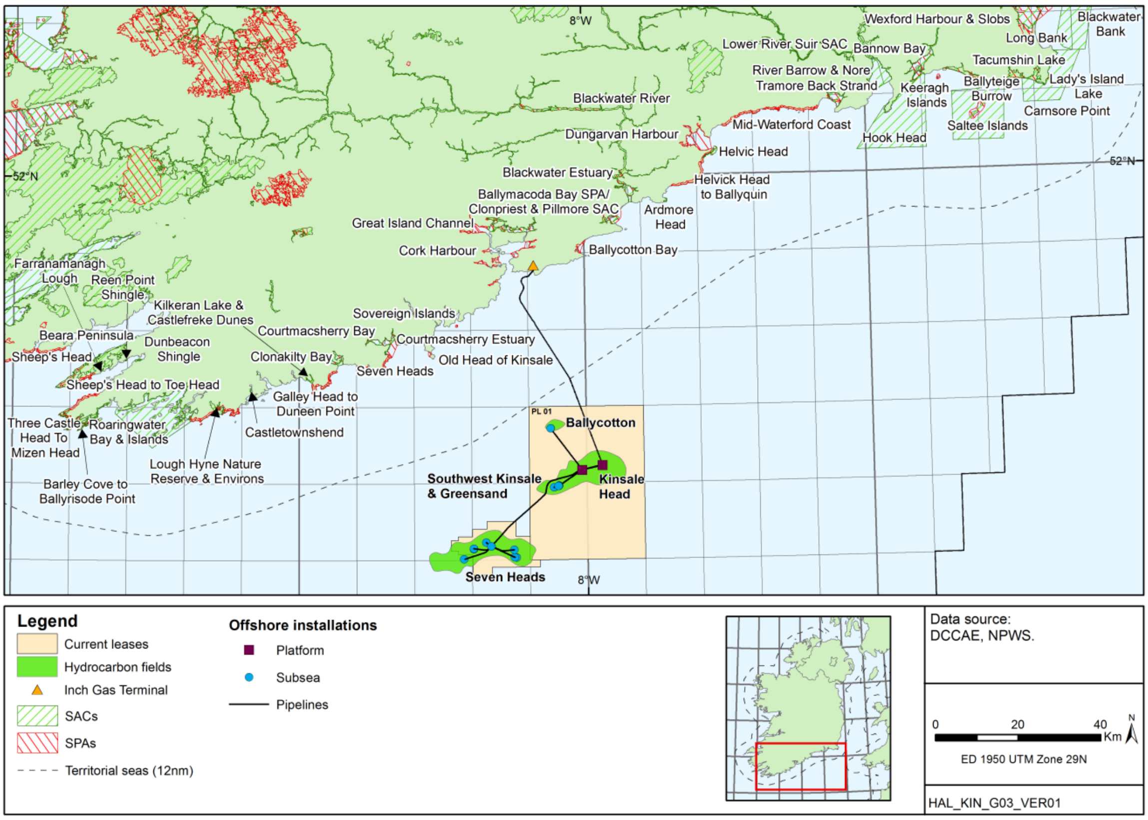
PSE Kinsale Energy Limited

Kinsale Area Decommissioning Project - Pre/Post Rock Placement Surveys



Pre-survey Fisheries Assessment Report

January 2022

Rev 1

Contents

GLOSSARY

Term	Definition
AA	Appropriate Assessment
AHV	Anchor handling vessel
AIS	Automatic Identification System
BOEM	Bureau of Ocean Energy Management
CFP	Common Fisheries Policy is a set of rules for managing European fishing fleets and for conserving fish stocks in the EU.
dB	Decibel, a logarithmic unit to measure sound level
DECC	Department of the Environment, Climate and Communications
DP	Dynamic positioning
EIA	Environmental Impact Assessment
EU	European Union
HRGS	High Resolution Geophysical Survey
ICES	International Council for the Exploration of the Sea
IMO	International Maritime Organisation
MARPOL	International Convention for the Prevention of Pollution from Ships
MSFD	Marine Strategy Framework Directive
Pa	Pascal unit of sound pressure
SEA	Strategic Environmental Assessment
SFPA	Sea Fisheries Protection Authority
SPL	Sound Pressure Level
TAC	Total Allowable Catch. Member States are allocated a proportion of TACs through the CFP which become the national quota.

1 INTRODUCTION

1.1 Background and document purpose

PSE Kinsale Energy Limited (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). 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 (Petroleum Lease area No.1), and the Seven Heads field (Seven Heads Petroleum Lease) in the North Celtic Sea Basin.

