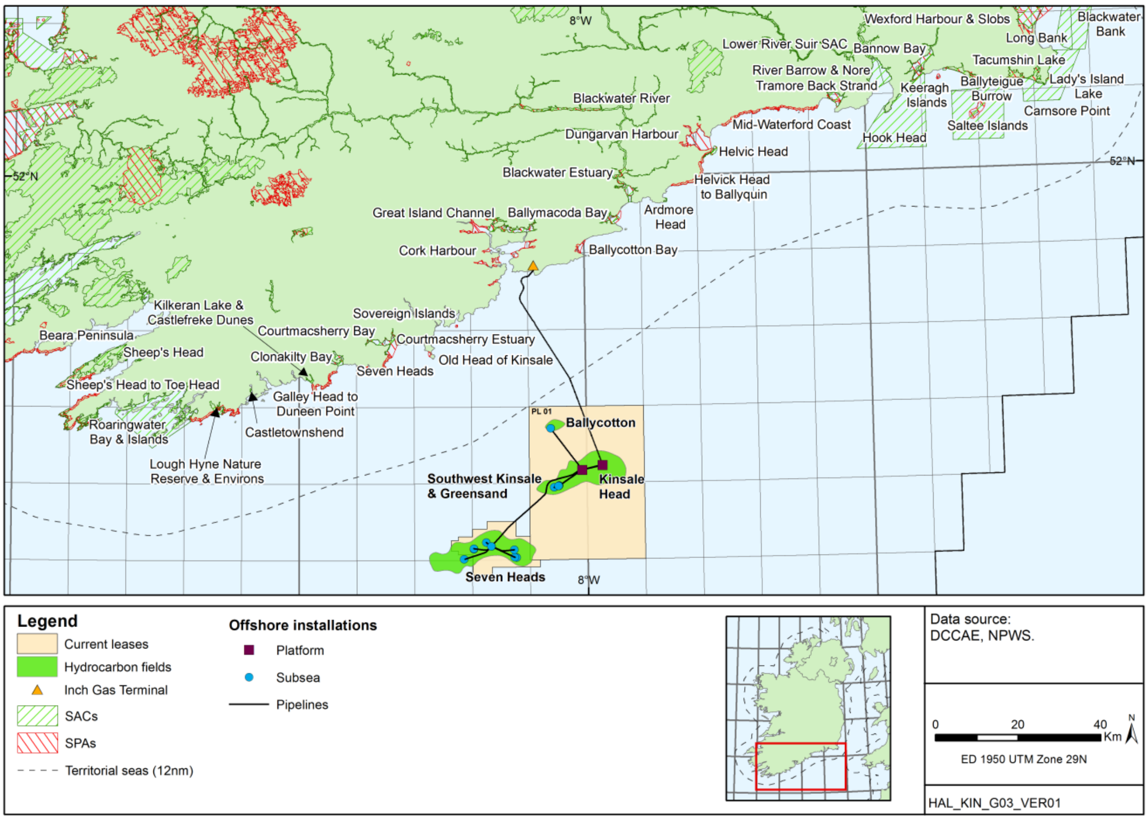
PSE Kinsale Energy Limited

Kinsale Alpha and Bravo Platforms Shallow Geological Survey



Pre-survey Fisheries Assessment Report

March 2020

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Contents

GLOSSARY

Term	Definition
AA	Appropriate Assessment
AIS	Automatic Identification System
BOEM	US 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.
CSHAS	Celtic Sea Herring Acoustic Survey
dB	Decibel, a logarithmic unit to measure sound level
DCCAE	Department of Communications, Climate Action and Environment
DCENR	Department of Communications, Energy and Natural Resources
DP	Dynamic positioning
EIA	Environmental Impact Assessment
EIAR	Environmental Impact Assessment Report
EU	European Union
GES	Good Environmental Status
HRGS	High-Resolution Geophysical Survey
ICES	International Council for the Exploration of the Sea
KA	Kinsale Alpha
KB	Kinsale Bravo
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.
NMFS	National Marine Fisheries Service, U.S. Department of Commerce
Pa	Pascal unit of sound pressure
PAD	Petroleum Affairs Division of the Department of Communications, Climate Action and Environment
SBP	Sub-Bottom Profiler
SFPA	Sea Fisheries Protection Authority
TAC	Total Allowable Catch. Member States are allocated a proportion of TACs through the CFP which become the national quota.
USBL	Ultra-Short Baseline (acoustic positioning)

1 INTRODUCTION

1.1 The Applicant

PSE Kinsale Energy Limited (Kinsale Energy) is applying for consent to undertake survey activities at the Kinsale Alpha (KA) and Bravo (KB) platforms in petroleum lease area No.1 covering Blocks 48/20, 48/25, 49/16 and 49/21 in the North Celtic Sea Basin. The platforms are located off the coast of Co. Cork, approximately 47km and 45km from the nearest landfall respectively (Figure 1.1).

Discovery of the Kinsale Head area gas reserves were made by Marathon Oil in 1971, and production commenced in 1978 following the installation of the KA and KB platforms. Subsequent discoveries were made in the Kinsale Head area including Ballycotton, Southwest Kinsale and the Seven Heads fields and developed as subsea tie-backs to the Kinsale Head platforms.

1.2 Background and document purpose

Kinsale Energy is preparing for the decommissioning of the Kinsale Area gas fields and facilities which are coming to the end of their productive life, and in keeping with lease obligations have prepared Decommissioning Plans and related Environmental Impact Assessment Report (EIAR) and Appropriate Assessment (AA) screening reports, which have been submitted to the Petroleum Affairs Division (PAD) of the Department of Communications, Climate Action & Environment (DCCAE). To inform the detailed removal procedures for the platform jackets, a survey is proposed to confirm the shallow seabed conditions in the immediate vicinity of the platforms. The survey will include the use of equipment (e.g. sub-bottom profiler and chirp) to detect the depth of surficial sediments and their contact with the underlying bedrock to inform the need for any excavation around the jacket piles during jacket removal (more detail is provided in Section 2).

1.2.1 EIA Screening

An EIA screening report has been prepared to fulfil the requirements of the EIA Directive by providing an environmental appraisal of the potential for direct and indirect significant effects of the proposed survey programme, in order to provide the relevant information to allow the Competent Authority to make a screening decision on whether an Environmental Impact Assessment (EIA) is required, and whether consent for the activities can be granted.

