Research Track Steering Committee April Meeting - Background Information

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PIN: 731 084 000#

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2029 Research Track Proposals

Skate Complex

Background

The skate complex is a 'data-poor' to 'data-moderate' set of stocks, with adequate estimates of total commercial fishery landings and discards, but the estimates of catch by species are highly uncertain. A single survey is used for stock status for each of the species although at least two surveys are available for each species. The last 'Benchmark' assessment was completed in 2008, with a data update nearly annually since, and a Management Track assessment completed in 2023. Management Track updates are planned for 2025 and 2027, and parentheticals below indicate work that could be completed during those Management Track assessments (MT 2025, MT 2027) vs what would be anticipated for a Research Track in 2029 (RT).

Research Focus/Goals

1. Improve the allocation of catches to species (MT 2025).
    a. split the recreational catch using species proportions in inshore surveys
    b. re-estimate length-width equations for each species
    c. use a three-year moving average of commercial lengths and apply the proportions in
    d. survey length compositions for hindcast species split

2. update maturity information and calculate Spawning Stock Biomass (MT 2025)

3. conduct simulations of the skate index-based method using skate fishing and life histories (MT 2025)

4. aging studies have been published for 6 of the seven species but could be updated with structures in freezer and/or collection of new vertebrae and rosette could be aged (RT, requires aging work in advance of RT)

5. Attempt to use length-based models for at least winter, little, barndoor and thorny skate (RT and need adequate time before the RT)

6. Revisit reference points for all species, in particular thorny skate, and try to account for changes in the environment (including predator/prey) over time (RT)

7. Include new information about thorny skate stock structure as appropriate (Denton et al. 2024) (maybe MT 2025 or 2027 or a RT)

Summer Flounder

Background

Summer flounder is a “data-rich” stock, with adequate estimates of commercial and recreational fishery landings, discards, and catch at age. There are multiple state, federal, and academic survey indices of aggregate stock numbers and biomass and survey catch at age. The current assessment model includes four fishery ‘fleets’ and 26 survey time series, 21 of which are ongoing. Summer flounder exhibit sexually dimorphic growth; however the implications of this were examined thoroughly during the last benchmark assessment in 2018 and were not found to impact management advice. The stock is currently not overfished but overfishing is occurring.

The last “benchmark” assessment was completed in 2018, with Management Track assessments in 2021 and 2023; a Management Track Assessment is planned for 2025.

Modifications that require a research track assessment:

1) Investigate the transition of the current ASAP SCAA model to the WHAM state-space model. An acute need for WHAM has not been identified; however, retrospective error in recruitment is not insignificant (28% overestimate) and the assessment has a recent history of retrospective patterning in F and SSB (Terceiro, 2024). WHAM has been shown to improve assessments by reducing retrospective errors (Stock and Miller, 2021). No retrospective adjustment is currently required for management advice (NEFSC 2023).

Modifications that may be addressed in either a management track or research track assessment:

2) Determine if changes in mean weights-at-age and maturity are density-dependent responses or arise from a different mechanism. Mean length- and weight-at-age had generally decreased since the early 2000s but have rebounded more recently (Terceiro, 2024). An understanding of processes that have driven these changes would help frame management strategy.

3) Investigate statistical methods (VAST, hierarchical analysis, others) to combine state/agency and stand-alone YOY indices into integrated series with more synoptic spatio-temporal coverage that may be more representative of the true stock size. Currently the summer flounder model includes 26 survey indices; if there are benefits to aggregating a set of these indices it may simplify the model fitting process as well as potentially improve results.

4) Examine potential mechanistic linkages between environmental/climate effects (e.g., surface and bottom temperatures and salinity, Gulf Stream position index, North Atlantic Oscillation index) and stock dynamic covariates (e.g., recruitment, natural mortality, catchability) in the assessment model structure.

WHAM provides a framework for such environmental variables to directly influence model processes (e.g., recruitment, catchability). Recent work (Terceiro, 2024) has modeled the relationships between environmental variables and biological metrics such as average size and weight, sex ratio, model recruitment and the ratio of model recruitment to spawner biomass. While there is evidence of covariation, the driving mechanisms are not clear and this warrants further examination.

References

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Stock, B.C., Miller, T.J., 2021. The Woods Hole Assessment Model (WHAM): a general state-space assessment framework that incorporates time-and age-varying processes via random effects and links to environmental covariates. Fisheries Research 240, 105967.

Terceiro, M., 2024. The Summer Flounder Chronicles IV: four decades of population dynamics, 1976-2022 (No. 24– 04), US Dept Commer Northeast Fish Sci Cent Ref Doc.

White Hake

Background

White Hake remains in a rebuilding plan (target date of 2031) as its most recent status from the 2022 stock assessment showed that the stock is no longer overfished but not yet to the rebuilding target biomass. In 2022, commercial landings of White Hake totaled 3.5 million pounds and were valued at over $5.5 million. Unlimited recreational fishing for the stock occurs year-round using hook-and-line.

The last benchmark assessment for White Hake was completed in 2013 using ASAP. Subsequent operational or Management Track assessments were completed in 2015, 2017, 2019, and 2022, with incremental improvements to the 2013 benchmark-approved ASAP model. The stock is considered to be data-moderate, with adequate estimates of commercial fishery landings and discards, but less adequate catch-at-age information. The catch-at-age is derived using survey ages to convert commercial landings and discards to length-at-age. Three surveys are currently used for tuning.

Management Track assessments for White Hake are planned for 2025 and 2028. A number of improvements to the existing ASAP model are planned within the Management Track, including a majority of the priority research goals listed below.

Research Focus & Goals

1. Add the Bottom Longline Survey spring and fall indices at age as tuning indices [likely to be completed for 2025 MT].

2. Investigate the utility of including more fishery selectivity 'blocks' in the model. There are only two selectivity blocks (1963-1997, 1998-2021) in the model. The first is really a nine year block since the fishery CAA started in 1989. The final selectivity block is now 24 years long and it may be advantageous to split that set into more blocks [likely to be completed for 2025 MT].

3. Utilize the results and SSC comments on the independent studies of White Hake recruitment impacts on projections conducted in 2023 to further investigate how recruitment is specified for short-term projections vs. long-term projections and biological reference point development [likely to be completed for 2025 MT].

4. Investigate the lack of recent White Hake recruitment, despite low harvest, and if this is signaling a longer-term change for stock productivity [likely to be completed for 2028 MT].

5. Investigate the implications of loss of the shrimp survey (added in 2022 MT) as an index included in the assessment (discontinued in 2024) [likely to be completed for 2025 MT].
6. Investigate the transition from ASAP to the WHAM assessment platform.

Witch Flounder

Background

The last benchmark assessment was completed at SARC 62 in 2016. The VPA model used in the 2015 assessment was updated to incorporate re-estimated discards and recent catch, survey, and maturity data. The updated VPA model exhibited a major retrospective pattern (rho adjusted estimates were outside the approximate 90% confidence region around the SSB and F point estimate) that was similar in direction and magnitude as the previous VPA models, in which F was underestimated and SSB and recruitment were overestimated. A new statistical catch at age model (ASAP) was developed in this assessment to better account for catch and survey data uncertainty. The ASAP model also exhibited a major retrospective pattern. The age structured model in the accepted final configurations provided calculated NEFSC survey q of approximately 4, exhibited major retrospective patterns requiring rho adjustments, and required a very large increase in catch or natural mortality (M) to remove the retrospective errors. The WG considered numerous sensitivity runs of the two analytical models (ASAP and another statistical catch at age [SCAA] model) and considered several empirical approaches (minimum swept area biomass, replacement yield model, and an empirical approach) in case analytical modeling approaches did not provide defensible results. The WG considered the pros and cons of each approach for determining stock status and catch advice. The WG noted that these data conflicts had been addressed in the previous accepted and current age structured models explicitly through a rho adjustment, without having to apply potentially implausible scalars of M or catch. The WG recommended the ASAP model (Run 9_5_v2) as the preferred model in which to evaluate stock status and provide catch advice. **However, an analytical model for witch flounder was not accepted at SARC 62 due to the retrospective pattern.**

Subsequent to the 2016 witch flounder assessment, Legault et al (2023) found that the rho-adjusted SCAA model performed at least as well as all the index-based approaches for stocks that exhibited strong retrospective patterns. Additionally, the State Space Research Track (SSRT 2023) found that the Woods Hole Assessment Model (WHAM) is often able to estimate SSB and F time series without strong retrospective patterns when random effects are included. The SSRT also recommended using random effect approaches to include environmental covariates in stock assessment models.

