

# Addendum

## SEDAR 84 Stoplight Parrotfish – St. Croix

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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 Stoplight Parrotfish in St. Croix, 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.
- 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 Stoplight Parrotfish in St. Croix, 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.

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

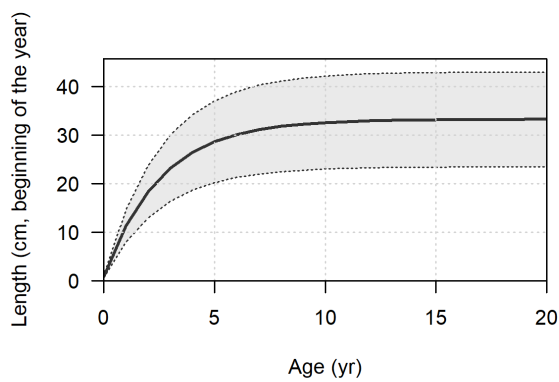
These analyses are exploratory and were conducted under panel direction during the SEDAR 84 Review Workshop. Further work is required to evaluate consequential assumptions, add sensitivity runs (e.g., steepness from FishBase), and ensure models are robust to uncertainty. Final recommendations and additional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

## 5 Tables

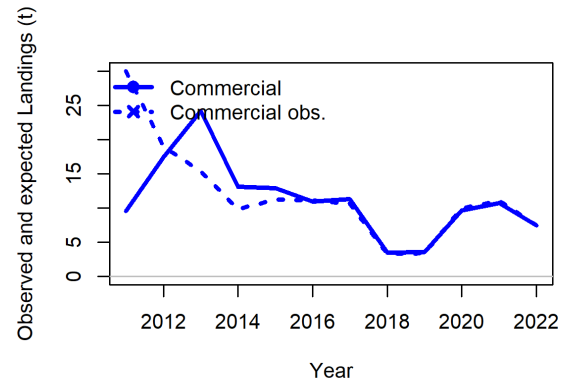
Table 1: Summary of Review Workshop SEDAR 84 models for Stoplight Parrotfish in St. Croix.

Model	Description
STX_RW_1	Single Sex, F method 2, Catch SE = 0.3, and Corrected Survey SE
STX_RW_2	STX_RW_1 + Catch SE = 2 and Estimated Growth

