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Southeast Fisheries Science Center

Sustainable Fisheries Division

Atlantic Fisheries Branch

# SEDAR 78 – U.S. Atlantic Spanish Mackerel Stock Assessment


South Atlantic Fisheries Management Council
September 15, 2022

# Credits

This stock assessment was constructed, coded, analyzed, diagnosed, fitted, summarized, and reported entirely by

- **Rob Cheshire**, with support from **Matt Vincent.**
- Thanks to Rob and Matt for all their efforts!

# Terms of Reference

SEDAR
SouthEast Data, Assessment, and Review
4055 Faber Place Drive #201
North Charleston SC 29405
Phone (843) 571-4366
Fax (843) 769-4520
www.sedarweb.org

**SEDAR 78**
**Spanish Mackerel**
**Operational Assessment**
**Terms of Reference**

1. Update the approved SEDAR 28 Spanish Mackerel model with data through 2020. Apply the current BAM configuration incorporating approved improvements developed since SEDAR 28.
2. Evaluate and document the following specific changes in input data or deviations from the benchmark model.
   - Update growth and reproductive models if additional samples are available for fish below 275 mm
   - If available, include any improved information on steepness for similar pelagic species.
   - Evaluate data uncertainty with respect to the recreational landings
   - Calculate different F metrics (in addition to apical F) (to address shifts in the age of apical F towards the end of the assessment time series).
3. Document any changes or corrections made to model and input datasets and provide updated input data tables. Provide commercial and recreational landings and discards in pounds and numbers.
4. Update model parameter estimates and their variances, model uncertainties, estimates of stock status and management benchmarks, and provide the probability of overfishing occurring at specified future harvest and exploitation levels.
5. Convene a working group including SSC representatives to meet via webinar, as needed to review model development relative to terms of reference 1 through 4
6. Develop a stock assessment report to address these TORs and fully document the input data, methods, and results.

# **TOR 1:** Update SEDAR 28 with data through 2020. Apply approved improvements to BAM

*SEDAR78 applied the current BAM configuration with a terminal year of 2020. The assessment model structure and data sources were very similar to those used in SEDAR28. Important modifications, such as selectivity functions were investigated through likelihood profiles and visual comparisons of model fit to the data. The decision to remove sex-specific growth and selectivity and modify the start year for the model were evaluated and shown to improve model performance.*

- SEDAR 28 (2012)
  - Not overfished ($SSB_{2011}$/MSST=2.29)
  - Not overfishing ($F_{2009\text{-}2011}/F_{MSY}$=0.526)
- SEDAR 78 Operational assessment
  - Updated through terminal year 2020
  - 1 data scoping call and 4 assessment webinars (**TOR 5**)
  - Panel input and approval of all decisions (**TOR 5**)



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# **TOR 2a:** Update growth and reproduction models if additional samples are available for fish <275mm

- Growth models were developed with increased age-0 samples primarily from the SEAMAP Coastal Trawl Survey. There was very limited reproduction information.
- Von Bertalanffy growth (***updated***)
  - Population growth curve – all data
  - Fishery growth curve – fishery samples taken during 12” minimum size limit
  - Female growth curve – female population growth
- Age-based natural mortality (***updated***)
  - Lorenzen curve scaled to Hoenig constant M as in SEDAR28 using updated population growth parameters



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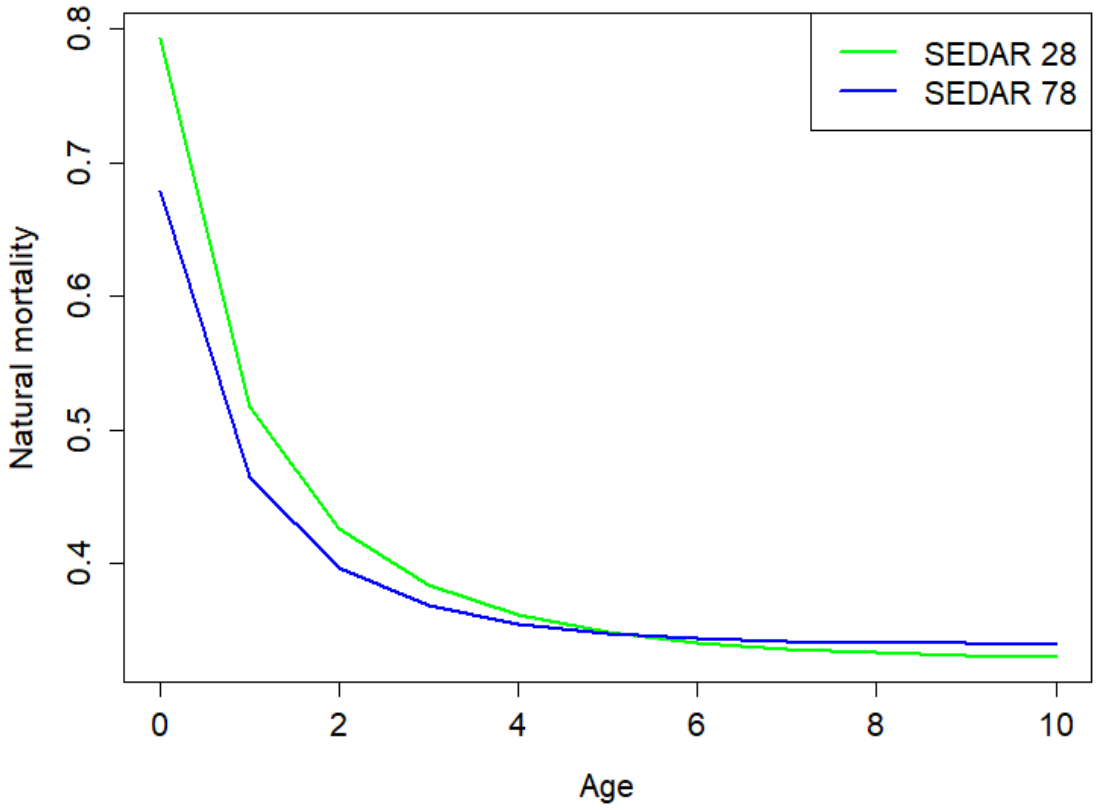
*Table 1, pdf page 90*

# Natural Mortality

- Constant = 0.35 based on Hoenig (fish only) as in SEDAR 28
- Age-dependent based on Lorenzen method with updated population growth model, scaled to ages 2+ as in SEDAR 28



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# **TOR 2b-d:** If available, include any improved information on steepness for similar pelagic species. Evaluate data uncertainty with respect to the recreational landings. Calculate different F metric to address shifts in the age of apical F towards the end of the assessment time series

- There was no new information on steepness that could be applied in this assessment. Likelihood profiles on steepness had similar results to SEDAR28.
- Uncertainty in recreational landings was presented in associated working papers. Years with large increases, such as 2020, were evaluated and discussed in greater detail.
- The spawning potential ratio conditional on annual F and exploitation rates were examined as additional F metrics.



