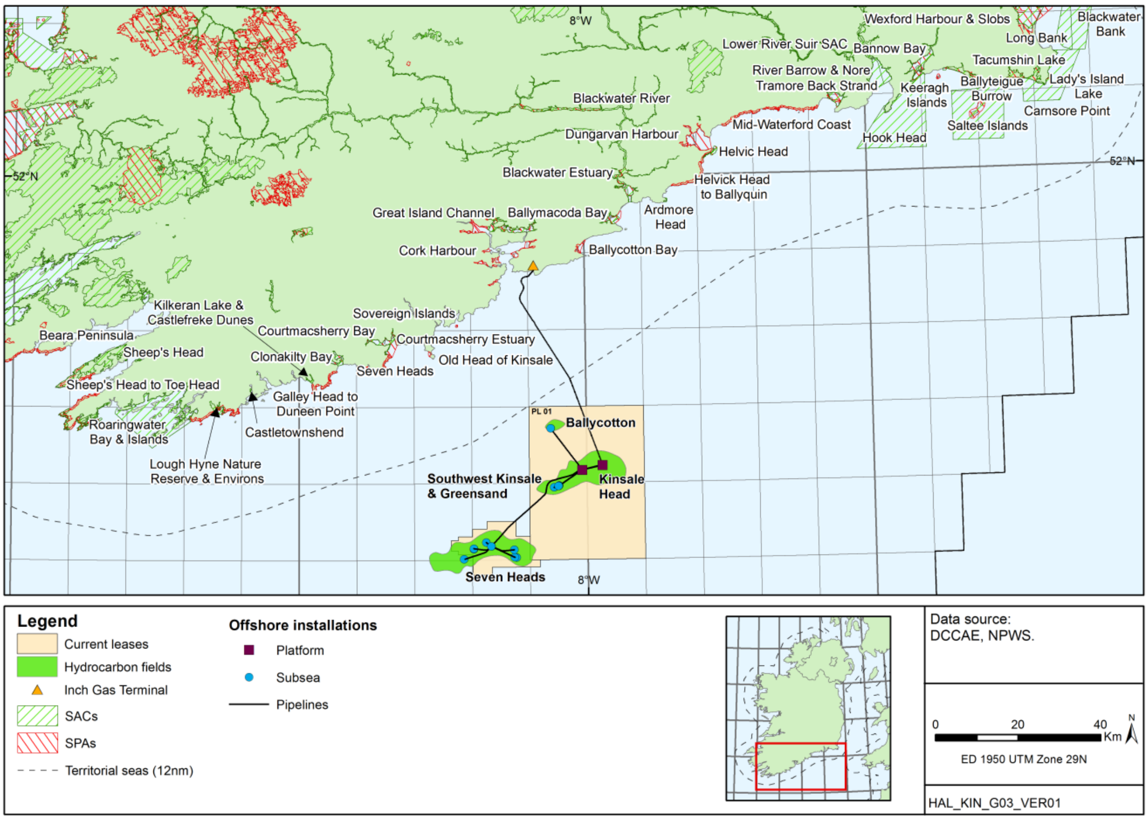
PSE Kinsale Energy Limited

Kinsale Area Decommissioning Project - Pre/Post Rock Placement Surveys



Environmental Impact Assessment Report: Addendum no. 3

January 2022

Rev 1

Contents

GLOSSARY

Term	Definition
AA	Appropriate Assessment
ASCOBANS	Agreement on the Conservation of Small Cetaceans of the Baltic and North Seas 1991
BOEM	US Bureau of Ocean Energy Management
BWI	Bird Watch Ireland
CSHAS	Celtic Sea Herring Acoustic Survey
DCCAE	Department of Communications, Climate Action and Environment
DCENR	Department of Communications, Energy and Natural Resources
DECC	Department of Environment, Climate and Communications
DECC	Department of Energy and Climate Change (UK)
EIA	Environmental Impact Assessment
EIAR	Environmental Impact Assessment Report
EPA	Environmental Protection Agency
EUNIS	European Nature Information System
HRGS	High-Resolution Geophysical Survey
IBA	Important Bird Areas
IMO	International Maritime Organisation
KA	Kinsale Alpha
KB	Kinsale Bravo
MARPOL	The International Convention for the Prevention of Pollution from Ships
MBES	Multibeam Echo Sounder
MSFD	Marine Strategy Framework Directive
Natura 2000	Natura 2000 is a network of nature protection areas in the territory of the European Union. It is made up of Special Areas of Conservation (SACs) and Special Protection Areas (SPAs) designated respectively under the Habitats Directive and Birds Directive.
NHA/pNHA	Natural Heritage Area/proposed Natural Heritage Area
NPWS	National Parks and Wildlife Service
PAM	Passive Acoustic Monitoring
PEXA	Military Practice and Exercise Areas
PTS	Permanent Threshold Shift
RAMSAR	Intergovernmental treaty that provides the framework for the conservation and wise use of wetlands and their resources
SAC	Special Area of Conservation: established under the Habitats Directive
SBP	Sub-Bottom Profiler
SFPA	Sea Fisheries Protection Authority
SPA	Special Protection Area: established under the Birds Directive
SSS	Side Scan Sonar
TTS	Temporary Threshold Shift
UKOOA	United Kingdom Offshore Operators Association
USBL	Ultra-Short Baseline (acoustic positioning system)

1 INTRODUCTION

1.1 Background and Document Purpose

PSE Kinsale Energy Limited (Kinsale Energy) is applying for consent to undertake survey activities at sites associated with the Kinsale Head, Ballycotton and Southwest Kinsale fields (Petroleum Lease area no.1), and the Seven Heads field (Seven Heads Petroleum Lease) in the North Celtic Sea Basin. The survey area is located off the coast of Co. Cork, extending from the landfall of the export pipeline at Powerhead to a distance of up to 47km from the nearest coast (Figure 1.1).

Kinsale Energy is progressing with the decommissioning of the Kinsale Area gas fields and facilities (incorporating the Kinsale Head gas fields and facilities and the Seven Heads gas field and facilities), which have come to the end of their productive life; gas production from the wells ceased on 5th July 2020. In keeping with lease obligations, Decommissioning Plans and related Environmental Impact Assessment Report (EIAR) and Appropriate Assessment (AA) screening reports were prepared and were submitted to the Department of Environment, Climate and Communications (formerly the Department of Communications, Climate Action & Environment), and a further application has been submitted to cover the remaining works to be consented as part of the decommissioning programme, the decommissioning of the Kinsale Head and Seven Heads pipelines. Together the decommissioning of the entirety of the Kinsale Area gas fields and facilities is collectively referred to as the Kinsale Area Decommissioning Project (KADP).

Consent applications are now being made for the remaining works required to complete the KADP (Consent Application no. 3 for Kinsale Head Petroleum Lease (OPL 1) and Consent Application no. 2 for Seven Heads).

At the time of previous Consent Applications for Kinsale Head and Seven Heads, Section 5 of the Dumping at Sea Act 1996 did not yet apply to “offshore installations” and there were ongoing studies by third parties that might have identified a future re-use of one or more of the offshore pipelines. Accordingly, previous Consent Applications did not address the offshore pipelines and umbilicals. As all studies on potential reuse of the pipelines and umbilicals have now concluded and no further use has been identified for any of the offshore pipelines or umbilicals, these are now the subject of this consent application.

Kinsale Head Consent Application no. 3 includes for the following facilities:

- To leave in situ all infield pipelines and umbilicals associated with the Kinsale Head gas fields
- To leave in situ the 24” export pipeline (offshore and onshore section) and to fill the onshore section with grout
- To use engineering materials to protect the pipelines and umbilicals in situ

Seven Heads Consent Application no. 2 includes the following:

- To leave in situ all infield pipelines and umbilicals associated with the Seven Heads gas field
- To leave in situ 18” Seven Heads export pipeline and umbilical
- To use engineering materials to protect the pipelines and umbilicals in situ

The consent applications (Section 7.2 thereof) also include the undertaking of survey activities at sites associated with the Kinsale Head, Ballycotton and Southwest Kinsale fields and the Seven Heads field. In order to accurately record the status of the pipelines and confirm the completion of the pipeline decommissioning activities, pre- and post-rock placement surveys are proposed as part of the Decommissioning Plans. In anticipation of the need to undertake such surveys, and now that greater definition is available on their scope and the types of equipment likely to be used than covered in the EIAR for KADP, the application for consent is accompanied by this addendum to the EIAR, an addendum to the Screening for AA Report and a Pre-survey Fisheries Assessment Report.

The surveys will include the use of equipment (e.g. multi-beam echosounder, sidescan sonar) to characterise the pipeline/umbilicals and the immediately adjacent seabed (more detail is provided in Section 2). The survey campaign will be carried out in phases, between Q2 and Q4 in 2022. However, these works may slip to between Q2 and Q3 2023 due to the potential for delays.

1.2 Legislative Background and EIA Process

There are mandatory requirements where an Environmental Impact Assessment Report (EIAR) is to be prepared (as outlined in Annex I of the EIA Directive 2011/92/EU[1]), also see Schedule 1 of the *European Communities (Environmental Impact Assessment) Regulations 1989* (as amended). Additionally, provisions relating to EIA for exploratory activities relating to oil & gas activity in Ireland are contained in the *European Union (Environmental Impact Assessment) (Petroleum Exploration) Regulations 2013*, amended by the *European Union (Environmental Impact Assessment) (Petroleum Exploration) (Amendment) Regulations 2019*. For projects listed in Annex II of the Directive, the approach in Ireland has been to set certain thresholds/criteria whereby an Environmental Impact Assessment Report (EIAR) would be prepared, and the competent authorities may request an EIAR be prepared with reference to those criteria set out in Annex III of the Directive, if in their opinion, the proposed activities are likely to have significant effects on the environment "by virtue, *inter alia*, of their nature, size and location". The *Licensing Terms and the Rules and Procedures for Offshore Petroleum Exploration and Appraisal Operations* specify various relevant standards and provisions for the offshore industry relevant to this application.

1.2.1 Other Relevant Legislation

Ireland is a contracting party to the *Convention on the Prevention of Marine Pollution by Dumping from Ships 1972*, and to the *Paris Convention on the Prevention of Marine Pollution from Land-based Sources 1974* (the "Oslo" and "Paris" Conventions respectively, both of which include offshore installations), and has adopted as a minimum requirement the international standards set by PARCOM and OSPAR. Ireland has ratified the *International Convention for the Prevention of Pollution from Ships 1973* as modified by the *Protocol of 1978* relating thereto (MARPOL 73/78) and implements requirements through regulations under the *Sea Pollution Act 1991 (as amended)*. Any vessel used in the survey campaign would therefore be subject to relevant controls under MARPOL.

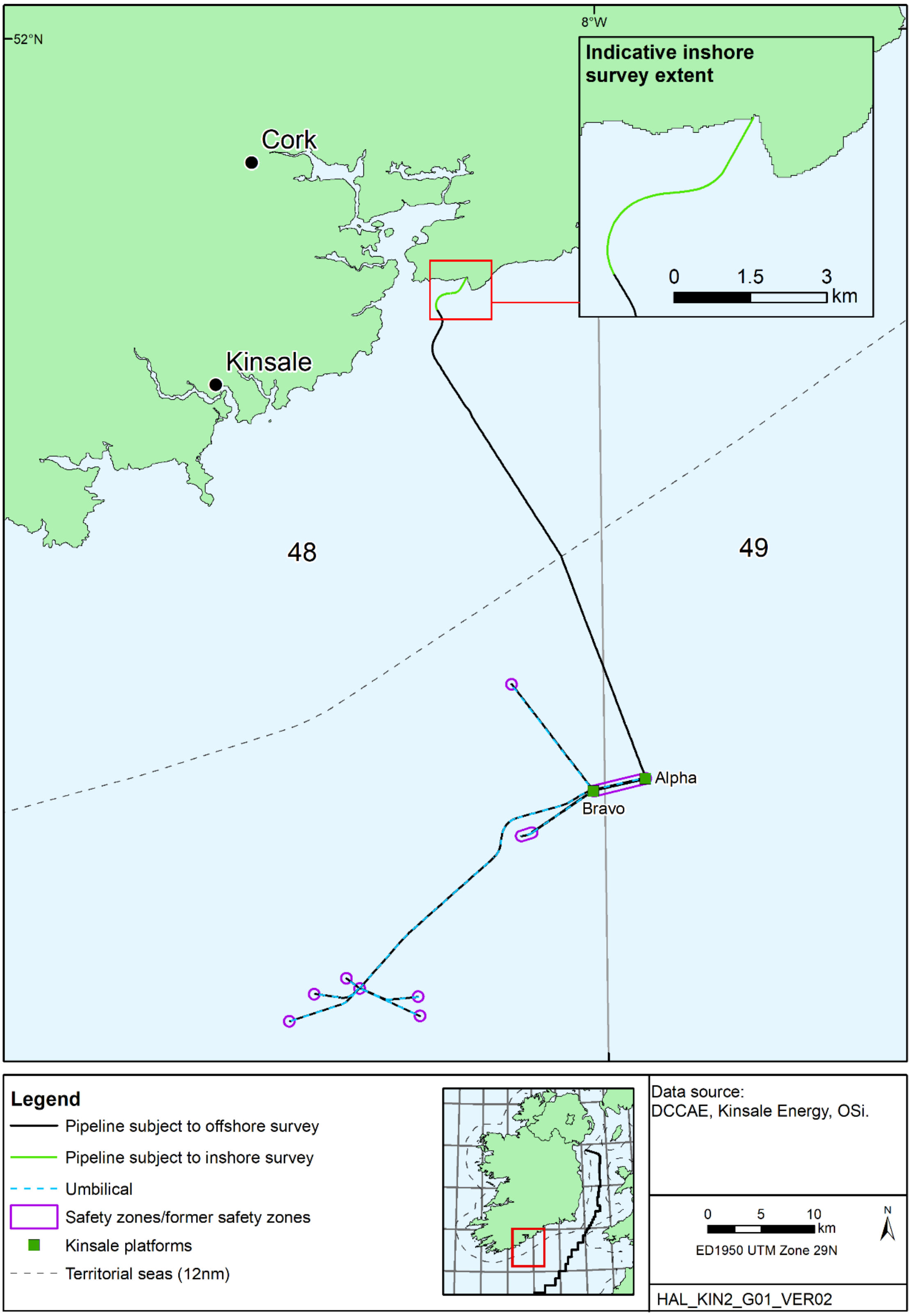
There is a range of international and national legislation aimed at protecting fauna, flora and habitats. The *UNESCO Convention on wetlands of international importance especially as waterfowl habitat* (Ramsar Convention) has been ratified by Ireland. The requirements of EU nature conservation directives *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 (Conservation of Wild Birds) Regulations 1985* (as amended) and the *European Communities (Birds and Natural Habitats) Regulations 2011* both under the *Wildlife Act 1976*

[1] Amended by Directive 2014/52/EU, and transposed by *The European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2018*

(as amended). Ireland is also a signatory to the *Agreement on the Conservation of Small Cetaceans of the Baltic and North Seas 1991* (ASCOBANS). ASCOBANS requires governments to undertake habitat management, conduct surveys and research and to enforce legislation to protect small cetaceans.

Ireland is a signatory to the *Espoo Convention 1991*, which requires government consideration of the potential of certain projects to have significant transboundary impact on the environment of any neighbouring state.

Figure 1.1: Location of the Kinsale Area infrastructure areas to be subject to survey



2 PROJECT DESCRIPTION

2.1 Survey Background and Purpose

As noted in Section 1, Kinsale Energy is progressing the decommissioning of the Kinsale area gas fields and facilities. Two applications have been made and approved in relation to the decommissioning of the Kinsale area facilities which were each accompanied by an Environmental Impact Assessment Report and Appropriate Assessment screening. These applications covered; facilities preparation, well plug and abandonment, platform topsides and subsea structure removal (application no. 1); and jacket removal (application no. 2). A third application was submitted in October 2021[2] which covers the remaining works associated with the overall KADP, which are the decommissioning of all Kinsale Head and Seven Heads pipelines and umbilicals by leaving them *in situ*, and the use of engineering materials (rock placement) to protect the pipelines and umbilicals. Decommissioning activity associated with the first two consent applications has already commenced, and has included the removal of pipeline spoolpieces and umbilical jumpers, which connected these to infrastructure subsea. Rock placement is only to be used at locations along the pipeline where freespans occur, a freespan being a section of pipe where seabed sediments have been eroded or scoured to leave a void beneath the pipeline so that it is no longer supported on the seabed, and at pipeline and umbilical ends where the spools/jumpers have been removed.

An inspection survey was undertaken in 2017 to accurately record the position of the pipelines and umbilicals and their status, such as their depth of burial and the presence of freespans, which helped to inform the likely nature of scale of rock placement necessary for pipeline decommissioning which in turn informed the EIAR submitted alongside the applications covering the KADP. In that EIAR, Kinsale Energy committed to undertaking a post-decommissioning survey of the pipelines, umbilicals, wellsites and platform locations, covering a 100m corridor along the pipeline and umbilical routes (50m either side), for debris clearance and to confirm the final position and status of the pipelines and umbilicals so that they can be accurately depicted on navigation charts. While the effects of such surveys were considered in the EIAR for the KADP, greater definition is now available on the nature of the equipment that may be used, which is the subject of this addendum to the EIAR.

The survey campaign has the following principal objectives:

- To inform the rock placement activities with the most recent set of pipeline inspection data (e.g. freespan location and seabed at pipeline/umbilical ends)
- To confirm the success of the rock placement activity which includes freespan areas and pipeline/umbilical ends
- To provide information on the status of the pipelines for charting purposes post-decommissioning

2.2 Survey Activity and Equipment

The specific equipment to be used as part of the surveys is yet to be selected, but the range of equipment which could be deployed is listed in Table 2.1, and all are considered in terms of their potential impact in Sections 4 and 5. The selected equipment will not differ substantially from those listed in Table 2.1 such that the scale or nature of potential effects will not differ from those assessed in this report. All of the survey equipment is non-intrusive and there will be no seabed interaction associated with the survey works.

[2] https://www.gov.ie/en/publication/58f06-decommissioning-of-certain-facilities-within-the-kinsale-area-gas-fields/

Pre-rock placement

The extent of the pipelines and umbilicals to be surveyed are shown in Figure 2.1. The survey will cover 100m along the pipelines and umbilicals and may be undertaken in a single pass of the survey vessel, or two passes may be required depending on final equipment selection (e.g. whether or not a ROV is used to perform the survey). The working area of the vessel will not extend beyond the 100m corridor other than during transit. The survey will be undertaken by two vessels, one of which will conduct the surveys of all offshore infield pipelines and umbilicals, and the export pipeline up to approximately 3km from the shore. A separate inshore vessel will be used to conduct the final portion of the survey due to water depth restrictions.

Survey data will mainly be collected using multibeam echo sounder (MBES) and side scan sonar (SSS), though other equipment including standard vessel echo sounder, and ultra-short baseline acoustic positioning (USBL) either will, or may, be used to assist in the positioning of the vessel and equipment deployed from it (see Table 2.1)

These survey operations are planned to take place between Q2 and Q4 in 2022. However, these works may be undertaken between Q2 and Q3 2023 due to the potential for delays. This part of the survey campaign is expected to be complete in approximately 14 days. In line with Section 4.3.4 iii) of the DAHG (2014) guidance, the nearshore survey operations will only start in daylight hours.

Post-rock placement

Rock will be placed in a controlled manner using a dedicated dynamically positioned fall pipe vessel, with the position of the rock placed over freespans to be surveyed using a fallpipe ROV (FPROV) at the time rock is deposited. The FPROV will collect MBES data over the area of rock placement only, which will be incorporated into the pre-rock placement data to provide a data source for the final position and status of the decommissioned pipelines/umbilicals. The extent of rock placement, and therefore the survey coverage for this aspect of the work, will only be known following completion of the pre-rock placement survey. On the basis of the 2017 survey, it was estimated that a total length of rock cover for all pipeline ends and freespans would be approximately 5,200m, and would take a rock fallpipe vessel approximately 14 days including transits to complete (see EIAR for the KADP). It has been assumed for the purposes of this assessment that the survey undertaken during the rock placement campaign will take 14 days including transits and be conducted in anticipated to be completed by Q4 2022. However, these works may be undertaken between Q2 and Q3 2023 due to the potential for delays.