Witch flounder is in a rebuilding plan; however, the accepted index-based method (empirical approach) does not provide biological reference points (no stock status) to track rebuilding progress. Based on information since the 2016 assessment, it would be beneficial to utilize an age-based approach, with rho-adjustment as needed and convert to a WHAM model and explore environmental covariates, similar to other stocks in the region.

Research Focus/Goals

1. Explore the impact of missing survey data on the catch advice using swept area biomass estimates.

2. Update the age-based model with recent data to determine if the retrospective pattern still persists, rho-adjust as needed, and convert to a WHAM model and explore environment covariates.

3. Explore how the age-based estimates of biomass and exploitation rates compare with those derived from the swept-area method.

BRP and Nonstationarity Conditions

Background

Developing longer-term projections and appropriate biological reference points (BRPs) is an essential component of the stock assessment process, one that requires consequential assumptions regarding future ecosystem dynamics. However, progressively unpredictable environmental conditions, changing fish population distributions, changing fisher behavior, and changes to fish population dynamics and productivity are all being seen on the water. As changing ocean conditions increasingly affect the Northwestern Atlantic, traditional assumptions of stationarity used in the stock assessment modeling process are no longer appropriate in a growing number of cases.

A variety of methodologies are commonly utilized across the U.S. and internationally to develop projections and determine BRPs, including those that are capable of incorporating uncertainty in environmental indicators (e.g., WHAM). However, there is currently a lack of consensus or good practices available on how to approach longer-term projections under non-stationary conditions. In the new Technical Guidance for NS1 on reference points, the Technical Group identified dealing with non-stationarity in developing population forecasts and related technical issues (e.g., selecting time blocks, identifying regime shifts, and dealing with changing recruitment patterns in models) as a required priority improvement. Stock assessment scientists and resource managers in the Northeast Region and elsewhere are urgently facing questions of how to identify non-stationarity, how to deal with increasing uncertainty in projections due to environmental variability, and what methods are appropriate to use when changing ocean conditions are affecting stock dynamics.

A Research Track Assessment on BRPs and non-stationary conditions in 2029 would build off of recent and ongoing work related to this topic, including:

- A workshop titled “Defining Biological Reference Points in a Dynamic Northeast U.S. Marine Environment” supported by CINAR funding and held in January 2024. This workshops objectives were to: 1) identify the need to redefine biological reference points (BRPs) in a changing ecosystem; 2) review existing approaches and challenges in defining BRPs; 3) evaluate approaches to defining BRPs in other areas of the US and globally; and 4) synthesize recommendations for estimating reference points for stocks in a changing Northeast ecosystem. The workshop was organized by Lisa Kerr (UMaine), Steve Cadrin (SMAST), and Jerelle Jesse (UMaine).
- IRA-funded national project (HQ leads) focused on stock assessment projections (scope TBD).
- NECLIM development and identification of climate/environmental indicators via Ecosystem and Socioeconomic Profiles (ESPs) for Northeast stocks
- 2027 Research Track Assessment focused on Improving [Short-Term] Stock Assessment Projections

Research Focus & Goals

1. Defining and identifying non-stationarity in stock population dynamics and how these changes may impact parameters in stock assessment models.

2. Developing technical guidance/best practices for estimating biological reference points when non-stationary conditions are identified.
    a. If/when assumptions for short and long term projections should be the same, or under what conditions using different assumptions are justified.
    b. The relative utility of regime shifts (i.e., change point analysis) vs. environmental covariates in developing long-term projections and identifying biological reference points. Utilize closed-loop simulations to compare and contrast different approaches to addressing non-stationarity in terms of the effects on catch advice and stock status.
    c. Statistical approaches for estimating BRPs of stocks experiencing non-stationary effects using analytical assessment methods.
    d. General guidance for stocks experiencing non-stationary effects that are assessed using index-based approaches.
    e. Appropriate methods for long-term projections of recruitment.
    f. Triggers, justifications, and methods for updating reference points within Management Track assessments when non-stationarity is identified.
    g. Consideration of risk to the stock and fishery if non-stationary conditions are expected to increase in the future.

3. Understanding the impact of redefining reference points on the performance of existing harvest control rules (e.g. using simulation testing or other methods).
    a. Investigate approaches to developing harvest control rules that are robust to the uncertainty associated with non-stationary stock dynamics.

Spatial Stock Assessment Modeling

Background

There have been recent national (Bosley et al. 2021, Berger et al. 2017) and international (Spatial Stock Assessment Simulation Experiment, Goethel et al. 2024) projects examining the ability to include spatial information in stock assessments. These efforts have focused on the idea of mixing rates among genetically distinct stocks with emphasis on tagging data to estimate movement rates. Locally, the rapid development of offshore wind energy (see https://www.boem.gov/renewable-energy/offshore-renewable-activities) will create large areas that are not available to current surveying techniques and may limit or change the ability of fishing activities or fish density as well. There is a need for developing methods to incorporate different data types to account for these wind energy areas as well as models to handle these changes. There have been a number of recent publications addressing the data collection and modeling challenges associated with offshore wind energy development (e.g., Hogan et al. 2023, Methratta et al. 2023, Methratta et al. 2023).

Research Focus/Goals

This research track will focus on applying the data collection and modeling issues associated with offshore wind energy development in the region in practice. Simulation studies will examine the ability to estimate stock abundance under varying levels of impact from the wind farms on fish behavior, fishery access, and survey catchability given expected levels of uncertainty in the different data sources. A default approach that ignores the wind energy areas and assumes a single homogenous stock will be compared to various area-based models in terms of bias and precision in stock estimates in these simulation studies. Results of these simulation studies will guide development of a closed-loop feedback simulation study (i.e., MSE) that explores the impact of the wind energy areas on different control rules to see if some are more robust than others in terms of preventing overfishing and the stock becoming overfished. The MSE could also be used to explore the impact of changes in precision and accuracy of survey data due to different designs and methods used in the wind energy areas. If time allows, case studies of specific stocks impacted by offshore wind energy will be explored using spatial approaches that appeared promising in the simulation studies.

Due to the rapid expansion of wind energy areas in the region, this research track will have to respond to developments between now and the start of the research track that cannot currently be predicted, so there will be a need for some leeway in developing Terms of Reference to account for the current state of understanding. This research track will require close collaboration among Population Dynamics Branch staff, Offshore Wind Energy Branch, Ecosystem Dynamics and Assessment Branch, local academics, and region managers to ensure full consideration of prioritized aspects are sufficiently addressed. It will build upon the rapidly growing literature on the effects of offshore wind energy on fish and fisheries.

Review Research Recommendations for the 2028 Research Track Assessments

Scup - Draft Research Recommendation Priorities

Critical Research	**Rationale** *(include source, if applicable)*
Transition from ASAP to WHAM	WHAM increases model flexibility by allowing for the inclusion of random effects and offering more comprehensive treatment of the relationships between environmental variables and population dynamic processes.
Consider relationships among disparate survey indices	Seventeen fishery-independent indices are currently available to the scup assessment; the model currently fits to eleven of these. The assessment could benefit from examining statistical methods (VAST, hierarchical analysis, others) to consider age structured and/or YOY indices together to create index series with more synoptic spatio-temporal coverage that may be more representative of stock size.
Important Research	**Rationale** *(include source, if applicable)*
Integrate environmental data	Examine the impact of likely environmental/climate effects (e.g., temperature, salinity, Gulf Stream position index, North Atlantic Oscillation index, others) on scup population dynamics. Such environmental variables could be considered directly as covariates in the assessment model or to provide additional context to spatial and/or temporal changes. Determine whether recent decreases in mean weights-at-age and maturity are reversible density-dependent responses or arise from a different mechanism.
Scup age validation	A 2014 scup aging workshop identified the need to validate scup otolith ages (Eric Robillard, personal communication). This research gap should be addressed prior to the Research Track so that the Working Group can address any aging issues that are identified.

