Summary Report of the Atlantic Scallop Research Track Stock Assessment Peer Review

April 21–24, 2025
Northeast Fisheries Science Center, Woods Hole, Massachusetts

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Introduction

The Northeast Region Coordinating Council (NRCC)[1] has developed an enhanced stock assessment process to improve the quality of assessments. The process involves two tracks of assessment work: 1) a management track that includes routine updates of previously approved assessment methods to support regular management actions (e.g., annual catch limits), and 2) a research track that allows comprehensive research and development of improved assessments on a stock-by-stock or topical basis. The research track assessment process allows for a more thorough review of information available and for the evaluation of different assessment approaches than would be possible in a standard stock assessment process where the results are immediately used for management advice. This Panel reviewed the Research Track Assessment for the Atlantic Sea Scallop stock

The most recent stock assessment for Atlantic Sea Scallop was a management track assessment in 2021 that was based on the benchmark assessment from SARC 65 in 2017 (NEFSC, 2018). Assessments for Atlantic Sea Scallop have used a catch at size analysis (CASA) framework since 2007. Materials for this assessment were prepared by a Workgroup (WG), chaired by Dr. Patrick Sullivan. The WG included staff from NOAA Fisheries, the regional management councils, academic institutions and, because the species distribution of Atlantic scallop extends into Canada, a scientist from Fisheries and Oceans Canada (DFO).

The Atlantic Sea Scallop Research Track Assessment Peer Review took place in Woods Hole, MA during April 21–24, 2025. All members of the Review Panel and all but one of the presenters were present in person at NEFSC for the peer review. The Review Panel greatly appreciates the availability of these scientists, as the in-person format greatly facilitated discussion and interactions. A hybrid option was available for agency and academic scientists, fishers and members of the public to participate, which helped ensure the process was open and transparent. Periods for public comment were set aside on each day of the meeting. The Panel included four independent, international scientists selected by the Center for Independent Experts (CIE). Yong Chen and Thomas Miller (chair) are both members of the Mid-Atlantic Fishery Management Council's Scientific and Statistical Committee (SSC). Noel Cadigan (Canada) and Martin Cryer (New Zealand) provided additional independent perspectives of the stock assessment. All four Panel members have extensive experience with size-structured stock assessment modeling approaches to invertebrate fisheries.

The Research Track Assessment Report and 14 supporting working papers were provided to the Panel on the NEFSC data portal (https://apps-nefsc.fisheries.noaa.gov/saw/sasi.php) on April 7, 2025. Appendix 3 lists the material provided to the Review Panel. Prior to the meeting, members of the Panel met with Brian Hooper (NEFSC's Stock Assessment Process Lead) and Kristan Blackhart (Chief, NEFSC Population Dynamics Branch) on April 16, 2025 to review and discuss the meeting agenda, reporting requirements, meeting logistics and the overall process. The Panel Chair is grateful for discussions with Cate O'Keefe, executive Director of the New England Fishery Management Council. The Review Panel is grateful to Jason Boucher, Toni Chute, Kiersten Curti,

[1] Atlantic States Marine Fisheries Commission (ASFMC), Greater Atlantic Regional Fisheries Office (GARFO), Mid-Atlantic Fishery Management Council (MAFMC), New England Fishery Management Council (NEFMC), and Northeast Fisheries Science Center (NEFSC).

Alex Hansell, Liz Brooks, Chris Legault and Emily Liljestrand who served as rapporteurs. Appendix 4 lists the attendees for the meeting.

Panel members and the Chair drafted this Summary Report in a Google Doc. A preliminary summary of the Panel's conclusions and recommendations was provided at the end of the meeting to the Atlantic Scallop Research Track Workgroup (WG) and members of the NEFSC Population Dynamics Branch. Subsequent to the meeting, the Panel Chair compiled and edited this Summary Report with assistance from the CIE Panelists before submission of a draft report to the WG. The scope of the WG review of the draft was limited to suggesting corrections for errors of fact or requesting that Panel recommendations be clarified. Additionally, each of the CIE Panelists will submit separate reviewer reports to the CIE.

Terms of Reference (ToRs) for the WG, and by extension the Review Panel, are provided in Appendix 1. We note that the specific ToRs deviate from the standard ToRs provided to a research track WG in that the assessment was charged with provision of biological reference points and a stock status specification statement.

The Review Panel noted that in several ways, the Atlantic Scallop Research Track Review was non-standard. For example, it was unusual in that it was required to provide stock status advice. This may have led the WG to adopt a more conservative approach to changes to the data analysis, model exploration and projection methodologies than might have occurred otherwise. Perhaps as a result the Atlantic Scallop Research Track Assessment is risk averse — in some ways more like a management track assessment than is typical. As a result, the Review Panel viewed the Atlantic Scallop Research Track Assessment to be an opportunity that was missed to more fully explore novel ways to analyze the data, and to more fully explore model configurations or even alternative model structures. In the Review Panel's experience, it is typical for Research Track Assessments to proceed from the previously approved assessment in a series of steps that may first update data, then assess changes in model fit based on alternative assumptions or model structures before arriving at the Research Track WG's final recommended model. Somewhat unusually, the WG for this Atlantic Scallop Research Track Assessment presented the recommended model first, and provided only limited evaluation of alternatives during the review. Based on discussions during the review meeting, the Review Panel believes that it is highly likely that modeling decisions were made carefully and in a structured order during data analyses and model development; however, the Review Panel was frequently unable to point to specific evidence that supported this belief. Finally, the information provided to the Review Panel was not comprehensive, which might limit its ability to better complete its task. Descriptions of evidence to support decisions made by the WG were often lacking from the written materials, and key citations were missing. The Review Panel notes that the WG may have tried to balance criticism that they provided too much information for SARC 65. Yet, the Review Panel notes that they are asked to provide evidence-based reviews of the work that was completed. This task is made more difficult when the analyses are not presented to the Review Panel in a logical, structured and documented sequence or when documentation is incomplete and the pathway to the final assessment is opaque.

The Panel's detailed evaluation of the WG's response to the nine Terms of Reference (ToRs) is provided in subsequent sections below. The Panel agreed that ToRs 1, 2, 7, 8 and 9 were fully met and ToRs 3-6 were partially met.

Term of Reference 1

> *Identify relevant ecosystem and climate influences on the stock. Characterize the uncertainty in the relevant sources of data and their link to stock dynamics. Consider findings, as appropriate, in addressing other TORs. Report how the findings were considered under impacted TORs.*

The Review Panel considers that work presented by the WG fully met this ToR. The Review Panel believes that the WG have clearly identified and documented ecosystem impacts on the abundance, distribution and composition of the Atlantic Sea Scallop population in the Mid Atlantic, Georges Bank and Gulf of Maine.

Distributional analyses from dredge surveys conducted between 1999–2023 demonstrate that Atlantic scallop have been excluded from shallower, inshore waters and from waters in the southern regions of the Mid-Atlantic by warming temperatures. Size distributions show survival of scallops 2 years and older have declined substantially, such that scallops larger than 70 mm shell height are largely absent from waters off of Virginia (Fig. 1). This recent truncation of the size distribution occurred during a time when there was essentially no fishing, implying a substantial increase in natural mortality rates (M) in this region. Water temperatures > 18°C represent a significant stress on Atlantic scallop, particularly for individuals older than 2 years. Data on oceanic temperatures in the Southern New England / Mid-Atlantic region developed using the GLORYS Ocean Reanalysis system (https://www.mercator-ocean.eu/en/ocean-science/glorys/) indicated increases in the proportion of suitable habitats that experienced temperatures > 18°C, particularly in summer and autumn months (Fig. 2). The spatial extent and duration of heat stress events increased from 1993 to 2023, particularly in September and

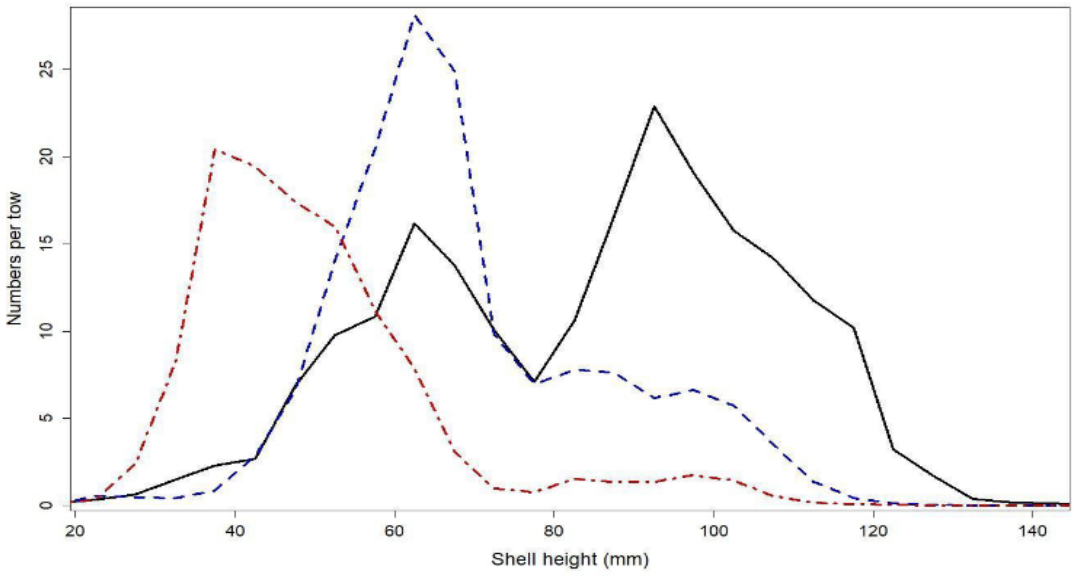

Figure 1. Dredge survey shell heights off of Virginia showing reduced numbers of larger scallops over time. The black solid line is for 1998-2000, the blue dashed line is from 2001-2008 and he red dashed line for 2009-2018. Credit: Figure 1.1 in SCA_RT_WP_TOR1a Ecosystem Influences.pdf

