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Marine Environmental Consultancy

Foreshore Licence Application for Site Investigations for Oriel Wind Farm, off Co. Louth

Supporting information for the Stage 1 Screening for Appropriate Assessment

Report for
Oriel Wind Farm Ltd

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1 INTRODUCTION

1.1 Background and document purpose

Oriel Windfarm Limited (Oriel) is an Irish renewable energy company developing the proposed Oriel offshore wind farm ("Oriel Wind Farm" or "the Project") located in the north-west Irish Sea, 22km off the coast of Dundalk, County Louth. The Project will include wind turbines mounted onto a foundation installed into the seabed, an offshore substation and interlinking cabling between the turbines and the substation and an export cable between the substation and the shore.

Oriel was granted a Foreshore Licence in October 2005 from the then Department of Communications, Marine and Natural Resources (DCMNR), giving permission to carry out a technical work plan to investigate the suitability of an area to the east of Dundalk Bay for the construction of an offshore wind farm. The technical work plan included a geotechnical site investigation, an engineering assessment and the completion of an Environmental Impact Statement (EIS).

Following the completion of this work, Oriel applied for a Foreshore Lease in February 2007, to construct an offshore wind farm of up to 330MW potential in an area located off the coast of County Louth, approximately 22km east of Dundalk. For a number of reasons, the development of the project was delayed.

In May 2019, Oriel obtained a Foreshore Licence reference no. FS 006840 for initial surveys in the offshore wind farm area and offshore cable corridor. Oriel undertook both onshore and offshore surveys and commenced the engineering design of the wind park. Oriel now intends to undertake further site investigations of the offshore wind farm area and the offshore cable corridor to investigate the stability of the soil (seabed sediments) for the design of foundations and the detailed routeing of the inter array and export cables.

This report forms part of a Foreshore Licence Application to the Department of Housing, Local Government and Heritage (DHLGH) seeking permission to undertake site investigation works within the proposed development site to support the Project. The purpose of this report is to provide the information required to enable the Competent Authority (DHLGH) to determine whether the proposed site investigation works could have significant effects on a Natura 2000 site (Stage 1 screening) and therefore require appropriate assessment (Stage 2), in accordance with the requirements as set out under Article 6(3) of the Habitats Directive (92/42/EEC).

1.2 Legislative background and AA process

The EU Habitats Directive (92/43/EEC) requires that Member States contribute to the creation of a coherent ecological network of sites through the identification and designation of Special Areas of Conservation (SAC) relating to those habitats and species listed in Annex I and Annex II of the Directive respectively. The EU Birds Directive (2009/147/EC) requires the protection of bird species listed in Annex I of that Directive, and regularly occurring migratory species, including the use of conservation measures through the designation of Special Protection Areas (SPAs). SACs and SPAs are collectively part of the Natura 2000 network. The relevant conservation agencies responsible for site selection designate sites on the basis of the presence of relevant qualifying habitats and species, and conservation objectives are set to maintain or, where relevant, restore, the features to a favourable conservation status. The requirements of the *EC Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora* (the "Habitats and Species Directive")*;* and *EC Council Directive*

2009/147/EC (the "Bird Directive") have been implemented through the *European Communities (Birds and Natural Habitats) Regulations 2011* (as amended).

Article 6(3) of the Habitats Directive provides that, "*Any plan or project not directly connected with or necessary to the management of the site but likely to have a significant effect thereon, either individually or in combination with other plans or projects, shall be subject to appropriate assessment of its implications for the site in view of the site's conservation objectives. In the light of the conclusions of the assessment of the implications for the site and subject to the provisions of paragraph 4*[1]*, the competent national authorities shall agree to the plan or project only after having ascertained that it will not adversely affect the integrity of the site concerned and, if appropriate, after having obtained the opinion of the general public*."

The Competent Authority (in this case DHLGH) must therefore undertake an Appropriate Assessment (AA) where likely significant effects are identified for qualifying interests of a relevant site from activities not directly connected with the management of the site. This requirement and the process by which such a consideration is made, is outlined in the *European Communities (Birds and Natural Habitats) Regulations 2011* (as amended), and in guidance at a European (European Commission 2019, European Commission 2021) and national (DoEHLG 2010, Office of the Planning Regulator 2021).

The key stages of the AA process are listed below and shown in Figure 1.1.

Stage 1: Screening for appropriate assessment. To assess, in view of best scientific knowledge, and in view of relevant site conservation objectives, if the project, individually or in-combination with another plan or project, is likely to have a significant effect on any Natura 2000 site.

Stage 2: Appropriate Assessment. Required if it cannot be excluded, on the basis of objective information, that the project, individually or in-combination with other plans or projects, will not have a significant effect on a Natura 2000 site. Where there are adverse impacts, an assessment of the potential mitigation of those impacts should be made. The appropriate assessment must include a final determination by the competent authority as to whether or not a proposed development would adversely affect the integrity of a Natura 2000 site. In order to reach a final determination, the consenting authority must undertake examination, analysis and evaluation, followed by findings, conclusions and a final determination. The appropriate assessment must contain complete, precise and definitive findings and conclusions, and may not have lacunae or gaps.

Stage 3: Assessment of alternative solutions. This process examines alternative ways of achieving the objectives of the project or plan that avoid adverse impacts on the integrity of the Natura 2000 site.

Stage 4: Assessment where no alternative solutions exist and where adverse impacts remain. An assessment of compensatory measures where, in the light of an assessment of imperative reasons of overriding public interest (IROPI), it is deemed that the project or plan should proceed.

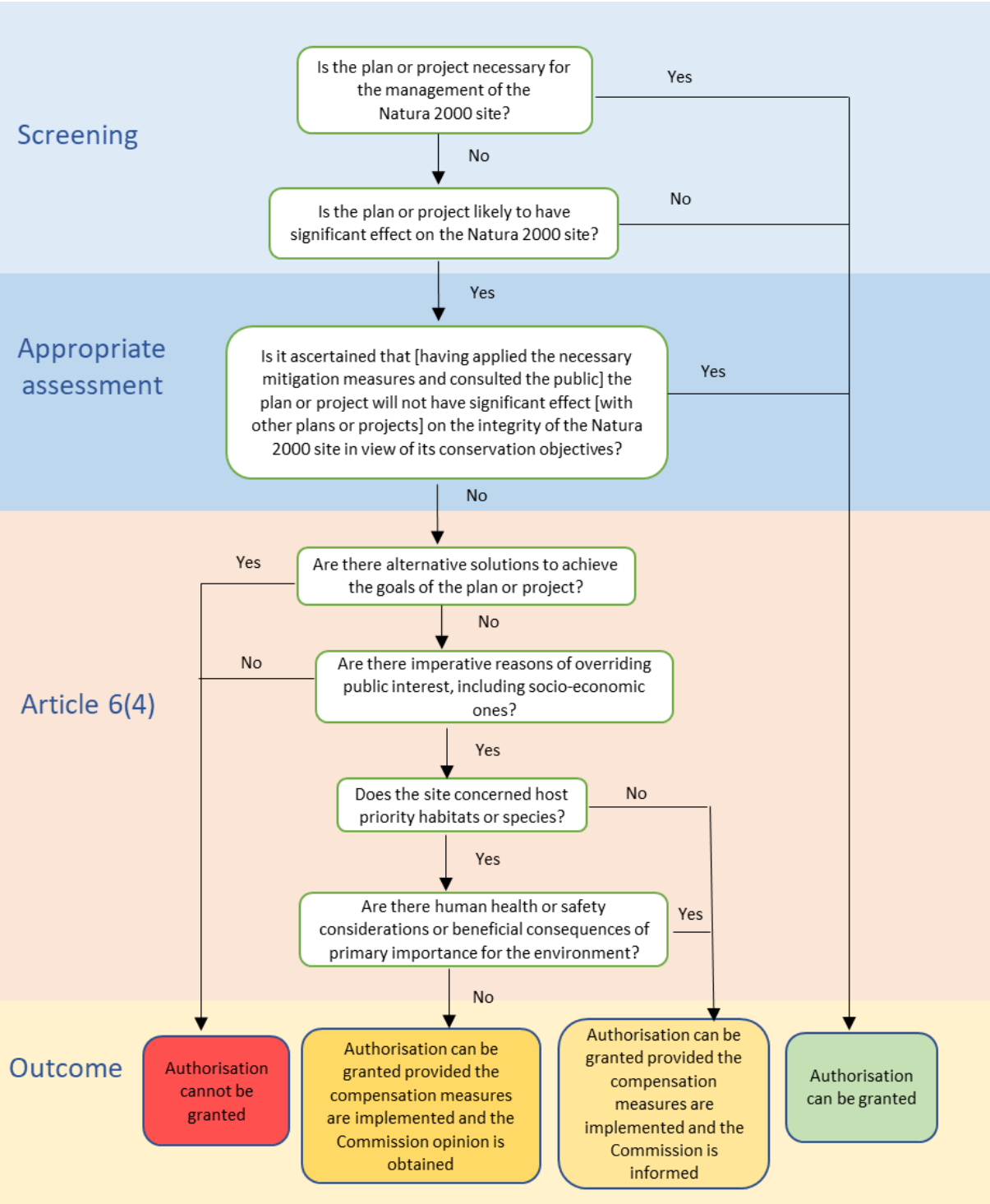
As the project is not directly connected with the management of a Natura 2000 site, a screening exercise (Stage 1) has been undertaken to consider the potential for likely

[1] Article 6(4) relates to plans or projects which must be undertaken despite identification of an assessment determining a negative effect on a given site due to imperative reasons of overriding public interest (IROPI), including those of a social or economic nature. Suitable compensatory measures are required to maintain the coherence of the network should such a case be made.

significant effects to arise in relation to Natura 2000 sites from activities associated with the proposed survey scope as defined in Section 2, including in-combination with other plans or projects. The approach taken to screening has been to:

- Define the location and nature of the proposed activities, together with their potential to result in likely significant effects on European sites.
- Identify all relevant European sites and their qualifying interests with the potential to be affected by the proposed survey activities.
- Screen the relevant sites for the likelihood of significant effects that could result from the activities, based on the nature and scale of potential effects, including in-combination with other relevant activities.
- Conclude whether likely significant effects have been identified.

Figure 1.1: Consideration of a plan or project affecting a Natura 2000 site



Source: European Commission (2021)

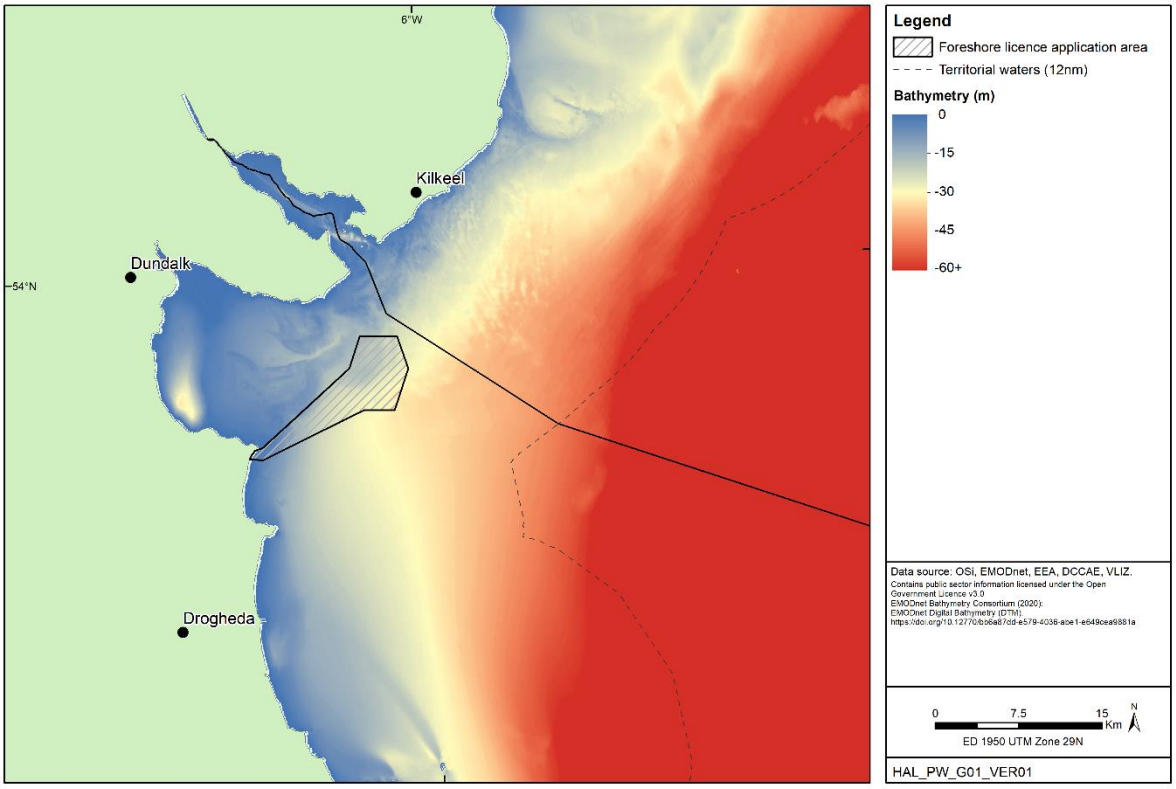
2 PROJECT DESCRIPTION

2.1 Location

The Foreshore licence application area comprises the Oriel offshore wind farm area and the offshore cable corridor (Figure 2.1). The offshore wind farm area is located off the coast of County Louth to the east of Dundalk Bay, approximately 22km east of Dundalk, 18km east of Blackrock, 5km south of the Cooley Peninsula and 10km north-east of Dunany Point. The offshore wind farm area covers approximately 27.8km^2 and is broadly hexagonal in shape with a length of approximately 5.3km west to east and 6.7 km north to south.

The offshore cable corridor is approximately 11km in length and covers an area of approximately 25km^2. The corridor is approximately 4km at its widest point, southwest of the offshore wind farm area, and narrows to approximately 1km at its narrowest point, just before landfall 700m south of Dunany Point.

Figure 2.1: Map of Foreshore Licence Application Area



2.2 Proposed site investigations

The site investigations will include:

- Geophysical surveys
- Geotechnical and sediment sampling
- Environmental/ecological surveys and sampling
- Oceanographic and meteorological survey.

Table 2.1 provides information on each of the elements of the works and an indication of their duration. It is anticipated that the survey works will commence in Q2 2022 subject to approval of the Foreshore Licence application, appointment of a suitable contractor, availability of vessels and suitable weather conditions. To allow for unforeseen delays approval of a Foreshore Licence for a 3 year period.

Table 2.1: Summary of surveys and indicative programme

Activity	Location	Proposed sample numbers	Duration
Geophysical Survey	Offshore windfarm area and offshore cable route	• Multibeam Echosounder (MBES) system for detailed bathymetric mapping • Side Scan Sonar (SSS) to achieve detailed seabed morphology and seafloor mapping • Magnetometer to detect geomorphological anomalies and ferrous obstructions • Sub-bottom Profiling (SBP), both single and multi-sources, to identify and characterise the layers of sediment/rock underneath the seafloor • Ultra-high-resolution multi-channel seismic (UHRS) to identify and characterise the layers of sediment/rock underneath the seafloor within the offshore site area. • Intertidal geophysical surveys including seismic, electrical resistivity and electromagnetic methods.	4 weeks (weather dependent)
Geotechnical Survey and Sediment Sampling	Offshore windfarm area and offshore cable route	27 no. deep investigation locations at proposed structure locations (25 wind turbines sites and two options for the offshore substation location). Each deep investigation location will require up to 3 drilled boreholes with a target depth of 50m below the seabed.	4-8 months (weather dependent; will be extended if unforeseen ground conditions are discovered)
		41 no. shallow investigation locations along proposed inter-array and export cable routes. Each location will require one vibrocore or gravity core with a target depth of 3m below the seabed.	
		Up to 6 no. deep investigation locations in the intertidal area. Each location would be a drilled borehole with a target depth of up to 50m.	
		Up to 12 no. shallow investigation locations in the intertidal area. Each location would be an excavated trial pit or borehole with a target depth of 3m below the beach. Excavated locations to be backfilled immediately on completion of the investigation. Cores and CPTs may be taken from the boreholes or trial pits.	
Environmental monitoring/ ecological sampling	Offshore windfarm area and offshore cable route	<u>FPODs or CPODs</u> Proposed to deploy up to 6 FPOD or CPOD devices to provide acoustic assessment of the presence/absence and species types of cetaceans (whales and dolphins). Each device will require a robust, heavy weight mooring blocks of *ca*. 250kg, clump chain and rope with either an acoustic release mechanism and benthic buoy or a robust	≤ 24 months (weather dependent)

Activity	Location	Proposed sample numbers	Duration
		mooring with a surface marker buoy. Batteries must be replaced and data downloaded every 3/4 months. Deployment and servicing would be undertaken from a survey vessel.	
	Offshore windfarm area and offshore cable route	Water Quality Sondes Proposed to deploy up to 6 sondes for water quality monitoring of parameters including turbidity, salinity, temperature, pH, dissolved oxygen, electrical conductivity. Each sonde will require a robust, heavy weight mooring block, clump chain and rope with either an acoustic release mechanism and benthic buoy or a robust mooring with a surface marker buoy.	
	Offshore windfarm area and offshore cable route	Benthic and intertidal Benthic survey techniques may include drop down video (DDV) and deployment of a mini Hamon grab or van Veen grab to obtain samples of 1-5kg in mass each. Manual digging may be used in the intertidal zone to collect the samples. Samples would be analysed to determine the benthic faunal community present and sediment geochemistry.	
	Offshore windfarm area and offshore cable route	Fish and shellfish GPS Tracking Up to 6 sondes may be deployed for the tracking of fish or shellfish within the windfarm and export cable corridor. Each sonde will require a robust, heavy weight mooring block, clump chain and rope with either an acoustic release mechanism and benthic buoy or a robust mooring with a surface marker buoy	
Oceanographic and meteorological	Offshore windfarm area and offshore cable route	All metocean survey works will occur at one location within the marine survey area. Data will be collected via a floating weather station, which will include a wave rider and a wind measurement LiDAR current profiler. The wave rider will be used to collect wave height and current data across the site, while the LiDAR system will be used to measure the wind characteristics within the site.	≤ 24 months (may be greatly reduced if findings are in line with existing data collected from previous surveys)

2.3 Description of the proposed survey works

2.3.1 Geophysical survey

The purpose of the geophysical survey is to determine the sediment conditions within the survey area in order to update the information gathered by previous surveys. This additional data will be used to better understand the sub-surface structure, in particular the sub-surface stratigraphy, and to confirm the bedrock elevation. The information will be used to assess the stability of the sub-surface soil for the design of foundations and the detailed routeing of the inter array and export cables.

The objectives of the geophysical survey are to:

- Produce detailed bathymetric mapping;
- Obtain detailed seabed morphology;

- Identify the nature of the seabed;
- Acquire both shallow and deep geological cross-sections of the wind farm site;
- Confirm the export cable route within the cable route corridor.

The geophysical survey will include bathymetric, side scan sonar, magnetometry and seismic sounding of the proposed site. Details of the exact survey equipment will be made available prior to commencement of the works; however, it is envisaged that the geophysical data acquisition will involve the following acoustic-based techniques:

- Multibeam Echosounder (MBES) system for detailed bathymetric mapping.
- Side Scan Sonar (SSS) for detailed seabed morphology and seafloor mapping.
- Magnetometer for detecting geomorphological anomalies and ferrous obstructions.
- Sub-bottom Profiling (SBP) to identify and characterise the layers of sediment/rock underneath the seafloor along the cable route corridor.
- Ultra-high-resolution multi-channel seismic (UHRS) to identify and characterise the layers of sediment/rock underneath the seafloor within the windfarm site.
- An ultra-short baseline acoustic positioning (USBL) system may be used to assist in the positioning of towed equipment relative to the vessel.

The geophysical survey will comprise transects with a total length of *ca*. 84km and a distance of 1km between each transect (Figure 2.2).

MBES

The MBES system will be used to provide detailed bathymetric mapping throughout the survey area. An MBES is a type of sonar (acoustic surveying) used in seabed mapping wherein acoustic waves are used to indicate depth-to-seabed. The device is typically affixed to a vessel's hull or towed in its wake. The process is non-intrusive, and the device will not make contact with the seabed at any point. The Kongsberg EM710 may be taken as an indicative example of a MBES system to be used in the completion of these works. The equipment will operate within a frequency range of 70-100kHz with sound pressure levels in the range of 225-231dB re1µPa at 1 metre range[2].

SSS

The side scan sonar will be used to achieve detailed seabed morphology and seafloor mapping of the survey area. The survey is carried out using a sonar device attached to a vessel that emits a fan-shaped pulse down towards the sea floor across a wide-angle perpendicular to the path of the sensor through the water. The intensity of the acoustic reflections from the seafloor of this fan shaped beam is recorded in a series of cross-track slices. When stitched together along the direction of motion, these slices form an image of the sea bottom within the swath (coverage width) of the beam. The equipment will operate within a frequency range of 100-500kHZ with source levels at 235dB re 1µPa at 1 metre range.

Magnetometer

A magnetometer detects ferrous objects and as such is used to locate and identify ferrous objects on or buried in the seabed within the range of the magnetometer. The device precisely measures the earth's magnetic field and detects any anomalies, which represent ferrous objects such as lost anchors, sunken ships and buried pipes. The magnetometer is typically towed behind a survey vessel or affixed to a vessel's hull. The process is non-intrusive, and

[2]https://cdn1.shipserv.com/ShipServ/pages/profiles/54162/documents/EM-710-Product-Description.pdf

the device will not make any physical contact with the seabed at any point. The G-882 Marine Magnetometer may be taken as an indicative example to be used in the completion of these works. The datasheet for this device in included in Appendix A of the Non-statutory Environmental Report.

SBP

The SBP will be used along the cable route corridor only. This device uses reflection seismology to give a 2D image of the sub-seabed geology. It is typically towed behind the vessel during survey works or affixed to the vessel's hull. The process is non-intrusive, and the device will not make any physical contact with the seabed at any point. The Innomar SES-2000 Quattro Parametric SubBottom Profiler[3] is used as an indicative example and the equipment will have a primary frequency of between 85 and 115kHz (with secondary low frequencies of between 2 and 20kHZ) and source levels of 235-245dB re 1µPa at 1 metre range.

UHRS

The UHRS will be used within the offshore wind farm area only, commonly used variants of this technology are known as sparkers and boomers. It will have the following characteristics as a minimum:

- repeatable source,
- frequency range of between 1kHz and 3.5kHz,
- broadband width in excess of 2.5kHz at -10db,
- vertical resolution better than 0.5 metres,
- penetration 50 metres,
- variable energy levels 100-1000 Joules,
- record length suitable for the maximum depth required (250ms),
- sampling rate 0.25ms.

Source levels estimated to be approximately 220dB re 1µPa at 1m[4]. A multi-channel hydrophone streamer will be used. The streamer will be neutrally buoyant or controlled, well maintained and free of air bubbles. The hydrophone will have a response appropriate to the source used but will generally have a flat response between 500Hz and 10kHz. The streamer will have at least 16 channels and be 50m long. A tail buoy with a radar reflector will be used to mark the streamer.

USBL

A USBL beacon may be used to precisely locate towed equipment (such as a sidescan sonar fish) relative to the vessel. Exemplar equipment includes Sonardyne Wideband Sub-Mini 6 Plus (WSM6+), Sonardyne Type 8300 Compatt 6, Kongsberg HiPAP which have a typical operating frequency of 20-40kHz.

2.3.2 Geotechnical survey

The purpose of the geotechnical survey is to investigate the stability of the soil for the design of foundations and the detailed routeing of the inter array and export cables.

[3] https://www.innomar.com/sbp-quattro.php
[4]https://www.aaetechnologiesgroup.com/applied-acoustics/products/sub-bottom-profiling/sound-source-sparkers/

Boreholes

Some 27 no. deep investigations will be carried out at potential structure locations (potential wind turbine and offshore substation locations) (Figure 2.2). Each deep investigation location will require up to 3 drilled boreholes with a target depth of 50m below the seabed. Thus, some 81 geotechnical boreholes will be drilled in the offshore wind farm area.

In situ testing will include the option of either down-hole wireline piezocone penetration testing (PCPT) associated to PS logging or down-hole wireline seismic cone testing (SCPT) over the full length of a borehole. These tests involve a shear wave source, located on a downhole probe or on the drilling frame at the surface respectively, and downhole geophones. While the activity can be described as resulting in impulsive sounds, the source levels are minor (70dB). SCPT tests will be executed at a minimum of four of the locations, which will be confirmed following the results of the geophysical survey. Two seismic measurements shall be carried out during each SCPT stroke at a depth interval of 1m; the envisaged number is 40-60 SCPT tests in total.

The boreholes will be advanced by alternating PCPT/SCPT and push/core sampling; requirements will depend on the material type encountered. Within a granular deposit, the boreholes will be advanced by alternating PCPT/SCPT and push sample. Where the sample recovery is poor using the push sampler, a hammer sampler will be used instead. Within the cohesive deposits, the boreholes will be advanced by PCPT/SCPT followed by two push samples. Rotary coring may be used instead of push sampling in suitable materials, in which case the CPT and cores will be alternated.

Up to 6 no. deep investigations will be carried out in the intertidal area. Each location would be a drilled borehole with a target depth of up to 50m.

Vibrocoring / gravity coring

It is estimated that some 41 no. shallow investigations will be required along the proposed inter-array and export cable routes. Each investigation will require one vibrocore or gravity core at each location with a target depth of 3m below the seabed. Figure 2.2 shows an indicative line for the cores. Vibrocoring is performed where cohesionless soil is expected. The vibrocorer will be lowered onto the seabed, after which the vibrocoring process will be started. Upon refusal or at target depth, the vibrocorer will be recovered on deck where the recovery rate is measured.

Gravity core (wireline self-weight penetration sampler) will be performed where cohesive soil is expected. The gravity corer will be lowered on the seabed and will penetrate in the seabed under its own weight. Upon refusal or at target depth, the gravity core will be recovered on deck where the recovery rate is measured.

Up to 12 no. shallow investigation locations will be carried out in the intertidal area. Each location would be an excavated trial pit or borehole with a target depth of 3m below the beach. Excavated locations will be backfilled immediately on completion of the investigation. Cores and CPTs may be taken from the boreholes or trial pits.

