Center for Independent Experts (CIE) Independent Peer Review Report for SEDAR 84 Caribbean Yellowtail Snapper and Stoplight Parrotfish

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Executive Summary

A peer review of the SEDAR 84 (Caribbean Stoplight Parrotfish and Yellowtail Snapper) assessment was held on July 15-18, 2025, in Fort Lauderdale, Florida. The Review Workshop (RW) included three stocks: i) the St. Croix Stoplight Parrotfish, ii) the St. Thomas/St. John Yellowtail Snapper, and iii) the Puerto Rico Yellowtail Snapper. All three stocks were assessed using Stock Synthesis (SS3), a flexible, age-structured stock assessment modeling platform within NOAA's Fisheries Integrated Toolbox. SS3 is capable of handling both data-limited to data-rich assessments.

The data decisions made by the Data Workshop (DW) and Assessment Workshop (AW) were partially robust and generally used appropriate sources: commercial landings, commercial length compositions, and fishery-independent survey indices and length composition data. However, concerns were raised about the short time series, limited length composition data, and exclusion of historical survey data. Some uncertainties were acknowledged in the DW and AW reports (e.g., survey limitations, length composition data quality), while others (e.g., high uncertainty in the index at the peak value, stock unit definition) were not fully addressed. The data quality and short duration raised concerns about supporting such a complex assessment model like SS3.

During the RW, the review panel (RP) requested several model revisions and additional runs for all three assessments. Diagnostics and the additional model runs revealed that the models were sensitive to assumptions about catch uncertainty and estimation of growth. These findings raised concerns about structural issues or data conflicts, particularly for the St. Croix Stoplight Parrotfish and St. Thomas/St. John Yellowtail Snapper, where data were especially limited. Even though the Puerto Rico Yellowtail Snapper had longer time-series, the model showed similar instability and conflicting signals across model runs and among datasets.

Appropriate diagnostic tools were applied, however multiple interacting sources of uncertainty limited the ability to pinpoint key drivers of uncertainty. The RP concluded that SS3 may be too complex for the available data. While efforts were made to address these during the RW, time constraints limited deeper exploration. Additional data collection, alternative model platforms/methods, and integration of historical data are necessary for future assessments.

Given these limitations, none of the three assessments produced results reliable enough to inform annual catch limits or other management measures. Model derived metrics (e.g., Spawning Potential Ratio) were highly sensitive to assumptions, and model runs showed conflicting results. As a result, the RP concluded that the stock status is unknown for all three stocks. Additional RP recommendations beyond those in the DW and AW reports include improving fishery-independent surveys (sampling design, survey domain, sample size), testing model-free approaches, investigating population structure and stock delineation, improving otolith sampling, and combining the St. Thomas/St. John and Puerto Rico Yellowtail Snapper assessment.

The RP recommended building a combined model for the Yellowtail Snapper stocks in response to data limitations of the St. Thomas/St. John assessment, the possibility of biological connectivity between the islands (shared shelf), and the recognition of synchronous peaks in survey indices (2012 for Puerto Rico and 2013 for St. Thomas/St. John). Two combined model runs were presented at the RW. While the first attempt failed to converge, the second run successfully converged. Despite some instability and absence of a full diagnostic suite for the

second model run, this combined model provides a promising first step toward a Yellowtail Snapper stock assessment in the U.S. Caribbean.

Background

The SEDAR 84 US Caribbean Stoplight Parrotfish and Yellowtail Snapper assessment process took place over a series of three main workshops: the Data Workshop (DW), Assessment Workshop (AW), and Review Workshop (RW). The SEDAR 84 RW was held on July 15-18, 2025, in Fort Lauderdale, Florida. This workshop is part of the Southeast Data, Assessment, and Review (SEDAR) cooperative process for assessments conducted in NOAA Fisheries' Southeast Region. The Review Panel (RP) was chaired by Vance Vicente (Chair; CFMC SSC) and included five other reviewers: Adriana Nogueira Gassent (CIE), Elizabeth Kadison (CFMC SSC), Ernesto Jardim (CIE), Jorge (Reni) Garcia-Sais (CFMC SSC), and Lisa Chong (CIE; author of this independent report).

The draft assessment report and all associated background documents (Appendix 1) were made available to the reviewers two weeks before the RW. At the RW, the Analyst Team presented the conclusions from the DW and AW, details of the assessment, and stock status evaluations. Additional model runs were produced at the Review Panel's (RP) request (Appendix 4). The workshop was well prepared and organized by SEDAR coordinator Emily Ott. This report is my independent review for the CIE and reflects my views, which are consistent with the Review Panel's conclusions.

Description of Reviewer's Role

The role of the reviewer is outlined in the CIE Statement of Work (attached in Appendix 2). This reviewer independently read the DW and AW reports, their appendices, and all supplementary documents before the Review Workshop. This reviewer also attended the RW in Fort Lauderdale, FL (July 15-18, 2025), provided technical guidance during the workshop, contributed to the RP's summary report, and authored this review report. Several additional model runs were requested during the RW, with preliminary results presented. Finalized base models and additional model runs were documented as an Addendum to the assessment report.

Terms of Reference Findings

1. Evaluate the data used in the assessment, addressing the following:

1.a. Are data decisions made by the DW and AW sound and robust?

Overall, some decisions made by the DW and AW were supported by the review panel (RP); others raised concerns.

Data Workshop

Stock assessments models were developed for the St. Croix Stoplight Parrotfish, St. Thomas/St. John Yellow Snapper, and Puerto Rico Yellowtail Snapper using an appropriate approach (SS3). Data used for all three assessments included landings data, length composition data from the Trip Interview Program (TIP), indices of abundance and length composition data from fishery independent surveys, and life history parameters including growth and reproduction characteristics from gonad studies.

A variety of fishing gears are used to commercially fish for Stoplight Parrotfish and Puerto Rico Yellowtail Snapper. To identify the most representative gear group for the commercial length composition data, a generalized linear mixed model (GLMM) was used for each assessment. This approach appears to be a valid method for filtering the length composition data. An outlier removal approach was also applied to the commercial landings data to correct for extreme values from inconsistencies, such as multiple trips being combined into a single logbook report. This approach seems valid for all three assessments.

Below are details for each species/assessment:

St. Croix Stoplight Parrotfish: It was recommended to use only commercial landings starting in 2012 because it was not possible to hindcast the data (from 1983-2011). While the rationale was reasonable, it resulted in a dataset covering only 12 years for a species with an approximate 30-year lifespan. The catch per unit effort (CPUE) index for the commercial fishery was excluded for the assessment as diver hours fished were considered an inappropriate measure of effort (due to multispecies diving trips), and the nominal CPUE coefficient of variance (CV) was too high to provide meaningful trends.

Discard mortality was assumed to be negligible for valid reasons (nature of spearfishing). There are no recreational catch records of Stoplight Parrotfish, so recreational landings data could not be included for the stock assessment. The recreational catch of Stoplight Parrotfish is also likely negligible on St. Croix as they are not easily caught by hook and line and are not targeted as a sustenance or trophy fish by recreational spear fishers.

Due to the low sample size of commercial length composition data, the decision at the DW was to combine the TIP length data across all years (i.e., super year period) to inform selectivity in the stock assessment model. While the rationale made sense, it was concerning that there might not be enough information on the size structure of the population, cohort strength, and/or recruitment and mortality trends.

There are still some limitations and uncertainties about life history (e.g., age-specific natural mortality, fecundity). The maximum age was set to 30. While it seemed plausible, a smaller plus group of 10-15+ years may be more realistic (based on the growth data).

The methods used to compile the index of abundance (from the National Coral Reef Monitoring Program; NCRMP) seemed reasonable. Calibration was applied to integrate old (belt transect) and new sampling schemes (stationary point counts), account for domain changes (regionally restricted to island-wide), and estimate for gear correction factors. After calibration, a design-based estimator was used to generate an index of abundance. However, only three years of fisheries-independent survey data, including index and length composition, were compiled. This was concerning for the stock assessment model, especially when combined with the fact that the other sources of size structure, mortality, and recruitment will also come from the super-year commercial length data.

St. Thomas/St. John and Puerto Rico Yellowtail Snapper: The stock unit for Yellowtail Snapper in St. Thomas/St. John and Puerto Rico should have been explored further. The initial decision to treat these as two separate stocks was based on administrative needs, a common approach when a management system is put in place for the first time. However, with more information and in the context of conducting a stock assessment, the definition of stock unit for assessment purposes should align with the biology and population dynamics of the species. Evidence suggests connectivity between the islands, with Yellowtail Snapper inhabiting the same shelf between them. Given that the time series for the St. Thomas/St. John fishery is relatively short (the species has a longevity of 20-30 years, but the time series spans only 12 years), the close proximity of the islands, and the ecological similarities in their habitats, it would be more logical to combine the data from St. Thomas/St. John and Puerto Rico for the assessment. Island specific comments follow:

St. Thomas/St. John: It was recommended to use only commercial landings starting in 2013 because it was not possible to hindcast the data (from 1983-2011). While the rationale was reasonable, this raised concerns for the stock assessment model. The Yellowtail Snapper has a maximum age 20-30, but only 12 years of data was available, which does not cover the life span of the species. The catch per unit effort (CPUE) index for the commercial fishery was excluded for the assessment as hook hours fished was considered an inappropriate measure of effort and the nominal CPUE CV was too high.

Due to the low sample size of commercial length composition data, the decision at the DW was to combine the TIP length data across all years (i.e., super year period) to inform selectivity in the stock assessment model. While the rationale made sense, it was concerning that there may not be enough information on the size structure of the population, cohort strength, and/or recruitment and mortality trends.

There are still some limitations and uncertainties about life history (e.g., age-specific natural mortality, fecundity). The maximum age was set to 26. While it seems like this could be a possibility, this should not define what the plus group will be in the assessment. It should be based on available data, which seems like it would be more appropriate to set the plus group to 10-15+ based on the growth data.