Table 2.1: Summary of potential survey equipment

Source type	Potential equipment	Operating frequency	Objectives
Main survey equipment			
Side-scan sonar (towed)	Edgetech 4200	400kHz	Record the position of objects within the survey corridor.
Multi-beam echosounder	R2Sonic 2024, Norbit iWBMS / Winghead, Kongsberg EM 2040, Reson 8125	400kHz	Record the seabed topography and pipeline/umbilical location and status (e.g. freespan) to inform rock placement campaign, and also used during rock placement to record the position of the rock berms.

Source type	Potential equipment	Operating frequency	Objectives
Other acoustic equipment used for safe vessel operation, or operation of survey equipment deployed from the vessel			
Vessel echo sounder	Furuno FE-800	50-200kHz	For measuring water depth below the vessel hull.
Acoustic Doppler	Teledyne Workhorse (Monitor / Navigator)	300kHz-1,200kHz	For measuring speed over ground
USBL	Sonardyne Wideband Sub-Mini 6 Plus (WSM6+), Sonardyne Type 8300 Compatt 6, Kongsberg HiPAP	20-40kHz	Required for acoustic positioning if remote vehicle used (towed fish or ROV).
Bathymetric sensor	Tritech SeaKing Bathy 704 with altimeter	500kHz	Depth measurement / bathymetry for ROV
Obstacle avoidance sonar	Kongsberg 1071, Tritech Super SeaKing DST	>300kHz	Possibly used on ROV for obstacle avoidance.
Sound velocity sensor	Valeport MiniSVS	2.5MHz	Used to generate accurate sound velocity profiles to calibrate survey equipment.

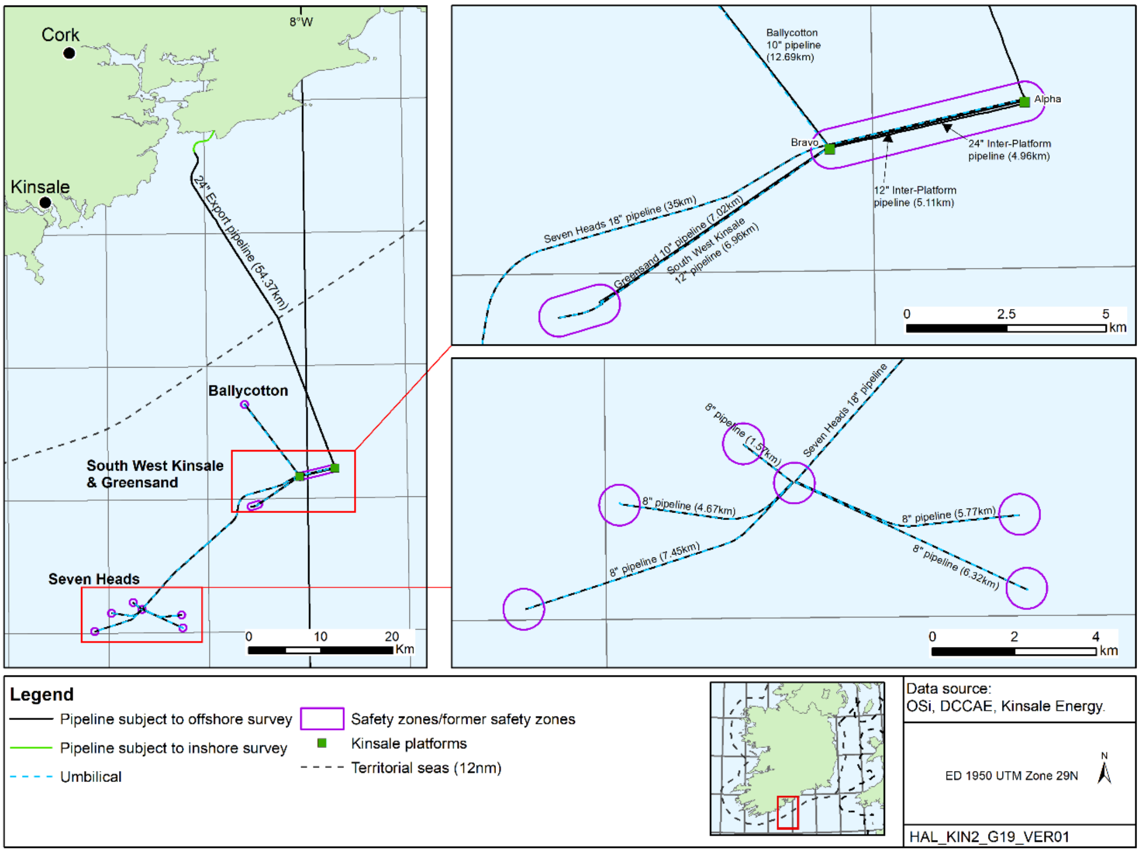
2.3 Vessel

The vessels to complete the survey programme have not yet been selected. For the purposes of this assessment, a representative vessel has been assumed (e.g. RV Celtic Explorer, RV Ocean Researcher or equivalent for the offshore survey, RV Tonn or equivalent for the inshore survey, and the Seahorse for the rock placement vessel). Note that only the effects of the survey components of the rock placement are considered here. The use of the rock-placement vessel (i.e. the effects of its transit, deposition of rock, emissions etc.) has already been subject to assessment in the EIAR for the KADP.

There will be no significant discharges from the survey vessels, and any discharge would be consistent with obligations under MARPOL[3] as implemented in Ireland, which effectively prevent pollution from such sources. In view of the scale and duration of the surveys these are not considered to be significant and are not considered further

[3] Following the guidance set out in EC (2021), compliance with MARPOL is a statutory requirement and forms a generic component of the project and is not a specific form of mitigation.

Figure 2.1: Kinsale Area pipelines/umbilicals, wellsite and platform locations safety zones to be subject to post-decommissioning surveys



3 ENVIRONMENTAL CHARACTERISTICS OF THE AREA

3.1 Physical Environment

3.1.1 Seabed topography, geology and sediments

The seafloor is generally flat in the area encompassing the Kinsale Area fields and related pipelines/umbilicals with gentle slopes across the region. Rig site and pipeline route surveys undertaken around the Seven Heads, SW Kinsale and Greensand developments all showed mosaics of high and low reflectivity (AquaFact 2003, 2004). The high reflectivity was interpreted as gravelly sands with megaripples of up to 0.3m height and 1.5m wavelength. The low reflectivity areas comprised muddy sand. At the prevailing water depths of 90-100m, the megaripples are indicative of a high energy environment. Ribbons of mobile sands lie in a southwest to northeast orientation. Outcrops of hard substrate – the underlying Cretaceous chalk bedrock – are also exposed intermittently with a variable covering of muddy sands. A distinctive feature of the sediments in the Kinsale Area is the apparent frequent juxtaposition of clean sand with mud.

3.1.2 Climate, oceanography and hydrography

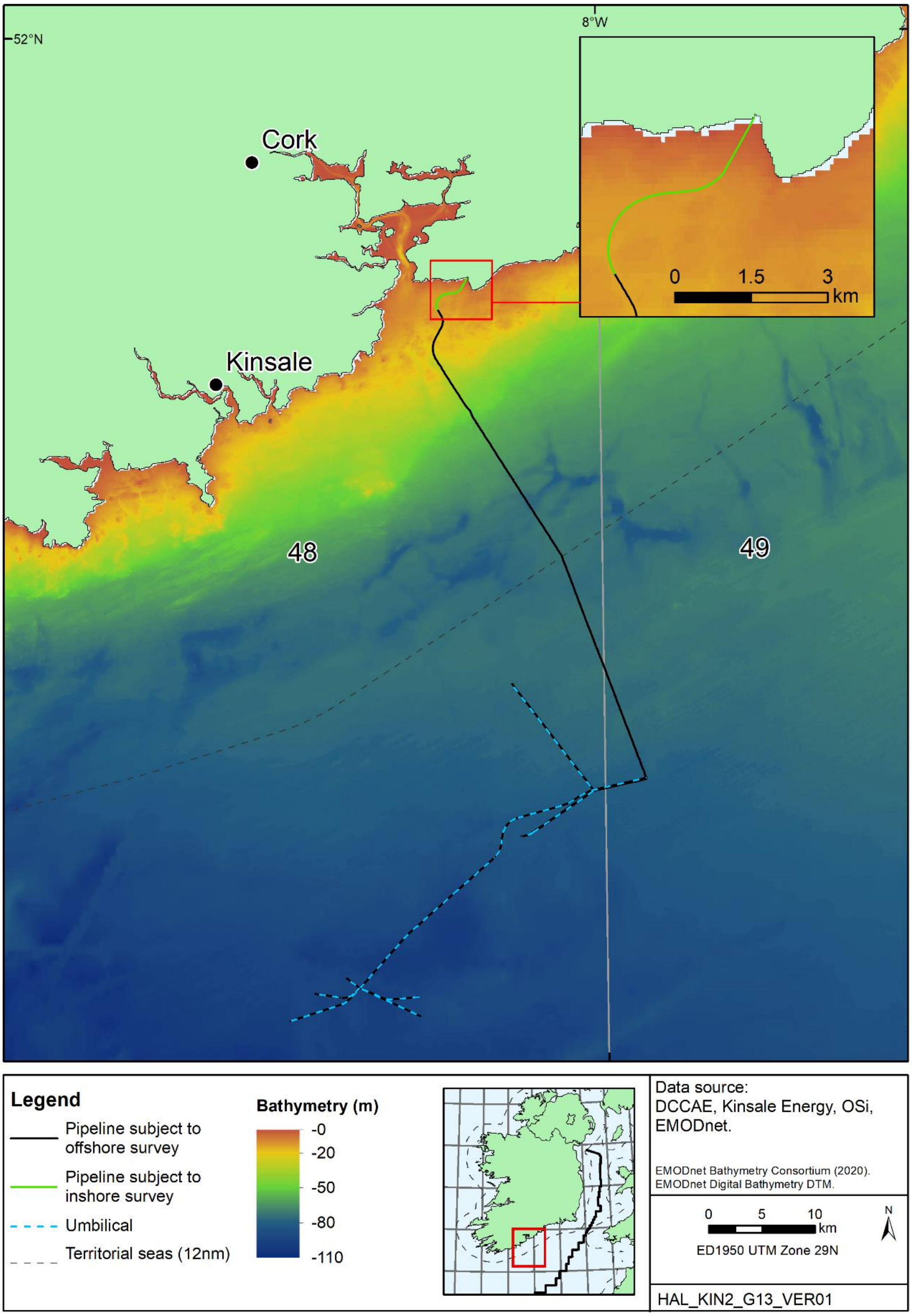
The area has a mild maritime climate with mean air temperatures varying between approximately 6-9°C in winter to 15-16°C in summer (seasonal mean temperatures for 1981-2010, Walsh 2012 and M5 Wexford Coast buoy observations 2004-2016, Met Eireann website). The predominant winds over the open waters south and west of Ireland are from the west and southwest (DCENR 2011). In the open ocean, winds of greater than 8m/s are experienced on 70-80% of occasions in winter (October to March) and 30-35% in summer (April to September) (Irish Coast Pilot 2006). Gales (17-20m/s) occur on approximately 20-30% of winter days and less than 2% of summer days (Irish Coast Pilot 2006). Sea fog is most frequent in summer, and most commonly associated with warm moist air blowing over a relatively cold sea with winds between southeast and southwest.

Swell distributions are dominated by swells from a south-west and west direction throughout the year, with mean significant wave heights varying between 1-1.5m in summer to 3m in winter (data for 15 July 2016 and 15 January 2016 respectively from Marine Institute monthly model means). Estimates of 100 year extreme metocean conditions indicate a significant wave height of up to 13.8m, a maximum wave height of 24.7m, and a current speed of 1.13m/s, all from a southwesterly direction (Fugro 2015).

The general pattern of transport of water into the Celtic Sea was reviewed by Pingree & Le Cann (1989), who identified a weak, variable but persistent flow, with typical mean speeds of 0.03m/s, moving northwards along the Brittany coast and across the mouth of the English Channel. North of the Scilly Isles, part of this flow diverges to the west and is deflected southwards around the south coast of Ireland, and there is generally a strong clockwise flow around the Irish coast caused by easterly winds and the Irish Coastal Current (Fernand *et al.* 2006).

Surface water temperatures range from 8-10°C in winter to 15-16°C in summer, while bottom temperatures show less variation and remain at around 8-10°C throughout the year (Connor *et al.* 2006). Thermal stratification of the water column develops in spring, with a thermocline between warm surface waters and colder deeper waters. Stratification breaks down to an extent through autumn, although the area remains frontal throughout winter (Connor *et al.* 2006). Mean sea surface salinity during the summer is 34.75‰ increasing in winter to 35.10‰, reflecting stratified and mixed conditions respectively (BODC 1998).

Figure 3.1: Bathymetry



3.2 Biological Environment

3.2.1 Plankton

The waters of the Celtic Sea are seasonally stratified, with greater mixing in shallower areas. There is a heavy terrestrial influence, but also an important oceanic influence from the Atlantic. In waters off the south of Ireland a phytoplankton bloom typically occurs every spring, usually from mid-April, as increasing light levels and the development of the thermocline in the stratified water column lead to an increase in phytoplankton biomass (O'Boyle & Silke 2010). Early in the season, the phytoplankton community largely comprises diatoms such as *Thalassiosira spp*. (the most frequently recorded phytoplankton taxa), *Skeletonema spp.* and *Chaetoceros spp*., with *Rhizosolenia spp.* and *Ceratulina spp*. increasing in abundance as the bloom develops (Pybus 1996, Johns & Wootton 2003). As stratification increases into the summer months, opportunistic diatom species decline, and dinoflagellate species such as *Ceratium spp.*, *Protoperidinium spp.*and *Dinophysis spp.* become dominant within the community. The bloom declines as summer progresses and nutrients deplete, although occasional, smaller autumn blooms may occur. There has been an increase in the numerical abundance of both diatoms and dinoflagellates in Irish waters since 1998 (Marine Institute 2009).

Zooplankton communities in the Celtic Sea are dominated by copepods. Small copepods such as *Acartia spp*., *Oithona spp*., *Centropages typicus*, *Paracalanus spp*. and *Pseudocalanus spp*. are abundant in the region, along with euphausiids, cladocerans and meroplankton such as echinoderm larvae. Amongst the calanoid copepods, the warm-water species *Calanus helgolandicus* is considerably more numerous than *Calanus finmarchicus* (Johns & Wootton 2003), and there has been a general movement north of *C. helgolandicus* and an increase in abundance off the coast of southwest Ireland (Marine Institute 2009). Jellyfish in the area include *Rhizostoma octopus, Aurelia aurita*, *Chrysaora hysoscella* and *Cyanea lamarckii*, as well as the hydrozoans *Physalia physalis* (the Portuguese man-o-war) and *Velella velella* (Pikesley *et al*. 2014). The zooplankton acts as a trophic link between the producers (phytoplankton) and the higher predators within the ecosystem. *Pelagia noctiluca*, an oceanic water-water species, may be carried into Irish waters by the shelf edge current (Marine Institute 2009).

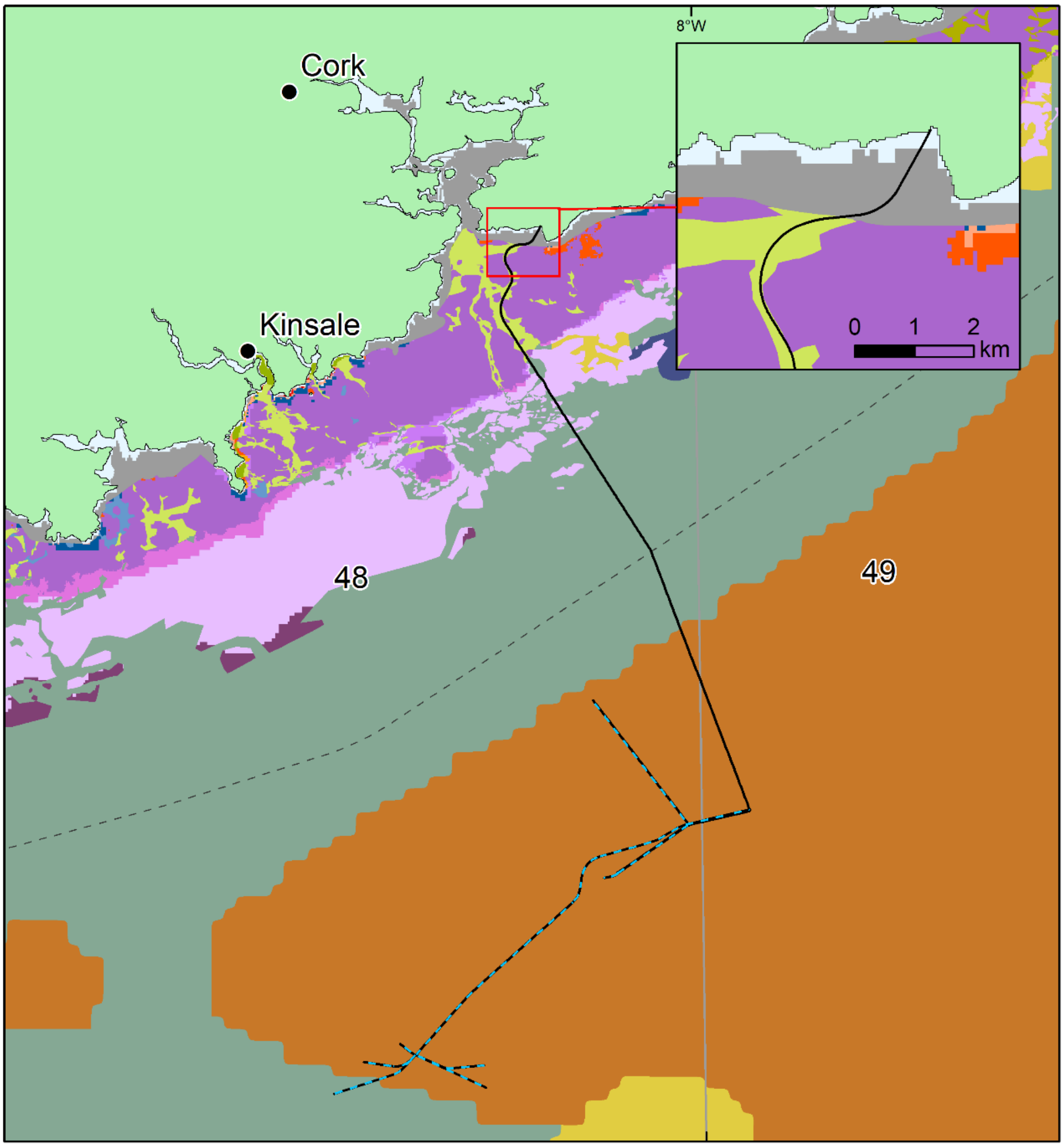
3.2.2 Benthos

Benthic communities are traditionally considered as two groups: infauna and epifauna. The infauna live within the seabed sediment, and represent the most commonly surveyed and well-known benthic community. Epifauna live on the surface of the sediment, are generally larger than infauna, and may be sessile, such as sponges and hydroids; or mobile, such as echinoderms and crustaceans.

The dynamic nature of the sedimentary environment of the Seven Heads and Kinsale Head gas fields presents a range of relatively impoverished heterogeneous benthic habitats. According to the EUNIS habitat classification, the underlying habitat is circalittoral coarse sediment (Figure 3.2). This habitat, as with shallower coarse sediments, can be characterized by robust infaunal polychaetes, mobile crustaceans and bivalves (Connor *et al* 2004).

Extensive survey work has been undertaken in the wider Kinsale Area since the discovery of the Kinsale Head field in 1971, with the most recent survey information covering the period 2002-2017 (Aquafact 2002, 2004, 2005, Hartley Anderson 2003, 2007, Marine Institute 2010, 2011, 2017, Ecoserve 2011, Fugro 2012, 2017, Gardline 2015).

