Source Levels and Spectral Characteristics of Sound Produced During Pile Driving at US East Coast Navy Installations

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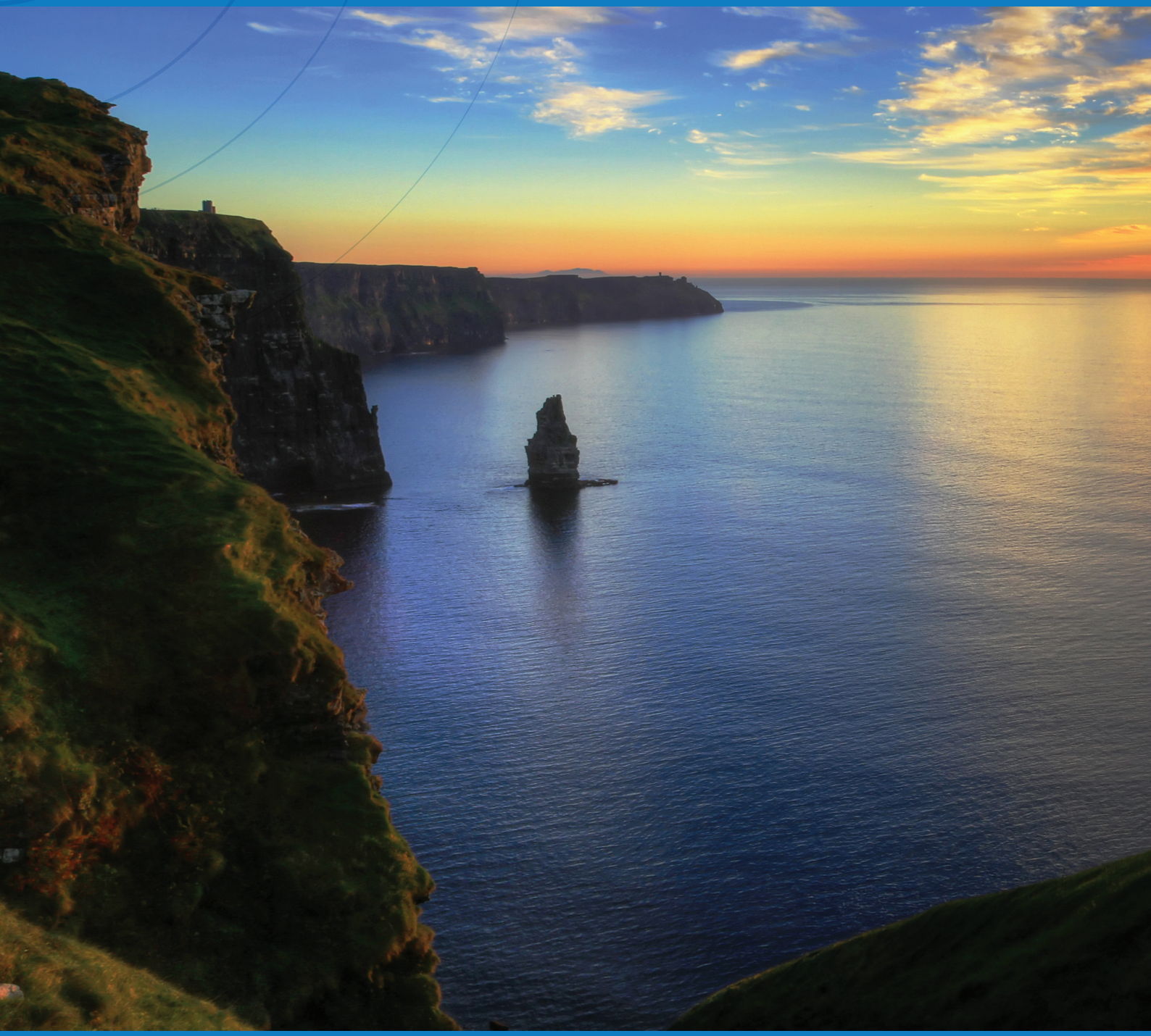
Pile installation and extraction are major sources of underwater noise along coastlines and offshore as a part of facility maintenance, oil and gas extraction, and wind-energy development. In the United States, most pile driving occurs on relatively small piles near the coastline during construction of bridges and piers. These projects often overlap the ranges of marine and aquatic species that may be vulnerable to physiological and behavioral impacts from underwater sound. Efforts to mitigate the impacts of such sound include modeling the estimated ranges to the possible impacts, adding observers to detect protected species and limit driving while they are present, and adding physical mitigations like bubble curtains to reduce sound around pilings. Most of these mitigations depend on knowing the source level of the sound, which can be estimated from measurements of similar pile types in other locations. Although a large database of sound source levels from pile installation exists along the US West Coast, very few measurements of pile-driving source levels have been made in the different bathymetric and geological conditions along the US East Coast. This project utilized the same methods that have been used to gather data from the West Coast to measure sound source levels during pile installation and extraction at five naval installations along the US East Coast. Underwater and airborne measurements were taken from a variety of pile types, including steel pipe, steel H-type, concrete, and timber pilings during both installation and extraction. Additionally, because of changes to the regulatory criteria put forth by the US National Marine Fisheries Service for addressing the potential effects of underwater sound to marine mammals, average spectral data in one-third octave bands were analyzed for the available pile types. Source levels varied with installation method, location, and pile type. Frequency spectra indicated that sound energy is concentrated below 500 Hz but that sound from pile driving can be detected up to at least 20 kHz. Measurements from locations ~200 m from the incident pile allowed for estimation of propagation equations at these locations. Source levels, spectral data, and measurements of time required to install and extract piles will be applied to US Navy compliance efforts to reduce the potential impacts from pile driving on marine species.

CONFERENCE PROGRAM & ABSTRACTS



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