Final Report

Partners in Science Workshop:

Identifying Ecological Metrics and Sampling Strategies for Baseline Monitoring During Offshore Wind Development

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Identifying Ecological Metrics and Sampling Strategies for Baseline Monitoring During Offshore Wind Development

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Organizers: Josh Kohut, Joseph Brodie, and Doug Zemeckis
Rutgers, The State University of New Jersey

Facilitated by Patrick Field, Maggie Osthues
Consensus Building Institute (CBI)

Sponsored by the New Jersey Board of Public Utilities

Executive Summary

The 2021 Partners in Science Workshop, hosted by the Rutgers University Center for Ocean Observing Leadership and Rutgers Cooperative Extension, was held via Zoom conference on January 28, 2021. The workshop also included a pre-workshop survey of participants, and was sponsored by the New Jersey Board of Public Utilities, with input from the New Jersey Department of Environmental Protection. Workshop logistics and moderation were supported by the Consensus Building Institute.

The survey and workshop aimed to gather community input to define the parameters required to quantify baseline ecological variability that will enable the evaluation of potential impacts from offshore wind development. This report details results from the pre-workshop survey, presentations from several workshop participants, and the multiple breakout sessions held during this half-day workshop. A summary of the main findings includes:

- The pace of offshore wind development is faster than the pace of fisheries science and it is critical that marine fisheries resources and fishing activity are considered during all phases of an offshore wind farm from pre-construction through operations and decommissioning.
- Baseline studies should begin at least 2-3 years prior to construction, with these efforts continuing via monitoring studies for at least 5 years post-construction, and less frequent sampling throughout the life of the wind farm.
- There was a clear consensus that any baseline and/or monitoring study should consider the entire system, from the dynamic oceanographic habitat up through the food web.
- There is a critical need for engaging the broader stakeholder community in developing techniques and survey design that would prevent disruption to existing survey methods once the wind farms are built; this could include instrumentation on the turbine platforms themselves, and/or new methods to fill any gaps within the wind farm areas.
- Studies should be designed and implemented through collaboration with all expert areas, including industry, academia, and state and federal government agencies; regional efforts should be made to coordinate, integrate, and consolidate existing and new data.
- The variability of the ocean makes it difficult to identify clear control areas for studies, particularly around physical and chemical variables; gradient design may be more appropriate.

- Ocean currents and other ocean variables related to the mixing of seasonal stratification (cold pool processes) are important and should be measured throughout the water column.
- Fisheries surveys should be hypothesis-driven, address gaps in existing research, and prioritize species within each study based on site-specific vulnerability.
- Spatial and temporal variability will impact fisheries vulnerability and risks, and the regional scope of development will require coordination in activities between sites.
- There should be a focus on monitoring specific marine mammals and other high conservation species; regional approaches for migratory species should cover night and day and inform knowledge gaps in species life stages.
- Use of and participation in community science sampling should be expanded.
- Cross-cutting each of these priorities was an emphasis placed on baseline and monitoring design that incorporated ecosystem approaches (described below) in a way that leveraged the power of partnerships.

Workshop Background and Goals

Rutgers, The State University of New Jersey has as a primary mission of applying science and research to the benefit of the state and society in general, particularly through its role as New Jersey's land grant institution. As part of that mission, its role in the ongoing development of offshore wind is to help guide the conversation using the latest scientific knowledge, and help develop the next generation of research techniques and questions to inform the development of offshore wind and understand how offshore wind interacts with the surrounding environment. This effort includes understanding both how the physical environment and offshore wind farms interact and how any changes in the physical system may drive ecological changes or shifts. Furthermore, it is important to be able to quantify any changes that may take place due to offshore wind and be able to isolate them from interannual variations and already existing and ongoing changes due to the changing climate.

In alignment with this mission, the Rutgers University Center for Ocean Observing Leadership (RUCOOL) and Rutgers Cooperative Extension co-hosted a 2021 Partners in Science Workshop to address specific action items identified during the first Partners in Science Workshop "Offshore Wind and the Mid-Atlantic Cold Pool[1]", which was hosted in 2019. The 2021 workshop solicited feedback on monitoring objectives, sampling parameters, and data sharing and access for monitoring related to offshore wind farm development. The objective was to gather community input to define the parameters required to quantify baseline ecological variability to enable the evaluation of potential impacts from offshore wind development. To do this, the organizers solicited stakeholder input through two different mechanisms: a pre-workshop survey and participation in break-out discussions during the half-day virtual workshop on January 28, 2021. The workshop was sponsored by the New Jersey Board of Public Utilities (NJBPU), with input from the New Jersey Department of Environmental Protection and workshop logistics and moderation supported by the Consensus Building Institute (CBI).

The survey[2] was intended to gather input on an initial set of priorities and specifications for baseline and monitoring efforts in the context of offshore wind development, with the intent of using the time during the live virtual workshop to discuss survey responses to ensure the community is able to fill gaps and produce a robust plan. The workshop[3] itself was organized in a "world cafe" format: after a brief set of introductory talks, participants were organized into cohorts which rotated between three discussion sessions focused on the physical/chemical, fisheries, and non-fisheries biota topic areas. The cohorts remained together throughout all three sessions, while the moderators remained in the same topic for all three sessions, and rotated through the different cohorts. Each cohort consisted of 10-15 individuals, representing stakeholders from all participating communities, including federal and state government, recreational and commercial fisheries, the offshore wind industry, non-governmental organizations (NGOs), private sector

[1] The final report from the 2019 workshop can be found at https://go.rutgers.edu/PS-Report-2019.
[2] The full list of questions from the survey can be found in Appendix 1 – Survey Questions.
[3] The full agenda for the workshop can be found in Appendix 2 – Workshop Agenda, while a listing of all attendees can be found in Appendix 3 – Workshop Participants.

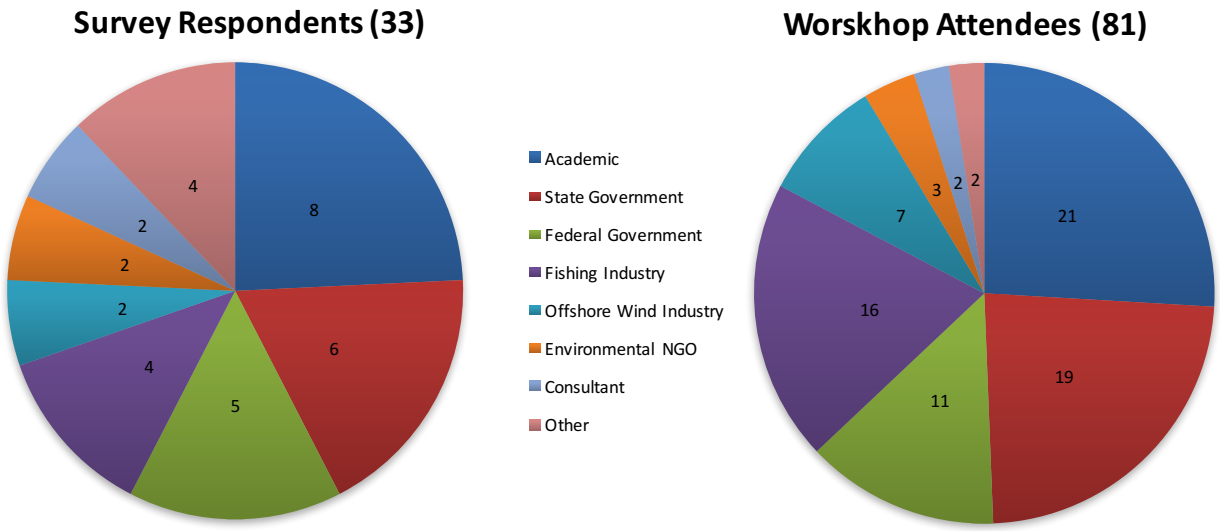

Figure 1: Breakdown of the sector representation by survey respondents (left) and all workshop attendees (right). The survey responses were self-reported based on the answer to the affiliation question (see Appendix 1 – Survey Questions), while attendees were sorted by the organizers. Of the "Fishing Industry" attendees in the right figure, 6 were affiliated with recreational fishing, while 10 were affiliated with commercial fishing. Due to the anonymity of survey responses, the breakdown of Fishing Industry in survey respondents is not possible.

consultants, and academia. The cross-section of sectors represented in the 33 pre-survey respondents and the 81 workshop discussion participants was consistent and diverse (Figure 1).

The following important definitions guided all input to this report including the pre-workshop survey and the workshop discussions:

- **Baseline Study**: A study conducted prior to offshore wind activities in order to establish a sufficient record of the pre-existing state, and observe any change taking place due to other factors.
- **Monitoring Study**: A study conducted continuously during and after offshore wind activities in order to monitor for any changes, and attribute these changes to the proper contributing factors.

Section 1: Background Presentations of Prior and Ongoing efforts

The following subsections summarize background information and activities that were relevant to inform the workshop. At the beginning of our virtual workshop, each activity was presented to the participants. The names listed in each subsection heading below are the individuals who presented the material and provided the summary text in this report.

1.1 Review of Ecological Monitoring and Mitigation Policies -- Mike Allen and Matt Campo (Rutgers University)

Researchers working on behalf of the New Jersey Climate Change Alliance reviewed policy documents, conducted a scientific literature search, and interviewed stakeholders resulting in a white paper published in August 2020 titled "Ecological Monitoring and Mitigation Policies

and Practices at Offshore Wind Installations in the United States and Europe."[4] The purpose of the study was to understand the policies and methods of other jurisdictions in the eastern U.S. and Europe used to monitor potential ecological impacts from offshore wind farms. Short-term (3-5 year) project-specific efforts dominate ecological monitoring efforts at offshore wind farms in North America and Europe. Longer-term, regional data sets were also leveraged to shed light on potential cumulative impacts. A rich scientific literature (over 300 references) forms an existing knowledge base of ecological monitoring at offshore wind installations particularly in Europe, which experienced a rapid increase in offshore wind energy from 2000-2020. The scientific literature also points to challenges in evaluating ecological impacts as monitoring technologies develop rapidly and scientists learn more about confounding factors of climate change and the natural variability of ecological systems.

State-level policies governing ecological monitoring in the Northeast and Mid-Atlantic rely on permitting processes, coastal zone management authorities, and the energy procurement process. Some states require ecological monitoring and mitigation plans to supplement federally-required planning documents as part of the bidding process. However, publicly available federal and state-level documents as they existed in 2020 only vaguely described planned ecological impact monitoring methods and durations. Many documents were unclear in differentiating required activities from recommended guidelines. Interview participants expressed concern that a patchwork approach to ecological monitoring was developing in the U.S., with developers committing resources to various research groups and taxa with few unified regional strategies. Interviewees suggested that continuing along such a path could lead to inconsistent requirements and a lack of coordination among states, inadequate spatial and temporal scales of monitoring, and a lack of mechanisms to fund coordinated regional approaches. Interview participants also expressed optimism that emerging regional science entities (e.g., the Responsible Offshore Science Alliance or the Regional Wildlife Science Entity for Offshore Wind) could help with identifying frameworks for ecological monitoring and coordinate processes for collecting and managing data to address concerns at spatial scales ranging from individual projects to regional ecosystems. Collaborative efforts to develop baseline regional data-sharing, at a minimum, can increase the chances for scientists to successfully detect and monitor any potential environmental impacts of offshore wind installations into the future.