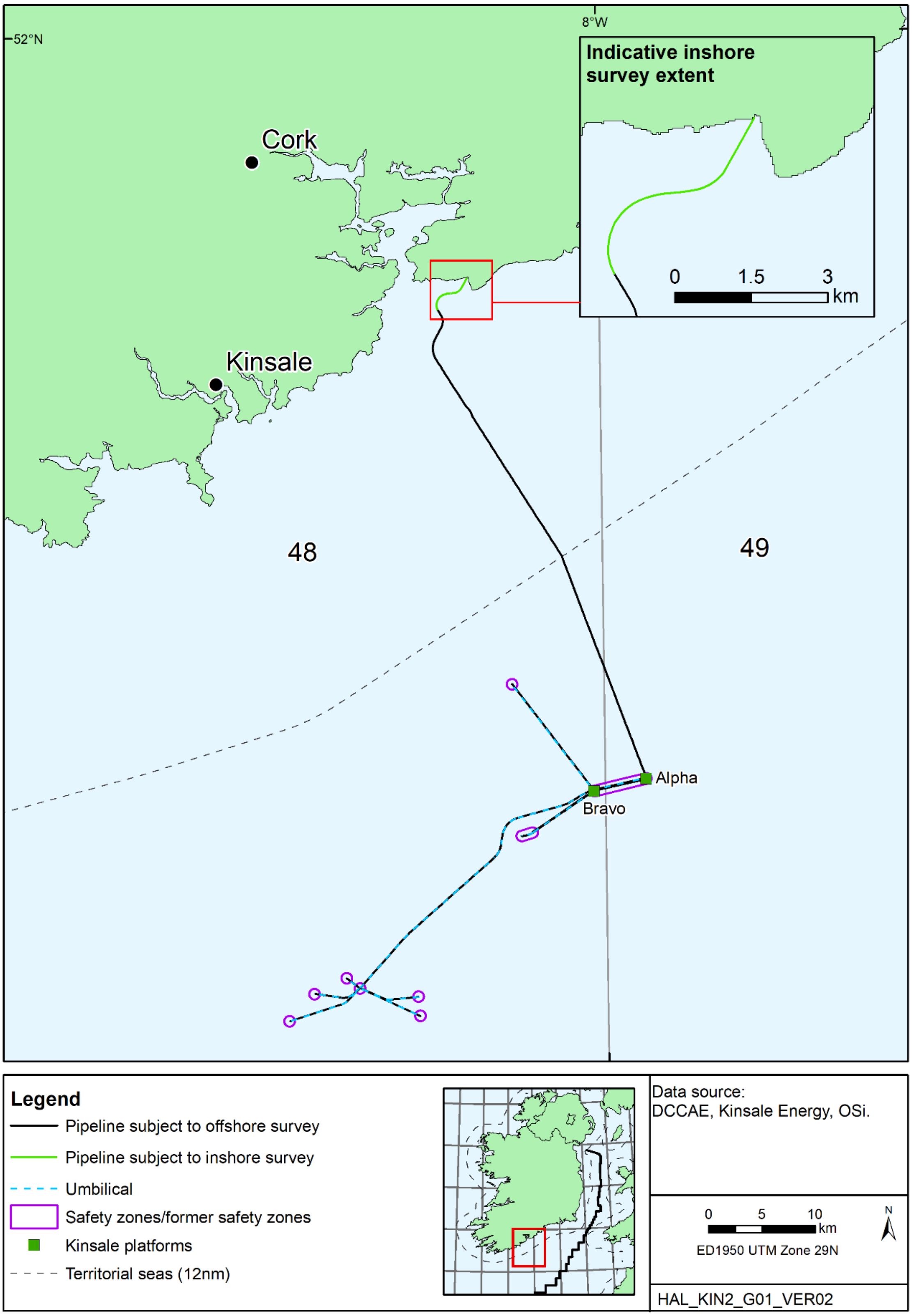
The survey area is located off the coast of Co. Cork, extending from the landfall of the export pipeline at Powerhead to a distance of up to 47km from the nearest coast (Figure 1.1). In order to accurately record the status of the pipelines and confirm the completion of the pipeline decommissioning activities, pre- and post-rock placement surveys are proposed as part of the Decommissioning Plans. Now that greater definition is available on the scope of the pipeline surveys and the types of equipment likely to be used than covered in the EIAR for KADP, this application for consent is accompanied by addenda to the EIAR and Screening for AA Report, and this 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.

1.1.1 Pre-survey fisheries assessment

The survey programme is focused on the Kinsale area pipelines and umbilicals areas as shown in Figure 1.1, with survey methods described in Section 2. The fisheries baseline is described in Section 3 and the potential for interaction with fisheries activities is considered in Section 4.

