ENERGINET

MARINE ENVIRONMENTAL STUDIES – NORTH SEA I

TECHNICAL REPORT – COMMERCIAL FISHERIES

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CONTENTS

Abbreviation	Explanation
A1, A2 and A3	Subareas in NSI.1 offshore wind farm
bn	Billion
CPUE	Catch Per Unit Effort
DEA	The Danish Energy Agency
DFA	The Danish Fisheries Agency
DFPO	Danish Fishermen Producers Organization. Fisheries organization
DPPO	Danish Pelagic Producers Organization. Fisheries organization
EC	Export Cable
ECC	Export cable corridor
ECC1, ECC2 and ECC3	Export cables for A1, A2 and A3, respectively
EIA	Environmental Impact Assessment
EPA	The Danish Environmental Protection Agency (Miljøstyrelsen, MST)
FOU	Foundation (used to install wind turbine on)
FSKPO	Low Impact Coastal Fishing Producers Organization (Foreningen for Skånsomt Kystfiskeri). Fisheries organization
ICES	International Council for Exploration of the Sea
Landfall	A location where the cable transfers from sea to land
LARS	Launch and Recovery Systems
MES	Marine Environmental Studies
mil	Million
NSI	North Sea I. The name of the offshore wind farm area (OWF). NSI is divided into NSI.1 and NSI.2. The present report is based on NSI.1, including all three subareas (A1, A2 and A3), the areas between the three subareas and all three export cable corridors (ECC1, ECC2, ECC3).
OWF	Offshore Wind Farm area
Subareas	The offshore wind farm area is subdivided into three subareas A1, A2 and A3
WP	Work Package

1 SUMMARY

INTRODUCTION

To accelerate the expansion of Danish offshore wind production, it was decided, with the agreement on the Finance Act for 2022, to offer an additional 2 GW of offshore wind capacity for establishment before the end of 2030. In addition, the parties behind the Climate Agreement on Green Power and Heat 2022 of 25 June 2022 (hereinafter Climate Agreement 2022) decided that areas capable of accommodating an additional 4 GW of offshore wind capacity must be offered for establishment before the end of 2030. Most recently, a political agreement was reached on 30 May 2023, establishing the framework for the Climate Agreement 2022. This framework aims to develop 9 GW of offshore wind capacity, which could potentially be increased to 14 GW or more. The concession winners – those who will set up the offshore wind turbines – have the freedom to exceed the tendered minimum capacity of 1 GW per tendered area.

To enable the realization of the political agreements on significantly more energy production from offshore wind before the end of 2030, the Danish Energy Agency has drawn up a plan for the establishment of offshore wind farms in three areas: the North Sea, the Kattegat, and the Baltic Sea.

The North Sea I area has a total area of 1.400 km^2 which is divided into three sub-areas (A1, A2 and A3) planned for offshore wind farms. The North Sea I area is located 20-80 km off the coast of West Jutland and from each of the three sub-areas there will be corridors for export cables (ECC1, ECC2, ECC3) connecting the offshore wind farms to the onshore grid.

METHODOLOGY

This technical report focuses on the commercial fisheries in the pre-investigation area, North Sea I.1 ECC and OWF (hereafter called NSI.1), planned for implementation of offshore wind farms. By integrating both quantitative and qualitative approaches, the methodology aims to provide a comprehensive analysis of commercial fisheries data and thereby describe the extent of commercial fisheries activities. Analyses of the German, British, Dutch, and Polish fisheries in the area are also included.

The analysis utilises vessel monitoring system (VMS) and logbook data from the following ICES rectangles: 41F7, 41F8, 40F7, and 40F8 (see Figure 2-1).The data encompassing parameters as vessel type, vessel size, and type of utilized fishing gear, which aid to comprehend the distribution and trends in fishing vessel demographics over the past decade. Catch data, including species composition, catch volumes, and estimated values, are examined to assess the importance of different species and gear types in the study area. To identify areas of high fishing intensity within the NSI.1 area, an exercise of mapping the fishing effort using VMS data is conducted. Qualitative interviews with local fishers are included, as these provide valuable socio-economic insights into their perceptions, preferences, and concerns regarding the offshore wind development, and its potential impact on their fishery activities.

DANISH FISHERIES

Commercial fisheries play a significant role in Denmark's maritime economy, with total landings amounting to 3.2 billion DKK in 2023. Over the past decade, changes in fisheries regulations and market dynamics have led to a general decrease in the number of fishing vessels. However, despite this decrease, the total Danish landings have remained substantial, with the North Sea continuing to be the primary fishing area (55 %), attributing to 1,760 mil DKK in total landings for 2023. The total quantities landed from the four ICES squares (40F7, 40F8, 41F7, and 41F8) contributed approximately 2,672 tons to Danish fisheries landings in 2023, showing a decline from 11,321 tons in 2014. Despite the overall decline in the weight of total catches landed, the value of catches from the NSI.1 remained high. It only

decreased by about 3%, from 54.8 mil DKK in 2014 to 39.5 mil DKK in 2023. This highlights the economic importance of the NSI.1 to the Danish fishing industry, contributing around 1.23 % to the overall values of Danish fisheries in 2023, which totaled to 3.2 billion DKK.

In the North Sea, the Danish commercial fisheries consist primarily of two types: industrial fisheries and fisheries for human consumption. Industrial fish landings, including species like sandeel (*Ammodytes tobianus*) and sprat (*Sprattus sprattus*), are processed into fishmeal and -oil, while catches of flatfish species such as European plaice (*Pleuronectes platessa*), Atlantic cod (*Gadus morhua*), and haddock (*Melanogrammus aeglefinus*) are used for human consumption.

Herring *(Clupea harengus)* and mackerel *(Scomber scombrus)* are the economically most important species in Danish fisheries in general, with a turnover of 520 mil DKK and 235 mil DKK in 2023, respectively. Other sought-after species include Norway lobster (*Nephrops norvegicus*), deep water shrimp (*Pandalus borealis*), Atlantic cod (*Gadus morhua*), and industrial species like sprat (*Sprattus sprattus*) and sandeel (*Ammodytes tobianus*), all of which contribute significantly to both the total quantities landed, and the total catch value.

In the NSI.1 area, trawl fisheries, including bottom, pelagic, and beam trawl, contribute significantly to the total catch value. This reflects its importance to Danish fisheries in the North Sea. Gillnet fisheries, while representing a smaller proportion of the total catch weight, still constitute an important economic significance.

Interviews with fishers reveals the significance of the shallow sandy banks of NSI.1 for the plaice fishery, especially for vessels of approximately 20 m or less. Fishing grounds in the eastern North Sea are gradually shrinking or becoming more scattered, due to offshore wind farms and cable corridors, concentrating the fisheries in smaller areas and forcing the commercial fish species westward. Limited engine power restricts vessels from reaching other suitable fishing grounds further west. The cable corridors in NSI.1 are essential for brown shrimp fisheries, while the area is expected to become increasingly important for the sprat and sandeel fisheries due to Brexit and the British fisheries ban on Dogger Bank, where the Danish fishers previously caught a significant proportion of sandeel.

FOREIGN FISHERIES

The four nations with the highest fishing intensity in and near NSI.1 were chosen for further analysis: Germany, Great Britain, The Netherlands, and Poland. The fishing intensity data (VMS data for 2014-2023) shows that the four countries utilise most of the NSI.1 for fishing. The German, British and Dutch fisheries predominately occur in the A2 and A3 subareas, while Polish fishers primarily use the A1 subarea. Only few of the catches of the German and Polish fisheries are landed in Danish ports, so their actual fishing intensity does not quite reflect the landings. However, the British fisheries have landed approximately 154 tons of fish and invertebrates earning 4 mil DKK from the four ICES rectangles from 2019-2023. The Dutch fisheries landed app. 912 tons with the value of nearly 10.5 mil DKK in the same area in the five-year period.

CONCLUSION

To summarize, this report describes the baseline situation for the commercial fisheries in the North Sea in and near the NSI.1 area. Danish and foreign commercial fishers have caught especially herring, mackerel and Norway lobster in the four ICES rectangles closest to the NSI.1. According to the fishers themselves, the NSI.1 OWF is also a valuable flatfish area due to the flat sandy banks here.

However, there is some degree of mismatch in the data originating from the commercial fisheries in the VMS (vessel location) and logbook data (catch amount and value), making it difficult to precisely estimate the value of area for the fisheries. Little can be done to rectify this as the data is only as precise as the data inserted in the system. In addition, regarding the foreign fisheries, there is only access to the amount and value of catches landed in Danish ports. Therefore, it is advised that data for the foreign fisheries is collected from local authorities when further analysis of the fisheries is carried out by the concessionaries.

2 INTRODUCTION

To accelerate the expansion of Danish offshore wind production, it was decided, with the agreement on the Finance Act for 2022, to offer an additional 2 GW of offshore wind capacity for establishment before the end of 2030. In addition, the parties behind the Climate Agreement on Green Power and Heat 2022 of 25 June 2022 (hereinafter Climate Agreement 2022) decided that areas capable of accommodating an additional 4 GW of offshore wind capacity must be offered for establishment before the end of 2030. Most recently, a political agreement was reached on 30 May 2023, establishing the framework for the Climate Agreement 2022. This framework aims to develop 9 GW of offshore wind capacity, which could potentially be increased to 14 GW or more. The concession winners – those who will set up the offshore wind turbines – have the freedom to exceed the tendered minimum capacity of 1 GW per tendered area.

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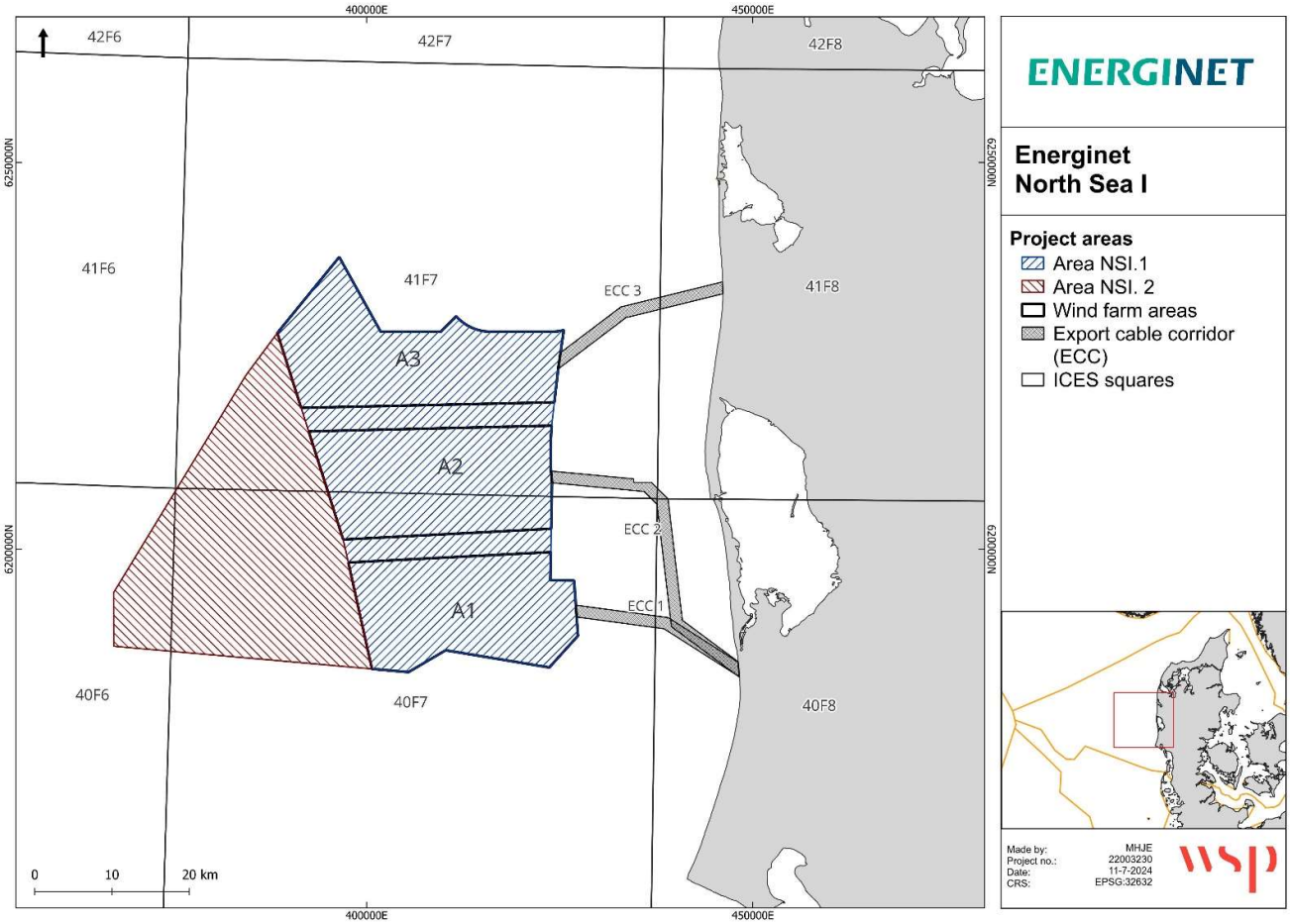

Figure 2-1. The NSI.1 illustrating the wind farm subareas A1, A2 and A3 and the export cable corridors ECC1, ECC2 and ECC3. The NSI.2 is not included in the present report. The NSI.1 is located within the fishery's statistical areas (hereafter called ICES rectangles) 41A7, 41F8, 40F7 and 40F8.

3 METHODOLOGY

The existing fisheries pattern of the commercial fisheries in and around NSI.1 is described using detailed official fisheries statistics. The data is obtained from the Danish Fisheries Agency, along with interviews with Danish fisheries organisations and fishers who actively fish in the NSI.1, and its adjacent regions. The following section outlines the methods used for data acquisition and analysis.

3.1 VMS DATA

Danish and European fishing vessels, exceeding 24 meters in length, has since 2002 been required to register their positions, using an electronic satellite system known as the Vessel Monitoring System (VMS) (EU, 2009). By 2005, this requirement was extended to vessels measuring 15 meters or more, and by 2012, it became compulsory for vessels of 12 meters or greater to utilise the VMS. The VMS data contains details regarding the identity, position, direction, and speed of fishing vessels.

Commercial fish catches are categorised into statistical rectangles according to ICES (International Council for the Exploration of the Sea) guidelines (ICES, 1977). The VMS enables the tracking of the position and speed of each fishing vessel within the relevant ICES rectangle at any given time. By examining the logged sailing speeds of fishing vessels during active fishing operations (Table 3-1), it is possible to distinguish whether a vessel is actively fishing or simply transiting to and from fishing grounds (ICES, 2019; Eigaard, et al., 2016). Furthermore, the VMS data from the current study have been sorted by gear types, facilitating an analysis that offers insights into the importance of different areas for various gear types.

Table 3-1. The estimated speed of fishing vessels when actively fishing.

Fishing type	Speed in knots
Trawlers, bottom and pelagic	0-5 knots
Beam trawlers	0-5 knots
Gillnetters	0-4 knots
Seiners	0-3 knots
Other gear	0-4 knots

By utilising VMS data, it is possible to depict the frequency of fishing activity for each gear type within the gross area of NSI.1 and assess the area's significance for the fishing fleet. However, it's important to note that VMS data is biased, as it only includes larger fishing vessels (>12m). To address this, the analysis also incorporates logbook data, which encompasses catches from all vessels irrespective of size. Moreover, the bias is mitigated through the utilisation of a large dataset and a statistical average perspective.

The VMS data retrieved from the Danish Fisheries Agency covers a ten-year period from 2014-2023 (The Danish Fisheries Agency, 2024). However, VMS data for foreign fisheries only covers a five-year period from 2019-2023. The Danish Fisheries Agency does not have a direct access to the VMS data from other Member nations, and receives it retrospectively from the European Commission, once the VMS data has been compiled.

ICES Statistical areas are used as bounding areas for calculation of fish statistics, e.g. catch per unit effort (CPUE) and stock estimates. NSI.1 is located within the ICES statistical area known as the "Central North Sea" (ICES subarea IVb) (ICES, 1977), which is further subdivided into ICES statistical rectangles 40F7, 40F8, 41F7 and 41F8. Each ICES rectangle covers approximately 30 x 30 nautical miles (Figure 3-1).

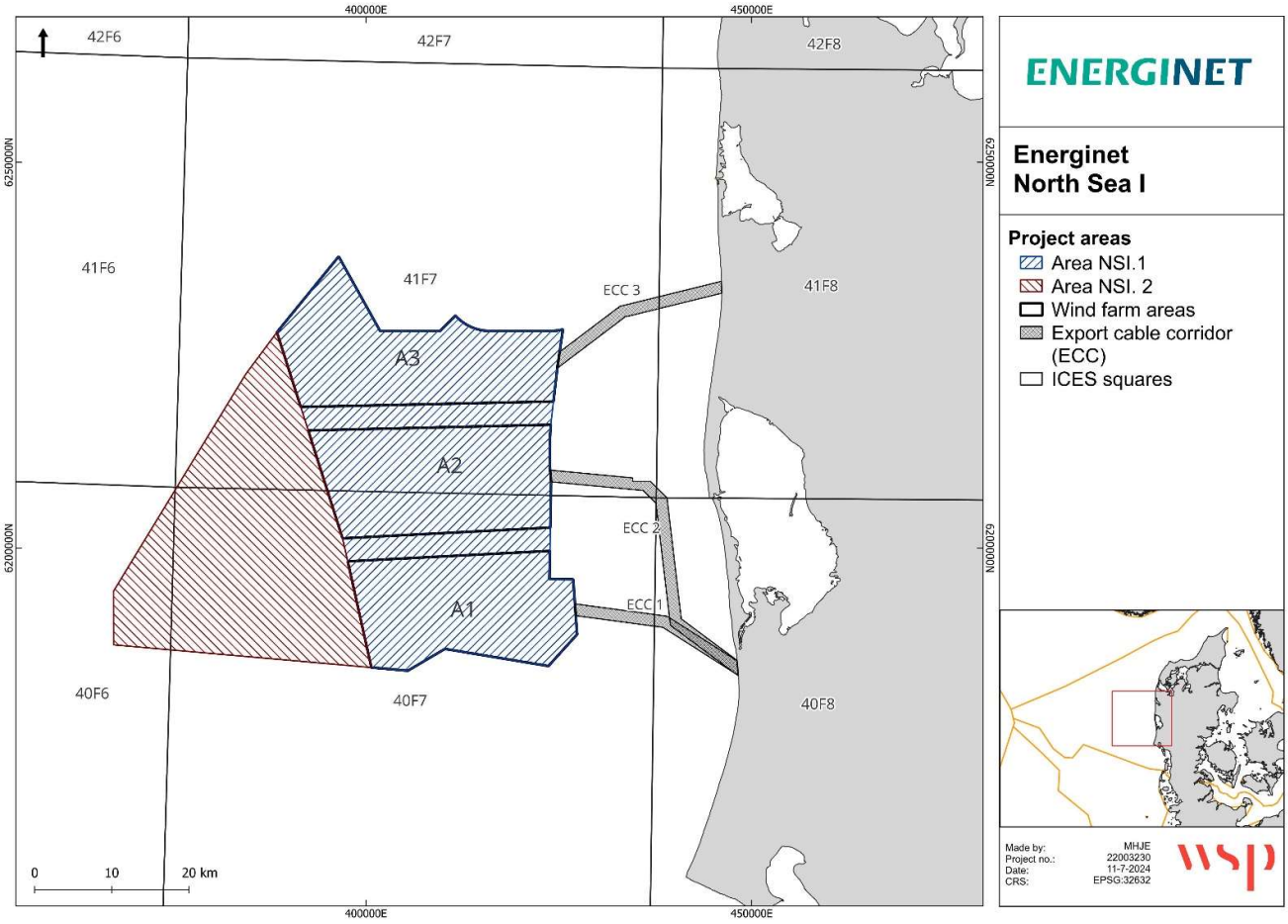

Figure 3-1. NSI.1 within ICES rectangles 40F7, 40F8, 41F7 and 41F8.

The combined sea area of the four ICES areas 40F1, 40F2, 41F7 and 41F8 is 8068 km^2, excluding land areas in western Jutland, where fishing is not possible (Table 3-2). The sea area also includes Ringkøbing Fjord for 40F8 and 41F8. Therefore, catch data for these waters are included in overall catch and landing analysis, as it is impossible to segregate it otherwise based on ICES rectangles alone. However, in the economic analysis (in section 4.4), only catch data that is comparable with the VMS-data is shown, so any catch data for Ringkøbing Fjord are not included here, as it is not relevant from the project's perspective.

Table 3-2. Sea area of each ICES rectangle and the area of NSI.1 and ECC in each ICES rectangle.

ICES rectangles	Sea area	NSI.1 OWF			NSI.1 ECC			Percentage NSI.1
		A1	A2	A3	To A1	To A2	To A3	
40F7	3495.6 km^2	366 km^2	145 km^2		15.5 km^2	0.3 km^2		15 %
40F8	737 km^2				18.8 km^2	39.2 km^2		8 %
41F7	3435 km^2	0 km^2	256 km^2	400 km^2		20.4 km^2	23 km^2	20 %
41F8	400 km^2					0.94 km^2	12.5 km^2	3 %

3.2 LOGBOOK DATA

All Danish commercial fishing vessels are required to maintain a logbook of their catches (BEK 793, 2022). Logging catches can be done either through an electronic logbook, or by submitting a statement of fishing area for small vessels that consistently operate in the same waters. The logbook contains details such as date, time, and location of the fishing operation, as well as information on catches, including fish species, body mass, and estimated economic value. The estimated value is determined based on the average landing value. Therefore, the logbook serves as a crucial source of information in regard to fish species present in specific areas of Danish waters and furthermore indicates the economic significance of these areas for commercial fisheries.

Logbook data was retrieved from the Danish Fisheries Agency for Danish and foreign fisheries for a 10-year period from 2014-2023 (The Danish Fisheries Agency, 2024). However, due to limitations in the VMS data reporting frequency for the foreign fisheries, only logbook data from 2019 to 2023 is listed and analysed in the present technical report. Logbook data for foreign fisheries is limited to include catches landed in Danish harbours. As market prices for good quality fish and invertebrates for human consumption are relatively high on the Danish market, it is highly likely that the majority of the catches from foreign vessels operation in NSI.1, are landed in Denmark. For industrial fisheries, it is less likely that the catch has been landed in Danish harbours. For parts of the German fisheries, the catch is probably brought back to Germany, as there are several larger German harbours just south of the Danish border.

3.3 DATA ANALYSIS

The economic analysis of the commercial fisheries in NSI.1 is based on the following two datasets provided by the Danish Fisheries Agency:

1. VMS data with information on the position of each fishing vessel along with speed, direction, and type of fishing gear.
2. Logbook data with information on catch and estimated value per day per species for each fishing vessel.

Both Danish datasets hold information from 10 years of fishing (2014-2023) while the foreign dataset holds information from 5 years of fishing (2019-2023).

Based on VMS data, it was estimated how many VMS location signals each fishing vessel had per day. Only VMS signals where the vessels were actively fishing (with a sailing speed of 0-5 knots (ICES, 2019)) were included in this analysis. Thus, all VMS signals where the vessels were merely sailing to and from the fishing grounds were excluded from further analysis. VMS signals indicating active fishing was selected based on the following rules:

```
*No sailing speed above 5 knots were included

select if (Speedknot < 5).
execute.

Select if
((red = 'Pelagic trawl' and Speedknot < 5)
or (red = 'Bottomtrawl' and Speedknot < 5)
or (red = 'Beamtrawl' and Speedknot < 5)
or (red = 'Gillnet' and Speedknot < 4)
or (red = 'Other gear' and Speedknot < 4)
or (red = 'Seine' and Speedknot < 3)).
The number of VMS signals were counted pr. day pr. vessel.
```

The VMS and logbook data sets were combined based on the key information provided in both data sets: Catch date, Vessel ID (anonymized), and ICES rectangle. The catch amount and estimated value was calculated pr. species pr. fishing point. The amount and estimated value were then traced back to the selected VMS information, now with a specific position.

The result is a geographical dataset linking VMS positions with catch amounts and estimated value for each point. Fishing points occurring inside and outside the three subareas of NSI.1 and the cable corridors were compared to assess the relative importance of NSI.1. The described datasets are the foundation for all tables and figures presented in section 4.4(Estimated value of the Danish fisheries in the NSi.1), 5.2.4 (Estimated value of the German fisheries), 5.3.4 (Estimated value of the British fisheries), 5.4.4 (Estimated value of the Dutch fisheries) and 5.5.4 (Estimated value of the Polish fisheries).

3.4 DATA QUALITY

The quality of the fisheries data always depends on the quality of the information logged in the logbook system. Therefore, the source of error may be relatively high in some cases. It can have a substantial impact on the dataset, if the gear type or landing site is registered incorrectly by the fishing vessel. Additionally, the data set for foreign fisheries may also be biased, depending on whether the fishing vessels have landed the catch in Danish harbours (in which case the data is included here) or if they have brought the landings to their home ports (data not included here). These factors all impact the data quality, and the results presented in the present report.

A supplementary dataset for VMS and logbooks may be obtained from the relevant fisheries nation. The data listed in this report (see chapter 5), both list the catch amount and value logged for the respective ICES rectangles by foreign fishing vessels. Chapter 5 also contains an economic analysis of the landings from foreign fishing vessels inside NSI.1 This is deemed adequate for indicating the level of landings from each of the foreign nations and for indicating where future concessionaries should look to find additional data.

3.5 INTERVIEWS WITH FISHERS

The fishing fleet possesses great insight and knowledge of the distribution of commercial fish species in the area. This expertise is often passed on verbally through generations of fishers and is rarely written down. Therefore, this information is included in the present analysis by interviewing the fishers, who are actively fishing in the project area and the adjacent areas.

The three main fisheries organisations in Denmark; Danish Fishermen Producers Organization (DFPO), the Danish Pelagic Producers Organisation (DPPO), and the Association for Low Impact Coastal Fishing Producers Organization (FSKPO), facilitated contact to fishers who actively fish in and near the NSI.1 area and who have home ports in Hvide Sande, Thyborøn or Hanstholm. Interviews were conducted with a pelagic fisher, as well as the DPPO in general. The DPPO represents only pelagic trawlers, all of which have vessels of more than 40 meters. Additionally, two fishers fishing with beam trawl and bottom trawl were interviewed. A list of interviewed persons is given in Appendix 2 – Interviewed fishes.

The fishers were asked to describe the status and patterns of the fisheries today, as well as the development over time. They outlined their main gear type and focus species, noting that most fishers also engage in secondary fisheries for supplementary species, in order to prolong the fishing season. The fishers were asked to indicate their fishing locations within ICES rectangles 40F7, 40F8, 41F7 and 41F8 (Figure 3-2), as well as to identify the most important fishing areas for them and where the positioning of the wind turbines would be least problematic to them. The information provided by the fishers was then compared to the 3 intensity maps for beam trawl, bottom trawl and net fishing (see Appendix 8.1 Fishing Intensity Danish Fisheries) which matched the overall description and information provided by the fishers in the interviews.

