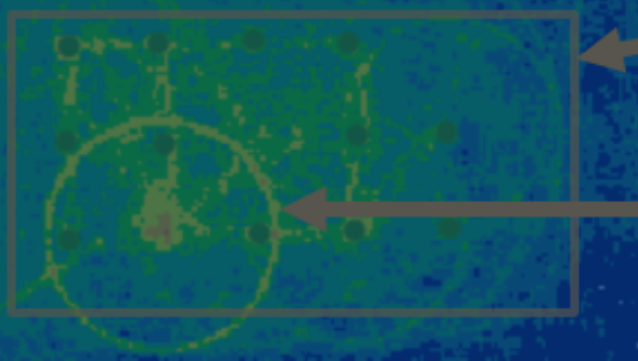
Collaborative Whale Detection Technology Evaluation Virtual Workshop Series

SESSION 2 | JUNE 26, 2024



About the Background Image: Pictured is 2023 Vessel Activity showing the track of the Protected Species Observer Vessel developed with Annual AIS Transit Count Data around the substation installation site at South Fork Wind Farm.

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Regional Wildlife Science Collaborative for Offshore Wind

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Collaborative Technology Workshop Series

Workshop Session 2: Idealized Technology Evaluation Pathways & Real-World Considerations

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Executive Summary

A collaborative virtual workshop series is being hosted by the RWSC, the Marine Technology Society (MTS), and the Consensus Building Institute (CBI), in partnership with the Pacific Northwest National Laboratory (PNNL) and National Renewable Energy Laboratory (NREL), with support from the U.S. Department of Energy (DOE) and contributions from NOAA Fisheries, the Bureau of Ocean Energy Management (BOEM), and Turn Forward to identify models, technologies, and information from other sectors, research areas, and potential partners in support of whale conservation and responsible offshore wind development.

The objective of the series is to assess the state of the science and metrics for evaluating technologies, tools, and methods for monitoring baleen whales specifically during sound-producing offshore wind construction activities. PNNL and NREL are leading the development of the technical workshop materials and outputs, with input from DOE, NOAA, and BOEM. RWSC, MTS, and CBI are providing the forum, workshop facilitation, and are developing workshop proceedings for each session that capture participant input and discussion.

The second session of the Collaborative Technology Workshop Series was held virtually on June 26, 2024. This report summarizes discussions and key takeaways from this second session. The objectives for this session were to:

- Be updated by PNNL and NREL on their technology characterization report development process, including how the report is evolving since the first workshop and how experts are being engaged.
- Discuss technology validation and evaluation approaches.
- Learn about real-world technology implementation including a summary of current requirements for monitoring during piledriving and perspectives on how humans in the field implement and interpret the data from technologies.

Materials from this session including an agenda and draft products produced by PNNL and NREL can be found here: https://bit.ly/46lBFeZ

Facilitated by CBI, workshop participants heard introductory presentations from DOE, RWSC, PNNL and NREL. RWSC presented synthesized information across current regulatory documents to demonstrate the range of sizes of clearance and shutdown zones during offshore wind construction across activity types, geographies, and species. A panel of offshore wind industry members discussed considerations around human decision making and communication related to the selection and deployment of technology and the challenging offshore environment.

Below are the key takeaways from the workshop:

- The PNNL and NREL report will outline a proposed three-phase approach for characterizing technologies for marine mammal monitoring during pile driving for

offshore wind construction, focusing on potentially standardizing the process of selecting, testing, and validating these technologies. Their approach covers system design, evaluation and field validation planning, and field validation execution. The final report will focus on potential performance metrics without endorsing specific products or operational performance thresholds, and will highlight the significance of emerging technologies in multi-modal monitoring systems. The draft final report will be completed by the end of September 2024.

- The PNNL and NREL have developed a Zotero Library that includes all the references used to develop the report.
- From the synthesis of current marine mammal monitoring requirements during offshore wind pile driving, it was clear that there are needs for:
    - Flexibility in technology evaluations as there are unique aspects for each project.
    - Real-time detections (<5-10 minutes), as they help trigger actions for monitoring in a timely manner.
    - The ability to speciate without reliance on noise signatures as animals may be silent. This is important as monitoring actions have different requirements.
    - Detection capabilities at a flexible range of distances, platforms, heights, and environmental conditions even within a project.
- There are many involved with technology use during offshore wind construction, from selection to deployment to interpretation. The technologies deployed must work within complex regulatory frameworks and in non-ideal testing conditions. Despite this, a panel of offshore wind industry members generally agreed that the two factors that influence technology's real-world performance the most are performance given environmental conditions and species behavior, and not human operational considerations.
- The volume of monitoring data collected during construction can be large, often causing data transmission, storage and general data management challenges.