Figure 1.1: Location of the proposed survey coverage



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[1] 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) 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 this survey 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 assessment.

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 survey 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.

[1] 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 vessels 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.

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.

Figure 2.1: Kinsale Area pipelines and umbilicals to be subject to post-decommissioning survey

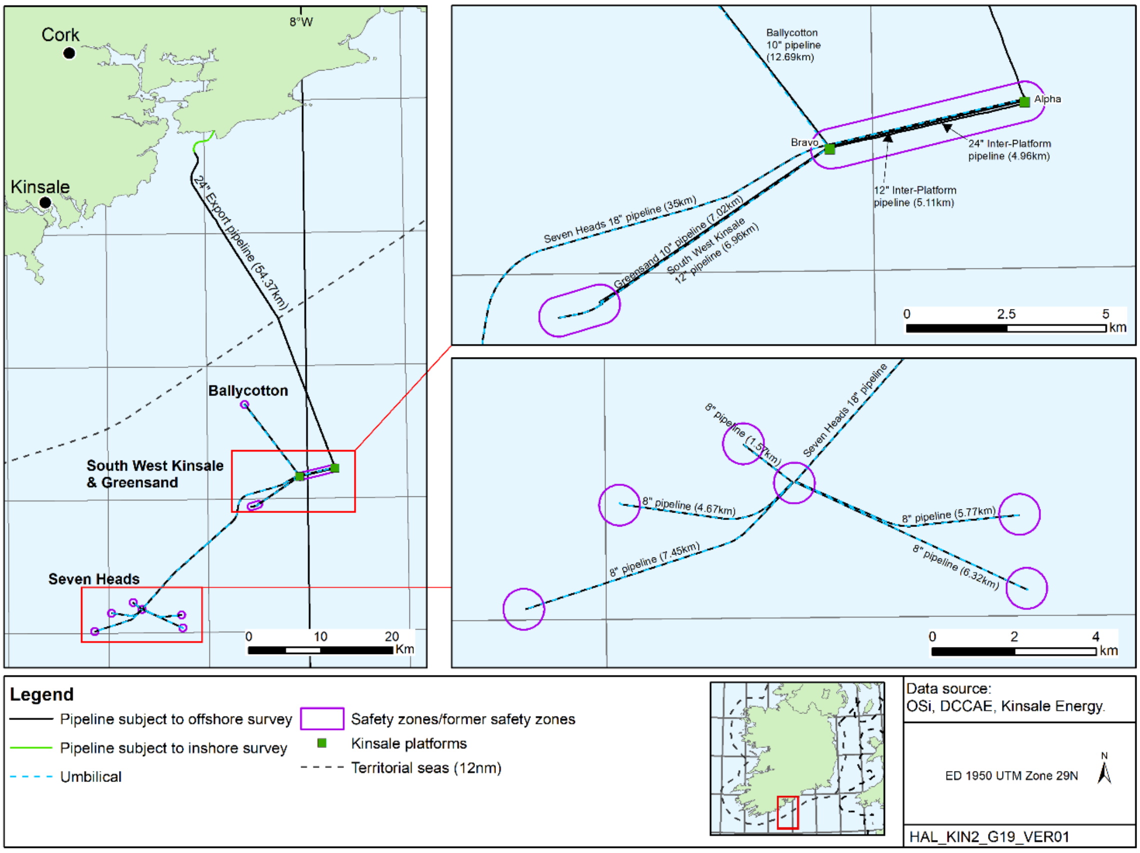


Table 2.1: Summary of potential survey equipment

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.
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

Source type	Potential equipment	Operating frequency	Objectives
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 Vessels

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[2] 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.

[2] 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.

3 FISHERIES BASELINE INFORMATION

3.1 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 3.1). 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 3.2) 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)

