

Summary Report of the Gulf of Maine Haddock Research Track Stock Assessment Peer Review

January 25-27, 2022
Northeast Fisheries Science Center, Woods Hole Massachusetts

Report prepared by Panel Members:
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1. Introduction

The most recent (NEFSC 2019) assessment of the Gulf of Maine haddock (*Melanogrammus aeglefinus*) stock was an operational assessment based on the previous benchmark assessment (NEFSC 2014). The 2019 assessment updated commercial and recreational fishery catch data, research survey indices of abundance, and the analytical ASAP assessment model and reference points through 2018. Stock projections were updated through 2022. Based on this updated assessment, the stock status for Gulf of Maine haddock stock was not overfished and overfishing was not occurring

Subsequently, the stock was the subject of a research track effort to update and improve the quality of the assessment with work beginning in 2020. A Working Group (WG) was created with staff from NOAA Fisheries, academia, and the Canadian Department of Fisheries and Oceans (DFO). This 12 person WG (Chaired by Brian Linton, NEFSC) met from November 2020 through December 2021 to provide updated assessment advice for three stocks of haddock – Gulf of Maine, Georges Bank and eastern Georges Bank. Terms of Reference for the WG work on Gulf of Maine haddock are provided in Appendix 1.

We report here on the peer review of the 2022 Gulf of Maine research track assessment results. The Georges Bank and eastern Georges Bank stock assessments will be evaluated at a subsequent meeting of a peer review panel.

The Gulf of Maine Haddock Research Track Stock Assessment Peer Review Panel met via WebEx on January 25-27, 2022 (see agenda in Appendix 2). The Panel was composed of three scientists selected by the Center for Independent Experts (CIE): Coby Needle (Marine Scotland Science), Anders Nielsen (Technical University of Denmark) and Kevin Stokes (Stokes.Net.NZ Ltd). The Panel was chaired by Richard Merrick, as a member of the New England Fisheries

Management Council Scientific and Statistical Committee. The Performance Work Statement for the CIE reviewers is included as Appendix 3.

The Panel was assisted by Michele Travers (Chair, NEFSC's Stock Assessment Workshop) and Russ Brown (Chief, NEFSC Population Dynamics Branch). Documentation was prepared by the Haddock Working Group, and presentations were made by Charles Peretti and Brian Linton (both NEFSC) but WG members and New England Fishery Management Councils members and staff contributed substantially to the discussions on various topics. Jason Boucher, Toni Chute, Jon Deroba, and Kathy Sosebee (all from the NEFSC) acted as rapporteurs throughout the meeting (see Appendix 4 for materials provided and Appendix 5 for meeting attendees).

One week prior to the meeting, assessment documents were made available to the Panel through a NEFSC website (https://appsnefsc.fisheries.noaa.gov/saw/sasi/sasi_report_options.php). Prior to the meeting, members of the Panel met with Michelle 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 Tuesday January 25, with welcoming remarks and comments on the agenda by Russ Brown, Michelle Traver, and Panel chair Richard Merrick. The first two and a half days of the meeting focused on presentations and discussion of the ten Terms of Reference (TOR) for this stock's 2022 research track assessment. Day 3 concluded with a Panel discussion of the ten TORs that provided the primary input to this, the Panel's Summary Report. The 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 of the CIE Panelists will submit their separate reviewer's reports to the Center for Independent Experts.

The scientific and statistical analyses conducted by the WG were thorough and of high quality. Their very clear reports and presentations made the Panel's job much easier.

The Panel agreed that all 10 TORs had been met, and that the WG's approach to estimating BRPs and making projections may be used for management purposes. The Panel's overarching evaluation of the WG's response to the 10 TORs is provided below. We also provide a series of recommendations for future improvements to the assessment and the Research Track process.

2. Evaluation of the Terms of Reference for Gulf of Maine Haddock

1. Review existing research efforts, data, and habitat information in the Gulf of Maine and Georges Bank, identify any findings relevant to influences of ecosystem conditions on haddock, and consider those findings, as appropriate, in addressing other TORs. For processes that the working group deems important and promising that are not currently feasible to consider quantitatively, describe next steps for development, testing, and review of quantitative relationships and how they could best inform assessments.

