



NOAA Fisheries Stock Assessments in 2014: Program Review and Plans for Advancements and Improvement

Background

Scientific integrity is a fundamental element of the process by which NOAA delivers the best available science and earns the public's trust in our science and management. To this end, NOAA has drafted a policy to uphold the principles of scientific integrity contained in the President's March 9, 2009, Memorandum and in the December 17, 2010, Memorandum on Scientific Integrity¹ from John Holdren, Director of the White House Office of Science and Technology Policy. NOAA considers peer review an essential element of this policy and considers these reviews to be an opportunity for scientific exchange, while maintaining and improving standards, improving performance, and increasing scientific credibility.

Peer reviews are an important feedback mechanism needed to provide fresh ideas and contributions toward constantly improving fisheries science programs. NOAA Fisheries provides opportunities for peer reviews at multiple levels (<http://www.st.nmfs.noaa.gov/science-quality-assurance/index>). In the 2013 response² to the Stock Assessment Data and Management review, we outlined the suite of peer-review processes NOAA Fisheries uses to ensure the quality of its scientific products, including but not limited to:

- Internal peer review of Fundamental Research Communications (including both internal and external scientific manuscripts, abstracts, and other media).
- External peer review of fishery stock assessments through region-specific panels (e.g., the SAW/SARC process in the Northeast region) and Regional Fishery Management Councils' Scientific and Statistical Committees.
- External review of marine mammal stock assessments by the three Marine Mammal Protection Act Scientific Review Groups.

This approach to peer reviews ensures that all research communications are properly vetted.

Historically, all NOAA Fisheries Science Centers and the headquarters Office of Science and Technology (OST) have conducted program-specific reviews for a variety of reasons. To this we added in FY 2013 the Science Program Reviews³ as the overarching and systematic national approach to peer review that ensures the NOAA Fisheries science enterprise is being properly conducted. Such an approach complements oversight by NOAA's Science Advisory Board and its Ecosystem Science and Management Working Group, which provide overarching thematic reviews of NOAA science by adding advice specifically geared toward individual Science Centers and OST. Through continued use of this agency-wide peer-review process, NOAA Fisheries will more effectively standardize and advance science nationally, and provide guidance for future science investments.

This document serves several purposes:

- Provides an overview of how NOAA Fisheries' Science Program reviews were conducted in FY 2014.
- Summarizes the key issues reviewers identified during the FY 2014 reviews.
- Presents a national-level response for those issues identified during three or more of the reviews.

¹ <http://nrc.noaa.gov/ScientificIntegrityCommons.aspx>

² http://www.st.nmfs.noaa.gov/Assets/science_program/NationalProgramReviewResponse_3_10_14_Final.pdf

³ <http://www.st.nmfs.noaa.gov/science-program-review/>

The FY 2014 Science Program Reviews

The Science Program Reviews proposed in FY 2011 and first implemented in FY 2013 allow NOAA Fisheries to evaluate its science programs across all regions simultaneously. As a part of this process, a national strategic planning effort (as a baseline for the reviews) was conducted in FY 2012 to facilitate the incorporation of results from the program reviews into operations.⁴

During FY 2012, the individual Science Centers and OST developed a preliminary 5-year schedule:

- FY 2013 – Review of data used for fishery stock assessments
- FY 2014 – Fishery stock assessment process
- FY 2015 – Protected species science
- FY 2016 – Ecosystem approaches to management, climate, and habitat
- FY 2017 – Economics and social sciences

Fishery stock assessment reviews were split into 2 years (one for data and one for the assessment process) to ensure each received a substantive review.

The Science Centers and Office Directors worked with OST staff to develop a general review process and terms of reference⁵ for the FY 2013 and FY 2014 reviews. Each Science Center and OST then refined the terms of reference to meet their specific needs.

The seven reviews for FY 2014 were scheduled between March and September 2014 as follows:

- Alaska Fisheries Science Center – March 24–28, Seattle, WA
- Northeast Fisheries Science Center – May 19–22, Woods Hole, MA
- Pacific Islands Fisheries Science Center – May 19–22, Honolulu, HI
- Northwest Fisheries Science Center – June 10–13, Seattle, WA
- Southeast Fisheries Science Center – July 8–12, Miami, FL
- Southwest Fisheries Science Center – July 28–August 2, La Jolla, CA
- Office of Science and Technology – September 9–12, Silver Spring, MD

Review panels were chaired by a non-NOAA Fisheries scientist and generally included:

- One scientist from a NOAA Fisheries Science Center other than the one conducting the review.
- One scientist from another NOAA line or staff office (optional).
- Three to five (the majority) scientists external to NOAA.
- Science Center Director (optional, and not from the Science Center conducting the review).