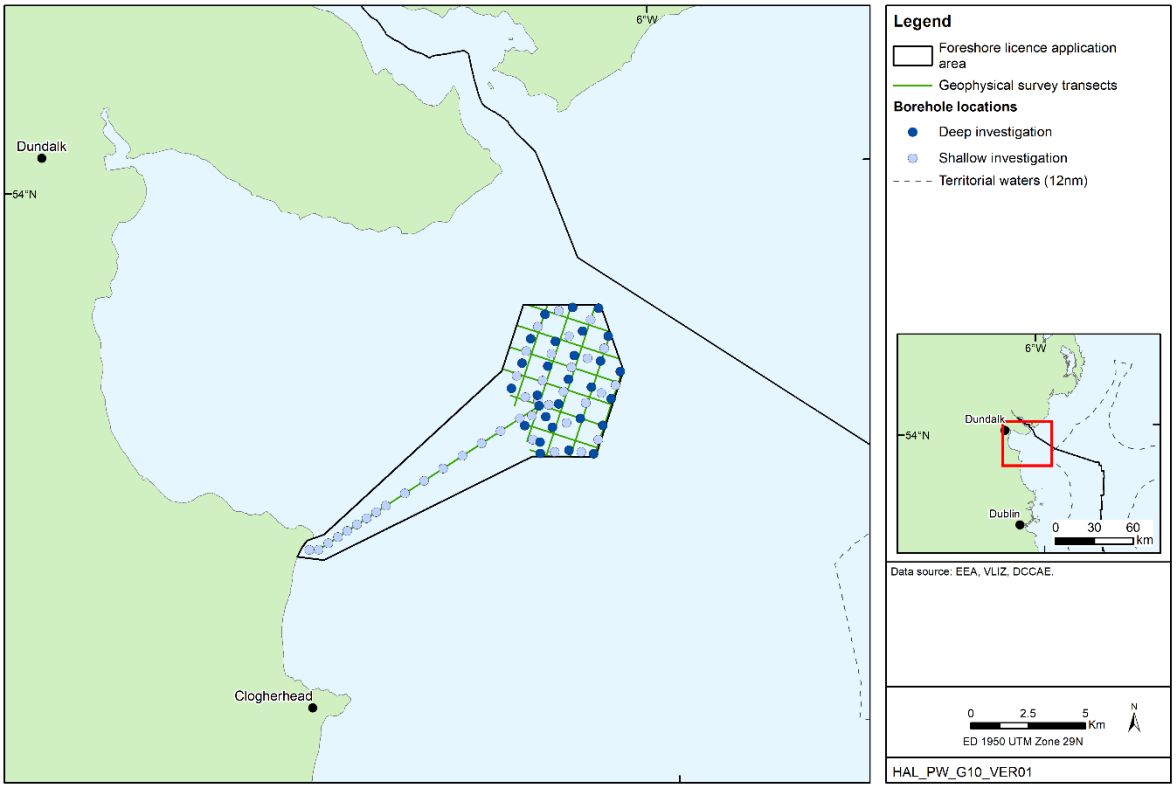
2.3.3 Ecological surveys

The purpose of the ecological surveys is to update the baseline environmental data collected from previous ecological surveys. The ecological scope of work will include the following:

CPODs

It is proposed to deploy up to 6 FPOD or CPOD devices for Static Acoustic Monitoring (SAM) of cetaceans. The devices will provide acoustic assessment of the presence/absence and species types of cetaceans to i) allow for the recording of species difficult to detect visually such as harbour porpoise, ii) provide data on other factors such as diel and tidal presence at the site. A CPOD is a self-contained computer and hydrophone in a sealed sonde approximately 1m in length which log the times and duration of click trains resembling the echo-location clicks produced by porpoises and dolphins. The acoustic device is independent of weather conditions once deployed and thus will ensure high quality data will be collected but only at a small spatial scale (typical detection distances of 250m (porpoises) to 800m (dolphins). Each CPOD will require robust, heavy weight mooring blocks of *ca*. 250kg, clump chain and rope with either an acoustic release mechanism and benthic buoy or a robust mooring with a surface marker buoy. Batteries will be replaced and data downloaded every 3/4 months. Deployment and servicing will be undertaken from a survey vessel.

Figure 2.2: Map of survey sample locations



Water quality sondes

It is proposed to deploy up to 6 sondes for water quality monitoring through the water column – these will be used to monitor a range of parameters including turbidity, salinity, temperature, pH, dissolved oxygen and electrical conductivity. Sondes will be either suspended from a surface marker buoy or a benthic buoy with acoustic release at a range of depths dependent on survey requirements. Each buoy would have a robust mooring on the seabed similar to the CPOD mooring described above.

Benthic and intertidal

Survey techniques will include drop down video (DDV) and deployment of a mini Hamon grab or van Veen grab to obtain samples of 1-5kg in mass each. Manual digging may be used in the intertidal zone to collect the samples. Samples will be analysed to determine the benthic faunal community present and sediment geochemistry.

Fish and shellfish GPS tracking

Up to 6 sondes may be deployed for the tracking of fish or shellfish within the windfarm and export cable corridor. Similar to the CPODs and water quality, the sondes will be deployed attached to a robust mooring with either a benthic buoy and acoustic release and/or a surface marker buoy.

2.3.4 Metocean Survey

The purpose of the metocean survey is to obtain site specific atmospheric, wave and wind data over a period of up to 24 months. All metocean survey works will occur at one location within the marine survey area which will be determined following the appointment of a suitable contractor. The data will be collected via a floating weather station, which will include a wave rider and a wind measurement LiDAR current profiler. This equipment will be mounted on specifically designed floating buoys which are moored to the seabed using an anchor chain and clump weights. All equipment including the moorings will be removed following completion of the survey. The wave rider will be used to collect wave height and current data across the site, while the LiDAR system will be used to measure the wind characteristics within the site.

2.4 Survey vessels

Separate survey vessels will be used for each activity. A larger vessel is required to complete the offshore geotechnical works, with smaller vessels used for the geophysical, metocean and ecological surveys. A smaller RHIB type vessel may be used for geophysical works in shallow waters. Land based drilling and excavators may be used for the investigations and surveys within the intertidal zone. The types of vessels are described below.

Offshore vessel

The survey vessel used for offshore geotechnical works will be either a jack-up barge or a Dynamic positioning (DP) vessel. Typical examples of the types of vessels used to undertake these works are provided in Appendix A of the Non-statutory Environmental Report.

Jack-up barges utilise a fixed anchoring system in order to maintain the required position within the site. The vessel consists of a self-elevating platform and four or six “legs”, that are deployed to the ocean floor mooring the vessel in place. The survey works are carried out from the self-elevating platform, which is raised above the water’s surface. If used, the jack-up barge will meet with the following minimum requirements:

- The vessel will have at least four mooring points
- The self-elevating platform must be permanently manned (i.e. off-shift personnel to stay onboard even if the accommodation is not a permanent equipment of the jack-up);
- The platform must be provided with a class certificate verifying the provision of adequate safety equipment for the type of vessel and the number of on-board personnel;

- The platform should be certified in compliance with the MODU (Mobile Offshore Drilling Unit) Code[5] and the RenewableUK guidelines[6].

Unlike jack-up barges, DP vessels maintain station via propellers and thrusters with inputs from satellite DGPS signals, allowing the vessels to be positioned over any point on the seabed and maintain position without employing a fixed anchoring system. Using thrusters or propellers, a DP vessel can maintain position within a 2m to 0.5m window depending on the sea state/weather conditions and available power. The vessel may also transit under DP control along a given pre-determined path.

If used, a DP vessel will meet the following minimum requirements:

- The vessel must be fully equipped with a Class II DP system as a minimum
- Two DP certified operators with the necessary experience must be members of the crew
- The offshore works will be carried out on a 24-hour shift basis, with personnel working two 12-hour shifts. This will allow the works to be continuous.

Nearshore vessel

The smaller, nearshore vessel will be used in locations where the water depth is too shallow for the larger, offshore vessel to carry out the works. This vessel does not need to have a dynamic positioning system, however must have full DGPS capability. The vessel is usually held on station by joy-stick control and will deploy an anchor to assist in maintaining station (depending on sea state and weather conditions). The smaller vessel will use similar equipment to the larger vessel to carry out the required survey works.

The nearshore works will be carried out on a 12 hour per day basis, with the vessel returning to port at the end of each day.

There will be no significant discharges from the offshore and nearshore survey vessels, and any discharge would be consistent with obligations under MARPOL, which effectively prevent pollution from such sources. The survey vessels will meet all relevant MARPOL requirements e.g. in relation to Annex I, Annex IV and Annex V on the prevention of pollution by oil, sewage and garbage from ships, respectively, under the Sea Pollution Act 1991 (as amended), and the Sea Pollution (Prevention of Pollution by Garbage from Ships) Regulations 2012 (as amended). The vessels will hold a Shipboard Oil Pollution Emergency Plan (SOPEP).

[5] https://rules.dnv.com/docs/pdf/gl/maritimerules/gl_iv-6-2_e.pdf
[6]https://www.renewableuk.com/news/309151/Guidelines-for-the-Selection-and-Operation-of-Jack-ups-in-the-Marine-Renewable-Energy-Industry.htm

3 IDENTIFICATION OF RELEVANT NATURA 2000 SITES

3.1 Site selection process

Guidance from the National Parks and Wildlife Service - *Appropriate Assessment of Plans and Projects in Ireland - Guidance for Planning Authorities* (DoEHLG, 2010) recommends that the identification of any Natura 2000 site which might be affected by any plan or project should be evaluated on a case-by-case basis but that the appropriate assessment process should include the following Natura 2000 sites:

1. Any Natura 2000 sites within or adjacent to the plan or project area.
2. Any Natura 2000 sites within the likely zone of impact of the plan or project. A distance of 15km is currently recommended in the case of plans, and derives from UK guidance (Scott Wilson *et al.* 2006). For some projects, the distance could be much less than 15km, and in some cases less than 100m, but this must be evaluated on a case-by-case basis with reference to the nature, size and location of the project, and the sensitivities of the ecological receptors, and the potential for in-combination effects.
3. Natura 2000 sites that are more than 15km from the plan or project area, depending on the likely impacts of the plan or project, and the sensitivities of the ecological receptors, bearing in mind the precautionary principle.

In addition to considering the above guidance, this AA screening has reflected the recent OPR 2021 Practice Note and identified Natura 2000 sites which could be affected by the survey based the Source-Pathway-Receptor model informed by the nature and scale of the proposed survey programme (Section 2), its sources of potential effect (Section 3.2), an understanding of the nature and scale of such effects (Section 3.3), and the potential for interaction between relevant qualifying interests and these effects (Section 3.4). Combined, these reflect the zone of influence of the project, which varies for each relevant site and sources of potential effect. The sites identified for screening are assessed for the likelihood for significant negative direct, indirect and in-combination effects in Section 4.

3.2 Sources of potential effect

In respect of the proposed survey activities, the main sources of potential effect relevant to Natura 2000 sites and their qualifying interests arise from:

- Physical disturbance of seabed habitats from survey activities,
- Physical presence of the survey vessels,
- Underwater noise including from the vessels and survey equipment,
- Oil spillage from the survey vessels

The evidence base for the sources of potential effect is considered in turn below against major groups of receptors for which there is considered to be a potential interaction, which are primarily marine mammals, birds and fish. The evidence is then considered against the potential presence of qualifying interests to allow identification of the relevant Natura 2000 sites.

3.3 Evidence base for the nature and scale of potential effects

3.3.1 Physical disturbance of seabed habitats from survey activities

Annex I habitats

There are a number of survey activities which could cause physical disturbance of Annex I habitats within SAC sites.

The use of a jack-up barge could cause physical disturbance of the seabed from the placement of the barge's legs with terminal spudcans on the seabed. The form of the spudcan footprint depends on factors such as the spudcan shape, the soil conditions, the footing penetration and methods of extraction, with the local sedimentary regime affecting the longevity of the footprint (HSE 2004). For example, swathe bathymetry data collected as part of FEPA monitoring of the Kentish Flats wind farm off the Kent coast indicated a set of six regular depressions in the seabed at each of the turbine locations resulting from jack-up operations. Immediately post-construction, a January 2005 survey recorded these depressions as having depths of between 0.5 and 2.0m. By November 2007, these depths had reduced by an average of 0.6m indicating that the depressions were naturally infilling as a result of the mobile sandy sediments present across the area (Vattenfall 2009). In locations with an uneven or soft seabed, material such as grout bags or rocks may be placed on the seabed to stabilise the rig feet, and recoverable mud mats may be used in soft sediment. If a survey vessel maintains position using dynamic positioning, depending on the vessel draught and water depth, sediment disturbance can occur from the strong water currents produced by the propellers and thrusters (ducted propellers). The placement of benthic mooring blocks, if used to hold underwater survey equipment (e.g. CPODs, sondes), could also cause physical disturbance.

Other activities including the collection of vibrocores, boreholes and grab samples may result in a small loss of seabed sediments and the release of relatively small and transient sediment plumes into the water column.

Criterion used: Screen in relevant sites which directly overlap with the marine survey area or are within a 5km buffer (encompasses the estimated maximum tidal excursion (3.5km) from the survey area and the extent to which suspended sediment plume effects would be expected to occur), and for which there is an impact pathway.

3.3.2 Physical presence of the survey vessel

Birds

The survey area may support important numbers of birds at certain times of the year including overwintering birds and those foraging from coastal SPAs. Therefore, the presence and/or movement of the survey vessel could temporarily disturb birds from relevant SPA sites.

Physical disturbance of seaduck and other waterbird flocks by vessels is possible, particularly in SPAs established for shy species (e.g. common scoter). Such disturbance can result in repeated disruption of bird feeding, loafing and roosting. For example, large flocks of common scoter were observed being put to flight at a distance of 2km from a 35m vessel, though smaller flocks were less sensitive and put to flight at a distance of 1km (Kaiser 2002, also see Schwemmer *et al.* 2011). Larger vessels would be expected to have an even greater disturbance distance (Kaiser *et al.* 2006). Mendel *et al.* (2019) further note behavioural response in red-throated diver within 5km of ships. Divers and sea ducks have been assessed as being the most sensitive species groups to offshore development and associated boat traffic. Whilst displacement effects for divers have been detected at greater distances (e.g. 5-

7km, Webb 2016; significant changes noted at 10-16.5km, Mendel *et al.* 2019), this relates to the construction and operation of offshore wind farms which have a much larger spatial and temporal footprint than survey activities. Fliessbach *et al.* (2019) reported maximum escape distances for individual birds in response to vessels to be 3.2km for common scoter, with other sea ducks, divers, red-breasted merganser and cormorant all ≥1.5km; consequently, these are the species considered to be sensitive to vessel disturbance for the purposes of this assessment. It is noted that flock escape distances for all the aforementioned species were 1.2km or less. Considering the evidence, for divers, sea ducks and other species identified as most sensitive to vessel disturbance, a 4km displacement buffer is considered to be appropriate. Additionally, such species generally forage in coastal waters of ≤20m depth (Fox *et al*. 2003), which limit their potential to interaction with offshore activities in deeper waters.

Certain seabird species (e.g. gulls, fulmar, kittiwake) are considered to have a low sensitivity to shipping activities (Garthe & Hüppop 2004, MMO 2018, Fliessbach *et al.* 2019), with others such as auks (razorbill, cormorant, guillemot) are regarded to have moderate sensitivity (Fliessbach *et al.* 2019, also see MMO 2018).

Criterion used: Screen in relevant SPAs for waterbird species sensitive to vessel disturbance (e.g. divers and seaducks) which are located within 4km of the survey area, or where activities take place within shallow coastal waters known to be used by such species. For seabirds, screen in relevant SPAs for which a sensitive qualifying interest (e.g. razorbill, cormorant and guillemot) could theoretically be present in the survey area based on available foraging range data (e.g. Woodward *et al*. 2019).

Marine mammals

The primary source of potential physical effect from vessels in relation to marine mammals is collision. Worldwide, collisions with vessels are a potential source of mortality to marine mammals, primarily cetaceans. Whales are occasionally reported to be struck and killed by ships, especially by fast-moving ferries, but smaller cetacean species and seals can also be impacted by propeller strikes from smaller vessels. In the UK certain areas experience very high densities of commercial and recreational shipping traffic, some of which may also be frequented by large numbers of marine mammals; despite this, relatively few deaths are recorded as a result of collisions (Hammond *et al*. 2008). Between 2000 and 2009, only 11 out of 1,100 post-mortems on harbour porpoises and common dolphins identified collision as the cause of death (UKMMAS 2010).

Criterion used: Screen in relevant SACs for marine mammal species where the site boundary overlaps the survey area, and for pinnipeds screen in any site within foraging range (50km for harbour seal and 100km for grey seal, see Section 3.4.1). Cetaceans are not central-place foragers, and attributing any animals to a specific SAC is challenging. For the purposes of this assessment, cetaceans which are qualifying interests of all SACs within the relevant management units as defined by IAMMWG (2021) have been used (see Section 3.4.1).

3.3.3 Underwater noise including from the vessel and survey equipment

Studies on the potential effects of underwater noise from marine survey have tended to focus on seismic survey using airgun arrays. While the proposed survey activities will generate significantly less noise than airgun sources, these studies are relevant to the consideration of potential noise effects on birds, fish and marine mammals and are therefore summarised here.

Birds

Information on the underwater hearing abilities of diving birds and evidence of the effects of underwater anthropogenic noise is very limited. Direct effects from underwater acoustic surveys on diving birds could potentially occur through physical damage, given exposure to sufficiently high amplitudes, or through behavioural disturbance. Deeper-diving species which spend longer periods of time underwater (e.g. auks) may be most at risk of exposure, but all species which routinely submerge in pursuit of prey and benthic feeding opportunities in marine and estuarine habitats may be exposed to anthropogenic noise. A list of relevant species is provided in Table 3.1.

Table 3.1: Migratory and/or Annex I diving bird species considered potentially vulnerable to underwater noise effects

Divers and grebes	**Diving ducks**
Great northern diver *Gavia immer*	Pochard *Aythya ferina*
Red-throated diver *Gavia stellata*	Tufted duck *Aythya fuligula*
Black-throated diver *Gavia arctica*	Scaup *Aythya marila*
Little grebe *Tachybaptus ruficollis*	Eider *Somateria mollissima*
Great crested grebe *Podiceps cristatus*	Long-tailed duck *Clangula hyemalis*
Slavonian grebe *Podiceps auritus*	Common scoter *Melanitta nigra*
	Velvet scoter *Melanitta fusca*
Seabirds	Goldeneye *Bucephala clangula*
Manx shearwater *Puffinus puffinus*	Red-breasted merganser *Mergus serrator*
Gannet *Morus bassanus*	Goosander *Mergus merganser*
Cormorant *Phalacrocorax carbo carbo*	
Shag *Phalacrocorax aristotelis*	
Guillemot *Uria aalge*	
Razorbill *Alca torda*	
Puffin *Fratercula arctica*	

Note: Includes species which are known to engage in pursuit diving or benthic feeding in marine, coastal and estuarine waters at least during part of the year.

Tests of hearing in a range of diving species suggest a hearing range of approximately 500Hz to 4kHz, with similar results obtained in air and underwater (Crowell 2014, Crowell e*t al.* 2015, Hansen *et al*. 2017). McCauley (1994) inferred from vocalisation ranges that the threshold of perception for low frequency seismic noise in some species (e.g. penguins, considered as a possible proxy for auk species) would be high, hence individuals might be adversely affected only in close proximity to the source.

Very high amplitude low frequency underwater noise may result in acute trauma to diving seabirds, with several studies reporting mortality of diving birds in close proximity (i.e. tens of metres) to underwater explosions (Yelverton *et al*. 1973, Cooper 1982, Stemp 1985, Danil & St Leger 2011). However, mortality of seabirds has not been reported during extensive seismic operations in the North Sea and elsewhere.

With the exception of Pichegru *et al*. (2017), which relates to penguins, there are no published reports of changes in abundance or distribution of diving birds concurrent with seismic or other acoustic survey activity. A study investigated seabird abundance in the Hudson Strait (Atlantic seaboard of Canada) during seismic surveys over three years (Stemp 1985). Comparing periods of shooting and non-shooting, no significant difference was observed in abundance of thick-billed murre (Brünnich's guillemot), or fulmar or kittiwake.

While seabird responses to approaching vessels are highly variable (e.g. Fliessbach *et al*. 2019), flushing disturbance would be expected to displace most diving seabirds from close proximity to the survey vessel and any towed equipment, thereby limiting their exposure to the highest sound pressures generated.

These data are limited, but the observed regions of greatest hearing sensitivity for cormorants in water and other diving birds in air are above those low frequencies (i.e. <500Hz) which dominate and propagate most widely from geological survey. While there is some evidence of noise-induced changes in the distribution and behaviour of diving birds in response to impulsive underwater noise, these have been temporary and may be a result of direct disturbance or reflect a change in prey distribution during that period (possibly as a result of seismic activities).

Marine mammals

Information on the potential effects of other geophysical surveys (e.g. sub-bottom profilers) is limited, with empirical studies of animal responses to such surveys lacking. The most recent UK Offshore Energy SEA (DECC 2016) concluded that, given the characteristics of the noise sources produced, effects are considered to be negligible but with a high level of uncertainty. Recent investigation of the source levels of a variety of high-resolution geophysical survey (HRGS) sources (Crocker & Fratantonio 2016, Crocker *et al*. 2019), combined with preliminary results of emitted sound fields, have provided evidence to support the conclusion of very low risk of significant effects from non-airgun HRGS sources, with received levels dropping to below that which might be expected to cause behavioural disturbance within a few hundred metres of the source (Halvorsen & Heaney 2018).

Evidence of the effects of seismic surveys on odontocetes and pinnipeds is limited but of note are studies in the Moray Firth observing responses to a 10 day 2D seismic survey (Thompson *et al.* 2013). The 2D seismic survey took place in September 2011 and exposed a 200km^2 area to noise throughout that period; peak-to-peak source levels generated by the 470 cubic inch airgun array were estimated to be 242-253 dB re 1 µPa at 1m. Within 5-10km from the source, received peak-to-peak SPLs were estimated to be between 165 and 172 dB re 1 µPa, with SELs for a single pulse between 145 and 151 dB re 1 µPa^{2}s. A relative decrease in the density of harbour porpoises within 10km of the survey vessel and a relative increase in numbers at distances greater than 10km was reported; however, these effects were short-lived, with porpoise returning to affected areas within 19 hours after cessation of activities.

More recently, the effects of a large 3D seismic survey conducted in the Danish sector of the North Sea on harbour porpoise echolocation activity were examined (Sarnocińska *et al*. 2020). The source comprised a 3,570in^3 airgun array and the survey lasted 103 days, with seismic activity occurring on all but 17 days, covering an area of 1,121km^2. Acoustic loggers were deployed inside and adjacent to the seismic survey area, before, during and after the survey over a total duration of 9 months. Three different measures of porpoise activity showed a dose-response effect, with the lowest activity closest to the source vessel, and activity increasing up to a range of 8-12km, beyond which baseline acoustic activity was attained and no general displacement could be detected compared to reference stations at 15km from the seismic activity. The lowest porpoise acoustic activity was recorded at SELs for a single pulse of 155dB re 1 µPa^{2}s - a similar level to that estimated by Thompson *et al*. (2013) at distances where harbour porpoise detections were reduced.

Overall, it was concluded that while short-term disturbance was induced, the survey did not lead to long-term or broad-scale displacement (Thompson *et al*. 2013). Further acoustic analyses revealed that for those animals which stayed in proximity to the survey, there was a 15% reduction in buzzing activity associated with foraging or social activity; however, a high

level of natural variability in the detection of buzzes was noted prior to survey (Pirotta *et al*. 2014). Passive acoustic monitoring provided evidence of short-term behavioural responses also for bottlenose dolphins, but no measurable effect on the number of dolphins using the Moray Forth SAC could be revealed (Thompson *et al*. 2013). Direct observations of disturbance specifically related to SCPT or hammer sampling methods are not available, however, in view of their comparatively small impulsive noise sources relative to that of the evidence available for seismic survey presented above, or studies related to wind farm pile driving (e.g. Brandt *et al*. 2018, Dähne *et al.* 2013, Graham *et al*. 2019), behavioural effects from their use would be expected to be much smaller and unlikely to be distinguishable from the effects of survey vessel noise.

Noise from the presence and movement of vessels could also potentially disturb marine mammals foraging within or close to sites for which they are a qualifying feature. Reported responses include avoidance, interrupted foraging behaviour, changes in swimming speed, direction and surfacing patterns, and alteration of the intensity and frequency of calls (review in Erbe *et al*. 2019). Chronic exposure has also been linked to an increase in stress-related hormones (Rolland *et al.* 2012). Harbour porpoises, white-sided dolphins and minke whales have been shown to respond to survey vessels by moving away from them, while white-beaked dolphins have shown attraction (Palka & Hammond 2001). A study on captive harbour porpoises in a semi-natural net-pen complex in a Danish canal, recorded their behaviour while simultaneously measuring underwater noise of vessels passing the enclosure; reaction to noise was defined to occur when a highly stereotyped 'porpoising' behaviour was observed. Porpoising occurred in response to almost 30% of vessel passages; the most likely behavioural trigger were medium- to high- frequency components (0.25–63kHz octave bands) of vessel noise, while low- frequency components of vessel noise and additional pulses from echo-sounders could not explain the results (Dyndo *et al*. 2015). A tagging study of a small number of free-ranging porpoises in Danish coastal waters estimated that porpoises encountered vessel noise 17-89% of the time (from evaluation of the wideband sound and movement tag recordings). Occasional high-noise levels (coinciding with a fast ferry) were associated with vigorous fluking, bottom diving, interrupted foraging and even cessation of echolocation, leading to significantly fewer prey capture attempts at received levels greater than 96dB re 1 mPa (16 kHz third-octave, Wisniewska *et al.* 2018). Though much larger than the type of jack-up vessels proposed for use in the survey, underwater noise associated with a jack-up rig of the type used in the offshore oil and gas industry is of a very similar dominant frequency range as that from large merchant vessels, albeit of lower average intensity (e.g. see Todd & White 2012), and measurements of noise generated by shallow drilling of the type to be conducted for this survey (Erbe & McPherson 2017) were of a similar amplitude to that of shipping. While direct behavioural disturbance from drilling has not been observed, the noise sources associated with it are expected to be similar to that of the vessels which would be used as part of the wider survey campaign.

