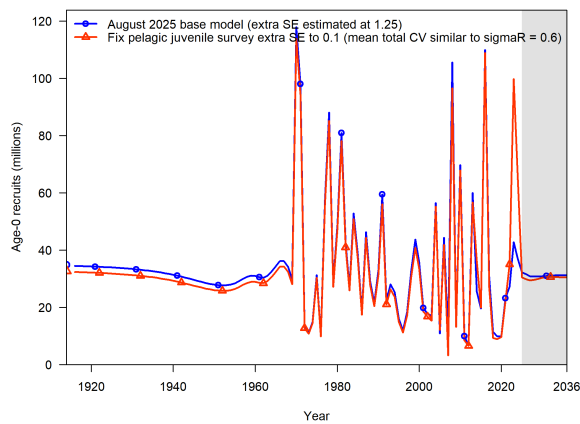
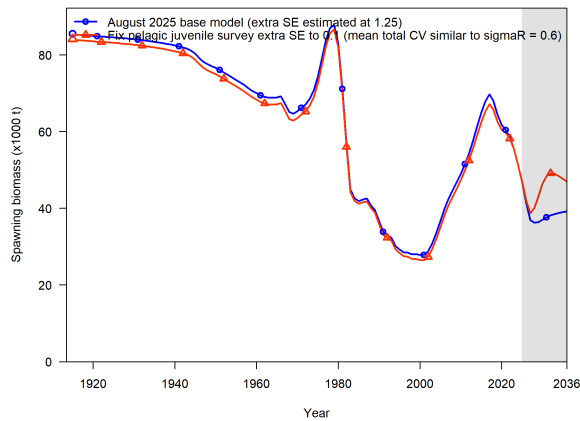
Response 12: The mean input uncertainty associated with this index is about 0.5, so we explored reducing the extra standard error from the estimated value of 1.25 to 0.1 so that

the total was similar to the sigma-R value of 0.6. This change leads to a large increase in the estimate of 2023 recruitment due to closer fit to the large JuvSurvey observation. This has a large impact on forecast trajectory, but the increase in ACLs takes a few years to appear (2% increase in 2027, 16% in 2028, 33% in 2029). Figures below show the change in fit to index on standard and log scale as well as impact on time series of spawning biomass and recruitment.

The lack of fit to the index in 2013-2016, when recruitment should be well-estimated based on composition data at this point, suggests that there is a lot of additional uncertainty associated with this index. The 2013 observation was 5 times bigger than the next largest and 27 times larger than the model expectation for that year. This raises questions about whether the high observation in 2023 is informative of recruitment in that year, or if it is more similar to the elevated index in 2013-2016.

Yr	Obs	Exp
2013	11184.10	416.554
2014	2192.81	265.580





- **Request 13:** Provide a sensitivity analysis in which size-dependent fecundity is accounted for based on the fecundity parameters from Dick et al. 2017 (see <https://github.com/EJDick-NOAA/rockfish-Fecundity/blob/main/README.md> for converted parameters).

Rationale 13: Accounting for size-dependent fecundity in rockfish stocks using the meta-analysis from Dick et al. (2017) or other information has become standard practice in recent years and is included in the TOR and Accepted Practices Guidelines documents.

Response 13: This leads to very little change in the age 4+ biomass time series, no change in likelihood, a 3% decrease in the 2025 stock status, and a 9% decrease in 2027 ACL (because the presence of older fish leads to more reduction in spawning potential at a given catch level).

- **Request 14:** Provide a summary of differences in compositional data (for example, mean length or mean age) by fishery (fleet) and state for the most data-rich fisheries. Oregon and Washington can be combined if there are insufficient numbers to allow for a robust analysis at that scale.
- **Rationale 14:** Catch data and public comments indicate that catches have been increasingly concentrated off central Oregon waters during recent years. It would be helpful to understand whether signals in the compositional data suggest differences in

recruitment and/or fishing intensity. Currently, data from the various states are pooled into an overall (catch-weighted) average. This is simply a data exploration request.

Response 14: As part of **Response 9**, we plotted recent catches from midwater trawl fleet for 2012-2023 period, that shows two major latitudinal bands where widow rockfish are caught in those years. Biological data from California and Washington are sparse in recent years relative to Oregon and are inadequate to provide state-specific composition data (see sample sizes in Table 4 of August 2025 assessment report).

Length composition samples in the assessment are weighted to account for differences in catch and sampling intensity among trips and states throughout time. Therefore, latitudinal changes in the distribution of where catch is landed are partially accounted for in how relative age and length compositions are generated from raw data.

The model also includes time blocks to allow for selectivity parameters to vary over time. The changes in selectivity can be caused by many factors, which include spatial changes in fishing areas and changes in management (please see **Response 9** for details on blocking).

GFSC Notes

- *The GFSC suggests that the following be considered, if time allows:*
 - *Include recreational catches, either as an additional fleet or pooled with the hook and line fleet. -*
 - **Response:** The response to this request is included as a part of the **Response 7**. Adding recreation catches from 2002 forward (as reported in from GEMM) did not have any impact on model outputs.
 - *Explore using “discard fleet” instead of the retention curve for discards*
 - **Response:** The response to this request is included as a part of the **Response 9**, fleet structure exploration section. The trajectories in model runs with Bottom trawl and Midwater trawl discards treated as separate fleets were very similar to the 2025 base model. No unexpected and unrealistic dynamics were discovered.