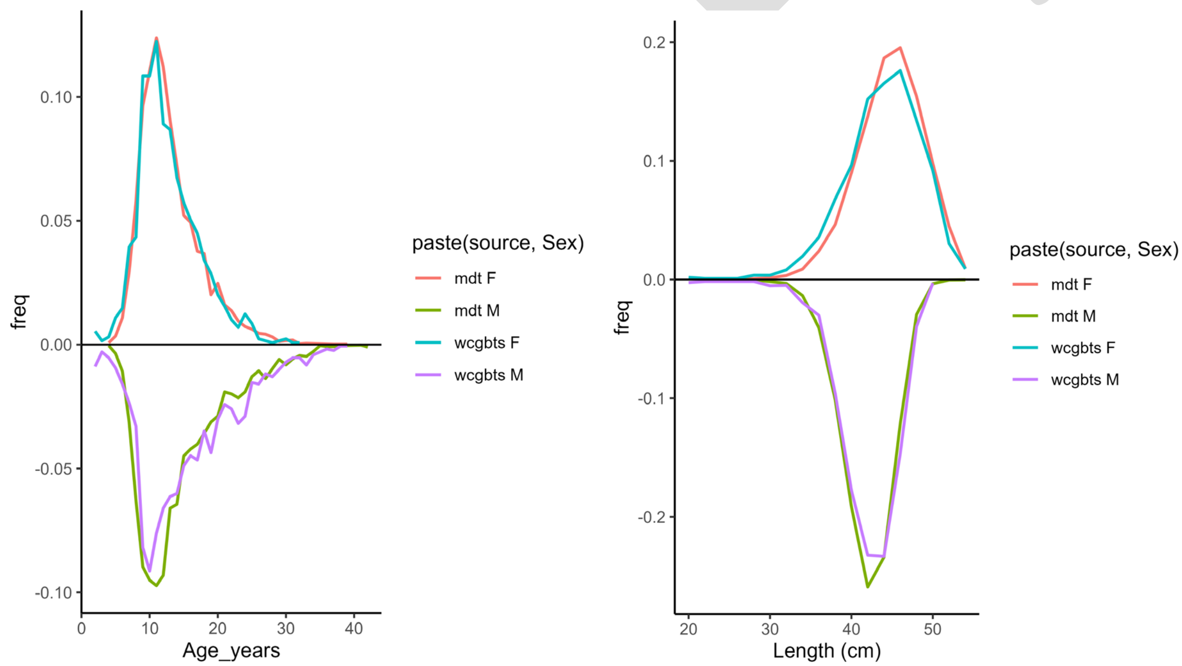
STAR Panel 1 - Responses to Requests

Yellowtail Rockfish (North of 40° 10’ N. Latitude)

Request No. 1: Compare length and age composition by sex between the midwater trawl fishery since resumed access to deeper depths since 2017 (for 2017 and onward) and the West Coast Groundfish Bottom Trawl Survey (WCGBTS) composition as in Figure 42 and Figure 20.

Rationale: Determine whether the fish presumably encountered over rocky reef between data sources are of comparable size and age to the fish sampled by the WCBTS. This will help resolve whether there might be some hidden biomass over rocky reef observed in the midwater fishery, that the WCBTS cannot access with bottom trawl gear.

STAT Response: Length and age distributions are generally similar between the bottom trawl survey and midwater trawl gear used in the commercial fishery. This is consistent with the similarity between a comparison of bottom trawl gear and midwater trawl gear in the commercial sector.

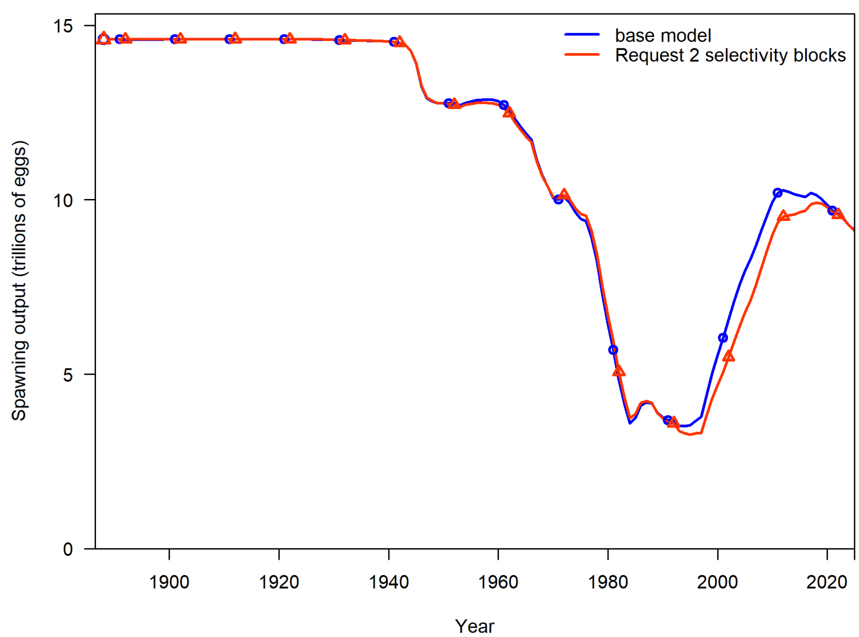


Panel Conclusion: The lack of consistently larger fish in the fishery would indicate that they are also available to WCBTS.