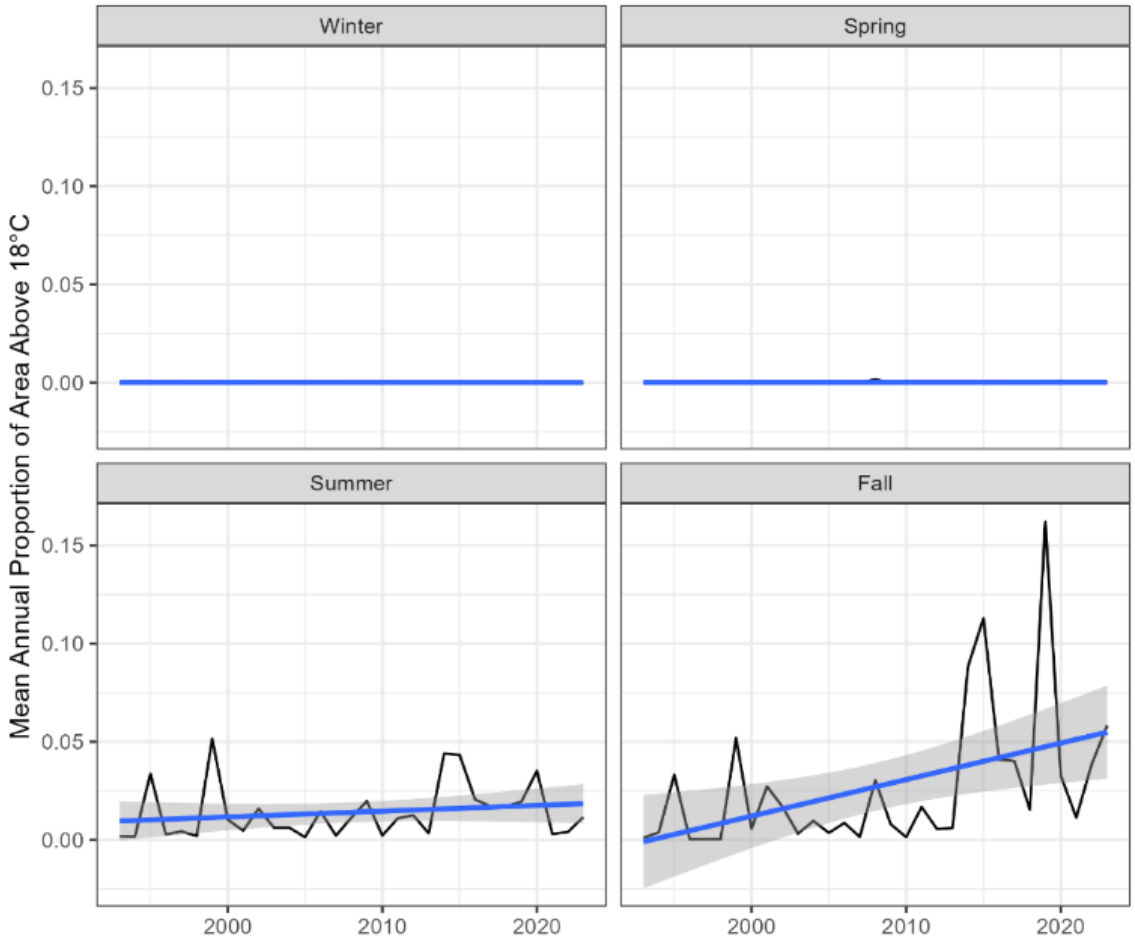

Figure 2. Mean seasonal heat stress area as proportion of SAMS areas. The blue lines show a linear regression with grey shading showing the 95% confidence interval. (Winter = Jan-Mar, Spring = Apr-Jun, Summer = Aug-Sept, Fall = Oct-Dec. Credit: Figure 1.12 2025_SCA_RT_WP_TOR1b Climate Influences.pdf

October. This warming can be expected to be a consistent and, perhaps, an increasing feature of the areas of potential scallop habitat in the short-term future.

It is uncertain if the high fall bottom temperatures thought to be harmful to scallop survival will persist in the medium- to long-term. Reliable forecasts of the relevant bottom temperatures are not available. However, the Review Panel agreed that it was appropriate that the assessment team included consideration of ecosystem and climate influences when setting reference points and forecast procedures. Time-varying M has been included in CASA scallop assessment models to account for changes in survival rates due to changes in the ecosystem.

Predation of Atlantic Sea Scallops by the sea star *Astropecten americanus* appears to be reducing or excluding sea scallops from the deeper waters of the Mid-Atlantic. Elevated levels of the sea star *Asterias vulgaris* and concomitantly increased numbers of sea scallop “clappers”, an indicator of recent natural mortality, were observed on surveys of the northern edge of Georges Bank in 2024, in both U.S. and Canadian waters. Off-colored “gray meats”, potentially caused by protists in the genus *Apicomplexa*, have been most commonly observed on Georges Bank, and in particular in Closed Area I. This may have contributed to the increased natural mortality observed

in the Georges Bank closed areas during 2011–13. Other parasitic infections and impacts on scallop mortality rates were described by the assessment team.

The WG presented information on growth of scallops under this ToR, but the Review Panel felt it was more appropriate to discuss this work under ToR 3.

The Review Panel finds that the WG completed work required to understand ecosystem effects on Atlantic Sea Scallop. The Review Panel encourages the WG to continue this work in preparation for future assessments. In particular, the Review Panel recognizes opportunities to "close the loop" by considering whether information on time-varying natural mortality derived from the assessment model can be analysed to further elucidate the importance and extent of ecosystem changes on Atlantic Sea Scallop population dynamics. Such analyses could examine disease and parasitism incidence or direct environmental factors such as temperature.

The Review Panel fully supports the regional approach taken by the WG in developing the assessment models. There is compelling evidence that the dynamics of Atlantic Sea Scallops in these two different regions are experiencing different patterns of natural and fishing mortality and other life history processes (e.g., growth). The Review Panel encourages the WG to initiate research to explore whether biological factors exist that underpin the regional differences observed in the assessment model results. This work could involve modern molecular approaches to stock definitions that have shown the ability to detect substructure in populations at this scale (Clucas et al., 2019; Reid et al., 2023). Other lines of evidence from coupled physical-biological models may also be helpful indicators of restrictions on connectivity between regions (Tian et al., 2009). Such work is important to assess whether multiple stocks exist within this region.

Term of Reference 2

> *Estimate catch from all sources including landings and discards. Describe the spatial and temporal distribution of landings, discards, and fishing effort. Characterize the uncertainty in these sources of data.*

The Review Panel considers that the work presented by the WG fully met this ToR. The Review Panel believes that the landings, discards and incidental mortality have been appropriately characterized, and where possible, sources of uncertainty have been identified and quantified.

The WG fully documented data sources related to catches from different sectors of the fishery over time. Data from 1975 onwards are used in the assessment, but the WG assembled data on long term landings for Atlantic Sea Scallop since 1887. The WG group documented well the history of management actions that have changed fishing patterns, and also reviewed how catches have been recorded and reported historically. Atlantic Sea Scallop catches have been reported as a part of the NEFSC Catch Accounting and Monitoring System (CAMS) since 2020.

Fishery catches are recorded from the Mid-Atlantic, Southern New England, Georges Bank and the Gulf of Maine. Southern New England and Gulf of Maine catches remain a minor component of the fishery. However, there have been increased landings from the Gulf of Maine in recent years. Landings are reported by five market categories, defined by the number of "meats" (the adductor muscle) per pound of scallop. During 1975–2000 landings were mostly of the 20–30 or

greater market categories. However, since 2000, approximately 75% of landings are U10 and 10–20 market categories.

The Review Panel discussed with the WG the potential importance of unreported landings. There is a small allowance for scallop landings in some groundfish fisheries, but the allowance is small (20 Lbs./trip) and WG believed that overall, this source of landings is likely small currently. However, information on incidental and unreported catches early in the history of the fishery are not available. ,

Catches are considered a census and thus estimates of uncertainty are not relevant.

There are no recognized recreational fisheries for scallops, which is a source of removals often associated with large degrees of uncertainty.

Discard levels of Atlantic Sea Scallop, and its associated uncertainty, have been estimated from the Northeast Fishery Observer Program since 1989. The approaches to estimating discard mortality have changed as the catch recording methodology has changed (e.g., SBRM to CAMS). Discard mortality averaged 5.2% of landings for 1989–2023 but has increased recently (5.9% for 2010–2023). Strong regional differences exist in the percentage of scallops discarded. Discarding and discard mortality is not included in the CASA, or SYM models. If discards remain at low levels, this may be acceptable. However, the evidence that catches are increasingly dominated by large scallops (U10 and 10–20 count) suggest that increased targeting is occurring, which may be related to an increase in discards. Similarly, the importance of high levels of uncertainty in some years and regions may warrant increased attention to discardiing and discard mortality in the future.

The WG considered incidental mortality in the Atlantic Sea Scallop fishery. Estimates of incidental mortality in published research have ranged from 15–20% on hard bottom in Canadian waters (Caddy, 1973) to more recent estimates of 2.5% for the Mid-Atlantic and 8% for Georges Bank (Ferraro et al., 2017). Incidental mortality estimates are derived from video surveys conducted after an area had been dredged. Ferraro et al. (2017) noted that the regional differences in incidental mortality likely reflect a difference in the character of the substrate with higher mortality on Georges Bank reflective of the presence of harder sediments generally. However, these estimates incorporate only the direct, physical damage to scallops of dredging and, based on experience from New Zealand, may under-estimate longer term mortality rates. The CASA assessment models use incidental mortality rates of 6 and 11% for the Mid-Atlantic and Georges Bank regions respectively. Similar values are used for the SYM and SAMS models.

Term of Reference 3

> *Present the survey data used in the assessment (e.g., indices of relative or absolute abundance, recruitment, state surveys, age-length data, application of catchability and calibration studies, etc.) and provide a rationale for which data are used. Describe the spatial and temporal distribution of the data. Characterize the uncertainty in these sources of data.*

The Review Panel concluded that the WG partially met this ToR. The Review Panel believes that the work presented during the review meeting represents our best understanding of trends in

population abundance, distribution and composition. The Review Panel indicated a lack of documentation provided limited its ability to fully understand the challenges in interpreting survey time series.

The dredge survey, which is the longest fishery-independent survey used in the assessment, was well described. Data are available from 1979 to present for the NEFSC dredge survey. Sampling was conducted from the R/V Albatross IV (1979–1989, 1993–2007) and the R/V Hugh R. Sharp (2008–2022). The Virginia Institute of Marine Science has been conducting a dredge survey in the Mid-Atlantic since 2005 using a commercial vessel. This has become the principal survey in the Mid-Atlantic since 2014, and it was expanded in 2023 to survey Georges Bank. Vessel calibration studies involving the three principal vessels involved have indicated that tow length is a more important factor than vessel identity. Accordingly, dredge survey catches are standardized for tow length and depth, but not vessel.

Dredge catches are reported in numbers per tow and biomass per tow with associated CVs. Plots of the dredge survey time series are shown in Fig. 3.