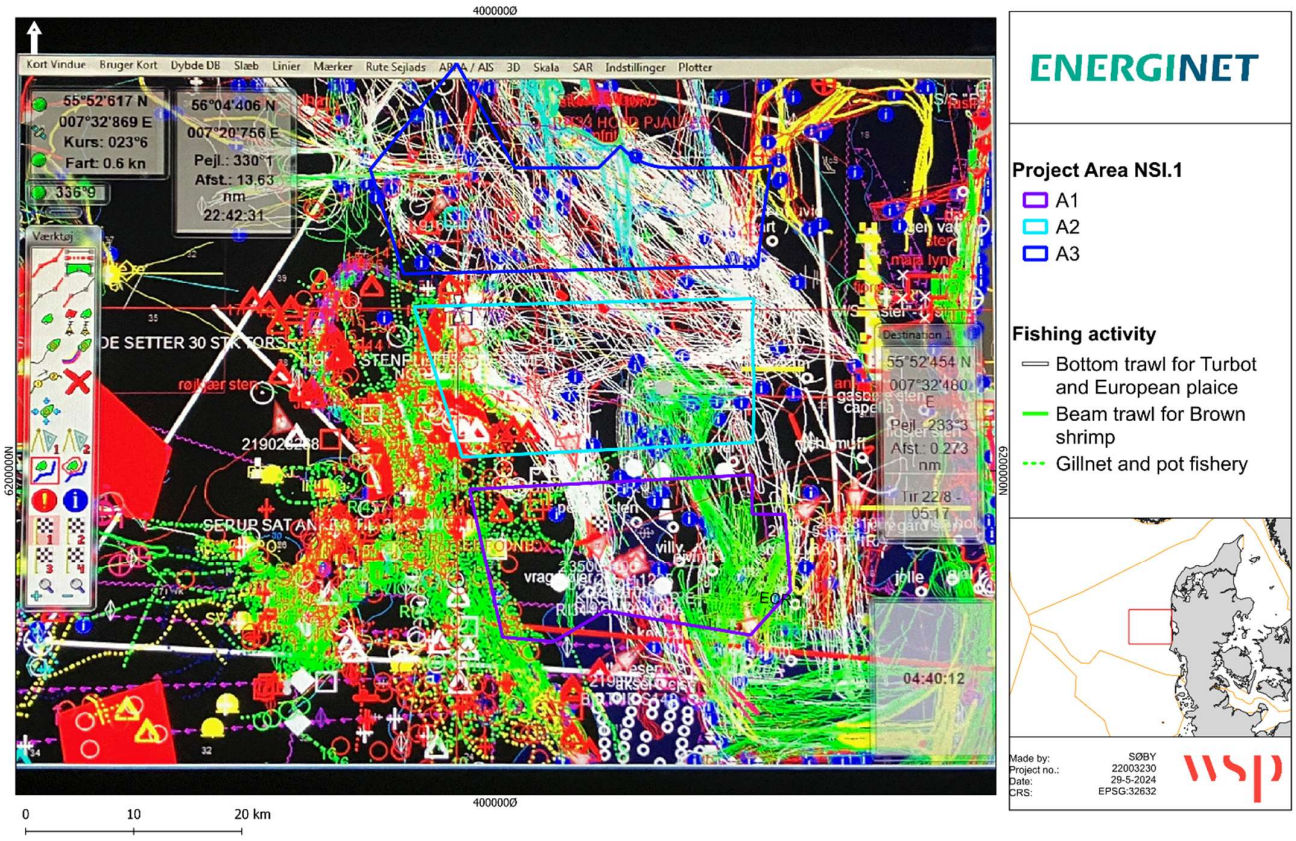

Figure 3-2. Screen dump from a fisher's chart plotter showing the fishing activity in and around NSI.1 obtained from the interviewed fishers. The map is based on approximately 3-5 years of fishing intensity. The three offshore windfarm subareas are visualized on the map with a purple, turquoise and blue line, respectively. The fishing intensity is divided into different gear types and illustrated using white lines for bottom trawl, green lines for beam trawl and green dots for gillnet fishing.

3.6 DESCRIPTION OF THE FISHING METHODS

Activities related to the construction, operation and decommissioning of offshore wind farms may influence the fisheries in the area. Maneuverability limitations of fishing fleets and possible impacts on the fish resource are expected to induce the largest impacts in the designated area. To obtain a more comprehensive understanding of the possible consequences of implementation of offshore constructions for the fish stocks and the commercial fisheries, a description of the three most important commercial fishing methods applied in the area of interest is provided below.

The Danish commercial fisheries in the North Sea consist of two primary types: the industrial fisheries and food fisheries. Industrial fisheries catch fish species such as sand eel (*Ammodytes tobianus*), sprat (*Sprattus sprattus*), and Norway pout (*Trisopterus esmarkii)*, which are processed into fishmeal and -oil, while food fisheries include species

like European plaice (*Pleuronectes platessa*), sole (*Solea solea*), and Atlantic cod (*Gadus morhua*) for human consumption.

3.6.1 BEAM TRAWL

Generally, trawling is one of the most common methods of fishing. The method includes one or more net bags being dragged through the water, either near or on the seabed (beam and bottom trawl respectively) or through the water column (pelagic), depending on the certain behaviour of the target species. The size of the trawl is adjusted to match to the engine power of the fishing vessel. Smaller engines can haul smaller trawls, while the same principle applies in reverse for larger engines.

Beam trawl fishing (Figure 3-3) includes two trawls being dragged from the beams attached to the foremast: one trawl on each side of the fishing vessel (Korsgaard et. al, 2006). While fishing, the beams are lowered to the almost horizonal position and pulled back up when the trawls are hauled in. Target species of beam trawling are benthic species, including species of flatfish and shrimps. All other trawl types, mentioned below, are very similar to the beam trawl: a steel bar is keeping the trawl bag open at all times (Korsgaard et. al, 2006).

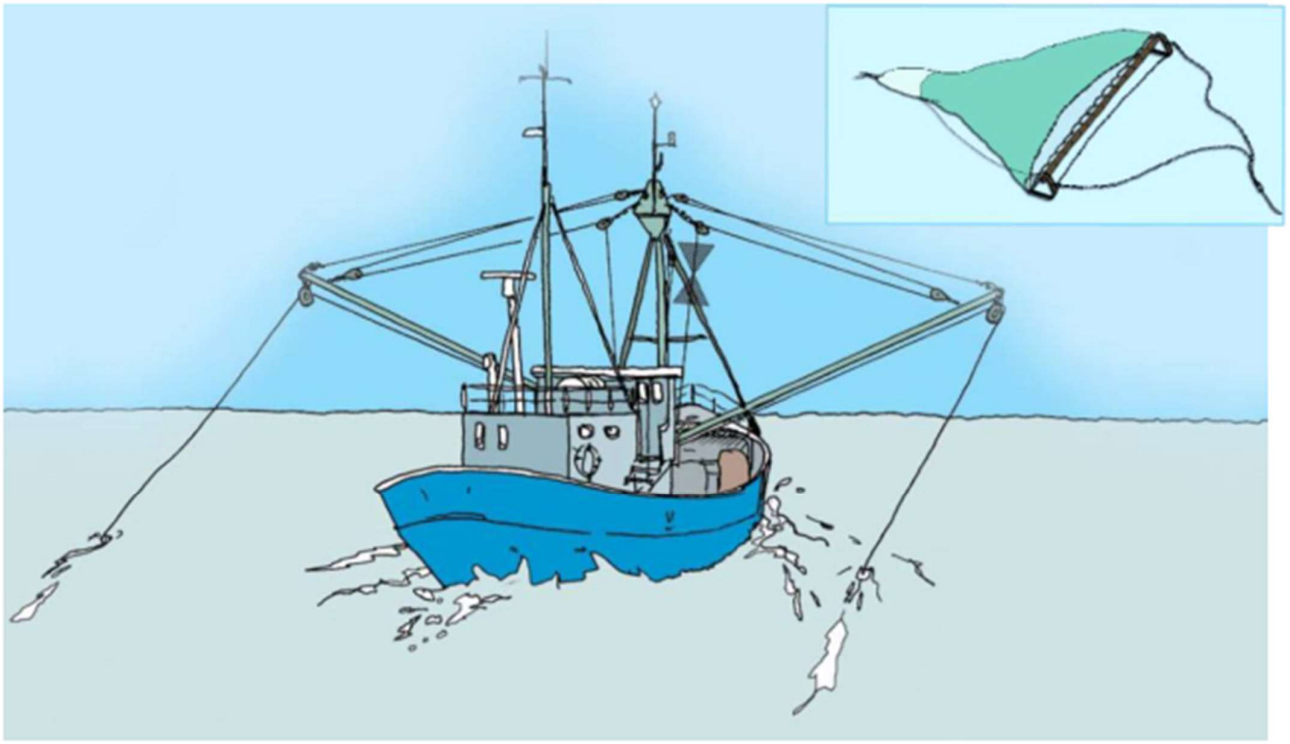

Figure 3-3. A beam trawler with trawls deployed. Top right corner: Illustration of the trawl kept open with a steel bar. Source: (Korsgaard et. al, 2006).

Trawling generally generates a high amount of bycatch of non-targeted species which consist of a wide range of species associated to the sea bottom, including crabs, shellfish, demersal fish, and other bottom dwelling species (Gislason, 2014). Due to the poor selectivity and the high impact on the seabed, the degree of environmental impact caused by beam trawling is high, while the sustainability is considered low. As the trawls are hauled hundreds of meters behind the vessel and for several kilometres, they have limited manoeuvrability and demands a lot of working space. Especially larger vessels with very long trawl systems requires large sandy areas devoid of obstacles such as rocks, reefs, and offshore constructions etc., to successfully execute the fisheries.

3.6.2 BOTTOM TRAWL AND PELAGIC TRAWL

Trawl designs have evolved greatly over the past 100 years, since the first introduction in Danmark in approx. 1907, (Korsgaard et. al, 2006). The trawl doors of the original design were designed to keep the trawl bag open with the outwards drag created by the doors, while the weight of the doors kept the trawl near the bottom.

The bottom trawl (Figure 3-4) is designed to catch species associated with the seabed, including cod, plaice, saithe, prawns, haddock, sand eel, and Norway lobster. The roof of the bottom trawl is longer than the underside, ensuring that the catch is unable to flee upwards and out, as it is caught by the roof of the trawl. Furthermore, the width of the bottom trawl is larger than the height. The largest bottom trawl can be 100 m wide and 30 m high.

The pelagic trawl is very similar to the bottom trawl, however, the doors lift the trawl up into the water column and thus off the bottom. This trawl type is designed to catch fish species associated with the water column, primarily schooling fish species such as sprat, mackerel, and herring. The pelagic trawl may cause bycatch of non-targeted species but is not associated with damage to the sea bottom habitat or the associated species.

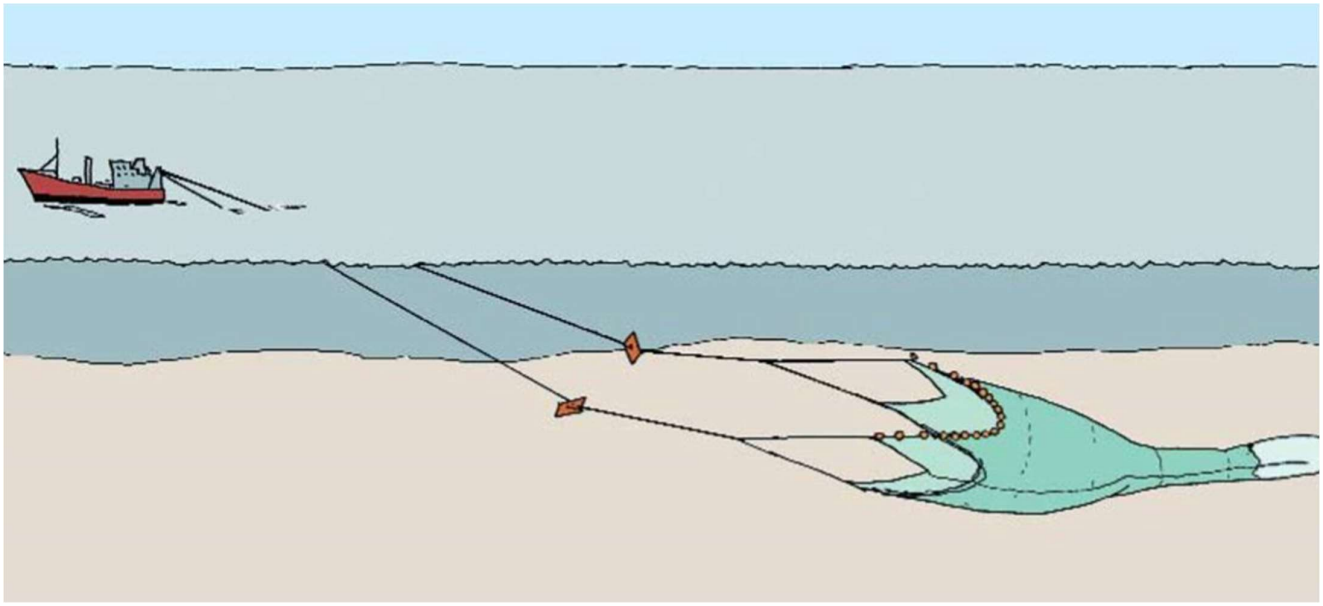

Figure 3-4. Schematic illustration of a fishing vessels hauling a single trawl. Source: (Korsgaard et. al, 2006)

Trawl fisheries (all types combined) are by far the most important fishing method in Denmark, and this is also the case in the North Sea, both in terms of value of the catch and the total weight of the catch (DFPO, 2019).

3.6.3 GILLNET

A gillnet is a net stretched out between floats that are attached to a rope at the top, and to a sink or lead line at the bottom, constituting a “wall” in the dermal -and semi-pelagic zone (Figure 3-5). Most gill nets are anchored to the seabed, but some types of net may float with the current, only being attached to a fishing vessel. A small mesh size is used to catch relativity small species, such as herring, whereas gillnets with larger mesh sizes are used to catch larger fish such as flatfish. Furthermore, the position of the gill net is important regarding the specific target species. Gillnets aimed to catch flatfish, and cod is positioned at or near the seabed, while floating nets near the surface catch pelagic species, such as mackerel and herring.

Gillnets are considered as a highly sustainable fishing method, due to the low environmental impact on the seabed and the low rate of bycatch. Furthermore, fish caught in gillnets are usually of a higher quality, due to the low amount of handling compared with fish caught by trawls, and because they are usually stored several hours at the trawler before being landed.

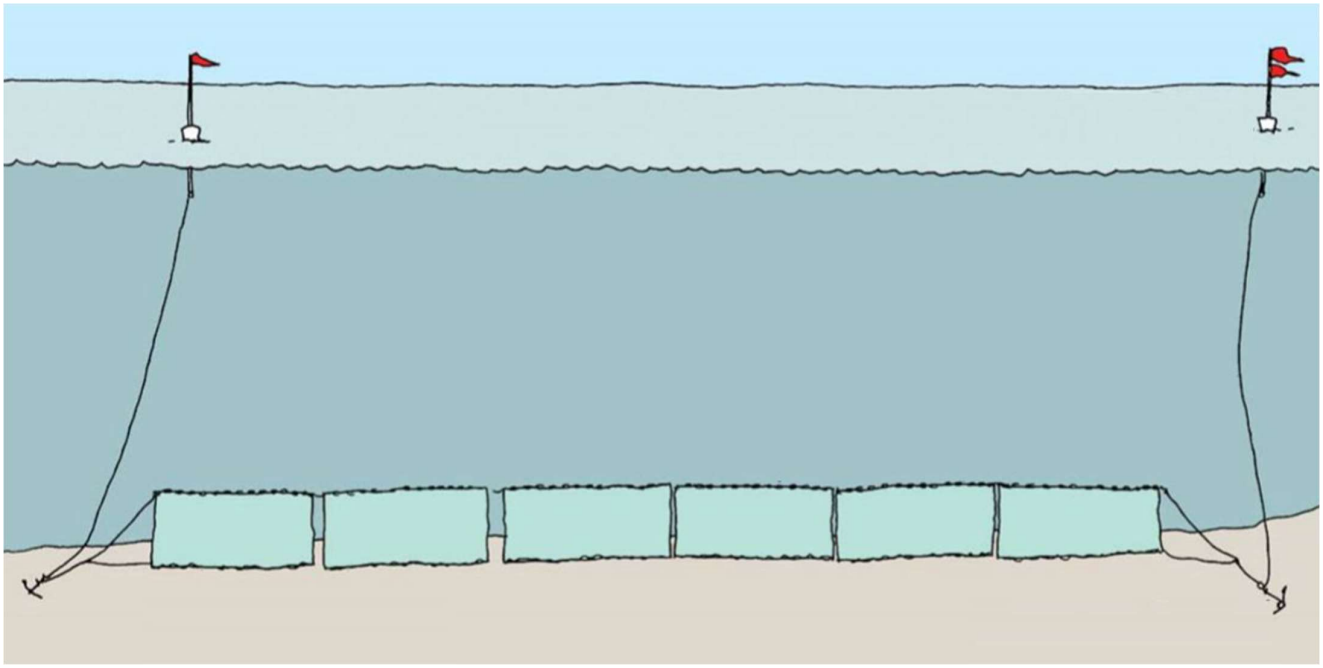

Figure 3-5. Schematic illustration of a gillnet Source (Korsgaard et. al, 2006).

3.6.4 SEINE

A seine consists of a mesh bag and two long rows of nets, each attached to long ropes (Figure 3-6). Seine fishing was originally a Danish invention (Korsgaard et. al, 2006), with the seine being sailed out in a circle from a small boat, and then pulled to shore from the beach. Today, a big anchor and buoys are used to mark the ends of the fishing gear, and while deploying the net and mesh bag, the boat sails in a large circle. When the boat completes the circle and returns to the anchor and buoy, both ropes are pulled towards the ship which “scare” the fish into the mesh bag. Seine fishing is ideal for catching fish for consumption, as the catch is high quality and consequently, the landing price is generally high. Target fish species in seine fisheries are mainly flatfish including plaice, as well as Atlantic cod and haddock.

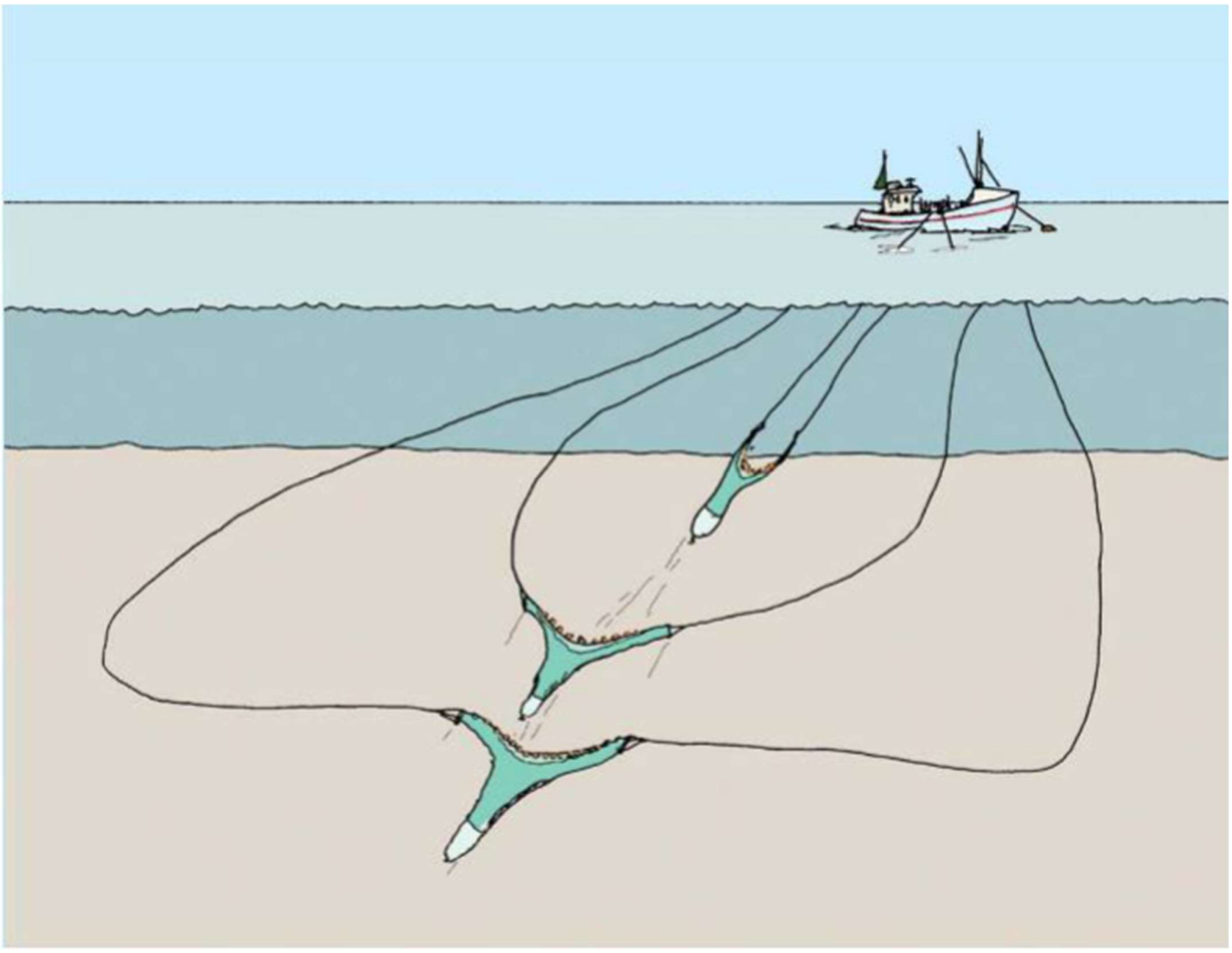

Figure 3-6. Schematic illustration of a seine fisheries. Source: (Korsgaard et. al, 2006).

3.7 COMMERCIALLY IMPORTANT SPECIES IN THE NORTH SEA

Activities related to the construction, operation and demolition of offshore turbines and connected cables will influence the fish stocks and thus the commercial fisheries in varying ways, depending on the behavior and nature of the various fish species inhabiting the area. To obtain a more comprehensive understanding of the possible consequences induced by implementation of offshore constructions for the fisheries, a description of the six fish species and three decapod species that are the most economically important species of the area of interest, is provided in the following sections.

3.7.1 EUROPEAN PLAICE (PLEURONECTES PLATESSA L.)

The European plaice is a flatfish from the family of Pleuronectidae. The plaice occurs on sandy or muddy bottoms and is found from a few meters to about 200 m depth. It inhabits open sea and estuaries, and rarely enters freshwaters. The fish mainly feeds on polychaetes and thin-shelled molluscs. As for most flatfish species in the North Sea, spawning occurs in the way illustrated in (Figure 3-7). The European plaice is commercially the most important flatfish in fisheries in Europe (Muus, 2006) and is especially caught by bottom trawls and gillnets.

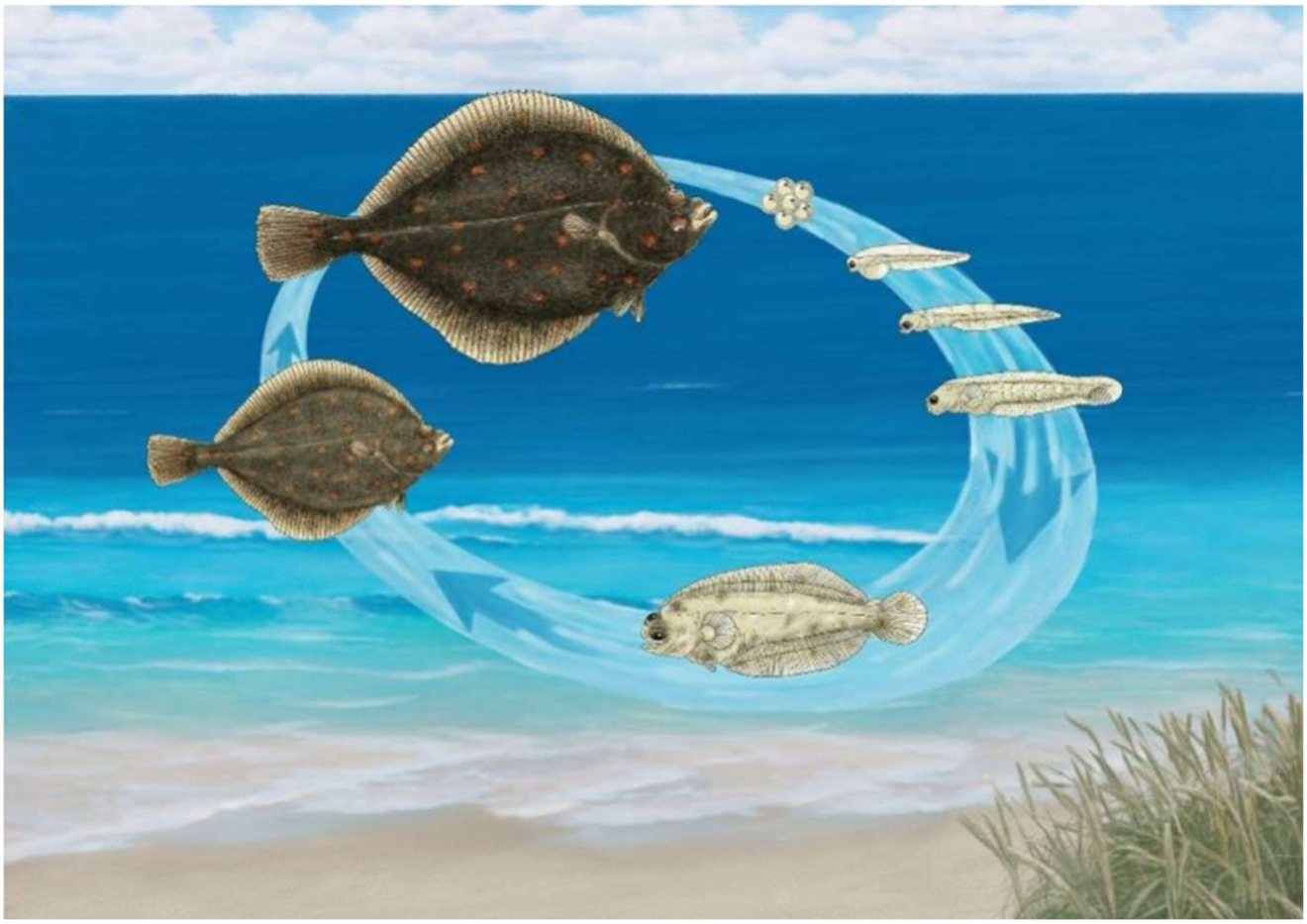

Figure 3-7. The life cycle of the European plaice and most other flatfish species. The eggs hatch in the pelagic zone and the juveniles subsequently settle in shallow sheltered areas where they grow up. During winter, the plaice gradually migrate into increasingly deeper waters, until they reach maturity and migrate to the spawning sites. Source: (Støttrup et al., 2019).

3.7.2 SAND EEL (AMMODYTES MARINUS R. AND AMMODYTES TOBIANUS L.)

Sand eels caught in the commercial fisheries comprise two separate species: the lesser sand-eel (*Ammodytes marinus*) and the small sand eel (*Ammodytes tobianus*). The two species are usually not differentiated in landings. Both species have long and slender bodies, that measure up to 20-25 cm. Both species are dominating in the North Sea area, between 10 and 150 m depth (Muus, 2006), however, the lesser sand eel is commonly found further offshore than the small sand eel. Both species of sand eel are caught using bottom trawls with small mesh sizes, and are important in the industrial fisheries, where they are processed into fish meal -and oil. Sand eel fishing grounds in the eastern part of the North Sea (Figure 3-8) are overlapping with the A1, A2 area and the area of the corridor between A1 and A2 as well as the ~~sailing~~ corridor between NSI.1 and NSI.2 just west of the NSI.1. (see Figure 2-1 where area NSI.2 is included).

