Stock Assessment Science Program Review

Alaska Fisheries Science Center, 2014

Summary of Review Meeting

The NOAA Alaska Fisheries Science Center (AFSC) conducted a programmatic review of its stock assessment science in April 2014. The Terms of Reference for the review are appended to this report (Appendix 1). This review is a component of the national review process for all Science Centers, mandated by the National Marine Fisheries Service Office of Science and Technology. The review was conducted during March 24-28, 2014 at the AFSC in Seattle, WA. The review was tasked with evaluating the AFSC's stock assessment program in terms of the direction and quality of technical modelling approaches, review process, communication, as well as its responsiveness to the mandates of the Magnuson-Stevens Act (2006) and those of other relevant international agreements. The review was not directed at particular stock assessments, rather it examined the performance of the overall assessment process in terms of achieving mandated objectives. Stakeholders were invited to participate as observers and to comment during the daily public comment sessions.

The review panel (Appendix 2) was composed of six members, each with fisheries science, management, or policy backgrounds and drew from agencies (NMFS Northwest and Northeast Fisheries Science Centers, Pacific Marine Environmental Laboratory), academia (University of Washington), and an intergovernmental body (International Pacific Halibut Commission). Members reviewed detailed background information provided by the AFSC, as well as receiving overview and example presentations on seven main themes:

- Overview of the assessment process
- Scientific and technical processes
- Peer review
- Organization and priorities
- Accomplishments relative to mandates
- Communication
- Opportunities

Panel members asked clarifying questions of presenters and other AFSC staff, as well as considered responses to questions from the public who attended the meeting.

Panel members then produced independent reports of their views and the Chair produced a separate report to the AFSC Directorate. The Chair's report is not intended to present consensus; rather, it summarizes the key features and recommendations from the panelists' reports. All reports were delivered to the AFSC Directorate by the conclusion of the meeting. In addition, the panel met with the AFSC Directorate to discuss the findings.

Report of the Review Panel Chair

General Observations

The stock assessment science program at the ASFC is a mature, professional endeavor that is strongly attuned to both the broad mandates of the Magnuson-Stevens Act and the expressed management needs of the North Pacific Fishery Management Council. It is characterized by very high scientific standards and staff performance, as well as strong and committed leadership at both the Center and Division levels. Fisheries conservation and management in the northeast Pacific is extremely well served by this program.

The program nonetheless faces significant challenges in continuing to produce the suite of products that form the foundation of its fisheries management advice. The Review Panelists note that reductions in fiscal resources have required the leadership to reduce support for some program functions (e.g., genetics, age and growth studies, contaminants monitoring and analysis, survey staffing) in order to maintain core assessment functions and data acquisition activities, such as field surveys. These restrictions will have negative consequences to program deliverables in the mid-term as management advice strives to keep pace with the effects of environmental change and the need to accommodate multispecies yield determination and the ecosystem approach to fisheries management. Panel members also note with concern the elimination of major NMFS support to educational institutions for the development of the intellectual capital upon which future stock assessment programs will rely.

In the longer term, reduction in FTEs will impede succession planning and recruitment of new staff. The 2013 AFSC review of data programs noted that reductions in resources can act as catalysts for innovation and efficiency but the limits on such mitigative solutions have very likely been reached. The reality of fiscal constraint requires that the AFSC leadership team continue its analyses and demonstration of the value of data collection and analysis programs to the reduction of uncertainty in its management advice and the realized value of fisheries to the nation.

The AFSC is unique in the frequency with which it provides stock assessments. The tier system of categorizing assessments by data/knowledge availability and management needs acts to mitigate the intensity of this activity among species but it remains a substantial annual endeavor. Center staff is encouraged to continue its analysis of the merits of this frequency and thoroughness with a Management Strategy Evaluation. In addition, the Panel members noted that the current national initiative to develop guidelines for prioritizing stock assessments will provide guidance the Center.

The Panel expresses its sincere appreciation to the AFSC leadership and staff for their enthusiastic and positive responses to our many queries and requests. In addition, the staff presentations and background documentation provided to the Panel were thorough, clear, and directed to the needs of the review. It was a pleasure to interact with this high quality staff.

Panel Members' Major Observations and Recommendations

The following is a summary of significant responses from the Panel and is not intended to represent consensus within it. There were several overarching elements concerning the assessment science program in the Panelists' responses:

- Committed, highly motivated, and technically skilled staff, with strong esprit de corps and pride in its products
- Comprehensive data collection programs in support of the assessment science
- Clear direction, guidelines, and responsiveness to conservation mandates and management needs
- Effective internal communication and interaction among disciplines, centers, and agencies
- Strong outreach, responsiveness to clients, and scientific productivity
- Partnership with the NPRB is extremely positive but concern expressed about basing process studies, in particular, on soft money
- Internal review and development of assessments should take advantage of the proximity of scientists at the two Fisheries Centers in the area
- Concern about the long-term viability of assessment frequency and the sustainability of the assessment production and review in a compressed time frame
- Concern about the rapid pace of climate change in Alaska and the concurrent need to understand the impacts of emerging spatial structure in stocks and biological processes
- Concern about impacts of reduced fiscal resources on maintenance of product quality, staff retention, assessment scientists' career advancement, and staff succession
- More explicit protocols for inclusion and removal of species in stock complexes required, as well as evaluation of the conservation efficacy of the stock complex approach
- Center communications become increasing important during times of reduced fiscal resources and poor public understanding of issues. Communications staff should be enhanced to meet the challenge of increasing communication to non-traditional groups

A summary of Panelists' main responses related to each of the seven themes are presented below. Detailed reports by each of the panelists follow this summary.

Theme 1: Scientific and Technical Process

Observations

Assessment products, particularly for Tiers 1-3, are of very high quality. Tiers 5-6 are weak due to poor information on either abundance or natural mortality. Models have appropriate complexity and undergo adequate testing. Assessments are relatively data-rich. A more consistent approach to characterizing status and projection uncertainty is desirable. Staff should evaluate ensemble modeling and other approaches to more fully characterize and present uncertainty.

Strengths

- Meets or exceeds National Standard 1
- Extremely strong and intellectually talented assessment team.
- Assessments use and develop state-of-the-art methodology
- MSE approaches valuable in evaluating the impacts of assessment inputs
- Various working groups promote model development and ensure adequate testing

Challenges/Recommendations

- Loss of age reading capacity ultimately limits delivery of assessment products
- Variance of alternate, plausible models not captured in the presentation of uncertainty
- Share approaches to assessment of data-limited stocks; potential role for inter-Center working group
- Examine ways to streamline data processing

Theme 2: Assessment Process

Observations

Well defined process with clear guidelines and responsibilities. Staff adheres to deadlines despite a very compressed time frame for analysis and document production. Advice meets the mandates of the MSA as well as the expressed needs of the North Pacific Fishery Management Council.

Strengths

- Dedicated and committed staff
- Process is well defined and transparent
- Diversity of the Council's SSC provides broad oversight
- Fishery professionals representing stakeholder interests contribute positively to products and process
- Working groups function effectively

Challenges/Recommendations

- Assessment scientists on plan teams almost exclusively AFSC scientists; more diversity desirable
- Compressed time frame for production of assessments
- Plan Team chairs must master a very large amount of information in short time

Theme 3: Peer Review

Observations

Although operating in a compressed time frame, good internal review of assessments achieved. The review process takes advantage of high internal standards, pride in products, and shared responsibilities for the quality of the material produced.

Strengths

- Internal review is efficient and well-structured, with adequate rotation
- SSC provides competent review and feedback to assessment authors
- Hierarchical process from AFSC, to Plan Teams, to the Council's SSC ensures high quality reviews
- CIE reviews occur when substantive changes to assessments are made or new data sources incorporated and help to stabilize assessments and the resulting advice

Challenges/Recommendations

- Steps should be taken to ensure that a collegial atmosphere to internal reviews does not compromise its effectiveness; sharing internal reviewing with the NWFSC should be explored
- Limited pool of reviewers for highly technical assessments
- CIE reviews of the stock assessments could be more regular, during off-cycle periods, even when no substantive changes to assessments have occurred
- CIE review recommendations should continue to be reviewed by the Plan Teams and the SSC so that inappropriate or unsound ones can be objectively dismissed

Theme 4: Organization and Priorities

Observations

In general, well organized and transparent. Intelligent leadership and good division of workload. Open engagement across all levels. Good responsiveness to the expressed needs of the North Pacific Fishery Management Council.

Strengths

- Tier system works well in guiding assessment activity and avoiding OFL
- Good alignment of expectations and products
- Core functions preserved in the face of reduced fiscal resources

Challenges/Recommendations

- Need formal protocols for inclusion and removal of species from species complexes
- Examine species complexes as to their efficacy at achieving goals under changing removal patterns
- Some non-target species are very difficult to assess
- Consider prioritizing the production of a Fishery Interaction model to assess the layering effect of the management system and the potential effects of stock structure

Theme 5: Accomplishments Relative to Mandates

Observations

The program serves the needs of the North Pacific Fishery Management Council very well. There are clear guidelines, staff comply with deadlines, and engage with stakeholders to ensure understanding. The synchronization between the delivery of management advice from the AFSC and the adoption of action by the Council is a very valuable attribute of the current system. The AFSC has a very strong ecosystem analysis group; the communication between this group and the assessment group could be a model for other Centers. While ecosystem science informs the understanding of population processes well, it is not imperative that it be applied to the estimation component of stock assessment, albeit there is some progress in using environmental variables in model-based estimates of CPUE. Ecosystem science does form an important component of understanding projection uncertainty and developing harvest policy; this activity should be continued and enhanced.

