Dudgeon and Sheringham Shoal Offshore Wind Farm Extensions

Preliminary Environmental Information Report

Volume 3

Appendix 14.1 - Commercial Fisheries Technical Report

April 2021

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Commercial Fisheries Technical Report

Dudgeon Extension and Sheringham Shoal Extension Projects

Final report

March 2021

POSEIDON
AQUATIC RESOURCE MANAGEMENT

Report Information

This report has been prepared with the financial support of Equinor. The views expressed in this study are purely those of the authors. The content of this report may not be reproduced, or even part thereof, without explicit reference to the source.

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Abbreviations

AfL	Agreement for Lease
$B_{trigger}$	Biomass trigger point
BMS	below minimum sized
CEA	Cumulative Effects Assessment
DCO	Development Consent Order
DEP	Dudgeon Extension Project
EC	European Commission
EEZ	Exclusive Economic Zone
EIA	Environmental Impact Assessment
EIFCA	Eastern Inshore Fisheries Conservation Authority
ES	Environmental Statement
EU	European Union
F_{lim}	Fishing mortality limit reference point
F_{msy}	Fishing mortality consistent with achieving Maximum Sustainable Yield
F_{pa}	Fishing mortality precautionary approach reference point
GIS	Geographical Information System
HVAC	High-Voltage Alternating Current
HVDC	High-Voltage Direct Current
ICES	International Council for the Exploration of the Sea
IFCA	Inshore Fisheries Conservation Authority
km	Kilometre
LCCC	Length Converted Catch Curve
LO	Landings Obligation
LPUE	Landings per unit effort
m	Metre
MAP	Multiannual plan
MLS	minimum landing size
MMO	Marine Management Organisation
MSY	Maximum sustainable yield
MW	Megawatts
NM	Nautical mile
NFFO	National Federation of Fishermen's Organisations
NNIFA	North Norfolk Independent Fishermen's Association
NPPF	National Planning Policy Framework
NPS	National Policy Statement
NSIP	Nationally Significant Infrastructure Project
OWF	Offshore Wind Farm
PEIR	Preliminary Environmental Information Report
RBS	Registration of Buyers and Sellers

SEP	Sheringham Extension Project
SNS	Southern North Sea
SoS	Secretary of State
SSB	Spawning stock biomass
TAC	Total allowable catch
UK	United Kingdom
UN	United Nations
WTG	Wind Turbine Generator

1. Introduction

1.1 Context

Equinor New Energy Ltd (hereafter called Equinor) is leading on the proposed development of the Dudgeon Extension Offshore Wind Farm Project (DEP) and the Sheringham Extension Offshore Wind Farm Project (SEP) on behalf of the partners currently in ownership of both Dudgeon and Sheringham Shoal Offshore Wind Farms.

This Commercial Fisheries Technical Report has been written in order to provide a detailed review of the commercial fisheries activities operating within and adjacent to, the proposed Sheringham and Dudgeon Extension Projects including the proposed offshore export cable corridor. DEP is located to the north (DEP north) and southeast (DEP south) of the existing Dudgeon Offshore Wind Farm and is 31 km at its closest point to shore. DEP is proposed to consist of up to 32 wind turbines, with a total of up to 448 MW capacity. SEP lies to the northeast of the existing Sheringham Shoal Offshore Wind Farm, 17.5 km at its closest point to shore. The expected capacity is up to 338 MW from up to 24 wind turbines.

The offshore export cable routes for both projects are proposed to connect to landfall on the North Norfolk coast at Weybourne.

For the purpose of this report, 'commercial fishing' is defined as any form of fishing activity legally undertaken with catch sold for taxable profit. Recreational fishing is addressed in Chapter 20: Petroleum Industry and Other Marine Users. Navigational aspects related to fishing vessels are assessed in Chapter 15: Shipping and Navigation. The ecology of fish and shellfish, including species of commercial interest, are assessed in Chapter 11: Fish and Shellfish Ecology.

1.2 Commercial fisheries study area

The Projects are within the International Council for the Exploration of the Sea (ICES) Division IVc (4c) within the UK Exclusive Economic Zone (EEZ) (Figure 1-1). Each ICES Division is divided into statistical rectangles within which fisheries landings are reported. Both DEP and SEP lie within ICES statistical rectangle 35F1, with the areal overlap being 2.79% and 2.49% respectively.

Figure 1-2 presents the boundaries of the proposed wind farm sites and cable corridor. DEP is divided into two areas DEP north and DEP south, which both lie outside the 12 nautical miles (NM) territorial waters limit in depths of between 11 m and 23 m. The closest distance to shore is at DEP south (31 km). Combined, DEP north and DEP south, cover an Agreement for Lease (AfL) area of 103.5 km^2.

SEP lies partially outside the 12 NM territorial limit and partially within the 6 to 12 NM boundaries. The proposed offshore export cable corridors for DEP and SEP will pass through both ICES rectangles 35F1 and 34F1 on approach to landfall and the areal overlap is calculated to be 1.91% for both rectangles, based on the construction option of building SEP and DEP simultaneously. The areal overlap of each possible construction scenario is presented in Table 1.1 and Figure 1-3, including:

- SEP only
- DEP only
- SEP and DEP simultaneously
- SEP and DEP successively

Table 1.1: Construction scenarios and project areal overlap with ICES statistical rectangles

Construction scenario	Proposed project area	Percentage area overlap
SEP only	Array area: 92.63 km^2	2.49% overlap with 35F1
	Export cable corridor: 19.23 km^2	0.26% overlap with 34F1 & 35F1
DEP only	Array area: 103.51 km^2	2.79% overlap with 35F1
	Export cable and interconnector cable corridors: 92.26 km^2	1.24% overlap with 34F1 & 35F1
SEP and DEP simultaneously	Array area: 196.14 km^2	5.28% overlap with 35F1
	Export cable and interconnector corridors: 142.52 km^2	1.91% overlap with 34F1 & 35F1
SEP and DEP successively	Array area: 196.14 km^2	5.28% overlap with 35F1
	Export cable and interconnector corridors: 92.26 km^2	1.24% overlap with 34F1 & 35F1

Since ICES statistical rectangles are the smallest area for which landings data are available these, along with the extension project footprint will be used to define the boundary for the study areas for describing commercial fisheries activity.

Given the potential for displacement of vessels the regional commercial fisheries study area also includes ICES rectangles 34F0 and 35F0.

The commercial fisheries study areas are defined as follows and depicted in Figure 1-4:

- DEP and SEP wind farm sites study area: 35F1;
- Offshore export cable corridor study area: 34F1 & 35F1; and
- Regional study area: 34F0, 34F1, 35F0 and 35F1.

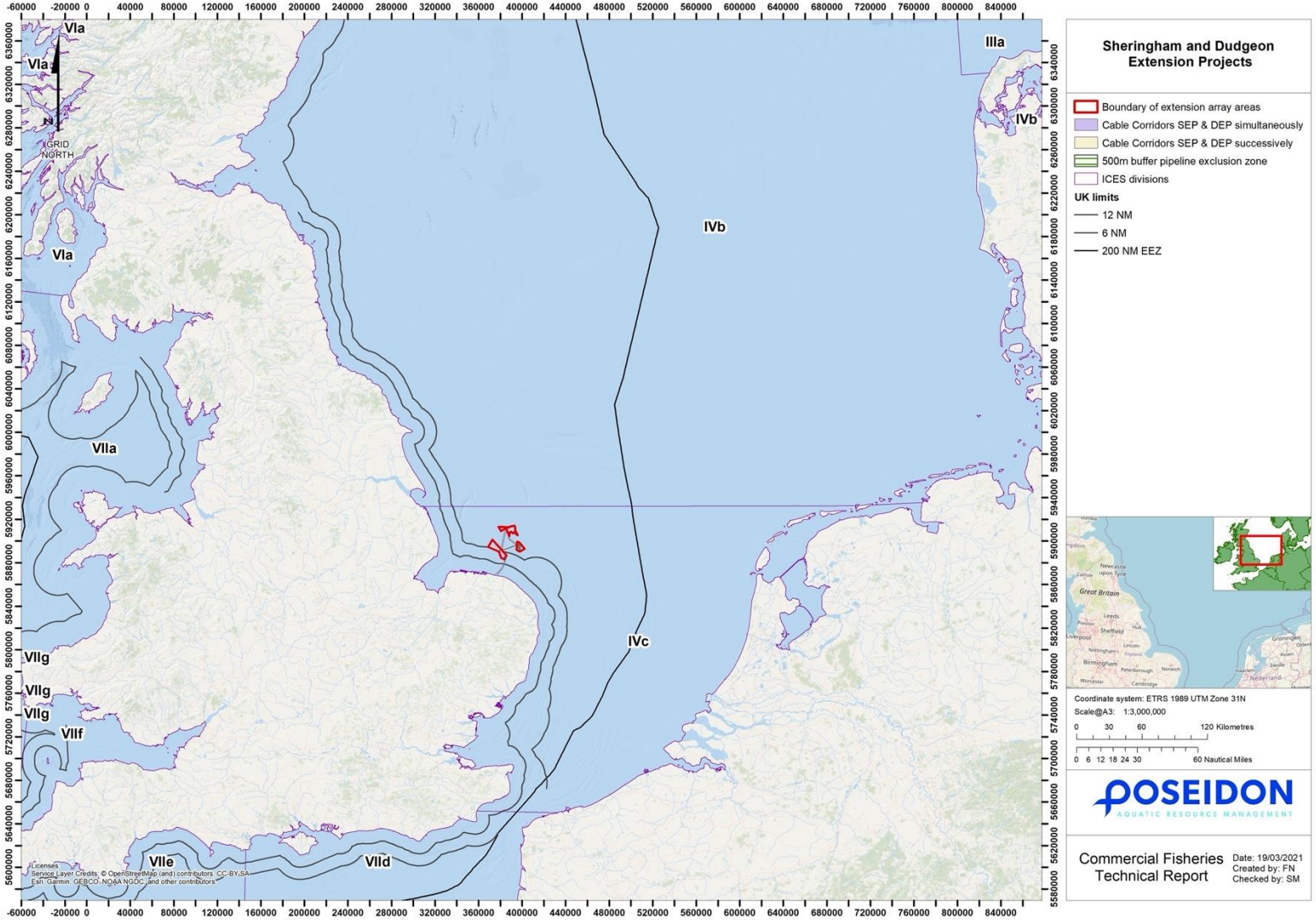

Figure 1-1: Location of the Sheringham and Dudgeon Extension Projects within ICES Division IVc

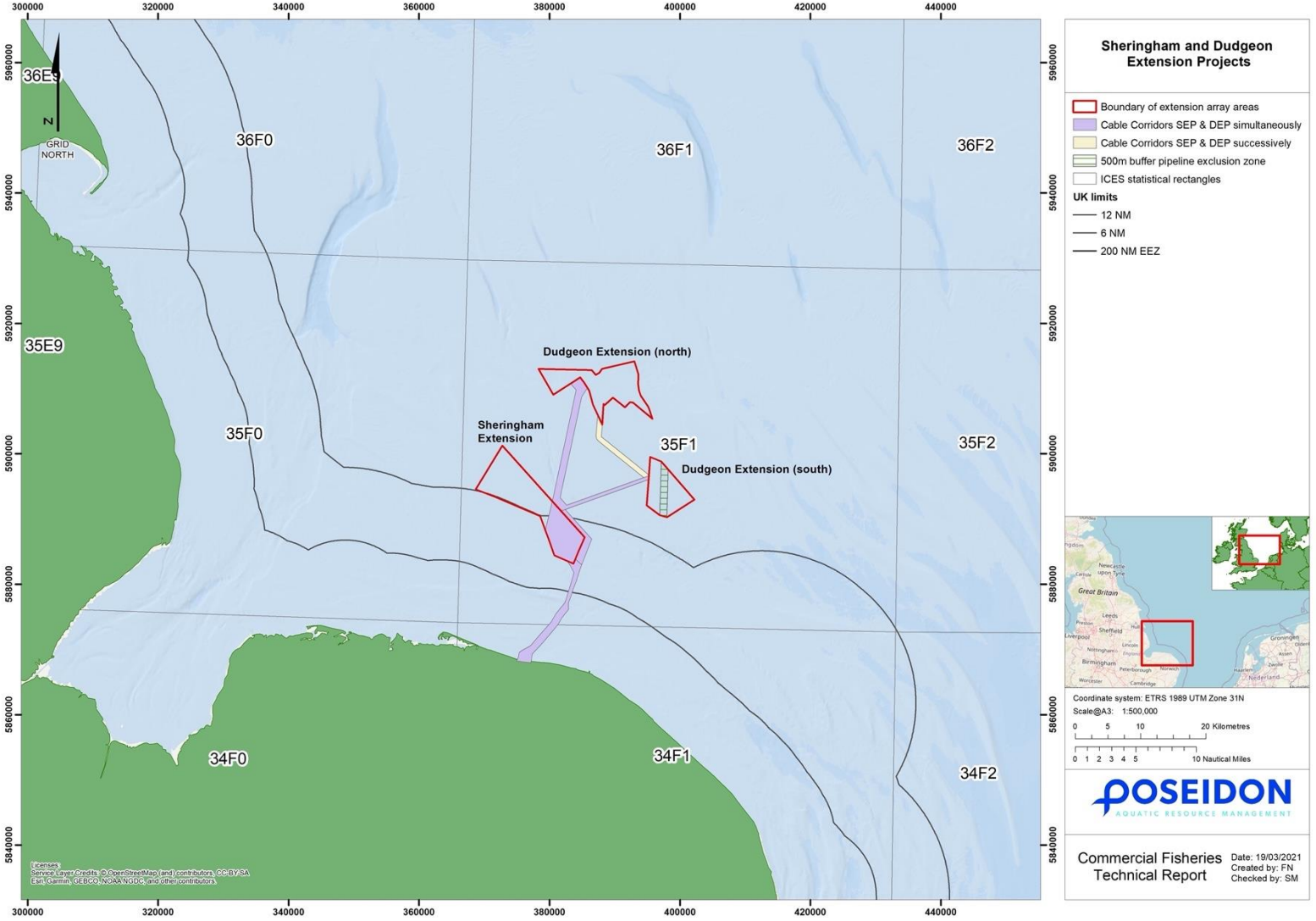

Figure 1-2: Boundary of Sheringham and Dudgeon Extension Projects relative to ICES statistical rectangles

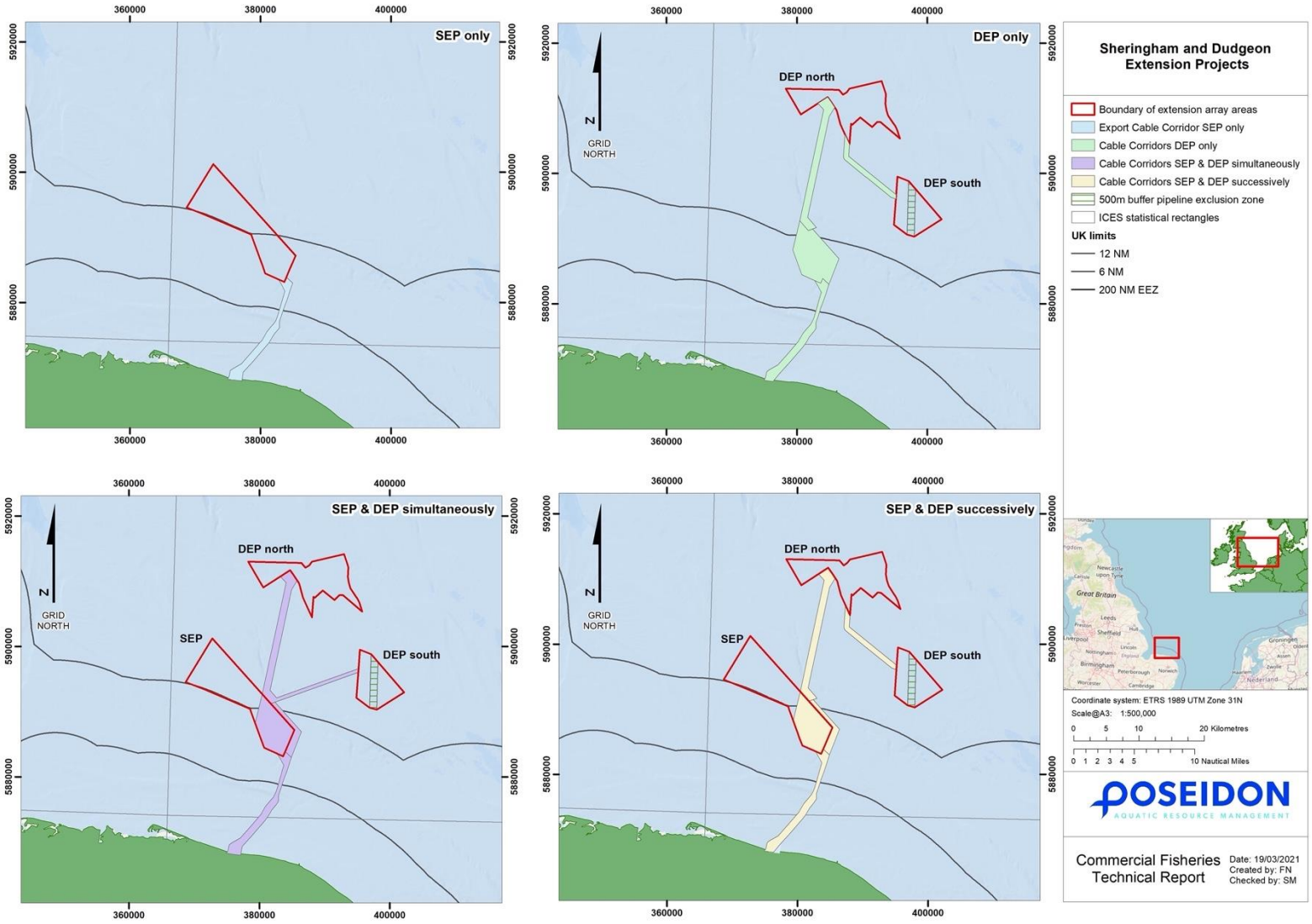

Figure 1-3: Boundary of Sheringham and Dudgeon Extension Projects relative to ICES statistical rectangles

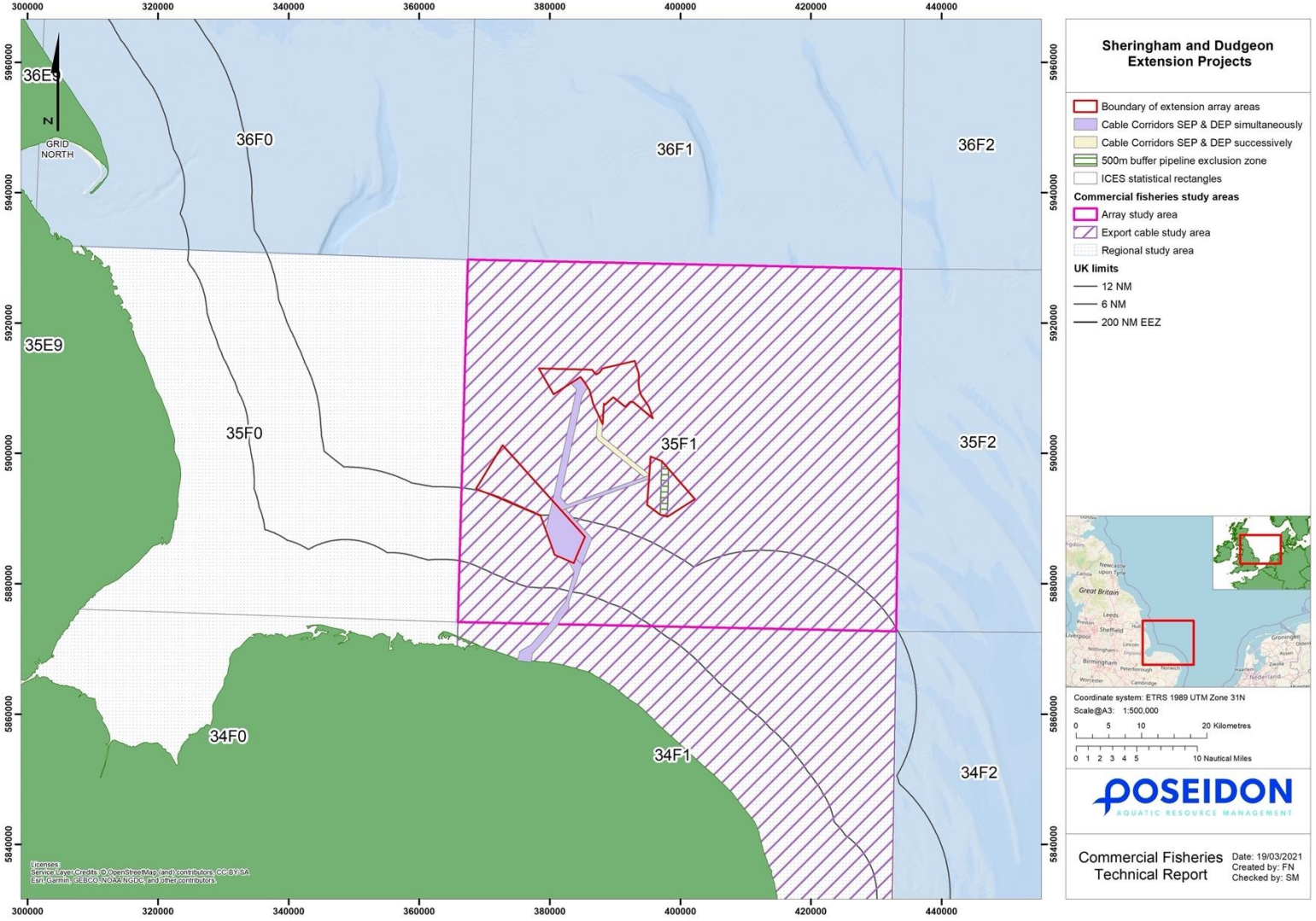

Figure 1-4: Commercial fisheries study areas, including DEP and SEP wind farm sites study area (35F1); Offshore export cable corridor study area (34F1 & 35F1); and Regional study area (34F0, 34F1, 35F0 and 35F1)

1.3 Data sources and methodology

To inform this extended Technical Report for commercial fisheries a number of data sources have been used as shown in **Table 1.2**. Information on the commercial fisheries within the regional study area was collected through a detailed desktop review of existing studies and datasets which are summarised below.

In addition, in order to ground-truth the data collected and to understand patterns of fishing activity both temporal and spatial, consultation has taken place with relevant inshore and offshore fisheries stakeholders.

Data limitations are described within the impact assessment in Section 5.3.

1.3.1 Landing statistics

Landings data has been collected from the following sources:

- Landings statistics have been analysed for UK registered vessels operating within the study area between 2015 and 2019. Data collected includes landing year; landing month; vessel length category; ICES Division and rectangle; vessel/gear type; port of landing; species; live weight (tonnes); and, value. Source: Marine Management Organisation (MMO);
- Landings statistics for EU vessels operating within the study area up to 2016 including Belgian, Dutch, French, Danish and UK registered vessels with data query attributes for: landing year; landing quarter; ICES rectangle; vessel length; gear type; species; and, landed weight (tonnes). Source: European Union Data Collection Framework (EU DCF);
- Price data for non-UK Member States sourced from European Market Observatory for Fisheries and Aquaculture Products (EUMOFA) for 2012 to 2016;
- Shellfish monthly return data. Source: Eastern Inshore Fisheries and Conservation Authority EIFCA (2015 to 2019).

Data has also been sourced from a number of European fisheries bodies, including Government, research bodies and directly from the fishing industry.

It is important to note that MMO landing statistics include landings made by all vessel lengths, where that landing is recorded in sales notes, as part of the Registration of Buyers and Sellars (RBS) (2005) Regulation. There are occasions when fish are not subject to the RBS Regulation and therefore are not represented within the MMO landings statistics database, for instance when purchases of first sale fish direct from a fishing vessel are wholly for private consumption, and less than 25 kg is bought per day.

Table 1.2: Data sources

Nationality	Data	Timeframe	Source
UK	Landing statistics data for UK registered vessels with data query attributes for: landing year; landing month; vessel length category; country code; ICES rectangle; vessel/gear type; port of landing; species; live weight (tonnes); and value.	2015 to 2019	MMO
	Vessel Monitoring System data for UK registered vessels with attributes for time fishing and value of catch at a resolution of 200th of an ICES rectangle amalgamated for all mobile vessels and all static vessels.	2014 - 2017	
	Monthly Shellfish Activity Returns data for: UK vessels landing shellfish species caught within EIFCA jurisdiction.	2015 to 2019	EIFCA

Nationality	Data	Timeframe	Source
Europe	Landings statistics for Belgian, Dutch, French and UK registered vessels for: landing year; quarter; ICES rectangle; vessel length; gear type; species and landed weight (tonnes).	2012 to 2016	EU DCF
	Price data for species landed by Belgian, Danish, Dutch, and French registered vessels for: landing year; species; price (€per kg)	2012 to 2016	EUMOFA
	Vessel Monitoring System data for Belgian, Dutch and French registered vessels with attributes for time fishing at a resolution of 1/200th of an ICES rectangle amalgamated for all mobile vessels. 2016 represents the latest data set available.	2016	MMO
	Maps of key sandeel grounds based on vessel tracking plots from Danish registered vessels	1985 - 2010	Danish Fishermen's Association & DTU Aqua
Netherlands	Vessel Monitoring System data for Dutch registered vessels with data attributes presented graphically for: year; gear type; value of catch to a resolution of 1/200th ICES rectangle.	2011 to 2015	Wageningen Economic Research

1.3.2 Vessel Monitoring Systems data

All UK and EU fishing vessels (i.e. fishing vessels flying the flag of the UK or an EU Member State), and third party fishing vessels operating in UK and EU waters that are ≥ 12 m in length are required to have a VMS on board. This reports the vessels' position to fisheries management authorities, which in the case of EU fishing vessels, is every two hours. Since 1st January 2012, this obligation has applied to vessels that are ≥ 12 m in length (before 1 January 2012 it applied to vessels ≥ 12 m in length, see Council Regulation (EC) No 1224/2009). Publicly available MMO VMS data (2014 to 2018) presented within this extended technical report includes vessels that are ≥ 12 m in length.

A vessel's range varies due to weather conditions and skipper preferences as well as technical aspects such as power, but it is generally the case that vessels < 12 m in length fish within 20 NM offshore. Vessels ≥ 12 m in length can and do fish further afield, but in recent years many skippers have altered fishing patterns to favour fishing grounds closer to home ports due to increased fuel prices and time at sea restrictions (vessels being permitted a specific number of days at sea). This has particularly affected vessels operating mobile gears with high fuel demands, such as beam trawlers.

Although figures presenting maps using VMS data may appear to show inshore areas as having lower (or no) fishing activity compared within offshore areas, this may not represent the true situation since, as noted, VMS data does not include vessels typically operating in inshore area (i.e. typically vessels < 12 m in length). This is particularly important when assessing the activity across the offshore cable corridor. Consultation has been key throughout the EIA process to determine extent and distribution of activity by the < 12 m fleet.

The MMO collate VMS data for UK registered vessels by aggregating the number of position plots by general gear type (mobile or static) in a grid of sub-rectangles approximately 5.3 NM^2 (i.e. at a resolution of 200th of an ICES rectangle). This has been integrated with landings values, thereby providing both effort (hours fished) and value (£) of each sub-rectangle for mobile and static gears. These data have been analysed across a five-year period from 2014 to 2018 for UK registered vessels. Note that 2018 represents the latest data set available for this information.

For fishing vessels registered under other European country flags, data has been collected through the European Data Collection Framework (DCF), which provides landings data for all vessel lengths by nationality, ICES rectangle, gear type, species and live weight (tonnes). The latest set of data that allows analysis to ICES statistical rectangle is 2016. Data available after 2016 onwards is amalgamated at ICES Division level e.g. Central North Sea, which does not allow analysis specific to the commercial fisheries study areas.

1.3.3 Surveillance data

In England the fishery protection squadron consists of two MMO fisheries patrol vessels, two MMO aircraft, contractual arrangements with two Royal Navy offshore patrol vessels and 22 patrol vessels from IFCA. Consultation with the Eastern IFCA indicates that over recent years patrol vessels effort has focused on targeted inspections of vessels at sea, rather than randomised surveillance. As a result, surveillance data is less useful for constructing an unbiased on-going picture of fishing activity, and for this reason has not been included as a data source within this assessment.

1.3.4 Other sources

Surveys carried out across the project area that inform the commercial fisheries assessment based on fishing gear encountered during the surveys include: benthic ecology surveys and geophysical surveys. The Dudgeon and Sheringham Shoal Extension Benthic Surveys Field Report (Survey Period: 10 to 19 August 2020) encountered the presence of fishing gear at four sample locations.

Other sources of data utilised in the preparation of the extended technical report include published and grey literature which are cited in the text and included in the reference section at the end of this report.

1.4 Consultation

Consultation with national and local fishing industry representatives, fishermen and one local processor has been undertaken to ground truth the datasets analysed within this report and inform the impact assessment.

Details of the commercial fisheries consultees consulted in relation to DEP and SEP are provided in Table 1.3.

Table 1.3: Consultation record

Consultee	Date(s)	Forum of consultation
Eastern Inshore Fisheries Conservation Authority	22 July 2020; 21 August 2020	Email, Teams meeting and telephone
National Federation of Fishermen's Organisations	23 July 2020	Email and Teams meeting
North Norfolk Independent Fishermen's Association	07 August 2020, 25 August 2020	Email and telephone
North Norfolk Fishermen's Society	21 August 2020	Email
Wells and District Fishermen's Association	21 August 2020	Email
Greater Wash Fishing Industry Group	27 July 2020	Email
Independent fisherman	27 July 2020	Email
Jonas Seafood Ltd	27 July 2020, 06 August 2020	Email and telephone
Eastern England Fish Producers Organisation Ltd	27 July 2020	Email

2. Key fleets and fisheries

2.1 Overview of total landings

2.1.1 Regional study area

2.1.1.1 All countries

The landed weight of species from the regional study area (ICES rectangles 34F0, 35F0, 34F1 and 35F1) from all countries is presented in Figure 2-1. Shellfish dominate the landings by both weight and value; whelk *Buccinium undatum* are landed in highest quantity (approximately 1,500 tonnes per annum) with a first sales value of over €2 million, while brown shrimp *Crangon crangon* are the highest value species with just under €4 million per annum (based on five year average form 2012-2016). Smaller quantities of finfish are landed including sole *Solea solea* and plaice *Pleuronectes platessa* by Dutch registered vessels and whiting *Merlangius merlangus* by French registered vessels.

Figure 2-2 represents the location and value of all EU beam trawlers over 12 m predominantly used to target plaice and sole which are usually caught together in a mixed fishery. The location and value of UK beam trawl activity is also presented in Figure 2-2. Areas of highest value are located to the east of the and southwest of the DEP and SEP extension projects. The area of highest value within the 6 NM limit of UK waters is located within the Wash which is the main area for the beam trawl fishery for brown shrimp. The project area does not overlap with the location of the beam trawl fishing grounds represented in VMS data.

The value of dredging activity within the regional study area for both EU registered vessels and for UK vessels over 12 m is presented in Figure 2-3. Dredges are predominantly used to target scallops and although there are low value areas within the regional study area the extension project area is not located within these fishing grounds. Figure 2-4 presents the value of demersal otter trawling activity in the regional study area, with minimal activity within the boundary of the Projects.

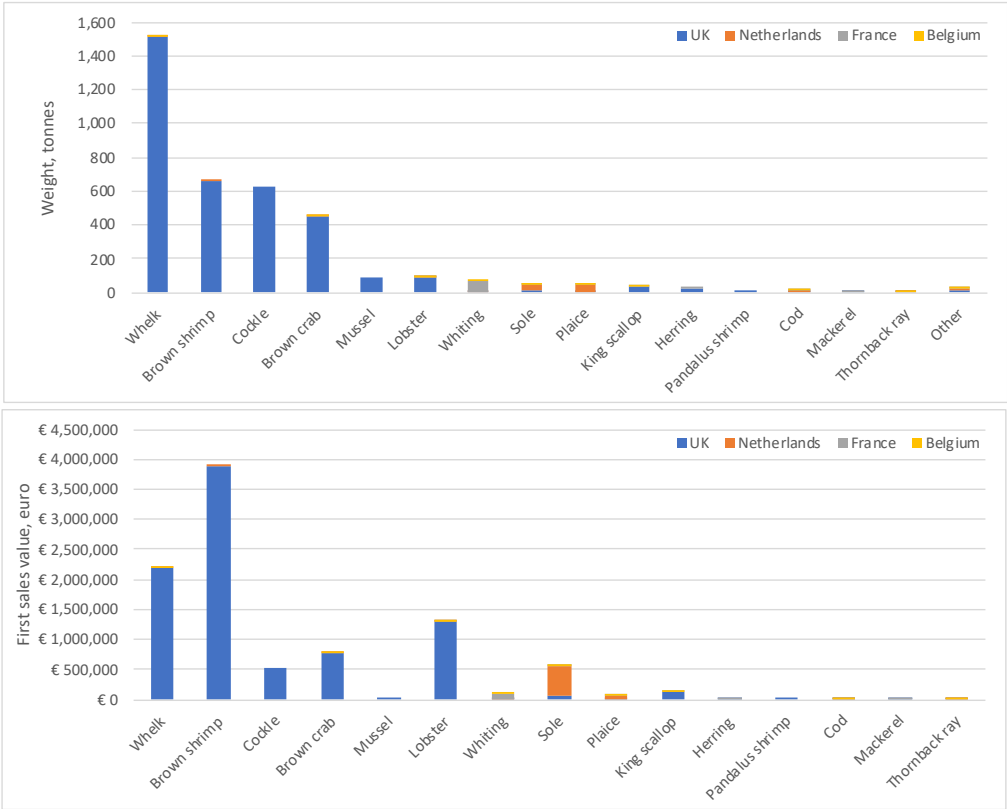

Figure 2-1: Regional study area average annual landings by weight, all countries and all vessel lengths (based on period 2012-2016; data source: EU DCF, 2019).

