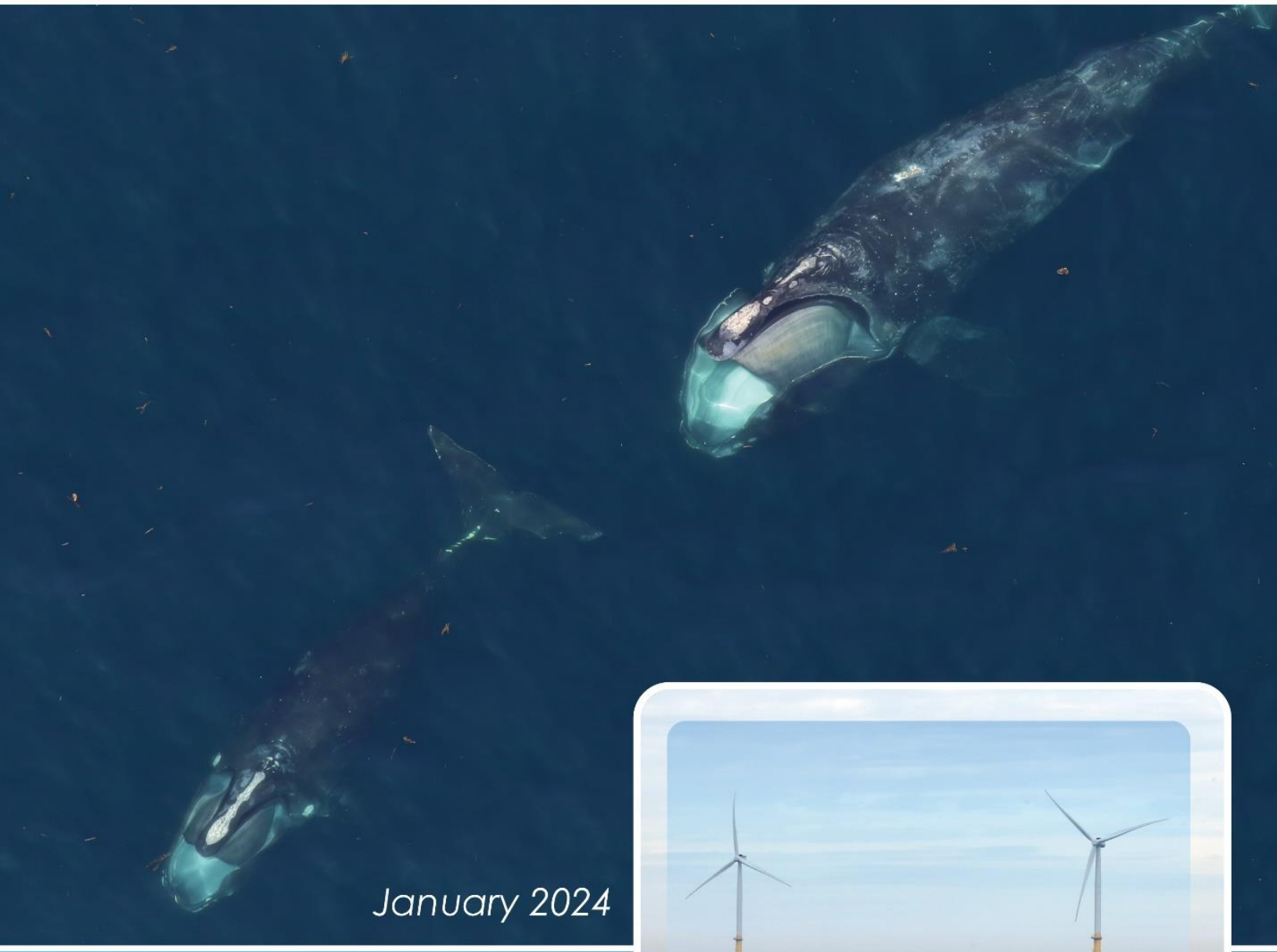
BOEM and NOAA Fisheries North Atlantic Right Whale and Offshore Wind Strategy



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BOEM
Bureau of Ocean Energy Management

NOAA FISHERIES

BOEM and NOAA Fisheries
North Atlantic Right Whale and Offshore Wind Strategy

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U.S. Department of the Interior
Bureau of Ocean Energy Management

U.S. Department of Commerce
National Oceanic and Atmospheric Administration
NOAA Fisheries

***Front Cover Photo Credits*:**
[top] An adult and juvenile North Atlantic right whale seen in the Great South Channel in 2016. Image collected under MMPA permit # 17355. NOAA/NEFSC/Allison Henry. [bottom] A North Atlantic right whale seen near the Block Island Wind Farm in January 2023. Image collected under MMPA permit # 21482. Amy Engelhaupt/HDR.

Table of Contents

List of Figures

Acronyms and Abbreviations

ASRG	Atlantic Scientific Review Group
ATN	Animal Telemetry Network
BOEM	Bureau of Ocean Energy Management
BSEE	Bureau of Safety and Environmental Enforcement
BWRI	Blue World Research Institute, Inc.
CEQ	Council on Environmental Quality
COP	Construction and Operations Plan
CZMA	Coastal Zone Management Act
DCO	Deputy Commandant for Operations
EBM	ecosystem-based management
ECP	Environmental Compliance Program
ESA	Endangered Species Act
ESP	Environmental Studies Program
GAP	General Activities Plan
GW	gigawatt
IKP	Indigenous Knowledge Plan
LCP	low frequency cetaceans
MARAD	Maritime Administration
MMPA	Marine Mammal Protection Act
NARW	North Atlantic right whale
NEPA	National Environmental Policy Act
NGO	Non-Governmental Organizations
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NOAA Fisheries	NOAA's National Marine Fisheries Service
NOI	Notice of Intent
OCS	Outer Continental Shelf
OPR	Office of Protected Resources
OSW	offshore wind
PAM	passive acoustic monitoring
PBR	potential biological removal
PCOMS	population consequences of multiple stressors
PET	Population Evaluation Tool
POWERON	Partnership for an Offshore Wind Energy Regional Observation Network
PSO	protected species observer

PTS	permanent threshold shift
RAP	Research Activities Plan
RWSC	Regional Wildlife Science Collaborative for Offshore Wind
RSLL	received sound level limit
SAP	Site Assessment Plan
SFV	sound field verification
TAP	Technology Assessment Program
UAV	unmanned aerial vehicle
UXO	unexploded ordinance

1 Summary

The Bureau of Ocean Energy Management (BOEM) and the National Oceanic and Atmospheric Administration (NOAA) Fisheries partnered to develop the North Atlantic right whale (NARW) and offshore wind (OSW) strategy to focus and coordinate efforts related to NARW and OSW development. In response to Executive Order 14008, *Tackling the Climate Crisis at Home and Abroad*, both agencies share a common vision to protect and promote the recovery of NARWs while responsibly developing OSW energy. This vision reflects the combined legislative mandates of the two agencies and their commitment to developing OSW while protecting biodiversity.

This shared *North Atlantic Right Whale and Offshore Wind Strategy* (hereinafter called "Strategy") identifies a number of actions to achieve the common vision under three goals: (1) Mitigation and Decision-Support Tools; (2) Research and Monitoring; and (3) Collaboration, Communication, and Outreach. These goals and actions will allow for coordinated and efficient collaborations between BOEM, NOAA, and our partners (including the OSW industry); collection and application of the best available scientific information and data and insights to inform future decisions, including monitoring and mitigation programs; and implementation of effective measures to reduce risk and avoid and minimize impacts to NARWs. Immediate impact mitigation efforts include, for instance, avoiding leasing in areas where major impacts to NARWs may occur, establishing noise limits during construction, and providing guidance to developers on conducting robust sound field verification (for certain activities) to ensure that expected impacts from OSW are not being exceeded.

The Strategy describes many potential actions for further development but does not define or require specific policies or regulatory actions.[1] A draft of this Strategy was made available for public comment in October 2022, and the input received was taken into consideration in developing the final Strategy here. The agencies intend to keep the Strategy as a "living" document that will be regularly evaluated and updated as progress is made and new information becomes available. Furthermore, an interagency implementation team will be formed to work with external partners in bringing the Strategy's vision to fruition.

[1] This guidance document is not a rule, regulation, or other legally binding instrument, and the recommendations it contains may not apply to a particular situation, depending on case specific facts and circumstances. Nothing in this document is intended to modify or amend any Federal statutes, regulations, permits, or leases, nor create any rights or cause of action or trust obligation that any person or party may enforce through litigation or otherwise against the U.S. Government or any of its employees or officers. This document is not legally enforceable. To the extent that there is any inconsistency between the provisions of this document and any Federal statutes, regulations, leases, or permits, the statutes, regulations, leases, or permits will control.

2 Issue Description

2.1 Background

Climate change poses a significant global threat, causing planet-wide physical, chemical, and biological changes that substantially affect the world's oceans, lands, and atmosphere. The most recent National Climate Assessment puts the climate crisis in stark terms: "Without significant reductions in greenhouse gas emissions, extinctions and transformative impacts on some ecosystems cannot be avoided, with varying impacts on the economic, recreational, and subsistence activities they support" (U.S. Global Change Research Program 2018).

To address this threat, a transition to cleaner, renewable energy is needed expeditiously and at scale (Intergovernmental Panel on Climate Change 2022). Decarbonization of the power sector, coupled with efficient electrification, can help decarbonize the transportation, building, and industrial sectors and provide significant climate and health benefits (Donohoo-Vallett et al. 2023). In the United States, the Biden-Harris administration set the goals of net zero greenhouse gas emissions by 2050 and a pollution-free power sector by 2035. Currently, 22 states, plus the District of Columbia and Puerto Rico, have 100% clean energy goals (Clean Energy States Alliance 2023). A May 2023 report from the Department of Energy, *On the Path to 100% Clean Electricity*, identified the rapid deployment of wind and solar power as a key action to achieve 100% clean electricity (Donohoo-Vallett et al. 2023).

OSW is an abundant, efficient, and renewable alternative domestic energy resource found close to major coastal cities, where more than half of the U.S. population resides and energy needs are high. Compared to onshore winds, offshore winds are generally stronger and more consistent. As higher wind speeds can produce significantly more energy, there is increasing interest in developing OSW. In March 2021, in response to Executive Order 14008, *Tackling the Climate Crisis at Home and Abroad*,[2] the Departments of the Interior, Energy, and Commerce announced a national goal[3] to deploy 30 gigawatts (GW) of OSW by 2030 while protecting biodiversity and promoting ocean co-use. Hence, the Bureau of Ocean Energy Management (BOEM)[4] plans, by 2025, to hold up to four additional OSW lease sales[5] and complete the review of at least 16 plans to construct and operate commercial OSW facilities, which would represent more than 27 GW of clean energy for the Nation's annual production of roughly 484 GW.

BOEM and NOAA's National Marine Fisheries Service (NMFS, or NOAA Fisheries)[6] recognize that OSW development (from siting to decommissioning) must be undertaken responsibly and in accordance with existing environmental laws. This requires identifying and mitigating the impacts from OSW to endangered species like the NARW (*Eubalaena glacialis*).[7] The NARW population is currently in decline,

[2] www.whitehouse.gov/briefing-room/presidential-actions/2021/01/27/executive-order-on-tackling-the-climate-crisis-at-home-and-abroad/

[3] www.doi.gov/news/interior-joins-government-wide-effort-advance-offshore-wind

[4] www.boem.gov

[5] www.boem.gov/sites/default/files/documents/renewable-energy/state-activities/OSW-Proposed-Leasing-Schedule.pdf

[6] www.fisheries.noaa.gov/

[7] www.fisheries.noaa.gov/species/north-atlantic-right-whale

mainly due to vessel strikes and entanglement in fishing gear (Pettis et al. 2023), and regulations to further mitigate those effects are underway. OSW development must be carried out in a way that avoids or minimizes the potential for introducing adverse effects to the species and the ecosystems on which it depends by integrating science-based avoidance and minimization approaches throughout the OSW siting, leasing, construction, operations, and decommissioning process to protect and conserve the species and its habitat.

Previous, current, and ongoing research efforts supported by BOEM, NOAA Fisheries, industry, and other partners and stakeholders over the past several decades provide the best available science to inform management decisions today on OSW development and its potential impacts to NARWs. Federal agencies are working to better understand the effects of OSW development on NARWs and their ecosystem, and to develop and improve strategies to avoid, minimize, and monitor impacts to NARWs from OSW development. As the OSW industry continues to grow and projects are proposed for and begin construction, BOEM and NOAA Fisheries will continue to use this Strategy to implement measures to reduce risk to NARWs, evaluate existing approaches, and collect and apply best available data and insights to inform future decisions, including monitoring and mitigation programs.

BOEM and NOAA Fisheries developed this shared *North Atlantic Right Whale and Offshore Wind Strategy* to focus and integrate past, present, and future efforts related to NARW and OSW development. Both agencies share a common vision: *to protect and promote the recovery of North Atlantic right whales while responsibly developing offshore wind energy*. This vision reflects the combined legislative mandates[8] of the two agencies and their commitment to developing OSW while protecting biodiversity and promoting ocean co-use. The Strategy identifies several actions to achieve the common vision and to meet the agencies' legislative mandates under three main goals: (1) Mitigation and Decision-Support Tools; (2) Research and Monitoring; and (3) Collaboration, Communication, and Outreach.

A draft of the Strategy was made available for public comment in October 2022, before being finalized with consideration of comments received. The agencies intend to keep this Strategy as a "living" document that will be regularly evaluated and updated as progress is made and new information becomes available.

BOEM and NOAA Fisheries recognize that there are ongoing efforts with similar goals and objectives inside and outside of these two agencies. Executing this Strategy will involve collaboration and coordination among the many Federal and non-Federal partners with shared interests. This Strategy is also an integral step to most effectively organize BOEM, NOAA Fisheries, and their partners around a shared vision and a clear path to study and manage this issue.

This Strategy does not establish policy or require regulatory actions, interpret existing laws or regulations, or establish any legal requirement; rather, it recognizes efforts to date and identifies areas where BOEM and NOAA Fisheries will work together alongside our partners (including the OSW industry) to further develop the information and science the agencies will use to inform their decisions

[8] Outer Continental Shelf Lands Act; Endangered Species Act Section (7(a)(1)) to use programs and authorities to provide for conservation of the species and Section (7(a)(2)) to ensure actions funded/authorized/carried out are not likely to jeopardize the species or destroy/adversely modify critical habitat.

to responsibly develop OSW while protecting and recovering NARWs. All OSW projects (ongoing, planned, and future) are subject to the National Environmental Policy Act (NEPA), Endangered Species Act (ESA), and Marine Mammal Protection Act (MMPA), which all bear on fully understanding and managing the impacts of OSW energy development on NARWs, and there are many ways that conditions can, and will continue to, be required for projects to mitigate effects on NARWs. BOEM and NOAA Fisheries will continue to work together to ensure a robust and comprehensive analysis of the effects of OSW development on NARWs and develop and implement effective measures to avoid, minimize, and mitigate and monitor effects of construction, operations, and eventual decommissioning of OSW projects.

Although this Strategy is focusing on OSW and NARWs in the Atlantic, BOEM and NOAA will monitor potential impacts from OSW development in the Gulf of Mexico, where small numbers of NARWs have occasionally been recorded, most recently in 2020. The Strategy will be updated in the future as new information becomes available.

2.2 BOEM & NOAA Fisheries' Missions and Responsibilities

BOEM's mission is to manage the energy and mineral resources of the OCS in an environmentally and economically responsible way. BOEM promotes energy independence, environmental protection, and economic development through responsible, science-based management of energy and mineral resources on the OCS. BOEM ensures that environmental protection—informed by the best available science as required by law—is a foremost concern and an indispensable consideration in BOEM's decision-making. The OCS Lands Act directs BOEM to study and consider coastal, marine, and human environmental impacts, and BOEM must also comply with many other statutes, regulations, executive orders, and policies in making decisions—including the ESA.

One of BOEM's key programs is offshore renewable energy[9] development on the OCS. In 2009, the U.S. Department of the Interior announced final regulations for the OCS Renewable Energy Program, which was authorized by the Energy Policy Act of 2005. These regulations provide a framework for issuing leases, easements, and rights-of-way for OCS activities to support production and transmission of energy from sources other than oil and natural gas, including environmental safeguards.

BOEM's OSW development approval process typically comprises four distinct phases: (1) planning and analysis; (2) leasing; (3) site assessment; and (4) construction and operations, with public and stakeholder engagements and consultation with Tribal Nations throughout the entire process. In the first two phases, planning and analysis and then leasing, BOEM obtains information regarding potential areas suitable for OSW development along with information regarding potential existing ocean uses, the presence of natural and cultural resources, and other key considerations before identifying an area to be considered in a formal Call for Information and Nominations, which is published in the *Federal Register.* This Call for Information and Nominations, which identifies what is frequently referred to as a "call area," is meant to obtain comments and information from the public and nominations from companies interested in commercial wind energy leases within the defined area.

[9] www.boem.gov/renewable-energy

Based on further resource evaluation and public feedback, BOEM typically winnows down the larger area to ultimately identify areas for environmental analysis and consideration for leasing (i.e., draft wind energy areas). Additional reviews are undertaken on these draft wind energy areas until final wind energy areas are identified for a lease sale. Then, each subsequent lease sale, Site Assessment Plan (SAP), and Construction and Operations Plan (COP) undergoes further evaluation under statutes—including the NEPA, ESA, MMPA (as applicable)—and are also subject to additional review by other Federal and State agencies, Tribal Nations, ocean users, and the public.

Thus, throughout each phase of the OSW development process from area identification for a lease sale through the construction and operation of an OSW project, there are integrated opportunities for avoiding areas critical to NARW and identifying mitigation measures.

As of September 2023, there are 30 renewable energy lease areas in the Atlantic Outer Continental Shelf (OCS) with an installed OSW capacity of 42 megawatts. COPs for OSW projects on 18 of those leases have been submitted to BOEM, with Records of Decision issued for four, and two currently under construction offshore Massachusetts and New York. BOEM anticipates completing the review of 16 OSW projects by 2025. All these projects are anticipated to have fixed foundation turbines, though future leasing plans in deeper areas of the Atlantic OCS contemplate the use of floating technology, which could help contribute to the goal of 15 GW of floating OSW by 2035.

NOAA Fisheries is a steward of the Nation's living marine resources, including fisheries, most marine mammals, anadromous and marine endangered and threatened species, and their habitats and ecosystems. NOAA Fisheries also assesses many living marine resources to promote their protection, conservation, recovery, and long-term sustainability. NOAA Fisheries' responsibilities for marine mammals and endangered species are defined under the ESA and MMPA. Pursuant to these laws, NOAA Fisheries lists species as threatened or endangered, designates critical habitat, promulgates protective regulations, monitors, assesses, protects, and recovers marine mammals and endangered and threatened species, and conserves the habitats upon which these species depend.

NOAA Fisheries strives to take an ecosystem-based approach to managing living marine resources, recognizing the interconnectedness of ecosystem components and the value of resilient and productive ecosystems to living marine resources. NOAA consults with Federal action agencies under Section 7(a)(2) of the ESA to ensure that actions they propose are not likely to jeopardize ESA-listed species or result in the destruction or adverse modification of designated critical habitat and through that process establishes non-discretionary measures to minimize the effects of incidental take of species and provides conservation recommendations to support their conservation and recovery. Further, under the MMPA, in response to an applicant's requests, NOAA issues authorizations to incidentally take marine mammals only in circumstances where the taking will not result in more than a negligible impact to marine mammals, including ESA-listed marine mammals, and the authorization prescribes the permissible methods of taking and other means of effecting the least practicable adverse impact on marine mammal species or stocks and their habitat, as well as requirements pertaining to the monitoring and reporting of such taking.

NOAA Fisheries has responsibilities for the NARW under the MMPA and ESA. This species, whose range overlaps with the area proposed for OSW development in the Atlantic OCS, is one of the most endangered large whales in the world (Hayes et al. 2023). NOAA Fisheries, working with other Federal

agencies and organizations and the Canadian government, is heavily invested in protecting and recovering this species. The NARW provides important ecosystem services, and its potential extinction could be a leading indicator for other ecosystem disruptions (Pershing et al. 2021). NOAA Fisheries responsibilities under the ESA include NARW listing, recovery, critical habitat designation, and interagency consultation. For example, NOAA Fisheries recently completed a 5-year review for the NARW, which concluded that no change to the listing status was warranted and included recommendations for future actions such as continuing to work with Federal action agencies to fully utilize Section 7 of the ESA to help address impacts from anthropogenic activities to NARW, as well as monitor and address impacts associated with new and emerging marine activities (e.g., OSW energy development) to NARW.

Section 7(a)(1) of the ESA requires BOEM and NOAA (and all other Federal agencies) to "utilize their authorities in furtherance of the purposes of this Act by carrying out programs for the conservation of endangered species." This Strategy was developed by BOEM and NOAA Fisheries in accordance with their respective obligations pursuant to Section 7(a)(1). Additionally, Section 7(a)(2) of the ESA requires that BOEM, as an action agency considering the approval of OSW activities that may affect the NARW, consult with NOAA Fisheries to ensure that those activities are not likely to jeopardize the continued existence of NARWs or result in the destruction or adverse modification of critical habitat designated for the species. NOAA Fisheries, as the consulting agency, provides its opinion to BOEM on whether a proposed OSW development action is likely to adversely affect NARW or its designated critical habitat and, if so, whether the action is likely to jeopardize the species or result in destruction or adverse modification of its designated critical habitat. BOEM and NOAA Fisheries are required by the ESA to use the best scientific and commercial data available when carrying out these consultations.

At the end of the formal ESA Section 7 consultation process, NOAA Fisheries prepares a Biological Opinion detailing how BOEM's proposed OSW action may affect NARWs or its critical habitat and, as noted, draws a conclusion as to whether the proposed action is likely to jeopardize the continued existence of the species or result in the destruction or adverse modification of its designated critical habitat. The "jeopardy" analysis considers whether the action will result in reductions in reproduction, numbers, or distribution of the species, and then considers whether these reductions (if any) would reduce appreciably the likelihood of both the survival and recovery of the species, as those terms are defined for purposes of the ESA. If a "jeopardy" or "adverse modification" conclusion is reached, the Biological Opinion would include one or more Reasonable and Prudent Alternatives to the proposed action that would avoid the likelihood of jeopardizing the continued existence of the listed species or the destruction or adverse modification of designated critical habitat.

If a "no jeopardy" conclusion is reached, either based on the proposed action (including its mitigation measures) or after adopting a Reasonable and Prudent Alternative, NOAA Fisheries issues with the Biological Opinion an Incidental Take Statement that exempts a certain amount and extent of incidental take from the prohibitions on take listed in ESA Section 9. The Incidental Take Statement includes Reasonable and Prudent Measures and implementing Terms and Conditions determined to be necessary and appropriate to minimize and monitor that take. The incidental take of marine mammals, including ESA-listed marine mammals, must also be authorized under the MMPA. Developers proposing activities, including surveys and construction activities, may request an incidental take authorization under the MMPA from NOAA Fisheries (Office of Protected Resources [OPR], Permits and Conservation Division).

