Atlantic States Marine Fisheries Commission
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Ecological Reference Point Work Group

Check-In Summary

May 27, 2025

Members in Attendance: M. Cieri, M. Celestino, D. Chagaris, A. Buchheister, A. Schueller, J. McNamee, H. Townsend, M. Dean
Staff: K. Drew, J. Patel, J. Boyle, S. Nehemiah
Public: A. Binstock, P. Himchak, B. Foor, M. Waine, J. Kaelin, W. Poston

Model Updates

NWACS-MICE

Since the last meeting, 3 additional runs and calibrations have been done for the NWACS MICE model, bringing the total runs and calibrations to 139. From these, Scenarios 1–3 tested various initial conditions, and the three new models incorporated monthly egg production and vulnerability forcing. The evaluation process identified the top 10% of models based on the lowest sum of squares, which included all model types except those with monthly fishing mortality. In most of the runs there were tensions between spiny dogfish, striped bass, and Atlantic herring, where fitting spiny dogfish often led to increased predation mortality for other groups, leading to increased natural or total mortality.

Concerns from previous discussions included the prevalence of models with parameters on boundary constraints and the potential of egg production scenarios to resolve seasonal predation dynamics, Run 139, which applied estimated vulnerabilities from Run 86 and integrated monthly forcing with caps for ERP species, showed promising diagnostics despite a higher sum of squares, and was recommended as the potential base run. Biomass trajectories for adult striped bass, benthic invertebrates, and spiny dogfish showed considerable divergence across model runs. Most equilibrium analyses produced fishing mortality estimates generally consistent with FMSY benchmarks, except for Atlantic herring, which had a much higher FMSY than what was in the most recent stock assessment in every scenario except the annual primary production scenario.

For Run 139, menhaden biomass remained stable, influenced by whether primary production (PP) was included. Striped bass showed age-specific dynamics, with egg productivity influencing age-0 biomass but having weaker links to vulnerability. Older age groups aligned better with empirical data, though some historical catch peaks were not well captured. Spiny dogfish biomass was overestimated compared to assessments, especially in post-2000 catch. Bluefish showed better model fits for adults than juveniles, with fishing mortality being the main driver. Weakfish juveniles exhibited noisy data, while adult mortality rose due to increased predation, largely from spiny dogfish. Herring presented the biggest challenges: while the model captured seasonal predation dynamics in younger age classes, it struggled to replicate recent declines in older herring biomass.

The group talked about the issues with Atlantic herring and how recently, recruitment has plummeted. The group wanted to know if it was possible for that dynamic to be forced in the EwE model. There is no certain firm hypothesis behind the drop in recruitment, because all the predictors in the WHAM model come up as slightly important. Each probable cause individually does not impact herring results, so the WG wanted to force it into the EwE without a “cause”. The current WHAM model does not allow for multiple effects, which results in herring having an age-constant M of 0.35 and using NAA transitions to capture transitions. This could be the cause behind some of the scaling issues for herring in the EwE model.

Next steps: M. Cieri to send Dave the WHAM output. D. Chagaris to look into the NAA matrix to see how to force the trend for Atlantic herring. D. Chagaris to run base model (run 139) and sensitivity runs and compare the results with previous assessment (accounting for change in units), finish the rainbow plot for the tradeoff analysis for the new base run, and finish writing the report.

NWACS-Full

The NWACS FULL model underwent significant revisions following the previous meeting to resolve issues for oscillations for yellowtail flounder, cod, and summer flounder as well as data processing errors in stock assessment inputs. These errors had skewed estimates of fishing mortality (F) for most non-ERP species due to incorrect age-based apportioning of landings and discards. With these corrections, the input data were fixed, the Ecopath model rebalanced, and Ecosim recalibrated, resulting in improved ecosystem efficiency values, especially for menhaden.

The Ecosim calibration process followed a multi-phase structure. The initial fitting phase involved four model combinations using a factorial design that tested the inclusion or exclusion of primary production (PP) forcing and various vulnerability (k_{ij}) initialization strategies. The best initial fit came from the model without PP forcing and with estimated k_{ij} values. Modifications to the best-fitting models were made through three approaches: manual adjustments to minimum k_{ij} values (V_{adj}), setting minimum k_{ij} to 1.01 for all groups (V_{min}), and applying a maximum cap to k_{ij} values (V_{cap}). Among these, V_{adj} provided the best improvement, particularly for aligning FMSY estimates. Additional tweaks, such as a minor adjustment to menhaden's minimum k_{ij} (V_{adj2}), further improved model behavior, especially the shape of the menhaden yield curve. The final recommended base run for this model was 2.9_V_{adj}2 where the ERP species with vulnerability parameters on lower bounds (Atlantic herring, bluefish, and weakfish) are bumped to 1.01 and menhaden bumped to 1.2.