Strengths

- Meets national standards, Council, and stakeholder needs
- Control rules provide adequate conservation protection and balance with fishery yield
- Strong ecosystem process models
- IEA well-coordinated with assessments; scientists in the two programs have good communication
- Ecosystem group's portal provides access to toolbox of multiple ecosystem indices of use in understanding stock dynamics

Challenges/Recommendations

- Support for process studies places too much reliance on soft money
- Need means to clearly evaluate ecosystem thresholds
- Continue development of ecosystem process and prediction models
- Support the proposed NMFS-OAR joint climate science initiative

Theme 6: Communications of Assessment Results and Data Needs

Observations

There is a deep commitment to outreach within the AFSC assessment science program. Internal communications are also very strong.

Strengths

- Documentation and communication by the program is exemplary
- Communications are clear and the staff hold regular workshops on key issues
- Excellent dialogue with client groups results in mutual respect and public support of AFSC science

Challenges/Recommendations

- Travel restrictions hamper the Center's ability to effectively communicate its scientific products
- Public awareness of AFSC's research and advice on topical issues could be improved
- Center's communication team needs to be bolstered to accommodate new communication approaches to non-traditional audiences

Theme 7: Opportunities

Observations

The Center has taken advantage of partnerships (e.g. NPRB, PMEL) to mitigate the effects of diminished resources. There is good internal leadership of the EAFM process and the Center has actively incorporated ecosystem considerations in its advice.

Strengths

- The Center is actively involved in technological improvement through numerous working groups
- Very good rapport and communication with industry
- Great nexus of talent in the Seattle area among the Centers, university, other agencies
- Strong relationships with University of Washington, University of Alaska, and Oregon State University
- Strong feedback loop between ecosystem science and assessment science groups
- Strong leadership at the Division level enhances synergisms

Challenges/Recommendations

- Moving to EAFM is difficult to operationalize
- Soft money basis for ecological process studies compromises long-term effectiveness and maintenance of ecosystem models/indices
- Loss of graduate student stipends hampers development of future intellectual capital; restore this activity
- Re-initiate national stock assessment workshop (NSAW)
- Engage climate scientists in the development of methods to present uncertainty
- Increased work on reproductive dynamics and maturity estimation
- Increase attention to spatial modeling; needs of spatial planning may precede the application in stock assessments
- Develop longer-term (20 yr) planning horizon for fish stock dynamics in conjunctions with climate scientists

Conclusions

The AFSC stock assessment science program is a model of effectiveness. It clearly serves its mandate of producing high-quality advice for conservation and management. Maintaining the scientific integrity and functionality of this program should be a top priority for the agency.

Reviewer report on Program Review of Stock Assessment Process

Science Center: Alaska Fisheries Science Center (AFSC), Seattle

Dates: 24-28 Mar. 2014

Reviewer 1

Background

The National Marine Fisheries Service is conducting an agency-wide review of science center programs. This review concerned the stock assessment program at the Alaska Fisheries Science Center.

General observations and recommendations

In the mid-1980s, as the Alaska fisheries were changing from foreign and joint-venture operations to American operations, AFSC stock assessments were weak. Abundance estimates generally relied on trawl survey data with catchability assumed to be one, and yield recommendations were based on equilibrium yield calculations or on a yield-per-recruit reference point, in some cases including some extreme F_{MAX} values. Over the next ten years AFSC stock assessments improved dramatically, thanks to strong support from center management and strong scientific leadership from an outstanding group of NMFS assessment scientists including Rick Methot, Grant Thompson, and Jim Ianelli. At the same time there was a lively interaction between the AFSC assessment scientists on the one hand and the plan teams and SSC of the North Pacific Council on the other, concerning how to determine ABC and later OFL and other reference points for a range of stocks with varying amounts of useful data. This dialogue, aided by a lot of leadership from Grant Thompson, eventually produced the tier system that has been used with great success by NPFMC. In this system, at present, OFL is the yield that would be taken by fishing at F_{MSY} if known. If F_{MSY} is unknown a proxy is used. F_{ABC} is stepped down from F_{OFL} by one or another buffer mechanism to avoid overfishing.

For the last 20 years AFSC stock assessments have been conducted using the best practices known to the scientific community (almost all of them based directly or indirectly on David Fournier's ADMB software). Occasionally we have had a problem assessment, but in almost all cases the assessments have produced credible estimates of biomass, OFL, and ABC, and the recommendations have been well accepted by the industry and the Council. Beyond that, the stocks being managed are almost all in good shape, with biomass levels and fishing mortality rates both within the desired range. As regards stock management, therefore, the AFSC/NPFMC practice has been very successful. In view of the biological result and the public acceptance, I regard the AFSC assessments coupled with NPFMC management as very successful.

For this review, the panelists were asked to judge AFSC performance in each of seven themes. We were also asked to consider seven questions mainly concerned with the formulation and reporting of stock assessment features and results. In response to those questions, I would say that the content and format of assessment reports has evolved over time according to the

direction of the teams and ultimately the SSC. The content of the assessment reports is now governed by the SAFE guidelines, and I would say the reports provide full information about the assessment methods and results. I would endorse Grant Thompson's account of those reports in his talk under Theme II. In short, I think the assessment results are well reported.

Theme I. Scientific process (the assessments themselves)

AFSC assessments are widely and rightly regarded as among the best in the world. The staff is very capable, the methods are state of the art, and the data for the major assessments are very good.

Strengths

- Excellent catch and survey data from the observer, catch accounting, survey and aging groups.
- Strong assessment staff including world leaders in development of stock assessment methods.
- Tier system provides straightforward rules for determining OFL and ABC from estimated abundance, depending on the data available, but authors, Teams and SSC can adopt a different procedure as appropriate in each case.
- SAFE guidelines result in standardized assessment reports that provide a clear description and complete reference for each assessment.
- Buffers between OFL and ABC have been effective in preventing overfishing.

Challenges

- Here as elsewhere, some assessments prove difficult, in that no model achieves a sensible and satisfactory fit to all the data. That is inevitable. Normally new data or a new model fixes the problem within a few years.
- Even in well-behaved assessments, any model that is sufficiently parsimonious to be fitted will inevitably be misspecified in some respects, and that can result in quite different abundance estimates from different models that are equally reasonable and fit the data equally well. Eventually one of the models is chosen by the SSC as the basis for specifications, but the variance among models is not captured in the estimate of uncertainty. This is consistent with practice elsewhere; no one has yet come up with a good, generally applicable way to estimate his source of variance.
- Some the OFL and ABC determinations for Tier 5 and Tier 6 stocks are weak because we lack reliable estimates of natural mortality and/or abundance.
- At present we do not have an agreed method for incorporating retrospective differences into estimates of uncertainty.
- The loss of three age reading positions has reduced the amount of critical age composition data available for assessments.

Solutions

The Center recognizes the (minor) assessment problems it faces and is working on them. The management strategy evaluations planned to evaluate the effect of survey frequency (among other things) on assessment precision will also provide information on the effect of model misspecification and age sample size. I want to stress that these are minor issues mainly concerning estimates of variance rather than reference points themselves. I believe that the ABC and OFL estimates chosen by the SSC on the basis of AFSC assessments are not just the best estimates possible with present methods, but truly sound and reliable as a guide for near- and medium-term fishery management.

Theme II. Overall assessment process (ABC/OFL determinations)

In Council management, the assessments are the basis of ABC/OFL recommendations by the plan teams and ultimately determinations by the SSC. This is a public process that involves a number of players and results in a high level of confidence in the eventual specifications.

Strengths

- The assessments themselves are of very high quality, and they all go through an in-house review before being presented to a plan team.
- The plan teams have a very diverse membership, including not only assessment scientists but also NMFS economists and people from the observer program, regional office, Council staff, state agencies, IPHC, NMML, USFWS, and universities. The meetings are public and well attended by survey staff and industry representatives. This provides an opportunity for all interested and involved parties to comment on the assessments, and a lot of people do in fact make valuable comments and answer questions about the data and the ABC recommendations even though it is generally just the assessment scientists and survey staff who discuss the mathematical modeling. In effect the team meetings serve as a public forum on the assessments, which strengthens the assessments and fosters an understanding of the assessments among a variety of parties.
- The contribution to the team meetings of fishery professionals representing industry groups is extremely valuable. They provide a knowledgeable channel of communication that in one direction informs the assessment scientists about industry practices and in the other informs the industry about the strengths (and occasional weaknesses) of the assessments. The quality of the assessments and the general acceptance of the assessments by the industry and Council are greatly assisted by these people.
- At the end of the discussion, the ABC/OFL recommendations that go forward are those of the team, not the author or the center. The recommendations therefore normally have the support of all the parties represented by the team members, and neither the author nor the center is regarded as the sponsor.
- The subsequent review of the assessments and final ABC/OFL determinations by the SSC are similarly regarded as competent, independent, and trustworthy.

- In addition to the ABC/OFL discussions, the teams and SSC provide direction to the assessment author about future work on the assessment. The author is required to do that work but has the freedom to do other things as well according to his or her judgment. Through this process there is always at least one reported version of the assessment that has the prior blessing of the SSC and can serve at need as the basis for specifications, but at the same time the author is free to innovate.

Challenges

- The assessment scientists on the teams are almost all AFSC staff. More outsiders would be desirable.