When processing requests for incidental take authorizations for OSW activities under the MMPA, NOAA Fisheries OPR may only authorize take of small numbers of marine mammals and must find that the total authorized take will have a negligible impact on the affected marine mammal species and stock. In any marine mammal incidental take authorization, NOAA Fisheries OPR must also prescribe mitigation measures that will result in the least practicable adverse impact on marine mammals and their habitat—paying particular attention to rookeries, mating grounds, and areas of similar significance—and include requirements pertaining to monitoring and reporting. The Section 7 consultation carried out between BOEM and NMFS includes all proposed Federal actions, including NOAA Fisheries OPR's proposed issuance of an MMPA incidental take authorization for an OSW activity.

2.3 Status of the NARW

NARWs are listed as endangered under the ESA and considered depleted under the MMPA. The species is in decline (Pace III et al. 2017; Pace III et al. 2021) and experiencing an ongoing unusual mortality event, which was declared in 2017 (Daoust et al. 2018; NOAA Fisheries 2022a). Preliminary estimates based on data through December 2022 indicate there are approximately 360 individuals remaining, including fewer than 70 reproductively active females (Hayes et al. 2023; Linden 2023).

The potential biological removal (PBR) level for the species, for the purposes of the MMPA, defined as the maximum number of animals that can be removed annually while allowing the stock to reach or maintain its optimal sustainable population level,[10] is less than one (Hayes et al. 2023). In addition to vessel strikes and entanglement in fishing gear, which are the primary causes of NARW mortality and serious injury, modeling indicates that low female survival, a male-biased sex ratio, and low calving rates are contributing to the population's current decline (Pace III et al. 2017). The species has low genetic diversity, as would be expected based on its low abundance, and the species' resilience to future perturbations is expected to be very low (Hayes et al. 2023).

Decreased prey abundance, climate-driven changes in habitat, and, potentially, ocean noise, also are contributing to the species decline and could further reduce calving rates and increase susceptibility to disease and predation (Bishop et al. 2022; Matthews and Parks 2021; Meyer-Gutbrod et al. 2021; Meyer-Gutbrod et al. 2022). Entanglement in fishing gear appears to have had substantial health and energetic costs that affect survival, reproduction, and decreased size at maturation for NARW (Rolland et al. 2012; Stewart et al. 2022; Stewart et al. 2021; Van der Hoop et al. 2016). Sublethal effects from changes in prey availability are difficult to separate from other sublethal effects (e.g., entanglement in fishing gear) but are directly linked to health, reproduction, and survival (Pirotta et al. 2023). Increasing levels of ocean noise due to anthropogenic activities may also cause sublethal effects to NARW (Matthews and Parks 2021). These stressors likely decrease the health of NARWs, which may cause a decrease in calving rates (Rolland et al. 2016). Calving rates have slowed from one calf per female every 3 to 4 years to one calf per female every 7 to 10 years (Pettis et al. 2023); in addition, the number of first-time mothers is decreasing (Reed et al. 2022).

[10] The term "optimal sustainable population" is defined in the MMPA as "with respect to any population stock, the number of animals which will result in the maximum productivity of the population or the species, keeping in mind the carrying capacity of the habitat and the health of the ecosystem of which they form a constituent element."

NARWs feed primarily on the late-stage, lipid-rich copepod (*Calanus finmarchicus*) but supplement their diet with other zooplankton species (Baumgartner et al. 2017). NARWs must find and feed on dense aggregations of copepods to survive (Baumgartner and Mate 2003). Climate-change-driven changes in ocean conditions have shifted the distribution of NARW prey (e.g.,Grieve et al. 2017; Meyer-Gutbrod and Greene 2018; Meyer-Gutbrod et al. 2021; Meyer-Gutbrod et al. 2022; Record et al. 2019). NARWs have in turn shifted their seasonal distribution into areas where they have not been observed regularly for at least the past few decades, including Canada's Gulf of St. Lawrence (Crowe et al. 2021) and southern New England (O'Brien et al. 2022; Quintana-Rizzo et al. 2021).

This shift in distribution has coincided with increased entanglements in fishing gear and vessel strikes (O'Brien et al. 2022). As of October 2023, the ongoing NARW unusual mortality event includes a total of 121 documented animals: 36 dead stranded NARWs, 34 seriously injured free-swimming NARWs, and 51 sublethal injuries/illness (i.e., morbidity) (NOAA Fisheries 2022a). Examinations by necropsy or photo documentation have been conducted on 31 of the 36 dead whales. Final results from some examinations are pending; however, preliminary findings indicate vessel strikes or entanglements in fishing gear as the causes of death. Additionally, 33 live free-swimming non-stranded NARWs have been documented with serious injuries from entanglements or vessel strikes, and 29 more have been documented with sublethal injuries and/or illness (NOAA Fisheries 2022c). To date, more than 20 percent of the population has been impacted by the unusual mortality event based on the documented cases and the 2017 abundance estimate, which is when the current event began. The actual situation is certainly much worse, with cryptic mortality (i.e., unobserved mortality, see Pace III et al. 2021) estimated to be 64% of all mortality.

Based on this information, roughly 237 animals have died since the population peaked at 481 in 2011, exceeding the PBR level on average by more than 40 times for the past 5 years (Pace III et al. 2021). Human-caused mortality is so high that no adult NARW has been confirmed to have died from natural causes in several decades (Hayes et al. 2023). Most animals have a low probability of surviving past 40 years even though the NARW can live up to a century. Consequently, for the remaining reproductively active females (currently fewer than 70 in number) and any subsequent calves that might mature, their lifetime calving potential has been reduced from more than a dozen to perhaps just two to three calves. NARW births remain significantly below what is expected, and the average inter-birth interval remains high. Additionally, there were no first-time mothers in 2022, underscoring recent research findings that fewer adult, nulliparous females are becoming reproductively active (Reed et al. 2022). Finally, the proportion of the population with compromised body condition has increased steadily over the last 20 years. Today, about 42% of the population is known to be in reduced health (Hamilton et al. 2021), likely contributing to the smaller body sizes at maturation (Stewart et al. 2022) and making NARWs generally more susceptible to threats, including potential impacts from OSW development.

Due to the declining status of NARWs, the resilience of this population to stressors affecting their distribution, abundance, and reproductive potential is low. The species faces a high risk of extinction, and the population size is small enough that the death of even very few individuals can have a measurable effect on its population status, trend, and dynamics. Furthermore, the loss of even one individual a year (e.g., higher than the current PBR level) may reduce the likelihood of species recovery and of their ability to achieve optimum sustainable population.

NOAA Fisheries' *North Atlantic Right Whale Priority Action Plan for 2021–2025*[11] identifies the need to improve our knowledge of factors that may limit NARW recovery, such as OSW development (NOAA Fisheries 2021). The plan identifies the need for a thorough and comprehensive analysis of temporary and long-term direct and indirect impacts of OSW development from construction and operation through decommissioning. Assessing and mitigating threats associated with the development of OSW has also been identified in NOAA Fisheries' *North Atlantic Right Whale Road to Recovery*,[12] which describes NOAA Fisheries' overall efforts to stop the current population decline and recover the species (NOAA Fisheries 2022b). Within the *Road to Recovery*, NOAA Fisheries identifies major existing threats to NARWs, including entanglements, vessel strikes, ocean noise, and climate-driven changes in habitat and habitat use (including prey). Given these threats, OSW must be developed based on responsible science-based decision-making and development and implementation of enduring avoidance, minimization, mitigation, and monitoring approaches to avoid exacerbating the species' dire status.

2.4 Intersection of NARWs and OSW

Due to the status of NARW, science-based decision-making, and protective measures designed to ensure survival and recovery of the species must be considered in managing NARWs. The most recent stock assessment report (Hayes et al. 2023) indicates there are approximately 360 individuals and that the PBR of this population is less than one individual. Given the uncertainty in the potential effects of the presence and operation of OSW facilities on protected species and their habitats (Dorrell et al. 2022; Raghukumar et al. 2023), management of OSW development should proceed with a focus on avoiding or minimizing known and potential impacts to NARWs and their habitat. The precarious status of the species necessitates that all human impacts be avoided or minimized in such a way that NARWs can recover in the coming years to be able to benefit from the long-term mitigation of climate impacts from OSW development.

NARWs inhabit the waters of the U.S. and Canadian Atlantic, with some parts of their range designated as critical habitat under the ESA (81 FR 4838, January 27, 2016) and Canada's Species At Risk Act (Fisheries and Oceans Canada 2014). Within the areas proposed for OSW development in the United States, NARWs engage in migration, foraging, socializing, reproduction, calving, and resting behaviors critical to their survival (Leiter et al. 2017; Muirhead et al. 2018; Quintana-Rizzo et al. 2021; Zoidis et al. 2021). The overlap between OSW development (planned, leased, and approved) and NARW habitat extends to areas outside the immediate development sites (i.e., wind energy developments and export cable corridors), where vessel traffic between ports and offshore sites would further overlap with the distribution of NARWs (**Figures 1a and 1b**, and **Appendix D**). Noise and ecosystem-level changes resulting from OSW development that may impact NARWs are also likely to extend beyond the immediate OSW lease areas. In the Atlantic OCS off the southeast United States, NARW presence is highly seasonal as evident in monthly density maps (**Appendix D**), with NARWs mostly present between November and May. In the Atlantic OCS off the northeast and Mid-Atlantic regions, NARWs are present year-round (Davis et al. 2017). See **Appendix D** for detailed maps of NARW density and distribution by month in relation to current and planned OSW activity. Given this, the potential for NARWs to be affected by OSW activities is related to the timing and location of those activities.

[11] www.fisheries.noaa.gov/resource/document/species-spotlight-priority-actions-2021-2025-north-atlantic-right-whale

[12] www.fisheries.noaa.gov/species/north-atlantic-right-whale/road-recovery

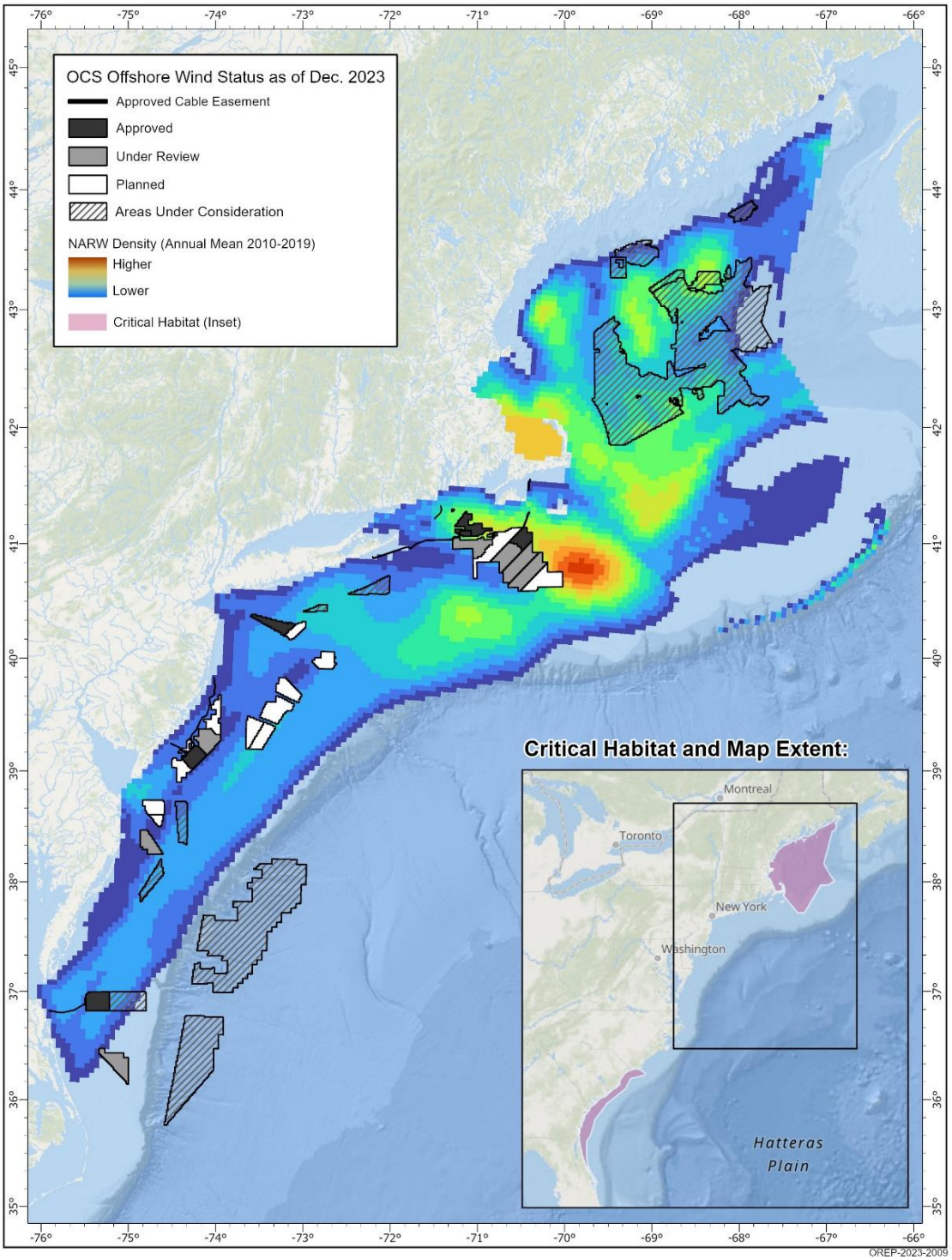

Figure 1a. Status of OSW activity overlaid on mean annual density of NARWs off the northeast United States (2010–2019)

Inset shows all designated NARW critical habitat under the ESA. Narrow lines leading from leases to land are cable route easements. Due to State/Federal jurisdiction, the easement shows as ending at the State waters boundary where other State and Federal regulations apply. All leases with approved COPs will include easements shortly after approval. Source: Roberts et al. (2023); Roberts et al. (2016).

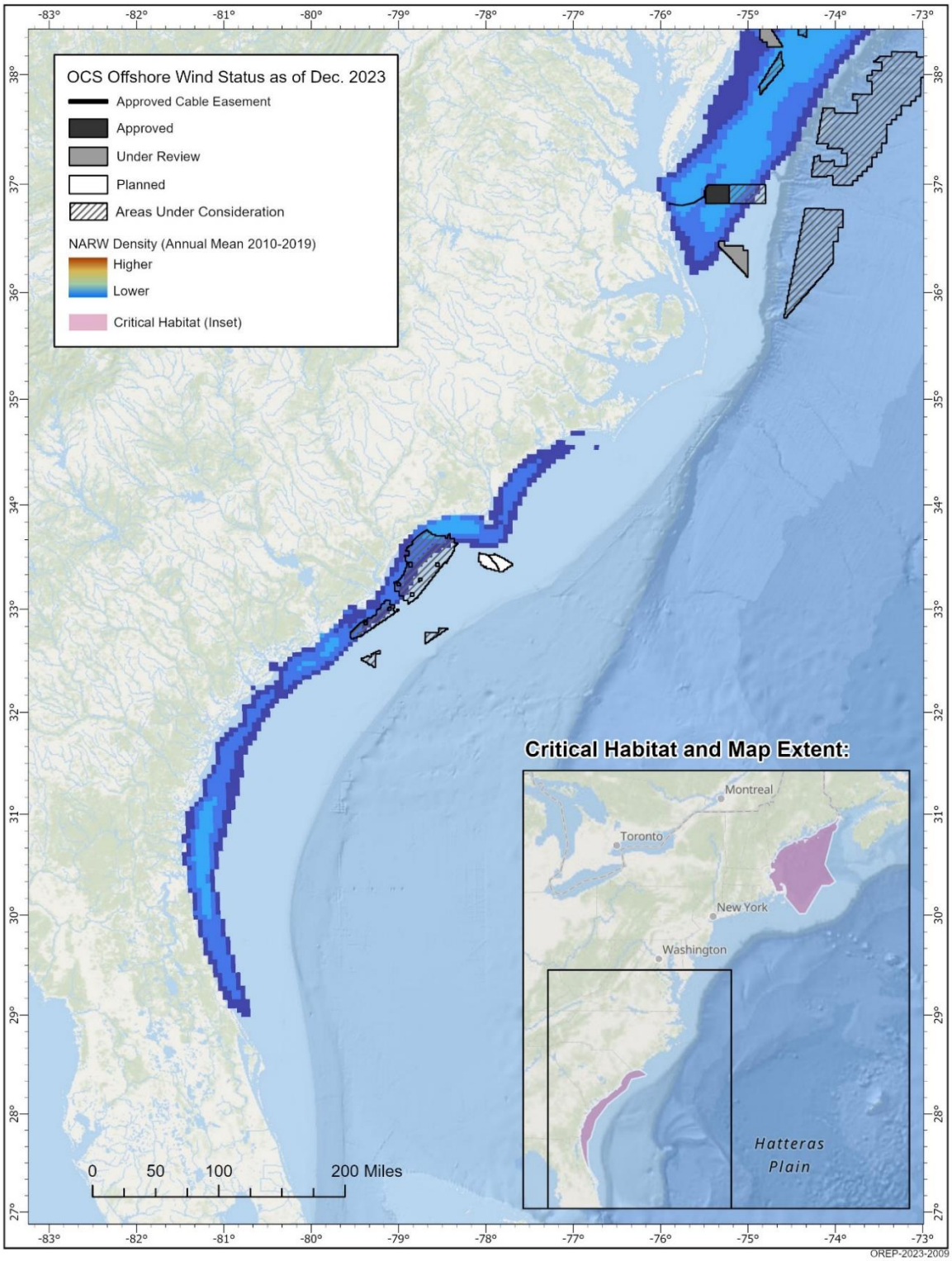

Figure 1b. Status of OSW activity overlaid on mean annual density of NARWs off the southeast United States (2010–2019)

Inset shows all designated NARW critical habitat under the ESA. Narrow lines leading from leases to land are cable route easements. Due to State/Federal jurisdiction, the easement shows as ending at the State waters boundary where other State and Federal regulations apply. All leases with approved COPs will include easements shortly after approval. Source: Roberts et al. (2023); Roberts et al. (2016).

The activities associated with OSW development would introduce or further contribute to existing stressors in the environment that affect NARWs (Daewel et al. 2022; Dorrell et al. 2022; Leiter et al. 2017; Maxwell et al. 2022; Quintana-Rizzo et al. 2021). The approaches identified in this Strategy are intended to mitigate the impacts of these stressors, while the Strategy's recommendations on scientific research are designed to help the agencies understand the extent to which OSW activities will contribute to and alter these stressors and, ultimately, the magnitude of potential impacts to NARWs.

The four primary stressors identified in this Strategy include the following (in no particular order):

1. **Exposure to noise.** Sound-producing activities associated with OSW activities have the potential to result in hearing impairment, masking of NARW vocal communication, physiological impacts (e.g., stress), and/or behavioral disturbance, as well as mortality and injury that may result from exposure to detonations of unexploded ordnance (UXO). The severity and magnitude of impacts are dependent upon the nature of the activity (e.g., most high resolution geophysical (HRG) sound sources used during site characterization are expected to have de minimis impacts, if any, see Ruppel et al. 2022).
2. **Strikes from vessels**. All vessels, including those associated with OSW activities, have the potential to strike and potentially injure or kill NARWs. In addition, OSW activities may result in shifts in species and/or vessel distribution, which may alter vessel strike risk from non-OSW vessels (e.g., vessels could be displaced from lease areas and into areas used more frequently by NARWs).
3. **Entanglement**. OSW activities may produce marine debris or involve appurtenances (e.g., from floating wind), which may cause entanglements that injure or kill NARWs. In addition, OSW activities may alter entanglement risk through changes in fishing activities or by interacting with abandoned, lost, or otherwise discarded fishing gear (e.g., attached to turbine structures).
4. **Changes to habitat.** OSW development will result in habitat changes that may affect the abundance, quality, or availability of NARW prey (e.g., changes in ocean circulation and mixing from in-water structures, including turbines and foundations, and impingement or entrainment of prey in cooling water intakes associated with High Voltage Direct Current cable systems) or attract predators (e.g., predators with an affinity for a new "reef structure" in the environment).

The consequence of NARW exposure to noise and/or pressure (particularly from construction activities) and vessel strikes are generally well known. Conversely, the extent to which OSW development may increase or alter entanglement risk and how changes in habitat may affect NARWs, particularly through sublethal effects that do not result in mortality or serious injury, are not as well understood. Sublethal effects can be direct or indirect, and often scientific quantification of indirect effects is challenging, though some can be modeled.

Relative to the threat of changes to habitat, this Strategy identifies a need for quantitative assessments of potential OSW impacts on NARW prey availability and consumption potential. Based on the best available science on ecosystem causation, this Strategy identifies the following conceptual cause-effect-impact pathway on female condition and calving rates that could occur if impacts to prey and foraging habitats occur (**Figure 2**).

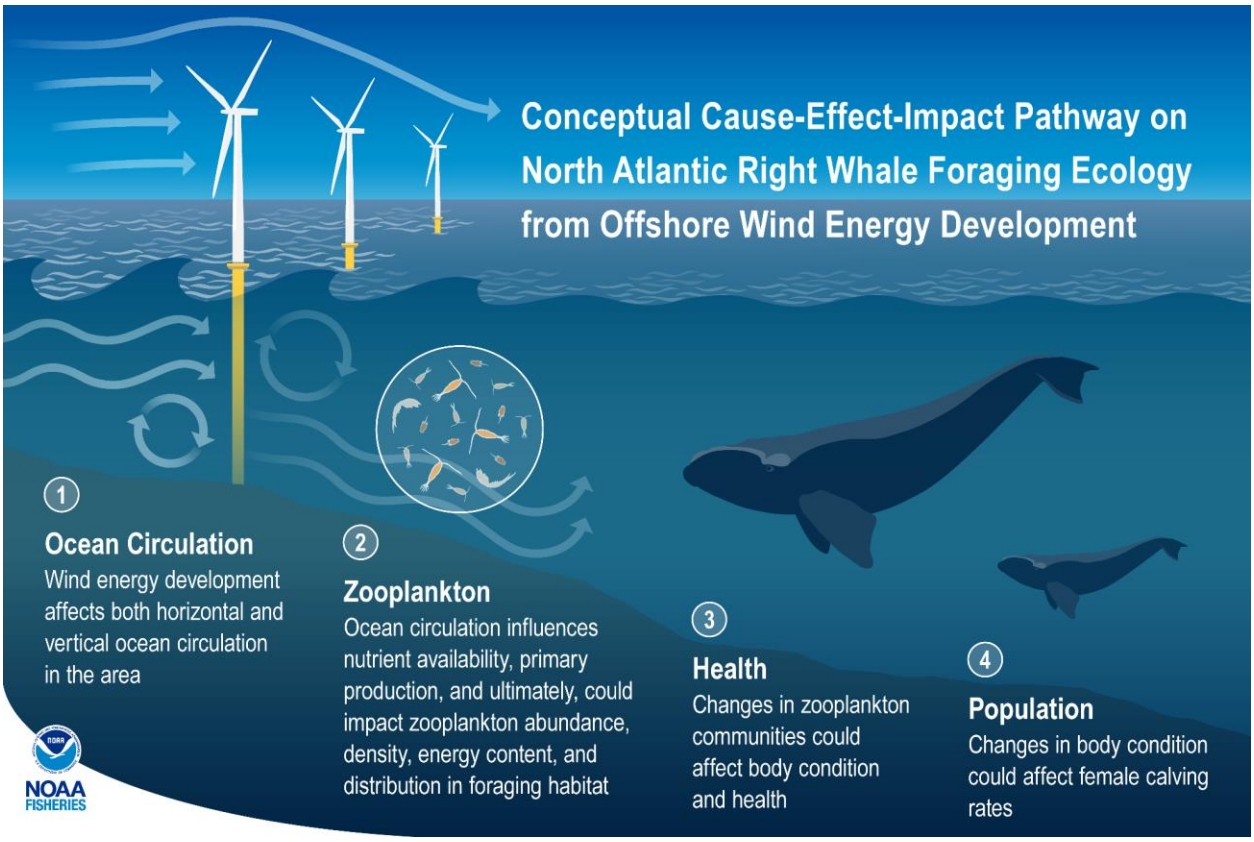

Figure 2. Conceptual cause-effect-impact pathway on NARW foraging ecology from OSW development

Although the above pathway is conceptual and additional research is needed, recent studies suggest that OSW has the potential to alter local- to regional-scale ocean circulation, including upwelling and downwelling, as well as primary and secondary production (e.g., Daewel et al. 2022; Floeter et al. 2022; National Academies of Sciences 2023; Raghukumar et al. 2023). A National Academy of Sciences, Engineering, and Medicine panel recently convened to assess potential impacts from OSW energy developments in the Nantucket Shoals region on marine hydrodynamics and the availability of NARW prey confirmed that OSW has the potential to alter local and regional hydrodynamics. The panel noted that "the paucity of observations and uncertainty of the modeled hydrodynamic effects make it difficult to assess the ecological impacts of offshore wind farms [energy development], particularly considering the scale of both natural and human-caused variability in the Nantucket Shoals region," and "as planning and construction of wind farms in the Nantucket Shoals region continue, further study and monitoring of the oceanography and ecology of the area is needed to fully understand the impact of future wind farms" (National Academies of Sciences 2023). In alignment with these recommendations, this Strategy identifies modeling studies to understand the physical and ecological complexities of these areas/regions and to assess potential impacts on hydrodynamics and NARW foraging resources, as well as coordinated regional monitoring efforts to validate model outputs with respect to hydrodynamic and ecological effects at turbine, wind energy developments, and regional scales.