The Panel agrees (with some reservations) that this TOR has been met.

The WG effectively reviewed the existing research that formed the basis for the TOR and probably has gone as far as they can, given the current state of knowledge about the GoM haddock's habitat relationships.

The Panel was concerned that the review would have been better if next steps in the research had been presented. For example, the research presented may be describing haddock distribution rather than habitat and as such, the Panel **suggests** that a more mechanistic model might improve the understanding of the relationship. Also, it was unclear how the research could be used in the assessment. If it is useful in predicting recruitment, then it could potentially improve the predictive modeling.

The Panel had no recommendations here.

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 Panel agrees that this TOR has been met.

The commercial catch (landings and discards) estimates appear robust and are consistent with the survey data. The method to hindcast discards in the early period without observer coverage could be a problem but is not of major concern. The observer coverage appears sufficient for commercial discard estimation.

Recreational catch data appears less robust. The Panel recognized this is because of the difficulty in sampling recreational catch (both landings and releases, as well as release mortality estimates), and that the actual data collection is nationally run (through the Marine Recreational Information Program [MRIP]) and therefore is out of the hands of the WG. All things considered these data are sufficient to document catch in the fishery.

Given the increased importance of the recreational fishery in the past decade, the Panel **recommends** that the NEFSC further consider a two-fleet model in future assessments. The WG did evaluate a two-fleet model, but the fit did not converge. Further research may find a solution to the issue.

3. Present the survey data being used in the assessment (e.g., indices of relative or absolute abundance, recruitment, state surveys, age-length data, etc.). Characterize the uncertainty in these sources of data.

The Panel agrees that this TOR has been met.

The Panel **recommends** further consideration of the state inshore surveys in future assessment work for the stock. This is because the Panel believes the areas sampled by these surveys, though small, may contain important information on the density of small fish in areas not covered by the current NEFSC surveys. A geospatial/geostatistical approach, as acknowledged by Dr. Perretti, might allow the inclusion of some of the information available from these finer

scale surveys. NOAA should also be sure to continue to fund the surveys, as consistent survey effort over long time periods has important implications to the quality of the stock's assessment.

Also, the Bottom Longline Survey (BLS) holds promise for providing more representative sampling of the haddock population occupying rough bottom areas. As such, the Panel **recommends** further consideration of these data in the upcoming 2022 and 2024 management track assessment for GoM haddock.

4. 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 model and evaluate the strength and direction of any retrospective pattern(s) in both the current and the previously accepted model. Enumerate possible sources of the retrospective patterns and characterize plausibility, if possible.

The Panel agrees that this TOR has been met.

The selected model's fit is acceptable and well explained. The retrospective patterns are reasonable and appear to be decreasing in recent years (though by ICES standards a Mohn's rho > 20% would have led to rejection of the model). This model, as parameterized, does the job, and will form a good basis for the management track assessment.

The Panel's review would have better understood why the "base_newcalib" model was chosen if diagnostics were available showing the development of the model and for the other models considered by the WG. The Panel **recommends** such diagnostics be made available in future research track assessments.

The Panel also **recommends** that future stock assessments consider other analytic models (rather than differently parameterized versions of the same model) to support the model selection and strengthen confidence that the results are robust. For example, in the case of GoM haddock, the Woods Hole Assessment Model (WHAM) would have been useful to support an exploratory approach to the assessment, as this would provide several useful modeling capabilities not available in the traditional ASAP approach. Examples of these additional capabilities include estimation of uncertainty parameters, time-varying selectivities, and inclusion of environmental variables in support of TOR1.

The Panel **recommends** further exploration of the BLS flat top model and a two-fleet model (commercial and recreational).

Finally, the Panel **recommends** analysis of whether a fixed natural mortality (e.g., $M = 0.2$ across all ages and years) is appropriate for this stock. The Panel recognizes the WG determination that conflicting evidence from the retrospective analysis and changes in growth suggested holding the M fixed at 0.2 was reasonable. However, the Panel is concerned that M is known to vary by age class and between years, which could be particularly exacerbated by changing predator prey and increased climate impacts on the Gulf of Maine ecosystem.

