ToR 7:
Research Recommendations

Yellowtail Flounder Research Track Stock Assessment Peer Review

November 18-22, 2024

Northeast Fisheries Science Center

Woods Hole, MA

TOR 7: Research Recommendations

- Review, evaluate, and report on the status of research recommendations from the last assessment peer review, including recommendations provided by the prior assessment working group, peer review panel, and SSC.

- Identify new recommendations for future research, data collection, and assessment methodology. If any ecosystem influences from TOR 1 could not be considered quantitatively under that or other TORs, describe next steps for development, testing, and review of quantitative relationships and how they could best inform assessments.

- Prioritize research recommendations.

Presentation Outline

1. Overview of WG approach to ToR 7
2. Status of Previous Research Recommendations by stock
3. New Research Recommendations

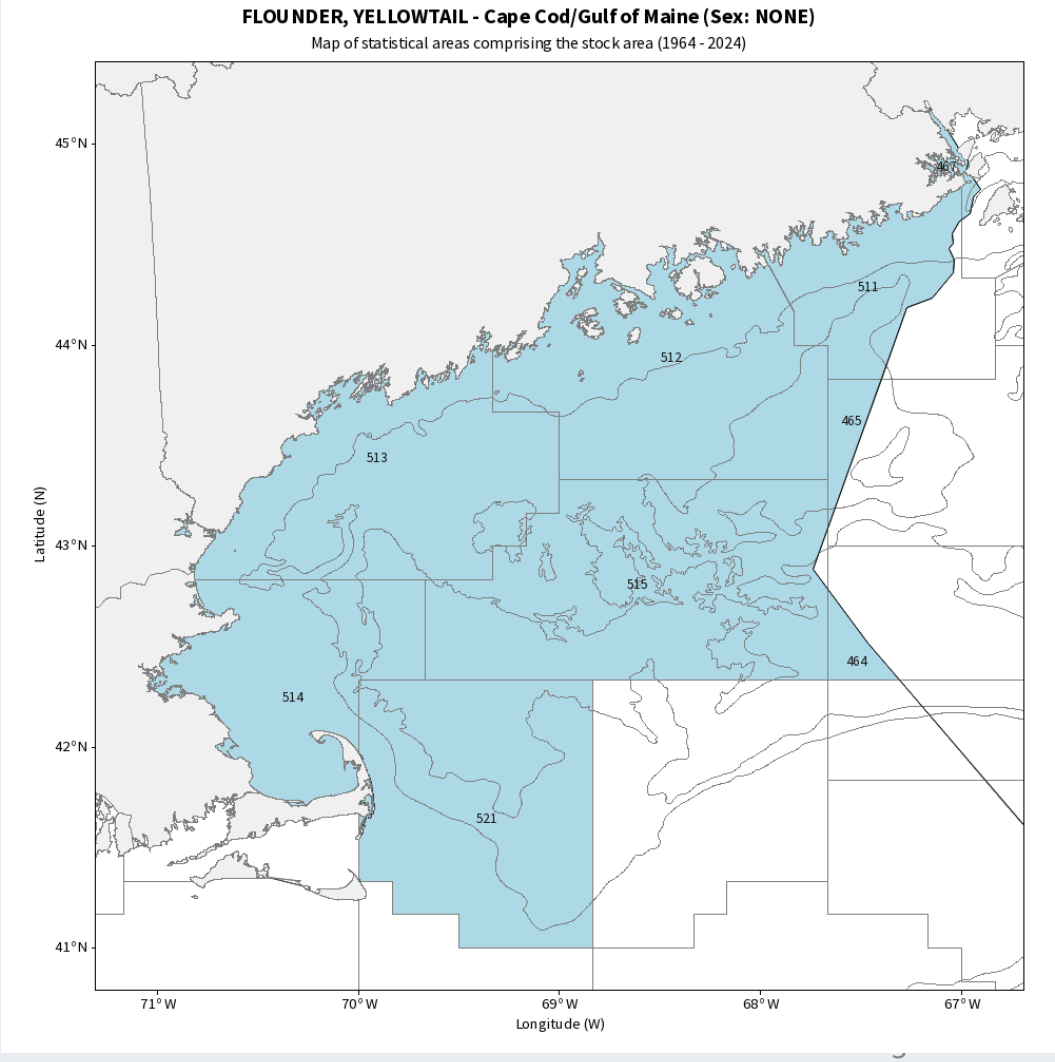
Overview of WG Approach

1. Review of recommendations made to the WG from recent assessments and peer review reports.
2. Recommendations shaped WG work plan.
3. WG responded to recommendations.
4. WG identified new recommendations for future research, data collection, and assessment methodology.