Reference Documents

[2015 SAW 60]

A standardized fishery dependent CPUE of scup targeted tows, from either NEFOP observer samples or the commercial study fleet, might be considered as an additional index of abundance to complement survey indices in future benchmark assessments: completed for 2015 SAW 60, CPUE indices not included model calibration

Explore additional sources of length/age data from fisheries and surveys in the early parts of the time series to provide additional context for model results: no success, likely alternative is to begin model in 1984 in next RTA

Explore experiments to estimate the catchability of scup in NEFSC and other research trawl surveys (side-by-side, camera, gear mensuration, acoustics, etc.): no progress

Refine and update the Manderson et al. availability analysis when/if a new ocean model is available (need additional support). Explore alternative niche model parameterizations including laboratory experiments on thermal preference and tolerance: no progress

Explore the Study fleet data in general for information that could provide additional context and/or input for the assessment: completed for 2015 SAW 60, CPUE indices not included model calibration

A scientifically designed survey to sample larger and older scup would likely prove useful in improving knowledge of the relative abundance of these large fish

[2019 Operational Assessment]

The recent recruitment of the largest year class in the assessment time series (the 2015 year class) has contributed to recent high commercial fishery discards. The exploration of management actions to reduce discarding in the event of future high recruitment events might include modification of the commercial fishery Gear Restricted Areas and modified commercial mesh sizes: considered annually as part of the specifications process

There is evidence of a decreasing trend in mean weights at age and maturity, perhaps indicative of density dependent effects. Potential effects on reference points and projected fishery yield should continue to be closely monitored: ongoing monitoring in assessment

[2021 Management Track Report]

The panel discussed the unusual direction of the retrospective pattern in the assessments (underestimating biomass and overestimating fishing mortality). There was concern that a retrospective adjustment would increase terminal year estimates of biomass and decrease the estimate of fishing mortality when biomass is likely declining due to the decline in the large 2015 year class. The panel discussed potential causes for the retrospective pattern including the potential for overestimation of catch by Marine Recreational Information Program (MRIP): in this 2023 assessment, a retrospective adjustment has been made for stock status and projections, in line with recent 'standard' procedures

The panel discussed ideas on how the model inputs could be altered to reduce the retrospective pattern, noting that recommending a Level 2 review would allow for this flexibility. It was noted that shifting model influence weights between catch and survey did not result in much response. Splitting the selectivity series with the final series starting in 2013 did not change the retrospective pattern very much, but did reduce the error sufficiently that an adjustment was not needed: terminal selection block for 2013+ implemented in the 2021 model and retained in 2023 model

2019-2022 MAFMC SSC

Improve estimates of discards and discard mortality for commercial and recreational fisheries: no specific progress, but no concerns expected if current levels of sampling are maintained; note 2022 commercial sampling at lowest (worst) intensity since 1994

Evaluate the degree of bias in the catch, particularly the commercial catch: no stock-specific progress, but GARFO CAMS estimates now included for 2020-2022 data

Conduct experiments to estimate catchability of Scup in NEFSC surveys: no progress

Explore the utility of incorporating ecological relationships, predation, and oceanic events that influence Scup population size on the continental shelf and its availability to resource surveys used in the stock assessment model: no new research progress

Explore additional source of age-length data from historical surveys to inform the early part of the time series, providing additional context for model results: no success, likely alternative is to begin model in 1984 in next RTA

Characterize the pattern of selectivity for older ages of Scup in both surveys and Fisheries: ongoing estimation in assessment

An MSE could evaluate the effectiveness of Scup management procedures: no progress

The Scup Statistical Catch at Age assessment model uses multiple selectivity blocks. The final selectivity block (2006-2018) is the longest in the model. The applicability of the most recent selectivity block to the current fishery condition is uncertain. If the fishery selectivity implied in this block changes, estimates of stock number, spawning stock biomass, and fishing mortality become less reliable: updated in 2021 model – new 2013+ selectivity block added to model and retained in 2023 model

Recruitment indices for Scup have been declining in recent years. The 2021 management track assessment should consider the implications on stock biomass projections should this trend continue: evaluated in the 2021 MTA assessment model and associated projections

Most of the fishery-independent indices used in the model provide estimates of the abundance of Scup < age 3. One consequence is that much of the information on the dynamics of Scup of older ages arises largely from the fishery catch-at-age and from assumptions of the model, and are not conditioned on fishery-independent observations. As a result, the dynamics of these older fish remain uncertain. Knowledge of the dynamics of these older age classes will become more important as the age structure continues to expand: no new research progress, but assessment indicated the abundance of older fish is increasing in fishery and survey catches, and there is evidence of possible density dependent effects on growth and maturity

The projection on which the ABC was determined assumes that the quotas would be landed in 2019, 2020, and 2021; however, landings in recent years have been below the quotas and perhaps a more realistic assumption should be used in future projections: given the uncertainty of fishery dynamics and catch estimated for 2020, the 2021 MTA projections assumed the ABCs would be caught in 2020-2021; prelim 2020 catch is 94% of 2020 ABC. In current assessment, recent 5 year pattern (101% of ABC caught) indicates that assuming 2023 ABC will be caught is a valid assumption for projections

Uncertainty exists with respect to the estimate of natural mortality used in the assessment: no new research progress

Uncertainty exists as to whether the MSY proxies (SSB40%, F40%) selected and their precisions are appropriate for this stock: no new research progress

Survey indices are particularly sensitive to Scup availability, which results in high inter-annual variability. Efforts were made to address this question in the Stock Assessment Workshop and Stock Assessment Review Committee (SAW/SARC) in 2015 that should be continued in the 2021 management track assessment: no new research progress

SSC is concerned over the reduction in port sampling which has the potential to exacerbate concerns about the dynamics of older fish: commercial landings sampling intensity in 2022 was the lowest (i.e., worst) since 1994

2023 Management Track Report

The Panel noted that all four fleets in the model (recreational and commercial landings and discards) had dome-shaped selectivity. The Panel recommends continued exploration of the functional form of the selectivity across fleets, and whether there could be a mechanistic explanation for the dome across fleets. Pg. 62

2024 Sam Truesdell additional suggestions

The MA DMF trawl survey is currently considered as a fully selected index for ages 1-2 in the spring and 0-2 in the fall (weight-based). This framework could be adapted to an abundance index-at-age approach. Such an approach would be improved by the inclusion of additional age-length pair data for use in a survey-specific age-length key or to supplement the NEFSC age-length pair data. There are currently 958 unaged structures from the spring trawl surveys during 2011-2021 and 1034 samples from fall surveys during 2010-2021.

Seventeen fishery-independent indices are currently available to the scup assessment; the model currently fits to 11 of these. Given the number of indices and the migratory nature of scup, a more intensive approach is required for index preparation relative to many other stock assessments. Generating a comprehensive understanding of how these indices relate to abundance prior to the Research Track would be of great benefit. This could include examining spatio-temporal correlations among indices (e.g., in VAST) and re-examining the NEFSC spring survey (currently not included).

2014 Scup Aging Workshop

At a 2014 scup aging workshop the need to validate scup otolith ages was identified as a research priority (Eric Robillard, personal communication). To date, this work has not been completed. This research gap should be addressed prior to the Research Track so that the working group can address any aging issues that are identified.

Scup (2020)

Research Focus/Goals

1) Investigate use of an alternative, shorter time series beginning in 1984, when fishery age information is available. The current series back to 1963 includes less reliable extrapolated estimates of commercial discards and recreational catch, and the model diagnostics indicate uncertain estimates of fishing mortality and stock size prior to 1984.