All Science Centers and OST provided their panelists with briefing materials and background documents approximately 2 weeks prior to the start of the review (documents are available on the regional and OST websites).

Reviews typically began with at least a half-day of background presentations on the roles and responsibilities of OST or the individual Science Center. The next 2 to 3 days were devoted to presentations by Science Center staff on the various stock assessment programs and assessment methods used by the Science Center or OST (e.g., modeling approaches and peer-review processes). Presentations typically ended by early afternoon to allow the panel time for discussion. Public comment was solicited daily at the end of presentations for the panelists' consideration. The review concluded with 1 to 2 days devoted to the panel for follow-up discussions and report writing. The review concluded with a debriefing of the panel by the Science Center Director or OST Director.

Following the review, the Panel Chair prepared a summary report of the meeting and submitted it, with the individual panelists' reports, to the Science Center Director or OST Director. The Director forwarded these reports to the NOAA Fisheries Chief Science Advisor, along with a brief response to the Chair's summary report, usually

⁴ <http://www.st.nmfs.noaa.gov/strategic-plan/index>

⁵ <http://www.st.nmfs.noaa.gov/science-program-review/program-review-reports/index>

within 10 weeks of receiving the report package. The Science Center Director's response included action items, timelines, and clarifying information, and sometimes responded to specific points within individual reports.

Generally, within 3 months of the close of the review, all documents (Chair's summary report, Director's response, and individual reviewers' reports) were posted on the Science Center and OST program review websites (<http://www.st.nmfs.noaa.gov/science-program-review/>).

Summary of Findings from the FY 2014 Reviews

Each of the seven program reviews produced a series of Panelist recommendations and Science Center responses, which are posted on the Science Center and OST program review websites. Most of the recommendations focused on the enterprise of individual Science Centers or OST, but there were also a number of crosscutting national themes that we respond to here. Recommendations contained in three or more of the reviews are listed below, together with national-level responses.

Prioritize fishery stock assessments

The need to prioritize stock assessments in a transparent process came up in all seven reviews. Reviewers noted that NOAA Fisheries' stock assessment scientists do an exceptional job of assessing the stocks for which the agency is responsible (often with limited or problematic data) on a tight timeline and under high public scrutiny. In addition to the actual assessments, our scientists provide assessment-related analytical products and scientific support to management. However, the rate at which management needs are increasing is outstripping capacity, leading to an unsustainable trajectory for assessment demand. In a capacity-limited environment, prioritization of the level and frequency with which each stock is assessed becomes paramount.

Recommendations: Reviewers singled out a variety of specific recommendations for areas where Science Centers should work with Regional Offices, Regional Fishery Management Councils, and other relevant regional fisheries management organizations to develop mutually agreed upon processes to prioritize stock assessments. It was suggested that the prioritization process should be transparent and:

- Balance management needs and agency capacity to meet those needs.
- Set clear targets for assessment frequency and timing.
- Define criteria for benchmark⁶ (i.e., full) versus update (i.e., incremental) assessments.
- Evaluate short-term and long-term assessment needs.
- Consider both regional and national priorities.

Response: We agree with the reviewers' comments. NOAA Fisheries has been working on a national stock assessment prioritization process since 2011 in response to a request from the Office of Management and Budget. A working group, under the lead of the NOAA Fisheries Senior Scientist for Stock Assessment, has already developed a draft protocol for prioritizing fish stock assessments.⁷ The Government Accountability Office commented favorably on the draft prioritization process in its 2013 review of stock assessments. This protocol was released to the Regional Fishery Management Councils and the public for comment in February 2014, prior to the start of the stock assessment program reviews. The process, which addresses many of the reviewers' concerns, will establish goals for the comprehensiveness and the timelines of assessments for each stock, and will evaluate standard factors in order to establish annual priorities for conducting assessments. Reviewers were provided the draft protocol as part of the review materials or were made aware of the effort during the reviews, and provided feedback. NOAA Fisheries will consider review comments as we finalize the prioritization process and begin implementation by the end of 2015.

