



Harbour porpoise detection rates decreased from up to one day before pile driving for the offshore wind farm *Global Tech I*

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INTRODUCTION

Many studies based on passive acoustic monitoring showed pronounced negative effects of pile driving by hydraulic hammers for the construction of offshore wind farms on harbour porpoise (*Phocoena phocoena*). However, effects of human activities before pile driving might also be important.

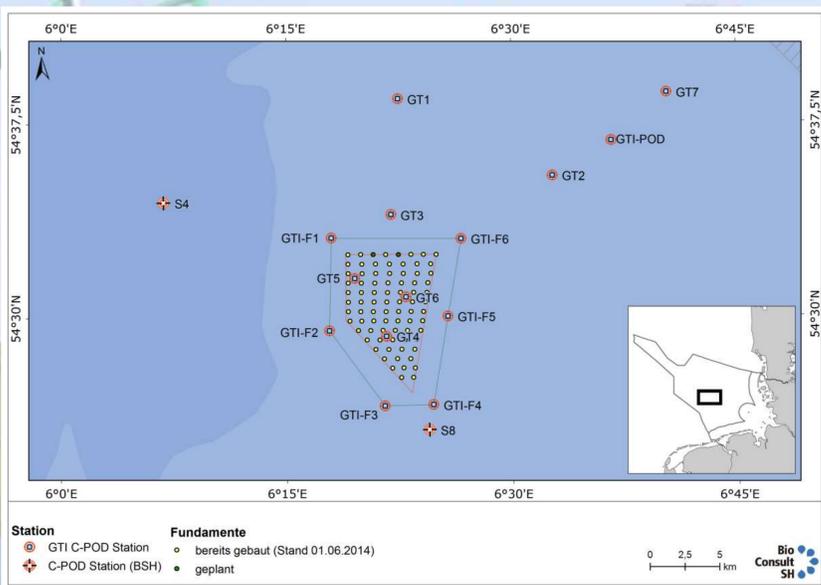


Figure 1: Offshore wind farm GTI area in the German Bight (North Sea), and positions of 16 C-POD stations around and within the wind farm area (not all C-POD stations operated during the whole project period from 2012-2014).

METHODS

For the construction of the German offshore wind farm (= OWF) *Global Tech I* (GTI), positioned about 90 km offshore in the German North Sea at around 40 m depth, 80 tripod foundations were driven into the seabed between 2012 and 2014. Porpoise activity in the study area was monitored by acoustic porpoise detectors (so-called C-PODs) at 16 stations positioned at different distances to the wind farm area (Fig. 1).

RESULTS AND DISCUSSION

Contrary to the common assumption that negative effects of OWF construction activities on harbour porpoise only start with deterrence and pile driving, a decrease in detection rates of porpoise clicks at OFW *Global Tech I* was observed up to 24 hours before pile driving started (Fig. 2), reaching up to several kilometres from construction sites (Fig. 3). Among factors to be considered with respect to the observed pre-piling decrease of harbour porpoise detection rates are:

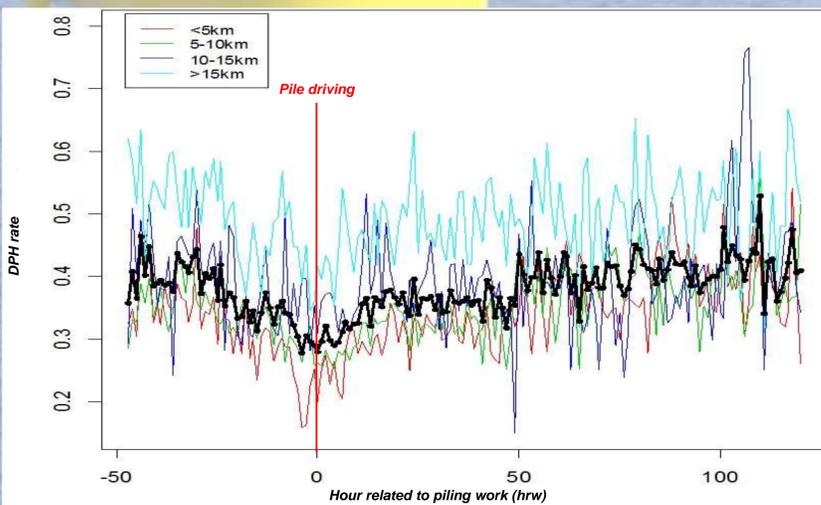


Figure 2: Average detection-positive hours (DPH) rate (max=1) at different distances from piling (mean: black line), and with respect to hours related to piling work (hrw: piling = hour 0); a remarkable decline of DPH rates occurs before piling, especially at close range (< 5 km).

- a) Enhanced ship traffic in the area before pile driving.
- b) Vibratoric pile driving which started 4-12 hours before pile driving and showed highly variable noise levels.
- c) Anticipatory behaviour of harbour porpoise driven by unknown triggers.
- d) Wind speed seems to be positively correlated with detected porpoise clicks → more effort needed to exclude a methodological problem.

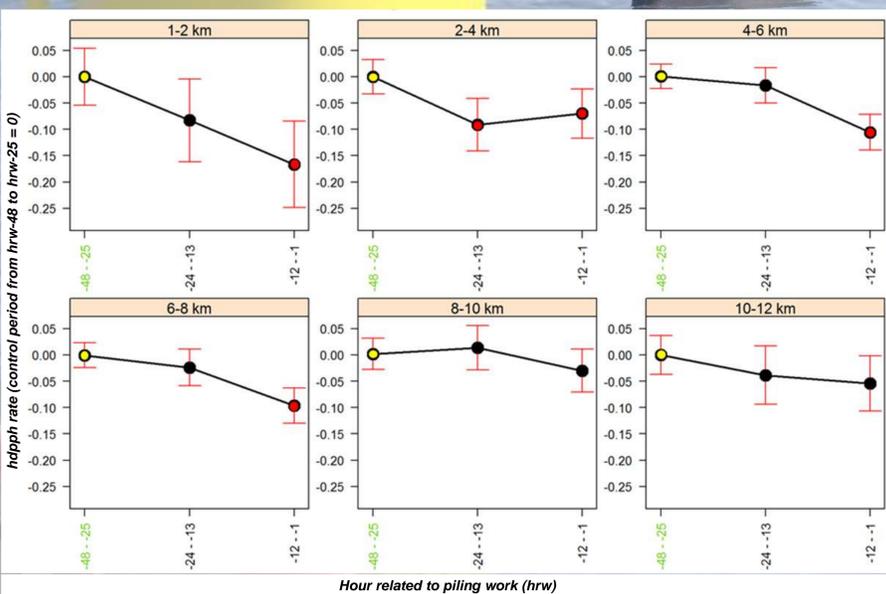


Figure 3: GLMM-modeled porpoise detection rates hdpbh, for different periods before piling, and for different distances from piling location; hdpbh rates are a special form of DPH rates standardised for a control period 24-48 hours before piling (for which detection rates are set to zero; yellow points); significant negative deviations of detection rates from those of the control period are marked in red; negative effects of unknown causation can be seen for the last 12 hours before piling started, up to 8 km distance from pilings.

CONCLUSIONS

Enhanced ship traffic, vibratoric pile driving and/or anticipatory behaviour of animals, potentially reduced harbour porpoise detection rates (C-PODs) around turbine foundations for the offshore wind farm *Global Tech I* before pile driving by hydraulic hammers started.