2) Investigate alternative stratification of the fisheries, potentially including the estimated discards as an ‘offset’ of the landings, rather than as a separate ‘fleets,’ in order to better reflect the actual process of fishery selectivity.

3) Investigate the utility of including more fishery selectivity ‘blocks’ in the later years of the model. The final selectivity block (2006-2018) is currently the longest in the model. The

applicability of the most recent selectivity block to the current and future fishery condition is uncertain.

4) Continue monitoring to determine if recent decreases in mean weights at age and maturity are reversible density-dependent responses or arise from a different mechanism.

5) It was conjectured in the 2019 Operational assessment that the increase in stock biomass since 2000 resulted from increased recruitments resulting from the imposition of gear restriction areas (GRAs) to minimize interactions between scup and squid fisheries and from increases in commercial mesh sizes. Low frequency climate variations is a potential alternative explanation for increased recruitments from 2000-2015. Consideration of any research to explore the validity of these hypotheses is warranted.

2023 Proposals for 2028 Research Track Assessments

Research Focus/Goals

1) Investigate the transition of the current ASAP SCAA model to the WHAM state-space model.

2) Investigate use of an alternative, shorter time series beginning in 1984, when fishery age information is available. The current series back to 1963 includes less reliable extrapolated estimates of commercial discards and recreational catch, and the model diagnostics indicate uncertain estimates of fishing mortality and stock size prior to 1984.

3) Investigate alternative stratification of the fisheries, potentially including the estimated discards as an ‘offset’ of the landings, rather than as a separate ‘fleets,’ in order to better reflect the actual process of fishery selectivity.

4) Investigate statistical methods (VAST, hierarchal analysis, others) to combine state/agency and stand-alone YOY indices to create index series with more synoptic spatio-temporal coverage that may be more representative of the true stock size.

5) Continue monitoring to determine if recent decreases in mean weights at age and maturity are reversible density-dependent responses or arise from a different mechanism.

6) Investigate the inclusion of likely environmental/climate effects (e.g., surface and bottom temperatures and salinity, Gulf Stream position index, North Atlantic Oscillation index, others) as covariates in the assessment model structure.

Redfish - Draft Research Recommendation Priorities

Critical Research	**Rationale** *(include source, if applicable)*
Evaluate alternative likelihood distributions for the fishery and survey age compositions.	From the 2024 Applied State Space Models Research Track: ● Expected to improve fits to the age compositions, reduce positive bias in the one step ahead age composition residuals, and could improve fits to the survey indices. Lack of fit to the survey indices has been a major concern since the 2020 assessment. ● Using a self-weighting distribution (e.g., logistic normal) would remove the need to specify effective sample sizes for the age compositions. ● ***This recommendation is planned to be addressed during the 2025 redfish management track assessment***.
Explore a full state space WHAM with survival-at-age modeled as random effects.	From the 2024 Applying State Space Models Research Track: ● Allow the model to account for processes other than F and M that may be affecting stock abundance (e.g., migration), which should improve fit to the survey indices. Lack of fit to the survey indices has been a major concern since the 2020 assessment. ● Would likely necessitate evaluating alternative assessment start years, due to the lack of fishery age and survey data in the early assessment years, 1913-1968. ● ***This recommendation is planned to be addressed during the 2025 redfish management track assessment***.
Explore growth-model branch configurations of WHAM.	From the 2024 Applying State Space Models Research Track: ● A possible solution to the lack of fishery and spring survey age data. ● Explore using length compositions for years without age data. ● Explore using length compositions for all years with conditional age compositions when available (i.e., similar to stock synthesis). ● New age data would be added as it becomes available.
Important Research	**Rationale** *(include source, if applicable)*
Include additional new and historic age data in the assessment.	From 2020 and 2023 management track assessments: ● Continue process of filling gaps in the historic fishery and spring survey age compositions.

	● May allow for estimation and use of time-varying weight-at-age and maturity-at-age as more age data become available. .
Conduct an evaluation of survey trends, including potential factors that may cause the trends to not reflect patterns in relative abundance.	From 2020 and 2023 management track assessments: ● Initial explorations could look for signals in age frequencies or Canadian survey data. ● Could include a genetic and/or tagging study to investigate transboundary stock movements.
Explore estimation of stock-recruit relationship internal and external to the assessment model.	From 2020 and 2023 management track assessments: ● Current WHAM uses Beverton-Holt stock-recruit relationship with annual deviations modeled as i.i.d. random effects.
Explore assumptions made about weight at age for female and male redfish in the assessment.	From the SSC after the 2023 management track assessment: ● Acadian redfish growth is sexually dimorphic , which could create inconsistencies among the weight-at-age used in the assessment, short-term projections, and biological reference points. ● ***This recommendation was previously addressed through a sensitivity analysis in the 2020 management track assessment, but could be explored further as more age data become available.***

Reference Documents

2024 Applying State Space Models Research Track Research Recommendations Working Group Report

- The Acadian redfish assessment appears to have difficulty estimating NAA in the first year and historic (1913-1964) recruitment. Starting the model in a later year, when survey indices and age composition data are available, may improve estimation of these important parameters.
- Explore the use of alternative distributional assumptions for the catch-at-age and survey index age compositions (e.g., logistic normal, Dirichlet). Using a different distribution may improve fit to the age composition, reducing the positive bias in the one step ahead residuals. In addition, doing so could improve fit to the survey indices, as was suggested by the re-weighting exercise in the 2023 management track assessment (NEFSC in prep.).
- Explore a full state-space model configuration of WHAM (i.e., treating all NAA as random effects) for Acadian redfish. Treating all NAA as random effects may improve the fit to

the survey indices by accounting for processes other than F that may be affecting stock abundance (e.g., migration between US and Canadian waters).

Peer Review Panel Summary Report

- The WG provided research recommendations that the Panel agreed with.
- A possible solution to the lack of age compositions is to include length composition information for years without age compositions using the growth-model branch of WHAM. Alternatively, this formulation could use length compositions for all years and condition age compositions.

2023 Redfish Management Track Assessment Research Recommendations

Assessment Report

- The Acadian redfish assessment could be improved by including additional age data, particularly from the commercial fishery, and investigating the sensitivity of biological reference points and stock projections to the mean weights at age.
- Future assessments should explore whether it Is better to estimate the stock-recruitment relationship inside the model or externally.
- An evaluation of survey trends should be conducted, including potential factors that may cause the trends to not reflect patterns in relative abundance.

Peer Review Panel Report

- The Panel suggested that temporal variability in weight at age be evaluated.
- SSB and recruitment were estimated in the assessment. The Panel suggested exploring possible stock-recruit relationships internal or external to the stock assessment model, but also to consider the way recruitment was modeled with a linear ramp from 0.1 in 1964 to 0.8 in 1969, and then a linear ramp from 0.8 in 2017 to 0.52 in 2019. It is unclear how these CVs play out in the model results and how they would be adapted in more work on the S-R relationship.
- The Panel recommended that a genetic study and/or tagging study be conducted to investigate transboundary stock movements, but initial explorations could look for signals in age frequencies or Canadian Survey data.
- Given the large change in the ecosystem, the Panel suggested considering moving to WHAM or a state-space model which can accommodate large process errors occurring in the ecosystem and the Panel suggested that static M and age at maturity assumptions in the current stock assessment be evaluated. [***The redfish assessment was moved to WHAM during the 2024 Applying State Space Models Research Track***].

2020 Fall Management Track Assessments

- aging material collected be processed and be made available to be used in the next assessment.
- Exploration of data weightings should be continued, implying an enhanced review for the next assessment.

2016 Operational assessment of 19 northeast groundfish stocks

Research Needs:

- additional age data, particularly from the commercial survey, and by investigating the sensitivity of biological reference points and stock projections to the mean weights at age.
- Future assessments should explore whether it is better to estimate the stock-recruit relationship inside the model or externally.
- Also, the panel recommends an evaluation of the survey trends, including potential factors that may cause the trends to not reflect patterns in relative abundance and the validity of the fall survey trend.
- Finally, the precision of the results appears to be high, and the panel suggests exploring data weighting scenarios to better reflect the completeness and reliability of available data.

