codling wind park

PROJECT DELIVERY TEAM

Codling Wind Park Geophysical and Geotechnical Surveys

European Protected Species Risk Assessment

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1 INTRODUCTION

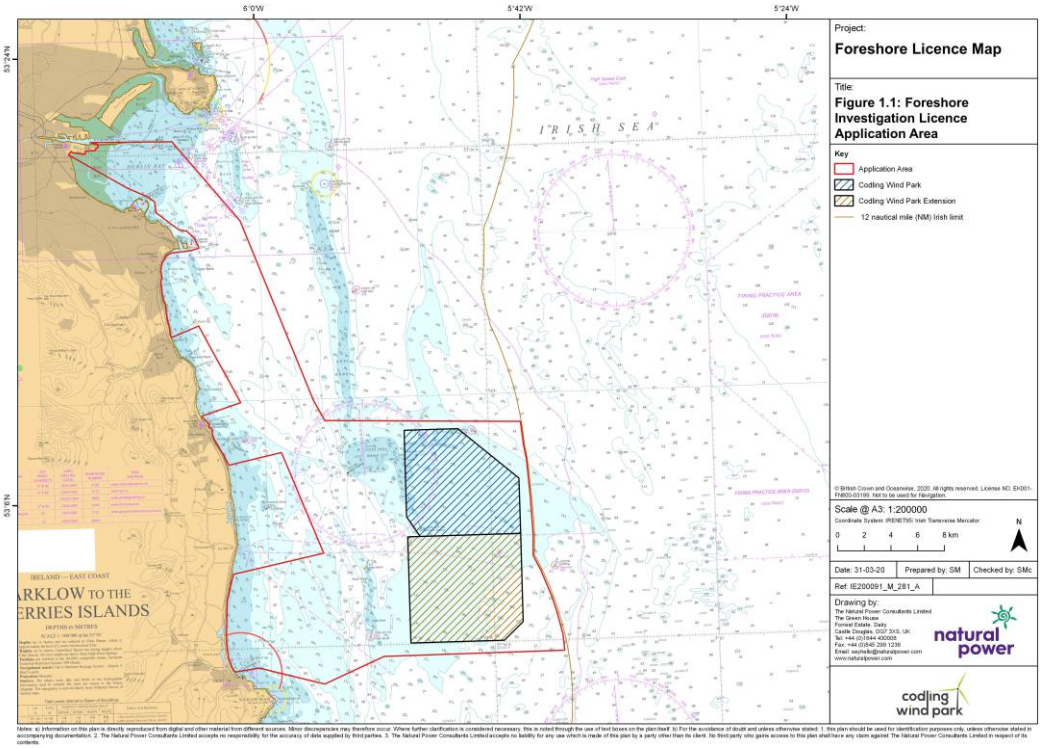
Codling Wind Park Limited (CWPL), a joint venture between Fred. Olsen Renewables Ltd. (FORL) and EDF Renewables (EDF-R), has been established to develop Codling Wind Park (CWP). For the purposes of this application, the Project (CWP) is considered to cover the area occupied by the original Codling Wind Park (CWP) project, which was awarded a lease in 2005, along with the proposed Codling Wind Park Extension (CWPE).

The CWP array site is located approximately 13 km off the east coast of Ireland between Greystones and Wicklow (Figure 1.1) on the Codling sand bank, which ranges in depth from nine to 18 metres.

A range of environmental surveys are planned for the CWP and surrounding area. Of these, those with potential to affect European Protected Species (EPS) are limited to geophysical and geotechnical surveys. The geophysical and geotechnical surveys will be undertaken within the Foreshore Investigation Licence Application Area (see Figure 1.1) to accurately map seabed conditions and hazards within the area, and gather information on ground conditions and geology. The aim of these surveys is to identify detailed engineering options for cable laying/turbine installation and required cable protection and inform environmental assessments.

The objective of this document is to outline the activities associated with the proposed surveys and to assess potential effects of these activities on EPS in Irish Waters.

Figure 1.1. Foreshore Investigation Licence Application Area



2 PLANNED WORK

2.1 Methodology

The main aims of the geophysical survey are to deliver mapped features including: water depths, the seabed sediments and sub-seabed lithology distribution, and topographical and geological features that could impact on the successful installation of the wind turbine foundations and burying of the cables such as wrecks, boulders, areas of sensitive benthic habitats such as Annex I reef, exposed bedrock, debris, and areas of uneven seabed such as sand waves.

The aims of the geotechnical survey are to determine soil bearing capacity, increase confidence in modelled data from the geophysical survey and assist in engineering design.

2.1.1 Geophysical Survey

The survey will be conducted using electromagnetic or acoustic tools (Table 2.1). All equipment listed may not be required but has been included within this risk assessment to cover worst-case scenarios.