1.2 Responsible Offshore Science Alliance Guidelines Document (Lyndie Hice-Dunton)

In June 2020, the Responsible Offshore Science Alliance (ROSA) formed a working group to develop draft guidelines to inform the development of fisheries research and monitoring plans at commercial offshore wind farms and associated areas. BOEM and some Atlantic Coast states require developers to create these plans, which summarize the potential impacts of offshore wind development on physical and biological resources. The ROSA guidelines build on existing guidance from BOEM and outline the fundamental elements to include in offshore wind fisheries survey and monitoring plans and identifying the primary resources required to help draft and

[4] This white paper can be found online at https://go.rutgers.edu/OSW-Eco-WPaper.

review such plans. They were developed by working group members and external reviewers representing various sectors involved in fisheries and offshore wind development, including state and federal government fisheries managers, fisheries scientists, recreational and commercial fishing industry representatives, and offshore wind developers. The presentation focused on the development of the working group to draft the guidance document, the Offshore Wind Project Monitoring Framework and Guidelines. This document was finalized in March 2021 and can now be accessed on the "Resources" page on the ROSA website[5]. The guidelines are intended to serve as a "living document" that will be updated on an ongoing basis.

1.3 Synthesis of the Science Workshop (Lane Johnston, Responsible Offshore Development Alliance)

In October of 2020, over 550 participants engaged in a three-day virtual workshop on the synthesis of the science around offshore wind energy and fisheries. The workshop involved commercial and recreational fishermen, state and federal agencies, academics, offshore wind energy developers, and other interested stakeholders. The workshop covered a host of topics from broad ecosystem effects to species-specific and socioeconomic effects. Panelists included experts in collaborative research, fisheries science, cumulative impacts, oceanography, fisheries management, and social science. The workshop was sponsored by National Oceanic and Atmospheric Administration (NOAA) Fisheries, Bureau of Ocean Energy Management (BOEM), and the Responsible Offshore Development Alliance (RODA). RODA is coordinating the completion of the full Synthesis of the Science report, which is expected to be finalized following a peer review.[6]

1.4 State of the Science Workshop (Kate McClellan-Press, New York State Energy Research and Development Agency)

The 2020 State of the Science Workshop on Offshore Wind and Wildlife, hosted by the New York State Energy Research and Development Authority (NYSERDA) was held virtually from November 16-20, 2020. This workshop brought together over 430 stakeholders, from around the world, engaged with environmental and wildlife research relevant to offshore wind energy development. The workshop sessions focused on assessing the state of the knowledge regarding offshore wind development's cumulative effects on populations and ecosystems. Following the plenary presentations in November, seven work groups met in the winter of 2021 to identify short-term research priorities for understanding offshore wind's cumulative impacts on sea turtles, marine mammals, fishes, invertebrates, birds, bats, and oceanographic processes in the eastern

[5] The ROSA Resources page is located at https://www.rosascience.org/resources.
[6] To learn more about the workshop and report visit: https://rodafisheries.org/portfolio/synthesis-of-the-science/.

United States. A final webinar for this effort was held to bring together the leads from the seven work groups to present their recommendations[7] and discuss common themes among groups.

Section 2: Baseline and Monitoring Study Guidance

Community input was gathered in two activities as part of the workshop, the pre-workshop survey sent to all the registrants and the virtual workshop agenda including the presentations summarized in Section 1 of this report and a series of breakout discussions. The survey enabled the participants to provide initial input on questions related to the baseline and monitoring design including specific variables and spatial and temporal sampling requirements. The survey served an initial starting point for the breakout discussions during the workshop itself. Both the pre-workshop survey and breakout discussions during the workshop were organized around guiding questions that asked what, how, when, and where measurements should be taken in baseline and monitoring studies. We organized the responses to these questions in themes based on the variable type. Physical and chemical data were considered in group discussions facilitated by Josh Kohut (Rutgers University) and Ruth Perry (Shell). The section recorders were Joseph Brodie (Rutgers University) and Samuel Coakley (Rutgers University). Observations specific to fisheries were discussed in groups facilitated by Lyndie Hice-Dunton (ROSA) and Doug Zemeckis (Rutgers University). The section recorders were Sarah Borsetti (Rutgers University) and Laura Nazzaro (Rutgers University). Non-fisheries biota including organisms from phytoplankton and zooplankton to migratory birds, bats and marine mammals were discussed in a third set of breakouts facilitated by Patrick Field (CBI) and Tony MacDonald (Monmouth University). The section recorders were Cameron Hager (CBI) and Jackie Veatch (Rutgers University). Over the course of the workshop, participants moved between groups, each having an opportunity to contribute to all three thematic areas. Following this design, each breakout group iterated on the output of the prior group. The results from the survey and breakout discussions are summarized within each guiding question in the following subsections.

2.1 What we need to measure?

2.1.1 Physical/Chemical Data

There are a plethora of physical and chemical variables that can be sampled as part of baseline and monitoring studies in offshore wind areas. The survey responses for the importance of physical and the chemical/water quality variables are shown in the two figures below. Broadly, physical/chemical variables can be broken up into two categories: variables measured at or close to the ocean's surface or the bottom, and variables that can be measured throughout the water or atmosphere column. A key example of a variable that crosses all measurement depths/heights is water temperature, which is measurable at the surface (i.e. sea surface temperature), bottom, and throughout the water column. As such, variables are broken out not just by the quantity they measure, but also by depth or altitude.

[7] A recording of the final webinar and final reports of the 7 work groups are available at https://www.nyetwg.com/2020-workgroups.

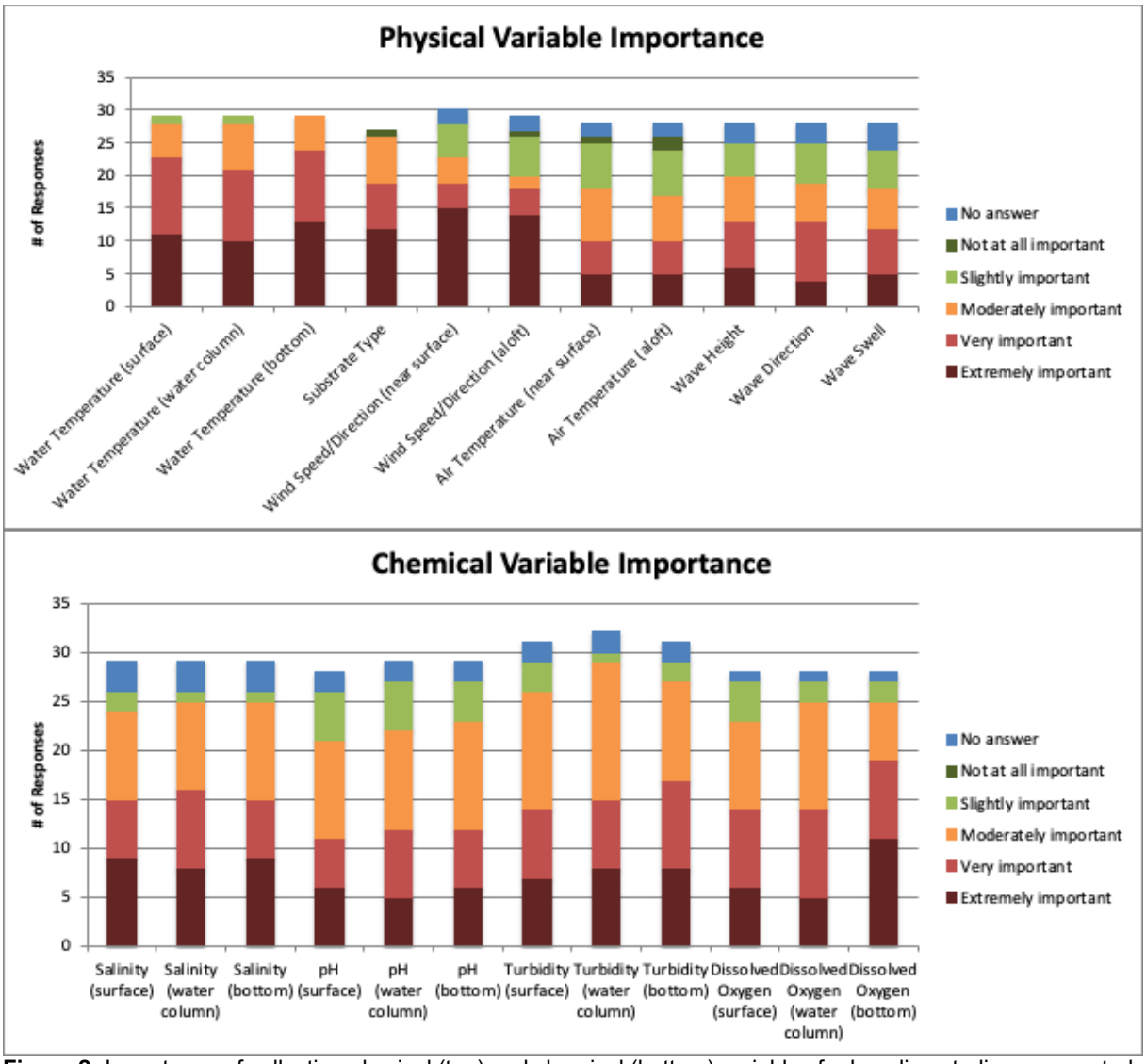

Figure 2: Importance of collecting physical (top) and chemical (bottom) variables for baseline studies as reported in the survey.

As can be seen in the survey results (Figure 2), temperature stands out as a particularly important variable; this is especially true of bottom temperature, where no respondents ranked its importance below "moderate" level. This is due to the vital role that the Mid-Atlantic Cold Pool serves in a variety of processes, ranging from the physical to the ecological. Measurements of temperature are key to tracking the evolution of the Cold Pool both within an annual cycle, and how it may change over time. Wind conditions, both near the surface and aloft, are an important variable for use beyond just wind resource assessment; they are useful for validating and improving physical models and are also important for avian and bat species, so a certain amount of sharing of wind data would be useful to a variety of stakeholders. Variables that are particularly relevant for marine biota include tracking of dissolved oxygen and turbidity.

Two variables were discussed more during the workshop that were not highlighted in the survey: the first was direct measurement of ocean currents, and the second was that there should

be a greater emphasis on collecting pH data than indicated in the survey results. *In situ* measurements of currents, like those of winds, are useful both for understanding the present state of the ocean and for validating and improving physical models. Acidity, through measurement of ocean chemistry metrics including pH, is becoming increasingly important to shellfish species as ocean acidification continues to evolve.

One important discussion point that arose during the workshop was the importance of measuring physical parameters as well when conducting biological surveys and studies. This is necessary in order to better understand and quantify changes taking place in the physical environment and how they influence the studied biota; this includes the ability to separate any changes that occur due to the presence of wind farms from other changes, such as climate.

