Boulder Relocation in Offshore Wind Development: A Framework for Guidance and Policy

This document was developed by the Massachusetts Office of Coastal Zone Management (CZM) and the Massachusetts Division of Marine Fisheries (DMF) on behalf of the Fisheries Working Group on Offshore Wind Energy in consultation with federal and state agency partners. The purpose is to summarize the working group's discussions and recommendations to help inform the development of best practices and regulatory policy for boulder relocation activities connected with offshore wind projects.

The relocation of boulders (i.e., rocks larger than about 0.5 meters [m], though definitions vary)[1] is a component of offshore wind development. Seabed preparation for cable laying and foundation installation activities requires the clearing of boulders in offshore wind lease areas and export cable corridors. Boulders may be moved individually with grabbing equipment or with a plow-like tool that is towed along the seabed to push boulders aside. Dredging and plowing can also bring previously buried boulders to the surface. Impacts from these activities are not completely understood, and regulations are evolving with the emerging offshore wind industry. Regulatory agencies with oversight should articulate policies on boulder relocation to guide developers to best practices for avoiding, minimizing, mitigating, and monitoring any potential impacts.

Potential Impacts

To assess the environmental impacts of boulder relocation for an offshore wind project, the magnitude of disturbance to benthic habitats and seabed topography must be quantified and impacts of this disturbance on marine ecosystems, species, and uses must be characterized. Some impacts from boulder relocation are likely similar to other seabed preparation activities that disturb the seafloor, such as dredging or debris removal, while others are specific to boulder relocation activities. Members of the Fisheries Working Group have raised the following concerns about potential impacts from boulder relocation activities:

Safety Hazards

- Relocated or uncovered boulders that create unexpected hangs and entanglements for fishing gear have the potential to pose significant risks to gear, vessels, and crew.

Habitat and Ecosystem Impacts

- Direct physical harm could occur from boulder movement (e.g., the crushing of benthic or epifaunal species attached to the boulder and at the location of boulder placement).

[1]While the standard Wentworth Scale classifies boulders as rock fragments > 25.6 centimeters (cm), for this document, the Bureau of Ocean Energy Management's size threshold for tracking moved rocks of 0.5 m is used.

- Habitat conversion from sandy substrate to hard or complex bottom at the boulder placement site may be beneficial to some species but detrimental to others.
- Shifts in predator/prey dynamics (e.g., due to new prey refugia or structure that attract predators) could result in changes in species prevalence.
- The spread of invasive species could be facilitated directly (e.g., by movement of invaders attached to a boulder) or indirectly (e.g., by seafloor disturbance creating openings for settlement by invaders).
- The displacement of fishing effort due to boulder relocations could result in increased or decreased impacts from fishing.
- Impacts from seabed disturbance that are not unique to boulder relocation activities—including resuspension of fine sediments and subsequent draping and burial of nearby fauna, as well as disturbances associated with construction noise and construction vessels (e.g., strike risk)—could occur.

Fishery Impacts

- Changes in stock levels (positive or negative) could occur as a result of the habitat and ecosystem impacts listed above.
- Revenue loss could result from reduced total available fishing area for some or all gear types.
- Costs to fishermen could be increased due to damage to fishing gear from hangs and snags.

Avoidance, Minimization, and Mitigation Approach

Regulatory agencies and developers should adopt requirements and industry best practices following a hierarchical approach that prioritizes avoidance, then minimization, then mitigation of the potential impacts of boulder relocation. Regulations should also emphasize monitoring of those potential impacts and, especially where impacts are poorly understood, research on potential impacts and potential mitigation measures. Management options are evolving, but the following approach and specific measures have been recommended through discussions with the Fisheries Working Group:

1. Boulder relocation activities should be **avoided** whenever possible to eliminate any potential impacts. To facilitate this approach, regulators and planning agencies can:
    - Site wind energy projects away from boulder areas.
    - Require sufficient bottom surveys during project planning phases to adequately map and characterize boulder areas.
    - Encourage coordination with resource agencies on cable routes early in the process to ensure that avoiding the need for boulder relocation is considered when identifying cable route alternatives.

- Encourage and facilitate coordination among developers to avoid the need for secondary relocation of boulders (i.e., avoid placing boulders where subsequent projects plan to lay cables), particularly at cable crossings and within shared transmission areas.