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# **TOR 3:** Document any changes or corrections made to model and input datasets and provide updated input data tables. Provide commercial and recreational landings and discards in pounds and numbers

Changes to data and model are documented in the stock assessment report, along with tables of updated data input and removals in both pounds and numbers. **In this presentation, relevant table/figure references appear at upper right of slide.**



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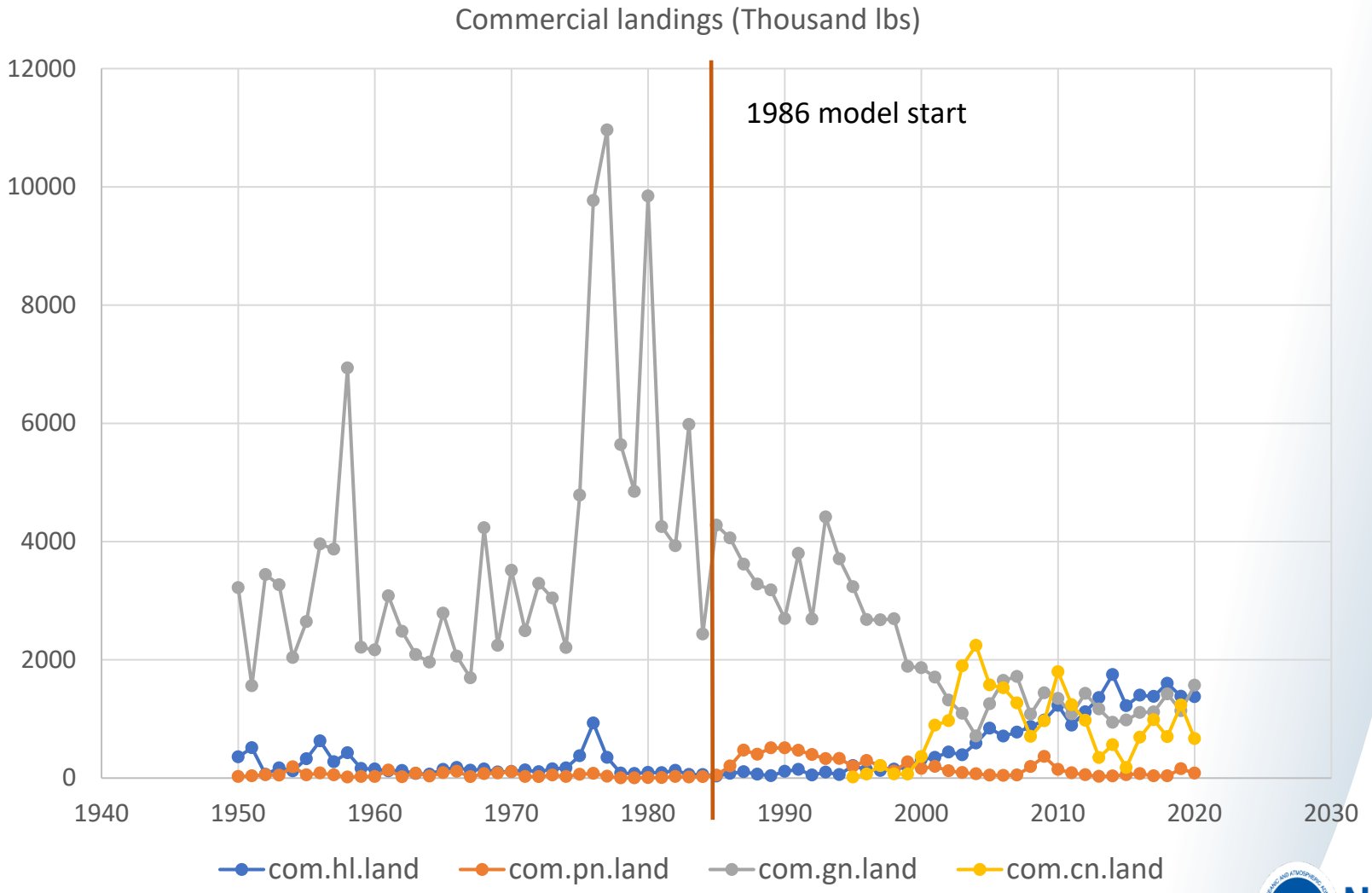
# Commercial Landings

