Addendum

SEDAR 84 St. Thomas and St. John Yellowtail Snapper

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1 Introduction

This addendum provides supplementary analyses developed in direct response to requests made by the SEDAR 84 Review Workshop Panel. The model runs and plots presented here build on the configurations documented in the SEDAR 84 Assessment Process Report for US Caribbean Yellowtail Snapper in St. Thomas and St. John, USVI.

The additional model runs conducted during the Review Workshop are intended to document exploratory work that may inform next steps toward refining the assessment framework for consideration by the Caribbean Fishery Management Council's Science and Statistical Committee (SSC).

Only the model runs reviewed by the panel during the Review Workshop are included in this addendum. While additional exploratory analyses could be pursued (e.g., steepness values informed by FishBase rather than assuming steepness near 1), these were not examined during the workshop. Future work to be considered by the SSC will integrate further panel recommendations and additional sensitivity analyses once the Review Workshop Report is finalized.

2 Key Considerations

- All model runs included here were developed under the direction of the Review Workshop Panel to explore data use and model behavior.

- The models remain preliminary and sensitive to consequential assumptions (e.g., initial equilibrium catch, recruitment steepness, selectivity). Further work is required to address these uncertainties and develop models more robust for informing management advice.

- At the panel's recommendation, an exploratory run was developed combining data from Puerto Rico and St. Thomas/St. John. This model run deviates from the Data Workshop guidance to analyze island platforms separately and to exclude spatially restricted survey data from La Parguera, Puerto Rico and St. John prior to when the surveys were conducted island-wide. The panel suggested this model configuration in an attempt to retain additional information to better fit length compositions and stabilize model initialization. Those results are only included in the Puerto Rico addendum.

- These models do not represent final scientific advice. They are intermediate steps in an iterative review process leading to future model development, SSC review, and eventual management consideration.

3 Model Runs

Included is a compilation of the stock assessment model runs developed during the SEDAR 84 Review Workshop held from July 15 to July 18, 2025 in Fort Lauderdale, Florida.

Building on the models documented in the assessment process report for Yellowtail Snapper in St. Thomas and St. John, the review workshop recommended several refinements and exploratory model runs. The initial review workshop model adopted a single-sex configuration, applied the Stock Synthesis fishing mortality method option 2 (F Method = 2), and corrected the standard error units for the NCRMP survey index of abundance. This represented a deliberate improvement over the setup reported in the assessment process report, which had implemented F Method = 3, referred to as the hybrid method. The hybrid method sequentially applies Pope's and Baranov catch equations to tune fishing mortality as a factor based on retained catch for each fleet. As noted in the SS3 manual, this approach generally performs best when catches are known with high precision (standard error < 0.05) and when the overall fishing mortality is not substantially higher than natural mortality.

In contrast, F Method = 2 treats fishing mortality as a parameter, which is often more appropriate in cases where fishing mortality is relatively high or where fleets have both retained and discarded catch. Changing from method 3 to method 2 was therefore an important refinement, as was correcting the index standard error units and simplifying the model to a single-sex structure, given that no sex-specific data inputs were available for this assessment.

These recommendations were motivated by the observed behavior in the initial models where catch data were fit almost exactly, largely due to the combination of the hybrid method and low uncertainty on the catch inputs. Switching to F Method = 2 provided the model with greater flexibility to balance the fit between fishery-dependent catch data and fishery-independent survey indices. This was particularly important because the NCRMP survey is a statistically designed survey providing independent information on abundance trends.

A second exploratory model run further increased the standard error on the catch and allowed estimation of two growth parameters (the growth coefficient, K, and the mean length at maximum age). This recommended model run aimed to test whether relaxing constraints on catch and growth assumptions would allow the model to better align with the survey data.

However, these two exploratory models produced notably different results, highlighting a significant trade off. This underscores an important area for further investigation. Additional work is required to evaluate model weightings, data input uncertainties, and configuration choices to ensure an appropriate balance in how information from different sources informs the assessment outcomes.

A third exploratory model examined the use of a plus age group at age 12 to test whether grouping older fish into a terminal age class would affect model results. However, this adjustment had no meaningful impact on model behavior or outputs.

Finally, two panel recommended models were developed with combined data from Puerto Rico and St. Thomas and St. John, USVI. These included two fleets and five surveys. This included two spatially restricted NCRMP surveys from 2001 to 2011, conducted in La Parguera, PR and in St. John, which were incorporated separately from the island-wide surveys (PR NCRMP, STTJ NCRMP, and STTJ DCRMP) that were recommended by the data workshop and included in the respective assessment process report model runs. To test for model convergence, the second model built on this combined island structure with fixed selectivity and steepness and estimated length at maximum age. The results of the models with combined data for Puerto Rico and St. Thomas and St. John data are included in the Puerto Rico addendum.

Table 1 summarizes the models described above and figures are provided in Section 6.

For each model, key Spawning Potential Ratio (SPR) plots are provided with horizontal red lines indicating the MSY proxy of 40% SPR. The SPR plot shows the estimated spawning potential ratio over time. Similarly, the unfished ratio plot presents the time series of the fraction of unfished spawning output. Lastly, the fishing intensity plot displays the inverse of the SPR $(1 - \text{SPR})$.

4 Conclusions and Next Steps

These analyses are exploratory and were conducted under panel direction during the SEDAR 84 Review Workshop. Further work is required to evaluate consequential assumptions, add sensitivity runs (e.g., steepness from FishBase), and ensure models are robust to uncertainty. Final recommendations and additional work steps will be determined following completion of the Review Workshop Report, outside of the SEDAR 84 process.

5 Tables

Table 1: Summary of Review Workshop SEDAR 84 models for Yellowtail Snapper in St. Thomas and St. John.

Model	Description
STTJ_RW_1	Single Sex, F method 2, Catch SE = 0.3, and Corrected Survey SE
STTJ_RW_2	STTJ_RW_1 + Catch SE = 2 and Estimated Growth
STTJ_RW_3	STTJ_RW_1 + 12-year Age Plus Group
PR_STTJ_RW_1	PR_RW_3 + STTJ Fleet and STJ Survey; **does not converge**
PR_STTJ_RW_2	PR_STTJ_RW_1 + Estimated Length at Maximum Age and Fixed Selectivity and 0.8 Steepness

6 Figures
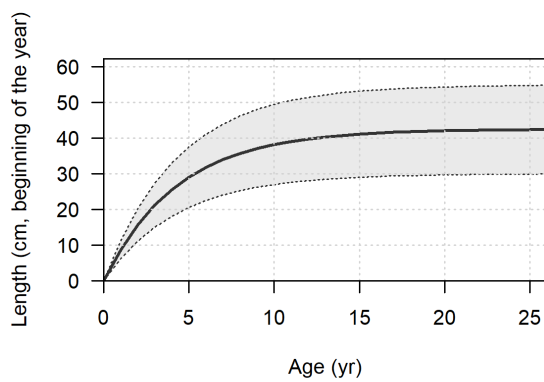
(a) Size at age
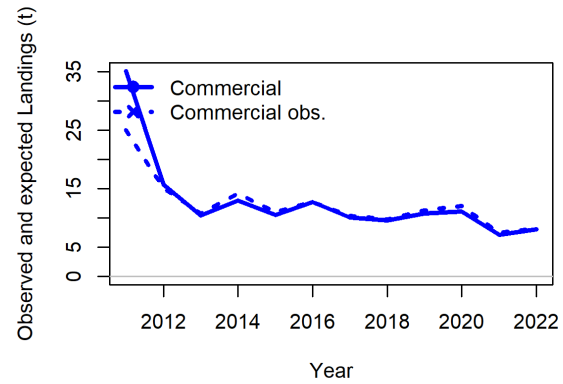
(b) Observed and expected landings
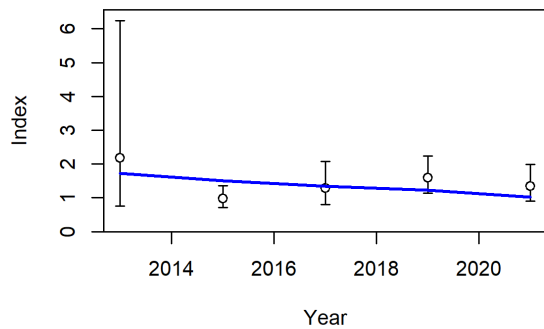
(c) Index NCRMP
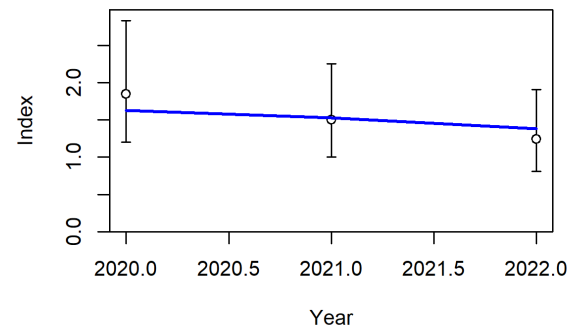
(d) Index DCRMP