Silver Hake - Draft Research Recommendation Priorities

Critical Research	**Rationale** *(include source, if applicable)*
Attempt to derive analytical models, based on WHAM, including environmental covariates (predation and temperature)	The current assessment is index-based and the reference points are proxies (SARC 51, all MT assessments). This could be done with the existing stock structure but if the stock structure changes all input data would need to be revised well ahead of the RT
Stock Structure	Work is being conducted but needs to be complete by early 2027 to be included.
Predation by large predators (marine mammals and sharks)	At SARC 51 predation was deemed to be very important but we were missing the impacts of the larger predators.
Important Research	**Rationale** *(include source, if applicable)*
Larval indices	Work was ongoing according to SARC51. This would give some information on recruitment or SSB as well as stock structure.
Examine data from the three monkfish surveys in deep water	These data may give some depth-related information about the two species currently included in the southern stock.

Reference Documents

2020 Assessment Update Reports

- GoM Silver Hake
- SNE/MA Silver Hake

2023 Management Track Assessment Report Northern Silver Hake

The Northern Silver hake assessment could be improved with an analytical assessment that uses a full range of age data to inform population trends. A re-evaluation of the existing biological reference points could benefit the stock by considering contemporary measures of productivity of the stock.

2023 Management Track Assessment Report Southern Silver Hake

The southern silver hake assessment could be improved with an analytical assessment that uses a full range of age data to inform population trends. A re-evaluation of the existing biological reference points could benefit the stock by considering contemporary measures of productivity of the stock.

SARC 51 in 2010

- The only one that is really important is the stock structure recommendation.

Studies to estimate discard mortality should be conducted.
Investigate silver and offshore hake data in deepwater surveys (e.g., monkfish survey).
Consider hydrographic information in conjunction with the larval indices. This is not currently available, but work is in progress to be able to back-calculate spawning areas.
Information on consumption by more predators (including mammals, highly migratory species (HMS)) needs to be included.
Examine diel (day/night) variation in consumption of hakes.
Validation of the ageing method for silver hake via tagging, radiocarbon, or tetracyclin research needs to be conducted.
More comprehensive analysis of silver hake stock structure based on DNA (expanded genetic analysis) needs to be conducted. Investigate stock identification questions for silver hake by using samples from Tom Helser and Bill Phoel.
Take M matrix from consumption model and put into model without consumption.

Sturgeon - Draft Research Recommendation Priorities

Critical Research	**Rationale** *(include source, if applicable)*
Develop robust estimates of abundance and removals (bycatch and vessel strikes) by DPS where possible.	The 2017 peer review found that "The paucity of data available to develop reliable indices of abundance and the inability to distribute historical catches to specific rivers or DPSs precluded the application of traditional stock assessment methods, except at a coastwide level. The nature of the assessment used and the nature of available data did not warrant the determination of conventional fisheries reference points." (ASMFC 2017)
Collect critical information for developing assessment models: DPS-specific age, growth, fecundity, and maturity information.	The 2017 peer review determined that there is a lack of data for South Atlantic fish, adult fish are not adequately represented in most data sets, and the age structure is not sufficiently documented for any DPS. They further stated that the representativeness of life history parameter estimates to the contemporary Atlantic sturgeon population, individual DPSs, or the general life history of the coastwide population is currently a significant source of uncertainty.
Continue development of the acoustic tagging model to refine estimates of survival, obtain abundance estimates, and incorporate movement.	Acoustic tagging of sturgeon represents some of the best available data for this species, and should be leveraged further (ASMFC 2017).
Important Research	**Rationale** *(include source, if applicable)*
Maintain and support current networks of acoustic receivers and acoustic tagging programs to improve the estimates of total mortality. Expand these programs in underrepresented DPSs.	The data provided by this research is critical to continue developing the acoustic tagging model (ASMFC 2017).

Reference Documents

[2017 Atlantic Sturgeon Benchmark Stock Assessment and Peer Review Report]

- Peer Review Recommendations

- Future Research
    - High Priority
        - Develop standardized methods that can be used to create reliable indices of abundance for adults and young juveniles (Age 1) to reflect the status of individual DPSs
            - A workshop is recommended to assess the efficacy of existing ‘sturgeon surveys’ (e.g., those presently conducted in NY, SC) and new approaches
        - Expand and improve the genetic stock definitions of Atlantic sturgeon, including the continued development of genetic baselines that can be applied coastwide, within- and among-DPS’s, and at the river-specific level. Consideration of spawning season-specific data collection will be required. Particular emphasis should be placed on collecting additional information from the Gulf of Maine and Carolina DPSs (Table 3).
    - Moderate Priority
        - Determine a permitting process to enable authorizations to sample and collect biological materials from any dead Atlantic sturgeon encountered
            - Pectoral fin spines to support age determination are considered to be of high value
            - Additional materials could include gonad tissues to support development of maturation schedules for males and females and fecundity
        - Evaluate potential reference point targets and their efficacy for Atlantic sturgeon. Options include (but are not limited too):
            - number of fish in spawning runs
            - number of rivers with sturgeon presence/absence (by DPS and coastwide)
            - frequency of catch in indices and/or observer sampling
            - evaluate rivers where you don’t have sturgeon, setting minimum bar
        - Determine freshwater, estuarine, and ocean habitat use by life history stage including adult staging, spawning, small and large juvenile residency, and larvae
        - Identify spawning units, using appropriate techniques (genetics, tagging, eDNA, collections of eggs or larvae, etc.), along the Atlantic coast that best characterize the meta-population structure of U.S. Atlantic sturgeon
            - Recent search efforts both in previously un-sampled rivers/tributaries and rivers thought to have lost their native populations have revealed evidence of spawning activity that results in the production of young juveniles. Such instances require particular attention to determine whether

        they are the result of reproduction by self-sustaining populations
    - Investigate the influence of warming water temperatures on Atlantic sturgeon, including the effects on movement, spawning, and survival
  - Low Priority
    - Evaluate incidence of and the effects of predation on Atlantic sturgeon
- Data Collection
  - High Priority
    - Establish centralized data management and data sharing protocols and policies to promote greater use of all available Atlantic sturgeon data. Priority data sets include (but are not limited to):
      - genetics/tissue samples
      - pectoral fin spines and associated age estimates
      - acoustic tagging and hydrophone metadata
      - external and PIT tag data
    - Emphasis should be placed on extracting all available data in underrepresented DPSs. Concurrently, continue to support programs that provide data sharing platforms such as the Atlantic Cooperative Telemetry Network. These initiatives will benefit from the support of federal funding agencies enforcing the requirement to make data collected via federal funds part of the public record within a reasonable period of time. If not a current requirement of funded Atlantic sturgeon research, this should become a requirement.
    - Implement directed monitoring of Atlantic sturgeon that is designed to support assessments both coastwide and at the DPS level and/or expand existing regional surveys to include annual Atlantic sturgeon monitoring. Monitoring two or more reproductively discrete populations within each recognized DPS is suggested. Use of emergent technologies such as validated side scan sonar surveys and acoustic tracking may allow for more cost effective monitoring of river runs.
      - Monitoring protocols that enable data gathering for a number of species (e.g., Shortnose sturgeon) is encouraged
      - Development of adult, YOY (or Age 1), and juvenile indices are a high priority, and considerations should be made for the use of appropriate survey gears
        - Associated length and age composition information is needed so that relative abundance-at-age