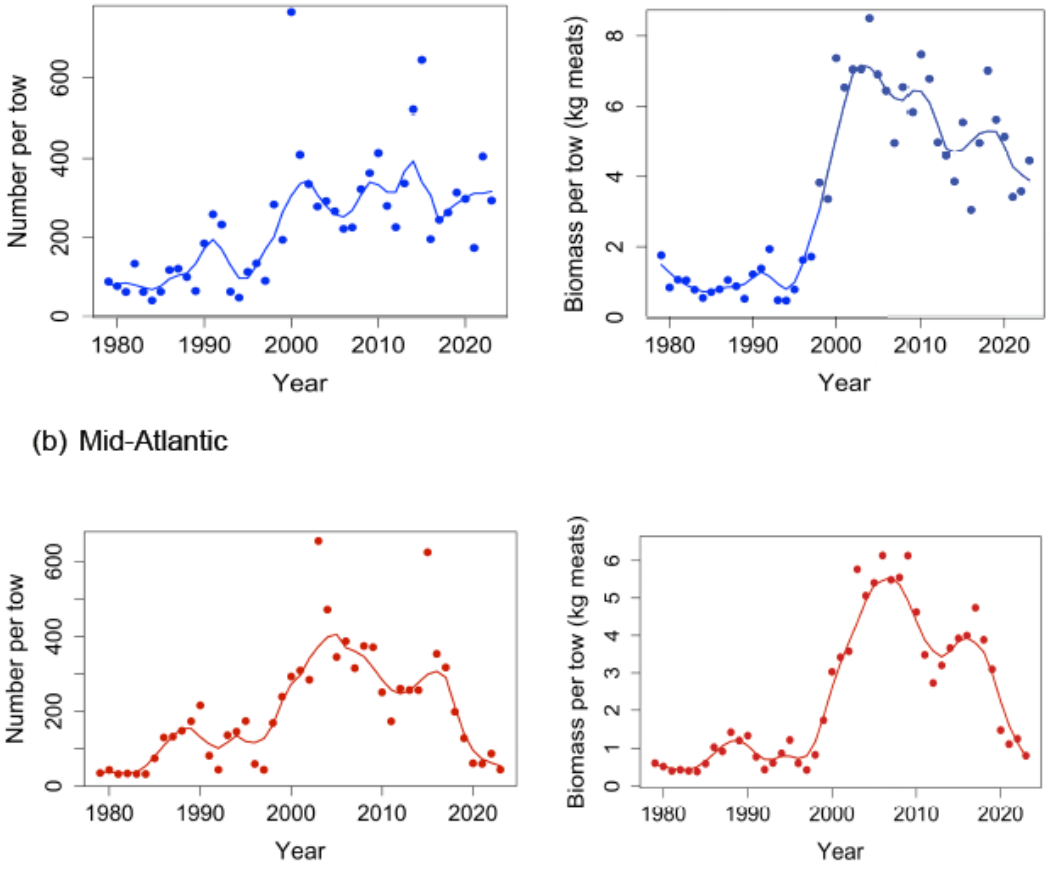

Figure 3. Dredge time series for numbers (left) and biomass (right) (dots), including lowess smoothers (lines) for a) Georges Bank and b) Mid-Atlantic. Credit. Figure 3.2. 2025_SCA_RT_TOR3 Survey Data.pdf

Atlantic Sea Scallops are also surveyed using two optical methods. A drop camera survey has been conducted since 2003 by researchers at the University of Massachusetts Dartmouth. A weighted frame that provides a structure for lights and cameras is lowered to the bottom, and

images are captured. The frame is then raised off the bottom while the vessel drifts a short distance before the frame is lowered back to sediment. Four such samples are collected at each location. Individual locations together form a 1.5 nautical mile (nm.) or 3 nm. sampling grid. Images are subsequently annotated to estimate the number and size of scallops observed at each sampling location. Digital still cameras were added in 2009 and the main camera was changed to digital format in 2017. These changes altered the field of view and the size-selectivity of the survey. Annotations have been calibrated in tank experiments. Drop camera surveys have been conducted in the Mid-Atlantic and Georges Bank. Annual surveys have a common footprint in each region, and data falling outside of this footprint were not used in the analysis. GAMs were used to create abundance and density maps throughout each common footprint area each year. Estimates of uncertainty were also calculated.

The second optical survey is a towed, habitat mapping camera system, termed Habcam. Habcam collects approximately 6 images/second while it is towed at 5–7 knots approximately 2 m above the bottom. Four different versions of the towed body have been used during the survey time period. There is a structural autocorrelation in sequential Habcam images, and thus only 1 image in 50 or 1 in 100 are annotated. This is equivalent to one image every 25–50 m. Data from each image are interpolated to maps of larger areas using zero-inflated general additive models to remove spatial trends, followed by ordinary kriging.

Estimates from Habcam have been used to estimate the survey capture efficiency of the dredge survey. The best estimate of the dredge survey q was 0.4 on sand and 0.27 in areas of gravel or cobble. The assessment uses these, and other calibration results, to expand the dredge estimates of relative abundance to estimates of absolute abundance. Beginning in 2015, a dredge efficiency estimate of 0.13 was applied to high-density scallop beds to account for reduced dredge efficiency. The reduced capture efficiency is observed when scallop density is ≥ 2 scallops m^{-2}.

The Review Panel noted a general lack of documentation in material provided to address this ToR. The Review Panel understands that three principal surveys have been reviewed previously by an independent CIE review (Center for Independent Experts, 2015). The Review Panel further recognizes that the previous assessment received criticism during the SARC 62 review process over the amount of material provided, and accordingly material provided for this review was abbreviated. However, the Review Panel noted that the lack of documentation, particularly for the complex, non-standard camera-based surveys, limited its ability to fully review and understand the survey time series presented. For example, no diagnostics were provided from the geostatistical models used to expand both optical surveys and it was unclear whether improvements to the analytical approaches recommended by the 2015 CIE (op. cit.) review had been adopted wholly or in part. There were large differences in survey estimates during 2015–2018 (Fig. 4) and the reasons for these differences should have been described and documented.

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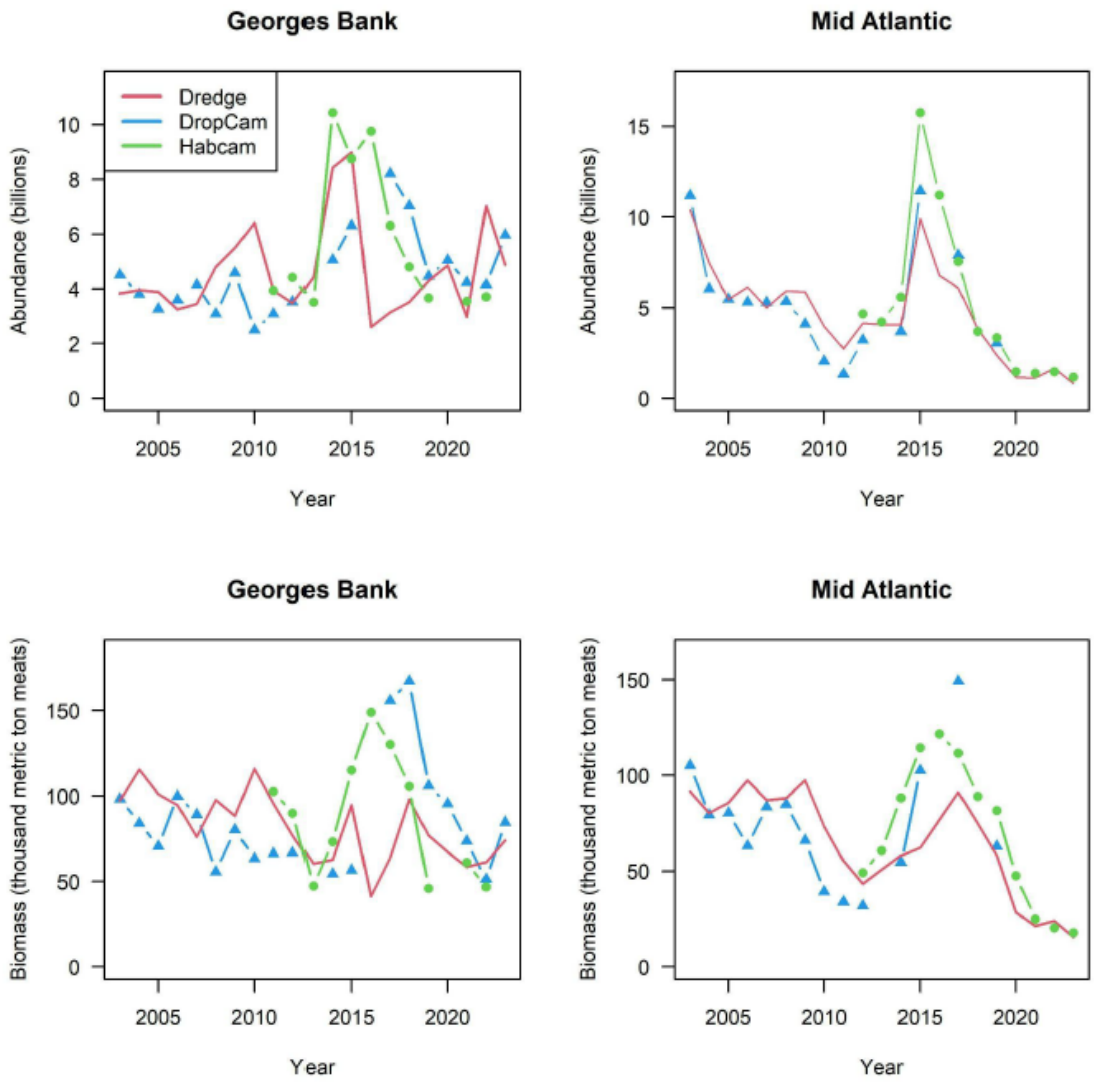

Figure 4. Comparison of survey estimates, 2003-2023, for Georges Bank (left), and Mid-Atlantic (right). Numbers are on the top row and biomass on the bottom row. Credit: 2025_SCA_RT_TOR3_Survey Data.pdf

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The Review Panel noted that CVs were not shown in any of the fishery-independent survey plots and requested that they be presented. The Review Panel believes that the uncertainty associated with survey estimates should be routinely shown on plots, unless there are strong compelling reasons not to do so. The lack of uncertainty estimates in survey plots (Figures 3 and 4) makes interpreting the reliability of trends more difficult.

The Review Panel was concerned that the reported CVs of the Habcam survey may be too small. This concern was also raised in the 2015 CIE review of the Atlantic Sea Scallop survey programs (Center for Independent Experts, 2015). It was not clear to the Review Panel whether or how the concerns of this earlier CIE review for Habcam survey methodologies, and indeed for the other surveys, have been evaluated and, where appropriate, incorporated.

The Review Panel suggests that size distributions associated with each survey should have been included in the assessment report. These data, when plotted as a ridge plot, allow reviewers to assess the ability of the survey to follow the progression of size classes through the sub populations over years. Information on how effective sample sizes were calculated was also missing.

As will be discussed under ToR 4, the model struggles to estimate survey catchabilities. Accordingly, a fuller discussion of the foundation of survey catchability estimates including data collection and analytical approaches used would have been helpful.

GROWTH AND MORTALITY

Growth of Atlantic Sea Scallops can be inferred from the presence of annuli laid down in the shell. However, transition of annuli counts to age can be problematic because of uncertainty in the timing of the formation of the first annulus. Each annulus is assumed to be a check mark produced by spawning. Age at first spawning is inconsistent among scallops, with most spawning for the first time at age-2, but a not inconsequential number are believed to spawn for the first time at age-3. For this reason, the assessment used annuli ring widths as an indication of recent growth.

Hart and Chute (2009) document a mixed effects modeling approach that allows for estimation of the von Bertalanffy parameters, k and L_∞. These methods were briefly summarized in the Assessment Report. Regional models for the Mid-Atlantic and Georges Bank were fit separately with and without covariates. The subsequent stock assessment used a number of growth transition matrix "blocks." The number of blocks differed between the Mid-Atlantic and Georges Bank.