2.1.2 Fisheries Data

Baseline and monitoring studies of fisheries resources at offshore wind farms will need to be collaborative to include fishing industry stakeholders, scientists, and appropriate data end-users, such as those from state and federal agencies or other decision-makers. These studies would need to remain mindful of the coexistence among the commercial and recreational fishing industries with offshore wind energy development. At present, the pace of offshore wind development is faster than the pace of fisheries science and it is critical that marine fisheries resources and fishing activity are considered during all phases of an offshore windfarm from pre-construction through operations and decommissioning.

Based on the pre-workshop survey, the vast majority of respondents indicated that they felt that all fisheries biota options (benthic finfish, pelagic finfish, bivalve shellfish, crustaceans, cephalopods) were very important or extremely important to be included in baseline and monitoring studies (Figure 3).

During the breakout discussions, participants further communicated that they felt that all species are important to measure given that all species are significant to commercial or recreational

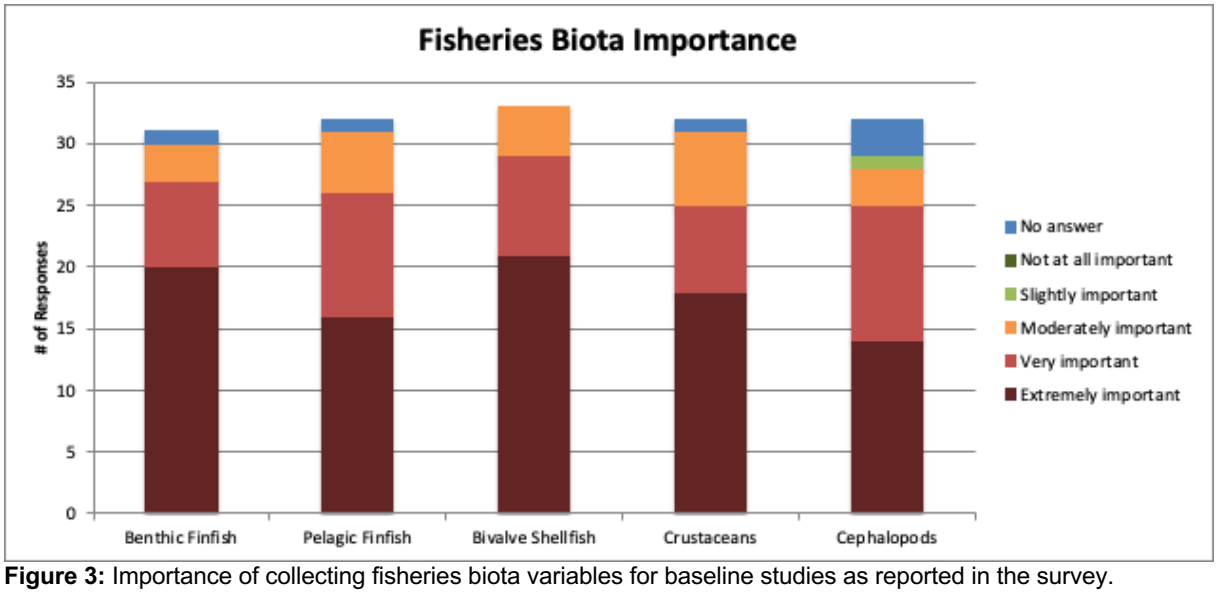

Figure 3: Importance of collecting fisheries biota variables for baseline studies as reported in the survey.

fisheries, or for their ecological roles within marine ecosystems. However, prioritization will be needed because studies that attempt to measure everything run the risk of functionally accomplishing nothing if inadequate information becomes available to inform decision-making. Additionally, research teams could be spread thin when attempting to address all issues related to offshore wind energy concurrent with other issues involved with fisheries science and management.

When considering what should be measured, participants of breakout discussions also felt that it is important to keep in mind why these items need to be measured in order to have hypothesis-based and goal-driven research following the scientific method. Prioritization of what species to measure in baseline and monitoring studies might be guided based on the value of species for commercial and recreational fisheries, or based on the amount or quality of data already available for a given species. Research priorities outlined in existing documents, such as from BOEM, ROSA, or fisheries monitoring plans developed for each lease site, could further help to guide the prioritization of baseline and monitoring data needs. Furthermore, prioritization of research needs could be guided by developing a matrix that considers the life history, stock status, and/or fishery value of a given species to gauge the expected vulnerability and sensitivity of species to potential impacts from offshore wind development, similar to the matrix developed[8] as an assessment of species vulnerability to climate change.

The priorities for baseline and monitoring studies will vary spatially among different windfarms given the variability in species' distribution and abundance. Some of the specific baseline and monitoring needs discussed during the fisheries breakouts included artificial reef effects (i.e., attraction vs. production effects), potential new or lost fishing opportunities, the vulnerability of finfish and shellfish to noise and electromagnetic fields, and studies focused on across all life history stages, such as seasonal and spatial abundance and distribution, spawning dynamics, and sex ratios. Additionally, monitoring of benthic and pelagic habitats were identified as research needs to investigate potential impacts from offshore wind development on these habitats and the associated benthic and pelagic species (e.g., mackerel, herring, menhaden, squid, highly migratory species). It was noted that certain species, such as stationary shellfish (e.g., surfclams, sea scallops), might serve as the most valuable indicator species for investigating potential ecological effects of offshore wind energy development on marine fisheries resources.

Another consideration identified during the breakout discussions was the potential impacts of offshore windfarms on access of existing surveys such as the NOAA NEFSC seasonal bottom trawl survey. Baseline and monitoring studies conducted in offshore wind farms will also have to disentangle the potential impacts of offshore wind energy development from stock- or coast-wide population dynamics, such as the life history and seasonal distribution of each species. Incorporation of control sites will be critical for evaluating potential impacts of offshore windfarm development on marine fisheries resources and their habitats.

[8] Hare, J. A., and Coauthors, 2016: A Vulnerability Assessment of Fish and Invertebrates to Climate Change on the Northeast U.S. Continental Shelf. *PLoS One*, **11**, e0146756, https://doi.org/10.1371/JOURNAL.PONE.0146756.

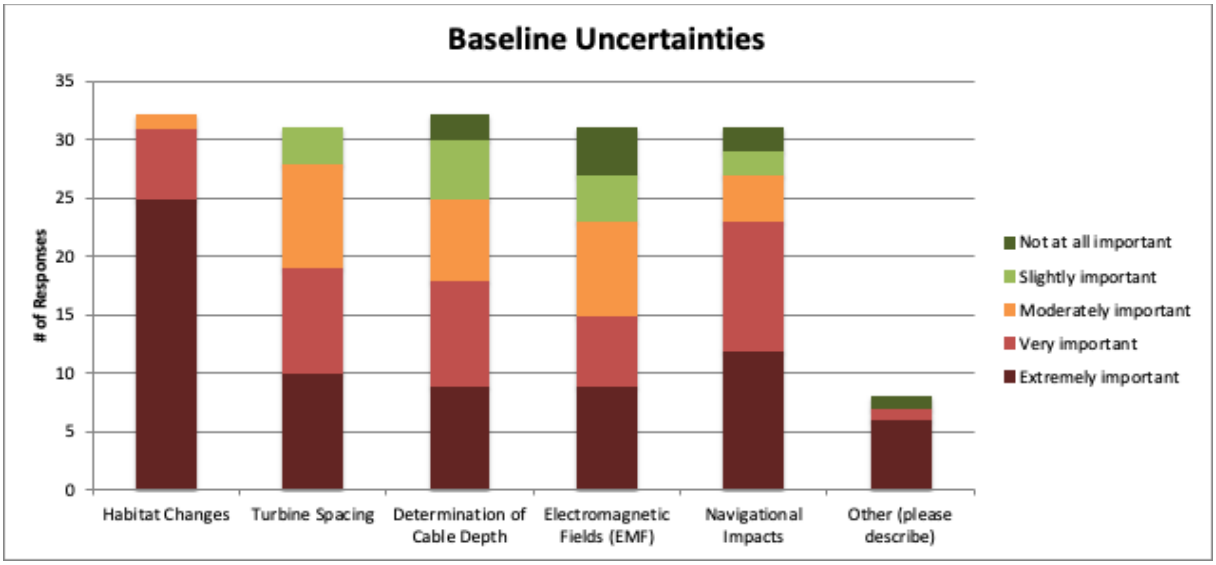

Figure 4: Importance of quantifying uncertainties for fisheries in baseline studies as reported in the survey.

This input from the breakout discussions supplemented and largely corroborated the results from the pre-workshop survey. Survey results indicated that almost all respondents felt that it would be very important or extremely important to monitor habitat changes, while turbine spacing, determination of cable depth, electromagnetic fields, and navigational impacts were also identified as moderately to extremely important by most respondents for baseline studies (Figure 4) and for monitoring studies.

2.1.3 Non-Fisheries Biota Data

The survey respondents evaluated variables that should be measured as part of baseline and monitoring studies associated with offshore wind development (Figure 5). The species considered in the survey ranged from phytoplankton and zooplankton near the base of the marine food web to higher trophic levels represented by turtles, birds, bats, and marine mammals. There was consensus that all the above species are at least moderately important with the vast majority ranking all species categories as very or extremely important. Expanding on these results, the responses clarified linkages and more specific categories that should be included in baseline and monitoring studies including:

- Forage species, predator species, and species targeted by commercial and recreational fisheries
- Species indicative of ecological changes
- Migrating birds/bats
- Federally threatened and endangered species

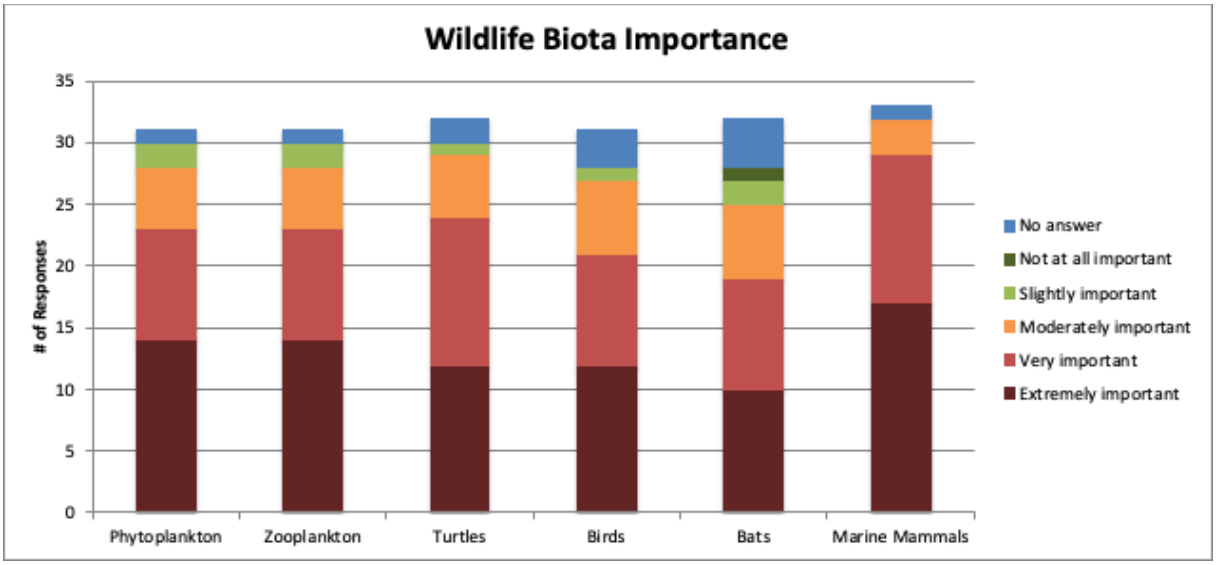

Figure 5: Importance of collecting non-fisheries (wildlife) biota variables for baseline studies as reported in the survey.