Acknowledgements

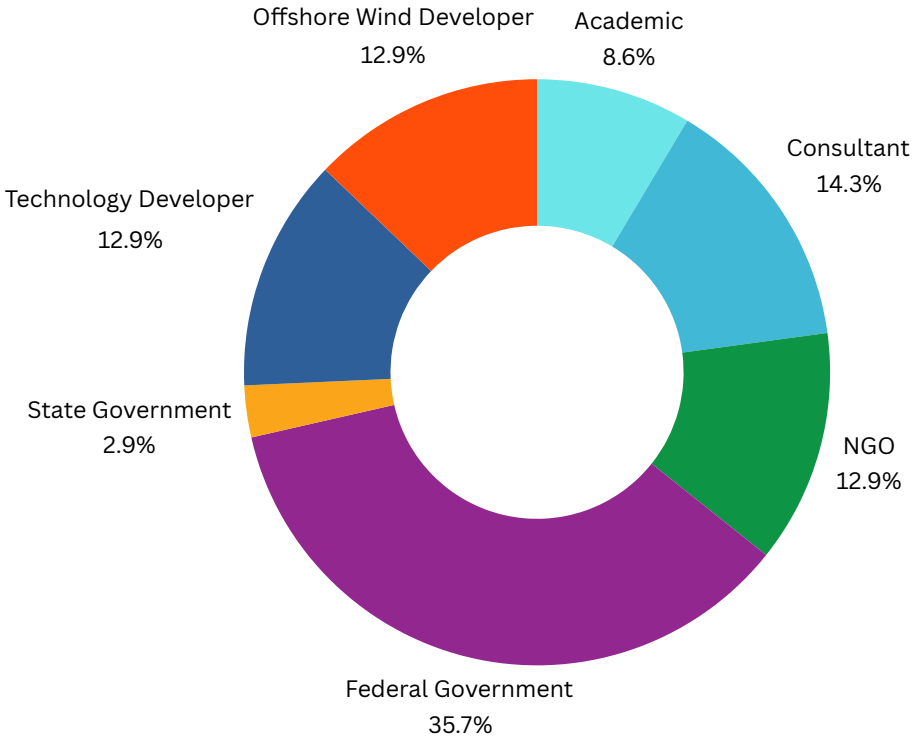
The Collaborative Technology Workshop Series was conceived through a collaboration between the Regional Wildlife Science Collaborative (RWSC), the Marine Technology Society (MTS), American Clean Power (ACP), Turn Forward, several environmental nonprofits, the U.S. Department of Energy (DOE), the Pacific Northwest National Laboratory (PNNL), and the National Renewable Energy Laboratory (NREL). The organizers are grateful for the facilitation provided by Patrick Field from the Consensus Building Institute (CBI). The organizers would also like to thank the following panelists for participating in the discussion: Ariana Spawn, Ørsted; Mary Jo Barkaszi, CSA Ocean Sciences; Elizabeth Marsjanik, Vineyard Offshore; and Laura Morse, Invenergy.

