

**Report of the
Atlantic Marine Assessment Program for Protected Species (AMAPPS)
Workshop: Looking Forward to 2015-2019**

Science Center on NOAA Campus
1301 East-West Hwy, Silver Spring, MD

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Executive Summary

The Northeast and Southeast Fisheries Science Centers of the National Oceanic and Atmospheric Administration (NOAA) National Marine Fisheries Service (NMFS), in collaboration with the Bureau of Ocean Energy Management (BOEM), US Navy, and US Fish and Wildlife Service (USFWS), convened a workshop focused on the Atlantic Marine Assessment Program for Protected Species (AMAPPS). The workshop took place on 06 August 2014 at the Science Center on the NOAA campus at 1301 East-West Hwy, Silver Spring, MD from 9 am – 5 pm. The workshop convened 49 participants from 12 U.S. federal agencies and one foreign agency.

The workshop goals were to review shared objectives for AMAPPS research across this wide array of federal agencies and to explore opportunities to better target research and products to meet the needs of existing and prospective federal partners with an interest in Atlantic protected species. Presentations and discussions at the workshop were intended to inform development of research plans for future AMAPPS efforts and to provide an opportunity to initiate or expand collaboration and coordination efforts.

The work conducted under AMAPPS during 2010 – 2014 was presented. This can broadly be divided into four categories: monitoring density and abundance, defining bias corrections to the density estimates, developing a database, and conducting integration/analyses. Most of the projects were collaborative and funded by a number of organizations.

Federal partners presented their interests and priorities for Atlantic protected species research and also listed relevant ongoing research that they were conducting or funding. This indicated that all participating agencies were engaged in activities that required scientific information on protected species that could be provided through AMAPPS research, though some would require modification or expansion of current AMAPPS research efforts. The types of needed information covered a diverse suite of research topics (e.g., density/abundance, distribution, stock structure, life history, behavior, habitat use, environmental drivers, impact assessment, etc.) and methods or tools (e.g., visual and acoustic surveys, animal telemetry, process studies, spatial modeling, etc.). When looking across all agencies, AMAPPS type research was desired across all seasons, all protected species taxa (i.e., for this workshop - marine mammals, sea turtles, and seabirds), and throughout the U.S. Atlantic EEZ (and in some cases beyond). Although this information provided by participants was not immediately helpful in setting priorities among research topics, it clearly indicated a need for AMAPPS research across a broad suite of federal agencies.

To facilitate discussion, AMAPPS scientists provided suggestions of potential modifications or additional research projects for 2015 – 2019 AMAPPS research. Discussions indicated interest among the participating agencies across all potential research activities, taxa, seasons, and geographic regions. Participants recognized the value of all project components. Although the discussion was deliberately informal and not designed to reach consensus or specific recommendations, some common themes and specific comments were detailed. In many cases, there were differences of opinion among agencies on the importance of particular research activities, taxa, etc. Further, in some cases, aspects were identified as important but were considered to fall outside the scope of AMAPPS, while other agencies considered those aspects to be central to AMAPPS. Rather than focus on those differences of opinion, the summaries in this report are intended to provide the essence of the discussion.

These discussions will be considered when developing future AMAPPS research projects to better target research and products that meet the needs of existing and prospective federal partners with an interest in Atlantic protected species.

Introduction

The Northeast and Southeast Fisheries Science Centers of the National Oceanic and Atmospheric Administration (NOAA) National Marine Fisheries Service (NMFS), in collaboration with the Bureau of Ocean Energy Management (BOEM), US Navy, and US Fish and Wildlife Service (USFWS), convened a workshop focused on the Atlantic Marine Assessment Program for Protected Species (AMAPPS). AMAPPS is a comprehensive multi-agency research program that aims to assess the abundance, distribution, ecology, and behavior of marine mammals, sea turtles, and seabirds throughout the US Atlantic and to place them in an ecosystem context, providing spatially explicit information in a format that can be used when making marine resource management decisions (<http://www.nefsc.noaa.gov/psb/AMAPPS/>).

The workshop took place on 06 August 2014 at the Science Center on the NOAA campus at 1301 East-West Hwy, Silver Spring, MD from 9 am – 5 pm. The workshop convened 49 participants from 12 U.S. federal agencies and one foreign agency (Appendix 1). The workshop goals were to review shared objectives for AMAPPS research across this wide array of federal agencies and to explore opportunities to better target research and products to meet the needs of existing and prospective federal partners with an interest in Atlantic protected species. Presentations and discussions at the workshop were intended to inform development of research plans for future AMAPPS efforts and to provide an opportunity to initiate or expand collaboration and coordination efforts.

To achieve these goals, the agenda (Appendix 2) included presentations from AMAPPS scientists on progress to date and suggestions for additions or modifications to the AMAPPS research portfolio, presentations from federal partners on their interests and priorities for AMAPPS-related research and any additional research funded by those partners, and a presentation on monitoring renewable energy development sites from the United Kingdom/European Union (UK/EU) prospective. Those presentations were followed by a priorities survey exercise that provided additional information for discussion of research interests and priorities across the suite of participating agencies. The workshop ended with a brief discussion of coordination and collaboration opportunities.

Abbreviations and acronyms used in this report are listed in Appendix 3.

Synopses of Workshop Presentations

1. Overview of AMAPPS I

An overview of the research projects and expected products that will result from the first five years (2010-2014) of the AMAPPS initiative (AMAPPS I) was presented to the workshop. The AMAPPS objectives are provided in Appendix 4. Detailed information on the NMFS data collection and analysis projects can be found in the annual reports located on the internet at <http://www.nefsc.noaa.gov/read/protsp/mainpage/AMAPPS/>.

Work conducted under AMAPPS I (Table 1) can broadly be divided into four categories: monitoring density and abundance, defining bias corrections to the density estimates, developing databases, and conducting integration/analyses. Nearly all of the projects were collaborative and funded by a number of organizations. Note some of these projects are ongoing and will continue after 2014.

Table 1 Summary of work conducted under AMAPPS I (2010 – 2014)

<p>Monitoring density and abundance</p> <ol style="list-style-type: none"> 1. USFWS aerial surveys targeting seabirds conducted 9 coastwise surveys and covered about 89,500 km of track line 2. NMFS surveys targeting marine mammals, sea turtles and seabirds conducted 5 coastwise aerial surveys, 2 coastwise shipboard surveys and 3 additional regional surveys, covering about 103,300 km of track lines. 3. Harbor seal abundance survey photographed and tagged animals 4. Two gray seal distribution and habitat usage surveys, also collected biological samples 5. Satellite-tagged Razorbills to monitor at-sea usage, movement patterns and migration paths 6. Deployed 15 bottom-mounted passive acoustic recorders to monitor baleen whales along the shelf break in 2013 and 2014. 7. Examined North Atlantic right whale migratory corridors using archived passive acoustic data 8. Deployed towed arrays during NMFS shipboard surveys to investigate deep diving whales and various dolphin whistles 9. During NMFS shipboard surveys also collected habitat and trophic biological data using EK60 echosounder, bongo nets, visual plankton recorders, MOCNESS nets, Isaac-Kidd midwater trawls, beam trawls and bottom grabs, and physical water column data using XBTs and CTDs 10. Collected dynamic satellite-based data (SST and chlorophyll) and dynamic model-based data (mixed layer depth, water temperature and salinity at depth)
<p>Bias corrections to the density estimates</p> <ol style="list-style-type: none"> 1. Used 2 independent team methods during NMFS shipboard and aerial surveys to account for perception bias 2. Conducted USFWS detection study to quantify detection, availability bias, counting errors and misidentifications 3. Tagged about 120 loggerhead turtles with satellite tags to correct for availability bias 4. Tagged 29 harbor seals to correct for availability bias 5. Collected blood and other samples from tagged loggerhead turtles, gray and harbor seals 6. Used skeletochronology and stable isotopes to determine the length of time juvenile loggerhead turtles spend outside the area being surveyed for abundance 7. Used DTAG data collected by other researchers in all oceans to correct for availability bias 8. Developed analytical methods to account for highly aggregated bird flocks detected in surveys 9. Developed analytical methods to account for the bird flocks not identified to species
<p>Database development</p> <ol style="list-style-type: none"> 1. Developed Oracle database for shipboard and aerial NMFS sightings and effort data, loggerhead turtle and seal satellite data, along with biopsy and photograph metadata, archived environmental data pulled from satellite and ocean model online databases 2. Developed database capabilities to easily plot track lines and sightings 3. Developed database capabilities to export data in formats needed for analysis methods 4. Used database of sightings data and photographs to develop a field guide of cetaceans and to develop a species identification guide of sea turtles 5. Added seabird sightings and effort data to the USGS marine bird compendium database 6. Developed a database to archive metadata associated with passive acoustic data collection and analyses

Integration and analyses of data

1. Integrated the abundance data with bias correction data to derive more accurate density/abundance estimates
2. Developed Bayesian hierarchical framework for spatially-explicit density models and maps
3. Developed generalized additive and linear model framework for spatially-explicit density models and maps
4. Developed loggerhead turtle spatially-explicit percent time at the surface model to account for availability bias
5. Developed methods to integrate passive acoustic and visual data to improve abundance estimates
6. Developed nonlinear methods to describe relationships between cetacean and lower trophic level distributions

2. The EU/UK perspective

Mark Tasker, from the Joint Nature Conservation Committee (JNCC), was invited to the workshop to share lessons learned on monitoring renewable energy development sites from the United Kingdom/European Union (UK/EU) perspective. A summary of his presentation follows. Currently the UK is developing renewable energy sites mostly on the east side of the UK because the locations proposed on the west side have been infeasible. Three types of information are needed to develop and monitor their renewable sites: (1) background general information on the species populations found in the general vicinity of the proposed site; (2) local information on what the animals are doing and why they are there; and (3) knowledge of the effects of human activities on these species. Though this sounds easy and logical, background data are comparatively rare and often incomplete when available. Local information is often difficult to interpret without the background and wider context. In addition, cumulative effects of humans are difficult to assess and human effects are often difficult to separate from effects due to natural variability.