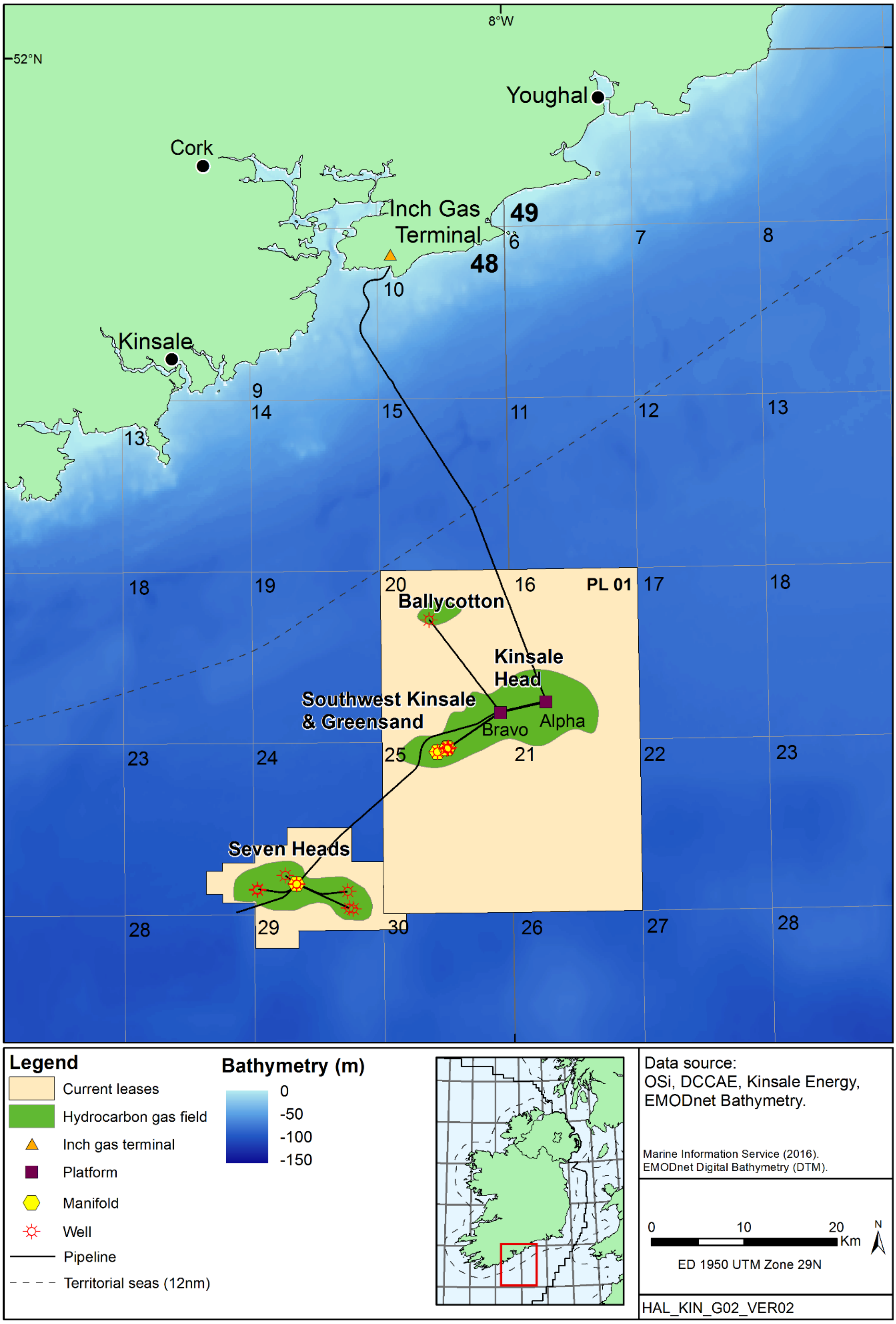
1.2.2 AA Screening

An AA screening exercise has been undertaken to consider the potential for likely significant effects to arise in relation to Natura 2000 sites from activities associated with the proposed survey. The outcome of the AA screening exercise is documented in a separate Screening for Appropriate Assessment report, which considers the implications of the proposed survey, on its own and in combination with other plans or projects, for European sites in view of the conservation objectives of those sites.

1.2.4 Pre-survey fisheries assessment

The survey programme is focussed on an area directly associated with KA and KB and within the statutory 500m safety exclusion zone around the two platforms and the pipelines between them, with operations expected to be complete within one day (see 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 Kinsale Alpha and Bravo platforms in the wider Kinsale Area



2 PROJECT DESCRIPTION

2.1 Survey background and purpose

As noted in Section 1, Kinsale Energy is preparing for the decommissioning of the Kinsale Area gas fields and facilities, including the Kinsale Alpha (KA) and Kinsale Bravo (KB) platforms. Two applications have been made in relation to the decommissioning of the Kinsale area facilities which were each accompanied by an Environmental Impact Assessment Report and Appropriate Assessment screening[1]. These applications covered; facilities preparation, well plug and abandonment, platform topsides and subsea structure removal (application no. 1); and jacket removal (application no. 2).

As noted in the decommissioning programme for application no. 2 (see Section 3 of the related EIAR), it is proposed that the jacket piles are cut prior to jacket removal through the use of an internal cutting tool, or where required, cutting externally. Some excavation of surficial seabed sediments may therefore be required to access the piles to allow external cutting as part of jacket removal.

The surficial sediments across the Kinsale Head area are shallow, with sub-cropping chalk present near the surface. It is proposed that a survey is undertaken in order to determine the present depth of the surficial sediments at each platform to inform the level of any excavation required. For the purposes of jacket lift, it is only required to determine whether the chalk/seabed sediment contact is within 5m of the seabed.

This Pre-survey Fisheries Assessment Report has been prepared to cover the survey elements only. The jacket removal procedures have already been detailed and assessed as part of the application no. 2 and will not be considered again here.

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 Section 4. The potential equipment includes several different types of sub-bottom profilers (SBPs) which can provide information on the shallow geology to depths of between a few metres to up to 100m below the seabed depending on the specific device and sediment characteristics. 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.

A line plan for the survey is shown in Figure 2.1, applicable to both platforms. Around each platform, four lines, each of approximately 120-160m length, will be surveyed at 30m off each platform face. Equipment may be hull mounted or towed; in the case of the latter, the equipment will first be deployed over board prior to the sailing of the survey lines. Data collection quality will be monitored and additional lines may need to be run if required, these will be in the same area as indicated in Figure 2.1.

