Summary Report

Bluefish and Spiny Dogfish Research Track Stock Assessment Peer Review

Members of the Research Track Peer Review Panel

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Prepared for the Northeast Regional Stock Assessment Workshop

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Meeting dates: December 5-9, 2022
Report date: December 23, 2022

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1. Introduction

1.1 Background

The most recent full update stock assessment of the spiny dogfish (*Squalus acanthias*) was in 2018 and the method used is the Stochastic Estimator approach (NEFSC 2006, SARC 43). Based on that assessment, spiny dogfish was not overfished and overfishing was not occurring. There were observed survey SSB decreases in recent years, especially in 2021; the smoothed survey SSB was lower than that projected in 2018.

The most recent full update stock assessment for the bluefish (*Pomatomus saltatrix*) was in 2021, and it was based on an ASAP (age-structured assessment program, Legault and Restrepo 1999) model peer-reviewed in the 2015 benchmark assessment (SARC 60, NEFSC 2015). The MRIP (Marine Recreational Information Program) calibration resulted in an increase in the estimated recreational catch and caused scale changes in both biomass and reference points. The bluefish population was overfished, and overfishing was not occurring according to the 2021 assessment (NEFSC 2021).

Both spiny dogfish and bluefish were selected for research track peer review in 2021. Two working groups were created with staff from NEFSC, MAFMC, ASMFC, state agencies, and academia in 2021. The Terms of References (TORs) for the spiny dogfish and bluefish working groups are provided in Appendix 1. The Research Track assessments allow for evaluating and using new datasets, models, or stock structures. The stock assessments are expected to provide the basis for future management track assessments. The 2022 research track spiny dogfish assessment changed the base model from Stochastic Estimator to Stock Synthesis (SS3, Methot et al., 2020) model. The 2022 research track bluefish assessment changed the base model from ASAP to a Woods Hole Assessment Model (WHAM, Miller et al., 2016, 2018).

The Research Track Peer Review meeting met via WebEx from December 5-9, 2022, to review the most recent stock assessments for spiny dogfish and bluefish (see agenda in Appendix 2). The review committee includes Yan Jiao (MAFMC SSC and Virginia Polytechnic Institute and State University, Review Panel Chair) and three scientists affiliated with the Center for Independent Experts: Robin Cook, Paul Medley, and Joe Powers.

The peer review was assisted by Michele Traver (NEFSC's Stock Assessment Process Lead) and Russ Brown (Chief, NEFSC Population Dynamics Branch). Supporting documentation for the spiny dogfish stock assessment was prepared by the Spiny Dogfish Working Group (SDWG) and presentation of the assessment was made by Conor McManus (SDWG co-chair, NEFMC), Cami McCandless (SDWG co-chair, NEFSC), Kathy Sosebee (NEFSC), Dvora Hart (NEFSC), and Jui-Han Chang (NEFSC). SDWG members and Mid-Atlantic Fishery Management Council members and staff contributed substantially to the discussions on various topics. Toni Chute, Chris Legault, Brian Linton and Liz Brooks (all NEFSC) acted as rapporteurs throughout the meeting. Technical documents for the bluefish stock assessment were prepared by the Bluefish

Working Group (BWG) and presentations were made by Michael Celestino (NJDFW, Chair of BWG), Katie Drew (ASMFC), Abby Tyrell (NEFSC), Sarah Gaichas (NEFSC), Sam Truesdell (MADMF), Tony Wood (NEFSC) and Tim Miller (NEFSC). Larry Alade, Chuck Adams, Russ Brown, and Alex Hansell (all NEFSC) served as rapporteurs. A total of 52 individuals attended this Research Track Peer Review meeting, representing NEFSC, MAFMC, ASMFC, GARFO, MADMF, MDNR, NJDFW, NCDMF, NYSDEC, RIDMF, various academic institutions, non-governmental organizations, and fisheries stakeholder organizations (see Appendix 4 for materials provided and Appendix 5 for meeting attendees). Their contributions to the Bluefish and Spiny Dogfish Research Track Stock Assessment Peer Review process are gratefully acknowledged.

1.2 Review of Activities

Approximately one-two weeks before the meeting, the assessment documents and supporting materials were made available to the Peer Review Panel through an NEFSC website (https://appsnefsc.fisheries.noaa.gov/saw/sasi/sasi_report_options.php). Before the meeting, the review panel members met with Michele Traver and Russell Brown to review and discuss the meeting agenda, reporting requirements, meeting logistics, and the overall process. The meeting opened on the morning of December 5 with welcoming remarks by Michele Traver and Russell Brown and Panel chair, Yan Jiao. Following introductions of the Review Panel, the SDWG and BWG, and other participants, the remainder of first two days were devoted to presentations of the spiny dogfish research track assessment and discussion of the first 8 TORs (Terms of Reference, see Appendix 1), and the third and fourth days were devoted to presentations of the bluefish research track assessment and discussion of the first 8 TORs. The final day of the meeting was dedicated to the review Panelists for report writing. The review panel Chair compiled and edited this Panel Summary Report with assistance (by correspondence) from the CIE Panelists before submission of the report to the NEFSC. Additionally, each CIE panelist will submit their separate reviewer's reports to the Center for Independent Experts.

The presentations during the meeting for each assessment followed the TORs, allowing the review panel to gain a deeper understanding of each assessment. The review panel asked each WG for additional information and clarifications to explore sensitivities and alternative model configurations, and the efforts by working group members to quickly generate those tables, figures and model runs were greatly appreciated. The tone of the meeting was collegial, and considerable time was devoted to facilitating dialog among Panelists, working group members, and MAFMC and ASMFC staff. The review panel was able to conduct a thorough review of both assessments.

The review panel was able to reach a consensus on both assessments. The review panel's evaluation of the working groups' 8 TORs is provided below. The review panel also provided future research recommendations. Since the last peer-reviewed assessments of each species, considerable research advancements have been made in each assessment. The assessments conducted by the SDWG and BWG were both new, and it was apparent that each working group devoted a significant amount of time

and effort to data analysis and synthesis, model construction and fitting, diagnostic and evaluation of uncertainty, and report preparation.

2. Review of Spiny Dogfish

2.1 General Comments

The SDWG developed a new Stock Synthesis (SS3) model, which is different from the previous Stochastic Estimator approach. The WG constructed the base model based on the updated landings and discards, size frequencies of landings and discards, the life history processes studied in TOR1, and survey indices studied in TOR3. Sensitivity runs were used to explore assumptions in growth, mortality, SR relationship, time blocks for biological processes, and survey selectivity of NEFSC spring bottom trawl survey and surveys included. Many of the model runs had convergence problems when SS3 was used. The base model and the sensitivity runs did not fit the indices well, because of the strong influence from the length-frequency data. The review panel agreed that all the TORs were met, but some were met with reservations. The review panel recommended continuing to explore the sensitivity of the SS3 model parameterization and configuration before the following management stock assessment review.

2.2 Evaluation of the Terms of Reference for Spiny Dogfish

TOR 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 agreed that this TOR had been met.