Figure 3.2: Predicted seabed habitats



Legend

Pipeline
Umbilical
Territorial seas (12nm)

EU SeaMap - EUNIS

- A3.1: Atlantic and Mediterranean high energy infralittoral rock
- A3.3: Atlantic and Mediterranean low energy infralittoral rock
- A4.1: Atlantic and Mediterranean high energy circalittoral rock
- A4.12: Sponge communities on deep circalittoral rock
- A4.2: Atlantic and Mediterranean moderate energy circalittoral rock
- A4.27: Faunal communities on deep moderate energy circalittoral rock
- A4.3: Atlantic and Mediterranean low energy circalittoral rock
- A4.33: Faunal communities on deep low energy circalittoral rock
- A5.15: Deep circalittoral coarse sediment
- A5.27: Deep circalittoral sand
- A5.35: Circalittoral sandy mud
- A5.37: Deep circalittoral mud
- No EUNIS habitat assigned

Data source:
DCCAE, Kinsale Energy, OSi, EMODnet.

EMODnet broad-scale seabed habitat map for Europe (v2019), licensed under CC-BY 4.0 from the European Marine Observation and Data Network (EMODnet) Seabed Habitats initiative

0 5 10 km
N
ED1950 UTM Zone 29N

HAL_KIN2_G02_VER01

In the Seven Heads field and along the pipeline route to the Kinsale Head field, Hartley Anderson (2003) described the seabed as a mosaic of rippled gravelly sands interspersed with areas of muddy sand; and the benthic epifauna as consisting of common and widely distributed species consistent with previous academic surveys in the region (Hartley & Dicks 1977, see Boelens *et al*. 1999). They noted a well-developed fauna on all hard substrates which ranged through cobbles, boulders and larger rock outcrops, with particular emphasis on two identified rock outcrops. The infauna of this same area was investigated by AquaFact (2003) and found to be low in species and individuals; it was ascribed to an *Ophelia*-type grouping. When comparing the species data with the expected *Amphiura/Chamelea* grouping identified in the area by Boelens *et al*. (1999), AquaFact found only small numbers of amphiurids at a few stations and no *Chamelea* were found. Other faunal elements of the *Amphiura/Chamelea* grouping such as *Notomastus, Melinna, Thyasira* and *Abra* sp., were either absent from some samples or were only rarely recorded. The dominant species throughout the Seven Heads area was found to be *Spiophanes kroyeri with* other characteristic taxa being *Magelona alleni, Ophelia rathkei* and *Echinocyamus pusillus*. Hence the faunal grouping was considered to be of the *Ophelia*-type.

The Marine Institute (2017) KADP pre-decommissioning survey sampled 31 stations with the sediments found being predominantly very coarse sand and very fine gravel, with typically little mud (silt and clay particles) present. However, at a few stations an appreciable proportion (up to 27%) of mud was present in addition to the coarse sands. The benthic fauna (sampled at 28 of the 31 stations) had a low to moderate abundance and species richness, with many species being found across the surveyed area. Multivariate analyses of the faunal data indicated three relatively weak clusters of stations which were geographically spread across the survey area and with some overlapping characteristic species. The characteristic species from the clusters included the polychaetes *Spiophanes kroyeri*, *Lumbrineris aniara*, *Mediomastus fragilis*, *Goniadella gracilis*, *Glycera lapidum*, and *Amphitrite cirrata*, the anemone *Edwardsia* sp., unidentified Nematoda and Nemertea, and the echinoderms *Amphiura filiformis* and *Echinocyamus pusillus*. This suite of species is similar to those recorded in previous surveys and is believed to reflect the nature of the sediments on the area; no species indicative of contamination or organic enrichment were recorded.

All recent benthic sampling and photographic surveys in the Kinsale Area have been consistent in reporting no indication of sensitive species or habitats which would be subject to protection under the EU Habitats Directive (92/43/EEC) i.e. Annex I habitats. Ramboll (2017a & b) noted the possible presence of the cold water coral *Lophelia* on some of the Kinsale Area subsea infrastructure (note that all subsea manifolds have now been removed). As such colonies would be of conservation interest, various areas with possible *Lophelia* were investigated by ROV during the 2017 pre-decommissioning surveys. All colonies of possible *Lophelia* inspected proved to be colonies of the serpulid polychaete *Filograna implexa*, a common and widespread species.

3.2.3 Fish and shellfish

The waters of southern Ireland support a diversity of fish and shellfish, including a number of commercially valuable species. Fish assemblages tend to be closely associated with particular physical environments, with temperature, depth and sediment type all influencing the community composition. The southern Irish coast acts as a gateway to the wider Atlantic from the enclosed waters of the Bristol Channel and Irish Sea. Pelagic species, including herring (*Clupea harengus*), mackerel (*Scomber scombrus*), sprat (*Sprattus sprattus*) and horse mackerel (*Trachurus trachurus*) are abundant in the region, and move widely between feeding and spawning grounds (Heessen *et al*. 2015). The most abundant species in the region are haddock (*Melanogrammus aeglefinus*), poor cod (*Trisopterus minutus*), Norway pout (*Trisopterus esmarkii*) and whiting (*Merlangius merlangus*) (Marine Institute 2012), while cod (*Gadus morhua*), monkfish (*Lophius piscatorius*), hake (*Merluccius merlucius*), plaice (*Pleuronectes platessa*) and dab (*Limanda limanda*) are also abundant (Heessen *et al*. 2015). The areas of sandy sediment tend to support flatfish and sandeels, while gobies, blennies, wrasse and large gadoids are more abundant over rockier regions (Boelens *et al*. 1999). There are important *Nephrops norvegicus* (Norway lobster, scampi) grounds to the south of Cork (Lordan *et al*. 2015).

The pipelines and related survey area are located within ICES Rectangles 31E1, 31E2 and 32E1. Table 3.1 shows that the proposed survey location overlaps known spawning grounds and nursery areas for certain fish species. Rectangles 31E2 and 32E2 are within the spawning areas for herring, sprat, cod, whiting, plaice, lemon sole and *Nephrops* (Coull *et al*. 1998), as well as haddock, megrim (*Lepidorhombus whiffiagonis*) and horse mackerel (Marine Institute data – see Figure 3.3). In addition Ellis *et al.* (2012) identified low spawning activity for mackerel in the area. Mackerel, cod, whiting, lemon sole, blue whiting (*Micromesistius poutassou*), ling (*Molva molva*), European hake, sandeels (*Ammodytes spp.*) and *Nephrops* all use the area as a nursery area at low intensity, while the area is a high intensity nursery area for monkfish (Ellis *et al*. 2012). The Marine Institute have also identified nursery grounds for herring, haddock, megrim and horse mackerel, in addition to whiting and mackerel (Figure 3.4) The Block is not located within any known elasmobranch spawning grounds, but was identified within a low intensity nursery ground for spurdog (*Squalus acanthias*) (Ellis *et al.* 2012). Fish spawning can vary temporally and spatially; spawning areas are not rigidly fixed and fish may spawn earlier or later in the season.

A number of elasmobranch species are present in the region, including the spurdog (*Squalus acanthias*) and the lesser spotted dogfish (*Scyliorhinus canicula*) (Marine Institute 2012). Aerial surveys from 2015-2016 for the ObSERVE project reported multiple sightings of blue sharks in the offshore Celtic Sea region in summer (Rogan *et al*. 2018). Other oceanic sharks such as thresher (*Alopias vulpinus*) and mako (*Isurus oxyrinchus*) sharks may make occasional, seasonal visits to the region. The southern Irish coast is an area where basking sharks are particularly common, with numerous sightings reported annually in the summer months (Solandt & Chassin 2014).

Aerial surveys from 2015-2016 in the ObSERVE project reported ocean sunfish (*Mola mola*) to be frequently observed in most offshore waters around Ireland, including off the south coast where mot sightings were recorded in summer (Breen *et al*. 2017, Rogan *et al*. 2018). For offshore waters of the Celtic Sea, design-based estimates of 4,625 (95% CI 2,679-7,987) and 2,068 (95% CI 1,398-3061) were produced for the two summer surveys, and 1,044 (95% CI 606-1,799) and 73 (95% CI 14-375) for the two winter surveys (Rogan *et al*. 2018).

The River Lee, contains populations of the diadromous species Atlantic salmon (*Salmo salar*) and brown trout (*Salmo trutta*), which migrate from the sea to spawning locations up-river. Salmon runs take place through the summer, with June to September particularly fruitful for anglers.

Table 3.1: Spawning and nursery grounds relevant to the survey area

Species	Spawning grounds	Nursery grounds	Spawning period
Herring (a,c)	✓	✓	January - March
Sprat (a)	✓	-	May - August
Mackerel (b,c)	✓	✓ (low)	March - July
Horse mackerel (c)	✓	✓	March - August
Blue whiting (b)	-	✓ (low)	-
Cod (a,b,c)	✓	✓ (low)	January - April
Haddock (c)	✓	✓	February – May
Whiting a,b,c)	✓	✓ (low)	February - June
Hake (b,c)	-	✓ (low)	-
Ling (b)	-	✓ (low)	-
Plaice (a)	✓	-	December - March
Lemon sole (a)	✓	✓	April - September
Megrim (c)	✓	✓	January - March
Monkfish (b,c)	-	✓ (high)	-
Spurdog (b)	-	✓ (low)	-
Common skate (b)	-	✓ (low)	-
Nephrops (a)	✓	✓	January - December

Sources: a = Coull et al. (1998), b = Ellis et al. (2012), c = Marine Institute (2012) – spawning period detail taken from Coull et al. (1998) and Ellis et al. (2012)

3.2.4 Marine reptiles

There are seven species of marine turtle, of which five species have been recorded in the seas around Ireland and the UK: leatherback turtle (*Dermochelys coriacea*), loggerhead turtle (*Caretta caretta*), Kemp's ridley turtle (*Lepidochelys kempii*), green turtle (*Chelonia mydas*) and hawksbill turtle (*Eretmochelys imbricata*). The leatherback turtle is the largest of the marine turtles and is the only species of turtle to have developed adaptions to cold water (Goff & Stenson 1988). The species is covered under Annex IV of the Habitats Directive (see Section 3.2.7).

A significant majority of turtle sightings recorded in Irish waters are of the leatherback turtle (King & Berrow 2009), which migrates into the waters of the Celtic and Irish Seas in response to the distribution of the gelatinous zooplankton which make up their favoured diet (Doyle *et al.* 2008, Fossette *et al.* 2010). Tagging studies show that they migrate across the Atlantic from the eastern American mainland and the Caribbean (Hays *et al.* 2004, Doyle *et al.* 2008). Sightings in the wider region are concentrated off the south and west of Ireland, the southwest of England and the west coast of Wales. Most sightings occur in the summer, peaking in August (Penrose & Gander 2016). The 2014 Celtic Sea Herring Acoustic Survey (Cronin & Barton 2014) made four sightings of leatherback turtle, three of them approximately 70km south of Cork Harbour, although no confirmed sightings of this species were made in subsequent surveys (O'Donnell *et al.* 2016, 2017, 2018, 2019, 2020). Aerial surveys for the ObSERVE project from 2015-2016 recorded a handful of leatherback turtle sightings at the southern limits of Irish offshore waters in summer; none were observed in the survey area (Rogan *et al*. 2018).

Figure 3.3: Fish spawning areas

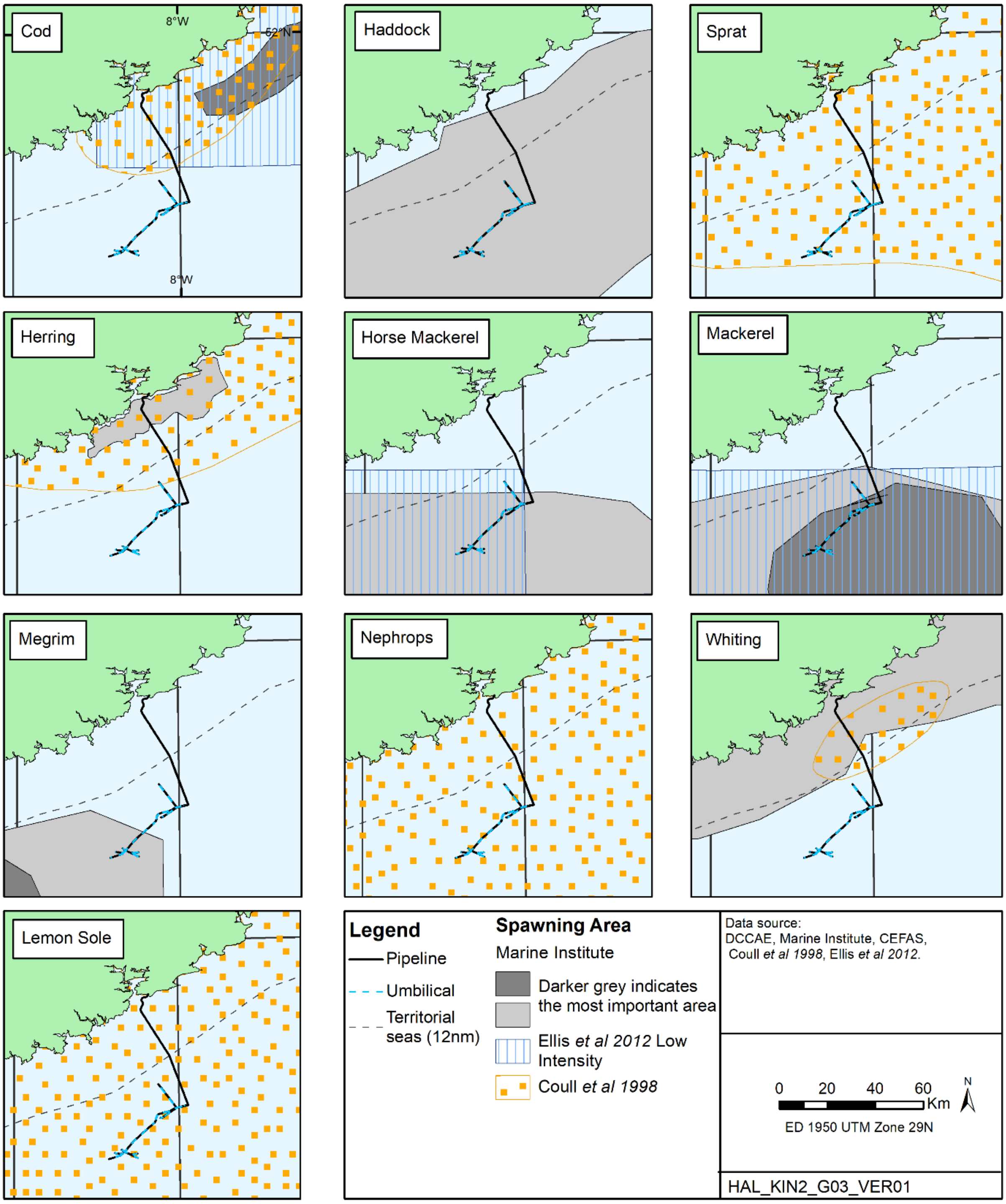
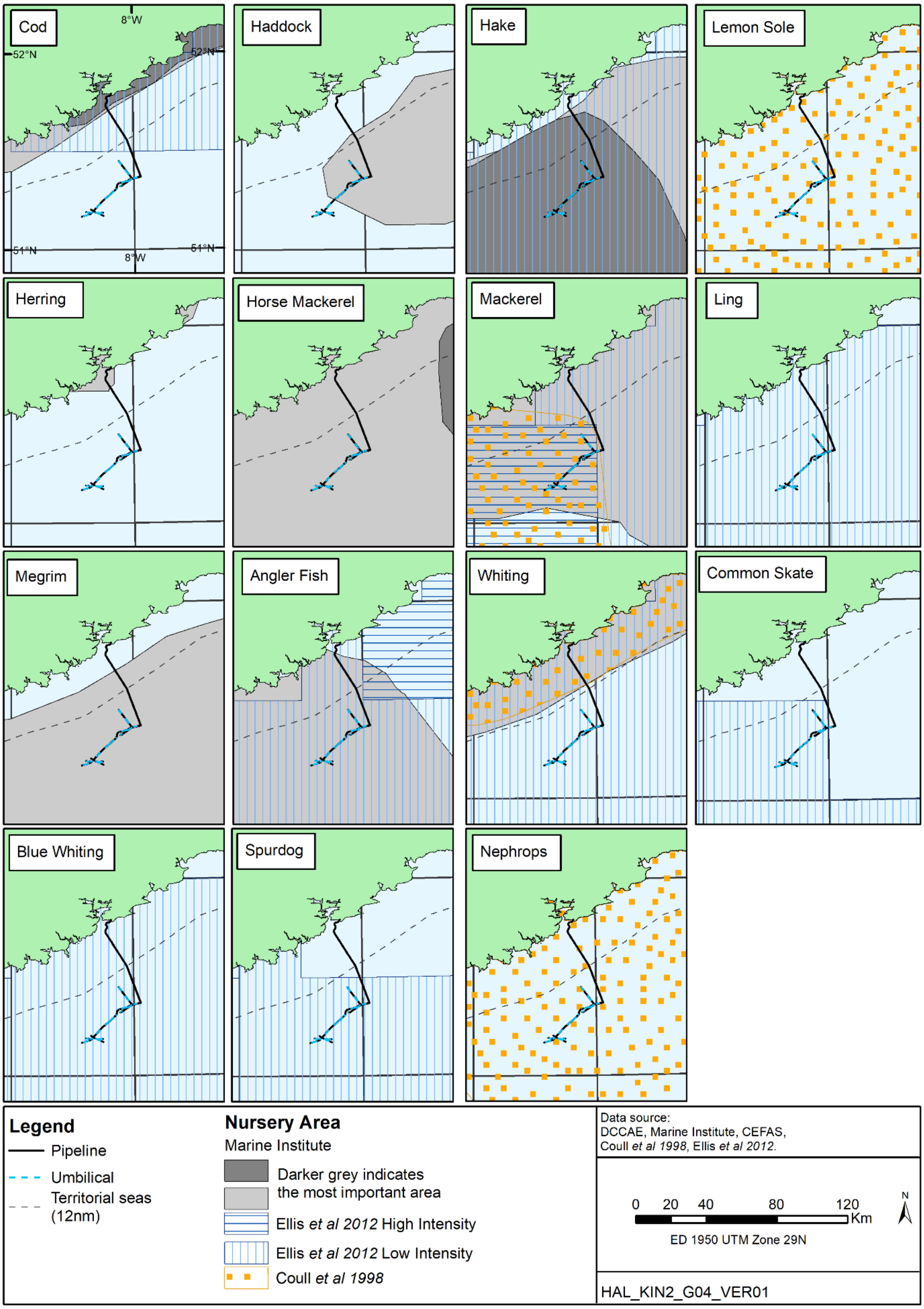


Figure 3.4: Fish nursery areas



3.2.5 Birds

The south coast of Ireland provides numerous habitats for seabirds, with rocky cliffs and productive seas supporting a variety of gulls, auks, terns and shearwaters. Seabird distribution is influenced by the distribution of prey species, which in turn is affected by a range of physical factors. Sandeels, herring, sprat and small gadoids are among the prey items favoured by most seabirds, and there are several spawning and nursery areas for these in the area. Each summer, over half a million seabirds, from 24 species, search for suitable breeding sites on the cliffs and islands of the south coast of Ireland. In addition, over 50 species of waterbirds arrive on migration either on passage or to over-winter[4]. There are numerous SPAs (Special Protection Areas) along the coast which offer protection to species or aggregations of seabirds and waterbirds (see Section 3.2.7). Key sources of information on the distribution of birds in the Celtic and Irish seas include Webb *et al.* (1990) and Stone *et al.* (1995). In addition, various surveys, including the Celtic Sea Herring Acoustic Surveys (O'Donnell *et al.* 2016, 2017, 2018, 2019, 2020) and the ObSERVE programme (Rogan *et al*. 2018) have recorded seabird sightings around the survey area.