Section 2.2: How we need to measure?

2.2.1 Physical/Chemical Data

Results from the pre-workshop survey indicated that the measurement of many physical and chemical variables would ideally take place continuously or near-continuously, with more than half of respondents preferring at least daily measurements of all variables except the substrate type, which is far less variable temporally than the other variables (Figure 6). During the workshop discussion, many participants stated that it was important to measure these variables with the same frequency for both baseline and monitoring studies; if anything, they should be sampled more frequently during continuous monitoring studies. Fortunately, many of these variables are able to be sampled autonomously using a variety of observing platforms, enabling continuous or near-continuous gathering of data.

There are various suites of sensors for these physical quantities that are relatively inexpensive, and can be included on both fixed and mobile platforms, either on crewed vessels or autonomous systems. Furthermore, many of these sensors can be deployed on existing vessel fleets, including commercial and recreational fishing vessels, and do not require specialized scientific research vessels to collect high quality data. It is important to leverage all possible vessels-of-opportunity in order to maximize data collection, and improve the understanding of connections between the physical environment and the underlying ecological systems.

One final key discussion point was the need to begin surveys and studies of the physical variables now using existing technologies and methods, and then extending these physical measurements once the turbines are in place using instruments and methods that are capable of being installed on the turbine structures themselves. This will allow both before and after installation data, as well as the ability to take advantage of the newly built infrastructure to reduce ongoing monitoring costs.

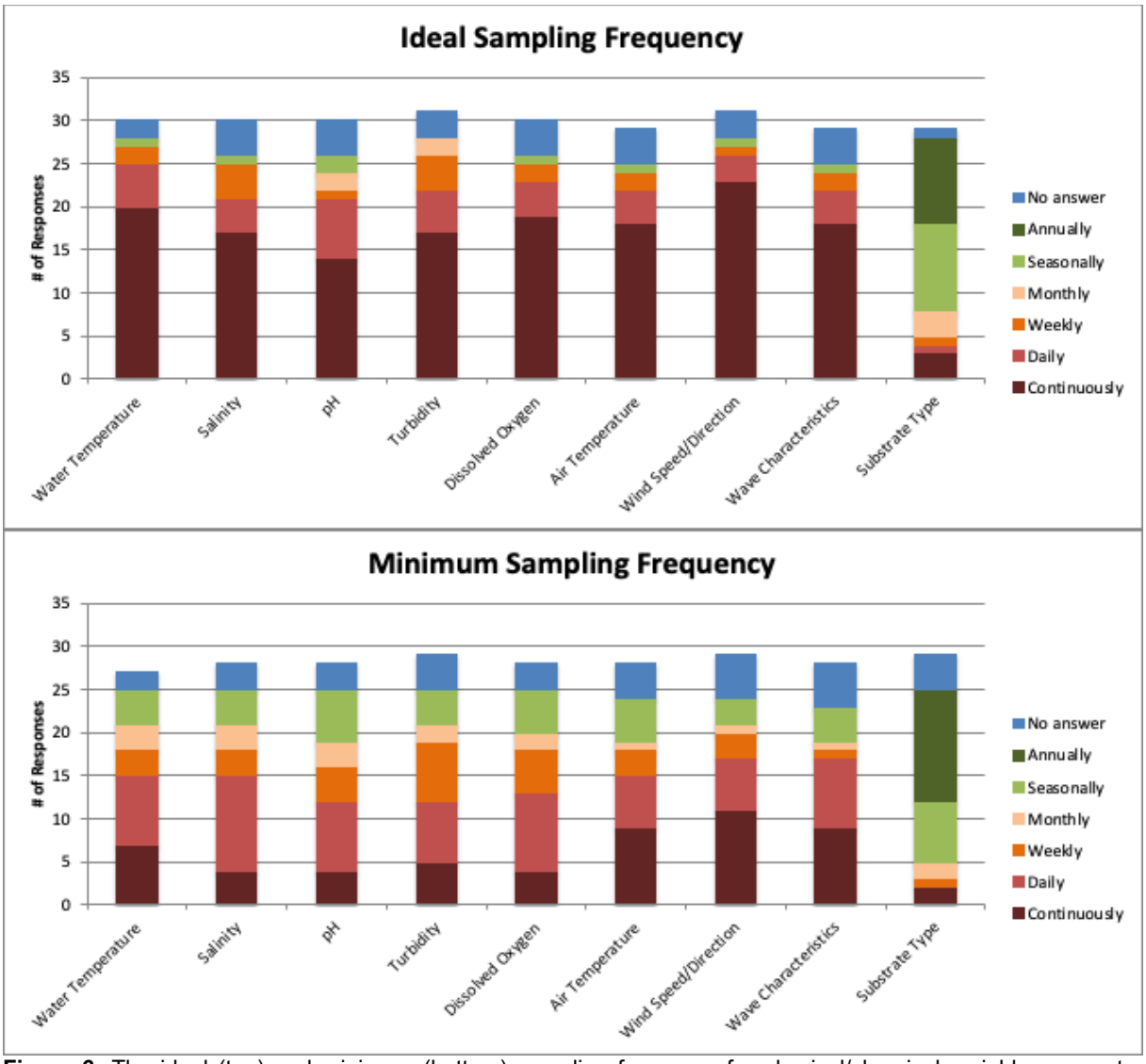

Figure 6: The ideal (top) and minimum (bottom) sampling frequency for physical/chemical variables as part of baseline studies as reported in the survey.

2.2.2 Fisheries Data

Baseline and monitoring studies will need to be coordinated throughout the northeast region to be coherent and able to meet their goals, while also balancing the need for some finer-scale studies to address local issues. Coordination will be essential to avoid redundancies and to have appropriate consistency in methods that could allow for comparison of study results or integration of results across studies. Given the expected limitations in funding, utilization of existing knowledge and studies related to fisheries and offshore wind from other countries could contribute to fisheries-related decision-making specific to US offshore wind development. Additionally, construction types (e.g., turbine or foundation characteristics) and wind farm layouts could also require tailoring of baseline and monitoring studies to a given location. Input from stakeholders and data end-users will be critical to ensure that studies incorporate local ecological

knowledge and are designed in a manner that maximizes their capability to meet intended objectives.

A diversity of scientific methods should be considered for baseline and monitoring studies, including existing methods and development of novel approaches. Ideally, data could be compared or integrated among different approaches to answer questions at the scales of individual wind farms or regionally across multiple windfarms and/or species. Existing datasets and methods used to survey marine fisheries resources could be used to guide baseline and monitoring studies, including consideration of approaches used in other countries. Calibration experiments should be performed as needed when applying novel approaches (i.e., potential use of eDNA) or to maintain time series integrity (i.e., continuation of modified trawl surveys); calibration experiments should also be performed prior to the start of wind farm construction. Discussion during breakout sessions included emphasis on the need to effectively maintain existing surveys so that they can continue to survey in offshore wind farms. An example would be the NOAA Northeast Fisheries Science Center's bottom trawl survey that is conducted annually along the northeast shelf in spring and fall. Maintaining this survey would be a valuable dataset for baseline and monitoring studies of offshore wind farms, in addition to continuing to serve its critical roles in informing stock assessments and fisheries management. Recommendations from the workshop also encouraged consideration of employing multiple survey techniques for synoptic observations and comparison among different approaches. These could include the more traditional fishing gear types used to survey fisheries resources, such as trawls, dredges, and traps, but also the use of eDNA, hydroacoustics, and other types of acoustics equipment (e.g., acoustic telemetry or passive acoustic monitoring of sound production) on fixed or mobile (e.g., gliders) platforms with as many sensors as possible to maximize the utility of sampling efforts. These types of approaches would allow monitoring of benthic and pelagic species, and many could be deployed from research vessels or aboard fishing industry vessels as a part of cooperative research partnerships.

Results from the pre-workshop survey collected input on the ideal frequency (i.e., assuming unlimited funding) of sampling of fisheries resources and the minimum sampling frequency of fisheries resources (Figure 7) using these types of survey methods. These survey responses indicated a preference for weekly or monthly sampling of fisheries resources in ideal scenarios, but that monthly, seasonally, or even annually (for sedentary shellfish) would be the minimum sampling frequency required.

Workshop participants communicated that they felt that it could be best for data from baseline and monitoring studies to be stored in an existing data portal to facilitate a regional approach and coordination, as well as for data access by appropriate end-users. Additionally, it was recommended that results from baseline and monitoring studies of offshore windfarms be integrated with other datasets, such as the trawl surveys done by federal, state, or academic scientists, so that they can be combined in assessing regional issues (e.g., cumulative impacts). However, it was acknowledged that obstacles could exist in standardization of methods or data sharing depending on who is conducting or funding the research, as well as the timing of the release of data before, during, or after review of construction and operations plans (COPs) and terms and