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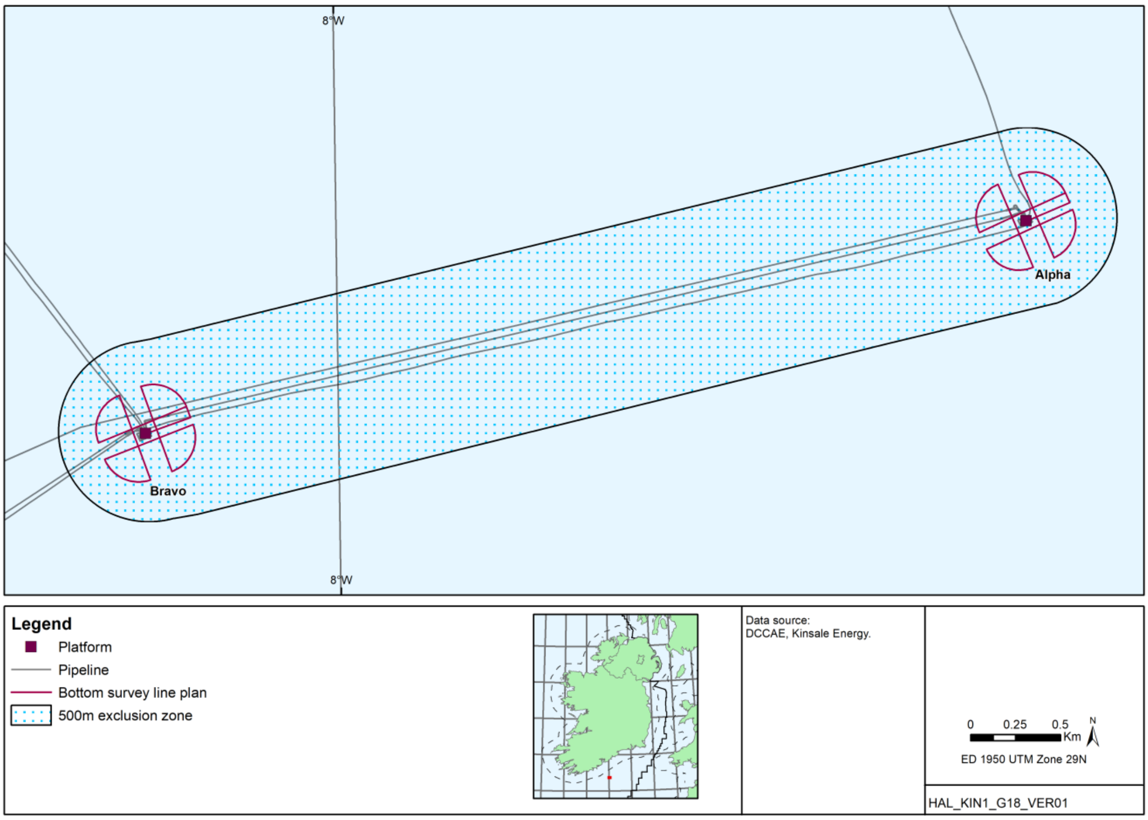
[1] See: https://www.dccae.gov.ie/en-ie/natural-resources/topics/Oil-Gas-Exploration-Production/environment/statutory-consents/ministerial-decisions/decommissioning-kinsale-head-and-seven-heads-facilities/Pages/Decommissioning%20Kinsale%20Head%20and%20Seven%20Heads%20Facilities.aspx and https://www.dccae.gov.ie/en-ie/natural-resources/consultations/Pages/Decommissioning-of-certain-facilities-within-the-Kinsale-Head-Petroleum-Lease-area.aspx

It is planned that the survey will take place between April to September 2020 and is expected to be completed in less than one day; operations will not take place in hours of darkness.

Table 2.1: Summary of potential survey equipment

Potential equipment	Source type	Central operating Frequency
Knudsen Pinger SBP	Pinger SBP	3.5kHz/15Hz
Edgetech 3100	Chirp SBP	2-16kHz
Knudsen Chirp 3260	Chirp SBP	3.5kHz
Innomar SES2000	Parametric/non-linear SBP	Primary: 100kHz Secondary: 2-22kHz (planned = 2kHz-10kHz)

Figure 2.1: Indicative survey lines for KA and KB



2.3 Vessel

The vessel to complete the survey programme has 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).

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 (see Gerritsen & Kelly 2019 for a description of relevant fishing grounds). 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 platforms are located within ICES Rectangles 31E1 and 31E2 (see Figure 3.3). Table 3.1 shows that the proposed survey location overlaps or is close to known spawning grounds and nursery areas for certain fish species. Rectangle 31E2 is 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 area 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 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 most 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 in the Kinsale 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