Seabirds

Gulls commonly found in the survey area include herring gull (*Larus argentatus*), lesser black-backed gull (*Larus fuscus*), great black-backed gull (*Larus marinus*), black-headed gull (*Chroicocephalus ridibundus*) and black-legged kittiwake (*Rissa tridactyla*). Most gulls are resident to the area, and are frequently recorded along the coast throughout the year. Also resident along the south coast of Ireland are a number of auks, including guillemot (*Uria aalge*), razorbill (*Alca torda*), Atlantic puffin (*Fratercula arctica*) and the black guillemot (*Cepphus grylle*). Razorbill, guillemot and black guillemot are generally found in coastal waters, although Atlantic puffin is more of an oceanic species, often found offshore off the Porcupine Seabight, or around small islands off the south coast or in the Irish Sea. The Old Head of Kinsale is the largest seabird colony on the south coast, between the Saltee Islands on the southeastern point and the Bull Rock on the southwestern point. The colony it supports has nationally important populations of black-legged kittiwake and guillemot, as well as significant populations of herring gull, razorbill, Northern fulmar (*Fulmarus glacialis*) and European shag (*Phalacrocorax aristotelis*)[5]. Great Cormorants (*Phalacrocorax carbo*) and European shag also tend to remain closely associated with the coast, largely as a result of their plumage which is less water resistant than many other seabirds. Key sites for Great cormorants and European shags include Helvick Head, the Keeragh Islands, the Saltee Islands and the Sovereign Islands (see Figure 3.8 for locations).

Northern Gannets (*Morus bassanus*) are found in large colonies, from which they forage up to 480km offshore, along the shelf edge (DCENR 2015). Highest densities occur off the south coast in spring and summer, with the breeding season starting in April and May. Great Saltee Island, to the east of the survey area, is the site of one of the largest gannetries in Ireland, with 2,446 pairs recorded there in 2004 (NPWS website).

Seasonal visitors to the area include various terns, skuas and shearwaters. Terns arrive in the summer months at inshore areas to breed. Tern species regularly sighted in the survey area include the common tern (*Sterna hirundo*), the Arctic tern (*Sterna paradisaea*), the Sandwich tern (*Sterna sandivicensis*) and the little tern (*Sternula albifrons*). Predatory Arctic skuas (*Stercorarius parasiticus*) also tend to be summer visitors, with high densities recorded along the Celtic Sea coast from July to September although the great skua (*Catharacta skua*) is a resident which breeds in the west of Ireland (DCENR 2015), and is occasionally recorded

[4] https://www.npws.ie/research-projects/animal-species/birds/wintering-waterbirds
[5] https://www.npws.ie/research-projects/animal-species/birds/seabirds

in the Celtic Sea. The highly pelagic petrels and shearwaters, including the fulmar (*Fulmarus glacialis*), the storm petrel (*Hydrobates pelagicus*) and the Manx shearwater (*Puffinus puffinus*), a species of which the Celtic and Irish Seas have particularly high densities, are all most abundant in spring and summer.

Many seabirds forage considerable distances from their breeding habitats. Thaxter *et al*. (2012) presented a review of representative foraging ranges during the breeding season, based on surveys conducted over breeding colonies across Europe (including Northern gannets on Saltee Island), which has recently been updated by Woodward *et al.* (2019). Species such as Northern fulmar, Northern gannet, guillemot, lesser black-backed gull and black-legged kittiwake, which have maximum foraging ranges in excess of 100km, may be present in the survey area. The Celtic Sea Herring Acoustic Surveys (O'Donnell *et al*. 2016, 2017, 2018, 2019, 2020) surveyed coastal and offshore waters from Mizen Head eastwards to the Irish Sea, each taking place over 2-3 weeks in October. The 2016 survey sighted a total of 26,429 individual seabirds representing 27 species. The most commonly recorded species were northern gannet (15,147 individuals), guillemot (3,293), lesser black-backed gull (1,901), black-legged kittiwake (928) and razorbill (763). The 2017 and 2018 surveys observed a similar species composition but the total number of individuals recorded on each survey (10,628 and 5,097 respectively) was less than in 2016, however the 2019 and 2020 surveys recorded more individuals (28,110 and 35,636 respectively).

As part of the ObSERVE programme, widespread aerial surveys of Ireland's offshore waters were conducted in both summer and winter in 2015 and 2016 to investigate the occurrence, distribution and abundance of seabirds, cetaceans and other marine megafauna (Rogan *et al.* 2018). Offshore waters off the south coast, including the survey area, are in Stratum 4, a large area of 62,510km^2 extending from approximately 15-20km off the coast to the RoI/UK median line and shelf waters, west to longitude 11°W. Density and abundance estimates for the most commonly sighted species and species groups in this area are presented in Table 3.2. These indicate that gannet, Manx shearwater and petrel are consistently the most abundant species/group in summer.

Table 3.2: Seabird density and abundance estimates for offshore waters south of Ireland (Stratum 4) from the ObSERVE aerial surveys

	Density; abundance, (CV)[1]			
Species	**Summer 2015**	**Winter 2015-16**	**Summer 2016**	**Winter 2016-17**
Gannet	0.26; 16,549 (14.6)	0.10; 6,487 (92.2)	0.34; 21,584 (16.5)	0.23; 14,169 (24.6)
Fulmar	0.12; 7,471 (42.4)	0.28; 17,225 (27.3)	0.11; 6,979 (31.4)	0.61; 38,320 (58.2)
Black-backed gull*	<0.01; 402 (35.9)	0.03; 1,874 (29.8)	<0.01; 432 (107.4)	0.03; 1,605 (34.3)
Common/herring gull*	<0.01; 142 (36.6)	<0.01; 288 (41.0)	0.03; 1,799 (62.7)	0; 0 (0)
Kittiwake	0.02; 1,044 (37.4)	0.45; 28,469 (33.6)	0.04; 2,590 (30.5)	0.24; 14,798 (15.9)
Manx shearwater	0.32; 19,758 (43.9)	0; 0 (0)	0.89; 55,696 (33.8)	<0.01; 267 (59.5)
Petrel species*	0.21; 13,336 (18.3)	<0.01; 288 (42.9)	0.29; 18,059 (12.5)	<0.01; 140 (55.4)
Auk species*	<0.01; 291 (72.7)	0.58; 36,594 (30.9)	0.23; 14,233 (40.5)	0.34; 21,479 (21.6)

*Notes: All estimates presented are design-based. [1] Density estimates (birds/km^2) rounded to 2 decimal places; individual abundance with coefficient of variation(CV) rounded to one decimal place. *In these circumstances it was not possible to differentiate between species, and so species are grouped as indicated: black-backed gull (greater and lesser black-backed*

gull); petrel (believed to be mostly European and Leach's storm petrel); auk (guillemot, razorbill, puffin)
Source: Rogan et al. (2018).

Waterbirds

Waterbirds, a loosely defined category including seaducks, divers, herons, waders, geese and swans, are a major feature of the coastal habitats of Ireland, with resident, migratory and over-wintering populations present in the area. Ireland lies on some of the major migratory flyways of the east Atlantic, with many species not only overwintering in the area, but also using the UK as a stopover during spring and autumn migrations. The rivers, estuaries, bays and other coastal areas of southern Ireland are of great importance to wintering and passage wildfowl, as well as for breeding waders and other waterbirds; several SPA sites are designated for such features in the region (see Section 3.2.7).

3.2.6 Marine mammals

Irish waters are among the most important in Europe for cetacean species, with 25 species having been recorded in the region, and, in 1991, the government declared Irish waters a whale and dolphin sanctuary[6]. Eighteen of these species are regularly observed, while the remaining seven might be classed as vagrant species (NPWS 2014). The combination of shallow waters, deep oceanic areas with complex bathymetry and the productive shelf edge provide a range of habitats and feeding opportunities.

There are several key data resources on the species composition and relative abundance of the marine mammal fauna in the survey area and wider Celtic Sea. The annual Celtic Sea Herring Acoustic Surveys (CSHAS) cover waters off the south coast of Ireland, typically over a three week period each October and extends from 2-3km off the coast to over 100km offshore (e.g. O'Donnell *et al.* 2017). Dedicated marine mammal observers recorded sightings when light and environmental conditions permitted; combined data from 12 years of surveys from 2008-2020 are provided in Table 3.3. Table 3.3 also shows data extracted from the Irish Whale and Dolphin Group's (IWDG) Casual Cetacean Sightings database, which includes sightings submitted by IWDG members, researchers and the general public and validated by the IWDG (IWDG 2018). These extracted data include all sightings from January 2008 to December 2019 (12 years) within an area spanning ~150km off the south coast of Ireland, approximately bounded by Ardmore in the east, Spain Point in the west and south to 51ºN (the typical offshore extent of the CSHAS) (Figures 3.5 and 3.6). The IWDG casual sightings data are not effort corrected, and are biased towards busier and more accessible coastal waters, and areas subject to research (e.g. Ryan *et al.* 2010, Whooley *et al.* 2011); but provide useful information on the composition and relative abundance of cetacean species of the area. Data from the IWDG casual database and other sources over the period 2005-2011 were synthesised by Wall *et al.* (2013), which includes an assessment of the seasonal occurrence of the most commonly sighted species.

The harbour porpoise (*Phocoena phocoena*), common dolphin (*Delphinus delphis*) and bottlenose dolphin (*Tursiops truncatus*) are the most common toothed cetaceans off the south coast of Ireland (Table 3.3), where they are sighted year-round (Table 3.4). Risso's dolphin (*Grampus griseus*) are occasionally seen in this region, primarily in summer, while a small number of killer whale (*Orcinus orca*) sightings have occurred close to the coast. Minke

[6] The Irish whale and dolphin sanctuary is not a legal entity, rather a statement of political will which has resulted in considerable public awareness and interest towards cetaceans in Irish waters. They are protected by national legislation (Whale Fisheries Act 1937 & 1982; Wildlife Act 1976), the EC Habitats Directive and several international conventions.

(*Balaenoptera acutorostrata*) and fin (*Balaenoptera physalus*) whales are the most commonly sighted baleen whales in summer and late summer-autumn, respectively. Minke whale are also frequently observed during late summer to autumn, albeit in apparently lower abundance. Small numbers of humpback whales also occur in this area, with sightings peaking from late summer through to January. Grey (*Halichoerus grypus*) and harbour (*Phoca vitulina*) seals are native to Irish waters and are found around the coast, although sightings off the south coast of Ireland and in the survey area are few.

Grey and harbour seal, harbour porpoise and bottlenose dolphin are listed on Annex II of the Habitats Directive and all cetaceans are listed on Annex IV, and their conservation status is noted in Section 3.2.7. The indicative seasonal occurrence of cetaceans is given in Table 3.4.

Table 3.3: Cetacean sightings: (i) recorded during the annual Celtic Sea Herring Acoustic Surveys and (ii) extracted from the IWDG Casual Cetacean Sightings database for the Kinsale area and ~150km of adjacent coast

Species	**Celtic Sea Herring Acoustic Surveys (CSHAS) 2008-2020**		**IWDG Casual sightings database 2008-2019**
	Number of years observed (of a maximum of 12)	**Total number of sightings (individuals)**	**Total number of sightings (individuals)**
Toothed cetaceans			
Common dolphin	12	1,230 (15,877)	1,117 (88,867)
Harbour porpoise	11	48 (263)*	588 (2,626)
Bottlenose dolphin	6	8 (40)	202 (1,469)
Risso's dolphin	4	6 (14)	50 (390)
Killer whale	1	1 (3)	10 (26)
Pilot whale	0	0 (0)	1 (5)
Unidentified dolphin	*na*	*81 (674)*	*102 (1,101)*
Baleen whales			
Fin whale	13	139 (237)	658 (2,530)
Minke whale	12	83 (94)	814 (4,665)
Humpback whale	7	19 (26)	245 (543)
Unidentified whale	*11*	75 (95)	*184 (383)*
Total	***na***	***1,690 (17,323)***	***3,971 (102,605)***

*Notes: See main text for a description of the two data sources. * Total harbour porpoise sightings in the CSHASs were heavily influenced by data from the 2016 cruise report where 22 sightings, representing 191 individuals, were reported in the Celtic Deep (>100km east of the Kinsale field); excluding 2016 data yields a total of 19 harbour porpoise sightings totalling 57 individuals.*
Source: Nolan et al. (2014), O'Donnell et al. (2008, 2011, 2012, 2013, 2015, 2016, 2017, 2018, 2019, 2020) Saunders et al. (2009, 2010), IWDG (2020).

Table 3.4: Seasonal occurrence of cetaceans in the Kinsale Area

Species	J	F	M	A	M	J	J	A	S	O	N	D
Harbour porpoise	2	2	2	3	3	2	2	2	2	2	2	2
Common dolphin	2	2	2	2	2	2	2	2	1	1	1	1
Bottlenose dolphin	3	3	3	3	3	3	3	3	3	3	3	3
Risso's dolphin	-	-	-	4	4	3	3	3	4	4	4	-
Minke whale	-	-	4	3	3	3	3	3	2	2	2	4
Humpback whale	3	4	-	4	4	4	3	3	3	3	2	3
Fin whale	4	4	-	-	4	4	3	3	3	2	2	3

Source: Wall et al. (2013) and S. Berrow, IWDG (pers. comm. May 2018) (see additional references provided in text below for additional further information) Notes: Information on seasonal abundance of cetaceans is limited, so this table should be regarded as indicative of general trends. Abundance has been ranked from 1-4, where 1 is "very abundant" and 4 is "low abundance". '-' means no sightings were recorded in that month and/or abundance is considered likely to be extremely low.

Two strata surveyed for marine mammals as part of the ObSERVE programme are relevant to the survey area. These are Stratum 4 (as described above) and Stratum 8, which was only surveyed in summer and winter 2016, and covered 9,506km^2 of coastal waters off the south and south-west coasts. Cetacean sightings and abundance estimates in these two strata are summarised in Table 3.4.

For Stratum 4 (offshore), the abundance of bottlenose, common and unidentified dolphins was considerably higher in winter. The opposite was observed for harbour porpoise, which were by far the most abundant species recorded in Stratum 4 in summer. In Stratum 8 (coastal), both harbour porpoise and all species of dolphin showed higher abundance in summer. Minke whale abundance was estimated to be similar across two summer and one winter surveys, although the number of sightings was low. Within Stratum 8, minke whales were not seen in the winter survey, but observed 20 times in summer, with sightings clustered off the south-west coast. There were very few sightings of pinnipeds off the south coast of Ireland, with those few being clustered in the south-west and south-east, distant to the survey area.

For the general survey area, predicted distribution maps suggested the presence of higher densities of harbour porpoise in summer, bottlenose dolphin in winter, and common dolphin in winter (relative to other surveyed areas for each species). Predicted densities of minke whale in the survey area are higher in summer than winter, with waters off the south-west coast appearing to be of higher importance.

The ObSERVE aerial survey data provide a greater level of quantification and seasonal information on cetaceans than was previously available for waters off the south coast of Ireland. These new data confirm the high diversity of cetacean species off the south coast, along with the seasonal patterns for the area which previous data had suggested.

Figure 3.5: Sightings of toothed cetaceans submitted to the IWDG Casual Cetacean Sightings database from 2008-2019

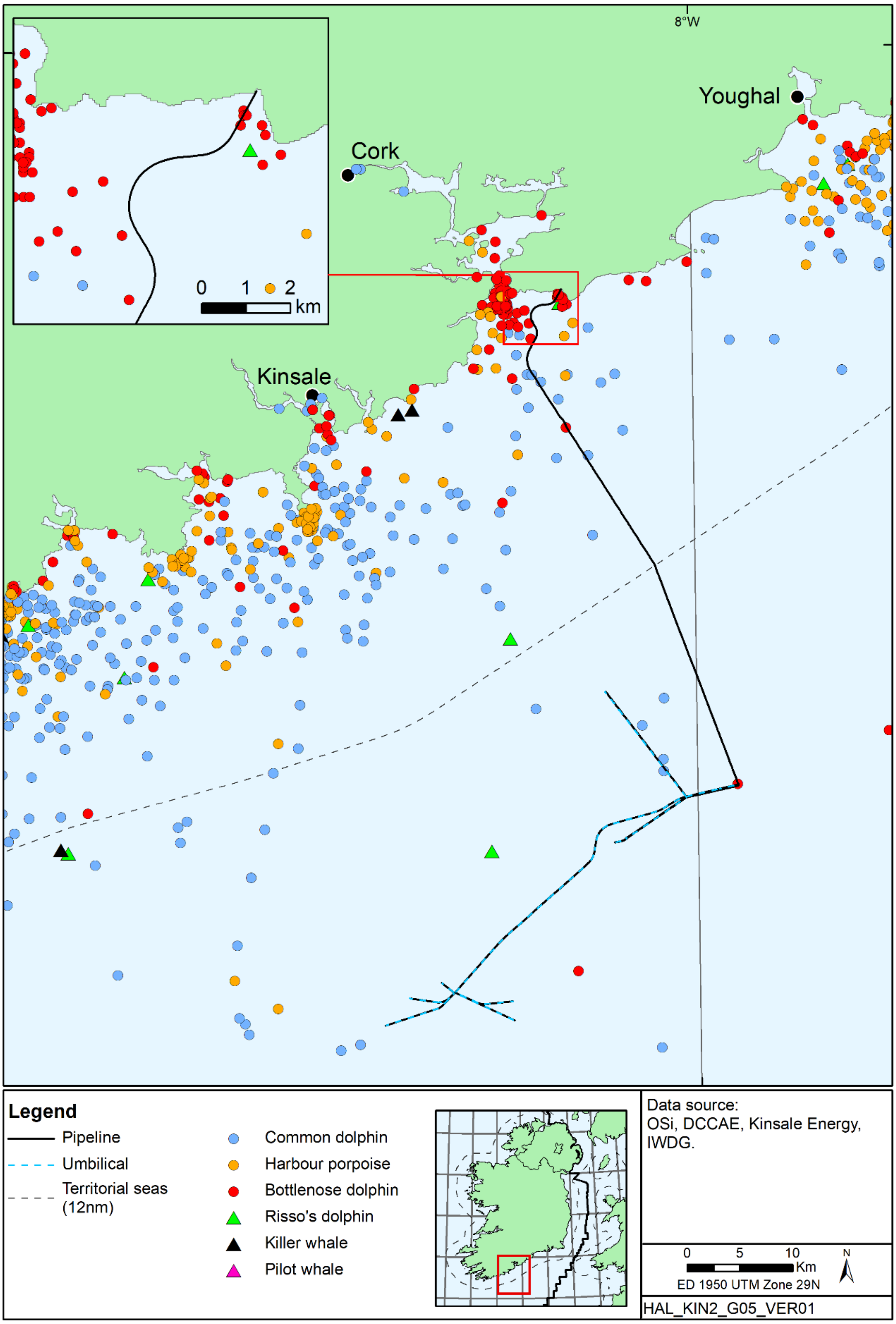


Figure 3.6: Sightings of baleen whales submitted to the IWDG Casual Cetacean Sightings database from 2008-2019

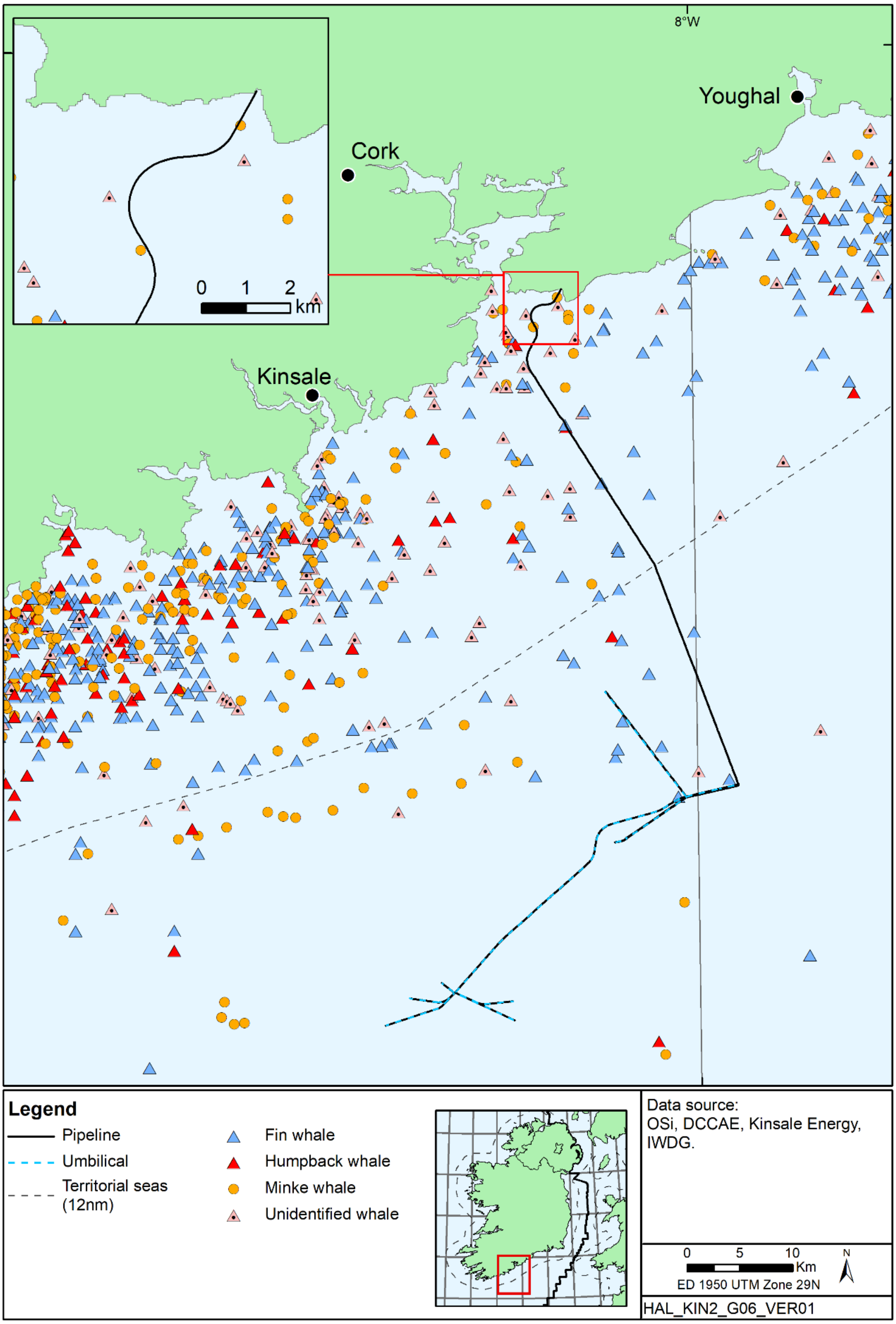


Table 3.4: Cetacean sighting numbers and abundance estimates for waters south of Ireland from the ObSERVE aerial surveys in 2015 and 2016