The SDWG explored the species distribution changes by estimating the center of gravity and effective area using a VAST (Vector Autoregressive Spatio-Temporal, Thorson 2019) model, but no significant changes were observed over time. The vessel trip report data over time was also explored to diagnose the spatial change of the spiny dogfish. The SDWG examined life history-related models such as SR (spawning stock and recruitment), maturity, and growth. SR with environmental factors did not improve model fitting, but a change in maturity was detected compared to the study done in 2010; the 50% maturity-at-length had significantly decreased over time. The SSB and recruitment estimates used for the SR were derived from the swept area survey data rather than estimated in the SS3 model. Exploration of the SR changes using the model estimated values were suggested because of the maturity at age and growth decreasing by the review panel but later realized that the SS3 base model run strongly fixed the SR relationship based on the observations from the swept area and with low variations. The new ageing data were rejected by the SDWG because of the high measurement error. Nevertheless, the spine ageing analysis and the tag-recapture analysis suggested a decreased growth curve after mid-2005 compared with the spiny dogfish sampled in the

1980s. These findings supported the changes in the biological models that were used in the SS3 base model configuration. The review panel agreed with these changes.

TOR 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 agreed that this TOR had been met.

The commercial and recreational landings and discards were estimated by SDWG according to the standard method. There had been some pooling and borrowing for developing length and sex compositions of landings and discards but these were found appropriate by the review panel. CPUE from US commercial otter trawl was developed but not considered in the SS3 model because of its short time series and it was not sex-specific. Continued exploration of such resources to inform population trends is recommended. The landings and discards uncertainty were quantified and reported in the assessment report. However, these uncertainties were not accounted for in the SS3 model runs because of convergence issues. The review panel recommended that uncertainty should be considered in the future SS3 model configuration (TOR4).

TOR 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 agreed that this TOR had been met.

Nine fishery-independent surveys within the stock boundaries were analyzed, and only the NEFSC bottom trawl survey index was recommended in the SS3 base model run. Indices from the NEAMAP inshore trawl survey, MADMF bottom trawl survey, and ME-NH inshore groundfish trawl survey were considered in the SS3 sensitivity run but their potential influence was hard to assess because of no data weighting and poor fits to the indices.

The VAST model was used to develop indices, and results were compared with the design-based estimates. When VAST was used to combine multiple surveys, the NEFSC bottom trawl dominated, which is not surprising given its wide spatial coverage compared with the other surveys. It was noticed that the VAST index has considerable differences from the survey design-based index. A sensitivity run was undertaken to test its influence in the SS3 model but it was found that the VAST index made little difference to the results, probably because of the strong influence from length-frequency data and the general lack of fitting to the indices for all the model runs.

Because of the importance of estimating cohort signals and given the pup/recruitment data seen in the NEFSC spring bottom trawl survey length frequency, which was not

well explained in the SS3 model fit, the review panel recommended that a pup index may be considered in the future as a recruitment index.

TOR 4. Use 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 agreed that this TOR had been met, but had some reservations.

The previous stock assessment (2018) model used a Stochastic Estimator based on the swept area of the NEFSC spring bottom trawl survey. This had been used for management purposes since the 2010s.

The SDWG chose to move to the SS3 framework for this research track assessment primarily because it allowed for sex-specific analyses. The underlying population model was fitted to length data. Attempts were made to utilize age-reading data from the recent period. However, significant problems were detected. There were problems in the age-reading, especially for the younger fish. These analyses indicated a decreased growth rate in 2006-2014 compared to Nammack (1985) which formed the basis of earlier understanding of growth. For these reasons the SDWG rejected the age data and constructed time-blocks of biological parameters. These blocks were based on analyses of TOR1 and the age-length analyses presented under TOR4. These blocks along with the catch data, indices/fisheries and selectivities, and a stock-recruitment model were integrated into the SS3 framework. The review panel agreed with this general construction but noted some areas that might be revisited as the model moves to a management track.

There were some concerns about the SDWG recommended SS3 base model run because of the lack of meaningful model comparisons among sensitivity runs and the model run itself because of data weighting and fixed parameters. All the model runs use a 6-fleet model set which includes 2 landing fleets, 3 discarding fleets and 1 survey fleet: NEFSC spring bottom trawl survey. The landing and discard from the same fishery were separated into 2 fleets. The base run only included NEFSC spring bottom trawl index, and the model did not fit the survey index well (shown as a flat line and did not capture the historical decrease well). The base model only down-weighted the length frequency of the NEFSC survey fleet but not the landings and discards fleets, which was probably the reason for the poor fit to the survey index. The model did not capture the recruitment signal well, which was mainly from the NEFSC survey and the fit to the small-sized group length compositions was consistently poor. Seventeen sensitivity runs tested the influence of the growth model setup, the mortality assumption, the SR relationships, the biology time blocks, NEFSC bottom trawl selectivity time blocks, the

model starting year, and the use of the survey indices. The sensitivity runs did not re-weight the data, so none fitted the survey indices well, and it was hard to diagnose the influence of each model change. According to the SDWG, many model runs did not converge, if the data weighting was turned on or manually fixed, which made diagnostics on alternative model runs not possible during the research track review. Additionally, the base model generated stock-recruitment data in the early years that appear anomalous (Fig 4.34 of the assessment report).

Despite these concerns, the review panel recommended the SS3 setup with suggestions for continued model re-configuration and evaluation before the management track review. For example, all the sensitivity runs should include data weighting, so that they are comparable with the base model run. Prior distributions rather than fixed parameter values may be used in future SR model configurations. The review panel felt there are many advantages with using an integrated model, such as the developed SS3 base model, compared with the empirical Stochastic Estimator approach. Other modeling frameworks or directly coding of alternative sub-models could be explored in the future if SS3 continues to have a convergence problem. The review panel also suggested that the ageing-length data collection and analysis should be continued considering its importance in both the assessment model, BRPs and projections (TORs 4, 5 and 6).

TOR 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.

The review panel agreed that this TOR had been met with some concerns.

The most recent stock assessment update for spiny dogfish was in 2018, in which the SSB_{MSY} (159,288 tonnes, based on SSB_{max} that results in max R in the Ricker SR model) and F_{MSY} (0.24/year, estimated as the F to reach stable SSB_{max}) were based on Rago and Sosebee (2010) and have not been updated since then. The data update based on the same approach resulted in a much larger SSB_{MSY} (445,349 tonnes) and a much lower F_{MSY} (0.03/year).

The SDWG found that the fish growth has been decreasing and the 50% maturity at length decreased after the early 2010s, and these were the major sources of uncertainty in estimating biological reference points when yield per recruitment and pup per recruitment were used. The SDWG conducted both landings per recruitment|F and pups per recruitment|F, and recommended using the spawning output (pups) of $SPR_{60\%}$ as the SSB_{target} or SSB_{MSY} proxy, and using the $F_{60\%}$ as the F_{limit} or F_{MSY} proxy. The recommendation of $SPR_{60\%}$ is based on the population responses to the fishing intensity between 2000 and 2019, which indicated that when F was lower than $F_{60\%}$ (during 2002-

2010) the population increased, and when F was higher than $SPR_{50\%}$ level, the population showed a decreased trend in spawning potential (during 2012-2019, shown as million pups). Based on $SPR_{60\%}$ reference points, the 2019 stock size was >½ $B_{SPR60\%}$ and the fishing mortality rate was > $F_{SPR60\%}$.

The review panel was concerned with the SR relationship from the assessment model because of the fixed parameters used and the anomalous data points mentioned under TOR4. It is recommended that the final selection of parameters be revisited in the context of additional years of data in the management track assessment. For these and other reasons the SDWG chose to utilize $SPR_{60\%}$ as a more appropriate surrogate for MSY than that generated directly from the stock-recruitment relationship. The review panel supports that decision for the next management track, but notes that there remains an inconsistency between $SPR_{60\%}$ and the underlying dynamics generated by the stock-recruitment model.

TOR 6. Define appropriate methods for producing projections; provide justification for assumptions of fishery selectivity, weights at age, maturity, and recruitment; and comment on the reliability of resulting projections considering the effects of uncertainty and sensitivity to projection assumptions.