The NCRMP data is restricted to a limited depth (30 m), so it only represents shallow water fish, and the majority of the fisheries are in deeper waters (30-65 m). The Deep NCRMP (DCRMP) dataset was used to accommodate for that (to 45 m), however both surveys were limited in the amount of data (time series and length composition data). There were some older data from the NCRMP survey (La Parguera survey) that were not used as well. Decisions about not using data for the stock assessments should have been made with considerations to the performance of the stock assessment model. Because of these decisions, there was not enough length composition data, and historical trends were not captured in the index data (e.g., flat trend in abundance in recent years, when this was not the case in the overall time series).

Puerto Rico: The Puerto Rico assessment overall had longer time series for commercial catch and length composition and NCRMP survey data. There were no concerns about the commercial catch and length composition datasets. The catch per unit effort (CPUE) index for the commercial fishery was excluded for the assessment as gear hours fished was considered an inappropriate measure of effort and the nominal CPUE CV was too high.

There are still some limitations and uncertainties about life history (e.g., age-specific natural mortality, fecundity). The maximum age was set to 26. While it seems like this could be a possibility, this should not define what the plus group will be in the assessment. It should be based on available data, which seems like it would be more appropriate to set the plus group to 10-15+ based on the growth data.

The NCRMP survey in Puerto Rico has been conducted since 2001, however only data from 2014 onward was used in the assessment. Although the sampling coverage before 2014 was different (regionally restricted) and only became island-wide in 2014, the RP agreed to include the earlier time series as a separate index to provide more information on stock scaling and trends in the earlier years.

The SouthEast Area Monitoring and Assessment Program Caribbean Survey (SEAMAP-C) was not used for the stock assessment. The data from this survey were not consistent in terms of methodology, so the decision to exclude this dataset was reasonable. Recreational catch data was also not used due to inconsistencies and mistrust of reporting.

Assessment Workshop

The Analyst Team developed and applied SS3 for all three assessments, however the RP found that SS3 may not be compatible with the available data due to data limitations. Input data and configurations were documented, however not all model configurations and assumptions were documented in the AW report. For example, the fishing mortality option (called the “F method” in SS3) was not specified in the report, which needed to be changed during the RW (see *TOR 2*).

The type of reference point/management benchmarks used for the three assessments were mentioned (Spawning Potential Ratio; SPR). However, the Analyst Team did not define the exact values of maximum fishing mortality threshold (MFMT) or the minimum stock size threshold (MSST). The Analyst Team also did not conduct any projections or provide any alternative procedures. The default alternative to SS3 will be to go back to the previous approach (i.e., set quotas based on ratios from past landings).

1.b. Are data uncertainties acknowledged, reported, and within normal or expected levels?

Several uncertainties were acknowledged in the DW and AW reports, including short time series in landings, difficulties in quantifying commercial CPUE, distrust in commercial landings, limited samples of TIP length composition data, and incomplete datasets (e.g., certain datasets not capturing juvenile trends). However, other uncertainties were not fully acknowledged or reported. For example, there are limitations with the NCRMP survey and its ability to capture indices of abundance for large Yellowtail Snapper or juvenile Stoplight Parrotfish.

In Puerto Rico, the NCRMP survey in 2012 showed a significant increase in Yellowtail Snapper density (in numbers / m2) with high uncertainty. Similarly, a large increase with high uncertainty was also observed in the NCRMP survey for St. Thomas/St. John Yellowtail Snapper in 2013. The cause of these sharp increases and associated uncertainty was not addressed in the DW report. During the Review Workshop (RW), it was found that these increases were likely due to high fish aggregation, with sampling concentrated around these aggregations. However, it remains unclear if this increase reflects a true population increase or is simply a result of the sampling. There are some indications that an actual increase in population could have occurred between 2012-2013; fishing effort shifted away from fishing for Yellowtail Snapper and net bans were implemented. This increase in density was not included in the assessment models (survey data started in 2014), which removed potentially informative signals in abundance.

1.c. Are data applied properly within the assessment model?

The data were properly implemented in SS3 across the three stock assessments.

1.d. Are input data series reliable and sufficient to support the assessment approach and findings?

There were concerns about the input data series for each of the assessments:

St. Croix Stoplight Parrotfish: There is a short catch time series for Stoplight Parrotfish due to change in gear type in 2008 and challenges in filtering out Stoplight Parrotfish from the complex catch time series. There were also challenges in generating commercial CPUE, which would have served as another source for scaling population abundance and trends. There was also very limited TIP length composition data (66 samples in the total dataset), and overall distrust in the catch report data. Given these data limitations, there were concerns about whether a complex assessment model like SS3 could fit well and describe Stoplight Parrotfish population dynamics based on the available data.

St. Thomas/St. John Yellowtail Snapper: Without using historic commercial landings data, there is only 12 years in the series, for a fish that lives 20-30 years. Using historic data requires estimating Yellowtail Snapper catch based on recent percentages in the catch of snapper and pot fish since they were not historically separated. This would introduce additional uncertainty. Given these data limitations, there were concerns about whether a complex assessment model like SS3 could fit well and describe Yellowtail Snapper population dynamics based on the available data.

Puerto Rico Yellowtail Snapper: More data are available for the Puerto Rico Yellowtail Snapper assessment (longer catch time series, more commercial length composition). However, there is still insufficient information on the scale of the population because much of the historical survey data was thrown out. The survey data retained (2014-2022) had a relatively flat abundance trend, which does not reflect the historical patterns of abundance. Changes in regulations, such as size limits and gear bans, suggest potential changes in selectivity over time. Additionally, a significant source of mortality, the recreational fishery, is also missing from this assessment. Without the recreational fishery data, the assessment may underestimate overall mortality. These issues pose challenges to the stock assessment, especially considering the limited fishery-independent data.

2. Evaluate the methods used to assess the stock, taking into account the available data.

2.a. Are methods scientifically sound and robust?

SS3 was applied to all three stock assessments (St. Croix Stoplight Parrotfish, St. Thomas/St. John Yellowtail Snapper, and Puerto Rico Yellowtail Snapper). SS3 has been used extensively for many stock assessments across the country and is part of NOAA's Fisheries Integrated Toolbox. This modeling tool and framework has been validated in many peer reviewed assessments and follows best practices in stock assessment. It is capable of handling a broad spectrum of model complexities, ranging from data-limited to data-rich assessments. SS3 allows for analysts to begin with a simple model structure and incrementally incorporate additional complexity as needed. For example in data-limited applications, there is a wrapper function and package (SS-DL-tool; https://github.com/shcaba/SS-DL-tool) that helps start data-limited assessments within the SS3 modeling framework by building the input files for provided data and life history information. Additionally, the model supports key biological settings, such as hermaphroditism, which is particularly relevant for the St. Croix Stoplight Parrotfish. The Analyst Team conducted an appropriate number of diagnostic tests to check for convergence, validate the model, and test key uncertainties through the r4ss R package (https://github.com/r4ss/r4ss).

2.b. Are assessment models configured properly and used consistent with standard practices?

Before the RW, there were some concerns about the configuration of the assessment models in SS3. The configurations and assumptions were not all documented in the AW report (e.g., fixed vs estimated parameters, which options were selected in SS3, etc.). During the RW, these configurations and assumptions were clarified, and the RP made additional recommendations to explore sensitivities of these choices made by the Analyst Team. For all three assessments, there were a few changes in the configuration and inputs of SS3 during the RW:

- Modification 1: During the RW, the option to model fishing mortality in SS3 (referred to as the "F method") was modified. The model was initially set to F method 3 (Hybrid F), which treats fishing mortality as tuning coefficients that closely match the input catch data, rather than estimating them as free model parameters. However, early model runs (in the AW report) showed a sensitivity: the model fit the catch tightly but poorly fit the index of abundance. In response, the RP asked the Analyst Team to explore how different weightings of the catch and index data affected model results - using $SE = 0.3$ to increase the influence (tighter fit) and $SE = 2$ to decrease it (looser fit). To enable flexibility in fitting the catch data, the Analyst Team switched to F method 2, which uses the Baranov equation and estimates fishing mortality for each year.

- Modification 2: The standard error units for the NCRMP surveys in SS3 were incorrectly specified in the AW report, but this was fixed during the RW.
- Modification 3: The St. Thomas/St. John and Puerto Rico Yellowtail Snapper models were supposed to have a single sex configuration, but two sexes were turned on for all model runs. The Analyst Team fixed this during the RW.

New base models were created for each of the stock assessments (see Appendix 1 for the list of base cases). The additional sensitivity tests that the RP requested are also listed in Appendix 1. For all three assessments, the two most critical sensitivity tests were i) the trade-off between fitting the commercial catch time series versus fishery independent surveys (NCRMP, DCRMP) and ii) estimation of growth. When the catch standard error was increased from $SE = 0.3$ to $SE = 2$, the growth parameters (e.g., length at maximum age and von Bertalanffy growth coefficient) had to be estimated to achieve convergence.

Another concern regarding the configurations of the three assessment models was the decision to fix steepness at $h = 0.99$. While the Analyst Team justifies this by stating that the stocks are not a closed population and recruitment may not be strongly tied to the local spawning stock biomass, fixing steepness to 0.99 carries consequential assumptions. Fixing steepness has significant implications for derived uncertainty estimates, and it essentially assumes that recruitment is not influenced by the spawning stock biomass (i.e., random recruitment). This is a strong and questionable assumption as it could overestimate stock productivity. By removing the relationship between spawning biomass and recruitment, this approach reduces the model's sensitivity to stock depletion. During the RW, it was found that steepness could not be estimated in the models. The Analyst Team explored fixing the steepness in the combined St. Thomas/St. John and Puerto Rico Yellowtail Snapper assessment based on the FishLife R package[1] (model run PR_STTJ_RW_2).