## hl – handline, pn – pound net, gn – gillnet, cn – cast net



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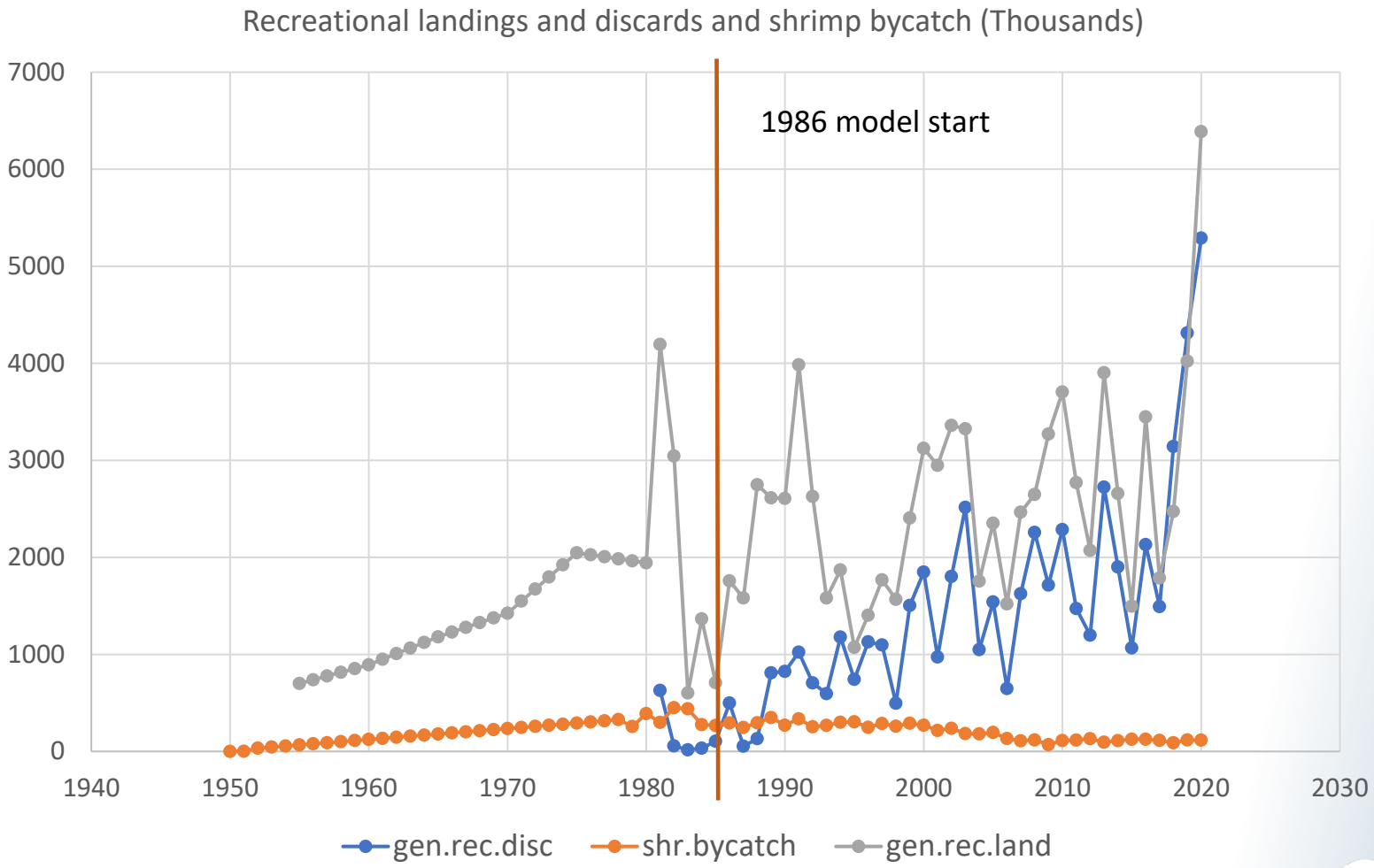
# Recreational and Shrimp Bycatch

## disc – discards (live and dead), shr – shrimp bycatch (dead)



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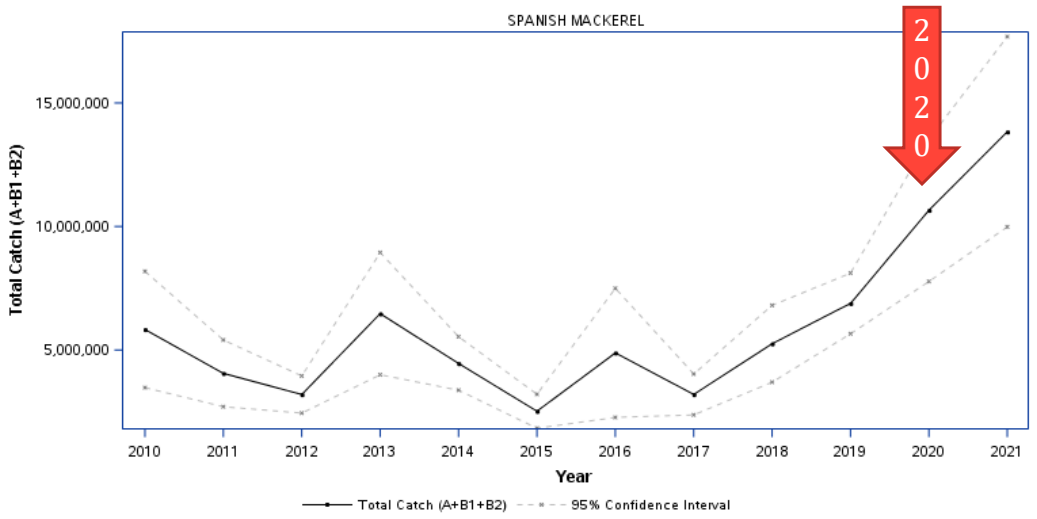
**Your Query Parameters:**

| | |
|---|---|
| **Query:** | MRIP CATCH TIME SERIES |
| **Year:** | 2010 - 2021 |
| **Wave:** | ANNUAL |
| **Species:** | SPANISH MACKEREL |
| **Geographic Area:** | SOUTH ATLANTIC |
| **Fishing Mode:** | ALL MODES COMBINED |
| **Fishing Area:** | ALL AREAS COMBINED |
| **Type of Catch:** | TOTAL CATCH (TYPE A + B1 + B2) |
| **Information:** | NUMBERS OF FISH |

**Some estimates may be considered preliminary. Please rerun your query with table output to view estimate status.
**NOTE: Y-axis scale may not be the same for multiple graphs.