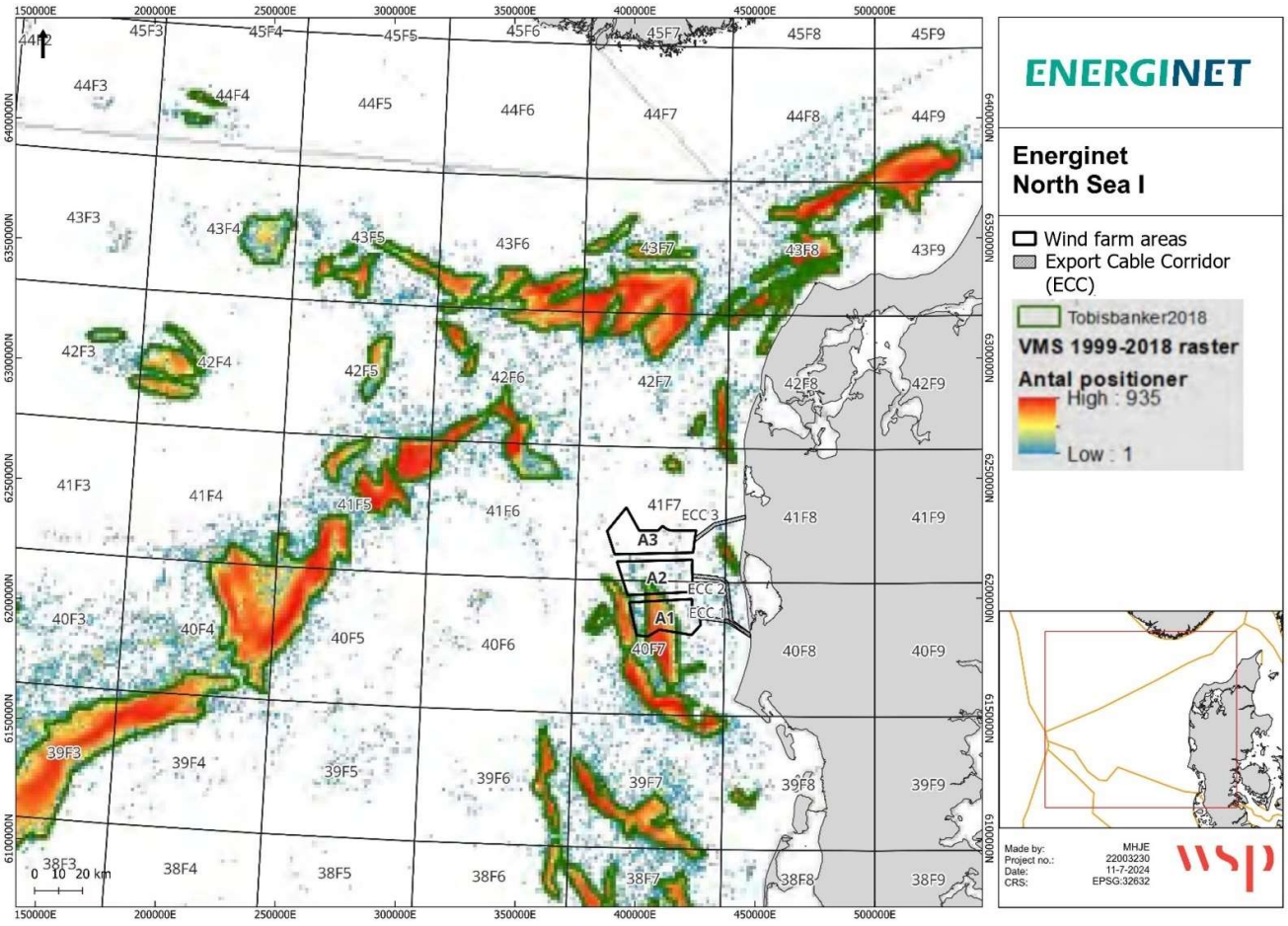

Figure 3-8. Sand eel fishing grounds digitalised from VMS data collected in 2018 (green lines) compared with sand eel fishing grounds registered in 1999-2018 (red: high intensity fishing ground, blue: low intensity. Source: (Deurs, 2019). Modified with the illustration of NSI.1 (black drawing).

3.7.3 SPRAT (SPRATTUS SPRATTUS L.)

Sprat is a pelagic fish, that occurs in fiords and coastal areas including estuaries (Muus, 2006). The fish has a "round" body shape and can easily be confused with herring. It can reach a size of 16 cm. Sprats form dense schools near the bottom during daytime but follow the diel migration of copepods and spread out near the surface to prey on these at night. It is found at 5-50 m depth in the summer and in deeper parts of the sea22. (approx. 150 m) in the winter. Sprat is caught using pelagic or bottom trawl and is an important part of the industrial fisheries in the North Sea, where it is processed into fish meal -and oil or preserved and tinned.

3.7.4 ATLANTIC COD (GADUS MORHUA L.)

The Atlantic cod is a member of the family of Gadidae, where most species have a characteristic chin hook and a round body shape (Muus, 2006). The species can reach a size of 150 cm, but due to high fishing pressure, individuals of this size are very rare today. The common maximum size is approx. 110 cm and 15 kg. Cod inhabit coastal areas to approx. 5-600 m depth near the bottom, but also occur in the pelagic zone. Generally, the cod spawns in January to April, the eggs are pelagic and drift with the water current. The juvenile cod use hard bottom areas as nursery grounds, in which

they feed on small crustaceans. Gradually, the diet shifts to increasingly piscivorous. The cod is caught for human consumption with bottom trawl or gillnets, but catches have been declining for several decades, due to fishing pressure and climate change.

3.7.5 COMMON SOLE (SOLEA SOLEA L.)

The common sole is a species of flatfish belonging to the family of Soleidae, which comprises two species that are both found in the North Sea, the other species being Solenette *(Buglossidium luteum)* (Muus, 2006) (Engelhard, 2011). The flatfish commonly reach a size of approx. 50 cm. The species inhabit soft bottoms in sandy or muddy areas down to 150 m depth. The sole is nocturnal and track down prey, which it senses in the sediment using its "beard". It feeds on small invertebrates such as worms, mussels, and other shellfish. Spawning occurs in the same way as for most flatfish in the North Sea, Kattegat, and Skagerrak (Figure 3-7). The eggs and larvae are pelagic and drift with the current, until they reach nursery grounds in shallow sandy areas, where they grow until winter and then swim to deeper and warmer waters. The sole is a very important and valuable fish for consumption and is caught in trawl or seine in the commercial fisheries.

3.7.6 TURBOT (PSETTA MAXIMA L.)

Turbot is a flatfish in the family of *Scophthalmidae*, which comprises 20 species all inhabiting the North Sea (Muus, 2006). The turbot has a more rounded body shape than most other flatfish and has spiny lumps on the upper side of the body, both characteristics making the fish easy to recognize. The fish inhabit sandy, rocky, or mixed bottoms in depths from 20-70 m. In their juvenile stage they prey on crustaceans, and as they grow, the diet also includes fish such as small cod, other flatfish, and sand eel. The turbot can reach a maximum size of approx. 100 cm and a weight of 25 kg, but the most common size is no more than 50 cm for males and 70 cm for females. Spawning occurs in the same way as for most flatfish in the North Sea (Figure 3-7). The turbot is caught using bottom trawl or gillnets and is a very important and valuable fish for consumption in the commercial fisheries.

3.7.7 BROWN CRAB (CANCER PAGURUS L.)

The brown crab is widespread throughout the North Sea. The species has an oval shell of orange-brown colour, with a width of usually 30 cm, and a weight of up to 6 kg (Muus, 2006). They inhabit rocky bottoms, and is found from 1-30 m depth during summer, and above 30 m depth during winter. The crab feeds on small invertebrates, especially snails and mussels. Egg production takes place in the autumn, where the females carry up to 3 million eggs until they hatch in the summer. The brown crab is caught in pots baited with fresh fish, or as bycatch from the trawling fisheries. The claws in particular represent a valuable resource for commercial fisheries.

3.7.8 BROWN SHRIMP (CRANGON CRANGON L.)

The brown shrimp is distributed throughout the North Sea (Muus, 2006).The species is grey, and unlike other shrimp species, it stays grey when exposed to high temperatures. They reach a maximum length of 8 cm, and is normally found in shallow waters from 0-20 m. They feed on smaller bottom dwelling animals. The brown shrimp is hermaphroditic for the first two years, after which it stays female. Spawning occurs twice per year. The shrimp is caught using beam trawl or push nets.

3.7.9 NORWEGIAN LOBSTER (NEPHROS NORVEGICUS L.)

The Norwegian lobster is widely distributed in the North Sea, particularly along the coast of Norway. The species is characterized by its long and slim claws, and a maximum body length of 24 cm (Muus, 2006). It resides in holes and cave systems in soft bottoms up to a depth of 250 m. Spawning occurs every other year from March to November, and the eggs are carried by the female for up to nine months before hatching. They mainly prey on different small bottom dwelling animals and serpent stars, and the feeding occur during dusk. For that reason, the Norwegian lobster is caught during the night, using trawl in targeted fisheries. The species also constitute an important and valuable by-catch in the shrimp fishing industry.

4 DANISH FISHERIES

4.1 FISHERIES IN THE NORTH SEA

Danish commercial fisheries are impacted by various factors such as vessel capabilities, catch composition, and regulatory frameworks. This analysis focus on the trends and dynamics of Danish fisheries, focusing on ICES squares 40F7, 40F8, 41F7 and 401F8, that cover NSI.1 designated for the offshore wind farm (NSI.1). In this section, the catch composition, economic significance, and seasonal patterns within Danish fisheries will be explored, shedding light on the dynamics, that shape the industry in the area.

Smaller fishing vessels, typically under 12 m, primarily operate near their home ports due to the limited engine power. A general decline in the number of Danish fishing vessels has been observed over the past decade and especially gillnetters have experienced significant decreases, particularly in the ports closest to fishing grounds.

The available logbook data describe the fisheries within a larger geographical context, specifically the four ICES statistical rectangles: 40F7, 40F8, 41F7, and 41F8. NSI.1 covers three relatively small parts of the two ICES statistical rectangles, 40F7 and 41F7 (see also Figure 3-1 and Table 3-2). The additional coverage is attributed to the export cable corridor, which spans across all four ICES statistical rectangles mentioned above. The coverage, however, represents only a small portion of the seabed surface within these rectangles, compared to their overall size. Consequently, estimating the exact weight and value of catches in NSI.1 is challenging. However, the VMS data provides an indication of fishing effort in the area, and additional interviews with local fishers offer insight into its´ importance for commercial fisheries.

4.2 FISHING VESSELS AND LANDINGS

4.2.1 LOGBOOK DATA

The logbook data comprises information on the fishing vessel, home port, date and weight and estimated value of the catches. The catches are referred to ICES square numbers, and not to an exact position in the North Sea, but as presented in section 4.3, only a few percentages of the fishing trips in each ICES square occurred inside NSI.1. Therefore, the fisheries are described based on weight and estimated value.

The intensity of the various fishing types in and near NSI.1 is based on VMS data filtered for vessel speed. Thus, the VMS points illustrated here, only represent active fishing and not vessels passing through the area at high speed to and from the fishing grounds. The maps in section 4.3 show a yearly average of all relevant VMS points for the past decade (2014-2023).

4.2.2 FISHING VESSELS AND PORTS

Smaller fishing vessels (<20 m) typically operate in the vicinity of their home port due to limited engine power and the extensive travel time to and from the fishing grounds please see section 4.5 Interviews). As NSI.1 is relatively close to shore, it is reasonable to assume that the smaller local vessels, to some extent, utilize the area as fishing grounds.

The number of fishing vessels has generally decreased over the past 10 years (The Danish Fisheries Agency, 2024). The same pattern is evident in the number of fishing vessels with a homeport in the three ports closest to NSI.1 – Hvide Sande, Thorsminde, and Thyborøn. In these ports, the number of fishing vessels has decreased by 32.23 % from 242 to 163 vessels in the past decade (Table 4-1). The decrease is especially pronounced in gillnets (particularly among larger vessels), beam trawlers, seines, and stern trawlers, which account for a reduction of approximately 85 % of the decrease.

Table 4-1. The number of Danish fishing vessels with homeport in Hvide Sande, Thorsminde, and Thyborøn in 2014 and 2023, respectively. Dinghies and aiding vessels are not included. The vessel types are divided into different length classes. Source: (The Danish Fisheries Agency, 2024).

Type of vessel	Vessel length															
	< 8 m		8-10 m		10-12 m		12-15 m		15-18 m		18-24 m		> 24 m		Total	
	2014	2023	2014	2023	2014	2023	2014	2023	2014	2023	2014	2023	2014	2023	2014	2023
Beam-/Side trawler									1						**1**	**0**
Beam trawl									6	4	7	7	1	1	**14**	**12**
Gillnets	96	79	33	25	12	7	12	2	9	6	5	4	1		**168**	**123**
Hook vessel			1	1											**1**	**1**
Multipurpose vessel (stern/side)								1			4	1	3	3	**7**	**5**
Mussel dredge	1	1	1												**2**	**1**
Other trawlers													3		**3**	**0**
Seine									2		9	3			**11**	**3**
Seine/Stern trawler	1												4	2	**5**	**2**
Side trawler			1	1			2	1	1	1	1		1		**6**	**3**
Stern trawler			2		2	1	1	1			3	3	16	8	**24**	**13**
Total	**98**	**80**	**38**	**27**	**14**	**8**	**15**	**5**	**19**	**11**	**29**	**18**	**29**	**14**	**242**	**163**

In addition to the commercial fishing vessels, fishing also occurs from vessels, which conduct fisheries as a secondary business. The number of these vessels increased slightly from 2014-2023 (The Danish Fisheries Agency, 2024), but as they are smaller vessels with relatively low fishing effort, their part of the total landings only comprises few percentages.

4.2.3 DANISH LANDINGS IN THE NORTH SEA (TIMELINE AND GEAR TYPE)

Commercial fisheries play a significant role in Denmark's maritime economy as a whole, with total earnings amounting to 3.2 billion DKK in 2023 (DFPO, 2024). Despite the decrease in number of vessels, the total Danish landings have remained substantial, with the North Sea continuing to be the primary fishing area (55 %), attributing to 1,760 mil DKK in total earnings or the equivalent of 326,154 tons in 2023 (DFPO, 2024). Trawl fisheries contributed 236,262 tons, while gillnet fisheries represented 3,098 tons of the total North Sea landings.

In 2014 the national landings from ICES square 40F7, 40F8, 41F7, 41F8 were approximately 11,321 tons. (The Danish Fisheries Agency, 2024), equivalent to 54.84 mil DKK. In comparison to the above, in 2023, those landings accounted for approximately 2,672 tons and 39.5 mil DKK in estimated value (The Danish Fisheries Agency, 2024).

For the past decade, the estimated yearly average value of landings from ICES statistical rectangles 40F7, 40F8, 41F7, 41F8 for all gear types, were 88 mil DKK. Beam trawl followed by the gillnet fisheries are the two gear types, which represents the greatest values compared to other gear types (Figure 4-1). The yearly average estimated value of beam trawl landings in 2014-2023 was approximately 19.2 mil DKK, whilst gillnet landings accounted for approximately 14.3 m DKK during the same period (which represents 36 % and 27 % respectively). In comparison, bottom trawl and pelagic trawl have followed each other closely, and amounted for an average yearly estimated value of 9 mil DKK and 8.7 mil DKK respectively (17 % and 16.6 %). Seine has accounted for the lowest estimated yearly landings in the period, only representing 0.1 % of the total average landed value (169,608 mil DKK), whilst other gear has experienced a decrease since 2020 (1.45 mil DKK or 2.68 %), which could potentially be explained by a better recording system and the introduction of the landing obligation in 2018.

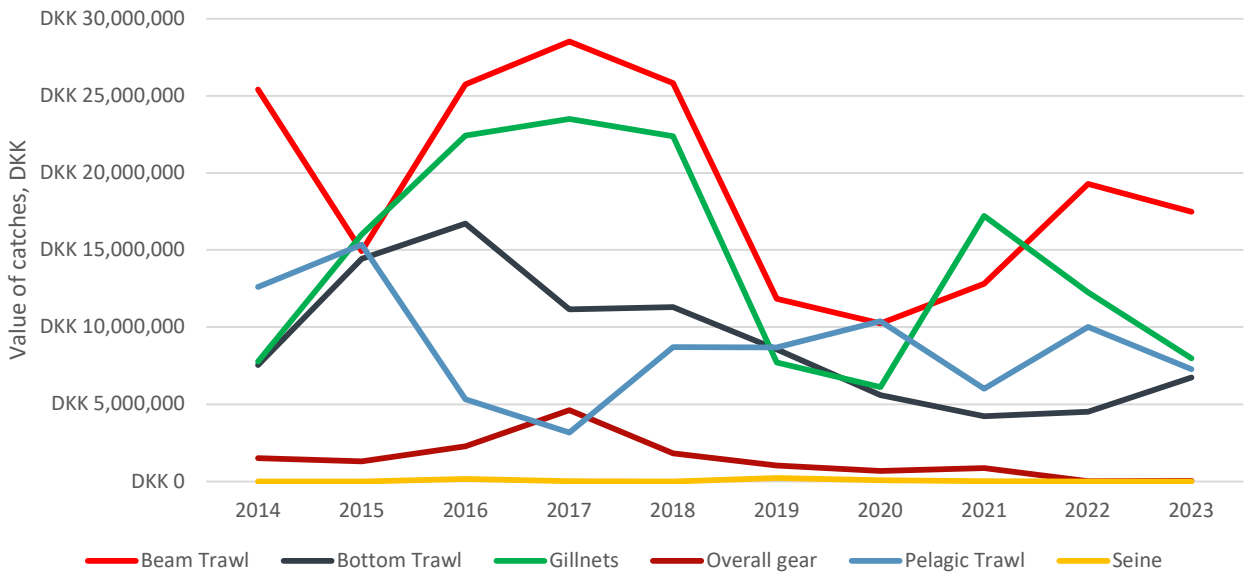

Figure 4-1. The development in estimated value of yearly landings for the different gear types in ICES statistical rectangles 41F7, 41F8 and 42F7. Source: (The Danish Fisheries Agency, 2024).

For the past decade, the average yearly catches from ICES statistical rectangles 40F7, 40F8, 41F7, and 41F8 for all gear types were 11,728 tons. For most gear types, the weight of the catches has fluctuated greatly for the past decade, with an overall decline in the total average landed catches (Figure 4-2). A particularly noticeable decrease is seen in the bottom trawl and pelagic trawl landings, that have dropped by 88 % and 77 % respectively, when comparing 2014 to 2023. This is possibly due to various factors, such as quota allocation, the full introduction of the landing obligation in January 2019, as well as the prior Regulation (EU) 2018-973 specifying details of the implementation of the landing obligation in the North Sea.

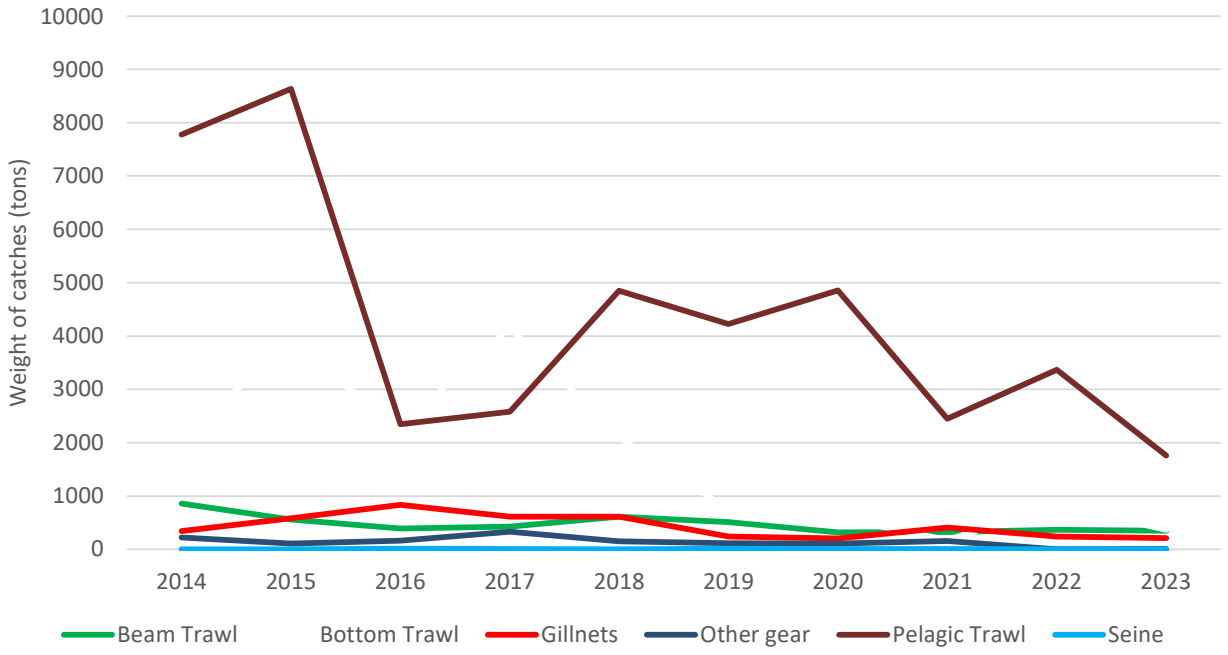

Figure 4-2. The development in yearly total landings for the different gear types in ICES statistical rectangles 40F7, 40F8, 41F7, and 41F8 Source: (The Danish Fisheries Agency, 2024).

The trawl fisheries (bottom, pelagic, and beam trawl) is the most important type of fisheries in the ICES statistical rectangles 40F7, 40F8, 41F7 and 41F8, comprising 92 % of the combined total catches from 2014-2023 (Figure 4-3) (The Danish Fisheries Agency, 2024). In comparison, gillnet fisheries comprised approximately 6 % of the total weight of landings in the same period and area, whilst other gear comprised around 7 %.

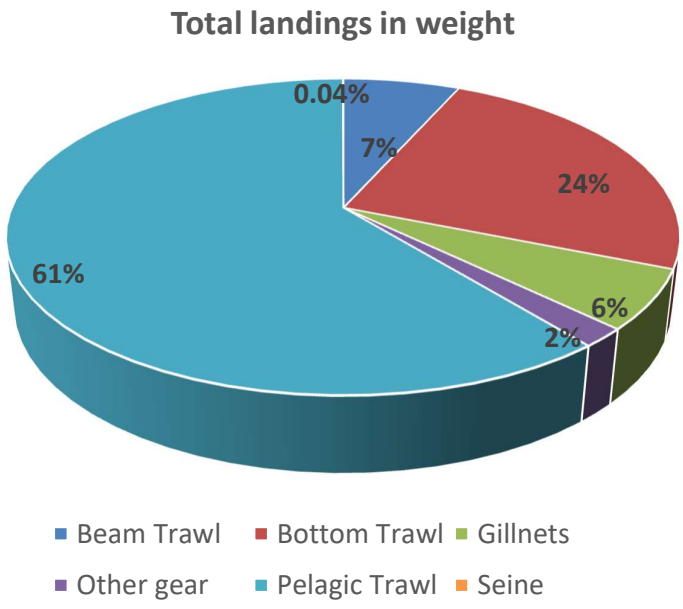

Figure 4-3. The total landings in tons for ICES square 42F7, 41F7 and 41F8 divided into gear type. Source: (The Danish Fisheries Agency, 2024).

In terms of estimated value, the beam trawl fisheries are the most valuable fisheries, as the estimated earnings for this gear type comprised 36 % of the total catches in 2014-2023 in ICES statistical rectangles 40F7, 40F8, 41F7, 41F8 and 42F7 (Figure 4-4) (The Danish Fisheries Agency, 2024). The gillnet fisheries comprised a total value of 27 % in the

area, while other fishing gears accounted for only 2.6 % of the total value. There have been some relatively large fluctuations in the estimated earnings, both for beam trawl and gillnet fisheries in 2014-2023, with a noticeable increase between 2016-2018. This could be explained by the full introduction of the landing obligation across the Danish and European waters in 2018 (EU, 2018), Brexit, as well as a possible behavioural change amongst fishers due to the gradual introduction of the landing obligation since 2013 on certain species, and on the demersal species in the North Sea since 2019. The phased implementation of the landing obligation, starting in 2013, might have influenced fishers' behavior, leading to variations in catches landed."

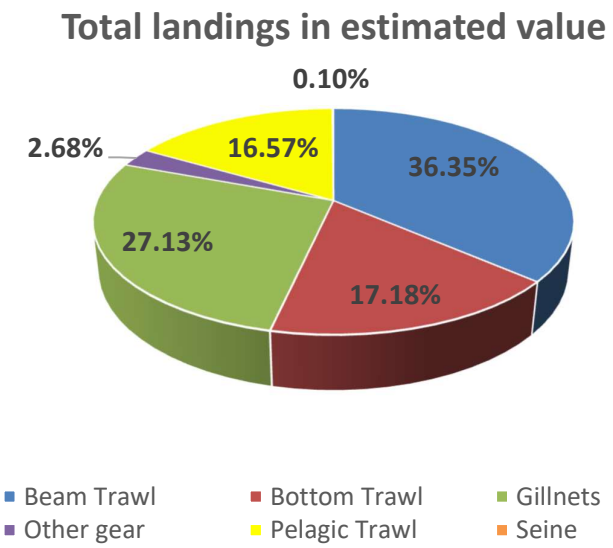

Figure 4-4. Total sum (in percentage) of estimated value of species for each fishing gear type. Source: (The Danish Fisheries Agency, 2024).

It is assumed, that the majority of the vessels with home port in Hvide Sande, Thorsminde, and Thyborøn have caught their fish in or near NSI.1, as the limited vessel size and engine power puts a limit to the mobility of the vessels. Overall, the species comprising the largest average yearly landings in tons for ICES Square 40F7, 40F8, 41F7 and 41F8, was sprat with 7,716 tons followed by sand eel with 5,363 tons (Table 4-2). Approximately 65 % of the sprat, sand eel and mackerel catches belonged to vessels from other ports. (“other vessels” in Table 4-2). Sand eel, blue mussel and plaice were the second, third and fourth most abundant species in the catches, with a total of 5,363 tons, 2,083 tons and 707 tons respectively. For sole, turbot, cod and dab landings, local vessels caught 80 % of the total landings, while this number amounted to 79 % and 78 % for plaice and brown shrimp, respectively. In general, local vessels seem to focus more on fish of high quality for consumption, compared to other vessels which mostly catch industrial fish species (see Table 4-2-4-7). This aligns with the significance of high-quality food fish and the preference for shorter fishing trips by local vessels, whereas industrial fish, which are less concerned with quality, may tolerate longer fishing journeys. All landings for common cockle (*Cerastoderma edule*) and clam (*Mactridae*) belonged to vessels from other ports.

ICES square 40F7 and 40F8 are dominated by catches of sprat, sand eel, brown shrimp, and herring. In ICES square 41F7, the dominant species were sprat, sand eel, and plaice, whilst in ICES square 41F8, the dominant species were sprat, blue mussel, and common cockle.

Table 4-2. Average yearly landings from 2014-2023 for each ICES area, divided into most commonly landed species. Local vessels are vessels with home port in Hvide Sande, Thorsminde, and Thyborøn. Other vessels represent landings from vessels belonging to all other ports. Source: (The Danish Fisheries Agency, 2024).

