New England Aquarium

Protecting the blue planet

December 2, 2022

Director Amanda Lefton
Bureau of Ocean Energy Management
1849 C Street, NW
Washington, D.C. 20240

Assistant Administrator Janet Coit
National Marine Fisheries Service
1315 East-West Highway
Silver Spring, MD 20910

Re: Draft North Atlantic Right Whale and Offshore Wind Strategy (Docket BOEM-2022-0066)

Dear Director Lefton and Assistant Administrator Coit,

The New England Aquarium (Aquarium) appreciates the opportunity to provide input on the Draft North Atlantic Right Whale and Offshore Wind Strategy (Docket BOEM-2022-0066) (hereafter, strategy). We applaud the Bureau of Ocean Energy Management (BOEM) and the National Oceanic and Atmospheric Administration's National Marine Fisheries Service (NOAA) for drafting a joint strategy to address protections for North Atlantic right whales (NARW) during the development and operation of offshore wind.

The Aquarium has a front row seat to the impacts of climate change, both along our stretch of waterfront and extending into the rapidly warming Gulf of Maine. The most pressing ocean health challenge of our time is this climate crisis, which impacts endangered species like the NARW. The NARW is one of the most endangered large whale species in the world, with fewer than 350 individuals remaining[1] and there were just over 70 breeding females in 2018.[2] In response to climate change, NARW distributions have shifted throughout their range, reproduction has slowed, and many have died or been injured from human activities resulting in a species decline since 2010.[3] Additional research shows that conditions prior to their recent decline were already limiting NARW recovery.[4] The impacts of climate change must be considered when making management decisions about this species.

Harnessing the power of the wind as an offshore renewable energy source is essential to our clean energy future and must be developed in a responsible manner. We support the need for rigorous, scientific review

[1] The last reported estimate was 356 individuals. Pettis, H.M., Pace, R.M. III, Hamilton, P.K. 2022. North Atlantic Right Whale Consortium 2021 Annual Report Card. Report to the North Atlantic Right Whale Consortium. The updated estimate will be published in 2023.
[2] Reed, J. et al. 2022. Multi-event modeling of true reproductive states of individual female right whales provides new insights into their decline. Frontiers in Marine Science. Vol. 9.
[3] Pettis, H.M., Pace, R.M. III, Hamilton, P.K. 2022. North Atlantic Right Whale Consortium 2021 Annual Report Card. Report to the North Atlantic Right Whale Consortium. The updated estimate will be published in 2023.
[4] Corkeron, P. et al. 2018. The recovery of North Atlantic right whales, *Eubalaena glacialis*, has been constrained by human-caused mortality. Royal Society Open Science 5:180892.

of industry development and practices that avoid, minimize or mitigate harm to marine species and habitat. For more than a decade, the Aquarium has been conducting surveys to understand the distribution and abundance of animals in waters slated for wind energy development.[5]

The Aquarium's scientific research is contributing to our understanding of how to adaptively manage impacts to marine species. We work with the renewable energy community (e.g., BOEM, NOAA, states, developers, NGOs) to monitor the occurrence and movement of marine species, ranging from highly migratory fish species to large whales. Our research contributes the information needed to aid the renewable energy community in their efforts to develop offshore wind in a responsible manner and to address the multiple interacting stressors that occur in the same spaces and times as this emerging industry.

Our recommendations are submitted in the spirit of strengthening the strategy. We support the ideas contained in the strategy, but how these ideas are implemented will determine their effectiveness for protecting NARW. We provide four recommendations relevant to the overall strategy and then provide recommendations specific to the three goals outlined in the strategy. For the overall strategy:

1) **We recommend that the agencies prioritize the inclusion of feedback from the public comment and finalize this strategy as soon as possible because construction is starting in right whale habitats in 2023 and new leases are continuing to be issued.**
2) **We recommend that the agencies ensure that all actions are measurable, achievable, relevant and time-bound.**
3) **We recommend that the agencies use a variety of mechanisms to review the implementation of the ideas and plans in the strategy, including public comment, independent scientific review of agency products, and collaboration with partners that have the needed expertise to conduct field work and analyses.**
4) **We recommend that both agencies dedicate substantial funding to implementing this strategy and provide a clear outline of how funding these plans will be accomplished.**

Goal 1: Mitigation and Decision-Support Tools

We recommend providing uniform standards that apply to all wind development projects whenever possible.