The review panel agreed that this TOR had been met with some concerns.

The SDWG conducted 3-year (2022-2024) short-term projections under 4 F levels (F=0, $SPR_{70\%}$, $SPR_{60\%}$, and $SPR_{50\%}$) using the SS3 internal projection tool processes and uncertainty in recruitment and numbers-at-age. Fleet selectivity, maturity, natural mortality, SR relationship, and growth are the same as estimated from the 2012-2019 period from the SS3 model run. The 3-year projection showed a sharp decrease in 2020 but increased after that, likely due to the maturation of many females in the large 2009-2012 year classes. There are concerns from the review panel on the projection method related to the definitions of fleets in SS3. These are in effect “pseudo fleets” that separate catch components into landings and discard “fleets” while combining gears in different groups. As a result, forward projections with different F multipliers assume particular fleet selectivity and discard selection that may be unrealistic. Furthermore, given the artificial nature of the model fleets, it is unclear how these relate to management, making the interpretation of potential interventions problematic. The SPWG should explicitly address this issue when carrying out projections.

The NEFSC bottom trawl survey swept area estimated SSB_{2022} indicated a large decline; the projection did not capture this decline. Combining the concerns from the SS3 model runs not fitting the survey abundance index (indices), the review panel recommended that future diagnostics on both the assessment model and projection be evaluated between the research track review and management track review.

TOR 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 2 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 agreed that this TOR had been met.

SDWG has made substantial progress on several of the research recommendations stemming from the 43rd SAW Stock Assessment Report (NEFSC 2006), MAFMC 2020-2024 Research Priorities (2019), and MAFMC SSC Research Recommendations in 2019. The review panel was highly impressed by the SDWG's progress in addressing these research recommendations, many of which were incorporated into the research track assessment model. The review panel recommended continued efforts on high-priority research topics from these lists. The SDWG also developed four new research recommendations, but thought the first one below is the most important:

- Consistently collect, process, and age spines of spiny dogfish to understand growth and support future age-based assessments.
- Continue exploration into the spatial distribution of spiny dogfish (e.g., off-shelf abundance).
- Further explore the sensitivity of the SS3 model parameterization and configuration.
- Conduct directed studies that estimate discard mortality rates for spiny dogfish by commercial and recreational harvesting gear type.
- Develop state-space models that can fit to length data.
- Investigate drivers in the decline in maturity over time.
- Continue developing the VAST models presented.
- Investigate datasets enumerating the abundance or diet of known spiny dogfish predators for insight into natural mortality rates.

The review panel agreed with the above new research recommendations and would like to emphasize the importance of consistently collecting and aging spiny dogfish. In addition, the review panel recommended exploring the use of other survey abundance indices and fishery catch rate that may inform either YOY or large spiny dogfish.

TOR 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 agreed that this TOR had been met.

The SDWG considered four backup approaches, including a stochastic estimator, Depletion-corrected Average Catch (MacCall 2009), Depletion-based Stock Reduction Analysis (Dick and MacCall 2011) and Ismooth (Legault et al., 2022). The stochastic estimator approach is based on the swept area and is the current stock assessment approach. The SDWG recommended the stochastic estimator approach as the backup

assessment approach if the research track review rejects the newly developed SS3 model run.

The review panel felt that the stochastic estimator was appropriate as a backup method. The SS3 model framework should be used subject to further consideration on data weighting and sensitivity analyses before application in management.

TOR 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.

N/A

3. Review of Bluefish

3.1 General Comments

The BWG developed a new WHAM model with the data and parameter configuration bridged from the last benchmark assessment in 2015, in which an ASAP model was used. The WG started with the ASAP 2021 MT (management track) run, RT (research track) continuity run, several model runs on new data or new data analysis methods, new M, new selectivity blocks and other parameter configurations, then moved to the new WHAM model setup. The report is well written, and the assessment is thorough and sound. The review panel unanimously agreed that all the TORs were met and accepted the WHAM model BF28W-m7 for use as the basis for bluefish stock assessment, and the WG's recommended BRPs and the estimation approach for BRPs and future population projections may be used for management advice.

3.2 Evaluation of the Terms of Reference for Bluefish

TOR 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 agreed that this TOR had been met.

The BWG had extensively reviewed the existing research and synthesized the existing data on the social-economic, ecosystem, and life history. The BWG developed new analyses, including VAST species distribution changes, ecosystem indicators, VAST forage fish index, and applied their findings to the stock assessment model runs. The findings suggested that Gulf of Mexico catch data should be omitted, used seasonal length frequencies and length-weight relationships at a minimum, and used a seasonal-regional level of data where possible. The BWG also developed age-specific natural mortality, which was used in the recommended BF28W-m7 model run for management

purposes. The BWG also addressed several previous research recommendations on life history, species distribution, and recruitment with environmental factors.

Although the forage fish index was not used in the recommended BF28W-m7 model run, its influence was tested in one model run as a covariate of MRIP catchability and was suggested for further research. The review panel also suggested that it may be considered in a catch rate standardization step before being used in the WHAM model to better understand the catchability changes of the MRIP CPUE.

The review panel thought that a tremendous amount of work was done to address this TOR and the work was extremely well done.

TOR 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 agreed that this TOR had been met.

Several new research items were included for developing commercial and recreational landing and discard total number, total weight, length distribution, and release mortality. They are all scientifically sound according to the review panel.

The commercial discard was ignored in the past but included in this assessment, and a release mortality of 32% was used based on literature review. The recreational release mortality was updated from 15% to 9.4% based on literature reviews, including the most recent research. The recreational effort was recalibrated based on APAIS and FES; the recreational length frequency was calculated by accounting for the differences among seasons and regions, which was further used in developing seasonal catch-at-age to account for fish size variation among seasons and regions.

Discussions on whether the hook type changes in the past and whether discard mortality is size specific should be considered in future studies.

TOR 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 agreed that this TOR had been met.

Several new research items were included for developing relative abundance indices, and age length keys (ALK). A Bayesian hierarchical model was used following Conn (2010) to develop a composite YOY index instead of using 6 separate YOY indices.

All the survey indices except the SEAMAP indices of ages 0 and 1, were developed using both a designed-based approach and a model-based approach (GLM framework used), and the BWG decided to use the result from the design-based approach. The trends of the survey indices are consistent between the two methods, and which method was used did not influence the output much according to the corresponding sensitivity runs. The BWG felt that the design-based approach would be easier to maintain consistency for future updates. The review panel found this a reasonable argument, although details were not discussed during the review.

The MRIP CPUE has been updated using a guild approach to select trips where a trip was considered a bluefish trip if it caught either bluefish or a species that was significantly positively associated with bluefish. This was from a previous research recommendation, and both the BWG and review panel believed that this was an important step forward in improving the recreational CPUE analysis.

A multinomial model was used to estimate probabilities in the age-length key, which avoided having to use an ad hoc “borrowing” method for empty cells when the sample sizes were small. The method was found reasonable for bluefish in this case. The review panel did realize that using multinomial ALK changed the scale of the population size in the stock assessment and suggested further evaluation of this method in the future.

TOR 4. Use 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 agreed that this TOR had been met.

The last benchmark stock assessment (2015) used an ASAP model and has been used for management purposes since then. It was last updated in 2021 in a management track assessment. The BWG moved the assessment from ASAP to a WHAM framework in this research track assessment review. The step-wise migration from ASAP to WHAM with the inclusion of new data or parameter configuration was clear, well thought out and reasonable. The BWG included a continuity ASAP run followed by a bridge model built with new data, smoothed age-length keys, age dependent M, new selectivity blocks, and other parameter configurations. This was then moved to the new WHAM model framework. This step-by-step approach, including results and diagnostics, helped the review process.