Request No. 2: Implement an alternative time blocking on selectivity for the commercial fleet with three time blocks; prior to 2000 or 2003 (depending on shifts in composition observed) with asymptotic selectivity, 2000 or 2003-2016 (with domed and asymptotic selectivity), and 2017 to present with asymptotic selectivity.

Rationale: The time blocking may improve the fit to the length and age composition data source over time. In 2000, vessels using bottom trawl footrope >8 inches were prohibited from retaining shelf rockfish species (which included yellowtail rockfish). In 2002, the trawl Rockfish Conservation Areas (RCAs) were established off all three states (Washington, Oregon, and California). However, there were some allowances for midwater trawl vessels to fish within the "no trawl" Darkblotched Conservation Area (DBCA) for midwater rockfish such as yellowtail and widow. In 2017, the trawl gear Experimental Fishing Permit (EFP) went into effect to monitor and minimize salmon bycatch when vessels target rockfish in the Individual Fishing Quota (IFQ) fishery. This was expanded in 2018 to include year-round midwater trawl targeting midwater stocks. Additionally, the canary rockfish (a co-occurring species) ACL increased in 2017 following the 2015 canary rockfish stock assessment.

STAT Response: Using three selectivity blocks (start to 2001, 2002 to 2016, 2017 to 2024) slightly improved fits to commercial age and length data (8.2 units of negative log-likelihood improvement in the age data and 5.3 for the length data). The unfished spawning output and terminal spawning output are nearly identical, though the trajectories are slightly different. The middle time block selects slightly larger fish, but selectivity in the the first and third block is nearly identical. Overall differences in selectivity among blocks are more muted than they were for the selectivity blocks in the candidate base model (recreational and at-sea hake fleets only).

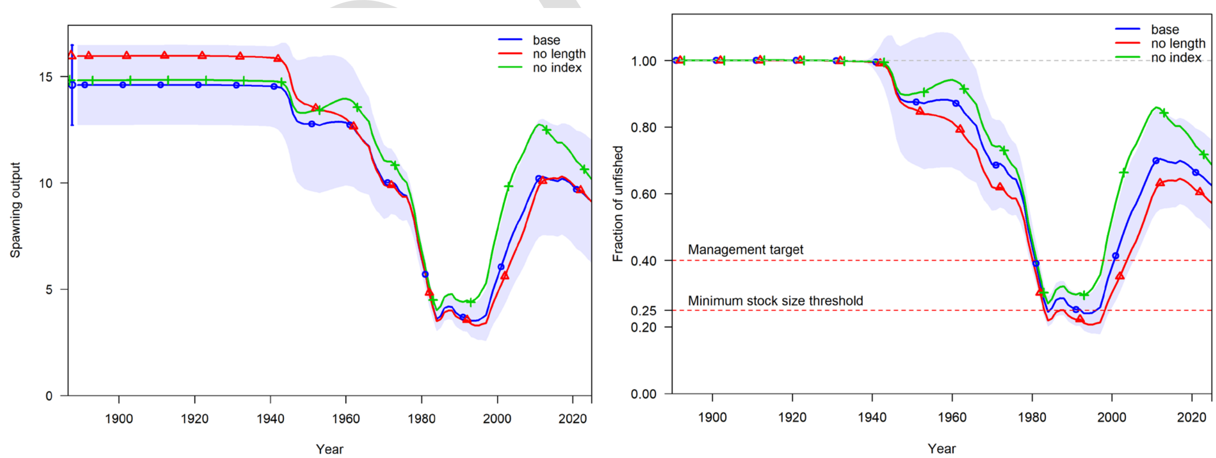


Panel Conclusion: The lack of improved fit to composition data or implications for spawning output indicates the model is not substantively improved by time blocking, while adding parameters. In the interest of parsimony, the time block is not essential to include.

Request No. 3: For the base model, the model with fishery length data removed, and the model with survey indices removed provide a table of input sample size, data weight, and adjusted input sample size. Also provide time series of spawning output and relative spawning depletion. Can we have more detail presented on the adjusted input sample sizes for the composition data, as a way to check on whether the composition data are appropriately weighted. This should also include any details on model runs that have dropped length composition data and/or age composition data and how this affected fits and outcomes.

Rationale: The assessment shows a substantial increase in abundance after about 2000 over a period when none of the abundance indices show material increases. This implies that the model is drawing abundance information from elsewhere, possibly from the composition data, which would not necessarily be appropriate.

STAT Response: For the base model, this information is in table 26 of the draft report. Reweighting the two sensitivity models only results in slight changes to adjusted sample sizes. Removing the two data sources leads to some changes in spawning output and relative spawning output.