As with other sections for this ToR, the Review Panel found that the documentation of the methods employed was incomplete. The Review Panel finds that details of the sample sizes, model diagnostics and fit that describe how the increment width data were transformed to stochastic growth matrices were not provided. There was no discussion of the adequacy of the sampling to support the estimation of the growth transition matrices.

The number of size transition matrix blocks for the Mid-Atlantic seemed high to the Review Panel, and lacked justification regarding how growth periods were separated.

Assuming that the first growth increment was formed at age-2, the WG developed regional empirical estimates of natural mortality using life history invariants based on the resultant estimate of t_{max}. The best estimate of natural mortality in the Mid-Atlantic was M=0.4 based on an oldest aged shell of 14 years. This was considerably higher than the estimate of M=0.25 used in recent past assessments. Similarly, the best estimate of natural mortality for Georges Bank

was M=0.27, based on an oldest aged shell of 19 years. This is higher than the estimate of M = 0.2 in previous recent assessments. The Review Panel supported this approach and these estimates.

Term of Reference 4

> *Use the appropriate assessment approach to estimate annual fishing mortality, recruitment and stock biomass (both total and spawning stock) for the time series, and estimate their uncertainty. Compare the time series of these estimates with those from the previously accepted assessment(s). Evaluate a suite of model fit diagnostics (e.g., residual patterns, sensitivity analyses, retrospective patterns), and (a) comment on likely causes of problematic issues, and (b), if possible and appropriate, account for those issues when providing scientific advice and evaluate the consequences of any correction(s) applied.*

The Review Panel concluded that the WG partially met this ToR. The Review Panel believes that the regional models presented during the review meeting provide a reliable foundation for generating management advice. However, as with ToR 3, the Review Panel noted a lack of documentation provided limits the Panel's full understanding of the performance of the assessment models.

The 2025 Research Track Assessment for Atlantic Sea Scallop continued to use the Catch at Size Analysis (CASA, Sullivan et al., 1990; NEFSC, 2018) that has been used in previous assessments. At its core, this model projects a size-structured population forward in time based on a growth transition matrix in which the probability of moving from one size class. The growth transition matrices were determined outside the CASA model. Inputs to the CASA model include the initial size, landings by size category, survey indices and size compositions (including diagnostics about effective sample sizes).

The 2025 Research Track Assessment developed three regional CASA models to assess the population dynamics of Atlantic Sea Scallop: the Mid-Atlantic; Georges Bank Open; and Georges Bank Closed. The regions follow earlier regional designations and reflect substantial differences in fishery, life history and natural mortality dynamics in each region (NEFSC, 2018). Each model considered scallop populations initiated at 5 mm shell height and used shell height to meat weight conversions from 2001–2023. Each model integrated data from 1975–2023. Commercial catch data was available throughout the modeled period. Commercial size composition data came either from port samples or from observer data. Fishery selectivity patterns differed by region and over time. Most were logistic in form, but dome-shaped selectivity functions were used for the Mid-Atlantic region for 1975–1979 and for Georges Bank Closed region for 2019 and 2022–2023. The Review Panel thought that more detailed information should have been provided to justify the selectivity forms chosen and for fixing those forms in the model. Information from up to six different fishery-independent surveys were incorporated depending on region and time period: NEFSC unlined dredge; NEFSC lined dredge; NEFSC winter bottom trawl; SMAST large drop camera survey; SMAST digital drop camera survey; and the Habcam survey. All survey data, except the unlined dredge and winter trawl surveys, were analysed and corrected for catchability external to the model such that they were essentially survey estimates of absolute biomass. Effective sample sizes for each survey were tuned so that the medians of

assumed values were similar to expected values based on goodness of fit. Logistic survey selectivity curves were used in model fitting. Only size classes > 40 mm shell height were used to fit the CASA models.

As noted under ToR 3, multiple size transition matrices were used in implementing CASA for this assessment. In particular, the Mid-Atlantic regional model used four different size transition matrices, with each block being applied for short time periods. For example, the size transition model varied from Model 2 (1978) to Model 3 (1979) to Model 4 (1980–1981) to Model 3 (1982–83) and back to Model 2 (1984–1989). The statistical methodology that produced these abrupt changes is documented by the WG, but questions over how biologically plausible such changes in growth are remains unaddressed.

Natural mortality was modeled by a very flexible function that admitted a logistic transition from a juvenile to an adult natural mortality rate with individual, independent yearly deviations. The average (for all years) juvenile and adult mortality rates were fixed for the Mid-Atlantic and Georges Bank Open regions; the mean mortality rate was estimated for the Georges Bank Closed region. The logistic transition point (i.e., L_{50}, the length at which M was 50% of the juvenile M plus 50% of the adult M) was fixed at 75 mm shell height.

Beta distributed priors were used to estimate catchabilities for the lined dredge, SMAST large camera, SMAST digital camera and Habcam surveys in each regional model. The survey abundance data in the model were multiplied by 0.5 and the assumed prior mean catchability was 0.5 for each survey; hence, effectively, the priors for surveys had a mean of 1.0. The CVs for the catchability priors were survey specific. The mean value was a consequence of the choice of beta distribution to fit catchabilities. Estimated catchabilities > 0.5 indicate the survey indices are greater than the model-estimated abundance.

The WG presented model fits for “base case” models in each region. The Review Panel interpreted these results as the WGs preferred model. Subsequent to the diagnostic consideration of model fits to the base model configuration, the WG presented a limited number of additional model runs that explored different assumptions or starting conditions.

A number of model outputs were included in the 2025 Research Track Assessment report. In most cases the regional models fit commercial catch data well — conditioned on the assumption that catch is well described (CV = 0.05). Survey size distributions were also generally well described by the model. However, there was a consistent pattern that the estimated survey catchabilities were often > 0.5, particularly for both SMAST surveys and the Habcam survey. This pattern suggests that unscaled values of these surveys are higher than expected from the abundances predicted by the model. In other words, either the model tends to underestimate biomass relative to the absolute abundance surveys or the surveys all overestimate biomass (to differing degrees).

The Review Panel felt that model results for the three regions, combined with the results presented on bottom water temperatures under ToR 1, fully support the WG’s decision to use a higher rate of natural mortality in the Mid-Atlantic than had been used previously, and that has been used in Georges Bank.

Overall, the Review Panel was felt that documentation of the modeling choices made by the WG was incomplete such that it struggled to understand how the WG moved from the SARC 65 (NEFSC, 2018) assessment to the current assessment and how the "base model" was identified. Moreover, the Review Panel felt that only limited model diagnostics were provided. The Panel concluded that additional information on modelling choices and assumptions about growth and fishery selectivity should have been provided.

The Review Panel expressed concern over the shifts in estimated survey catchability values from their prior means. The Review Panel could not determine whether the shift in these values represent features of the survey data streams, or constraints in other parts of the model structure. Additional likelihood profiling might have been useful to identify the data sets or penalties which were most influential in causing the model to estimate biomass lower than the surveys suggested. In addition, the only real source of process error is the annual deviations permitted in M (Fig. 5).

The extent to which the clear patterns in the temporal distributions in M in the three regions evident in Fig. 5 may reflect underlying variation in M, or may reflect the model altering its understanding of M to fit other input time series. If the pattern is not caused by variation in the true value of M, the Review Panel asks whether there are attributes of camera-based surveys that lead to biases in estimated abundances, or is high precision in other data inputs constraining the way the model can fit the data so as to increase estimates of survey catchabilities? Does the lined dredge provide a reliable index of absolute abundance based on the efficiency values assumed in the inputs for the CASA model?

The Review Panel felt that the presentation of model fits to size composition made it difficult to assess whether model misspecification had occurred. The Review Panel requests that future assessments present size-composition fits as ridge plots, which facilitates comparing fits across years. There was concern expressed by the Review Panel that some abundance pulses were not well tracked as they moved through the size compositions of the population.

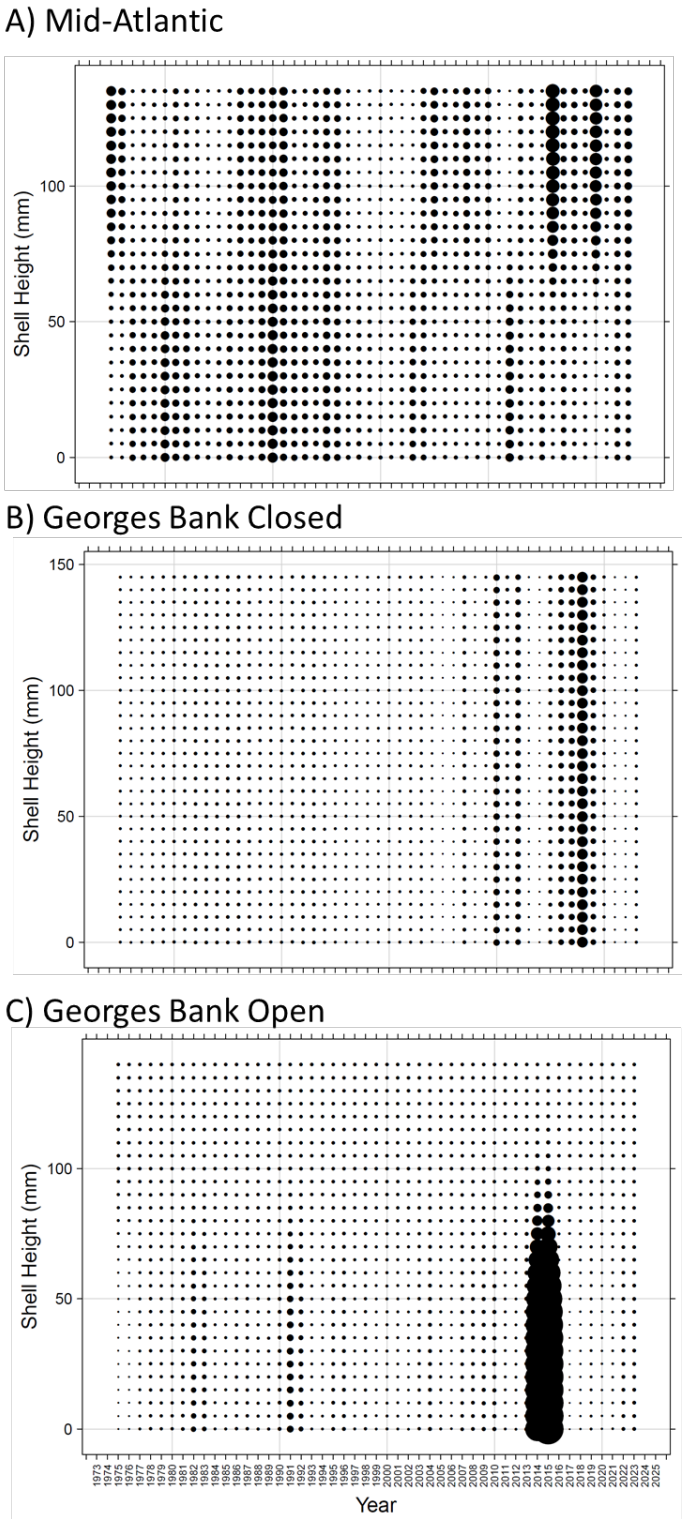

Figure 5. Size-specific annual estimates of natural mortality (M) for Atlantic Sea Scallop in three separate modeled regions: A) Mid-Atlantic, B) Georges Bank Closed, and C) Georges Bank Open. Credit: 2025 Atlantic Sea Scallop Research Track Assessment WG.