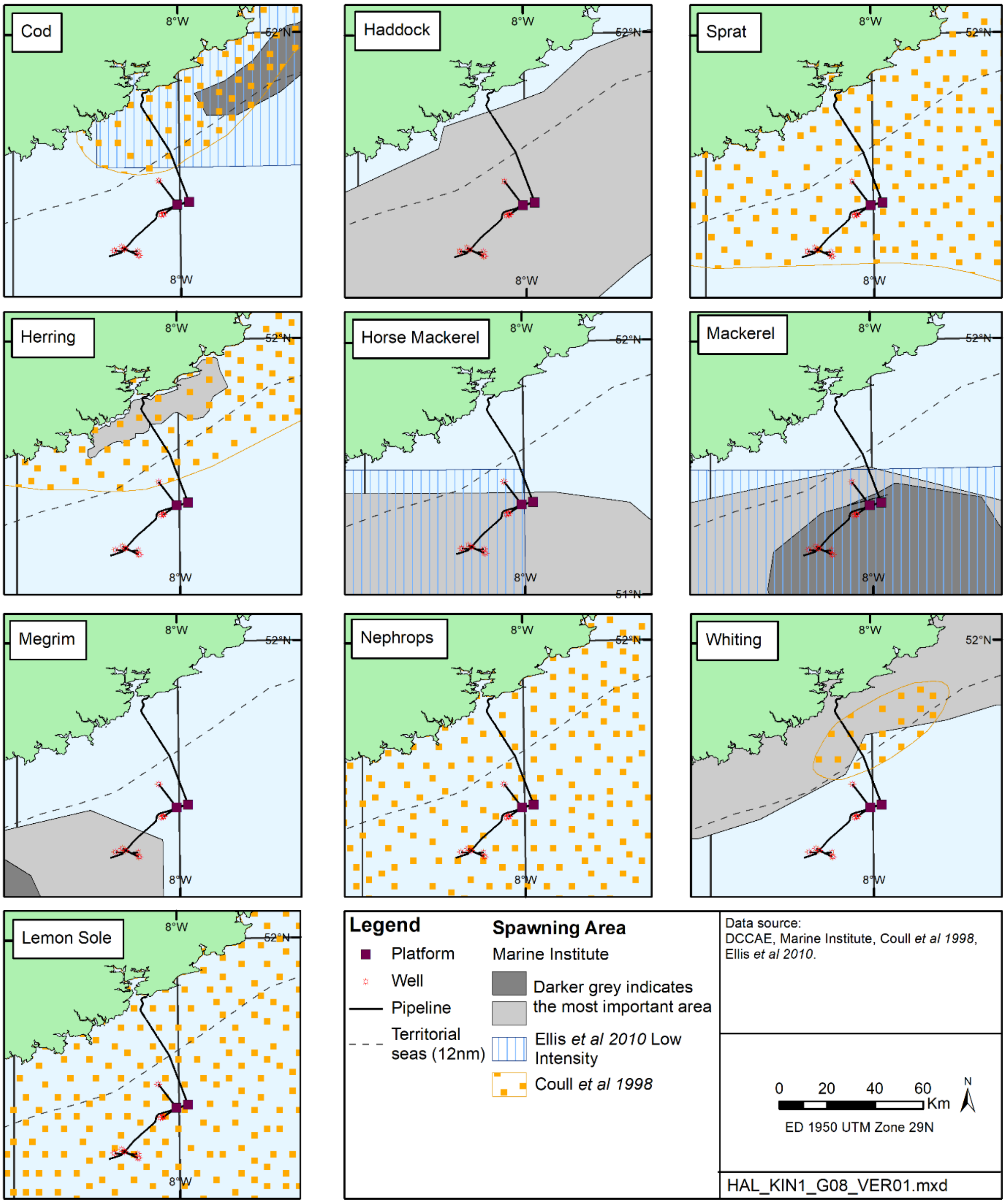
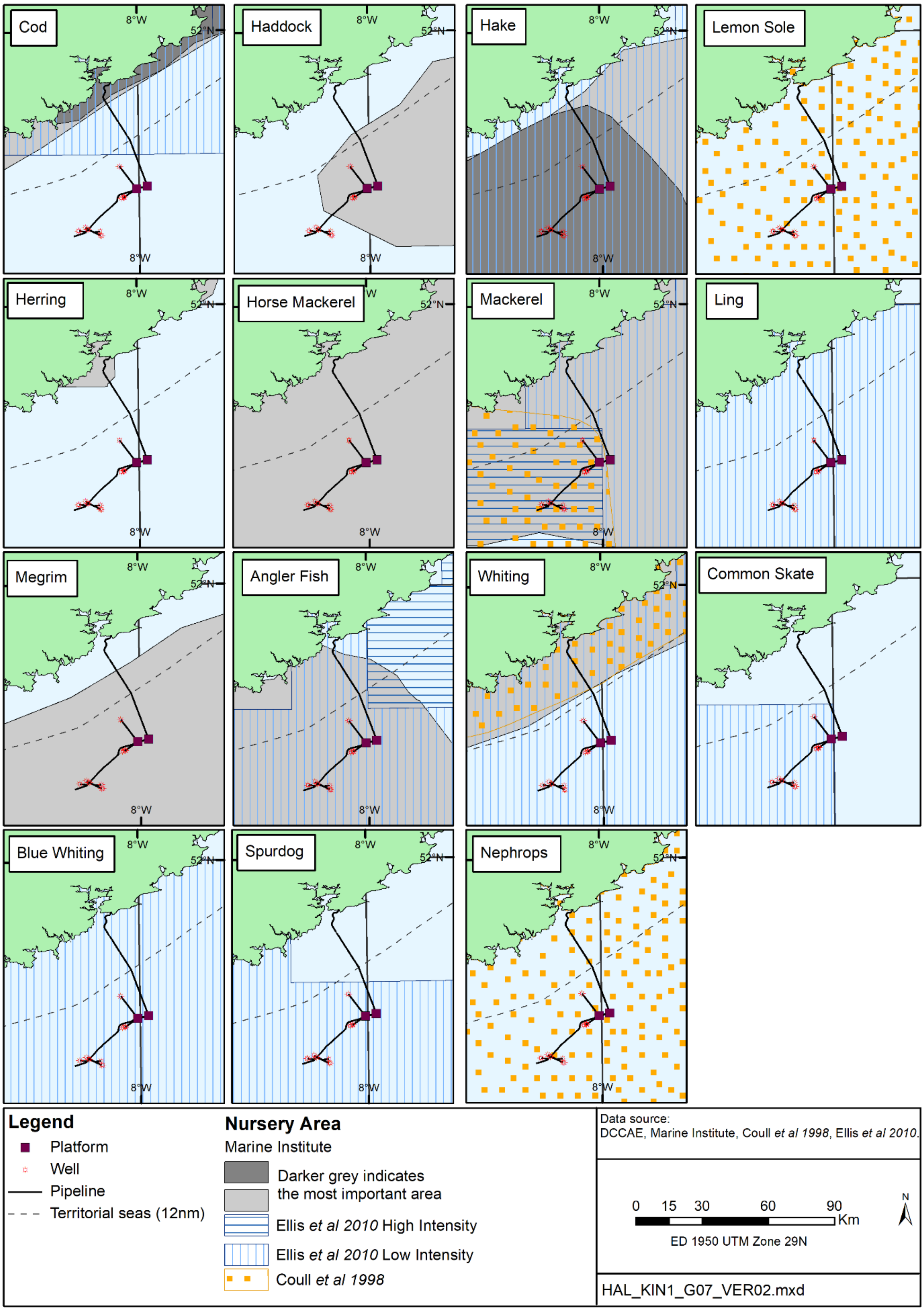


Figure 3.2: Fish nursery areas



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). The overall 2019 fishing opportunities (i.e. Total Allowable Catches, TAC's species) for stocks to which the Irish fleet has access to, were 1.15 million tonnes of fish, with an estimated landed value of €1.44 billion. Ireland's total share of these TACs in 2019 amounted to 193,924 tonnes with a value of €216 million[2] (Marine Institute 2019). The largest ports near the Kinsale 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) (see Figure 3.3).

