

**From:** Dominika Phillips <DOMPH@orsted.co.uk>

**Sent:** 08 February 2019 21:13

**To:** KJ Johansson <KJ.JOHANSSON@planninginspectorate.gov.uk>; Kay Sully <Kay.Sully@pins.gsi.gov.uk>; Hornsea Project Three <HornseaProjectThree@pins.gsi.gov.uk>

**Cc:** Andrew Guyton <ANGUY@orsted.co.uk>; Stuart Livesey <STLIV@orsted.co.uk>

**Subject:** Hornsea Project Three (UK) Ltd response to Deadline 6 (Part 6)

Dear Kay, K-J

Please find attached the 6<sup>th</sup> instalment of documents.

Best regards,

**Dr Dominika Chalder PIEMA**

Environment and Consent Manager



Environmental Management UK; Wind Power  
5 Howick Place | London | SW1P 1WG



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Hornsea Project Three  
Offshore Wind Farm



## Hornsea Project Three Offshore Wind Farm

Appendix 20 to Deadline 6 submission –  
Graham et al., 2018

Date: 8<sup>th</sup> February 2019

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Ørsted

5 Howick Place,

London, SW1P 1WG

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Front cover picture: Kite surfer near a UK offshore wind farm © Ørsted Hornsea Project Three (UK) Ltd., 2019.



# Porpoise displacement at different noise levels during construction of an offshore windfarm

**I.M. Graham**  
B. Cheney  
T.R. Barton  
P.M. Thompson

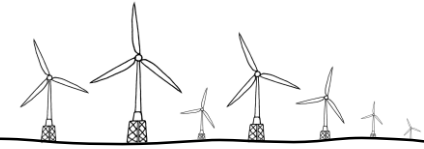


A. Farcas  
N.D. Merchant

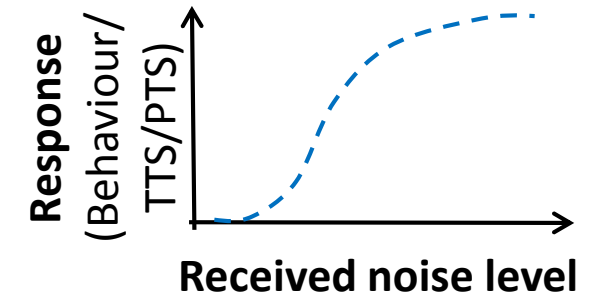
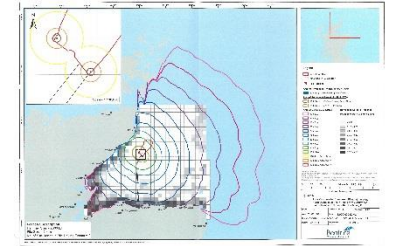




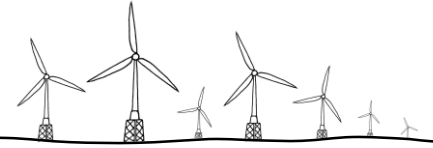
# Context: modelling population impacts



1. Model spatial variation in animal distribution and received noise levels
2. Use noise exposure criteria to estimate number of individuals disturbed or with PTS
3. Estimate how disturbance or PTS affects an individuals' reproductive probability or mortality risk
4. Apply these changes in a population model to explore longer term trends in relation to baseline



# Key Questions

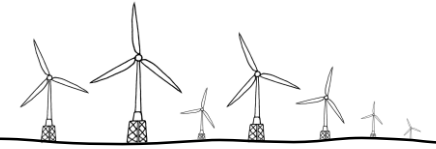


1. How do porpoise responses to piling vary in relation to:
  - a) received noise levels?
  - b) distance from piling?
  - c) piling duration?
  - d) time since the start of construction?
2. To what extent is this response modified by ADD use prior to piling?

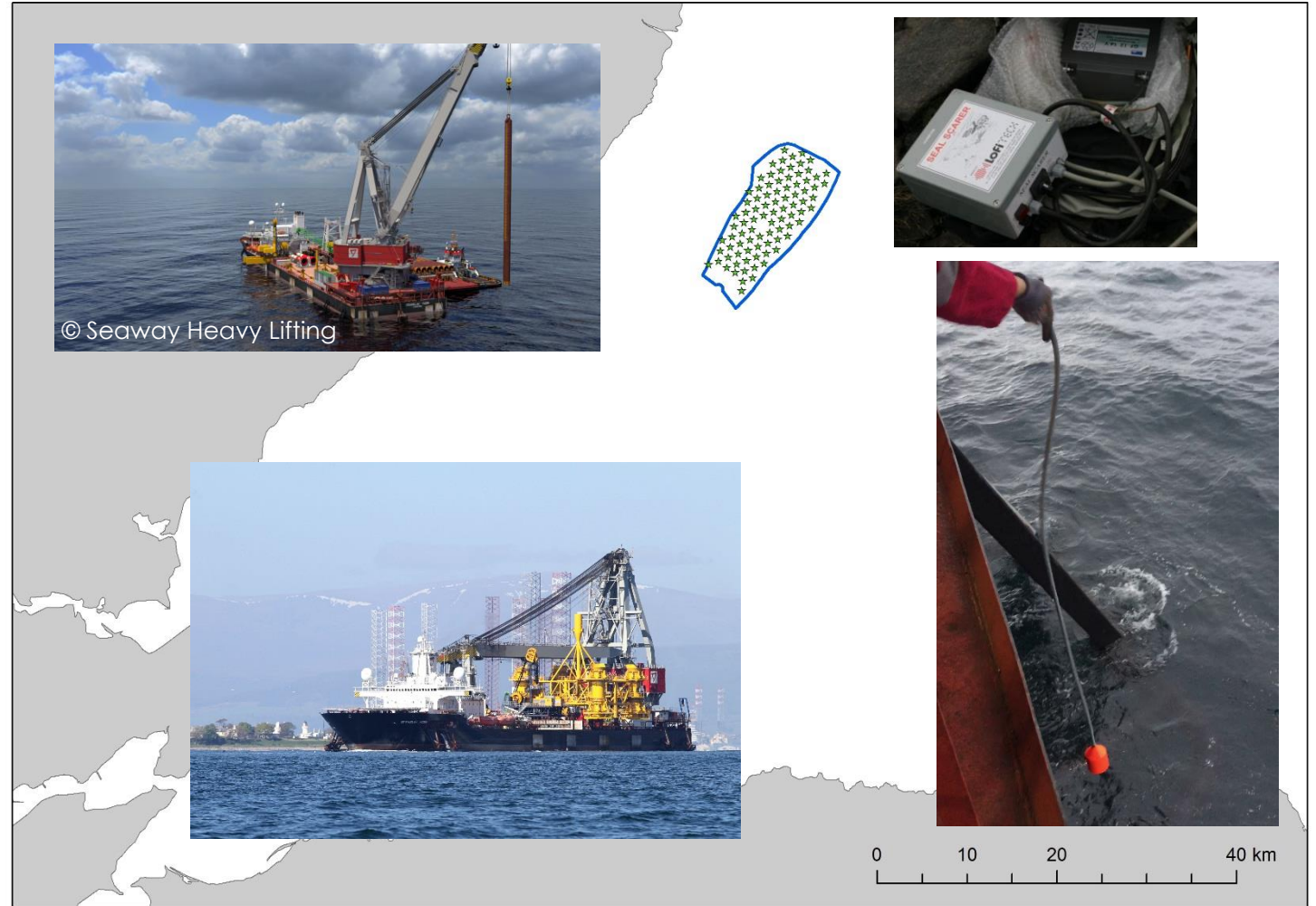
**Aims to address key questions that emerged during the development of the Piling Mitigation Protocol**



