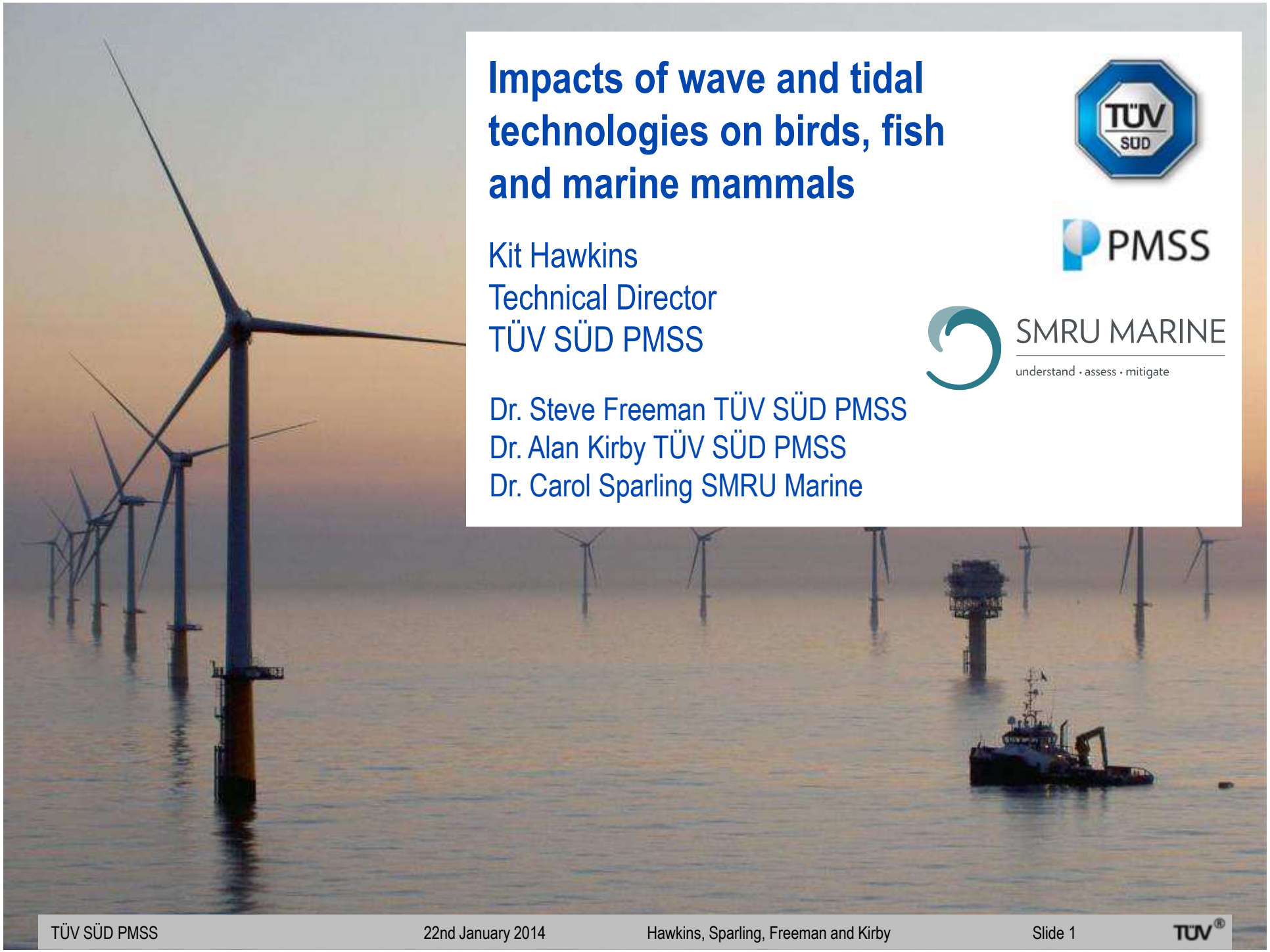

Impacts of wave and tidal technologies on birds, fish and marine mammals

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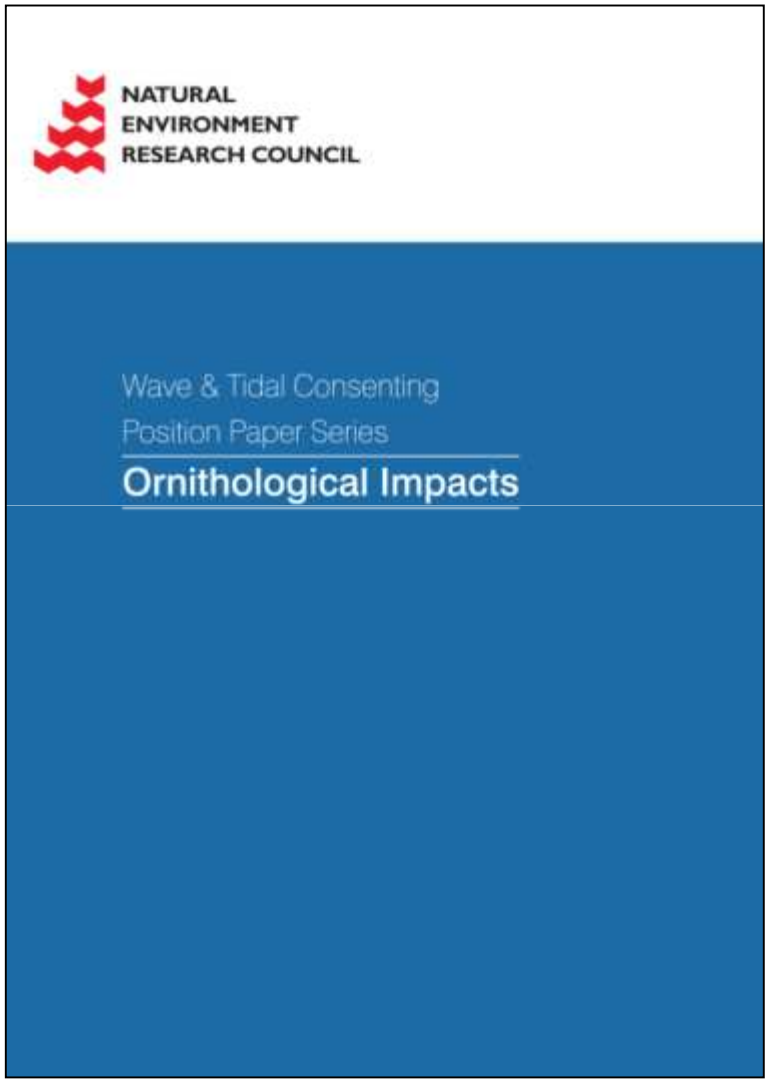
Introduction

- Provide a consolidated industry consensus on key impacts arising from the diverse range of wave and tidal technologies on birds, fish and marine mammals; and

- Identify recommendations to help developers, academics and the Government in addressing future consenting risks, as well as identifying knowledge gaps and steering independent research.

Paper One



Kirby, A. D., Hawkins, K. R., Freeman, S. M., McCall, R. A., Furness, R. W. & Edhouse, E. S. (2013). Wave & Tidal Consenting Position Paper Series: Paper One: Ornithological Impacts.

https://ke.services.nerc.ac.uk/Marine/Members/Documents/Position%20Papers%20-%20Reports/Ornithological%20Impacts%2016pp%20A4%20v2.pdf

Ornithology – key impacts

- Disturbance:
  - ➢ Resulting in displacement – lower foraging success – reduced survival or productivity rates.
- Collision:
  - ➢ Mortality or injury of individual birds.
- Changes in hydrodynamic regime:
  - ➢ Positive or negative responses (e.g. increased foraging success, increased predation rates).

Ornithology – challenges

The challenge is understanding the likelihood of the potential impacts occurring:

- Surveys do not enable quantification of specific impacts;
- Surveys should focus on answering questions on level of effect;
- Monitoring of ornithological impacts of current devices and those to be installed is key; and
- Dealing with uncertainty now should help to avoid the pitfalls faced by offshore wind developers.