Solutions

- NWFSC could be asked to supply an assessment scientist or two to each team.

Theme III. Peer review process.

Every AFSC assessment is reviewed in-house, then by the team, then by the SSC. In addition, all assessments go through a detailed external CIE review on a roughly 5-year cycle.

Strengths

- The annual reviews (in-house, team, SSC) are done by people who know the assessments well because they have seen them before. They also take the task seriously because the teams and SSC become responsible for the ABC/OFL recommendations they make based on the assessments.

Challenges

- The in-house reviewer and most of the assessment scientists on the teams are all AFSC staff, so the reviews are not really independent. The SSC is not similarly dominated by AFSC but it too is slightly contaminated.
- The external reviews by CIE are truly independent, but some of the reviewers are not qualified and experienced assessment scientists, and some of their recommendations are not sound.

Solutions

- Add NWFSC assessment scientists to the teams.
- Have CIE reviewers' recommendations considered by the teams and SSC so that clearly unsound ones can be disregarded. This is in fact customary practice.

Theme IV. Organization and priorities.

The assessments done by AFSC include not only large stocks subject to major fisheries but also a number of small ones, species complexes, and non-target species. They receive different levels of assessment on different schedules depending on the data available. The tier system handles the range of cases well.

Strengths

- All species in the Council area are monitored and assessed appropriately, and catches are kept below ABC even for bycatch-only species.
- National guidance is expected shortly on prioritization.

Challenges

- Some non-targets (e.g., octopus, squid, sleeper sharks) are very difficult to assess.

Theme V. Adequacy of assessments.

AFSC assessments serve the Council very well, and they are models and leaders in the agency's FSSI index. The center is working hard to incorporate ecosystem processes into the ABC/OFL discussions and eventually into the production assessments themselves. Strengths and weaknesses of the production assessments are covered under Theme I. Comments below refer to the ecosystem assessment work.

Strengths

- Food web modeling has produced quantitative estimates of trophic interactions.
- Large bottom-up models are producing good predictions of zooplankton abundance and distribution.
- Maintaining time series of numerous ecosystem features makes it possible to detect decadal-scale regime shifts as well as long-term effects of global warming.

Challenges

- The staff seems to feel a pressing need to incorporate at least some elements of the ecosystem model into the production assessment models. It is doubtful that this will be possible anytime soon, and it is not clear that it would lead to better estimates of present abundance of exploited fish and crab stocks.

Solutions

- The ecosystem modeling is worthwhile in its own right as a means to inform fishery and eventually ecosystem management. Is there really any need to try to plug it into stock size

estimation? Is there a danger of putting the continuation of this work at risk by making that a requirement?

Theme VI. Communication

Strengths

- Good internal communication among the various AFSC programs involved in data collection and assessments.
- Good rapport with industry and other agencies.

Challenges

- Public unawareness of the agency's and Council's work in fishery assessment and conservation.

Solutions

- Probably not.

Theme VII. Opportunities

The science of stock assessment has advanced dramatically in the last thirty years and is still advancing. AFSC is participating in the progress but needs to be present and active in the larger scientific community to maintain its excellence.

Strengths

- Location in Seattle allows frequent contact with scientists at NWFSC, UW, IPHC.
- Fruitful partnerships with faculty at UAF (Juneau), UW, OSU.
- Center policy allows approximately 30% of scientists' time for development and self-directed research.
- NPRB provides some grants for research.
- CAPAM offers a regular forum for critical examination of assessment topics.

Challenges

- Termination of funding for NSAW and graduate student stipends.
- Irrational travel restrictions.

Solutions

- Difficult with present budget prospects.

Reviewer report on Program Review of Stock Assessment Process

Science Center: Alaska Fisheries Science Center (AFSC), Seattle

Dates: 24-28 Mar. 2014

Reviewer 2

Background

The NOAA Alaska Fisheries Science Center (AFSC) conducted a programmatic review of its stock assessment science as part of a national review process for all Science Centers. The purpose of the review was to evaluate the overall AFSC's stock assessment program in terms of the technical modeling approaches, the peer review process, communication of results and fidelity to the mandates of the Magnuson-Stevens Act. The review focused on the performance of the overall assessment process organized by seven main themes:

- Overview of the assessment process
- Scientific and technical processes
- Peer review
- Organization and priorities
- Accomplishments relative to mandates
- Communication
- Opportunities

My review provides comments on each of these themes along with suggestions in several areas. The suggestions represent minor modifications of an outstanding, well integrated and effective program.

The meeting was well organized. Background papers were provided in advance to reviewers and all presentations were made available at the meeting. Presentations were lucid and informative and sufficient time to question the presenters was incorporated into the process. Staff was available for questions and follow-up work assignments were provided in a timely fashion. I wish to thank the Center leadership and staff for their gracious hospitality during the review.

General Observations and Recommendations

Overall productivity and quality of stock assessment program is exemplary. The high quality stems from strong support from all levels of management at the Center and its easily discerned and demonstrated priorities for assessments. The high quality is further enhanced by rigorous review by Plan Team and SSC. Programmatic strength is important but at its core the high quality is achieved and maintained by motivated staff unified by a broad understanding of priorities.

The internal review process works because it relies on a pool of dedicated staff at all levels but especially by supervisors. The process also relies on a high degree of cohesiveness and common purpose among staff that ensures fair and effective reviews of each other's reports. . Esprit de corps among staff appears to be high.

Success of the program begins with setting clear expectations and rigid deadlines while maintaining an uninterrupted supply of assessment data. Similarly, the absence of "friction" about results by clients is another essential component of success. These same factors pose risks for the future if reduced funding disrupts deadlines or causes loss of critical staff.

Despite the high volume of assessments produced annually, the Assessment Team produces a large number of significant publications from their stock assessments and associated research.

I have no major recommendations for improvements to the Stock Assessment Science program at the AFSC. Some minor concerns are described below. Many of these are expressions of concern related to the tight timing of the assessment process and the organizational stress such timetables can induce.

Theme 1: High Level Scientific / Technical approach

Methods employed by AFSC are world class and state of the art. Assessments are uniformly high quality and apply methods appropriate to the data. Staff works continuously to improve methodology and the quality of the assessment products.

Models appear to have appropriate level of complexity and are capable of adapting to new conditions. The Center employs a good mix of operational and research tools to achieve its stock assessment objectives. Both standard models and simulation testing methods are employed is stock assessments. These latter tools appear to a regular feature of the modeling environment and reflect a high level of sophistication by staff.

The models operate in a data rich environment. Multiple assessment models are used but generally rely on two primary models: SS3 and AMAK. Both of these are highly evolved and modern models. Their ability to allow alternative model parameterizations by individual assessment authors. This is a strength that could become a liability if major changes occur without sufficient time to test new features. Assessment staff is, of course, well aware of these potential problems and the template for assessment production does allow for cross testing of new features by staff, especially those reviewing the assessments.

It is not clear at what point the individual customization of model formulations is fully consolidated. Problems can arise if the added features or improvements of multiple custom models are not regularly consolidated into the core models. Divergence of performance properties could occur if subsequent analysts are not fully aware of such changes, or if the coding of new features is not sufficiently generalized. Consideration should be given to regular documentation of features made by individual analysts and periodic reviews of features so that the core features of models are updated and documented.

The annual update cycle puts a premium on consistency of results across years. Forecasts of stock size from the previous assessments were generally consistent with the subsequent estimates in the same year. Large changes in assessment results between years were not evident in most of the assessments. This is a positive feature of the assessment program. This feature may become a negative if it is the need for model change is suppressed by the exigencies of the annual assessment schedule. Presently there are no apparent structural features of the process that would impede the identification of problems or suppress innovation.

There is a general recognition that more work on data-limited stocks is necessary. The Center has been a leader in the development of methods that could have broad applicability across the Agency. The use of special working groups, such as the Working Group on Methods for Averaging Surveys" is laudable. Work on such projects should continue. The agency may wish to broaden the use of such working groups by creating virtual working groups across Centers.

Theme 2: Assessment Process

The overall stock assessment process is well defined and guidelines are understood. A combination of individual assignments, multi-authorship, and internal review helps to ensure high quality. Collaboration among groups appears to be good.

AFSC employs a Taguchi-like approach (or Statistical Control Theory) of process improvement to the stock assessments. This is achieved at several levels of organization. It begins with the individual assessment lead who is well aware of the strengths and weaknesses of the current model. The previous year's feedback from the SSC as well as the results of the "Geeks and Tweaks" meetings serve as starting points for innovations. The internal review process continues the refinement of model formulation whereby supervisors and colleagues provide feedback. Following these reviews, results are vetted to the Plan Team for further consideration and preparation of the SAFE report for consideration by the SSC. The SSC then meets to discuss the results for each stock. It is not clear how intensive this process could be given the sheer volume of material that must be considered. However it is clear that the various checks and balances along the way ensure both quality and efficiency. Each assessment author appears to be guided (driven?) by a principle of incremental and continuous improvements to assessments. The high degree of unity among staff and pride in the quality of the assessments also helps ensure that staff are candid with each other about model limitations. While not explicitly stated by staff, there is a palpable sense of collective pride in the stock assessment products.

Special teams for assessment projects are valuable for bridging differences among groups. Specialized teams for key topics include recruitment variability, retrospective patterns, and methods for survey averaging. These appear to be useful for addressing broad thematic problems, training of junior staff, and improving staff morale.