Below are the details for each assessment:

St. Croix Stoplight Parrotfish: The use of age 30+ as the plus group was questioned given the limited amount of data (i.e., length composition) out to the larger length bins and there were not many older aged fish in the growth data (DW report Figure 2.3). While this specific sensitivity was not explored for St. Croix Stoplight Parrotfish, reducing the plus group to 12+ was explored for the St. Thomas/St. John Yellowtail Snapper (STTJ_RW_3). The Analyst Team showed that there were no differences between the two plus group configurations, and therefore the configuration of plus group = 30+ was retained for Stoplight Parrotfish. After the RW, it remained unclear if other model configurations were correctly specified based on the diagnostics

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[1] Thorson, J.T., Maureaud, A.A., Frelat, R., Mérigot, B., Bigman, J.S., Friedman, S.T., Palomares, M.L.D., Pinsky, M.L., Price, S.A., Wainwright, P., 2023. Identifying direct and indirect associations among traits by merging phylogenetic comparative methods and structural equation models. Methods Ecol. Evol. https://doi.org/10.1111/2041-210X.14076

(see more details in *TOR 4*). For example, the standard errors around the estimates of fishing mortality were high, indicating that the model was not able to estimate fishing mortality well. This could either be an indication of model misspecification or data quality issues (i.e.,, there is not enough contrast in the length composition data to effectively separate the effects of recruitment vs mortality). There was also poor convergence of F_{MSY} in both model runs (STX_RW_1 and STX_RW_2). It should be noted that the Analyst Team is using SPR as the reference point metric for Stoplight Parrotfish; however, this poor convergence is another indication of model misspecification or data quality issues.

St. Thomas/St. John Yellowtail Snapper: The use of dome-shaped selectivity for the two fishery-independent surveys (NCRMP and DCRMP) was questioned as the assumption has strong implications for the representations of large fish in the population and the fishery. Additionally, the choice of age 26+ as the plus group was questioned given the limited amount of data (i.e., length composition) out to the larger length bins and the smaller number of older fish in the growth data in the DW report. It appears that the larger plus group may have influenced the estimation of selectivity, so the RP asked the Analyst Team to reduce the plus group (Analyst Team chose plus group = 12+) for a model run (STTJ_RW_3). The Analyst Team found no differences between the two plus group configurations, and the shape of selectivity for NCRMP and DRMP remained unchanged. As a result, the plus group configuration of 26+ and dome-shaped selectivity were retained for Yellowtail Snapper (including the Puerto Rico stock). After the RW, it remained unclear if other model configurations were correctly specified based on the diagnostics (see more details in *TOR 4*). Similar issues to those observed with the St. Croix Stoplight Parrotfish model were evident for this model as well, including high uncertainty around fishing mortality and recruitment estimates and poor convergence of F_{MSY}.

Puerto Rico Yellowtail Snapper: The RP raised concerns about the use of dome-shaped selectivity for the NCRMP survey and the choice of 26+ as the plus group. These choices were retained based on the additional model runs from the St. Thomas/St. John model. After the RW, it remained unclear if other model configurations were correctly specified based on the diagnostics (see more details in *TOR 4*). Although this assessment included longer time series than the St. Thomas/St. John assessment, the higher uncertainty around fishing mortality and recruitment estimates suggests that the data may not be able to differentiate between these two processes, indicating a potential data quality issue. Similar issues to those observed with the St. Croix Stoplight Parrotfish and St. Thomas/St. John Yellowtail Snapper models were evident for this model as well, including high uncertainty around fishing mortality and recruitment estimates and poor convergence of F_{MSY}.

2.c. Are the methods appropriate given the available data?

St. Croix Stoplight Parrotfish: The RP was concerned about the short time series (commercial catch, length composition, index of abundance). While SS3 is a flexible and powerful stock assessment model, its performance depends on having sufficient data to inform the model. In this case, data appear insufficient to support the model's complexity even with data-limited/moderate settings. There are too many uncertainties about key parameters (e.g., initial equilibrium catch, natural mortality, steepness, etc.) and population processes (e.g., growth, recruitment). Additionally, only five years of survey index data were available, along with one super-year period that includes just 66 TIP trips over the entire time series for commercial length composition (with no age composition). Even though SS3 allows length composition only configurations, SS3 is ultimately an age-structured model that converts lengths to ages, which this assessment does not have enough information or data for. Sensitivity analyses (base model **m3_v7**, STX_RW_1, STX_RW_2) conducted during the RW also showed how sensitive model outputs were to the trade-off of fits between the commercial catch and NCRMP survey and estimation of growth parameters. The two model runs also showed opposite signals in overfishing and overfished statuses, also indicating the sensitivity of the model. The data was not sufficient enough for the Analyst Team to produce a final assessment model.

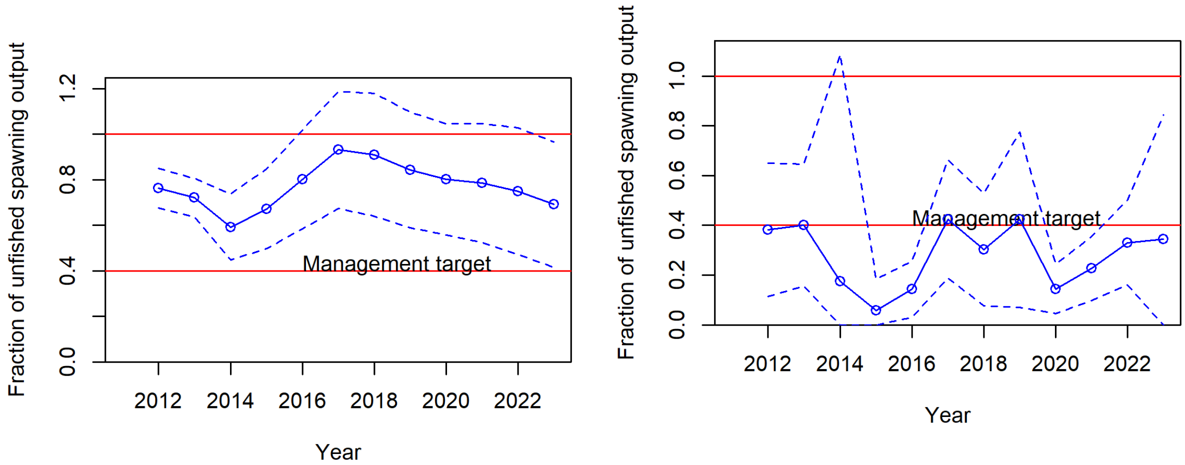
St. Thomas/St. John Yellowtail Snapper: Similar to the St. Croix Stoplight Parrotfish stock assessment, the RP was concerned about the short time series and data appear insufficient to support the complexity of SS3. There are too many uncertainties about key parameters (e.g., initial equilibrium catch, natural mortality, steepness, etc.) and population processes (e.g., growth, recruitment). Only 3-5 years of fishery-independent survey and length composition data (NCRMP and DCRMP) were available, along with one super-year period for commercial length composition (due to low sample sizes). Even though SS3 allows length composition only configurations, SS3 is ultimately an age-structured model that converts lengths to ages, which this assessment does not have enough information or data for. Sensitivity analyses (base model **m3_v19**, STTJ_RW_1, STTJ_RW_2, STTJ_RW_3) conducted during the RW also showed how sensitive the model outputs were to the trade-off of fits between the commercial catch and NCRMP + DCRMP surveys and estimation of growth parameters. The data were not sufficient enough for the Analyst Team to produce a final assessment model.

Puerto Rico Yellowtail Snapper: While longer time series were available for the Puerto Rico Yellowtail Snapper stock assessment, model diagnostics (e.g., standard errors on key parameters, parameters hitting bounds, poor convergence in F_{MSY}) indicate that either the model was not configured correctly or SS3 may still be too complex given the data quality. Although SS3 allows length composition only configurations, it is still ultimately an age-structured model that converts lengths to ages. Sensitivity analyses (base model **m3_v31**, PR_RW_1, PR_RW_2, PR_RW_3, PR_RW_4) conducted during the RW showed how sensitive model outputs were to the trade-off of fits between the commercial catch and NCRMP + NCRMP La Parguera surveys (the latter covering an older, smaller NCRMP survey domain time series from 2002-2012) and estimation of growth parameters. The RP suggested that the Analyst Team investigate combining the St. Thomas/St. John and Puerto Rico Yellowtail Snapper assessments instead of further revising the Puerto Rico assessment. Given that it is unclear if the model is sensitive because of model misspecification or data quality issues, and considering the sufficient length of data, it remains uncertain if SS3 is an appropriate model for this assessment.

3. Evaluate the assessment findings with respect to the following:

3.a. Can the results be used to inform management in the U.S. Caribbean (i.e., develop annual catch recommendations)?

St. Croix Stoplight Parrotfish: The RP concluded that the model results cannot be used to inform management of St. Croix Parrotfish stock. The additional model runs requested by the reviewers highlighted that the model outcomes (i.e., stock status) were highly dependent on the decisions made about the model assumptions about catch uncertainty (fit between catch vs index of abundance) and estimation of the von Bertalanffy growth model parameters. The model produced conflicting results, indicating either an unfished or overfished stock (Figure 1), along with vastly different trends in key metrics such as numbers at age and fishing mortality.



(a) STX_RW_1 (base model)

(b) STX_RW_2 (SE = 2 and estimated growth)

Figure 1: Depletion level (i.e., fraction of unfished spawning output) estimated by the base run (a) and sensitivity run (b).

There were also concerning patterns (e.g., likelihood profiles, variances in fishing mortality) that further underscore the model's instability. Given the limited data, there was a conflict among the index of abundance, length composition, and commercial landings datasets, which contributed to the challenges in the assessment model that cannot be easily resolved.