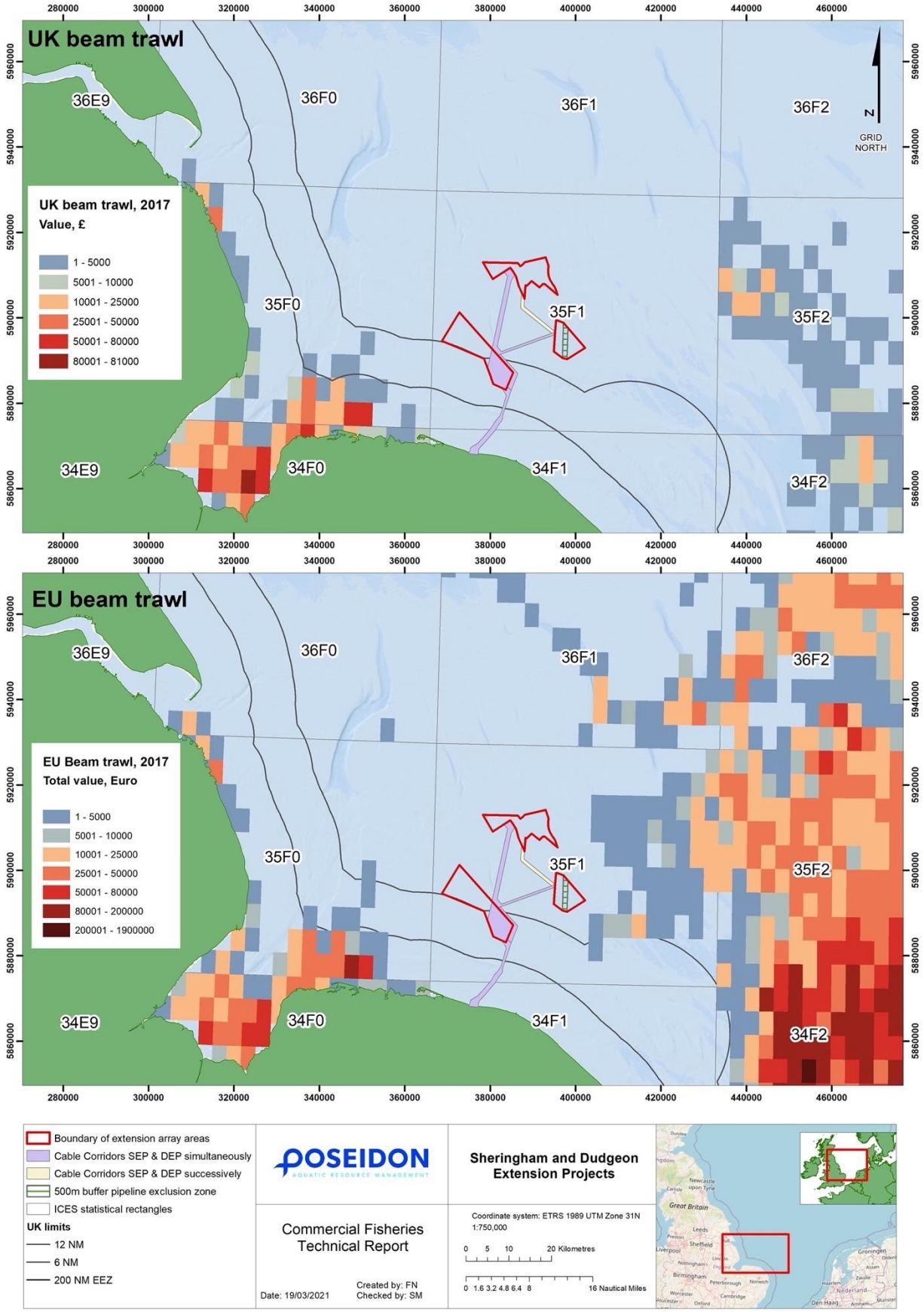

Figure 2-2: VMS data indicating value of beam trawling activities for vessels ≥ 12 m in length in 2017 for UK vessels only (top) and all EU (including UK) vessels (bottom) (Data sources: MMO, 2019 and ICES, 2019)

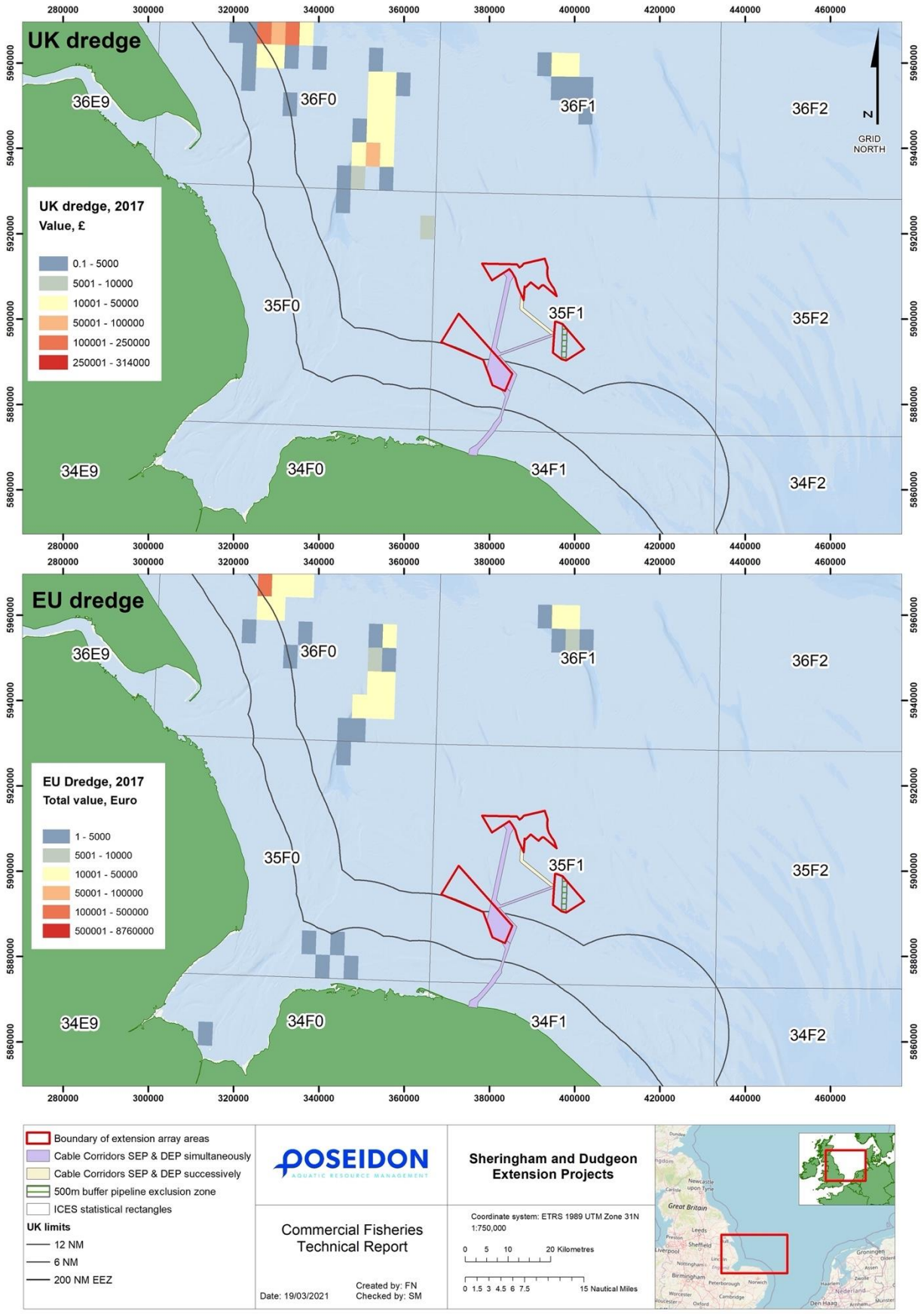

Figure 2-3: VMS data indicating value of dredging activities for vessels ≥ 12 m in length in 2017 for UK vessels only (top) and all EU (including UK) vessels (bottom) (Data sources: MMO, 2019 and ICES, 2019)

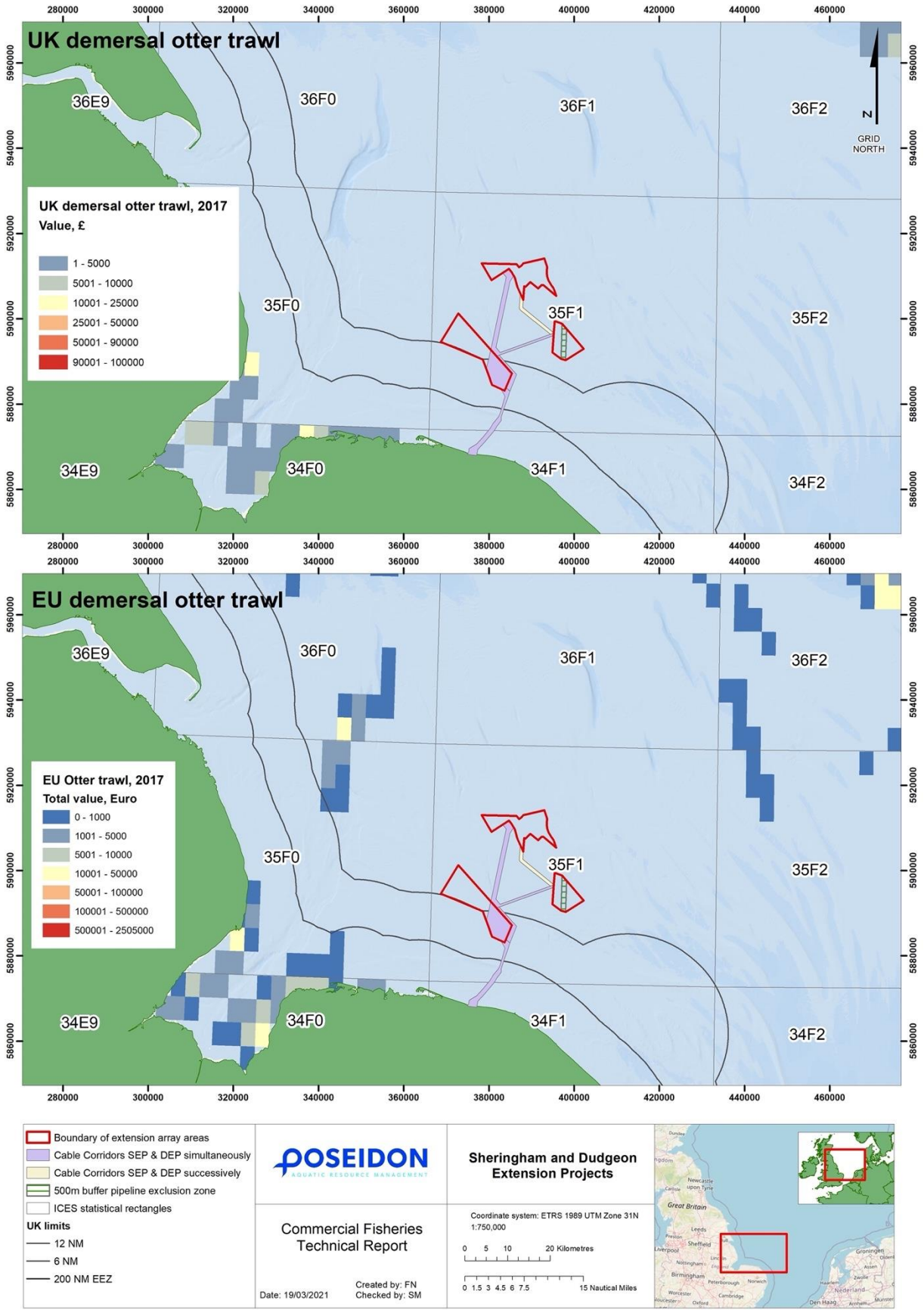

Figure 2-4: VMS data indicating value of demersal otter trawling activities for vessels ≥ 12 m in length in 2017, for UK vessels only (top) and all EU (including UK) vessels (bottom) (Data sources: MMO, 2019 and ICES, 2019)

2.1.1.2 UK Landings

The UK landings from the regional study area are dominated by shellfish species including brown shrimp, whelk, brown crab *Cancer pagurus* and European lobster *Homarus gammarus* (hereafter named as lobster) with an average annual first sales value of £1.7 million, £1.9 million, £0.9 million and £0.9 million respectively (Figure 2-5).

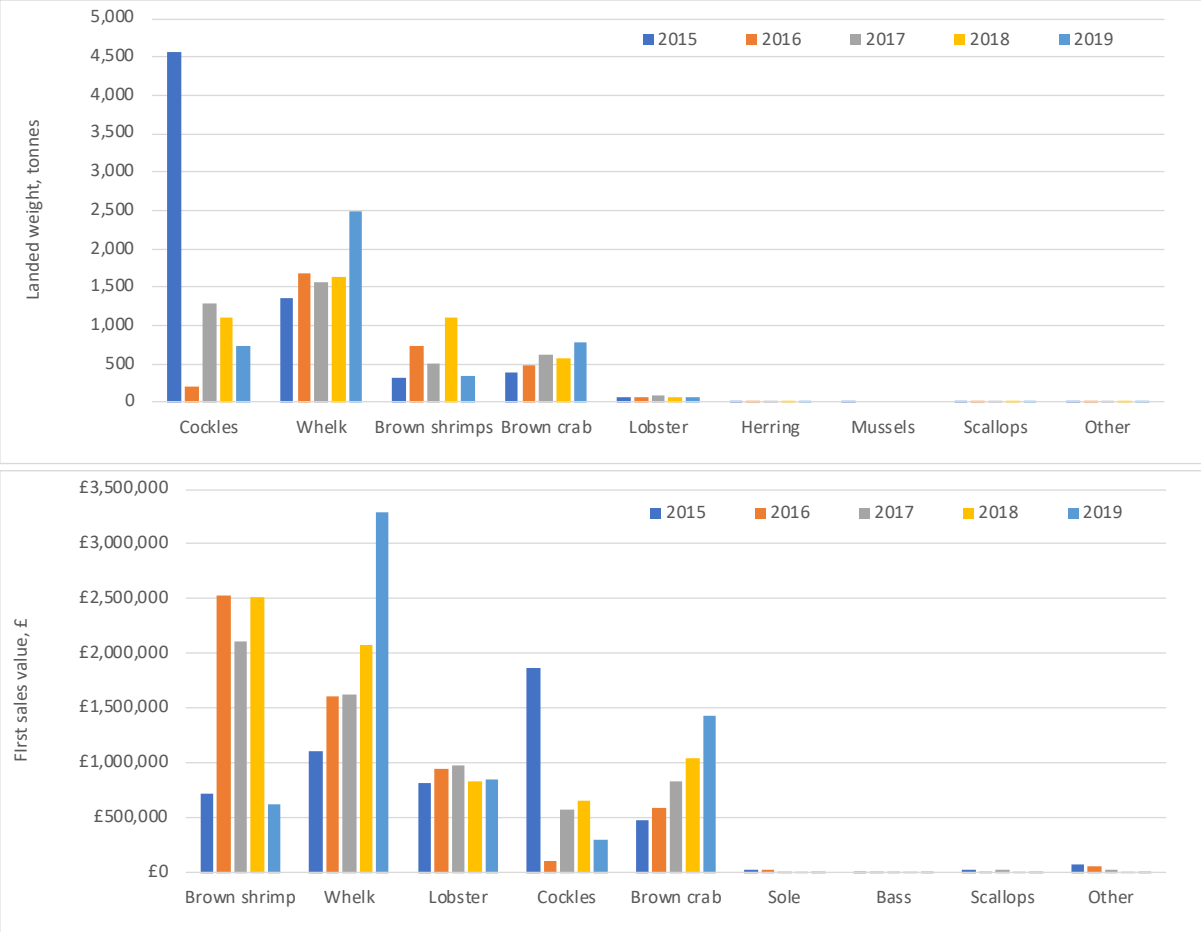

Figure 2-5: Total landed weight and value all species by UK registered vessels in the regional study area (Data source: MMO, 2020).

Whelk dominate the landings in the regional study area by weight and value, with significant growth seen in 2019. The landing statistics indicate a significant beam trawl shrimp fishery within the Wash which is within the 6 NM UK territorial limit and ICES rectangles 34F0 and 35F0 (see Figure 2-2) i.e., outside the project area, but within the regional study area.

Other species of shellfish are caught using a variety of gear. Lobster, brown crab and whelk are caught using pots and traps and cockles are caught using a suction dredge or harvested by hand. Scallops are targeting specifically with dredging gear.

Potting activity for the ≥ 15 m vessels within the regional study area is presented in Figure 2-6 and shows that the main location of offshore potting for vessels in this size category occurs outside the 6 NM territorial waters to the north and west of SEP. DEP north and DEP south are located within the lowest value areas for potting by vessels ≥ 15 m in length, with the quadrat values indicating a value between £1 - £5,000 for both DEP project areas.

Figure 2-3 presents the main grounds targeted by the UK registered vessels using dredges primarily targeting scallop. The majority of the scallop fishing grounds lie to the north of the regional study area and lower value grounds lie just within the northern part of ICES rectangle 35F0.

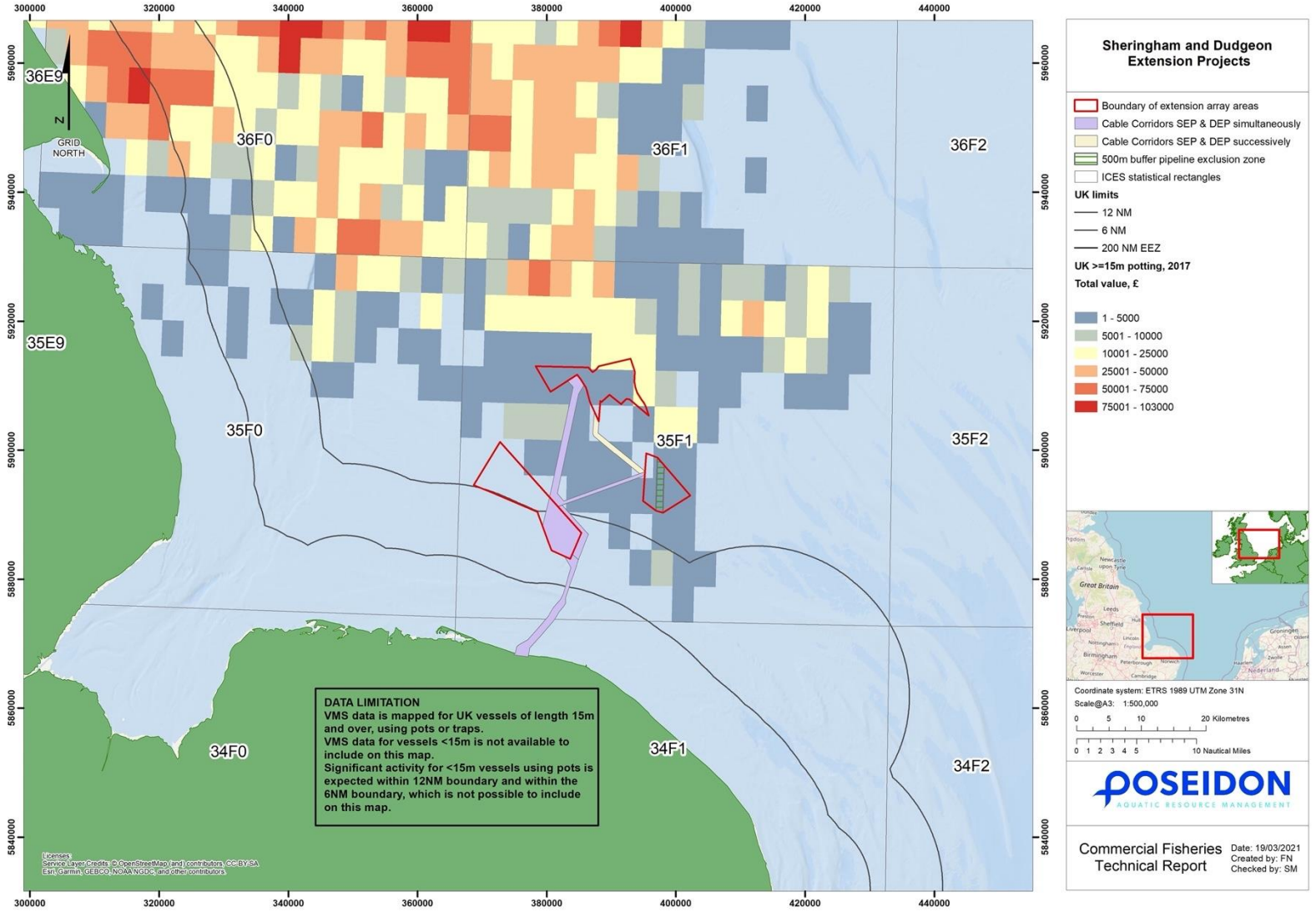

Figure 2-6: Regional study area – UK potting fishery (by value)

The proportion of landed weight by gear type is presented in Figure 2-7. Within the regional study area, pots and traps represent the major proportion (50%) of gear used. A smaller proportion gear used (12%) is represented by beam trawls and 5% by dredge, with the remaining 33% by other mobile gears, including demersal otter trawl. This is indicative of the importance of the shellfish fishery in the regional study area.

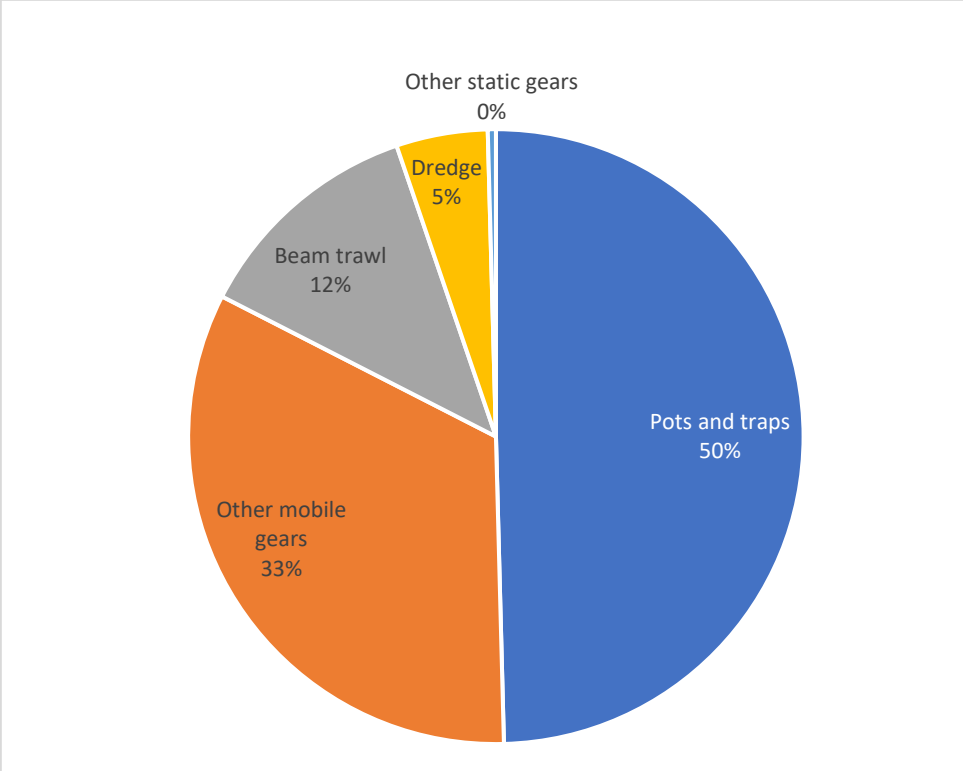

Figure 2-7: Regional study area - proportion of landed weight by gear type for UK vessels of all lengths (based on annual average across five year period 2015-2019, data source: MMO, 2020).

Figure 2-8 illustrates that the majority of potting effort for crab and lobster occurs in ICES rectangles 34F1 and 35F0, with significantly lower effort in 35F1, which overlaps with the Sheringham and Dudgeon wind farm sites.

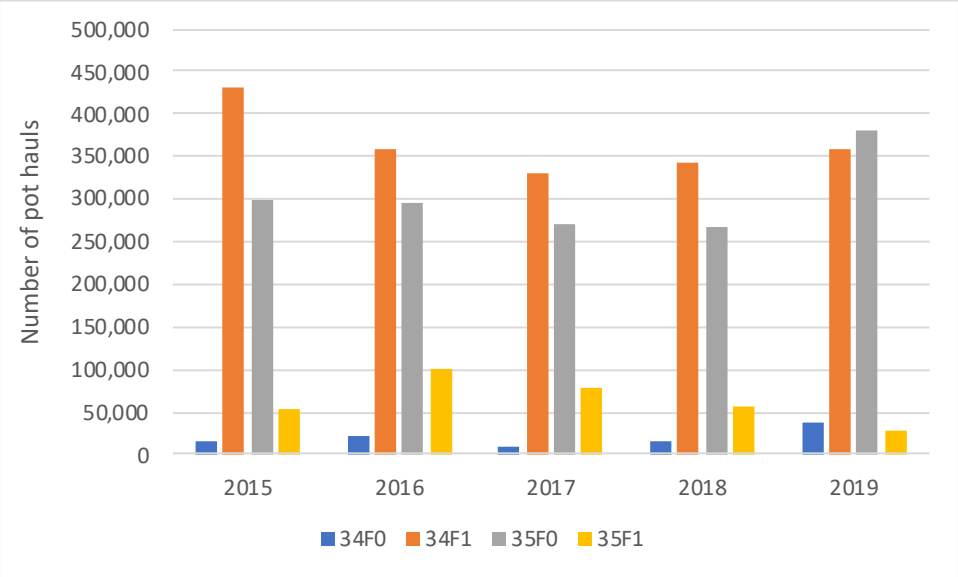

Figure 2-8: Regional study area – number of pots hauled by 10 m and under vessels targeting crab and lobster by ICES rectangle (data source: EIFCA, 2020).

2.1.2 Array and export cable study areas

2.1.2.1 Landings by EU vessels

The annual average landings of the main species of fish by value by all EU countries (excluding UK) fishing within the commercial fisheries study area (ICES rectangles 34F1 and 35F1) is presented in Figure 2-9.

Dutch vessels dominate the landings by weight for sole, plaice, turbot *Scopthalmus maxima*, dab *Platichthys flesus*, and cod *Gadus morhua.* Whiting is predominantly landed by French vessels which are also responsible for the entire landings of mackerel *Scombrus scombrus.* Belgian vessels primarily target sole and plaice but to a much lesser extent than the Dutch fleet and all three countries land an equal weight of other species as shown in Figure 2-9**.** Apart from sole, plaice and whiting all other species have a landed weight of less than 5 tonnes.

The individual annual average weight landed by the three top species of fish, namely sole, plaice and whiting is 42, 38 and 32 tonnes respectively. The annual average value for these three species is shown in Figure 2-10 noting that approximately €383,000 of sole, €55,000 plaice and €1,600 is landed by Dutch vessels and €52,000 of whiting is landed by French vessels from this study area (34F1 and 35F1). These figures are based on a five-year average from 2012 to 2016 (EU DCF, 2019).

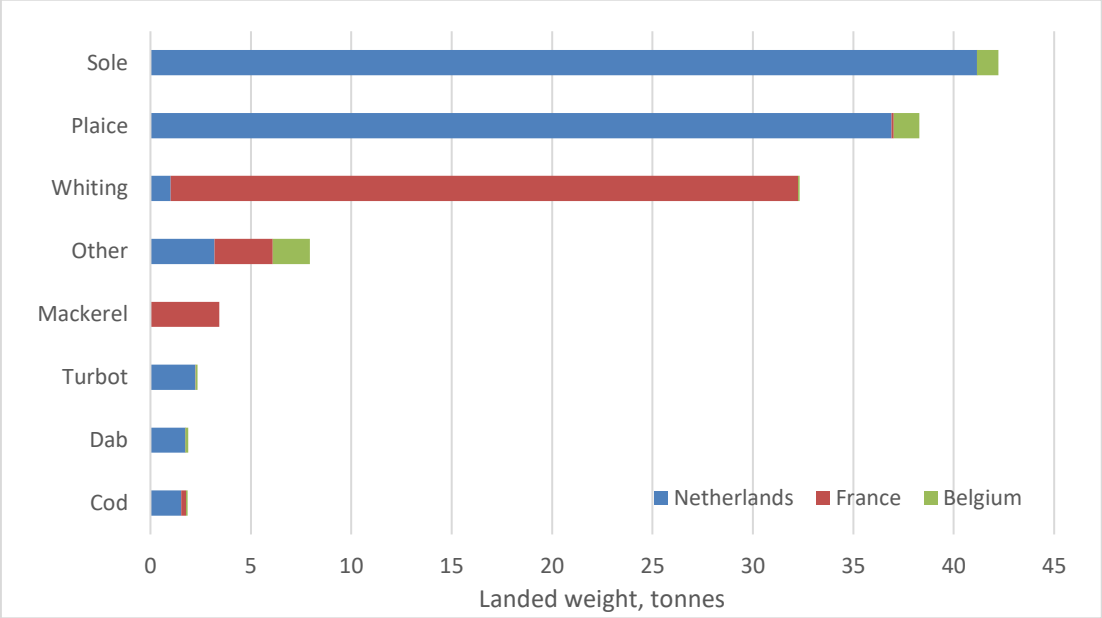

Figure 2-9: Average annual weight of finfish landings by EU countries (excluding UK) in the commercial fisheries wind farm sites and export cable study areas (based on five years 2012-2016; data source: EU DCF, 2019)

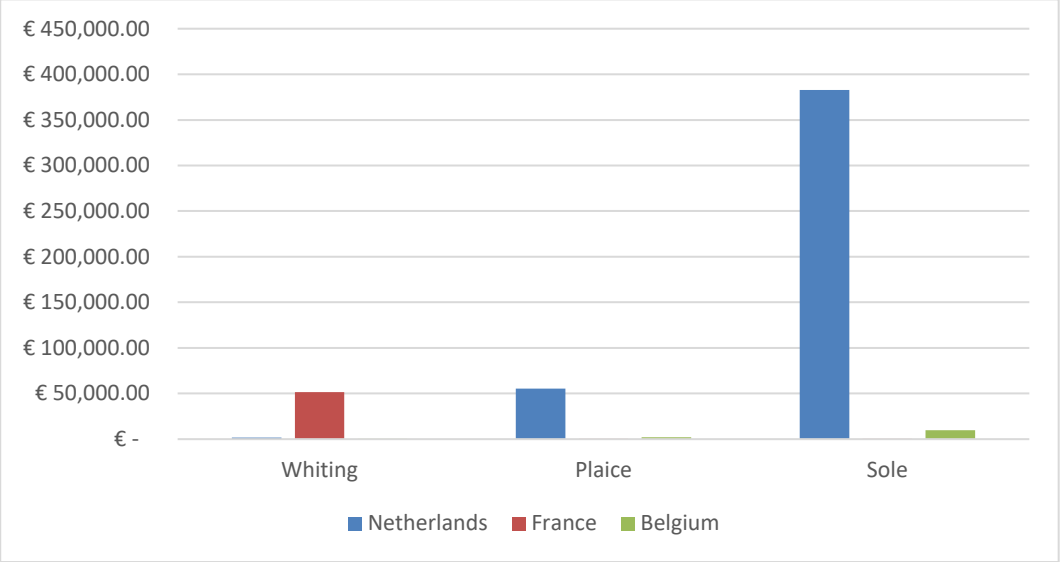

Figure 2-10: Average annual first sales value of top 3 species landed by EU countries (excluding UK) in the commercial fisheries wind farm sites and export cable study areas (based on five years 2012-2016; data source: EU DCF, 2019)

The commercial fisheries wind farm sites and export cable study areas lie within the sandeel management area for the Dogger Bank , in the central and southern North Sea . There has also been historical fishery for sandeel *Ammodytes* species and sprat *Sprattus sprattus* by Danish vessels in the study area (Figure 2-11). There was a significant sandeel fishery targeted in this area between 2003-2004 with an approximate value of €1.4 million. The value of landings fell significantly from 2004 onwards and there have been no landings of sandeel recorded since 2011. Although the TAC for sandeel was reduced to zero initially in 2015 the fishery may resume in the future therefore the potential overlap of the DEP and SEP Extension Project on the key sandeel areas is evaluated within the assessment.

The main sandeel fishing areas lie to the north and west of DEP and SEP (Figure 2-12). A proportion of these ground lie within ICES rectangle 35F1 and overlaps with 2.04% of the whole project area. Sandeel grounds within the commercial fisheries wind farm sites study area overlap with 13.07% of DEP north and DEP south combined. However, only DEP north overlaps with these grounds and this overlap is calculated as being 20.87%. SEP lies to the south and out with the key sandeel fishing grounds.

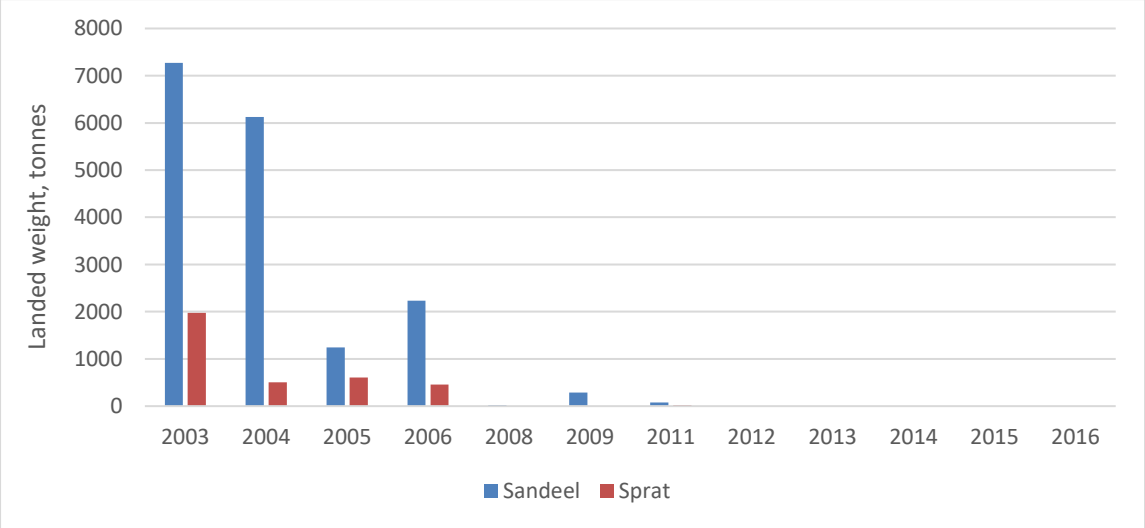

Figure 2-11: Long term trend in Danish landings of sandeel and sprat from the commercial fisheries wind farm sites and export cable study areas (34F1 and 35F1; data source EU DCF, 2019).

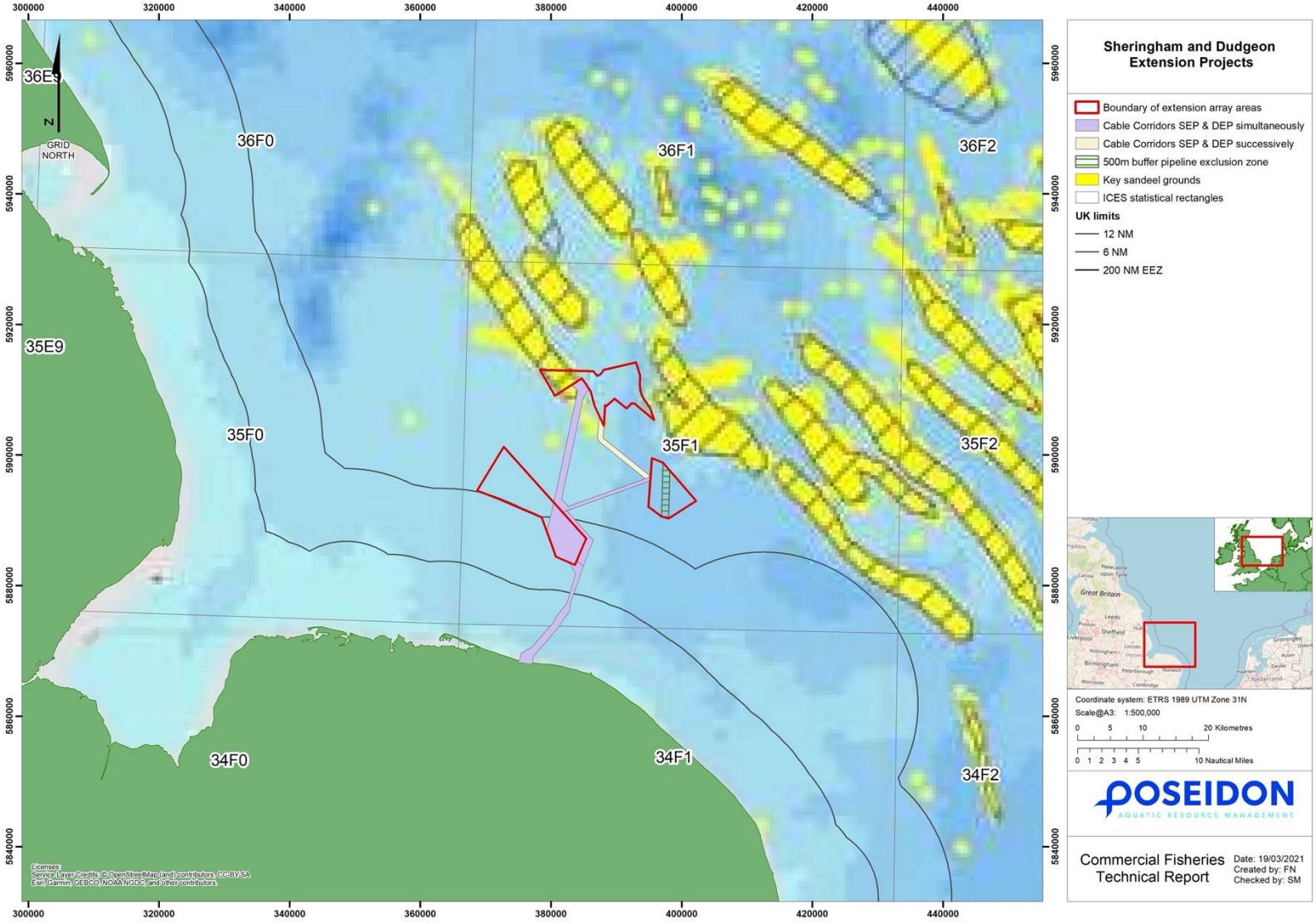

Figure 2-12: Key North Sea sandeel fishing grounds targeted by EU Member States and Norway (DTU Aqua, 2010).

2.1.2.2 Landings by UK vessels

Sheringham and Dudgeon wind farm sites study area

Data indicate that within the wind farm sites study area (ICES rectangle 35F1) there are only three species with an annual landed weight of over 5 tonnes. These are whelk, brown crab and lobster. The total landed weight and first sales value of these species from 2015 to 2019 is presented in Figure 2-13. Whelk dominate the landings from 35F1 and have grown significantly over the time period analysed, worth £1.5 million in first sales value landed from 35F1 in 2019.

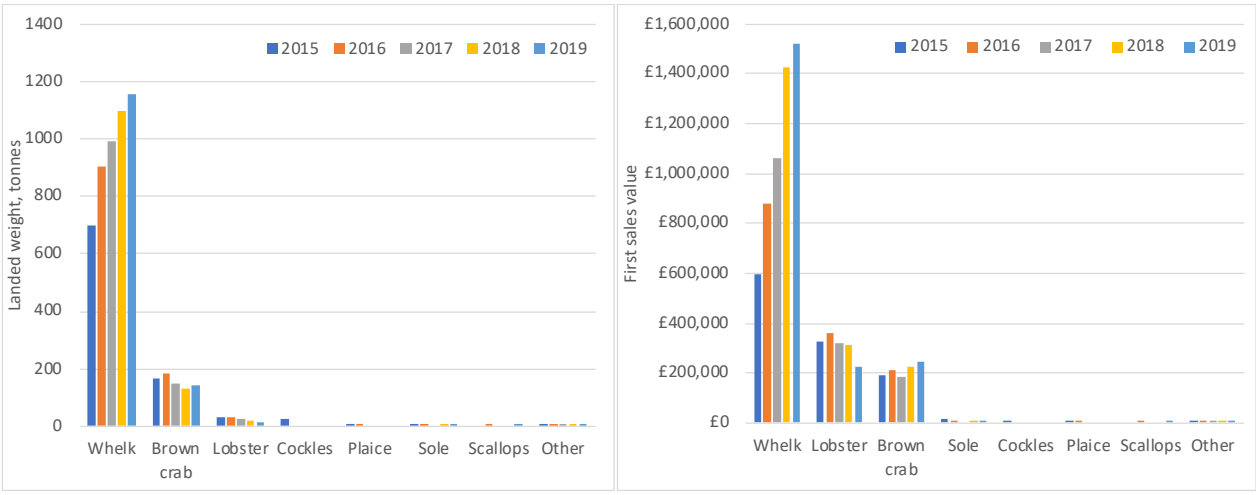

Figure 2-13: Landings by UK vessels by weight and value from 2015 to 2019 the wind farm sites study area (35F1) (data source: MMO, 2020).

Ninety nine percent (99%) of all landed weight in the wind farm sites study area (35F1) is caught using pots and traps with a minimal amount landed by other gear types (Figure 2-14).

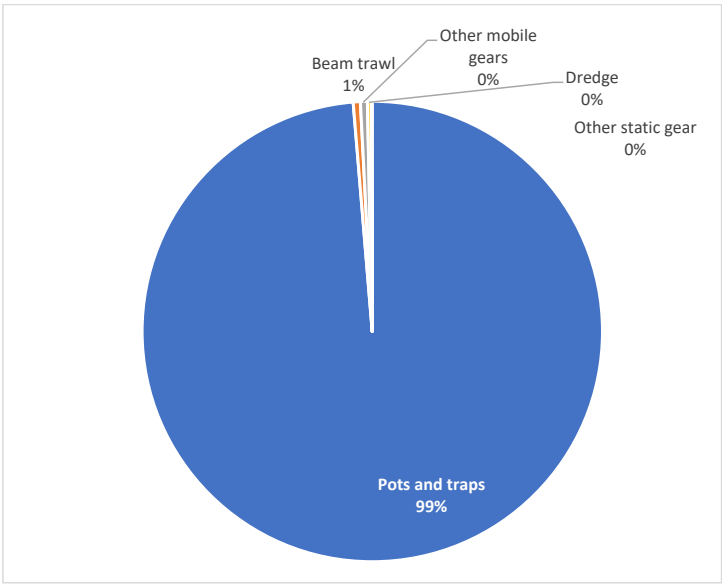

Figure 2-14: Proportion of landed weight by gear type from 2015-2019 from the wind farm sites study area (35F1) (data source: MMO, 2020).

Offshore export cable study area

The proportion of the area covered by the proposed offshore export cable corridor within ICES rectangle 34F1 and 35F1 is 1.91% (for SEP and DEP simultaneously). Data from both ICES rectangles is used to describe the fisheries landings for the proposed offshore export cable

corridor although it is noted that fishing is not proportional throughout ICES rectangles therefore figures are only indicative of fishing activity within the proposed offshore export cable corridor.

The key species landed in 2019 included whelk, brown crab and lobster with a combined first sales value of £2.9 million landed from ICES rectangles 34F1 and 35F1. Small amounts of brown shrimp, sole, bass and herring were also landed (Figure **2-15**).