Part of this Strategy is to further research the possibility of cause-effect-impact pathways for sublethal effects, such as displacement from calving grounds, impacts of ocean noise, reduced lactation or reduced nursing, and reduced ability to become pregnant or maintain a viable pregnancy. Such research

is merited because sublethal effects may have a similar impact on the species as lethal effects by reducing the potential for the population to grow (Moore et al. 2021; Sharp et al. 2019). Moreover, increased energetic costs (e.g., from potential displacement from foraging areas due to noise or prey availability) could lead to increased susceptibility to other stressors (e.g., a shift in distribution can change the overlap with vessel traffic and fishing activities). Cause-effect-impact pathways can also vary based on body condition (Bishop et al. 2022; Christiansen et al. 2020; Moore et al. 2021; Pettis et al. 2017). Whales that are in compromised condition (e.g., injured, entangled, malnourished) and exposed to stressors are likely to experience more severe consequences than healthy animals (Christiansen et al. 2020; Knowlton et al. 2022; Moore et al. 2021; Pettis et al. 2017).

Effects to NARWs could result from stressors generated from a single project; there is potential for these effects to be compounded by exposure to multiple projects. NARWs migrating along the U.S. Atlantic Coast have the potential to travel near or through many currently proposed OSW developments along the Atlantic Coast. In some cases, OSW development may occur in areas that are important for NARW vital functions. For example, if the OSW development being considered in the Gulf of Maine moves forward, it would occur in designated NARW critical habitat (Leiter et al. 2017; O'Brien et al. 2022; Quintana-Rizzo et al. 2021; Stone et al. 2017).

It is important to keep in mind that the northwest Atlantic—in particular the mid-Atlantic shelf and slope—has been experiencing strong interannual and decadal-scale variability (Andres 2016; Forsyth et al. 2015; Gangopadhyay et al. 2019; Harden et al. 2020). The long-term warming trend in this region since the 1980s is several times larger than the global mean warming trend (Forsyth et al. 2015; Großelindemann et al. 2022). Enhanced regional warming in the northwest Atlantic as a response to climate change has been seen in at least one climate model (Saba et al. 2016), but it is still unclear whether the recent climatic variability is primarily a regionally enhanced response to climate change or due to decadal variability in the climate system (e.g., the Gulf Stream or Meridional Overturning Circulation) that may reverse sign in the future. Therefore, any efforts to model or observe the impacts of OSW projects will have to place the OSW-induced variability in this wider context.

2.5 NARW and OSW Research and Monitoring Efforts

Previous, current, and ongoing research efforts supported by BOEM, NOAA, the OSW industry, and other partners and stakeholders over the past 15 years provide the best available science to inform consideration of the effects of OSW on NARWs.

To ensure that BOEM and NOAA Fisheries had an inventory of available and planned research and mitigation methods and technologies prior to developing this Strategy, BOEM contracted with the Blue World Research Institute, Inc. (BWRI) to synthesize current and near-term NARW research and monitoring efforts, in-use or developing tools and methods, and measures to avoid or minimize OSW-related impacts on the NARW population (see Silber et al. in review). BWRI canvassed OSW energy industry representatives, NARW researchers, environmental groups, and others about their ongoing and planned work and their views on innovations that may be applied in a 1- to 5-year time horizon. The research emphasized emerging or novel uses of existing methodologies that study NARW occurrence, distribution, and health, as well as potential impact-mitigating methods and technologies.

The report's findings acknowledge the magnitude of work previously and currently being undertaken related to NARWs and OSW (as well as future planned efforts) but does not include an exhaustive list of all research efforts to date. Examples of this work include support for workshops; working groups; passive acoustic monitoring (PAM); vessel and aerial monitoring; photo identification; infrared camera and related technology studies; satellite and unmanned aerial vehicle (UAV) remote sensing; tagging and telemetry; oceanographic, ecological, and prey studies; noise and quieting; stress and health; modeling; habitat-based density modeling and analysis techniques; and risk assessments (including vessel strike, entanglement, and population-level risk assessment) (Silber et al. in review). Overall, the BWRI report demonstrates how BOEM, NOAA Fisheries, and others have actively worked to understand NARWs and the intersection of this species and OSW development, and to develop mitigation strategies that minimize impacts to NARWs.

The following workshops held over the past 5 years provide an overview of areas where BOEM and NOAA Fisheries recently have been focusing efforts and will improve the understanding of the interaction between NARW and OSW:

- March 2017 *Workshop on Best Management Practices Workshop for Atlantic Offshore Wind Facilities and Marine Protected Species* (BOEM 2018)
- May 2018 *Workshop on a Framework for Studying the Effects of Offshore Wind Development on Marine Mammals and Turtles* (Kraus et al. 2019)
- June 2019 *Health Assessment Workshop for North Atlantic Right Whales* (Fauquier et al. 2020)
- October 2019 *Workshop on Monitoring and Surveillance: North Atlantic Right Whale Expert Working Group* (Oleson et al. 2020)
- October 2020 *Workshop on New York Bight Passive Acoustic Monitoring* (Wildlife Conservation Society 2021)
- November 2020 *Workshop on the State of the Science on Wildlife and Offshore Wind Energy 2020: Cumulative Impacts* (Southall et al. 2021)
- Annual meetings of the Atlantic Scientific Review Group (ASRG) to advise on the status of marine mammal stocks
- June 2022 workshop convened by NOAA on *Oceanographic Impacts of Offshore Wind Energy Development: Implications for Protected Species* (report under development)

As the OSW industry continues to grow and as projects begin construction, BOEM and NOAA Fisheries will continue to work with our partners to evaluate existing strategies and to further collect and apply newly available information to inform future decisions. This Strategy is an integral step to organize BOEM, NOAA Fisheries, and their partners around a shared vision and clear path to effectively study and manage this issue moving forward.

3 Strategy Framework

3.1 Background

In March 2021, in response to Executive Order 14008, the Departments of the Interior, Energy, and Commerce announced a national goal to deploy 30 GW of OSW by 2030 while protecting biodiversity and promoting ocean co-use. This Strategy's shared vision, therefore, is *to protect and promote the recovery of North Atlantic right whales while responsibly developing offshore wind energy.* This Strategy identifies areas where BOEM and NOAA Fisheries will work together, and with partners, to further develop the information and science needed to responsibly develop OSW and protect and recover NARWs.

This Strategy addresses three main goals: 1) Mitigation and Decision-Support Tools, 2) Research and Monitoring, and 3) Collaboration, Communication and Outreach. Specific priorities and actions under each of those goals are then identified (see below; also see **Appendix A** for more detail on the actions). This Strategy also lays out both agencies' plan to engage stakeholders, partners, and other ocean users throughout (per Goal 3) and identifies potential sources for financial resources needed for successful implementation.

This Strategy is intended to be a "living" document that will be regularly evaluated and updated as we make progress and new information becomes available. A joint BOEM-NOAA Fisheries NARW and OSW Strategy implementation group will be formed to update progress regularly; to identify resources, needs, and collaborations for continued implementation; and to employ adaptive approaches for implementing of the Strategy. Other Federal agencies may be added to the implementation group based on their contributions to the vision and components of this Strategy. The Strategy is an important part of NOAA Fisheries' broader overall strategy for NARWs laid out in NOAA Fisheries' *North Atlantic Right Whale Road to Recovery* (NOAA Fisheries 2022b).

BOEM and NOAA Fisheries recognize the ongoing efforts internal and external to Federal agencies with similar goals. For example, we are actively coordinating with the Regional Wildlife Science Collaborative for Offshore Wind (RWSC)[13] on several upcoming workshops, and we encourage additional coordination with the RWSC to increase effectiveness, utility, and data sharing as it relates to responsibly developing OSW. In December 2023, BOEM held a workshop focused on the development of improved predictive tools for NARWs. As another example, NOAA Fisheries' *North Atlantic Right Whale Road to Recovery* highlights the need to address threats to the species and monitor its progress toward recovery; this Strategy provides more detail on the threats and mitigation of these threats specifically related to OSW energy development. This Strategy will be implemented in coordination with the NOAA Fisheries *Road to Recovery* and other NOAA Fisheries and BOEM activities related to NARW protection and recovery.

It is important to note that this Strategy will not supersede the policy and regulatory processes of, or create legal requirements for, the two agencies; it is intended to provide a framework and guidance for agencies and partners as they seek to improve the information and science needed to support OSW development. This work will also support the continued development and refinement of mitigation and

[13] rwsc.org/

monitoring standards that will be adapted as new information is collected and collated under the Strategy.

Finally, NOAA and BOEM recognize that the majority of the funding required to support the actions described in this Strategy will require support from multiple sources, including Federal and State governments, developers, and other stakeholders. This funding has not been secured; this Strategy can be used to bolster efforts to secure funding, to the extent permitted by applicable law, to further information and science to support the agencies' shared vision.

3.2 Strategy Goals and Objectives

This section identifies goals, objectives, and associated actions to be taken in order to achieve the objectives of this Strategy; more details are provided in **Appendix A**. **Section 3.4** identifies a list of priority actions to achieve research and mitigation needs.

GOAL 1: Mitigation and Decision-Support Tools

Develop, use, and evaluate measures that avoid or minimize impacts of OSW activities on NARWs and their habitat. Establish quieting performance standards for OSW. Work to improve and develop tools to support decision-making as it relates to OSW development and NARW recovery. Ensure mitigation and decision-support tool development are undertaken in close coordination with those entities involved in regulation, rulemaking, and decisions related to NARWs and OSW.

The definition of *mitigation* used in this Strategy is derived from the Council on Environmental Quality (CEQ) NEPA regulations (40 CFR 1508.1(s)). NOAA's Mitigation Policy for Trust Resources[14] (NAO 216-123) uses the CEQ definitions (see below) and then divides mitigation into three elements: avoidance, minimization, and compensation.[15] As described below, this Strategy supports avoiding impacts as the primary goal wherever practicable, followed by impact minimization.

- **Avoid** – avoid the impact altogether by not taking a certain action or parts of an action or by modifying the action to avert impacts
- **Minimize** – minimize the impact by limiting the degree or magnitude of the impact, the action, or its implementation

BOEM will consider recommendations from NOAA Fisheries based on the best available science and attempt to avoid issuing new leases in areas that may impact potential high-value habitat and/or high-use areas for important life history functions such as NARW foraging, migrating, mating, or calving. For areas that are leased, permitting activities should minimize any known or potential threat to NARWs and their habitats, and developers and BOEM should support research and monitoring.

[14] www.noaa.gov/organization/administration/noaa-administrative-orders-chapter-216-program-management/nao-216-123-noaa-mitigation-policy-for-trust-resources

[15] CEQ defines compensation as to "offset or compensate for the impact by replacing or providing equivalent substitute resources or environments." This strategy does not focus on or address compensation to offset adverse effects of OSW development; it currently focuses on avoiding and minimizing impacts to NARWs from OSW. Thus, when the term mitigation is used in this strategy, it refers to avoidance and minimization, not compensation.

The key actions for this category are noted below and described in more detail in **Appendix A**.

OBJECTIVE 1.1: Refine existing, and develop additional, mitigation and monitoring measures, including those that consider new technologies, that are effective at avoiding or minimizing effects of OSW projects on NARWs, individually and cumulatively. Review and update these measures (on a case-by-case basis or programmatic basis) as new information and technologies become available.

OBJECTIVE 1.2: Prioritize research, development, and implementation of mitigation on quieting technology and methods to reduce noise levels for all OSW phases.

OBJECTIVE 1.3: Develop risk-analysis and decision-support tools to improve how project-specific and cumulative environmental effects from OSW are evaluated for NARWs and their habitat considering each primary threat to NARW recovery related to OSW, including entanglement, vessel strike, acoustics/noise, and changes in habitat and habitat use (including prey).

OBJECTIVE 1.4: Improve marine spatial planning tools and approaches for OSW siting to inform decision-making and support avoiding impacts as a priority and mitigating impacts as necessary.

With respect to **OBJECTIVE 1.1**, the agencies have developed a list of measures that have the potential to avoid and minimize impacts to NARWs from OSW activities. These measures are categorized by renewable energy development stages: (1) project planning, siting, and leasing; (2) site characterization, site assessment, and UXO surveys; and (3) construction and operations. The intent of the measures identified for project planning, siting, and leasing is to avoid and minimize impacts to NARWs at the onset of exploring potential lease areas, which provides the most protection to the species. During site characterization/UXO survey phases, the measures are designed to minimize noise from survey sources into the marine environment and minimize exposure of NARWs to unavoidable noise sources. Lastly, during construction and operation, the measures are designed to minimize noise footprints and NARW exposure to noise during construction; avoid vessel strikes and entanglement; and ensure detection of NARWs is maximized using protected species observers (PSOs) and PAM to trigger mitigative actions. The agencies also have developed preliminary monitoring measures to better understand, detect, and mitigate impacts to NARWs during site characterization/assessment/UXO survey and construction and operation phases. Details regarding these measures can be found in **Appendix B.**

The agencies are sharing these measures to communicate the types of measures that regulatory agencies and project proponents have, and should continue, to consider for individual projects. Avoidance, minimization, and monitoring measures may be proposed by developers or be applied by the regulatory agencies on a project-specific basis; thus, not all projects (planned, current, future) are subject to the same measures. It is important to note that these measures will be updated, as appropriate per the best available science, and that none of the measures included here supersede measures developed during project-specific environmental review, permitting, and approvals processes or other generally applicable regulatory requirements (e.g., vessel speed rule). Furthermore, although commitments by developers to implement any or all of these measures in proposed plans or other documents seeking authorization from BOEM or NOAA Fisheries may facilitate consultation, permitting, and authorization processes, they do not ensure approval of projects or other permits or authorizations, as those decisions are made on a case-by-case basis by the responsible agency.

OBJECTIVE 1.2 recognizes that the benefits of quieting the oceans apply to many marine resources, including marine mammals, sea turtles, fish, and invertebrates. With respect to addressing noise impacts, the agencies share a common goal of reducing noise generated during OSW construction and operation (NOAA's Ocean Noise Strategy[16] and BOEM's Center for Marine Acoustics[17]). Though many activities associated with OSW operation and construction produce noise, this Strategy currently focuses on quieting pile-driving and vessel noise. For example, when activities such as pile driving cannot be avoided (e.g., using foundations that do not require pile driving), pile-driving-quieting technology and methods may be required through approvals under OCSLA, ESA, and MMPA. Although developers are already committing to using quieting technology (e.g., noise abatement systems during pile driving of turbine and substation foundations), the effectiveness of such technology can be improved by broadening the scope of quieting actions and through further technological innovation, especially with respect to lower frequency hearing specialists like NARWs. BOEM intends to pursue development of a quieting performance standard for impact pile driving to set a common goal for providing additional environmental protection, promoting predictability, and driving technological innovation. Goal 1 includes several actions involving quieting technology and methods (**Appendix A**) to reduce noise during impact and vibratory pile driving of foundation piles and to encourage integration of vessel quieting technology in new OSW vessels built in the United States.

OBJECTIVE 1.3 identifies the needs for decision-support tools that address the four identified stressors to NARWs that may result from OSW development: entanglement, vessel strike, acoustics/noise, and changes in habitat and habitat use (including effects to prey). This action includes assessing our current understanding of these stressors to identify any data gaps, evaluating the current tools available to support evaluation of effects, and developing tools to provide for both qualitative and quantitative analyses. Over time, the intent is to develop and combine tools to evaluate cumulative and synergistic effects (Goal 2).

Finally, **OBJECTIVE 1.4** recognizes that marine spatial planning tools for OSW siting are being developed to inform BOEM's identification of call areas and lease areas. BOEM will continue to use these tools in the planning and leasing phase to avoid known and potential impacts to NARWs and their habitats to the maximum extent practicable. Available information includes, but is not limited to, critical habitat and other biologically important habitats, occurrence data (both sightings and acoustic detections), modeled density distributions, and the locations of management areas (e.g., Farmer et al. 2023; Farmer et al. 2022). However, the proactive use of marine spatial planning tools to inform BOEM's planning, analysis, and leasing processes is unlikely to remove all areas from leasing that will present known and potential threats from OSW activities to NARWs; in these instances, BOEM and NOAA Fisheries will work to minimize these impacts during the leasing, site characterization/assessment, and Construction and Operation Plan phases.

[16] oceannoise.noaa.gov/
[17] www.boem.gov/center-marine-acoustics

GOAL 2: Research and Monitoring

Identify, support, coordinate, and conduct research and monitoring to better understand the current status of NARWs (e.g., abundance, distribution, life history, health, habitat use, and ecological interactions);[18] understand the impacts to NARW from project-level and cumulative effects from multiple projects; and evaluate and address any uncertainty associated with the effects of OSW development.

Monitoring under this goal relates to "general monitoring," specific to NARW and OSW, conducted to increase knowledge of the species, improve tool development, and enhance understanding of the effects of OSW development on NARWs. This activity differs from "mitigation monitoring" (i.e., observation/detection), which is discussed under Goal 1 (Mitigation and Decision Support) and is carried out to avoid or minimize an effect during a particular OSW activity (e.g., monitoring an area for NARWs prior to starting pile driving). The actions under general monitoring are predominantly long-term efforts and could involve collecting data before and during OSW construction, and during operation. The study design for any particular general monitoring effort will differ depending on the specifics of the situation (e.g., location, desired data, methodology).

The key objectives for this category are noted below and described in more detail in **Appendix A**.

OBJECTIVE 2.1: Develop and disseminate a research plan that identifies key data gaps related to NARW and OSW development and details how to work with partners, stakeholders, and other ocean users to fill data gaps. The research plan will include a variety of research methods (e.g., acoustic and vessel surveys, aerial surveys, tagging, eDNA, health assessments) appropriate to the question being addressed.

OBJECTIVE 2.2: Support the development of studies, particularly those with sufficient statistical power, to predict and detect changes in NARW ecology, demographics, and health resulting from OSW development (e.g., changes in foraging activity, residency in key habitats, displacement) at various scales (e.g., turbine, development, regional, ecosystem).

OBJECTIVE 2.3: Develop and support efforts to improve understanding of OSW impacts on oceanographic and lower trophic level ecosystem processes for all foundation, turbine, mooring, and layout types, with a particular focus on understanding potential impacts on the distribution and abundance of NARW zooplankton prey.

In implementing these key objectives, the following additional data and research areas are prioritized:

- Data and research to assess the potential of OSW to alter NARW foraging ecology, habitat and habitat use (inclusive of foraging, calving, migration, socializing, and other behaviors), and predation risk, as well as to assess when such alterations may have population-level consequences (lethal and/or sublethal effects).

[18] Note that NOAA Fisheries' *North Atlantic Right Whale Road to Recovery* includes an objective of "Monitor Population and Health," which provides an understanding of individual health and reproduction, as well as distribution, abundance, and habitat-use patterns of the population. NOAA Fisheries is developing a comprehensive U.S. strategy related to NARW population and health status, as well as distribution and habitat use (NOAA Fisheries 2022b).

- Data and research to assess how OSW development may contribute to or alter vessel strike risk. Considering NOAA Fisheries' existing NARW vessel speed regulations (87 FR 46921) and forthcoming modifications, research should include monitoring vessel strike risk associated with OSW development and assessing how non-OSW vessel traffic affected by OSW development may change risk (e.g., shifts in vessel patterns due to presence of OSW structures) and may warrant additional mitigation through project-specific approvals.
- Data and research to assess how OSW development may contribute to or alter entanglement risk. Evaluate entanglement risk from appurtenances (e.g., cables) associated with OSW development or biological monitoring activities associated with development of floating and fixed wind technology. Develop approaches to reduce entanglement risk. Understand how changes in fishing effort resulting from OSW development changes the risk profile for NARW entanglement in fishing gear.
- Data and research to assess, avoid, and minimize noise/acoustic impacts from OSW activities, including long-term operation of wind turbines.
- Data and research to assess the cumulative effects of OSW combined with stressors from other human activities. The definition of cumulative effects for purposes of this Strategy is derived from the CEQ NEPA regulations (40 CFR 1508.1(g)(3)) (2020): "Cumulative effects, which are effects on the environment that result from the incremental effects of the action when added to the effects of other past, present, and reasonably foreseeable actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative effects can result from individually minor but collectively significant actions taking place over a period of time."
- Innovation and improvements in NARW detection technologies, including acoustic and visual techniques.
- Data sharing across the board and develop and support long-term data management and archival systems for data collected as part of the Strategy.
- Evaluation of uncertainties in ability to monitor, document, or detect impacts from OSW development on NARWs and develop plans to address those uncertainties.
- Implement efforts identified in the NOAA Fisheries and BOEM Northeast U.S. Federal Survey Mitigation Strategy[19] to mitigate disruption of existing NARW survey strategies by OSW development.

[19] repository.library.noaa.gov/view/noaa/47925

GOAL 3: Collaboration, Communication and Outreach

While this goal is not discrete from the previously identified goals in this Strategy, BOEM and NOAA Fisheries recognize that continued collaboration between the two agencies and partners is needed for the success of this Strategy. Further, the two agencies recognize that internal and external communication and outreach are important for the success of this Strategy. NOAA Fisheries and BOEM will have a transparent process for communication and outreach to support all three goals of this Strategy. BOEM and NOAA Fisheries will develop and implement this Strategy by strengthening partnerships, combining resources, and sharing and communicating information. BOEM and NOAA Fisheries will also ensure professional, transparent, and equitable communication; and engagement with Tribes, Federal and State agencies, partners, and stakeholder groups.

