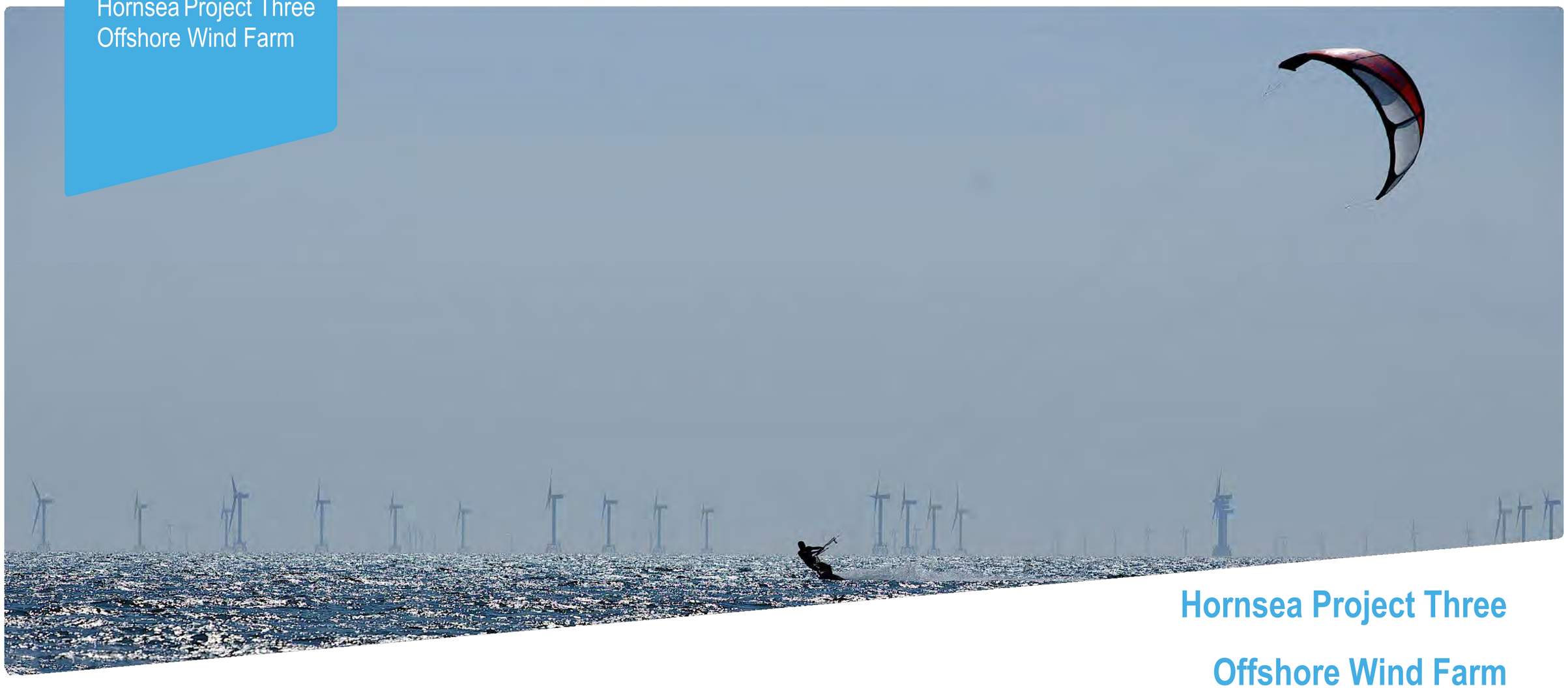
Hornsea Project Three
Offshore Wind Farm



Hornsea Project Three

Offshore Wind Farm

Preliminary Environmental Information Report:
Annex 6.1 – Commercial Fisheries Technical Report

Date: July 2017

Hornsea 3
Offshore Wind Farm

DONG energy

Environmental Impact Assessment

Preliminary Environmental Information Report

Volume 5

Annex 6.1 – Commercial Fisheries Technical Report

Report Number: P6.5.6.1

Version: Final

Date: July 2017

This report is also downloadable from the Hornsea Project Three offshore wind farm website at:
www.dongenergy.co.uk/hornseaproject3

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Front cover picture: Kite surfer near one of DONG Energy's UK offshore wind farms © DONG Energy Hornsea Project Three (UK) Ltd., 2016.

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Table of Contents

List of Tables

List of Figures

Glossary

Term	Definition
Beam trawlers	A method of bottom trawling with a net that is held open by a beam, which is generally a heavy steel tube supported by steel trawl heads at each end. Tickler chains or chain mats, attached between the beam and the ground rope of the net, are used to disturb fish and crustaceans that rise up and fall back into the attached net.
Bycatch	Catch which is retained and sold but is not the target species for the fishery.
CNPMEM	The French National Committee for Maritime Fisheries and Aquaculture, of which CRPMEM Nord, along with 13 other CRPMEMs are members.
Cooperative Maritime Etaploise (C.M.E.) Producer Organisation	A French producer organization representing 45% of French landings, representing 44 active vessels including their owners, skippers, crew and ancillary services.
CRPMEM Nord	One of 14 French regional committees for marine fisheries and marine farming which manages licensing of commercial fishing.
Danish Fisheries Directorate	Part of the Danish Ministry of Food, responsible for ensuring biologically, environmentally and socially sustainable Danish fisheries
Danmarks Fiskeriforening	Danish Fishermen's Association
Demersal	Living on or near the sea bed.
Demersal trawl	A fishing net used by towing the trawl along or close to the sea bed.
Eastern Inshore Fisheries and Conservation Authority	A UK authority that license, regulate and plan commercial fisheries activities in the seas around England, with jurisdiction from 0 to 6 NM.
European Market Observatory for Fisheries and Aquaculture Products	An online database that enables direct monitoring of the weight, value and price of fishery and aquaculture products, from the first sale to retail stage, for EU countries, Norway and Iceland.
European Union Data Collection Framework	An EU framework for the collection and management of fisheries data
Fish stock	Any natural population of fish which is an isolated and self-perpetuating group of the same species.
Fishery	A group of vessel voyages which target the same species or use the same gear;
Fishing ground	An area of water or sea bed targeted by fishing activity.
Fishing mortality	Mortality due to fishing; death or removal of fish from a population due to fishing.
Fleet	A physical group of vessels sharing similar characteristics (e.g. nationality).
Fly shooting	A fishing net consisting of a conical net with two long wings with a bag where the fish collect. Drag lines extend from the wings, and are long so they can surround an area. A seine boat drags the net in a circle around the fish, the motion of the drag lines herds the fish into the central net.
From Nord	A French non-cooperative producer organization, legally in the form of an association, representing 40% of all French quotas (on average across all species) and specifically 61% of sole *Solea solea* quota.
Gear type	The method / equipment used for fishing.
German Federal Ministry for Food, Agriculture and Consumer Protection (BMELV)	A cabinet-level ministry of the Federal Republic of Germany responsible for German fisheries.
Gill net	Fishing net set vertically in the water so that fish swimming into it are entangled by the gills in its mesh.
ICES statistical rectangles	Defined areas, 1 degree longitude x 0.5 degree latitude equalling approximately 30 x 30 NM used for fisheries statistics.
Industrial fishery	Highly mechanised commercial fishing operations whose ultimate products are principally fish meal and fish oil.
L'Institut Français de Recherche pour l'Exploitation de la Mer (IFREMER)	A French research institute for the exploitation of the sea.
Landings	Quantitative description of amount of fish returned to port for sale, in terms of value or weight.
Landings per unit effort	The weight of landings per unit of effort used to catch those landings, e.g. 2 kg per pot for brown crab landed by a potting vessel.
Marine Management Organisation	A UK government department that license, regulate and plan commercial fisheries activities in the seas around England, with jurisdiction from 0 to 12 NM.
Maximum sustainable yield	Maximum sustainable yield (MSY) is the largest yield (catch, in tonnes) that can be taken from a specific fish stock over an indefinite period under constant environmental conditions. Fishing at MSY levels should ensure the capacity of the stock to continue to produce this level in the long term.
Metier	A homogenous subdivision, either of a fishery by vessel type or a fleet by voyage type.
Minimum Landing Size	Is a technical measure that limits the size of fish or shellfish species that can be legally landed and sold. The MLS varies per species. With the implementation of the Landings Obligation, the existing MLS are changed into minimum conservation reference sizes (MCRS), but they will remain largely the same.
National Federation of Fishermen's Organisations	A UK organisation comprised of members from Producers' Organisations, fishermen's groups and individuals, representing fishermen in England, Wales, Northern Ireland and the Channel Islands.
Norwegian Directorate of Fisheries	A Norwegian government agency responsible for Norwegian fisheries.
Otter trawl	A net with large rectangular boards (otter boards) which are used to keep the mouth of the trawl net open. Otter boards are made of timber or steel and are positioned in such a way that the hydrodynamic forces, acting on them when the net is towed along the seabed, pushes them outwards and prevents the mouth of the net from closing.
Pelagic	Of or relating to the open sea.
Pelagic trawl	A net used to target fish species in the mid water column.
Precautionary Biomass Reference Point	Precautionary reference point for biomass as defined in fisheries management plans.
Recruitment	Recruitment can be defined as the number of fish surviving to enter the fishery or to some life history stage such as settlement or maturity.

Term	Definition
Rederscentrale	The only Belgian producer organization, an umbrella organization led by a Board of Directors, representing Belgian vessel owners and members.
Scallop dredge	A method to catch scallop using steel dredges with a leading bar fitted with a set of spring loaded, downward pointing teeth. Behind this toothed bar (sword), a mat of steel rings is fitted. A heavy net cover (back) is laced to the frame, sides and after end of the mat to form a bag.
Shrimper	A vessel that predominantly targets shrimp.
Soak time	The duration of time that pots are left on the seabed in between hauls.
Spawning	The act of releasing or depositing eggs (fish).
Spawning stock biomass	The stock population of a species capable of reproducing.
Stock assessment	An assessment of the biological stock of a species and its status in relation to defined references points for biomass and fishing mortality.
String	A series of static fishing gear (pots) joined together to form a single deployable linear line of pots.
Sydvestjysk Fiskeriforening	Swedish Fishermen's Association
The Crown Estate	An independent commercial business, created by Act of Parliament that owns the UK seabed out to 200 NM.
Total Allowable Catches	Total Allowable Catches (TACs) are catch limits, expressed in tonnes or numbers, that are set for some commercial fish stocks.
Vessel Monitoring System	A system used in commercial fishing to allow environmental and fisheries regulatory organizations to monitor, minimally, the position, time at a position, and course and speed of fishing vessels.
VisNed	(Cošperatie Kottervisserij Nederland u.a.) a Dutch umbrella organisation of producer organisations, representing 75% of the Dutch Demersal Fishing interest.
Vivier	A fishing vessel, normally targeting crab, which has a tank on board allowing the catch to be stored live in water.
Wageningen Economic Research	A Dutch independent research institute, part of the Wageningen University & Research.
Year class	The individual animals of a single species of fish or shellfish that were born in any one-year.

Acronyms

Acronym	Description
AIS	Automatic Identification System
BMELV	German Federal Ministry for Food, Agriculture and Consumer Protection
DCF	Data Collection Framework
EC	European Council
EEC	European Economic Community
EEFPO	The East of England Fish Producers Organisation
EEZ	Exclusive Economic Zone
EIA	Environmental Impact Assessment
EU	European Union
EUMOFA	European Market Observatory for Fisheries and Aquaculture Products
FU	Functional Unit
ICES	International Council for the Exploration of the Sea
IFCA	Inshore Fisheries and Conservation Authorities
LEI	Wageningen Economic Research
LPUE	Landings per Unit Effort
MLS	Minimum Landing Size
MMO	Marine Management Organisation
NFFO	National Federation of Fishermen's Organisations
SSB	Spawning Stock Biomass
TAC	Total Allowable Catches
UK	United Kingdom
VMS	Vessel Monitoring System

Units

Unit	Description
€	Euro
fathom	fathom (1 fathom = 1.8288 m)
£	Great British pounds
£/kg	Great British pounds per kilogram
hours	hours
kg	kilograms
km	kilometres
m	meters
minutes	minutes
mm	millimetres
NM	Nautical Mile

1. Introduction

1.1 Context

1.1.1.1 DONG Energy Power (UK) Ltd. (hereafter referred to as DONG Energy), on behalf of DONG Energy Hornsea Project Three (UK) Ltd., is promoting the development of the Hornsea Project Three Offshore Wind Farm (hereafter referred to as Hornsea Three). Hornsea Three is a proposed offshore wind farm located in the southern North Sea, with a total generating capacity of up to 2,400 MW.

1.1.1.2 The purpose of this Commercial Fisheries Technical Report is to provide a detailed review of the commercial fisheries fleets that operate within and adjacent to Hornsea Three on a country basis including the United Kingdom (UK), Netherlands, France, Belgium, Denmark, Germany, Sweden and Norway.

1.1.1.3 An overview of the baseline presented in this Commercial Fisheries Technical Report, together with the impact assessment, cumulative and transboundary impact assessment are provided within volume 2, chapter 6: Commercial Fisheries. Details of the commercial fisheries study area, legislation and guidance, consultation undertaken to date, data sources, methodology for data collection and analysis of Vessel Monitoring System (VMS) data are also included within volume 2, chapter 6: Commercial Fisheries.

1.2 Commercial Fisheries Study area

1.2.1.1 The former Hornsea Zone is within the southwest portion of the International Council for the Exploration of the Sea (ICES) Division 4b (Central North Sea) and lies outside the 12 nautical miles (NM) limit in UK Exclusive Economic Zone (EEZ) waters. For the purpose of recording fisheries landings, ICES Division 4b is divided into statistical rectangles, which are consistent across all Member States operating in the North Sea.

1.2.1.2 From a commercial fisheries perspective, the study areas are defined by the ICES statistical rectangles that Hornsea Three overlaps (Figure 1.1). The commercial fisheries study areas are defined as follows:

- Hornsea Three array area commercial fisheries study area: ICES rectangle 36F2;
- Hornsea Three offshore cable corridor commercial fisheries study area: ICES rectangles 36F2, 36F1, 35F1 and 34F1; and
- Regional commercial fisheries study area: ICES rectangles: 37F0 to F3, 36F0 to F3, 35F0 to F3 and 34F0 to F3.

1.3 Data sources and methodology

1.3.1 Data sources

1.3.1.1 A number of data sources have informed the commercial fisheries Environmental Impact Assessment (EIA). In particular, five forms of data sources have been key in the assessment:

- Landing statistics for fisheries operating within the regional commercial fisheries study area (2011 to 2015). Data for UK landings primarily sourced from the Marine Management Organisation (MMO) and Eastern Inshore Fisheries and Conservation Authority (EIFCA)) and data for non-UK landings sourced from European Union (EU) Data Collection Framework (DCF);
- Price data for non-UK Member States sourced from European Market Observatory for Fisheries and Aquaculture Products (EUMOFA) for 2011 to 2015;
- Surveillance data for all vessel lengths and nationalities (2011 to 2015);
- VMS data for vessels ≥ 15 m (2010 for Belgian, French, Danish, German and Norwegian (noting that 2010 is the latest data set for this information) and 2011 to 2015 for UK and Dutch); and
- Consultation with UK inshore and offshore fisheries and European offshore fisheries.

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

1.3.1.3 In addition surveys carried out across the Hornsea Three array area and the offshore cable corridor (in particular see volume 2, chapter 2: Benthic Ecology, volume 2, chapter 3: Fish and Shellfish Ecology and volume 2, chapter 7: Shipping and Navigation for details), include:

- Benthic ecology surveys;
- Geophysical surveys;
- Commercial fisheries scouting surveys; and
- Automatic Identification System (AIS) and radar surveys.

1.3.1.4 Many sources of literature have also been reviewed in the preparation of the commercial fisheries EIA. A full list of references is provided at the end of this technical report and cited within the text where appropriate. A summary of the data sources is provided in Table 1.1.

1.3.1.5 A full description of the data sources and associated limitations used within the commercial fisheries EIA is provided within volume 2, chapter 6: Commercial Fisheries.

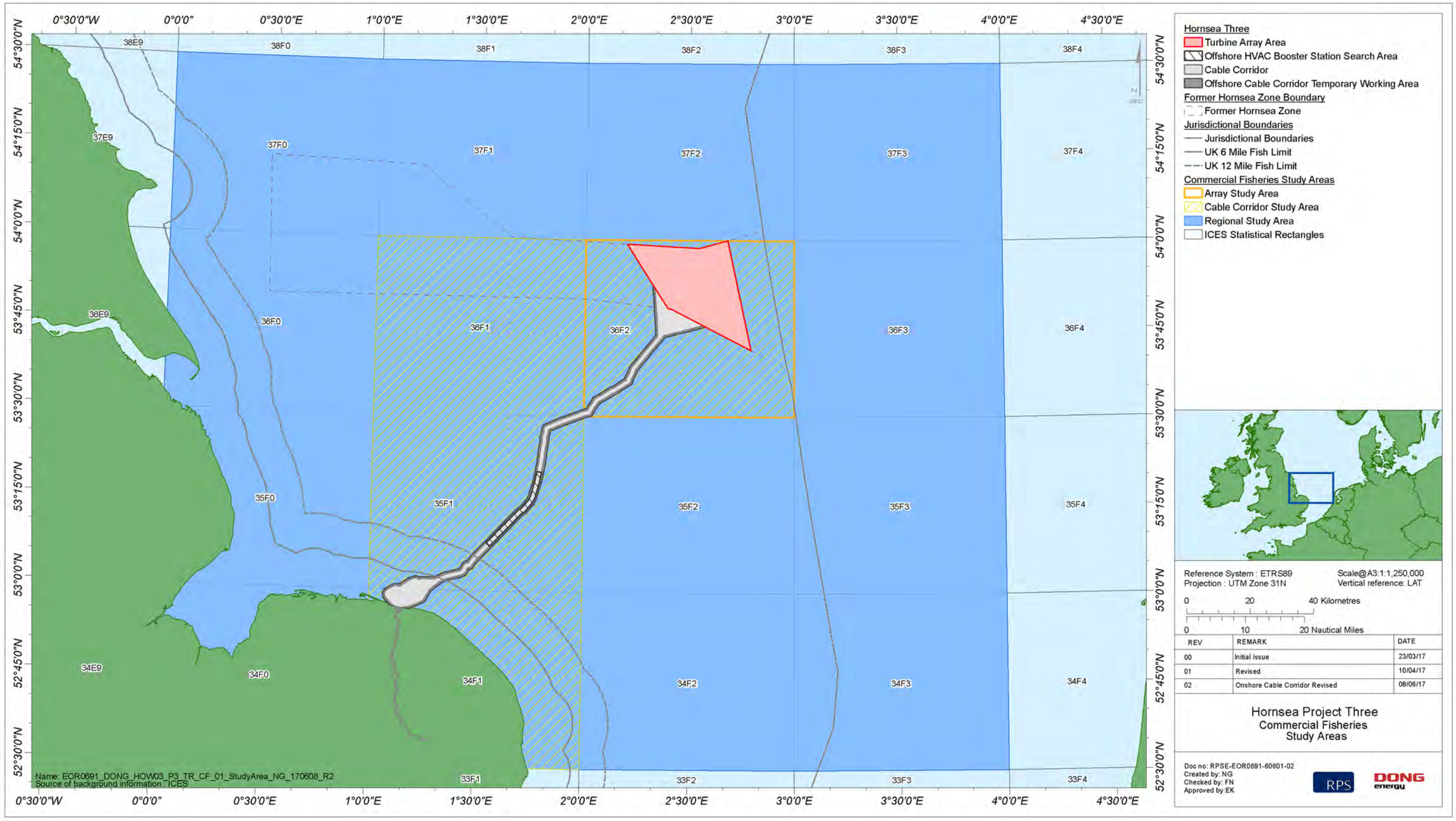

Figure 1.1: Commercial fisheries study areas for Hornsea Three.

Table 1.1: Data sources utilised to inform the commercial fisheries EIA.

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.	2011 to 2015	Marine Management Organisation
	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.	2011 to 2015	
	Surveillance data with data query attributes for: sighting date; ICES rectangle; ICES subsquare; latitude; longitude; vessel/gear type; activity; nationality; course; speed; and number of sightings.	2011 to 2015	
	Monthly Shellfish Activity Returns data for: UK vessels landing shellfish species caught within EIFCA jurisdiction.	2006 to 2015	Eastern Inshore Fisheries and Conservation Authority
Europe	Landings statistics for Belgian, Danish, Dutch, French, German, Swedish and UK registered vessels for: landing year; quarter; ICES rectangle; vessel length; gear type; species and landed weight (tonnes).	2003 to 2015	European Union Data Collection Framework
	Price data for species landed by Belgian, Danish, Dutch, French, German and Swedish registered vessels for: landing year; species; price (€per kg)	2011 to 2015	European Market Observatory for Fisheries and Aquaculture Products
	Vessel Monitoring System data for Belgian, Danish, Dutch, French, German, and Norwegian registered vessels with attributes for time fishing at a resolution of 1/200th of an ICES rectangle amalgamated for all mobile vessels. 2010 represents the latest data set available for this information.	2010	Marine Management Organisation
	Commercial fishing activity density mapping across the former Hornsea Zone for beam trawl and demersal otter trawl.	1985 to 2010	The Crown Estate
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
	Vessel Monitoring System data for Dutch registered vessels with data attributes presented graphically for: year; gear type; effort in hours fishing to a resolution of 1/200th ICES rectangle.	2011 to 2015	
France	Mapping of effort (hours fishing) for demersal and combined demersal/pelagic otter trawling (French data provided in response to the consultation on The Crown Estate Round 3 UK offshore wind proposal). 2008 represents the latest data set available for this information.	2008	French National Committee for Maritime Fisheries and Aquaculture (CNPMEM)
Belgium	Landing statistics data for Belgian registered vessels with data query attributes for: ICES rectangle and value. 2009 represents the latest data set available for this information.	2009	Rederscentrale
Denmark	Vessel Monitoring System data for Danish registered vessels with positional data points presented graphically for: year; gear type. 2010 represents the latest data set available for this information.	2010	Danish Fisheries Directorate
	Maps of key sandeel grounds based on vessel tracking plots from Danish registered vessels.	1985 to 2010	Danish Fishermen's Association
Germany	Vessel Monitoring System data for German registered vessels with positional data points presented graphically for: year; gear type. 2010 represents the latest data set available for this information.	2010	German Federal Ministry for Food, Agriculture and Consumer Protection (BMELV)
Norway	Vessel Monitoring System data for Norwegian registered vessels with positional data points presented graphically for: year; gear type. 2010 represents the latest data set available for this information.	2010	Norwegian Directorate of Fisheries

2. Key Species and Fishing Gears

2.1 Key species

2.1.1 Overview of regional landings

2.1.1.1 Average annual landings by all countries from the regional commercial fisheries study area is presented by species and landed weight in Figure 2.1.

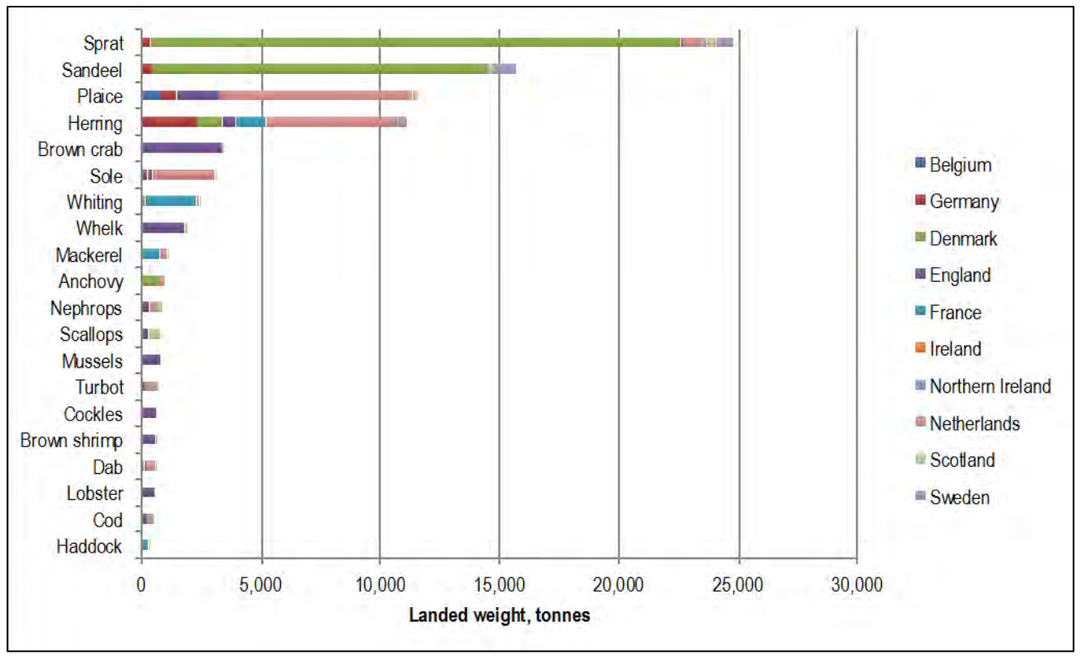

Figure 2.1: Average annual landed weight, tonnes, of species landed by all EU member states from the regional commercial fisheries study area (based on five-years' data from 2011 to 2015) (data source: EU DCF database, 2017).

2.1.1.2 By weight sprat *Sprattus sprattus* and sandeel *Ammodytes* species caught by Danish vessels dominate the landings, followed by plaice *Pleuronectes platessa*, herring *Clupea harengus* and sole *Solea solea* that are primarily landed by Dutch vessels. Brown crab *Cancer pagurus* is the top shellfish species to be landed, followed by whelk *Buccinum undatum*, which are both targeted by English vessels. Whiting *Merlangius merlangus* is almost entirely landed by the French fleet.

2.1.2 Total Allowable Catch (TAC) and quotas

2.1.2.1 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 2.2. 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: sole, plaice, turbot *Scophthalmus maxima* (including brill *Scophthalmus rhombus*), dab *Platichthys flesus,* sprat, sandeel and *Nephrops Nephrops norvegicus*.

2.1.2.2 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 Inshore Fisheries and Conservation Authorities (IFCA) that control fisheries out to 6 NM. From 6 NM to 12 NM, non-UK vessels may fish if they have acquired historical rights to do so. Outside 12 NM, international vessels are permitted to fish subject to quota allocation and other EU level restrictions including technical gear measures and effort restrictions such as days at sea.

2.1.3 Demersal finfish

Sole and plaice

2.1.3.1 Sole TAC is set for the stock across the North Sea, Norwegian Sea and Spitsbergen and Bear Island. Countries that have been allocated a quota from this TAC can fish for sole within ICES Divisions 4a, b and c and 2a and b. In 2015 Netherlands had 75% of quota allocation for the sole stock defined in area 4 and 2; Belgium had 8%, Germany 7%, UK 4%, Denmark 4% and France 2% (Table 2.1).

2.1.3.2 Plaice TAC is set for the stock areas across the North Sea and Norwegian Sea, allowing plaice to be caught from 4a,b,c and 2a. In 2015 Netherlands had 36% of quota allocation for the plaice stock defined in area 4 and 2a; UK had 27%, Denmark 19%, Belgium 6%, Germany 5% and France 1% (Table 2.1).

2.1.3.3 Sole and plaice are primarily caught by the beam trawl fleet working with 80 mm mesh nets. Days-at-sea regulations, high oil prices, and different patterns of TACs changes between plaice and sole have led to a transfer of fishing effort from the northern (4a) to the central and southern North Sea (4b and 4c), where sole tend to be primarily distributed (ICES, 2011; ICES 2016a).

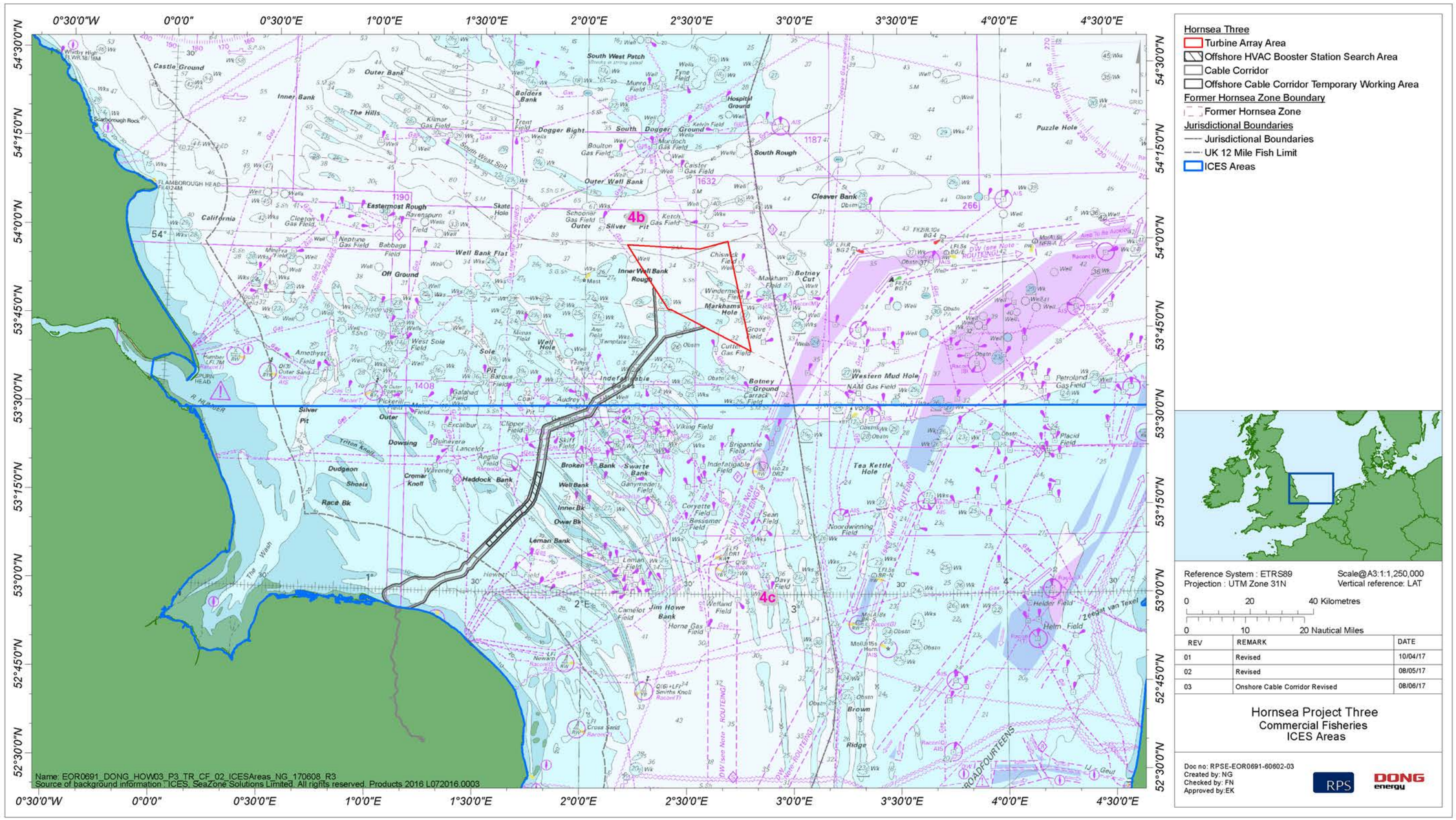

Figure 2.2: ICES Divisions for EU fisheries management purposes across the UK and wider (Source: EU, 2017).

Table 2.1: Total Allowable Catch (TAC) and quotas in tonnes per country for key species landed from the regional commercial fisheries study area for 2015 (Source: EU, 2016).

Species	ICES Division	TAC	Belgium	Denmark	Germany	France	Netherlands	UK	Sweden
Dab	2a, 4	18434	503	1,888	2,832	196	11,421	1,588	6
		Proportion	3%	10%	15%	1%	62%	9%	<0.1%
Herring	2a, 4, 7d	15744	78	15,072	78	78	286	74	0
		Proportion	0.5%	96%	0.50%	0.5%	2%	0.5%	0%
Nephrops	2a, 4	17,843	933	933	14	27	480	15,456	0
		Proportion	5%	5%	0.1%	0.2%	3%	87%	0%
Plaice	2a, 4	128,376	7,365	23,938	6,905	1,381	46,035	34,066	0
		Proportion	6%	19%	5%	1%	36%	27%	0%
Sandeel	2a, 3a, 4	207,219	0	195,471	298	0	0	4,273	7,177
		Proportion	0%	94%	0.1%	0%	0%	2%	3%
Sole	2, 4	11,900	991	453	793	198	8,945	510	0
		Proportion	8%	4%	7%	2%	75%	4%	0%
Sprat	2a, 4	227,000	2,506	198,375	2,506	2,506	2,506	8,271	1,330
		Proportion	1%	87%	1%	1%	1%	4%	1%
Turbot (incl. brill)	2a, 4	4,642	340	727	186	88	2,579	717	0
		Proportion	7%	16%	4%	2%	56%	15%	0%
Whiting	2a, 4	13678	280	1,209	314	1,817	699	8,739	2
		Proportion	2%	9%	2%	13%	5%	64%	<0.1%

[Note: sandeel TAC and quotas are presented for 2014, as 2015 TAC was set at zero due to scientific advice related to stock abundance].

2.1.3.4 Plaice is predominantly caught in the central part of the North Sea (4b) across the Dogger Bank, which is north of the former Hornsea Zone. However, across the regional commercial fisheries study area, plaice is taken within the mixed fishery targeting sole. The North Sea plaice stock is well within precautionary boundaries, and has reached its highest levels in recorded history since 1957. Recruitment has been around the long-term average from 2005 onwards.

2.1.3.5 When setting TACs the European Commission is informed by scientific stock assessments and advice provided by ICES on an annual basis. Sole and plaice stocks in the North Sea are currently considered by ICES to be harvested sustainably (fishing mortality is below precautionary reference points and at levels that support maximum sustainable yield) (ICES, 2016a, ICES 2016b). The biomass levels of sole and plaice stocks in the North Sea are considered to be at full reproductive capacity and above maximum sustainable yield (ICES, 2016a, ICES 2016b).

2.1.3.6 Landing statistics for the regional commercial fisheries study area indicate that sole landings peak from July to December (Figure 2.3). Since plaice is often taken as bycatch from the sole fishery, landings also peak during the same period (i.e. from July to December) (Figure 2.3).

Turbot and brill

2.1.3.7 Turbot TAC has been set in combination with brill in the North Sea and Norwegian Sea. Combined TACs for two different species makes effective control of the single species exploitation rates difficult and could lead to the overexploitation of either species (ICES, 2015a). For turbot, ICES report that fishing mortality has been increasing since 2006, while spawning-stock biomass (SSB) has decreased and in recent years (2010-2015) has stabilised at a low level. ICES consider that the North Sea turbot stock is at a historical low level and is likely to be below safe biological limits (ICES, 2015a). Many parameters within the brill ICES assessment are undefined due to a lack of information, however, the stock is considered to be generally stable based on landing trends and a stock size index calculated from landings per unit effort (LPUE) from the Dutch beam trawl fleet (ICES, 2015b).

2.1.3.8 Turbot and brill are mainly bycatch species in the sole and plaice beam trawl fishery and demersal otter trawl fishery.

Sandeel

2.1.3.9 Sandeel are largely stationary after settlement and there is a complex of local (sub) stocks in the North Sea. There are indications that the survival of sandeel larvae is linked to the availability of copepod prey in the early spring, especially *Calanus finmarchicus*. Sandeel are taken by trawlers using small-mesh demersal gear. The fishery is seasonal, taking place mostly in the spring and early summer (Figure 2.3). Most of the catch consists of *Ammodytes marinus*, but other sandeel species are caught as well including *A. tobianus*.

2.1.3.10 To avoid local depletion, ICES advice for sandeel is provided for seven areas in Division 3a and 4. The former Hornsea Zone is located within Sandeel Area 1 - Dogger Bank. Fishing mortality in Sandeel Area 1 has decreased from 2009 onwards. Spawning stock biomass levels were very low (and below the limit reference point) from 2013 to 2015, but since then have increased likely linked to above-average recruitment in 2016 (ICES, 2017). TACs in 2016 were advised to be zero, with provision for quantities taken for stock survey purposes. Due to improved spawning-stock biomass levels and good recruitment in 2016, the maximum sustainable yield approach allowed a TAC to be set in 2017.

2.1.3.11 Denmark has 94% of the TAC in the North Sea, Norwegian Sea, Skagerrak and Kattegat; with Sweden (3%) and UK (2%) holding the remainder (Table 2.1).

Whiting

2.1.3.12 Whiting are commonly found on mud and gravel bottoms, but also on sand and rock. Whiting migrate to the open sea after the first year of life (Cohen *et al*., 1990). 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, spawning stock biomass is at full reproductive capacity and has been fluctuating around the ICES maximum sustainable yield reference point for biomass since 2008 (ICES, 2016c).

2.1.3.13 The UK has 64% of the TAC, followed by France with 13% and Germany with 9%. Whiting are targeted by demersal otter trawlers as part of targeted and mixed demersal fisheries.

2.1.4 Pelagic finfish

Sprat

2.1.4.1 Sprat in the North Sea is short-lived and the catch is dominated by young fish. The stock size is mostly driven by the recruiting year class; for example the fishery in 2015 was dependent on the 2015 incoming year class. The majority of the sprat landings are taken in the Danish industrial trawl fishery, with Denmark holding 87% of the TAC set for the North Sea and Norwegian Sea (Table 2.1).

2.1.4.2 Recruitment since 1986 has been more stable than is often the case for short-lived species, with recruitment in 2015 estimated to be above the long term average (ICES, 2016d). The fishery is seasonal with landings mostly in late autumn and winter (Figure 2.3).

Herring

2.1.4.3 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. Spawning usually occurs on gravel or rock bottoms (Whitehead, 1985).

2.1.4.4 Despite below average recruitment from 2003 to 2013, herring in the North Sea, Skagerrak, Kattegat and eastern English Channel are at full reproductive capacity and considered to be harvested sustainably (ICES, 2016e).

2.1.4.5 The majority of the herring landings are taken in the Danish pelagic trawl fishery, with Denmark holding 96% of the TAC (Table 2.1). The fishery is seasonal with landings mostly in late autumn and winter.

2.1.5 Shellfish

European lobster

2.1.5.1 European lobster *Homarus gammarus* (hereon referred to as 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.

2.1.5.2 Lobsters are caught by pots and there are no TACs or quotas in place. Primary management is by the technical measure of a Minimum Landing Size (MLS) of 87 mm (Council Regulation 850/98). 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 Eastern IFCA from 0 to 6 NM and the MMO from 6 to 12 NM.

2.1.5.3 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, thought to be due to habitat limitations (Welby, 2015).

2.1.5.4 Lobster is one of the highest value per kg, 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).

Brown crab

2.1.5.5 Brown crab is a long-lived, large decapod crustacean. Brown crabs are very productive animals and each female can hatch between 1 and 4 million eggs. Post larvae are known to settle inshore and juvenile crabs are more common in shallow waters. Adult crabs undertake extensive migrations, which may be associated with their reproductive cycle.

2.1.5.6 As with lobster, brown crab are predominately targeted by the UK potting fleet located along the North Norfolk coast, under jurisdiction of the Eastern IFCA from 0 to 6 NM and the MMO from 6 to 12 NM.

2.1.5.7 A stock assessment undertaken by the Eastern IFCA in 2015 describes the main season for brown crab as starting in late March to early April with peak landings in May and June and falling through late September or early October (Welby, 2015). However, ladings data for the regional commercial fisheries study area shows brown crab to be landed in highest quantities from July to December (Figure 2.3). Brown crab is found across a wide range of habitat types, ranging from rocky reefs to soft mud and sand. As with lobster, studies have revealed a smaller average size in brown crab in North Norfolk when compared to adjacent areas, thought to be due to migration patterns and recruitment regimes (Eaton 2003). From hatching it takes approximately four years for a brown crab to recruit to the fishery.

2.1.5.8 As with lobster, brown crab are caught by pots and have no TACs or quotas in place. Brown crab is primarily managed by a MLS, which is set at 130 mm carapace width for areas 6 to 12 NM (Council Regulation 850/98) and 115 mm carapace width for areas 0 to 6 NM (due to a derogation for Eastern IFCA jurisdiction to reflect the smaller individuals typical of the Norfolk population).

2.1.5.9 A stock assessment undertaken by the Eastern IFCA in 2015 found that trends in effort and landings for brown crab and lobster in the district were stable or displaying an increasing trend and indicated no cause for immediate concern (Welby, 2015). However, based on length converted catch curve and yield per recruit analysis Welby (2015) found that:"…fishing effort in the North Norfolk fishery was above biological reference points (F_{max} and $F_{0.1}$) suggesting that growth overfishing is occurring. Changes to fishing patterns required to meet reference targets were calculated, suggesting that substantial reductions to fishing mortality may be necessary to achieve sustainability in the fishery." With recommendations to improve data collection including the resolution of areas fished and consideration of implications of potential management measures.

Common whelk

2.1.5.10 Common whelk are found across a range of habitats including muddy sand, gravel and rock. Whelk are caught using plastic pots often deployed by the same potting vessels that target crab and lobster. Consultation with the industry indicates that vessels tend to move from crab and lobster in the summer/autumn, to target whelk in the late autumn and winter months. However, landings data illustrate peaks in the first half of the year (Figure 2.3). Whelk are cleaned and frozen raw in-shell to be exported to the far east. The fishery is very dependent on market conditions and prices.

2.1.5.11 No TAC or quotas are in place for whelk. A MLS of 45 mm is in place outside 6 NM (Council Regulation 850/98), while a minimum legal size of 55 mm is defined for 0 to 6 NM through the Eastern IFCA Whelk Permit Byelaw, 2016. The permit scheme limits vessels to 500 pots each when fishing within Eastern IFCA jurisdiction.

Brown shrimp

2.1.5.12 Brown shrimp *Crangon crangon* (also known as common shrimp) are found mainly in shallow inshore waters and are fast growing with a relatively short lifespan (four to five years). Shrimp fisheries have high recoverability and low vulnerability to fisheries exploitation, due to rapid maturation. Beam trawlers in the inshore waters, specifically in the Wash, target brown shrimp.

2.1.5.13 No TAC or quotas are in place and there is no legal minimum landing size for brown shrimp in the EU. The shrimp fishery is principle managed by the Eastern IFCA Byelaws; in addition, an Eastern IFCA Shrimp Permit Scheme is expected to be implemented imminently.

Nephrops

2.1.5.14 *Nephrops* (known as langoustine, prawn and Norway lobster, hereon referred to as *Nephrops*) are limited to muddy habitats and therefore stock assessments are based on nine separate Functional Units (FUs) within the North Sea. The regional commercial fisheries study area lies across part of the Botney Gut – Silver Pit FU. The *Nephrops* fisheries in the Botney Gut are solely bottom trawl fisheries.

2.1.5.15 The UK holds 87% of the quota for the North Sea and Norwegian Sea; there are no restrictions in terms of which North Sea FUs this quota can be taken from. The state of this stock is unknown. Preliminary stock surveys (2010 and 2012) indicate relatively high density compared to neighbouring FUs (ICES 2016f). Landings peak during summer months (Figure 2.3).

Scallop

2.1.5.16 Scallop (including king scallop *Pecten maximus* and queen scallop *Aequipecten opercularis*) are most common in water depths of 20 to 70 m, in areas of clean firm sand and fine gravel exposed to water currents, which provide good feeding conditions. Recruitment is usually unpredictable as it depends not only on successful spawning and larval production but also on retention of larvae or transport of larvae into areas suitable for settlement. Settlement in a particular area may be unpredictable leading to an unstable age structure. As a consequence of this, scallop beds frequently show a regional separation of year classes and spatial variability in age structure.

2.1.5.17 Scallop are targeted by dredgers and there are no TACs or quotas in place with this species, therefore this species is primarily managed by a MLS of 100 mm for king scallop and 40 mm for queen scallop (Council Regulation 850/98). As indicated within VMS data, scallop dredgers operate to the west of, and well outside of the former Hornsea Zone. Scallop dredgers are not known to routinely fish across the Hornsea Three offshore cable corridor or array area.

Mussels and other shellfish

2.1.5.18 Intertidal mussel *Mytilus edulis* stocks in the Wash were traditionally harvested for direct sale or relayed within Several Order areas, including within the Blakeney Harbour Fishery Order 1966 (Several Order) and The Wash Fishery Order 1992 (Hybrid Order). However, the abundance of mussels has undergone significant decreases since 1980s, resulting in relatively small fisheries being open since 2009, and none at all in 2015 (Jessop, 2015).

2.1.5.19 The Wash Fishery Order regulates mussel, oyster, cockle, clam, king scallop and queen scallop fisheries. It is located 35 km west of Hornsea Three offshore cable corridor.

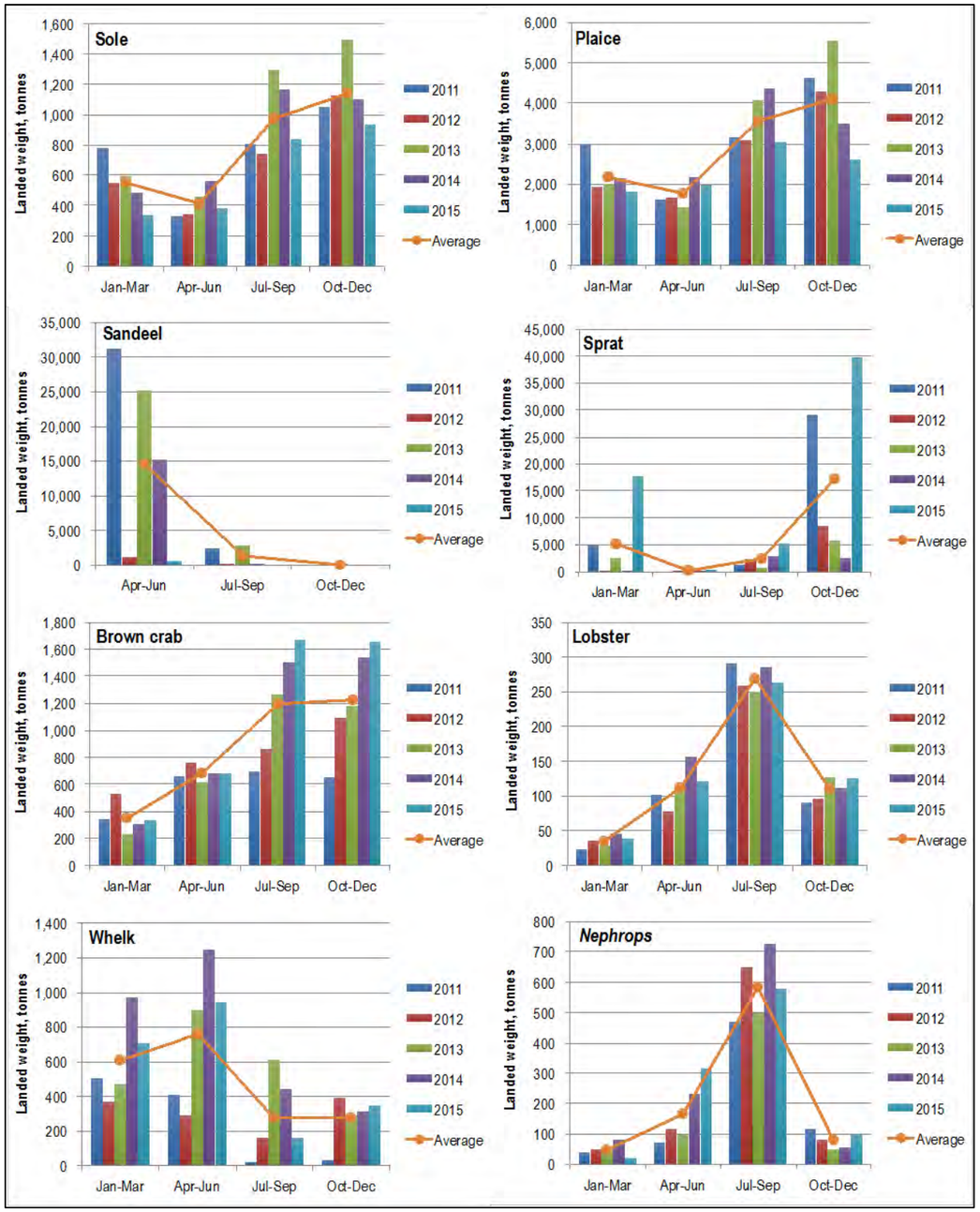

Figure 2.3: Seasonality of total landings (tonnes) by Belgium, Denmark, France, Germany, Ireland, Netherlands, Sweden and UK by species from 2011 to 2015 for the regional commercial fisheries study area (Data source: EU DCF database, 2017).

2.2 Key gears

2.2.1.1 There are three descriptive units used for defining fisheries (Marchal, 2008):

- Fishery – a group of vessel voyages which target the same species or use the same gear;
- Fleet – a physical group of vessels sharing similar characteristics (e.g. nationality); and
- Métier – a homogenous subdivision, either of a fishery by vessel type or a fleet by voyage type.

2.2.1.2 Vessel and gear types within the key fleets and fisheries that operate across the regional commercial fisheries study area are described within this section.

2.2.2 Beam trawl

Beam trawlers targeting flatfish

2.2.2.1 Figure 2.4 shows a typical beam trawler and associated gear and Table 2.2 describes the profile of beam trawling vessels active across the regional commercial fisheries study area. Since 2011, the use of pulse trawls in the Dutch fishery has increased sharply to 74 vessels (of which 65 > 221 kW) and only eight vessels operating with traditional beam trawls are now left (ICES, 2016a).

Table 2.2: Profile of typical beam trawling vessels active across regional commercial fisheries study area, targeting flatfish and brown shrimp.

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.

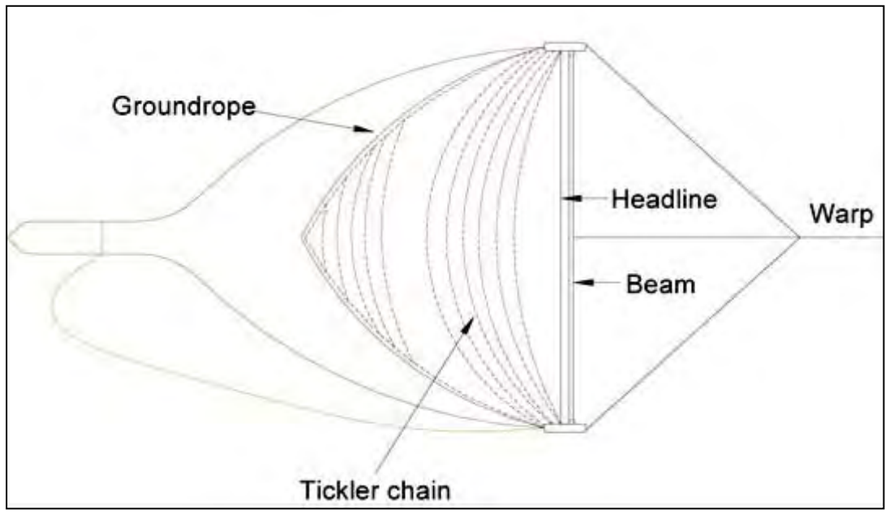

Figure 2.4: Typical beam trawler vessel and gear diagram (Sources: Visserijnieuws, 2010; FAO, 2005).

2.2.2.2 Beam trawl gear is used to target flatfish such as sole and plaice, which are often somewhat buried in the seabed. Traditional beam trawls use tickler chains to scare the flatfish into the net. Pulse beam trawls replace tickler chain with drag wires through which electric impulses are sent, which stimulate the fish out of the seabed and into the net. Pulse beam trawl uses less fuel and has less seabed disturbance as drag wires do not penetrate the seabed.

2.2.2.3 Catches with beam trawl form the bulk of the annual landings (70% by value) from the Hornsea Three array area commercial fisheries study area with the main target species being sole and plaice. These demersal flatfish species are not regarded as shoaling species; therefore fishing effort is spread over a wide area and across various grounds throughout the North Sea.

2.2.2.4 It is recognised that in some cases, significant investments in quota have been made by vessels registered to other EU Member States in order to fish for these species within ICES Division 4b.

Beam trawlers targeting brown shrimp

2.2.2.5 There are approximately 60 UK registered beam trawling vessels that actively target brown shrimp 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 Figure 2.4. Vessels operate principally in inshore waters, normally from 0 to 6 NM and are from 7 m to 18 m in length.

2.2.3 Demersal otter trawl

2.2.3.1 Figure 2.5 shows a typical UK demersal trawler and associated gear and Table 2.3 describes the profile of demersal otter trawling vessels active across the regional commercial fisheries study area.

2.2.3.2 Vessel numbers vary and their presence is dependent upon the success of demersal and/or *Nephrops* catches elsewhere. Important *Nephrops* grounds are located within the Outer Silver Pit, which extends into the north section of Hornsea Three array area, and within Markhams Hole, which extends into the central section of the Hornsea Three array area. Demersal trawlers operating across the regional commercial fisheries study area tend to tow in directions which are in line with natural seabed contours.

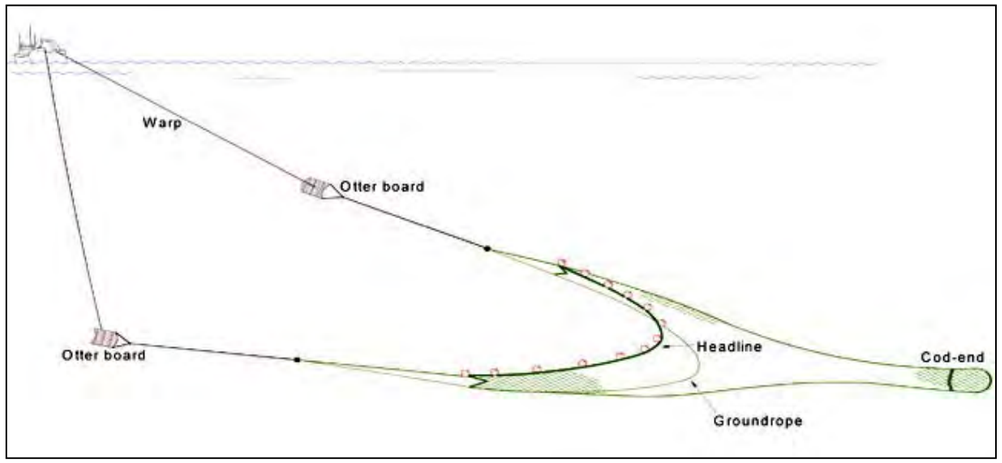

Figure 2.5: Typical demersal otter trawler vessel and gear diagram (Sources: Visserijnieuws, 2010; FAO, 2005).