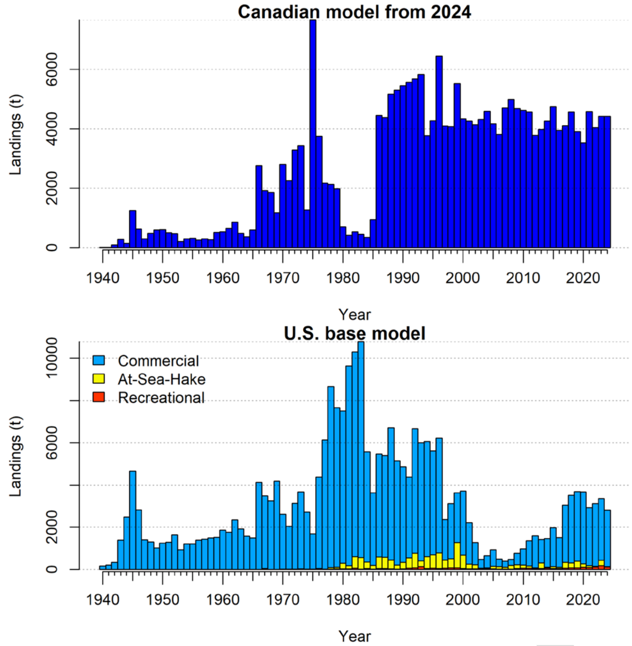


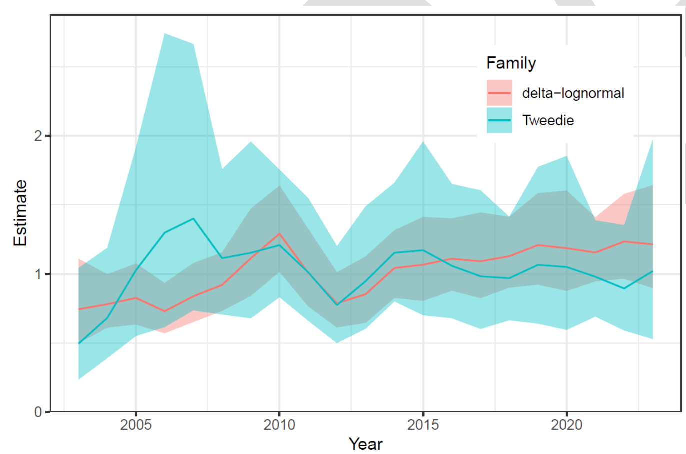
Panel Conclusion:

Request No. 4: Present a comparison of the Canadian recruitment and trawl survey index for discussion.

Rationale: This was not discussed during the presentation and it would be good to see how well they compare.

STAT Response: Comparisons to Canadian time series and recruitment are in figure 72 of the report. Canadian catches have been consistently around 4000 mt (more than the U.S. fishery) since the mid-1980s. The Canadian trawl survey index is fairly flat and does not contain the same increase and decrease as the U.S. trawl index.





Panel Conclusion: Similar trends were observed between the US and Canadian recruitment and fraction of unfished biomass, with a decline in the 1970s and 80s, and an increase in the 2000s. The fraction unfished biomass was lower in Canada, never dropping below 50%. Since 1986 the Canadian catch has remained consistently high and their fraction unfished biomass has remained relatively stable.

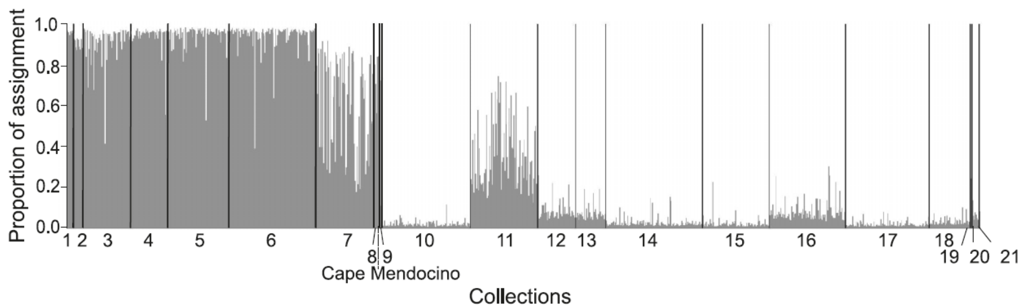
Request No. 5: What evidence exists pertaining to stock structure, including for yellowtail rockfish in Canadian waters and the Gulf of Alaska?

Rationale: The current assessment makes a strong assumption of the spatial extent of the stock. This is supported by evidence from the southern boundary but not for the northern boundary. This is key to understanding aspects of the uncertainty of the assessment, particularly if the assessment is of a partial biological population, etc.

STAT Response: The main source on genetic differentiation in yellowtail rockfish does not indicate any break near the U.S.-Canada border.

Hess et al. 95

Fig. 3. Individual assignment values from the Structure analysis using microsatellite data and a cluster setting of $K = 2$. The collections are depicted on the *x* axis and posterior probabilities along the *y* axis. The location of Cape Mendocino is indicated between collections 8 and 9.



Panel Conclusion: There does not appear to be genetic structure across the US/Canadian border. This would support the potential for a trans-boundary stock assessment in the future.

Request No. 6: Implement an alternative time blocking on selectivity for the commercial fleet with three time blocks; prior to 2002 (depending on shifts in composition observed) with asymptotic selectivity, 2002-2010 (with domed and asymptotic selectivity), and 2011 to present with asymptotic selectivity.

Rationale: The time blocking may improve the fit to the length and age composition data source over time. In 2002, the trawl Rockfish Conservation Areas (RCAs) were established off all three states (Washington, Oregon, and California). However, there were some allowances for midwater trawl vessels to fish within the "no trawl" Darkblotched Conservation Area (DBCA) for midwater rockfish such as yellowtail and widow. In 2011, the Individual Fishing Quota (IFQ) trawl fishery was established. This change in the time block will also encompass the midwater rockfish trawl fishery that started to catch more yellowtail rockfish in 2013 due to an increased widow rockfish Annual Catch Limit (ACL). This increase in yellowtail rockfish catch across the U.S. West Coast (including south of 40° 10' North Latitude) by commercial sector across time is shown in Figure 1. While this figure includes catch from outside the scope of this stock assessment, the midwater rockfish targeting occurred in Washington and Oregon, so the increases in the Midwater Rockfish and Midwater Rockfish - Electronic Monitoring (EM) sectors shown in Figure 1 are relevant to this stock assessment.