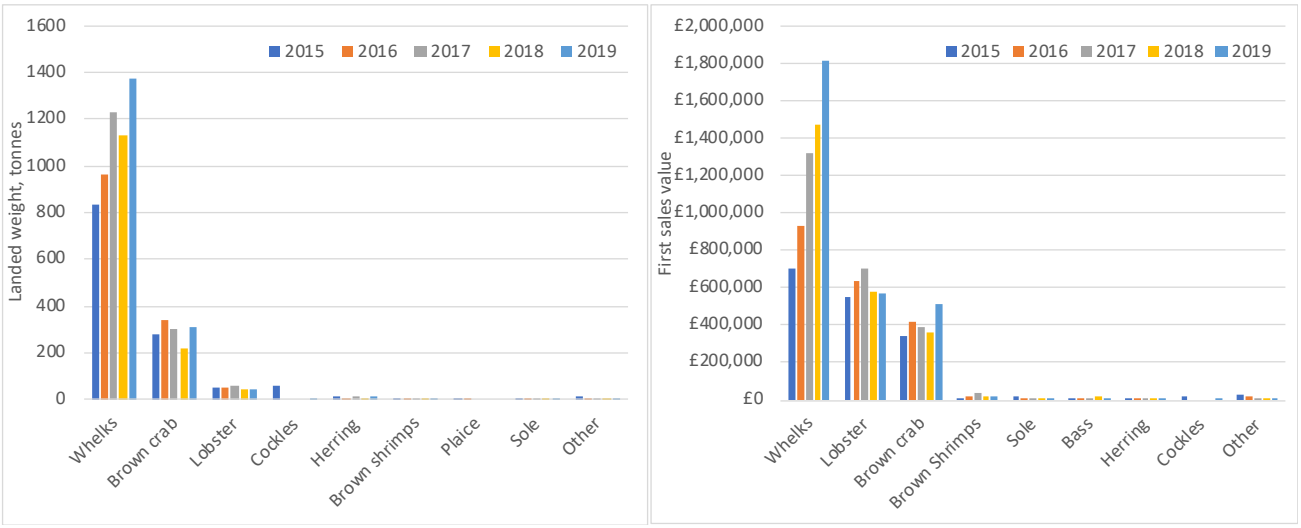

Figure 2-15**: Landings by UK vessels by weight and first sales value from 2015 to 2019 from the offshore export cable study area (ICES 34F1 and 35F1) (data source: MMO, 2020)**

Pots and traps are used for 97% of the landed weight in the export cable corridor which highlights the importance of the shellfish fishery (Figure 2-16).

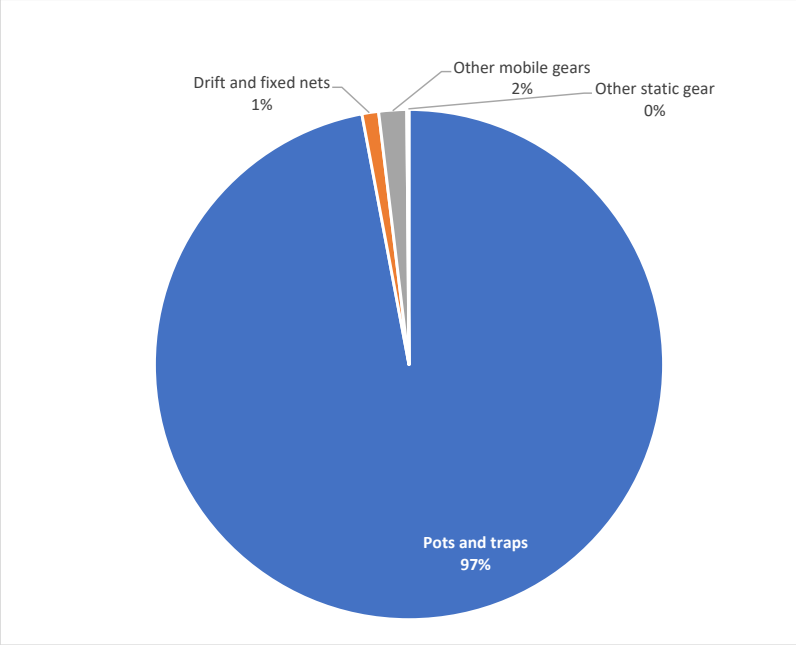

Figure 2-16: Proportion of landed weight by gear type from 2015-2019 from the offshore export cable study area (ICES 34F1 and 35F1) (data source: MMO, 2020)

Monthly shellfish returns data indicate the importance of ICES rectangle 34F1 to the 10 m and under potting fleet targeting crab and lobster (Figure 2-17).

EIFCA whelk catch return data illustrate the growth in the whelk fishery from 2015 to 2019, with 1,000 tonnes landed in 2019 from the EIFCA district (Figure 2-18).

Figure 2-17: Landings of brown crab and lobster by 10 m and under vessels from the offshore export cable study area (ICES 34F1 and 35F1) that overlaps the EIFCA jurisdiction (data source: EIFCA, 2020)

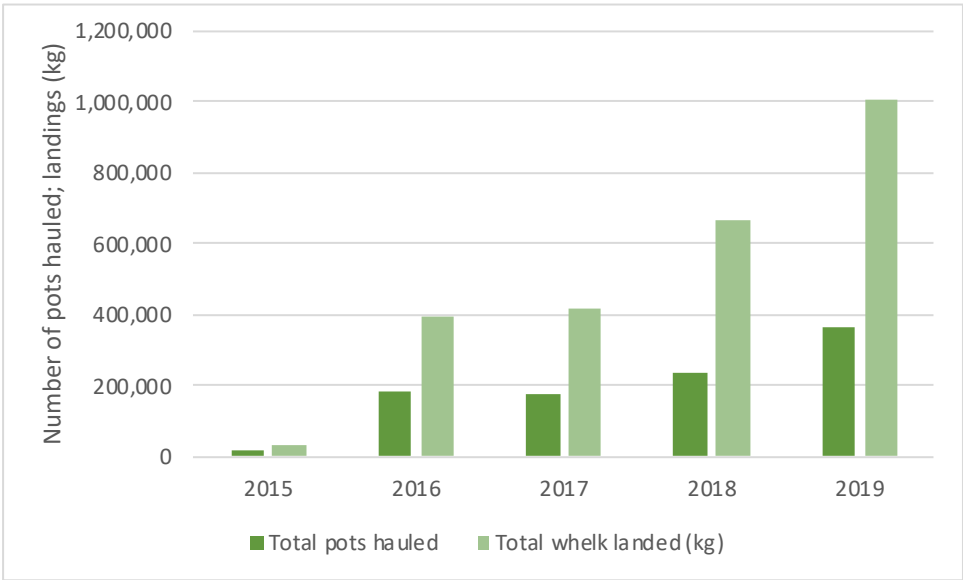

Figure 2-18: Landings of whelk by 10 m and under vessels from the EIFCA jurisdiction (data source: EIFCA, 2020)

2.1.3 Total allowable catch (TAC) and quotas

As per EU Council Regulations, Total Allowable Catches (TACs) and quotas are in place for many commercial fish species based on their stock distribution across ICES Divisions, as presented in Figure 1-1. The TACs set for a species across ICES Divisions 4 (North Sea) and 2 (Norwegian Sea) for example, allow countries that have been allocated a quota from this TAC to fish within ICES Divisions 4a, 4b, 4c, 2a and 2b. TACs and quotas per country are presented in Table 2.1 for key species landed from the regional commercial fisheries study area including cod, sole, plaice, turbot (including brill *Scophthalmus rhombus*), mackerel, herring and whiting. It is noted that the TAC for sandeel in 2019 was set at zero due to the status of the stock, and therefore there are currently no sandeel fisheries being exploited in the North Sea.

Within the UK EEZ, fishing activity from the shore to 6 NM is only permissible for UK registered vessels. A number of restrictions are in place based on byelaws set by English IFCAs that control fisheries out to 6 NM. From 6 NM to 12 NM, non-UK vessels may still be able to fish where they had historical rights to do so (under the London Fisheries Convention) following

the UK's exit from the EU on 31st January 2020 and implementation of The Fisheries Act 2020.

On 1st January 2021, at the end of the transition period, the UK became an independent coastal state and in control of waters out to 200 NM. Under the EU-UK Trade and Cooperation Agreement (TCA) international vessels are still permitted to fish outside 12 NM under licence but subject to reduced quota allocation and other restrictions including technical gear measures and effort restrictions such as days at sea. Access rights of non-UK vessels to UK EEZ waters will remain until at least the end of 2026 with reducing quotas, after which rights will be subject to the conclusion of negotiated agreements.

Table 2.1: Total allowable catch (TAC) and quotas in tonnes by country for the key species landed in the regional fisheries study area in 2020 (EU, 2020)

Species	ICES Division	TAC (tonnes)	Netherlands	Belgium	France	Denmark	UK	Germany	Sweden
Cod	2a, 4	12,216	1,412	435	537	2,499	5,732	1,584	17
		Proportion	11%	3.5%	4.4%	20%	47%	13%	0.1%
Herring	4c, 7d	42,351	18,162	8,632	10,277	800	3,950	530	0
		Proportion	43%	20%	24%	2%	9%	1%	-
Mackerel	2a, 3a, 4	32,022	1,842	581	1,830	19,998	1,706	606	5,459
		Proportion	5.7%	1.8%	5.7%	62%	5.33%	1.9%	17%
Plaice	2a, 4	89,728	34,510	5,522	1,035	17,946	25,538	5,177	0
		Proportion	38%	6%	1%	20%	28%	6%	-
Sandeel/ Sprat*	1r, 4c	0	0	0	0	0	0	0	0
		Proportion	-	-	-	-	-	-	-
Sole	2a, 4	12,545	9,439	1,045	209	478	538	836	0
		Proportion	75%	8%	2%	4%	4%	7%	-
Whiting	2a, 4	15,382	823	329	2,140	1,424	10,293	370	3
		Proportion	5%	2%	14%	9%	67%	2%	0.01 %
*sandeel TAC and quota were set at zero due to scientific advice related to stock abundance									

2.2 Key species

2.2.1 Shellfish

2.2.1.1 Brown crab

Brown crab (also known as edible crab) is one of the most economically important crab species in UK waters. Along the coast of Lincolnshire and North Norfolk brown crab is primarily targeted by the UK potting fleet under the jurisdiction of the EIFCA within the 6 NM limit and the MMO between 6 and 12 NM. Traditionally this fishery is mixed with crab and lobster caught together. The combined landings in 2019 totalled 771 tonnes with a value of £1.75 million. This industry supports a considerable number of fishers and businesses in the EIFCA district (Bridges, 2019).

This decapod crustacean is benthic and is found in a wide range of habitats ranging from soft mud to rocky substrata. Activity tends to be higher at night when foraging occurs although smaller crabs are known to be equally active during both day and night (Scott *et al*., 2018). Post larval settlement is generally in inshore areas and juvenile crabs are more commonly associated with the inshore shallower intertidal zones whereas the adults are commonly found at depths of 6 – 40 m but have been known to occur at 100 m.

Peak mating period is July to September usually at night and after the female has moulted (Brown and Bennet, 1980). Fecundity varies between 0.25 and 3.5 million eggs depending on size (Haig *et al*., 2015). Eggs are attached to the female pleopods and take around 7-8 months to hatch, during which time the female does not feed but remains hidden and is unlikely to be captured in baited pots (Ondes *et al*., 2019). In the North Sea females tend to move offshore to release the planktonic larvae then move back inshore to feed. The period from hatching to recruitment into the fishery takes approximately 4 years and adults move into deeper water as they grow and mature.

Adult crabs are known to undertake extensive migrations, although previous studies have indicated that there were no migratory exchanges between the North Sea and English Channel. Adult females have shown a migratory movement northward along the east coast from Norfolk to Yorkshire and Humberside (Bannister, 2009).

The main fishing season for brown crab in the EIFCA district is from March/early April with a peak in May and June and steadily dropping to late September/early October (Bridges, 2019). The majority of vessels fishing for crab are under 10 m although with the development of new markets for shellfish the number of over 10 m offshore boats has increased to target crab in deeper waters.

Both crab and lobster are caught using pots and both species have no TACs or quotas in place. Management is principally through a minimum landing size, as well as limited regulations around effort, gear or catch controls. Compared to other areas, brown crab in the EIFCA district has a smaller average size and as a result there is a dispensation in the regulations on minimum landing size (MLS) allowed. Nationally this is set at 130 mm carapace length (Council Regulation 850/98 ANNEX XII) but there is a derogation given for the EIFCA district (between 0 – 6 nm) of 115 mm carapace length ((Undersized Edible Crabs Order 2000 (2000 No 2029)) (Bridges, 2019).

A stock assessment of crab and lobster undertaken by the EIFCA in 2018 identified that there was a decreasing trend in landings and effort across the EIFCA area from a peak in 2016 when the combined landed weight was over 1,000 tonnes. Landings per unit effort (LPUE) measured as pot hauls has also decreased although this has been somewhat offset by higher market prices.

In relation to the study area ICES rectangle 35F1 is considered to be an offshore area targeted by larger vessels. Landings from this area are influenced by the recruitment patterns seen in the inshore areas which is known to provide settlement substrate for larvae from the north.

Removal of stock from the inshore fishery will have a knock-on effect on the offshore landings through removal of individuals which may have migrated offshore.

A yield per recruit analysis for the inshore and offshore crab fishery in 2018 showed that fishing mortality in both fisheries exceeded the maximum recommended exploitation rate F_{max} for both males and females (Bridges, 2019). This departure was highest for the inshore fishery and may have implications for future management measures.

The primary drivers for management of the crustacean fishery include the Length Converted Catch Curve (LCCC) used to estimate fishing mortality and Landings Per Unit Effort (LPUE) to provide information on stock health. Calculations of LCCC indicated that the brown crab fishery is likely to be operating beyond maximum sustainable yield (Bridges, 2018), although it is not thought that the fishery is in danger of collapse since LPUE have been relatively stable since 2013.

2.2.1.2 Lobster

The crab and lobster fishery is one of the most important fisheries economically for the inshore potting fleet in the EIFCA district and operates from Saltfleet in Lincolnshire, throughout Norfolk and down to the southern limits of the district in Felixstowe. Due to the inshore location of lobster they are predominately targeted by the UK potting fleet located along the North Norfolk coast, under jurisdiction of the EIFCA from 0 to 6 NM and the MMO from 6 to 12 NM.

Lobsters are caught in a mixed fishery with crab using potting gear. The main focus of potting activity is along the North Norfolk coast. Historically the potting fleet was a mixed species creel fishery which fished within 2 NM of the coast but with improved technology, improved storage facilities on board and new markets the fleet has moved further offshore. There is now a range of vessels in the fleet such as those remaining close to shore, some remain within the inshore 6 NM limits while larger more powerful vessels travel offshore, and these vessels include under 10 m catamarans. The majority of vessels within the EIFCA district are under 10 m.

European lobster is a long-lived, large decapod crustacean. Lobster breed once per year in the summer and newly berried females begin to appear from September to December. Juveniles or adult lobsters do not undertake any significant migrations and juveniles in the first 3 to 4 years of life may be particularly sedentary. From hatching it takes approximately five years for a lobster to recruit to the fishery.

Lobsters typically inhabit rocky reef and rough ground sheltering in crevices between rocks and boulders. The availability of suitable habitat is considered to influence the carrying capacity and size structure of lobster populations (Seitz et al., 2014; Welby, 2015). The Norfolk lobster population is understood to be comprised of individuals that are on average smaller than those found in other areas and this is thought to be due to habitat limitations (Welby, 2015).

Lobster is one of the highest valued commercially exploited shellfish species found in UK waters. The North Norfolk lobster season begins in mid-May or June, with landings peaking in June and July and falling through autumn and winter (Welby, 2015). Within the EIFCA district the average annual combined crab and lobster landings of 771 tonnes with a value at first sale of £1.7 million supports many business and fishers within the area (EIFCA, 2020).

There are no TACs or quotas in place for shellfish. Therefore, to ensure sustainable exploitation of commercial fish populations and to fulfil duties under Section 153 of the Marine and Coastal Access Act (2009), the EIFCA initiated a crustacean stock assessment programme in 2013 with a focus on brown crab and lobster. For lobster there is less data than for the crab fishery but data from 2018 indicated that the fishery is operating above maximum sustainable yield.

Primary management is through the technical measure of an MLS of 87 mm carapace length for lobster (Council Regulation 850/98) although the quantities permitted to be landed are not restricted.

Management measures for this fishery are seen as a priority and have been driven in part by the EIFCA Strategic Assessment of 2019 (EIFCA, 2020) which noted the potential negative impact of fishing activities on the Cromer Chalk Beds MCZ which was designated as an MCZ in 2016. The Strategic Assessment also noted that the evidence base upon which management measures are based may be insufficient in relation to lobsters.

2.2.1.3 Whelk

The whelk fishery is currently the largest fishery both by landed weight and value in the commercial fisheries study area and targeted predominately by the UK fleet. Overseas markets have expanded in the last five years which has boosted the increase in vessels targeting this species.

The common whelk is a slow growing, subtidal carnivorous species which is distributed throughout most of the northern Atlantic between low water and 1000 m. Most are caught in

depths of 40-60 m. Breeding is thought to take place during the autumn and winter and egg laying occurs on hard benthic strata as the temperature reduces below 9 degrees. This is usually between November and April and since whelks are close to their southern limit, temperature is thought to be a limiting factor for reproduction. The larval stage develops within the egg and there is no pelagic stage which results in limited dispersal.

Due to the limited dispersal of whelk juveniles it is thought that there is limited connectivity between populations which could have implications for management and may make the species susceptible to local depletion and longer recovery rates (Blue Marine Foundation (BMF) 2018).

Whelks caught in shallower waters are thought to mature at smaller sizes and in England studies have shown that there is a negative correlation between depth and temperature with maturity (Bayse *et al*., 2016).

Stock status is relatively unknown in the UK therefore Catch per Unit Effort (CPUE) and Landings per Unit Effort (LPUE) are taken as a proxy for stock status. A reduced CPUE could be an indication that the fishery has exceeded the limits of sustainability. Whelk fisheries are, in general, unrestricted, lightly regulated and require little financial start-up resources.

More recently byelaws have been introduced which have set out a suite of management measures including catch and size limits, pot limits, escape holes and increased MLS. In the EIFCA district an MLS of 55 mm (shell height) has been set with a pot limit of 500. This is compared to an EU wide MLS of 45 mm (EC Regulation 850/98).

Within the UK, whelk are often considered to be a suitable alternative to seasonal fishing especially for the crab and lobster fleet as well as for vessels targeting more regulated fisheries. The whelk fishery is therefore a potential displacement fishery, and this is especially noticeable along the east coast of England where the increase in landings have been significant (BMF 2018).

In the EIFCA district the landed weight of whelk is significant and one of the major processing factories is located in the district. The EIFCA has identified that, as a result of increased fishing effort in 2019, a stock assessment is required as well as a review of permit conditions (EIFCA, 2020).

2.2.2 Finfish

The majority of finfish from the commercial fisheries study area are landed by EU vessels as noted in Section 2.1.

2.2.2.1 Sole and Plaice

Plaice is commonly found just below the sediment surface on sandy, shingle and muddy bottoms associated with the European shelf at depths between 10 and 50 m. It is a slow growing and long-lived species with a maximum recorded weight of 7 kg and an age of 50 years. The average size of fish caught in commercial fishing vessels is 50-60 cm. This species is predominantly caught in subarea 4b but also caught across the regional fishery study area in the mixed fishery targeting sole.

The TAC for plaice was set at 89,728 tonnes and the Netherlands and the UK have the largest proportion of the TAC for plaice in ICES Divisions 2a and 4 at 38% and 28% respectively (ICES 2018a). In the commercial fisheries study area, the main landings of plaice are attributed to Dutch registered vessels.

Plaice is considered to have a spawning stock biomass (SSB) well above the MSY trigger reference point (MSY $B_{trigger}$[1]) and the stock is therefore considered to be at full reproductive

[1] MSY $B_{trigger}$: ICES considers that a sustainably fished stock will fluctuate around BMSY, so has defined MSY Btrigger as the lower bound of this fluctuation . ICES measures the status of a stock against MSY $B_{trigger}$

capacity. Fishing pressure is assessed to be below all fishing mortality reference points[2] (i.e. F_{MSY}, F_{pa} and F_{lim}) and therefore harvested sustainably. A multiannual plan has been proposed for this stock (EU 2016) but since this has not been adopted by Norway it is not used as a basis of advice for shared stocks.

Of relevance to the stock assessment in subarea 4 is that according to ICES, and despite the introduction of the Landings Obligation (LO), 34% of the total catch was discarded in 2017. The reported quantities of below minimum sized (BMS) fish caught under the LO is considerably lower than discard estimates from observer programmes (ICES 2018b).

The TAC for sole is set at 12,545 tonnes and includes the stock across the North Sea, Norwegian Sea, Spitsbergen and Bear Island. The majority of the TAC (75%) is held by the Netherlands with 4% held by the UK.

ICES advice for sole relates to the F ranges in the EU Multiannual plan (MAP) for the North Sea of between 10,192 tonnes ($F_{MSY\ lower}$) and 26,767 tonnes ($F_{MSY\ upper}$). The EU MAP advises that catches higher than those corresponding to F_{MSY} (17,545 tonnes) should only be taken under MAP specified conditions.

Stock development figures for sole show that recruitment in 2019 was estimated to be the highest since 1988 and although fishing pressure is currently above F_{MSY} it is also below F_{pa} and $F_{lim.}$ In relation to SSB the stock size is considered to be above the trigger point and the stock is in full reproductive capacity and harvested sustainably (ICES 2019).

A larger proportion of sole is now harvested from the southern part of Division 4c as a result of the introduction of pulse fishing gear under technical measures which allows vessels to fish in softer grounds compared to the traditional beam trawls used to catch both sole and plaice. The revision of the technical measures is under discussion although current information indicates that all such gear will be prohibited from June 2021. This may result in vessels reverting to previous fishing grounds further north using towed demersal gear (ICES 2019).

In May 2020, as a result of a request from the Netherlands, ICES has advised that pulse trawling could contribute to reducing the ecosystem/environmental impact of the sole fishery when exploitation is part of the TAC. The report from ICES only relates to the sole fishery and does not cover other forms of electrofishing such as that used for brown shrimp or razor shells or its use in other ecosystems. The report also considers that bycatch of most species of undersized fish and invertebrates is reduced with pulse fishing. The impact on the seabed and benthic ecosystem is also reduced as is the use of fuel and associated CO_2 emissions in comparison to traditional beam trawling (ICES 2020b).

2.2.2.2 Whiting

Whiting is a demersal species and an active predator feeding on commercial species such as Norway pout, sandeel, haddock and cod as well as juvenile fish. The species is widely distributed both inshore and offshore throughout the North Sea on mud and gravel bottoms, but also on sand and rock. Immature fish can be found in nursery areas close inshore and migrate to the open sea after the first year of life (Cohen *et al.*, 1990). Growth is rapid in the first year, after which, the growth rate slows. Growth rates vary considerably between individuals and significant differences have been recorded between the growth rates of individual fish such that, a 30 cm fish could be as young as one or as old as six years. Maturity and spawning take place at approximately 2 years old and the fecundity of a four year old female fish of reasonable size can be in excess of 400,000 eggs. This species is a broadcast

[2] F_{MSY}: This is the maximum rate of fishing mortality allowing a population size to eventually reach or maintain B_{MSY} within a single stock, usually across a long time frame.

F_{pa}: This is the precautionary reference point for fishing mortality, designed to ensure that there is a high probability that F_{lim} will be avoided. Fishing mortality rates above F_{pa} are generally regarded as overfishing.

F_{lim}: This is the limit reference point for fishing mortality, representing the maximum level of fishing mortality, above which the capacity of self-renewal of the stock is impaired and there is risk of stock collapse.

spawner with a prolonged spawning season lasting from late January until June. Spawning distribution is widespread throughout the North Sea.

While ICES consider the North Sea stock to be harvested sustainably (as fishing mortality is below precautionary levels), fishing mortality has been too high to support maximum sustainable yield for the whole time series (since 1990). Notwithstanding this, SSB is at full reproductive capacity and has been fluctuating around the ICES maximum sustainable yield reference point for biomass since 2008 (ICES, 2020).

The UK has 67% of the TAC for whiting, followed by France with 14% and Denmark with 9%. Whiting are targeted by demersal otter trawlers as part of targeted and mixed demersal fisheries.

2.2.2.3 Mackerel

Mackerel are highly migratory pelagic species widely distributed in the continental shelf seas around the UK and Ireland. Distribution is affected by temperature as well as the abundance and composition of its main diet of zooplankton. Mackerel can be found in large shoals feeding on small fish and prawns.

This species is known to shoal and migrate distances of up to 500 km along the continental shelf edge from mid-November to early March. The location of the relatively warm currents of the shelf edges are thought to influence the migratory pathways to the main spawning areas in the southern North Sea (Jansen *et al*., 2012).

The SSB for mackerel is estimated to have increased since 2008 but reached a maximum in 2014 and thereafter has declined. The stock has remained above MSY reference points B_{trig} $B_{pa\ and}$ B_{lim}. Although the fishing mortality has decreased since 2003, it is still estimated to have remained above F_{msy} but below F_{pa} and F_{lim} reference points. Despite these estimates the advised catch is higher for 2020 than for 2019 because of the high recruitment for 2016 and 2017 year classes.

2.2.2.4 Dab

Dab is particularly abundant in the North Sea and can be found from the shore to depths of 500m on sandy habitats. Juveniles are found in shallow water but move offshore as adults.

The TAC for Dab was removed on ICES advice in 2017 since the risk of having no catch quota for dab was considered to be low. This advice was predicated on both dab and founder remaining predominately as bycatch species in the plaice and sole fishery and this fishery remain sustainably fished.

2.2.2.5 Cod

Cod in the North Sea have a wide distribution although there is evidence that there may be different subpopulations in different regions which may have a limited degree of mixing. This may have the effect of a slow recovery from a general low SSB and fishing mortality above MSY.

ICES advice for cod in subarea 4, Division 7.d and subarea 20 has been updated since June 2019 to recommend a decrease in TAC in this area to no more than 13,686 tonnes. Between 2018 and 2019 the TAC was reduced by approximately 33%.

The reduction is due to the increased fishing mortality and lowered SSB since 2016. Added to this are long term poor recruitment patterns since 1998. The stock is now considered to be fished unsustainably and has a reduced reproductive capacity (ICES 2019a).

2.2.2.6 Herring

Herring schools move between spawning and wintering grounds in coastal areas and feeding grounds in open water. Herring populations are known to use traditional spawning grounds, many of which are along shallow coastal areas (15 to 40 m depth) or on offshore banks down to 200 m. Herring in the North Sea have several discrete spawning populations and within

ICES Division 4c is the location of the Downs herring population. This population is an autumn spawner and this species is predominantly caught in the southern North Sea in late autumn and winter. Sub-TACs have been set for Division 4.c and 7.d to give some protection to the discrete spawning components. Herring spawn on gravel or rock substrates and eggs are laid in mats (Whitehead, 1985).

Despite below average recruitment from 2003 to 2013 and very low recruitment in 2015 and 2017, herring in the North Sea, Skagerrak, Kattegat and eastern English Channel are at full reproductive capacity and considered to be harvested sustainably (ICES, 2020). ICES recommends that, although the advice for 2020 is for an increased catch, the stock size is expected to reduce in the future due to the potential for reduced year class recruitment.

In ICES areas 2a and 4 the TAC for 2020 is set at 42,351 tonnes and of this, the Netherlands, Belgium and France hold 43%, 20% and 23% respectively.

2.3 Key gear

2.3.1 Pots and traps

Vessels predominately target crab and lobster with mainly parlour (two chambered) creels, but also standard (single chambered) creels, both of which are side opening. Whelks are targeted with top opening plastic pots. Some vessels will operate fleets of crab and lobster pots and whelk pots simultaneously. Whelk fishing activity is driven by market prices; when the price goes up, vessels will focus on whelk. Whelk are predominately targeted in muddy habitats, and not generally found on mobile sand or rocky ground.

When targeting whelk, vessels operating outside 6 NM may deploy up to 1,500 to 2,000 pots, with 50 to 100 pots per string and 10 fathoms between pots. Commercial vessels within the EIFCA jurisdiction are limited to 500 pots with an internal volume of 30 litres per vessel, as per the Whelk Permit Byelaw. All whelk pots must have a minimum of two escape holes at least 24 mm in diameter per pot and must be tagged with EIFCA supplied tags. There are no pot limits outside 6NM.

There tends to be two to three crew per vessel, including the skipper. Soak time is approximately two days; anything longer and a pot will fill with mud. Vessels fish out to 30 NM for whelk, with steaming time ranging from 20 minutes to three hours depending on grounds being targeted. Whelks are sold to a Kings Lynn processor and are collected and transport by lorry to the facility. Vessels tend to work with the tides, so when transiting to grounds they carry the tide to the east, haul/set pots during slack water and come back west with the tide.

When targeting brown crab and lobster, vessels operate parlour pots and creels. Parlour pots are favoured for more offshore locations. Vessels may operate 1,000 to 3,500 pots in total, with 25 to 30 pots per string for a typical vessel, and up to 50 per string for larger vessels; pots are spaced 15 fathoms (27.4 m) apart. Pots are shot away with the tide; one string can cover up to 0.3 NM. Vessels may operate three fleets of pots, so soak time is generally three days, weather permitting. A profile of the main element of a potting vessel is described in Table 2.2.

Table 2.2: Profile of typical potting vessels active across regional fisheries study area.

Potting profile	
Main target species	Lobster, brown crab, shrimp, whelk
Nationality	UK
Vessel length	Majority are under 10 m, with some 10 to 15 m
Horsepower	60 hp to 200 hp
Typical speed of shooting and hauling gear	0.0 to 9.0 knots

Potting profile	
Typical gear	Fleets of baited pots are placed on the seabed. Pots are typically hauled every week but may be left for a number of weeks. Generally, day boats, but also includes a vivier fleet (crabs stored live in water tanks).

2.3.2 Beam Trawlers

Flatfish such as sole and plaice landed from the commercial fisheries study area are found partially buried in the seabed sediment. Beam trawls are designed to use tickler chains which run along the seabed and scare the flatfish into the net (Table 2.3). Since flatfish are not shoaling species fishing effort can be widespread across a number of grounds in the North Sea.

Within the regional fisheries study area landings data indicate that plaice and sole are predominantly caught by Dutch beam trawlers (37 and 41 tonnes respectively) with a small quantity caught by Belgian registered boats. Landings data for English vessels indicate that under 1 tonne of sole is landed within the commercial fisheries study area.

An established brown shrimp fishery is targeted by approximately 60 UK registered beam trawling vessels in the Wash. This is recognised as a nationally important fishery, representing 93% of the UK North Sea brown shrimp landings. The gear operates as described for beam trawlers targeting flatfish and as depicted in Table 2.3. Vessels operate principally in inshore waters, normally from 0 to 6 NM and are from 7 m to 18 m in length.

The EIFCA mapping project (Figure 4-5) indicates shrimp fishing areas extending east from The Wash and across the offshore export cable corridor in shallow waters near landfall. Beam trawl activity in this area no longer occurs due to the EIFCA MPA Byelaw which prohibits mobile gear within the large majority of the Cromer Shoal MCZ and the entirety of the MCZ overlap with the offshore export cable.

Table 2.3: Profile of typical beam trawl vessels active across regional fisheries study area.

Beam trawling profile	
Main target species	Plaice and sole Brown shrimp
Nationality	UK, Dutch, Anglo-Dutch and Belgian
Vessel length	25 m to 45 m for flatfish 7 m to 18 m for brown shrimp
Horsepower	500 hp to 2,000 hp for flatfish 50 hp to 300 hp for brown shrimp
Typical towing speed	3.5 to 8 knots
Typical gear	Twin beam, max length 12 m each beam. Each beam weighing <10 tonnes. Chain matting or individual chains attached to underside

2.3.3 Pulse Trawlers

Pulse trawling has been used on an experimental basis since 2006 to target sole in the North Sea under a derogation from the EU. At present over 80 Dutch registered vessels are fishing for sole under the derogation in the southern North Sea outside the UK 12 NM limit.

Pulse beam trawls replace the heavy ground gear and tickler chain with drag wires through which electric impulses are sent. The electric pulse passes into the seabed and stimulates the fish to rise up out of the substrate and into the trawl net. The beam can be replaced by a more hydrodynamically shaped structure called the Sum wing beam which is designed to further reduce the impact on the seabed. Pulse beam trawls use less fuel and have less seabed disturbance as drag wires do not penetrate the seabed. Table 2.4 provides a profile of the type of pulse gear used to target sole.

Table 2.4: Profile of typical pulse trawl vessels active across regional fisheries study area.

Pulse trawling profile	
Main target species	Sole and plaice
Nationality	Dutch
Vessel length	25 m to 45 m
Horsepower	500 hp to 2,000 hp
Typical towing speed	3.5 to 8 knots
Typical gear	Using a series of electrodes trailing from the beam down to the seabed in front of the trawl.

2.3.4 Demersal otter trawling

Table 2.5 describes the profile of demersal otter trawling vessels active across the regional commercial fisheries study area.

Whiting is the main species caught with demersal trawling gear in the regional study area and this is predominantly targeted by French registered vessels.

Table 2.5: Profile of typical demersal trawl vessels active across regional fisheries study area.

Demersal trawling profile	
Main Target species	Whiting, cod and haddock
Nationality	UK, Dutch, Belgian, Danish and French
Vessel length	16 m to 35 m
Horsepower	300 hp to 850 hp
Typical towing speed	2.0 to 6.0 knots
Typical gear	Demersal otter trawl. Possible twin or multi-rig bottom trawl. Two trawl doors approximately 1 tonne each hold the net open horizontally. Various forms of ground gear depending on target species.

2.3.5 Pelagic trawling

Table 2.6 describes the profile of pelagic trawl vessels active across the regional commercial fisheries study area.

Pelagic or mid-water trawls are towed at the appropriate level in the water column to intercept shoaling fish such as herring, sprat, mackerel or anchovy. The location of the shoals is determined by sonar or vertical sounder echoes.

Table 2.6: Profile of typical pelagic trawl vessels active across the regional fisheries study area.

Pelagic trawl profile	
Main target species	Herring, anchovy, mackerel, sprat
Nationality	French
Vessel length	30 m to 50 m
Horsepower	500 hp to 1200 hp
Typical towing speed	2.5 to 5.0 knots
Typical gear	Pair or single pelagic (mid-water) trawling. Little or no bottom contact occurs, and ground ropes are not required. Net depth is changed by altering either warp (rope) length or towing speed.

3. Key ports

3.1 Overview

The North Norfolk coast has a long history of potting for crab and lobster and Cromer crab are one of Norfolk's most well-known exports. The annual Sheringham and Cromer crab and lobster festival celebrates the importance of these species to the economy of the local area. There are approximately 50 active vessels operating along the coast, many of which are under 10 m. Most operators are members of fishermen's associations or societies with few exceptions.

The two main types of potter include the beach boats which are open to the elements and tend to operate close inshore (0 – 3 NM) with two crew. These boats tend to go out for shorter periods of time in comparison to the larger mobile potters which have various ranges depending on size. The larger vessels operating out of harbours tend to be <10 m although a few exceed this length and operate further offshore between 3 - 40 NM. The fleet includes six catamarans, three of which operate out of Cromer and which are under 10 m but can be landed and launched from the beach and have a larger outboard engine than the single hulls which means they can also fish further offshore and for longer.

Designated ports in the EIFCA district include Felixstowe, Great Yarmouth, Kings Lynn, Lowestoft, and Southwold. The main landing points for the fishing fleet along the North Norfolk coast include: Kings Lynn, Wells, Lowestoft, Boston, Southwold, Great Yarmouth, Sheringham, Cromer (including East and West Runton), Brancaster, Winterton and Blakeney. First sales value by port are presented in Figure 3-1 for the period 2014 to 2019 based on the MMO iFISH database.

Until 2018 the main port by first sales value was Kings Lynn but in 2018 the value fell from approximately £2.7 million to £1.3 million in 2019 and was overtaken Wells (£2.4 million) and Lowestoft (£1.78 million). Other ports in order of first sales value in 2019 are Southwold (£0.53 million), Cromer (£0.52 million), Great Yarmouth (£0.30 million) and Boston (£0.19 million). The other ports of Brancaster, Sheringham, Winterton and Blakeney all have first sales values of under £0.1 million. Consultation with the North Norfolk Independent Fishermen's Association (NNIFA) confirmed that the value of species landed into ports varies between years and that Kings Lynn is considered to be the main port in the area.

Further interrogation of the data reveals that the values of species landed varies between ports over the period 2014 to 2019. The following sections describes the changes to landings of the main species of value, namely shellfish in the main four ports of Kings Lynn, Wells, Lowestoft and Boston.

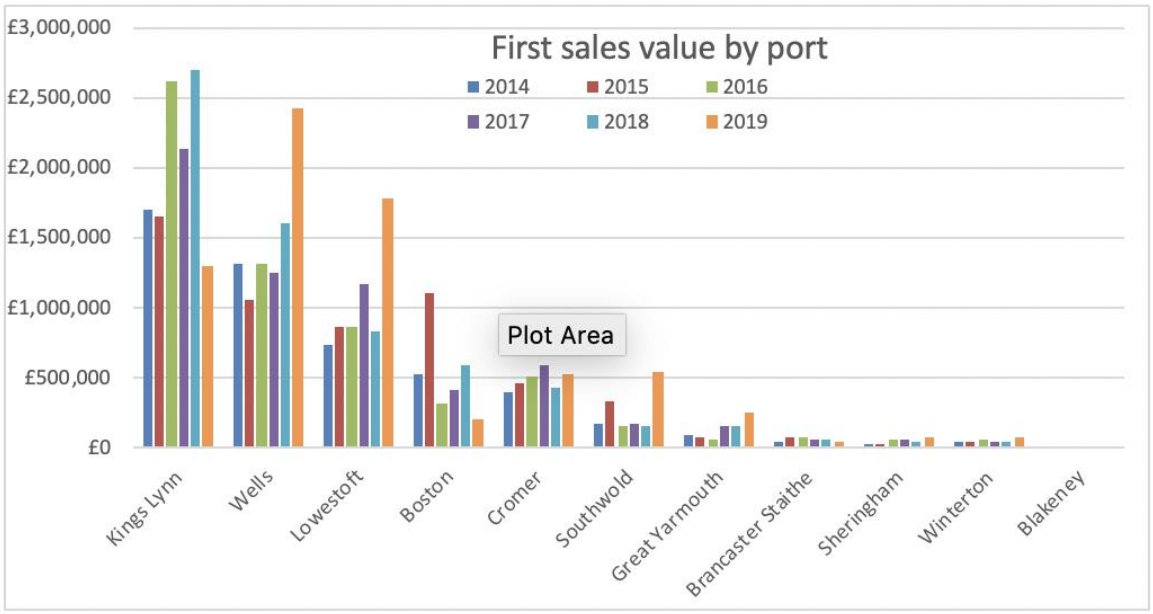

Figure 3-1: First sale value of species landed by port (MMO, 2020)

3.2 Kings Lynn

Prior to 2019 the main species by value landed in Kings Lynn were shrimps and prawns followed by cockles. This changed to whelk in 2019 and all other species decreased by value (Figure 3-2). From 2014 to 2018 cockles and whelk were the main species landed by weight and shrimps and prawns by value. However, in 2019 the significant rise in value of whelk above shrimp and prawn is considered to be the reason for the increased fishing effort for whelk in relation to shrimp, prawn and cockles. This may also be the reason that Kings Lynn was not considered to be the main port by value in 2019. However, as noted by local fishermen's associations during consultation, landings into ports vary year on year and Kings Lynn is still considered to be the main port in the EIFCA district.

Considering the annual average landings by vessel group and species between 2014 to 2019 the majority of vessels targeting shrimps and prawns are over 10 m whereas for cockles the under 10 m fleet predominate and for whelks the ratio of over 10 m to under 10 m is almost 50:50 (Figure 3-3).