Figure 3.1: Fish spawning areas

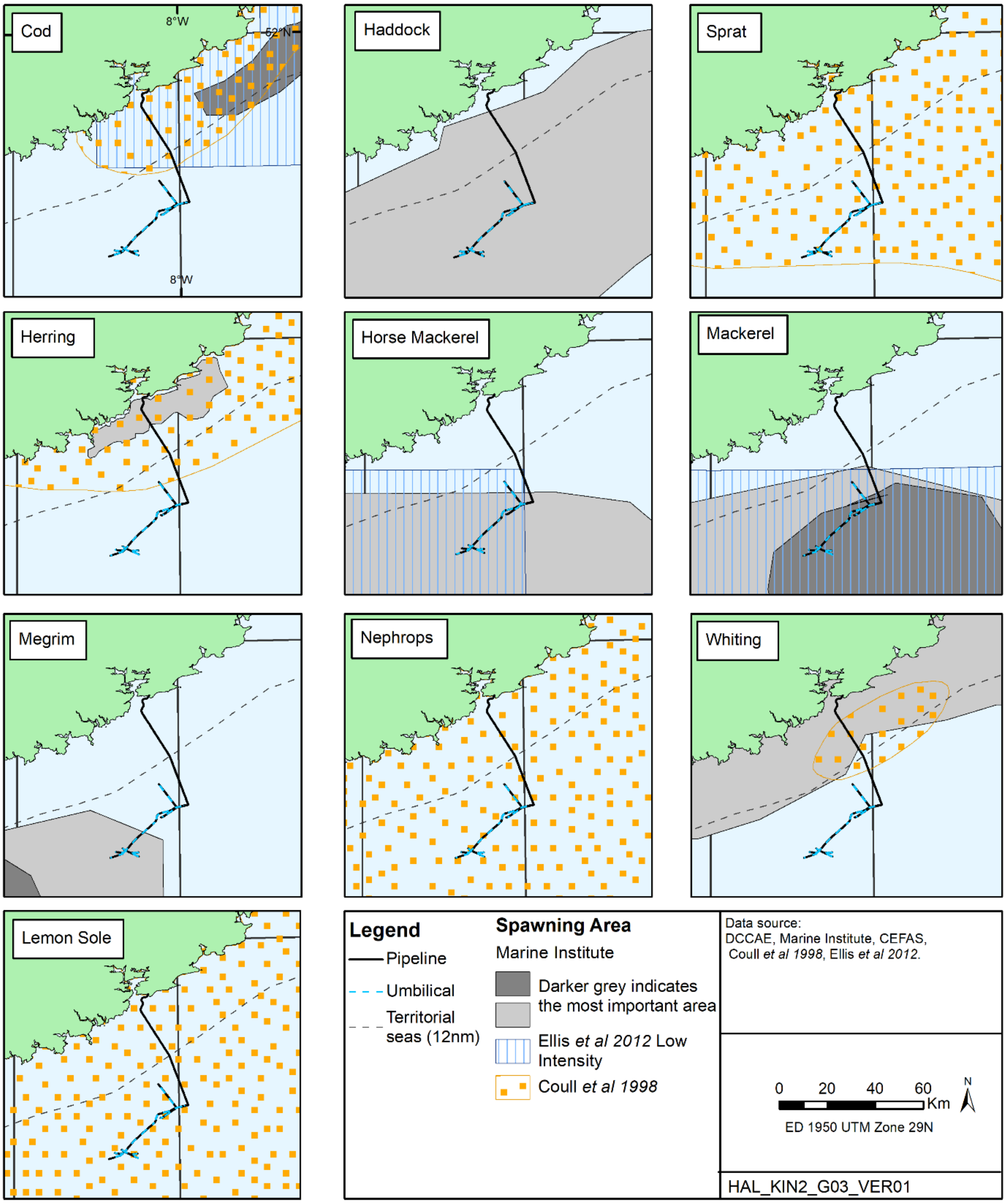