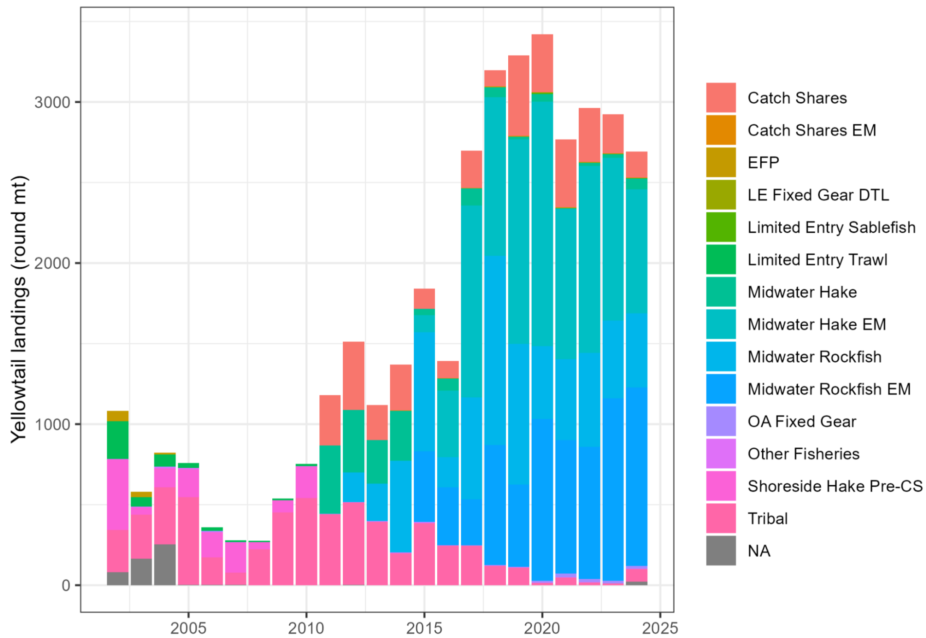
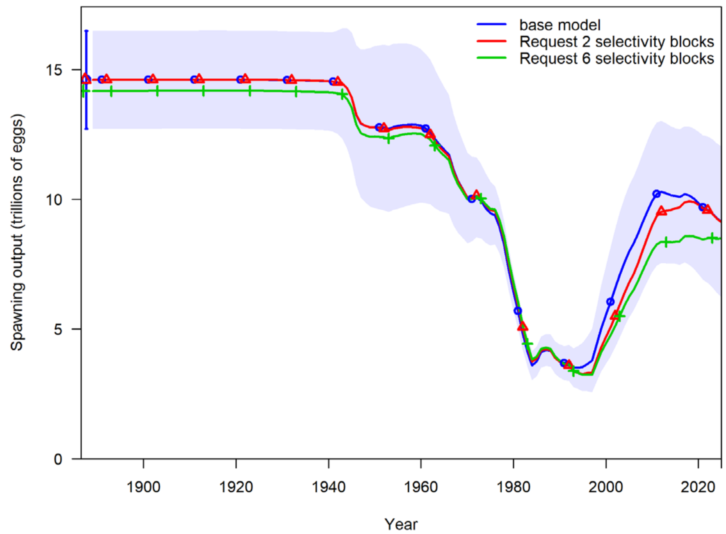


Figure 1. Yellowtail rockfish commercial landings from 2002-2024 in metric tonnes broken out by sector using Fishery Observation Science (FOS) sector codes. Note that this includes yellowtail rockfish catch from south of 40° 10' North Latitude, which is not in the scope of this stock assessment.

STAT Response: While the population trajectory was more sensitive to this time blocking than the time blocking for request 2, request 2 had a better fit to the data as measured by the likelihood (e.g. index fit was better by 1.5 units of negative log-likelihood in request 2 and worse by 0.2 units in request 5).

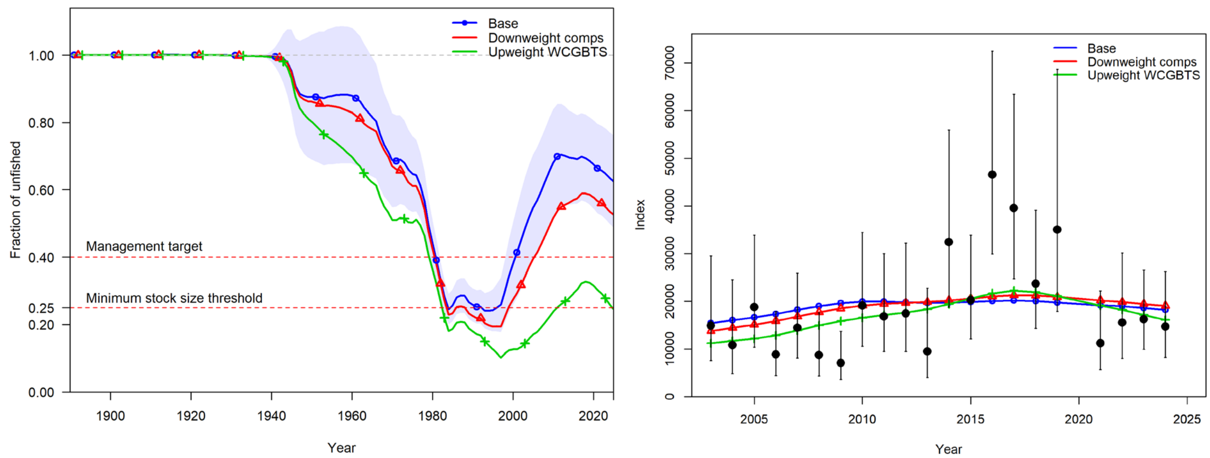


Panel Conclusion: The fit to the commercial length data was not appreciably improved by time blocking, thus the base model is preferred.