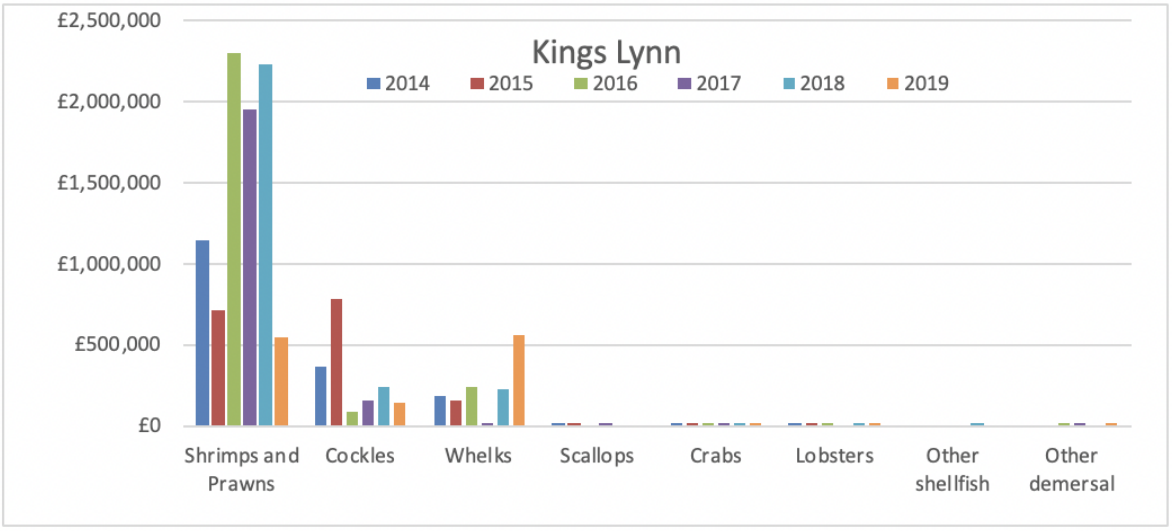

Figure 3-2: First sales value of species landed into Kings Lynn 2014 – 2019 (MMO, 2020)

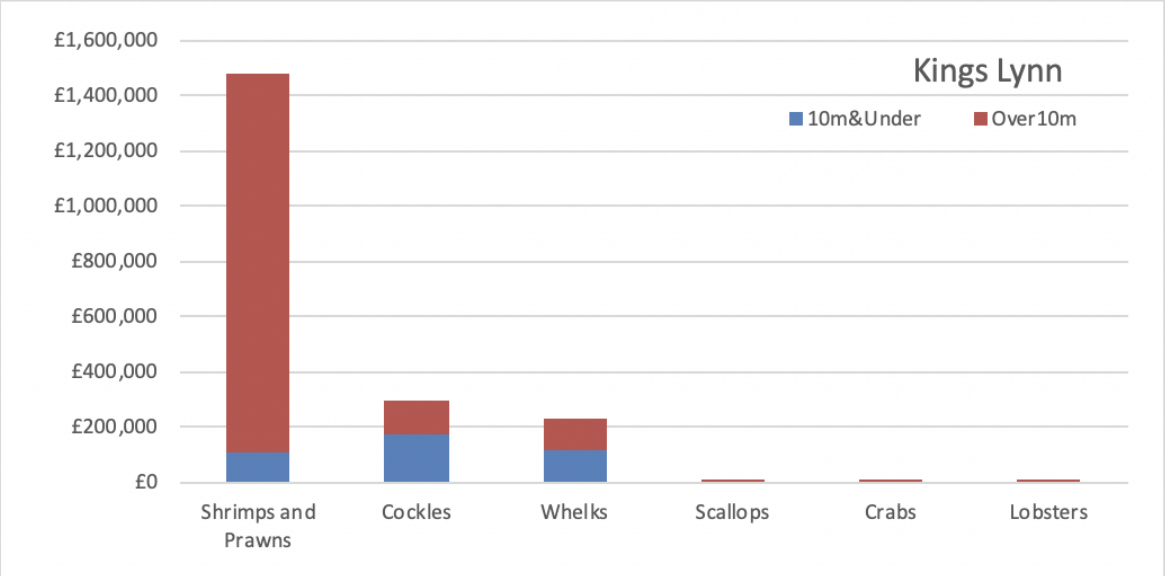

Figure 3-3: Annual average value of landings by vessel group, Kings Lynn 2014 -2019 (MMO, 2020)

3.3 Wells

Between 2014 and 2018 whelk was the main species by value landed in Wells. This was followed by lobster and crab (Figure 3-4). The value of whelk rose rapidly in 2019 and there was a similar rise in the value of crab but a decrease in the landed value of lobster. The first sales value of other species landed in Wells such as shrimps and prawns, skates and rays, scallops and other demersal fish species is low in comparison to the main shellfish species mentioned above.

The majority of vessels targeting whelks and crab are under 10 m whereas there are slightly more over 10 m vessels targeting lobster indicating that the fishery for lobster operates in both inshore and offshore areas (Figure 3-5).

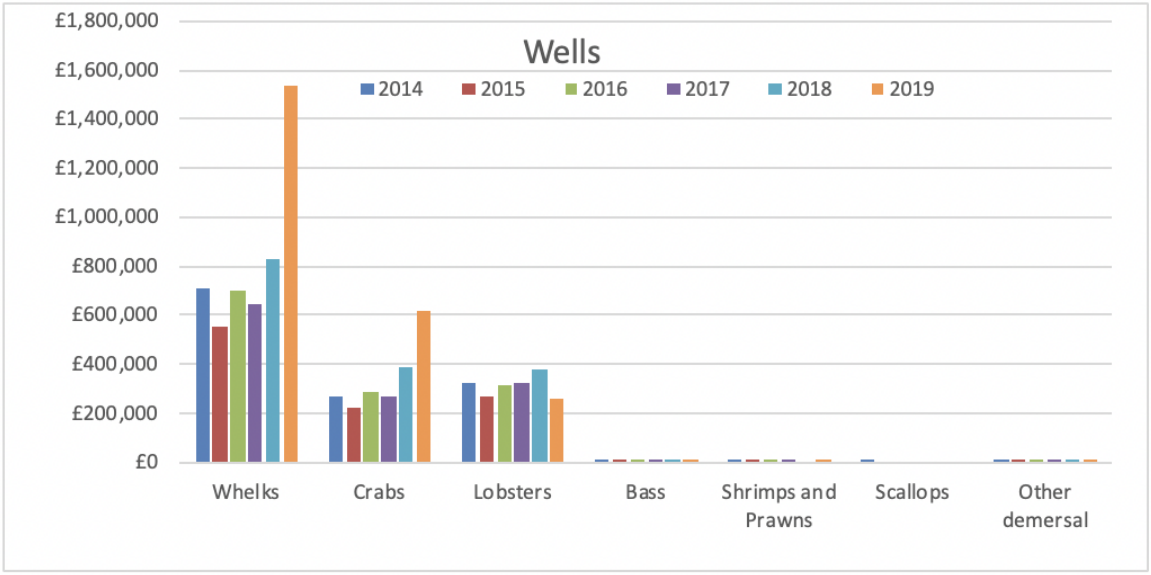

Figure 3-4: First sales value of species landed into Wells 2014 – 2019 (MMO, 2020)

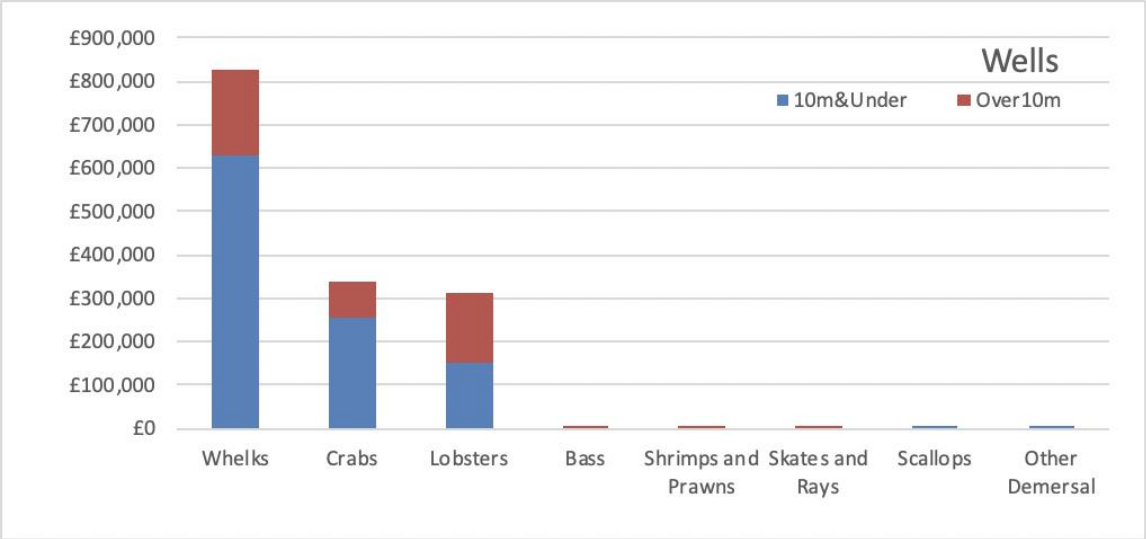

Figure 3-5: Annual average value of landings by vessel group, Wells 2014 -2019 (MMO, 2020)

3.4 Lowestoft

Whelk has been the main species by first sale value to be landed in Lowestoft since 2014. Between 2018 and 2019 the first sales value of whelk rose by over 250% from a total of £601,609 in 2018 to £1,515,399 in 2019. In comparison the other species caught such as sole, bass, skates and rays and cod have remained relatively stable in terms of value (Figure 3-6).

This is an indication of the importance of the whelk fishing in this area and which the data suggests is carried out primarily by vessels over 10 m. Other species landed such as sole, bass, skates and rays and cod are targeted by the under 10 m fleet but these species have a substantially lower first sale value (under £100,000) than whelk (Figure 3-7).

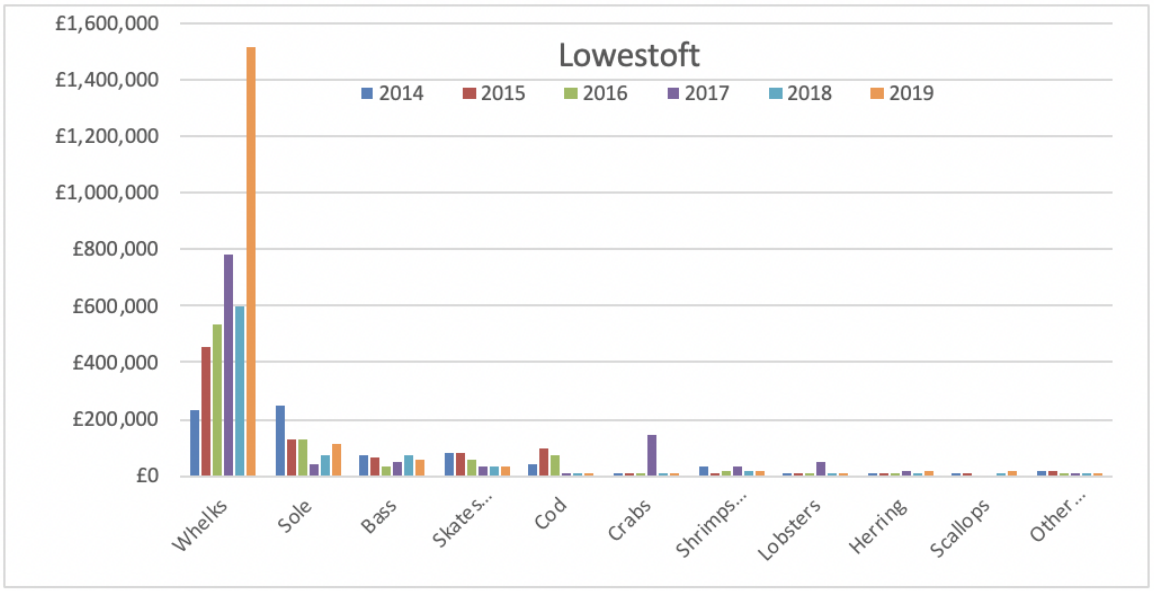

Figure 3-6: First sales value of species landed into Lowestoft 2014 – 2019 (MMO, 2020)

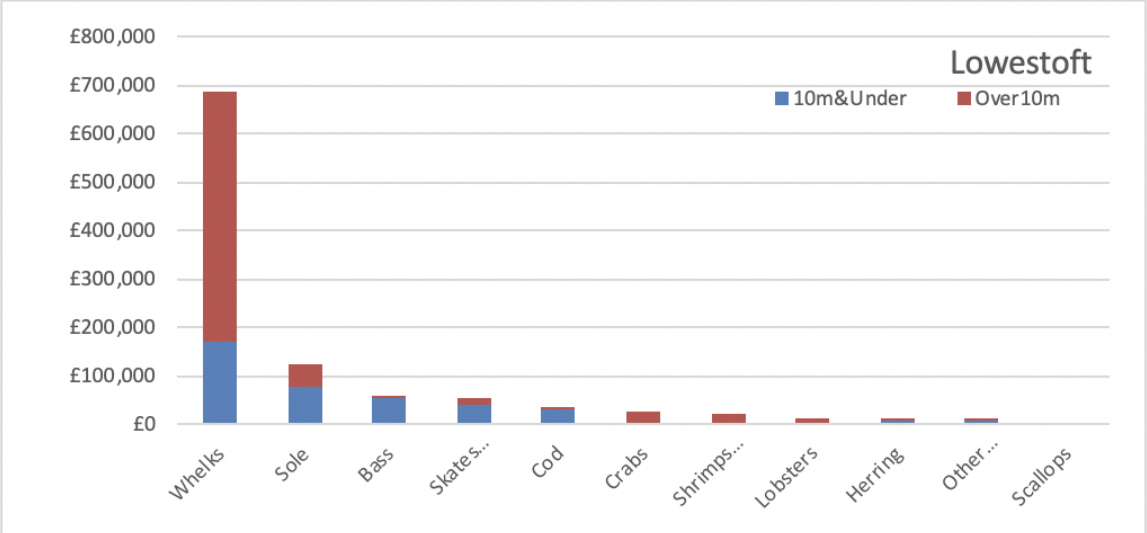

Figure 3-7: Annual average value of landings by vessel group, Lowestoft 2014 -2019 (MMO, 2020)

3.5 Boston

Since 2014 cockles have been the main species by value landed in Boston with a first sale value of over £1million in 2015 but this has since reduced to a value of approximately £157,000 in 2019. The value of shrimp and prawn landings has also decreased significantly since a peak in in value of approximately £290,000 in 2016 to a value of £36,107 in 2019. The value of whelks landed has increased slightly from 2018 to £3429 but is substantially lower than the levels of 2014 (£13,151). Given the increase in price for whelk in 2019 the figures suggest that Boston is not the main port for whelk and in general the landed value for all species into this port has declined significantly since 2015 (Figure 3-8).

Cockles are mainly targeted by the under 10 m fleet although there is almost a similar value landed by the over 10 m vessels. The over 10 m fleet land the majority of shrimps and prawns (Figure 3-9).

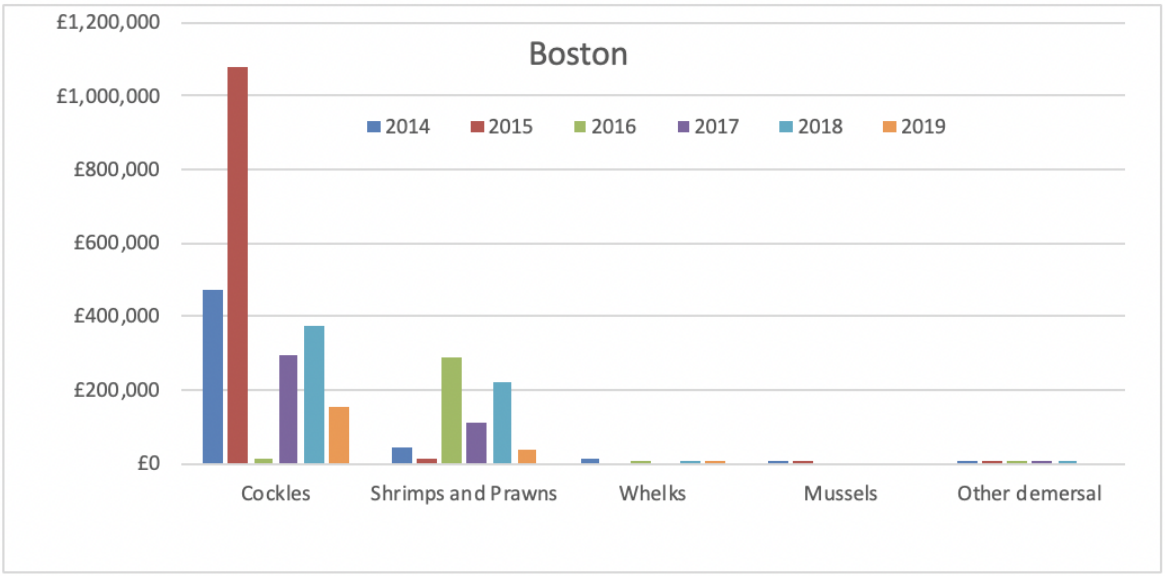

Figure 3-8: First sales value of species landed into Boston 2014 – 2019 (MMO, 2020)

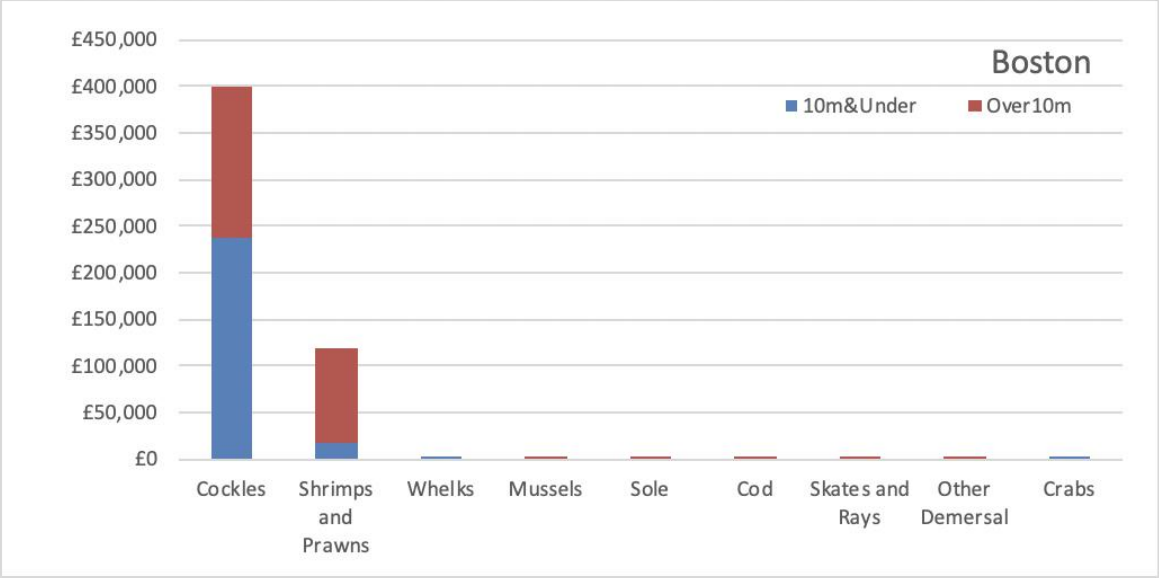

Figure 3-9: Annual average value of landings by vessel group, Boston 2014 -2019 (MMO, 2020)

3.6 Cromer

Cromer has a greater variety of species landed and lobster, crab and whelk dominate the landed weight and value until 2018 after which there were no recorded landings by value for whelk. There is also a small amount of bass landed with a value of £1863, and smaller values of shrimp and prawn, herring, skates and rays and sardine all with a landed value of under £300 (Figure 3-10).

Cromer vessels are predominantly 10 m and under in comparison to the other ports described in this section (Figure 3-11). Since lobster and crab make up the majority of species landed by value this is indicative that potting takes place closer to shore from this port.

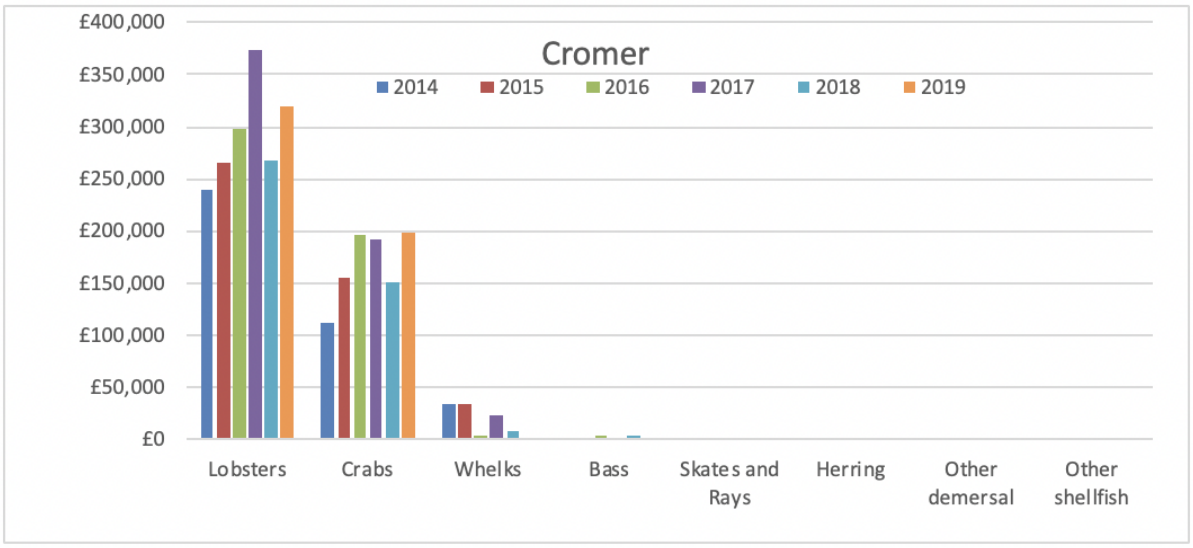

Figure 3-10: First sales value of species landed into Cromer 2014 – 2019 (MMO, 2020)

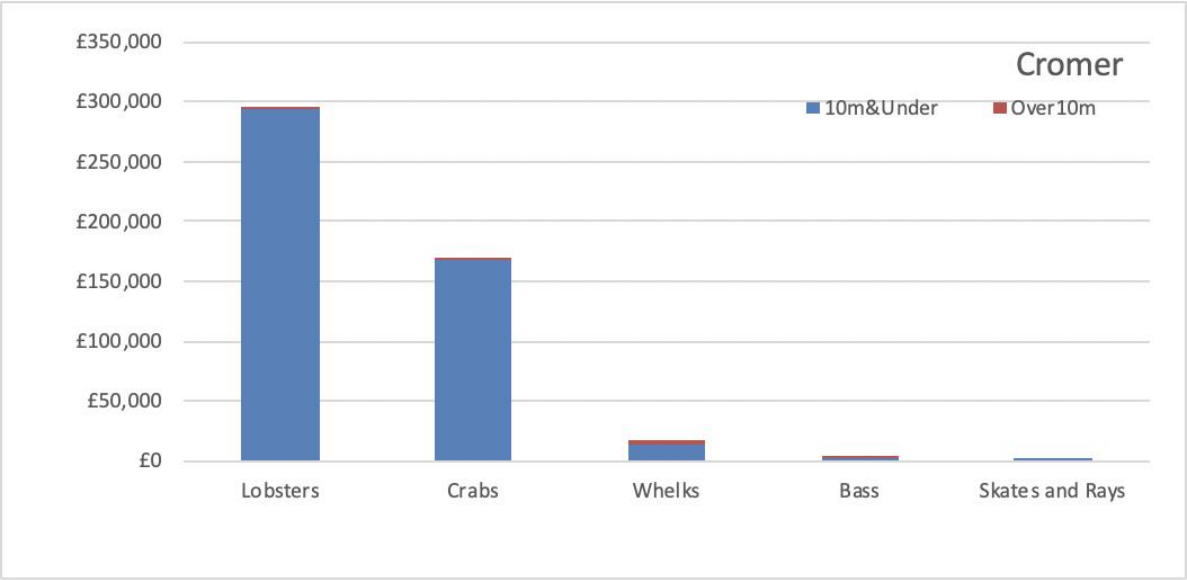

Figure 3-11: Annual average value of landings by vessel group, Cromer 2014 -2019 (MMO, 2020)

4. Fisheries activity assessment

4.1 Wind farm sites study area

4.1.1 UK Landings trends

Landing trends for UK vessels from the wind farm sites area (ICES rectangle 35F1) by weight are presented in Figure 4-1. The surface area of the ICES rectangle covered by DEP is 2.79% and SEP 2.49% although this does not represent the proportion of landings from these areas since fishing grounds are not equally distributed throughout the rectangle.

The average annual landings from UK registered vessels from ICES rectangle 35F1 by value between 2015 and 2019 are shown in Figure 4-2 and are dominated by three species namely whelk, brown crab and lobster with a value of £1.5 million, £249,000 and £224,000 respectively in 2019. As noted in Section 2.1 the proportion of species landed by pots and traps is over 99% in the commercial fisheries array study area. For vessels over 15 m potting activity is greater in the area overlapped by DEP where the value of landings from pots and traps in 2017 was in the region of £1000-5000 per quadrat (MMO, 2019).

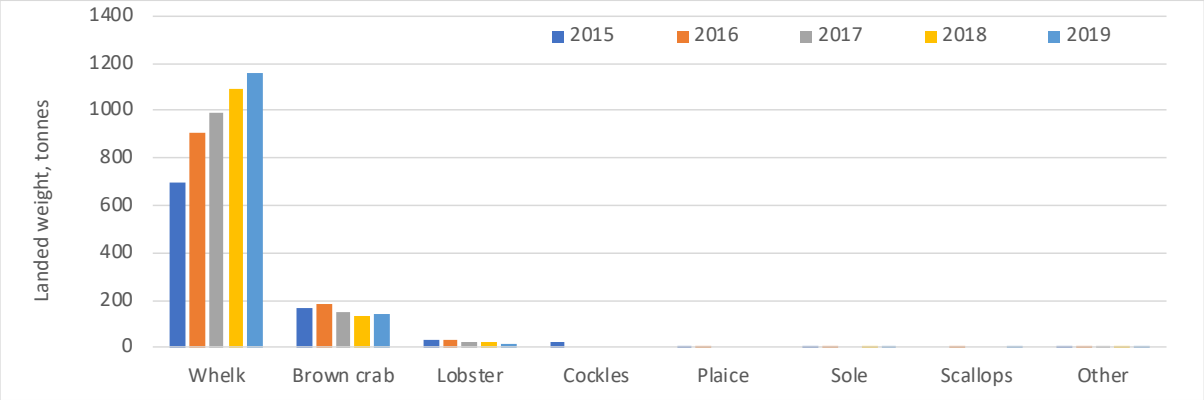

Figure 4-1: Landed weight of species caught by UK vessels 2015 – 2019 from 35F1 (data source: MMO, 2020)

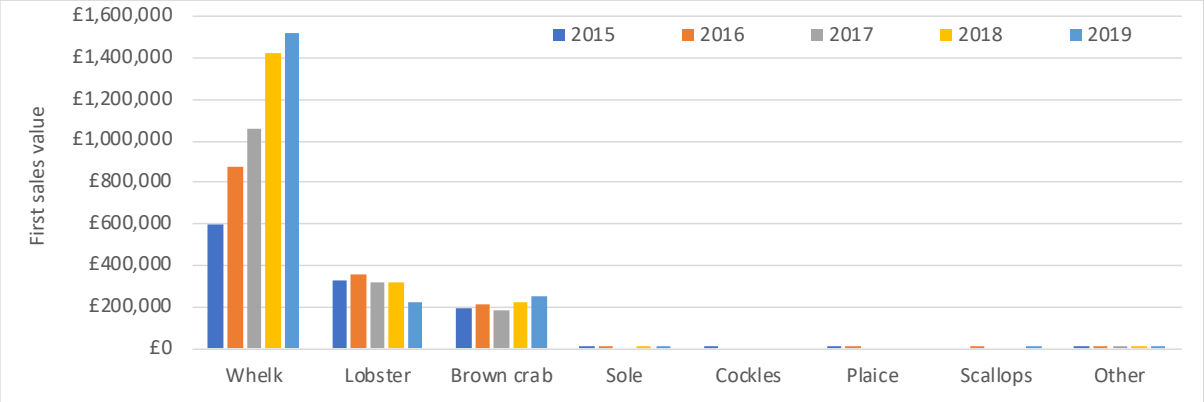

Figure 4-2: First sales value of species landed by UK vessels 2015-2019 from 35F1 (data source: MMO, 2020)

Although the total landed weight for all species from ICES rectangle 35F1 caught by the UK fleet did not increased significantly between 2015 (928 tonnes) and 2019 (1,317 tonnes) the notable exception is for whelk. Landings for whelk increased from just under 700 tonnes in 2015 to 1156 tonnes in 2019, which is an increase of 66% by weight. However, in terms of value the increase was 155% ostensibly as a result of the increase in price per tonne from £855 in 2015 to £1314 in 2019.

Shellfish landings shown a distinct seasonality as presented in Figure 4-3. Although crab and lobster tend to be targeted together, the season for crab runs from May to October/November with a peak in May/June. This can be compared to the main season for lobster which runs from March/April to November with a peak between July and October. The main whelk season is earlier and runs from January through to December although the peak landings are between April and June. The shellfish fishery is therefore active throughout the year with a slight decrease in the winter months.

Although VMS data for the over 15 m fishing vessels presented in Figure 2-6 suggests there is little or no potting activity in the area overlapped by SEP, data presented in Figure 4-4 indicates that the 10 m and under fleet are active in the wind farm sites area and port data presented in Section 3 shows the predominance of under 10 m vessels targeting shellfish from some of the local ports such as Cromer.

Since 2015 the proportion of landed weight caught by 10 m and under has declined for brown crab and lobster as a result of larger boats entering the fishery to target the offshore stock. In relation to whelk the proportion of landed weight caught by vessels of 10 m and under has increased slightly although the over 10 m fleet still dominate the fishery.

A mapping project undertaken by the EIFCA in 2010 described the spatial coverage of fishing for shellfish species for all vessels in the UK fleet. Figure 4-5 presents the shellfish fishing grounds which indicates that in 2010 whelk fishing grounds and some crab and lobster fishing grounds were in the same location as DEP north whereas DEP south and SEP are located only within crab and lobster fishing grounds.

Consultation with the EIFCA to verify the current shellfish grounds indicate that the 2010 map is based on targeted interviews with a sample of fishermen (~12) at the time and is therefore not representative of the entire fleet. Indeed, consultation directly with the industry indicates that currently all shellfish species are targeted across the district.

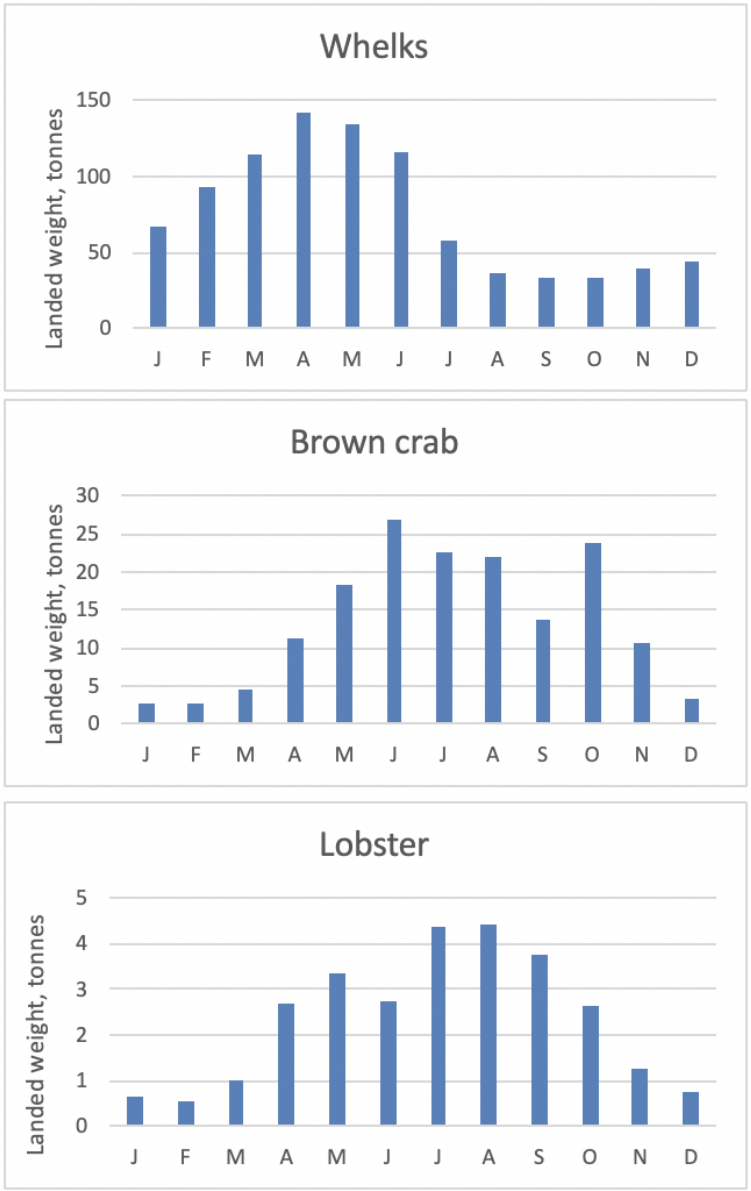

Figure 4-3: Wind farm sites area – seasonality for shellfish fishing (Data source: MMO, 2020)

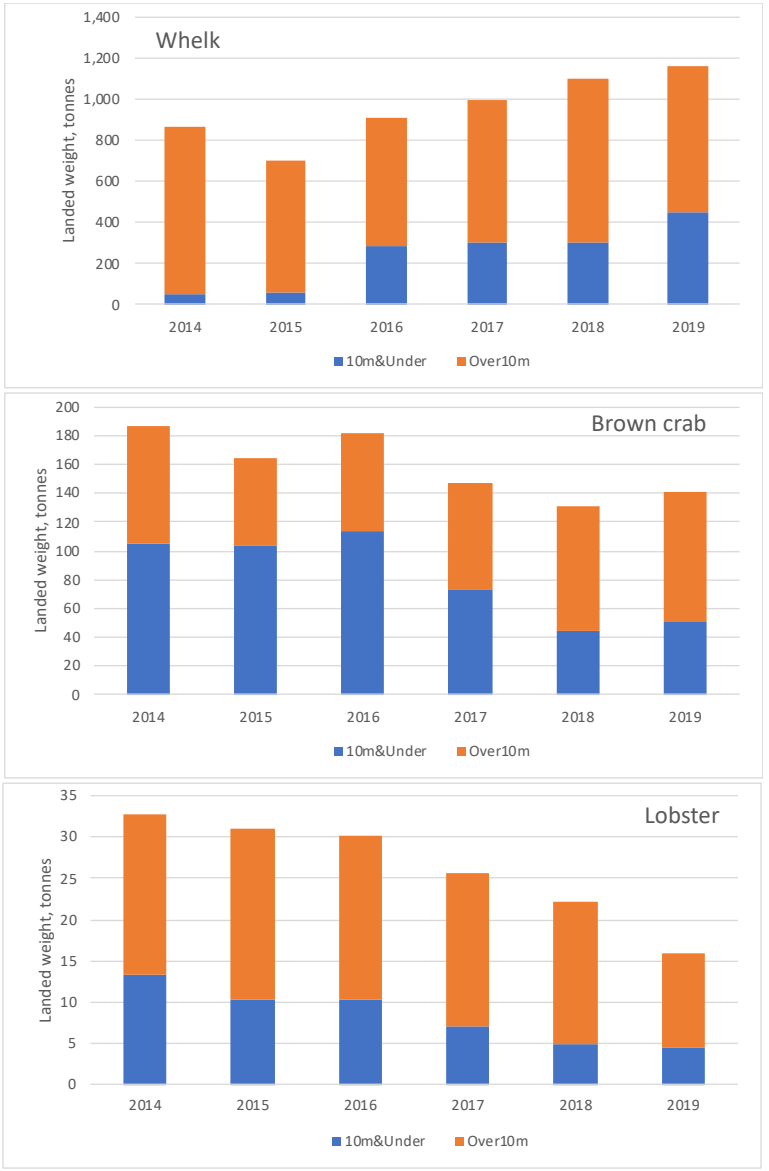

Figure 4-4: Wind farm sites area – trends in vessel sizes 2014-2019 (Data source: MMO, 2020)

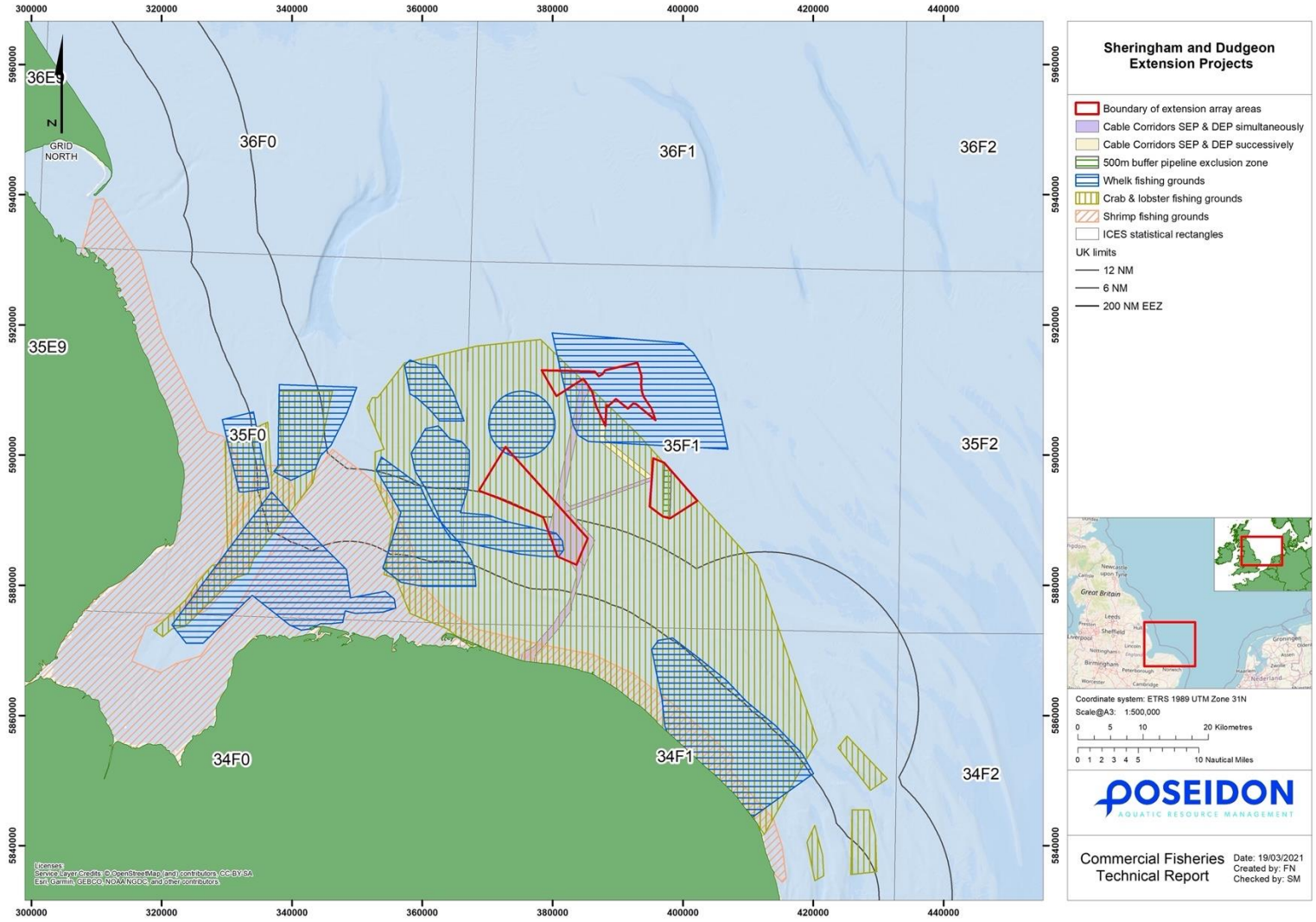

Figure 4-5: EIFCA Mapping Project – shellfish fishing grounds based on interviews undertaken by the EIFCA with a sample of fishermen in 2010

4.1.2 EU Landings trends

The commercial fisheries wind farm site study area is defined as ICES rectangle 35F1. Landings by EU Member States are predominately from 35F1, with very low activity and landings from 34F1.