# Beatrice Offshore Wind Farm



- 84 turbines (7MW)
- 2 Offshore Transformer Modules
- Piling started April 2nd





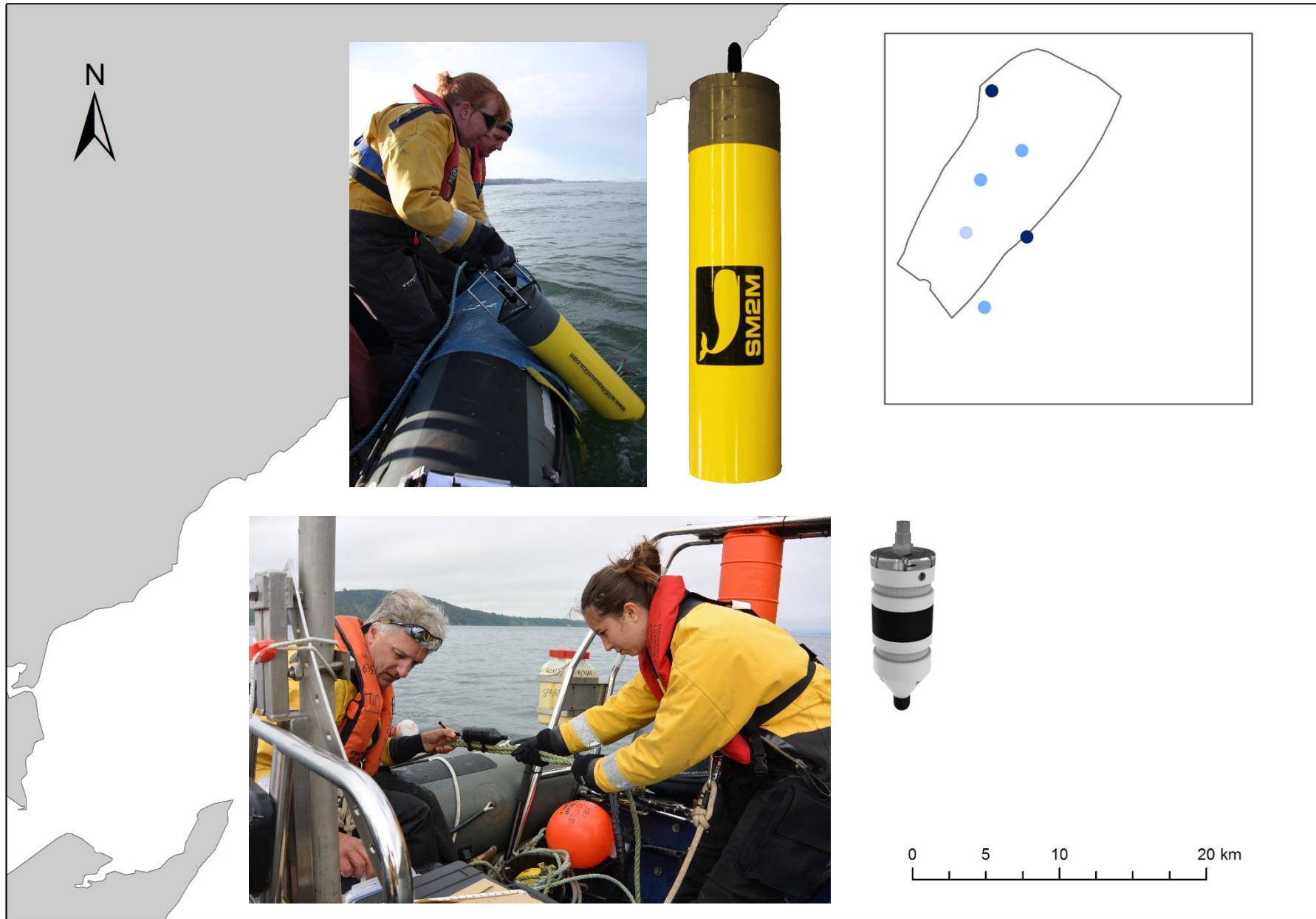
# Noise recorders:

Mar – Oct 2017

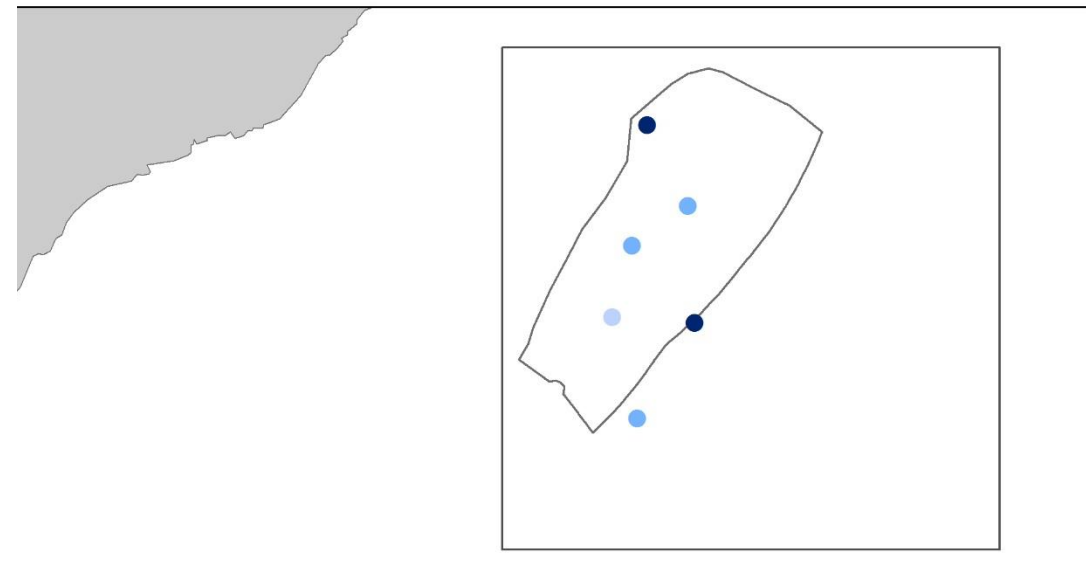
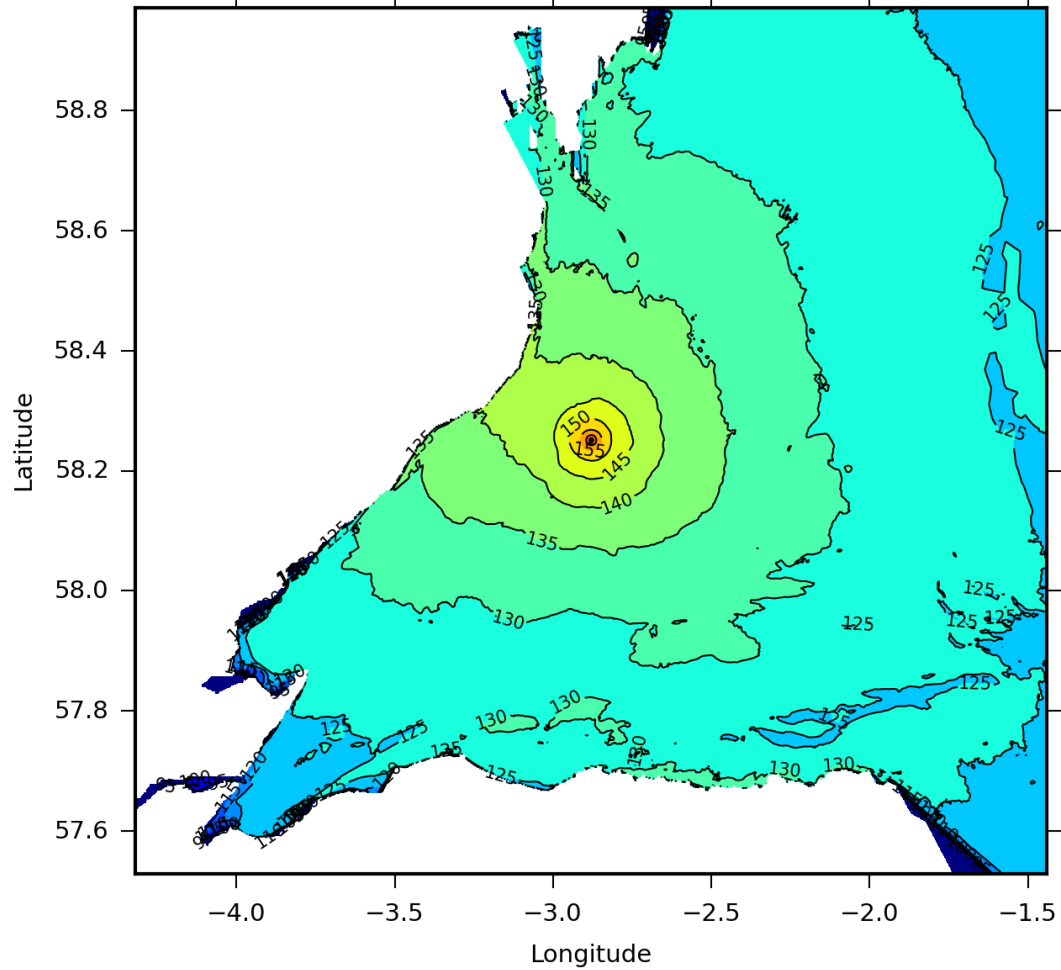
10 deployments