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). 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[4] of fishing vessels over 2015/16 showed the busiest month to be February, with 540 vessel-days recorded by 77 different vessels and the quietest month, December with 277 vessel-days recorded from 66 different vessels (Figure 3.4). 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.

Vessels estimated to be actively fishing in the Kinsale Head area, colour-coded by gear-type, are presented in Figure 3.5, based on 18 months of AIS (Automatic Identification System) analysis (Anatec 2017). The majority of active fishing was from vessels with demersal gear (including single demersal trawlers, beam trawlers and dredger). On average there were approximately four demersal vessels per day actively fishing within the area highlighted on Figure 3.5.

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[5]. Table 3.6 lists the weight and value of landings from the Kinsale Area rectangles (se Figure 3.3) over the period 2014-2016.

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[2] These values do not include the valuable inshore fisheries (e.g. lobster, whelk) which are not managed using internationally agreed TACs but do come within the remit of the CFP. These inshore fisheries resources represent a very important resource base for the coastal communities around Ireland (Marine Institute 2019).

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

[4] The monthly count is taken as number of vessel-days per month, which is defined as the number of unique vessels per day summed for each month (Anatec 2017).

[5] Long term management plans of relevance to the mixed demersal fisheries in the area include the recently adopted Western Waters multi-annual plan for demersal species (Marine Institute 2019).

Figure 3.3: Fishing ports in the region

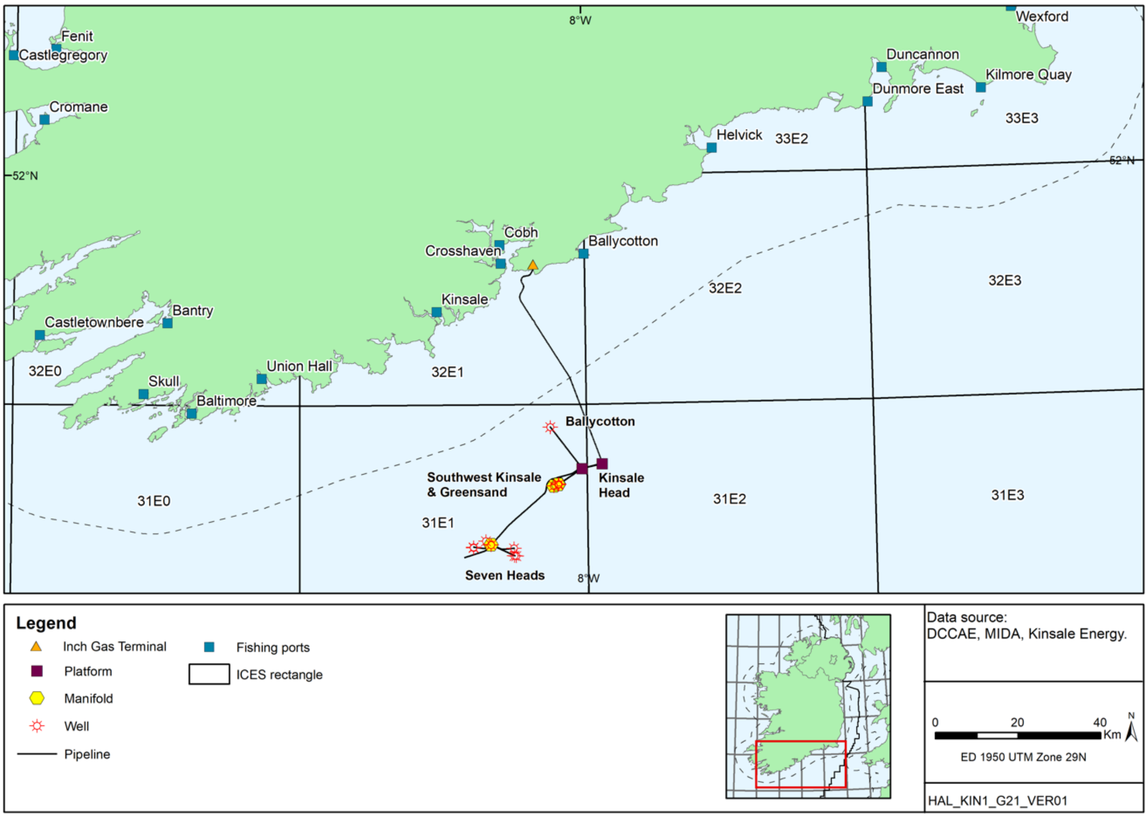
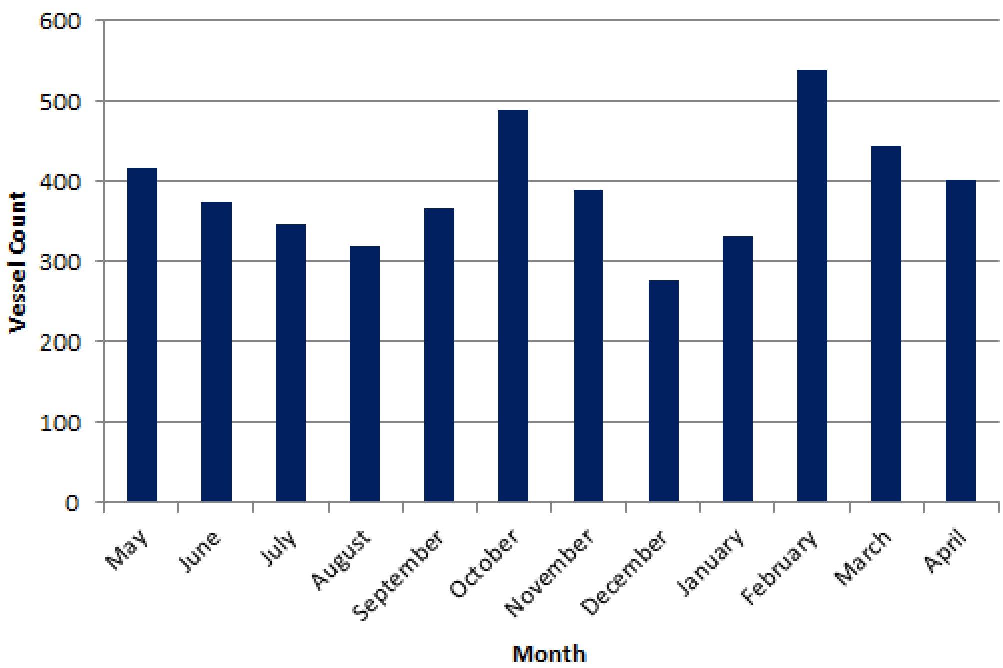
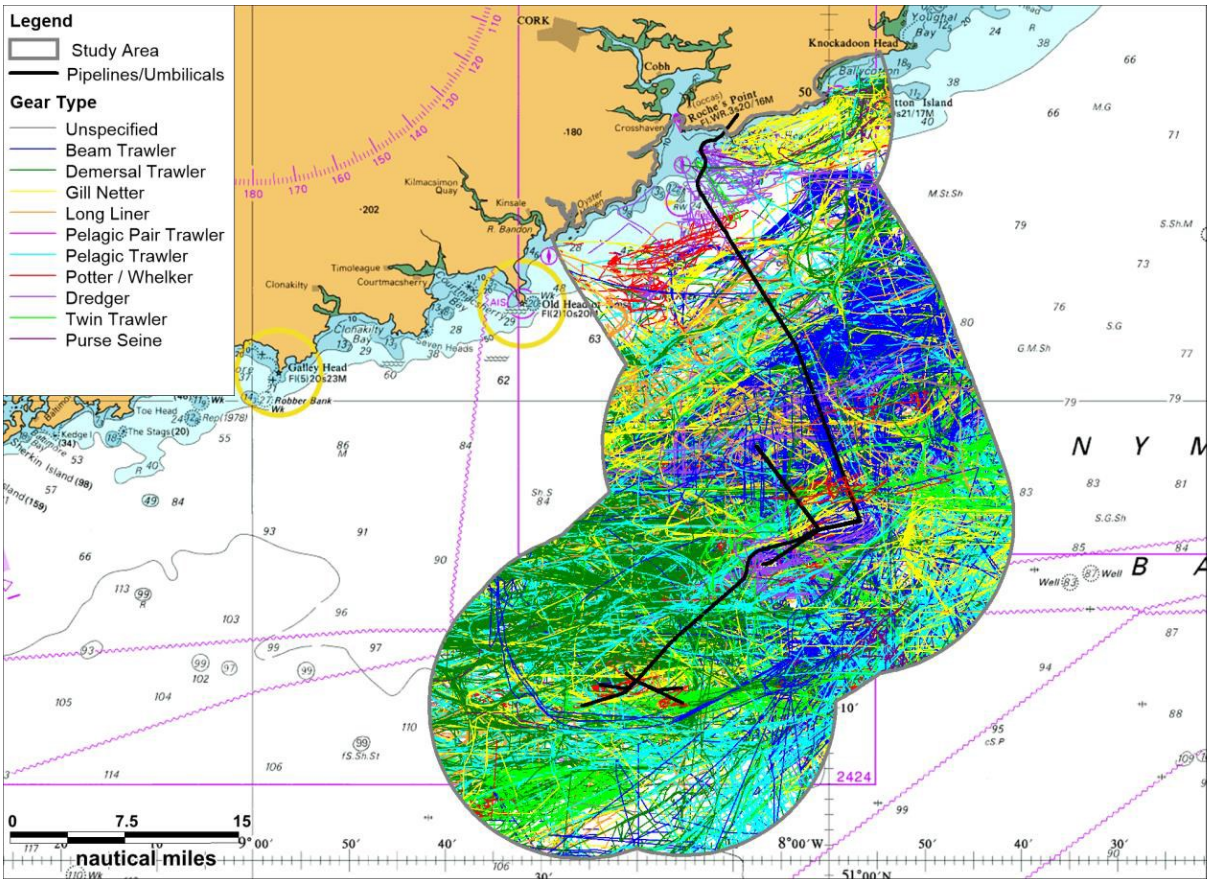