The key objective for this category is noted below and described in more detail in **Appendix A**.

OBJECTIVE 3.1: Develop long-term and proactive coordination strategies, including establishing a joint BOEM-NOAA Fisheries NARW and OSW Strategy implementation group, and share outreach and communications plans. This implementation group will engage regularly with partners, Tribes, and stakeholders in a variety of ways such as informal meetings, formal Requests for Information, and presentations to the RWSC and the NARW Consortium.

The actions for this goal include the following:

- For BOEM and NOAA Fisheries to collaborate effectively with each other and partners on implementing this Strategy, including integrating this Strategy with NOAA Fisheries' *North Atlantic Right Whale Road to Recovery*
- To provide regular and predictable opportunities for partners and stakeholders to comment on and contribute to the Strategy via subsequent updates of this "living" document
- To develop a collaborative environment to provide for interaction between stakeholders and partners
- To emphasize scientific processes, including scientific integrity, peer-reviewed publications, scientific presentations, independent peer review, and publicly accessible data and documents
- To incorporate Indigenous and Local Ecological Knowledge
- To conduct outreach on the Strategy from development through implementation

Communication and outreach will consist of the following methods:

- **Publications:** Peer review is foundational to the scientific process (USGS Fundamental Science Practices: Peer Review).[20] Peer-reviewed publications ensure effective experimental methodology and wide dissemination of results from the Strategy.
- **Presentations:** NOAA Fisheries and BOEM will be proactive in presenting and communicating the Strategy to scientists, policy makers, partners, Tribes, stakeholders, and the public,

[20] www.usgs.gov/survey-manual/5023-fundamental-science-practices-peer-review

whenever appropriate. Such meetings may include scientific conferences, regional planning meetings, workshops, and information seminars.

- **Workshops:** As new information becomes available, workshops will be used to further progress on different components of the Strategy. These workshops will serve to develop and inform specific areas related to the Strategy as new information warrants.
- **Solicitation of Comments:** There will be opportunities for partners and the public to provide comments and input on the Strategy. NOAA and BOEM will share information on the public input process as the initiative evolves.
- **Public Access to Information:** Relevant documents will be posted online and available to the public on a website dedicated to this Strategy.
- **Press Releases and Science Briefs:** All important events—such as relevant meeting announcements and start and completion of projects and plans—will be announced publicly via press releases.
- **Independent Scientific Peer Review:** Where appropriate, independent peer-review panels will evaluate different components of the Strategy, such as associated research plans, changes in statistical designs, and new analyses based on new data.

3.3 Implementation and Timeline

As noted above, BOEM and NOAA Fisheries will form a joint implementation group for this Strategy. An important first step is to request dedicated personnel from both agencies to coordinate, facilitate, and support ongoing activities to implement this Strategy. Another step is to seek support for continuing and implementing the actions identified in this Strategy.[21] This support will involve working with partners (**Section 4**) and identifying financial resources (**Section 5**) to implement this Strategy. Given that the Strategy is currently not fully resourced, it is premature to develop a specific timeline for completing the actions and meeting the goals defined herein.

BOEM and NOAA Fisheries recognize that there is still additional work necessary for the two agencies to develop joint guidance and information for developers. For example, BOEM recently published the Notice of Intent (NOI) Checklist[22] and Marine Acoustic Modeling and Measurement Guidelines.[23] Also, as this Strategy was developed, a number of topics were identified through internal agency discussions and from public comment. These topics are described in **Appendix C** and require further development to assess if and how they integrate with the actions identified in this Strategy. As these topics are further developed, they may be included in future updates to this living Strategy document. This ongoing work will contribute to the Strategy's vision—*to protect and promote the recovery of North Atlantic right whales while responsibly developing offshore wind energy.* Furthermore, this ongoing work will recognize the dire status of NARWs and the uncertainty around the effects of OSW development on NARWs and their habitat.

[21] Note that many of the actions identified in this strategy serve multiple purposes and are part of NOAA Fisheries' broader *North Atlantic Right Whale Road to Recovery*.

[22] www.boem.gov/sites/default/files/documents/renewable-energy/state-activities/BOEM%20NOI%20Checklist.pdf

[23] www.boem.gov/node/30991

3.4 Priority Actions

The list below identifies a prioritized list of actions to achieve priority research and mitigation needs:

OBJECTIVE 1.1: Refine existing, and develop additional, mitigation and monitoring measures, including those that consider new technologies, that are effective at avoiding or minimizing effects of OSW projects on NARWs, individually and cumulatively. Review and update these measures (on a case-by-case basis or programmatic basis) as new information and technologies become available.

Action 1.1.4: Support research to develop new avoidance and minimization technologies and incorporate advancement in NARW detection technologies as they occur.

OBJECTIVE 1.2: Prioritize research, development, and implementation of mitigation on quieting technology and methods to reduce noise levels for all OSW phases.

OBJECTIVE 1.3: Develop risk-analysis and decision-support tools to improve how project-specific and cumulative environmental effects from OSW are evaluated for NARWs and their habitat considering each primary threat to NARW recovery related to OSW, including entanglement, vessel strike, acoustics/noise, and changes in habitat and habitat use (including prey).

The following are the key tools to develop in this element:

- **Action 1.3.3:** Expand/modify Expert Relativistic Framework to address project-level and cumulative effects of noise and then noise plus other stressors. (Although this currently focuses on noise, it could be expanded into a more comprehensive cumulative effects trade off analysis.)
- **OBJECTIVE 1.4:** Improve marine spatial planning tools and approaches for OSW siting to inform decision-making and support avoiding impacts as a first priority and mitigating impacts as necessary.
- **Action 2.3.5:** Conduct a risk assessment and improve understanding of how OSW development will impact features of NARW critical habitat—as well as "high-value habitat" per NOAA's Mitigation Policy—and policy; develop strategies for how these impacts can be avoided or minimized.

OBJECTIVE 2.1: Develop and disseminate a research plan that identifies key data gaps related to NARW and OSW development and details how to work with partners, stakeholders, and other ocean users to fill data gaps. The research plan will include a variety of research methods (e.g., acoustic and vessel surveys, aerial surveys, tagging, eDNA, health assessments) appropriate to the question being addressed.

- **Action 2.1.3:** Review resources available and perform funding gap analysis on the priority research questions identified in this Strategy.

OBJECTIVE 2.1: Support the development of studies, particularly those with sufficient statistical power, to predict and detect changes in NARW ecology, demographics, and health resulting from OSW development (e.g., changes in foraging activity, residency in key habitats, displacement) at various scales (e.g., turbine, development, regional, ecosystem).

- **Action 2.2.4:** Develop a long-term PAM network to strategically collect baseline and soundscape data.
- Monitor and assess how OSW development changes NARW risk of vessel strikes and entanglement, including risk from OSW development itself, as well as risk from non-OSW activities that are influenced by OSW development (e.g., shifts in fishing or vessel activity due to construction and operation of OSW projects).

OBJECTIVE 3.1: Develop long-term and proactive coordination strategies, including establishing a joint BOEM-NOAA Fisheries NARW and OSW Strategy implementation group, and share outreach and communications plans. This implementation group will engage regularly with partners, Tribes, and stakeholders in a variety of ways such as informal meetings, formal Requests for Information, and presentations to the RWSC and the NARW Consortium.

- **Action 3.1.1:** Form a joint Agency implementation group to fulfill the goals of this Strategy.
- **Action 3.1.2:** Develop an outreach and communications plan that includes schedules for soliciting and vetting adjustments periodically.

4 Partners

The Strategy emphasizes a collaborative approach to support the protection, and promote the recovery, of NARW while responsibly developing OSW. Engagement with federally recognized Tribes, Federal and State agencies, industry, partners, stakeholders, and other ocean users will be critical to successfully implementing the Strategy. Though not an exhaustive list, the following represents anticipated key partners.

4.1 Government

The **Bureau of Safety and Environmental Enforcement (BSEE)** promotes safety, protects the environment, and conserves resources offshore through vigorous regulatory oversight and enforcement. The agency ultimately will work to ensure that OSW development lessees and operators comply with all required laws and regulations, and requirements in leases, plans and permits, including applied mitigations and conditions of approval. Under 30 C.F.R. 285.417(2), BSEE has the authority to suspend operations "when continued activities pose an imminent threat of serious or irreparable harm or damage to natural resources; life (including human and wildlife); property; the marine, coastal, or human environment; or sites, structures, or objects of historical or archaeological significance." More information is available at www.bsee.gov.

NOAA Office of National Marine Sanctuaries is the trustee for a network of underwater parks, including Stellwagen Bank and Gray's Reef National Marine Sanctuaries in the U.S. Atlantic. Stellwagen Bank National Marine Sanctuary is one of the world's premiere whale-watching destinations and a historically important fishing ground. Gray's Reef National Marine Sanctuary is a natural live-bottom reef and is part of the NARW calving grounds. NOAA Fisheries and NOAA National Marine Sanctuaries share NOAA's mission to 1) understand and predict changes in climate, weather, ocean, and coasts; 2) share that knowledge and information with others; and 3) conserve and manage coastal and marine ecosystems and resources. More information is available at sanctuaries.noaa.gov/about.

The **Marine Mammal Commission** is an independent government agency charged by the MMPA to further the conservation of marine mammals and their environment. The Commission works to ensure that marine mammal populations are restored and maintained as functioning elements of healthy marine ecosystems. They provide science-based oversight of domestic and international policies and actions of Federal agencies with mandates to address human impacts on marine mammals and their ecosystems. More information is available at www.mmc.gov.

The **U.S. Navy** is responsible for compliance with a suite of Federal environmental laws and regulations that apply to marine mammals and other marine protected species, including the ESA and MMPA. As part of the regulatory compliance process associated with these Acts, the Navy is responsible for meeting specific requirements for monitoring and reporting on military readiness activities involving active sonar and underwater detonations from explosives and explosive munitions. These military readiness activities include Fleet training events and Navy-funded research, development, test, and evaluation activities. The U.S. Navy, BOEM, and NOAA Fisheries have partnered for decades on issues related to marine mammal and endangered species protection and recovery. More information is available at www.navy.mil.

The **U.S. Department of Transportation's Maritime Administration (MARAD)** is responsible for America's waterborne transportation system. MARAD supports the technical aspects of the U.S. maritime transportation infrastructure, such as ships and shipping, port and vessel operations, national security, environment, and safety. MARAD promotes the use of waterborne transportation and ensures that its infrastructure integrates seamlessly with other methods of transportation. More information is available at www.maritime.dot.gov.

The **Department of Energy** supports a broad portfolio of OSW research, development, and demonstration projects and continues to work jointly with the Department of the Interior to advance OSW development. More information is available at www.energy.gov/eere/wind/wind-energy-technologies-office.

The **Environmental Protection Agency** works to protect human health and the environment. The agency reviews all Federal environmental impact statements prepared by other agencies under NEPA and permits projects under the Clean Air Act. More information is available at www.epa.gov.

The **National Science Foundation** is an independent Federal agency created by Congress in 1950 to promote the progress of science; to advance national health, prosperity, and welfare; and to secure national defense. More information is available at www.nsf.gov.

The **Deputy Commandant for Operations (DCO) of the U.S. Coast Guard** is charged with developing and overseeing the execution of operational planning, policy, and international engagement at the strategic level. Additionally, it establishes and maintains relations with interagency partners and maritime stakeholders to support policy development and resource acquisition. The DCO also is charged with ensuring the alignment within mission areas to optimize mission execution as the recognized international leader of Maritime Safety, Security and Stewardship. More information is available at www.dco.uscg.mil.

The **U.S. Army Corps of Engineers** is an engineer formation of the U.S. Army with three primary mission areas: Engineer Regiment, military construction, and civil works. The Corps' mission is to deliver vital engineering solutions, in collaboration with partners, to secure our Nation, energize our economy, and reduce disaster risk. The Corps also has a role in authorizing certain components of OSW projects through its implementation of Section 10 of the Rivers and Harbors Act and Section 404 of the Clean Water Act. More information is available at www.usace.army.mil.

Federally Recognized Tribes are critically important partners, and NOAA Fisheries and BOEM will work to ensure timely and meaningful government-to-government consultation on this Strategy and engagement with Tribes on wind-related actions affecting NARW, including follow-up and appropriate action. The agencies recognize the cultural and spiritual significance of the NARWs to Tribes and Indigenous Peoples.

States set renewable energy goals and facilitate agreements for the purchase of OSW. States (individually and through the Atlantic States Marine Fisheries Commission) also are important partners in living marine resource management, working closely with NOAA on sustainable fisheries, wildlife conservation, aquaculture development, and habitat conservation. Some States have been proactive in establishing developer-supported funds that support data collection priorities and communication

mechanisms (including the Responsible Offshore Science Alliance). States may review OSW lease sales and projects in Federal waters under Section 307 of the Coastal Zone Management Act (CZMA). However, State CZMA review of OSW projects is not automatic; it depends on whether State review is authorized pursuant to NOAA's CZMA regulations at 15 C.F.R. Part 930.

Fisheries Management Organizations (including the South Atlantic, Mid-Atlantic, and New England Fisheries Management Councils and Atlantic States Marine Fisheries Commission) comprise fisheries stakeholders along the East Coast and are bodies that advise NOAA Fisheries (and the States with respect to the Commission) on the sustainable management of our Nation's fisheries under the Magnuson-Stevens Fisheries Management and Conservation Act, the Atlantic Coastal Fisheries Cooperative Management Act, and various State laws. These organizations have been working with NOAA Fisheries for years to reduce the impact of fisheries on marine mammals and endangered and threatened species.

Regional Ocean Partnerships include the Northeast Regional Ocean Council and Mid-Atlantic Regional Council on the Ocean and are State and Federal partnerships that address ocean and coastal issues from a regional perspective. Both councils augment existing governance structures to generate new information and facilitate communication to advance resource management priorities. More information is available at www.northeastoceancouncil.org and www.midatlanticocean.org.

Fisheries and Oceans Canada is responsible for safeguarding Canadian waters and managing Canada's fisheries and oceans resources. The agency conducts science and develops regulations to promote the protection and recovery of NARW in Canadian waters and collaborates on transboundary research and management efforts with NOAA Fisheries through discussions from leadership to staff levels. More information is available at www.dfo-mpo.gc.ca/index-eng.html.

4.2 Industries

OSW energy leaseholders, grantees, operators, and associated entities hold leases and authorizations to conduct geophysical surveys and to construct, operate, and maintain OSW facilities. Industry is responsible for implementing conditions of those authorizations to avoid and minimize the impacts of OSW development on NARWs. Proactive engagement of industry to implement approaches to OSW development beyond regulatory requirements is an important component of this Strategy.

Commercial and recreational fishing industries comprise a highly diverse group (fishermen, dealers, processors, retailers, restaurants, and suppliers) involved in catching fish and shellfish, and include the communities that depend on these industries. The fishing industry will be affected by the development of OSW. NOAA Fisheries engages with this community to protect and recover marine mammals and endangered and threatened species. Many members of this community are participating in modifying gear to reduce risk to NARWs, including participation in the development of Ropeless or On-Demand Fishing to reduce entanglement risk.

Other industries relevant to this Strategy include commercial shipping, whale watching, aquaculture, and ecotourism. We will work with these entities on relevant aspects of this Strategy.

4.3 Academia/Research Organizations

The **Regional Wildlife Science Collaborative for Offshore Wind** (RWSC) was cooperatively established and is led by four sectors: Federal agencies, states, eNGOs, and the OSW industry. The RWSC supports research and monitoring on wildlife and OSW by identifying priorities for scientific research and monitoring at the project, regional and ecosystem-wide scales; coordinating and aligning funding to meet those priorities; and ensuring appropriate data and standards are in place to support science priorities. Working with RWSC is a priority for BOEM and NOAA. The RWSC has developed a draft Science Plan,[24] and BOEM and NOAA will work with RWSC to align activities. More information at rwsc.org.

The **North Atlantic Right Whale Consortium** includes stakeholders from a variety of research and non-governmental groups who share a common interest—research and using the results of that research to formulate science-based conservation measures to protect NARW. More information at www.narwc.org.

The **Atlantic Scientific Review Group** (ASRG) advises NOAA Fisheries on the status of marine mammal stocks under Section 117 of the MMPA. The ASRG is a representation of marine mammal and fishery scientists and members of the commercial fishing industry mandated to review the marine mammal stock assessments and provide advice to the NOAA Assistant Administrator for Fisheries. (More information at www.fisheries.noaa.gov/national/marine-mammal-protection/scientific-review-groups#atlantic-scientific-review-group)

The **NARW Recovery Plan Implementation teams** advise NOAA Fisheries on issues related to the status and conservation of NARWs. These multi-disciplinary recovery teams are appointed by NOAA Fisheries under the ESA to assist with the development and implementation of the NARW recovery plan. The Northeast team (NEIT) advising NOAA on NARWs from Maine to Virginia and the Southeast team (SEIT) advising NOAA on NARWs from North Carolina to Florida.

Scientists from academia and other public and private institutions are actively researching topics related to NARWs and OSW. Collaboration with scientists is needed to identify efficiencies and integrate relevant data, as appropriate, in analyses to fulfill the goals and priorities of this Strategy. Examples include, but are not limited to, the Anderson Cabot Center for Ocean Life at the New England Aquarium, the Center for Coastal Studies, and Duke University[25].

4.4 Non-Governmental Organizations

Environmental Organizations in general have a mission to protect the environment, and many are specifically interested in the protection and recovery of NARWs, as well as the advancement of offshore renewable energy. Each particular organization has different focal areas and approaches, and different working relationships with BOEM and NOAA Fisheries.

[24] rwsc.org/science-plan/#chapters

[25] offshorewind.env.duke.edu

5 Financial Resources

The effort to investigate, monitor, and mitigate the impact of OSW development on NARWs is complex and will require a significant amount of resources. The scale of OSW development along the Atlantic Coast continues to increase; thus, the scale needed for research and monitoring, mitigation and decision-support tools, and coordination also increases. The complexity, cost, and longevity of this effort mean that multiple funding sources will be needed to meet the goals of this Strategy. Listed below are some of the potential funding sources the agencies hope to collaboratively leverage, to the extent permitted by applicable law, to resource the Strategy.

NOAA Programs—As supported through congressional appropriations and supplemental funding, NOAA Fisheries conducts science related to NARWs, provides scientific support for the regulatory process, has regulatory responsibilities related to NARW status under MMPA and ESA, and is involved in the review and approval of OSW development activities. In addition, as authorized by the Consolidated Appropriations Act of 2023, NOAA Fisheries is developing a strategic partnership with the National Fish and Wildlife Foundation to support activities that address the lethal and sublethal effects of human activities on NARWs using congressional appropriations, as well as donations. Funding through the Inflation Reduction Act also provides substantial support for NARW science much of which is relevant to the Research and Monitoring goal of this Strategy. Although these funds are not specifically dedicated to supporting this Strategy, there is significant overlap, including support for expanding PAM for NARW and for developing technologies to reduce vessel strike risk. Finally, there may be other resources within NOAA more broadly, outside of NOAA Fisheries, that may be appropriate to use to further the goals of this Strategy. This Strategy can be used to help direct available funding, identify further funding needs, and develop partnerships to meet the shared vision to protect and promote the recovery of NARWs while responsibly developing OSW energy.

BOEM Environmental Studies Program—BOEM's Environmental Studies Program (ESP)[26] develops, funds, and manages rigorous scientific research specifically to inform policy decisions on the development of energy (both traditional and renewable), mineral resources, and carbon sequestration on the OCS. BOEM's ESP has an annual budget (of about $30 million) to support new and ongoing projects. Its research covers physical oceanography, atmospheric sciences, biology, protected species, social sciences, and economics, submerged cultural resources, environmental fates and effects, climate science and conservation, and more. The ESP also supports research needs of BOEM's Center for Marine Acoustics.[27] Given the large OCS area under BOEM jurisdiction (approximately 3.2 billion acres), leveraging partnerships to satisfy common scientific needs is a central component of BOEM's approach.

Bureau of Safety and Environmental Enforcement (BSEE)—BSEE receives funding to support BOEM's environmental compliance and enforcement needs for joint OCS operations. However, BSEE's Environmental Compliance Program (ECP) will need to dedicate additional staff and operational funding to support the tasks identified in this Strategy. Additionally, BSEE's Technology Assessment Program (TAP), as well as new and emerging programs and the renewable energy program are available to support mission-specific research of equipment and operations that have the potential to impact NARW

[26] www.boem.gov/environmental-studies

[27] www.boem.gov/center-marine-acoustics

and/or their habitat. Findings from such research would be available to assist with policy development and decision-making tools that can focus on reducing risks to NARWs through the development of improved mitigation measures. It is expected that BSEE Renewable Energy program leads will work with ECP and TAP management to best address NARW research needs.

OSW Developer Support—Developers can support this effort through complying with requirements of project approvals and authorizations or through voluntary efforts to fund or carry out actions related to this Strategy. As part of this Strategy, BOEM and NOAA Fisheries will continue to identify the impacts of OSW development on NARWs and ways for developers to mitigate and monitor these impacts. To aid in this effort, **Appendix B** includes development of measures that could be implemented as lease terms, plan conditions, or other mechanisms. BOEM and NOAA Fisheries highly encourage developers to coordinate and share plans, results, and data to help improve the efforts and monitor progress on addressing the information needs under this Strategy.

Other Support—There are elements of this Strategy that could be supported by other entities. Such support should fit into the overall goals of the Strategy.

- **Other Federal Agencies**—Other Federal agencies, such as the Department of Energy, have funded environmental and technology improvements related to OSW development.
- **States**—States are establishing programs to examine and mitigate the effects of OSW development on State resources. This Strategy will include coordinating with States to understand and integrate their efforts with Strategy implementation.
- **Non-Governmental Organizations (NGOs)**—Various NGOs, foundations, and philanthropic interests have interests related to marine ecosystem science, the conservation of protected species, and the management of OSW development. We expect that some components of this Strategy could be supported by NGOs such as The National Offshore Wind Research and Development Consortium.
- **Academic Researchers and Institutions**—Academic researchers can align their work with this Strategy, working on priorities identified here and communicating results with NOAA Fisheries and BOEM.

APPENDIX A: NARW and OSW Strategy Action Plan Details

Actions to meet prioritized research and mitigation needs are identified with an * (see Section 3.4)

GOAL 1: Mitigation and Decision-Support Tools

Develop, use, and evaluate measures that avoid or minimize impacts of OSW activities on NARWs and their habitat. Establish quieting performance standards for OSW. Work to improve and develop tools to support decision-making as it relates to OSW development and NARW recovery. Ensure mitigation and decision-support tool development are undertaken in close coordination with those entities involved in regulation, rulemaking, and decisions related to NARWs and OSW.