Table 2.1. Equipment proposed for the geophysical survey work at Codling Wind Park

Equipment type[1]	Purpose	Frequency Range	Maximum Source Pressure Level (dB re 1 µPa @ 1 m)
Multibeam Echo Sounder (MBES)	Determines depth and nature of the seabed by transmitting sound pulses (active sonar) Transmits broad acoustic pulse	200-400 kHz	220
Side Scan Sonar (SSS)	Determines depth and nature of the seabed by transmitting sound pulses (active sonar)	High frequency min. 600 kHz Preferred high frequency 800 kHz	210-224
Sub-bottom Profiler (SBP) – Pinger	Identifies and measures sediment layers below the seabed	500 Hz-15 kHz	149-225
Ultra-high resolution seismic (UHRS) - Sparker	To identify and characterise the deeper layers of sediment/bedrock underneath the seafloor	500 Hz-5 kHz	200-225
Ultra-Short Base Line (USBL)	Positioning of the vessel and ROV	18-55 kHz	190-220
Magnetometer	Locate and identify ferrous objects on the seabed	No sound emitted	No sound emitted

2.1.2 Geotechnical Survey

The number and location of the proposed geotechnical activities (Table 2.2) are indicative and will be informed by other work streams including geophysical survey campaigns.

Table 2.2. Geotechnical survey work proposed at Codling Wind Park

Survey Type	Purpose	Approximate numbers of locations across the Application Area	Frequency range	Maximum Source Pressure Level (dB re 1 µPa @ 1 m)
Vibrocore	Used to determine the sediment structure and composition of the seabed.	An estimated maximum of 177 vibrocores are proposed	30 Hz	187.4
Cone Penetration Testing (CPT), including potential Seismic CPT (SCPT)	Used to determine the geotechnical engineering properties of sediments	A maximum of 260 CPTs are proposed	28 Hz	118-145
Boreholes[1]	Determine soil composition and soil strength	Up to 170 (including 100 pre-construction) boreholes are proposed	120 Hz	145

Source: Vibrocore frequency LGL (2010); CPT frequency from Campanella et al. (1986); SPL values from EIRGRID (2014); Boreholes SPL and frequency values from BOEM (2012)

2.1.3 Timing and Duration of Activity

The exact timings and duration of surveys are yet to be determined but this assessment takes into account any seasonal variation and therefore covers all seasons. Estimated duration of surveys is approximately 6 months to 1 year per campaign. Campaigns may be repeated in baseline and pre-construction years.

2.1.4 Proposed Vessels

Vessels to be used for the proposed geophysical and geotechnical surveys are yet to be confirmed, but it is anticipated that different vessels will be used for geophysical and geotechnical surveys. Larger vessels will be used for offshore work (CWP array area) with smaller vessels used closer to shore (part of the potential export cable routes). It is currently unknown whether geophysical and geotechnical surveys will be occurring simultaneously. It is a possibility that other archaeological or benthic surveys will also be occurring in this timeframe.

[1] Borehole work may include 'Down P/Check-Shot' and/or 'P-S Suspension' Logging (PSSL). Both techniques use seismic sources. Sound produced during check-shot logging is greater than that produced during PSSL and can therefore be considered worst case. The source level of the check-shot sparker is comparable to that of the sparker used during the UHRS survey (200-225 dB re 1 µPa @ 1 m; see Table 2.1).

3 LEGAL REQUIREMENTS

All species of cetacean in waters around the British Isles are considered European Protected Species (EPS) under Annex IV of the Habitats Directive (Council Directive 92/43/EEC) which covers animal and plant species of community interest in need of strict protection.

The Habitats Directive has been transposed into Irish law by the European Communities (Birds and Natural Habitats) Regulations 2011 (S.I. No. 477 of 2011).

These Regulations provide for the protection of cetacean and marine turtle fauna and as such it is an offence to:

- Deliberately capture or kill any specimen of these species in the wild;
- Deliberately disturb these species particularly during the period of breeding, rearing, hibernation and migration;
- Deliberately take or destroys eggs of those species from the wild;
- Damage or destroy a breeding site or resting place of such an animal; or
- Keep, transport, sell, exchange, offer for sale or offer for exchange any specimen of these species taken in the wild, other than those taken legally as referred to in Article 12(2) of the Habitats Directive.

Derogation licences may be granted by the Minister (for Arts, Heritage and the Gaeltacht) which would allow otherwise illegal activities to go ahead provided that:

- There is no satisfactory alternative; and
- The action authorised will not be detrimental to the maintenance of the population of the species concerned at a Favourable Conservation Status (FCS) in their natural range.

FCS is defined in the Habitats Directive as when:

- Population dynamics data on the species concerned indicate that it is maintaining itself on a long-term basis as a viable element of its natural habitats;
- The natural range of the species is neither being reduced nor is likely to be reduced for the foreseeable future; and
- There is, and will probably continue to be, a sufficiently large habitat to maintain its populations on a long-term basis.

3.1 Guidance

Guidance entitled 'The protection of marine European Protected Species from injury and disturbance: Guidance for the marine area in England and Wales and the UK offshore marine area' was published in 2010 by the JNCC, Natural England and the Countryside Council for Wales (now Natural Resources Wales) (JNCC *et al.*, 2010). In the apparent absence of equivalent guidance for Irish waters[2], this document has been used as a resource when a view is needed as to whether there is potential for an offence of deliberately disturbing or injuring/killing a marine EPS to occur within Irish territorial and offshore waters, as a result of any activity associated with the proposed works.