These standards should be designed to maximize protections to NARW from this emerging ocean use. These standards should be developed immediately and all existing NOAA Incidental Harassment Authorizations (IHAs), BOEM leases, and other wind energy permits should be updated to include these standards. Some specific areas in which standards are needed are documented below.

[5] As a matter of scientific integrity, we list our associations with offshore wind development: 1) The BlueSwell incubator program, of which the Aquarium is one of two partners, has received funding from Ørsted; 2) The Fisheries Science and Emerging Technology program in the Anderson Cabot Center for Ocean Life is funded by multiple offshore wind development companies; 3) The EcoMap program in the Anderson Cabot Center for Ocean Life has been funded by BOEM, NOAA, Massachusetts Clean Energy Center, and wind energy development companies to conduct aerial surveys of wind energy lease areas off Massachusetts and Rhode Island

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We recommend identifying the important NARW habitats mentioned in the vessel strike risk reduction measures (Appendix B).

Speed restrictions are a critical tool for reducing the risk of vessel strikes to right whales.[6] The Aquarium supports the strategy's approach for vessel strike risk reduction:

> Avoid vessel traffic in important NARW habitats, including active Seasonal Management Areas, Dynamic Management Areas, and Slow Zones, when possible (73 FR 60173). When avoidance is not possible, reduce vessel speeds to 10 knots or less in these areas during these times, and post lookouts or PSOs on vessels to search for and aid in avoiding whales.[7]

However, the strategy does not identify the "important NARW habitats" beyond reference to both the existing (e.g., Seasonal and Dynamic Management Areas) and currently under consideration (i.e., Zones) in the revised NARW vessel speed rule. These important habitats and the criteria used to define them should be explicitly stated.

We recommend clarity regarding the decision-making process related to the taking of NARW and exceeding PBR-equivalent impacts (e.g., vessel strike).

It is necessary to outline the steps that will occur if takes or a PBR-equivalent is exceeded before, during, and after wind energy development. Additionally, statistical analyses, which will most likely be conducted after construction, may be able to document displacement of NARW from wind energy areas. Under these different scenarios, it is important for the agencies to provide information about what will happen in individual leases (e.g., turbine construction could be stopped if annual takes are exceeded and only allowed to resume if effective mitigation measures are put into place) and more broadly along the U.S. East Coast (e.g., new leases will not be issued in NARW habitat, if displacement is detected).

Although NARW are the focus of this strategy, the strategy should address what will happen if the species of large whales seen or heard cannot be determined. We recommend that the most stringent measures be implemented if the species cannot be quickly identified.

We recommend the strategy include criteria for when pile driving should occur.

The time periods that exclude pile driving should be consistent with NOAA rules for ship-speed reductions and fishing closures. For example, pile driving should be excluded from time periods represented in seasonal fishing closures, Seasonal Management Areas, and the pending Seasonal Speed Zones. These closures and speed restrictions are established in consideration of time periods that represent increased NARW presence and/or risk. Additionally, the strategy should explicitly address what will happen, if a Dynamic Management Areas, or pending Dynamic Speed Zone (DSZ) overlaps with a construction area. We recommend that pile driving be stopped during such an overlap.

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[6] Refer to the New England Aquarium public comment submitted re: Amendments to the North Atlantic Right Whale Vessel Strike Reduction Rule: NOAA-NMFS-2022-0022 also available at http://www.neaq.org/wp-content/uploads/2022/10/NEAq-Comments-on-NOAA-NMFS-2022-0022.pdf

[7] Strategy at 41 (Appendix B).

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Current monitoring of clearance zones is inadequate. **We recommend the strategy provide guidance for this monitoring and that these new requirements be incorporated in existing and new IHAs.**

Passive acoustic monitoring must be conducted for a minimum of 24 hours before pile driving begins. The current one-hour monitoring period (i.e., IHA for South Fork Wind[8] and Vineyard Wind 1[9]) does not conform to the best available scientific information on the appropriate timing for passive acoustic monitoring for NARW. Specifically, Baumgartner et al. (2019)[10] developed performance metrics for using near-real-time passive acoustic data collected from a moored buoy. They compared these acoustic data with visual data and found that there was a strong relationship between visual survey data and acoustic data collected on the scale of 24-48 hours. Additionally, the one-hour monitoring period does not account for variations in NARW calling rates by demographic groups[11] and behavior.[12] Visual observations must be designed to cover the entire area in which NARW may be impacted by construction operations and should also be conducted during daylight hours 24 hours before pile driving. Night vision devices, infrared technology, and passive acoustic monitoring should be used at night or in low visibility conditions. In the absence of suitable detection measures, pile driving should be limited to daytime hours with adequate visibility.