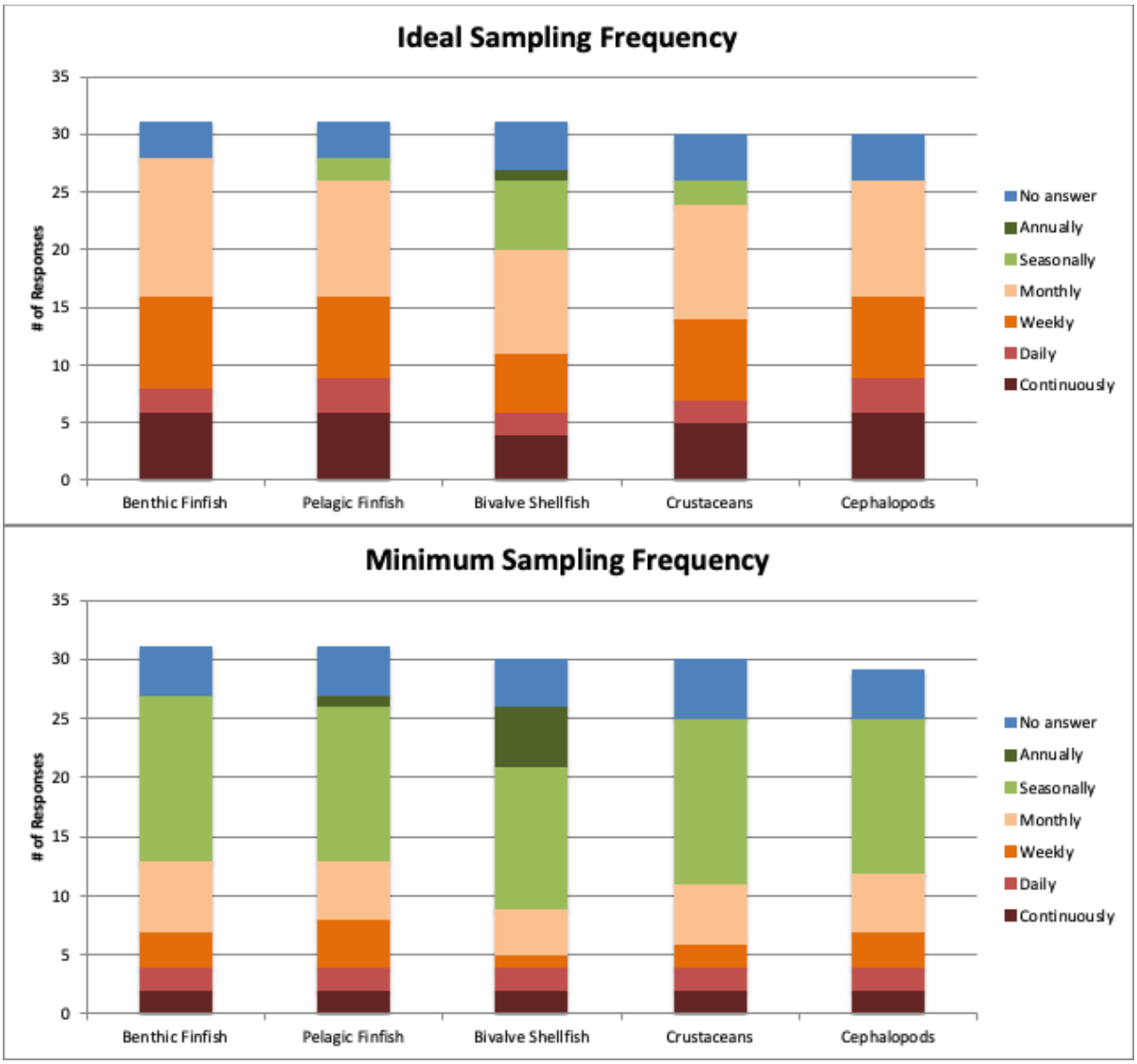

Figure 7: The ideal (top) and minimum (bottom) sampling frequency for fisheries biota as part of baseline studies as reported in the survey.

conditions issuance. Regional coordination with groups such as ROSA or federal agencies could help to overcome some of these obstacles in order to dually meet local and regional needs.

2.2.3 Non-Fisheries Biota Data

The ideal frequency for sampling non-fisheries biota variables (Figure 8) indicated that observations at the base of the food pyramid of phytoplankton and zooplankton should be sampled most frequently, with about half of respondents indicating at least daily sampling. Higher organism ideal sampling indicated that less frequent sampling would be acceptable, with the exception of marine mammals. The minimum sampling frequencies for all biota were similar to the fisheries biota, indicating monthly/seasonal sampling may be sufficient.

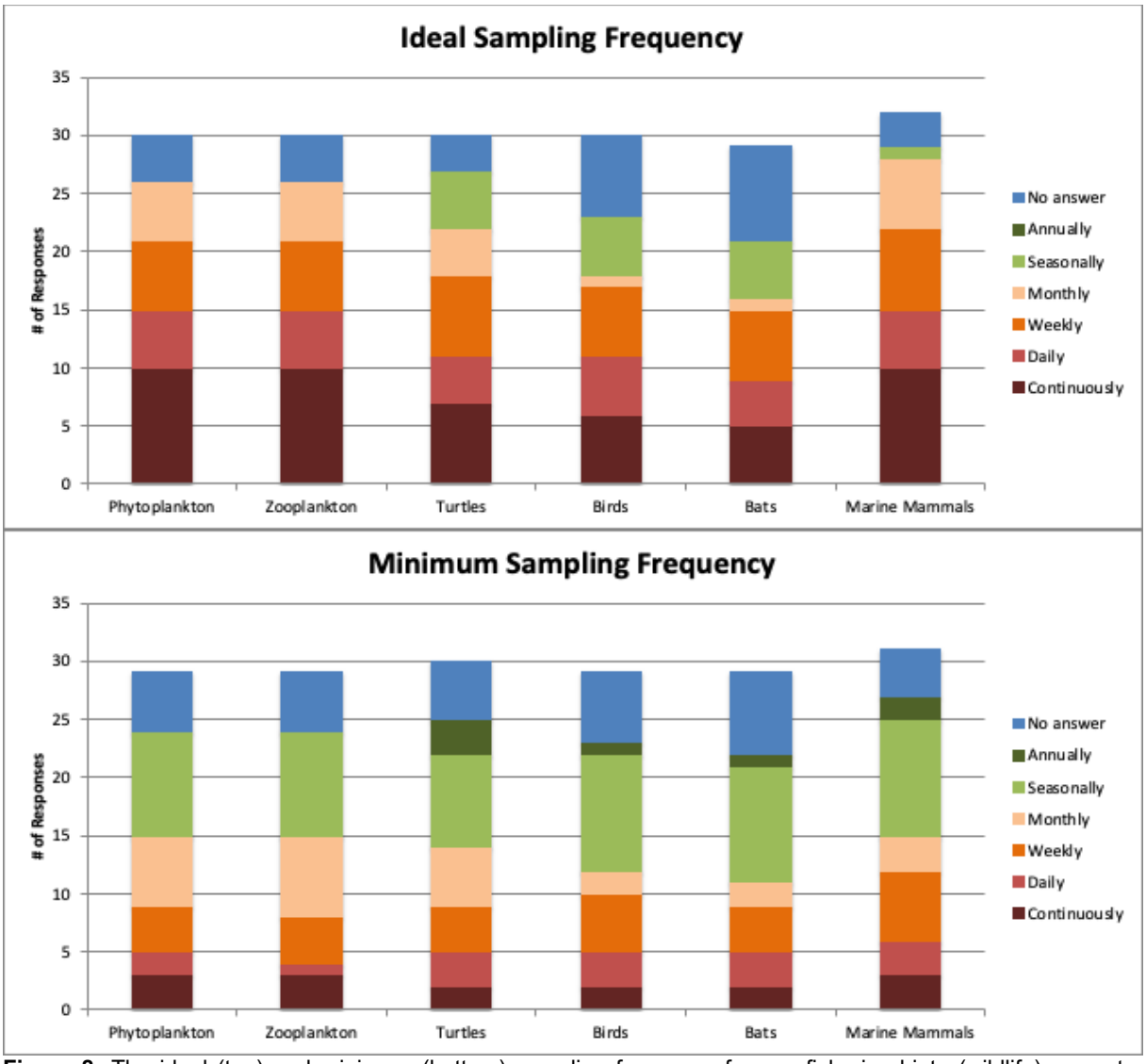

Figure 8: The ideal (top) and minimum (bottom) sampling frequency for non-fisheries biota (wildlife) as part of baseline studies as reported in the survey.

The survey responses considering sampling of non-fisheries biota stressed the integration of multiple sampling platforms. These platforms and methods extend the sampling beyond traditional methods alone. They include:

- Ocean Observing Technology (HF Radar, gliders, fixed stations)
- Optics and Acoustics (passive and active)
- eDNA, marine mammal and fish tags
- High-def photography, lidar, aerial surveys
- Trawls and Traps

Using a network of sensors integrated in autonomous (AUVs, gliders, the biota themselves) and fixed platforms (affixed to the turbines, moorings in the WEAs), new sensors could

continuously sample the local environment and associated ecology. Specific areas of emphasis raised by the participants included:

- Radars are very useful to understand the flux of aerial biota
- Passive acoustic monitoring
- Animal telemetry
- Baited cameras

Specific to the bird- and bat-related sampling, it was noted that the study designs should resolve the vertical distribution of these species relative to the turbines. These data will provide a baseline with which one can assess any potential attracting or displacement factors of the turbines on their migration patterns.

2.2.4 Integrating New Observations with Modeling and Existing Baseline Information

All respondents agreed that modeling activities should also complement these observing programs in multiple ways (Figure 9). All uses listed in the figure below were mostly ranked very important or extremely important by the majority of respondents. Only uses that inform baseline studies by either ecological or physical models received any ranks of slightly important or not important at all.

Building on these survey results, the breakout discussions during the workshop stressed the importance of leveraging and integrating existing sources of relevant baseline data including existing surveys (trawl, benthic, aerial) and regional ocean observing efforts through federal, state, academic and Integrated Ocean Observing System (IOOS) associations. The introduction of offshore wind to this region is an opportunity to coordinate all of these efforts to properly deliver baseline data to the process. Existing data standards for quality control and public access will enable this coordination throughout the region.

Section 2.3: When we need to measure?

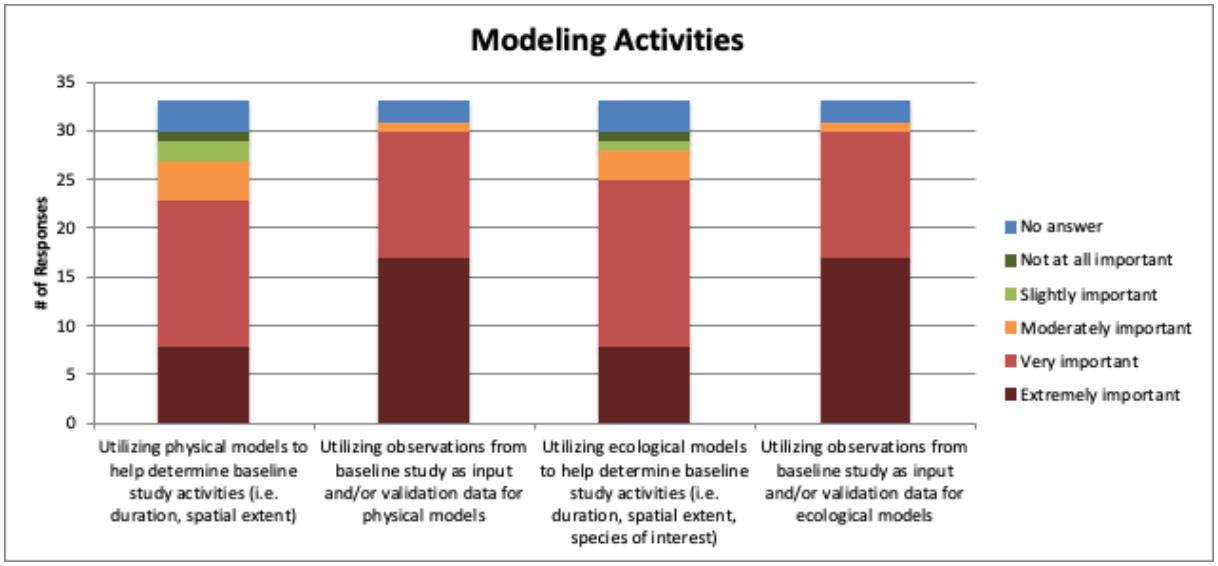

Figure 9: Ways to utilize modeling activities as part of baseline and monitoring studies as reported in the survey.