Action items:

⁶ The term "benchmark" is generally used when new methods and/or data types are introduced. They need full testing and a high level of peer review. "Update" is used when assessments, using previously fully reviewed methods and data types, are refreshed using additional year(s) of the same types of data. Such updates rely upon previous documentation and peer review plus limited additional review..

⁷http://www.st.nmfs.noaa.gov/Assets/stock/documents/PrioritizingFishStockAssessment_Feb2014_finaldraft.pdf

- Assemble data needed for prioritization, including fishery importance, ecosystem importance, stock biology and status, and assessment history (early 2015).
- Test prioritization system and finalize protocol (mid 2015).
- Make a database available to regional coordinating committees charged with setting priorities for regional assessments via the NOAA Fisheries Species Information System public portal⁸ (2015).
- Support and guide regional coordinating committees in applying the prioritization process, possibly through decision support system facilitators (2016).

Standardize, streamline, and simplify the stock assessment process to increase throughput

Reviewers recognized a need to improve the stock assessment process and touched on a wide range of areas that could use improvement. Generally the comments focused on ways to make the stock assessment process more streamlined and efficient without compromising the quality of the assessment. In order to achieve this, reviewers recognized a need to introduce some level of standardization in the stock assessment development and review processes. This was seen as a way to diminish the perception that most assessments are changed so dramatically each time they are done as to warrant a full benchmark review.

Recommendation: Reviewer recommendations fell into two broad categories: efforts to improve the assessment process and efforts to improve the assessment review process. In some cases reviewers suggested simplifying the assessment review processes that can become overly complicated and burdensome. In other cases reviewers recommended that newly developed review processes evolve to be efficient, respected, and opportunities for independent peer-review. More specific examples of areas that would benefit from being addressed at a national level are outlined below.

Assessment Methods and Process

- Develop standard criteria for benchmark assessments and updates and shift more assessments from benchmarks to updates.
- Standardize operating protocols for models and analytical methods that overlap among assessments. Conduct peer review of these methods and post in a central internet location, along with peer-review comments and findings. This will simplify documentation of stock assessments by referring to peer-reviewed standard methods wherever possible, and focusing on summaries of departures from standard methods and previous assessments, thus making the key differences readily accessible.
- Standardize the process of setting terms of reference (TORs) for assessments with the intention of reducing the number of TORs for the current assessment being used to provide management advice. For example, use separate TORs for setting annual catch limits (operational) from TORs aimed at long-term improvement to the assessment (research). TORs that address research and future changes to the assessment should be moved to a “research track” until ready for use in an assessment that provides management advice. Allow staff time to do research, develop new models, and conduct analyses based on TORs assigned to the research track.
- Update the NOAA Fisheries Toolbox.

Assessment Review Process

- Provide continuity between successive reviews of a stock assessment by documenting and providing sufficient history on previous reviews of assessment—during the current assessment review—to inform the next review panel.
- Separate the review of methods and data types from the review of assessment results derived from those methods and data. Separate the evaluation of research to make long-term assessment improvements from the choice of which model(s) to use in operational assessment updates.

Response: We agree with panelists’ recommendations and see the need to improve the assessment process. Review of stock assessments is conducted through Regional Fishery Management Council- and NOAA Fisheries-approved processes in each region. Standardizing processes across all regions is a major undertaking and in some instances may not meet regional needs. However, that does not diminish the utility of making changes where standardization makes sense. Moreover, regional assessment programs have developed independently over time, and methods used in one region may inform improvements in other regions.

⁸ <https://www.st.nmfs.noaa.gov/sis/>

Action Items:

- Convene a group to address: best practices to improve the efficiency of the stock assessment process, standardizing the stock assessment process and protocols, and consistent guidelines for the use of benchmark and update assessments. Input from the Regional Fishery Management Councils' Scientific and Statistical Committees will be sought. This national working group will compare and contrast existing regional TORs for stock assessments and provide advice on which aspects of assessments can be made more uniform nationally. The group will consider data-limited versus more data-rich approaches, use of multiple models, use of streamlined updating processes, and other factors (2016).
- We are currently evaluating the efficacy of the NOAA Fisheries Toolbox and plan to update it. We will consider review panelists' recommendations for updating and improving the user interface, model features, and documentation and review of model testing. Recommendations will be provided to the NOAA Fisheries Science Board by the end of 2015.

