

## **Summary Report**

### **Southeast Fisheries Science Center Science Data Collection Program Review**

Reviewer 1

The National Marine Fisheries Service's Southeast Fisheries Science Center (SEFSC) in Miami, Florida conducted an external review to evaluate its current scientific data gathering and management procedures. Specifically, the review focused on fishery-independent data, fishery-dependent data, biological data, and data management as they relate to fishery stock assessments in the various geographic locales for which the Center has jurisdiction. The review was conducted over a 3-day period during which Center staff (from headquarters and satellite laboratories) provided presentations to a 5-member reviewer panel, partners, constituents, and the public. The presentations described the Center's data collection and management activities for various fish stocks under its jurisdiction and outlined procedural strengths, challenges, and opportunities related to each activity. To supplement the on-site presentations, the reviewers were provided web-based access to numerous supplemental readings (including workshop results, publications, and operational protocols) that outlined much of the Center's work in much greater detail. The reviewers were tasked with processing this information and providing the Center with independent written and oral feedback aimed at improving its ability to fulfill its mission objectives. As Chairman of the review panel, I was further tasked with reading each panel member's report and summarizing recurring themes in the reports' findings.

The range of topics covered, the level of details provided, and the degree to which specific recommendations were made all varied among the five panellists. However, there were some recurring themes that are recounted here. First, there was consistent sentiment that the Center was to be commended for the large amount of hard work that must have been necessary to prepare and present the information the panellists were given for this review. Issues with the volume of information, the level of detail contained in the information, and the timeframe to process it and prepare a report did not detract from the panellists' acknowledgement of the SEFSC accomplishment in compiling and presenting large volumes of very complex data. There was also consistent sentiment that the review timeframe, as currently constructed, was daunting. There was verbal feedback to change the resolution of the review (i.e., scale of topics covered) to something that could be accomplished in the week time frame that was viewed by the panellists as an appropriate length for a Center review. Other recurring themes in the reports include the belief that the Center staff was thorough and honest in conducting a self-assessment and in identifying strengths, challenges, and strategies for overcoming challenges. Generally, the panellists supported the Center's self-assessment and recommended moving forward as planned. Some of these strategies include the following:

- Continue and expand use of electronic logbooks to the extent possible
- Improve and increase mapping of benthic habitat
- Improve and expand fishery-dependent and fishery-independent data collection in the U.S. Caribbean
- Increase the number of permanent federal staffing to expedite age determination for various fish stocks and stock assessment
- Continue to expand and enhance IT infrastructure

Further, the panellists recognized that the Center has limited resources and probably cannot complete all its tasks equally well; as such, there was a recurring sentiment of the Center's

need to prioritize its mission objectives and to allocate resources to where they will make the most difference, not simply incrementally improve already-successful mission objectives. For example, sensitivity analysis of an existing stock assessment for a particular species could be used to identify the degree to which additional data used in the assessment would be helpful for the management of that species or whether those resources could be better used elsewhere or for another species.

## **Southeast Fisheries Science Center Science Program Review: Data Collection**

Reviewer 1

### **Introduction**

The Southeast Fisheries Science Center, hereafter the Center, is a National Marine Fisheries Service (NMFS) agency tasked under the Magnuson-Stevens Act with the stewardship of living marine resources through science-based conservation and management and the promotion of healthy ecosystems. The SEFSC is headquartered in Miami, Florida and has satellite laboratories in NC, FL, MS and TX. Together, these facilities have geographic responsibilities for three large marine ecosystems: the US South Atlantic, the US Gulf of Mexico, and the US Caribbean Sea. The Center works cooperatively with three fishery management organizations representing the three US geographic regions for which it has jurisdiction as well as an international organization (the International Commission for the Conservation of Atlantic Tunas) representing the international Atlantic Ocean and specific stocks of an economically important group of fishes (i.e., tunas) that occur there. The Center's mission is important because of the large, diverse, geographic scale its jurisdiction encompasses, the economic value of the marine resources under its stewardship, and the variety of regional management agencies (e.g., fishery management councils and fish commissions) that rely on the Center's research products as the basis for their management actions.

The Center's work is achieved by conducting research to address questions related to a variety of topics including stock and population assessments, habitat research and monitoring, life history, and by-catch reduction. This research is done collaboratively through NMFS and non-NMFS ship-based surveys, cooperative research surveys, commercial and recreational log books, and on-board observer data collection. Such a broad range of collaboration requires coordination with many partners, and these include regional fish commissions (i.e., Gulf and Atlantic), state and territorial natural resources agencies, industry, academia, and non-governmental organizations. As part of its goal of achieving this mission, the Center has undertaken a review to evaluate its current scientific data gathering and management procedures. Specifically, the review is focused on fishery-independent data, fishery-dependent data, biological data, and data management as they relates to fishery stock assessments in the various geographic locales for which the Center has jurisdiction.

The review was conducted over a 3-day period during which Center staff (from headquarters and satellite laboratories) provided presentations to a 5-member reviewer panel, partners, constituents, and the public. The presentations described the Center's data collection and management activities for various fish stocks under its jurisdiction and outlined procedural strengths, challenges, and opportunities related to each activity. In addition to the presentation, the reviewers were provided web-based access to supplemental readings that outlined much of the Center's work (including workshop results, publications, and operational protocols), but in much greater detail than that given in the presentations. The reviewers were tasked with processing this information and providing the Center with written feedback aimed at improving its ability to fulfil its mission objectives. Specifically, the reviewers were asked the following questions: are there opportunities that the Center should be pursuing in collecting and compiling fishery assessment data, including shared approaches with partners? Are the Center's fishery data objectives adequate, and is the Center using the best suite of techniques and approaches to meet those objectives? Is the Center's fishery data system

properly organized to meet its mandates and is the allocation of resources among program appropriate? Are the Center's fishery data programs being conducted properly?

## First Impressions

The Center should be commended for a well-planned and executed review. The panel was provided with detailed information regarding the Center's extensive and myriad activities by personnel from Center and all of its satellite labs. The information contained in the many presentations was very thorough and helped provide context for evaluating whether and how the Center was achieving its goals and helped to identify opportunities for improvement. The level of breadth and depth of the information provided must have consumed many hours of personnel time to prepare and convey. However, the volume of information provided and the time allotted to process it were sometimes incompatible. In those instances, having the presentations available for later review remedied the potential for information overload. Further, the requirement of a written report within 1 day mandates that the review report be focused on large scale issues and not a project by project evaluation and review. There simply is not enough time to individually address all the data collection programs the Center manages and were highlighted over the 3-day review. Overall, the Center's management and staff did a wonderful job with a challenging task and ultimately made the review successful.

## Reviewer Assessment

### *Fishery Independent Data*

The Center is involved with direct data collection (fishery independent sampling) in each of the three geographic areas for which it has jurisdiction. This sampling is achieved through a variety of programs, some of which are limited by geography. Further the various sampling targets different stocks within each region. These sampling programs are implemented collaboratively with state agencies and other regional fishery organizations. Generally, the sampling is fulfilling its intended objective: the data are being used to assess some stocks of important sport and recreational species. The information shared on the Center's fishery independent data collection identified several strengths and challenges to the program. In some instances, proposed solutions were offered. Self-identified strengths of the programs include: long-term, time-series data (some going back 30-40 years), participation of all Gulf states, probability-based sampling, use of standardized sampling gear and survey design (except for one state), multiple species sampling, use of electronic data recording, and utility of data for assessing status of at least 10 stocks. Self-identified weakness in some aspects of the program include: limited number of sea days (weather- or vessel-related interruptions), a state that does not use program gear or sampling design, lack of sediment or bottom type data, lack of net mensuration equipment, inability to determine catchability coefficient of the sampling nets, sample processing time (e.g., for ichthyoplanton surveys), complex data structure, and limited geographic coverage (in some instances).

### *Fishery Dependent Data*

The Center also is involved with indirect data collection (fishery dependant) with a number of partner organizations in each of the three regions for which it has jurisdiction. This sampling program is similar in scale and scope to the fishery independent data; however, in this instance that data are collected directly from commercial or recreational fishery operations, and the Center has less influence over how and when the data are collected. Generally, the data reported include catch information, catch and effort information (CPUE), and some basic biological information. The data are divided into two main categories (recreational and commercial) and reported from recreational log books, onboard observers, and commercial fish processors. Each data type has its own strengths, challenges, and strategies for improvement. There are also geographic issues related to data quality and quantity.

The recreational catch and effort data are generated primarily through a series of statistically-based survey programs that are implemented on the mainland and Puerto Rico as well as logbook surveys from headboats and billfish tournaments. The fishery dependent data have proven to be useful for document landings of important recreational and commercial species and allows for the evaluation of basic stock trend assessments. As with the fishery independent data, the Center staff also identified strengths and weakness with the fishery-dependent data. For the recreational segment of those data, statistically sound surveys and tightly monitored log book surveys were identified as strengths of the data. In those instances where these programs occur, coverage and data utility are good. However, there were many concerns identified with these data, including: little if any observer coverage, self-reporting of data, low participation rates, lack of reporting of releases, limited geographic range, and potentially incomplete information. A different set of strengths and weakness were identified for the commercial landings. The interest from and involvement by the states, the existence of programmatic standards (e.g., Atlantic Coastal Cooperative Statistics Program) for data timeliness and formatting, programmatic integration (e.g., Gulf Fisheries Information Network), mandatory catch reporting, and species specific catch reporting (in some jurisdictions) were deemed strengths of the commercial fishery dependent data collection. Challenges to commercial fishery-dependent data collection included limited processing capacity in most states, processing delays, data entry delays, late reporting, unlicensed fishers, and incomplete reporting. Most of the problems with the commercial fishery dependent data were evident in the US Caribbean Sea. This area was identified as problematic for many reasons, and the challenges there seemed to frustrate Center staff.

### *Biological Data*

Harvest pressure acts as a strong selective force on the biology of exploited fishes, such that shifts in life history traits can occur as a response to harvest pressures. As such, abundance and distribution data alone do not tell the whole story of a stock's status or trends. Biological data such as growth, mortality, length-at-age, age of first reproduction, fecundity measures, and migration patterns are useful to determine if a stock is being overfished. Two of the Center's satellite laboratories (Beaufort, NC and Panama City, FL) are involved with collecting age and growth information of exploited fishes in two of the three geographic areas under the Center's jurisdiction. The goals of this effort are to determine age frequency, growth, and longevity of harvested species in the US south Atlantic and Gulf of Mexico, and the use of fecundity and condition to determine reproductive strategies and maturity parameters for harvested fishes. Samples for this work come from a variety of partners including state agencies and survey programs. These two labs have been successful at

collaborating with other agencies, which improved the number of representative species sampled, built a network of aging labs, increased precision among aging labs, and built shared references sets for staff training. Other tangible successes include modernizing the sample processing equipment, maintaining a biological sampling database, the ability to decode a very heterogeneous reporting template for sample data, and the ability to process and age a limited number (~20%) of samples for 17 species total. Specific stock assessment uses for the biological data generated by these labs are not as obvious, although age-at-length keys can be useful indicators in shifts in life history traits (e.g., growth rates and maximum size). Further, the collection of other biological attributes (e.g., food habits and diet analysis) seems like obvious areas for expanding the scope of the work performed by these two labs.

This program seems to be facing many challenges. For example, the two labs have been successful at aging some species, but species-specific aging workshops are needed to increase accuracy and precision for estimated ages. Further, age validation studies are needed for major recreation and commercial species and species of concern. Current staffing levels are insufficient to meet the workload demands, and there is a dependence on extramural funding to increase staffing to address workload. When extramural funding is available to hire staff, turnover rates are high, and valuable time is spent retraining new employees. Despite these difficulties, advancing the aging mission of the labs is far ahead of advancing the reproductive mission. Reproductive tissues are difficult to obtain, and such samples in the south Atlantic currently relies entirely on one state agency. There is a need for increased reproductive sampling across the Center's entire jurisdiction. When samples are available from the Gulf of Mexico, there are problems assessing fecundity of batch spawners in subtropical waters. Finally, lack of biological information from the US Caribbean Sea is glaring. Given the current challenges with the two geographic regions being served, adding a third would certainly not be easily accomplished. Perhaps the Center must balance this omission with its other responsibilities and balance trade-offs between costs and benefits of such an expansion in the collection of biological data.

Still, there is reason for optimism in the biological sampling program. The Panama City lab is investigating the feasibility of including otolith microchemistry sampling into their otolith sampling protocols. The determination that there were distinct geochemical signals in the otoliths would allow for the discernment of nursery sources for adult populations and whether certain stocks were self-sustaining or dependant on recruitment from elsewhere. This lab is also investigating the feasibility of using automated image scanning for enumerating oocytes in gonadal tissue. This process would help with fecundity estimation and speed up reproductive tissue processing.

### *Data management*

Data management is the process of organizing and storing data so that it is easily retrieved and queried to provide answers to specific questions by various end users. Data management can be simple or complex, depending on the amount and type of data, how it was collected and processed, and how it is accessed and archived. The Center is tasked with managing two types of data: fishery-independent and fishery-dependent, and each type has its strengths and weaknesses. Currently, the Center manages data from at least five sources of fishery-independent data, including trawls, longline, and ichthyoplanton surveys as well as multiple video surveys. Each of these datasets is processed differently, depending on the type.

Generally, there are protocols for data chain-of-custody and protocols for quality assurance/quality control. In the case of the multiple surveys conducted under the fishery independent data collection, each seems to have its own set of processes, housed in a separate location, maintained with different software programs, and managed by different agencies. To further complicate this picture, the data are voluminous (i.e., spanning many decades) and have been collected and stored on constantly changing technologies. Attempts have been made to upgrade storage technologies as they evolve, but this process is not fool proof and there have been data losses (e.g., water logged data sheets during Hurricane Katrina). Similar losses are possible. For example, none of the video images captured during the various video surveys are back up. This seems like a disaster waiting to happen. The Center is aware of these challenges and seems to be working diligently towards avoiding similar issues in the future. Currently, fisheries-independent data are collected on different computing systems (depending on survey) and consolidated for integration into a staging database and eventually deposited into a master data store. Distribution of data to partners must come from this master data store. The Center's intends to maintain its databases on current technological platforms by maintaining responsive software development and by sharing common software solution with partners. The Center also plans to formalize a data management plan that identifies the Center's governance over all aspects of data collection, processing, storage, and dissemination. This plan seems like an appropriate strategy for dealing with multiple streams of data from many sources and with multiple potential end users. The real test of this system will be the accessibility of the data for the Center staff to conduct stock assessments and make management recommendations.

The fishery-dependent data management challenges are similar to the fishery-independent data management challenges, but with their own layers of complexity, most of which deal with data collection and reporting. There are multiple data sources, most of which are self-reported. Center staff were thorough in their assessment of the strengths and weaknesses of these various data sources, and those strengths and weaknesses were as varied as the programs themselves. Many of the proposed solution to these data collection challenges seemed reasonable, but some are easier to implement than others. For example, slow connectivity for data entry by partner VI Dept. Parks and Natural Resources and underreporting by Virgin Islands fishermen have been identified as weaknesses in the self-reporting from the region. Proposed solutions to these two problems include "address connectivity" and validate dockside landing. These solutions are easy conceptually, but what does "address connectivity" actually mean? How can the Center affect connectivity (i.e., infrastructure) in the US Virgin Islands? Also, how would validating dockside landing be useful there when some fishers sell part of their catch before they reach port? Conversely, inconsistent methodology over time and between users has been identified as a weakness in the Trip Interview Program. The proposed solution to this problem is to develop a standardized curriculum (for sampling) and establishing a sampling update manual. This solution seems accessible and easy to implement.

## Overall Assessment

Generally, the Center's staff seemed to have completed a thorough self-evaluation of the various sampling programs and have been successful at identifying their strengths, challenges, and strategies for overcoming those challenges. I concur with staff's assessment and encourage them to move forward with implementing those strategies, as appropriate.

However, given the scope of the Center's work, finite resources, political challenges (e.g., operating in state waters), some prioritizing of work objectives will be necessary. Prioritizing should not only be based on what is feasible, but also on where the work would produce the most benefits.

The Center seems to have met its various objectives with varying degrees of success. In most cases, the management and staff are doing an admirable job with the resources available to them. There are some easily identified successes such as fishery independent surveys in the Gulf of Mexico and fishery-dependent log book surveys in the South Atlantic. However, there are some easily identified opportunities for improvement as well. The US waters in the Caribbean Sea are seemingly underserved in most categories. Why this is so is uncertain. Notably, the two other geographic regions the Center serves have labs that are physically located in the specific region. Perhaps the Center consider planning and seek opportunities for to establish a satellite laboratory in either Puerto Rico or the Virgin Islands. This lab would be tasked with a specific subset of the Center's mission. Such a lab would bring attention and resources to a region that seems to be underserved compared to the other two regions. Further, this lab's potential successes would further the Center's ability to fully meet its mission objective of stewardship in all its jurisdictions, not just a portion of them.

NMFS/PROGRAM REVIEW  
DATA COLLECTION, MANAGEMENT & QUALITY  
MIAMI, FLORIDA  
JUNE 3-7, 2013

Reviewer #2

The objective for this review is to review and evaluate the Southeast Fishery Science Center's current scientific fishery-dependent and fishery-independent data as they relate to fishery stock assessments conducted pursuant to the Magnuson-Stevens Act (i.e., NOAA ship-based surveys, cooperative research surveys, logbook and observer data, data management and quality control). In preparation for the review meeting, reviewers were tasked with reading 93 primary documents with an additional 73 documents recommended for further reading (totaling well over 4,500 pages). SEFSC staff gave thorough presentations and led discussions for the first three days, leaving the fourth day for reviewers to write their reports and the fifth day to present and discuss their findings. The topics raised in this report generally follow the chronological order of the topics as presented in the meeting but with an additional section to cover the broader, more cross-cutting issues.

***Overview and Cross-cutting Issues***

The SEFSC staff undertook the herculean effort of summarizing information for 45 separate fishery-independent surveys and 34 fishery-dependent data collection programs. Their presentations were thorough, well-organized, and very detailed. Every presentation included helpful information on that data's strengths and weaknesses as well as concrete recommendations for changes in data collection or management that would increase the usefulness of that data. I concur with every one of their recommendations – each of the recommendations would improve the usefulness of the data.

Unfortunately, I am only able to comment on how improvements or changes to data collection and management would affect stock assessments in the broadest of terms because the information relative to that question was provided in only a few narrowly-focused documents. For example, "Review of Fishery-Independent Survey Programs in Southeastern U.S. Atlantic Waters" focused solely on MARMAP/SEAMAP and SEFIS for the South Atlantic. While it did make recommendations as to which surveys were most useful, that document did not discuss which surveys were related to which assessment nor the specific ways in which improvements in the surveys would improve the output of the assessments. The document "An Internal Review of the SEFSC Ship-Based Resource Surveys Program" provided a list of which surveys are used (or could be used with modifications) for which stocks that are included in the US Fish Stock Sustainability Index (FSSI, through 2008), but gave no measure of the importance of that survey for each assessment. During the meeting, we were provided with an updated list, but this only defined which surveys produced indices that were considered in stock assessments, not which ones were actually implemented. While power analyses that explore the sample size – precision trade-offs for a particular piece of data (e.g., estimate of bycatch from a particular fishery) are useful for discussing how to improve surveys, they do not tell us how that change in precision affects the assessment which was the task of this review.

There are a number of analyses that could have been undertaken to answer the question, “To what extent do fishery-independent or fishery-dependent data quality, statistical precision, and timeliness issues impact overall assessment accuracy and precision?” Most, if not all, SEDAR stock assessments include a set of sensitivity runs to explore how the assessment results change with either the removal of specific data or changes in specific parameters (see Table 1 for an example from the 2010 Atlantic Menhaden assessment). A meta-analysis based on currently-existing sensitivity runs could be undertaken to summarize how the accuracy or precision of stock assessments change with the removal of specific surveys or changes in specific biological or fishery-related parameters. This would help the SEFSC determine which surveys are most central to the currently assessed stocks and determine how improvements in accuracy or precision in specific biological or fishery-related parameters might improve stock assessments. When specific data are available for a stock assessment but not included in the assessment, the assessment document gives specific reasons why they were excluded (e.g., lack of spatial coverage or representativeness, limited length of time series, high CV) and often includes specific recommendations on how that data could be improved so that it may be included in the future. Performing a formal analysis of the recommendations from the assessments, as well as the justification for excluding data sources, (e.g., via content analysis) could lend insight into what changes to which data sources would have the widest impact on assessments. The complete list of all recommendations made from every SEDAR assessment was included in our documents; however, that 247-page document was of limited use without formal analysis. Tracking which recommendations were actually implemented would also help the SEFSC determine how improvements in data affect stock assessments. Finally, performing a series of simulation-estimation exercises could also help the SEFSC examine the importance of data accuracy and precision for their assessments, but linking these exercises to real-world data sources may prove challenging.

Even if we did have information on how specific changes to data collection and management would affect specific stock assessments, we would only be able to address questions like, “What recommendations do you have for prioritizing fishery-independent and fishery-dependent data collection improvements?” in the very broadest of sense. The problem lies in the complete absence of clearly defined objectives. Without defined objectives, we cannot say what is better or worse. We cannot even define “good enough.” Is it better to reduce the uncertainty in the estimate of abundance for an economically and ecologically valuable, well-assessed stock (e.g., Atlantic menhaden) by instituting a coast-wide survey to produce fishery-independent index of abundance or is it better institute data collection to provide even a minimally reliable estimate of abundance for a stock whose ACL is currently being estimated using a catch-only (ORCS) method? It depends on your objectives.

Another common theme throughout all the presentation was the need for timeliness. Nearly every data collection or processing program had recommendations to improve timeliness. However, it was unclear as to which improvements in timeliness would actually lead to improvements in stock assessment accuracy, precision, or timeliness. Based on the presentations, it appears that the dealer data for commercial landings creates the greatest lag in the timing of assessments (e.g., an assessment only being able to use one- or two-year-old data). But that does not appear to be uniform across fisheries. It was unclear how delays in the reporting of data affect the ability of analysts to provide information for assessments. For example, reducing the MRIP reporting time from two months to one month may not result in more timely assessments (because the bottleneck is elsewhere), but that decreased time may affect the accuracy or precision of the estimates or the ability of analysts to derive better estimates of bycatch mortality (by having finer temporal data)? One way to explore this would be to create an information flowchart that includes a temporal component (similar to a Gantt Chart.) This would allow SEFSC to explore how increased or

decreased timeliness in one data collection or processing program trickles down through the entire process to inevitably affect the stock assessment. Such an exploration will be crucial if SEFSC hopes to anticipate where future bottlenecks may arise as data collection programs become more automated.

Finally, I wish to further emphasize that all comments and suggestions are in reference to data collection, management, and quality with respect to stock assessment, as per the terms of reference. A survey or datastream that has a low impact on stock assessment may be crucial for other aspects of fishery management. For example, improved timeliness may greatly increase the regional office's ability to monitor landings relative to the ACL even if it does not improve the assessment. A survey that does not currently contribute to any stock assessment may be crucial for ecosystem or process-oriented studies. Changes in data collection that would improve economic analysis or help managers better understand fishermen's response to management actions are not considered here.

### ***Fishery-dependent Data***

Based on the reading materials and the presentations, the major areas for improvement with respect to the collection of fishery-dependent data revolve around the recreational fishery (landings and discards) and bycatch in the commercial fishery. There are obviously other issues with this data, but the above categories were the most prominent. We were informed that reviewing MRIP was not part of our purview, and improvements gained through MRIP were not explicitly considered.

The main shortcomings of the data from the recreational fishery are its coarse spatial resolution, the large uncertainty in the estimates of effort, the lack of biological samples (length, weight, and especially hard parts for aging), as well as the uncertainty in discard estimates and complete lack of biological data for the discards. Given that the recreational fishery can account for 50% or more of total landings and discards for many reef fishes, and recreational discards may be two to three times the recreational landings for some fisheries, getting a handle on these issues is crucial. Increased sampling intensity will help with some of this, however much of this will require higher intercept rates for creel surveys in particular. This will also help the recreational fishery data become less reliant on self-reporting, an issue that was raised frequently. However, this may not lead to many improvements with respect to the estimation of discards, especially when it comes to estimating the size or age distribution of the discards. The presence of bag limits makes it such that analysts cannot assume that all discarding is due to minimum sizes (which would make it easy to estimate the age distribution of the discards). An additional problem with the recreational data is the lack of standardization between Texas's recreational fishery data collection (limited species, limited temporal resolution, limited spatial resolution) and that of the rest of the Gulf. The lack of standardization should be resolved as soon as possible.

The main issue with the commercial discards is that the vast majority of the data is self-reported and highly uncertain. The primary reason for this is that there is very limited observer coverage in Gulf of Mexico and zero observer coverage in the South Atlantic. This leads to large estimates of uncertainty (e.g., annual bycatch estimates from the Gulf of Mexico shrimp fleet can be quite large and have CVs greater than 200%), incomplete spatial coverage of discard data, little size information, and almost no age data. Even when there is observer coverage to estimate discards, this discard rate is often then applied to the fleet based on self-reported estimates of effort. Increased electronic monitoring in lieu of observers in the absence of 100% retention requirements will not solve this issue. There may be other creative analytical ways obtain reliable estimates of

discard (such as by estimating the bias in the logbooks based on observer data), and these should also be explored.

An additional problem with the commercial data centers around changes in catchability. Due to the lack of fishery-independent indices for many species, fishery-dependent catch-per-unit-effort data plays a primary role in many assessments. Changes in efficiency can wreak havoc on analysts' ability to construct reliable indices of abundance from fishery-dependent data. While some solutions were presented to account for past changes in efficiency, the SEFSC should implement data collection to assist in detecting changes in efficiency in the future. For example, perhaps a survey could be conducted to assess the current distribution of technology and fishing gear throughout the fleets, and this could be repeated on a regular basis to monitor the uptake of technology over time. Alternatively, questions relating to technology could be included in data collection programs that already exist (e.g., logbooks). Monitoring effort on finer spatial scales may also assist in tracking changes in catchability over time.

Finally, it is a well-known problem that catch and landings are poorly monitored in the Caribbean. In fact, there isn't even a standardized sampling of recreational fisheries for the Virgin Islands (MRIP does not sample there). Progress is being made in the Caribbean, but it is crucial for catch to be better monitored and validated if even the ORCS approaches to setting ACLs are to be applied to the region.

### ***Fishery-independent Data***

The paucity of fishery-independent data, especially in the South Atlantic and Caribbean, was a frequent theme throughout the meeting. Along with this, the need for fine-scale bathymetry and habitat mapping throughout all three regions was highlighted in many of the documents and was one of the most frequently mentioned data-needs in the meeting. Such a map will help improve survey design and hopefully reduce the variability in indices of abundance. That said, small sample sizes and high variability in the surveys are currently causing large problems for stock assessments. One issue that should be considered is reducing the temporal frequency of some surveys but increasing the spatial coverage of said surveys (both in extent and density) in the years they do occur. However, such a change should not be made until the consequences of this change on the assessment results have been fully quantitatively explored.

The precision and accuracy of stock assessment results are greatly improved with the inclusion of reliable fishery-independent indices of abundance. Generating such indices should be a major focus for efforts designed to improve data collection and quality for stock assessment. A well-designed coast-wide fishery independent survey could provide indices of abundance, age and length information, updated life history information while also informing selectivity, spatial extent and movement of the stocks.

As stated in the Overview, I was not able to assess the importance of most surveys when it comes to the stock assessments. We were provided with information on when fishery-independent indices were created for assessments, but there was no up-to-date summary of when they were actually included in the final assessment. However, there are a few specific surveys to note. Four out of the six SEAMAP surveys in the South Atlantic do not target federally managed species and are not used in any assessment. From the perspective of stock assessment of federally managed species, these resources should be reallocated (though there may be many other reasons not do so). These surveys are especially good candidates for exploring the importance of annual surveys; perhaps

these surveys (if continued at all) could take place less frequently. This could free up valuable resources that could then be redirected to improving data collection for federally managed species.

In early 2012, a select panel of experts was assembled at the NOAA Beaufort Laboratory to review state and federal systems for collecting fishery-independent data on reef fishes in the Exclusive Economic Zone of the South Atlantic bight offshore of North Carolina, South Carolina, Georgia, and Florida. In the abstract of their report (“Review of Fishery-Independent Survey Programs in Southeastern U.S. Atlantic Waters”), which focused solely on MARMAP/SEAMAP and SEFIS, they state:

*In general, the panel recommended shifting effort and funding from long longline sampling to other gear usage, making short longline gear sampling biannual rather than annual, and extending its coverage in the study region to span the length of the continental shelf break. Trap/video sampling was recommended annually throughout the study area using spatial strata based on depth and latitude with the goal of homogeneity of fish abundance within a stratum.*

I have included the full section on survey utility from their report as an Appendix.

There was a great deal of discussion about the use video surveys (and AUVs) to generate indices of abundance. I agree with the recommendations of the previously mentioned Beaufort Panel that, “the video should not replace the trap without adequately addressing potential sources of bias and calibration of the two gears. In addition the sheer volume of processing time will make its use as an index limited in the short term, until more efficient reading technology can be incorporated.” It is also important to note that video surveys will not provide hard parts for aging, and even basic size information will be limited depending on the technology. Video surveys hold great promise, especially when used in conjunction with other sampling gears, but it will not be a panacea.

As in the case of fishery-dependent data, fishery-independent data is sorely lacking in the Caribbean. Progress is being made, but current efforts are generally fairly local or focused on a restricted depth range. In the long run, improving the fishery-independent data for the Caribbean will likely be far more useful than improving the catch and landing data when it comes to understanding the health of the Caribbean stocks.

Finally, there was a great deal of discussion about the various observer programs and the need to increase observer coverage, especially in the South Atlantic where it is completely absent. Current coverage levels in the Gulf of Mexico are based largely on available funding rather than on attempting to optimize the estimation of particular parameters. These coverage levels are generally inadequate if the SEFSC wishes estimate discards from observers.

### ***Biological Sampling***

In general, sample sizes for age information, in both the commercial and recreational fisheries, in all regions, are smaller than what would be optimal for age-structured assessments of even the primary fisheries. In some cases, they are truly limiting SEFSC’s ability to conduct age-structured assessments. Even beyond simply providing information for age-structured assessments, aging data can be extremely helpful for understanding the life history of species for which age-structured assessment cannot be performed and can provide valuable information that can be incorporated into other types of assessments. Similar statements can be made for reproductive information.

One of the ways stock assessment models can go horribly wrong is when they assume, usually out of necessity due to lack of data, that life history traits, such as growth and maturity, and spatial distribution are constant over time. We are already seeing changes in these characteristics due to climate change. The lack of adequate biological sample may be hindering SEFSC's ability to detect such changes as well as their ability to account for such changes in their stock assessment models. Increased biological sample should be viewed as an investment in SEFSC's ability to properly assess stocks now and in the future

Estimates of biomass and trends are often highly sensitive to the estimate of natural mortality, yet this parameter is often one of the most uncertain inputs in the assessment, and they are frequently based on historical studies that had small sample sizes and limited spatial extent. Age-dependent natural mortality is even less certain. I fear to even mention the possibility of time-varying, age-dependent natural mortality. Despite the crucial role this parameter plays in nearly every age-structured stock assessment, very few resources are being dedicated to estimating it. Unfortunately, estimating contemporary natural mortality requires expensive research focused around things such as large-scale tagging or predator-prey dynamics. While it may not be economically feasible to directly estimate contemporary natural mortality, SEFSC should ensure that it is collecting (or collaborating with agencies which do collect) environmental and diet-related data that may allow analysts to estimate relative changes in natural mortality over time. The collection of diet-related data will have the added benefit of improving SEFSC's ability to tackle multi-species and ecosystem issues.

The SEFSC should ensure that it is able to maintain or increase funding for process-oriented studies that will improve stock assessments. Research that helps us understand processes such as the occurrence of ontogenetic shifts, the drivers and triggers of sequential hermaphroditism, factors affecting discard mortality rates all play a role in improving stock assessments. Studies such as these are often quite vulnerable during times of economic hardship, and SEFSC should ensure that such important research continues.

Finally, the SEFSC's ability to process the biological samples is on very tenuous grounds, and in some cases it is this lack of personnel that is preventing the processing of archived and even contemporary samples. Of those individuals who are able to process biological samples, an undue percentage of them are either funded by external grants or have to be hired as contractors. The processing of biological samples is an essential function for stock assessment, and these positions need to be secure in order to guarantee the availability of qualified staff.

### ***Data Quality and Management***

The review panel received a great deal of information about SEFSC's data management program. While it appears that they have a good plan in place for improving their data management and integrating their various datastreams (especially with respect to fishery-dependent data), it is abundantly clear that they desperately need individuals whose primary role is data management. These individuals should not be biologists with some database experience, but rather professional database designers and managers. Contract workers currently provide an unreasonable percentage of the support for data management; these positions need to be brought in-house.

One of the primary challenges for data quality and management is the integration of data products from various state and federal collaborators. SEFSC relies heavily on its collaborators, but data collection forms, editing, meta-data, and error-tracking / correcting routines need to be

standardized. The lack of coordination is likely causing large inefficiencies in data processing and likely contributing to errors in data.

Given the huge sums of money spent to collect these data and the incredibly important role data has in fisheries management, it is astounding at how few resources are available to properly manage and preserve this data. From what we were told, lack of funding has resulted in none the videos from the video surveys being backed up; there is one and only one copy of the data. Any data worth collecting is worth backing up. Period. This needs to change.

### ***Summary of Primary Recommendations***

- 1) If the SEFSC wants to know what data are important for assessments, there are analytical methods to determine this, and these should be undertaken.
- 2) In order to prioritize data collection and management programs, the SEFSC needs to develop clear, measurable objectives.
- 3) Landings and discard from the recreational fishery are often a major source of mortality, and programs should be improved or developed.
- 4) The SEFSC is heavily reliant upon self-reporting for tracking commercial fishery effort, landings, and discards. Improved observer coverage and automated, electronic data collection will likely reduce the problems associated with self-reporting, but estimating bycatch should receive more attention.
- 5) More resources need to be directed towards fishery-independent data collection, especially with respect to the development of fishery-independent indices of abundance in the South Atlantic and Caribbean and habitat mapping throughout all regions.
- 6) More resources need to be directed toward the collection and processing of biological samples.
- 7) More resources need to be directed toward data management, both in terms of infrastructure (hardware and software) and personnel.
- 8) Creative solutions need to be found to overcome the long-standing difficulties in data collection and management for the Caribbean.

Table 1. Reprint of “Table 7.8 - Results from base BAM model, sensitivity runs, and retrospective analysis” from the 2010 Atlantic Menhaden Assessment Report (Revised March 2011)

BAM Model Run	Median R	F <sub>MED</sub>	F <sub>target</sub>	FEC <sub>MED</sub>	FEC <sub>thresh</sub>	F <sub>(2008) / F<sub>MED</sub></sub>	FEC <sub>(2008) / FEC<sub>thresh</sub></sub>
Base Run	13.2	1.25	0.61	18,628	9,314	1.00	1.98
Time invariant Natural Mortality (M)	13.1	1.29	0.62	17,549	8,775	0.91	2.22
Eight year average used for benchmark calculations	13.2	1.37	0.66	18,628	9,314	0.92	1.98
Pound net index coefficient of variation (CV)=0.2	13.2	1.25	0.62	18,609	9,305	0.80	2.31
Pound net index coefficient of variation (CV)=0.8	13.2	1.25	0.60	18,667	9,334	1.04	1.93
No ageing reading error	13.1	1.06	0.53	22,035	11,017	1.01	1.88
Four separate juvenile abundance indices (JAIs) with estimated weights	13.2	1.25	0.65	18,484	9,242	0.91	2.05
Dome-shaped selectivity in last period (1994-2008) for the reduction fishery	13.1	1.29	0.67	18,664	9,332	0.97	1.91
Start model in 1964	13.0	1.38	0.85	15,363	7,682	1.01	2.23
Three year average used for benchmark calculations	13.2	1.18	0.53	18,628	9,314	1.06	1.98
Random walk on pound net index catchability (q)	13.2	1.25	0.60	18,696	9,348	1.05	1.92
Leave out juvenile abundance index (JAI)	13.3	1.25	0.59	18,714	9,357	1.60	1.51
Leave out pound net (PN) index	13.2	1.25	0.60	18,692	9,346	1.08	1.90
GLM based on pound net (PN) index	13.2	1.25	0.61	18,641	9,320	0.99	2.00
Natural mortality (M) re-scaled +25%	22.9	1.08	0.46	20,547	10,274	1.10	1.88
Natural mortality (M) re-scaled -25%	7.6	1.42	0.75	16,719	8,359	0.92	2.12
Estimate natural mortality (M) scalar	70.3	0.76	0.19	25,697	12,849	1.35	1.69
Estimate MSY based on Beverton-Holt curve	13.2	1.25	0.61	18,627	9,313	1.00	1.98
Estimate MSY based on Ricker curve	13.2	1.25	0.69	18,633	9,317	1.02	1.95
Retrospective to 2007	13.2	1.26	0.60	18,377	9,189	1.30	1.29
Retrospective to 2006	13.2	1.24	0.63	18,813	9,407	1.13	2.23
Retrospective to 2005	13.3	1.25	0.65	18,606	9,303	0.44	3.97
Retrospective to 2004	13.3	1.25	0.64	18,643	9,322	0.62	2.42
Retrospective to 2003	13.3	1.30	0.63	17,823	8,912	0.58	2.21
Retrospective to 2002	13.5	1.27	0.62	18,243	9,122	0.79	3.52
Retrospective to 2001	13.6	1.33	0.63	17,301	8,651	0.33	6.04

#### A. Survey Utility:

***To what extent are data generated from MARMAP/SEAMAP (trap, video, still pictures, short longline, long longline, and hook and line) and SEFIS (trap & video) surveys utilized, or likely to be utilized, in stock assessments or to address other management needs? How could the utility of surveys be improved?***

Short longline—Data from the short longline survey are currently not used in any current stock assessment, but have potential for such use for snowy grouper and speckled hind, which inhabit the targeted shelf edge / ledge habitat. The primary shortcoming of the survey is that its spatial distribution, between 32oN and 34oN, is likely inadequate to cover the spatial distribution of key species, particularly snowy grouper and red snapper. If sufficient resources cannot be obtained to expand the latitudinal range of the current survey, we recommend pooling resources over time and conducting more spatially comprehensive surveys in alternate years. If such a spatial expansion would require the use of another vessel, in addition to the RV Palmetto, the review committee is concerned that the skill level of the new vessel to fish in this difficult habitat may not be sufficient to avoid a vessel effect in the data unless considerable effort is expended in standardizing fishing techniques.

Long longline—Data from the long longline survey, which targets tilefish, were used for tilefish assessment, but the catch rates are so low that their information content was deemed substantially lower than the fishery-dependent index. Consequently this survey is not likely to play an important assessment role. One reason for this is that the survey was initiated as an exploratory fishing operation to determine if the stocks of tilefish could support a northward extension of the commercial fishery, so that the survey spatial distribution is disjointed from the bulk of the fishery. The initially low catch rates remain low and the commercial tilefish fishery remains in Florida. However, if it was considered necessary to continue a survey for this species, some type of industry partnership should be considered. This could be funded by a research set-aside of some fraction of the quota similar to what is done for Atlantic sea scallops, Pacific sablefish and other species. In addition, it may also be possible to obtain funds from the NMFS fisheries Cooperative Research Program to help fund the survey, similar to the monkfish trawl survey conducted by the NEFSC. This approach shares the costs of assessment between the fishery and the scientific agencies.

Hook and line—Survey personnel should be commended for the proactive efforts to collect and process data that will facilitate ecosystem management. The data from the hook and line collections are primarily for biological material, diet and life history studies, but currently plays a very small role in the stock assessment process.

Trap survey—Data from the MARMAP trap survey are currently used in several fish stock assessments; however there are several shortcomings of the survey that limit the utility of the data. The most important of these is the spatial coverage of the survey. The survey index of abundance is based on the premise that the population trends in the observed areas accurately reflect trends in the unobserved areas. The survey targets species associated with hard, live bottom habitat distributed in widely dispersed patches whose locations are incompletely known, but has not extensively covered the northern and southern extremes of the south Atlantic bight. The spatial coverage has been greatly improved by the addition of the SEFIS sampling in the southern part of the area, but there still remain significant under-sampled areas where commercial and sport catch

and fisher knowledge indicates there may be habitat, especially in the far north. We believe that it is critical to expand exploratory operations to currently under-sampled areas with the objective of finding new areas of appropriate habitat and achieving a more representative spatial distribution of the trap sampling effort. This need is so important that some redirection of vessel time currently used for trap sampling might be better spent surveying for new sampling locations. This tradeoff is examined below.

Coupled with the likely spatial variation in the proportion of the habitat that is actually sampled, an additional shortcoming is the potential for uneven spatial coverage due to interruption of the survey by weather or other events. Although the sample allocation at the beginning of the survey is based on random sampling over the known distribution of live bottom habitat, the number of samples actually collected may be quite less than the initial allocation, leaving holes in the spatial pattern of final samples. We recommend a sampling strategy below that should help to alleviate some of these issues, while maintaining the integrity of the index.

We believe that it is imperative that a clearly written sampling manual be created, consistent with the NMFS Fixed Gear Survey Protocols Manual (NOAA 2003), that details trap specifications, bait, deployment procedures, site selection and all issues that could potentially affect trap catchability. This is to ensure consistency between the MARMAP and SEFIS data as well as the continuity of the data over time. Creation of such a document was once mandated by the Director of NOAA for all NMFS surveys and is standard for NMFS trawl and acoustic surveys.

Video surveys—Data from the video and still cameras attached to the fish traps are currently not used in any stock assessment and we feel that the video should not replace the trap without adequately addressing potential sources of bias and calibration of the two gears. In addition the sheer volume of processing time will make its use as an index limited in the short term, until more efficient reading technology can be incorporated. However this data could provide ancillary information to the stock assessment models that may lead to better predictions. Video, in conjunction with trap catches, may help to address biases due to species and size selectivity, saturation and incomplete detectability in trap catches. Video observations are also subject to biases due to the inability to directly measure and speciate the observed fish and environmental variability affecting viewing conditions. The issue with fish measurement can be partially addressed by using stereo video cameras; variability in viewing conditions can be addressed by measuring light level and water transparency or restricting counts to be within a specified distance from the camera. But with currently available technology the limiting factor to the utility of video data is the huge amount of time needed to view the videos and extract the data. The cost of video processing is repeatedly reported as a limiting factor at all NMFS labs that use video to obtain fish density estimates, although labs processing the videos only for the relative abundance by species or fish length are achieving greater success. The video data now being collected, however, can play a very important role in stock assessment models. Stock assessment models currently estimate selectivity, which is generally considered a function of the availability of the fish to the sampling gear and the size selectivity of the gear. If the size distribution of fish determined from the video for a single trap can be considered as representing the size distribution of fish available to the trap, then the size selectivity of the trap can be determined using models widely available for trawl and gillnet mesh selectivity (Millar 1992, Wileman et al. 1996). The empirical estimation of size-based selectivity could provide information on the functional form of selectivity and inform priors in Bayesian stock assessment models. Using informative Bayesian priors to constrain the values of selectivity parameters has been increasingly shown to produce better behaved model fits, often with more precise model outputs.

## 2013 Data Collections Science Program Reviews June 3-7 2013

### Reviewer 3

#### General Overview

The NOAA Southeast Fisheries Science Center (SEFSC) is to be commended for establishing this review process of their data programs used to inform stock assessment pursuant to the requirement of the Magnuson-Stevens Act. This process is clearly intended to increase transparency in NOAA science and elucidate both externally and internally, their data programs strengths, shortcomings, and deficiencies. This review process is a unique opportunity for the SEFSC and its partners to critically evaluate if current programs are able to meet their obligation of providing scientific advice for the setting of ACLs at the specified level of rigor and precision required by the Fishery Management Councils. Specific terms of reference for this review (see Appendix A) were provided to aid the SEFSC and its partners in this evaluation process. Within this documentation I have provided, to the best of my ability within the time constraints allotted, an evaluation of the SEFSC data collection programs as they relate to the role of *single-species* stock assessment in providing scientific advice on Over Fishing and Allowable Biological Catch Levels. Stock assessment is one component of the SEFSC broader mission of the stewardship of living marine resources through science based conservation and management and the promotion of healthy ecosystems. At times, the political climate places emphasis on the importance of stock assessment in the stewardship of marine resources and I hope readers that readers of this review will appreciate that there is a broader mandate when considering the recommendations of this report.

In relation to the management of fisheries, the SEFSC is embedded within a complex fishery management system comprised of three management councils governing 3 large marine ecosystems (Gulf of Mexico, South Atlantic, and Caribbean), and an obligation to the International Commission for the Conservation of Atlantic Tunas. The SEFSC data collection is intimately tied to the activities of its data partners: the Gulf States Commission, the Atlantic States Commission, states and territories, industry, academic researchers, and environmental NGOs. Within this context the SEFSC is responsible for providing advice for >100 stocks in Fishery Management Plans out of >700 stocks intercepted by fisheries that are responsible for more than half the recreational angler trips in the US and commercial fisheries that capture ~20% of the national value of commercial landings.

Providing scientific advice for the management within such a complex system in a scientifically rigorous and timely manner is a daunting task particularly in the face of shrinking budgets. The presentation from SEFSC personnel during the week of this review indicate a clear understanding of the challenges and direction that the Center must take in order to meet their scientific obligations in terms of changes and additions to data collection programs, the timeliness of data processing, and the

timeliness of stock assessment advice. It is also clear that there are insufficient funds to facilitate the proposed changes and additions for such activities. Some of the top challenges moving forward the SEFSC include: a reliance on state, territorial, and academic partners to provide information in a timely manner, inadequate IT personnel to facilitate the collection, processing, and dissemination of current data systems and the integration and development of more efficient electronic monitoring and recording systems, noticeable gaps in habitats covered by fishery independent monitoring programs, an inadequate characterization of the 'for hire' and private sectors of the recreational fishery, and a lack of qualified stock assessment personnel to produce assessment in a timely manner. The SEFSC is well aware of these challenges and are working within current constraints to address some of these issues. In some instances improvements to programs can be made through the evaluation of program performance relative to apparent Management Council benchmarks and diminishing return to stock assessment performance; but, the addition of FTE positions are required to reconcile others.

## **SEFSC Fishery-Dependent Data**

### **Commercial Fisheries**

#### *Commercial landing statistics*

From the information provided within this review the SEFSC is well aware of the data deficiencies and impediment to timely reporting within the fishery dependent data collections systems. Improving the 1-1.5 year lag of incorporating commercial landings into stock assessment is likely to be improved with a shift toward electronic reporting and fostering partnerships with the states and territories. Improving the timely nature of this data in stock assessments is crucial for stocks, or fisheries undergoing rapid changes. While improvements in this reporting system may reduce this reporting time lag, it is unclear if this improvement will translate into providing data for stock assessment in a timely manner unless support is given to the development of new data management and dissemination methods. The viability of such improvements will be dependent on state participation and support. The implementation of electronic data reporting will also improve the SEFSC's ability to validate data.

Continued support for estimating commercial landing within the Caribbean is essential for management by ACLs and should be key priority for the territories. Information provided during this review indicates noteworthy improvement in establishing viable systems for determining total commercial landing and validating self reported catch. While there is some concern regarding the accuracy and coverage of the current system it is likely that continued investment in these programs would help resolve these issues. Improvement in dockside monitoring is likely to be beneficial in determining total commercial removals and facilitate the collection of composition information.

### *Observer program*

It is apparent that the observer program is not only providing valuable biological information with regards to species captured but also helps to capture discrepancies in the logbook reporting program. *Power analysis in the form of simulation-evaluation would help to evaluate the impact of uncertainty in estimated by-catch levels on the outcome of stock assessment recommendations.* This is of particular importance for priority stocks. It is not intuitive what impact varying degrees of uncertainty in by-catch estimation will have on assessment recommendations and such information is crucial in determining if current coverage levels are sufficient. As a review it is not possible to determine if current coverage levels or programs are sufficient without such information.

### *Biological information*

The statistical methods used to determine sampling for biological information appears to be sound though there is some concern as to biases of individual samplers. Deficiencies in these programs are well recognized by the SEFSC and programs are in place to address some of the concerns. One major concern that needs to be addressed is the minimum sample sizes needed to represent the age distribution in the catch in a statistically reasonable manner. The SEFSC recognizes that some species may be oversampled while there is a paucity of samples for others. *It is recommended that power analysis though simulation-evaluation be performed to determine 'reasonable' sample sizes.* The results for such evaluation will help to streamline collection programs with the intent of improving the timeliness of age composition information for stock assessments and ensuring that sufficient samples are collected to ensure representative sampling of the catch for species requiring stock assessments. The SEFSC ageing facilities are currently understaffed to handle all biological samples and streamlining data requirement would allow these facilities to more efficiently allocate their time. In addition, an evaluation can be made as to the suitability of current capacity at these facilities to meet stock assessment demands. However, as the demand for more, timelier age structured assessment increases these facilities will require additional personnel.

Establishing ACLs for stock in the Caribbean beyond simplistic catch based methods (ORCS methods) is hindered by the lack of basic biological information. Reliance on alternative published information may or may not be appropriate for the stock in question and is often inaccurate. If the Caribbean council intends to move beyond simple catch based settings of ACL the SEFSC will need to improve the collection of basic biological information within the Caribbean. Success in such programs are likely to be achieved though external collaborations.

### **Recreational Fisheries**

Collecting data to inform stock assessment as to the impact of recreational fisheries in any region is potentially an insurmountable task. This is particularly true for the

Southeast given the magnitude and diversity of the recreational fishery. The SEFSC 'self-reporting' programs focusing on characterizing the 'for-hire' sector of the recreational are reported to have met with some success. *Given the discrepancy in the 'self-reported' and 'observer-reported' statistic in the commercial fishery, efforts intended to validate both the effort and catch statistics though these programs are warranted and should be extended to capture the magnitude of discarding in these operations.* The feasibility of similar reporting programs should be explored for the smaller charter operators.

The greatest challenge in the characterization of the recreational fishery is representative sampling of the private sector. While the MRIP program is intended to provide timely estimates of recreational catches though expansions of effort and catch rate estimates from phone interview, uncertainty in these catch estimates impacts overall assessment recommendations particularly when composition information of the catch and discards is not available for age-structured assessments. While retained catch characterization can be achieved though dock side sampling, statistically reliable estimates of discard have not been obtained. *Developing statistically reliable estimates of recreational discards to validate MRIP estimates of discard rates and to provide composition information of discards should be a research priority for the SEFSC.* Developing statistically valid methods to correct for non-response bias of participatory program should be feasible. Collaboration with statistic departments particularly those focusing on human dimension research at collaborating universities should provide insight as to the direction such investigations should take. Ongoing collaboration with state agency performing dockside creel program where federally managed species are intercepted will also facilitate in the validation of MRIP reporting and provide information of the size and species composition of landings.

Recreational surveys of the Texas Parks & Wildlife Department are reported to have little utility to the SEFSC in determining recreational catch of federally managed species due to sampling biases. If it important for the SEFSC to the potential impact this under-sampling may have on stock assessments. A worthwhile exercise would be to utilize current fishery dependent and fishery independent data to determine the contribution catches in Texan waters are to the overall catch inputs in to stock assessment. The SEFSC has indicated that they are continuing to work with the TPWD in hopes to improve the utility of the recreational survey.

The lack of any consistent recreational fishing statistics from the US Virgin Islands is an obvious omission in the recreational data available to the SEFSC for stock assessment. As information on the commercial fishery improves in this territory the relative impact of recreational fishery in this area needs to be assessed and a determination should be made as to the utility of obtaining more consistent recreational fishery information in this area even if the establishment of ACLs within this region are based solely on catch (ORCS methods).

### **SEFSC Fishery-Independent Data**

The SEFSC has extensive monitoring programs that require a considerable expenditure to cover the requisite days at sea. Not all of these programs were developed as fishery-independent monitoring programs but will be evaluated in this document as to their utility to inform fisheries stock assessments. Basing any stock assessment solely on fishery-dependent data potentially introduces severe bias into any management recommendations. Having fishery independent data can dramatically reduce these biases and improve the characterization of life-history characteristics provided such surveys representatively sample a stock across its range. Unless a sampling program is intended to explore specific questions, programs that cover large spatial areas and intercept multiple species in suitable numbers are unlikely to improve stock assessments. Furthermore, surveys that do not cover federally managed species are of little utility to the SEFSC in terms of improving stock assessment capabilities. SEFSC surveys should also be evaluated for their adaptability and broad applicability. Ultimately there are >100 stocks that have Fishery Management Plans and require some form of assessment to establish ACLs and monitoring programs design and development should provide information to this end.

Trawl and line surveys under the SEAMAP program are reported to provide useful relative abundance trends for particular age components of some assessed species. With further development these programs have the potential to produce absolute density estimates provided catch rates can be determined for the species intercepted. *The addition of acoustics and cameras to these surveys may afford this opportunity and should be considered for pilot studies.* In conjunction with habitat information these surveys could be used to estimate population densities within the surveyed habitats. A lack of benthic habitat information within all regions of the SEFSC area is a significant barrier to the appropriate stratification of many of the SEFSC sampling programs and to the expansion of survey estimates. *A goal of the SEFSC should be improved habitat mapping.* It is also not apparent that given the depth limits of the SEAMAP survey gears if the full range of a given species is covered. *Determining the habitat limits of assessed species and potential proportion of a stock distribution not assessed would be a worthwhile exercise for determining the suitability of indexes derived from SEAMAP data.* There is some concern that the sampling intensity from these surveys is insufficient to provide reasonable levels of uncertainty around relative abundance trends and age/length composition information. *A simulation evaluation would be useful to in determining suitable sampling intensity for species of primary concern.* Thresholds for such an exercise could be informed by a survey of SEDAR assessment rejected by Fishery Management councils due to high uncertainty. Results for this exercise would be useful for determining the suitability of sampling intensity of the SEAMAP programs as they pertain to stock assessment.

Internal documents indicate that MARMAP in the South Atlantic and the bottom and pelagic longline programs in the Gulf of Mexico South Atlantic, in their current configuration, have not afforded useful information for stock assessments. *As they*

*pertain to stock assessment, these programs should either be expanded at the cost of other current programs to a spatial and temporal scale to make them useful for stock assessments or ended.* Similarly surveys such as the Panama City sea grass trawls are unlikely to have sufficient geographic scope to improve stock assessment and may potentially introduce bias should relative abundance or composition information be utilized in assessment with a broader geographic scope.

The use of video as a survey tool is still in its infancy and the usefulness of such programs for developing abundance indices, estimating abundance, and collecting composition data are unproven at the large geographic scale required by the SEFSC. To date the video data collected in program of the SEFSC have not proven useful in improving stock assessment. These methods do hold some promise for improving the sampling of rocky habitat at all depths. Though the SEFSC has a few proven programs that quantify assessed species in rocky habitats (RVC survey) they are limited in spatial extent. *The SEFSC is encouraged to critically evaluate to potential for each of these new programs as to their suitability: to be deployed in a range of rock habitats, the spatial extent of the area surveyed, the timeliness of data compilation, and the ability to automate data processing.* Collaboration with partners will be essential in developing a system that provided sufficient species and geographic coverage to be useful for stock assessment. As with other sampling programs the ability to appropriately stratify any survey focusing on rocky habitat will be hampered by the availability of habitat maps.

Larval surveys have been used to inform spawning stock biomass for a number of assessments (e.g., bluefin tuna, king mackerel). It is unclear if spatial extent of the current sampling programs is sufficient to provide an unbiased index of the spawning stock biomass. Current sampling locations appear to be concentrated within areas predicted to have high larval densities. If this is indeed the case there is a potential for hyper-stability in the larval index. The SEFSC is encouraged to carefully consider if the current sampling protocol is truly an unbiased sample of the larval distributions in the Gulf and the relative influence these indices have on assessment based management recommendations.

## **In Closing**

The SEFSC is clearly committed to providing the best scientific advice possible to the Fishery Management Councils. In addition, the SEFSC appears well aware of the strength, weaknesses, and deficiencies within their data programs as they pertain to providing stock assessment advice. The SEFSC presented clear plans as to how to improve the accuracy, centralization, cross-linkages and availability of the data they store and disseminate. There is however no clear prioritization of assessing and updating assessment for stocks within Fishery Management Plans. It is also unclear that given current staffing levels, changes in Fishery Council priorities, and the structure of the SEDAR process if such a prioritization is possible given the SEFSC obligations and the complexity of the Southeast Region. Streamlining through vertical integration is unlikely given the centers reliance on a diversity of partners

and collaborators. The reliability and timeliness of commercial fishery data is likely to improve in the near future given the shift toward electronic reporting and the maintenance and refinement of programs aimed at data validation such as observer programs. Significant advances have been made toward the classification of the recreational fishing sector through the headboat logbook program and improvements to the statistical validity of the MRIP program. There are still noteworthy omissions within the MRIP data that impact its utility for more complex age based assessment. The SEFCS is encouraged to continue to explore viable statistical methods to improve composition information in the recreational retained catch and discards. The lack of a fishery independent monitoring program aimed at assessing stocks or stock components utilizing rocky habitat on a broad spatial scale in an obvious gap in the suite to monitoring programs used to inform stock assessments. Developing such monitoring programs is likely to add highly informative information to current and new stock assessment in the future. The lack of comprehensive habitat data is a notable hindrance in the development and refinement of the SEFSC's sampling programs. Stratification of and extrapolation from monitoring programs would be greatly improved if habitat data were available. SEFSC has improved the quality of commercial and some recreational catch statistics in the Caribbean. The extent to which these programs are to be improved and expanded is unclear. Few stocks in the Caribbean have ACL and even fewer are assessed. The Caribbean Fishery Management Council is encouraged to work with the SEFSC to develop a clear direction for defining data and assessment needs in the Caribbean as they pertain to obligation under the Magnuson-Stevens Act.

## **Appendix A**

### **Terms of Reference (TOR) for 2013 Data Collections Science Program Reviews**

#### **Objective**

The objective for these reviews is to review and evaluate the Center's current scientific fishery-dependent and fishery-independent data as it relates to fishery stock assessments conducted pursuant to the Magnuson-Stevens Act:

- NOAA ship-based surveys
- Cooperative research surveys
- Logbook and observer data
- Data management and quality control

Reviewers will provide advice to the Center on the direction and quality of these data collection and management programs

Using as context, two-three or more typical and important stock assessments conducted by the Center, reviewers should address:

To what extent do fishery independent survey data quality, statistical precision, and timeliness issues impact overall assessment accuracy, precision and timeliness?

What are the major fishery independent survey successes and how should they be supported?

1. What are the major fishery independent survey limitations/weaknesses and how could they be resolved? Define potential improvements and priorities for recommended improvements.
2. To what extent do fishery dependent data quality, statistical precision, and timeliness issues impact overall assessment accuracy, precision and timeliness?
3. What are the major fishery dependent data sources successes and how should they be supported?
4. What are the major fishery dependent data limitations/weaknesses and how could they be resolved? Define potential improvements and priorities for recommended improvements.
5. What recommendations do you have for prioritizing fishery-independent and fishery-dependent data collection improvements?
6. To what extent are fishery independent and fishery dependent data readily accessible to Center stock assessment scientists and to various external researchers who may wish to replicate NMFS stock assessments?
7. Identify the highest priority needs for improving fishery dependent and fishery independent data. Define potential improvements.

#### **Overarching Questions for Reviewers**

- Relationship of current and planned fishery assessment data activities to Center fishery assessments mandates and requirements – is the Center doing the right things?
- Opportunities – are there opportunities that the Center should be pursuing in collecting and compiling fishery assessment data, including shared approaches with partners?
- Scientific/technical approach – are the Center’s fishery data objectives adequate, and is the Center using the best suite of techniques and approaches to meet those objectives?
- Organization and priorities – is the Center’s fishery data system properly organized to meet its mandates and is the allocation of resources among program appropriate?
- Scientific conduct – are the Center’s fishery data programs being conducted properly (survey design, standardization, integrity, peer review, transparency, confidentiality, PII, etc.)?

2013 Data Collections Science Program Review, Southeast Fisheries Science Center  
3 – 7 June 2013  
Miami, FL

Reviewer #4

The Southeast Fisheries Science Center supports data and assessment needs for at least seven regional fishery management bodies, with unique spatial scales of ecological and fishery dynamics; histories of fishery data collection, and ranges of life history characteristics of managed species or species complexes in each jurisdiction. To assess the adequacy of individual data collection systems and prioritize improvements or recommend specific changes in the context of that complexity and the time available for the review has been daunting. Overall, senior scientific staff has provided thoughtful and candid considerations of program strengths and weaknesses, and their proposed future improvements are reasonable and appropriate. Some very broad endorsements or recommendations for future investigations and directions are possible, and a few considerations are offered for some potentially tractable local issues. However, given the diversity of programs and complex regional management environment, it is difficult to determine precedence of individual programs given the timeframe of the review.

A more systematic quantitative evaluation would be necessary to answer several of the questions in the terms of reference on the impact of data streams on assessment accuracy and precision. Several approaches of varying complexity are possible. At the simplest level, a change in accuracy and precision of stock biomass and fishing mortality rate can be observed given the incorporation or absence of data from a given data source, e.g., through sensitivity runs with or without the data source. For assessments with complex suites of input data, some form of a factorial or fractional factorial design sensitivity analysis may potentially be used to evaluate the effects of combinations of data input sources on precision and accuracy, either relative to a baseline assessment result or in a management strategy evaluation (MSE) framework. For more complex evaluations of tradeoffs by re-allocating resources to different data input sources that change the precision of those input data, MSE models would be required. Given the multispecies nature of many of the data collection systems, evaluation and optimization of those results over the entire set of regional stock assessments would be challenging, however.

#### Fishery-dependent Data

The recent and near-future implementation of electronic reporting in the trip ticket, logbook and TIP systems has substantially improved the accuracy, precision and timeliness of commercial landings, trip and length/biological data in this region: this is a significant success. The Center should support expanded use of electronic logbooks (including discard data) to the widest extent possible in both commercial and recreational fisheries; adaptation of TIP or some similar electronic system for use by state/territorial partners for the collection of biological data; and development of electronic dealer reporting for dealers not under the trip ticket system. Having the capacity to share or migrate electronic reporting technology to partners is critical: given the interdependencies within the region, there is no advantage for the Center to obtain rapid turnaround for the data components they collect only to have to wait on less timely, accurate or compatible data collected by partners. For electronic logbooks, most of the development costs have already accrued, and so incremental costs of expanding participation should

be relatively low. For expanded electronic dealer reporting and biological sampling, there may be opportunities to adapt components of existing software. This should continue to improve quality of commercial landings data, especially in terms of timeliness.

To support the expansion of electronic reporting, the composition of staff or staff skill sets must evolve to include more IT capability in all areas, e.g. hardware installation, maintenance, troubleshooting and upgrading; database design, maintenance and programming; software installation, troubleshooting and upgrading; Web-based application development; and special applications programming. Expansion of electronic reporting to state partners may also require sharing federal IT capacity. Meanwhile, the need to comply with more and more complex IT security policies probably has reduced availability of IT talent for scientific data acquisition and management at the same time that scientific demand for electronic data services is increasing. In addition to recruitment of additional IT personnel, continuous and aggressive education of current IT personnel or individuals interested in expanding their IT skills should be a top training priority within the Center, as part of an overall program to expand capacity in this area. Contractors may provide a quick start to augment resources, but long-term monitoring programs should have long-term capacity for maintaining and upgrading those programs.

Long-term maintenance of electronic monitoring systems is an active, dynamic process requiring recurring investments. Technology for data acquisition and processing moves quickly, and future budgets should include regular costs for upgrades as hardware and software/operating systems become obsolete and unsupported. In the case of the Center, additional logistical and training costs will be encountered as partners and participants are distributed over two coasts and territories. These additional recurring costs are occasionally overlooked when developing budgets for new technologies.

For many stocks in the Gulf of Mexico and South Atlantic where recreational landings and discards represent a significant if not dominant component of removals, gaps in sampling and incompatibility of reporting by the MRIP/MRFSS and Texas Parks and Wildlife Division partners become critical. However, because administration of both these programs is external to the Center, decisions to modify the programs (e.g., increase intercept or biological sampling rates for kept and especially released fish, otherwise expand coverage to un- or under-observed components of the catch, or change the temporal resolution of reporting) cannot be made unilaterally. While the Center is likely in a position to work directly with Texas to achieve some improvements, necessary intensification or expansion of MRIP coverage in the southeast likely will require national-level attention.

Estimates of commercial discards from logbook landings have been shown to be biased low, based on comparisons with estimates based on fishery observer data, but could at least provide a minimum estimate of discards. While it may be possible to develop bias-correction factors if the amount of bias is relatively constant over time and/or stratum, this is less desirable than direct observations. At the least, this approach would argue for maintaining a level of observer coverage at least adequate to periodically characterize variation in the bias. (Similarly, it may be possible to develop observer programs to characterize bias in self-reported data and biological characteristics of catch components in at least some elements of the recreational fishery.)

Expansion of observer coverage should be considered rather than automatic decision. Although the quality and resolution of observer data is much higher than self-reported data, it can also be one of the most expensive data streams to maintain. Bias still may occur if vessels alter behavior when observers are on board. If not already completed, as a first cut, analysis of available data for representative species should determine changes in CV of discard estimates as a function of cost, and/or considered within a MSE evaluation such as proposed above. The latter may help determine how sensitive assessment accuracy and precision is to this component and whether better accuracy and precision could be obtained if resources were deployed to support other data streams. Again, however, these evaluations are complicated by the multispecies nature of many data streams, and determining the relative benefit of expanding a multispecies observer program vs. a multispecies fishery-independent index to a suite of stock assessments supported by those data will not be straightforward.

Consolidations or economies of scale should be implemented in observer programs before any program expansions: potential changes in data capture, database structure and storage are more easily undertaken when programs are relatively small. To most efficiently move toward data entry at sea, there would be economies of scale to first develop a single data system for the five currently relatively independent programs, with program-specific options; rather than developing and maintaining capacity for five separate data structures. That system could include shared and program-specific error checking routines, to be ported to the data entry at sea system. The data warehouse should include all elements for each program, rather than the lowest common denominator of common variables for all programs which would make some program-specific data inaccessible through the warehouse.

Depending on the evolution of regulations in the continental fisheries, and extent of within-year effort shifts in response to those regulations, it may be valuable at some point for observer programs to develop an adaptive sampling contingency plan. If effort deviates significantly from the previous years', this would enable the deployment of observers proportional to current rather than historical effort patterns.

The Center should move to uniformly adopt Oracle as a standard for relational databases, to replace Access. Although there may be initial training costs and recurring license costs associated with Oracle, it is a well-supported and powerful tool with flexibility to support and access large complex relational databases.

CPUE data and interpretations are constructed by analysts with specialized knowledge of regional fishery regulations and historical databases. This expertise enables separation of regulatory effects from abundance effects on changing cpue/lpue, as well as ensuring that any changes in database structure etc. over time have been dealt with appropriately in constructing the time series. This is especially important when assessments rely heavily on commercial cpue/lpue data. Although this task is time-consuming, it adds significant value, saving stock assessment scientists from having to have a detailed knowledge of regulatory changes in FMPs over time in order to interpret results.

Compared to continental programs, progress with respect to fishery-dependent data in the Caribbean has been more modest; and although the trajectory is positive, it continues to be much slower than continental counterparts. The Caribbean Commercial Landings Improvement Plan appears to be an attempt to address the situation, and progress has been made. If many stock assessments in the region are assessed

primarily using catch data, then that catch data should at least be of acceptable quality, however. Stepwise improvements to biological sampling can then follow.

### Fishery-independent Data

Although there are approximately 57 potential fishery-independent data sources listed for the Center (including two to be initiated in 2014-2015), and approximately 36 species or species group assessments that draw on those data sources, the mapping between surveys and their relative importance in the assessments is not easy to determine. Many of the surveys listed appear to be used opportunistically (e.g., SEAMAP ichthyoplankton, Marine Protected Area surveys) because they index or have the potential to index only one or two stocks, yet require 14-126 days at sea on a NOAA ship, not a cost-effective approach to index generation. The high number of fishery-independent data sources meant that little detail could be examined and few specific recommendations could be made beyond some broad common themes, several of which are common to the fishery-dependent data collection system.

Stratification for surveys of species inhabiting higher relief, untrawlable ground is much less straightforward than for typical trawl surveys, because finer scale information on vertical structure is required. It is not clear that this finer scale information is available over the range of some random stratified surveys, but could be improved by implementation of ROV/AUV surveys. Moreover, drop cameras (e.g. stationary video) typically sample a much smaller area than mobile gears. Combinations of video and acoustic surveys using mobile gear have the potential to expand the region surveyed beyond point observations in all regions.

Trawl survey protocols appeared to follow best practices. Most of the trawl surveys have undergone some procedural modifications over time, although there was not enough time to explore the statistical treatment of those modifications. Some of the surveys do not use trawl mensuration gear. Fishing the net to meet measurement standards would represent a change in protocol, but collecting data on the variability of behavior of the net under different environmental conditions may be helpful in evaluating variability in catch rates. As well, data from piggybacked acoustics surveys may provide additional data to interpret trawl survey results. It was unclear whether other surveys with restricted areal coverage indexed the abundance of the stock or the target life history stage over its entire range (e.g., Panama City sea grass trawl).

The Center needs to determine the rate at which predation mortality effects will be incorporated into stock and ecosystem assessments, and what detectable level of change is desirable in order to determine whether and how many stomach samples should be collected as part of survey activities.

Like fishery-dependent data collection programs, fishery-independent data collection programs continue to move toward or rely on electronic data entry in the field, and IT support to continue to upgrade and maintain those systems is critical. Again, because of interdependencies between state and federal partners, the Center may need to be prepared to help partners move ahead if partners lack the capacity to do it themselves, to avail themselves of technological improvements. For example, SEAMAP trawl surveys currently use the FSCS system for data entry at sea. The new version of FSCS (FSCS 2.0) leads

to significant reductions in data error rates and incorporates new flexibilities and improvements, but not all state survey partners may have the IT capacity to implement a new data

As with fishery-dependent data in the region, data management issues, including the inability to track data changes when data are distributed among multiple partners, appears to be a significant and recurring problem. The proposed governance process should be encouraged, and if successful, adopted for fishery-dependent data.

#### Life History Information

Again, improved regional electronic data systems and IT support would also improve productivity in this component of the data collection system, as evidenced in the examples in the presentation.

If the Center is committed to supporting age-based assessments in the region for the long term, then it should invest in permanent staff to replace contract personnel. If not yet available, statistical analysis to determine the number of ages necessary to support target numbers of age-based assessments should be undertaken. This should lead to an estimate of the number of age processors and readers required to maintain production to meet demand. Adequate numbers of age processors allow age readers to focus on more specialized functions.

## **NMFS's SEFSC Review for Data Collection to Support Stock Assessments**

Reviewer: #5

### **Overview Comments**

The purpose of this report is to provide comments, recommendations, and my opinions as one of five external reviewers to support the SEFSC Science Program Review. The objective of this peer review process as defined by the SEFSC is to evaluate the Center's current scientific fishery-dependent (FD) and fishery independent (FI) data as it relates to fishery stock assessments conducted pursuant to the Magnuson-Stevens Act.

The SEFSC is tasked with an enormous effort to provide robust scientific data and assessments in support of federally managed fisheries and some state co-managed species. The Center's geographic area of responsibility includes the South Atlantic, US Caribbean, and US Gulf of Mexico. The number of fisheries and the wide variation of ecosystem characteristics and conditions across the regions, results in a very complex set of fishery, economic, and societal management issues that the SEFSC must address across multiple time scales. This is evidenced by the inventory of data bases the SEFSC provided to the review panel indicating they support 45 FI and 34 FD programs/projects. The SEFSC staff did a fantastic job in describing each of their data collection programs and was very transparent in describing their successes and limitations of data collected across the multitude of FI and FD programs.

The Center should be commended for their comprehensive efforts in collections of FD and FI data. However, based on the 3 days of presentations and background documents covering FI, FD, and data management activities, I believe it is not sustainable to conduct field surveys and maintain the current FI and FD portfolio and continue to advance the science to provide more accurate and timely stock assessment data. In most of the presentations on the various programs/projects conducted to support stock assessments, the SEFSC staff provided a list of new actions required that increase the quality of data collection, information content, and data management and dissemination required to better support their customers and partners in the management of coastal and marine fisheries. Given the economic conditions and reduced federal and state budgets (obligate partners), the SEFSC has already made very hard decisions on what programs/projects to reduce in scope or eliminate, but I believe additional hard tradeoffs will be required to conduct the highest priority programs in support of stock assessment requirements as defined by the Magnuson-Stevens Act. Given the review time and format, I cannot recommend specific programs/projects to be eliminated, as that must be done by the SEFSC leadership in consultation with staff, partners, and customers based on set of scientific, economic, and political criteria.

The continued optimization of the SEFSC FI and FD data collection and management portfolio will be required to maintain and increase the quality of scientific data and associated products provided to customers, such as, the 3 fishery management councils in the region and the state and territorial partners. Stopping historical programs/projects is a very difficult decision from both from a scientific and management perspective, but is required to shift human and fiscal resources to advance the highest priority programs/projects. However, from an economic viewpoint, the SEFSC has in part, already defined their highest priority projects based on the current allocation of program resources. Thus, each of these programs should have a clear accounting of resources applied and routinely evaluated to

determine if they are the highest priority programs to continue based on science to support stock assessment management needs. For example, there is quite a disparity in data content and quality between the Atlantic, Caribbean, and Gulf of Mexico regions, thus efforts to define priorities should be accounted for through a strategic assessment process taking into consideration the users and clients of the FI and FD data collections and the SEFSC's ability to maintain the data bases and efficiently produce scientific papers, assessments, and geo-spatial products across all 3 regions. The NMFS headquarters and SEFSC leadership and key staff are the individuals that should be engaged in the discussions on what programs/projects that need to stop, continue as is, or be enhanced to be more accurate and relevant to stock assessment management and science.

The majority of the 79 programs/projects are currently ongoing and the remaining ones if terminated still require data management and product development in support of customer and partner requests. I suggest each one the programs/projects be scrutinized to determine if they are "must haves" to meet federally mandated requirements, such as, the use of Annual Catch Limits (ACLs). *In other words, if SEFSC was to start a suite of FI and FD programs today to support ACL and other management targets, due each of the current programs/projects need to be continued or maintained to address the highest priority fisheries and issues or do new initiatives need to be funded to support its stock assessment portfolio?* To aid the SEFSC in answering this question I have structured my report by addressing key issues in the fishery independent programs, fishery dependent programs, and recommended key future investments that advance fishery stock assessment and move towards ecosystem based fishery management. I have listed below in my opinion 5 key issues and/or needs that I suggest the SEFSC address as they attempt to at least maintain and where possible expand data collection efforts to support stock assessments.

- Determine how best to minimize self-reporting of fishery catch and effort, possibly through additional observer coverage.
- Expand efforts to move towards electronic data collection, monitoring, and data access through actions, such as, electronic log books, permits, and centralized databases to increase the timeliness of stock assessments.
- In cooperation with state and federal partners leverage resources to expand benthic habitat mapping programs that support quantitative sample designs to improve data collection and accuracy.
- Through strategic planning, determine if additional investments should and can be made to implement much more robust Caribbean stock assessment data collection programs.
- Determine if FI and/or FD programs can be spatially expanded to provide more accurate fishery stock assessment data.

### **Fishery Independent Programs**

The SEFSC FI programs are a set of robust data collections across multiple habitats and species' life history stages that aid in developing indices of abundance that attempt to tracking changes in stock abundance over space and time as key information for stock assessments. Fishery-independent surveys conducted by the SEFSC have contributed important data to many stock assessments including the US Gulf of Mexico stocks, US South Atlantic stocks, and some US Caribbean stocks. The FI trap and trawl surveys appear to provide reasonably accurate and precise data, however the data process and access to data impacts the ability to ingest data to support timely stock assessment analyses and products. A

solution to this issue is to continue investments in the programs to move to more efficient electronic data collection, such as not having to convert data in Access to Oracle databases.

The FI programs vary in their spatial and temporal coverage and examinations of which programs would benefit the most with increased sample density, spatial, and temporal coverage could be used to determine resource allocation to specific programs. For example, shifting effort and funding from a specific annual sampling program to tri-annual rather than annual, and using those resources to extend the spatial coverage of key data sets across a region or the range of a specific stock. Specifically, the MARMAP trap survey data are used in stock assessments and a key limitation of the trap program is limited spatial coverage. The survey index of abundance is based on the premise that the population trends in the sampled areas accurately reflect trends in areas not sampled. Trap surveys often target species associated with live bottom habitats, but without having spatially comprehensive and accurate benthic habitat maps it is very difficult to develop and implement sampling designs that are adequate to develop accurate indices of species abundances.

Pilot or experimental research studies are a key component to the SEFSC stock assessment portfolio. However, relative to focusing limited resources that support development of management targets, such as ABCs and ACLs, careful consideration must be given to the amount of resources directed to pilot studies. For example, data from the video and still cameras attached to FI fish traps and other platforms are currently not used in SEFSC stock assessments, thus a directed effort to determine what components of the video/camera programs could be enhanced by stopping other activities should be undertaken to move this experimental technology to applied stock assessments. Video observations can be difficult to use to identify species and obtain accurate species counts due to the limited field of view of cameras and environmental variability affecting viewing conditions. The large volume of data and associated processing time will make video derived indices difficult to move to applied stock assessments unless efficient processing technologies can be developed, thus questioning the amount effort needed for gear calibration studies.

### **Fishery Dependent Programs**

Data collected from FD programs are critical to determine the amount of fish and invertebrates removed from the regional ecosystems. The SEFSC has an extensive FD portfolio that directly supports stock assessment data requirements. The programs primarily determine the amount of catch and effort from commercial and recreational landings and vary in quality and quantity of information collected and processed in each region. For example, the fishery observer program in the Gulf of Mexico commercial vertical line fishery has demonstrated the vast differences in reported catch statistics from fisherman self-reported data when compared to fishery observer data. The reported commercial catch was much lower than the observer data on the number of red grouper, red snapper, and greater amberjack caught. In the South Atlantic there is opportunistic sampling of the recreational head-boat fishery and if deemed important enough with respect to fish removal, it could be considered a key potential program to develop in the South Atlantic. This recommendation could be applied to several of the SEFSC's commercial and recreational fisheries, thus a targeted assessment on the tradeoffs of placing more observers on existing South Atlantic and Gulf of Mexico vessels versus initiating new observer programs should be conducted by SEFSC.

In an effort to prioritize data collection and ultimately funding for FD programs, I suggest enhancements to existing or proposed new data collections be filtered by their ability to significantly contribute to management targets for particular species or species groups. This could be combined with information on the economic and ecological importance of species in a region. For example, the menhaden fishery is the second largest fishery by volume in the US. The SEFSC staff recommended to develop a well-designed coast-wide FI survey to provide an index, provide age and length information, provide updated life history information, inform selectivity, and inform spatial extent and movement for the stock assessment. Currently, the FD menhaden abundance index is linked to data supplied by the Potomac River Fishery Commission based on collections in the Potomac pound net fishery. There is little doubt that the proposed SEFSC FI coast-wide survey would significantly contribute to stock assessment requirements, but due the costs warrant its development of this relatively well managed fishery or should additional effort be placed in other FI and FD programs?

Another way the SEFSC can prioritize data collection activities is to maintain long-term and generally consistent FD programs, such as the MRIP (formerly MRFSS) which is a statistical survey to define recreational effort and catch rates through phone interviews of registered anglers. MRIP's geographic range is from NC-LA and Puerto Rico and is conducted by SEFSC and its GulfFIN, States, and Puerto Rico partners. However, the state of Texas contributes to MRIP, but the data are not consistent in scope and timing of the delivery of data with the SEFSC program. In addition, MRIP is not conducted in the USVI. Given this type of example, the SEFC should rank its long-term and relatively geographically spatially comprehensive FD programs and determine in priority those that should be expanded relative reducing or stopping other efforts.

In instances where self-reporting is the method to obtain FD data, SEFSC scientists raised a multitude of issues with the data including under reporting and limited to no data on discards of fishery species. The SEFSC is making good advances in the use of electronic technology, such as mandatory reporting of federally permitted dealers and dealers handling all federally regulated species are required to have electronic permits in 2014. These types of efforts and pilot study investments to move to electronic fishery log books will aid in addressing the timeliness issue of the FD data into the stock assessment process. As important, are efforts to continue investments in information technology to aid in conducting QA/QC of FI/FD data and enable stock assessment scientists and various external researchers to easily access raw data from web-based data management portals.

### **Key Future Investments**

This section of my report addresses key future investments that I suggest the SEFSC consider as they are currently limited in scope or not part of its research portfolio to support stock assessment data collection.

#### *Caribbean Region*

The Caribbean data collection and assessment programs are very limited in scale, scope, and data content. Thus, SEFSC should determine if status quo is sufficient to maintain or make significant investments where possible in FI and FD data collection efforts in the region. The FI surveys are spatially and/or temporally limited and often restricted to SCUBA diver depth range (0-33 m). In addition, the lack of representative age, growth, maturity biological samples severely hamper stock assessments. For

some species, such as lobster and conch, quantitative assessments are possible, but time series often lack contrast needed to characterize stock status.

Fish Mean-Length estimators can be used to estimate ACLs for data-poor stocks, but require representative length and age samples and reliable catch information. The SEFSC has demonstrated the mean lengths obtained from SCUBA diver reef fish visual surveys (RVCs) support length-based fishery stock assessments as they provide comparable length data to commercial and recreation data programs. The Puerto Rico Department of Natural Resources and Environment and the US Virgin Islands Department of Fisheries and Wildlife are undertaking the US Caribbean Commercial Data Improvement Project (CCDIP) jointly with guidance and input from the SEFSC, the NOAA Southeast Regional Office and the Caribbean Fishery Management Council. If the SEFSC determines additional investments in the US Caribbean should be made, they could complement the CCDIP by supporting a pilot program that conducts stock assessment through the integration of traditional FI and FD surveys with RVCs in water depths 0-33 m and remote sensing and trap surveys for waters greater than those depths. This type of partnership-based effort would begin to advance stock assessment data collection in the USVI and Puerto Rico.

#### *Habitat Mapping*

Comprehensive and accurate benthic habitat maps were continuously mentioned in the SEFSC presentations as necessary tool to aid in implementing quantitative sample designs to support stock assessment data collections. In areas where adequate habitat maps have been developed, many studies have demonstrated the usefulness of these products in support of stock assessment and greater ecosystem based management needs and would aid in quantitatively defining species habitat affinities. Our ability to map benthic habitats through a suite of space based and in-situ remote sensing technologies continues to increase and automated optical and acoustic data classification algorithms complement traditional visual classification of remote sensing imagery. By integrating information on species habitat affinities and distribution of benthic habitats, species abundance models can be developed and validated with traditional FI programs. The SEFSC should continue to build on its partnerships within NOAA NOS, the Coral Reef Conservation Program, and USGS to advance habitat mapping to support stock assessments through the development of robust sampling designs and protocols. This in turn can enable additional product development from existing data collection programs through the use of geo-spatial models and resultant maps to portray complex species spatial and temporal patterns and the certainty of those projections based statistical analyses.

#### **Concluding Comments**

The SEFSC has a number of options or criteria to aid them in defining data collection programs to maintain, enhance, or initiate in support of stock assessment requirements. These include the status of the stock abundance, ecological and economic importance, end users, such as fishery management councils, data collection partners, spatial geography, and balancing fishery independent and fishery dependent data collections. The challenges are great and well recognized by the SEFSC ranging from

incomplete data collections is space and time, limited information on fishery discards, continued reductions of NOAA fleet survey days, and large areas, such as the US Caribbean lack accurate and timely commercial and recreational fishery data and have very limited fishery independent programs and biological samples. Despite these tremendous challenges, the SEFSC is using sound management, science, and innovation to improve the accuracy and efficiency of data collection programs to support fishery stock assessments. Activities include moving to electronic reporting and monitoring (e.g., VMS) and technology initiatives to determine gear catchability, the use of towed cameras with video to characterize deeper fisheries, fish acoustic sonar and arrays to determine numbers and movements of fish, and multibeam sonar to collect bathymetry data in support to habitat mapping.

These types of advancements in conjunction with ongoing SEFSC data collections to support stock assessment will contribute to the evolving paradigm to move from single species management to ecosystem based fisheries management through the characterization of the biological, physical and socio-economic conditions of the South Atlantic, US Caribbean, and US Gulf of Mexico.



# NOAA FISHERIES

## Southeast Fisheries Science Center

## Data Collection and Management Program Review

### Southeast Fisheries Science Center Summary and Response

### August 2013

#### Introduction

On June 3-5, 2013, the Southeast Fisheries Science Center (SEFSC) hosted a panel of experts to conduct a peer review of the data collection and data management programs that feed assessments and scientific advice for stocks managed under the Magnuson-Stevens Act. This review was the first of a series of annual reviews, conducted on a different theme each year over a five-year cycle, designed to obtain expert input on opportunities to improve the quality of science products and scientific advice delivered by the SEFSC. Results from this year's review, along with those being conducted at each of the other five fishery science centers and the Office of Science and Technology, will be used to prepare a national summary, to highlight best practices and to inform decisions on opportunities for improving data collection and data management programs across NOAA Fisheries. More information regarding the SEFSC review may be found at:

<http://www.sefsc.noaa.gov/spr/sefsc-science-program-review.html>

#### Acknowledgements

It seems fitting to begin with a few words of appreciation. First, thanks go to the review panelists who devoted a significant amount of time to prepare for and participate in this review. Their observations are invaluable in providing a feedback on how our data programs are faring relative to our goals and objectives. Similarly, their recommendations provide an opportunity to refine these programs to improve their effectiveness and efficiency. Panelists for this review were:

- Cecil Jennings (Chair), US Geological Survey/University of Georgia
- Robert Ahrens, University of Florida
- Andrew Cooper, Simon Fraser University, British Columbia, Canada
- Wendy Gabriel, NOAA Fisheries – Northeast Fisheries Science Center
- Mark Monaco, NOAA Ocean Service – Center for Coastal Monitoring and Assessment

Our data collection partners in the states, the Virgin Islands and Puerto Rico, the interstate commissions, and academia collaborated on presentations made during the review, which was essential in helping us portray the rich collaborations we've built together over the years. Many of these partners made the trip to join us for the review.

Several of our management partners, the key users of our science products and scientific advice, also joined us for the review. This created an opportunity for them to offer their unique perspective on our programs and for them to get a broad overview of our data collection efforts, providing context for how their issues fit into the broader whole.

Finally, I'd like to thank the constituents who attended. Their insights and questions were informative for the reviewers, but also for SEFSC staff as we strive to improve our science and how we communicate about it.

## Remarks

High quality and timely data inputs are a prerequisite for a scientifically sound stock assessment, making this review on data collection and data management programs a logical starting place for our five-year cycle of reviews. At the same time, the scope of the review was daunting. Stocks managed under the Magnuson-Stevens Act within the southeastern United States are diverse, and they dwell in an equally diverse range of habitats over their respective life histories. Sampling strategies within the region reflect this diversity, making the preparation for and conduct of this review challenging, but well worth the effort. The review panelists' reports yielded some excellent observations and recommendations to improve our data collection and management programs.

As a first step, a meta-analysis of the challenges and the recommendations identified by the panelists was conducted to enable us to look for common themes, or unique observations among the reviewers (Appendix A). SEFSC staff will continue to study the panelists' reports to evaluate potential costs and benefits of the recommendations. This will help guide a focused effort to prioritize and ultimately implement the recommendations deemed to have the highest return on the investment. Meantime, some recommendations stand out as particularly germane.

Panelists universally recognized the importance of having a sound strategy for priority setting to ensure the data collection efforts remain focused on high-impact work. This is especially true in an environment of static or shrinking budgets.

The recommendation to make better use of the assessment and peer review reports from the Southeast Data, Assessment and Review (SEDAR) process is a good one. The assessment reports provide sensitivity analyses on data inputs which are informative in evaluating how the various inputs stack up in terms of their relative contribution to the precision of the estimate. Likewise, assessment reports include a list of research priorities, augmentations to existing data collections or altogether new surveys, which could strengthen the subject stock assessment. This information is valuable for setting priorities for data collection within a given stock assessment, and for making decisions among competing demands among assessments or geographic areas.

Exploiting the benefits of electronic monitoring and electronic reporting came up in the discussions and was mentioned in the reports. The SEFSC has made some good progress on moving to electronic reporting, and recognizes that more gains in the timeliness and quality of our data can be realized by continuing investments in this area.

Another common theme was that the quantity and maturity data collections in the Caribbean lagged behind those of the Gulf of Mexico and South Atlantic areas. NOAA Fisheries recognizes this is true of programs for the Caribbean and also the Pacific Islands. The FY14 President's Budget includes an initiative to improve data collections in these insular areas.

Investments to support biological sample processing to keep pace with data demands of stock assessment scientists was another area highlighted in the report. In the same vein, a need for investments to bolster data management staffing and infrastructure was viewed as critical.

During one of the public comment periods, a constituent reminded us of the importance of catalyzing the evolution toward ecosystem approaches to management in the region. Strengthening our capacity for process studies must have a seat at the table when priorities are set for at-sea data collections.

Throughout the review, it was abundantly clear what a critical role our collection partnerships play in the success of our data collection programs. At least one reviewer rightly pointed out that an adequate flow of resources and strong planning and communications are required to maintain these collaborations for them to remain one of our greatest strengths.

We will watch with interest the outcomes of the remaining reviews to be conducted this fiscal year and look forward to the national synthesis of those results. The synthesis of findings and recommendations from across the science enterprise and development of best practices will provide powerful guidance for improving the data collections feeding stock assessments in this region.

## Appendix A

### Summary of Challenges and Recommendations

Fishery-dependent Sampling	
Comments	x of 5 Commenters
<b>CHALLENGES</b>	
Lack of ability to track changes in catchability to generate unbiased CPUE trends	2
Self-reported data with inadequate ground truthing	2
Low observer coverage	2
Coarse spatial resolution of MRIP	1
Uncertainty in effort estimates	1
Increased recreational intercept rates	1
Texas' departure from MRIP protocols	3
Caribbean is underserved in commercial and recreational catch monitoring	3
Time lag in incorporating data into assessments	1
Lack of recreational sampling in Virgin Islands	1
<b>RECOMMENDATIONS</b>	
Collaborate more closely with Texas on recreational sampling and estimation	3
Estimate bias of self-reported discards using comparisons with observer data	4
Establish data collection to monitor changes in catchability; perhaps in form of a fleet-wide survey on changes in gear and fishing practices done periodically, or incorporate questions into current surveys	2
Increase observer coverage everywhere (especially in SA)	3
Landings and discards from recreational fleet must be better measured	1
Bycatch estimation requires more attention	1
Continue investments in electronic reporting to improve timeliness and facilitate data validation	4
Improve dockside validation of commercial landings for Caribbean	1

<b>Fishery-dependent Sampling</b>	
<b>Comments</b>	<b>x of 5 Commenters</b>
Use simulation evaluation to quantify impact of bycatch estimate uncertainty to determine required sampling levels for observers	1
As improvements in commercial sampling in Caribbean are made, conduct an analysis of relative importance of recreational data collections to optimize relative investments in each	3
Analyze bycatch estimate CVs against cost of observer coverage to increase them and a sensitivity analysis in the assessment models to enable a cost-benefit analysis	1
Consider one, consolidated at-sea data entry program for all observer programs to gain efficiency	1
Consider an adaptive sampling plan to account for in-season effort shifts for observer program rather than relying exclusively on historic fishing patterns to set coverage	1
Improve spatial resolution of sampling	1

<b>Fishery-independent Sampling</b>	
<b>Comment</b>	<b>x of 5 Commenters</b>
<b>CHALLENGES</b>	
Limited ship time	1
Some departure from standards by state partners	1
Lack of benthic habitat maps	4
Lack of net mensuration for trawl surveys	2
Long sample processing time - video	1
Limited geographic coverage for some surveys	2
Caribbean and South Atlantic underserved	2
Gaps in habitats sampled	1
Geographic scope of Florida panhandle seagrass trawls may limit data utility	2
<b>RECOMMENDATIONS</b>	
Consider reducing temporal resolution to enable expanded spatial resolution, provided analysis shows this is a net benefit	2
High priority to generate fishery-independent indices of abundance	1
Summarize how each current fishery-independent survey is used in stock assessments	1
Revisit SEAMAP surveys to ensure they focus on priority stocks, or if not, do them less frequently to use savings on other surveys	2
Concurs that video sampling should not replace trap sampling without adequately addressing potential bias and calibration between gears	1
Improving Fishery independent sampling in Caribbean may be a higher priority than improving fishery-dependent sampling there.	1
Increase resources expended on estimating natural mortality	1
Habitat characterization in all regions must be increased	3
Ensure we're collecting the data necessary (e.g., diet, environmental to allow estimates of relative changes in natural mortality over time	1
Collect diet data to enable eventual multi-species assessments and ecosystems questions	3
Maintain or increase funding for process-oriented studies that improve assessments	3

<b>Fishery-independent Sampling</b>	
<b>Comment</b>	<b>x of 5 Commenters</b>
Increase fishery-independent sampling for use in indices of abundance (So.Atlantic and Caribbean)	2
Redirect some of the South Atlantic trap effort into surveying for new sampling locations	2
Formalize sampling protocol manual for video trap survey	1
Explore potential of shifting to sampling regime that allows absolute abundance rather than relative abundance indices using cameras and acoustics	1
Ensure MARMAP and SEAMAP sampling in the South Atlantic is at a resolution and geographic scope that is adequate for stock assessments	1
Continue work on sampling methodologies for untrawlable habitats	3
Study larval survey sampling protocols to ensure they are unbiased	2
Employ net mensuration on trawl surveys and piggy back acoustic sampling to gain additional data valuable in interpreting the data	2
Continue to invest in electronic reporting for fishery-independent sampling on federal and partner cruises	2
Expand benthic habitat mapping to improve fishery-independent sampling precision	1
Improve spatial resolution of sampling	1

<b>Biological Sampling</b>	
<b>Comments</b>	<b>X of 5 Commenters</b>
<b>CHALLENGES</b>	
Insufficient staffing	3
Dependency on extra mural funding	1
Long sample processing time	1
Inadequate reproductive sampling	1
Inadequate bio sampling in Caribbean	1
Inadequate sampling in general weakens stock assessments	1
Inadequate bio sampling of discards	1
Inadequate bio sampling impacts ability to apply ecosystem approaches - e.g. quantify impacts of climate change	1
<b>RECOMMENDATIONS</b>	
Increase resources for collection and processing of biological samples.	1
Use simulation evaluation methods to set sample size targets for biological sampling for both fishery-independent and fishery-dependent sampling	2
Increase biological sampling in Caribbean to enable more sophisticated assessments	1
Incorporate diet studies to understand predation mortality	1
Imbalance in ratio of FTE to contract staff processing biological samples	1

Data Management	
Comments	X of 5 Commenters
<b>CHALLENGES</b>	
Ratio of contractors to FTEs controlling the data is too high	2
Inadequate staffing levels	1
Reliance on state and territorial partners	1
<b>RECOMMENDATIONS</b>	
Need staff specifically dedicated to data management rather than having biologist/s assessment scientists do this work	1
Shift to higher percentage of FTEs managing the data	2
Better data standards and coordination among partners	1
Ensure all data are adequately backed up, especially the videos	1
More resources needed for both staff and infrastructure	2
Invest in aggressive training programs for current and new IT staff to improve and maintain capabilities	1
Invest in IT infrastructure	1
Collaborate on governance systems for fishery-dependent data collections across the Center and partners	1

Cross-cutting Issues	
Comments	X of 5 Commenters
<b>RECOMMENDATIONS</b>	
Use SEDAR sensitivity runs to determine what surveys are contributing most to precision	4
Perform meta-analysis of all research recommendations from SEDARs and track which were implemented	1
Perform simulation-estimation exercises to examine contribution of data sources to accuracy and precision	4
Need strong objectives to set priorities for what gets fixed first for both precision and timeliness	1
Create a flow chart, similar to a Gantt chart to explore how increased or decreased timing of one data collection or data processing influences timing of a stock assessment	1
Seek solutions to long-standing issues in Caribbean	4

**Chair's Summary of Program Review of Stock Assessment Process**  
**NOAA-NMFS Southeast Fisheries Science Center**  
**Miami, Florida**  
**8-10 July 2014**

**Review Panel Members**

- Michael Hansen, USGS – Great Lakes Science Center, Chair
- Robert Atlas, NOAA – Atlantic Oceanographic and Meteorological Laboratory, Reviewer
- Ewen Bell, UK – Center for Environment, Fisheries & Aquaculture Science, Reviewer
- Joseph Hightower, USGS – North Carolina Cooperative Fish & Wildlife Research Unit, Reviewer
- William Karp, NMFS – Northeast Fisheries Science Center, Reviewer

**Background and Overview of Meeting**

The stock assessment process conducted by the NOAA Southeast Fisheries Science Center (SEFSC) was reviewed at the Mayfair Hotel in Miami, Florida, during 8–10 July 2014. The review was convened as an annual review of science programs at National Marine Fisheries Service (NMFS) Science Centers (including associated laboratories) and the Office of Science and Technology (ST) to: (1) evaluate quality, relevance, and performance of science and research conducted in NMFS Science Centers and associated laboratories; and (2) strategically position Science Centers and ST in planning future science and research. As defined in the Terms of Reference (TOR) for the review, the objective of the review was to examine and evaluate the SEFSC fishery stock assessment program that is conducted pursuant to the Magnuson-Stevens Act (2006) and comparable international agreements. Stock assessments apply mathematical and statistical models to data collected from living resources and their associated fisheries to provide scientific advice on current and future status of managed resources. Fishery, survey, and biological data available for stock assessments were reviewed in 2013, so the present review focused on the process of developing stock assessments from these data, including modeling approaches, review process, and communication of advice. The review was not intended as an in-depth review of any particular stock assessment, but rather, as a review of the body of assessments conducted in response to available data and management needs. During the review, the panel considered materials provided by the Center to comment on seven assessment themes related to the NMFS marine stock assessment program in the southeast. Each theme and operational discussion item was led off by a short presentation, followed by in-depth discussion among panelists and designated discussants (SEFSC, SEDAR, and management council representatives). Each panel member, including the chair, summarized their comments about seven themes in individual summary reports (attached below the Chair's report). The Chair also summarized comments that emerged from multiple panel members (immediately below).

**General Observations and Recommendations**

Stock assessment scientists at the SEFSC complete an extraordinary number of assessments for a very large number of high-valued species. Clearly, the requested number of stock assessments exceeds total capacity of the work force of lead scientists. The Center Director is therefore challenged to balance a need to produce the largest number of assessments possible within work force limits (i.e. the number of stock assessment scientists), while also ensuring the work force of assessment scientists is allowed time for professional development (e.g. publishing scholarly articles and attending professional conferences). The latter need for career development has been increasingly sacrificed in favor of the former need to complete the largest possible number of stock assessments, because of attrition in the work force, which is at least partly induced by the intensive work load of lead scientists, and lags in replacing scientists who leave, which is largely a function of the agency's personnel management system. A need for stock assessments is not expected to dissipate in the future, which argues for stream-lining the stock assessment process. Similarly, stock assessment scientists must be allowed to develop their careers by allowing them time to publish scholarly articles and to attend scientific conferences, which argues for changing work-force management in the Center to explicitly reserve time for professional development. Specific issues related to thematic areas of the review are summarized below, which collectively support this general observation and overall recommendation.

**Summary of Panel Member's Major Observations and Recommendations**

- **Theme 1: Science and Technical Approaches**
  - Observation – The approach used by stock assessment scientists at the SEFSC is state-of-the-art, and relies on a lead scientist to develop a model that is appropriate for the available data, but also meets management needs for fishery advice. Clearly, data limits model complexity, whereas managers may desire a model that is more complex than is warranted by the available data. A consequence of the overall approach is that any assessment model has an appearance of a “one off” model that is highly unique for the available data and the specific fishery management need. Another consequence of the overall approach is that managers may

desire a model that is more complex than warranted by available data, because a more complex model is often believed to be better than a less complex model. This tension between quality and quantity of the available data and a desire by managers and modelers to seek the most complex model possible can lead assessment scientist to seek a more complex model than is reasonable or necessary.

- Recommendation #1 – Invest in data collection that is commensurate with management system needs, so data needed for the most appropriate stock assessment model are of sufficient quality and quantity (e.g. age compositions for catch-age models; fishery independent surveys).
- Recommendation #2 – Develop a written standard operating protocol to formalize the process of model development in response to: (1) quality and quantity of available data; and (2) needs of the management system.
- Recommendation #3 – Ensure that uncertainty of each data stream is propagated through model development, so management advice correctly reflects model uncertainty, to ensure managers are fully aware of the level of risk associated with their management actions.

- **Theme 2: Assessment Process**

- Observation – The assessment process aims to secure assessments of high priority stocks by prioritizing stock assessment needs in relation to availability of lead scientists. Overall, the process is sound and seems to produce assessments of stocks that are of highest priority. However, the process sometimes seeks a level of assessment that may not be reasonable or necessary, as when a “Benchmark” assessment is requested to seek a better answer than an earlier “Benchmark” assessment.
  - Recommendation #1 – Account for lead scientist time in hours, rather than “slots”, to provide a better match between available effort and requested effort.
  - Recommendation #2 – Shift emphasis from “Benchmark” assessments to “Update” assessments, to ensure the most appropriate level of assessment is applied.
  - Recommendation #3 – Thoroughly review the SEDAR process every 10 years, to ensure the process is both meeting management needs and appropriately using SEFSC scientist effort.

- **Theme 3: Peer Review Process**

- Observation – The peer review process used for stock assessments ensures an objective review of the process and products (i.e. the gold standard in science). Overall, the peer review process is sound. However, over-emphasis on “Benchmark” assessments and extensive documentation for assessments challenges the process and peer reviewers.
  - Recommendation #1 – Develop a standard operating procedure for methods commonly used in stock assessments (e.g. perhaps through a working group).
  - Recommendation #2 – Peer-review standard operating procedures using standard review methods, such as the CIE.
  - Recommendation #3 – Exempt subsequent stock assessments that rely on standard methods from peer review, and require peer review only of alterations in standard methods.

- **Theme 4: Communication**

- Observation – Stock assessments are documented through extensive open-access publication of documents that elaborately describe all details of each assessment, from data compilation and manipulation through model selection and development. This extensive documentation is redundant among assessments when standard methods are used and lacks transparency by being too technically dense for many stakeholders and cooperators.
  - Recommendation #1 – Simplify documentation of stock assessments by referring to standard methods wherever possible, which should be posted in the same internet location, along with peer review comments and findings.
  - Recommendation #2 – Summarize departures from standard methods and previous assessments early in the documentation, to facilitate reader understanding of departures from standard operating procedures or protocols.
  - Recommendation #3 – Add a concise summary of each assessment that is understandable to stakeholders and cooperators, preferably to be written by a communication specialist or by a lead scientist who is trained in public outreach and communication.

- **Theme 5: Research Opportunities**

- Observation – Stock assessment scientists produce high-quality state-of-the-art assessments that are highly responsive to cooperator needs. However, scientists are allocated too little time for research to both improve stock assessments and to advance their careers, a consequence of which is turnover among stock assessment scientists that is higher than expected or desired.
  - Recommendation #1 – Reserve a portion of each lead scientist’s annual FTE for research into improvement of stock assessment methodology and to personal research.
  - Recommendation #2 – Ensure scientists are current in their knowledge by supporting their attendance at one conference per year.
- **Theme 6: Ecosystem Considerations and Next-Generation Assessments**
  - Observation – The SEFSC is actively engaged in developing models that integrate multiple species and the surrounding environment. However, this effort was funded externally, which suggests the effort was not high enough in priority for base resources to be allocated. Further, next-generation assessments should include management strategy evaluations to test performance of the overall system.
    - Recommendation #1 – Provide base support for the GOM IEA 3-year plan by allocating a portion of lead scientist’s time to this effort.
    - Recommendation #2 – Incorporate environmental variables within assessment models to increase precision of management advice, if variables are predictable (i.e. decadal oscillations).
    - Recommendation #3 – Undertake a management strategy evaluation of the stock assessment process and associated fishery management system.
- **Theme 7: Organization, Priorities, and Accomplishments**
  - Observation – See descriptions of Themes 1–6, for background related to these recommendations, which cross over all preceding themes.
    - Recommendation #1 – Adopt the national model for using the most appropriate assessment model for each stock selected by SEDAR.
    - Recommendation #2 – When allocating scientist effort to stock assessments, reserve a portion of each scientist’s time for professional development
    - Recommendation #3 – Support scientist’s attendance at national and international conferences, to ensure scientist knowledge is state-of-the-art and to promote career development.

**Conclusions** – The stock assessment program at the SEFSC benefits from a highly skilled and extraordinarily dedicated workforce whose throughput of stock assessments serves fishery managers and stakeholders very well across a broad region of ocean resources. Throughput of stock assessments would benefit from streamlining the process by: (1) shifting more assessments from benchmarks to updates; (2) standardizing methods that overlap among assessments; and (3) shortening stock assessment reports by using standard operating protocols. Workforce management would benefit from: (1) treating lead stock assessment scientists in units of hours, rather than slots; and (2) reserving a portion of each lead scientist’s FTE for career development (publishing scholarly articles and attending conferences). Communication of stock assessment findings would benefit from: (1) summarizing key changes or innovations at the front end of documentation; and (2) adding a concise layperson summary to each assessment.

**Reviewer Report on Program Review of Stock Assessment Process**  
**NOAA–NMFS Southeast Fisheries Science Center**  
**Miami, Florida**  
**8–10 July 2014**

**Background**

A review of the stock assessment process conducted by the NOAA Southeast Fisheries Science Center (SEFSC) was undertaken at the Mayfair Hotel in Miami, Florida, during 8–10 July 2014. The review was convened as an annual review of science programs at National Marine Fisheries Service (NMFS) Science Centers (including associated laboratories) and the Office of Science and Technology (ST) to: (1) evaluate quality, relevance, and performance of science and research conducted in NMFS Science Centers and associated laboratories; and (2) strategically position Science Centers and ST in planning future science and research. As defined in the Terms of Reference (TOR) for the review, the objective of the review was to examine and evaluate the SEFSC fishery stock assessment program that is conducted pursuant to the Magnuson-Stevens Act (2006) and comparable international agreements. Stock assessments apply mathematical and statistical models to data collected from living resources and their associated fisheries to provide scientific advice on current and future status of managed resources. Fishery, survey, and biological data available for stock assessments were reviewed in 2013, so the present review focused on the process of developing stock assessments from these data, including modeling approaches, review process, and communication of advice. The review was not intended as an in-depth review of any particular stock assessment, but rather, as a review of the body of assessments conducted in response to available data and management needs. During the review, the panel considered materials provided by the Center to comment on seven assessment themes related to the NMFS marine stock assessment program in the southeast. Each theme and operational discussion item was led off by a short presentation by a facilitator, followed by in-depth discussion among panelists and designated personnel who were assigned as discussants. Discussants included key SEFSC, SEDAR, and management council representatives. Each panel member summarized their comments about the seven themes in individual summary reports. The Chair also summarized comments that emerged from multiple panel members as General Observations and Recommendations (immediately below).

**General Observations and Recommendation**

Stock assessment scientists at the SEFSC complete an extraordinary number of assessments for a very large number of high-valued species. Clearly, the requested number of stock assessments exceeds total capacity of the work force of lead scientists. The Center Director is therefore challenged to balance a need to produce the largest number of assessments possible within work force limits (i.e. the number of stock assessment scientists), while also ensuring the work force of assessment scientists is allowed time for professional development (e.g. by publishing scholarly articles and attending professional conferences). The latter need for career development has been increasingly sacrificed in favor of the former need to complete the largest possible number of stock assessments because of attrition in the work force, which is at least partly induced by the intensive work load of lead scientists, and lags in replacing scientists who leave, which is largely a function of the agency's personnel management system. A need for stock assessments is not expected to dissipate in the future, which argues for stream-lining the stock assessment process. Similarly, stock assessment scientists must be allowed to develop their careers by allowing them time to publish scholarly articles and to attend scientific conferences, which argues for changing work-force management in the Center to explicitly reserve time for professional development. Specific issues related to thematic areas of the review are summarized below, which collectively support this general observation and overall recommendation.

**Key Specific Findings and Recommendations**

- **Theme 1: Science and Technical Approaches**
  - Overall Approach – The Center employs a rigorous approach to stock assessments that aims to use a model appropriate for the available data. Within a hierarchy of models that extends from simple (e.g. surplus production) to complex (e.g. statistical catch-age), a lead stock assessment scientist integrates available data into the most appropriate model for the data. In general, a more complex model is used for stock assessments of species that are highly valued or heavily fished, and therefore, have more available data, than for species that are less valued or lightly fished, and therefore, have less available data.
    - Strengths – The overall approach is reasonable and should produce a stock assessment model that optimizes use of available data. Further, the overall approach should produce a stock assessment model that is state-of-the-art for the available data.
    - Challenges – The overall approach is reasonable, but lacks a formal written protocol to both guide model development and to communicate the standard approach to stakeholders. Consequently,

stock assessments have an appearance of “one off” uniqueness that may seem to be more art than science to naïve stakeholders or managers.

- Recommendation – Develop a standard operating procedural manual that describes the overall approach, as a tool for guiding future stock assessments and for communicating the procedure to stakeholders and managers. Post the procedural manual on a publicly available website.
- Classification of Stock Assessments – The Center is asked to produce stock assessments for a large number of species that range widely in available data from “data poor” to “data rich” species. In general, a more complex and integrated assessment can be derived for “data rich” species than for “data poor” species (as noted above). Further, the lead stock assessment scientist will likely be drawn to apply the most data intensive (i.e. complex) model to each species, because a more complex model would hopefully produce a more convincing estimate of stock status.
  - Strengths – The overall approach described above would hopefully produce a stock assessment model that is most appropriate for the available data, as described above. Further, the overall approach would generally maximize, rather than minimize, use of available data by seeking to use the most complex model possible for available data.
  - Challenges – The desire to maximize use of available data, and thereby, to produce a more convincing stock assessment using the most complex model possible fails to recognize that some fisheries may be adequately assessed with models of low complexity.
  - Recommendation – A decision rule should be developed that anticipates management need in addition to data availability, when selecting the most appropriate stock assessment model. Some fisheries can be adequately managed using simple stock assessment models that lead to simple fishery management rules, thereby foregoing unnecessarily complex data compilation and assessment model development.
- **Theme 2: Assessment Process**
  - Overall Approach – To ensure stock assessments are of good quality, reliable, and relevant to management needs, stock assessments are prioritized for inclusion in the Center’s work plan using a coordinated process (SEDAR or ICCAT). The process is designed to be inclusive by allowing participation of all relevant interest groups and also transparent by posting all records in a publicly available internet location. The Center identifies the number of “slots” (approximately equivalent to a lead stock assessment scientist) that are available for leading the development of stock assessments, which are then assigned in priority order to requested stock assessments.
    - Strengths – The process seems likely to designate the highest priority needs for stock assessments to the species that are most in need of management advice, thereby ensuring relevancy of effort spent by the Center on stock assessments.
    - Challenges – The process allows managers to designate the level of a requested stock assessment (i.e. “benchmark” or “update”) that differ greatly in the effort required for completion of the stock assessment by a lead scientist and supporting effort.
    - Recommendation – The process could be revised to match the level of stock assessment effort requested to the amount of time available for stock assessment biologists in the Center. This will require stock assessments to be defined in terms of hours required (e.g. “benchmark” = 1000 hours; “update” = 500 hours) and lead stock assessment “slots” to be replaced by “hours” or some other measure of lead stock assessment scientist time available in each year.
  - Priority Setting – Cooperators request stock assessments of species that are deemed to be most in need of management advice. Therefore, species that are prioritized to be most in need of stock assessments are, not surprisingly, the species that are most highly valued, most controversial, or potentially over-fished.
    - Strengths – The process assures that stock assessments are completed for species that are in need of management advice, or for species for which the original stock assessment was questionable or contentious with stakeholders.
    - Challenges – For some high-profile or contentious species, “benchmark” stock assessments may be requested in the hope of obtaining a different answer, because the original “benchmark” stock assessment produced unpopular (usually, overly restrictive) management advice.
    - Recommendation – The process could be revised to only allow benchmark stock assessments for species for which a stock assessment was not previously completed. This would thwart attempts by unhappy stakeholders to “shop” for a better answer.
- **Theme 3: Peer Review Process**

- Overall Process – The stock assessment process is subjected to rigorous peer review at all stages, as required by the national standard. The process meets the national standard for being transparent, inclusive, unbiased, independent, and not duplicative.
  - Strengths – Peer review of the stock assessment process ensures scientific quality of products, as for many other science processes, such as scientific publications, research funding programs, and scientist tenure and promotion. Peer review is widely viewed by stakeholders and cooperators as a standard approach to ensure integrity of scientific processes and products.
  - Challenges – The requirement for peer review adds time to any process and ensures rigorous application of the scientific method, but also ensures “benchmark” stock assessments cost much more than “update” stock assessments. Further, standard methods used for multiple assessments are peer reviewed for each assessment.
  - Recommendation – Reduce the number of “benchmark” stock assessments by shifting recurring assessments to an “update” of the previous assessment (see Theme 2). In addition, develop a standard operating protocol (SOP) for stock assessments (see Theme 1) that can be peer reviewed once, but not for each stock assessment that relies on the SOP thereafter.
- Sequence – Independent peers review stock assessment products after the Stock Assessment Workshop (which follows the Data Workshop) and the assessment has completed.
  - Strengths – Placement of peer review after the stock assessment has been developed should ensure that stock assessment products are of high scientific quality.
  - Challenges – Placement of peer review after the stock assessment has been developed prevents peer review from “advising” the peer review process until after, rather than before, extraordinary effort has been expended.
  - Recommendation – Consider moving peer review ahead of the stock assessment workshop, to advise stock assessment development toward a model that is most appropriate for available data. This would provide support for an assessment that aims for the most parsimonious approach, thereby reducing effort spent toward a more complicated approach than is either possible, based on available data, or necessary, based on management need.
- **Theme 4: Communication**
  - Stock Assessment Documentation – To achieve transparency, stock assessments are documented in great detail, including detailed recording of workshops, data streams, and stock assessment model structure. The number and extent of documents has grown significantly over time.
    - Strengths – The level of detail documenting each stock assessment ensures a level of detail that serves as a permanent record of all details related to the stock assessment.
    - Challenges – The level of detail documenting each stock assessment may not be necessary for data or methods in common to multiple assessments. Further, the level of detail documenting each peer review is challenging to peer reviewers, who are asked to review assessments that are described in extraordinarily large numbers of documents and pages.
    - Recommendation – Use of standard methods described in standard operating protocols (see Theme 1) would allow for fewer documents describing individual stock assessments.
  - Stock Assessment Complexity – To provide an appropriate level of detail for peer review, stock assessments must include enough detail to enable the assessment to be reproduced (i.e. reproducibility standard). The number and extent of documents is substantial, to serve as a reference for peer review.
    - Strengths – The level of detail documenting each stock assessment ensures a level of detail that can be reviewed by peers.
    - Challenges – Extensive details and complexity of stock assessments may not be understandable for all stakeholders and cooperators.
    - Recommendation – A simplified summary of each stock assessment would enable communication of key findings to stakeholders and cooperators.
- **Theme 5: Research Opportunities**
  - Workload Allocation – Each lead scientist is treated as a “slot” when planning and prioritizing assessments within the Center’s work plan. This system enables scheduling of stock assessments to high priority species over species of lower priority (see Theme 2).
    - Strengths – The system for assigning lead scientists to assessments allows the highest priority assessments to be incorporated into the Center’s work plan. Further, the Center has a remarkable record of completing assessments to support management council cooperators.

- Challenges – Development of stock assessments consumes nearly all available time of scientists in the Center. Therefore, devotion of nearly all available time of lead scientists to stock assessments affords little time for research. A strong and recurring signal from participants of this review was related to this single issue!
  - Recommendation – The Center Director could define a “slot” to include a smaller fraction of a lead stock assessment time (< 1.0 FTE), to reserve a fraction of each scientist’s time for research. The resulting effort toward research would enable innovation and improvement in stock assessments. To enable conversion of “slots” into time, time spent on assessments must be quantified.
- **Theme 6: Ecosystem Considerations and Next-Generation Assessments**
  - Ecosystem Approach – Incorporation of environmental variables has explained some of the previously unexplained variation in fishery harvest, recruitment variation, and distribution of some species of fish in the Gulf of Mexico. Clearly, such measured environmental variation can be used to understand variation in fishery parameters, but may also be useful for predicting future fishery states when the environmental variation follows a predictable pattern (e.g. decadal oscillations).
    - Strengths – Stock assessment models could be improved by incorporating environmental variables by increasing precision of stock assessments and thereby reducing uncertainty of management advice and associated risk of overfishing based on that management advice.
    - Challenges – Incorporating environmental variation in stock assessment models increases model complexity, which increases time to maintain data streams supporting stock assessment models (may compete with a need for less time spent on stock assessments in favor of more time needed for research). Unfortunately, randomly varying environmental variables cannot improve model predictions in the absence of a predictable linear or nonlinear pattern of variation in the variable.
    - Recommendations – Wherever possible, environmental variables should be tested as correlates of apparent changes in the temporal pattern of catchability or recruitment. Large-scale, long-term trends in ocean currents may be especially useful for both correlating to trends in catchability and recruitment, and by following a predictable nonlinear pattern of change through time.
- **Theme 7: Organization, Priorities, and Accomplishments**
  - Workload Balance – The number of stock assessments needed by cooperators is matched to the number of scientists available to lead assessments through a process of prioritization that ensures high-priority stock assessments are included in annual work-load planning at the Center. The number of assessments is not expected to decline in the future, according to the Regional Manager. Further, the number of lead scientists is not expected to grow beyond a few vacancies that are presently in the process of being filled.
    - Strengths – The process used to assign assessments to lead scientists would seem to ensure that the highest priority assessments are completed. Therefore, cooperators would seem to be served well by the present process.
    - Challenges – The process used to assign assessments to lead scientists does not seem to allow lead scientists time in their annual work plan for professional development, which leads to frustration, and ultimately, attrition and turnover.
    - Recommendations – The process used to assign assessments to lead scientists must explicitly reserve time for professional development in annual work-force planning. Continuation of the present process will perpetuate job frustration, and thereby perpetuate attrition and turnover.

**Conclusions** – The stock assessment program at the SEFSC benefits from a highly skilled and extraordinarily dedicated workforce whose throughput of stock assessments serves fishery managers and stakeholders very well across a broad region of ocean resources. Throughput of stock assessments would benefit from streamlining the process by: (1) shifting more assessments from benchmarks to updates; (2) standardizing methods that overlap among assessments; and (3) shortening stock assessment reports by using standard operating protocols. Workforce management would benefit from: (1) treating lead stock assessment scientists in units of hours, rather than slots; and (2) reserving a portion of each lead scientist’s FTE for career development (publishing scholarly articles and attending conferences). Communication of stock assessment findings would benefit from: (1) summarizing key changes or innovations at the front end of documentation; and (2) adding a concise layperson summary to each assessment.

**Reviewer Report on Program Review of Stock Assessment Process**  
**NOAA–NMFS Southeast Fisheries Science Center**  
**Miami, Florida**  
**8–10 July 2014**  
**Background**

**General Observations and Recommendations:** The Stock Assessments that are performed, are in response to both the Magnuson-Stevens Sustainable Fisheries Act and the Atlantic Tuna Conservation Act. These assessments are extremely intensive, and are difficult to perform due to the limited data that is available. I am extremely impressed with the leadership provided by the SEFSC Center Director Dr. Bonnie Ponwith, and her division directors and branch chiefs, as well as by the dedication and motivation of the staff scientists at SEFSC. All of the above personnel are highly motivated to preserve the important fisheries that they are responsible for, while minimizing the impact on commercial and recreational fishermen. The methodologies that they apply are state of the art and the work involved is extensive.

The presentations given by stock assessment scientists clearly demonstrate a mastery of the biological and statistical knowledge required to conduct or contribute to the required Data, Assessment, and Review phases of the SEDAR process for stock assessments. Every presenter clearly communicated a strong commitment to transparency in all aspects of data analysis and conclusions. I also commend the presenters for reflecting on the current SEDAR process and identifying areas that would benefit from evaluation and restructuring, and for proposing specific suggestions for improvement. This demonstrates a continued effort to improve and refine a process to produce the best possible science to inform fisheries management decisions, and personal dedication as public servants.

My most important recommendations are to streamline the process wherever possible, go to the Proposed National Approach to set priorities for assessments, invest in people, and to perform research in combination with partners to further validate and improve their models and to improve the representation of uncertainties in the assessments.

**Key (Specific) Findings and Recommendations (as reviewer has comments on)**

- **Scientific and technical approaches**
  - Observations
    - Strengths: The approaches reflect the current state of the art.
    - Challenges: It is very complex and time consuming.
  - Recommendations to address issue: Streamline where possible.

- **Assessment process**

- Observations

- Strengths: Utilizes the current state of the art and is very comprehensive.
    - Challenges: The SEDAR process that determines the number of stock assessments and updates targeted for each year, and for prioritizing targeted species, results in a stock assessment workforce that is overwhelmed and unable to dedicate time to researching new models and understanding to advance stock assessment science. This also leads to reduced workforce morale and higher than expected staff turnover. The current SEDAR process requires a considerably greater number of benchmark assessments versus update assessments and is another factor contributing to an overwhelmed workforce. The benchmark assessments are appropriately more time consuming, requiring a greater investment of staff time and effort. The number of workshop webinars is excessive.

- Recommendations to address issue: Reduce and possibly limit both the number and duration of workshop webinars conducted during the assessment process. I recommend that the Center reconsider methods used to determine how many “slots” are to begin a new assessment each year. Creating specific, planned opportunities for staff to alternate between months dedicated to an assessment, and months available for research could yield a more productive workforce and greater staff retention. The SEDAR process should consider an approach to prioritize when certain stock assessments need to be updated. SEDAR also needs to clearly and carefully define thresholds that would trigger a benchmark assessment versus an update. Consideration should be given to types of new indices, understanding, or model updates that would be considered a significant change and thus provide compelling reason to dedicate the increased resources necessary to conduct a benchmark assessment, as opposed to an update. The assessment process could potentially be improved by testing and validating fisheries models using an approach similar to that used for Observing System Simulation Experiments (OSSEs). This could provide a means to test various models used to estimate future fisheries stock populations and demonstrate their relative uncertainties in a controlled setting. This could increase the relative confidence in the resulting model projections for stock populations and predicted changes. I recommend that the SEFSC explore the possibility for doing this with NOAA AOML.

- **Peer review process**
  - Observations
    - Strengths: Very comprehensive.
    - Challenges: Too demanding on available reviewers.
  - Recommendations to address issue: Streamlining the documents would make this less labor intensive.
- **Communication**
  - Observations
    - Strengths: Well documented, transparent, publicly accessible.
    - Challenges: While the SEDAR process clearly meets high standards of transparency, the final stages of the assessment process falls short in not effectively or clearly communicating a summary of the assessment for stakeholders. Leaving lay audiences and non-scientific stakeholders to dig through hundreds of pages of analysis likely leads to greater confusion and distrust of results and a lengthy process that is not well understood. Effective communication and stakeholder buy-in of assessment results is vital and should be considered just as essential to the other more technical components of the assessment process.
  - Recommendations to address issue: Streamline assessment documents. Focus on rationale and basis for critical decisions. Include an executive summary for each assessment. Prepare a simplified plain language summary for stakeholders and the general public. This should be prepared by or in conjunction with a communication specialist. Explore increased cooperation with Sea Grant. Look for ways to communicate and increase awareness of the stock assessment process in the stakeholder community, leveraging or continuing the successful MREP approach. Look for opportunities to communicate the success of assessment-driven management decisions to stakeholders, for example where a stock was effectively rebuilt or sustained.
- **Research opportunities**
  - Observations
    - Strengths: Development of improved models and indices, biophysical modeling, and incorporation of environmental data and satellite observations are major strengths.

- Challenges: Additional research is needed to improve assessment process and policy advice. The current assessment load is too large and there is not enough time for research. This affects morale, retention and recruitment adversely.
  - Recommendations to address issue: Current level of research needs to be expanded, through options such as hiring of more personnel, streamlining the stock assessment process, and increased partnering. Research should be considered a priority that is not diminished if the demand for additional stock assessments increases. Requirements for promotion should be realigned to reflect the work being performed by stock assessment scientists. Avenues to enhance ownership of stock assessments should be explored through interactions with other NMFS centers and NOAA line offices.
- **Ecosystem considerations and next-generation assessments**
  - Observations
    - Strengths: Excellent progress through very effective collaborations. This activity is proactive and represents substantial forward thinking. It takes into account environmental factors that affect productivity and recruitment, and has potential to result in improved assessments, by explicitly accounting for physical effects. This contributes to an improved relationship with stakeholders.
    - Challenges: Resources are limited and must be borrowed. Historic data is missing.
  - Recommendations to address issue: Follow the GOM IEA 3 year plan, and continue to work closely with NOAA AOML and other partners. Development of an ecosystem based fisheries management plan should be the highest priority. An Ecosystem team if formed should be cross-line office. It appears that the addition of ecosystem indices have the potential to improve the accuracy of assessments, but consideration of trading-off or removing other indices should be considered so that the overall process is not further overwhelmed. (See comments on modeling for suggestions on how to evaluate which indices would be most important to include.)
- **Organization, priorities, and accomplishments**
  - Observation

- Strengths: Outstanding leadership at all levels of SEFSC. Excellent partnerships. Stock status overall has improved.
  - Challenges: High turnover of staff. Diverse locations. Prioritizing assessments. Personnel (and monetary) costs substantial for each SEDAR assessment.
- Recommendations to address issue: Adopt the national approach to determine level and frequency of assessment. Simplify assessments where possible. Reduce length and number of documents where possible. Increase investment in people, both staff and constituents. Travel of NMFS SEFSC scientists to scientific conferences should be encouraged and supported.

**Conclusions:** See General observations and recommendations (above)

**Reviewer Report on Program Review of Stock Assessment Process**  
**NOAA–NMFS Southeast Fisheries Science Center**  
**Miami, Florida**  
**8–10 July 2014**  
**Background**

**General Observations and Recommendation**

**Key (Specific) Findings and Recommendations (as reviewer has comments on)**

- **Scientific and technical approaches**
  - The approach taken to stock assessment by the South Eastern Fisheries Science Center appears to be thorough, investing considerable resource in ensuring that both data sources and modelling approaches are fit for purpose and as compliant with world class standards as possible.
  - The use of well documented and reviewed assessment software is appreciated in that it means that one, highly technical aspect of the review process is already covered. This does not mean, however, that the search for stock assessment methodologies is complete. The development of more integrated ecosystem approaches is important and should deliver alternative approaches to the field in the long term, however there is a pressing need to develop novel assessment techniques for the data limited situations which are prevalent in the SEFSC jurisdiction.
  - The range of potential data sources (and often their fragmentation) means that data compilation exercises are considerably more complex than in other fishery assessment arenas. I understand that the previous program review on data issues concentrated on this area and that there are moves to house a centralized database for several of the data streams which should some way to streamlining the whole assessment process.
  - The high level of recreational activity and the high discarding ratio means that estimates of current catches is quite uncertain and it is entirely appropriate that the assessment methodologies used do not treat catches as being exactly known (in the majority of cases). Avenues for increasing the precision of estimates for these two fishery components should continue to be actively explored.
  - In the absence of an absolute abundance index from survey series, the model estimations of absolute stock abundance will be scaled by the landings and hence any bias in the reporting of catches will influence estimates of abundance, reference points and subsequently the various catch limit levels. Should the magnitude of any bias change through time then this will have consequences for the perception of stock status. Reference points are typically influenced by long term stock dynamics and therefore will be less influenced by shifts in bias levels in the terminal years when compared to the stock biomass levels. Whilst this is true for any stock assessment the impact of such biases will be more acutely felt where the management system is actively seeking to achieve given biomass levels.
  - The use of abundance indices in stock assessment models as linear predictors of stock abundance has at its base the statistical assumption that every fish in the stock system has an equal probability of capture by the gear. This assumption is always violated but the degree to which this violation might be influential varies according to the capture methods employed. There was discussion regarding how changes in the behavior of fishers in relation to management action would affect the commercial catch rate indices and efforts are made by the SEFSC staff to account for such changes in their standardization approaches. There appears to be the implicit assumption that fishery independent data (i.e. scientifically designed survey) will be comparatively free from potential bias, however the behavioral traits of the target species will influence their catchability. In particular gears which rely upon attraction are likely to be influenced by behavioral interactions within and between species at the sample site. Pot/trap gears rely upon the behavioral response of individuals to enter the trap and the presence of other individuals can influence the choice as to whether to enter the trap and can experience saturation. Catch rates from hook and line/long-line fishery methods may also be influenced by the abundance of other species in the area by either out-competing at the hook, or by displacement from the immediate vicinity. The potential for such influences upon the survey indices should be explored.

- Age based assessment is usually seen as the “gold standard” for fisheries assessments as they offer the potential for the most accurate estimates of current stock size and exploitation rate. The data requirements for age-based assessment are vastly more than for simpler models and given the often complex and fragmented nature of the data inputs it is not clear that moving to an age-based platform will necessarily be more useful to management. Indeed even the current attempts to use age or length disaggregated assessment techniques may be stretching the limits of what is possible given the data quality. Discussions during the last session made it clear that the existing otolith collection program is at capacity and consequently there is no scope for an expansion of the routine age based program. With this in mind a critical evaluation should be undertaken to ensure that age or length disaggregated assessments are only conducted when the benefits of such an approach outweigh the potential risks given the data limitations. The SESFC should take all care to ensure that assessment terms of reference are in keeping with the available data.
- Some reference was made during the presentations to the issue of Natural Mortality (M) and the reviewer acknowledges the difficulty in arriving at accurate or realistic values of this parameter, but it is one of the cornerstones of the assessment process and can have a stronger influence on reference point estimation than the estimate of terminal population size. Reference points based upon the virgin stock status (e.g. spawner per recruit levels) are particularly susceptible to the choice of M, I have experience of stocks being classed as significantly under-exploited or significantly over-exploited depending upon which value of M is chosen from a range of published values! There are several ways of tackling this: 1) investing in research into values of M, 2) incorporating uncertainty in M into the assessment process 3) moving away from reference points based upon virgin stock states.
- Whilst there is evidently a significant body of work undertaken in respect to capturing uncertainty within the data and modelling processes, it is not clear if this fully feeds through to the final product (e.g. the small buffer between the OFL and ABC for GOM Gag Grouper).
- **Recommendations to address issues**
  - Ensure sufficient research time is available to staff for the encouragement of novel assessment technique creation.
  - Fishery independent surveys have the potential to offer indices of abundance with the least level of bias. These surveys should be defended from rationalization and expanded wherever possible to be as inclusive of stock range/species composition as possible.
  - Further research and analysis on the potential for behavioral interaction around survey gear to ensure the index is as appropriate as possible for use as a linear predictor of stock abundance.
  - Develop programs to obtain better estimates of natural mortality and incorporate uncertainty around this crucial factor in the stock assessment/reference point estimation process.
- **Assessment process**
  - The process of delivering stock assessment products to the Council SSCs was well laid out for the panel and it was clear that there are several issues with the process which cause the process to be sub-optimal for all parties.
  - The SEDAR program appears to have expanded beyond its original brief as the place for the thorough review of particularly difficult and potentially contentious stock assessments. The current practice of putting a majority of assessments through the SEDAR process would seem to be missing the point.
  - Potential for the number of annual stock assessments is limited by availability of staff. There are 248 stocks under FMPs of which we were informed that 107 could undergo some form of stock assessment. With 20 potential assessment leads this represents a formidable task as being able to conduct a meaningful assessment means that the assessment lead needs to understand and have recall on the intricacies of the data streams, biology and ecology of each stock they are assigned to. This means that each assessment will have a significant “spin-up” time whilst the assessor reacquaints themselves of the details.
  - There are a number of ways in which the system seems to be imploding under its own weight including how the assessments are commissioned and the steps taken to deliver assessments to the SSCs.
  - **Commissioning.**

- The high level of input by fishery manager into the scheduling and prioritisation of stocks assessments causes issues not only for the SEFSC but potentially for the managers as well. There has been an understandable tendency to focus on the key species for fishery managers, but this is open to misuse in that assessments could be repeatedly requested until one is found that delivers a desirable outcome for management subsequent to which an assessment may not be requested for many years in which time the true stock status may have changed substantially
  - There would appear to be a desire for benchmark assessments over the use of update assessments, particularly on high-profile stocks. Benchmarks as currently undertaken represent a particularly burdensome task and the number of benchmarks requested is suffocating the system.
  - A benchmark should deliver the most contemporary and appropriate methodology to assess a given stock and the frequency of new data streams appearing or advances in biological understanding is such that a further benchmark is unlikely to deliver a significant shift in assessment methodology within a short time frame. The use of update assessment procedures would appear to be more appropriate to deliver contemporary estimates of stock status unless there was a significant body of evidence to indicate that the previous benchmark process was no longer suitable.
  - The purpose of benchmark processes in the ICES arena is to establish the data streams, determine biological parameter inputs and decide upon an assessment approach (i.e. create a recipe for an assessment). The recipe is then used to generate the next scheduled assessment. This process allows the optimal scientific approach to be developed independently from consequences of the management advice which would result. Benchmark products (the recipe) are then used for the subsequent assessments with only minor deviations from the process tolerated (e.g. missing years from a particular survey). More substantial revisions to a data series or change in model structure may require an “inter-benchmark” process in which scientists make specific proposals and analyses which are peer-reviewed before acceptance. Such “inter-benchmark” processes are often undertaken by correspondence. Finally where major revisions have occurred then a full benchmark process is scheduled but this would not typically happen within a 5 year window from the previous benchmark. The decision of which category any proposed amendments fall within is at the discretion of the professional staff within ICES.
  - By sticking to a moderately ridged system of update assessments interspersed with periodic benchmarks, managers would benefit as they would be able to have more frequently revised stock statuses for a wider number of stocks (as the update process should be vastly quicker and easier for SESFC staff). SESFC staff would benefit from having fewer benchmarks to prepare for and be able to devote a more appropriate amount of time to research targeted at delivering improved scientific understanding for future benchmarks.
- **Conduct**
- The division into three separate processes has a certain amount of logic to it, however it places a considerable constraint upon the way of working in that there is little or no opportunity to use common approaches to cover multiple stocks and explore mixed fishery interactions.
  - Having all meeting fully open to the public does satisfy the openness mandate of the SEDAR process but it does mean that meetings can become large and cumbersome. It is unlikely that stakeholders have interest throughout the full duration of the meetings and it could be beneficial to have a set portion of the meeting where public consultation is undertaken. Such sessions could be partly presentation of the work undertaken to date and part input from stakeholders.
  - The dispersed geography of the area does place significant limitations upon physical meetings and I understand the use of video-conferencing / webinars. From the description of the webinar program it would appear that these are often being scheduled too frequently and

for too long. They are also of questionable use when feedback and interaction from stakeholders is minimal, especially given that they require significant preparation time from SEFSC staff. The use of webinars should be carefully scheduled at key points to disseminate progress.

- Documentation of the process is important to demonstrate the science behind the process and the decisions necessary to move the process forward, however the current volume of documentation provided presents a significant challenge to the SEFSC staff and to those interested in the assessments. This topic is dealt with in the communications section of my report.
  - The SEFSC have proposed a new approach to the SEDAR process which should deliver benefits to both managers and the SEFSC staff.
    - **Methods working group.** This group would be responsible for appraising stock assessment methodologies and data analysis tools. This has the great advantage that many stock assessments have similar issues and it save going over the same ground each time a new benchmark is commissioned. It also enables SESFC staff to see more across the spectrum rather than being narrowly focused on their own stocks and this can only help develop a more integrated approach to assessment and advice. The work of this group could significantly streamline the benchmark process.
    - **Stakeholder Advisory Panels.** This group would establish better routes for communication and dialogue between science and stakeholders which can only be a good thing!
    - **Reducing the frequency of Benchmark Assessments.** As discussed above, the role of the benchmark should only be to revise a process when there are significant developments in data or science.
    - **Moving the balance of review responsibility from CIE to SSC.** My comments on this are in the “Peer review” section of the report.
  - **Recommendations to address issues**
    - The SESFC needs to be more assertive in setting out what is possible in terms of assessment workload. This could include setting a general rule for the minimum amount of time permissible for the conducting of benchmarks and a limit on the number of benchmarks commissioned per council per year. All other assessments would be updates and again these would be limited in number.
    - The proposed national approach to the prioritization and frequency of stock assessments looks to be an eminently sensible approach.
    - The adoption of the plans for the Methods Working Group and Stakeholder Advisory Panel is encouraged.
    - Provided that the Methods WG system is operational, stock-specific benchmark meetings would be condensed to a single point to undertake compilation of data and assessment model selection. Peer review is probably best undertaken at this stage.
    - To help identify the number of assessments possible under a revised SEDAR process the Center needs to have a better understanding of the true cost in terms of finance and person hours that assessments take.
    - Monitor staff time on assessments and the various tasks associated with them. Whilst I appreciate that collecting such data represents an additional administrative burden upon staff it needn’t be onerous (5 minutes per week completing some form of on-line database sheet).
- **Peer review process**
  - Peer review serves two purposes
    - ensuring that the approach taken is the most appropriate and

- Checking that the approach has been applied properly
- It is not clear that the current review process is able to fully deliver on these two factors simultaneously. The sheer volume of data inputs and data working group deliberations means that it is difficult for CIE review to properly appraise whether the appropriate methodologies have been applied to the data. This would be vastly simplified if the methods were pre-approved by a Methods Working group.
- In the current scheduling, the review being placed at the end of the process is really best placed to ensure that due process has been followed and that the selected methods have been applied correctly. Given the protracted period of time the current SEDAR process takes, it is simply too late for reviewers to identify fundamental flaws in assumptions and methodologies. It would be better to have independent reviewers be involved with the benchmarking process as it develops to offer advice and scrutiny. CIE input is probably best around the assessment group stage to bring in outside ideas. Final review (i.e. has the method been applied properly for the current assessment) could be the job of the SSC.
- As stated previously the proposals for the creation of a Methods Working Group is sound. It should avoid duplication of methodology review by the benchmark groups. The benchmark groups can then be condensed to a single compilation and assessment meeting which will considerably aid the job of those tasked with reviewing the data and methodologies selected by the benchmark.
- I am not wholly sold on the idea of using desk based CIE reviewers as additional inputs to the benchmark process. This would have to occur after the benchmark meeting had occurred and is likely to deliver less real benefit to the system than having them embedded within the benchmark meeting itself. As was commented in the discussions, there is only so much one can gain from reading papers and the face-to-face discussions of physical meetings are invaluable. It partly depends upon what benefit the SEFSC wish to gain from the use of CIE participants. I would contend that they could be used to gain additional input /alternative viewpoints to the process just as usefully as reviewers.
- If the suggested changes are made to the SEDAR process then the majority of assessments conducted within any one year will be update assessments. The review process for this is considerably less than for a benchmark process and it would be entirely appropriate that the SSC undertake the role of ensuring that the methodologies defined by the benchmark process have been followed.
- **Recommendations to address issue**
  - Provided the Methods Working Group system is adopted, peer review of the benchmark system will be greatly easier and therefore more likely to be constructive.
  - Embedding (truly) external reviewers/experts in a single benchmark meeting is likely to deliver the greatest benefit of their experience.
  - Final review of the assessment products be conducted by the SSC with a mandate to ensure that the processes identified as most appropriate by the benchmark have been correctly carried out.
- **Communication**
  - There is a universal need for improved communication between science and stakeholders, these issues to not only apply to SEFSC!
  - Transparency has two components, openness and inclusiveness. The current process of publishing all materials is open, but not inclusive as the contents are not accessible to all. To those less steeped in assessment science they are likely to be baffling and simply presenting those documents might cause some tension. To determine which documents are used by people it should be possible to use web statistics to see which documents have been downloaded and how many times however I suspect that the vast majority of document accesses will be by SEDAR staff and reviewers.
  - For benchmark assessments a summary document explaining key pieces of data / analysis may well be sufficient for the majority of stakeholders.

- There is a vast literature depository created by each benchmark in terms of research and working papers. It is acknowledged that this is a burdensome task, however it is important for future stock assessment scientists to have access to the research and findings of these exercises especially as a large proportion of these analyses never make it to peer reviewed publication. In order to make these working documents as useful as possible a brief lay-person description (i.e. executive summary) could be the first page, followed by description of data, methods and findings *sufficient* for future generations to follow.
- **Recommendations to address issue**
- The full scientific documentation is important for the scientists to follow what has been done, but the style and content could be significantly pared back unless the working document could be used as the basis for a peer-reviewed journal article.
- Short descriptions of stock assessments in plain language would be of help. This is probably best facilitated by the use of dedicated communication experts to help draft such documents.
- MREP is evidently working and should continue, including funding of fishers.
- A training program could be developed for scientists to assist them in delivering to a wide range of audiences. This is likely to be most beneficial if it combines some training from professional experts in verbal communication alongside the experiences of senior staff in dealing with the specific stakeholder groups unique to the SEFSC. Learning by trial and error is not ideal (I know from experience), one bad interaction with industry can take several good interactions to repair!
- Use the Stakeholder Advisory Panel to define what style and level of documentation is required to enable the widest possible access.
- Use the services of communication experts to assist the processes of public outreach in disseminating assessment and research results.
- **Research opportunities**
  - The current assessment system places considerable demands upon the SESFC staff. There appears to be a widespread feeling of despondency regarding control over the workload and scientific direction that individuals can take. Against this there is an obvious need for the Center to deliver products of sufficient quality to meet the needs of the fishery management councils however the ability of the Center to deliver is wholly dependent upon the availability of staff. There is a clear need to find the middle ground between Centre needs and fostering a motivated workforce.
  - Low morale was mentioned and seems to be a function of a) promotion prospects, b) lack of recognition for their efforts, c) being trapped in a closed cycle and d) divorced from the original interests which brought them into the field.
  - If the difficulties in conducting original research are widely appreciated outside the organization this could cause difficulty in attracting the optimal caliber of staff to existing vacancies.
  - The ability to conduct original research and produce peer-reviewed journal articles is seen as a pre-requisite to maintain their sense of being scientists rather than assessment technicians. However the ability to conduct and understand rigorous stock assessment should not be viewed as a purely technical exercise and does require a high level of training and insight. Mechanisms should be sought to recognize this and ensure that those involved in stock assessment know that their work is just as valuable to the Center as those focusing on research. For many people their feeling of self-worth in relation to their employment is inextricably linked to their title and position on the pay-scale so wherever possible, the demands of stock assessment should be taken into account when appraising staff for promotion although I realize there are Federal limits to this.
  - As mentioned in previous sections, an accurate picture of how long different stock assessment tasks take is vital to understand where the bottle-necks are and how tasks could be re-structured/reallocated to free up time for individual researchers.

- The disparity between the time allocated to “research” compared to what is considered desirable is not inconsiderate and the suggested value of ~20% of staff time that needs to be “found” is not unreasonable as a minimum average. This is not going to be an easy task. Moving towards the suggested frameworks of the Methods group, limited benchmarks and more updates should free up some time but it is not clear how much time this will potentially deliver.
- There is also a desire of the Management Councils to see more throughput of assessments which is at odds with the desire of scientific staff. Managing the expectations of the Councils is a key role for senior management. Again, an improved understanding the resource requirements for benchmark/update assessments will be a vital tool for the Centre management.
- The Centre staff are clearly highly professional and dedicated and have garnered a reputation for getting assessments out “whatever the cost”. Whilst this is admirable it is almost certainly contributing to the current work-load. I also suspect that there is a tendency to try and “gold-plate” the outputs (as evidenced by the volume of writing in the working documents). Management should work with the scientific staff to determine when a product has reached an appropriate quality for the task in hand. As with so many comments and observations in this review, these issues are not unique to the Centre and are problems that panelists are tackling in their own institutes (mine included).
- Specifying set proportions of individual staff time for research would seem like an obvious first step. Getting people to stick to them will be another matter. For protracted assessment time-frames (e.g. benchmarks), other tasks are likely to get squeezed out unless staff are particularly disciplined. Having update assessments with a condensed time frame should allow a “clear run” for research efforts. Resolving these issues will require dialogue between scientists and managers. Adopting a more project-based work system in which staff are allocated specific time windows to the various tasks may help. I acknowledge that within a scientific enquiry framework, projected time per task rarely meets reality but it could help people be more rationale in deciding when a task is sufficiently complete.
- **Recommendations to address issue**
  - Determine the staff time required for assessment purposes making sure that Fishery Management Councils understand how much time they can allocate in any one year.
  - Delineate a proportion of staff time to research and tasks other than assessment with the management structure to follow it up.
  - Determine approaches for appropriate recognition of assessment work.
- **Ecosystem considerations and next-generation assessments**
  - Setting appropriate harvest levels across the board for long term sustainability is the ultimate, aspiration of fishery managers, but the short term decisions of setting the next year’s quota often override the longer term look.
  - Developing ecosystem based modelling approaches for fishery management is an important task but is very much a long term process and there will be considerable challenges in maintaining momentum and demonstrating utility to funding bodies and managers. The interjections to assessments already made by some of the research strands will help maintain the interest but such efforts need to continue.
  - Staff involved in the fisheries assessment part of ecosystem approaches should not be divorced from the current reality of single species approaches and all avenues for cross-over should be sought. As a minimum, I would suggest that ecosystem based researchers should have exposure to the full working of at least one assessment round, preferably a benchmark.
  - The development of the Ecosystem Approach will by definition require the integration of many different skill sets and there are obvious challenges to combining the expertise whilst allowing staff to continue to develop. My personal view point is that it would seem most appropriate to have an umbrella group of scientists sitting in different specialisms who can pool together to combine their skills. Such a group would likely require a small core of facilitators who can manage the various experts. The alternative of a new Ecosystem Group would be more prone to “silo-mentality” (from

both within the team and from those teams outside) and ultimately have a less productive outreach across the specialisms. Ultimately it is a management decision about how best to structure the work to balance budgets and needs, there is no perfect model for this!

- Irrespective of how staffing organization is developed, the Ecosystem Approach to fisheries is a big program which requires big thinkers, lots of data and significant resourcing. It is unlikely that “salami-slicing” budget from current areas will deliver the kind of resources required for this long term venture so new sources of funding should be sought. It also requires that those involved with an Ecosystem Approach program (and I would expect this to be a considerable number) have the time to make significant contributions. This in turn means that the assessment burden would be required to be spread amongst a wider pool of scientists.
- Ultimately the Ecosystem Approach will necessitate a shift in thinking and approach of fishery managers and scientists need to be continually (but subtly) appraising fishery managers of how approaches and developments are helping inform their decisions.

- **Organization, priorities, and accomplishments**

- Many of my points regarding the actions of the Center in relation to current demands have already been addressed in the above sections.
- The Center is blessed with a hardworking and dedicated staff who continually rise to the challenge of meeting the large workload, however this cannot be sustained in the face of increased assessment demands and the stress is evident.
- With 248 stocks under FMPs, 51 of which have been assessed over the past 10 years (some of the multiple times) and 56 further potential assessments, the current system is clearly inadequate for the production assessments as demanded by the Fishery Management Council in response to legislation.
- With the filling of current vacancies, the projected assessment throughput can only increase modestly under the current system.
- Even with a more streamlined system, once the balance of research & development requirements has been redressed, the assessment potential of the Center will be limited compared to the potential demand.
- The main restrictions to further assessment throughput have been identified by the Center, (data availability, over-use of the SEDAR benchmark process, scheduling control and staff availability). The suggestions of the Center staff, along with further inputs from the review panel should, if promptly and sufficiently enacted, help to redress the balance of capacity vs expectance.

**Reviewer Report on Program Review of Stock Assessment Process**  
**NOAA–NMFS Southeast Fisheries Science Center**  
**Miami, Florida**  
**8–10 July 2014**

**Background:** Panelists were tasked with an evaluation of the SEFSC's fishery stock assessment program and were asked to consider modeling approaches, the review process, uncertainty of results, communication of advice, usefulness to managers and explicit consideration of environmental factors. Evaluations were based on reference material made available prior to the review and presentations made by SEFSC staff and colleagues from the Councils and other participants in the management process. My comments below are not based on an up-to-date knowledge of stock assessment or NMFS policies and procedures. They are my attempt to suggest some alternatives that might improve the quality or timeliness of assessments and management targets. I did not restrict my comments based on what I thought might be feasible with regard to budgets, policies, or politics.

**General Observations and Recommendation:** The SEFSC has a strong team of assessment scientists, using up-to-date methods and developing new approaches to meet management needs and in attempts to account for data limitations. Other Center scientists (in programs not reviewed here) provide underlying biological data, monitor commercial and recreational fisheries, and generate fishery-independent data that are essential for reliable assessment. As detailed below, the primary issues related to stock assessment are: (1) poor data quality for many species, (2) assessment models that are not always consistent with the type and quality of data available, (3) management needs that are not consistent with the type and quality of data available, and (4) assessment workloads that provide very limited time for research or publishing.

**Key Findings and Recommendations**

- **Scientific and technical approaches**

*Does the Center apply a suitable scientific/technical approach to fishery stock assessment modeling? What is the suitability of the stock assessment models employed, taking into account the constraints imposed by the available data?*

Center scientists use an array of analytical approaches, from data-poor methods based on landings or size data only to data-intensive methods such as a catch-at-age model requiring landings, size and age composition, as well as survey indices. Scientists consider the available data when selecting models but in some cases the management process provides an underlying pressure to use models more complex than warranted by the data, in order to provide stock status or fishing mortality targets/levels. The Magnuson-Stevens Fisheries Conservation and Management Act (MSA; see [National Standards](#)) requires estimates of acceptable biological catch (ABC) and Annual Catch Limit (ACL). The difference between ABC and ACL is supposed to account for the risk of overfishing, which depends on uncertainty, which is difficult to estimate in general but especially for data poor stocks. If fairly characterized for data-poor stocks, there would be a large difference between ABC and ACL. These reference points and measures of uncertainty may be reasonable for data-rich stocks and can clearly protect against overfishing, but are poorly suited to many of the southeastern stocks (especially those in the Caribbean). Very simple assessment and management options are needed for these data-poor or data-absent situations.

Center scientists are familiar with the full spectrum of assessment models in use in the U.S. and in some cases develop new approaches. However, because of the constant demand for assessments, there appears to be very little time for this type of research or to do simulation studies to assess the performance of existing methods. This might be less critical in other regions with strong data (e.g. long set of catch-at-age and survey data, for standard utilization of a catch-at-age model) but are very important here since Center staff are trying to address management needs with

marginal or inadequate data. Providing time for research (developing methods for data-poor fisheries) would help to address Council needs but would also be a welcome break from the assessment treadmill. This is important to support career growth and to reduce burnout.

It may not be feasible given national requirements related to the MSA and overfishing standards, but it would seem appropriate to have alternative management needs and strategies for data-poor situations. The current system forces decisions that do not appear to be scientifically sound; for example, using length data and a whole set of questionable assumptions to generate Z estimates, then subtracting an assumed M to "estimate" fishing mortality. This assessment model should be evaluated through simulation, using realistic assumptions (i.e., that recruitment is not constant, that growth does vary from year to year). If performance of that model degrades under realistic assumptions about the species and the quality of the data, then other simpler management approaches will be needed.

One strong recommendation would be to put increased resources into developing fishery-independent survey methods, especially for the Caribbean stocks. For these stocks where fishery monitoring is difficult or infeasible, assessment and management should be based on surveys. It would seem desirable to develop habitat-based (stratified) surveys and to focus on estimating absolute abundance. There was brief mention of a habitat-based approach in a trap survey (Puerto Rico?). Such approaches could provide a strong, immediate basis for evaluating the impact of fishing. Even for data-moderate or data-rich stocks in the South Atlantic and Gulf of Mexico, reliance on "adjusted" data to obtain fishery-dependent indices seems ill-advised. It is difficult to measure effective fishing effort under the best of circumstances, and in a system with multiple regulation changes, it seems likely to produce biases that will be unknown in magnitude and direction.

In summary, the problem here is not in the assessment models or capabilities of the scientists, but strictly data quality and quantity. It cannot be solved by newer, more complicated models, but rather by obtaining consistent, long-term funding for fishery-independent surveys. Adequate survey data will improve the reliability of assessments and eliminate the need to generate fishery-dependent indices of unknown reliability.

- **Assessment process**

*What is the efficacy of the assessment process regarding clarity of terms of reference, transparency to stakeholders, throughput, documentation, and reproducibility of results? What is the efficacy of the assessment process from an SSC perspective?*

The SEDAR process provides a detailed, well-thought-out structure for stock assessments. There is plenty of opportunity for stakeholder involvement, although one concern is that the process requires too much time for effective participation of stakeholders or SSC members. A more streamlined process with a shorter primary assessment document would help. Details about the assessment can be put in appendices or covered through standardization of methods.

One recommendation would be to include more information about alternative models. This seems particularly useful for data-poor situations where model choice can substantially affect the results. It was mentioned that the stock synthesis model can be used to provide model fits of increasing complexity, from an age-structured surplus production model (with only two parameters) to more complex models as additional data sources are added. The change in results and uncertainty with additional data (and added model complexity) could be a routine part of stock assessments, rather than immediately moving to the most complex model supported by the data (or going beyond that, in some cases). There was also discussion about how to compare among models. This is a difficult topic and a useful area for staff research time.

Another recommendation is to carry forward the full level of uncertainty in stock assessments. This is difficult to do because many assumptions and decisions are made during the process. For example, when the natural mortality rates by age are treated as known constants based

on a Lorenzen curve, the assessment results become conditional on that (strong) assumption. When data are summarized outside the assessment model (e.g., converting length to age), that reduces the apparent uncertainty of the assessment results. Given the current emphasis on probability-based decision making, it is important to provide a realistic picture of the true level of uncertainty. If that causes assessment results to be disregarded, then that provides guidance for the future in terms of either reducing uncertainty (getting better data) or changing the assessment and management process for that species (e.g. going to a simpler management approach that does not require precise assessment results). It was mentioned in one presentation that the GOM SSC was investigating simplified control rules. That seems like a very productive direction, given that many assessments rely on marginal data and uncertainty seems to always be underrepresented.

It would also be useful to carry out an analysis similar to that described for PPMC assessments by Ralston. That analysis was a look back at assessment parameters, and how much they varied among assessments (as a better measure of uncertainty compared to internal measures). This would provide a firmer basis for adjustments between ABC and ACL and would be informative to the SSC and Council about the stability and uncertainty of assessment results. It should be done for stocks in all categories (data-rich, data-moderate, data-poor) because the cases considered by Ralston were probably all in the data-rich category. If it is difficult to find a common parameter among past assessments, this could be something to standardize moving forward. For example, for South Atlantic (SA) red snapper, it could be a standard policy to always present table of mean  $F_s$  for ages 2-5, and compare estimates 5+ years prior from the series of assessments. This is similar to a retrospective analysis (although done one year at a time) but would include more of the changes in model structure, software or assumptions that can vary among assessments.

On a related note, one difficult issue is that we never know the right answer. Unlike meteorologists who are proven right or wrong every day, we never know the level of error. Are there ways to validate assessment models? A retrospective analysis is somewhat useful, but that is mostly a measure of internal consistency. One possible way would be to carry out a tagging study and predict the number of tags that would be returned by each fishery sector in the year ahead. Including that information in an assessment provides a clear measure of performance, which is currently lacking.

On a related note, some of these species seem highly amenable to a tagging study. My experience has been that tagging studies of freshwater, estuarine and (accessible) marine species can provide detailed information about fishing and natural mortality. Our recent tagging studies have shown, for multiple species, strongly seasonal fishing and natural mortality. These estimates of  $M$  are stock- and year-specific, rather than relying on meta-analyses (of estimates of unknown quality) that provide proxies that are a simple function of fish size or other life history features. In some cases, we have contracted with guides to distribute tags over the full range of the stock. In all cases, we use high-reward tags and double-tagging to address non-reporting and tag loss. Tagging studies provide immediate results, and do not depend on landings or tenuous analyses of fishing effort. Tagging should be quite feasible for some of the shallow reef fishes or sharks and would provide direct estimates of  $F$  and  $M$ . Telemetry methods have also been used for some east coast and Gulf migratory species. The current generation of transmitters lasts for 2+ years for larger fish, and a series of releases can be used to obtain precise seasonal information on total mortality (see [Rudd et al. 2014](#) as an example).

- **Peer review process**

*What is the adequacy of the Center and SEDAR assessment peer review process, taking into consideration the participation of other entities such as the Council's Scientific and Statistical Committees?*

Stock assessments produced by Center scientists receive substantial review. In addition to the SEDAR Review Workshop that includes outside experts (CIE), assessments are reviewed by the

SSC. Presentations indicated that a shift was underway to have an increasing role of the SSC in reviews. An advantage of that shift is that SSC reviewers are very familiar with the data limitations and management needs of that Council. One concern about the current process is that decisions made at the Assessment Workshop are revisited and frequently changed at the Review Workshop or during SSC review. There are many subjective decisions made in an assessment, and every knowledgeable reviewer might have made a slightly different set of decisions. To keep the process moving forward without excessive second-guessing, it might help to develop a standard protocol for reviewing versus changing assessments. For example, the protocol could outline characteristics of a suitable base model versus sensitivity runs, and which things might warrant new runs in a Review Workshop versus things to be examined in the next assessment cycle. There is little point in spending a lot of time choosing (and writing up) a base model and alternate sensitivity runs in an Assessment Workshop if those decisions are routinely overturned at subsequent reviews.

- **Communication**

*Does the assessment programs adequately communicate to the councils, state commissions, and headquarters their methods and results? Does the assessment program adequately communicate to NMFS headquarters its research and needs?*

Center scientists seem to do a reasonable job in presenting results to councils and commissions, and documents are available to the public through the SEDAR website. As noted in the presentations, one thing that is not well documented (or at least easy to find) is the set of decisions or calculations that take the SEDAR assessment result and produce management targets (e.g. ABC or ACL). One obvious area for improvement would be to provide a short summary of each assessment (on the SEDAR site and that Council web site). For example, the GOM gag stock assessment report is 609 pages, but there is no Executive Summary. A one page summary for each assessed species on a web site would be useful as well as a summary at the start of the SEDAR report.

- **Research opportunities**

*Are there opportunities for improving stock assessments and the stock assessment process? What are there avenues for improving stock assessments and the stock assessment process?*

Center scientists have made some significant contributions within the area of stock assessment models and software (e.g. Prager's ASPIC). Some of these have resulted in software additions to the NOAA Fisheries Toolbox (NFT) and highly cited journal articles (e.g. Prager 1994 regarding ASPIC; 109 journal citations). Others are useful new developments that have not been added to the NFT or published (Beaufort Assessment Model, Williams and Shertzer), but should be if some research time can be made available. The BAM approach was not discussed in any detail, but it seems particularly noteworthy because it is a linked set of routines in R and ADMB for carrying out the assessment and producing report elements (e.g. tables, graphs) that would aid in putting together an assessment. Carving out time to make this widely available (within and beyond the Center) would be valuable for the stock assessment community as well as a good opportunity for professional growth. It also has the potential for streamlining the assessment process if adopted or mimicked Center-wide.

Center researchers has also shown environmental factors that affect stock dynamics such as the work linking gag grouper mortality to red tides. These studies can reduce bias in stock assessments (e.g., compared to assuming constant natural mortality), increase precision, and increase our understanding of biological factors that regulate these populations (versus fishing impacts). Again these research contributions require a reallocation of staff time to research and publishing. These are not "ivory tower" studies that are unlinked to stock assessment, but applied studies that will improve the assessment and ultimately management.

The rate of publishing in the primary literature is low for PhD scientists but that is fairly typical for scientists within the stock assessment world (NOAA and otherwise). Nevertheless, having sufficient time for research, publishing and attending scientific meetings is important for career advancement and preventing burnout/excessive turnover. It may be helpful to map out the time required for benchmark and update assessments, and to sketch out staff availability for assessments. This would allow administrators to set aside (and protect) research time. For example, each assessment scientist might block out one month per year for research (not the same month!), and that could be factored into the planning for the number of assessments and their timing. The demand for assessments is unlimited, and there is no way for assessment scientists to "catch up", so administrators will need to plan for and protect that time.

- **Ecosystem considerations and next-generation assessments**

*How important are ecosystem considerations and next-generation assessments for improving the science used in management of managed fishery species in the southeastern United States?*

The overview presentation showed several impressive examples of the potential for incorporating environmental factors as covariates. These are straightforward improvements to current assessment models, but will not often happen without a "set-aside" of analyst time for research. Other larger scale plans for multispecies complex or multisector models will require larger allocations of research time. These models may be useful for improving management, but only if the products are consistent with management needs (e.g. the detailed, fishery specific benchmarks that are being used).

Also mentioned within that presentation was increased use of management strategy evaluations. These have proven useful in other agencies and regions within NMFS, and can allow for better decision-making about types and intensity of monitoring (e.g. fishery-dependent vs independent), types of assessment models, harvest policies, etc. The difficult part is to develop a sufficiently realistic simulation of the whole process, in order to provide real insights about what has potential. This is again a research activity that will require time away from assessments, but should provide important insights about monitoring, assessment and management.

- **Organization, priorities, and accomplishments**

*How well is the SEFSC organized to maximize stock assessment throughput and quality based on best available data for a given stock?*

Evidence was presented that stock status, on average, is gradually improving, so current approaches are working. Changing stock status is a slow process that relies not only on the quality of the data and assessment but on managers to set appropriate regulations. It is good to examine those scores as a sort of feedback about how well the process is working.

One area for improvement is in setting assessment priorities. These are not internal Center decisions but nevertheless analyses done within the Center could help to influence the process. The proposed national standard appears to be a very useful template, and it would seem useful to move ahead and apply that to the set of candidate assessments facing the Center. Thinking through the various weighting factors and having a prioritized list would provide a stronger basis for decision making, or at least would clarify the extent to which current decisions are at odds with these (entirely reasonable) factors. For example, it would be valuable to see how assessment (as well as survey and fishery monitoring) effort compared to the magnitude of the various fisheries under Center purview. It would also seem valuable to develop a more formal policy regarding whether to do a benchmark assessment versus an update. This again is not a Center decision but it greatly affects workload and throughput. Currently there seems to be a poor understanding of what is to be gained from repeated benchmark assessments versus updates. There is also the appearance that calls for frequent assessments (of either type) are done in the hope of a different result, when in

reality not much changes from the addition of one or two years of additional data. Pushing at the Council level for a formal policy on assessment type could help in reducing the clearly excessive frequency of benchmark assessments.

Regarding time for research, administrators and assessment scientists could work together to identify a suitable fraction of time for research, then build that (and appropriate measures of research performance) into performance plans. If assessment scientists are going to be kept on the "assessment treadmill" without a set-aside of research time, then performance plans will need to reflect that, in order to be fairly judged on accomplishments.

One important future direction is to put much more effort into collecting more meaningful data. As mentioned above, new technologies such as acoustic telemetry or ROVs for absolute abundance estimation have the potential to greatly strengthen current assessments, or perhaps to replace current assessments based on traditional catch sampling that have little potential. The habitat-based trap study in the Caribbean and ROV work would seem to have very high potential for reef fish. These field studies also provide assessment scientists with opportunities to get on or in the water, gaining first-hand biological experience that would result in better assessments.

- **Conclusions**

- Match assessment and management complexity to data quality. Spend time internally and with partners to categorize species based on a realistic assessment of data quantity and quality. This categorization should help in setting realistic expectations about assessment and management approaches
- Invest in fishery-independent data, especially for data-poor situations
- Better represent the true level of uncertainty in assessments and benchmarks
- Find approaches for a true validation of assessment results
- Consider alternative methods (e.g. tagging, visual surveys) that can replace or improve traditional catch-based assessments
- Develop policies for assessment prioritization, review of assessments
- Define and protect a suitable fraction of time for research

**Reviewer Report on Program Review of Stock Assessment Process**  
**NOAA–NMFS Southeast Fisheries Science Center**  
**Miami, Florida**  
**8–10 July 2014**

**Introduction**

The Southeast Fisheries Science Center's (SEFSC's) 2014 Program Review, focusing on the stock assessment process associated with meeting requirements under the Magnuson-Stevens Fishery Conservation and Management Act (MSA), took place in Miami, Florida, July 8-10, 2014. The review was well organized and thorough, and Center leadership and staff are to be commended for their preparation, organization, and thoroughness.

SEFSC is unique among the NOAA Fisheries Science Centers in the number and diversity of stock assessments that it carries out and in the number of partners with whom it must work to provide assessment information and management advice. These include three regional fishery management councils (Southeast Atlantic, Caribbean, Gulf of Mexico), two interstate commissions (Atlantic, Gulf of Mexico), the NOAA Fisheries Highly Migratory Species Office (HMS) and the International Commission for the Conservation of Atlantic Tunas and (ICCAT). Meeting MSA requirements, in association with the Councils, has become especially challenging since the 2006 reauthorization of the act, which mandated setting of Annual Catch Limits (ACLs) for all managed stocks.

Even though it is faced with very substantial assessment demands, severe data limitations, and inadequate staffing in support of stock assessments, the Center is to be applauded for its ongoing accomplishments. The staff involved in conducting assessments are professional, highly qualified, and effective. Nevertheless it must be emphasized that too much is being asked of them and this is undermining their opportunities for research and professional development. These circumstances are already impacting morale and staff turnover and can be expected to undermine the integrity of the assessment process if not remedied.

To facilitate the regional stock assessment process, the SouthEast Data, Assessment, and Review process (SEDAR) was established in 2002. This enabled an effective partnership among the 8 entities involved in meeting MSA stock assessment requirements across the region. SEDAR has been very effective in establishing protocols and procedures, facilitating prioritization of stock assessments, and ensuring that assessments are adequately documented. However, over its 12-year history, it has not managed increasing demands very well, and procedural changes are necessary to improve efficiency, better constrain, focus and manage document production, and reduce burdens that are being placed on the stock assessment analysts.

While stock assessment methodology and the SEDAR process were emphasized during this review, attention was also directed towards the peer review process, opportunities for research, communication of assessment results, and ecosystem considerations. Observations and recommendations related to each of these topics are provided below.

- **Science and Technical Approach**

The panel received a thorough and comprehensive briefing regarding the scientific and technical approaches employed for assessing stocks and developing management advice. Relevant presentations included the introductory general overview, background on the data used in the stock assessment process and related issues summarized from the 2013 Program Review, specific examples of stock assessments, and a very informative presentation of the entire process which included careful consideration of many of the data-related challenges, procedures for selecting and evaluating models used for assessment and provision of management advice, evaluation of model performance, and characterization of uncertainty. Together with documents provided to the reviewers, these characterized the breadth and depth of the stock assessment demands placed on the Center. In general, stock assessments performed throughout the Center appear to be carried out with a very high degree of professionalism, and methodology is appropriate with careful focus on important details and quality control. Methods selected for specific stocks are consistent with the biology of the stocks, fishery dynamics, and data limitations. Data limitations are of considerable concern for most assessments since long term, fishery dependent time series are lacking, and fishery dependent data are often inadequate or require careful, time consuming preprocessing which incorporate assumptions that may be difficult to substantiate. The overall lack of data necessitates the use of data poor methods for many stocks. For many fisheries, these data poor circumstances are likely to persist.

While the presentation of scientific and technical approaches on day two was thorough, it did not provide a basis for determining how well these approaches have actually been followed, on a stock-by-stock basis. However, the stock-specific assessment presentations on day one, which covered data rich and data poor stocks assessed under different authorities and from different regions with the Southeast, support the perception that overall methodology is, in fact, appropriate.

Nevertheless, some overarching issues emerged during the presentations and ensuing discussion. These included concerns regarding characterization of uncertainty associated with different stages of the assessment process and propagation of uncertainty through the entire process, as well as the heavy emphasis placed on preprocessing fishery dependent data to develop CPUE based abundance indices. This reliance on fishery dependent data is necessary because useful time series of fishery independent data are almost entirely lacking. To quote directly from the presentation, these (landings reconstruction) approaches are time consuming and difficult to defend for many species although they can reduce possibilities for illogical assessment outcomes and stabilize estimation. Estimation of error also requires substantive and difficult to validate assumptions.

Even when survey time series are available, they are generally short and interruptions (missing years) can be problematic. The paucity of fishery independent data is a major limitation in the Center's stock assessment work.

Discard and bycatch data are also limited. Discard can be a major source of fishing mortality, and exceeds landings in some fisheries (especially recreational). Bycatch of small fish in the shrimp fisheries is also a major source of fishing mortality which has, traditionally, been very difficult to quantify due to very high levels of effort in the shrimp fisheries and low (or historically zero) levels of monitoring. In general, monitoring is inadequate and a high reliance is placed on self reporting even though this is known to be biased low. Furthermore, data on discard mortality are very limited. The relatively recent innovation of an electronic logbook which automatically logs, and transmits information on shrimp fishing effort has been highly successful and now facilitates effort-based bycatch estimation.

### Recommendations

Even though assessment methodology does appear to be appropriate, consistency is lacking, especially among the different assessment groups within the Center. Many factors contribute to this inconsistency and it is certainly not appropriate to move towards a single assessment approach. The organizational structure, which maintains different reporting lines for the different assessment groups, likely contributes to this situation. Changes in organizational structure may be merited but occasional Center-wide assessment methods meetings may also be beneficial. Implementation of the stock synthesis approach for some GOM shrimp stocks has been successful even though it was challenging. This approach should be considered for the other shrimp stocks and implemented if possible.

Research should be directed towards improving methods for estimating uncertainty in each step of the assessment process and properly integrating uncertainty within the overall assessment. Better characterization of assessment uncertainty is important for many reasons and will facilitate comprehensive analyses of the consequences of incorporating each data set, perhaps through management strategy evaluation. In particular, estimation of natural mortality and associated uncertainty is problematic for some stocks so research in this area should be prioritized.

Emphasis should be placed on improving estimates of discard and discard mortality. Broader implementation of the electronic logbook developed for the shrimp fisheries should be considered in this regard, together with other electronic reporting approaches. Working directly with commercial and recreational fishers to improve reporting is essential. Strategic use of observers to address specific bycatch/discard information needs should be considered. For example, by selecting target fisheries and bringing high levels of observer coverage to bear for relatively short time periods.

Data limitations are of serious concern in almost all fisheries. A concerted effort should be directed towards improving fishery independent data and moving away from the dependence on historic landings data and the associated preprocessing. Investments should include research to estimate survey catchability, and use of advanced observing technologies which facilitate absolute abundance estimation.

Some emphasis should be placed on improving size and age composition estimation while minimizing the need for reading otoliths and other aging structures. The Center is evidently engaged in this type of work and additional research would likely reduce sample processing costs and error associated with size and age composition estimation.

- **Assessment Process**

The SEDAR process was described, initially through an overview presentation on day one and in considerable detail on day two. This process has evolved over time to become a cooperative enterprise which involves the Southeast Fisheries Science Center, the Southeast Regional Office, the three regional fishery management councils (South Atlantic, Caribbean, Gulf); the two regional marine fisheries commissions (Atlantic and Gulf), and the NOAA Fisheries Highly Migratory Species Division. It is administered by the South Atlantic Fishery Management Council on behalf of the cooperators. Standard operating procedures for benchmark, standard and update assessments are documented and the roles and responsibilities of the participants are defined. The process works well in many ways but it is complex and labor intensive. This is to be expected given the number of cooperators (8), assessment teams (7), and management regimes. Transparency and thoroughness are emphasized but timeliness is not and this can be problematic. Since its inception in 2002, demands placed on the SEDAR process have increased and divergence in implementing SEDAR policies among cooperators has become problematic.

SEDAR provides an effective mechanism for prioritizing and scheduling stock assessments and defines procedures and requirements for three different levels of assessment (benchmark, standard, update). However, the process has become inefficient and administratively burdensome over time. While thoroughness and transparency have, appropriately, been emphasized, requirements for documentation and in-person meetings or webinars have grown to the point where it is no longer possible for many potential participants to engage in the process; thus transparency has been eroded. Many other procedural problems have also been identified, including unacceptable delays by some cooperators in providing data for assessments.

Demands for stock assessments have increased, especially following the establishment of ACL requirements in the 2006 reauthorization of MSA. Furthermore, cooperators tend to prefer benchmark assessments rather than standard or update assessments even when this is not merited and this places additional and sometimes unnecessary demands on the SEDAR process and the assessment teams. The SEDAR process requires the cooperator who proposes an assessments (generally a Fishery Management Council) to play a lead role in drafting and approving assessment terms of reference. This sometimes results in unnecessary analytical demands being placed on the assessment team. Peer review requirements are clearly defined (see subsequent comments under “peer review” heading).

While one of the principles under which SEDAR was established was to ensure joint ownership of the process among the cooperators, stakeholders still tend to view the Center as the “owner” of assessments carried out by its staff, and negative feedback from unhappy stakeholders tends to be directed towards the Center. The SEDAR process does not apply to all stock assessments carried out in the region. In particular, different protocols apply to stocks assessed through ICCAT and this is appropriate given the nature of these stocks and their international governance. Shrimp assessments carried out by Center scientists are also not managed through SEDAR and it appears that some other exceptions apply, such as the recent SAFMC wreckfish assessment that was carried out by scientists retained by the fishing industry.

### Recommendations

A thorough review and updating of SEDAR policies and procedures should be conducted every 10 years. Since it is now 12 years since SEDAR was established, the first review and update should be scheduled during 2014 or early 2015. The following issues and concerns should be considered:

- The need to ensure that data are provided to analysts in a timely manner, as agreed among the cooperators, should be emphasized
- Every effort should be made to allow the analysts to focus on analytical work and not be burdened by unnecessary documentation requirements or other procedural requirements
- Documentation requirements should be clearly defined with emphasis placed on brevity and clarity. Consistency of documentation across analytical teams should be strongly encouraged. A clear protocol should be established for documenting changes from previous assessments of the same stock.
- Executive summaries should be drafted for each assessment.
- Standardized formats for analytical documents and reports should be developed and enforced
- Procedures workshops should be continued
- The possibilities for third parties (academics, etc) to conduct SEDAR assessments under the same requirements that are placed on agency assessment teams should be considered.
- The Center should partner with the proposing cooperator in drafting and approving assessment TORs.

- All assessments other than those carried out under ICCAT protocols should fall within the purview of SEDAR. While this will increase the SEDAR workload, it will ensure consistency of peer review and documentation requirements as well as recognition of the resources required. Furthermore, stakeholders will perceive that a single set of protocols is applied uniformly.
- Criteria for prioritizing stock assessments, determining appropriate assessment frequency, and determining appropriate assessment level should be developed, documented and applied through SEDAR; these would likely be based on those currently being developed by NOAA. A policy for selecting the simplest assessment approach appropriate to meet management information needs should be embodied in this process.
- The idea of establishing a methods working group, and the potential for this WG to streamline the model selection process and reduce peer review requirements should be carefully considered.
- The peer review process, and the roles of the CIE and SSCs in this process should be reviewed and this review should consider alternatives to current practice. However, the CIE should continue to peer review benchmark assessments and desk reviews should be discouraged.
- Protocols should preclude SSCs from considering modeling changes during post review meetings and any assessment related analytical work carried out by or for the SSCs should be documented within the SEDAR archive

Three additional recommendations are offered:

- SEDAR should consider annual multispecies data workshops when appropriate
- Approaches for improving stakeholder involvement and trust should be implemented. The idea of a SEDAR advisory panel was raised during the review. This idea has merit but could be administratively burdensome. Including a SEDAR module within MREP may also be effective.
- Investment in software improvements should be made to streamline the SEDAR process, improve consistency and, potentially, to facilitate documentation.

#### • **Peer Review Process**

Peer review is essential to the stock assessment process. Peer review protocols and requirements are established under SEDAR policies and are, in part, discussed in the preceding section. However, this topic was also presented separately during the program review and will be addressed in this section of the reviewer's report.

The presenter asserted that a peer review process should be transparent, inclusive, unbiased, independent and not duplicative. These requirements are clearly articulated within the MSA National Standard 2 guidelines and implemented through the SEDAR process. The role of CIE as reviewers in the benchmark assessment process, and SSC as reviewers of assessment updates is consistent with this requirement.

Improving the efficiency of the overall assessment process and the peer review requirements was also discussed during this presentation. Certainly shifting towards more updates and fewer benchmarks would reduce overall assessment burdens as well as peer review requirements (or create "room" for additional assessments). Establishment of a SEDAR Methods Working Group could also reduce peer review requirements by eliminating duplicative reviews of the same methods, but establishment of this type of working group would also require drafting of clear guidelines for determining the point at which modifications to a previously-reviewed model require additional peer review. The idea of reducing the cost of CIE reviews by encouraging or requiring desk reviews seems unwise in most instances because discussion among CIE reviewers and between the reviewers and the analysts greatly enhances the peer review process.

#### • **Communication of Assessment Results and Data Needs**

The discussion under this theme focused on the effectiveness of communicating stock assessment results to the Councils and their SSCs, and to stakeholders and the public. Concerns regarding voluminous and inconsistent SEDAR documentation, and specific potential improvements are addressed in preceding sections. Consistency, brevity, clear documentation of changes from previous assessments, and the need for assessment executive summaries are of particular importance.

Specific technical communication is required by SSCs. This may require preparation of new reports and presentations describing assessments results. These are not currently archived on the SEDAR server but this should be remedied.

Assessment scientists generally brief the SSCs and communication appears to be satisfactory. Preparation of posters summarizing stock status and assessment results for display at council meetings may improve communication with members and attendees. Use of one-page summary stock status documents should also be considered.

Greater emphasis on communicating stock assessment methods and results to stakeholders should be encouraged. The Marine Resources Education Program (MREP) has been successful in this regard and the program should be continued and, if possible, expanded.

- **Research Opportunities**

Research to improve stock assessment methods and to improve stock assessments is an essential to the success of a stock assessment enterprise. This truism was articulated on several occasions during the review and was the focus of this theme. SEFSC has a long and very well respected history of noteworthy advances in this discipline and important contributions continue to appear in spite of the ever increasing demands for stock assessments. Analysis done more than a decade ago suggested that successful stock assessment scientists should spend about 30% of their time conducting research and about 40% of their time conducting stock assessments. Today, at SEFSC, much more time is spent conducting assessments, considerably less time is spent on research, and administrative requirements have increased to a substantial degree. Failure to invest sufficiently in this science undermines the ability of staff to improve their skills and bring innovation to their work; often prospects for advancement are enhanced through successful research and associated peer-review publications. Thus morale is also compromised. The integrity of the Center's scientific credentials is also eroded when this situation persists.

Steps have already been taken to leverage the Center's reduced capacity for stock assessment related research through collaborations with colleagues and students from other institutions and this has been effective to a limited degree. Since demands for stock assessments can only be expected to increase, the Center leadership must bring new resources to bear to support the stock assessment enterprise as well as improve efficiency as detailed elsewhere in this report. At SEFSC, as elsewhere in the NOAA Fisheries Science Enterprise, very difficult decisions must be made if to restore the balance between essential research and essential stock assessments.

- **Ecosystem Considerations and Next Generation Assessments**

Fish stocks do not exist in isolation, they are integral components of complex marine ecosystems and their dynamics are influenced, to varying degrees, by physical, chemical and biological conditions and by interactions with other species. The relative importance of fishing and environmental factors on stock dynamics has been and continues to be a topic of debate and active research. Under this theme, the panel was briefed regarding progress towards the Gulf of Mexico (GOM) Integrated Ecosystem Assessment, general approaches to merging ecosystem information into stock assessments, and the GOM Ecosystem Status Report. Three examples of research which has elucidated ecosystem influences on stock dynamics were also described; swordfish in the North Atlantic and Atlantic Multidecadal Oscillation, the influence of ocean currents on larval advection and resultant consequences for survival and recruitment, and red tide as an indicator for gag natural mortality.

The Center has made noteworthy progress in bringing ecosystem considerations to bear in stock assessments and in next generation assessments even though resources for this work are very limited. Most progress has occurred in the Gulf of Mexico and regional partners are beginning to recognize the importance of developing products that integrate ecosystem analyses into the SEDAR stock assessments.

Research and development of this capacity at SEFSC is strongly encouraged and ongoing interaction between stock assessment scientists and scientists involved in ecosystem research and assessment is essential to the success of this endeavor.

- **Organization, Priorities and Accomplishments**

Discussion under this theme focused on organization and staffing, accomplishments, and challenges and potential solutions. Information on the SEFSC organizational structure and the configuration of stock assessment teams had not been presented previously. The remainder of the presentation served as an eloquent review of many of the issues raised earlier in the week, along with constructive ideas for addressing some of the more compelling challenges.

The Center's stock assessment enterprise consists of 5 teams located in 4 different locations throughout the Southeast. Some teams are very small. Most individuals are located at the main laboratory, in Miami. Team responsibilities are defined by region and type of assessment (e.g., HMS, Gulf and Caribbean, South Atlantic, Sharks, Shrimp). Reporting lines differ and there is no common supervisory oversight of the entire enterprise. This structure is consistent with the overall organizational structure of SEFSC and has both strengths and weaknesses. Changes in organizational structure to consolidate stock assessment activities could improve consistency and the ability to be responsive to region-wide changes in stock assessment priorities.

The importance of bringing objective criteria to bear in setting stock assessment priorities as well as assessment levels and assessment frequencies has been raised earlier. Here the discussion included a thoughtful overview of the agency's draft prioritization scheme and this framework does, indeed, offer some very useful guidance. Tradeoffs between thoroughness, transparency and timeliness also demand greater consideration. What is actually necessary to support requirements for management advice? How can data quality and availability be improved? Here the need for improved surveys which employ advanced technologies and provide absolute abundance estimates was emphasized.

As discussed in preceding sections, staffing and workload problems persist and interact. Nevertheless, the Center has been effective in maintaining and, to a small degree, increasing stock assessment throughput. Furthermore, overall stock status, as indicated by FSSI and proportion of stocks not overfished and/or not subject to overfishing has improved. None of this obviates the urgent need to recognize the demands placed on staff and to develop strategies for relieving this pressure and encouraging and supporting more research and professional development. Needs for improving trust through communication and engagement with stakeholder, and for broader education and outreach were also detailed.

## **Conclusions**

The SEFSC stock assessment enterprise excels technically and professionally in spite of major challenges associated with burgeoning demands (for stock assessment and other products). However, these increasing demands, as well as limitations associated with meeting assessment data requirements and an overburdened staff greatly constrain the Center's ability to meet throughput expectations. Furthermore the workload is compromising the ability of key staff to engage in research and professional development; this is resulting in morale issues and jeopardizes the integrity of the overall process.

Some specific recommendations for addressing scientific and technical concerns related to stock assessment and for a much needed reform of the SEDAR process are provided above. Several of these recommendations also relate to the peer review process. Some, especially those directed towards improving the SEDAR process, could be effected relatively quickly while others, such as those directed towards improvements in fishery independent monitoring, will be expensive and time consuming to implement. Concerns associated with excessive demands on staff, and increasing demands for stock assessment products are especially challenging to resolve but should be prioritized. Improving efficiency and managing expectations are both important in this regard. Provision of additional staff to support stock assessment would certainly be beneficial but this may not be possible due to budget limitations and the need to balance staffing requirements across the range of scientific activities within the Center.

In general, the research that is being carried out by stock assessment scientists at SEFSC is of very high quality and has resulted in noteworthy methodological improvements. Communication of research results is effective although emphasis on improving communication with stakeholders should be encouraged. The Center is to be commended for work that has been done in bringing ecosystem considerations to bear in stock assessments and towards broader, integrated ecosystem assessment in the Gulf of Mexico. Even though resources to support these activities are lacking, efforts should be directed towards maintaining and increasing this type of work.



## Stock Assessment Science Program Review

*Southeast Fisheries Science Center Summary and Response – December 2014*

### Introduction

In July, 2014, the Southeast Fisheries Science Center (SEFSC) hosted a panel of experts charged with conducting a programmatic peer review of stock assessment activities supporting stocks managed under the Magnuson-Stevens Act (2006) and International Commission for the Conservation of Atlantic Tunas (ICCAT). This peer review is part of a five-year cycle of reviews designed to strengthen the SEFSC's science programs and generate valuable insights to help guide strategic planning. This review process is harmonized across NOAA Fisheries' six fisheries science centers and the Office of Science and Technology, which enables us to tune our efforts across the science enterprise.

The review was organized around six themes:

1. Science and Technical Approaches
2. Assessment Process
3. Peer Review Process
4. Communication
5. Research Opportunities
6. Ecosystem Considerations and Next-Generation Assessments
7. Organization, Priorities, and Accomplishments

More information about the review, including the Terms of Reference, background materials and review presentations may be found at:

[http://www.sefsc.noaa.gov/program\\_reviews/2014/default.htm](http://www.sefsc.noaa.gov/program_reviews/2014/default.htm)

### Acknowledgements

Thanks go to the panelists for the time they invested in preparing for and conducting this review. The experience and the unique perspectives each of these individuals brought to the table enabled them to provide valuable insights that have already made a mark on the SEFSC stock assessment programs. The panelists for this review were:

- Michael Hansen – US Geological Survey - Great Lakes Science Center (Chair)
- Ewen Bell - United Kingdom, Center for Environment, Fisheries and Aquaculture Science
- Joe Hightower - North Carolina State University, Cooperative Fish and Wildlife Research Unit

- Bob Atlas - NOAA Atlantic Oceanographic and Meteorological Laboratory, Oceanic and Atmospheric Research
- Bill Karp - NOAA Fisheries, Northeast Fisheries Science Center

Thanks also go to Stephanie Oakes for her role as the national coordinator for this review. We're also grateful to the several partners and stakeholders who attended and to those who agreed to serve on discussion panels and provide their perspectives to the panelists. Finally, the stock assessment and data teams from the SEFSC are recognized for the considerable amount of planning and preparation they put into presenting the program to the reviewers, addressing questions and synthesizing the panel reports to position us for implementing the advice they provided. The full suite of recommendations will be maintained as a reference to help guide decisions regarding the stock assessment program going into the future, and as a benchmark against which to measure our progress in improving the program for the next programmatic review five years from now.

## Response to Key Panel Recommendations

The collection of observations and recommendations made by the panelists provided invaluable insights from a fresh perspective on the stock assessment enterprise in the SEFSC. The recommendations have been analyzed with respect to their impact on improving the stock assessment process and the quality of scientific advice and products the assessments generate as well as their cost and complexity to execute. Some key recommendations and comments on them are highlighted here.

- ❖ SEDAR needs to streamline its process wherever possible. The proposed national prioritization approach for stock assessments should be adopted and implemented. Along these lines, the emphasis should be shifted from benchmarks to updates and SEDAR should consider an approach to identify and prioritize when certain stock assessments need to be updated.

We agree that one means of managing the growing demand for stock assessments within available means is to apply a rigorous set of criteria to determine assessment priorities for any given year and to determine the most appropriate level for each assessment. The SEFSC will continue to collaborate with the national-scale effort to refine and ultimately finalize the stock assessment prioritization tool, and will work through the Council and the SEDAR process to adapt or adopt it.

- ❖ Simplified harvest control rules should be considered that would potentially require less complex stock assessments and similar or higher levels of policy effectiveness.

Execution of this recommendation can make analyses less onerous and more approachable without sacrificing management/policy effectiveness. This recommendation must be carried out through the Council process with substantive input from each of the three Council's Scientific and Statistical Committees.

- ❖ SEDAR should adopt plans for the proposed Methods Working Group, which would peer review methods for the purpose of creating standard operating procedures (SOPs). The SOPs should go through the peer review only once, and not for each stock assessment that relies on approved SOPs thereafter.

Evaluating key decisions for handling data and for modeling approaches in a framework setting could improve the efficiency of the SEDAR process. By evaluating options, landing on best practices and peer reviewing and documenting those decisions, they become the standardized best practice. This was discussed as an approach at the last two SEDAR meetings and during the fall 2014 meeting, agreement was reached to schedule a Data Methods Workshop for spring of 2015. Holding an assessment methods workshop has been discussed for the following year. Establishing a standing Methods Working Group would be a strong step to maintain the momentum these workshops gained.

- ❖ Greater emphasis on communicating stock assessment methods and results to stakeholders should be encouraged. The Marine Resources Education Program (MREP) has been successful in this regard and the program should be continued and, if possible, expanded.

We agree that ensuring stakeholders understand the role the stock assessment process and products have in managing their fisheries is an important undertaking. Reviews and comments from MREP program participants have been very positive and indicate this program has been an effective communications tool. We would endorse its continuation and expansion. The SEFSC will also continue to seek means of improving outreach and communications regarding stock assessments.

- ❖ Simplify stock assessment documentation by referring to standard methods whenever possible. Departures from standard methods and earlier assessments should be summarized early in the documentation. A concise summary of each assessment that is understandable to stakeholders and cooperators should be added to the documentation.

Simplification of data, assessment and peer review reports, and including an executive summary will help streamline the SEDAR process and make those reports more approachable for stakeholders and partners. Coupled with the first recommendation, can be expected to improve the efficiency of the stock assessment process.

- ❖ Management Strategy Evaluations (MSE) should be conducted of the stock assessment process and associated fishery management system overall. It should

also be used to evaluate assessment models, particularly those used for data-poor stocks (e.g., length based estimators).

This would be a very valuable effort and would create a feedback loop to improve the overall process. It would also take a significant amount of time and resources and would have an impact on the SEFSC's stock assessment throughput, given the staff most suited to conduct the MSE are the SEFSC's stock assessment analysts. Means to carry out this recommendation will be explored. Meantime, extramural funds for MSEs on smaller scale questions pertaining to stock assessments are being sought.

- ❖ Current level of research needs to be expanded, through options such as hiring of more personnel, streamlining the stock assessment process, and increased partnering. Research should be considered a priority that is not diminished if the demand for additional stock assessments increases.

Research is an important element in maintaining and improving the stock assessment process, and is also important for strengthening the scientific status and capabilities of the SEFSC stock assessment scientists. Each stock assessment conducted, includes a list of research recommendations for improving the assessment the next time it is conducted. The evolution toward an ecosystem approach to science and management hinges on sound research to guide that progression. Striking a balance between operational stock assessments and making progress on these research demands is also important for the professional development of our stock assessment scientists and to building job satisfaction that leads to staff retention.

- ❖ Wherever possible, environmental variables should be tested as correlates of apparent changes in the temporal pattern of catchability or recruitment. Large-scale, long-term trends in ocean currents may be especially useful for both correlating to trends in catchability and recruitment, and by following a predictable nonlinear pattern of change through time.

This is a good example of the type of research needed to strengthen stock assessments in the region. Evaluating stock responses to long-term, environmental trends is an important step in describing the patterns observed and improving the ability to project changes into the future. Care must be taken to carry this work out as research supporting stock assessments rather than within the assessment process to avoid assessments from becoming exploratory and bogging them down.

- ❖ Ultimately, stock assessments in the Southeast are most limited by the sparse data often available for inclusion. Expanding fishery independent surveys, improving catch data, analyzing the potential behavioral interaction around survey gear, and conducting tagging studies could improve the quality of and potentially the throughput for stock assessments.

The quantity and quality of data feeding our stock assessments continues to be a significant, limiting factor in the stock assessments conducted in the region. In some

cases, we're overly dependent on landings data, and in the Caribbean, the reliability of those data come into question. Investments must be made to ensure the long-term viability of current data streams and expand their geographic and temporal scales. Care must be taken to tend to the data collection partnerships to maintain the shared vision and resources required to maintain them. Resources should be sought for expansion beyond current collections, informed by research priorities within the SEFSC, the Fishery Management Councils' Scientific and Statistical Committees and the "Research Recommendations" sections of specific stock assessments.

A second component to this is captured in another related recommendation to, "Match assessment and management complexity to data quality. Spend time internally and with partners to categorize species based on a realistic assessment of data quantity and quality. This categorization should help in setting realistic expectations about assessment and management approaches." Paring these two recommendations equates to either garnering the resources to increase fishery-independent data collections, or if this is not possible, ensuring that the management measures implemented and the stock assessment approaches used are commensurate with the quality and quantity of data available.

## Conclusions:

This is the second in the series of programmatic peer reviews carried out under the new, nationally-standardized program review process within NOAA Fisheries. Progress has been made in implementing recommendations from the first review in the cycle, which focused on the data collection programs that feed stock assessments carried out under the Magnuson-Stevens Act. The connectivity between these first two peer reviews is strong and opportunities for synergies will be explored. Examination of the collective set of recommendations will also be important for resourcing and staging their implementation. In some cases, improvements in the data collection processes may be a prerequisite for more effectively carrying out a recommendation for the stock assessment process. An example of this is the emphasis that both review panels put on the importance of high quality fishery-independent data.

Some of the recommendations can be implemented via discrete actions, others require long-term, continuous investments. Hence, timelines for carrying these out range from discrete to continuous. Based on the evaluation of the recommendations, a suite of actions and timelines has been generated (Table 1).

**Table 1: Summary of Action Items and Schedules**

Action	Timeline
Contribute to completion of the national stock assessment prioritization tool and adopt/adapt it into the SEDAR process	2016
Conduct a Data Methods Workshop to establish, peer review and document standard practices and decrease the inconsistencies in methodologies among the different assessment groups within the Center.	Spring, 2015
The Marine Resources Education Program (MREP) approach, used to increase awareness of the stock assessment process in the stakeholder community should be continued and potentially expanded.	2015 - continuing
Simplified harvest control rules should be considered that would potentially require less complex stock assessments and similar or higher levels of policy effectiveness.	2015 - 2016
Documentation requirements should be clearly defined with an emphasis placed on brevity and clarity. A concise summary for each assessment that is understandable to stakeholders and cooperators should be included.	2015
Make consistent investments in research that improve stock assessments and advance the professional capabilities and status of assessment scientists	Continuous
Continue to invest in maintaining and improving the fishery-dependent and fishery-independent data that are crucial inputs for stock assessments.	Continuous