Table 2.3: Profile of typical demersal otter trawling vessels active across regional commercial fisheries study area.

Demersal trawling profile	
Main Target species	*Nephrops*, plaice, cod *Gadus morhua*, haddock *Melanogrammus aeglefinus*, and whiting
Nationality	UK, Dutch, Belgian, Danish, 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.

2.2.4 Fly shooting

2.2.4.1 Figure 2.6 shows a typical fly shooting vessel and associated gear and Table 2.4 describes the profile of fly shooting vessels active across the regional commercial fisheries study area.

2.2.4.2 Fly shooting, also known as fly dragging and Scottish seine, is a skillful method of fishing requiring extensive knowledge in locating fish within the grounds, accurate rigging of the gear, and consideration of tidal streams in relation to the gear throughout the shooting, towing and hauling operation (Seafish, 2015). In setting the gear, an end of rope is shot attached to a dhan (buoy). The vessel then steams round in a circular shaped course shooting rope, the net and more rope, completing the circle by picking up the dhan and beginning to winch the gear. The vessel will gradually start to tow the gear during the hauling process by steaming ahead slowly at approximately 0.5 knots. Each hauling and shooting routine will take about an hour and a half to three hours.

2.2.4.3 There has been a resurgence in fly shooting within the Dutch fleet, with approximately 12 vessels deploying this gear across the North Sea region. This form of fishing is very fuel efficient and for a number of stocks is certified to the Marine Stewardship Council (MSC) standard and thereby favored over beam trawling, which has not been MSC certified.

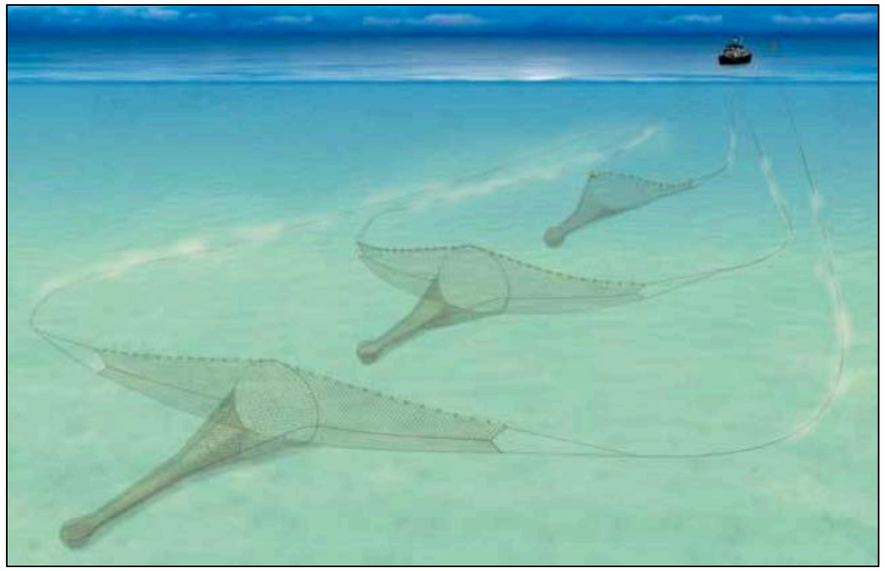

Figure 2.6: Typical fly shooting gear.

Table 2.4: Profile of typical fly shooting vessels active across regional commercial fisheries study area.

Fly shooting profile	
Main Target species	Sole, plaice, cod, haddock, and whiting
Nationality	Dutch
Vessel length	25 m to 35 m
Horsepower	300 hp to 850 hp
Typical towing speed	0.5 knots
Typical gear	Fly shooting, also called fly dragging or Scottish seine. Varies from Danish seine in that no anchor is set. In fly shooting long lengths of rope are used, up to 3 km per side, herding fish into the path of the net as the gear is hauled. Gear is shot from a dhan buoy, which is picked up prior to hauling the gear.

2.2.5 Industrial trawl

2.2.5.1 Industrial trawling is predominately defined by vessels targeting species that are used in animal feed, such as sandeels, sprat etc. Figure 2.7 shows a typical Danish industrial trawler and Table 2.5 describes the profile of industrial trawling vessels active across the regional commercial fisheries study area.

Figure 2.7: Typical industrial trawler vessel (Source: Visserijnieuws, 2010).

Table 2.5: Profile of typical industrial trawling vessels active across regional commercial fisheries study area.

Industrial trawling profile	
Main Target species	Sandeel
Nationality	Predominantly Danish but some UK
Vessel length	30 m to 50 m
Horsepower	500 hp to 1200 hp
Typical towing speed	2.5 to 5.0 knots
Typical gear	Demersal otter trawl. Large net with a small mesh. Two trawl doors approximately 1.25 tonne each hold the net open horizontally.

2.2.6 Potting

2.2.6.1 Figure 2.8 shows typical potting vessels and pots and Table 2.6 describes the profile of potting vessels active across the regional commercial fisheries study area.

Figure 2.8: Typical inshore potting vessels: top left: beach launched vessels in Cromer; bottom left: plastic whelk pots and crab and lobster pots; centre: catamaran and right: potting vessel moored at Wells-Next-the-Sea (Source: Poseidon).

Table 2.6: Profile of typical potting vessels active across regional commercial fisheries study area.

Potting profile	
Main Target species	Lobster, brown crab and whelk
Nationality	UK
Vessel length	Under 10 m, or 10 to 15 m
Horsepower	60 hp to 200 hp
Typical speed of shooting and hauling gear	0.0 to 9.0 knots
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).

2.2.6.2 The Hornsea Three offshore cable corridor commercial fisheries study area represents significant crab and lobster fishing grounds. The majority of potters are under 10 m or 10 to 15 m in length and operate as day boats; returning to port after hauling and re-setting fleets of pots. Pots are therefore not normally returned to shore, but left in the water.

2.2.6.3 Whelk are caught by pots that are small but heavy, often made from discarded plastic containers, or purpose built. The bottom of the plastic pot is weighted to ensure that the pot lands and remains upright on the seabed when it's fishing.

2.2.7 Scallop dredge

2.2.7.1 Figure 2.9 shows a typical scallop dredging vessel and Table 2.7 describes the profile of scallop dredging vessels active across the regional commercial fisheries study area. Scallop dredgers fish as the tooth bar of each dredge rakes through the sediment lifting out scallops and the spring-loaded tooth bar swings back, allowing the dredge to clear obstacles on the seabed. The dredges are held in a series on two beams, which are fished on each side of the vessel.

2.2.7.2 Based on VMS data, surveillance data and consultation with the industry, dredgers are not known to routinely fish across the Hornsea Three offshore cable corridor or array area, but are recorded to target areas west and inshore of the former Hornsea Zone. Occasionally they will target a wider area that overlaps with the Hornsea Three offshore cable corridor.

Figure 2.9: Typical scallop dredging vessel (Source: Poseidon).

Table 2.7: Profile of typical scallop dredging vessels active across regional commercial fisheries study area.

Scallop dredging profile	
Main target species	Scallop
Nationality	UK
Vessel length	10 m to 25 m
Horsepower	200 hp to 400 hp
Typical towing speed	2.0 to 6.0 knots
Typical gear	Normally operate with 8 to 10 dredges per side of vessel. Each dredge consists of a triangular frame leading to an opening, a tooth bar with spring loaded teeth, and a bag of steel rings and netting back.

Table 2.8: Profile of typical pelagic trawl vessels across the regional commercial fisheries study area.

Pelagic trawl profile	
Main target species	Herring, anchovy, mackerel, sprat
Nationality	Danish, Swedish
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.

2.2.8 Pelagic trawl

2.2.8.1 Figure 2.10 shows a typical pelagic trawl vessel and Table 2.8 describes the profile of pelagic trawl vessels active across the regional commercial fisheries study area.

2.2.8.2 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.

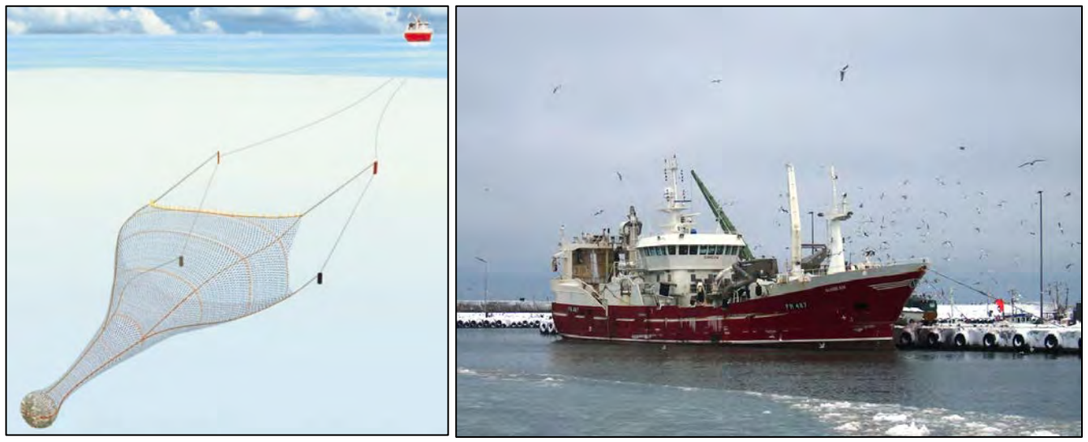

Figure 2.10: Typical pelagic trawl gear (Source: Galbraith *et al*., 2004) and vessel (Source: Poseidon).

3. UK Fisheries Activity Assessment

3.1 Hornsea Three array area

3.1.1 Landing trends, fishing grounds and key species

3.1.1.1 The trends in UK vessel landings by weight and value from the Hornsea Three array area commercial fisheries study area (ICES rectangle 36F2) are presented in Figure 3.1. In terms of surface area the Hornsea Three array area equates to 19% of the ICES rectangle area (i.e. 3,668 km^2 compared to 696 km^2), although it is noted that the landings cannot be equally proportioned based on aerial split as this does not take account of specific fishing grounds.

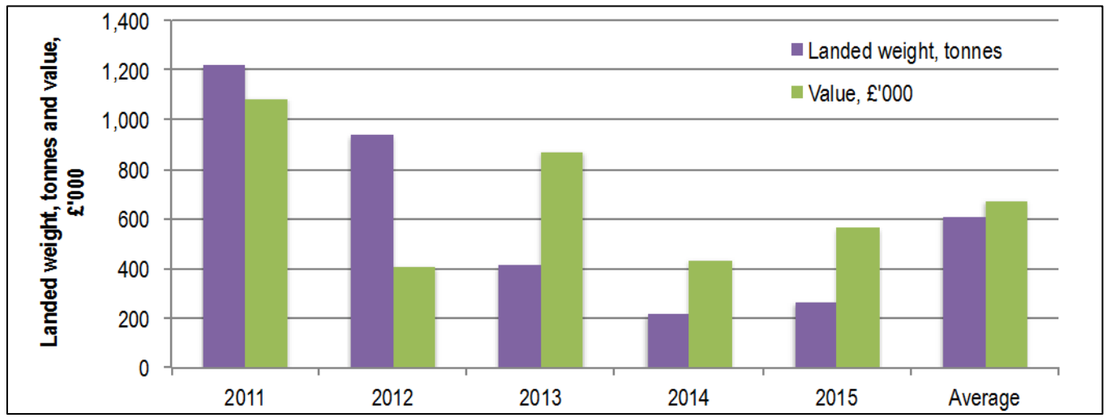

Figure 3.1: Landed weight and value of all landings by UK vessels from Hornsea Three array area commercial fisheries study area (ICES rectangle 36F2) from 2011 to 2015 (Date source: MMO, 2017).

3.1.1.2 The average annual value of all landings from 36F2 by UK registered vessels (including landings into UK and non-UK ports) was £670 k, with an average annual landed weight of just over 600 tonnes (based on five years data, 2011 to 2015; MMO, 2017). Landings were solely by vessels greater than 10 m in length.

3.1.1.3 A significant drop in landed weight is seen across 2011 to 2014, with a slight increase from 2014 to 2015. The significant decrease since 2011 is due to large pelagic landings of sprat (in 2011) and boarfish (in 2012), which are taken in large quantities, but are comparably lower in value. This is the reason for the shift in relationship between weight and value from 2013 onwards (i.e. lower quantities of higher value species are being landed from 2013 to 2015, compared to 2011 and 2012). Landings of pelagic species are more sporadic in nature due to the high mobility of schooling pelagic species.

3.1.1.4 Key species landed by UK flagged vessels include plaice, sole and turbot, targeted by beam trawl vessels; and *Nephrops* and mixed demersal species landed by demersal otter trawl (Figure 3.2). The beam trawl vessels are understood to be Dutch owned, but UK flagged and therefore presented within the UK dataset. Sprat and boarfish are open-water schooling fish and therefore caught by pelagic trawl and/or purse seine (and included within the demersal trawl/seine gear category within Figure 3.2).

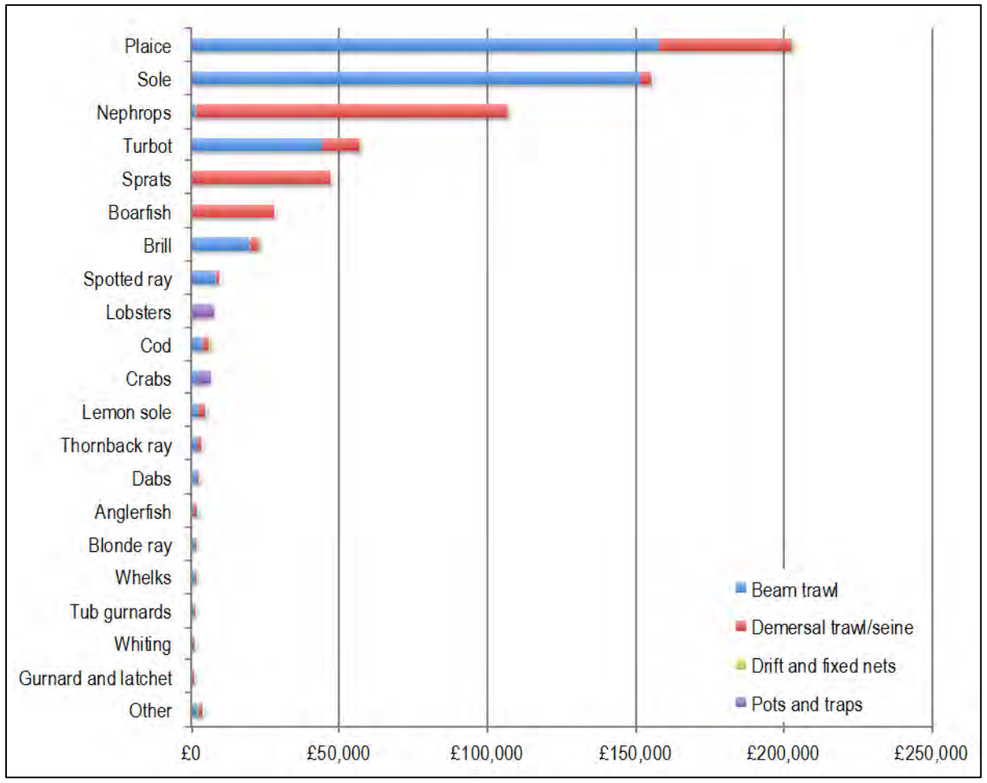

Figure 3.2: Average value (£) of all landings by UK vessels from Hornsea Three array area commercial fisheries study area (ICES rectangle 36F2) by species and gear type ((based on five years data, 2011 to 2015; data source: MMO, 2017).

3.1.1.5 Small quantities of lobster and crabs are noted to be landed from 36F2, but generally it is understood that these fisheries are targeted within F1 ICES rectangles, and not as far offshore as 36F2. Landings recorded from 36F2 could be from UK vivier crab vessels that fish nomadically, or could be wrongly entered to be from 36F2, when they are more likely to be taken from 36F1.

3.1.1.6 Annual variations in landings per species are presented in Figure 3.3. As plaice, sole, turbot and brill are caught together, their annual trends follow the same pattern. A significant drop is seen in 2012, followed by highest landings in 2013 and a drop in 2014 and 2015. This may be due to quota allocations, or fishers preferring certain grounds in different years (i.e. outside 36F2), or a combination of these factors.

3.1.1.7 As previously discussed the sporadic landings of sprat and boarfish are reflected in Figure 3.3. All of the sprat landings were taken in 2011 during November by Scottish a vessel(s); the boarfish landings were taken in 2012, also during November by Scottish and Northern Irish vessels. Consultation indicates that UK pelagic vessels do not regularly or routinely fish within 36F2, with their fishing patterns reflecting the movement of the pelagic schooling fish that are being targeted.

3.1.1.8 VMS data for UK registered vessels have been analysed by the MMO to provide effort (hours fished) and value for mobile and passive fishing activity. The value of landings in 2015 by UK vessels ≥ 15 m in length are presented in Figure 3.4 for mobile gears (i.e. beam trawl, demersal trawl, demersal seine and other gear types physically towed by fishing vessels) and in Figure 3.5 for passive gears (i.e. potters, static netters, drift netters and longliners/hook and line). Appendix A provides VMS data for UK vessels deploying mobile and passive gears for effort (hours fished) and first sale value for 2011 to 2015. It should be noted that the majority of potters are under 15 m in length and therefore not represented within the passive VMS dataset.

3.1.1.9 In addition to VMS data for UK registered vessels, the MMO have collated activity of non-UK vessels operating in the UK EEZ; these are presented in Appendix B.

3.1.1.10 Surveillance data is presented in for all lengths of vessels, amalgamated for 2011 to 2015 in Figure 3.6 indicating nationality of vessel and in Figure 3.7 indicating gear type. Surveillance data provides a snapshot of activity at the time of patrol and is not standardised against frequency or coverage of patrols across different areas. The data is therefore not sufficient to determine activity with accuracy, but provides some indication of areas targeted by specific gears and fleets.

3.1.1.11 In the VMS data analysed (2011 to 2015) for UK registered vessels, fishing activity is shown to take place across much of the Hornsea Three array area. Higher levels of activity are noted from 2013 to 2015, compared to 2011 to 2012.

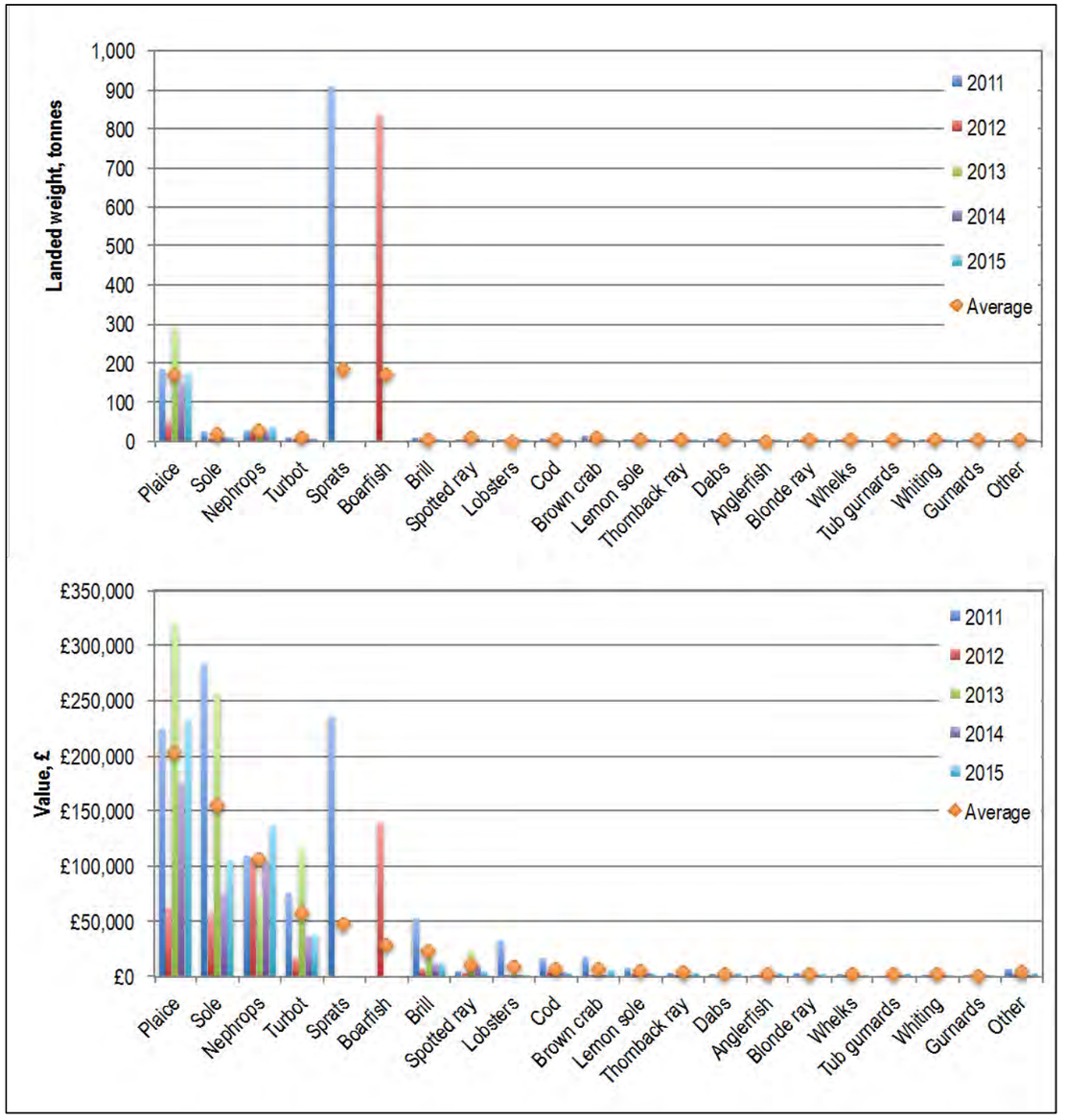

Figure 3.3: Value (£) and landed weight (tonnes) of landings by UK vessels from Hornsea Three array area commercial fisheries study area (ICES rectangle 36F2) by species and year for 2011 to 2015 (Date source: MMO, 2017).

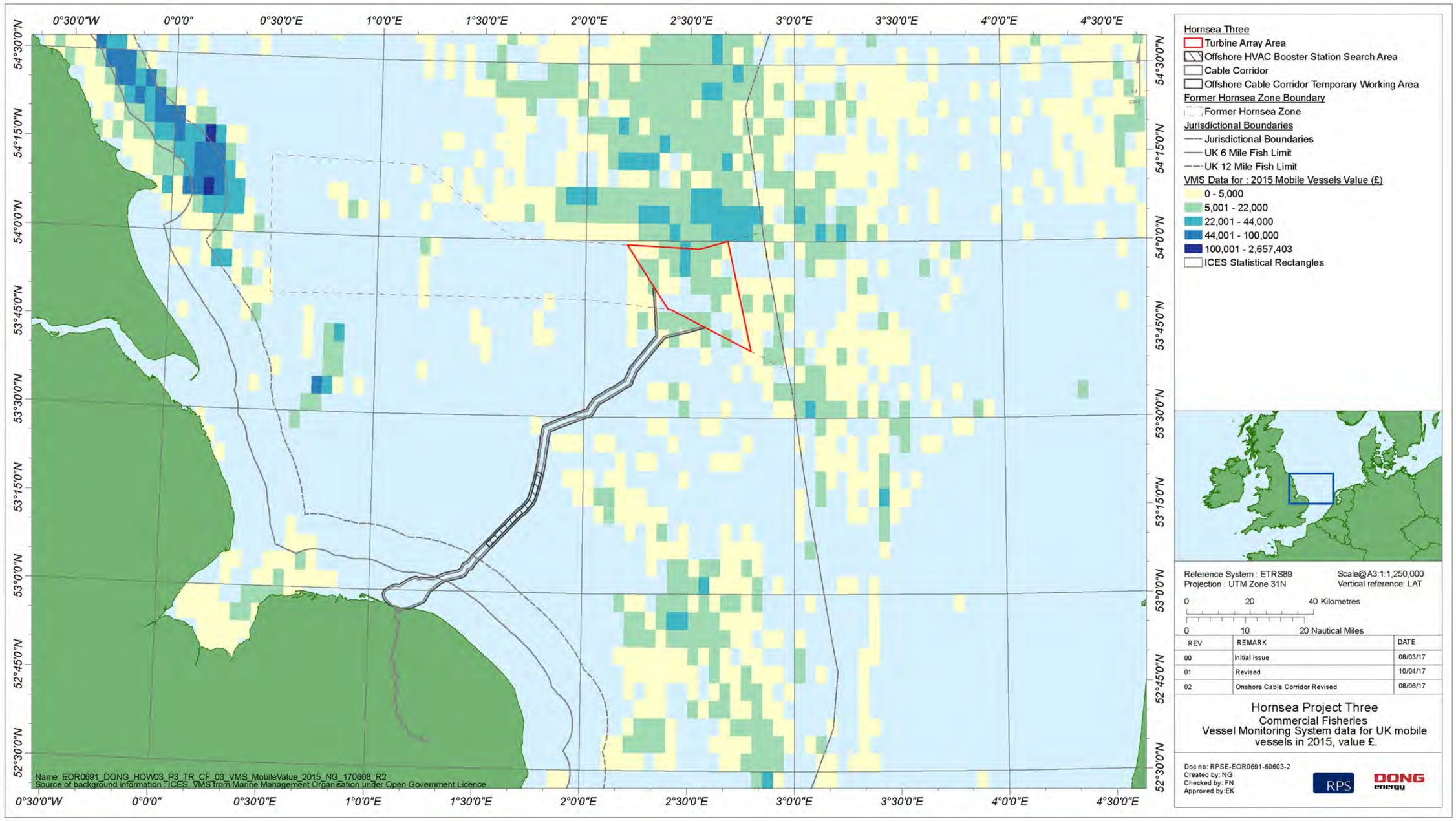

Figure 3.4: Vessel Monitoring System data for UK mobile vessels (≥ 15 m) actively fishing within regional commercial fisheries study area in 2015 indicating value of catch (Source: MMO, 2017).

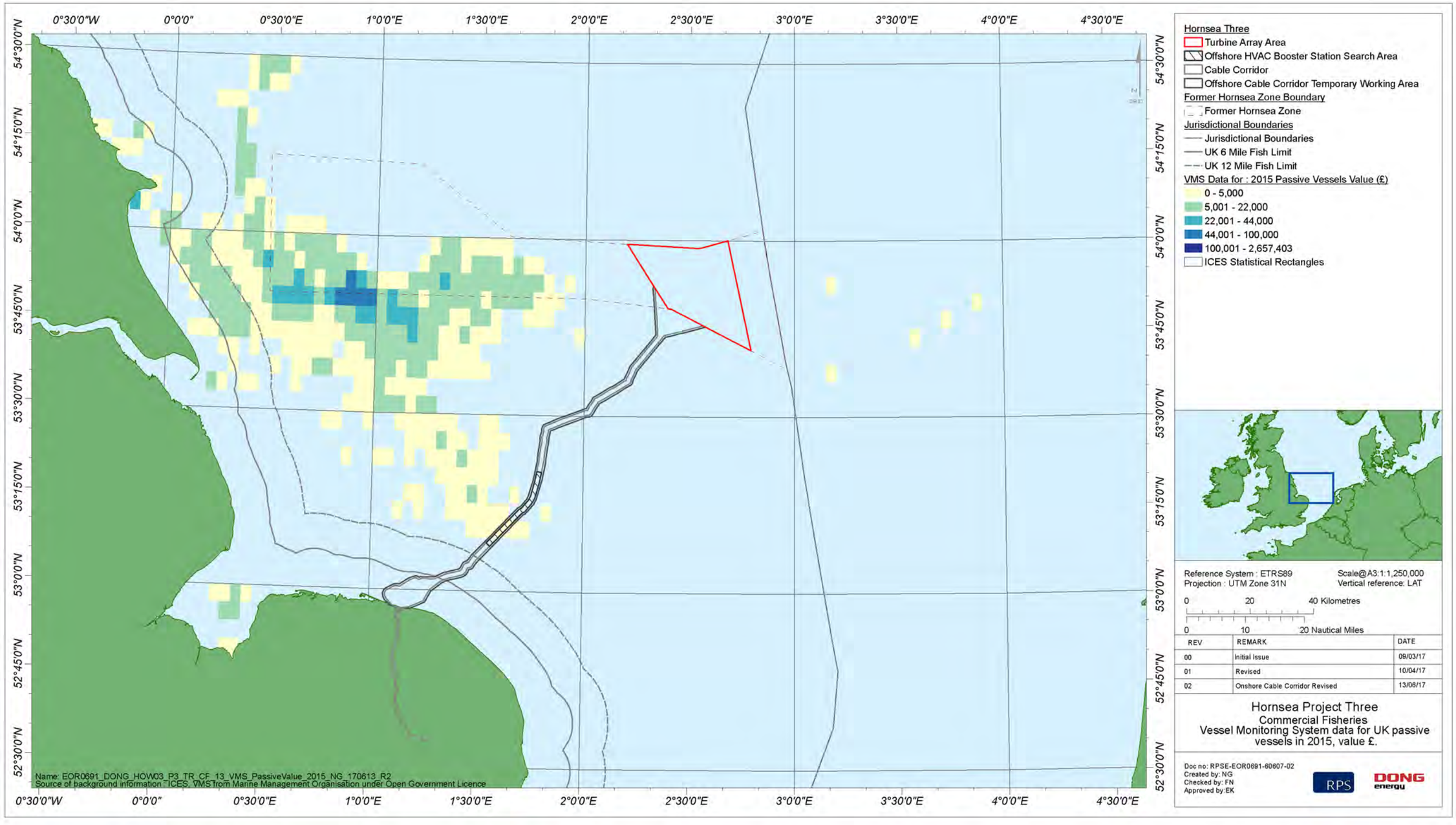

Figure 3.5: Vessel Monitoring System data for UK passive vessels (≥ 15 m) actively fishing within regional commercial fisheries study area in 2015 indicating value of catch (Source: MMO, 2017).

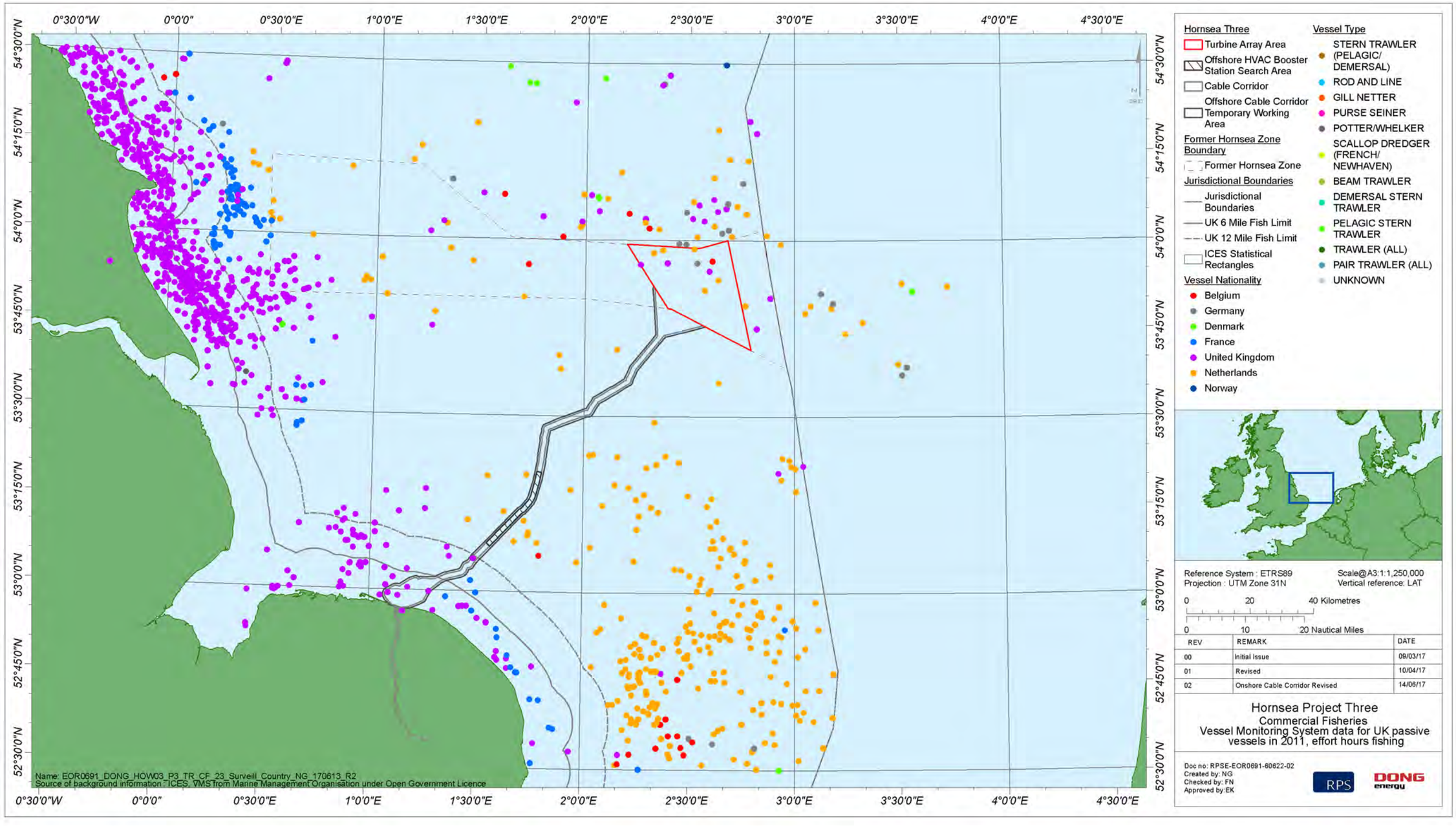

Figure 3.6: Surveillance data for vessels (all lengths) actively fishing within regional commercial fisheries study area, amalgamated for 2011 to 2015 indicating country of vessel (Data source: MMO, 2017).

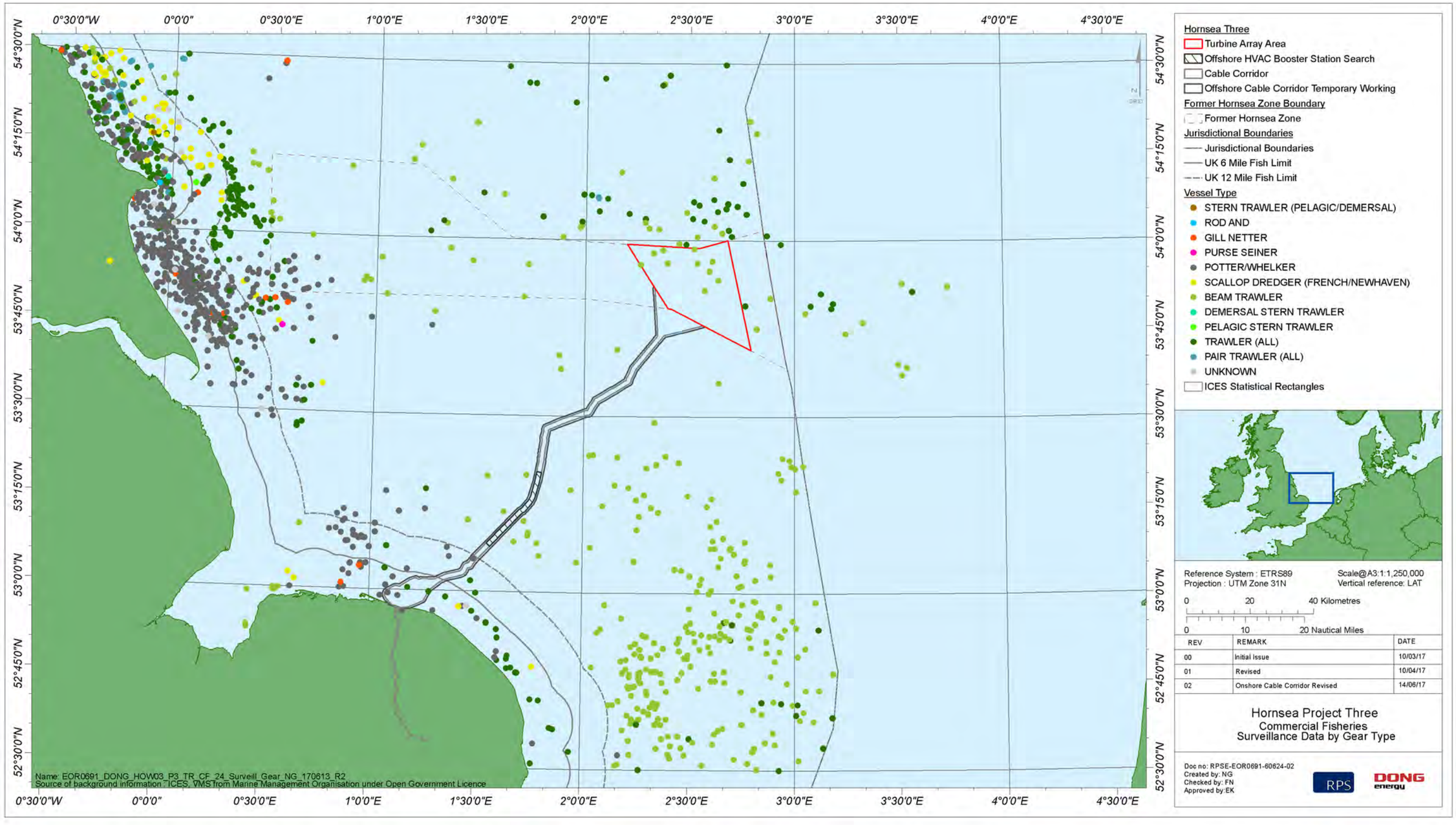

Figure 3.7: Surveillance data for vessels (all lengths) actively fishing within regional commercial fisheries study area, amalgamated for 2011 to 2015 indicating gear type (Data source: MMO, 2017).

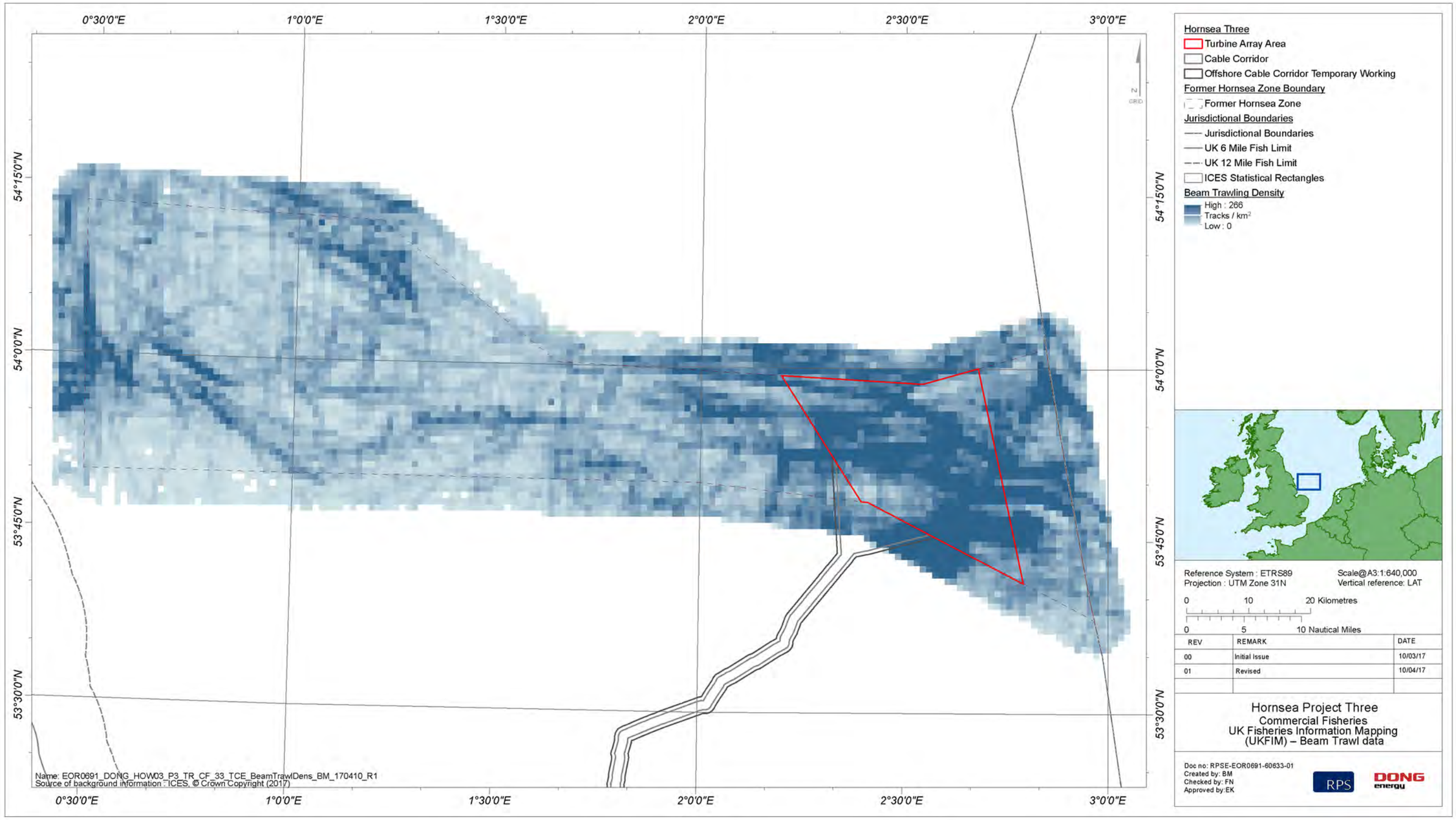

Figure 3.8: The Crown Estate UK Fisheries Information Project (UKFIM) beam trawl density mapping across Hornsea Three array area and the former Hornsea Zone (Source: The Crown Estate, 2012).

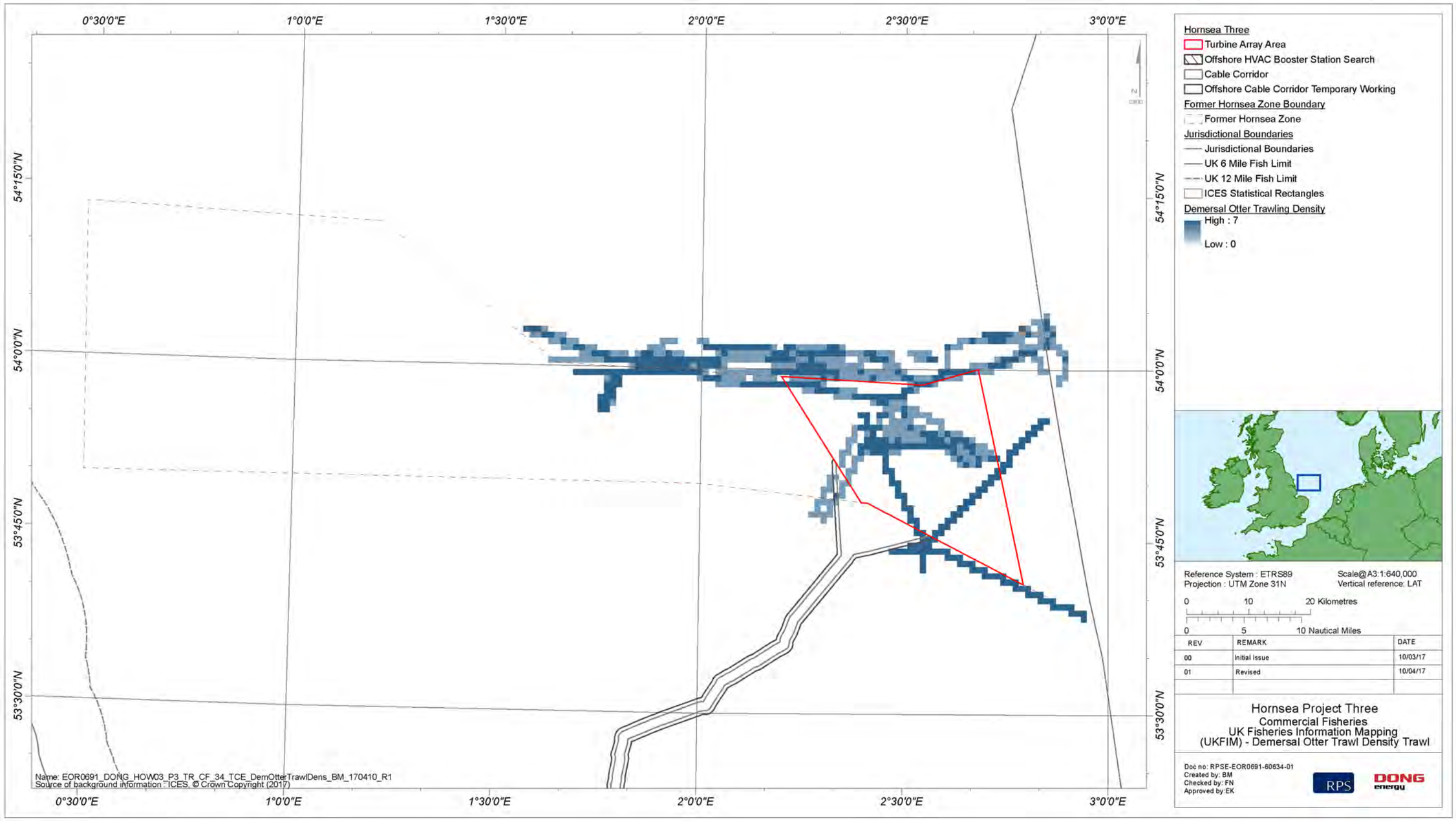

Figure 3.9: The Crown Estate UK Fisheries Information Project (UKFIM) demersal otter trawl density mapping across Hornsea Three array area and the former Hornsea Zone (Source: The Crown Estate, 2012).

3.1.1.12 Large vessels (25 to 45 m in length) deploying beam trawl or demersal otter trawl gear fish throughout the Hornsea Three array area commercial fisheries study area targeting sole and plaice, as well as other whitefish species such as turbot, brill and lemon sole *Microstomus kitt*. Effort by demersal otter trawlers targeting *Nephrops* grounds is noted within the Hornsea Three array area, in Markhams Hole (located in the central eastern section of the array area) and in the Outer Silver Pit (located at the very north of the array area). Higher intensity fishing is noted by demersal otter trawlers targeting *Nephrops* immediately north of Hornsea Three array area, throughout the Outer Silver Pit. On these grounds the highest level of activity is seen immediately north of the Hornsea Three array area and this has been consistent across the period for which VMS data has been analysed (2011 to 2015). This area forms key fishing grounds within the *Nephrops* Botney Gut FU.

3.1.1.13 UK potting vessels operate to the west of the former Hornsea Zone, along the Holderness coast, and to the south of the former Hornsea Zone, along the North Norfolk coast. Based on consultation and corroborated by data, the Hornsea Three array area is outwith the normal operating range of local UK potters. The lobster and brown crab landings that are recorded in 2011 (Figure 3.3) may be attributable to one or two large UK vivier crabbers that may occasionally enter 36F2.

3.1.2 Ports and vessel fleets

3.1.2.1 The average annual value of catch taken from 36F2 is presented by port of landing and gear type in Figure 3.10.

3.1.2.2 MMO data from 2011 onwards does not allow the port of landing to be analysed in conjunction with ICES rectangles, and therefore the data presented in Figure 3.10 is based on a five-year average across 2006 to 2010. While the total values may have changed when comparing averages across 2006 to 2010 and 2011 to 2015, the ports of landing and proportions of landings into those ports are likely to remain representative.

3.1.2.3 Landings of sole, plaice and related demersal species targeted by the beam trawl fleet are landed into Harlingen, Scheveningen, IJmuiden and Urk. These landings into Dutch ports are understood to be by UK registered Dutch owned vessels.

3.1.2.4 *Nephrops* and related species targeted by the demersal trawl fleet are landed into Whitby, North Shields and Scarborough.

3.1.2.5 A number of organisations represent UK beam trawl and demersal otter trawl vessels operating across the regional commercial fisheries study area including: National Federation of Fishermens' Organisations (NFFO), Eastern England Fish Producers Organisation (EEFPO), Anglo Scottish Fish Producers Organisation, Anglo Scottish Fishermen's Association and Lowesoft Fish Producers Organisation.

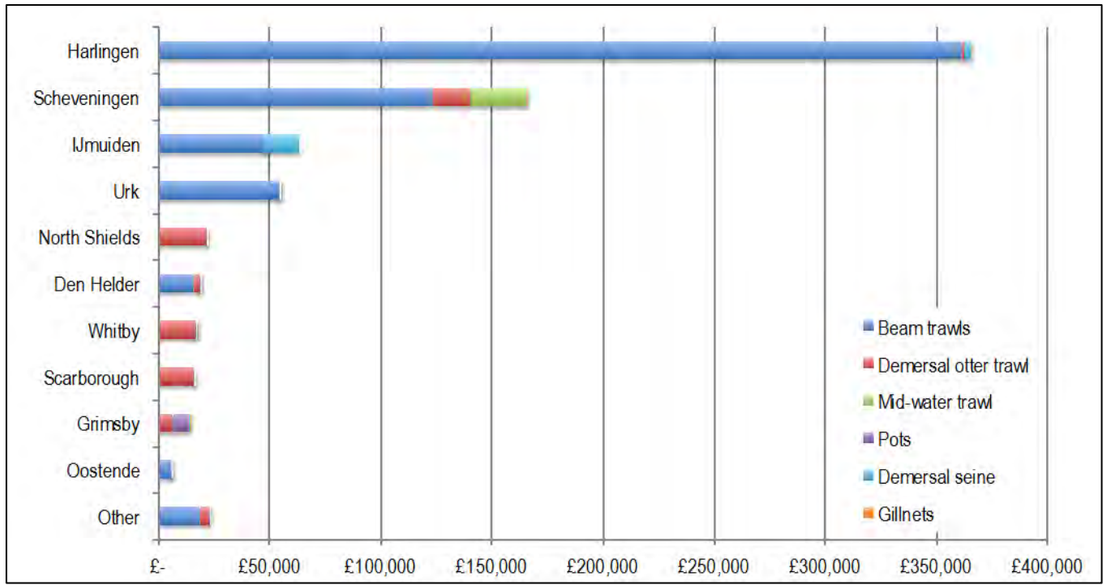

Figure 3.10: Average annual value (£) of all landings by UK vessels from Hornsea Three array area (ICES rectangle 36F2) by port of landing and gear type (based on five years' data 2006 to 2010; data source MMO, 2011).

3.1.2.6 The Eastern England Fish Producers Organisation represents 48 members including approximately five UK registered Dutch owned vessels and approximately ten lobster and crab vessels. The remaining vessels are 12 to 16 m and 22 to 27 m demersal trawlers that target plaice and *Nephrops* in long, narrow muddy grounds of 60 to 74 m depth in the Outer Silver Pit and Markhams Hole.

3.1.2.7 The UK registered Dutch owned vessels are beam trawlers (>25 m) targeting plaice and sole. Consultation with this group of vessels has been undertaken via the NFFO and VisNed. It is understood that these vessels currently target plaice and sole further north of the former Hornsea Zone, namely across the Dogger Bank. However, areas across the former Hornsea Zone including Hornsea Three array area were targeted with more frequency in years preceding 2009 and notably pre 2005. The change in effort patterns is closely linked with distribution of target species and quota allocations. The Dogger Bank is understood to be targeted for plaice, with sole and other species also landed, while the former Hornsea Zone is targeted for sole, with plaice and other species also landed in association with the catch. Therefore, vessels wishing to meet their plaice quota are likely to target the Dogger Bank area, while those with sole quota will focus elsewhere, including across the former Hornsea Zone.

3.2 Hornsea Three offshore cable corridor

3.2.1 Landing trends, fishing grounds and key species

3.2.1.1 The annual average value of landings by UK vessels from the Hornsea Three offshore cable corridor commercial fisheries study area (ICES rectangles 34F1, 35F1, 36F1 and 36F2) is £3.2 million (Figure 3.11). Based on value, ICES rectangles 35F1 and 36F1 are the most important to UK vessels (Figure 3.12) along the Hornsea Three offshore cable corridor.

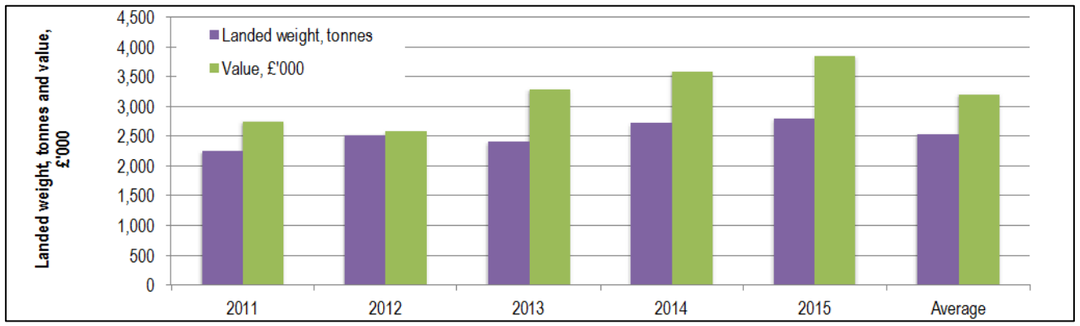

Figure 3.11: Landed weight (tonnes) and value (£ '000) of all landings by UK vessels from the Hornsea Three offshore cable corridor commercial fisheries study area (ICES rectangles 34F1, 35F1, 36F1 and 36F2) from 2011 to 2015 (Data source: MMO, 2017).