@ 6 locations

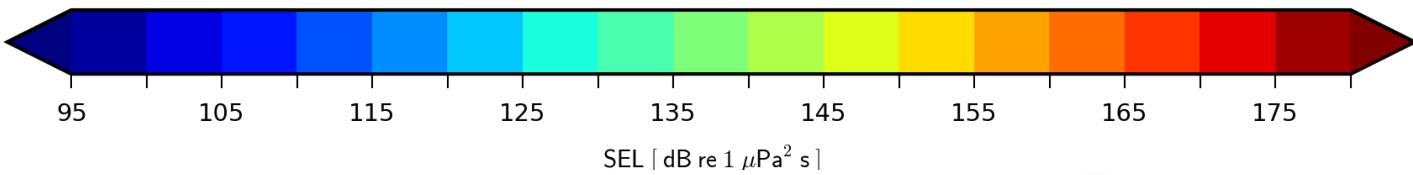
All retrieved



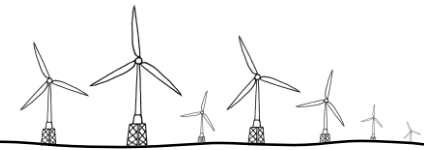
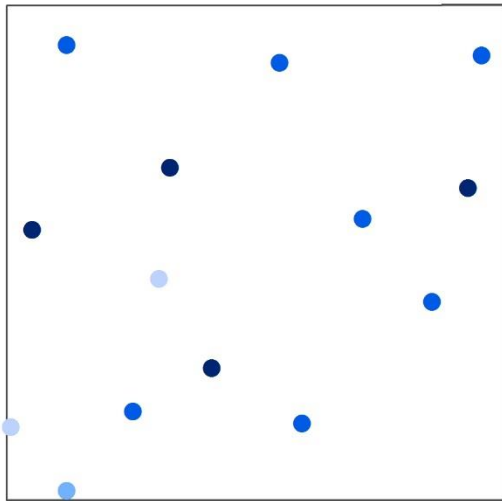
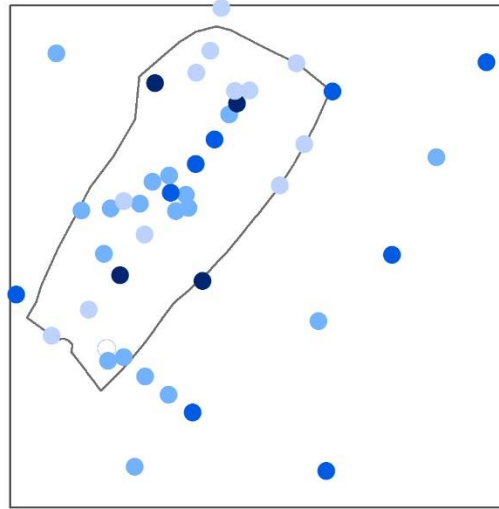
Single-pulse sound exposure level