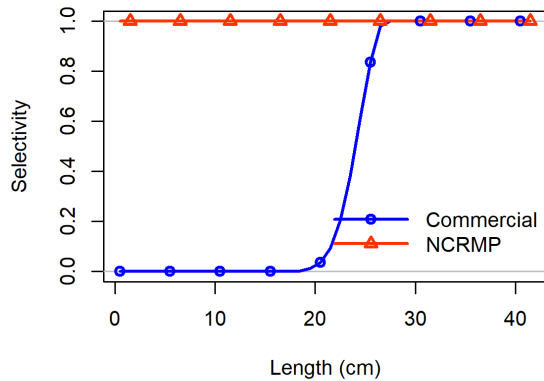
## 6 Figures



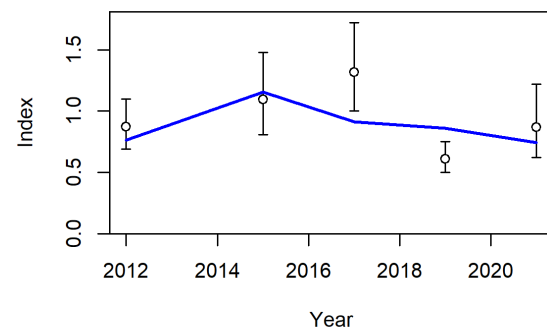
(a) Size at age



(b) Observed and expected landings

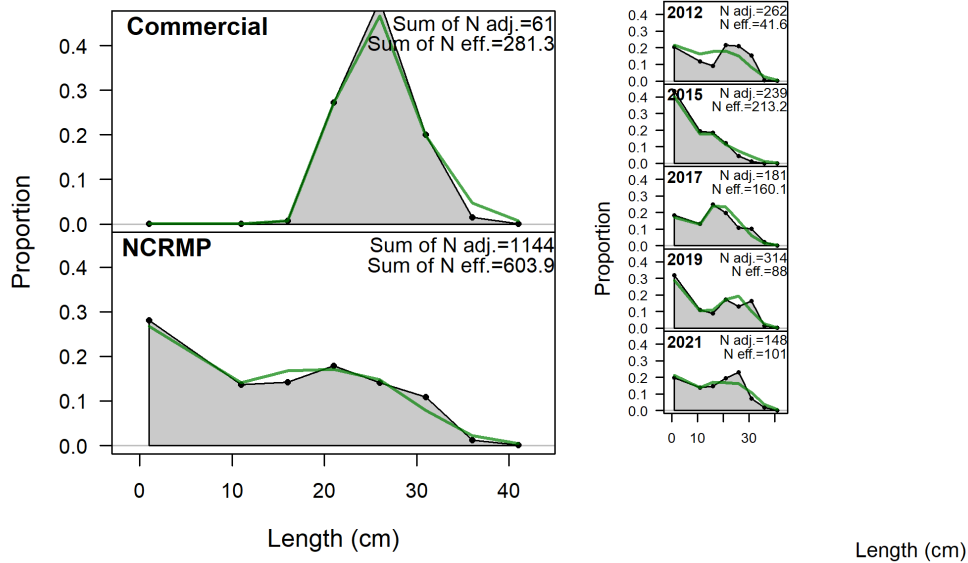


(c) Selectivity



(d) Index NCRMP

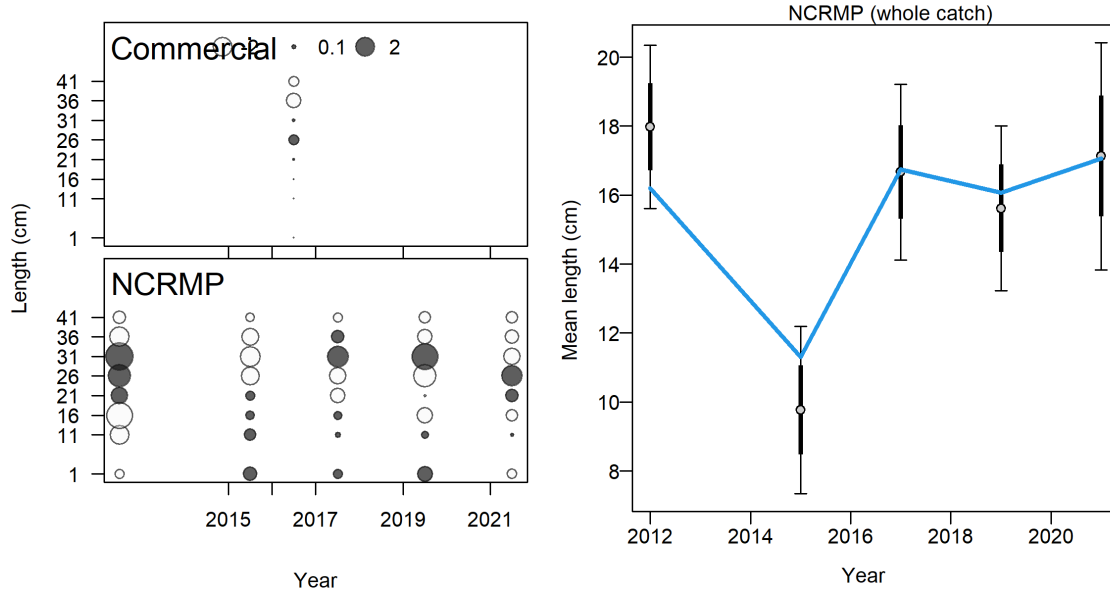
Figure 1: St. Croix Stoplight Parrotfish Review Workshop Model STX\_RW\_1. (a) Length at age in the beginning of the year (or season) in the final year of the model. Shaded area indicates 95% distribution of length at age around estimated growth curve; (b) observed and expected landings; (c) selectivity at length by fleet; and (d) Fit to index data for the NCRMP survey.