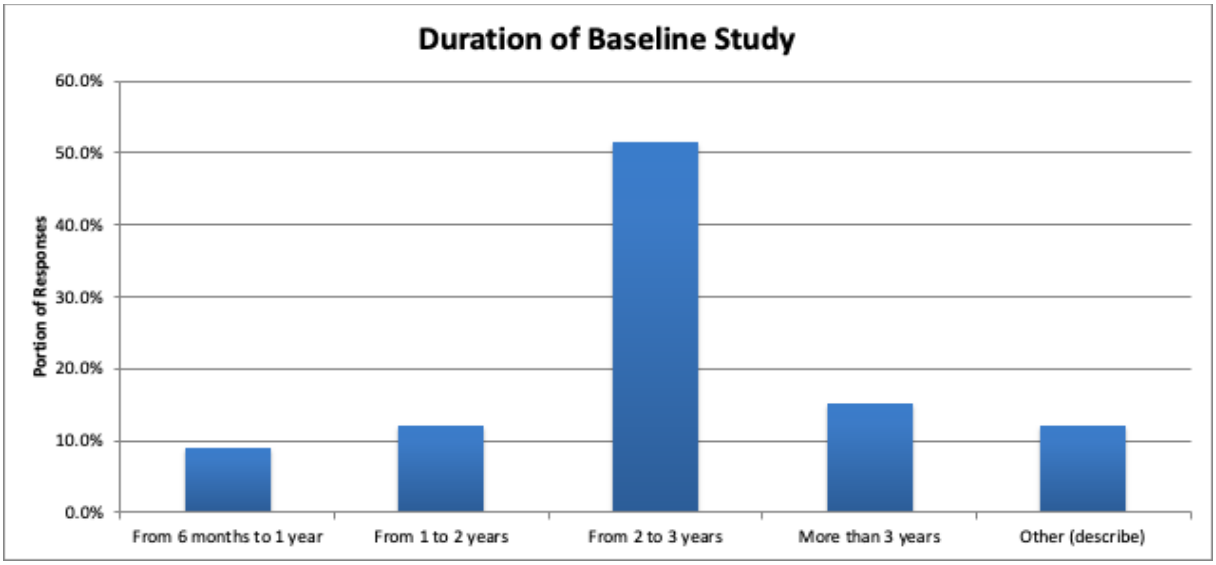

Figure 10: Suggested duration of baseline studies as reported in the survey.

A large majority of respondents selected 2-3 years (Figure 10) as their recommended timeframe when baseline monitoring should occur prior to construction. The breakout discussions during the workshop supported this result, stressing the importance of utilizing existing data as part of this baseline while integrating new techniques and data (as described above).

The extension of the baseline data gathering into monitoring during construction and operation of a wind farm was also discussed in the workshop (Figure 11). Overall, there was consensus that monitoring studies should continue through the first five years of wind farm operation at the same frequency as that established in the baseline time period 2-3 year prior to construction.

Additionally, the extension of the monitoring beyond five years post construction was encouraged, although there was general agreement that the frequency of some observations could be reduced during this time period. This recommended sampling strategy would provide the data necessary to assess the potential impacts of offshore wind facilities on the environment and ecology and maintain the continuity of existing surveys to consider climate scale variability over the entire lifespan of a wind farm. Discussion during the fisheries breakouts agreed that baseline and monitoring studies should span the entire lifespan of an offshore windfarm from pre-construction periods to decommissioning, but that the frequency of sampling could change over time. Depending on the life history of a given species (i.e., short-lived species such as squid vs. longer-lived species such as sea scallops), different durations of baseline studies conducted pre-construction would be recommended to assess potential impacts of the offshore wind energy development. Therefore, life history characteristics should be considered when determining baseline study duration, as well as when interpreting results from monitoring studies conducted during windfarm operation phases. Participants noted that 2-3 years of baseline studies might not be sufficient but perhaps is the most realistic given observed timelines of offshore wind projects and available funding. Ideally, if resources allow, baseline studies would be conducted for longer periods to better interpret trends and evaluate potential impacts from offshore wind development.

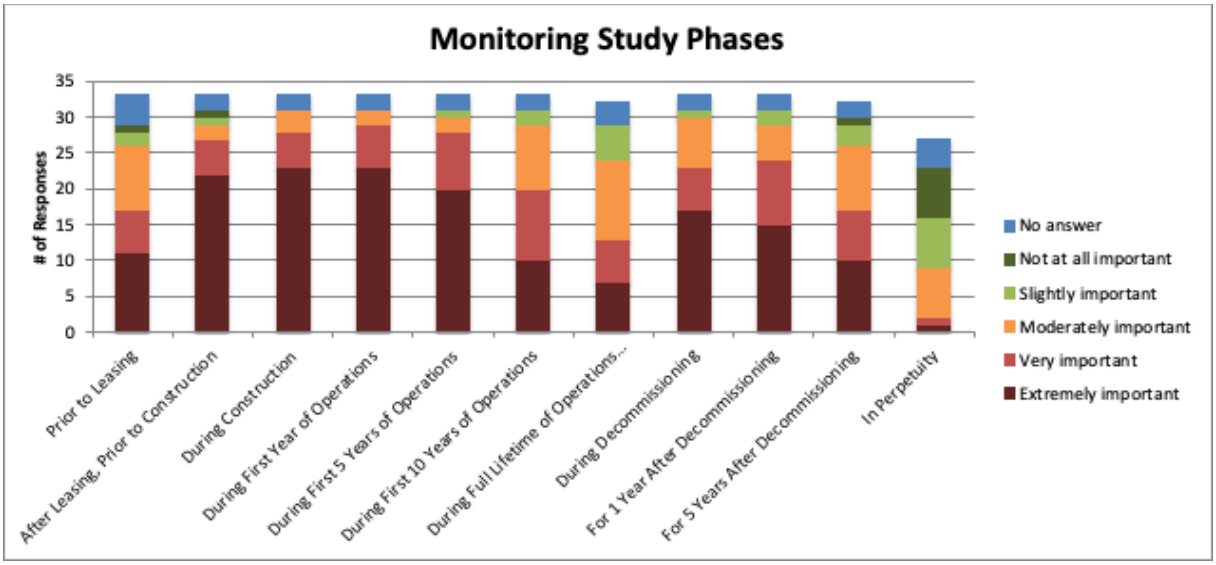

Figure 11: Phases of wind farm construction and operations during which monitoring activities should occur, as reported in the survey.

Studies initiated prior to or during offshore windfarm installation should continue through the lifespan of the windfarm to be able to parse out natural variability versus windfarm-induced impacts. Additionally, adaptive planning should be considered in the development of plans for baseline and monitoring studies in order to be able to address research needs that are likely to be identified over time.

Section 2.4: Where we need to measure?

Similar to the timing of the sampling summarized above, there was general consensus among the survey respondents and workshop participants on the spatial scale of monitoring required (Figure 12). All agree that baseline and monitoring studies should consider the entire region with areas identified as control sites outside of the influence of changes from offshore wind facilities.

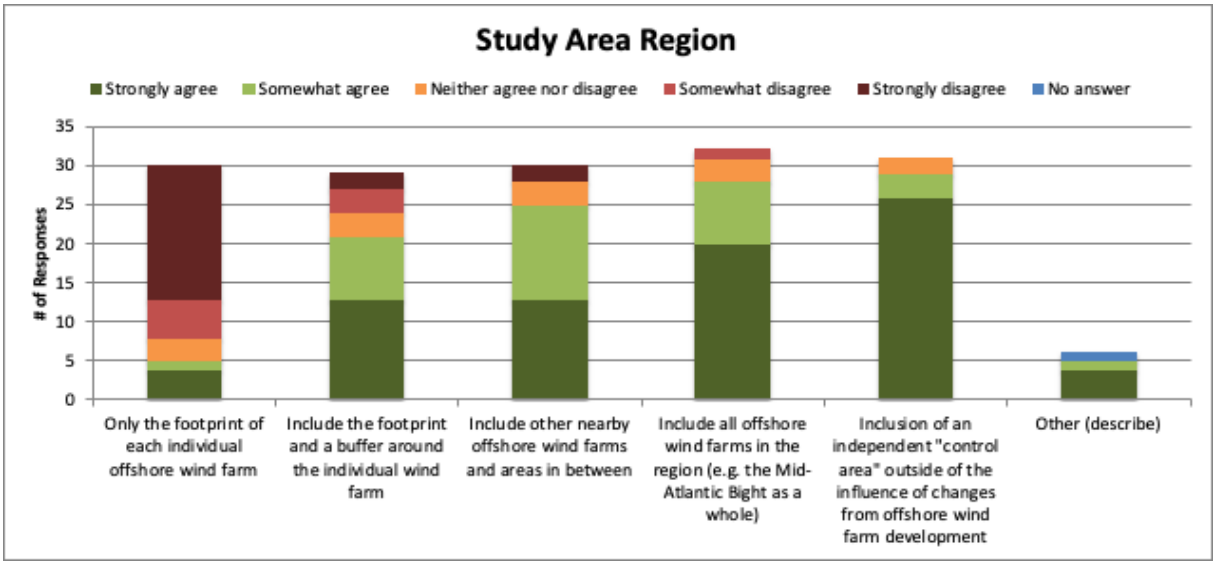

Figure 12: Region of study for baseline and monitoring studies as reported in the survey.

As summarized above, the workshop participants indicated that the way this could be done is through regional coordination and integration of local scale survey efforts. It is critical to simplify and facilitate contributions of data to a single regional product built from effort of many over different scales throughout the region. Environmental data will be critical to help delineate control areas in an incredibly dynamic coastal ocean.

Workshop participants emphasized the need to get the spatial scales of baseline and monitoring studies correct in order to meet study objectives and provide meaningful results for end-users on issues related to fisheries resources. Breakout discussions communicated that studies shouldn't only be done at the spatial scale of an individual offshore windfarm, but also beyond the scale of each windfarm and in the areas between offshore windfarms with the inclusion of control sites. This presents the need to balance both fine-scale data needs at the scale of an individual windfarm (or, even an individual turbine) and regional data needs, which, as noted above, will be critical for considering results in the context of stock- or coast-wide population dynamics and trends. Not only were offshore habitats considered important, but also nearshore and estuarine waters that might be impacted by offshore wind energy development, particularly along cabling routes.

Section 3: Workshop Synthesis and Next Steps

Workshop Synthesis

The general topics discussed among the workshop participants included the recommended research, tools, and partnerships needed to better define baseline and monitoring studies that will quantify potential impacts of offshore wind development. In addition to the specific variables detailed in Section 2, there was a clear consensus that any baseline and/or monitoring study should consider the entire system, from the dynamic oceanographic habitat up through the food web. In addition to temperature and dissolved oxygen, the discussion groups identified additional oceanographic measures of ocean currents and pH as priorities for inclusion in such studies. While all biota (fisheries and non-fisheries) variables were highlighted as important, there was a recognition that hypothesis-driven, site-specific considerations should be used to help to prioritize and fit within available resources.