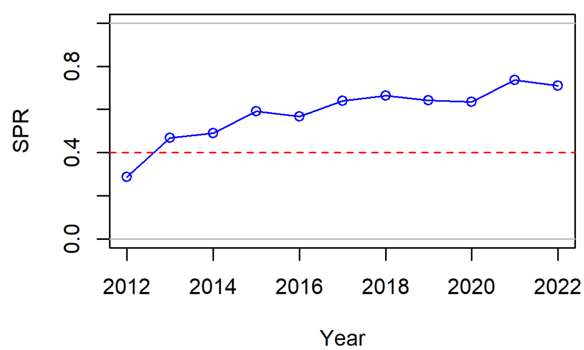
Additionally, the current management framework is based on setting fishing opportunities for a species complex, which includes two indicator species (Stoplight and Redtail Parrotfish), neither of which is currently assessed using analytical models. Incorporating an analytical assessment for Stoplight Parrotfish alone would require adjustments to the management framework to accommodate the use of such results for only one species, which is not a straightforward task. The RP is unsure of how the management system would need to be modified to allow for this incorporation of stock complex, adding further uncertainty to the feasibility of using current results for management advice and purposes.

As mentioned in *TOR 2*, SS3 seems too complex for this stock and fishery. The RP suggests using data-poor/limited methods, which may be more appropriate in line with the data availability, size of the fishery, and information about the stock.

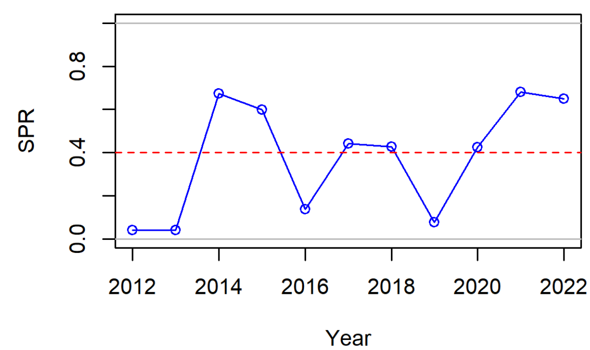
St. Thomas/St. John Yellowtail Snapper: This assessment is undermined by a short and fragmented time series across key data streams (i.e., length composition, survey indices, and commercial landings), which limited the ability of the model to characterize population dynamics robustly. Additionally, the stock unit definition for Yellowtail Snapper remains uncertain, adding ambiguity that could lead to spurious or misleading model outcomes.

Diagnostics (e.g., likelihood profiles, jitter analyses, variance of fishing mortality and recruitment) revealed instability and sensitivity of the model. The model was highly dependent on the fits between the catch and index of abundance, as well as the ability to estimate growth. The two fishery-independent surveys (NCRMP and DCRMP) had conflicting signals, which cannot be reconciled within the current modeling framework without arbitrarily favoring one survey over the other.

The three model runs converged to a similar SPR and fishing intensity ($1 - SPR$), suggesting that the stock is not overfished nor undergoing overfishing. However, in the second run (STTJ_RW_2), which integrated higher catch SEs and estimated growth, the model outputs showed high uncertainty in SPR values, and the stock status oscillated between underfished and overfished statuses before 2022 (Figure 2). Additionally, the temporal trends in overfished status were inconsistent between model runs.



(a) STTJ_RW_1 (base model)



(b) STTJ_RW_2 (SE = 2 and estimated growth)

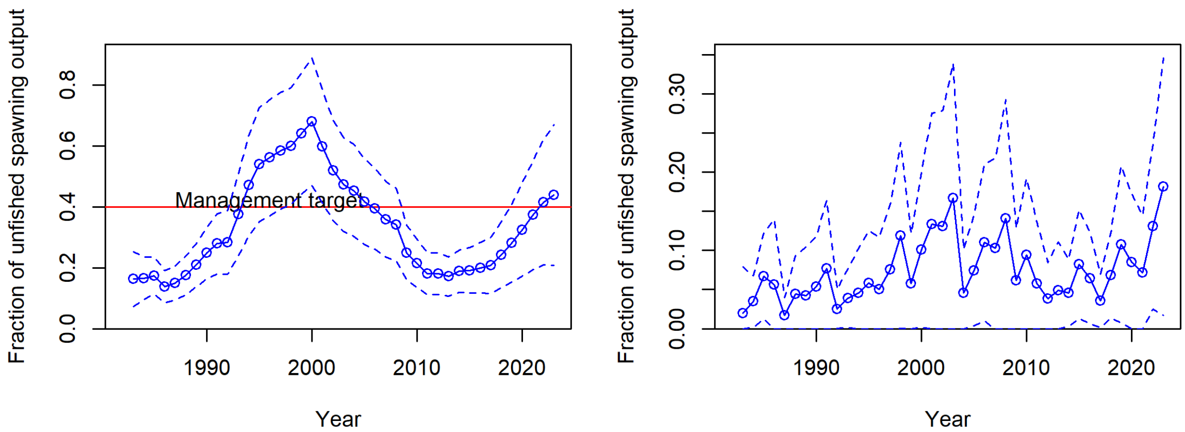
Figure 2: Spawning Potential Ratio (SPR) estimated by the base run (a) and sensitivity run (b).

Given these limitations, the assessment results are not sufficiently robust to support the development of reliable annual catch limits or other management measures for the St. Thomas/St. John Yellowtail Snapper.

Puerto Rico Yellowtail Snapper: The current assessment for Puerto Rico Yellowtail Snapper does not support the development of annual catch recommendations. Despite having a longer time series compared to the St. Thomas/St. John assessment, the model exhibited instability and high sensitivity, as demonstrated by the diagnostics (e.g., likelihood profiles, jitter analyses, and large variances in fishing mortality and recruitment). These indicators raised concerns about the model's ability to provide reliable stock status estimates.

Although the issue of stock unit definition is less concerning than in the St. Thomas/St. John assessment due to the better spatial coverage of the data, the stock unit is still a large uncertainty for the Puerto Rico assessment. The model also faced unresolved data conflicts between different data sources, particularly between commercial catch, length composition, and the fishery-independent survey.

Although all four model runs converged to a similar SPR and fishing intensity (roughly around the management target), this convergence masked significant historical variability, including periods of overfishing and overfished statuses. Of particular concern were results in the second model run (PR_RW_2), which incorporated higher catch uncertainty and estimated growth. This model run showed high uncertainty in the SPR estimates (Figure 3).



(a) PR_RW_1 (base model)

(b) PR_RW_2 (SE = 2 and estimated growth)

Figure 3: Depletion level (i.e., fraction of unfished spawning output) estimated by the base run (a) and sensitivity run (b).

Overall, the combination of model sensitivity to different assumptions, data conflicts, and uncertainty in the historical trends limits the assessment's utility for informing robust, science-based management measures.

3.b. Is it likely the stock is overfished? What information helps you reach this conclusion?

3.c. Is it likely the stock is undergoing overfishing? What information helps you reach this conclusion?

St. Croix Stoplight Parrotfish: Unknown stock statuses. The results were too sensitive to model assumptions to allow for a conclusion about stock status. See *TORs 2 and 4*.

St. Thomas/St. John Yellowtail Snapper: Unknown stock statuses. The results were too sensitive to model assumptions to allow for a conclusion about stock status. See *TORs 2 and 4*.

Puerto Rico Yellowtail Snapper: Unknown stock statuses. The results were too sensitive to model assumptions to allow for a conclusion about stock status. See *TORs 2 and 4*.

4. Comment on the degree to which methods used to evaluate uncertainty reflect and capture the significant sources of uncertainty in the population, data sources, and assessment methods. Ensure that the implications of uncertainty in technical conclusions are clearly stated.

SS3 and r4ss provide a set of standard approaches to investigate uncertainties. These tools were applied and presented in the AW report, with a consistent set of diagnostics applied to evaluate model convergence and stability across the three assessments. These diagnostics included checks for convergence (via maximum gradients), correlation analysis, variance evaluation, jitter analysis, residual analysis, retrospective analysis, and likelihood profiles. Additionally, sensitivity tests were conducted. During the RW, the base models from the AW were modified due to configuration errors that were identified (see *TOR 2*). The revised base model and sensitivity runs are documented in Appendix 4. Following the RP's recommendations, a new model combining the St. Thomas/St. John Yellowtail Snapper stocks was developed and presented on the third day of the meeting. It is important to note that the full set of diagnostics were not updated for the new base models agreed upon during the RW or for the combined models. Therefore, the discussions in this report regarding some of the diagnostic tests pertain to the earlier base models (from the AW report). The Analyst Team shared SS3 output files with the RP, which included some diagnostics (e.g., variances, gradients, model fit).

Below are details for each assessment:

St. Croix Stoplight Parrotfish: The old base model (**m3_v7**) was presented on the first day at the RW. Although the model converged (via convergence message, inverted Hessian, and maximum gradient values) and the jitter analysis appeared satisfactory, other diagnostics revealed structural and data-related concerns. A strong correlation was observed between commercial selectivity parameters, which resulted in knife-edge selectivity. It was unclear if this selectivity was plausible. The retrospective patterns showed poor performance, however this is likely due to the low amount of data. The likelihood profiles indicated a conflict between the equilibrium catch and length composition model, indicating that the model struggled with reliably estimating equilibrium catch and the data had limited information on this parameter. Several key uncertainties were identified during the RW, particularly concerning initial equilibrium catch, natural mortality, and steepness. Therefore, this model was found to be highly sensitive, and it is difficult to isolate and clearly identify the most influential sources of uncertainty.

The new base model agreed upon during the RW included modifications described in *TOR 2* (F method 2, corrected survey SE). The RP also recommended several sensitivity analyses, particularly focusing on assumptions around fits of catch vs index (using the input standard errors) and fixing vs estimating growth parameters. These were appropriate steps for testing the sensitivity of the model; however, time constraints of the RW limited exploration of additional uncertainties, such as estimating fixed parameters (e.g., catchability) or testing alternative model structures. The new base model still showed high sensitivity to assumptions about catch uncertainty and the estimation of the von Bertalanffy growth parameters. While the fits to the length composition data were reasonably good, the model was unable to simultaneously fit both the commercial catch data and the survey index of abundance well. The reason why the model was sensitive to assumptions about growth was probably due to the absence of age composition data. There was also poor convergence of F_{MSY}, which suggests that the data may not provide enough contrast to estimate fishing mortality and distinguish between processes of fishing mortality and recruitment. Notably, the two model runs (STX_RW_1 and STX_RW_2) estimated opposite stock statuses (overfished vs underfished), which further complicates interpretation of the model.