Dutch fishing activity

Landings by Dutch registered vessels in the commercial fisheries wind farm sites and export cable study areas (ICES rectangles 34F1 and 35F1) are described in Section 2.1. The two key species with landings of over five tonnes per year are sole and plaice with a landed value of €383,000 and 55,500 per annum respectively, based on a five-year average from 2012 to 2016.

Figure 4-6 presents the annual landings of sole and plaice between 2012 and 2016. From 2012 there was a slight increase in landings of sole to the maximum weight of 60 tonnes in 2014. This figure fell by over 50% in 2015 to 27 tonnes and only increased by a small percentage to 34 tonnes in 2016.

Over the same period plaice landings within the commercial fisheries study area reached 54 tonnes in 2014 and since that period landings have declined to a weight of 30 tonnes in 2016. Figure 4-7 presents the main gear types used by the Dutch registered vessels and indicates that beam trawling is the gear predominantly used to target sole and plaice.

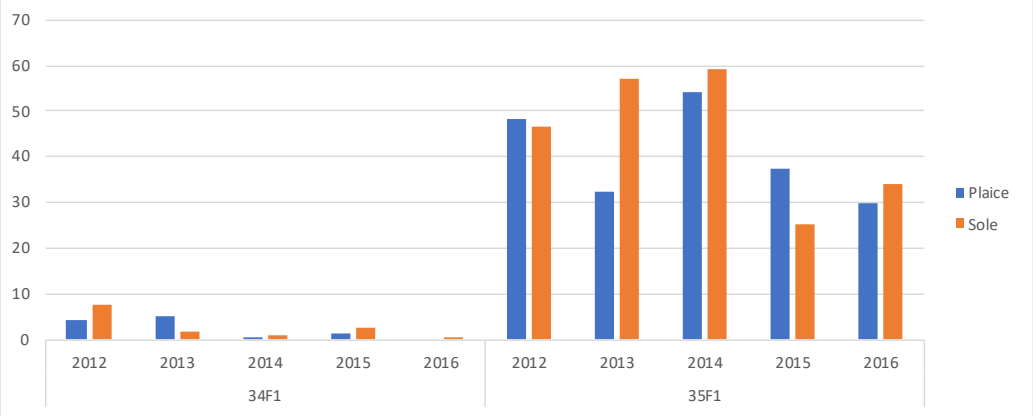

Figure 4-6: Landed weight of all species by Dutch registered vessels from the commercial fisheries wind farm sites and export cable study areas (34F1 and 35F1) (Source: EU DCF 2019).

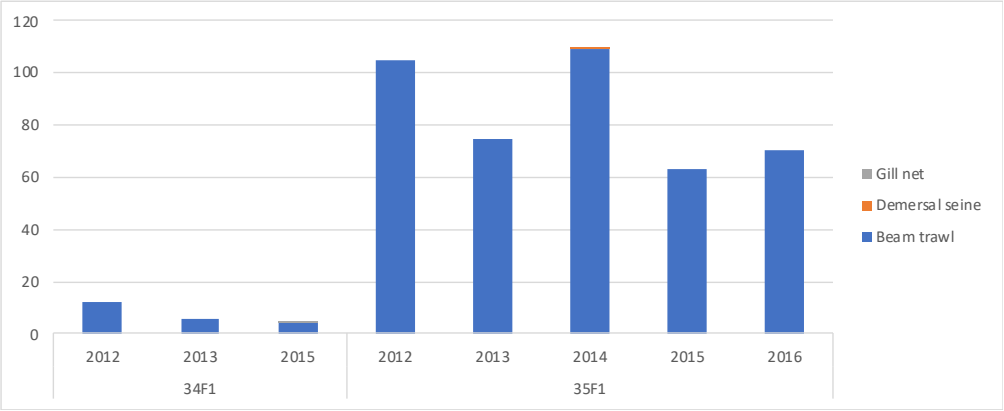

Figure 4-7: Landed weight of all species by Dutch registered vessels by gear type from the commercial fisheries wind farm sites and export cable study areas (34F1 and 35F1) (Source: EU DCF 2019).

The trends in sole and plaice landings are likely to be related to the changes in quota allocations in the North Sea for the Netherlands. Figure 4-8 presents the average annual value of landings between 2001-2015.

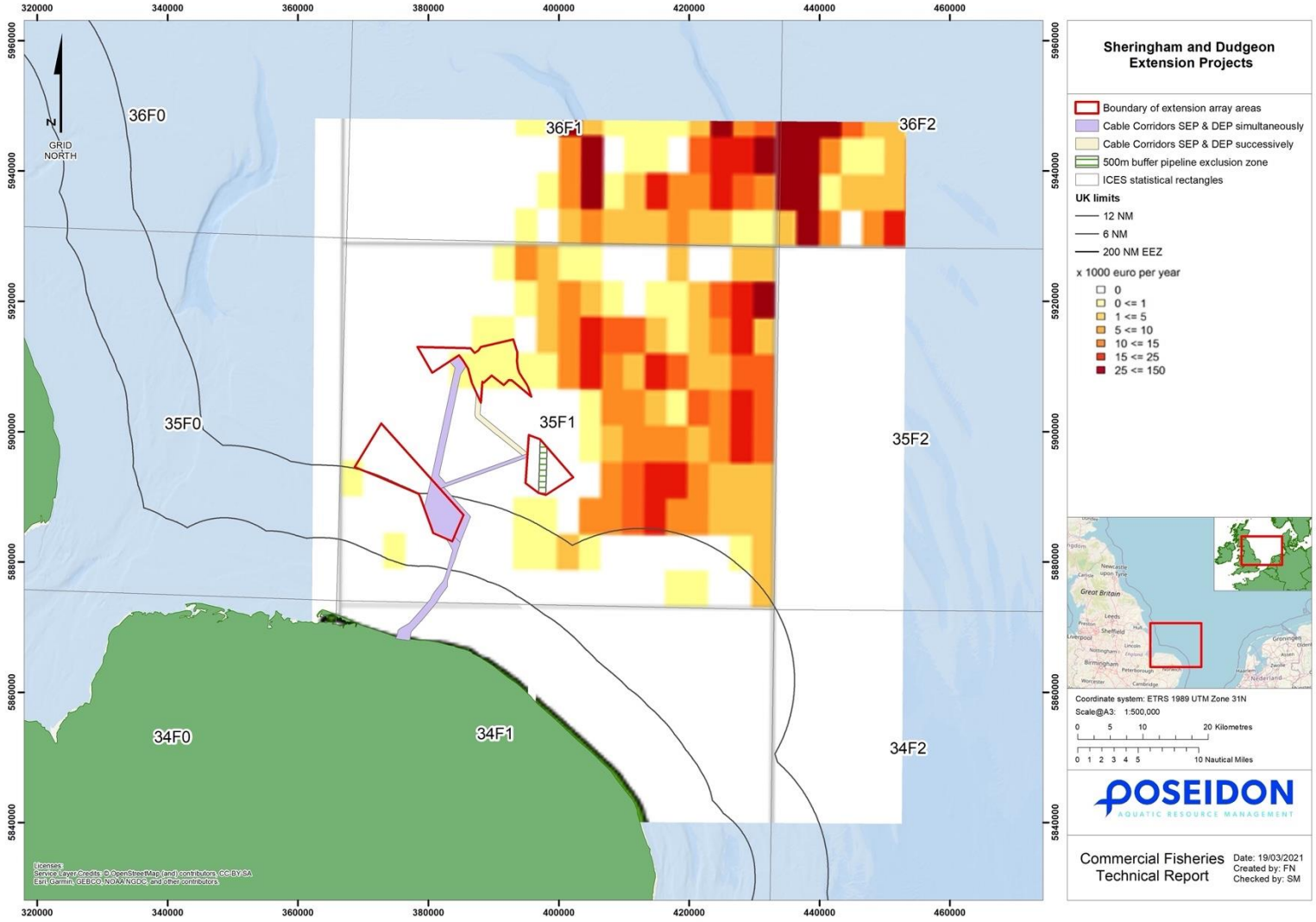

Figure 4-8: Dutch spatial distribution of average annual landings value (based on data from 2011-2015) (Source: Wageningen University & Research, 2017)

Within the commercial fishing wind farm sites and export cable study areas the greatest value of landings comes from the western region of ICES rectangle 35F1. DEP north lies within the identified fishing grounds although the value of landings for the overlapped area is low, at €0-€1000 per year. SEP and DEP south are not located within the targeted grounds for Dutch registered vessels.

In 2017 the Netherlands held 36% of the TAC for plaice with a quota of 46,471 tonnes. Landings of plaice at the end of 2016 from the commercial fisheries study area were recorded as 30 tonnes which represents 0.06% of the quota for 2017 in ICES Divisions 2a and 4.

Similarly, in 2017 the Netherlands held 75% of the TAC for sole (12,122 tonnes) in ICES Divisions 2a and 4. The landed weight recorded for sole at the end of 2016 in the commercial fisheries study area was 34 tonnes which represents 0.28% of the Dutch quota.

Belgian fishing activity

Landings data for ICES rectangle 34F1 and 35F1 for key species landed by Belgian registered vessels are presented in Figure 4-9. Only plaice and sole were landed in quantities over 2 tonnes during between 2012 and 2016.

Since a peak in 2013, landings for both plaice and sole has fallen to 1.08 and 0.21 tonnes respectively. In 2017 Belgium had a quota of 7,435 tonnes for plaice and a quota of 1,343 tonnes for sole in ICES Division 2a and 4 in which the project is located. The landings data in for each species at the end of 2016 represents this to be 0.014% of the quota for plaice and 0.015% of the quota for sole. The commercial fisheries study area is therefore not considered to be an important fishing area for Belgian registered vessels.

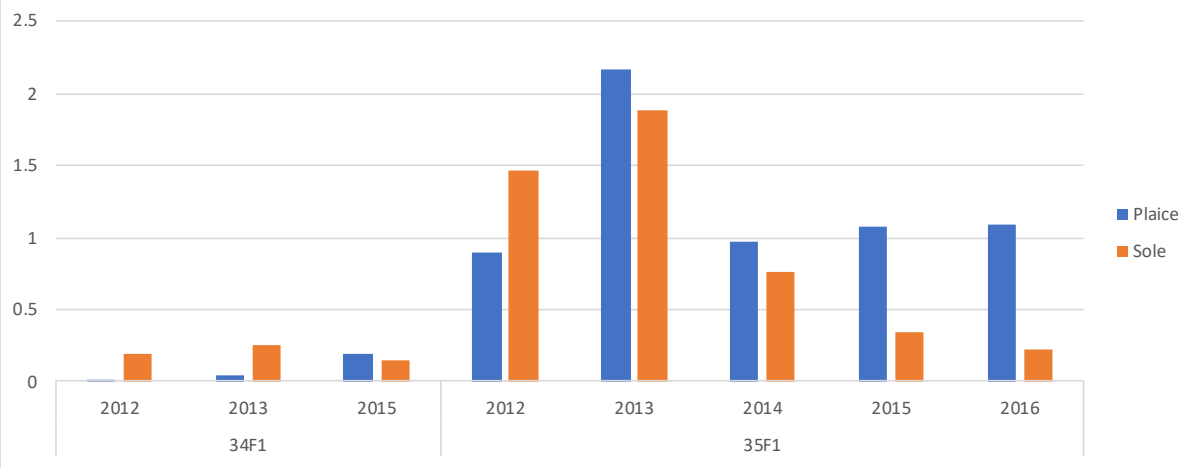

Figure 4-9: Landed weight of key species by Belgian registered vessels from the commercial fisheries wind farm sites and export cable study areas (34F1 and 35F1) (Source: EU DCF 2019).

French fishing activity

Prior to 2015 French registered demersal trawlers targeted whiting within the commercial fisheries study area but the landed weight has reduced significantly and in 2016 this was less than 0.5 tonnes. A similar trend was seen in the landings for mackerel targeted by the pelagic trawling fleet which has declined from approximately 7 tonnes in 2012 to less than 1 tonne in 2016 (Figure 4-10). The commercial fisheries study area is not considered to be an important fishing area for French registered vessels.

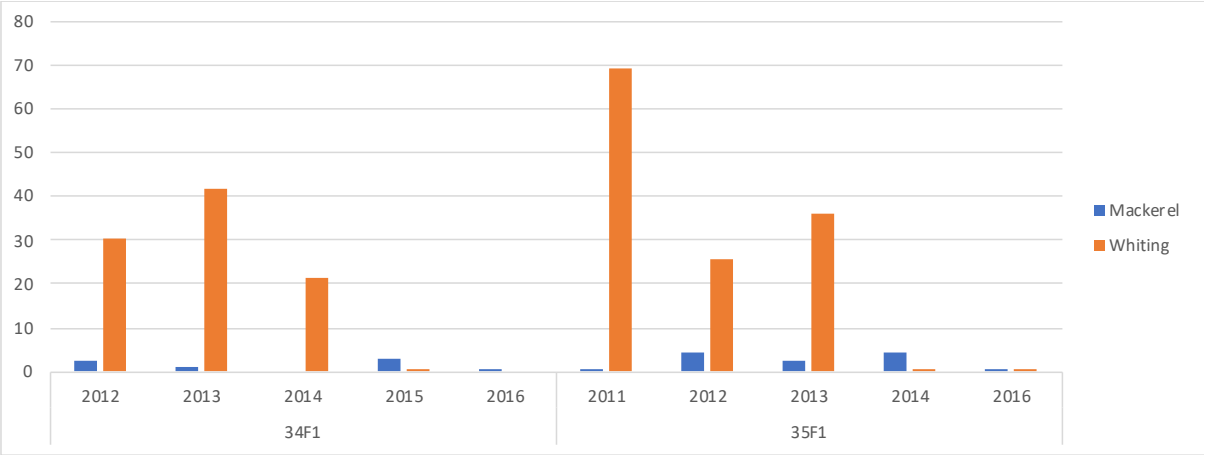

Figure 4-10: Landed weight of key species by French registered vessels from the commercial fisheries wind farm sites and export cable study areas (34F1 and 35F1) (Source: EU DCF 2019).

Danish fishing activity

Danish registered vessels principally target sandeel and sprat in a mixed fishery using demersal otter trawl gear. Significant sandeel grounds are located across the northern part of ICES rectangle 35F1 as presented in Figure 2-12. DEP north overlaps with a small proportion (2.04%) of the southernmost limit of the sandeel grounds. It is estimated that this small area of sandeel ground overlaps with 20.87% of the proposed DEP north.

Landings of sandeel by Danish vessels reached a maximum of over 7,000 tonnes in 2003 (Figure 2-11) but have since declined and after 2011 no sandeel were caught in the commercial fisheries study area. Sandeel currently have a zero TAC in this area but as fishing for this species may resume in the future it is included within the assessment.

4.2 Offshore Export Cable Corridor Study Area

The proposed offshore export cable corridor will be constructed between DEP to SEP and from SEP to landfall at Weybourne, with a total corridor length of 40 km and overlapping ICES rectangles 35F1 and 34F1.

A similar trend for fishing activity is observed in the proposed offshore export cable corridor study area (35F1 & 34F1) and within the wind farm sites study area (35F1). In terms of landed weight, whelk predominate and despite there being a slight reduction in landed weight between 2017 and 2018 (Figure 4-11) the first sales value has increased from £1.3 million to £1.4 million. This growth is also seen from 2018 to 2019, with an increase in landed weight and first sales value to over £1.8 million from 34F1 and 35F1 in 2019 (MMO, 2020). This demonstrates the importance of the whelk fishery for this area.

The total landed weight for whelk in the wind farm sites area (35F1) in 2019 was approximately 1,156 tonnes compared with a weight of 1,374 tonnes from the wind farm sites and offshore export cable corridor areas combined (35F1 and 34F1) demonstrating that the main whelk fishing area is located within the wind farm sites area. This is similar for the other two key species namely, brown crab and lobster. The landed value of brown crab and lobster in the proposed offshore export cable corridor area between SEP to landfall has remained relatively stable over the last five years, with slight growth in 2019 reaching values of approximately £512,000 and £573,000 respectively (Figure 4-12). This is in comparison with the landed values in 2019 in the wind farm sites area from brown crab and lobster of £249,000 and £224,000.

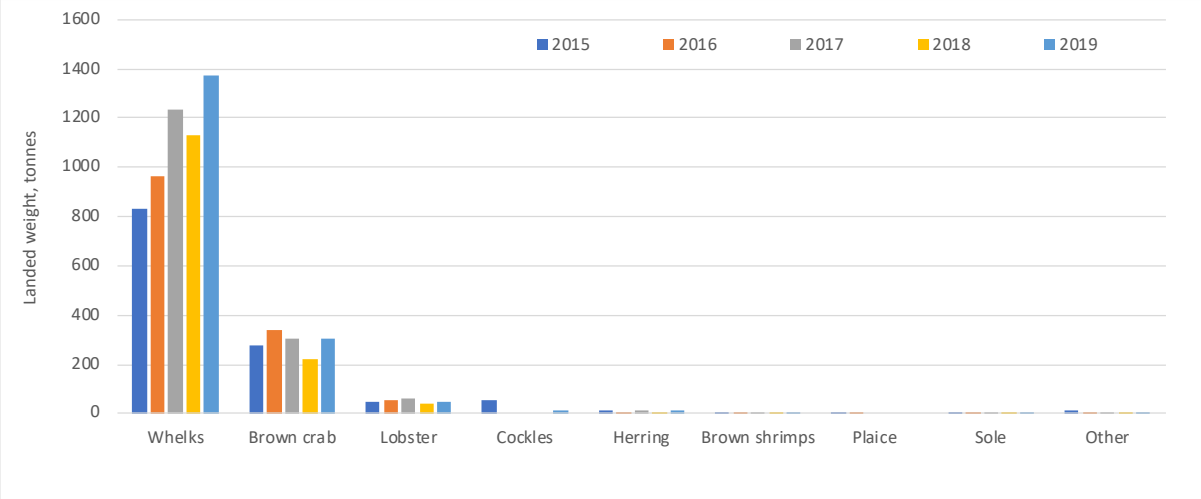

Figure 4-11: Landed weight (tonnes) for key species within the export cable corridor study area (34F1 and 35F1) (data source: MMO, 2020).

The figures suggest that the inshore areas are important grounds for the shellfish fisheries and consultation with a local fishermen's association confirm that the majority of boats are under 10 m and fish relatively close to shore.

Figure 4-13 presents the proportion of landed weight by gear which demonstrates that pots and traps are the predominate gear used in the offshore cable corridor area.

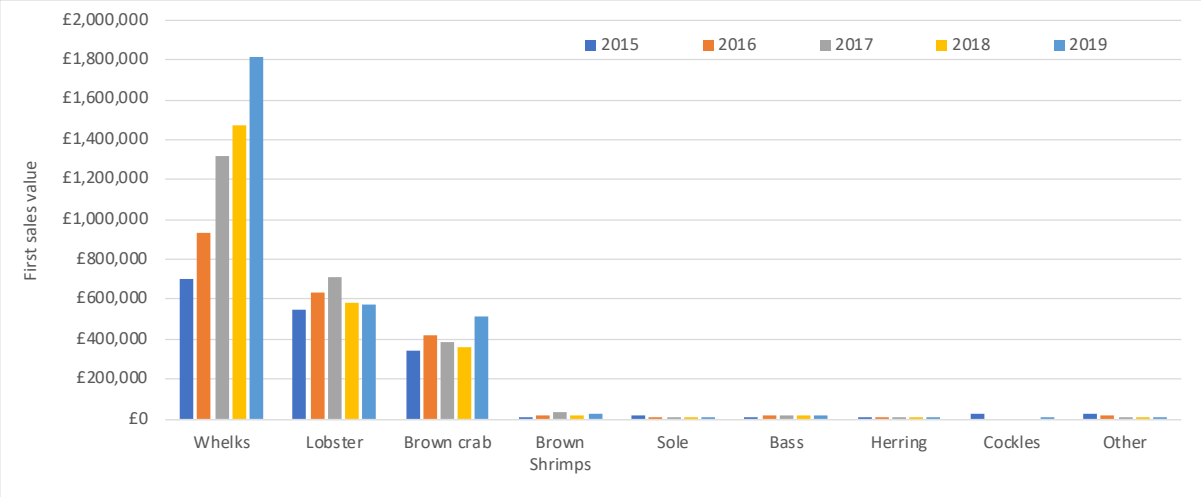

Figure 4-12: First sales value (£) for key species within the export cable corridor study area (34F1 and 35F1) (data source: MMO, 2020).

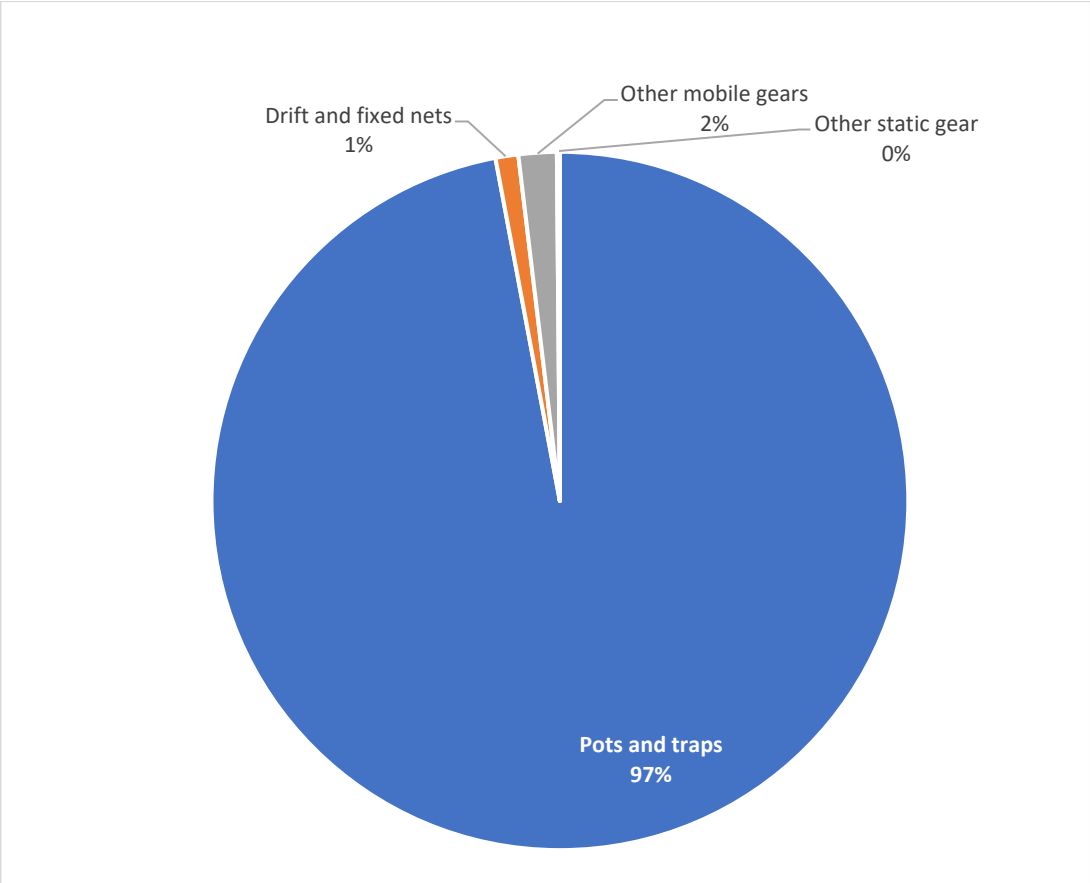

Figure 4-13: Proportion of landed weight be gear type – offshore export cable corridor area based on five year average 2015-2019 (data source: MMO, 2020).

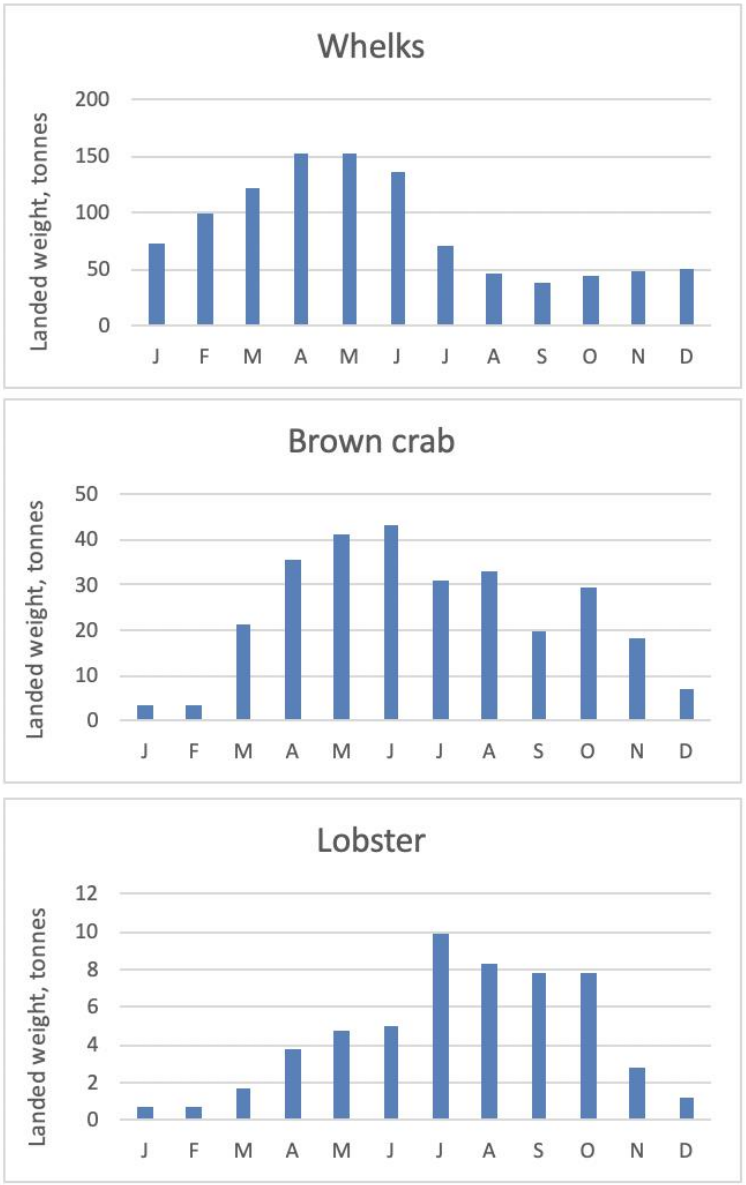

Figure 4-14: Export cable study area (35F1 & 34F1): seasonality for shellfish fishing (based on average 2014-2019) (MMO, 2020)

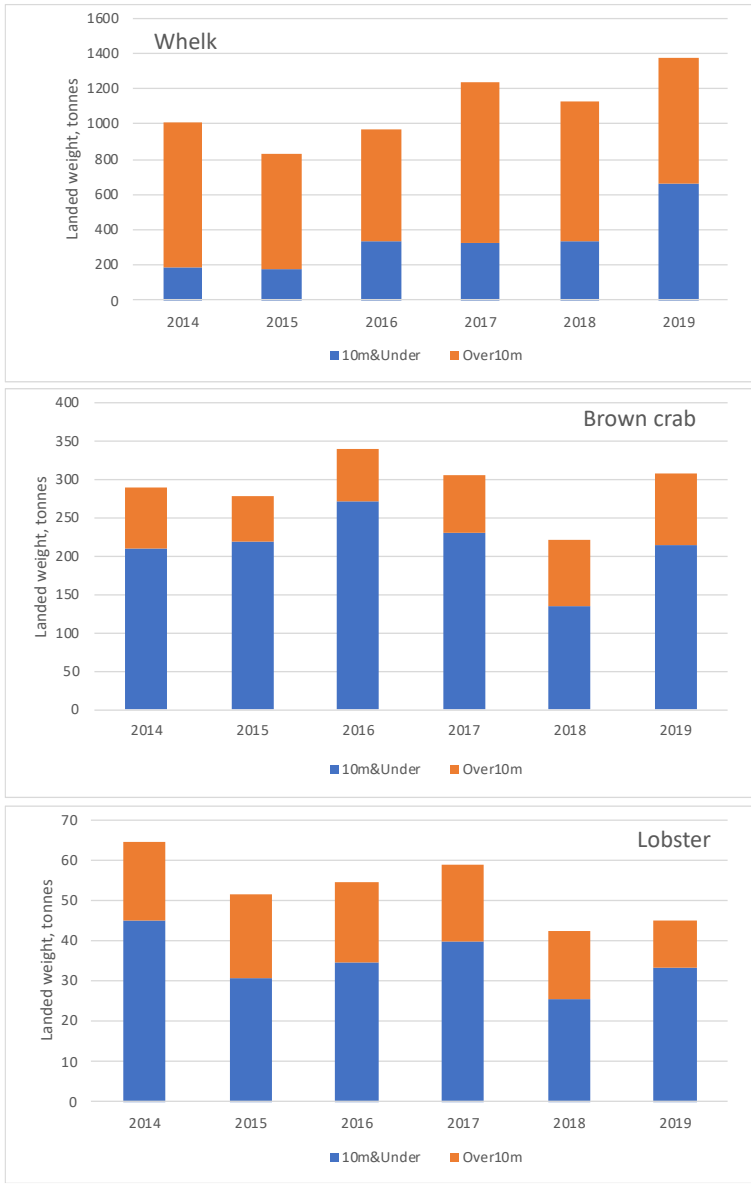

Figure 4-15: Export cable study area (35F1 & 34F1): trends in landings by vessel size 2014-2019 (MMO, 2020)

5. Impact assessment

5.1 Key parameters for assessment

The following sections of this report present the results of the EIA for the potential impacts of the Projects on commercial fisheries during all phases of construction, operation with maintenance and decommissioning.

The EIA draws on environmental baseline data and other information gathered and analysed in this report and presents the potential effects on commercial fisheries of both DEP and SEP. Assumptions and limitations of the information compiled are identified within the EIA and any necessary monitoring and/or mitigation measures which could prevent, minimise, reduce or offset the possible environmental effects identified in the EIA process are highlighted.

The impact assessment methodology for commercial fisheries is consistent with that described in Chapter 6 EIA Methodology.

5.2 Impact assessment criteria

Determining the significance of effects is undertaken in two stages. This involves defining the sensitivity of the receptors and the magnitude of the impact. This section presents the criteria applied in order to allocate values to receptor sensitivity and the magnitude of potential impacts.

The criteria for defining sensitivity is described in Table 5.1 below.

Table 5.1: Definition of terms relating to receptor sensitivity

Sensitivity	Definition used in this chapter
High	Receptor is highly vulnerable to impacts that may arise from the project and recoverability is long term or not possible. And/or: No alternative fishing grounds are available.
Medium	Receptor is somewhat vulnerable to impacts that may arise from the project and has moderate levels of recoverability. And/or: Moderate levels of alternative fishing grounds are available and/or fishing fleet has moderate operational range.
Low	Receptor is not generally vulnerable to impacts that may arise from the project and/or has high recoverability. And/or: High levels of alternative fishing grounds are available and/or fishing fleet has large to extensive operational range; fishing fleet is adaptive and resilient to change.
Negligible	Receptor is not vulnerable to impacts that may arise from the project and/or has high recoverability. And/or: Extensive alternative fishing grounds available and/or fishing fleet is highly adaptive and resilient to change.

In assessing the magnitude of the impact, the value and vulnerability of the receptor, i.e. the fishing fleet under assessment, together with the reversibility of the impact are also considered. Due to the range in scale, value (in terms of both landings and income/profit) and operational practises, within the commercial fishing fleets assessed, specific economic criteria were not set for defining value within the categories of high, medium or low. Instead, these classifications were based on judgement informed by the baseline characterisation and consultation with the industry.

The criteria for defining magnitude in this report are described in Table 5.2 below.

Table 5.2: Definitions of terms relating to magnitude of an impact

Magnitude of impact	Definition used in this chapter
High	Impact is of long-term duration (e.g. greater than 12 years duration) and/or is of extended physical extent; And: Impact is expected to result in one or more of the following: • Substantial loss of target fish or shellfish biological resource (e.g. loss of substantial proportion of resource within project area); and • Substantial loss of ability to carry on fishing activities (e.g. substantial proportion of effort within project area). (Negative)
	Impact is expected to result in one or more of the following: • Large scale or major improvement of resource quality, measurable against biomass reference points; and • Extensive restoration or enhancement of habitats supporting commercial fisheries resources. (Beneficial)
Medium	Impact is of medium term duration (e.g. less than 12 years) and/or is of moderate physical extent; And: Impact is expected to result in one or more of the following: • Partial loss of target fish or shellfish biological resource (e.g. moderate loss of resource within project area); and • Partial loss of ability to carry on fishing activities (e.g. moderate reduction of fishing effort within project area). (Negative)
	Impact is expected to result in one or more of the following: • Moderate improvement of resource quality; and • Moderate restoration or enhancement of habitats supporting commercial fisheries resources. (Beneficial)
Low	Impact is of short-term duration (e.g. less than 5 years) and/or is of limited physical extent; And: Impact is expected to result in one or more of the following: • Minor loss of target fish or shellfish biological resource (e.g. minor loss of resource within project area); and • Minor loss of ability to carry on fishing activities (e.g. minor reduction of fishing effort within project area). (Negative)
	Impact is expected to result in one or more of the following: • Minor benefit to or minor improvement of resource quality; and • Minor restoration or enhancement of habitats supporting commercial fisheries resources. (Beneficial)

Magnitude of impact	Definition used in this chapter
Negligible	Impact is of very short-term duration (e.g. less than 2 years) and/or physical extent of impact is negligible; And: Impact is expected to result in one or more of the following: • Slight loss of target fish or shellfish biological resource (e.g. slight loss of resource within project area); and • Slight loss of ability to carry on fishing activities (e.g. slight loss of fishing effort within project area). (Negative)
	Impact is expected to result in one or more of the following: • Very minor benefit to or very minor improvement of resource quality; and • Very minor restoration or enhancement of habitats supporting commercial fisheries resources. (Beneficial)

The correlation of the sensitivity of the receptor and the magnitude of the impact provides an indication of the significance of the effect on the receptor namely, commercial fisheries. Table 5.3 presents the method used for this assessment.

Table 5.3: Matrix used for the assessment of the significance of effect

		Negative Magnitude				Beneficial Magnitude			
		High	Medium	Low	Negligible	Negligible	Low	Medium	High
Sensitivity	High	*Major*	*Major*	*Moderate*	*Minor*	*Minor*	*Moderate*	*Major*	*Major*
	Medium	*Major*	*Moderate*	*Minor*	*Minor*	*Minor*	*Minor*	*Moderate*	*Major*
	Low	*Moderate*	*Minor*	*Minor*	*Negligible*	*Negligible*	*Minor*	*Minor*	*Moderate*
	Negligible	*Minor*	*Negligible*	*Negligible*	*Negligible*	*Negligible*	*Negligible*	*Negligible*	*Minor*

5.3 Data limitations

Limitations of landings data include the spatial size of ICES rectangles from which data is collected and the area overlapped by the DEP and SEP project. For example, the surface-area of DEP wind farm site is 2.79%, and SEP wind farm site is 2.49% of the surface area of ICES rectangle 35F1 respectively. The proposed offshore export cable and interlink corridors overlap 1.91% of the surface area of ICES rectangle 35F1 and 34F1 (for construction of SEP and DEP simultaneously).

This can misrepresent the actual fishing activity across DEP, SEP and the proposed offshore export cable corridor area and care is therefore required when interpreting these data. A further limitation of landings data is the potential under-reporting of landings associated with potting vessels, which may occur as a result of estimating catches (as opposed to accurate weighing) and not reporting catches that fall below the acceptable limit as defined within the UK RBS 2005 Regulation (i.e. when purchases of first sale fish direct from a fishing vessel are wholly for private consumption, and less than 25 kg is bought per day).

Limitations of VMS data are primarily focused on the coverage being limited to vessels ≥12 m. It is important to be aware that where mapped VMS data may appear to show inshore areas as having lower (or no) fishing activity compared within offshore areas, this is not the case

because VMS data do not include vessels typically operating in inshore area (i.e. which typically comprises of vessels <12 m in length). This is particularly important when assessing the activity across DEP, SEP and the offshore cable corridor. Consultation has been key throughout the EIA process to determine extent and distribution of activity by the <12 m fleet.

Data limitations were managed by ensuring accurate interpretation of the data and clear understanding of its scope (i.e. VMS data provided by MMO includes vessels ≥12 m in length). Consultation was fundamental in understanding the validity of data, enabling appropriate interpretation and ground-truthing of data, particularly for the UK potting fleet.

As data form only part of the evidence base, the limitations identified are not considered to significantly affect the certainty or reliability of the impact assessments in section 5.

The EIFCA fisheries mapping project published in 2010 which was used to provide indicative charts of fishing grounds notes the small number of participants providing the data (12). The EIFCA noted that this data should not be used as the only source for which to ascertain the current or complete distribution of fishing activity for the species identified in the study.

5.4 Key parameters for assessment

5.4.1 Realistic worst case scenario

The realistic worst case scenarios (RWCS) identified in Table 5.4 have been selected as those having the potential to result in the greatest effect on commercial fisheries. These scenarios have been selected from the details provided in the project description (Chapter 5 Project Description).