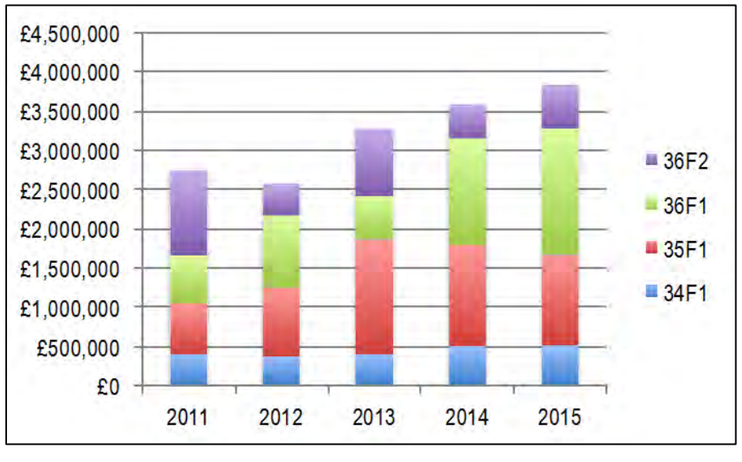

Figure 3.12: Value (£) of all landings by UK registered vessels from the Hornsea Three offshore cable corridor commercial fisheries study area (ICES rectangles 36F2, 36F1, 35F1 and 34F1) from 2011 to 2015 (Data source: MMO, 2017).

3.2.1.2 Across the five-year period from 2011 to 2015 the total quantity of landings (i.e. weight in tonnes) has remained fairly consistent. However, the total value has increased steadily from 2012 onwards. This is due to a shift in the quantity of higher value species being landed. Namely a sharp increase in the quantity of brown crab being landed from 2013 to 2015; and a drop in landings of sprat (from 2011 to 2012 only), whelk and plaice (both from 2013 to 2015) (Figure 3.13). There appears a relationship between the whelk and brown crab fishery, whereby when whelk landings increase, brown crab landings are lower (2013 to 2014) and when whelk landings drop, brown crab increases (2015). This is corroborated by industry consultation that indicates whelk is targeted when market prices are high.

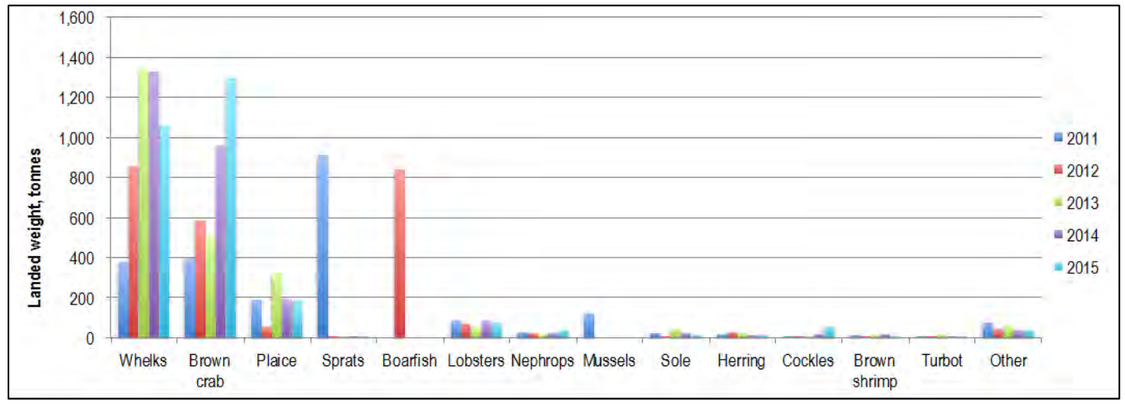

Figure 3.13: Landed weight (tonnes) of all landings by UK vessels from the Hornsea Three offshore cable corridor commercial fisheries study area (ICES rectangles 34F1, 35F1, 36F1 and 36F2) from 2011 to 2015 by individual species (Data source: MMO, 2017).

3.2.1.3 Brown crab, lobster and whelk form the key species landed from ICES rectangles 34F1, 35F1 and 36F1 by UK vessels (Figure 3.14), while sole, plaice and mixed demersal are the key species landed form 36F2. While data for the Hornsea Three offshore cable corridor commercial fisheries study area is presented within figures to ensure a complete dataset for this study area, the focus of this section describes activity within ICES rectangles 34F1, 35F1 and 36F1 (i.e. brown crab, lobster and whelk targeted by the potting fleet). Landings and activity for 36F2 are described in Section 3.1 Hornsea Three array area (i.e. sole, plaice and mixed demersal targeted by beam trawl and demersal otter trawl).

3.2.1.4 Figure 3.15 shows average annual values landed from the Hornsea Three offshore cable corridor commercial fisheries study area (ICES rectangles 34F1, 35F1, 36F1 and 36F2) based on five-years' data (2011 to 2015). On average the brown crab fishery is worth £900 k, £736 k for whelk and £735 k for lobster. Data in Figure 3.15 is sourced from the MMO landings database, which indicates the majority of landings to be by vessels over 10 m in length (75% of brown crab landed by vessels >10 m; 86% for whelk and 57% for lobster). However, industry consultation has consistently signalled that these figures underrepresent the landings by vessels under 10 m in length.

Figure 3.14: Average annual value of all landings by UK vessels from the Hornsea Three offshore cable corridor commercial fisheries study area (ICES rectangles 34F1, 35F1, 36F1 and 36F2) for brown crab, lobster and whelk, based on five-year's data from 2011 to 2015 (data source: MMO, 2017).

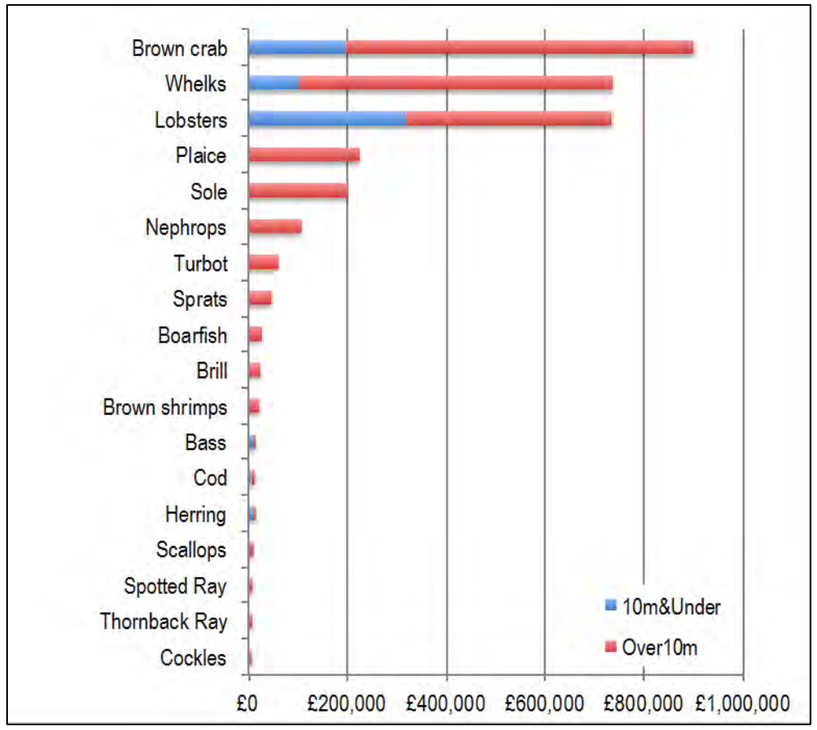

Figure 3.15: Average annual value of all landings by UK vessels from the Hornsea Three offshore cable corridor commercial fisheries study area (ICES rectangles 34F1, 35F1, 36F1 and 36F2) based on five-year's data from 2011 to 2015 (data source: MMO, 2017).

3.2.1.5 The seasonality of landings by potting vessels is illustrated in Figure 3.16. Brown crab, lobster and whelk are landed throughout the year with peak seasons as follows; brown crab: July to November; lobster: August to October; whelk: May to July.

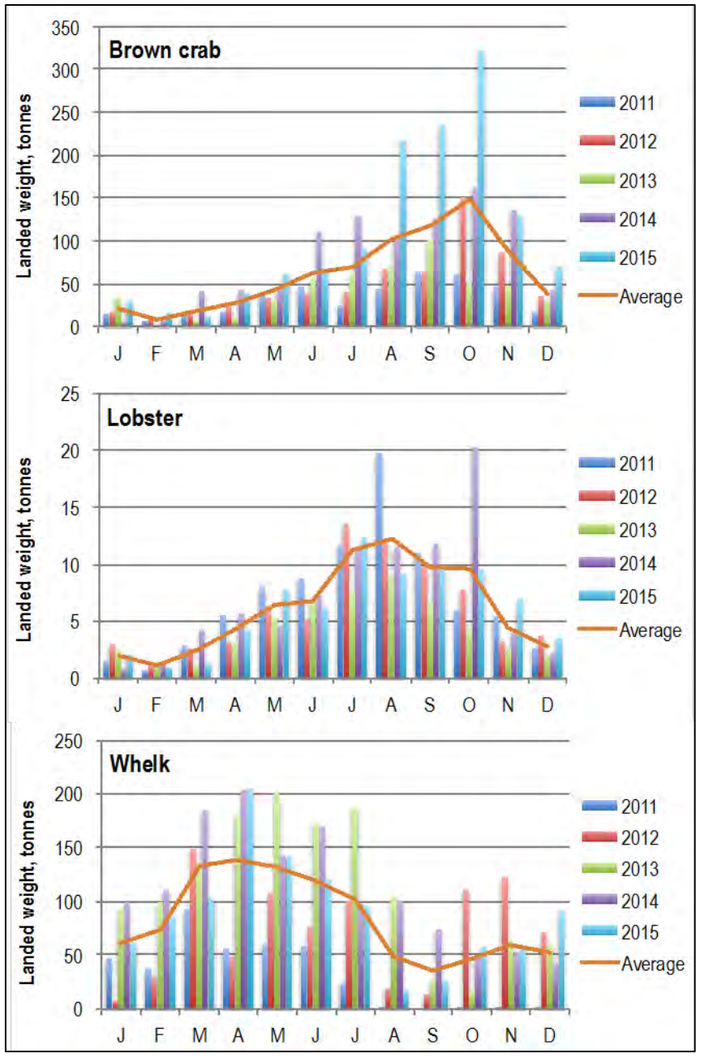

Figure 3.16: Seasonality of landed weight (tonnes) of brown crab, lobster and whelk by UK vessels from the Hornsea Three offshore cable corridor commercial fisheries study area (ICES rectangles 34F1, 35F1, 36F1 and 36F2) from 2011 to 2015 (Data source: MMO, 2017).

3.2.1.6 As previously mentioned, consultation with the North Norfolk Fishermen's Associations (including North Norfolk Fishermen's Society, Wells and District Fishermen's Association and Norfolk Independent Fishermen's Association) indicates that data presented from the MMO landings database (iFISH data) is considered, by the fishing industry, to under-represent landings by the 10 m and under potting vessels. This could be for a number of reasons,; including under-reporting by the potting fleet based on entering estimations of catch, rather than true weights and the fact that the Buyers and Sellers Register does not require submission of sales notes for quantities <30 kg to be recorded. In addition, it is difficult to determine the first sales value of brown crab and lobster, as many vessel owners also process and sell their catch independently within local sales outlets, which can at least double the first sale value of the catch.

3.2.1.7 To explore the potential under-representation of landings, MSAR data for brown crab and lobster (sourced from the Eastern IFCA stock assessment, Welby, 2015) landed from 34F1 and 35F1 within the Eastern IFCA district (i.e. 0 to 6 NM) is compared with MMO landings for brown crab and lobster from the entirety of 34F1 and 35F1 (i.e. 0 to 6 NM and beyond). On average, brown crab landings are 64% higher within the MSAR data compared to MMO iFISH data. The variance between lobster landings is not as high with the MMO iFISH data showing 10% higher than the MSAR data. Clearly it would be expected that the MMO iFISH data would be higher, as this covers landings from the entirety of each ICES rectangle, whereas the MSAR figures presented are specifically for within Eastern IFCA district.

3.2.1.8 Based on consultation and supported by Figure 3.17, MSAR data is considered more representative of the inshore activity for brown crab and lobster. Unfortunately, comparable data is not available for the whelk fishery, or brown crab and lobster outside 6 NM.

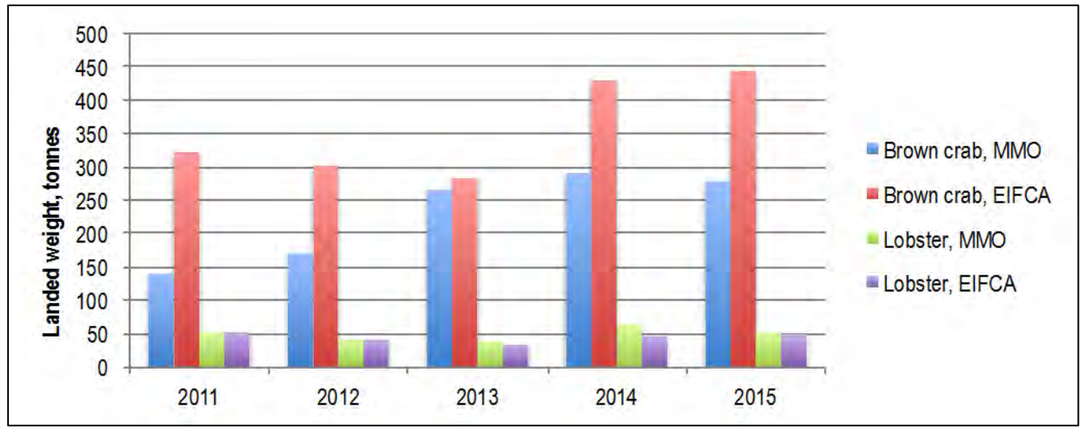

Figure 3.17: Landings of brown crab and lobster reported within the Eastern IFCA Monthly Shellfish Activity Returns (MSAR) for areas 0 to 6 NM within ICES rectangles 34F1 and 35F1; and MMO iFISH data for the entirety of ICES rectangles 34F1 and 35F1. (Data sources: MMO, 2017 and Welby, 2015).

3.2.1.9 The MSAR data available (Welby, 2015) is presented in Figure 3.18 and Figure 3.19 for 2006 to 2015. Brown crab landings have been fairly consistent from 2006 to 2013, with a significant increase from 2013 to 2014, that has been maintained in 2015 (Figure 3.18). In 2015 brown crab landings were recorded at 444 tonnes from ICES rectangles 34F1 and 35F1 (within 0 to 6 NM); this equates to a value of £888 k (Welby, 2015). In 2015 lobster landings for the same area were 48 tonnes, worth £531 k (based on a first sales price of £11 per kg; Welby, 2015).

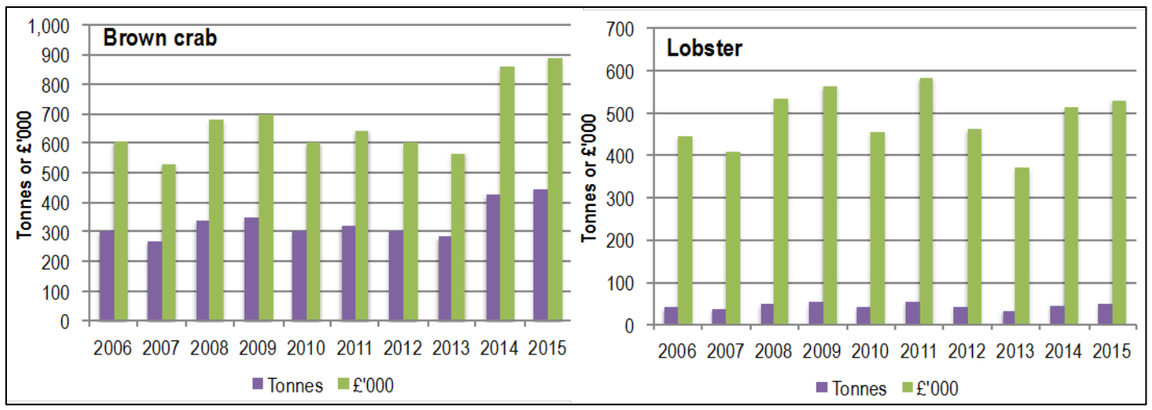

Figure 3.18: Landings of brown crab and lobster from ICES rectangles 34F1 and 35F1 within the Eastern IFCA district (i.e. within 6 NM) (Data source: Welby, 2015).

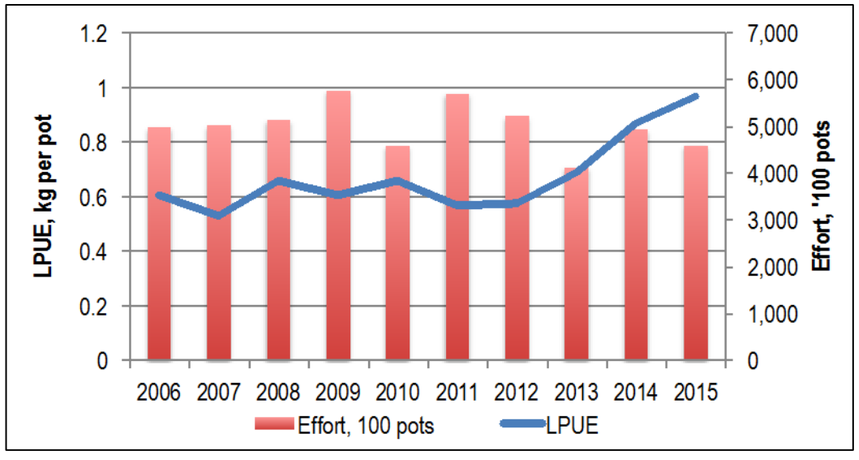

Figure 3.19: Landings per unit effort (LPUE) for brown crab from ICES rectangles 34F1 and 35F1 within the Eastern IFCA district (i.e. within 6 NM) (Data source: Welby, 2015).

3.2.1.10 The landings per unit effort for brown crab have increased from 2013 to 2015 (Figure 3.19), indicating that while the overall effort (number of pots) has remained fairly consistent, the quantity of catch has increased (although this does not take soak times into account).

3.2.1.11 In addition to the crab and lobster stock assessment, the Eastern IFCA has published inshore fisheries activity mapping for a range of species, based on fisheries interviews conducted in 2010. This data is presented for crab and lobster, whelk and brown shrimp in Figure 3.20, Figure 3.21 and Figure 3.22, respectively.

3.2.1.12 Brown shrimp activity is seen close in shore along much of the North Norfolk coast within Figure 3.22. However it is understood based on industry consultation that the brown shrimp fishery is focused within the Wash and does not interact with potting fleets along the North Norfolk coast.

3.2.1.13 Potting vessels also occasionally use rod and line for mackerel, and drift or set nets for sole, plaice etc. Finfish are landed in quantities below the required reporting level (<25 kg) within the Registration of Buyers and Sellers (RBS), so are not routinely captured in landing statistics.

3.2.2 Ports and vessel fleets

3.2.2.1 Approximately 50 potting vessels are understood to be active along the North Norfolk coast; the majority are members of a range of fishermen's associations and societies, although a number of vessel owners are non-affiliated.

3.2.2.2 Key landing points for the potting fleet along the North Norfolk coast include: Great Yarmouth, Sheringham, Cromer (including East and West Runton), Wells, Bacton, Lowestoft, Brancaster, Winterton, and Sea Palling (Figure 3.23). Landings by port are presented in Table 3.1 for 2015, based on the MMO iFISH database. Wells and Cromer are noted as the most important landings points for brown crab and lobster landings; Wells, Lowestoft, Southwold and Kings Lynn are noted for whelk landings.

3.2.2.3 The majority of vessels are <10 m (with many 9.99 m in length), a few are >10 m. The fleet includes approximately six catamarans with three operating from Cromer. These catamarans tend to be under 10 m in length, beach launched, and have a larger outboard compared to vessels with a single hull, so are able to target grounds further offshore. There are no gentlemen's agreements in terms of areas worked, but generally vessels operating from harbours are bigger than beach launched vessels, and so tend to work further from shore. Beach launched vessels dominate areas from 0 to 3 NM, while harbour based vessels operate from 3 to 30 NM offshore.

3.2.2.4 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 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.

3.2.2.5 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. Vessels within the Eastern IFCA jurisdiction are limited to 500 pots per vessel, as per the Whelk Permit Byelaw. There tend 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, so are collected by lorry. 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.

3.2.2.6 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; so 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. Key ports are Wells, Blakeney and Cromer (Figure 3.23).

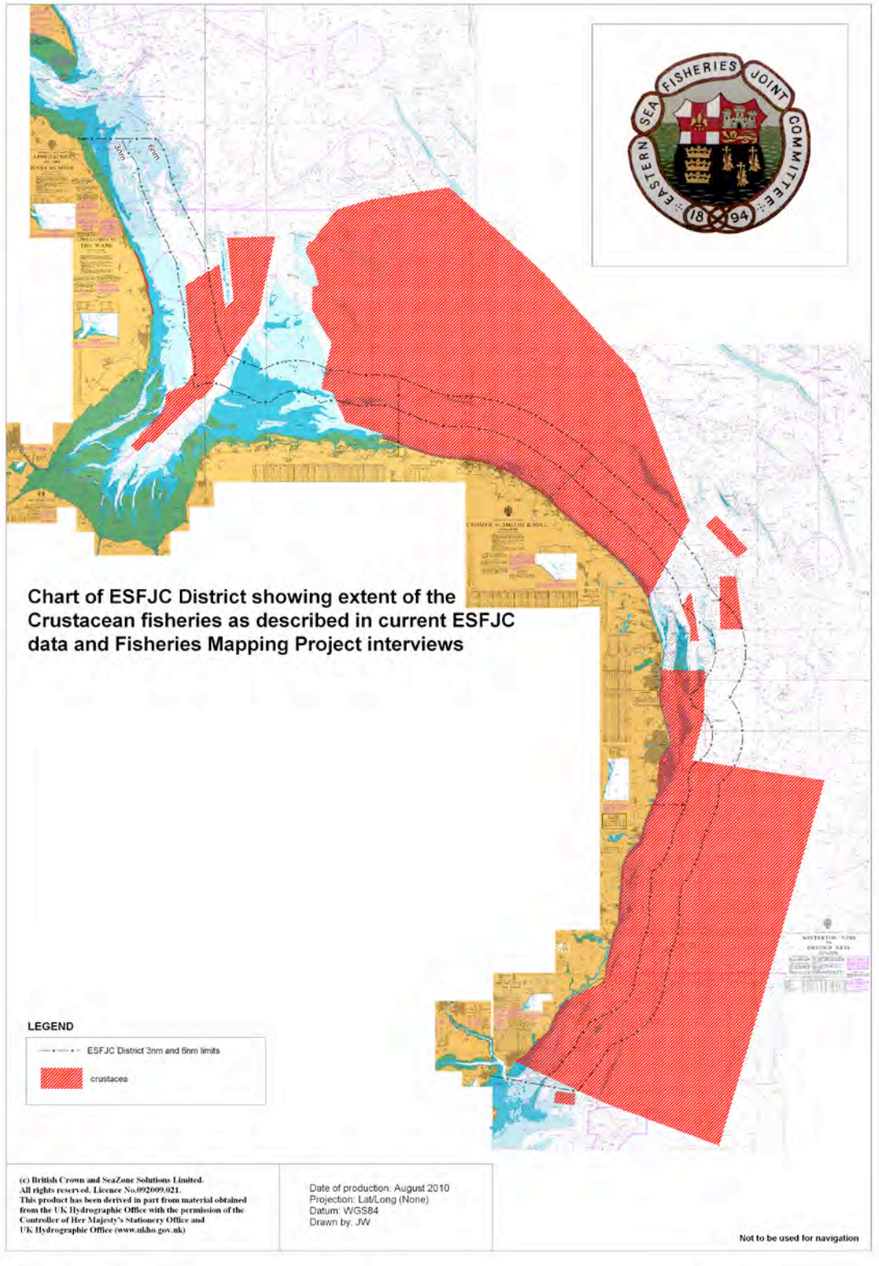

Figure 3.20: Eastern IFCA inshore fisheries activity mapping for brown crab and lobster (Source: Eastern IFCA, 2010).

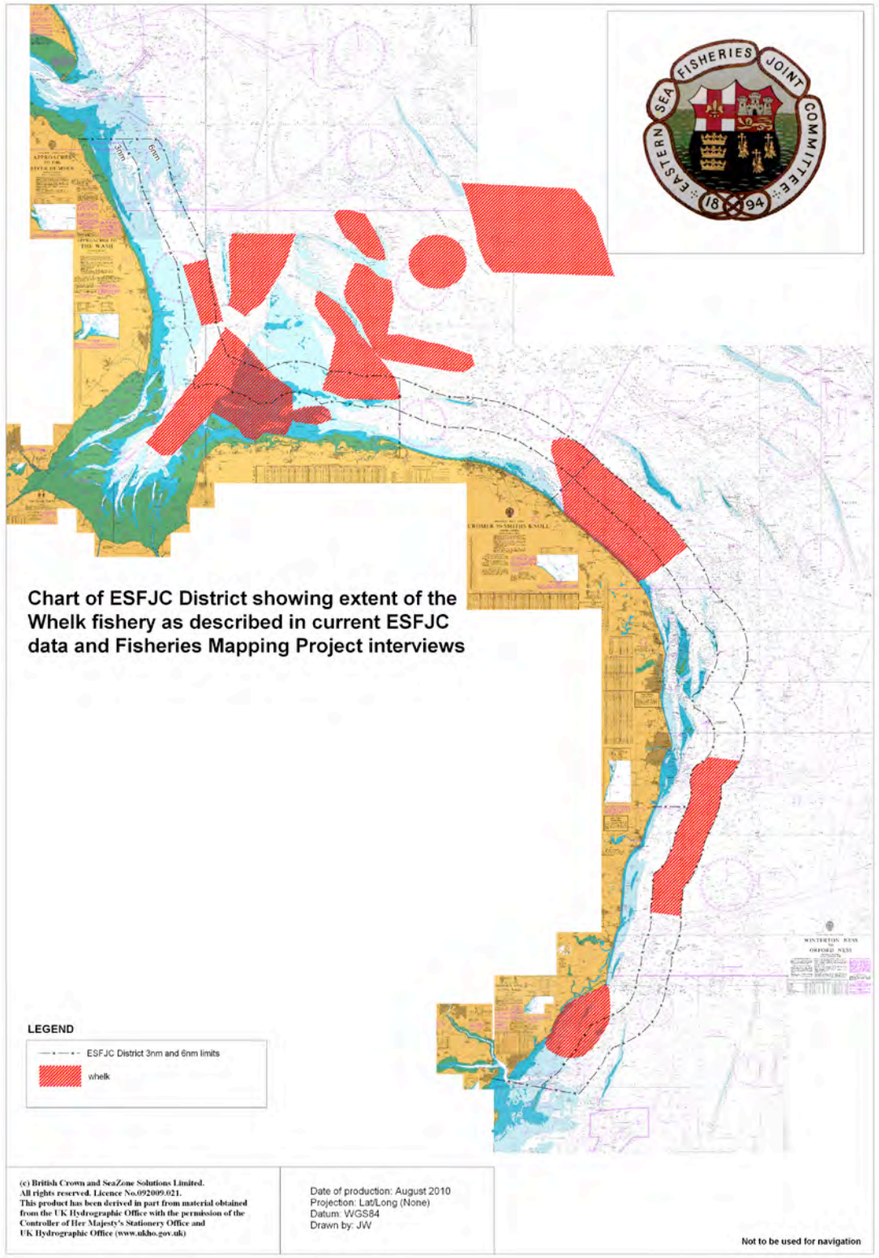

Figure 3.21: Eastern IFCA inshore fisheries activity mapping for whelk (Source: Eastern IFCA, 2010).

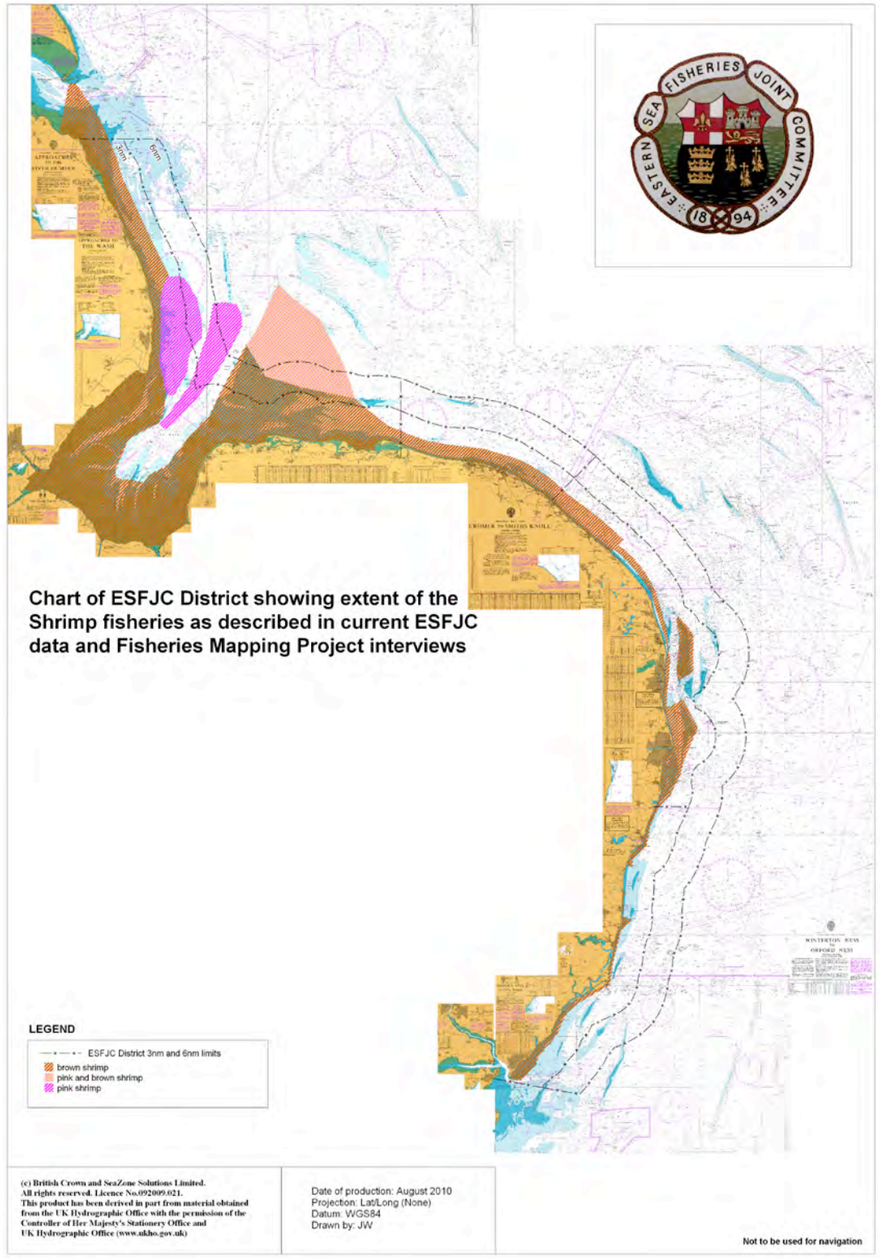

Figure 3.22: Eastern IFCA inshore fisheries activity mapping for brown and pink shrimp (Source: Eastern IFCA, 2010).

Table 3.1: Landings by port in East Anglia and Lincolnshire regions for 2015, tonnes, based on the MMO iFISH database.

	Boston	Kings Lynn	Wells	Lowestoft	Cromer	Southwold	Great Yarmouth	Felixstowe	Brancaster Staithe	Other
Cockles *Cerastoderma edule*	2,582.16	1,959.24	0	0	0	0	0	0.09	0	0.00
Whelks *B. undatum*	0	201.75	680.88	539.31	42.67	330.91	85.00	0	0	0.00
Brown crab *C. pagurus*	0.54	0.47	183.93	0.00	123.35	0.06	0.22	0.01	26.60	29.76
Brown shrimp *C. crangon*	6.34	309.30	0.01	1.30	0	0	0	0	2.17	1.25
Cod *G. morhua*	0.03	0	0.00	41.84	0	7.11	0.67	25.37	0.08	15.49
Rays *Raja* species	0.07	0	0	46.44	0	1.85	0.24	6.62	0.05	14.65
Lobsters *H. gammarus*	0	0.13	25.51	0.21	24.92	0.11	0.15	0.70	3.21	5.05
Sole *S. solea*	0.04	0	0	20.62	0	3.53	0	13.59	0	15.91
Herring *C. harengus*	0	0	0.16	11.89	0.12	0.18	0.39	0.45	0	16.07
Mussels *Mytilus edulis*	20.00	0	0	0	0	0	0	0	0	0.00
European seabass *Dicentrarchus labrax*	0	0	0.98	6.47	0.03	2.66	0.02	3.40	0.02	4.01
Scallop *P. maximus*	0	4.61	0	0.63	0	0	0	0	0	0
Total	2,609.16	2,475.50	891.48	685.12	191.09	346.70	86.76	51.01	32.13	102.19

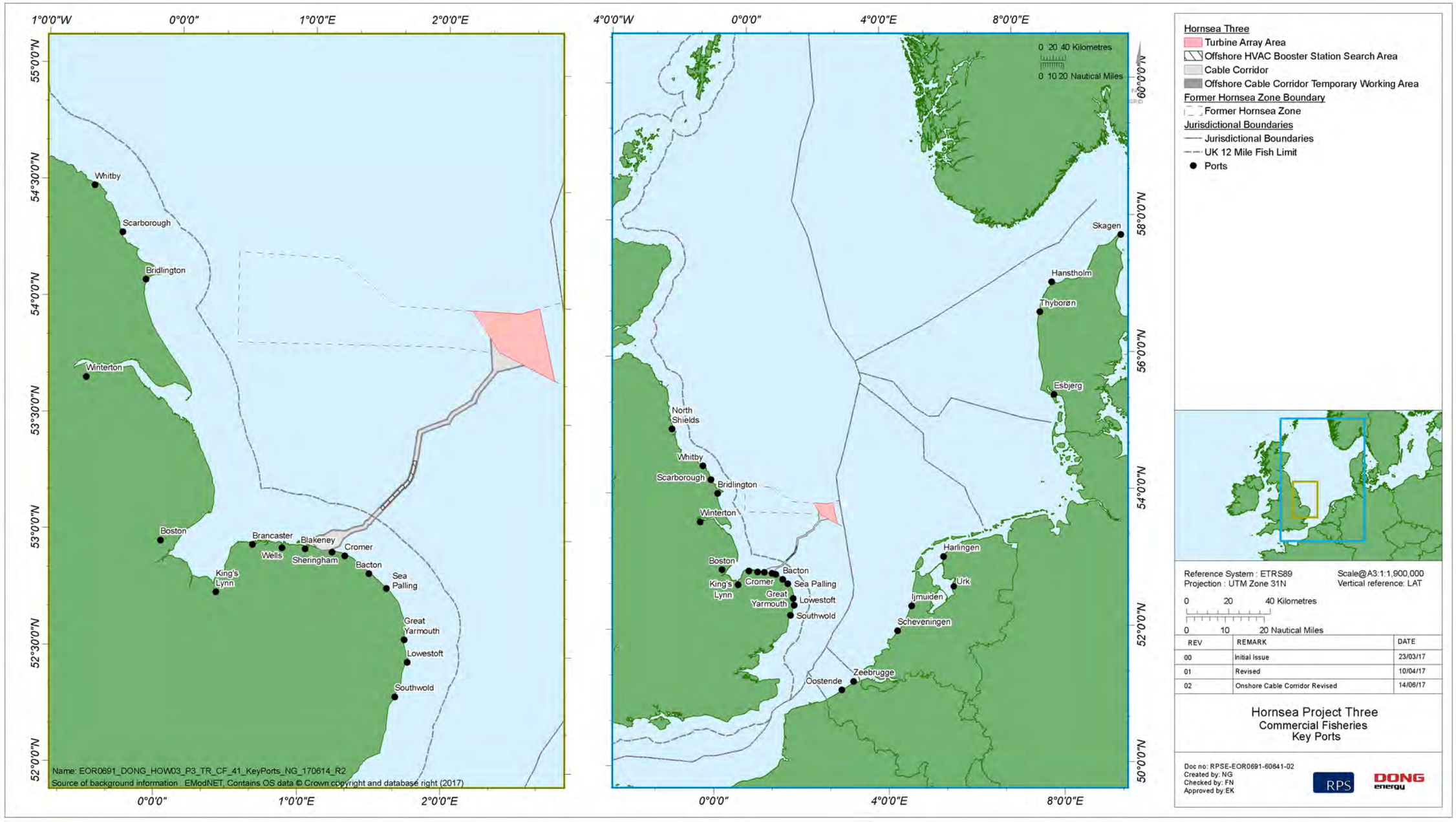

Figure 3.23: Key ports for commercial fisheries operating across the Hornsea Three array area and Hornsea Three offshore cable corridor study areas.

4. Netherlands Fisheries Activity Assessment

4.1 Hornsea Three array area

4.1.1 Landing trends, fishing grounds and key species

4.1.1.1 Landings by Dutch registered vessels from ICES rectangle 36F2 are presented in Figure 4.1 by gear type and Figure 4.2 by species. Figure 4.3 presents a ten-year time series for sole and plaice landings. Dutch registered vessels landed an annual average of 1,554 tonnes, worth €3.8 million in first sales value from ICES rectangle 36F2 (based on five-year average from 2011 to 2015, EU DCF, 2017; EU MOFA, 2017).

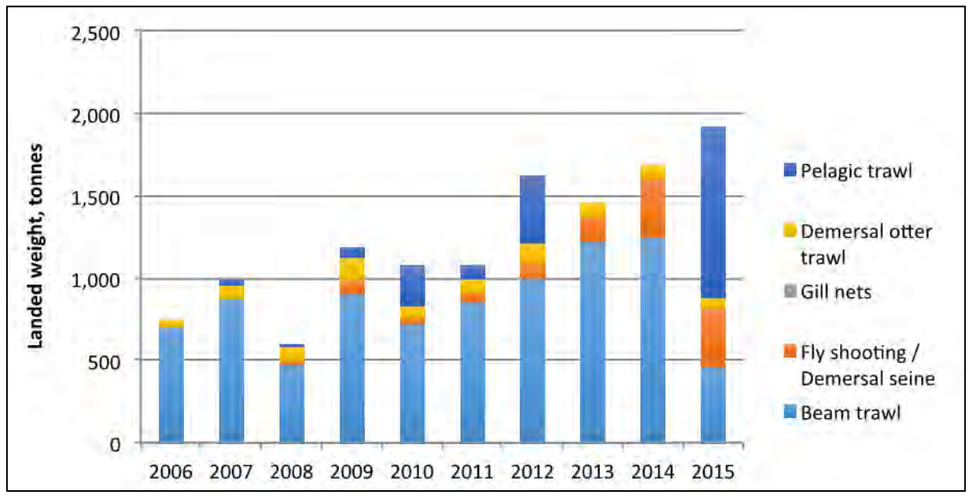

Figure 4.1: Landed weight of all landings by Dutch registered vessels from ICES rectangle 36F2 from 2006 to 2015 indicating gear type (Data source: EU DCF, 2017).

4.1.1.2 The Dutch landings are dominated by the beam trawl fleet from 2006 to 2014. Landings fluctuated from 2006 to 2010 and then increased steadily from 2010 to 2014; a significant drop in beam trawl landings is noted in 2015. Landings made using fly shooting (or demersal seine) gear have steadily increased since 2012; this method of fishing is increasingly favoured over beam trawl due to lower fuel consumption and Marine Stewardship Council (MSC) certification for this fishery.

4.1.1.3 Sporadic landings by pelagic trawl are noted in 2010, 2012 (herring and sprat) and 2015 (anchovy). Dutch vessels operating pelagic trawling gear are not known to routinely target ICES rectangle 36F2; they operate throughout north-western waters using sonar to locate shoals of pelagic fish that are highly mobile and not associated with any particular seabed habitat. No concern over pelagic species has been raised during consultation with Dutch fisheries organisations.

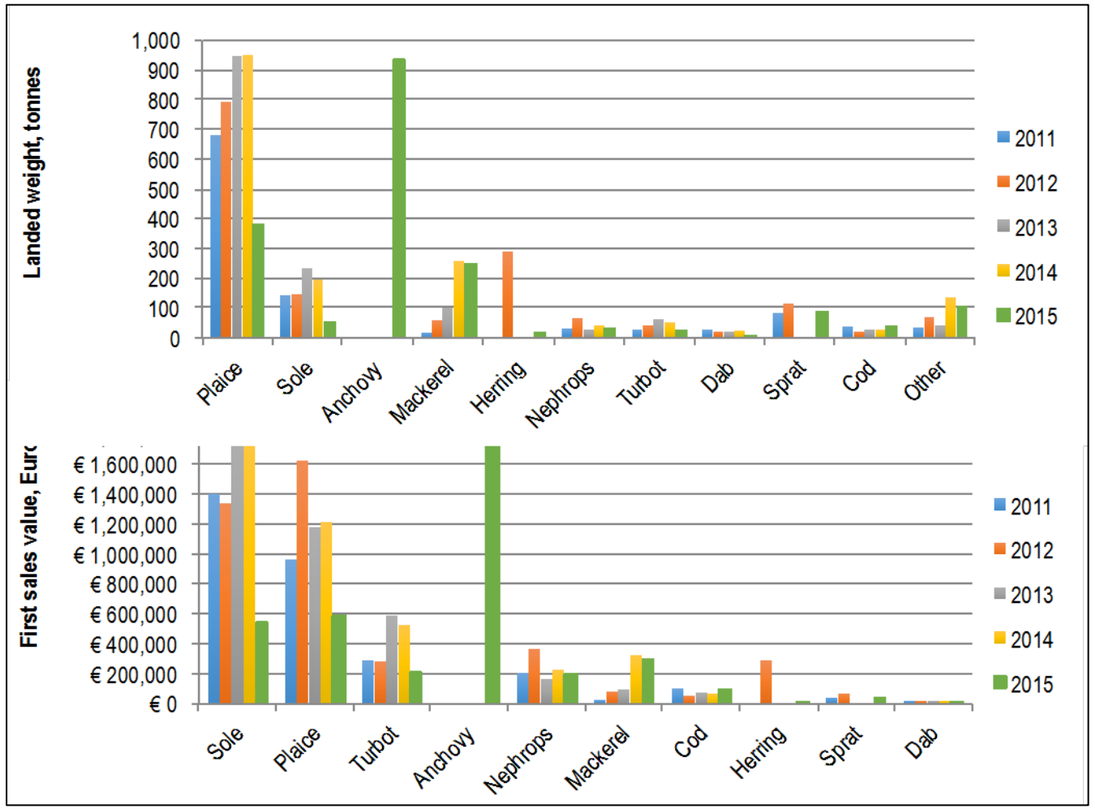

Figure 4.2: Landed weight (top) and value (bottom) of all landings by Dutch registered vessels from ICES rectangle 36F2 from 2011 to 2015 indicating species (Data sources: EU DCF, 2017; EU MOFA, 2017).

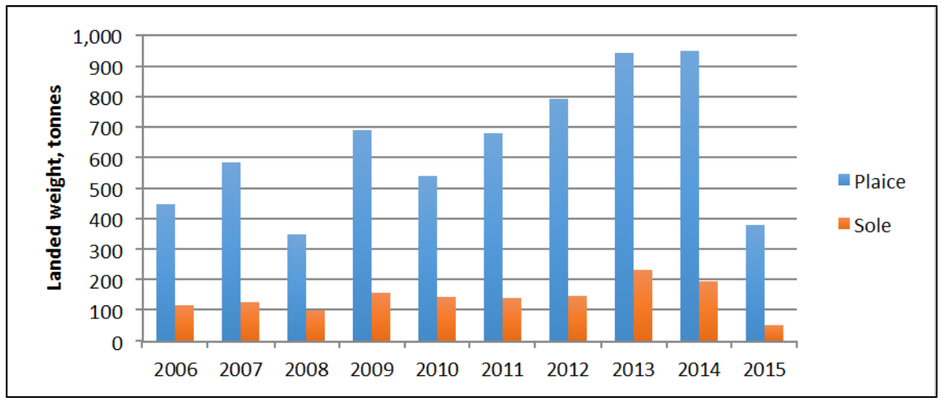

Figure 4.3: Landed weight of plaice and sole landings by Dutch registered vessels from ICES rectangle 36F2 from 2006 to 2015 (Data source: EU DCF, 2017).

4.1.1.4 The key species landed by the Dutch beam trawl and fly shooting fleets are sole and plaice. Plaice are landed in higher quantities than sole, but sole is eight times more valuable, so is the most economically important species landed from ICES rectangle 36F2.

4.1.1.5 During consultation it was requested that a ten-year dataset be analysed to ensure trends are captured. In general, landings from 2006 to 2010 are lower than 2011 to 2014, but there is an uncharacteristic drop in plaice and sole landings in 2015.

4.1.1.6 In the ten-year period from 2006 to 2015, landings of sole and plaice (and associated demersal species) peaked in 2014, at 1,250 tonnes worth €3.7 million in first sales value.

4.1.1.7 The trends in sole and plaice landings are highly likely to be linked to the Netherlands quota allocations. From 2011 to 2015 the sole quota allocated to the Netherlands for the North Sea and Norwegian Sea has decreased by 15%, while the plaice quota has increased by 74%. Consultation indicates that fishing grounds further north of the former Hornsea Zone (notably the Dogger Bank) are favoured when targeting plaice, while the former Hornsea Zone is more favourable when targeting sole. With the large increase in plaice quota and decrease in sole quota, it is logical that Dutch effort has moved from the former Hornsea Zone to focus on the Dogger Bank plaice fishery. However, it is expected that this pattern will shift and adapt with changes in TACs and quota; and therefore the 2015 data is not typically characteristic of Dutch activity. Different vessels will choose to target the Dogger Bank, the former Hornsea Zone and a combination of both depending on their home port, quota allocation and individual preferences. It is understood that Dutch vessels will typically fly shoot during winter and move to beam trawl in the Dogger Bank in summer.

4.1.1.8 Most of the other species taken by the Dutch fleet follow the same pattern as sole and plaice, since they are landed in conjunction with this fishery.

4.1.1.9 Consultation indicates that the Markhams Hole and Outer Silver Pit grounds that overlap with the Hornsea Three array area are targeted for *Nephrops*, sole, plaice and mixed demersal species due to the habitat type of soft muddy/sandy mud grounds, which supports burrowing *Nephrops*. A specific route made by vessels actively fishing from Markham's Hole to the Outer Silver Pit was identified during consultation. Sole, plaice and mixed demersal species were cited as being caught throughout the entirety of the Hornsea Three array area.

4.1.1.10 VMS data collated by the MMO for Dutch mobile vessels indicating hours fished are presented in Appendix B, for 2010 only.

4.1.1.11 VMS data collated by Wageningen Economic Research (LEI) for Dutch vessels indicating value of catch are presented in Appendix C, for 2011 to 2014, and in Figure 4.4 for 2015.

4.1.1.12 The Hornsea Three array area is an important fishing ground within ICES rectangle 36F1. In total, Dutch vessels spent approximately 120 days annually fishing within the array area (based on five-years data from 2011-2015). Approximately 40% of the landings from 36F1 were taken from within the Hornsea Three array area, with an average annual value of 1 million specifically from the Hornsea Three array area.

4.1.1.13 A progression from beam trawl gear (including traditional beam trawl and pulse trawl) to fly shooting is noted from 2011 to 2015, which is corroborated by consultation with the industry (see Appendix C for further data analysis and Appendix D for meeting minutes). The Hornsea Three array area is considered to be a productive and valuable fishing ground for the Dutch fleet (Oostenbrugge and Hamon, 2017).

4.1.1.14 Other gears including pelagic trawls and gill nets were rarely noted to be operated in the area.

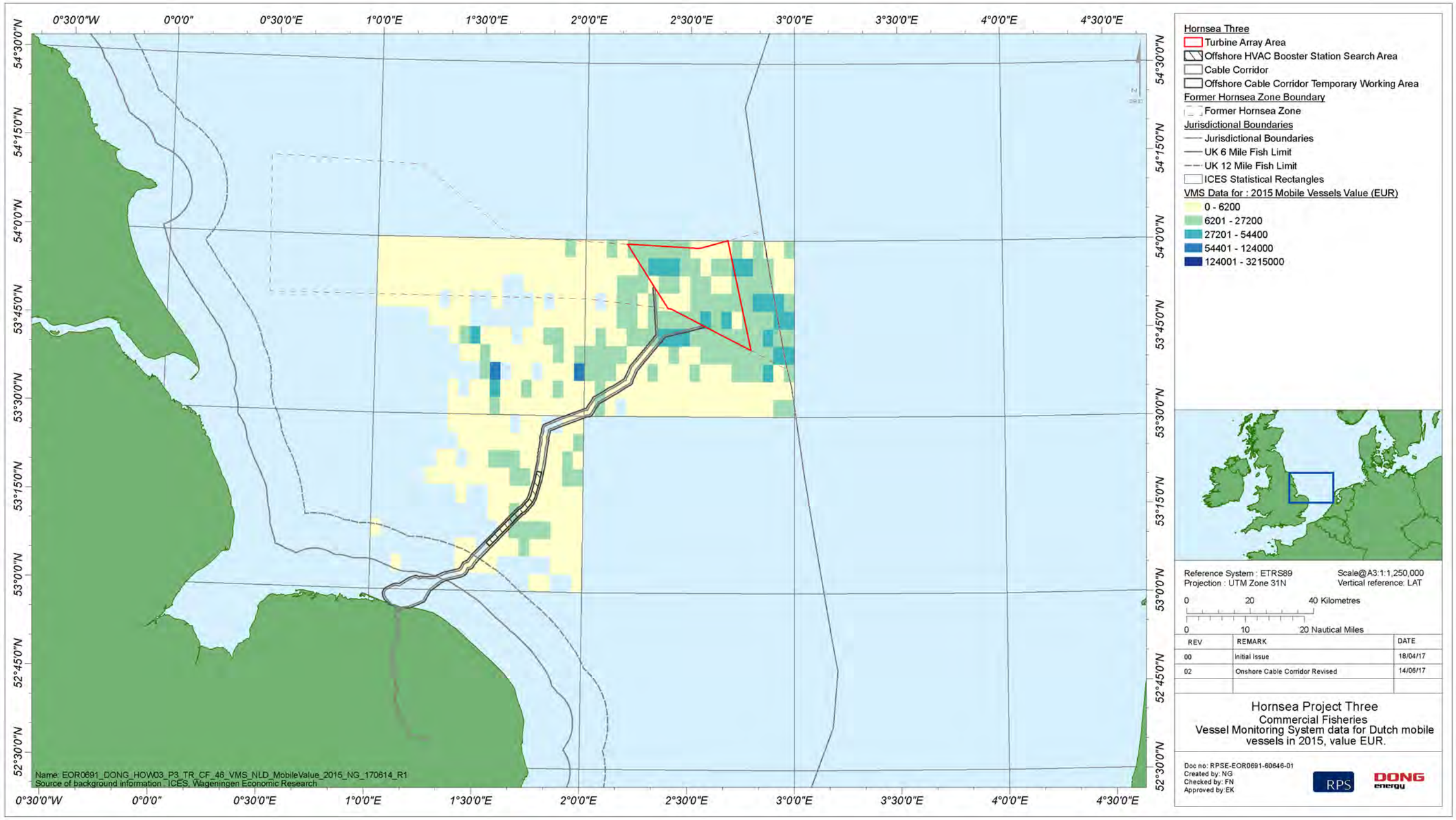

Figure 4.4: VMS data for actively fishing Dutch registered beam trawl vessels indicating value of catch in 2015 (Source: LEI, 2017).

4.1.2 Effort and vessel fleets

4.1.2.1 Effort by Dutch registered vessels from ICES rectangle 36F2 is presented in Figure 4.5 indicating hours of active fishing by gear type. Effort within 36F2 represents 8% of Dutch effort within the regional commercial fisheries study area.

4.1.2.2 The effort by gear type follows the landings patterns, as would be expected. On average 5,504 hours were fished annually by beam trawls from 2011 to 2014, with significantly lower effort of 2,015 hours in 2015. As with the landings values, fly shooting effort is seen to steadily increase between 2013 and 2015. The high weight of anchovy landed in 2015 by pelagic trawl is attributed to only 55 hours of effort.

4.1.2.3 Consultation indicates the following Dutch fleets to be operating across the Hornsea Three array area:

- UK registered, Dutch owned beam trawlers: 6 vessels 30-45 m in length (included within data presented within Section 3: UK Fisheries Activity Assessment);
- Dutch registered, Dutch owned beam trawlers: 10 vessels 30-45 m in length;
- Dutch registered, Dutch owned fly shooters: 12 vessels 25-35 m in length;
- Dutch registered, Dutch owned demersal trawlers: 15-20 vessels less frequently operating across the former Hornsea Zone targeting *Nephrops* and mixed demersal in the Outer Silver Pit and Markhams Hole; and
- Dutch registered, Dutch owned pelagic vessels: numbers unknown, but generally not common.

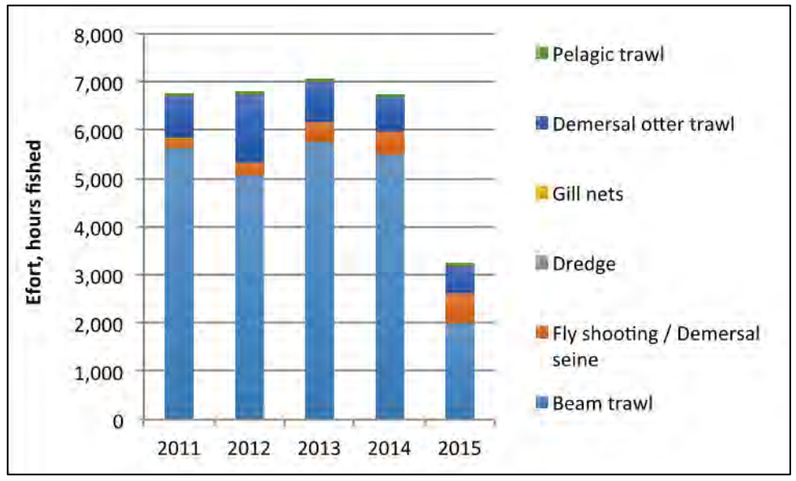

Figure 4.5: Effort (hours fished) of Dutch registered vessels fishing within ICES rectangle 36F2 indicating gear type (Data source: EU DCF, 2017).