5. *Update or redefine status determination criteria (Status Determination Criteria, point estimates or proxies for B_{MSY} , $B_{THRESHOLD}$, F_{MSY} and Maximum Sustainable Yield [MSY]) and provide estimates of their uncertainty. If analytic model-based estimates are unavailable, consider recommending alternative measurable proxies for Biological Reference Points (BRPs).*

The Panel agrees that this TOR has been met.

The Panel **recommends** review of the use of the last five-year average to represent “prevailing conditions” for estimation of Weight at Age (WAA) for Reference Points. While this approach was reasonable for the Projections, such an approach could bias the calculation of the stock’s Reference Points if the stock is experiencing density-dependent growth effects. It was acknowledged that it was the generally accepted approach in this region to use only the very recent years for Projections and a longer time period for the Reference Points.

The Panel **recommends** that analysts develop a quantitative model that accounts for cohort strength to replace the averaging of WAA over recent years in the assessment model

The Panel also **recommends** reconsideration of whether setting an MSY proxy based on achieving a spawning potential ratio (SPR) of 40% unfished SSB was the best proxy. This seems rather ad hoc and is at odds with the knowledge that M varies by age class and year. Again, the Panel recognized that while this was the norm for the region (and much of the US), it was still uncertain whether this was the appropriate proxy approach for such a well-studied stock. Additional justification or sensitivity analysis would be appropriate. The Panel’s concern over whether this provides robust management advice could be addressed with a Management Strategy Evaluation contrasting constant vs age-varying M and how it affects yields.

6. *Define the methodology for performing short-term projections of catch and biomass under alternative harvest scenarios, including the assumptions of fishery selectivity, weights at age, maturity, and recruitment.*

The Panel agrees that this TOR has been met.

In particular, the analysis supporting the short-term projection approach using the two terminal years to estimate Weight at Age seemed particularly useful. There was, however, some concern by the Panel that this approach might mask density dependent effects resulting from highly variable recruitment which could have a significant cohort effect on growth (and the projection). The Panel’s **recommendation** (see TOR5) regarding the development of a model for weights-at-age accounting for cohort strength would be equally applicable here.

7. *Review, evaluate and report on the status of the Stock Assessment Review Committee (SARC) and Working Group research recommendations listed in most recent SARC reviewed assessment and review panel reports. Identify new research recommendations.*

The Panel agrees that this TOR has been met with some reservations:

The Panel was disappointed that so many of the SAW59/MT2019 research recommendations were deferred to a large multispecies analysis without at least pointing out the relevance of the recommendation to the Gulf of Maine haddock stock.

The research recommendation about developing CPUE/LPUE indices for use in an assessment is of concern. As this WG found, frequently such indices simply follow the condition of the fishery and not stock status. When stocks decline, fisherman have found ways to maintain high CPUE. This approach might work, however, for nontarget/bycatch species.

The various stock recruitment research topics are particularly germane to this stock and are strongly supported by the Panel.

The Panel **suggests** that the SAW59 recommendation that “further advice from the Council SSCs is needed to advance the application of multi-model inference and risk evaluation in Northeast Region stock assessments” be refined so that the advice requested from the NEFMC SSC is clear.

It is good to see the recommendation that multiple Northeast Region haddock assessments be conducted at the same time, but the Panel **suggests** that the WG should have also considered a single haddock assessment as a contrast. Given the countervailing trends in retrospective patterns for the GoM and GB assessments, it would be interesting to see if the pattern disappeared in a combined analytic model. Alternatively, there are ways that the GoM and GB models can be linked Albertsen et al. (2018); more details will be provided in the Panelist reports.

The Panel strongly supported all four of the WG research recommendations.

8. *Develop a “Plan B” for use if the accepted assessment model fails in the future.*

The Panel agrees that this TOR has been met.

The logic for the selection of the PlanBsmooth works well; the results of the Index Methods WG indicating this approach worked as well as any other Index Based method was important.