Cape Cod Gulf of Maine

Recommendations from:

- 2022 Management Track Assessment (MT) Report
- 2019 Operational Assessment and peer review
- 2008 Groundfish Assessment Review Meeting (GARM III) and peer review



Status of Previous Research Recommendations
Stock Structure and Biology

Growth and Maturity: This assessment could benefit from updated growth and maturity studies. The current maturity and growth parameters are based on GARM III estimates (NEFSC 2008) which are over a decade old. [2022 MT, 2019 Operational Assessment]

- *Updates to maturity were addressed with a white paper on geographic variation in maturity for all three yellowtail flounder stocks (Alade and Hansell WP).*
- *A literature review of stock structure found faster growth and maturation in the southern stocks (Cadrin 2003).*
- *Life history parameters were updated for all three stocks.*

Status of Previous Research Recommendations
Stock Structure and Biology

Size-dependent distribution: Investigations to characterize spatial dynamics in age and size dependent distribution of yellowtail and any potential implications it may have on the survey catch. [2019 Operational Assessment]

- *Spatial dynamics in age and size-dependent distribution of yellowtail flounder were broadly characterized as part of the literature review on stock structure (Cadrin 2003), yet fine scale analyses are still needed.*

- *For state inshore surveys (MADMF and MEDMR) it is hypothesized that spatial aspects of spawning migration and shifting distribution may influence catchability as it relates to survey timing. Future assessments could explore effects of these state surveys to evaluate this hypothesis more effectively.*

Status of Previous Research Recommendations
ToR1: Ecosystem and Climate Influences

Catchability: Following the approach for the Georges Bank stock, it would be worthwhile splitting the survey time series to explore whether similar trends with survey catchability are present. If so, spatial differences in the survey selectivity and/or environmental covariates (temperature) should be investigated as potential. causative processes. [2008 GARM III Peer review]

- *This research recommendation is less relevant as of the writing of this report, as it pertains to a potential approach for addressing the retrospective pattern in the VPA model platform, which no longer applies to this research track due to the use of the WHAM model platform for this stock.*
- *The current model splits the survey time series and updates natural mortality from 0.2 to 0.4, which is time and age invariant.*
- *Model runs were conducted to explore environmental covariates on natural mortality and recruitment. None of those model formulations were considered acceptable.*

Status of Previous Research Recommendations
ToR1: Ecosystem and Climate Influences

Productivity: The Panel noted the need to investigate long-term changes in stock productivity given the severe decline of the resource. This has implications for the determination of biological reference points. [GARM III Peer review].

- *This research recommendation is less relevant as of the writing of this report as it was when it was written for GARM III. The stock is now increasing.*
- *Addressed via exploration of time-varying recruitment with and without a stock-recruit relationship.*
- *Directed research found productivity estimated from a stock-recruit relationship was not found to be significant for the CCGOM stock (Tableau et al. 2019).*
- *Future studies could continue to reconsider environmental covariates on recruitment.*

Status of Previous Research Recommendations
ToR2: Catch

Length-weight conversion: The length-to-weight conversion should be examined in the future to determine if it has changed over time.[2019 Operational Assessment Peer Review].

- *This research recommendation was completed by transitioning to the Woods Hole Assessment Model (WHAM) which incorporates statistical fits and accounts for uncertainty within the model.*

Status of Previous Research Recommendations
ToR4: Model

Model Platform:

The Cape Cod-Gulf of Maine yellowtail flounder assessment could be improved with a change in model platform that incorporates statistical fits and accounts for measures of uncertainty in the model. [2022 MT Assessment].

- *This research recommendation was completed by transitioning to the Woods Hole Assessment Model (WHAM) which incorporates statistical fits and accounts for uncertainty within the model.*

Future modeling efforts should consider forward-projecting statistical catch-at-age models to account for uncertainty in the data inputs. [2019 Operational Assessment]

- *Addressed. WHAM is an age-structured model that allows for projections.*

We are expecting that the remaining VPA stocks, which all have research tracks coming up, will be moving away from the VPA. [2019 Operational Assessment Peer Review]

- *Addressed by transitioning to WHAM.*

Status of Previous Research Recommendations
ToR4: Model

Natural Mortality:

A Lorenzen M is being used for SNE yellowtail, and it may be that a similar M should be considered for this stock. During the RT for all three yellowtail stocks in 2024, a consistent approach to determining natural mortality should be applied across yellowtail flounder stocks. [2019 Operational Assessment Peer Review].