Average yearly landings in tons									
Species	ICES 40F7		ICES 40F8		ICES 41F7		ICES 41F8		Total
	Local vessels, t	Other vessels, t	Local vessels, t	Other vessels, t	Local vessels, t	Other vessels, t	Local vessels, t	Other vessels, t	Tons
Sprat	0.0	1,747.6	1,251.0	1,774.4	864.1	919.4	574.7	585.3	**7,716.4**
Blue mussel	930.5	0.0	0.0	0.0	0.0	0.0	0.0	1,153.3	**2,083.8**
Sand eel	1,593.2	2,999.1	11.9	44.4	142.3	310.7	98.0	163.6	**5,363.2**
Plaice	21.9	9.6	5.7	2.3	508.7	121.9	27.0	10.4	**707.5**
Brown shrimp	94.1	40.8	289.9	79.6	2.5	0.4	86.5	5.9	**599.7**
Common- cockle	0.0	0.0	0.0	0.2	0.0	0.0	0.0	540.9	**541.1**
Clam	0.0	386.6	0.0	8.4	0.0	0.0	0.0	0.0	**395.1**
Herring	24.1	38.2	69.5	43.8	28.6	24.7	33.1	13.8	**275.9**
Sole	2.5	0.2	0.2	0.1	68.2	11.2	7.9	0.4	**90.7**
Brown crab	2.3	14.8	6.0	0.0	30.7	10.6	13.3	0.6	**78.2**
Mackerel	7.0	14.2	6.6	13.1	2.3	2.4	3.6	6.0	**55.2**
Turbot	3.0	0.3	0.3	0.3	33.0	5.6	2.0	1.7	**46.2**
Cod	1.4	0.0	0.4	2.1	26.3	5.5	7.2	0.4	**43.2**
Dab	1.5	0.7	0.8	0.6	21.0	5.3	7.8	0.7	**38.5**
Total	**2,681.8**	**5,252.2**	**1,642.1**	**1,969.2**	**1,727.8**	**1,412.4**	**861.1**	**2,483.0**	**18,029.4**

In ICES square 41F7, the total annual average catch is 3,134 tons with an estimated value of 24.69 mil. DKK (Table 4-3). With a lower total weight of the catch, but the highest estimated earnings, ICES square 41F7 could be characterised as the area with the most valuable fish.

Table 4-3. The average yearly landings from 2014-2023 in tons and DKK for ICES square 40F7. Source: (The Danish Fisheries Agency, 2024).

Species	Average yearly landings in tons and value			
	ICES 40F7			
	Local vessels, t	Value, DKK	Other vessels, t	Value, DKK
Blue mussels	930.52	1,765,576	0.00	0
Brown crab	2.34	57,694	14.76	348,202
Brown shrimp	94.11	3,767,488	40.77	1,788,459
Clam	0.00	0	386.60	1,125,341
Cod	1.42	28,893	0.05	991
Common- cockle	0.00	0	0.00	0
Dab	1.53	14,412	0.75	7,629
Herring	24.14	109,141	38.18	167,769
Mackerel	6.98	579,614	14.18	128,587
Plaice	21.94	327,125	9.59	105,794
Sand eel	1593.23	2,557,153	2999.06	4,742,476
Sole	2.53	217,117	0.24	20,441
Sprat	0.00	0	1747.64	3,217,712
Turbot	3.02	245,587	0.35	25,397
Total	**2681.77**	**9,669,800**	**5252.15**	**11,678,799**

Although local vessels caught slightly more than 30 % of the total landings within area 40F7 (see above), they earned only a bit less than 50 % of the total amount compared to other vessels, with an annual average value of 11.6 mil DKK. The most significant catch in terms of weight was sand eel (Table 4-3), which was the case for both local and other vessels. The yearly average catch of sand eel from 2014-2023 was 4,592 tons, with local vessels landing approximately 35 %. Blue mussel was the second largest landing for local vessels, comprising approximately 930 tons yearly and ranking third in estimated value. Due to its relatively high landing price, brown shrimp was the most important species in terms of estimated value for local vessels, earning just over 3.7 m DKK per year. Among other vessels, sand eel accounted for the largest number of landed species (65 % of their total landings). Sprat, which was only landed by other vessels, ranked second in estimated value in 40F7. Despite its small total weight of only 40.7 tons for other vessels, brown shrimp was the third largest species in terms of estimated value landed. Clam was the third largest species in terms of weight landed only by other vessels, generating a relatively high yearly earning of 1.7 mil DKK.

Table 4-4. The average yearly landings from 2014-2023 in tons and DKK for ICES square 40F8. Source: (The Danish Fisheries Agency, 2024).

Species	Average yearly landings in tons and value			
	ICES 40F8			
	Local vessels, t	Value, DKK	Other vessels, t	Value, DKK
Blue mussels	0.00	0	0.00	0
Brown crab	5.98	147,703	0.00	0
Brown shrimp	289.89	12,079,169	79.59	3,268,896
Clam	0.00	0	8.44	22,403
Cod	0.37	7,098	2.06	38,056
Common- cockle	0.00	0	0.15	733
Dab	0.81	8,525	0.59	6,459
Herring	69.48	284,085	43.81	197,211
Mackerel	6.55	63,061	13.15	130,002
Plaice	5.70	81,432	2.26	28,952
Sand eel	11.87	18,073	44.39	63,843
Sole	0.16	14,853	0.09	7,493
Sprat	1,250.98	2,302,604	1,774.36	3,258,802
Turbot	0.27	20,972	0.26	18,532
Total	**1,642.07**	**15,027,575**	**1,969.15**	**7,041,383**

The total annual catches in ICES square 40F8 were approximately 3,611 tons with an estimated value of 22.07 mil DKK (see Table 4-4). Sprat comprised the largest proportion of the catch in terms of weight. This was the case for both the local vessels and other vessels, and both groups had an annual average landing of sprat of well over 1,250 tons. For the local vessels, brown shrimp is an important species in terms of landed weight, accounting for nearly 55 % of the overall total value for all fish from 40F8. For other vessels, herring and mackerel were the second and third most important species in terms of estimated value, accounting for 41 % and 67 % respectively, when compared to their local counterparts. However, the most important species in terms of estimated value is the brown shrimp, which is caught just off the coastline using beam trawl. It is estimated, that the brown shrimp catches have a value of 12 mil DKK on average pr. year for local vessels. Other vessels caught approximately 27.5 % of the brown shrimp compared to the local vessels.

Table 4-5. The average yearly landings from 2014-2023 in tons and DKK for ICES square 41F7. Source: (The Danish Fisheries Agency, 2024).

Species	Average yearly landings in tons and value			
	ICES 41F7			
	Local vessels, t	Value, DKK	Other vessels, t	Value, DKK
Blue mussels	0.00	0	0.00	0
Brown crab	30.70	809,165	10.58	255,215
Brown shrimp	2.50	65,398	0.41	15,395
Clam	0.00	0	0.00	0
Cod	26.26	579,393	5.51	118,652
Common- cockle	0.00	0	0.00	0
Dab	21.03	195,341	5.29	47,853
Herring	28.63	100,886	24.72	81,481
Mackerel	2.34	22,248	2.40	22,513
Plaice	508.67	7,740,553	121.93	1,871,114
Sand eel	142.32	199,179	310.71	471,678
Sole	68.24	5,864,708	11.21	946,722
Sprat	864.09	1,578,598	919.36	1,588,018
Turbot	33.04	2,620,575	5.56	444,735
Total	**1,727.81**	**19,776,043**	**1,412.12**	**5,418,641**

In ICES square 41F7, the total average landings amounted to just over 3,100 tons pr. year (both local and other vessels) and an estimated value of 25.1 mil DKK (Table 4-5). This made ICES square 41F7 the most important area in terms of total estimated value of catches landed. The landings for local vessels accounted for 55 %. However, the estimated earnings for the local vessels (19.7 mil DKK) were 3.5 times more than the earnings estimated for the other vessels (5.4 mil DKK), as seen in the table above. Average yearly landing data indicates that 41F7 is a highly valuable area for the local vessels, as also noted by the interviewed fishers in section 4.5, due to its proximity to land and thus less steaming time required for favourable fishing grounds.

The species comprising the largest landings in terms of weight was sprat. Vessels from other ports caught approximately the same amount as the local vessels, which accounted for 52 % of the total landings for the species. In terms of value, plaice was the species that generated the majority of the earnings from ICES square 41F7 for both local and other vessels, with an estimated value of 7.7 mil and 1.8 mil DKK respectively. The second and third most profitable species were sole and turbot. For the local vessels, plaice was the species comprising the highest estimated earning, with just over 6.5 mil DKK on average pr. year. Sole was the second most profitable species with approximately 5.8 mil DKK on a yearly average.

Table 4-6. The average yearly landings from 2014-2023 in tons and DKK for ICES square 41F8. Source: (The Danish Fisheries Agency, 2024).

Species	Average yearly landings in tons and value			
	ICES 41F8			
	Local vessels, t	Value, DKK	Other vessels, t	Value, DKK
Blue mussels	0.00	0	1153.31	837,524
Brown crab	13.29	322,421	0.58	16,692
Brown shrimp	86.52	3,550,789	5.90	238,933
Clam	0.00	0	0.04	131
Cod	7.19	165,071	0.37	9,518
Common- cockle	0.00	0	540.93	2,048,445
Dab	7.81	77,404	0.71	6,209
Herring	33.15	119,452	13.79	47,129
Mackerel	3.59	36,038	6.02	58,197
Plaice	26.95	376,836	10.42	142,775
Sand eel	98.03	132,441	163.62	201,244
Sole	7.86	701,655	0.38	32,261
Sprat	574.68	1,058,942	585.29	1,031,442
Turbot	2.00	164,609	1.68	129,080
Total	**861.06**	**6,705,660**	**2483.04**	**4,670,500**

The total annual catches in ICES square 41F8 were approximately 3,344 tons, with an estimated value of 11.4 mil DKK (Table 4-6). Catches in 41F8 were lower compared to 40F7, 40F8, 41F7, which was expected due to the close proximity to land, which limits stock availability – 41F8 is situated just off the Danish west coast. Sprat comprise first and second largest proportion of the catch in terms of weight and value for both local and other vessels, while brown shrimp, with a value of 3.5 mil DKK, caught just off the coastline using beam trawl, are considered the most valuable species for local vessels. For other vessels, blue mussels are the most landed species in tons, followed by sprat and common cockle. On average, local vessels sold a catch worth 6.7 mil DKK yearly.

VESSEL SIZE

For all four ICES squares included in this analysis, (40F7, 40F8, 41F7, and 41F8), the mid-size and larger vessels (12 m - 24 m) had the larger landings and highest estimated values of the catch (Table 4-7). ICES square 40F7 and 41F7 are the two areas furthest from shore. In these two areas, the dominance by mid-size to larger vessels is especially pronounced, which is due to the fact that, contrary to the smaller vessels, the larger motor power of these vessels enables them to travel the distance back and forth to the fishing grounds far from shore. This difference is also reflected in the numbers for catch weight and estimated value for these two squares, where the smaller vessels account for only 2 % of the total. For 41F7 and 41F8, the smallest vessels (<12m) represent 13 % and 8 % of the total estimated value and 9.7 % and 4.6 % of the total catch weight, respectively.

Table 4-7. The total landings and estimated value from 2014-2023 for the different vessel sizes. Source: (The Danish Fisheries Agency, 2024).

Vessel size	40F7		40F8		41F7		41F8	
	Catch (tons)	Estimated value (mil. DKK)	Catch (tons)	Estimated value (mil. DKK)	Catch (tons)	Estimated value (mil. DKK)	Catch (tons)	Estimated value (mil. DKK)
Under 10m	0	0	514	3,089,714	1	31,699	257	1,756,389
10-11,99m	287	1,950,424	14	245,193	1,676	26,498,382	144	4,010,239
12-14,99m	7,138	14,297,159	3,852	8,609,005	4,189	35,472,818	2,868	14,229,492
15-23,99m	15,611	71,469,043	11,511	139,797,759	9,514	139,418,123	5,156	51,504,150
>=24m	4,774	8,677,655	787	1,586,926	1,878	5,567,829	196	352,968
Total	**27,810**	**96,394,281**	**16,677**	**153,328,597**	**17,259**	**206,988,851**	**8,620**	**71,853,239**

4.2.4 FISHING SEASONS

The seasonal extent of the fisheries in the North Sea varies greatly over a year (Figure 4-5). The largest catches are caught in summer from May through July, peaking in June. The lowest catches are registered in winter.

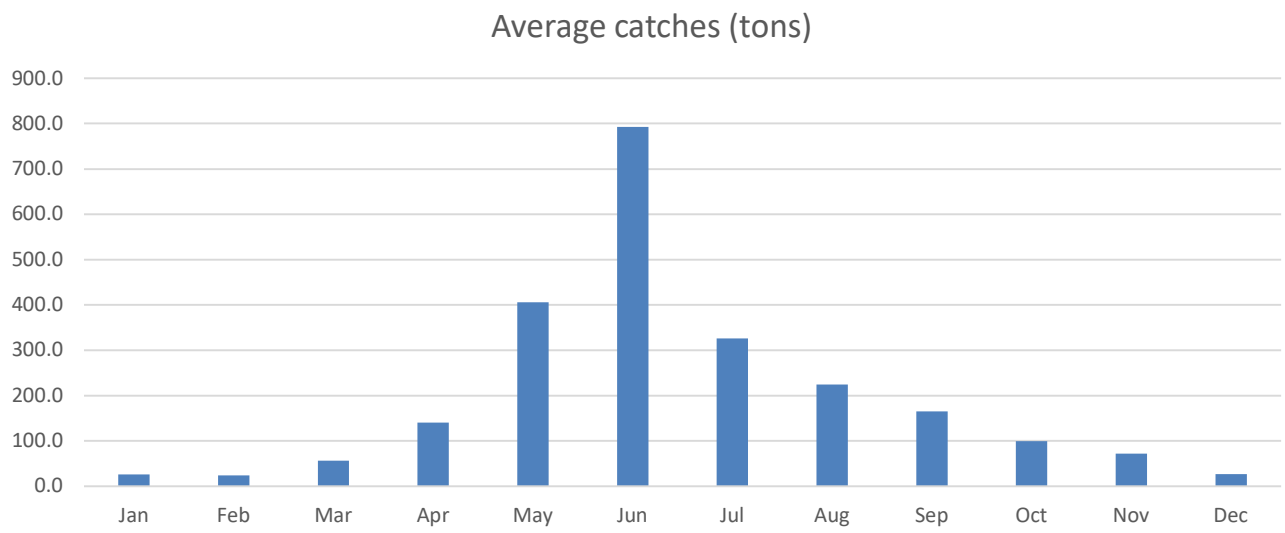

Figure 4-5. The average monthly catches of all marine species by Danish fishers in ICES statistical rectangles 40F7, 40F8, 41F7 and 41F8, from 2014-2023 (The Danish Fisheries Agency, 2024).

Most species are targeted during different seasons of the year. Generally, flatfish are caught during spring and early summer (Figure 4-6). Plaice and sole tend to be in season from March through to May, while turbot and dab occur slightly later, from April through June. However, plaice is so abundant in the catches, that even in the months of lowest plaice catches, the number of plaice is relatively high compared to the peak seasons of the other flatfishes.

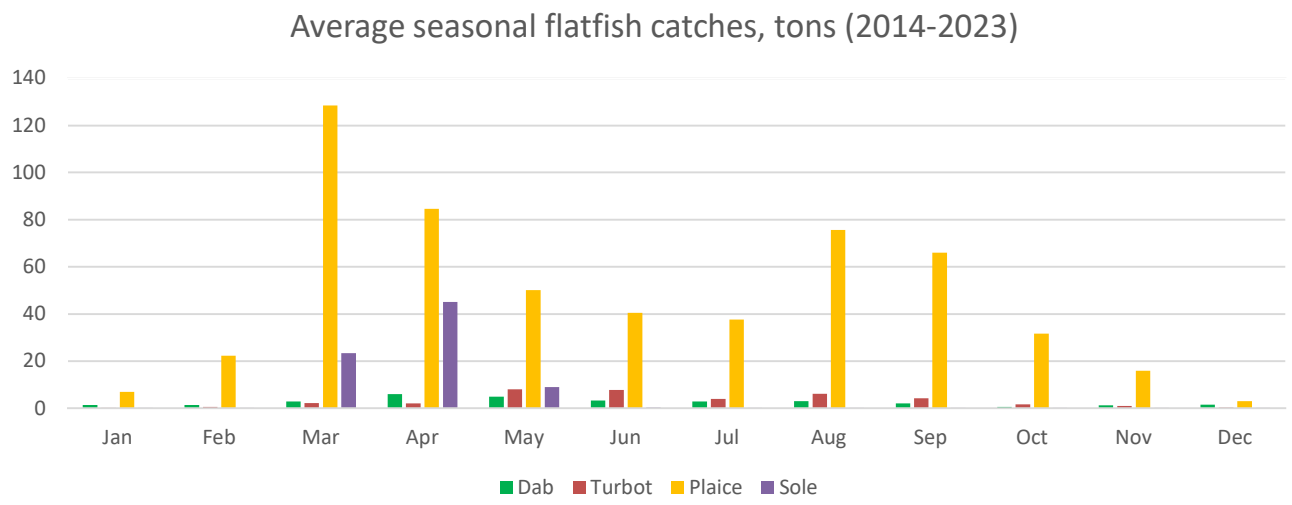

Figure 4-6. The seasonal variation in the yearly catches of flatfish in ICES statistical rectangles 40F7, 40F8, 41F7 and 41F8, from 2014-2023 (The Danish Fisheries Agency, 2024).

4.3 FISHING INTENSITY

4.3.1 BEAM TRAWL

For the past 11 years (2014 to 2023), beam trawl fisheries for fishing vessels of 12 m or longer, has occurred near and in most of the gross area of NSI.1. The fisheries intensity has been moderate in most of the project area, but with somewhat lower intensity in the southwestern parts of the sub-areas, especially in the southernmost area A1. The fisheries show the highest intensities in the southeastern part of the A1 area and is especially intense in a large area near the coastline, and in the vicinity of the southern export cable route (Figure 4-7).

Comparing 2014 to 2023, the beam trawl fisheries activity (VMS) shows a northward moving tendency within the project area, as the fisheries mainly occurred in the southeastern part in 2014. By 2023, the fisheries have increased and has spread to A3, in which the intensity now is highest, see Appendix 1 - Fishing intensity Danish .

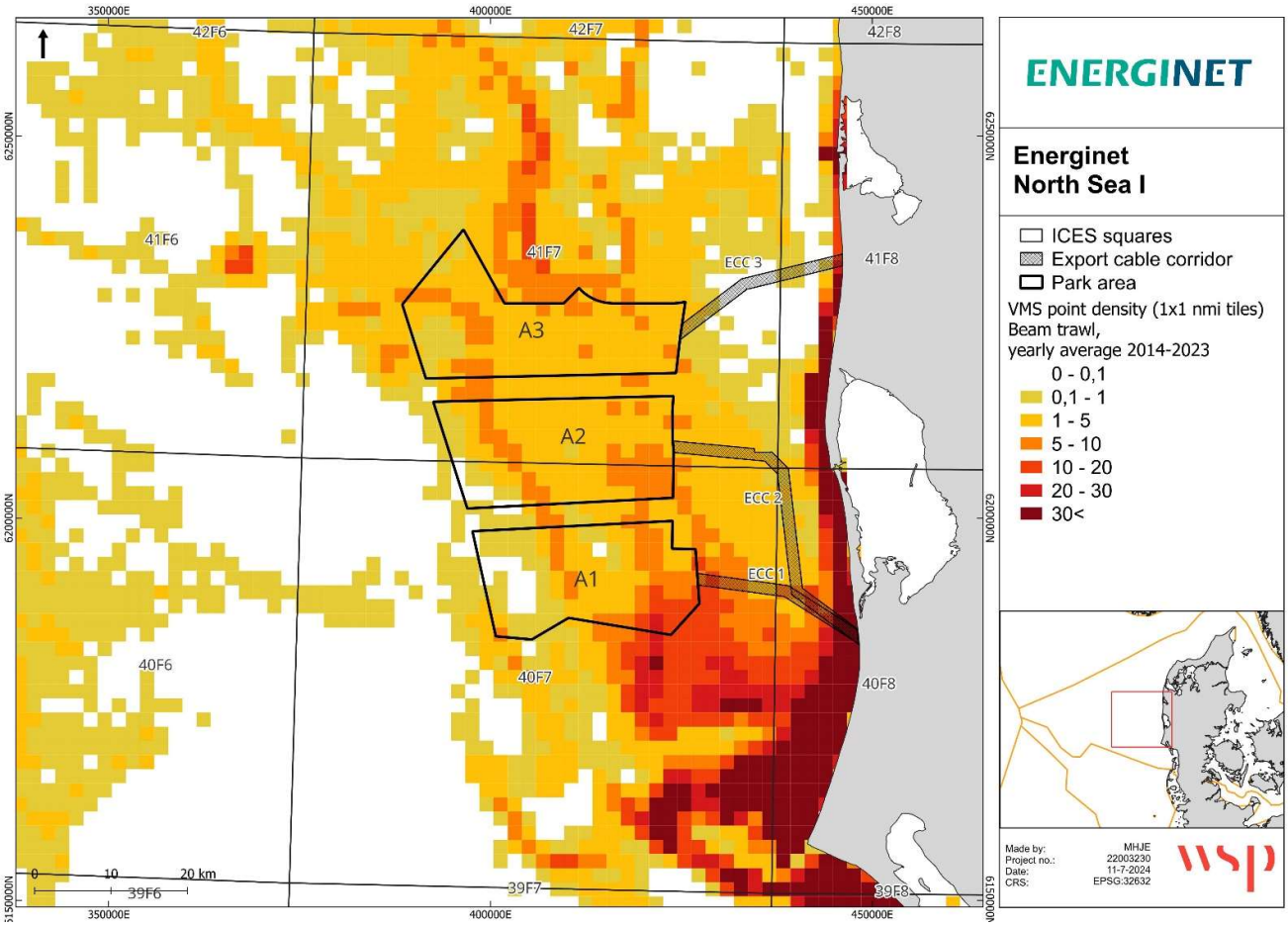

Figure 4-7. The distribution of the main fishing grounds for beam trawl based on VMS data on a yearly average in the period 2014-2023 Source: (The Danish Fisheries Agency, 2024).

4.3.2 BOTTOM TRAWL

For the past 11 years (2014 to 2023), bottom trawl fisheries for fishing vessels of 12 m or longer, has occurred in most of the gross area of NSI.1. The fisheries intensity has been moderate in most of the project area, but with a higher intensity in the eastern part of A3 area, in the sailing corridor west of A1, and in the area of the export cable corridors (Figure 4-8).

Comparing 2014 to 2023, the bottom trawl fisheries activity (VMS) shows a decreasing tendency within the project area. In 2014, the bottom trawl fisheries was mainly concentrated in the coastal area and the eastern parts of the area, whereas the tendency shows a more scattered pattern in the area of NSI.1 by 2023, with a lot of activity in the A1 area, see Appendix 1 - Fishing intensity Danish fisheries.

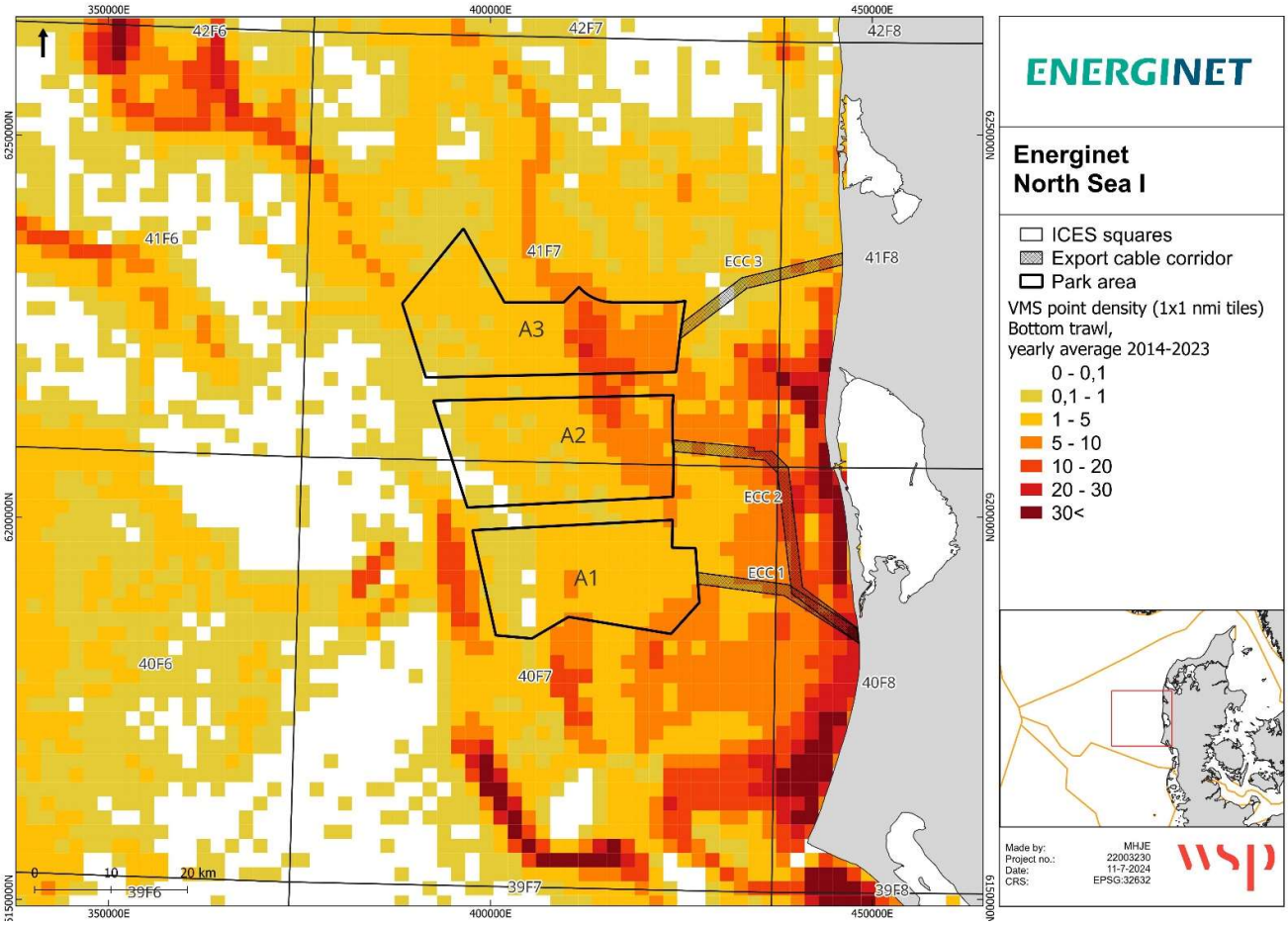

Figure 4-8. The distribution of the main fishing grounds for bottom trawl based on VMS data on a yearly average in the period 2014-2023. Source: (The Danish Fisheries Agency, 2024).

4.3.3 PELAGIC TRAWL

For the past 11 years (2014 to 2023), pelagic trawl fisheries for vessels of 12 m or longer, have occurred partly and with low intensity in the gross area of NSI.1. Most activity has been in the northeastern part and near the export cable routes (Figure 4-9).

Comparing 2014 to 2023, the pelagic trawl fisheries activity (VMS) shows a decreasing tendency within the project area. In 2014, the pelagic trawl fisheries was mainly concentrated in the areas of A3 and A2 and in the coastal areas, whereas the tendency is much lower and scattered in the NSI.1 and nearby coastal area by 2023, see Appendix 1 - Fishing intensity Danish .