Species & season	**Stratum 4 (offshore)**		**Stratum 8 (coastal)**	
	N groups (mean group size)	**Abundance; density (CV)**	**N groups (mean group size)**	**Abundance; density (CV)**
Harbour porpoise				
Summer 2015	41 (1.2)	14,190; 0.227 (27.4)	-	-
Winter 2015-16	11 (1.3)	3,752; 0.060 (41.3)	-	-
Summer 2016	42 (1.3)	14,196; 0.227 (37.2)	8 (1.6)	1,977; 0.208 (62.6)
Winter 2016-17	0 (na)	na	3 (1)	568; 0.060 (73.2)
Bottlenose dolphin[1]				
Summer 2015	7 (6)	3,885; 0.062 (64.3)	-	-
Winter 2015-16	26 (2.9)	6,217; 0.098 (28.4)	-	-
Summer 2016	17 (4)	5,549; 0.088 (47.7)	39 (7.2)	11,266; 1.161 (59.9)
Winter 2016-17	91 (7.8)	58,647; 0.929 (22.3)	17 (3.8)	3,322; 0.342 (47.6)
Common dolphin and common/striped dolphin[2]				
Summer 2015	3 (4.5)	2,554; 0.041 (73.8)	-	-
Winter 2015-16	45 (8.9)	40,027; 0.639 (51.5)	-	-
Summer 2016	0	na	5 (5.2)	1,319; 0.139 (45.5)
Winter 2016-17	0	na	2 (4.0)	779; 0.082 (76.0)
Risso's dolphin[1, 3]				
Summer 2015	0	na	-	-
Winter 2015-16	1 (1)	40; 0.001 (101.6)	-	-
Summer 2016	2 (10)	809; 0.013 (94.8)	3 (7.7)	549; 0.057 (50.9)
Winter 2016-17	0	na	0	na
Unidentified dolphin[1]				
Summer 2015	19 (4.9)	4,814; 0.076 (43.9)	-	-
Winter 2015-16	92	27,348; 0.433 (39.0)	-	-
Summer 2016	27 (3.3)	4,982; 0.079 (37.2)	57 (6.2)	10,047 (45.0); 1.035
Winter 2016-17	107 (7.1)	38,413; 0.608 (20.9)	28 (3.5)	4,142 (41.4); 0.427
Minke whale				
Summer 2015	4 (1.0)	836 (66.6); 0.013	-	-
Winter 2015-16	4 (1.0)	751 (64.8); 0.012	-	-
Summer 2016	4 (1.0)	761 (63.3); 0.012	20 (1.0)	2,242 (66.1); 0.236
Winter 2016-17	0	na	0	na
Fin whale[1, 3]				
Summer 2015	0	na	-	-
Winter 2015-16	0	na	-	-
Summer 2016	0	na	0	na
Winter 2016-17	0	na	1 (2.0)	33 (98.4); 0.003

Notes. [1] Abundance estimates for these species are uncorrected for detection probability and are therefore likely to be underestimates. [2.] Includes a small number of sightings where the two species could not be differentiated; as Strata 4 and 8 are restricted to shelf waters and

striped dolphins favour deeper waters, the values presented here can be assumed to be almost exclusively common dolphins. 3. The abundance estimates for Risso's dolphin and fin whale are based on very few sightings, are highly uncertain and should be interpreted with caution. Abundance estimates are rounded to the nearest whole number; CV rounded to 2 decimal places.
Source: Rogan et al. (2018).

Harbour porpoise

The harbour porpoise is the most abundant and widespread species occurring around the Irish coast, commonly seen in shallow coastal waters in the summer, although surveys suggest highest densities along the south coast occur in autumn (Marine Institute 2013). They move further offshore in the spring; although the details of this migration are uncertain, it may be linked to calving (DCENR 2015). Harbour porpoise are generally less often encountered in the Celtic Sea than in the Irish Sea, although it may be that this is a result of lower survey effort and higher sea states off the south coast (Wall *et al*. 2013). In both the CSHAS and selected IWDG casual sightings data (Table 3.2), harbour porpoise are the second most frequently sighted toothed cetacean, seen both close to shore and in offshore waters (Figure 3.5). 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. Harbour porpoise are a designated feature within the Roaringwater Bay and Islands SAC, ~76km to the west of the survey area, with a population that has been consistently estimated at between 150-160 individuals (Berrow *et al*. 2014).

Common dolphin

The common dolphin is Ireland's most common dolphin species and it is most abundant off the south and southwest coasts, where they are often seen in very large groups. They tend to move east over the winter, with sightings off County Cork at their greatest between September and January (Berrow *et al*. 2010). Common dolphins were, by a large margin, the most frequently observed and numerous species during the recent CSHAS and in the IWDG casual sightings data extract. Sightings were widely distributed throughout the waters off the south coast of Ireland (Figure 3.5). Common dolphins typically move further offshore in the summer and are seen in large groups, moving to inshore waters in autumn, probably linked to the presence of large numbers of schooling pelagic fish (Marine Institute 2013).

Bottlenose dolphin

Bottlenose dolphins are present in the Celtic Sea and there is a small semi-resident population present at Cork Harbour, where six individuals have been repeatedly sighted (Ryan *et al*. 2010), with larger numbers visiting the area during the summer. The species is more commonly seen off the west coasts of the country, with sightings peaking in summer (Berrow *et al*. 2010). There are few CSHAS records of bottlenose dolphins in offshore waters off the south coast, although there are occasional opportunistic sightings of the species offshore, including around the Kinsale field (Wall *et al*. 2013, IWDG 2020). Photo-identification data from groups of bottlenose dolphins at several locations around the coast of Ireland have revealed movement of animals between sites separated by 130-650km over durations of 26-760 days, providing evidence that many individuals should be considered highly mobile and transient (O'Brien *et al*. 2009).

Other dolphins

Risso's dolphin are occasionally observed in the wider area, most commonly in the summer months and within a few kilometres of the coast (Wall *et al*. 2013). One Risso's dolphin was recorded outside Cork Harbour during the 2014 CSHAS (Nolan *et al.* 2014), while none were seen off the south coast of Ireland in 2016 or 2017. A small number of killer whales have been recorded off the south coast, primarily during summer (Wall *et al*. 2013). Records of other toothed cetacean species off the south coast (i.e. white-beaked dolphin *Lagenorhynchus albirostris* and long-finned pilot whale *Globicephala melas*) are very rare and these species would be highly unlikely to be present in the survey area.

Baleen whales

Baleen whales are sighted along the south coast of Ireland primarily from late summer through autumn. Minke whales are observed in most months of the year, but are most frequently seen from April to November (Berrow *et al*. 2010). The larger fin and humpback whales are regularly observed in small numbers both close to the coast and further offshore, primarily in autumn and winter when these waters are a known foraging ground (Marine Institute 2013). Fin whales sightings peak in November (Berrow *et al*. 2010, Whooley *et al*. 2011), and they were the most frequently sighted and most numerous baleen whale in the CSHAS data (Table 3.2). Photo-identification data were collected from whale-watching vessels over 79 trips from 2003-2008, which resulted in the identification of 62 individual fin whales, of which 11 were sighted across multiple years (Whooley *et al*. 2011). Ryan *et al*. (2016) analysed several hundred humpback whale sightings from the IWDG casual database collected from 1999-2013, revealing an annual easterly movement along the southern coast; most sightings in the wider survey area occurred from October-December.

Grey seals

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 as such, the largest colonies are found on exposed islands off the west and southwest coasts. The closest major colony to the survey area is at Roaringwater Bay. They are a designated feature of the Roaringwater Bay and Islands SAC, where a permanent population of up to 150 individuals is estimated (NWPS website). The total grey seal population of Ireland has been estimated at between 5,500 and 7,000 individuals (Ó Cadhla *et al*. 2008) and Duck & Morris (2013) estimated that 9% were present along the County Cork coast. Grey seals may forage at distances of up to 100km from their haul-out (Jones *et al*. 2015). Distances travelled by seals tagged on Great Blasket Island in County Kerry by Cronin *et al*. (2011) were variable. It was found that larger seals spent longer foraging at sea but travelled shorter distances, while smaller seals were found to travel as far as the Western Isles of Scotland, utilising haul-out sites along the way. The seals were found to spend more time at sea during the summer.

Marine usage maps for the UK and Ireland based on extensive tagging data suggest a very low occurrence of grey seals in the survey area, with animals present in waters around the south coast of Ireland focused off southwest Cork and southeast Wexford (Jones *et al*. 2015). Grey seals were observed in five of the 11 annual CSHAS from 2008-2018, comprising 14 sightings of single seals, most of which were close to the coast (e.g. O'Donnell *et al.* 2018).

Harbour seals

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*. 2008, 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 and foraging behaviour seems to vary with geographical location. The Irish population of harbour seal was estimated at 3,000-4,150 individuals (DCENR 2015) and Duck & Morris (2013) estimated 13% of the total population were present along the County Cork coast.

Marine usage maps for the UK and Ireland based on extensive tagging data suggest a very low occurrence of harbour seals in the survey area, with animals present in waters around the south coast of Ireland focused off southwest Cork and Kerry (Jones *et al*. 2015).

No confirmed harbour seal sightings occurred off the south coast of Ireland in any of the 12 annual CSHAS.

3.2.7 Conservation sites and species

Relevant conservation sites (see Figures 3.7 and 3.8) include Natura 2000 sites (SACs and SPAs), some of which are also OSPAR MPAs or coincident with Ramsar designations (e.g. Cork Harbour, Ballycotton Bay and Blackwater Estuary) which are designated as wetlands of international importance. The conservation sites labelled in the figures reflect those considered to be relevant to the survey area; for SACs and SPAs, this considers the potential for relevant mobile qualifying features to be present which are some distance from site boundaries based on reported foraging ranges (after Woodward *et al.* 2019).

National designations (Figure 3.9) along the coast include Natural Heritage Areas and proposed Natural Heritage Areas, which were created under the *Wildlife Amendment Act 2000* and are protected from damage, though they have largely terrestrial components and are not considered to be relevant to the proposed survey.

Figure 3.7: SACs

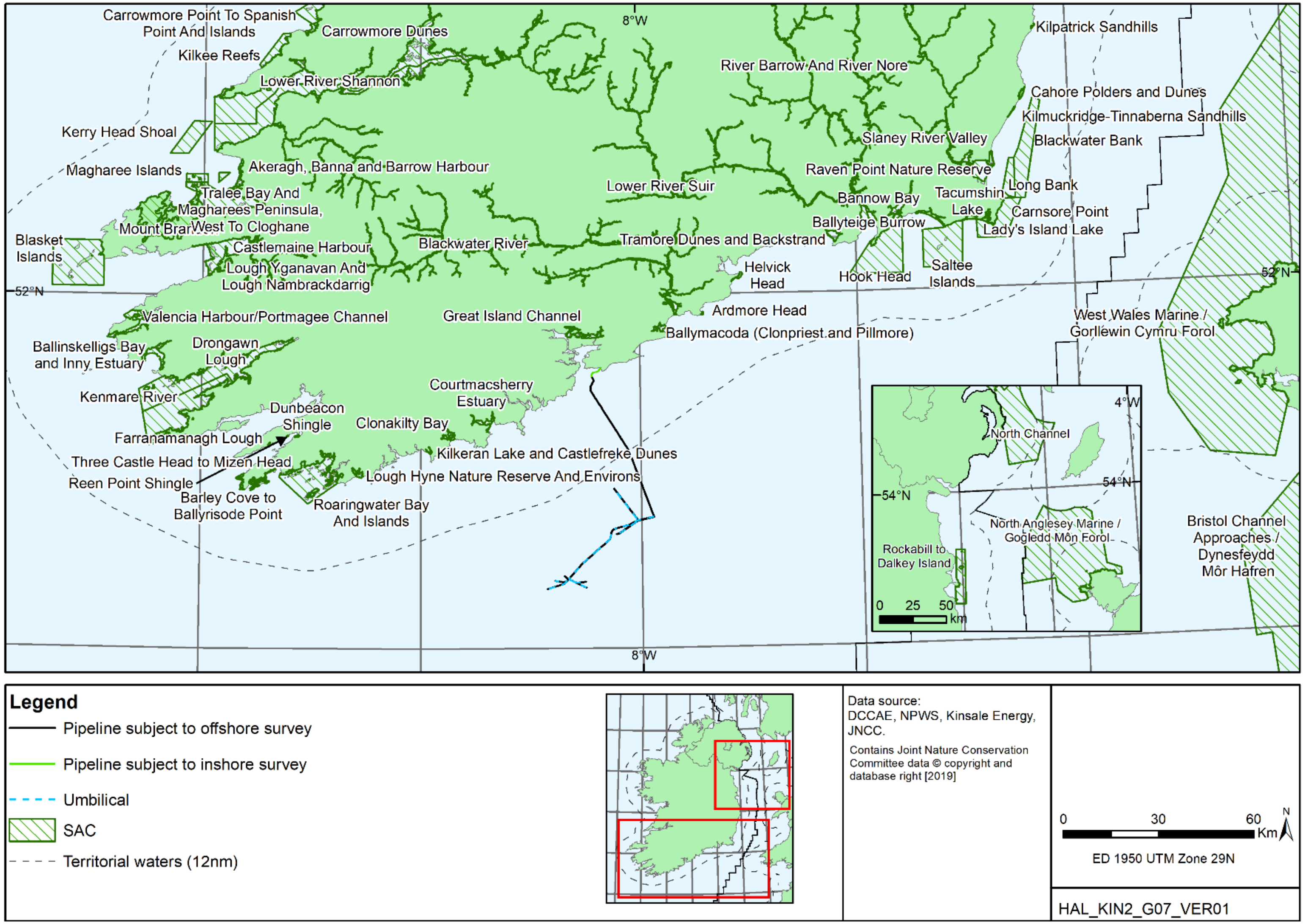


Figure 3.8: SPAs

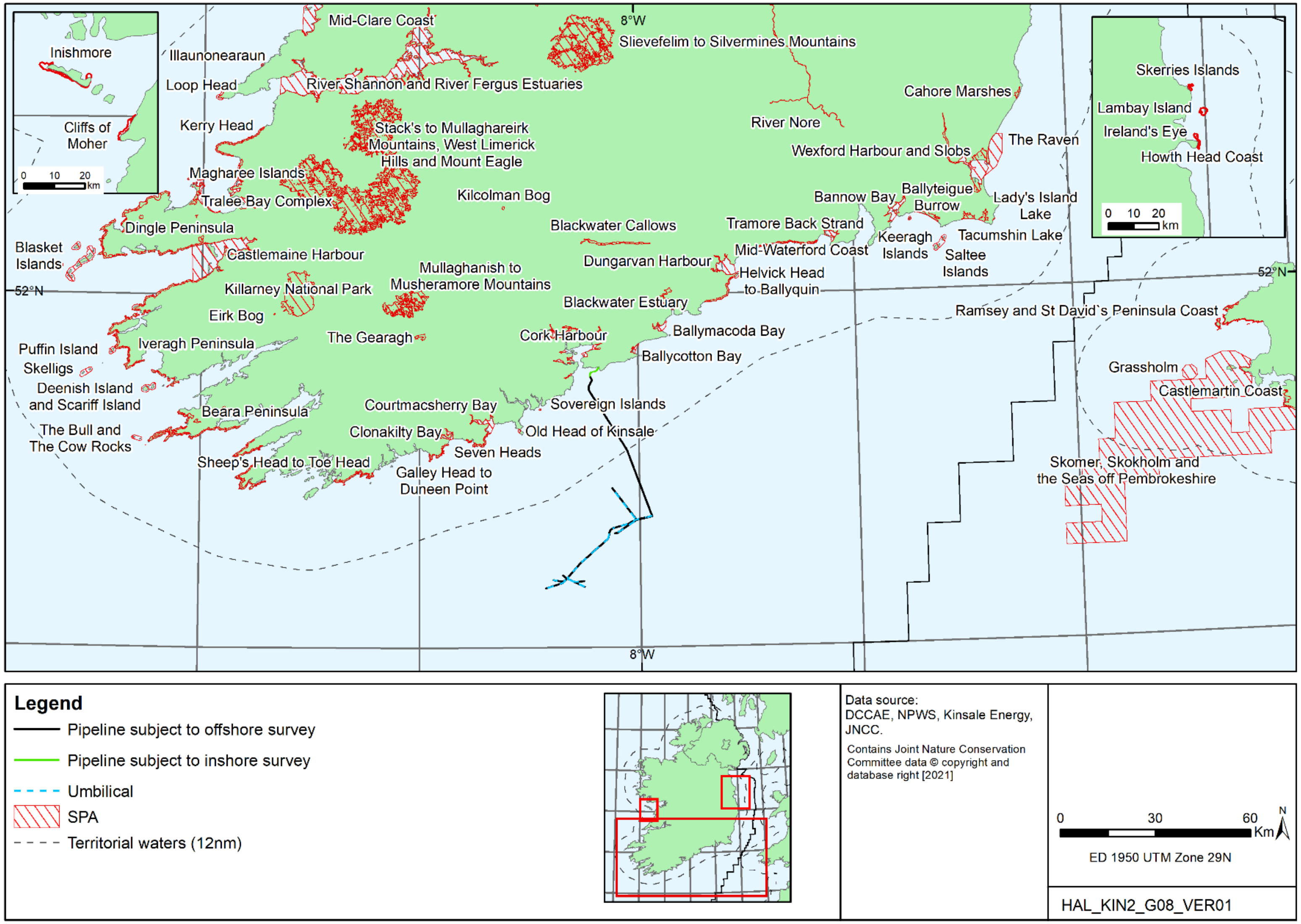
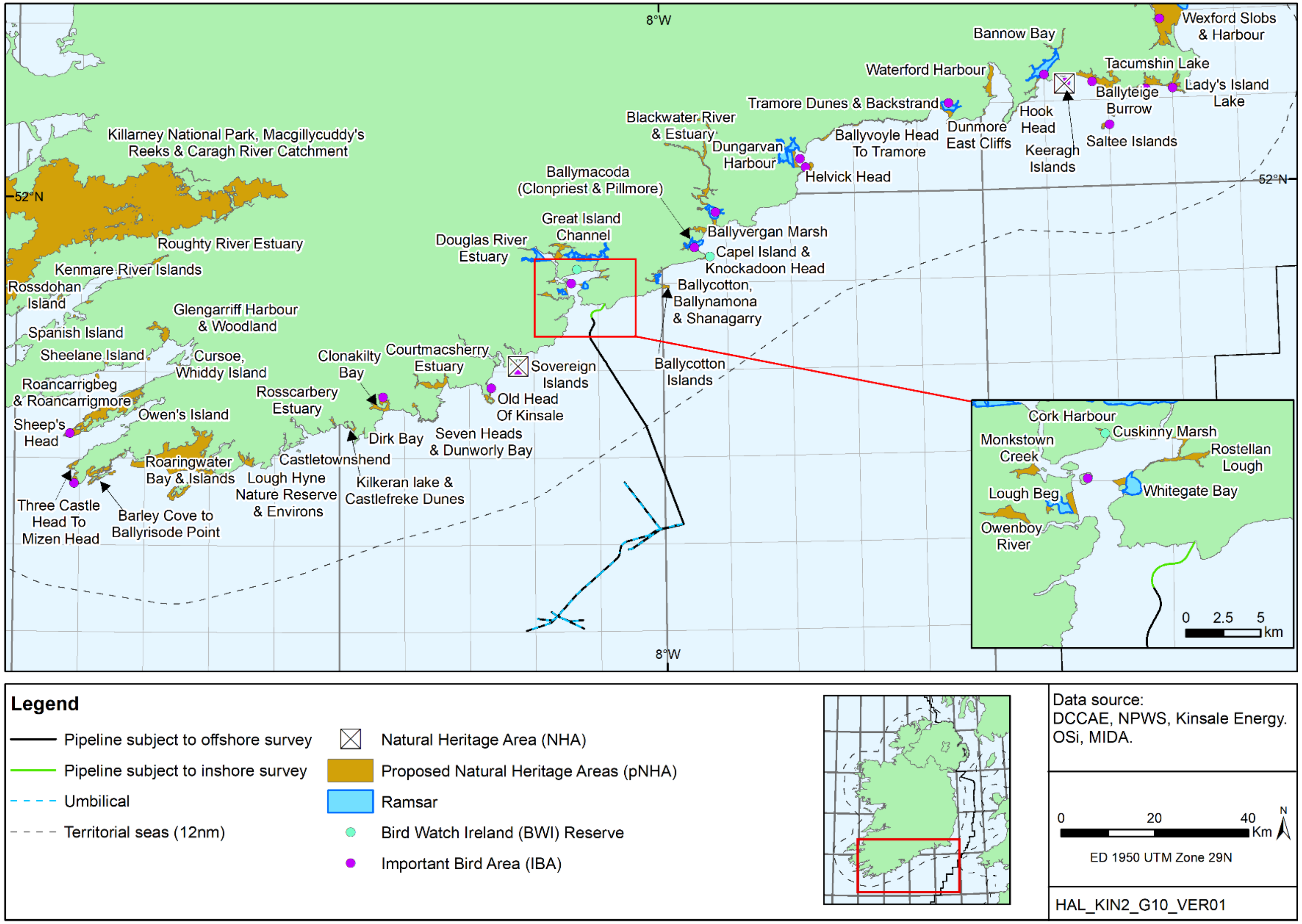