Table 5.4: Realistic Worst Case Scenarios for impacts on commercial fisheries

Impacts	Realistic Worst Case Scenario	Justification
Construction		
Construction activities and physical presence of constructed wind farm infrastructure leading to reduction in access to, or exclusion from established fishing grounds.	**Wind turbines:** - DEP: up to 32 wind turbine generators (WTG); - SEP: up to 24 WTG; - 0.99 km minimum separation distance between WTG; - Max foundation footprint area of gravity based structure 14,314m^2 per WTG; - Total WTG foundation footprint area including scour protection for DEP: 0.46km2 and for SEP: 0.34km2; - WTGs utilising the entire area of the DEP and SEP wind farm sites. **Offshore platforms (substations):** - 2 substation platforms (1 in SEP and 1 in DEP); - Maximum scour protection area (per foundation, comprising all legs where relevant) of 1,662 m^2. **Cables:** - Infield cables (linking turbines in arrays): DEP 135 km, SEP 90 km; - Cable burial depth 0-1.5m (0.5-1.5m outside Cromer Shoal Chalk Beds MCZ); - Up to 2.5km of overtrawlable rock protection (1.5km DEP, 1.0km SEP); - 4 m width of rock protection; and - Up to 5 cable crossings for DEP infield cables. **Construction Duration:** - Total: 4 years, with 2 years for offshore construction **Exclusion zones:** - 500 m exclusion zones around construction activities = 0.79 km^2 per structure under construction at any one time; and - 50 m exclusion zones around incomplete structures = 7,854 m^2 per partially constructed structure at any one time.	This represents the maximum duration and extent of fishing exclusion throughout the construction phase and hence the greatest potential to restrict access to fishing grounds.

Impacts	Realistic Worst Case Scenario	Justification

Offshore export cable corridor construction activities leading to reduction in access to, or exclusion from established fishing grounds	**Offshore cables including export and interlink cables:**
	- Length of cables for each scenario:
	  - SEP in isolation: 40 km length of export cable
	  - DEP in isolation: 62km length of export cable and 20km length interlink cable (between DEP North and DEP South);
	  - SEP and DEP in tandem: 40km length export cable, 15km length interlink cable within SEP and 40 km length interlink cable between DEP and SEP.
	  - SEP and DEP in tandem represents RWCS.
	- Cable burial depth 0.5 m outside MCZ and 0-0.3m inside MCZ;
	- Indicative max area of disturbance from trenching 0.12 km²;
	- Rock protection scenarios:
	  - If SEP in isolation: export cable 0.5km rock protection (0.5km total).
	  - If DEP in isolation: export cable to DEP North: 1.0km rock protection and interlink cables: 0.5km rock protection (1.5km total)
	  - SEP and DEP in tandem: export cable to SEP: 0.5km rock protection x2 cables and interlink cables: 0.5km + 1.0km (2.5km total)
	  - SEP and DEP in tandem represents RWCS.
	- 3 m width of rock protection, with
	- Total rock berm protection area footprint 0.0015km²; and
	- Up to 8 overtrawlable cable crossings (4 for Dudgeon export cables, 4 for Hornsea Three export cables);
	Construction Duration:
	- Total: 90 days
	Safe passing distance
	- Roaming 500 m safe passing distance for mobile installation vessels, which may, in exceptional circumstances, be increased to 1,000 m dependant on the nature of the installation works.
		This represents the maximum duration and extent of fishing exclusion throughout the construction phase and hence the greatest potential to restrict access to fishing grounds.

Impacts	Realistic Worst Case Scenario	Justification
Displacement from the wind farm site leading to gear conflict and increased pressure on adjacent grounds	As per RWCS for "Construction activities and physical presence of wind farm infrastructure leading to reduction in access to, or exclusion from established fishing grounds".	This represents the maximum duration and extent of fishing exclusion throughout the construction phase and hence the greatest potential for displacement.
Displacement from cable corridor leading to gear conflict and increased pressure on adjacent grounds	As per RWCS for "Offshore cable corridor construction activities and physical presence of wind farm infrastructure leading to reduction in access to, or exclusion from established fishing grounds".	This represents the maximum duration and extent of fishing exclusion throughout the construction phase and hence the greatest potential for displacement.
Wind farm sites and offshore export cable corridor construction activities leading to displacement or disruption of commercially important fish and shellfish resources	See Fish and Shellfish Ecology RWCS	The scenarios presented in Fish and Shellfish Ecology provide for the greatest disturbance to fish and shellfish species and therefore the greatest knock on effect to Commercial Fisheries
Increased vessel traffic within fishing grounds as a result of changes to shipping routes and transiting construction vessel traffic from wind farm sites and offshore export cable corridor infrastructure leading to interference with fishing activity.	**Vessel trips related to installation:** - up to 21 construction vessels, including foundation installation, WTG installation, infield, interlink and export cable vessels, landfall cable installation, substation and accommodation vessels etc.	The maximum number of vessels transits and the maximum duration of the construction would result in the greatest potential for interference.
Operation		
Physical presence of wind farm site infrastructure leading to reduction in access to, or exclusion from established fishing grounds	**Duration:** - Operational design life of 35 years. **Wind turbines:** As for construction above. **OSPs:** As for construction above. **Cables:** As for construction above.	

Impacts	Realistic Worst Case Scenario	Justification
	Safety Zones: - Up to 500m when major maintenance is in progress (use of jack-up vessel or similar). **Assumption:** Assessment assumes that fishing will resume around and between infrastructure within the DEP/SEP wind farm sites where possible, with the exception of an assumed 50 m operating distance from infrastructure, areas of cable protection, and safety zones around infrastructure undergoing major maintenance or replacement. Furthermore, the individual decisions made by skippers with their own perception of risk will determine the likelihood of whether their fishing will resume within the DEP/SEP wind farm sites. Inclement weather will be a significant contributor to this risk perception. In addition, certain gear types including pelagic trawl, twin rigged trawls and demersal seine / fly shooting will not be practically deployed within the operational wind farm sites.	
Physical presence of offshore export cable and infrastructure within the Project offshore export cable corridor leading to reduction in access to, or exclusion from established fishing grounds	**Duration:** - Operational design life of 35 years. **Offshore cables:** As for construction above. **Safety Zones:** - - Up to 500m when major maintenance is in progress (use of jack-up vessel or similar). **Assumption:** Assessment assumes that fishing will resume along the DEP/SEP offshore cable corridor, with the exception of an assumed 50 m operating distance from infrastructure, areas of cable protection and safety zones around infrastructure undergoing major maintenance.	
Displacement from the wind farm site and offshore export cable corridor leading to gear conflict and increased pressure on adjacent grounds	As per RWCS for "Physical presence of wind farm site infrastructure leading to reduction in access to, or exclusion from established fishing grounds".	This represents the maximum duration and extent of fishing exclusion throughout the operation and maintenance

Impacts	Realistic Worst Case Scenario	Justification
		phase and hence the greatest potential for displacement.
Physical presence of the wind farm site and offshore export cable leading to gear snagging	As per RWCS for "Physical presence of wind farm site infrastructure leading to reduction in access to, or exclusion from established fishing grounds".	This represents the maximum scenario for project infrastructure present during operation and maintenance phase and hence the greatest potential for gear snagging.
Operation and maintenance activities leading to displacement or disruption of commercially important fish and shellfish resources	See Fish and Shellfish Ecology RWCS	The scenarios presented in Fish and Shellfish Ecology provide for the greatest disturbance to fish and shellfish species and therefore the greatest knock on effect to Commercial Fisheries
Increased vessel traffic within fishing grounds as a result of changes to shipping routes and maintenance vessel traffic from DEP/SEP array area and Project offshore export cable corridor infrastructure leading to interference with fishing activity.	**Duration:** - Operational design life of 35 years. **Vessel trips related to operation and maintenance:** - up to 9 operational and maintenance vessels per year, including lift, cable maintenance, auxiliary and accommodation vessels etc.	
Decommissioning		
Wind farm site decommissioning activities leading to reduction in access to, or exclusion from, potential and/or established fishing grounds	In the absence of detailed methodologies and schedules, decommissioning works and associated implications for commercial fisheries are considered analogous with those assessed for the construction phase.	Decommissioning is likely to include removal of all of the wind turbine components and part of the foundations (those above seabed level) and removal of all other surface infrastructure. Some or all of the array cables, interconnector cables, and offshore export cables may be removed. Scour and cable
Project offshore export cable corridor decommissioning activities leading to reduction in access to, or exclusion from, potential and/or established fishing grounds		
Displacement from wind farm site and export cable corridor leading to gear conflict and		

Impacts	Realistic Worst Case Scenario	Justification
increased fishing pressure on adjacent grounds		protection would likely be left in situ.
Physical presence of any infrastructure left in situ leading to gear snagging		
Decommissioning activities leading to displacement or disruption of commercially important fish and shellfish resources		
Increased vessel traffic within fishing grounds as a result of changes to shipping routes and transiting decommissioning vessel traffic from the Projects leading to interference with fishing activity		

5.5 Impacts scoped out of the assessment

On the basis of the baseline environment and the project description outlined in Chapter 5 Project Description, no impacts are scoped out of the assessment for commercial fisheries.

5.6 Embedded mitigation

The commitments adopted as embedded mitigation in the design for Sheringham and Dudgeon Extension Projects in relation to commercial fisheries are presented in Table 5.5.

Table 5.5: Embedded mitigation measures relevant to commercial fisheries

Parameter	Embedded mitigation
Cable protection	Where possible, cable burial will be the preferred option for cable protection.
Communication	Advance warning and accurate location details of construction, maintenance and decommissioning operations, associated Safety Zones and advisory passing distances will be given via Notices to Mariners and Kingfisher Bulletins.
Liaison	Ongoing liaison with fishing fleets will be maintained during construction, maintenance and decommissioning operations via an appointed Fisheries Liaison Officer and Fishing Industry Representative.
Navigation	Aids to navigation (marking and lighting) will be deployed in accordance with the latest relevant available standard industry guidance and as advised by Trinity House, MCA and Civil Aviation Authority (CAA) and MoD as appropriate.
Navigation	The United Kingdom Hydrographic Office will be notified of both the commencement (within two weeks), progress and completion of offshore construction works (within two weeks) to allow marking of all installed infrastructure on nautical charts.
Co-existence	A Fisheries Co-existence and Liaison Plan will be developed
Liaison and disruption payments	The following guidance will be followed where appropriate; 'Recommendations For Fisheries Liaison: Best Practice' guidance for offshore renewable developers (FLOWW, 2006 and 2014; BERR, 2008).
Safety zones	Safety zones of up to 500 m will be applied during construction, maintenance and decommissioning phases. Where defined by risk assessment guard vessels will also be used to ensure adherence with Safety Zones or advisory passing distances to mitigate impacts which pose a risk to surface navigation during construction, maintenance and decommissioning phases

5.7 Assessment of significance

During the construction phase of the DEP and SEP including associated infrastructure and cabling, commercial fishing will be prevented where construction is taking place. This includes a 500 m safety zone distance around the vessels involved in construction.

The following principles set out the framework for how DEP and SEP may be constructed:

- DEP and SEP may be constructed at the same time, or at different times;
- If built at the same time, both DEP and SEP could be constructed in four years, with offshore construction being undertaken over two years (likely years three and four) of the overall construction period;
- If built at different times, either project could be built first;
- If built at different times the first project would require a four-year period of overall construction and a two year offshore construction period, the second project a three-year period of construction including a two year offshore construction period;

- If built at different times, the duration of the gap between the start of construction of the first project, and the start of construction of the second project may vary from 2 to 4 years;
- Assuming maximum construction periods, and taking the above into account, the maximum period over which the construction of both projects could take place is 7 years; and
- The earliest construction start date is 2024 and the latest is 2028.

5.7.1 Construction phase

5.7.1.1 Construction activities and physical presence of constructed wind farm infrastructure leading to reduction in access to, or exclusion from established fishing grounds

5.7.1.1.1 DEP wind farm site in isolation

Offshore construction of DEP will take place over a period of up to 2 years with a maximum of 32 turbines constructed within the wind farm site. There will be a range of construction activities taking place simultaneously. The minimum space between turbines will be 0.99 km.

Magnitude of impact

This impact will lead to a localised loss of fishing grounds and fish and shellfish resources within these grounds for a range of fishing opportunities during the construction period.

The impact is predicted to be of regional spatial extent, reversible, over a short-term period (maximum offshore construction period for DEP of up to 2 years) and will affect the receptors directly. Fishing may be prevented from up to <1% of the seabed disturbed during construction of DEP and from safety zones around localised construction activities. In addition, there will be a 500m safety distance around infrastructure under construction (equating to 0.79 km^2 per structure).

The impact of construction on UK and EU fishing fleets is described below on a fleet by fleet basis.

UK potters: DEP overlaps significant shellfish grounds routinely targeted by UK vessels. Key species targeted include whelk as well as brown crab and lobster caught in a mixed fishery. The proportion of species landed by pots and traps is over 99% in the commercial fisheries array study area and DEP overlaps with 2.79% of the ICES rectangle 35F1. Higher resolution MMO VMS data for vessels over 15 m in ICES rectangle 35F1 indicate that annual first sales value of landings for the larger potters which operate within the DEP wind farm area is in the region of £1000 – 5,000 per quadrat.

The under 10 m fleet are also active within the ICES rectangle 35F1 as indicated from port landings. The EIFCA mapping project indicated that in 2010 DEP overlapped with whelk and crab and lobster fishing grounds. In 2018, first sales value of whelk, brown crab and lobster from ICES rectangle 35F1 were £1.4 million, £224,000 and £316,000 respectively.

The landings for the UK potting fleet is considered to be of high value for the key crustacean species landed from ICES rectangle 35F1 and within DEP wind farm area. The fleet operates between shallower inshore areas to outside the 12 NM limit with a range of vessel size. The opportunities for fishing in alternative areas are limited due to the depth limit for key crustacean species and the operational range limit for under 10 m vessels. Although DEP overlaps ICES rectangle by 2.79% the whole of the DEP wind farm area is considered to be a key potting ground. The magnitude for the UK potting fleet is therefore considered to be medium.

Non-UK vessels: landings statistics and VMS data indicate that EU vessels fishing in the area include those registered to the Netherlands, France and Belgium. Landings from the ICES rectangle 35F1 in which DEP is located indicate these vessels are targeting four key finfish species identified as sole, plaice, whiting, and mackerel.

EU beam trawl VMS data (for 2017, Figure 2-2), together with Dutch demersal, beam and pulse trawl spatial data (for 2011-2015, Figure 4-8) indicate that activity within DEP wind farm site is low. The average annual landings by Dutch vessels within DEP are low at €0 - 1000 per year (based on spatial data from 2011 to 2015).

Landings data for ICES rectangle 35F1 for Dutch registered vessels indicate that two key species namely sole and to a lesser extent plaice are targeted with a value of approximately €383,000 and €55,000 respectively based on a five-year average between 2012 to 2016. The latest figures (2016) for landings of sole and plaice by Dutch vessels deploying demersal beam trawling gear represents 0.28% and 0.06% respectively of the quota set for the Netherlands in 2017. While DEP lies within the area identified as fishing grounds for Dutch registered vessels, activity is limited in comparison to grounds located outside and to the east of DEP.

Belgian registered demersal vessels: Landings statistics indicate that Belgian vessels target plaice and sole with beam trawling gear. In 2016 landed weight for both species was 1.08 tonnes and 0.21 tonnes for plaice and sole respectively. The landings data in the commercial fishing area for each species at the end of 2016 represents 0.014% of the quota for plaice and 0.015% of the quota for sole. The value of EU beam trawling is considered to be very low within the DEP wind farm site.

French registered demersal trawlers: Within ICES rectangle 35F1, French vessels predominantly target whiting with an average annual first sale value of €52,000. DEP does not overlap with the EU demersal trawling activity mapped within ICES rectangle 35F1. Prior to 2015 French registered demersal trawlers targeted whiting within the commercial fisheries study area but the landed weight has reduced significantly and in 2016 this was less than 0.5 tonnes. Mackerel landings taken by French mid-water/pelagic trawlers in 2016 were less than 1 tonne. The value of EU demersal trawling is considered to be very low within DEP wind farm area.

Danish sandeel industrial trawlers: Mapping of the sandeel grounds within the North Sea indicate that DEP overlaps with a small proportion of these grounds (2.04%) which represents 20.87% of the DEP north proposed wind farm site. However, landing statistics indicate that no landings of sandeel have occurred within the commercial fisheries study area. The sandeel fishery is highly dependent on recruitment on a year to year basis and there is currently a zero TAC for sandeel due to low stock abundance (ICES 2019). Sandeel grounds are well established and understood throughout the North Sea and it is reasonable to assume that the sandeel grounds overlapping the DEP north wind farm area could be productive in the future including within the four year construction period.

The landings from Dutch beam trawling for plaice and sole are considered to be of low value representing a very small proportion of the total quota caught by the Dutch fleet in Division 4c. The landings by Belgian beam trawlers and French demersal trawlers are considered to be very low. Landings for the Danish industrial sandeel trawlers is currently zero but this could resume in the future. The overlap of DEP with the sandeel grounds is considered to be small (2%). The maximum area of loss will be small, the value of the area lost is low and the duration short-term. The magnitude is assessed to be negligible for the Dutch and Belgian beam trawlers and French and Danish demersal trawlers.

Sensitivity of the receptor

EU vessels targeting fish resources within the commercial fisheries study area are over 15 m in length and operate across large areas of the North Sea. These vessels can avoid construction areas if given sufficient notification. Mobile fleets over 15 m in length are considered to have a large operational range.

The Dutch and Belgian beam trawl fleet and the French and Danish demersal trawl fleet are considered to have high levels of alternative fishing grounds based on their low dependence on the DEP wind farm area. These fleets are considered to be of low vulnerability, high recoverability and low value. The sensitivity of the receptor is deemed to be low for the Dutch, Belgian, French and Danish fleet.

The UK potting fisheries operates across distinct areas of ground and although these areas can extend from close to the shore to outside the 12 NM limit, they are considered to have lower levels of alternative fishing grounds. The under 10 m fleet have a lower operational range compared to the over 10 m fleet. The potting fleets targeting whelk, crab and/or lobster within the DEP wind farm site are considered to be of medium vulnerability, medium recoverability and high value. The sensitivity of this receptor is therefore considered to be medium.

Significance of the effect

Dutch and Belgian beam trawl, French and Danish demersal trawl fleets: The sensitivity is considered to be low and the magnitude negligible. The effect with therefore be of **negligible** significance

UK Potting fleet: The sensitivity is considered to be medium and the magnitude medium. The significance of the effect with therefore be of **moderate adverse** significance which is significant in EIA terms.

Further mitigation

UK potting fleet: with respect to any justifiable disturbance payment, the procedures as outlined in the FLOWW guidance documents (2014 and 2015), will be followed. Specifically, this will consist of the provision of evidence and data, examples of which include (FLOWW, 2015):

- Copy of certificate of registry for each vessel for which a claim is being made;
- Copy of a valid MCA certification or equivalent;
- Copy of the relevant vessel fishing licenses and entitlements for each vessel for which a claim is being made;
- Sight of vessels fishing charts and GPS plotter records to provide clear historic evidence of potential disruption in the area of the operations;
- Evidence of sales notes where available for an agreed time period;
- Fishing accounts of the vessels concerned for an agreed time period;
- Fishing vessel or and/or fisheries landings data held by fisheries authorities. Due to the requirements of the Data Protection Act, for access to individual records a declaration will need to be completed in order for records to be released.
- It may be appropriate to validate sources of evidence not obtained directly from claimants in order to verify accuracy (for example, transcription errors may exist in official landings data). Similarly, corroboration/validation of evidence provided by claimants may be possible via independent sources such as fishery officers, for example.

Through the application of justifiable disturbance payments, the residual effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms.

5.7.1.1.2 SEP wind farm site in isolation

Offshore construction of SEP will take place over a period of up to 2 years with a maximum of 24 turbines constructed within the wind farm site. There will be a range of construction activities taking place simultaneously. The minimum space between turbines will be 0.99 km.

Magnitude of impact

This impact will lead to a localised loss of fishing grounds and fish and shellfish resources within these grounds for a range of fishing opportunities during the offshore construction period of up to 2 years

The impact is predicted to be of regional spatial extent, reversible, over a short term period and will affect the receptors directly. Fishing may be prevented from <1% of the seabed disturbed during construction of SEP and from safety zones around localised construction activities. In addition, there will be a 500m safety distance around infrastructure under construction (equating to 0.79 km^2 per structure).

The impact of construction on UK and EU fishing fleets is described below on a fleet by fleet basis.

UK potters: VMS data for the over 12 m vessels indicate that SEP does not overlap significant shellfish grounds routinely targeted by larger UK vessels. Landings data for ICES rectangle 35F1 show that species targeted by potters include whelk, brown crab and lobster.

SEP overlaps with 2.79% of the ICES rectangle 35F1 and the proportion of species landed by pots and traps in this area is over 99%. The under 10 m fleet are known to be active within ICES Rectangle 35F1 as indicated from port landings. The EIFCA mapping project indicates that in 2010 SEP wind farm area overlapped with the main crab and lobster fishing grounds and consultation with the NNIFA indicated that the whole area was fished for shellfish species including whelk. In 2018, first sales value of whelk, brown crab and lobster from ICES rectangle 35F1 were £1.4 million, £224,000 and £316,000 respectively.

Landings by UK potters targeting areas within the SEP wind farm site are considered to be of medium-high value. The fleet operates between inshore areas to outside the 12 NM limit with a range of vessel sizes. The opportunities for fishing in alternative areas are limited due to fishing pressure on adjacent grounds and the operational range of the potting fleet. Although SEP overlaps ICES rectangle by 2.49%, the whole of the SEP wind farm site is considered to be routinely targeted potting ground. The magnitude for the UK potting fleet is therefore considered to be medium.

Non-UK vessels: landings statistics and VMS data indicate that EU vessels fishing in the area include those registered to the Netherlands, France and Belgium. Landings from the ICES rectangle 35F1 in which SEP is located indicate these vessels are targeting four key species identified as sole, plaice, whiting, and mackerel.

EU beam trawl VMS data (for 2017, Figure 2-2), together with Dutch demersal, beam and pulse trawl spatial data (for 2011-2015, Figure 4-8) indicate no activity within SEP wind farm site.

Belgian registered demersal vessels: Landings statistics indicate that Belgian vessels target plaice and sole with beam trawling gear. In 2016 landed weight for both species was 1.08 tonnes and 0.21 tonnes for plaice and sole respectively. The landings data in the commercial fishing area for each species at the end of 2016 represents 0.014% of the quota for plaice and 0.015% of the quota for sole. The value of Belgian beam trawling is considered to be very low within the SEP wind farm site.

French registered demersal trawlers: Within ICES rectangle 35F1, French vessels predominantly target whiting with an average annual first sale value of €52,000. SEP does not overlap with the EU demersal trawling activity mapped within ICES rectangle 35F1. Prior to 2015 French registered demersal trawlers targeted whiting within the commercial fisheries study area but the landed weight has reduced significantly and in 2016 this was less than 0.5 tonnes. Mackerel landings taken by French mid-water/pelagic trawlers in 2016 were less than 1 tonne. The value of EU demersal trawling is considered to be very low within the SEP wind farm area.

Danish sandeel industrial trawlers: Mapping of the sandeel grounds within the North Sea indicate that SEP does not overlap with these grounds which lie to the north of the site. If, in the future, there was a resumption of fishing for sandeel it is not considered that this activity will overlap with the SEP wind farm site.

The landings from Dutch beam trawling for plaice and sole are considered to be of moderate value although they represent a small proportion of the total quota caught by the Dutch fleet in Division 4c. The landings by Belgian beam trawlers and French demersal trawlers is considered to be very low. Landings for the Danish industrial sandeel trawlers is currently zero but this could resume in the future. SEP does not overlap with sandeel grounds. The maximum area of loss will be small, the value of the area lost is low and the duration short term. The area will be fishable post construction. The magnitude is assessed to be negligible for the Dutch and Belgian beam trawlers and French and Danish demersal trawlers.

Sensitivity of the receptor

EU vessels targeting fish resources within the commercial fisheries study area are over 12 m in length and operate across large areas of the North Sea. These vessels can avoid construction areas if given sufficient notification. Mobile fleets over 12 m in length are considered to have a large operational range.

The Dutch and Belgian beam trawl fleet and the French and Danish demersal trawl fleet are considered to have high levels of alternative fishing grounds based on their low dependence on the SEP wind farm area. These fleets are considered to be of low vulnerability, high recoverability and low value. The sensitivity of the receptor is deemed to be low for the Dutch, Belgian, French and Danish fleet.

The UK potting fisheries operates across distinct areas of ground and although these areas can extend from close to the shore to outside the 12 NM limit, they are considered to have lower levels of alternative fishing grounds. The under 10 m fleet have a lower operational range compared to the over 10 m fleet. The potting fleets targeting whelk, crab and/or lobster within the SEP wind farm site are considered to be of medium vulnerability, medium recoverability and high value. The sensitivity of this receptor is therefore considered to be medium.

Significance of the effect

Dutch and Belgian beam trawl, French and Danish demersal trawl fleets: The sensitivity is considered to be low and the magnitude negligible. The effect with therefore be of **negligible** significance

UK Potting fleet: The sensitivity is considered to be medium and the magnitude medium. The significance of the effect with therefore be of **moderate adverse** significance which is significant in EIA terms.

Further mitigation

UK potting fleet: as described in Section 5.7.1.1.1 ‘Further mitigation’.

Through the application of justifiable disturbance payments, the residual effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms.

5.7.1.1.3 DEP and SEP wind farm sites together

The construction of DEP and SEP together increases the maximum offshore construction period to 4 years over a total 7 year period if DEP and SEP are constructed sequentially. This construction scenario includes a one-year gap between offshore construction if offshore construction is in years 3 and 4 for the first project, then the second project offshore construction in years 6 and 7. It is assumed that fishing would be possible to resume both during the construction period of each project, with the exception of safety zones around localised construction activities, and during the gap between construction phases.

5.7.1.1.4 Magnitude of Impact

While the overall construction period is longer, the construction activities remain localised to specific construction events and short-time in nature. The magnitude of the impact on each receptor remains consistent with the assessment for DEP or SEP in isolation i.e., medium for UK potting, low for Dutch beam trawling and negligible for all other fleets.

Sensitivity of the receptor

The sensitivity of the receptor remains consistent with the assessment for DEP or SEP in isolation i.e., medium for UK potting, low for Dutch beam trawling and negligible for all other fleets.

Significance of the effect

The significance of the effect is of **moderate adverse** significance for UK potters, which is significant in EIA terms, **minor adverse** significance for Dutch beam trawlers and of **negligible** significance for all other fleets, which is not significant in EIA terms.

Further mitigation

UK potting fleet: as described in Section 5.7.1.1.1 'Further mitigation'.

Through the application of justifiable disturbance payments, the residual effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms.

5.7.1.2 Offshore cable construction activities leading to reduction in access to, or exclusion from, establish fishing areas

5.7.1.2.1 DEP or SEP in isolation

Fishing activity will be locally and temporarily excluded at the location of construction owing to the presence of construction vessels, construction operations and the need to observe The Convention on the International Regulations for Preventing Collisions at Sea, 1972 (COLREGS).

The construction scenario for each offshore export cable corridor associated with DEP or SEP built in isolation is based on an installation period of up to 110 days for each cable during a two year offshore construction period (for each project). Outside this installation period it is assumed that there will be fishing access. An advisory safety distance up to 1 km radius around cable installation vessels active along the proposed offshore export cable corridor, is recommended i.e., a roaming 3.14 km^2 area along the 40 km DEP and SEP offshore cable corridor which overlap with 35F1 and 34F1 by 0.26 (for SEP in isolations) and 1.24% (for DEP in isolation).

Magnitude of Impact

This impact will lead to a loss of access to fishing grounds and the fish resources within these grounds for a range of fishing opportunities during the construction activities for each project, which will directly affect fleets over a short-term duration. The impact is predicted to be intermittent with potential resumption of activities for two years between construction of each proposed offshore export cable corridor. The impact is of relevance to international fishing fleets outside the 6 NM limit and for UK fishing fleets in all areas and is described below on a fleet-by-fleet basis.

UK Potters: Consultation with the EIFCA indicates that the offshore export cable corridor overlaps with fishing grounds routinely targeted by potting vessels targeting brown crab and lobster using creels and whelk using pots. Consultation with the NNIFA indicates that beach launched vessels tend to target areas from 0 to 3 NM, while harbour based vessels predominately target areas from 3 NM to distances of 40 NM offshore depending on the weight bearing capacity of the vessels. During the construction process vessels with pots set along the offshore export cable corridor will be required to move these pots and cease fishing activities at particular construction locations. Sufficient notice, together with the support of a guard vessel where appropriate, will be provided to facilitate this process.

Dutch and Belgian beam trawlers, and French and Danish demersal trawlers: VMS and landings statistics indicate that there is a very low level of activity by vessels with mobile gear along the length of the offshore cable corridor.

UK Beam trawlers targeting shrimp: The Wash is a nationally significant area for the UK brown shrimp fishery; however, activity is predominately within ICES rectangles 34F0 and 35F0 (which the Project offshore cable corridor does not overlap). The shrimp fishery also extends along the North Norfolk coast and within the Cromer Shoal Chalk Beds MCZ through which the offshore corridor is proposed to be located with ICES rectangle 34F1. Brown shrimp landings from 34F1 have an average annual value of £21,500 (from 2014 to 2018), with minimal landings from 35F1. A notable reduction in landings was seen in 2015 which is linked to EIFCA management of closed areas to protect designated sites within their jurisdiction.

Recent spatial restrictions of bottom towed gear have been put in place under the Marine Protected Areas (MPA) Byelaw 2019 (EIFCA 2019) which came into force in March 2020 and is now in effect as from 4th May 2020. This byelaw prohibits bottom towed gears from operating in specified restricted areas within the MPA. The measures have been put in place to mitigate the risk to the sensitive sub-features, including subtidal chalk bed, *Sabellaria spinulosa* (ross worm), sub-tidal mixed sediment and subtidal mud. The restrictions will affect vessels using bottom towed gear.

The impact is predicted to be of regional spatial extent, intermittent, reversible and will affect the receptors directly. It is predicted that the construction impact of each Project will be short term (each Project will take 2 years for offshore construction) but the duration will be short-term (2 year period). Fishing may be prevented from roaming 500m radius from mobile installation vessels to allow safe passing distance (equating to a roaming 0.79km^2 exclusion from centre of installation vessels).

The magnitude is considered to be negligible for Dutch, Belgian beam trawlers, negligible for French and Danish demersal trawlers, low for UK shrimp beam trawlers and medium for UK potters.

Sensitivity of the receptor

The EU mobile vessels are over 15 m in length and operate over large areas of the North Sea and have a large operational range. Adequate notification will allow all vessels to avoid construction areas.

Dutch, Belgian and French demersal trawlers have high alternative fishing grounds and a low dependency on the DEP/SEP offshore cable corridor. There are considered to have a low vulnerability, high recoverability and low value. The sensitivity of the receptor is considered to be negligible.

Sandeel grounds are not overlapped by the offshore cable corridor therefore the Danish sandeel fleet of industrial trawlers have little dependency on the offshore cable route. This fleet is considered to have substantial alternative fishing grounds and are adaptable to change (e.g. given large fluctuations in TACs). The Danish sandeel fleet are considered to be of low vulnerability, high recoverability and low value. The sensitivity of the receptor is deemed to be negligible.

The UK beam trawl shrimp fleet are predominantly <18 m in length and operate in distinct areas typically within 6 NM of the shore and are concentrated within ICES rectangle 34F0 and 35F0 but there is a smaller level of activity within 34F1. In the area overlapping the offshore export cable corridor, the UK beam trawl fleet targeting brown shrimp are deemed to be of low vulnerability, medium recoverability and low value. The sensitivity of the receptor is therefore, considered to be low.

The UK potting fleet in the inshore areas are typically < 12 m in length and operate across more distinct areas of ground, typically 0 to 6 nm from shore, but also extending from 6 nm. The UK potting fleet are deemed to be of medium vulnerability, medium recoverability and medium value. The sensitivity of the receptor is therefore, considered to be medium.

Significance of the effect

Dutch, Belgian and French demersal trawlers: The overall sensitivity is considered to be low, and the magnitude negligible. The effect will, therefore, be **negligible** and not significant in EIA terms.

Danish sandeel trawlers: The overall sensitivity is considered to be low, and the magnitude negligible. The effect will, therefore, be **negligible** and not significant in EIA terms.

UK shrimp beam trawlers: The overall sensitivity is considered to be low and the magnitude low. The effect will, therefore, be **minor adverse** and not significant in EIA terms.

UK potting fleet: The overall sensitivity is considered to be medium and the magnitude medium. The effect will, therefore, be **moderate adverse** and significant in EIA terms.

5.7.1.2.2 DEP and SEP together

The construction of DEP and SEP together increases the maximum offshore construction period to 4 years over a total 7 year period if DEP and SEP are constructed sequentially. This construction scenario includes a one-year gap between offshore construction if offshore construction is in years 3 and 4 for the first project, then the second project offshore construction in years 6 and 7. It is assumed that fishing would be possible to resume both during the construction period of each project, with the exception of safety zones around localised construction activities, and during the gap between construction phases.

Magnitude of Impact

While the overall construction period is longer, the construction activities remain localised to specific construction events and short-time in nature. The magnitude of the impact on each receptor remains consistent with the assessment for DEP or SEP in isolation i.e., medium for UK potting, low for UK beam trawling and negligible for all other fleets.

Sensitivity of the receptor

The sensitivity of the receptor remains consistent with the assessment for DEP or SEP in isolation i.e., medium for UK potting, low UK shrimp beam trawling and negligible for all other fleets.

Significance of the effect

The significance of the effect is of **moderate adverse** significance for UK potters, which is significant in EIA terms, **minor adverse** significance for UK beam trawlers and of **negligible** significance for all other fleets, which is not significant in EIA terms.

Further mitigation

UK potting fleet: as described in Section 5.7.1.1.1 ‘Further mitigation’.

Through the application of justifiable disturbance payments, the residual effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms.

5.7.1.3 Displacement from the wind farm site leading to gear conflict and increased pressure on adjacent grounds

5.7.1.3.1 DEP in isolation

Localised exclusion from fishing grounds during phased construction of DEP wind farm site may lead to temporary increases in fishing effort in other areas that may already be exploited thereby leading to gear conflict and increased fishing pressure on adjacent grounds.

In terms of the area impacted by construction activities within the DEP wind farm sites, the footprint of infrastructure under construction equates to 0.46km^2 of seabed. In addition, there will be a 500m safety distance around infrastructure under construction (equating to 0.79km^2 per structure).

Magnitude of impact

The impact is predicted to be of regional spatial extent, short-term duration, intermittent and with medium reversibility. It is predicted that the impact will affect the receptor directly. The impact is of relevance to international and UK fishing fleets as described below.

VMS and landings statistics for the area surrounding DEP wind farm site indicate that there are numerous other areas where vessels (EU and UK) over 15 m are using the same gear as those within ICES rectangle 35F1 in which DEP is sited. Data on the value of landings for vessels over 12 m using demersal gear (beam trawling and otter trawling) indicate that the value is much higher the in areas around DEP wind farm site than within the DEP wind farm site.

VMS data show that UK, Dutch, French and Belgian beam trawlers targeting finfish, and Danish sandeel industrial trawlers fish in large areas throughout the North Sea.

Gear conflict is likely to occur if vessels operating mobile gear explore areas traditionally fished by potters. Hutniczak (2018) built models of decision making by fishermen facing spatial choices and uncertain payoffs. The results suggest that when spatial restrictions on mobile gear fishing are implemented, fishermen will prioritise exploring areas known to them to be of greatest profit, rather than other grounds that they have limited acquired knowledge of.

In the case of vessels operating beam trawls the most valuable areas are to the east of DEP wind farm site. Sandeel grounds are well developed and concentrated to the north of DEP wind farm site.

Historically, under the CFP, certain EU vessels had historical agreements allowing rights to fish within the UK 12 NM limit, including vessels from France, Belgium, Germany, Ireland and the Netherlands. Post UK exit from the EU, the agreement between the UK and EU permits non-UK vessels access to fish in UK waters under certain conditions, including between 6NM to 12NM. EU vessels may fish UK waters if they hold an appropriate licence from the UK Single Issuing Authority, which authorises access to UK waters to fish.

UK potting vessels of over 10 m and under 10 m operate throughout the DEP wind farm area from the shore to over 12 NM. Displacement of potting vessels as a result of construction activities may place pressure on diminishing grounds and other shellfish fisheries.

The magnitude of potential increased conflict over alternative fishing grounds is considered to be low for all demersal trawlers and medium for UK potting vessels.

Sensitivity of the receptor

All commercial vessels operating outside the 12 NM limit are considered to have a substantial availability of alternative grounds and a large operation range outside DEP wind farm area. All mobile fleets are deemed to be of low vulnerability, high recoverability and medium value. The sensitivity of all mobile fleets is therefore, considered to be low.

The UK potting fleet operates across large areas including both DEP and SEP wind farm areas and across the offshore cable corridor. This form of static fishing gear is considered to be of high vulnerability to gear conflict interactions since it is left unattended on the seabed. It is expected that any displacement from mobile vessels may lead to exploring other fishing grounds outside DEP wind farm site, which includes areas currently targeted by potters. The UK potting fleet are deemed to be of high vulnerability, medium recoverability and medium value. The sensitivity of the UK potting fleet is therefore, considered to be medium.

Significance of the effect

All mobile fleets deploying demersal trawl gear: overall, the sensitivity of the receptor is considered to be low and the magnitude is deemed to be low. The effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms.

UK potting fleet: overall, the sensitivity of the receptor is considered to be medium and the magnitude is deemed to be medium. The effect of mobile gears being displaced into potting ground will, therefore, be of **moderate adverse** significance to UK potters, which is significant in EIA terms.

Further mitigation

UK potting fleet: as described in Section 5.7.1.1.1 ‘Further mitigation’.

Through the application of justifiable disturbance payments, the residual effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms.

5.7.1.3.2 SEP in isolation

Localised exclusion from fishing grounds during phased construction of the DEP wind farm site may lead to temporary increases in fishing effort in other areas that may already be exploited thereby leading to gear conflict and increased fishing pressure on adjacent grounds.

In terms of the area impacted by construction activities within the SEP wind farm site, in total 0.61 km^2 of seabed will be disturbed during construction. In addition, there will be a 500m safety distance around infrastructure under construction (equating to 0.79 km^2 per structure).

Magnitude of impact

The impact is predicted to be of regional spatial extent, short-term duration, intermittent and with medium reversibility. It is predicted that the impact will affect the receptor directly. The impact is of relevance to international and UK fishing fleets as described below.

VMS and landings statistics for the area surrounding SEP wind farm site indicate that there are numerous other areas where vessels (EU and UK) over 15 m are using the same gear as those within ICES rectangle 35F1 in which SEP is sited. Data on the value of landings for vessels over 12 m using demersal gear (beam trawling and otter trawling) indicate that the value is much higher the in areas around SEP wind farm site and little activity occurs within the SEP wind farm site. A similar situation exists for the over 15 m potting fleet where VMS data indicates that there is a minimal amount of potting activity and the value within SEP wind farm site is the lowest within the regional study area.

VMS data show that UK, Dutch, French and Belgian beam trawlers and Danish sandeel industrial trawlers fish in large areas throughout the North Sea.

In the case of vessels operating beam trawls the most valuable areas are to the east and in the Wash to the southwest of SEP wind farm site and for the over 15 m potting vessels the more valuable sites are to the west. Sandeel grounds are well developed and concentrated to the north of ICES rectangle 35F1 although SEP wind farm site does not overlap the established fishing grounds.