Figure 1: St. Thomas and St. John Yellowtail Snapper Review Workshop Model STTJ_RW_1 (a) Length at age in the beginning of the year (or season) in the final year of the model. Shaded area indicates 95% distribution of length at age around estimated growth curve; (b) observed and expected landings; (c) Fit to index data for the NCRMP survey.; and (d) Fit to index data for the DCRMP survey.
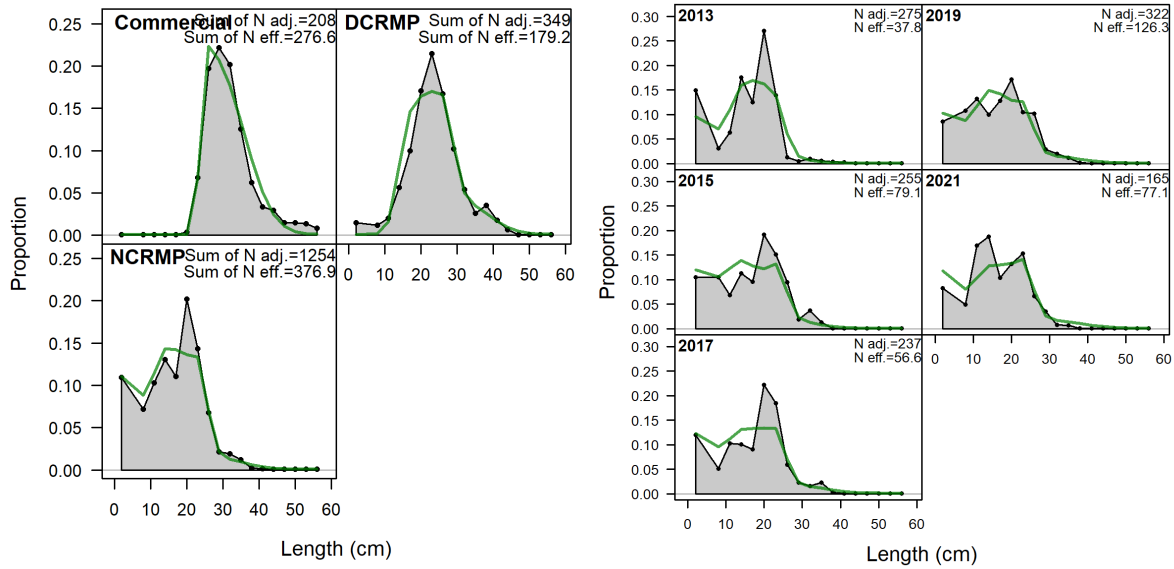
(a) Length fit aggregated across time

(b) Length comps NCRMP
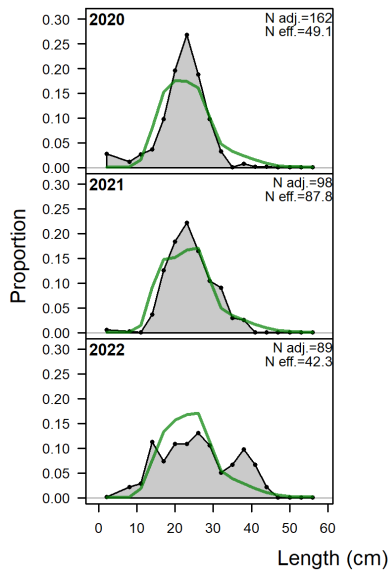
(c) Length comps DCRMP

Figure 2: St. Thomas and St. John Yellowtail Snapper Review Workshop Model STTJ_RW_1. (a) Observed and predicted length distributions in centimeters, aggregated across time by fleet; (b) observed and predicted length distributions in centimeters, by year for the NCRMP survey; and (c) observed and predicted length distributions in centimeters, by year for the DCRMP survey. 'N adj.' is the input sample size after data-weighting adjustment. N eff. is the calculated effective sample size used in the McAllister-Ianelli tuning method.

(a) Mean length NCRMP   (b) Mean length DCRMP
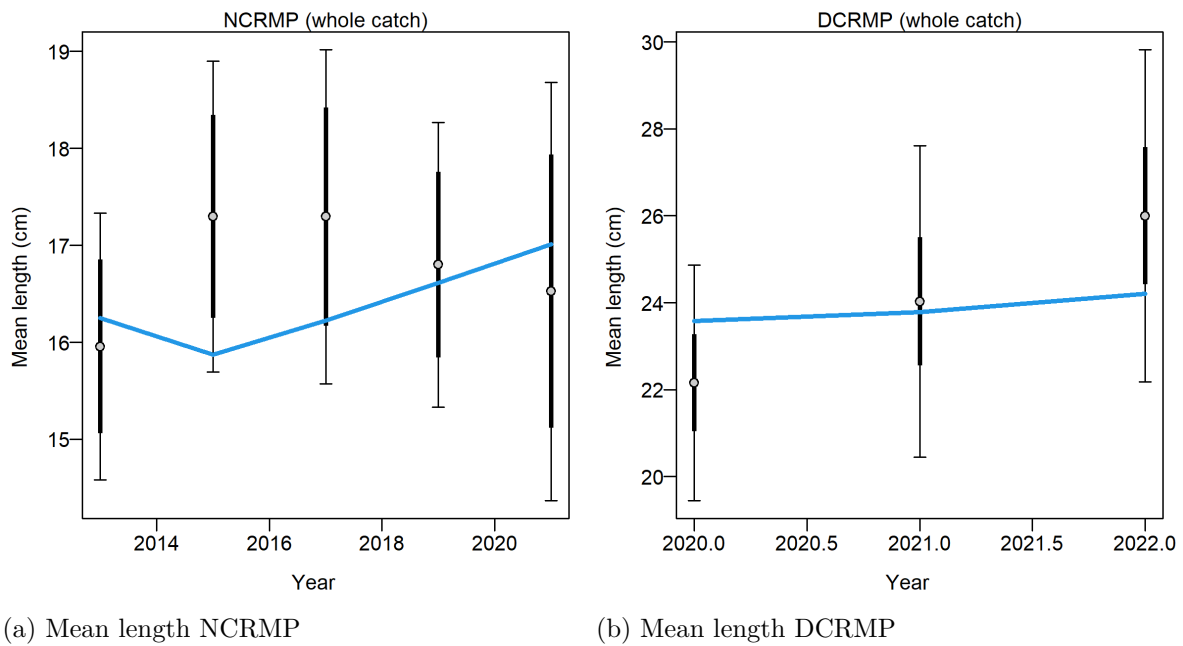
Figure 3: St. Thomas and St. John Yellowtail Snapper Review Workshop Model
STTJ_RW_1. Mean length for with 95% confidence intervals for (a) the NCRMP survey
and for (b) the DCRMP.

(a) Selectivity

(b) Length fit
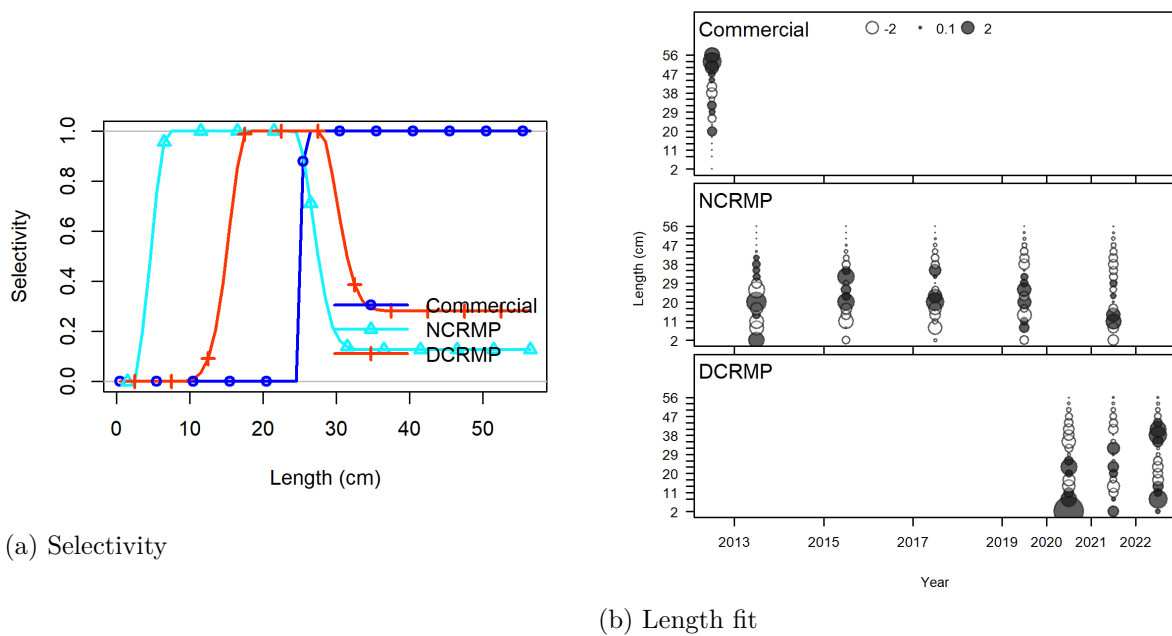
Figure 4: St. Thomas and St. John Yellowtail Snapper Review Workshop Model
STTJ_RW_1. (a) selectivity at length by fleet; and (b) Pearson residuals, comparing
across fleets. Closed bubbles are positive residuals (observed > expected) and open
bubbles are negative residuals (observed < expected).