Concerns about scheduling include disruption of the data supply chain, e.g. government furlough, and loss of survey or key data sources. While such changes would require substantial adaptation, the loss of key supervisory personnel or lead scientists would be far more consequential if sustained for more than a year. One of the strong points of the program is the high current level of acceptance of science and the interleaving of annual assessment advice across two years. The interleaving process provides a robust buffer that would reduce the disruption of a missing assessment. This robust process could be emulated nationwide by other Councils and Regional Offices. As this process is uncommon across the US it would have been useful for the Review Panel to have had input from the Regional Office staff on the management process that allows this exceptional flexibility.

Theme 3: Peer Review

The peer review process for routine assessments includes three essential components: 1) internal review, 2) input from the Plan Team and 3) final review by the SSC. Collectively this process appears to work exceptionally well. The panel noted that the internal review process has the potential to become more relaxed than desirable. It is important to emphasize that the panel did not sense or imply that this was occurring.

For the internal review process the Center may wish to involve additional reviewers in the process on an experimental basis. In keeping with a Taguchi-like principle of evolutionary change, expansion of the pool of reviewers could be done for some subset of assessments. Not all assessments would be "cross-reviewed" but a small subset of reviews, could be considered. Similar procedures for cross-division evaluations of performance plans are used at some NMFS Science Centers. Such an experiment would have to be carefully considered and evaluated to see if a modified internal peer-review process added value.

The internal assignments of assessment reviews serves junior staff well by building rapid familiarity with assessment methods and stocks dynamics. The internal assignment process also provides some leveling of assessment responsibilities for staff whose assessments are reliant on biennial surveys. These staff will take a greater share of the internal assessment reviews in their off years.

The use of CIE reviewers appears to be measured and appropriate. External reviewers are used for the formulation of new assessments or when existing models require some major changes in formulation or parameterization. Unlike some other Centers the CIE-reviewed assessments generally are done in the "off season" and the results do not directly feed into catch advice in the current year. This decoupling of benchmarks from catch advice helps stabilize the assessment process and ensures an orderly introduction of new information to the Council advisory process. The use of CIE reviewers ensures that their expertise complements, but does not replace the collective knowledge of the lead author, the plan team and the SSC.

Theme 4: Organization and Priorities

The Center places a high value on the stock assessment process and meeting the demands of Council. The process of providing the scientific basis of management is clearly defined and expectations are understood by all parties. Priorities are well established and expectations of clients are met.

The efficiency of the process can in part be attributed to the coevolution of organizations oriented to a common goal of using the most recent scientific information to guide catch advice. The Center, Council, State and Regional Office are aligned to accept the trade-offs inherent in a system that compresses the peer-review process for updated assessments, reduces the number of alternative model formulations, accepts the results of the model runs, and has the capacity to maintain regulatory compliance by interleaving new catch advice in to the regulations. The ability to replace results the January specifications with new results is unique from a regulatory perspective (to the best of my knowledge) and from the standpoint of industry acceptance. In many parts of the country, mid-season corrections would be immediately challenged by either industry or ENGOs.

The high priority on stock assessments is evinced by decisions that have preserved core functions in the face of shrinking budget priorities. Moreover the Center appears to consider economic value as a primary determinant of priorities. This is not necessarily a sufficient basis for setting priorities but is a useful starting point.

Theme 5: Accomplishments relative to mandates

Overall there is a very high level of accomplishment relative to the mandates. Resources are well managed and the assessments supply information as needed for management. The system is not only sufficient for existing needs but also adaptive to emerging and future needs. Perhaps the best measure of success is that the science is well respected. The underlying reasons for these accomplishments are previously discussed under Themes 1 to 4.

The current control rules are appropriate for stocks that are well above Bmsy levels. Evidence suggests that sufficient precaution is built into the catch recommendations such that between year reductions in biomass attributable to overfishing are minimized. However it is not clear if the existing control rules would be sufficient to ensure restoration of stocks should an overfished status occur. Should such conditions obtain, the Center will likely need to invest resources into development of more formal rebuilding strategies.

One concern about the current assessment process is the lumping species into groups (e.g., sleeper sharks, spiny dogfish and salmon sharks) and applying a total ABC. This approach to harvest policy seems risky especially if the large differences in abundance or economic value are attributes of the species group. The potential for overharvest of more valuable but lower abundance stocks is inherent in such a system. Simulation exercises to evaluate the efficacy of such policies may be valuable. Such exercises would be motivated if sharp increases in landings of one or more of the components occurred.

Theme 6: Communication of Assessment results and data needs

SAFE document and coordination with council are exemplary. By all measures the Center, Council and Region appear to work well with fishermen, industry, state governments and ENGOs. This positive environment is more likely to be a manifestation of sound science, mutual respect and trust rather than a communications policy. No communication policy can compensate for an absence of trust.

Theme 7: Opportunities

The "Organization Ecosystem" {Center, Council, Regional Office, Industry, ENGOs} is basically at equilibrium and appears to be the product of the aforementioned co-evolution of management and scientific priorities. The synchronization of assessment activities helps ensure that staff have the ability to pursue research activities during the well-defined interim between assessments. Perturbations from externally mandated special projects/ emergencies from Council are minimal. This equilibrium serves to ensure staff morale since the workloads are distributed fairly across the Branch and staff time for research activities is protected.

Ecosystem processes are well integrated into the preparation of the SAFE reports but actual findings from ecosystem models are not broadly used in stock assessments. The use of ecosystem information is valuable because it provides a context for broad-scale changes that might not be fully appreciated from the set of assessments. However, climate change is occurring rapidly in the Gulf of Alaska and Bering Sea so the need for improved understanding

and early indicators of change is widely appreciated. There appears to be an important feedback loop wherein the ecosystem processes can inform the stock assessments. This understanding allows for identification of model configurations to help identify underlying ecosystem processes and potentially ecosystem processes could inform stock assessment and vice versa. The "best model" in a single stock assessment will often include features that alias underlying aspects of ecosystem change. Examples include changes in average weights, delay in maturation, changes in selectivity or reductions in estimated recruitment. Hence model identification process becomes an empirical test of ecosystem change. Stock assessment scientists can use ecosystem results to help ascribe causal mechanisms to alternative model formulations. Ecosystem scientists can use single species model results to focus process studies and observing systems to gain further insights into broad-scale changes. Reciprocally, the stock assessment scientists participate as full partners in the development of ecosystem models, thereby enhancing their long-term potential for use in management.

Other Considerations

Interactions with other center groups are good. The overall support from the Center for estimation of catch, discards, age and growth is especially noteworthy.

More work on reproductive dynamics, particularly maturation rates may be useful especially in light of changes in average weights observed for several stocks. Lack of appropriately timed information on maturation is a problem nationwide as most species are unaware of NMFS's survey schedules. Hence methods for year round data collection or targeted collections for certain species are necessary. The Center has employed novel approaches using At-Sea Observers to meet these needs. Not much quantitative use of food habits information at this time.

Given the high abundance of most stocks supported by science from AFSC there is relatively little concern about stock structure apart from the natural division of Gulf of Alaska and Bering Sea/Aleutian Islands. These broad geographical regions pose some risk if stocks decline which in turn could require further spatial subdivision of management units to help prevent localized depletion.

Conclusions

The overall quality of the assessments is exemplary and the process for incorporation of such information into the management process is uniformly exceptional. The Alaska Fisheries Science Center should take great pride in its stewardship of time, talent and resources to provide sound science for fisheries management.

Reviewer report on Program Review of Stock Assessment Process

Science Center: Alaska Fisheries Science Center (AFSC), Seattle

Dates: 24-28 Mar. 2014

Reviewer 3

Background

The National Marine Fisheries Service has initiated a series of program reviews to examine the full scope of the science conducted to support the core objectives of sustainable fisheries and conserving and restoring protected resources. This current review is focused on the stock assessment process for federally managed marine fish species conducted by the Alaska Fisheries Science Center (AFSC). The AFSC provides the science to support four Fisheries Management Plans (FMPS). The Center annually conducts 50 groundfish stock assessments and 4 crab assessments

General Observations and Recommendations

Observations

This review of the stock assessment process at the AFSC demonstrated across the board that high scientific standards exist, from the data quality to the high technical rigor of the stock assessments, as well as a strong relationship and trust among the key parties directly involved in fisheries management; specifically, the Alaska Regional Office and the North Pacific Fishery Management Council (NPFMC). This leads to a process that delivers high quality science in support of fisheries in the North Pacific that to date are yielding high economic value while maintaining stocks at levels that should support sustainable fisheries into the future. The top to bottom commitment from Center staff to proactively provide the best science available in support of the management system.

The Center is in an envious position of having the North Pacific Research Board (NPRB) as a partner/collaborator. The NPRB provides competitive research grants for investigations in the regions for which the Center has responsibility and as such is an avenue to seek competitive funding for process studies and broad investigations of the mechanisms controlling upper trophic level productivity. The findings from NPRB studies have clearly advanced the Center's understanding of the Bering Sea, for example, and allowed major steps forward in furthering ecosystem based fisheries management and steps toward ecosystem-based management.

The AFSC has routinely and consistently made strong use of internal working groups to address key gaps or areas deserving cross-Center investigation. I find that the use of internal working groups is a strength and a practice to be continued.

The Center acknowledged that they are in an enviable position, compared to other regions, of being relatively data rich to support stock assessments. Nonetheless, as in all other regions they do have a range from data rich to data poor stock assessments and are making strides to evolve the lower tier assessments to a higher level, as appropriate. Achieving this goal is made more difficult by the current budget conditions. The Center is to be commended for taking a proactive approach to make the difficult decisions to reduce overall staffing at the Center to support the core activities of surveys of key stocks and maintaining the stock assessment infrastructure.