While appropriate diagnostics and sensitivity runs were conducted, the combination of model instability and sensitivity and interacting uncertainties made it difficult to confidently attribute outcomes to specific sources. This makes it difficult to reach clear conclusions due to the various sources of uncertainty. Further investigation of model assumptions and configurations, alternative parameterizations, and potential data conflicts is necessary.

St. Thomas/St. John Yellowtail Snapper: The old base model (**m3_v19**) was documented in the AW report and presented on the second day at the RW. While the model converged (via convergence message, inverted Hessian, and maximum gradient values), the jitter analysis showed instability as it did not consistently converge to the same maximum likelihood estimate (MLE), which indicates model misspecification or conflicting data. The likelihood profile for equilibrium catch showed signs of instability, and indicated a conflict between the equilibrium catch and length composition and index datasets. There were also poor retrospective patterns; however, with limited data, it was expected for these patterns to be poor. Several key uncertainties were identified during the RW, particularly concerning initial equilibrium catch, natural mortality, and steepness. Therefore, this model was found to be highly sensitive, and it was difficult to isolate and clearly identify the most influential sources of uncertainty.

The new base model agreed upon during the RW included modifications described in *TOR 2* (F method 2, single sex configuration, corrected survey SE). The RP also recommended several sensitivity analyses, particularly focusing on assumptions around fits of catch vs index (using the input standard errors), fixing vs estimating growth parameters, and reducing the plus group from 26+ to 12+. These were appropriate steps for testing the sensitivity of the model; however, time constraints of the RW limited exploration of additional uncertainties, such as estimating fixed parameters (e.g., catchability) or testing alternative model structures. The new base model still showed high sensitivity to assumptions about catch uncertainty and the estimation of the von Bertalanffy growth parameters. The model was unable to simultaneously fit the commercial catch data and the two surveys (NCRMP and DCRMP) well. There was conflict between NCRMP and DCRMP, and between the commercial catch and length composition datasets, all indicating uncertainty in population scaling and trends. The reason why the model was sensitive to assumptions about growth was probably due to the absence of age composition data. There was also poor convergence of F_{MSY}, which suggests that the data may not provide enough contrast to estimate fishing mortality and distinguish between processes of fishing mortality and recruitment.

The combination of model instability and interacting uncertainties make it difficult to confidently attribute outcomes to specific sources. Drawing clear conclusions remains challenging. To address this, improvements to data quality, extension of the time series (e.g., incorporate old data back in), and combing this stock with the Puerto Rico stock are recommended.

Puerto Rico: The old base model (**m3_v31**) was documented in the AW report and presented on the second day at the RW. While the model converged (via convergence message, inverted Hessian, and maximum gradient values), the jitter test showed instability as it did not consistently converge to the same MLE, which indicates model misspecification or conflicting data. The likelihood profiles showed instability in the total likelihood and equilibrium catch, indicating that the model did not find the MLE. There were also poor retrospective patterns and showed some different patterns at the terminal year estimates, indicating either model misspecification or data quality issues. Several key uncertainties were identified during the RW, particularly concerning initial equilibrium catch, natural mortality, and steepness. Therefore, this model was found to be highly sensitive, and it is difficult to isolate and clearly identify the most influential sources of uncertainty.

The new base model agreed upon during the RW included modifications described in *TOR 2* (F method 2, single sex configuration, corrected survey SE). The RP also recommended several sensitivity analyses, particularly focusing on assumptions around fits of catch vs index (using the input standard errors), fixing vs estimating growth parameters, inclusion old NCRMP survey data (La Parguera survey), and modeling commercial selectivity as splines. These were appropriate steps for testing the sensitivity of the model; however, time constraints of the RW limited exploration of additional uncertainties, such as estimating fixed parameters (e.g., catchability) or testing alternative model structures. The model run with the inclusion of the historical survey time series failed to converge (PR_RW_3). Overall, the new base model and model runs showed high sensitivity to assumptions about catch uncertainty and the estimation of the von Bertalanffy growth parameters. The model was unable to simultaneously fit the commercial catch data and the two surveys (NCRMP and La Parguera NCRMP) well. There was conflict between the commercial catch, length composition, and survey indices, indicating uncertainty in population scaling and trends. The reason why the model was sensitive to assumptions about growth was probably due to the absence of age composition data. Strong correlations among the growth parameters were found, indicating that growth could not be reliably estimated (PR_RW_4). There was also poor convergence of F_{MSY}, which suggests that the data may not provide enough contrast to estimate fishing mortality and distinguish between processes of fishing mortality and recruitment.

The combination of model instability and interacting uncertainties make it difficult to confidently attribute outcomes to specific sources. Drawing clear conclusions remains challenging. To address this, improvements to data quality, extension of the time series (e.g., incorporate old data back in), and combing this stock with the St. Thomas/St. John stock are recommended.

Combined St. Thomas/St. John and Puerto Rico Yellowtail Snapper: The RP recommended building a combined model using data from both St. Thomas/St. John and Puerto Rico due to uncertainties in the model structure, the recognition that the stocks from St. Thomas/St. John and Puerto Rico are part of a larger population, the short time series available for the stock in St. Thomas/St. John, and looking into the survey indices that peaked in 2012 in Puerto Rico and in 2013 in St. Thomas/St. John. Efforts were initiated, presented and discussed during the RW. While the first combined model run (PR_STTJ_RW_1) did not converge, a second attempt (PR_STTJ_RW_2, fixed selectivity and steepness) successfully converged.

Despite showing some instability, and without evaluating the full set of diagnostics, this run provided a good first step to developing a stock assessment model for the Yellowtail Snapper stock in St. Thomas/St. John and Puerto Rico to inform management of this fishery in the U.S. Caribbean. Results of this can be found in the Addendum of the AW report.

5. Consider the research recommendations provided by the Data and Assessment workshops and make any additional recommendations or prioritizations warranted. Clearly denote research and monitoring that could improve the reliability of, and information provided by, future assessments.

The RP supports the research recommendations outlined in the DW and AW reports for the US Caribbean Stoplight Parrotfish and Yellowtail Snapper assessment processes. Based on those recommendations, the following were identified as high priority and are listed in order of importance:

St. Croix Stoplight Parrotfish:

- Short term:
  - Investigate the applicability of hindcasting for all parrotfish combined or other applicable future assessments.
    - For example, the proportion of Stoplight Parrotfish could be investigated from 2012, and a mean of that proportion could be applied to split the catches prior to the species-specific split.
    - Conduct focused research on historical catches and fishing history to inform and constrain early model conditions.
  - Further evaluate natural mortality and growth assumptions.
    - Explore the use of natural mortality at age.
  - Investigate the relationship between the catch and effort of the diving data to document the disconnect between time diving and species-specific targeted effort for species considered bycatch or opportunistically targeted.
  - Investigate stock connectivity to better understand local versus regional recruitment dynamics and their implications for informing steepness.
- Long term:
  - Ensure statistically robust sample sizes of small and large size classes of fish.
  - Maintain and expand commercial catch monitoring programs. Expand port sampling and other fishery-dependent data collection to fill gaps in length composition and effort data.
    - Increase collection efforts to increase sample size in TIP.
  - There are several biases in the current NCRMP survey design. Notably, the survey is conducted over a limited time frame (for two weeks every two years), which would miss seasonal or environmental changes. Additionally, the survey may not be adequately capturing the full size distribution of the population (e.g., upwelling/high turbulence areas that have high density of larger fish, underrepresentation of young of the year, etc.). The RP support the following recommendations for the NCRMP survey:
    - Ensure the continuation of fishery-independent survey programs (e.g., National Coral Reef Monitoring Program) with consistent spatial and temporal coverage.
    - Expand fishery-independent survey time series and resolution.
    - Investigate the potential impact of changes in habitat on the surveys.
    - There is an association between the habitat and fish, but we should consider whether the habitat changes the spatial distribution of fish.

        - Investigate highly turbid areas that are currently not surveyed.
        - Expand fishery-independent surveys to seagrass/mangrove habitats since these areas are essential for recruitment.
    - Conduct recreational fishery port sampling surveys to determine removals due to recreational fishing.

St. Thomas/St. John and Puerto Rico Yellowtail Snapper:

- Short term:
    - Investigate the applicability of hindcasting for all parrotfish combined or other applicable future assessments (for St. Thomas/St. John commercial catch data).
    - Further evaluate natural mortality and growth assumptions.
        - Explore the use of natural mortality at age.
    - Explore parameterizing retention to improve selectivity of the commercial fleet and interpret the apparent high selectivity of larger individuals that are poorly estimated by the current models.
    - Request for USVI fisher to provide their logbooks to further investigate the fisher behavior as an index assignment for CPUE.
    - Investigate stock connectivity to better understand local versus regional recruitment dynamics and their implications for informing steepness.
- Long term:
    - There are several biases in the current NCRMP survey design. Notably, the survey is conducted over a limited time frame (for two weeks every two years), which would miss seasonal or environmental changes. Additionally, the survey may not be adequately capturing the full size distribution of the population (e.g., upwelling/high turbulence areas that have high density of larger fish, underrepresentation of young of the year, etc.). Currently, there is limited DCRMP data, which would target larger, older fish that are in deeper waters and help complement the NCRMP survey. The RP support the following recommendations for the NCRMP survey:
        - Ensure the continuation of fishery-independent survey programs (e.g., National Coral Reef Monitoring Program) with consistent spatial and temporal coverage.
        - Expand fishery-independent survey time series and resolution.
        - Continue DCRMP work in the future.
        - Look into National Parks transect data and compare it to the NCRMP data.
    - Maintain and expand commercial catch monitoring programs. Expand port sampling and other fishery-dependent data collection to fill gaps in length composition and effort data.
        - Increased port sampling is needed in St. Thomas and St. John to enable analyses required or quantifying removals.
        - Increase collection efforts to increase sample size in TIP.
    - Conduct recreational fishery port sampling surveys to determine removals due to recreational fishing.