4.2 Hornsea Three offshore cable corridor

4.2.1 Landing trends, fishing grounds and key species

4.2.1.1 Landings by Dutch registered vessels from ICES rectangles 34F1, 35F1, 36F1 and 36F2 are presented in Figure 4.6 by gear type and ICES rectangle.

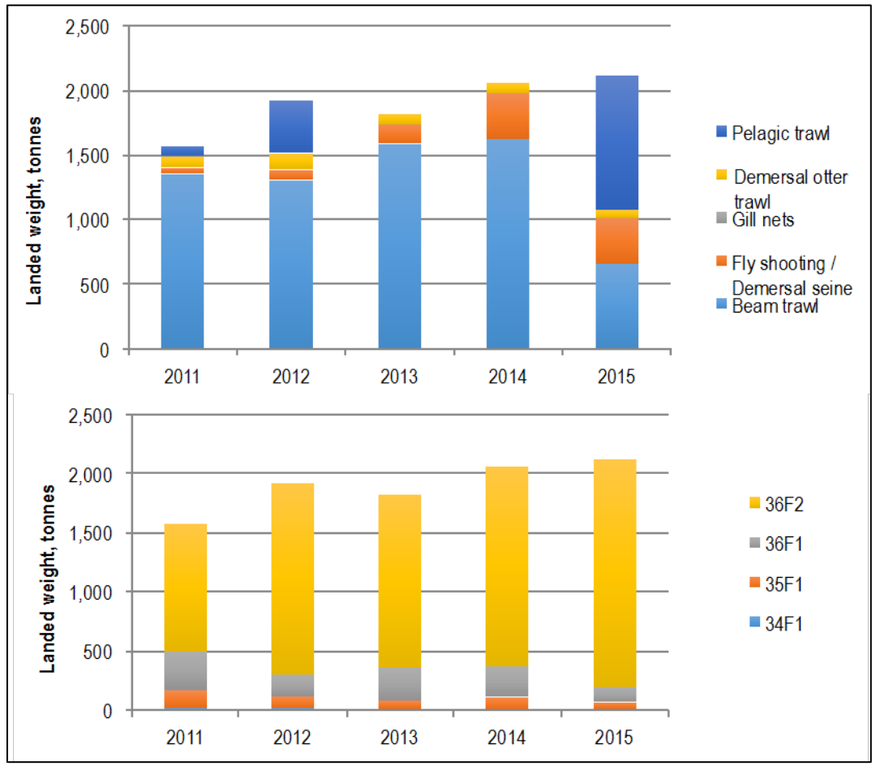

Figure 4.6: Landed weight of all landings by Dutch registered vessels from ICES rectangles 34F1, 35F1, 36F1 and 36F2 from 2011 to 2015 indicating gear type (top) and ICES rectangle (bottom) (Data source: EU DCF, 2017).

4.2.1.2 The majority of landings by weight (on average 84%) are from ICES rectangle 36F2, which has been characterised in section 4.1. To avoid duplication, the remainder of this section will focus on ICES rectangles 36F1 (which accounts for 12% of landings by weight), 35F1 (5%) and 34F1 (<1%).

4.2.1.3 Landings by Dutch registered vessels from ICES rectangles 36F1, 35F1 and 34F1 are presented in Figure 4.7 indicating landed weight and first sales value by species. Again, the beam trawl and fly shooting fleets are targeting sole, plaice and mixed demersal species. Sole and plaice landed from 36F1 and 35F1 by the Dutch fleet had an average annual first sales value of €1.5 million, with peaks seen in 2011.

4.2.1.4 It is noted that landings by Dutch registered vessels from 36F1 are focused from areas north of the offshore cable corridor, which overlaps with a very small area of 36F1 (see Figure 4.4 and Appendix C).

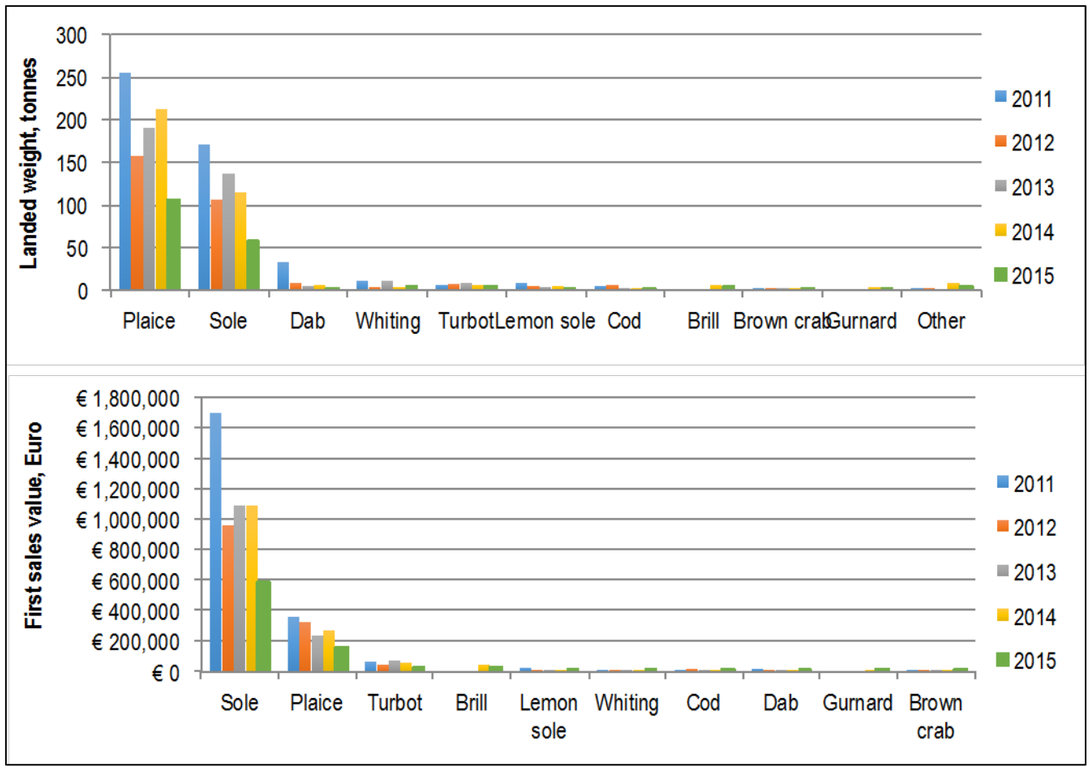

Figure 4.7: Landed weight (top) and value (bottom) of all landings by Dutch registered vessels from ICES rectangles 34F1, 35F1 and 36F1 from 2011 to 2015 indicating species (Data sources: EU DCF, 2017; EU MOFA, 2017).

5. France Fisheries Activity Assessment

5.1 Hornsea Three array area

5.1.1 Landing trends, fishing grounds and key species

5.1.1.1 Landings by French registered vessels from ICES rectangle 36F2 are presented in Figure 5.1 by gear type and Figure 5.2 by species.

5.1.1.2 Landings by French registered vessel fluctuate widely from 2011 to 2015 with no discernible pattern or trend. The majority of landings by the French fleet from ICES rectangle 36F2 are of mackerel and whiting. The highest landed weight is recorded in 2012 for 445 tonnes of mackerel worth €544 k in first sales value. This is recorded as being landed by demersal otter trawl, but is more likely to be attributable to vessels that operate both demersal and pelagic trawl gear as mackerel is a mid-water shoaling species. Landings of mackerel by pelagic trawl are also noted in 2014 and 2015. Mackerel are highly mobile pelagic species and are not associated with any particular benthic habitat type. It is therefore assumed that mackerel (as well as other pelagic species) potentially caught within Hornsea Three array area, would also be available to target outside the Hornsea Three array area.

5.1.1.3 Whiting is also noted within landings by French vessels, with average annual landings of 26 tonnes worth €42 k in first sales value.

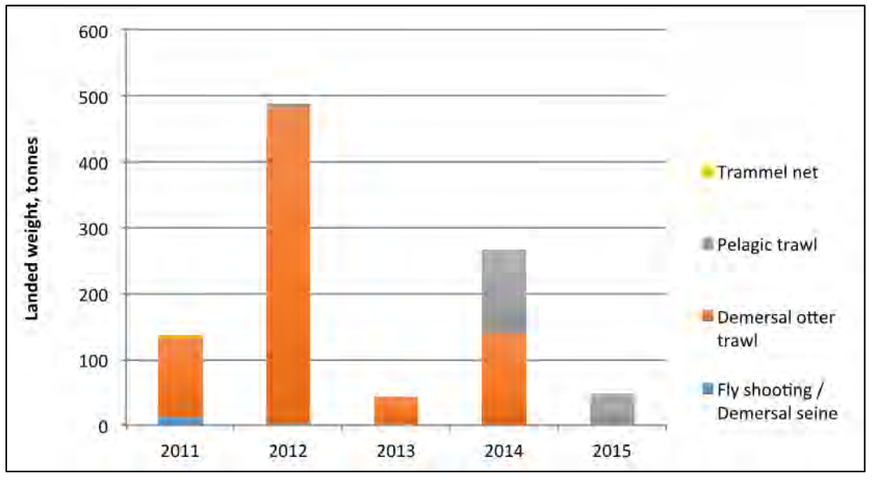

Figure 5.1: Landed weight of all landings by French registered vessels from ICES rectangle 36F2 from 2006 to 2015 indicating gear type (Data source: EU DCF, 2017).

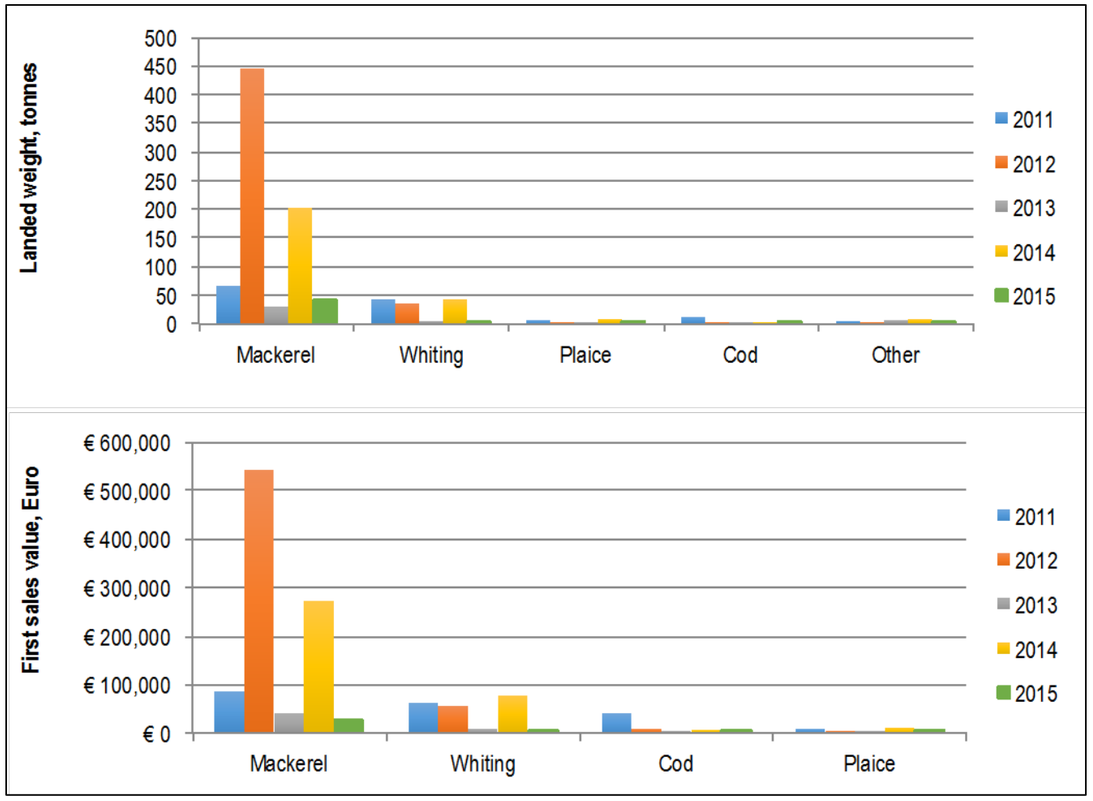

Figure 5.2: Landed weight (top) and value (bottom) of all landings by French registered vessels from ICES rectangle 36F2 from 2011 to 2015 indicating species (Data sources: EU DCF, 2017; EU MOFA, 2017).

5.1.1.4 Recent VMS data was not available for French registered vessels. The French National Committee on Marine Fisheries and Aquaculture (CNPMEM) undertook a preliminary assessment of French fishing vessel activities within Round 3 offshore wind zones, based on VMS data analysed by the French Research Institute for Exploration of the Sea (IFREMER, 2009) which is presented in Figure 5.3 and Figure 5.4. During 2008, a total of 30 French vessels were recorded as active within the former Hornsea Zone, with the majority undertaking demersal and/or pelagic trawling. One purse seiner was also recorded. The average dependence of these French vessels on the Hornsea Zone was assessed as 2 to 3% (i.e. 97 to 98% of their effort is exerted in other fishing grounds). Dependency values specific to Hornsea Three array area are not available.

5.1.1.5 VMS data collated by the MMO for French mobile vessels indicating hours fished is presented in Appendix B, showing minimal effort across the regional commercial fisheries study area.

Figure 5.3: Vessel Monitoring System data for French demersal trawl vessels (≥ 15 m) actively fishing within regional commercial fisheries study area in 2008 (Source: CNPMEM, 2009).

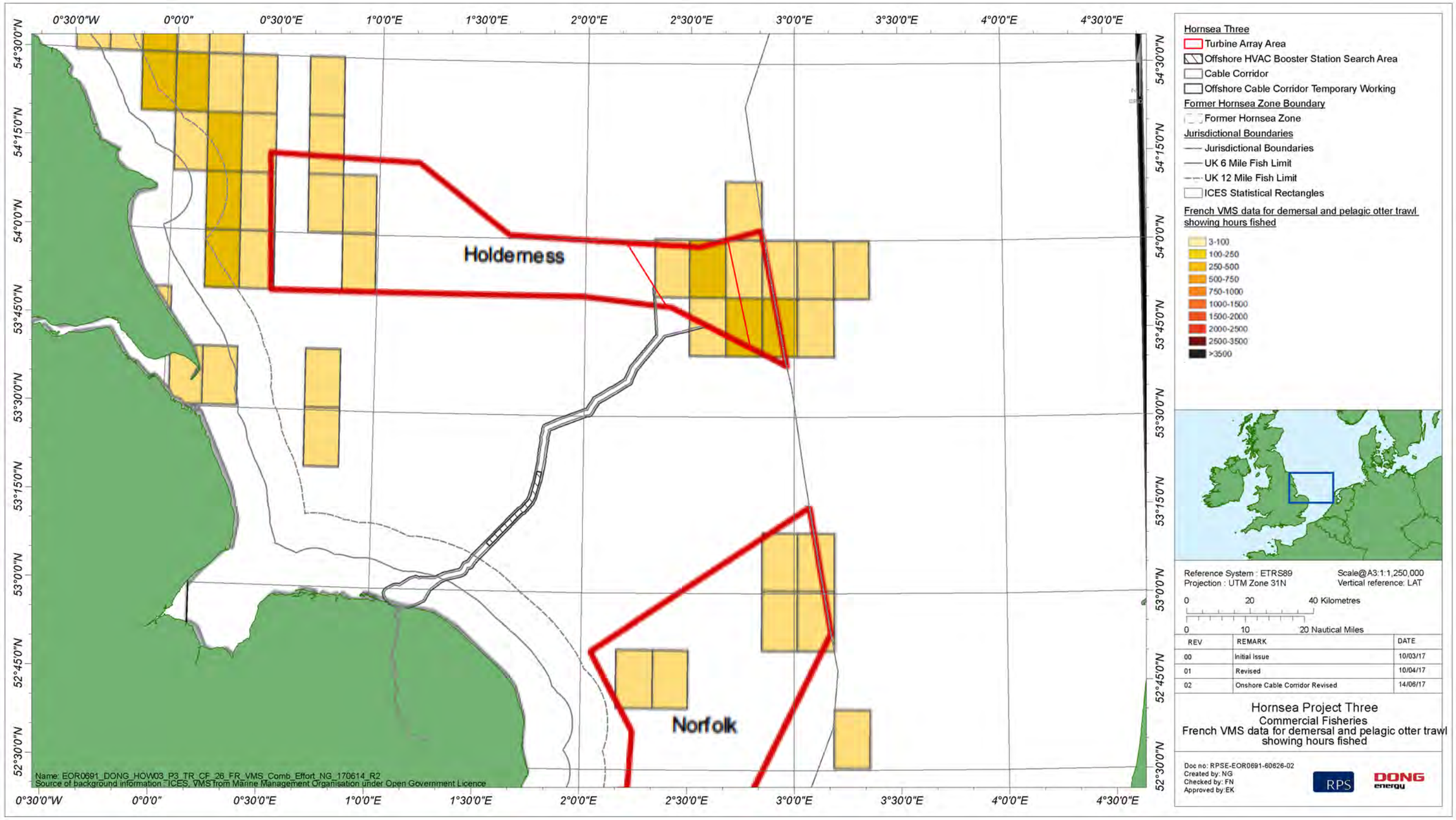

Figure 5.4: Vessel Monitoring System data for French combined demersal and mid-water trawl vessels (≥ 15 m) actively fishing within regional commercial fisheries study area in 2008 (Source: CNPMEM, 2009).

5.1.2 Effort and vessel fleets

5.1.2.1 Effort by French registered vessels from ICES rectangle 36F2 is presented in Figure 5.5 indicating hours of active fishing by gear type. Effort within 36F2 represents 8% of French effort within the regional commercial fisheries study area.

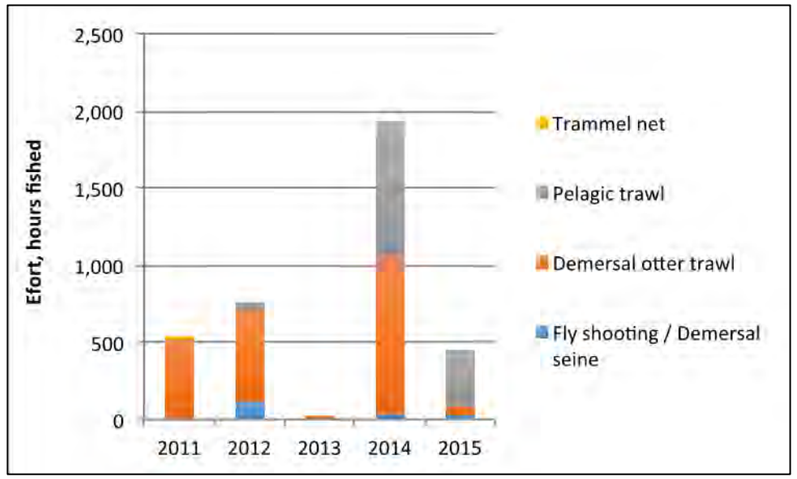

Figure 5.5: Effort (hours fished) of French registered vessels fishing within ICES rectangle 36F2 indicating gear type (Data source: EU DCF, 2017).

5.1.2.2 Two French Producer Organisations represent French vessel owners that operate throughout the North Sea: From Nord and Cooperative Maritime Etaploise (C.M.E.). Approximately two vessels within From Nord and 20 vessels from C.M.E. have the potential to fish across the former Hornsea Zone, including within the Hornsea Three array area boundaries. These vessels are >22 m in length and operate otter trawling gear to target mackerel and whiting throughout the regional commercial fisheries study area.

5.2 Hornsea Three offshore cable corridor

5.2.1 Landing trends, fishing grounds and key species

5.2.1.1 Landings by French registered vessels from ICES rectangles 34F1, 35F1, 36F1 and 36F2 are presented in Figure 5.6 by gear type and Figure 5.7 by species.

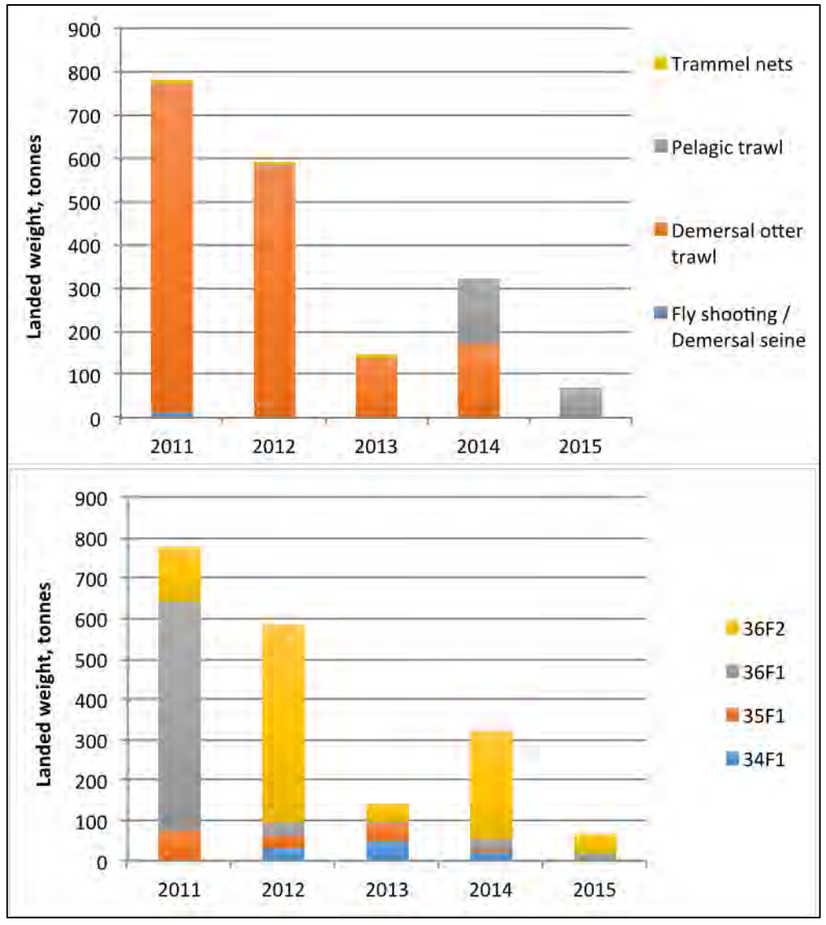

Figure 5.6: Landed weight of all landings by French registered vessels from ICES rectangles 34F1, 35F1, 36F1 and 36F2 from 2011 to 2015 indicating gear type (top) and ICES rectangle (bottom) (Data source: EU DCF, 2017).

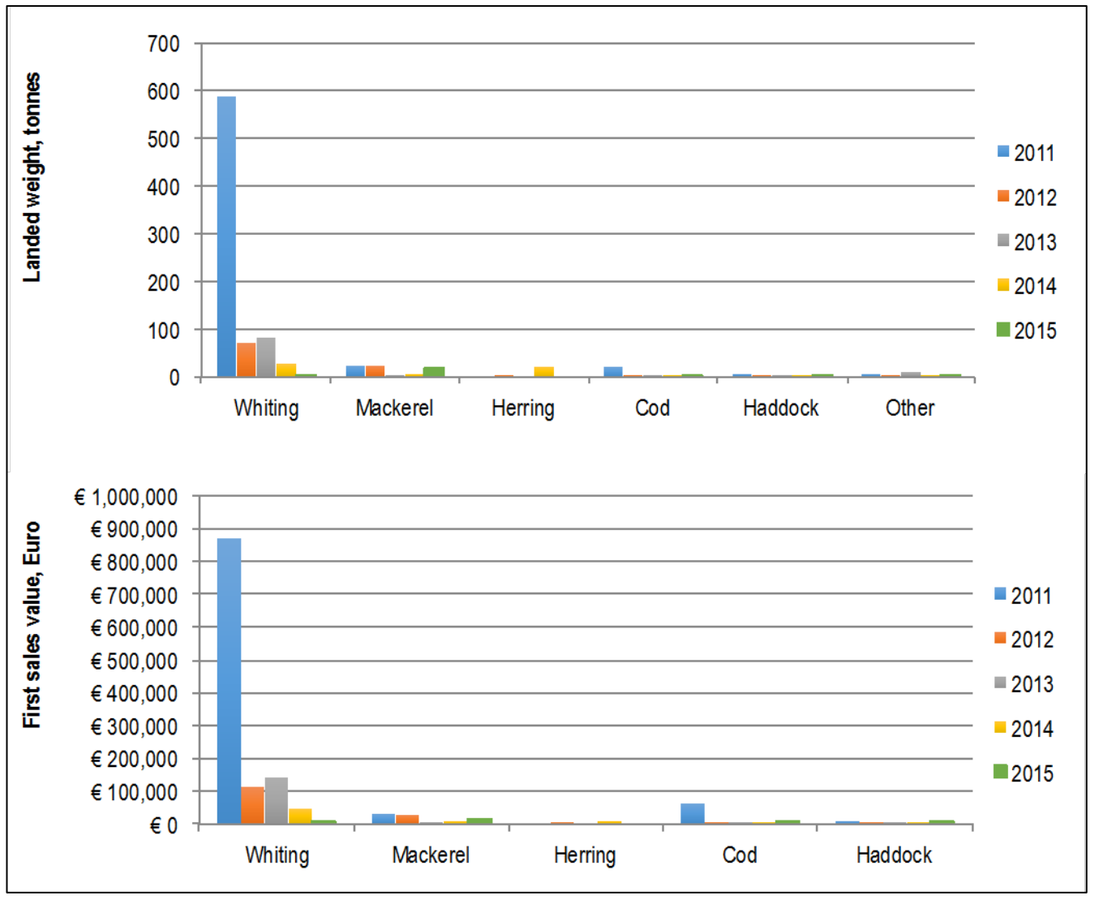

Figure 5.7: Landed weight (top) and value (bottom) of all landings by French registered vessels from ICES rectangles 34F1, 35F1 and 36F1 from 2011 to 2015 indicating species (Data sources: EU DCF, 2017; EU MOFA, 2017).

5.2.1.2 In 2012 and 2014, the majority of landings were from ICES rectangle 36F2, which is detailed in Section 5.1. Whiting makes up the majority of the landings from 34F1, 35F1 and 36F1. Significant landings from 36F1 are noted in 2011, when 588 tonnes of whiting were landed, worth €870 k in first sales value. From 2012 to 2015 whiting landings by French vessels from 36F1, 35F1 and 34F1 averaged an annual value of €76 k.

6. Belgium Fisheries Activity Assessment

6.1 Hornsea Three array area

6.1.1 Landing trends, fishing grounds and key species

6.1.1.1 Landings by Belgian registered vessels from ICES rectangle 36F2 are presented in Figure 6.1 by gear type and Figure 6.2 by species. Landings are consistently by beam trawl and demersal otter trawl targeting plaice, sole, turbot, *Nephrops* and mixed demersal species (Figure 6.2). Landing peaked in weight and value in 2011 and 2012, attributable to plaice, and dropped to more typical levels from 2013 to 2015. These trends may be linked to Belgian quota allocations for plaice in the North Sea which have increased by 74% from 2011 to 2015. Such a quota increase may lead vessels to focus effort on grounds more commonly targeted for plaice e.g. Dogger Bank.

6.1.1.2 The average annual landings by Belgian vessels from 36F2 is 337 tonnes, worth €733 k in first sales value.

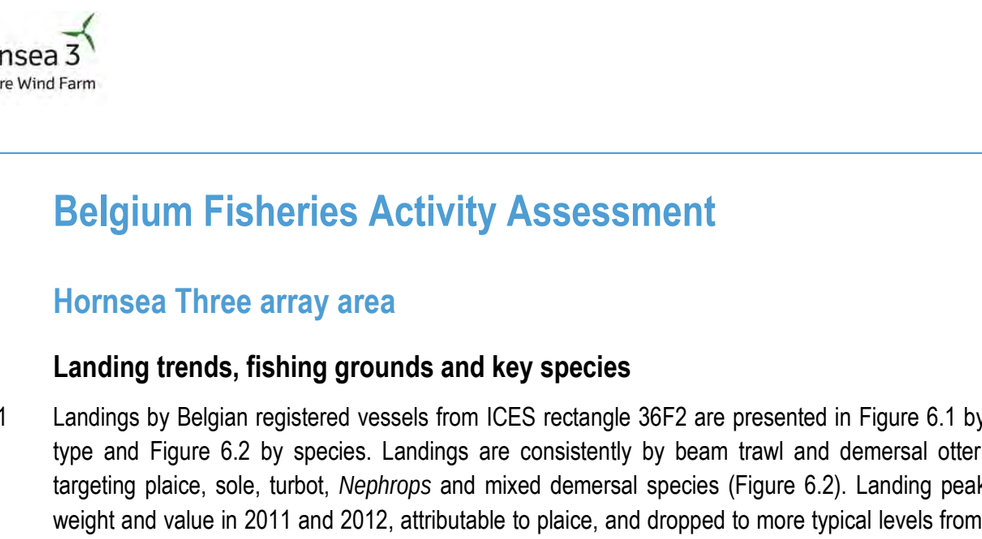

Figure 6.1: Landed weight of all landings by Belgian registered vessels from ICES rectangle 36F2 from 2006 to 2015 indicating gear type (Data source: EU DCF, 2017).

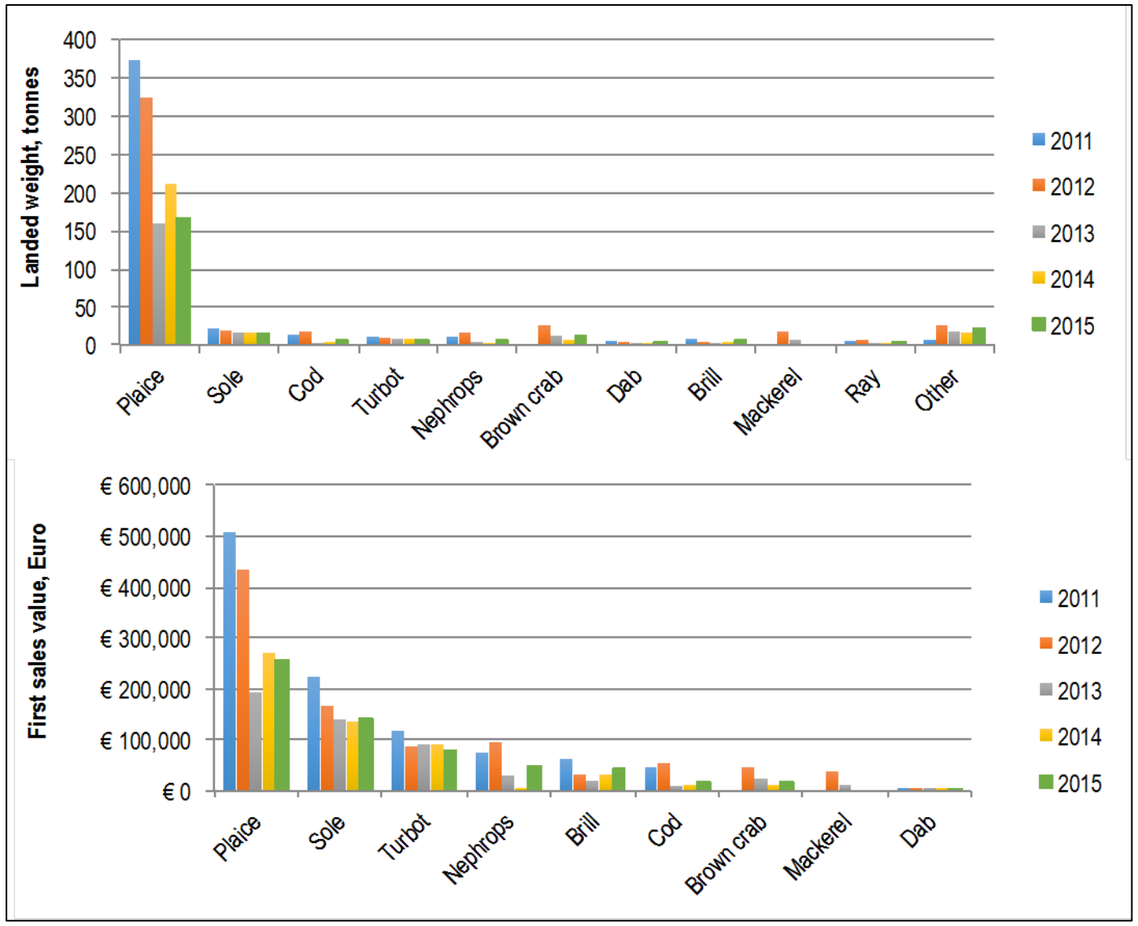

Figure 6.2: Landed weight (top) and value (bottom) of all landings by Belgian registered vessels from ICES rectangle 36F2 from 2011 to 2015 indicating species (Data sources: EU DCF, 2017; EU MOFA, 2017).

6.1.1.3 VMS data for Belgian vessels actively fishing in 2009 indicate that the highest effort occurs immediately north of the former Hornsea Zone and within the Hornsea Three array area (Figure 6.3). The Belgian VMS data indicates that the activity within ICES rectangle 36F2 is focused across the Hornsea Three array area and offshore cable corridor.

6.1.1.4 VMS data collated by the MMO for Belgian mobile vessels indicating hours fished are presented in Appendix B, and corroborate the data provided by the Belgian fishing industry.

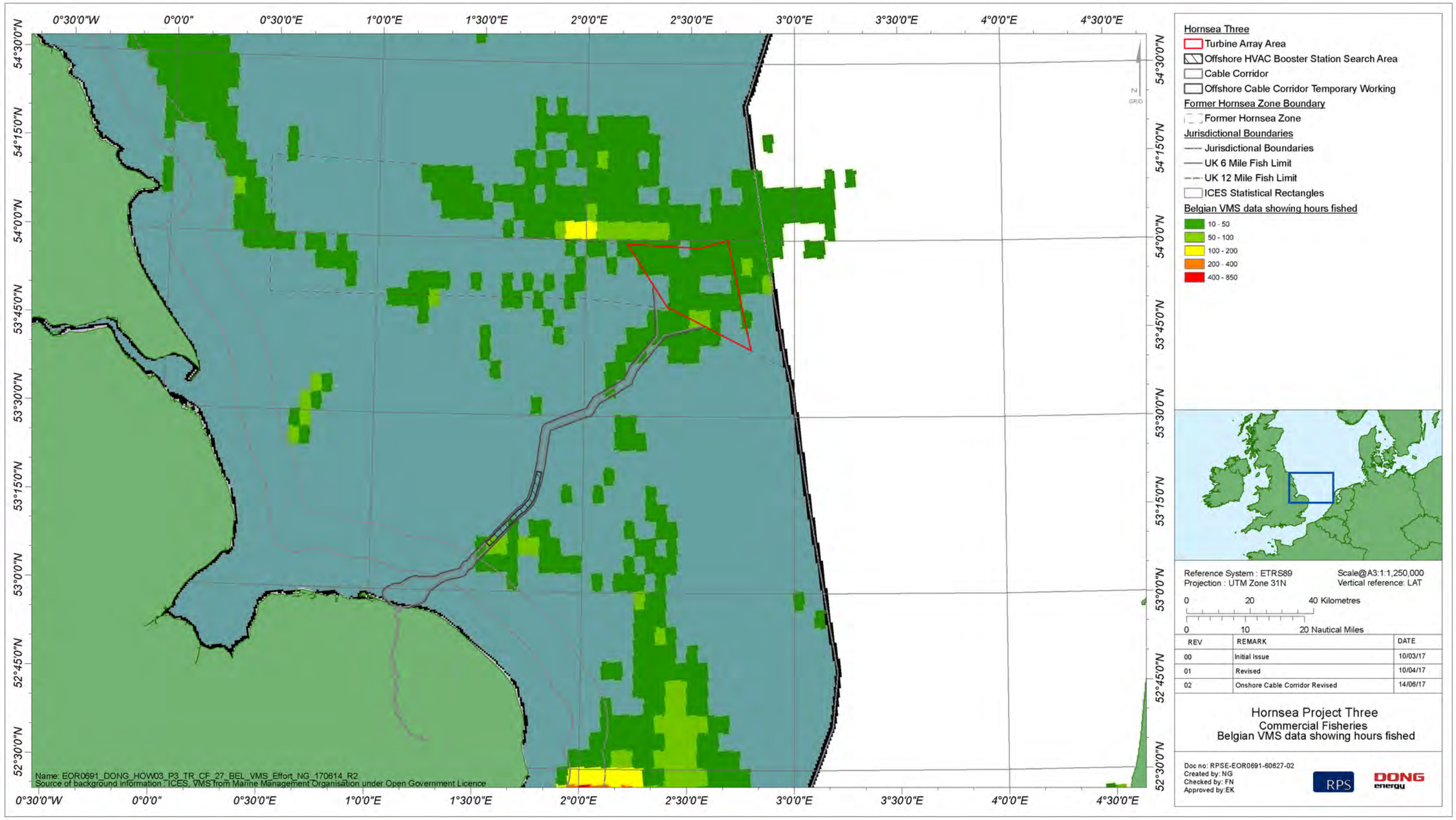

Figure 6.3: Vessel Monitoring System data for Belgian beam trawl vessels (≥ 15 m) actively fishing within the regional commercial fisheries study area in 2009 indicating hours fished (Source: Rederscentrale, 2011).

6.1.2 Effort and vessel fleets

6.1.2.1 Effort by Belgian registered vessels from ICES rectangle 36F2 is presented in Figure 6.4 indicating hours of active fishing by gear type. Effort within 36F2 represents 22% of Belgian effort within the regional commercial fisheries study area.

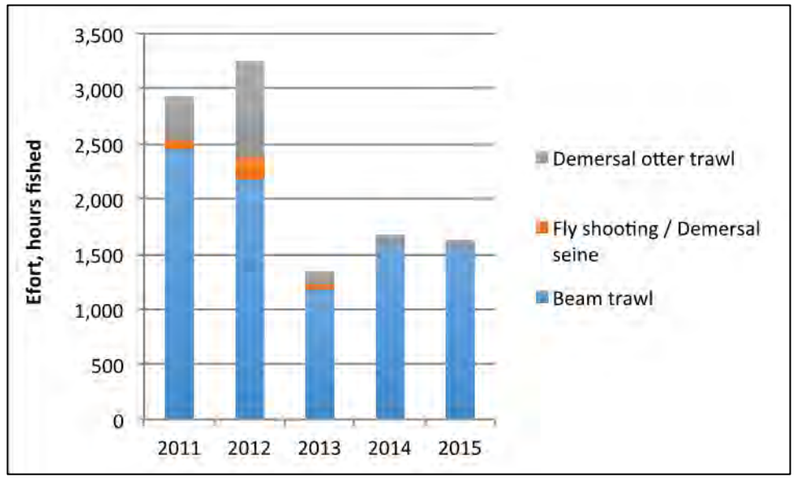

Figure 6.4: Effort (hours fished) of Belgian registered vessels fishing within ICES rectangle 36F2 indicating gear type (Data source: EU DCF, 2017).

6.1.2.2 On average, annual effort within 36F2 is 1,800 hours for Belgian beam trawlers and 300 hours for Belgian demersal otter trawlers (based on a five-year data from 2011 to 2015; Data source: EU DCF, 2017).

6.1.2.3 Belgian beam trawlers and otter trawlers ≥ 20 m in length operate within the former Hornsea Zone and across the regional commercial fisheries study area.

6.1.2.4 There are 80 vessels within the Belgian fleet represented by the only Belgian Producer Organisation, Rederscentrale. Of the 80 vessels, approximately ten vessels are not expected to be able to steam as far north as the Hornsea Three array area. Of the remainder, 20 to 70 vessels have the potential to operate across the Hornsea Three array area, or to steam through it to other areas, the most notable being Dogger Bank. Catch is landed into Oostende, Zeebrugge or UK ports (Figure 3.23).

6.2 Hornsea Three offshore cable corridor

6.2.1 Landing trends, fishing grounds and key species

6.2.1.1 Landings by Belgian registered vessels from ICES rectangles 34F1, 35F1, 36F1 and 36F2 are presented in Figure 6.5 by gear type and Figure 6.6 by species.

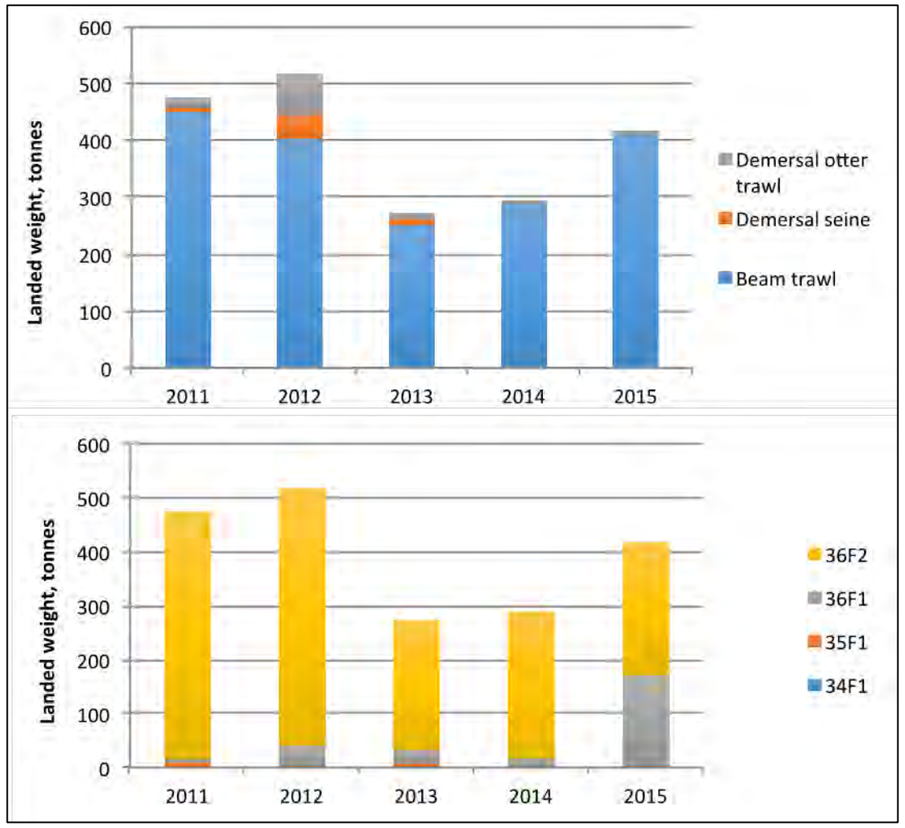

Figure 6.5: Landed weight of all landings by Belgian registered vessels from ICES rectangles 34F1, 35F1, 36F1 and 36F2 from 2011 to 2015 indicating gear type (top) and ICES rectangle (bottom) (Data source: EU DCF, 2017).

Figure 6.6: Landed weight (top) and value (bottom) of all landings by Belgian registered vessels from ICES rectangles 34F1, 35F1 and 36F1 from 2011 to 2015 indicating species (Data sources: EU DCF, 2017; EU MOFA, 2017).

6.2.1.2 On average 86% of landings are from ICES rectangle 36F2, which is described in section 6.1.

6.2.1.3 Landings from 36F1, 35F1 and 34F1 typically form <10% of Belgian landings from the Hornsea Three offshore cable corridor commercial fisheries study area, with the exception of 2015 when significant landings of plaice and sole were recorded to be taken from 36F1 by the Belgian fleet.

7. Denmark Fisheries Activity Assessment

7.1 Hornsea Three array area

7.1.1 Landing trends, fishing grounds and key species

7.1.1.1 Landings by Danish registered vessels from ICES rectangle 36F2 are presented in Figure 7.1 by gear type and Figure 7.2 by species.

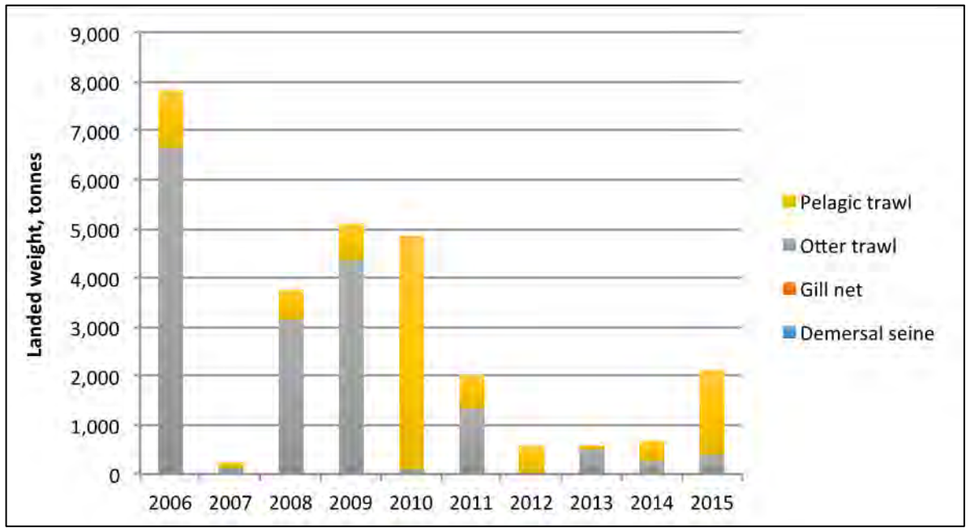

Figure 7.1: Landed weight of all landings by Danish registered vessels from ICES rectangle 36F2 from 2006 to 2015 indicating gear type (Data source: EU DCF, 2017).

7.1.1.2 The Danish fleet target sandeel and sprat within ICES rectangle 36F2. Sandeel are caught by large industrial demersal otter trawlers and sprat are targeted by pelagic trawlers. Significant landings of anchovy were also taken by pelagic trawl in 2015. Danish landings of sandeel and sprat undergo large fluctuations. Notably sandeel landings are very low in 2012 (largely due to the low recruitment in 2010 and 2011) and absent in 2015 (due to zero TAC in 2015 for sandeel in the North Sea).

7.1.1.3 The Danish sandeel vessels have not heavily targeted the former Hornsea Zone area for the past five to six years due to 80 to 90% of effort being focused on Dogger Bank.

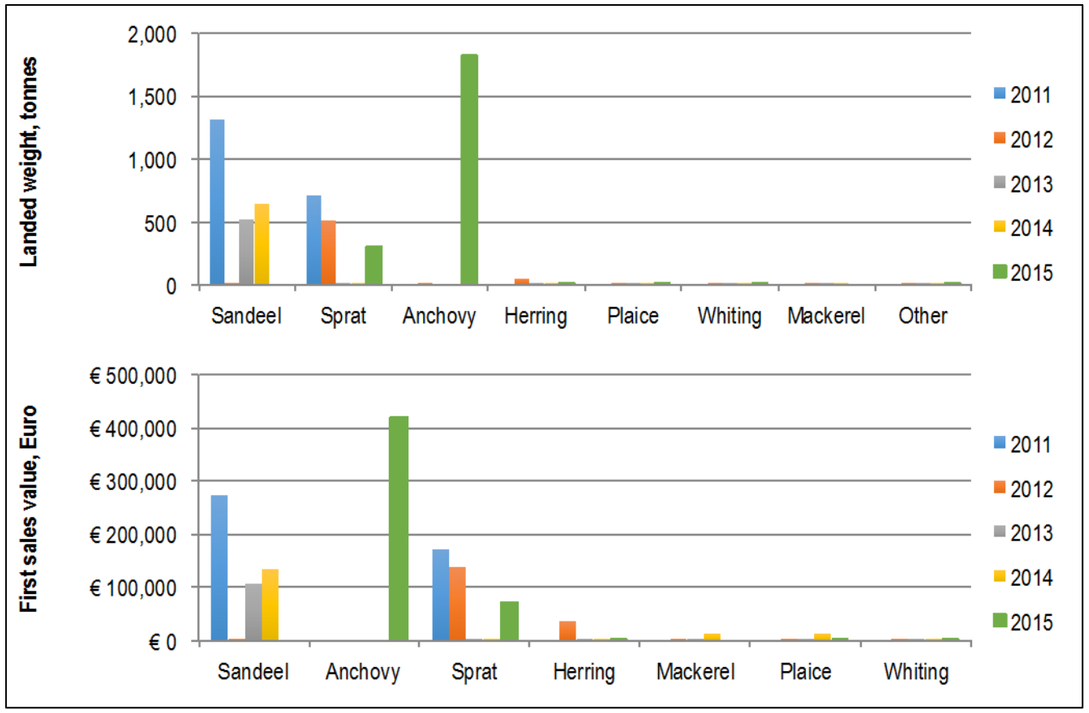

Figure 7.2: Landed weight (top) and value (bottom) of all landings by Danish registered vessels from ICES rectangle 36F2 from 2011 to 2015 indicating species (Data sources: EU DCF, 2017; EU MOFA, 2017).

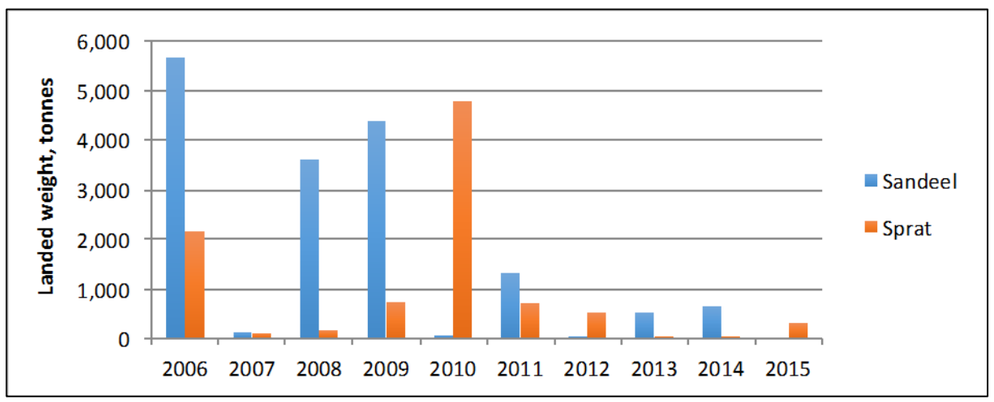

Figure 7.3: Landed weight of sandeel and sprat landings by Danish registered vessels from ICES rectangle 36F2 from 2006 to 2015 (Data source: EU DCF, 2017).

7.1.1.4 Figure 7.4 and Figure 7.5 present the key sandeel fishing grounds targeted by the Danish fleet based on historical VMS data and vessel tracking information provided by the fishing industry across a 20 year period (approximately 1991 to 2011). VMS data for Danish vessels active in the regional commercial fisheries study area are presented in Figure 7.6 for all Danish vessels activity fishing in 2010 and Appendix B for the hours fished during 2010 for all mobile vessels.

7.1.1.5 Sandeel are short-lived species and therefore the fishery is highly dependent on recruitment from the previous year. The sandeel season runs from 1 April to 31 July each year. At the start of the season fishermen will sample different grounds and then fish where the catch rates are highest. This means they may focus on one area, or a range of grounds throughout the North Sea, dependant on catch rates.

7.1.1.6 The sandeel ground that overlaps Hornsea Three array area is understood to have been less productive in the past five years, with historical trends showing higher catch rates in 36F2 in 2006, 2008 and 2009. Based on this evidence it is reasonable to assume that the sandeel grounds overlapping Hornsea Three array area could be productive in the future.

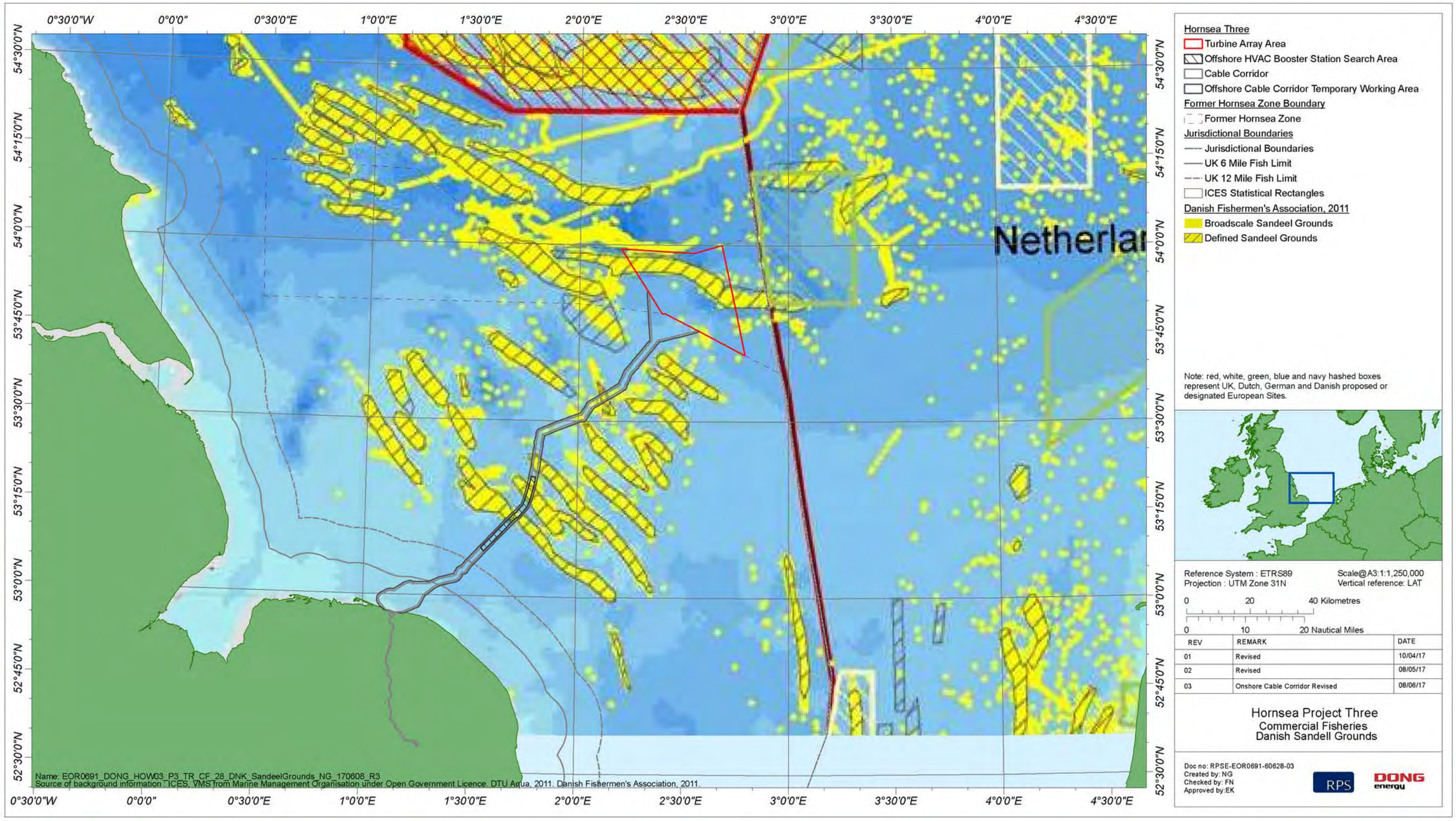

Figure 7.4: Map of key sandeel fishing grounds (yellow) for Danish fleet based on Vessel Monitoring System data (Source: DTU Aqua, 2011). [Note: red, white, green, blue and navy hashed boxes represent UK, Dutch, German and Danish proposed or designated European Sites).