Request No. 7: For the base model, reduce all composition weights by a large amount (e.g., 90%). Show model fits to indices and composition data, and spawning output and spawning depletion time series**.**

Rationale: Desire to explore potential conflicts between the indices and compositional data, and the impacts on quality of fit and stock trajectory.

STAT Response: Down-weighting composition data by 90% leads to a slightly increased unfished spawning output, lower terminal spawning output, and a more substantial decrease in terminal relative spawning output. Fits to the survey likelihood improved, but not visibly so. Fits to composition data are visibly similar. Also included in this comparison is the sensitivity upweighting the WCGBTS (CV set to 0.05) which resulted in more dramatic changes to the trajectory in a similar direction as downweighting composition data. Terminal spawning depletion is near the minimum stock size threshold. The fits to the trawl survey index are visibly improved, but still miss the magnitude of the increase in the late 2010s.



Panel Conclusion: The alternative weighting did not lead to a material degradation in the fits to the composition data, suggestive that the base model does overweight the composition data despite the application of the Francis reweighting. This did not improve the fit the high CPUE values from the WCGBTS. Though the likelihood of the model improved with request 7, the nature of the survey is a bottom trawl unable to access rocky reef making representation of the stock uncertain, thus the base model result was retained rather than downweighting the composition data or upweighting of the survey. Future research into the environmental drivers that may be affecting interannual variation in the index values affecting catchability is an area for future research given conflicts with the composition data.

Request No. 8: Provide more information on the relative abundance in the WCGBTS by year north and south of the Columbia River.

Rationale: To begin an evaluation of variability in relative abundance across time in the respective strata given the apparent variation in distribution of the stock within the assessment area.

STAT Response: The WCGBTS used for yellowtail rockfish has spatial blocks north and south of Cape Mendocino. For multi-region models, indices are not interpretable other than the split used in the model. To investigate the variation in distribution of the stock relative to the Columbia River, we fit an new sdmTMB model to the WCGBTS data that had state-specific blocks in order to compare the temporal variability of the index north and south of the Columbia River. The index of abundance for WA is approximately 90% of the total OR and WA abundance. The two indices were more synchronous than anticipated, both state indices had an increasing trend from 2008 - 2015 and a decreasing trend from 2017 - 2024. Over these time periods, the index for OR increased and decreased steeper than WA. Given the observations shared during the public comment on day 1, we expected there may be an increase in abundance in WA relative to OR reflecting fish migrating north as they age, as a possible explanation for the increases observed in WA not represented in the WCGBTS. This evaluation of state-specific abundance based on WCGBTS did not support this hypothesis, and instead indicated that changes in abundance were actually similar in WA compared to OR, although fish are more abundant in WA.

