

Key issue 2 - The potential effects on marine mammals and basking shark from shock / pressure waves generated by wave and tidal energy converters

What are the relevant technologies and support structures?

The following technologies and support structures were identified during the assessment process to have the potential to significantly affect marine mammals and basking shark through the generation of shockwaves / pressure waves and should therefore, be subject to further investigation on a project specific basis.

Relevant technologies and support structures	Relevant features, components or activities	Phase
Wave technologies		
Oscillating water column (offshore) Point absorber	<i>There is potential for shock / pressure waves to be generated due to large waves hitting the side of surface piercing structures with a high profile above the surface.</i>	Operation
Support structures		
Monopile	<i>There is potential for shock / pressure waves to be generated due to large waves hitting the side of surface piercing structures with a high profile above the surface.</i>	Operation

What species / groups may be vulnerable?

The following species were identified during the assessment process as being particularly sensitive to shock pressure waves and should therefore, be considered further on a project specific basis.

Relevant species / groups	Possible consequences
Seals Cetaceans Otter Basking shark	<i>The effect on the species concerned is unknown.</i>

What species / groups are affected by which technologies and support structures

The following table provides a summary of the assessment results for each species or habitats in combination with each technology & Moorings/Support structures listed above.

Potentially significant at a 10MW scale	Unknown whether this will be significant at a 10 MW scale	Not Applicable	Assessed as not significant at a 10MW scale
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Common Name	Technology & Moorings and Support structures							
	Horizontal axis turbine & Monopile	Reciprocating hydrofoils & Monopile	Oscillating water column (offshore) & Gravity/deadweight anchor and mooring lines	Oscillating water column (offshore) & Rock anchors and mooring lines	Oscillating water column (offshore) & Drag embedment anchor and mooring lines	Point absorber & Gravity/deadweight anchor and mooring lines	Point absorber & Rock anchors and mooring lines	Point absorber & Drag embedment anchor and mooring lines
Common seal								
Grey Seal								
Killer whale								
Minke whale								
Long finned pilot whale								
Atlantic white-sided dolphin								
White-beaked dolphin								
Bottlenose dolphin								
Short-beaked common dolphin								
Risso's dolphin								
Harbour Porpoise								
Otter								
Basking Shark								

How could the issue be addressed on a project and site specific basis?

The following tables provide a series of suggested activities and recommendations that may be taken forward to address the effects of shock / pressure waves on marine mammals and basking shark for those technologies and/or support structure and species / habitats assessed as significant in the assessment. This information is not prescriptive and should be used as a platform for discussion on a project and site specific basis in order to develop an appropriate impact assessment strategy and monitoring programme for the project.

Single test deployments

Preliminary desk based studies

Activity	Objective	Recommendation / comment
No activity recommended	N/A	N/A

Baseline characterisation surveys

Activity	Objective	Recommendation / comment
No activity recommended	N/A	N/A

Further desk based studies

Activity	Objective	Recommendation / comment
No activity recommended	N/A	N/A

Monitoring during and post installation

Activity	Objective	Recommendation / comment
Monitor single machine over duration of test period	To determine under what conditions (if any) shockwaves are produced and to investigate magnitude etc. This work will inform the EIA for any relevant demonstration and commercial arrays	This should only be undertaken in circumstances where the project is expected to generate shockwaves and where the developer feels that similar conditions will arise in any follow-on demonstration arrays.

Demonstration arrays

Preliminary desk based studies

Activity	Objective	Recommendation / comment
Desk based review of existing information regarding species distribution / behaviour etc across the site	To establish the importance of the proposed development area for any potentially vulnerable species (as listed above)	Undertake this work for all demonstration arrays.
Determine the potential for the surface piercing structures to generate shockwaves	Use predictive models to investigate under what circumstances shockwaves may be generated by the relevant surface piercing structure(s) e.g. weather, wave conditions, etc.	This work should only be undertaken in areas of high sensitivity and if particularly high surface piercing / floating structures are to be installed in high energy waves.
Undertake impact assessment	To determine whether or not there are likely to be any significant impacts on the species identified. To identify any particular areas of concern regarding the proposed development and to determine what/if further baseline characterisation is required (see below).	This should follow the normal project specific EIA procedures.

Baseline characterisation surveys

Activity	Objective	Recommendation / comment
Conduct baseline marine mammal and basking shark surveys	To determine behaviour and distribution of species through and around the proposed development site	This should only be undertaken in high sensitivity areas under circumstances where the project is expected to repeatedly generate shockwaves during particularly sensitive times.

Further desk based studies

Activity	Objective	Recommendation / comment
Undertake impact assessment	To determine, based on the further baseline characterisation work and the results of the initial impact assessment, whether or not there are likely to be any significant impacts on the species identified	This should only be undertaken in high sensitivity areas under circumstances where the project is expected to repeatedly generate shockwaves during particularly sensitive times and further baseline characterisation surveys have been undertaken.

Monitoring during and post installation

Activity	Objective	Recommendation / comment
Monitor marine mammals and basking shark activity around demonstration arrays	<p>To determine response from species within the area and to validate predictions made during impact assessments</p> <p>To inform ongoing and future environmental monitoring work</p>	<p>This should only be undertaken in high sensitivity areas under circumstances where the project is expected to repeatedly generate shockwaves during particularly sensitive times.</p> <p>It may prove particularly difficult to link any behavioural response or observed event to the generation of shockwaves.</p>
Monitor shockwaves produced by the arrays	To validate predictions and to inform future site selection and project development work	This should only be undertaken in high sensitivity areas under circumstances where the project is expected to repeatedly generate shockwaves during particularly sensitive times although data gathered from any area will be valuable for future deployments.