(a) Recruitment deviations

(b) Fishing Mortality
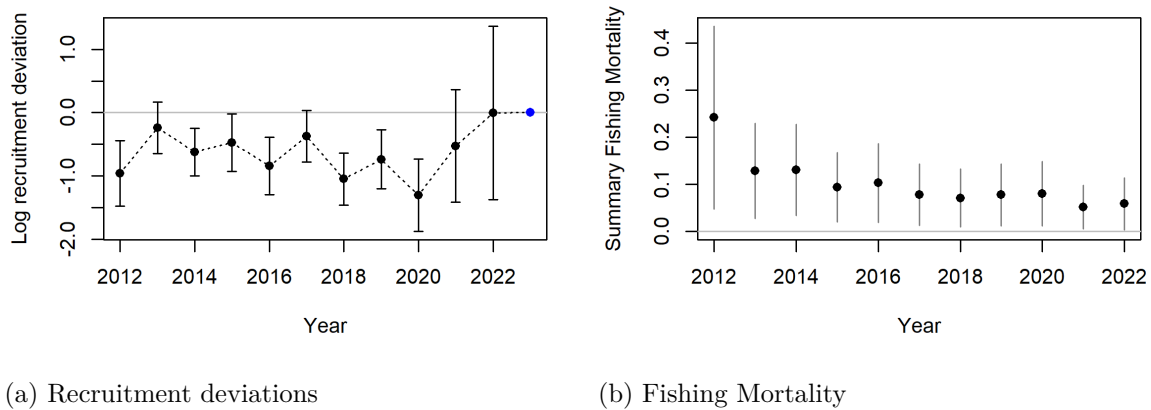
Figure 5: St. Thomas and St. John Yellowtail Snapper Review Workshop Model
STTJ_RW_1 (a) Recruitment deviations with 95% intervals; and (b) fishing mortality
(total biomass killed / total biomass).
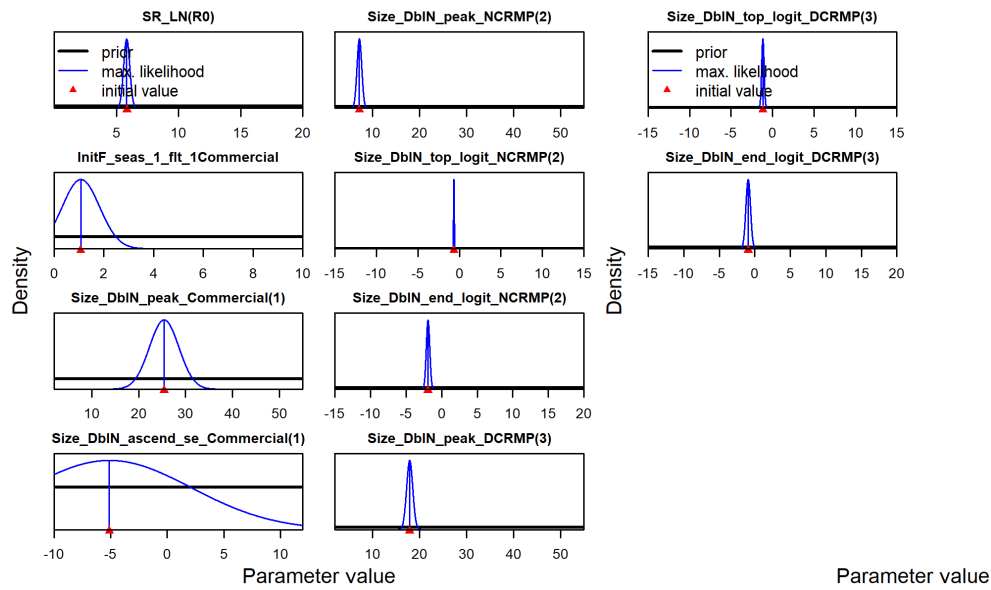
(a) Parameters pg. 1 of 2   (b) Parameters pg. 2 of 2

Figure 6: Parameter distribution plots for the St. Thomas and St. John Yellowtail Snapper Review Workshop Model STTJ_RW_1.