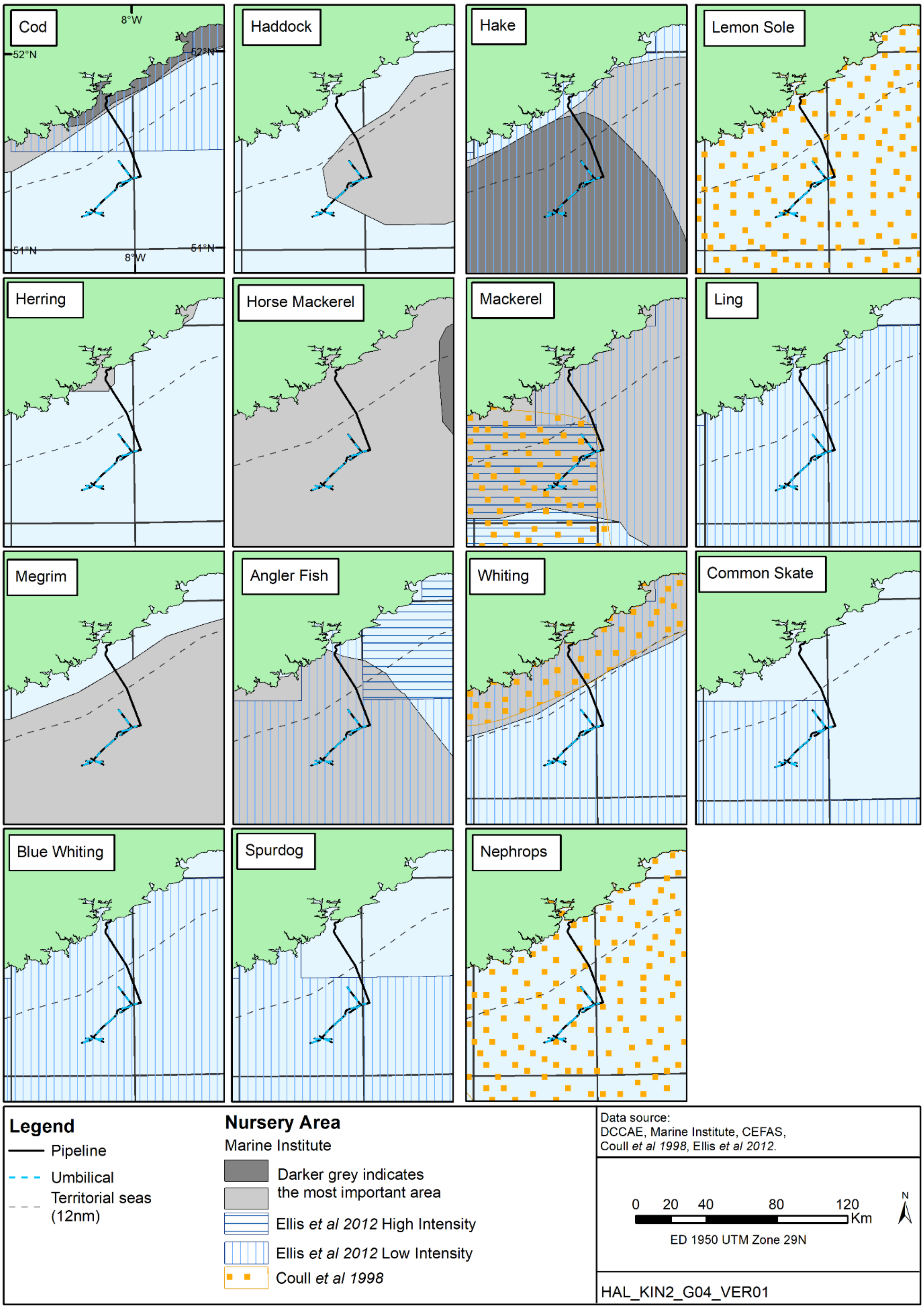


