SEDAR 98: US Gulf of Mexico Red Snapper

Benchmark Stock Assessment
Data Workshop Introduction
December 10, 2024

Outline

Goals

General conceptual model for the red snapper assessment model

Composition data quality requirements for model inclusion

Survey and index data requirements for model inclusion

- GRSC requirements
- Updated G-Fisher requirements
- Updated Shrimp Bycatch requirements
- Newly introduced external survey requirements

Recreational landings and discard data requirements for model inclusion

- Recreational Fishery Sensitivities

Analyst Goals for Data Workshop

Address CIE concerns from SEDAR 74 review

Insure quality over quantity:

- Expose stakeholders and data providers to model specifics
- Help providers understand the implications of their data
- Encourage data providers to share their expert opinions when discussing data quality timelines for use in a stock assessment
- **Ensure documentation of timelines for changes and uncertainty in the data are clear in the final data workshop report**

Red Snapper Conceptual Model Structure

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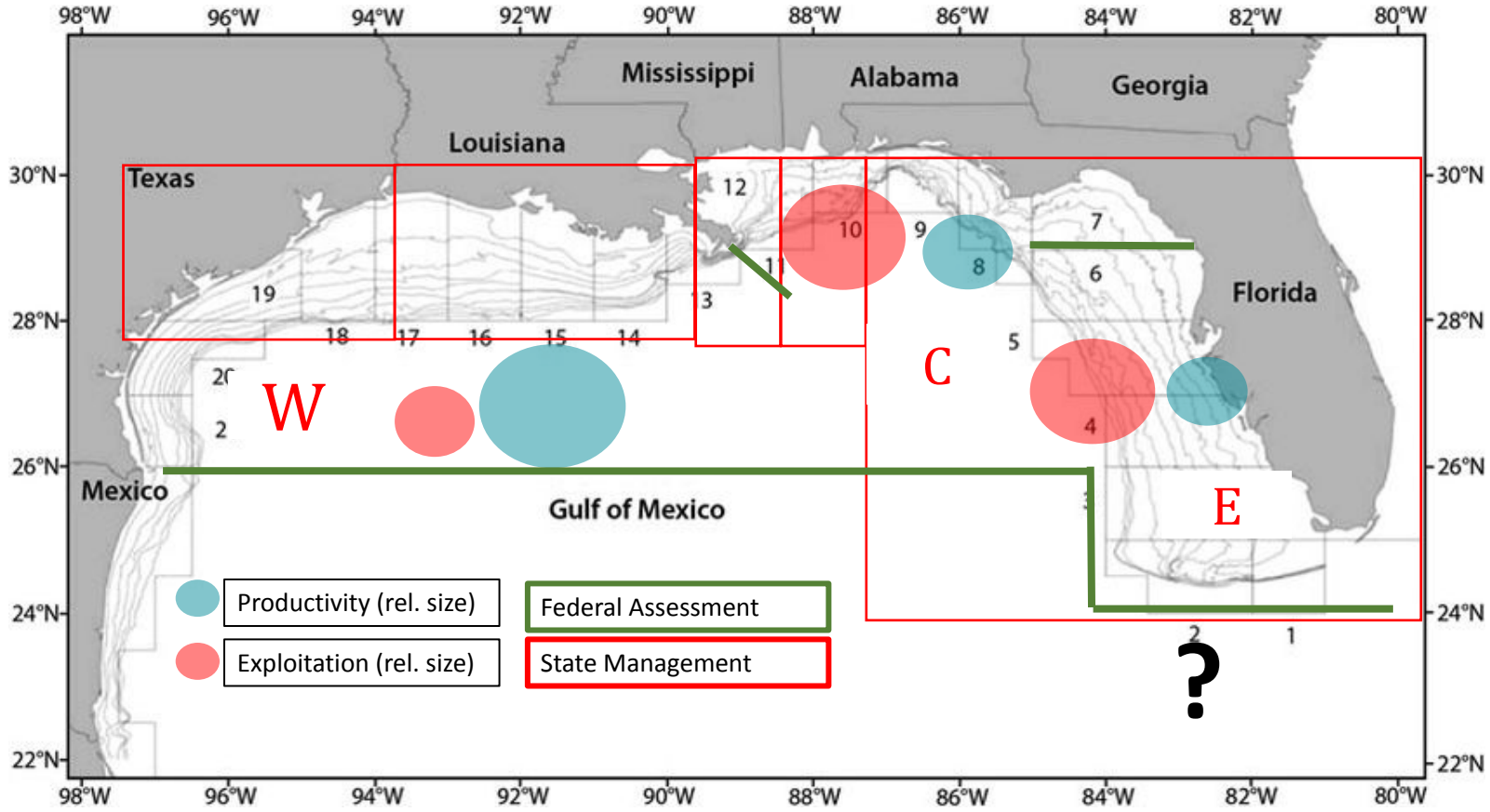

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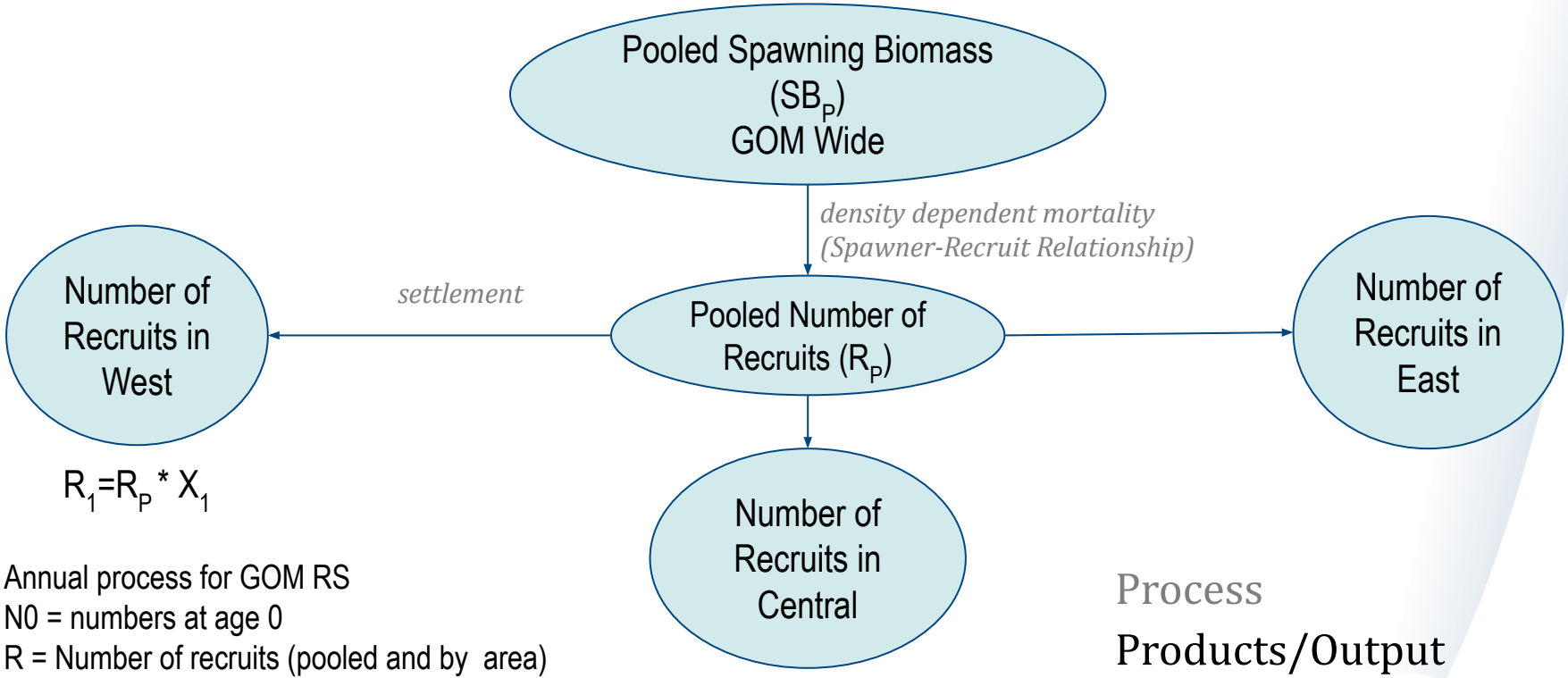
What does a stock boundary mean in terms of the model?