(a) SPR

(b) SPR Ratio

(c) Unfished ratio

(d) SPR Phase
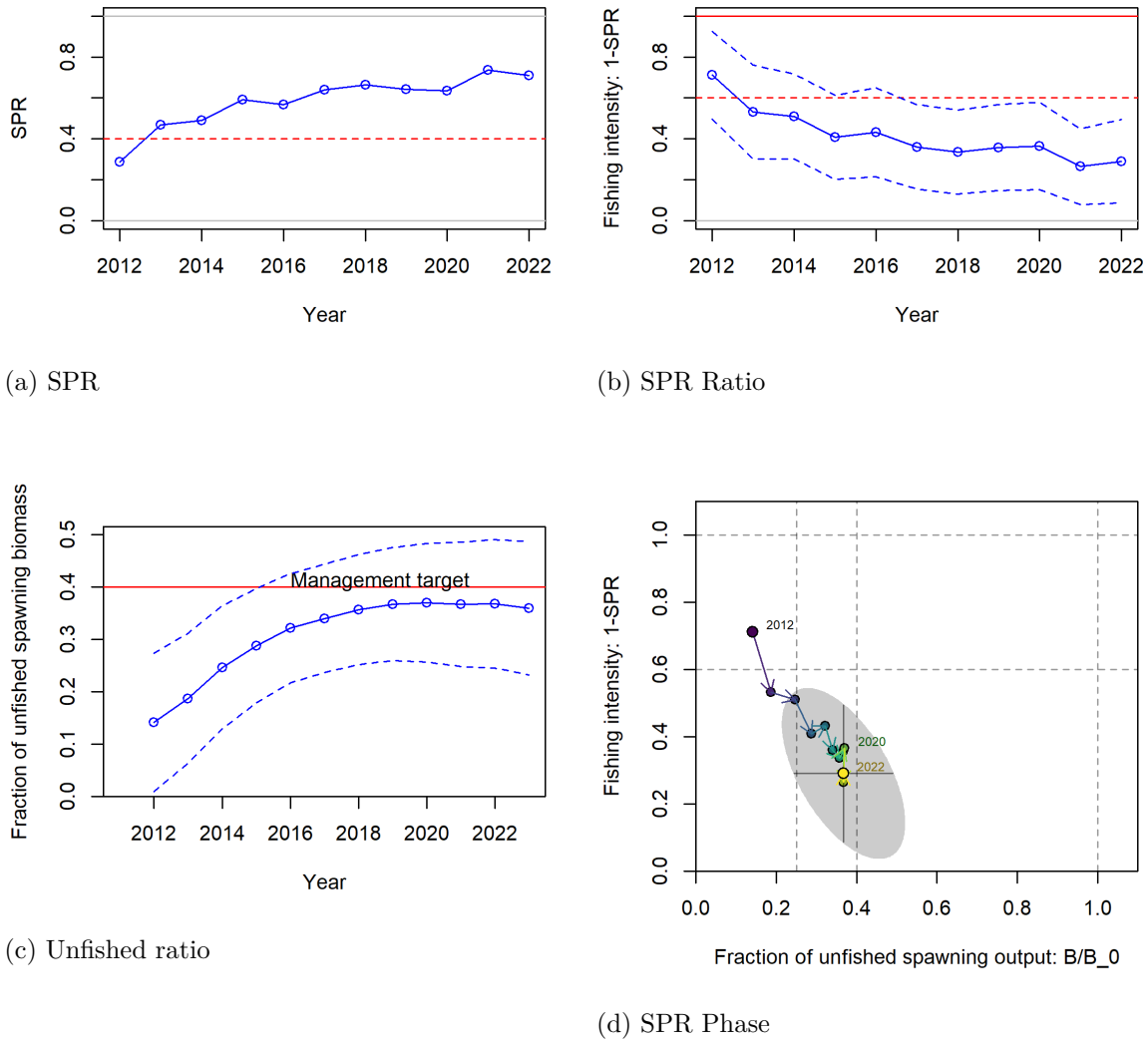
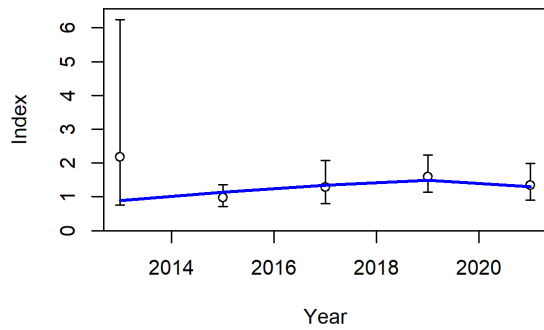Figure 7: St. Thomas and St. John Yellowtail Snapper Review Workshop Model STTJ_RW_1. (a) Time series of SPR. Horizontal reference line is at SPR target: 0.4, (b) time series of 1-SPR. Horizontal reference lines 1 and at 1 - SPR target: 1 - 0.4 = 0.6; (c) the relative spawning stock biomass (total biomass / virgin spawning stock biomass) with ~95% asymptotic intervals. Horizontal reference lines at 1 and SPR target: 0.4; and (d) phase plot of biomass ratio vs. SPR ratio where warmer colors (red) represent early years and colder colors (blue) represent recent years. Lines through the final point show 95% intervals based on the asymptotic uncertainty for each dimension. The shaded ellipse is a 95% region which accounts for the estimated correlation between the two quantities: -0.58.
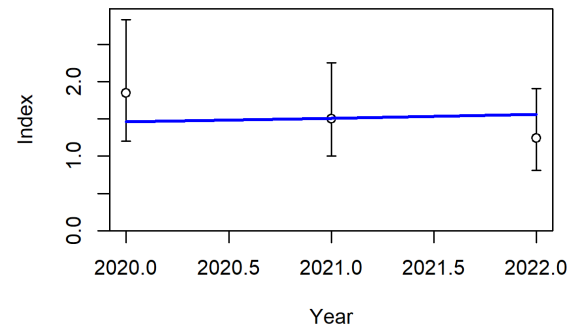
(a) Size at age
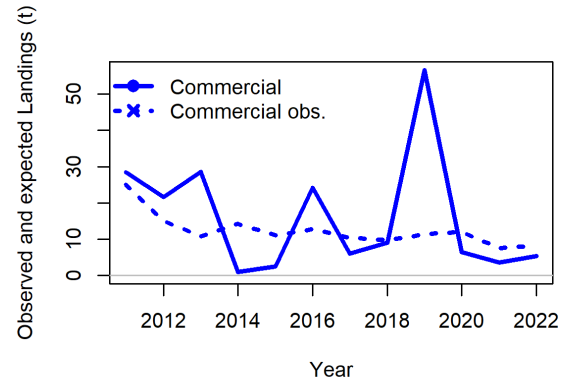
(b) Observed and expected landings

(c) Index NCRMP

(d) Index DCRMP

Figure 8: St. Thomas and St. John Yellowtail Snapper Review Workshop Model
STTJ_RW_2. (a) Length at age in the beginning of the year (or season) in the final year
of the model. Shaded area indicates 95% distribution of length at age around estimated
growth curve; (b) observed and expected landings; (c) Fit to index data for the NCRMP
survey.; and (d) Fit to index data for the DCRMP survey.
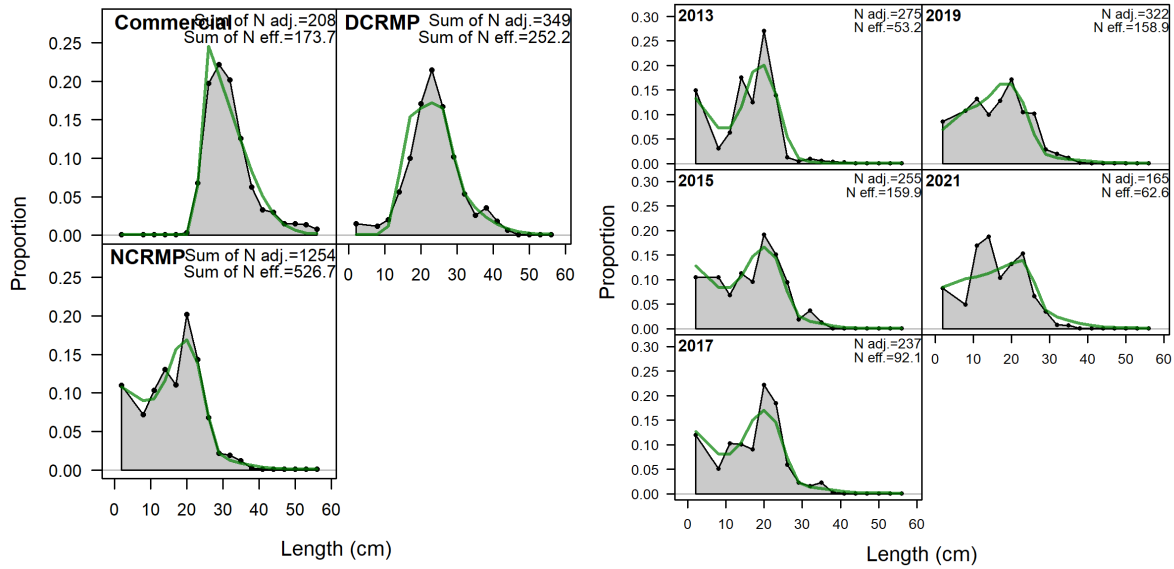
(a) Length fit aggregated across time

(b) Length comps NCRMP
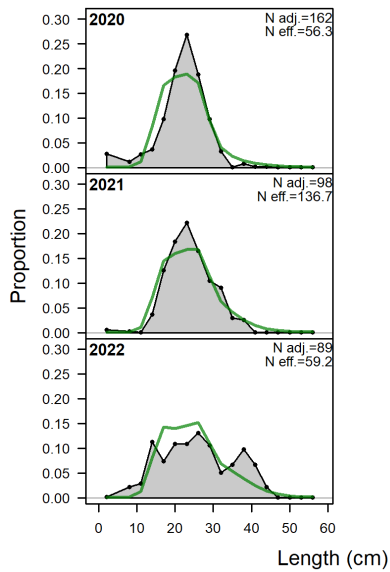
(c) Length comps DCRMP

Figure 9: St. Thomas and St. John Yellowtail Snapper Review Workshop Model
STTJ_RW_2. (a) Observed and predicted length distributions in centimeters, aggregated
across time by fleet; (b) observed and predicted length distributions in centimeters, by
year for the NCRMP survey; and (c) observed and predicted length distributions in
centimeters, by year for the DCRMP survey. 'N adj.' is the input sample size after
data-weighting adjustment. N eff. is the calculated effective sample size used in the
McAllister-Ianelli tuning method.