Some suggestions to attempt to address these difficulties include: attempt to understand the mechanisms that cause changes; focus monitoring on variables that are measurable and thought to be sensitive enough to show significant changes (if there are any); incorporate power analyses and sensitivity analyses to define the variables to be monitored; monitor and regulate for sensitive species; where impacts are uncertain, carry out more detailed studies to understand the cause of the uncertainty; and employ adaptive management in an attempt to take care of unforeseen future issues.

Studies in the Moray Firth offshore renewable proposed site provide examples of these suggestions. Individual-based photo-ID research is being conducted at harbor seal haul-out sites in the Moray Firth to study the seal's reproduction, survivorship patterns and abundance trends. Year-round passive acoustic monitoring and individual-based photo-ID studies are being done on bottlenose dolphins to define spatial/temporal occupancy patterns and abundance trends. In contrast, it is known that harbor porpoises and minke whales also use this proposed site, but there is currently not enough known about individuals or local populations, so there is insufficient power to reliably detect changes due to future human activities, if they do occur.

Another example is the Disturbance Effects on the Harbour Porpoise in the North Sea (DEPONS) project (<http://depons.au.dk/>). Since it was documented that harbor porpoises move away from wind-farm pile-driving but then returned after construction was complete, the DEPONS project was initiated to further investigate this behavior. The objective is to gain new insights into harbor porpoise responses to underwater piling noise, as well as their

small and large-scale general movements. This information will be fed into a model which will provide an evidence-based framework for the assessment of wind farm underwater noise impacts. Information going into the model includes: harbor porpoise response to noise, prey distribution, movement patterns, population density patterns, and harbor porpoise dispersal patterns when they are triggered by environmental cues.

3. Interests and priorities

Federal partners presented their interests and priorities for Atlantic protected species research and also listed any relevant ongoing research that they were conducting or funding. To assist in identifying priorities, each agency was asked to complete a questionnaire before the workshop and then use their response to inform their presentation of research interests and priorities and additional funded research. The presentations and questionnaire responses are summarized together in Appendix 5.

The questions asked were:

1. What Atlantic activities do you expect your agency to be engaged in, either directly or through activities that your agency regulates, in the next five years that will require scientific information on marine mammals, turtles, and/or seabirds?
2. What types of information will be needed and what are their priorities? Specify the seasonal scope (when?), taxonomic scope (which species, species groups or stocks?), and geographic scope (where?)
3. What research or monitoring activities does your agency fund or carry out in the Atlantic on marine mammals, turtles, and/or seabirds?
4. What new/alternative research or monitoring activities/techniques is your agency interested in employing in the Atlantic for use on marine mammals, turtles, and/or seabirds?

Survey responses and presentations indicated that all participating agencies were engaged in activities that required scientific information on protected species that could be provided through AMAPPS research, though some would require modification or expansion of current AMAPPS research efforts. The types of needed information covered a diverse suite of research topics (e.g., density/abundance, distribution, stock structure, life history, behavior, habitat use, environmental drivers, impact assessment, etc.) and methods or tools (e.g., visual and acoustic surveys, animal telemetry, process studies, spatial modeling, etc.). When looking across all agencies, AMAPPS research was desired across all seasons, all protected species taxa (i.e., for this workshop - marine mammals, sea turtles, and seabirds), and throughout the U.S. Atlantic EEZ (and, in some cases, beyond). Although this information provided by participants was not immediately helpful in setting priorities among research topics, it clearly indicated a need for AMAPPS research across a broad suite of federal agencies.

Survey responses and presented information associated with ongoing Atlantic protected species research and novel research activities and tools were very useful in setting the stage for potential future collaborations.

4. Potential modifications or enhancements to AMAPPS

To facilitate discussion, AMAPPS scientists provided suggestions of potential modifications or additional research projects for AMAPPS, organized by the list of AMAPPS objectives identified in the current BOEM-NMFS interagency agreement (Table 2).

Table 2 Summary of potential projects that could be undertaken in AMAPPS during 2015 – 2019, organized by the objectives of AMAPPS

<p>Objective 1: collect broad-scale data over multiple years on the seasonal distribution and abundance of marine mammals (cetaceans and pinnipeds), marine turtles, and seabirds using direct aerial and shipboard surveys of U.S. Atlantic Ocean waters</p> <ol style="list-style-type: none"> 1. Broad-scale aerial surveys similar to those conducted in the first AMAPPS, focusing on non-summer months and covering the entire coast at least twice before 2018 2. Assess effects of increasing USFWS seabird aerial surveys coverage to deeper waters in the Gulf of Maine to capture other bird species and more complete range of other species 3. Broad-scale shipboard surveys in summer similar to those conducted in the first AMPPS with the goal to estimate population abundance in offshore waters, including visual sightings, passive acoustics, prey sampling, biopsies, photo-ids, physical and biological sampling 4. During fall/winter conduct similar survey to #3 above 5. Broad-scale harbor seal abundance survey once before 2018 including photographic and tagging efforts
<p>Objective 2: collect distribution and abundance data at finer scales at several sites of particular interest to BOEM, NOAA, and their partners using visual and acoustic survey techniques</p> <ol style="list-style-type: none"> 1. During aerial and shipboard surveys continue with fine-scale track lines in areas of interest 2. Monitor harbor and gray seal seals at major pupping colonies in appropriate months 3. Conduct monthly flights over seal haul out sites to obtain an index of abundance 4. Monitor using passive acoustics year round, including lines of recorders along the continental shelf to evaluate coastal baleen whale migratory movements, and including dispersed sites along the shelf break to monitor seasonal presence of all cetaceans in those areas 5. In select fine-scale areas, simultaneously survey via visual and passive acoustic surveys, tag animals, and photograph and biopsy target species to address data gaps for specific species
<p>Objective 3: conduct tagging studies of protected species to develop corrections for availability bias in the abundance survey data and to investigate behavior and ecology of species in areas of interest</p> <ol style="list-style-type: none"> 1. Utilize previously collected telemetry data from all oceans to define dive and surface patterns to be used for availability bias corrections 2. Deploy DTAGs and LIMPET tags on fin, sei and beaked whales and coastal bottlenose dolphins 3. Deploy satellite transmitters on adult brown pelicans and royal terns in South Atlantic Planning Area, greater shearwaters in the Gulf of Maine, and Black-capped petrels in mid-Atlantic 4. Deploy satellite tags on leatherback and loggerhead turtles in New England and Florida waters 5. Deploy TDRs and animal-borne cameras on leatherback and loggerhead turtles 6. Deploy satellite, cell phone GPS, and sonic tags on gray and harbor seals
<p>Objective 4: collect additional data on life-history and ecology, including habitat use, residence time, frequency of use, and behavior</p> <ol style="list-style-type: none"> 1. In conjunction with tagging and visual sightings efforts, sample the physical and biological habitat using mid-water trawls, EK60 echosounders, bongo nets, visual plankton recorders, and CTD casts 2. Combine above data with satellite-derived data (SST and chlorophyll), ocean model-derived data (salinity at depth), and wind and current data 3. Use ROVs and AUVs to collect in-situ observations of tagged turtles and to collect in-situ physical habitat characteristics

4. Collect biological samples at same time as tagging any species of animals to assess body conditions

Objective 5: identify currently used, viable technologies and explore alternative platforms and technologies to improve population assessment studies, if necessary

1. Conduct seabird detection rate experiments to quantify detection function and availability bias and to understand counting errors and misidentification
2. Explore crowd-sourcing to interpret the massive digital imagery from photographic aerial surveys
2. Use unmanned aircraft systems with real-time transmissions to: detect potential animals to be tagged; launch from abundance survey ship to identify species of distance groups; and launch from land to monitor seal haul out sites
3. Compare counts of animals from manned aerial surveys to those collected from hi-definition manned aerial surveys and from photographic unmanned aircraft systems
4. Use hi-definition cameras to measure sizes of turtles detected during aerial surveys and to confirm identification of animals detected during regular aerial surveys

Objective 6: assess the population size of surveyed species at regional scales; and develop models and associated tools to translate these survey data into seasonal, spatially explicit density estimates incorporating habitat characteristics