The guidance considers certain activities that produce loud noises in areas where an EPS could be present to have the potential to result in an injury or disturbance offence, unless appropriate mitigation measures are implemented. The risk of an offence being committed is dependent on a number of factors, including the following:

[2] A request for assistance locating guidance on how the Regulations have been interpreted in Irish waters was made to the National Parks and Wildlife Service on 17/02/2020. A response was received on 03/03/2020 which suggested using the UK guidance (JNCC *et al*., 2010) to supplement the DAHG (2014) guidelines where required.

- Presence/absence of EPS;
- Noise associated with the activity and resulting impacts on EPS species;
- Frequency of occurrence of EPS;
- Density of EPS; and
- Length of exposure of EPS to noise associated with proposed activities.

The JNCC *et al*. (2010) guidance also considers that the potential for disturbance from some activities can be considered "trivial". Activities which might be considered trivial include those that lead to "sporadic disturbances without any likely negative impact on the species".

For an activity to be considered "non-trivial", the JNCC guidance (JNCC *et al*., 2010) states that "the disturbance to marine EPS would need to be likely to at least increase the risk of a certain negative impact on the species' FCS".

The guidance states that the two main potential causes of death or injury are physical contact (with a vessel) and anthropogenic noise.

Likelihood of disturbance for individuals includes factors such as:

- Spatial and temporal distribution of the animal in relation to the activity;
- Any behaviour learned from prior experience with the activity;
- Similarity of the activity to biologically important signals (particularly important in relation to activities creating sound); and
- The motivation of the animal to remain within the areas (e.g. food availability).

Assessment of likelihood of potential impacts should include the following considerations:

- Type of activity;
- Duration and frequency of the activity;
- Extent of the activity;
- Timing and location of the activity; and
- Other known activities in the area at the same time.

4 EUROPEAN PROTECTED SPECIES IN THE REGION OF THE CODLING WIND PARK PROJECT IN IRISH WATERS

There are more than 24 marine mammal species found to occur in the waters around Ireland. However, only seven species (harbour porpoise, bottlenose dolphin, common dolphin, Risso's dolphin, minke whale, grey seal and harbour seal) are considered to be regularly found in the Irish sea whilst others are either transitional visitors or have only been documented from stranding data (O'Brien *et al.*, 2009; Wall *et al.,* 2013). Harbour porpoise, bottlenose dolphin, common dolphin and Risso's dolphin are thought to be present year-round whilst minke whales are considered to be seasonal visitors (summer; Berrow, 2001; NPWS, 2008).

This assessment will only consider the cetacean species which are regularly found in the Irish Sea as other occasionally occurring species will be incidental. Whilst not considered specifically in this assessment due to their low likelihood of occurrence, any assessment of, or mitigation measures put in place for, the species assessed are considered to be appropriate/relevant for other less commonly occurring species of cetacean.

The Small Cetaceans in European Atlantic waters and the North Sea (SCANS) III surveys were undertaken in the summer of 2016 (Hammond *et al*., 2017). Densities for most common cetacean species encountered during the survey were estimated for the different survey blocks. The CWP is located within SCANS III Block E. SCANS III surveys found harbour porpoise, bottlenose dolphin, Risso's dolphin and minke whale in this block. The SCANS III data suggest that harbour porpoises are the most common cetacean in the Irish Sea (see Table 4.1). This is also evidenced by other sightings data (Berrow *et al*., 2018; Berrow *et al.,* 2008; DAHG, 2009). This species is the primary qualifying feature of the Rockabill to Dalkey Island, North Anglesey Marine and West Wales Marine Special Areas of Conservation (SAC) which are at distances of 0 km, 35.1 km and 54.7 km respectively from the Application Area.

Table 4.1. Density and abundance estimates for species in the project area from SCANS III surveys (block E)

Species		SCANS III density estimate	MU	Abundance of animals in MU
Harbour porpoise	*Phocoena phocoena*	0.239	Celtic Sea	104,695
Bottlenose dolphin	*Tursiops truncatus*	0.008	Irish Sea	397
Risso's dolphin	*Grampus griseus*	0.031	Celtic and Greater North Sea	No current estimate available
Minke whale	*Balaenoptera acutorostrata*	0.017	Celtic and Greater North Sea	23,528
Common dolphin	*Delphinus delphis*	No current estimate	Celtic and Greater North Sea	56,556

Source: Hammond et al. (2017) and IAMMWG (2015)

Aerial surveys were undertaken across Ireland's Exclusive Economic Zone (EEZ) as part of the ObSERVE Programme in both summer and winter from 2015 to 2017 (Rogan *et al.,* 2018). The CWP lies within ObSERVE stratum 5 (11,110 km^2; Figure 4.1). Sightings were

continuously higher for marine mammal species in summer months than in winter. As with the SCANS III surveys harbour porpoises were the most sighted species (see Table 4.2) and stratum 5 showed higher densities than other strata surveyed. Only one sighting of a group of five bottlenose dolphins was recorded during the entirety of the survey. Similar to the SCANS III surveys, no common dolphins were recorded within the Irish Sea with sightings predominately occurring off the south and west of Ireland. Risso's dolphins sighted during these surveys were thought to represent a community that is frequently located near the Saltee Islands off Co. Wexford. Group size in this community is estimated to range from 1 to 10 individuals (Rogan *et al.,* 2018, Wall *et al*., 2013). The predictive modelling carried out from this survey suggested that for minke whales the Irish Sea is more important for this species during the summer period rather than during winter.

