Stock Assessment Process and Modeling Program Review
Northeast Fisheries Science Center Summary and Response
August 2014

Introduction

In May, 2014, six peer reviewers evaluated the Northeast Fisheries Science Center’s (NEFSC’s) processes and modeling approaches used to develop stock assessments in support of the Magnuson-Stevens Fishery Conservation and Management Act (MSA) as reauthorized in 2006. This review focused on the overall program of assessment modeling, the use and evaluation of various assessment methods, the Center’s assessment review processes, and the extent and adequacy of communications/interactions with the Center’s partners, clients, stakeholders, and other users of our stock assessment results. The reviewers were asked to consider NEFSC’s stock assessment program, processes, and modeling approaches within eight themes (or terms of reference --TORs), which are discussed in the body of this memorandum. The panelists were:

- John Armor (Chair), NOAA National Ocean Service
- Mark Dickey-Collas, International Council for the Exploration of the Sea
- Patricia Livingston, NOAA Fisheries/Alaska Fisheries Science Center
- Gunnar Stefansson, University of Iceland
- Jon Helge Vølstad, Institute of Marine Research, Norway
- Stephen Walsh, Department of Fisheries and Oceans, Canada

Center scientists and partner organizations provided the review panel with presentations and information relevant to each of the themes. Each reviewer subsequently provided a report documenting observations, findings, and recommendations. The chair’s report summarized and synthesized comments provided by the entire panel.

The Center has established a public website for its program reviews. Here you will find meeting information, documents, presentations, review panel reports, and panelists’ resumes for both this review and the 2013 review of the NEFSC stock assessment data collection programs: http://www.nefsc.noaa.gov/program_review/

The reviewers were presented with a wealth of information covering all aspects of our stock assessment program. I would like to express my appreciation to Center staff and others who prepared documents and presentations for the review and otherwise ensured that we were well-prepared and responsive to the reviewers’ needs. I would also like to thank the reviewers for their committed and insightful participation and for their comments and suggestions, both during the proceedings and in their written reports. This review was open to the public and I am grateful to our partners and stakeholders who participated and contribute positively and constructively to the process.

Readers of this document should be aware of the role of the Northeast Regional Coordinating Council (NRCC) in planning, prioritizing, and overseeing the Center’s MSA stock assessment activities. The NRCC consists of the leadership of the Center and the Center’s four primary management partners: the Atlantic States Marine Fisheries Commission (ASMFC), the NOAA Fisheries Greater Atlantic Fisheries Office (GARFO), the Mid-Atlantic Fishery Management Council (MAFMC), and the New England Fishery Management Council (NEFMC).

Promoting Innovation and Increasing Efficiency

The reviewers provided strong positive feedback regarding the quality and integrity of the Center’s stock assessment processes and products, as well as on the productivity, commitment, and professionalism of the Center’s stock
assessment staff. Activities carried out by the Center in support of MSA requirements are among our highest priorities and I am very pleased to see us receive this type of recognition. Nevertheless, there is opportunity and need for substantive improvement to address public confidence in the results of our assessments, to invest in research and development of methodological improvements, to develop and implement changes that recognize the importance of an ecosystem approach to fisheries management, and to improve our efficiency and our responsiveness to management needs.

A key issue, relevant to all areas of the review and articulated repeatedly by the reviewers, is that the Center’s assessment staff are severely overburdened by demands for stock assessments, related analytical products, and regulatory support. Furthermore, reviewers recognized that failing to address this overarching concern presents risks. They emphasized that our stock assessment system has become “overly complicated,” and that unsustainable demands placed on the Center’s stock assessment scientists may compromise “the quality and timing of the advice provided to fishery management authorities.” We agree with the reviewers’ observations that demands placed on stock assessment scientists also preclude them from engaging in research to improve stock assessments or otherwise develop their professional skills. We will take a series of steps to remedy this situation.

The eight themes, or TORs, for this review address different aspects of our work to provide sound scientific advice for fisheries management. However, the individual themes interconnect in many ways and this was evident in the discussions and in the reviewers’ reports. Therefore we begin by proposing a series of overarching, multi-thematic measures as elements of a strategic approach to reform our stock assessment enterprise. In some cases these measures also support broader, Center-wide change. Later in the document, I will return to the individual TORs and some specific concerns. Please note that some of the following initiatives are already underway and will be informed by the results of this review, while others will be initiated in the coming months.