The RP also recommends the following:

- St. Croix Stoplight Parrotfish.
    - Consider the entire stock complex rather than single species for stock assessment.

    - Population structure studies could be conducted through genetics, tagging, fish larvae, otolith microchemistry, or modeling.
    - Improve otolith samples.
- St. Thomas/St. John and Puerto Rico Yellowtail Snapper.
    - Further investigate the population structure of those two stocks.
        - Population structure studies could be conducted through genetics, tagging, fish larvae, otolith microchemistry, or modeling.
    - Improve otolith samples.
    - Reconsider not removing old NCRMP survey data (before 2013/2014; La Parguera).

6. Provide guidance on key improvements in data or modeling approaches that should be considered when scheduling the next assessment.

Key improvements in data or modeling approaches are:

St. Croix Stoplight Parrotfish:
- Consider the entire stock complex rather than single species for stock assessment.
- Increase the time series for all key data streams: commercial catch, commercial length compositions, NCRMP index of abundance, and NCRMP length compositions.
- Consider using model-free approaches (e.g., harvest control rules based on life history and/or fisheries data) or data-limited methods.
- If there are enough otolith samples, try to convert length compositions into ages. The conditional age-at-length approach in SS3 allows the incorporation of length and age data.

St. Thomas/St. John Yellowtail Snapper:
- If there are enough otolith samples, try to convert length compositions into ages. The conditional age-at-length approach in SS3 allows the incorporation of length and age data.
- Consider using model-free approaches (e.g., harvest control rules based on life history and/or fisheries data) or data-limited methods.
- Explore model-based approaches for analyzing index data, such as spatial-temporal models.
    - Potential to combine the NCRMP indices from both islands.
- Combine the St. Thomas/St. John and Puerto Rico assessments: This combined SS3 model seems like a good path forward for future assessments. Right now, this combined model cannot be used for management advice because of the instability and sensitivity of the model. With further tweaking of model configurations, it may be possible to obtain a converged, stable model.

7. Provide recommendations on possible ways to improve the SEDAR process.

The SEDAR process was well organized, and the meeting was efficient. All background material was provided to the RP on time (two weeks before the workshop). There should be additional stock assessment experts in all workshops (including the DW). The experts would have helped validate the amount of data that would need to be retained for the stock assessment. For example, for the St. Thomas/St. John and Puerto Rico Yellowtail Snapper, a lot of older survey data were thrown away due to issues with the different survey domains (regionally restricted to island-wide) and different sampling schemes (belt transect vs stationary point counts), even though a calibration analysis was conducted to integrate these changes (Grove et al. 2022).

Four days may have been enough to review three separate assessments. It would have been enough if there were no additional model runs required. The Analyst Team were highly constrained by the time pressure.

8. Prepare a Peer Review Summary summarizing the Panel's overall conclusions and recommendations.

This report is the individual report of this reviewer. A summary report highlighting overall conclusions and recommendations has been prepared jointly by the RP. For the summary report, this reviewer specifically drafted the parts about the model (TOR 2) and contributed to other TORs.

Appendix 1

Document #	Title	Authors	Date Submitted
Documents Prepared for the Data Workshop			
SEDAR84-DW-01	Radiocarbon Age Validation for Caribbean Parrotfishes	Jesus Rivera Hernández and Virginia Shervette	9 January 2024 Updated: 5 March 2024
SEDAR84-DW-02	SEDAR 84 Commercial fishery landings of Yellowtail Snapper (*Ocyurus chrysurus*) in St. Thomas and St. John, US Caribbean, 2012-2022	Stephanie Martínez Rivera, Kimberley Johnson, and M. Refik Orhun	18 January 2024 Updated: 21 February 2024
SEDAR84-DW-03	SEDAR 84 Commercial fishery landings of Stoplight Parrotfish (*Sparisoma viride*) in St. Croix, US Caribbean, 2012-2022	Stephanie Martínez Rivera, Kim Johnson, and M. Refik Orhun	18 January 2024 Updated: 21 February 2024
SEDAR84-DW-04	Analysis of SEAMAP-C hook and line survey data for yellowtail snapper in Puerto Rico (1992-2020)	Walter Ingram, Refik Orhun, and Carlos M. Zayas Santiago	19 January 2024
SEDAR84-DW-05	Summary of Management Actions for Stoplight Parrotfish (*Sparisoma viride*) from St. Croix (1985 - 2021) as Documented within the Management History Database	G. Malone	22 January 2024 Updated: 21 February 2024
SEDAR84-DW-06	Summary of Management Actions for Yellowtail Snapper (*Ocyurus chrysurus*) from Puerto Rico and St. Thomas/St. John (1985 - 2021) as Documented within the Management History Database	G. Malone	22 January 2024 Updated: 21 February 2024
SEDAR84-DW-07	Addressing Critical Life History Gaps for U.S. Caribbean Yellowtail Snapper: Bomb radiocarbon of age estimation method and a summary	Virginia Shervette, Jesus Rivera Hernandez, Sarah Zajovits	22 January 2024

	of the regional demographic patterns for size, age, and growth		Updated: 15 February 2024
SEDAR84-DW-08	U.S. Caribbean Yellowtail Snapper Population Demographics, Growth, and Reproductive Biology: Addressing Critical Life History Gaps	Virginia Shervette, Jesus Rivera Hernandez, Noemi Pena Alvarado	18 February 2024
SEDAR84-DW-09	SEDAR 84 Trip Interview Program (TIP) Size Composition Analysis of Yellowtail Snapper (*Ocyurus chrysurus*) in Puerto Rico, U.S. Caribbean, 1983-2022	Katherine Godwin, Adyan Rios, Kyle Dettloff	21 February 2024
SEDAR84-DW-10	SEDAR 84 Trip Interview Program (TIP) Size Composition Analysis of Yellowtail Snapper (*Ocyurus chrysurus*) in St. Thomas/St. John, U.S. Caribbean, 1983-2022	Katherine Godwin, Adyan Rios, Kyle Dettloff	21 February 2024
SEDAR84-DW-11	SEDAR 84 Trip Interview Program (TIP) Size Composition Analysis of Stoplight Parrotfish (*Sparisoma viride*) in St. Croix, U.S. Caribbean, 1983-2022	Katherine Godwin, Adyan Rios, Kyle Dettloff	21 February 2024
SEDAR84-DW-12	SEDAR 84 Commercial fishery landings of Yellowtail Snapper (Ocyurus chrysurus) in Puerto Rico, US Caribbean, 2012-2022	Stephanie Martínez Rivera, Kimberley Johnson, and M. Refik Orhun	21 February 2024
SEDAR84-DW-13	Length-Frequency Snapshot of Yellowtail Snapper from Image Analysis in Puerto Rico	Derek Soto, Alejandro Carrera Montalvo, Todd Gedamke	22 February 2024
SEDAR84-DW-14	Fishery-Independent Reef Fish Visual Survey Population Density and Length Composition for Stoplight Parrotfish in the St. Croix	Laura Jay W. Grove, Jeremiah Blondeau, and Jerald S. Ault	16 February 2024
SEDAR84-DW-15	Fishery-Independent Reef Fish Visual Survey Population Density and Length Composition for Yellowtail Snapper in the Puerto Rico	Laura Jay W. Grove, Jeremiah Blondeau, and Jerald S. Ault	16 February 2024

SEDAR84-DW-16	Fishery-Independent Reef Fish Visual Survey Population Density and Length Composition for Yellowtail Snapper in St. Thomas/John	Laura Jay W. Grove, Jeremiah Blondeau, and Jerald S. Ault	16 February 2024
Documents Prepared for the Assessment Process			
SEDAR84-AP-01	Report on the status of U.S. Caribbean stoplight parrotfish *Sparisoma viride* age, growth, and reproductive biology for the SEDAR84 Stock Assessment	Jesús M. Rivera Hernández and Virginia Shervette	6 July 2024
SEDAR84-AP-02			
SEDAR84-AP-03			
SEDAR84-AP-04			
Documents Prepared for the Review Workshop			
SEDAR84-RW-01	SEDAR 84 Public Comment	Public Comment	25 July 2025
Final Stock Assessment Reports			
SEDAR84-SAR1	US Caribbean Yellowtail Snapper – Puerto Rico	SEDAR 84 Panels	
SEDAR84-SAR2	US Caribbean Yellowtail Snapper – St. Thomas & St. John	SEDAR 84 Panels	
SEDAR84-SAR3	US Caribbean Stoplight Parrotfish – St. Croix	SEDAR 84 Panels	
Reference Documents			
SEDAR84-RD01	Selectividad Pesquera del Buche (Seno) en Chinchorros de Playa con mallas de 2.5, 2.0 y 1.0 pulgadas, a lo largo de la costa Oeste y Noreste de la Isla de Puerto Rico	Edgardo Ojeda Serrano, Omayra Hernandez Vak, and Samuel Garcia Vazquez	