The AFSC has initiated several management strategy evaluations (MSEs) to address a range of issues including simulations to address the question of what is the right balance between survey intensity and stock assessments. The MSE effort is all evaluating the possible consequences to setting annual catch limits (ACLs) and the subsequent effects on fishery yield. This latter effort is has yielded some very informative information on the consequences of changes in survey intensity.

Overall Recommendations

The Center is to be commended on the ability to conduct 54 annual stock assessments that are to the vast majority found to represent the best scientific information available by the North Pacific Fishery Management Council. They are effectively balancing high throughput and effective review of the individual stock assessments. They have developed an effective internal quality assurance/quality control (QA/QC) system, coupled with additional QA/QC by the Plan Teams, underpinned by independent peer review (CIE) of the structure and analytical framework of the stock assessments. It is my recommendation that the Center strongly consider revising how they describe the overall review system. I propose that it should be presented as coupled QA/QC program strongly linked to independent peer review that has allowed high throughput and high quality.

To enhance the communication between the Center and NPFMC on the specifics of the individual stock assessments the Council and Center should consider revising the Council meeting schedule to have the December Council meeting in Seattle so that the maximum number of stock assessment authors can be at the Council meeting to either present the results of their assessment or be present to support the presentation of the assessments by the Scientific and Statistical Committee (SSC).

During times of constrained budgets and heightened scrutiny it is very important to ‘get the message out’ on the activities and value of the science at all of the NOAA Fisheries Science Centers. It is therefore necessary to have sufficient staff focused on communications both internally and externally. Given the size of the Alaska Fisheries Science Center and its scope of operations having only two FTEs committed to Communications is not sufficient. I would recommend doubling the staff to four FTEs; consisting of a Team Lead, a communication specialist with some focus on social media, a graphics person, and an individual focused on education. While doing so would mean that some aspects of the science program would be providing the FTEs it is critically important to have sufficient resources to tell the story of the Center’s high quality science and value to the nation.

There was considerable discussion on the relative merits of taking an ensemble approach of models for stock assessments. While there appears to be a range of views among the Center’s stock assessment scientists on the merit of pursuing more in-depth investigations of value of ensemble approach in enhancing the characterization of uncertainty I recommend that it should

be pursued. Further, it may be of value to consider establishing a cross Center working group of scientists from the three west coast Science Centers to build on recent agency discussions of a multi-model or ensemble approach to assessments.

The AFSC has an active research program on developing Integrated Ecosystem Assessments that has made significant strides in introducing ecosystem considerations into the management cycle of the NPFMC. The progress is impressive and I fully support continued active support of this science program. The panel discussed at some length the relative merit of a focus on explicitly introducing ecosystem variables into stock estimation models versus the approach outlined by Dr. Aydin of developing a tool box of multispecies and ecosystem models linked to enhanced means of communicating to policy makers the status and trend in ecosystem condition to provide strategic advice to support setting harvest quotas. I recommend that the Center continue to pursue the latter because I foresee greater yield from the IEA program in providing improved scientific advice on when and how to alter a reference point for setting harvest policy based on ecosystem conditions than pursing adding environmental variables to annual stock assessment models.

It was highlighted that additional attention to stock structure is warranted. In this review there was not sufficient time to go into detail on current or past work by the Center on stock structure of key species, thus I am not versed on the current status of the research. Nonetheless, I recommend that additional focus on stock structure is warranted. Moreover, exploring a cooperative effort with the NW Center and the Pacific Biological Station (DFO) in Canada may be warranted as we the three institutions 'share' some species and a more comprehensive approach to the northern west coast could have efficiencies.

Specific Findings and Recommendations

High-level Scientific/Technical Approach (Theme 1)

Observations

The AFSC has developed cutting edge stock assessment techniques, is beginning to incorporate multispecies models, conduct retrospective analyses to identify 'assessments of concern', and has a strong cadre of stock assessment scientists.

Strengths

- The level of scientific expertise of the stock assessment teams is exemplary.

Challenges

- Insuring sufficient ageing capacity is critical to maintaining the high throughput of annual stock assessments. Similarly maintaining capacity of stock assessment scientists is critical to maintaining high throughput for annual stock assessments.

Recommendations to address issue

The Center Director noted that he instituted strict hiring controls and staffing limits in order to insure that the supply chain of data for stock assessments and critical staffing in the stock assessment groups could be maintained. This has led to significant reductions in staff in other

programs of the Center with some replacement of capacity by contractors, such as hiring contract age readers. While Center Leadership has been able to maintain core capacity for stock assessments there is some concern that continued reductions in overall staff levels will eventually have negative consequences for maintaining the level of annual stock assessments. Given current budget constraints it may be necessary to take a larger strategic view on the ability of the Center to maintain all of its current programs.

Assessment Process (Theme 2)

Observations

The AFSC is committed to delivering 54 annual assessments of groundfish and crab to meet expectations of the Regional Office and Council. To meet this goal they have instituted a number of best practices to insure that under tight timeframes that the data is available in a timely manner to feed the assessments, there is pre-planning to institute annual improvements to an assessment, specific detailed guidance on content and format of stock assessment reports is developed annually and a strong QA/QC program is in place to help insure that final stock assessment documents will meet the needs of the SSC of Council and is best scientific information available.

Strengths

- Dedicated staff that is committed to the objective of annual stock assessments and striving for continual improvement in their quality.

Challenges

- In discussion of the assessment process the Panel delved into the topic of the use of multiple models in stock assessments. There were clear differences in opinion among Center scientists in the benefits of exploring an ensemble approach.

Recommendations to address issue

- As noted above I endorse exploring further the pros and cons of using multiple models. Building on the value that the Center has found in using internal working groups, I suggest serious consideration of establishing a working group on the topic.

Peer Review (Theme 3)

Observations

The key metric of the success of a peer review program in this context is the acceptance by the Council SSC that a stock assessment does constitute the best scientific information available. The Panel heard that it is an extremely rare event that an annual stock assessment is not used by the SSC for setting the available biological catch (ABC). This speaks directly to all steps taken to insure high quality stock assessments and the high quality models and data that are at the core of an assessment.

Strengths

- The Center has developed an efficient, well-structured internal QA/QC approach that allows for completion of 54 annual assessments of high quality. The QA/QC program is coupled with a five year cycle obtaining independent peer review of underlying model structure of individual stocks (e.g., Pollock) and groups of species using the same model structure (e.g., rockfish). This is an approach to be commended.

Challenges

- A potential challenge is maintaining the high rigor of assessments for the current throughput, but it appears the Center is maintaining the rigor, and the commitment of staff is high, which strongly suggests that they are capable of maintaining the high quality. The only potential area of concern is within the internal QA/QC program. The sole use of internal Center reviews may not always lead to constructive critical review. It can be hard at times to tell your colleague that they he/she has a serious flaw in their assessment.

Recommendations to address issue

- First Center leadership should undertake a self-assessment of the rigor of the internal QA/QC program and if needed consider exploring, as noted above, periodically using stock assessment scientists from other NOAA Fisheries Centers to review stock assessments before they go to the Plan Teams.

Organization and Priorities (Theme 4)

Observations

Because all stocks/stock complexes are assessed annually a key focus of prioritization is on insuring that frequency and level of assessment is based on uncertainty, vulnerability, ecosystem importance and value of resources. Another area of focus is on stock complexes and insuring that their composition is revised based on current information from assessments.

Strengths

- The Center is commended for their efforts to move an assessment to higher tier (high quality) by either improving the modeling framework or improving the data quality by advising the survey group on the key information to be collected.

Challenges

- A challenge for all NOAA Fisheries Centers is defining stock complexes that do not lead to issues such as overfishing of individual stocks in a complex. The Panel heard of active steps by the Center to react to new information to revise the composition of a complex when issues of concern arise. It appears that the Center reacts to new

information rather than having a set of criteria for a more proactive assessment of stock complex structure. Nonetheless, the Center has been effective in getting Council support to revise a complex when it was found that a species was at risk of overfishing compared to other species in the complex.

Recommendations to address issue

- In the ideal situation it would be desirable to have a well prescribed set of criteria that leads to timely and routine periodic assessment of the composition of stock complexes. Therefore, the Center should consider whether the current approach to assessing stock complexes should be amended to include routine periodic evaluation of stock complexes to assess whether they should be revised.

Accomplishments Relative to Mandates (Theme 5)

Observations

The Center is achieving regional and national mandates of the Magnuson-Stevens Act in an exemplary manner. In addition, there is a robust research program on the agency's Integrated Ecosystem Assessments initiative in support of the agency's goal of implementing ecosystem based management.

Strengths

- The research program on Integrated Ecosystem Assessment is well coordinated with the stock assessment teams, which is highly commendable, and is and will lead to effective addition of ecosystem considerations into the science advice the Center provides to the Council. There are already examples of effective communication of ecosystem science during the quota setting process. The ecosystem report cards summarize key ecosystem indicators in a manner that is useful to policy makers. In addition, they team is developing an impressive IEA toolbox of multispecies and ecosystem models.

Challenges

- As noted previously, the Center is under significant budget constraints and a key challenge is that while maintaining the core capabilities for key surveys and stock assessments there is the challenge of adequately supporting the science that will lead to the new quantitative tools to make ecosystem based management a fundamental component of the business practices of the NPFMC.