**Received single-pulse  
sound exposure levels**







## CPODs:

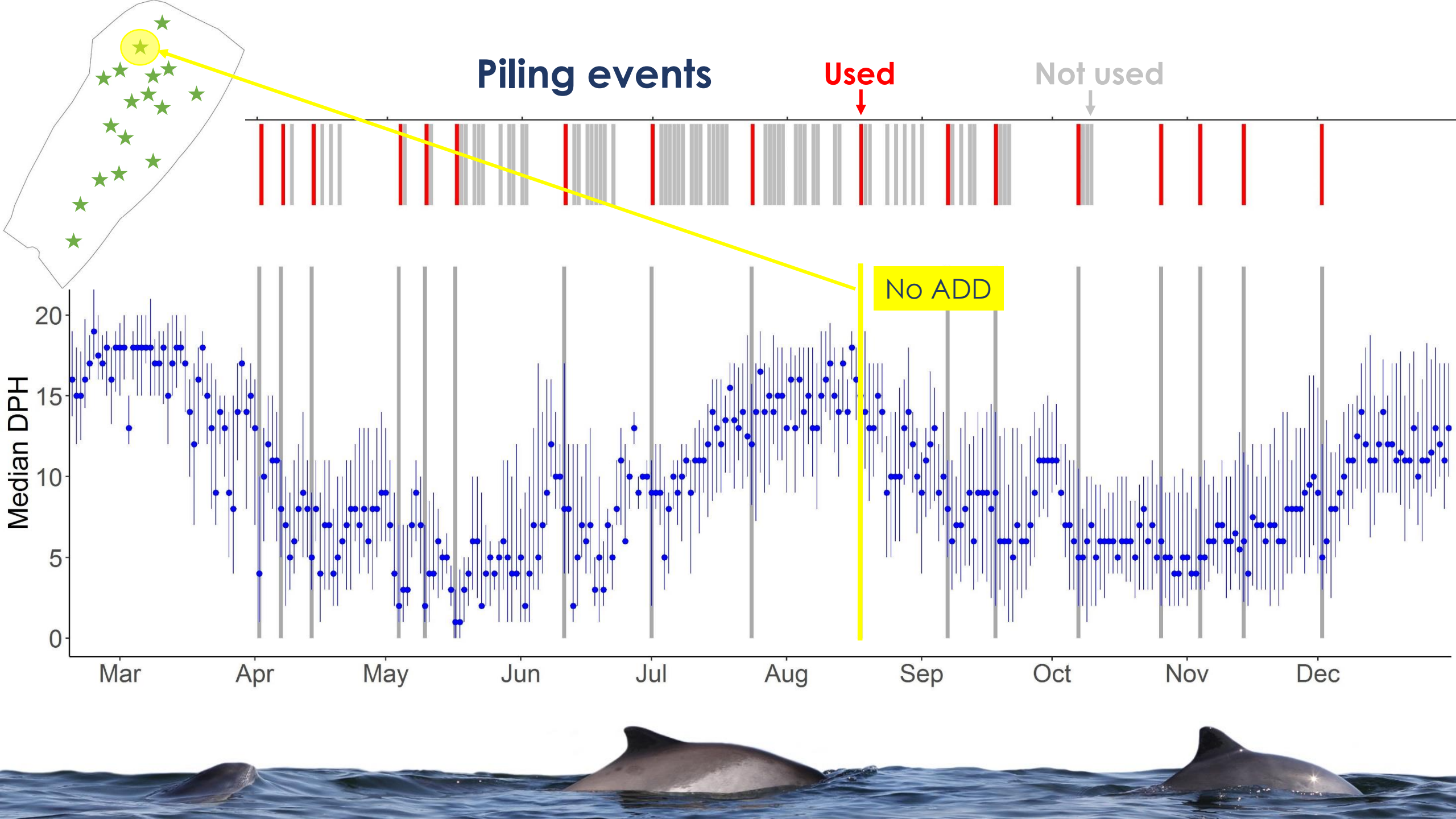
Feb – Dec 2017

105 deployments

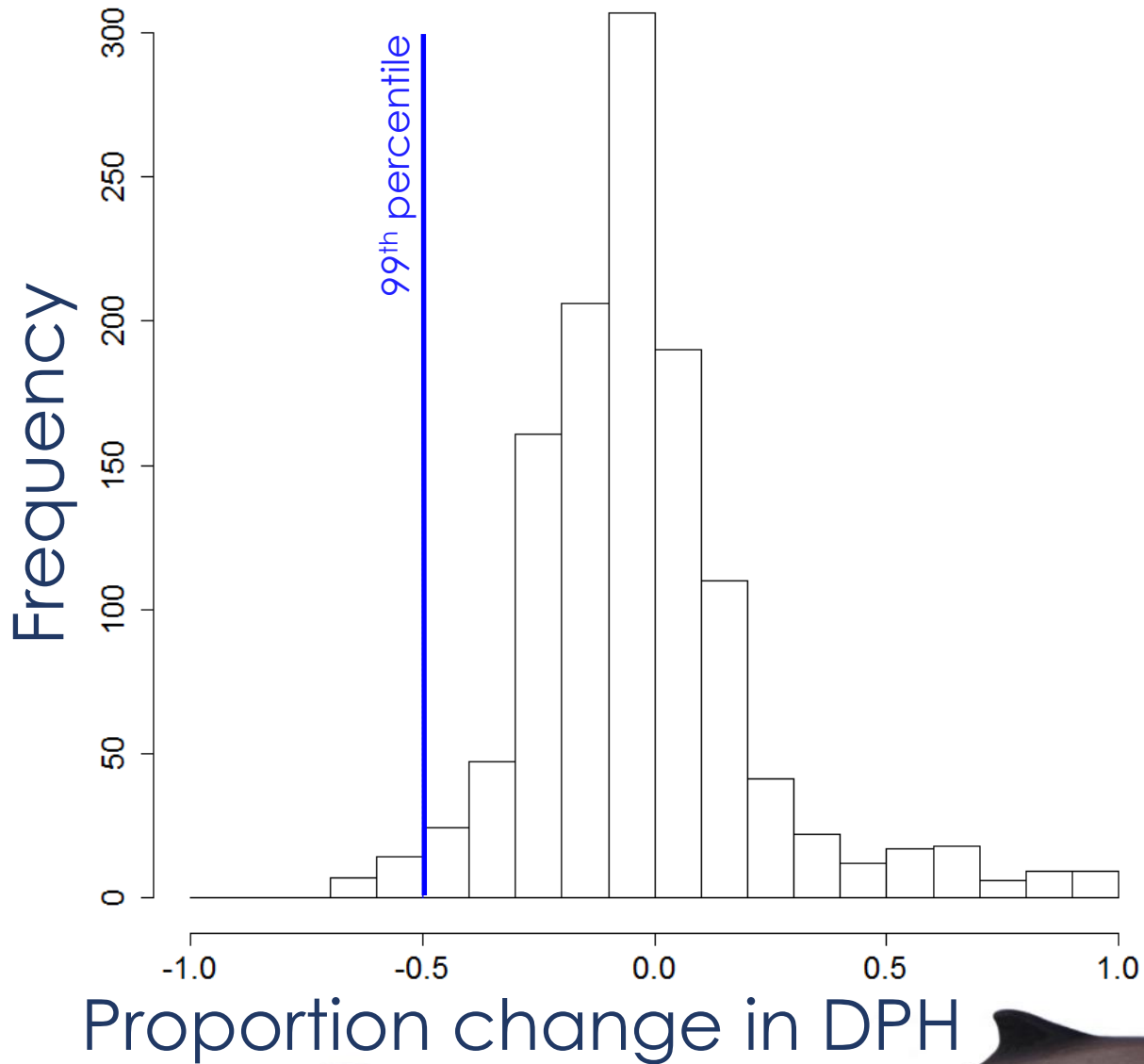
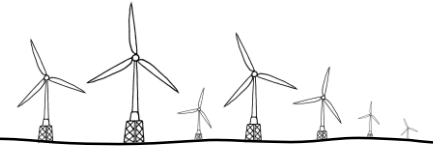
@ 68 locations

Only 5 lost/failed





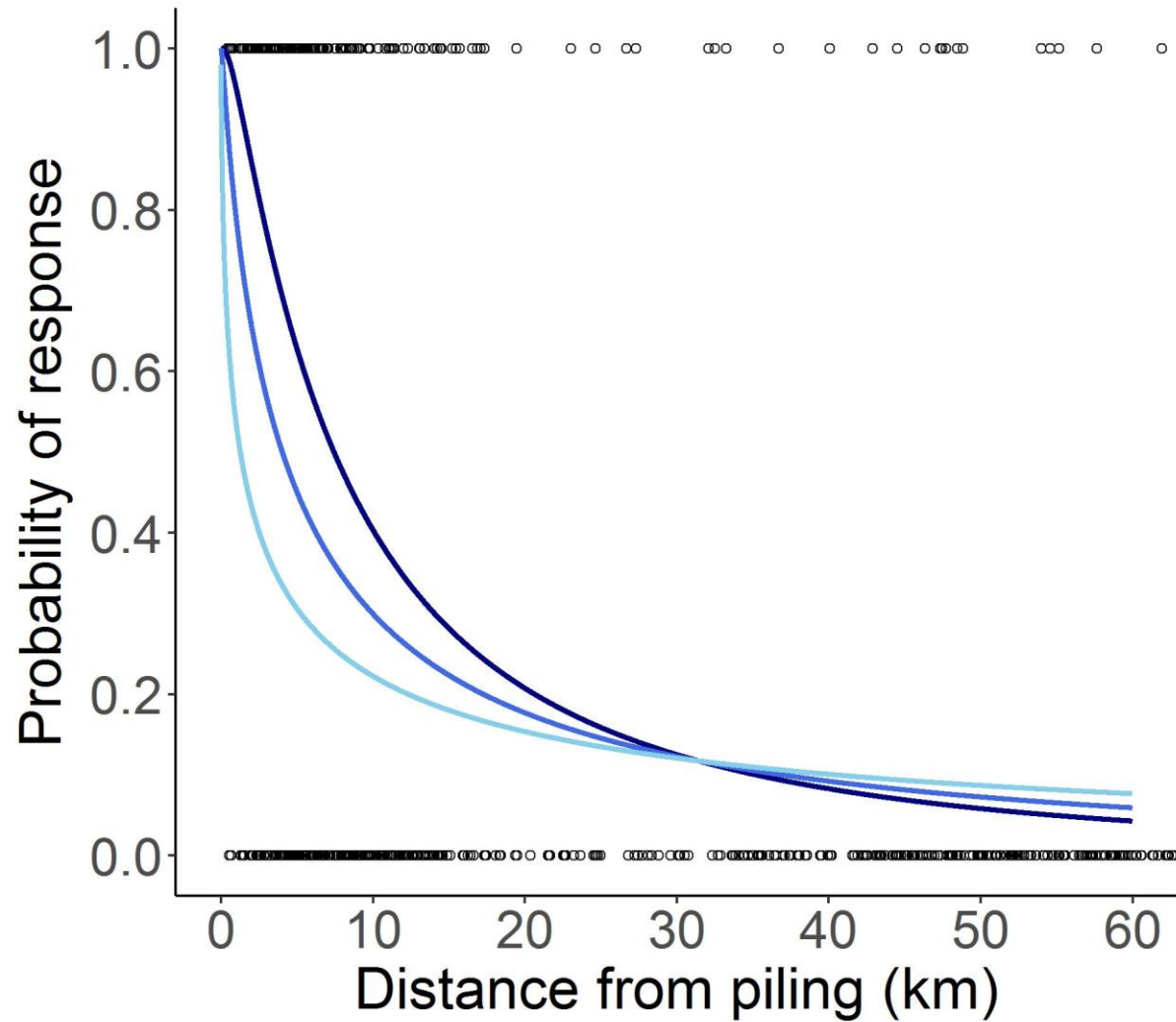
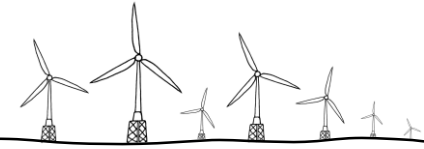
# What is a response?