We recommend that the strategy strengthens protocols for the use of Protected Species Observers (PSOs) and the collection of data by PSOs.

Conflicts of interest for PSOs could occur because developers directly contract PSO companies or the survey companies that contract PSO companies.[13] These potential conflicts of interests need to be addressed. We recommend that BOEM and NOAA develop a system that resolves this conflict.[14]

We applaud BOEM and NOAA for setting standards for PSO training. However, given the overlap between important NARW habitat and wind energy development, the requirements for PSOs for these projects need to be reviewed. For example, the number of years of experience for PSOs is a critical

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[8] South Fork Wind Incidental Harassment Authorization available at https://media.fisheries.noaa.gov/2021-12/SFW_IHA_issued_OPR1.pdf.

[9] Vineyard Wind 1 Incidental Harassment Authorization available at https://media.fisheries.noaa.gov/2021-05/VWconstr_FinalIHA_OPR1.pdf?null.

[10] Baumgartner, M. F., J. Bonnell, S. M. Van Parijs, P. J. Corkeron, C. Hotchkin, K. Ball, L.-P. Pelletier, J. Partan, D. Peters, J. Kemp, J. Pietro, K. Newhall, A. Stokes, T. V. N. Cole, E. Quintana, and S. D. Kraus. 2019. Persistent near real-time passive acoustic monitoring for baleen whales from a moored buoy: System description and evaluation. Methods in Ecology and Evolution 10:1476-1489.

[11] Parks, S., L. Conger, D. Cusano, and S. V. Parijs. 2014. Variation in the acoustic behavior of right whale mother-calf pairs. The Journal of the Acoustical Society of America 135:2240-2240.

[12] Parks, S. E., A. Searby, A. Célérier, M. P. Johnson, D. P. Nowacek, and P. L. Tyack. 2011. Sound production behavior of individual North Atlantic right whales: implications for passive acoustic monitoring. Endangered Species Research 15:63-76.

[13] Baker, K., D. Epperson, G. Gitschlag, H. Goldstein, J. Lewandowski, K. Skrupky, B. Smith, and T. Turk. 2013. National standards for a protected species observer and data management program: a model using geological and geophysical surveys. U.S. Department of Commerce. NOAA Technical Memorandum. NMFS-OPR-49.

[14] For example, see Baker, K., D. Epperson, G. Gitschlag, H. Goldstein, J. Lewandowski, K. Skrupky, B. Smith, and T. Turk. 2013. National standards for a protected species observer and data management program: a model using geological and geophysical surveys. U.S. Department of Commerce. NOAA Technical Memorandum. NMFS-OPR-49.

element of effectiveness and experience observing protected species in the region of interest is valuable. Additionally, a minimum standard of at least one senior PSO with a specified number of years and type of experience, beyond the minimum eligibility and qualification standards, should be required for these projects.

We also recommend BOEM and NOAA use specific requirements for the collection of all PSO data, including the collection of effort data at a minimum of 30 second intervals (i.e., the latitude and longitude of the ship every 30 seconds), consistent data fields, and consistent units and definitions for each data field. Finally, both the PSO effort and sightings data must be publicly available. We understand that there may be concerns about the effort data containing proprietary business information. However, there are many methods that can be used to protect business information, including down-sampling or providing gridded summaries of the data. Rigorous evaluation of PSO data is needed to understand potential biases and improve data collection protocols. This evaluation and improvement cannot occur unless the data are publicly available so that reproducible scientific analyses can be conducted.

We recommend that the strategy strengthens protocols for developing and using decision support tools and that these tools account for cumulative impacts.