The Panel **recommends** that future research and management track assessments consider the use of an alternative analytic approach, given that Index Based methods limit the management advice that can be provided (e.g., no Status Determinations or projections).

9. *Review and present any research related to recruitment processes (e.g., spawning and larval transport, and retention), and potential hypotheses for large recruitment events.*

The Panel agrees (with some reservations) that this TOR has been met.

The Panel noted that the research was reviewed and presented but there was no hypothesis presented to explain large Gulf of Maine (GoM) recruitment events (e.g., the 2013 year-class) and as a result the Panel **recommends** that future research consider this gap in knowledge. More

specifically, the evaluation of the impact of the fall bloom should be updated for the GoM as it was for Georges Bank (GB) haddock. The previous evaluation of the fall bloom did not consider the 2013 recruitment event.

The apparent synchrony in large recruitment events between the GoM and GB stocks suggested the question of whether these are truly separate stocks. While this separation may be useful for management, it may not be biologically significant.

10. Review and present any research related to density-dependent growth.

The Panel agrees that this TOR has been met.

As a general comment, it is always hard to parse out the different influences on growth of density dependence versus environment versus genetics. While the data presented strongly suggests density dependent effects on growth have been observed, the Panel thought it was odd that the 2013 year-class did not show stronger density dependent effects.

The analysis presented on density-dependent growth, while useful, was very visual and qualitative. The Panel **recommends** that a more comprehensively quantitative and statistical modelling approach be taken to this analysis, which would strengthen the possible inference. This would further support TOR5.

3. Additional Panel Recommendations

Overall, the Panel thought the Gulf of Maine haddock assessment and the new research track review process were well done. The Panel has several additional recommendations - some for research and for the research and management track process.

The Panel **recommended** previously in this report further research into:

- Use of a two-fleet model in the assessment.
- Evaluation of bias resulting from five-year averaging of Weights at Age for Biological Reference Points (WAA) and development of a quantitative cohort-based model to replace averaging for estimation of WAA.
- Use of variable natural mortality (M) to incorporate age-class differences and system dynamics (including the effect on management advice);
- The appropriateness of the F40% proxy;
- Use of analytic models rather than Index Based approaches for alternative (Plan B) management advice; and
- Generation of testable hypotheses to explain recruitment variability in the Gulf of Maine (including an updating of the fall bloom relationship to recruitment)
- A quantitative and statistical modelling approach to the analysis of density dependent growth

With respect to the modeling effort, the Panel **recommends** the research track should typically consider multiple analytic assessments models using different model forms with diagnostics provided for rejected models. Once this process is developed an ensemble approach to the modeling might be appropriate. The Panel recognizes and endorses the thematic research track project focused on state-space modeling.

The Panel **recommends** the NEFSC consider adjusting the management track process to allow a research track accepted analytic model that was rejected in the management track to be re-considered in a subsequent management track Enhanced Review. This would allow an “on ramp” back to analytic assessments with updated data or inputs, after the “off ramp” to an Index Method was required to deal with a rejected analytic model.

Appendix 1 - Terms of Reference for Research Track Gulf of Maine Haddock Stock Assessment

1. Review existing research efforts, data, and habitat information in the Gulf of Maine and Georges Bank, identify any findings relevant to influences of ecosystem conditions on haddock, and consider those findings, as appropriate, in addressing other TORs. For processes that the working group deems important and promising that are not currently feasible to consider quantitatively, describe next steps for development, testing, and review of quantitative relationships and how they could best inform assessments.
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 being used in the assessment (e.g., indices of relative or absolute abundance, recruitment, state surveys, age-length data, etc.). Characterize the uncertainty in these sources of data.
4. 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 model and evaluate the strength and direction of any retrospective pattern(s) in both the current and the previously accepted model. Enumerate possible sources of the retrospective patterns and characterize plausibility, if possible.
5. Update or redefine status determination criteria (SDC point estimates or proxies for B_{MSY} , $B_{THRESHOLD}$, F_{MSY} and MSY) and provide estimates of their uncertainty. If analytic model-based estimates are unavailable, consider recommending alternative measurable proxies for BRPs.
6. Define the methodology for performing short-term projections of catch and biomass under alternative harvest scenarios, including the assumptions of fishery selectivity, weights at age, maturity, and recruitment.
7. Review, evaluate and report on the status of the Stock Assessment Review Committee (SARC) and Working Group research recommendations listed in most recent SARC reviewed assessment and review panel reports. Identify new research recommendations.
8. Develop a “Plan B” for use if the accepted assessment model fails in the future.
9. Review and present any research related to recruitment processes (e.g., spawning and larval transport, and retention), and potential hypotheses for large recruitment events.
10. Review and present any research related to density-dependent growth.