Figure 3.2: Fish nursery areas



3.2 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 2019, the Irish fleet had access to 193,924 tonnes of fish at a potential value of €216 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[3]). Of the more local ports, the most significant in 2019 were Union Hall (1,857 tonnes, €8.2 million), Kinsale (1,030 tonnes, €2.6 million) and Kilmore Quay (3,653 tonnes, €10.6 million) (SFPA website).

The dominant fishing method in the area is demersal (otter) trawling (Figure 3.3 and 3.4), 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 3.5) 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 3.2 lists the weight and value of landings from ICES rectangles relevant to the survey area over the period 2014-2016.

Table 3.2: 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**

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

Species type	2014		2015		2016	
	Live weight (tonnes)	Value (€)	Live weight (tonnes)	Value (€)	Live weight (tonnes)	Value (€)
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[4] 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 2020, 45% (33) of fish stocks were sustainably fished, 18% (13) overfished and with the remaining stocks (28) 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).

[4] 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 3.3: Irish Fishing effort, 2014-2018

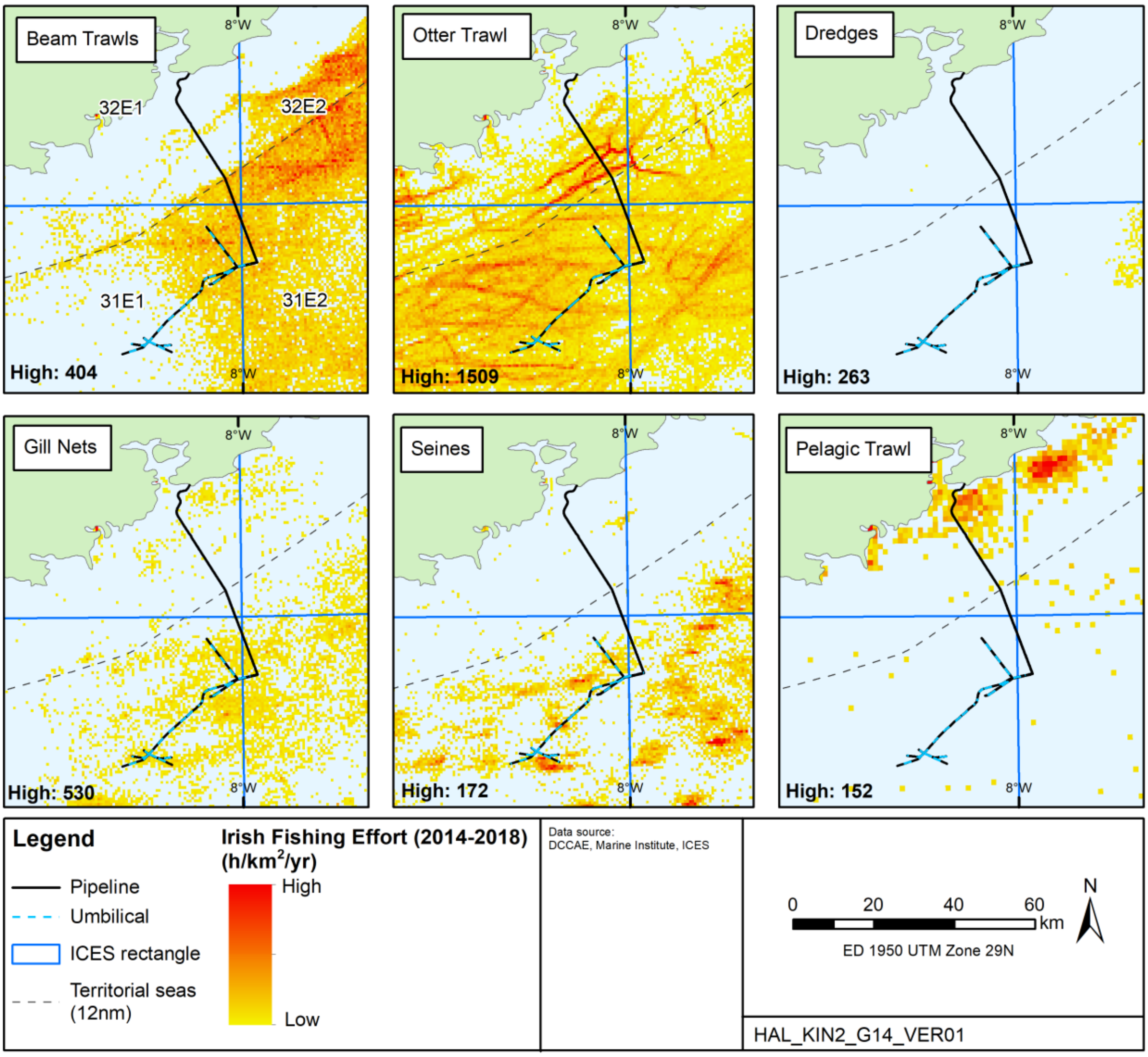


Figure 3.4: International Fishing effort, 2014-2018

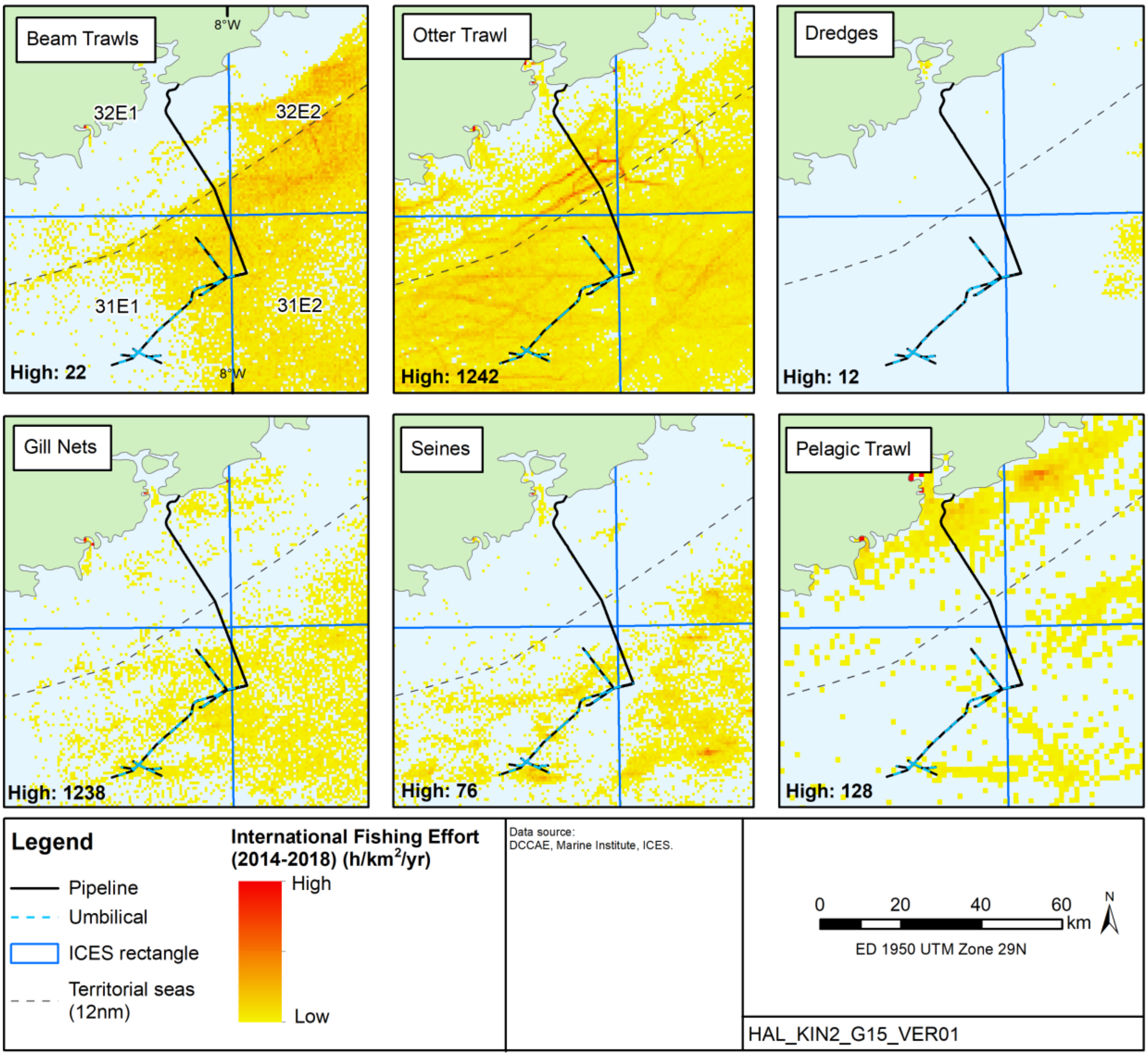
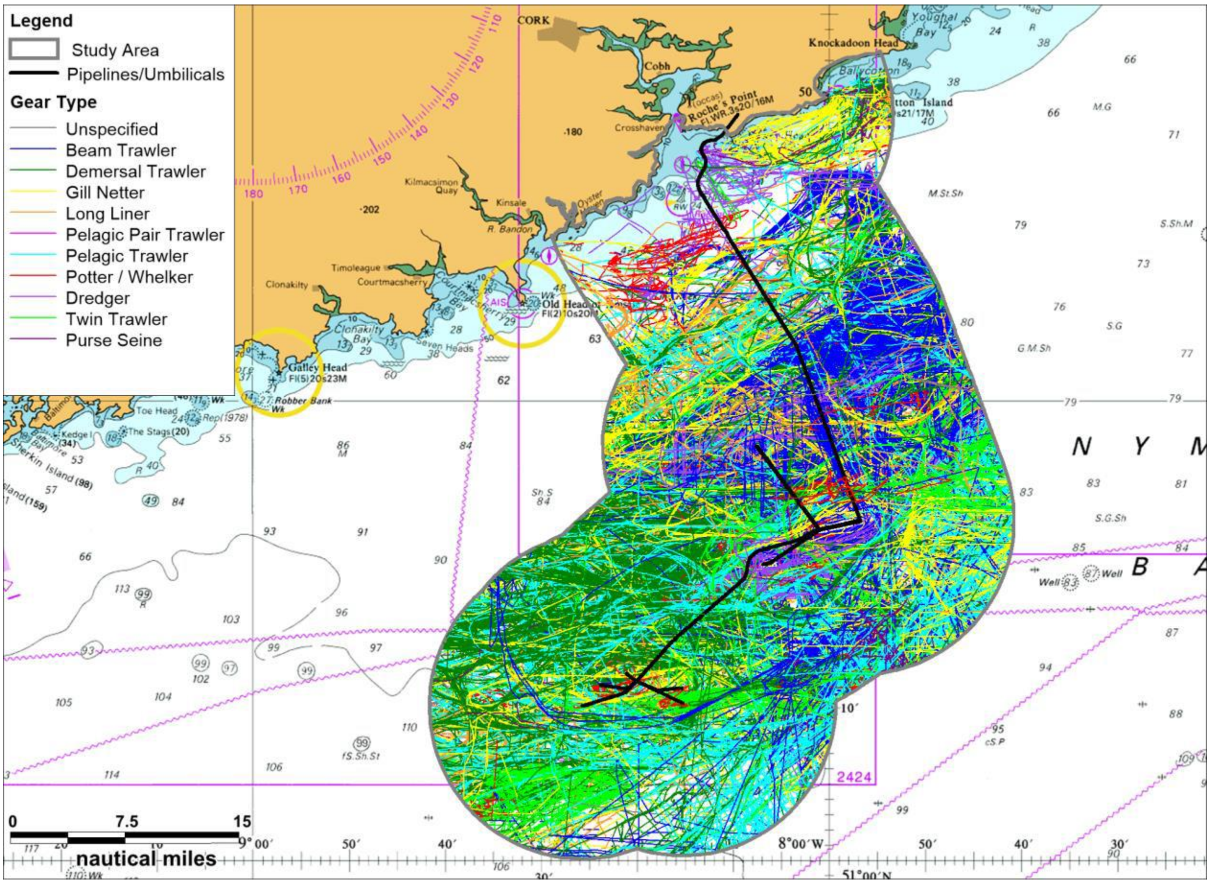