information can be obtained from the adult and juvenile indices
    - See Table 8 in the assessment report for a list of surveys considered by the SAS during the assessment
    - See Table 3 of this report to see current data gaps identified by the Review Panel
  - Continue to collect biological data, PIT tag information, and genetic samples from Atlantic sturgeon encountered on surveys that require it (e.g., NEAMAP). Consider including this level of data collection from surveys that do not require it. Push permitting agencies to allow sampling (to the extent possible) of all encountered Atlantic sturgeon via scientific research activities.
  - Maintain and support current networks of acoustic receivers and acoustic tagging programs to improve the estimates of total mortality. Expand these programs in underrepresented DPSs, using a power analysis to define direction and magnitude of expansion, as required to support next assessment.
  - Collect sub-population specific (river, tributary, or DPS level) life history information (e.g., age, growth, fecundity, maturity, spawning frequency). Where feasible, emphasis should be on collecting information by sex and for reproductive information by size/age. Particular focus should be on collecting information on Atlantic sturgeon from the South Atlantic DPS given less data and suspected regional life history differences (see Table 3).
  - Improve monitoring of bycatch in other fisheries, gears, and locations (notably northern and southern range). When scaling up to unobserved trips, need better data/measures of effective effort that can be reasonably expected to encounter Atlantic sturgeon. This may include collection of more detailed information on type of gear deployed, locations of deployment, etc. To assess the potential for currently missing significant sources of Atlantic sturgeon bycatch, do a simple query of all observed fisheries to see if Atlantic sturgeon are encountered in other gears beyond gillnet and trawl (e.g., scallop dredges) Investigate and account for extra-jurisdictional sources of mortality. Include data on fish size, health condition, and number of fish affected.
- Moderate Priority
  - Collect more information on regional vessel strike occurrences, including mortality estimates. Identify hot spots for vessel strikes and develop strategies to minimize impacts on Atlantic sturgeon.
  - Promote greater Canadian-US Atlantic sturgeon data sharing, cooperative research, and monitoring. Exploring interactions between Canadian and US Atlantic sturgeon may more fully

explain mortality trends, particularly with regards to the Gulf of Maine DPS.

- Assessment Methodology
  - High Priority
    - Establish recovery goals and risk tolerance for Atlantic sturgeon to measure progress of and improvement in the population since the moratorium and ESA listing
    - Expand the acoustic tagging model to incorporate movement
    - Conduct a power analysis to determine sufficient acoustic tagging sampling sizes by DPS
  - Moderate Priority
    - Evaluate methods of imputation to extend time series with missing values. ARIMA models were applied only to the contiguous years of surveys due to the sensitivity of model results to missing years observed during exploratory analyses.
    - Explore feasibility of combining telemetry tagging and sonar/acoustics monitoring to generate abundance estimates

- Assessment Recommendations
  - Future Research
    - High Priority
      - Identify spawning units along the Atlantic coast at the river or tributary and coastwide level.
      - Expand and improve the genetic stock definitions of Atlantic sturgeon, including developing an updated genetic baseline sample collection at the coastwide, DPS, and river-specific level for Atlantic sturgeon, with the consideration of spawning season-specific data collection.
      - Determine habitat use by life history stage including adult staging, spawning, and early juvenile residency.
      - Expand the understanding of migratory ingress of spawning adults and egress of adults and juveniles along the coast.
      - Identify Atlantic sturgeon spawning habit through the collection of eggs or larvae.
      - Investigate the influence of warming water temperatures on Atlantic sturgeon, including the effects on movement, spawning, and survival.
    - Moderate Priority
      - Evaluate the effects of predation on Atlantic sturgeon by invasive species (e.g., blue and flathead catfish).
  - Data Collection
    - High Priority
      - Establish regional (river or DPS-specific) fishery-independent surveys to monitor Atlantic sturgeon abundance or expand existing regional surveys to include annual Atlantic sturgeon

monitoring. Estimates of abundance should be for both spawning adults and early juveniles at age. See Table 8 for a list of surveys considered by the SAS.

        - Establish coastwide fishery-independent surveys to monitor Atlantic sturgeon mixed stock abundance or expand existing surveys to include annual Atlantic sturgeon monitoring. See Table 8 for a list of surveys considered by the SAS.
        - Continue to collect biological data, PIT tag information, and genetic samples from Atlantic sturgeon encountered on surveys that require it (e.g., NEAMAP). Consider including this level of data collection from surveys that do not require it.
        - Encourage data sharing of acoustic tagged fish, particularly in underrepresented DPSs, and support programs that provide a data sharing platform such as The Atlantic Cooperative Telemetry Network. Data sharing would be accelerated if it was required or encouraged by funding agencies.
        - Maintain and support current networks of acoustic receivers and acoustic tagging programs to improve the estimates of total mortality. Expand these programs in underrepresented DPSs.
        - Collect DPS-specific age, growth, fecundity, and maturity information.
        - Collect more information on regional vessel strike occurrences, including mortality estimates. Identify hot spots for vessel strikes and develop strategies to minimize impacts on Atlantic sturgeon.
        - Monitor bycatch and bycatch mortality at the coastwide level, including international fisheries where appropriate (i.e., the Canadian weir fishery). Include data on fish size, health condition at capture, and number of fish captured.

- Assessment Methodology
    - HIgh Priority
        - Establish recovery goals for Atlantic sturgeon to measure progress of and improvement in the population since the moratorium and ESA listing.
        - Expand the acoustic tagging model to obtain abundance estimates and incorporate movement.
    - Moderate Priority
        - Evaluate methods of imputation to extend time series with missing values. ARIMA models were applied only to the contiguous years of surveys due to the sensitivity of model results to missing years observed during exploratory analyses.

Review Research Progress for the 2027 Research Track Assessments

Monkfish - Draft Research Recommendation Priorities

Critical Research	**Rationale** *(include source, if applicable)*
Aging	Required for age-based assessment. However, no currently accepted approach, and no indication of accepted approach in near future.
Stock Structure	Assessment and management approach (North and South) does not match current genetics (one stock). RT would move ahead with one stock without additional research showing two stocks is appropriate.
Important Research	**Rationale** *(include source, if applicable)*
Assessment Modeling	Current Ismooth approach considered too variable from year to year by some and does not provide biological reference points. Delay-difference or SPiCT approaches could be considered.
Monkfish RSA	Two current projects estimating CPUE/LPUE. Could be used in Ismooth or other assessment approaches if thought to represent population trend not management/market changes.

(see pages 32-33 for Research Track 2027 Options)

Reference Documents:

2022 Management Track Assessment
Below is a list of the research topics included in the previous assessment (NEFSC 2020).

- A benchmark assessment should consider the feasibility of using both observer and port samples in estimating length composition of commercial landings.
- Ongoing research on age and growth of monkfish may lead to an acceptable growth curve, even if not an aging method that could be used for routine aging. If so, age structured models could be explored assuming static growth.
    - Finding a routine aging method seems unlikely. The growth and maturity characteristics of monkfish, however, make attempts at delay-difference type models likely worth trying.

- A better understanding of monkfish movements and stock structure would be helpful to interpretation of monkfish population data.
- Future modeling efforts may want to consider the possible role of cannibalism in stock dynamics of monkfish in light of the strong negative relationship observed in the north between median size of monkfish in the population and recruitment indices. – No progress

2022 Peer-review Report

- Both the shrimp and scallop survey indices should be considered for inclusion in future assessments
- Given the lack of success developing an aging technique, NMFS should not continue to pursue this avenue of research; consider estimating growth through cohort tracking
- Given the lack of growth information on Monkfish, it was recommended the analyst explore a Simple Delay-Difference Model as a potential modeling approach relative to the Ismooth method
- Other Data Limited methods should also be considered for the assessment.
- A better understanding of stock structure (beyond North and South) could improve the assessment effort
- Reconsider the catchability coefficient of the chain swept estimates and how this applies to separate surveys

Research Recommendations from SSC Report to NEFMC

- The SSC recommends that alternative assessment methods for monkfish should be investigated in the next assessment iteration.
- The SSC recommends consideration of additional survey indices, analyses of differences in survey indices, and swept-area biomass estimates derived from survey indices be analyzed.
- The SSC recommends analysis of a recruitment index as a predictor for future discards.
- The SSC recommends further evaluation of the accuracy of discard information from fisheries that catch monkfish, including both targeted and bycatch fisheries.