$R_1 = R_P * X_1$

Annual process for GOM RS
N0 = numbers at age 0
R = Number of recruits (pooled and by area)
X = Fraction of recruits (by area)

Process

Products/Output

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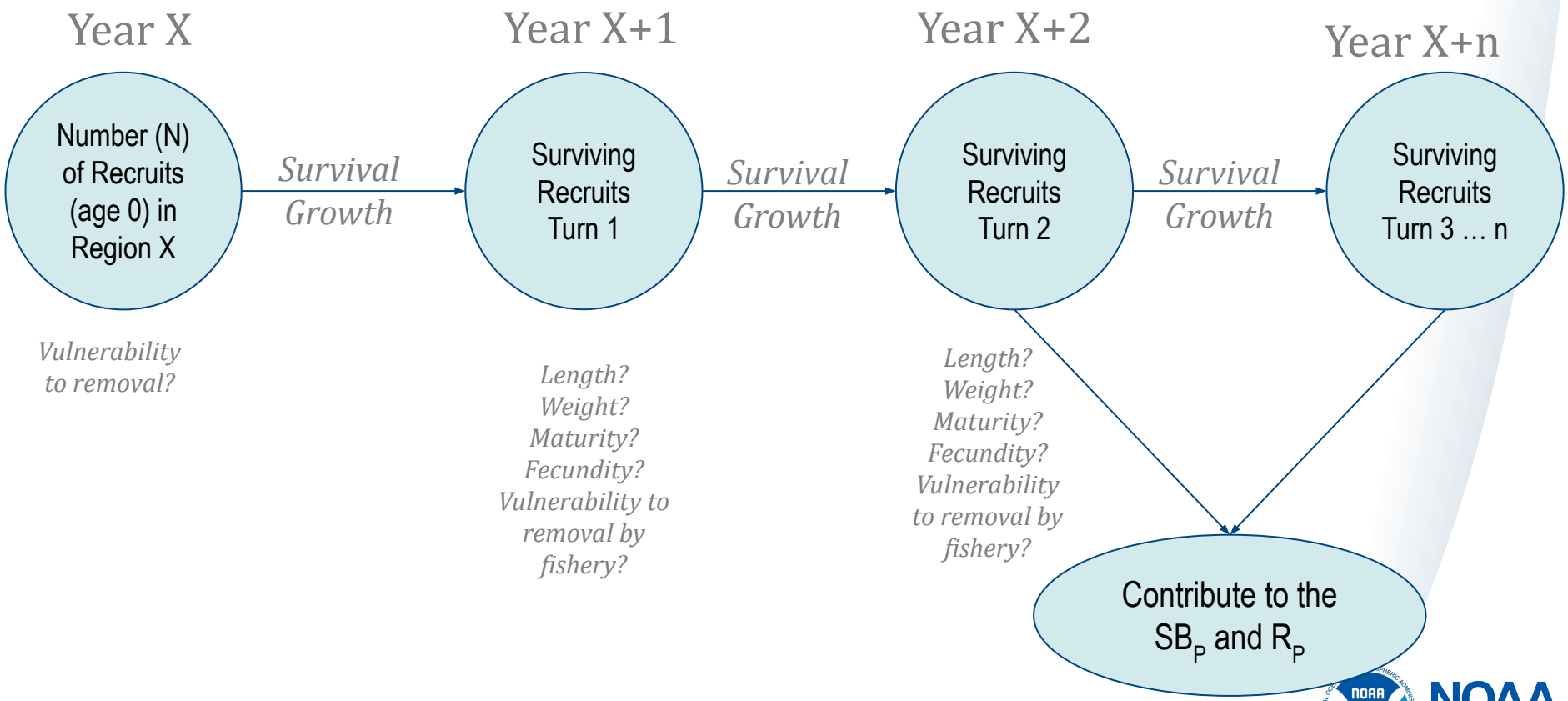
Dynamics in Each Region from Year to Year



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RS Management Impacts on Population

Size limits, bag limits, federal season closures and state vs. federal season closures cause changes in reported catch and effort that influence our image of the true population.

Year	Bag Limits Rec	Year	Size Limits Rec/Com
1984	none	1984	13”
1990	7 fish	1990	13”
1995	5 fish	1994	15”
1999	4 fish		
2000	5 fish	2000	16”/15”
2007	2 fish	2008	16”/13”

In 2016 states began setting recreational closures separate from federal closures.

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Composition Data (Age, Length, CAAL)

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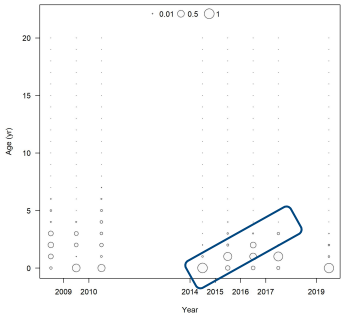
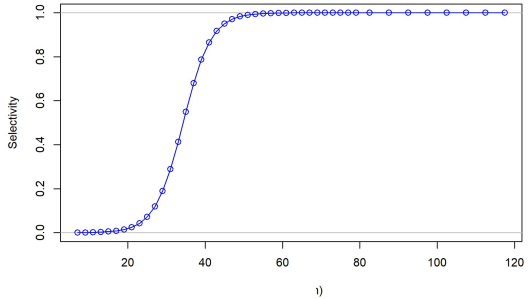
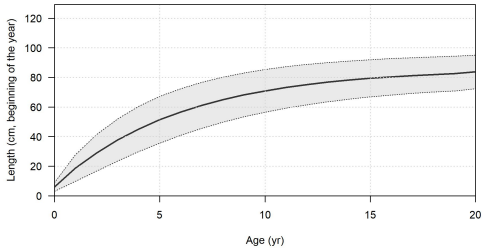
General Composition Data Influences In an Assessment Model

Composition Data (length, age, CAAL**)

- Size and age of fish moving through the population (i.e., pulse of young fish through the years = cohort strength)
- Fishery and area specific removals and mortality rates (by size and/or age)
- Individual growth or average size at age**







** Used for estimating growth parameters which are currently fixed by region in the model. But if the data is sufficiently representative we can use it.

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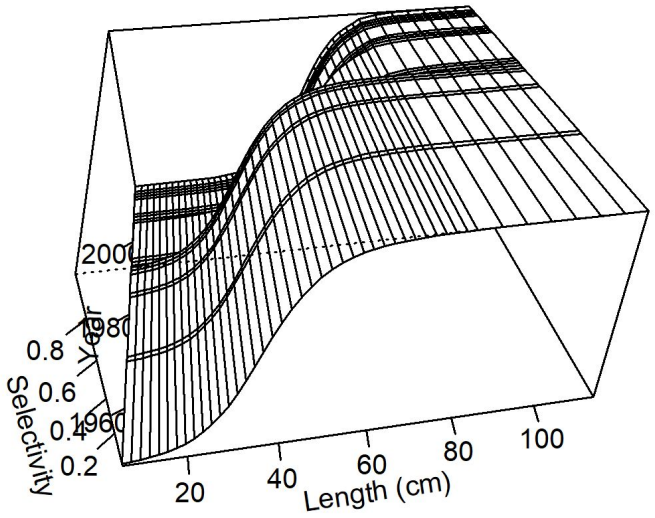
Fishery - Dependent Composition Data

Changes caused by management or market dynamics can be addressed through separation (i.e. blocking):

- Gulf of Mexico bathymetry is different from east to west (regional gear efficiency)
- Management has changed over time
  - size limits remove fish from our data/picture of the population if not accounted for by selectivity
  - open/closed seasons have different targeting and discarding behavior thus selectivity and retention changes