OBJECTIVE 1.1*: *Refine existing, and develop additional, mitigation and monitoring measures, including those that consider new technologies, that are effective at avoiding or minimizing effects of OSW projects on NARWs, individually and cumulatively. Review and update these measures (on a case-by-case basis or programmatic basis) as new information and technologies become available.*

No.	Action
1.1.1	Periodically review, evaluate, and update avoidance and minimization measures that can be implemented or required during all phases of OSW development, both at project-specific and regional scales (**Appendix B**).
1.1.2	Work to ensure that all efforts to develop recommendations or requirements for avoidance, minimization, and monitoring measures are complementary to and consistent with NEPA analyses, ESA and Essential Fish Habitat consultations, and MMPA authorizations.
1.1.3	Track evolving mitigation technologies and international mitigation strategies and/or policies.
1.1.4*	Support research to develop new avoidance and minimization technologies and incorporate advancement in NARW detection technologies as they occur [see also *Goal 2: Research and Monitoring*].
1.1.5	Encourage earlier timelines for submission of project-specific mitigation and monitoring plans to allow agencies sufficient time to review plans and incorporate of any agency-identified changes (refer to NOI checklist[28]).

[28] www.boem.gov/node/30996

OBJECTIVE 1.2*: *Prioritize research, development, and implementation of mitigation on quieting technology and methods to reduce noise levels for all OSW phases.* [29]

No.	Action
1.2.1	Develop and implement quieting performance standards for construction activities (e.g., pile driving and UXO detonation).
1.2.2	Advance quieting technologies and methods (e.g., foundation types).
1.2.3	Promote integration of quieting technologies into all OSW vessels (new and existing) by collaborating with the Department of Energy, Maritime Administration, and developers. Consider engaging with individual ports and port authorities in setting vessel quieting goals.

[29] NOAA Fisheries strongly supports the use of quieter sources and techniques. Based on feedback from multiple stakeholders, NOAA Fisheries wishes to clarify that the current differences in NOAA Fisheries' marine mammal behavioral harassment thresholds between intermittent (e.g., impact pile driving) and continuous sources (e.g., vibratory pile driving) does not mean that innovative techniques using continuous sources will be impeded or penalized through the regulatory process (e.g., be more concerning in the context of hearing impairment [temporary or permanent threshold shifts] and potential impacts on prey species). NOAA Fisheries has begun the process of developing updated thresholds for behavioral disturbance, which will undergo extensive internal, peer, and public review. NOAA Fisheries is actively supporting the use of quieter technologies (continuous or otherwise), intends to facilitate compliance processes wherever possible, and recommends dialogue with the agency before assumptions are made regarding the requirements or limitations for new or quieter technologies.

OBJECTIVE 1.3: *Develop risk-analysis and decision-support tools to improve how project-specific and cumulative environmental effects from OSW are evaluated for NARWs and their habitat considering each primary threat to NARW recovery related to OSW, including entanglement, vessel strike, acoustics/noise, and changes in habitat and habitat use (including prey).*

No.	Action
1.3.1	***[Cumulative]*** Consider Population Viability Analysis & Cumulative Effects modeling (e.g., entanglement, vessel strike, acoustics/noise, and climate-driven changes in habitat and habitat use (including effects to prey)). Multipath processes underway and when available, for example: ● NOAA Fisheries Population Evaluation Tool (PET) Subgroup's analysis ● Sea Mammal Research Unit – Interim Population Consequences of Disturbance (iPCoD) model with NARW case study
1.3.2	***[Cumulative]*** Develop an approach for improving the assessment of cumulative and synergistic impacts of all phases of all OSW on NARWs considering existing and future multiple stressors and cumulative effects, including those related and unrelated to OSW (e.g., fishing, climate change).
1.3.3*	***[Noise]*** Expand/modify Expert Relativistic Framework to address project-level and cumulative effects of noise and then noise plus other stressors.
1.3.4	***[Noise]*** BOEM fund NARW population consequences of multiple stressors (PCOMS) expert elicitation of noise/construction impacts on NARW behavior.
1.3.5	***[Noise]*** Secure long-term modeling capacity for the purposes of assessing acute, chronic, and cumulative impacts of noise and scenario testing of mitigation strategies (to include incorporation of PAM data).
1.3.6	***[Vessel Strike]*** Investigate use of modeling options (similar to the NOAA Fisheries Vessel Strike Risk Assessment Model developed for 2022 proposed Federal Vessel Speed Regulations) to assess vessel strike risk from OSW development beyond what would be minimized by any finalized vessel speed rule modifications and to determine whether additional mitigation measures are necessary.
1.3.7	***[Entanglement]*** Evaluate entanglement risk from appurtenances (e.g., cables) associated with the development of floating wind technology or biological monitoring activities associated with OSW development. Develop approaches to reduce entanglement risk.
1.3.8	***[Entanglement]*** Understand how changes in fishing effort resulting from OSW development changes the risk profile for NARW entanglement in fishing gear.
1.3.9	***[Habitat Change]*** Explore adding a wind module to the NOAA Fisheries' Large Whale Entanglement Decision Support Tool[30] to evaluate the relative impacts of OSW on NARW habitat.

[30] www.fisheries.noaa.gov/feature-story/decision-support-tool-helpful-those-finding-ways-reduce-whale-entanglement-fishing

OBJECTIVE 1.4*: *Improve marine spatial planning tools and approaches for OSW siting to inform decision-making and support avoiding impacts as a priority and mitigating impacts as necessary.*

No.	Action
1.4.1	Identify new and emerging marine spatial planning tools and approaches to continue to inform responsible OSW siting.
1.4.2	Develop efficient data sharing protocols between all stakeholders to support effective marine spatial planning efforts.

GOAL 2: Research and Monitoring

Identify, support, coordinate, and conduct research and monitoring to better understand the current status of NARWs (e.g., abundance, distribution, life history, health, habitat use, and ecological interactions); understand the impacts to NARW from project-level and cumulative effects from multiple projects; and evaluate and address any uncertainty associated with the effects of OSW development.

OBJECTIVE 2.1: *Develop and disseminate a research plan that identifies key data gaps related to NARW and OSW development and details how to work with partners, Tribes, stakeholders, and other ocean users to fill data gaps. The research plan will include a variety of research methods (e.g., acoustic and vessel surveys, aerial surveys, tagging, eDNA, health assessments) appropriate to the question being addressed.*

No.	Action
2.1.1	Continue to update the baseline of relevant current and future NARW research related to OSW development.
2.1.2	Periodically review, evaluate, and update priority research questions.
2.1.3*	Review resources available and perform funding gap analysis on the priority research questions identified in this Strategy.
2.1.4	Complete scoping phase of the Standardizing Integrated Ecosystem Based Assessment by engaging stakeholders and establishing a "common" understanding of the issues using Conceptual Modeling in the ecosystem-based management (EBM) approach (a BOEM-funded project).
2.1.5	Develop processes to meet best science available standards,[31] as applicable (e.g., independent peer review of publicly available data and information, integration of new with existing data/products).
2.1.6	Disseminate results regularly to inform new lease areas and projects.
2.1.7	Coordinate with the RWSC and Federal and State partners to evaluate new data and emerging data gaps and to develop data access and sharing guidelines.
2.1.8	The agencies, in consultation with federally recognized Tribes, develop an Indigenous Knowledge Plan (IKP) for the NARW, consistent with White House guidance.[32] Future iterations of the joint strategy will incorporate information gathered under the IKP.

[31] www.ecfr.gov/current/title-50/chapter-VI/part-600/subpart-D/section-600.315
[32] www.whitehouse.gov/wp-content/uploads/2022/12/OSTP-CEQ-IK-Guidance.pdf

OBJECTIVE 2.2: *Support the development of studies with sufficient statistical power to predict and detect changes in NARW ecology, demographics, and health resulting from OSW development (e.g., changes in foraging activity, residency in key habitats, displacement) at various scales (e.g., turbine, development, regional, ecosystem).*

No.	Action
2.2.1	Continue and improve efforts to track NARW abundance, distribution, health, reproduction, survival, and habitat use.
2.2.2	Continue and expand long-term aerial and vessel-based survey efforts of NARWs (including the NARW Catalog and University of Rhode Island sightings database).
2.2.3	Evaluate, design, and implement regional and project-based aerial and vessel surveys to further evaluate the impact of OSW development on NARW distribution and habitat use.
2.2.4*	Develop a long-term PAM network to strategically collect baseline and soundscape data. ● Measure the short and long-term changes in local and regional soundscapes during OSW construction and operations. ● Quantify spatial and temporal masking and potential loss of communication space for NARWs. ● Quantify NARW detection rates before, during, and after construction and during operation. ● Monitor for shifting baseline potential associated with climate change. ● Establish a NARW acoustic database catalog. ● Establish and maintain a web portal of historical PAM data and incorporate Before-After-Gradient surveys with NOAA's National Centers for Environmental Information to streamline long-term storage of data and data products. ● Inform spatial scales for future monitoring of the operational noise of larger, direct drive turbines that may be installed at Atlantic Coast projects.
2.2.5	Explore and expand the use of satellite data, unmanned systems (gliders or autonomous underwater vehicles [AUVs]) and emerging technologies (e.g., eDNA) for NARW distribution and habitat use.
2.2.6	Develop and deploy safe, long-duration satellite tagging telemetry technology for tracking high-resolution movements of NARW in and around OSW.
2.2.7	Coordinate activities conducted as part of this Strategy with NOAA Fisheries and Fisheries and Oceans Canada's NARW monitoring plans.
2.2.8	Support continued development of NARW habitat models focused on predictive habitat use (including results from 1.3 above).
2.2.9	Continue development and sampling of stress and health indicators (e.g., hormones, microbiome, new biomarker studies, baleen) blended with remote and other Visual Health Assessments methodologies.
2.2.10	Improve analysis of monitoring data through artificial intelligence, automated acoustic image processing, and near real-time data availability.

OBJECTIVE 2.3: *Develop and support efforts to improve understanding of OSW impacts on oceanographic and lower trophic level ecosystem processes for all foundation, turbine, mooring, and layout types, with a particular focus on understanding impacts on the distribution and abundance of NARW zooplankton prey.*

No.	Action
2.3.1	Collect priority data and other information from field surveys to understand NARW habitat use in and around OSW developments.
A	Collect oceanographic, zooplankton, and benthic data in areas with and without NARWs.
B	Support quantification of existing zooplankton data in OSW energy areas.
C	Support research on the plankton species abundance and distribution in southern New England (Gulf of Maine vs. offshore) and continue to evaluate any climate-change-influenced effects.
D	Assess energy density of potential prey resources.
E	Quantify NARW feeding preferences using DNA analysis of scat.
F	Link prey resources and oceanography with tagged NARWs.
G	Conduct dedicated process studies in Nantucket Shoals frontal region (for an example, see White and Veit 2020) to better understand mechanisms linking bathymetry, tides, fronts, zooplankton, and NARW.
H	Collection of oceanographic and ecological observations through robust integrated monitoring programs within the Nantucket Shoals region and in the region surrounding wind energy areas before and during all phases of wind energy development to assess the region's complex oceanography and to validate future model outputs with respect to potential hydrodynamic and ecological effects at turbine, wind farm, and regional scales (see National Academies of Sciences 2023).
I	Explore use of CODAR (high-frequency radar) to assess oceanographic drivers of distribution of NARWs and their prey.
J	Explore and expand the use of satellite data, unmanned systems (gliders or AUVs), and emerging technologies for routine physical and biological oceanographic monitoring.
2.3.2	Align current oceanographic modeling efforts per National Academies of Sciences (2023) to evaluate potential impacts to oceanographic processes from OSW, with an initial focus on the southern New England project areas and subsequent focus on other OSW development areas.

No.	Action
2.3.3	Hold a workshop among modelers to compare oceanographic model approaches, benefits and drawbacks of each, and appropriate level of commonality and differences to effectively assess and compare research findings using a multi-model approach. Workshop would focus on the models' ability to accurately predict the ● Physical environment driving zooplankton distributions ● Likelihood of conditions that may aggregate zooplankton ● Likely changes in copepod distribution between pre- and post-OSW construction
2.3.4	Synthesize and report on observed changes in oceanographic processes after several years of OSW operation.
2.3.5	Conduct a risk assessment and improve understanding of how OSW development will impact features of NARW critical habitat—as well as "high-value habitat" per NOAA's Mitigation Policy—and policy. Develop strategies for how these impacts can be avoided or minimized.

GOAL 3: Collaboration, Communication and Outreach

While this goal is not discrete from the previously identified goals in this Strategy, BOEM and NOAA Fisheries recognize that continued collaboration between the two agencies and partners is needed for the success of this Strategy. Further, the two agencies recognize that internal and external communication and outreach are important for the success of this Strategy. NOAA Fisheries and BOEM will have a transparent process for communication and outreach to support all three goals of this Strategy. BOEM and NOAA Fisheries will develop and implement this Strategy by strengthening partnerships, combining resources, and sharing and communicating information. BOEM and NOAA Fisheries will also ensure professional, transparent, and equitable communication; and engagement with Tribes, Federal and State agencies, partners, and stakeholder groups.

OBJECTIVE 3.1*: *Develop long-term and proactive coordination strategies, including establishing a joint BOEM-NOAA Fisheries NARW and OSW Strategy implementation group, and share outreach and communications plans. This implementation group will engage regularly with partners, Tribes, and stakeholders in a variety of ways such as informal meetings, formal Requests for Information, and presentations to the RWSC and the NARW Consortium.*

No.	Action
3.1.1*	Form a joint agency implementation group to fulfill the goals of this Strategy.
3.1.2*	Develop an outreach and communications plan that includes schedules for soliciting and vetting adjustments periodically.
3.1.3	Conduct meetings with partners to provide periodic updates and receive feedback, as needed.
3.1.4	Coordinate closely with the RWSC.
3.1.5	Develop a web page on "NARWs and Offshore Wind" to describe the current state of the science, ongoing research and management efforts, and other outreach materials.
3.1.6	Identify similar activities and coordinate on or share progress of this Strategy to help inform other NARW recovery efforts (e.g., NOAA Fisheries *Road to Recovery*).

APPENDIX B: Avoidance and Minimization Measures

This appendix provides a general description of preliminary measures that BOEM and NOAA Fisheries agree may have potential to avoid and minimize impacts to NARWs from OSW activities (siting to decommissioning). The agencies are sharing these measures to communicate the types of requirements that regulatory agencies and project proponents should consider for individual projects.

Consideration and implementation of these measures may be done at a project-specific scale, with details being provided in project-specific consultations, authorizations, or approvals. Other measures may be implemented at a regional scale and may involve implementation by BOEM or NOAA Fisheries. Note that this list of measures is not comprehensive and does not supersede measures that may be required by the agencies during regulatory processes, such as COP approvals, ESA consultations, or processing of MMPA incidental take authorizations. Note also that commitments by developers to implement any or all of these measures in proposed plans or other documents seeking authorization from BOEM or NOAA Fisheries does not ensure approval of projects or other authorizations, as those decisions are made on a case-by-case basis.

The measures identified here will be updated as new information becomes available. As described above, NOAA Fisheries and BOEM are currently engaging in efforts outside this Strategy to develop standard avoidance and minimization measures for OSW projects in the Atlantic OCS; the preliminary measures identified here will complement those efforts. The most currently applied project-specific mitigation measures for OSW can be found on NMFS' webpage on Incidental Take Authorizations for Other Energy Activities (Renewable/LNG),[33] which includes details on authorizations both in progress and active, and on BOEM's webpage on NMFS ESA Consultations[34] for renewable energy, including finalized Biological Opinions and/or Assessments.

Project Planning, Leasing, and Siting

NOAA Fisheries and BOEM will continue to collaborate to inform BOEM's identification of wind energy areas in consideration of the best available information on NARW distribution and habitat use. NOAA Fisheries should provide BOEM information that BOEM should consider in identifying new wind energy areas and new leases. This information may include marine spatial planning information, basic risk assessments (e.g., high risk, medium risk, low risk) based on the best available scientific data and uncertainty, including predictive data on NARW distribution over the potential duration of the lease given anticipated changes in ocean conditions and the distribution and behavior of species due to climate change. In general, BOEM will consider recommendations from NOAA Fisheries based on the best available science and attempt to avoid issuing new leases in areas that may impact potential high-value habitat and/or high-use areas for important life history functions such as NARW foraging, migrating, mating, or calving. BOEM and NOAA Fisheries will include potential lessees in these conversations as early as possible to raise awareness of concerns over impacts to NARWs.

[33] www.fisheries.noaa.gov/national/marine-mammal-protection/incidental-take-authorizations-other-energy-activities-renewable

[34] www.boem.gov/renewable-energy/state-activities/nmfs-esa-consultations

After reviewing the best available information, if BOEM decides to initiate the planning and analysis phase for potential future leasing in **areas that overlap with NARWs and their habitat, BOEM will partner with NOAA's National Centers for Coastal Ocean Sciences to use marine spatial planning approaches. The use of spatial planning tools and coordination with NOAA Fisheries will ensure best available information is incorporated into those tools (Randall et al. 2022) and supports BOEM's iterative determination of optimal locations for wind energy areas with the least impact to NARWs and their habitat.**

The lease does not grant the lessee the right to construct any facilities; rather, the lease grants the right to use the lease area to develop its plans, which must be approved by BOEM before the lessee can move on to the next stage of the process. Developers must include measures to avoid and minimize impacts to NARWs and their habitat in their COPs.

Developers should evaluate multiple project design options such as the type, number, size (physical dimensions and power output), location, and orientation of wind turbines and offshore substations, with a focus on identifying design options that avoid and minimize impacts to NARWs and their habitat within and with adjacent projects; tradeoffs for other resources need to be evaluated during project planning.

Site Characterization and UXO Surveys

Although the Renewable Energy Regulations currently are being modernized (88 FR 7657),[35] lessees will continue to be required to submit physical characterization and baseline environmental survey data results in support of a plan submission. BOEM will work with NOAA Fisheries to ensure that all survey activities fall within the scope of existing ESA consultations and, if not, will initiate Section 7(a)(2) consultation under the ESA. The following are preliminary measures that BOEM and NOAA Fisheries agree may apply to site characterization and UXO surveys:

- **Equipment and Effort**: Lessees should avoid using air guns and, wherever possible, only use equipment that is unlikely to impact NARWs. Where the use of sub-bottom profilers (e.g., compressed high intensity radar pulse [CHIRP], boomers, and sparkers) cannot be avoided, lessees should implement project design criteria and best management practices, such as those outlined in NOAA Fisheries ESA programmatic consultation (issued June 2021, as amended September 2021)[36] (Anderson 2021) (or any updated versions of this document or similar guidance issued by the agencies) for all geophysical and geotechnical surveys carried out over the life of the leases. Examples include the following: using lowest practicable sound source levels; deactivating the acoustic source when not acquiring data or preparing to acquire data, except as necessary for testing; and minimizing survey efforts to the maximum extent practicable.
- **Clearance Zones:** A clearance zone is an area around a sound source, monitored by PSOs, wherein a detection of a NARW triggers a delay in turning on the sound source. The size of clearance zones for NARWs are established in project-specific approvals. Use of clearance zones can minimize the extent of exposure to acoustic sources and the amount and severity of behavioral disturbance.

[35] www.federalregister.gov/documents/2023/02/06/2023-02398/renewable-energy-modernization-rule-correction
[36] media.fisheries.noaa.gov/2021-12/OSW-surveys-NLAA-programmatic-rev-1-2021-09-30-508-.pdf

- **Shutdown Zones:** Shutdown zones are an area around a sound source, monitored by PSOs, wherein a detection of a NARW triggers a shutdown of the source (i.e., a stop of using the source). The size of shutdown zones are identified in project-specific approvals. Shutdown zones can minimize the extent of exposure to acoustic sources and the amount and severity of behavioral disturbance.
- **Protected Species Observers (PSOs)**: Use trained, third-party PSOs with no duties other than to effectively implement mitigation and monitoring measures during survey activities. Adopt standards for protected species monitoring (e.g., minimum visibility, PSO protocols). Locate PSOs at the best vantage point(s) to ensure coverage of the entire visual clearance and shutdown zones, and as much of the behavioral harassment zones as possible. Ensure PSOs do not exceed 4 consecutive watch hours on duty at any time, have a 2-hour (minimum) break between watches, do not exceed a combined watch schedule of more than 12 hours in a 24-hour period, and are well equipped (binoculars, infrared if appropriate).
- **Vessel Strike Risk Reduction:** Vessel captains, trained crew members, and PSOs should maintain a vigilant watch for all protected species and slow down, stop their vessel, or alter course, as appropriate and regardless of vessel size, to avoid striking any protected species. The presence of a single individual at the surface may indicate the presence of submerged animals in the vicinity; therefore, precautionary measures should always be exercised upon the sighting of a single individual. Developers should also monitor, daily, available sources of NARW presence in the area vessels may be transiting. Vessels underway should not divert their course to approach any protected species. All vessels should have a dedicated observer watching for NARWs at all times and slow to 10 knots or less at any time and/or location that NARWs may be present and at any time when visibility is poor. Any use of PAM in transit corridors to aid in detection and awareness of NARW presence should complement visual monitoring efforts.

  All OSW-associated vessels must comply with all regulations for the protection of NARWs in effect at the time, including vessel speed regulations and approach regulations (62 FR 6729; 73 FR 60173, 87 FR 46921). In addition, vessels must follow all vessel strike reduction measures, as specified in individual project approvals (e.g., NOAA Fisheries MMPA Incidental Take Authorizations and ESA Biological Opinions, and BOEM leases and conditions of COP approval).

Construction and Operation

For existing leases, lessees will submit a COP. BOEM's regulations require that BOEM first analyze and evaluate the COP before approving, disapproving, or approving it with modifications (30 CFR 585.628(f)). If disapproved, BOEM will inform the lessee of the reasons and allow the lessee an opportunity to resubmit a revised plan addressing the concerns identified. BOEM recently published the NOI Checklist,[37] based on BOEM's regulations, and describes how BOEM will process incomplete COP submissions. The checklist is designed to 1) provide clarity to lessees; 2) establish a pre-application and pre-NOI process with lessees and cooperating agencies that will benefit all stakeholders; and 3) improve the efficiency of proposed OSW project reviews by avoiding delays to the NEPA analysis after the NOI has been published. During the environmental review of the COP, BOEM will work with NOAA Fisheries to ensure environmental review under applicable statutes evaluate measures to avoid (primary goal) or

[37] www.boem.gov/node/30996

minimize (secondary goal) impacts to NARW and high-value habitat and/or high-use areas for important life history functions such as NARW foraging, migrating, mating, or calving. The results of these environmental reviews, including any conditions that result from ESA consultation or an MMPA authorization, will ultimately inform COP conditions of approval.