1. Estimate population abundances using summer aerial and shipboard data
2. Add additional sightings and environmental data to refine current seasonal, spatially-explicit density maps
3. Develop new analytical models to estimate spatially-explicit density maps
4. Develop methods to incorporate bycatch and other types of data into spatially-explicit density maps
5. Develop methods to incorporate passive acoustic data with visual data to refine abundance estimates
6. Develop strategies to combine results from various density models
7. Investigate distribution changes and trends in abundance
8. Compare model performance of various modeling techniques used to develop spatially-explicit density maps
9. Develop *a priori* models relating seabird occurrence/abundance with ecological covariates

Discussions of research interests across agencies

These discussions considered each agency's interests and priorities and the potential modification and enhancements presented earlier, with the goal of identifying shared interests and collaboration opportunities. To facilitate discussions, a short priorities survey was distributed and completed by participants prior to the lunch break (Appendix 6). Survey results were synthesized and displayed graphically to facilitate discussion. Survey results are not presented here, because the survey and discussion were both deliberately informal to allow for a free exchange of ideas. The survey and discussion were not intended to develop consensus recommendations nor to establish specific agency priorities, rather they were intended to gain a sense of the breadth (across agencies) and depth of interest in various research activities, taxa, seasons, geographic regions (inshore versus offshore, and latitudinal regions) and project components – with the goal of using those insights to inform planning for future AMAPPS efforts and to foster recognition among agencies of their shared interests, hopefully promoting future collaborations.

In summary, as was apparent in the agency-specific presentations, the discussion indicated very deep and broad interest among the participating agencies across all research activities, taxa, seasons, and geographic regions. Participants recognized the value of all project components. Although the discussion was deliberately informal and not designed to reach consensus or specific recommendations, some common themes and specific comments are summarized below. In many cases, there were differences of opinion among agencies on the importance of particular research activities, taxa, etc. Further, in some cases, aspects were identified as important, but were considered by some agencies to fall outside the scope of AMAPPS, while other agencies might consider those aspects to be central to AMAPPS. Rather than focus on those differences of opinion, the summaries below are intended to provide the essence of the discussion. They are not intended to comprehensively capture all comments, nor should they be considered to represent the formal position of any agency or suite of agencies. The summary below was structured to follow the general heading of the survey.

1. Research activities

For the survey and discussion, research activities were broadly categorized as abundance and distribution, passive acoustic monitoring, tagging, habitat studies, and process/behavioral studies.

Abundance/distribution – Several agencies expressed interest in AMAPPS continuing to provide broad scale abundance and distribution data using a variety of platforms (such as ships, planes, and passive acoustics). Some of the reasons for this included: NMFS has the resources (particularly the planes and ships) and capabilities to conduct broad-scale, off-shore surveys; many of the species of interest undertake long-distance migrations and conducting broad-scale surveys is one way to capture as much of the habitat as is feasible; and continuing the time series is important for achieving the shared goals of monitoring, documenting trends and trying to determine reasons for changes in distribution and abundance (such as climate change or increased human activity).

Passive acoustic monitoring – Passive acoustic monitoring can be conducted via many platforms, including moorings and towed arrays. Both of these were identified by several agencies as methods to collect priority data. It was recognized that moorings can provide year round information about presence of some species at the locations of the moorings, they can help define migratory paths of some species, they can provide real-time data (or close to it), and they also can monitor human-induced changes to ambient sound levels. In particular, USCG noted that moorings could provide near-real-time data that could help with enforcement. It was noted that there are already some data from the continental shelf (though not enough), but there are very few data from deeper offshore waters. It was also recognized that information collected from towed arrays can be used to develop acoustic abundance estimates, which could improve the visual abundance estimates of long diving species.

Tagging and tracking – Tagging and tracking animals provide important information, such as: a) defining vocalization signatures which are needed to interpret passive acoustic monitoring data; b) defining dive time patterns which are needed to improve abundance estimates of long diving species when using visual sightings; and c) defining long term movements and small scale patterns of how animals utilize their habitat. Participants noted that there were opportunities for AMAPPS researchers to collaborate and coordinate with other researchers already collecting tagging and tracking data on various species.

Habitat studies – Habitat studies are recognized as useful and important to help explain species distribution patterns and variability in these patterns. Participants discussed the costs

and benefits of habitat studies and collection of habitat data, and noted opportunities to collaborate with other researchers to best utilize what habitat data are already available and what can be collected in the future.

Process/behavioral studies – Process/behavior studies can use information from the above types of studies (abundance/distribution, tagging, habitat and passive acoustic) but the emphasis of a process/behavioral study is generally on a smaller spatial scale and/or on an individual animal level. It was recognized that process studies are important to understand residence times, persistence of site use, breeding and foraging patterns, etc., and these types of information are important to several agencies. It was also noted that for some species there are other behavioral monitoring programs already collecting this type of data, again pointing to collaboration opportunities.

2. Products

For the survey and discussion, examples of possible products included: interactive maps with estimated animal density; total abundance estimates for populations or stocks; life history, behavior, and ecology; and monitoring and mitigation tools (e.g., design of before-after-control-impact studies, spatial management tools, mitigation approaches).

Agencies indicated interest in a variety of products. With respect specifically to interactive maps, participants noted ongoing efforts by other projects to display similar map products (e.g., OBIS-SEAMAP (<http://seamap.env.duke.edu/>), NOAA's CetSound Project (<http://cetsound.noaa.gov/>), Marine Cadastre Initiative (<http://www.marinecadastre.gov/>), and Northeast Regional Ocean Council data portal (<http://northeastoceancouncil.org/>), again pointing out opportunities for collaboration and information sharing.

In regards to other products, agency interests varied, with recognition that the various products were important for all species, but agencies differed in the degree to which these products should be prioritized (or not) among species or product types, etc.

Several agencies recommended that for all data collected under AMAPPS, both the raw clean data and finished products be made available to the public in a timely manner.

3. Taxa

For the survey and discussion, taxa were broadly divided into seabirds, turtles, large whales (baleen and sperm whales), beaked whales, small cetaceans (dolphins and porpoises) and seals. It was recognized that some types of information are needed for all of these taxa, and generally speaking, each taxonomic group was deemed important to one or more agencies. Some agencies indicated taxa of particular concern for their agency, often pointing to endangered and listed species under the ESA or MMPA, species with high levels of interactions with humans, and/or species with major data gaps.

4. Seasons

It was noted that there was a reason for each season to be a priority for data collection for at least some taxa, based on either the biology of the species (e.g., seasons when species are particularly vulnerable, such as pupping or calving season) or seasons when interactions with agency or agency-regulated activities are most likely. It was noted that there was a data gap in the abundance/density data for non-summer months, because of the lack of previous surveys in non-summer months, and therefore agencies expressed interest in fall to spring data collection projects. It was also noted that many anthropogenic activities occur year-round (such as Navy and fishing activities), so all seasons would need to be monitored at least to some degree to support decision making for these types of activities.

5. Region: inshore versus offshore

For the survey and discussion, inshore was defined as waters outside of the coastal bays and inlets and shallower than about 100 m depth contour, which is about 50 miles offshore. For some agencies, inshore waters had been higher priority in the past, because that is where most of the interactions with human activities occur. However, it was noted that the offshore region is also of importance because of expanding human activities, including Navy exercises, fishing, and possible future oil and gas exploration, and because many of the species that inhabit inshore waters also reside offshore, so to get appropriate abundance estimates and develop more complete understanding of their ecology and habitat use, both the inshore and offshore waters need to be studied.

6. Region: north versus south along the coast

For the survey and discussion, the Atlantic coast was divided into four sections: Gulf of Maine to Cape Cod, MA, including Georges Bank; Cape Cod, MA to Cape Hatteras, NC; Cape Hatteras, NC to Georgia; and Florida. It was noted that all areas were of some importance to at least one agency, in many cases based on where anticipated human activities would be occurring, but in some cases due to the location of specific taxa. Many species range across several or all of these regions, thus coast-wide studies are required to get appropriate abundance estimates and ecological understanding.

7. Project components

For the survey and discussion, a project was divided into components, and workshop members were asked which components were of higher priority for AMAPPS research. The project components included: planning, project management and data management; method development; collection of new data; analysis; coordination with related external research projects; and presentation of products (including the web interface).

All components were recognized as being necessary for AMAPPS research, and it was suggested that none of the components be ignored. It was noted that the costs of the components differ substantially, which made it more difficult for agencies to provide advice regarding prioritizing among components. The limited feedback that was provided was inconsistent among agencies, though all agencies generally agreed that timely data and product delivery was important.

8. Coordination efforts

The stage for a discussion on this topic was set by noting that along the Atlantic coast a wide variety of federal, state and academic organizations are engaged in protected species research that is relevant to AMAPPS. Though many researchers are aware of each other's work, it is challenging to coordinate all of these projects. Coordination is relevant to data collection, data sharing, collaborative analyses, and interpreting/integrating results from all of the individual studies. Some approaches to improving coordination could include hiring a dedicated coordinator and holding workshops.