Historically, under the CFP, certain EU vessels had historical agreements allowing rights to fish within the UK 12 NM limit, including vessels from France, Belgium, Germany, Ireland and the Netherlands. Post UK exit from the EU, the agreement between the UK and EU permits non-UK vessels access to fish in UK waters under certain conditions, including between 6NM to 12NM. EU vessels may fish UK waters if they hold an appropriate licence from the UK Single Issuing Authority, which authorises access to UK waters to fish.

UK potting vessels of over 10 m and under 10 m operate throughout the SEP wind farm area from the shore to over 12 NM. Displacement of potting vessels, as a result of construction activities, may place pressure on diminishing grounds and other shellfish fisheries.

The magnitude of potential increased conflict over alternative fishing grounds is considered to be low for all demersal trawlers and medium for UK potting vessels.

Sensitivity of the receptor

All commercial vessels operating outside the 12 NM limit are considered to have a substantial availability of alternative grounds and a large operation range outside SEP wind farm area. All mobile fleets are deemed to be of low vulnerability, high recoverability and medium value. The sensitivity of all mobile fleets is therefore, considered to be low.

The UK potting fleet operates across large areas including both DEP and SEP wind farm areas and across the offshore export cable corridor. This form of static fishing gear is considered to be of high vulnerability to gear conflict interactions since it is left unattended on the seabed. It is expected that any displacement from mobile vessels may lead to exploring other fishing grounds outside SEP wind farm site, which includes areas currently targeted by potters. The UK potting fleet are deemed to be of high vulnerability, medium recoverability and medium value. The sensitivity of the UK potting fleet is therefore, considered to be medium.

Significance of the effect

All mobile fleets deploying demersal trawl gear: overall, the sensitivity of the receptor is considered to be low and the magnitude is deemed to be low. The effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms.

UK potting fleet: overall, the sensitivity of the receptor is considered to be medium and the magnitude is deemed to be medium. The effect of mobile gears being displaced into potting ground will, therefore, be of **moderate adverse** significance to UK potters, which is significant in EIA terms.

Further mitigation

UK potting fleet: as described in Section 5.7.1.1.1 'Further mitigation'.

Through the application of justifiable disturbance payments, the residual effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms.

5.7.1.3.3 DEP and SEP together

Magnitude of Impact

While the overall construction period is longer for this scenario, the construction activities remain localised to specific construction events and short-time in nature. The magnitude of the impact on each receptor remains consistent with the assessment for DEP or SEP in isolation i.e., medium for UK potting and low for all other fleets.

Sensitivity of the receptor

The sensitivity of the receptor remains consistent with the assessment for DEP or SEP in isolation i.e., medium for UK potting and low for all other fleets.

Significance of the effect

The significance of the effect is of **moderateadverse** significance for UK potters and for all other fleets, which is significant in EIA terms.

Further mitigation

UK potting fleet: as described in Section 5.7.1.1.1 'Further mitigation'.

Through the application of justifiable disturbance payments, the residual effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms.

5.7.1.4 Displacement from cable corridor leading to gear conflict and increased pressure on adjacent grounds

5.7.1.4.1 DEP or SEP in isolation

Exclusion from fishing grounds during construction of the offshore cable corridor may lead to temporary increases in fishing effort in other areas that may already be exploited thereby leading to gear conflict.

For each project in isolation, export cable installation will take up to 90 days for each cable during a two-year offshore construction period. It is assumed that outside this period there will be fishing access.

In terms of the area impacted by construction activities, there will be an advisory safety distance up to 500m radius around cable installation vessels active along the offshore cable corridors i.e., a roaming 0.79km^2 area along the offshore cable corridors.

Magnitude of impact

The impact is predicted to be of regional spatial extent, short-term duration, intermittent and with medium-high reversibility. It is predicted that the impact will affect the receptor directly.

UK potters: The vessels deploying pots across offshore export cable corridor will be required to temporarily relocate gear to other grounds during the construction process. The density of pots varies significantly along the length of the export cable. Within the EIFCA jurisdiction of

6 NM a pot limit of 500 is set for whelks. There are no pot limits outside 6 NM. Vessels deploy between approximately 300 and 3,500 pots for targeting crab and lobster.

However, it is not likely that all fleets (or pots from one vessel) will overlap the offshore export cable corridors or interlink cables (for DEP) given that a number of fleets of pots and a range of grounds are targeted at any given time. Vessels deploying pots in the North Norfolk area tend to leave their pots on the ground (i.e. do not bring pots back to shore in between fishing trips, with the exception of carrying out gear maintenance on specific pots/stings).

Spatial closures in specific restricted areas for bottom towed gear came into effect under the Marine Protected Areas Byelaw 2019 which came into force in March 2020. The measures have been put in place to mitigate the risk to the sensitive sub-features, including subtidal chalk bed, *Sabellaria spinulosa* (ross worm), sub-tidal mixed sediment and subtidal mud. The restrictions will affect vessels using bottom towed gear.

Therefore, when considering the impact of potters being displaced into grounds already targeted by potters two scenarios are feasible:

- Alternative fishing grounds are available to relocate gear, in which case gear conflict and displacement effects will be low; or
- Alternative fishing grounds are not available as adjacent areas are already being fished by potters, in which case the gear already on the ground limits the level of displacement. While there remains potential for gear conflicts and increased fishing pressure to arise, appropriately mitigated exclusion impacts will limit this.

The displacement effect to UK potters targeting the offshore export cable corridor is considered to have a lower magnitude of impact than the impact of safety zones causing the displacement. Taking all of these aspects into consideration, the magnitude of the displacement impact for the offshore export cable corridor is assessed to be low for UK potters.

For all mobile fleets deploying demersal trawl gear, due to the lower level of activity across the offshore export cable corridor, together with the range of alternative grounds, the magnitude is considered to be negligible.

Sensitivity of the receptor

All mobile commercial fisheries fleets operating within ICES rectangle 35F1 are considered to have high availability of alternative fishing grounds of higher value, and an operational range that is not limited to windfarm sites. All mobile fleets are deemed to be of low vulnerability, high recoverability and medium value. The sensitivity of all mobile fleets is therefore, considered to be low.

The UK potting fleet operates across large areas including the wind farm sites and across the offshore export cable corridor. This form of static fishing gear is considered to be of high vulnerability to gear conflict interactions since it is left unattended on the seabed. It is expected that any displacement of mobile vessels may lead to exploring other fishing grounds outside the offshore export cable corridor, which includes areas currently targeted by potters. The UK potting fleet are deemed to be of high vulnerability, medium recoverability and medium value. The sensitivity of the UK potting fleet is therefore, considered to be medium.

Significance of effect

UK potting fleet: overall, the sensitivity of the receptor is considered to be medium and the magnitude is deemed to be low. The effect of mobile gears being displaced into potting ground will, therefore, be of **minor adverse** significance to UK potters, which is not significant in EIA terms.

All mobile fleets deploying demersal trawl gear: overall, the sensitivity of the receptor is considered to be low and the magnitude is deemed to be negligible. The effect will, therefore, be **negligible**.

5.7.1.4.2 DEP and SEP together

Magnitude of Impact

While the overall construction period is longer for this scenario, the construction activities remain localised to specific construction events and short-time in nature. The magnitude of the impact on each receptor remains consistent with the assessment for DEP or SEP in isolation i.e., low for UK potting and negligible for all other fleets.

Sensitivity of the receptor

The sensitivity of the receptor remains consistent with the assessment for DEP or SEP in isolation i.e., medium for UK potting and low for all other fleets.

Significance of the effect

The significance of the effect is of **minor adverse** significance for UK potters and of **negligible** significance for all other fleets, which is not significant in EIA terms.

5.7.1.5 Construction activities leading to displacement or disruption of commercially important fish and shellfish resources

5.7.1.5.1 DEP or SEP in isolation

Temporary displacement due to noise and disruption of habitats during construction activities may decrease or displace commercially important fish and shellfish populations from the area. This section assesses the potential temporary knock-on impact for the owners of fishing vessels, where commercially important stocks may be disturbed or displaced to a point where normal fishing practices would be affected

Magnitude of impact

Assessments of the following potential construction impacts have been undertaken in Chapter 11: Fish and Shellfish Ecology for key commercial species (including whelk, brown crab, lobster, sandeel, herring and 'other' fish and finfish species such as sole, plaice and whiting):

- Temporary habitat loss/disturbance from construction operations including foundation installation and cable laying operations;
- Increased suspended sediment concentrations as a result of foundation installation, cable installation and seabed preparation resulting in potential effects on fish and shellfish receptors;
- Sediment deposition as a result of foundation installation, cable installation and seabed preparation resulting in potential effects on fish and shellfish receptors; and
- Underwater noise as a result of foundation installation (i.e., piling) and other construction activities (e.g. cable installation) resulting in potential effects on fish and shellfish receptors.

With respect to the magnitude of this impact on commercial fisheries, the overall significance of the effect on fish and shellfish species is considered (i.e. both the magnitude and sensitivity of fish and shellfish species are considered to assess the magnitude on commercial fishing fleets). For instance, where an effect of negligible significance is assessed for a species, a negligible magnitude is assessed for commercial fishing; where an effect of minor adverse significance is assessed for a species, a low magnitude is assessed for commercial fishing, and so on.

Details of the fish and shellfish ecology assessment are summarised in Table 5.6 with evidence, modelling and justifications for these assessments provided in Chapter 11: Fish and Shellfish Ecology.

The impact is predicted to be of regional spatial extent, of relevance to international fishing fleets, and of short-term duration. It is predicted that the impact will affect the receptor directly through loss of resources. The magnitude is therefore considered to be low for all species and all potential impacts.

Table 5.6: Significance of effects of construction impacts on fish and shellfish ecology

Potential impact	Species	Significance of impact
Habitat loss/ disturbance	Shellfish (including whelk, brown crab and lobster)	Minor adverse
	Sandeel and herring	Minor adverse
	All other fish and species	Minor adverse
Increased suspended sediment concentrations	Shellfish eggs and larvae	Minor adverse
	Sandeel and herring eggs and larvae	Minor adverse
	All other fish and shellfish species	Minor adverse
Sediment deposition	Shellfish eggs and larvae	Minor adverse
	Sandeel and herring eggs and larvae	Minor adverse
	All other fish and shellfish species	Minor adverse
Underwater noise	Shellfish	Minor adverse
	Demersal and pelagic finfish	Minor adverse
	Eggs and larvae	Minor adverse

Sensitivity of the receptor

Exposure to the impact is likely and commercial fleets targeting key species will be affected, including whelk, brown crab, lobster, brown shrimp and finfish species.

Due to the locality of the impact on whelk, brown crab and lobster, the sensitivity of the UK potting fleet is considered to be medium. This is based on the potential for grounds beyond the immediate construction activities to be affected by increased suspended sediment and sediment deposition, impacting the wider potting fleet.

Brown shrimp are primarily targeted in the Wash, and also along the North Norfolk coast adjacent to the Wash. Brown shrimp fishing grounds are understood not to overlap with the offshore export cable corridor. Based on these fishing locations, and the rate of dispersion predicted by modelling, it is expected that elevated suspended sediment concentrations and sediment deposition will not impact brown shrimp grounds and therefore the sensitivity of UK beam trawlers targeting this species is considered to be low.

Due to the range of alternative areas targeted and the distribution of key commercial species throughout the central and southern North Sea the sensitivity of all other fleets is considered to be low.

Significance of effect

UK potting fleet: overall, the sensitivity of the receptor is considered to be medium and the magnitude is deemed to be low. The effect will, therefore, be of **minor adverse** significance to UK potters, which is not significant in EIA terms.

All mobile fleets: overall, the sensitivity of the receptor is considered to be low and the magnitude is deemed to be low. The effect will, therefore, be of **minor adverse** significance to UK potters, which is not significant in EIA terms.

5.7.1.5.2 DEP and SEP together

Magnitude of Impact

The magnitude of the impact on each receptor remains consistent with the assessment for DEP or SEP in isolation i.e., low for UK potting and low for all other fleets.

Sensitivity of the receptor

The sensitivity of the receptor remains consistent with the assessment for DEP or SEP in isolation i.e., medium for UK potting and low for all other fleets.

Significance of the effect

The significance of the effect is of **minor adverse** significance for all fleets, which is not significant in EIA terms.

5.7.1.6 Increased vessel traffic within fishing grounds as a result of changes to shipping routes and transiting construction vessel traffic leading to interference with fishing activity

5.7.1.6.1 DEP or SEP in isolation

Magnitude of impact

Vessel movements (i.e. construction vessels transiting to and from areas undergoing construction works) related to the construction of DEP or SEP, the offshore export cable corridor and all associated infrastructure will add to the existing level of shipping activity in the area (see Chapter 15: Shipping and Navigation for a full assessment of additional vessel movements).

Based on the extent of fishing across the Projects and level of construction vessel movement proposed, the magnitude of this impact is considered to be low for all fleets.

Sensitivity of the receptor

Construction traffic is likely to constrain most potting activity across established construction supply routes due to the vulnerability of the marker buoys to the propellers of passing construction vessels. The sensitivity of potting is therefore considered to be medium.

All other fleets are expected to be in a position to avoid the Project areas during construction and the sensitivity of all other fleets is considered to be negligible.

Significance of effect

UK potting fleet: overall, the sensitivity of the receptor is considered to be medium and the magnitude is deemed to be low. The effect will, therefore, be of **minor adverse** significance to UK potters, which is not significant in EIA terms.

All mobile fleets: overall, the sensitivity of the receptor is considered to be negligible and the magnitude is deemed to be low. The effect will, therefore, be **negligible**, which is not significant in EIA terms.

5.7.1.6.2 DEP and SEP together

Magnitude of Impact

The magnitude of the impact on each receptor remains consistent with the assessment for DEP or SEP in isolation i.e., low for UK potting and low for all other fleets.

Sensitivity of the receptor

The sensitivity of the receptor remains consistent with the assessment for DEP or SEP in isolation i.e., medium for UK potting and negligible for all other fleets.

Significance of the effect

The significance of the effect is of **minor adverse** significance for UK potters and **negligible** for all mobile fleets, which is not significant in EIA terms.

5.7.2 Operation and maintenance phase

5.7.2.1 Physical presence of the wind farm site infrastructure leading to reduction in access to, or exclusion from established fishing grounds

5.7.2.1.1 DEP in isolation

The impacts of the offshore operation and maintenance DEP wind farm site have been assessed on commercial fisheries. The environmental impacts arising from the operation and maintenance DEP wind farm site are listed in Table 5.4 along with the maximum design scenario against which each operation and maintenance phase impact has been assessed

The assessment assumes that commercial fisheries will be prevented from actively fishing from an area of 0.46 km^2 due to infrastructure within the DEP wind farm site, including 32 turbines with GBS foundations, together with associated safety zones for manned platforms and maintenance activities and assumed operating distances (full details of the area breakdowns are provided in Table 5.4. Minimum turbine spacing is 0.99 km, including between turbines and all other infrastructure.

Outwith the area of 0.46 km^2, the assessment assumes that fishing will resume within the DEP wind farm site where fishing grounds can be targeted, with the exception of safety zones around infrastructure undergoing major maintenance and advisory safety distances around vessels undertaking major maintenance activities. In addition, the individual decisions made by skippers with their own perception of risk will determine the likelihood of whether their fishing will resume within DEP wind farm site. Inclement weather will be a significant contributor to this risk perception.

Magnitude of impact

This impact will lead to localised loss of access to fishing grounds and the fish resources within these grounds for a range of fishing opportunities during the operational and maintenance phase, which will directly affect fleets over a long-term duration. The impact is predicted to be continuous with low reversibility and is of relevance to international fishing fleets.

The value and importance of DEP windfarm site to commercial fishing fleets is presented for construction in section 5.7.1. It is considered that this is the same for the operational and maintenance phase.

Localised loss of access to fishing grounds from within DEP wind farm site amounts to an area of 0.46 km^2 due to infrastructure, (equating to <1% of the total DEP wind farm site), plus safety zones, assumed operational distances and additional safety zones for infrastructure undergoing major maintenance. Based on the assumption that fishing will resume within DEP wind farm site, the magnitude of impact is considered negligible for Dutch beam trawlers, Belgian beam trawlers, French and Danish demersal trawlers and low for UK potters.

Sensitivity of the receptor

The sensitivity of the commercial fisheries receptors is the same as that presented for construction in section 5.7.1. The sensitivity of the receptor is deemed to be low for the Dutch, Belgian, French and Danish fleet and medium for the UK potting fleet.

Significance of the effect

Dutch, Belgian, French ad Danish demersal trawlers: The sensitivity of the receptor is considered to be low and the magnitude negligible. The effect will, therefore be **negligible**.

UK potting fleet: The sensitivity of the receptor is considered to be medium and the magnitude low. The effect will, therefore, be **minor adverse** significance, which is not considered to be significant in EIA terms.

5.7.2.1.2 SEP in isolation

The impacts of the offshore operation and maintenance SEP wind farm site have been assessed on commercial fisheries. The environmental impacts arising from the operation and maintenance SEP wind farm site are listed in Table 5.4 along with the maximum design scenario against which each operation and maintenance phase impact has been assessed

The assessment assumes that commercial fisheries will be prevented from actively fishing within a total area of 0.34 km^2 due to infrastructure within the SEP wind farm stie, including 23 turbines with gravity base foundations, plus associated safety zones for manned platforms and maintenance activities and assumed operating distances (full details of the area breakdowns are provided in Table 5.4). Minimum turbine spacing is 0.99 km, including between turbines and all other infrastructure.

Outwith the area of 0.34 km^2, the assessment assumes that fishing will resume within the SEP wind farm site where fishing grounds can be targeted, with the exception of safety zones around infrastructure undergoing major maintenance and advisory safety distances around vessels undertaking major maintenance activities. In addition, the individual decisions made by skippers with their own perception of risk will determine the likelihood of whether their fishing will resume within SEP wind farm site. Inclement weather will be a significant contributor to this risk perception.

Magnitude of impact

This impact will lead to localised loss of access to fishing grounds and the fish resources within these grounds for a range of fishing opportunities during the operational and maintenance phase, which will directly affect fleets over a long-term duration. The impact is predicted to be continuous with low reversibility and is of relevance to international fishing fleets.

The value and importance of SEP windfarm site to commercial fishing fleets is presented for construction in section 5.7.1. It is considered that this is the same for the operational and maintenance phase.

Localised loss of access to fishing grounds from within SEP wind farm site amounts to an area of 0.34 km^2 due to infrastructure (equating to <1% of the total SEP wind farm site), safety zones, assumed operational distances and additional safety zones for infrastructure undergoing major maintenance. Based on the assumption that fishing will resume within SEP wind farm site, the magnitude of impact is considered negligible for Dutch beam trawlers, Belgian beam trawlers, French and Danish demersal trawlers and low for UK potters.

Sensitivity of the receptor

The sensitivity of the commercial fisheries receptors is the same as that presented for construction in section 5.7.1. The sensitivity of the receptor is deemed to be low for the Dutch, Belgian, French and Danish fleet and medium for the UK potting fleet.

Significance of the effect

Dutch, Belgian, French and Danish demersal trawlers: The sensitivity of the receptor is considered to be low and the magnitude negligible. The effect will, therefore be **negligible**.

UK potting fleet: The sensitivity of the receptor is considered to be medium and the magnitude low. The effect will, therefore, be **minor adverse** significance, which is not considered to be significant in EIA terms.

5.7.2.1.3 DEP and SEP together

Magnitude of Impact

The magnitude of the impact on each receptor remains consistent with the assessment for DEP or SEP in isolation i.e., low for UK potting and negligible for all other fleets.

Sensitivity of the receptor

The sensitivity of the receptor remains consistent with the assessment for DEP or SEP in isolation i.e., medium for UK potting and low for all other fleets.

Significance of the effect

The significance of the effect is of **minor adverse** significance for UK potters and **negligible** for all mobile fleets, which is not significant in EIA terms.

5.7.2.2 Physical presence of the proposed offshore export cable and interlink cables leading to reduction in access to, or exclusion from established fishing grounds

5.7.2.2.1 DEP or SEP in isolation

Temporary 500 m advisory safety distances requested around vessels engaged in export cable repair works, could limit fishing opportunities within localised areas.

Magnitude of impact

It is assumed in the assessment that fishing will resume within the vicinity of the offshore cable corridors during operation. The minimum burial depth of cables is 0m within Cromer Shoal Chalk Beds MCZ and 0.5m outside the MCZ. Outside the MCZ, it is assumed that where cable protection is not considered to be necessary this depth of burial will be sufficient for any trawling gear to operate and will not hinder the laying of pots. A proposed option for the laying of the export cable located within the Cromer Shoal Chalk Beds MCZ is to surface lay the cable without protection.

A proposed option for the laying of the export cable located within the Cromer Shoal MCZ is to surface lay the cable without protection.

Notices to Mariners will be issued in advance of any maintenance works. Potting vessels may be required to temporarily relocate pots during maintenance works, although such works are likely to be infrequent.

The impact is predicted to be of local spatial extent and of short-term duration for maintenance works that may be required along the offshore export cable corridor and interlink cable corridors. It is predicted that the impact will affect the receptor directly. Given that fishing can resume across the majority of the offshore export cable corridor and interlink cable corridors, the magnitude is considered to be low for all fishing fleets.

Sensitivity of the receptor

All mobile commercial fishing fleets known to operate within the area of the export cable corridors are considered to have a considerable alternative fishing grounds available and of higher value. These vessels have a large operational range which is not limited to the offshore export cable corridor area. Commercial fishing fleets carrying mobile gear are considered to be of low vulnerability, high recoverability and low value. The sensitivity of the receptor is therefore deemed to be low.

The UK potting fleet are typically < 12 m in length and operate across more distinct areas of ground, typically 0 to 6 nm from shore, but increasingly extending from 6 nm. The UK potting fleet are deemed to be of medium vulnerability, medium recoverability and high value. The sensitivity of the receptor is therefore, considered to be medium.

Significance of the effect

All mobile fleets: overall, the sensitivity of the receptor is considered to be low and the magnitude is deemed to be low. The effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms.

UK potting fleet: overall, the sensitivity of the receptor is considered to be medium and the magnitude is deemed to be low. The effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms.

5.7.2.2.2 DEP and SEP together

Magnitude of Impact

The magnitude of the impact on each receptor remains consistent with the assessment for DEP or SEP in isolation i.e., low for UK potting and negligible for all other fleets.

Sensitivity of the receptor

The sensitivity of the receptor remains consistent with the assessment for DEP or SEP in isolation i.e., medium for UK potting and low for all other fleets.

Significance of the effect

The significance of the effect is of **minor adverse** significance for UK potters and **negligible** for all mobile fleets, which is not significant in EIA terms.

5.7.2.3 Displacement from the wind farm site leading to gear conflict and increased pressure on adjacent grounds

5.7.2.3.1 DEP or SEP in isolation

Exclusion from fishing grounds during operation and maintenance of the DEP wind farm area may lead to increases in fishing effort in other areas that may already be exploited thereby leading to gear conflict.

Magnitude of impact

The magnitude of impact of displacement during the operational and maintenance phase is expected to be the same or similar to that during the construction phase for all commercial fishing fleets deploying mobile demersal gear. The magnitude of potential increased conflict over alternative fishing grounds is considered to be low for all demersal trawlers.

In the construction phase it is considered that the displacement of potting vessels as a result of construction activities may place pressure on diminishing grounds and the presence of other shellfish fisheries as well as local ports. During operation, it is assumed that potting will resume within the DEP or SEP wind farm sites, with exception of wind farm infrastructure. Given this resumption of fishing, the magnitude of displacement is assessed as low for UK potting vessels.

Sensitivity of the receptor

The sensitivity of the commercial fisheries receptors is the same as that presented for construction summarised as low for all fleets deploying mobile gear and medium for UK potters.

Significance of effect

All mobile fleets deploying demersal trawl gear: overall, the sensitivity of the receptor is considered to be low and the magnitude is deemed to be low. The effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms.

UK potting fleet: overall, the sensitivity of the receptor is considered to be medium and the magnitude is deemed to be low. The effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms.

5.7.2.3.2 DEP and SEP together

Magnitude of Impact

The magnitude of the impact on each receptor remains consistent with the assessment for DEP or SEP in isolation i.e., low for all fleets.

Sensitivity of the receptor

The sensitivity of the receptor remains consistent with the assessment for DEP or SEP in isolation i.e., medium for UK potting and low for all other fleets.

Significance of the effect

The significance of the effect is of **minor adverse** significance for UK potters and for all mobile fleets, which is not significant in EIA terms.

5.7.2.4 Physical presence of the wind farm site and offshore export cable leading to gear snagging

5.7.2.4.1 DEP in isolation

The array cables, interconnector cables, export cables and associated cable protection, together with any structures on the seabed represent potential snagging points for fishing gear and could lead to damage to, or loss of, fishing gear. The safety aspects including potential loss of life as a result of snagging risk are assessed within chapter 14: Shipping and Navigation.

Magnitude of impact

In the instance that snagging does occur, the developer would work to the protocols laid out within the guidance by the FLOWW group and 'Recommendations For Fisheries Liaison: Best Practice' guidance for offshore renewable developers, in particular section 9: Dealing with claims for loss or damage of gear (FLOWW, 2006 and 2014; BERR, 2008).

Snagging poses a risk to fishing equipment and in extreme cases may potentially lead to capsize of vessel and crew fatalities, as well as damage to subsea infrastructure. Three phases of interaction are possible: initial impact of gear and subsea infrastructure; pullover of gear across subsea infrastructure; and snagging or hooking of gear on the subsea infrastructure. The snagging or hooking of fishing gear with infrastructure/cables on the seabed is the most hazardous to the vessel and crew due to the possibility of capsize.

It is considered likely that fishermen would operate appropriately given adequate notification of the locations of any snagging hazards; and are highly likely to avoid the DEP wind farm site infrastructure and cable protection. The EU mobile fleet has a low effort within the DEP wind farm site. For this reason, the magnitude of gear snagging is considered to be low.

The UK potting fleet has considerable effort within the DEP wind farm site and therefore the magnitude of gear snagging to this fleet is considered medium.

Sensitivity of the receptor

Due to the nature and operation of mobile trawling gear (i.e., it is actively towed and demersal gear directly penetrates the seabed with near continuous contact) there is increased vulnerability to this impact and the sensitivity is therefore considered to be medium for demersal and pelagic fleets.

UK potters show a low vulnerability as the gear is placed, not towed and is less likely to penetrate the seabed. The sensitivity of UK potters is considered to be low.

Significance of the effect

All mobile fleets deploying demersal gear: overall, the sensitivity of the receptor is considered to be medium and the magnitude is deemed to be low. The effect will, therefore, be of **minor** adverse significance, which is not significant in EIA terms.

UK potting fleet: overall, the sensitivity of the receptor is considered to be low and the magnitude is deemed to be medium. The effect will, therefore, be of **minor** adverse significance, which is not significant in EIA terms.

5.7.2.4.2 SEP in isolation

The inter-array cables, interconnector cables, export cables and associated cable protection, together with any structures on the seabed represent potential snagging points for fishing gear and could lead to damage to, or loss of, fishing gear. The safety aspects including potential

loss of life as a result of snagging risk are assessed within Chapter 15: Shipping and Navigation.

Magnitude of impact

In the instance that snagging does occur, the developer would work to the protocols laid out within the guidance by the FLOWW group and 'Recommendations For Fisheries Liaison: Best Practice' guidance for offshore renewable developers, in particular section 9: Dealing with claims for loss or damage of gear (FLOWW, 2006 and 2014; BERR, 2008).

Snagging poses a risk to fishing equipment and in extreme cases may potentially lead to capsize of vessel and crew fatalities, as well as damage to subsea infrastructure. Three phases of interaction are possible: initial impact of gear and subsea infrastructure; pullover of gear across subsea infrastructure; and snagging or hooking of gear on the subsea infrastructure. The snagging or hooking of fishing gear with infrastructure/cables on the seabed is the most hazardous to the vessel and crew due to the possibility of capsize.

Consultation with the NFFO indicate that there are concerns relating to snagging for vessels deploying/hauling gear and vessels operating mobile gear in areas where there is unprotected surface lay of cable (which is proposed as an option within the Cromer Shoal MCZ). It is noted that the EIFCA Marine Protected Areas Byelaw 2019 prohibits mobile gear within the large majority of the Cromer Shoal MCZ and the entirety of the MCZ overlap with the offshore export cable. Implications of gear snagging with surface laid cable are therefore specific to non-mobile gear including potting.

It is considered likely that fishermen would operate appropriately given adequate notification of the locations of any snagging hazards; and are highly likely to avoid the SEP wind farm site infrastructure and cable protection. The EU mobile fleet has a low effort within the SEP wind farm site. For this reason, the magnitude of gear snagging is considered to be low.

The UK potting fleet has considerable effort within the SEP wind farm site and therefore the magnitude of gear snagging to this fleet is considered medium.

Sensitivity of the receptor

Due to the nature and operation of mobile trawling gear (i.e., it is actively towed and demersal gear directly penetrates the seabed with near continuous contact) there is increased vulnerability to this impact and the sensitivity is therefore considered to be medium for demersal and pelagic fleets.

UK potters show a low vulnerability as the gear is placed, not towed and is less likely to penetrate the seabed. The sensitivity of UK potters is considered to be low.

Significance of the effect

All mobile fleets deploying demersal gear: overall, the sensitivity of the receptor is considered to be medium and the magnitude is deemed to be low. The effect will, therefore, be of **minor** adverse significance, which is not significant in EIA terms.

UK potting fleet: overall, the sensitivity of the receptor is considered to be low and the magnitude is deemed to be medium. The effect will, therefore, be of **minor** adverse significance, which is not significant in EIA terms.

5.7.2.4.3 DEP and SEP together

Magnitude of Impact

The magnitude of the impact on each receptor remains consistent with the assessment for DEP or SEP in isolation i.e., medium for UK potting and low for all other fleets.

Sensitivity of the receptor

The sensitivity of the receptor remains consistent with the assessment for DEP or SEP in isolation i.e., low for UK potting and medium for all other fleets.

Significance of the effect

The significance of the effect is of **minor adverse** significance for UK potters and all mobile fleets, which is not significant in EIA terms.

5.7.2.5 Operation and maintenance activities leading to displacement or disruption of commercially important fish and shellfish resources

Displacement or disturbance of commercially important fish and shellfish resources may occur during the operational phase due to a range of impacts brought on by the physical presence and operation of the project, including long-term habitat alterations and potential electromagnetic field (EMF) effects.

Long-term changes to benthic habitat due to rock protection at specific locations of the Project wind farm sites, export cables, inter-array cables and other infrastructure may affect spawning and nursery grounds, most notably for demersal spawners.

Other ecological effects, such as the creation of artificial habitat and the potential for the wind farm sites to act as a refuge for commercially important fish and shellfish species, are considered within the assessment carried out in Chapter 11: Fish and Shellfish Ecology.

5.7.2.5.1 DEP or SEP in isolation

Magnitude of Impact

As described in Chapter 11: Fish and Shellfish Ecology, EMF during operation would be mitigated by use of armoured cable for array, interconnector cables and export cables together with burial to a minimum target depth of 0.5 m, with exception of surface laid cable within the MCZ area.

With the exception of elasmobranchs, no experiments have highlighted significant concerns and the magnitude of impact of EMFs is generally considered to be low for most marine organisms (Switzer and Meggitt, 2010; Polagye, et al., 2011). Evidence from post construction surveys of Round 1 wind farms (Kentish Flats, Lynn and Inner Dowsing, Burbo Bank and Barrow) show no significant effects to fish populations as a result of EMF.

Elasmobranchs do not form a targeted fishery in this area, and are not taken in significant quantities as retained species by the fleets in operation across the Project areas.

The permanent habitat loss due to the installation of foundations, scour protection and cable protection will result in a reduction of potential spawning habitat available to a number of commercial species including, sole, plaice, sandeel, mackerel and cod. The breakdown of potential habitat lost per species is presented in Chapter 11: Fish and Shellfish Ecology, together with a full assessment of this impact.

Overall, the magnitude of disruption or displacement of commercially important species during operation is considered to be low for shellfish and negligible for finfish species.

Sensitivity of the receptor

For UK potters the sensitivity is considered to be medium, based on their reliance on grounds across the offshore export cable corridor. The sensitivity of all other fleets to the displacement of resources is considered low, based on the range of alternative areas available and the distribution of key commercial species throughout the central southern North Sea.

Significance of the effect

All mobile fleets: overall, the sensitivity of the receptor is considered to be low and the magnitude is deemed to be negligible. The effect will, therefore, be of **negligible** significance, which is not significant in EIA terms.

UK potting fleet: overall, the sensitivity of the receptor is considered to be medium and the magnitude is deemed to be low. The effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms.

5.7.2.5.2 DEP and SEP together

Magnitude of Impact

The magnitude of the impact on each receptor remains consistent with the assessment for DEP or SEP in isolation i.e., low for fleets targeting shellfish species and negligible for fleets targeting finfish.

Sensitivity of the receptor

The sensitivity of the receptor remains consistent with the assessment for DEP or SEP in isolation i.e., medium for UK potting and low for all other fleets.

Significance of the effect

The significance of the effect is of **minor adverse** significance for UK potters and **negligible** for all mobile fleets, which is not significant in EIA terms.

5.7.2.6 Increased vessel traffic within fishing grounds as a result of changes to shipping routes and maintenance vessel traffic leading to interference with fishing activity

5.7.2.6.1 DEP or SEP in isolation

The effects of the operational and maintenance phase are expected to be the same or similar to the effects from construction. The significance of effect is therefore **minor adverse** for the UK potting fleet and **negligible** for all other fleets, which is not significant in EIA terms.

5.7.2.6.2 DEP and SEP together

The significance of effect on each receptor remains consistent with the assessment for DEP or SEP in isolation.

5.7.3 Decommissioning phase

The impacts of the offshore decommissioning of the Projects have been assessed on commercial fisheries. The assessment below is relevant to both scenarios of DEP or SEP in isolation and DEP and SEP together.

5.7.3.1 Wind farm site decommissioning activities leading to reduction in access to, or exclusion from, potential and/or established fishing grounds

The effects of decommissioning activities are expected to be the same or similar to the effects from construction. The significance of effect is therefore **moderate adverse** for the UK potting fleet, which is significant in EIA terms, **minor adverse** for Dutch beam trawl fleet and **negligible** for all other fleets, which is not significant in EIA terms.

Further mitigation

UK potting fleet: with respect to any justifiable disturbance payment, the procedures as outlined in the FLOWW guidance documents (2014 and 2015), will be followed as described in as described in Section 5.7.1.1.1 ‘Further mitigation’.

The residual effect for the UK potting fleet will, therefore, be of **minor adverse** significance, which is not significant in EIA terms.

Project offshore export cable corridor decommissioning activities leading to reduction in access to, or exclusion from, potential and/or established fishing grounds

The effects of decommissioning activities are expected to be the same or similar to the effects from construction. The significance of effect is therefore **moderate adverse** for the UK potting fleet, which is significant in EIA terms, **minor adverse** for UK shrimp beam trawl fleet and **negligible** for all other fleets, which is not significant in EIA terms.

Further mitigation

UK potting fleet: with respect to any justifiable disturbance payment, the procedures as outlined in the FLOWW guidance documents (2014 and 2015), will be followed as described

in as described in Section 5.7.1.1.1 ‘Further mitigation’. The residual effect for the UK potting fleet will, therefore, be of **minor adverse** significance, which is not significant in EIA terms.

5.7.3.2 Displacement from wind farm site and export cable corridor leading to gear conflict and increased fishing pressure on adjacent grounds

The effects of decommissioning activities are expected to be the same or similar to the effects from construction. The significance of effect is therefore **minor adverse** for all fleets, which is not significant in EIA terms.

5.7.3.3 Physical presence of any infrastructure left in situ leading to gear snagging

The effects of decommissioning activities are expected to be the same or similar to the effects from operation. The significance of effect is therefore **minor adverse** for all fleets, which is not significant in EIA terms.

5.7.3.4 Decommissioning activities leading to displacement or disruption of commercially important fish and shellfish resources

The effects of decommissioning activities are expected to be the same or similar to the effects from construction. The significance of effect is therefore **minor adverse** for all fleets, which is not significant in EIA terms.

5.7.3.5 Increased vessel traffic within fishing grounds as a result of changes to shipping routes and transiting decommissioning vessel traffic leading to interference with fishing activity

The effects of decommissioning activities are expected to be the same or similar to the effects from construction. The significance of effect is therefore **minor adverse** for UK potting and **negligible** for all other fleets, which is not significant in EIA terms.

6. Cumulative effects assessment

Cumulative effects can be defined as effects upon a single receptor from the Sheringham and Dudgeon Extension Projects when considered alongside other proposed and reasonably foreseeable projects and developments. This includes all projects that result in a comparative effect that is not intrinsically considered as part of the existing baseline environment and is not limited to offshore wind projects.

A screening process has identified a number of reasonably foreseeable projects and developments which may act cumulatively with either DEP or SEP wind farm projects.

When assessing the potential cumulative impact for the Sheringham and Dudgeon Extension Projects an important consideration is that some projects may not be taken forward or built as described in their RWCS. These include 'proposed' projects or those identified in development plans. There is therefore a need to build in some consideration of certainty (or uncertainty) with respect to the potential impacts which might arise from such proposals. For example, those projects under construction are likely to contribute to cumulative impacts (providing effect or spatial pathways exist), whereas those proposals not yet approved are less likely to contribute to such an impact, as some may not achieve approval or may not ultimately be built due to other factors.

For the reasons set out above, all projects and plans considered alongside the Sheringham and Dudgeon Extension Projects have been placed into 'tiers' to reflect the current status within the planning and development process. This allows the cumulative impact assessment to present several future development scenarios, each with a differing potential for being ultimately built out. This approach also allows appropriate weight to be given to each scenario (tier) when considering the potential cumulative impact. The proposed tier structure that is intended to ensure that there is a clear understanding of the level of confidence in the cumulative assessments provided in the ES. An explanation of each tier is included in

Table 6.1.

Table 6.1: Description of tiers of other developments considered for CEA

Tier	Consenting or Construction Phase	Data Availability
Tier 1	Built and operational projects should be included within the cumulative assessment where they have not been included within the environmental characterisation survey, i.e. they were not operational when baseline surveys were undertaken, and/or any residual impact may not have yet fed through to and been captured in estimates of "baseline" conditions e.g. background" distribution or mortality rate for birds.	Pre-construction (and possibly post-construction) survey data from the built project(s) and environmental characterisation survey data from proposed project (including data analysis and interpretation within the ES for the project).
Tier 2	Tier 1 + projects under construction	As Tier 1 but not including post construction survey data
Tier 3	Tier 2 + projects that have been consented (but construction has not yet commenced)	Environmental characterisation survey data from proposed project (including data analysis and interpretation within the ES for the project) and possibly pre-construction
Tier 4	Tier 3 + projects that have an application submitted to the appropriate regulatory body that have not yet been determined	Environmental characterisation survey data from proposed project (including data analysis and interpretation within the ES for the project)
Tier 5	Tier 4 + projects that the regulatory body are expecting an application to be submitted for determination (e.g. projects listed under the Planning Inspectorate programme of projects)	Possibly environmental characterisation survey data (but strong likelihood that this data will

		not be publicly available at this stage).
Tier 6	Tier 5 + projects that have been identified in relevant strategic plans or programmes (e.g. projects identified in Round 3 wind farm ZAP documents)	Historic survey data collected for other purposes/by other projects or industries or at a strategic level.