Recommendations to address issue

- Center Leadership is very aware of the need to balance maintaining core capability while insuring strategic investment in key areas that will substantively advance ecosystem

science. I fully support their commitment to supporting key strategic initiatives, such as Integrated Ecosystem Assessments, while recognizing that to do so may mean curtailing other research activities at the AFSC.

Communication of Assessment Results and Data Needs (Theme 6)

Observations

There is a broad based commitment to actively work to enhance communication among key constituents and stakeholders and to conduct outreach to the public at several levels.

Strengths

- The active efforts by scientists to engage to key constituents, the interested public and to support education efforts to engage K-12 students.
- Constituent acknowledgement that the communication is effective.

Challenges

- The Center's Communications Team is not sufficient to support the needed communication/outreach needs of an organization the size of the AFSC.

Recommendations to address issue

- A key recommendation noted above is to double the size of the Communications Team. Having said this, dedicating additional resources to communications must be balanced with other demands.

Opportunities (Theme 7)

Observations

Projecting the status and trends in groundfish stocks on a 20 year time horizon is a key scientific objective of the Center and it appears to be an achievable goal given the groundwork that has been laid in developing ecosystem model, FEAST, and in continued collaboration with NOAA's Pacific Marine Environmental Laboratory (PMEL). In addition, at the level of single species models there is a proposed initiative to develop 'environmentally enhanced assessment models.

Strengths

- The interaction with the NPRB has been an excellent opportunity to conduct large scale, multi-investigator ecosystem scale research that has substantially improved the understanding of mechanisms controlling productivity at several levels.

Challenges

- It is a difficult challenge to be highly strategic in setting the Center's research agendas when one has to rely on soft money funding from another organization such as NPRB, for research to advance understanding of ecosystem structure and function and the underlying mechanisms.

Recommendations to address issue

- The Panel was informed of a proposed new partnership between NMFS and OAR to develop a joint climate science program. The advantages are clear under constrained budgets in leveraging resources within NOAA to address the paramount issue of climate change and to develop operational forecasts that aid in fishery management.

Reviewer report on Program Review of Stock Assessment Process

Science Center: Alaska Fisheries Science Center (AFSC), Seattle

Dates: 24-28 Mar. 2014

Reviewer 4

Preamble

I have had the privilege to study the development of US fisheries in the Alaska Region since the passage of the Fisheries Conservation and Management Act in 1976 [and as reauthorized]. I served as a member of the North Pacific Fishery Management Council for nine of these years. Thus, I have observed the stock assessment science /decision process from both sides. I am familiar with AFSC stock assessments and understand well how they are communicated to the Council and how they inform Council decision-making. In recent years, I have focused on adoption of ecosystem-based management approaches in the NPFMC arena. I am convinced stock assessments are foundational in terms of understanding a fished ecosystem.

Nothing in this experience over the last 40 years can compare with the comprehensive, intense and intelligent briefing on the AFSC approach to stock assessment that I have enjoyed over the last three days of presentations and discussions. I feel like I have just been introduced to the base of the iceberg whose shining tip I had been observing. This experience convinces me all the more fully of the quality, integrity and cutting edge nature of stock assessment science at AFSC. It points as well to what appears to be a successful balancing of investments between collection of data and data analysis in a time difficult budgets.

In this review, I make reference to key documents or presentations that are available on the AFSC 2014 Stock Assessments Science Program Review web site. The provision of the right kinds of documents and presentations by AFSC through the website for this review is exemplary and sets a high standard for other regional reviews.

For the sake of consistency, I utilize the seven themes outlined in the Terms of Reference to organize this review. My areas of interest and expertise are not equal with respect to each of these themes so the treatment may be somewhat uneven.

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

Strengths

In my estimation, the AFSC meets or exceeds the requirements set forth in National Standard 1.

Challenges

Given the large scale and variability of the Alaska ecosystem, the efforts to embed the annual stock assessments in the context of changes in the ecosystem that can affect fisheries are an absolute necessity.

Recommendations

Efforts by stock assessment authors to explore use Extended Environmental/Ecosystem Models [EEM], for example, are proving invaluable in terms of developing the capacity to track interannual variability and long term trends (see below). These efforts should continue as part of developing ecosystem-based management in the Council setting.

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

Strengths

The annual or biennial cycle of stock assessment is clearly laid out. It consists of review of performance of previous year results [including feedback from the SSC and others], planning for the next assessment, research on new methods and models between about February until September. This part of the process ensures constant efforts to improve the stock assessments. Following this more considered effort is an intense period (September- January) to complete and test the improved stock assessment models when survey data become available from summer surveys.

Challenges

In this compressed time period stock assessment models are tested and selected in time for internal quality control and subsequent presentation to the NPFMC. By ramping up on the assessments on a regular basis, assessment authors and review processes produce nearly real time estimates of stocks for Council and NMFS decision-making.

Recommendation

Continue to produce stock assessment guidance documents in this manner because they are highly valued. Within the science/policy interface the process is well understood and very efficient. Using these stock assessments the Council [peer reviewed and vetted by the SSC] can set appropriate ABC/TAC/ACL in a timely manner.

2. ***Does the Center, in conjunction with other entities such as the Council's Scientific and Statistical Committee (SSC), have an adequate peer review process?***

Strengths

The combination of internal quality assurance reviews, Plan Team reviews and SSC peer review produces high quality stock assessments for Council and NMFS management decisions. The five-year CIE peer review of each stock assessment ensures that rigorous standards are being met in the interim [See CIE Reports].

Challenges

None

Recommendation

None

3. Is the Center's program organization effective at accomplishing needed assessments according to a set of assessment priorities? Include program structure, staffing, and funding; include prioritization of stocks for assessment.

Strengths

The commitment to annual or biennial obviates a prioritization in the conventional sense. With reference to the Feb. 2014 discussion draft on Regional Prioritization, it appears that if the same national criteria are applied in terms of fishery importance/ ecosystem importance/ status of stock, stock biology, etc. the frequency of stock assessment is well justified. There seems to be excellent leadership an intelligent division of work load and a very high level of esprit de corps.

Challenges

It is difficult to maintain this level of effort with increased costs and reduced budgets.

Recommendation

None but the obvious

4. Does the Center achieve adequate assessment accomplishments relative to mandates particularly with respect to the number of Fishery Management Plan (FMP) species assessed?

Strengths

The answer to this question is clearly yes. [See Grant Thompson's presentation Theme V]

Challenges

Maintaining or increasing the assessments in response to mandates with decreasing resources.

Recommendations

None

5. Does the assessment program adequately communicate their results, needs, and research?

Strengths

The link between the Council processes and the science processes has co-evolved and is tightly coupled. All the formal requirements are met, e.g., annual feedback from the SSC and the Council on research prioritization and uptake of these requests by AFSC. There are regular workshops where AFSC stock assessors and modelers meet with the Council "family." Plan

team meetings provide a public and transparent process for finalizing stock assessments. The Council SSC serves a primary role in peer review of stock assessments. The Advisory Panel and the Council receive briefings and engage in dialogue. I would argue that the delivery system for stock assessments in the NPFMC is a model of a functioning communication system.

Challenges

Because model conditions exist that, there is a tremendous opportunity in this system to test new scientific models and scenarios [linking long-term ecosystem perspectives with long term industry planning] within a knowledgeable and receptive Council family. The AFSC has the potential to be a test bed for new concepts in fishery management.

It seems that regionally and nationally, NOAA Fisheries has difficulty matching NASA and environmental non-governmental organizations in setting the ocean fisheries agenda in the news media. I do not have a solution for this conundrum.

Recommendations

Seek additional resources to realize a national program to experiment with model and scenario use in the NPFMC arena

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

Strengths

I see the stock assessment process as foundational to an Ecosystem Approach to Management [EAM]. Already there is strong external impetus across the nation and, in particular, Alaska to broaden fishery management. This I see in addition to the internal leadership and forward thinking that characterizes the thrust of AFSC activity. Already the Council is responding by developing stock assessments that take into account Threatened or Endangered Species as required under the Endangered Species Act and the Marine Mammal Protection Act.

Challenges

Maintain and utilize the ability developed so far.

Recommendations

I was impressed by Theme IV presentation on prioritization and Theme VII presentation for further efforts. The content of presentations for these two themes is very responsive to what I see as macro trends affecting fisheries management and science in support of stock assessments. First, there is an active campaign with respect to the role of forage fish in fished ecosystems that influences the demands placed on foodweb analyses in stock assessment and assessment of other ecosystem components. Second, with the significant improvements in fisheries management and implementation of rebuilding plans for the assessed stocks, attention is shifting to identification of species complexes and assessments of other ecosystem components. Here PSA and Vulnerability Analysis are critical. Third, advanced genetic techniques allow for definition of spatial distribution and abundance of harvested stocks which may have significant implications for how stock assessments are carried out and the advice needed for management. Fourth, the

multiple overlapping spatial regulations already in place may be having cumulative unintended consequences in the ecosystem. Thus, other approaches to spatial management of stocks could be usefully explored like Fishery Technical Interactions Model (Hollowed, Theme IV slides 18-19). This type of spatial analysis could be required in regional implementation of Integrated Ecosystem Assessments and in Marine Spatial Planning. Fifth, the North Pacific and its marginal seas [Gulf of Alaska, Bering Sea and Aleutian Islands] are identified as being exposed to changes in water temperature and ocean acidification which could bring about regime changes as big as or bigger than those experienced in the mid-1970s. Thus, the efforts to use EEM Extended Ecosystem/Environmental Modeling effort to assist in forecasting changes in parameters that can affect stock assessments 3-5 years out would be of great benefit. Indeed, effort to explore how major commercial species might be affected out as much as 20 years consistent with climate models would contribute to the learning and dialogue about long-term change in marine ecosystems. AFSC and its partners (especially Pacific Marine Environmental Laboratory and the North Pacific Research Board) in federal and state agencies, academic institutions, etc. serve a receptive and responsive fishery management institution by providing consistent high quality and cutting edge scientific leadership.