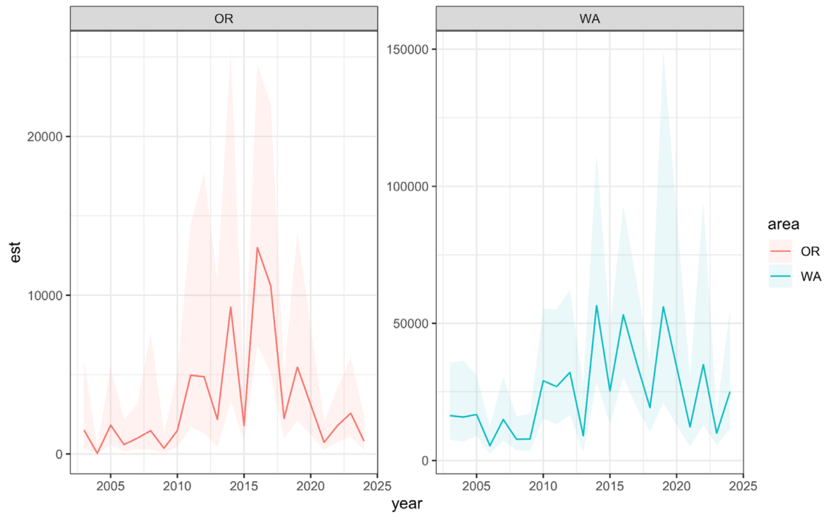


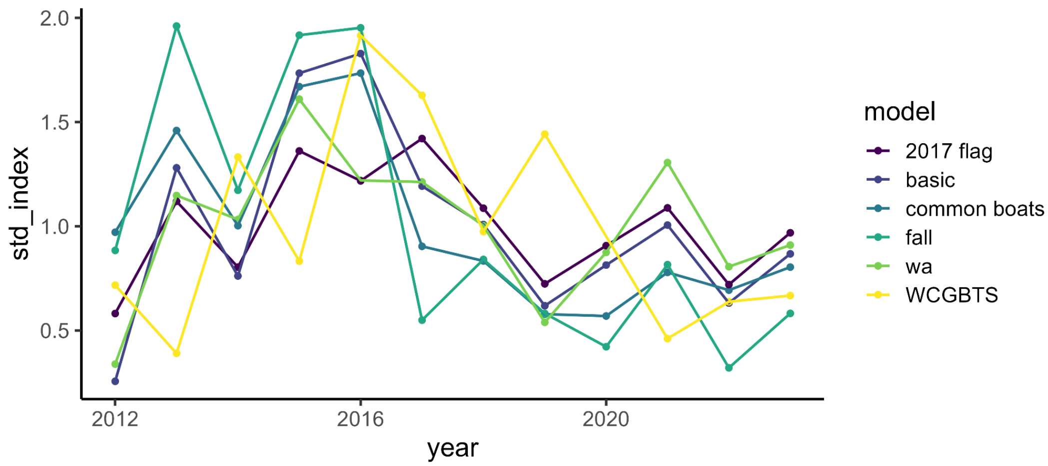
Figure: WCGBTS state-specific index of abundance for OR and WA. Note the y-axis for both indices represent different scales.

Panel Conclusion: The Washington area had much higher CPUE, but both reflected similar trends of increase and decrease over time.

Request No. 9: Provide more information on the approaches used to develop a midwater (and other) commercial CPUE time series.

Rationale: The panel is seeking to explore the availability of alternative indices that may be more informative than the current fishery-independent indices.

STAT Response: The data included and the standardization procedure are described in section 2.1.4.1 of the draft document. Alternative indices considered under this request include 1) a model fit for a subset of vessels that more frequently encounter yellowtail, which includes a vessel specific spline for Julian day, 2) a model that only includes tows in Washington (where vessels are more likely to be targeting yellowtail), 3) a model that only includes tows in September-December (when vessels are more likely to be targeting yellowtail), and 4) a model that includes an effect for before or after constraints on widow and canary rockfish were lifted in 2017. The indices are variable, but generally align with the increase and decrease from the WCGBTS index. The index with the flag for before or after 2017 is least variable. However, this model also has year modeled as a hierarchical random effect rather than a fixed effect, because the fixed effects are confounded with the 2017 flag and cannot all be estimated. Thus, less interannual variability would be expected from the index based on the model with the 2017 flag.



Panel Conclusion: The trends in the midwater commercial CPUE index is similar to that of the WCGBTS, thus the same considerations concerning fit to high values are likely to apply if the WCGBTS was supplanted by the midwater commercial CPUE index. The conflicts with length data in attempting to fit either survey may not be resolved.

Request 10: Plot, for each year, the cumulative proportion of the catch limit attained across the year for bottom trawl and midwater trawl trips.

Rationale: To see if fish are easier to catch in different years to evaluate consistency with the observations of fishermen provided in public comment.

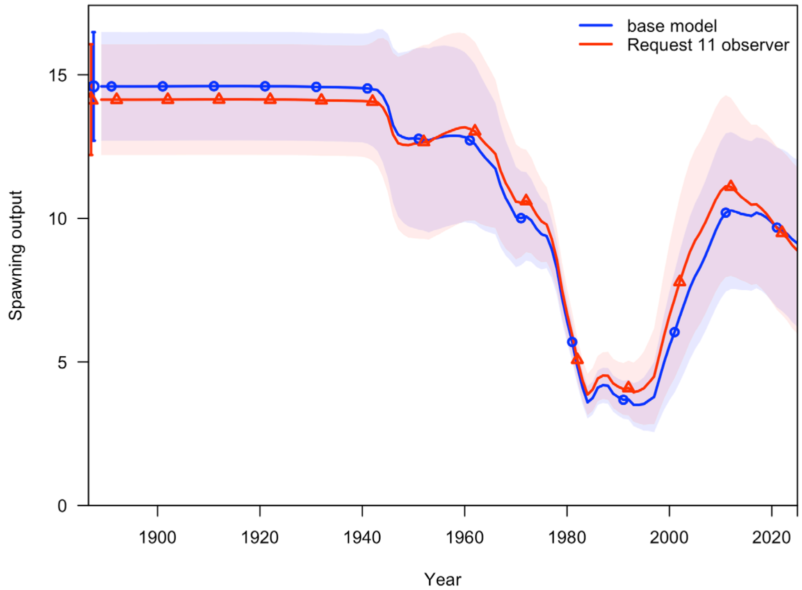
STAT Response:

Panel Conclusion: Though there is a shift in the rates of accumulation of catch in 2017 with the liberalization of catch limits for constraining co-occuring species canary and widow rockfish that recently rebuilt, in recent years the rates of accumulation have not increased as would be expected if the biomass were increasing in the last few years as noted in public comment.

Request 11: Rerun the model with the commercial CPUE index in place of the WCGBTS. Show the fit to the commercial index and pertinent diagnostics.

Rationale: The model was unable to fit high CPUE values from the WCGBTS and although they have a similar trend, investigation of the ability of the model to fit this trend in the commercial index can be explored.

STAT Response: The model had similar fits to both the CPUE index and the WCGBTS. Both indices produced similar estimates of spawning output. Both the CPUE index and WCGBTS indicated an above average period in 2014 - 2018 (see request 9 response) and the model had poor fits to this period for both indices. We note the uncertainty for the CPUE index in that period was greater, and the fits were in the 95% confidence interval for 2015 - 2017.