The plans and projects selected as relevant to the CEA of impacts to commercial fisheries are based on an initial screening exercise undertaken on a long list. A consideration of effect-receptor pathways, data confidence and temporal and spatial scales has been given to select projects for a topic-specific short-list. For the majority of potential effects for commercial fisheries, planned projects were screened into the assessment based on a study area of 100 km from project elements, to provide appropriate coverage of relevant fishing grounds.

The specific projects scoped into the CEA for commercial fisheries, as well as the tiers into which they have been allocated are presented in Table 6.2. The operational projects within the table are included due to their completion/commissioning subsequent to the data collection process for Sheringham and Dudgeon Extension Projects and as such not included within the baseline characterisation. Note that this table only includes the projects screened into the assessment for commercial fisheries based on the criteria outlined above.

The CEA includes designated sites as a project or plan in the context of commercial fisheries, as management measures implemented to protect designated features in these sites may lead to reduced access for commercial fisheries, amongst other impacts. The Marine Protected Areas (MPAs) considered in the assessment include all Special Areas of Conservation (SACs), Marine Conservation Zones (MCZs), Special Protected Areas (SPAs) and non-UK Sites of Community Importance (SCI) within 100 km of Sheringham and Dudgeon Extension Projects. As all sites are designated, they are considered in the Tier 1 CEA.

A key element of the 2013 reformed Common Fisheries Policy is the progressive elimination of discards in EU fisheries through the introduction of a landing obligation. The landing obligation requires all catches of regulated commercial species on-board to be landed and counted against TACs and quota.

Pelagic species were subject to the landing objective from January 2015. Phased implementation for demersal species occurred from January 2016, with statutory guidance provided to fishers from October 2015. Sole, plaice, Nephrops, and haddock (as well as other species) landed from the North Sea by demersal trawl, seine and beam trawl were included in the landing obligation in 2016. It is therefore considered that the effects of the landing objective for the fisheries included in this assessment are captured within the baseline characterisation and the landing obligation is therefore not included as a plan or project within the CEA.

Certain impacts assessed for the project alone are not considered in the cumulative assessment due to:

- The highly localised nature of the impacts (i.e. they occur entirely within the DEP and SEP limits only);
- Management measures in place for DEP and SEP will also be in place on other projects reducing their risk of occurring; and/or
- Where the potential significance of the impact from DEP and SEP alone has been assessed as negligible.

The impacts excluded from the CEA for the above reasons are:

- Increased risk of gear snagging;
- Displacement or disruption of commercially important fish and shellfish resources; and
- Increased vessel traffic within fishing grounds as a result of changes to shipping routes and project related vessel traffic leading to interference with fishing activity.

Therefore, the impacts that are considered in the CEA during construction and operation and maintenance are as follows:

- Reduction in access to, or exclusion from established fishing grounds; and
- Displacement leading to gear conflict and increased fishing pressure on established fishing grounds.

The cumulative RWCS described in Table 6.2 have been selected as those having the potential to result in the greatest cumulative effect on commercial fisheries.

The cumulative impacts presented and assessed in this section have been selected from the details provided in the project description for the DEP and SEP extension projects as well as the information available on other projects and plans in order to inform a cumulative realistic worst case scenario. The cumulative RWCS for commercial fisheries is presented in Table 6.3. Effects of greater adverse significance are not predicted to arise should any other development scenario, based on details within the project design envelope to that assessed here, be taken forward in the final design scheme.

In order to assess the cumulative effect of the projects scoped into the commercial fisheries CEA, the commercial fisheries impact assessment findings for key offshore wind farms have been reviewed and summarised in Table 6.4. These findings are informed by the individual Environmental Statements published for each offshore wind farm included in this CEA.

Table 6.2: Projects screened into the commercial fisheries cumulative assessment.

Tier	Project/Plan	Status	Distance from project (km)	Nearest project element
1	SACs within 100km of the Project, including: North Norfolk Coast, The Wash and North Norfolk Coast, Haisborough, Hammond and Winterton, Inner Dowsing, Race Bank and North Ridge, North Norfolk Sandbanks and Saturn Reef, Southern North Sea and Dogger Bank.	Designated	1.26 km	Export cable
1	SPAs within 100 km of the Project, including: The Wash, North Norfolk Coast, Greater Wash and Humber Estuary.	Designated	0	Export cable
1	MCZs within 100 km of the project, including: Cromer Shoal Chalk Beds, Markham's Triangle, Holderness Inshore and Holderness Offshore	Designated	0	Export cable
1	Dudgeon Offshore Wind Farm	Operational	0	Dudgeon Extension
1	Sheringham Shoal Offshore Wind Farm Maintenance of existing works and Other deposits	Application submitted	0	Sheringham Extension
1	EIFCA Byelaw 12 Inshore trawling restriction and Byelaw 15 Towed gear restriction for bivalve molluscs	Active	0	Export cable
1	Race Bank Offshore Wind Farm Operation and Maintenance for non-cable activities - Generator assets	Marine license (L/2018/00214) granted. Valid 24th October 2018-31st May 2043.	9.97	Sheringham Extension
1	Lincs Offshore Wind Farm	Operational	34.37	Export cable
1	Lincs Offshore Windfarm Maintenance of existing works	Marine license granted (L/2015/00094/1). Valid 13th March 2015-31st October 2038.	34.5	Sheringham Extension
1	Lynn and Inner Dowsing Offshore Wind Farm	Operational	37.17	Export cable
1	Scroby Sands Offshore Wind Farm	Operational	51.43	Export cable

Tier	Project/Plan	Status	Distance from project (km)	Nearest project element
1	Great Yarmouth inner harbour dredge disposal. The works will be undertaken on an annual basis when required.	Marine license (L/2016/00376) granted. Valid 12 December 2016-1st April 2026.	55.09	Dudgeon Extension
1	Humber Gateway Offshore Wind Farm	Operational	63.94	Export cable
1	Westermost Rough Offshore Wind Farm	Operational	80.6	Export cable
2	Triton Knoll Offshore Wind Farm	In construction	13.15	Dudgeon Extension
2	Hornsea Project Two Offshore Wind Farm	In construction	52.36	Dudgeon Extension
2	Hornsea Project One Offshore Wind Farm	Commissioning	54.9	Dudgeon Extension
3	EIFCA Marine Protected Areas Byelaws Restricted area 35 (Weybourne to Happisburgh) closure to towed demersal gear to protect Cromer Shoal chalk bed	Implemented	0	Export cable
3	Independent Oil and Gas / Blythe Hub Development. Elgood well tied back via production pipeline to a new production platform (Blythe)	Consented	1	Dudgeon Extension
3	Norfolk Vanguard Offshore Wind Farm	Consented	58.44	Dudgeon Extension
3	East Anglia THREE Offshore Wind Farm	Consented	94.83	Dudgeon Extension
3	Dogger Bank A Offshore Wind Farm	Consented	166.96	Dudgeon Extension
3	Dogger Bank B Offshore Wind Farm	Consented	191.30	Dudgeon Extension
3	Sofia Offshore Wind Farm	Consented	194.78	Dudgeon Extension

Tier	Project/Plan	Status	Distance from project (km)	Nearest project element
3	North Falls Offshore Wind Farm	Consented	165.22	Dudgeon Extension
3	Five Estuaries Offshore Wind Farm	Consented	147.83	Dudgeon Extension

Table 6.3: Cumulative RWCS for commercial fisheries

Project phase	Potential impact	Realistic Worst Case Scenario	Justification
Construction, Operation & maintenance and decommissioning	Reduction in access to, or exclusion from established fishing grounds	Tier 1 - 19 MPAs: including 7 SACs, 8 SPAs and 4 MCZs. - 1 dredge /disposal activity - 1 EIFCA Byelaw - 9 offshore wind farms Tier 2 – 3 wind farms Tier 3 – 1 EIFCA Byelaw; 1 oil operation; 7 wind farms	Outcome of the CEA will be greatest when the greatest number of other schemes, present or planned, are considered.
Construction, Operation & maintenance and decommissioning	Displacement leading to gear conflict and increased fishing pressure on established fishing grounds		

Table 6.4: Summary of commercial fisheries impact assessment findings for key offshore wind farms included in the cumulative assessment

Project	Source	Consented Capacity/ scale	Status of Development	Tier	Impact assessment results as assessed for individual offshore wind farms	
					Exclusion or reduction in access to fishing grounds	Displacement into alternative grounds.
Dudgeon	Warwick Energy (2009)	402 MW and 67 turbines	Operational	1	Minor for all fleets during construction and negligible during operations	Minor for all fleets during construction and negligible during operations

Project	Source	Consented Capacity/ scale	Status of Development	Tier	Impact assessment results as assessed for individual offshore wind farms	
					Exclusion or reduction in access to fishing grounds	Displacement into alternative grounds.
Race Bank	DONG Energy (2014)	Up to 580 MW	Operational	1	Minor to negligible for all fleets during construction and decommissioning; and negligible during operation.	Minor to negligible for all fleets during construction and decommissioning; and negligible during operation.
Sheringham Shoal (maintenance)	Scira Offshore Energy (2006)	317 MW and 88 turbines	Operational	1	Negligible for all fleets during operation and maintenance phase.	Negligible for all fleets during operation and maintenance phase.
Linc Offshore Wind Farm	Lincs Wind Farm Limited (2010).	22 MW and 6 turbines	Operational	1	Negligible for all fleets during operation and maintenance phase.	Negligible for all fleets during operation and maintenance phase.
Lynn and Inner Dowsing Offshore Wind Farm	Centrica Energy (2009)	195 MW and 54 turbines	Operational	1	Negligible for all fleets during operation and maintenance phase.	Negligible for all fleets during operation and maintenance phase.
Humber Gateway Offshore Wind Farm	Humber Wind Limited (2015)	219 MW and 73 turbines	Operational	1	Moderate (reduced to minor with mitigation) for UK static fleet during construction. Minor or negligible for all other fleets.	Minor for all fleets during all phases of the development
Westermost Rough Offshore Wind Farm	DONG Energy (2009)	210 MW and 35 turbines	Operational	1	Impacts assessed as being negligible to moderate, impacts specific to potting fleet identified.	
Hornsea Project One	SMart Wind (2013)	Up to 240 5-8 MW turbines	In construction	2	Minor for all fleets during all phases of the development	Minor for all fleets during all phases of the development
Hornsea Project Two	SMart Wind (2015)	Up to 300 6-15 MW turbines	Commissioning	2	Minor for all fleets during all phases of the development	Minor for all fleets during all phases of the development
Triton Knoll	RWE npower renewables (2003)	750-900 MW (113-288x8 MW turbines)	In construction	2	Negligible for all fleets	Negligible for all fleets

Project	Source	Consented Capacity/ scale	Status of Development	Tier	Impact assessment results as assessed for individual offshore wind farms	
					Exclusion or reduction in access to fishing grounds	Displacement into alternative grounds.
East Anglia Three	ScottishPower Renewables and Vattenfall (2015)	Up to 1200 MW (up to 172 turbines of up to 7 – 12 MW capacity)	Consented	3	Minor to Negligible for all fleets during construction and operations; except moderate (reduced to minor with mitigation) for UK static fleet during construction of offshore cable corridor.	Minor to negligible for all fleets
Norfolk Vanguard Offshore Wind Farm	Vattenfall (2018)	1.8 GW	Consented	3	Minor to negligible for all fleets	Minor to negligible for all fleets
Dogger Bank A	Forewind (2013a)	Up to 1.2 GW (Up to 200 turbines of up to 10 MW capacity)	Consented: Construction expected 2021-2024	3	Minor for all fleets during all phases, except: moderate for potters targeting crab & lobster across export cable route during construction.	Minor for all fleets during all phases, except moderate for potters targeting crab & lobster across export cable route during construction
Dogger Bank B	Forewind (2013a)	Up to 1.2 GW (Up to 200 turbines of up to 10 MW turbines)	Consented: Construction expected 2021-2024	3	Minor for all fleets during all phases, except: moderate for potters targeting crab & lobster across export cable route during construction	Minor for all fleets during all phases, except: moderate for potters targeting crab & lobster across export cable route during construction
Sofia	Forewind (2013b)	Up to 1.2 GW	Consented: Construction expected 2023-2026	3	Minor for all fleets during all phases, except: moderate for seine nets across wind farm site during construction & operation.	Minor for all fleets during all phases, except: moderate for seine nets across wind farm site during construction & operation.
North Falls	SSE Renewables (2021)	504 MW	Pre-application	3	The impacts have yet to be assessed.	The impacts have yet to be assessed.
Five Estuaries	RWE (2020)	300MW +	Pre-application	3	The impacts have yet to be assessed.	The impacts have yet to be assessed.

6.1.1 Assessment of Cumulative Impacts

6.1.1.1 Cumulative effects of reduction in access to, or exclusion from, potential and/or established fishing grounds

Tier 1

Magnitude of effect

The impacts of reduced access or exclusion from fishing grounds assessed within individual commercial fisheries assessments for key offshore wind farms are presented in Table 6.4.

Due to the proximity of the operational Sheringham Shoal, Dudgeon and Race Bank offshore wind farms to DEP and SEP and to the grounds targeted by potters, they have the greatest potential to result in a cumulative impact for the North Norfolk potting fleet. All other wind farms are expected to have a negligible to low magnitude of effect on this fleet. It is noted that the Westermost Rough Offshore Windfarm ES predicted negligible to moderate adverse impacts for commercial fisheries. It is considered that the key potting fleet operating within the Westermost Rough is the Holderness Coast Fishing Industry Group, and that the Norfolk potting fleets do not routinely operate as far north as the Westermost Rough Offshore Wind Farm.

The ES for Sheringham Shoal, Dudgeon and Race Bank confirm activity by North Norfolk potting fleets across their array areas and offshore cable corridors. However, the impacts are assessed as minor during the construction and decommissioning of Race Bank and Dudgeon and negligible during operation on account of the opportunity for co-existence of potting fisheries.

Overall, for all operational wind farms included in Tier 1, the magnitude of the cumulative effect is assessed as being low to UK potters.

In relation to all other fleets (including UK, Dutch, Danish, French and Belgian otter trawlers, and/or beam trawlers) the following wind farms have the most potential to result in a cumulative impact due to the location of the wind farms and the grounds targeted and/or operational range of the fishing fleets: (from south to north) North Falls, Five Estuaries, East Anglia One, Triton Knoll, Race Bank, Dudgeon, Hornsea Project One and Hornsea Project Two, Dogger Bank A, Dogger Bank B and Sofia. Based on the available evidence, including VMS data provided by the MMO, all other wind farms are expected to have a low to negligible magnitude of impact for these fleets.

Based on available Environmental Statements (Forewind, 2013a; Forewind 2013b; Lincs Wind Farm Limited, 2010; RWE npower renewables, 2003; Scottish Power Renewables and Vattenfall, 2015; SMart Wind, 2013; SMart Wind, 2015; Vattenfall, 2018), it is understood that these offshore wind farms are considered to represent effects within a range of negligible to minor adverse significance to demersal trawl commercial fisheries. This is due to fishing not being excluded within the operational wind farms, together with commitment to follow FLOWW guidance (BERR, 2008 and FLOWW, 2014). As such a low magnitude is assessed for these fleets.

The magnitude of impact of harbour dredging activities and oil and gas production activities is considered to be low to all fishing fleets based on the time-frame of associated works and limited areal overlap with fishing activities.

A network of MCZs, SACs and SPAs are included as plans with potential to have cumulative impacts on commercial fisheries. Of specific note based on their proximity to DEP and SEP and the activity of the commercial fishing fleets under assessment are the:

- North Norfolk Sandbanks and Saturn Reef SAC;
- North Norfolk Coast SPA and SAC;
- Cromer Shoal Chalk Beds MCZ; and
- Dogger Bank SAC.

The objective for these proposed/recommended designations is to maintain the integrity of the sites and identified features. There is uncertainty as to whether management measures would be implemented in relation to commercial fisheries operating within these sites. Where management measures are required, it is Defra's policy that:

- Both regulatory and non-regulatory mechanisms should be investigated (e.g. voluntary agreements);
- Management measures with the least social and economic impact should be implemented where effective in meeting conservation objectives (e.g. gear adaptations or seasonal closures rather than area closures); and
- Management measures should be proportionate to the conservation objectives of the feature (e.g. permit schemes rather than area closures).

The impact of the designated Cromer Shoal MCZ on the UK potting fleet has been considered. The Cromer Shoal Chalk Beds MCZ is one of the most ecologically significant chalk beds in the UK and Europe. Natural England have recently provided advice to the EIFCA on fisheries management in this MCZ and the significance of potential damage by the potting fleet (Natural England, 2020). Natural England's report (2020) finds that cumulative active potting across the MCZ significantly damages areas of complex, rugged chalk within the MCZ. Management is highly likely to be implemented (Natural England, 2020) to reduce the impact of potting on these specific areas of rugged chalk that exist within the MCZ. In addition, Natural England (2020) advises that management is implemented immediately to stop storing of pots within the MCZ area, as well as the introduction of a lost gear and recovery system.

Due to the introduction of these management measures within the MCZ, together with the potential for further management to be necessary in the future to protect the chalk features (e.g. if an adaptive approach to managing activity over the rugged chalk is not possible), the cumulative impact is assessed as having a medium magnitude for this fleet of UK potters.

Management restrictions have been implemented for UK mobile bottom contact gears, including otter trawl and beam trawl, within the Cromer Shoal MCZ (EIFCA MPA Byelaw 2019). However, given the low level of mobile gear effort across the DEP and SEP project, the cumulative magnitude of impact to all demersal trawling fleets is considered to be low.

Sensitivity of receptor

Based on the operating range of the UK potting fleet under assessment, it is deemed to be of medium vulnerability, medium recoverability and medium value. The sensitivity of the receptor is therefore, considered to be medium.

Demersal fisheries fleets are deemed to be of low vulnerability, medium recoverability and low value. The sensitivity of the receptor is therefore, considered to be low.

Significance of impact

For UK potters, overall, the sensitivity of the receptor is considered to be medium and the magnitude is deemed to be medium. In the absence of any further mitigation, the cumulative impact will, therefore, be of **moderate adverse** significance, which is significant in EIA terms. This assessment takes account of a high degree of uncertainty.

For all other mobile fleets overall, the sensitivity of the receptor is considered to be low and the magnitude is deemed to be low. The cumulative impact will, therefore, be of **minor adverse** significance, which is not significant in EIA terms.

Tier 2 and Tier 3

The plans and projects included in Tiers 2 and 3 are not considered to raise the cumulative effect beyond that assessed for the Tier 1 assessment for all fishing fleets. The significance of effect is therefore **moderate adverse** for the UK potting fleet, which is significant in EIA terms and **minor adverse** for all other fleets, which is not significant in EIA terms.

6.1.1.2 Cumulative effects of displacement leading to gear conflict and increased fishing pressure on alternative grounds

Magnitude of effect

The effect of displacement leading to gear conflict and increased fishing pressure is directly correlated to the previous impact of reduced access to fishing grounds (i.e. if there is no reduction in access, then there will be no displacement). There is a medium magnitude of effect for reduced access to fishing grounds for the UK potting fleet and therefore displacement is expected. As such the magnitude of effect of displacement is assessed as medium for all UK potting fleet; and low for all other mobile gear commercial fisheries fleets.

Sensitivity of receptor

The sensitivity of the receptors is consistent with the assessment of reduced access to fishing grounds. The sensitivity is therefore medium for potting fleets and low for all other commercial fishing fleets.

Significance of impact

For UK potting vessels, overall, the sensitivity of the receptor is considered to be medium and the magnitude is deemed to be medium. In the absence of any further mitigation, the cumulative impact will, therefore, be of **moderate adverse** significance, which is significant in EIA terms. This assessment takes account of a high degree of uncertainty.

For all other mobile gear fleets, overall, the sensitivity of the receptor is considered to be low and the magnitude is deemed to be low. The cumulative impact will, therefore, be of **minor adverse** significance, which is not significant in EIA terms.

Tier 2 and Tier 3

The plans and projects included in Tiers 2 and 3 are not considered to raise the cumulative effect beyond that assessed for the Tier 1 assessment for all fishing fleets. The significance of impact is therefore **moderate adverse** for the UK potting fleet, which is significant in EIA terms and **minor adverse** for all other fleets, which is not significant in EIA terms.

7. Transboundary impacts

This commercial fisheries chapter has assessed the potential impacts incurred by non-UK registered vessels operating within UK waters. This includes the potential effects on Belgian, Danish, Dutch and French commercial fishing fleets across all impact categories assessed, including exclusion from the Sheringham and Dudgeon Extension Projects and displacement effects. Transboundary impacts within UK waters have therefore been intrinsically considered throughout the commercial fisheries EIA process and are consistent to those presented in sections 5 and 6.

Transboundary impacts outside UK waters are limited to potential displacement of fishing effort from the Sheringham and Dudgeon Extension Projects into non-UK EEZs, namely the Dutch EEZ. Based on the established fishing grounds targeted by the fleets under assessment it is not anticipated that displacement effects into the Dutch EEZ would be significant.

8. Summary

Commercial fisheries baseline activity data has been assessed for the following countries: UK, Netherlands, France, Belgium and Denmark. Based on quota allocations and landing statistics for the commercial fisheries regional study area it is understood that vessels registered to other countries have low levels of activity within the DEP and SEP project areas.

The key fleets included in this assessment are (in no particular order):

- UK potters targeting lobster, brown crab and whelk;
- UK beam trawlers targeting brown shrimp;
- French demersal and midwater trawlers targeting whiting and mackerel;
- Dutch beam trawlers and fly shooting targeting sole, plaice and mixed demersal finfish species;
- Belgian beam trawlers targeting sole, plaice and mixed demersal finfish species;
- Danish demersal trawlers targeting sandeel throughout the North Sea with occasional effort overlapping the project area.

Table 8.1 presents a summary of the impacts assessed within this ES, any mitigation and the residual impacts.

Table 8.1: Summary of potential impacts assessed for commercial fisheries.

Potential impact	Receptor	Sensitivity	Magnitude	Pre-mitigation impact	Mitigation measures proposed	Residual impact
Construction phase						
Construction activities and physical presence of constructed wind farm infrastructure leading to reduction in access to, or exclusion from established fishing grounds	UK potting	Medium	Medium	Moderate adverse	With respect to any justifiable disturbance payment, the procedures as outlined in the FLOWW guidance (2014 and 2015), will be followed.	Minor adverse
	Dutch beam trawl	Low	Low	Minor adverse	None beyond embedded mitigation	Minor adverse
	All other mobile fleets	Low	Negligible	Negligible	N/A	Negligible
Offshore cable construction activities leading to reduction in access to, or exclusion from, establish fishing areas	UK potting	Medium	Medium	Moderate adverse	With respect to any justifiable disturbance payment, the procedures as outlined in the FLOWW guidance (2014 and 2015), will be followed.	Minor adverse
	UK shrimp beam trawl	Medium	Low	Minor adverse	None beyond embedded mitigation	Minor adverse
	All other mobile fleets	Low	Negligible	Negligible	N/A	Negligible
Displacement from the wind farm site leading to gear conflict and increased pressure on adjacent grounds	UK potting	Medium	Medium	Moderate adverse	With respect to any justifiable disturbance payment, the procedures as outlined in the FLOWW guidance (2014 and 2015), will be followed.	Minor adverse
	All mobile fleets	Low	Low	Minor adverse	None beyond embedded mitigation	Minor adverse
Displacement from cable corridor leading to gear conflict and increased pressure on adjacent grounds	UK potting	Medium	Low	Minor adverse	None beyond embedded mitigation	Minor adverse
	All mobile fleets	Low	Negligible	Negligible	N/A	Negligible
	UK potting	Medium	Low	Minor adverse	None beyond embedded mitigation	Minor adverse

Potential impact	Receptor	Sensitivity	Magnitude	Pre-mitigation impact	Mitigation measures proposed	Residual impact
Construction activities leading to displacement or disruption of commercially important fish and shellfish resources	All mobile fleets	Low	Low	Minor adverse	None beyond embedded mitigation	Minor adverse
Increased vessel traffic within fishing grounds as a result of changes to shipping routes and transiting construction vessel traffic leading to interference with fishing activity	UK potting	Medium	Low	Minor adverse	None beyond embedded mitigation	Minor adverse
	All mobile fleets	Negligible	Low	Negligible	N/A	Negligible
Operation and maintenance phase						
Physical presence of the wind farm site infrastructure leading to reduction in access to, or exclusion from established fishing grounds	UK potting	Medium	Low	Minor adverse	None beyond embedded mitigation	Minor adverse
	All mobile fleets	Low	Negligible	Negligible	N/A	Negligible
Physical presence of the proposed offshore export cable and interlink cables leading to reduction in access to, or exclusion from established fishing grounds	UK potting	Medium	Low	Minor adverse	None beyond embedded mitigation	Minor adverse
	All mobile fleets	Low	Negligible	Negligible	N/A	Negligible
Displacement from the wind farm site leading to gear conflict and increased pressure on adjacent grounds	UK potting	Medium	Low	Minor adverse	None beyond embedded mitigation	Minor adverse
	All mobile fleets	Low	Low	Minor adverse	None beyond embedded mitigation	Minor adverse
Physical presence of the wind farm site, offshore export cable and interlink cables leading to gear snagging	UK potting	Low	Medium	Minor adverse	None beyond embedded mitigation	Minor adverse
	All mobile fleets	Medium	Low	Minor adverse	None beyond embedded mitigation	Minor adverse
Operation and maintenance activities leading to displacement or disruption of commercially important fish and shellfish resources	UK potting	Medium	Low	Minor adverse	None beyond embedded mitigation	Minor adverse
	All mobile fleets	Low	Negligible	Negligible	N/A	Negligible
Increased vessel traffic within fishing grounds as a result of changes to shipping routes and maintenance vessel traffic leading to interference with fishing activity	UK potting	Medium	Low	Minor adverse	None beyond embedded mitigation	Minor adverse
	All mobile fleets	Negligible	Low	Negligible	N/A	Negligible
Decommissioning phase						
Wind farm site decommissioning activities leading to reduction in access to, or exclusion	UK potting	Medium	Medium	Moderate adverse	With respect to any justifiable disturbance payment, the procedures as outlined in the	Minor adverse

Potential impact	Receptor	Sensitivity	Magnitude	Pre-mitigation impact	Mitigation measures proposed	Residual impact
from, potential and/or established fishing grounds					FLOWW guidance (2014 and 2015), will be followed.	
	Dutch beam trawl	Low	Low	Minor adverse	None beyond embedded mitigation	Minor adverse
	All other mobile fleets	Low	Negligible	Negligible	N/A	Negligible
Project offshore export cable corridor decommissioning activities leading to reduction in access to, or exclusion from, potential and/or established fishing grounds	UK potting	Medium	Medium	Moderate adverse	With respect to any justifiable disturbance payment, the procedures as outlined in the FLOWW guidance (2014 and 2015), will be followed.	Minor adverse
	UK shrimp beam trawl	Medium	Low	Minor adverse	None beyond embedded mitigation	Minor adverse
	All other mobile fleets	Low	Negligible	Negligible	N/A	Negligible
Displacement from wind farm site and export cable corridor leading to gear conflict and increased fishing pressure on adjacent grounds	UK potting	Medium	Medium	Moderate adverse	With respect to any justifiable disturbance payment, the procedures as outlined in the FLOWW guidance (2014 and 2015), will be followed.	Minor adverse
	All mobile fleets	Low	Low	Minor adverse	None beyond embedded mitigation	Minor adverse
Physical presence of any infrastructure left in situ leading to gear snagging	UK potting	Low	Medium	Minor adverse	None beyond embedded mitigation	Minor adverse
	All mobile fleets	Medium	Low	Minor adverse	None beyond embedded mitigation	Minor adverse
Decommissioning activities leading to displacement or disruption of commercially important fish and shellfish resources	UK potting	Medium	Low	Minor adverse	None beyond embedded mitigation	Minor adverse
	All mobile fleets	Low	Low	Minor adverse	None beyond embedded mitigation	Minor adverse
Increased vessel traffic within fishing grounds as a result of changes to shipping routes and transiting decommissioning vessel traffic leading to interference with fishing activity	UK potting	Medium	Low	Minor adverse	None beyond embedded mitigation	Minor adverse
	All mobile fleets	Negligible	Low	Negligible	N/A	Negligible

References

Bannister, R.C.A, 2009. On the management of brown crab fisheries. Shellfish Association of Great Britain (SAGB). Internal Report 2009

Bayse, S.M., Rillahan, C.B., Jones, N.F., Balzano, V., He, P., 2016. Evaluating a large-mesh belly window to reduce bycatch in silver hake (*Merluccius bilinearis)* trawls. *Fish. Res. 174*, 1–9. https://doi.org/10.1016/j.fishres.2015.08.022

BERR (Department for Business, Enterprise and Regulatory Reform) (2008) Fisheries Liaison with Offshore Wind and Wet Renewables Group (FLOWW) Recommendations For Fisheries Liaison: Best Practice guidance for offshore renewable developers.

Blue Marine Foundation (2018) Management recommendations for English non-quota fisheries: Common whelk

Bridges T.J., Research Report 2019. Crab and lobster assessment. Eastern IFCA 2018 https://www.eastern-ifca.gov.uk/wp-content/uploads/2019/09/2019_04_25_Crustacean_Stock_Assessment_report_2018.pdf

Brown, C. G. & Bennett, D. B. 1980. Population and Catch Structure of the Edible Crab (Cancer pagurus) in the English-Channel. *J Conseil* 39:88-100

Centrica Energy (2009). Lynn and Inner Dowsing Offshore Wind Farms http://www.cargos-paquebots.net/Revue%20de%20presse/0000_IMAGES-07/117-Eoliennes_P&O.pdf

DONG Energy (2009) Westermost Rough Offshore Wind Farm Non-Technical summary https://www.eib.org/attachments/registers/53897501.pdf

DONG Energy (2014) Race Bank Offshore Wind Farm Electricity Act 1989 Section 36 Consent Variation: Supporting Environmental Information. Report prepared by Royal HaskoningDHV.

EIFCA 2020. Eastern IFCA Monthly Shellfish Returns for brown crab, lobster and whelk.

EIFCA 2010. Eastern IFCA Fisheries Mapping Project 2010. https://www.eastern-ifca.gov.uk/about/fisheries/fisheries-mapping-project/

EIFCA (2019) Eastern IFCA Marine Protected Areas Byelaw 2018. https://www.eastern-ifca.gov.uk/wp-content/uploads/2020/05/EIFCA-MPA-Byelaw-2018.pdf

EIFCA 2020 Eastern IFCA North Norfolk Coast Habitat Mapping Report 2018-2019. https://www.eastern-ifca.gov.uk/wp-content/uploads/2020/04/EIFCA_North-Norfolk-Coast_Habitat_Mapping_Survey_Report_2018-2019.pdf

EIFCA, 2020b Eastern IFCA Strategic Assessment 2020. https://www.eastern-ifca.gov.uk/wp-content/uploads/2020/03/2020-Strategic-Assessment-1.pdf

European Union Data Collection Framework (EU DCF) (2019). Data by quarter-rectangle: Tables and maps of effort and landings by ICES statistical rectangles.

European Union Market Observatory for Fisheries and Aquaculture products (EUMOFA) (2019). Yearly comparison between member states.

EU 2016. REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on establishing a multi-annual plan for demersal stocks in the North Sea and the fisheries exploiting those stocks and repealing Council Regulation (EC) 676/2007 and Council Regulation (EC) 1342/2008. COM(2016) 493 final. 23 pp. https://eurlex.europa.eu/resource.html?uri=cellar:9aa2aaae-5956-11e6-89bd-01aa75ed71a1.0008.02/DOC_1&format=PDF

EU 2020. COUNCIL REGULATION (EU) 2019/529 of 28 March 2019 amending Regulation (EU) 2019/124 as regards certain fishing opportunities https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32019R0529&from=EN

Fisheries Liaison with Offshore Wind and Wet Renewables group FLOWW (2015) FLOWW Best Practice Guidance for Offshore Renewables Developments: Recommendations for Fisheries Disruption Settlements and Community Funds (FLOWW, 2015).

FLOWW (2014) FLOWW Best Practice Guidance for Offshore Renewables Developments: Recommendations for Fisheries Liaison. January 2014.

Forewind (2013a) Dogger Bank Creyke Beck A & B Offshore Wind Farms, Environmental Statement.

Forewind (2013b) Sofia Offshore Wind Farm, Environmental Statement.

Gray, M., Stromberg, P-L., Rodmell, D. 2016. 'Changes to fishing practices around the UK as a result of the development of offshore windfarms – Phase 1 (Revised).' The Crown Estate, 121 pages. ISBN: 978-1-906410-64-3.

Haig, J. A., Bakke, S., Bell, M. C., Bloor, I. S. M., Cohen, M., Coleman, M., Dignan, S., Kaiser, M. J., Pantin, J. R., Roach, M., Salomonsen, H. & Tully, O. 2016. Reproductive traits and factors affecting the size at maturity of *Cancer pagurus* across Northern Europe. *ICES Journal of Marine Science* 73:2572-85

Humber Wind Limited (2015) Humber Gateway Offshroe Wind Farm Non-Technical Summary. https://www.group.rwe/en/our-portfolio/our-sites/humber-gateway-offshore-wind-farm

Hutniczak, B., and A. Munch 2018. Fishermen's location choice under spatio-temporal update of expectations. *Journal of Choice Modelling* 28 pp 124-136.

ICES. 2018a. Mixed-fisheries advice for Subarea 4, Division 7.d, and Subdivision 3.a.20 (North Sea, eastern English Channel, Skagerrak). In Report of the ICES Advisory Committee, 2018. ICES Advice 2018, mix-ns. 16 pp. https://doi.org/10.17895/ices.pub.4612

ICES, 2018b ICES Advice on fishing opportunities, catch, and effort Greater North Sea Ecoregion, November 2018 https://doi.org/10.17895/ices.pub.4613

ICES Advice 2019a – Cod (*Gadus morhua*) in Subarea 4, Division 7.d, and Subdivision 20 (North Sea, eastern English Channel, Skagerrak) http://ices.dk/sites/pub/Publication%20Reports/Advice/2019/2019/cod.27.47d20.pdf

ICES Advice 2019b – Turbot in Subarea 4 (North Sea). http://ices.dk/sites/pub/Publication%20Reports/Advice/2019/2019/tur.27.4.pdf

ICES Advice 2020a - Herring (*Clupea harengus*) in Subarea 4 and divisions 3.a and 7.d, autumn spawners (North Sea, Skagerrak and Kattegat, eastern English Channel) http://www.ices.dk/sites/pub/Publication%20Reports/Advice/2020/2020/her.27.3a47d.pdf

ICES, 2020b. Request from the Netherlands regarding the impacts of pulse trawling on the ecosystem and environment from the sole (*Solea solea*) fishery in the North Sea. https://visserij.nl/wp-content/uploads/2020/05/ICES-rapport-Puls-20-05-2020.pdf

Jansen T, Campbell A, Kelly C, Hátún H, Payne MR 2012. Migration and Fisheries of North East Atlantic Mackerel (Scomber scombrus) in Autumn and Winter. PLoS ONE 7(12): e51541. https://doi.org/10.1371/journal.pone.0051541

Lincs Wind Farm Limited (2010). LID6 Environmental Statement. https://www.eib.org/attachments/registers/53221928.pdf

Marine Management Organisation (MMO) (2020) IFISH database with landing statistics data for UK registered vessels for 2015 to 2019 with attributes for: landing year; landing month; vessel length category; country code; ICES rectangle; vessel/gear type; species; live weight (tonnes); and value; and landing year; landing month; vessel length category; country code; vessel/gear type; port of landing; species; live weight (tonnes); and value.

Martinsson J. 2011. Ecology of juvenile turbot and flounder in the central Baltic Sea. Stockholm University 2011. https://www.diva-portal.org/smash/get/diva2:452813/FULLTEXT01.pdf

Natural England (2020). Human impacts on Cromer Shoal Chalk Beds MCZ: Chalk complexity and population dynamics of commercial crustaceans. Natural England Research Report RR04412. http://publications.naturalengland.org.uk/publication/4884193307000832

Ondes, F., Emmerson, J. A., Kaiser, M. J., Murray, L. G. & Kennington, K. 2019. The catch characteristics and population structure of the brown crab (*Cancer pagurus*) fishery in the Isle of Man, Irish Sea. *Journal of the Marine Biological Association of the United Kingdom* 99:119-33.

Polagye, B., B. Van Cleve, A. Copping, and K. Kirkendall (editors) (2011) Environmental effects of tidal energy development. U.S. Dept. Commerce, NOAA Tech. Memo. F/SPO-116, 181 p.

RWE npower renewables (2003) Triton Knoll Offshore Wind Farm Ltd Environmental Statement ES Volume 3 (Annex I) Commercial Fisheries.

RWE (2020). Five Estuaries Offshore Wind Farm https://fiveestuaries.co.uk

Scira Offshore Energy (2006). Environmental Statement of the Sheringham Shoal wind farm. http://sheringhamshoal.co.uk/downloads/Offshore%20environmental%20statement.pdf

Scott, K., Harsanyi, P. & Lyndon, A. R. 2018. Baseline measurements of physiological and behavioural stress markers in the commercially important decapod *Cancer pagurus* (L.). *Journal of Experimental Marine Biology and Ecology* 507:1-7

Scottish Power Renewables and Vattenfall (2015) East Anglia THREE Chapter 14 Commercial Fisheries Environmental Statement Volume 1 Document Reference – 6.1.14. Report prepared by Brown and May Limited.

SMart Wind (2013) Hornsea Offshore Wind Farm Project One – Environmental Statement Volume 2 Chapter 7 – Commercial Fisheries.

SMart Wind (2015) Hornsea Offshore Wind Farm Project Two – Environmental Statement Volume 2 Chapter 6 – Commercial Fisheries.

SSE Renewables (2021) North Falls Offshore Wind Farm. https://www.sserenewables.com/offshore-wind/projects/north-falls/

Switzer, T. & Meggitt, D. (2010). Review of Literature and studies on Electro Magnetic Fields (EMF) generated by undersea power cables and associated influence on Marine Organisms. Sound & Sea Technol. DOI: .1109/OCEANS.2010.5664611.

UKFEN (2012) Best Practice Guidance for Fishing Industry Financial and Economic Impact Assessments.

Vattenfall (2018) Norfolk Vanguard Offshore Wind Farm Chapter 14 Commercial Fisheries Environmental Statement. https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010079/EN010079-001502-Chapter%2014%20Commerical%20Fisheries%20Norfolk%20Vanguard%20ES.pdf

Warwick Energy (2009) Dudgeon Offshore Wind Farm Environmental Statement Non Technical Summary June 2009. Report prepared by Royal Haskoning.

Windrush, Warborne Lane
Portmore, Lymington
Hampshire SO41 5RJ
United Kingdom

Telephone: +44 1590 610168
tim@consult-poseidon.com
http://www.consult-poseidon.com