Figure 4.1. Area covered by ObSERVE surveys

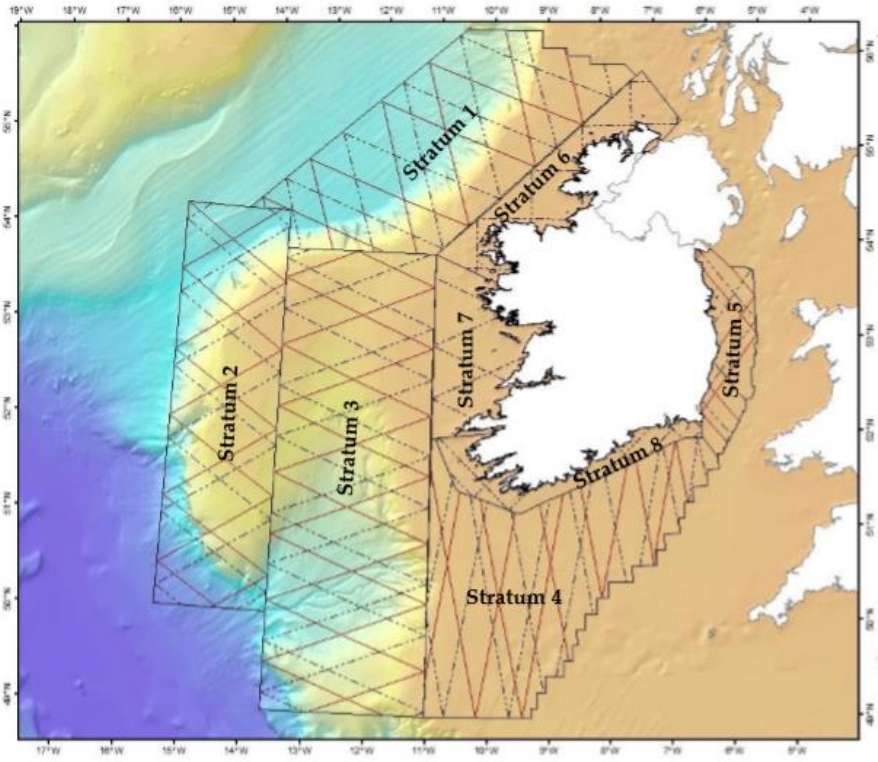


Table 4.2. Density estimates for species in the project area from ObSERVE surveys (stratum 5)

Species	Season	Animals per km^2
Harbour porpoise	Summer '15	0.196
	Winter '15	0.244
	Summer '16	0.295
	Winter '16	0.260
Bottlenose dolphin	Winter '16	0.036
Risso's dolphin	Summer '15	0.0032
Minke whale	Summer '15	0.014
	Summer '16	0.005
Common dolphin	No sightings	No sightings

Source: Rogan et al. (2018)

The leatherback turtle (*Dermochelys coriacea*) is the most common turtle species found in Irish waters, but with sightings concentrated off the southwest coast of Ireland (King and Berrow, 2009; Doyle *et al*., 2007). Due to the low likelihood of occurrence in the CWP area, it is proposed marine turtles not be considered further. However, any mitigation proposed for cetacean species will also be applied to turtles.

4.1 Site-specific data

Two years of monthly site-specific visual boat-based surveys were conducted from 2013 to 2014 and 2018 to 2019. Three EPS (harbour porpoise, common dolphin and minke whale) were encountered in 2018/2019 survey; five EPS (minke whale, killer whale, Risso's dolphin, common dolphin and harbour porpoise) were encountered in 2013/2014 surveys.

During the 2013/2014 surveys, five cetacean species and two seal species were observed. Minke whale sightings occurred over the summer months suggesting a prolonged presence in the survey area over the summer months. Killer whale was only observed in one survey suggesting a transient path through the survey area. The rare sightings of both common dolphin (two sightings of three individuals over both years) and Risso's dolphin (two sightings over both years) suggest only an occasional use of the Application Area. The majority (94%) of sightings were of harbour porpoises.

During the 2018-2019 surveys, three cetacean species and two seal species were observed. A total of 309 individual marine mammals were sighted in the area with harbour porpoises comprising 71.2% of individuals recorded. Harbour porpoises were observed all through the year. Other cetaceans include common dolphin (one sighting of two individuals in 2019) and minke whale (two sightings of three individuals in 2019).