If new information becomes available indicating that activities previously authorized by BOEM through a plan approval (e.g., SAP, General Activities Plan [GAP], COP) are now resulting in an imminent threat of serious or irreparable harm or damage (e.g., injury or mortality) to NARWs, BSEE has the authority to suspend operations. Likewise, BOEM may require the lessee to submit a plan revision if activities previously authorized by BOEM are resulting in undue harm to NARWs. The plan revision would detail new measures that will be taken to increase protection of NARWs impacted by the activities authorized under the plan approval. BOEM will determine if the new measures are adequate and, if warranted, could then reinitiate ESA Section 7(a)(2) consultation with NOAA Fisheries prior to approving any plan revision. BOEM also will use any new information to inform future project decisions and mitigation strategies. In addition, reinitiation under Section 7 of the ESA is required when certain conditions are met (50 CFR § 402.16). The measures outlined below apply to foundation installation activities (e.g., pile driving and drilling) and other activities, including but not limited to, UXO detonation and cable landfall construction or other pile-driving activities. Developers should work with the agencies when considering the following:

- **Foundation Installation Time/Area Restrictions:** Project schedules should avoid installing foundations during the time of year when NARWs are most likely to occur in the lease areas and along vessel routes, including known areas of higher NARW density and persistence, and including, but not limited to, Nantucket Shoals, Cape Cod Bay, calving grounds, and designated NARW critical habitat. Avoiding foundation installation during these times/areas also minimizes vessel traffic; thereby lowering vessel strike risk. Time/area restrictions also minimize risks at times when NARWs are predicted to be present, but monitoring of NARWs may not be effective.
- **Quieter Foundations and Impact Piling Noise Reduction**: The agencies are committed to requiring developers to reduce noise levels during construction to the maximum extent practicable and ensure actual noise levels are within the bounds of those analyzed within a project's environmental review process. Sound fields generated during impact pile driving should be reduced to the maximum extent practicable with a goal of not exceeding NOAA Fisheries' Level A permanent threshold shift (PTS) limits for low frequency cetaceans (LFC) at distances greater than 1,000 meters from each foundation. This would limit the potential for PTS for species of greater concern, such as NARWs and other baleen whales (all considered LFC). Although developed for LFCs and linked to acoustic thresholds used in the context of the MMPA and ESA, implementation of this measure also is meant to afford protection to other groups of marine mammals, such as mid-frequency cetaceans and pinnipeds, as well as sea turtles and fishes. Application of the Level A LFC Received Sound Level Limit (RSLL) also reduces zones for temporary threshold shift and behavioral impacts to some extent.

  In order to reduce noise levels during construction, the agencies are committed to working with lessees to develop standards for determining where it would be preferred to use foundation designs that do not rely on pile driving (e.g., gravity-based foundations), as well as to not detonate UXOs when other means of removal are possible. Factors for consideration that

minimize impacts to NARWs and habitat may include engineering feasibility, impacts of the foundation type on benthic resources and environmental conditions, and impacts of noise during construction. Where pile driving and UXO detonations cannot be avoided, lessees should use the most effective methodologies available to reduce noise to the maximum extent practicable, including, but not limited to, use of noise abatement systems (e.g., double big bubble curtains) and a hammer schedule that results in the lowest sound exposure level to NARWs as possible.

- **Clearance Zones:** Clearance zones are an area around a pile (or detonation location), monitored by PSOs, wherein a detection (visual or acoustic) of a NARW triggers a delay of the start of the activity. Use of clearance zones can limit 1) the potential that an activity would begin when a NARW is close enough to a pile or explosion to experience mortality, serious injury, non-auditory injury, or auditory injury (e.g., PTS) and 2) the amount and severity of temporary threshold shift and/or behavioral disturbance. The size of clearance zones for NARWs are project and activity specific but, for foundation installation and UXO detonation, are generally unlimited (i.e., any distance from PSOs or within a large PAM detection distance). PAM of clearance zones should be carried out for 24 hours in advance of foundation installation activities (e.g., pile driving and drilling) and other activities such as UXO detonation.
- **Shutdown Zones:** Shutdown zones are an area around a pile (or other activity) that is monitored by PSOs, wherein a detection (visual or acoustic) of a NARW triggers a stop of the activity. Use of shutdown zones can avoid exposure of NARWs to noise or other conditions that could result in mortality, non-auditory injury, and auditory injury (e.g., PTS) and minimize the amount and severity of temporary threshold shift and/or behavioral disturbance.
- **Protected Species Observers (PSOs)**: The agencies require use of trained, third-party PSOs with no duties other than to effectively implement mitigation and monitoring measures during construction activities and are developing standards for protected species monitoring (e.g., minimum visibility, PSO protocols). PSOs are not construction personnel and must be approved by NOAA Fisheries prior to deployment. PSOs must be located at the safest and best vantage point(s) to ensure coverage of the entire visual clearance and shutdown zones, and as much of the harassment zones as possible. PSOs must not exceed 4 consecutive watch hours on duty at any time, have a two-hour (minimum) break between watches, not exceed a combined watch schedule of more than 12 hours in a 24-hour period, and be well equipped to effectively monitor for large whales during various conditions. During foundation installation and UXO detonation, three PSOs are recommended at each platform (e.g., three PSOs at the pile-driving vessel and any secondary, dedicated PSO vessel(s) located further from the pile), with minimum requirements to be included in project-specific approvals. If aerial-based PSO monitoring is used, the minimum number of PSOs will be included in project-specific approvals.
- **Sound Field Measurement**: Sound field verification (SFV) will need to be conducted for activities the agencies deem necessary, including but not limited to pile driving, UXO detonation, and operations. To properly validate acoustic modeling results for pile driving, measurements should be collected from each foundation installed. There is inherent variability in the sound levels produced during foundation installation in a complex environment. Some variation can be predicted based on foundation, construction, and environmental parameters. Lessees will conduct *Thorough SFV Monitoring* (defined as recording along a minimum of two radials with at

least one radial containing three or more recorders) for the first three foundations of a project, and when a foundation is to be installed with a substantially different set of values for these parameters. The exact number of *Thorough SFV Monitoring* measurements per project cannot be provided *a priori*, as different situations may require different measurements. The SFV process should be sufficient to assess sound propagation from the foundation and the distances to isopleths for potential injury and harassment. The measurements should be compared to the modeled PTS and Level B (behavioral) harassment zones for marine mammals (and the injury and behavioral disturbance zones for sea turtles and ESA-listed fish), thus the plan should include the target modeled sound levels that each monitored installation will stay below. Interim results from each pile for which thorough monitoring is conducted would be submitted to BOEM and NMFS within 48 hours of pile installation. *Abbreviated SFV Monitoring* consisting of a single acoustic recorder unit (at least a bottom and midwater hydrophone) at approximately 2,460 feet (750 meters, with location dependent on project-specific details, including consideration of the location of noise abatement systems) should be performed on any foundation installations for which *Thorough SFV Monitoring* is not planned, to assess whether any particular pile or location led to received levels above what was modeled. For additional guidance refer to BOEM Nationwide Recommendations for Impact Pile Driving Sound Exposure Modeling and Sound Field Measurement for Offshore Wind Construction and Operations Plans.[38] BOEM may also develop additional guidance on requirements for instituting and reporting SFV. SFV will be used to identify that developers are not generating noise levels above those modeled and assumed in environmental reviews. If SFV suggests distances to harassment thresholds are being exceeded, developers must take action to reduce noise levels to those modeled.

- **UXO Detonation:** The agencies are committed to working with Federal partners and lessees to develop and implement standard protocols for addressing unexploded ordinances, including implementation of best available technology to avoid or minimize exposure of NARWs and their sensitive habitats to in-situ disposal (low order incineration or high order detonation). If disposal is necessary, after demonstrating that avoidance through micrositing is not feasible, low order incineration is preferred over high order detonations.
- **Vessel Strike Risk Reduction:** Vessel captains, trained crew members, and PSOs should maintain a vigilant watch for all protected species and slow down, stop their vessel, or alter course, as appropriate and regardless of vessel size, to avoid striking any protected species. The presence of a single individual at the surface may indicate the presence of submerged animals in the vicinity; therefore, precautionary measures should always be exercised upon the sighting of a single individual. Vessels underway must not divert their course to approach any protected species. All vessels should have a dedicated lookout or PSO watching for NARWs at all times and slow to 10 knots or less at any time/location that NARWs may be present and at any time when visibility is poor. Any use of PAM in transit corridors to aid in detection and awareness of NARW presence should complement visual monitoring efforts. All OSW-associated vessels should comply with all regulations for the protection of NARWs in effect at the time, including vessel speed regulations and approach regulations (62 FR 6729; 73 FR 60173, 87 FR 46921). In addition, vessels should follow all vessel strike reduction measures as specified in individual project

[38] www.boem.gov/node/30991

approvals (e.g., NOAA Fisheries MMPA Incidental Take Authorizations and ESA Biological Opinions, and BOEM leases and conditions of COP approval).

- **Marine Debris and Gear**: Implement routine clean ups of abandoned, lost, or otherwise discarded fishing gear and/or other debris associated with OSW development within the lease areas. Implement measures designed to avoid and minimize interaction between protected species and any gear in the water that is related to OSW construction or operations, including but not limited to anchor and buoy lines.
- **Adaptive Planning**: Empirical data collected during construction and operations of all OSW projects can be used to inform and improve the reliability of future risk assessments and inform adaptive management of approved projects. Develop an adaptive framework to quickly incorporate results from empirical data to resolve unanticipated issues so that impacts to NARWs are minimized quickly and efficiently.

Decommissioning

Per BOEM's regulations (30 CFR 585), all plans (Research Activities Plans [RAPs], SAPs, GAPS, and COPs) must include a conceptual description of decommissioning methodologies. However, prior to any decommissioning activities occurring, a detailed project decommissioning plan will be submitted to BOEM for environmental and technical review. This review will be undertaken in consideration of applicable laws and regulations, and best management practices at that time, including appropriate measures to avoid and minimize impacts to NARWs from decommissioning activities. Decommissioning applications must be submitted by Lessees to BSEE in accordance with 30 CFR 285.902.[39]

Project-Specific Monitoring Measures

Pre-construction monitoring is essential to document and understand the baseline conditions in a project area. Long-term monitoring is also necessary to assess the environmental impact of projects throughout construction and operations. Data collected prior to and during the COP approval process will be used to evaluate the potential impacts of a project on NARWs and their habitat. The data generated by the monitoring measures listed below will assist in assessing the impacts of OSW development on NARWs, their habitat, and habitat use.

During construction and operations, long-term monitoring and targeted monitoring (e.g., during pile driving) will assist in evaluating the effectiveness of mitigation measures, whether additional measures are necessary to minimize unanticipated impacts, and the impacts of the project. Together with broader-scale monitoring efforts, these project-specific monitoring measures will be used by BOEM and NOAA Fisheries to evaluate, track, and avoid and minimize impacts to NARWs. These monitoring studies should be designed to also contribute to cumulative impact analyses to assess the spatial and temporal accumulation of OSW development on NARWs, their habitat, and habitat use. BOEM and NOAA Fisheries also encourage coordination of research and monitoring studies through the RWSC and the NOAA Fisheries and BOEM Federal Survey Mitigation Strategy to increase effectiveness, utility, and data sharing.

[39] www.ecfr.gov/current/title-30/chapter-II/subchapter-B/part-285/subpart-I/subject-group-ECFR0c2b7ea7919f137/section-285.902

BOEM and NOAA Fisheries encourage scientifically rigorous monitoring studies that are standardized across OSW development projects within the region. All monitoring studies and research activities should be based on scientifically rigorous study designs. Regional experts should be consulted to develop effective monitoring and study designs with adequate sample sizes and appropriate spatial and temporal coverage to allow the detection of potential impacts of OSW developments on NARWs, their habitat, and habitat use. All monitoring study designs should be reviewed by BOEM and NOAA Fisheries and, where appropriate, independently peer reviewed prior to initiation and then annually reviewed during the study period. These designs should include clearly stated goals and objectives for monitoring and use regionally standardized field and analytical methodologies.

To facilitate the application of data collected by developers, the agencies will develop reporting standards and identify existing (or develop as necessary) databases for data storage and access (e.g., www.northeastoceandata.org). A centralized, publicly accessible data portal would allow for data to be integrated across projects and queried to answer a range of scientific questions to inform management decisions. The goal is for all monitoring data to be stored in standard format (e.g., RWSC standards for PAM data processing and management)[40] in an openly accessible repository to facilitate transparency, data analysis, and sharing of information.

None of the preliminary monitoring measures below supersede measures that are or may be required by the agencies during regulatory processes such as COP approvals, ESA consultations, or processing of MMPA incidental take authorizations. In addition, project-specific approvals may contain additional measures. Note that the implementation of any or all of these measures by developers does not ensure project or permitting approval as those decisions are made on a case-by-case basis.

The following preliminary monitoring measures may be considered by BOEM and NOAA Fisheries during project environmental review processes, in addition to any other measures adopted by the agencies (e.g., from ESA Biological Opinions or MMPA ITAs):

- Ensure all environmental reviews are informed by baseline data on the use of the project area by NARWs, to include at least 3 years of baseline data. Implement continued monitoring during the construction period and for at least 3 years post construction to assess impact of the project on NARWs and their habitat. Establish long-term monitoring for the duration of construction and operations to evaluate the potential impacts on key components of the ecosystem (e.g., NARWs and their prey). Conduct monitoring using rigorous scientific designs with the intent of measuring the impact of OSW development on NARWs, their habitat and habitat use, and the effectiveness of measures described above. Report data in a timely manner and make publicly available. See additional aerial survey and long-term PAM measures below.
- Conduct monitoring to assess the impacts of the physical presence and operation of the turbines. Monitoring should assess changes in the atmospheric and oceanographic environment—including benthic and pelagic habitats and oceanographic features (e.g., stratification and fronts)—particularly as these environments relate to NARW feeding behavior and ecology.

[40] rwsc.org/wp-content/uploads/2022/12/RWSC-PAM-Data-Management-Storage-Best-Practices.pdf

- Conduct monitoring for changes to fishing operations and displacement of fishing effort into other areas. Monitor changes in fishing activity to detect changes in bycatch or entanglement rates of protected species, particularly NARWs.
- Fully implement NMFS and BOEM Survey Mitigation Strategy and a Northeast Survey Mitigation Program, including incorporating measures to implement necessary NARW survey mitigation activities as lease term stipulations, as COP conditions, and by other means.
- Develop and implement plans for research and monitoring to address new and emerging issues and technology in a scientifically rigorous and systematic way. Consider including requirements that OSW infrastructure (e.g., turbine foundations, submarine cables, substations, and other equipment) be instrumented to meet project and regional monitoring objectives.
- When feasible, conduct aerial surveys for a minimum of 3 years prior to BOEM starting its environmental review process in the lease areas and surrounding waters to collect baseline data on the presence, abundance, distribution, and seasonality of NARWs, their habitat, and habitat use. Surveys should follow a similar protocol to the aerial surveys conducted in the Massachusetts and/or Rhode Island Wind Energy Areas and should be flown on a regular basis. Surveys should continue during construction and operational phases of OSW development and be used beyond monitoring purposes with the goal of assessing effects of OSW development on marine megafauna species.
- Use long-term PAM to develop baselines and monitor changes in the presence of marine species, as well as changes in ambient noise due to operations for 1 year before construction and up to 10 years post construction. The number of devices in each lease area should be sufficient to ensure that vocalizing baleen whales could be detected based on the assumption of a 10-kilometer detection range for NARW calls. The sampling rate of the recorders should prioritize the detection of baleen whale vocalizations but also should have, at a minimum, the capability to detect and store acoustic data on noise from vessels, pile driving, and wind turbine generator operation.

  Following the RWSC PAM data management best practices document[41] would ensure that the appropriate steps are taken prior to deployment, sufficient metadata is captured, and the data are processed and archived in a standardized fashion. The data will be processed to document, at the very least, the presence of baleen whale vocalizations, as well as standard metrics of ambient noise. Archiving the full acoustic record at National Centers for Ecological Information will allow for complete transparency of the data. Baleen whale detections also will be submitted to BOEM, BSEE, and NOAA Fisheries at least twice a year.

  As an alternative to conducting PAM in its project area, the lessee may opt to meet this monitoring measure through an annual deposit to BOEM's Environmental Studies Program in support of its Partnership for an Offshore Wind Energy Regional Observation Network (POWERON) initiative. The lessee's contribution would cover activities within its lease area, such as the purchase of instruments, annual deployments and refurbishment, data processing, and long-term data archiving. Funding from BOEM—such as monies received through the Inflation Reduction Act, other partners, and potentially other lessees—will support long-term PAM throughout the region, which will enable broader-scale analyses on cumulative effects to marine

[41] rwscollab.github.io/pam-data-mgmt/

species. Under this option, the lessee will be expected to cooperate with the POWERON team to facilitate deployment and retrieval of instruments within the project area. If necessary, the lessee may request temporary withholding of the public release of acoustic data that has been collected within its project area.

- Use both long-term and real-time PAM to collect baseline information on the presence, distribution, and seasonality of NARWs in transit routes and to minimize risk of vessel strike of transiting vessels. Additionally, real-time PAM can be deployed beyond required monitoring zones to detect NARWs to provide better situational awareness for operators during construction.
- Monitor to implement mitigation (e.g., use PSOs and PAM) and identify the effectiveness of mitigation measures.
- If any additional telemetry technologies (e.g., satellite, acoustic, and multi-sensor D-tagging) are adopted as part of monitoring, users should follow similar best practices described above, including data sharing, storage in relevant network (e.g., Animal Telemetry Network [ATN], Mid-Atlantic Acoustic Telemetry Observation System), and archiving at the National Center for Environmental Information. In addition, all animal tracking data should be made publicly accessible within 18 months after data collection ends, acoustic and other archival tag data should be submitted to the ATN web portal at a minimum of every 6 months during the life of a project, and the fv months after data collection ends. Any future use of data in the public domain should be done in accordance with the ATN data sharing policy.

APPENDIX C: Potential Actions to be Further Developed by the Agencies During Implementation of the Strategy

As this Strategy was developed, a number of topics were identified through internal agency discussions and from public comment. These topics require further development to assess if and how they integrate with the actions identified in this Strategy. Some items included in this appendix are in various stages of development. As these topics are further developed, they may be included in future updates to this living Strategy document.

- In order to comply with the regulatory requirements for results of environmental data to support RAPs, SAPs, GAPs, or COPs as described in 30 CFR 585, developers may be able to elect to direct established, appropriate levels of funding to BOEM to support environmental data collection, as a lease or plan approval option. This approach would address, standardize, and coordinate research needs and efforts. Mechanisms will be identified based on available authority. In addressing research and monitoring needs identified in this Strategy, these funds would conceivably assist in the implementation of the goals of this Strategy.
- Continue to support research and monitoring to assess the effects of proposed OSW development in leases south and west of Nantucket Shoals.
    - Support the recommendations of the National Academy of Sciences Committee's report on the *Evaluation of Hydrodynamic Modeling and Implications for Offshore Wind Development: Nantucket Shoals.*
    - Conduct research to better understand NARW foraging in the area and the potential effects of OSW development on NARW prey and foraging habitat and behaviors.
- Continue to work to evaluate the transferability of European OSW research, as well as evaluate the current U.S. approaches, to better understand the potential of OSW structures to cause habitat change, and the potential implications thereof to NARWs.
    - Support activities with the National Academy of Science[42] and with the International Council for the Exploration of the Sea
- Continue research to understand the potential effect of different turbine sizes and wind energy development layouts/designs on NARW habitat and prey.
- Improve availability and utility of Protected Species Observer data for conservation and management uses, specifically in terms of NARW sightings and in understanding the impacts of vessels and construction on NARW behavior and the potential for injury.
- Develop criteria for nighttime and low-visibility monitoring plans to increase the potential for effective monitoring of NARWs during activities carried out in these conditions and to minimize the impact or potential impacts of OSW activities on NARWs or their habitats.
- Develop a framework to implement BOEM and BSEE's authority to suspend OSW operations if, based on the best available decision-support tools available at the time, there is an imminent threat of serious or irreparable harm or damage (e.g., injury or mortality) to NARWs.

[42] www.nationalacademies.org/our-work/evaluation-of-hydrodynamic-modeling-and-implications-for-offshore-wind-development-nantucket-shoals

- Continue to develop regional approaches to science and management.
- Consider the criteria for how operators could develop underwater noise management plans for inclusion in a COP. For example, an underwater noise management plan could consider the daily and/or seasonal amount of acoustic energy that will be introduced into the marine environment over the lifetime of the project. The plan should describe how equipment, technology, and best practices will be used to produce the least amount of noise practicable to avoid and minimize noise impacts to the environment. Every effort should be made to implement these low-noise options, and where this is not practicable, justification would need to be provided as to why this is not practicable.
- Understand Level A LFC RSLL reduces zones for temporary threshold shift and behavioral impacts to some extent, but more reduction may be needed. Consider working towards a more stringent (or additional) RSLL aimed at further reducing impacts.
- Establish a vessel noise management plan on best practices for vessel quieting and low-noise equipment or operations per project and follow the most current International Maritime Organization's Guidelines to reduce underwater vessel noise, to the extent reasonable and practicable.

APPENDIX D: Monthly Densities of North Atlantic Right Whales in U.S. Waters (2010–2019)

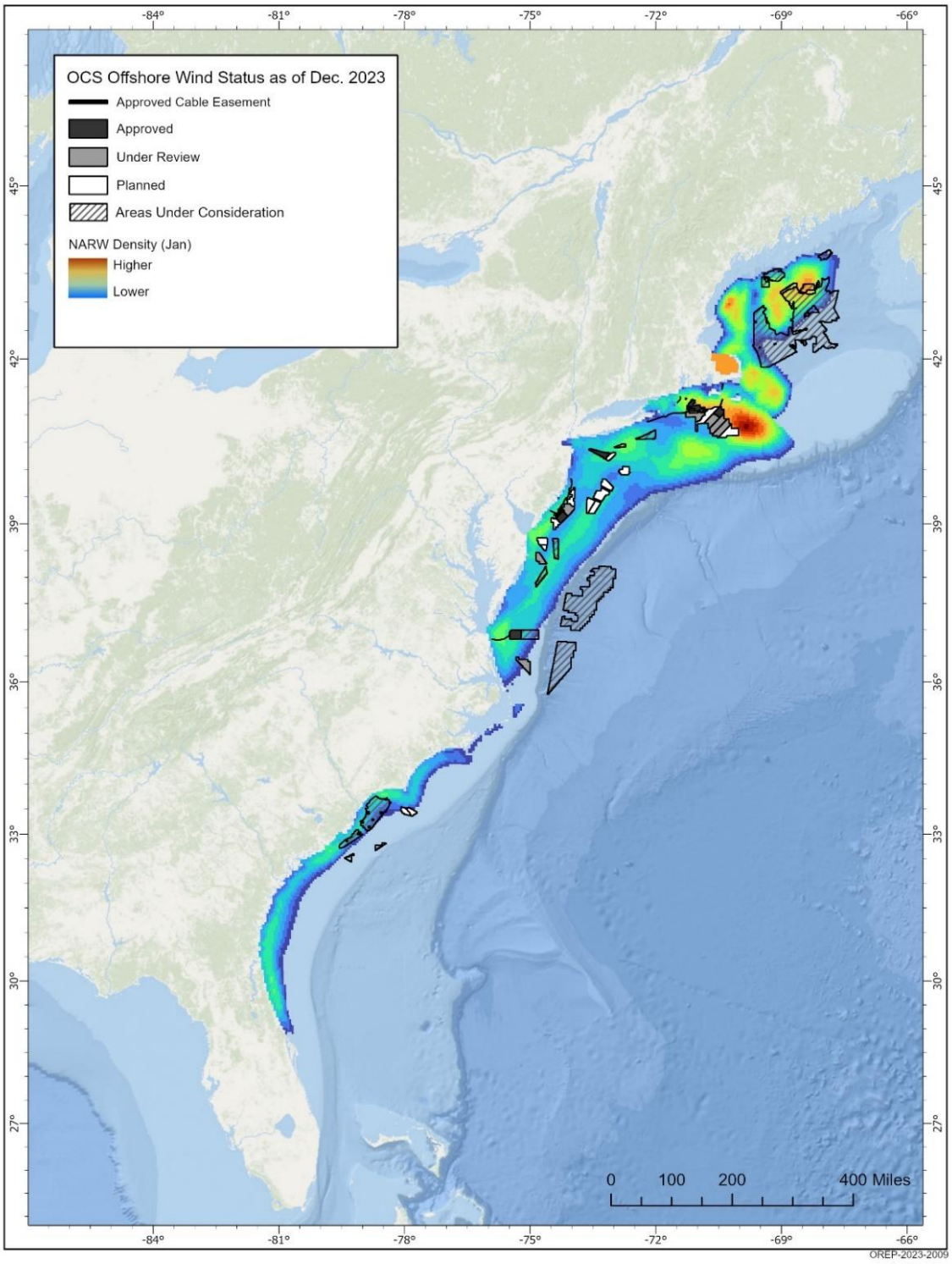

Figure D-1. Density of NARWs in U.S. waters during the month of January (2010–2019)

Narrow lines leading from leases to land are cable route easements. Due to State/Federal jurisdiction, the easement shows as ending at the State waters boundary where other State and Federal regulations apply. All leases with approved COPs will include easements shortly after approval. Source: Roberts et al. (2023); Roberts et al. (2016).