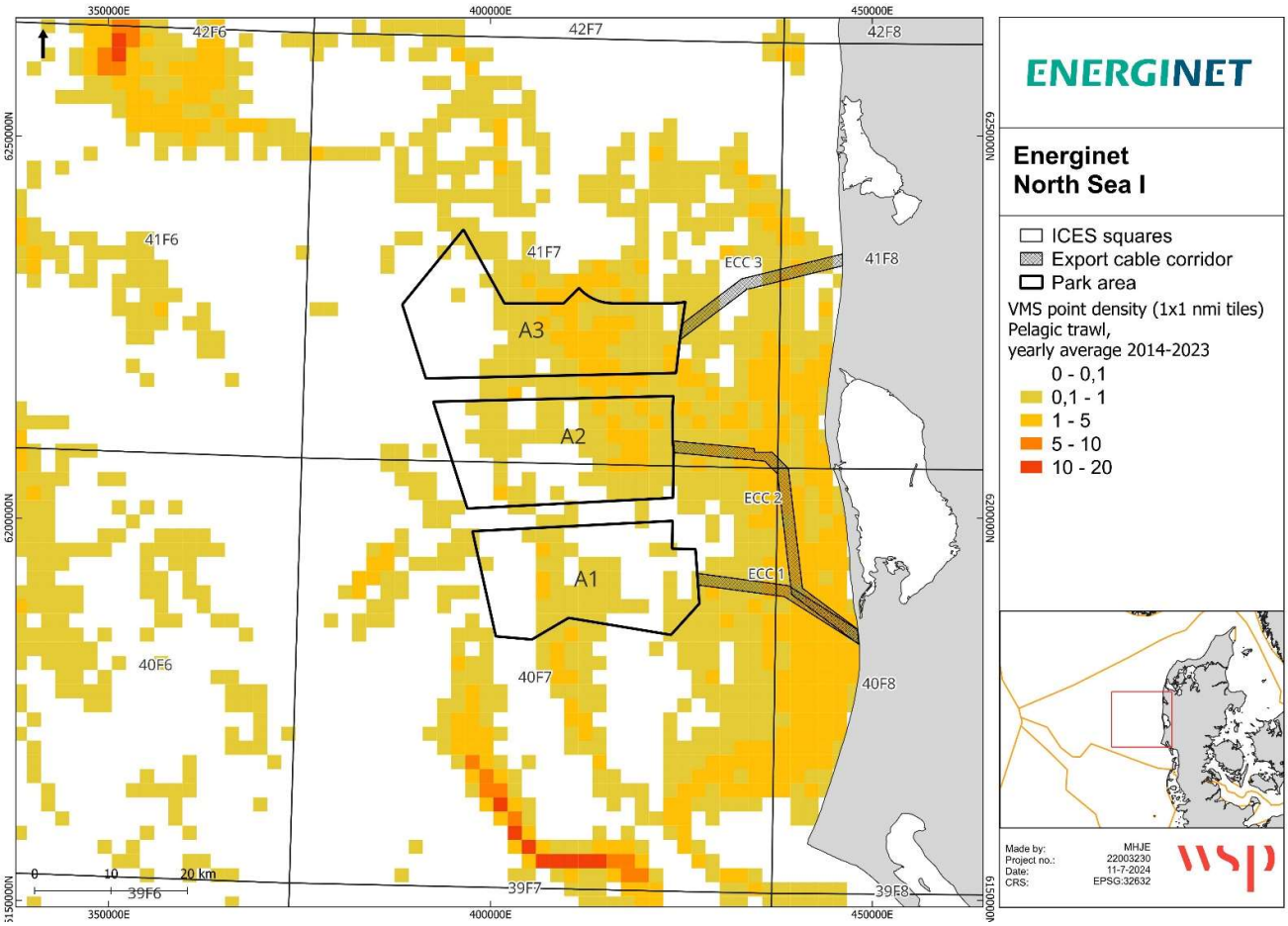

Figure 4-9. The distribution of the main fishing grounds for pelagic trawl based on VMS data on a yearly average in the period 2014-2023. Source: (The Danish Fisheries Agency, 2024).

4.3.4 NET FISHING

For the past 11 years (2014 to 2023), net fisheries for fishing vessels of 12 m or longer has occurred in most of the nearby areas, especially the norther parts, and with rather high intensity. Net fisheries occur in most of NSI.1, including the ECC 1-3 and the corridors between A1-A3. Especially A3 show a high and dense fisheries activity, whereas the intensity decreases southward within the project area (Figure 4-10).

Comparing 2014 to 2023, the net fisheries activity (VMS) has decreased immensely, from occurring in a major part of the NSI.1 as well as concentrated in the coastal area in 2014, to a scattered activity in the northern part of the area, while entire coastal areas with previous activity, show very low or no activity by 2023, see Appendix 1 - Fishing intensity Danish .

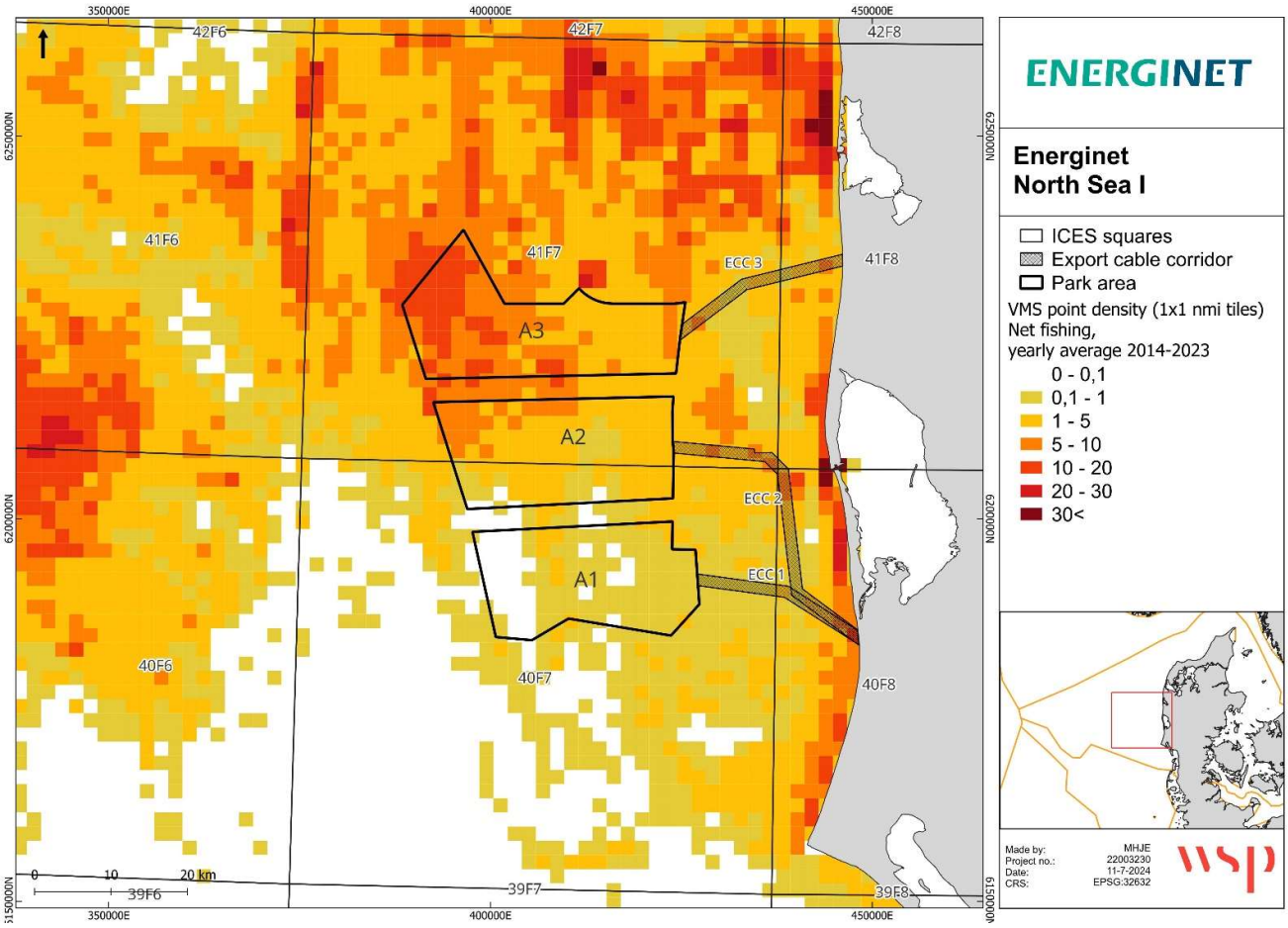

Figure 4-10. The distribution of the main fishing grounds for gill nets based on VMS data on a yearly average in the period 2014-2023. Source: (The Danish Fisheries Agency, 2024).

4.3.5 SEINE FISHING

For the past 11 years (2014 to 2023), seine fisheries for fishing vessels of 12 m or longer have occurred with a scattered distribution within the gross area of NSI.1 and near the export cable routes, mainly in the western parts and with low intensity, showing an overall decrease in activities over the years (see Appendix 1 - Fishing intensity Danish). In most of the NSI.1, seine fisheries are absent. However, west of the A3 area, is a spot with rather high seine fisheries intensity (Figure 4-11).

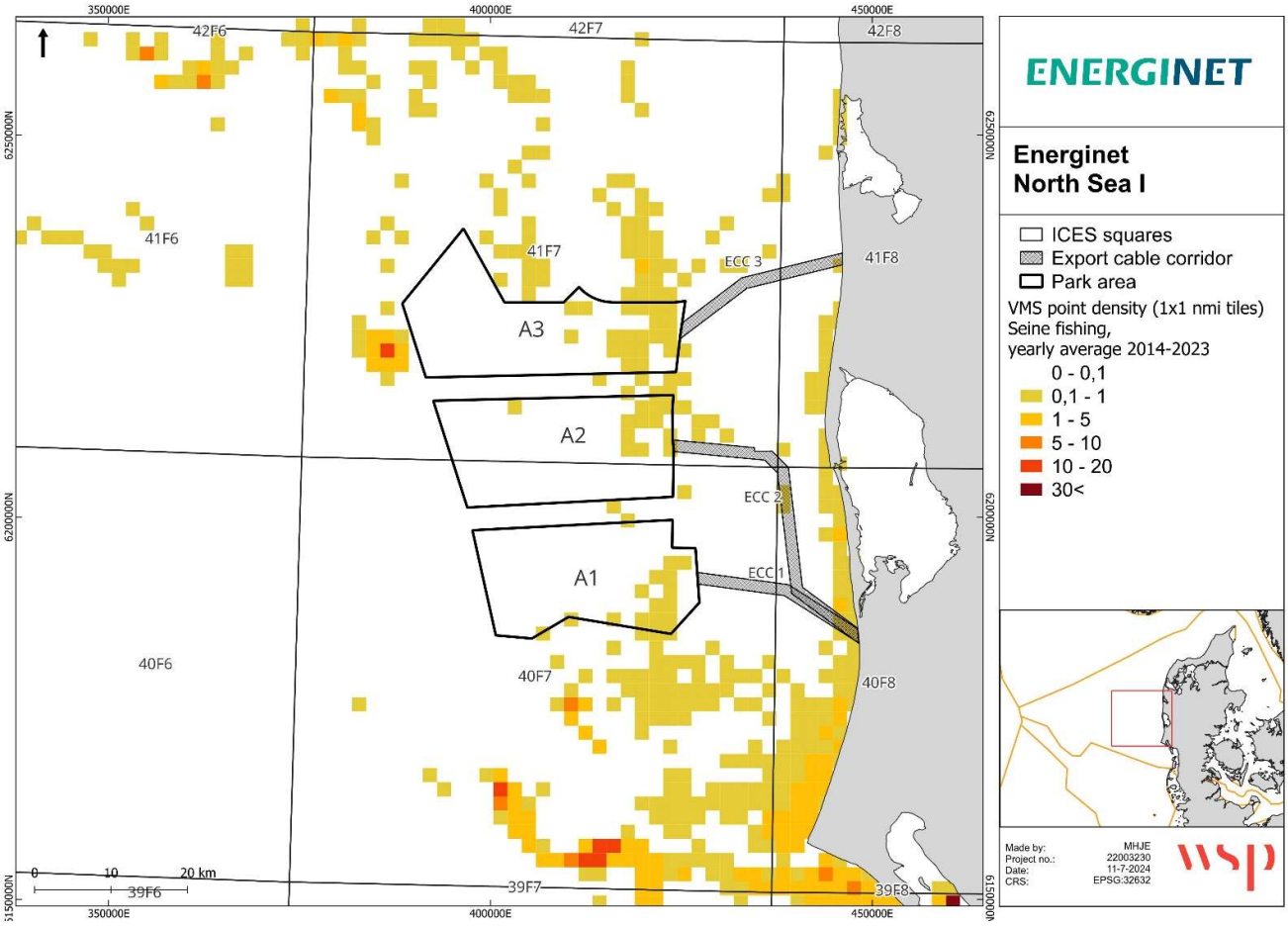

Figure 4-11. The distribution of fisheries with seine based on VMS data on a yearly average in the period 2014-2023. Source: (The Danish Fisheries Agency, 2024).

4.3.6 OTHER GEAR

Other gear is a combination of several types of fishing gear, including traps, hooks, lines, and mussel dredges. For the past 11 years (2014 to 2023), fishing by other gear from vessels of >12 m has occurred with very low and scattered frequency, mainly in the vicinity of the cable corridors, and with one registration within the gross area of NSI.1 (Figure 4-12).

Comparing 2014 and 2023, fishing by “Other gear” (VMS) has not occurred in or near the area of NSI.1, see Appendix 1 - Fishing intensity Danish .

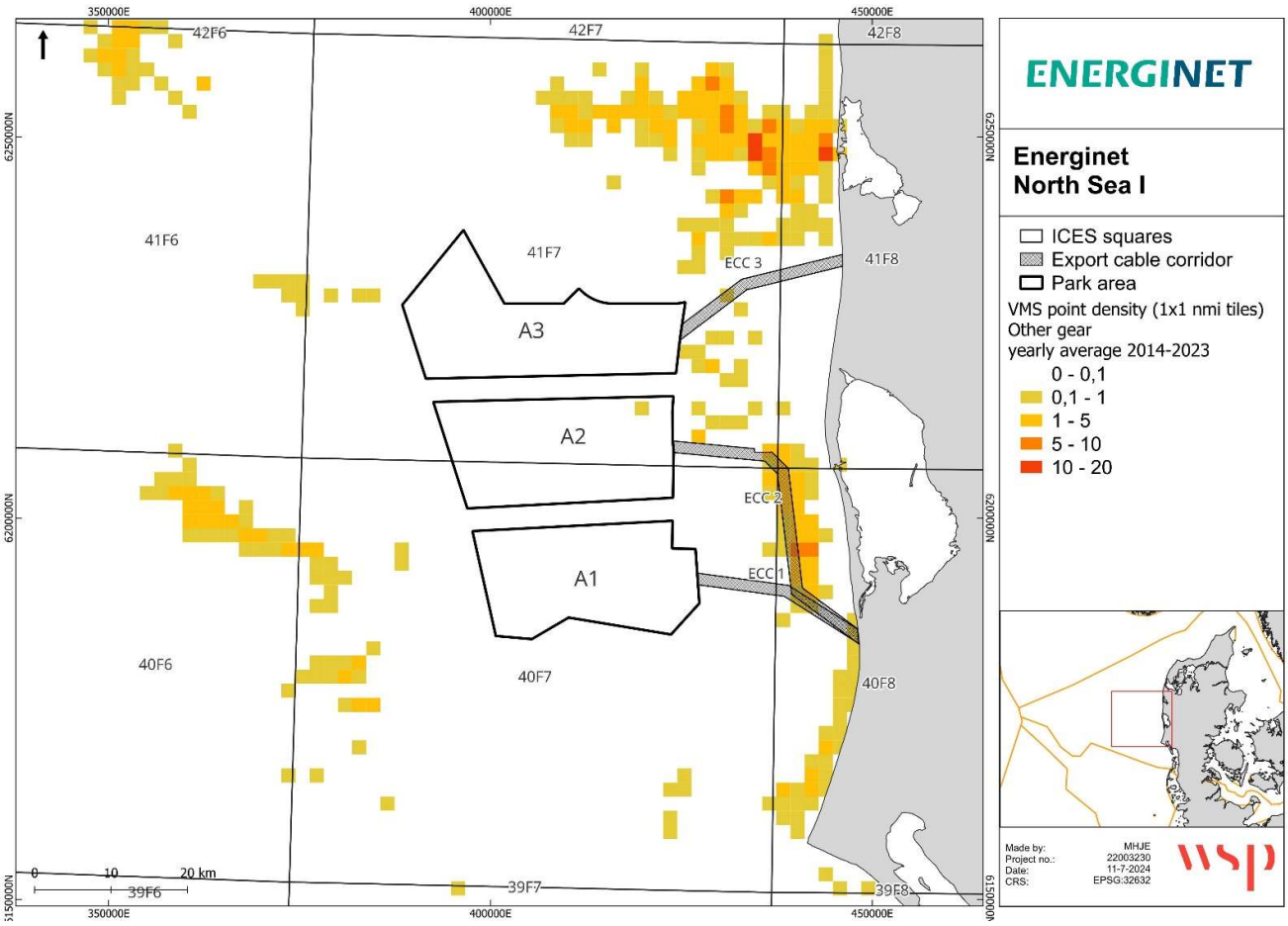

Figure 4-12. The distribution of fisheries with other gear based on VMS data on a yearly average in the period 2014-2023. Source: (The Danish Fisheries Agency, 2024)

4.4 ESTIMATED VALUE OF THE DANISH FISHERIES IN THE NSI.1

4.4.1 FISHING POINTS FOR VESSELS > 12 M

The importance of the NSI.1 for the commercial fisheries, can be illustrated when comparing the number of VMS-points inside NSI.1, relative to the number of points outside the area. Data is slightly biased, since commercial fishing vessels of less than 12 m are not included in the VMS-register and no recordings exist of the vessels' locations when fishing. However, due to the proximity of NSI.1 from land, only few fishing vessels smaller than 12 m in length can safely make the journey. All interviewed fishers had vessels of 20+ meters (see section 4.5 Interviews). This is supported by the landings and earnings of vessels for various vessel sizes illustrated in Table 4-7, showing that vessels < 12 m account for 1-2 % of the landings and earnings in ICES rectangle 40F7 and 10-13 % of the landings and earnings from ICES rectangle 41F7. Therefore, the smaller vessels contribute very little to the total landings, and earnings and can be disregarded here without it affecting the final results.

The total number of fishing points for ICES squares 40F7, 40F8, 41F7, and 41F8 was 316,973 for the period of 2014-2023 (Table 4-8). This is equivalent to a yearly average number of approximately 31,697 fishing points. Of these, only 3,149 fishing points were positioned inside the area of NSI.1 OWF on average per year, and 551 points in the NSI.1 ECC on average per year. Generally, the number of fishing points were highest in the beginning of the period and gradually decreased, which could potentially be explained by several factors, such as a general decrease in fishing vessels numbers, post-Brexit quota allocations and/or fish stocks presence. The number of fishing points were especially high in 2019. On a yearly average, 12 % of the fishing points analyzed here were located inside the NSI.1 OWF and ECC.

Table 4-8. The distribution of fishing points in ICES rectangles 40F7, 40F8, 41F7 and 41F8 and NSI.1 OWF and ECC for vessels > 12 m. Source: (The Danish Fisheries Agency, 2024).

Years	Fishing points in 40F7, 40F8, 41F7 and 41F8	Fishing points inside NSI.1 OWF	Fishing points inside NSI.1 ECC	Percentage fishing points inside NSI.1 OWF and ECC
2014	40,467	5,125	918	15 %
2015	36,748	4,336	833	14 %
2016	31,683	3,960	469	14 %
2017	30,939	2,216	405	8 %
2018	35,710	2,953	714	10 %
2019	25,012	3,549	474	16 %
2020	24,333	2,044	346	10 %
2021	28,970	2,285	467	9 %
2022	34,771	3,049	492	10 %
2023	28,340	1,969	387	8 %
Total	316,973	31,486	5,505	
Yearly average	31,697.3	3,149	551	12 %

4.4.2 AMOUNT AND VALUE OF CATCHES FOR VESSELS > 12 M

The total catch in the NSI.1 OWF and ECC is estimated to 17,050 tons in total over the 10 year-period from 2014-2023 (Table 4-9). This is based on total catches of 10,941 tons in the OWF and 6,109 tons in the ECC. The percentage of landings from the NSI.1 has fluctuated greatly over the 10-year period. The largest landings originating from the NSI.1 OWF and ECC were caught in 2014 (19 %) and in 2023 (20 %), while significantly lower catches were caught in e.g. 2017 (4 %) and 2018 (7 %).

The yearly average of landings originating from the NSI.1 was 11 % for 2014-2023. There is a tendency to higher percentages originating from the NSI.1 in 2022 and 2023, however, it is difficult to say, if it is a tendency, that will continue in the future. Based on the interviews with the pelagic fisheries organisation (DPPO), the NSI.1 may become increasingly important for the international pelagic fisheries in the future, due to Brexit and the closure of sand eel fishing grounds in British waters (please see section 4.5).

Table 4-9. The yearly landings in tons in ICES rectangles 40F7, 40F8, 41F7 and 41F8 and NSI.1 OWF and ECC areas for vessels > 12 m. Source: (The Danish Fisheries Agency, 2024).

Years	Landings in tons in 40F7, 40F8, 41F7 and 41F8	Landings in tons in NSI.1 OWF	Landings in tons in NSI.1 ECC	Landings in %
2014	29,309	4,522	957	19 %
2015	31,452	1,249	1,344	8 %
2016	9,826	1,160	384	16 %
2017	19,051	320	367	4 %
2018	20,303	787	585	7 %
2019	11,815	427	814	11 %
2020	11,800	539	588	10 %
2021	6,310	141	350	8 %
2022	9,413	1,066	339	15 %
2023	5,498	730	381	20 %
Total	154,777	10,941	6,109	
Yearly average	15,478	1,094	611	11 %

The total earnings from NSI.1 OWF and ECC is estimated to be 85,2 mil DKK for the 10-year period from 2014-2023 with 68 mil DKK from the OWF and 17,1 mil DKK from the ECC area (Table 4-10). The yearly average of earnings from the OWF was 6.8 mil DKK and 1.7 mil DKK from the ECC areas. Earnings have fluctuated between 9 % and 14 % over the years, with a yearly average of 12 % originating from the OWF and ECC areas. The higher fluctuations in landings in tons is not reflected in earnings. This may partly be explained by a shift in the relationship between industrial catches

and catches for human consumption, with a higher proportion of fish for human consumption being caught in the OWF and ECC area. As fish for consumption has a significantly higher marked price than industrial fish, lower landings are compensated for by catching fish of a higher quality with a higher value.

Table 4-10. The yearly earnings in DKK in ICES rectangles 40F7, 40F8, 41F7 and 41F8 and NSI.1 OWF and ECC areas for vessels > 12 m. Source: (The Danish Fisheries Agency, 2024).

Years	Earnings in DKK in 40F7, 40F8, 41F7 and 41F8	Earnings in DKK in NSI.1 OWF	Earnings in DKK in NSI.1 ECC	Earnings in %
2014	84,291,356	10,236,921	2,148,164	15 %
2015	91,864,755	10,262,245	2,779,614	14 %
2016	81,387,613	9,070,648	1,478,888	13 %
2017	87,564,209	6,351,885	1,187,834	9 %
2018	93,378,830	8,284,667	1,729,158	11 %
2019	48,191,063	4,418,820	2,023,785	13 %
2020	45,313,618	2,988,242	1,395,394	10 %
2021	48,350,818	4,215,941	1,190,378	11 %
2022	61,943,901	6,721,928	1,437,325	13 %
2023	51,294,375	5,482,921	1,767,107	14 %
Total	693,580,538	68,034,219	17,137,647	
Yearly average	69,358,054	6,803,422	1,713,765	12 %

Based on the landings and earnings from NSI.1 OWF and ECC, a kilo price is calculated in Table 4-11. Historically, the kilo price in OWF has varied greatly from 2.26 DKK/kg in 2014 to 29.91 DKK/kg in 2021. The low kilo price in the beginning of the 10-year period, indicates that a great deal of the catches originating from OWF were industrial landings or perhaps bivalves with a low marked price. In 2021, the landings most likely consisted of fish species with a very high marked price, such as sole and turbot.

In the ECC, the kilo price has been more or less the same for the 10-year period. The prices have varied from as little as 2.02 DKK/kg to 4.64 DKK/kg. The low prices indicate industrial landings.

Table 4-11. Kilo price in DKK/kg of the landings in NSI.1 OWF and ECC areas for 2014-2023. Source: (The Danish Fisheries Agency, 2024).

Years	Kilo price in NSI.1 OWF (DKK/kg)	Kilo price in NSI.1 ECC (DKK/kg)
2014	2.26	2.24
2015	8.22	2.07
2016	7.82	3.85
2017	19.82	3.24
2018	10.53	2.96
2019	10.35	2.49
2020	5.55	2.37
2021	29.91	3.40
2022	6.31	4.24
2023	7.51	4.64
Yearly average	6.22	2.81

4.4.3 FISHING GEAR FOR VESSESL > 12 M

The landings from the NSI.1 OWF and ECC areas from vessels > 12 m in length using various fishing gear, are mapped in Table 4-12. The bottom trawl dominated with regards to weight, with a yearly average of nearly 1,300 tons, constituting 76 % of the landings in the OWF and ECC areas. Pelagic trawl accounted for 14 %, with a yearly average of 241 tons, while gillnet and beam trawl made up 7 % (111 tons pr. year) and 3 % (55 tons pr. year), respectively. Landings were generally higher in 2014 and 2015, with approximately 5,500 tons and 2,600 tons per year for all gear types. For the rest of the 10-year period, landings ranged between 500 and 1,500 tons.

Table 4-12. The landings in tons for each fishing gear in NSI.1 OWF and ECC areas for vessels > 12 m. Source: (The Danish Fisheries Agency, 2024).

Year	Beam trawl	Bottom trawl	Gillnet	Pelagic trawl	Seine
2014	26	4,329	123	1,000	3
2015	108	1,931	259	292	2
2016	93	1,202	227	14	9
2017	30	423	157	78	
2018	32	924	176	241	
2019	118	821	40	262	
2020	30	867	49	180	
2021	33	360	43	55	
2022	45	1,101	29	230	
2023	37	998	12	63	
Total	552	12,956	1,114	2,414	14
Yearly average	55	1.296	111	241	1

With regards to value, bottom trawl represented the majority of the landings from the NSI.1 OWF and ECC areas, comprising 38 % or a yearly average of 3.225.999 DKK in the period from 2014-2019 (Table 4-13). The value of gillnet fishing was almost as high, accounting for 37 % of the total value, with a yearly average of 3.140.422 DKK. Beam trawl and pelagic trawl accounted for 1.426.096 (17 %) and 662.039 DKK (8 %), respectively. Seine accounted for less than 1 % of the earnings from the OWF and ECC areas.

The reason the large landings originating from bottom trawl are not reflected in the earnings is due to the very low kilo price (3 DKK/kg) from this gear. Sand eel and sprat, which are industrial fish with a very low market price, constitute the majority of the landings in bottom trawl. The price pr. kilo was highest for gillnets with an average of 35 DKK/kg, ranging from 18 DKK/kg to as high as 70 DKK/kg. The high earnings from gillnets can be attributed to the high-quality fish caught by this gear type, including species as sole, plaice, turbot, brill (*Scophthalmus rhombus*), cod, lumpsucker (*Cyclopterus lumpus*) and brown crab, which are all sold for human consumption.

The yearly average market kilo price in beam trawl is 30 DKK/kg. The majority of landings from the beam trawl fisheries consist of brown shrimp with an average kilo price of 41 DKK/kg. The brown shrimp is caught along the west coast of Jutland in long trawl hauls and is very popular in the German and Dutch market, but not quite as common on the Danish market.

Table 4-13. The landings in DKK for each fishing gear in NSI.1 OWF and ECC areas for vessels > 12 m. Source: (The Danish Fisheries Agency, 2024).