Participant Overview

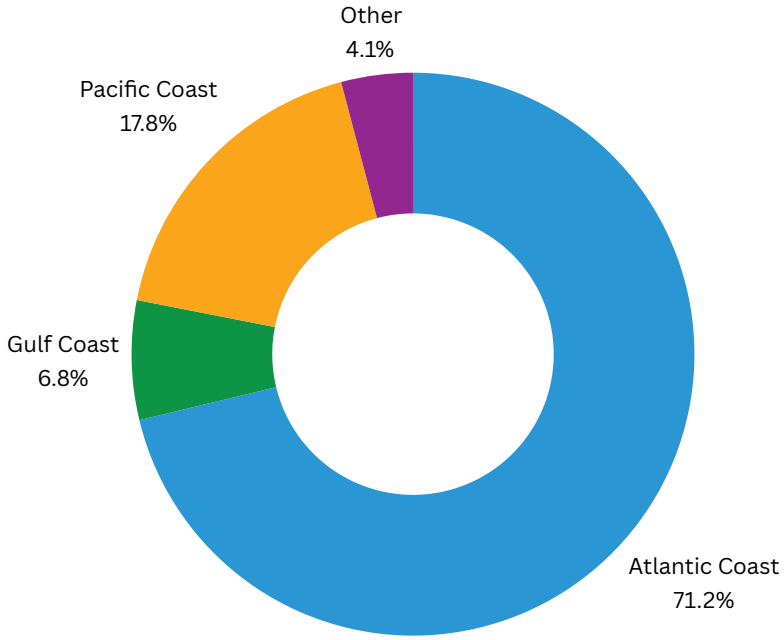
215 Persons Registered

131 Persons Attended

Participants by Sector



Location of Participants



Update on Process and Timeline to Develop Whale Detection Technology Characterization Report

Presenter: Mark Severy, P.E., Pacific Northwest National Laboratory

Key Takeaways

- The PNNL and NREL report will outline standardized documentation for validating detection technologies aimed at monitoring baleen whales during offshore wind construction activities.
- The final PNNL and NREL report will focus on potential performance metrics without endorsing specific products or operational performance thresholds.
- The PNNL and NREL report will highlight the significance of emerging technologies in multi-modal monitoring systems. The PNNL and NREL have developed a Zotero Library that includes all the publicly available references used to develop the report.
- The draft final report will be completed by the end of September 2024.

During this session, Mark Severy, PNNL, provided an update on the process and timeline for developing documentation that describes a potential approach to validate detection technologies for monitoring baleen whales around sound-producing offshore wind construction activities using a consistent and standardized method. The project's outcomes will include written documents describing that potential validation approach and how to quantify performance metrics relevant to each distinct detection technology.

It was noted that there will not be recommendations on which technologies or products or sensors are suitable for use in different conditions. PNNL and NREL are also not determining or suggesting performance metric thresholds.

A potential technology characterization or validation process was outlined that starts by defining a use case, describing system specifications, collecting validation data consistently, and then quantifying performance metrics.

Throughout the report development process, the PNNL and NREL team is engaging with experts for review and feedback on approach, format, and content. This engagement is conducted through a multi-agency steering committee (NOAA, BOEM, DOE), as well as individual outreach to researchers, technologists, and practitioners. PNNL and NREL have also developed a Zotero Library that includes all the references used to develop the report. The Zotero Library only includes references that are available publicly. PNNL and NREL welcomed additional reviewers or literature sources.

Summary of Q&A
Questions and discussions from workshop participants included:

- The importance of emerging technology, like eDNA, for monitoring, was raised, with concerns that the workshop's findings might exclude these promising technologies, potentially affecting their long-term development and funding. PNNL and NREL acknowledged this concern and noted that the final report would highlight the significance of emerging technologies, recognizing the role of these tools in the multi-modal combinations of monitoring technologies.
- A participant asked if the final report would explain why certain technologies did not pass the evaluation filter. Mark explained that the report would describe the limitations and reasons why some technologies are not considered standalone solutions, instead perhaps suggesting that they could be paired with other technologies.
- Another attendee highlighted the need to consider how technologies interact when deployed together. They mentioned a related study on low visibility detection for real-time monitoring of marine mammals and offered to share the published report for further reference.

Potential Technology Validation (or Characterization) Approach

Presented by: Angela Szesciorka, Ph.D., California Ocean Alliance

Key Takeaways

- PNNL and NREL are proposing a three-phase approach for validating marine mammal monitoring technologies for offshore wind construction, focusing on standardizing the process of selecting, testing, and validating these technologies. Their proposed approach covers system design, evaluation and field validation planning, and field validation execution.
- The proposed validation process emphasizes the importance of testing technologies in real-world conditions that match the intended use case. This includes considering various environmental factors and using standardized performance metrics. However, the term "characterization" was suggested as more appropriate than "validation" for this process.
- In their report, PNNL and NREL are proposing guidance and minimum suggestions for technology assessment, but they will not recommend specific systems or brands. Their role is to offer a framework for evaluation, while leaving final decision-making to relevant authorities.

