

Key issue 4 - Potential for collision between marine mammals and basking shark and offshore wave and tidal energy converters and associated moorings / support structures

What are the relevant technologies and support structures?

The following technologies and support structures were identified during the assessment process to have the potential for collision with marine mammals and basking shark and should therefore be subject to further investigation on a project specific basis.

Relevant technologies and support structures	Relevant features, components or activities	Phase
Tidal technologies		
Horizontal axis turbine Vertical axis turbine Reciprocating hydrofoils	<i>Moving parts may increase the likelihood of collisions and any collisions that do occur will more likely result in death / severe injury.</i>	Operation
Wave technologies		
Oscillating wave surge converter Oscillating water column (offshore) Overtopping device (offshore) Attenuator Point absorber Submerged pressure differential	<i>Moving parts may increase the likelihood of collisions and any collisions that do occur will more likely result in death / severe injury.</i>	Operation
Support structures		
Gravity / deadweight anchor and mooring lines Gravity base structure Monopile Rock anchors and mooring lines Drag embedment anchor and mooring lines	<i>Collision with stationary structures e.g. mooring lines, anchors and support structures are less likely to cause death but injuries may result.</i>	Operation

What species / groups may be vulnerable?

The following species were identified during the assessment process as being at risk from collision and should therefore be considered further on a project specific basis.

Relevant species / groups	Possible consequences
Seals Cetaceans Otter ¹ Basking shark	<i>Collisions have the potential to cause death / injury to marine mammals.</i>

¹ Some technologies (Oscillating water column (offshore), Overtopping device (offshore), Attenuator, Point absorber, Submerged pressure differential) are likely to be located in water depths which are outside an otter's normal foraging range.

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 & Gravity/deadweight anchor and mooring lines	Horizontal axis turbine & Gravity base structure	Horizontal axis turbine & Monopile	Horizontal axis turbine & Rock anchors and mooring lines	Vertical axis turbine & Gravity/deadweight anchor and mooring lines	Vertical axis turbine & Gravity base structure	Vertical axis turbine & Rock anchors and mooring lines	Reciprocating hydrofoils & Gravity base structure	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	Overtopping device (offshore) & Gravity/deadweight anchor and mooring lines	Overtopping device (offshore) & Rock anchors and mooring lines	Overtopping device (offshore) & Drag embedment anchor and mooring lines	Attenuator & Gravity/deadweight anchor and mooring lines	Attenuator & Rock anchors and mooring lines	Attenuator & Drag embedment anchor and mooring lines	Oscillating wave surge converter & Gravity base structure	Point absorber & Gravity/deadweight anchor and mooring lines	Point absorber & Rock anchors and mooring lines	Point absorber & Drag embedment anchor and mooring lines	Submerged pressure differential & Gravity base structure		
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 risk of collision with marine mammals and basking shark for those technologies and/or support structures, 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
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) and screen potential impact on species present	Undertake this work for all single deployments. If it is possible to determine that either the area is not particularly important for the species identified, or that there is no reasonable hypothesis for significant effect based on the character of the site, or the characteristics of the device, it is possible that no further pre-deployment information is required for a single deployment.
Determine the rotational speed of the turbine at all stages of the tide	To provide indicative speeds and inform the impact assessment process	
Undertake impact assessment	To identify any particular areas of concern regarding the proposed development and to determine what/if further baseline characterisation is required (see below)	

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 where potentially significant effects are anticipated from a single deployment i.e. in a highly sensitive area or a narrow channel etc.

Further desk based studies

Activity	Objective	Recommendation / comment
Collision risk assessment	To predict the likelihood of a collision event based on the character of the site, distribution and behaviour of the species identified	This work should only be undertaken with regards to single deployments within areas of high sensitivity for the species identified.
Impact assessment	To determine, based on baseline characterisation surveys, whether or not there are likely to be any potentially significant effects on the species identified	This should follow the normal project specific EIA procedures.

Monitoring during and post installation

Activity	Objective	Recommendation / comment
Incident reporting	To report any potential / known collision incidents to the Regulator	<p>This should be undertaken in all circumstances.</p> <p>Any additional monitoring that can be undertaken e.g. with video cameras, strain gauges, acoustic cameras etc may provide useful information for future impact assessment work and licence applications.</p> <p>There is a well established mechanism for analysing stranded marine mammal carcasses. Any evidence suggesting trauma from collision with tidal turbines would be recognised through this scheme.</p> <p>A number of parties are also developing collision monitoring techniques. Should any of these prove cost effective, they could be used more widely if useful data can be gathered.</p> <p>No collision events with tidal turbines have been reported to date.</p>

Demonstration arrays (up to 10MW)

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) and screen potential impact on species present.	<p>Undertake this work for all single arrays.</p> <p>If it is possible to determine that either the area is not particularly important for the species identified, or that there is no reasonable hypothesis for significant effect based on the character of the site, or the characteristics of the device, it is possible that no further pre-deployment information is required for an array.</p>
Determine the rotational speed of the turbine at all stages of the tide	To provide indicative speeds and inform the impact assessment process	
Undertake impact assessment	To identify any particular areas of concern regarding the proposed development and to determine what/if further baseline characterisation is required (see below).	

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	<p>This should only be undertaken where potentially significant effects are anticipated from arrays i.e. in a highly sensitive area or a narrow channel etc.</p> <p>Additionally, it is possible that such surveys may be required in areas where data is scarce and it is anticipated that important populations may be present. It is recommended that in such instances targeted seasonal studies (spring-summer for basking sharks, summer for cetaceans) are used initially to determine the relative sensitivity of a potential deployment area.</p> <p>The need for any baseline characterisation surveys should be determined by the preliminary desk-based studies.</p>

Further desk based studies

Activity	Objective	Recommendation / comment
Collision risk assessment	To predict the likelihood of a collision event based on the character of the site, distribution and behaviour of the species identified	<p>This work should only be undertaken with regards to arrays within areas of high sensitivity for the species identified.</p> <p>This may be particularly relevant where an SAC population might be affected by the proposed development.</p>
Impact assessment	To determine, based on baseline characterisation surveys, whether or not there are likely to be any potentially significant effects on the species identified	This should follow the normal project specific EIA procedures.

Monitoring during and post installation

Activity	Objective	Recommendation / comment
<p>Monitor marine mammal and basking shark activity around demonstration arrays</p>	<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 be undertaken in areas of high sensitivity and the data reviewed regularly to inform ongoing requirements.</p> <p>The timing of surveys should coincide with periods of maximum abundance.</p> <p>It should be noted that the results of monitoring undertaken regarding this issue could prove highly valuable in future impacts assessment and consenting work. It is therefore in the developer's best interest to gather as much information as possible.</p>