- Baseline distribution of proportion change
- 99% values  $> -0.5$
- Response defined as:  
Proportion change in DPH  $\leq -0.5$



# Response to piling (and ADD)



... decreases ~~over~~ ~~at~~ ~~is~~ ~~time~~

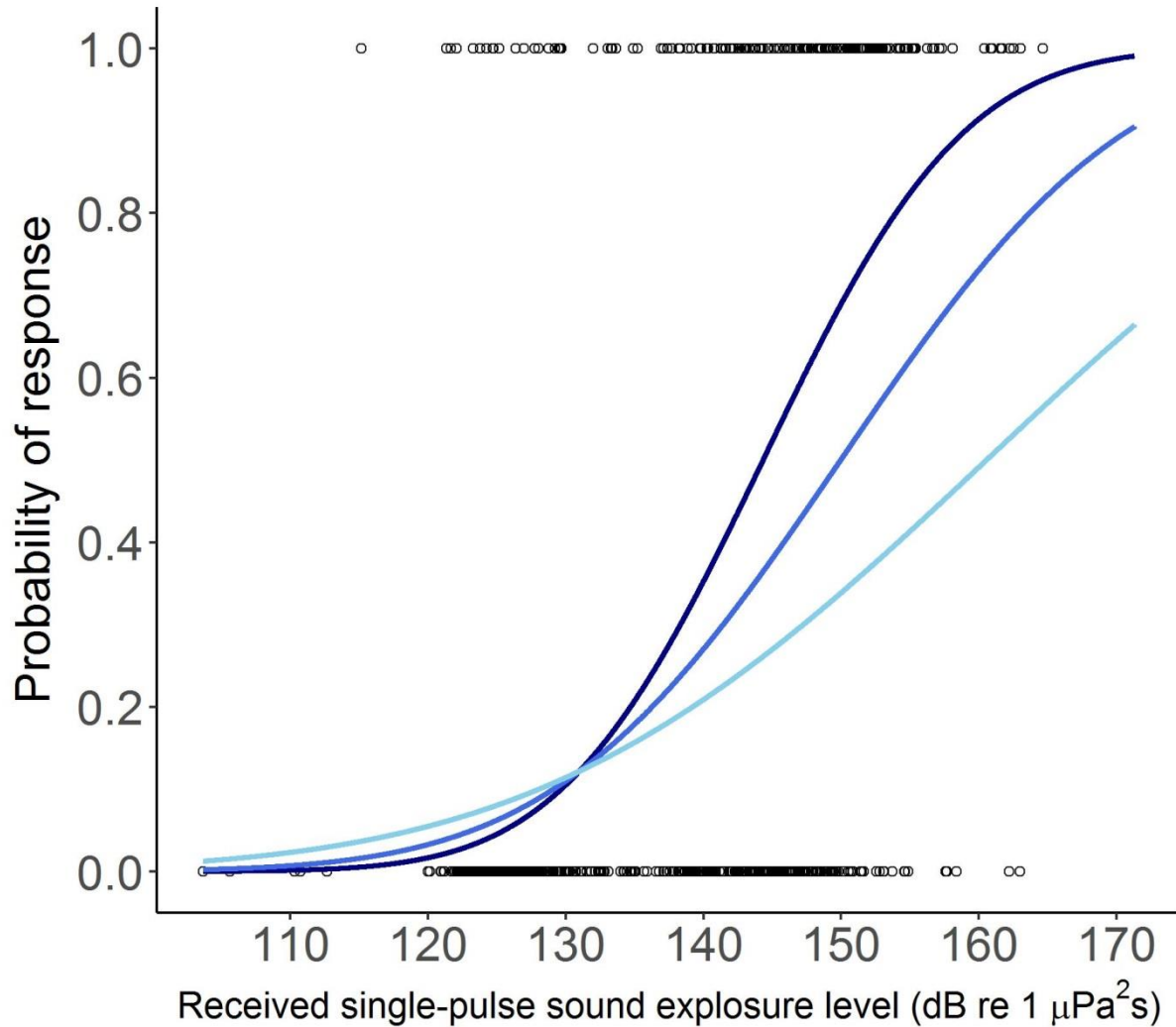
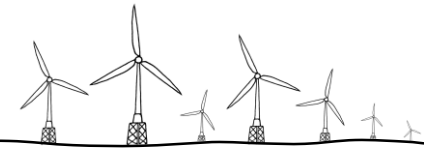
**50% Response (24 h)**

Date	Turbine	Distance (km)
<b>2 Apr</b>	<b>1<sup>st</sup></b>	<b>7.4</b>
<b>24 Jul</b>	<b>47<sup>th</sup></b>	<b>4.0</b>
<b>2 Dec</b>	<b>86<sup>th</sup></b>	<b>1.3</b>





# Response to received noise levels

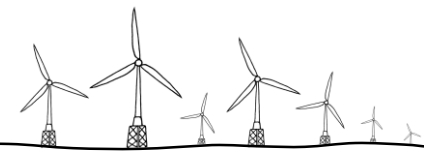


## 50% Response (24 h)

Turbine	> SEL (dB re 1 $\mu\text{Pa}^2\text{s}$ )
<b>1<sup>st</sup></b>	<b>144.3</b>
<b>47<sup>th</sup></b>	<b>149.9</b>
<b>86<sup>th</sup></b>	<b>160.5</b>