It was recognized that coordination is essential and is happening at various levels, though it was suggested that more coordination needs to occur, particularly when it comes to sharing data and conducting collaborative analyses.

Appendix 1

List of workshop participants, their organizations and email addresses. Abbreviations of organizations spelled out in Appendix 3.

	Last Name	First Name	Organization	email address
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* Participated remotely via phone conference call.

Appendix 2

Agenda for AMAPPS II planning workshop

6 August 2014

Science Center (NOAA Campus)
1301 East-West Hwy, Silver Spring, MD
0900 – 1700

Objectives: Consider progress made in AMAPPS I, review shared objectives for continued AMAPPS II research, and explore opportunities to better target research and products to meet our needs and the needs of current and potential federal partners with an interest in Atlantic protected species.

Time	Topic	Presenter(s)
0900	Welcome, introductions	Simpkins
0910	I. Presentation/discussion of progress under AMAPPS I	Palka
0940	II. Presentation/discussion of monitoring of renewable energy development sites from the UK/EU perspective, with lessons learned and suggestions for areas of focus for the US	Tasker
1000	– BREAK –	
1015	III. Interests and priorities for Atlantic protected species research and any relevant ongoing research funded. Presentations from federal partners.	
	NMFS	LeBoeuf
	USFWS	Bortner
	BOEM and BSEE	Reeb/Davidson
	USN	Buonantony/DiMatteo/Kumar
	NASA (via phone)	Turner
	DOE	Brown-Saracino
	MMC	Cornish
	Coast Guard	Tucker
	NOS	Nelson
1215	Research priorities survey (quick survey of priorities by research type, species, region, etc. – provide context for afternoon discussion)	
1230	– LUNCH –	
1330	IV. Presentation regarding potential add-ons/modifications to AMAPPS (i.e., new research pursuits, technologies, etc.)	Palka/Jones
1400	V. Discussion of priorities across agencies and suggestions for refocusing or expanding AMAPPS efforts	All
1530	– BREAK –	
1545	Discussion continued. Mapping exercise – identify regions of particular interest and annotate with specific research needs and partnership opportunities	All
1630	VI. Coordination process – discuss how to build linkages to coordinate research/monitoring efforts and align modeling and other analyses	All
1700	Closing	

Appendix 3

List of Abbreviations and Acronyms

Abbreviation	Meaning	Abbreviation	Meaning
AFTT	Atlantic Fleet Training and Testing	MAIN	Marine Animal Identification Network
AIS	Automatic Identification System	Marine BONs	Marine Biodiversity Observation Networks
AMAPPS	Atlantic Marine Assessment Program for Protected Species	MARU	Marine Autonomous Recording Units
AMAR	Autonomous multichannel acoustic recorder	MMB	Navy's Marine mammals and Biology Program
AUV	Autonomous underwater vehicle	MMC	Marine Mammal Commission
BOEM	Bureau of Ocean Energy Management	MMPA	Marine Mammal Protection Act
BSEE	Bureau of Safety and Environmental Enforcement	MOCNESS	Multiple opening closing net environmental sensing system
C-POD	Click Porpoise Detector	NASA	National Aeronautics and Space Administration
CTD	Conductivity Temperature Depth profiler	NCCOS	NOS's National Centers for Coastal Ocean Science Program
DEPONS	Disturbance Effects on the Harbour Porpoise in the North Sea	NEPA	National Environmental Policy Act
DMA	Dynamic Management Areas	NMFS	National Marine Fisheries Service
DOE	Department of Energy	NOAA	National Oceanic and Atmospheric Administration
DTAG	Digital acoustic recording tags	NOPP	National Oceanographic Partnership Program
eDNA	environmental DNA	NOS	National Ocean Service
EEZ	exclusive economic zone	OBIS-SEAMAP	Ocean Biogeographic Information System Spatial Ecological Analysis of Megavertebrate Populations
EIS	environmental impact statement	ONR	Navy's Office of Naval Research
		ROV	remote operated vehicle

Abbreviation	Meaning	Abbreviation	Meaning
ESA	Endangered Species Act	SAR	Stock Assessment Report for marine mammals
ESP	BOEM's Environmental Studies Program	SEFSC	Southeast Fisheries Science Center
EU	European Union	SST	sea surface temperature
FWRI	Fish and Wildlife Research Institute	T-PODs	Timing Porpoise Detector
GIS	Geographic Information System	UK	United Kingdom
HARPs	High-Frequency Acoustic Recording Packages	UME	Unusual Mortality Event
JNCC	Joint Nature Conservation Committee	USCG	U.S. Coast Guard
LIMPET	Low Impact Minimally Percutaneous External-electronics Transmitter	USFWS	US Fish and Wildlife Service
LMR	Navy's Living Marine Resources Program	WWPTO	DOE's Wind and Water Power Technologies Office
		XBT	expendable bathythermographs

Appendix 4

Objectives Identified in BOEM-NOAA Interagency Agreements for AMAPPS I (2010-2015) and II (2014-2019)

Objectives of AMAPPS I

1. Collect broad-scale data over multiple years on the seasonal distribution and abundance of marine mammals (cetaceans and pinnipeds), marine turtles, and seabirds using direct aerial and shipboard surveys of coastal U.S. Atlantic Ocean waters
 2. Collect similar data at finer scales at several (~3) sites of particular interest to NOAA partners using visual and acoustic survey techniques
 3. Conduct tag telemetry studies within surveyed regions of marine turtles, pinnipeds and seabirds to develop corrections for availability bias in the abundance survey data and collect additional data on habitat use and life-history, residence time, and frequency of use
 4. Explore alternative platforms and technologies to improve population assessment studies
 5. Assess the population size of surveyed species at regional scales
 6. Develop models and associated tools to translate these survey data into seasonal, spatially-explicit density estimates incorporating habitat characteristics.
-

Objectives of AMAPPS II

1. Collect broad-scale data over multiple years on the seasonal distribution and abundance of marine mammals (cetaceans and pinnipeds), marine turtles, and seabirds using direct aerial and shipboard surveys of U.S. Atlantic Ocean waters;
2. Collect similar data at finer scales at several sites of particular interest to BOEM, NOAA, and their partners using visual and acoustic survey techniques;
3. Conduct telemetry studies of protected species to develop corrections for availability bias in the abundance survey data and to investigate behavior and ecology of species in areas of interest;
4. Collect additional data on life-history and ecology, including habitat use, residence time, frequency of use, and behavior;
5. Identify currently used, viable technologies and explore alternative platforms and technologies to improve population assessment studies, if necessary; and
6. Assess the population size of surveyed species at regional scales; and develop models and associated tools to translate these survey data into seasonal, spatially explicit density estimates incorporating habitat characteristics.

Appendix 5

Responses to pre-meeting questionnaire

Federal partners presented their interests and priorities for Atlantic protected species research and also listed any relevant ongoing research that they were conducting or funding. To assist in identifying priorities, each agency was asked to complete a questionnaire before the workshop and then use their response to inform their presentation of research interests and priorities and additional funded research. The presentations and questionnaire responses are summarized below, organized by question (Tables A5.1 – A5.8).

1. What Atlantic activities do you expect your agency to be engaged in, either directly or through activities that your agency regulates, in the next five years that will require scientific information on marine mammals, turtles, and/or seabirds?

NMFS: NMFS activities that require information on marine mammals, turtles and/or seabirds include: development of the Stock Assessment Reports (SARs); Endangered Species Act (ESA) section 7 consultations (Biological Opinions) for sea turtles, ESA whales and sturgeon; sea turtle recovery actions tracking; critical habitat designation (for species such as green turtles); monitoring and evaluating Take Reduction Plans for large whales, harbor porpoises, bottlenose dolphins and pilot whales; monitoring the ship speed reduction regulations to prevent vessel strikes of large whales; supplement regulations by implementing Dynamic Management Areas (DMAs) where aggregations of right whales are located; understand the potential impact of the mid-Atlantic Unusual Mortality Event (UME) on bottlenose dolphin populations; status reviews (for some turtle species other than loggerhead and green turtles); ESA 5-year reviews; ESA section 10 incidental take permits; ESA rulemaking (and National Environmental Policy Act (NEPA) documents); and for MMPA rule-making and/or identifying effective voluntary measures. In addition public outreach and education is enhanced and requires information on marine mammals, turtles and/or seabirds.

USFWS: The U.S. Fish and Wildlife Service (Service) oversees the implementation and enforcement of several laws that protect trust resources such as the Migratory Bird Treaty Act (MBTA), Bald and Golden Eagle Protection Act (Eagle Act), and the ESA. In addition, the Service works with federal agencies to implement Executive Order 13186: Responsibilities of Federal Agencies to Protect Migratory Birds (E.O. 13186). Due to these legal responsibilities, the Service has a conservation obligation to evaluate potential local, regional, and cumulative impacts to Species of Concern that may be adversely affected by various development activities. To assist proponents who intend to site, construct, operate, and maintain, offshore projects, the Service must provide information empowering these proponents and stakeholders to make informed planning and operation decisions and reduce impacts to trust resources using the offshore environment. The information needed to help make these decisions includes pre-construction baseline data on birds and their resources, including distributions, densities, seasonality of use, and behavior. Specifically, USFWS's Objectives over the next 5 years include:

Objective 1: collect broad-scale data over multiple years on the seasonal distribution and abundance of marine birds using direct aerial surveys of U.S. Atlantic Ocean waters and the Gulf of Maine.