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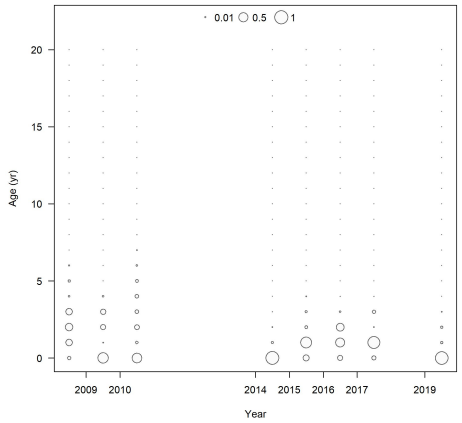
Fishery - Independent Composition Data

- Unbiased trends in the population
- No influence from management or targeting
  - changes in sampling designs may change CPUE
- Provides information on those in the population



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Composition Data & Model Parameters

$$'F = f_{fleet} * S_{A/L}$$

Estimated using catch landings and discards

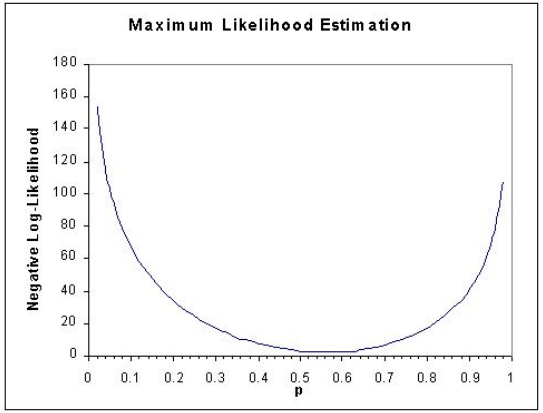
Predicted using provided composition data. Model will change free parameters to fit observed data.

$$C = 'F * N$$

Predicted - Model will change free parameters to fit the observed data

Calculated in the model using other data

- Selectivity(S) can be a function of length(L) and age(A)
- Fishing mortality rate ('F) is function of the fleet fishing mortality rate (f) and selectivity (s)
- Catch(C) = Fishing mortality rate('F) *Number of fish (N)



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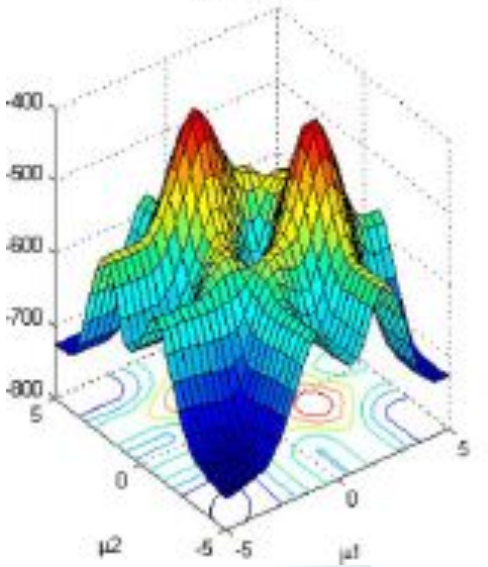
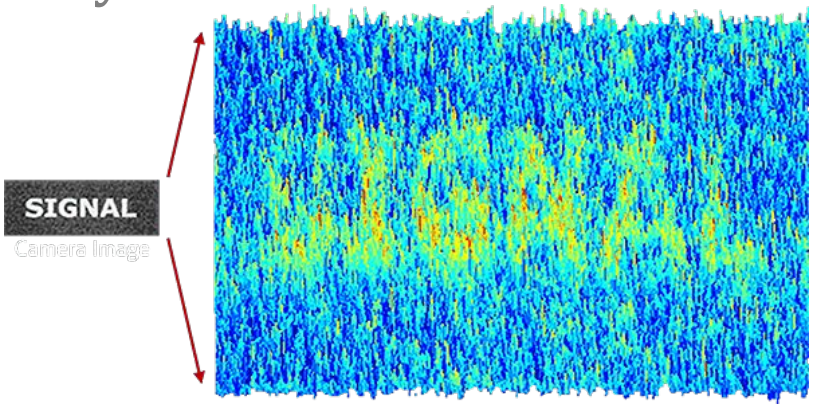
Consequences of Poor Composition Data

- Systemic bias in model outputs
- Model misses year classes
- Model outputs do not match up with reality
- Noise leads to poor model fits and model instability





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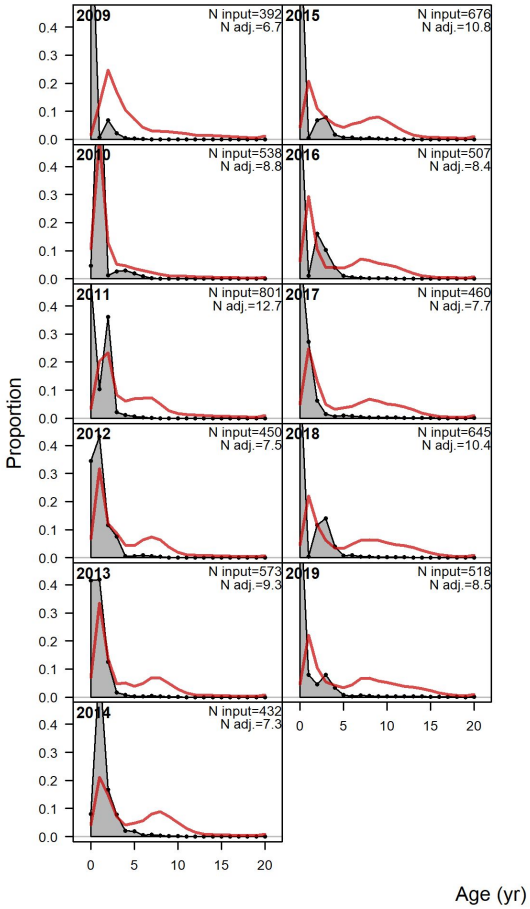
Consequence of Poor Quality Composition



Early explorations from SEDAR 74:

Model could not fit trawl composition well using external ALKs

- ALK's were poorly estimated for young fish due to incomplete sampling and ageing of small/young red snapper
- Example - 2015, 2016, 2018 - ALK assigns no fish to age 1

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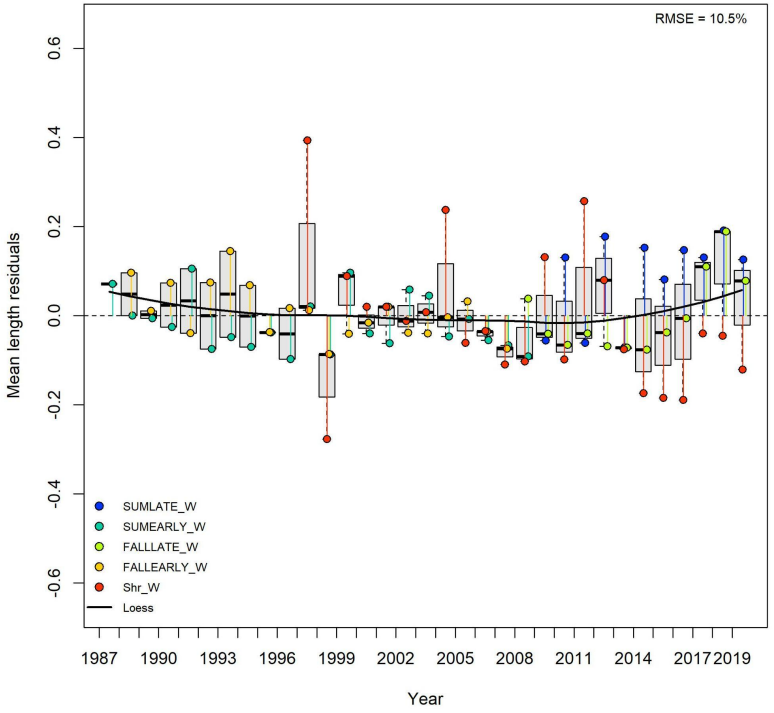
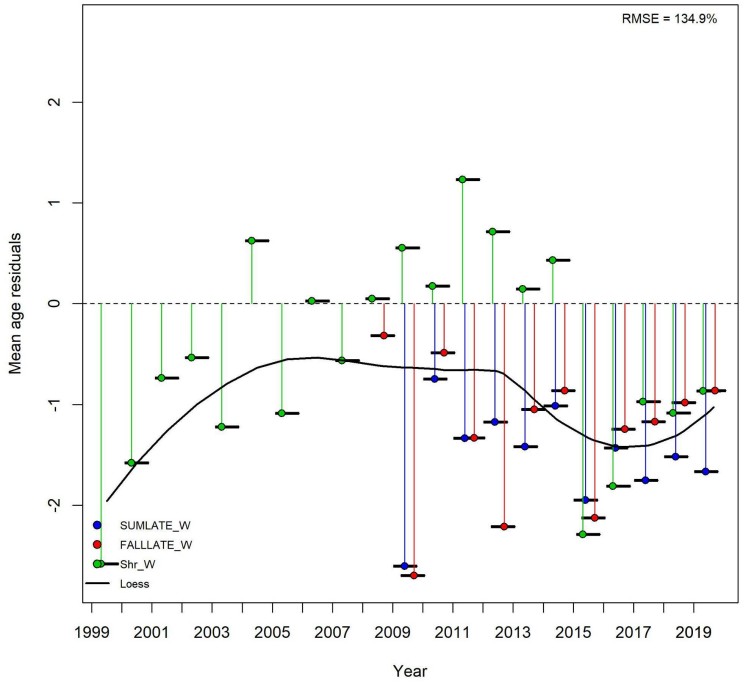
Poor Summer Trawl Age Comp Fit