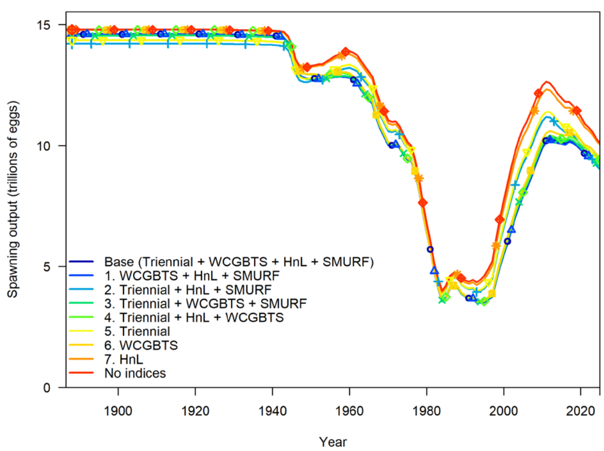
Panel Conclusion: The trends in spawning output resulting from the inclusion of each index do not differ appreciably between the WCGBTS and the mid-water trawl fishery apart from the peak in 2015. This would indicate the survey and fishery are providing similar information to the assessment. Neither index observed substantial increases in abundance in recent years as would be expected if abundance were increasing in recent years. Comparing the index values from WCGBTS and the observer survey over time they both increase during the period 2014-2018, but the model does not fit well to either. The increase in the index values may be the result of the distribution of biomass during the marine heat wave or other systemic changes in availability or random sampling variability as the model is not able to fit the increase given tension with composition data.

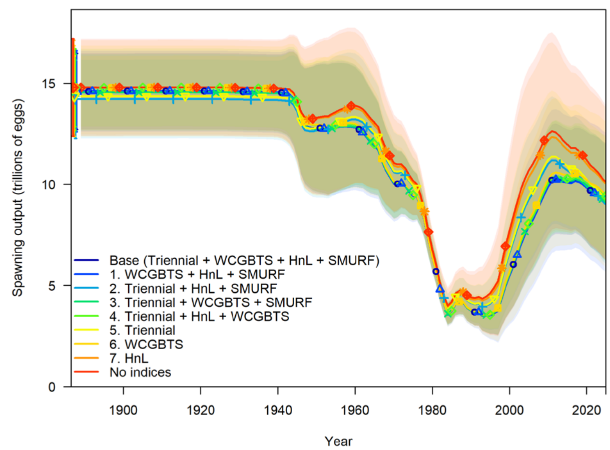
Request 12: Rerun the model using the fishery-independent index combinations below.

1. WCGBTS, H&L, SMURF
2. Triennial, H&L, SMURF
3. Triennial, WCGBTS, SMURF
4. Triennial, H&L, WCGBTS
5. Triennial
6. WCGBTS
7. H&L

Rationale: This will allow for the testing of the sensitivity of the model to each index.

STAT Response: The impact of removing the indices in different ways was relatively small for each of the combinations requested (figure below left). The biggest changes came from removing the WCGBTS, the next biggest changes came when the Triennial was removed, and third biggest changes came from removing the Hook and Line index. The uncertainty in estimated spawning output increases significantly when both trawl surveys are removed, leaving only the Hook and Line and SMURF indices, or when all indices are removed (figure below right).





Panel Conclusion: The results provide information on how influential the respective indices are on the model. The WCGBTS is a longer time series and is more influential on model results and prevents the model from showing a strong peak then decline in abundance later in the time series in its absence.

Request 13: Explore alternative models to inform decision tables such as those based on R_0, natural mortality or data weighting alternatives between the WCGBTS and the composition data as well as McAllister Ianelli as opposed to Francis data weighting. Provide the range of spawning output and relative depletion over time. Examine the fits and outputs to ensure the resulting models are feasible.

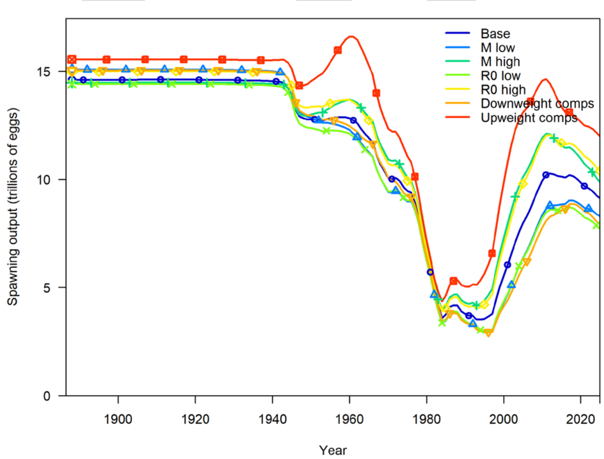
Rationale: R_0 and natural mortality display a wide range of spawning output of parameter values in explored sensitivities and the alternative weighting provides information on uncertainty from model structure.

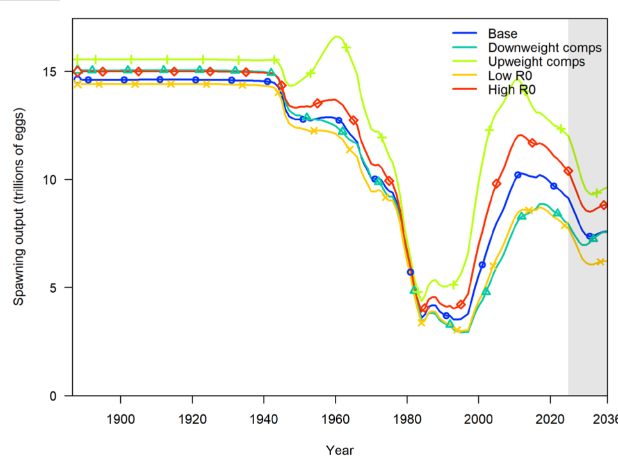
STAT Response: Three low and three high candidate states of nature were provided based on the guidance in the Terms of Reference (quoted below).