Angela Szesciorka from the California Ocean Alliance introduced a potential roadmap for evaluating technology performance for monitoring marine mammals during offshore wind

construction, including during low to no light conditions. The roadmap consists of three phases: system design, evaluation and field validation planning of the system design, and field validation execution. The approach aims to standardize the process of selecting, testing, and validating monitoring technologies.

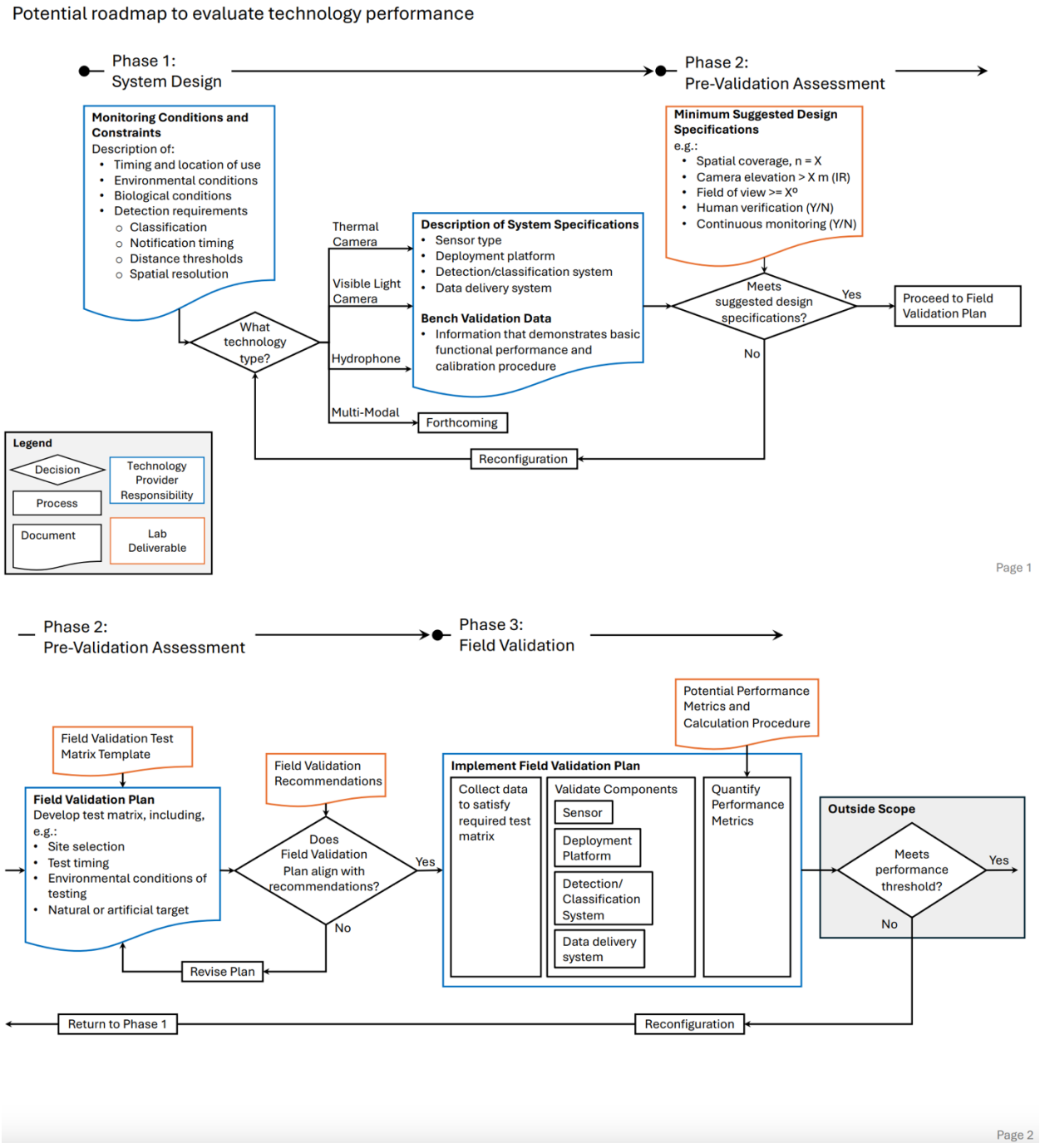


Figure 1. Potential roadmap for evaluating technology performance for monitoring marine mammals during offshore wind construction.