The most significant structural changes for the selected model run (BF28W-m7) included the process error on number at age in the model (NAA) and the use of fixed

natural mortality varying with weight (Lorenzen M). The new model used the MRIP guild CPUE and multinomial ALK data. The model fit was generally good, with no serious retrospective patterns that needed a correction to the final results. The review panel felt that the BF28W-m7 was appropriate for management purposes to provide scientific advice.

Previous assessments were dependent on the MRIP CPUE. The new assessment is no longer as reliant on this index. The assessment is, however, now more sensitive to the PSIGNS index, the removal of which results in lower SSB and higher F. The PSIGNS index contained most of the information on the older fish abundance. However, given that this survey is limited in geographical coverage, some care is merited in interpreting the results.

The review panel noted that multinomial ALKs used to derive age composition data may have the effect of implying these data are more precise than is actually the case. A potential issue with pre-processing the data in this way may be to over-weight the composition data relative to the abundance data. A sensitivity run using ALKs applying the older "borrowing" method resulted in poorer model convergence but lower F and higher SSB.

The BWG investigated the use of a forage index to account for changes in survey catchability. The review panel saw this as an innovative approach that merits further analysis before being used in an assessment for management purposes.

The review panel suggested that the WHAM framework-based model may further consider processes such as natural mortality and fish spatial distribution changes based on what the BWG found in TOR1.

TOR 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.

The review panel agreed that this TOR had been met.

The BWG continued the use of $SSB_{35\%}$ as the SSB_{MSY} proxy and used the last five-year average Weight at Age (WAA) and selectivity for reference points estimation. The WG agreed that the literature (Rothschild et al. 2012; Thorson et al. 2012) supported the use of $F_{35\%}$ for bluefish and continued the use of $F_{35\%}$ as the F_{MSY} proxy. It was acknowledged that it was the generally accepted approach in this region to use SPR analysis for the reference points estimation. Both $F_{35\%}$ and $SSB_{35\%}$ were calculated internally in WHAM using average recruitment over the time series (1985-2021), and 5-year averages for fishery selectivity and weights-at-age for SSB per recruit calculations

$F_{35\%}$ = 0.248. $SSB_{35\%}$ was calculated using SPR at 35% (0.718), and the mean of the full time series of recruitment (127,924 tonnes) $SSB_{35\%}$ = 91,897 tonnes. Natural mortality and maturity were assumed constant over time in the model. Uncertainties of the BRP estimations were included in the assessment report shown as CIs and were calculated internally in WHAM. The Kobe plot showing the uncertainty envelope of current stock status relative to reference points is particularly useful.

The review panel discussed whether $SPR_{35\%}$ was the best proxy of MSY. Based on the plot of YPR|F and SPR|F, the $SPR_{35\%}$ is less than F_{max} but may be close to $F_{0.1}$ (not estimated in the report). Combined with the literature and the bluefish SPR and YPR analyses, the review panel agrees that $SPR_{35\%}$ is a reasonable proxy of SSB_{MSY}. Future exploration of SR relationship and MSY reference points by combining YPR and stock recruitment relationship may be explored (Shepherd 1982).

TOR 6. Define appropriate methods for producing projections; provide justification for assumptions of fishery selectivity, weights at age, maturity, and recruitment; and comment on the reliability of resulting projections considering the effects of uncertainty and sensitivity to projection assumptions.

The review panel agreed that this TOR had been met.

The BWG conducted short-term projections under 3 F levels in WHAM, which incorporated auto-regressive processes and uncertainty in recruitment and numbers-at-age. The projections used the entire time series of recruitment (1985-2021), 5-year averages for natural mortality (assumed age varying but constant cross years), maturity (constant), fishery selectivity, and weights-at-age. The life history study from TOR1 found that the maturity changes over time are limited, and the changes in weight-at-length are trivial.

The projection algorithm in dealing with multi-fleet fishery matched the operational model setup. The review panel found it reasonable for projections under alternative fishing mortality level based on the council's risk policy and appropriate for management advice identification.

TOR 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 agreed that this TOR had been met.

BWG made considerable progress on several research recommendations stemming from the 2015 assessment (SAW/SARC 60) and MAFMC SSC recommendations in 2015 and 2021. The review panel was highly impressed by the BWG's progress in addressing these research recommendations, and many of them were incorporated into the research track assessment model. The review panel recommended continued efforts on high priority research topics from these lists. The BWG also developed four new research recommendations:

- Expand collection of recreational release length frequency data. The recreational release length frequency spatially stratified; borrow if n < 30.
- Continue coastwide collection of length and age samples from fishery dependent and fishery independent sources
- Continued development and refinement of forage fish index; incorporate into the base model for management
- Initiate fishery-independent or fishery dependent sampling programs to provide information on larger, older bluefish

The review panel agreed with the above new research recommendations and suggested more be added to the list:

- Continue exploring the appropriate application of the WHAM model, including alternative ALK estimation.
- Explore the reasons for bimodal length frequency observed in bluefish harvest.
- Continue the forage fish index study and explore the potential application in catch rate standardization to remove the forage fish influence on catchability
- Explore WHAM process error in simulating key parameter changes caused by climate or environmental changes, such as M and fish spatial distribution changes over time.

TOR 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 agreed that this TOR had been met.

The logic for the selection of the Ismooth (Legault et al. 2022) was clear. The BWG indicated this approach worked as well as any other Index Based method. The BWG also addressed reasons for not selecting other candidate approaches, including swept area, Depletion-corrected Average Catch (MacCall 2009), and Depletion-based Stock Reduction Analysis (Dick and MacCall 2011).

The review panel felt that Ismooth method is appropriate as a backup method even though it is not needed in this case. The review panel recommended the WHAM model run BF28W-m7 for management purposes.

TOR 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.

N/A

4. Supporting Materials for Research Track Peer Review

4.1 Spiny Dogfish

Assessment Report

"Spiny_Dogfish_SAW_SARC_2022_FINAL.pdf" = Main assessment document

Background

"Read Me.pdf" – Document and materials guide, as well as a repository of any report revisions.

"plots_v3.6.2_1.5_fnum_a12.zip" - This zip file contains the base case model figures and files produced from SS3. Within this zip file, there is a file labeled '_SS_output.html', which is an html that allows for viewing SS3 produced plots and results in an organized fashion (i.e. by various data type or model result).

Working Papers

Anstead K. 2022a. Natural mortality estimates for spiny dogfish.

Anstead K. 2022b. Two data poor methods applied to spiny dogfish.

Chang J-H, Hart D and McManus MC. 2022. Stock synthesis for Atlantic spiny dogfish.

Hansell A and McManus C. 2022. Spatio-temporal dynamics of spiny dogfish (*Squalus acanthias*) in US waters of the northwest Atlantic.

Hart DR, and Chang J-H. 2022. Per recruit modeling and reference points for spiny dogfish.

Hart DR, and Sosebee K. 2022. Length/Weight/Fecundity relationships for Atlantic spiny dogfish.

Jones AW. 2022. Exploring vessel trip report and observer based fishery information for spiny dogfish.

Jones AW, Didden JT, McManus MC, and Mercer AJ. 2022. Exploring commercial CPUE indices for the spiny dogfish in the northeast U.S.

McCandless C. 2022. Preliminary spiny dogfish movements and growth estimates from NEFSC mark recapture data.

McManus MC, Sosebee K, and Rago P. 2022. Biological Reference Points for Spiny Dogfish: Revisiting Rago and Sosebee (2010).