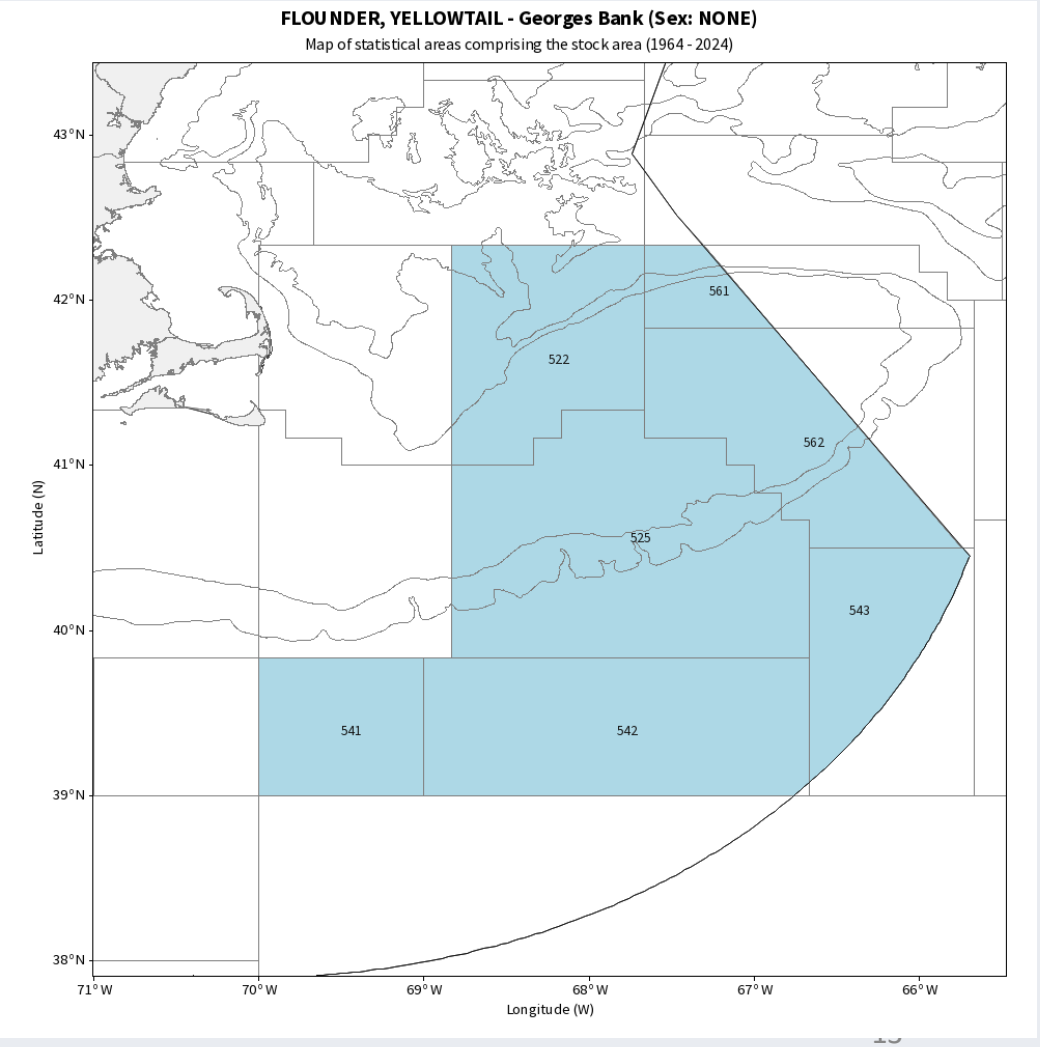
- *This recommendation was addressed in a white paper on approximating the natural mortality rate for all three stocks (Cadrin WP). A suite of estimators, including Lorenzen M, were compared.*
- *Estimating M via the Lorenzen (1996) method was one setting that was explored in model comparison for the CCGOM stock but was not selected for the final model.*

Georges Bank

Recommendations from:

- 2022 Transboundary Resource Assessment Committee Status Report and peer review

- 2008 Groundfish Assessment Review Meeting (GARM III) and peer review



Status of Previous Research Recommendations
Stock Structure and Biology

Stock Structure:

Consider all three stocks (Georges Bank, Cape Cod – Gulf of Maine and Southern New England – Mid Atlantic Bight) as a complex with migration between components. [GARM III Peer Review]

- *This recommendation was addressed by directed research (Goethal et al. 2015). Results indicated that movement among stocks was low, estimates of stock size and fishing mortality were similar to those from conventional stock assessments, and incorporating stock connectivity did not resolve residual patterns.*

Status of Previous Research Recommendations
ToR2: Catch

Discards: Clarify discard estimation procedures.[2022 TRAC]

- *Resolved within TRAC 2022.*

Status of Previous Research Recommendations
ToR4: Model

Model Platform:

Investigate the limiter approach and note the lack of responsiveness in the stock. [2022 TRAC].

- *Resolved by transitioning to WHAM.*

Age Composition:

Examine tradeoffs in model specification regarding the likelihood of age composition data and fit to survey trend vs. commercial age. [2008 GARM III Peer Review]

- *After an exploration of tradeoffs, it was concluded that logistic normal age compositions were the most appropriate.*

Status of Previous Research Recommendations
ToR4: Model

Catchability: Investigate survey catchability as it relates to habitat shifts. Consider splitting the survey time series in the mid-1990s. [2008 GARM III Peer Review]

- *Splitting the NMFS BTS survey in the mid-1990s was recommended to improve the diagnostics of the model used in GARM III and is not considered appropriate for the current model framework.*
- *However, in this RT splitting the survey for the change in vessel (2009) was explored. Additionally, process error was explored on survey catchability and selectivity.*

Status of Previous Research Recommendations
ToR4: Model

Selectivity:

The partial recruitment pattern on the ages four plus needs corroboration. Model fits presented at the meeting suggested dome partial recruitments in both the survey and commercial fishery which was at odds with the results of tagging analysis, which suggested no dome. [GARM III Peer Review]

- *This recommendation was addressed by changing the modeling platform to WHAM. There were no diagnostic issues that indicated further exploration was needed.*

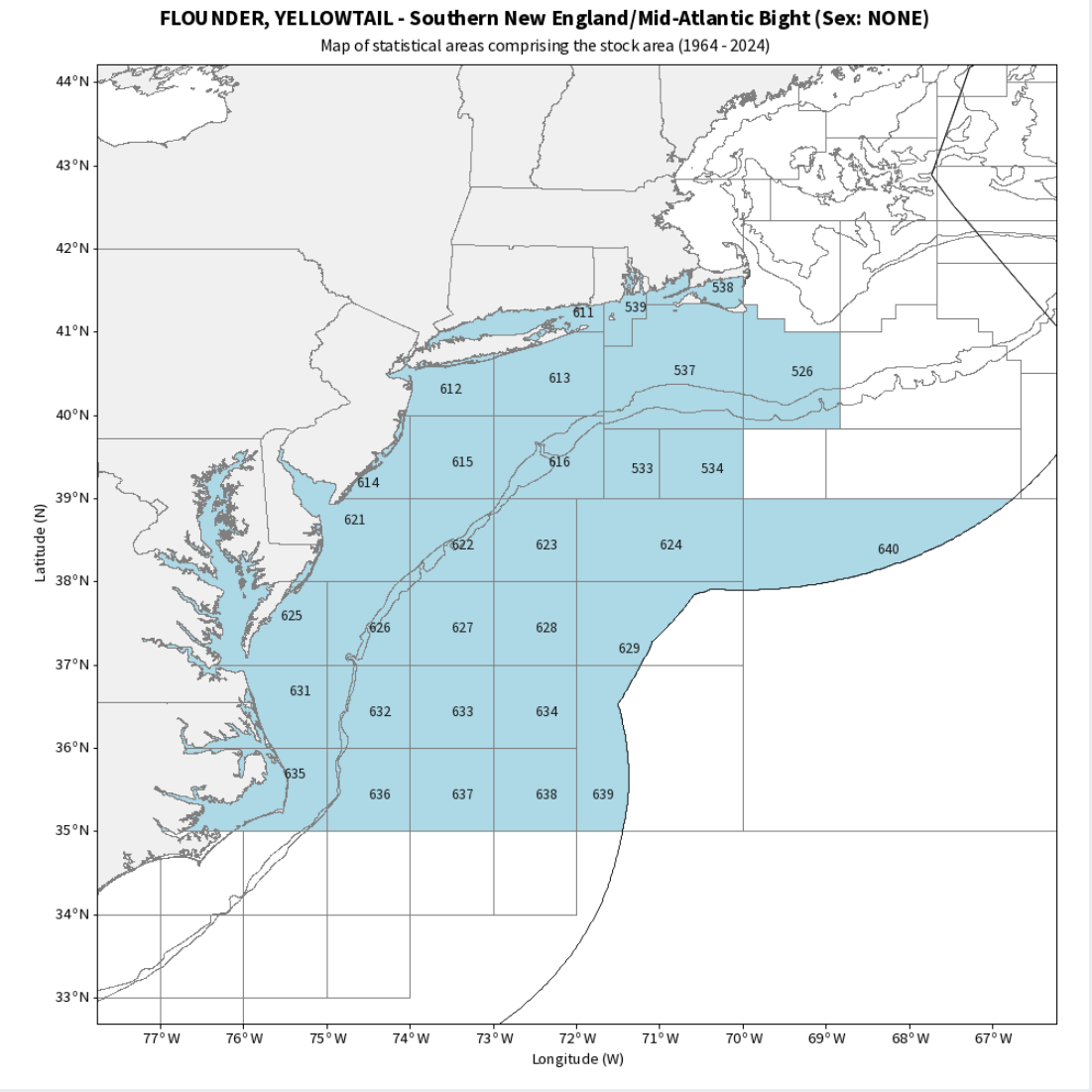
Try catch and discards as separate fleets. [GARM III Peer Review]

