Key issue 15 - Potential effects of changes in turbulence on foraging success of marine birds due to the presence of 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 to significantly affect marine birds through the effects of changes in turbulence on foraging success 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	*Localised changes in turbulence due to the presence of moving blades in the water column.*	Operation
Support structures		
Gravity / deadweight anchor and mooring lines Gravity base structure Monopile Rock anchors and mooring lines	*Localised changes in turbulence due to the presence structures in the water column*	Operation

What species / groups may be vulnerable?

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

Relevant species / groups		Possible consequences
Greater Scaup (Scaup)	Sooty Shearwater	*Potential effects of changes in turbulence on foraging success of marine birds are unknown.*
Common Eider	Manx Shearwater	
Long-tailed Duck	Balearic Shearwater	
Black Scoter (Common Scoter)	Northern Gannet	
Surf Scoter	Great Cormorant	
Velvet Scoter	European Shag	
Common Goldeneye	(Western) Lesser Black-backed Gull	
Red-breasted Merganser	(Western) Herring Gull	
Goosander	Black-legged Kittiwake	
Red-throated Diver	Little Tern	
Black-throated Diver	Sandwich Tern	
Great Northern Diver	Common Tern	
Yellow-billed Diver (White-billed Diver)	Roseate Tern	
Great Crested Grebe	Arctic Tern	
Red-necked Grebe	Common Guillemot	
Slavonian grebe	Razorbill	
Black-necked Grebe	Black Guillemot	
Northern Fulmar	Little Auk	
Cory's Shearwater	Atlantic Puffin	
Great Shearwater		

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

	Technology & Moorings and Support structures														
Common Name	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	Overtopping device (offshore) & Gravity/deadweight anchor and mooring lines	Attenuator & Gravity/deadweight anchor and mooring lines	Oscillating wave surge converter & Gravity base structure	Point absorber & Gravity/deadweight anchor and mooring lines	Submerged pressure differential & Gravity base structure
Greater Scaup (Scaup)															
Common Eider															
Long-tailed Duck															
Black Scoter (Common Scoter)															
Surf Scoter															
Velvet Scoter															
Common Goldeneye															
Red-breasted Merganser															
Goosander															
Red-throated Diver															
Black-throated Diver															
Great Northern Diver															
Yellow-billed Diver (White-billed Diver)															
Great Crested Grebe															
Red-necked Grebe															
Slavonian grebe															

	Technology & Moorings and Support structures														
Common Name	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	Overtopping device (offshore) & Gravity/deadweight anchor and mooring lines	Attenuator & Gravity/deadweight anchor and mooring lines	Oscillating wave surge converter & Gravity base structure	Point absorber & Gravity/deadweight anchor and mooring lines	Submerged pressure differential & Gravity base structure
Black-necked Grebe															
Northern Fulmar															
Cory's Shearwater															
Great Shearwater															
Sooty Shearwater															
Manx Shearwater															
Balearic Shearwater															
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Common Guillemot															
Razorbill															
Black Guillemot															
Little Auk															
Atlantic Puffin															

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 changes in turbulence on foraging success of marine birds due to the presence of wave and tidal energy converters and associated moorings / support structures, 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.

Note - t will be very difficult, if not impossible to monitor and establish any causal link between levels of sea turbulence and foraging strategies in birds linked to the deployment of marine renewables devices. This is especially true where a reduction of foraging is hypothesised. The only change that is likely to be measurable is an increase in foraging around devices. The aggregation of foraging in the vicinity of a device or an array could be analysed, but is unlikely to lead to any alteration to licence conditions and would therefore be simply noted.

No baseline or monitoring activity related to this issue is considered appropriate.

Single test deployment

Preliminary desk based studies

Activity	Objective	Recommendation / comment
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

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
No activity recommended	N/A	N/A

Demonstration arrays

Preliminary desk based studies

Activity	Objective	Recommendation / comment
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

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
No activity recommended	N/A	N/A