Neiland JL and McElroy WD. 2022. NEFSC Gulf of Maine Bottom Longline Survey Data and Analyses for Spiny Dogfish

Passerotti MS, and McCandless CT. 2022. Updated age and growth estimates for spiny dogfish Squalus acanthias.

Sosebee KA. 2022a. Maturity of spiny dogfish in US waters from 1998-2021.

Sosebee KA. 2022b. Spiny dogfish catch summary and derivation of catch at length and sex.

4.2 Bluefish

Assessment Report

Bluefish_SAW_SARC_2022_FINAL.pdf = Main assessment document

Background

readme.docx – document guide and repository of any report revisions.

Background Documents

NEFSC. 2015. 60th Northeast Regional Stock Assessment Workshop (60th SAW) assessment report. US Dept Commer, Northeast Fish Sci Cent Ref Doc. 15-08; Available from: National Marine Fisheries Service, 166 Water Street, Woods Hole, MA 02543-1026 http://doi.org/10.7289/V5W37T9T

Stock, B.C., and 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. Doi: 10.1016/j.fishres.2021.105967

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Legault, C. M. 2012. User manual for ASAP 3. 22 p.

Ng, E.L., Deroba, J.J., Essington, T.E., Grüss, A., Smith B.E., and Thorson, J.T. 2021. Predator stomach contents can provide accurate indices of prey biomass. ICES Journal of Marine Science 78(3):1146–1159.

Thorson, J.T. 2019. Guidance for decisions using the Vector Autoregressive Spatio-Temporal (VAST) package in stock, ecosystem, habitat and climate assessments. Fisheries Research 210:143–161.

Working Papers

Tyrell et al. 2022. Bluefish Ecosystem and Socioeconomic Profile.

Valenti 2022a. The Spatial Distribution of Bluefish (*Pomatomus saltatrix*): Insights from American Littoral Society Fish Tagging Data

Tyrell 2022. Bluefish VAST Index Exploration.

Gaichas et al. 2022. Vector Autoregressive Spatio-Temporal (VAST) modeling of piscivore stomach contents, 1985-2021.

Truesdell et al. 2022. Life History Analyses for Bluefish.

Tyrell and Truesdell 2022. Natural mortality of bluefish.

Celestino et al. 2022a. Index of abundance exploration and development by the Bluefish Working Group's Fishery Independent Data Group.

Wood 2022a. TOR 2: Commercial and Recreational Data Collection and Analysis.

Drew 2022a. Recreational Data Changes for Bluefish, 2012-2021.

Drew 2022b. The Spatial Distribution of Bluefish (*Pomatomus saltatrix*): Insights from MRIP Data.

Valenti 2022b. Catch-and-Release Recreational Angling Mortality of Bluefish (*Pomatomus saltatrix*): Updated Analysis for 2022

Drew 2022c. Development of the Composite YOY Index for Bluefish.

Drew 2022d. A Fishery-dependent CPUE index for bluefish derived from MRIP data.

Celestino et al. 2022b. Development of Bluefish Age-Length Keys.

Wood 2022b. Bluefish Model Bridge-Building in ASAP.

Wood 2022c. ASAP diagnostic plots.

Wood 2022d. WHAM diagnostic plots.

Truesdell 2022. Alternative assessment plan.

Other References

Conn, PB. 2010. Hierarchical analysis of multiple noisy abundance indices. Canadian Journal of Fisheries and Aquatic Sciences 67:108-120.

Dick, E.J. and MacCall, A.D. 2011. Depletion-based stock reduction analysis: a catch-based method for determining sustainable yields for data-poor fish stocks. Fisheries Research 110(2): 331-341.

Legault C.M., and Restrepo V.R. 1998. A flexible forward age-structured assessment program. ICCAT. Col. Vol. Sci. Pap. 49:246-253.

Legault, C.M., Wiedenmann, J., Deroba, J.J., Fay, G., Miller, T.J., Brooks, E.N., Bell, R.J., Langan, J.A., Cournane, J.M., Jones, A.W., Muffley, B. 2022. Data-rich but model-resistant: an evaluation of data-limited methods to manage fisheries with failed age-based stock assessments. Canadian Journal of Fisheries and Aquatic Sciences e-First https://doi.org/10.1139/cjfas-2022-0045

McCall, A. 2009. Depletion-corrected average catch: a simple formula for estimating yields in data poor situations. ICES Journal of Marine Science 66:2267-2271.

Methot, R.D., Jr., Wetzel, C.R. Taylor, I.G. and Doering, K. 2020. Stock Synthesis User Manual Version 3.30.15. U.S. Department of Commerce, NOAA Processed Report NMFS-NWFSC-PR-2020-05. https://doi.org/10.25923/5wpn-qt71

Miller, T.J., Hare, J.A., and Alade, L.A. 2016. A state-space approach to incorporating environmental effects on recruitment in an age-structured assessment model with an application to Southern New England yellowtail flounder. Canadian Journal of Fisheries and Aquatic Sciences 73(8): 1261-1270. Do: 10.1139/cifas-2015-0339

Miller, T.J., O'Brien, L., and Fratantoni, P.S. 2018. Temporal and environmental variation in growth and maturity and effects on management reference points of Georges Bank Atlantic cod. Canadian Journal of Fisheries and Aquatic Sciences 75(12): 2159-2171. Doi:10.1139/cifas-2017-0124

NEFSC. 2021.Atlantic Bluefish Operational Assessment for 2021. Updated Through 2019. https://apps-st.fisheries.noaa.gov/stocksmart?stockname=Bluefish%20-%20Atlantic%20Coast&stockid=10388

Northeast Fisheries Science Center (NEFSC). 2006. 43rd Northeast Regional Stock Assessment Workshop (43rd SAW): 43rd SAW assessment report. Northeast Fisheries Science Center Reference Document 06-25; 400p.

Northeast Fisheries Science Center (NEFSC). 2015. 60th Northeast Regional Stock Assessment Workshop (60th SAW) Assessment Report. US Dept Commerce, Northeast Fish Sci Cent Ref Doc. 15-08; 870 p.

Northeast Fisheries Science Center (NEFSC). 2019. Operational Assessment of the Black Sea Bass, Scup, Bluefish, and Monkfish Stocks, Updated Through 2018. US Dept Commerce, Northeast Fish Sci Cent Ref Doc. 20-01; 164 p.

Rago, P.J., Sosebee, K.A. 2010. Biological Reference Points for Spiny Dogfish. Northeast Fish Sci Cent Ref Doc. 10-06; 52 p. Available from: National Marine Fisheries Service, 166 Water Street, Woods Hole, MA 02543-1026, or online at: http://www.nefsc.noaa.gov/nefsc/publications/

Rothschild, B.J., Jiao, Y., and Hyun, S.Y. 2012. Simulation study of biological reference points for Summer Flounder. Transactions of the American Fisheries Society 141(2):426-436

Thorson, J.T., Cope, J.M., Branch, T.A., and Jensen, O.P. 2012. Spawning biomass reference points for exploited marine fishes, incorporating taxonomic and body size information. Canadian Journal of Fisheries and Aquatic Sciences 69(9):1556-1568.

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Attachment 1: Performance Work Statement (PWS)

National Oceanic and Atmospheric Administration (NOAA)
National Marine Fisheries Service (NMFS)
Center for Independent Experts (CIE) Program
External Independent Peer Review

Bluefish and Spiny dogfish Research Track Peer Review

Background

The National Marine Fisheries Service (NMFS) is mandated by the Magnuson-Stevens Fishery Conservation and Management Act, Endangered Species Act, and Marine Mammal Protection Act to conserve, protect, and manage our nation's marine living resources based upon the best scientific information available (BSIA). NMFS science products, including scientific advice, are often controversial and may require timely scientific peer reviews that are strictly independent of all outside influences. A formal external process for independent expert reviews of the agency's scientific products and programs ensures their credibility. Therefore, external scientific peer reviews have been and continue to be essential to strengthening scientific quality assurance for fishery conservation and management actions.