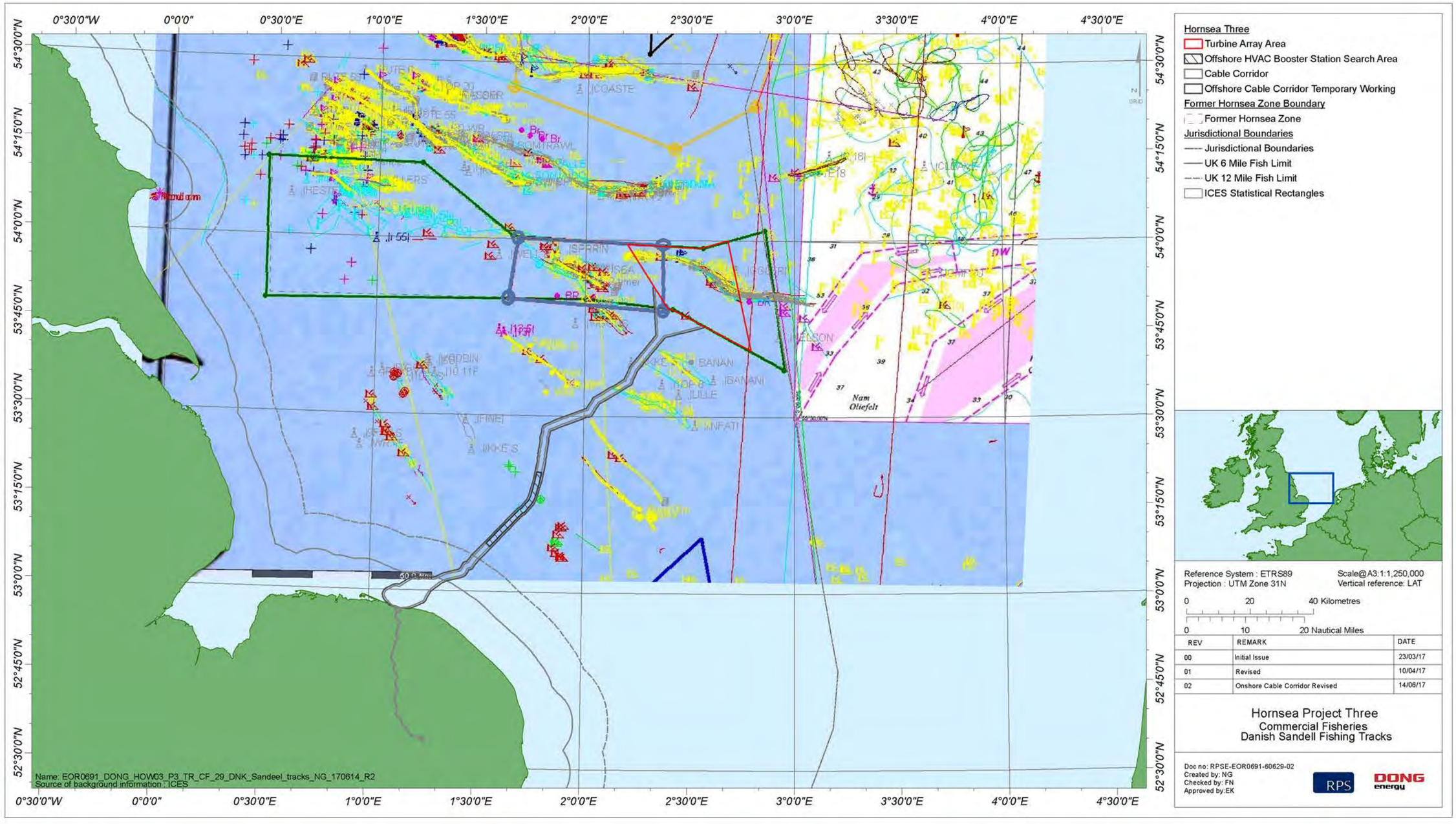

Figure 7.5: Map of key sandeel fishing grounds (yellow) for Danish fleet based on vessel tracking data (Source: Danish Fishermen's Association, 2011).

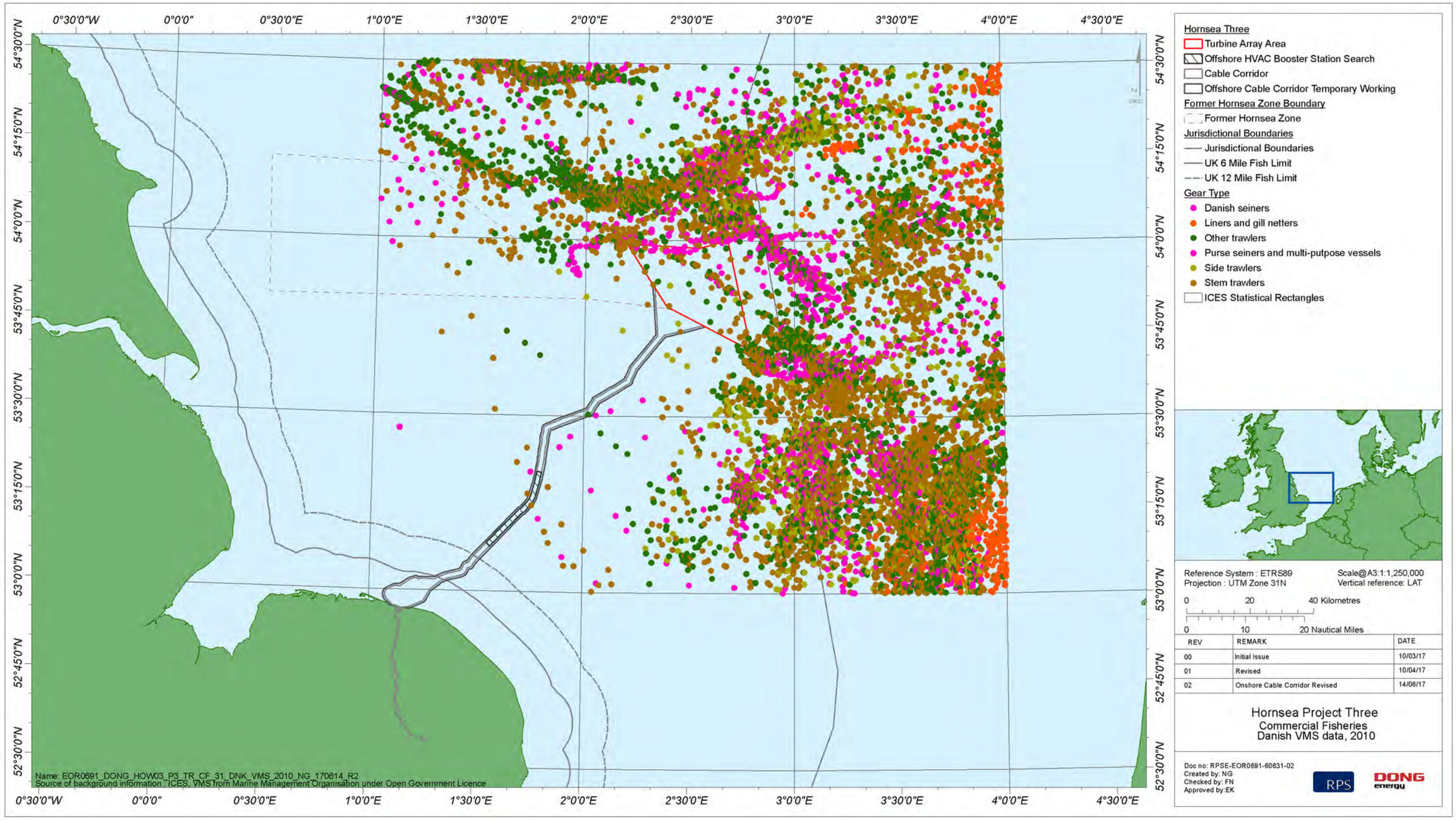

Figure 7.6: Vessel Monitoring System data for Danish vessels (≥ 15 m) actively fishing within the regional commercial fisheries study area in 2010 (Source: Danish Fisheries Directorate, 2011).

7.1.2 Effort and vessel fleets

7.1.2.1 Effort by Danish registered vessels from ICES rectangle 36F2 is presented in Figure 7.7 indicating hours of active fishing by gear type. Effort within 36F2 represents 4% of Danish effort within the regional commercial fisheries study area. On average, annual effort within 36F2 is 326 hours for Danish demersal otter trawlers and 152 hours for pelagic trawl (based on a five-year data from 2011 to 2015; Data source: EU DCF, 2017).

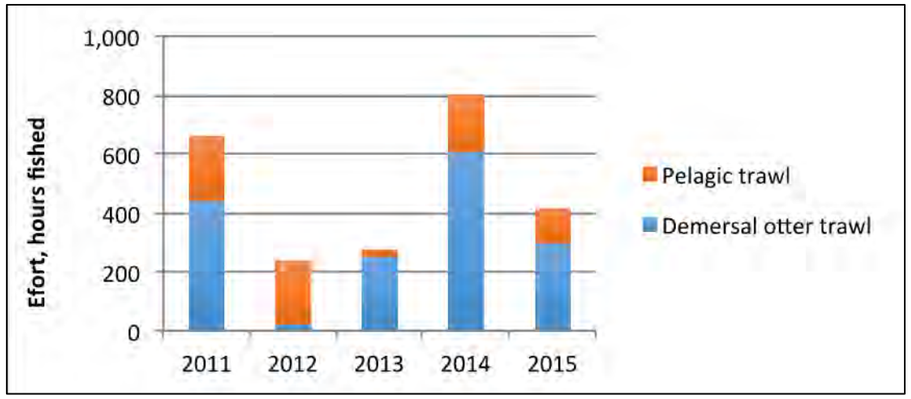

Figure 7.7: Effort (hours fished) of Danish registered vessels fishing within ICES rectangle 36F2 indicating gear type (Data source: EU DCF, 2017).

7.1.2.2 Approximately 30 to 40 Danish vessels (demersal and semi-pelagic otter trawlers), 35 to 75 m in length, targeting sandeels are capable of fishing in the Hornsea area, including across the sandeel ground that overlaps with the Hornsea Three array area. Key landing ports are Esbjerg and Thyborøn, with smaller amounts landed into Hanstholm and Skagen (Figure 3.23).

7.2 Hornsea Three offshore cable corridor

7.2.1 Landing trends, fishing grounds and key species

7.2.1.1 Landings by Danish registered vessels from ICES rectangles 34F1, 35F1, 36F1 and 36F2 are presented in Figure 7.8 by gear type and ICES rectangle indicating, on average, 81% by weight is landed from 36F2, which is described in Section 7.1.

7.2.1.2 Figure 7.9 depicts landings from 34F1, 35F1 and 36F1 (i.e. omitting 36F2). Landings from 36F1 are noted in 2013 and 2014, relating to sandeel catches.

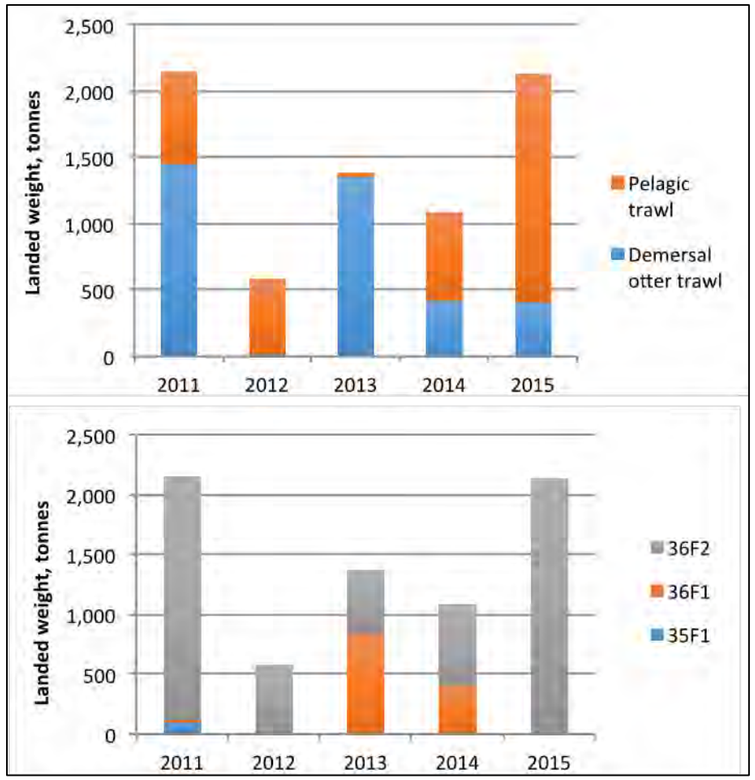

Figure 7.8: Landed weight of all landings by Danish registered vessels from ICES rectangles 34F1, 35F1, 36F1 and 36F2 from 2011 to 2015 indicating gear type (top) and ICES rectangle (bottom) (Data source: EU DCF, 2017).

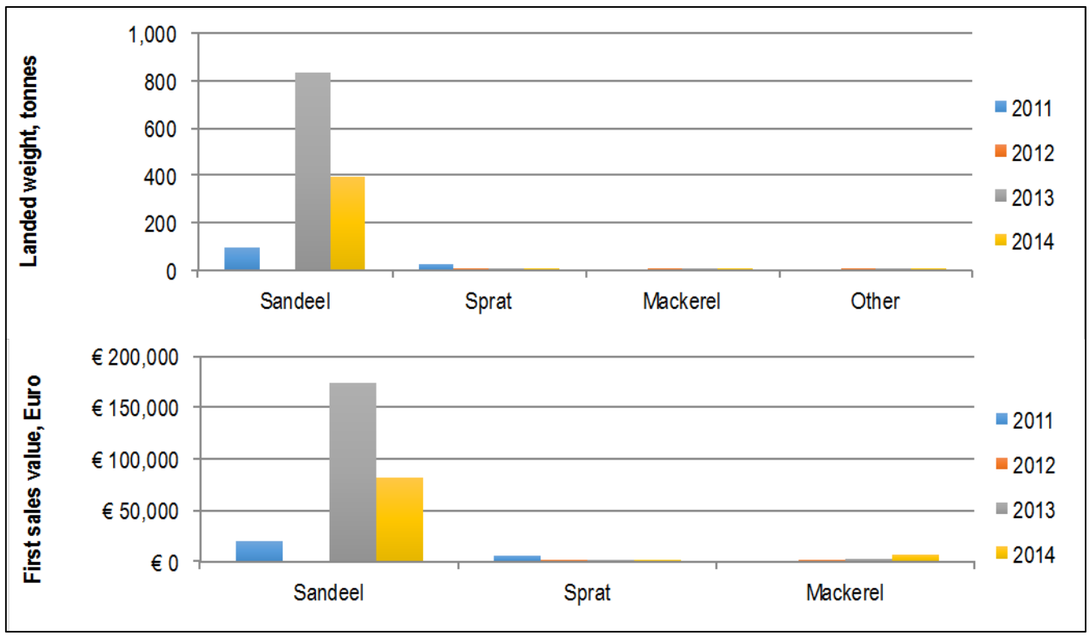

Figure 7.9: Landed weight (top) and value (bottom) of all landings by Danish registered vessels from ICES rectangles 34F1, 35F1 and 36F1 from 2011 to 2015 indicating species (Data sources: EU DCF, 2017; EU MOFA, 2017).

8. Germany Fisheries Activity Assessment

8.1 Hornsea Three array area

8.1.1 Landing trends, fishing grounds and key species

8.1.1.1 Landings by German registered vessels from ICES rectangle 36F2 are presented in Figure 8.1 by gear type and Figure 8.2 by species. Landings in 2011 were significantly higher compared to 2012 to 2015. Demersal otter trawls increasingly dominate the landings from 2012 to 2015.

8.1.1.2 On average German registered vessels landed 113 tonnes per year, worth €188 k from 36F2, based on five-year data from 2011 to 2015. A progression from beam trawls targeting sole and plaice to demersal trawls targeting *Nephrops* and mixed demersal is seen from 2011 to 2015.

8.1.1.3 Sandeel landings are noted in 2011 and 2014. Germany was allocated 0.1% of the North Sea, Norwegian Sea, Skagerrak and Kattegat TAC in 2014 (Table 2.1). The sandeel landed by German vessels from 36F2 is relatively lower value (with a first sales value of €17 k in 2014) in comparison to the mixed demersal fisheries. It is considered that from time to time the German sandeel fleet may enter the regional commercial fisheries study area, but significant, consistent activity is not likely within the Hornsea Three array area.

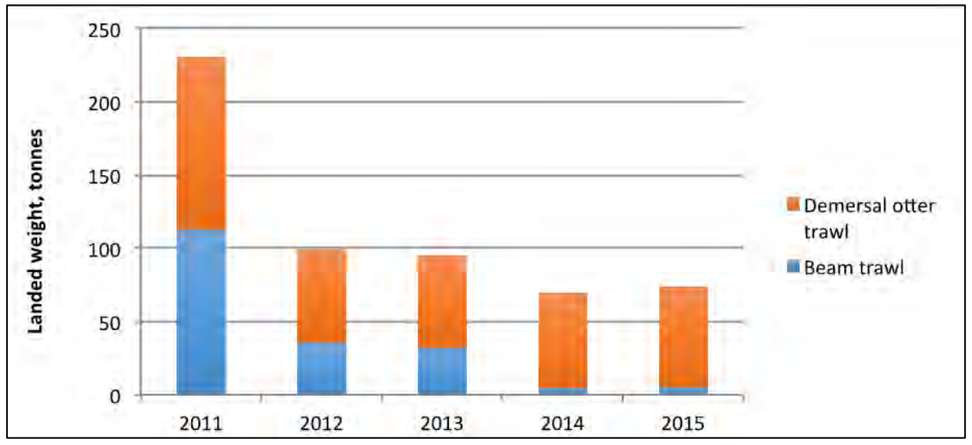

Figure 8.1: Landed weight of all landings by German registered vessels from ICES rectangle 36F2 from 2006 to 2015 indicating gear type (Data source: EU DCF, 2017).

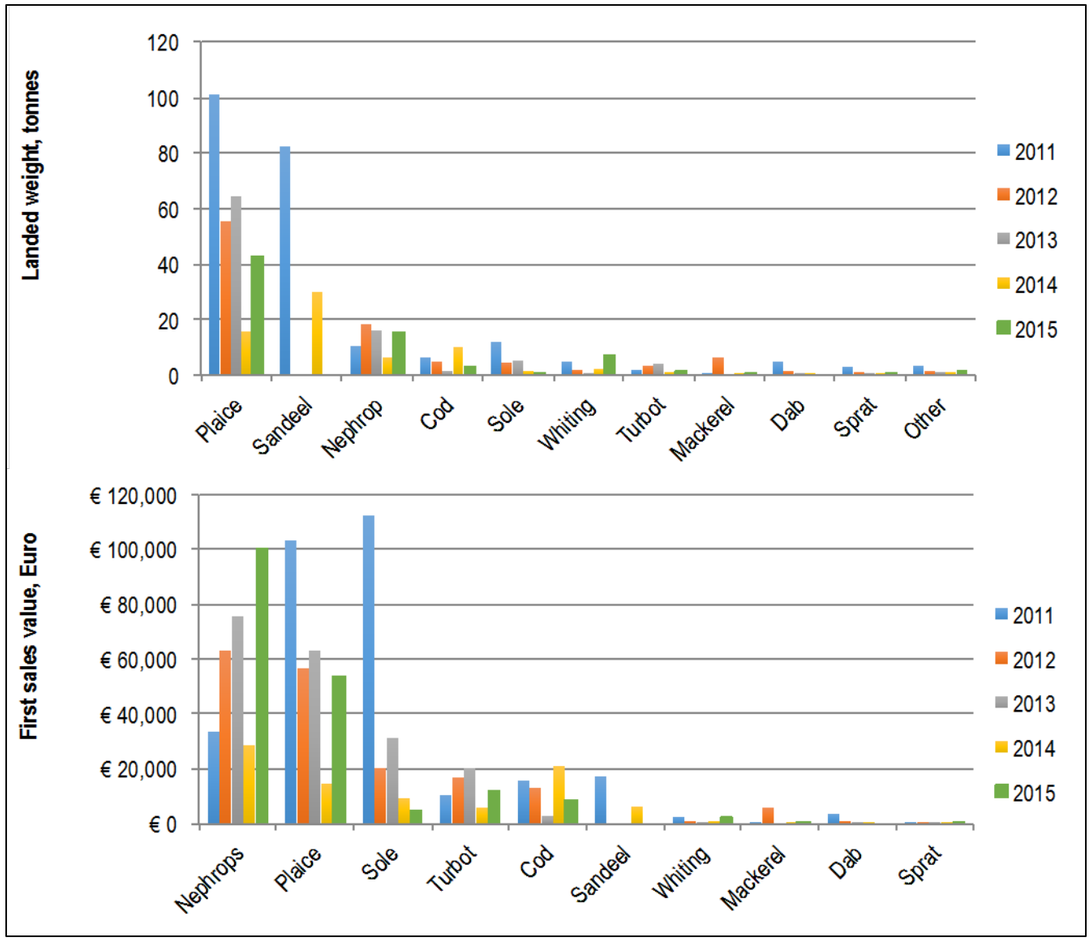

Figure 8.2: Landed weight (top) and value (bottom) of all landings by German registered vessels from ICES rectangle 36F2 from 2011 to 2015 indicating species (Data sources: EU DCF, 2017; EU MOFA, 2017).

8.1.1.4 VMS data for German vessels actively fishing across the regional commercial fisheries study area are presented in Figure 8.3. Distinct grounds are noted in the north and central sections of the Hornsea Three array area related to the Outer Silver Pit and Markhams Hole respectively. Effort by both beam trawls and demersal otter trawls are noted in these areas. The beam trawl fleet target plaice and mixed demersal species, of which sole is particularly valuable. The demersal otter trawl fleet target nephrops and mixed demersal species.

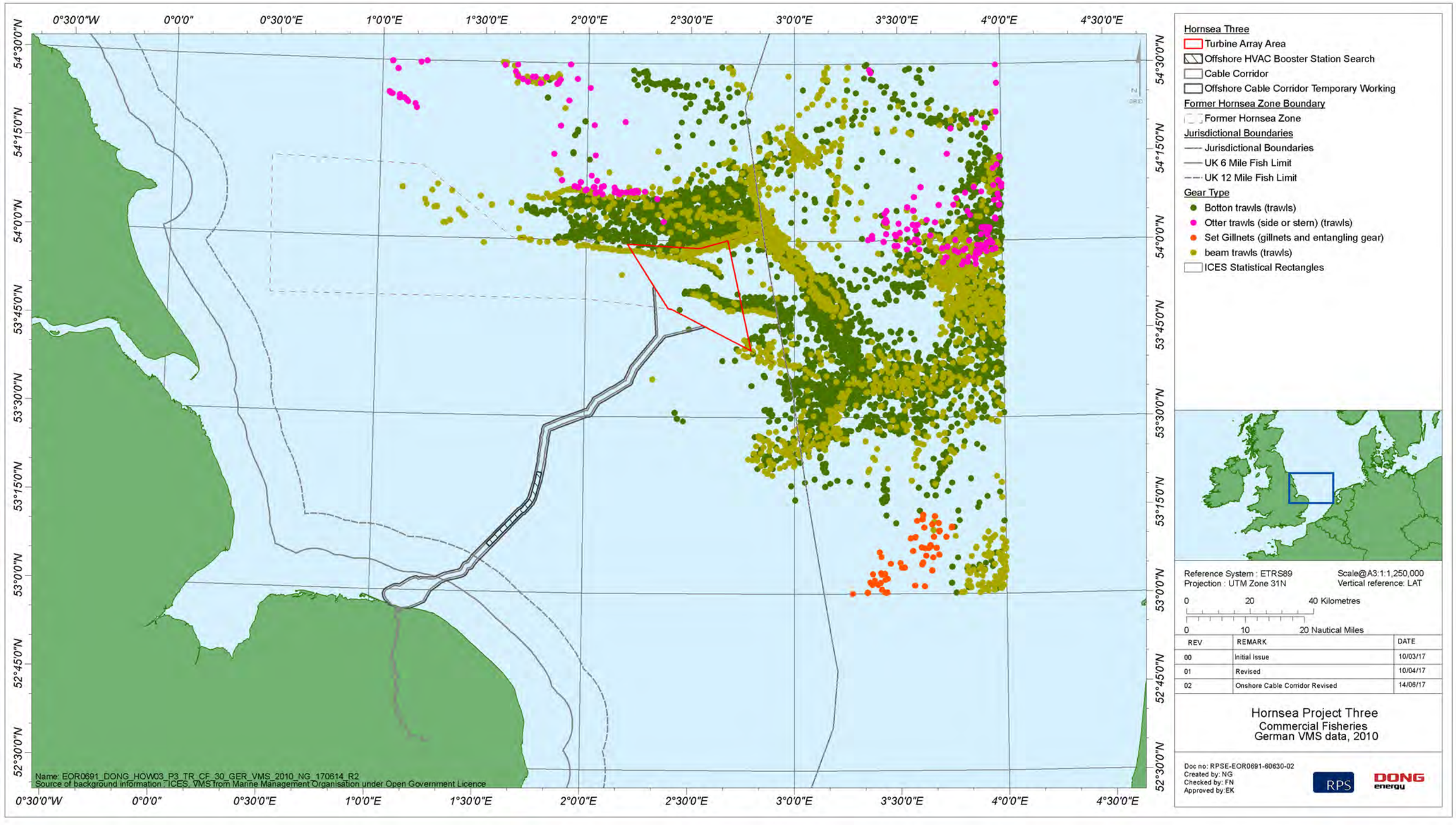

Figure 8.3: Vessel Monitoring System data for German vessels (≥ 15 m) actively fishing within the regional commercial fisheries study area in 2010 (Source: BMELV, 2011).

8.1.1.5 VMS data collated by the MMO for German mobile vessels indicating hours fished are presented in Appendix B, and corroborate the above findings.

8.1.2 Efforts and vessel fleets

8.1.2.1 Effort by German registered vessels from ICES rectangle 36F2 is presented in Figure 8.4 indicating hours of active fishing by gear type. Effort within 36F2 represents 8% of German effort within the regional commercial fisheries study area.

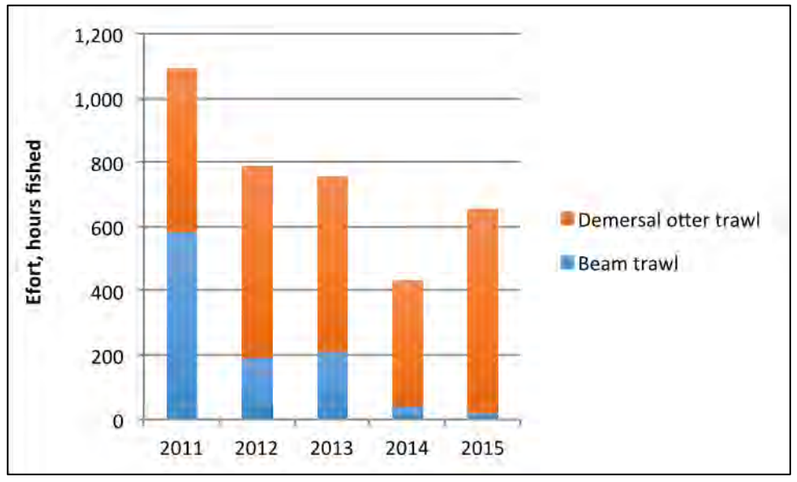

Figure 8.4: Effort (hours fished) of German registered vessels fishing within ICES rectangle 36F2 indicating gear type (Data source: EU DCF, 2017).

8.1.2.2 On average, annual effort within 36F2 is 535 hours for German demersal otter trawlers and 210 hours for beam trawl (based on a five-year data from 2011 to 2015; Data source: EU DCF, 2017).

8.2 Hornsea Three offshore cable corridor

8.2.1 Landing trends, fishing grounds and key species

8.2.1.1 There are negligible landings by German vessels from ICES rectangles 34F1, 35F1 and 36F1. Therefore the characterisation of the Hornsea Three offshore cable corridor in relation to German commercial fisheries activity is limited to ICES rectangle 36F2, which is presented in section 8.1.

9. Sweden Fisheries Activity Assessment

9.1 Hornsea Three array area

9.1.1 Landing trends, fishing grounds and key species

9.1.1.1 Landings by Swedish registered vessels from ICES rectangle 36F2 are presented in Figure 9.1 by gear type and Figure 9.2 by species.

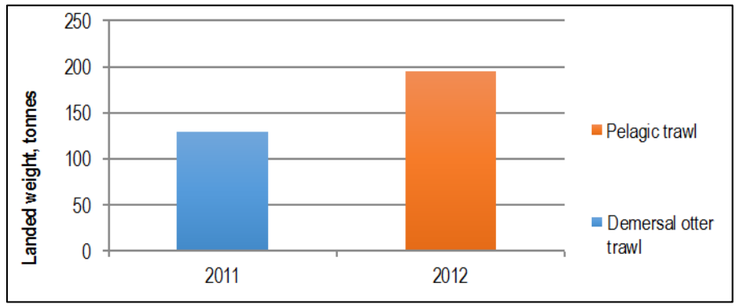

Figure 9.1: Landed weight of all landings by Swedish registered vessels from ICES rectangle 36F2 from 2006 to 2015 indicating gear type (Data source: EU DCF, 2017).

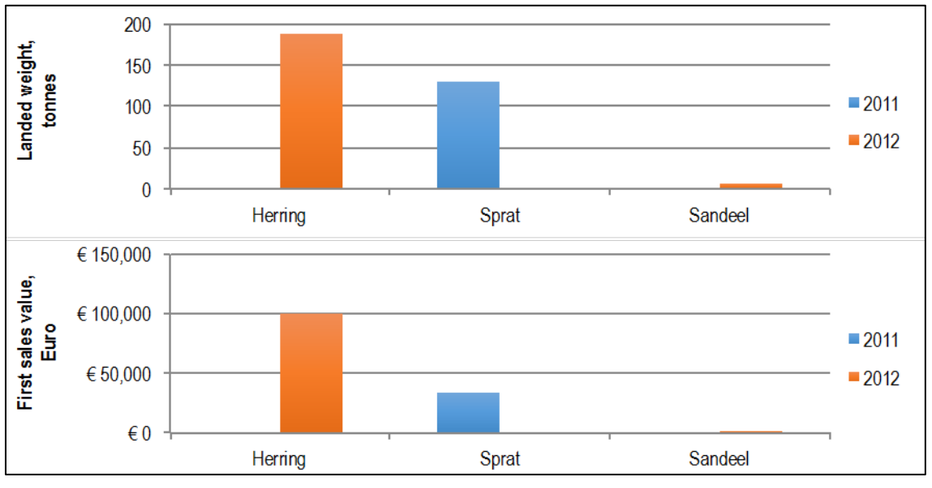

Figure 9.2: Landed weight (top) and value (bottom) of all landings by Swedish registered vessels from ICES rectangle 36F2 from 2011 to 2015 indicating species (Data sources: EU DCF, 2017; EU MOFA, 2017).

9.1.1.2 VMS data provided by the MMO for Swedish vessel activity based on hours fished across the regional commercial fisheries study area is presented in Appendix B. This effort appears outside Hornsea Three array area, and outside 36F2, across grounds known to be targeted for *Nephrops* and mixed demersal species.

9.1.1.3 The landings of sprat in 2011 and herring in 2012 are likely to be one-off landings. It is considered that from time to time the Swedish fleet may enter the regional commercial fisheries study area, but significant, consistent activity is not likely within the Hornsea Three array area.

9.1.2 Effort and vessel fleets

9.1.2.1 Effort by Swedish registered vessels from ICES rectangle 36F2 is presented in Figure 9.3 indicating hours of active fishing by gear type. Effort within 36F2 represents 6% of Swedish effort within the regional commercial fisheries study area.

9.1.2.2 Effort of 16 hours of active fishing is recorded for demersal trawl in 2011, linked to the sprat landings; and 22 hours in 2012 for pelagic trawl, linked to the herring landings. This corroborates the fact that Swedish effort within 36F2 is unlikely to routinely occur in the future due to the mobile nature of these species.

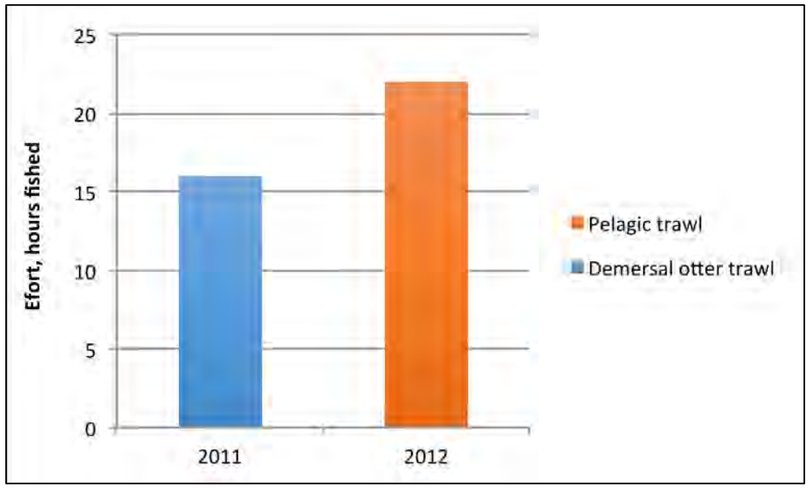

Figure 9.3: Effort (hours fished) of Swedish registered vessels fishing within ICES rectangle 36F2 indicating gear type (Data source: EU DCF, 2017).

9.2 Hornsea Three offshore cable corridor

9.2.1 Landing trends, fishing grounds and key species

9.2.1.1 There are negligible landings by Swedish vessels from ICES rectangles 34F1, 35F1 and 36F1. Therefore the characterisation of the Hornsea Three offshore cable corridor in relation to Swedish commercial fisheries activity is limited to ICES rectangle 36F2 (see section 9.1).

10. Norway Fisheries Activity Assessment

10.1 Hornsea Three array area

10.1.1 Landing trends, fishing grounds and key species

10.1.1.1 Norwegian industrial trawlers operate within the North Sea targeting sandeel with demersal trawls and sprat with pelagic trawls. From time to time they may enter the regional commercial fisheries study area, but significant activity within the Hornsea Three array area is not likely.

10.1.1.2 VMS data provided for Norwegian vessels across the regional commercial fisheries study area confirms that activity is low across the Hornsea Three array area (Figure 10.1).

10.1.1.3 Correspondence with the Norwegian Fisheries Directorate confirms that Norwegian fishing across the former Hornsea zone is limited to sporadic purse seine activity targeting pelagic species.

10.1.1.4 Landings data has been requested, but not yet obtained.

10.2 Hornsea Three offshore cable corridor

10.2.1 Landing trends, fishing grounds and key species

10.2.1.1 Activity by the Norwegian fleet is not expected to occur across the Hornsea Three offshore cable corridor.

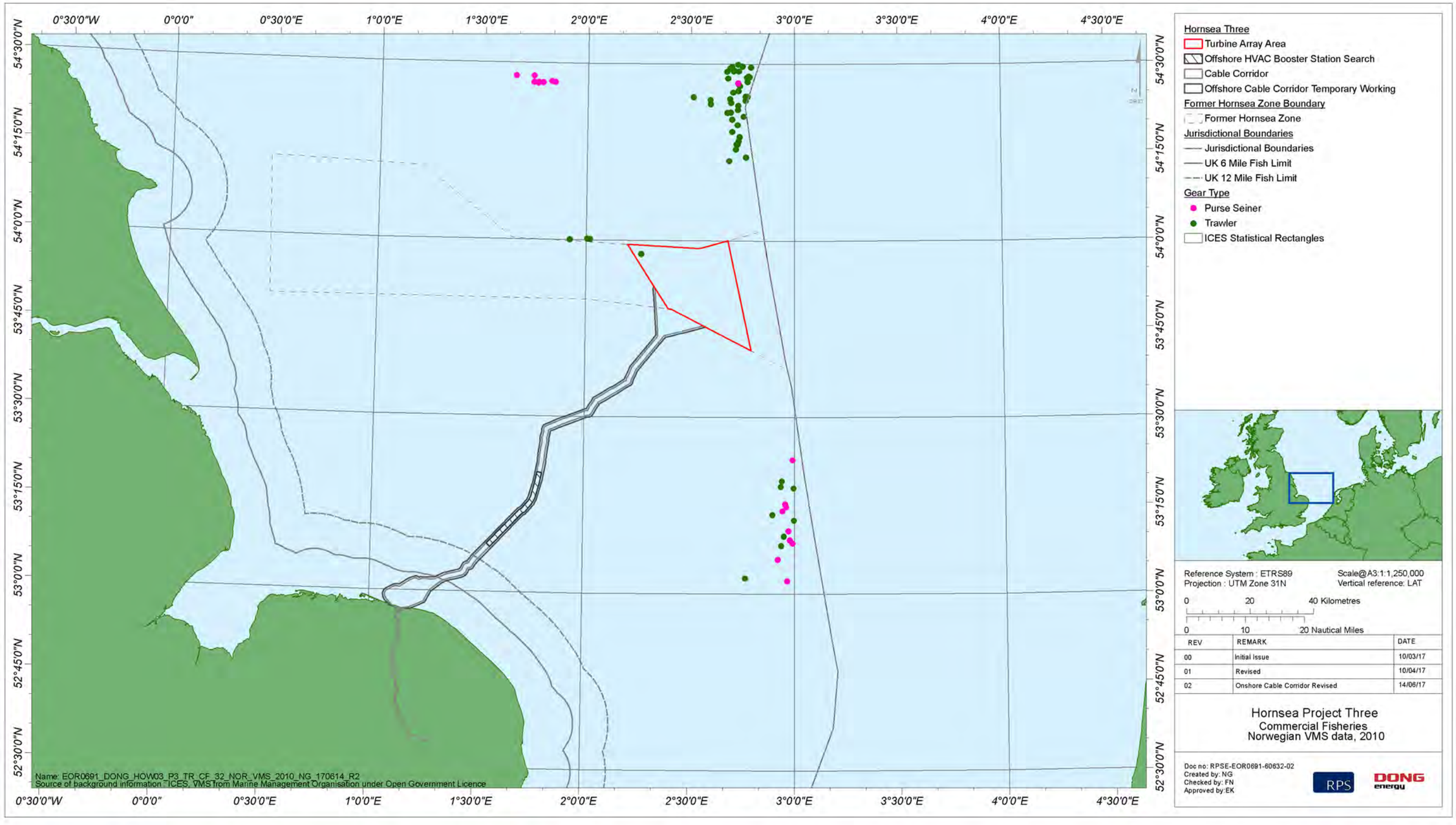

Figure 10.1: Vessel Monitoring System data for Norwegian vessels (≥ 15 m) actively fishing within the regional commercial fisheries study area in 2010 (Source: Norwegian Fisheries Directorate, 2011).

11. Summary

11.1.1.1 This technical annex has presented baseline activity data for the following countries: UK, Netherlands, France, Belgium, Denmark, Germany, Sweden and Norway. Based on quota allocations and landing statistics for the regional commercial fisheries study area it is understood that vessels registered to other countries do not operate across the Hornsea Three array area, the offshore cable corridor and the wider former Hornsea Zone.

11.1.1.2 The key fleet metiers operating across the Hornsea Three array area, the offshore cable corridor, the former Hornsea Zone and/or the regional commercial fisheries study area include (in no particular order):

- UK potters targeting brown crab, lobster and whelk (vessels typically 10 m and under in length), operating across the Hornsea Three offshore cable corridor;
- UK (Dutch owned) beam trawlers targeting sole and plaice (vessels >25 m in length), operating across the Hornsea Three array area;
- UK demersal otter trawlers targeting *Nephrops* and mixed demersal species (vessels 12 to 27 m in length), operating within the Hornsea Three array area (Markhams Hole and Outer Silver Pit, the locations of which are shown on the admiralty chart in Figure 2.2) and outside the former Hornsea Zone (Outer Silver Pit);
- UK shrimp beam trawlers targeting brown shrimp (vessels 10 to 20 m in length), operating close inshore, primarily in the Wash and not across the Hornsea Three offshore cable corridor (or Hornsea Three array area);
- UK scallop dredgers targeting scallop, operating west of the former Hornsea Zone and across a wider area that may encompass the Hornsea Three offshore cable corridor;
- Dutch beam trawlers targeting sole, plaice and mixed demersal species (vessels >25 m in length), operating across the Hornsea Three array area;
- French demersal trawlers targeting whiting (vessels 15 to 25 m in length), operating across the regional commercial fisheries study area;
- French pelagic trawlers targeting mackerel (vessels 15 to 25 m in length), occasionally within the former Hornsea Zone (but not regularly in the Hornsea Three array area), targeting highly mobile species that consistently move/shoal throughout the wider southern North Sea;
- Belgian beam trawlers targeting sole, plaice, *Nephrops* and mixed demersal species (vessels >25 m in length), operating across the regional commercial fisheries study area;
- Belgian fly shooting vessels targeting sole, plaice, *Nephrops* and mixed demersal species (vessels >25 m in length), operating across the regional commercial fisheries study area;
- Danish demersal trawlers targeting sandeel (vessels >25 m in length), including specific fishing grounds within the Hornsea Three array area;
- Danish pelagic trawlers targeting sprat and herring (vessels >25 m in length), occasionally within the Hornsea Three array area, targeting highly mobile species that consistently move/shoal throughout the wider southern North Sea;
- German beam trawl targeting sole, plaice, *Nephrops* and mixed demersal species (vessels >25 m in length), operating within specific grounds within the Hornsea Three array area;
- Swedish demersal trawlers targeting sandeel throughout the North Sea with occasional effort within the regional commercial fisheries study area; and
- Norwegian demersal trawlers targeting sandeel throughout the North Sea with occasional effort within the regional commercial fisheries study area.

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ICES (2015a). ICES Advice on fishing opportunities, catch and effort Greater North Sea and Celtic Seas ecoregions 6.3.54 Turbot (Scophthalmus maximus) in Subarea IV (North Sea)

ICES (2015b). ICES Advice on fishing opportunities, catch and effort Greater North Sea and Celtic Seas ecoregions 6.3.2 Brill (Scophthalmus rhombus) in Subarea IV and Divisions IIIa and VIId,e (North Sea, Skagerrak and Kattegat, English Channel)

ICES (2016a). ICES Advice on fishing opportunities, catch and effort Greater North Sea and Celtic Seas ecoregions 6.3.49 Sole (Solea solea) in Subarea 4 (North Sea)

ICES (2016b). ICES Advice on fishing opportunities, catch and effort Greater North Sea and Celtic Seas ecoregions 6.3.36 Plaice (Pleuronectes platessa) in Subarea 4 (North Sea) and Subdivision 3.a.20 (Skagerrak)

ICES (2016c). ICES Advice on fishing opportunities, catch and effort Greater North Sea and Celtic Seas ecoregions 6.3.56 Whiting (Merlangius merlangus) in Subarea 4 and Division 7.d (North Sea and eastern English Channel)

ICES (2016d). ICES Advice on fishing opportunities, catch and effort Greater North Sea and Celtic Seas ecoregions 6.3.51 Sprat (Sprattus sprattus) in Subarea 4 (North Sea)

ICES (2016e). ICES Advice on fishing opportunities, catch and effort Greater North Sea and Celtic Seas ecoregions 6.3.18 Herring (Clupea harengus) in Subarea 4 and divisions 3.a and 7.d, autumn spawners (North Sea, Skagerrak, Kattegat, and eastern English Channel)

ICES (2016f). ICES Advice on fishing opportunities, catch and effort Greater North Sea and Celtic Seas ecoregions 6.3.33 Norway lobster (*Nephrops* norvegicus) in divisions 4.b and 4.c, Functional Unit 5 (central and southern North Sea, Botney Cut-Silver Pit)

ICES (2017). ICES Advice on fishing opportunities, catch and effort Greater North Sea and Celtic Seas ecoregions. Sandeel (Ammodytes spp.) in divisions 4.b–c, Sandeel Area 1r (central and southern North Sea, Dogger Bank)

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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.

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Appendix A VMS data for UK registered vessels

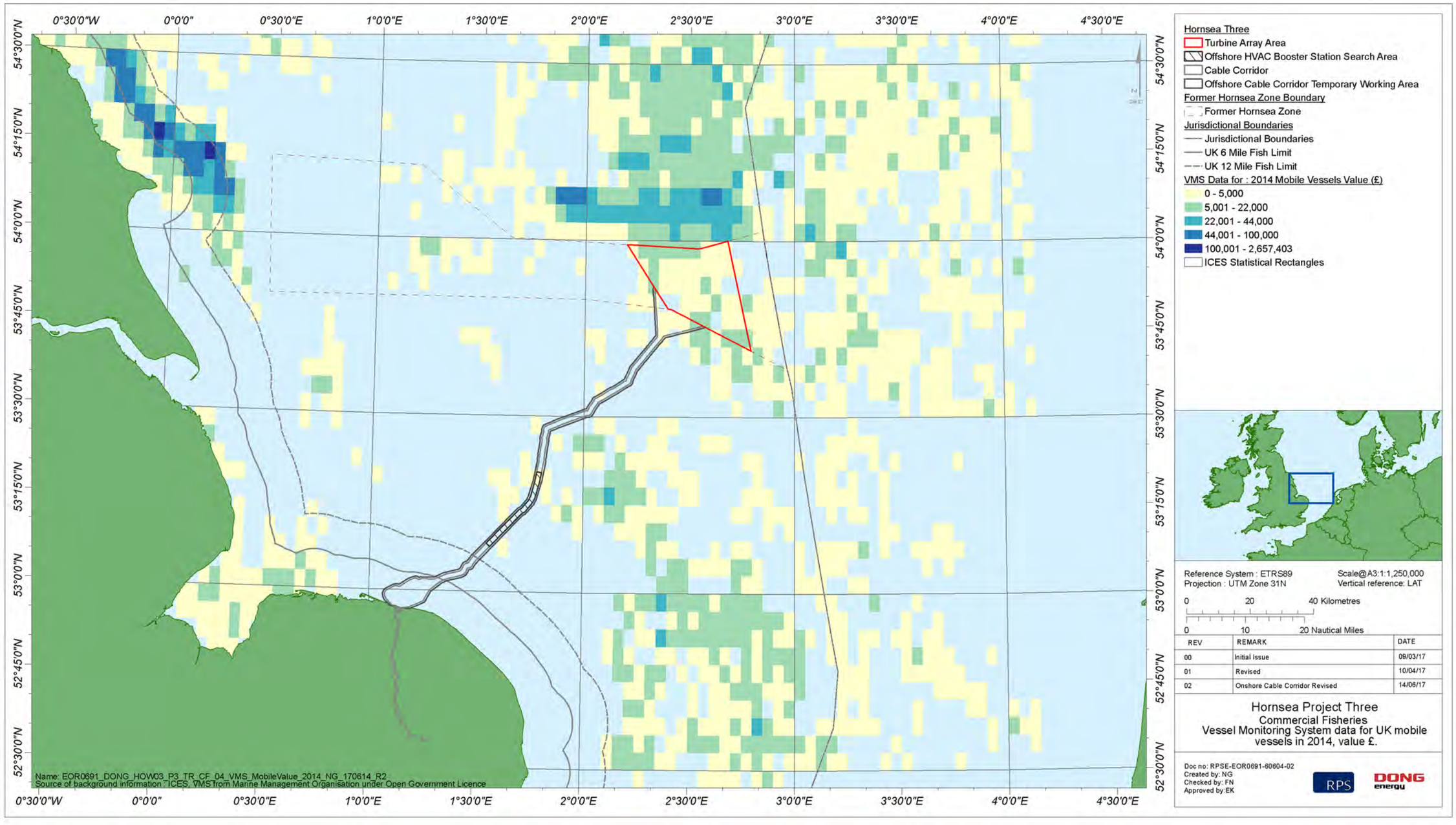

Figure A.1: VMS data for actively fishing UK registered mobile vessels indicating value of catch in 2014 (Data source: MMO, 2017).

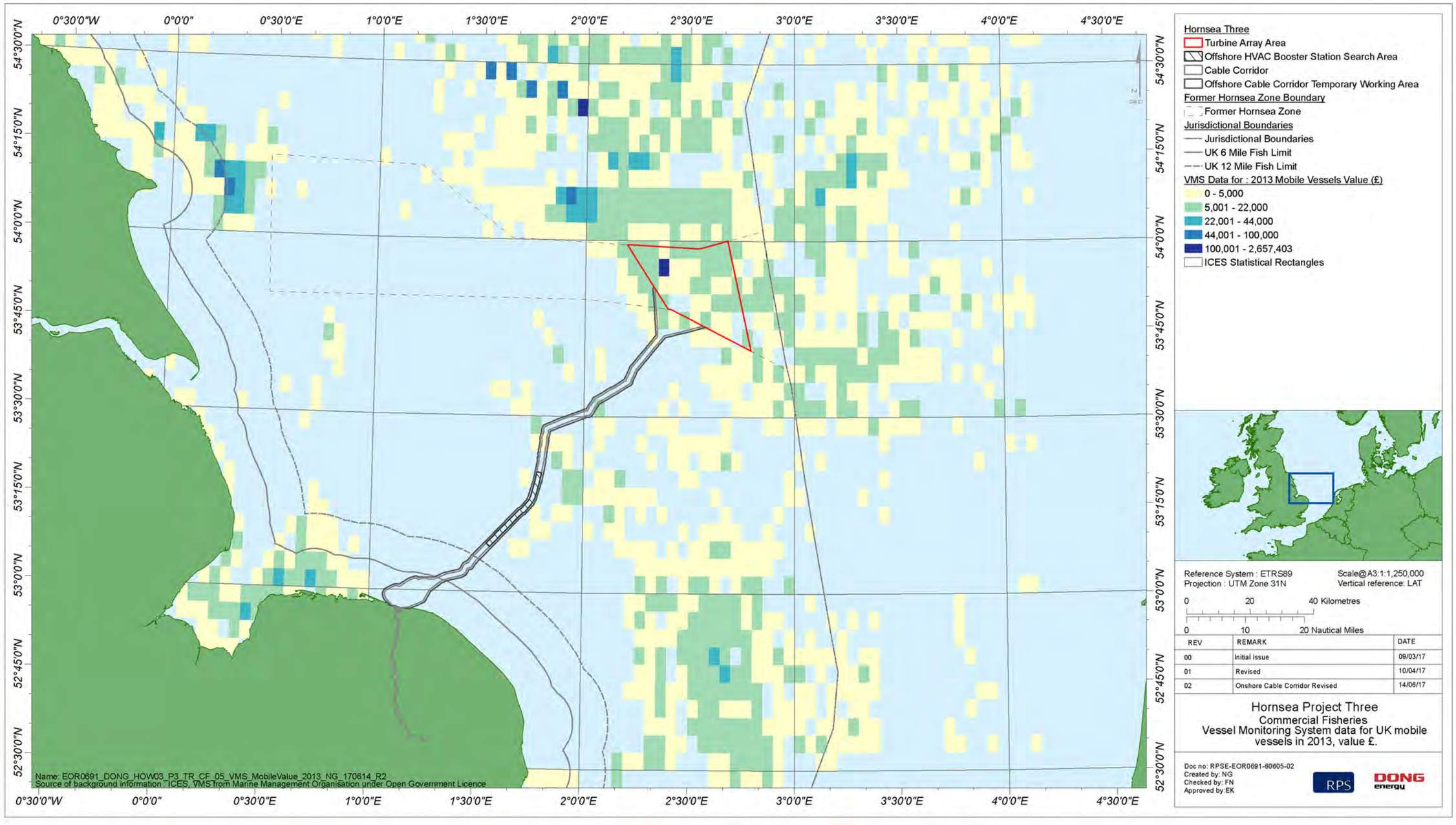

Figure A.2: VMS data for actively fishing UK registered mobile vessels indicating value of catch in 2013 (Data source: MMO, 2017).