- *This recommendation was addressed by changing the modeling platform to the WHAM. There were no diagnostic issues that indicated further exploration was needed.*

Southern New England/Mid-Atlantic

Recommendations from:

- 2022 Management Track Assessment
- 2019 Operational Assessment and peer review
- 2012 Stock Assessment Workshop and peer review (SAW/SARC 54)
- 2008 Groundfish Assessment Review Meeting (GARM III) and peer review



Status of Previous Research Recommendations
ToR1: Ecosystem and Climate Influences

Environmental influences on recruitment:

- Converting the modeling framework for this stock from ASAP to WHAM (or another state-space model) would allow estimation of the relationship between environmental factors and modeled recruitment. The long-term potential yield of this stock associated with climate change could then be considered. **[2022 MT]**
- Future studies should investigate some of the underlying ecological mechanisms of poor recruitment in the stock as it may relate to the physical environment. Recent studies on evaluating environmental effects on Southern New England yellowtail stock productivity suggest that oceanographic features, such as the cold pool and Gulf Stream are likely important predictors of recruitment (Miller et al., 2016; Xu et al., 2017), however the mechanisms driving these predictions are not well known. **[2019 Operational Assessment]**
- The work on the influence of the cold pool and associated environmental parameters on yellowtail population dynamics has not been fully developed, and merits further research. **[2012 SAW 54]**

Status of Previous Research Recommendations
ToR1: Ecosystem and Climate Influences

Environmental influences on recruitment:

- *SAW/SARC 54 explored the application of the cold pool index in ASAP. The present assessment transitioned to the WHAM*
- *Time-varying recruitment was modeled using several environmental covariates across model runs. Environmental covariates on recruitment evaluated included the Gulf Stream Index (GSI), Gulf Stream Index Spring, Atlantic Multidecadal Oscillation (AMO), North Atlantic Oscillation (NAO), Spring Bottom Temperature (BTS), and Cold Pool Index (CPI).*

Status of Previous Research Recommendations
ToR1: Ecosystem and Climate Influences

Productivity: Investigate long-term changes in stock productivity given the severe decline of the resource. This has implications for the determination of biological reference points. [2008 GARM III]

- *Investigated through directed research (i.e., Perretti et al. 2017). A change point analysis was used in in this RT to capture recent environmental conditions and recruitment.*

Status of Previous Research Recommendations
ToR2: Catch

Length-weight conversion: Update the length-weight parameters used to convert commercial landings (in weight) into numbers of fish. This could be accomplished by expanding existing data collection programs (e.g., Cooperative Research, Industry Based Surveys, NEFSC port sampling) to collect individual fish weights while collecting length and age data. This research recommendation is applicable to numerous species/stocks in the northeast, not just SNE/MA yellowtail flounder. [2012 SAW 54].

- *SAW/SARC 54 revised the existing length-weight relationship and adopted the spring length-weight relationship as a basis for fishery weights to numbers.*

Status of Previous Research Recommendations
ToR2: Catch

Sampling: If the volume of commercial landings increases in the future, ensure that adequate samples of the landings are obtained for all market categories on at least a quarterly basis. [2012 SAW 54].