Return to Query Page

Common Name=SPANISH MACKEREL



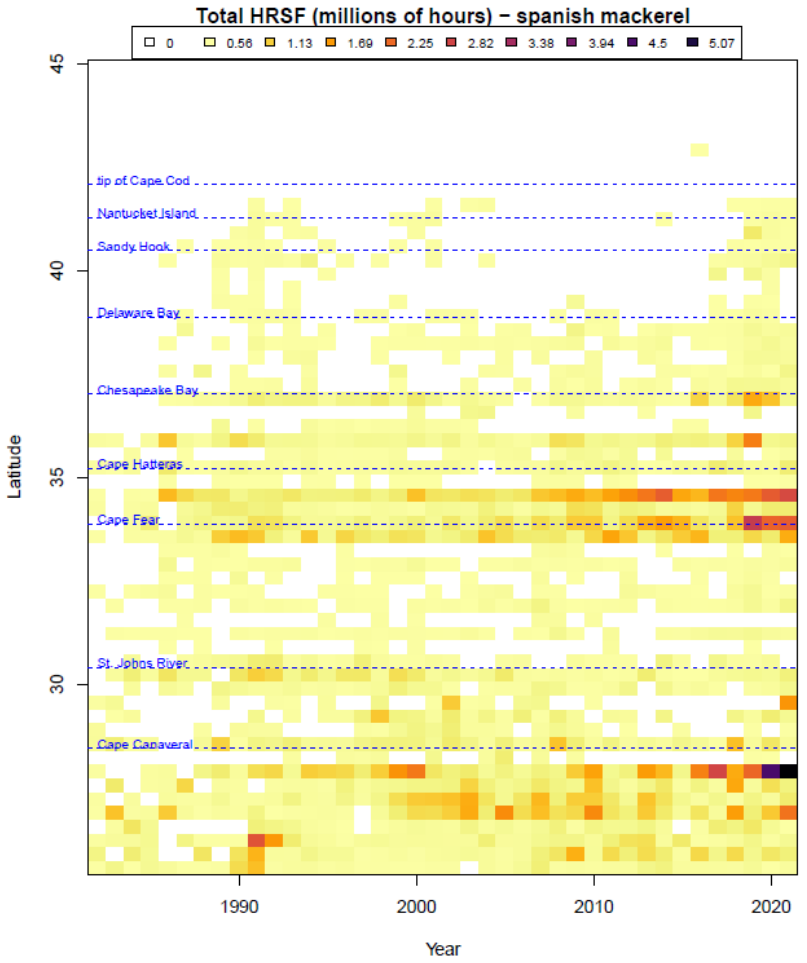
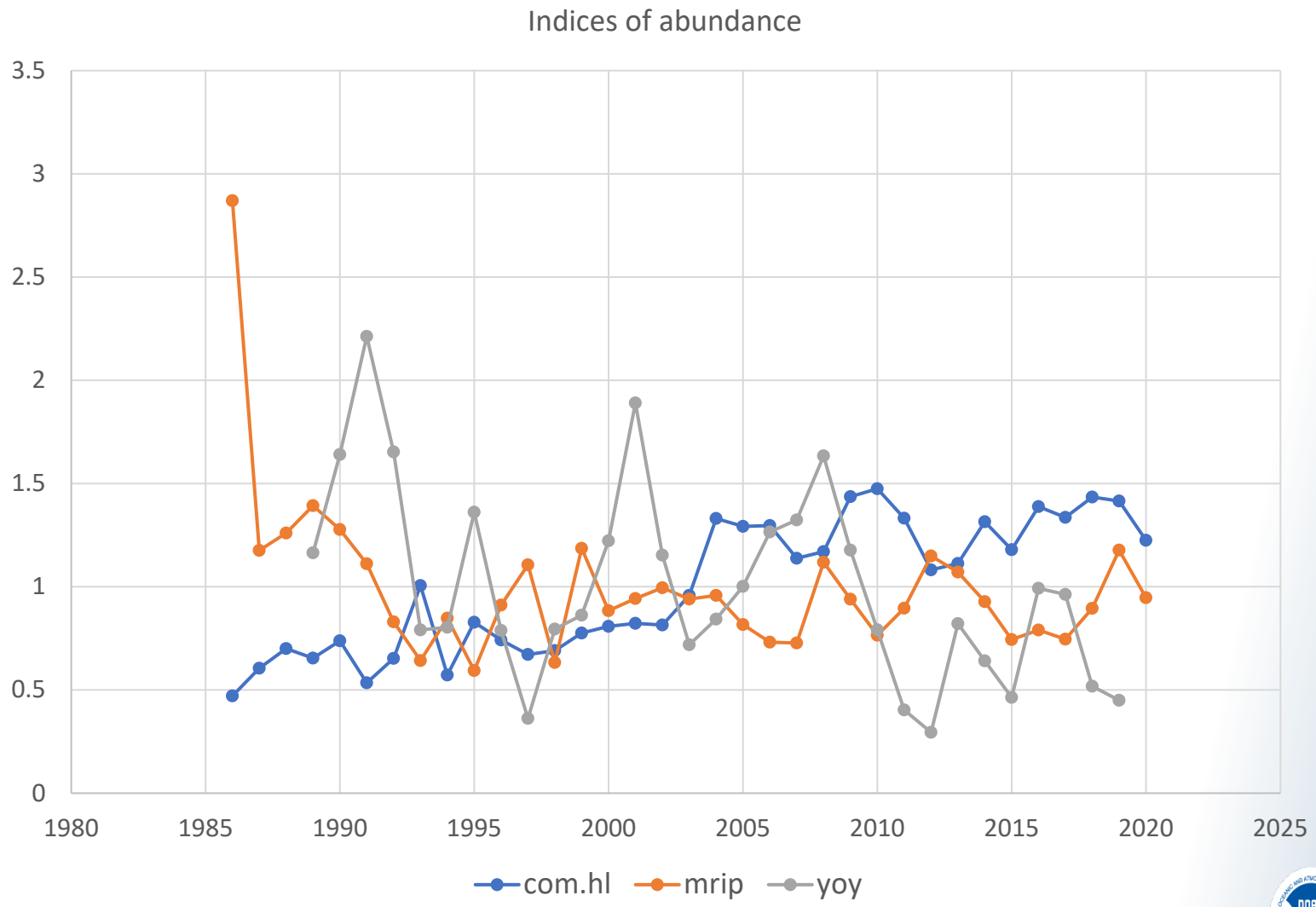



*Table 3, pdf page 92*

*Fig 11-13, pdf pages 134-136*

# Indices of abundance

## com.hl – FL trip ticket, mrip – recreational, yoy – SEAMAP trawl



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*Tables 4-8, pdf pages 93-95*

# Length and age compositions

- Length compositions determined to be noisy and uninformative as in previous assessments
- Modified minimum sample size requirements for age compositions to match current best practices (30 fish, 10 trips)
  - Annual commercial handline and cast net fleet age compositions did not meet minimum sample size for most years
  - Selectivity differences precluded pooling with other gears
  - Pooled across years, annual samples sizes included for model fit

# **TOR 4:** Update model parameter estimates and their variances, model uncertainties, estimates of stock status and management benchmarks, and provide the probability of overfishing occurring at specified future harvest and exploitation levels

- Detailed information about key estimates and outputs are available in the stock assessment report.
- Key uncertainties explored included: assessment start year, selectivity, initial F, M, steepness



