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. The reviewers were tasked with processing this information and providing the Center with independent written and oral feedback aimed at improving its ability to fulfil 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.

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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 is 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 to 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 is 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 success 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 underserviced 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 SEFSCs 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 the occurrence of ontogenetic shifts, the drivers and triggers of sequential hermaphrodism, 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 undo 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_{MED}	F_{target}	FEC_{MED}	FEC_{thresh}	$F_{(2008)}/F_{MED}$	$FEC_{(2008)}/FEC_{thresh}$
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

Appendix: Summary analysis from the 2012 "Review of Fishery-Independent Survey Programs in Southeastern U.S. Atlantic Waters"

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.

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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 is 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 thought 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 worth 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 severely 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 manage 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 stock 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 to 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 is 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

<u>Objective</u>

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, addition 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 a 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. Morevover, 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, abut 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.

June 7, 2013

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 and 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 of 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.