4.2 Other species

4.2.1 Pinnipeds

Two species of pinnipeds, grey seal (*Halichoerus grypus*) and harbour seal (*Phoca vitulina*), are commonly found in Irish waters. Both species range widely in the Irish Sea as evidenced by tagging studies in the region (Hammond *et al*., 2005; Thompson *et al.,* 2012). Site specific boat-based surveys have recorded low numbers of seals during each survey period. In 2013/2014, 36 grey seals, three harbour seals and 48 unidentified seals were recorded. In 2018/2019, 73 sightings of grey seals and one sighting of a harbour seal were made. Seven unidentified seals were recorded, however, given the very high proportion of grey seals (90.24% of seals recorded), it is likely that most unidentified seals belong to this species.

Harbour and greys seals are one of the primary qualifying features for the Lambay Island SAC located approximately 14 km from the Application Area. These two species are found year-round here, and it has been identified as an important area for breeding/moulting (Kiely *et al.*, 2000). Slaney River Valley SAC is located 759 km from the Application Area with harbour seals listed as a qualifying interest.

4.2.2 Basking sharks

Basking sharks are listed as an endangered fish in Irish waters. Spatial and temporal movement of basking sharks (*Cetorhinus maximus*) is determined by the distribution of prey species increasing the difficulty in identifying distribution patterns. “Hotspots” have been established off the coast of the Isle of Man, Southwest England and Northwest Scotland between April and September (Witt *et al*., 2012). During the ObSERVE surveys one basking shark was recorded in the Irish Sea (Rogan *et al*., 2018).

As basking sharks are not EPS they have not been assessed here. However, any mitigation measures proposed for EPS will also be applied to this species.

5 RISK ASSESSMENT

5.1 Anthropogenic Noise Related Risk Assessment

During the proposed geophysical and geotechnical surveys to be conducted for the proposed CWP development there is potential for marine EPS to be impacted.

The main potential impacts include:

- Increased anthropogenic noise from geophysical surveys;
- Increased anthropogenic noise from geotechnical works; and
- Increased collision risk.

5.1.1 Overview of Potential Impacts on Marine Mammals

5.1.1.1 Marine Mammal Hearing Sensitivities

Marine mammal species have different hearing sensitivity thresholds resulting in different species detecting underwater noise at varying frequency bands (Table 5.1).

Potential effects of underwater noise on marine mammals can be summarised as:

- Physical (non-auditory) injury;
- Auditory injury; and
- Behavioural response.

Table 5.1. Auditory range for the three different cetacean and phocid hearing groups (Southall et al., 2007)

Functional hearing group	Example species	Estimated auditory bandwidth (kHz)
Low frequency cetacean	Minke whale	0.007-22
Mid frequency cetacean	Bottlenose dolphin Common dolphin Risso's dolphin	0.15-160
High frequency cetacean	Harbour porpoise	0.2-180
Phocid pinnipeds	Harbour seal Grey seal	0.075-75

5.1.1.2 Auditory Injury

Underwater sound can cause injury to the auditory system of marine mammals either following a brief exposure to extremely high sound levels or following more prolonged exposure to lower levels of continuous sound (Richardson *et al.,* 1995).

Southall *et al.* (2007) provide thresholds for received sound levels that have the potential to induce the onset of auditory injury (Permanent Threshold Shift (PTS) and Temporary Threshold Shift (TTS)) in marine mammals (Table 5.2). Although updated thresholds (NOAA, 2018; Southall *et al*., 2019) exist, it is the Southall *et al*. (2007) thresholds upon which the Irish guidance (DAHG, 2014) is based. Following advice from the Department of Culture, Heritage and the Gaeltacht (DCHG) received 03/04/2020, the Southall *et al*. (2007) thresholds (Table 5.2) have been used to undertake this Risk Assessment.

These thresholds are based on unweighted, instantaneous peak sound pressure levels (SPLs), and weighted Sound Exposure Levels (SELs), where:

- SEL: expression of total energy of a sound wave which incorporates both the sound pressure level and duration. This measure can be considered a cumulative noise exposure, e.g. to pulsed sound such as that produced by operation of geophysical survey equipment, during a 24-hour period; and
- M-Weighted function: frequency weighting applied to the SEL accounting for the functional hearing bandwidths of the different marine mammal groups (e.g. low frequency cetacean vs. high frequency cetacean) by taking a relevant or derived species audiogram into account.

SPL thresholds have been used throughout this Risk Assessment because information on SPLs, rather than SELs, was available from equipment manufacturers.

Where noise sources exceed the PTS thresholds, the potential for physical (non-auditory) injury should be considered.

Table 5.2. Auditory injury thresholds – SPLs (dB re 1 µPa @ 1 m) – for assessing the potential for injury to occur instantaneously

Functional hearing group (Southall *et al*., 2007)	Example species	Pulsed sound		Non-pulsed sound
		PTS	TTS	PTS
Low frequency cetacean	Minke whale	230	224	230
Mid frequency cetacean	Bottlenose dolphin Common dolphin Risso's dolphin			
High frequency cetacean	Harbour porpoise			
Phocid pinnipeds	Harbour seal Grey seal	218	212	218

5.1.1.3 Behavioural Response

Where possible, assessment of the potential for a behavioural response has used information from studies where this has been explored.

In the absence of such information, the dB_{ht} approach has been used. The dB_{ht} (species) metric (Nedwell *et al*., 2007) was developed as a means of quantifying the potential for a behavioural effect on a species in the underwater environment (Table 5.3).