- *Adequate port sampling remains an issue in the present assessment. Quarterly resolution was not explored in this assessment for deriving fishery catch data due to low landings.*

Status of Previous Research Recommendations
ToR4: Model

Retrospective bias:

Future work should continue to address the retrospective bias, including further work on the sensitivity analyses (i.e., determination of appropriate input data weighting by evaluating the CV and effective sample sizes in the model). However, this update resulted in an improvement in retrospective diagnostics relative to the 2017 assessment [2019 Operational Assessment and Peer Review]

- *Transitioning to the WHAM framework led to a reduction in retrospective bias.*

Status of Previous Research Recommendations
ToR4: Model

Stock-Recruit Relationship: The use of 'windows' of biomass rather than the breakpoint should be explored to create the stanzas in the stock – recruitment relationship. This may better address inconsistencies in rebuilding plans that might arise as the biomass grows from the lower to the higher stanza. [2008 GARM III]

- *This recommendation is a remnant from the VPA modeling framework. Transitioning to the WHAM framework more accurately captures time-varying recruitment.*
- *Model runs with and without a stock-recruit relationship were explored.*
- *In some cases, ecological covariates captured the effects of a stock-recruit relationship. In other runs, the stock-recruit relationship was modeled explicitly.*

Status of Previous Research Recommendations
ToR4: Model

Catchability:

Splitting the survey time series to explore whether trends in survey catchability are present in Southern New England. If so, spatial differences in the survey selectivity and/or environmental covariates (temperature) should be investigated as potential causative processes. [2008 GARM III]

- *Splitting the NMFS BTS survey in the mid-1990s was recommended to improve the diagnostics of the model used in GARM III and is not considered appropriate for the current model framework.*
- *However, the NMFS BTS survey time series was split in 2009, the year that the survey vessel changed from the FRV Albatross IV to the FSV Henry B. Bigelow.*
- *The effect of environmentally-mediated annual deviations on survey catchability were explored but led to poor diagnostics.*

Status of Previous Research Recommendations
ToR4: Model

Selectivity:

Investigation of spatial differences in the survey selectivity and/or environmental covariates (temperature). [2008 GARM III]

- *The WG explored many different functional forms for survey selectivity, with and without random effects, and incorporated different selectivities for the NEFSC Spring, Fall and Winter surveys.*

Partial recruitment of the plus-age groups (particularly with regards to the uncertainty in the catch-at-age of the SNE stock). [2008 GARM III]

- *The WG tested the use of selectivity blocks for the NMFS BTS, separating the FRV Albatross IV and the FSV Henry B. Bigelow time series in 2009. Selectivity in the plus age group of the fishery data was also explored.*

Research Recommendations Developed during the 2024 Research Track Assessment

2024 RT Research Recommendations
ToR 1: Ecosystem and Climate Influences

Environmental Covariates (Low Priority):

- Update and confirm that the relationships of environmental variables continue (bottom temperature for CCGOM and GB, GSI for SNEMA).
  - If relationships break down, consider alternative environmental metrics that may be more directly influencing yellowtail stocks.
  - In general, continue to explore the relationships of recruitment and other parameters with environmental covariates for all three stocks and continue to explore alternative projection methodologies for GSI (SNEMA) and bottom temperature (GB).

- Create a data product for salinity that could be explored in future models.

2024 RT Research Recommendations
ToR 2: Catch

Catch-at-Age estimates (High Priority):

- Enhanced port sampling for improved catch-at-age estimates for all stocks.

2024 RT Research Recommendations
ToR 4: Model

Model Platform (High Priority):

- Given the increasingly low survey catches for SNEMA and GB and the increasing chances of true zeroes in the survey data for this stock, it is imperative to modify WHAM to be able to more appropriately address zero values.

- WHAM configurations should follow guidance on lognormal adjustment bias correction contemporaneous to the assessment being conducted. The decisions and guidance on how and when to apply lognormal adjustment bias correction should be documented within the report.

2024 RT Research Recommendations
ToR 6: Projections

Environmentally-informed projections (High Priority):

- Confirm that the assumptions of current conditions continue for projections and reference points (breakpoints for GB bottom temperature and SNEMA Gulf Stream Index).

- Explore near-term projections of environmental covariates to inform short-term catch projections.

References

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