Year	Beam trawl	Bottom trawl	Gillnet	Pelagic trawl	Seine
2014	761,856	7,368,274	2,530,151	1,636,938	81,919
2015	1,459,363	4,191,847	6,819,012	309,426	55,831
2016	1,966,175	4,208,192	4,190,371	363,959	124,326
2017	1,278,179	1,202,911	4,948,623	315,723	0
2018	1,227,242	2,343,240	5,917,690	676,698	14,314
2019	2,519,969	2,386,518	1,004,629	359,898	0
2020	841,174	2,154,074	1,025,887	59,220	0
2021	1,156,808	1,486,327	2,411,759	258,122	0
2022	1,907,549	3,596,408	2,020,421	432,574	0
2023	1,142,642	3,322,204	535,678	2,207,831	0
Total	14,260,957	32,259,995	31,404,221	6,620,390	276,390
Yearly average	1,426,096	3,225,999	3,140,422	662,039	27,639

4.5 INTERVIEWS

Upon request to the DFPO, DPPO, and FSK fisheries organisations, fishers were interviewed. (Appendix 2 – Interviewed fishers). The interviewed fishers' homeports are Hvide Sande, Thyborøn and Hanstholm, and they all utilise NSI.1 for fishing. Their vessels vary in size from < 10 m for beam- and bottom trawlers, to > 40 m for the pelagic fisheries. The gear types utilized by the fishers are beam trawl, bottom trawl, pelagic and semi-pelagic trawl.

The beam trawlers catch brown shrimp from October to January - or as long as the market price for the species is high. The brown shrimp is bought by Dutch companies for further processing and retail. Brown shrimp is caught along the coast of Jutland in several kilometers long north-southwards trawl tracks. According to the interviewed fishers, approximately 25 beam trawlers fish for brown shrimp from Hvide Sande to Horns Rev. In 2023, 12 beam trawlers were registered (see Table 4-1), but due to decreasing landings and earnings, many fishers have modified their vessels to switch between gear types and target species. Consequently, not all vessels fishing with beam trawl were registered as such in the official register.

The fisheries for brown shrimp have been limited by the construction of other OWF north and south of the NSI.1, as trawling across the cables is prohibited (BEK 939, 1992). Therefore, it has become increasingly difficult to find areas for the long straight trawl hauls necessary for catching the brown shrimp in an economically sustainable way. The beam trawlers also speculate, whether the cable corridors of the OWFs on the west coast of Jutland have made a negative impact on the brown shrimp fisheries, which they are concerned may be caused by a change in behaviour of the shrimp due to e.g. electromagnetism in the sediment. According to the interviewed fishers, the catches of brown shrimp have decreased significantly after construction of the Horns Rev 1-3 OWF. The lowered catches of brown

shrimps have forced the beam trawlers to modify their vessels within the last 5-6 years, to alternate between beam trawl and bottom trawl, so they also can catch flatfish, with main focus on plaice. Some also convert to sand eel fisheries temporarily. Others again leave their home port for several months finding alternative fishing grounds near Hirtshals or inner Danish waters.

The bottom trawlers point out the entire NSI.1 as the main fishing ground for plaice in summertime from June to October (app. 80 % of the catch). The fishery for plaice also provides bycatch of other flatfish species including the high value species turbot and brill. The opening of the trawl is usually kept short in terms of height, to avoid catching cod, which is an expensive quota to rent. According to the interviewed fishers, approximately six bottom trawlers specifically utilize the NSI.1 area for plaice fisheries. There is a high degree of overlap between the shallow, sandy banks ideal for flatfish fisheries, and suitable areas for an offshore windfarm. The areas suitable for fishing is becoming increasingly scattered and divided by OWFs and cable corridors, forcing several fishing vessels to fish in the same location with a negative impact on the sediment. This forces the fish to migrate further west. The smaller fishing vessels (< 20 m) have limited engine power and cannot sail more than 25-30 nautical miles from shore, corresponding to the western part of the NSI.1. This means, that fishing vessels of < 20 m cannot sail further west in pursuit of alternative fishing grounds.

The interviewed fishers were asked to point out the areas, where the location of the turbines would cause least disturbance to their fisheries. The pelagic fisheries pointed toward the A2-park area, as the A1-park area overlaps with fisheries for sand eel (see section 3.7.2) and A3 overlaps with the fisheries for sprat. Usually, the fisheries for sand eel and sprat takes place in Dogger Bank, however, the pelagic fisheries state that it is expected that the NSI.1 will become increasingly important due to Brexit and the closure of sand eel fishing grounds at Dogger Bank by the British government. The Danish fishing fleet formerly caught a substantially percentage of the total sand eel fisheries in the North Sea. The pelagic fishers also point towards important fishing grounds west of the NSI.1, which may be in NSI.2 or in the sailing corridor between NSI.1 and NSI.2 (see Figure 2-1).

Since 2010-2013, the pelagic fishing fleet has been reduced substantially, and over the past five years, the fleet has been reduced to half. The reduction in fishing vessels is primarily due to the fact, that fishing quotas are spread over fewer, but larger vessels, and a gradual decrease in quotas in general. Earlier, mackerel was caught nearer to the west coast of Jutland, however, this species is now primarily caught much further west than the NSI.1.

5 FOREIGN FISHERIES

VMS and logbook data from foreign fisheries nations for 2019-2023 was retrieved from the Danish Fisheries Association (DFA). The VMS dataset include data from Belgium, Germany, Great Britain, Ireland, the Netherlands, Poland, Sweden, Finland, Spain, France, and Latvia fisheries. Logbook data include fishery data for Belgium, Germany, Great Britain, Ireland, the Netherlands, Poland, and Sweden. Most foreign fisheries nations have very little fisheries activity in the ICES squares 40F7, 40F8, 41F7 and 41F8. Therefore, only the four nations with the highest fishing intensity in and near NSI.1 were chosen for further analysis, namely Germany, Great Britain, the Netherlands and Poland.

In the following sections, the fisheries of these four foreign nations are analysed combined and, in more depth, based on logbook data, VMS data and a combination of the two, resulting in an economical estimation of the four countries' fisheries within the NSI.1.

5.1 FOREIGN FISHERIES IN THE NORTH SEA

Based on logbook data, the total landings for all foreign fisheries in ICES-rectangle 41F7, 41F8, 40F7, and 40F8 combined, amounted to 911.6 tons for 2019-2023 (Table 5-1), with a total value of 10.5 mil DKK, as evident by the logbook data. This yields a yearly average of 182.3 tons and 2.1 mil DKK. The total yearly amount (tons) of catches from foreign fisheries landed in Danish harbours has fluctuated, showing an overall decrease during the five-year period from 2019 to 2023, from 256.7 tons in 2019 to merely 20.2 tons in 2023. This is a substantial decrease of 92 % from 2019 to 2023. Correspondingly, the value of the landings has decreased considerably (with minor fluctuations) with 67 % from 2019 to 2023.

The value of the landings has varied a great deal over the years from as little as 4.8 DKK/kg in 2020 to 49 DKK/kg in 2023. The extremely low prices in 2020 may partly be caused by the Covid19 pandemic that caused the prices on fish to drop, due to lockdown in several nations. However, prices were also low in 2022, so it may also be a combination of quality and species caught, as invertebrates and fish for industrial purposes (sand eel, sprat etc.) usually has lower prices than e.g. larger fish species for human consumption (plaice, cod, sole etc.).

Table 5-1. Total yearly landings from Belgium, Germany, Great Britain, Ireland, Netherlands, Poland, and Sweden in ICES-rectangle 41F7, 41F8, 40F7 and 40F8 for 2019-2023, based on logbook data. Source: (The Danish Fisheries Agency, 2024).

Year	Landings (tons)	Value (DKK)
2019	256.7	2,989,174
2020	187.7	900,829
2021	280	4,326,338
2022	168	1,259,283
2023	20.2	989,432
Total	**911.6**	**10,465,055**

Based on the total landings, data retrieved from the Logbook provided by The Danish Fisheries Agency, Sweden was the foreign nation that caught the largest number of fish and invertebrates in the 41F7 area and accordingly landed in Danish harbours in the five-year period from 2019-2023(Figure 5-1).. Sweden was accountable for 37 % of the total landings, however when combining logbook and VMS data there is a mismatch making it uncertain that the landings were caught in the area. Germany landed 25 % and the Netherlands landed approximately 16 %. Belgium and Poland landed 8 % and 7 %, respectively.

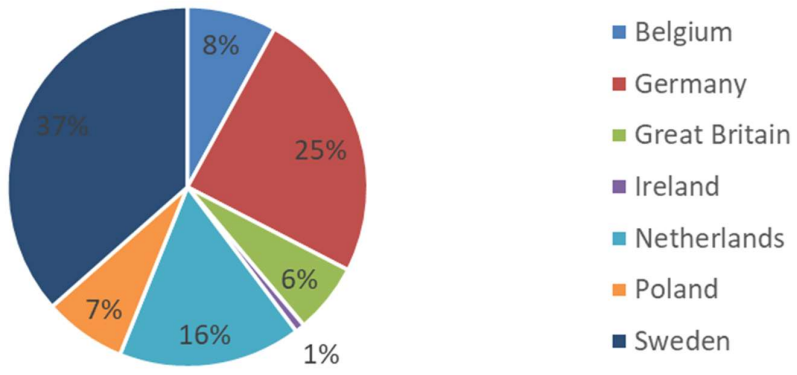

Figure 5-1. Landings from foreign fisheries based on weight from 2019-2023. Source: (The Danish Fisheries Agency, 2024)

With regards to earnings, Germany landed 32 % of the fish and invertebrates in Danish harbours caught by foreign nations in 40F7, 40F8, 41F7 and 41F8 from 2019-2023 (Figure 5-2). The Netherlands was accountable for 20 % of the total earnings, while Great Britain and Belgium each represented 17 % of the earning. Poland and Sweden represented 6 % of the earnings each, while Ireland only accounted for 2 %.

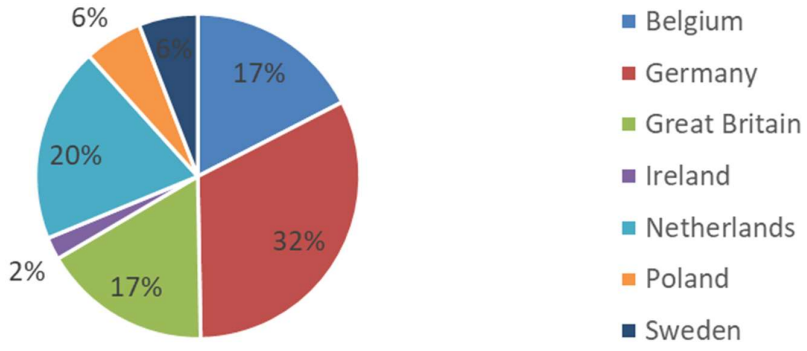

Figure 5-2. Landings from foreign fisheries based on value from 2019-2023. Source: (The Danish Fisheries Agency, 2024)

During the specified period, fishing using “Other gear” was the predominant method in the area. This is likely because foreign fishers did not adequately provide information on their fisheries activities to the Danish authorities. Net fisheries (gillnets) in the NSI.1 is absent in 2019-2022 and the amount (tons) of catches is low in 2023 as well. This tendency correlates with the fact that nets are usually deployed from smaller boats (vessel <12 m of length) in coastal areas. Additionally, due to small motor sizes, smaller vessels do seldom fish abroad. A large decrease in the amount (tons) of landings from beam trawling, and by “Other gear” occurred from 2019 to 2020, which may be related to the Covid-19 pandemic, as global fish prized dropped significantly due to international lockdowns (Table 5-2).

Table 5-2. Catches in tons from foreign fisheries landed in Danish harbours. Source: (The Danish Fisheries Agency, 2024)

	2019	2020	2021	2022	2023	Total
Beam trawl	65.9	1.4	3.5	11.4	17.1	99.3
Bottom trawl		167.5	3.1	1.6		172.2
Gillnets					3.1	3.1
Pelagic trawl	5.9	15.4		0.5		21.9
Seine	5.5		4.6	3.4		13.6
Other gear	178.3	3.3	268.7	151		601.4
Total	255.7	187.7	280	168	20.2	911.6

The value of catches using different fishing gears in the period, also show that fishing by "Other gear" yielded the highest catch values for the period, followed by beam trawl, and pelagic trawl (Table 5-3). Landings from other gear amounted to nearly 6 mil DKK, which is more than half of the total earnings for the foreign fisheries. Beam trawl earned app. 3 mil DKK for the five-year period. Bottom trawl and pelagic trawl each earned app. 0.5 mil DKK and gillnets and seine app. 0.2 mil DKK.

Table 5-3. Catches in DKK from foreign fisheries landed in Danish harbours. Source: (The Danish Fisheries Agency, 2024)

	2019	2020	2021	2022	2023	Total
Beam trawl	1,488,495	46,319	98,971	572,082	780,675	2,986,543
Bottom trawl		398,651	71,447	45,702		515,799
Gillnets					208,756	208,756
Pelagic trawl	153,905	347,193		15,831		516,929
Seine	122,146		82,677	49,761		254,585
Other gear	1,224,627	108,666	4,073,243	575,907		5,982,442
Total	2,989,174	900,829	4,326,338	1,259,283	989,431	10,465,055

Data on catches from foreign fisheries for the ten most dominating species (based on landing weight), show that trough shells (*Mactridae*) is the dominant species, followed by species of crabs (unspecified), brown crab and sand eel sp. However, catches of trough shells are fluctuating a lot within the period, which also applies for catches of crabs and sand eel, with the latter only registered landed in 2020. Moreover, catches of European plaice have decreased steadily in the period, from 56.6 tons in 2019 to 2.9 tons by 2023, while the tendency for dab, turbot, and cod is rather stable and low (Table 5-4).

Table 5-4. Catches from foreign fisheries for the ten most dominating species based on weight (tons). Source: (The Danish Fisheries Agency, 2024).

	2019	2020	2021	2022	2023	Total
Trough shell	0.0	0.0	120.0	143.0	0.0	263.0
Crabs	162.6	0.0	13.8	0.0	0.0	176.3
Brown crab	18.7	3.8	134.1	8.0	1.0	165.6
Sand eel sp.	0.0	165.0	0.0	0.0	0.0	165.0
European plaice	56.6	13.5	6.2	3.2	2.9	82.4
Common shrimp	0.0	1.4	0.1	10.4	12.3	24.2
Dab	4.4	0.7	1.4	1.4	0.0	7.9
Turbot	3.3	1.7	0.5	0.1	0.1	5.6
Cod	3.0	0.1	0.0	0.0	0.8	3.9

Data on catches from foreign fisheries for the ten most dominating species (based on estimated value DKK), show that the species of the highest value in this period is brown crab, followed by European plaice, common shrimp, and other species of crabs. The catch values fluctuate for a variety of the species within in the period including cod, which also underwent a drastic decline from 2019 to 2020, which may have to do with the Covid-19 pandemic. This also applies for common shrimp, and common sole, while the value of landings for European plaice and turbot has been steadily declining(Table 5-5).

Table 5-5. Catches from foreign fisheries for the ten most dominating species based on estimated value (DKK). Source: (The Danish Fisheries Agency, 2024).

	2019	2020	2021	2022	2023	Total
Brown crab	372,127	123,750	3,417,721	333,318	27,190	4,274,106
European plaice	1,095,940	225,445	116,460	78,566	70,531	1,586,943
Common shrimp		46,319	2,334	549,070	622,912	1,220,635
Crabs	910,173		170,296			1,080,470
Trough shell			315,000	242,963		557,963
Turbot	259,038	111,094	39,806	9,291	8,319	427,548
Sand eel sp.		346,579				346,579
Common sole	69,276	4,095	14,961	1,006	162,071	251,408
European lobster			170,710			170,710
Cod	83,036	3,490	1,226	304	26,837	114,893
Total	2,789,589	860,772	4,248,515	1,214,519	917,860	10,031,255

5.2 GERMAN FISHERIES

5.2.1 FISHERIES IN THE NORTH SEA

The total landings for the German fisheries in ICES-rectangle 41F7, 41F8, 40F7 and 40F8 (Table 5-6) amounted to 3.14 tons with a yearly average of 0.6 tons (The Danish Fisheries Agency, 2024) in the period of 2019-2023. The total value landed for the nation in the area within the period was 208,756 DKK, with a yearly average value of 41.8 DKK and an average kilo price of 66.5 DKK (The Danish Fisheries Agency, 2024).

According to the dataset, the German fishers only landed catches in Danish harbours during 2023 and only from the rectangle 41F7, and therefore data on further landings and catches from the German fisheries in the ICES-rectangles is not available for the remaining years (The Danish Fisheries Agency, 2024). However, as it appears from the fishing intensity maps (Figure 5-3 in section 5.2.3) displaying the fishing intensity within the current ICES rectangle, that fisheries from German vessel occurs within the entire area. Thus, the amount (tons) and value (DKK) of the German catches is doubtlessly considerably higher than what appears from the data (Table 5-6), and by other gear types than gill nets (The Danish Fisheries Agency, 2024). E.g. it is well established that German trawlers catch brown shrimp along the west coast of Jutland (Kristensen & Wellendorph, 1995).

Table 5-6. Total yearly landings from Germany in ICES-rectangle 41F7, 41F8, 40F7 and 40F8 for 2019-2023. Source: (The Danish Fisheries Agency, 2024). Please note that the table covers all four ICES rectangles, however, the landings from the German vessels occurred only for the ICES 41F7 in 2023.

Year	Landings (tons)	Value (DKK)
2019	-	-
2020	-	-
2021	-	-
2022	-	-
2023	3.14	208,756
Total	3.14	208,756

5.2.2 GEAR TYPE AND SPECIES

According to the logbook data, all German landings from 40F7, 40F8, 41F7 and 41F8 were caught in gillnets (Table 5-7). In 2023, a total of 3.1 tons was landed from the area, with an estimated value of 208,756 DKK. The catches were comprised of primarily flatfish, including plaice and sole, in addition to brown crab (Table 5-8). The catches were fairly even distributed, with approximately 1 ton of each species. However, with regards to value, sole was by far the most valuable species caught by the German fisheries in the area. Earnings from plaice and brown crab was approximately 25,000 DKK with a kilo price of 25 DKK/kg, while sole had a kilo price of 158 DKK/kg, earning the German fishers 158,277 DKK.

Table 5-7. Catches in tons and DKK from German fisheries landed in Danish harbours. Source: (The Danish Fisheries Agency, 2024).

Gear type	Landings in tons in 2023	Landings in DKK in 2023
Gillnets	3.1	208,756

Table 5-8. Catches from German fishing vessels for the dominating species based on amount (tons) and estimated value (DKK). Source: (The Danish Fisheries Agency, 2024).

Species	Landings in tons	Landings in DKK
Plaice	1	25,198
Brown crab	0.9	25,280
Common sole	1.2	158,277

5.2.3 FISHING INTENSITY

The fishing intensity for vessels > 12 m inside the NSI.1 was mapped using a heatmap (Figure 5-3). The map illustrates the main fishing grounds in and around the NSI.1 for the German fisheries.

For the past five years, the fishing grounds for the German commercial fisheries in and near NSI.1, show fisheries activity (yearly average) ranging from none/low to moderate intensities. The fisheries are most intense in A3 and gradually decreasing southward, being low or absent, especially in the eastern part of the A1 subarea.

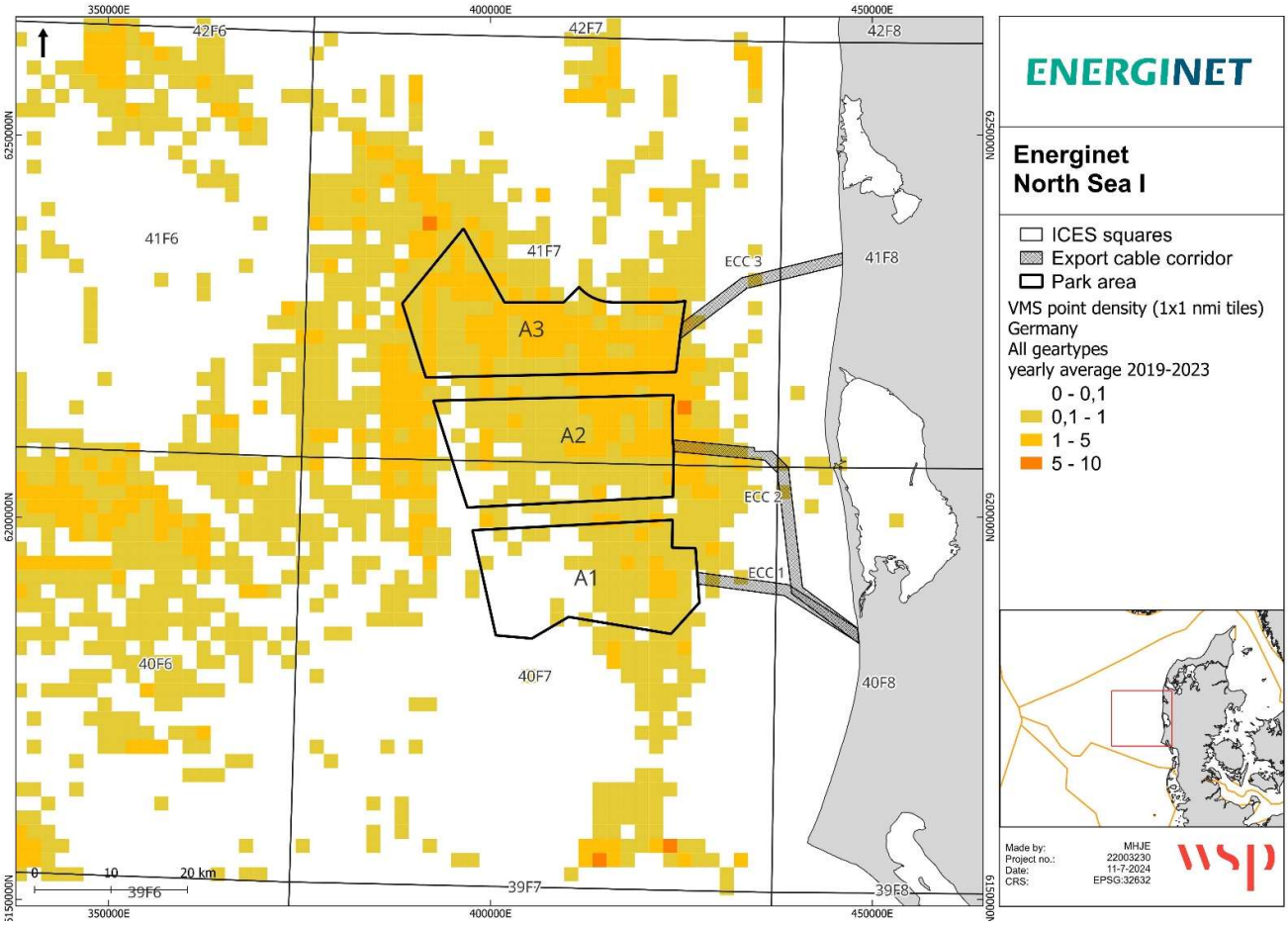

Figure 5-3. The distribution of fishing grounds for the German commercial fisheries in and near the NSI.1. The map is based on a yearly average of VMS data from 2019-2023. Source: (The Danish Fisheries Agency, 2024).

5.2.4 ESTIMATED VALUE OF THE GERMAN FISHERIES IN THE NSI.1

FISHING POINTS

There is a relatively low correlation between VMS and logbook data for the German fisheries. Although the intensity maps show that German fishing vessels have fished in Danish waters in most years, there is only logbook data for 2023. Therefore, there is a large mismatch between the number of fishing points (based on VMS) and the logbook data, that shows the catches landed in Danish harbors.

Between 2019 and 2023, German fishing activity in ICES squares 40F7, 40F8, 41F7, and 41F8 involved a total of 76 fishing points with recorded catch data (Table 5-9). Notably, all these data points occurred in 2023. Among them, only 4 were located in NSI.1 OWF and none in the ECC areas. This represents approximately 5 % of the overall fishing intensity. However, as shown in Figure 5-3 heat maps, German fishing activity extended beyond these 76 points, indicating a broader fishing intensity across the specified period, from where we have data for the foreign fisheries. It is possible that the German fishers – with their close proximity to home ports (Hamburg and Bremerhaven) have landed the catches in German harbors. The landings include brown shrimp, which is popular in Germany and caught near the coastline of the west coast of the Netherlands, Germany and Denmark.

Table 5-9. The distribution of German fishing points with catch data in ICES rectangles 40F7, 40F8, 41F7 and 41F8 and NSI.1 and ECC for vessels > 12 m. Source: (The Danish Fisheries Agency, 2024).

Years	Fishing points in 40F7, 40F8, 41F7 and 41F8	Fishing points inside NSI.1 OWF	Fishing points inside NSI.1 ECC	Percentage fishing points inside NSI.1 OWF and ECC
2019	-	-	-	-
2020	-	-	-	-
2021	-	-	-	-
2022	-	-	-	-
2023	76	4		5 %
Total	76	4	-	5 %
Yearly average	12.7	0.7		

AMOUNT AND VALUE

The total German catch landed in Danish ports that can be traced back to NSI.1 OWF and ECC is estimated to be 0.1 tons in total over the 5 years period from 2019-2023 (Table 5-10). This is again based on landings and fishing points from 2023. Based on these data, the landings originating from the OWF and ECC amounts to less than 1 % of the landings from the four ICES rectangles 40F7, 40F8, 41F7 and 41F8. However, as stated above, the German fishing intensity and landings is known to be substantially larger than estimated here, but these are the only catch data that can be traced back to specific fishing points for the German fishing fleet.

Table 5-10. The yearly German landings in tons landed in Danish ports from ICES rectangles 40F7, 40F8, 41F7 and 41F8 and NSI.1 OWF and ECC for vessels > 12 m. Source: (The Danish Fisheries Agency, 2024).

Years	Landings in tons in 40F7, 40F8, 41F7 and 41F8	Landings in tons in NSI.1 OWF	Landings in tons in NSI.1 ECC	Landings in %
2019	-	-	-	-
2020	-	-	-	-
2021	-	-	-	-
2022	-	-	-	-
2023	3,140	0.1	-	0 %
Total	3,140	0.1	-	0 %
Yearly average	628	0.0		

The total earnings from NSI.1 OWF and ECC based on fishing points with attached catch data, is estimated to be 4,895 DKK for the 5-year period from 2019-2023 (Table 5-11), again with 2023 being the only year with landing registrations. According to this data, merely 2 % of the German earnings originated from the OWF and the ECC areas.

Table 5-11. The yearly German landings in DKK landed in Danish ports from ICES rectangles 40F7, 40F8, 41F7 and 41F8 and NSI.1 OWF and ECC for vessels > 12 m. Source: (The Danish Fisheries Agency, 2024).

Years	Landing in DKK in 40F7, 40F8, 41F7 and 41F8	Landings in DKK in NSI.1 OWF	Landings in DKK in NSI.1 ECC	Landings in %
2019	-	-	-	-
2020	-	-	-	-
2021	-	-	-	-
2022	-	-	-	-
2023	208,756	4,895	-	2 %
Total	208,756	4,895	-	2 %
Yearly average	41,751.2	979		

5.3 BRITISH FISHERIES

5.3.1 FISHERIES IN THE NORTH SEA

The total landings for the British fisheries in ICES-rectangle 41F7, 41F8, 40F7 and 40F8 (Table 5-12) amounted to 154.1 tons with a yearly average of 30.8 tons (The Danish Fisheries Agency, 2024) in the period of 2019-2023. The total value landed for the nation in the area within the period was 4.011,07 mil. DKK, with a yearly average value of 802,213 DKK and an average kilo price ranging from 20 to 33 DKK (The Danish Fisheries Agency, 2024). From 2019 to 2021, large increases have occurred in the yearly total landing and value; 854 % and 1141 %, respectively. Data on yearly British fisheries landings is available for 2019, 2020, and 2021.

Table 5-12. Total yearly landings from Great Britain in ICES-rectangle 41F7, 41F8, 40F7 and 40F8 for 2019-2023. Source: (The Danish Fisheries Agency, 2024).

Year	Landings (tons)	Value (DKK)
2019	15.8	314,454
2020	3.3	108,666
2021	135	3,587,946
2022	-	-
2023	-	-
Total	**154.1**	**4,011,066**

5.3.2 GEAR TYPE AND SPECIES

All British landings were caught with "other gear" according to the Danish logbook. This is probably because of erroneous logging of data into a less familiar system for the British fishers (Table 5-13 and Table 5-14).