Table 5.3. Assessment criteria to estimate the potential responses by EPS to underwater noise (Nedwell et al., 2007)

Level in dB_{ht} (species)	Reaction
0-50	Low likelihood of disturbance
75	Significant avoidance reaction occurs in majority of individuals
90 and above	Strong avoidance by most individuals
Above 110	Tolerance limit of sound; unbearably loud.
Above 130	Possibility of traumatic hearing damage from single event.

5.2 Increased Noise from Geophysical Survey Equipment

Geophysical surveys work by directing sound at the seabed and analysing the resulting reflections, increasing anthropogenic noise in the environment. Underwater noise travels substantially further than airborne noise, therefore potential impacts can occur at distance from the sound source.

As the equipment for the geophysical surveys has yet to be determined, frequency ranges and power outputs have been collated from a variety of different sources and are considered to be the worst-case (Table 2.1). This allows for a precautionary approach when dealing with uncertainty.

5.2.1 Prediction of Impacts from Geophysical Survey Equipment

5.2.1.1 Auditory injury

Even using the maximum source levels (Table 2.1), which can be considered to represent using the worst-case scenario, the potential for auditory injury (PTS onset) from use of the geophysical survey and positioning equipment proposed is considered to be nil[3]. This is because the Southall *et al*. (2007) threshold for PTS onset for pulsed sound (230 dB re 1 µPa @ 1 m; Table 5.2) is not reached.

Although there is potential for TTS onset in individuals in close proximity to the SSS, SBP and UHRS sound sources, the risk is considered to be negligible. This is because the presence of the survey vessel is likely to lead to small-scale temporary displacement of cetaceans, resulting in them being a sufficient distance from the survey equipment so as not to be susceptible to TTS. Furthermore, sound produced by the higher frequency equipment (SSS) is likely to attenuate quickly (JNCC, 2017).

Therefore, the risk of auditory injury from use of geophysical survey and positioning equipment is considered to be nil or negligible.

5.2.1.2 Behavioural responses

With the exception of the SBP, UHRS, check-shot during borehole activity (see section 5.3.1.2), and USBL, the sound emitted by the survey equipment will not be audible to marine mammals because the frequencies over which the equipment operates (Table 2.1) are greater than the higher frequency hearing cut-offs for each of the functional hearing groups (Table 5.1).

It is possible that the above listed equipment may be detected by cetaceans and therefore their use may have the potential to cause disturbance. The most likely response will be temporary behavioural avoidance (there is evidence that short-term disturbance caused by a commercial two-dimensional seismic survey does not lead to long-term displacement of harbour porpoises (Thompson *et al*., 2013)).

Using information from the Thompson *et al*. (2013) study where harbour porpoise responses to geophysical (seismic) survey vessels in the Moray Firth were observed over ranges of 5 to 10 km, the number of individuals which have the potential to be affected has been estimated (Table 5.4). The use of 10 km is considered to result in highly conservative estimates because the noise levels produced by the oil and gas exploration geophysical surveys described in Thompson *et al*. (2013) will be well in excess of those produced during the use of the equipment described here. Therefore, for the purposes of this assessment, an impact range of 5 km is considered appropriate to represent the worst-case for audible systems.

The 5 km radius impact range was used to calculate the area (πr^2) of potential impact (78.5 km^2). Using the calculated area and the greatest animal density estimates found in Hammond

[3] Instantaneous, rather than cumulative, PTS was considered because information on SPLs, rather than SELs, was available from equipment manufacturers.

et al. (2017) and Rogan *et al*. (2018), the number of animals within this area of potential impact was calculated. The percentage of the appropriate reference population (IAMMWG, 2015; see Table 4.1) that could potentially be affected was calculated for each species using the number of animals in the area divided by the abundance of the reference population multiplied by 100.

The percentage of the reference population estimated to have the potential to be affected was less than 1% for the four main cetacean species occurring within the study area (Table 5.4).

Table 5.4. The number of individuals estimated to have the potential to be disturbed by geophysical survey equipment

Species	Range of potential impact (km)	Area of potential impact (km^2)	Number of individuals within the area of potential impact	Percentage of reference population which has the potential to be affected
Harbour porpoise	5	78.5	23	0.02
Minke whale	5	78.5	1	0.01
Bottlenose dolphin	5	78.5	3	0.7
Risso's dolphin	5	78.5	0	0.01

Source: SCANS III density estimates/ObSERVE density estimates used in calculations from Hammond et al. (2017)/Rogan et al. (2018) and reference population abundance estimates used in calculations from IAMMWG (2015).

5.3 Increased Noise from Geotechnical Surveys

Geotechnical surveys and the associated works may increase anthropogenic noise in the marine environment, which in turn has the potential to affect marine mammals. The impacts of the geotechnical surveys are thought to be of low concern in terms of disturbance to EPS (JNCC, 2010).

It is generally expected that the activity of setting up the drilling equipment will deter marine mammals from entering the immediate work area (BOEM, 2012). Borehole work may include 'Down P/Check-Shot' and/or 'P-S Suspension' Logging (PSSL; see Table 2.2).