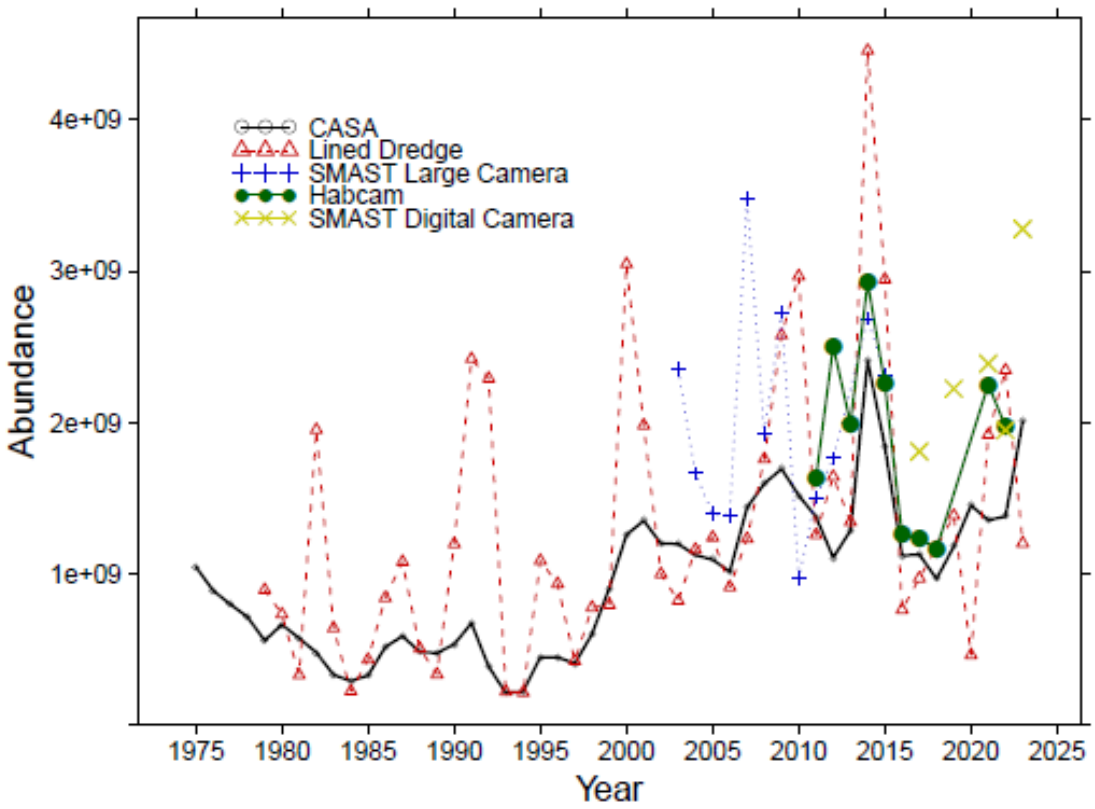

Figure 6. Trends in CASA estimated (solid black line) and observed survey based estimates of annual abundance for the Georges Bank Open Base Case. Credit Fig 4.73 from 2025_SCA_RT_WP_TOR4a Fishing Mortality, Recruitment and Stock Biomass.pdf

The Review Panel considered closely the patterns in the lined dredge survey in the Georges Bank Open model fits (Fig. 6). The model clearly does not "believe" the short-term peaks in abundance evident in the lined dredge survey time series. This is a situation where knowledge of the survey CVs would have been helpful, but the Review Panel also expressed interest in understanding whether patchiness in survey catches within strata are driving the oscillating patterns in the survey time series. Analyses conducted by members of the WG during the Review Panel meeting indicated that extreme patchiness is indeed a feature of dredge survey catches. The Review Panel recommends the WG consider using geometric means as a foundation for calculating survey indices rather than arithmetic means as currently used.

The Review Panel felt that lack of fit to the model should continue to be discussed regionally. For example, the issue raised above related to survey catchability is particularly evident in the Georges Bank Open model runs. The Review Panel asks whether there is something specific about the spatial distribution of scallop in this region that is responsible for the model fit observed? However, the Review Panel also appreciated the WGs attempt to compare model-derived estimates across regions to identify potential broader patterns of change (Fig 7.)

Trends in biomass, fishing mortality rate, size-specific natural mortality rates and recruitment for the three regions modeled in the 2025 Atlantic Sea Scallop Research Track Assessment

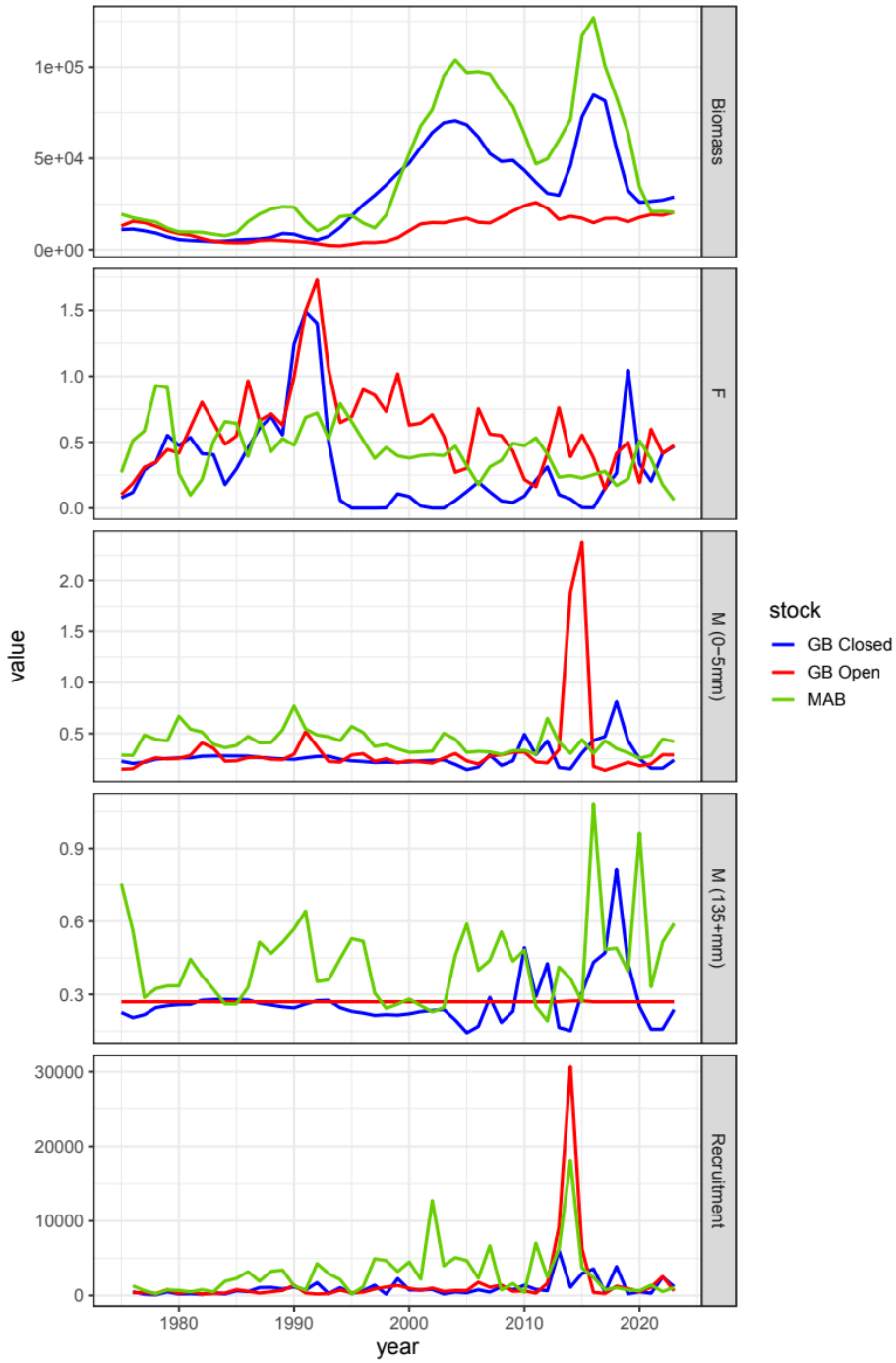

Figure 7. Trends in biomass, fishing mortality rate, size-specific natural mortality rates and recruitment for the three regions modeled in the 2025 Atlantic Sea Scallop Research Track Assessment. Credit 2025 Atlantic Sea Scallop Research Track Assessment WG.

Term of Reference 5

> *Update or redefine Status Determination Criteria (SDC; point estimates or proxies for BMSY, BTHRESHOLD, FMSY and MSY reference points) and provide estimates of those criteria and their uncertainty, along with a description of the sources of uncertainty. If analytic model-based estimates are unavailable, consider recommending alternative measurable proxies for reference points. Compare estimates of current stock size and fishing mortality to existing, and any redefined, SDCs. Provide stock status based on updated reference points.*

The Review Panel felt that the information provided by the WG partially met this ToR. The Review Panel believes that the approach to establishing reference points is reasonable, and appropriately includes uncertainty in input parameters, thereby producing reference point distributions. The Review Panel believes that the reference points produced are appropriate for providing management advice. However, as with ToR 3, the lack of documentation provided limited the Panel's full understanding of the details of how reference points were determined.

Biological Reference Points were estimated in the SYM program which uses stochastic equilibrium analyses, detailed in Hart (2013), and are not derived directly from CASA. The peer review paper on which the method is based was provided at the request of the Review Panel. Separate SYM models were presented for the Mid-Atlantic and Georges Bank regions. The Review Panel was provided initially with distributions of M and stock-recruitment relationships that are used as input into the analysis for each region. The Review Panel requested and subsequently received information on estimates of recruits per spawner, an input to the projection analysis.

The WG noted further that initial simulations for the Mid-Atlantic, which used the full stock recruitment relationship, resulted in non-credible reference points. Investigations of the reasons for this outcome identified a recent (2016–2021) pattern of consistently negative residuals in the stock recruitment pattern, that was not evident in similar data for Georges Bank (Fig. 8, provided by the WG to the Review Panel during the meeting). Recruitment in the Mid-Atlantic during 2016–2021 had been 59% lower than estimated in the stock-recruitment model. Accordingly, recruitment in the Mid-Atlantic SYM model was reduced by a factor of 0.41. Additionally, natural mortality rates have been higher for adult Mid-Atlantic scallops in recent years (Fig. 8), and so an elevated M was also used.

