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Re: Concerns regarding OCS Study BOEM 2020-041 "Comparison of Environmental Effects from Different Offshore Wind Turbine Foundations."

Dear Dr. Boatman,

Our organizations are champions of environmentally responsible offshore wind development and work closely with state and federal agencies, offshore wind developers, and other stakeholders to consider and advise on best management practices for avoiding, minimizing, and mitigating potential environmental impacts associated with site assessment, construction, and operations of offshore wind facilities. The "mitigation hierarchy" of avoidance, minimization, and mitigation has served as our foundational framework for considering how to make all stages of offshore wind development compatible with marine life and existing human uses; following the hierarchy, it is more advantageous to avoid an impact than to minimize or mitigate it.

Pile driving noise during the construction phase has been identified as a stressor of high concern for multiple taxa of marine life, including federally protected species of marine mammals. Avoiding pile driving noise altogether addresses this impact across all taxa and thus unequivocally represents the best practice based on the mitigation hierarchy. Fortunately, there are commercially available options for the construction of offshore wind turbines that do not require pile driving, and thus avoid the noise impacts stemming from this activity. These options currently include various designs of suction bucket (or "suction caisson" or "suction pile"), gravity-based foundations, and gravity/suction hybrids.

Our organizations have long highlighted the value of conducting an independent and in-depth evaluation of the environmental costs and benefits, as well as technical considerations, associated with the suite of commercially available foundation options to better inform responsible offshore wind development in the United States. We were therefore encouraged by the publication of OCS Study BOEM 2020-041 "Comparison of Environmental Effects from Different Offshore Wind Turbine Foundations." However, upon review of the study, it became clear that its contents do not reflect best available knowledge of offshore wind foundation technologies, either in terms of environmental effects or even basic technical

understanding. The reliance on select and outdated sources, and instances where information is omitted entirely, leads to misleading and potentially harmful conclusions.

Our major concerns include the following:

1/ Impacts of noise produced from pile-driving on marine life, including marine mammals, are significantly downplayed, ignore implications for seabirds,[i] and are discussed almost solely in the context of avoidance behavior in the body of the report.[ii] The study is completely at odds with best available scientific information in this regard. The inaccurate framing of noise impacts serves to essentially equalize negative environmental effects across all foundation types and, in doing so, disregards the value of non-pile-driven foundations in effectively eliminating a major environmental stressor associated with offshore wind development. This framing also belies the need for noise mitigation and attenuation when pile driving does occur.

2/ Technical descriptions of gravity-based and suction bucket foundations are inaccurate and learnings from decades of use by the oil and gas industry are entirely overlooked. Depth and substrate limitations represent just two examples of where the Study falls short. The Study inaccurately asserts that gravity-based and suction bucket foundations have a maximum water depth suitability of 30 m and frames monopiles as more suitable for deep waters.[iii] In reality, the opposite is true. Offshore wind gravity-based foundations are already installed at water depths exceeding 30 m[iv] and gravity-based foundations have been deployed in water depths of more than 300 m in the oil and gas context (*e.g.*, "Condeep Troll A platform"[v]). Suction bucket jacket foundations have been successfully deployed for offshore wind in waters far deeper than 30 m and across a range of substrate types internationally,[vi] not just medium stiff clays and fine to medium sand as suggested by the report.[vii] From nacelles and blades to foundations, technology and engineering in the offshore wind energy development space is rapidly advancing and today multiple manufacturers of gravity-based and suction bucket jacket foundations are developing and marketing foundations for use in the US offshore wind market to water depths of 60 m or greater.

3/ Negative environmental effects of gravity-based foundations are based on limited and outdated information (*e.g.*, statements repeated throughout the document in relation to dredging are based on a single study published in 2009)[viii] and do not reflect technological advancements[ix] made by the industry over the past decade to both reduce potential environmental impacts and generate cost savings.