Length



Age



A lack of samples became a source of bias that would be propagated throughout the model estimates and outputs

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Minimum Requirements for Composition Data

- Appropriate spatial and temporal coverage (East, Central, West)
- Separated by sector and gear (Rec private, Rec headboat, Rec charter boat, Com HL, Com LL)
- Spatially balanced and consistent sampling
  - Provided weighted and in frequencies
- A clear and consistent understanding of gear selectivity spatially

Detailed Composition Data Requirements

What we need to know from you (⅓):

- Maps and/or tables of comp sample sizes by year, if available.
- What sizes or ages are the target catch, do we see these sizes in the data? When, why or why not?
  - Do the target sizes change by assessment area (regional industry differences)?

Detailed Composition Data Requirements

What we need to know from you (⅔):

- What years do you think are the most representative of the fisheries behavior or population structure?
  - Can we combine individual years into stanzas of information?
  - Periods of questionable sample sizes and why? Are these years similar enough that they can be pooled?

Detailed Composition Data Requirements

What we need to know from you (3/3):

- Note specific years of changes in sampling dynamics, behavior or management that have drastically impacted what sizes or ages were taken.
  - What is the magnitude of the change? Does the magnitude change make sense or is there a sampling/reporting issue?

Indices of Effort and Relative Abundance

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Survey and Index Model Influences

- Provides a less biased estimate of relative population abundance compared to landings
- Shows changes in magnitude of different segments (size or age class) of the population over time

$$CPUE = q*N$$

Catch Per Unit Effort
Predicted -
Model will change free parameters to fit the observed data

Catchbilty
Estimated parameter
- gear effectiveness

Number of Fish
Calculated using other data in the model including composition

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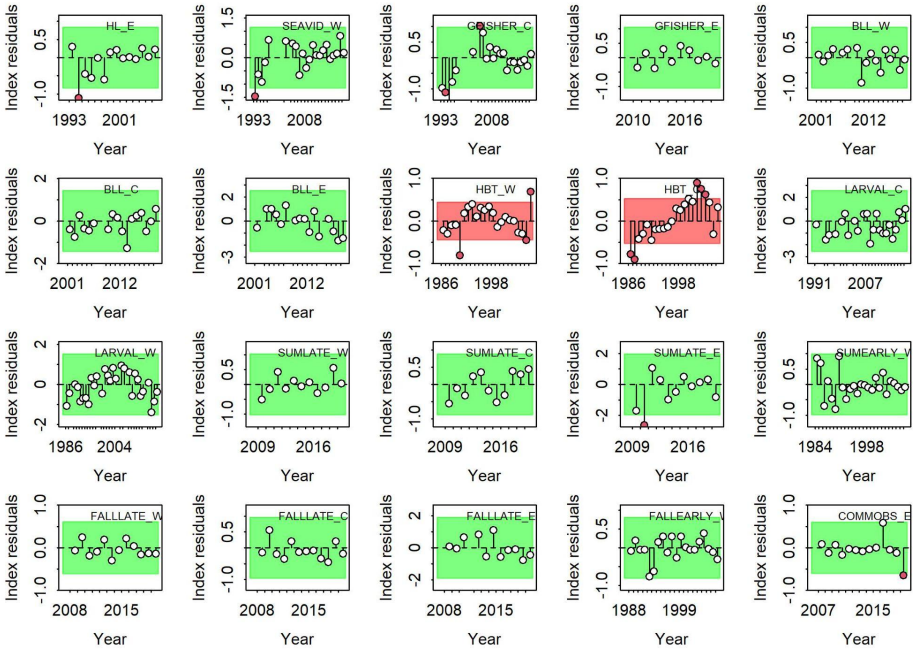
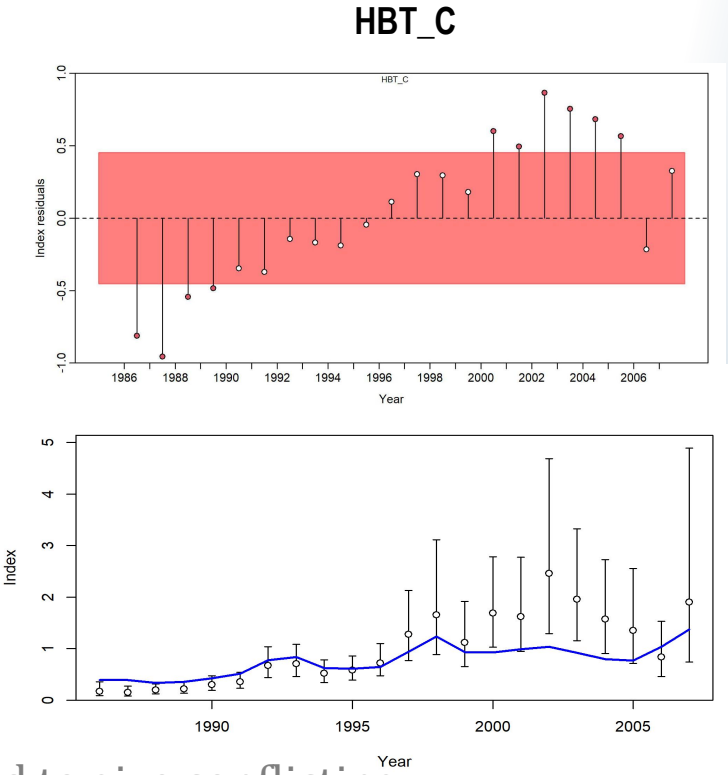
Survey and Index Requirements

- A survey must have appropriate spatial and temporal coverage
  - Within each region are all possible habitats covered? We want to avoid only sampling areas of high or low density
- An index needs to accurately account for factors influencing changes in abundance over time
- An index needs to show changes over time (contrast)
  - Does it capture high and low periods in abundance?
- Index should have accompanying representative composition data
  - "What we need to know from you" questions in previous slides still apply

Poor Survey and Index Consequences





If indices do not meet the requirements, they tend to give conflicting views of the population which leads to overall poor model fit and instability (i.e. q and selectivity parameters can be anything)

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NOAA Survey
G-Fisher

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G-Fishery Requirements

- Account for changes in sampling design
  - What years are important to note, how did they change the index or the composition data?
  - Is it better to split the index over space and time, given the differences? Will there be enough data if that occurs?
- Account for the addition of surveys over time
- Age/Length composition of samples over time and space (provide maps of samples size proportions, if possible)
  - “What we need to know from you” questions in previous slides still apply