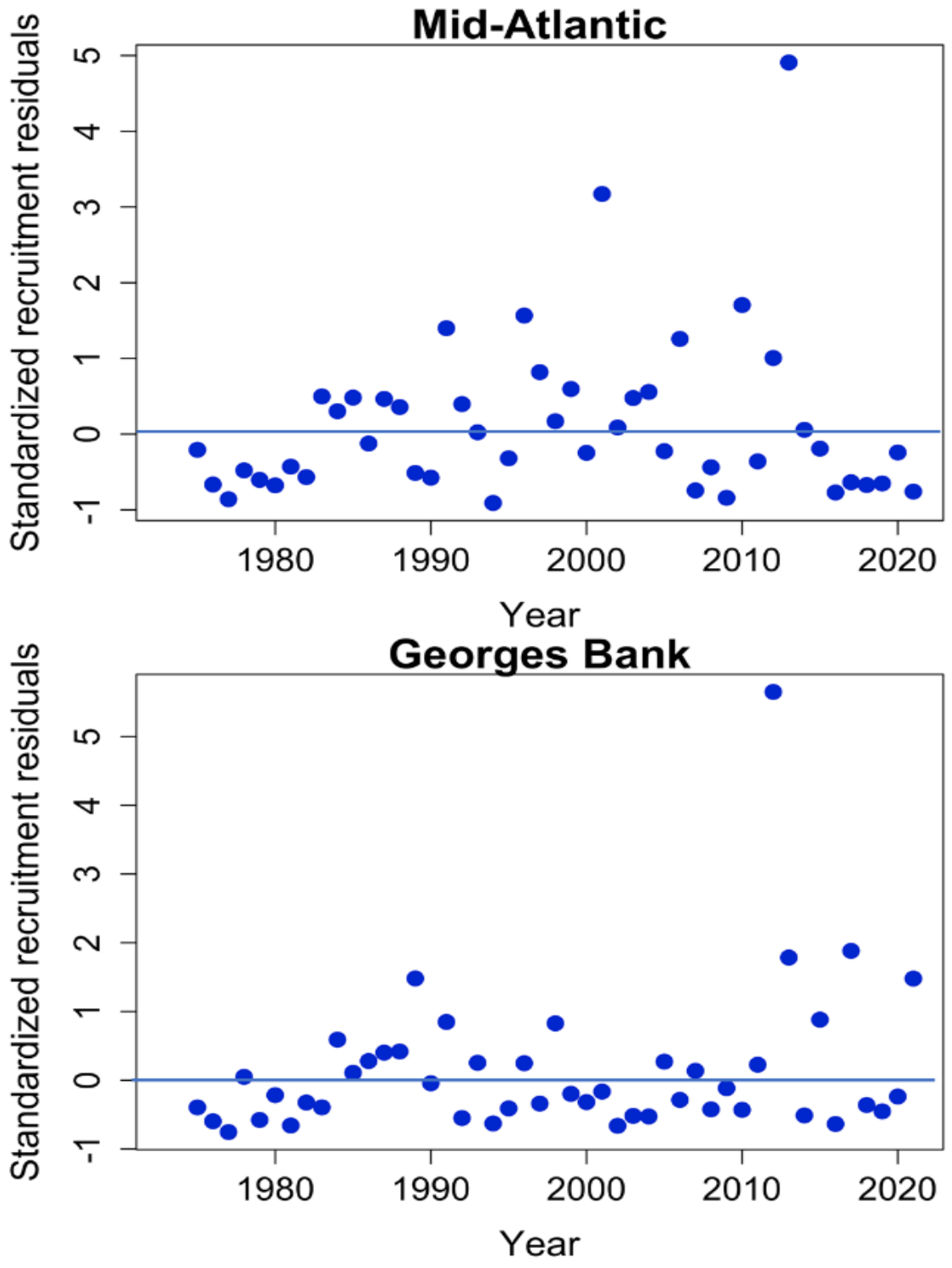

Figure 8. Trends in recruitment estimated in the SAMS model developed for the Mid-Atlantic and Georges Bank for the 2025 Atlantic Sea Scallop Research Track Assessment. The Review Panel added the solid line at zero for clarity. Credit 2025 Atlantic Sea Scallop Research Track Assessment WG.

The calculated Mid-Atlantic yield curve was very flat, suggesting F_{MSY} is not well defined for this region. Indeed, this is reflected in the high value for F_{MSY} for the Mid-Atlantic. In contrast the yield curve for Georges Bank was well defined. The estimated reference points for the two regions were combined appropriately to produce an estimate of the biological reference point for the two regions combined. The resulting reference points for the two regions are presented below.

Table 1. Select biological reference points for Atlantic Sea Scallop derived from the SAMS model developed for the 2025 Atlantic Sea Scallop Research Track Assessment

Region	MSY (mt of meats)	F_{MSY}	B_{MSY} (mt of meats)	$B_{threshold}$ (mt of meats)	B_{2023} (mt of meats)	F_{2023}
Mid-Atlantic	7,941	1.56	15,909		20,556	0.06
Georges Bank	22,706	0.36	83,414		49,400	0.47
Combined	28,402	0.49	93,282	41,707	69,956	0.33

The Review Panel is concerned about the reliability of the combined region reference point. There is strong evidence in the material presented to the Panel that there needed to be different spatial regions in the CASA model to fully represent the range of dynamics present throughout the stock range. The different modelling regions appear to be experiencing substantially different environmental conditions, different rates and temporal patterns of natural mortality, growth, and recent patterns of exploitation. Thus, it seems to the Review Panel that reference points are region-specific and that combining them, although done so in a mathematically correct way, introduces additional and unquantified risk. For example, a single reference point based on the entire region risks not identifying overfishing that could be occurring in Georges Bank. The Review Panel questions whether a single reference point for the entire region is appropriate.

Term of Reference 6

> *Define and document methods for producing projections; provide justification for assumptions of fishery selectivity, fecundity, mortality and recruitment; comment on the reliability of resulting projections considering the effects of uncertainty and sensitivity to projection assumptions. Compare the results of SAMS and GeoSAMS and comment on their appropriateness for use in management.*

The Review Panel felt that the information provided by the WG partially met this ToR. The Review Panel believes that the approach to providing projections for setting fishery quotas is reasonable and appropriately includes uncertainty in input parameters. However, as with ToR 3, the Review Panel noted a lack of documentation provided to it limits the Panel's full understanding of the details of how projections were made.

Projections are obtained through a computer simulation application called SAMS, which was initially developed in 1999. This program simulates the dynamics of Atlantic Sea Scallop in 24 separate geographic subareas; 7 in the Mid-Atlantic, 12 on Georges Bank, and five in the Gulf of Maine. Recruitment in each sub region is modelled stochastically with the log-transformed mean and covariance for recruitment in each area matching that observed in NEFSC dredge survey time series. Mean recruitment is then scaled to a region-wide Beverton-Holt stock recruitment relationship, making the SAMS model more comparable to the SYM reference points model. Within each region, separate dynamic models track annual patterns in growth, mortality, and exploitation. A fleet dynamics model distributes fishing activity among the different spatial regions. The model has been used in largely the same format since 1999. The simulation program predates application of CASA to Atlantic Sea Scallops. Although the scallop dynamics within SAMS are broadly similar to those in CASA, the two programs do not have any formal connection. The Review Panel requested evidence of the extent to which the dynamics of the two models are similar. During the meeting, the WG presented information from earlier comparisons of CASA and SAMS that show a high degree of coherence between the two models (Fig 9).

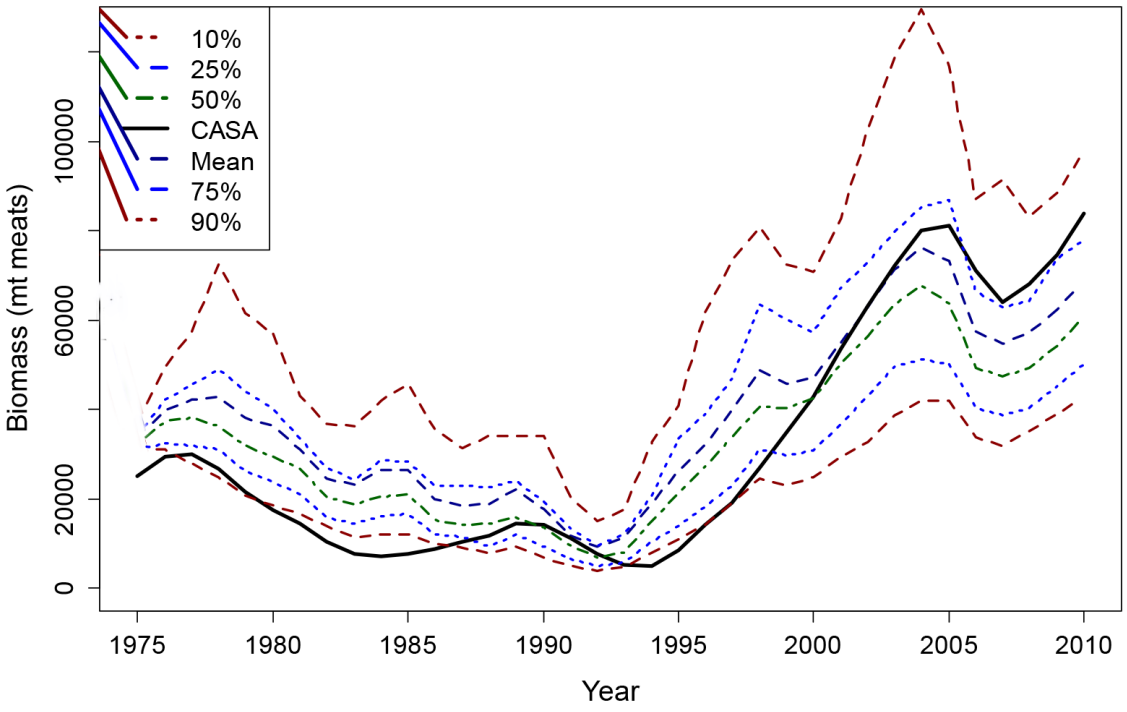

Figure 9. Performance of model forecasted biomasses from CASA (solid black line) and SAMS (colored, dashed lines). The coherence of the forecasts between the models is taken as evidence that they are reliable for management use. Credit 2025 Atlantic Sea Scallop Research Track Assessment WG.

The WG presented evidence that there is a systemic bias in the performance of the SAMS model based on comparisons of 1-yr forward projections and observed values. The WG expressed belief that the bias — particularly in the Mid-Atlantic — results from the low natural mortality rates that were used in projections. Public comment at the meeting highlighted strong concerns over whether this makes the model useful in projections.

The Review Panel noted that the documentation for SAMS was particularly deficient and incomplete. The Panel strongly recommends additional details are provided in the future.

The Review Panel accepts the WG's explanation that the bias in model performance is likely to be related to the existence of high rates of natural mortality being present in both the Mid-Atlantic region and Georges Bank. This explanation is considerably strengthened by the results of the CASA model which indeed suggest higher natural mortality rates in both of these regions than previously estimated. Accordingly, the Review Panel was surprised that SAMS was not updated for the 2025 Research Track Assessment to verify if the purported role for increased natural mortality does indeed reconcile the discrepancy between 1-yr forward projections and observations. The Review Panel also noted that the increases in base rates and deviations in natural mortality would be expected to increase variability among SAMS simulations.