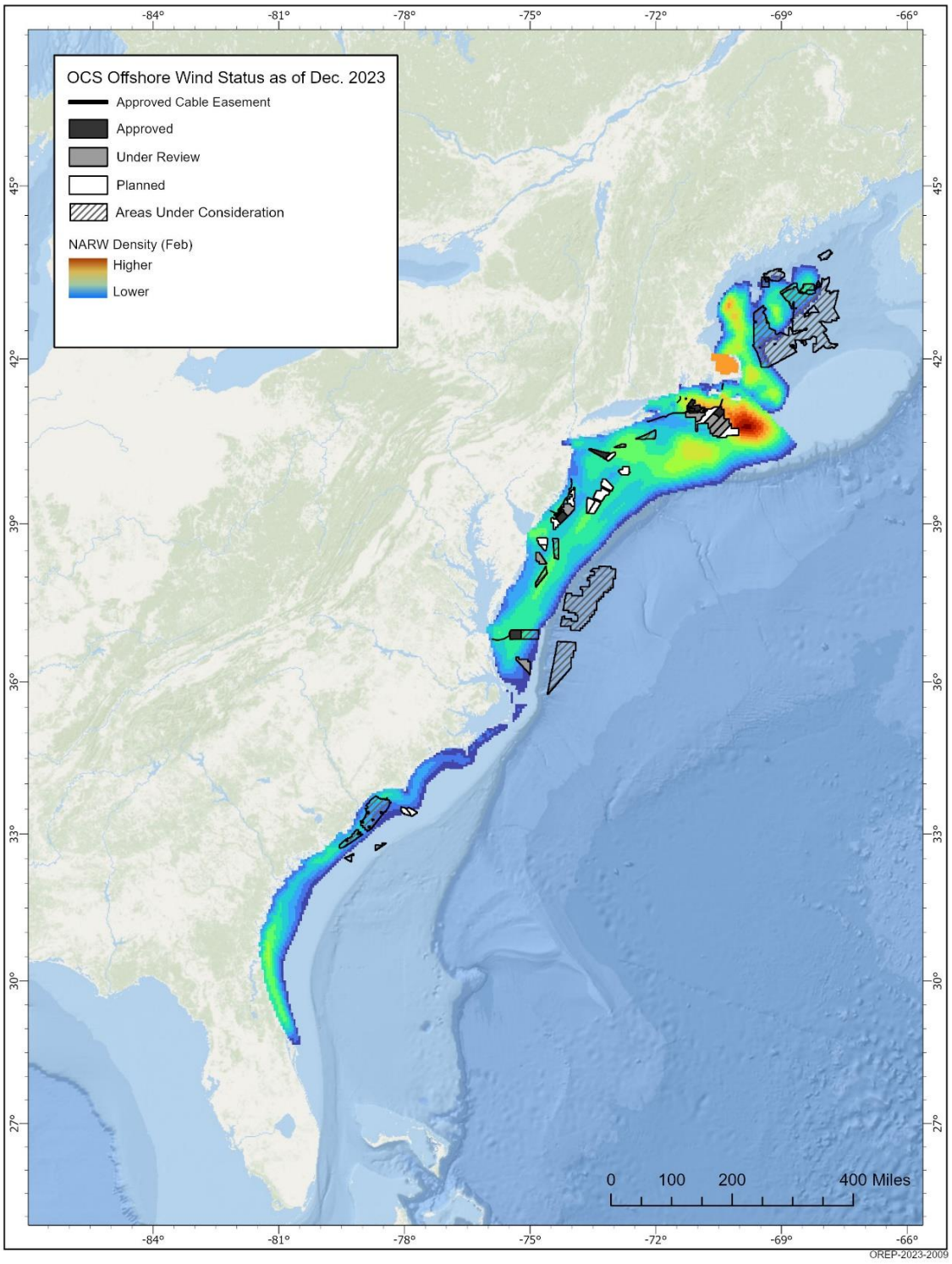

Figure D-2. Density of NARWs in U.S. waters during the month of February (2010–2019)

Narrow lines leading from leases to land are cable route easements. Due to State/Federal jurisdiction, the easement shows as ending at the State waters boundary where other State and Federal regulations apply. All leases with approved COPs will include easements shortly after approval. Source: Roberts et al. (2023); Roberts et al. (2016).

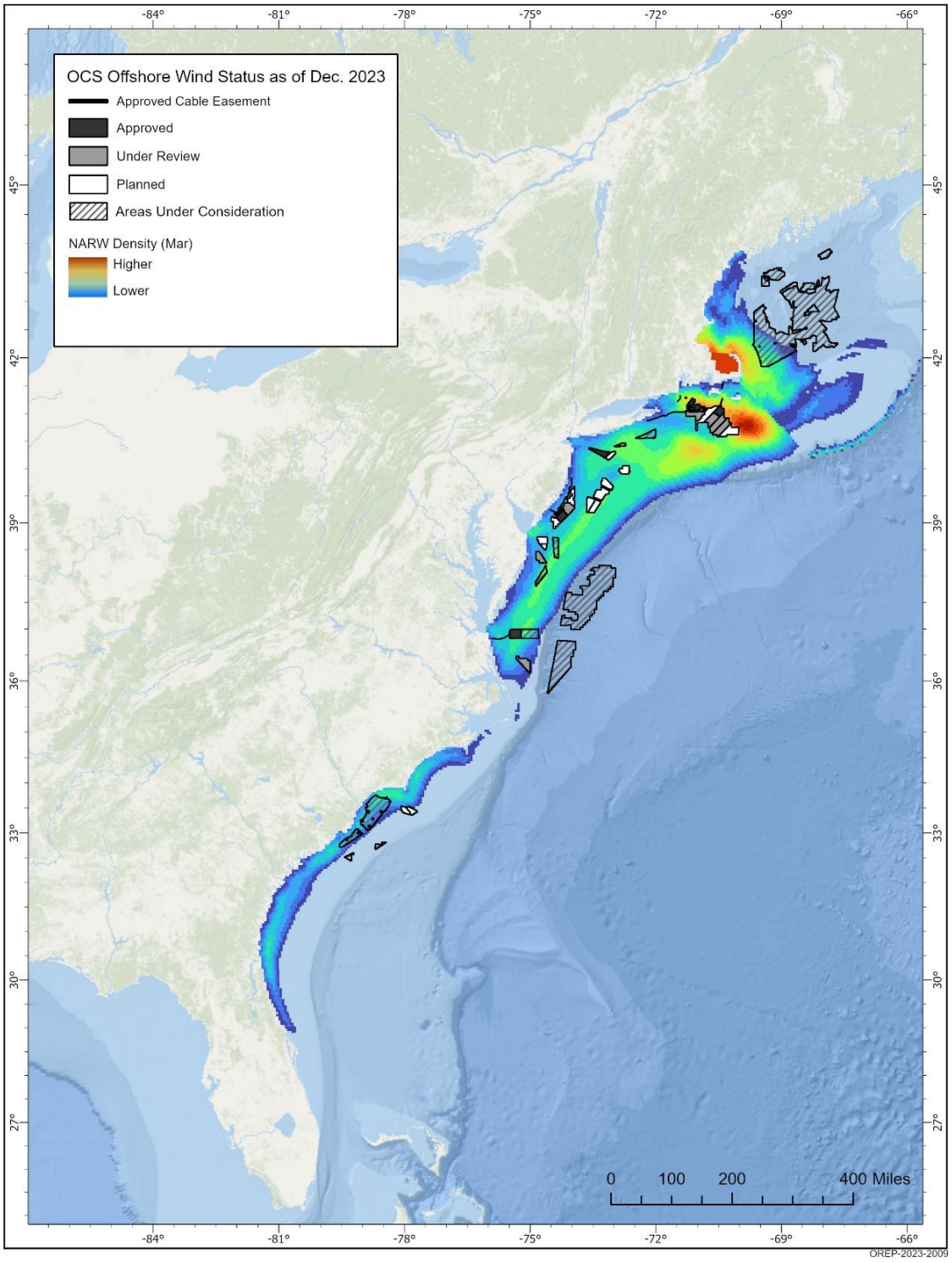

Figure D-3. Density of NARWs in U.S. waters during the month of March (2010–2019)

Narrow lines leading from leases to land are cable route easements. Due to State/Federal jurisdiction, the easement shows as ending at the State waters boundary where other State and Federal regulations apply. All leases with approved COPs will include easements shortly after approval. Source: Roberts et al. (2023); Roberts et al. (2016).

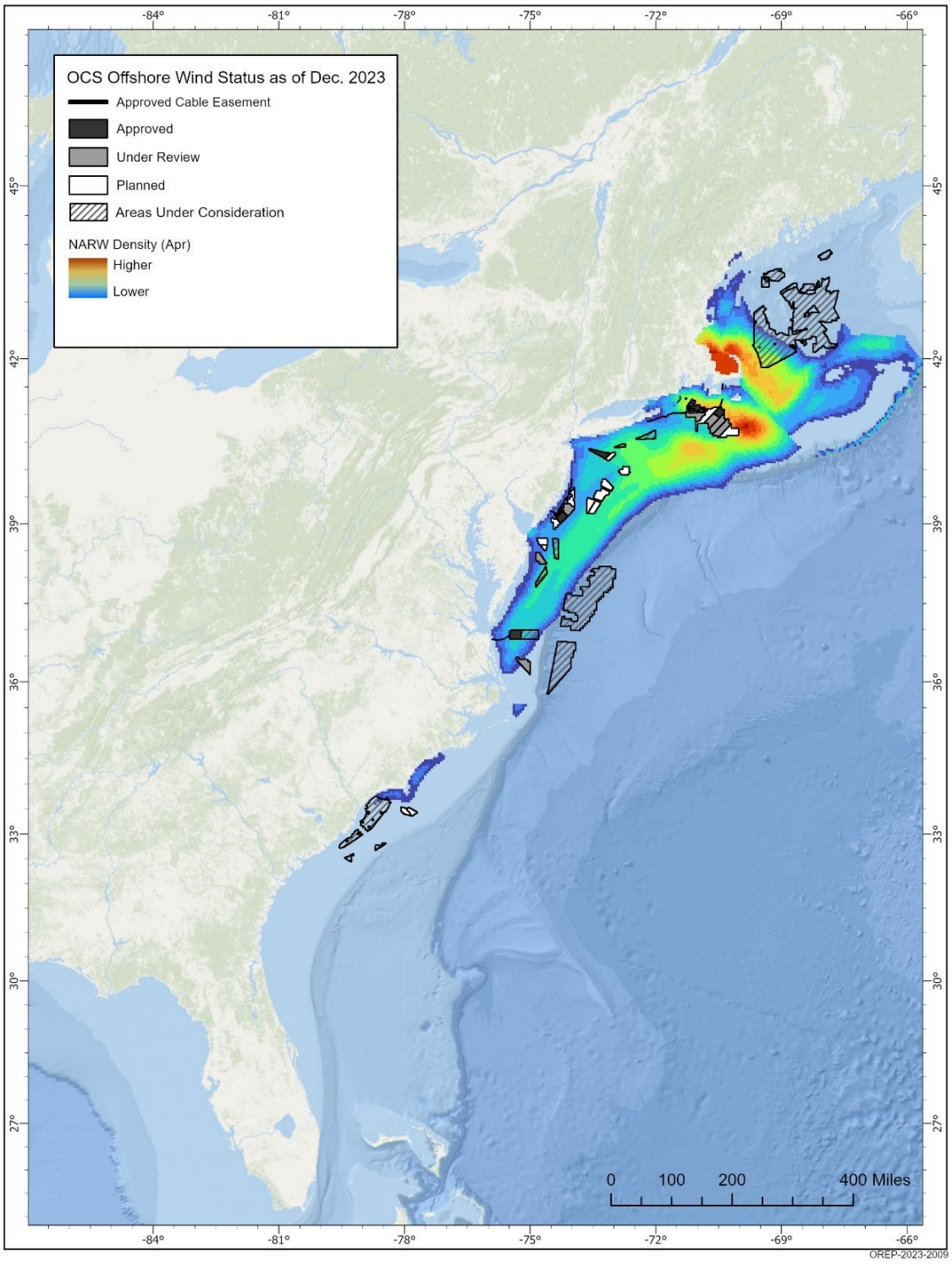

Figure D-4. Density of NARWs in U.S. waters during the month of April (2010–2019)

Narrow lines leading from leases to land are cable route easements. Due to State/Federal jurisdiction, the easement shows as ending at the State waters boundary where other State and Federal regulations apply. All leases with approved COPs will include easements shortly after approval. Source: Roberts et al. (2023); Roberts et al. (2016).

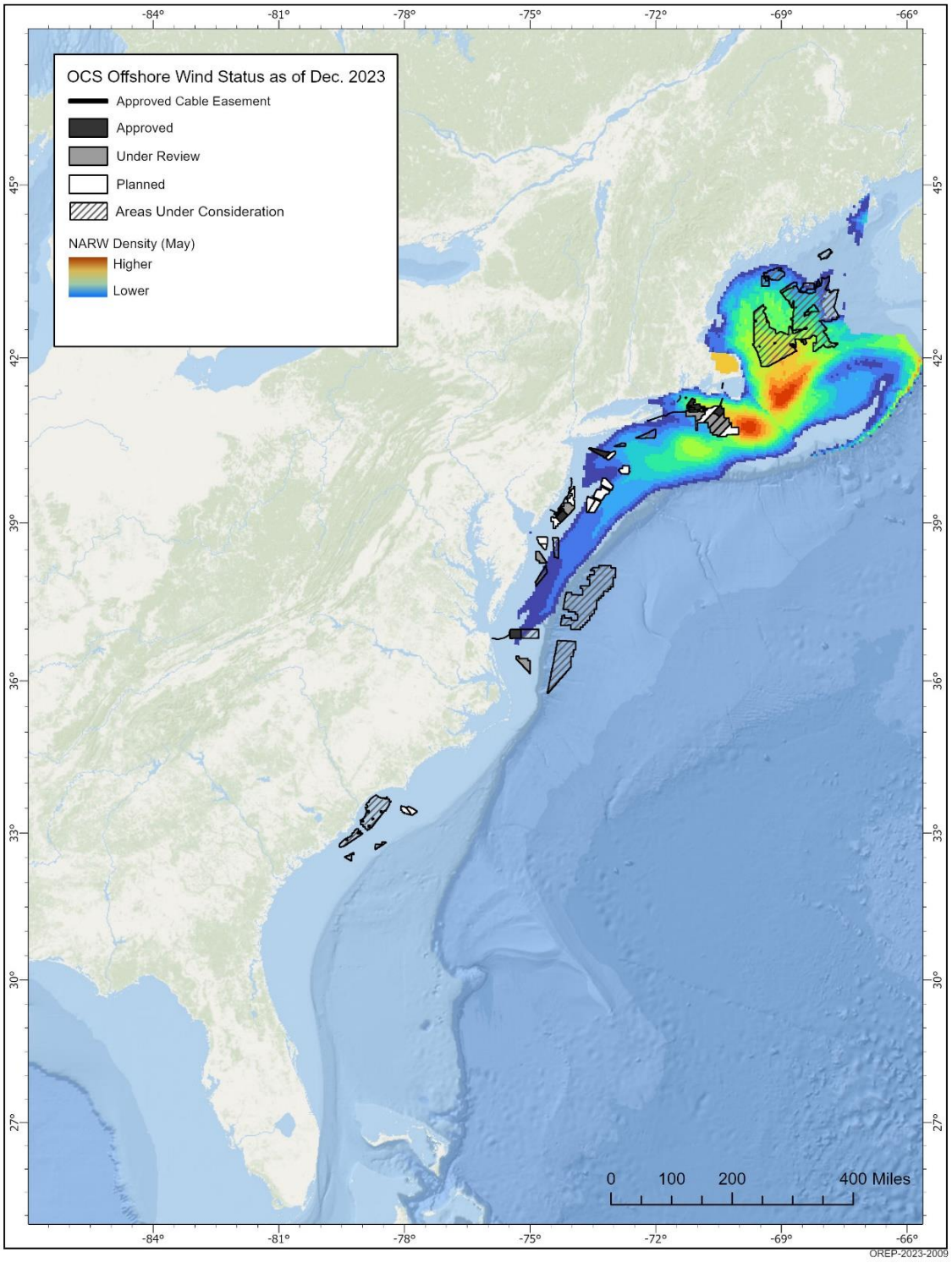

Figure D-5. Density of NARWs in U.S. waters during the month of May (2010–2019)

Narrow lines leading from leases to land are cable route easements. Due to State/Federal jurisdiction, the easement shows as ending at the State waters boundary where other State and Federal regulations apply. All leases with approved COPs will include easements shortly after approval. Source: Roberts et al. (2023); Roberts et al. (2016).

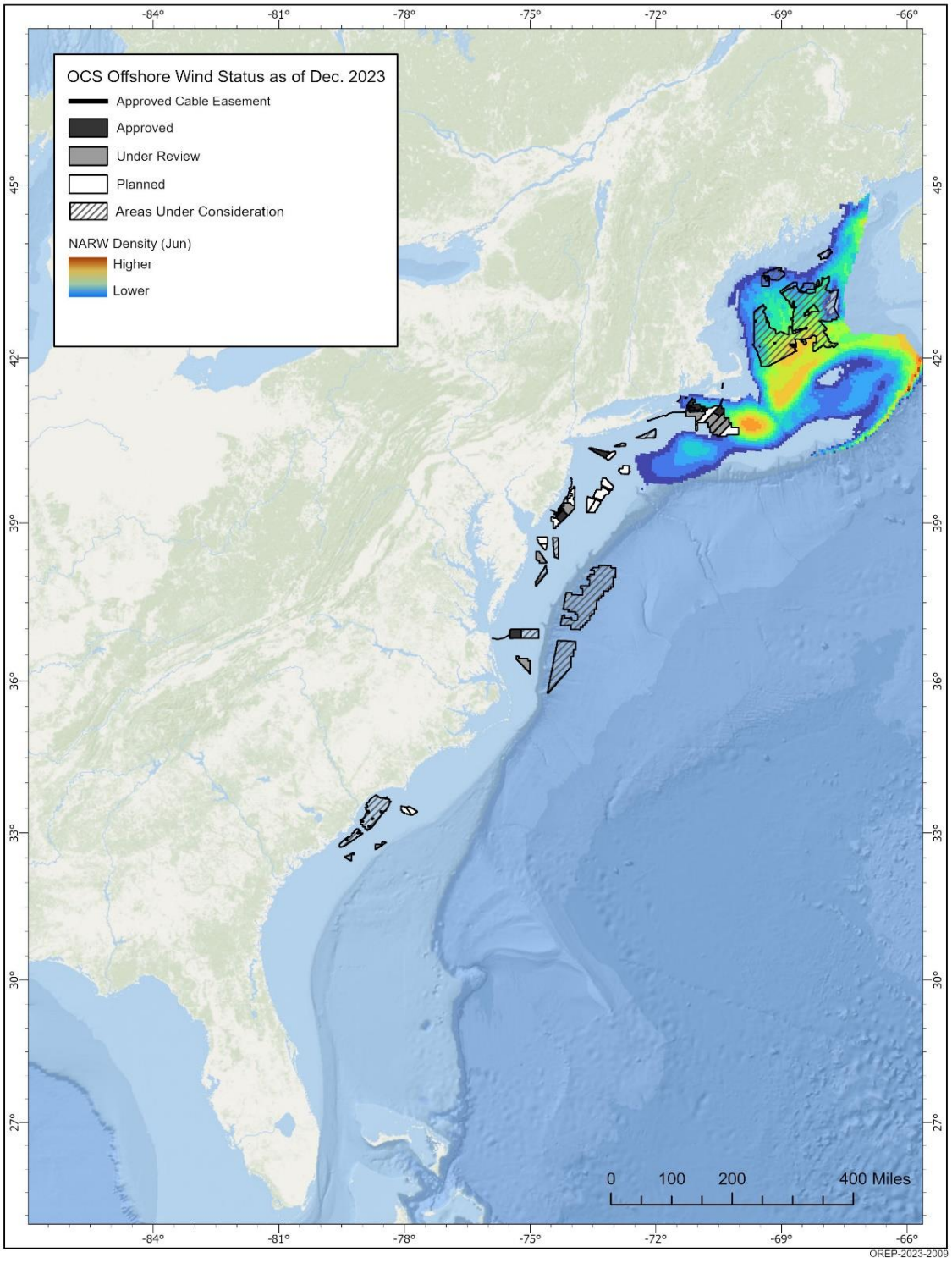

Figure D-6. Density of NARWs in U.S. waters during the month of June (2010–2019)

Narrow lines leading from leases to land are cable route easements. Due to State/Federal jurisdiction, the easement shows as ending at the State waters boundary where other State and Federal regulations apply. All leases with approved COPs will include easements shortly after approval. Source: Roberts et al. (2023); Roberts et al. (2016).