Objective 2: Collect distribution and abundance data at finer scales at sites of particular interest with respect to MBTA and ESA regulatory responsibilities (e.g., WEA's, state wind leases, etc.).

Objective 3: conduct tagging studies of select species to investigate behavior and ecology of species in areas of interest to better understand and be able to make informed regulatory decisions.

Objective 4: collect additional data on life-history and ecology, including habitat use, residence time, frequency of use, and behavior

Objective 5: assess the population densities of surveyed species at appropriate geographic scales; and develop models and associated tools to translate these survey data into seasonal, spatially explicit density estimates tied to habitat characteristics

Objective 6: identify currently used, viable technologies and explore alternative platforms and technologies to improve population assessment studies, if necessary

BOEM: BOEM regulates offshore renewable energy (such as marine hydrokinetics and wind turbines) and geological and geophysical activities (such as seismic surveys for oil and gas, and mining for sand). These activities require permitting and appropriate environmental impact analyses under NEPA and ESA that require information on marine mammals, turtles and seabirds.

Currently Atlantic offshore wind projects consist of 14 Wind Energy Areas, lease areas, call areas and proposed lease areas. These are off the coasts of Maine, Massachusetts, Rhode Island, New York, New Jersey, Delaware, Maryland, Virginia, North Carolina and Florida within about 50 miles of the coastline.

A programmatic environmental impact statement was recently issued for possible Atlantic oil and gas, renewable, and marine minerals activities until 2020 (<http://www.boem.gov/Atlantic-G-G-PEIS/#ROD>). These activities are in the Mid-Atlantic and South Atlantic Planning Areas (off the coasts of Delaware to central Florida, from the coast to beyond the US 200 nautical mile exclusive economic zone (EEZ)).

Navy: The U.S. Navy requires scientific information on marine mammals and sea turtles, and seabirds to support their environmental compliance documentation (NEPA, MMPA, ESA, etc.) for their at-sea training and testing activities in the Atlantic and Gulf of Mexico. Specifically, data collected during the next five years would be used to support quantitative modeling of the effects of low-, medium-, and high-frequency sonar and explosive to be reported in the compliance documents, and to support in-water construction projects involving pile driving at our Navy installations.

NASA: NASA, NOAA, and BOEM are initiating two to three projects to develop demonstration Marine Biodiversity Observation Networks (Marine BONs) in the Atlantic, Pacific, and potentially Arctic Oceans. The Atlantic site will be based around the Florida Keys National Marine Sanctuary and will involve the integration of existing observations, ranging from satellite observations to DNA sampling, and fill data gaps with new observations.

DOE: The siting, permitting, and evaluation of the environmental impacts of ocean renewable energy technologies require data on protected species. Additionally, DOE funds work to examine the environmental impacts of these technologies and such impact assessments often require detailed understanding of species pre-construction site use patterns.

Specific data needs include baseline data on species distribution and abundance to inform siting decisions (year round), especially in less-researched migratory corridors and for North Atlantic right whales; data on behavior (e.g. habitat use, dive depths) to inform risk analyses (especially in areas suitable for wind energy development); data on behavior to inform monitoring methodologies (e.g. surfacing time and frequency, vocalization rates); and finally, predictive models of species distribution, abundance, and behavior.

The WWPTO prioritized regional and temporal scopes based on time to commercialization. Specifically, in the near term are: (1) offshore wind development in the Mid-Atlantic, South Atlantic, New England, Gulf of Mexico and US west coast; (2) tidal energy development New England, US west coast and Alaska; and (3) wave energy development off the US west coast, Alaska and Hawaii. On a longer term: (1) ocean current projects in Florida are expected to develop open-water testing presently; and (2) ocean thermal energy conversion projects could be developed in Hawaii and other Pacific Islands.

MMC: The Marine Mammal Commission, as an oversight agency, uses scientific information on marine mammals and associated habitats and prey species in all areas of the Atlantic to evaluate and provide recommendations on all federal agency actions that may affect those species and their habitats.

USCG: Information about the spatial distribution and likelihood of disturbing/encountering protected species helps USCG operational planning and tactics and helps to reduce potentials for adverse impacts. The USCG has a role regulating many activities that require scientific information to determine their degree of impact to protected species and their habitats, including commercial vessel traffic, ocean energy facilities, ocean aquaculture facilities, installation of moored monitoring moorings/instruments, and special events such as ocean races.

Since the USCG is the United States' principle resource for at-sea enforcement of laws and regulations, readily accessible, accurate/up-to-date information regarding seasonality and spatial distribution of protected species can inform decisions about allocation of enforcement effort to address potential interactions.

2. What types of information will be needed and their priority? Specify the seasonal scope (when?), taxonomic scope (which species, species groups or stocks?), and geographic scope (where?)

In general all agencies needed some type of spatial-temporal density and/or abundance and population size information (Tables A5.1 – A5.8). In addition, each type of data (biologically important areas, demographic, fine scale information, habitat use, movements, social behavior, stock structure, and trophic information) was indicated as a high priority need for at least one agency. The taxonomic scopes of interest included at least species of concern (for example, ESA species, species involved in MMPA Take Reduction Teams). All of the US Atlantic waters were included in the geographic scopes of interest, but the shelf waters, where there are more chances of protected species/human interactions, emerged as a priority for some (Tables A5.1 – A5.8).

Table A5.1 NMFS's needed data and priorities

Type(s) of information	Priority	Geographic scope	Seasonal scope	Taxonomic scope
Spatially and temporally explicit water column density estimates	High	Shelf waters. Higher priority is Massachusetts and southward	May-Nov (for waters north of NC). All seasons south of NC	Sea turtles, with loggerhead and leatherback as highest priority
Population estimates	High	Entire Atlantic wide	All seasons	Sea turtles, with loggerhead and leatherback as highest priority
Demographic and trophic data, incorporating physical oceanography (especially frontal boundaries)	High	US Atlantic	All seasons	Sea turtles, with loggerhead and leatherback as highest priority
Whale density estimates overlaid with fishing and other threats	High	US Atlantic	All seasons	Right and humpback whales in particular
Population abundance and trends	High	US Atlantic	All seasons	All marine mammals
Stock structure	High	US Atlantic	All seasons	All marine mammals
Spatially and temporally explicit water column density estimates or at least presence/absence	High	US Atlantic	All seasons	All marine mammals
Identify and quantify stressors and population level impacts (including acute and chronic noise)	High	US Atlantic	All seasons	All marine mammals
Identification and evaluation of avoidance, minimizations and mitigation measures	High	US Atlantic	All seasons	All marine mammals
Improve understanding of relationship between environmental factors and distribution/behavior	High	US Atlantic	All seasons	All marine mammals
Fine scale behavior, migratory movement and timing	High	In particular off NC for bottlenose dolphins and Mid-Atlantic Bight for pilot whales	All seasons for bottlenose dolphins and in particular fall/winter for pilot whales	Bottlenose dolphins and pilot whales in particular
Spatial and temporal patterns of mortality	High	US Atlantic	All seasons	MMPA strategic species involved in TRTs
Determine if NC is a sperm whale calving area	High	North Carolina	All seasons	Sperm whales

Table A5.2 USFWS’s needed data and priorities

Type(s) of information	Priority	Geographic scope	Seasonal scope	Taxonomic scope
Seasonal representation of bird distribution abundance– broad scale	High	US Atlantic	All seasons	All birds
Seasonal representation bird distribution and abundance at finer scales	High	WEA’s, state wind lease areas, etc.	All seasons	All birds
Life history, habitat use, residence time, frequency of use and behavior	High	US Atlantic	All seasons	All birds
Detectability and double observer study	High	US Atlantic	All seasons	All birds
Interpreting Digital Photography	Medium	US Atlantic	All seasons	All birds
Translate survey data into seasonal, spatially explicit density estimates tied to habitat characteristics	High	US Atlantic	All seasons	All birds
Explore alternative technologies to improve population assessment studies, if possible	Medium	US Atlantic	All seasons	All birds

Table A5.3 BOEM’s needed data and priorities

Type(s) of information	Priority	Geographic scope	Seasonal scope	Taxonomic scope
Behavioral status/habitat use (breeding, migrating, foraging) to define time and space that may be sensitive to impacts from offshore development activities.	High	Mid-Atlantic wind energy and planning areas	All seasons	Emphasis on North Atlantic right Whales
Population density	High	Atlantic continental shelf waters	All seasons	All stocks with emphasis on ESA populations
Sea turtle densities/locations	High	Mid- and South Atlantic planning areas (south of New Jersey both nearshore and offshore)	Particularly non-nesting seasons	Green sea turtles, loggerhead sea turtles, leatherbacks. Particularly Mid-Atlantic male leatherback and loggerhead turtles.
Additional information on plankton: prey studies of	High	Mid- and South Atlantic	Particularly Apr-Oct coinciding	13 federally managed fish

marine mammals and sea turtles; characterization of all life stages of ichthyoplankton; seasonal distributions, seismic impacts on ichthyoplankton; analysis of long term impacts to stocks due to loss of larval/juvenile stages or long term fishery impacts of acoustic mortality of larval fishes		planning areas (south of New Jersey both nearshore and offshore)	with G&G survey timing	species and their prey
Distribution/abundance/social behavioral ecology	High	Outer 50% of the outer continental slope	Particularly Apr-Oct coinciding with G&G survey timing	Deep diving whales (sperm, melon headed, beaked whales).