Scientific peer review is defined as the organized review process where one or more qualified experts review scientific information to ensure quality and credibility. These expert(s) must conduct their peer review impartially, objectively, and without conflicts of interest. Each reviewer must also be independent from the development of the science, without influence from any position that the agency or constituent groups may have. Furthermore, the Office of Management and Budget (OMB), authorized by the Information Quality Act, requires all federal agencies to conduct peer reviews of highly influential and controversial science before dissemination, and that peer reviewers must be deemed qualified based on the OMB Peer Review Bulletin standards[1]. Further information on the Center for Independent Experts (CIE) program may be obtained from www.ciereviews.org.

Scope

The Research Track Peer Review meeting is a formal, multiple-day meeting of stock assessment experts who serve as a panel to peer-review tabled stock assessments and models. The research track peer review is the cornerstone of the Northeast Region Coordinating Council stock assessment process, which includes assessment development, and report preparation (which is done by Working Groups or Atlantic States Marine Fisheries Commission (ASMFC) technical committees), assessment peer review (by the peer review panel), public presentations, and document publication. The results of this peer review will be incorporated into future management track assessments, which serve as the basis for developing fishery management recommendations.

The purpose of this meeting will be to provide an external peer review of the Spiny dogfish and Bluefish stock. The requirements for the peer review follow. This Performance Work Statement (PWS) also includes: **Appendix 1**: TORs for the research track, which are the responsibility of the analysts; **Appendix 2:** a draft meeting agenda; **Appendix 3:** Individual Independent Review Report Requirements; and **Appendix 4:** Peer Reviewer Summary Report Requirements.

[1] http://www.cio.noaa.gov/services_programs/pdfs/OMB_Peer_Review_Bulletin_m05-03.pdf

Requirements
NMFS requires three reviewers under this contract (i.e. subject to CIE standards for reviewers) to participate in the panel review. The chair, who is in addition to the three reviewers, will be provided by either the New England or Mid-Atlantic Fishery Management Council's Science and Statistical Committee; although the chair will be participating in this review, the chair's participation (i.e. labor and travel) is not covered by this contract.

Each reviewer will write an individual review report in accordance with the PWS, OMB Guidelines, and the TORs below. All TORs must be addressed in each reviewer's report. The reviewers shall have working knowledge and recent experience in the use and application of index-based, age-based, and state-space stock assessment models, including familiarity with retrospective patterns and how catch advice is provided from stock assessment models. In addition, knowledge and experience with simulation analyses is required.

Tasks for Reviewers

- Review the background materials and reports prior to the review meeting
    - Two weeks before the peer review, the Assessment Process Lead will electronically disseminate all necessary background information and reports to the CIE reviewers for the peer review.
- Attend and participate in the panel review meeting
    - The meeting will consist of presentations by NOAA and other scientists, stock assessment authors and others to facilitate the review, to provide any additional information required by the reviewers, and to answer any questions from reviewers
- Reviewers shall conduct an independent peer review in accordance with the requirements specified in this PWS and TORs, in adherence with the required formatting and content guidelines; reviewers are not required to reach a consensus.
- Each reviewer shall assist the Peer Review Panel (co)Chair with contributions to the Peer Reviewer Summary Report
- Deliver individual Independent Reviewer Reports to the Government according to the specified milestone dates
- This report should explain whether each research track Term of Reference was or was not completed successfully during the peer review meeting, using the criteria specified below in the "Tasks for Peer Review Panel."
- If any existing Biological Reference Points (BRP) or their proxies are considered inappropriate, the Independent Report should include recommendations and justification for suitable alternatives. If such alternatives cannot be identified, then the report should indicate that the existing BRPs are the best available at this time.
- During the meeting, additional questions that were not in the Terms of Reference but that are directly related to the assessments and research topics may be raised. Comments on these questions should be included in a separate section at the end of the Independent Report produced by each reviewer.
- The Independent Report can also be used to provide greater detail than the Peer Reviewer Summary Report on specific stock assessment Terms of Reference or on additional questions raised during the meeting.

Tasks for Review panel

- During the peer review meeting, the panel is to determine whether each research track Term of Reference (TOR) was or was not completed successfully. To make this determination, panelists should consider whether the work provides a scientifically credible basis for developing fishery management advice. Criteria to consider include: whether the data were adequate and used properly, the analyses and models were carried out correctly, and the conclusions are correct/reasonable. If alternative assessment models and model assumptions are presented, evaluate their strengths and weaknesses and then recommend which, if any, scientific approach should be adopted. Where possible, the Peer Review Panel chair shall identify or facilitate agreement among the reviewers for each research track TOR.
- If the panel rejects any of the current BRP or BRP proxies (for B_{MSY} and F_{MSY} and MSY), the panel should explain why those particular BRPs or proxies are not suitable, and the panel should recommend suitable alternatives. If such alternatives cannot be identified, then the panel should indicate that the existing BRPs or BRP proxies are the best available at this time.
- Each reviewer shall complete the tasks in accordance with the PWS and Schedule of Milestones and Deliverables below.

Tasks for Peer Review Panel chair and reviewers combined:
Review the Report of Spiny Dogfish and Bluefish Research Track Working Group.

The Peer Review Panel Chair, with the assistance from the reviewers, will write the Peer Reviewer Summary Report. Each reviewer and the chair will discuss whether they hold similar views on each research track Term of Reference and whether their opinions can be summarized into a single conclusion for all or only for some of the Terms of Reference of the peer review meeting. For terms where a similar view can be reached, the Peer Reviewer Summary Report will contain a summary of such opinions.

The chair's objective during this Peer Reviewer Summary Report development process will be to identify or facilitate the finding of an agreement rather than forcing the panel to reach an agreement. The chair will take the lead in editing and completing this report. The chair may express their opinion on each research track Term of Reference, either as part of the group opinion, or as a separate minority opinion. The Peer Reviewer Summary Report will not be submitted, reviewed, or approved by the Contractor.

Foreign National Security Clearance
When reviewers participate during a panel review meeting at a government facility, the NMFS Project Contact is responsible for obtaining the Foreign National Security Clearance approval for reviewers who are non-US citizens. For this reason, the reviewers shall provide requested information (e.g., first and last name, contact information, gender, birth date, country of birth, country of citizenship, country of permanent residence, country of current residence, dual citizenship (yes, no), passport number, country of passport, travel dates.) to the NEFSC Assessment Process Lead for the purpose of their security clearance, and this information shall be submitted at least 30 days before the peer review in accordance with the NOAA Deemed Export Technology Control Program NAO 207-12 regulations available at the Deemed Exports NAO website: http://deemedexports.noaa.gov/ and http://deemedexports.noaa.gov/compliance_access_control_procedures/noaa-foreign-national-registration-system.html. The contractor is required to use all appropriate methods to safeguard Personally Identifiable Information (PII).

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Place of Performance
The place of performance shall be held remotely, via WebEx video conferencing.

Period of Performance
The period of performance shall be from the time of award through December 23, 2022. The Chair's duties shall not exceed **14** days to complete all required tasks.

Schedule of Milestones and Deliverables: The contractor shall complete the tasks and deliverables in accordance with the following schedule.