Recommendations from NEFMC Meeting 12/8/2022 - Jon Hare's Notes

- A CPUE fishery-dependent index
- An industry based gill-net survey (monkfish, skates, dogfish, pollock)
- Add VIMS Scallop survey index
- A composite index

Monkfish 2027 Research Track Options

1. Keep monkfish 2027 RT

- Pro: Already scheduled
- Pro: Can change modeling approach from Ismooth to something else (Delay Difference of SPiCT)
- Pro: new model may allow status determination
- Pro: can address one (data-limited methods) and possibly another (stock structure) of the three research focus/goals in the proposal that led to monkfish being added to the RT schedule
- Con: Will not be able to address the one of the three research focus/goals in the proposal that led to monkfish being added to the RT schedule (aging)
- Con: A lot of time and energy
- Con: New model may not be any more stable than Ismooth (a concern with Ismooth is that year-to-year advice can vary widely)

1.A. Keep monkfish 2027 RT model Northern and Southern Management Areas (status quo, not recommended)

- Pro: Addresses different gears used in the two regions
- Pro: Makes management decisions easier (no allocation decisions between North and South)
- Con: Does not incorporate best scientific information available

1.B. Keep monkfish 2027 RT but model single area

- Pro: Based on best scientific information available (Hasbrouck et al. RSA projects)
- Pro: Previous reasons for separating Northern and Southern not appropriate now (differences in recruitment N&S not seen for strong 2016 cohort, changes in growth N&S not clear due to lack of aging, different gear types in N&S not a basis for stock identification)
- Pro: Simplifies modeling
- Con: Creates challenges for management (allocation N&S)

2. Remove monkfish 2027 RT

- Pro: Opportunity for regional experts to participate in other RT
- Con: Unclear when next opportunity for monkfish RT would be
- Con: No ability to change model (Ismooth) or stock ID in management track assessments

Striped Bass - Draft Research Recommendation Priorities

Critical Research	**Rationale** *(include source, if applicable)*
Develop more robust estimates of stock composition and migration rates for the Atlantic striped bass stock complex.	This would address a recommendation from SARC 66 and provide important data to support a multi-stock model.
Continue development of a multi-stock model and conduct additional simulation testing.	This would address SARC 66 Panel comments.
Transition the current custom single-stock model to another modeling framework such as Stock Synthesis.	This would allow the assessment to take advantage of more modern statistical approaches and more complex dynamics for the catch-and-release component of the fishery, as well as reduce the burden on the lead analyst and Stock Assessment Subcommittee for future model development and updates, if the multi-stock model requires more development.
Important Research	**Rationale** *(include source, if applicable)*
Continue collection of paired scale and otolith samples, particularly from larger striped bass, to facilitate development of otolith-based age-length keys and scale-otolith conversion matrices.	
Collect sex ratio information on the catch and improve methods for determining population sex ratio for use in estimates of female SSB and biological reference points.	

Reference Documents

[Saltonstall-Kennedy Competitive Grants Program summaries FY2023]

Two funded projects to develop spatially-explicit, multi-stock models for striped bass are in progress and scheduled for completion in time to inform the 2027 Research Track assessment, addressing the top two “Critical Research” items. Members of the Striped Bass Stock Assessment Subcommittee are collaborating on both projects.

- **Population modeling to explore effects of the environment on Chesapeake Bay species** – M. Wilberg (University of Maryland Center for Environmental Science) and R. Latour (Virginia Institute of Marine Science)
  - The project was funded through CINAR in part to develop a spatially explicit statistical catch-at-age model to estimate abundance and mortality rates of Striped Bass in the Chesapeake Bay and along the Atlantic coast. Occupancy probabilities and natural mortality rates are estimated using informative priors from a mark-recapture analysis of conventional tagging data. This project was scheduled to be completed at the end of 2023 and will be available soon for the Striped Bass TC to review and consider developing further. Preliminary results were presented at AFS in 2023; the abstract for that session is attached.
- **Stock assessment model development and spatial management strategy evaluation for striped bass** – Y. Jiao (Virginia Polytechnic Institute and State University)
  - This project was funded through the 2023 Saltonstall-Kennedy Competitive Grants Program to develop improved integrated "mixed" stock models using a Bayesian framework, test the model with simulation studies, and conduct a spatial management strategy evaluation (MSE) for striped bass. This project is scheduled to be completed in August 2025, which will be in time for any results to be incorporated into the 2027 Research Track Assessment. The proposal summary from the S-K funding announcement is attached.

    In addition, states continue to collect paired scale and otolith samples and have expanded sampling of otoliths for striped bass through existing port sampling and fishery independent sampling programs to facilitate development of otolith-based age-length keys and scale-otolith conversion matrices.

    Work has not yet begun on the transition of the existing SCA model to another modeling framework, but will be considered further after the 2024 Management Track assessment update. Sex ratio information is being collected under current sampling programs, but the spatial extent remains limited.

https://asmfc.org/uploads/file/63ea88f2ResearchPriorities_AtlStripedBass_2019.pdf

2019 NEFSC Assessment Summary Report - 66th SAW

- Investigate all fisheries independent and dependent data sets, including life history, indices of abundance, and tagging data.
- Discuss strengths and weaknesses of the data sources

- Estimate commercial and recreational landings and discards. Characterize the uncertainty in the data and spatial distribution of the fisheries.
- Review new MRIP estimates of catch, effort and the calibration method, if available.
- Use an age-based model to estimate annual fishing mortality, recruitment, total abundance and stock biomass (total and spawning stock) for the time series and estimate their uncertainty. Provide retrospective analysis of the model results and historical retrospective.
- Provide estimates of exploitation by stock component and sex, where possible, and for total stock complex.
- Use tagging data to estimate mortality and abundance, and provide suggestions for further development.
- Update or redefine biological reference points (BRPs; point estimates or proxies for BMSY, SSBMSY, FMSY, MSY) for each stock component where possible and for the total stock complex. Make a stock status determination based on BRPs by stock component, where possible, and for the total stock complex.
- Provide annual projections of catch and biomass under alternative harvest scenarios.
- Projections should estimate and report annual probabilities of exceeding threshold BRPs for F and probabilities of falling below threshold BRPs for biomass.

2022 ASMFC Atlantic Striped Bass Stock Assessment Update Report

- 2019 Benchmark assessment recommendations remain relevant, particularly the enhanced collection of life history and biological information including paired scale-otolith samples, migration rates, and sex ratio data.
- Refining migration rates and stock composition estimates
- Incorporating tagging data into the spatial statistical catch-at-age model will be required before the next benchmark assessment.

2022 ASMFC Atlantic Striped Bass Stock Assessment Overview

- Continued development of a two-stock spatial assessment model
- Better characterization of commercial discards
- Expanded collection of sex ratio data and paired scale-otolith samples
- Development of an index of relative abundance for the Hudson River stock
- Better estimates of tag reporting rates
- Continued collection of mark-recapture data to better understand migration dynamics
- Impacts of Mycobacteriosis on striped bass population dynamics and productivity.
- Technical Committee recommends the next benchmark stock assessment be conducted in 2027 allowing time to work on state-specific scale-otolith conversion factors and incorporating tagging data into the two-stock assessment model.

2019 ASFMC Atlantic Striped Bass Stock Assessment Overview

- Made progress on developing a spatially and temporally explicit catch-at-age model incorporating tag-based movement information.
- Did not accept the migration model for management use
- Better characterization of commercial discards
- Expanded collection of sex ratio data and paired scale-otolith samples
- Development of an index of relative abundance for the Hudson River stock
- Better estimates of tag reporting rates
- Continued collection of mark-recapture data to better understand migration dynamics
- Impacts of Mycobacteriosis on striped bass population dynamics and productivity.
- State-specific scale-otolith conversion factors
- incorporating tagging data into the two-stock assessment model.