Shrimp Effort & Bycatch

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Shrimp Effort & Bycatch Model Influences

Drives Age 0 (new recruits) and Age 1 mortality ⇒ R_0 (Population Productivity)

$$C_{a=2+} = N_{a=2+} *' F\ (f_{fleets}, S_{a/L})$$

Catch at age 2 plus is predicted- Model will change free parameters to fit the observed data

fishing mortality rate based on fleet specific f & selectivity by age/length

$$N_{a<2} = f(R_0, m_{a=0\&1}, f_{\text{shrimp fleet, ...}})$$

Calculated as a function of the following:

Fixed by age

estimated using shrimp effort and bycatch data

R_0 - Estimated parameter

- A lever the model uses to support the catches of age 2+
- Determines the sustainability of the stock (i.e., SPR proxy 0.26)
- Influences reference points
- Currently estimated high to support large removals of age 2+

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Shrimp Data Model Influences & Requirements

What we need to know:

- Should new bycatch estimates be averaged across years or do we trust annual estimates?
- Recommendations for handling early part of the time-series that no longer have direct estimates.
- Robustness of compositional data or recommendations for fixed selectivity form
  - sampling changes that influence length frequency distributions

Newly Introduced External Surveys

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Red Snapper Count Requirements

- A catchability (q) parameter estimate for each of the assessment regions
  - Values should account for differences in gears across regions
- Clean and representative length composition frequencies by assessment region
  - meta data for sampling schemes

Red Snapper Count: provided length compositions

- Provided length composition data was not representative of the entire GOM, and needed to be parsed into the three areas.

- Data Set 1:
  - Includes 2010-2020
  - No indication of # measured vs seen (sampling protocol, max,etc.?)
  - Only Alabama and Texas in 2018
  - VLL, BLL, ROV
  - Multiple habitat types
  - Data sources:
    - TAMCC, TWDP_ARP, TWDP_SEAMAP, University of South Alabama

- Data Set 2:
  - Assuming from one source across entire GOM FL shelf
  - Stereocamera/Lasers for measurement
  - multiple habitat types, number seen vs measured available
  - max 24 measured at a site

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Reminder Minimum Requirements for Composition Data:

- Appropriate spatial and temporal coverage
- Spatially balanced and consistent sampling
- A clear and consistent understanding of gear selectivity spatially
- Provided in length frequencies, and weighted by gear and space where appropriate

RSC Length Composition Data Requirements

- Texas data includes SEAMAP samples and Texas Parks and Wildlife
  - Risk of double counting data
  - Sampling protocol difference?
  - Which gear/habitat should be used?
    - May not have enough data for multiple gears
- Provided Florida data was not split according to new stock ID bounds
  - When split, data weighting methodology needs to be discussed (considering habitat/depth, etc.)
- Discussion is needed on how to include the LGL Louisiana study for a complete western composition.

RSC Final Setup Used in SEDAR 74

- All decision were discussed by the Assessment Development Panel which included members of the RSC team.
- Values included as an index of absolute abundance in one year (2018) by region.
  - Catchability coefficient (q) fixed at 1.
- Given equal model weight as other data sources (Lambda = 1)
- Selectivity:
  - East - fixed at 100% for ages 2+, and set to 0 for ages 0 and 1
  - West and Central - selectivity was estimated for ages 2+, and fixed at 0 or ages 0 and 1.

Reminder: Red Snapper Count Requirements

- A catchability (q) parameter estimate for each of the assessment regions
  - Values should account for differences in gears across regions
- Clean and representative length composition frequencies by assessment region
  - meta data on sampling schemes are welcome

Recreational Landings and Discards

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Recreational Data

- Removals (landings and dead discards) are critical sources of data.
- To be most useful the time-series should be long, continuous, and consistent.
- Consistency of the data is important whether within a survey (e.g., MRIP APAIS and FHS calibrations) or between surveys (e.g., MRIP to State or between States)

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Recreational Data

- When data is not consistent through time, the model interprets the anomalous changes in removals as true changes in fishing mortality (i.e., the model doesn't know the survey design changed).

- When data is not consistent through space, Gulf wide catch advice will be based on a "hybrid" unit that can lead to mismatches at the State level in quota and monitoring which will result in unintended management outcomes.

Recreational Data

- To aid the recreational statistics working group, a series of sensitivity runs were completed to demonstrate how the stock assessment model responds to a series of hypothetical recreational landings and discard scenarios.

Methodology: Private Rec Data Sensitivities

Sensitivity Scenarios Tested:

1. Full time series of Landings in State units
   - Uses state provided data from start of state survey (variable by state)
   - Uses MRIP x Calibration factor for 1981-survey start
   - includes converted discards
2. Landings in state units, no discards
   - uses state provided data from start of state survey (variable by state)
   - uses MRIP x Conversion factor for 1981-survey start
   - no discards
3. Only state survey data
   - Only uses data from the start of the state surveys
   - no discards
4. Full time series of Landings in Blended units
   - MRIP data from 1981-survey start
   - State survey data from start date onward

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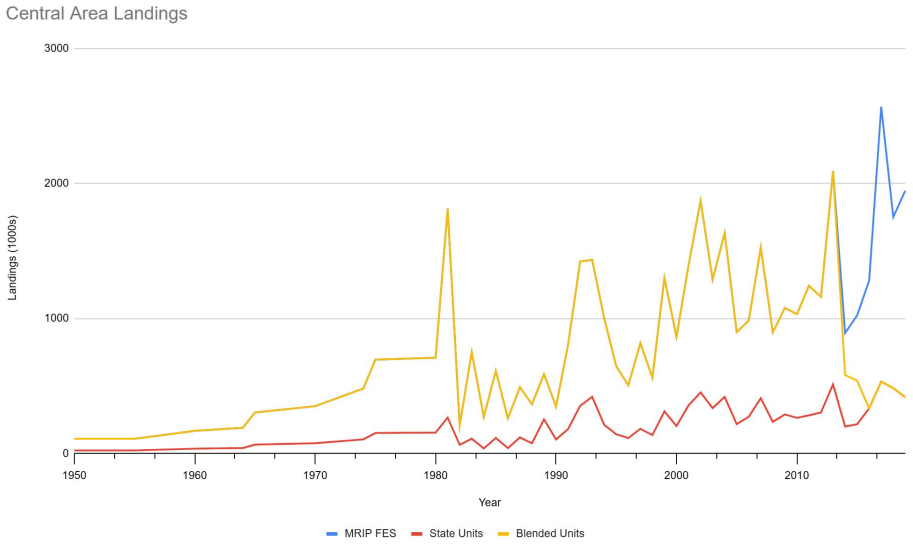
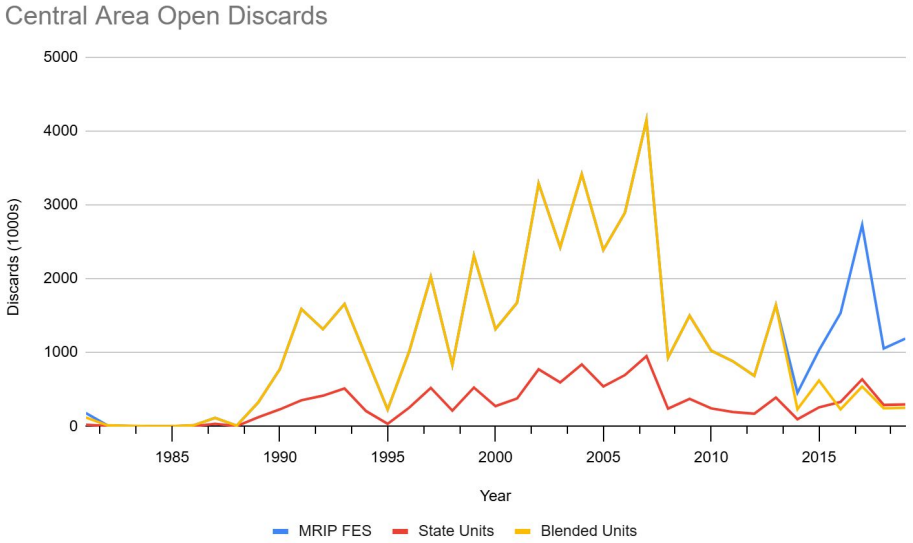
Time Series Central





