



The use of seal scarers during offshore pile driving – an effective mitigation measure for harbour porpoises (*Phocoena phocoena*)?



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INTRODUCTION: Pile driving noise emitted during offshore wind farm construction can potentially harm marine mammals. In order to avoid any physical damage in porpoises and seals the use of seal scarers during offshore windfarm construction is mandatory in German waters. However, little information exists as to how far deterring effects of seal scarers on harbour porpoises reach and existing knowledge is ambiguous.

METHODS: We investigated the spatial and temporal effect of a Lofitech seal scarer on the acoustic activity of harbour porpoises. We deployed 16 C-PODs at different distances (0.75 to 7.5 km) to the seal scarer, which was deployed in the middle (Fig. 1). We conducted 10 trials during which the seal scarer was activated for 4 continuous hours. Trials were separated by at least 4 days between them. Data were analysed using porpoise positive minutes per 3 hours (PPM/3H). Porpoise activity **prior**, **during** and **after** the seal scarer deployment were compared using a non-parametric Friedman test for several dependent samples.

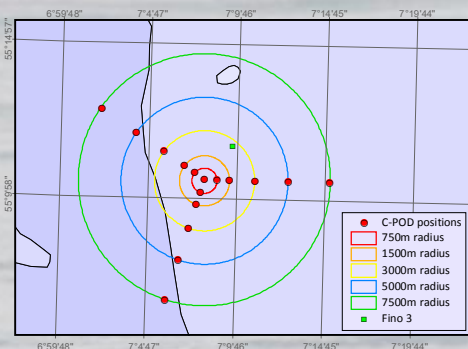


Fig. 1: Map showing the POD-positions. The seal scarer was deployed next to the POD in the middle.

RESULTS: Porpoise acoustic activity recorded by C-PODs was significantly lower at the three hours **during** seal scarer activity than at the three hours **before** and **after** it at all distance categories apart from the 5 km distance (Fig. 2). However, considering only the trials with porpoises presence before seal scarer deployment, porpoises were recorded at least 30 min after the start of seal scarer activity during 14-63% of these trials (Tab. 1). On average, porpoise activity was reduced by 95 % to 67 % depending on distance (Tab. 1).

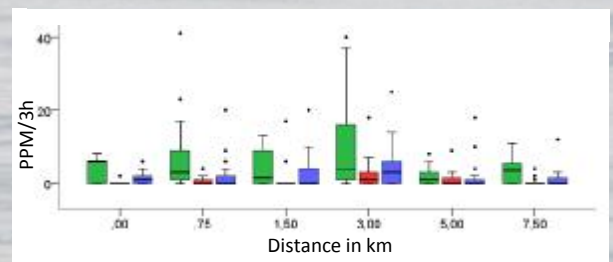


Fig. 2: Porpoise positive minutes per three hours **before**, **during** and **after** seal scarer deployment. Differences were significant at all distances apart from 5 km.

DISCUSSION: These results point to a far reaching effect of seal scarers on porpoise abundance. Why there was no effect at 5 km distance but at 7,5 km distance remains unclear. However, the use of seal scarers does not guarantee the complete absence of porpoises from the near vicinity of pile driving. Possibly individuals react differently, or animals may not be able to accurately locate the sound source. Future measures of seal scarer sound propagation and a visual study on harbour porpoise reaction to seal scarer sound will address these issues.

Tab. 1: The percentage of trials during which porpoises were recorded at least 30 min after the start of seal scarer activity and the magnitude of reduction in PPM/3h. Only trials with recorded porpoise activity before the start of seal scarer activity were considered.

Distance	N	% with porpoise activity	Mean reduction in % PPM/3h
0,0 km	7	14 %	95 %
0,75 km	23	35 %	68 %
1,5 km	11	63 %	80 %
3,0 km	14	58 %	79 %
5,0 km	14	43 %	67 %
7,5 km	11	18 %	82 %



CONCLUSIONS: Preliminary results show that while seal scarers reduce porpoise activity they do not completely deter harbour porpoises from the zone of injury during pile driving. This highlights the necessity for further evaluations and developments of mitigation measures.