Ornithology – recommendations

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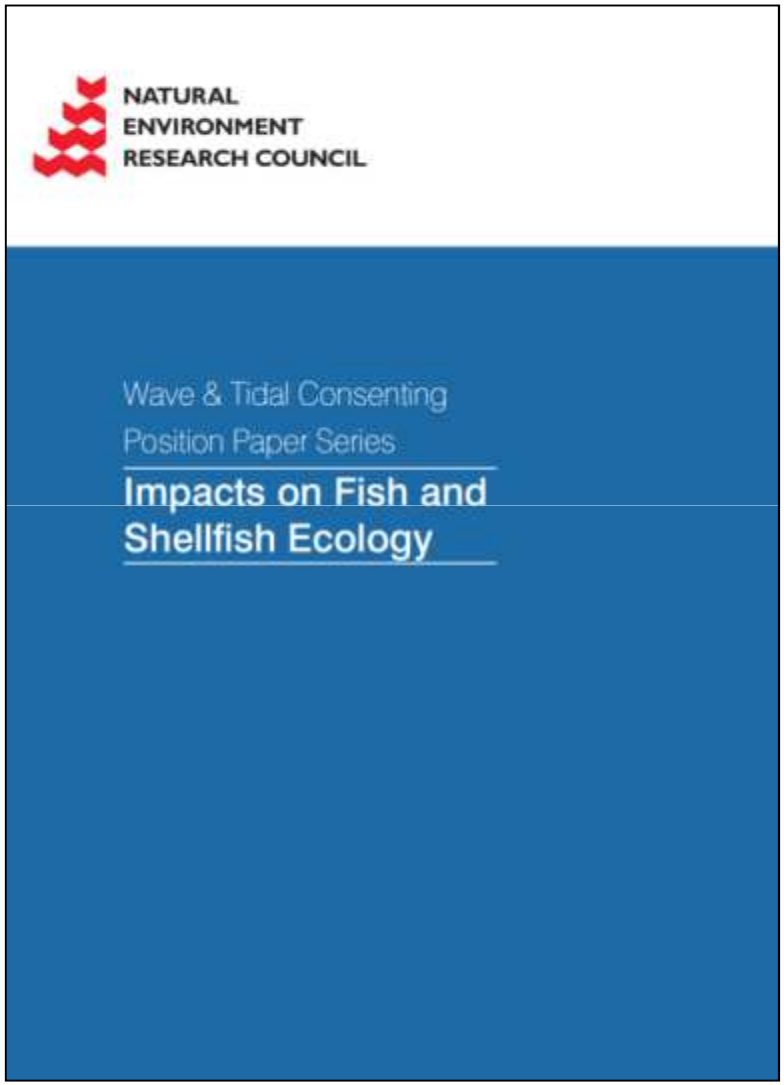
- The survey – monitor – deploy approach is a pragmatic idea that will aid the industry;
- Uncertainty should be addressed 'head on' to facilitate a rapid and cost effective expansion of the industry;

- Survey methodology should be discussed and agreed by developers, regulators and advisers at an individual project level;
- Collaboration will lead to the best outcomes for all; and
- New research (much is likely to become available in 2014) should give the ability to provide more robust predictions in EIA.

Paper Two

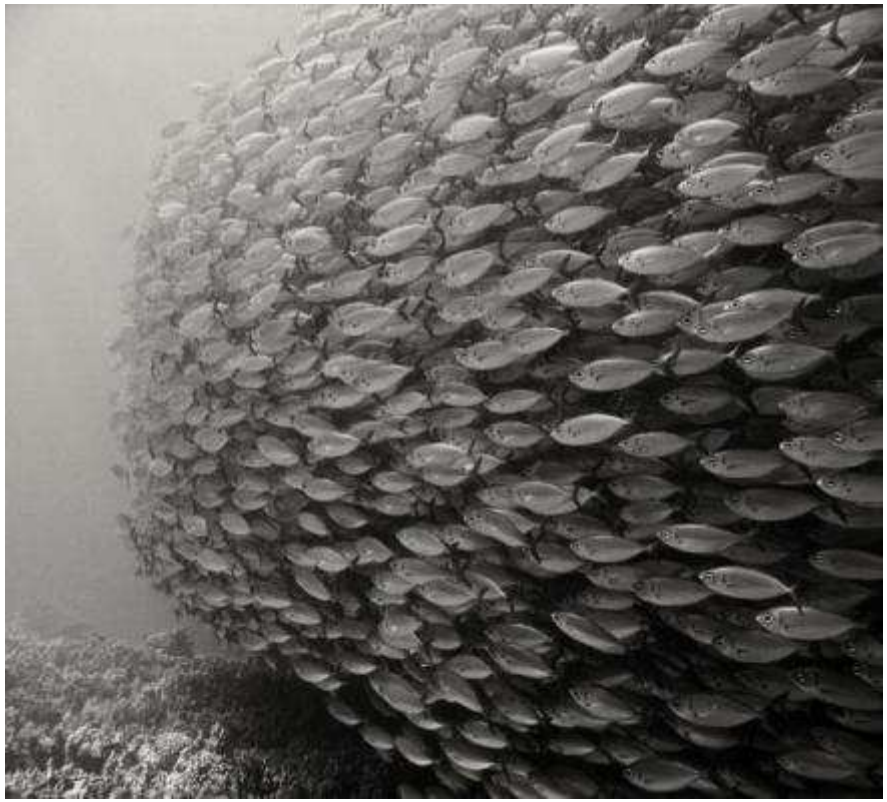


Freeman, S. M., Hawkins, K. R., Kirby, A. D., McCall, R. A., Blyth-Skyrme, R. E. & Edhouse, E. S. (2013). Wave & Tidal Consenting Position Paper Series: Paper Two: Impacts on fish and shellfish ecology.

https://ke.services.nerc.ac.uk/Marine/Members/Documents/Position%20Papers%20-%20Reports/Fish%20Impacts%2016pp%20A4%20v2.pdf

Fish – key impacts

- Barrier effects
  - ➢ Effects act on diadromous species and differences in life stages.
- Collision
  - ➢ Mortality or injury.
- Underwater noise
  - ➢ Spawning, feeding and migration of diadromous fish, noise considered unlikely to cause mortality or injury.