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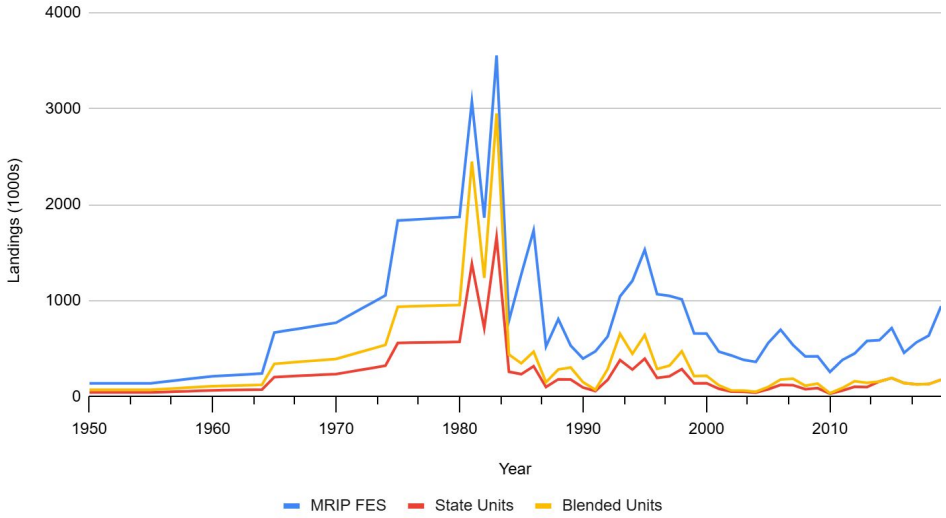
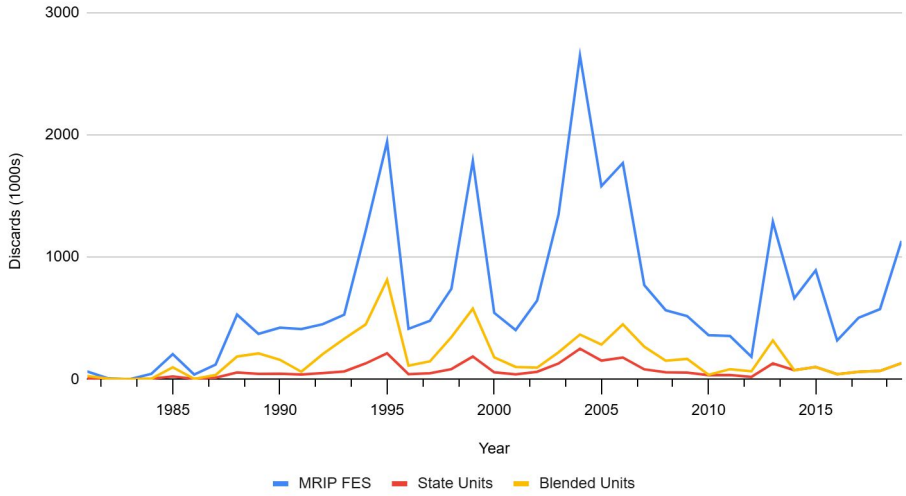
Time Series West

West Area Landings



West Area Open Discards



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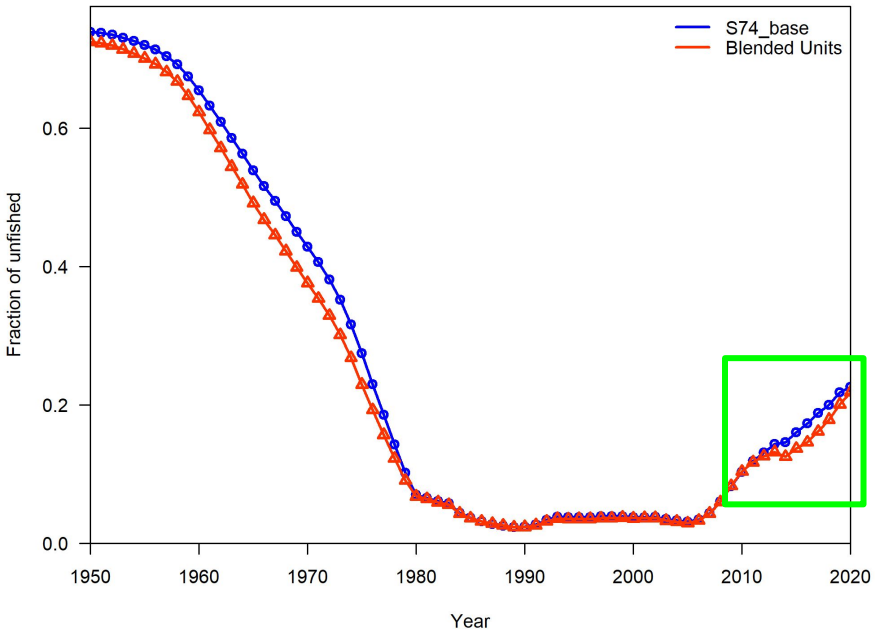
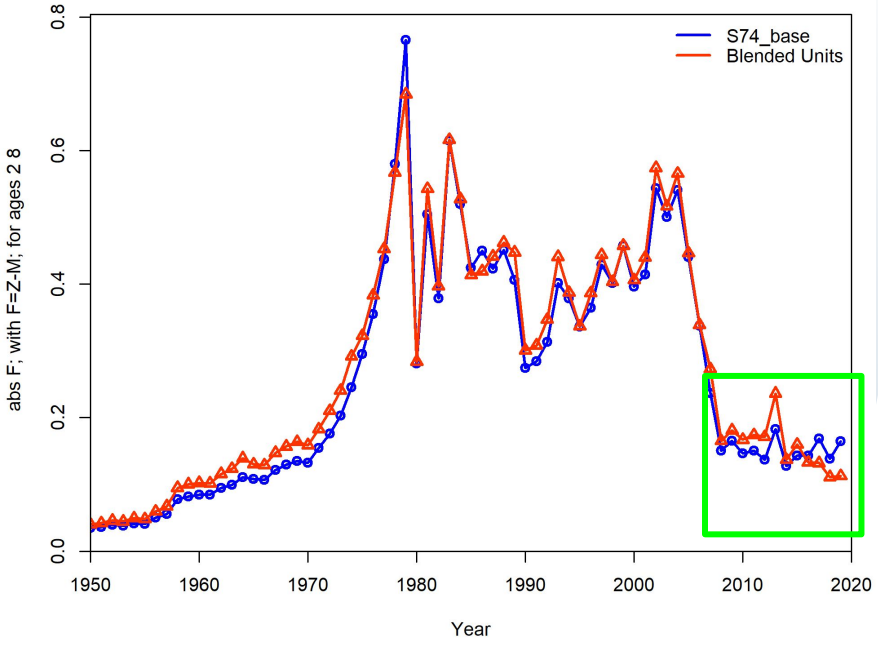
Results (Blended vs Base)





Model can only interpret changing survey units through time as true shifts in fishing mortality and/or abundance.