Table 5-13. The catches from the British fisheries in tons from ICES rectangles 40F7, 40F8, 41F7 and 41F8 landed in Danish harbours. Source: (The Danish Fisheries Agency, 2024)

	2019	2020	2021	2022	2023	Total
Other gear	15.8	3.4	135.0			154.1

Table 5-14. The value of catches from the British fisheries in DKK from ICES rectangles 40F7, 40F8, 41F7 and 41F8 landed in Danish harbours. Source: (The Danish Fisheries Agency, 2024)

	2019	2020	2021	2022	2023	Total
Other gear	314,454	108,666	3,587,946			4,011,066

The species caught in greatest numbers in the British fisheries were brown crab, which made up the majority of the catches (153 tons), while European lobster only accounted for the last approximately 1 ton (Table 5-15). The brown crab earned the British fishers 3.8 mil DKK in 2019-2021, while European lobster only earned them 170,710 DKK (Table 5-16). That gives a kilo price of 25 DKK/kg for the Brown crab and 190 DKK/kg for the lobster.

Table 5-15. Catches from the British fisheries for the most dominating species based on weight (tons). Source: (The Danish Fisheries Agency, 2024).

	2019	2020	2021	2022	2023	Total
Brown crab	15.8	3.3	134.1			153.2
European lobster			0.9			0.9
Total	15.8	3.3	135			154.1

Table 5-16. Catches from the British fisheries for the most dominating species based on value (DKK). Source: (The Danish Fisheries Agency, 2024).

	2019	2020	2021	2022	2023	Total
European lobster			170,710			170,710
Brown crab	314,454	108,666	3,417,237			3,840,357
Total	314,454	108,666	3,587,946			4,011,066

5.3.3 FISHING INTENSITY

The fishing intensity for vessels > 12 m inside the NSI.1 was mapped using a heatmap (Figure 5-4). The map illustrates the main fishing grounds in and around the NSI.1 for the British fisheries.

For the past five years, the fishing grounds for the British commercial fisheries in and near NSI.1, show fisheries activity (yearly average) ranging from low-moderate to moderate-high intensity within the entire area. The intensity is highest

in the western part of the A2 area (Figure 5-4) and north of the A3 area, whereas the activity is somewhat scattered and low-moderate near the export cable routes.

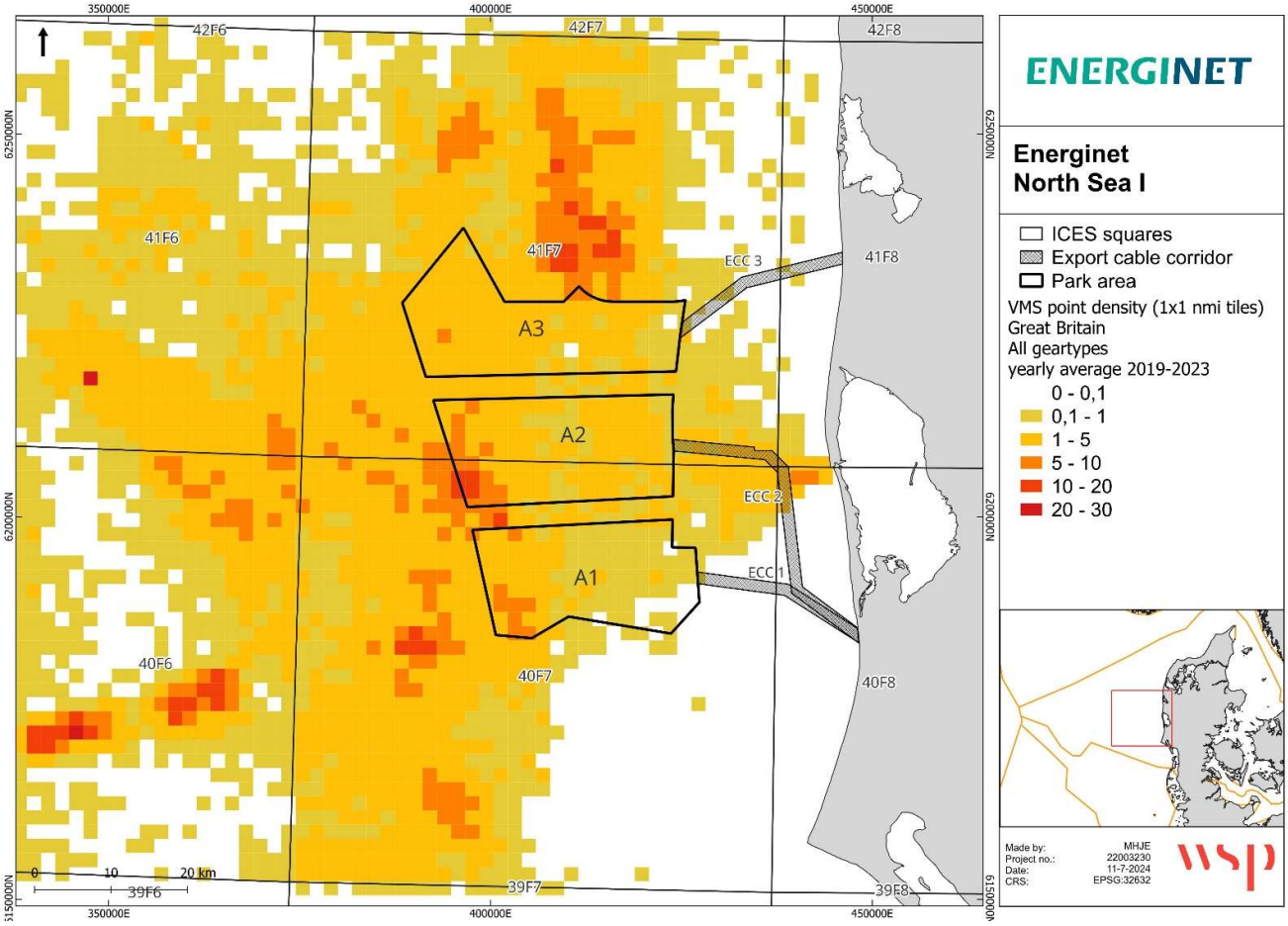

Figure 5-4. The distribution of fishing grounds for the British commercial fisheries in and near NSI.1. The map is based on a yearly average of VMS data from 2019-2023. Source: (The Danish Fisheries Agency, 2024).

5.3.4 ESTIMATED VALUE OF THE BRITISH FISHERIES IN THE NSI.1

FISHING POINTS

The total number of British fishing points with catch data attached for ICES squares 40F7, 40F8, 41F7 and 41F8, was 727 for the period of 2019-2023 (Table 5-17). Fishing points with catch data attached are available from 2020 and 2021. However, only 80 fishing points were positioned inside the NSI.1 OWF and one point in the ECC. This was equivalent to a yearly average of the fishing points inside the NS.1 OWF and ECC areas of 2 % with the highest percentage occurring in 2021 with 11 %.

Table 5-17. The distribution of Britain fishing points with catch data in ICES rectangles 40F7, 40F8, 41F7 and 41F8 and NSI.1 and ECC for vessels > 12 m. Source: (The Danish Fisheries Agency, 2024).

Years	Fishing points in 40F7, 40F8, 41F7 and 41F8	Fishing points inside NSI.1 OWF	Fishing points inside NSI.1 ECC	Percentage fishing points inside NSI.1 OWF and ECC
2019	-	-	-	-
2020	5	-	-	-
2021	722	80	1	11 %
2022	-	-	-	-
2023	-	-	-	-
Total	727	80	1	11 %
Yearly average	145.4	16.0	0.2	2 %

AMOUNTS AND VALUE

The total British catch landed in Danish ports that can be traced back to the NSI.1 OWF and ECC, is estimated to be 12.1 tons in total over the 5-year period from 2019-2023 (Table 5-18). Based on these data, the yearly average landings originating from the OWF and ECC, amounts to 3 % of the landings from the four ICES rectangles 40F7, 40F8, 41F7, and 41F8. However, as stated above, the British fisheries have landed approximately 154 tons in total over the five-year period, but due to the poor correlation between VMS and logbook data, the rest of the catches cannot be traced back to a location.

Table 5-18. The yearly British landings in tons landed in Danish ports from ICES rectangles 40F7, 40F8, 41F7 and 41F8 and NSI.1 OWF and ECC for vessels > 12 m. Source: (The Danish Fisheries Agency, 2024).

Years	Landings in tons in 40F7, 40F8, 41F7 and 41F8	Landings in tons in NSI.1 OWF	Landings in tons in NSI.1 ECC	Landings in %
2019	-	-	-	-
2020	2.0	-	-	-
2021	74.8	12	0.124	16 %
2022	-	-	-	-
2023	-	-	-	-
Total	76.8	12.0	0.124	
Yearly average	15.4	2.4	0	3 %

The total earnings from NSI.1 OWF and ECC based on fishing points with attached catch data, is estimated to be 2 mil DKK for the 5-year period from 2019-2023 (Table 5-19). However, this only accounts for half of what was calculated in section 5.3.1. Logbook data and VMS data is combined by matching an anonymized vessel ID, date and time. However,

if e.g. the logbook shows landings from a fishing trip without matching VMS positions, then that trip cannot be accounted for here in this analysis and vice versa. The logbook is based on what the fishers write, while the VMS data is automatically generated. A certain degree of mismatch between logbook data and VMS data is common in these datasets, and in this case only half of the landings could be accounted for with matching VMS positions, which is a relatively high degree of mismatch.

Table 5-19. The yearly British landings in DKK landed in Danish ports from ICES rectangles 40F7, 40F8, 41F7 and 41F8 and NSI.1 OWF and ECC for vessels > 12 m. Source: (The Danish Fisheries Agency, 2024).

Years	Landing in DKK in 40F7, 40F8, 41F7 and 41F8	Landings in DKK in NSI.1 OWF	Landings in DKK in NSI.1 ECC	Landings in %
2019	-	-	-	-
2020	63,253	-	-	-
2021	1,977,696	308,385	3,469	16%
2022	-	-	-	-
2023	-	-	-	-
Total	2,040,950	308,385	3,469	15%
Yearly average	408,190	61,677	694	3%

5.4 DUTCH FISHERIES

5.4.1 FISHERIES IN THE NORTH SEA

The total landings for the Dutch fisheries in ICES-rectangle 41F7, 41F8, 40F7 and 40F8 (Table 5-2020) amounted to 911.6 tons with a yearly average of 182.3 tons (The Danish Fisheries Agency, 2024) in the period of 2019-2023. The total value landed for the nation in the area within this period was 10.465,06 mil DKK, with a yearly average value of 2.093,01 mil and an average kilo price ranging from 4,8 to 48,97 DKK (The Danish Fisheries Agency, 2024). From 2019 to 2013, decreases occurred in the yearly total landing and value; 92 % and 67 % respectively (The Danish Fisheries Agency, 2024).

Table 5-20. Total yearly landings from The Netherlands in ICES-rectangle 41F7, 41F8, 40F7 and 40F8 for 2019-2023. Source: (The Danish Fisheries Agency, 2024)

Year	Landings (tons)	Value (DKK)
2019	255.7	2,989,174
2020	187.7	900,829
2021	280.0	4,326,338
2022	168.0	1,259,283
2023	20.2	989,432
Total	**911.6**	**10,465,055**

5.4.2 GEAR TYPE AND SPECIES

The Dutch fisheries is registered using beam trawl, bottom trawl, pelagic trawl, seine and other gear, meaning that the only gear category they did not use, was gillnets. However, other gear was the dominant gear type, which may cover gillnets, if the Dutch fishermen did not manage to register the proper information. In 2021 and 2022, only catches using "other gear" were registered. In total, 263 tons was caught with "other gear", which is the equivalent of 69 % of the total landings (Table 5-21). Beam trawl was the second most used gear type landing approximately 78 tons (20 %) of fish or invertebrates, while pelagic trawl and seine landed nearly 22 tons (6 %) and 13.6 tons (4 %), respectively. Bottom trawl had the lowest catches in the analysed period with merely 7.2 tons (2 %).

Table 5-21. Catches from the Dutch fisheries in tons from ICES rectangles 40F7, 40F8, 41F7 and 41F8 landed in Danish harbours. Source: (The Danish Fisheries Agency, 2024)

	2019	2020	2021	2022	2023	Total
Beam trawl	49.5	1.4	3.5	11.4	12.3	78.2
Bottom trawl		2.5	3.1	1.6		7.2
Pelagic trawl	6	15.4		0.6		21.9
Seine	5.5		4.6	3.4		13.6
Other gear			120	143		263
Total	61	19.3	131.2	160	12.3	383.8

Although "other gear" had by far the largest catch in terms of weight, this is not reflected in the value of the catches. While other gear accounted for 69% of the total weight, it only accounted for 14 % of the value, or 557,963 DKK (Table 5-22). Beam trawl, on the other hand, represented 62 % of the earnings for the Dutch fisheries, with nearly 2.5 mil DKK in earnings from this gear type. Pelagic trawl earned 516,929 DKK (13 %), while seine and bottom trawl earned 254,585 DKK (6 %) and 169,220 DKK (4 %).

Table 5-22. Catches from the Dutch fisheries in DKK from ICES rectangles 40F7, 40F8, 41F7 and 41F8 landed in Danish harbours. Source: (The Danish Fisheries Agency, 2024)

	2019	2020	2021	2022	2023	Total
Beam trawl	1,135,040	46,319	98,971	572,082	622,912	2,475,325
Bottom trawl		52,072	71,447	45,702		169,220
Pelagic trawl	153,905	347,193		15,831		516,929
Seine	122,147		82,677	49,761		254,585
Other gear			315,000	242,963		557,963
Total	1,411,092	445,584	568,095	926,340	622,912	3,974,022

For catches caught by Dutch fishers in ICES rectangles 40F7, 40F8, 41F7 and 41F8 and landed in Danish harbours, the dominating species in terms of weight were trough shells, which amounted to 263 tons caught in 2021 and 2022 (Table 5-23). This is exactly the same amount that was caught in other gear, and looking at the value of the trough shells, the value of them corresponds very well with what was caught in other gear (557,963 DKK) (Table 5-24). Therefore, it is fairly possible, that other gear represents a variation of mussel dredges, that is used to catch the trough shells.

Similarly, the earnings from beam trawl correspond to the earnings based on common shrimp and plaice. Beam trawl is used for shrimp fisheries, however, it might not be all plaice only that is caught in this gear type, but bycatches of several flatfish species is likely. A total of nearly 68 tons of plaice was caught by the Dutch fishers, earning nearly 1,3 mil DKK. Common shrimp amounted to 24 tons, earning 1.2 mil DKK. A number of other flatfish species (dab, turbot and brill) along with tub gurnard (*Chelidonichthys lucerne)*, cod, haddock and brown crab was caught in lower numbers (Table 5-23). Apart from turbot that had a high kilo price (approx. 75 DKK/kg), earning 381,777 DKK, the rest of the species earned less than 100,000 DKK per species.

Table 5-23. Catches from the Dutch fisheries for the ten most dominating species based on weight (tons). Source: (The Danish Fisheries Agency, 2024).

	2019	2020	2021	2022	2023	Total
Trough shell			120	143.0		263.0
European plaice	45.1	13.5	6.2	3.2		67.9
Common shrimp	0.0	1.4	0.1	10.4	12.3	24.2
Dab	2.0	0.7	1.4	1.4		5.5
Turbot	2.8	1.7	0.5	0.1		5.1
Tub gurnard	0.4	0.3	1.9	0.8		3.5
Brown crab	2.9	0.5	0.0	0.0		3.4
Cod	2.8	0.1	0.0	0.0		2.9
Haddock	2.4	0.1		0.0		2.5
Brill	0.8	0.5	0.2	0.0		1.5
Total	59.2	18.8	130.2	159.0	12.3	379.5

Table 5-24. Catches from the Dutch fisheries for the ten most dominating species based on value (DKK). Source: (The Danish Fisheries Agency, 2024).

	2019	2020	2021	2022	2023	Total
European plaice	872,182	225,445	116,460	78,566		1,292,653
Common shrimp		46,319	2,334	549,070	622,912	1,220,635
Trough shell			315,000	242,963		557,963
Turbot	221,586	111,094	39,806	9,291		381,777
Common sole	65,123	4,095	14,961	1,006		85,185
Cod	76,415	3,490	1,226	304		81,435
Brown crab	57,673	15,084	484	375		73,615
Brill	40,789	19,592	9,940	2,509		72,830
Tub gurnard	5,447	4,166	37,656	20,317		67,586
Dab	18,571	4,769	14,145	15,808		53,294
Total	1,357,786	434,053	552,013	920,211	622,912	3,886,974

5.4.3 FISHING INTENSITY

The fishing intensity for vessels > 12 m inside the NSI.1 was mapped using a heatmap (Figure 5-5). The map illustrates the main fishing grounds in and around the NSI.1 for the Dutch fisheries.

For the past five years, the fishing grounds for the Dutch commercial fisheries in and near NSI.1, show fisheries activity (yearly average) ranging from none to moderate-high in few areas. The fisheries activity is mostly low to moderate within the entire area. In the eastern parts of A1 and A2, there are areas with no or very little activity, whereas the activity is scattered and very low near the export cable routes.

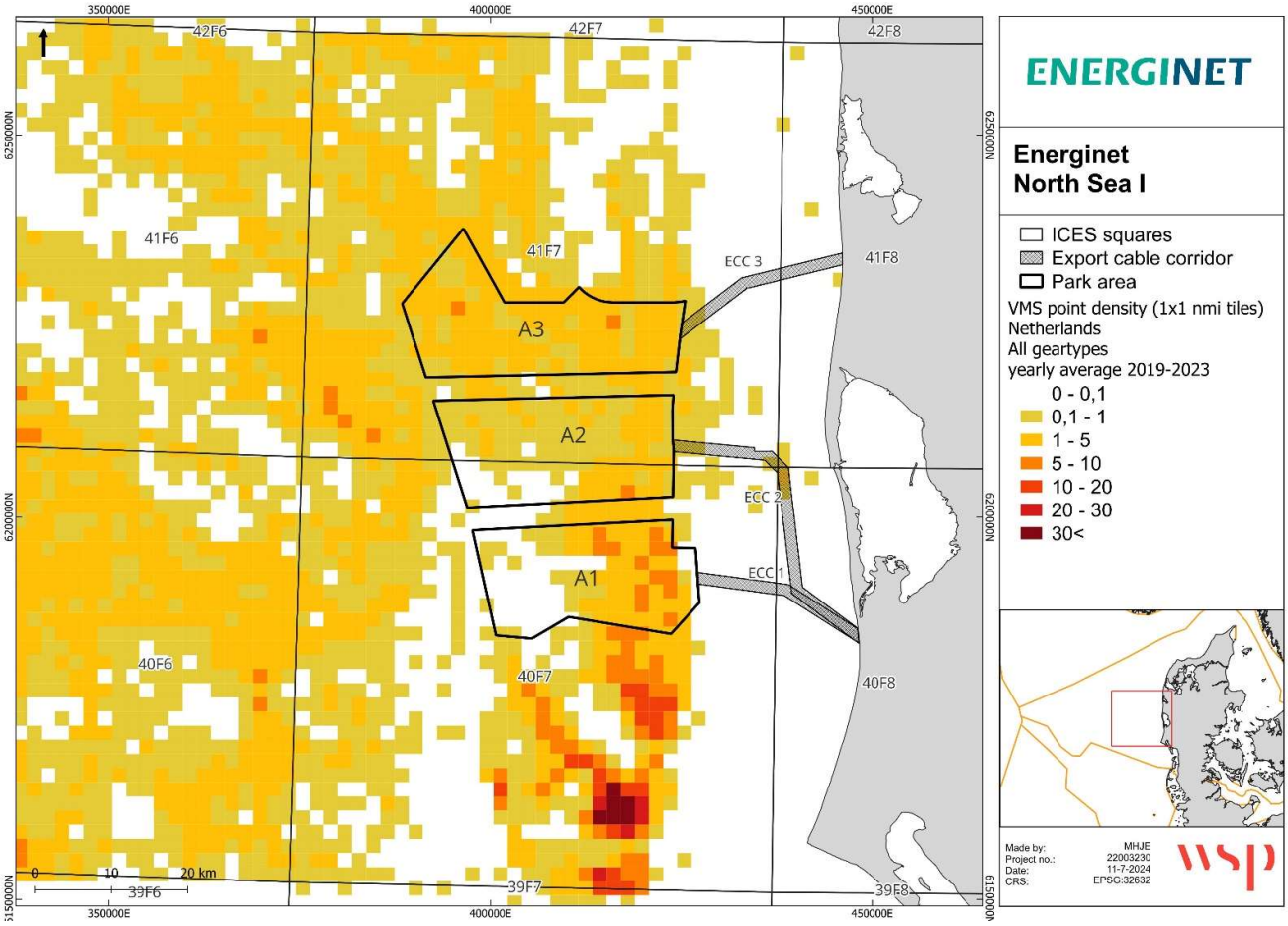

Figure 5-5. The distribution of fishing grounds for the Dutch commercial fisheries in and near NSI.1. The map is based on a yearly average of VMS data from 2019-2023. Source: (The Danish Fisheries Agency, 2024).

5.4.4 ESTIMATED VALUE OF THE DUTCH FISHERIES IN THE NSI.1

FISHING POINTS

The total number of Dutch fishing points with catch data attached for ICES squares 40F7, 40F8, 41F7 and 41F8, was 1,109 for the period of 2019-2023 (Table 5-25). Fishing points with catch data attached is available from 2019 to 2023, so there is data for each year. However, only 136 fishing points were positioned inside the NSI.1 OWF and none in the ECC. This is equivalent to a yearly average of the fishing points inside the NSI.1 of 13%, with the highest percentage occurring in 2020 and 2021 with 19 % and 30 %, respectively.

Table 5-25. The distribution of Dutch fishing points with catch data in ICES rectangles 40F7, 40F8, 41F7 and 41F8 and NSI.1 and ECC for vessels > 12 m. Source: (The Danish Fisheries Agency, 2024).

Years	Fishing points in 40F7, 40F8, 41F7 and 41F8	Fishing points inside NSI.1 OWF	Fishing points inside NSI.1 ECC	Percentage fishing points inside NSI.1 OWF and ECC
2019	4	-	-	-
2020	282	53	-	19 %
2021	60	18	-	30 %
2022	424	60	-	14 %
2023	339	5	-	1 %
Total	1109	136	-	12 %
Yearly average	221.8	27.2	0	13 %

AMOUNTS AND VALUE

The total Dutch catch landed in Danish ports that can be traced back to ICES rectangles 40F7, 40F8, 41F7 and 41F8, and that have logbook data attached to them, amounts to a total 297.4 tons. Landings from inside the NSI.1 OWF and ECC is estimated to 7.8 tons in total over the 5 years period from 2019-2023 (Table 5-26). In 2020, the landings from OWF and ECC accounted for 20 % of the landings caught by the Dutch fisheries analysed here. However, the yearly average was substantially lower, and only 5 % of the landings were caught inside the NSI.1.

Table 5-26. The yearly Dutch landings in tons landed in Danish ports from ICES rectangles 40F7, 40F8, 41F7 and 41F8 and NSI.1 and ECC for vessels > 12 m. Source: (The Danish Fisheries Agency, 2024).

Years	Landings in tons in 40F7, 40F8, 41F7 and 41F8	Landings in tons in NSI.1 OWF	Landings in tons in NSI.1 ECC	Landings in %
2019	4.7	-	-	-
2020	18.2	3.7	-	20 %
2021	125.0	2.2	-	2 %
2022	137.9	1.8	-	1 %
2023	11.7	0.2	-	2 %
Total	297.4	7.8	-	3 %
Yearly average	59.5	1.6	0	5 %

The total earnings from ICES rectangles 40F7, 40F8, 41F7 and 41F8, are estimated to be 2.4 mil DKK (Table 5-27). Of that, only 0.2 mil DKK can be traced back to OWF and ECC based on the economic analysis of data from 2019-2023. However, this only accounts for approximately one fourth of the earnings listed in section 5.4.1. Although the catch was landed in Danish ports, the correlation between VMS data and logbook data is low.

Table 5-27. The yearly Dutch landings in DKK landed in Danish ports from ICES rectangles 40F7, 40F8, 41F7 and 41F8 and NSI.1 OWF and ECC for vessels > 12 m. Source: (The Danish Fisheries Agency, 2024).

Years	Landing in DKK in 40F7, 40F8, 41F7 and 41F8	Landings in DKK in NSI.1	Landings in DKK in ECC	Landings in %
2019	117,588		0	0 %
2020	414,210	86,470	0	21 %
2021	426,797	40,789	0	10 %
2022	879,660	85,482	0	10 %
2023	594,228	9,773	0	2 %
Total	2,432,483	222,514	0	9 %
Yearly average	486,497	55,628	0.0	8 %

5.5 POLISH FISHERIES

5.5.1 FISHERIES IN THE NORTH SEA

The total landings for the Polish fisheries in ICES-rectangle 41F7, 41F8, 40F7 and 40F8 (Table 5-28) amounted to 184.3 tons, with a yearly average of 36.9 tons (The Danish Fisheries Agency, 2024) in the period of 2019-2023. The total value landed for this nation in the area was 1,413.41 mil DKK, with a yearly average value of 282.7 and an average kilo price ranging from 5.6 to 41.6 DKK (The Danish Fisheries Agency, 2024).

From 2019 to 2022, decreases occurred in the yearly total landing and value, 95 % and 65 % respectively (The Danish Fisheries Agency, 2024). Data on yearly Polish fisheries landings is available for 2019, 2021, and 2022.

Table 5-28. Total yearly landings from Poland in ICES-rectangle 41F7, 41F8, 40F7 and 40F8 for 2019-2023. Source: (The Danish Fisheries Agency, 2024)

Year	Landings (tons)	Value (DKK)
2019	162.5	910,173
2020	0	0
2021	13.8	170,296
2022	8	332,943
2023	0	0
Total	**184,3**	**1.413.413**

5.5.2 GEAR TYPE AND SPECIES

The dominant gear type used by the Polish fisheries in ICES 40F7, 40F8, 41F7 and 41F8 for catches landed in Danish harbours, was "Other gear" (Table 5-29). This is presumably because the foreign fishers fail to fill out information on fisheries activity for the Dansh authorities adequately. The Polish fishing fleet caught a total of 184.3 tons in the four ICES rectangles, of which the majority was caught in 2019 totalling 162.6 tons.

Table 5-29. Catches from the Polish fisheries in tons from ICES rectangles 40F7, 40F8, 41F7 and 41F8 landed in Danish harbours. Source: (The Danish Fisheries Agency, 2024)

	2019	2020	2021	2022	2023	Total
Other gear	162.6	13.8	0.0	8.0	0.0	184.3

The Polish fisheries landed catches for a total of 1.4 mil DKK in the five-year period 2019-2023 in the four analysed ICES rectangles (Table 5-30). As for the landings, the majority of the earnings originated from 2019, where 910,173 DKK was earned by the Polish fisheries. Earnings in 2020 were significantly lower, with a total of 170,296 DKK. The reason for the low landings and earnings may be because of Covid-19, that caused fish prices to drop and made it difficult for foreign fishing vessels to land their catches in Danish harbours due to restrictions and quarantines. However, no catches were registered in 2022 and 2023 where the Covid-19 situation had settled again, so other factors may also play a part.

Table 5-30. Catches from the Polish fisheries in DKK from ICES rectangles 40F7, 40F8, 41F7 and 41F8 landed in Danish harbours. Source: (The Danish Fisheries Agency, 2024).