(a) Lenth fit aggregated across time

(b) Length comps NCRMP

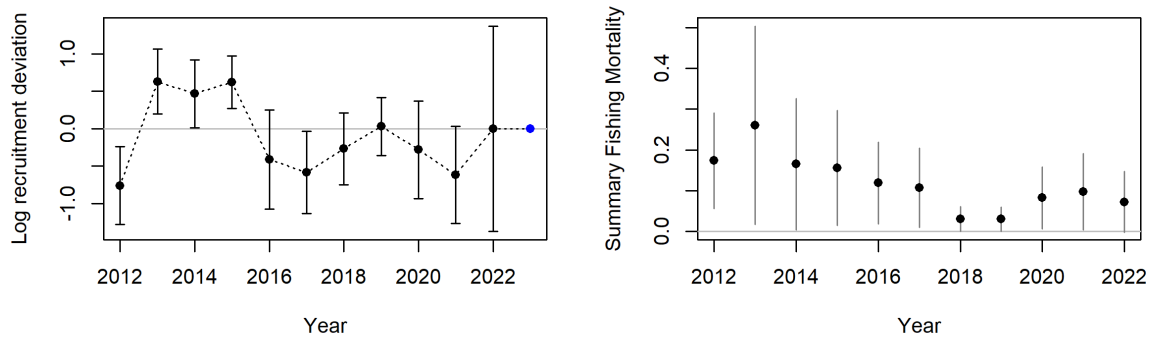
Figure 2: St. Croix Stoplight Parrotfish Review Workshop Model STX\_RW\_1. (a) Observed and predicted length distributions in centimeters, aggregated across time by fleet; and (b) observed and predicted length distributions in centimeters, by year for the NCRMP survey. ‘N adj.’ is the input sample size after data-weighting adjustment. N eff. is the calculated effective sample size used in the McAllister-Ianelli tuning method.



(a) Length fit

(b) Mean length NCRMP

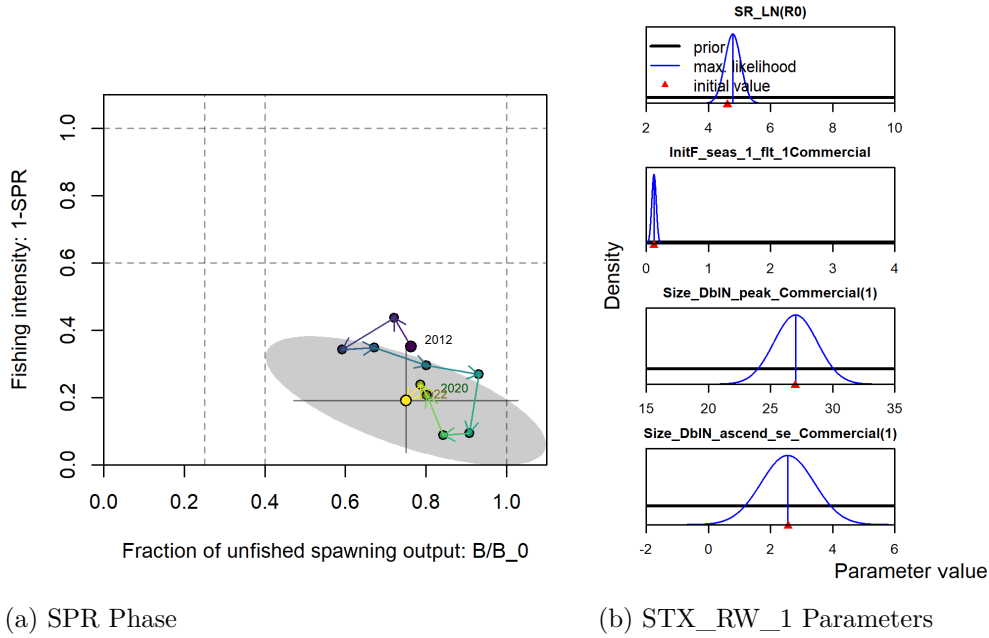
Figure 3: St. Croix Stoplight Parrotfish Review Workshop Model STX\_RW\_1. (a) Pearson residuals, comparing across fleets. Closed bubbles are positive residuals (observed > expected) and open bubbles are negative residuals (observed < expected); and (b) mean length for the NCRMP survey with 95% confidence intervals.



(a) Recruitment deviations

(b) Fishing Mortality

Figure 4: St. Croix Stoplight Parrotfish Review Workshop Model STX\_RW\_1. (a) Recruitment deviations with 95% intervals; and (b) fishing mortality (total biomass killed / total biomass).

