

Spanager – Orehoved kabelforbindelse

Underwater noise from cable laying activities

Energinet

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1 Introduction

In connection with proposed cable laying activities in “Storstrømmen,” this note provides a brief assessment of the potential underwater noise emission.

2 Proposed activities

Cable laying activities are planned for the project area to span “Storstrømmen.” The activities will include a cable laying vessel and might require the use of a USBL system to accurately track the cable positioning on the seabed. No specific equipment models have been selected at this point, and the assessment of underwater noise emission is therefore based on typically used equipment from similar activities.

3 Underwater noise from cable laying activities

A cable laying vessel, using a cable reel, a tensioner, and potentially a burial tool to bury the cable in the seabed, installs the cable along the predetermined route. The underwater noise emission from the cable laying vessel itself is characterized as typical vessel noise, being low frequency in nature, with vessel specific frequency content based on the thrusters, propellers and noise emitted through the hull. To ensure that the cable is positioned precisely along the intended route, a USBL positioning system could be used.

In 2021, a measurement was conducted by JASCO (Pace, Robinson, Lumsden, & Martin, 2021) for Energinet.dk during geophysical survey activities of the Danish Energy Island North Sea project. This survey included the use of a USBL system. A Kongsberg HiPaP 501 transceiver unit was used to determine the position of a towed SSS system, with a “Kongsberg cNODE Micro” transponder unit. It is not known exactly which USBL make, and model is intended for the cable laying activity. It is therefore assumed, that the USBL system to be used is comparable in terms of underwater noise emission, to the one used in the North Sea survey in 2021.

In the 2021 survey the USBL system was operated as follows (Pace, Robinson, Lumsden, & Martin, 2021):

- The transceiver (Kongsberg HiPaP 501) was operated at maximum source level, $SL = 191 \text{ dB re. } 1 \mu\text{Pa}$
- The transponder (Kongsberg cNODE Micro 30-180) was operated at source level, $SL = 170 \text{ dB re. } 1 \mu\text{Pa}$
- Pulse rate (trigger rate): 1.5 Hz (1.5 pulses per second)
- Center frequency of both USBL and transponder units: 25 kHz
- Operational mode: “Transponder mode”
- Directivity: Both transceiver and transponder were omnidirectional.

The study measured, and calculated the impact ranges for the USBL system and related the measurements to the newest threshold metrics for harbour porpoise avoidance behaviour criteria, $SPL_{RMS,125ms,VHF} = 100 \text{ dB re. } 1 \mu\text{Pa}$ (Tougaard J, 2015), as well as to relevant hearing impact thresholds (NOAA, April 2018) in marine mammals. The threshold value for avoidance behaviour has since the completion of the measurements been revised in (Tougaard, 2021), to a value of **103 dB**, thus allowing for 3 dB higher noise levels. As the measurements were compared to a threshold level of 100 dB, this is used for the following assessment considered to be conservative.

In the measurements, impact ranges for the harbour porpoise avoidance behaviour threshold of 100 dB were found to be ~2.7 km for the best fit, and up to ~3 km for the 90% prediction interval. For Temporary Threshold Shift (TTS) in harbour porpoise, impact ranges up to 500 m were calculated, and up to ~17 m for Permanent Threshold Shift (PTS). These impact ranges included several other acoustic sources, so the impact ranges from the USBL system itself are likely shorter.

The measurement results are used as a reference for potential underwater noise emission, as it represents the best data available to date on the underwater noise emission of the USBL system. When using measurement results to assess the underwater noise emission in a different region, it is important to evaluate the environmental differences in between the measurement site and the project area, with regards to the underwater sound propagation. Influencing factors include the bathymetry, sediment composition and the salinity and temperature conditions.

The project area is in a very shallow near-coastal area of Sjælland and Falster, with water depths between 0 m to 13 m. The North Sea measurements were obtained in an area with ~30 m water depth. In terms of sound propagation, this would comparatively imply a significantly stronger attenuation of noise in the project area. Especially at low frequencies (< 200 Hz), the underwater noise emission from the cable laying vessel itself would be reduced significantly faster as low frequency sound propagation is governed primarily by the water depth. For the higher frequencies, stronger attenuation would also occur, however primarily due to increased interaction with the sea surface and seabed, resulting in increased backscatter and absorption.

The salinity in Storstrømmen, is historically significantly lower than in the North Sea, which may lead to an increased sound propagation of especially higher frequency, such as those from the USBL system, however due to the limited water depth, it is not considered likely to have a significant impact in this case.

4 Conclusion

The sound propagation at the project site is likely to be significantly reduced compared to the North Sea measurement location, due to the very shallow bathymetry which results in significant sound transmission loss over distance. It is therefore assessed that the impact ranges previously presented from (Pace, Robinson, Lumsden, & Martin, 2021), can be considered very conservative for the project area. Taking the +3 dB revised threshold value for behaviour reaction in harbour porpoise into account, this further supports the view of conservative impact ranges.

It is thus considered likely, that actual impact ranges for avoidance behaviour in harbour porpoise will not exceed 3 km distance for the proposed equipment types, and that TTS will not occur for harbour porpoise located further than 500 m from the survey at onset. Appropriate soft start procedures are recommended to deter marine mammals to this distance.