We believe that decision support tools are valuable for evaluating alternative management options. To ensure that decision support tools fulfill their objectives, they must meet the standard of reproducible science, including making the data and code used to develop the tools publicly available. Existing NARW decision support tools rely on the Roberts et al. (2016)[15] NARW distribution models. These models have been developed to estimate density for multiple species, which can result in some constraints (e.g., broadly applicable habitat variables, the use of data only collected using line-transect methodology). We recommend that BOEM and NOAA support the development of multiple NARW distribution models (including models that can use acoustic and opportunistic data), the comparison of these models, and model averaging, when appropriate, in the decision support tool. We also recommend that BOEM and NOAA address the comments made in the review of the decision support conducted by the Center for Independent Experts, particularly the comments about addressing uncertainty.[16] Finally, we also recommend that BOEM and NOAA support the development of multiple decision support tools and local-scale decision support tools where possible.[17]

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[15] Roberts, J. J., B. D. Best, L. Mannocci, E. Fujioka, P. N. Halpin, D. L. Palka, L. P. Garrison, K. D. Mullin, T. V. N. Cole, C. B. Khan, W. A. McLellan, D. A. Pabst, and G. G. Lockhart. 2016. Habitat-based cetacean density models for the U.S. Atlantic and Gulf of Mexico. Scientific Reports 6:22615.

[16] Review of the North Atlantic Right Whale Decision Support Tool (December 2019) Peer Review Summary Report available at https://media.fisheries.noaa.gov/dam-migration/cie-reviewer-summary-2019-narw-decision-support-tool.pdf; Dr. Julie van der Hoop, Review of the North Atlantic Right Whale Decision Support Tool (December 2019) Center for Independent Experts (CIE) External Independent Peer Review Report available at https://media.fisheries.noaa.gov/dam-migration/vanderhoop-2019-narw-decision-support-tool-cie-review.pdf.

[17] Redfern, J. V., M. F. McKenna, T. J. Moore, J. Calambokidis, M. L. DeAngelis, E. A. Becker, J. Barlow, K. A. Forney, P. C. Fiedler, and S. J. Chivers. 2013. Assessing the risk of ships striking large whales in marine spatial planning. Conservation Biology 27:292-302.

The current use of decision support tools should also be expanded to consider cumulative impacts. Human activities (e.g., fishing, shipping, offshore wind) are exerting pressure on marine species and ecosystems. Generally, the total cumulative impact of these activities on ocean ecosystems is greater than each activity's impact in isolation, and the combination of activities has the potential to cause severe environmental degradation.[18] Despite mandates to analyze and minimize cumulative impacts as part of environmental reviews, there is evidence that cumulative impacts are continually increasing, particularly in marine ecosystems.[19] Agencies should conduct cumulative impacts analyses and incorporate the results into management strategies. The cumulative impacts analyses must be consistent with sound science, establishing appropriate baselines, accounting for past, present and future impacts from all projects, and selecting appropriate spatial scales.[20]

The strategy acknowledges cumulative impacts modeling, but not the limitations associated with current models. For example, the iPCoD model relies heavily on metabolic parameters for NARW that remain unknown and for which field measurements have not yet been attempted. Additionally, it is important to ensure that the strategy reflects whole system interactions and the associated multiple, interacting stressors on the species. For example, we agree that it is important to understand potential changes in the distribution of fishing gear resulting from wind energy development.[21] Changes in the distribution of fishing gear will change entanglement risk. For example, Cole et al. (2021)[22] showed that time-area closures for the southern Gulf of St. Lawrence snow crab fishery shifted fishing effort to areas that previously had low effort, which produced higher entanglement risk in these areas.

Floating wind energy may also be associated with entanglement risk and we agree that it is important to evaluate this risk.[23] The agencies should consider using the *OrcaFlex* modeling tool to investigate this risk.[24] Aquarium scientists have been working with ocean engineers to integrate whale behavior into the *OrcaFlex* model that is focused on lobster gear. Ocean engineers could create a model of floating turbines/cables, and other structures, to simulate a whale colliding with these objects to determine whether they pose a risk.