2. When boulder relocation cannot be avoided, impacts should be **minimized**; it may be possible to avoid certain impacts when boulder relocation is necessary. Impacts to mariner safety, habitat, fisheries, and other natural and cultural resources should be considered and may need to be balanced against one another. Impacts are likely to be site specific, and the approach to minimization should be tailored to the project in consultation with regulators of all resources involved. Depending on site-specific factors and regulatory priorities, recommended options may include:
    - To avoid creating new hangs, place relocated boulders where mobile gear fishing is precluded, such as with existing boulders or with wind farm infrastructure.
    - To minimize the number of new hangs created, place relocated boulders in groups.
    - To minimize ecosystem disturbance, use relocation methods that reduce harm to benthic organisms and epifaunal growth on relocated boulders; for example, place boulders in the same orientation as the original (e.g., do not flip upside down and bury boulder epifauna) and place boulders gently on seabed to minimize sediment resuspension.
    - To minimize sediment disturbance and berm creation, move individual boulders (e.g., with a grab or pick) rather than plowing.
    - To minimize the extent of habitat conversion and resulting ecological shifts, place boulders in areas where the habitat is similar to the source location.
    - To minimize harm to protected habitats such as hard and complex bottom while also minimizing habitat conversion, place boulders derived from protected habitats adjacent to, but not directly on, other areas of the same protected habitat type.
    - To minimize the risk of invasive species transfer, minimize the overall distance each boulder is moved.

3. When boulders must be moved and after impacts have been minimized, steps must be taken to **mitigate** remaining impacts. Recommended options include:
    - To mitigate safety hazards, communicating final boulder placement to vessel operators effectively and accurately by providing complete data in a timely manner, including:
        - reporting data in an accessible format compatible with mariners' plotters,

    - reporting all boulders 0.5 m and greater (or smaller, depending on fisheries and typical gear used in the area),
    - reporting the sizes of boulders and other relevant data with their location, and
    - reporting initial boulder locations in addition to reporting final locations.
- Exploring options for beneficial reuse of boulders, including using them for or with scour protection and cable armoring or adding them to a new or existing artificial reef.

Monitoring

Monitoring is needed to understand the effects of boulder movement and other bottom disturbance on benthic habitats, species, and uses. Boulder movement monitoring could be incorporated into benthic monitoring plans already required in permitting of most projects or could stand alone if the existing benthic monitoring framework is not suited to assessing boulder concerns. Comprehensive and effective monitoring of boulder relocation impacts should:

- Begin before boulder movement occurs.
- Continue after the disturbance until a return to baseline (or a similar metric) is documented.
- Include videos or photos of exposed boulders to detect the presence of or change in epifauna and invasive species.
- Allow for the detection of species shifts including by invasive species.
- Include surveys that assess habitat usage by commercially important fish species.
- Follow Best Practices for offshore wind monitoring and research, such as those developed for the Habitat and Fisheries Working Groups (see CZM Offshore Wind Publications).

Related Issues

Boulder relocation is one form of seabed disturbance from offshore wind construction and should be considered in the context of other offshore wind-related changes to the seafloor with the potential for habitat and fisheries impacts, including installation of scour protection, cable armoring, and other infrastructure. Boulder safety hazards should be considered in the context of other hazards to fishing gear and survey activities, including the risks of snags on infrastructure and contact with unexploded ordnance and other munitions and explosives of concern.

Current Regulatory Framework and Best Practices

Boulder relocation is regulated in federal waters by the Bureau of Ocean Energy Management, Bureau of Safety and Environmental Enforcement, United States Army Corps of Engineers, and National Oceanographic and Atmospheric Administration, and by the Department of Environmental Protection in Massachusetts state waters. These agencies typically require that offshore wind developers submit plans for the agencies to review prior to seabed preparation, and then submit reports after the planned activities are completed. Regulatory requirements have evolved rapidly over the course of permitting and construction of the first offshore wind projects in U.S. federal waters in response to stakeholder concerns. In particular, requirements for communication of boulder relocations to mariners, guidance on appropriate seabed locations to receive relocated boulders, and survey requirements before and after relocation have been introduced and then refined since the first offshore wind project plan was approved in 2021.

References

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- Revolution Wind Farm Construction and Operations Plan
- Sunrise Wind Farm Construction and Operations Plan
- Moray Offshore Windfarm (West) Limited Boulder and Debris Relocation - Supporting Information (PDF, 1 MB)
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