Approximately November 21, 2022	NOAA/NMFS provides the pre-review documents to the reviewer panel (Reviewers and Chair)
December 5-9, 2022	Panel peer review meeting
December 23, 2022 (approximately 2 weeks later)	Chair submits a draft summary peer review report to NEFSC and NEFMC
January 6, 2023 (within 2 weeks of receiving draft reports)	Chair submits final reports to the Government (to NEFSC and NEFMC)

Applicable Performance Standards
The acceptance of the contract deliverables shall be based on three performance standards:
(1) The reports shall be completed in accordance with the required formatting and content (2) The reports shall address each TOR as specified (3) The reports shall be delivered as specified in the schedule of milestones and deliverables.

Travel
No travel is necessary, as this meeting is being held remotely.

Restricted or Limited Use of Data
The contractors may be required to sign and adhere to a non-disclosure agreement.

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Appendix 1. Generic Research Track Terms 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.

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 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.

6. Define appropriate methods for producing projections; provide justification for assumptions of fishery selectivity, weights at age, maturity, and recruitment; and comment on the reliability of resulting projections considering the effects of uncertainty and sensitivity to projection assumptions.

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 2 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.

*Any additional TORs will require review and approval.

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Research Track TORs:

General Clarification of Terms that may be used in the Research Track Terms of Reference

Guidance to Peer Review Panels about "Number of Models to include in the Peer Reviewer Report":

In general, for any TOR in which one or more models are explored by the Working Group, give a detailed presentation of the "best" model, including inputs, outputs, diagnostics of model adequacy, and sensitivity analyses that evaluate robustness of model results to the assumptions. In less detail, describe other models that were evaluated by the Working Group and explain their strengths, weaknesses and results in relation to the "best" model. If selection of a "best" model is not possible, present alternative models in detail, and summarize the relative utility each model, including a comparison of results. It should be highlighted whether any models represent a minority opinion.

On "Acceptable Biological Catch" (DOC Nat. Stand. Guidelines. Fed. Reg., v. 74, no. 11, 1-16-2009):

Acceptable biological catch (ABC) is a level of a stock or stock complex's annual catch that accounts for the scientific uncertainty in the estimate of Overfishing Limit (OFL) and any other scientific uncertainty…" *(p. 3208) [In other words, OFL ≥ ABC.]*

ABC for overfished stocks. For overfished stocks and stock complexes, a rebuilding ABC must be set to reflect the annual catch that is consistent with the schedule of fishing mortality rates in the rebuilding plan. *(p. 3209)*

NMFS expects that in most cases ABC will be reduced from OFL to reduce the probability that overfishing might occur in a year. (p. 3180)

ABC refers to a level of ''catch'' that is ''acceptable'' given the ''biological'' characteristics of the stock or stock complex. As such, Optimal Yield (OY) does not equate with ABC. The specification of OY is required to consider a variety of factors, including social and economic factors, and the protection of marine ecosystems, which are not part of the ABC concept. (p. 3189)

On "Vulnerability" (DOC Natl. Stand. Guidelines. Fed. Reg., v. 74, no. 11, 1-16-2009):

"Vulnerability. A stock's vulnerability is a combination of its productivity, which depends upon its life history characteristics, and its susceptibility to the fishery. Productivity refers to the capacity of the stock to produce Maximum Sustainable Yield (MSY) and to recover if the population is depleted, and susceptibility is the potential for the stock to be impacted by the fishery, which includes direct captures, as well as indirect impacts to the fishery (e.g., loss of habitat quality)." (p. 3205)

Participation among members of a Research Track Working Group:

Anyone participating in peer review meetings that will be running or presenting results from an assessment model is expected to supply the source code, a compiled executable, an input file with the proposed configuration, and a detailed model description in advance of the model meeting. Source code for NOAA Toolbox programs is available on request. These measures allow transparency and a fair evaluation of differences that emerge between models.

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Appendix 2. Peer Review Meeting Agenda

Spiny Dogfish/Bluefish Research Track Assessment Peer Review Meeting

December 5-9, 2022

WebEx link: https://noaanmfs-meets.webex.com/noaanmfs-meets/j.php?MTID=m537714866febfc8ede459d55b0482239

Meeting number (access code): 2764 137 9769

Meeting password:

AhFMe8W3DS5 Phone: +1-415-

527-5035 US Toll

AGENDA* (v. 11/17/2022)

**All times are approximate, and may be changed at the discretion of the Peer Review Panel chair. The meeting is open to the public; however, during the Report Writing sessions we ask that the public refrain from engaging in discussion with the Peer Review Panel.*

Monday, December 5, 2022

Time	Topic	Presenter(s)	Notes
9 a.m. - 9:15 a.m.	Welcome/Logistics Introductions/Agenda/ Conduct of Meeting	Michele Traver, Assessment Process Lead Russ Brown, PopDy Branch Chief Yan Jiao, Panel Chair	
9:15 a.m. - 9:30 a.m.	Introduction/Executive Summary	Conor McManus (WG co-chair) (Spiny Dogfish)	
9:30 a.m. - 10 a.m.	Term of Reference (TOR) #1	Conor McManus	Ecosystem Data
10 a.m. - 10:30 a.m.	TOR #3	Cami McCandless (WG co-chair)	Survey Data
10:30 a.m. - 10:45 a.m.	Break		
10:45 a.m. - 11:45 a.m.	TOR #2	Kathy Sosebee	Catch Data
11:45 a.m. - 12:15 p.m.	Discussion/Summary	Review Panel	
12:15 p.m. - 12:30 p.m.	Public Comment	Public	
12:30 p.m. - 1:30 p.m	Lunch		

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Time	Topic	Presenter(s)	Notes
1:30 p.m. - 2:30 p.m.	TOR #4	Dvora Hart Jui-Han Chang	Models
2:30 p.m. - 3 p.m.	End of Day Wrap-up/ Discussion/Summary	Review Panel	
3 p.m. - 3:15 p.m.	Public Comment	Public	
3:15 p.m.	Adjourn		

Tuesday, December 6, 2022

Time	Topic	Presenter(s)	Notes
9 a.m. - 9:05 a.m.	Welcome/Logistics Introductions/Agenda	Michele Traver, Assessment Process Lead Yan Jiao, Panel Chair	
9:05 a.m. - 10:30 a.m.	TOR #4 cont.	Dvora Hart Jui-Han Chang	Models
10:30 a.m. - 10:45 a.m.	Break		
10:45 a.m. - 12 p.m.	TORs #5 and #6	Dvora Hart Jui-Han Chang	Reference Points Projections
12 p.m. - 12:30 p.m.	Discussion/Summary	Review Panel	
12:30 p.m. - 12:45 p.m.	Public Comment	Public	
12:45 p.m. - 1:45 p.m	Lunch		
1:45 p.m. - 2:30 p.m.	TOR #8	Dvora Hart	Alternative Assessment Approach
2:30 p.m. - 2:45 p.m.	TOR #7	Conor McManus	Research Recommendations
2:45 p.m. - 3:15 p.m.	End of Day Wrap-up/ Discussion/Summary	Review Panel	
3:15 p.m. - 3:30 p.m.	Public Comment	Public	
3:30 p.m.	Adjourn		

Wednesday, December 7, 2022

Time	Topic	Presenter(s)	Notes
9 a.m. - 9:05 a.m.	Welcome/Logistics Introductions/Agenda	Michele Traver, Assessment Process Lead	