1. **NEFSC Strategic Science Planning.** The Center is developing a new strategic science plan. Through this process, we are reviewing and updating our research priorities. We are also seeking ways to break down barriers that currently hinder interdisciplinary science and crosscutting research. Upon completion of the new plan, we will review the Center’s organizational structure and, potentially, make changes to address this need. During this process we will consult broadly with partners, stakeholders and staff.

2. **Improvements in Fishery Dependent Data and Information Systems - Developing an Integrated and Comprehensive Fishery Dependent Data System (Data Visioning Project).** Our ability to complete stock assessments in a timely and accurate manner is greatly constrained by antiquated and poorly integrated data collection and management systems that have evolved over time to meet changing needs for management and stock assessment. We recognize the importance of building a new, integrated state-of-the-art system that will greatly improve data quality and timeliness. We are working with the GARFO and other partners on this multi-year initiative. I am confident that this process will greatly improve efficiency and bring substantive improvements in stock assessment quality and timeliness.

3. **Improvements in Stock Assessment Process and Efficiency**

   a. **Stock Assessment Process Efficiency Initiative.** This program complements the Data Visioning Project. It is designed to streamline the preparation of data inputs to stock assessment models, focus the model outputs for management decisions, and simplify the internal review process while ensuring adequate oversight and quality control. The goal is to provide more timely information for management. Standardized databases for processed fishery-independent and fishery-dependent data are under development. We will also identify ways to reduce and simplify the document preparation workload, while improving communication with interested stakeholders. This is an ongoing project, and some process improvements have already been implemented.

   b. **Assessment Staff Time-Budgeting.** The demand for stock assessment advice exceeds our current capacity to provide it. To ensure that the Center is responsive to NRCC partners and that some fraction of staff time is available for research and professional development, we will work with the NRCC to implement a new approach to allocating staff time. We will create a staff time-budget composed of the estimated number of staff days available per year to conduct stock assessments and to respond to other analytical requests, and the number of days available per year for each assessment scientist to conduct research, professional development, and administrative duties. We will work with the NRCC to allocate this staff time-budget among the partners and use it to address and prioritize assessments within each partner’s budget.
c. **Stock Assessment Prioritization and Process Rationalization.** NMFS is drafting a national stock assessment prioritization process that uses objective criteria to guide frequency, timing, and level of analytical approach for assessment of individual stocks. We will work with the NRCC to develop and implement a similar framework for the Northeast Region, and to reinitiate a plan for rationalizing the regional stock assessment process that was first proposed in 2011. Together with the aforementioned assessment budgeting proposal, we expect this will lead to a more consistent and efficient approach for determining the type of assessment that is appropriate and necessary for a specific stock, as well as to determine assessment frequency and timing.

d. **Regulatory Support Management.** We will work directly with the Councils to better manage staff participation on Plan Development Teams and Fishery Management Advisory Teams, and in providing review and analytical support related to development of regulatory documents. When possible, we will seek staff expertise from Center research groups that are not heavily utilized to address GARFO and Council needs. We will also strive to better balance responsibilities and workload associated with these functions among staff from the NRCC partners.

4. **Management Strategy Evaluation/Management Procedures (MSE/MP).** Management Strategy Evaluation (MSE), or the Management Procedure (MP) approach, is designed to identify and operationalize fishery management strategies that are robust to several types of uncertainty and capable of balancing multiple economic, social, and biological objectives. Many of the panelists for this review, as well as those for the 2013 review, recommended the use of MSE approaches for evaluating alternative sampling methodologies and data processing strategies, structural uncertainty in assessment models, and analyses of harvesting policy alternatives. These approaches will also provide tools for NRCC partners to use in analyzing the risks of alternative management actions. MSE requires cross-disciplinary expertise in mathematics, statistics, and decision theory, as well as large-scale computer simulations and database management. In coordination with a similar national effort, we will develop an initiative to establish a cross-cutting MSE capacity in the Center and bring resources to bear in developing the necessary skills. Initial funding for this initiative will be provided in FY15. We expect this innovation to bring multiple benefits, including improved ability to make staffing and other Center resource allocation decisions (such as data collection resources) relative to both assessment and management uncertainty.

5. **Incorporating Ecosystem Processes into Stock Assessments.** The Center is working with NRCC partners to bring broader ecosystem considerations into MSA stock assessments as we move toward a more integrated, ecosystem approach to fisheries management. Center staff are working with both Councils on how best to meet this challenge. Within the Center we have established a Climate, Ecosystem, Habitat, and Assessment Steering Group (CEHASG), which includes representation from all Center Science Divisions and Programs. The steering group is working on protocols for drafting ecosystem and climate TORs to be considered during benchmark stock assessments. We have already demonstrated some success in this regard. Through our strategic planning, we will work on ways to break down barriers within the Center that impede our ability to bring a more holistic approach to the stock assessment process. We will also consider how best to meet information needs for this approach. In the coming fiscal year, the Center plans to develop and test a multispecies stock assessment model and to evaluate the potential for deriving management advice from this type of approach.