In Phase 1, technology providers would outline the conditions and constraints for their planned operations. This includes specifying the location, timing, environmental and biological considerations, and monitoring requirements they need to meet. Providers would then select appropriate technologies (individual or combination of technologies) they wish to use. The criteria suggested by PNNL and NREL for selecting specific technologies included:

- the ability to record time and location of an animal,
- a cue that can be detected and delivered within the decision-making time window, and
- a practical ability to detect any individual whale that enters the zone of perception and displays/produces the cue.

Phase 2 would involve evaluating the system design against minimum suggested criteria and developing a field validation plan. PNNL and NREL will be developing guidance documents, including a field validation matrix template and technology-specific recommendations as appendices to their final report. PNNL and NREL are not recommending any specific system, brand, or design. But, drawing on literature reviews, they are providing a proposed list of minimum suggestions that could be used to assess whether the monitoring system might be able to effectively monitor and detect marine mammals during pile driving activities necessary for offshore wind construction including during low to no light conditions.

Phase 3 would encompass the actual field validation, where providers test their chosen monitoring systems in real-world conditions. This phase would include assessing sensors, platforms, detection and classification systems, and data delivery capabilities in the field. For example, passive acoustic monitoring might involve playing specific sounds underwater at various distances to test detection capabilities under different sea states. Similarly, infrared cameras might be tested on vessels to evaluate whale detection rates during various weather conditions. The final report will offer suggestions on potential performance metrics to quantify and report technology performance, such as false positive rates, detection error rates, and reliable detection ranges.

The full three-phase approach suggests a standardizable pathway from defining a specific use case to evaluating performance in relevant, real-world settings. While PNNL and NREL will provide suggestions for critical metrics and outline methods to quantify them in their report, they will not determine appropriate thresholds or requirements for performance metrics. This responsibility is left to relevant decision-makers.

Summary of Q&A

Questions and discussions from workshop participants included:

- It was clarified that the report will include consideration of platforms on which technologies will be mounted (buoys, gliders, pile driving platforms, vessels, etc.) to be used, including notes on potential best heights and stabilization methods.

- In the workflow diagram, orange boxes indicate products that PNNL and NREL will produce and include as appendices in the final report, while blue boxes represent technology provider responsibilities.
- PNNL and NREL clarified that recommended testing conditions depend on the defined use case. They will provide guidance on which conditions should be tested.
- It was noted that how the validation information is used to inform actions, approvals, or decisions is outside the scope of PNNL and NREL's work. PNNL and NREL are not responsible for determining appropriate operational detection ranges.
- "Characterization" was suggested as a more appropriate term than "validation." The approach seeks to "characterize" technology performance under the specific conditions and operational constraints that are identified during Phase 1 of the workflow.
- Participants inquired about the possibility of providing a standardized workflow for contractors or developers to characterize their technology. PNNL and NREL confirmed that this is within their scope and will be addressed in the "field validation recommendations" section of the workflow and report.
- Discussion followed on whether validated technologies could be reused without repeated validation. PNNL and NREL clarified that their intention is not to endorse specific brands or companies, but to characterize performance in certain field conditions. Revalidation may be necessary if the system is used in different conditions or with different species and this question is ultimately one for regulators.

What are We Asking the Technologies to Achieve?

Presenter: Emily Shumchenia, Ph.D., Regional Wildlife Science Collaborative for Offshore Wind

Key Takeaways

- There is a need for flexibility in technology evaluations as there are unique attributes that drive monitoring requirements for individual projects (e.g., sound modeling, species present, etc.).
- Real-time detections (<5-10 minutes) are important as they help trigger actions for monitoring in a timely manner.
- There is a need for the ability to speciate without reliance solely on noise signatures as animals may be silent.
- There is a need for detection capabilities at a flexible range of distances, platforms, heights, and environmental conditions even within a project

Emily Shumchenia, Ph.D. (RWSC) presented an overview of key parameters in existing regulatory documents that inform technology evaluation and explain what technology needs to achieve. The goal of this presentation was not to examine the monitoring requirements for any individual project or compare among projects, but to provide a general understanding of what, how and why monitoring requirements may vary across projects and by what factors they vary. To provide context for this discussion, Emily presented a map (see Figure 2) that illustrates an entire year of AIS vessel traffic for 2023 to show the signature of Protected Species Observer vessels' monitoring within the South Fork Wind Farm.