Vibrocoring and Cone Penetration Tests may be within audible range for cetacean species in the area (Table 5.1) however, both are short in temporal and spatial scales (Table 2.2), with SPL levels unlikely to exceed 187.4 dB re 1 µPa @ 1 m (BOEM, 2012; LGL, 2010).

5.3.1 Prediction of Impacts from Geotechnical Surveys

5.3.1.1 Auditory injury

The maximum source pressure levels of all equipment (Table 2.2) do not have the potential to induce the onset of auditory injury (PTS[4]) even at very close range. The non-pulsed SPLs are unlikely to exceed 187 dB re 1 µPa (see Table 2.2) and therefore fall below the threshold for PTS onset (230 dB re 1 µPa for cetaceans; Southall *et al*., 2007).

Although there is potential for TTS onset in individuals in close proximity to check-shot logging, the risk is considered to be negligible. This is because the presence of the survey vessel is

[4] TTS thresholds are not available for non-pulsed sound (Southall *et al*., 2007).

likely to lead to small-scale temporary displacement of cetaceans, resulting in them being a sufficient distance from the survey equipment so as not to be susceptible to TTS.

5.3.1.2 Behavioural responses

The information used in this assessment is based on high quality recordings of a similar operation (pin pile drilling) at another location (Strangford Lough; Nedwell and Brooker, 2008). These recordings were made at ranges of 28 m to 2.13 km from the drilling operation and indicated a source SPL of 162 dB re 1 µPa @ 1 m, i.e. comparable to the geotechnical survey work (see Table 2.2). Nedwell and Brooker (2008) assessed the likelihood of avoidance of the drilling noise using the dB_{ht} approach (see section 5.1.1.4). The data indicated that the noise did not exceed the 90 dB_{ht} level (Table 5.5) at any measured range and that the 75 dB_{ht} and 50 dB_{ht} avoidance ranges were 1.5 m and 85 m respectively. Therefore, marine mammals are considered to be unlikely to be disturbed by noise from drilling or, as in this case, geotechnical survey work unless they are in the close vicinity of the work. This is unlikely due to small-scale temporary displacement which may occur as a result of the presence of the survey vessel itself.

It is possible that the check-shot logging may be detected by cetaceans and therefore have the potential to cause disturbance. The most likely response will be temporary behavioural avoidance by a small number of animals (see section 5.2.1.2).

5.4 Non-Anthropogenic Noise Related Risk Assessment

5.4.1 Collision Risk

Vessel strikes are a known cause of mortality in marine mammals and basking sharks (Laist *et al*., 2001). Non-lethal collisions have also been documented (Laist *et al*., 2001; Van Waerebeek *et al*., 2007). Injuries from such collisions can be divided into two broad categories: blunt trauma from impact and lacerations from propellers. Injuries may result in individuals becoming vulnerable to secondary infections or predation.

Avoidance behaviour by cetaceans is often associated with fast, unpredictable boats such as speedboats and jet-skis (Bristow and Reeves, 2001; Gregory and Rowden, 2001; Leung and Leung, 2003; Buckstaff, 2004), while neutral or positive reactions have been observed with larger, slower moving vessels such as cargo ships (Leung and Leung, 2003; Sini *et al.,* 2005).

Slower vessels following a consistent trajectory allow cetaceans the opportunity to avoid collisions. Marine mammals occur at relatively low abundance across the Application Area and basking sharks are very infrequent visitors.

5.4.2 Prediction of Impact

The vessels to be used for these surveys are yet to be confirmed but due to the nature of the surveys at least two different vessels will be required. These vessels will be travelling at slow speeds, in a predefined trajectory, allowing for animals to predict movement of the vessels and avoid collisions. Cetaceans in the area are exposed to marine traffic on a regular basis and should therefore be habituated to vessel movements. The small number of vessels that will be required for these surveys will not significantly increase vessel traffic in the area. Accordingly, it is predicted that collisions between survey vessels and marine EPS are extremely unlikely and there is no risk of significant effects presenting.

6 ASSESSMENT OF POTENTIAL OFFENCE

Cetaceans have been recorded within the Irish Sea all year round with harbour porpoise, common dolphin, bottlenose dolphin, minke whale and Risso's dolphin most common. Any of these species may therefore be present within the area during at least some part of the proposed survey work. Other species may also be present.

Assessment of the potential for impacts from geophysical survey and positioning equipment concluded that there is no/negligible potential for the sounds emitted to induce the onset of auditory injury (either PTS or TTS) in cetacean EPS. Any disturbance from the geophysical survey and positioning equipment is likely to be localised, short term and reversible and, where it could be estimated, the percentage of the reference population which has the potential to be disturbed is considered to be negligible (less than 1%). Therefore, following the JNCC *et al*. (2010) guidance it can be concluded that the impact of sound produced by operation of equipment used during the proposed geophysical survey work is unlikely to be detrimental to the maintenance of the populations of the species concerned at a FCS in their natural range. Therefore, an EPS licence will not be required for this aspect of the proposed work or any other environmental investigations in which similar equipment is proposed for use.