Figure 3.9: Other conservation sites



Habitats Directive Annex IV species that could potentially occur in the survey area are listed in Table 3.5. The known abundance and distribution of these species in the Celtic Sea, and of relevance to the survey area, is described in Section 3.2.4 and 3.2.6.

Table 3.5: Annex IV species relevant to the survey and wider Kinsale area

Group	Common Name	Scientific Name	Habitats Directive Annex (es)
Cetaceans	Harbour porpoise	*Phocoena phocoena*	II and IV
	Common dolphin	*Delphinus delphis*	IV
	Bottlenose dolphin	*Tursiops truncatus*	II and IV
	Risso's dolphin	*Grampus griseus*	IV
	Killer whale	*Orcinus orca*	IV
	Striped dolphin	*Stenella coeruleoalba*	IV
	Northern right whale	*Eubalaena glacialis*	IV
	Blue whale	*Balaenoptera musculus*	IV
	Atlantic white-sided dolphin	*Lagenorhynchus acutus*	IV
	White-beaked dolphin	*Lagenorhynchus albirostris*	IV
	Long-finned pilot whale	*Globicephala melas*	IV
	Northern bottlenose whale	*Hyperoodon ampullatus*	IV
	Minke whale	*Balaenoptera acutorostrata*	IV
	Humpback whale	*Megaptera novaeangliae*	IV
	Fin whale	*Balaenoptera physalus*	IV
	Sei whale	*Balaenoptera borealis*	IV
Marine Reptiles - Turtles	Leatherback turtle	*Dermochelys coriacea*	IV
	Loggerhead turtle	*Caretta caretta*	IV
	Kemp's Ridley turtle	*Lepidochelys kempii*	IV
	Hawksbill turtle	*Eretmochelys imbricata*	IV
	Green turtle	*Chelonia mydas*	IV

3.3 Other Users

3.3.1 Offshore energy: renewables and oil & gas

No offshore energy developments are located within or in close proximity to the proposed surveys, however, there have been a number of recent Foreshore Licence applications for site investigations relating to potential projects in the territorial and offshore waters of Ireland, these include several areas offshore of Co. Cork (Figure 3.9). The site investigations include those for the Emerald project, led by Simply Blue Energy and Shell, and Inis Ealga Marine Energy Park, led by DP Energy Ireland Ltd and Iberdrola. To date, the investigations concentrate on territorial waters. However, it is the intention of the applicants to submit further applications which would cover offshore waters, and for the Emerald project, this would include the Kinsale Area[7].

Applications have not been made in relation to the development phases of these projects, which are both at an early/conceptual stage. The Emerald project is intended to be a 1.3GW floating offshore wind farm constructed in two phases, located approximately 35-60km offshore. The Inis Ealga Marine Energy Park is similarly proposed to be a floating offshore wind farm, with a capacity of 1GW. The proposed array areas for both wind farms are located in offshore waters (i.e. seaward of 12nm from the coast).

3.3.2 Shipping

Vessel traffic in the coastal regions of the Celtic Sea is generally moderate, and higher along routes connecting major ports in the south including Cork and Waterford; higher traffic around the KA and KB platforms is generally associated with support and standby vessels which were routinely present, and more recently, are associated with decommissioning activity as part of the wider KADP. A shipping study based on AIS data completed for IOSEA4 (DCENR 2011) indicated that generally up to 300-750 vessels per year were present in waters off the south coast of Ireland and in the vicinity of the offshore survey area (see other data sources including MMO 2014 and subsequent data updates, and EMODnet 2019[8], Figure 3.10), however, the inshore survey is located is a lower density shipping area, frequented primarily by recreational and inshore fishing vessels.

No IMO routeing measures or designated anchorages are located in or close to the proposed survey area.

3.3.3 Fisheries

The seas around Ireland are among the most productive in EU waters and most fisheries resources come under the remit of the Common Fisheries Policy (CFP). In 2020, the Irish fleet had access to 195,221 tonnes of fish at a potential value of €252 million (Marine Institute 2020). The largest ports near the survey area are Castletownbere and Dunmore East, which are both among the top four ports (by landings) in Ireland (SFPA website[9]). Of the more local ports, the most significant in 2020 were Union Hall (1,845 tonnes, €5.9 million), Kinsale (1,270 tonnes, €2.9 million) and Kilmore Quay (3,793 tonnes, €16.9 million) (SFPA website).

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[7]Emerald Project: https://www.gov.ie/en/foreshore-notice/61ccf-simply-blue-emerald-site-investigations-for-possible-floating-offshore-wind-project-off-kinsale/, Inis Ealga: https://www.gov.ie/en/foreshore-notice/c9ea6-dp-energy-site-invesigations-at-inis-ealga/

[8] 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

[9] https://www.sfpa.ie/Statistics/Annual-statistics/Annual-Statistics/2018-Statistics

Figure 3.9: Relevant Foreshore Licence applications related to offshore wind site investigations

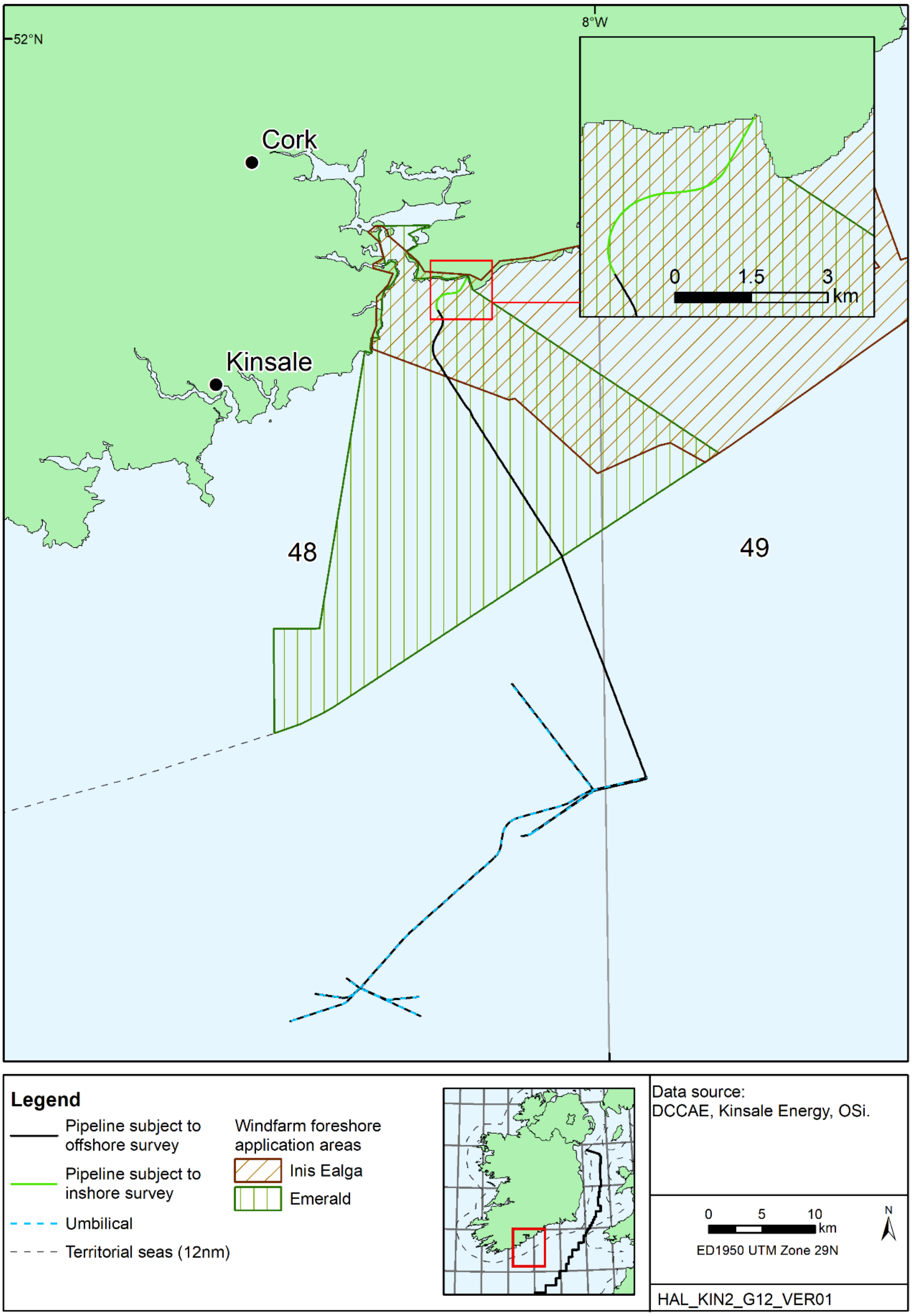
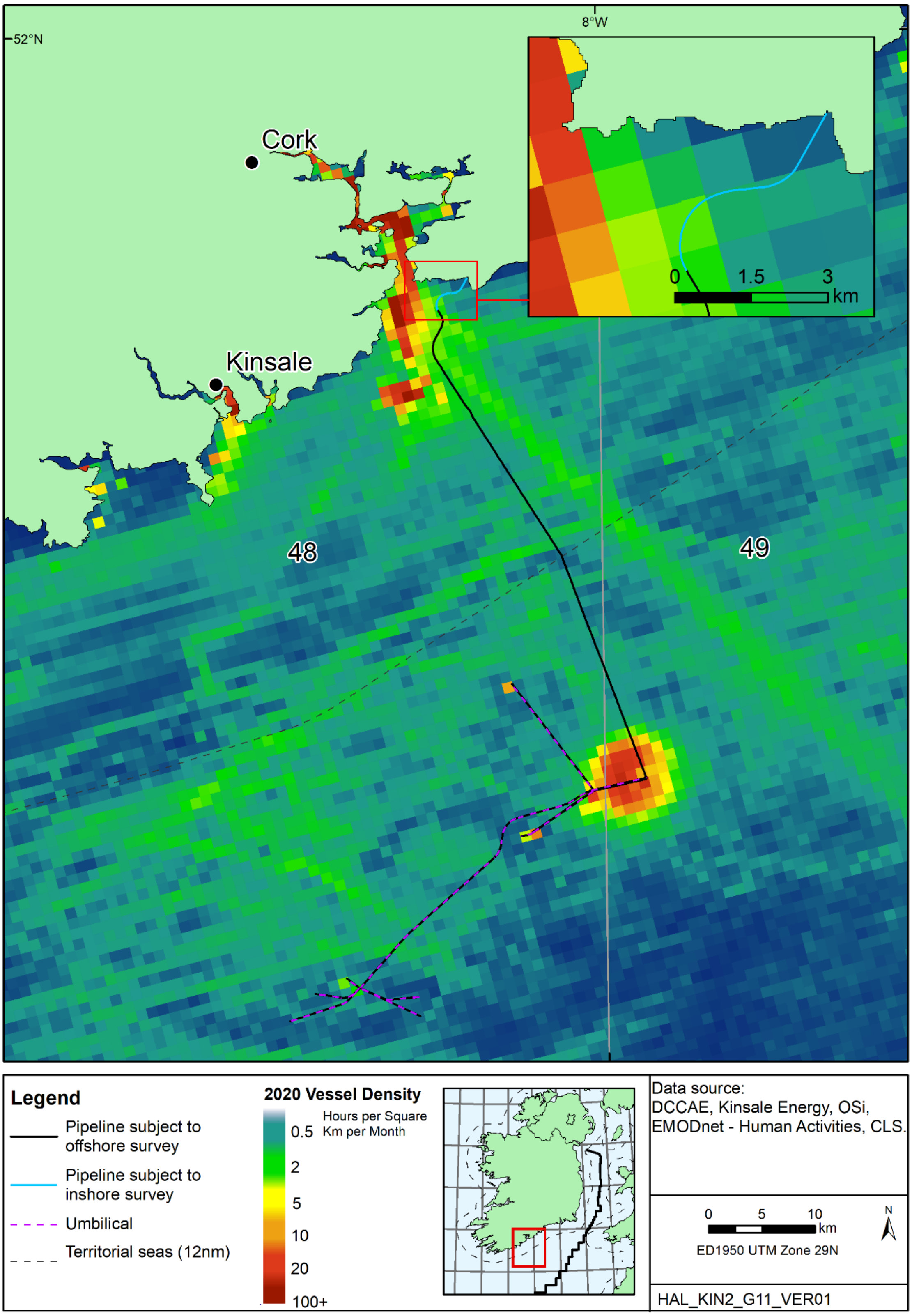


Figure 3.10: Shipping in the survey area



The dominant fishing method in the area is demersal (otter) trawling (Figure 3.11), which is, in the waters around the survey area, mainly used to catch *Nephrops*, haddock and whiting (Gerritsen & Kelly 2019). Other gears in use in the area include pelagic trawls (predominantly targeting herring in the area), seine nets (targeting haddock and whiting) and gill nets (targeting pollack and hake) (Gerritsen & Kelly 2019). Anatec (2017) conducted a survey of fishing activity within the Kinsale Area. A monthly count of fishing vessels over 2014 and 2015/16 (also see Figure 3.12) showed the busiest month to be February 2016, with 540 vessel-days recorded by 77 different vessels within the study area. The most common gear types were single demersal trawlers (30%), single pelagic trawlers (20%), gill netters (19%), beam trawlers (8%) and long liners (7%). Purse seines, twin trawlers (which may be demersal or pelagic) and dredgers all contributed 4%, while potters/whelkers contributed 2%, primarily in coastal waters. Over 90% of all vessels were Irish-registered, and 70% were registered to ports on the south coast.

The south coast of Ireland is of particular importance for smaller vessels (<12m), which tend to be local, fishing from, and landing at home ports. Fishing is restricted within the Irish Conservation Box (or Biologically Sensitive Area), within which vessels >10m must report their movements into and out of the zone, and record their catch every two hours. ICES rectangles are used for fisheries data recording and management. Table 3.6 lists the weight and value of landings from ICES rectangles relevant to the survey area over the period 2014-2016.

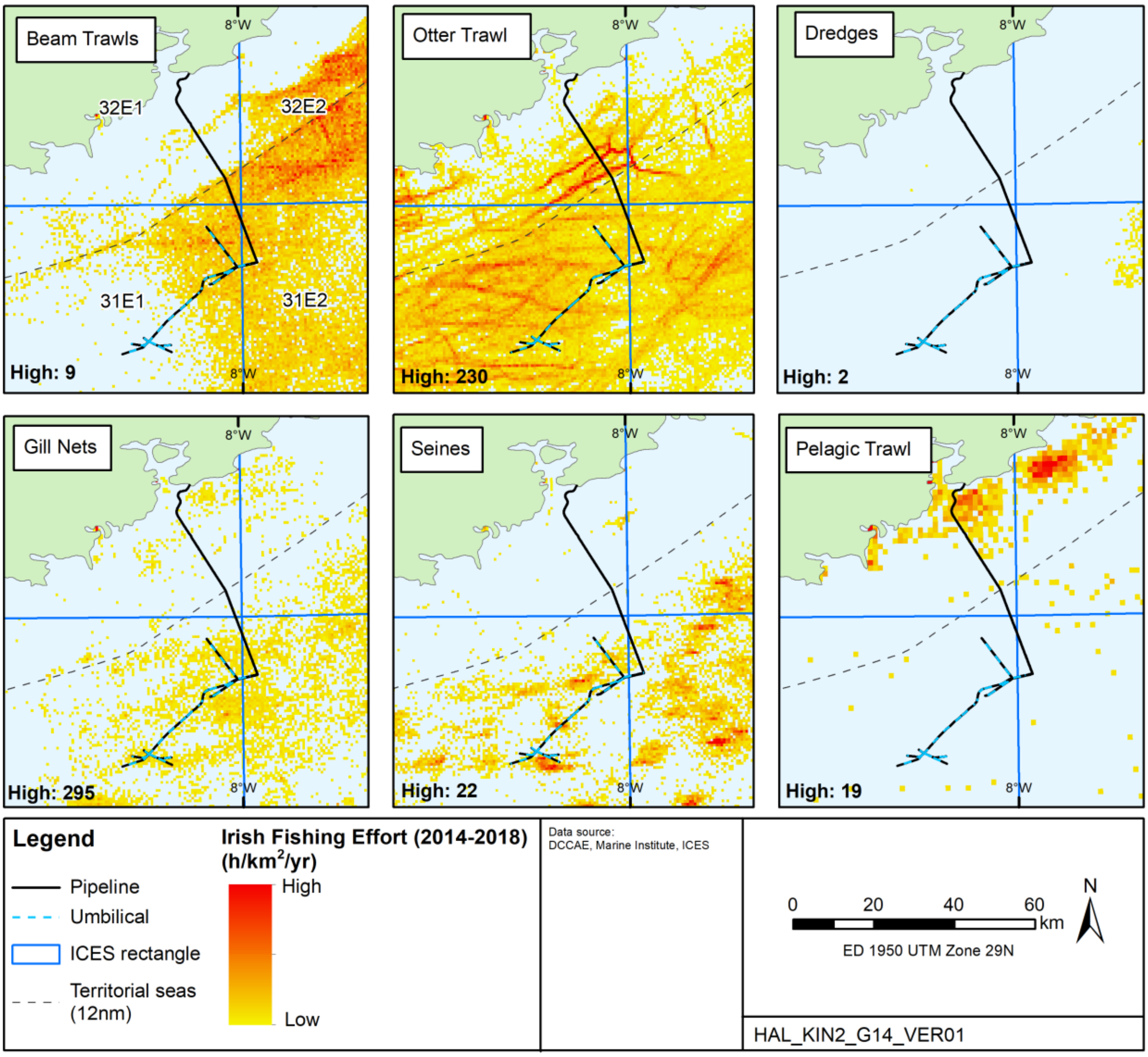
Table 3.6: Weight and value of landings from ICES rectangles 31E1, 31E2 & 32E1, 2014-2016