Most of the community agreed that baseline studies should begin at least 2-3 years prior to construction. For most data categories, these baseline efforts should continue in monitoring studies at similar frequency for at least 5 years post construction, with less frequent sampling then continuing for the life of the wind farm. Considering available technology, most agreed that physical/chemical data could be collected continuously with most sampling occurring at least once each day. The frequency of fisheries and non-biota data sampling could be less frequent with minimal sampling requirements each season (4 times a year) and weekly to monthly sampling if possible.

Expertise from all stakeholder communities is critical to accomplish this sampling integration. Collectively, these communities bring a diversity of platforms and methods that can support both baseline and monitoring studies at the local scale and integration at the regional scale.

These baseline and monitoring plans should welcome new non-extractive techniques with proper side-by-side evaluation with more traditional sampling methods. These studies should integrate with ongoing federal and state efforts. Additionally, there was consistent input on the priority effort that should be placed on the preservation of the existing surveys (federal and state) given potential disruption by offshore wind development. Finally, the breakouts stressed the importance of leveraging the wind farm facilities themselves in regional environmental and ecological monitoring. A critical need was to engage the broader community in techniques and survey design that would prevent any disruption in the existing surveys highlighted above. This was addressed in two areas of effort 1) How can the offshore wind farm facilities be instrumented to maintain environmental and ecological time series? And 2) What new sampling platforms and methods could be implemented to fill gaps in survey coverage within the wind farm? As the discussion evolved among groups, it became clear that these two areas of effort were one and the same. In order for either to help maintain existing multi-decadal time series, new techniques and platforms should be tested and properly integrated into an overall design. A regional methodology that is accepting of new technology and setup was recommended to facilitate multiple data providers to a single regional product that maintains the continuity of existing surveys and monitoring. Participants considered both fixed and autonomous platforms, many already with a proven track record, as discussed in Section 2.2.

Baseline and Monitoring Priorities

At the conclusion of the breakout discussions, we asked the moderators to summarize the priorities identified in the survey and breakouts within each category of variables. These priorities were presented to the workshop participants and they were asked to rank order the list. Every item on each list received votes from the participants, indicating that each priority should be considered in baseline and monitoring plans. The results of these polls for each category of data described above are listed below, in order of importance (some editorial revisions made for clarity):

Physical and Chemical Breakout Groups

1. More measures of ocean currents, particularly as it relates to mixing of seasonal stratification (cold pool processes)
2. Initiate monitoring now using autonomous platforms with sampling strategies that anticipate the location and distribution of wind farm development
3. Utilize multiple platforms that can collect physical/chemical data
4. Data collected by developers prior to construction can contribute to baseline monitoring
5. Existing data collection from ocean observing and survey effort already contribute a significant baseline of some physical and chemical variables
6. The variability of the ocean makes it difficult to identify obvious control sites, so gradient study design, which accounts for the dynamic nature of the environment, may be more appropriate

7. All breakout groups agreed that pH, water clarity and dissolved oxygen were generally undervalued in the survey and surface to bottom measurements should be prioritized in baseline and monitoring studies

Fisheries Breakout Groups

1. Baseline and monitoring studies should address gaps in existing surveys and research
2. These studies should be hypothesis driven design
3. All species are important, prioritization within a particular study should be based on site specific vulnerability of that species to impact
4. Recognition that varying spatial scales and the regional scope of offshore wind development require coordination in baseline and monitoring effort between adjacent sites, but there may be specific questions that need to be addressed for a specific site
5. These studies should be designed and implemented through collaboration with all expert sectors including industry, academia, state and federal agencies.
6. Pilot new techniques in baseline studies and calibrate with more traditional methods early on
7. Vulnerability and perceived risks to impact of offshore wind will be variable in space and time
8. All baseline and monitoring activities should consider impact on the existing state and federal surveys

Non-Fisheries Biota Breakout Groups

1. There is a need for a regional effort to coordinate, integrate, and consolidate data to learn from what we have already gathered
2. Adapting surveys to wind farms in a way that will sample the migratory species and inform the knowledge gaps in species life stages
3. Existing surveys should be sustained through offshore wind development
4. Coordination across the collection of distributed 2-3 year baseline studies will establish a regional baseline that is truly representative and non-arbitrary
5. Monitoring of primary production should be connected with the physical and chemical variables
6. A focus on monitoring specific marine mammals and high conservation species
7. Regional monitoring approaches to migratory birds that covers both night and day sampling will require the integration of multiple methods
8. Expand the use and participation of citizen science sampling

Cross-cutting each of these priorities was an emphasis placed on baseline and monitoring design that incorporated ***ecosystem approaches*** in a way that leveraged the ***power of partnerships***.

An Ecosystem Approach

Throughout the workshop, there was a general sense to look at the entire ecosystem to understand impacts to these target species, from the oceanography of their dynamic habitat through the primary and secondary species that form the foundation of their target prey species. The natural variability of the oceanography will inform the impact analysis of target species. Plankton serve as the base of the food web, a critical energy foundation across all target species identified by the breakout groups. These studies should capture the variability across important gradients in the oceanography and the base of the marine food web. Quantifying the covariance of these variables and the target species will reduce the uncertainty in their observed variability. This will in turn permit a regional whole-system approach to quantify potential displacement or impact on patterns of the target species migration and foraging.

Power of Partnerships

Partnerships are critical to the implementation of regional approaches needed for coordination, data sharing, and evaluating cumulative impacts. To realize the potential and to properly integrate a balance of new and existing platforms, the participants prioritized collaborative research efforts. Through these collaborative efforts that engage across the expert communities (fishing industry; NGOs; academia; local, state, and federal government; government labs; and citizen scientists), comparative studies could test different survey approaches to minimize disruption of existing surveys. They could evaluate new sensors and methods to inform the continued monitoring across the region and finally, they will demonstrate effective data management practices that enable data integration and sharing across the region. Prioritizing this effort now will ensure that valuable time series data are not disrupted and enable more continuous observations throughout the region and across seasons to inform the multiple communities utilizing the ocean and its resources in and around the wind farms.

Appendix 1 – Survey Questions

Preliminary Questions

- What best describes your affiliation?
    - Academic
    - State Government
    - Federal Government
    - Fishing Industry
    - Offshore Wind Industry
    - Environmental NGO
    - Consultant
    - Other
- Please rate the importance of the following study types on the Outer Continental Shelf (OCS) with regard to the siting and presence of offshore wind farms. [Scale: Extremely important; very important; moderately important; slightly important; not at all important]
    - Studies conducted prior to offshore wind farm construction (baseline studies)
    - Studies conducted during construction, operations, and decommissioning (monitoring studies)
    - Other (optional, please define)

Physical and Chemical Measurements

- Please rate the importance of measuring the below **physical/chemical** variables as a part of **baseline studies** at and around offshore wind development. Please answer only for variables with which you are familiar, or skip this question entirely if you do not feel you are able to answer. [Scale: Extremely important; very important; moderately important; slightly important; not at all important; No answer]
    - Water Temperature (surface, water column, bottom)
    - Salinity (surface, water column, bottom)
    - pH (surface, water column, bottom)
    - Turbidity (surface, water column, bottom)
    - Dissolved Oxygen (surface, water column, bottom)
    - Air Temperature (near surface, aloft)
    - Wind Speed/Direction (near surface, aloft)
    - Wave Height
    - Wave Direction
    - Wave Swell
    - Substrate Type
    - Other
- For variables above for which you answered "water column" or "aloft," at what depths/heights would you take measurements as part of a **baseline study**?

- If designing an **ideal baseline study**, **where cost is not an issue**, how often would you conduct your monitoring of these variables? [Scale: Continuously; Daily; Weekly; Monthly; Seasonally; Annually; Never; No answer]
    - Water Temperature
    - Salinity
    - pH
    - Turbidity
    - Dissolved Oxygen
    - Air Temperature
    - Wind Speed/Direction
    - Wave Characteristics
    - Substrate Type
    - Other
- What would be the **minimum frequency** with which you would monitor those same variables in order to obtain a reliable, scientifically meaningful dataset? [Scale: Continuously; Daily; Weekly; Monthly; Seasonally; Annually; Never; No answer]
- If conducting a continuous **monitoring study**, how would the **minimum sampling frequency** of these variables have to change? [Scale: Much higher; Moderately higher; Slightly Higher; About the same; Slightly lower; Moderately lower; Much lower]

Marine Biota Measurements

- Please rate the importance of measuring the spatial and temporal abundance of the following **marine biota** as a part of **baseline studies** at and around offshore wind development. Please answer only for categories with which you are familiar, or skip this question entirely if you do not feel you are able to answer. [Scale: Extremely important; very important; moderately important; slightly important; not at all important; No answer]
    - Phytoplankton
    - Zooplankton
    - Benthic Finfish
    - Pelagic Finfish
    - Bivalve Shellfish
    - Crustaceans
    - Cephalopods
    - Turtles
    - Birds
    - Bats
    - Marine Mammals
    - Other
- What **species** do you feel are of particular importance as part of a **baseline study**? Why?

- If designing an **ideal baseline study**, **where cost is not an issue**, how often would you conduct your monitoring of these biota? [Scale: Continuously; Daily; Weekly; Monthly; Seasonally; Annually; Never; No answer]
    - Phytoplankton
    - Zooplankton
    - Benthic Finfish
    - Pelagic Finfish
    - Bivalve Shellfish
    - Crustaceans
    - Cephalopods
    - Turtles
    - Birds
    - Bats
    - Marine Mammals
    - Other
- What would be the minimum frequency with which you would monitor those same biota in order to obtain a reliable, scientifically meaningful dataset? [Scale: Continuously; Daily; Weekly; Monthly; Seasonally; Annually; Never; No answer]
- If conducting a continuous **monitoring study**, how would the **minimum sampling frequency** of these biota have to change? [Scale: Much higher; Moderately higher; Slightly Higher; About the same; Slightly lower; Moderately lower; Much lower]
- For biota identified as your highest priority, should studies be conducted in the following areas: [Scale: Strongly agree; Somewhat agree; Neither agree nor disagree; Somewhat disagree; Strongly disagree; No answer]
    - Only the footprint of each individual offshore wind farm
    - Include the footprint and a buffer around the individual wind farm
    - Include other nearby offshore wind farms and areas in between
    - Include all offshore wind farms in the region (e.g. the Mid-Atlantic Bight as a whole)
    - Inclusion of an independent "control area" outside of the influence of changes from offshore wind farm development
    - Other (describe)
- What are some of the monitoring/surveying methods that you would recommend for your highest priority species?