Figure 3.5: Vessels estimated to be actively engaged in fishing (2014 & 2015/16)



4 FISHERIES ASSESSMENT

4.1 Introduction

This fishery assessment forms part of a suite of assessments to be submitted as part of the application for approval of the proposed survey activities, including addenda to the EIAR and Screening for Appropriate Assessment Report. The assessment considers those potential effects on fisheries identified through the EIAR process of the proposed survey activities. 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.

The EIAR process identified the following sources of potential effects of relevance to fish and shellfish, and fisheries:

- Physical presence of the survey vessels
- Noise generated from survey equipment and survey vessels
- Accidental events
- Cumulative effects

4.2 Physical presence of survey vessels

The dominant fishing method in the area is demersal (otter) trawling, which is, in the waters around the survey area, mainly used to catch *Nephrops*, haddock and whiting (Gerritsen & Kelly 2019). The Anatec (2017) survey indicated that on average in 2015/16 there were approximately four demersal vessels per day actively fishing within the area highlighted on Figure 3.5, with most vessels in February, October and March.

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 survey, which represent a minor increment to activity.

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.

4.2.1 Conclusions

Given the limited duration of the planned survey, low number of vessels involved, and the low number of fishing vessels likely to be present within the general area, **the risk of displacement of fishing activities due to the presence of the survey vessels is considered to be extremely remote and significant effects are not considered to be likely.**

4.3 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.

4.3.1 Noise sources and propagation

As outlined in Section 2, the planned surveys 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 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 4.1 summarises indicative source characteristics of the survey equipment (and comparable equipment) which will potentially be used in the planned survey, drawing on results of Crocker & Fratantonio (2016) supplemented by manufacturer specifications where required. In addition to those sources described in Table 4.1, 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 4.1: 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)[5] beyond 200m from any echosounder or side-scan sonar device tested. While recognising that these results require refining, preliminary evidence suggests that these

[5] 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).

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 sounds fields are likely to be very small and of limited/no audibility above that of the concurrently operating survey equipment and vessel.

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 vessels are 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 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).

4.3.2 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.

4.3.3 Conclusions

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 survey, **the risk of injury to fish is considered to be extremely remote and significant effects are not considered to be likely.** Similarly, given the limited and variable evidence of behavioural responses of fish to such noise sources, **the risk of significant effects on fish due to behavioural disturbance is considered to be extremely low.**

4.4 Accidental events

The survey activities will be communicated through notices to mariners and the vessels will display appropriate navigational lighting. In view of the non-continuous duration and scale of survey activity, the probability of a collision with another vessel is considered to be extremely low, such that potential effects are not considered to be likely.

4.5 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 survey (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 survey (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.

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 survey was completed in November 2021 and thus interactions with the proposed survey campaign are not considered possible.

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

4.6 Fisheries stakeholder engagement

The following relevant fisheries organisations and forums were consulted with during the preparation of the Kinsale Area Decommissioning Project:

- Irish South & West Fish Producer Organisation (IS&WFPO)
- Irish South & East Fish Producer Organisation (IS&EFPO)
- South West Regional Fisheries Forum / (Regional Inshore Fisheries Forum)
- South East Regional Fisheries Forum / (Regional Inshore Fisheries Forum)
- National Inshore Fisheries Forum (NIFF)
- Irish Fish Producers Organisation (IFPO)
- Killybegs Fishermen Organisation (KFO)
- Bord Iascaigh Mhara

These groups will be notified of the proposed survey vessels and timings once these are known.

5 CONCLUSION

The overall conclusion of the Pre-survey Fisheries Assessment is that, in view of the predicted scale, intensity and duration of the survey activities, the survey campaign will not result, directly or indirectly, in likely significant adverse effects on fisheries, alone or cumulatively with other existing or approved projects. No residual effects are predicted to occur.

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