Table A5.4 Navy’s needed data and priorities

Type(s) of information	Priority	Geographic scope	Seasonal scope	Taxonomic scope
Population density/stock abundance	High	Atlantic continental shelf waters, Navy operation areas	All seasons	All endangered, threatened populations, all marine mammals
Population density / Extrapolative density models (RES or other methods)	Medium	Offshore waters, out to the mid-Atlantic ridge	All seasons	All endangered, threatened populations, all marine mammals
Biologically important areas (foraging areas, calving grounds, migratory corridors)	Medium	Atlantic continental shelf waters, Navy operation areas	All seasons	All endangered, threatened populations, all marine mammals
Stock boundaries	Low	Atlantic continental shelf waters, Navy operation areas	All seasons	All endangered, threatened populations, all marine mammals
Behavioral response studies to sound in the ocean	High	n/a	n/a	Cetaceans, ESA listed species

Table A5.5 NASA’s needed data and priorities

Type(s) of information	Priority	Geographic scope	Seasonal scope	Taxonomic scope
Time series of species data, species movement data, and other types of <i>in situ</i> information	High	Global	All seasons	All taxa from phytoplankton to whales

Table A5.6 DOE’s needed data and priorities

Type(s) of information	Priority	Geographic scope	Seasonal scope	Taxonomic scope
Spatially explicit population density and distribution data and predictive models to inform siting decisions	High	Atlantic continental shelf waters, especially in less surveyed areas	All seasons, with special focus on seasons suitable for construction activities for noise-sensitive organisms	All endangered, threatened, depleted, or otherwise protected populations
Population size and predictive models to inform permitting and siting decisions	High	Atlantic continental shelf waters	All seasons	All endangered, threatened, depleted, or otherwise protected populations
Movement/migration pattern, location, and timing data to inform risk analyses	High (especially for North Atlantic Right Whales)	Atlantic continental shelf waters	All seasons	All endangered, threatened, depleted, or otherwise protected populations
Flight height to inform risk analyses and monitoring methodologies	Medium	Atlantic continental shelf waters	All seasons	Since all birds protected under the MBTA, information needed for all, but higher priority for endangered, threatened, or depleted populations
Non-migratory behavior, including but not limited to: residence times, persistence of site use, breeding, and foraging patterns to inform risk analyses and monitoring methodologies	Medium/High, for North Atlantic Right Whales	Atlantic continental shelf waters	All seasons	All endangered, threatened, depleted, or otherwise protected populations

Table A5.7 MMC’s needed data and priorities

Type(s) of information	Priority	Geographic scope	Seasonal scope	Taxonomic scope
Stock structure, distribution and seasonal movements, abundance and trends, frequency and causes of mortality, and vital rates via aerial surveys, ship surveys, towed arrays, year-round coastwide passive acoustic monitoring. And habitat-use patterns and trophic relationships for an ecosystem-based management approach via expansion of tagging	High	All areas of the Atlantic, from coastal bays, sounds, and estuaries to the high seas.	All seasons	All marine mammal species and their prey, with particular emphasis on North Atlantic right whales, humpback whales, beaked whales, harbor porpoises, long- and short-finned pilot whales, bottlenose dolphins, and pinnipeds.

Table A5.8 USGS’s needed data and priorities

Type(s) of information	Priority	Geographic scope	Seasonal scope	Taxonomic scope
Real time or near real time information about presence, absence and vulnerability of protected species to direct interactions like ship strikes or fishing	High	All areas in the US Atlantic	All seasons	All marine protected species
Trends over years or seasons in availability to threats to protected species to help inform operational decision making	High	All areas in the US Atlantic	All seasons	All marine protected species
Benthic fauna and protected species and their habitat that might be affected by Federal buoys, channel markers or hazardous material spills	High	Nearshore or intertidal range	All seasons	Benthic fauna and marine protected species

3. What research or monitoring activities does your agency fund or carry out in the Atlantic on marine mammals, turtles, and/or seabirds?

NMFS: In addition to contributing funds to the AMAPPS projects, NMFS funds a variety of research in the Atlantic related to mostly marine mammals and turtles, with limited funding of seabird projects.

The NOAA Fisheries Service Greater Atlantic Region's Protected Resources Division administers grants and cooperative agreements to a variety of partners, including state agencies, fishing industry members, academic institutions, and non-profit organizations, to provide financial assistance to address research questions and management needs for protected marine species. The funding for these projects originates from a variety of sources, including Congressionally-directed and discretionary funds. Categories of types of projects include:

- gear research
- bycatch reduction
- fishing gear exchange/buyback,
- large whale disentanglement response, and
- marine mammal research.

For details on present and previously funded projects, including project reports see <http://www.greateratlantic.fisheries.noaa.gov/Protected/grantsresearchprojects/>.

The NOAA Fisheries Service Southeast Regional Office funds a variety of right whale research in the Southern US Atlantic along with high priority research recommendations made by the bottlenose dolphin, pelagic long line and large whale Take Reduction Teams. For example:

- Stock structure of bottlenose dolphins in the mid-Atlantic region
- Stock structure, distribution and abundance of coastal and estuarine bottlenose dolphins in northern South Carolina
- Studies on the effects of weak hook and other hook types on the bycatch of pilot whales and fishing effectiveness
- Seasonal abundance and stock structure studies of pilot whales
- Aerial surveys for right whales
- Right whale recovery projects
- Recreational vessel characterization study of Northeast Florida
- Compilation of mid-Atlantic historical and existing right whale data
- Monitoring sea turtle strandings in Georgia, South Carolina and Florida
- In-water sea turtle surveys off South Carolina.

Other funded projects covering a broad spectrum of species include:

- Collection of bycatch data of marine mammals, sea turtles, and seabirds from a sample of Atlantic commercial fisheries
- Estimation of total bycatch for Atlantic commercial fisheries
- Exploration of above observer data to determine gear characteristics associated with high bycatch and other analyses to support the Take Reduction Teams.

Projects focusing on North Atlantic right whales include:

- Nearly year round aerial surveys targeting North Atlantic right whales
- The North Atlantic right whale Catalog which is the repository of all images of photo-identified North Atlantic right whales throughout their range and is managed by the North Atlantic Right Whale Consortium
- The North Atlantic right whale Database which is the repository of all sightings records of right whales, along with many other species of marine wildlife, in the North Atlantic Ocean and is managed through the University of Rhode Island.

Projects focusing on seals include:

- A gray seal pup production monitoring aerial survey, for counting the images, and field equipment for live capture work
- NEFSC has funded seasonal (approx. September to April) aerial surveys of major seal haul-out sites in southeastern Massachusetts, and 1 to 3 surveys of the Cape Cod and Maine gray seal pupping colonies to monitor pup production
- NEFSC has provided small boat, supplies and equipment, and staff support for the 2014 collaborative gray seal pup capture and sampling project on Muskeget Island.

Projects focusing on sea turtles include:

- Synthesis and analysis of environmental data to inform the interpretation of in-water and survey data and to improve assessment quality (NEFSC)
- Characterization of loggerhead sea turtle abundance and habitat use at a seasonal 'hot spot' using mark-recapture, autonomous underwater vehicle (AUV) surveys and telemetry (SEFSC)
- Space use, movement, and distribution of leatherback turtles in the Gulf of Mexico (SEFSC)
- Nearshore habitat usage of juvenile Kemp's ridleys in the Northern Gulf Of Mexico (SEFSC)
- Tracking the sea turtle "lost years": early dispersal, survival, foraging ecology and habitat use of oceanic stage sea turtles in the Gulf of Mexico (SEFSC)
- Annual survival of Peninsular Florida nesting loggerhead turtles (SEFSC)
- Northwest Atlantic loggerhead nesting variability and trends: a mechanistic modeling approach to understand the synergistic effects of climate and fisheries (NEFSC)
- Assessment of age and size at maturation and adult stage duration for loggerhead sea turtles in the western North Atlantic (SEFSC)
- Neonate loggerhead dispersal, behavior, and survivorship in the Western North Atlantic (SEFSC)
- Pelagic survival of juvenile loggerheads (SEFSC)
- Collaborative work with regional researchers who are funded under other pots (like NMFS Section 6 and NMFS research set asides).

NMFS funds a limited number of projects related to seabirds including:

- Estimate the total bycatch of seabirds in the Atlantic commercial fisheries
- Necropsies of bycaught seabirds
- Collection of strip-transect abundance data on seabirds during marine mammal shipboard surveys

- Collaborate with the Stellwagen Sanctuary on relating locations of tagged seabirds relative to locations of commercial fishing.

