

Shrimp Management Committee

VIII. SSC Recommendations on Development and Process of Using Empirical
Dynamic Models on Brown and White Shrimp

- Dr. Michelle Masi (SERO) detailed the SEFSC's research since June 2019 on shrimp assessment models, including age-structured models.
- NMFS Shrimp SEAMAP Working Group had determined SEAMAP data to be a representative index of offshore penaeid stock abundance.
- Shrimp Amendment 15 used Stock Synthesis for developing annual status determination criteria (SDC) for the three penaeid species.
- SSC: Is an age-structured model appropriate to provide relative SDC for the three Gulf penaeid shrimp populations?

- Dr. Stephan Munch (Southwest Fisheries Science Center) described Empirical Dynamic Models (EDMs)
 - EDM can implicitly account for unobserved variables using lags in observed variables.
- EDMs:
 - (1) Don't need continuous data on all variables to make accurate predictions
 - (2) Don't need pre-defined parameter relationships if enough data are available
- Published research comparing prediction errors between EDM and traditional models across 185 fish stocks determined that EDM forecasts were better for roughly 90% of the populations.
- EDMs can predict adult shrimp abundance for brown and white shrimp in each SEAMAP statistical zone.

- Initial EDM using SEAMAP Trawl Survey data included lags of abundances, temperature, salinity, and dissolved oxygen.
 - Only temperature and abundance were found to be relevant in the models.
 - For brown shrimp, overall correlation was found to be 0.86.
 - For white shrimp, overall correlation was found to be 0.75.
- Next step: Use EDMs to determine stock status.
- SSC: A shift from age-structured models for shrimp may be needed, but encouraged running simple biomass models for comparison with EDM results.

- SEFSC plans to derive SDC for brown and white shrimp and provide Gulf-wide updates to the SSC in late 2022.
- State recruitment indices will need to be considered for inclusion.
- A peer-review of the developed brown and white shrimp models, as part of the SEDAR research track assessment, will commence in 2023.
- Royal red shrimp is currently only tracked for its ACL and landings and that, at this time, there are not enough points from SEAMAP for EDM to be developed for pink shrimp.

Reef Fish Committee (Tab B, No. 7a)

VII. Review of Revised Great Red Snapper Count Estimates and SSC
Recommendations for Red Snapper Catch Advice

- Outline of SSC Discussion and Recommendations:
 - Estimating Absolute Abundance of Red Snapper off Louisiana
 - Post-stratification Analysis for Florida Absolute Abundance
 - SEFSC Catch Analysis for Gulf of Mexico Red Snapper

Estimating Absolute Abundance of Red Snapper off Louisiana

- Dr. Scott Raborn (LGL Ecological Research Associates, Inc.) presented completed research to generate an estimate of absolute abundance of red snapper off Louisiana (LGL study).
- Study designed for model-based inference of red snapper abundance through field surveys for two separate responses: total fish density (TFD) from hydroacoustic surveys and the proportion of TFD that were red snapper (PropRS) using submerged rotating video cameras (SRVs).

- Five habitat types (artificial reefs, natural banks, uncharacterized bottom [UCB], pipeline crossings, and oil platforms) were evaluated within depth strata across the Gulf (west, central, and east).
- Largest discrepancy between the LGL study and the Great Red Snapper Count (GRSC) was on the estimated abundance over natural banks.
- Differences were also noted between the GRSC and LGL study for standing platforms and artificial reefs (GRSC 4.7x greater than LGL for platforms).
- Abundance estimates for UCB were comparable between the two studies.

- The SSC discussed the differences in the LGL and GRSC estimates for absolute abundance recorded for Louisiana, noting the limitations of the sampling design in the LGL study and the imputation of some Louisiana data from Texas in the GRSC.
- The comparability of the studies, due to these differences, remains difficult. However, the SSC concluded that in general, the difference between the surveys highlights the uncertainty in both estimates, which is likely underestimated.
- The SSC noted the LGL study was designed to focus on the present habitats off Louisiana, and likely represented a better abundance estimate for that area compared to the abundance estimate from the GRSC (empirically collected versus partially imputed, respectively).

- SSC agreed that LGL study was an improvement to the data utilized in the GRSC, which was partially extrapolated from nearby Texas waters.

Motion: The SSC decided the LGL red snapper abundance study for Louisiana would be an improvement over using the Louisiana data in the GRSC study for conducting subsequent catch analyses.

Motion carried with 6 abstentions and 1 absent.

Post-stratification Analysis for Florida Absolute Abundance

- Dr. Katie Siegfried (SEFSC) presented the post-stratification analysis of the estimates of red snapper absolute abundance in the west Florida shelf.
- This effort was driven by concerns of higher than expected numbers of fish in the shallow water stratum (10 – 40 meters) off Florida.
- Those data were post-stratified from 10 – 40 m to 10 – 25 m and 25 – 40 m.
- Analysis still estimated a large relative abundance of red snapper in the Big Bend region, with a larger number of fish in the new deeper depth bin compared to the 10 – 25 m bin.

Motion: The SSC agrees that the post-stratification analysis for the state of Florida is appropriate and should be included in the overall estimate of age 2+ red snapper in the Gulf of Mexico informed by the finalized GRSC data and random forest design.