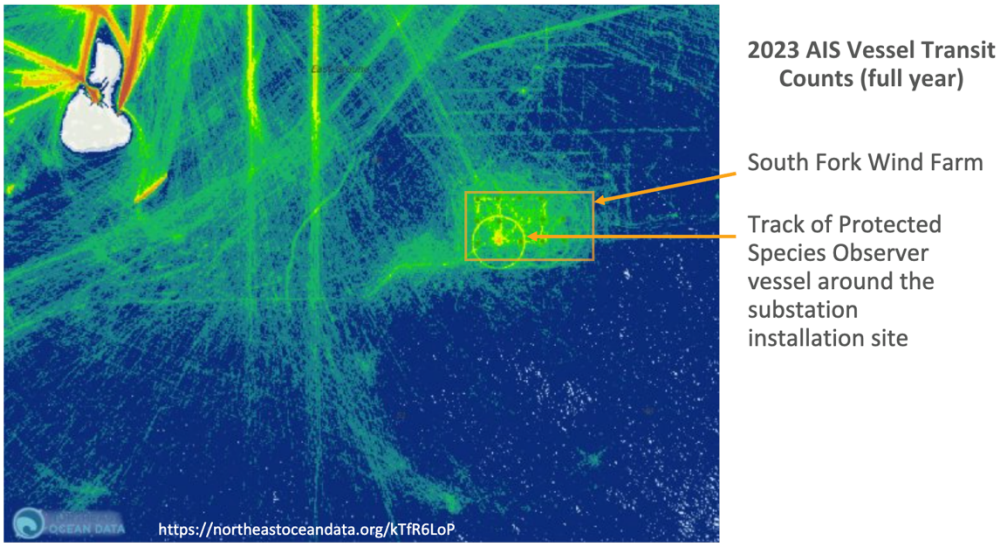


Figure 2. AIS vessel traffic for 2023 within the South Fork Wind Farm.

To understand what we are asking technologies to achieve, Emily compiled publicly available information from recent biological opinions on the NOAA Fisheries website. This synthesis revealed the complexity of monitoring specifications and highlights that there is no one size fits all technology solution for every project. Monitoring required for individual projects may depend on the species known to be present in the project area, any mitigation actions applied during construction, and acoustic/sound modeling associated with the construction activity which is in turn influenced by turbine foundation type, type of pile driving, substrate type and hammer energy, time of year, and other factors. This synthesis underscored the following key themes for technology evaluation measures:

- There is a need for flexibility in technology evaluations as there are unique aspects for each project.
- Real-time detections (<5-10 minutes) are important as they help trigger actions in a timely manner.
- There is a need for the ability to speciate without reliance solely on noise signatures as animals may be silent. This is important as monitoring actions have different requirements.

- There need to be detection capabilities at a flexible range of distances, platforms, heights, and environmental conditions even within a project.

Summary of Q&A
Questions and discussions from workshop participants included:

- Participants from the Bureau of Ocean Energy Management (BOEM) clarified the types of documents where monitoring requirements are captured which include NOAA's Biological Opinions and Incidental Take Regulation (ITR).
- Participants are interested in future discussions with decision-makers to identify a goal post that outlines the maximum and minimum protections that these systems provide for baleen whales. This decision should also include a discussion on the tolerance for missed mitigation to help design a monitoring program that is feasible.
- Participants highlighted that the application of technologies is multimodal and NREL and PNNL need to consider that this is a multi-system approach that is complicated and different for each developer.

Interactive Poll

During the break, workshop participants were invited to participate in an interactive poll to get their feedback on the following questions:

- What is one thing you would most like technology development to do?
- Given everything you've heard so far today, what do you think are important next steps to advance technology evaluation?
- What are your ideas for accelerating the validation pathways for technologies?
- What have you learned and what do you want to discuss more?
- Which two factors do you think influence technology's real-world performance the most?

The poll received on average of 20 responses per question. Key themes from participant's responses include:

- Participants are interested in seeing technology development improve and increase data quality and impact mitigation.
- There are several next steps to advance technology evaluation but participants especially highlighted the need to standardize methods for technology characterization, methods, reporting, and criteria.
- To accelerate the validation pathways for technologies, participants highlighted the need for funding, federal support, and collaborating through the RWSC.