Reviewer report on Program Review of Stock Assessment Process

Science Center: Alaska Fisheries Science Center (AFSC), Seattle

Dates: 24-28 Mar. 2014

Reviewer 5

I. General Observations

The Alaska Fisheries Science Center clearly takes a lot of pride in their annual stock assessments, and rightly so. The staff is highly motivated, is very involved in a wide range of activities associated with fisheries management, and wants to do what is right for both the fishing industry and the Alaska ecosystems. The Alaska Fisheries Science Center produces more assessments and covers more U.S. coastal waters than any other Science Center (SC). The assessment scientists work very closely with the data collection and research components of the lab so there is a lot of cross fertilization of ideas that keep the assessments on the cutting edge. The SC should be commended for its very high level of quality work conducted by enthusiastic and dedicated staff. The SC has suffered from recent federal budget cuts and every effort should be made to sustain and enhance, if possible, the assessment activities.

The recommendations made here are not intended to suggest large changes to the assessment efforts, but just small tweaks to hopefully improve a system that is already operating smoothly. I recognize that some of the challenges and potential solutions may be beyond the SC's immediate control, but my hope is that these suggestions can be used to encourage NOAA headquarters to provide the guidance and support necessary to keep the assessment groups moving forward and allow them to expand and improve their current approaches.

Theme 1: High-level scientific/technical approach

Observations:

The assessment teams are well versed in a range of techniques for conducting the assessments. They produce annual assessments on a compressed schedule for a number of species that cover a range of tiers. It is clear that the co-location of the assessment team with the data collection teams promotes healthy interactions between the groups and should be maintained and encouraged. The connections with other national and international science and assessment panels are also important to the groups' productivity and success.

Strengths:

- The assessments are supported with regular survey data. Although some species are considered “data limited”, in general there is a wealth of data that can be used to generate regular, annual assessments. The assessment team is also very involved in national and international science and assessment team activities and seems to be regularly testing and updating their model approaches using multiple software platforms.

Challenges:

- A challenge for the program is the wealth of data. As previously noted, this is a strength because it allows for robust assessments, but it is also a challenge because there are potentially valuable data that have not yet been incorporated into the models as fully as one might hope. For example, I would like to see a better link to the ecosystem research conducted at the Science Center. Another challenge of having good data is that it allows a more thorough evaluation of the uncertainties in the models and projections. The catch limits resulting from these assessments appear to be successful and the assessment teams should be commended, but I believe more can be done to improve the evaluation of the models.

Recommendations to address issue:

- I know that the assessment teams have a long list of improvements they would like to make in the technical approaches. I believe that the team should focus their attentions on streamlining and automating the process as much as possible to find efficiencies where possible. The Science Center might also consider devoting resources to an assessment development group to develop, test and implement improvements would benefit the assessment program. The assessment process limits the ability of these scientists to do research, so easing up on that burden should improve productivity. Having a devoted development group might also allow the exploration of multi-species models, exploring how multi-model ensembles might be incorporated into the assessment process and how to better address the broader questions of incorporating environmental data into the assessments.

Theme 2: Assessment process

Overall the assessment process works amazingly well. The AFSC conducts a large number of assessments every year, incorporating that year’s data in a very compressed timeframe. The processes for assessments are laid out clearly and seem to function well. The fact that none of the assessed fisheries are overfished and the fishing community seems to work well with NMFS suggests that the overall process is working.

Strengths:

- The strengths of this approach are that the assessments are well supported with data, the review process is transparent and open, and they respond to stakeholder needs. There are clear expectations in the SAFE guidelines.

Challenges:

- The data turn around and assessment timeline is very short. Other challenges are the fact that it is difficult for authors to find relevant comments in the SSC minutes, compliance with guidelines is sometimes less than perfect, and the team chairs have to master 2000 page SAFE documents very quickly.

Recommendations to address issue:

- Better communication between the different groups (survey, ageing, observer, assessment) might make the process go more smoothly during the crunch time. Refining automated error checking procedures could make the entire process move more quickly and smoothly. Asking the SSC to provide specific comments to particular assessments in a concise and organized way would also make it easier for the assessment scientists to respond and reduce missed requests.

Theme 3: Peer review

There is a multi-level review process that includes annual in-house reviews, annual external reviews at the Plan Team and SSC levels and reviews every 5 years by the Center for Independent Experts. There are well documented guidelines for each of the review steps that make the process transparent and efficient despite the compressed timeline for the assessments.

Strengths:

- The strength of this approach is the documented and clearly outlined process for the reviews.

Challenges:

- The compressed timeline for the assessment is a challenge for the review because the AFSC must balance the time allowed for writing the assessment and the time allotted for the review. The internal review relies on a very limited pool of people because AFSC is limiting the reviewers to the internal assessment teams.

Recommendations to address issue:

- An expansion of the reviewer pool within the AFSC would decrease the time constraints and likely lead to improved assessments and better reviews. The center should be careful about the internal reviews becoming too collegial and routine. There needs to be a process to ensure that there really is a careful review of the content or acknowledge that

the in-house evaluation perhaps is more of a quality assessment of the report rather than a review. The AFSC should also consider some schedule for rotating authors so the assessments have the benefit of a fresh perspective every few years. Consider using the 5 year CIE reviews as more in-depth evaluations of the current assessment approach regardless of whether the models have changed substantially or not.

Theme 4: Organization and priorities

The AFSC appears to be well organized and transparent in its organization and prioritization. There was some discussion of the management of stock complexes and the efforts to break out species from the complexes. There was a very interesting discussion of management strategy evaluations. This type of work should be encouraged and continued.

Strengths:

- The AFSC is well organized and has clearly identified priorities. They have open engagement with a number of regulatory and oversight panels and transparent decision making. The prioritization of frequency and level of assessment appears to be consistent with national protocols.

Challenges:

- Maintaining the annual assessment schedule is a challenge but seems to be well justified. The effects of environmental factors are difficult to include with the current organization and priorities. There is a complex suite of interacting regulations that require careful examination of any proposed actions. There is no clear process that was explained to the review team for when or how to break out individual species from the managed complexes.

Recommendations to address issue:

- Formal workshops or meetings during inter-seasonal periods should be used to consider potential changes to the assessment process, including improvements beyond any specific model changes recommended by the panels. A formal process for determining when and how individual species should be pulled out of the current complexes should be developed and documented so this work can be more formally prioritized. Consider prioritizing the development of a fishery technical interaction model to assess layering effect of management system and more effort in understanding stock structure. This could be a responsibility of the assessment development group if one were formed.

Theme 5: Accomplishments relative to mandates

The AFSC does more assessments than any other science center and do not generally have overfished stocks. They follow clear timelines, meet critical deadlines, and comply with the SAFE guidelines. The point was made that the SSC almost always accepts the assessments as

presented. This was the theme under which the ecosystem considerations were discussed. The ecosystem group has a data portal with a very large number of useful indices. They produce annual Bering Sea and Aleutian Islands ecosystem reports that track key indices that can inform the management decisions.

Strengths:

- The AFSC is meeting all its mandates. The ecosystem group and its products are closely tied to the assessment and council process. It also has a strong connection with partners to leverage resources and expertise.

Challenges:

- The challenge is that meeting the assessment mandates takes a lot of science center resources. The ecosystem group has challenges with long term funding stabilization, data limitations, computing power, and how to accurately evaluate possible ecosystem thresholds.

Recommendations to address issue:

- The system for meeting the mandates seems to be working so it is difficult to recommend changes for that aspect of the program. My primary suggestion would be to continue looking for ways to make the process more efficient either through automation in appropriate places or further standardizing approaches. The AFSC climate and ecosystem research is truly cutting edge and a great example for the direction that future of ecosystem management should be moving. The AFSC should continue to develop this work and continue to explore how to properly integrate the ecosystem work into the assessment process.

Theme 6: Communication of assessment results and data needs

The communications discussion focused primarily on communications with all of the relevant groups during the assessment process. There was some discussion of the importance of meetings and workshops and how recent travel restrictions were curtailing communications. There was relatively little discussion of outreach and education components although it was pointed out that the science center does have some personnel and a small budget devoted to outreach.

Strengths:

- Communications both within the AFSC and between the AFSC and outside assessment and research groups appears to be very active and productive.

Challenges:

- The fact that AFSC is actually spread across three states presents a challenge since recent travel restrictions have made it much more difficult to get together and discuss ideas and coordinate activities. The AFSC could improve its outreach and education

activities. AFSC does great work, but they are not great at letting the general public know how they are helping the fishing community and society.

Recommendations to address issue:

- Although it is generally out of the science center's control, an easing of the travel restrictions would significantly improve communication and improve morale. I believe the science center should also look at its outreach and education activities and consider how to better inform the public of the important work coming from the assessment groups.