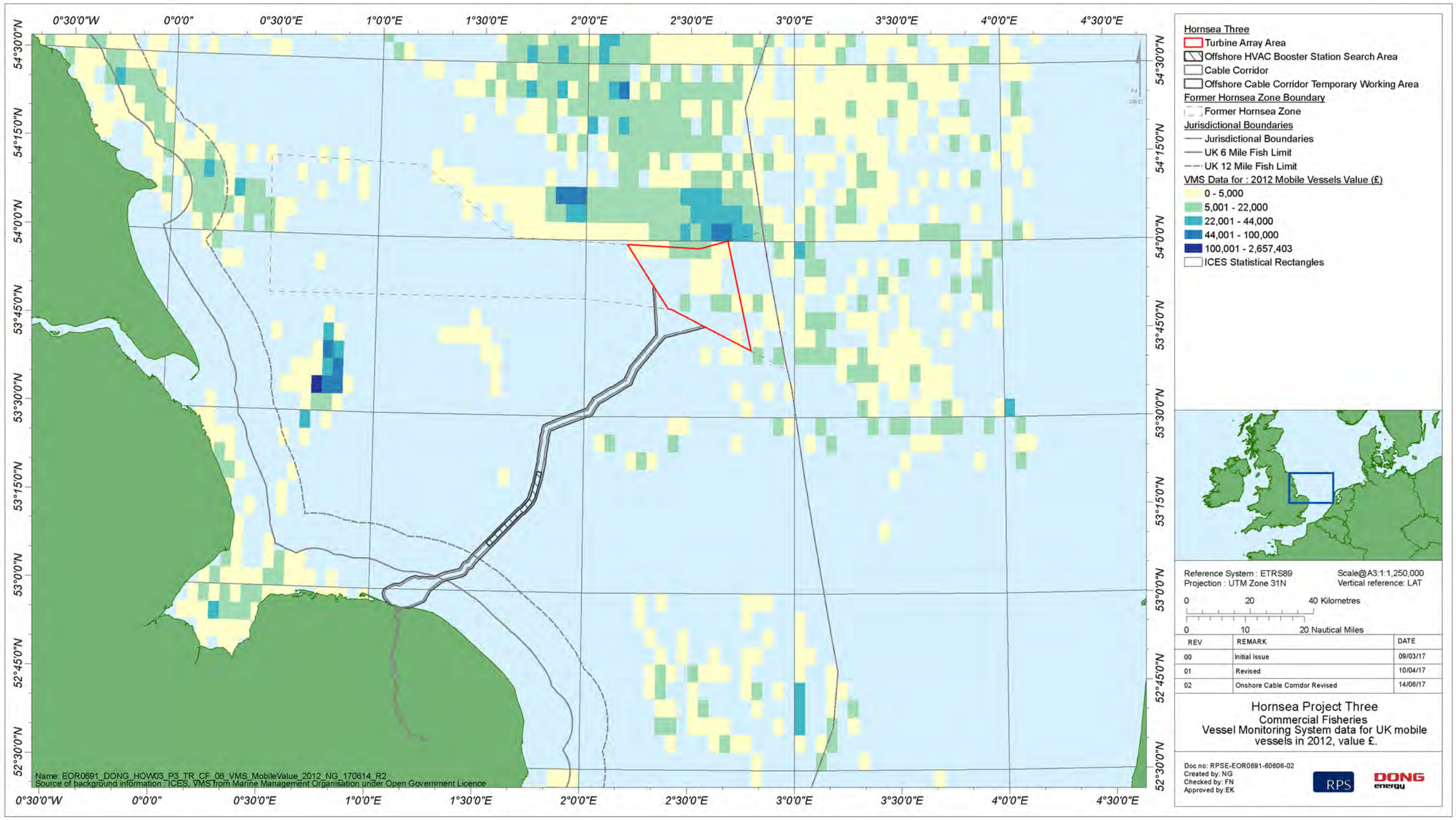

Figure A.3: VMS data for actively fishing UK registered mobile vessels indicating value of catch in 2012 (Data source: MMO, 2017).

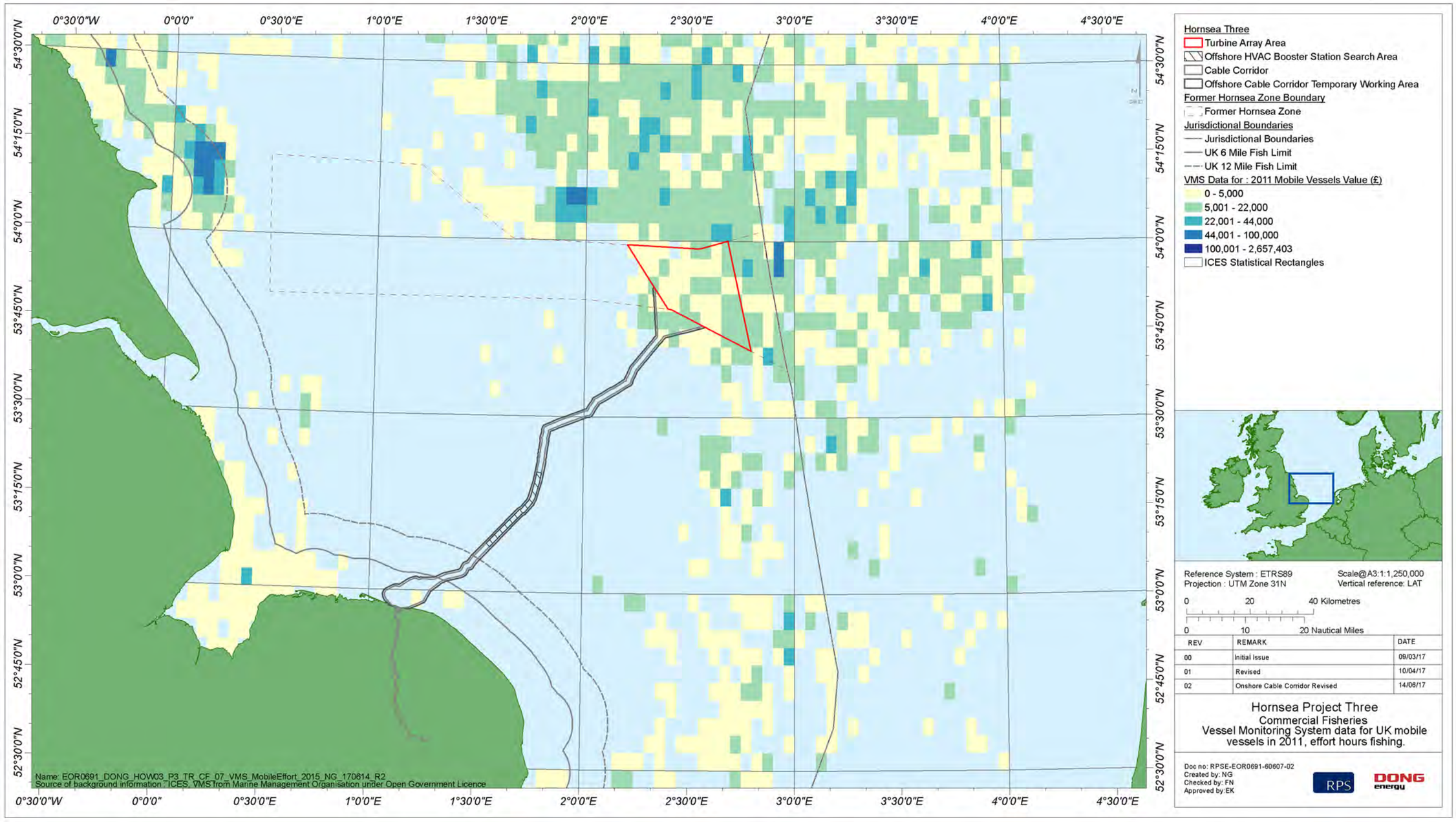

Figure A.4: VMS data for actively fishing UK registered mobile vessels indicating value of catch in 2011 (Data source: MMO, 2017).

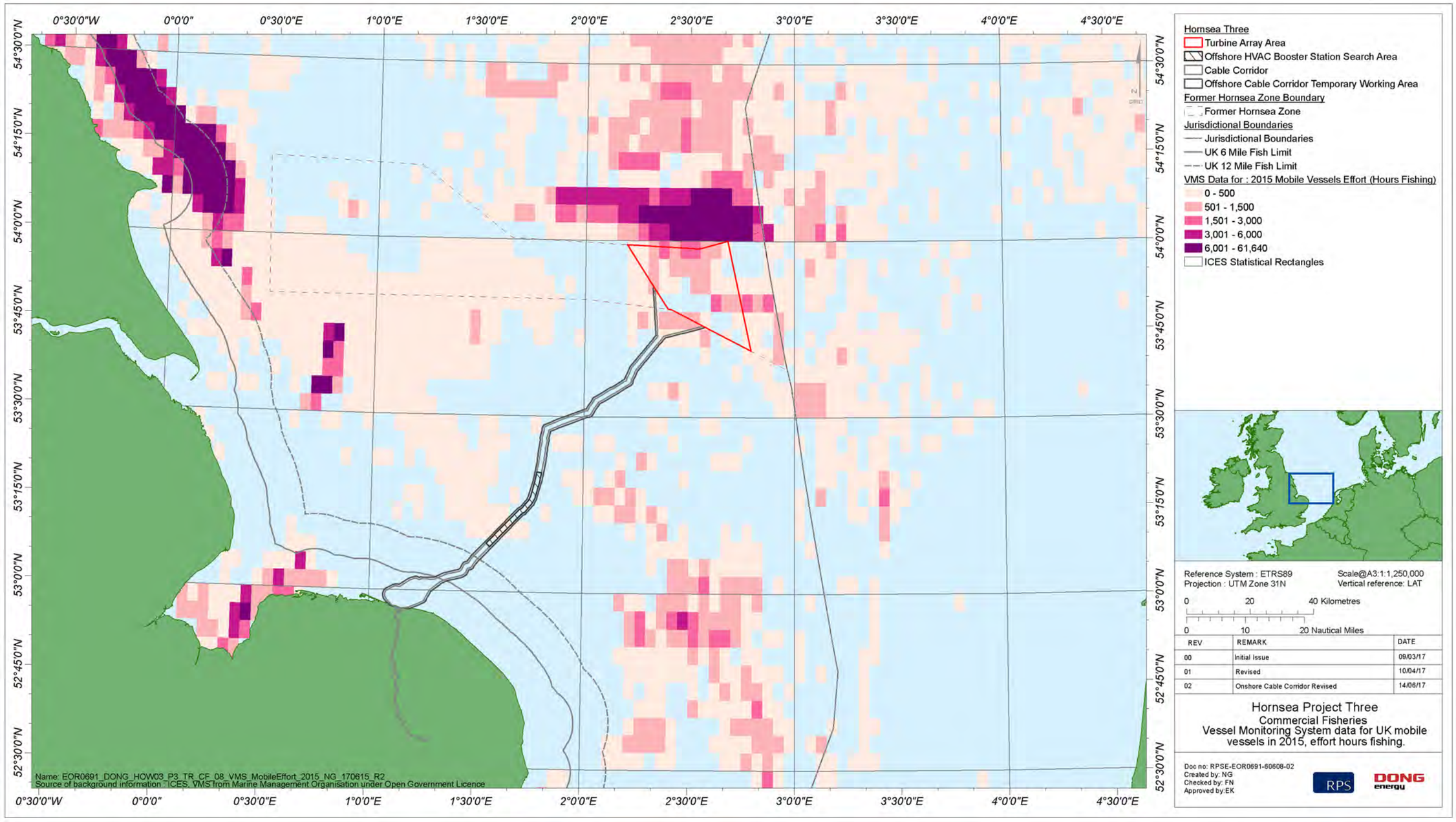

Figure A.5: VMS data for actively fishing UK registered mobile vessels indicating hours fished in 2015 (Data source: MMO, 2017).

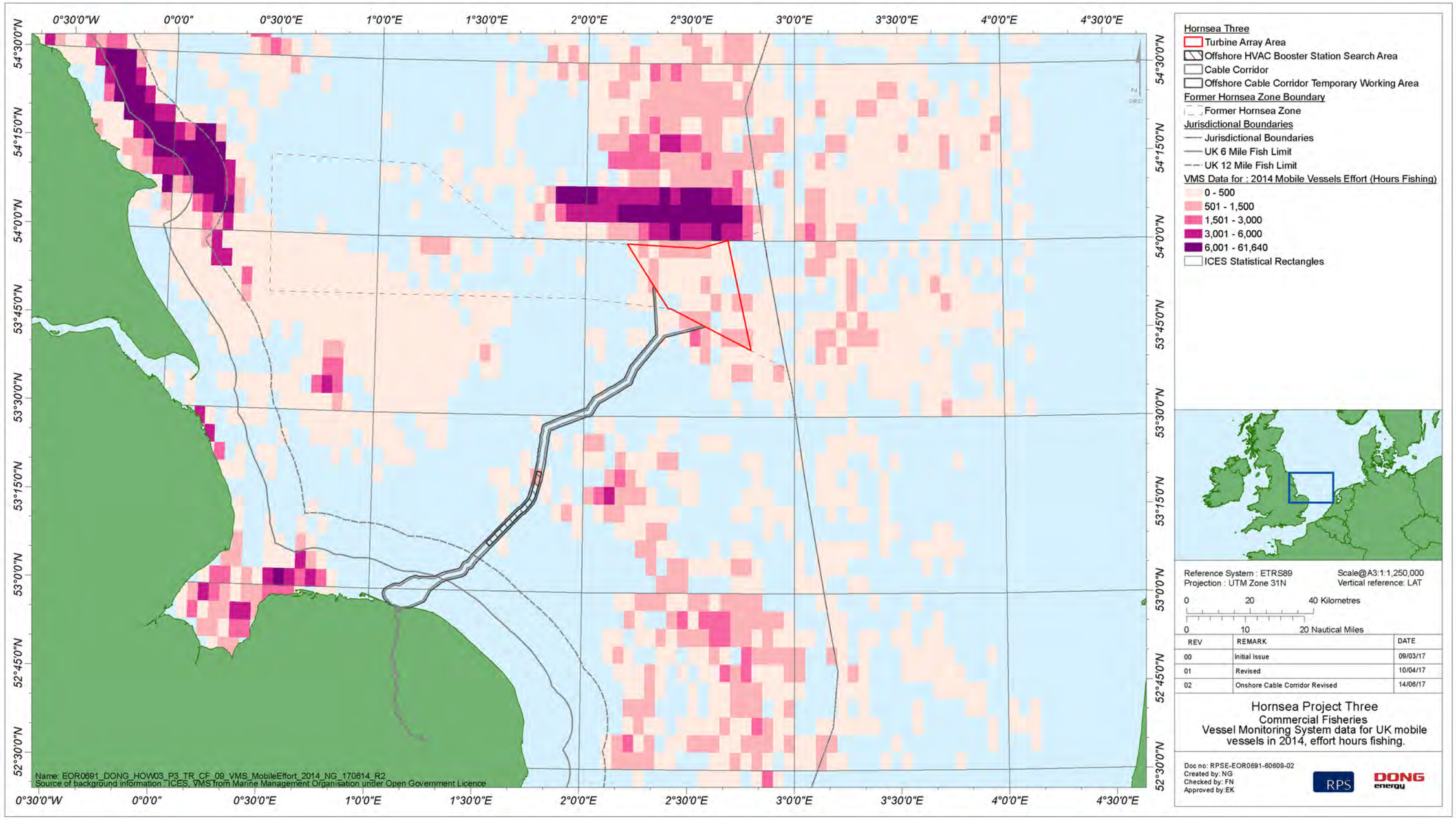

Figure A.6: VMS data for actively fishing UK registered mobile vessels indicating hours fished in 2014 (Data source: MMO, 2017).

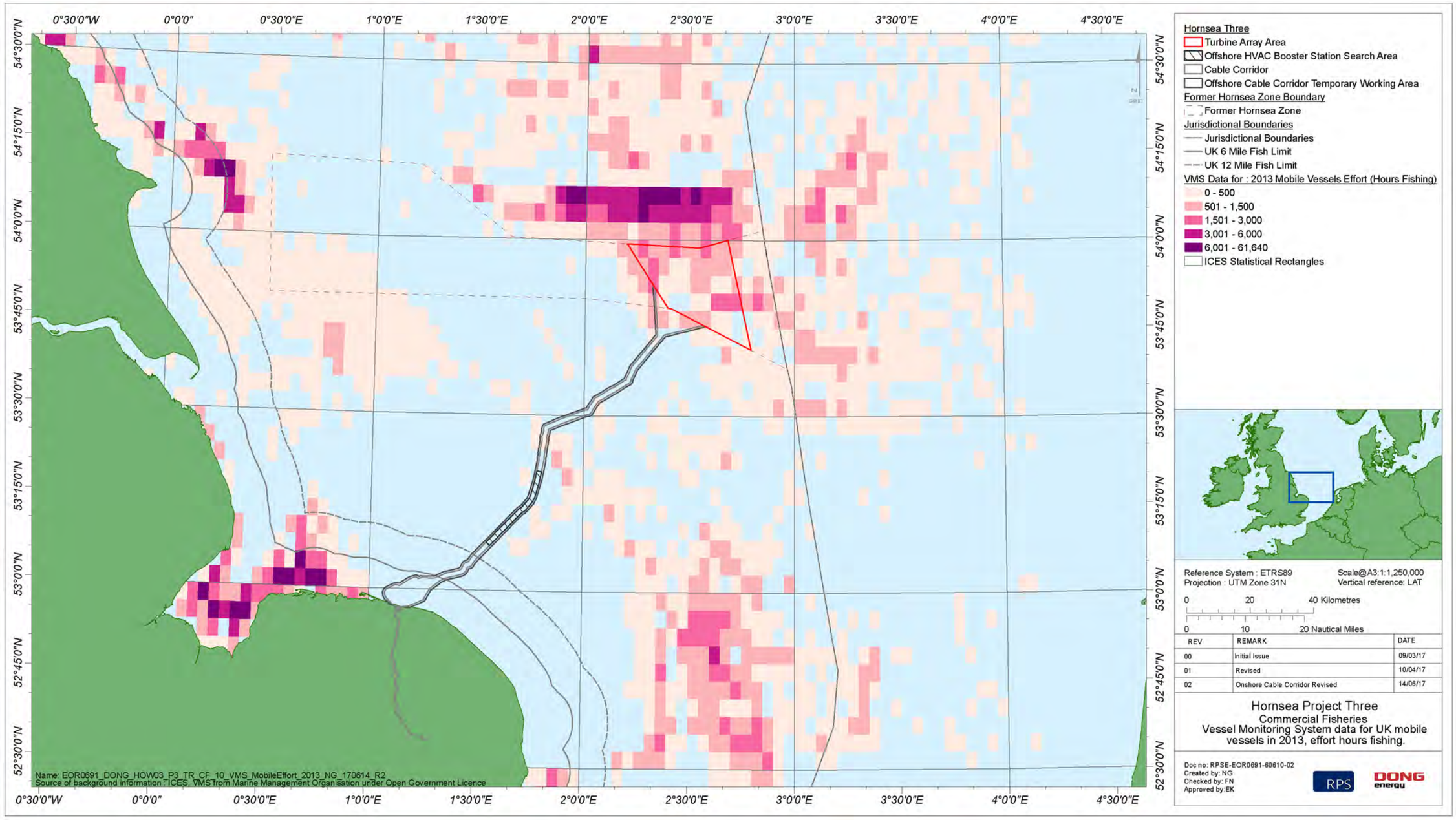

Figure A.7: VMS data for actively fishing UK registered mobile vessels indicating hours fished in 2013 (Data source: MMO, 2017).

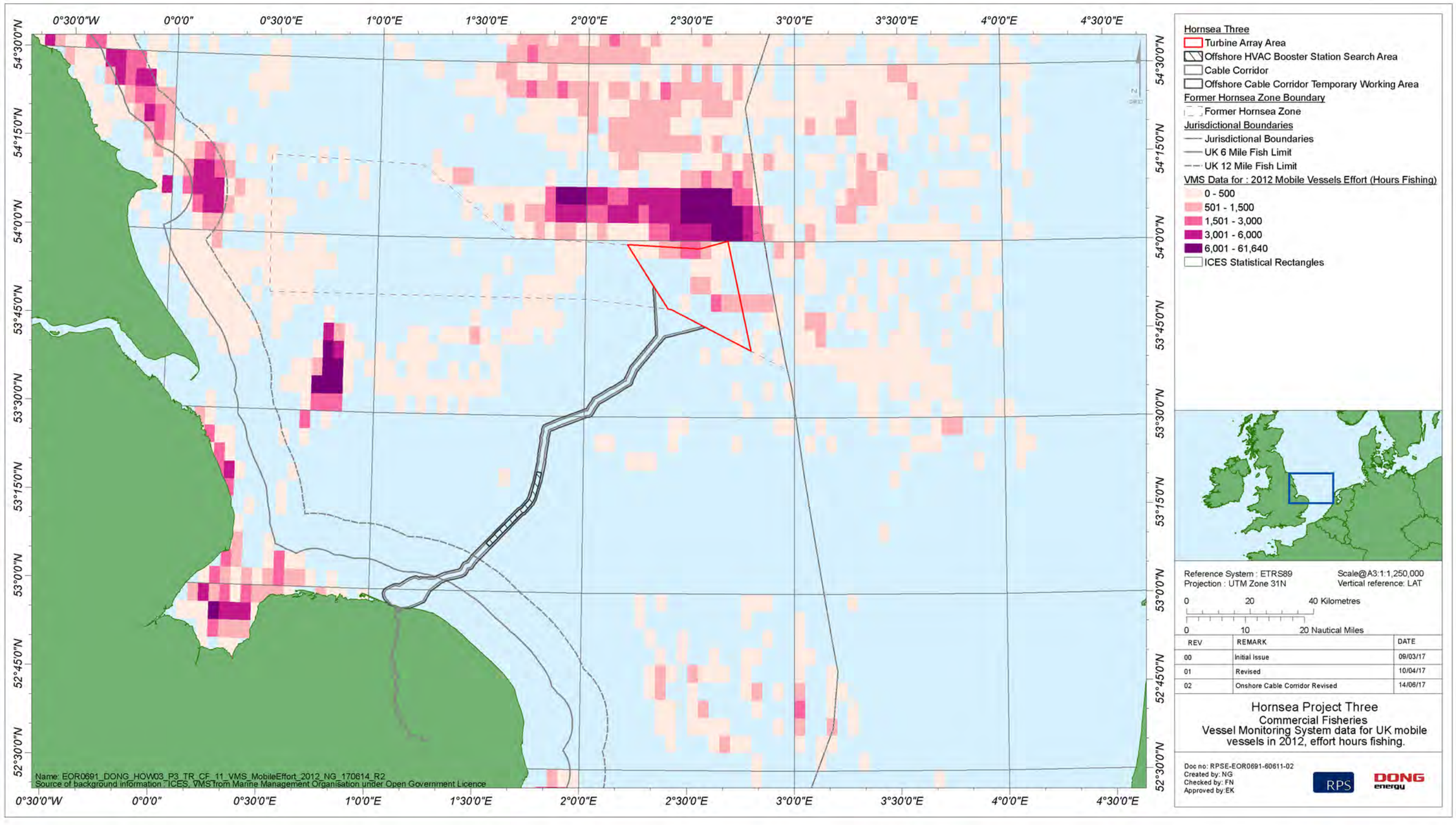

Figure A.8: VMS data for actively fishing UK registered mobile vessels indicating hours fished in 2012 (Data source: MMO, 2017).

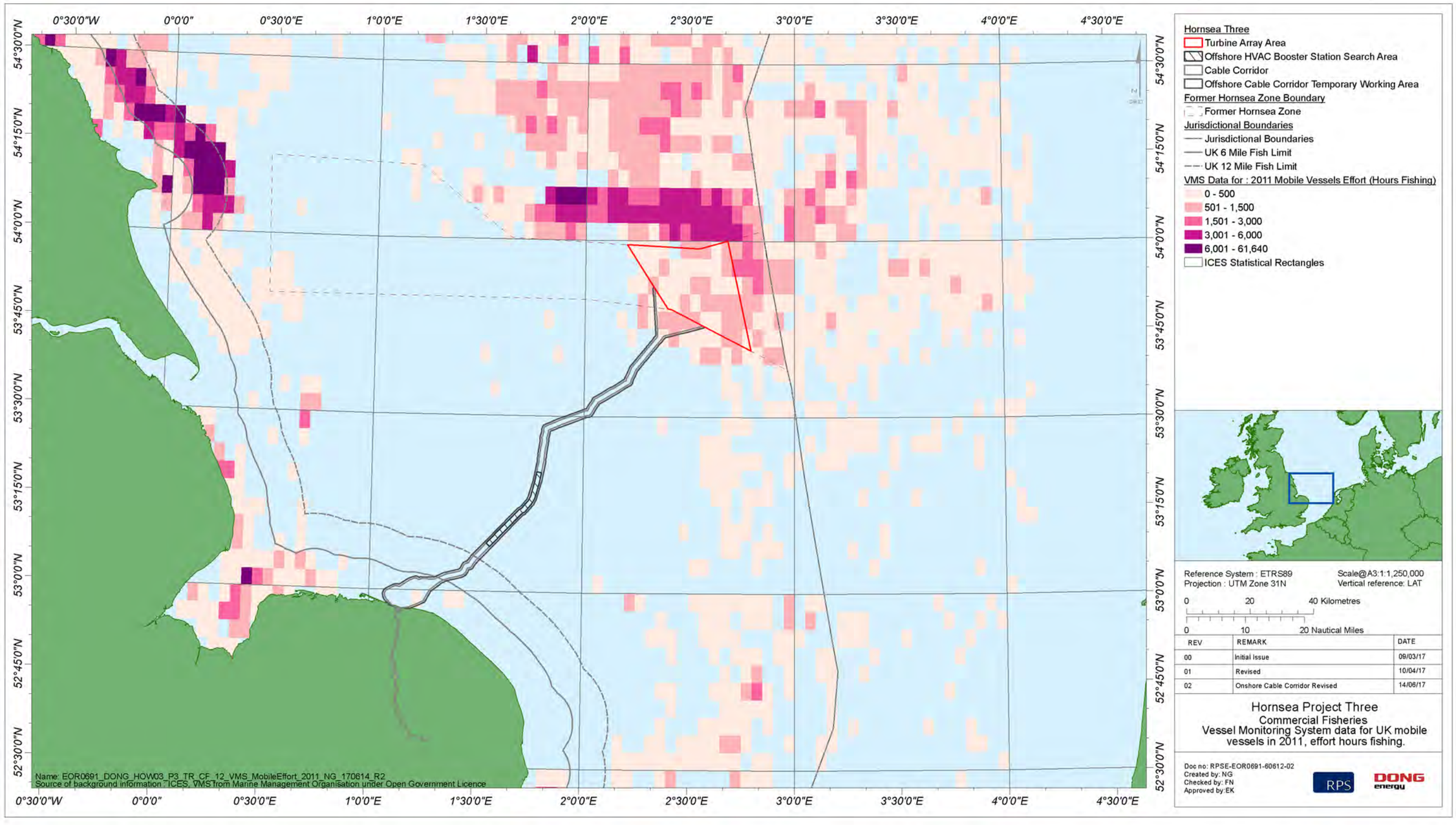

Figure A.9: VMS data for actively fishing UK registered mobile vessels indicating hours fished in 2011 (Data source: MMO, 2017).

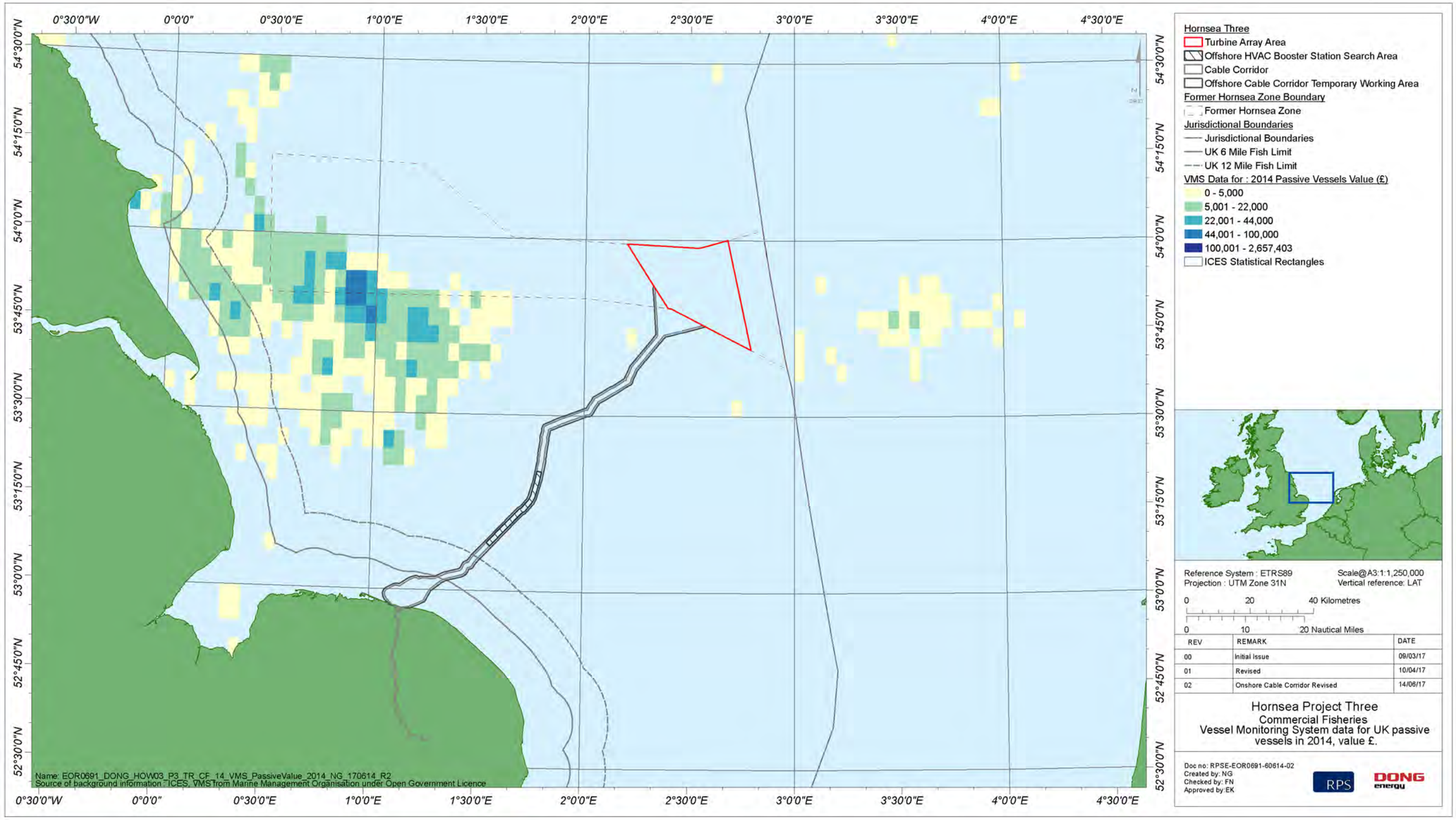

Figure A.10: VMS data for actively fishing UK registered passive vessels indicating value of catch in 2014 (Data source: MMO, 2017).

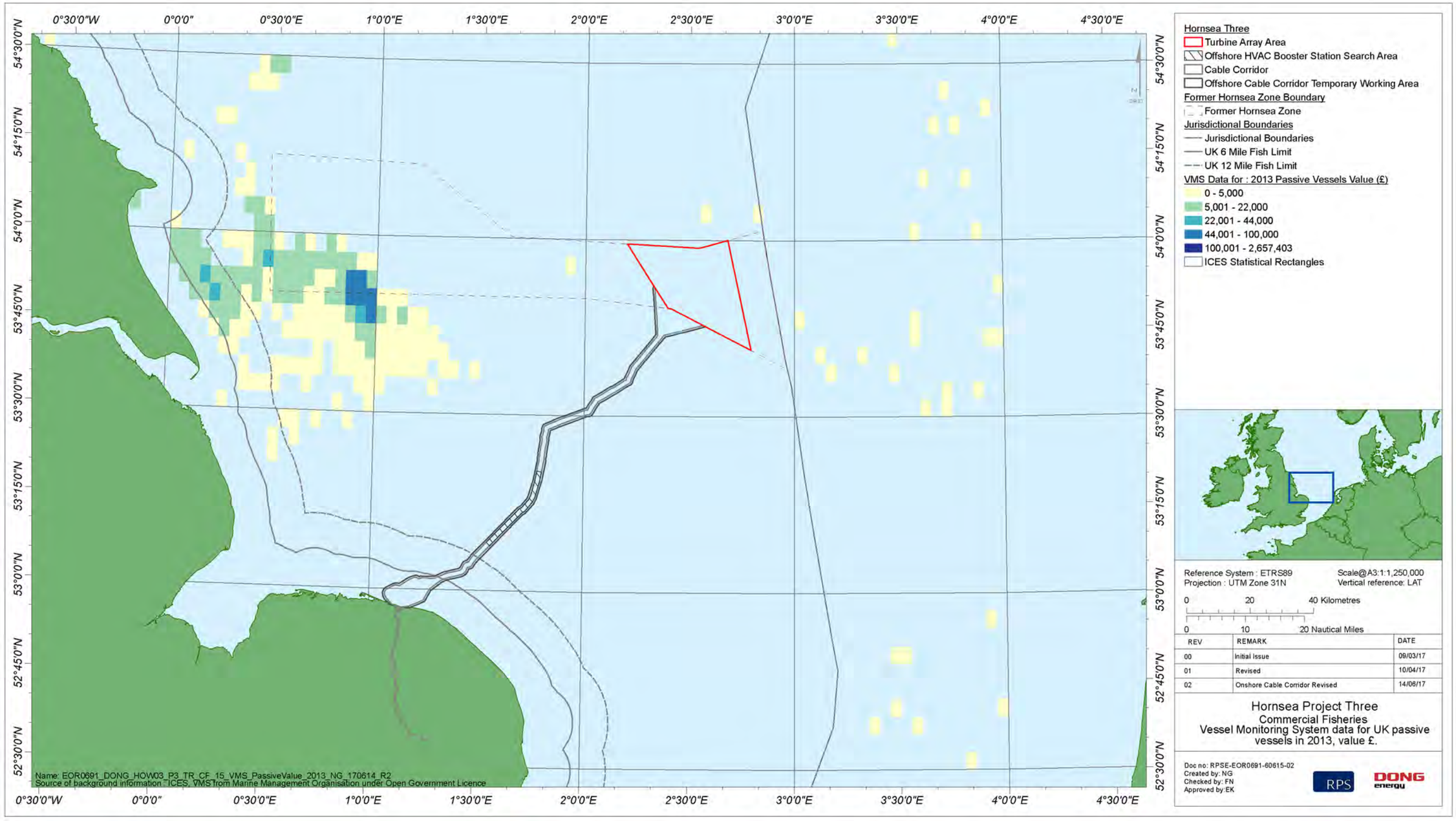

Figure A.11: VMS data for actively fishing UK registered passive vessels indicating value of catch in 2013 (Data source: MMO, 2017).

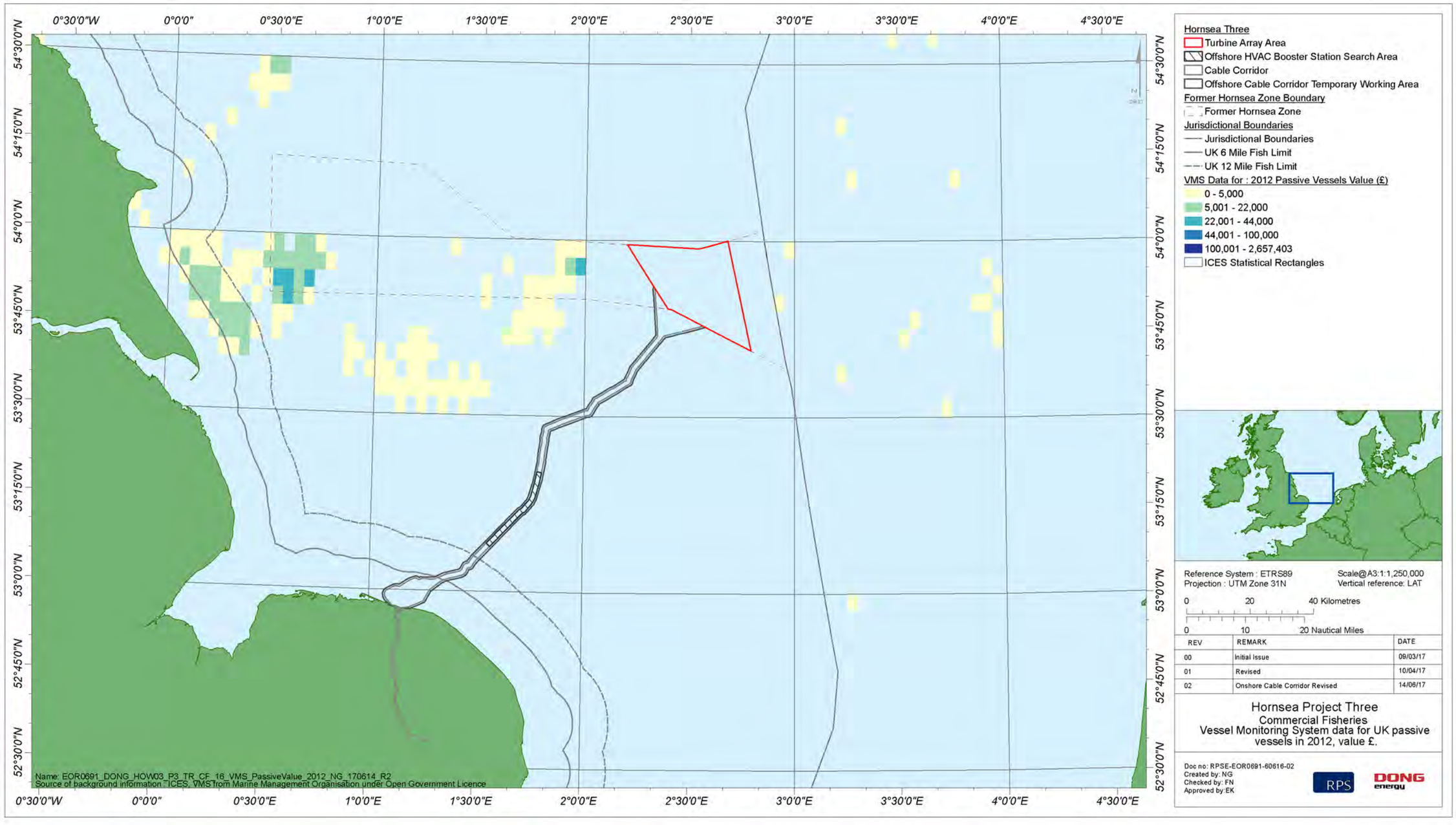

Figure A.12: VMS data for actively fishing UK registered passive vessels indicating value of catch in 2012 (Data source: MMO, 2017).

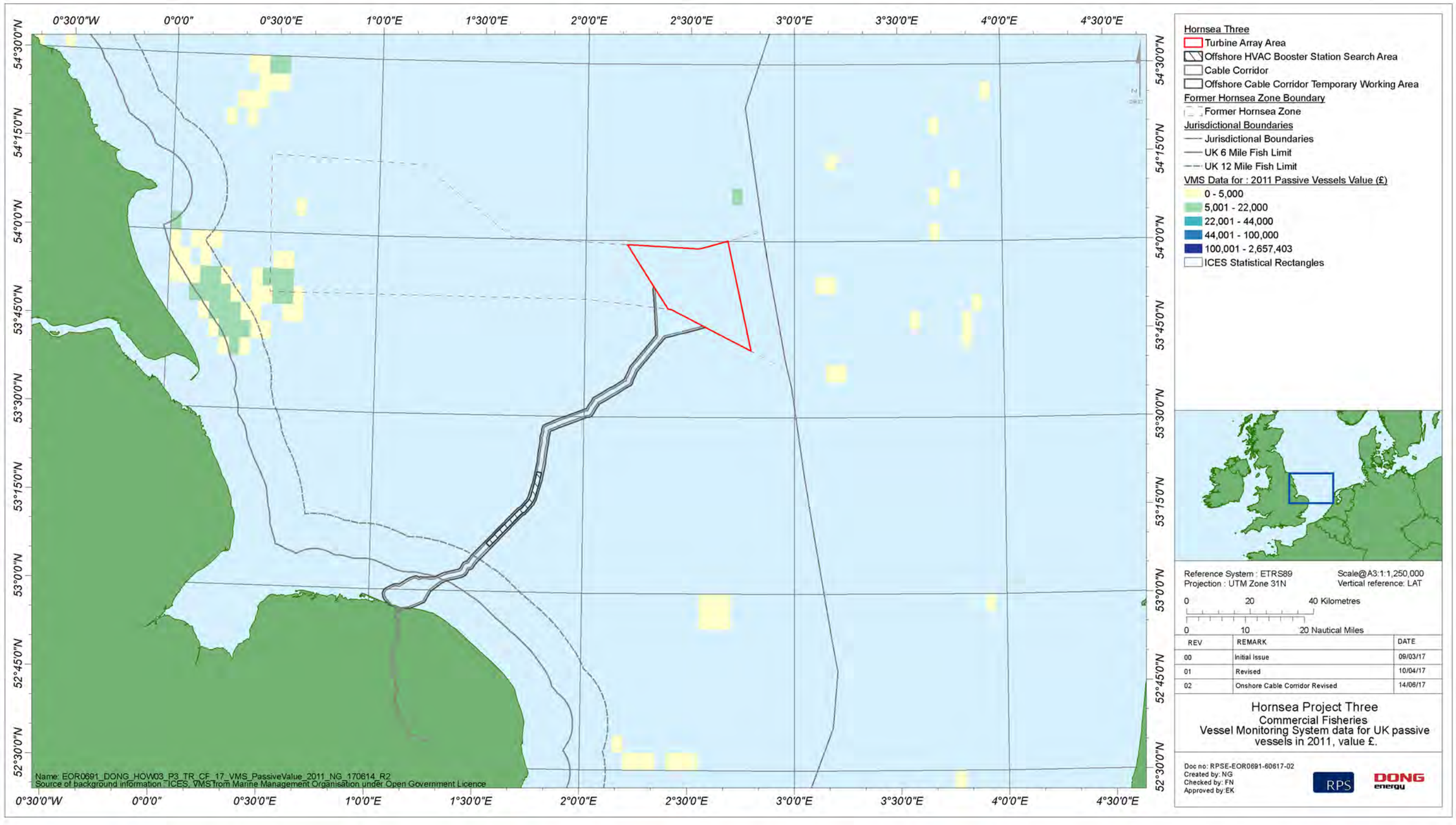

Figure A.13: VMS data for actively fishing UK registered passive vessels indicating value of catch in 2011 (Data source: MMO, 2017).

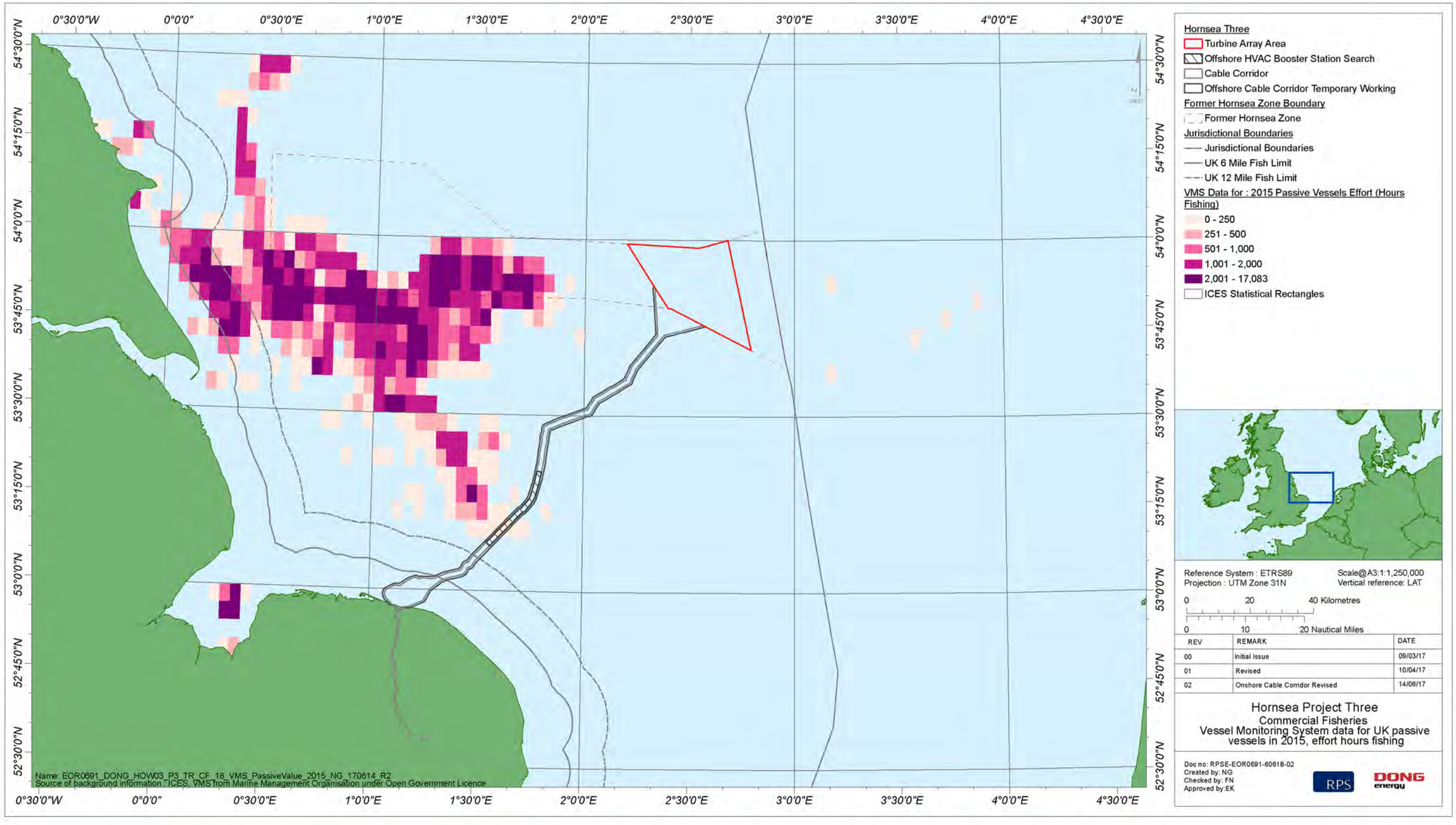

Figure A.14: VMS data for actively fishing UK registered passive vessels indicating hours fished in 2015 (Data source: MMO, 2017).

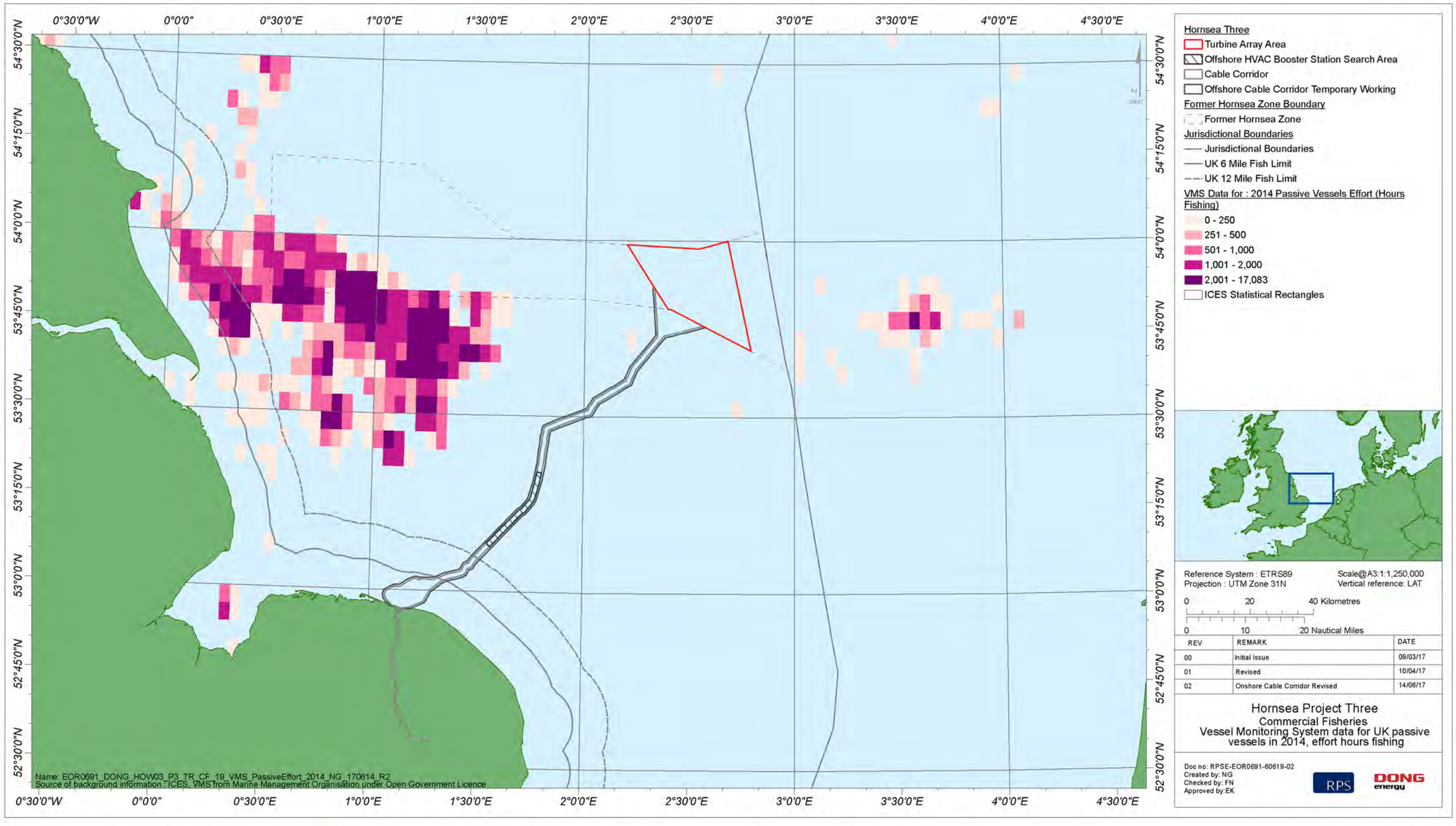

Figure A.15: VMS data for actively fishing UK registered passive vessels indicating hours fished in 2014 (Data source: MMO, 2017).

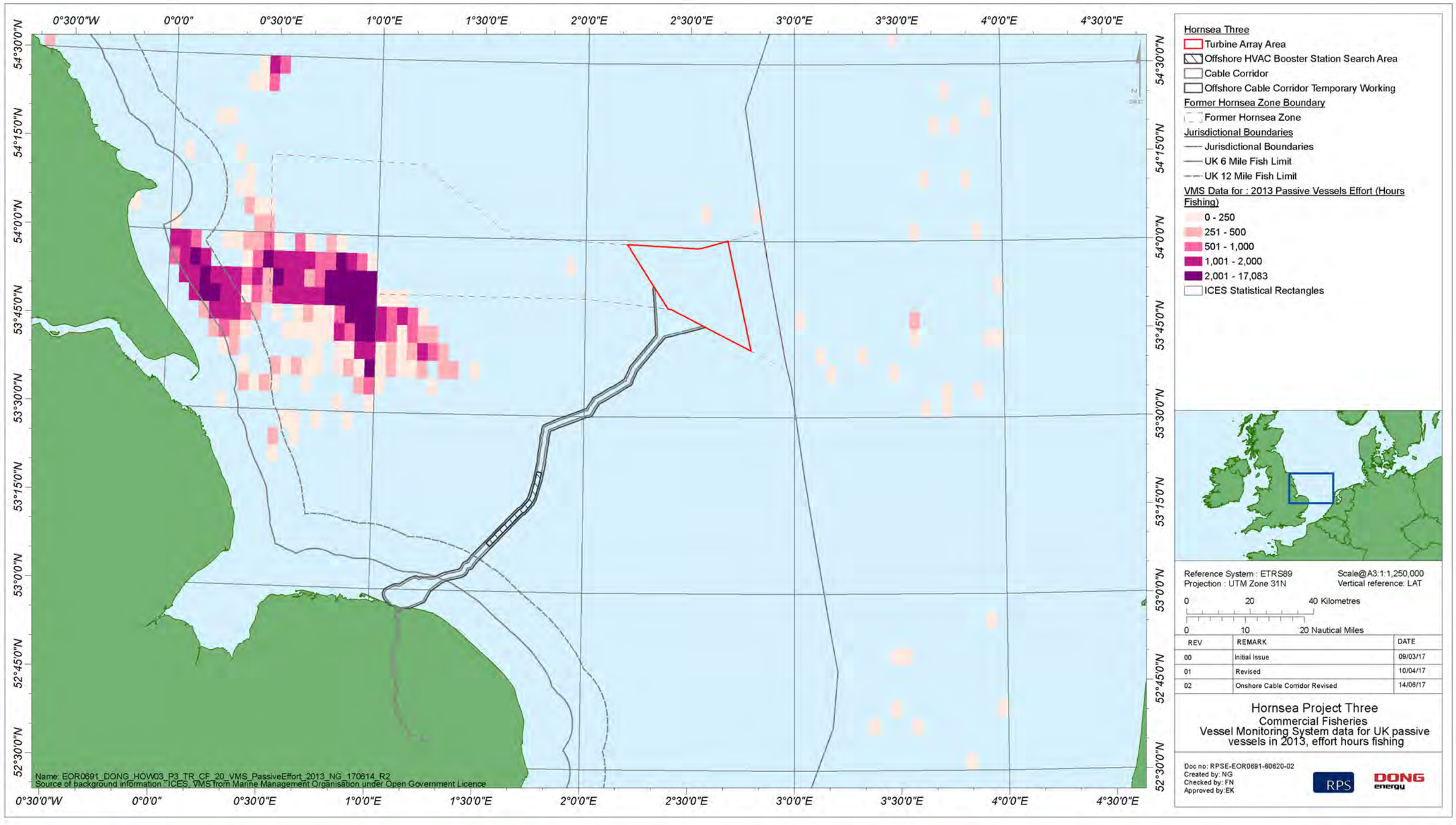

Figure A.16: VMS data for actively fishing UK registered passive vessels indicating hours fished in 2013 (Data source: MMO, 2017).