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Time	Topic	Presenter(s)	Notes
		Yan Jiao, Panel Chair	
9:05 a.m. - 9:30 a.m.	Introduction/Executive Summary	Mike Celestino (WG chair) (Bluefish)	
9:30 a.m. - 10:30 a.m.	TOR #2	Mike Celestino Katie Drew	Catch Data
10:30 a.m. - 10:45 a.m.	Break		
10:45 a.m. - 11:45 a.m.	TOR #3	Mike Celestino Katie Drew	Survey Data
11:45 a.m. - 12:15 p.m.	Discussion/Summary	Review Panel	
12:15 p.m. - 12:30 p.m.	Public Comment	Public	
12:30 p.m. - 1:30 p.m	Lunch		
1:30 p.m. - 3 p.m.	TOR #1	Abby Tyrell Sarah Gaichas	Ecosystem Data
3 p.m. - 3:30 p.m.	End of Day Wrap-up/ Discussion/Summary	Review Panel	
3:30 p.m. - 3:45 p.m.	Public Comment	Public	
3:45 p.m.	Adjourn		

Thursday, December 8, 2022

Time	Topic	Presenter(s)	Notes
9 a.m. - 9:05 a.m.	Welcome/Logistics Introductions/Agenda	Michele Traver, Assessment Process Lead Russ Brown, PopDy Branch Chief Yan Jiao, Panel Chair	
9:05 a.m. - 10:30 a.m.	TOR #4	Tony Wood Tim Miller	Models
10:30 a.m. - 10:45 a.m.	Break		
10:45 a.m. - 11:15 a.m.	TOR #4 cont.	Tony Wood Tim Miller	Models
11:15 a.m. - 11:45 a.m.	Discussion/Summary	Review Panel	
11:45 a.m. - 12 p.m.	Public Comment	Public	

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Time	Topic	Presenter(s)	Notes
12 p.m. - 1 p.m	Lunch		
1 p.m. - 2:30 p.m.	TORs #5, #6, #8, and #7	Tony Wood Sam Truesdell Mike Celestino	Reference Points, Projections, Alternative Assessment Approach Research Recommendations
2:30 p.m. - 3 p.m.	Meeting Wrap-up/ Discussion/Summary	Review Panel	
3 p.m. - 3:15 p.m.	Public Comment	Public	
3:15 p.m.	Adjourn		

Friday, December 9, 2022

Time	Topic	Presenter(s)	Notes
9 a.m. - 5 p.m.	Report Writing	Review Panel	

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Appendix 3. Individual Independent Peer Reviewer Report Requirements

1. The independent Peer Reviewer report shall be prefaced with an Executive Summary providing a concise summary of whether they accept or reject the work that they reviewed, with an explanation of their decision (strengths, weaknesses of the analyses, etc.).

2. The report must contain a background section, description of the individual reviewers' roles in the review activities, summary of findings for each TOR in which the weaknesses and strengths are described, and conclusions and recommendations in accordance with the TORs. The independent report shall be an independent peer review, and shall not simply repeat the contents of the Peer Reviewer Summary Report.

   a. Reviewers should describe in their own words the review activities completed during the panel review meeting, including a concise summary of whether they accept or reject the work that they reviewed, and explain their decisions (strengths, weaknesses of the analyses, etc.), conclusions, and recommendations.

   b. Reviewers should discuss their independent views on each TOR even if these were consistent with those of other panelists, but especially where there were divergent views.

   c. Reviewers should elaborate on any points raised in the Peer Reviewer Summary Report that they believe might require further clarification.

   d. The report may include recommendations on how to improve future assessments.

3. The report shall include the following appendices:

   Appendix 1: Bibliography of materials provided for review
   Appendix 2: A copy of this Performance Work Statement
   Appendix 3: Panel membership or other pertinent information from the panel review meeting.

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Appendix 4. Peer Reviewer Summary Report Requirements

1. The main body of the report shall consist of an introduction prepared by the Research Track Peer Review Panel chair that will include the background and a review of activities and comments on the appropriateness of the process in reaching the goals of the peer review meeting. Following the introduction, for each assessment /research topic reviewed, the report should address whether or not each Term of Reference of the Research Track Working Group was completed successfully. For each Term of Reference, the Peer Reviewer Summary Report should state why that Term of Reference was or was not completed successfully.

   To make this determination, the peer review panel chair and reviewers should consider whether or not the work provides a scientifically credible basis for developing fishery management advice. If the reviewers and peer review panel chair do not reach an agreement on a Term of Reference, the report should explain why. It is permissible to express majority as well as minority opinions.

   The report may include recommendations on how to improve future assessments.

2. If any existing Biological Reference Points (BRPs) or BRP proxies are considered inappropriate, include recommendations and justification for alternatives. If such alternatives cannot be identified, then indicate that the existing BRPs or BRP proxies are the best available at this time.

3. The report shall also include the bibliography of all materials provided during the peer review meeting, and relevant papers cited in the Peer Reviewer Summary Report, along with a copy of the CIE Performance Work Statement.

   The report shall also include as a separate appendix the assessment Terms of Reference used for the peer review meeting, including any changes to the Terms of Reference or specific topics/issues directly related to the assessments and requiring Panel advice.

Appendix 5 - Meeting attendees at the Spiny Dogfish/Bluefish Research Track Peer Review
December 5-9, 2022

GARFO - Greater Atlantic Regional Fisheries Office
MADMF - Massachusetts Division of Marine Fisheries
MAFMC - Mid Atlantic Fisheries Management Council
MDNR - Maryland Department of Natural Resources
NEFMC - New England Fisheries Management Council
NEFSC - Northeast Fisheries Science Center
NCDMF - North Carolina Division of Marine Fisheries
NJFW - New Jersey Fish and Wildlife
NYSDEC - New York State Department of Environmental Conservation
RIDEM - Rhode Island Department of Environmental Management
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Yan Jiao - Chair
Joe Powers - CIE Panel
Robin Cook - CIE Panel
Paul Medley - CIE Panel

Russ Brown - NEFSC, Population Dynamics Branch Chief
Michele Traver - NEFSC, Assessment Process Lead

Abby Tyrell - NEFSC
Alan Bianchi - NCDMF
Alex Dunn - NEFSC
Alex Hansell - NEFSC
Alexei Sharov - MDNR
Andy Jones - NEFSC
Anna Mercer - NEFSC
Brandon Muffley - MAFMC staff
Brian Linton - NEFSC
Cami McCandless - NEFSC
Charles Adams - NEFSC
Charles Perretti - NEFSC
Chris Legault - NEFSC
Conor McManus - RIDEM
Cynthia Ferrio - GARFO
Dave McElroy - NEFSC
Dvora Hart - NEFSC
Eric Robillard - NEFSC
Greg DiDomenico - Lunn’s Fisheries
Hannah Hart - MAFMC staff
James Fletcher - United National Fishermen's Association
Jason Didden - MAFMC staff
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John Maniscalco - NYSDEC
Jose Montanez - MAFMC staff
Jui-Han Chang - NEFSC
Julie Nieland - NEFSC
Karson Cisneros - MAFMC staff
Kathy Sosebee - NEFSC
Katie Drew - ASMFC staff
Kiersten Curti - NEFSC
Kristen Anstead - ASMFC
Larry Alade - NEFSC
Liz Brooks - NEFSC
Mark Terceiro - NEFSC
Mike Celestino - NJFW
Michelle Passerotti - NEFSC
Paul Nitschke - NEFSC
Rich McBride - NEFSC
Ricky Tabandera - NEFSC
Sam Truesdell - MADMF
Samantha Werner - NEFSC
Sarah Gaichas - NEFSC
Scott Large - NEFSC
Tim Miller - NEFSC
Toni Chute - NEFSC
Tony Wood - NEFSC