(a) Mean length NCRMP (b) Mean length DCRMP
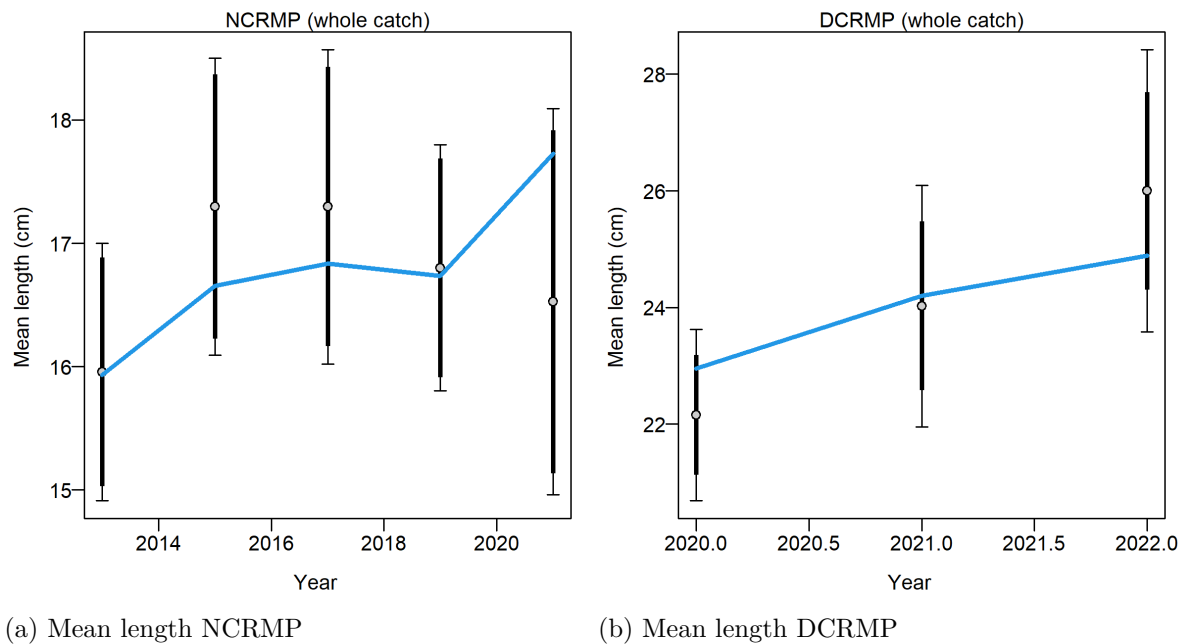
Figure 10: St. Thomas and St. John Yellowtail Snapper Review Workshop Model
STTJ_RW_2. Mean length for with 95% confidence intervals for (a) the NCRMP survey
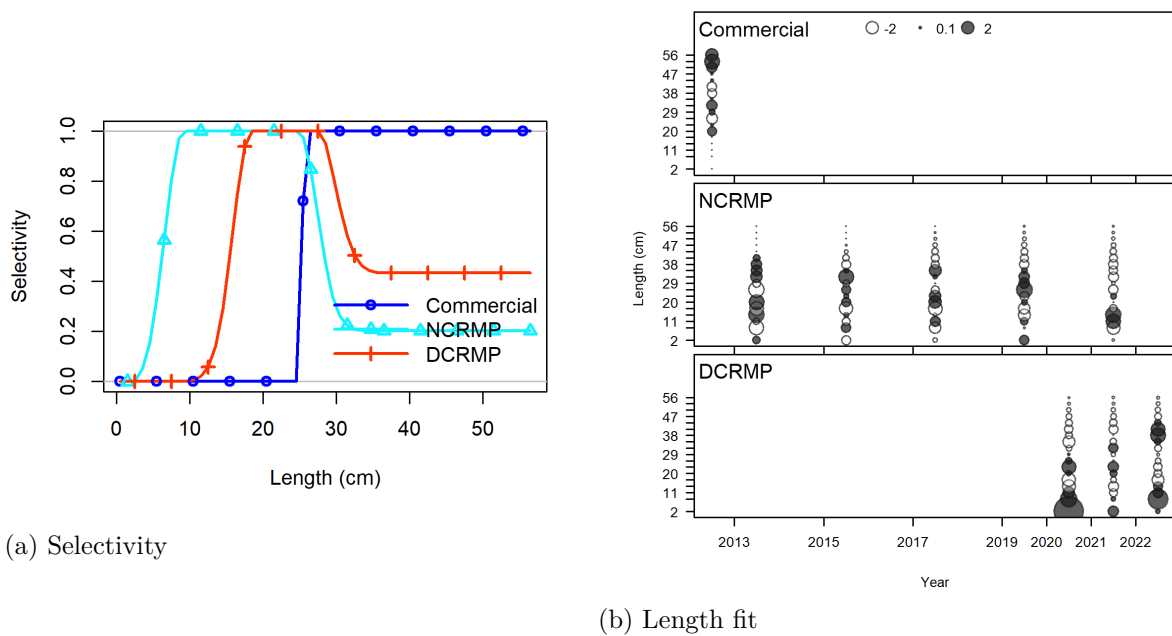and for (b) the DCRMP.

(a) Selectivity

(b) Length fit

Figure 11: St. Thomas and St. John Yellowtail Snapper Review Workshop Model
   STTJ_RW_2. (a) selectivity at length by fleet; and (b) Pearson residuals, comparing
   across fleets. Closed bubbles are positive residuals (observed > expected) and open
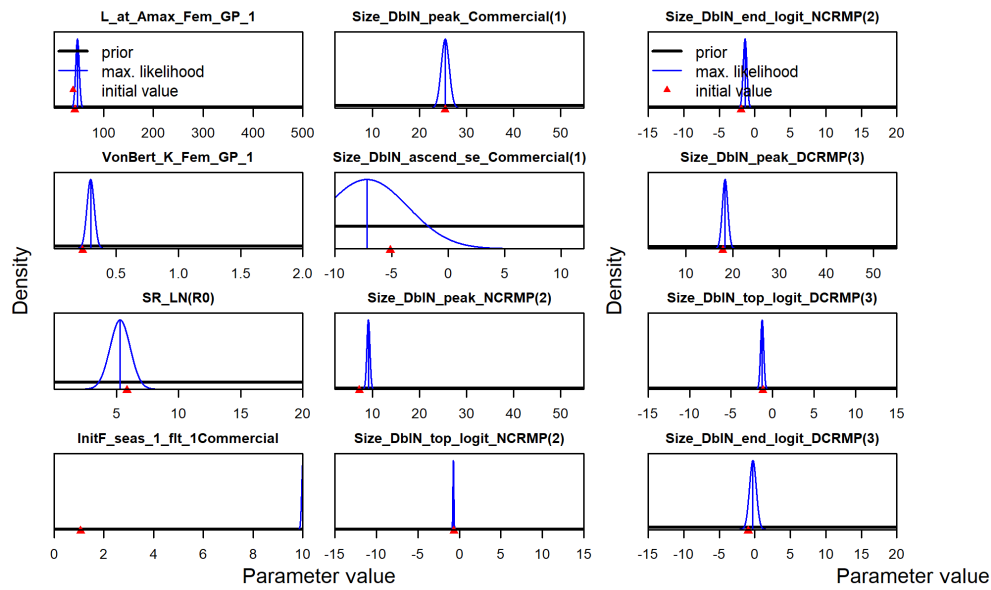   bubbles are negative residuals (observed < expected).

(a) Recruitment deviations

(b) Fishing Mortality
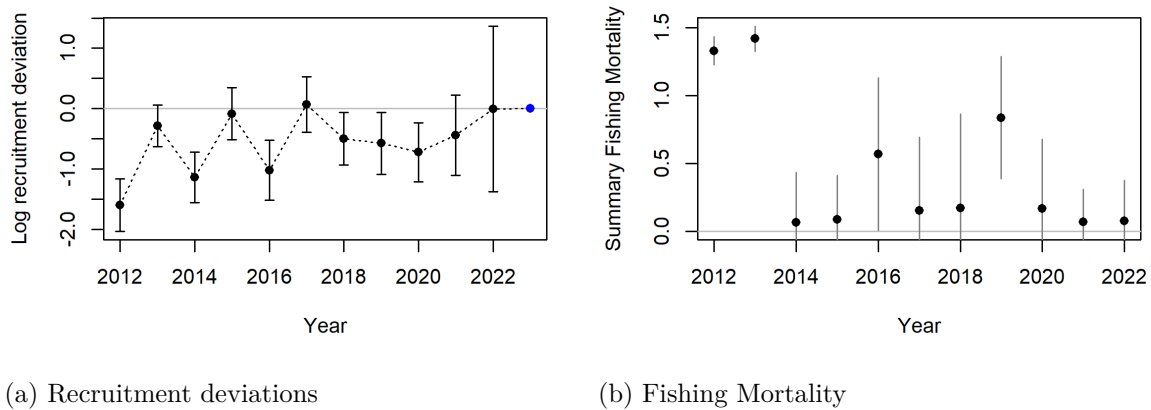
Figure 12: St. Thomas and St. John Yellowtail Snapper Review Workshop Model
   STTJ_RW_2 (a) Recruitment deviations with 95% intervals; and (b) fishing mortality
   (total biomass killed / total biomass).

