Strategic monitoring of marine mammals and offshore wind

Paul Thompson, Isla Graham, Barbara Cheney, Becky Hewitt, Saliza Bono, Tim Barton, Aude Benhemma-Le Gall, Line Cordes, Oihane Fernandes, Virginia Iorio, Gordon Hastie, Phil Hammond, Monica Arso Civil, Adrian Farcas, Nathan Merchant, Simon Moss, Ailsa Hall and many others....
The challenge of balancing nature conservation & sustainable development
Potential impacts of construction noise

**Temporal Scale**
- Hrs
- Days
- Months
- Years

Traumatic Injury
Displacement
TTS/PTS

↓ condition
↓ breeding success
↓ survival
↓ population size

**Spatial Scale**
- Site-specific
- Regional
- Population
Dev't. of Strategic Marine Mammal Monitoring

2010

2012

2013

2014
## Devt. of Strategic Marine Mammal Monitoring

<table>
<thead>
<tr>
<th>Pre-construction</th>
<th>Construction</th>
<th>Post-construction?</th>
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- [marine scotland](https://www.marine.scot)
- Beatrice Offshore Windfarm Ltd
- [MORAY EAST OFFSHORE WINDFARM](https://www.morayeastwindfarm.com)
- Scottish Natural Heritage
- [THE CROWN ESTATE](https://www.crown-estate.co.uk)
- Highlands & Islands Enterprise
- [UNIVERSITY OF ABERDEEN](https://www.aberdeen.ac.uk)

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[Image of offshore wind farm]
Underpinning studies in the Moray Firth
1) meet requirements of BOWL & MORL to monitor protected harbour seal and bottlenose dolphin populations

2) underpin strategic research on impacts of windfarm construction & operation on marine mammals
   - testing assessment frameworks
   - assessing population consequences of disturbance
   - exploring ecosystem effects
Moray Firth Renewables Advisory Group
MMMP Workplan: Pre-construction

Harbour Seal Monitoring

1) Individual based studies of reproduction and survival
2) Trends in abundance
3) Characterisation of foraging areas

Bottlenose Dolphin Monitoring

1) Individual based studies of reproduction and survival
2) Trends in abundance
3) Baseline occurrence of dolphins in favoured areas
MMMP Workplan: Construction

- WP 1 Harbour seal monitoring
- WP 2 Bottlenose Dolphin monitoring
- WP 3 Responses to ADD & Soft Start
- WP 4 Noise Measurement & Modelling

- Aim to assess population consequences of disturbance
- Focus on characterising shorter term responses to piling & ADD use
WP1 Harbour seal demography & trends

> 250 known individuals 2006-2018
WP 1 Trends in Loch Fleet mean counts during pupping (●) & moult (○)

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<tr>
<th>Year</th>
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<th>Known births</th>
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<td>2018</td>
<td>60</td>
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WP 1 Characterisation of foraging areas and noise exposure

Maximum 24 hr cumulative SEL (NOAA weightings) for 32 GPS tagged harbour seals during piling in 2017

PTS Threshold = 185 dB
WP2 Bottlenose dolphin monitoring

#11 Muddy: born 1988

#970 born 2002
#1024 born 2007
#1109: born 2010
#1144 born 2012
#1192 born 2014
#1238 born 2016

#1200: born 2015
born 2018
WP 2 Trends in abundance within SAC (■) and population size (□)
WP 2 Passive acoustic monitoring of dolphins

Patterns dominated by high inter-annual & seasonal variation
WP3 Responses of porpoises to ADD & piling noise

105 CPOD deployments @ 68 locations
Feb – Dec 2017
WP 4 Noise measurement & modelling
Everyone’s come a long way in 12 years
Remaining uncertainties relevant to consenting

- Drivers of seasonal and inter-annual variation in occurrence
- Relative importance of vessel noise, piling activity and ADD use
- Mechanisms underlying marine mammal responses to noise
- Variation in responses in relation to habitat quality and construction techniques
- Longer-term effects of wind farms on marine mammals & their prey
Lessons learned

• Ensure monitoring programmes are strategic, designed to reduce uncertainties in key processes

• Continuity in support for strategic research maximises science outputs

• Conversely, short & unpredictable lead times constrain science

• Opportunities remain for more integrated monitoring
Collaboration has been key

• Between Industry, Academia, Government
• Environmental scientists and engineers
• Early discussions with all stakeholders (eg. MFRAG)
• Industry collaboration to support the MMMP
• Academic collaboration to deliver work programme