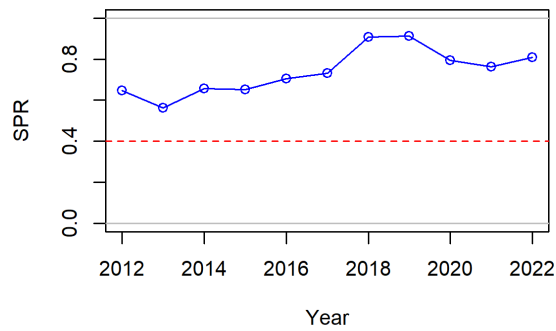


(a) SPR Phase

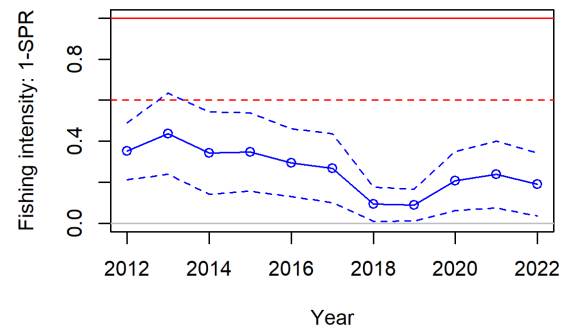
(b) STX\_RW\_1 Parameters

Figure 5: St. Croix Stoplight Parrotfish Review Workshop Model STX\_RW\_1. (a) 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: -0.681; and (b) parameter distribution plots.

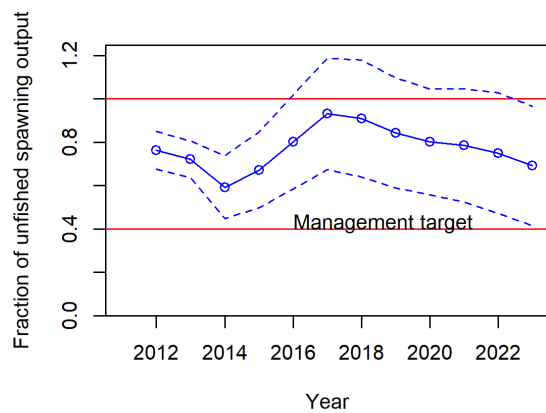




(a) SPR

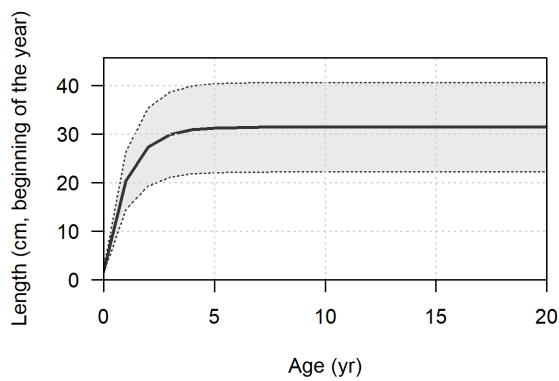


(b) SPR Ratio

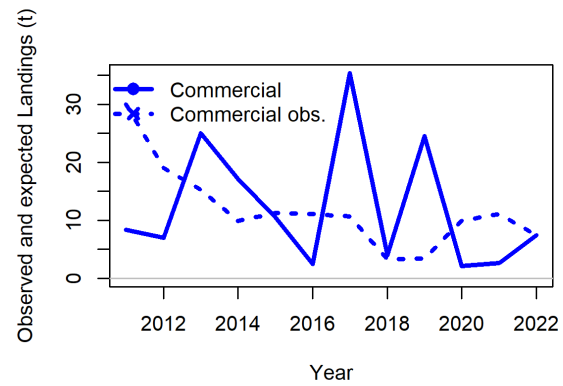


(c) Unfished ratio

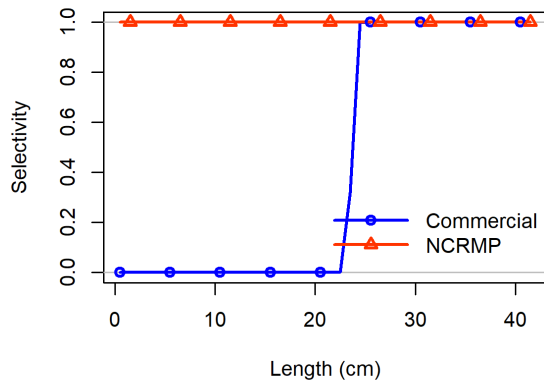
Figure 6: St. Croix Stoplight Parrotfish Review Workshop Model STX\_RW\_1. (a) Time series of SPR. Horizontal reference line is at SPR target: 0.4, (b) time series of 1-SPR. Horizontal reference lines 1 and at 1 - SPR target:  $1 - 0.4 = 0.6$ ; and (c) the relative spawning stock biomass (total biomass / virgin spawning stock biomass) with ~95% asymptotic intervals. Horizontal reference lines at 1 and SPR target: 0.4.