More evidence is available on bottlenose dolphins, especially for coastal populations. Shore-based monitoring of the effects of boat activity on the behaviour of bottlenose dolphins off the US South Carolina coast, indicated that slow moving, large vessels, like ships or ferries, appeared to cause little to no obvious response in bottlenose dolphin groups (Mattson *et al*. 2005). Pirotta *et al*. (2015) used passive acoustic techniques to quantify how boat disturbance affected bottlenose dolphin foraging activity in the inner Moray Firth. The presence of moving motorised boats appeared to affect bottlenose dolphin buzzing activity (foraging vocalisations), with boat passages corresponding to a reduction by almost half in the probability of recording a buzz. The boat effect was limited to the time where a boat was physically present in the sampled area and visual observations indicated that the effect increased for increasing numbers of boats in the area (Pirotta *et al.* 2013). Dolphins appeared to temporarily interrupt their activity when disturbed, staying in the area and quickly resuming foraging as the boat moved away.

Fish

Studies of fish mortality or behavioural response to noise have tended to focus on geological seismic survey using airgun arrays, and while the proposed survey activities will generate significantly less noise than these, these studies have relevance to the consideration of potential noise effects on fish and are therefore summarised here.

Studies investigating fish mortality and organ damage from noise generated during seismic surveys are limited and results are highly variable, from no effect to long-term auditory damage (reviewed in Carroll *et al*. 2017). Behavioural responses and effects on fishing success ("catchability") have been reported following seismic surveys (Pearson *et al.* 1992, Skalski *et al.* 1992, Engås *et al.* 1996, Wardle *et al*. 2001), although a similar number of studies have reported no effects on catches or abundance, or conflicting results (Carroll *et al*. 2017). Existing studies do not yield completely coherent results but show that short-term startle responses are common at high exposure levels, and that fish can stop foraging and move down in the water column (Slabbekoorn *et al*. 2019). Such temporary displacement and/or altered feeding behaviour are likely to be responsible for the reduced catches reported in some circumstances.

Potential effects on migratory diadromous fish is an area of significant interest for which empirical evidence is still limited, especially as salmonids and eels are sensitive to particle motion (not sound pressure) (Gill & Bartlett 2010). Atlantic salmon *Salmo salar* have been shown through physiological studies to respond to low frequency sounds (below 380Hz), with best hearing at 160Hz (threshold 95 dB re 1 µPa). Harding *et al.* (2016) note a lower sensitivity at 100Hz than previously reported (Hawkins & Johnstone 1978), and greater sensitivity at frequencies of >200Hz, with evidence of some response at 400-800Hz. However, the authors qualify their results with differences in methodological approach, and the use of fish maintained in tanks receiving low frequency ambient sound within the greatest range of sensitivity (<300Hz) for some time in advance of the experiments taking place. The ability of salmon to respond to sound pressure is regarded as relatively poor with a narrow frequency span, a limited ability to discriminate between sounds, and a low overall sensitivity relative to other fish species (Hawkins & Johnstone 1978, cited by Gill & Bartlett 2010, Harding *et al.* 2016). A recent study of the hearing ability of sea lamprey (*Petromyzon marinus*) reported that, consistent with fish lacking a swim bladder, sea lamprey showed a limited sensitivity to sound, with juveniles detecting tones of 50-300Hz, but not higher frequencies (Mickle *et al*. 2019).

Criterion used: Screen in relevant SACs and SPAs with qualifying interests which are noise sensitive (marine mammals, migratory fish, diving birds) either where the site boundary is within 15km of the survey area or where foraging ranges may bring such qualifying interests to within this distance. For cetaceans, screen in any SAC within the relevant management unit (after IAMMWG 2021) where the survey is proposed to take place.

3.3.4 Oil spillage

The surveys will result in a marginal increase in levels of marine traffic and therefore could theoretically increase the risk of accidents and potentially spillage of marine diesel fuel. The survey activities will be communicated through notices to mariners and the vessels will display appropriate navigational lighting. In view of the duration and scale of activity and standard good navigation practice, the probability of a collision with another vessel is considered to be extremely low, such that diesel spillage and potential effects are not considered to be likely. Diesel contains very high levels of light hydrocarbons, which evaporate quickly on release, with a proportion dissolving into the water column. Evaporation can be enhanced by higher

wind speeds, warmer water and air temperatures. The low asphaltene contents prevents emulsification of spilled diesel, reducing its persistence in the marine environment, a diesel spill typically disperses with 8 hours which limits the distance a slick can spread. A diesel spillage in coastal waters could reach the waters and intertidal habitats of adjacent Natura 2000 sites within 10km.

Criterion used: Screen in relevant SACs and SPAs with qualifying interests (intertidal habitats, seabirds and waterfowl) where the site boundary is within 10km of the survey area.

3.4 Relevant sites

Natura 2000 sites (Special Areas of Conservation, SACs and Special Protection Areas, SPAs) have been identified on the basis that they could have a potential interaction with the survey activities, using the criteria outlined in Section 3.3. These are presented in Figures 3.2 and 3.3. More detail on the rationale for the site selection is presented below and in Appendix 1[7].

An overview of the current understanding of the foraging ranges of relevant species is given below. While these may indicate a theoretical interaction between a site feature and the survey area, there is an important distinction to be made between a potential interaction with site features and the potential for likely significant effects (i.e. those which could undermine a site's conservation objectives), which are considered further in Section 4.

3.4.1 SACs

Annex I habitats

There is one relevant SAC for which an interaction with survey activities could cause physical disturbance of Annex I habitats. Dundalk Bay SAC is 4.5km from the survey area and supports a number of marine Annex I habitats as qualifying interests (estuaries, mudflats and sandflats not covered by seawater at low tide). Given the nature and scale of potential physical disturbance associated with survey activities, no impact pathway was identified for the coastal Annex I habitats within the site (perennial vegetation of stony banks, *Salicornia* and other annuals colonising mud and sand, Atlantic salt meadows (Glauco-Puccinellietalia maritimae), Mediterranean salt meadows).

Marine mammals

Relevant SACs for which an interaction is considered possible include those for harbour porpoise, bottlenose dolphin, grey seal and harbour seal.

The harbour porpoise is an abundant and widespread species occurring around the Irish coast, commonly seen in shallow coastal waters in the summer (Marine Institute 2013). A comparison of the results of the broad-scale SCANS and SCANS-II surveys (SCANS-II 2008) indicate there has been a general shift to the southwest and an increase in the harbour porpoise population in the region over the period between the surveys. The wind farm survey area lies within Stratum 5 of the ObSERVE (Rogan *et al.* 2018) survey programme, which extends from Carlingford Lough in the north to Carnsore Point in the south, and from the coast offshore to approximately the limit of the Irish EEZ. This area was surveyed a total of four times during the ObSERVE programme, in summer and winter 2015 and 2016. Harbour

[7] Sites were selected on the basis of the screening criteria outlined in Section 3.4, and the qualifying interests of SACs (datasheet at May 2020) and SPAs (datasheet at June 2020) in Ireland listed by the NPWS, those for the UK listed by the Joint Nature Conservation Committee (datasheet at December 2020) and by the EEA (datasheet at July 2021) for other adjacent states.

porpoise were observed throughout this area in all surveys, with density estimates of between approximately 0.7 and 1.0 porpoise per km^2 – the highest estimated across any survey strata. More specifically to the wind farm survey area, APEM (2020) recorded one porpoise in June 2020, two in August and three in September, with none recorded in April, May and July.

SACs for harbour porpoise represent areas supporting persistently higher densities of animals relative to elsewhere in their range (e.g. Heinänen & Skov 2015). Harbour porpoise are a highly mobile, wide-ranging species; while some individuals using designated SACs will exhibit a degree of site fidelity, they are not central place foragers like seals or breeding seabirds and will travel and forage over a large area. While harbour porpoise using more distant SACs are less likely to occur in the survey area, their broad-scale movements are poorly understood, and so a precautionary approach has been taken to screen in any SACs occurring within the same management unit as where the survey is proposed to take place. The survey area lies within the large Celtic and Irish Seas harbour porpoise management unit, which encompasses the majority of coastal waters of Ireland, in addition to those of Wales, south-west and north-west England and south-west Scotland (IAMMWG 2021). Relevant SACs are, Roaringwater Bay and Islands SAC, Blasket Islands SAC, Rockabill to Dalkey Island SAC, Bristol Channel Approaches SAC, North Anglesey Marine SAC, West Wales Marine and North Channel SAC.

Bottlenose dolphins are known to occur in the western Irish Sea but at relatively low densities compared with the Celtic Sea, and offshore waters to the west of Ireland (e.g. Rogan *et al*. 2018); also note that only two unidentified dolphins were recorded by APEM (2020). There are two SACs within the relevant management unit of the Irish Sea where this species is a qualifying feature (Cardigan Bay SAC and Lleyn Peninsula and the Sarnau SAC).

Grey seals occupy haul-outs along the Irish coast, to which they return to rest, breed and rear young. Breeding in Ireland generally takes place between September and December (Cronin *et al*. 2011). Grey seals favour exposed rocky shores, sand-bars or sea caves, with easy access to deep water for breeding and the largest colonies are found on exposed islands off the west and southwest coasts. At-sea densities of grey seals are generally predicted to be low (< 1 seal per 5x5m grid cell), but higher (up to 30 seals per grid cell) within approximately 10km of the coast (Russell *et al.* 2017), particularly in the waters around Lambay Island, which is the principal breeding colony of grey seals on the east coast of Ireland supporting approximately 200-250 animals of all ages. Grey seals may range widely to forage and frequently travel over 100km between haulout sites (SCOS 2017). Grey and harbour seals are qualifying features of Lambay Island SAC, with harbour seal qualifying features of Murlough SAC and Strangford Lough SAC (NI). APEM (2020) recorded two grey seals in August and September 2020, and none in April to July.

Harbour seals are generally found in more sheltered areas, again predominantly along the west coast. Females pup in June or July, and the annual moult takes place in July and August, so harbour seals tend to be at or near haul-outs through the summer (Cronin *et al*. 2007, Rakka & Minto 2015). Harbour seals rarely forage far from their haul-out, with surveys in southwest Ireland suggesting they generally stay within 20km of their haul-out (Cronin *et al*. 2008), although longer distances do occur (e.g. Jones *et al.* 2015 noted that only 3% of tagged harbour seals foraged further than 50km) and foraging behaviour seems to vary with geographical location. Marine usage maps for the UK and Ireland based on extensive tagging data suggest a low to moderate occurrence of harbour seals in the survey area (Jones *et al*. 2015). APEM (2020) did not record any harbour seals, however, a low number (2-7) unidentified seals were recorded between May and September 2020, which could have been either harbour or grey seals.

The above evidence of at-sea distribution of seals suggests that the survey area is within the normal foraging range of Lambay Island SAC for grey and harbour seals, and from Murlough SAC and Strangford Lough SAC for harbour seal.

Fish

Of those fish listed under Annex II of the EC Habitats Directive, those relevant to potential sources of effect identified for the survey are Atlantic salmon, sea lamprey, river lamprey and twaite shad, as these are migratory and spend part of their life cycle at sea. Atlantic salmon and river lamprey are qualifying features of the River Boyne and River Blackwater SAC, which flows into the Irish Sea *ca*. 27km south west of the survey area. Salmon use the tributaries and headwaters of the River Boyne as spawning grounds and run the Boyne almost every month of the year. The Boyne is important as it represents an eastern river which holds large three-sea-winter fish which generally arrive in February, with smaller spring fish arriving in April/May. The grilse come in July, and the river gets a further run of fish in late August[8]. There is the potential for interaction with the survey area, though any direct interaction with activities would be limited to where the timing of the survey coincided with that of fish returning to their natal rivers, or smolts migrating to sea.

While river lamprey are an anadromous qualifying interest of the River Boyne and River Blackwater SAC, they are likely to be found in estuarine waters rather than offshore, and are unlikely to be present in any significant numbers in the survey area.

Diesel spillage from vessel collision could reach the Dundalk Bay SAC and the Carlingford Shore SAC.

On the basis of the screening criteria, and the evidence base presented above, Table 3.2 lists those SACs (see Figure 3.3) and relevant qualifying interests requiring further consideration in the screening assessment (Section 4). More information on the rationale for the screening of relevant sites and features is provided in Appendix 1.

Table 3.2: SACs identified for further consideration

Site code	Site name	Relevant qualifying interests
IE0000455	Dundalk Bay SAC	Mudflats and sandflats not covered by seawater at low tide
		Estuaries
IE0002306	Carlingford Shore SAC	Annual vegetation of drift lines
IE0000781	Slaney River Valley SAC	Harbour porpoise
IE0000204	Lambay Island SAC	Harbour porpoise
		Grey seal
IE0000101	Roaringwater Bay and Islands SAC	Harbour porpoise
IE0002172	Blasket Islands SAC	Harbour porpoise
IE0003000	Rockabill to Dalkey Island SAC	Harbour porpoise
IE0002299	River Boyne and River Blackwater SAC	Atlantic salmon
UK0016612	Murlough SAC	Harbour seal
UK0016618	Strangford Lough SAC	Harbour seal
UK0030396	Bristol Channel Approaches SAC	Harbour porpoise
UK0030399	North Channel SAC	Harbour porpoise

[8] https://www.npws.ie/sites/default/files/protected-sites/synopsis/SY002299.pdf

Site code	Site name	Relevant qualifying interests
UK0012712	Cardigan Bay SAC	Bottlenose dolphin
UK0013117	Lleyn Peninsula and the Sarnau SAC	Bottlenose dolphin
UK0030398	North Anglesey Marine SAC	Harbour porpoise
UK0030397	West Wales Marine SAC	Harbour porpoise

3.4.2 SPAs

Waterbirds

Physical disturbance of seaduck and other waterbird flocks by vessel traffic is possible, but for all SPAs other than Dundalk Bay, the distance from the survey vessel at which flushing of birds could take place (~4km) is less than the minimum distance from the proposed survey.

Six aerial digital surveys were undertaken between April and September 2020 for an area covering the potential array and export cable corridor (APEM 2020). The abundance and distribution of birds within the survey area was estimated, and where possible, information on bird flight height and direction. The survey was designed to complement earlier boat-based ornithological surveys (Aquafact 2019) which were undertaken between May 2018 and January 2020. Few waterbird species were recorded within the survey, and of those species identified to be relevant to this assessment, abundance was generally recorded to be low, for example unidentified duck species (three individuals recorded in April). Common scoter were recorded in relatively high abundance in April, although the birds were concentrated at the seaward edge of Dundalk Bay and to the north of the survey area relevant to this assessment. Peak counts of red-throated diver (10) and great northern diver (268) were recorded by APEM (2020), with few or no birds recorded in the other survey months, indicating their wintering presence in the area. Similarly, cormorant were recorded in low numbers, with nine recorded in June 2020, declining to one in August and September.

Seabirds

Information on the foraging movements of a number of seabird species has increased in recent years, mainly due to advances in satellite and other tracking technologies (e.g. Langston *et al*. 2013, Wakefield *et al*. 2015, 2017, Thaxter *et al*. 2014, 2018, Cleasby *et al*. 2015, 2018, Bogdanova *et al*. 2017, Carter *et al*. 2016, Edwards *et al*. 2016, Votier *et al*. 2017). There is generally limited information on foraging areas used by species from particular colonies and to help address this, Thaxter *et al*. (2012) reported on representative breeding season foraging ranges for a range of species, which were recently updated by Woodward *et al.* (2019).

Table 3.3 provides indicative foraging ranges (mean and mean maximum) travelled for a range of seabird species from a breeding colony to a foraging area, which have been used to identify relevant sites on the basis that related qualifying interests could interact with the survey area. The mean maximum foraging range value has been used here to show possible connectivity to breeding colony SPAs, but bird density will not be continuous throughout this range. Other ways of representing foraging ranges (e.g. the mean, or percentage foraging area derived from kernel analyses) may therefore provide more useful information, where available. Whilst applying mean maximum foraging radius would encompass the majority of a population's home-range area, the overall size of the predicted foraging areas around the colony would potentially make it too large to be a useful management tool, without further refinement using habitat and bathymetric data (Soanes *et al.* 2016). Similarly, the assumption that seabirds are uniformly distributed out to some threshold distance from their colonies, such as their putative maximum foraging range, is unrealistic. Seabird density declines with distance from the colony with density-dependent competition, coastal morphology and habitat preferences

(Wakefield *et al*. 2017), for example oceanographic features at which seabirds preferentially forage including shelf-edge fronts, upwelling and tidal-mixing fronts, offshore banks and internal waves, regions of stratification, and topographically complex coastal areas subject to strong tidal flow (Cox *et al.* 2018), resulting in highly non-uniform distributions. While Critchley *et al*. (2018) used a distance-weighted foraging radius approach to project distributions at sea for a wide range of seabird species during the breeding season, the authors recognised the limitations of not considering environmental variables that contribute to such non-uniform distributions noted above.

Table 3.3: Indicative breeding season foraging ranges

Species	**Mean maximum[1] (km)**	**Mean[2] (km)**	**Confidence[3]**
Eider	21.5	3.2 ± 4.2	Poor
Red-throated diver	9	4.5	Low
Fulmar	542.3±657.9	134.6 ± 90.1	Good
Manx shearwater	1346.8±1018.7	136.1 ± 88.7	Moderate
Leach's storm petrel	n/a	657	Moderate
Gannet	315.2±194.2	120.4 ± 50	Highest
Cormorant	25.6 ± 8.3	7.1 ± 3.8	Moderate
Shag	13.2 ± 10.5	9.2 ± 4.9	Highest
Arctic skua	n/a	2 ± 0.7	Poor
Great skua	443.3 ± 487.9	67 ± 31.5	Uncertain
Black-headed gull	18.5	7	Uncertain
Common gull	50	n/a	Poor
Mediterranean gull	20	11.5	Uncertain
Herring gull	58.8 ± 26.8	14.9 ± 7.5	Good
Lesser black-backed gull	127 ± 109	43.3 ± 18.4	Highest
Kittiwake	156.1 ± 144.5	54.7 ± 50.4	Good
Sandwich tern	34.3 ± 23.2	9 ± 9.2	Moderate
Roseate tern	12.6 ± 10.6	4.1 ± 2.6	Moderate
Common tern	18.0 ± 8.9	6.4 ± 4.5	Good
Arctic tern	25.7 ± 14.8	6.1 ± 4.4	Good
Little tern	5	3.5	Moderate
Guillemot	73.2 ± 80.5 (55.5 ± 39.7)[4]	33.1 ± 36.5 (23.9 ± 21.1)[4]	Highest
Razorbill	88.7 ± 75.9 (73.8 ± 48.4)[4]	61.3 ± 33.4 (31.2 ± 17.3)[4]	Good
Puffin	137.1 ± 128.3 (119.6 ± 131.2)[4]	62.4 ± 34.4 (48.1 ± 28.3)[4]	Good

Source: Woodward et al. (2019). Notes: 1. The maximum range reported in each study averaged across studies. 2. The mean foraging range reported for each colony averaged across all colonies. For tracking studies, this was typically the mean foraging range from all central place foraging trips assessed at the colony. 3. Confidence levels were assigned as follows: highest (based on >5 direct studies with low variation between sites); good highest (based on >5 direct studies with wider variation between sites); moderate (between 2-5 direct studies); low (indirect measures or only one direct tracking study); uncertain (survey-based estimates); poor (few survey estimates or speculative data available). 4. May be affected by unusually high foraging ranges from Fair Isle due to reduced prey availability in study year. Ranges excluding Fair Isle data also provided.

The selection of all sites within the mean maximum foraging range of the survey area is a useful but simplistic approach to identifying relevant sites. The approach taken here has been to review the initial selection of sites on this basis, and exclude those for which an interaction would be unrealistic, which primarily relates to sites for which fulmar has been identified as a

qualifying interest in sites to the far north and west of Ireland. Fulmar are a highly pelagic seabird, and are unlikely to move large distances over land which could bring them to within the survey area. The potential mean maximum foraging range for this species has therefore been applied across the marine area, including where birds could move around headlands.

The mean maximum foraging range for Manx shearwater is large (1,346.8 ± 1,018.7km), which when applied as a means to identify sites for consideration in the screening results in a broad range of sites being selected as far south to northern Spain (Figure 3.1). While the putative mean maximum foraging range of this species could theoretically result in individuals from very distant sites coming within the survey area, evidence suggests substantial variation in trip distance and range. For example, trips may vary by life stage (Fayet *et al.* 2015), and be substantially less during the chick-rearing period compared to the incubation period (Dean *et al.* 2015; however, note regular far-ranging activity presented in Wischnewski *et al.* 2019). Tracks (Wischnewski *et al.* 2019, Fayet *et al.* 2015) and density distributions (Dean *et al.* 2012, 2015, Fayat *et al.* 2015) suggest that for UK and Irish colonies studied, longer trips were to offshore waters of the North Atlantic, with higher levels of activity closer to colonies (note the ten-fold difference in mean (136.1±88.7km) and mean maximum (1,346.8 ±,1,018.7km) foraging range).

On the basis of this evidence, it is considered that the sites for Manx shearwater that are most relevant to this screening assessment are Saltee Islands SPA, Puffin Island SPA, Skelligs SPA, Blasket Island SPA, Lambay Island SPA, Deenish Island and Scariff Island SPA, Skomer, Skokholm and the Seas off Pembrokeshire SPA, Aberdaron Coast and Bardsey Island SPA, Copeland Islands SPA, and the Irish Sea SPA (and by association those SPAs related to this offshore aggregation).

All of the seabird species which are qualifying interests of sites to be considered in this assessment were identified to be present in the survey area (APEM 2020). Auks were recorded widely across the ornithological survey area. Guillemot were particularly abundant across the survey area (peak count in September 2020 of 5,562), with puffin and razorbill still numerous (peak counts in September 2020 of 21 and 952 respectively). The next most abundant species recorded were northern gannet (peak count of 144 in July) and Manx shearwater (peak count of 1,245 in August), with relatively low numbers of black-legged kittiwake (peak count of 40 in April), and very low numbers of herring gull (peak count of 19 in July), lesser black-backed gull (peak count of two in May), common gull (peak count of three in April), black-headed gull (two, only recorded in April), and fulmar (one in April and August). Sandwich tern (peak count of three in April and September) and common tern (five, only recorded in September) were recorded but in relatively low numbers. The survey results are generally consistent with those of the ObSERVE programme (Rogan *et al.* 2018), in terms of the relative abundance of species which would be expected to frequent the survey area including gannet, Manx shearwater, auks and terns.

Diesel spillage from vessel collision could reach the Dundalk Bay SPA and the Carlingford Lough SPA.

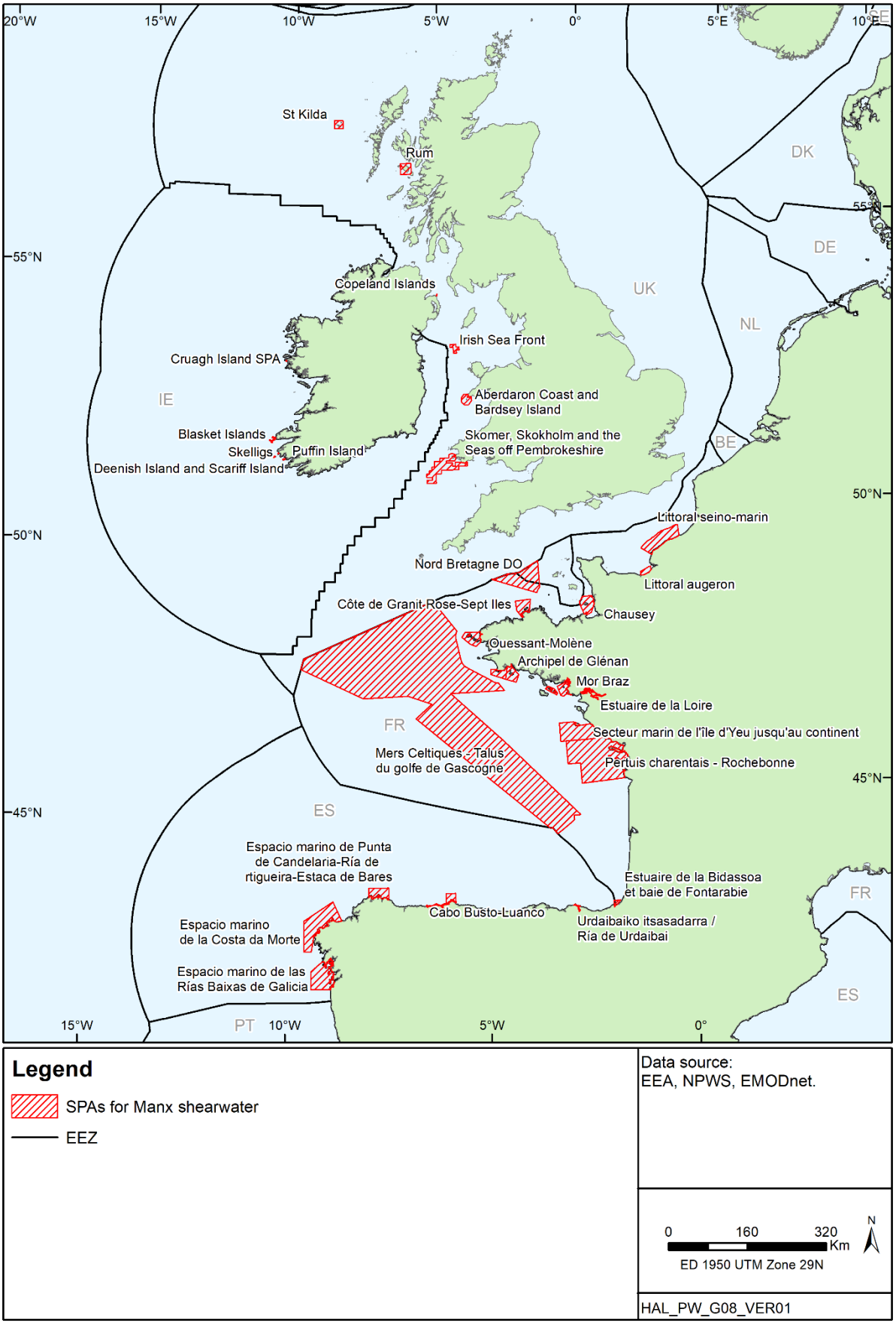
Table 3.4 and Figure 3.2 identify those SPAs and relevant qualifying interests requiring further consideration in the screening assessment (Section 4).