There is no/negligible potential for the sounds emitted by the proposed geotechnical surveys to induce auditory injury. The displacement of EPS as a result of noise from geotechnical surveys can be considered 'trivial' and is very unlikely to be detrimental to the maintenance of the populations of the species concerned at FCS level in their natural range. Therefore, an EPS licence will not be required for this aspect of the proposed work.

The potential for collision with vessels was considered to be extremely unlikely. Therefore, following the JNCC *et al*. (2010) guidance it can be concluded that collision risk is unlikely to constitute an offence.

Therefore, no EPS licence will be required for any aspect of the proposed surveys.

7 MITIGATION MEASURES

The potential for auditory injury from the proposed survey work is nil/negligible therefore, no mitigation (to reduce the risk of auditory injury) is considered necessary to protect EPS.

However, the DAHG (2014) guidance outlines measures which are applicable to all seismic surveys (including the testing and full operational use of airguns, water guns, sparkers, boomers and vertical seismic profiling (VSP) or checkshot systems) in Irish waters[5]. It is therefore proposed that the measures outlined below be followed for the UHRS survey and check-shot logging work only.

7.1 Pre-start survey

As the proposed surveys are to be conducted in waters of less than 200 m deep, the pre-start survey will commence a minimum of 30 minutes prior to the scheduled start time. For all pre-start surveys, a monitored zone of 500 m will be employed, i.e. if a marine mammal is observed within 500 m of the sound source in the 30 minutes prior to the scheduled start, works will be delayed until no marine mammals have been observed in the monitored zone for 30 minutes. If the marine mammals do not leave the area, the survey vessel may alter its course to ensure that the animals are outside the monitored zone when the soft start commences. The Marine Mammal Observer (MMO) will use a distance measuring stick or reticule binoculars to ascertain distances to marine mammals.

A qualified and experienced MMO will be appointed to monitor for marine mammals and to log all relevant events using standardised data forms provided by the DAHG. In order to allow 24-hour working, or for work to commence when visual observation is not possible due to weather conditions or sea state, a proven Passive Acoustic Monitoring (PAM) system and experienced operator(s) will be employed to undertake pre-start surveys during these times.

7.2 Soft Start

A soft start is the gradual ramping of power over a set period of time. The UHRS and check-shot logging equipment is assumed to have this capability inbuilt.

Once the soft start commences, there is no requirement to halt or discontinue the procedure at night-time, if weather or visibility conditions deteriorate, or if marine mammals enter the monitored zone (500 m radial distance of the sound source).

The following ramp up procedure will be undertaken in line with the DAHG (2014) guidance:

1) Energy output will commence from a low energy start-up and be allowed to gradually build up to the necessary maximum output over a period of up to 40 minutes.

2) This controlled build-up of energy output will occur in consistent stages to provide a steady and gradual increase over the ramp-up period.

3) If marine mammals enter or are detected within the monitored zone while the ramp-up procedure is under way but incomplete, the energy output will not be increased until the marine mammals are no longer within the monitored zone.

7.3 Line changes and breaks in survey periods

Where the duration of a survey line or station change is greater than 40 minutes, the activity will, on completion of the line/station being surveyed, either cease (i.e., shut down) or

[5] Although partly coastal, none of the area proposed for survey is enclosed. Therefore, there is no risk of animals being driven into or artificially confined within an enclosed comparatively shallow area.

preferably undergo a reduction in energy output to a lower state where the peak sound pressure level from any operating source is 170 dB re 1 µPa @ 1 m. Prior to the start of the next line/station, if the power was shut down, all pre-survey monitoring measures and soft start procedures will be followed as for start-up. If there has been a reduction in power, a soft start will be undertaken gradually from the lower output level. The latter sound reduction measure may be applied to line changes at night-time or in daytime conditions of poor visibility. Where the duration of a survey line/station change is less than 40 minutes the activity will continue as normal (i.e. under full output).

If there is a break in sound output for a period greater than 10 minutes (e.g., due to equipment failure, shut-down, survey line/station change) then all pre-survey monitoring measures and ramp-up (soft start) will recommence prior to re-starting.

7.4 Reporting

Full reporting on operations and mitigation will be provided to the DAHG to facilitate reporting under Article 17 of the EC Habitats Directive and future improvements to guidance (DAHG, 2014).

8 CONCLUSION

This assessment of the potential impacts on EPS from activities associated with the proposed geophysical and geotechnical survey work for the CWP (increased anthropogenic noise from use of the geophysical survey and positioning equipment, increased anthropogenic noise from the use of geotechnical equipment and collision with vessels) from a worst-case scenario concluded that:

- The potential for auditory injury is considered to be nil or negligible; and
- The potential for disturbance is considered to be trivial.

Therefore, because the surveys will not significantly affect the FCS of any EPS as defined in the Habitats Directive and corresponding European Communities (Birds and Natural Habitats) Regulations 2011, it is considered that an EPS licence will not be required.

Although the potential for auditory injury from the proposed survey work is considered to be nil/negligible, the seismic survey mitigation measures set out in this document, which are based on the DAHG (2014) guidance, will be followed prior to UHRS survey and check-shot logging work.

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