Model fits to the updated time series showed clear improvements, with catch data fitting better than biomass estimates. For ERP species, catch fits captured most patterns in the observed data, though Atlantic herring (age 2+), striped bass (age 6+), and adult weakfish had intermediate fits. Biomass fits were more variable with Atlantic herring (age 2+) showing a moderate fit, and spiny dogfish and weakfish with weaker fits. Weakfish biomass appeared flat over time, diverging from expected trends.

Ecosystem projections assessed the impact of fishing intensity on ERP species. All ERP species except menhaden were modeled at their target fishing levels, while menhaden fishing varied across a gradient from zero to complete removal (F multiplier from 0 to 20). Species most sensitive to changes in menhaden fishing included haddock, nearshore birds, and striped bass. In particular, striped bass and spiny dogfish benefited from no menhaden fishing, while bluefish biomass declined in that scenario. Weakfish responses were minor, and herring biomass declined regardless of menhaden harvest levels.

Further analysis of equilibrium biomass relative to the 2023 menhaden fishing level highlighted several species that declined by more than 50% at maximum menhaden F, including striped bass, haddock, osprey, medium pelagics, and menhaden—though uncertainty remains high due to sparse data for many of these groups. Equilibrium catch outcomes showed similar declines in species like striped bass and menhaden.

Group discussion focused on weakfish inputs (especially the version of mortality Z used), the role of menhaden in herring declines, and potential scaling issues with mortality estimates. Concerns were raised about the high proportion of parameters on bounds—about 50%—which, while higher than desired, may be expected in a model of this complexity. Looking ahead, the team discussed whether to explore more aggressive approaches to improve herring fits, such as recruitment forcing as done in the MICE model.

However, this approach would require considerably more effort in the FULL model and might not be feasible before the report deadline. Still, it may be worthwhile to explore in peer review or future iterations.

VADER

There was limited new information to report on the VADER model. However, the behavior of the dynamic M (natural mortality) function generated differing estimates of abundance for Striped Bass throughout the time series. Specifically, VADER tends to produce higher abundance estimates in the earlier part of the series, while single-species models show higher estimates later on. This raised the question of whether the dynamic M feature should be disabled to align better with other model outputs.

Currently, the model lacks full diagnostics, projections, and sensitivity analyses. The group was asked whether some of the sensitivity runs could be conducted without the indices or by using the dynamic M as a sensitivity case. Based on this, the group inquired whether there was a plot available without the dynamic M and it was noted that the model has been run without the dynamic M but the plots have yet to be created. The group also expressed concern about the defensibility of dynamic M without empirical backing, suggesting that the single-species approach might be more robust. The primary driver of abundance changes is age-1 fish and referenced S. Schiano's work which suggests a potential relationship between length-at-age and natural mortality.

There was also a question of if top-down effects would still be observed if dynamic M was turned off, and it was confirmed that the model retains those effects to the extent possible. The group proposed that both versions—one with dynamic M and one without—be presented to show the current state of development. This would highlight the importance of transparently documenting the model's development and the rationale behind various methodological choices. However, concerns were raised about complicating the review process by including such developmental features in the main report. It was agreed that the detailed modeling work might be better suited for a working paper rather than the main report and noted that additional sensitivity runs involving dynamic M are unlikely.

Finally, the importance of comparisons to single-species models, especially for species like herring, where additional complexities such as recruitment autocorrelation cannot be incorporated was emphasized. This further underlined the need for clear and comprehensive documentation of modeling decisions and outputs.

<u>Final Decisions and Next Steps</u>

For the NWACS-MICE model, Run 139 was selected as the base run. Additional exploration will be conducted to address concerns around the herring collapse in biomass, potentially through modifications to recruitment or survival of age 2+ fish. Outputs from the ASAP and WHAM models will be sent to D. Chagaris to support further analysis. Additionally, K. Drew and D. Chagaris will correct the rainbow plots, and D. Chagaris will supply ERP F target and threshold numbers to A. Schueler and K. Drew for the single-species projections.

For the NWACS-FULL model, Run 2.9v_{adj}2 was chosen as the base run. This model will proceed without primary productivity (PP) forcing and will use unfished (B_0) conditions for ERP species. Parameters for ERP species will be manually adjusted as needed. Depending on the results from the herring forcing in the MICE model, similar approaches may be considered for the full model. The group will also investigate the bluefish model output, particularly the observed increases in abundance associated with higher menhaden fishing mortality (F). If these results can be reasonably explained, the group is generally comfortable with the model's current trajectory.

In terms of the VADER model, the focus remains on documenting its developmental progress rather than presenting it as a finalized or fully viable option at this stage. The model is specifically being refined in its handling of dynamic natural mortality (M) and compared to single-species models. Sensitivity analyses will be limited, concentrating mainly on issues related to M.

For the report, K. Drew has a working draft. By June 2, a version of the report will be shared with the Menhaden SAS and ERP Working Group, depending on how many ERP model versions are ready by that time. The complete report must be finalized by June 17, at which point it will be reviewed during a group call. The Technical Committee is scheduled to review the report on June 30, with the goal of approving it by July 9 or 11.