Species type	2014		2015		2016	
	Live weight (tonnes)	Value (€)	Live weight (tonnes)	Value (€)	Live weight (tonnes)	Value (€)
31E1						
Pelagic	178	88,257	38	12,646	2	1,331
Demersal	1,407	3,127,042	1,993	4,429,025	2,244	4,866,119
Shellfish	103	705,903	128	878,350	172	1,185,287
Total	**1,689**	**3,921,201**	**2,159**	**5,320,021**	**2,418**	**6,052,738**
31E2						
Pelagic	5,458	1,779,804	1,706	558,566	84	27,951
Demersal	1,739	3,700,550	1,982	4,313,845	1,795	3,859,776
Shellfish	34	195,763	56	326,403	36	222,516
Total	**7,231**	**5,676,123**	**3,744**	**5,198,815**	**1,915**	**4,110,243**
32E1						
Pelagic	815	156,201	277	99,996	457	116,872
Demersal	511	1,152,666	325	785,269	368	817,341
Shellfish	138	950,196	130	890,759	134	875,031
Total	**1,463**	**2,259,063**	**732**	**1,776,024**	**959**	**1,809,244**
Grand Total	**10,383**	**11,856,387**	**6,636**	**12,294,859**	**5,291**	**11,972,224**

Source: Compiled from data supplied by Sea Fisheries Protection Authority (SFPA)

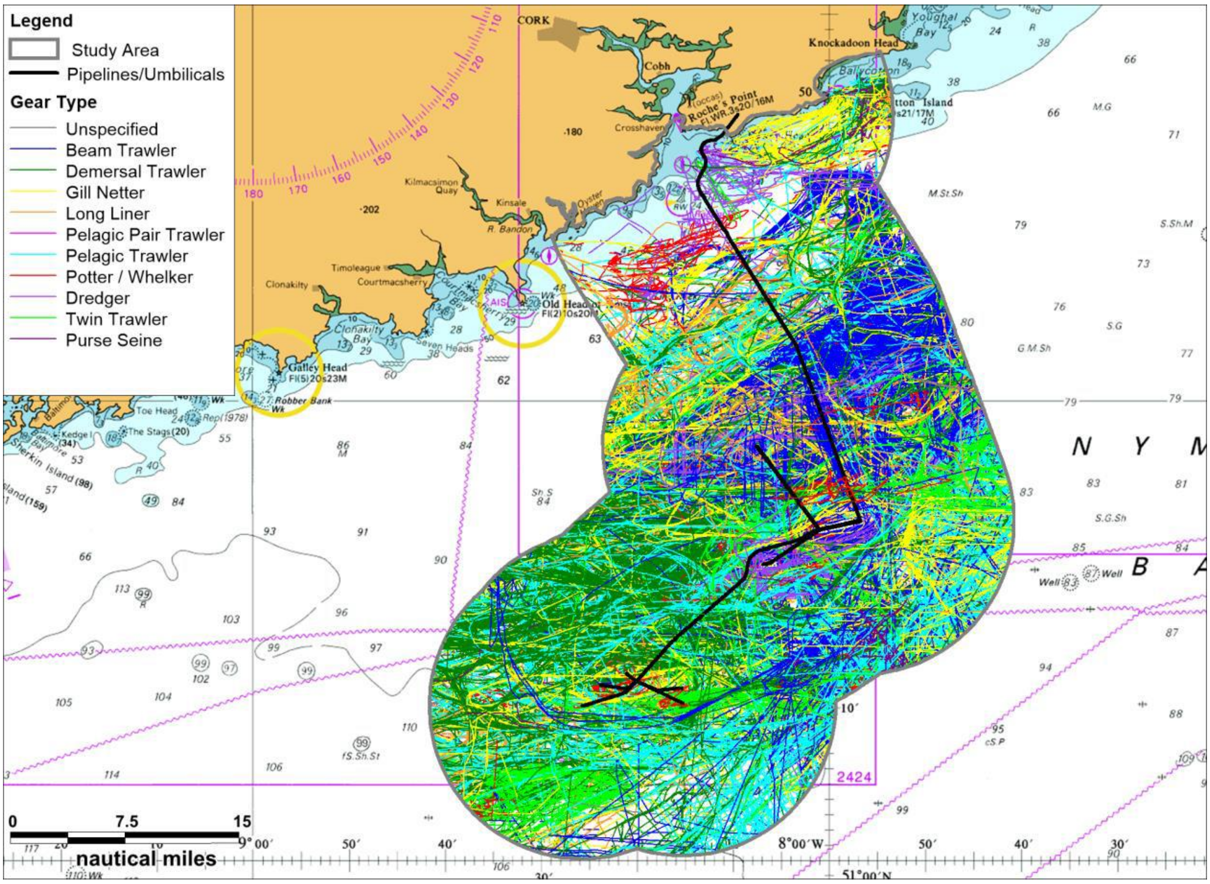
The status of commercial fish and shellfish populations was considered in relation to MSFD Descriptor 3[10] in the Initial Assessment of Ireland's marine waters (Marine Institute 2013). Monitoring of commercial fisheries in Ireland for MSFD is based on data collected under the Common Fisheries Policy, with the Marine Institute (2019) indicating that for 2019, 47% (35) of fish stocks were sustainably fished, 18% (13) overfished and with the remaining stocks (26) having an unknown status. Overall fishing pressure on commercial fish and shellfish stocks in the Celtic Sea have declined since a peak in 1998, and there has been a corresponding increase in stock biomass with gradual progress towards sustainability (Marine Institute 2017).

Figure 3.11: Fishing effort in the Kinsale Area, 2014-2018



[10] Populations of all commercially exploited fish and shellfish are within safe biological limits, exhibiting a population age and size distribution that is indicative of a healthy stock.

Figure 3.12: Vessels estimated to be actively engaged in fishing (2014 & 2015/16)



Source: Anatec (2017)

3.3.4 Military activity

Military Practice and Exercise Areas (PEXAs) located in Irish waters are used for aircraft and ship manoeuvres or in ranging and bombing practice. There are a number of military installations and firing ranges along the Irish coast, the largest of these include the naval base at Haulbowline in Cork Harbour. There are no PEXA danger areas located within or close to the survey area.

3.3.5 Subsea cables

Existing subsea cables (Hibernia Atlantic, Hibernia Express) are some distance from the survey area. Two cables (the Celtic Interconnector electricity and the Ireland France subsea fibreoptic cable) are proposed to be installed in the Celtic Sea, but both are some distance from the survey area, and their installation is not expected until after the surveys have taken place.

3.3.6 Aggregates

In general, no significant marine aggregate extraction takes place in Ireland (DCENR 2015), with areas identified to potentially supplement terrestrial aggregate sources identified in the western Irish Sea to the north, some distance from the survey area (Sutton 2008).

3.3.7 Recreation and tourism

Recreational activities are concentrated at the coast, with the most relevant activities to the survey area being sea angling, sailing/boating and whale and dolphin watching, primarily from Cork Harbour and Kinsale, as well as other smaller centres along the Cork coast.

An online review of sea angling charter operators in the region (see Ramboll 2017a, b) indicated that most offered half-day to one-day trips (i.e. angling, wreck, reef and shark angling) and were generally licensed to operate within a 30 nautical mile (56km) radius of the harbour, with only a few companies with a licence to operate up to approximately 40 nautical miles (74km). However, Angling Ireland indicates that most offshore angling trips are likely to be within 32km of the coast[11].

As part of an assessment of coastal recreational activity and capacity for increased boating in Cork Harbour (Kopke *et al.* 2008), a 'spill out area' was estimated to take account of boats that left the harbour on day trips. It was estimated that an average boat travelling at 6-7 knots (3.1-3.6m/s) under favourable conditions and with the desire to return to the harbour the same day, could travel a distance of approximately 24km.

3.3.8 Cultural heritage

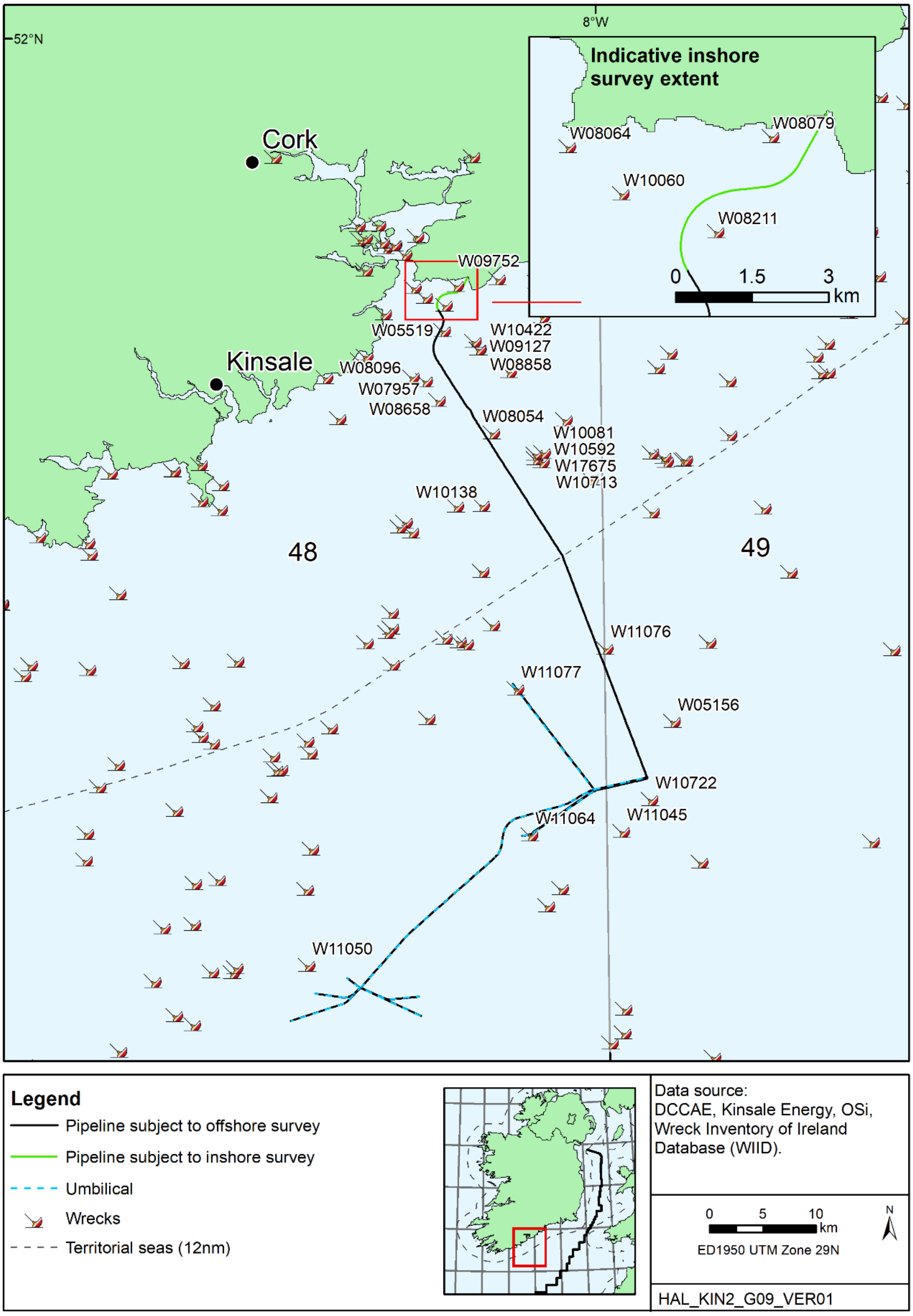
Wrecks over 100 years old and archaeological objects found underwater are protected under the *National Monuments (Amendment) Acts 1987* to *2004*. Significant wrecks less than 100 years old can be designated by Underwater Heritage Order (UHO) on account of their historical, archaeological or artistic importance. The Archaeological Diving Company Ltd. (ADCO) carried out a desk-top Cultural Heritage Assessment in November 2018 covering the Kinsale Area which included the subsea fields which are the subject of the proposed surveys.

A number of wrecksites were identified in relatively close proximity to the Kinsale Area pipelines by ADCO (2018), and those within 5km of the pipelines are shown in Figure 3.13. The closest wreck to any of the Seven Heads pipelines is W11050 (unnamed) which is 2.7km away and some distance from the proposed survey coverage. Similarly, wrecks associated with the Kinsale Head infield pipelines are at least 1.7km distance (W10722, unnamed), with others being closer to the Western Drill Centre pipeline (W11064, unnamed, 190m) and Ballycotton pipeline (W11077, unnamed, 30m). There are several charted wrecksites that lie close to the export which include W1076 (unnamed, 700m), W08054 (*Carrabin*, 680m), the W08211 (*Elizabeth Jane*, 600m) and W5519 (UC-42, 30m).

The proposed survey activities are non-intrusive and therefore there is no possible impact on any wreck locations.

[11] http://www.fishinginireland.info/sea/index.htm

Figure 3.13: Wrecks



4 IDENTIFICATION OF POTENTIALLY SIGNIFICANT EFFECTS

4.1 Introduction

This addendum to the EIAR is intended to provide an environmental appraisal of the potential for direct and indirect significant effects of the proposed survey programme as outlined in Section 2, in order to provide the relevant information to allow the Competent Authority to make a decision on whether consent for the activities can be granted.

4.2 Approach to Assessment of Potential Effects

Effects likely to arise from the survey programme (relevant to those factors within the meaning of Article 3(1) of the EIA Directive[12]) have been identified on the basis of the nature of the project as described in Section 2 (including its location, physical and operational characteristics, residues, emissions and wastes), considered against the description of the environment in Section 3, and the understanding of impact pathways from a range of sources, including:

- Regional and site specific environmental data, including a number of field-specific surveys previously undertaken in the Kinsale area, most recently in 2017
- Vessel and survey equipment specifications
- Experience of relevant aspects and operations of analogous projects in the Celtic Sea, Irish Sea, North Sea and elsewhere
- Peer reviewed scientific papers describing the effects of specific and analogous interactions
- Other publicly available “grey” literature
- The Irish Offshore Strategic Environmental Assessment (IOSEA) 4 Environmental Report and
- Irish Offshore Strategic Environmental Assessment (IOSEA) 5 Environmental Report
- Relevant conservation site designations, potential designations, and any site advice
- Applicable legislation, guidance and policies

Defined consequence and likelihood criteria (Table 4.1) were used to screen for the potential effects of the survey activities (Table 4.2). These are primarily based on a modified version of United Kingdom Offshore Operators Association (UKOOA) Environmental Impact Assessment Guidelines (UKOOA 1998), and taking account of relevant EPA Advice Notes on preparing EIA documents (EPA 2015, 2017) and European Commission guidance (EC 2017). It allows for the consideration of effect likelihood, scale, duration and frequency (Table 4.2), and forms the basis for those sources of potential effect considered further in Section 5.

The identification of potential effects (positive or negative) considered those which are direct and indirect, and which could lead to cumulative or transboundary effects. The vulnerability of the project to risks of major accidents and/or disasters of relevance has also been considered. While this includes a consideration of potential major accidents, as the Celtic Sea shows relatively little seismicity and is not prone to significant natural disasters, the potential for effects to be generated by such events has not been considered.

[12] a. Population and human health; b. Biodiversity, with particular attention to species and habitats protected under Directive 92/43/EEC and Directive 2009/147/EC, c. Land, soil, water, air and climate; d. Material assets, cultural heritage and the landscape; e. The interaction between the factors referred to in points (a) to (d).

Table 4.1: High level description of the criteria used to consider potential environmental effects

Effect	Consequences
None Foreseen	**No detectable effects**
Positive	Activity may contribute to recovery of habitats Positive benefits to local, regional or national economy
Negligible	Change is within scope of existing variability but potentially detectable.
Moderate	Change in ecosystem leading to short term damage with likelihood for recovery within 2 years to an offshore area less than 100 hectares or less than 2 hectares of a benthic fish spawning ground Possible but unlikely effect on human health Possible transboundary effects Possible contribution to cumulative effects Issue of limited public concern May cause nuisance Possible short term minor loss to private users or public finance
Major	Change in ecosystem leading to medium term (2+ year) damage with recovery likely within 2 - 10 years to an offshore area 100 hectares or more or 2 hectares of a benthic fish spawning ground or coastal habitat, or to internationally or nationally protected populations, habitats or sites Transboundary effects expected Moderate contribution to cumulative effects Issue of public concern Possible effect on human health Possible medium term loss to private users or public finance
Severe	Change in ecosystem leading to long term (10+ year) damage with poor potential for recovery to an offshore area 100 hectares or more or 2 hectares of a benthic fish spawning ground or coastal habitat, or to internationally or nationally protected populations, habitats or sites Major transboundary effects expected Major contribution to cumulative effects Issue of acute public concern Likely effect on human health Long term, substantial loss to private users or public finance

Frequency with which activity or event might occur	Likelihood
Unlikely to occur	**Remote**
Once during activity	**Unlikely**
Foreseeable possibly once a year	**Possible**
Once a month or regular short term events	**Likely**
Continuous or regular planned activity	**Definite**

	Likelihood				
Consequences	Definite	Likely	Possible	Unlikely	Remote
Severe	A5	A4	A3	A2	A1
Major	B5	B4	B3	B2	B1
Moderate	C5	C4	C3	C2	C1
Negligible	D5	D4	D3	D2	D1
Positive	E5	E4	E3	E2	E1
None foreseen					

Key for Table 4.2	
(dark blue)	Potentially significant effects requiring assessment (see Section 5)
(light blue)	Potential positive or minor or negligible effects
(white)	No likely effects

Table 4.2: Matrix of potential activity/environment interactions

Activity/Source of Potential Effect	Population and human health	Biodiversity, with particular attention to species and habitats protected under Directive 92/43/EEC and Directive 2009/147/EC							Land, soil, water, air, climate			Material assets, cultural heritage and landscape						Summary consideration
		Benthic Fauna	Plankton	Fish and Shellfish	Marine Reptiles	Marine Mammals	Waterbirds & Seabirds	Conservation Sites and Species[2]	Soils & seabed[2]	Water quality	Air & climate	Fisheries & aquaculture	Other users & resources[3]	Shipping	Waste treatment & landfill resource onshore	Cultural heritage	Landscape/seascape	
Power generation on survey vessels	D1										D3							There will be minor and temporary atmospheric emissions from the survey vessels during transit and working in the field which will be incremental to those of wider shipping in the Kinsale area. It is estimated that a representative vessel working for 5 days would use ~35 tonnes of diesel, generating ~113tCO_2eq[13]. These will make a contribution to global greenhouse gas concentrations and local air quality, but these are extremely small in a regional context. **Potential for significant effects discounted**

[13] These emissions associated with the fall pipe vessel have already been considered in the EIAR for the KADP. These are not considered again here as the only relevant aspect of the rock placement that is subject to this assessment is the use of survey equipment to record the position of the rock berms.