USFWS: In addition to contributing funds to the AMAPPS projects, USFWS is working on:

- Tracking offshore occurrence of Common Terns and American Oystercatchers with VHF arrays
- Determining offshore use by diving marine birds using satellite telemetry
- Atlantic Marine Assessment Program for Protected Species (AMAPPS)
- Statistical Analyses for assessment of broad scale offshore bird surveys
- Data management of marine bird offshore survey data
- Determining the movement patterns and habitat use of seabirds to support marine spatial planning along the Atlantic coast
- Mapping marine bird “hot spots”.

BOEM: In addition to contributing funds to the AMAPPS projects, BOEM has funded a variety of protected species research in the Atlantic and Pacific waters. The Environmental Studies Program (ESP) develops, conducts and oversees world-class scientific research specifically to inform policy decisions regarding development of Outer Continental Shelf energy and mineral resources. Research covers physical oceanography, atmospheric sciences, biology, protected species, social sciences and economics, submerged cultural resources and environmental fates and effects (<http://www.boem.gov/Studies/>). Examples of recent funded projects in the Atlantic include:

- Massachusetts Clean Energy Center: Field surveys and marine resource characterization for offshore wind energy planning in the Massachusetts wind energy area 2012-2015
- Bird/Bat surveys (high resolution aerial surveys)
- Biologically Important areas for Marine Mammals
- Maryland: Determining Offshore Use by Marine Mammals and Ambient Noise Levels Using Passive Acoustic Monitoring, 2014-2017.
- Pilot Study of Aerial High-Definition Video Surveys for Seabirds, Marine Mammals, and Sea Turtles on the Atlantic OCS (AT-10-02)
- Rice, Aaron N., Janelle L. Morano, Kristin B. Hodge, Daniel P. Salisbury, Charles A. Muirhead, Christopher W. Clark. 2014. *Baseline Bioacoustic Characterization for Offshore Alternative Energy Development in North Carolina and Georgia Wind Planning Areas*. US Dept. of the Interior, Bureau of Ocean Energy Management. OCS Study BOEM 2014-xxx. 188 pp. BOEM Award M10PC00087.
- Martin, B, D. Zeddies, J. MacDonnell, J. Vallarta, and J. Delarue. 2012. *Characterization and Potential Impacts of Noise Producing Construction and Operation Activities on the Outer Continental Shelf: Phase I: Data Synthesis Report*. JASCO Document 00160, Version 3.0. Technical report by JASCO Applied Sciences for BOEM.
- Compendium of Marine Bird Data for Offshore Renewable Energy Decision Making, 2014-2019 (USFWS)
- Compendium of Avian Information: Part 2, 2011-2014 (USGS)
- Integrative Statistical Modeling and Predictive Mapping of Seabird Distribution and Abundance on the Atlantic Outer Continental Shelf, 2013-2015 (NOAA)

- Determining Offshore Use by Diving Marine Birds Using Satellite Telemetry, 2012-2016, (USFWS)
- Surveying for Marine Birds in the Northwest Atlantic, 2009-2014 (USFWS)
- Pilot Study: Tracking Offshore Occurrence of Common Terns and American Oystercatchers with VHF Arrays, 2013-2014 (USFWS)
- Aerial Surveys for Roseate Terns, 2013-2014 (City University of New York)
- Acoustic Monitoring of Temporal and Spatial Abundance of Birds Near Structures on the OCS of the Atlantic and Gulf of Mexico (AT-10-01).
- Building a Database to Assess the Relative Vulnerability of Migratory Bird Species to Offshore Renewable Energy Projects on the Atlantic outer continental shelf (AT-12-05)
- Exploration and research of Mid-Atlantic deepwater hard bottom habitats and shipwrecks with emphasis on canyons and coral communities (ongoing National Oceanographic Partnership Program (NOPP) project).
- 1980's Atlantic Continental Slope and Rise studies.

Navy: In addition to contributing funds to the AMAPPS projects, the Navy carries out an extensive marine species monitoring program as part of its monitoring requirements under current MMPA and ESA permits. Projects range from aerial and shipboard surveys to determine density/abundance, to acoustic monitoring, to tagging and behavioral response studies. The focus is not on particular Navy events or geographic areas (though that is a consideration) but on expanding the understanding of distribution and behavior of marine species. Current Fleet training and testing monitoring projects include:

- Tagging and tracking of endangered North Atlantic right whales in Florida waters
- Lower Chesapeake Bay sea turtle tagging and tracking
- Assessment of deep diving cetacean behavior in relation to Navy training activities
- Occurrence, distribution, and density of marine mammals near Naval Station Norfolk and Virginia Beach, VA.
- Acoustic monitoring and evaluation of Tursiops response to Mine Warfare Exercise training activities
- Cetacean tagging on the planned Undersea Warfare Training Range
- Baseline monitoring for marine mammals in the East Coast Range Complexes
- Assessment of marine mammal vocal response to sonar

For a full list of current projects and descriptions see <http://www.navymarinespeciesmonitoring.us/regions/atlantic/current-projects/>.

The Navy also funds density estimation and methodology development work. For example projects funded for the Phase III include:

- Virginia Aquarium Foundation aerial surveys for the Chesapeake Bay and Mid-Atlantic region focusing on bottlenose dolphin and loggerhead turtle spatial density models
- Loggerhead availability bias preliminary methodological development for a spatially explicit availability surface correction factor
- Sea turtle density theoretical framework development on how to incorporate non-line transect data types into sea turtle density estimates

- Updated marine mammal density models for the Air Force Test Team (AFTT) study area.

Lastly, the Navy carries out a significant amount of research focusing on the effect of sound on marine mammals. This is funded through two primary programs: the Navy's Living Marine Resources Program and the Office of Naval Research's Marine Mammals and Biology Program. The projects funded by these efforts are geographically distributed (i.e. not all within the Atlantic), but the results are often generally applicable across wide geographic regions. Some research funded by these programs includes:

- Hearing research (i.e. temporary threshold shifts, auditory weighting functions, etc.). For example:
 - Use response delay of trained dolphins to determine perceived loudness of low frequency sound and derive hearing weighting functions
 - Use Alternative Audio Evoked Potential methods to generate weighted hearing function
 - Develop computational model-based methods for generating audiograms from anatomical data and test and validate modeling approach by application to different species
- Sensor and tag development (i.e. digital acoustic recording tags (DTAGs))
- Behavioral response studies (i.e. MED and SOCAL BRS), and
- Monitoring and detection techniques (i.e. passive acoustic monitoring devices and processing tools). For example:
 - Demonstrate integrated passive acoustic monitoring for high and low frequency marine mammals on a powered remote operated vehicle (ROV)
 - Demonstrate performance of glider and profiler float's ability to passively acoustically monitor for marine mammals on Navy ranges
 - test and demonstrate upgrades to the High-Frequency Acoustic Recording Packages (HARPs)
 - Develop and test automated classifiers that incorporate whistles, clicks and information about location and vocal behavior
 - Develop easy-to-use system for automatic detection of marine mammal sounds and make detectors, and their performance information instantly accessible
 - Develop an acoustic database for the development and evaluation of automated signal processing algorithms
 - Test performance of an improved automated detection algorithm using Generalized Power-Law on Navy range data and environmentally calibrated call densities
- Develop data standards database for visual surveys

NASA: NASA has funded a variety of studies integrating marine mammals and sea turtles and satellite-derived data. Examples include:

- Modeling movements of right whales based on ocean color (phytoplankton), sea surface temperature and other variables to forecast the distribution of their zooplankton food.
- Forecasting whale densities in the Atlantic and Pacific Oceans

- Studying climate change, sea ice, and polar bears in Greenland
- Modeling bowhead whale habitat: integration of ocean models with satellite, biological survey and oceanographic data
- Developing the WhaleWatch prediction tool for reducing blue, gray, fin and humpback whale shipstrikes (<https://nex.nasa.gov/nex/projects/1219/>)
- Developing a daily 5-km satellite coral bleaching thermal stress monitoring program (<http://coralreefwatch.noaa.gov/satellite/bleaching5km/index.php>)
- Creating a decision support system for ecosystem-based tropical coral reef management (<http://imars.marine.usf.edu/crw-dss/crw-dss-description>)
- With BOEM and NOAA, supporting an initiative that will lay the foundation for the first national network to monitor marine biodiversity at scales ranging from microbes to whales (<http://www.nasa.gov/press/2014/october/us-initiates-prototype-system-to-gauge-national-marine-biodiversity/>).