- ***Motion carried without opposition.***

SEFSC Catch Analysis for Gulf of Mexico Red Snapper

- Mr. Matt Smith (SEFSC) presented revised catch advice for red snapper based on the estimates of absolute abundance from the GRSC for Florida (post-stratified re-analysis), Alabama, Mississippi, Texas, and the LGL study for Louisiana.
- After including the LGL estimate, and the post-stratification of the Florida estimate from the GRSC-derived estimate using the random forest approach, the revised combined estimate of absolute abundance of age-2+ red snapper is approximately 85.6 million fish.

- Age and length composition data were informed by SEDAR 52, using data through 2016.
- The frequency of age-2+ fish were estimated using the last 10 years of available data (2007-2016).
- An estimate of virgin spawning stock biomass (SSB) was derived from the fraction of SSB in 2019 divided by the projected SPR for 2019 from SEDAR 52 (20.7% based on the projected pace of rebuilding from SEDAR 52).
- The terminal year of data for the analysis is 2019, with future yields projected forward from that point.

- Uncertainty was quantified using deterministic projections at 75% of the fishing mortality rate corresponding to 26% SPR ($F_{26\%SPR}$), and also from Monte Carlo simulations incorporating uncertainty for the number of age-2+ red snapper, with recruitment, fishing mortality rates, and initial depletion based on SEDAR 52.
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- Three scenarios for considering the abundance over the UCB were generated: assuming all structure (e.g., all natural and artificial habitats), all structure plus 10% of the UCB, and all structure plus 15% of the UCB.
- SEFSC also presented an ensemble (all artificial and natural structures, plus ~8% UCB fished) approach that estimates a grand mean and variance for the catch advice and provides a broader estimate of uncertainty across the three UCB scenarios.

- Dr. John Walter (SEFSC) presented spatial analyses (“Gardner analysis”) of commercial and recreational catch compared to biomass derived from the GRSC. Two objectives:
 - Assign spatial recreational and commercial catch and effort, using estimates of biomass derived from the GRSC
 - Calculate exploitation rates for scenarios to inform potential fishery yields based on those rates
- Gardner analysis updated to include LGL estimate for Louisiana, and to post-stratify the shallowest depth stratum in Florida.
- Biomass was estimated using composition data and mean weights from SEDAR 52, and regional abundance estimates from the GRSC-derived data to estimate biomass in weight.

- Gardner analysis used a mean weight in the eastern Gulf of 3.2 pounds whole weight (lbs ww), and 4.8 lbs ww in the western Gulf.
- SSC: Stock is larger than previously estimated by SEDAR 52, and that exploitation rates are likely lower than estimated by that assessment.
- SSC: Other aspects of population dynamics, like recruitment, reproduction, updates to age and length compositions, and other information have not been updated with current information, as is customary from a stock assessment.

Motion: The SSC finds that the catch analysis developed by the SEFSC and informed by age-2+ red snapper abundance from the GRSC for Texas, Alabama, Mississippi, and the post-stratified abundance data for Florida, and from the LGL red snapper abundance study for Louisiana, is the BSIA for abundance information and useful for development of OFL and ABC recommendations.

Motion carried 14 – 7, with three abstentions and one absent.

- Uncertainty in the catch advice, and abundance over the UCB received a lengthy discussion by the SSC.

Motion: The SSC accepts the SEFSC catch analysis and establishes an OFL based on the ensemble analysis using the 5-year average of 18.91 mp ww.

Motion carried 12 – 9, with three abstentions and one absent.

- The SSC discussed an appropriate catch recommendation for the ABC, acknowledging the uncertainties with respect to the data used in the catch analysis, and the catch analysis itself.

Motion: The SSC approves an ABC of 16.31 mp ww for red snapper, based on the 5-year average using the ensemble approach, and based on a P* value of 0.3.

Motion carried 11 – 9 with two abstentions and three absent.

Reef Fish Committee (Tab B, No. 7a)

IX. Individual Fishing Quota (IFQ) Programs - SSC Recommendations

- SSC: Equally support all recommendations, or should some recommendations be prioritized over others?
- SSC: Lack of data available for evaluating the impacts of LAPPs in existing commercial programs, and the greater lack of data available for the potential establishment of a recreational sector LAPP.

Motion: The SSC agrees with the recommendations from the National Academies of Science report on the use of Limited Access Privileges Programs (LAPP) in mixed-use fisheries.

Motion carried 17 to 6 with 2 abstentions

Reef Fish Committee (Tab B, No. 7a)

X. Review of Gulf Red Grouper Interim Analysis Health Status and SSC Recommendations

- Dr. Katie Siegfried (SEFSC) presented the 2022 Gulf red grouper interim analysis, using data through 2021.
- This interim analysis is provided as a “health check” of the stock.
 - Updated catch advice transmitted for implementation from last IA; pending with NMFS
- A reduced spatial area NMFS Bottom Longline index (NMFS BLL) and the NMFS Summer Groundfish Survey were used to examine juveniles and young adults in the red grouper population.
- Both indices show relatively higher abundance in 2021 compared to other recent years, which matches observations by fishermen on the water.