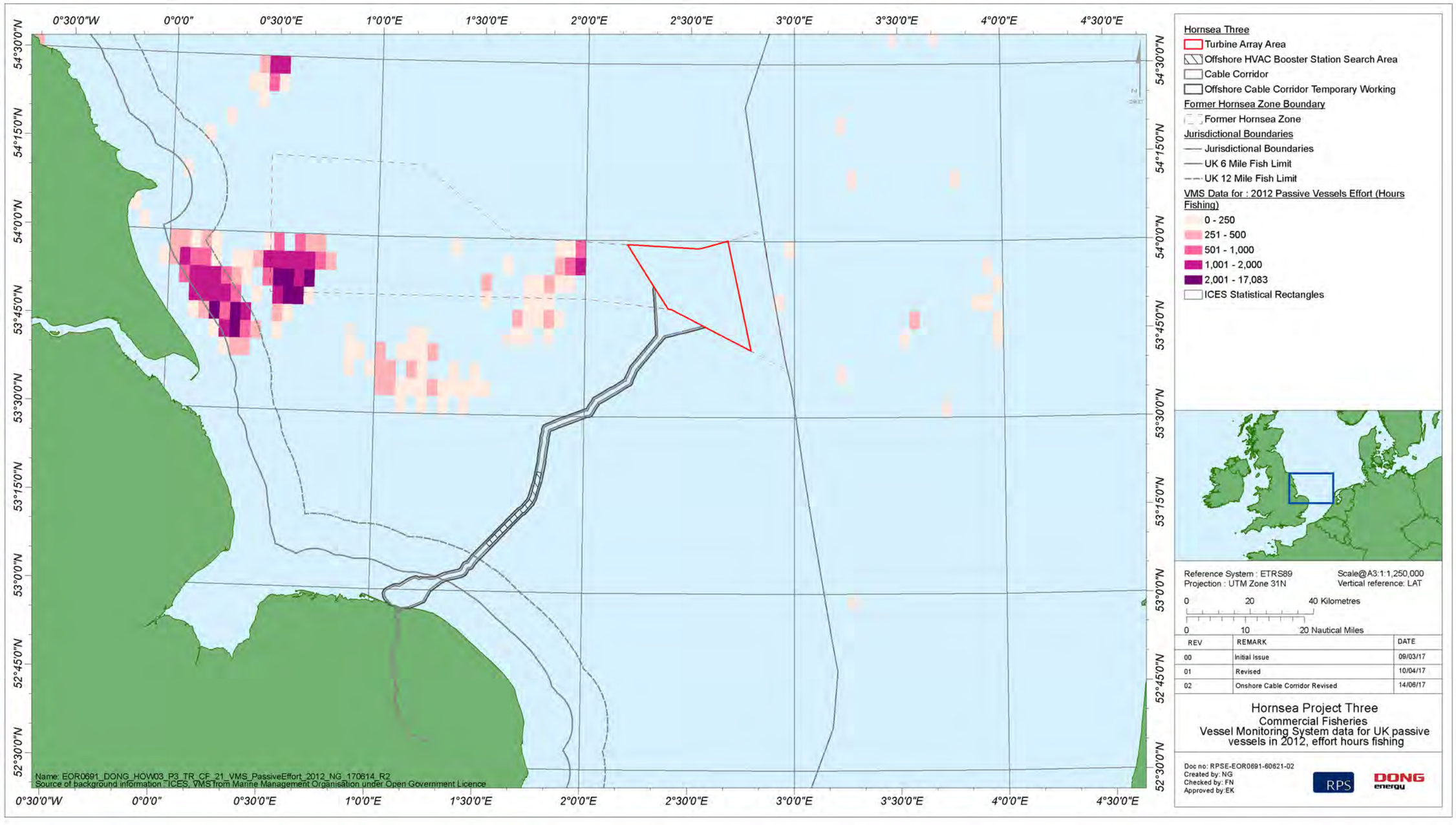

Figure A.17: VMS data for actively fishing UK registered passive vessels indicating hours fished in 2012 (Data source: MMO, 2017).

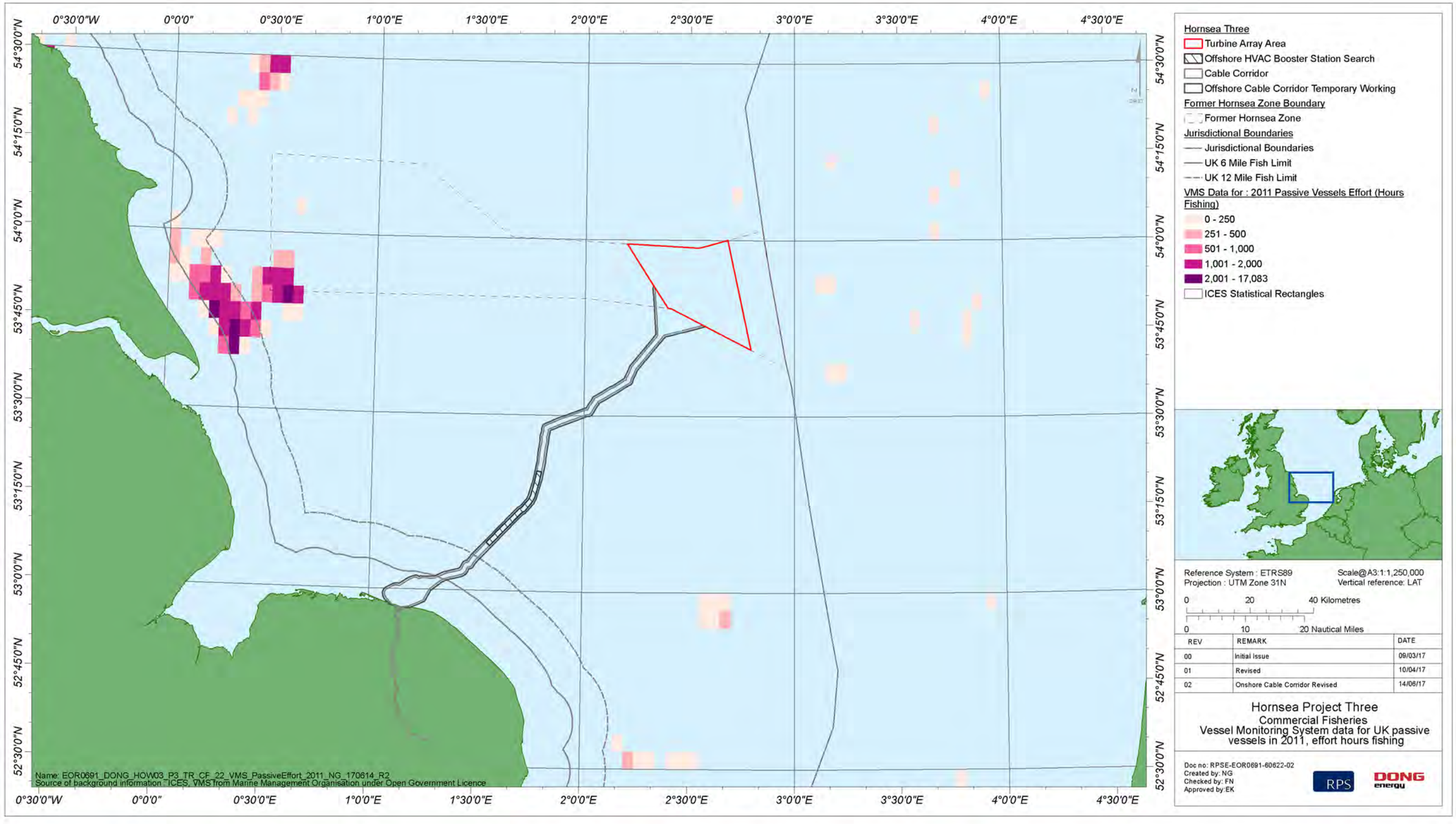

Figure A.18: VMS data for actively fishing UK registered passive vessels indicating hours fished in 2011 (Data source: MMO, 2017).

Appendix B VMS data for non-UK registered vessels

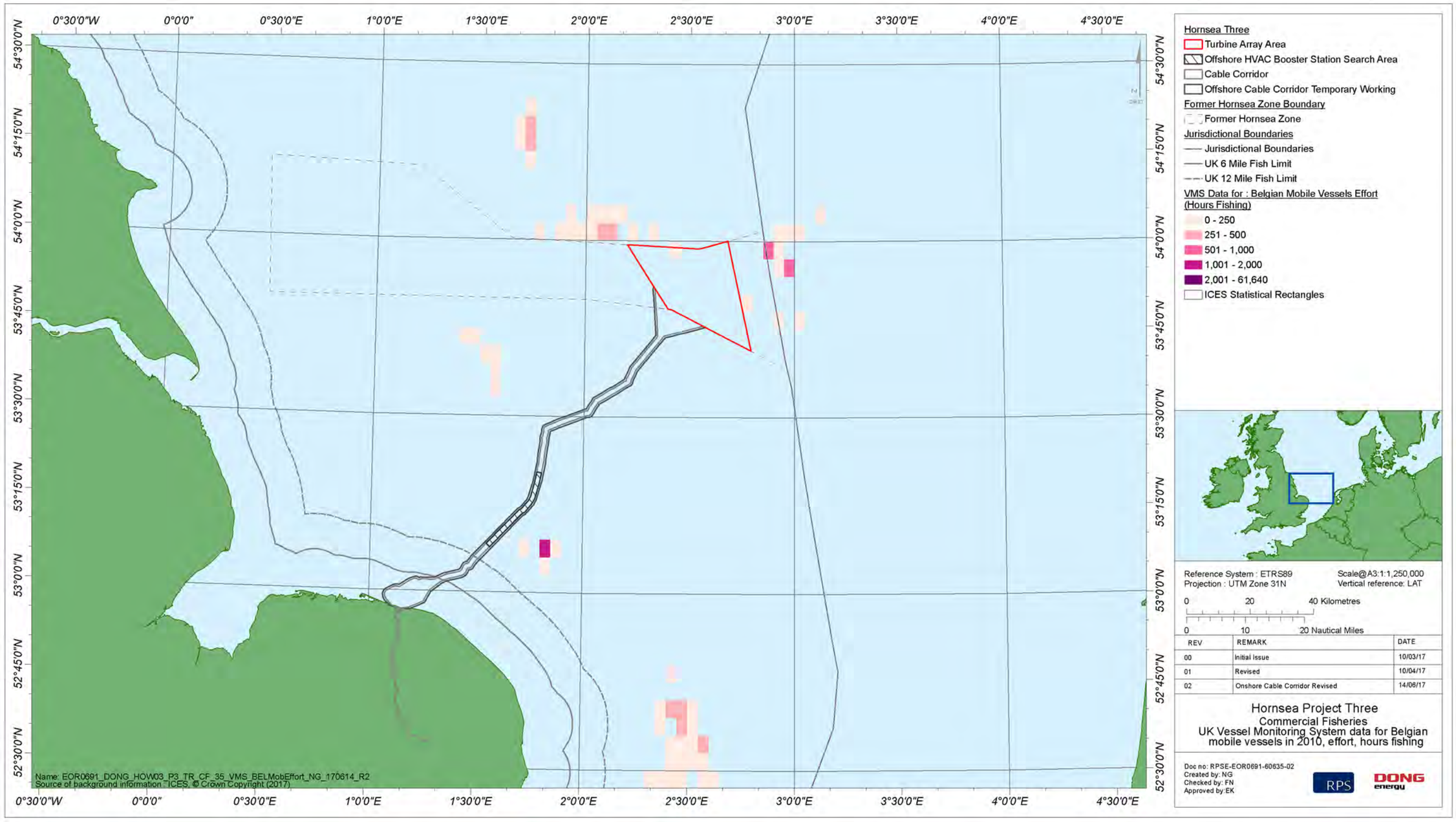

Figure B.1: VMS data for actively fishing Belgian registered mobile vessels indicating hours fished in 2010 (Source: MMO, 2013).

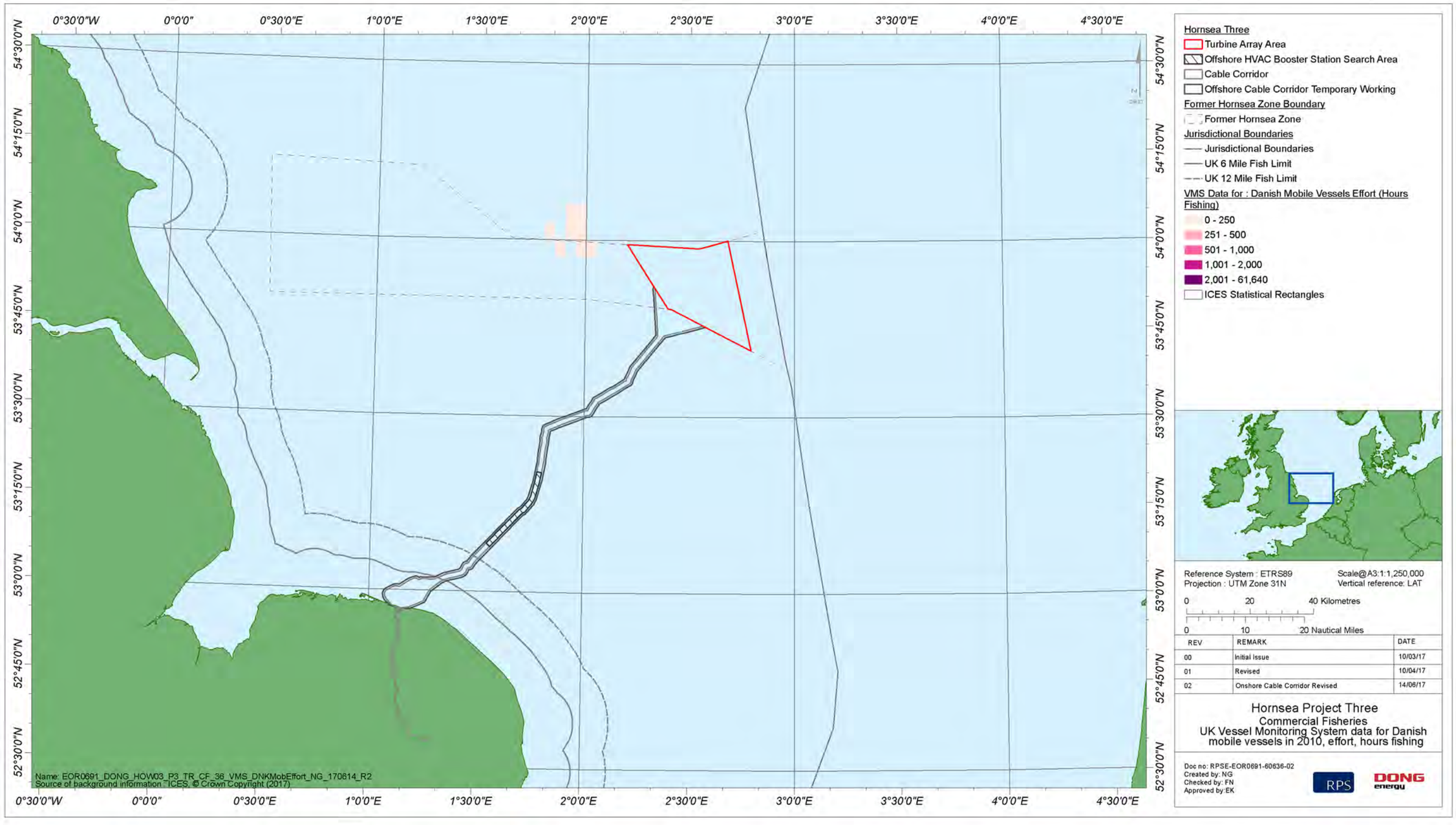

Figure B.2: VMS data for actively fishing Danish registered mobile vessels indicating hours fished in 2010 (Source: MMO, 2013).

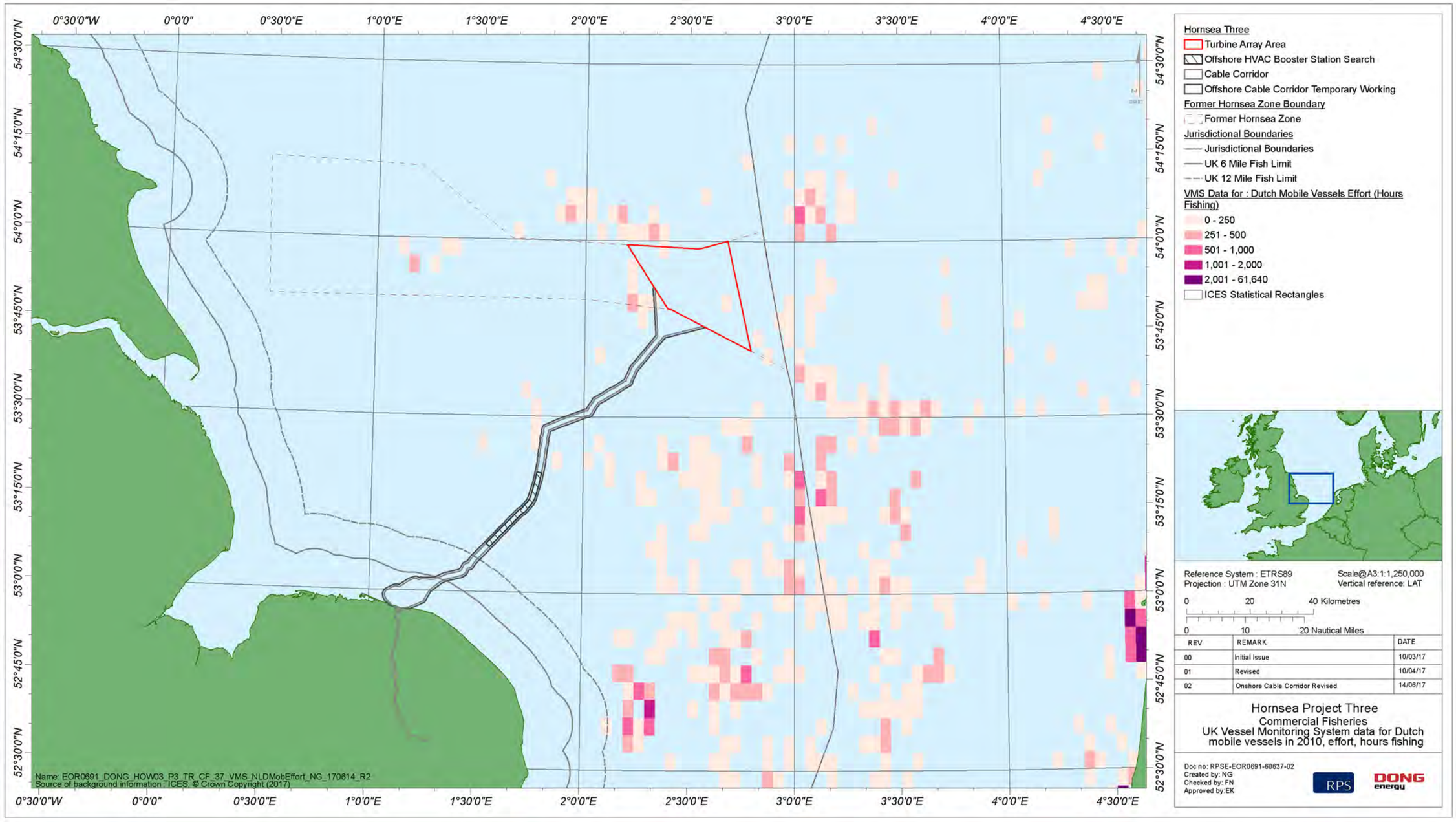

Figure B.3: VMS data for actively fishing Dutch registered mobile vessels indicating hours fished in 2010 (Source: MMO, 2013).

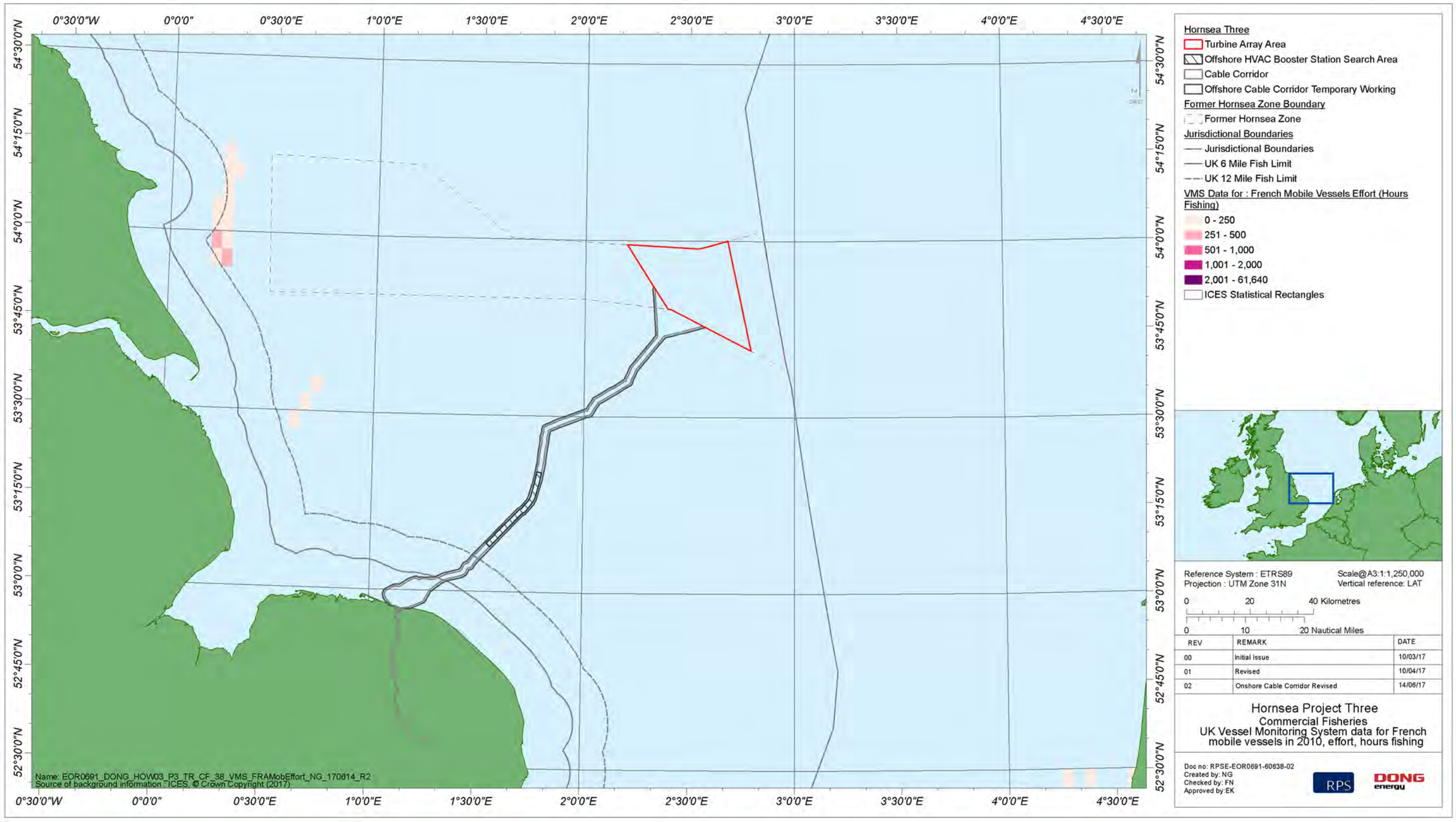

Figure B.4: VMS data for actively fishing French registered mobile vessels indicating hours fished in 2010 (Source: MMO, 2013).

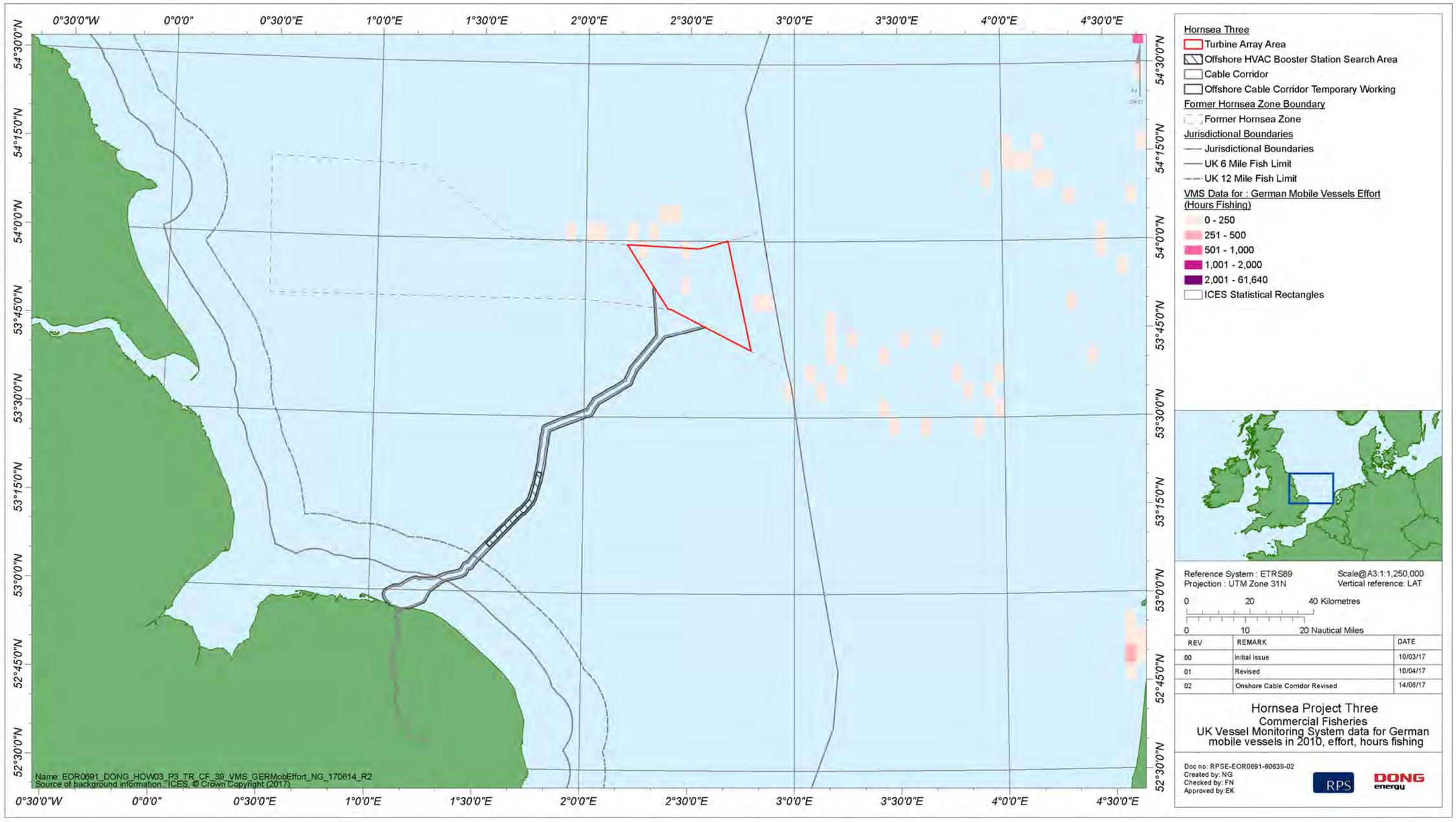

Figure B.5: VMS data for actively fishing German registered mobile vessels indicating hours fished in 2010 (Source: MMO, 2013).

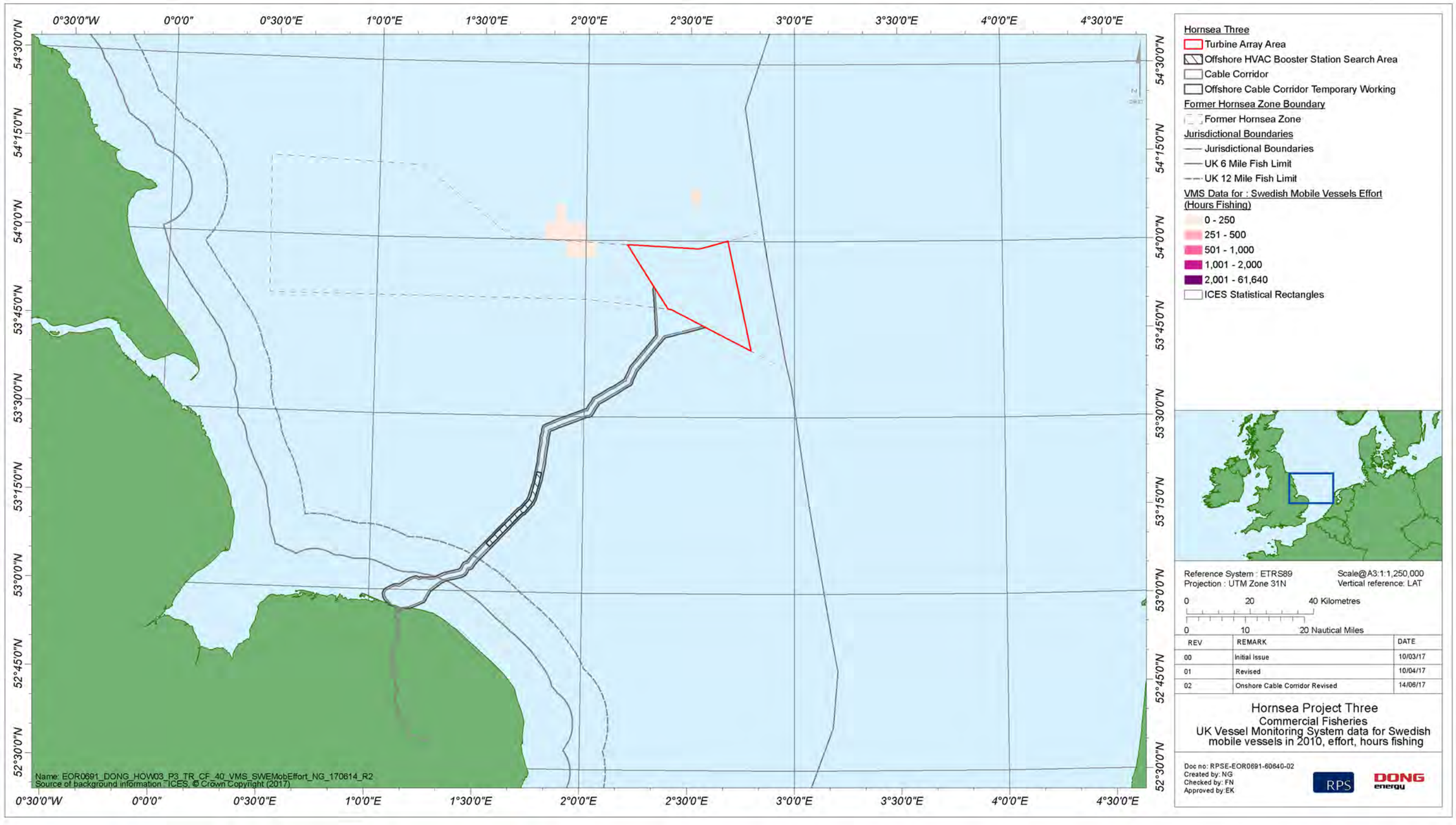

Figure B.6: VMS data for actively fishing Swedish registered mobile vessels indicating hours fished in 2010 (Source: MMO, 2013).

Appendix C VMS data for Dutch vessels and Wageningen Economic Research Report

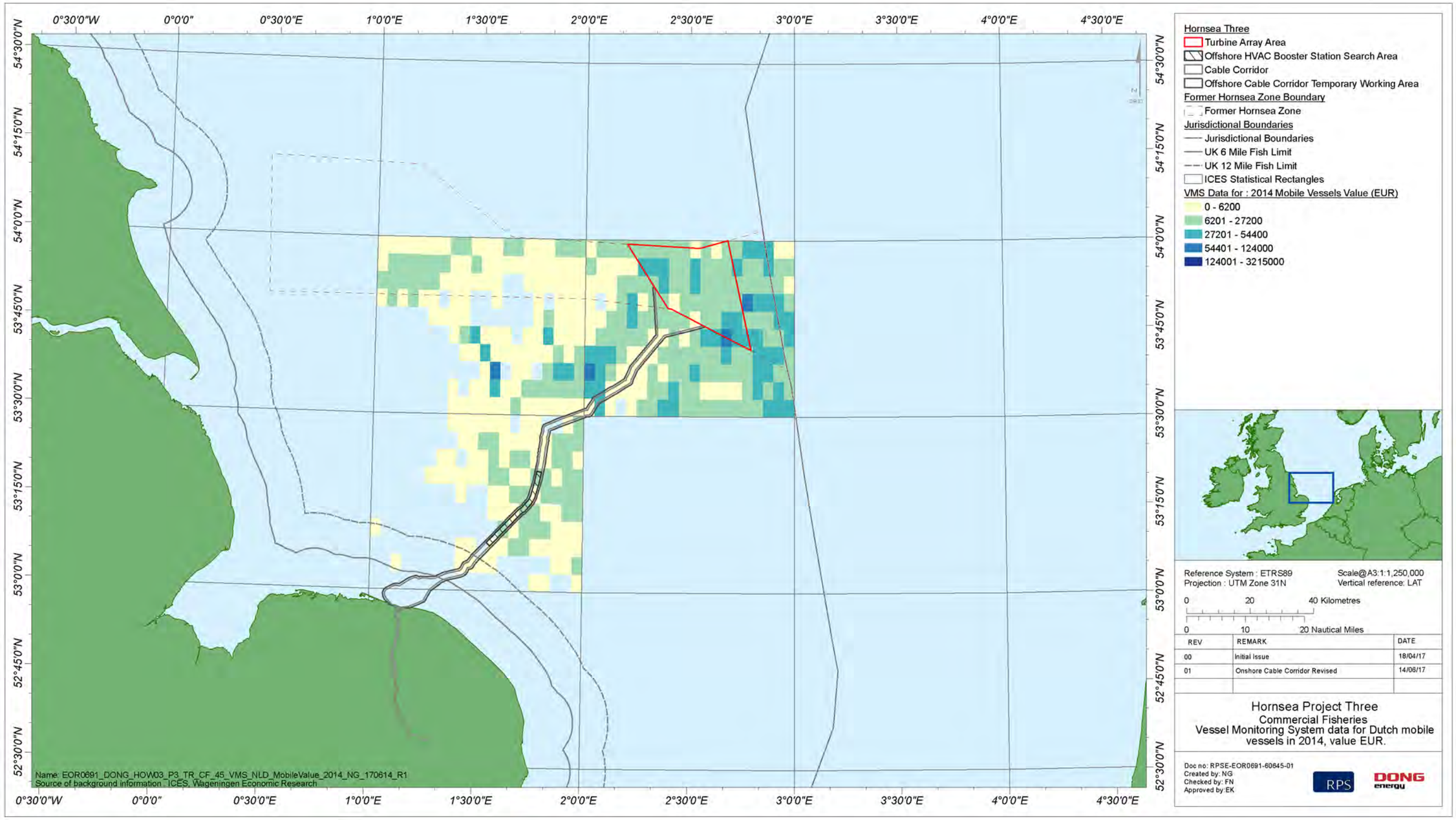

Figure C.1: VMS data for actively fishing Dutch registered mobile vessels indicating value of catch in 2014 (Source: LEI, 2017).

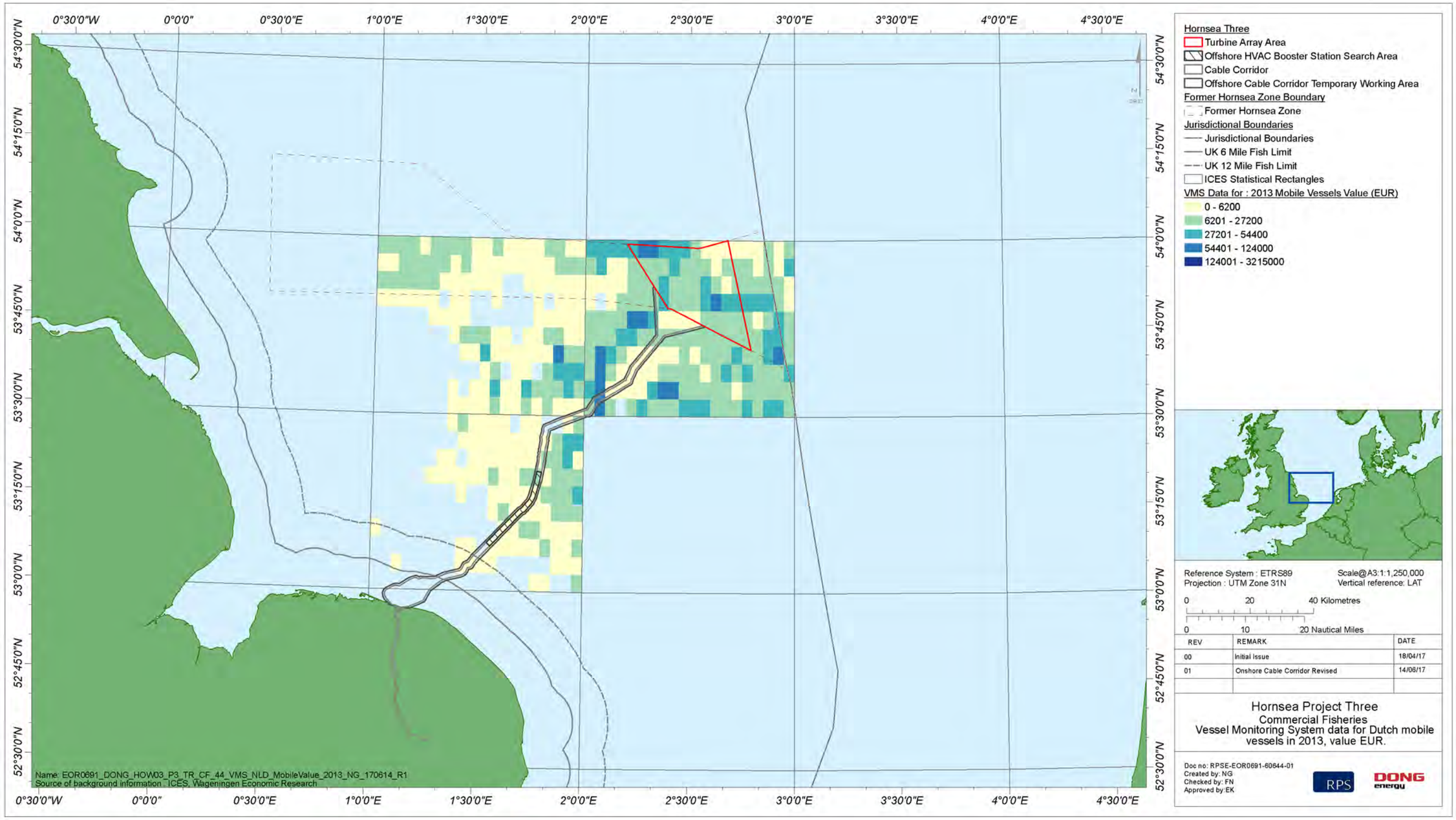

Figure C.2: VMS data for actively fishing Dutch registered mobile vessels indicating value of catch in 2013 (Source: LEI, 2017).

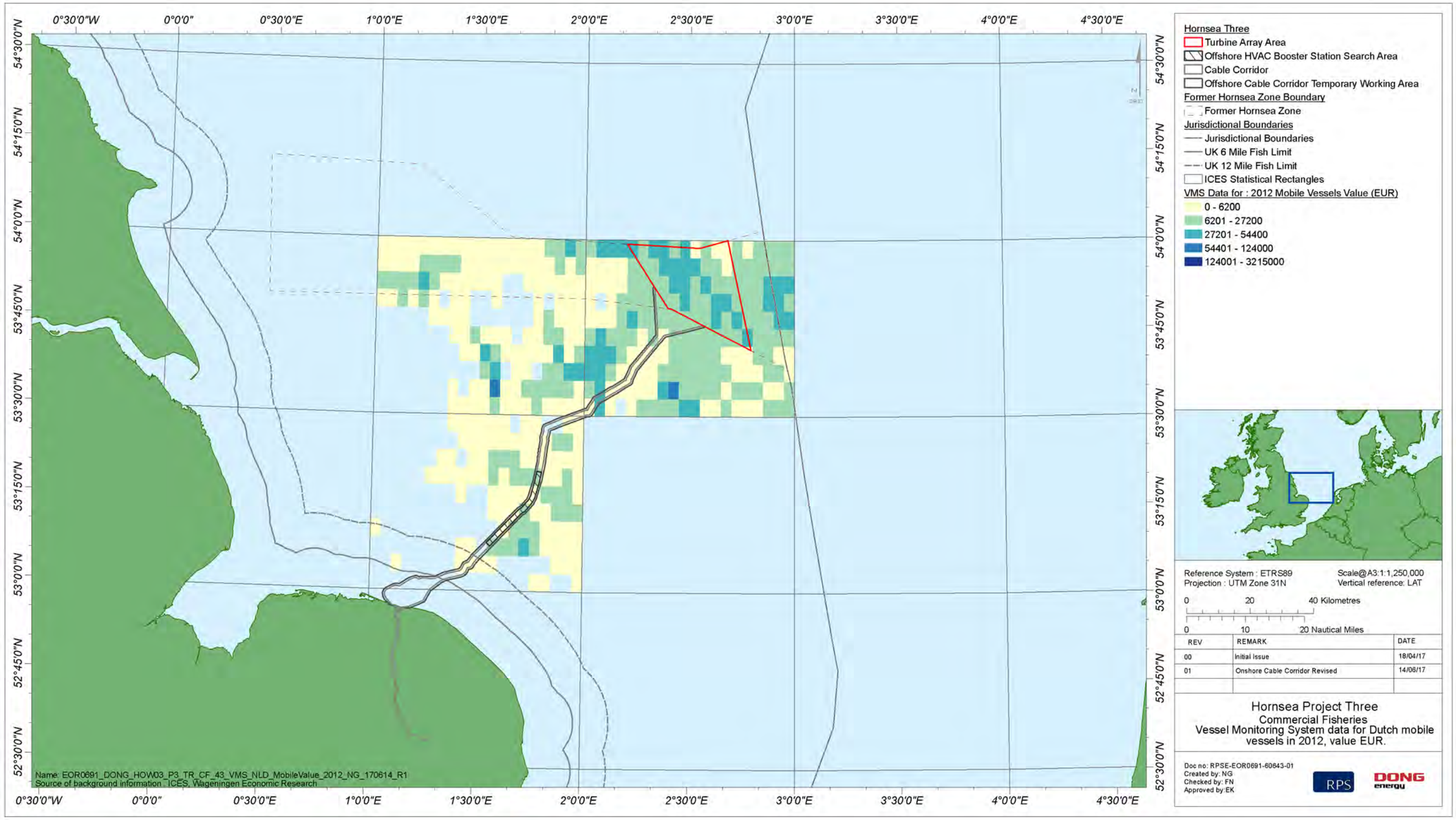

Figure C.3: VMS data for actively fishing Dutch registered mobile vessels indicating value of catch in 2012 (Source: LEI, 2017).

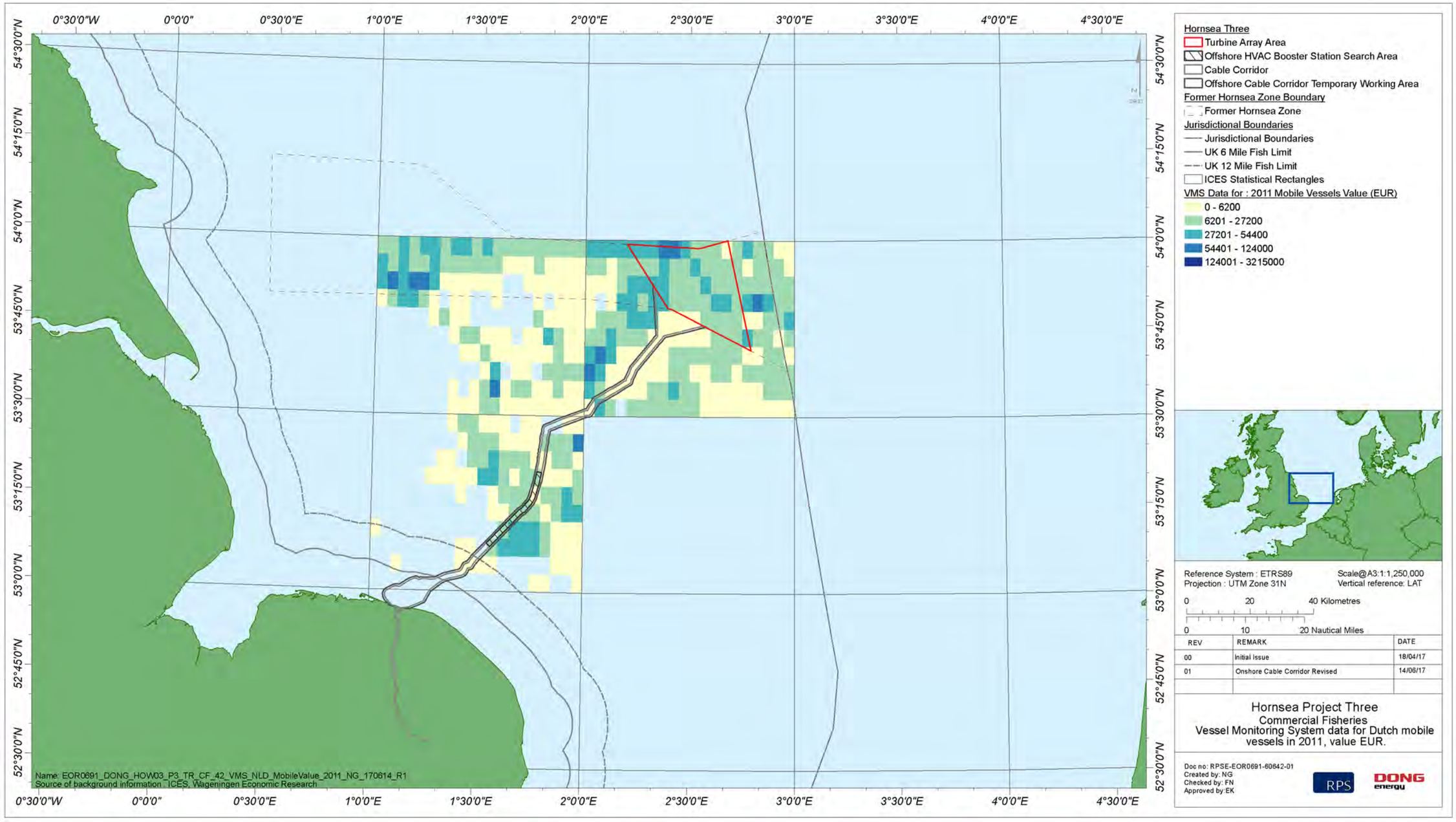

Figure C.4: VMS data for actively fishing Dutch registered mobile vessels indicating value of catch in 2011 (Source: LEI, 2017).

Wageningen Economic Research Report

Overview of the Dutch fishing activities on the Horn Sea area (draft)

Trends in effort, landings and landings value for 2011-2015

Hans J. A. E. van Oostenbrugge and Katell G. Hamon

Wageningen Economic Research

This study was carried out by Wageningen Economic Research and was commissioned and financed by RPS Energy

Wageningen Economic Research

Wageningen, April 2017

REPORT

ISBN XXXX

Oostenbrugge, J.A.E. van and K. G. Hamon, 2017. Overview of the Dutch fishing activities on the Horn Sea area; . Wageningen, Wageningen Economic Research, Report . ?? pp.; ? fig.; ? tab.; ?? ref.

This report can be downloaded for free at http://dx.doi.org/10.18174/xxxxxx or at www.wur.nl/economic-research (under Wageningen Economic Research publications).

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Summary

S.1 In response to a request to Wageningen Economic Research from RPS Energy an analysis of the fishing activities of the Dutch fishing fleets on the area of the planned wind park on the Horn Sea was prepared. This report uses the method presented in Chapter 5 of Effects of seabed protection on the Frisian Front and Central Oyster Grounds (Van Oostenbrugge *et al*. 2015), to estimate the fishing effort, landings volume and landings value of the Dutch fleet in the period 2011-2015 in the total area of the Horn Sea (defined as ICES rectangles 36F2, 36F1, 35F1 and 34F1) and the area of the planned wind park. The Horn Sea area is a fishing ground for beam trawls and, to a lesser extent, for demersal trawls and seiners. During the reference period, Dutch vessels spent around 650 days per year in the ICES rectangles selected, catching approx. 1.7 mln. kg of fish worth 5.5 mln. Euro. The wind park area resembles an important fishing ground within the selected rectangles. Dutch vessels spent approx. 120 days annually over the period 2011-2015. The fishing activities resulted in an average landings volume of 0.3 mln. Kg of fish, worth around 1.0 mln. Euro. Although in total, landings from the wind park area represent approx. 0.4% of the total landings value of the Dutch demersal fleet over the reference period, the productivity of around 1.4 kEur/km^2/year makes the area a valuable fishing ground for the Dutch fleet.

S.2 Key words: Spatial analysis, Bottom fishing, Horn Sea, wind park.

C.1 Introduction

C.1.1.1 Currently several wind parks are being developed in various parts of the North sea. For each of these parks environmental impact assessments need to be developed. The UK consultancy RPS Energy is in the framework of such an environmental impact assessment working on an analysis of the effect of the development of a wind farm on the Horn Sea area (Figure C.5) on the distribution of international fishing effort as the reallocation of fishing effort might have detrimental environmental effects elsewhere.

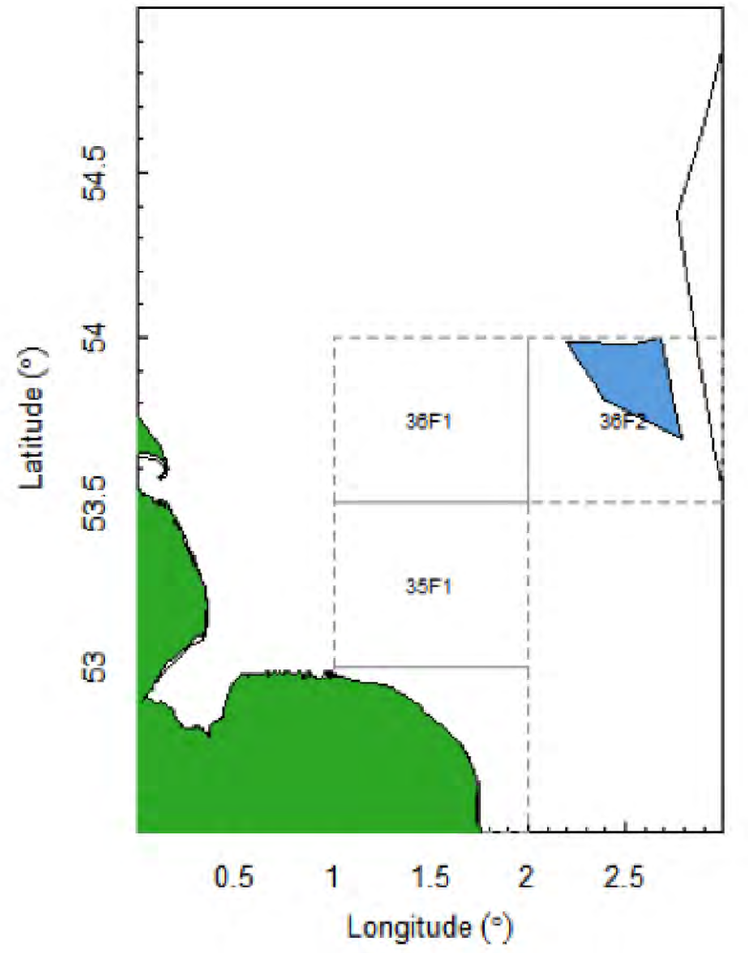

Figure C.5: Map of the proposed wind park on the Horn Sea with the adjacent ICES rectangles.

C.1.1.2 Within this framework RPS Energy has a need for an overview of the fishing activities of the Dutch fishing fleet in the Horn Sea area and has contacted Wageningen Economic Research as being the main expertise group in this field of work. The request from RPS Energy to WEcR is twofold: a report with recent trends in the fishing activities in the area of the wind park and a dataset including data on the distribution within the wider area which can be used by RPS Energy for further analysis on the effects of this windfarm.

C.1.1.3 The objectives of this project are to:

- Provide RPS Energy with a note on the fisheries activities in the Horn sea with special focus on the area of the planned find park:
  - Description of the methodology used for the analyses;
  - Description of trends in Effort, Landings and Landings value of Dutch flagged vessels;
  - Gear type: as specified in the DCF (beam trawl, demersal trawls and seines, pelagic trawls etc.); and
  - Period: 2011-2015.
- Provide RPS Energy with a dataset with the following information:
  - Variables: Effort, Landings and Landings value of Dutch flagged vessels;
  - Gear type: as specified in the DCF (beam trawl, demersal trawls and seines, pelagic trawls etc.);
  - Spatial dimension: ICES rectangles 36F2, 36F1, 35F1 and 34F1, per 1/200 rectangle; and
  - Period: 2011-2015.

C.1.1.4 The former is covered by the present report and the latter is provided separately.

C.2 Methodology

C.2.1.1 The methodology used for the estimation of the fishing activities in the area follows the methodology as described in Chapter 5 of Effects of seabed protection on the Frisian Front and Central Oyster Grounds (Van Oostenbrugge *et al*. 2015).

C.2.2 Data

C.2.2.1 Several data sources were used in this study: Vessel Monitoring System (VMS) data, catch data from logbooks (Fish Registration and Information System), Fleet data from the Netherlands Register of Fishing Vessels (NRV) and data on fish prices from the Dutch auctions.

C.2.3 Fishing activity

Base data

C.2.3.1 The data above-mentioned sources are being analysed in a standardised manner, where a script is developed that describes the processing and analysis of the data sets and can be applied by any nation that has similar VMS and logbook data in a standardised format. The script calculates effort, total landings and landings of the main fish species in the area of interest based on VMS and logbook data for the years 2011 to 2015.