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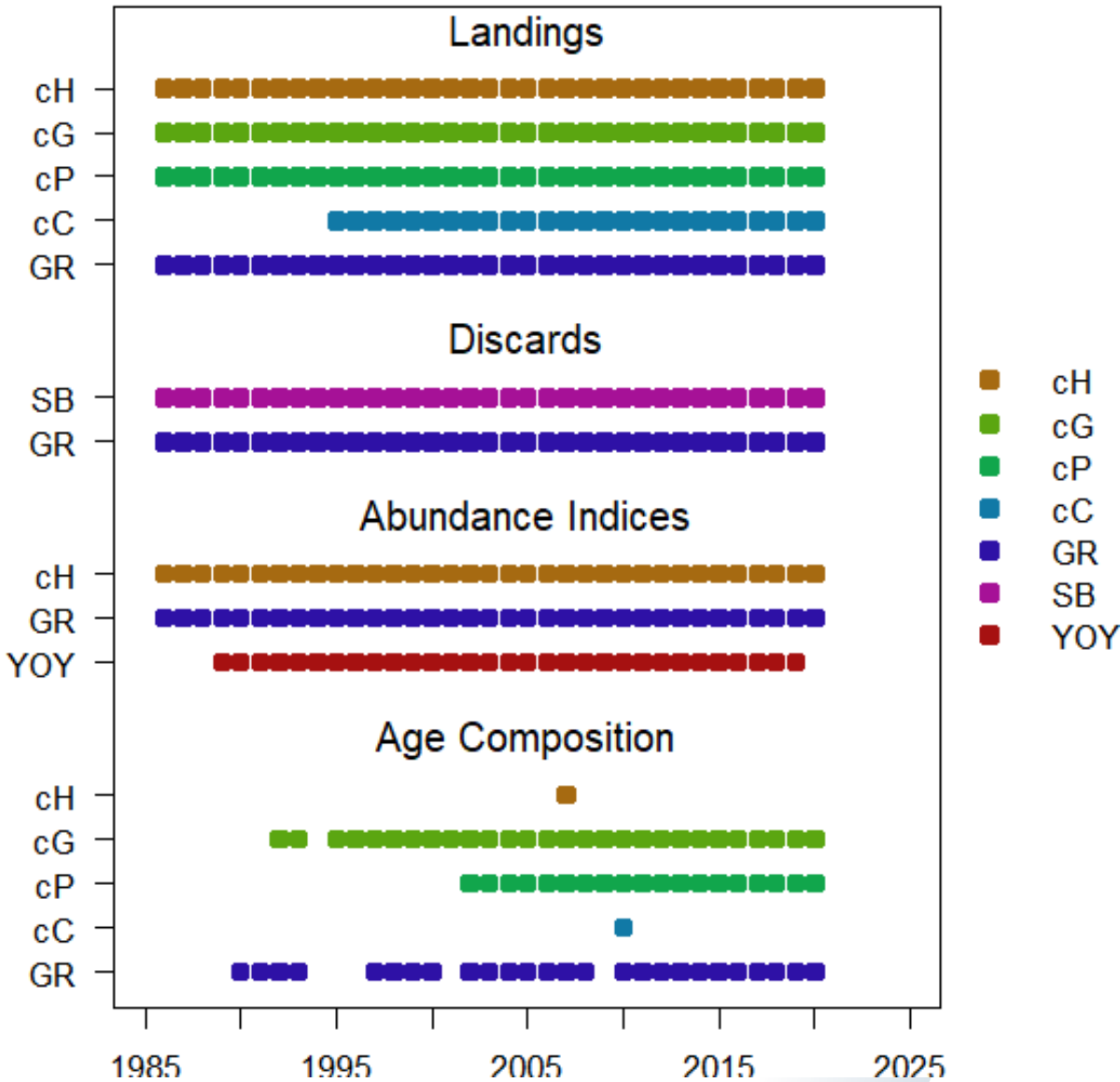
# Base Run Recommendations:

- Start model in 1986 (and truncate MRIP index)
- Allow model to estimate initial F
- No information in M or steepness profiles to deviate from fixed values from SEDAR 28 for base run

# Base Run Data:

commercial handline (cH)
commercial gill net (cG)
commercial pound net (cP)
commercial cast net (cC)
general recreational (GR)
shrimp bycatch (SB)
young-of-the-year (YOY)



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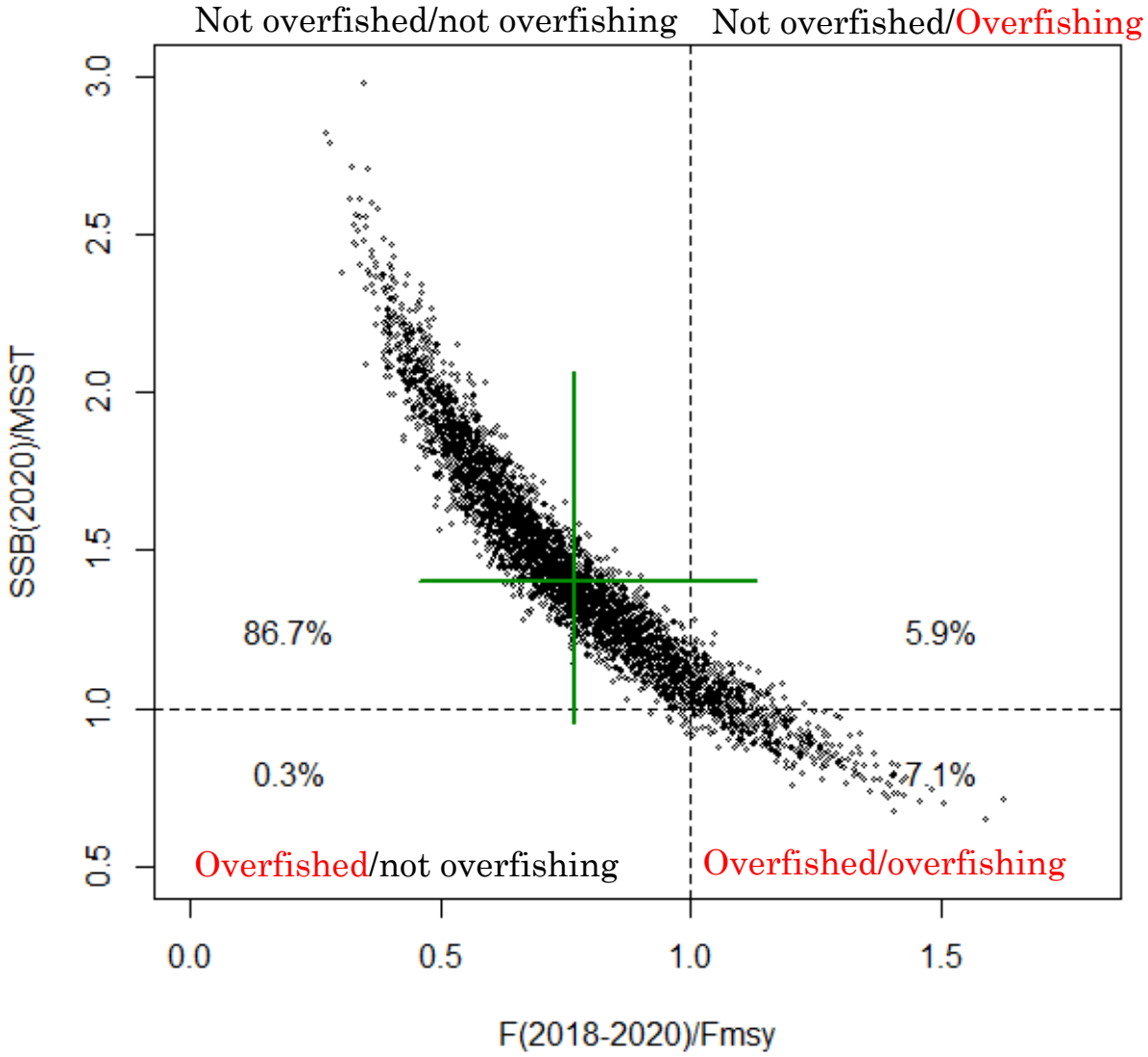
# Uncertainty Characterization (MCB Ensemble):