(a) Parameters pg. 1 of 2

(b) Parameters pg. 2 of 2

Figure 13: Parameter distribution plots for the St. Thomas and St. John Yellowtail Snapper Review Workshop Model STTJ_RW_2.
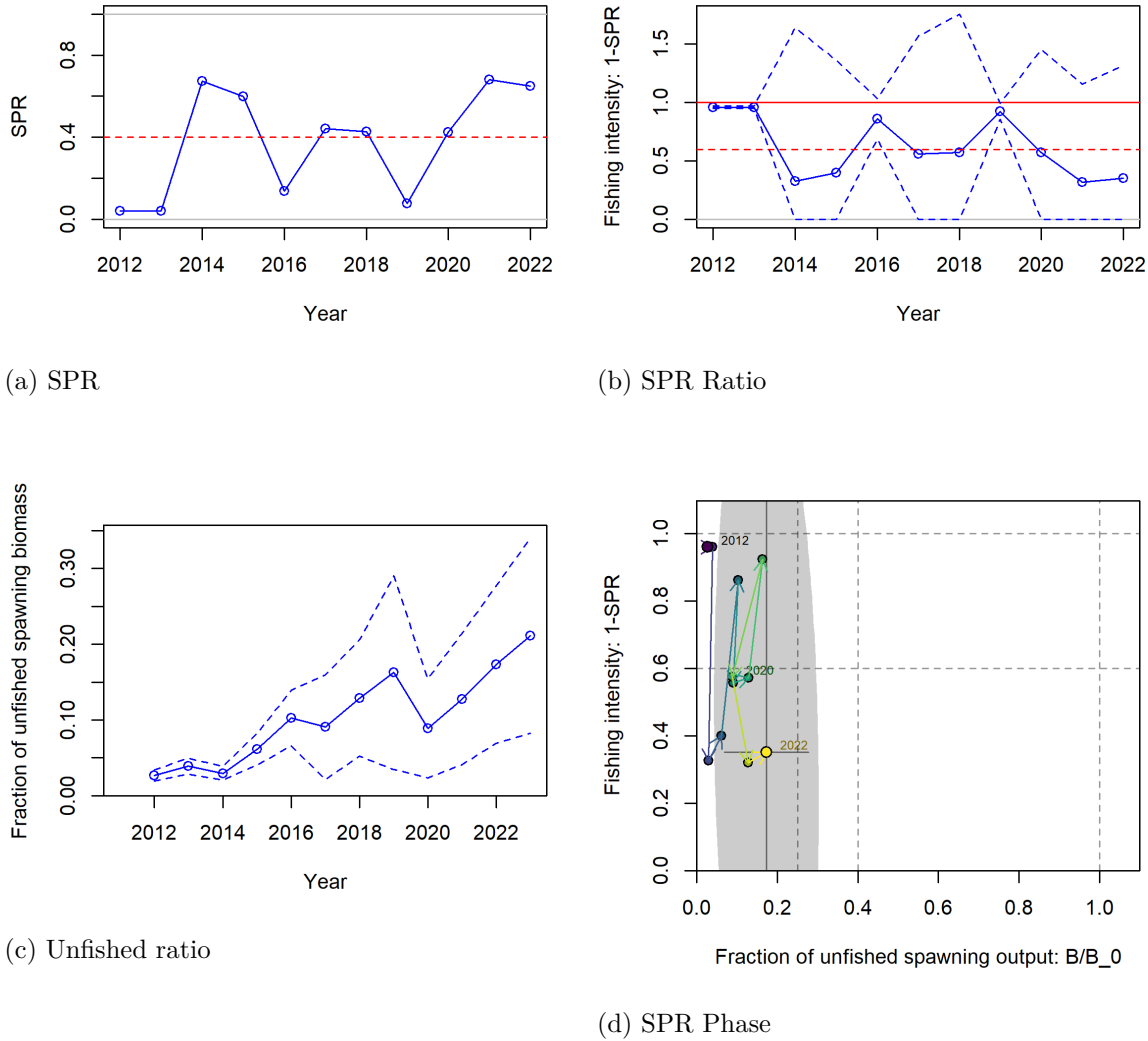
(a) SPR

(b) SPR Ratio
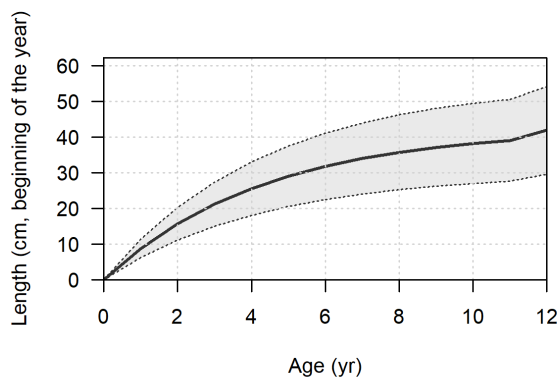

(c) Unfished ratio

(d) SPR Phase

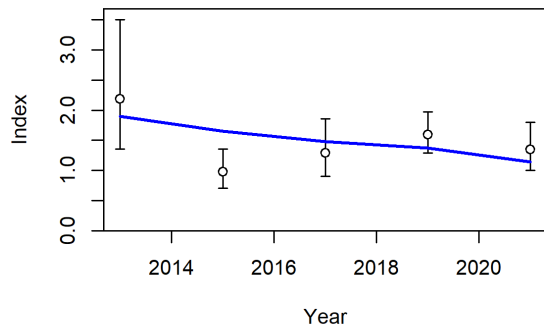Figure 14: St. Thomas and St. John Yellowtail Snapper Review Workshop Model
STTJ_RW_2. (a) Time series of SPR. Horizontal reference line is at SPR target: 0.4, (b)
time series of 1-SPR. Horizontal reference lines 1 and at 1 - SPR target: 1 - 0.4 = 0.6; (c)
the relative spawning stock biomass (total biomass / virgin spawning stock biomass) with
~95% asymptotic intervals. Horizontal reference lines at 1 and SPR target: 0.4; and (d)
phase plot of biomass ratio vs. SPR ratio where warmer colors (red) represent early years
and colder colors (blue) represent recent years. Lines through the final point show 95%
intervals based on the asymptotic uncertainty for each dimension. The shaded ellipse is a
95% region which accounts for the estimated correlation between the two quantities:
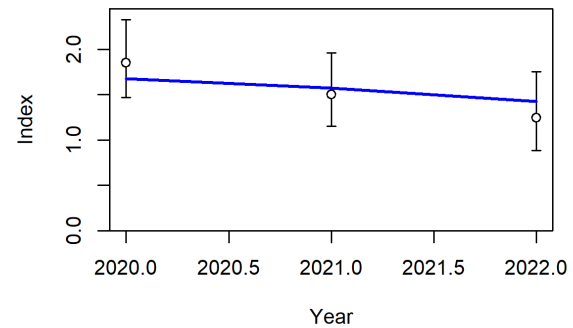-0.569.

(a) Size at age
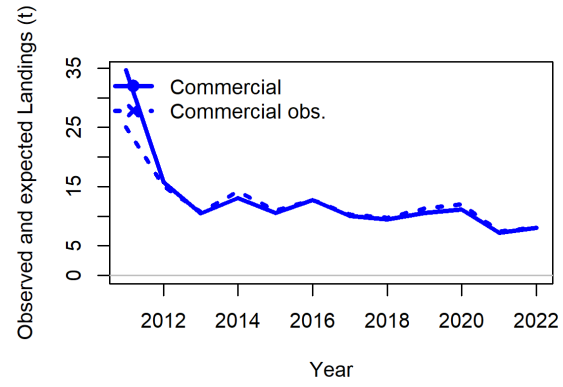
(b) Observed and expected landings


