

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.