SEDAR84-RD02	Monitoring of Mesophotic Habitats and Associated Benthic and Fish/Shellfish Communities from Abrir la Sierra, Bajo de Sico, Tourmaline, Isla Desecheo, El Seco and Boya 4, 2018-20 Survey	Jorge R. Garcia-Sais, Stacey Williams, Evan Tuohy, Jorge Sabater-Clavell and Milton Carlo
SEDAR84-RD03	Population Size, Growth, Mortality and Movement Patterns of Yellowtail Snapper (*Ocyurus chrysurus*) in the U.S. Virgin Islands Determined Through a Multi-institutional Collaboration	St. Thomas Fishermen's Association
SEDAR84-RD04	S8-DW-09: An Update on the Reported Landings, Expansion Factors and Expanded Landings for the Commercial Fisheries of the United States Virgin Islands (with Emphasis on Spiny Lobster and the Snapper Complex)	Mónica Valle-Esquivel and Guillermo Díaz
SEDAR84-RD05	SEDAR68-DW-13: Marine Recreational Information Program Metadata for the Atlantic, Gulf of Mexico, and Caribbean regions	Vivian M. Matter and Matthew A. Nuttall
SEDAR84-RD06	Nearshore habitats as nursery grounds for recreationally important fishes, St. Croix, U S. Virgin Islands	Ivan Mateo
SEDAR84-RD07	Seasonal Patterns of Juvenile Fish Abundance in Seagrass Meadows in Teague Bay Bank Barrier Reef Lagoon, St. Croix, U.S. Virgin Islands	Ivan Mateo and William J. Tobias
SEDAR84-RD08	The Distribution of Herbivorous Coral Reef Fishes within Fore-reef Habitats: the Role of Depth, Light and Rugosity	Michael Nemeth and Richard Appeldoorn
SEDAR84-RD09	The Use of Vertical Distribution Data in the Identification of Potential Spawning Sites and Dispersal Pathways for Parrotfish (Genera *Sparisoma* and *Scarus*)	Kristen A. Ewen

	within Territorial Waters of the U.S. Virgin Islands	
SEDAR84-RD10	Evaluating the impact of invasive seagrass *Halophila stipulacea* on settlement, survival, and condition factor of juvenile yellowtail snapper, *Ocyurus chrysurus*, in St. Thomas, USVI	Sophia Victoria Costa
SEDAR84-RD11	The Commercial Yellowtail Snapper Fishery off Puerto Rico, 1983-2003	Nancie J. Cummings
SEDAR84-RD12	S8-DW-08: The commercial reef fish fishery in Puerto Rico with emphasis on yellowtail snapper, *Ocyurus chrysurus*: landings and catch per unit of effort from 1983 through 2003	Nancie J. Cummings and Daniel Matos-Caraballo
SEDAR84-RD13	The Net Buyback and Ban in St. Croix, U.S. Virgin Islands	Juan J. Agar, Flavia Tonioli, Chloe Fleming
SEDAR84-RD14	Best practices for defining spatial boundaries and spatial structure in stock assessment	Steven X. Cadrin[a], Daniel R. Goethel[b], Aaron Berger[c], Ernesto Jardim[d]
SEDAR84-RD15	Good practices, trade-offs, and precautions for model diagnostics in integrated stock assessments	Maia S. Kapur [a,*], Nicholas Ducharme-Barthe [b], Megumi Oshima [b], Felipe Carvalho [b]

Appendix 2

Performance Work Statement (PWS)
National Oceanic and Atmospheric Administration (NOAA)
NOAA Fisheries
Center for Independent Experts (CIE) Program
External Independent Peer Review

SEDAR 84 US Caribbean Yellowtail Snapper and Stoplight Parrotfish
July 15-18, 2025

Background

The NOAA Fisheries is mandated by the Magnuson-Stevens Fishery Conservation and Management Act, Endangered Species Act, and Marine Mammal Protection Act to conserve, protect, and manage our nation's marine living resources based upon the best scientific information available (BSIA). NOAA Fisheries science products, including scientific advice, are often controversial and may require timely scientific peer reviews that are strictly independent of all outside influences. A formal external process for independent expert reviews of the agency's scientific products and programs ensures their credibility. Therefore, external scientific peer reviews have been and continue to be essential to strengthening scientific quality assurance for fishery conservation and management actions.

Scientific peer review is defined as the organized review process where one or more qualified experts review scientific information to ensure quality and credibility. These expert(s) must conduct their peer review impartially, objectively, and without conflicts of interest. Each reviewer must also be independent from the development of the science, without influence from any position that the agency or constituent groups may have. Furthermore, the Office of Management and Budget (OMB), authorized by the Information Quality Act, requires all federal agencies to conduct peer reviews of highly influential and controversial science before dissemination, and that peer reviewers must be deemed qualified based on the OMB Peer Review Bulletin standards[2].

Scope

The **SouthEast Data, Assessment, and Review (SEDAR)** is the cooperative process by which stock assessment projects are conducted in NMFS' Southeast Region. SEDAR was initiated to improve planning and coordination of stock assessment activities and to improve the quality and reliability of assessments.

SEDAR 84 will be a compilation of data, an assessment of the stock, and CIE assessment review conducted for U.S. Caribbean yellowtail snapper and stoplight parrotfish. The review workshop provides an independent peer review of SEDAR stock assessments. The term review is applied broadly, as the review panel may request additional analyses, error corrections and sensitivity runs of the assessment models provided by the assessment panel. The review panel is ultimately responsible for ensuring that the best possible assessment is provided through the SEDAR

[2] https://www.whitehouse.gov/wp-content/uploads/legacy_drupal_files/omb/memoranda/2005/m05-03.pdf

process. The stock assessed through SEDAR 84 is within the jurisdiction of the Caribbean Fisheries Management Council and the Commonwealth of Puerto Rico and the Territory of the U.S. Virgin Islands.

The specified format and contents of the individual peer review reports are found in **Annex 1**. The Terms of Reference (ToR) of the peer review are listed in **Annex 2**. The tentative agenda of the panel review meeting is attached in **Annex 3.**

Requirements
NMFS requires three reviewers to conduct an impartial and independent peer review in accordance with the Performance Work Statement (PWS), OMB guidelines, and the ToRs below. The reviewers shall have expertise in data limited assessment methods and a working knowledge of Stock Synthesis as applied to model data limited species. The chair, who is in addition to the three reviewers, will not be provided by the CIE. Although the chair will be participating in this review, the chair's participation (e.g., labor and travel) is not covered by this contract.

Each reviewer will write an individual review report in accordance with the PWS, OMB Guidelines, and the TORs below. Modifications to the PWS and TORs cannot be made during the peer review, and any PWS or TORs modifications prior to the peer review shall be approved by the Contracting Officer's Representative (COR) and the CIE contractor. All TORs must be addressed in each reviewer's report.

Tasks for Reviewers

1) Pre-review Background Documents: Review the following background materials and reports prior to the review: Working papers, reference documents, and the Data Workshop and Assessment Process Reports will be available on the SEDAR website: https://sedarweb.org/assessments/sedar-84-caribbean-yellowtail-snapper-and-stoplight-parrotfish/

2) Attend and participate in an in-person review meeting. The meeting will consist of presentations by NOAA and other scientists, stock assessment authors and others to facilitate the review, to answer any questions from the reviewers, and to provide any additional information required by the reviewers.
3) After the review meeting, reviewers shall conduct an independent peer review report in accordance with the requirements specified in this PWS, OMB guidelines, and ToRs, in adherence with the required formatting and content guidelines. Reviewers are not required to reach a consensus.
4) Each reviewer shall assist the Chair of the meeting with contributions to the summary report.
5) Deliver their reports to the Government according to the specified milestones dates.

Foreign National Security Clearance
When reviewers participate during a panel review meeting at a government facility, the NMFS Project Contact is responsible for obtaining the Foreign National Security Clearance approval for reviewers who are non-US citizens. For this reason, the reviewers shall provide requested

information (e.g., first and last name, contact information, gender, birth date, passport number, country of passport, travel dates, country of citizenship, country of current residence, and home country) to the Project Contact for the purpose of their security clearance, and this information shall be submitted at least 30 days in advance. For additional information, please see the following link: https://www.commerce.gov/osy/programs/foreign-access-management. The contractor is required to use all appropriate methods to safeguard Personally Identifiable Information (PII).

Place of Performance
The place of performance shall be in Fort Lauderdale, FL.

Period of Performance
The period of performance shall be from the time of award through August 2025. Each reviewer's duties shall not exceed **14** days to complete all required tasks.

Schedule of Milestones and Deliverables: The contractor shall complete the tasks and deliverables in accordance with the following schedule.

Schedule	**Milestones and Deliverables**
Within 2 weeks of award	Contractor selects and confirms reviewers
Approximately 2 weeks prior to the review	Contractor provides the pre-review documents to the reviewers
July 15 – 18, 2025	Panel review meeting
Approximately 2 weeks later	Contractor receives draft reports
Within 3 weeks of receiving draft reports	Contractor submits final reports to the Government

* The Peer Review Summary Report will not be submitted to, reviewed, or approved by the Contractor.

Applicable Performance Standards
The acceptance of the contract deliverables shall be based on three performance standards: (1) The reports shall be completed in accordance with the required formatting and content (2) The reports shall address each ToR as specified (3) The reports shall be delivered as specified in the schedule of milestones and deliverables.

Confidentiality and Data Privacy

This contract may require that services contractors have access to Privacy Information. Services contractors are responsible for maintaining the confidentiality of all subjects and materials and may be required to sign and adhere to a Non-disclosure Agreement (NDA).

Travel

All travel expenses shall be reimbursable in accordance with Federal Travel Regulations (Travel resources | GSA), and all contractor travel must be approved by the COR prior to the actual travel. Any travel conducted prior to the receipt of proper written authorization from the COR will be done at the Contractor's own risk and expense. International travel is authorized for this contract. Travel is not to exceed $12,000.00.

Project Contacts

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Annex 1

1. The report must be prefaced with an Executive Summary providing a concise summary of the findings and recommendations, and specify whether the science reviewed is the best scientific information available.
2. The report must contain a background section, description of the individual reviewers' roles in the review activities, summary of findings for each TOR in which the weaknesses and strengths are described, and conclusions and recommendations in accordance with the TORs.
    a. Reviewers must describe in their own words the review activities completed during the panel review meeting, including a brief summary of findings, of the science, conclusions, and recommendations.
    b. Reviewers should discuss their independent views on each TOR even if these were consistent with those of other panelists, but especially where there were divergent views.
    c. Reviewers should elaborate on any points raised in the summary report that they believe might require further clarification.
    d. Reviewers shall provide a critique of the NMFS review process, including suggestions for improvements of both process and products.
    e. The report shall be a stand-alone document for others to understand the weaknesses and strengths of the science reviewed, regardless of whether or not they read the summary report. The report shall represent the peer review of each TOR, and shall not simply repeat the contents of the summary report.
3. The report shall include the following appendices:
    a. Appendix 1: Bibliography of materials provided for review
    b. Appendix 2: A copy of this Performance Work Statement
    c. Appendix 3: Panel membership or other pertinent information from the panel review meeting.