(c) Index NCRMP

(d) Index DCRMP

Figure 15: St. Thomas and St. John Yellowtail Snapper Review Workshop Model
STTJ_RW_3. (a) Length at age in the beginning of the year (or season) in the final year
of the model. Shaded area indicates 95% distribution of length at age around estimated
growth curve; (b) observed and expected landings; (c) Fit to index data for the NCRMP
survey.; and (d) Fit to index data for the DCRMP survey.
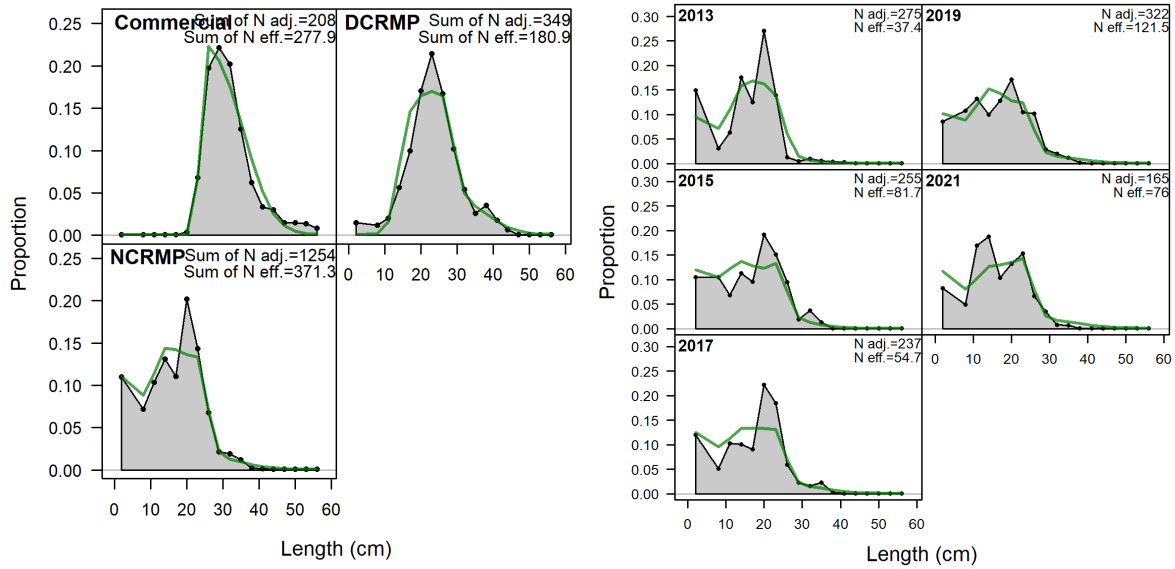
(a) Length fit aggregated across time

(b) Length comps NCRMP
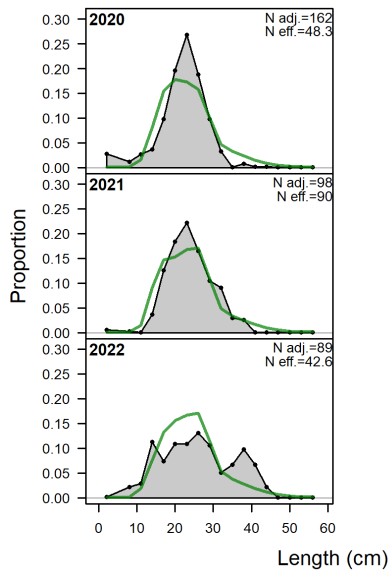
(c) Length comps DCRMP

Figure 16: St. Thomas and St. John Yellowtail Snapper Review Workshop Model STTJ_RW_3. (a) Observed and predicted length distributions in centimeters, aggregated across time by fleet; (b) observed and predicted length distributions in centimeters, by year for the NCRMP survey; and (c) observed and predicted length distributions in centimeters, by year for the DCRMP survey. 'N adj.' is the input sample size after data-weighting adjustment. N eff. is the calculated effective sample size used in the McAllister-Ianelli tuning method.

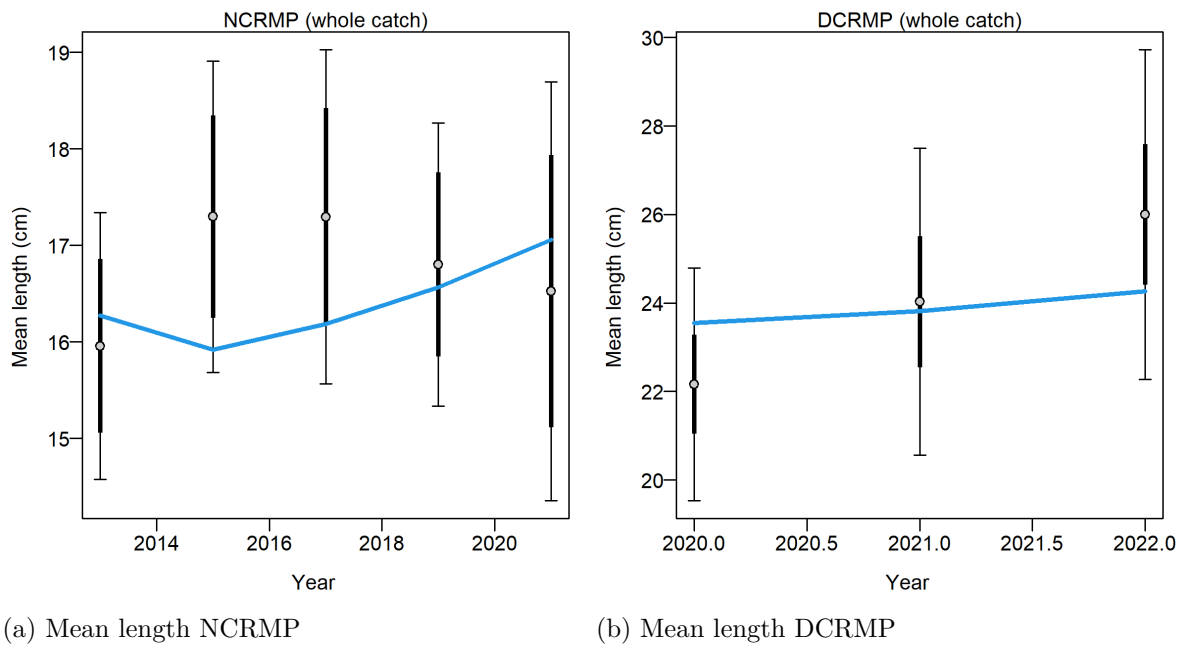(a) Mean length NCRMP   (b) Mean length DCRMP

Figure 17: St. Thomas and St. John Yellowtail Snapper Review Workshop Model
    STTJ_RW_3. Mean length for with 95% confidence intervals for (a) the NCRMP survey
    and for (b) the DCRMP.

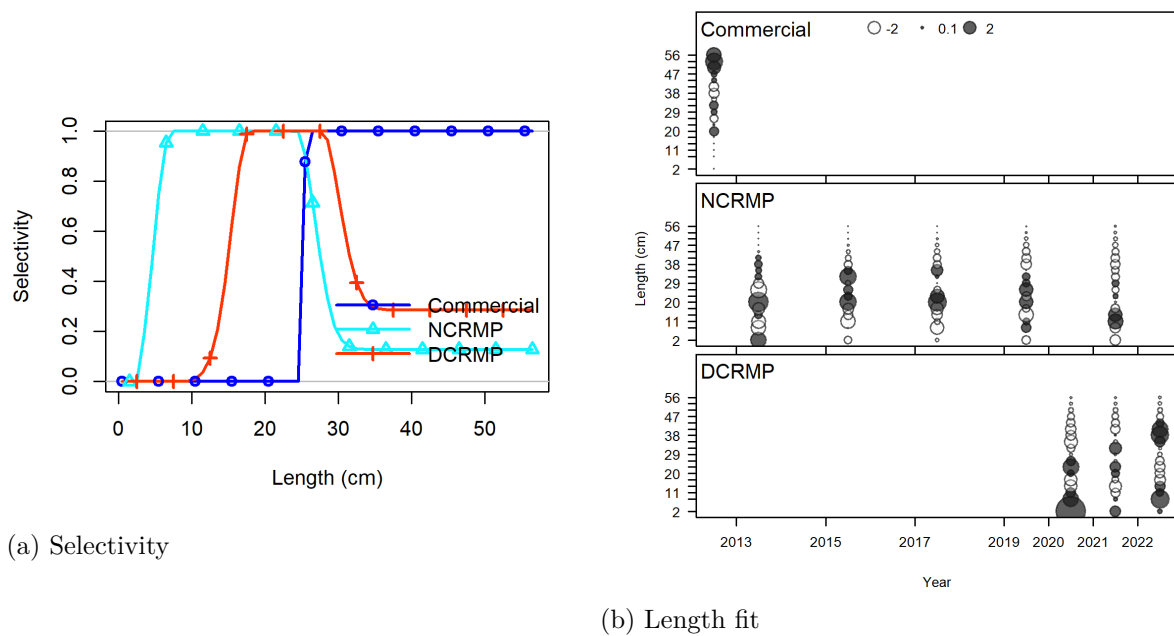(a) Selectivity

(b) Length fit

Figure 18: St. Thomas and St. John Yellowtail Snapper Review Workshop Model STTJ_RW_3. (a) selectivity at length by fleet; and (b) Pearson residuals, comparing across fleets. Closed bubbles are positive residuals (observed > expected) and open bubbles are negative residuals (observed < expected).