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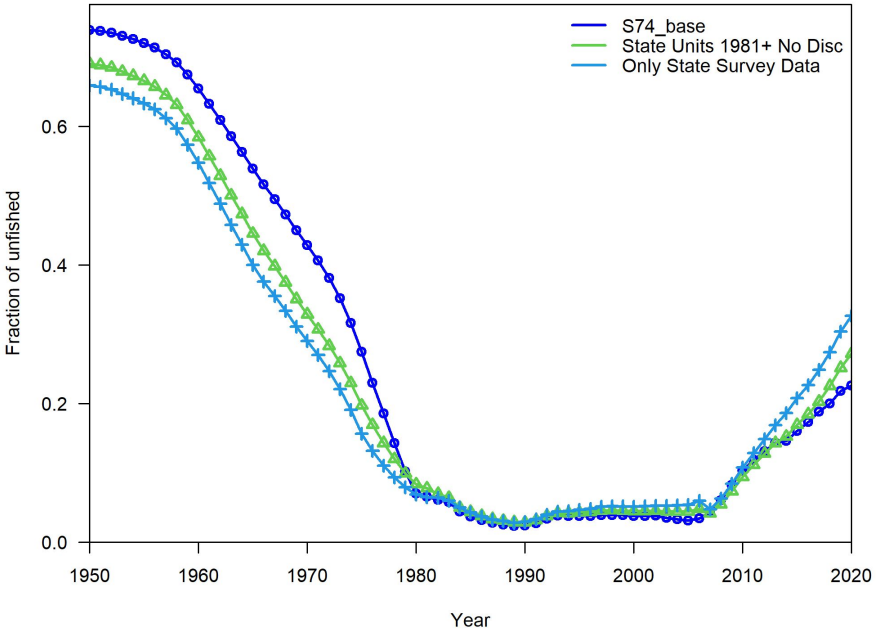
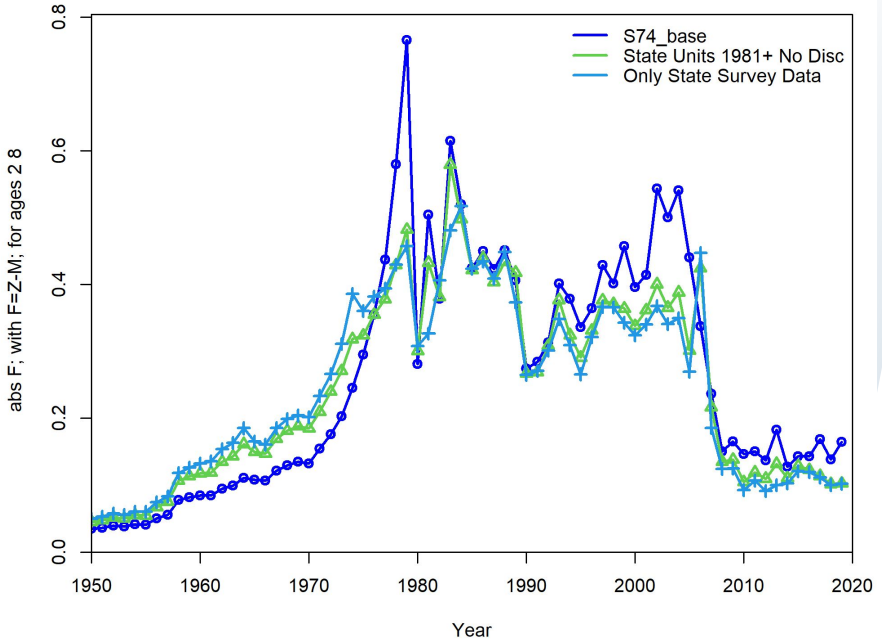
Results (No Discards vs Base)





Failing to include all sources of removals will result in changes to estimates of fishing mortality, biomass ratios and SPR.

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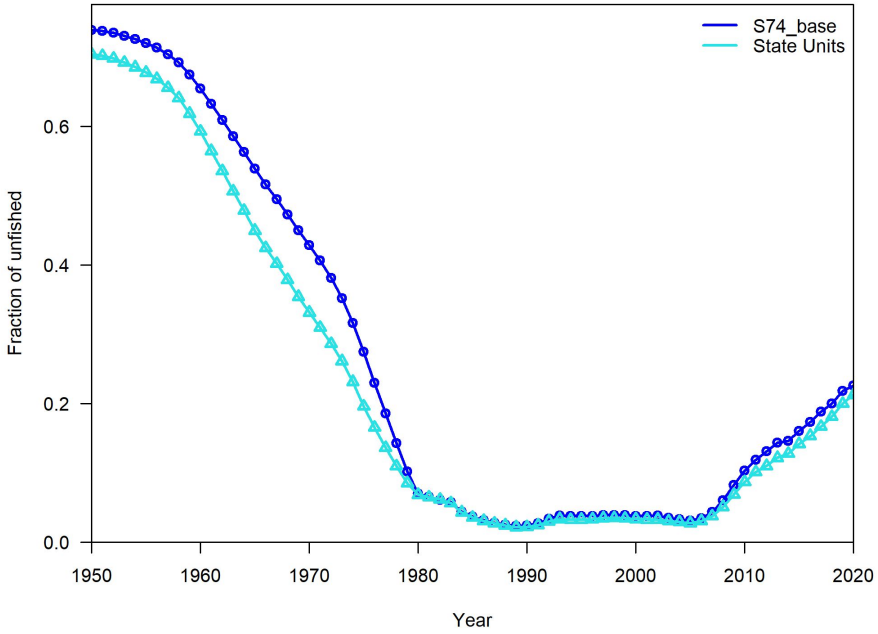
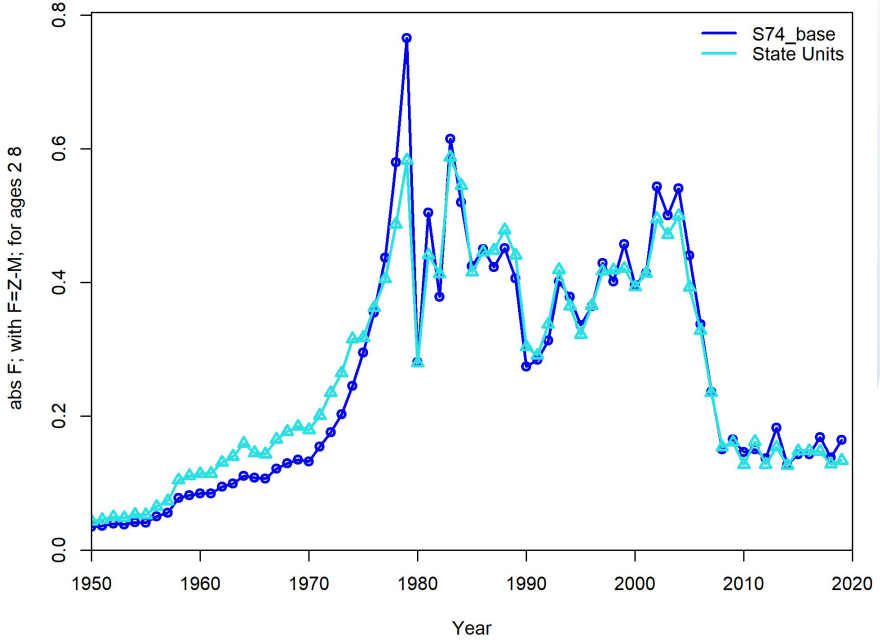
Results (Full Calibrated State vs Base)





Fully calibrated time-series of different magnitudes but with similar interannual variability will produce similar estimates of stock trends; however, changes to stock status, key parameters (e.g., R0, SSB0) and forecasted yields are likely.