Table 3.4: SPAs identified for further consideration

Site code	Site name	Relevant qualifying interests
IE0004002	Saltee Islands SPA	Northern gannet
IE0004003	Puffin Island SPA	Manx shearwater

Site code	Site name	Relevant qualifying interests
IE0004007	Skelligs SPA	Manx shearwater
IE0004008	Blasket Islands SPA	Manx shearwater
IE0004026	Dundalk Bay SPA	Common scoter
		Red-breasted merganser
		Great crested grebe
		Common shelduck
IE0004078	Carlingford Lough SPA	Light-bellied Brent Goose
IE0004069	Lambay Island SPA	Razorbill
		Atlantic puffin
		Common guillemot
IE0004117	Ireland's Eye SPA	Razorbill
		Common guillemot
IE0004170	Cruagh Island SPA	Manx shearwater
IE0004175	Deenish Island and Scariff Island SPA	Manx shearwater
UK9020161	Carlingford Lough SPA	Light-bellied Brent Goose
		Sandwich tern
		Common tern
UK9020291	Copeland Islands SPA	Manx shearwater
UK9020328	Irish Sea Front SPA	Manx shearwater
UK9003091	Ailsa Craig SPA	Northern gannet
UK9001341	Rum SPA	Manx shearwater
UK9001031	St Kilda SPA	Manx shearwater
UK9013121	Aberdaron Coast and Bardsey Island SPA	Manx shearwater
UK9014041	Grassholm SPA	Northern gannet
UK9014051	Skomer, Skokholm and the Seas off Pembrokeshire SPA	Manx shearwater

Figure 3.1: Sites identified using Manx shearwater mean maximum foraging range



Legend

SPAs for Manx shearwater

EEZ

Data source:
EEA, NPWS, EMODnet.

0 160 320 Km

ED 1950 UTM Zone 29N

HAL_PW_G08_VER01

Figure 3.2: SPAs identified for further assessment

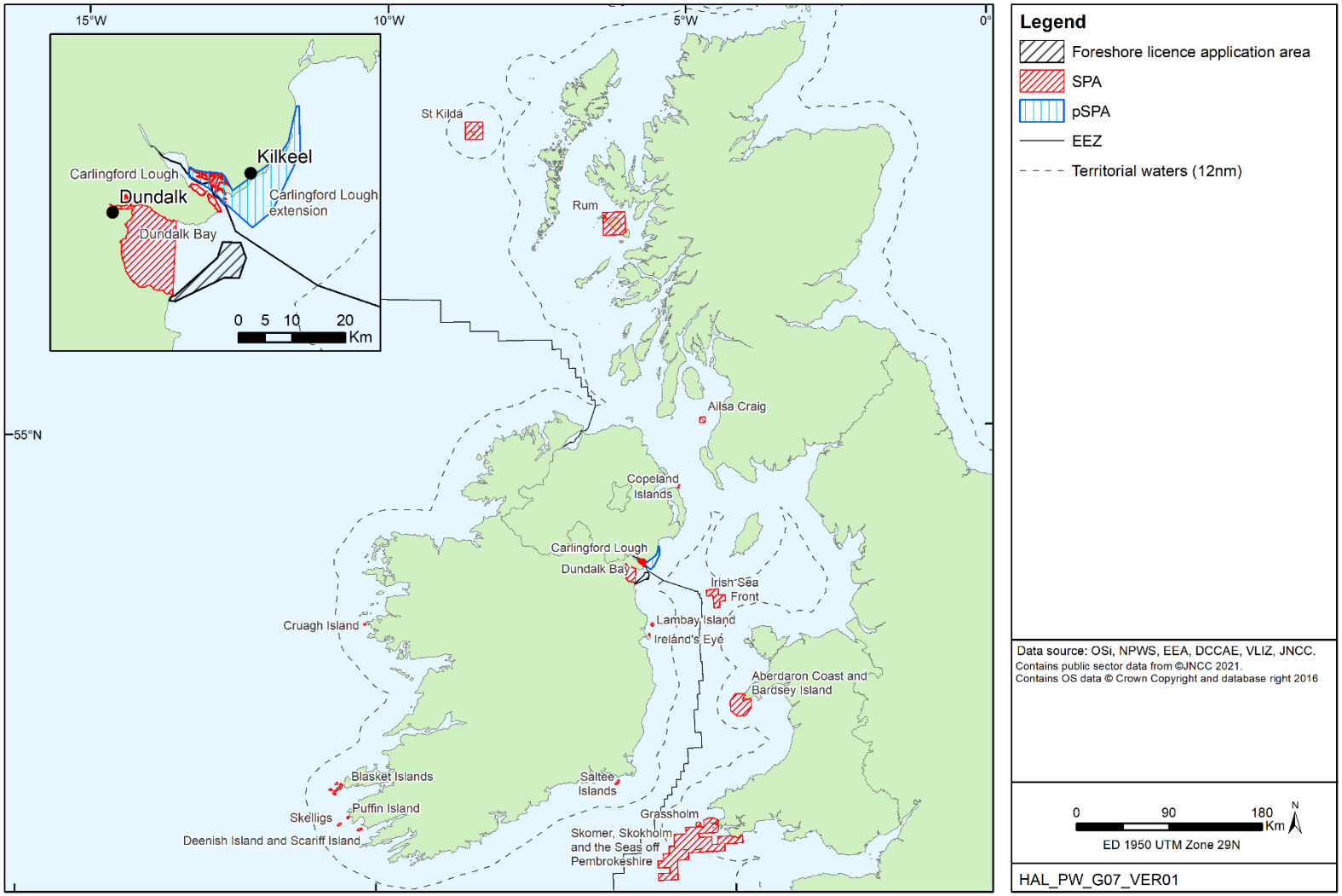
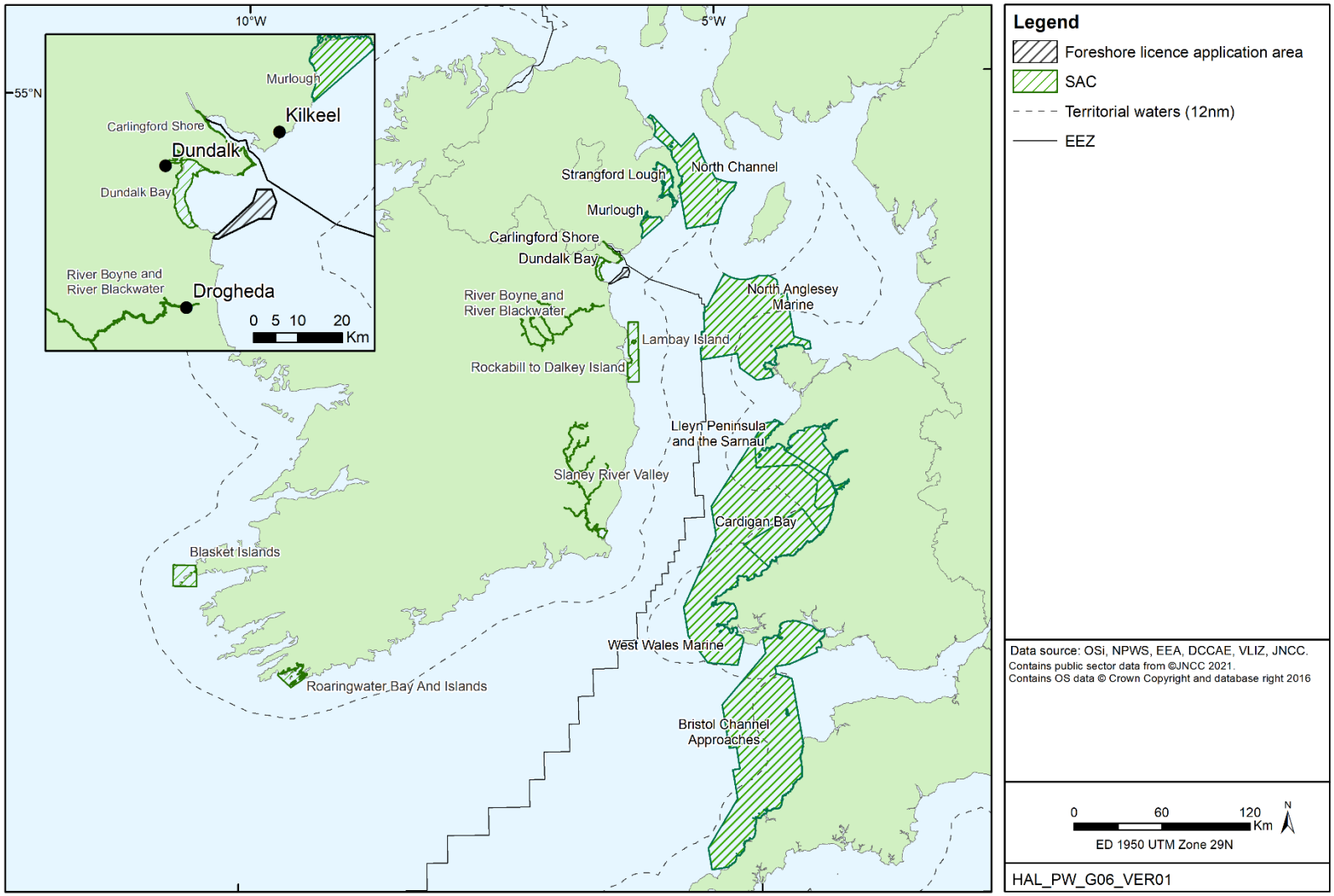


Figure 3.3: SACs identified for further assessment



4 SCREENING FOR LIKELY SIGNIFICANT EFFECTS

The sources of potentially significant effect from proposed survey activities considered relevant to the screening (i.e. where there is a recognised pathway for interaction with features subject to protection under the Birds and Habitats Directives) are physical disturbance from survey activities, the production of underwater noise, the physical presence/disturbance by vessels and spillage of oil. Section 4.1 links the sources of potentially significant effect to individual sites and their relevant qualifying features. The potential for likely significant effects on the qualifying interests of the sites identified is considered in Section 4.2. Appendix 1 provides, for all sites listed in Table 4.1, tabulations of the site information (relevant qualifying interests, qualifying interests with a foreseeable interaction with the survey area, summary Conservation Objectives), the closest distance to the survey area and a consideration of site interest features against potential sources of likely significant effect.

4.1 Consideration of potential sources of effect

Table 4.1 shows the individual sites and their relevant qualifying features linked to the sources of potentially significant effect from the proposed survey activities. Those sites identified are considered in Section 4.2.

Table 4.1: Sites identified for further consideration

Site code	Site name	Relevant qualifying interests	Physical disturbance	Physical presence	Underwater noise	Pollution
SACs						
IE0000455	Dundalk Bay	Mudflats and sandflats not covered by seawater at low tide	✓	×	×	✓
		Estuaries	✓	×	×	✓
IE0002306	Carlingford Shore	Annual vegetation of drift lines	×	×	×	✓
IE0000101	Roaringwater Bay and Islands	Harbour porpoise	×	✓	✓	×
IE0000781	Slaney River Valley	Harbour porpoise	×	✓	✓	×
IE0000204	Lambay Island	Harbour seal	×	✓	✓	×
		Grey seal	×	✓	✓	×
IE0002172	Blasket Islands	Harbour porpoise	×	✓	✓	×
IE0003000	Rockabill to Dalkey Island	Harbour porpoise	×	✓	✓	×
IE0002299	River Boyne and River Blackwater	Atlantic salmon	×	✓	✓	×
UK0016612	Murlough	Harbour seal	×	✓	✓	×
UK0016618	Strangford Lough	Harbour seal	×	✓	✓	×
UK0030396	Bristol Channel Approaches	Harbour porpoise	×	✓	✓	×
UK0030399	North Channel	Harbour porpoise	×	✓	✓	×
UK0012712	Cardigan Bay	Bottlenose dolphin	×	✓	✓	×
UK0013117	Lleyn Peninsula and the Sarnau	Bottlenose dolphin	×	✓	✓	×

Site code	Site name	Relevant qualifying interests	Physical disturbance	Physical presence	Underwater noise	Pollution
UK0030398	North Anglesey Marine	Harbour porpoise	×	✓	✓	×
UK0030397	West Wales Marine	Harbour porpoise	×	✓	✓	×
SPAs						
IE0004002	Saltee Islands	Northern gannet	×	×	✓	×
IE0004003	Puffin Island	Manx shearwater	×	×	✓	×
IE0004007	Skelligs	Manx shearwater	×	×	✓	×
IE0004008	Blasket Islands	Manx shearwater	×	×	✓	×
IE0004026	Dundalk Bay	Common scoter	×	✓	✓	✓
		Red-breasted merganser	×	✓	✓	✓
		Great crested grebe	×	✓	✓	✓
IE0004078	Carlingford Lough	Light-bellied Brent Goose	×	×	×	✓
IE0004069	Lambay Island	Razorbill	×	✓	✓	×
		Atlantic puffin	×	✓	✓	×
		Common guillemot	×	✓	✓	×
IE0004117	Ireland's Eye	Razorbill	×	✓	✓	×
		Common guillemot	×	✓	✓	×
IE0004170	Cruagh Island	Manx shearwater	×	×	✓	×
IE0004175	Deenish Island and Scariff Island	Manx shearwater	×	×	✓	×
UK9020161	Carlingford Lough	Light-bellied Brent Goose	×	×	×	✓
		Sandwich Tern	×	×	×	✓
		Common Tern	×	×	×	✓
UK9020291	Copeland Islands	Manx shearwater	×	×	✓	×
UK9020328	Irish Sea Front	Manx shearwater	×	×	✓	×
UK9003091	Ailsa Craig	Northern gannet	×	×	✓	×
UK9001341	Rum	Manx shearwater	×	×	✓	×
UK9001031	St Kilda	Manx shearwater	×	×	✓	×
UK9013121	Aberdaron Coast and Bardsey Island	Manx shearwater	×	×	✓	×
UK9014041	Grassholm	Northern gannet	×	×	✓	×
UK9014051	Skomer, Skokholm and the Seas off Pembrokeshire	Manx shearwater	×	×	✓	×

4.2 Screening for likely significant effects

On the basis of the evidence presented in Section 3 and the information given in Appendix 1, the potential for likely significant effects on the qualifying interests of the relevant sites (Table 4.1) is assessed below.

4.2.1 Physical disturbance from survey activities

Annex I habitats

A number of survey activities were identified that could cause physical disturbance to Annex I habitats in the Dundalk Bay SAC, which is located 4.5km from the survey area. Physical disturbance may be associated with the placement of the jack-up barge spudcans (if this vessel option is selected); the operation of propellers and thrusters on a vessel under dynamic positioning (particularly on shallow water depths); the placement of benthic mooring blocks (if this option selected to tether underwater survey equipment), and the small loss of seabed sediments and associated release of sediment plumes into the water column associated with the collection of vibrocores/gravity cores, boreholes and grab samples.

As indicated in Section 2.3.2, eighty one boreholes will be drilled in the offshore wind farm area (located *ca*. 13.5km from the SAC) from the offshore vessel which may be a jack-up barge. Up to 6 boreholes will also be drilled in the intertidal section of the survey area. An estimated 41 shallow vibrocores or gravity cores will be taken along the proposed inter-array and export cable routes, most probably by both offshore and nearshore vessels depending on their location. A further 12 shallow investigations (excavated trial pit or borehole with a target depth of 3m below the beach) will be made in the intertidal area. Benthic sampling in the survey area will be by grab sampling with the manual digging of samples in the intertidal section of the offshore cable corridor, which is outside the Dundalk Bay SAC. Up to 19 benthic mooring blocks of *ca*. 250kg could be placed on the seabed within the survey area although none will be located within 5km of the site.

Within Dundalk Bay SAC, a fine sand community complex occurs both intertidally and subtidally. The intertidal element of the bay contains the Annex I habitat mudflats and sandflats not covered by seawater at low tide (estimated habitat area 4,375ha, NPWS 2011a). The subtidal element occurs in the shallow channels running through the sandflat at the western margins of the site and the larger channel of the Castletown River, within the Annex I estuaries habitat (estimated habitat area, 2,799ha, NPWS 2011a) and extends throughout the open waters of the bay (NPWS 2011b).

None of the proposed activities will take place within Dundalk Bay SAC. Given the distance of the survey area from the site (4.5km) and the relatively localised and transient nature of the physical disturbance associated with spudcan footprints, coring, trialpits, boreholes and other samples, significant effects on Annex I habitats within the site are not likely. The estimated maximum tidal excursion in the area is *ca*. 3.5km and therefore any sediment plumes generated by these activities (likely to be very localised and transient) are not likely to reach the site. Therefore, physical disturbance from survey activities will not result in likely significant effects to the marine Annex I habitats of Dundalk Bay SAC.

4.2.2 Physical presence of the survey vessel

Birds

The physical presence of the survey vessel may potentially cause displacement and/or other behavioural responses in birds. Most species from relevant SPAs within foraging range of the survey area have been judged to have a low to moderate sensitivity to disturbance by shipping traffic; these include northern gannet, fulmar, common guillemot, kittiwake, Manx shearwater and gulls (Garthe & Hüppop 2004, MMO 2008, Fliessbach *et al.* 2019). While the presence of shy species, in particular common scoter associated with Dundalk Bay SPA, have been noted in recent ornithological survey work (APEM 2020, see Section 3.4.2), these were largely aggregated towards the seaward edge of Dundalk Bay and therefore some distance from the offshore survey work being assessed here. While rafting birds which are qualifying interests

of sites may move in response to vessels in transit, such effects are of low magnitude and short duration[9], and will represent negligible temporary additional disturbance over other vessel movements, including that of fishing and cargo traffic. For example, a shipping study based on Automatic Identification System (AIS) data completed for IOSEA4 (DCENR 2011) indicated that generally up to 300-750 vessels per year were present in waters off Dundalk Bay and in the vicinity of the survey area. Other data sources including MMO (2014), and subsequent data updates, and EMODnet (2019[10]), similarly reflect a moderate to high level of vessel traffic in this area, particularly associated with fisheries in the offshore area, with lower levels of cargo vessel traffic in the nearshore towards the ports of Drogheda and Dundalk (see Figure 4.1).

In view of the available evidence on the potential for the survey activities to generate disturbance to qualifying bird interests of relevant sites for which a potential interaction was identified, significant effects are not considered to be likely.

Fish and Marine Mammals

The physical presence of the survey vessels (offshore and nearshore vessels) may influence the distribution and movements of sensitive species in the water column, specifically protected migratory fish (Atlantic salmon) and marine mammals (harbour porpoise, harbour seal and grey seal) of the relevant sites. As hearing specialists, any displacement of marine mammals is most likely associated with acoustic disturbance, which is discussed below in Section 4.2.3. There may also be responses from marine mammals and fish to the general physical presence of vessels (Sparling *et al.* 2015), along with the risk of collisions from vessels in transit. However, the physical presence of the vessels around areas of existing shipping activity, and their temporary presence, are anticipated to cause no more than temporary and localised low-level behavioural responses similar to those from established vessel traffic (as noted above), such that significant effects are not predicted.

4.2.3 Underwater noise

Noise sources and propagation

As outlined in Section 2, the planned survey will use high-resolution geophysical survey (HRSG) sources to obtain detailed bathymetry and shallow geological data to support wind farm array and export cable planning. Equipment used will include a Multibeam Echosounder (MBES), Side Scan Sonar (SSS), Sub-bottom Profiler (SBP) and Ultra-High-Resolution multi-channel Seismic (UHRS).

Calibrated measurements of the acoustic characteristics of electromechanical sources used in HRGS have, until recently, been lacking, with assessments reliant upon manufacturer specifications. However, a recent study commissioned by the US Bureau of Ocean Energy Management (BOEM) provided calibrated measurements of source characteristics under controlled test tank conditions for a variety of equipment used in HRGSs (Crocker & Fratantonio 2016, Crocker *et al*. 2019). Table 4.2 summarises indicative source characteristics of the equipment (and comparable equipment) which will potentially be used in the planned survey, drawing on manufacturer specifications. Source levels provided are those reported for the sources operated at the maximum power tested. In addition to those sources

[9] approximately four weeks for the geophysical survey, six months for the geotechnical work, with intermittent activities taking place over the course of 24 months, e.g. CPOD data download and battery replacement every three months.

[10] https://www.emodnet-humanactivities.eu/search-results.php?dataname=Vessel+Density+ and https://www.emodnet-humanactivities.eu/search-results.php?dataname=Route+density+%28source%3A+EMSA%29

described in Table 4.2, there may be the use of an ultra-short baseline (USBL) system to monitor the position of towed equipment. The USBL system consists of a multi-element transducer mounted on the hull of the vessel and a transponder attached to the towed equipment (e.g. side-scan sonar). The hull-mounted transducer emits an acoustic pulse that is detected by the transponder, which replies with its own acoustic pulse, and its position is subsequently determined from the range and angle of the pulse as received by the transducer. USBL equipment is widely used by offshore commercial and research vessels where positional accuracy of towed survey equipment is critical. The emitted pulses will be short pulse width 'pings', approximately in the range of 20-35kHz and with a source level of up to ~200dB re 1µPa @1m (peak).

Table 4.2: Potential acoustic survey equipment and indicative source characteristics

Equipment	Indicative source characteristics	
	Nominal operating frequency	**Source level**
UHRS sparker/boomer	1-3.5kHz	222dB re 1µPa @1m (peak)
Side-scan sonar	100kHz & 500kHz	235 dB re 1µPa @1m (peak)
Multi-beam echosounder e.g. Kongsberg EM710 (1)	70-100kHz	225-231dB re 1µPa @1m (peak)
Sub-bottom Profiler e.g. Innomar SES-2000 Quattro Parametric	Primary: 85-115kHz Secondary: 2-20kHz	235-245dB re 1µPa @1m (peak)
USBL	20-40kHz	187–196 dB re 1µPa @1m

The propagation of sound in the marine environment is complex and has been the subject of considerable research (e.g. Wang *et al*. 2014). Once a sound is emitted, its characteristics will be altered with distance from source. Changes will affect the amplitude of the signal and its frequency content and, in the case of impulsive sounds, the injurious elements will be reduced through propagation (i.e. pulse duration increases and rise-time decreases with distance). The main process that reduces the amplitude of the sound wave as it propagates is geometrical spreading; while a host of other processes come into play (e.g. reflection, refraction, scattering, reverberation and absorption), many of which are dependent on environmental conditions. The effect of frequency-dependent absorption loss is small on lower frequency sources (e.g. <0.3dB/km at 4kHz), which contributes to seismic survey noise being detectable by hydrophones hundreds of km from the source, but acts to rapidly attenuate higher frequency sources (e.g. 36dB/km at 100kHz) (Francois & Garrison 1982).

The propagation of noise from seismic surveys has undergone considerable investigation; while the process is complex and influenced by many variables, general expectations of broadband received levels from airguns can be made. In terms of peak sound pressure levels, while the nominal source levels for a large airgun array (250-260dB 1 µPa @1m, peak-to-peak) are never reached, levels >230dB re 1 µPa can be expected in close proximity (metres); levels are commonly reported to have decreased below 200dB re 1 µPa at a range of 100-1,000m, and below 160dB re 1 µPa at a range of 10-11km (e.g. Breitzke *et al*. 2008).

The emitted sound fields from HRGS sources such as SBPs, side-scan sonar and echosounders are of much lower amplitude and extent compared to seismic surveys using airguns due to their lower source levels, higher central operating frequencies and greater directionality (narrower beam widths) (e.g. Boebel et al*.* 2005*,* Genesis 2011). However, very few empirical field data are available to quantify these expectations. The most relevant work to date is part of the study funded by the US BOEM: following the calibrated measurements of Crocker & Fratantonio (2016), measurements were made in shallow (≤ 100m depth) open-water environments to investigate the propagation of sound from various HRGS sources

(Halvorsen & Heaney 2018). Problems were encountered during the open-water testing resulting in a lack of calibration in the reported sound source levels (Labak 2019). The accompanying advice note (Labak 2019) emphasises that these uncalibrated data should not be used to provide source level measurements, and consequently the reported isopleths (summarising sound propagation) should not replace project-specific sound source verifications. A further project to calibrate these measures and provide an expanded assessment of propagation commenced in 2019.

Despite these caveats, it is worth noting some general patterns observed in Halvorsen & Heaney (2018). In all test environments, broadband received levels from all SBP chirper, echosounder and side-scan sonar devices tested were rapidly attenuated with distance from source, with particularly pronounced fall-off for directional sources when the receiver was outside of the source's main beam. The greatest propagation was generally observed at the deepest test site (100m water depth) from sources generating low frequencies (<10kHz); by contrast, at 100m water depth, some of the highest frequency sources (>50kHz) experienced such attenuation that they were only weakly detectable or undetected by recording equipment. In all open-water test environments, broadband received levels did not exceed 160dB re 1µPa (rms)[11] beyond 200m from any chirper SBP, echosounder or side-scan sonar device tested. While recognising that these results require refining, preliminary evidence suggests that these electromechanical HRGS sources generate a very limited sound field in the marine environment, and of a much lower magnitude than those generated by seismic airgun sources.

It is noted that neither BOEM studies tested a parametric SBP, and that this potential source has the highest indicative source level of those listed in Table 5.1. The mechanism by which these devices generate the low-frequency signal of interest (secondary) requires initial emission of a high amplitude signal (primary). However, the high frequency of this initial signal and its associated narrow beam width (~2 degrees) will limit its horizontal propagation; in the absence of empirical measurements, a similar pattern to that observed by Halvorsen & Heaney (2018) for chirper SBPs and echosounders can be reasonably assumed for a parametric SBP of this specification.

While independently-measured sound fields are not available for USBL, their nominal source levels and central operating frequencies are such that emitted sounds fields are likely to be very small and of limited/no audibility above that of the concurrently operating survey equipment and vessel. Similarly, noise measurements of emitted sounds from logging involving sound sources including PS logging (entirely downhole) and SCPT (downhole logging with a surface source) are not available. These involve very small noise sources (~70dB) which generate a shear wave that is detected at depth within the borehole. A small (75kg) free fall hammer may be used in sampling should it not be possible to recover samples using a push sampling method. Measurements from the use of a 100kg free fall hammer for standard penetration testing (Erbe & McPherson 2017) recorded source levels of 151-160 dB re 1 µPa^{2}s @ 1 m (20-24kHz), which are likely to be comparable to that which could be generated by the hammer sampling for this survey.