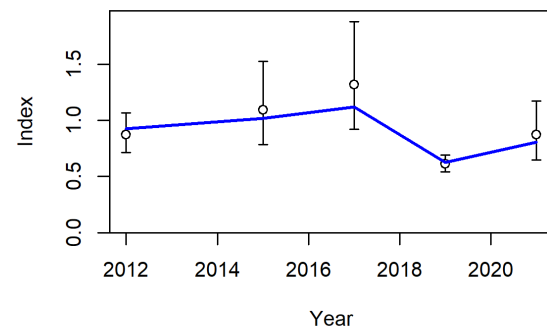
(a) Size at age



(b) Observed and expected landings

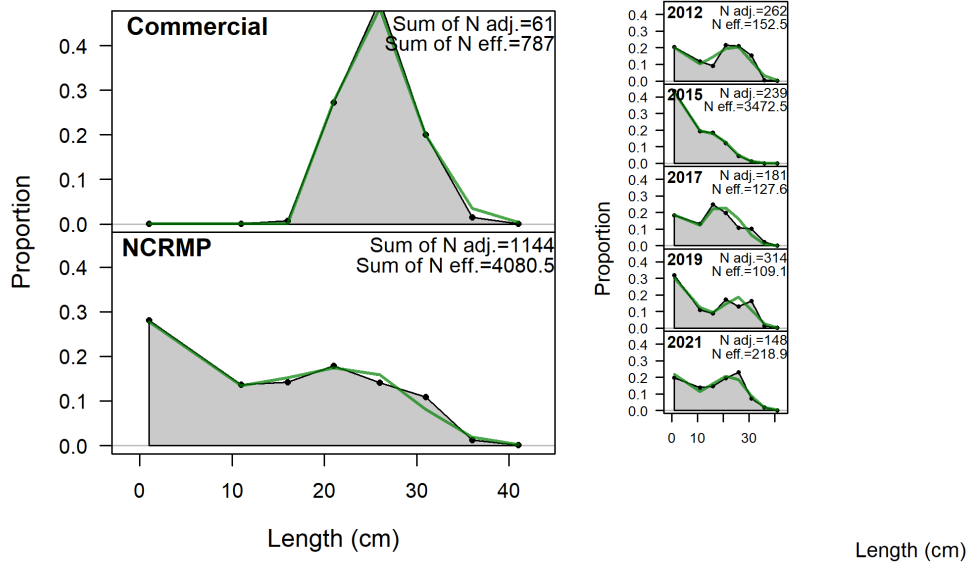


(c) Selectivity



(d) Index NCRMP

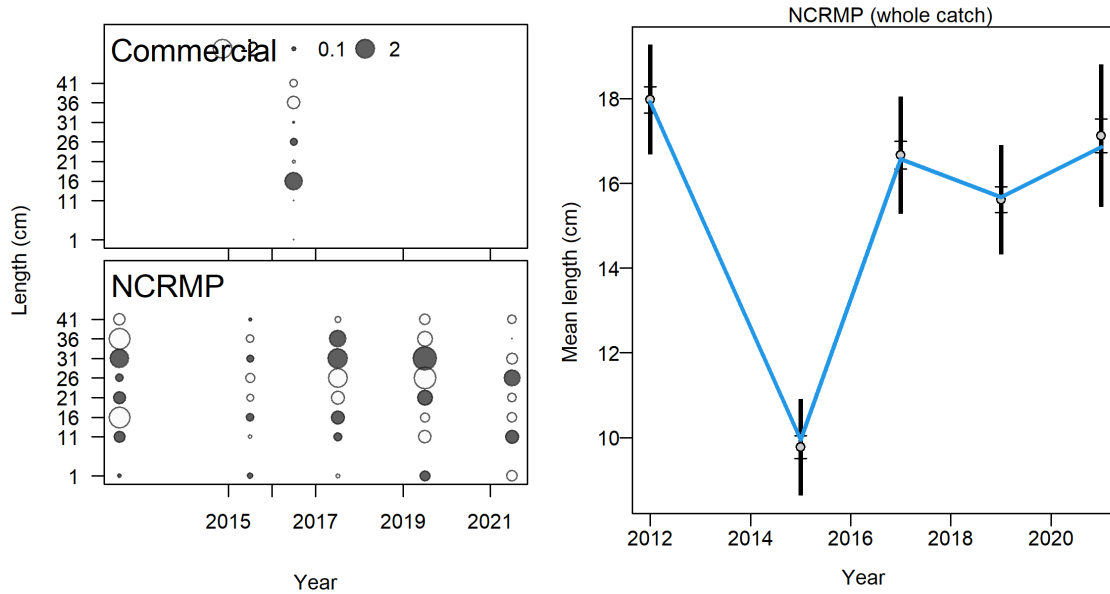
Figure 7: St. Croix Stoplight Parrotfish Review Workshop Model STX\_RW\_2. (a) Length at age in the beginning of the year (or season) in the final year of the model. Shaded area indicates 95% distribution of length at age around estimated growth curve; (b) observed and expected landings; (c) selectivity at length by fleet; and (d) Fit to index data for the NCRMP survey.