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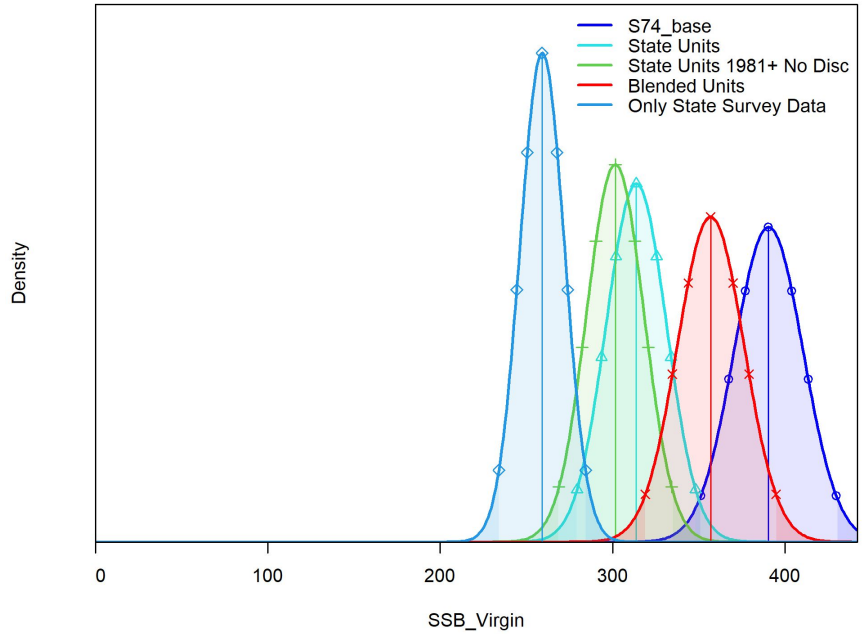
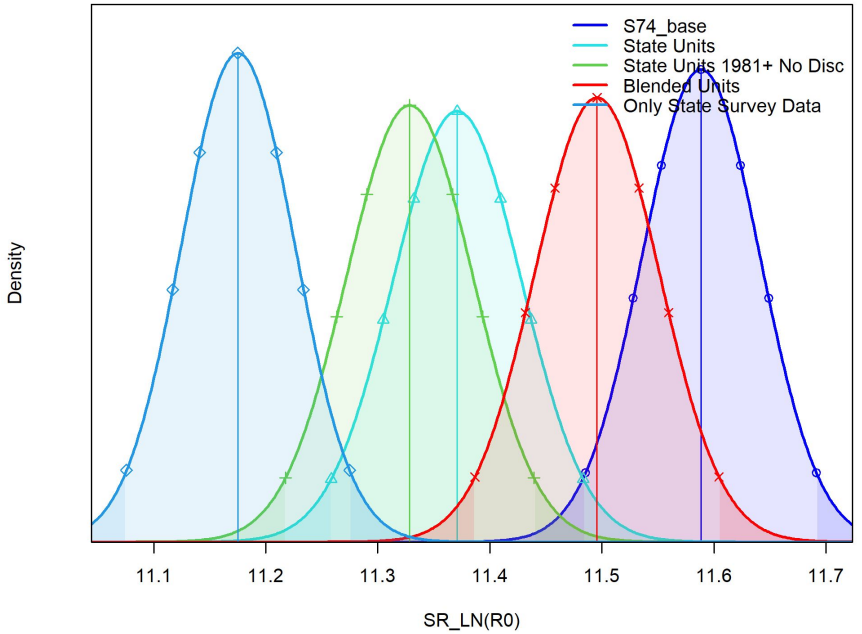
Results (SSB0, R0)





As total removals are reduced, model estimates of productivity (R0) virgin spawning stock biomass (SSB0) are reduced. Declines in these quantities will result in lower relative yield.

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Discussion

- So long as the removal time-series are long, continuous, and consistent, the model will likely estimate similar historic stock trajectories; however, status may vary.

- Yields will differ and will reflect the magnitude of the removals (i.e., if the model sees fewer removals and all other data stays the same, estimates of sustainable yield will come down and vice versa)

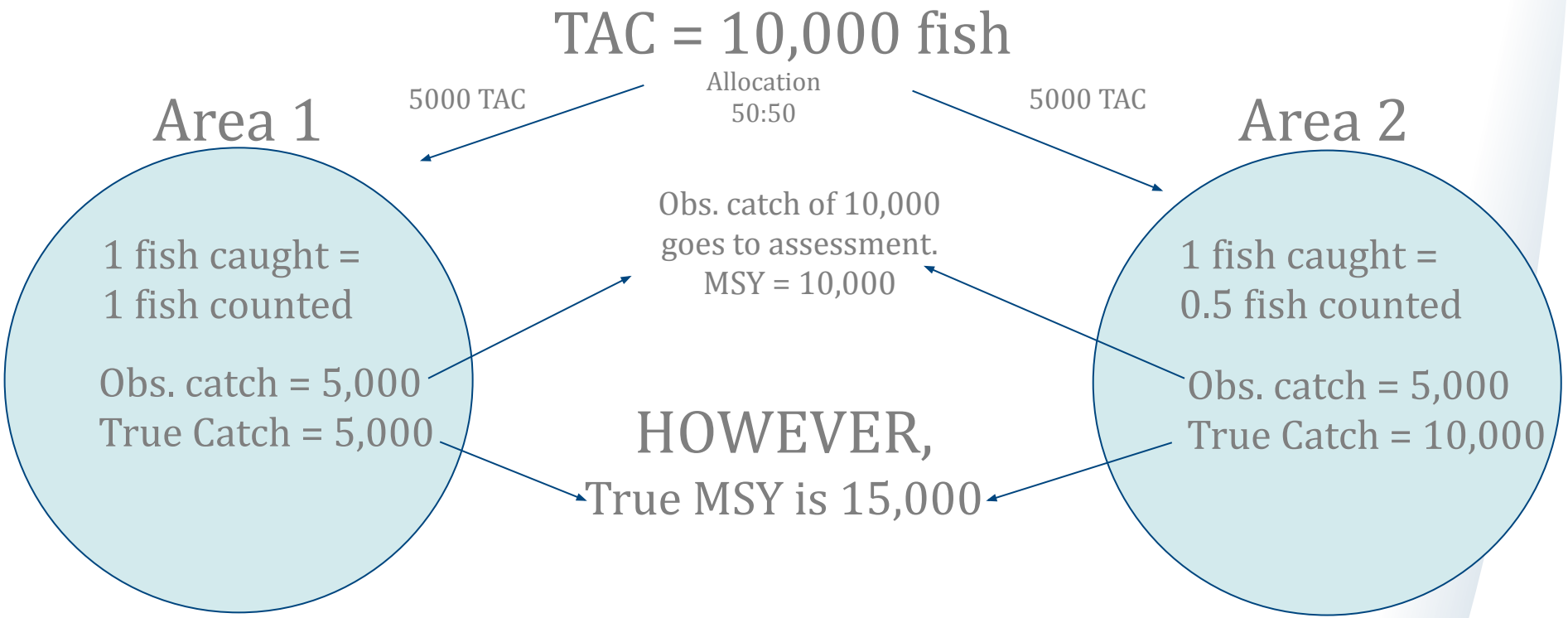
- Tricky part - actual harvest may not differ much (e.g., if you can catch 10,000 fish but we count each as 2 that's the same actual harvest as if you could catch 5,000 fish but we count each as 1)

Discussion (more on the “Tricky Part”)

- Assuming we move toward state surveys as the basis for assessment, interstate calibrations will be important for ensuring that quota and management align.

Interstate calibration hypothetical

- Population at equilibrium, one quota produced and split 50/50 between 2 areas with each area harvesting the quota each year.
- Each areas quota is 5000 annually and the model estimates MSY to be 10,000 fish.
- However, Area 1 and Area 2 use different surveys to monitor their catch



Which means the true area-specific TAC should be 7,500 and the stated 50:50 allocation management goal is not being achieved (current allocation 33:67).

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Discussion (more on the “Tricky Part”)

- Not calibrating between state surveys can:
  - Affect the accuracy of MSY estimates.
  - Lead to unintended departures from allocation goals.
  - Lead to over or under harvest.
  - Generally introduce inefficiencies and inequity into the assessment and management of the stock.
- Area-specific differences in the monitoring and reporting of discards would result in similar distortions.

Recreational Tasks for this Data Workshop

- Critical to the success of this assessment is identifying the range of plausible and defensible recreational statistic time-series.
  - Preferably there will be a “base” case we can agree to and sensitivities as needed.

- All sources of potential bias and uncertainty should be highlighted for each time-series in the report.
  - Identify uncertainty “stanzas” for rec discards.

- Outlier data years for all time-series should be identified and smoothing options recommended.

Presentation Recap

- We encourage data providers to directly answer questions raised during this presentation and document suggested time blocks for data sources in final working group reports.
- Data workshop expectation is quality data over quantity, specifically considering:
  - Composition data from all sources
  - NOAA Internal surveys
  - NOAA External surveys
  - Recreational private landings and discards

Contact

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