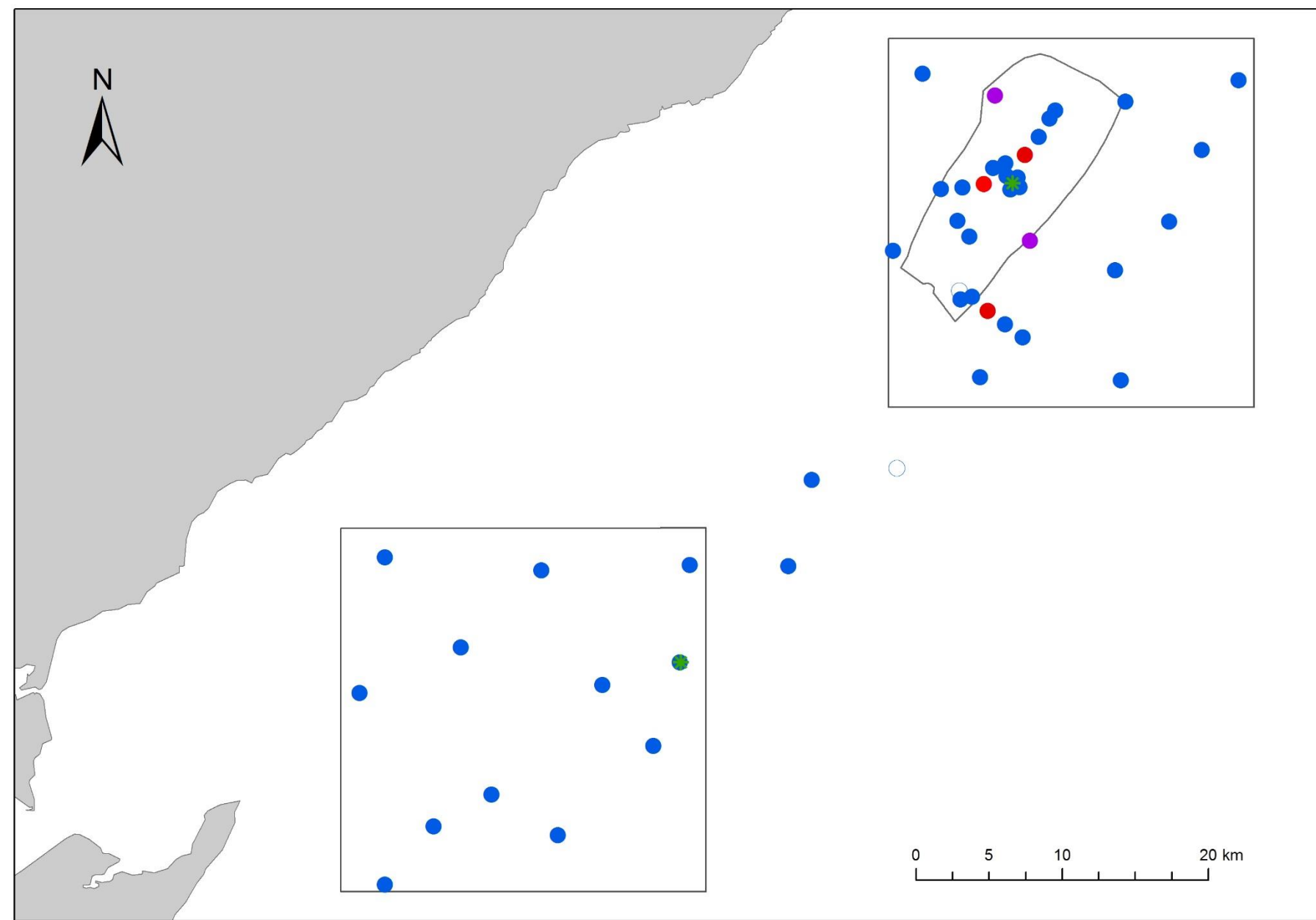


# ADD playbacks

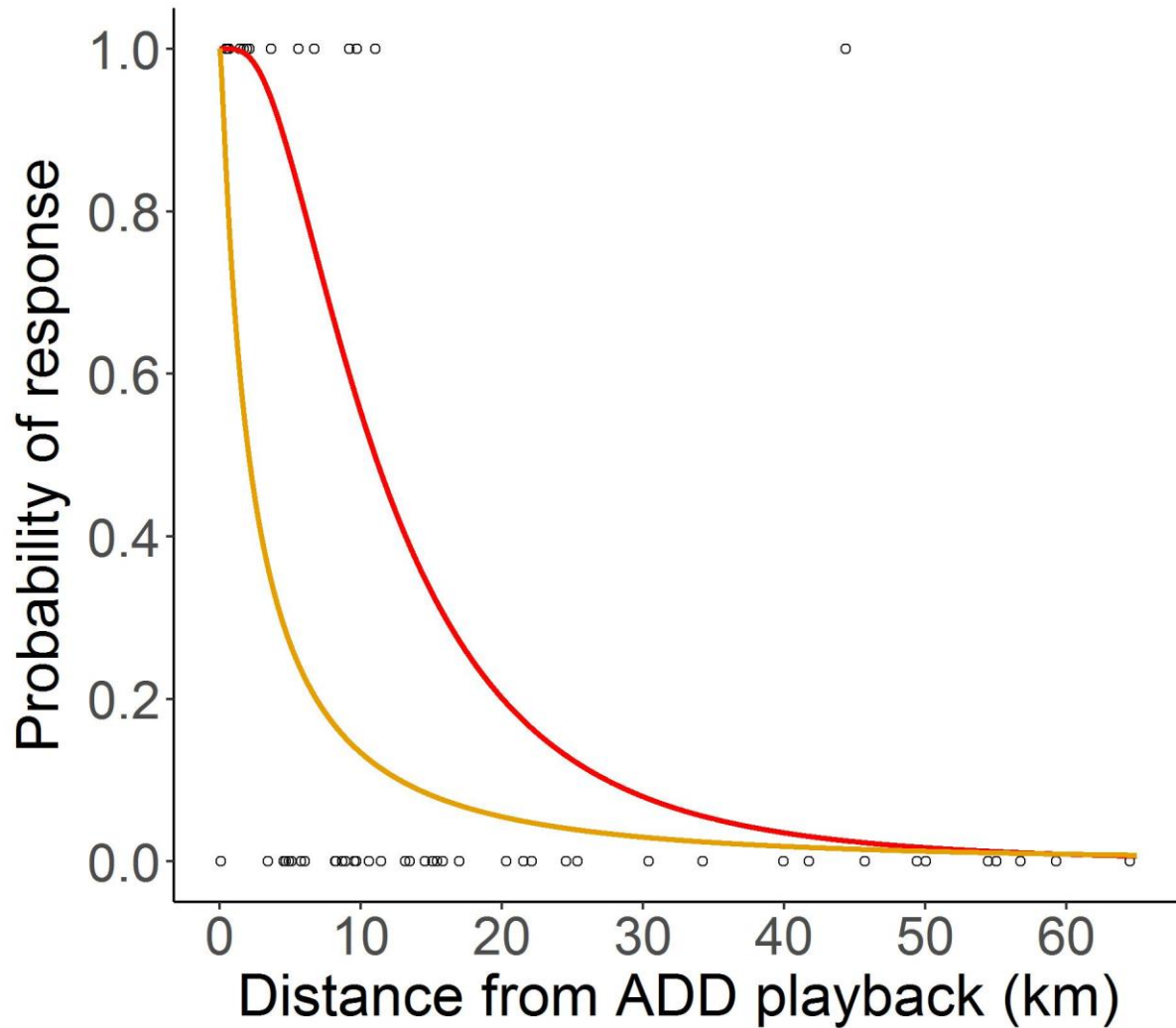
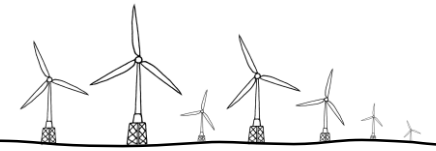
March 2017

