# SEDAR 74 Gulf of Mexico Red Snapper Research Track Stock Assessment: Assessment Webinar 4 

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January 24, 2023

## Outline - Research Track

- Applicable Assessment TORS
- Progress to Date
- Age Based and Length Based Models
- High Priority Issues
- Potential Next Steps


## Applicable Assessment Terms of Reference

1. Review any changes in data or analyses following the Data Workshop. Summarize data as used in each assessment model. Provide justification for any deviations from Data Workshop recommendations.
2. Develop population assessment model(s) that are appropriate for the available data

- Evaluate selectivity and retention functions for all directed, discard, and bycatch fleets as appropriate.
- Explore whether alternate recreational fleet structures are supported in the assessment model. Specifically, determine whether selectivity functions are estimable and model stability is maintained.

4. Characterize uncertainty in the assessment and estimated values.

- Consider uncertainty in input data, modeling approach, and model configuration.

Full TORS on SEDAR website::
https://sedarweb.org/documents/sedar-74-gulf-of-mexico-red-snapper-research-track-assessment-terms-of-reference/

## Progress to Date

## Two Full Models

Age Based:

- Age based selectivity for fleets that had an ALK
- Length based retention (no length data)


Length Based:

- Age structured model
- Length based selectivity and retention for fleets that have length data (no age data)

Both Models Currently Include:

- All available catch and discard data
- Reduced uncertainty in the catch and closed season discards
- S52 based biology across regions
- Some differences in available composition data
- Some differences in selectivity parameterization


## Composition Data Available and In Use

| Data Source/Type | In Both Models |
| :--- | :--- |
| Com HL Landings/Discards (W,C,E) | Yes/Yes |
| Com LL Landings/Discards (W,C,E) | Yes/Yes |
| Rec HBT, CBT and Priv Landings (W,C,E) | Yes |
| Rec HBT and CBT Discards Open/Closed (E) | NL* $^{*}$ |
| SEAMAP Larval Survey (Spawning Bio) (W, C) | Yes |
| Combined Video Survey - Gfisher (E,C) | Yes |
| Combined Video Survey - SEAVID (W) | Yes |
| Summer Trawl Late (W,C,E) | Yes |
| Summer Trawl Early (W) | NA* $^{*}$ |
| Fall Trawl Late (W,C,E) | Yes |
| Fall Trawl Early (W) | NA* |
| BLL (W,C,E) | Yes |
| Shrimp Effort/Bycatch (age-0 mortality) | Yes/Yes |
| Commercial Reef Observer Program | Yes |

Yes - In Current Models

NL - Not Available for the length based model

NA - Not available for the age based model

Note: Expecting SEAMAP age data for the operational assessment

## Steps Taken to Build the Length Model

- Corrected data issues after data workshop
- Revisited data originally used to create ALKs
- Changed the bins of the data from 1 and 2 cm to 5 and 10 cm
- unsure of which bin sizes were needed during data workshop
- rebinning reduces run time while model building
- Established appropriate length based selectivities and retentions for fleets with length composition data
- Simultaneously incorporating improvements from the age based model
- Changes to how F's are calculated and how recruitment devs are estimated, etc.


## Composition Samples By Gear and Region

| Fleet | $\underline{N}$ Years | $\underline{N}<10$ | \% $\mathrm{N}>10$ | Fleet | $N$ Years | $\mathrm{N}<10$ | \% $\mathrm{N}>10$ | Fleet | $\underline{N}$ Years | $\underline{\mathrm{N}}<10$ | \% $\mathrm{N}>10$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| HL_W | 50 | 6 | 88 | BLL_E | 16 | 15 | 6.25 | SUMLATE_W | 11 | 0 | 100 |
| HL_C | 50 | 0 | 100 | CBT_C | 39 | 2 | 94.87 | SUMLATE_C | 11 | 0 | 100 |
| HL_E | 50 | 3 | 94 | CBT_W | 39 | 5 | 87.18 | SUMLATE_E | 11 | 7 | 36.36 |
| SEAVID_W | 21 | 2 | 90.48 | CBT_E | 33 | 20 | 39.39 | SUMEARLY_W | 22 | 0 | 100 |
| GFISHER_C | 19 | 2 | 89.47 | HBT_W | 39 | 2 | 94.87 | FALLLATE_W | 12 | 0 | 100 |
| GFISHER_E | 10 | 0 | 100 | HBT_C | 39 | 1 | 97.44 | FALLLATE_C | 12 | 0 | 100 |
| LL_W | 47 | 28 | 40.43 | HBT_E | 32 | 15 | 53.13 | FALLLATE_E | 11 | 5 | 54.55 |
| LL_E | 50 | 7 | 86 | PRIV_W | 39 | 1 | 97.44 | FALLEARLY_W | 20 | 0 | 100 |
| LL_C | 36 | 35 | 2.78 | PRIV_C | 39 | 6 | 84.62 | Shr_W | 23 | 2 | 91.30 |
| BLL_W | 17 | 1 | 94.12 | PRIV_E | 33 | 26 | 21.21 | Shr_C | 22 | 3 | 86.36 |
| BLL_C | 17 | 16 | 5.88 |  |  |  |  | Shr_E | 20 | 11 | 45 |

## Note:

Age and length use the same sample sizes
The sample sizes are a combination of $n=$ number of fish and $n=$ number of trips.
A switch to fish measured has been discussed

## Age Based Selectivity and Retention Fits



Thought to be due to selectivity mirroring/blocking.