Management Strategy Evaluation

Management strategy evaluation (MSE) is a form of simulation testing that allows researchers and managers to explore the potential outcome of change in survey design, assessment approach or management before change is chosen and implemented. Recommendations from the 2013 Data Collection and Management program review suggested use of MSEs to explore short- and long-term improvements to surveys in order to better align data collection effort with assessment needs. In the 2014 stock assessment program reviews, simulation testing was again suggested to explore improvements to the evaluation of stock assessment results.

Recommendation: Reviewers again highlighted that simulation exercises would be useful to better align data collection with assessment needs, as well as some specific areas where MSEs would be useful to evaluate the stock assessment process, including use of MSEs to:

- Assess alternative sampling and assessment strategies.
- Define research and data collection needs and assessment complexity relative to the agency's efforts to implement a prioritization framework for assessments.
- Explore issues related to model performance and retrospective patterns in assessment results.
- Evaluate realistic performance of current harvest control rules and alternative data-based rules for setting catch levels, and data-rich and data-moderate assessments methods and assumptions.

Response: We agree with panelists' recommendations that MSEs and other simulation-based testing can be used to explore a variety of issues related to stock assessment, such as impact of data quality on assessment precision, alternative biological reference points, control rules and harvest strategies, and candidate environmental time series affecting stock productivity.

Action Items:

- To address recommendations from the FY 2013 Data Collection and Management program review, the NOAA Fisheries Assessment Methods Working Group is coordinating MSE studies to evaluate the impact of surveys, sample sizes, and related data questions on stock assessment performance. The Working Group will be charged with reporting and developing a schedule on MSEs that address the recommendations provided by the FY 2014 stock assessment program review (2015).
- Allocate staff time for research and funding for cross-Science Center development of MSEs and other simulation tools that will be made available through the Toolbox.
- Develop MSE expertise (through hires and training) such that at least one Subject Matter Expert is available at each Center (2016).

Retain and increase workforce capacity

NOAA Fisheries has known since the 2006 reauthorization of the Magnuson-Stevens Fishery Conservation and Management Act that there would likely be a shortage of stock assessors, as detailed in a 2008⁹ report to Congress. Nearly all the Science Centers have unfilled stock assessment positions and would like to hire more staff. The number of unfilled positions varies by region, with some Science Centers experiencing greater vacancies than others. There are varied reasons for this shortage, including a lengthy process for approval of vacancy announcements, difficulty attracting enough qualified candidates, Science Center proximity to a research university that has fisheries science graduate programs, and the amount of time allocated for staff to engage in research in addition to preparing stock assessments.

Recommendation: Reviewers recommended several approaches to address this shortage of qualified staff, coming from two perspectives: the need to retain existing staff and the need to attract new staff. Specific recommendations included:

Existing staff

- Increase scientific exchange, training, and research opportunities for current stock assessment staff, including reinstating the National Stock Assessment Workshop and other national-scale methods workshops and meetings.
- Provide opportunities for staff exchange between Science Centers.
- Define expectations for allocating staff time between routine assessments and research. Use this system to communicate to relevant regional fisheries management organizations, Regional Offices, and Regional Fishery Management Councils each Science Center's actual capacity to address assessment demand on an annual basis.

Future staff

- Develop student pipelines in close proximity to Science Centers. The University of Washington is well known for producing stock assessment scientists who go on to careers in NOAA Fisheries. This model should be pursued in other regions in collaboration with universities, including the development of virtual fisheries science institutes where faculty from multiple campuses in a system (e.g., University of California campuses) contribute expertise.
- Increase financial support for graduate student education in the fisheries sciences and develop a clear pathway from graduate school to employment.

Response: This issue was identified at all Science Centers. We agree with many of the panelists' recommendations and propose several steps to alleviate this problem. We believe this recommendation needs to be approached simultaneously in two ways: 1) retaining current stock assessment staff and 2) developing future stock assessment scientists.

Action items:

Existing staff

- NOAA Fisheries will reinstate the National Stock Assessment Workshop on a biennial basis in FY 2015 to serve as a forum for cross-Center collaboration.
- Annual performance plans for stock assessment scientists will include a minimum of 20 percent time allocated for research to improve assessment methods, conduct research on factors affecting fish stocks, and publish research findings (2016).
- Create opportunities for assessment staff to pair with staff in other regions when conducting assessments in both regions.
- Create opportunities for international sabbaticals and collaborations (2015).

Future staff

⁹ DOC and DOE (U.S. Department of Commerce and U.S. Department of Education). 2008. The shortage in the number of individuals with post-baccalaureate degrees in subjects related to fishery science. NOAA Technical Memorandum NMFS-F/SPO-91.