		Biodiversity, with particular attention to species and habitats protected under Directive 92/43/EEC and Directive 2009/147/EC							Land, soil, water, air, climate			Material assets, cultural heritage and landscape						
Activity/Source of Potential Effect	**Population and human health**	**Benthic Fauna**	**Plankton**	**Fish and Shellfish**	**Marine Reptiles**	**Marine Mammals**	**Waterbirds & Seabirds**	**Conservation Sites and Species[2]**	**Soils & seabed[2]**	**Water quality**	**Air & climate**	**Fisheries & aquaculture**	**Other users & resources[3]**	**Shipping**	**Waste treatment & landfill resource onshore**	**Cultural heritage**	**Landscape/seascape**	**Summary consideration**
Discharges and wastes			D2	D2						D2								The vessels used for the surveys will meet MARPOL requirements (e.g. in relation to Annex I and Annex IV on the prevention of pollution by oil and sewage from ships respectively, under the Sea Pollution Act 1991 as amended). Similarly, the vessels will meet MARPOL Annex V requirements. This includes the implementation of a Garbage Management Plan (under the Sea Pollution Act 1991 as amended and the Sea Pollution (Prevention of Pollution by Garbage from Ships) Regulations 2012 as amended) which details specific waste management procedures, documents the segregation and safe handling and storage of waste and waste reduction measures. Wastes including litter will be retained on the vessels and disposed of at a suitable reception facility on return to shore. Kinsale will ensure that such plans are in place as part of standard contractor management. **Potential for significant effects discounted**
Noise generated from survey equipment and survey vessels	C3			C3	C3	C3	C3	C3				C3						The surveys will include the use of noise generating equipment (Section 2) and contribute to underwater noise with the potential for impact on noise sensitive species which include fish, marine mammals and seabirds, which include species subject to conservation, and commercially exploited fish species. **See Section 5.1.2 for further consideration**

Activity/Source of Potential Effect	**Population and human health**	**Biodiversity, with particular attention to species and habitats protected under Directive 92/43/EEC and Directive 2009/147/EC**							**Land, soil, water, air, climate**			**Material assets, cultural heritage and landscape**						**Summary consideration**
		Benthic Fauna	**Plankton**	**Fish and Shellfish**	**Marine Reptiles**	**Marine Mammals**	**Waterbirds & Seabirds**	**Conservation Sites and Species[2]**	**Soils & seabed[2]**	**Water quality**	**Air & climate**	**Fisheries & aquaculture**	**Other users & resources[3]**	**Shipping**	**Waste treatment & landfill resource onshore**	**Cultural heritage**	**Landscape/seascape**	
Accidental events	B1											B1		B1				The survey vessels represents a minor increment to vessel traffic in Kinsale Area and interaction with other users is limited by its short time in the field. Vessels will display navigational lighting and awareness of the survey will be communicated through Notices to Mariners. The risks to population and human health are limited and not considered to be likely. Risks of oil spills (including all types of liquid hydrocarbon) associated with the proposed surveys are considered small. **See Section 5.1.3 for further consideration**

		Biodiversity, with particular attention to species and habitats protected under Directive 92/43/EEC and Directive 2009/147/EC							Land, soil, water, air, climate			Material assets, cultural heritage and landscape						
Activity/Source of Potential Effect	**Population and human health**	**Benthic Fauna**	**Plankton**	**Fish and Shellfish**	**Marine Reptiles**	**Marine Mammals**	**Waterbirds & Seabirds**	**Conservation Sites and Species**[2]	**Soils & seabed**[2]	**Water quality**	**Air & climate**	**Fisheries & aquaculture**	**Other users & resources**[3]	**Shipping**	**Waste treatment & landfill resource onshore**	**Cultural heritage**	**Landscape/seascape**	**Summary consideration**
Physical presence of survey vessel (ecological impacts)						D3	D3	D3										The physical presence of the vessels has the potential for interaction/disturbance of birds and marine mammal species through physical presence. Most species from relevant SPAs within foraging range of the survey area (Woodward *et al.* 2019) have been judged to have a low to moderate sensitivity to disturbance by shipping traffic (e.g. gannet, fulmar, kittiwake, gulls, auks; Old Head of Kinsale SPA 25km distant; Saltee Islands SPA 116km distant see Garthe & Hüppop 2004, Fliessbach *et al.* 2019). Physical disturbance of seaduck and other waterbird flocks by vessel traffic is possible, but the distance from the survey at which flushing of birds could take place (~4km) is less than the minimum distance from the proposed survey (at least 5.5km, Cork Harbour SPA). The coastal nature of the foraging activities of waterbirds further limits the potential for interaction between such birds and the offshore aspects of the surveys, however, there is the potential for interaction with certain wintering features associated with Cork Harbour SPA (e.g. cormorant, red-breasted merganser), though this could be avoided depending on survey timing. The presence of the inshore survey vessel will be temporary and incremental to the relatively low density of shipping in the area. **Potential for significant effects discounted**

Activity/Source of Potential Effect	**Population and human health**	**Biodiversity, with particular attention to species and habitats protected under Directive 92/43/EEC and Directive 2009/147/EC**							**Land, soil, water, air, climate**			**Material assets, cultural heritage and landscape**						**Summary consideration**
		Benthic Fauna	**Plankton**	**Fish and Shellfish**	**Marine Reptiles**	**Marine Mammals**	**Waterbirds & Seabirds**	**Conservation Sites and Species[2]**	**Soils & seabed[2]**	**Water quality**	**Air & climate**	**Fisheries & aquaculture**	**Other users & resources[3]**	**Shipping**	**Waste treatment & landfill resource onshore**	**Cultural heritage**	**Landscape/seascape**	
Physical presence of survey vessels (other users of the sea)	D1											D2		D2				There is the potential for interaction with fisheries and shipping interests, but this is limited by the small working area and limited duration of the surveys relative to the wider Celtic Sea, and its distance from most other offshore activities. Interactions are limited to the survey vessels in transit and time spent conducting the surveys, which represent a minor increment to activity. The vessels will be mobile and only operating for a limited number of days, and the activities will be communicated through relevant notices to mariners. **Potential for significant effects discounted**

Notes: [1]. Includes Annex II and IV species [2]. Includes natural seabed features [3]. Includes amenity, cables, oil and gas, aggregate and other dredging, military, renewables etc.

5 CONSIDERATION OF POTENTIAL EFFECTS

5.1 Introduction

The following section presents a description and assessment of those potential significant environmental effects identified in Section 4. The assessment has been undertaken on the basis of the survey methods described in Section 2. These include a worst case assessment (e.g. in terms of vessel timings and the range of potential equipment which could be used), such that those effects described below will not be exceeded, regardless of the final equipment selected.

5.2 Underwater Noise

Anthropogenic noise in the marine environment is widely recognised as a potentially significant concern to marine fauna, especially in relation to marine mammals, with much attention also given to effects on fish and, more recently, invertebrates. Potential (and postulated) effects of anthropogenic noise on receptor organisms range from acute trauma to subtle behavioural and indirect ecological effects (e.g. effects on prey species). The sources, measurement, and propagation of anthropogenic underwater noise, along with the auditory abilities of marine fauna, evidence of effects and potential mitigation have been extensively reviewed and assessed (e.g. Richardson *et al*. 1995, McCauley *et al*. 2000, Southall *et al*. 2007, 2019, Popper *et al*. 2014, Carroll *et al*. 2017). Further, seismic survey effects on the UK and Irish marine environment have been extensively assessed; for example the UK Offshore Energy SEAs (DECC 2009, 2011, 2016) and SEAs for offshore energy in Irish waters (e.g. DCENR 2011) provided detailed strategic assessments at a regional scale.

5.2.1 Noise sources and propagation

As outlined in Section 2, the planned survey campaign will use high-resolution geophysical survey (HRSG) sources to obtain information on the pipelines, umbilicals and surrounding seabed around all of the Kinsale Head, Seven Heads, Ballycotton and South-West Kinsale/Greensands field areas. All acoustic sources are electromechanical and use a piezoelectric transducer(s) to transmit a computer-generated frequency-amplitude modulated signal of pre-determined pulse length and frequency. No low frequency survey equipment will be used (the lowest frequency source which may be used is the USBL, which typically operates at 20-40kHz); no airgun, sparker (electrostatic discharge) or boomer (accelerated water mass) will be used.

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 5.1 summarises indicative source characteristics of the survey equipment (and comparable equipment) which will potentially be used in the planned surveys, drawing on results of Crocker & Fratantonio (2016) supplemented by manufacturer specifications where required. In addition to those sources described in Table 5.1, there may be the use of an USBL system to monitor the position of towed equipment. The USBL system consists of a multi-element transducer mounted on the hull of a 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 20-40kHz and with a source level of up to ~200dB re 1µPa @1m (peak).

Table 5.1: Potential acoustic survey equipment and indicative source characteristics

Potential equipment	**Indicative source characteristics**	
	Nominal operating frequency	**Source level**
Side-scan sonar e.g. Edgetech 4200 (3)	400kHz	210 dB re 1µPa @1m (peak) (1)
Multi-beam echosounder e.g. Kongsberg EM 2040 (4)	400kHz	223 dB re 1µPa @1m (peak) (2)
e.g. Tritech SeaKing Bathy 704 with altimeter	500kHz (bathymetry only, altimeter is passive)	

Notes: (1) Calibrated measurements for Edgetech 4200 tested at 400kHz reported in Crocker & Fratantonio (2016). (2) Manufacturer-specified source level not available for the Kongsberg EM710, so values (calibrated measurements) are taken for the comparable Reson Seabat T20P MBES operated at a frequency of 400kHz reported in Crocker & Fratantonio (2016).

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 have received a lot of attention and while different survey designs and environmental conditions may warrant survey specific modelling and/or measurements for assess impacts, 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 100-1000m, and below 160 re 1 µPa at a range of 10-11km (e.g. Breitzke *et al*. 2008).

The emitted sound fields from HRGS sources such as 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). Unfortunately, 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 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)[14] beyond 200m from any 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. While independently-measured sound fields are not available for USBL, their nominal source levels and central operating frequencies are such that emitted sound fields are likely to be very small and of limited audibility above that of the concurrently operating survey equipment and vessel. USBL emissions are considered to be incapable of causing physical or auditory injury to marine mammals, with a short term behavioural response over a short range being the possible effect; given the short term and transient nature of the survey activities such an effect would not be considered significant at an individual animal or population level.

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 offshore survey vessel is assumed to be of 50-100m in length, though the inshore survey vessel will be significantly smaller (perhaps <10m). Veirs *et al*. (2016) 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 100-1000Hz), 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 148.0dB 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).

Acoustic modelling in support of oil & gas operations have shown that across a variety of vessels, activities and localities, exposure to sound pressure level (SPL) above >180 dB re 1

[14] 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).

μPa rms is highly unlikely; SPL >160 dB re 1 μPa rms are encountered only within the immediate vicinity of the activity (<50m) while SPL >120 dB re 1 μPa rms are encountered up to a few kilometres (Neptune LNG 2016, Fairweather 2016, Owl Ridge Natural Resource Consultants 2016).

5.2.2 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 5.2 provides details of the relevant marine mammals 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 5.2: Marine mammal auditory injury criteria to pulsed sounds by functional hearing group

Functional hearing group (species relevant to the Kinsale area)	**Estimated hearing range** (region of greatest sensitivity) [frequency of peak sensitivity]	**Proposed injury (PTS onset) threshold criteria to impulsive noise** (dB re 1μPa, peak, unweighted)
Low frequency cetaceans Fin whale (*Balaenoptera physalus*) Minke whale (*Balaenoptera acutorostrata*) Humpback whale (*Megaptera novaeangliae*)	7Hz to 35kHz (200Hz to 19kHz) [5.6kHz]	219
High frequency cetaceans Common dolphin (*Delphinus delphis*) Bottlenose dolphin (*Tursiops truncatus*) Risso's dolphin (*Grampus griseus*) Killer whale (*Orcinus orca*)	150Hz to 160kHz (8.8kHz to 110kHz) [58kHz]	230
Very high frequency cetaceans Harbour porpoise (*Phocoena phocoena)*	275Hz to 160kHz (12kHz to 140kHz) [105kHz]	202
Phocid seals in water Grey seal (*Halichoerus grypus*) Harbour seal (*Phoca vitulina*)	50Hz to 86kHz (1.9kHz to 30kHz) [13kHz]	218

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.

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 Kinsale survey will either not generate source levels of this amplitude, or will not result in received sound levels exceeding this threshold beyond more than a few metres from the source and/or not overlap frequencies of greatest sensitivity. For all other species/functional hearing groups, the risk is lower still. Therefore, **the risk of injury to marine mammals (including all Annex IV Cetacea) from the planned survey activities 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. Research on potential effects of seismic airguns has focused particularly on baleen whales, because of the low-frequency overlap in noise sources and their hearing abilities; the potential for avoidance reactions and for changes in vocalisation has been demonstrated across several species and a variety of distances (see review in DECC 2016).

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 sub-bottom profilers (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 vessels could potentially cause behavioural disturbance of marine mammals present in the area. Reported responses 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).

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.

The waters off the south coast of Ireland support a high diversity of cetaceans, and the wider Kinsale-Ballycotton-Seven Heads area may occasionally experience temporarily high localised densities of some species (primarily common dolphins) during the period April-December. However, considering the acoustic characteristics of the potential sources and their propagation, the relevant evidence of effects on marine mammals from vessel noise, seismic survey and the proportionally lower potential for effects of the specific sources being used, in addition to the small spatial footprint and short duration (see Section 2.2) of the planned pre- and post-rock placement surveys, **the risk of behavioural disturbance to any species of marine mammal (including on Annex IV species) is considered to be extremely low, and significant effects are not considered to be likely.**

The risk of negative effects on marine mammals is considered to be sufficiently low that no mitigation measures are necessary. The planned survey campaign does not include seismic sources (such as airguns, sparkers or boomers) and the location of the offshore survey area is such that it is not necessary to adhere to the DAHG Guidance to Manage the Risk to Marine Mammals from Man-made Sound Sources in Irish Waters (DAHG 2014). This reflects the low risk to marine life posed by the potential equipment and the survey area environment not being of high sensitivity. As the inshore survey extent, which will use a different vessel to the offshore survey, could be categorised as taking place within a bay or within 1,500m of the entrance of an enclosed bays, the measures outlined in DAHG (2014) will be followed.

5.2.3 Fish and fisheries

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).

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. The high frequency signals generated by side-scan sonar, echosounders and USBL are above the hearing range of fish.

Given the limited evidence of physical injury to fish from exposure to high amplitude low-frequency seismic survey noise, and the comparatively lower amplitude and higher frequency source characteristics of the potential sources in the planned surveys, **the risk of injury to fish is considered to be extremely remote and significant effects are not considered to be likely.**

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 comparative characteristics of the potential sources in the planned surveys, in addition to the small spatial footprint and short duration of the planned surveys, **the risk of significant effects on fish due to behavioural disturbance is considered to be extremely low.**

Exposure to seismic survey noise during spawning or on their way to spawning grounds can impact on a fish's spawning success and consequently the recruitment (OSPAR 2009). The Kinsale area and proposed timing of the survey campaign overlaps reported spawning and nursery areas for a variety of fish species; however, given the above assessment in relation to behavioural disturbance, **significant disruption of spawning or nursery activity is not anticipated, and significant effects are not considered to be likely.**

Considering the aforementioned conclusions and that activities will primarily occur within long-established statutory exclusions zones, **no impacts on commercial fisheries in the wider Kinsale-Ballycotton-Seven Heads area will occur.**

5.2.4 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.

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 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.

While acknowledging limited data and the importance of the survey area to several species of diving birds (i.e. guillemot and razorbill), 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 surveys, in addition to the small spatial footprint and short duration of the planned surveys, leads to the conclusion that **significant negative effects on diving birds are considered to be highly unlikely.**

Marine turtles

Available information on potential effects of underwater sound on marine turtles is very limited (Nelms *et al*. 2016). The hearing range of cheloniid species has been estimated to be between 50-2,000Hz, with highest sensitivity below 400Hz (Popper *et al*. 2014). For leatherback turtles, measurements made on hatchlings suggested a similar low frequency sensitivity, with sound detection ranging between 50 and 1200Hz when in water and between 50 and 1600Hz in air (Dow Piniak *et al*. 2012).

A variety of potential functions of hearing have been proposed for marine turtles, although the issue is poorly understood; they do not appear to vocalize or use sound for communication, but may use sound for navigation, locating prey, avoiding predators, and general environmental awareness (see Dow Piniak *et al*. 2012, Nelms *et al*. 2016 and references therein). While some authors have raised concerns over the potential for physical injury (including hearing damage) to marine turtles from seismic surveys (Nelms *et al*. 2016) and disturbance from increasing anthropogenic noise generally (Samuel *et al*. 2005), such potential impacts remain to be investigated, as do any subsequent ecological effects (Nelms *et al*. 2016).

Underwater noise generated by the survey and rock placement vessels may be detectable by leatherback turtles, although their low density and limited seasonal presence in the area dictates that very few individuals are likely to be exposed to noise levels beyond that of the background for the region.

Considering this low likelihood of exposure, the perceived limited sensitivity of the receptor, and the moderate intensity nature of the noise source, **significant impacts on marine turtles (including Annex IV species, see Section 3.2.7) are considered extremely remote**.

5.3 Accidental Events

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 (see Section 2.2), the probability of a collision with another vessel is considered to be extremely low, such that potential effects are not considered to be likely.

While the risks of oil spills (including all types of liquid hydrocarbon) associated with the proposed surveys are extremely small, consideration of the potential sources and effects enables effective management and mitigation. Given the duration of the proposed surveys refuelling at sea is not expected to occur. With regard to oil discharges (e.g. from machinery space drainage), the vessels will operate to MARPOL requirements for a Special Area, requiring oily water separation and monitoring prior to discharge. Discharges must be 15ppm or less, recorded in the Oil Record Book and only be made when underway. The vessels will also implement a Shipboard Oil Pollution Emergency Plan (SOPEP) in accordance with guidelines issued by the Marine Environment Protection Committee of the International Maritime Organisation. Kinsale will ensure that such plans are in place prior to any work taking place as part of standard contractor management.

5.4 Cumulative Effects

The range of activities undertaken in and around the Kinsale area are detailed in Section 3.3. Proposed projects in the wider Kinsale Area include the Celtic Interconnector and Ireland-France subsea cable. The timing of any works associated with these projects is not considered likely to interact with the proposed survey schedule, and in view of the nature and scale of potential effects associated with the surveys (Sections 4 and 5), significant in-combination effects are not considered to be likely.

Two Foreshore Licences have been applied for in relation to offshore wind farm site investigation work in the territorial waters off Cork (see Section 3.3). The application most of relevance to the surveys (both pre- and post-rock placement) is for the Emerald project, though there is also some overlap with the offshore and full overlap with the inshore survey area and the Inis Ealga project area (Figure 3.9). The proposed schedules for the inshore surveys associated with Emerald and Inis Ealga both indicate a five year window from the date of consent to completion. The indicative schedule in their respective applications suggest activities starting in 2021, or likely taking place 2020-2023. As neither application has been approved, there is the potential for the timescale within which works take place to be later than proposed. There is the potential for interaction between the timings of these surveys and work associated with the proposed surveys, but the duration and scale of the survey campaign are such that there is considerable scope to avoid interactions.

The wind farm proposals associated with the site investigations are at a conceptual stage. No consent application for either development has been made, and no approvals have been granted. In the absence of project information, including indicative design parameters and schedule, the development stages of these wind farms will not be considered here, in keeping with Article IV(5e) of the EIA Directive.

There is the potential for future development associated with the Barryroe oil discovery. An application was made to conduct a site survey within the Barryroe licence area (EL 1/11), which was completed in September 2019 and a further subsequent survey application was made in August 2019 for an area covering a proposed appraisal well ('K'), which overlaps parts of the Seven Heads field. The proposed survey has been completed and thus interactions are not possible with the proposed survey campaign which is scheduled to be carried out in phases, between Q2 and Q4 in 2022. However, these works may slip to between Q2 and Q3 2023 due to the potential for delays.

Kinsale Energy will maintain a dialogue with the developers of both wind farms, and further proposals in relation to the Barryroe field, to ensure that activities do not proceed in a manner which could lead to cumulative impacts.

5.5 Transboundary Effects

Ireland has ratified the Convention on Environmental Impact Assessment in a Transboundary Context (the Espoo Convention) and thus an assessment is needed of the potential for the proposed KADP to result in significant transboundary effects[15] – the shortest distance to the nearest Median line is 75km (Ireland/UK).

The likely nature and footprint of effects described above are regarded to be localised in extent, minor in a regional context, and are not regarded to pose a risk of transboundary effects to UK waters.

[15] Defined in the Espoo Convention as, "any impact, not exclusively of a global nature, within an area under the jurisdiction of a Party caused by a proposed activity the physical origin of which is situated wholly or in part within the area under the jurisdiction of another Party".

6 CONCLUSION

6.1 EIAR Addendum Conclusion

The overall conclusion of the Environmental Impact Assessment Report addendum is that, in view of the predicted scale, intensity and duration of the survey activities, the surveys will not result, directly or indirectly, in likely significant adverse effects on the environment, alone or cumulatively with other existing or approved projects. No residual effects are predicted to occur.

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