In generic terms, underwater noise emitted by small leisure craft and vessels <50m tends to have a source level of 160-175 dB re 1µPa@1m, and with greater sound energy in relatively higher frequency (above 1kHz) when compared to large ships; support and supply vessels (50-100m) are expected to have source levels in the range 165-180dB re 1µPa@1m range and with most energy in lower frequencies (OSPAR 2009). For the purpose of this noise assessment, the survey vessel is assumed to be of 50-100m in length. Veirs *et al*. (2016)

[11] The 160dB re 1µPa (rms) isopleth represents the acoustic exposure criterion for behavioural disruption from impulsive noise as described by NMFS (2016), although this criterion is not universally adopted in policy or guidance elsewhere (such as the UK).

estimated sound characteristics for a wider variety of ships (from pleasure craft to container ships) in transit across the Haro Strait (west coast of North America). Median received levels of ship noise within the study area were measured to be most elevated above ambient noise at the lower frequencies (20-30dB from 100-1,000Hz), and to a lesser extent also at higher frequencies (5-13dB from 10-40kHz).

Cavitational noise commonly arises at speeds between 8 and 12 knots and grows in amplitude with increasing speed; its frequency spectrum is broad with dominant frequencies above a few hundred Hz. In addition to vessels in transit, cavitational noise is important when vessels are operating under high load conditions (high thrust) and when dynamic positioning (DP) systems are in use. For example, the use of thrusters for DP has been reported to result in increased sound generation of ~10dB compared to the same vessel in transit: measurements at 600m range to an offshore supply vessel of 79m length recorded broadband SPL (18-3,000Hz) of 148dB re 1µPa (root-mean-squared, rms) when in DP mode, compared to 135.5dB re 1µPa rms when in transit at a speed of 10 knots (Rutenko & Ushchipovskii 2015).

Though much larger than the type of jack-up vessels proposed for use in the survey, underwater noise associated with a jack-up rig of the type used in the offshore oil and gas industry is of a very similar dominant frequency range as that from large merchant vessels, albeit of lower average intensity. Measurements alongside a three-legged jack-up rig drilling in shallow water on the Dogger Bank showed that sound levels were in the order of $L_{p,rms}$ 120dB re 1µPa broadband with most energy between 2-1,200Hz; sound levels dropped off rapidly above 8kHz and were in the region of 15-20dB quieter during operations other than drilling (Todd & White 2012). It was noted that, at lower frequencies, the rig was considerably quieter than its associated support vessels (Todd & White 2012). Measurements of noise generated by shallow drilling in water depths of 7-13m through sand and mudstone produced source levels of 142-145 dB re 1 µPa rms @ 1 m (30-2,000Hz) (Erbe & McPherson 2017).

Marine mammals

Marine mammals, for which sound is fundamental across a wide range of critical natural functions, show high sensitivity to underwater sound. Generally, the severity of effects tends to increase with increasing exposure to noise with both sound intensity and duration of exposure being important. A distinction can be drawn between effects associated with physical (including auditory) injury and effects associated with behavioural disturbance. With respect to injury, risk from an activity can be assessed using threshold criteria of sound levels, with the most recent criteria presented in Southall *et al.* (2019). Auditory capabilities, and in particular the range of frequencies over which sensitivity is greatest, varies between species and criteria are assigned to functional hearing groups with accompanying injury criteria. Table 4.3 provides details of the relevant marine mammals (i.e. those which are qualifying interests of relevant sites) listed by functional hearing group, their estimated hearing range and recommended injury criteria, defined as the sound level at which a permanent threshold shift (PTS; permanent hearing damage) is estimated to occur.

Table 4.3: Marine mammal auditory injury criteria to impulsive and non-impulsive noise by functional hearing group

Functional hearing group (species relevant to the survey area)	**Estimated hearing range** (region of greatest sensitivity) [frequency of peak sensitivity]	**Proposed injury (PTS onset) threshold criteria**	
		Impulsive noise (dB re 1µPa, peak, unweighted)	**Non-impulsive noise** $L_{E,24h}$ (dB re 1 µPa²·s)
High-frequency cetaceans Bottlenose dolphin (*Tursiops truncatus*)	150 Hz to 160 kHz (8.8 kHz to 110 kHz) [58 kHz]	230	198
Very high frequency cetaceans Harbour porpoise (*Phocoena phocoena)*	275Hz to 160kHz (12kHz to 140kHz) [105kHz]	202	173
Phocid seals in water Grey seal (*Halichoerus grypus*) Harbour seal (*Phoca vitulina*)	50Hz to 86kHz (1.9kHz to 30kHz) [13kHz]	218	201

Source: Southall et al. (2019). Notes: The region of greatest sensitivity represents parameters f1 and f2, which are the bounds of the flat, central portion of the frequency-weighting curve region; the frequency of peak sensitivity represents parameter f0. $L_{E,24h}$ *= cumulative sound exposure level over 24 hours, weighted according to functional hearing group.*

Of the species likely to occur in the survey area, the harbour porpoise has the lowest threshold criteria for the onset of PTS at 202dB re 1µPa. Given the source characteristics and evidence of propagation presented above, the potential sources in the planned survey will not result in received sound levels exceeding this threshold beyond more than a few metres from the source, or are not within the estimated hearing range of the high or very high frequency functional groups. The exception is the sparker/boomer, and the sub-bottom profiler in relation to pinnipeds, which have a frequency range overlap and source level higher than the criteria for the onset of PTS. For the sparker/boomer, there is limited overlap with the region of greatest sensitivity and the proposed equipment, and it does not overlap peak sensitivity. The parametric SBP (Innomar SES-2000) which is characterised by a narrower beam width (~2.5°) than other sources, resulting in a very small area beneath this source being ensonified to the extent that injury to a marine mammal may occur. Similarly, the noise source associated with hammer sampling (up to 160dB re 1µPa) is considerably lower than the proposed injury criteria for impulsive noise for all functional hearing groups, as is the small size of the shear wave noise source associated with the SCPT (70dB). Sources of non-impulsive noise including vessel movements may achieve sound pressure levels of ca.180dB re 1µPa; however, received levels within the general vicinity of operations (i.e. hundreds of metres to a few kilometres) are likely to be of the order of 120-160dB re 1µPa. **The risk of injury to marine mammals which are qualifying interests of relevant SACs (Section 3.4.1) is considered to be negligible, and significant effects are not considered to be likely**.

With respect to behavioural disturbance of marine mammals, it has proved much more difficult to establish broadly applicable threshold criteria based on exposure alone. This is due, in part, to the challenges encountered in studies of wide-ranging species with complex behaviour, but is largely because many behavioural responses are context-specific (e.g. Gomez *et al*. 2016, Harding *et al*. 2019). Field observations during industrial activities are

fundamental sources of information for assessment. For harbour porpoise, there is empirical evidence to support a temporary effective deterrence radius around seismic survey of approximately 10km, with Thompson *et al.* (2013) using passive acoustic monitoring (PAM) to observe a reduction in harbour porpoise density within 5-10km of a 470in^3 airgun array in the Moray Firth, with animals returning 19 hours after exposure ceased. More recently, Sarnocińska *et al.* (2020) also used PAM to observe a dose-response effect among porpoise activity and 3D seismic survey in the Danish North Sea using a 3,570in^3 airgun array. The lowest porpoise activity was recorded closest to the source vessel increasing up to a range of 8-12km, beyond which baseline acoustic activity was observed. No long-term or large-scale displacements were observed throughout the survey.

Consistent with the findings of Thompson *et al*. (2013), the most recent UK Offshore Energy SEA (OESEA3, DECC 2016) concludes that a conservative assessment of the potential for marine mammal disturbance from seismic surveys will assume that firing of airguns will affect individuals within 10km of the source, resulting in changes in distribution and a reduction of foraging activity, but the effect is short-lived. The applicability of this value of 10km to other marine mammals is justified by harbour porpoise showing greater sensitivity to hearing damage and apparently stronger responses to anthropogenic noise than other species commonly occurring in UK shelf waters. A 10km Effective Deterrence Radius (EDR) has also been suggested by UK Statutory Nature Conservation Bodies as an appropriate approach to assessing disturbance due to seismic surveys.

In comparison to the work on seismic airguns, potential effects from other acoustic surveys such as SBPs or echosounders on marine mammals, or any other marine fauna, have received much less attention. High frequency sources with central operating frequencies at the upper end of marine mammal hearing ranges or above (e.g. echosounders, side-scan sonar) have been shown to emit energy at lower frequencies audible to most marine mammals (e.g. Risch *et al*. 2017), although at reduced amplitudes and with a small emitted sound field which is unlikely to cause behavioural effects (Cotter *et al*. 2019). Evidence of responses to echosounders is variable and limited, with the strongest evidence of negative effects relating to deep-diving odontocetes and with echosounder use which is not representative of most survey applications in shelf waters (e.g. Cholewiak *et al*. 2017). Consideration of the higher frequency signals, typically lower source levels and higher directionality of these and other HRGS sources has resulted in the assumption that these would not propagate far enough for marine species to be negatively affected by received levels (Halvorsen & Heaney 2018). However, a precautionary approach has been adopted where it is acknowledged that such sources are within the hearing range of marine mammals and therefore could, in a few cases, cause localised short-term impacts on behaviour or temporary displacement of a small number of individuals (Boebel *et al*. 2005). The aforementioned results of recent BOEM studies into source characteristics and preliminary evidence of propagation appear to support this assertion.

Underwater noise from the survey vessel itself, the drilling of the boreholes and related operations including SCPT and hammer sampling could potentially cause behavioural disturbance of marine mammals present in the area. Reported responses to vessels include avoidance, changes in swimming speed, direction and surfacing patterns, alteration of the intensity and frequency of calls (review Erbe *et al*. 2019). Harbour porpoises and minke whales have been shown to respond to survey vessels by moving away from them, while some other species, such as common dolphins, have shown attraction (Palka & Hammond 2001). In view of the nature of the drilling noise associated with completion of the boreholes as described above, this would not be greater in intensity than the vessel noise associated with the drilling.

While there is potential for some behavioural disturbance of cetaceans in response to survey vessel noise, the area of potential disturbance will be highly localised (i.e. within a few hundred metres radius), in an open sea habitat (i.e. with movement of animals not restricted by geographic features such as a shoreline), transient and of short overall duration. The increase in underwater noise from the survey vessel activities, relative to existing levels in the wider area from other shipping and fisheries, is expected to be negligible.

Considering the acoustic characteristics of the potential sources and their propagation, the relevant evidence of effects on marine mammals from vessel/drilling noise, seismic survey and the proportionally lower potential for effects of the majority of sources being used, the low potential hammer energy and short duration of any hammer sampling and SCPT (as noted in relation to the potential for injury) in addition to the small spatial footprint and short duration of the planned survey, **the risk of behavioural disturbance to any species of marine mammal which is a qualifying interest of a relevant SAC (Section 3.4.1) is considered to be extremely low, and significant effects are not considered to be likely.** It is recognised that this screening conclusion differs from that in earlier Report for Screening for AA and Natura Impact Statement for this project. However, the current conclusion reflects the latest scientific information on effects thresholds on marine mammals (and specifically Southall *et al*. 2019 and Southall *et al*. 2021) which were not available to the earlier assessment.

Fish

Fish exhibit large variation in their response to sound, largely due to the great diversity in anatomical features, hearing physiology and behaviour; all species respond to particle motion, but several have adaptations that make them sensitive also to the pressure component of sound. Most species can detect sounds from <50Hz to a few hundred Hz, with some extending this range to approximately 500Hz (e.g. cod, saithe), and those with specialisations to be sensitive to sound pressure being able to detect sounds up to several kHz (e.g. herring) (review in Hawkins & Popper 2017). Broadly applicable sound exposure criteria have been published (Popper *et al.* 2014); the criteria for mortality and potential injury from seismic survey noise for species lacking a swim bladder (sensitive to particle motion only) is >213dB re 1 µPa (peak) and for all other groups is >207dB re 1 µPa (peak). Salmon associated with the River Boyne and River Blackwater SAC is the only fish species relevant to this assessment. The ability of salmon to respond to sound pressure is regarded as relatively poor with a narrow frequency span, a limited ability to discriminate between sounds, and a low overall sensitivity relative to other fish species (Hawkins & Johnstone 1978, cited by Gill & Bartlett 2010, Harding *et al.* 2016).

There have been numerous reviews of the effects of anthropogenic sound on fish (e.g. Popper *et al*. 2014, Hawkins *et al*. 2015, Slabbekoorn *et al*. 2019). Of relevance is Carroll *et al*. (2017), who present a systematic and critical review of scientific studies investigating the impacts of low-frequency sound on marine fish, with a focus on seismic surveys. Of studies investigating adult/juvenile fish mortality and physical injury, the majority showed no effects, some reported temporary hearing loss and one observed long-term hearing damage; none showed mortality. Of six studies investigating mortality of fish eggs or larvae, none reported mortality at realistic known exposure levels. Behavioural effects are the most studied aspect, numbering 15 studies, with most being laboratory or caged field experiments. Startle/alarm responses, avoidance of the sound source or changes in vertical or horizontal distribution were widely reported, while several studies reported no significant response or conflicting results. Observed responses were temporary, and fish returned to pre-exposure behaviour typically within less than an hour of the last exposure. The majority of studies of effects on catch rates or abundance report no effect or conflicting results, although in some cases reduced trawl and/or longline catch occurred; where effects have been reported, these are most likely due to changes in fish distribution and behaviour, such as vertical movements.

As key prey items of fish, there has been increasing interest in the potential effects of seismic and other high amplitude low-frequency noise on plankton. McCauley *et al*. (2017) reported a significant decrease in zooplankton abundance and a significant increase in mortality of adult and larval zooplankton, particularly krill, following repeated exposure to a 150in^3 airgun. By contrast, Fields *et al*. (2019) found only limited effects on mortality of the copepod *Calanus finmarchicus* (a key food source of commercial fish in the North Atlantic) when exposed to single blasts of a 2x260in^3 airgun cluster. While studies are limited, and further investigation is required, most evidence to date suggests negligible effects on plankton from exposure to seismic survey noise (Carroll *et al*. 2017); it is reasonable to infer that the potential for effects from lower-amplitude acoustic surveys sources will be proportionally less.

Given the reported hearing ranges of fish, it is anthropogenic sound sources generating high amplitude low-frequency noise (i.e. seismic airgun surveys, along with percussive pile-driving and explosions) which are of primary concern to fish. Studies which have experimentally tested the effects of other fairly low-frequency acoustic survey sources (i.e. SBPs) on fish are lacking. Pinger and chirp SBPs show limited overlap only among fish species which primarily detect sound pressure, such as herring, while the high frequency signals generated by side-scan sonar, echosounders and USBL are above the hearing range of fish. There is no evidence of mortality or potential mortal injury to fish from ship noise (Popper *et al*. 2014).

Given the limited evidence of physical injury to fish from exposure to high amplitude low-frequency seismic survey noise, and shipping or drilling related noise, the comparatively lower amplitude and higher frequency source characteristics of the majority of sources in the planned survey, and the low amplitude nature of the hammer sampling and SCPT, **the risk of injury to any fish species which is a qualifying interest of a relevant SAC (Section 3.4.1) is considered to be extremely remote and significant effects are not considered to be likely.**

While it is recognised that vessel and other continuous noise (e.g. drilling) may influence several aspects of fish behaviour, including inducing avoidance and altering swimming speed, direction and schooling behaviour, (e.g. De Robertis & Handegard 2013, Popper *et al*. 2014), such effects will be in the context of the small and temporary increment of vessel presence compared to wider shipping in the survey area. Given the limited and variable evidence of behavioural responses of fish to high amplitude low-frequency seismic survey noise (which are low-level and short-term), the comparatively lower amplitude and higher frequency source characteristics of the majority of sources in the planned survey, and the low amplitude nature of the hammer sampling and SCPT, in addition to the small spatial footprint and short duration of the planned survey, **the risk of significant effects on any fish species which is a qualifying interest of a relevant SAC (Section 3.4.1) due to behavioural disturbance is considered to extremely low.**

Diving birds

Information on the underwater hearing abilities of diving birds and evidence of the effects of underwater anthropogenic noise is very limited. Direct effects from underwater acoustic surveys on diving birds could potentially occur through physical damage, given exposure to sufficiently high amplitudes, or through behavioural disturbance. Deeper-diving species which spend longer periods of time underwater (e.g. auks) may be most at risk of exposure, but all species which routinely submerge in pursuit of prey and benthic feeding opportunities in marine and estuarine habitats (i.e. also including divers *Gavia spp*., grebes, diving ducks, cormorant, shag, gannet, and Manx shearwater) may be exposed to anthropogenic noise.

The reported in-air hearing sensitivity for a range of diving duck species, red-throated diver, gannet and puffin have been tested for tone bursts between frequencies of 500Hz and 6kHz. Results indicated a common region of greatest sensitivity from 1-3 kHz, with a sharp reduction in sensitivity >3-4 kHz (Crowell e*t al.* 2015, Mooney *et al*. 2019). Testing on the long-tailed duck underwater showed reliable responses to high-intensity stimuli (>117 dB re 1µPa) from 500Hz-2.9 kHz (Crowell 2014). Hansen *et al*. (2017) suggested cormorant to have greatest hearing sensitivity at 2kHz, with an underwater hearing threshold of 71dB re 1µPa. It was further noted by the authors that cormorant hearing thresholds are comparable to seals and toothed whales in the 1-4kHz frequency band, suggesting the possibility that they use auditory cues for foraging and/or orientation. McCauley (1994) inferred from vocalisation ranges that the threshold of perception for low frequency seismic noise in some species (e.g. penguins, considered as a possible proxy for auk species) would be high, hence individuals might be adversely affected only in close proximity to the source. The use of sound underwater by diving birds is poorly understood, with underwater vocalisations (which occurred in only a minority of prey capture attempts) only noted for penguins (Thiebault *et al*. 2019), the function of which is unknown.

Very high amplitude low frequency underwater noise may result in acute trauma to diving seabirds, with several studies reporting mortality of diving birds in close proximity (i.e. tens of metres) to underwater explosions (Yelverton *et al*. 1973, Cooper 1982, Stemp 1985, Danil & St Leger 2011). However, mortality of seabirds has not been reported during extensive seismic operations in the North Sea and elsewhere.

With the exception of Pichegru *et al*. (2017), which relates to penguins, there are no published reports of changes in abundance or distribution of diving birds concurrent with seismic or other acoustic survey activity. A study investigated seabird abundance in Hudson Strait (Atlantic seaboard of Canada) during seismic surveys over three years (Stemp 1985). Comparing periods of shooting and non-shooting, no significant difference was observed in abundance of thick-billed murre (Brünnich's guillemot), or fulmar or kittiwake.

While seabird responses to approaching vessels are highly variable (e.g. Fliessbach *et al*. 2019), flushing disturbance would be expected to displace most diving seabirds from close proximity to the survey vessel and any towed equipment, thereby limiting their exposure to the highest sound pressures generated. Similarly, any behavioural disturbance of seabirds due to the survey activities is most likely to be temporary displacement associated with the physical presence of the vessel, comparable to that experienced by routine shipping traffic. Hearing sensitivity for species measured so far, peaks between 1 and 3kHz, with a steep roll-off after 4kHz (Crowell *et al*. 2015). The observed region of greatest hearing sensitivity suggests limited overlap with peak energy from vessel operations.

While acknowledging limited data and the importance of the survey area to several species of diving birds which are qualifying interests of relevant SPAs (i.e. guillemot, razorbill, northern gannet and Manx shearwater), a consideration of the lack of reported effects of seismic survey on diving birds, the comparatively lower amplitude and higher frequency source characteristics of the potential sources in the planned survey (other than the sparker/boomer), the limited likely sensitivity of species to vessel and drilling noise, the low amplitude nature of the hammer sampling and SCPT, in addition to the small spatial footprint and short duration of the planned survey, leads to the conclusion that **significant effects on diving birds are considered to be highly unlikely.**

4.2.4 Oil spills

There will be no significant discharges from the offshore and nearshore survey vessels, and any discharge would be consistent with obligations under MARPOL, which effectively prevent

pollution from such sources. The survey vessels will meet all relevant MARPOL requirements in relation to Annex I on the prevention of pollution by oil, under the Sea Pollution Act 1991 (as amended). The vessels will hold a Shipboard Oil Pollution Emergency Plan (SOPEP).

The survey activities will be communicated through notices to mariners and the vessels will display appropriate navigational lighting. The surveys will result in a marginal increase in levels of marine traffic and therefore could theoretically increase the risk of accidents and potentially spillage of marine diesel fuel.

The probability of a collision with another vessel and spillage of diesel fuel is considered to be extremely low, since a nearshore diesel spillage could reach the waters and intertidal habitats and given proximity of adjacent Natura 2000 sites (Dundalk Bay SAC, boundary 4.5km from the closest point of the survey; Carlingford Shore SAC, 4.5km; Dundalk Bay SPA,<1km; and Carlingford Lough SPA, 5.7km, and proposed marine extension in NI waters, 3.5km), **significant effects could not be ruled out, and Dundalk Bay SAC, Carlingford Shore SAC, Dundalk Bay SPA and Carlingford Lough SPA have been screened in for Stage 2 assessment**.

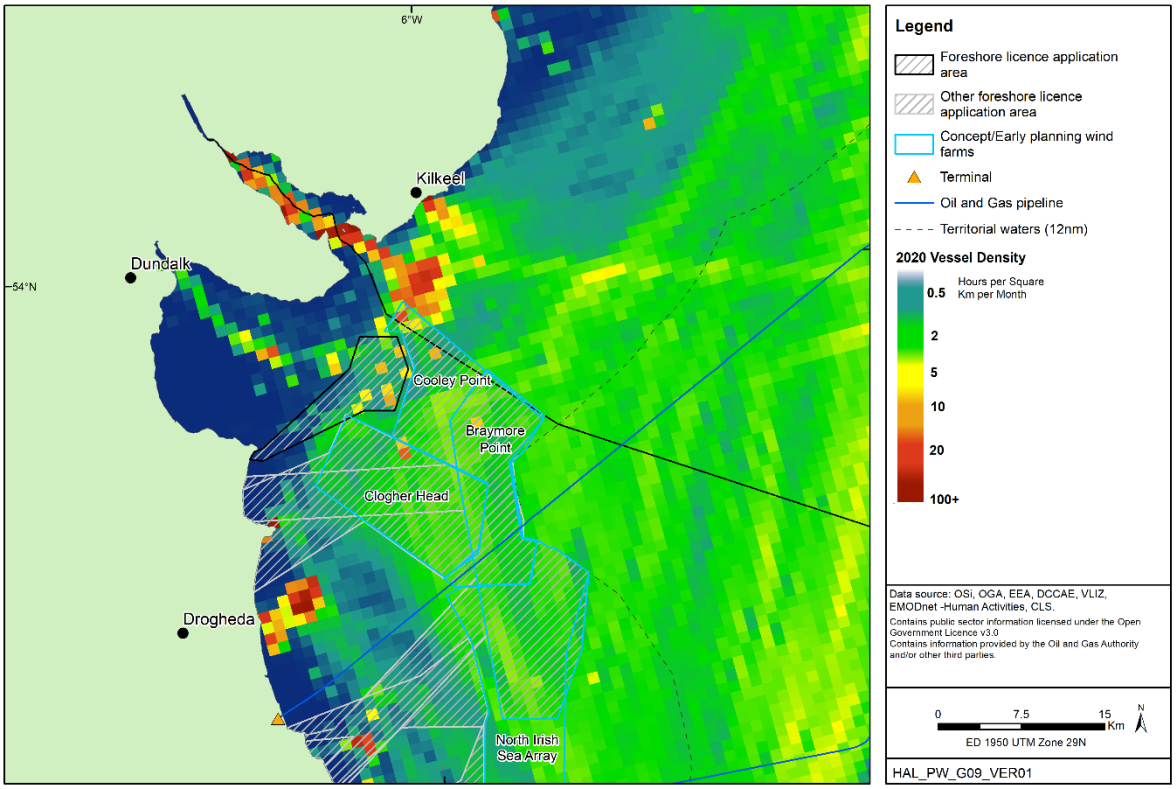
4.3 In-combination effects

A number of early concept offshore wind farm areas are located close to the proposed Oriel survey area (Figure 4.1). None of these have received consent, and the timing of any potential works for these is uncertain and is highly likely to be outside of the proposed Oriel survey schedule. All of these areas and related cable corridor areas of search have been, or are being, subject to foreshore licence applications for investigative works of a similar nature to that proposed for this application[12]. There is the potential for works associated with site investigations at Cooley Point, Braymore Point, Clogher Head and the North Irish Sea Array to take place within the schedule of works for this application, for example, as the licences granted provide a five year period within which to complete the works. In view of the similarity of the nature of the works between these applications, and the potential for in-combination effects, particular in relation to underwater noise, Oriel will maintain awareness of the scheduling associated with these other licences, and engage with the licence holders, as required. However, in view of the low sound power levels of the acoustic equipment used in such surveys, which are spatially discrete, and of short duration, it is concluded that such surveys will not result in likely significant in-combination effects.

Shipping activity in the area is dominated by fishing, particularly in the offshore area, with vessels in transit to or actively fishing the West Irish Sea Mudbelt, which is primarily targeted for *Nephrops*. Cargo vessels in transit to Dundalk, Warrenpoint and Drogheda are also present in the area, with lower densities of recreational, passenger and other vessels. In view of the level of existing shipping in the area, the temporary presence of the survey vessels will not result in likely significant in-combination effects.

[12] Cooley Point, Braymore Point, Clogher Head, North Irish Sea Array

Figure 4.1: Other relevant activities



5 AA SCREENING STATEMENT AND CONCLUSIONS

This report to support screening for Appropriate Assessment has been prepared according to the process and requirements outlined in the European Communities (Birds and Natural Habitats) Regulations 2011 and the Habitats Directive, and is consistent with European (European Commission 2019, European Commission 2021) (see Figure 1.1 of this document) and national (DoEHLG 2010 and Office of the Planning Regulator 2021) guidance, and relevant case law. The screening assessment was carried out in accordance with best published scientific knowledge and taking into consideration each of the relevant sites' conservation objectives, to ascertain if the proposed survey, on its own or in-combination with any other known plan or project, would be likely to have a significant effect on any of the relevant Natura 2000 sites.