- Habitat creation
  - ➢ Suitable surface and structural complexity for colonisation and where floating structures are deployed can act as fish aggregation devices (FADs) – not enough is known about population level effects to predict impacts with certainty.

Fish – challenges

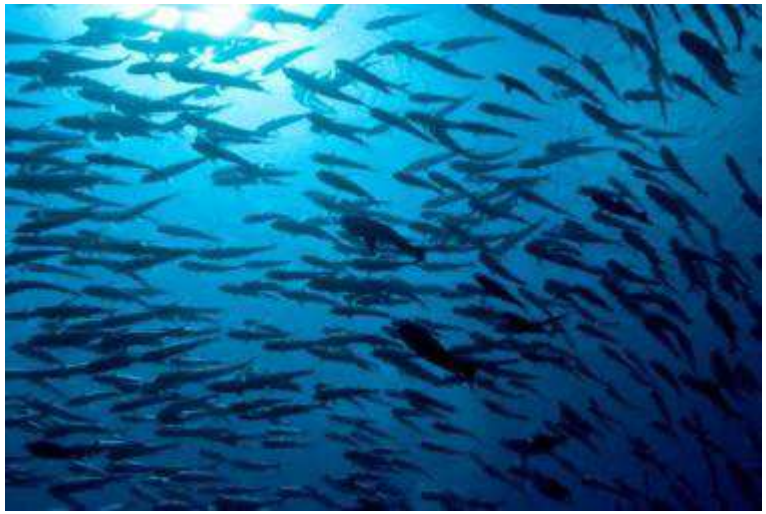
The challenge is understanding the likelihood of the potential impacts occurring:

- Assessing complex population dynamics;
- Validating collision risks;
- Standardising impacts from wave and tidal devices should be discouraged;
- Undertaking further research to reduce uncertainties;
- Acknowledge impacts on fish and shellfish ecology are less significant than for other receptors;

- Acknowledging the positive effects of habitat creation/FADs; and
- Improving equipment for observations at appropriate resolution and reliability.

Fish – recommendations

- Fast-track arrays of around 10 MW in size or phased larger arrays;
- Consider non-diadromous fish and shellfish as low risk consenting issue;
- Encourage treatment of wave and tidal devices as separate technologies;
- Support research that provides greater certainty over the migration routes of diadromous species;
- Ensure scientific investigations on the back of licensing requirements remain proportionate to the risk posed by the device.
- Ensure risked based approach to assessment is maintained;
- Encourage testing of equipment / instruments before deployment; and
- Link more spatial planning and co-operative initiatives with fishing industry/local stakeholder groups.



Paper Three

Sparling, C. E., Coram, A. J., McConnell, B., Thompson, D., Hawkins K. R. & Northridge, S. P. (2013). Wave & tidal Consenting Position Paper Series: Paper Three: Marine Mammal Impacts.

https://ke.services.nerc.ac.uk/Marine/Members/Documents/Position%20Papers%20-%20Reports/Marine%20Mammal%20Impacts%2016pp%20A4%20v2.pdf

Marine mammals – key impacts

- Collision (tidal devices)
  - ➢ Mortality and injury to individual marine mammals.
- Disturbance
  - ➢ Displacement or behavioural change caused by construction or presence and operation of devices.
- Underwater Noise
  - ➢ Construction noise may cause temporary disturbance, while operational noise may cause disturbance (but not over large distances).

- Ecological Effects
  - ➢ Structures may act as artificial reefs and FADs, while changes to flow and sedimentation may affect prey availability.

Marine mammals – challenges

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The challenge is understanding the likelihood of the potential impacts occurring:

- Surveys provide information on marine mammal presence but do not enable understanding of specific impacts;
- Understanding collision risk is the biggest priority;
- Acknowledge that the current scale of projects and variable abundance / distribution means that displacement impacts may be difficult to detect;
- Cumulative impacts; and
- Improving equipment to undertake observations at appropriate resolution and reliability.

Mammals – recommendations

- Undertake robust, focused studies at demonstrator and early array sites, with the focus on collision risk and displacement;
- Development of sensors and methodologies to enable data collection;
- Research into mitigation solutions for identified and potential impacts;
- Development of models to predict the population level consequences of individual level responses/impacts;
- Review of how evidence is used in decision making; and
- Strategic studies to increase baseline understanding of marine mammal use of wave and tidal development areas and mapping of sensitive areas.

Conclusions

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