General Methods and Survey Design

- For how long should a **baseline study** be conducted **prior** to the commencement of offshore wind construction activities? [Scale: Less than 6 months; From 6 months to 1 year; From 1 to 2 years; From 2 to 3 years; More than 3 years; Other (describe)]

- Please rate the importance of **continuous monitoring studies** that take place during these phases of wind farm construction and operations. [Scale: Extremely important; very important; moderately important; slightly important; not at all important; No answer]
    - Prior to Leasing
    - After Leasing, Prior to Construction
    - During Construction
    - During First Year of Operations
    - During First 5 Years of Operations
    - During First 10 Years of Operations
    - During Full Lifetime of Operations (approx. 25 years)
    - During Decommissioning
    - For 1 Year After Decommissioning
    - For 5 Years After Decommissioning
    - In Perpetuity
- How might sampling strategy and measured variables/species vary during these different phases of wind farm operations?
- Is it more useful for studies to be **designed around a standard** for collecting data with the same methodology, or to conduct studies **designed independently** for differing objectives based on site and priorities? [Scale: Fully Standard; More Standard; Equally Standard and Independent; More Independent; Fully Independent]
- How important are each of the following uncertainties for inclusion in **baseline studies**? [Scale: Extremely important; very important; moderately important; slightly important; not at all important]
    - Habitat Changes
    - Turbine Spacing
    - Determination of Cable Depth
    - Electromagnetic Fields (EMF)
    - Navigational Impacts
    - Other (please describe)
- How important are each of the following uncertainties for inclusion in continuous **monitoring studies**? [Scale: Extremely important; very important; moderately important; slightly important; not at all important]
    - Habitat Changes
    - Turbine Spacing
    - Determination of Cable Depth
    - Electromagnetic Fields (EMF)
    - Navigational Impacts
    - Other (please describe)

- Please rate the importance of the following **modeling activities** as a part of a **baseline study**. [Scale: Extremely important; very important; moderately important; slightly important; not at all important; No answer]
    - Utilizing physical models to help determine baseline study activities (i.e. duration, spatial extent)
    - Utilizing observations from baseline study as input and/or validation data for physical models
    - Utilizing ecological models to help determine baseline study activities (i.e. duration, spatial extent, species of interest)
    - Utilizing observations from baseline study as input and/or validation data for ecological models
- How might the use of **modeling activities** vary if used throughout a continuous **monitoring study** with the goal of quantifying the impact of wind farms on the measured variables/species?
- How should data from **baseline and monitoring studies** be made available? **Please select all that apply**.
    - Through existing data portals (i.e. MARACOOS Oceansmap, MARCO, etc)
    - Through a dedicated data portal established by a pre-existing organization
    - Through a dedicated data portal established by a new regional organization
    - Other (describe)
- What organization(s) should be involved in establishing and maintaining this database?
- Would you and/or your organization be willing to sign a non-disclosure agreement to access certain types of data? [Scale: Definitely yes; Probably yes; Might or might not; Probably not; Definitely not]

Concluding Comments

- Do you have any other comments for the workshop organizers?

Appendix 2 – Workshop Agenda

2021 Partners in Science Workshop: Identifying Ecological Metrics and Sampling Strategies for Baseline Monitoring During Offshore Wind Development

PARTICIPANT AGENDA
January 28, 2021
9:00 AM to 1:00 PM ET

Join Zoom Meeting
https://cbuilding.zoom.us/j/98628661059 Meeting ID: 986 2866 1059
One tap mobile
+13017158592,,98628661059# US (Washington D.C)
+13126266799,,98628661059# US (Chicago)

TIME	PURPOSE	ITEM	PRESENTER
8:45	Tech Check	Sign on and Tech Check as Needed	All
9:00	Welcome	Welcome	Josh Kohut, Rutgers Kira Lawrence, BPU
9:10	Setting the Stage	● Quick Poll of who is Participating ● Review agenda and ground rules	Pat Field
9:15	Back-ground	● Review of Monitoring Paper ● Review of ROSA Interim Monitoring ● Update on BOEM-RODA-NOAA Synthesis of Science and NYSERDA State of Science ● Review of Survey Results Briefly	Mike Allen & Matt Campo, Rutgers Lyndie Hice-Dunton, ROSA Lane Johnston, RODA, Kate Press, NYSERDA Joe Brodie & Doug Zemeckis, Rutgers
9:55	Setting up Break outs	● Setting up the Discussions	Joe Brodie, Rutgers and Pat Field, CBI

10:00	Discussion Round #1	● Three rounds in round robin or world café format: Physical and chemical measurements; Fisheries and Shellfisheries; Marine Mammals, Birds, & Bats; phyto and zooplankton ● *What do we measure? (What baseline and monitoring is essential)* ● *How do we measure (methods?)*	Facilitators and Recorders
10:45	Break	● Stay in breakout zoom rooms ● Recorder shares notes on Google sheet for facilitator to review and prepare brief summary for next group	Facilitators & Recorders
10:55	Discussion Round #2		All
11:35	Break	● Stay in breakout zoom rooms ● Recorder shares notes on Google sheet for facilitator to review and prepare brief summary for next group	Facilitators & Recorders
11:45	Discussion Round #3		All
12:15	Break	● Participants back to the main room ● Facilitators/recorders stay in breakout zoom rooms to review and prepare brief summary full group	Facilitators & Recorders
12:30	Reporting out and Prioritizing	● Each of six facilitators succinctly reports out no more than 5 key priorities ● Poll after each theme reports out	Facilitators and participants
12:55	Close	● Next steps ● Thank you	Rutgers Team
1:00	Adjourn		CBI

Appendix 3 – Workshop Participants

First Name	Last Name	Job Title	Affiliation
Michael	Allen	Postdoctoral Research Associate	Rutgers University
Michael	Auriemma	Fisheries Biologist	NJDEP Bureau of Marine Fisheries
Crista	Bank	Fisheries Liaison	Vineyard Wind
Linda	Barry	Fisheries Biologist	NJ DEP, Div. Fish & Wildlife, Marine Fisheries Administration
Anthony	Bevacqua	Research Scientist	New Jersey Board of Public Utilities
Joseph	Bilinski	Research Scientist	New Jersey Department of Environmental Protection
Sarah	Borsetti	Graduate Student	Rutgers
Catherine	Bowes	Program Director	National Wildlife Federation
Joseph	Brodie	Director of Atmospheric Research	Rutgers University
Koen	Broker	Environmental manager	Shell
Megan	Brunatti	Acting Director	NJDEP Office of Permitting
Morgan	Brunbauer	Offshore Wind Marine Fisheries Manager	NYSERDA
Colleen	Brust	Research Scientist	NJDEP
Gary	Buchanan	Director	NJDEP Division of Science and Research
Brandon	Burke	Director of Policy and Outreach	Business Network for Offshore Wind
Steve	Cadrin	Professor	Univ. Massachusetts School for Marine Science & Technology
Matt	Campo	Senior Research Specialist	Rutgers University
Susan	Chambers	Deputy Director	West Coast Seafood Processors Association
Doug	Christel	Fishery Policy Analyst	National Marine Fisheries Service
Samuel	Coakley	Graduate Assistant	Rutgers University
Doug	Copeland	Development Manager	Atlantic Shores
Tom	Dameron	Government Relations & Fisheries Science Liaison	Surfside Foods, LLC
Genevieve	Davis	Research Acoustician	NOAA NMFS NEFSC
Greg	DeCelles	Senior Environmental Specialist	Orsted
Amanda	Dey	Principal Zoologist - Nongame	NJ Dept. of Env. Protection, Div. of Fish & Wildlife, Endangered & Nongame Spp
Jennifer	Draher	Oceanographer	BOEM
Paul	Eidman		
Steve	Evert	Director, Marine Field Station	Stockton University
Jim	Ferris	Bureau Chief of New Technology, Division of Clean	New Jersey Board of Public Utilities

First Name	Last Name	Job Title	Affiliation
Patrick	Field	Senior Mediator	Consensus Building Institute
Charlie	Flagg	Research Professor	Stony Brook University
Paula	Fratantoni	Oceans and Climate Branch Chief	NOAA NEFSC
Jeff	Freedman	Research Associate	University at Albany, Atmospheric Sciences Research Center
Barry	Gibson	New England Regional Director	Recreational Fishing Alliance
Scott	Glenn	Distinguished Professor	Rutgers University
Willy	Goldsmith	Executive Director	American Saltwater Guides Association
MacKenzie	Hall	Environmental Specialist 2	NJ Division of Fish and Wildlife
Simi	Harrison	Marine Biologist	Tetra Tech
Kevin	Hassell	Environmental Specialist	New Jersey Department of Environmental Protection
Emily	Heiser	Assistant Biologist	New Jersey Division of Fish & Wildlife
Tom	Herrington	Associate Director	Urban Coast Institute, Monmouth University
Lyndie	Hice-Dunton	Executive Director	ROSA
Peter	Himchak	Senior Fishery Scientist	Cooke Inc.
Fiona	Hogan	Research Director	RODA
Brian	Hooker	Biology Team Lead	BOEM
Ursula	Howson	Fish Biologist	BOEM
Sherryll	Huber Jones	NYS Ocean Coordinator	NYSDEC
Lane	Johnston	Programs Manager	RODA
Jeff	Kaelin	Director of Sustainability & Government Relations	Lund's Fisheries, Inc.
Josh	Kohut	Professor	Rutgers University
Elizabeth	Lange	Fisheries Biologist	NJ DEP Marine Fisheries Administration
Kira	Lawrence	Eagleton Science Fellow	NJBPU Division of Clean Energy
Andy	Lipsky	Fisheries and Offshore Wind Lead	NOAA
Tony	MacDonald	Director	Urban Coast Institute
Scot	Mackey	Executive Director	Garden State Seafood Assoc.
Elizabeth	Marchetti	Fisheries Manager	Equinor Wind US / Sea Risk Solutions
Travis	Miles	Assistant Professor	Rutgers University
David	Mizrahi	Vice-president, Research and Monitoring	New Jersey Audubon
Laura	Morse	Environmental Manager	Orsted North America
Daphne	Munroe	Associate Professor	Rutgers University
Eileen	Murphy	Vice President	NJ Audubon
Sarah	Murphy		
Stephen	Myers	Research Scientist	NJDEP
Laura	Nazzaro	Research Analyst	Rutgers University
Adam	Nowalsky		

First Name	Last Name	Job Title	Affiliation
Chris	Orphanides	Research Zoologist	NOAA Fisheries
Ruth	Perry	Marine Scientist	Shell
Kate	Press	Project Manager	NYSERDA
Grace	Saba	Assistant Professor	Rutgers University
David	Secor	Professor	Chesapeake Biological Laboratory
Guy	Simmons	Sr. Vice President	Sea Watch Office
Nick	Sisson	Marine Resources Management Specialist	NOAA Fisheries
Christine	Sloan	Program Manager	National Offshore Wind Research and Development Consortium
David	Tobey	Vice President VSSA	Dominion Energy
John	Toth	Recreational Angler	Jersey Coast Anglers Association
Stacy	VanMorter	Assistant Biologist	NJ Fish and Wildlife
Jacquelyn	Veatch	PhD Student	Rutgers University
Kevin	Wark	Commercial Fisherman/Fisheries Liaison	Atlantic Shores
Douglas	Zemeckis	Assistant Professor	Rutgers Cooperative Extension