For the avoidance of doubt, it is confirmed that measures intended to avoid or reduce impacts on any European Site were not considered as part of the screening assessment carried out, as these are not required to conclude that likely significant effects will not occur. However, in view of the requirements of the DAHG (2014) "Guidance to Manage the Risk to Marine Mammals from Man-made Sound Sources in Irish Waters", those measures outlined in sections 4.3.2 and 4.3.4(i) and (ii) as applicable of that report will be adopted. This is due to the requirement that they should be employed for drilling operations, surveys using a sparker/boomer, and for non-seismic sources, where activities will take place within 1,500m of the entrance of enclosed bays/inlets/estuaries".

This report concludes that most activities associated with the proposed survey (see Section 2) will not result in any likely significant effects (either alone or in-combination with other plans or projects) on the features or conservation objectives of any relevant Natura 2000 site (see Section 4). However, in the case of pollution from oil spillage, likely significant effects could not be definitively ruled out as such likelihood is uncertain, it is concluded therefore that an Appropriate Assessment is required to further assess the risks and to identify mitigation measures.

These conclusions are based on objective scientific evidence and there is no reasonable scientific doubt in relation to these conclusions.

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APPENDIX 1: NATURA 2000 SITE INFORMATION

The tabulations in this Appendix contain lists of the qualifying interests for each Natura 2000 site for which a potential interaction has been identified (Table 4.1) and those features of relevance to the survey programme. Additional information on site conservation objectives is also provided, which along with the qualifying interests inform a consideration of the nature of the interaction with the potential sources of likely significant effect.

Special Areas of Conservation (SAC)

Site Name: Dundalk Bay SAC
Site Code: IE0000455

Site information

Relevant qualifying interests: Estuaries, mudflats and sandflats not covered by seawater at low tide, perennial vegetation of stony banks, *Salicornia* and other annuals colonising mud and sand, Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*), Mediterranean salt meadows (*Juncetalia maritimi*)

Qualifying interests identified for further consideration on the basis of a foreseeable interaction with the survey area: estuaries, mudflats and sandflats not covered by seawater at low tide (note other Annex I features of the site are beyond the 5km screening criterion noted in Section 3.3.1)

Summary Conservation objectives:

- To maintain the favourable conservation condition of estuaries
- To maintain the favourable conservation condition of mudflats and sandflats not covered by seawater at low tide
- To maintain the favourable conservation condition of perennial vegetation of stony banks
- To maintain the favourable conservation condition of *Salicornia* and other annuals colonising mud and sand
- To restore the favourable conservation condition of Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)
- To maintain the favourable conservation condition of Mediterranean salt meadows (*Juncetalia maritimi*)

Feature attributes and targets defining favourable conservation status:
https://www.npws.ie/sites/default/files/protected-sites/conservation_objectives/CO000455.pdf

Closest distance (km) to the survey: 4.5km

Consideration of site interest features against potential sources of likely significant effect

Seabed disturbance from survey activities
A number of survey related activities (potential use of a jack-up barge, use of mooring blocks, vibrocoring, boreholes and grab sampling) will interact with the seabed and generate localised physical disturbance which is a source of potential effect for Annex I habitats. The majority of these activities will be located some distance from Dundalk Bay SAC, which is located 4.5km from the survey area, and only just within a distance for which effects are considered possible (see Section 3.3.1). Given the potential for interaction between the survey activities and the Annex I habitats located within a 5km distance of the survey area, the site is considered further in Section 4.2.1.

Site Name: Carlingford Shore SAC
Site Code: IE0002306

Site information

Relevant qualifying interests: Annual vegetation of drift lines, Perennial vegetation of stony banks

Qualifying interests identified for further consideration on the basis of a foreseeable interaction with the survey area: Annual vegetation of drift lines

Summary Conservation objectives:

- To maintain the favourable conservation condition of Annual vegetation of drift lines
- To maintain the favourable conservation condition of Perennial vegetation of stony banks

Feature attributes and targets defining favourable conservation status:
https://www.npws.ie/sites/default/files/protected-sites/conservation_objectives/CO002306.pdf

Closest distance (km) to the survey: 4.5km

Consideration of site interest features against potential sources of likely significant effect

Oil spills
Oil spills from the survey vessels would be a source of potential effect for Annex I habitats. Given the potential for an oil slick to drift under wind and water currents to the Annex I habitats adjacent to the survey area, the site is considered further in Section 4.2.4**.**

Site Name: Roaringwater Bay and Islands SAC
Site Code: IE0000101

Site information

Relevant qualifying interests: Large shallow inlets and bays, reefs, vegetated sea cliffs of the Atlantic and Baltic coasts, harbour porpoise *Phocoena phocoena*, otter *Lutra lutra*, grey seal *Halichoerus grypus*, European dry heaths, submerged or partly submerged sea caves

Qualifying interests identified for further consideration on the basis of a foreseeable interaction with the survey area: harbour porpoise

Summary Conservation objectives:

- To maintain the favourable conservation condition of large shallow inlets and bays
- To maintain the favourable conservation condition of reefs
- To maintain the favourable conservation condition of vegetated sea cliffs of the Atlantic and Baltic coasts
- To maintain the favourable conservation condition of harbour porpoise
- To restore the favourable conservation condition of otter
- To maintain the favourable conservation condition of grey seal
- To maintain the favourable conservation condition of European dry heaths
- To maintain the favourable conservation condition of submerged or partly submerged sea caves

Feature attributes and targets defining favourable conservation status:
https://www.npws.ie/sites/default/files/protected-sites/conservation_objectives/CO000101.pdf

Closest distance (km) to the survey: 415km

Consideration of site interest features against potential sources of likely significant effect

The physical presence of survey vessel
The survey will result in a small increase in vessel traffic. With respect to potentially sensitive qualifying species (e.g. harbour porpoise) these are expected to cause no more than temporary and localised low-level behavioural responses similar to those from normal shipping activity in the Dundalk Bay and wider Irish Sea areas. However, given the potential presence of these qualifying

Site Name: Roaringwater Bay and Islands SAC
Site Code: IE0000101

species the survey area there is the potential for interaction which is considered further in Section 4.2.2.

Underwater noise from vessel and survey activities
The primary contributor to underwater noise is from the use of survey equipment (one or more high-resolution geophysical survey (HRSG) sources). Given the potential presence of noise-sensitive qualifying species (e.g. harbour porpoise) in the survey area, there is the potential for interaction which is considered further in Section 4.2.3.

Site Name: Blasket Islands SAC
Site Code: 0002172

Site information

Relevant qualifying interests: reefs, vegetated sea cliffs of the Atlantic and Baltic coasts, harbour porpoise *Phocoena phocoena*, otter *Lutra lutra*, grey seal *Halichoerus grypus*, European dry heaths, submerged or partly submerged sea caves

Qualifying interests identified for further consideration on the basis of a foreseeable interaction with the survey area: harbour porpoise

Summary Conservation objectives:

- To maintain the favourable conservation condition of reefs
- To restore the favourable conservation condition of vegetated sea cliffs of the Atlantic and Baltic coasts
- To maintain the favourable conservation condition of harbour porpoise
- To restore the favourable conservation condition of otter
- To maintain the favourable conservation condition of grey seal
- To maintain the favourable conservation condition of European dry heaths
- To maintain the favourable conservation condition of submerged or partly submerged sea caves

Feature attributes and targets defining favourable conservation status:
https://www.npws.ie/sites/default/files/protected-sites/conservation_objectives/CO002172.pdf
Further supporting information on the site conservation objectives:
https://www.npws.ie/sites/default/files/publications/pdf/Blasket%20Islands%20SAC%20(002172)%20Conservation%20objectives%20supporting%20document%20-%20Marine%20habitats%20[Version%201]_1.pdf

Closest distance (km) to the survey: 540km

Consideration of site interest features against potential sources of likely significant effect

The physical presence of survey vessel
The survey will result in a small increase in vessel traffic. With respect to potentially sensitive qualifying species (e.g. harbour porpoise) these are expected to cause no more than temporary and localised low-level behavioural responses similar to those from normal shipping activity in the Dundalk Bay and wider Irish Sea areas. However, given the potential presence of these qualifying species the survey area there is the potential for interaction which is considered further in Section 4.2.2.

Underwater noise from vessel and survey activities
The primary contributor to underwater noise is from the use of survey equipment (one or more high-resolution geophysical survey (HRSG) sources). Given the potential presence of noise-sensitive qualifying species (harbour porpoise) in the survey area, the potential for likely significant effect is considered further in Section 4.2.3.

Site Name: Rockabill to Dalkey Island SAC
Site Code: 0003000

Site information

Relevant qualifying interests: reefs, harbour porpoise *Phocoena phocoena*

Qualifying interests identified for further consideration on the basis of a foreseeable interaction with the survey area: harbour porpoise

Summary Conservation objectives:

- To maintain the favourable conservation condition of reefs
- To maintain the favourable conservation condition of harbour porpoise

Feature attributes and targets defining favourable conservation status:
https://www.npws.ie/sites/default/files/protected-sites/conservation_objectives/CO003000.pdf
Further supporting information on the site conservation objectives:
https://www.npws.ie/sites/default/files/publications/pdf/003000_Rockabill%20to%20Dalkey%20Island%20SAC%20Marine%20Supporting%20Doc_V1.pdf

Closest distance (km) to the survey: 29km

Consideration of site interest features against potential sources of likely significant effect

The physical presence of survey vessel
The survey will result in a small increase in vessel traffic. With respect to potentially sensitive qualifying species (e.g. harbour porpoise) these are expected to cause no more than temporary and localised low-level behavioural responses similar to those from normal shipping activity in the Dundalk Bay and wider Irish Sea areas. However, given the potential presence of these qualifying species the survey area there is the potential for interaction which is considered further in Section 4.2.2.

Underwater noise from vessel and survey activities
The primary contributor to underwater noise is from the use of survey equipment (one or more high-resolution geophysical survey (HRSG) sources). Given the potential presence of noise-sensitive qualifying species (harbour porpoise) in the survey area, the potential for likely significant effect is considered further in Section 4.2.3.

Site Name: River Boyne and River Blackwater SAC
Site Code: IE00002299

Site information

Relevant qualifying interests: Alkaline fens, river lamprey *Lampetra fluviatilis*, Atlantic salmon *Salmo salar*, alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion, Alnion incanae, Salicion albae*), otter *Lutra lutra*

Qualifying interests identified for further consideration on the basis of a foreseeable interaction with the survey area: Atlantic salmon

Summary Conservation objectives:

- To maintain or restore the favourable conservation condition of the Annex II habitat(s) and/or the Annex II species for which the SAC has been selected

Feature attributes and targets defining favourable conservation status:
https://www.npws.ie/sites/default/files/protected-sites/conservation_objectives/CO002299.pdf

Closest distance (km) to the survey: 15km

Consideration of site interest features against potential sources of likely significant effect

The physical presence of survey vessel
The survey will result in a small increase in vessel traffic (a single vessel), being present for one day during April-September 2020. With respect to potentially sensitive qualifying species (e.g. migrating Atlantic salmon) these are expected to cause no more than temporary and localised low-

Site Name: River Boyne and River Blackwater SAC
Site Code: IE00002299

level behavioural responses similar to those from wider shipping activity in Dundalk Bay area. However, given the migratory nature of the qualifying species, there is the potential for interaction, which is considered further in Section 4.2.2.

Underwater noise from vessel and survey activities
The primary contributor to underwater noise from the survey will be vessel activity and noise associated with the survey equipment. In view of the potential noise sensitivity of qualifying interests which have the potential to occur in or near the survey area (e.g. migrating Atlantic salmon), the potential for likely significant effect is considered further in Section 4.2.3.

Site Name: Lambay Island SAC
Site Code: IE0000204

Site information

Relevant qualifying interests: vegetated sea cliffs of the Atlantic and Baltic coasts, grey seal (*Halichoerus grypus*), harbour seal (*Phoca vitulina*)

Qualifying interests identified for further consideration on the basis of a foreseeable interaction with the survey area: harbour seal, grey seal

Summary Conservation objectives:
To maintain the site qualifying interests in favourable conservation condition.

Feature attributes and targets defining favourable conservation status:
https://www.npws.ie/sites/default/files/protected-sites/conservation_objectives/CO000204.pdf

Closest distance (km) to the survey: 41km

Consideration of site interest features against potential sources of likely significant effect

The physical presence of survey vessel
The survey will result in a small increase in vessel traffic within the wider Dundalk Bay area. With respect to potentially sensitive qualifying species (harbour seal, grey seal) these are expected to cause no more than temporary and localised low-level behavioural responses similar to those from existing shipping activity in the survey area and wider Irish Sea. However, given the potential presence of these qualifying species the survey area there is the potential for interaction which is considered further in Section 4.2.2.

Underwater noise from vessel and survey activities
The primary contributor to underwater noise is from the use of survey equipment (one or more high-resolution geophysical survey (HRSG) sources). Given the potential presence of noise-sensitive qualifying species (harbour seal, grey seal) in the survey area, the potential for likely significant effect is considered further in Section 4.2.3.

Site Name: Murlough SAC
Site Code: UK0016612

Site information

Relevant qualifying interests: sandbanks which are slightly covered by sea water all the time, mudflats and sandflats not covered by seawater at low tide, large shallow inlets and bays annual vegetation of drift lines, *Salicornia* and other annuals colonizing mud and sand, Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*), embryonic shifting dunes, shifting dunes along the shoreline with *Ammophila arenaria* ("white dunes"), fixed coastal dunes with herbaceous vegetation ("grey dunes"), Atlantic decalcified fixed dunes (*Calluno-Ulicetea*), dunes with *Hippopha rhamnoides*, dunes with *Salix* repens ssp. argentea (*Salicion arenariae*), Marsh fritillary butterfly *Euphydryas (Eurodryas, Hypodryas) aurinia*, harbour seal *Phoca vitulina*.

Qualifying interests identified for further consideration on the basis of a foreseeable interaction with the survey area: harbour seal

Site Name: Murlough SAC
Site Code: UK0016612

Summary Conservation objectives:
To maintain (or restore where appropriate) the:

- Atlantic decalcified fixed dunes (*Calluno-Ulicetea*)
- Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)
- Dunes with *Salix* repens ssp. Argentea (*Salicion arenariae*)
- Embryonic shifting dunes
- Fixed dunes with herbaceous vegetation (grey dunes)
- Mudflats and sandflats not covered by seawater at low tide
- Sandbanks which are slightly covered by sea water all the time
- Shifting dunes along the shoreline with Ammophila arenaria (white dunes)
- Marsh fritillary *Euphydryas aurinia*
- Harbour (common) seal *Phoca vitulina*

Further supporting information on the site conservation objectives: https://www.daera-ni.gov.uk/sites/default/files/publications/doe/Murlough%20SAC%20Conservation%20Objectives%202018%20%28002%29.pdf

Closest distance (km) to the survey: 22km

Consideration of site interest features against potential sources of likely significant effect

The physical presence of survey vessel
The survey will result in a small increase in vessel traffic within the wider Dundalk Bay area. With respect to potentially sensitive qualifying species (harbour seal) these are expected to cause no more than temporary and localised low-level behavioural responses similar to those from existing shipping activity in the survey area and wider Irish Sea. However, given the potential presence of these qualifying species the survey area there is the potential for interaction which is considered further in Section 4.2.2.

Underwater noise from vessel and survey activities
The primary contributor to underwater noise is from the use of survey equipment (one or more high-resolution geophysical survey (HRSG) sources). Given the potential presence of noise-sensitive qualifying species (harbour seal) in the survey area, the potential for likely significant effect is considered further in Section 4.2.3.

Site Name: Strangford Lough SAC
Site Code: UK0016618

Site information

Relevant qualifying interests: sandbanks which are slightly covered by sea water all the time, estuaries, mudflats and sandflats not covered by seawater at low tide, coastal lagoons, large shallow inlets and bays, reefs, annual vegetation of drift lines, perennial vegetation of stony banks, *Salicornia* and other annuals colonizing mud and sand, *Spartina* swards (*Spartinion maritimae*), Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*), Fixed coastal dunes with herbaceous vegetation ("grey dunes"), harbour seal *Phoca vitulina*.

Qualifying interests identified for further consideration on the basis of a foreseeable interaction with the survey area: harbour seal

Summary Conservation objectives:
To maintain (or restore where appropriate), to favourable condition, the:

- Large shallow inlet and bay
- Coastal lagoons
- Mudflats and sandflats not covered by sea water at low tide
- Reefs
- Annual vegetation of drift lines
- Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)

Site Name: Strangford Lough SAC
Site Code: UK0016618

- Perennial vegetation of stony banks
- Salicornia and other annuals colonising mud and sand
- Harbour (common) seal *Phoca vitulina*

Further supporting information on the site conservation objectives: https://www.daera-ni.gov.uk/sites/default/files/publications/doe/Strangford%20Lough%20SAC%20Conservation%20Objectives%202018_.pdf

Closest distance (km) to the survey: 50km

Consideration of site interest features against potential sources of likely significant effect

The physical presence of survey vessel
The survey will result in a small increase in vessel traffic within the wider Dundalk Bay area. With respect to potentially sensitive qualifying species (harbour porpoise) these are expected to cause no more than temporary and localised low-level behavioural responses similar to those from existing shipping activity in the survey and wider Irish Sea. However, given the potential presence of these qualifying species the survey area there is the potential for interaction which is considered further in Section 4.2.2.

Underwater noise from vessel and survey activities
The primary contributor to underwater noise is from the use of survey equipment (one or more high-resolution geophysical survey (HRSG) sources). Given the potential presence of noise-sensitive qualifying species (harbour porpoise) in the survey area, the potential for likely significant effect is considered further in Section 4.2.3.

Site Name: Bristol Channel Approaches / Dynesfeydd Môr Hafren SAC
Site Code: UK0030396

Site information

Relevant qualifying interests: harbour porpoise *Phocoena phocoena*

Qualifying interests identified for further consideration on the basis of a foreseeable interaction with the survey area: harbour porpoise

Summary Conservation objectives:
To ensure that the integrity of the site is maintained and that it makes the best possible contribution to maintaining Favourable Conservation Status (FCS) for Harbour Porpoise in UK waters

In the context of natural change, this will be achieved by ensuring that:

- 1. The species is a viable component of the site.
- 2. There is no significant disturbance of the species.
- 3. The condition of supporting habitats and processes and prey availability are maintained.

Further supporting information on the site conservation objectives:
http://archive.jncc.gov.uk/pdf/BristolChApproaches_ConsAdvice.pdf

Closest distance (km) to the survey: 285km

Consideration of site interest features against potential sources of likely significant effect

The physical presence of survey vessel
The survey will result in a small increase in vessel traffic within the wider Dundalk Bay area. With respect to potentially sensitive qualifying species (harbour porpoise) these are expected to cause no more than temporary and localised low-level behavioural responses similar to those from existing shipping activity in the survey and wider Irish Sea. However, given the potential presence of these qualifying species the survey area there is the potential for interaction which is considered further in Section 4.2.2.

Underwater noise from vessel and survey activities

Site Name: Bristol Channel Approaches / Dynesfeydd Môr Hafren SAC **Site Code: UK0030396**
The primary contributor to underwater noise is from the use of survey equipment (one or more high-resolution geophysical survey (HRSG) sources). Given the potential presence of noise-sensitive qualifying species (harbour porpoise) in the survey area, the potential for likely significant effect is considered further in Section 452.2.

Site Name: North Anglesey Marine / Gogledd Môn Forol SAC **Site Code: UK0030398**
Site information
Relevant qualifying interests: harbour porpoise *Phocoena phocoena* **Qualifying interests identified for further consideration on the basis of a foreseeable interaction with the survey area:** harbour porpoise **Summary Conservation objectives:** To ensure that the integrity of the site is maintained and that it makes the best possible contribution to maintaining Favourable Conservation Status (FCS) for Harbour Porpoise in UK waters In the context of natural change, this will be achieved by ensuring that: • 1. The species is a viable component of the site. • 2. There is no significant disturbance of the species. • 3. The condition of supporting habitats and processes and prey availability are maintained. **Further supporting information on the site conservation objectives:** http://archive.jncc.gov.uk/pdf/NAnglesey_ConsAdvice.pdf
Closest distance (km) to the survey: 55km
Consideration of site interest features against potential sources of likely significant effect
The physical presence of survey vessel The survey will result in a small increase in vessel traffic within the wider Dundalk Bay area. With respect to potentially sensitive qualifying species (harbour porpoise) these are expected to cause no more than temporary and localised low-level behavioural responses similar to those from existing shipping activity in the survey and wider Irish Sea. However, given the potential presence of these qualifying species the survey area there is the potential for interaction which is considered further in Section 4.2.2. **Underwater noise from vessel and survey activities** The primary contributor to underwater noise is from the use of survey equipment (one or more high-resolution geophysical survey (HRSG) sources). Given the potential presence of noise-sensitive qualifying species (harbour porpoise) in the survey area, the potential for likely significant effect is considered further in Section 4.2.3.

Site Name: West Wales Marine / Gorllewin Cymru Forol SAC **Site Code: UK0030397**
Site information
Relevant qualifying interests: harbour porpoise *Phocoena phocoena* **Qualifying interests identified for further consideration on the basis of a foreseeable interaction with the survey area:** harbour porpoise **Summary Conservation objectives:** To ensure that the integrity of the site is maintained and that it makes the best possible contribution to maintaining Favourable Conservation Status (FCS) for Harbour Porpoise in UK waters In the context of natural change, this will be achieved by ensuring that:

Site Name: West Wales Marine / Gorllewin Cymru Forol SAC
Site Code: UK0030397

- 1. The species is a viable component of the site.
- 2. There is no significant disturbance of the species.
- 3. The condition of supporting habitats and processes and prey availability are maintained.

Further supporting information on the site conservation objectives:
https://cdn.naturalresources.wales/media/681439/w-wales-marine-objectives-advice.pdf?mode=pad&rnd=131625760750000000

Closest distance (km) to the survey: 135km

Consideration of site interest features against potential sources of likely significant effect

The physical presence of survey vessel
The survey will result in a small increase in vessel traffic within the wider Dundalk Bay area. With respect to potentially sensitive qualifying species (harbour porpoise) these are expected to cause no more than temporary and localised low-level behavioural responses similar to those from existing shipping activity in the survey and wider Irish Sea. However, given the potential presence of these qualifying species the survey area there is the potential for interaction which is considered further in Section 4.2.2.

Underwater noise from vessel and survey activities
The primary contributor to underwater noise is from the use of survey equipment (one or more high-resolution geophysical survey (HRSG) sources). Given the potential presence of noise-sensitive qualifying species (harbour porpoise) in the survey area, the potential for likely significant effect is considered further in Section 4.2.3.

Site Name: North Channel SAC
Site Code: UK0030398

Site information

Relevant qualifying interests: harbour porpoise *Phocoena phocoena*

Qualifying interests identified for further consideration on the basis of a foreseeable interaction with the survey area: harbour porpoise

Summary Conservation objectives:
To ensure that the integrity of the site is maintained and that it makes the best possible contribution to maintaining Favourable Conservation Status (FCS) for Harbour Porpoise in UK waters

In the context of natural change, this will be achieved by ensuring that:

- 1. The species is a viable component of the site.
- 2. There is no significant disturbance of the species.
- 3. The condition of supporting habitats and processes and prey availability are maintained.

Further supporting information on the site conservation objectives:
http://archive.jncc.gov.uk/pdf/NorthChannel_ConsAdvice.pdf

Closest distance (km) to the survey: 48km

Consideration of site interest features against potential sources of likely significant effect

The physical presence of survey vessel
The survey will result in a small increase in vessel traffic within the wider Dundalk Bay area. With respect to potentially sensitive qualifying species (harbour porpoise) these are expected to cause no more than temporary and localised low-level behavioural responses similar to those from existing shipping activity in the survey and wider Irish Sea. However, given the potential presence of these qualifying species the survey area there is the potential for interaction which is considered further in Section 4.2.2.

Underwater noise from vessel and survey activities

Site Name: North Channel SAC **Site Code: UK0030398**
The primary contributor to underwater noise is from the use of survey equipment (one or more high-resolution geophysical survey (HRSG) sources). Given the potential presence of noise-sensitive qualifying species (harbour porpoise) in the survey area, the potential for likely significant effect is considered further in Section 4.2.3.

Site Name: Lleyn Peninsula and the Sarnau **Site Code: UK0013117**
Site information
Relevant qualifying interests: sandbanks which are slightly covered by sea water all the time, estuaries, mudflats and sandflats not covered by seawater at low tide, coastal lagoons, large shallow inlets and bays, reefs, *Salicornia* and other annuals colonizing mud and sand, *Spartina* swards (*Spartinion maritimae*), Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*), submerged or partially submerged sea caves, bottlenose dolphin *Tursiops truncatus,* otter *Lutra lutra,* grey seal *Halichoerus grypus* **Qualifying interests identified for further consideration on the basis of a foreseeable interaction with the survey area:** bottlenose dolphin **Summary Conservation objectives:** To achieve favourable conservation status all the following, subject to natural processes, need to be fulfilled and maintained in the long-term. If these objectives are not met restoration measures will be needed to achieve favourable conservation status. • **Habitat features**: the overall distribution and extent of the habitat features within the site, and each of their main component parts is stable or increasing. As part of this objective it should be noted that; for the estuaries feature additional land which should form an integral part of the estuarine ecosystem should be restored. • **Structure and function**: the physical biological and chemical structure and functions necessary for the long-term maintenance and quality of the habitat are not degraded. As part of this objective it should be noted that; for the estuaries feature the structure and functions of the estuaries that have been damaged/degraded by the constraints of artificial structures such as flood banks, are restored. • **Typical species**: The presence, abundance, condition and diversity of typical species is such that habitat quality is not degraded. As part of this objective it should be noted that; for the reefs feature the potential for expansion of the horse mussel *Modiolus modiolus* community off the north Llŷn coast is not inhibited. • **Populations**: The population is maintaining itself on a long-term basis as a viable component of its natural habitat. For grey seal populations should not be reduced as a consequence of human activity. • **Range**: The species population within the site is such that the natural range of the population is not being reduced or likely to be reduced for the foreseeable future. • **Supporting habitats and species**: The presence, abundance, condition and diversity of habitats and species required to support this species is such that the distribution, abundance and populations dynamics of the species within the site and population beyond the site is stable or increasing. • **Restoration and recovery**: As part of this objective it should be noted that for the bottlenose dolphin and otter, populations should be increasing. **Further supporting information on the site conservation objectives:** https://cdn.naturalresources.wales/media/688001/eng-pen-llyn-ar-sarnau-reg-37-report-2018.pdf?mode=pad
Closest distance (km) to the survey: 135km
Consideration of site interest features against potential sources of likely significant effect
The physical presence of survey vessel

Site Name: Lleyn Peninsula and the Sarnau
Site Code: UK0013117

The survey will result in a small increase in vessel traffic within the wider Dundalk Bay area. With respect to potentially sensitive qualifying species (harbour porpoise) these are expected to cause no more than temporary and localised low-level behavioural responses similar to those from existing shipping activity in the survey and wider Irish Sea. However, given the potential presence of these qualifying species the survey area there is the potential for interaction which is considered further in Section 4.2.2.