- Bootstrap the data
  - Multinomial resampling of age and length comps
  - Multiplicative lognormal error on indices, landings, and discards
- Monte Carlo draws
  - Natural mortality – Truncated Normal distribution
    - $M \sim N(0.35, 0.036)$ with bounds $(0.3, 0.42)$
    - Use +/- 2 ages for Hoenig(fish) M bounds (0.3,0.42)
  - Steepness – Truncated Normal distribution
    - $S \sim N(0.75, 0.097)$ with bounds $(0.6, 0.9)$
  - Discard mortality – Truncated Normal distribution
    - $D \sim N(0.2, 0.05)$ with bounds $(0.1, 0.3)$

# Status – Phase SSB/MSST

The base run of the BAM indicated that the stock is not overfished SSB/MSST =1.4, and that overfishing is not occurring based on the 3–year geometric mean *F* /*F*MSY =0.77



# Management Advice:

- To inform catch recommendations, three projection scenarios were developed by the assessment panel and are described in the stock assessment report. They will not be presented because the SSC has not yet accepted the base model for use in management.



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# SSC Evaluation :

- Council staff prepared a very comprehensive outline to guide the SSC review of SEDAR 78. The SSC expressed a number of concerns, most notably:
  - Inputs and data quality need to be more thoroughly investigated before setting catch recommendations (e.g. recreational landings, age composition)
  - The operational assessment TORs constrained the modeling approach and there could be alternative data inputs that would benefit future assessments.
  - Stock status classification has great deal of uncertainty because of terminal year data; this uncertainty leads into little confidence in projections.
- The SSC proposes to assemble a group to compile a specific list of recommendations to the SEFSC to improve the assessment in order to achieve stock status determination and catch level recommendations.
- The SEFSC notes that some concerns are outside the scope and TORs of an OA, and that complicated and/or numerous revisions could require substantial adjustments to the 2023 assessment calendar.




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# EXTRA SLIDES

- Click to edit Master text styles
  - Second level
    - Third level
      - Fourth level
        - Fifth level



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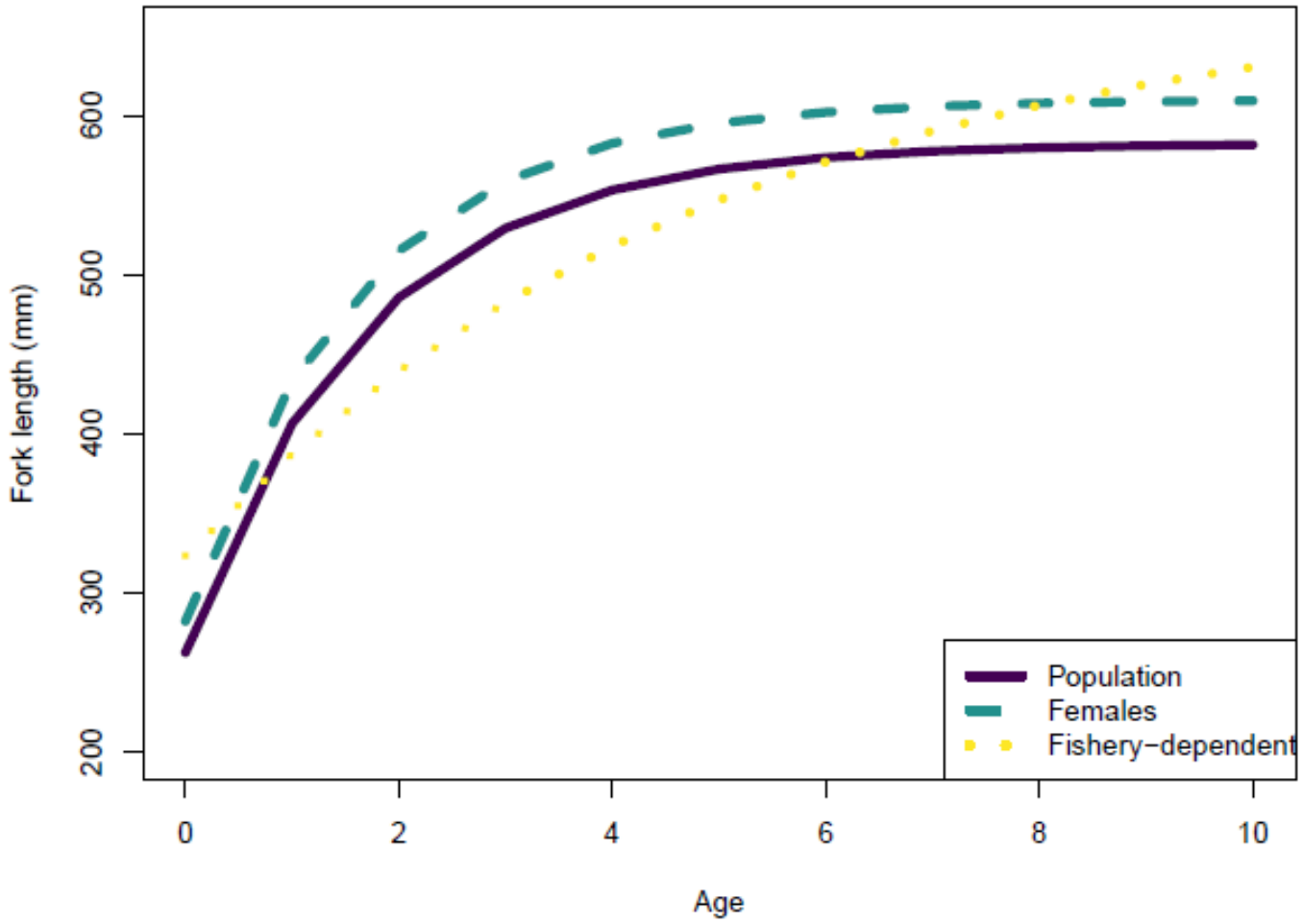
# Growth