4/ The report touts the attraction effects for seabirds as an environmental benefit. In reality, artificial reefs may not have beneficial effects for seabirds. Enhanced foraging and perching opportunities within a wind turbine array, which might attract seabirds, may also serve to increase collision risk for these species.[x]

In sum, OCS Study BOEM 2020-041 uses insufficient and outdated research, resulting in a misleading document that should not be used as a basis for recommendations pertaining to environmentally responsible offshore wind development in the United States, or as an informational resource on the current status of offshore wind turbine foundation technology. We ask that BOEM withdraw its publication of the study, conduct a full review of the topic, and revise the document according to the concerns outlined above, as well as those of other stakeholders.

Sincerely,

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[i] Anderson Hansen, K., Hernandez, A., Mooney, T.A., Rasmussen, M.H., Sørensen, K., Wahlberg, M. (2020). The common murre (*Uria aalge*), an auk seabird, reacts to underwater sound. The Journal of the Acoustical Society of America 147, 4069–4074. https://doi.org/10.1121/10.0001400

[ii] *See* Section 3.10 "Acoustic Effects," at p. 28.

[iii] *See*, *e.g.*, Table ES-1: "Site Conditions and Foundation Selection," at p. ES-2.

[iv] *See*, https://www.bam.com/en/documents/blyth-offshore-demonstrator-wind-farm.

[v] *See*, https://en.wikipedia.org/wiki/Troll_A_platform.

[vi] *E.g.*, Aberdeen Offshore Wind Farm: complex soils with loose to dense sands over stiff clays with lots of cobbles. This project used fixed 3-leg suction pile jackets at 11 locations in up to 34m water; Seagreen Scotland up to 60m water: very complex soils and highly variable (very stiff to hard clays 300 KPa, very dense sands 60 MPa up to 40 deg and layered soils) and several cobbles, gravel and boulders and bed rock. The sediment layer on top of the bed rock is at several locations only 10m deep. This project uses fixed 3-leg suction pile jackets at 114 locations; Yangxi Shaba, China: 3-leg suction pile jackets in very soft to soft clays in up to 45m water; Fujian Changle Area C: 3-leg suction pile jackets in very soft to soft clays in up to 50m water. 74 suction pile jackets to be installed from October 2020 till September 2021. It's worth noting that suction pile anchors have been installed in waters of 2,500 m depth in the Mississippi Canyon (Sparrevik, P. (2002, January). Suction pile technology and installation in deep waters. In *Offshore technology conference*. Offshore Technology Conference). Available at: https://doi.org/10.4043/14241-MS.

[vii] *See*, *e.g.*, Table ES-1: "Site Conditions and Foundation Selection," at p. ES-2.

[viii] "For example, dredging for foundation pits of gravity foundations can disturb up to 7 percent of the overall windfarm site area (Piere et al. 2009)" at p. ES-1.

[ix] *E.g.,* the "Gravitas" gravity-based foundation can be installed directly on the seabed, whenever possible, to avoid the need to remove or disturb existing sediments. *See*, https://www.arup.com/-/media/arup/files/publications/g/gravitas_brochure_final_press_quality2.pdf; "Rockmat" is a patented technology for the interface between soil and a superstructure (including concrete gravity-based foundations). It consists of a combined grout injection and jack leveling system that requires no site preparation. *See*, http://www.rockmat.com/index_EN.php; Gravity/suction hybrids are also in development that do not require dredging. See, e.g., https://renews.biz/108967/spt-unveils-hybrid-foundation.

[x] Willmot, J., Forcey, G., Kent, A. (2013). The Relative Vulnerability of Migratory Bird Species to Offshore Wind Energy Projects on the Atlantic Outer Continental Shelf: An Assessment Method and Database (Final Report to the U.S. Department of the Interior, Bureau of Ocean Energy Management, Office of Renewable Energy Programs No. OCS Study BOEM 2013-207); Adams, J., Kelsey, E.C., Felis, J.J., Pereksta, D.M. (2017). Collision and displacement vulnerability among marine birds of the California Current System associated with offshore wind energy infrastructure (ver. 1.1, July 2017): U.S. Geological Survey Open-File Report 2016-1154, 116 p., https://doi.org/10.3133/ofr20161154.