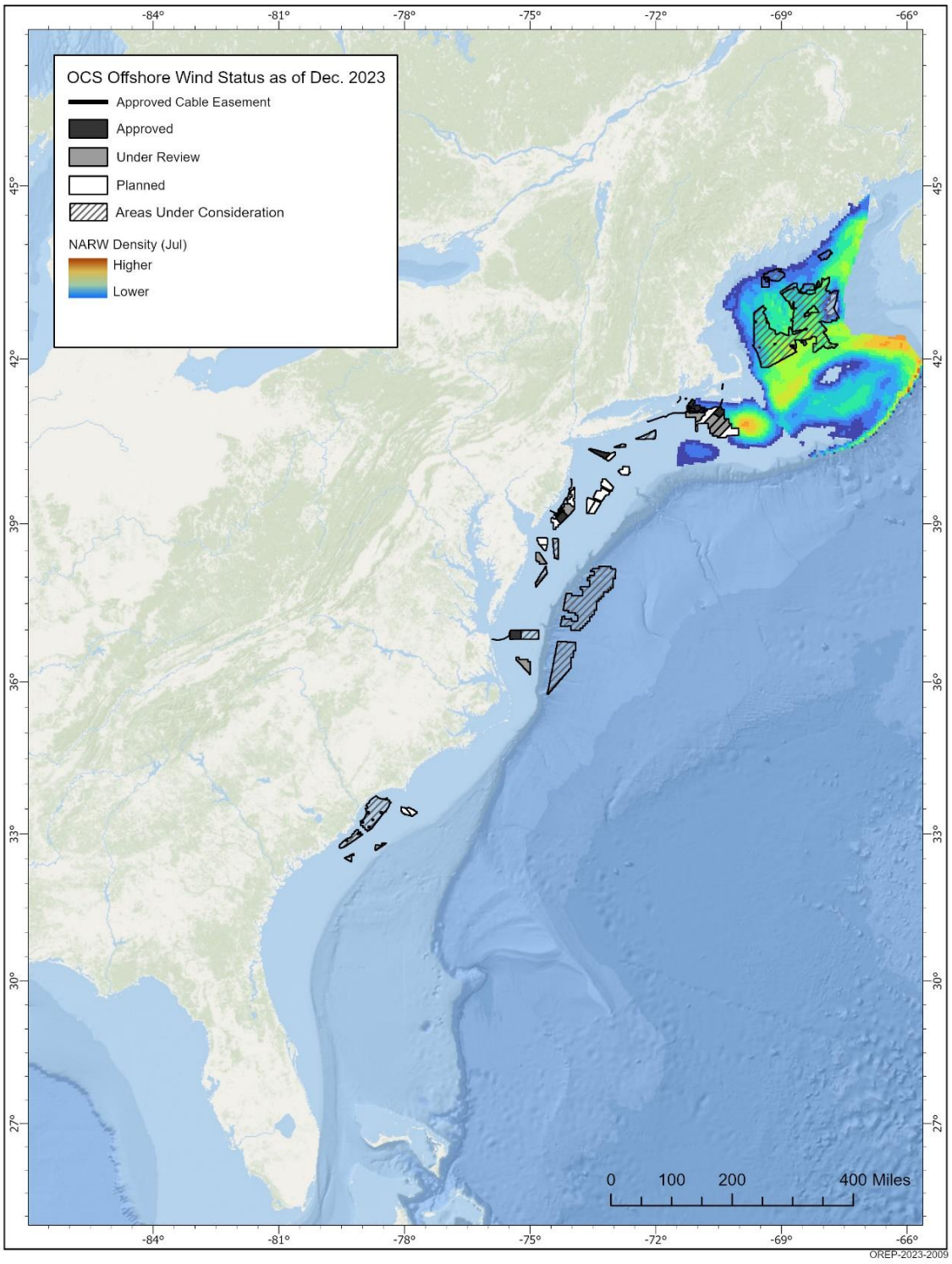

Figure D-7. Density of NARWs in U.S. waters during the month of July (2010–2019)

Narrow lines leading from leases to land are cable route easements. Due to State/Federal jurisdiction, the easement shows as ending at the State waters boundary where other State and Federal regulations apply. All leases with approved COPs will include easements shortly after approval. Source: Roberts et al. (2023); Roberts et al. (2016).

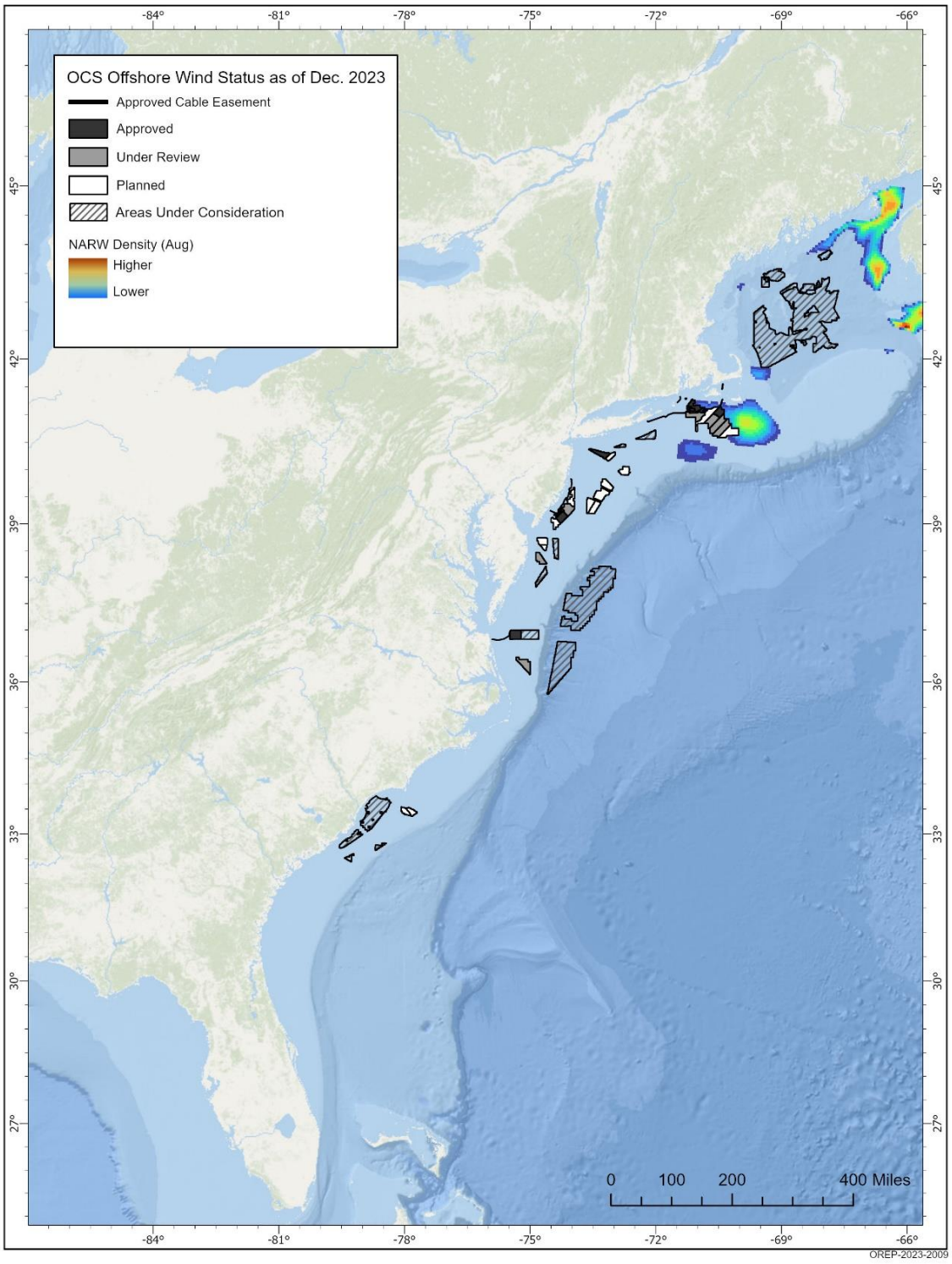

Figure D-8. Density of NARWs in U.S. waters during the month of August (2010–2019)

Narrow lines leading from leases to land are cable route easements. Due to State/Federal jurisdiction, the easement shows as ending at the State waters boundary where other State and Federal regulations apply. All leases with approved COPs will include easements shortly after approval. Source: Roberts et al. (2023); Roberts et al. (2016).

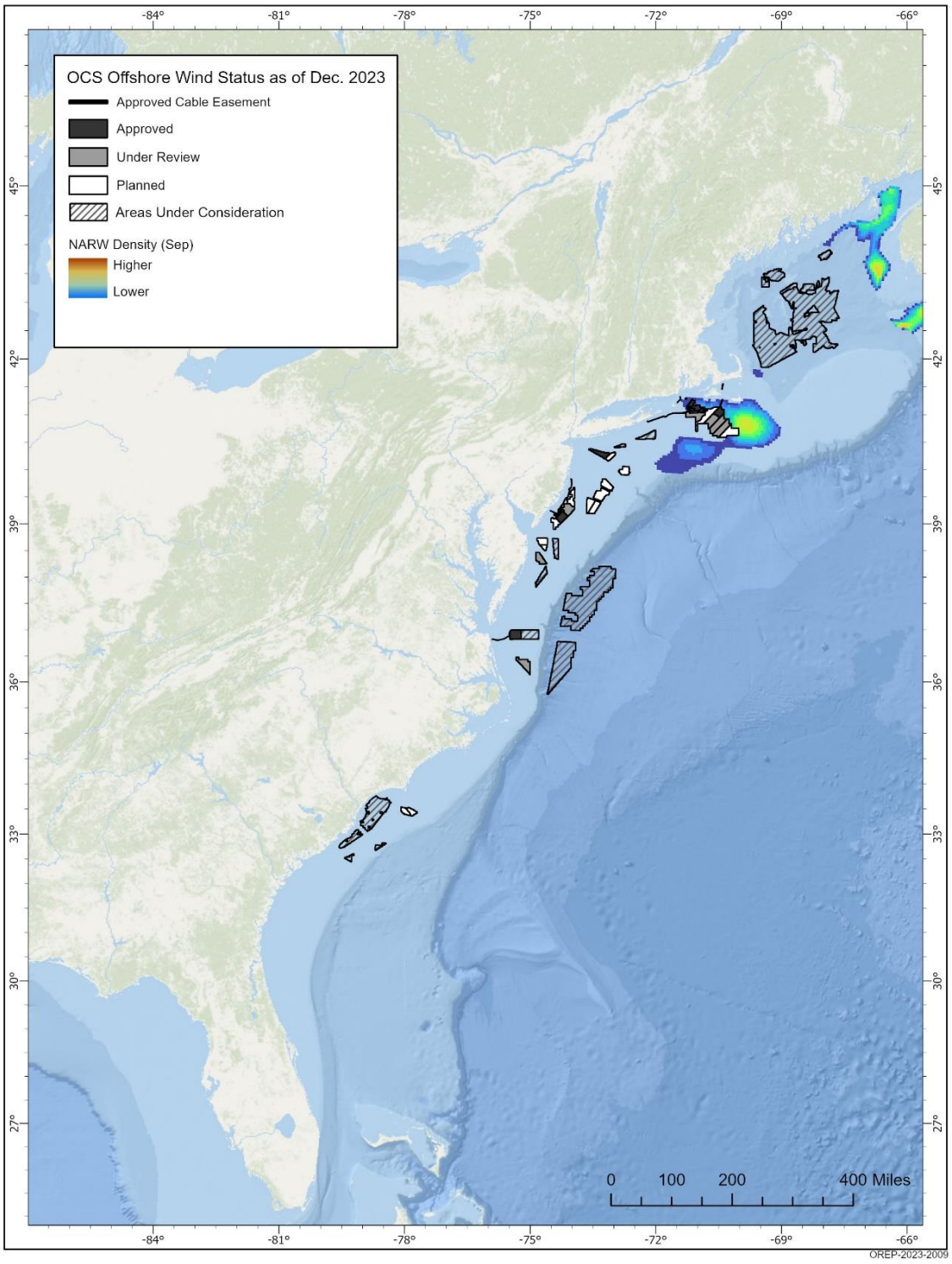

Figure D-9. Density of NARWs in U.S. waters during the month of September (2010–2019)

Narrow lines leading from leases to land are cable route easements. Due to State/Federal jurisdiction, the easement shows as ending at the State waters boundary where other State and Federal regulations apply. All leases with approved COPs will include easements shortly after approval. Source: Roberts et al. (2023); Roberts et al. (2016).

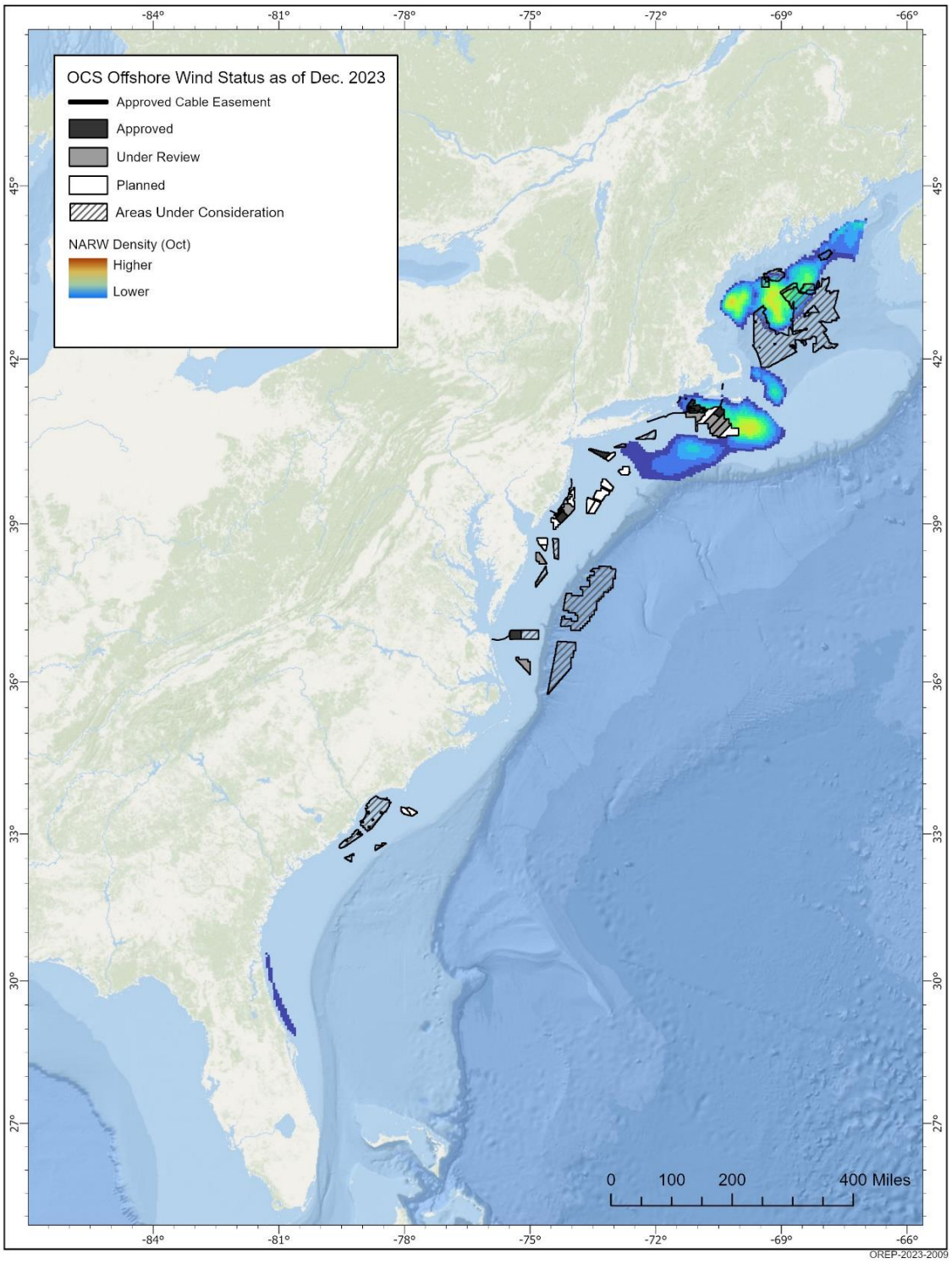

Figure D-10. Density of NARWs in U.S. waters during the month of October (2010–2019)

Narrow lines leading from leases to land are cable route easements. Due to State/Federal jurisdiction, the easement shows as ending at the State waters boundary where other State and Federal regulations apply. All leases with approved COPs will include easements shortly after approval. Source: Roberts et al. (2023); Roberts et al. (2016).

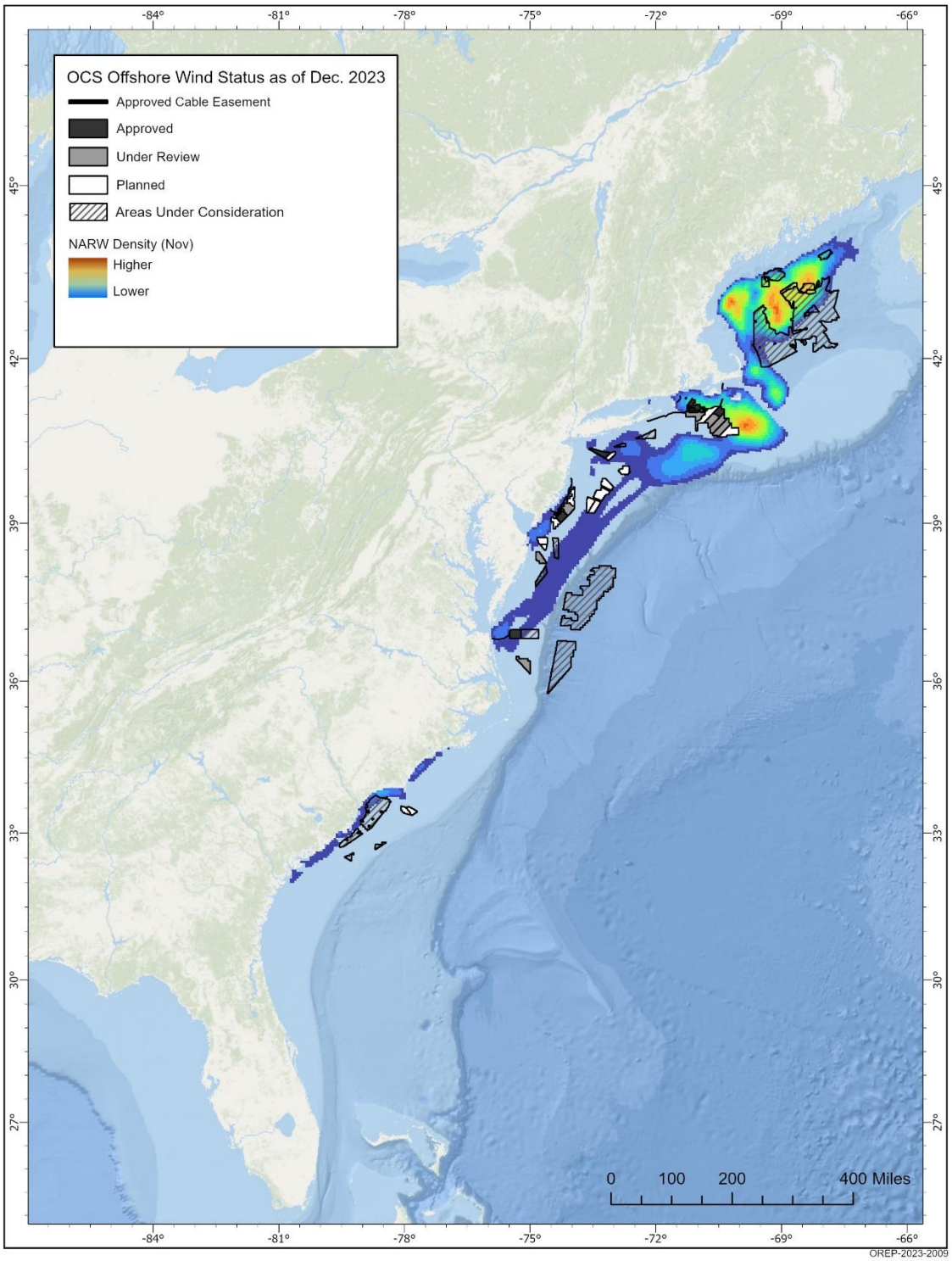

Figure D-11. Density of NARWs in U.S. waters during the month of November (2010–2019)

Narrow lines leading from leases to land are cable route easements. Due to State/Federal jurisdiction, the easement shows as ending at the State waters boundary where other State and Federal regulations apply. All leases with approved COPs will include easements shortly after approval. Source: Roberts et al. (2023); Roberts et al. (2016).

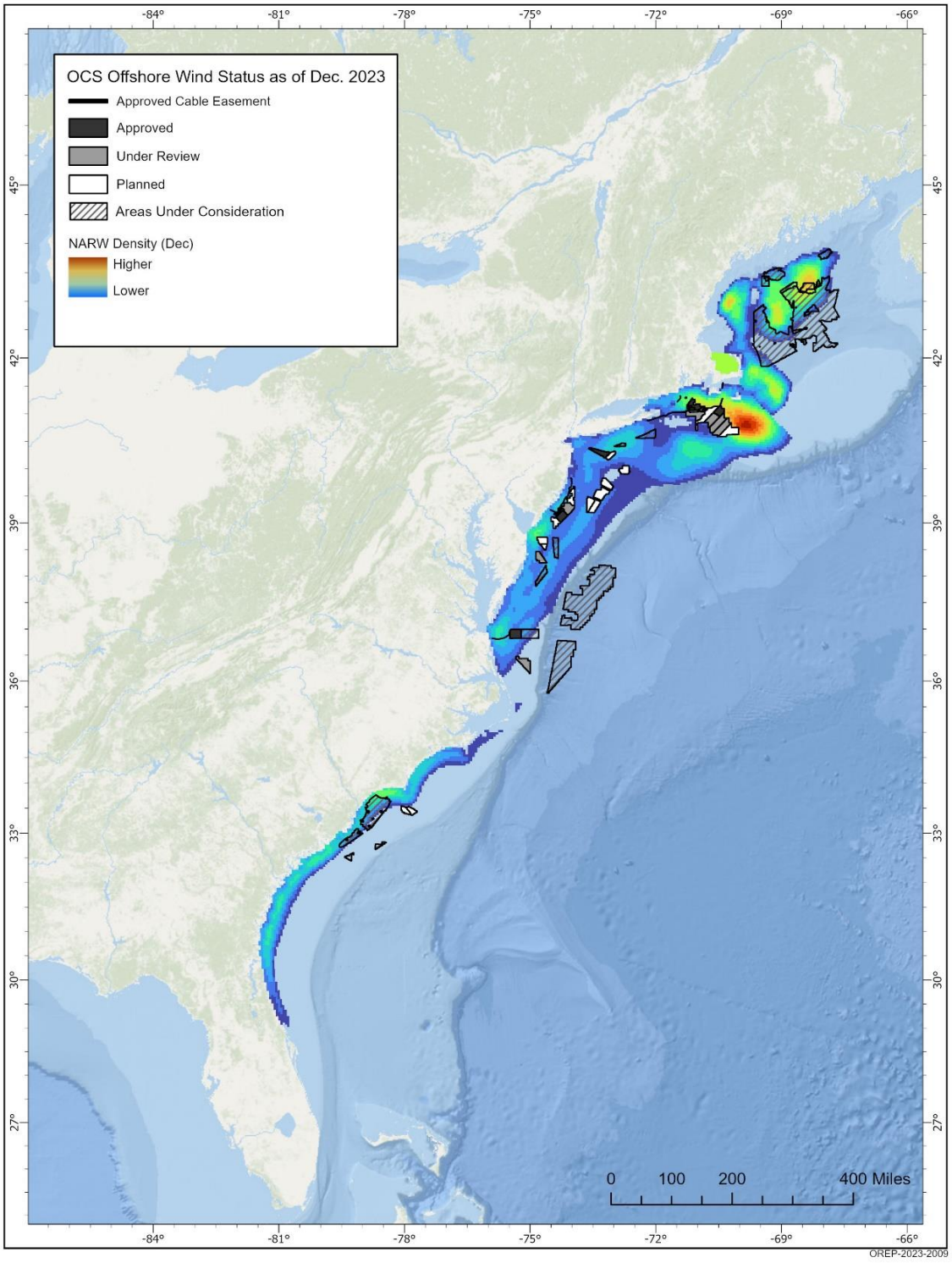

Figure D-12. Density of NARWs in U.S. waters during the month of December (2010–2019)

Narrow lines leading from leases to land are cable route easements. Due to State/Federal jurisdiction, the easement shows as ending at the State waters boundary where other State and Federal regulations apply. All leases with approved COPs will include easements shortly after approval. Source: Roberts et al. (2023); Roberts et al. (2016).

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