(a) Length fit aggregated across time

(b) Length comps NCRMP

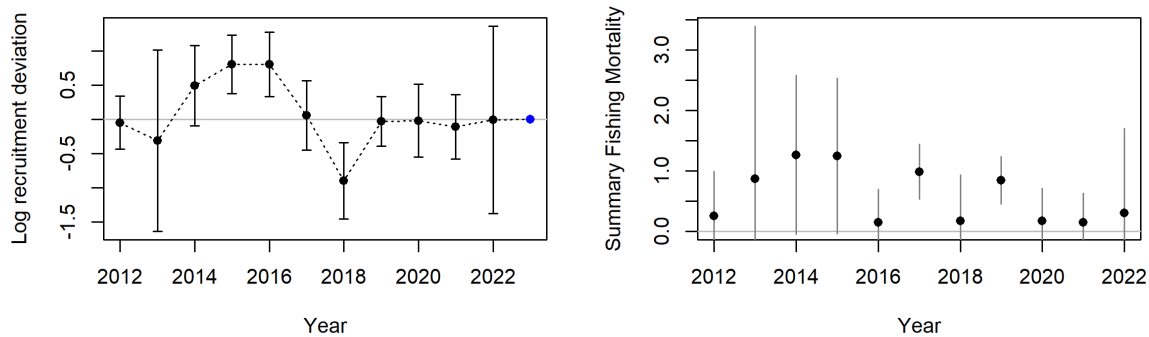
Figure 8: St. Croix Stoplight Parrotfish Review Workshop Model STX\_RW\_2. (a) Observed and predicted length distributions in centimeters, aggregated across time by fleet; and (b) observed and predicted length distributions in centimeters, by year for the NCRMP survey. ‘N adj.’ is the input sample size after data-weighting adjustment. N eff. is the calculated effective sample size used in the McAllister-Ianelli tuning method.



(a) Length fit

(b) Mean length NCRMP

Figure 9: St. Croix Stoplight Parrotfish Review Workshop Model STX\_RW\_2. (a) Pearson residuals, comparing across fleets. Closed bubbles are positive residuals (observed > expected) and open bubbles are negative residuals (observed < expected); and (b) mean length for the NCRMP survey with 95% confidence intervals.



(a) Recruitment deviations

(b) Fishing Mortality

Figure 10: St. Croix Stoplight Parrotfish Review Workshop Model STX\_RW\_2. (a) Recruitment deviations with 95% intervals; and (b) fishing mortality (total biomass killed / total biomass).