DOE: DOE has funded projects ranging from data collection and experimentations (e.g., effects on aquatic organisms and physical systems), to monitoring and mitigation technologies and techniques (e.g., development of new monitoring technologies; instrumentation evaluation; deployment, and data collection at test facilities; development of evaluation of monitoring protocols), to information sharing and international collaboration (Tethys/Annex IV database; webinar series; State of the Science reports; coastal and marine spatial planning; fellowships; and regulatory assessments). A few examples include:

- Modeling Wildlife Densities and Movements across Temporal and Spatial Scales on the Mid-Atlantic Continental Shelf (<http://www.briloon.org/MABS>)
- Observing patterns in offshore bat activity and species composition in the Gulf of Maine, Great Lakes, and Mid-Atlantic coastal states, and analyzing spatial and temporal use-patterns
- Tethys, a knowledge management system that gathers, organizes, and provides access to information on the environmental effects of marine and hydrokinetic and offshore wind energy development (<http://tethys.pnnl.gov/>)

MMC: MMC has funded a variety of marine mammal projects. For a full listing of projects supported by MMC see http://www.mmc.gov/research/recent_grants.shtml. Some of the recently funded projects that relate to AMAPPS include:

- Expansion of Whale Alert app to Android platform
- Understanding western North Atlantic coast-wide distribution patterns of North Atlantic right whales
- Support for a Northwest Atlantic Seal Research Consortium workshop on seals and ecosystem health
- Support for a Citizen Science Website for pinnipeds, the Marine Animal Identification Network (MAIN: <http://main.who.edu/>)
- Assessing the performance and health effects of type 1 satellite tags for large whales, with a focus on humpback whales in the Gulf of Maine.

USCG: The USCG does not generally pursue research into or assessment of natural resources though they undertake some activities, covering costs out of its operating budget, that contribute data and/or information to research and monitoring activities, including:

- Through its Atlantic and Pacific Area commands, the USCG is a sub-permitee under NOAA's Marine Mammal Health and Stranding Program. In this capacity and in the course of normal duties, direct sightings and observations may be conveyed from Coast Guard platforms to stranding networks and reporting programs.
- In some instances, the USCG may assist onsite when stranding responses and disentanglement operations take place.
- During releases of hazardous materials into the ocean, the USCG may provide information about observed wildlife mortality and extent of affected habitat.

In addition the USCG:

- Contributes funds for the New England and Southeast region right whale aerial observing program (aka Sighting Advisory System).

4. *What new/alternative research or monitoring activities/techniques is your agency interested in employing in the Atlantic for use on marine mammals, turtles, and/or seabirds?*

NMFS:

- Leatherback tagging and fine scale behavioral studies
- For sea turtles use long-term in-water abundance estimation methods
- Monitor climate change impacts
- Develop more cost-effective monitoring methods of right whales
- Develop methods to replace observer coverage on pelagic long line fishing vessels
- Passive acoustic monitoring year-round for large whales, including immediate data analyses and publication
- Right whale population model for better predictions of management action outcomes
- Directed and controlled sound exposure research to investigate right and other endangered large whale response to high intensity, short duration (e.g. seismic air guns, etc.) sounds.

USFWS:

- Quantify observer detection rates and the effect of aircraft on seabird behavior
- Create a crowd sourcing site for photo-identification of aerial seabird survey imagery to automate image processing and identification
- Explore the use of alternative technologies for surveying birds in the offshore environment to increase survey opportunities – especially those beyond the 30 meter contour.
- Compare unmanned aerial vehicle (i.e., drone) with traditional aerial survey techniques.
- Develop *a priori* models relating occurrence/abundance with ecological covariates
- Deploy satellite transmitters on other species of concern not well monitored with aerial surveys (e.g., Black-capped Petrels)
- Increase capacity for managing and sharing data and data products useful for offshore development decision-making.

- Increase sample sizes and number of species tagged to improve understanding of seasonal distribution and abundances, life history, habitat use, frequency of use, behavior, and residence time.
- Develop and implement study to better understand foraging/commuting pathways, migratory corridors, crossover areas, and preferred rafting/roosting areas.

BOEM:

- High definition cameras during aerial surveys; regional scale passive acoustic monitoring of submarine acoustic environment
- Behavioral response studies to BOEM-related activities (marine mammals and sea turtles) that could use satellite automatic identification system (AIS), Glider AIS, and autonomous underwater vehicles (AUVs) for passive acoustics
- Move towards more geographic information system (GIS)-based impact studies.

Navy:

- Innovative methods to monitor behavioral responses to sound exposures utilizing technology like DTAGs and passive acoustic monitoring
- Survey methods that extend monitoring capabilities offshore to inform density estimates in data poor areas (e.g. off the continental shelf and outside the US EEZ) such as gliders, offshore shipboard surveys, and unmanned aircraft
- Use of automated or semi-automated platforms to increase the regularity of surveys, decrease cost, and reduce the need for human observers
- Using passive acoustic monitoring to aid in determining density/abundance data
- Utilize AMAPPS recent line-transect data to validate Navy's existing models and improve the robustness of those models.

NASA:

- eDNA
- Tagging of marine mammals, turtles and seabirds
- Drone technologies
- Satellite remote sensing.

DOE:

- Use of high definition aerial survey methodologies
- Long-term passive acoustic monitoring data to help provide additional data on vocalizing organisms
- Tools and platforms for long-term, fixed observations using a range of instrumentation (e.g. hydrophones, cameras, bat detectors, avian acoustic detectors, etc.
- Development and testing of a range of project-level monitoring and mitigation technologies and techniques (e.g. automated bird strike instrumentation packages, enhanced algorithms for automated infrared and visual camera detection of birds and bats, etc.).

MMC:

- Towed passive acoustic recorders

- Moored passive acoustic recording arrays (MARUs, HARPs, T-PODS)
- High-resolution aerial imaging surveys
- Tagging and telemetry of key marine mammal species, such as right whales, beaked whales, and pinnipeds
- Underwater gliders (e.g., for beaked whales and other deep-diving species)
- Aerial survey drones (for pinniped haulouts).
- Public availability of AMAPPS survey methods and expertise to ensure data collected from smaller or site-specific studies in the Atlantic are able to be integrated with AMAPPS data
- Public availability of strandings and health assessment data as these are key to life history traits
- Public availability of all AMAPPS data and metadata in a timely manner (e.g., through OBIS-SEAMAP)
- Expansion of partnerships with other federal and state agencies and private researchers that can aid in data collection or funding where possible.

USCG:

- Initiatives and facilities/capabilities that augment real-time sightings and render that information accessible to the maritime community, particularly given the emergence of electronic chart display and information helm displays and the increasing data saturation faced by commercial and professional mariners.

Appendix 6

Survey used to facilitate discussions on research interests across agencies

Agency _____ Optional Name _____

We'd like to know how you would "spend" a hypothetical \$100 AMAPPs budget....

...across AMAPPS objectives?

<input type="checkbox"/>	Collect broad-scale data on the seasonal distribution using direct aerial and shipboard surveys
<input type="checkbox"/>	Collect similar data at finer scales using visual & acoustic survey techniques
<input type="checkbox"/>	Conduct tagging studies to investigate availability, behavior and ecology
<input type="checkbox"/>	Collect data on life-history and ecology
<input type="checkbox"/>	Explore alternative platforms and technologies
<input type="checkbox"/>	Assess population size; develop methods for seasonal, spatially-explicit density estimates incorporating habitat
+ _____	
100	

...across research activities?

<input type="checkbox"/>	Abundance and distribution surveys
<input type="checkbox"/>	Tagging and tracking studies
<input type="checkbox"/>	Passive acoustic monitoring and tracking
<input type="checkbox"/>	Process and behavioral studies
<input type="checkbox"/>	Collection and incorporation of habitat, trophic, and ecosystem data
+ _____	
100	

...across project components?

<input type="checkbox"/>	Planning, project management, data management
<input type="checkbox"/>	Methods development
<input type="checkbox"/>	Collection of new data
<input type="checkbox"/>	Analysis
<input type="checkbox"/>	Coordination with related external research projects
<input type="checkbox"/>	Presentation of products (including Web interface)
+ _____	
100	

...across seasons?

<input type="checkbox"/>	Spring
<input type="checkbox"/>	Summer
<input type="checkbox"/>	Fall
<input type="checkbox"/>	Winter
+ _____	
100	

...across taxa?

<input type="checkbox"/>	Seabirds
<input type="checkbox"/>	Turtles
<input type="checkbox"/>	Large whales (baleen & sperm)
<input type="checkbox"/>	Beaked whales
<input type="checkbox"/>	Small cetaceans (dolphins & porpoises)
<input type="checkbox"/>	Seals
+ _____	
100	

...across anticipated products?

<input type="checkbox"/>	Interactive maps with estimated animal density
<input type="checkbox"/>	Total abundance estimates for populations/stocks
<input type="checkbox"/>	Life history, behavior, and ecology
<input type="checkbox"/>	Monitoring and mitigation tools (e.g., design of before-after-control-impact studies, spatial management tools, mitigation approaches)
+ _____	
100	

...across regions?

<input type="checkbox"/>	Gulf of Maine to Cape Cod
<input type="checkbox"/>	Cape Cod to Hatteras
<input type="checkbox"/>	Hatteras through Georgia
<input type="checkbox"/>	Florida
+ _____	
100	

...across depth strata?

<input type="checkbox"/>	Inshore (<200m)
<input type="checkbox"/>	Offshore (>200m)
+ _____	
100	