Alternative approaches to mitigating the impacts of piling noise

I.M. Graham
B.J. Cheney
T.R. Barton
P.M. Thompson
A. Farcas
N.D. Merchant
Assessing Impacts of Piling Noise

1. Death or injury (< 100 m)
2. Auditory damage from accumulated noise doses
3. Behavioural disturbance

HRA typically assumes no impact if developers follow JNCC guidance.

Population modelling to inform Habitats Regulations Assessment.
1. Optimised hammer energies used to predict source levels (& impact ranges)

2. Alternative mitigation procedure:
   1. Acoustic Deterrent Device (ADD) used for 15 min
   2. Soft start at lowest hammer energy for 20 min
   3. Gradual ramp up to max energy permitted: 2500 kJ

3. Risk assessment should ADD mitigation fail
Key Uncertainties

1. To what extent are porpoises displaced by ADDs?
2. How soon do porpoises return after ADD use?
3. Do responses to piling change through construction?
4. How do noise levels vary with hammer energy?
What is a response?

- Baseline distribution of proportion change
- 99% values > -0.5
- Response defined as: Proportion change in DPH \(\leq -0.5\)
Responses to piling & piling without ADD
1. Porpoise responses to ADD playback

50% Response

<table>
<thead>
<tr>
<th>Response Length</th>
<th>Distance (km)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 h</td>
<td>21.7</td>
</tr>
<tr>
<td>6 h</td>
<td>13.8</td>
</tr>
<tr>
<td>12 h</td>
<td>3.9</td>
</tr>
</tbody>
</table>
2. How soon do porpoises return after ADD?

Minimum time to next detection = 133 min

<table>
<thead>
<tr>
<th>CPODs within 1 km</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Playback</td>
<td>8</td>
</tr>
<tr>
<td>Control</td>
<td>5</td>
</tr>
</tbody>
</table>

Graph showing return time distribution for baseline, control, and playback conditions.
3. Responses to piling (and ADD)

... decrease over time

50% Response (24 h)

<table>
<thead>
<tr>
<th>Date</th>
<th>Turbine</th>
<th>Distance (km)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 Apr</td>
<td>1&lt;sup&gt;st&lt;/sup&gt;</td>
<td>7.4</td>
</tr>
<tr>
<td>24 Jul</td>
<td>47&lt;sup&gt;th&lt;/sup&gt;</td>
<td>4.0</td>
</tr>
<tr>
<td>2 Dec</td>
<td>86&lt;sup&gt;th&lt;/sup&gt;</td>
<td>1.3</td>
</tr>
</tbody>
</table>
ADD use increases response to piling

50% Response (12 h)

<table>
<thead>
<tr>
<th>ADD used</th>
<th>Distance (km)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>5.2</td>
</tr>
<tr>
<td>No</td>
<td>0.7</td>
</tr>
</tbody>
</table>

No ADD: 61st turbine (18 Aug)
Yes ADD: 62nd turbine (19 Aug)
4. Noise levels & hammer energy?

Minutes from start of piling

Mean % maximum energy

Mean % maximum SEL

Time [s]

WAV level [± 1]
Key Results

Porpoises were present on windfarm site throughout construction

1. Response appears to be increased by ADD use

2. Porpoises return > 2 hours after ADD playback

3. Porpoise dose-response curve, but decline in response over time

4. Distance to piling & length of pile exposed influence noise levels more than hammer energy