> One method bases uncertainty in management quantities for the decision table on the asymptotic standard deviation for the OFL in the final year of the model from the base model. Specifically, the current year spawning biomass for the high and low states of nature are given by the base model mean plus or minus 1.15 standard deviations (i.e., the 12.5th and 87.5th percentiles). A search across fixed values of lnR0 are then used to attain the current year spawning biomass values for the high and low states of nature.

The asymptotic standard deviation for the 2025 OFL from the base model was 0.186 and the point estimate of the 2025 OFL was 5440 mt. The associated 12.5th and 87.5th percentiles were 4392 mt and 6739 mt. Model runs from the likelihood profiles for log(R_0) and M were explored to find the steps in the profile for which the OFL values best matched these two values. The resulting models had log(R_0) = 10.25 and 10.75, and M = 0.14 and 0.175. The model with down-weighted composition data from request 7 and the model with up-weighted composition data from the sensitivity analysis where the McAllister-Ianelli data-weighting was applied were also considered as candidate states of nature.

Among the proposed options, the log(R_0) and M states had very similar results (figure below left) while the upweight comps model was higher than the other high-state alternatives. The catches from the default harvest control rule (P* = 0.45, sigma = 0.5) applied to the based model to calculate forecast catches which were input as fixed values to a subset of the candidate states of nature (figure below right, note different colors for same models than the figure at left). The low and high M models were so similar to the low and high log(R_0) models so they were not included in the projections. These projections showed that the projections for the downweight comps converged in the projection years toward the base model, suggesting that this model did not adequately represent the range of uncertainty about the stock status in the near future. Therefore, the STAT proposes the low and high log(R_0) models as the best choice for the alternative states of nature.





Label	Base	M low	M high	R0 low	R0 high	Down-weight comps	Upweight comps
Diff. in likelihood from base model							
Total	0	1.7	1.84	1.22	0.92	-963.711	1260.87
Index	0	-1.025	2.418	-0.744	1.531	-5.772	7.13
Length comp	0	1.416	-1.217	0.986	-0.809	-275.869	533.677
Age comp	0	1.962	-1.154	1.578	-1.097	-672.632	712.662
Recruitment	0	-0.46	1.497	-0.425	1.098	-9.657	6.683
Parm priors	0	-0.188	0.312	-0.158	0.194	-0.145	0.46
Estimates of key parameters							
Recruitment unfished	36.63	27.665	50.233	28.282	46.63	30.312	60.869
log(R0)	10.509	10.228	10.824	10.25	10.75	10.319	11.017
M Female	0.157	0.14	0.175	0.144	0.169	0.145	0.182
M Male	0.136	0.122	0.151	0.125	0.146	0.126	0.158
L at Amax Female	52.9	52.9	53	52.9	53	52.9	52.5
L at Amax Male	47.9	47.9	48.0	47.9	48.0	47.9	47.5
Estimates of derived quantities							
Unfished age 4+ bio 1000 mt	135.0	127.7	147.3	124.4	147.5	130.8	158.7
B0 trillions of eggs	14.6	15.1	14.5	14.4	15.0	15.0	15.5
B2025 trillions of eggs	9.13	8.306	9.87	7.754	10.384	7.929	12.005
Fraction unfished 2025	0.626	0.551	0.682	0.538	0.693	0.527	0.773
Fishing intensity 2024	0.638	0.744	0.548	0.762	0.546	0.746	0.45
Catchability for WCGBTS	0.329	0.377	0.288	0.39	0.284	0.411	0.231
OFL mt 2025	5440	4388	6666	4223	6701	4391	8555

Panel Conclusion: Natural mortality is not the most uncertain parameter and others may provide a more reasoned axis of uncertainty. While natural mortality and R0 provide similar ranges of values in spawning output and are correlated parameters, natural mortality is expected to be more consistent than R0. Downweighting and upweighting composition data provides a range of spawning output reflective of the structural differences in the assessment. The R0 provides the broadest range of spawning output. Downweighting of comps is similar to low R0 the at the downweighting composition, but the downweighting composition converges with the base model in projections of spawning output, therefore R0 may provide a more reasoned basis for the primary axis of uncertainty. Alternative means of estimation the range of values from the TOR from the axis of uncertainty provides a narrower range than provided by the presented range for R0 and remains the preferred basis for the axis of uncertainty. The results for R0 capturs a similar range of spawning output observed from upweighting and downweighting of composition, and can be more easily derived as described in the TOR, further supporting its use as the preferred basis for the axis of uncertainty.

Request 14: Compare the trends in the WCGBTS index for yellowtail rockfish to those for canary and widow rockfish stratified at 40 deg 10 min. N. Lat.

Rationale: The comparison will provide an indication as to whether there may be environmental influences contributing to the increased index values in the mid 2000s.

STAT Response:

Panel Conclusion:

Request 15: Provide a decision table using R0 as the primary axis of uncertainty based on the catch time series reflecting full attainment as required by the TOR as well as alternative catch projections based on recent catch and attainment to bracket the range of catch alternatives in the decision table.

Rationale: This will help compose the basis for the catch time series in the decision table.

STAT Response:

Panel Conclusion: