

Chair's Summary on Program Review of Protected Species Science

Northeast Fisheries Science Center

166 Water Street

Woods Hole, MA 02543

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Review Panel Members:

- Garry Stenson - Chair (Department of Fisheries and Oceans, Canada)
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Background and Overview of Meeting

The review panel reviewed the research activities related to protected species being carried out at the NOAA NE Fisheries Science Center in Woods Hole, Mass. This research is carried out primarily by the staff of the Protected Species Branch and Atlantic Salmon Research Program (which reports through the Population Dynamics Branch). These groups are responsible for research related to species that are protected under the Marine Mammal Protection Act (MMPA) and Endangered Species Act (ESA), i.e. marine mammals, sea turtles, salmon, sturgeon and marine fish. They are also heavily involved in the scientific review of species proposed for listing (or delisting) under the ESA. An overview of the science program was presented in public sessions during the first three days of the meeting, followed by a one day closed session to provide time for panelists to work on their individual reports and to report back to NEFSC directors. The panel was asked to evaluate the quality, relevance and performance of science and research conducted in the Center (and associated laboratories) and to assess the extent to which current science programs are focused on the highest priority information needs identified by NMFS managers.

The material provided for review consisted of documents containing brief summaries of the various programs, background information, and a set of presentations describing the science needs to support management programs as well as organization and budgets. This was followed by presentations describing the various science programs including their strengths, challenges and recommendations to address these challenges. It was clear that the scientists and other staff put considerable effort into providing concise summaries of these complex programs.

This report summarizes some of the key comments by the panel members. However, the individual reports should be considered to be the full record of the panel's observations and recommendations.

Panel Member's Major Recurrent Observations and Recommendations

The listed observations and recommendations below are not in any specific order and do not represent consensus, but represent the general views of the panel or the views of individuals.

General Observations:

Overall, the Center has done an excellent job identifying and developing the research programs required to meet the needs identified by the Region. They appear to work closely with the Region and other stakeholders to develop a research program that meets their needs. It is apparent from

all presentations that the staff, permanent or contract, are highly dedicated and skilled researchers who are motivated to conduct the research and analyses needed for conserving/recovering the species and their habitats. They are willing to do the work under conditions of poor funding, and in the case of contract employees, with the lack of predictable long-term employment stability. They should all be commended.

All of the programs have developed a high degree of collaboration and partnering involving a wide array of academia, industry, government agencies, NGOs and others. Together with their excellent publication record and outreach programs, the open data sharing, the extensive use of collaboration and partnering to fulfill research mandates, and the many examples of innovation are all evidence of the commitment these individuals have to meeting the science needs in this region.

However, it should be noted that the focus of much of the research carried out by the center has been on 'traditional' issues (e.g. impacts of bycatch, ship strikes). Likely future demands will require a change in focus to address new issues (e.g. impact of climate change, large scale marine projects, oil and gas exploration, wind farms, etc.). Understanding how changes in the environment and human use patterns will impact estimates of PBR, population status and/or trends, and the ability to interpret these changes is critical and may require a change in focus.

It is also important to develop programs that will address questions related to multispecies and ecosystem interactions, as well as the impacts of cumulative and combined stressors on populations of concern. Many of these issues will have to be addressed at the Center level since they will cross all research groups. The role of science is to provide advice to support the current needs of management AND to carry out the research that will allow them to answer future requests for advice. This requires the Center to identify the priorities and resources (human and financial) to develop a balance between addressing current demands and preparing for future ones.

Theme 1: Staffing/Funding and General Operations

Observations

- The majority of permanent funding, particularly within the Protected Species Branch, is currently used to cover labor costs, while most the remaining permanent operational funding is directed to specific programs to address specific questions which reduced the amount of flexibility required to address emerging needs. Programs rely extensively on temporary and external funding to deliver the core mandate.
- Emerging regional concerns requiring science advice include: ocean noise; seismic activity (oil and gas exploration); wind and tidal energy; liquefied natural gas; aquaculture interactions; recreational fisheries; and increasing numbers of ESA petitions.
- Many of these problems appear to be national issues and require coordination among regions and headquarters.

Strengths

- The Center has done an excellent job dealing with shrinking budgets and increasing restrictions that limit flexibility on how allocated funds can be spent; they have done a very good job of obtaining outside funding to carry on important research.
- Center staff have been diligent and creative in forging collaborations with external groups to pool resources and accomplish things that are not feasible with federal funds alone.
- The Center has developed a flexible method of obtaining contracted help and moving funds around to maximize the use of available funding.

- The Center has been able to maintain a dedicated group of researchers and contractors, many of who have remained with the programs for many years even in the face of uncertainty.

Challenges

- There is clearly insufficient funding for many important projects (e.g. seals, ‘other’ listed fish and listed large whales) while other projects (e.g. acoustics) rely entirely upon outside funding. As a result, many important programs have to rely on unreliable funding which does not allow planning for multi-year research.
- The Center is wholly or partially responsible for producing scientific information to inform management of ~30+ protected species. Although Congress (and/or NMFS Headquarters) largely dictates the way current funds are spent, it is difficult to see how the overall result (~90% or more of the funds are spent on 2 species) is optimal from any objective perspective. The Center and RO should work together to develop what they jointly consider an optimal distribution of resources to meet NOAA’s stewardship responsibility for these species and then take steps to try to steer implementation of effort toward that desired outcome.
- The majority of staff in the protected species group are contract employees, an issue that raises concerns about continuity of research personnel and institutional memory.
- Relying upon collaborations to accomplish fundamental research has a number of potential problems. The expanded capacity for accomplishing specific objectives comes at the cost of flexibility and efficiency. The collaborations might be fragile and might fall apart with turnover of key personnel or changing priorities of collaborators. Often it will be difficult or impossible to implement ideal experimental designs with such collaborations. Reliance on external funds also produces a greater challenge for longer-term planning and results in scientists diverting more time to seek alternative sources of funding than should be the case.

Comments and Recommendations

Funding from federal appropriations to support the full mandate under the various relevant legislation (e.g., Endangered Species Act, Marine Mammal Protection Act, Magnusson-Stevens Act, National Environment Protection Act, etc.) is inadequate. With the exception of earmarked money for the NARW and Atlantic salmon programs, internal funding primarily goes toward permanent FTEs, leaving little operating money to conduct needed science efforts for other marine mammals, marine turtles, and other listed fish. Most federal (internal) funding to support operations is in the form of temporary funds that cannot necessarily be counted on from year to year. For the most part, the work that is accomplished on all other ESA listed species and marine mammals is carried out through external funding and collaborations. While there are likely limitations on the ability to change the budget situation, effort to improve internal funding should be continued at higher levels within the region and nationally. Also, the burden for obtaining external funding should be shifted from staff scientists to higher levels in the agency to minimize the extent to which this responsibility falls on the shoulders of the scientists doing the critical work.

The process and roles of the Regional Office and the Center for ESA listing determinations seems to be clear for species that are wide ranging and cover more than one region (and may even be established at a higher level), but for “regional species” the process and roles of the Center and the Regional Office appears to be variable among programs and less well defined. It is unclear what the responsibilities of the Center are and how it provides independent science advice. This process could be improved to make clear the role of science in the process.

The Center could/should play a larger role in developing stand-alone science documents at some key steps in the ESA process. The transparency of the listing process would be improved if the Center were to produce a publicly available document that summarizes the key scientific issues that must be considered in listing determinations. The RO or HQ can then prepare the listing determination, which can cite the science document and explain any policy overlays required to reach the listing decision.

It is not apparent what role the Center has played in developing recovery targets for listed species, except perhaps salmon. This is unfortunate, as NOAA recovery planning guidelines stipulate that recovery plans must contain objective, measurable criteria that indicate when a species can be delisted, and developing these targets should largely be a scientific responsibility.

The number of ESA petitions has been increasing and is expected to continue to increase. Most of these petitions are for fish species. This will result in an increased workload for Science to provide data and assess these populations. Many of these species fall outside of the protected species / ESA groups and will require involvement of staff from the population dynamics group, likely resulting in a requirement for additional resources. It is important that the Center develop a plan to deal with the expected increased workload that cuts across all divisions at the Center. Assessing many proposed species may not be possible using traditional assessment techniques (e.g. data poor species, non-commercial data, etc.). The skill sets required may not currently exist and may require specialized experts.

There are a number of emerging issues (e.g. oil and gas exploration, impact of vessel noise) that will require the development of new research themes, data collection and data analyses. The Center will need to consider if it has the resources and scientific expertise (either within the center or among their collaborators) to deal with the increased, and new, requirements. NOAA may wish to consider if these inter-regional issues could be addressed by developing a team of experts to deal with specific issues (e.g. impact of oil and gas exploration) across regions.

In some cases, the Center appears to have taken a rather narrow view of what it considers to be its core mandate related to assessment, takes and PBR. For marine mammals, this results in most funding going to estimating abundance and providing science for traditional threats that produce mortality (e.g. fisheries bycatch or avoiding ship strikes for large whales). The opportunity to investigate emerging or more recent issues, or examine broader ecosystem concerns (i.e., ocean noise impact associated with energy development, reproduction limitations on recovery in right whales, etc.) is for the most part precluded, except for occasional windfalls in funding. An effort should be made to obtain a better balance between these competing needs.

The panel was presented with relatively little detail about how the Center is planning to adjust to the major changes likely to occur in the near future as a result of climate change. The RO indicates that taking a proactive approach to conservation is important. It is apparent that Center scientists have thought about this, but it is less clear what it specifically means for protected species. This is important, as NMFS has recently released a draft climate change strategy that directs all management programs of the agency to consider the reality of climate change and factor it into its management planning. The Center should compile a document outlining the issues faced by protected species in the region and identify the research required to monitor the impact of climate change on their population dynamics.

Currently a number of important programs are run with a single (or less) NOAA employee. This is most obvious in the passive acoustic and seal programs. Both of these projects address important issues and should be continued. They have been extremely successful using contract personnel or outside collaborators, but without a larger permanent NOAA presence, these programs are at risk. Reliance on outside/contract researchers can lead to increased costs, reduced stability and predictability for maintaining needed staffing of projects, and can result in staff morale problems. Consideration should be given to creating several FTEs, either through new funding or shifting of funding within the Center more broadly. The three FTE positions recommended as clear priorities are:

1. An additional position in support of the Acoustics program. The need for passive acoustics and other acoustic work is broad, it accumulates large data sets for analyses, and requires considerable data archiving and management. There will be an increasing need for this program as increased energy development occurs in the Atlantic. A researcher with expertise in the impact of noise or sound propagation would be extremely helpful to the program.
2. An additional position to focus on listed fish other than Salmon. The effort for these species is virtually unfunded and minimal effort occurs. The development of a program for this unfunded mandate will require a position to begin. Given the nature of the data available for many of these species, a researcher with expertise in assessing data poor species may be most appropriate.
3. The seal program is currently supported by a half position. This program should have a full FTE to support its development and needs. Currently, the lack of staffing and funding precludes more than a minimal effort to collect abundance information and insufficient effort to investigate the extent to which interactions between humans and seals are real or perceived.

Theme 2: Assessments, surveys and other data collection and analyses.

a) Surveys and Assessments

Strengths:

- There is a relatively long series of surveys that have allowed them to estimate abundance of a wide number of species. Unlike many regions, there are only two marine mammal stocks out of 25 for which there is not at least minimal information to establish PBR.
- The AMMAPS program is a model for joint funding and partnering to support the shortfall of base funds to conduct critical work. The funding comes primarily from BOEM and the Navy; and NOAA provides the ship and aerial support for the surveys at no cost to the Center.
- The AMMAPs program provides the resources to improve marine mammal assessments by filling gaps to do survey and analyses for species for which there are no or limited internal funds to support. This program has added significantly to NOAA's capabilities.
- The AMMAPS program provides resources for a multi-discipline and multifaceted effort that satisfies important information needs and development of tools/models that would not otherwise be possible for most marine mammal and marine turtle species. While there are some constraints on how resources are used, there is considerable flexibility.
- The recent emphasis on conducting surveys in seasons other than summer is providing the opportunity to estimate season-specific density estimates and maps that will be

extremely valuable for management's need in estimating potential take levels; these seasonal surveys are relatively unique.

- The use of the seasonal survey data, and associated environmental information, to develop habitat indices for use in habitat models will provide an important dataset for understanding change.
- The program involves a wide number of national and international collaborations.
- The line-transect survey methods are world-class; Center scientists have developed many of the approaches that are broadly used by others and continue to work with colleagues to advance the methods.
- The MSE-type simulations being developed for sea turtles to evaluate the efficacy of potential monitoring metrics as well as ecological and management scenarios for turtles are an excellent method to evaluate assessment requirements for the populations, as well as to prioritize potential threats for research purposes.
- The assessment methods for Atlantic salmon are well established.

Challenges:

- For a substantial fraction of the target species, the AMAPPS survey area encompasses only part of the distributional range. This creates significant difficulties in translating observational data into estimates of key parameters for the species or population as a whole.
- Although AMMAPS has been funded until 2019, should the Navy or BOEM decide to end the partnership, there will be a need to find other sources of funding to continue surveys to update assessment information; any change in NOAA priorities can also impact the program through reductions in ship and aircraft time.
- Seasonal density maps constructed from AMMAPS efforts will be useful for stakeholders and managers. However, their usefulness over the long-term requires they be updated periodically, especially during this period of rapidly changing environments that will potentially have an effect on movements and distribution of animals.
- Most marine mammal stock assessments are Tier 1, as are the assessments for Atlantic Sturgeon and Shortnose Sturgeon; most programs do not have the data to improve the assessments to Tier II.
- The program relies upon contract workers with a heavy reliance on a limited number of experienced FTEs.
- Survey estimates are imprecise and as a result, it is difficult to determine trends in the abundance of many species. Although this may not be necessary for the calculation of PBR, it is important in understanding the status of the populations and potential changes in their ecological role.

Comments and Recommendations

Given the fundamental importance of the survey and the AMAPPS program for fulfilling science needs, there is a need to either secure long-term funding for the program or to establish a permanent multi-agency, organizations, and/or stakeholder supported program of a similar nature.

The Center has done an excellent job of obtaining estimates of abundance for most of the marine mammal populations found in the Greater Atlantic area. This has allowed them to provide PBR estimates for most of the species. While this meets the basic requirements of the Region under the MMPA, it does not necessarily provide the data needed to understand trends in the populations or identify the factors influencing changes in abundances. The latter

are needed in order to understand ecosystem interactions and how species may respond to changes in the environment or human activities.

The current survey program provides the basic data required to assess abundance of cetaceans under the MMPA and so is an important part of the core mandate of the branch. To ensure that they continue, it is important to develop a long-term survey plan that will ensure the surveys continue. Given the limitation in resources, survey planning should be done at a national level and may require exchange of experience personnel among the regions for both planning and execution. This will also provide a level of consistency among areas and ensure that the best methods are used.

The usefulness of employing different survey designs focused towards large or small cetaceans should be explored as a way to reduce the variance of the estimates and increase their ability to determine trends in abundance. The usefulness of habitat variables to stratify survey results to reduce variance should be explored.

The vast majority of assessments are Tier I. All efforts should be made to collect the data required to improve the assessments to Tier II, as a minimum, and preferably Tier III as soon as possible. This may require a change in research priorities that should be considered within the strategic planning being carried out within the Center.

Efforts to integrate the various data sets from ecological studies, tagging, line transects passive acoustics, bycatch, etc. to improve our estimates of seasonal trends in distribution and abundance of species/stocks should be continued and considered a priority.

The continued development of habitat models is strongly encouraged. These models may improve our understanding of how changes in the environment will impact cetacean populations. Combining models from different species may also identify important ecological areas that have wider significance.

Assessing of the status of listed marine turtles is difficult in the absence of a framework such as those that exist for marine mammals or salmon. It is important to ensure completion of the collaborative work being done by the NE and SE Centers to develop a framework.

b) Bycatch

Strengths:

- The Center has been able to estimate bycatch mortality rates for most fisheries in the region. The Program meets the needs of the RO to provide basic information on a variety of species on a routine basis; the methods are well developed and receive multiple levels of review.
- Observer coverage appears to be good, at least for many fisheries.
- Researchers have done a very good job comparing estimates from different methods to identify biases.
- A number of new methods for estimating bycatch levels have been developed and new approaches are continuing to be developed.

Challenges:

- Obtaining appropriate effort data is extremely difficult; the use of landings has a lot of problems and potential biases when used to scale up bycatch ratios.
- Much of the bycatch data for marine mammals comes from fish and turtle observer efforts because observer coverage for marine mammal needs is relatively poorly

supported. Thus, while bycatch is observed, more detailed data from sampling animals in the bycatch may not be obtained and specific marine mammal issues may not get covered.

- Particularly for animals at low abundance, detecting bycatch occurring at low rates, and therefore providing accurate estimates of take, can be difficult.
- Basic abundance, demographic and ecological data are required to develop reference points or interpret bycatch estimates that are not available for some species.
- Changes to monitoring protocols (e.g. to electronic monitoring) and/or the criteria used to assign observer coverage may not produce data comparable to the older data.

Comments and Recommendations

Efforts to identify levels of allowable removals, particularly under changing environmental conditions, and the metrics required to monitor them, should be continued. Ways to improve allocation of observer effort to specifically address marine mammal issues should be sought.

A considerable amount of mortality of large whales is unaccounted for. Efforts are required to explore methods that would better account for unobserved mortalities, particularly as the level of known ship strikes and entanglement decline.

There are no standard reference points to determine the allowable level of take for turtles and the appropriate metric to use when describing takes is unknown. The current approach to use 'adult equivalents' may be inappropriate if the relationship between younger age classes and adult equivalent varies over time. It is important to identify acceptable levels of turtle bycatch in order to meet the requirements of the ESA. However, the impact of changes in age structure must be accounted for, and monitored, to ensure that the levels identified are sustainable.

Studies to compare results from the observer programs and electronic monitoring are critical for understanding how these proposed changes in observing bycatch would impact the results. This should be considered a high priority.

As shifting from human observers to electronic monitoring of fisheries occurs, it may become necessary to find alternative means for collecting data (e.g., biopsy or other biological data) that are now a very important component of the observer program.

c) Acoustics

Strengths:

- The development and use of passive acoustics at the NEFSC is strong and provides a set of data that can be used to address a broad array of specific ecological questions and to improve assessments of species/stocks, especially those that are difficult to observe or survey through visual means; Center scientists provide national and international leadership in this field.
- The program is extremely productive and has a wide scope, addressing multiple issues; it has been successful using external funds and extensive collaborations.
- The acoustic telemetry program successfully integrates research for several species into a combined program by using the same sampling platforms for monitoring the distribution of each species.
- The study for obtaining baseline data for the area being considered for seismic exploration is proactive and a strong example of the benefits of this program.

Challenges:

- This program is based almost entirely on outside funds and therefore continuation cannot be ensured. It is heavily dependent upon the efforts of a single FTE. Not only is relying on external funding uncertain, it also requires a significant investment of the researcher's time to prepare funding requests resulting in less time being available to carry out research.
- The acoustics program is designed primarily to identify species distribution rather than impact of noise; it provides information on the presence of calling individuals but not necessarily abundance.
- The distance at which individuals can be detected is poorly known for some species and depends upon the sound propagation characteristics of the area. These vary and are not well understood in many areas.
- Passive acoustic methods produce extremely large data sets that require substantial time and resources to analyze and integrate with other types of data. They also create extensive archival storage needs that may eventually exceed the Center's capacity.
- Human-caused ocean noise, which can be disruptive to marine mammals, is increasing around the globe and will increase in the Atlantic with the pending increase in energy development activity. Understanding its impact on marine mammals is difficult because it does not usually lead to direct mortality, but efforts are needed to assess the changing levels and determine its impact.
- The use of platforms of opportunity for installing receivers to monitor movements of acoustically tagged fish can lead to difficulties when interpreting detections because the receiver deployments are not based on a designed survey. Because the number of tags available to be detected is not known (due to mortality), the extent to which detections are representative of the distribution of the species is not known. However, given the lack of knowledge for many species, it is a cost effective way of collecting some of the basic data required to design a survey.
- There seems to be limited coordination among the various groups putting out tags/receivers on fish. The situation with marine mammals appears somewhat better, but still requires considerable coordination among scientists.

Comments and Recommendations

Passive acoustics has become a fundamental component in improving assessment efforts and to explore movements and distribution questions for cetaceans, especially NAWR. The burden of funding the program has been on the leader and only staff person for the program. To the extent possible, the Center should find ways to reduce that burden to maximize the research that can be pursued within the program.

The Center should review the passive acoustics work and determine what role they expect this type of information to play in the future for protected species and other fishery management needs. If the Center agrees that this project is important, they should find a way to provide more stable funding to ensure its continuation.

The importance of understanding the impact of increasing ocean noise on protected species will continue to increase, as will requests for advice. Addressing these requests will require considerable effort. There is research being done by others that can help, but it requires individuals with specialized knowledge that should be incorporated into the acoustic program at NEFSC.

The datasets produced using passive acoustics are extremely large. It is important that options be identified for archiving these datasets and ensuring that they are available for data sharing and analysis. Having routine methods will be increasingly important as the program transitions to the operational stage.

There appears to be little coordination among the various groups deploying acoustic tags on fish. Efforts should be made to improve coordination for the deployment and sharing of data obtained from the tags. For now, researchers should continue to use platforms of opportunity for installing receivers to collect basic distribution information for several poorly-studied fish species, but work towards using the resulting information to design surveys that will be less biased by receiver locations.

Theme 3: North Atlantic Right Whales (NARW) and other listed large cetaceans

Strengths:

- The NARW research program is well funded compared to efforts for most other species and has developed very useful collaborations with a wide variety of governmental, academic and NGO partners.
- The right whale program has been very successful in carrying out a number of important studies on NARW, particularly in the offshore area. This has resulted in an impressive publication record.
- The program is directly responsive to needs of the RO to quantify take and PBR, and has a strong emphasis on assessing the effectiveness of management measures.
- The program's efforts have resulted in a reduction in the impacts of ship strikes on the population.
- There is a strong record of adaptively using new science information to improve or modify mitigation efforts.
- The intensive Photo ID and biopsy studies provide the opportunity for identifying a large proportion of the population, which provides a bases for assessing status as well as understanding other aspects of their ecology and behavior.
- Habitat-use models appear to be based on a strong dataset and appear to provide excellent guidance on shipping lanes.

Challenges:

- With the increasing industrialization of US EEZ, keeping takes of large whales to appropriate levels is expected to be increasingly difficult.
- Although the program appears to be well funded, much of the non-salary funding could be considered 'non-discretionary' as it funds basic data/analysis that are fundamental to the overall assessment of NARW and so must be continued (e.g. NARW catalogue) .
- The current distribution of a large portion of the NARW population and the cause of the change in distribution are unknown. The efforts in 2007 to focus surveys on where NARW are likely to be located has potentially reduced the ability to understand the where and why of this shifting distribution.
- A significant portion of mortalities is not observed, which makes assigning causes of mortality difficult.
- Evaluating non-lethal effects of entanglements is difficult but needed in order to understand the population dynamics of NARW.
- The recovery of NARW population is relatively slow, especially by comparison to the southern right whale. Assessing the reasons for this is difficult and will likely require new approaches.

- Maintaining the level of support for the intensive mitigation efforts may be consuming resources that restrict the ability of the Center to carry out the research needed for an overall evaluation of population viability and absolute abundance; these are needed in order to determine if there are new management actions that should be implemented to move recovery to the next level.

Comments and Recommendations

The NOAA research program on NARW is critical in providing data that cannot be obtained by the other NARW collaborators. There are some data that can only be collected by government agencies and so should be continued.

The 2007 change in aerial survey design that focused on areas where NARW were known to be may have limited the Center's ability to understand the changes in distribution that have occurred. Passive acoustics will help identify where NARW may be present, but researchers should consider reinstating the large-scale synoptic aerial surveys to identify the location of right whales. Other methods to monitor movements such as satellite telemetry and the use of stable isotopes should also be considered. This is particularly important as portions of the population have always been outside of the areas where research has traditionally been concentrated.

The slower than expected recovery of the population, along with the apparent success in reducing the impact of vessel collisions, suggests that a greater emphasis should be placed on looking at sub-lethal effects of impacts and factors affecting reproductive success. Effects of stress from various factors on reproduction may be one area to consider.

The use of mark-recapture (M-R) estimates should be examined to determine if changes in distribution will impact the apparent trends in abundance estimated using N_{\min} , especially if resighting effort is restricted. Also the availability of biopsies and photo ids provides an opportunity to extend the M-R analyses to provide additional information about individual life histories and life history variation.

While it is important to continue the M-R dataset, the impact of changes in resighting effort should be examined. Reductions in resighting effort may provide funds that can be used to address other key uncertainties.

Passive acoustics can provide a method to determine the presence of NARW over large areas throughout the year. Continued efforts to integrate the passive acoustic presence with seasonal distributions from surveys are encouraged.

The changing movement and distribution of NARW makes it important to consider expanding the efforts to collect data in the mid-Atlantic.

While estimates of N_{\min} may allow calculation of PBR to meet the requirements of the MMPA, without a better understanding of total abundance, vital parameters, etc., the reasons for the slow rate of recovery cannot be identified. Determining the ecological processes responsible for changes in population dynamics and habitat use are critical for understanding or interpreting the abundance estimates. This may require that overall research priorities be reassessed and ecological research program further developed.

The amount of research that can be carried out is always limited by funding. However, with the exception of the large-scale surveys, there do not appear to be many efforts to carry out

research on listed large whales (or other protected marine mammals) other than NARW. This is a large gap in the mandate of the Center.

Theme 4: Seals

Strengths:

- A considerable amount of research has been accomplished by the seal research program using a combination of external funding and collaborations. Research includes: bycatch monitoring and analysis; diet studies; grey seal and harbor seal abundance and seasonal monitoring surveys; and grey and harbor seal pup captures. The research team is to be commended.

Challenges:

- The primary challenge to this program is adequate funding and staffing. The minimal internal resources available to support seal research limits the ability to develop and implement a long-term research program to address basic information needs about trends in abundance and distribution, as well as their impacts on commercial and recreational fisheries, other human activities, and ecosystems.
- While AMMAPS has been a source for making up for a lack of internal funding for many of the cetacean species and marine turtles, it is unfortunate that the use of AMMAPS funds, or some similar source of funding, for seal work is not available.
- Because research lags behind public discourse, public perceptions are often not science-based. With limited resources, it is difficult to evaluate the extent to which apparent conflicts between stakeholders and seals are real or perceived to be significant.
- The potential impact of increasing grey seals on harbor seal abundance is unknown.
- Surveys need consistent geographic coverage and methods in order to ensure that estimates are comparable and trends in abundance can be quantified.
- There is high level of public interest in seals both as a conservation issue and with respect to potential impact on fisheries. This can result in conflicting priorities and management demands.

Comments and Recommendations

Although the Center has accomplished a considerable amount of progress with little or no resources, there are a number of issues related to seals (e.g. quantifying population trends) that cannot be addressed. Developing a cohesive research program to identify priorities and carry out the required research will require a decision by the Center to provide permanent funding to this program. The Center must find a way to increase funding from internal sources or seek external funds in order to develop a viable program to determine long-term population trends in the two seal species and to provide the support to understand and mitigate human interactions with seals.

The potential impact of seals on commercial and endangered fish species should be given a higher priority and programs to address these issues should be initiated. This will require adequate data on abundance, diets (including special, temporal and age/sex variation), growth and condition, and seasonal distribution. Current methods may not be adequate, the most appropriate, or efficient, so there is a need to incorporate new technologies (e.g., stable isotopes, UAS platforms, satellite phone tags, etc).

The Center should consider implementing studies targeted to address public concerns about seals. Increased outreach and education programs to better inform the public about seals are needed.

In order to identify and carry out a useful research program, the Center would benefit from the continued development of collaborative research initiatives with Canadian scientists, stakeholders, pinniped researchers elsewhere in the USA, and other partners in the Northeast region.

Theme 5: Salmon

Strengths:

- The program has a good level of stable funding and a mix of labor and operating funds that allows for some flexibility.
- Researchers have been active in forging a large number of effective collaborations at many scales (local, national, international). Data sharing, review, and transparency is extensive and well established.
- Research has been well integrated with regulatory and management needs
- The Center has developed a long-term program that is broad based, focusing on many key aspects of the species' life history and ecology. This provides a strong understanding of the behavior and ecology of this species to support its conservation.
- The program has pioneered the use of some technologies for monitoring Atlantic Salmon, resulting in methods that are now used regularly elsewhere and are well-established.
- Researchers appear to have done a good job identifying major factors influencing trends in salmon abundance and focusing research on these areas (marine survival, dams, etc). They have developed new insights on topics such as the effects of dams, ecosystem connections in the ocean, latent mortality, and the synergistic effects of other diadromous species.

Challenges:

- The high reliance on partnerships to deliver core mandate can be both a strength and a challenge given the time and energy required to maintain the partnerships, as well as the limiting effects that partnering may have on research direction, implementation and resulting conclusions.
- The program lead has identified a lack of quantitative expertise; particularly quantitative modelers. There is also a need for expertise in the area of conservation genetics.
- There is a need for analyses and models that fully integrate the multiple data sets being collected for these populations. These would allow more complete evaluation of progress towards affecting recovery, and would help identify points in the life cycle where recovery actions would be expected to reduce extinction risk.
- Separating abundance and survival for wild and hatchery fish is difficult and makes analyzing population dynamics difficult. The overall conservation goals are not clear.
- There is still considerable uncertainty about the distribution of salmon at sea and the causes of at-sea mortality.
- Research programs currently do an excellent job of characterizing the effects of the various threats to Atlantic salmon, but programs that evaluate the effects of recovery actions focused on alleviating these threats appear limited.

Comments and Recommendations

While not identified under staffing priorities above in Theme 1, the salmon program, (as well as the programs for sturgeons) would significantly benefit from a quantitative ecologist who would advance the program via evaluation of the recovery actions and progress towards recovery using population dynamics models.

The program should continue the 3-pronged approach to threats and management needs based on at-sea survival, the impacts of dams, and an ecosystem approach to salmon recovery. A fourth approach associated with freshwater productivity, habitat, and habitat recovery initiatives should be considered. This additional component would allow the life cycle to be fully closed, and would allow the sufficiency of existing recovery initiatives to be evaluated in the context of how they are reducing extinction risk.

The Center should consider implementing experimental approaches in which goal-oriented recovery actions are initiated, their effectiveness in achieving those goals is evaluated, and results are interpreted in the context of how extinction risk is changed. Examples include methods of reducing / mitigating high mortality in estuaries, and how dam removal alters the overall productivity of freshwater environments.

Telemetry efforts provide a strong documentation of timing of migration and the platform of opportunities work provides some information on locations at sea. However, there is much more that could be gained by a more deliberate or experimental approach to the telemetry work.

There has been considerable research on ecosystem changes in the NW Atlantic that occurred concurrently with the apparent decline in salmon productivity in the late 1980s. Oceanographers and/or researchers working with other species groups should be contacted and a comprehensive view of the changes that occurred compiled.

Theme 6: Other (i.e. fish other than salmon) protected species

Strengths:

- Some research on 'other' protected fish species has been successfully carried out as part of the salmonid program. However, the majority of the advances in understanding of these species are the result of the development of good partnerships.
- The Center has been able to provide survey and commercial data along with scientific expertise to ASMFC committees for stock assessments using the small amounts of funding from NEFSC and collaboration with partners.

Challenges:

- There are two species of sturgeon listed under the ESA and several species of concern for which very little research is being carried out because of the lack of resources (human and financial). The Center does not appear to be meeting NOAA's stewardship responsibility for these species.
- Although the ability to develop strong partnerships to address science requirements has allowed some advances in knowledge, it is also a challenge because of the time required to maintain the partnerships and the need to incorporate the partner's research requirements into the larger program.
- If the expertise is not developed within the Center, there is a risk of loss of continuity in program direction with changes in external partners as well as changes in their research interests.
- Many of these species are data poor and there is very little on which to base status designations.
- There is only limited capacity to do stock assessments within the entire Center and there have been several recent petitions for listing additional species. Some of these decisions are still pending, while others have been denied; it is likely that there will be more in the future.

Comments and Recommendations

As noted under general comments, additional staff with primary responsibilities dedicated to these species appear to be necessary to fulfill the science requirements for providing advice. The Center should consider creating an FTE to support the other listed fish, candidate species, and species of concern, and begin to build a program for listed Sturgeon species.

If staff and funding are dedicated to these species, some re-organization may be necessary to group individuals together who are working on species with overlaps in sampling platforms, or threats.

Reviewer Report on Program Review of Protected Species Science

Northeast Fisheries Science Center
166 Water Street
Woods Hole, MA 02543
13-16 April 2015

Reviewer #1

General issues - roughly corresponds to Theme I (Funding and Staffing), but not restricted to those presentations.

1. Staffing, budget, and priorities

Strengths

- The Center has done an outstanding job dealing with shrinking budgets and increasing restrictions that limit flexibility on how allocated funds can be spent.
- Center staff have been diligent and creative in forging collaborations with external groups to pool resources and accomplish things that are not feasible with federal funds alone.
- Center staff are dedicated, hardworking, and productive

Challenges

- The extensive collaborations are a two-edged sword. The expanded capacity for accomplishing specific objectives comes at the cost of flexibility and efficiency. The collaborations might be fragile and might fall apart with turnover of key personnel or changing priorities of collaborators. Often it will be difficult or impossible to implement ideal experimental designs with such collaborations.
- There are limits to how far the Center and its staff can continue to do more with less resources, and the system might be close to the breaking point (for example, some programs now depend very heavily on one or two key federal staff keeping large and complex programs afloat). Very soon the Center might have to make hard decisions about triage and affirm that the staff can no longer continue to do more without more resources. [Analogy: you can pound gold into a very thin leaf, but once you achieve one molecule of thickness the process cannot go on.] This might mean that accepting new assignments will require termination of some activities that are currently considered high priority. It would be prudent for the Center to plan in advance for that eventuality.
- The Center is wholly or partially responsible for producing scientific information to inform management of ~30+ protected species. Although the way current funds are spent is largely dictated by Congress, it is difficult to see how the overall result (~90% or more of the funds are spent on 2 of these species) is optimal from any objective perspective. The Center and RO should work together to develop what they jointly consider an optimal distribution of resources to meet NOAA's stewardship responsibility for these species and then take steps to try to steer implementation of effort toward that desired outcome.

2. Roles of NEFSC and Regional office

Strengths

- Communication and coordination between RO and Center appears to be good
- RO has clearly spelled out a number of specific areas where NEFSC input is needed for management
- Center has oriented protected species programs toward addressing these specific needs

- RO and Center have developed a process whereby the RO requests and the Center provides other science-support assistance as needed (e.g., review of draft Biological Opinions and related documents). This coordination is crucial, as the resulting workload can be very substantial and reduces staff time/resources for applied research.

Opportunities for improvement

- A) In some cases the Center has taken a rather narrow view of what it considers its “core” responsibilities with respect to protected species science. Although collecting data and conducting analyses required to evaluate “take” under the ESA and PBR under the MMPA is an important role, the narrow focus by the Center on these issues comes at the expense of attention to a much wider range of issues that directly related to long-term viability of protected species. Examples include:
- The vast majority of right whale funds are directed toward estimating PBR and anthropogenic sources of mortality. This is important and directly addresses a need of the RO. Furthermore, scientific results developed by the Center have led to reductions in anthropogenic mortality. Finally, the long-term datasets that have been developed through extensive collaborations are valuable and should be continued. However, although the growth rate of this population is positive, it is much lower than observed in other similar species, and rapid growth to get past the population bottleneck is the key to long-term viability of this population. Net growth rate is determined by two factors: reproduction and mortality, and almost no effort is directed toward understanding reproductive biology, in spite of indications that this could be a key limiting factor. Allocating some funds toward this key topic could potentially provide large marginal benefits compared to those of continuing to allocate the same amount to existing projects (see below under Right Whales for more on this topic).
 - NOAA has general stewardship responsibilities for living marine resources and the ecosystems upon which they depend. The key link between protected species and their ecosystems is explicit in the purposes of the ESA. The material we reviewed did not provide much indication of how this issue is being considered. Perhaps this is coming in next year’s review, but the role ecosystem science plays in protected species research at the Center is not entirely clear.
- B) The Center could/should play a larger role in developing stand-alone science documents at some key steps in the ESA process
- It appears that the RO takes the lead in ESA status review for species restricted to the NE region. As the ESA mandates that listing determinations be based “solely” on the best scientific and commercial data, it seems inappropriate for the management/policy arm of the agency to lead this effort. It is more transparent to have the Center produce a publicly available document that summarizes the key scientific issues that must be considered in listing determinations. The RO or HQ then prepares the listing determination, which can cite the science document and explains any policy overlays required to reach the listing decision.
 - We saw a long list of candidate species or Species of Concern, but the science component of this process (what criteria were used to make these determinations, and what role did the Center play in that process) was not clear. Similarly, determining what subspecific units of species like sturgeon might be DPSs is largely a science-based activity, but what role the Center plays in this is not clear.
 - It is not apparent what role the Center has played in developing recovery targets for listed species, except perhaps salmon. This is unfortunate, as NOAA recovery planning guidelines stipulate that recovery plans must contain objective, measurable criteria that indicate when a species can be delisted, and developing these targets should largely be a scientific responsibility.

There are a number of precedents within NMFS for how this can be accomplished with Center staff playing a leading role.

- In implementing the MMPA, a crucial step is determining what units can be considered populations or stocks. How this is done and what role the Center plays in this crucial process is not clear.

C) Climate change

The material we reviewed provides relatively little detail about how the Center is planning to adjust to the major changes likely to occur in the near future as a result of climate change. The RO indicates that taking a proactive approach to conservation is important. From follow-up questions and offline discussions, it is apparent that Center scientists have thought about this (and have even produced an as-yet unpublished report on a pilot project of climate change vulnerability assessments for marine fish), but it is less clear what it specifically means for protected species. This is important, as NMFS has recently released a draft climate change strategy that directs all management programs of the agency to consider the reality of climate change and factor it into its management planning. Here is a small sample of things that might be affected:

- Recent exercises to generate habitat-distribution maps that link abundance and distribution to physical features of the habitat will have to be recalibrated if correlations in the past no longer apply in the future
- The carefully crafted collaborative effort to track distribution of right whales by visual mark recapture relies heavily on directing efforts toward areas where right whales can be expected to be encountered, but this approach might be wholly inadequate to detect distributional changes related to climate change.
- The innovative method to calculate adult equivalents of “take” of sea turtles at different life stages, based on reproductive value, will need to be recalibrated if climate change causes changes in age at maturity, age-specific survival, or age-specific fecundity.
- Who is evaluating the capacity of species for adaptive responses to climate change (phenotypic plasticity and/or evolution)?

Theme 2: Cross-cutting data collection and analysis

Strengths

- This program significantly adds to NOAA capabilities
- Has been achieved through lots of coordination and leverage of external funds
- Nobody else does offshore line transects like this, so data are very valuable to many other groups
- Passive acoustics work is top-notch and result of creative and determined effort by a small group

Challenges

- For a substantial fraction of the target species (perhaps the majority?), the AMAPPS survey area encompasses only part of the distributional range. This creates substantial difficulties in translating observational data into estimates of key parameters for the species or population as a whole (particularly evident in white-sided dolphin data).
- There have been some issues regarding distribution of data in a timely fashion, but that might be improved during the second 5-year phase
- Ship time is expensive and hard to secure
- Bycatch estimation is important but often involves a large expansion factor, so results are uncertain

- The importance of conducting surveys outside of summer months is evident, but this is logistically challenging
- The Center should develop a plan for what will happen if/when BOEM and the Navy decide they have other funding priorities
- The Center should review the passive acoustics work and determine what role they expect this type of information to play in the future for protected species and other fishery management needs. If this project is expected to be important into the future, the Center should find a way to provide more stable funding for it.

Theme 3: North Atlantic right whales

Strengths

- This program has generated great long-term datasets
- Center staff have leveraged funds and resources through extensive collaborations
- Data are shared rapidly and widely
- The program is directly responsive to needs of RO to quantify take and PBR
- Demonstrable success in reducing ship strike mortality and assessing effectiveness of management measures

Challenges

- Difficulty detecting source of entanglements, which affect most animals
- Difficulty evaluating non-lethal effects of entanglements
- The patchwork of survey efforts does not produce data suitable for unbiased estimates of distribution or abundance of right whales, or other biological parameters
- Although existing methods make some attempt to account for heterogeneity and changes in whale behavior, these cannot fully compensate for non-ideal aspects of experimental design
- There does not seem to be much interest in generating the type of information generally considered central to any overall evaluation of population viability: absolute abundance; basic life history traits like generation length; historical trends in population size, including magnitude and duration (in generations) of any bottlenecks
- There seems to be a disconnect between the area defined as Critical Habitat and the area the species actually occupies. What role does Center science play in this issue?
- The Center relies on collaborators from Trent to conduct genetic analyses from biopsy samples. However, there is no evidence of a plan to ensure that the most management-relevant information is generated, or of how this information is incorporated into the Center's scientific evaluations of the status of the species.

Here are some more specific suggestions related to comments in the General Issues section

- The long-term mark-recapture dataset is very valuable and should be continued. However, it does not necessarily follow that it is essential to apply the same level of effort every year—or if it is, that need has not been demonstrated in material the Panel reviewed. The Center should conduct sensitivity analyses to evaluate the consequences for performance of the models assuming that effort is reduced at least temporarily in the future. Here are some scenarios that might be evaluated: Reduction of effort by 10%/50%/100% for 1-5 years (these numbers are arbitrary and only meant as examples). This could easily be evaluated by selectively dropping partial data from previous years. Results might show that performance would not diminish much from such temporary reductions of effort. In contrast, the marginal benefits of shifting that effort toward study of key uncertainties for which virtually nothing is known at present

could be very large. This effort might be devoted to one or more of the following types of studies

- i. Reproductive biology (biopsy samples of reproductive condition, or feces)
- ii. Estimates of absolute abundance. This would probably require some type of stratified random sampling design. The value of this information would be very high, as all population viability models depend heavily on population size and growth rate/productivity.
- iii. Distribution in space at time. The current strategy of directing effort toward where whales have been found in the past cannot be expected to provide useful information regarding response of the species to climate change.

Theme 4. Seals

Not a great deal can be said here. Quite a lot has been accomplished with a minimal investment, but the lack of data means that NOAA cannot provide much useful guidance on issues of keen interest to management and to the public. More resources are needed for pinniped research.

A Modest (Swiftian) Proposal

Empirical data for a wide range of protected species indicate a strong, negative correlation between amount of funds spent on a species and its status. Some debate whether this reflects a causal relationship and, if so, in which direction it works. A plausible prediction is that, if the Center were to devote substantially more money and effort to seal research, the recent surges in abundance would be reversed, sending the species into steep decline. This would help address concerns expressed by the commercial fisherman on Day 1, and it might even be possible to entice the industry into funding the seal research with this end in mind.

Theme 5. Atlantic Salmon

Strengths

- Staff have been active in forging effective collaborations at many scales (local, national, international).
- Research has been well integrated with regulatory and management needs under the ESA for over 2 decades.
- This productive group has produced a large amount of high quality research
- The overall program is broad based, focusing on many key aspects of the species' life history.
- They have made incremental progress in understanding marine survival
- They have developed new insights on topics such as selective effects of dams, ecosystem connections in the ocean, latent mortality, and the synergistic effects of other diadromous species

Challenges

- I am a bit uncertain about the overall conservation goal. What is the ultimate vision for Atlantic salmon in New England? Long-term research priorities should be congruent with these long-term goals/objectives.

- Overall there is a heavy reliance on artificial propagation, which is conducted by USFWS. NMFS has only a limited ability to affect how these programs are operated. Although they have the potential to assist conservation, they also can reduce long-term viability of natural populations, so determining the optimal role requires explicit consideration of tradeoffs of risks and potential benefits.
- The Penobscot R. hatchery program appears to be just in a holding pattern, maintaining the population until ... what?
- Can they find ways to get more detailed information about performance of natural fish, which are the key to long-term viability?

Theme 6. Other species

There is not much to say here except that the agency is hardly meeting NOAA's stewardship responsibility for these species. The Center needs dedicated staff to deal with these species.

Reviewer Report on Program Review of Protected Species Science

Northeast Fisheries Science Center

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13-16 April 2015

Reviewer #2

General observations + Theme 1 (Staffing and Funding)

First and foremost, it is apparent from all presentations that the staff, permanent or contract, are highly dedicated, motivated to conduct the research and analyses needed for conserving/recovering the species and their habitats. They clearly are competent and have the needed skill sets. They are willing to do the work under conditions of poor funding, and in the case of contract employees, with the lack of predictable long-term employment stability. I will not repeat this as a strength under each program, it is a given.

Another general characteristic of all programs is a high degree of collaboration and partnering. The collaborations involve academia, industry, other federal agencies (especially BOEM and the Navy), State agencies, Tribes, and NGOs and formal Consortiums. Such collaborations have become an essential part of the Center's way of maximizing what gets accomplished and provides supplemental funding.

A third area of excellence within the Center as a whole is the dissemination of findings. Publication in peer-reviewed sources is extensive. With individual publication records, staff would be highly competitive in an academic environment. Use of the internet to communicate information and public outreach programs are apparent for all programs.

Funding from federal appropriations to support the full mandate of the various relevant legislation (e.g., Endangered Species Act, Marine Mammal Protection Act, Magnusson-Stevens Act, National Environment Protection Act, etc.) is inadequate. With the exception of earmarked money for the NARW and Atlantic salmon programs internal funding primarily goes toward permanent FTEs, leaving little operating money to conduct needed science efforts for all other marine mammals, marine turtles, and other listed fish. Most federal (internal) funding to support operations is in the form of temporary funds that cannot necessarily be counted on from year to year. For the most part, the work that is accomplished on all other ESA listed species and marine mammals managed under the MMPA is done through external funding and collaborations. The overall net effect of this is there is limited discretionary or flexible funds to use for innovative efforts or adaptive needs. Center staff do an outstanding job at all levels to bring in the external funding to fill gaps left by internal money. Reliance on external funds also produces a greater challenge for longer-term planning and results in scientists spending diverting more time seeking alternative sources of funding than should be the case. **While there are likely limitations on the ability to change the budget situation, continued effort to improve internal funding should be continued at higher levels within the region and nationally. Also, the burden for obtaining external funding should be shifted from staff scientists to higher levels in the**

agency to minimize the extent to which this responsibility falls on the shoulders of the scientists doing the critical work.

Communication between the Regional Office and the Center appears to be relatively informal but works to transmit the needs of the region for science information. There does not appear to be a formal process for determine priorities across all protected resources, but this in part appears to be driven by the funding situation that leaves little flexibility in how money is spent, at least with regard to marine mammals, marine turtles, and other listed fish. The needs of the regional are given to the Center on an annual basis, and include science review for upcoming actions. The “omnibus” document provided by the Region at the beginning of each year for needed information or review of action items gives the Center an opportunity to plan ahead for the time-consuming task of providing science review of upcoming actions rather than having to react under more stringent time constraints. **This proactive approach should be continued. It is especially useful science staff, who are already overloaded with data collection and analyses. Should funding levels increase and greater flexibility in how funds may be spent occur, a more formalized process of establishing priorities may be warranted.**

The process and roles of the Regional Office and the Center for ESA listing determinations seems to be clear for species that are wide ranging and cover more than one region and may even be established at a higher level, but for “regional species” the process and roles of the Center and the Regional Office may be variable among programs and less well defined. It is unclear to what extent the Center drives the review and provides independent science documentation (as opposed to a single document that includes science and management recommendations collectively). **This process could be improved to make clear the role of science in the process and if independent science input is not being documented it should be.**

Another challenge of the limited internal funding and heavy reliance on external funding is that an unusually high level of personnel conducting the work are on contract, which may increase costs, reduce stability and predictability for maintaining needed staffing of projects, and can result in staff morale problems. If FTEs are available, while there are tradeoffs in creating permanent positions with temporary money, consideration should be given to creating several FTEs when the opportunity for doing so with permanent funds does become available, either through new funding or shifting of funding within the Center more broadly. **The three FTE positions recommended as clear priorities are:**

- 1. Add a position in support of the Acoustics program. This program has expanded from the single FTE created nearly a decade ago to an additional staff of 9, all of whom are contract employees, and it has done so on primarily external funds. The need for passive acoustics and other acoustic work is broad within the marine mammal program, it accumulates large data sets for analyses, and requires considerable data archiving and management. There will be an increasing need for this program as increased energy development occurs in the Atlantic.**
- 2. Add a position that supports listed fish other than Salmon. The effort for these species is virtually unfunded and minimal effort occurs. The development of a program for this unfunded mandate will require a position to begin. There appears to be a pattern of increased petitions for listing fish, and the science input being given for evaluation of these petitions is either being contracted out or taxing staff who do not have the full level of expertise and certainly limited time as should be available to produce the best advice support these important decisions.**

3. **The seal program is currently supported by a half position. This program should have a full FTE to support its development and needs. Currently, the lack of staffing and funding precludes more than a minimal effort to collect abundance information and insufficient effort to investigate the extent to which interactions between humans and seals are real or perceived.**

The Center manages with the combination of internal and external funding to satisfy the immediate needs of the managers or what might be considered its “core activities” relating to assessment, takes and PBR under the MMPA. For marine mammals this results in most funding going to estimating abundance and providing science for traditional threats that produce mortality (e.g. fisheries bycatch or avoiding ship strikes for large whales). The opportunity to investigate emerging or more recent issues or examine broader ecosystem concerns (i.e., ocean noise impact associated with energy development, reproduction limitations on recovery in right whales, etc.) is for the most part precluded, except for occasional windfalls in funding. **An effort should be made to obtain a better balance between these competing needs.**

Theme 2: Cross-cutting Programs: Stock Assessment, AMMAPS, Fishery-dependent data, and Acoustics Program

Observations:

The AMMAPS program is a model for joint funding and partnering to support the shortfall of base funds to conduct critical work. The funding comes primarily from BOEM and the Navy but there are other partners too. NOAA provides the ship and aerial support at no cost to the Center. Collaboration and coordination is required between the NEFSC and the SEFSC as well as with many collaborators. At the heart of the AMMAPS program is the need to improve assessments of marine mammal species and stocks. This program provides resources that allow filling gaps to do survey and analyses for species for which there are no or limited internal funds to support. The Acoustics program is also one that involves external funding, primarily from the Navy. It operates with minimal internal support and only a single FTE.

Strengths:

- Stock Assessments for marine mammals in the NE, unlike in many regions, have only two stocks out of 25 for which there is not at least minimal information to establish PBR.
- The Center is collaborating with the SEFSC to develop a framework within which to evaluate stock assessment for marine turtles
- AMMAPS provides opportunity to gather information to improve availability and perception bias to feed into abundance estimates
- AMMAPS provides survey and analysis opportunity to fill in the gaps in information needed to update assessments for species not covered under internal dedicated or flexible internal funding
- The AMMAPS program provides resources for a multi-discipline and multifaceted effort that satisfies important information needs and development of tools/models that would not otherwise be possible for most marine mammal and marine turtle species. While there are some constraints on how resources are used, there is considerable flexibility.

- With AMMAPs, the emphasis on conducting surveys in seasons other than summer is providing the opportunity to estimate season-specific density estimates and maps that will be extremely valuable for management's need in estimating potential take levels.
- Fisheries bycatch methods are well developed and allow estimating bycatch rates.
- Fisheries bycatch data are highly transparent and receive multiple tiers of review (e.g., Atlantic Scientific Research Group, Fisheries Councils, Take reduction teams and through peer reviewed publications)
- The development and use of passive acoustics at the NEFSC is strong and provides a set of data that can be used to address a broad array of specific ecological questions and to improve assessments of species/stocks, especially those that are difficult to observe or survey through visual means.
- Establishing a designed study to use passive acoustic monitoring along the coast in regions where energy development will be focused is proactive and a strong example of the benefits of this program.

Challenges:

- AMMAPS provides key support for assessment needs for most species with little to no internal support, but it is not available to support seal assessment work.
- Although AMMAPS has been funded for another five years, should the Navy or BOEM decide to end the partnership, there will be a need to find other sources of funding to continue surveys to update assessment information.
- Seasonal density maps constructed from AMMAPS efforts will be useful for stakeholders and managers. However, their usefulness over the long-term requires they be updated periodically, especially because we are in a period of a rapidly changing environment that will potentially have an effect on movements and distribution of animals.
- While information is available for most marine mammal stocks to determine PBR, most stock assessments (about 2/3) are still Tier 1 and require additional information to be elevated to Tier II, the new national standards.
- Much of the critical ecological and demographic data for marine mammals is currently funded by the AMMAPS program and other funding from the Navy, leaving many programs vulnerable should these collaborative efforts come to an end.
- The estimates of human caused serious injury and mortality of marine mammals are based on strandings, observer efforts, and reports of fishermen and other vessels at sea. For large whales, the level of unobserved mortality is likely high resulting in potentially overestimating PBR and allowing takes that could be too high.
- Much of the bycatch data for marine mammals comes from fish and turtle observer efforts because observer coverage for marine mammal needs is relatively poorly supported. Thus, while bycatch is observed, more detailed data from sampling bycaught animals may not be obtained and specific marine mammal issues may not get covered.
- Passive acoustic methods produce extremely large data sets that require substantial time and resources to analyze and integrate with other types of data. They also create extensive archival storage needs that will likely push the Center's capacity with time.
- Human-caused ocean noise, which can be disruptive to marine mammals is increasing around the globe and will increase in the Atlantic with the pending increase in energy development

activity. Understanding its impact on marine mammals is difficult because it does not usually lead to direct mortality, but efforts are needed to assess the changing levels and determine its impact.

- Real-time acoustic monitoring has the potential to be developed more fully to help support efforts to minimize collisions between large whales and ships.

Recommendations:

- It will be important to do whatever one can to ensure a continuation of the AMMAPs program beyond the second 5-year period, or work to establish a permanent multi-agency (organizations, stakeholders) supported program of a similar nature.
- Appropriate management action is dependent on an understanding of what the “units” of management should be. Hence, it is important to establish structuring within a species. Genetic analyses are a critical component for such needs. Additional efforts within the expanded AMMAPs program should include dedicated surveys to collect biopsy samples from animals.
- Continue efforts to integrate the various data sets from ecological studies, tagging, line transects passive acoustics, bycatch etc. to improve our estimates of seasonal trends in distribution and abundance of species/stocks. Such efforts should be a priority.
- Assessment of status of listed marine turtles is difficult in the absence of a framework such as those that exist for marine mammals or salmon. It is important to ensure completion of the collaborative work being done by the NE and SE Centers to develop a framework.
- Improve allocation of observer effort to specifically address marine mammal issues.
- As shifting from human observers to electronic monitoring of fisheries occurs, it may become necessary to find alternative means for collecting data (e.g., biopsy or other biological data) that are now a major component of the observer program. Consideration should also be given to assessing the impact of such a change on the quality of marine mammal and turtle bycatch data.
- Seek to develop methods that would better account for unobserved mortalities due to ship strike and entanglement for large whales.
- Support efforts to find options for archiving the extremely large data sets from passive acoustics. The need for data sharing and retrospective analysis is important.
- Support efforts to explore the use of real-time acoustic monitoring networks as a mitigation tool for ship strikes of large whales.
- Passive acoustics has become a fundamental component in improving assessment efforts and to explore movements and distribution questions for cetaceans, especially NAWR. The burden of funding the program has been on the leader and only staff person for the program. To the extent possible find ways to reduce that effort to allow maximizing the research that can be pursued within the program.

Theme 3: North Atlantic Right Whales

Observations:

The NARW conservation science program is a relatively well-funded program, but still benefits from collaborators/partners to accomplish components of data collection and analyses. The program’s efforts

over the years has led to diminishing the impacts of ship strikes on the population, but not without an extensive mitigation effort, in part accomplished through frequent aerial surveys during certain times of the year and providing the science to justify moving shipping lanes formally or informally. The population trajectory has reversed and is now one that leads to cautious optimism rather than one of pessimism.

Strengths:

- Extent to which internal funding and dedicated FTEs have been devoted to this critically endangered species relative to others
- There is a strong record of adaptively using new science information to improve or modify mitigation efforts.
- Sighting survey and advisory system relies on extensive collaboration.
- The intensive Photo ID work provides the opportunity for knowing a large proportion of the population, which provides a bases for assessing status as well as understanding other aspects of the ecology and behavior of animals.
- A large proportion of the population has had biopsy samples taken for genetics analyses.

Challenges:

- Despite extensive efforts to address the known threats of ship strike and entanglement, and to understanding the ecology and biology of this species, the recovery of NARW is slower than one might expect, especially by comparison to the southern right whale. Assessing the reasons for this is difficult but will likely require new efforts.
- Maintaining the level of support for the intensive mitigation efforts may be consuming resources that preclude moving science in new directions that could help to better understand the slow recovery and whether there are new management actions that should be implemented to move recovery to the next level.
- The movements and distribution of animals appears to be changing. The efforts in 2007 to focus surveys on where NARW are likely to be located has potentially reduced the ability to understand the where and why of this shifting distribution.

Recommendations:

- The lower than expected recovery of the population along with the apparent success in reducing the impact of vessel collisions, suggests that a greater emphasis should be placed on looking at sub-lethal impacts and reproduction. Effects of stress effects on reproduction from various factors might be one area to consider.
- Given the changing movement and distribution patterns of whales, it may be fruitful to incorporate new or expanded efforts such as stable isotope and satellite telemetry that has the capability for longer duration deployments.
- Given the different courses of recovery between the NARW and the SWR, and especially the apparent differences in reproduction, some consideration should be given to whether comparative efforts between these two species may provide insights into the poorer reproduction of the NARW.

- Ensure continuation of biopsy sampling program of calves to obtain year-round calf survival estimates and to maximize maintaining pedigrees in the photo-ID database.
- The changing movement and distribution of NARW makes it important to consider expanding the efforts to collect data in the mid-Atlantic.

Theme 4: Seals

Observations:

The main issues regarding gray seals at present have less to do with conservation, but rather concern the level to which an increasing population is interacting with humans, resulting in the need for management and mitigation efforts under the MMPA. Because of this situation, and the fact that neither harbor seals nor gray seals are listed species, the science effort on these species has been a low priority, receiving approximately one-half FTE support and very limited internal funding.

Strengths:

- Given the long-standing limited funding for this program it should be seen as positive that we know what we do know. Much of this comes from leveraging the small amount of money with external collaborators.

Challenges:

- The primary challenge to this program is adequate funding and staffing. While AMMAPS has been a source for making up for a lack of internal funding for many of the cetacean species and marine turtles, use of AMMAPS funds for seal work has been precluded by the funders.
- With the rapidly expanding gray seal population the area being used for haul-out and pupping seems to be increasing, making it difficult to provide survey effort in some places.
- With limited resources, it is difficult to evaluate the extent to which apparent conflicts between stakeholders and seals are real or perceived to be significant.

Recommendations:

- Find ways to shift increased funds from internal sources or seek external funds to begin to develop a viable program to determine long-term population trends in the two seal species and to provide the support to understand and mitigate human interactions with seals.
- Current methods used to determine diets, obtain behavioral data and spatial information may not be adequate, the most appropriate, or efficient, so there is a need to incorporate new technologies, e.g., stable isotopes, UAS platforms, satellite phone tags, etc. Explore whether there is a potential to use the network of receivers for sonic tags (or develop an independent network to address some human-seal interaction issues).
- As noted above under general comments, especially given the pending retirement of the staff person who conducts the seal work currently done, ensure that a full permanent position is

created to develop an appropriate program to support the research needed to manage seals and their interactions with humans.

Theme 5: Atlantic Salmon

Observations:

Like the NARW program, the science program for Atlantic salmon is reasonably well-funded and staffed by FTEs. An incredible collaborative network provides a strong understanding of the behavior and ecology of this species to support its conservation. There is a well-established and structured process or framework for evaluating stock status. Data collected also feed into international programs to manage and conserve salmon (e.g., ICES and NASCO). A focus of recovery has been on determining relevant biological structure and maintaining genotypic and phenotypic diversity to maintain population stability. The two major threats toward which substantial research efforts are focused are dam-related mortality and mortality at sea.

Strengths:

- This program is generally better funded than others and reasonably well-staffed with FTEs.
- Cooperation and collaboration among agencies of the federal government, states, academia, and stakeholders is extremely strong.
- An ecosystem approach to salmon conservation science is possible because of over a 100 US and international collaborators.
- Data sharing, review, and transparency is extensive and well established. Among the databases and reports are those of the US Atlantic Salmon Assessment Committee, ICES Working Group on North Atlantic Salmon, the Atlantic Cooperative Telemetry Network, the Ocean Tracking Network, as well as others.
- Long-term tracking efforts both in rivers and at sea has produced a wealth of data on behavior, survival, and post-smolt dynamics during migration. The extensive tracking effort has led to the development of migration models, which are being used in taking management actions.
- A combination of retrospective analyses and trophic ecology and resource availability studies have resulted in evidence of changing trophic dynamics as a result of changing ocean conditions (e.g., climate change impacts) and these are having a negative effect on salmon abundance.

Challenges:

- Providing support for non-salmon species listing evaluations and efforts advice on listed non-salmon species takes effort away from salmon work.
- The lack of a quantitative ecologist versed in integrating quantitative habitat-population dynamics models prevents taking the program to another level.
- Telemetry efforts provide a strong documentation of timing of migration and the platform of opportunities work provides some information on locations at sea. However, there is much more that could be gained by a more deliberate or experimental approach to the telemetry work.

Recommendations:

- As noted in the general comments, establishing a position dedicated to address non-salmon fish issues will remove some of the burden placed on staff in the salmon program.
- While not identified under staffing priorities under general comments, nonetheless, a quantitative ecologist would advance the program in an important direction. Insofar as the permanent funding precludes backfilling positions and creation of such a new position, the program will have to evaluate which is most critical to its needs until sufficient increase in funding can be obtained.
- Developed targeted studies to increase what is learned from the extensive tagging and tracking effort.

Theme 6: Other Protected Fish

Observations:

There are two sturgeon species listed for which almost no effort toward recovery science occurs. There is also a list of species of concern that have the potential to be listed for which there is no opportunity to be proactive in monitoring their status.

Strengths:

- Leveraging what little resources are available and to use collaborations to get minimal efforts accomplished.
- The Center is able to provide survey and commercial data along with scientific expertise to ASMFC committees for stock assessments because of small amounts of funding from NEFSC and collaboration with partners.

Challenges:

The primary challenge for other protected fish is the lack targeted funding for research and science advice, and no targeted FTE to support a program. What does get accomplished is done through the Regional Office or through overlap in activities relating to Atlantic salmon science needs.

It is not possible to meet the current needs for the two listed species, and there have been several recent petitions for listing additional species. Some of these decisions are still pending and while others have been denied, the likelihood is that there will be more in the future.

Recommendations:

As noted under general comments, consider creating an FTE to support the other listed fish, candidate species, and species of concern, and begin to build a program for listed Sturgeon species.

Reviewer Report on Program Review of Protected Species Science

Northeast Fisheries Science Center

166 Water Street

Woods Hole, MA 02543

13-16 April 2015

Reviewer #3

General Comments

Overall, the Centre has done an excellent job identifying and developing the research programs required to meet the requirements identified by the Region. This is primarily due to the dedication and hard work of their researchers (FTEs and contractors) and leaders. The researchers working in both of these units have shown a very high level of expertise; they are truly 'World Class'. The various research units are very productive, particularly in view of the financial and HR limitations they face. They have developed a number of new approaches and have extensive publication records that have advanced their respective fields tremendously. They are to be commended and encouraged to continue their excellent work.

Some of the presentations provided information on the outreach programs that are being carried out. Although not specifically mentioned in other presentations, I know that they are also actively involved in informing the decision makers and the public about the science they are doing. This is a very important component of the role of scientist, especially those working within a government agency. Providing explanations of what they do at a level that can be understood by non-scientists (especially children) is not always easy but it is rewarding.

The center has maintained a core of permanent researchers that have been supplemented by contract researchers. They have been successful in developing an approach to contracting that provides the considerable degree of flexibility required to meet the research demands. However, over 50% of the Protected Species Branch is contract personnel. This is primarily due to lack of permanent funding that precludes making some of these positions permanent. Unfortunately reliance on contract personnel can result in a lack of continuity in a program as people change, as well as increased workloads on the permanent employees who are required to seek out funds, preparing the staffing requests, etc. Fortunately, many of the contractors working with the NEFSC have remained for many years but this should not be depended upon. The problems associated with relying primarily upon contract personnel are greater in some programs (e.g. acoustics, seals) and recommendations to supplement staffing to specific units are identified below.

There appear to be regional differences in their approaches to a number of issues. For example, status reviews for ESA listing seems to be done differently in different offices while under the MMPA there does not appear to be clear criteria to define a stock/population and there seems to be differences between how they are applied. Although there will always be regional differences in priorities and specific approach that reflect individual situations, the general approaches/criteria should be standardized across regions and applied equally.

The focus of the research carried out by the center appears to be primarily 'traditional' fisheries issues (e.g. impacts of bycatch, ship strikes). However future demands will likely require a change in focus to address new issues (e.g. impact of climate change, large scale marine projects, oil and gas exploration, wind farms, etc.). Understanding how changes in the environment and human use patterns will impact estimates of PBR, population status and/or trends, and our ability to interpret these changes is critical.

In general, much of the research carried out is focused upon single species issues (e.g. abundance, bycatch, seasonal distribution). While the MMPA focuses mainly on single species criteria, it is not clear how it deals with larger issues that cross species. One of the principles behind the MMPA is to ensure adequate abundance of marine mammals to maintain their ecological role which requires a good understanding of the role they currently have or had in the past. Therefore, it is important to develop programs that will address questions related to multispecies and ecosystem interactions. The salmon research program appears to be considering some of these issues and they are being considered within the NARW program, but the Center may wish to consider how to address ecosystem questions for other protected species. Some topics that could be considered include questions such as the data needs required to identify ecologically significant areas for multiple species, or how to quantify impacts of marine mammals on fisheries and/or impacts of fisheries on marine mammals (other than bycatch or ship strikes).

One of the largest challenges facing researchers trying to determine the impact of human activities on protected species is developing approaches to address cumulative and combined impacts. This is an issue facing researchers globally. In conjunction with this other initiatives, the Center should consider identifying the suite of impacts affecting the species they are responsible and ways in which they can be combined.

Developing a strategic plan for the Centre requires a mechanism to identify priorities and to evaluate existing and proposed research against these priorities. One of the apparent strength in the programs is the excellent degree of consultation that occurs between the Center and the Region. However, there do not appear to be any explicit plans for species other than turtles. Such plans are required for other programs.

The role of science is to provide advice to support the current needs of management (the Region). But it must also anticipate future needs of managers and carry out the research that will be needed. This requires a balance between addressing current demands and preparing for future ones.

As workloads increase and funding remains restricted, it is important to not only develop a strategic plan for the center, but also to develop an implementation (operational) plan that includes a transparent mechanism to identify priorities. It is important to not only identify what will be done, but also what research will NOT be done.

Theme 1: Staffing/Funding

Observations

- current funding is 'stove piped' more than in the past. This reduces the amount of flexibility need to address emerging needs.
- Most of the Protected Species Branch funds go to labor costs; salmon research has more free operating funds. It appears as if some of this difference is due differences in approaches/ decisions by unit leaders.
- These appear to be national issues – no flexibility in O&M

Strength

- the Center has done a very good job of obtaining outside funding
- they have developed a flexible method of obtaining contracting help and moving funds around to maximize the use of available funding even if obtained late in the year.
- The Center has been able to maintain a dedicated group of researchers (FTEs) and contractors, many of who have remained with the programs for many years.

Issues

- Many important programs have to rely on unreliable funding
- Insufficient funding for many important projects (e.g. seals, other ESA fish; large ESA listed whales); other projects such as Acoustics rely entirely upon outside funding.
- Uncertain funding does not allow planning for multi-year research
- Good projects may be stopped because of non-science priorities.
- >50% of staff in the protected species group are contract which raises concerns about continuity of research personnel and institutional memory.

Comments and Recommendations

The number of ESA petitions has been increasing and is expected to continue to increase. Most of these petitions are for fish species. This will result in an increased workload for Science to provide data and assess these populations. Many of these species fall outside of the protected species /ESA groups and will require involvement of staff from the population dynamics group. Most likely will require additional resources for this group. Therefore it is important that the center develop a plan on how to deal with the expected increased workload that cuts across all divisions at the Center.

Assessing many proposed species may not be possible using traditional assessment techniques (e.g. data poor species, non-commercial data, etc). The skill sets required may not currently exist and may require specialized experts.

The number of marine development projects is predicted to increase over the coming decade (e.g. oil and gas exploration, impact of vessel noise). The center will need to consider if it has the resources and scientific expertise (either within the center or among their collaborators) to deal with the increased, and new, requirements. NOAA may wish to consider if these inter-regional issues could be addressed by developing a team of experts to deal with specific issues (e.g. impact of oil and gas exploration) across regions.

Currently a number of important programs are run with single (or <1) NOAA employee. This is most obvious in the passive acoustic and seal programs. Both of these projects provide important data and should be continued. They have been extremely successful using contract personnel or outside collaborators. However, without a larger permanent NOAA presence, these programs are at risk. Reliance on outside/contract researchers can lead to inefficiencies and inconsistencies (e.g. data collection and analyses) as well as require the NOAA lead to devote a large proportion of their time to HR issues and obtaining outside funding. Therefore, I feel that it is important additional researchers be assigned to these programs so that they do not have to rely on single researchers.

The Protected Species Branch assigns almost all of its permanent funding to labor costs, relying on non-permanent funding for operating costs (including contractors). The preferred solution is to increase the amount of permanent funding provided to the branch. However, this may not be possible within the current fiscal situation. Until such time as permanent funding can be increased, the balance between labor and operating costs should be reconsidered by leaving any FTE vacancies open (to the extent possible). This should be done as part of an overall strategic review.

If additional permanent funding is obtained that essentially replaces the 'temporary' funding currently being use to carry out an existing project (i.e. essentially a change in how the funds

are identified), the Center should not tax the funds additionally since the demands on the Center have not really changed.

Based upon the discussions we have had throughout the course of this review I identified 3 positions that I feel should be considered to be of high importance for indeterminate staffing. These are:

1. A second scientist with an expertise in acoustics. Perhaps someone with a focus on the impact of noise or sound propagation
2. A researcher with expertise in assessing data poor species to address expected workload increases in ESA petitions and, in the present situation, to focus on non-salmonid listed fish species.
3. A scientist with expertise in pinniped research to take over, and hopefully expand, scientific research on pinnipeds.

Theme 2: Assessments, surveys and other data collection and analyses.

a) Surveys and Assessments

Strengths:

- There is a relatively long series of surveys that have allowed them to estimate abundance of a wide number of species.
- Recently surveys have identified abundance and distribution in periods other than summer; these seasonal surveys were described as unique within NOAA.
- The seasonal survey data, and associated environmental information, are being used to develop habitat indices to develop habitat models (relatively new project, started in 2010 under this program)
- The program involves a wide number of national and international collaborations
- The survey methods are world-class; they have developed many of the approaches used by others and continue to work with colleagues to continue to advance the methods (e.g. CREEM)
- Ship time and aircraft are paid for by NOAA. This means that outside funding is not needed and as long as the surveys are considered a priority they will continue.

Challenges:

- The program relies upon contract workers with a heavy reliance on a limited number of experienced FTEs.
- Reliance upon NOAA ships and planes means that if NOAA changes priorities it can affect the program.
- Non-ship/aircraft costs are covered under the AMAPPS program that has only been renewed until 2019.
- Difficult to maintain a consistent frequency of surveys (~4 year or so but this is not always possible).
- Appears to use a single survey design for all species which may not be optimized for all species.
- Survey estimates are imprecise and as a result, it is difficult to determine trends in the abundance of many species. Although this may not be necessary for the calculation of PBR, it is important in understanding the status of the populations and potential changes in their ecological role.

Comments and Recommendations

The Center has done an excellent job of obtaining estimates of abundance for most of the marine mammal populations found in the Greater Atlantic area. This has allowed them to

provide PBR estimates for most of the species. While this meets the basic requirements of the Region under the MMPA, it does not necessarily provide the data needed to understand trends in the population or identify the factors influencing changes in abundance. The latter are needed in order to understand ecosystem interactions and how species may respond to changes in the environment or human activities.

A focus on obtaining estimates of PBR may meet the requirements of the MMPA but it does not necessarily provide the information need to determine 'status' of the population needed for listing/delisting decisions (i.e. the intersection between MMPA and ESA). Listing/delisting criteria are required and the appropriate data collected to allow the Center to assess the overall status of a population to ensure that it is healthy.

The current survey program provides the basic data required to assess abundance of cetaceans under the MMPA and so are an important part of the core mandate of the branch. To ensure that they continue, it is important to develop a long-term survey plan that will ensure the surveys continue. Given the resources limitations, survey planning should be done at a national level and may require exchange of experience personnel among the regions for both planning and execution. This will also provide a level of consistency among areas and ensure that the best methods are used.

The continued development of new survey designs, including the use of UAS, is encouraged. The excellent international collaborations developed within the Centre will facilitate these efforts and should be supported.

The usefulness of employing different survey designs focused towards large or small cetaceans should be explored as a way to reduce the variance of the estimates and increase their ability to determine trends in abundance. The usefulness of habitat variables to stratify survey results to reduce variance should be explored.

The continued development of habitat models is strongly encouraged. These models may improve our understanding of how changes in the environment will impact cetacean populations. Combining model from different species may also identify important ecological areas that have wider significance.

b) Bycatch

Strengths:

- The Center has been able to estimate bycatch mortality for most fisheries in the region. The Program meets the needs of the Region to provide basic information on a variety of species on a routine basis.
- There appears to be reasonable observer coverage in many fisheries.
- Researchers have done a very good job comparing estimates from different methods to identify biases. The study to compare observer data to VTR to identify inaccuracies was an excellent example of how these data need to be examined.
- A number of new methods for estimating bycatch levels have been developed and new approaches are continuing to be developed.

Challenges:

- Obtaining appropriate effort data is extremely difficult; the use of landings has a lot of problems and potential biases when used to scale up bycatch ratios.
- The impact of the proposed change in criteria used to assign observer coverage on the estimates of bycatch levels is unknown.

- Much of the observer data are based upon the needs of the fish assessments rather than protected species.
- It is not clear how data gaps are dealt with. If clear protocols have not already been developed, they need to be.
- There was little discussion of the biological data obtained from bycatch; the opportunity to gather these data will decline if they move to electronic monitoring.
- It is not known how the move to electronic monitoring will affect their ability to estimate bycatch or if the estimates will be comparable (although it appeared that some comparative studies are being done).

Comments and Recommendations

Efforts to identify levels of allowable removals, particularly under changing environmental conditions, and the metrics required to monitor them, should be continued.

There is no standard reference points to determine the allowable level of take of turtles and the appropriate metric to use when describing takes is unknown. Currently they appear to be using 'adult equivalents' but the relationship between younger age classes and adult equivalent may vary over time. It is important to identify acceptable levels of turtle bycatch in order to meet the requirements of the ESA. However, the impact of changes in age structure must be accounted for and monitored to ensure that the levels identified are sustainable.

Studies to compare results from the observer programs and electronic monitoring are critical for understanding how these proposed changes in observing bycatch will impact the results. This should be considered a high priority.

Rigorous studies designed to 'ground truth' bycatch estimates obtained using different methods (particularly any that are self reported) are encouraged. All data collections should be examined to ensure that the assumptions required are still valid.

The use of diet data from incidentally caught animals is known to be biased in some situations. Therefore, before using bycaught animals to determine diets (or other biological parameters), the data needs to be carefully examined to determine if any biases are apparent.

c) Acoustics

Strengths:

- The use of passive acoustics to determine presence/distribution has developed over the past 10 years and is a very promising field of study.
- The program developed within the NEFSC is extremely productive and has a wide scope, addressing multiple issues.
- This program has been built on external funds and collaborations.
- The plan for obtaining baseline data for the area being considered for seismic exploration is well conceived and an example of how to approach the need for addressing emerging demands for advice.

Challenges:

- This program is based almost entirely on outside funds and therefore continuation cannot be ensured. It is heavily dependent upon the efforts of a single FTE. Not only is relying on external funding uncertain, it also requires a significant investment of the researcher's time to prepare funding requests resulting in less time being available to carry out research.

- The acoustics program is designed primarily to identify species distribution rather than impact of noise.
- Using passive acoustics to estimate abundance is not reliable for most species. It does, however, provide information on the presence of calling individuals.
- The usefulness of using passive acoustics to determine presence will depend upon the calling characteristics of the species, age and sex of the individual species.
- The distance between the receiver and sources is poorly known for some species (although is generally understood). It is quite short for NARW which limits the distance at which whales can be detected.
- The distance at which individuals can be detected also depends upon the sound propagation characteristics of the area. These vary and are not well understood in many areas.
- The acoustic data need to be integrated into the survey data and habitat studies. This is being planned, but will require considerable work.
- The fish acoustics program has deployed tags on salmon only and relies heavily upon platforms of opportunity to deploy receivers. There seems to be limited coordination among the various groups putting out tags/receivers

Comments and Recommendations

This program is extremely valuable and should have permanent funding allotted to ensure its survival.

Please see my earlier comments about the dangers of running a program with only a single FTE and the recommendation for staffing.

The importance of understanding the impact of increasing ocean noise on protected species will continue to increase which will require considerable study in order to meet the requests for advice. There is considerable research being done by others that can help but it requires individuals with specialized knowledge that should be incorporated into the acoustic program at NEFSC. It is particularly difficult to determine the relationship between ocean noise and 'impact' on protected species when the effects are not lethal. Currently this work appears to be centered at Stilwagon Bank and NOAA should consider increasing this collaboration by developing some in-house expertise.

NOAA should consider developing a program to build sound propagation models for much of the Atlantic (and Pacific) seaboards (if they do not already exist). The models will be needed in order to understand both passive acoustics and the impact of noise in these areas.

There appears to be little coordination among the various groups deploying acoustic tags on fish. I suggest that the various groups (who already seem to work together quite well) develop a committee to coordinate the deployment and information on recovery of the tag data.

With the exception of a brief mention during the seal presentation, the use of satellite-linked data transmitters provide extremely valuable data on movements, diving behavior and habitat use of protected species. Attachment techniques for cetaceans have been improving in recent years. I strongly encourage their use to address some of the fundamental questions facing the Center, particularly as the demands for scientific advice change.

Theme 3: North Atlantic Right Whales (NARW) and other listed large cetaceans

Strengths:

- The right whale program has very successful in carrying out a number of important studies on NARW, particularly in the offshore area.
- NOAA has develop very useful collaborations with a wide variety of governmental, academic and NGO partners.
- The program is well funded (although not as well funded as in the past) with some flexibility in how the funds are used. It has a good mix of FTEs and Contract personnel.

Challenges:

- Although the program appears to be well funded, much of the non-salary funding could be considered 'non-discretionary' as it funds basic data/analysis that are fundamental to the overall assessment of NARW and so must be continued (e.g. NARW catalogue)
- The current distribution of a large portion of the NARW population and the cause of the change in distribution are unknown. There has always been a proportion of the population that has not gone to the Bay of Fundy or other well studied areas but the proportion appears to have increased significantly in recent years.
- There has been a decline in the proportion of calves going to the BoF. Where they have gone and why it has changed is unknown.
- Fecundity of NARW appears to be unusually low. Similarly there may have been a decline in the condition of NARW. It is not clear if this is in fact the case or, if so, why biological parameters of NARW appear to differ from the Southern Right Whale.

Comments and Recommendations

The NOAA research program on NARW is critical in providing data that cannot be obtained by the other NARW collaborators. There are some data that can only be collected by government agencies and so should be continued.

In 2007 there was a change in aerial survey design to focus on areas where NARW were known to be. This may limit the ability to understand the current changes in distribution that appear to have occurred. Passive acoustics will help identify there NARW may be present, but researchers should consider reinstating the large-scale synoptic aerial surveys to identify the location of right whales. This assumes that the AMAPP surveys cannot provide the same data.

If it has not already been done, the resighting data should be examined to ensure that focusing resightings in the same areas each year does not violate the assumptions of the MR methods used and bias the estimates.

The potential impact of using Nmin based on resightings to determine trends in the population during a period of change in distribution (especially if resighting effort is restricted) must be clarified and explained to the managers.

Passive acoustics can provide a method to determine the presence of NARW over large areas throughout the year. Continued efforts to integrate the passive acoustic presence with seasonal distributions from surveys are encouraged.

If not already done, information for the large scale surveys for NARW, especially any estimates of abundance and/or distribution that can be obtained, should be compared to data obtained from other sources.

Known mortality of NARW appears to be declining. This raises the question about the current rates of overall mortality. Is it known if these have changed? A better understanding of the causes of 'unexplained' mortality is important for understanding population dynamics of NARW.

A number of presenters identified a gap in the knowledge of the mid Atlantic areas. The need to fill in this data gap should be considered in the context of addressing ecological questions.

There was a brief mention of the use of UAS for RW work; new developments in the use of unmanned aircraft provide new opportunities to collect data and every effort to obtain the appropriate permits should be made to allow researchers to have access to these platforms.

Historically, the focus of much of the research at the center has been directed towards providing estimates of PBR as required by the MMPA. The estimates of N_{min} may be all that is required to estimate PBR for this species but without a better understanding of total abundance, vital parameters, etc., the reasons for the low rate of recovery cannot be identified. Determining the ecological processes responsible for changes in population dynamics and habitat use are critical for understanding or interpreting the abundance estimates. The recent changes observed in the distribution of NARW illustrate the importance of applying a more holistic view. This may require that overall research priorities be reassessed and ecological research program further developed.

It is not clear how priorities for the overall NARW research are identified and what flexibility there is to address emerging questions. Given the changes seen in recent years, it may be necessary to re-evaluate the research priorities. This will require extensive coordination among Centers, other government agencies and NGOs.

The amount of research that can be carried out is limited by funding. However, even given the funding there is usually something that can be done while carrying out other projects. However, with the exception of the large scale surveys, there does not appear to be many effort to carry out research on listed large whales (or other protected marine mammals) other than NARW. This is a large gap in the mandate of the Center

Theme 4: Seals

Strengths:

- The seal program has accomplished a lot with virtually no support. The research team is to be commended.
- The program has developed very good collaborations that have enabled it to carry out its goals

Challenges:

- Consistent abundance estimates, seasonal distribution and diets are needed
- Funding must be found and adequate staffing assigned to address important questions related to pinnipeds.
- The potential impact of increasing grey seals on harbor seal abundance is unknown.
- Surveys need consistent geographic coverage and methods in order to ensure that estimates are comparable and trends can be quantified.
- The potential impact of predation on endangered and commercial prey species are unknown.

- There is high level public interest in seals both as a conservation issue and fisheries impact. This can result in conflicting priorities and management demands.

Comments and Recommendations

Although they have accomplished a considerable amount of progress with little or no resources, there are a number of issues related to seals (e.g. quantifying population trends) that cannot be addressed. Developing a cohesive research program to identify priorities and carry out the required research will require a decision by the Center to provide permanent funding to this program. I encourage the Center to do whatever is possible to provide adequate funding to this program.

The potential impact of seals on commercial and endangered fish species should be given a higher priority and programs to address these issues should be initiated. This will require adequate data on abundance, diets (including special, temporal and age/sex variation), growth and condition, and seasonal distribution.

Continued and expanded collaboration with colleagues in Canada who have extensive experience working with seals is encouraged.

The only NOAA researcher working on seals will be retiring soon. This raises the likelihood that NOAA will lose all 'in-house' expertise in this area (as well as a lot of corporate memory). This position should be restaffed as soon as possible and a succession plan be implemented to ensure that there is adequate knowledge transfer for staff that are leaving in the future.

Theme 5: Salmon

Strengths:

- The program has a good level of stable funding and a mix of labor and operating funds that allows for some flexibility
- The Center has developed a long term program that has provided a large amount of detailed data that can be used to identify factors influencing trends in salmon abundance.
- Researchers appear to have done a good job identifying major factors influencing trends in salmon abundance and focusing research on these areas (marine survival, dams, etc).
- The program has focused on an ecological approach to salmon survival both in the rivers and at sea. These studies are very interesting and provide valuable insight.
- The researchers in this program have developed good collaborations with many partners, especially Maine DMR.
- The program has strong data management and outreach programs.

Challenges:

- The program lead has identified a lack of quantitative expertise; particularly quantitative modeler.
- It is important to maintain flexibility in operating funds in light of staffing requirements.
- There is still considerable uncertainty about the distribution of salmon at seal and the causes of at sea mortality.

- The current team members do not have the expertise to progress more on some priority research related to habitat conditioning and so must rely on collaborators.

Comments and Recommendations

Telemetry provides a lot of data that are extremely useful but may require more dedicated lines to answer some of the questions needed.

Additional taggings and coordination with outside agencies may be necessary to obtain the data needed for distribution of salmon at sea.

There has been considerable research on ecosystem changes in the NW Atlantic that occurred concurrently with the apparent decline in salmon productivity in the late 1980s. Oceanographers and/or researchers working with other species groups should be contacted and a comprehensive view of the changes that occurred compiled.

Theme 6: Other (i.e. fish other than salmon) protected species

Strengths:

- Some research on 'other' protected fish species has been successfully carried out as part of the salmonid program.
- The development of good partnerships has resulted in some advances in our understanding of these species.

Challenges:

- There is little or no dedicated funding for other protected fish species.
- Many of these species are data poor and there is very little on which to base status designations.
- There is only limited capacity to do stock assessments within the entire Centre and the demands for additional assessments are increasing.
- The data needs to assess many of these stocks are not necessarily the same as those of more traditional species.

Comments and Recommendations

Please see earlier comments about increasing petitions and the needs for additional FTE with expertise with data poor species.

The demands for information on these species will almost assuredly increase and providing additional support should be considered within the context of the Centre strategic plan.

Reviewer Report on Program Review of Protected Species Science

Northeast Fisheries Science Center

166 Water Street

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13-16 April 2

Reviewer #4

Background and Overview of Meeting

This report contains a summary of my observations and recommendations pertaining to the protected species science program at the Northeast Fisheries Science Center (NEFSC) after participating as a panelist in a review of the program during April 13-16, 2015. The review focused on scientific research for species managed under the Marine Mammal Protection Act and the Endangered Species Act. An overview of the science program was presented in public sessions during the first three days of the meeting, followed by a one day closed session to provide time for panelists to work on their individual reports and to report back to NEFSC directors.

The material provided for review consisted of documents containing brief summaries of the various programs, background information, and a set of presentations describing first the science needs to support management programs as well as organization and budgets; followed by presentations describing the various science programs including their strengths, challenges and recommendations to address these challenges. Scientists and other staff at NEFSC put considerable effort into providing concise summaries of these complex programs. I found the organization and presentation of the material greatly simplified my role as a reviewer, and I extend my deepest thanks to the presenters for their efforts preparing for this review.

Overall, the breadth, depth and quality of the science presented are all really quite impressive. It is very clear that the protected species science program at NEFSC has many dedicated and talented scientists and other staff that are leaders in their respective fields. The excellent publication record, the open data sharing, the extensive use of collaboration and partnering to fulfill research mandates, and the many examples of innovation are all evidence of the commitment these individuals have to meeting the science needs in this region.

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

Theme 1: Mandates, Science Needs, NEC Organization and Budget

Presentations:

Protection, Conservation, and Recovery of Endangered Species
Organization and Budget

Observations:

The major information needs to fulfill mandates under the MMPA and the ESA are clearly described, and in very general terms include information about population status (abundance and trends); identification of threats and quantification of their impacts; development of mitigation options and evaluation of their effectiveness; and prediction of future status and threats. Emerging regional concerns requiring science advice include: ocean noise; seismic activity (oil and gas exploration); wind and tidal energy; liquefied natural gas; aquaculture interactions and

recreational fisheries. The majority of permanent funding is currently used to cover labor costs, and most the remaining permanent operational funding is directed to specific programs to address specific questions. Programs rely extensively on temporary and external funding to deliver the core mandate. The number of ESA petitions is increasing, and scientific questions to address emerging issues and the MMPA/ESA mandates appear to be increasing in both number and complexity.

Strengths:

- Major information needs are well described in both acts (although there appears to be more room for subjective interpretation in the ESA).
- Excellent partnerships at many levels to deliver mandate.
- Working with stakeholders to develop mitigation measures
- Management strategies (e.g. ensuring human-caused serious injury and mortality is sustainable) via use of mortality thresholds and Potential Biological Removals appear to be based on established biological principles.
- Substantial funding for Right Whales and Atlantic Salmon
- Substantial external funding for AMAPPS and passive acoustic research

Challenges:

- ESA: increasing number of petitions, increasing complexity (e.g., multiple species instead of single species petitions), and increasing petitions for commercially and recreationally important species.
- Emerging needs (ocean noise, energy, aquaculture, recreational fisheries) will require development of new research themes, data collection and data analysis.
- A significant portion of budget is committed to FTE labor and other fixed costs, resulting in limited internal funds, staff capacity and flexibility to support programs for many protected species.
- At least several of the species that fall under the protected species mandate would be considered data-poor, particularly the “other fish” species.

Recommendations:

- As workload increases due to an increasing number of petitions, increasing complexity and emerging issues, it seems intuitive that the number of staff and operating budgets will need to keep pace with these increases if the scientific basis for meeting the protected species mandates is not to be eroded.
- Although working on data-poor assessment methods might identify some improvements for the assessments of data-poor stocks, there are minimum data requirements for applying data poor methods, and texts on data-poor methods do recommend building programs in order that better assessment methods can be utilized. To reach this goal, an increase in the base funding, or identification of alternative sources of long-term funding, for research for under-funded (data-poor) taxa will be required.
- Many of the strengths, challenges and recommendations provided by scientists at the NEFSC via the presentations are excellent. They are the individuals most familiar with the programs. If it is not already part of the recommendation evaluation process, reviewing their recommendations for addressing the challenges identified in this review, in addition to reviewing the recommendations provided herein, should be considered.

Theme 2: Cross-cutting Data Collection and Analysis Programs

Presentations:

- Stock Assessment Overview
- Overview of AMAPPS Program and Distance Sampling
- Fishery Dependent Data and Bycatch Estimation
- Passive Acoustics & Acoustic Telemetry (two presentations)

Observations:

The topics included in this theme are quite broad, including an overview of stock assessment methods, aerial and vessel-based monitoring programs for marine mammals, bycatch monitoring programs, the passive acoustics program, and an acoustic telemetry program. The data collections and analyses presented to the review panel are clearly fundamentally important for the provision of scientific advice for each species. Science needs include: population abundances and trends; availability of species for surveys; seasonal distribution and behavior; projections of future distribution under changing environmental conditions; improved understanding of stock structure; risk profiles based on ecology, life history and threats; PVA; information for ecosystem models; and fishery-dependent bycatch. The methods for monitoring cetacean abundance using passive acoustics appear to be on the transition from the research and development stage to the operational stage for several applications and species. The ground-breaking research presented to the review panel showed the huge potential in advancing cetacean monitoring and research using these new technologies, as well as advancing research about the effects of underwater noise.

Strengths:

- Stock assessment overview:
 - The MSE-type simulations being developed for sea turtles to evaluate the efficacy of potential monitoring metrics as well as ecological and management scenarios for turtles are an excellent method to evaluate assessment requirements for the populations, as well as to prioritize potential threats for research purposes.
 - The assessment methods for Atlantic salmon are well established.
- AMAPPS:
 - The combined use of aerial, vessel-based and other survey methods provides the opportunity to work at various spatial scales in the offshore and inshore environment.
 - Extensive partnering and coordination among NEFSC, SEFSC, USFWS, BOEM, US Navy, industry, academics and other partners has resulted in an integrated program that provides some of the best marine mammal survey data in the world.
 - Analytical methods to estimate abundance from line transect data and to model spatial and seasonal densities is a topic on ongoing research and methods are being improved.
 - Effective data sharing, including collection of information about other taxa such as seabirds.
 - Sources of bias are well understood, and can therefore be studied systematically.
 - Use of satellite tags to examine availability bias.
- Fishery Dependent Data and Bycatch Estimation:
 - Observer coverage appears quite high, at least for many fisheries
 - Relatively long time series are available for some fisheries
 - Population impacts are evaluated using demographic information for some species

- Mitigation options are being developed and tested using observer data
- The program meets management needs by providing data regularly.
- Passive Acoustics & Acoustic Telemetry
 - The passive acoustics research program at NEFSC provides national and international leadership in this field.
 - The program is highly successful in attracting external funding.
 - Strong partnerships and skilled contract analysts.
 - Impressive publication record (both breadth and depth).
 - The acoustic telemetry program successfully integrates research for several species into a combined program by using the same sampling platforms for monitoring the distribution of each species.
 - The acoustic telemetry program is very cost-effective because it uses platforms of opportunity for installing the acoustic receivers for monitoring movement and distribution of the tagged animals.

Challenges:

- Stock Assessment Overview:
 - Although the conceptual model of the stock assessment process, including stock identification, mortality estimates, abundance and trends, ecosystem considerations and review, does appear to meet the requirements for MMPA, research towards an improved understanding of life history, productivity and population dynamics would be expected to lead to a better understanding of the risk to populations and the magnitude of the interventions required to prevent extinction (via population viability analyses, improved estimates of R_{max}).
 - Most marine mammal stock assessments are Tier 1, as are the assessments for Atlantic Sturgeon and Shortnose Sturgeon.
 - Standard reference points are not available for sea turtles and some fish species (e.g. sturgeon).
- AMAPPS:
 - Program relies extensively on external funding as well as contract field and analytical staff, and the surveys are dependent on available funding.
 - Surveys use a single design for all species and do not cover the full distribution of these species. As a result, varying levels of extrapolation are required to estimate abundance, which can be quite high for some species.
 - Stock structure is not well understood for many species.
 - Existing data collections are very useful for estimating abundance and mapping distribution, but appear to be less useful for the life history and demographic research required for PVA and development of risk profiles, at least for some species.
 - Incorporating information into complex ecosystem models remains challenging.
- Fishery Dependent Data and Bycatch Estimation:
 - Scaling up by landings may not provide as good an estimate of bycatch as scaling up by effort, although when effort information is not reliable, there may not be an alternative.
 - Changes to monitoring protocols (e.g. to electronic monitoring) may not produce data comparable to the older data.
 - Allocating observer effort in a way that is appropriate for several species of fish, turtles and marine mammals is problematic, particularly where the areas of concern for these species do not overlap.
 - Particularly for animals at low abundance, detecting bycatch occurring at low rates can be difficult.

- Basic abundance, demographic and ecological data are required to develop reference points or interpret bycatch estimates that are not available for some species.
- Passive Acoustics & Acoustic Telemetry:
 - Challenges in the passive acoustics program were well outlined in the presentation, including:
 - Transitioning research tools from development to operational stage
 - Massive data management and sharing needs
 - Data processing needs in addition to the continued development and improvement of automated detectors
 - Maintenance of NOAA wide, national and international collaborations requires time and FTE support
 - Extensive reliance on external support and contract analysts
 - The capacity to keep collecting PAM data long term is difficult to ensure given the programs reliance on external funding
 - The PAM program does appear understaffed, at least with permanent positions.
 - With respect to acoustic telemetry, the use of platforms of opportunity for installing receivers does lead to difficulties when interpreting detections because the receiver deployments are not based on a designed survey. Because the number of tags available to be detected is not known (due to mortality), the extent to which detections are representative of the distribution of the species is not known. This said, for many of the species, nothing is known about their distribution and the approach being used is a cost effective way of collecting some of the basic data required to design a survey.

Recommendations:

- Stock assessment overview:
 - Continue population simulation modeling for turtles to evaluate monitoring methods/metrics and ecological and management scenarios.
 - Develop assessment protocols for Atlantic Sturgeon and Shortnose Sturgeon and other fish species using simulation methods to evaluate the design of the monitoring program.
- AMAPPS:
 - Given the fundamental importance of this program for fulfilling science needs, work towards securing long-term funding for the program.
 - Continue the development and use of habitat models. They are valuable for stratified survey design, abundance estimation, and also understanding whether changes in distribution are the result of changing environmental conditions or changing behaviours.
 - Continue work towards understanding population structure.
 - Continue work towards methods that integrate the different data streams into single assessments.
- Fishery Dependent Data and Bycatch Estimation:
 - When changes in bycatch monitoring occur (e.g. a shift to electronic monitoring), it will be important to continue the older program for a few years in order that calibration of the two methods can occur.
 - Observer coverage provides the opportunity to collect biological samples for protected species. If electronic monitoring is put in place, a means to continue to collect these samples should be established.

- Continue work towards developing reference points or other metrics for interpreting the effects of bycatch for species for which methods are not developed.
- **Passive Acoustics & Acoustic Telemetry**
 - Particularly as the passive acoustic program transitions from the research/development stage to the operational stage, securing long-term funding for its operation will become increasingly important.
 - As recommended in the presentation:
 - Continue to pursue real-time monitoring efforts, implementation of broad sensing networks, studies of ocean noise impacts, and integration of acoustics and visual survey data.
 - Reduce excessive reliance on temporary and external funding for all parts of this program.
 - The datasets produced using passive acoustics can be very large. The development of methods to simplify data sharing and ensuring data are publically available will likely require separate funding given the challenges associated with the size of the datasets. Having routine methods will be increasing important as the program transitions to the operational stage.
 - Continue working on integration passive acoustics and other methods of monitoring for marine mammals.
 - With respect to acoustic telemetry, continue to use platforms of opportunity for installing receivers to collect basic distribution information for several poorly studied fish species, but work towards using the resulting information to design surveys that will be less biased by receiver locations. As a recommendation, this is easier to say than to do, particularly when several species are involved, and it pushes the limits of what can practically be done with current technology.

Theme 3: North Atlantic Right Whales and Other Large Whales

Presentations:

Right whale research
 Aerial Surveys and Analyses of Serious Injuries and Mortalities
 Vessel Based Right Whale Research
 North Atlantic Right Whale Passive Acoustic Research Program
 Right whale population assessments at NEFSC
 Southeast Right Whale Research
 Summary and Conclusions

Observations:

The North Atlantic Right Whale (NARW) research program is one of the best funded research programs presented at this review. The species is managed under both the MMPA and the ESA. Science needs include: investigation of changing seasonal behavior and distribution; development of monitoring methods that account for these changes; estimation of cause-specific mortality; development of criteria for assigning country of origin to serious injuries including entanglement; and real-time monitoring of the species in areas of concern. With the increasing industrialization of US EEZ, keeping takes of large whales to appropriate levels is expected to be increasingly difficult.

Strengths:

- Monitoring occurs using several methods, including vessel-based surveys, passive acoustics and aerial surveys, resulting in very good long-term datasets

- The pedigree of many of the whales is known, which will afford the opportunity to examine things like variation in individual fitness as time passes and the database grows.
- The photo identification program affords the opportunity to study the ecology and behavior of the species at the individual level, an opportunity that does not exist for many species.
- Very broad multi-agency and multi-partner collaborations with good data sharing and sharing of sampling opportunities exist both within and outside of NOAA.
- The strong emphasis on assessing the effectiveness of management measures.
- Ship strikes in the NEUS appear to have been reduced via the use of real-time data and other measures to inform decisions about shipping lanes.
- The publication record is impressive.
- Serious injury guidelines appear well founded in science.
- Habitat-use models appear to be based on a strong dataset and appear to provide excellent guidance on shipping lanes.

Challenges:

- Despite an extensive monitoring program, there are aspects of their changing distribution that are not well understood, which creates difficulties for monitoring.
- A significant portion of the expected number of mortalities is not observed, which makes assigning causes of mortality difficult.
- As the distribution of NARW changes, maintaining existing monitoring and data collections while expanding into new areas is problematic.
- The need to provide substantial amounts of near real time monitoring data competes with the need to do research.
- Ensuring adequate resources for monitoring, assessment and research for other large whales.

Recommendations:

- I agree with most of the recommendations provided to the review panel, and think the following are particularly important:
 - Develop a means to estimate actual human-caused mortality.
 - Continue the calf biopsy program.
 - Work to maintain ability for SB work from NOAA ships.
 - Continue emphasis on contributions from offshore habitats.
 - Maintain support for: Photo-ID catalog, sightings database, aerial and vessel surveys, necropsy, calf biopsy.
 - With respect to the Southeast program: maintaining aerial survey efforts and integrating adaptive approaches to the surveys; employing multiple tools to evaluate habitat use and risks in mid-Atlantic waters, and integrating demographic data from SEUS surveys into assessment models, are all good recommendations.
- Particularly as the passive acoustic program transitions from the research/development stage to the operational stage, securing long-term funding for its operation will be important (it is not accidental that this recommendation appears twice).
- New tools are needed for monitoring the movements and distribution of NARW. Satellite tagging could be revisited, or could there possibly be a way to follow them via a combination of the gliders and passive acoustics?
- Although it may be difficult to assess whether vessel strikes have actually been reduced in the SEUS due to their low number, it could be informative to use the habitat model to test whether the probability of a vessel strike has been reduced by comparing the

- probabilities based on the vessel tracks before and after the recommendations on pathways came into effect.
- The very detailed information about individual right whales resulting from the biopsy and PhotoID provides the opportunity to take the mark-recapture analyses beyond the aggregated analyses being used to estimate abundance, to individual-based approaches that would be informative about the variation in reproductive rates, distribution, life history variation and behaviour that forms the basis for natural selection and resilience.
 - There are many methods available to monitor NARW and developing approaches for further integrating these methods would be expected to improve advice for the management of this species.

Theme 4: Seal Research

Presentations:

Seals: Assessment on a Shoestring

Observations:

Science needs for seals result from increasing abundance resulting in an increasing overlap with human activities; including: entanglement in fishing gear, growing ecotourism, and concerns about factors such as competition with fisheries and effects on water quality at beaches. Public perceptions about the species appear not well informed by science. Science needs include the estimation of abundance and population trends, assessment of bycatch rates, assessment of human-seal interactions, mixing between USA and Canada, deterrent methods, and strategies for education and outreach. The seal research program at NEFSC receives a low level of internal funding and has one partial FTE.

Strengths:

- A lot of research had been accomplished by the seal research program using combinations of external funding and collaborations. Research includes: bycatch monitoring and analysis; diet studies; grey seal and harbor seal abundance and seasonal monitoring surveys; and grey and harbor seal pup captures.

Challenges:

- The limited internal (NOAA) resources available to support seal research limits the ability to develop and implement a long-term research program to address basic information needs about trends in abundance and distribution, as well as their impacts on commercial and recreational fisheries, other human activities, and ecosystems. It also limits the potential for education and outreach.
- Because research lags behind public discourse, public perceptions are often not science-based.
- There is a limited understanding of the ecology of seals, and how human activities and natural processes influence their dynamics and abundance.

Recommendations:

- Continue to develop collaborative research initiatives including those with Canadian scientists, stakeholders, pinniped researchers elsewhere in the USA and other partners in the Northeast region.
- Develop and implement surveys with sufficient coverage and frequency to monitor changes in abundance and distribution for both harbor and gray seals.

- Implement studies targeted to address public concerns about seals. Increase outreach and education programs to better inform the public about seals.
- An increased number of staff dedicated to seal research within the NEFSC, secure long-term internal funding, and increased partnering are all likely to be necessary to address the science needs outlined in the presentations.

Theme 5: Atlantic Salmon

Presentations:

Salmon Listing, Conservation Science, and ESA Assessment
 International Salmon Assessment and Science Successes
 Partnerships in Salmon Ecosystem Science and Future Challenges

Observations:

The Atlantic Salmon program is world class. It provides program leadership ranging from the grass roots community group/NGO level to the highest international research and advisory processes occurring in the Atlantic Salmon world. The program has pioneered the use of some technologies for monitoring Atlantic Salmon, resulting in methods that are now used regularly elsewhere and are considered well-established. Major successes include research on marine survival, including partitioning mortality in time and space and identifying plausible causal mechanisms; research on the impacts of dams, including quantifying the impacts to salmon restoration and quantitative support for management; and using an ecosystem approach to salmon recovery science, in which holistic approaches to salmon recovery that include other diadromous species are being tested and facilitated. Overall, the program and staff have clearly advanced our knowledge of salmon ecology and the effects of the threats to their persistence.

Strengths:

- Dedicated internal funds; very dedicated and energetic FTE and contractors
- Strong working relationship with GARFO
- Synergy resulting from multiple partnerships, as well as international collaborations.
- Salmon are a very well-studied species resulting in well-defined research questions
- Methods for abundance monitoring for returning adults, smolts and juveniles are well established and generally produce precise abundance estimates.
- Data time series spanning several decades (as a result of ongoing efforts by the salmon program staff) are available for addressing research questions.

Challenges:

- High reliance on partnerships to deliver core mandate, which can be both a strength and a challenge, given the time and energy required to maintain the partnerships, as well as the limiting effects that partnering may have on research direction, implementation and resulting conclusions.
- Expertise gaps, including:
 - Conservation genetics, which is a very important area of expertise given the role of captive rearing in preventing the extinction of the GOM Atlantic salmon ESU,
 - Quantitative analysis with an emphasis on population dynamics.
- Separating abundance and survival for wild and hatchery fish is difficult and makes analysing population dynamics difficult.
- A need for analyses and models which fully integrate the multiple data sets being collected for these populations. These would allow much more complete evaluation of

progress towards affecting recovery, and would also help identify points in the life cycle where recovery actions would be expected to reduce extinction risk.

- Research programs currently do an excellent job of characterizing the effects of the various threats to Atlantic salmon, but programs that evaluate the effects of recovery actions focused on alleviating these threats appear limited.

Recommendations:

- The salmon program, (as well as the programs for sturgeons) would strongly benefit from a quantitative ecologist to address the challenges outlined above. Addressing the need via short term contracts or assignments may be problematic given that the expertise required only arises from multi-year involvement with the program and ongoing analyses of the many datasets that exist in this program.
- Continue the 3-pronged approach to threats and management needs based on at-sea survival, the impacts of dams, and an ecosystem approach to salmon recovery.
- Add a fourth approach associated with freshwater productivity, habitat and habitat recovery initiatives, using analyses of the egg deposition, electrofishing and smolt datasets, and work to include carrying capacity in the life cycle model. This fourth component would allow the life cycle to be fully closed, and would allow the sufficiency of existing recovery initiatives to be evaluated in the context of how they are reducing extinction risk.
- Implement experimental approaches in which goal-oriented recovery actions are initiated, their effectiveness in achieving those goals is evaluated, and results are interpreted in the context of how extinction risk is changed. Examples include methods of reducing / mitigating high mortality in estuaries, and how dam removal alters the overall productivity of freshwater environments.

These last two recommendations likely require the additional expertise of quantitative analyst.

Theme 6: Other Protected Fish

Presentations:

An Overview of Other Protected Fish and Science Challenges

Observations:

There are both listed species (Atlantic Sturgeon and Shortnose Sturgeon) and several Species of Concern for which scientific advice is either required or would be beneficial. As presented, the science needs for the sturgeons include: population estimates by river (essential), evaluation of the impact of dams, fisheries, and other anthropogenic influences (essential), PVA (essential), increased fisheries sampling to better assign bycatch to each DPS (high), projections of future distributions under changing environmental conditions (high), identification of important marine areas/migratory routes (high), and improved understanding of stock structure (high). There is no directed research for these species occurring at NEFSC; although GARFO does provide monetary support and NEFSC does provide technical assistance for sturgeon research to other organizations.

Strengths:

- The strengths for this component of the program provided for review do not really appear to be strengths, but rather descriptions of how the program is currently being delivered, given the challenges.
- A key strength is the ability of staff to carry out some research via partnerships and via integration into other program components (e.g. acoustic tracking work to better

understand distribution is accomplished by using the same monitoring platforms for several species).

Challenges:

- The presentations by NEFSC staff clearly outlined the challenges associated with this program component, as well as emerging issues such as the need for transboundary management for Atlantic Sturgeon and a five-year review for Shortnose Sturgeon.
- Although the ability to develop strong partnerships to address science requirements is a strength, it is also a challenge because of the time required to maintain the partnerships and the need to incorporate the partner's research requirements into the larger program.
- If the expertise is not developed within the SC, then there is a risk of loss of continuity in program direction with changes in external partners as well as changes in their research interests.
- Managing the collection, maintenance and distribution of long-term datasets is an example of one of the challenges that arises when the science program responsibilities are met via external partnering.
- PVA requirements for Shortnose Surgeon and Atlantic Sturgeon are not just a capacity issue, but also a data issue.

Recommendations:

- Staff whose primary responsibilities are dedicated to these species appears necessary to fulfill the science requirements for these species.
- With respect to the sturgeons, long-term monitoring programs that include population-specific abundance and distribution components, as well as basic life-history information, will need to be developed in order to meet the science requirements identified for these species.
- Staff and funding allocations will need to keep pace with the increased number of species for which ESA petitions are being developed.
- If staff and funding are dedicated to these species, some re-organization may be necessary to group individuals together who are working on species with overlaps in sampling platforms, or threats.