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# Growth

Figure 1, pdf page 115

| model | Diaz Correction | weighted | Linf (mm) | K | t0 | cv |
|---|---|---|---|---|---|---|
| Population* | yes | yes | 582.5 | 0.598 | -0.5 | 0.18 |
| population | yes | no | 491.6 | 0.786 | -0.5 | 0.17 |
| model | Diaz Correction | weighted | Linf (mm) | K | t0 | cv |
| fishery | no | yes | 738.9 | 0.146 | -3.57 | 0.13 |
| Fishery* | no | no | 680. 4 | 0.197 | -2.77 | 0.12 |
| model | Diaz Correction | weighted | Linf (mm) | K | t0 | cv |
| Females* | yes | yes | 610.1 | 0.62 | -0.5 | 0.16 |
| females | yes | no | 518.3 | 0.779 | -0.5 | 0.16 |

*Fig 40, pdf page 163*

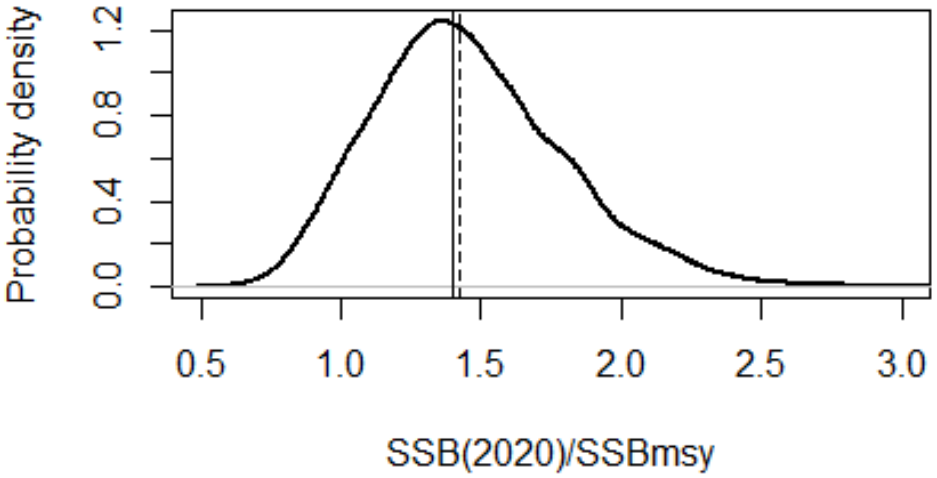
# Stock Status

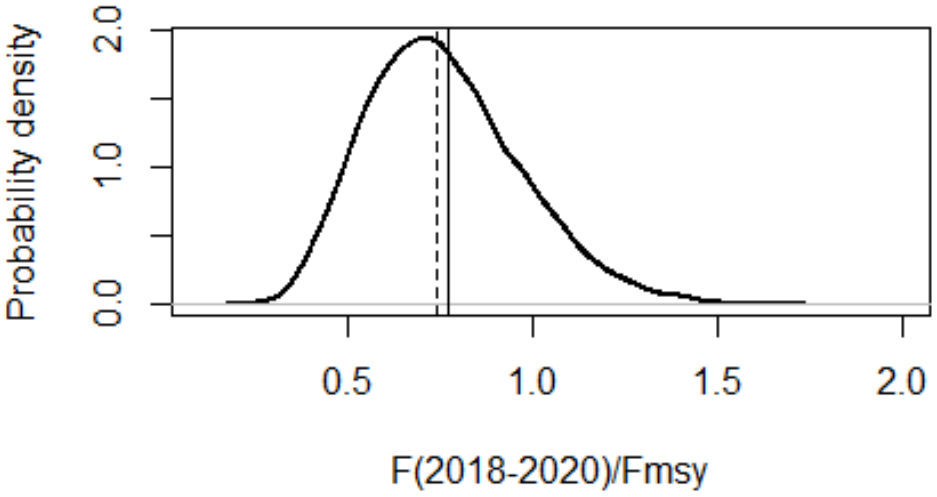
Solid vertical line=point estimate from base run