**Reviewer’s Comments on Specific Themes and Proposed Solutions**

**Does the Center apply a suitable scientific/technical approach to fishery stock assessment modeling?**

Panelists found the Center’s approach generally suitable and that Center scientists are working on improvements. However, they expressed concerns regarding the complexity of the review process leading to management advice and the heavy burden placed on stock assessment scientists, which in turn limits opportunities for investigating new modeling techniques and provides few opportunities to work on improving existing models. They also expressed concern about reliance on the NOAA Fisheries Stock Assessment Toolbox.

The panelists recommended moving forward with the assessment staff time-budgeting concept, ensuring that emphasis is placed on setting aside sufficient time for staff to engage in essential research, methods development,
training, and professional development. We agree with this recommendation and will begin working with the NRCC to develop and implement the concept.

The Center is participating in a national effort to improve the NOAA Fisheries Toolbox and to secure a programmer to develop the next generation of stock assessment models. We will continue internal efforts to improve and support existing modeling software and to add new software when appropriate. We will also continue to test the integrated modeling approaches and various state-space models such for stock assessments in the Northeast.

**Is the assessment process efficient, effective and clearly described, including terms of reference for assessment reports?**

Panelists found the assessment process to be highly complex, inefficient, and burdensome. They observed differences in the way that assessment processes are described among regional and fishery management plans and noted the potential for adding complex (and perhaps unnecessary) TORs for stock assessments. They noted that inefficiencies in the assessment process are caused mostly by problems with data-streams, excessive reporting demands, and an overly complex and time-consuming meeting schedule related to the peer-review process.

Panelists recommended reducing the number of TORs, and moving some to a research-only (benchmark) track. Those moved to the research track would only be brought forward as a formal TOR when ready for inclusion in an assessment. They also recommended instituting an improved, automated fishery-dependent data collection and transfer system to minimize lags in delivery times, as well as streamlining the assessment process to improve delivery of scientific advice. In particular, they recommended moving forward with improvements described under our Stock Assessment Prioritization and Process Rationalization initiatives.

We concur with these recommendations. In addition to our Prioritization and Rationalization Initiative, our Data Visioning Project, Stock Assessment Process Efficiency Initiative, and MSE initiative address concerns raised under this theme. In particular, we will conduct the following two projects under the MSE initiative:

- Conduct a comprehensive evaluation of the monitoring program for biological samples. A primary focus will be on the effective sample size of current designs for estimation of catch-at-age, length frequencies, and other biological information such as maturity and sex.
- Investigate methods to automatically process age-length keys to estimate catch-at-age

**Does the Center, in conjunction with other entities such as the Councils’ Scientific and Statistical Committees, have an adequate peer review process?**

In general, panelists found the peer review process to be thorough and appropriate. However, they identified some possibilities for improvement through streamlining to enhance timeliness of scientific advice. They cautioned that improvements should not compromise the independence of the reviews. They noted potential problems resulting from lack of continuity among reviewers (i.e., always bringing new and different Center for Independent Experts (CIE) reviewers to assessments of the same or similar stocks), and functional differences between the NEFMC and MAFMC Scientific and Statistical Committees (SSCs), control rules, and criteria for acceptance of assessments. The specific responsibilities and skills of CIE reviewers were also the subject of some reviewers’ comments, with suggestions that these types of reviewers are best at evaluating assessment methodology, but less likely to understand regional or local conditions that may influence stock dynamics.

Panelists recommended keeping at least one CIE reviewer at consecutive reviews of the same stock, or having an SSC member chair the assessment meetings (as is done currently in some cases). They also underscored the importance of the role the SSC chair plays, or should play, to ensure reviewers understand the results and recommendations from the previous assessments, and that they focus on the primary TORs and requirements for setting acceptable biological catch (ABC) and overfishing limits (OFLs). We acknowledge the concerns expressed by the panelists and will determine whether some changes can be made in the contract with the CIE in response. We will also work with the Councils and SSCs, directly and through the NRCC, to address concerns regarding unnecessary TORs and/or prioritization of TORs.
Does the Center work effectively internally and in coordination with the NEFMC, MAFMC, ASMFC, and GARFO to accomplish needed assessments according to a set of priorities?