Underwater noise from vessel and survey activities
The primary contributor to underwater noise is from the use of survey equipment (one or more high-resolution geophysical survey (HRSG) sources). Given the potential presence of noise-sensitive qualifying species (harbour porpoise) in the survey area, the potential for likely significant effect is considered further in Section 4.2.3.

Site Name: Cardigan Bay
Site Code: UK0012712

Site information

Relevant qualifying interests: sandbanks which are slightly covered by sea water all the time, mudflats and sandflats not covered by seawater at low tide, reefs, submerged or partially submerged sea caves, sea lamprey, *Petromyzon marinus*, river lamprey *Lampetra fluviatilis*, grey seal *Halichoerus grypus*, bottlenose dolphin *Tursiops truncatus*

Qualifying interests identified for further consideration on the basis of a foreseeable interaction with the survey area: bottlenose dolphin

Summary Conservation objectives:
To achieve favourable conservation status all the following, subject to natural processes, need to be fulfilled and maintained in the long-term. If these objectives are not met restoration measures will be needed to achieve favourable conservation status.

- **Range**: The overall distribution and extent of the habitat features within the site, and each of their main component parts is stable or increasing.
- **Structure and function**: The physical biological and chemical structure and functions necessary for the long-term maintenance and quality of the habitat are not degraded.
- **Typical species**: The presence, abundance, condition and diversity of typical species is such that habitat quality is not degraded.
- **Populations**: The population is maintaining itself on a long-term basis as a viable component of its natural habitat.
- **Range**: The species population within the site is such that the natural range of the population is not being reduced or likely to be reduced for the foreseeable future.
- **Supporting habitats and species**: The presence, abundance, condition and diversity of habitats and species required to support this species is such that the distribution, abundance and populations dynamics of the species within the site and population beyond the site is stable or increasing.
- **Restoration and recovery**: As part of this objective it should be noted that for the bottlenose dolphin populations should be increasing.

Further supporting information on the site conservation objectives:
https://cdn.cyfoethnaturiol.cymru/media/687993/eng-cardigan-bay-reg-37-report-2018.pdf

Closest distance (km) to the survey: 196km

Consideration of site interest features against potential sources of likely significant effect

The physical presence of survey vessel
The survey will result in a small increase in vessel traffic within the wider Dundalk Bay area. With respect to potentially sensitive qualifying species (harbour porpoise) these are expected to cause no more than temporary and localised low-level behavioural responses similar to those from

Site Name: Cardigan Bay **Site Code: UK0012712**
existing shipping activity in the survey and wider Irish Sea. However, given the potential presence of these qualifying species the survey area there is the potential for interaction which is considered further in Section 4.2.2. **Underwater noise from vessel and survey activities** The primary contributor to underwater noise is from the use of survey equipment (one or more high-resolution geophysical survey (HRSG) sources). Given the potential presence of noise-sensitive qualifying species (harbour porpoise) in the survey area, the potential for likely significant effect is considered further in Section 4.2.3.

Special Protection Areas (SPAs)

Site Name: Beara Peninsula SPA **Site Code: 0004155**
Site information
Relevant qualifying interests: northern fulmar (*Fulmarus glacialis*), chough (*Pyrrhocorax pyrrhocorax*) **Qualifying interests identified for further consideration on the basis of a foreseeable interaction with the survey area:** northern fulmar **Summary Conservation objectives:** • To maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests for this SPA. **Feature attributes and targets defining favourable conservation status:** Not listed – https://www.npws.ie/sites/default/files/protected-sites/conservation_objectives/CO004155.pdf
Closest distance (km) to the survey: 465km
Consideration of site interest features against potential sources of likely significant effect
The physical presence of survey vessel Fulmar, while having the potential to forage within range of the survey area (see Woodward *et al.* 2019), are regarded to have a low sensitivity to shipping traffic (Garthe & Hüppop 2004, Fliessbach *et al.* 2019), and therefore, physical presence of the survey vessel is not considered to be a source of likely significant effect. **Underwater noise from vessel and survey activities** None of the qualifying interests are diving seabirds which are likely to be most at risk of any underwater noise effects, and therefore underwater noise is not considered to be a source of likely significant effect.

Site Name: Cruagh Island SPA **Site Code: 004170**
Site information
Relevant qualifying interests: Manx shearwater (*Puffinus puffinus*), barnacle goose (*Branta leucopsis*) **Qualifying interests identified for further consideration on the basis of a foreseeable interaction with the survey area:** Manx shearwater **Summary Conservation objectives:** • To maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests for this SPA

Site Name: Cruagh Island SPA
Site Code: 004170

Feature attributes and targets defining favourable conservation status:
https://www.npws.ie/sites/default/files/protected-sites/conservation_objectives/CO004170.pdf

Closest distance (km) to the survey: 710km

Consideration of site interest features against potential sources of likely significant effect

The physical presence of survey vessel
Manx shearwater has the potential to forage within range of the survey area (see Woodward *et al.* 2019). Sensitivity to vessel movements is considered to be low for this species (see MMO 2018), but in view of the potential for interaction, this is considered further in Section 4.2.2.

Underwater noise from vessel and survey activities
There is the potential for interactions between diving seabird species (Manx shearwater) which are potentially sensitive to underwater noise, and the survey activities. This is considered further in Section 4.2.3.

Site Name: Deenish Island and Scariff Island SPA
Site Code: 004175

Site information

Relevant qualifying interests: Northern fulmar (*Fulmarus glacialis*), European storm petrel (*Hydrobates pelagicus*), lesser black-backed gull (*Larus fuscus*), Manx shearwater (*Puffinus puffinus*), Arctic tern (*Sterna paradisaea*)

Qualifying interests identified for further consideration on the basis of a foreseeable interaction with the survey area: northern fulmar, Manx shearwater

Summary Conservation objectives:

- To maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests for this SPA

Feature attributes and targets defining favourable conservation status:
https://www.npws.ie/sites/default/files/protected-sites/conservation_objectives/CO004175.pdf

Closest distance (km) to the survey: 495km

Consideration of site interest features against potential sources of likely significant effect

The physical presence of survey vessel
Fulmar and Manx shearwater have the potential to forage within range of the survey area (see Woodward *et al.* 2019). Sensitivity to vessel movements is considered to be low for those species (see Garthe & Hüppop 2004, MMO 2018, Fliessbach *et al.* 2019), and therefore, physical presence of the survey vessel is not considered to be a source of likely significant effect.

Underwater noise from vessel and survey activities
There is the potential for interactions between diving seabird species (Manx shearwater) which are potentially sensitive to underwater noise, and the survey activities. This is considered further in Section 4.2.3.

Site Name: Dundalk Bay SPA
Site Code: 004026

Site information

Relevant qualifying interests: Northern pintail (*Anas acuta*), Eurasian teal (*Anas crecca*), mallard (*Anas platyrhynchos*), greylag goose (*Anser anser*), light-bellied brent goose (*Branta bernicla hrota*), dunlin (*Calidris alpina*), red knot (*Calidris canutus*), ringed plover (*Charadrius hiaticula*), black-headed gull (*Chroicocephalus ridibundus*), Eurasian oystercatcher (*Haematopus ostralegus*), herring gull (*Larus argentatus*), common gull (*Larus canus*), bar-tailed godwit (*Limosa lapponica*), black-tailed godwit (*Limosa limosa*), common scoter (*Melanitta nigra*), red-breasted merganser

Site Name: Dundalk Bay SPA
Site Code: 004026

(*Mergus serrator*), Eurasian curlew (*Numenius arquata*), European golden plover (*Pluvialis apricaria*), grey plover (*Pluvialis squatarola*), great crested grebe (*Podiceps cristatus*), common shelduck (*Tadorna tadorna*), common redshank (*Tringa totanus*), northern lapwing (*Vanellus vanellus*); Waterbird assemblage

Qualifying interests identified for further consideration on the basis of a foreseeable interaction with the survey area: common scoter, red-breasted merganser, great crested grebe

Summary Conservation objectives:

- To maintain the favourable conservation condition of those qualifying interests listed above in Dundalk Bay SPA, including the wetland habitat as a resource for the regularly occurring migratory birds that utilise it.

Feature attributes and targets defining favourable conservation status:
https://www.npws.ie/sites/default/files/protected-sites/conservation_objectives/CO004026.pdf

Closest distance (km) to the survey: <1km

Consideration of site interest features against potential sources of likely significant effect

The physical presence of survey vessel
Common scoter, red-breasted merganser and great-crested grebe are highly or moderately sensitive to vessel movements (Garthe & Hüppop 2004, Fliessbach *et al.* 2019), and in view of the potential for interaction with the survey area, these species are considered further in Section 4.2.2.

Underwater noise from vessel and survey activities
There is the potential for interactions between diving ducks and grebes (common scoter, red-breasted merganser, great-crested grebe) which are potentially sensitive to underwater noise, and the survey activities. This is considered further in Section 4.2.3.

Site Name: Carlingford Lough SPA
Site Code: IE0004078

Site information

Relevant qualifying interests: Light-bellied Brent Goose (*Branta bernicla hrota*), Wetland and Waterbirds

Qualifying interests identified for further consideration on the basis of a foreseeable interaction with the survey area: Light-bellied Brent Goose, Wetland and Waterbirds

Summary Conservation objectives:

- To maintain the favourable conservation condition of Light-bellied Brent Goose
- To maintain the favourable conservation condition of the wetland habitat

Feature attributes and targets defining favourable conservation status:
https://www.npws.ie/sites/default/files/protected-sites/conservation_objectives/CO004078.pdf

Closest distance (km) to the survey: 5.7km

Consideration of site interest features against potential sources of likely significant effect

Oil spills
Oil spills from the survey vessels would be a source of potential effect for the qualifying interests indicated above. Given the potential for an oil slick to drift under wind and water currents to beach on the intertidal habitats adjacent to the survey area, the site is considered further in Section 4.2.4.

Site Name: River Nanny Estuary and Shore SPA
Site Code: 0004158

Site information

Relevant qualifying interests: Oystercatcher (*Haematopus ostralegus*), ringed plover (*Charadrius hiaticula*), golden plover (*Pluvialis apricaria*), knot (*Calidris canutus*), sanderling (*Calidris alba*), herring gull (*Larus argentatus*), Waterbird assemblage

Qualifying interests identified for further consideration on the basis of a foreseeable interaction with the survey area: herring gull

Summary Conservation objectives:

- To maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests for this SPA.

Feature attributes and targets defining favourable conservation status:
https://www.npws.ie/sites/default/files/protected-sites/conservation_objectives/CO004158.pdf

Closest distance (km) to the survey: 18km

Consideration of site interest features against potential sources of likely significant effect

The physical presence of survey vessel
Herring gull, while having the potential to forage within range of the survey area (see Woodward *et al.* 2019), are regarded to have a low sensitivity to shipping traffic (Garthe & Hüppop 2004, Fliessbach *et al.* 2019), and therefore, physical presence of the survey vessel is not considered to be a source of likely significant effect.

Underwater noise from vessel and survey activities
None of the qualifying interests are diving seabirds which are likely to be most at risk of any underwater noise effects, and therefore underwater noise is not considered to be a source of likely significant effect.

Site Name: Horn Head to Fanad Head SPA
Site Code: 004194

Site information

Relevant qualifying interests: Northern fulmar (*Fulmarus glacialis*), cormorant (*Phalacrocorax carbo*), shag (*Phalacrocorax aristotelis*), barnacle goose (*Branta leucopsis*), peregrine (*Falco peregrinus*), kittiwake (*Rissa tridactyla*), guillemot (*Uria aalge*), razorbill (*Alca torda*), chough (*Pyrrhocorax pyrrhocorax*), Greenland white-fronted goose (*Anser albifrons flavirostris*)

Qualifying interests identified for further consideration on the basis of a foreseeable interaction with the survey area: northern fulmar

Summary Conservation objectives:

- To maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests for this SPA.

Feature attributes and targets defining favourable conservation status:
https://www.npws.ie/sites/default/files/protected-sites/conservation_objectives/CO004194.pdf

Closest distance (km) to the survey: 270km

Consideration of site interest features against potential sources of likely significant effect

The physical presence of survey vessel
Fulmar, while having the potential to forage within range of the survey area (see Woodward *et al.* 2019), are regarded to have a low sensitivity to shipping traffic (Garthe & Hüppop 2004, Fliessbach *et al.* 2019), and therefore, physical presence of the survey vessel is not considered to be a source of likely significant effect.

Underwater noise from vessel and survey activities

Site Name: Horn Head to Fanad Head SPA **Site Code: 004194**
None of the qualifying interests are diving seabirds which are likely to be most at risk of any underwater noise effects, and therefore underwater noise is not considered to be a source of likely significant effect.

Site Name: Howth Head Coast SPA **Site Code: 004113**
Site information
Relevant qualifying interests: Black-legged kittiwake (*Rissa tridactyla*), **Qualifying interests identified for further consideration on the basis of a foreseeable interaction with the survey area:** black-legged kittiwake **Summary Conservation objectives:** • To maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests for this SPA (above). **Feature attributes and targets defining favourable conservation status:** Not listed - https://www.npws.ie/sites/default/files/protected-sites/conservation_objectives/CO004113.pdf
Closest distance (km) to the survey: 52km
Consideration of site interest features against potential sources of likely significant effect
The physical presence of survey vessel Black-legged kittiwake, while having the potential to forage within range of the survey area (see Woodward *et al.* 2019), are regarded to have a low sensitivity to shipping traffic (Garthe & Hüppop 2004, Fliessbach *et al.* 2019), and therefore, physical presence of the survey vessel is not considered to be a source of likely significant effect. **Underwater noise from vessel and survey activities** None of the qualifying interests are diving seabirds which are likely to be most at risk of any underwater noise effects, and therefore underwater noise is not considered to be a source of likely significant effect.

Site Name: West Donegal Coast SPA **Site Code: 004150**
Site information
Relevant qualifying interests: razorbill (*Alca torda*), peregrine falcon (*Falco peregrinus*), northern fulmar (*Fulmarus glacialis*), herring gull (Larus argentatus), European shag (*Phalacrocorax aristotelis*), great cormorant (*Phalacrocorax carbo*), red-billed chough (*Pyrrhocorax pyrrhocorax*), black-legged kittiwake (*Rissa tridactyla*) **Qualifying interests identified for further consideration on the basis of a foreseeable interaction with the survey area:** northern fulmar **Summary Conservation objectives:** • To maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests for this SPA (above) **Feature attributes and targets defining favourable conservation status:** Not listed - https://www.npws.ie/sites/default/files/protected-sites/conservation_objectives/CO004150.pdf
Closest distance (km) to the survey: 320km
Consideration of site interest features against potential sources of likely significant effect
The physical presence of survey vessel

Site Name: West Donegal Coast SPA
Site Code: 004150

Fulmar, while having the potential to forage within range of the survey area (see Woodward *et al.* 2019), are regarded to have a low sensitivity to shipping traffic (Garthe & Hüppop 2004, Fliessbach *et al.* 2019), and therefore, physical presence of the survey vessel is not considered to be a source of likely significant effect.

Underwater noise from vessel and survey activities
None of the qualifying interests are diving seabirds which are likely to be most at risk of any underwater noise effects, and therefore underwater noise is not considered to be a source of likely significant effect.

Site Name: Saltee Islands SPA
Site Code: 004002

Site information

Relevant qualifying interests: Razorbill (*Alca torda*), peregrine (*Falco peregrinus*), Atlantic puffin (*Fratercula arctica*), northern fulmar (*Fulmarus glacialis*), lesser black-backed gull (*Larus fuscus*), cormorant (*Phalacrocorax carbo*), Manx shearwater (*Puffinus puffinus*), red-billed chough (*Pyrrhocorax pyrrhocorax*), black-legged kittiwake (*Rissa tridactyla*), northern gannet (*Morus bassanus*), guillemot (*Uria aalge*)

Qualifying interests identified for further consideration on the basis of a foreseeable interaction with the survey area: northern fulmar, northern gannet

Summary Conservation objectives:

- To maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests for this SPA (above)

Feature attributes and targets defining favourable conservation status:
Not listed - https://www.npws.ie/sites/default/files/protected-sites/conservation_objectives/CO004002.pdf

Closest distance (km) to the survey: 212km

Consideration of site interest features against potential sources of likely significant effect

The physical presence of survey vessel
Fulmar and northern gannet have the potential to forage within range of the survey area (see Woodward *et al.* 2019). Sensitivity to vessel movements is considered to be low for those species (see Garthe & Hüppop 2004, MMO 2018, Fliessbach *et al.* 2019), and therefore, physical presence of the survey vessel is not considered to be a source of likely significant effect.

Underwater noise from vessel and survey activities
There is the potential for interactions between diving seabird species (northern gannet) which are potentially sensitive to underwater noise, and the survey activities. This is considered further in Section 4.2.3.

Site Name: Puffin Island SPA
Site Code: 004003

Site information

Relevant qualifying interests: Razorbill (*Alca torda*), Atlantic puffin (*Fratercula arctica*), northern fulmar (*Fulmarus glacialis*), European storm-petrel (*Hydrobates pelagicus*), lesser black-backed gull (*Larus fuscus*), Manx shearwater (*Puffinus puffinus*)

Qualifying interests identified for further consideration on the basis of a foreseeable interaction with the survey area: northern fulmar, Manx shearwater

Summary Conservation objectives:

Site Name: Puffin Island SPA
Site Code: 004003

- To maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests for this SPA (above)

Feature attributes and targets defining favourable conservation status:
Not listed - https://www.npws.ie/sites/default/files/protected-sites/conservation_objectives/CO004003.pdf

Closest distance (km) to the survey: 520km

Consideration of site interest features against potential sources of likely significant effect

The physical presence of survey vessel
Fulmar and Manx shearwater have the potential to forage within range of the survey area (see Woodward *et al.* 2019). Sensitivity to vessel movements is considered to be low for those species (see Garthe & Hüppop 2004, MMO 2018, Fliessbach *et al.* 2019), and therefore, physical presence of the survey vessel is not considered to be a source of likely significant effect.

Underwater noise from vessel and survey activities
There is the potential for interactions between diving seabird species (Manx shearwater) which are potentially sensitive to underwater noise, and the survey activities. This is considered further in Section 4.2.3.

Site Name: Skelligs SPA
Site Code: 004007

Site information

Relevant qualifying interests: Atlantic puffin (*Fratercula arctica*), northern fulmar (*Fulmarus glacialis*), European storm-petrel (*Hydrobates pelagicus*), Manx shearwater (*Puffinus puffinus*), red-billed chough (*Pyrrhocorax pyrrhocorax*), black-legged kittiwake (*Rissa tridactyla*), northern gannet (*Morus bassanus*), common guillemot (*Uria aalge*)

Qualifying interests identified for further consideration on the basis of a foreseeable interaction with the survey area: northern fulmar, northern gannet, Manx shearwater

Summary Conservation objectives:

- To maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests for this SPA (above)

Feature attributes and targets defining favourable conservation status:
Not listed - https://www.npws.ie/sites/default/files/protected-sites/conservation_objectives/CO004007.pdf

Closest distance (km) to the survey: 515km

Consideration of site interest features against potential sources of likely significant effect

The physical presence of survey vessel
Fulmar, Manx shearwater and northern gannet have the potential to forage within range of the survey area (see Woodward *et al.* 2019). Sensitivity to vessel movements is considered to be low for those species (see Garthe & Hüppop 2004, MMO 2018, Fliessbach *et al.* 2019), and therefore, physical presence of the survey vessel is not considered to be a source of likely significant effect.

Underwater noise from vessel and survey activities
There is the potential for interactions between diving seabird species (Manx shearwater, northern gannet) which are potentially sensitive to underwater noise, and the survey activities. This is considered further in Section 4.2.3.

Site Name: Blasket Islands SPA
Site Code: 004008

Site information

Relevant qualifying interests: razorbill (*Alca torda*), peregrine falcon (*Falco peregrinus*), Atlantic puffin (*Fratercula arctica*), northern fulmar (*Fulmarus glacialis*), European storm-petrel (*Hydrobates pelagicus*), common gull (*Larus canus*), lesser black-backed gull (*Larus fuscus*), leach's storm-petrel (Oceanodroma leucorhoa), Manx shearwater (*Puffinus puffinus*), red-billed chough (*Pyrrhocorax pyrrhocorax*), black-legged kittiwake (*Rissa tridactyla*), Arctic tern (*Sterna paradisaea*), guillemot (*Uria aalge*)

Qualifying interests identified for further consideration on the basis of a foreseeable interaction with the survey area: Manx shearwater

Summary Conservation objectives:

- To maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests for this SPA (above)

Feature attributes and targets defining favourable conservation status:
Not listed - https://www.npws.ie/sites/default/files/protected-sites/conservation_objectives/CO004008.pdf

Closest distance (km) to the survey: 546km

Consideration of site interest features against potential sources of likely significant effect

The physical presence of survey vessel
Manx shearwater have the potential to forage within range of the survey area (see Woodward *et al.* 2019). Sensitivity to vessel movements is considered to be low for this species (see MMO 2018), and therefore, physical presence of the survey vessel is not considered to be a source of likely significant effect.

Underwater noise from vessel and survey activities
There is the potential for interactions between diving seabird species (Manx shearwater) which are potentially sensitive to underwater noise, and the survey activities. This is considered further in Section 4.2.3.

Site Name: Lambay Island SPA
Site Code: 004069

Site information

Relevant qualifying interests: Razorbill (*Alca torda*), greylag goose (*Anser anser*), Atlantic puffin (*Fratercula arctica*), northern fulmar (*Fulmarus glacialis*), herring gull (*Larus argentatus*), lesser black-backed gull (*Larus fuscus*), European shag (*Phalacrocorax aristotelis*), cormorant (*Phalacrocorax carbo*), black-legged kittiwake (*Rissa tridactyla*), common guillemot (*Uria aalge*)

Qualifying interests identified for further consideration on the basis of a foreseeable interaction with the survey area: razorbill, Atlantic puffin, northern fulmar, herring gull, lesser black-backed gull, black-legged kittiwake, common guillemot

Summary Conservation objectives:

- To maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests for this SPA (above)

Feature attributes and targets defining favourable conservation status:
Not listed - https://www.npws.ie/sites/default/files/protected-sites/conservation_objectives/CO004069.pdf

Closest distance (km) to the survey: 41km

Consideration of site interest features against potential sources of likely significant effect

The physical presence of survey vessel

Site Name: Lambay Island SPA
Site Code: 004069

Northern fulmar, herring gull, lesser black-backed gull and black-legged kittiwake have the potential to forage within range of the survey area (see Woodward *et al.* 2019). Sensitivity to vessel movements is considered to be low for these species (Garthe & Hüppop 2004, Fliessbach *et al.* 2019), and therefore, physical presence of the survey vessel is not considered to be a source of likely significant effect. Atlantic puffin and common guillemot are judged to have a moderate sensitivity to disturbance, and in view of the potential for interaction with the survey area, these species are considered further in Section 4.2.2.

Underwater noise from vessel and survey activities
There is the potential for interactions between diving seabird species (guillemot, puffin) which are potentially sensitive to underwater noise, and the survey activities. This is considered further in Section 4.2.3.

Site Name: Ireland's Eye SPA
Site Code: 004117

Site information

Relevant qualifying interests: razorbill (*Alca torda*), cormorant (*Phalacrocorax carbo carbo*), black-legged kittiwake (*Rissa tridactyla*), northern gannet (*Morus bassanus*), common guillemot (*Uria aalge*)

Qualifying interests identified for further consideration on the basis of a foreseeable interaction with the survey area: razorbill, black-legged kittiwake, northern gannet, common guillemot

Summary Conservation objectives:

- To maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests for this SPA (above)

Feature attributes and targets defining favourable conservation status:
Not listed - https://www.npws.ie/sites/default/files/protected-sites/conservation_objectives/CO004117.pdf

Closest distance (km) to the survey: 50km

Consideration of site interest features against potential sources of likely significant effect

The physical presence of survey vessel
Black-legged kittiwake and northern gannet have the potential to forage within range of the survey area (see Woodward *et al.* 2019). Sensitivity to vessel movements is considered to be low for these species (Garthe & Hüppop 2004, Fliessbach *et al.* 2019), and therefore, physical presence of the survey vessel is not considered to be a source of likely significant effect. Razorbill and common guillemot are judged to have a moderate sensitivity to disturbance, and in view of the potential for interaction with the survey area, these species are considered further in Section 4.2.2.

Underwater noise from vessel and survey activities
There is the potential for interactions between diving seabird species (guillemot, razorbill) which are potentially sensitive to underwater noise, and the survey activities. This is considered further in Section 4.2.3.

Site Name: Skerries Islands SPA
Site Code: 004122

Site information

Relevant qualifying interests: ruddy turnstone (*Arenaria interpres*), light-bellied brent goose (*Branta bernicla hrota*), purple sandpiper (*Calidris maritima*), herring gull (*Larus argentatus*), European shag (*Phalacrocorax aristotelis*), great cormorant (*Phalacrocorax carbo*)

Site Name: Skerries Islands SPA
Site Code: 004122

Qualifying interests identified for further consideration on the basis of a foreseeable interaction with the survey area: herring gull

Summary Conservation objectives:

- To maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests for this SPA (above)

Feature attributes and targets defining favourable conservation status:
Not listed - https://www.npws.ie/sites/default/files/protected-sites/conservation_objectives/CO004122.pdf

Closest distance (km) to the survey: 31km

Consideration of site interest features against potential sources of likely significant effect

The physical presence of survey vessel
Herring gull, while having the potential to forage within range of the survey area (see Woodward *et al.* 2019), is regarded to have a low sensitivity to shipping traffic (Garthe & Hüppop 2004, Fliessbach *et al.* 2019), and therefore, physical presence of the survey vessel is not considered to be a source of likely significant effect.