Unknown

## Early Length Based Selectivity and Retention Fits



## Age Based Index Fits



Mixed success. Possibly a data weighting issue - will attempt runs with common mean CV

## Length Based Index Fit Examples



Shrimp Central


HBT West


Early Summer Trawl West


## Age Based Fits to Discards

Closed_season and shrimp forced. Directed open season, mixed results.





## Length Based Fits to Discards

- Currently a reasonable fit if closed season CVs are reduced from $\sim 0.6$ to 0.05. Not a final decision.

Total discard for HL_E


Total discard for LL_E


Total discard for HL_CIsd_E


## Removal of Trends in Discard Fraction

## Age Based



## Length Based

- Freely estimated selectivity and retentions



## Total Catch Including Discards

Age Based

## Length Based




## Improvement in Recruitment Deviations

- Current approach only estimates deviations for years informed by composition data.
- Rec devs no longer have to be forced to be zero sum



Length Based


## Improvement in Recruitment Apportionment

## Age Based

1985 dev start year apportionment


Age Based - 1985


1970 dev start year apportionment


way to handle apportionment deviations SE

Started the apportionment estimation where there is daata $\sim 1980$ s

## Numbers at Age - East

Age Based

## Length Based



Year

## Numbers at Age - Central <br> Age Based <br> Length Based




## Numbers at Age - West

Age Based

## Length Based


 $\begin{array}{llllllllllll}1949 & 1955 & 1961 & 1967 & 1973 & 1979 & 1985 & 1991 & 1997 & 2003 & 2009 & 2015\end{array}$

## Biomass Trajectories Age Based

## Length Based






## High Priority Issues

## Summer Trawl Fit Issues

Age Based Summer Late West and Central



Length Based Summer Late West and Central



## Summer Trawl Fit Issues

Age Based Summer Late West



- Are low N's and low DM parameters to blame for poor fit.
- Is tension between comp and index to blame?
- Comp shown here is length-converted-age. (Year class "smearing" expected). Directly aged fish may show very different selectivity
- Are these providing what we expected (Pseudo-Age 1 index)


## Summer Trawl Fit Possible Solutions

- Logistic with negative slope (length) or random walk (age) but bound the parameters for each region to a reasonable place based on the data (no priors)
- Tighten bounds on one region and let the others mirror that region
- Develop informative priors based on what the gear is intended to catch (age ones)


## Survey Timing

- New SS feature used to capture year class strength
- Has had an effect in the east (jump to next)
- Not include in the Length Based Model yet
- Alt. suggestions?

| Event | Time of Year |
| :--- | :--- |
| Spawning | July |
| Summer Trawl | June |
| Fall Trawl | September |
| All other Surveys | July |

## Survey Timing in the Age Based Model

- Has had an effect in the east


July Settlement, July survey composition


July Settlement, June survey composition

## Selectivity in the Age Based Model

HL Central


HL East


Year

## Selectivity in the Age Based Model

## HL East



- Model is tracking cohorts but consistently underestimates their presence in the comp.
- Pattern could be caused by constant modeled selectivity imposed on a fleet that is actually targeting a strong cohort.
- Pattern exists in all fleets is the above likely or even possible?


## Selectivity in Length Based Model



- Some underestimation
- Still too early to determine the cause


## Shrimp Selectivity

Age Based Model

- Random walk (3 param.)


Length Based Model

- Logistic (2 param.) currently random walk not available for length
- Will likely fit a spline with multiple knots

- Keep model parsimony in mind



# Too Early to Determine the Appropriate Base Model 

## Next Steps

## Summary of Requested Feedback

- Summer and Fall trawl
- Continue to try and fit available comp?
- Fit fall trawl as an age 0 survey (ignore comp)?
- Alternate suggestions for survey timing
- Adjust survey CV's to common mean?
- How should we determine the appropriate base model (age vs length)?


## Work Left to Do

## Length Based:

- Adjust timing of the surveys
- Ensure model assumptions are similar to those made in the Age Based

Age Based:

- Finalize approach to trawl survey selectivity
- Hopefully Identify base Age-structured model by Feb. call
- GRSC

All Models:

- Improve selectivity and retention fits
- utilizing different forms (negative slope logistic, splines, etc.)
- Explore alternative weighting schemes for composition data (Dirichlet Parameters)
- Diagnostics for individual model fit
- Determine diagnostics to compare length and age based models

Consider sensitivities (biology, CMS, natural mortality, steepness, etc.)

## Red Snapper Count Considerations

-Need numbers by Stock ID regions
-Tentative Approach:

1) Use the 2018 GRSC values as indices of abundance in the various regions, $q=1$
a) adjust data weighting to determine model sensitivity