Panelists felt that priority-setting should be improved and better coordinated to improve the stock assessment process at the Center. In particular they felt that the NRCC has not been effective in prioritizing stock assessments objectively. They were also concerned that the efficiency of stock assessment scientists is compromised by requirements for them to attend numerous scientific review and regulatory support meetings.

Panelists recommended considering whether non-stock assessment personnel could participate in Plan Development Teams to free up stock assessment scientist time. NEFSC research could still be brought to bear to assist in analyses, but in some cases Council or GARFO staff could play a greater role than they do at present. They also recommended managing the time spent on assessment work by individual staff members through the assessment budgeting approach.

Many of the broad-based initiatives described earlier are responsive to these concerns. In particular, through the Stock Assessment Process Efficiency Initiative, we will work with the NRCC to improve the utility of assessment reports while providing the information necessary for the SSCs to properly evaluate risk and uncertainty. We will ensure that we meet the needs of GARFO for determination of stock status, rebuilding plans, and reporting to national databases. We will also continue our active engagement with the two regional SSCs to ensure that we tailor assessment outputs for direct use in setting ABCs and annual catch limits.

Does the Center achieve adequate assessment accomplishments relative to mandates?

Most panelists expressed satisfaction that the Center’s stock assessments were meeting the demands of managers. However, many felt some streamlining was needed to sustain the current level of service. They expressed concerns over the impacts on the timeliness of assessments caused by inadequate fishery-dependent data systems and data delivery lag times. They also suggested that research recommendations emanating from stock assessments be reviewed and prioritized through the NRCC.

The Data Visioning Project is directly responsive to concerns about data quality and timeliness, although it should be noted that many current fishery data collection systems were not designed to meet the spatial (and, in some cases temporal) resolution needs required for some management programs. Inadequate spatial resolution can be constraining in stock assessment as well. These concerns will be discussed within the NRCC, since it is important that we have a mutual understanding of the limitations of existing monitoring and sampling programs, and that increases in data collection and monitoring will be achieved at the expense of other Center priorities.

Does the Center have an effective process in place for taking ecosystem and climate change factors into consideration in the stock assessment process?

Panelists felt that the initial steps taken by NEFSC on the ecosystem approach to fisheries management were encouraging. Some felt that incorporation of ecosystem considerations is currently most appropriate for strategic advice, rather than operational annual advice, and that reference points should reflect the reality of the ecosystem dynamics. It was also remarked that lack of research resources for developing modeling approaches and inadequate resources for ecosystem surveys were problematic. They recommended that ecosystem surveys be funded to the extent possible. They also recommended better integration among stock assessment and ecosystem assessment scientists to encourage modeling and methods development, better implementation of tools for spatial analysis, and a more holistic approach to stock and ecosystem assessment. NEFSC concurs with these concerns and recommendations. Funding and prioritization for ecosystem surveys must be considered together with other funding and prioritization challenges but we will endeavor to maintain an adequate investment in these activities.

We will continue to advance our work in this area through the CEHASG, and by encouraging Center branches and programs to contribute data and analysis and participate in working groups focused on incorporating ecosystem and climate factors into stock assessments. Through our strategic planning, we will examine approaches supporting more interdisciplinary science within the Center (and with our partners) and we will consider organizational change to facilitate this need. We also view the MSE initiative as a powerful opportunity to address the multidisciplinary research and data collection that is necessary to move us toward integrated ecosystem science and assessment, as well as to evaluate strategies and set priorities.
Does the Center adequately engage stakeholders in the stock assessment process and communicate assessment-related results, needs, and research to them effectively?

Panelists felt the Center does a good job communicating with stakeholders and others about the stock assessment process and related results although they did suggest that more dialog would be beneficial. They suggested that the NRCC should play a greater communications role during the assessment process and with the general public. They also suggested that the closed report-writing period of the Stock Assessment Review Committee be made open to the public. We will work with the NRCC to follow up on the suggestion regarding their role in communication. We will also work with the CIE on making the report-writing sessions open to the public.

Regardless of the panelists’ positive comments, the Center is subject to criticism from stakeholders regarding opacity in the stock assessment process and in communicating results. We take these concerns seriously. Within our Stock Assessment Process Efficiency Initiative we will evaluate how well we communicate process and results to stakeholders. We will also develop improved communications approaches, using both web-based and paper-based approaches.

Are there opportunities for improving stock assessments and the stock assessment process?