Dashed vertical line=median from MCBE

SSB=mature female biomass

F=apical F



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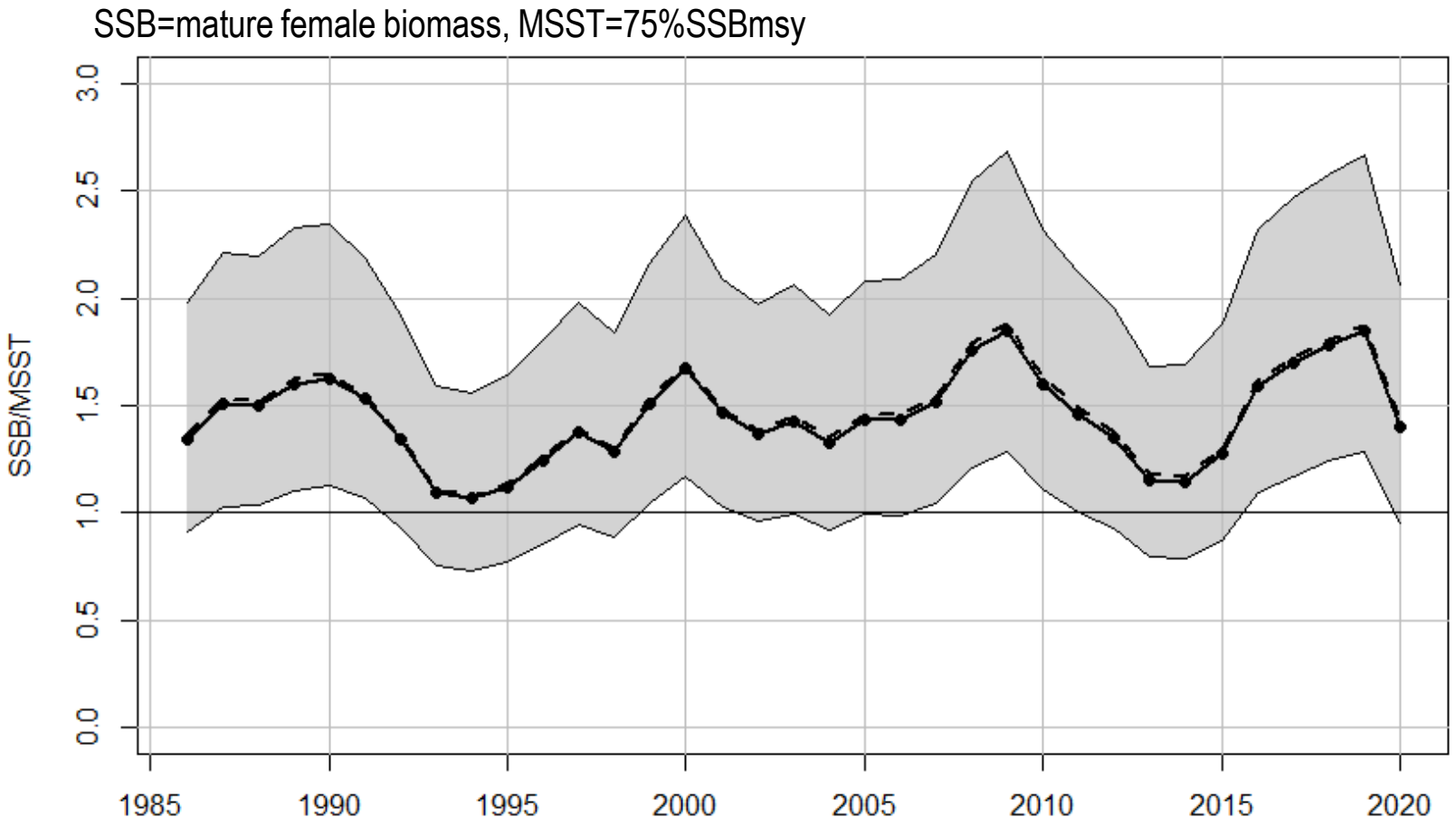
# Status time series – SSB/MSST




Solid line indicates estimates from base run; dashed lines indicate the median of the MCBE trials; gray error bands indicate 5th to 95th percentiles of the MCB trials.



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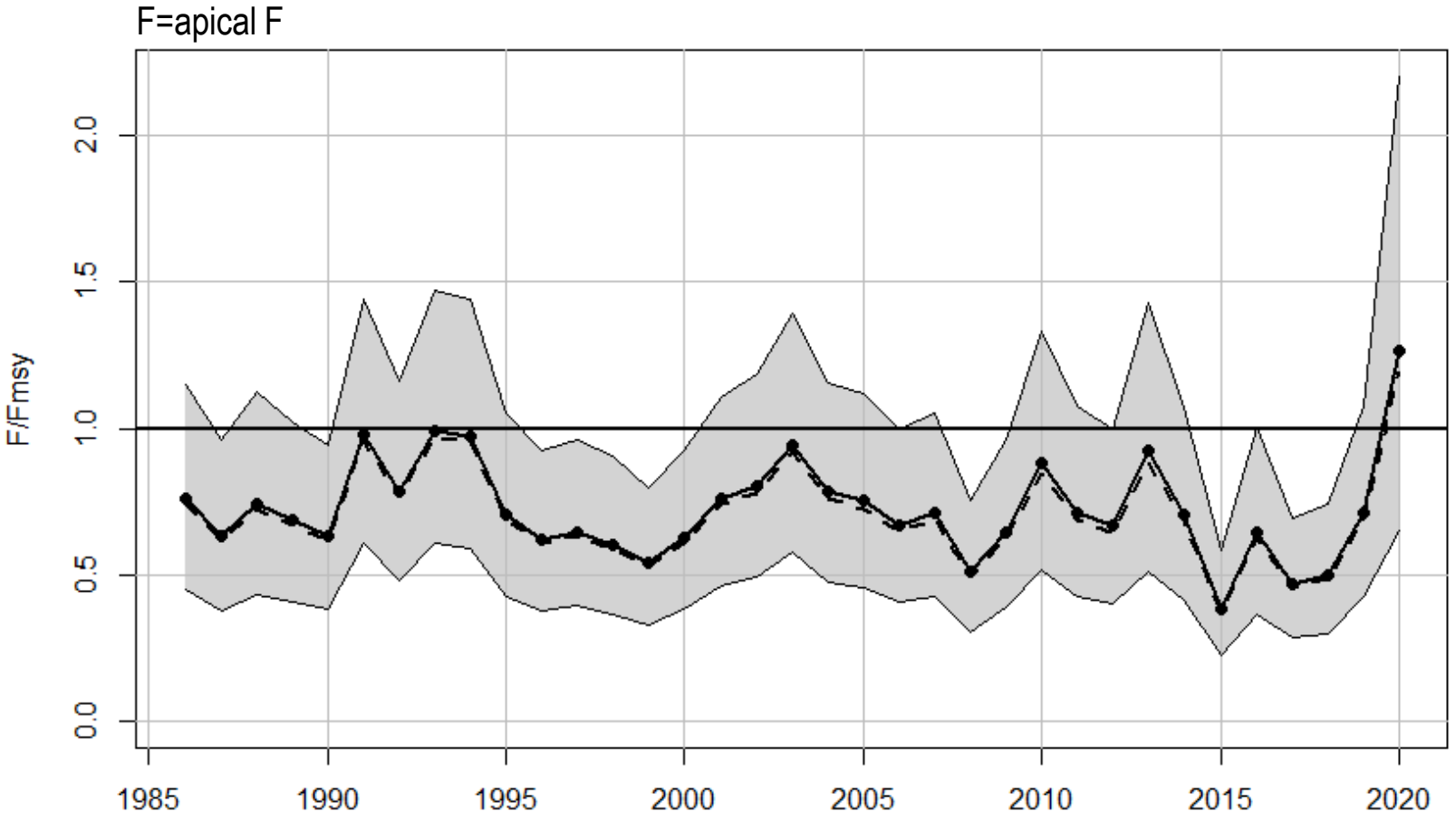
# Status time series – F/Fmsy




Solid line indicates estimates from base run; dashed lines indicate the median of the MCBE trials; gray error bands indicate 5th to 95th percentiles of the MCB trials.



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