The Review Panel was asked to comment on the development of geoSAMS, which was not ready to be reviewed at the 2025 Research Track. The Review Panel felt that insufficient information was provided to permit a fuller evaluation of the geoSAMS platform. The Review Panel appreciated that the finer spatial resolution of geoSAMS may lead to better performance of the fleet demand model. However, the Review Panel notes that the higher resolution may challenge the parameterization of recruitment, growth and natural mortality in the model; indeed, there may be a spatial mismatch between the scales at which the fleet demand model operates and those of the other population processes.

Term of Reference 7

> *Review, evaluate, and report on the status of research recommendations from the last assessment peer review, including recommendations provided by the prior assessment working group, peer review panel, and SSC. Identify new recommendations for future research, data collection, and assessment methodology. If any ecosystem influences from TOR 1 could not be considered quantitatively under that or other TORs, describe next steps for development, testing, and review of quantitative relationships and how they could best inform assessments. Prioritize research recommendations.*

The Review Panel felt that the WG fully met this ToR. The WG provided detailed responses to research recommendations from SARC 65, the 2018 Management Track Assessment and from annual SSC reports. Impressive progress has been made in some areas, such as the development and application of Generalized Random Tessellation Stratified (GRTS) methods for survey design for Georges Bank and the Mid-Atlantic. Incorporation of environmental data into this Research Track Assessment is another example of where substantial progress has been made. The WG acknowledged transparently that there were other areas in which progress has been more limited. The

Review Panel recognizes the challenge of addressing multiple research recommendations, obtained from multiple venues and from different perspectives.

The Review Panel was uncertain over the extent to which the WG had responded to research recommendations received from the 2015 CIE review of the Atlantic Sea Scallop surveys. For example, this Review Panel report has already raised concerns over the small CVs associated with the Habcam survey under ToR 3, a point that was also raised in the 2015 CIE review. It was not clear to the Review Panel whether the 2015 CIE review was not included in the WGs comprehensive compilation of review recommendations because it predated SARC 65, but the Review Panel recommends the findings of this review be re-visited.

The Review Panel found that the specific research recommendations developed by the 2025 Research Track Assessment for Atlantic Sea Scallop to be limited in scope.

The Review Panel supports the effort to expand aging of scallop both to fill in historical gaps in the record, but also to assess whether age-based assessment models are feasible. The Review Panel recognizes the challenge of the indeterminacy of the age of first ring formation may represent, however, the panel felt that the power that age-based assessment models may provide make this assessment approach worthwhile.

The Review Panel strongly supports the recommendation to re-evaluate the current size-based approach to the assessment of sea scallop. New size-based approaches have been developed and applied to other species (e.g., Cao et al., 2017), some of which have a state-space structure, and more appropriately incorporate time-varying M and other model process errors as stochastic processes, and environmental covariates, which the 2025 Research Track Assessment have shown are important. Another factor motivating the change is that CASA is written in ADMB, a nonlinear estimation program that was state of the art when CASA was first coded. Today, ADMB is no longer being developed or supported, and thus its stability will come into question over the next 5–10 years. Some members of the Review Panel are already struggling in their own work to use ADMB code that once compiled successfully, but now no longer does. Additionally, the emerging generation of assessment analysts are more likely to code in TMB or RTMB and so the institutional knowledge of ADMB is waning. All of these factors suggest that the WG should be actively exploring new approaches to assessing Atlantic Sea Scallop, so that they will be prepared by the time this species is next subject to a Research Track Assessment.

The Review Panel noted the concerns over the estimation of survey q's in the current model under ToR 4. The Panel believes that this likely results from constraints in other areas of the model leaving changes in q as one of the few pathways the model optimization can explore, although the panel has no specific evidence to support this belief. We view the substantial deviations in q from their priors to be a significant source of uncertainty in our understanding of the 2025 Research Track assessment model performance, and a source of risk in interpreting model results. The Review Panel recommends strongly that additional work be conducted to explore alternative hypotheses regarding model structure and data inputs that may be driving the shifts in survey q's evident in the results.

The Review Panel discussed concerns over the reliability and consistency of annotation of optical images that impact the survey abundance and biomass time series derived from these images. The Review Panel discussed the extent to which best practices are followed in the analysis of images, which would see multiple annotators scoring the same image for some or all samples (Holmes et al., 2025). Practices such as the interspersion of test images into the analytical workflow to assess reliability of estimates are standard in routine aging laboratories, and could perhaps be evaluated for optical surveys. Discussion with WG members indicated that some efforts to assess the reliability of image annotation occurs, but the lack of documentation of the QA/QC of annotation in the 2025 Research Track Assessment Report challenges the Review Panels full understanding of the processes followed. WG members expressed hope in further advancements in machine learning and AI algorithms may help solve these challenges. Even were this to be achieved, questions over reliability of image annotation would remain. The Review Panel recommends that those conducting and using the optical surveys evaluate how the reliability of extracting data from survey images can be improved. The Review Panel notes the importance of this action, given the discrepancies between the assumed and estimated catchabilities for the optical surveys.

The Review Panel has previously noted concerns over spatial autocorrelation that characterizes many optical surveys as well as the highly contagious distribution of Atlantic Sea Scallop themselves. The Review Panel recommends that the performance of the CASA or future assessment models be assessed when fitted using survey indices that downweight the highly contagious distribution of scallops in some stations by considering use of geometric means rather than arithmetic means.

The Review Panel supports the development of regional assessment models to characterize the dynamics of Atlantic Sea Scallops. The Review Panel noted in ToR 5 the incongruency of having spatial assessment models that are required to reflect the differences in the dynamics of scallop “populations” in the different regions, and then combining results to produce a single management reference point. Explorations of the appropriate scale of stock definitions in this species seems appropriate. The Review Panel recommends research to identify and, where possible, characterize differences in productivity among the different spatial regions. Genetic analysis of stock structure using modern molecular approaches (e.g., radSeq or other approaches) appear warranted.

The 2025 Research Track Assessment clearly demonstrated the importance of environmental and ecosystem factors in understanding stock dynamics. Given that adult sea scallops have greatly limited motility, the Review Panel suggests that development of habitat suitability models and joint species distribution models may be helpful to understanding the future trajectory of scallops in different sub regions. The Review Panel suggests that this might be particularly relevant in understanding the potential for recovery of scallop populations in closed areas in MAB.

Term of Reference 8

> *Develop a backup assessment approach to providing scientific advice to managers if the proposed assessment approach does not pass peer review or the approved approach is rejected in a future management track assessment.*

The Review Panel view this ToR as having been fully met.

The Research Track WG provided a hierarchical approach to addressing the challenge in which either the length-based model (CASA), or the SYM model or biological reference points become unavailable. The WG provides a logical sequence of decision-making of how management advice could continue to be provided. The Review Panel questioned how biological reference points could be estimated from catch and area swept data. The Review Panel suggested that data poor approaches in which catch and area swept information provide a foundation of biological reference point proxies. The Review Panel noted that Plan B does not include consideration of a case in which the SAMS model that is used to set catch advice fails. SAMS relies on estimates of M from CASA. While in the short term, SAMS could continue to be used in the absent of recent estimates from CASA, a point would be reached in which the input parameters to SAMS from prior CASA runs become unreliable. In such circumstances, analysts would be able to provide biological reference points, and stock status advice, but would not be in a position to provide catch advice.

Additional Material Considered by the Review Panel

The work presented related to fisheries and surveys in the Gulf of Maine contributed to the Review Panel's understanding of the extent, pattern and scale of fisheries for Atlantic Sea Scallop. The Review Panel supports further work to extend our knowledge of scallop fisheries in the Gulf of Maine such that future assessments may be able to present a unified analysis covering the entire range of scallops in US waters.

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Appendix 1 - Terms of Reference for Atlantic Scallop Research Track Stock Assessment

1. Identify relevant ecosystem and climate influences on the stock. Characterize the uncertainty in the relevant sources of data and their link to stock dynamics. Consider findings, as appropriate, in addressing other TORs. Report how the findings were considered under impacted TORs.
2. Estimate catch from all sources including landings and discards. Describe the spatial and temporal distribution of landings, discards, and fishing effort. Characterize the uncertainty in these sources of data.
3. Present the survey data used in the assessment (e.g., indices of relative or absolute abundance, recruitment, state surveys, age-length data, application of catchability and calibration studies, etc.) and provide a rationale for which data are used. Describe the spatial and temporal distribution of the data. Characterize the uncertainty in these sources of data.
4. Use the appropriate assessment approach to estimate annual fishing mortality, recruitment and stock biomass (both total and spawning stock) for the time series, and estimate their uncertainty. Compare the time series of these estimates with those from the previously accepted assessment(s). Evaluate a suite of model fit diagnostics (e.g., residual patterns, sensitivity analyses, retrospective patterns), and (a) comment on likely causes of problematic issues, and (b), if possible and appropriate, account for those issues when providing scientific advice and evaluate the consequences of any correction(s) applied.
5. Update or redefine Status Determination Criteria (SDC; point estimates or proxies for BMSY, BTHRESHOLD, FMSY and MSY reference points) and provide estimates of those criteria and their uncertainty, along with a description of the sources of uncertainty. If analytic model-based estimates are unavailable, consider recommending alternative measurable proxies for reference points. Compare estimates of current stock size and fishing mortality to existing, and any redefined, SDCs. Provide stock status based on updated reference points.
6. Define and document methods for producing projections; provide justification for assumptions of fishery selectivity, fecundity, mortality and recruitment; comment on the reliability of resulting projections considering the effects of uncertainty and sensitivity to projection assumptions. Compare the results of SAMS and GeoSAMS and comment on their appropriateness for use in management.
7. Review, evaluate, and report on the status of research recommendations from the last assessment peer review, including recommendations provided by the prior assessment working group, peer review panel, and SSC. Identify new recommendations for future research, data collection, and assessment methodology. If any ecosystem influences from TOR 1 could not be considered quantitatively under that or other TORs, describe next steps for development, testing, and review of quantitative relationships and how they could best inform assessments. Prioritize research recommendations.
8. Develop a backup assessment approach to providing scientific advice to managers if the proposed assessment approach does not pass peer review or the approved approach is rejected in a future management track assessment.

9. Identify and consider any additional stock specific analyses or investigations that are critical for this assessment and warrant peer review, and develop additional TOR(s)* to address as needed.

Appendix 2 – Initial agenda for Atlantic Scallop Research Track Assessment Peer Review meeting, April 21 – 24, 2025.