Appendix 2 - Agenda for Gulf of Maine Haddock Research Track Assessment Peer Review meeting, January 25-27, 2021

Tuesday, January 25, 2022

Time	Topic	Presenter(s)	Notes
10 a.m. - 10:15 a.m.	Welcome/Logistics Introductions/Agenda/Conduct of Meeting	Michele Traver, Assessment Process Lead Russ Brown, PopDy Branch Chief Richard Merrick, Panel Chair	
10:15 a.m. - 11:45 a.m.	TOR #3	Charles Perretti	Survey Data
11:45 a.m. - 12 p.m.	Discussion/Summary	Review Panel	
12 p.m. - 12:15 p.m.	Public Comment	Public	
12:15 p.m. - 12:45 p.m.	Lunch		
12:45 p.m. - 2:15 p.m.	TOR #2	Charles Perretti	Catch Data
2:15 p.m. - 2:30 p.m.	Discussion/Summary	Review Panel	
2:30 p.m. - 2:45 p.m.	Public Comment	Public	
2:35 p.m. - 3 p.m.	Wrap up	Review Panel	
3 p.m.	Adjourn		

Wednesday, January 26, 2022

Time	Topic	Presenter(s)	Notes
10 a.m. - 10:15 a.m.	Welcome/Logistics	Michele Traver, Assessment Process Lead Richard Merrick, Panel Chair	
10:15 a.m. - 11:15 a.m.	TORs #1, #9, and #10	Charles Perretti	Ecosystem, Recruitment Processes, and Density Dependent Growth
11:15 a.m. - 12:15 p.m.	TOR #4	Charles Perretti	Mortality, Recruitment and Biomass Estimates
12:15 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. - 1:15 p.m.	Lunch		
1:15 p.m. - 2:15 p.m.	TORs #5 and #6	Charles Perretti	BRPs and Projections
2:15 p.m. - 2:30 p.m.	Discussion/Summary	Review Panel	
2:30 p.m. - 2:45 p.m.	Public Comment	Public	
2:45 p.m. - 3 p.m.	Wrap up	Review Panel	
3 p.m.	Adjourn		

Thursday, January 27, 2022

Time	Topic	Presenter(s)	Notes
10 a.m. - 10:15 a.m.	Welcome/Logistics	Michele Traver, Assessment Process Lead Richard Merrick, Panel Chair	
10:15 a.m. - 11:15 a.m.	TORs #8 and #7	Charles Perretti Brian Linton	Alternative Assessment Approach and Research Recommendations
11:15 a.m. - 11:30 a.m.	Discussion/Summary	Review Panel	
11:30 a.m. - 11:45 a.m.	Public Comment	Public	
11:45 a.m. - 12:45 p.m.	Wrap up	Review Panel	
12:45 p.m.	Adjourn		

Appendix 3 - Performance Work Statement (PWS) - Center for Independent Experts (CIE) Program - Gulf of Maine Haddock 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 standards¹. 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 Gulf of Maine haddock 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.

Requirements

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

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 Haddock Research Track Working Group.

The Peer Review Panel (co)Chair, with the assistance from the reviewers, will write the Peer Reviewer Summary Report. Each reviewer and the (co)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 (co)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 (co)chair will take the lead in editing and completing this report. The (co)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).

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 February 11, 2022. Each reviewer’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.