- Provide funding support from headquarters for one to two new “stock assessment” hires for each Center. These hires should fill region-specific needs. For example, in the Pacific Islands and Southeast regions, individuals should be hired to focus on the backlog of assessments needed in the territories. In the Northeast, at least one hire should be focused on dealing with the impacts of climate change on managed stocks. In Alaska and the West Coast, one or more new hires at each Center should provide support for development of Next Generation stock assessments (early 2015).
- The Quantitative Ecology and Socioeconomics Training (QUEST¹⁰) program, recently initiated by NOAA Fisheries, provides both virtual and in-person education and training opportunities for stock assessment scientists, ecosystem scientists, and economists. NOAA Fisheries will further develop student pipelines and virtual institutes through partnerships with academia at scales, from local to national, that meet agency needs (2015).
- NOAA Fisheries will develop opportunities to increase recruitment of quantitative fisheries scientists into the agency through available educational programs and authorities, including but not limited to the Pathways Recent Graduate program and the Public Lands Service Corps Act consulting interns (2016).

In addition to these areas, the topic of incorporating ecosystem, climate, and habitat information into stock assessments was raised in all reviews. We are planning to formally review these topics in 2016 as part of the 6-year Science Center and OST program review cycle. Pending the outcome of those reviews we will consider how to best address incorporating this information into stock assessments from a national perspective if deemed appropriate.

Planning for the FY 2015 Reviews

Planning is underway for the third year of NOAA Fisheries program reviews, with the focus shifting to protected species science. Changes for FY 2015 include conducting some joint reviews on the West Coast, in cases where more than one Center has responsibility for a species or species complex, rather than conducting a Center-specific review. We will also take a retrospective look at how well we are completing the action items developed to improve data collection and management in response to the FY 2013 program reviews.

Overarching TORs for the FY 2015 reviews are posted at:

- <http://www.st.nmfs.noaa.gov/science-program-review/index>

As in FY 2014, schedules and results of all reviews will be posted on this site as they become available.

¹⁰ <http://www.st.nmfs.noaa.gov/quest/>

Table 1. Schedule for implementation of Action Items

| Action Item | Timeline |
|--|----------|
| Assemble data needed for prioritization, including fishery importance, ecosystem importance, stock biology and status, and assessment history. | 2015 |
| Test prioritization system and finalize protocol. | 2015 |
| Make a database available to regional coordinating committees charged with setting priorities for regional assessments via the NOAA Fisheries Species Information System public portal. | 2015 |
| Support and guide regional coordinating committees in applying the prioritization process, possibly through decision support system facilitators. | 2016 |
| Convene working group to address: best practices to improve the efficiency of the stock assessment process, standardizing the stock assessment process and protocols, and consistent guidelines for the use of benchmark and update assessments. | 2016 |
| Evaluate the efficacy of the NOAA Fisheries Toolbox and develop plan to update the toolbox considering review panelists' recommendations for updating and improving the user interface and underlying models. | 2015 |
| To address recommendations from the FY 2013 Data Collection and Management program review, the NOAA Fisheries Assessment Methods Working Group is coordinating MSE studies that are evaluating the impact of surveys, sample sizes, and related data questions on stock assessment performance. The Working Group will be charged with reporting and developing a schedule on MSEs that address the recommendations provided by the FY 2014 stock assessment program review. | 2015 |
| Allocate staff time for research and funding for cross-Center development of MSEs and other simulation tools that will be made available through Fisheries Toolbox. | 2015 |
| Develop MSE expertise (through hires and training) such that at least one Subject Matter Expert is available at each Center. | 2016 |
| Reinstate the National Stock Assessment Workshop on a biennial basis. | 2015 |
| Annual performance plans for stock assessment scientists will include a minimum of 20 percent time allocated for research to improve assessment methods, establish linkages to ecosystem and environmental factors, and publish results. | 2016 |
| Create opportunities for assessment staff to pair with staff in other regions when conducting assessments in both regions. | 2015 |
| Create opportunities for international sabbaticals and collaborations. | 2015 |
| Provide funds to hire one to two new "stock assessment" scientists per Center. | 2015 |
| Develop student pipelines through partnerships with academia at scales, from local to national, that meet agency needs. | 2015 |
| Develop opportunities to recruit quantitative fisheries scientists through existing | 2016 |

| Action Item | Timeline |
|---------------------------------------|----------|
| educational programs and authorities. | |