Goal 2: Research and Monitoring

We applaud the inclusion of data collection before and during offshore wind construction and during operation as described in the strategy. Collection of data prior to the start of construction has been a focus in

[18] Prahler, E., Reiter, S. et al. (2014). It All Adds Up: Enhancing Ocean Health by Improving Cumulative Impacts Analyses in Environmental Review Documents. Stanford Environmental Law Journal, 33 (3), pp. 352-417.
[19] Prahler, E., Reiter, S. et al. (2014). It All Adds Up: Enhancing Ocean Health by Improving Cumulative Impacts Analyses in Environmental Review Documents. Stanford Environmental Law Journal, 33 (3), pp. 352-417.
[20] Prahler, E., Reiter, S. et al. (2014). It All Adds Up: Enhancing Ocean Health by Improving Cumulative Impacts Analyses in Environmental Review Documents. Stanford Environmental Law Journal, 33 (3), pp. 352-417.
[21] Strategy at Appendix A 1.3.8.
[22] Cole et al. 2012. Effects of time-area closures on the distribution of snow crab fishing effort with respect to entanglement threat to North Atlantic right whales. ICES Journal of Marine Science 78: 2109–2119. https://doi.org/10.1093/icesjms/fsab103.
[23] Strategy at Appendix A 1.3.7.
[24] OrcaFlex available at https://www.orcina.com/orcaflex/.

many offshore wind energy development areas.[25] These efforts are necessary to understand the environment in proposed lease areas, the species that occur in the area, and how species use these areas, especially as the environment continues to change. The data collected are essential for developing plans to mitigate any negative effects of wind energy on these species and their habitat.

Data collection during offshore wind construction and operation is necessary to document the effects of offshore wind development on species and their habitat. It is also an essential element of implementing management that adapts to lessons learned during these early stages of wind energy development in our waters.

It is imperative to ensure that data collection occurs in all wind energy areas through all phases of activity. These data must be collected in a way that is comparable across lease areas and useful for understanding impacts of construction on wildlife. Management of and data collection within offshore wind areas should be considered across the entire U.S. East Coast, rather than considering each individual wind energy lease. With this broader perspective, we can view the sequential development of wind energy leases as replicate study sites from which inference on impacts can be made.

We recommend the agencies define a scientific question of interest when planning data collection in wind energy development areas.

When planning data collection, it is important to ensure analyses are conducted to determine the correct survey designs and the amount of data collection necessary to answer specific questions. For example, a blanket requirement for three years of baseline data may not be adequate to obtain the sample sizes necessary to determine the possible impacts of wind development on protected species. Additionally, data collection efforts may need to include more than aerial surveys and passive acoustic monitoring. For example, boat-based surveys are needed to collect imagery and other samples (e.g., biopsy, fecal, blow) that can be used to detect potential changes in whale health. Specifically, shipboard photography provides an avenue to detect changes in Visual Health Assessments and scarring of individual whales that are often not detectable from aerial photography. Collection of behavioral data is critically important as well. Measurements of stress hormones from biopsy and fecal samples could be valuable for understanding the effects of wind energy development on NARW health.

[25] O'Brien, O., D. E. Pendleton, L. C. Ganley, K. R. McKenna, R. D. Kenney, E. Quintana-Rizzo, C. A. Mayo, S. D. Kraus, and J. V. Redfern. 2022. Repatriation of a historical North Atlantic right whale habitat during an era of rapid climate change. Nature Scientific Reports; Quintana-Rizzo, E., S. Leiter, T. V. N. Cole, M. N. Hagbloom, A. R. Knowlton, P. Nagelkirk, O. O'Brien, C. B. Khan, A. G. Henry, P. A. Duley, L. M. Crowe, C. A. Mayo, and S. D. Kraus. 2021. Residency, demographics, and movement patterns of North Atlantic right whales Eubalaena glacialis in an offshore wind energy development area in southern New England, USA. Endangered Species Research 45:251-268; Murray, A., M. L. Rekdahl, M. F. Baumgartner, and H. C. Rosenbaum. 2022. Acoustic presence and vocal activity of North Atlantic right whales in the New York Bight: Implications for protecting a critically endangered species in a human-dominated environment. Conservation Science and Practice 4:e12798; Zoidis, A. M., K. S. Lomac-MacNair, D. S. Ireland, M. E. Rickard, K. A. McKown, and M. D. Schlesinger. 2021. Distribution and density of six large whale species in the New York Bight from monthly aerial surveys 2017 to 2020. Continental Shelf Research 230:104572.

We strongly disagree that long-term satellite tagging is an appropriate tool to address questions pertaining to high-resolution movements of NARW.[26] The only satellite-linked tags that may be considered appropriate for use with NARW currently are LIMPET tags, because they are minimally invasive relative to other implantable tag types, but are typically short duration. Other implantable tags in current use on baleen whale species are too invasive to consider for NARW because of the poor body condition of all individual NARW, particularly when compared with congeneric Southern right whales (*E. australis*)[27] and the physiological damage observed in NARW with deeply implanted objects.[28] Any proposed tagging efforts on NARW should have a clearly defined hypothesis that is testable given tag type and duration. Additionally, implantable tags should not be permitted for reproductive females or any NARW in compromised health.