2019 66th Northeast Regional Stock Assessment Workshop (66th SAW) Assessment Report. Sci. Cent. Ref. Doc. 19-08; 1170 p

- Fishery-Dependent Priorities High
    - Continue collection of paired scale and otolith samples, particularly from larger striped bass, to facilitate development of otolith-based age-length keys and scale-otolith conversion matrices.
    - Develop studies to provide information on gear specific (including recreational fishery) discard morality rates and to determine the magnitude of bycatch mortality.
    - Conduct study to directly estimate commercial discards in the Chesapeake Bay. • Collect sex ratio information on the catch and improve methods for determining population sex ratio for use in estimates of female SSB and biological reference points.
- Fishery-Dependent Priorities Moderate
    - Improve estimates of striped bass harvest removals in coastal areas during wave 1 and in inland waters of all jurisdictions year round.
- Fishery-Independent Priorities High
    - Develop and index of relative abundance from the Hudson River Spawning Stock Biomass survey to better characterize the Delaware Bay/Hudson River stock.
    - Improve the design of existing spawning stock surveys for Chesapeake Bay and Delaware Bay.
- Fishery-Independent Priorities Moderate
    - Develop a refined and cost-efficient, fisheries-independent coastal population index for striped bass stocks.
    - Collect sex ratio information from fishery-independent sources to better characterize the population sex ratio.
- Modeling / Quantitative Priorities   High
    - Develop better estimates of tag reporting rates; for example, through a coastwide tagging study.

- Investigate changes in tag quality and potential impacts on reporting rate. Updated 2019 2
- Explore methods for combining tag results from programs releasing fish from different areas on different dates.
- Develop field or modeling studies to aid in estimation of natural mortality and other factors affecting the tag return rate.
- Compare M and F estimates from acoustic tagging programs to conventional tagging programs.

- Modeling / Quantitative Priorities Moderate
    - Examine methods to estimate temporal variation in natural mortality.
- Modeling / Quantitative Priorities Low
    - Evaluate truncated matrices to reduce bias in years with no tag returns and covariate based tagging models to account for potential differences from size or sex or other covariates. Life History, Biological, and Habitat Priorities High • Continue in-depth analysis of migrations, stock compositions, sex ratio, etc. using markrecapture data.
    - Continue evaluation of striped bass dietary needs and relation to health condition.
    - Continue analysis to determine linkages between the Mycobacteriosis outbreak in Chesapeake Bay and sex ratio of Chesapeake spawning stock, Chesapeake juvenile production, and recruitment success into coastal fisheries.
- Moderate
    - Examine causes of different tag based survival estimates among programs estimating similar segments of the population.
    - Continue to conduct research to determine limiting factors affecting recruitment and possible density implications.
    - Conduct study to calculate the emigration rates from producer areas now that population levels are high and conduct multi-year study to determine inter-annual variation in emigration rates.
- Additional Habitat Research Recommendations
    - Passage facilities should be designed specifically for passing striped bass for optimum efficiency at passing this species.
    - Conduct studies to determine whether passing migrating adults upstream earlier in the year in some rivers would increase striped bass production and larval survival, and opening downstream bypass facilities sooner would reduce mortality of early emigrants (both adult and early-hatched juveniles).
    - All state and federal agencies responsible for reviewing impact statements and permit applications for projects or facilities proposed for striped bass spawning and nursery areas Updated 2019 3 shall ensure that those projects will have no or only minimal impact on local stocks, especially natal rivers of stocks considered depressed or undergoing restoration. • Federal and state fishery management agencies should take steps to limit the introduction of compounds which are known to be accumulated in striped bass tissues and which pose a threat to human health or striped bass health.

- Every effort should be made to eliminate existing contaminants from striped bass habitats where a documented adverse impact occurs.
- Water quality criteria for striped bass spawning and nursery areas should be established, or existing criteria should be upgraded to levels that are sufficient to ensure successful striped bass reproduction.
- Each state should implement protection for the striped bass habitat within its jurisdiction to ensure the sustainability of that portion of the migratory stock. Such a program should include: inventory of historical habitats, identification of habitats presently used, specification of areas targeted for restoration, and imposition or encouragement of measures to retain or increase the quantity and quality of striped bass essential habitats.
- States in which striped bass spawning occurs should make every effort to declare striped bass spawning and nursery areas to be in need of special protection; such declaration should be accompanied by requirements of non-degradation of habitat quality, including minimization of non-point source runoff, prevention of significant increases in contaminant loadings, and prevention of the introduction of any new categories of contaminants into the area. For those agencies without water quality regulatory authority, protocols and schedules for providing input on water quality regulations to the responsible agency should be identified or created, to ensure that water quality needs of striped bass stocks are met.
- ASMFC should designate important habitats for striped bass spawning and nursery areas as HAPC.
- Each state should survey existing literature and data to determine the historical extent of striped bass occurrence and use within its jurisdiction. An assessment should be conducted of those areas not presently used for which restoration is feasible. Management, Law Enforcement, and Socioeconomic Priorities Moderate
- Examine the potential public health trade-offs between the continued reliance on the use of high minimum size limits (28 inches) on coastal recreational anglers and its long-term effects on enhanced PCB contamination among recreational stakeholders.

Projections - Research Progress and TORs

Draft Terms of Reference (adapted from RTA Proposal)

(1) **Evaluate the past performance of stock assessment projections in the Northeast.** This ToR aims to update and expand on previous research examining projection performance in our region. Quantifying past projection accuracy, and uncertainty, relative to the most recent assessment across a range of stocks provides a baseline for subsequent improvements.

(2) **Determine the most important sources of error in the projections.** Possible sources of error include inaccurate biological rates (e.g., growth, maturity, or natural morality), misspecified selectivity, inappropriate assumptions of future recruitment, or inaccurate initial abundance estimates. Building on previous work, a retrospective projection analysis could be carried out to evaluate this ToR.

(3) **Establish guidelines for projecting recruitment.** Recruitment is often projected without temporal correlation, and time spans of past recruitment used in projections can be difficult to justify. The importance of recruitment assumptions will vary by stock, with short-lived, young-harvested stocks being the most impacted in short-term projections. The aim of this ToR would be to establish good practices for projecting recruitment and its uncertainty.

(4) **Examine methods for projecting biological rates (e.g., growth, maturity, and natural mortality).** Biological rates are typically projected by assuming that the recent average rate will continue into the future. However, the accuracy of this approach has not been comprehensively evaluated. Averaging approaches could be compared to more sophisticated methods, such as modeling temporal and cohort correlation, and explicit linkages to driving variables.

(5) **Establish procedures for determining when to incorporate ecosystem drivers into projections.** Incorporating ecosystem drivers is hypothesized to improve projections. However, methods for evaluating the robustness of these driving relationships, and their ability to be projected forward, are not well established. This ToR aims to determine when ecosystem drivers would be expected to be useful for improving projections.

Ongoing Research

- Inflation Reduction Act Projections Project – Coordinated by NMFS HQ; project not yet defined but is described as " a National project to help transform how the agency produces population projections in stock assessments and ensure we are able to continue supporting sustainable fisheries."
- Interdisciplinary Projections for EBFM – Led by HQ, project aims to use an interdisciplinary forecasting approach to achieve climate-ready, ecosystem-based, sustainable fisheries management.

- Building Next-Generation Fishery Forecasting Capacity: Building next-generation diagnostic and forecasting capacity to achieve management objectives by increasing stock assessment accuracy and throughput – Funded through a RESTORE Act grant in 2023. The project team will develop new methods and technological capacity to increase the accuracy of projection assumptions, improve transparency in the impact of structural assumptions made in model development, and increase the throughput of stock assessment models to improve the accuracy of management advice under changing environmental conditions.The team will develop, test, and implement capacity to 1) better incorporate known uncertainties and regulatory impacts into stock assessment model projections and management reference points; 2) facilitate multi-model ensemble inference approaches, though improved model diagnostics and interpretation techniques; and 3) utilize scalable model complexity between current full and interim assessment methods to iteratively update data sources and parameter estimates as available and appropriate to maximize the accuracy and timeliness of management advice. This project will reduce bias and uncertainty in the estimation of overfishing limits and acceptable biological catch limits critical to the management of fisheries in the Gulf of Mexico. This will be achieved by providing practical and actionable improvements to existing stock assessment modeling software in conjunction with focused training for stock assessment analysts integrated directly into current stock assessment workflows. Lead Investigator Nathan Vaughan, Vaughan Analytics. Work is scheduled for October 2023-September 2028.