Within 2 weeks of award	Contractor selects and confirms reviewers
Approximately 2 weeks later	Contractor provides the pre-review documents to the reviewers
January 25-27, 2022	Panel review meeting
Approximately 2 weeks later	Contractor receives draft reports
Within 2 weeks of receiving draft reports	Contractor submits final reports to the Government

* The Peer Reviewer Summary Report will not be submitted to, reviewed, or approved by the Contractor.

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.

Appendix 4 - Materials provided or referenced during the Gulf of Maine Haddock Research Track Stock Assessment Peer Review meeting:

Albertsen, C., A. Nielsen, and U. Thygesen, 2018. Connecting single-stock assessment models through correlated survival. *ICES Journal of Marine Science*. 75: 234-244.

Northeast Fisheries Science Center. 2014. 59th Northeast Regional Stock Assessment Workshop (59th SAW) Assessment Report. US Dept Commer, Northeast Fish Sci Cent Ref Doc. 14-09; 782 pp. Available from: National Marine Fisheries Service, 166 Water Street, Woods Hole, MA 02543-1026. CRD14-09

Northeast Fisheries Science Center. 2019. Gulf of Maine haddock 2019 Assessment Update. Unpubl. Rpt. 10 pp. https://apps-nefsc.fisheries.noaa.gov/saw/sasi/sasi_report_options.php

Northeast Fisheries Science Center. In Review. Final Report of the Haddock Research Track Assessment Working Group. Unpubl. Rpt. 65 pp. https://apps-nefsc.fisheries.noaa.gov/saw/sasi/sasi_report_options.php

Appendix 5 - Meeting attendees at the Gulf of Maine Haddock Research Track Stock Assessment Peer Review meeting

NEFSC - Northeast Fisheries Science Center
GARFO - Greater Atlantic Regional Fisheries Office
NEFMC - New England Fisheries Management Council
DFO - Department of Fisheries and Oceans (Canada)
SMAST - University of Massachusetts School of Marine Science and Technology
MADMF - Massachusetts Division of Marine Fisheries
MEDMR - Maine Department of Marine Resources
MAMFI - Massachusetts Marine Fisheries Institute

Richard Merrick - Chair
Coby Needle - CIE Panel
Anders Nielsen - CIE Panel
Kevin Stokes - CIE Panel

Russ Brown - NEFSC
Michele Traver - NEFSC

Abby Tyrell - NEFSC
Alex Dunn - NEFSC
Alex Hansell - NEFSC
Andy Jones - NEFSC
Angela Forristall - NEFMC Staff
Ashok Deshpande - NEFSC
Brian Linton - NEFSC
Catriona Regnier-McKellar - DFO
Chad Demarest - NEFSC
Charles Adams - NEFSC
Charles Perretti - NEFSC
Daniel Caless - GARFO
Dave McElroy - NEFSC
Deidre Boelke - NEFMC staff
Elizabeth Etrie - NEFMC Member
George Lapointe - George Lapointe Consulting LLC
Jamie Cournane - NEFMC Staff
Jason Boucher - NEFSC
John Couture - Unama'ki Institute of Natural Resources, Nova Scotia, Canada
Jon Deroba - NEFSC
Julie Nieland - NEFSC
Kathy Sosebee - NEFSC
Kelly Kraska - DFO
Kevin Friedland - NEFSC
Liz Brooks - NEFSC
Liz Sullivan - GARFO

Mark Grant - GARFO
Mark Terceiro - NEFSC
Matthew Cutler - NEFSC
Melanie Griffin - MAMFI
Michael Pierdinock - NEFMC Member (from MA)
Mike Simpkins - NEFSC
Monica Finley - DFO
Paul Nitschke - NEFSC
Rebecca Peters - MEDMR
Rick Bellavance – NEFMC Member; Captain, Priority Fishing Charters (RI)
Robin Frede - NEFMC Staff
Ryan Morse - NEFSC
Scott Large - NEFSC
Steve Cadrin - SMAST
Tara Trinko Lake - NEFSC
Toni Chute - NEFSC
Tom Nies - NEFMC Director
Xavier Mouy - NEFSC
Yanjun Wang - DFO