DRAFT AGENDA*

*All times are approximate at the discretion of the Review Panel Chair. This meeting is open to the public

Day 1: Monday April, 21 2025

Time	Topic	Presenter(s)	Notes
9:00 - 9:05 a.m.	Welcome & Logistics	Brian Hooper	
9:05 - 9:15 a.m.	Introductions & Agenda	Tom Miller	
9:15 - 9:40 a.m.	Overview of Research Track Process and Scallop Research Track	Kristan Blackhart	
9:40 - 10:10 a.m.	Management History and Fishery Practices	Jonathon Peros	
10:10 - 10:30 a.m.	Summary of Community Engagement Session	Jonathon Peros	
10:30 - 10:45 a.m.	BREAK		
10:45 - 11:30 a.m.	Scallop Life History	Dvora Hart	
11:30 - 12:00 p.m.	Term of Reference (TOR) 1 Overview	Dvora Hart	Ecosystem
12:00 - 1:00 p.m.	LUNCH		
1:00 - 1:30 p.m.	Temperature Influences	Joseph Caracappa	Ecosystem
1:30 - 2:00 p.m.	Shell Disease and Nematodes	Dave Rudders	Ecosystem
2:00 - 2:45 p.m.	TOR 1 Question and Answer (Q&A)	Review Panel	Ecosystem
2:45 - 3:00 p.m.	BREAK		
3:00 - 3:30 p.m.	TOR 2	Jessica Blaylock	Catch
3:30 - 4:00 p.m.	TOR 2 Q&A	Review Panel	Catch
4:00 - 4:15 p.m.	Public Comment	Public	
4:15 - 5:00 p.m.	Discussion & Summary	Review Panel	Conclusions,

			Recommendations, & Final Wrap-up for TORs 1 & 2
5:00 p.m.	ADJOURN		

Day 2: Tuesday April 22, 2025

Time	Topic	Presenter(s)	Notes
9:00 – 9:05 a.m.	Welcome & Logistics Agenda	Brian Hooper Tom Miller	
9:05 - 9:25 a.m.	Gulf of Maine Surveys	Jonathon Peros	
9:25 - 10:10 a.m.	TOR 3	Dvora Hart	Surveys
10:10 - 10:45 a.m.	TOR 3 Q&A	Review Panel	Surveys
10:45 - 11:00 a.m.	BREAK		
11:00 - 12:00 p.m.	Mid-Atlantic Catch At Size Analysis (CASA) Model	Jui-Han Chang	Models
12:00 - 1:00 p.m.	LUNCH		
1:00 - 2:00 p.m.	Georges Bank Closed Areas CASA Model	Jui-Han Chan	Models
2:00 - 3:00 p.m.	Georges Bank Open Areas CASA Model	Jui-Han Chan	Models
3:00 - 3:15 p.m.	BREAK		
3:15 - 3:45 p.m.	TOR 4 Q&A	Review Panel	Models
3:45 - 4:00 p.m.	Public Comment	Public	
4:00 - 5:00 p.m.	Discussion & Summary	Review Panel	Conclusions, Recommendations, & Final Wrap-up for TORs 3 & 4
5:00 p.m.	ADJOURN		

Day 3: Wednesday April 23, 2025

Time	Topic	Presenter(s)	Notes

9:00 - 9:05 a.m.	Welcome & Logistics Agenda	Brian Hooper Tom Miller	
9:05 - 10:00 a.m.	Review Homework	Review Panel	If needed
10:00 - 10:45 a.m.	TOR 5	Dvora Hart	Biological Reference Points (BRPs)
10:45 - 11:00 a.m.	BREAK		
11:00 - 12:00 p.m.	TOR 5 Q&A	Review Panel	BRPs
12:00 - 1:00 p.m.	LUNCH		
1:00 - 1:45 p.m.	TOR 6	Dvora Hart	Projections
1:45 - 2:30 p.m.	TOR 6 Q&A	Review Panel	Projections
2:30 - 3:00 p.m.	TOR 8	Patrick Sullivan	Backup Approach
3:00 - 3:15 p.m.	BREAK		
3:15 - 3:45 p.m.	TOR 8 Q&A	Review Panel	Backup Approach
3:45 - 4:00 p.m.	Public Comment	Public	
4:00 - 5:00 p.m.	Discussion & Summary	Review Panel	Conclusions, Recommendations, & Final Wrap-up for TORs 5, 6, & 8
5:00 p.m.	ADJOURN		

Day 4: Thursday April 24, 2025

Time	Topic	Presenter(s)	Notes
9:00 - 9:05 a.m.	Welcome & Logistics Agenda	Brian Hooper Tom Miller	
9:05 - 10:30 a.m.	Review Homework	Review Panel	If needed
10:30 - 10:45 a.m.	BREAK		
11:00 - 11:30 a.m.	TOR 7	Jonathon Peros	Research Recommendations

11:30 - 11:45 a.m.	TOR 7 Q&A	Review Panel	Research Recommendations
11:45 - 12:00 p.m.	Public Comment	Public	
12:00 - 1:00 p.m.	Discussion & Summary	Review Panel	Conclusions, Recommendations , & Final Wrap-up TOR 7; any remaining issues
1:00 p.m.	ADJOURN		

Appendix 3 - Materials provided or referenced during the Atlantic Sea Scallop Research Track Stock Assessment Peer Review meeting

Working papers and presentations were available on a NEFSC website (https://apps-nefsc.fisheries.noaa.gov/saw/sasi.php) by selecting the species and year of assessment.

Working Papers and Background Documentation:

Report (Available on April 7)
2025_SCA_RT_Working Group Summary Report_rev.pdf

Background (generally available by April 7)
2025_SCA_RT_WP_Sea Scallop Life History Parameters.pdf
2025_SCA_RT_WP_Sea Scallop_TOR1a Ecosystem Influences.pdf
2025_SCA_RT_WP_Sea Scallop_TOR1b Climate Influences.pdf
2025_SCA_RT_WP_Sea Scallop_TOR2 Landings, Fishing Effort, Discards.pdf
2025_SCA_RT_WP_Sea Scallop_TOR3 Survey Data.pdf
2025_SCA_RT_WP_Sea Scallop_TOR4a Fishing Mortality, Recruitment and Stock Biomass.pdf
2025_SCA_RT_WP_Sea Scallop_TOR4b CASA Technical Description.pdf
2025_SCA_RT_WP_Sea Scallop_TOR5 reference points.pdf
2025_SCA_RT_WP_Sea Scallop_TOR6 projections.pdf
2025_SCA_RT_WP_Sea Scallop_TOR7 Research Recommendations.pdf
2025_SCA_RT_WP_Sea Scallop_TOR8 Plan B Backup Approach.pdf
2025_SCA_RT_WP_Sea Scallop_TOR9a Gulf of Maine Scallop Resources.pdf
2025_SCA_RT_WP_Sea Scallop_TOR9b Scallop Community Engagement Meeting.pdf
2025_SCA_RT_WP_Sea Scallop_TOR9c Management History.pdf

Presentations (generally available the day before the presentation)
SCA_Presentation_Atlantic Sea Scallop RT Review Intro – 2025.pdf
SCA_Presenation_Gulf of Maine.pdf
SCA_Presentation_Management History and Fishery Practices.pdf
SCA_Presentation_Summary of Community Engagement Meeting.pdf
SCA_Presentation_TOR 7_Research recommendations.odf
SCA_Presentation_TOR1_Nematodes and Shell Blisters.pdf
SCA_Presentation_TOR1_Overview.pdf
SCA_Presentation_TOR1_Temperature Influences.pdf
SCA_Presentation_TOR2_rev.pdf
SCA_Presentation_TOR3.pdf
SCA_Presentation_TOR4_CASA_rev.pdf
SCA_Presentation_TOR5.pdf
SCA_Presentation_TOR6.pdf
SCA_Presentation_TOR8.pdf
SCA_Presentation_life history.pdf

Figures (Generally available during meeting in response to Review Panel questions)
2025_SCA_RT_Homework_Additional figures.pdf
2025_SCA_RT_Howework_PlotAllStat.pdf

2025_SCA_RT_Homework_mortality_bubble_plots.pdf

Tables (Generally available during meeting in response to Review Panel questions)
2025_SCA_RT_Homework_TOR2.pdf

Appendix 4 - Meeting attendees at the Atlantic Sea Scallop Research Track Stock Assessment Peer Review meeting

GARFO - Greater Atlantic Regional Fisheries Office
MAFMC - Mid Atlantic Fisheries Management Council
NEFSC - Northeast Fisheries Science Center
SSC - Science and Statistical Committee
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Peer Review Panel

First	Last	Affiliation
Thomas	Miller	Chair - MAFMC SSC
Noel	Cadigan	CIE
Yong	Chen	CIE
Martin	Cryer	CIE

Research Track Working Group

First	Last	Affiliation
Patrick	Sullivan	Chair - Cornell University
Jessica	Blaylock	NEFSC
Jui-Han	Chang	NEFSC
Adam	Delargy	SMAST
Dvora	Hart	NEFSC
David	Keith	Canada
Amber	Lisi	SMAST
Jonathon	Peros	NEFMC
David	Rudders	VIMS

Attendees

First	Last	Affiliation
Kiara	Acevedo Martinez	NEFSC
Evan	Balzano	Maine Coast Fishermen's Association
Andrew	Beet	NEFSC
Kristan	Blackhart	NEFSC
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Jason	Boucher	NEFSC
Liz	Brooks	NEFSC
Russell	Brown	NEFSC
Connor	Buckley	NEFMC
Steve	Cadrin	SMAST
Joseph	Caracappa	NEFSC
Toni	Chute	NEFSC
Jamie	Cournane	NEFMC
Kiersten	Curti	NEFSC
Rachel	Feeney	NEFMC
Corrin	Flora	NCDMF
Benjamin	Galuardi	GARFO
Maxwell	Grezlik	NEFSC
Melanie	Griffin	MADMF
Alex	Hansell	NEFSC
Eric	Hansen	Hansen Scalloping Inc
Amanda	Hart	NEFSC
Cameron	Hodgdon	NEFSC
Brian	Hooper	NEFSC
Carl	Huntsberger	UMaine
Kim	Hyde	NEFSC
Emily	Keiley	GARFO
Scott	Large	NEFSC
Chris	Legault	NEFSC
Emily	Liljestrand	NEFSC
Nancy	Mchugh	NEFSC
Michael	McManus	NEFSC
Drew	Minkiewicz	Fisheries Survival Fund
Adelle	Molina	NEFSC
Dana	Morton	NEFSC
Robert	Murphy	NEFSC

Chandler	Nelson	NEFMC
Cate	O'Keefe	NEFMC
Emily	O'Toole	Coonamessett Farm Foundation
Stephanie	Owen	NEFSC
John	Pappalardo	Cape Cod Commercial Fishermen's Alliance
Jonathon	Peros	NEFMC
Ted	Platz	Ocean Harvest, Inc
John	Quinn	Quinn Fisheries
Paul	Rago	MAFMC SSC
Sally	Roman	VIMS
Sefatia	Romeo Theken	MA Department of Fish and Game (FWE)
Melissa	Smith	MEDMR
Laura	Solinger	NEFSC
Bridget	St Amand	NEFSC
Kevin	Stoksbury	SMAST
Michele	Traver	NEFSC
Samuel	Truesdell	NEFSC
Abigail	Tyrell	NEFSC
Kelly	Whitmore	MADMF
Renee	Zobel	NH Fish and Game