Figure 3.4: AIS fishing vessel monthly count (2015/16)



Source: Anatec (2017).

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



Source: Anatec (2017)

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**
32E1						
Pelagic	815	156,201	277	99,996	457	116,872
Demersal	511	1,152,666	325	785,269	368	817,341

Species type	2014		2015		2016	
	Live weight (tonnes)	Value (€)	Live weight (tonnes)	Value (€)	Live weight (tonnes)	Value (€)
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)

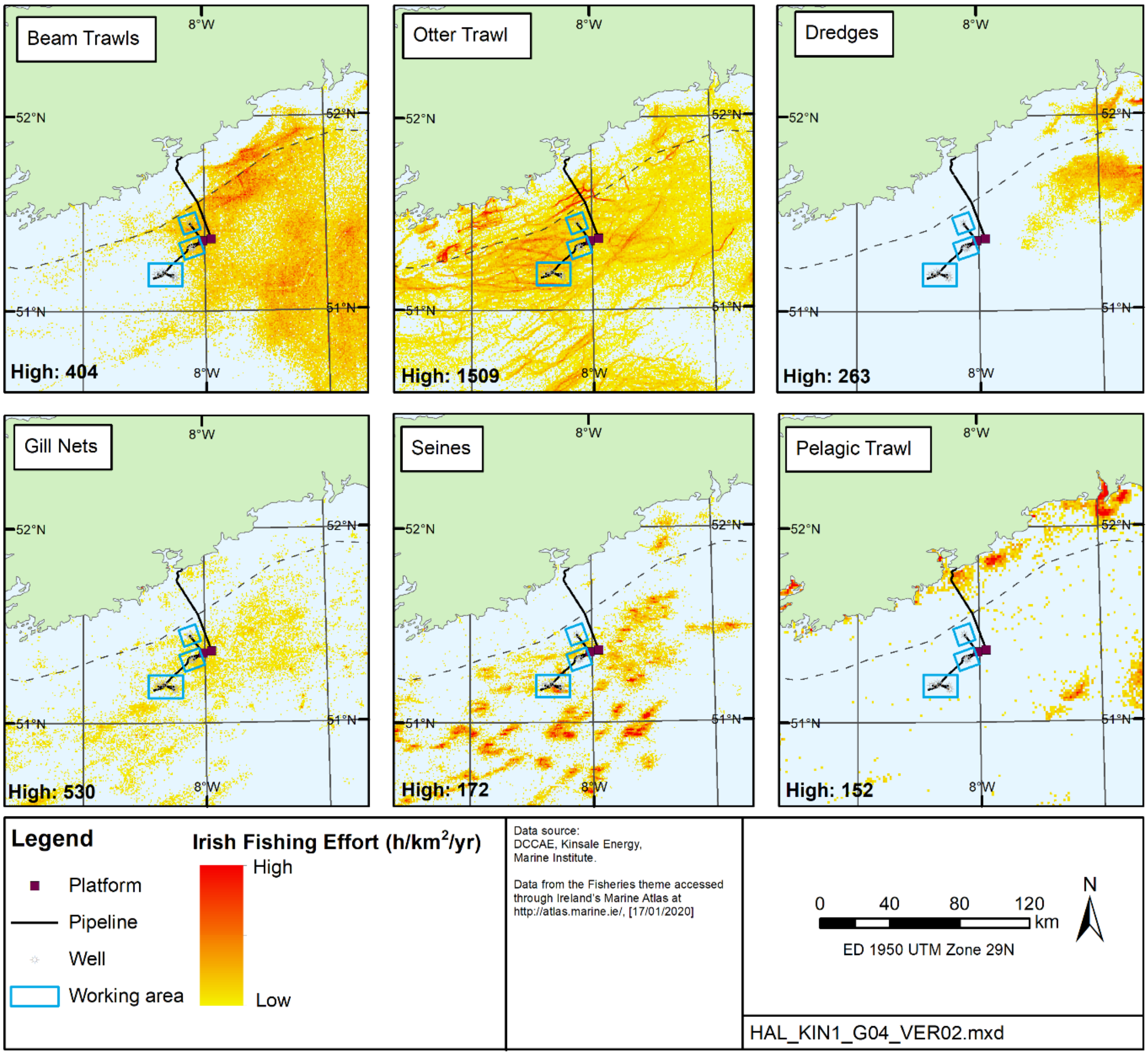
Over the period 2014-2016, reported landings from these rectangles were largely dominated by demersal fish species. Total landings have remained relatively similar across the three years, although there were very high catches of pelagic species (mostly herring) in ICES rectangle 31E2 in 2014 and 2015, a region where high abundances of herring and sprat are reported (O'Donnell *et al*. 2016). Lower total landings in 32E1 than in 31E1 and 31E2 may be attributed in part to the smaller available fishing area of this coastal rectangle (see Figure 3.3), as well as the predominance of smaller, inshore vessels in these areas. Pelagic fish are usually caught in large quantities, but at low value (a tonne of herring averages €326), while several demersal species and, particularly shellfish, attract high market values (cod may fetch €2,519/tonne, monkfish €3,326/tonne, *Nephrops* €6,920/tonne and lobster €13,781/tonne), and thus, with a slight increase in demersal landings over this period, the total value has remained very similar.

Figure 3.6 illustrates the fishing effort around the Kinsale Area. Clear areas of greater effort by otter trawl can be seen. These areas correlate with muddy sediments where small but productive *Nephrops* grounds are located (Lordan *et al.* 2015, Gerritsen & Kelly 2019).

The current status of commercial fish and shellfish populations was considered in relation to MSFD Descriptor 3[6] as part of the Initial Assessment of Ireland's marine waters (Marine Institute 2013). This initial assessment has recently been updated and is currently being consulted upon[7] as part of the second MSFD implementation cycle. The assessment indicates that thirty-four stocks are considered to be compatible with Good Environmental Status (GES), while 44 stocks are not. The compatibility of 99 stocks in relation to GES is unknown. Overall, the assessment concluded that the status of commercial fish and shellfish stocks is not fully compatible with GES.

[6] 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.
[7] https://www.housing.gov.ie/sites/default/files/public-consultation/files/msfd_public_consultation_report_december_2019.pdf

Figure 3.6: Fishing effort in the Kinsale Area, 2014-2018



4 FISHERY 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 an EIA screening and an Appropriate Assessment Screening Statement. The assessment considers those potential effects on fisheries identified through the EIA screening 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 EIA screening process identified the following sources of potential effects of relevance to fisheries:

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

4.2 Physical presence of survey vessel

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 fishing vessels, but this is limited by the small working area of the survey vessel relative to the wider Kinsale Area and Celtic Sea. Interactions are largely limited to the survey vessel in transit or any time spent outside of the statutory 500m fishery exclusion zone which surrounds the platforms, which represents a minor increment to existing supply and support activity. The vessel is estimated to be present for less than one day, and the activities will be advertised through relevant notices to mariners. It is planned that the survey will take place between April to September 2020.

4.2.1 Conclusions

Given the limited duration of the planned survey by a single vessel, the low number of fishing vessels likely to be present within the general area and that activities will primarily occur within long-established statutory exclusions zones, **the risk of displacement of fishing activities due to the presence of the survey vessel 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. However much attention has also been given to effects on fish. 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 survey will use high-resolution geophysical survey (HRSG) sources to obtain information on the seabed, existing infrastructure, potential obstructions and anchoring conditions at the KA and KB platforms. 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. The lowest frequency source which may be used is a pinger or chirp sub-bottom profiler (SBP); no airgun, sparker (electrostatic discharge) or boomer (accelerated water mass) will be used. Chirp SBPs typically sweep through a range of frequencies from a lower bound of approximately 1-2kHz.

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 equipment (and comparable equipment) which will potentially be used in the planned Kinsale survey, drawing on results of Crocker & Fratantonio (2016) supplemented by manufacturer specifications where required. Source levels provided are those reported for the sources operated at the maximum power tested. In addition to those sources described in Table 4.1, there may be the use of an ultra-short baseline (USBL) system to monitor the position of towed equipment. The USBL system consists of a multi-element transducer mounted on the hull of the vessel and a transponder attached to the towed equipment (e.g. side-scan sonar). The hull-mounted transducer emits an acoustic pulse that is detected by the transponder, which replies with its own acoustic pulse, and its position is subsequently determined from the range and angle of the pulse as received by the transducer. USBL equipment is widely used by offshore commercial and research vessels where positional accuracy of towed survey equipment is critical. The emitted pulses will be short pulse width ‘pings’, approximately in the range of 20-35kHz and with a source level of up to ~200dB re 1µPa @1m (peak).