- Participants are interested in discussing the application and implementation of NREL and PNNL's proposed technology evaluation approach. Participants also highlighted the need to ensure regulators are aligning with the proposed approach.
- The two factors that participants think influence technology's real-world performance the most are performance given environmental conditions and species behavior.

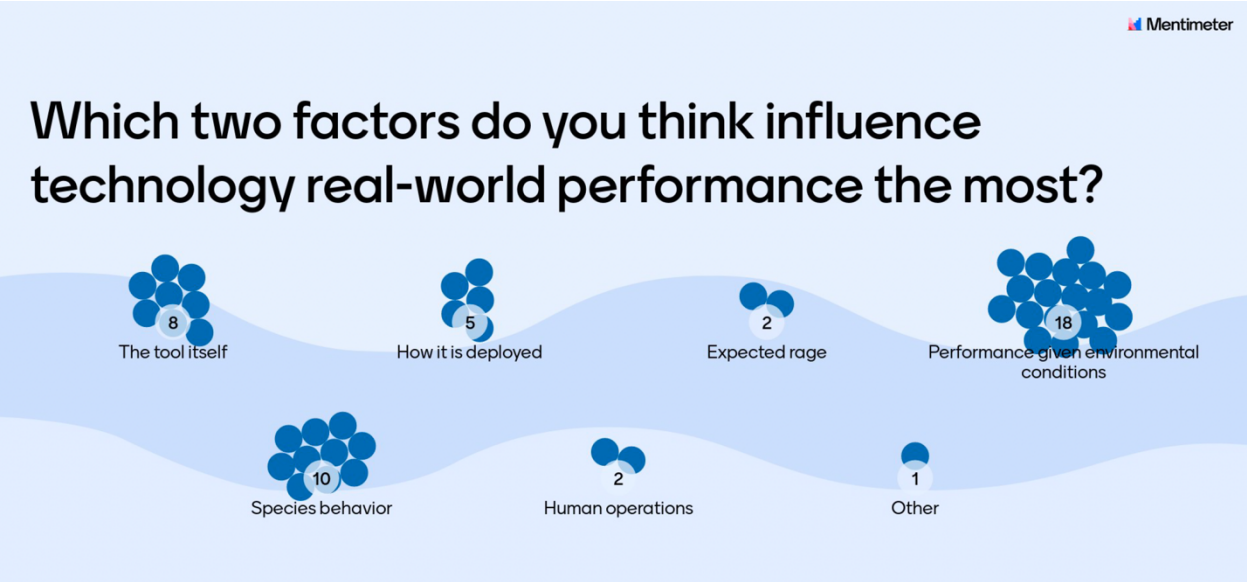


Figure 3. Poll results. Note that a typo in the poll was carried through on these results but clarified verbally for all participants; "Expected rage" should read "Expected range".

Full results from the poll can be found here.

Panel: The Human Element and Field Realities

Moderator: Pat Field, Consensus Building Institute, Emily Shumchenia, Ph.D., Regional Wildlife Science Collaborative for Offshore Wind

Panelists: Ariana Spawn, Ørsted; Mary Jo Barkaszi, CSA Ocean Sciences; Elizabeth Marsjanik, Vineyard Offshore; Laura Morse, Invenergy

Key Takeaways
• There are many involved with technology use and the technologies deployed have to work in complex mitigation frameworks and in mitigation timeframes in non-ideal testing conditions. • Panelists described deployment logistics as one of the biggest operational challenges associated with technologies as these technologies need to work under varying conditions, on multiple vehicles, and for different personnel. • The volume of data collected can be large, which causes data management issues.

- Panelists see opportunities for innovation in the areas of offshore network connectivity / communication / data transmission, as well as for tools like drones that are currently limited by battery life but could augment and/or verify visual observations by humans in the field.
- The panelists generally agreed with the poll results that the two factors that they think influence technology's real-world performance the most are performance given environmental conditions and species behavior. They also noted deployment is a key factor.