Panelists offered many suggestions for improving the Center’s stock assessment process. These include streamlining and improving assessment process efficiency, developing and implementing an effective and objective process for prioritizing assessments and assessment TORs, and use of MSEs to evaluate alternative sampling and assessment strategies. They also recognized that improvements can only be made by working closely with our assessment partners through the NRCC. Some very specific recommendations focused on research priorities and areas of expertise. In particular, panelists recognized the importance of addressing research needs identified during assessments in a manner that supports information needs for subsequent assessments and in improving the fishery-dependent information systems that support the Center’s assessments. One comment, reiterating a theme articulated throughout the review, deserves direct quotation:

*It is extremely important for assessment personnel to also be researchers, actively publishing research papers. The assessment scientists thus need to be given time for this purpose. This is not for academic reasons, but for personal development and simultaneously keeping assessment methods up-to-date. Most assessments automatically include some new development. Such developments must be evaluated for adequacy and their effects and these tests commonly lead to results, which can and should be published in scientific journals.*

All of these concerns and suggestions and others raised under this TOR have been discussed in our description of initiatives or in responses to panelists’ comments and recommendations related to individual TORs. All of the initiatives are responsive to the reviewers’ guidance on the need and opportunity for change and improvements, and the results of this review will be considered carefully as we move forward with each initiative. Of very high priority among these initiatives are the need for stock assessment prioritization and process rationalization and the related need for assessment budgeting that recognizes the importance of providing dedicated time for research and professional development of stock assessment staff.

Closing Comments

This was a rigorous review that asked a great deal of Center staff, partners and, of course, the review panel. I consider it to have been a worthwhile and productive exercise both for the reviewers’ assertion that we are performing stock assessment responsibilities well under difficult conditions and for their constructive guidance, creative suggestions and enthusiastic support for initiatives that are either underway or were discussed during the review. The program of reform and improvement proposed here is essential to the overall success of the Center as well as our ability to meet burgeoning needs for assessment and management advice from our NRCC partners. I am committed to moving forward with our initiatives and to addressing the specific concerns as outlined above. Senior staff will be assigned lead responsibilities for initiatives and specific actions and we will report back on progress annually, through the Center’s web site.
Table 1: Summary of Major Action Items and Schedules

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<th>Action Item</th>
<th>Schedule</th>
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<tr>
<td>Develop and implement an assessment staff time budgeting process</td>
<td>Initial presentation and discussion will occur in October 2014, with full implementation expected in 2016</td>
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<tr>
<td>Participate in national effort to improve the NOAA Fisheries Toolbox</td>
<td>New hire to support this effort in 2015</td>
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<td>Evaluate integrated modeling and state-space models</td>
<td>New integrated modeling approach presented at ICES in 2014, and further developments will occur in 2015</td>
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<tr>
<td>Improve fishery-dependent data quality and timeliness</td>
<td>Target date for full implementation is May 2017</td>
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<tr>
<td>Implement NEFSC Stock Assessment Process Efficiency Initiative</td>
<td>Initial implementation in 2015 for 20 groundfish stocks, further refinement will occur in 2016</td>
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<tr>
<td>Implement NEFSC Management Strategy Evaluation Initiative</td>
<td>First two MSE projects will be completed in FY16, and additional projects will occur over several years</td>
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<td>Implement standardized stock assessment prioritization process and re-initiate plan for rationalizing the regional stock assessment process</td>
<td>Initial discussions with NRCC in 2014, full implementation over a two-year period.</td>
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<td>Improve management of staff participation in Council teams and committees, and in review and analytical support related to the regulatory process</td>
<td>Discussions between GARFO and NEFSC have been initiated, improvements expected over a two-year period.</td>
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<td>Strive to keep at least one CIE reviewer at consecutive reviews of the same stock, and have an SSC member chair each assessment meeting. Work with the CIE to open the SARC report-writing session to the public.</td>
<td>NEFSC will work with the CIE and the Councils in 2015 to determine if these changes can be made for 2016</td>
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<td>Work with the Councils and SSCs to address concerns regarding unnecessary ToRs and prioritization of ToRs</td>
<td>Ongoing. Initial improvements are expected with standardized assessment of 20 groundfish stocks in 2015</td>
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<tr>
<td>Bring broader ecosystem considerations into stock assessments</td>
<td>Work internally and with partners on draft protocols for ecosystem and climate ToRs, to be implemented initially in 2015</td>
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<tr>
<td>Develop and test multispecies stock assessment models and evaluate of their potential for supporting management advice</td>
<td>Ongoing. Evaluation and recommendations expected in 2016</td>
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<tr>
<td>Improve communication with stakeholders on the assessment process and its results</td>
<td>During 2015, review and develop a plan for improved communication for implementation will in 2016. Initial discussions with NRCC on enhancing their role in this process will occur in 2014.</td>
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