Table 4.1: Potential acoustic survey equipment and indicative source characteristics

Potential equipment	Indicative source characteristics		
	Nominal operating frequency	**Source level**	**Beam width (degrees)**
Hull-mounted pinger/chirp SBP e.g. Edgetech 3300	1-16kHz	212dB re 1µPa @1m (peak)[(1)]	20-40[(1)]
Towed pinger/chirp SBP e.g. Edgetech 2400 [(2)]	1-16kHz	186-187dB re 1µPa @1m (peak) [(2)]	51-80 [(2)]
Side-scan sonar e.g. Edgetech 4200 [(3)]	100kHz & 500kHz	206-210 dB re 1µPa @1m (peak) [(3)]	1.6-2.6 along track; ~50 across track per beam [(3)]
Multi-beam echosounder e.g. Kongsberg EM710 [(4)]	70-100kHz	214-228dB re 1µPa @1m (peak) [(4)]	1.5-6.0 along track; ~160 across track [(4)]
Single beam echosounder e.g. Kongsberg EM400 [(5)]	35-200kHz	192-197dB re 1µPa @1m (peak) [(5)]	7.0 [(5)]

Notes: (1) manufacturer-specified; beam width varies with operating frequency and transducer configuration. Source characteristics are manufacturer-specified unless stated otherwise. (2) Manufacturer-specified source level and beam width not available for the Edgetech 2400 towed SBP, so values (calibrated measurements) are taken for the comparable Edgetech 512i and 424 towed chirp SBPs reported in Crocker & Fratantonio (2016). (3) Calibrated measurements for Edgetech 4200 tested at 100kHz and 400kHz reported in Crocker & Fratantonio (2016). (4) Manufacturer-specified source level not available for the Kongsberg EM710, so values (calibrated measurements) are taken for the comparable Reson Seabat 7111 MBES operated at a central frequency of 100kHz reported in Crocker & Fratantonio (2016). (5) Manufacturer-specified source level and beam width not available for the Kongsberg EM400, so values (calibrated measurements) are taken for the comparable Teledyne Echotrac CV100 operated at a central frequency of 200kHz 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 SBPs, side-scan sonar and echosounders are of much lower amplitude and extent compared to seismic surveys using airguns due to their lower source levels, higher central operating frequencies and greater directionality (narrower beam widths) (e.g. Boebel *et al.* 2005, Genesis 2011). However, very few empirical field data are available to quantify these expectations. The most relevant work to date is part of the study funded by the US BOEM: following the calibrated measurements of Crocker & Fratantonio (2016), measurements were made in shallow (≤ 100m depth) open-water environments to investigate the propagation of sound from various HRGS sources (Halvorsen & Heaney 2018). Problems were encountered during the open-water testing resulting in a lack of calibration in the reported sound source levels (Labak 2019). The accompanying advice note (Labak 2019) emphasises that these uncalibrated data should not be used to provide source level measurements, and consequently the reported isopleths (summarising sound propagation) should not replace project-specific sound source verifications. A further project to calibrate these measures and provide an expanded assessment of propagation commenced in 2019.

Despite these caveats, it is worth noting some general patterns observed in Halvorsen & Heaney (2018). In all test environments, broadband received levels from all SBP chirper[8], 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)[9] beyond 200m from any chirper SBP, echosounder or side-scan sonar device tested. While recognising that these results require refining, preliminary evidence suggests that these electromechanical HRGS sources generate a very limited sound field in the marine environment, and of a much lower magnitude than those generated by seismic airgun sources. 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 survey vessel is assumed to be of 50-100m in length. 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 100-1,000Hz), and to a lesser extent also at higher frequencies (5-13dB from 10-40kHz).

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[8] While no device marketed as a 'pinger' was tested, one chirper SBP tested had very similar specifications to the Knudsen Pinger SBP and so results can be considered applicable to this potential source in the planned Kinsale survey.

[9] 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).

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. Pinger and chirp SBPs show limited overlap only among fish species which primarily detect sound pressure, such as herring, while the high frequency signals generated by side-scan sonar, echosounders and USBL are above the hearing range of fish.

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 platforms survey, **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 platforms survey, in addition to the small spatial footprint and short duration (less than one day) of the planned survey, **the risk of significant effects on fish due to behavioural disturbance is considered to 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 recruitment (OSPAR 2009). The Kinsale area and proposed timing of the survey 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 zone, **no impacts on commercial fisheries in the vicinity of the KA and KB platforms will occur.**

4.4 Accidental events

The survey activities will be communicated through notices to mariners and the vessel will display appropriate navigational lighting. In view of the duration and scale of activity (one vessel for less than one day), 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

Exola DAC, a subsidiary of Providence Resources plc has applied for approval for a site survey in the Barryroe field (licence area SEL 1/11), some 25km from the Kinsale Bravo platform. The survey is planned for between April and November 2020 or between February and November 2021. The geophysical survey equipment comprises side scan sonar, single-beam & multi-beam echosounders, pinger SBP, USBL and magnetometer, and the survey is anticipated to take about 1.5 days. The proposed Barryroe survey overlaps with the 500m safety exclusion zones of 2 Seven Heads field wells. Exola requires prior permission from Kinsale Energy to enter these zones, this will allow coordination of timing of the 2 surveys such that in-combination effects would be avoided.

Marine Notice No. 11 of 2020 advises of several surveys to be undertaken in 2020 to the south and southwest of Ireland. These surveys are part of the INFOMAR Programme (Integrated Mapping for the Sustainable Development of Ireland's Marine Resource), a jointly managed seabed mapping initiative between the Geological Survey Ireland (GSI) and the Marine Institute, funded by DCCAE. Between April and October GSI's R.V.s *Keary*, *Geo*, *Mallet* and *Lir* will operate in the Celtic Sea, including a survey area covering the Kinsale Head and Seven Heads fields. Details of the GSI survey equipment are not provided and Kinsale Energy will liaise with GSI on the timing of the various surveys with the aim of avoiding potential in-combination effects.

Other 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 on fisheries associated with the survey (Sections 4.2 to 4.4), significant in-combination effects are not considered to be likely.

This survey is a precursor to work to be undertaken to decommission certain aspects of the Kinsale facilities, and no interaction with activities associated with the currently approved decommissioning programme are possible.

Kinsale Energy also propose to undertake a short (one week) survey using a range of equipment which may include SBP, side-scan sonar, echosounder and magnetometer, in and around existing Kinsale facilities (excluding the platforms), with the wider survey working areas extending into a broader area of approximately 4km around each of the subsea wells. This will be subject to a separate application. Kinsale Energy will ensure that the survey schedules are such that there will be no temporal overlap such that cumulative effects are not considered to be likely.

4.6 Fisheries stakeholder engagement

The following relevant fisheries organisations and forums relevant 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's Organisation (KFO)

- Bord Iascaigh Mhara

These groups will be notified of the proposed survey vessel and timing 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 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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