Underwater noise from vessel and survey activities
None of the qualifying interests are diving seabirds which are likely to be most at risk of any underwater noise effects, and therefore underwater noise is not considered to be a source of likely significant effect.

Site Name: Wicklow Head SPA
Site Code: 004127

Site information

Relevant qualifying interests: black-legged kittiwake (*Rissa tridactyla*)

Qualifying interests identified for further consideration on the basis of a foreseeable interaction with the survey area: black-legged kittiwake

Summary Conservation objectives:

- To maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests for this SPA (above)

Feature attributes and targets defining favourable conservation status:
Not listed - https://www.npws.ie/sites/default/files/protected-sites/conservation_objectives/CO004127.pdf

Closest distance (km) to the survey: 98km

Consideration of site interest features against potential sources of likely significant effect

The physical presence of survey vessel
Black-legged kittiwake, while having the potential to forage within range of the survey area (see Woodward *et al.* 2019), is regarded to have a low sensitivity to shipping traffic (Garthe & Hüppop 2004, Fliessbach *et al.* 2019), and therefore, physical presence of the survey vessel is not considered to be a source of likely significant effect.

Underwater noise from vessel and survey activities
None of the qualifying interests are diving seabirds which are likely to be most at risk of any underwater noise effects, and therefore underwater noise is not considered to be a source of likely significant effect.

Site Name: Iveragh Peninsula SPA
Site Code: 004154

Site information

Relevant qualifying interests: peregrine falcon (*Falco peregrinus*), northern fulmar (*Fulmarus glacialis*), red-billed chough (*Pyrrhocorax pyrrhocorax*), black-legged kittiwake (*Rissa tridactyla*), common guillemot (*Uria aalge*)

Qualifying interests identified for further consideration on the basis of a foreseeable interaction with the survey area: northern fulmar

Summary Conservation objectives:

- To maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests for this SPA (above)

Feature attributes and targets defining favourable conservation status:
Not listed - https://www.npws.ie/sites/default/files/protected-sites/conservation_objectives/CO004154.pdf

Closest distance (km) to the survey: 493km

Consideration of site interest features against potential sources of likely significant effect

The physical presence of survey vessel
Fulmar, while having the potential to forage within range of the survey area (see Woodward *et al.* 2019), are regarded to have a low sensitivity to shipping traffic (Garthe & Hüppop 2004, Fliessbach *et al.* 2019), and therefore, physical presence of the survey vessel is not considered to be a source of likely significant effect.

Underwater noise from vessel and survey activities
None of the qualifying interests are diving seabirds which are likely to be most at risk of any underwater noise effects, and therefore underwater noise is not considered to be a source of likely significant effect.

Site Name: Carlingford Lough SPA
Site Code: UK9020161

Site information

Relevant qualifying interests: Sandwich tern (*Sterna sandvicensis*), common tern (*Sterna hirundo*), light-bellied brent goose (*Branta bernicla hrota*)

Qualifying interests identified for further consideration on the basis of a foreseeable interaction with the survey area: sandwich tern, common tern

Summary Conservation objectives:
To maintain or enhance the population of the qualifying species
Fledging success sufficient to maintain or enhance population
To maintain or enhance the range of habitats utilised by the qualifying species
To ensure that the integrity of the site is maintained;
To ensure there is no significant disturbance of the species and
To ensure that the following are maintained in the long term:

- Population of the species as a viable component of the site
- Distribution of the species within site
- Distribution and extent of habitats supporting the species
- Structure, function and supporting processes of habitats supporting the species

https://www.daera-ni.gov.uk/sites/default/files/publications/doe/carlingford-lough-SPA-conservation-objectives-2015.pdf

Site Name: Carlingford Lough SPA
Site Code: UK9020161

Closest distance (km) to the survey: 7km

Consideration of site interest features against potential sources of likely significant effect

The physical presence of survey vessel
Terns, while having the potential to forage within range of the survey area (see Woodward *et al.* 2019), are regarded to have a low sensitivity to shipping traffic (Garthe & Hüppop 2004, Fliessbach *et al.* 2019), and therefore, physical presence of the survey vessel is not considered to be a source of likely significant effect.

Underwater noise from vessel and survey activities
None of the qualifying interests are diving seabirds which are likely to be most at risk of any underwater noise effects, and therefore underwater noise is not considered to be a source of likely significant effect.

Oil spills
Oil spills from the survey vessels would be a source of potential effect for the qualifying interests indicated above. Given the potential for an oil slick to drift under wind and water currents to **affect the waters of the site and to** beach on the intertidal habitats adjacent to the survey area, the site is considered further in Section 4.2.4

Site Name: Copeland Islands SPA
Site Code: UK9020161

Site information

Relevant qualifying interests: Arctic tern (*Sterna paradisaea*), Manx shearwater (*Puffinus puffinus*)

Qualifying interests identified for further consideration on the basis of a foreseeable interaction with the survey area: Manx shearwater

Summary Conservation objectives:

- To maintain or enhance the population of the qualifying species
- Fledging success sufficient to maintain or enhance population
- To maintain or enhance the range of habitats utilised by the qualifying species
- To ensure that the integrity of the site is maintained;
- To ensure there is no significant disturbance of the species and
- To ensure that the following are maintained in the long term:
    - Population of the species as a viable component of the site
    - Distribution of the species within site
    - Distribution and extent of habitats supporting the species
    - Structure, function and supporting processes of habitats supporting the species

https://www.daera-ni.gov.uk/sites/default/files/publications/doe/copeland-islands-SPA-conservation-objectives-2015.pdf

Closest distance (km) to the survey: 87km

Consideration of site interest features against potential sources of likely significant effect

The physical presence of survey vessel
Manx shearwater has the potential to forage within range of the survey area (see Woodward *et al.* 2019). Sensitivity to vessel movements is considered to be low for this species (see MMO 2018), and therefore, physical presence of the survey vessel is not considered to be a source of likely significant effect.

Underwater noise from vessel and survey activities
There is the potential for interactions between diving seabird species (Manx shearwater) which are potentially sensitive to underwater noise, and the survey activities. This is considered further in Section 4.2.3.

Site Name: Rathlin Island SPA
Site Code: UK9020011

Site information

Relevant qualifying interests: peregrine falcon (*Falco peregrinus*), guillemot (*Uria aalge*), razorbill (*Alca torda*), Seabird assemblage: black-legged kittiwake (*Rissa tridactyla*), northern fulmar (*Fulmarus glacialis*), common gull (*Larus canus*), lesser black-backed gull (*Larus fuscus*), herring gull (*Larus argentatus*), puffin (*Fratercula arctica*)

Qualifying interests identified for further consideration on the basis of a foreseeable interaction with the survey area: northern fulmar, black-legged kittiwake

Summary Conservation objectives:

- To maintain or enhance the range of habitats utilised by the qualifying species
- To ensure that the integrity of the site is maintained;
- To ensure there is no significant disturbance of the species and
- To ensure that the following are maintained in the long term:
    - Population of the species as a viable component of the site
    - Distribution of the species within site
    - Distribution and extent of habitats supporting the species
    - Structure, function and supporting processes of habitats supporting the species

https://www.daera-ni.gov.uk/sites/default/files/publications/doe/rathlin-spa-conservation-objectives-2015.pdf

Closest distance (km) to the survey: 87km

Consideration of site interest features against potential sources of likely significant effect

The physical presence of survey vessel
Fulmar and kittiwake have the potential to forage within range of the survey area (see Woodward *et al.* 2019). Sensitivity to vessel movements is considered to be low for those species (see Garthe & Hüppop 2004, MMO 2018, Fliessbach *et al.* 2019), and therefore, physical presence of the survey vessel is not considered to be a source of likely significant effect.

Underwater noise from vessel and survey activities
None of the qualifying interests are diving seabirds which are likely to be most at risk of any underwater noise effects, and therefore underwater noise is not considered to be a source of likely significant effect.

Site Name: Skomer, Skokholm and the Seas off Pembrokeshire SPA
Site Code: UK9014051

Site information

Relevant qualifying interests: Atlantic puffin (*Fratercula arctica*), Manx shearwater (*Puffinus puffinus*), European storm-petrel (*Hydrobates pelagicus*), lesser black-backed gull (*Larus fuscus*), red-billed chough (*Pyrrhocorax pyrrhocorax*), short-eared owl (*Asio flammeus*); Seabird assemblage: other than qualifying features already listed, includes razorbill (*Alca torda*) and guillemot (*Uria aalge*).

Qualifying interests identified for further consideration on the basis of a foreseeable interaction with the survey area: Manx shearwater, European storm-petrel

Summary Conservation objectives:
Only draft conservation objectives are presently available for the site**:**
https://cdn.naturalresources.wales/media/675733/skomer-skokholm-and-seas-off-pembs-pspa-draft-conservation-objectives-final.pdf?mode=pad&rnd=131625760740000000

Site Name: Skomer, Skokholm and the Seas off Pembrokeshire SPA
Site Code: UK9014051

Closest distance (km) to the survey: 238km

Consideration of site interest features against potential sources of likely significant effect

The physical presence of survey vessel
Manx shearwater and European storm petrel have the potential to forage within range of the survey area (see Woodward *et al.* 2019). Sensitivity to vessel movements is considered to be low for those species (see MMO 2018), and therefore, physical presence of the survey vessel is not considered to be a source of likely significant effect.

Underwater noise from vessel and survey activities
There is the potential for interactions between diving seabird species (Manx shearwater) which are potentially sensitive to underwater noise, and the survey activities. This is considered further in Section 4.2.3.

Site Name: Irish Sea Front SPA
Site Code: UK9020328

Site information

Relevant qualifying interests: Manx shearwater (*Puffinus puffinus*)

Qualifying interests identified for further consideration on the basis of a foreseeable interaction with the survey area: Manx shearwater

Summary Conservation objectives:
To avoid significant deterioration of the habitats of the qualifying species or significant disturbance to the qualifying species, subject to natural change, thus ensuring that the integrity of the site is maintained in the long term and makes an appropriate contribution to achieving the aims of the Birds Directive for each of the qualifying species.

This contribution would be achieved through delivering the following objectives for each of the sites qualifying features:

- Avoid significant mortality, injury and disturbance of the qualifying features, so that the distribution of the species and ability to use the site are maintained in the long-term;
- Maintain the habitats and food resources of the qualifying features in favourable condition.
- Ensure access to the site from linked breeding colonies

Closest distance (km) to the survey: 57km

Consideration of site interest features against potential sources of likely significant effect

The physical presence of survey vessel
Manx shearwater and European storm petrel have the potential to forage within range of the survey area (see Woodward *et al.* 2019). Sensitivity to vessel movements is considered to be low for those species (see MMO 2018), and therefore, physical presence of the survey vessel is not considered to be a source of likely significant effect.

Underwater noise from vessel and survey activities
There is the potential for interactions between diving seabird species (Manx shearwater) which are potentially sensitive to underwater noise, and the survey activities. This is considered further in Section 4.2.3.

Site Name: Aberdaron Coast and Bardsey Island SPA
Site Code: UK9013121

Site information

Relevant qualifying interests: Chough (*Pyrrhocorax pyrrhocorax*), Manx shearwater (*Puffinus puffinus*)

Site Name: Aberdaron Coast and Bardsey Island SPA
Site Code: UK9013121

Qualifying interests identified for further consideration on the basis of a foreseeable interaction with the survey area: Manx shearwater

Summary Conservation objectives:
The vision for this feature is for it to be in a favourable conservation status, where all of the following conditions are satisfied:

- Breeding population of Manx shearwater (confined to Ynys Enlli) is stable or increasing.
- Reproductive rates remain stable.
- Deaths from the lighthouse attractions, fencing and other infrastructure are minimal.
- No ground predators are introduced.
- Nesting birds are not disturbed by restoration works on boundary walls or recreational activities.
- All factors affecting the achievement of these conditions are under control.

https://naturalresources.wales/media/672092/glannau-aberdaron-plan-english.pdf

Closest distance (km) to the survey: 140km

Consideration of site interest features against potential sources of likely significant effect

The physical presence of survey vessel
Manx shearwater have the potential to forage within range of the survey area (see Woodward *et al.* 2019). Sensitivity to vessel movements is considered to be low for those species (see MMO 2018), and therefore, physical presence of the survey vessel is not considered to be a source of likely significant effect.

Underwater noise from vessel and survey activities
There is the potential for interactions between diving seabird species (Manx shearwater) which are potentially sensitive to underwater noise, and the survey activities. This is considered further in Section 4.2.3.

Site Name: Grassholm SPA
Site Code: UK9014041

Site information

Relevant qualifying interests: Northern gannet (*Morus bassanus*)

Qualifying interests identified for further consideration on the basis of a foreseeable interaction with the survey area: Northern gannet

Summary Conservation objectives:
The vision for this feature is for it to be in a favourable conservation status, where all of the following conditions are satisfied:

- The population will not fall below 30,000 pairs in three consecutive years,
- It will not drop by more than 25% of the previous year's figures in any one year.
- There will be no decline in this population significantly greater than any decline in the North Atlantic population as a whole.

https://naturalresources.wales/media/674134/Grassholm%20SPA%20Management%20Plan%2021%5B1%5D.4.08%20(English).pdf

Closest distance (km) to the survey: 239km

Consideration of site interest features against potential sources of likely significant effect

The physical presence of survey vessel
Northern gannet has the potential to forage within range of the survey area (see Woodward *et al.* 2019). Sensitivity to vessel movements is considered to be low for those species (see Garthe & Hüppop 2004, MMO 2018, Fliessbach *et al.* 2019), and therefore, physical presence of the survey vessel is not considered to be a source of likely significant effect.

Site Name: Grassholm SPA
Site Code: UK9014041

Underwater noise from vessel and survey activities
There is the potential for interactions between diving seabird species (northern gannet) which are potentially sensitive to underwater noise, and the survey activities. This is considered further in Section 4.2.3.

Site Name: Ailsa Craig SPA
Site Code: UK9003091

Site information

Relevant qualifying interests: Northern gannet (*Morus bassanus*), lesser black-backed gull (*Larus fuscus*), Seabird assemblage: guillemot (*Uria aalge*), herring gull (*Larus argentatus*), black-legged kittiwake (*Rissa tridactyla)*

Qualifying interests identified for further consideration on the basis of a foreseeable interaction with the survey area: northern gannet, black-legged kittiwake

Summary Conservation objectives:
To ensure for the qualifying species that the following are maintained in the long term:

- Population of the species as a viable component of the site
- Distribution of the species within site
- Distribution and extent of habitats supporting the species
- Structure, function and supporting processes of habitats supporting the species
- No significant disturbance of the species

https://apps.snh.gov.uk/sitelink-api/v1/sites/8463/documents/29

Closest distance (km) to the survey: 154km

Consideration of site interest features against potential sources of likely significant effect

The physical presence of survey vessel
Northern gannet and black-legged kittiwake have the potential to forage within range of the survey area (see Woodward *et al.* 2019). Sensitivity to vessel movements is considered to be low for those species (see Garthe & Hüppop 2004, MMO 2018, Fliessbach *et al.* 2019), and therefore, physical presence of the survey vessel is not considered to be a source of likely significant effect.

Underwater noise from vessel and survey activities
There is the potential for interactions between diving seabird species (northern gannet) which are potentially sensitive to underwater noise, and the survey activities. This is considered further in Section 4.2.3.

Site Name: Flannan Isles SPA
Site Code: UK9001021

Site information

Relevant qualifying interests: Leach's petrel (*Oceanodroma leucorhoa*), Seabird assemblage: northern fulmar (*Fulmarus glacialis*), guillemot (*Uria aalge*), kittiwake (*Rissa tridactyla*), puffin (*Fratercula arctica*), razorbill (*Alca torda*)

Qualifying interests identified for further consideration on the basis of a foreseeable interaction with the survey area: northern fulmar

Summary Conservation objectives:
To ensure for the qualifying species that the following are maintained in the long term:

- Population of the species as a viable component of the site
- Distribution of the species within site
- Distribution and extent of habitats supporting the species

Site Name: Flannan Isles SPA
Site Code: UK9001021

- Structure, function and supporting processes of habitats supporting the species
- No significant disturbance of the species

https://apps.snh.gov.uk/sitelink-api/v1/sites/8502/documents/29

Closest distance (km) to the survey: 530km

Consideration of site interest features against potential sources of likely significant effect

The physical presence of survey vessel
Northern fulmar has the potential to forage within range of the survey area (see Woodward *et al.* 2019). Sensitivity to vessel movements is considered to be low for those species (see Garthe & Hüppop 2004, MMO 2018, Fliessbach *et al.* 2019), and therefore, physical presence of the survey vessel is not considered to be a source of likely significant effect.

Underwater noise from vessel and survey activities
None of the qualifying interests are diving seabirds which are likely to be most at risk of any underwater noise effects, and therefore underwater noise is not considered to be a source of likely significant effect.

Site Name: Mingulay and Berneray SPA
Site Code: UK9001121

Site information

Relevant qualifying interests: razorbill (*Alca torda*), Seabird assemblage: northern fulmar (*Fulmaris glacialis*), guillemot (*Uria aalge*), kittiwake (*Rissa tridactyla*), puffin (*Fratercula arctica*), shag (*Phalocrocorax aristotelis*)

Qualifying interests identified for further consideration on the basis of a foreseeable interaction with the survey area: northern fulmar

Summary Conservation objectives:
To ensure for the qualifying species that the following are maintained in the long term:

- Population of the species as a viable component of the site
- Distribution of the species within site
- Distribution and extent of habitats supporting the species
- Structure, function and supporting processes of habitats supporting the species
- No significant disturbance of the species

https://apps.snh.gov.uk/sitelink-api/v1/sites/8545/documents/29

Closest distance (km) to the survey: 370km

Consideration of site interest features against potential sources of likely significant effect

The physical presence of survey vessel
Northern fulmar has the potential to forage within range of the survey area (see Woodward *et al.* 2019). Sensitivity to vessel movements is considered to be low for those species (see Garthe & Hüppop 2004, MMO 2018, Fliessbach *et al.* 2019), and therefore, physical presence of the survey vessel is not considered to be a source of likely significant effect.

Underwater noise from vessel and survey activities
None of the qualifying interests are diving seabirds which are likely to be most at risk of any underwater noise effects, and therefore underwater noise is not considered to be a source of likely significant effect.

Site Name: Rum SPA
Site Code: UK9001341

Site information

Relevant qualifying interests: Golden eagle (*Aquila chrysaetos*), red-throated diver (*Gavia arctica*), Manx shearwater (*Puffinus puffinus*), Seabird assemblage: guillemot (*Uria aalge*), black-legged kittiwake (*Rissa tridactyla*)

Qualifying interests identified for further consideration on the basis of a foreseeable interaction with the survey area: Manx shearwater

Summary Conservation objectives:
To ensure for the qualifying species that the following are maintained in the long term:

- Population of the species as a viable component of the site
- Distribution of the species within site
- Distribution and extent of habitats supporting the species
- Structure, function and supporting processes of habitats supporting the species
- No significant disturbance of the species

https://apps.snh.gov.uk/sitelink-api/v1/sites/8574/documents/29

Closest distance (km) to the survey: 365km

Consideration of site interest features against potential sources of likely significant effect

The physical presence of survey vessel
Manx shearwater has the potential to forage within range of the survey area (see Woodward *et al.* 2019). Sensitivity to vessel movements is considered to be low for those species (see MMO 2018), and therefore, physical presence of the survey vessel is not considered to be a source of likely significant effect.

Underwater noise from vessel and survey activities
There is the potential for interactions between diving seabird species (Manx shearwater) which are potentially sensitive to underwater noise, and the survey activities. This is considered further in Section 4.2.3.

Site Name: St Kilda SPA
Site Code: UK9001031

Site information

Relevant qualifying interests: northern gannet (*Morus bassanus*), Great skua (*Catharacta skua*), Leach's petrel (*Oceanodroma leucorhoa*), puffin (*Fratercula arctica*), European storm petrel (*Hydrobates pelagicus*), Seabird assemblage: northern fulmar (*Fulmarus glacialis*), guillemot (*Uria aalge*), kittiwake (*Rissa tridactyla*), Manx shearwater (*Puffinus puffinus*), razorbill (*Alca torda*)

Qualifying interests identified for further consideration on the basis of a foreseeable interaction with the survey area: northern fulmar, Manx shearwater

Summary Conservation objectives:
To ensure for the qualifying species that the following are maintained in the long term:

- Population of the species as a viable component of the site
- Distribution of the species within site
- Distribution and extent of habitats supporting the species
- Structure, function and supporting processes of habitats supporting the species
- No significant disturbance of the species

https://apps.snh.gov.uk/sitelink-api/v1/sites/8580/documents/29

Closest distance (km) to the survey: 485km

Consideration of site interest features against potential sources of likely significant effect

The physical presence of survey vessel

Site Name: St Kilda SPA **Site Code: UK9001031**
Northern fulmar and Manx shearwater have the potential to forage within range of the survey area (see Woodward *et al.* 2019). Sensitivity to vessel movements is considered to be low for those species (see Garthe & Hüppop 2004, MMO 2018, Fliessbach *et al.* 2019), and therefore, physical presence of the survey vessel is not considered to be a source of likely significant effect. **Underwater noise from vessel and survey activities** There is the potential for interactions between diving seabird species (Manx shearwater) which are potentially sensitive to underwater noise, and the survey activities. This is considered further in Section 4.2.3.

Site Name: Seas off St Kilda SPA **Site Code: UK9020332**
Site information
Relevant qualifying interests: northern gannet (*Morus bassanus*), Seabird assemblage: European storm petrel (*Hydrobates pelagicus*), northern fulmar (*Fulmaris glacialis*), guillemot (*Uria aalge*), puffin (*Fratercula arctica*), **Qualifying interests identified for further consideration on the basis of a foreseeable interaction with the survey area:** northern fulmar **Summary Conservation objectives:** To avoid significant deterioration of the habitats of the qualifying species or significant disturbance to the qualifying species, subject to natural change, thus ensuring that the integrity of the site is maintained in the long term and makes an appropriate contribution to achieving the aims of the Birds Directive for each of the qualifying species. This contribution would be achieved through delivering the following objectives for each of the sites qualifying features: • Avoid significant mortality, injury and disturbance of the qualifying features, so that the distribution of the species and ability to use the site are maintained in the long-term; • Maintain the habitats and food resources of the qualifying features in favourable condition. https://data.jncc.gov.uk/data/da761bd3-6968-429c-87a6-835a966c34fc/seas-off-st-kilda-sas-conservation-objectives-reg-18.pdf
Closest distance (km) to the survey: 370km
Consideration of site interest features against potential sources of likely significant effect
The physical presence of survey vessel Northern fulmar has the potential to forage within range of the survey area (see Woodward *et al.* 2019). Sensitivity to vessel movements is considered to be low for those species (see Garthe & Hüppop 2004, MMO 2018, Fliessbach *et al.* 2019), and therefore, physical presence of the survey vessel is not considered to be a source of likely significant effect. **Underwater noise from vessel and survey activities** None of the qualifying interests are diving seabirds which are likely to be most at risk of any underwater noise effects, and therefore underwater noise is not considered to be a source of likely significant effect.

Site Name: The Shiant Isles SPA **Site Code: UK9001041**
Site information
Relevant qualifying interests: puffin (*Fratercula arctica*), razorbill (*Alca torda*), shag (*Phalacrocorax aristotelis*), Barnacle goose (*Branta leucopsis*), Seabird assemblage: northern fulmar (*Fulmarus glacialis*), guillemot (*Uria aalge*), kittiwake (*Rissa tridactyla*)

Site Name: The Shiant Isles SPA
Site Code: UK9001041

Qualifying interests identified for further consideration on the basis of a foreseeable interaction with the survey area: northern fulmar

Summary Conservation objectives:
To ensure for the qualifying species that the following are maintained in the long term:

- Population of the species as a viable component of the site
- Distribution of the species within site
- Distribution and extent of habitats supporting the species
- Structure, function and supporting processes of habitats supporting the species
- No significant disturbance of the species

https://apps.snh.gov.uk/sitelink-api/v1/sites/8575/documents/29

Closest distance (km) to the survey: 485km

Consideration of site interest features against potential sources of likely significant effect

The physical presence of survey vessel
Northern fulmar has the potential to forage within range of the survey area (see Woodward *et al.* 2019). Sensitivity to vessel movements is considered to be low for those species (see Garthe & Hüppop 2004, MMO 2018, Fliessbach *et al.* 2019), and therefore, physical presence of the survey vessel is not considered to be a source of likely significant effect.

Underwater noise from vessel and survey activities
None of the qualifying interests are diving seabirds which are likely to be most at risk of any underwater noise effects, and therefore underwater noise is not considered to be a source of likely significant effect.

Site Name: Treshnish Isles SPA
Site Code: UK9001041

Site information

Relevant qualifying interests: Barnacle goose (*Branta leucopsis*), European storm petrel (*Hydrobates pelagicus*)

Qualifying interests identified for further consideration on the basis of a foreseeable interaction with the survey area: European storm petrel

Summary Conservation objectives:
To ensure for the qualifying species that the following are maintained in the long term:

- Population of the species as a viable component of the site
- Distribution of the species within site
- Distribution and extent of habitats supporting the species
- Structure, function and supporting processes of habitats supporting the species
- No significant disturbance of the species

https://apps.snh.gov.uk/sitelink-api/v1/sites/8586/documents/29

Closest distance (km) to the survey: 320km

Consideration of site interest features against potential sources of likely significant effect

The physical presence of survey vessel
European storm petrel has the potential to forage within range of the survey area (see Woodward *et al.* 2019). Sensitivity to vessel movements is considered to be low for this species (see MMO 2018), and therefore, physical presence of the survey vessel is not considered to be a source of likely significant effect.

Underwater noise from vessel and survey activities

Site Name: Treshnish Isles SPA **Site Code: UK9001041**
None of the qualifying interests are diving seabirds which are likely to be most at risk of any underwater noise effects, and therefore underwater noise is not considered to be a source of likely significant effect.