Annex 2

SEDAR 84 U.S. Caribbean Yellowtail Snapper and Stoplight Parrotfish
Review Workshop Terms of Reference
December 2022

Review Workshop Terms of Reference

1. Evaluate the data used in the assessment, addressing the following:
    a. Are data decisions made by the DW and AW sound and robust?
    b. Are data uncertainties acknowledged, reported, and within normal or expected levels?
    c. Are data applied properly within the assessment model?
    d. Are input data series reliable and sufficient to support the assessment approach and findings?
2. Evaluate the methods used to assess the stock, taking into account the available data.
    a. Are methods scientifically sound and robust?
    b. Are assessment models configured properly and used consistent with standard practices?
    c. Are the methods appropriate given the available data?
3. Evaluate the assessment findings with respect to the following:
    a. Can the results be used to inform management in the U.S. Caribbean (i.e., develop annual catch recommendations)?
    b. Is it likely the stock is overfished? What information helps you reach this conclusion?
    c. Is it likely the stock is undergoing overfishing? What information helps you reach this conclusion?
4. Comment on the degree to which methods used to evaluate uncertainty reflect and capture the significant sources of uncertainty in the population, data sources, and assessment methods. Ensure that the implications of uncertainty in technical conclusions are clearly stated.
5. Consider the research recommendations provided by the Data and Assessment workshops and make any additional recommendations or prioritizations warranted. Clearly denote research and monitoring that could improve the reliability of, and information provided by, future assessments.
6. Provide guidance on key improvements in data or modeling approaches that should be considered when scheduling the next assessment.
7. Provide recommendations on possible ways to improve the SEDAR process.
8. Prepare a Peer Review Summary summarizing the Panel’s overall conclusions and recommendations.

Annex 3

SEDAR 84 US Caribbean Yellowtail Snapper and Stoplight Parrotfish Assessment Review
July 15 – 18, 2025
Fort Lauderdale, Florida

Tuesday

8:30 am – 9:00 am	**Introductions and Opening Remarks** *- Agenda Review, TOR, Task Assignments*	**Coordinator**
9:00 am – 12:00 pm	**Assessment Presentations** **-** *Background* **-** *Assessment Data & Methods*	**Analytic Team**
12:00 pm – 1:30 pm	**Lunch Break**	
1:30 pm – 5:30 pm	**Assessment Presentations (continued)** **-** *Assessment Data & Methods* *- Identify additional analyses, sensitivities, corrections*	**Analytic Team**
5:30 pm – 6:00 pm	**Public Comment**	**Chair**

Tuesday Goals**:** Initial assessment presentations completed, sensitivities and modifications identified.

Wednesday

8:30 a.m. – 11:30 pm	**Assessment Presentations (continued)** **-** *Assessment Methods* *- Identify additional analyses, sensitivities, corrections*	**Analytic Team**
11:30 a.m. – 1:00 pm	**Lunch Break**	
1:00 pm – 5:30 pm	**Panel Discussion** *- Review additional analyses, sensitivities* *- Recommendations and comments*	**Chair**
5:30 pm - 6:00 pm	**Public Comment**	**Chair**

Wednesday Goals: Presentations completed, additional sensitivities identified, preferred models selected, Summary report drafts begun.

Thursday

8:30 a.m. – 11:30 pm	**Panel Discussion** *- Review additional analyses, sensitivities* *- Recommendations and comments*	**Chair**
11:30 a.m. – 1:00 pm	**Lunch Break**	
1:00 pm – 5:30 pm	**Panel Discussion**	**Chair**

	- Final sensitivities reviewed.	
5:30 pm - 6:00 pm	**Public Comment**	**Chair**

Thursday Goals: Review final sensitivities, complete assessment work, and finalize discussions.

<u>Friday</u>

8:30 a.m. – 2:00 pm	**Panel Discussion or Work Session** *- Review Summary Reports*	**Chair**

Friday Goals: Final results available. Draft Summary Report reviewed.

Appendix 3

SEDAR 84
Caribbean Yellowtail Snapper and Stoplight Parrotfish
Review Workshop Participants

LIST OF PARTICIPANTS

Review Panel
Adriana Nogueira Gassent .... Centro Oceanográfico de Vigo / CIE Reviewer
Elizabeth Kadison .... UVI/CFMC SSC
Ernesto Jardim .... Independent Fisheries Consultant / CIE Reviewer
Jorge (Reni) Garcia-Sais .... CFMC SSC
Lisa Chong .... Michigan State University / CIE Reviewer
Vance Vicente .... Vincent Associates / CFMC SSC

Analytic Team
Adyan Rios..SEFSC
Kevin McCarthy...SEFSC

Appointed Observers
Julian Magras .... St. Thomas DAP

Staff
Emily Ott.. SEDAR
Graciela Garcia-Moliner ....CFMC Staff

Observers
Nathan Vaughan...SEFSC

Observers via Webinar
Anne Kersting ....NOAA
David Behring...NOAA
Gerson Martinez.. St. Croix DAP
Jesus Rivera Hernandez ....USC
John Froeschke... GFMC
Katherine Godwin ....NOAA
Kelly Klasnick ....SAFMC
Maggie Rios ....DPNRVI
Maria Lopez-Mercer ....NOAA
Nelson Crespo .... PR Industry
Nicole Greaux .... CFMC

Rachael Silvas ....SAFMC
Rachel Banton ....NOAA
Refik Orhun ....NOAA
Sarah Stephenson ....NOAA

Sennai Habtes..DPNR VI
Suz Thomas...SAFMC
Virginia Shervette ....USC

Appendix 4

Appendix 4. List of stock assessment model runs developed during the SEDAR 84 Review Workshop (RW).

Model Name	Description
m3_v7	Base model from the assessment report – model initialized with continuum tool + hermaphroditism + adjusted length at age zero + index + annual fishery-independent length data + recruitment deviations
STX_RW_1	single sex + F method 2 + catch standard error = 0.3 + corrected survey standard error
STX_RW_2	STW_RW_1 + catch standard error = 2 + estimated growth
m3_v19	Base model from the assessment report – model initialized with continuum tool + adjusted length at age zero + continuous recruitment + catch uncertainty + index + annual fishery-independent length data + dome-shaped selectivity + recruitment deviations
STTJ_RW_1	single sex + F method 2 + catch standard = 0.3 + corrected survey standard error
STTJ_RW_2	STTJ_RW_1 + catch standard error = 2+ estimated growth
STTJ_RW_3	STTJ_RW_1 + plus group = 12+
m3_v31	Base model from the assessment report – model initialized with continuum tool + adjusted length at age zero + continuous recruitment + catch uncertainty + index + annual fishery-independent length data + annual fishery-dependent length data + dome-shaped fishery-independent selectivity + time block + recruitment deviations
PR_RW_1	Single sex + F method 2 + catch standard error = 0.3 + corrected survey standard error
PR_RW_2	PR_RW_1 + catch standard error = 2 + estimated growth
PR_RW_3	PR_RW_1 + La Parguera survey + selectivity spline
PR_RW_4	PR_RW_3 + estimated growth
PR_STTJ_RW_1	PR_RW_3 + STTJ fleet and STTJ survey
PR_STTJ_RW_2	PR_STTJ_RW_1 + estimated length at maximum age + fixed selectivity + steepness = 0.8

For the Stoplight Parrotfish in St. Croix (STW), the initial model used a single-sex configuration and applied F method 2 (Baranov continuous F) with corrected standard error units for the National Coral Reef Monitoring Program (NCRMP) survey (STW_RW_1) and catch standard error of 0.3. The second model run for Stoplight Parrotfish (STW_RW_2) applied an increased standard error on catch (SE = 2) and estimated growth parameters (growth coefficient and mean length at maximum age).

For the Yellowtail Snapper in St. Thomas and St. John (STTJ), the initial model used a single-sex configuration and applied F method 2 (Baranov continuous F) with corrected standard error units for the National Coral Reef Monitoring Program (NCRMP) survey (STTJ_RW_1) and catch standard error of 0.3. The second model run for St. Croix Yellowtail Snapper (STTJ_RW_2) applied an increased standard error on catch (SE = 2) and estimated growth parameters (growth coefficient and mean length at maximum age). The third model run for St. Thomas and St. John Yellowtail Snapper (STTJ_RW_3) explored the use of a plus group at age 12.

For the Yellowtail Snapper in Puerto Rico (PR), the initial model used a single-sex configuration and applied F method 2 (Baranov continuous F) with corrected standard error units for the National Coral Reef Monitoring Program (NCRMP) survey (PR_RW_1) and catch standard error of 0.3. The second model run for Puerto Rico Yellowtail Snapper (PR_RW_2) applied an increased standard error on catch (SE = 2) and estimated growth parameters (growth coefficient and mean length at maximum age). The third model run for Puerto Rico Yellowtail Snapper (PR_RW_3) included a survey corresponding to the spatially restricted years of the NCRMP (La Parguera) and a combination of splines and time blocks to model commercial selectivity. The fourth model (PR_RW_4) built on the third model run with estimated growth parameters (growth coefficient and length at maximum age).

The St. Thomas and St. John and Puerto Rico Yellowtail Snapper models were developed with combined data (PR_STTJ). This included two commercial fleets and five surveys (two historical surveys, two NCRMP, and one DCRMP; PR_STTJ_RW_1). The second model run (PR_STTJ_RW_2) built on the first model run with fixed selectivity and steepness (value = 0.8 obtained from the FishLife R package) and estimated length at maximum age.