Goal 3: Collaboration, Communication and Outreach

We applaud the agencies for including "collaboration, communication, and outreach" in the strategy. However, the goals and associated actions currently lack criteria that can be measured for progress and impact. We recommend the strategy be revised so that all actions are measurable, achievable, relevant and time-bound. A plan is needed to establish an accountability mechanism through which experts and users alike play a role in informing and augmenting the existing governance structure. For example, Goal 3.1.1 is to "form a joint Agency implementation group to fulfill the goals of this Strategy." This goal appears to be internal to the agencies only; while a joint agency implementation group may be necessary to implement and fulfill the goals of the strategy, this internal goal is not relevant to "stakeholders, partners, and other ocean users." There is room to consider whether a separate implementation team comprised of "stakeholders, partners, and other ocean users," is relevant.

The goal of collaboration must include actions that speak to how the agencies intend to solicit and integrate feedback from "stakeholders, partners, and other ocean users," as appropriate in decision making processes. It is also important to outline how conflicts among different stakeholder perspectives will be reconciled. For example, Goal 3.1.2 is to "develop an outreach and communications plan that includes schedules for soliciting and vetting adjustments periodically." It is not clear whether this plan is intended for interagency purposes only, or whether these materials will be sent to "stakeholders, partners, and other ocean users" for feedback. Additionally, Goal 3.1.3 is to "conduct meetings with partners to provide periodically updates and receive feedback, as needed." Though the strategy sets out to engage "stakeholders, partners and users," it does not establish actions that demonstrate there will be processes in place to ensure all stakeholders, partners, and other ocean users, are adequately engaged. Specifically, this goal does not mention "stakeholders" or "other ocean users," and only mentions "partners" in the context of providing periodic updates. This language needs to be revised to be inclusive of the "stakeholders, partners, and other ocean users," referenced as the basis of the goal, and the processes through which

[26] Strategy at Appendix A 2.2.6.

[27] Christiansen, F., S. M. Dawson, J. W. Durban, H. Fearnbach, C. A. Miller, L. Bejder, M. Uhart, M. Sironi, P. Corkeron, W. Rayment, E. Leunissen, E. Haria, R. Ward, H. A. Warick, I. Kerr, M. S. Lynn, H. M. Pettis, and M. J. Moore. 2020. Population comparison of right whale body condition reveals poor state of the North Atlantic right whale. Marine Ecology Progress Series **640**:1-16.

[28] Moore, M., Andrews, R., Austin, T., Bailey, J., Costidis, A., George, C., Jackson, K., Pitchford, T., Landry, S., Ligon, A., McLellan, W., Morin, D., Smith, J., Rotstein, D., Rowles, T., Slay, C. and Walsh, M. (2013), Rope trauma, sedation, disentanglement, and monitoring-tag associated lesions in a terminally entangled North Atlantic right whale (Eubalaena glacialis). Mar Mam Sci, 29: E98-E113. https://doi.org/10.1111/j.1748-7692.2012.00591.x

these "stakeholders, partners, and other ocean users" play a role in collaborating with the government need to be more clearly outlined. In addition, the terms, stakeholder, partner, and other ocean user need to be clearly defined.

The above recommendations will strengthen the strategy to help ensure that it effectively addresses protections for NARW during the development and operation of offshore wind. The blue economy of the future is one where the needs of clean energy are met while simultaneously safeguarding marine species and habitats. Having the right commitment and policies in place can effectively recover struggling populations. The endangered NARW requires swift, decisive, and effective action. As we continue to contribute to the body of scientific knowledge informing the conservation of this species, the Aquarium remains committed to working closely with the agencies and other stakeholders to prevent injuries and mortalities to NARW from impacts related to the development and operation of offshore wind energy. Implementing the recommendations included in this comment represents additional progress towards reducing the risk to NARW.

Sincerely,

John Mandelman, Ph.D.
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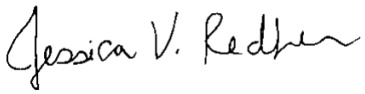
New England Aquarium



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