2 days

ADD on for 15 min



# Response to ADD playbacks



## 50% Response

Response Length      Distance (km)

**12 h**

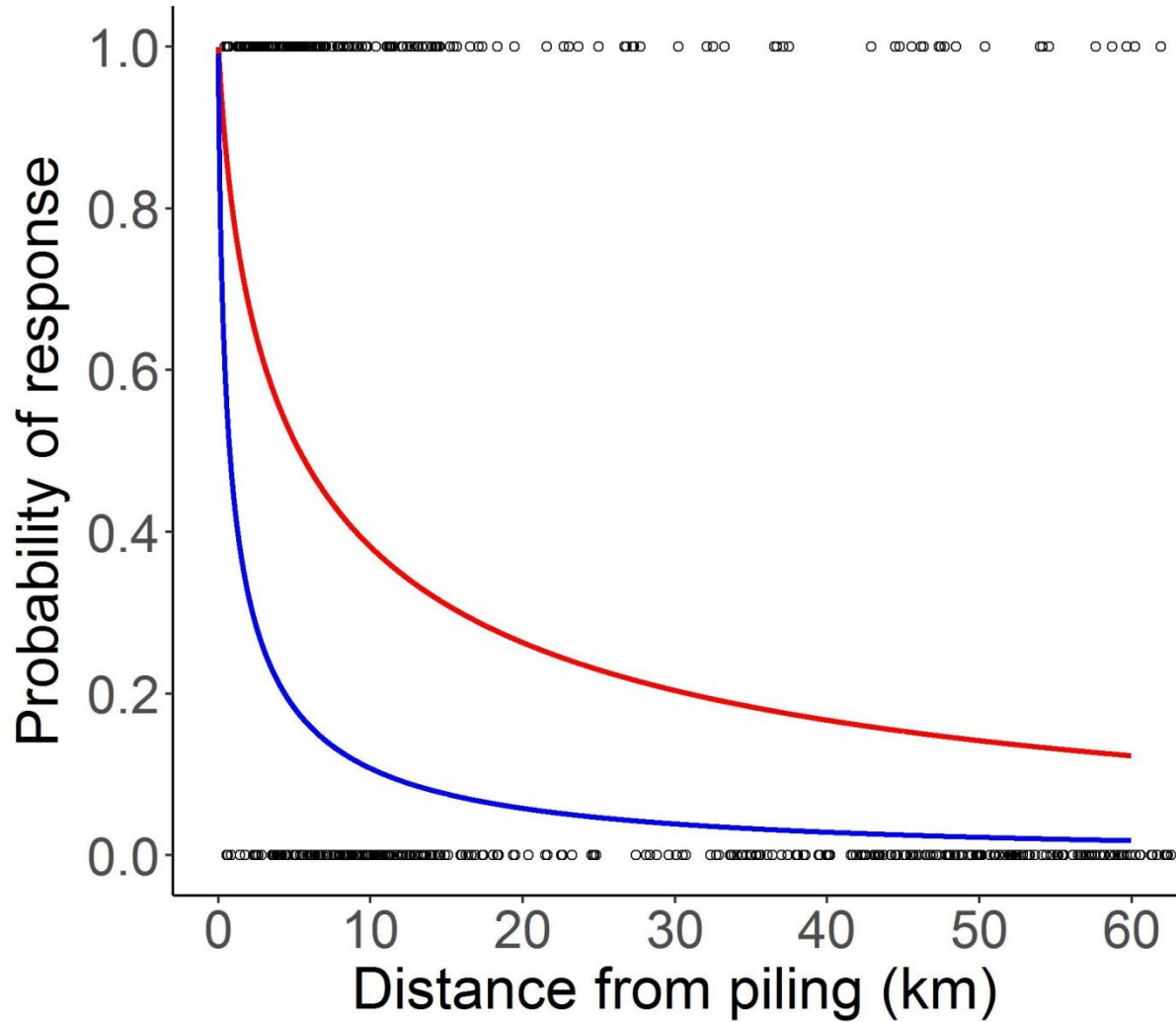
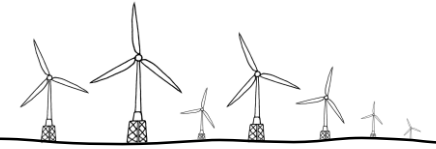
**2.1**

**6 h**

**11.0**



# ADD use increases response to piling



## 50% Response (12 h)

ADD used      Distance (km)

**Yes**

**5.33**

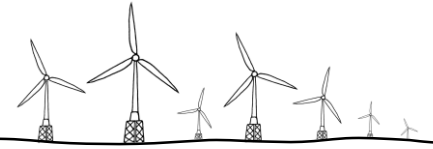
**No**

**0.76**

18 Aug: 61<sup>st</sup> Turbine



# Key Results



- Porpoises were **present throughout piling**
- Porpoise dose-response curve but **decline** in response over time
  - assessments based on initial response will be conservative
- Response appears to be **increased by ADD** use
  - therefore successful in mitigating risk of injury/death
  - but need to balance sources of disturbance during construction