(a) Recruitment deviations
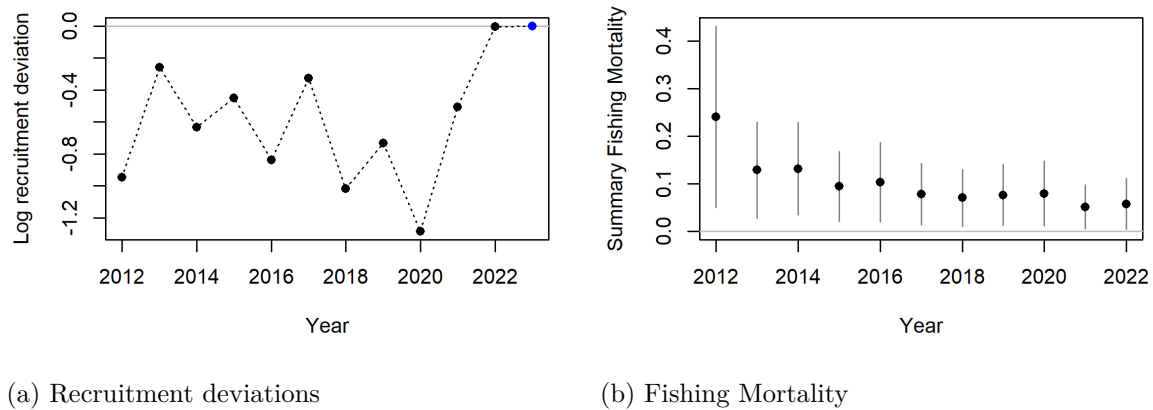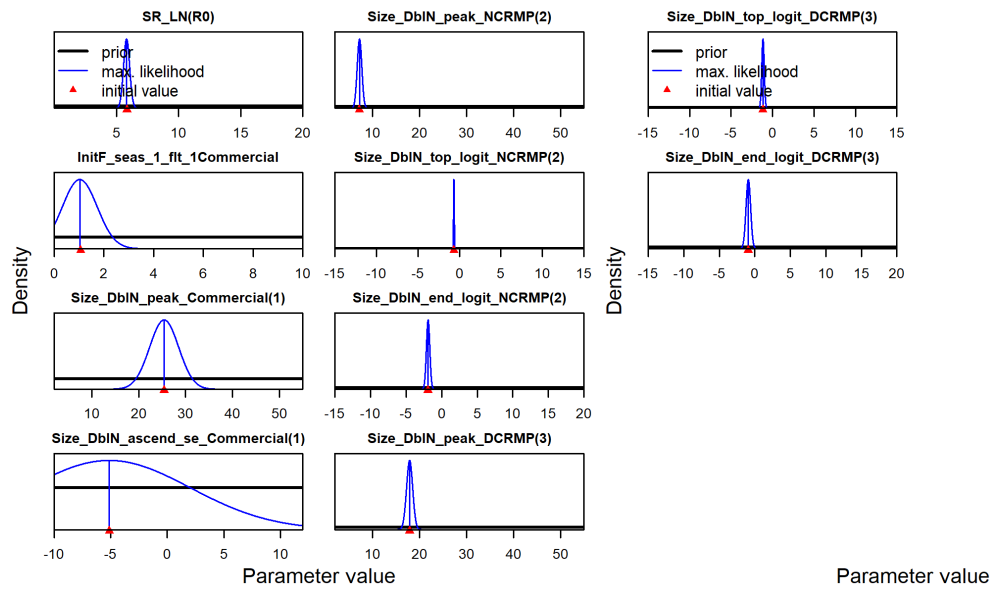

(b) Fishing Mortality

Figure 19: St. Thomas and St. John Yellowtail Snapper Review Workshop Model STTJ_RW_3. (a) Recruitment deviations with 95% intervals; and (b) fishing mortality (total biomass killed / total biomass).

(a) Parameters pg. 1 of 2   (b) Parameters pg. 2 of 2

Figure 20: Parameter distribution plots for the St. Thomas and St. John Yellowtail Snapper Review Workshop Model STTJ_RW_3.

(a) SPR

(b) SPR Ratio
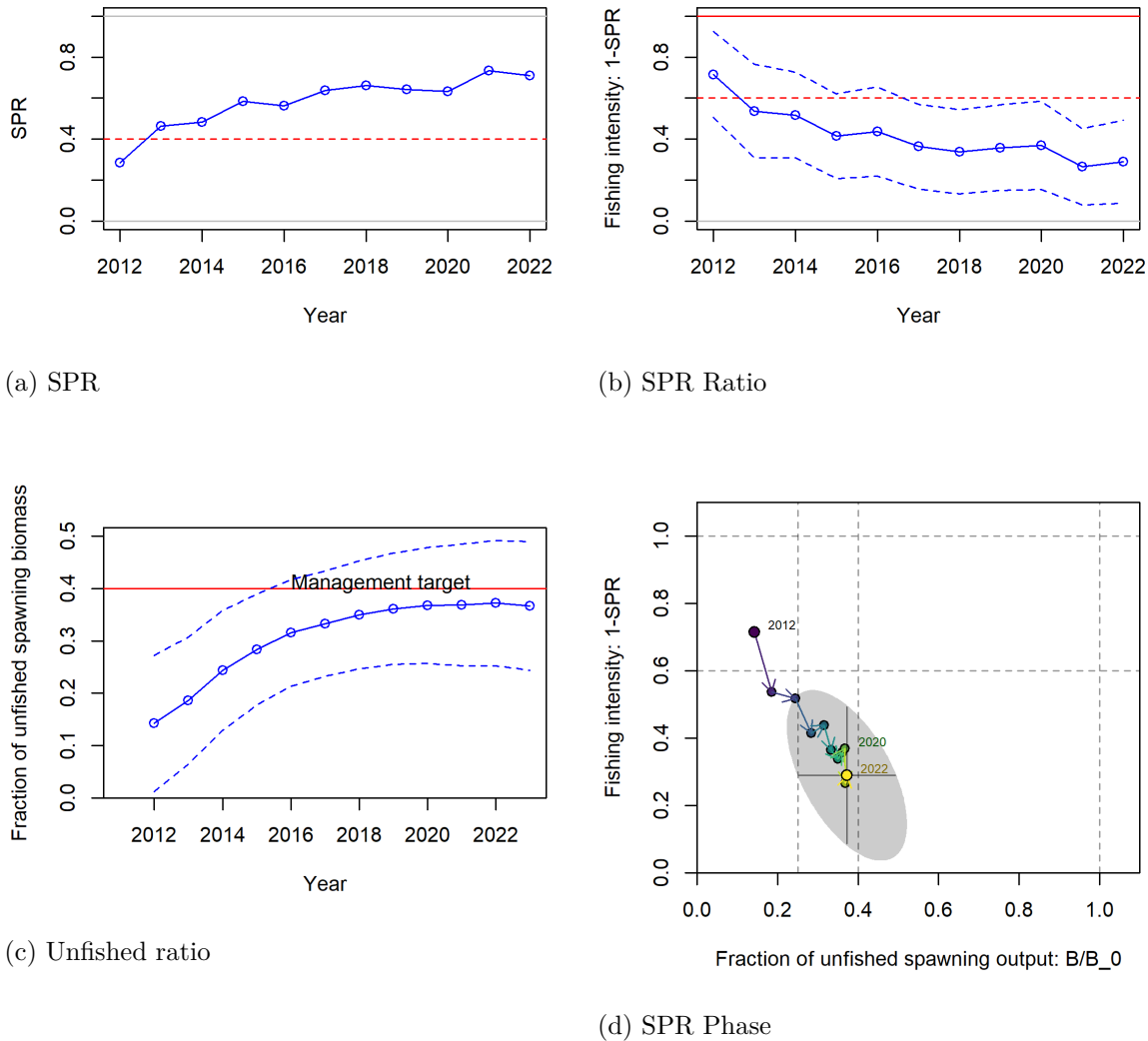

(c) Unfished ratio

(d) SPR Phase

Figure 21: St. Thomas and St. John Yellowtail Snapper Review Workshop Model STTJ_RW_3. (a) Time series of SPR. Horizontal reference line is at SPR target: 0.4, (b) time series of 1-SPR. Horizontal reference lines 1 and at 1 - SPR target: 1 - 0.4 = 0.6; (c) the relative spawning stock biomass (total biomass / virgin spawning stock biomass) with ~95% asymptotic intervals. Horizontal reference lines at 1 and SPR target: 0.4; and (d) phase plot of biomass ratio vs. SPR ratio where warmer colors (red) represent early years and colder colors (blue) represent recent years. Lines through the final point show 95% intervals based on the asymptotic uncertainty for each dimension. The shaded ellipse is a 95% region which accounts for the estimated correlation between the two quantities: -0.126.