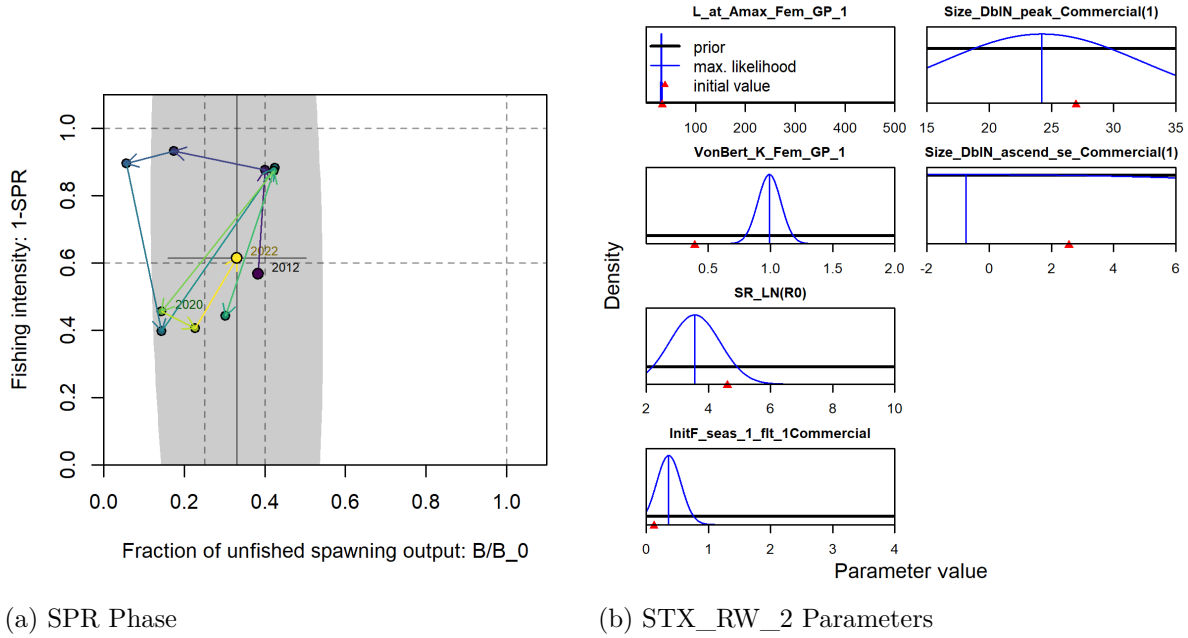
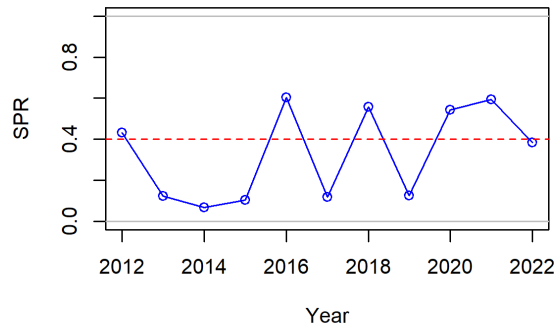
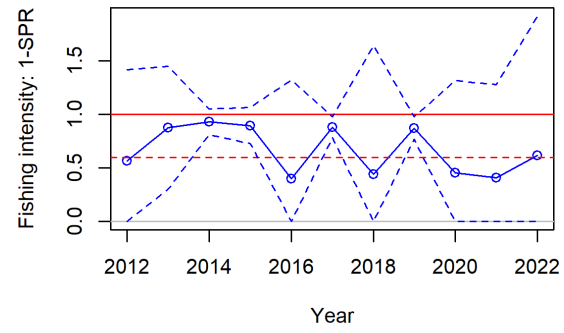


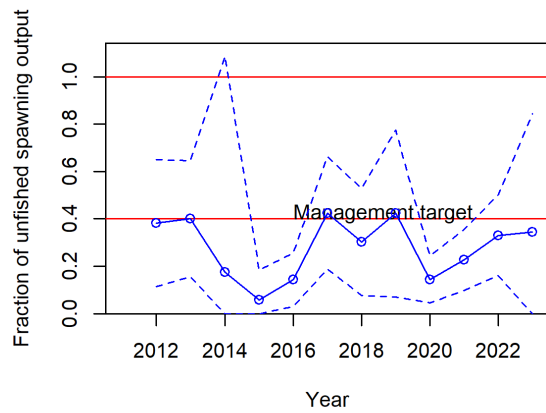
Figure 11: St. Croix Stoplight Parrotfish Review Workshop Model STX\_RW\_2. (a) phase plot of biomass ratio vs. SPR ratio where warmer colors (red) represent early years and colder colors (blue) represent recent years. Lines through the final point show 95% intervals based on the asymptotic uncertainty for each dimension. The shaded ellipse is a 95% region which accounts for the estimated correlation between the two quantities: -0.112; and (b) parameter distribution plots.



(a) SPR



(b) SPR Ratio



(c) Unfished ratio

Figure 12: St. Croix Stoplight Parrotfish Review Workshop Model STX\_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:  $1 - 0.4 = 0.6$ ; and (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.