Opportunities

Everyone recognizes that assessments can always be improved. It is not always so easy to identify the best ways to produce those improvements. The AFSC is proactively involved in research and evaluation of new models and approaches to improve the assessments. There are many ideas, but ultimately it is a challenge of resources to develop those ideas. The AFSC is well positioned to continue to evolve the assessments and places a strong emphasis on innovation.

Strengths:

- The AFSC staff is aware of and use diverse modeling approaches in their assessments. The strong connections to the Science Center research and data collection groups, to the national assessment panels and to regional research programs (e.g. North Pacific Research Board) provide opportunities for the assessment groups to innovate and incorporate cutting edge developments into the assessment approaches. The AFSC also has a good history of mentoring students that can feed into future positions with the Science Center.

Challenges:

- A significant challenge is how to incorporate climate change into future assessments and how to move from fisheries management to a more integrated ecosystem based management. Related to this is the fact that most research is supported on soft money that is very uncertain and not conducive to long-term development projects. The recent loss of graduate student stipends has also reduced productivity and fresh thinkers as well as the loss of training opportunities for younger scientists.

Recommendations to address issue:

- The AFSC is very good at leveraging its capabilities and assets against the strengths and assets of its partners and collaborators. Stable funding for ongoing partnerships (e.g. AFSC-PMEL partnership through EcoFOCI) will help advance the Science Center's goals in an efficient and productive manner. Similarly, the Science Center should find a way to bring back the student fellowships. The Science Center should prioritize efforts to incorporate more climate forcing into the assessment process and move from a fisheries management to more of an integrated ecosystem management model.

Reinstituting the National Stock Assessment Workshops would also help advance assessment work across all of NMFS.

Other

Although there was an indication that uncertainty estimates were included in the assessment report, it was not clear how this information actually contributes to the ultimate management decisions. I would encourage the AFSC to consider how to more effectively incorporate uncertainty estimates into the assessments in a way that is clear and effective with the management community. This is a problem throughout the sciences and is an area of very active research, particularly for the climate community. It might be useful for the Science Center to engage the climate community and see if there are synergies that can be used to help both communities.

II. Key (Specific) Findings and Recommendations

1) The SC should be commended for its very high level of quality work conducted by enthusiastic and dedicated staff.
2) The AFSC appears to be well organized and transparent in its organization and prioritization.
3) The Science Center might also consider devoting resources to an assessment development group to develop, test and implement improvements would benefit the assessment program.
4) Asking the SSC to provide specific comments to particular assessments in a concise and organized way would help assessment scientists to respond and reduce missed requests.
5) The AFSC should consider some schedule for rotating authors so the assessments have the benefit of a fresh perspective every few years.
6) The AFSC should continue to develop the climate and ecosystem work and continue to explore how to properly integrate the ecosystem work into the assessment process.
7) Stable funding for ongoing partnerships would help advance the Science Center's goals in an efficient and productive manner.
8) The Science Center should find a way to bring back the student fellowships.
9) The AFSC should help the assessment community move from a fisheries management to more of an integrated ecosystem management approach.

III. Conclusions

In conclusion, I would like to reiterate that the recommendations made here are not intended to suggest large changes to the assessment efforts, but just small tweaks to hopefully improve a system that is already operating smoothly. My hope is that these suggestions can be used to improve what is already an excellent program.

Appendix 1.

Terms of Reference for NOAA Fisheries Science Center
Fiscal Year 2014
Stock Assessment Science Program Reviews

Purpose of the Review

Reviews of science programs at the National Marine Fisheries Service (NMFS) Science Centers (including associated laboratories) and the Office of Science and Technology (ST) are conducted annually to:

- Evaluate the quality, relevance, and performance of science and research conducted in NMFS Science Centers and associated laboratories
- Strategically position the Science Centers and ST in planning future science and research.

Scope of Review

The objective for this review is to examine and evaluate each Center's fishery stock assessment program that is conducted pursuant to the Magnuson-Stevens Act (2006) and comparable international agreements. Stock assessments are demographic analyses designed to provide particular scientific advice to living resource managers. Fishery, survey and biological data for stock assessments were reviewed in 2013. In 2014, the review focus shifts to the overall program of assessment modeling, approach, review process and communication. This is not intended to be an in-depth review of a particular stock assessment. For the review, the Panel shall consider materials provided by the Center and comment on 7 themes that define the stock assessment program:

1) Does the Center apply a suitable scientific/technical approach to fishery stock assessment modeling?
2) Is the assessment process efficient, effective and clearly described, including terms of reference for assessment reports?
3) Does the Center, in conjunction with other entities such as the Council's Scientific and Statistical Committee (SSC), have an adequate peer review process?
4) Is the Center's program organization effective at accomplishing needed assessments according to a set of assessment priorities? Include program structure, staffing, and funding; include prioritization of stocks for assessment.
5) Does the Center achieve adequate assessment accomplishments relative to mandates particularly with respect to the number of Fishery Management Plan (FMP) species assessed?
6) Does the assessment program adequately communicate their results, needs, and research? Are there opportunities for improving stock assessments and the stock assessment process?

Background

Reviewers are asked to provide advice to the Center Directorate on the direction and quality of the Center's stock assessment program(s). The following background questions are provided to stimulate thinking with respect to the themes, but these specific questions need not be explicitly answered by the review:

1) Scientific/technical approach to fishery stock assessment modeling –

a) Is the Center using an appropriate suite of analytical methods to meet the regional fishery stock assessment objectives?
b) Does the suite of assessment models cover considerations from data-poor to data-rich?
c) Are assessments capable of considering possible ecosystem effects?
d) Does the Center work on enhancing and testing these analytical methods? Are they keeping with and contributing to the state-of-the-science nationally and internationally?

2) Is the Center's process for conducting stock assessments efficient and effective?

a) Is there an explicit terms of reference for conducting and reporting assessments?
b) Do reports provide a complete description of the work and a concise summary?
c) Do assessments adequately and incrementally build upon past assessments and reviews?
d) Are there clear protocols for delivering draft assessment products to peer reviews?
e) Is involvement of assessment scientists in preliminary data preparation and analysis sufficient to utilize their statistical expertise, but not burdensome?
f) Are there protocols for consistently dealing with technical issues, as appropriate to the stock, for example: calibration of catchability, consideration of dome-shaped and time-varying selectivity, natural mortality, estimation of stock productivity, characterization of uncertainty, etc.?
g) Are there protocols in the assessment process for conducting sensitivity analyses and evaluation of risk?

3) Peer review process

a) What is the relative role of the Center and the Council's Scientific and Statistical Committee (SSC) in organizing and conducting the peer review?
b) Are TORs for assessment reviews clear and well defined prior to the assessment? Are they focused on key issues needing review? Are they appropriately, but not excessively, broad in scope? Do they focus the review on key, answerable questions?
c) Are major data collection programs and modeling methods reviewed separately from the final review of assessments?
d) Are there clear protocols for considering and including input from scientists not on the agency assessment team?
e) Does the regional peer review process achieve an appropriate balance between transparency, thoroughness, and throughput?

4) Organization and priorities –

a) Does the Center/Region schedule stock assessments in a manner that meets national standards and regional needs?

i) What protocols are used to prioritize need, frequency and appropriate level of stock assessments?
ii) Has the Center reasonably balanced Council, other domestic and international stock assessment needs as well as additional analytical and review demands?

How well does the Center involve internal and external clients and stakeholders in priority setting and the assessment process?

iii) Are the Center's scheduling and scale (e.g., benchmark vs. updates) for individual fishery stock assessments balanced with Center resources, and regional, national and international needs?
iv) What steps are the primary bottleneck in the number and timeliness of stock assessments each year: surveys, input data processing and management, assembly of assessment reports, ability to address questions from previous assessment, availability of assessment scientists, and review scheduling? Are any excessively limiting? b) Is the Center prioritizing the appropriate initiatives and research areas to address current and anticipated stock assessment needs, including connection of stock assessments to broader ecosystem investigations?

5) Accomplishments relative to mandates

a) How many FMP and non-FMP stocks are being assessed?
b) Do current and planned fishery stock assessments meet regional, national, and international expectations in terms of quality, quantity and timeliness?
c) How well does the Center attain a prioritized portfolio of baseline assessments for all managed stocks (including data-poor) and full assessments for important stocks?
d) How well does the Center consider ecosystem and environmental factors affecting fish stocks and their assessments?

6) Communication –

a) Are assessment data needs being communicated to survey scientists, advanced technology experts, and fisheries-dependent data sources; and have improved data resulted from these efforts?
b) Are assessment process and results adequately communicated to fishery managers, affected public and the scientific community?

7) Opportunities –

a) Is the Center conducting the research necessary to improve stock assessments and produce timely and assessment-relevant scientific research products?
b) Do assessment scientists engage in research published in peer-reviewed journals?
c) Are there areas of expertise that could be added in the future to strengthen the ability of the Center to meet its management and research objectives?

d) Should the Center be taking greater advantage of opportunities for collaboration in conducting fishery stock assessments and related research, including shared approaches with other Centers, regional academic partners, other government agency partners, and stakeholders?

Appendix 2.

Review Panel

Dr. Bruce Leaman (Chair)	International Pacific Halibut Commission
Dr. Bill Clark	International Pacific Halibut Commission (retired)
Dr. David Fluharty	University of Washington
Dr. Paul Rago	NMFS Northeast Fisheries Science Center
Dr. Christopher Sabine	NOAA Pacific Marine Environmental Laboratory
Dr. John Stein	NMFS Northwest Fisheries Science Center