The workshop concluded with a panel on how humans and field conditions influence the implementation of technology. The goal of this panel was to allow participants to hear perspectives from individuals responsible for implementing technologies in the field and turning sensor data into information during offshore wind pile driving. This panel set out to help participants understand what happens in the real-world during construction when a whale is detected and if this affects our consideration of the performance criteria being applied to the technologies. The panelists included:

- Ariana Spawn, Ørsted
- Mary Jo Barkaszi, CSA Ocean Sciences
- Elizabeth Marsjanik, Vineyard Offshore
- Laura Morse, Invenergy

Panel questions and discussions included:

Brief description of a typical field crew and communication protocols

Panelists explained the typical field crew and communication protocols for offshore wind construction. Before a technology operator and field crew (usually a contractor to offshore wind company) is selected, developers need clarity on what the technology needs and metrics for evaluation are. These conversations need to happen as early as possible. The field crew is led by a lead protected species observer (PSO) or environmental manager. The lead PSO is responsible for communications with the larger communications team (visual or monitoring personnel), report compilation, mitigation discrepancies, reporting to agencies, and liaising with others in the field. The lead PSO oversees a team of visual PSOs (3-6 per platform). These visual PSOs use handheld binoculars, mounted big-eye binoculars, and mounted thermal and high-definition cameras for detecting marine mammals and other protected species. There is also an acoustic team in the field that staffs any acoustic hardware being deployed. Communications are parsed between platform and monitoring type and done by the lead PSO. Most operators use a universal data collection display platform (e.g. Mysticetus) which creates a common operating picture. Crews in the field also use WhatsApp, cell phones, and VHF radios to communicate. Communication usually runs smoothly and has not been a problem for mitigation implementation.

It is important to note that these team structures and monitoring frameworks are project dependent. There are also other deployments happening simultaneously, so these systems are usually multimodal. The key takeaway is that there are a lot of people involved and the technologies deployed must work within complex mitigation frameworks and timeframes during non-ideal conditions. The technology needs to work under any conditions for any level of personnel.

In your experience, what are some of the operational challenges associated with these technologies? How does the implementation differ from what has been discussed as ideal / target performance?

Panelists described deployment logistics as one of the biggest operational challenges associated with technologies. Technologies need to work under varying conditions, on multiple vehicles, and for different personnel. This challenge is further complicated by issues not becoming apparent until technologies are deployed offshore. For example, it is important to ensure that technologies can handle various sea states, weather conditions, platforms, network connectivity, battery life, maintenance, surrounding technologies, etc. More reliable technology will result in more reliable monitoring. Technology applications are also limited by proprietary communications networks. In other words, internet access is limited offshore or is often too slow for the volume of data being transferred. More self-sufficient platforms can help resolve these issues, but they are larger and more fragile. Technology providers need to consider what their communications needs are and how information will be sent.

Do the panelists have advice for NREL and PNNL as they evaluate technology?

Panelists advised NREL and PNNL to consider deployment logistics and network connectivity needs of technology in their evaluation. They also advised the PNNL and NREL to consider data packages and data transfers in their review. One panelist noted that they are facing challenges in transferring their acoustic monitoring data to the NOAA National Centers for Environmental Information (NCEI) and the NOAA Fisheries Passive Acoustic Cetacean Map (PACM) due to the volume of data. There are evident data management issues that are further complicated by cost and storage volume barriers to entry. Lastly, panelists reminded technology providers and PNNL and NREL to not overburden the PSOs, who are already juggling several different tools and mechanisms for recording/reporting information.

What are opportunities in the workflow from tool selection to deployment and calibration, to operation, interpretation and communication to innovate on the human dimensions portion?

Panelists are interested in seeing advancements in AI technology to help with the detection and mobilization of information. The panelists are also interested in seeing advancements in platforms, specifically aerial platforms as they currently have limited battery life capabilities and need to be piloted. R&D should also focus on advancing systems that are permanently underwater.

Which factors do you think influence technology real-world performance the greatest? The tool itself, its deployment, its expected range, its range given environmental conditions/weather, expected species, species behavior and dynamicism, or human operation/interpretation factors?

The panelists generally agreed with the poll results that the two factors that they think influence technology's real-world performance the most are performance given environmental conditions and species behavior. Panelists noted that deployment is another important factor as there are other conditions such as deployment location capabilities and interference with other systems that technologies need to perform under.

Wrap-up and Next Steps

The workshop closed with Emily Shumchenia, Ph.D., giving a brief overview of the next steps: this workshop proceeding will be posted on the RWSC website. The next workshop session will occur in Fall 2024. More information will be sent out closer to the meeting.

Appendices

- Appendix A: Workshop Attendees
- Appendix B: Zotero Library of Resources
- Appendix C: Potential Flow Chart for Technology Validation
- Appendix D: Presenter Slides