C.2.3.2 First the datasets were pre-processed to remove erroneous fields. This pre-processing of the dataset for the Dutch data follows the approach developed in Hintzen *et al*. (2012, 2013).

C.2.3.3 VMS records are removed when they are:

- Duplicates or pseudo-duplicates;
- Not positioned on the globe;
- Located in a harbour;
- Located on land; and
- Associated with vessel speeds >20 knots.

C.2.3.4 Logbook records are removed when they:

- Are duplicates;
- Have arrival times before departure times;
- Start before the 1 of January of the year considered (despite the fact that the end of the trip falls within the considered year); and
- Overlap with other trips.

Link VMS and logbook data

C.2.3.5 To further analyse the data, the spatial resolution in the VMS data must be linked to the catch and effort data in the logbooks. Therefore, the VMS and logbook data in the ICES rectangles of interest were selected. All ICES rectangles overlapping with the Horn Sea area were selected (see Figure C.5).

C.2.3.6 VMS and logbook datasets are linked using the vessel identifier and date-time stamp. In other words, records (also called pings) in the VMS dataset that fall within the departure-arrival timeframe of a trip described in the logbook are assigned the unique trip number from the logbook record and allow for an analysis of the two datasets simultaneously.

Define fishing activity

C.2.3.7 For each gear type, the activity of the vessel (floating, fishing or steaming) is defined based on the instantaneous speed in VMS records (see Table C.1). For each ping, the state of the vessel is identified based on gear and speed.

Table C.1: Determination of fishing activity based on the vessel speed. The speeds used in the Dutch fleet are presented.

Gear	Gear code	Floating	Fishing	Steaming
Beam trawls	TBB	<2 knots	2-8 knots	>8 knots
Danish and Scottish Seines	SDN and SSC	<0.5 knots	0.5-6 knots	>6 knots
Dredges	DRB	<1 knots	1-5 knots	>5 knots
Otter board or twin trawls	OTB and OTT	<1 knots	1-5 knots	>5 knots
Pair trawls	PTB	<1 knots	1-5 knots	>5 knots
Pelagic trawls	OTM and PTM	<1 knots	1-7 knots	>7 knots
Lines	LHM		<4 knots	>4 knots
Nets	GNS		<4 knots	>4 knots

Assign effort and landings to pings

C.2.3.8 Each VMS ping represents a certain amount of time, usually equal to the interval rate at which VMS pings are emitted, ranging from 30 minutes to 2 hours. The fishing effort is defined as the sum of these time steps for those pings where the previous analysis indicated a 'fishing' state.

C.2.3.9 The landings are recorded by trip, per ICES rectangle and day in the logbook. For this analysis, we retained the total landings per year for the ICES rectangles and gears of interest.

C.2.3.10 For each trip that could be linked to VMS data, the landings and the days at sea, as registered in the logbooks, are allocated to the VMS pings in a stepwise process: If a match in trip, ICES rectangle, and fishing day is found, the registered landings are assigned to the VMS pings, weighted by the average time each VMS ping represents (ranging from 30 minutes to 2 hours). If a match cannot be found, fishing day and/or ICES rectangle is left out of the equation. Any remaining logbook record that could not be matched to any VMS ping is assigned to following the same stepwise process, but dropping the requirement that vessel ID in both datasets must be the same. This results in a full allocation of all landings of the logbook data to the VMS data.

Define pings in the areas of interest

C.2.3.11 The coordinates of each VMS ping are compared to the location of the proposed closed areas on the Horn Sea (see Figure C.5). When a VMS ping is located inside any of the areas, it is selected and assigned to the area of interest.

C.2.3.12 The data is hereafter aggregated by year, area, gear type and vessel length category. The logbook records without VMS data are also aggregated by year, ICES rectangle and gear type.

Uncertainty in the analyses

C.2.3.13 In the analyses a number of assumptions have to be made related to fishing activity and linking catches to VMS pings. Although these assumptions have been tested thoroughly, consultations with fishermen to verify our assumptions and international consultations on these methods have taken place, the final results are uncertain and changes in assumptions will likely affect the numeric values presented in the results. It is anticipated however that these differences do not alter the conclusions. No exercise has been undertaken to quantify the uncertainty however.

C.2.4 Economics

C.2.4.1 The value of landings was based on the landings volume per species and the average auction prices per month and species from Dutch auctions. From the vast majority of landings (>95% of total value) prices per month and species were available. For other (rare) species aggregated prices of "other species" were used.

C.3 Results

C.3.1 Fishing activity

C.3.1.1 Over the 2011-2015 the area of the Horn Sea has been an area of interest for the Dutch fishing fleet. On average Dutch vessels spent around 650 days in the ICES rectangles selected catching approx. 1.7 mln. kg of fish worth 5.5 mln. Euro (Table C.2). During the reference period the fishing activities and the resulting landings decreased, despite some variation from year to year. On average the effort and landings value decreased by 13% annually and the landings volume by 6%. This decrease was mainly due to the drop in activities in 2015 when effort and landings from the area dropped by more than one third.

Table C.2: Overview of effort, landings and values of the Dutch fishing sector in the research area and the proposed wind park area (VMS and logbook merged data only).

Country	2011	2012	2013	2014	2015	Average
Total area (ICES rectangles 36F2, 36F1, 35F1 and 34F1)						
Effort (days at sea)	806	645	711	669	420	650
Landings (tonnes)	1,784	1,705	1,819	2,001	1,283	1,718
Value (1,000 euros)	6,766	5,547	5,949	5,663	3,670	5,519
Planned wind park area						
Effort (days at sea)	130	139	112	122	100	121
Landings (tonnes)	322	330	252	412	394	342
Value (1,000 euros)	1,038	1,050	867	986	897	968

Source: Logbook data and VMS data and data from Dutch auctions, processed by WUR.

C.3.1.2 Within the research area, fishing effort was generally higher in the offshore the North eastern part, where also the wind park is planned (Figure C.6). The absence of fishing activities near the coast is explained by the fact that Dutch fishermen are not allowed to fish within the UK 12 mile zone. The data presented here represent more than 97% of the total landings as nearly all of the logbook records in the area could be matched with VMS data (see Appendix 2). This result allows us to focus more on the dataset where VMS and Logbooks are linked and provide greater spatial and temporal resolution.

C.3.1.3 Within the proposed wind park the Dutch fleet spend approx. 120 days annually over the period 2011-2015. The fishing activities resulted in an average landings volume of 0.3 mln. Kg of fish, worth around 1 mln. Euro. In contrast to the trend in the overall research area, trend in fishing activities in the wind farm is not that clear: effort seems to be decreasing slowly (by 7% in 5 years), whereas landings from the area have increased in the same period (6%). Landings value has decreased (7%), which is probably mainly due to a change in species composition.

C.3.1.4 In the greater research area, effort by Dutch vessels has been dominated by beam trawlers (Figure C.7). More than 80% of the fishing activities in the area were carried out by this type of gear. This gear category includes both the traditional beam trawler with heavy tickler chains as well as the recently developed pulse trawls. The other main gear used in the area was the gear group of demersal trawlers and seines. This group consists of outrig fisheries, otter trawls and twin rig fisheries, and Scottish and Danish seines. This group of gears contributed around 20-25% to the total effort in the area and the same in terms of value of landings. The contribution to the landings volume is somewhat higher as these gears (especially twin rig fishery) can be used to catch large amounts of plaice, that has a relatively low price. Whereas the fishing activities of the beam trawlers decrease over the reference period, the activities of the demersal trawler and seiners was stable/increased slightly. Other gears like pelagic trawls and nets were hardly operated in the area.

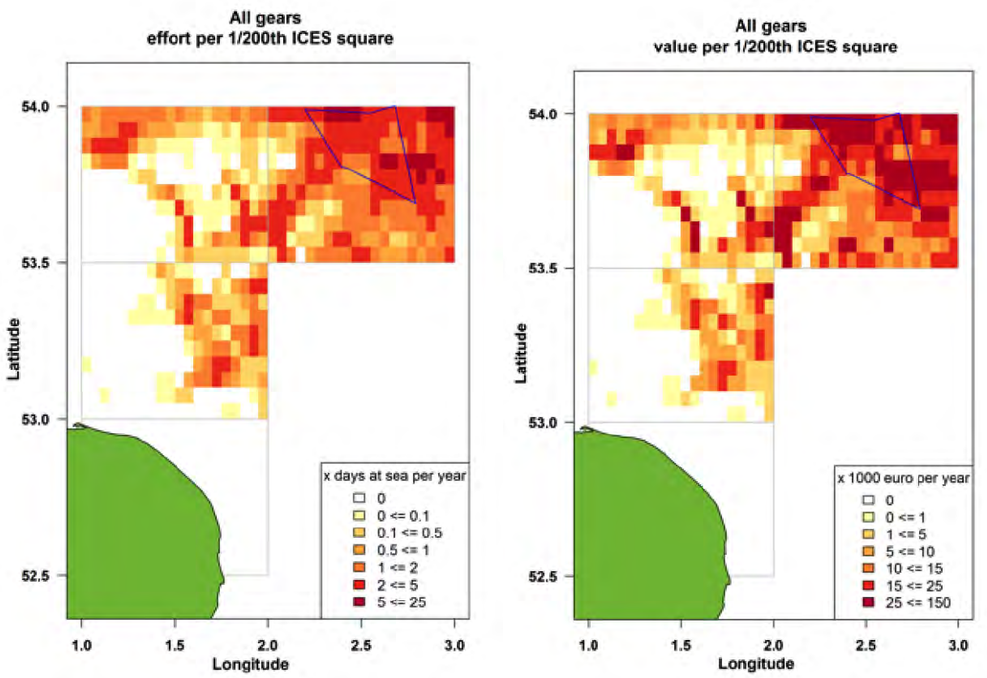

Figure C.6: Spatial distribution patterns of effort (left) and landings value (right) per year over the period of 2011-2015.

Source: Logbook data and VMS data and price data, processed by WUR.

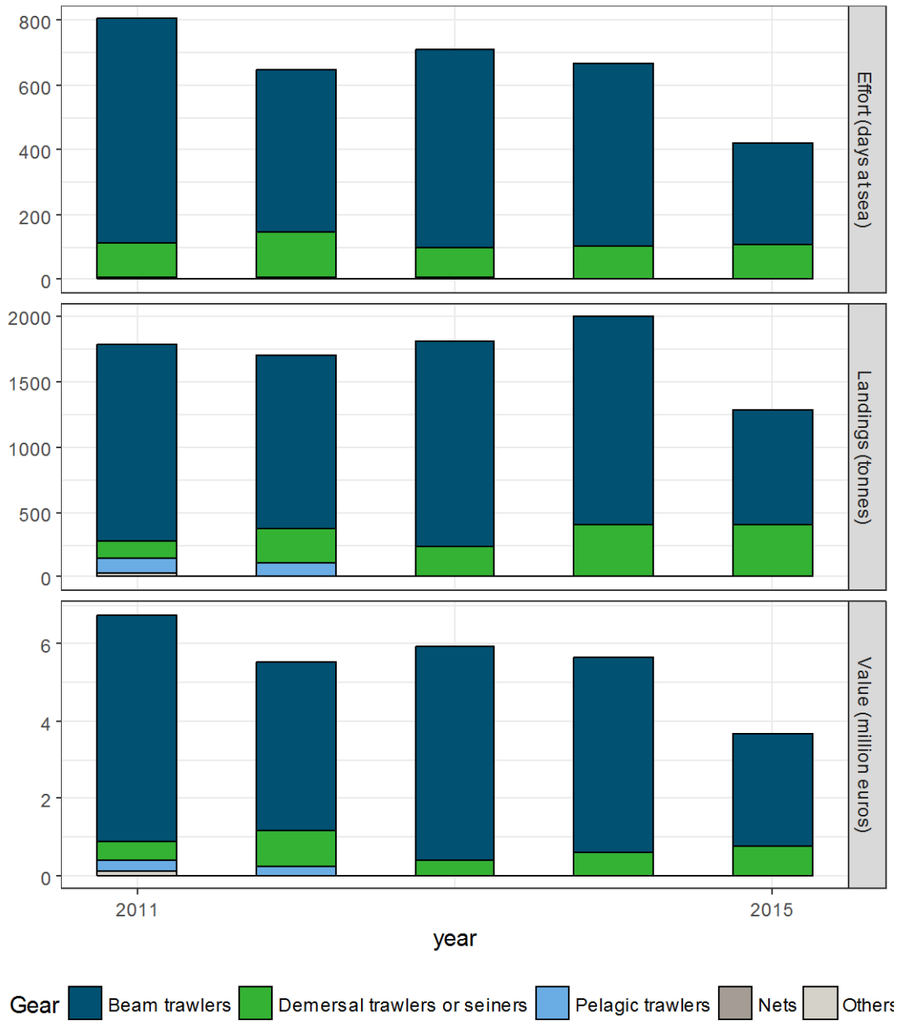

Figure C.7: Historical trend of the fishing activities with different gear types in the total area of the Horn Sea (4 ICES Rectangles).

Source: Logbook data and VMS data and price data, processed by WUR.

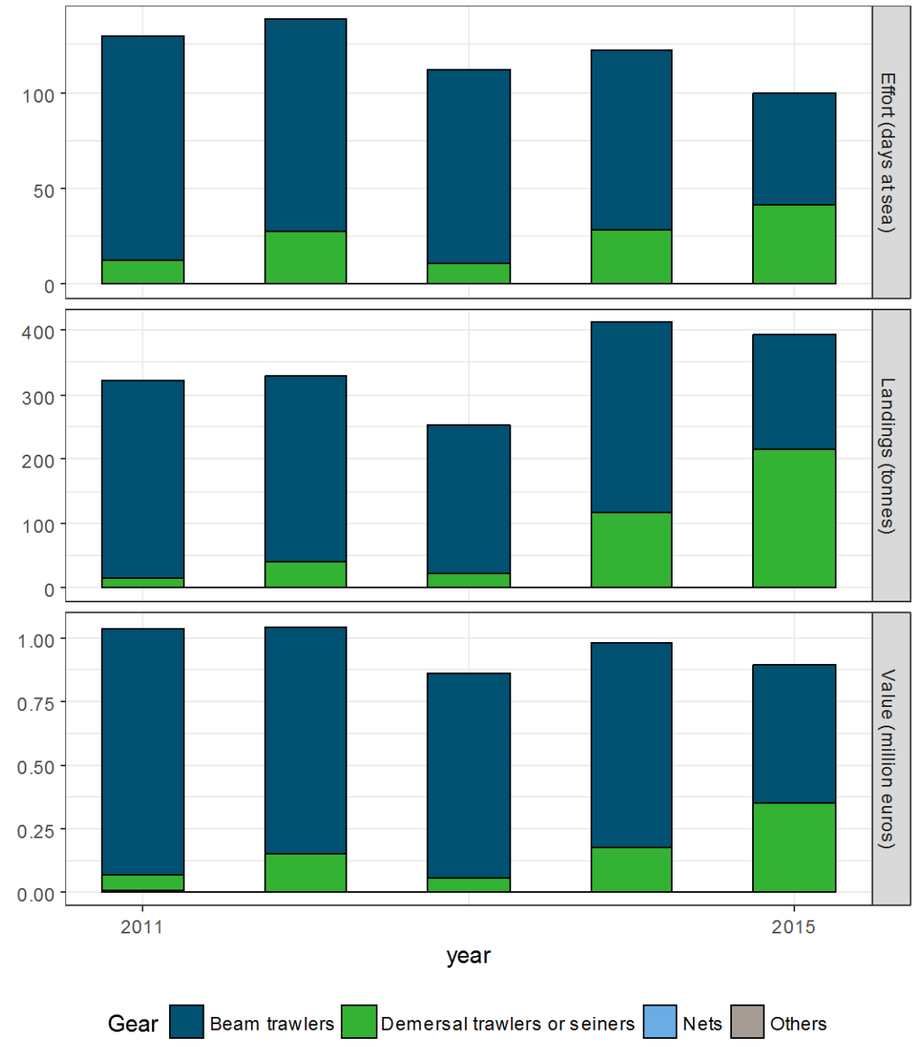

Figure C.8: Historical trend of the fishing activities with different gear types in the area of the Horn Sea wind park.

Source: Logbook data and VMS data and price data, processed by WUR.

C.3.1.5 Within the planned wind park the balance between the main gear types shifted during the reference period. In 2011, the beamtrawl was by far the most important gear used in the area, whereas by 2015, more than half of the landings from this area caught by demersal trawlers and seiners. As the beam trawl fishery targets the more valuable sole, this fishery still represents to biggest part of the value of landings (approx. 60%). Other fishing gears such as pelagic trawls of static gears (gill nets) have been hardly operated in the area.

C.4 Discussion and conclusion

C.4.1.1 This note provides an overview of the fishing patterns and temporal changes in the fishing activities in the Horn Sea area and specifically in the area of the planned wind farm. We conclude that the area are used mainly by Dutch beam trawlers and demersal trawlers and seiners and represent a total landings value of around 1.0 mln Euros per year during the reference period (2011-2015). The total landing from the area make up around 0.4% of the total landings value of the Dutch demersal fishing fleet for the reference period (www.visserijincijfers.nl). However, with the productivity of around 1.4 kEur/km^2/year the productivity and relative importance of the area is comparable to that of the Cleaver Bank (Hamon *et al,* 2013), which is acknowledged as an important fishing ground for the Dutch fleet. Moreover, if effects are small at the scale of the fleet, this does not imply that individual fishers will not be affected substantially by a closure of a specific area at sea. The effects of closing a specific area are generally thought to have less effect fleet wide than on specific individuals or fishing companies.

C.4.1.2 The numbers presented here as the value of the area for the Dutch fishing fleet represent the current knowledge on estimation of spatial fishing activities (Hintzen *et al*. 2013). As stated before, there is a number of uncertainties and assumptions in the analysis that cause uncertainty in the outcomes. The main ones are briefly discussed here:

- The value are based on a combination of the official logbook and Vessel Monitoring System data. The data cover in principle the complete Dutch fleet, but the combination of both datasets shows that both datasets are not completely compatible. This results in coverage rates of the data that are less than 100%, but the % of data that cannot be merged is small;
- The status of the vessel (fishing or steaming) is derived from the vessel for which there are general thresholds per gear. Although for the majority of the pings this assessment will be valid, for some of the pings this will lead to an erroneous allocation of landings; and
- In allocating the landings to the VMS pings, it is assumed that the landings volume of each of the species is proportional to the effort applied by the vessel during that day. In other words it is assumed that the productivity per hour fishing is constant for all species within a day of a fishing trip. This assumption introduces uncertainty in the estimate of the landings from an area as catches vary from haul to haul and from location to location.

C.4.1.3 Al of these assumptions might lead to increased uncertainty, especially in small areas in which low levels of fishing effort, so it is assumed that for the area under study, the possible uncertainty in the data is low. Nevertheless, more research is needed to quantify this uncertainty.

C.4.1.4 The reported values of the areas of interest do not necessarily reflect the value of these areas for the fishing sector in the (near) future. The value of an area results from the combination of available fish, fish prices and the effort applied in an area. Moreover, the applied effort in the area depends on the fisheries context (management, fish prices and fuel prices). Currently many of these factors are uncertain as a result of the developments in the landing obligation, Brexit, other area closures for environmental protection or other wind park developments, and the transition to pulse fishing. If one of these factors changes, the value of fishing areas change as well. When fishers move their effort to different locations, the future value of these areas will decline and closure of these specific areas may result in smaller economic losses. We assume that fishers move their effort to other locations in case of area closures. The effects of moving effort to another location (displacement) on catch and revenue are less well understood. Research in the field of displacement is therefore necessary.

C.5 References and websites

Hamon, K., J.A.E. van Oostenbrugge and H. Bartelings, (2013). Fishing activities on the Frisian Front and the Cleaver Bank; Historic developments and effects of management. LEI Memorandum 13-050. 67 p., fig., tab., app.

Hintzen, N., A. Coers and K. Hamon (2013). A collaborative approach to mapping value of fisheries resources in the North Sea (Part 1: Methodology). IMARES Wageningen UR IMARES Wageningen UR. C001/13: 24p.

Hintzen, N.T., F. Bastardie, D. Beare, G.J. Piet, C. Ulrich, N. Deporte, J. Egekvist and H. Degel (2012). 'VMStools: Open-source software for the processing, analysis and visualisation of fisheries logbook and VMS data.' Fisheries Research 115: 31-43.

Oostenbrugge, J.A.E. van, D.M.E. Slijkerman, K.G. Hamon, O.G. Bos, M.A.M. Machiels, O.M.C. van der Valk, N.T. Hintzen, E.J. Bos, J.T. v. d. Wal and J.W.P. Coolen (2015). Effects of seabed protection on the Frisian Front and Central Oyster Grounds; A Cost Benefit Analysis. LEI Report LEI Wageningen UR. 2015-145: 170p.

Appendix D Meeting minutes

Minutes are provided for the following meetings:

National Federation of Fishermen's Organisations	8 February 2017
North Norfolk Independent Fishermen's Association	22 February 2017
Eastern Inshore Fisheries and Conservation Authority	23 February 2017
Jonas Seafood	23 February 2017

Once finalised, meeting minutes for the following meetings will be included in the Commercial Fisheries Technical Report which is appended to the Environmental Statement:

Wells and District Fishermen's Association	22 February 2017
North Norfolk Fishermen's Society	23 February 2017
VisNed	24 February 2017

Subject	Hornsea Project Three Pre-Application Consultation – Commercial Fisheries
Date - hours	8 February 2017
Venue	**NFFO, 30 Monkgate, York**
Attendees	**In person** Hywel Roberts (HR) Adam Payne (AGP) Dale Rodmell (DR) Nick Garside (NG) Allan Piggott (AP) **Apologies:** Fiona Nimmo
Supporting Material	Presentation

Item	Description	Action
1	*Introduction* All participants introduced themselves and their current relevant role.	
2	*HOW03 overview* **HR** provided an overview of DONG Energy and the Hornsea Three offshore wind farm project. This included a presentation of cost reduction targets and the progress in technology developments for offshore wind projects. **HR** presented the schedule and timetable for the Hornsea Three DCO application, including pre-application consultation, and construction of the project. **DR** asked what the current minimum separation distance between turbines is (with reference to Burbo Bank)? **HR** responded that DE were committed to a minimum 1 km separation distance for Hornsea Three (centre point to centre point). **NG** enquired whether the survey area is larger than the cable corridor? **HR** responded that it is to some degree and that DONG Energy may have over surveyed by 500 m or so.	
3	*Project Description* **HR** outlined the key project components, including the HVAC vs. HVDC transmission systems, turbine sizes, use of platforms and potential size of substations if the HVDC transmission system is utilised. **HR** indicated that the HVDC transmission system may be more likely due to the distance offshore, and that the HVAC transmission system will require booster stations along the export cable route. Both transmission systems are being considered in order to future proof against technological advances over the next 5 or 6 years. The usual foundation designs (including monopiles, jackets and gravity base foundations) are being considered, as well as floating foundations. Floating foundations are being considered as costs might be greatly reduced or present a better cost case than fixed foundations at the time of construction. The actual	

	foundation type selected will ultimately depend on a variety of factors. Platforms will need to be included within the array (and ECR for the HVAC transmission system). The potential for subsea HVAC booster stations for HVAC option was also presented. **DR** asked whether there were any issues that DONG Energy foresee in relation to interactions with fisheries if the HVDC option is chosen? **HR** suggested that it may be preferable for fisheries as offshore HVAC booster stations along the cable route will not be required. However, there will be a greater number of substations in the array area. **AP** suggested that, from a navigation perspective, above sea platforms were preferable to subsea HVAC booster stations and that from a fishing perspective they are also preferable as subsea booster stations are likely to present a greater snagging risk. **NG** wanted to know how many cables will be needed? **HR** responded that there will be up to 6 export cables. The number of array cables will depend on the number of turbines and there are expected to be up to 15 interconnector cables between platforms. The length of array cabling and interconnectors were provided on the slides as 850 km and 225 km respectively. **AP** queried the width of the cable trench? **HR** outlined the parameters: 1.5 km corridor, 6 trenches, up to 10 m width of seabed disturbance for each trench, export cable route length of 173 km. **DR** responded querying whether, with a 10 m width of cabling, there are likely to be berms formed either side of the cable corridor? **HR** replied that in general there is not a discernible berm in other wind farms and with mobile sediments this is likely to be a temporary issue but will very much depending on the type of sediment present. **AP** suggested that it will very much depends on the technique employed. Ploughing is the main cause of berms. Backfill and jetting eliminates berms. **AP** also noted that you can get boulders and there will be blue clay patches also which are more likely to cause issues for fishing activity after trenching has been completed. However, this will all depend on the seabed. There was also significant discussion regarding the deployment of floating turbines. **AP** made a number of enquiries including whether they are ready for commercial deployment, what happens if one gets loose and are there any operating? **AGP** responded by providing some details regarding the Hywind Scotland pilot park (Statoil), which is a demonstration project. Once this project is up and running (end of 2017) Statoil will be looking to move to a full commercial deployment as they learn more from the Hywind Scotland deployment, so they are getting closer to full commercial deployment. **AGP** understands that Hywind had to go through significant discussion with BP regarding the forties pipeline which was very close to the Hywind site and the potential for a turbine to become loose from its mooring, especially regarding liabilities. As a result, they have a protocol in place if one gets loose and it is likely that other technology developers will need to have the same in place for their specific turbine / foundation / mooring designs. Hywind also a have a 2.3 MW demonstrator operating in Norway which has been operational since 2009. **DR** also asked about the potential interactions between moorings and gear. **HR** suggested that TLP presented a better case for commercial fisheries as their moorings are closer to the centre of the floating structure, whereas catenary moorings have a much greater spread and take up a greater area of the seabed. **DR** suggested that TLP are still a bigger snagging risk than other fixed designs. However, they are better than catenary moorings. **DR** suggested that there is still some uncertainty regarding the potential impacts of floating turbines, particularly as there are no arrays currently operating. This uncertainty will need to be covered / accounted for within the assessment.	

4	*Baseline Data* **AGP** provided a summary of the key datasets either already collected or currently being requested in order to inform the EIA - including landings data, VMS, aerial surveillance data, inshore fishing mapping, inshore VMS, EU Data collection framework data, The Crown Estate (TCE) beam trawl density tracks and specific country datasets. Maps of fishing areas from VMS data, the TCE beam trawl density maps and aerial surveillance maps were presented alongside key landings statistics. **AGP** also provided a summary of the key stakeholders, including management and scientific, UK Fishermen's organisations, North Norfolk Fishing groups and EU and Norwegian Fishermen's organisations. **AGP** summarised the baseline findings so far by showing a map which identified the cable route as being dominated by crab, lobster and whelks landed by potters and the array being dominated by flatfish landed by beam trawlers and *Nephrops* landed by demersal trawl. **DR** enquired whether the TCE data was from the UK FIM project as there are concerns over the data usage from this project. **AGP** showed the slide with the TCE data which is aggregated and has been used in both Hornsea Project One and Hornsea Project Two Environmental Statements to demonstrate that there should not be any data usage concerns. **AGP** also suggested that **FN** would contact NFFO to discuss further. **DR** indicated that the inshore-VMS trial has provided some potentially useful data. **DR** also suggested that DONG Energy look into using the FisherMap data that was collected as part of the MCZ programme. **AGP** said that DONG Energy would look into using the FisherMap data and also suggested that the EIFCA fishing maps data may be the same information. However**, AGP / FN** would check to see if there is any further useful data. **DR** also enquired whether the Belgian fleets have been contacted. **AGP** confirmed that they had. **DR** also suggested that DONG Energy contact the North Sea FPO and Lowestoft FPO which have Anglo-Dutch representation. **DR** pointed out that some of the North Norfolk fleets are also represented by the NFFO, including members of NNFS, NIFA, Wells and District FA, Greater Wash FIG and Dave Chambers (Vice-Chair of the East Anglia Regional Committee). **DR** pointed out that there might be one or two Lowestoft potters in the area also. **NG** suggested that there might also be vessels using trammel nets to target turbot in Markham's hole, which is close to the array area. It was agreed that the relevant European stakeholders were listed. The Outer Silver Pit prawn ground (to the north of the Hornsea Three array area) and the Botney-Cut channel and Markham's Hole (shrimp and plaice) prosecuted by Anglo-Dutch and Dutch fishers were referenced by the NFFO. It was also pointed out that Andries de Boer had helped inform the boundary of the Markham's Triangle MCZ via the Net-Gain project. The NFFO queried the reference to boarfish. **DR** also enquired how the Marine Plan was being considered within the ES. Eastern inshore and offshore marine plans need to be considered particularly regarding the general coexistence policy and whether DONG Energy need to alter their assessment to accommodate these. The Cable Policy in terms of burial and achieving cable burial also need to be reviewed and considered by DONG Energy.	**FN** to discuss TCE data with NFFO **FN / AGP** to check Fishermap data **FN** to contact FPOs **FN** to investigate marine plans and to discuss further with **DR**.

5	*Overview of Topics for impact assessment* **AGP** provided an overview of the potential impacts being considered within the assessment for construction, operation and maintenance, and decommissioning, including change to access to fishing grounds, displacement, displacement of fishing resources (i.e. target species), increased vessel traffic, longer steaming distances and snagging. **DR** commented that significance of the impact is not the only issue and that DONG Energy will need to look at whether there is an interaction with the fishing industry and whether the two can co-exist. Generally, impacts considered not significant if fishing activity can take place elsewhere, although this needs to consider whether the activity can go somewhere else or not. The assessment needs to consider uncertainty about whether fishing activity can go elsewhere. **DR** also suggested that the assessment needs to look at the type of fishing and whether fishing activity is compatible with the project. Again, to what degree of certainty can this be ascertained? **DR** further suggested that if fishing activity is displaced then it is not the end of the impact. It needs to be looked at in terms of loss of income or reduction of income. The coexistence plan is key. **HR** pointed out that the coexistence plan will be dealt with at later stages of the project and not at PEIR. **DR** reiterated that the main issue is dealing with the framework and coexistence plan and that seeing the approach for the coexistence plan upfront would be helpful. This will ensure that the process is eased. The difficulty of identifying a suitable Onshore FIR that would be acceptable to the full range of North Norfolk commercial fisheries stakeholders was discussed. It was agreed that, unless a suitable Onshore FIR can be identified, the current approach of the Company Fisheries Liaison Officer liaising and meeting directly with the representatives of the various North Norfolk fisheries associations through the EIA-phase would have to suffice.	
6	*Further engagement* **HR** and **AGP** discussed further engagement as the EIA process moves forward, including the level of engagement going forward and the frequency of meetings moving forward. Agreed that FN should call **DR** and agree the frequency of further engagement.	**FN** to speak to **DR** regarding engagement going forward.

Actions

1. Fiona Nimmo to discuss TCE data with NFFO
2. Fiona Nimmo / Adam Payne to check Fishermap data
3. Fiona Nimmo to contact FPOs
4. Fiona Nimmo to investigate marine plans and to discuss further with Dale Rodmell.
5. Fiona Nimmo to speak to Dale Rodmell regarding engagement going forward.

Subject	Hornsea Project Three Pre-Application Consultation with North Norfolk Fishermen's Society
Date - hours	22 February 2017
Venue	**Cromer Pier**
Attendees	**In person** Hywel Roberts (HR) Fiona Nimmo (FN) Billy Gaff (BG) John Lee (JL)
Supporting Material	Presentation

Introduction

All participants introduced themselves and their current relevant role.

Hornsea Project Three overview

HR provided overview of DONG Energy and the Hornsea Three project. Included presentation of cost reduction targets and progress in technology developments.

HR presented the schedule and timetable for submission of an application for a Development Consent Order (DCO) including the timetable for consultation. Key documents include:

- Preliminary Environment Information Report (PEIR) which is effectively a draft Environmental Statement. The PEIR will be submitted and available on the UK Planning Inspectorate (PINS) website in summer 2017. There is a 28-day formal consultation period on this document and stakeholders can submit representations and comments.
- Final ES will be submitted in Q2 2018 followed by a second formal consultation period. The PINS examination panel will then assess the development.
- If consent is successful, marine construction will commence no earlier than 2023.

Project Description

HR outlined the key project components, including use of HVAC vs. HVDC transmissions systems, turbine sizes, potential use of accommodation platforms and potential size of substations. An HVAC transmissions system may require boosters along the cable route. Turbine foundations being considered include: pile, jacket/suction, and gravity based, as well as floating turbines. Floating turbines are a relatively new technology (at the demonstration-phase in the UK) which may potentially be a technically and economically viable option for consideration when future fabrication contracts are tendered. Floating turbine designs include up to 12 mooring lines per turbine, each with up to 1km radius. The choice of turbine foundations will be decided post consent.

Platforms will need to be constructed within the array area (and approximately half way along the export cable route if an HVAC transmission system is selected). The potential for subsea HVAC booster stations was also presented.

HR outlined the parameters for the export cable route: 140km from shore, 1.5 km corridor with up to 6 cables/trenches, 10 m width of disturbance per cable/trench, and each export cable is 173 km in length.

Baseline Data

FN provided a summary of the key datasets either already collected or requested by Poseidon including landings data, VMS, aerial surveillance data, inshore fishing mapping, inshore VMS, EU Data collection framework data, The Crown Estate (TCE) beam trawl density tracks and specific country datasets. Maps of fishing areas from VMS data, aerial surveillance and inshore fishing activity maps were presented alongside key landings statistics.

FN also provided a summary of the key stakeholders, including management and scientific, UK Fishermen's organisations, North Norfolk Fishing groups and EU and Norwegian Fishermen's organisations.

FN summarised the baseline findings so far by showing a map which identified the cable route as being dominated by crab, lobster and whelks landed by potters and the array being dominated by plaice and sole landed by beam trawlers.

FN provided an overview of the potential impacts being considered within the assessment for construction, operation and maintenance and decommissioning, including change to access to fishing grounds, displacement of fishing vessels and gear, displacement of fishing resources (i.e. target species), increased vessel traffic, longer steaming distances and snagging. It was agreed that appropriate impacts were being assessed, and that the proposed methodology for assessing these impacts was fit-for-purpose.

Discussion

Previous wind farm experience: **BG** notes that the NNFS have been involved in discussions with Vattenfall regarding survey work associated with the Norfolk Vanguard offshore wind farm project, but otherwise this is the first DCO project they have been involved with. Previous experience is focused on Round 1 and 2 offshore wind farms.

BG asked how many offshore wind farms have not made it through planning. **HR** noted that offshore wind farms that have been refused consent include the Round 3 project Navitus Bay Wind Park off the Devon coast, Shell Flats in the East Irish Sea and, more locally, Docking Shoal in the outer-Wash area, that was refused consent due to bird interactions.

Separation distances within the wind farm: JL asked about the spacing between turbines. HR confirmed the minimum distance between turbines will be 1km, but that the average separation distance between turbines is likely to be significantly greater, although this cannot be confirmed until post-consent. It is recognised that approx. 700km^2 is a large area and that the mooring systems associated with floating turbines would preclude or restrict certain forms of fishing within the wind farm array area. Floating turbines are not specifically required due to engineering constraints such as depth, given that the wind farm array is located in depths of 30-70m. It is also noted, that the Hornsea Project Three wind farm is located 140km from shore and therefore beyond the range of the NNFS members.

Export Cable Route: BG and **JL** confirmed that the focus for the NNFS is the export cable route and enquired about the timing for the construction of the export cable route.

HR confirmed that there may be periods of time between the installation of separate export cables linked to wind farm construction. HR reiterated that offshore construction works won't commence before 2023. The Environmental Impact Assessment (EIA) will assess the worst case scenario which relates to the longest time period for export cable installation, and the installation of the maximum number of export cables.

Fisheries data: FN asked about ground-truthing the Marine Management Organisation (MMO) landing statistics presented for 2011-2015. BG indicated that these appear low for both weight and value, but that the weight of whelk landed into Cromer in 2015 seemed reasonable. It is difficult to obtain accurate first-time sales values, as many fishermen also process their catch and sell locally within shops, so the first sales value is not necessarily recorded.

BG notes that the Monthly Shellfish Activity Returns (MSAR) data is likely to be more complete than the Registration of Buyers and Sellers (RBS) data. The MSAR data is submitted to the MMO, who send a copy to the EIFCA. FN to enquire about MMO data processes for MSAR.

BG also highlights that the accuracy of MSAR data varies from fisherman to fisherman, with some providing accurate data based on recording actual weights, while others provide estimates based on number of boxes and an estimate of weight per box. The methods vary depending on the market the crab is entering (e.g. sold to processors/suppliers, or local retail outlets). A scale of kg can be difficult to work with when providing estimates of weight and value e.g. at local retail outlets price is often considered per crab, not per kg.

BG notes that the whelk data per port is not too far out, that only 1-2 vessels target whelks from the NNFS, and that the whelk grounds are located beyond the 3nm limit.

BG noted that the spatial extent of the crustacean fishery presented in the ESFJC chart provided an approximately representation of the current extent of fishing grounds.

Inshore stakeholders: BG reviewed the list of stakeholders provided in the meeting presentation. It is noted that some members of the Sea Palling Fishermen's Association and Peter Loose are also members of the NNFS, and that it likely to be sensible for the NNFS to represent both. **FN**/**HR** to ask Sea Palling **FA** and Peter Loose if this is acceptable. One non-affiliated fishermen is noted: David Little operating from Weybourne.

North Norfolk Fishermen's Society activity: **BG** confirms there are 30 vessel owning members within the NNFS (and that there are some outstanding applications to join). Vessels are predominately beach launched and operate from Weybourne round to Sea Palling. Each vessel has its own tractor to assist with launching and landing. Vessels are not tidally restricted, however, some skippers avoid high water due to large stones/boulders damaging vessels. All vessels are under 10m and focus activity within 6 nm. The majority of effort is from the beach out to 3 nm, with effort dropping off moving from 3-6 nm. This is historically based in an unspoken gentlemen's agreement to allow the more inshore waters (0-3 nm) to be targeted by smaller, beach launched vessels; while larger vessels operating from harbours target 3-6+ nm. That being said, a number of vessel owners within the NNFS are moving to catamarans, 6 in total, with 3 in Cromer. Catamarans are under 10m, beach launched, but with a large outboard are able to target grounds further offshore.

In terms of crew, approximately 3 or 4 vessels have one skipper and one crew member, whereas the remaining members operate single-handed.

In terms of number of pots: fishermen targeting whelks typically operate 300-500 pots (a vessel is limited to 500 via EIFCA Byelaw); fishermen targeting crab and lobster operate 300 – 1,000 pots increasing with the size of vessel. A smaller vessel would typically operate 20 strings of pots, each with 15 pots spaced approximately 27.4m apart (15 fathoms), equating to a length per string of 384 m. A larger vessel would typically operate 40 strings of pots, each with 25 pots spaced approximately 27.4m apart, equating to a length per string of 658 m. Vessels typically operate in fine weather and work two fleets of pots (so 10-20 strings per fleet depending on size of vessel) and land daily (fishing time is typically from early morning to midday). Therefore, pots generally have a soak time of 48 hours. Steaming to 6 nm would take approximately 20 minutes on a fine day.

Seasonality: Crab is predominately targeted in summer months and tails off in the winter due to colder water temperatures. Whelk is predominantly targeted in the winter months. Some members will tend to leave their gear offshore all year round, whereas others will typically bring it ashore to men during the winter months.

Fishing villages: BG lists the following fishing villages from which NNFS members operate: Sea Palling, Bacton, Mundesley, East Runton, Cromer, Sheringham, Weybourne, Cley, Blakeney and Brancaster. BG noted that there are 18 Cromer-based vessels, and that not all of the owners are members of the NNFS.

Key concerns: BG confirms that the export cable route will be the key concern to his members during the construction phase of the project. Notably construction methods for the export cable route and the potential that suspension of sediment and chalk plumes might affect crab resources. The potential cumulative impact of management measures related to the Cromer Shore chalk bed Marine Conservation Zone is also noted.

Further engagement

The PEIR will be published in Summer 2017, the NNFS will be alerted to this and invited to provide comments. Further EIA related consultation will continue post PEIR.

Actions

1. Fiona Nimmo to enquire with MMO on how MSAR are logged and which dataset the MMO statistics utilise (i.e. RBS or MSAR).
2. Fiona Nimmo/Hywel Roberts to enquire with Sea Palling FA if they are happy for their interests to be represented by NNFS.

Subject	Hornsea Project Three Pre-Application Consultation with EIFCA
Date - hours	22 February 2017
Venue	**Kings Lynn**
Attendees	**In person** Hywel Roberts (HR) Fiona Nimmo (FN) Julian Gregory (JG) Stephen Thompson (ST)
Supporting Material	Presentation

Introduction

All participants introduced themselves and their current relevant role.

Hornsea Project Three overview

HR provided overview of DONG Energy and the Hornsea Three project. Included presentation of cost reduction targets and progress in technology developments.

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FN also provided a summary of the key stakeholders, including management and scientific, UK Fishermen's organisations, North Norfolk Fishing groups and EU and Norwegian Fishermen's organisations.

FN summarised the baseline findings so far by showing a map which identified the cable route as being dominated by crab, lobster and whelks landed by potters and the array being dominated by plaice and sole landed by beam trawlers.

FN provided an overview of the potential impacts being considered within the assessment for construction, operation and maintenance and decommissioning, including change to access to fishing grounds, displacement of fishing vessels and gear, displacement of fishing resources (i.e. target species), increased vessel traffic, longer steaming distances and snagging. It was agreed that appropriate impacts were being assessed, and that the proposed methodology for assessing these impacts was fit-for-purpose.

Discussion

EIFCA jurisdiction: **JG** confirms that the EIFCA boundary extends to the 6-nmile limit and that the EIFCA has no jurisdiction beyond 6 nm including any aspects related to gear marking. **ST** clarifies that any events that happen outside the EIFCA jurisdiction that could have consequences within 6 nm would be of interest to the EIFCA, e.g. construction works outside 6 nm that could result in suspended sediment displacement impacting shellfish resources within 6 nm.

Landfall: **JG** enquires about the landfall location. **HR** confirms that the cable will connect to the National Grid at Norwich - where the offshore cable meets land is to be decided, but will be within the export cable route corridor search area. A site selection document will form part of the Environmental Statement (ES) and will provide an overview of constraints assessed/considered when designing the export cable route and landfall location.

JG enquires whether the landfall location and onshore cable route have been routed with regard to avoiding the Broads National Park, and if so, it should be noted that this area is not actually designated as a nature reserve or National Park. **HR** confirms this information will be fed back to the team.

SAC and MCZ: **ST** highlights that landfall looks to be between the Wash and North Norfolk Coast SAC and Cromer Shoal Chalk Beds MCZ. **FN** enquires about current management measures within the SAC and MCZ. **ST** confirms that the SAC has been assessed and potting at current levels is considered not to impact the features of the SAC. However, management measures to cap effort at current levels may be considered in the future for crab & lobster potting. Currently whelk pots are limited to 500 per vessel due to resource/stock management (rather than for habitat protection). **JG** confirms that a similar assessment is ongoing for the Cromer Shoal MCZ to determine whether management measures are necessary for all fishing fleets; results are expected in Dec 2017. The features of the MCZ include chalk beds and associated assemblages, so theoretically crab and lobster are features of this MCZ. **ST** confirms that it is the responsibility of Natural England to provide fit for purpose data on the feature extent within the MCZ. Action for HR to enquire with Natural England on coverage of survey data in this area.

The SAC assessment was completed in Dec 2016 and assessed the potential for 30 different gear types to interact with 70 different features within the SAC. The results are to be published imminently. **ST** highlights that SAC and MCZ measures are focused on conservation management, not total exclusion.

Fishing areas: **JG** confirms that vessels >15 m in length operating trawling gear are not permitted within 3 nm.

JG and **ST** note the difficulties in determining where fishing effort occurs. Current methods utilise patrol vessel sightings, consultation and Monthly Shellfish Activity Returns (MSAR). ST agreed to consider whether the E-IFCA patrol sightings data could be shared with DONG Energy in order to inform the EIA baseline characterisation. MSARs for whelk provide more detail compared to crab & lobster. The whelk forms have a higher resolution for logging geographic area of fishing – the EIFCA area is split into 8 blocks along the coast and from 0-3 nm and 3-6 nm. Vessel owners have submitted this data since 2014, so two years of data have been collated. ST agrees to explore whether amalgamated datasets can be provided for whelk, crab and lobster based on the EIFCA MSARs database.

A general distinction for the area is noted with Cromer vessels being smaller, beach launched and targeting more inshore areas (0-3 nm), while vessels operating from Wells are larger and target further offshore areas (3-6 nm and beyond). It is noted that potting fishing grounds from 0-3 nm are almost exclusively targeting crab and lobster, with whelk fishing taking place further offshore >3 nmiles.

JG and **ST** note that over-flight surveillance data coverage is very light. **FN** explains this is due to the frequency of flights, which are

inconsistent across areas. **FN** agrees to include detail within the ES on the number of flights per ICES rectangle to provide further context to the data.

Inshore fisheries maps: **FN** presents the 2010 inshore fishing area maps produced by the Eastern Sea Fisheries Joint Committee. JG and **ST** note that the crustacean map under-represents some areas of fishing, with activity up to the Humber. The whelk mapping also under-represents whelk activity, with effort increasing for this fishery since 2010. It is noted that whelk fishing operates across a much wider area than depicted. The shrimp fishery is noted to be more focused within the Wash, with little effort along the North Norfolk coast. **FN** enquires if the shape files for these fisheries maps can be provided and **ST** confirms this will be explored.

Inshore VMS (iVMS): **JG** discusses the intention for introducing iVMS across all vessels that do not have EU required VMS systems (i.e. all vessels <12 m being fitted with iVMS). JG sits on a national project with MMO, Defra and IFCAs looking to implement iVMS. It is hoped that iVMS will be implemented at a national level in the next two years. **JG** confirms that AIS is not a preferred option as it does not maintain confidentiality for the fishing vessels, and it can easily be turned off.

Range of pressures that will impact commercial fisheries: **ST** explains that an ES is often difficult to navigate and tease out the various pressures that will impact commercial fishing, e.g. noise, vibration, sedimentation transportation etc. **FN** highlights that all of the potential impacts to the fish and shellfish resources will be assessed within the Fish and Shellfish Ecology Chapter, and these results will inform the commercial fisheries assessment. **HR** recommends that **ST** read the PEIR and request any specific shape files or data that would be of assistance.

ST enquires whether the EIA will consider nursery and spawning grounds. FN confirms that this will be considered in detail within the Fish and Shellfish Ecology Chapter and any subsequent effects to important commercial stocks will be assessed within the Commercial Fisheries Chapter.

Operation and maintenance servicing: **JG** enquires about vessel or helicopter servicing. HR confirms that the concept of Service and Operation Vessels that remain permanently on site, together with helicopter support and fixed accommodation platforms are being considered.

Commercial fisheries stakeholders: **JG** and **ST** note that Brancaster Fishermen's Association (Thomas Large) should be added. **HR** enquires whether a potential candidate could be recommended to act as an Onshore Fishing Industry Representative. **JR** and **ST** agree that there is no one person that would be good to act as a single industry contact and recommend that consultation is undertaken with each fishermen's' association/society.

Information sources: **ST** recommends that we review the EIFCA 2013 research report, which examines the fishing industry by area and size/type of vessels. **FN** enquires about vessel information by port. **ST** agrees to provide data on active vessels per port/beach including numbers of vessels and length.

Recreational angling: **FN** states that recreational angling is included within the Infrastructure and Other Users Chapter and enquires about data sources. **ST** and **JG** confirm that the 2013 Defra report includes the EIFCA data available, so will be the best data source. **JG** explains that there are a handful of charter boats using hook and line that operate from Lowestoft, Wells, Great Yarmouth, Brancaster and Morston. EU management measures for bass are noted with recreational no take policy from Jan-Jun and a bag limit of one bass per person from July onwards. The EIFCA consult with recreational angling associations as recreational take may impact of important fish stocks.

Data: **ST** and **JG** note that MMO statistics presented seem low for the area, and perhaps up to one order of magnitude out. **JR** notes the recent EIFCA Business Plan sites a value in the region of £1.5 million for the potting fleet. **JR** and **ST** confirm that there are no cockles within 34F1 and 35F1. The record of cockles within the data is most likely due to human error of entering 34F1 instead of 34F0, which is much more likely. It is noted that any landings of finfish will not be captured within data, as this will be <25-30 kg and so is exempt from Registration of Buyers and Sellers (RBS).

Further engagement

The PEIR will be published in Summer 2017, the EIFCA will be alerted to this and invited to provide comments. Further EIA related consultation will continue post PEIR.

Actions

1. Hywel Roberts to enquire with Natural England on coverage of survey data for the Cromer Shore Chalk Beds MCZ.
2. Stephen Thompson to explore whether amalgamated datasets can be provided for whelk, crab and lobster based on the EIFCA MSARs database.
3. Fiona Nimmo to include detail within the ES on the number of flights per ICES rectangle to provide further context to the over flight surveillance data.
4. Stephen Thompson to explore if shapefiles of the inshore fishing activity maps can be provided to FN.
5. Stephen Thompson to explore whether the E-IFCA patrol sightings data can be shared with DONG Energy in order to inform the Hornsea Three EIA baseline characterisation.
6. Stephen Thompson to explore if data on active vessels per port/beach including numbers of vessels and length can be provided.

Subject	Hornsea Project Three Pre-Application Consultation with Kevin Jonas
Date - hours	22 February 2017
Venue	**Jonas Seafood, Cromer**
Attendees	**In person** Hywel Roberts (HR) Fiona Nimmo (FN) Kevin Jonas (KJ)
Supporting Material	Presentation

Introduction

All participants introduced themselves and their current relevant role.

Hornsea Project Three overview

HR provided overview of DONG Energy and the Hornsea Three project. Included presentation of cost reduction targets and progress in technology developments.

HR presented the schedule and timetable for submission of an application for a Development Consent Order (DCO) including the timetable for consultation. Key documents include:

Preliminary Environment Information Report (PEIR) which is effectively a draft Environmental Statement. The PEIR will be submitted and available on the UK Planning Inspectorate (PINS) website in summer 2017. There is a 28-day formal consultation period on this document and stakeholders can submit representations and comments.

Final ES will be submitted in Q2 2018 followed by a second formal consultation period. The PINS examination panel will then assess the development.

If consent is successful, marine construction will commence no earlier than 2023.

Project Description

HR outlined the key project components, including use of HVAC vs. HVDC transmissions systems, turbine sizes, potential use of accommodation platforms and potential size of substations. An HVAC transmissions system will require boosters along the cable route. Turbine foundations being considered include: pile, jacket/suction, and gravity based, as well as floating turbines. Floating turbines are a relatively new technology (at the demonstration-phase in the UK) which may potentially be a technically and economically viable option for consideration when future fabrication contracts are tendered. Floating turbine designs include up to 12 mooring lines per turbine, each with up to 1km radius. The choice of turbine foundations will be decided post consent.

Platforms will need to be constructed within the array area (and approximately half way along the export cable route if an HVAC transmission system is selected). The potential for subsea HVAC booster stations was also presented.

HR outlined the parameters for the export cable route: 140 km from shore, 1.5 km corridor with up to 6 cables/trenches, 10 m width of disturbance per cable/trench, and each export cable is 173 km in length.

Baseline Data

FN provided a summary of the key datasets either already collected or requested by Poseidon including landings data, VMS, aerial surveillance data, inshore fishing mapping, inshore VMS, EU Data collection framework data, The Crown Estate (TCE) beam trawl density tracks and specific country datasets. Maps of fishing areas from VMS data, aerial surveillance and inshore fishing activity maps were presented alongside key landings statistics.

FN also provided a summary of the key stakeholders, including management and scientific, UK Fishermen's organisations, North Norfolk Fishing groups and EU and Norwegian Fishermen's organisations.

FN summarised the baseline findings so far by showing a map which identified the cable route as being dominated by crab, lobster and whelks landed by potters and the array being dominated by plaice and sole landed by beam trawlers.

FN provided an overview of the potential impacts being considered within the assessment for construction, operation and maintenance and decommissioning, including change to access to fishing grounds, displacement of fishing vessels and gear, displacement of fishing resources (i.e. target species), increased vessel traffic, longer steaming distances and snagging. It was agreed that appropriate impacts were being assessed, and that the proposed methodology for assessing these impacts was fit-for-purpose.

Discussion

Stakeholders: **KJ** notes that Brancaster Staithe Fishermen's Association should be added to North Norfolk stakeholders. Thomas Large is the chair and the Loose brothers are members. They target crabs in the summer and whelks and mussels in the winter. It is noted that whelk is targeted north of Great Yarmouth, so south of the export cable route (and 28 nm from Wells).

Jonas Seafood: approximately 25-30 vessels sell their catch to Jonas Seafood; all from local landing points, from Brancaster to Gorleston.

Prices: typical prices are as follows: crab £1.20 per kg; lobster £9 (in summer) up to £19 (in winter) per kg, current price is £17 per kg; whelk £1 per kg live weight.

Weights: **KJ** comments that landing weights presented appear low, with the top performing vessel based from Wells landing approximately 65 tonnes crab per year, the next vessel down would land 40-50 tonnes crab per year. In total, approximately 200 tonnes of crab and lobster are taken by Jonas Seafood in one year. For whelk, one vessel could land up to 50 tonnes per year.

Markets: **KJ** describes markets for key species – whelk is washed and frozen raw in shell and shipped to Vietnam where it is finely sliced as a sushi topping in Japan; crab are cooked and sold to UK markets (Morrison's and Iceland), with some exported to France; lobster are exported to Spain.

Velvet crab: velvets appeared in in 2006-2007, but since 2008-2009 they have all moved south and are not routinely caught.

Landing points: **KJ** confirms landings points as follows: Great Yarmouth, Sheringham, Cromer (including East and West Runton), Wells, Bacton, Lowestoft, Brancaster, Winterton, and Sea Palling.

Concerns: **KJ** notes the effects of compensation related to other wind farms in the area. Fishermen that have been paid compensation may invest in gear, which they deploy to 'hold' ground, but may not routinely fish as they've been paid compensation. So effort increases across the ground, ghost fishing may occur, but supply to processors has reduced.