	2019	2020	2021	2022	2023	Total
Other gear	910.173	170.296	0.0	332.943	0.0	1.413.413

The only landings from Polish fishing vessels registered in Danish harbours, and originating from the four analysed ICES rectangles, are species of invertebrates (Table 5-31). Unspecified crab was the dominant group in terms of weight. The crabs may be brown crab, as this is the dominant crab species in the commercial fisheries in the North Sea, and perhaps the Polish fishers have failed to register the species properly in the Danish logbook system. According to the data, unspecified crab was caught in 2019 and 2020, while landings in 2022 consisted of brown crab. It is reasonable to believe that in 2022, the crabs have been registered as the correct species, and therefore, there are no unspecified crab in the catches this year. A total of 176.3 tons of unspecified crab and 8 tons of brown crab was caught by the Polish fishers – or as stated above – more likely a total of 184.3 tons of brown crab was caught.

Table 5-31. Catches from the Polish fisheries for the dominating species based on weight (tons). Source: (The Danish Fisheries Agency, 2024).

	2019	2020	2021	2022	2023	Total
Crab	162.6	13.8	0.0	0.0	0.0	176.3
Brown crab	0.0	0.0	0.0	8.0	0.0	8.0
Total	162.6	13.8	8.0	0.0	0.0	184.3

In terms of earnings, the crab fisheries for the Polish fishers landed in Danish ports, were worth 910,173 DKK in 2019 (Table 5-32). In 2020, the earnings were significantly lower, possibly due to Covid-19 that made it difficult for fishing vessels to enter foreign ports to land the catch without being quarantined. Therefore, earnings in 2020 were merely a sixth of earnings in 2019. Earnings in 2022 were doubled compared to 2020, however, still substantially lower than for 2019. The catches for the Polish fishers have been inconsistent over the years, probably caused by fluctuations in

fish/invertebrate distribution and price. The vessels often go for the species with the best prices and highest catch rates, and this varies from year to year.

Table 5-32. Catches from the Polish fisheries for the dominating species based on value (DKK). Source: (The Danish Fisheries Agency, 2024).

	2019	2020	2021	2022	2023	Total
Crabs	910,173	170,296				1.080.470
Brown crab				332,943		332.943
Total	910,173	170,296		332,943		1.413.413

5.5.3 FISHING INTENSITY

The fishing intensity for vessels > 12 m inside the NSI.1 was mapped using a heatmap (Figure 5-6). The map illustrates the main fishing grounds in and around the NSI.1 for the Polish fisheries.

For the past five years, the fishing grounds for the Polish commercial fisheries in and near NSI.1 show fisheries activity (yearly average) ranging from none to moderate, and a scattered distribution within most of the NSI.1 area. The fishing intensity is highest in southern parts of the area, in A1 and near the two southern export cable routes, whereas the intensity is rather low and scattered in the remaining parts of the area.

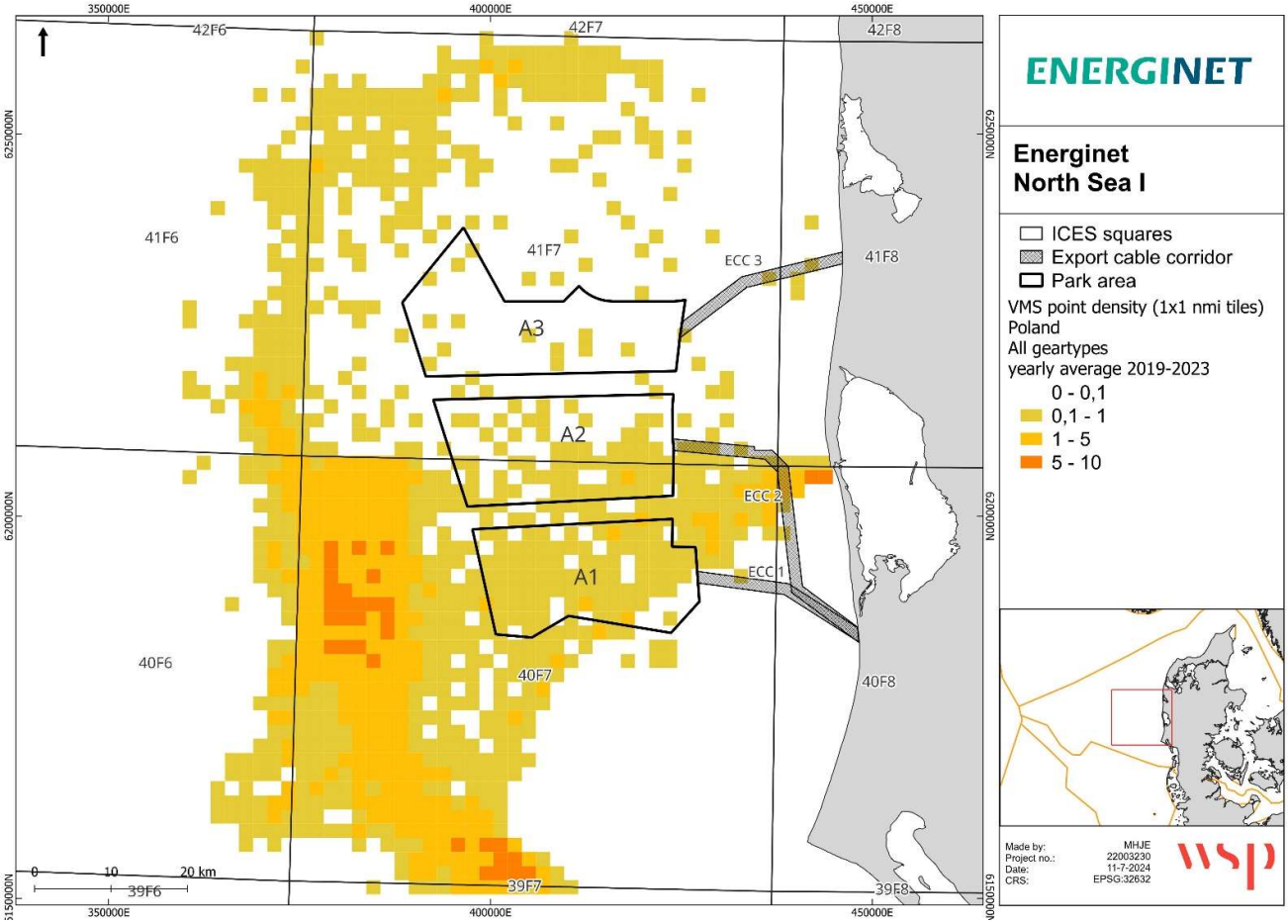

Figure 5-6. The distribution of fishing grounds for the Polish commercial fisheries in and near NSI.1. The map is based on a yearly average of VMS data from 2019-2023. Source: (The Danish Fisheries Agency, 2024).

5.5.4 ESTIMATED VALUE OF THE POLISH FISHERIES IN THE NSI.1

FISHING POINTS

The total number of Polish fishing points with catch data attached, for ICES squares 40F7, 40F8, 41F7 and 41F8, was 128 for the period of 2019-2023 (Table 5-33). Fishing points with catch data attached are available only from 2019 and 2022. However, no fishing points were positioned inside the NSI-1 or in the ECC. Therefore, no economic analysis could be carried out for this country with regards to landings and earnings from the NSI.1 OWF and ECC.

Table 5-33. The distribution of Polish fishing points with catch data in ICES rectangles 40F7, 40F8, 41F7 and 41F8 and NSI.1 OWF and ECC for vessels > 12 m. Source: (The Danish Fisheries Agency, 2024).

Years	Fishing points in 40F7, 40F8, 41F7 and 41F8	Fishing points inside NSI.1 OWF	Fishing points inside NSI.1 ECC	Percentage fishing points inside NSI.1 OWF and ECC
2019	113	-	-	-
2020	-	-	-	-
2021	-	-	-	-
2022	15	-	-	-
2023	-	-	-	-
Total	128	-	-	-
Yearly average	25.6	0.0	0	0

6 CONCLUSION

6.1 METHODOLOGY

This technical report has conducted a thorough investigation into the Danish commercial fisheries within the North Sea and in and around the North Sea I 1 pre-investigation area (NSI.1). Additionally, it has provided an analysis of the foreign fisheries conducted in the area. The methodology employed in this report has applied both quantitative and qualitative approaches to illustrate the commercial fisheries activities in and around the NSI.1 area. By integrating vessel monitoring system (VMS) and logbook data encompassing various parameters such as vessel type, size, and fishing gear used, the report has aimed to outline the distribution and trends in fishing vessel demographics over the past decade. Moreover, through an examination of catch data including species composition, catch volumes, and estimated values, the report has strived to evaluate the significance of different species and gear types within the study area. Additionally, an exercise of mapping the fishing effort using VMS data has been conducted to identify areas of high fishing intensity within the NSI.1 area and potential overlaps with proposed offshore wind farm locations. The quantitative analysis has been complemented by qualitative interviews with fishers, providing socio-economic insights into their perceptions, preferences, and concerns regarding offshore wind development and its potential impact on their fisheries activities. By integrating both quantitative and qualitative approaches, the methodology has strived to provide a comprehensive analysis of commercial fisheries data, thereby facilitating an informed decision-making process.

6.2 DANISH COMMERCIAL FISHERIES

Commercial fisheries play an indispensable role in Denmark's maritime economy, making significant contributions to both local livelihoods and national food security. The Danish commercial fisheries in the North Sea encompass two primary types of fisheries: industrial fisheries and fisheries for human consumption. While industrial fish landings, such as sand eel and sprat, are processed into fishmeal and -oil, species like flatfish, cod, and haddock are destined for human consumption. Despite a decline in the number of fishing vessels over the past decade, due to changes in regulations and market dynamics, the total Danish landings have remained substantial, with the North Sea remaining the primary fishing area. Trawl fisheries, including bottom, pelagic, and beam trawl, consistently account for a significant portion of the total catch value in the NSI.1, underscoring the importance of these gear types in Danish fisheries, particularly in the North Sea. Although gillnet fisheries represent a smaller proportion of the total catch weight, they maintain economic significance, particularly in the NSI.1.

The total quantities landed from the four ICES squares (40F7, 40F8, 41F7, and 41F8) contributed approximately 2,672 tons to Danish fisheries landings in 2023, showing a decline from 11,321 tons in 2014. Despite the overall decline in the weight of total catches landed, the value of catches from the NSI.1 remained high. It only decreased by about 3%, from 54.8 mil DKK in 2014 to 39.5 mil DKK in 2023. The economic significance of the NSI.1 area to the Danish fishing industry is underscored by its contribution of around 1.23% to the total value of Danish fisheries in 2023, which amounted to 3.2 billion DKK. However, this also indicates that NSI.1 plays a relatively minor role in the overall turnover of Danish fisheries, with the majority of catches from the North Sea being harvested outside of the NSI.1 area.

The most crucial species for Danish fisheries include herring and mackerel, with respective values of 520 mil DKK and 235 mil DKK in 2023, closely followed by sought-after species like Norway lobster, deep water shrimp, and cod, valued at 328 mil DKK, 272 mil DKK, and 122 mil DKK, respectively. Additionally, industrial species such as sprat and sand eel, valued at 276 million DKK and 143 mil DKK, respectively, contribute significantly to both the total quantities landed and the total value of the catches, playing a crucial role in sustaining the fishing industry and meeting the demand for seafood in Denmark and beyond. Sprat, sand eel, and plaice are, as dominant species across all four ICES squares,

reflecting their ecological importance and economic significance within Danish fisheries. While sprat dominates in terms of catch weight, species like sand eel and plaice contribute significantly to the overall economic value of landings.

The statistical analysis combining VMS and logbook data, showed that approximately 16.500 tons of fish and shellfish were landed from the OWF and ECC areas between 2014 and 2023. Catches have generally decreased over the 10-year period analysed. The yearly average landings from OWF and ECC represented approximately 11 % of what was landed from the four ICES rectangles. This percentage aligns with the expected amount based on the area comprised by OWF and ECC in the four ICES rectangles, assuming an even distribution of fish in the area. The yearly average of earnings from the NSI.1 was 6.8 mil DKK, with an additional 1.7 mil DKK from the ECC areas. Earnings fluctuated between 9 % and 14 % over the years, with a yearly average of 12 % originating from the OWF and ECC areas. Again, this aligns with expectations based on the area's composition in the four ICES rectangles.

According to fishers interviewed for this report, the shallow sandy banks of NSI.1 are crucial for plaice fishery, particularly for commercial fishing vessels of approximately 20 meters or less. Some of the interviewed fishers estimated that plaice landings originating from the NSI.1, accounted for approximately 80% of their yearly catches. However, fishing grounds in the eastern North Sea are gradually shrinking and becoming more scattered among offshore wind farms (OWF) and sailing corridors. This concentration of fisheries in smaller areas is pushing commercial fish species further westward. Limited engine power restricts smaller fishing vessels from venturing farther west to other suitable fishing grounds. Cable corridors, located in one of the remaining larger areas for brown shrimp fisheries, serve as sites where beam trawl is deployed for several kilometers along the west coast of Jutland. The interviewed shrimp fishers speculate, that the lower landings of brown shrimp may be caused by electromagnetism from subsurface cables for the OWFs along the Danish west coast. Additionally, NSI.1 is expected to become increasingly important for sprat and sand eel fisheries due to Brexit and the British fisheries ban on Dogger Bank, where Danish fisheries previously caught a significant proportion of sand eel. If asked, the fishers point toward the westernmost areas of subarea A1, A2, and A3 as the area where the turbines would have the least impact on the fisheries, as they would then have a relatively large area for trawling without obstacles.

6.3 FOREIGN COMMERCIAL FISHERIES

VMS and logbook data from foreign fishing nations were obtained from the Danish Fisheries Agency. The VMS dataset included data from Belgium, Germany, Great Britain, Ireland, the Netherlands, Poland, Sweden, Finland, Spain, France, and Latvia, while logbook data covered Belgium, Germany, Great Britain, Ireland, the Netherlands, Poland, and Sweden. The total landings for foreign fisheries in ICES rectangles 41F7, 41F8, 40F7, and 40F8 combined amounted to 911.6 tons for 2019-2023, yielding a yearly average of 182.3 tons. The total value landed for the same area and period for the foreign fisheries was 10.5 mil DKK, with a yearly average of 2.1 mil DKK. Comparing with the Danish fisheries, this only adds up to 1.5% of the yearly average landings from the Danish fishing vessels. In terms of earnings, the foreign fisheries account for 2.3% of the earnings by the Danish fishing fleet in the four ICES rectangles. The total yearly amount (tons) of catches from foreign fisheries landed in Danish harbours has decreased steadily during the five-year period from 2019 to 2023, from 256.7 tons in 2019 to merely 20.2 tons in 2023. This is a substantial decrease of 92% from 2019 to 2023. Correspondingly, the value of the landings has decreased considerably by 67% from 2019 to 2023, although it has fluctuated quite a bit.

According to the dataset from the Danish Fisheries Agency, most foreign fishing nations hardly contribute to the fisheries intensity in ICES squares 40F7, 40F8, 41F7, and 41F8. Therefore, further analysis focused on the four nations with the highest fishing intensity in and near NSI.1: Germany, Great Britain, the Netherlands, and Poland. Based on fishing intensity (VMS), the four countries have utilised most of the NSI.1 for fishing. The German, British, and Dutch

fisheries have primarily fished in the A2 and A3 areas, while Polish fishers mostly used the A1 area. Unfortunately, for the German and Polish fisheries, very little of the catches have been landed in Danish ports, so the fishing intensity does not quite match the landings accessible in this report. However, the Dutch fisheries have landed an average of 1.6 tons of fish in the OWF area in Danish ports, ranging from 0 to 3.7 tons in 2019 and 2020, respectively. This amounts to an average of 55,628 DKK. The British fisheries have landed an average of 2.4 tons of fish in Danish ports ranging from 0 to 12 tons pr. year. This is equivalent to 61,677 DKK on average pr. year ranging from 0-308,385 DKK pr. year.

6.4 GENERAL CONCLUSIONS

To summarize, this report describes the baseline situation for the commercial fisheries in the North Sea in and near the NSI.1 area. Danish and foreign commercial fishers have caught especially herring, mackerel and Norway lobster in the four ICES rectangles closest to the NSI.1. According to the fishers themselves, the NSI.1 OWF is also a valuable flatfish area due to the flat sandy banks here.

However, there is some degree of mismatch in the data originating from the commercial fisheries in the VMS (vessel location) and logbook data (catch amount and value), making it difficult to precisely estimate the value of area for the fisheries. Little can be done to rectify this as the data is only as precise as the data inserted in the system. In addition, regarding the foreign fisheries, there is only access to the amount and value of catches landed in Danish ports. Therefore, it is advised that data for the foreign fisheries is collected from local authorities when further analysis of the fisheries is carried out by the concessionaries.

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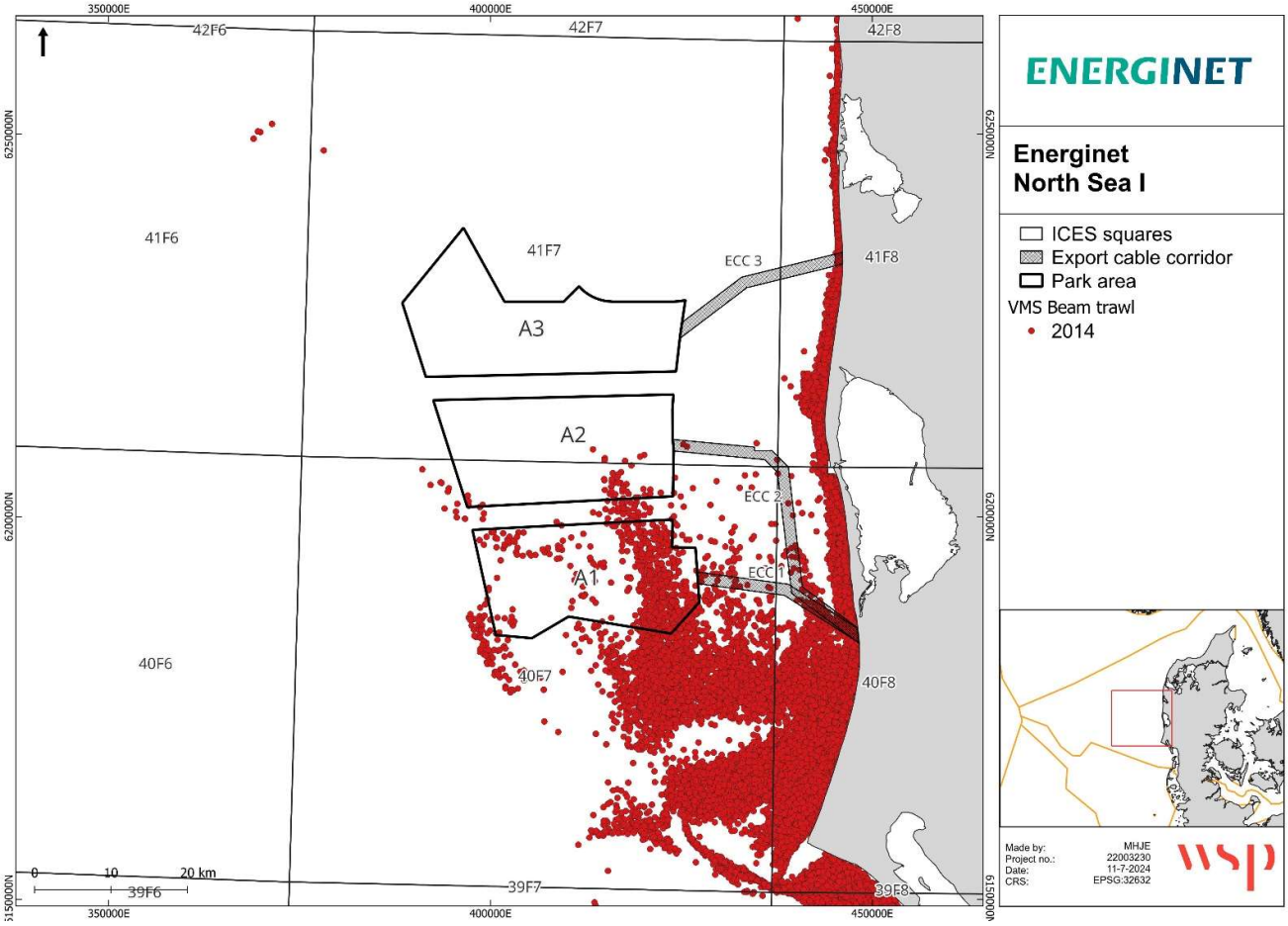
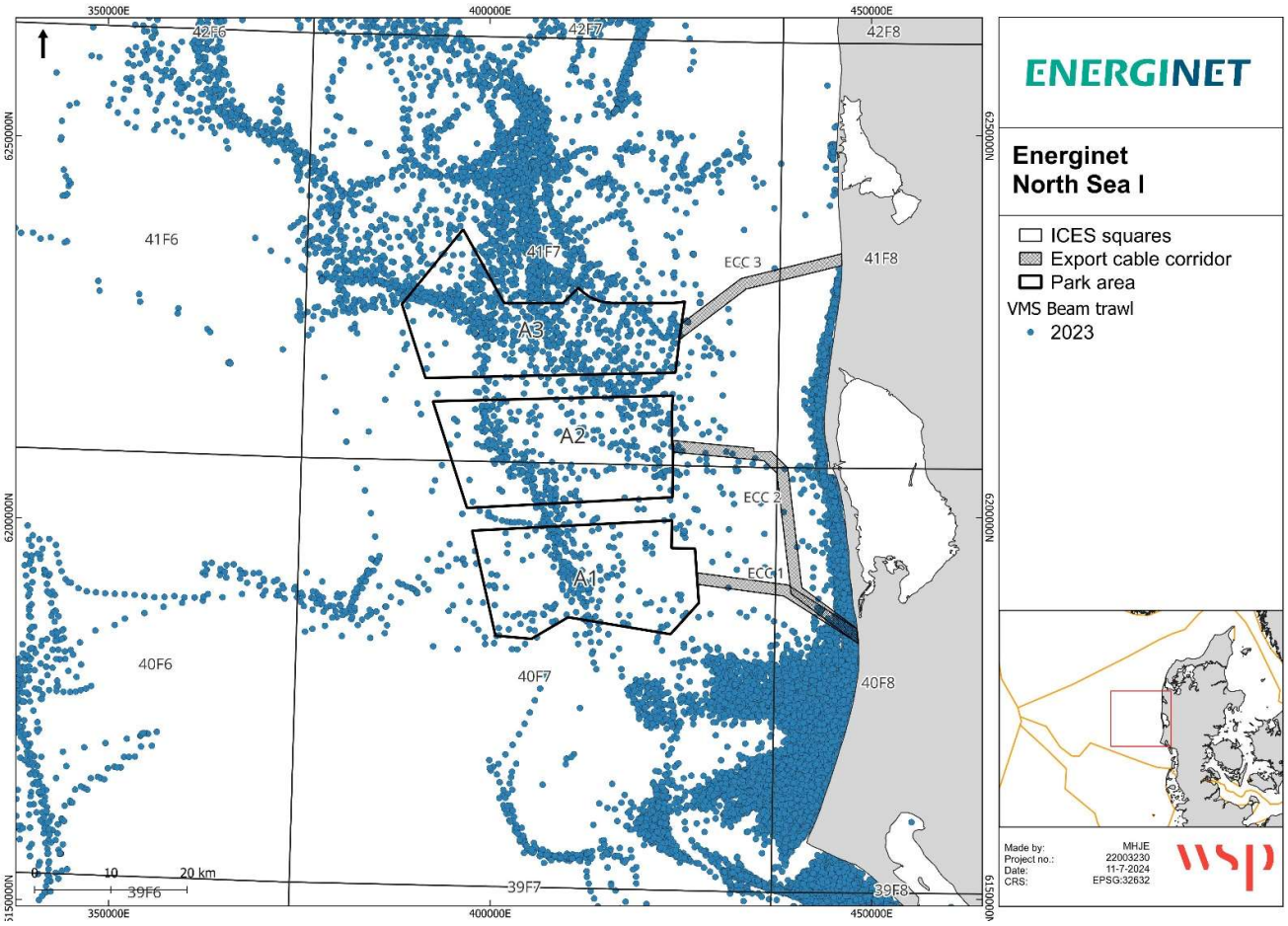
8 APPENDICES

8.1 APPENDIX 1 - FISHING INTENSITY DANISH FISHERIES

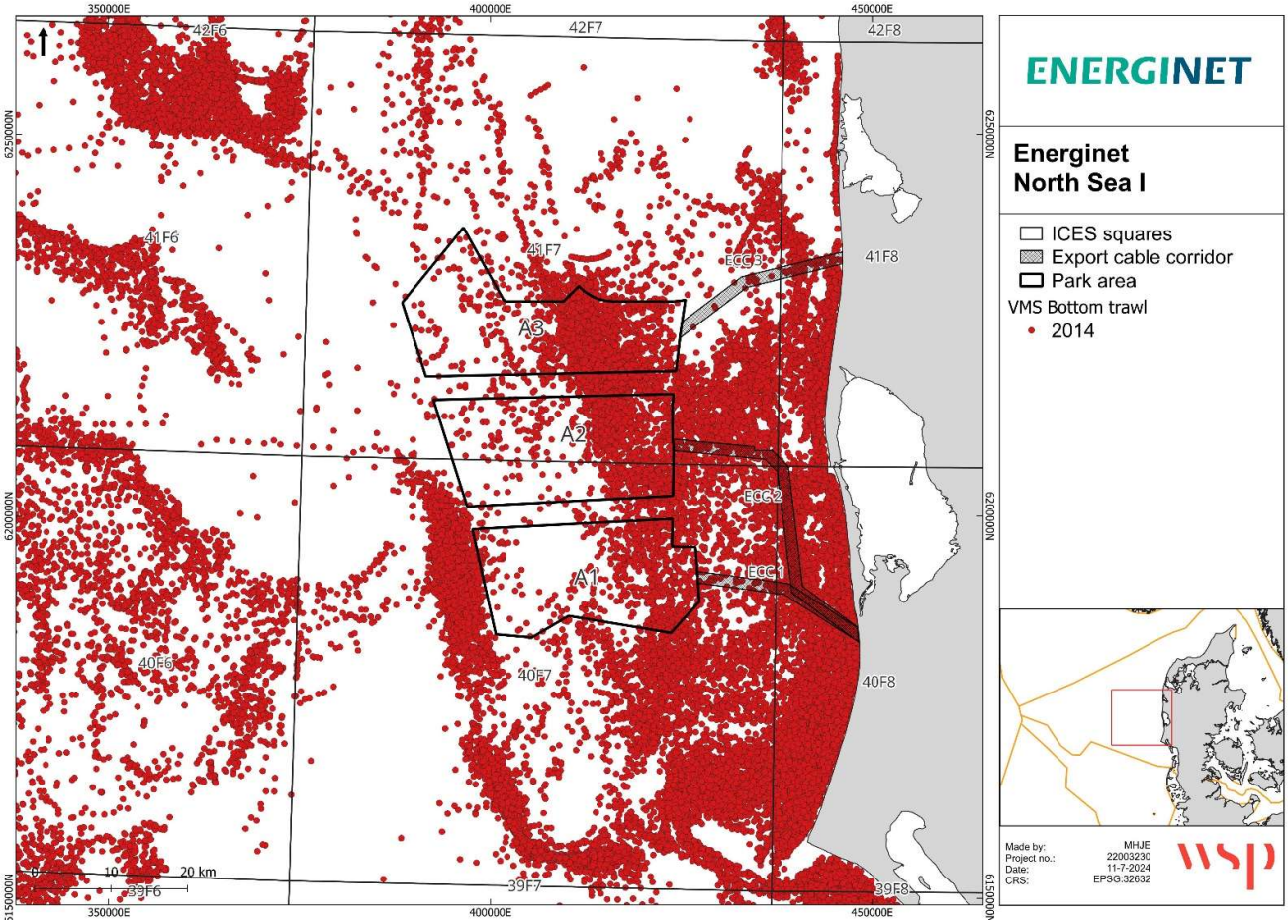
BEAM TRAWL 2014



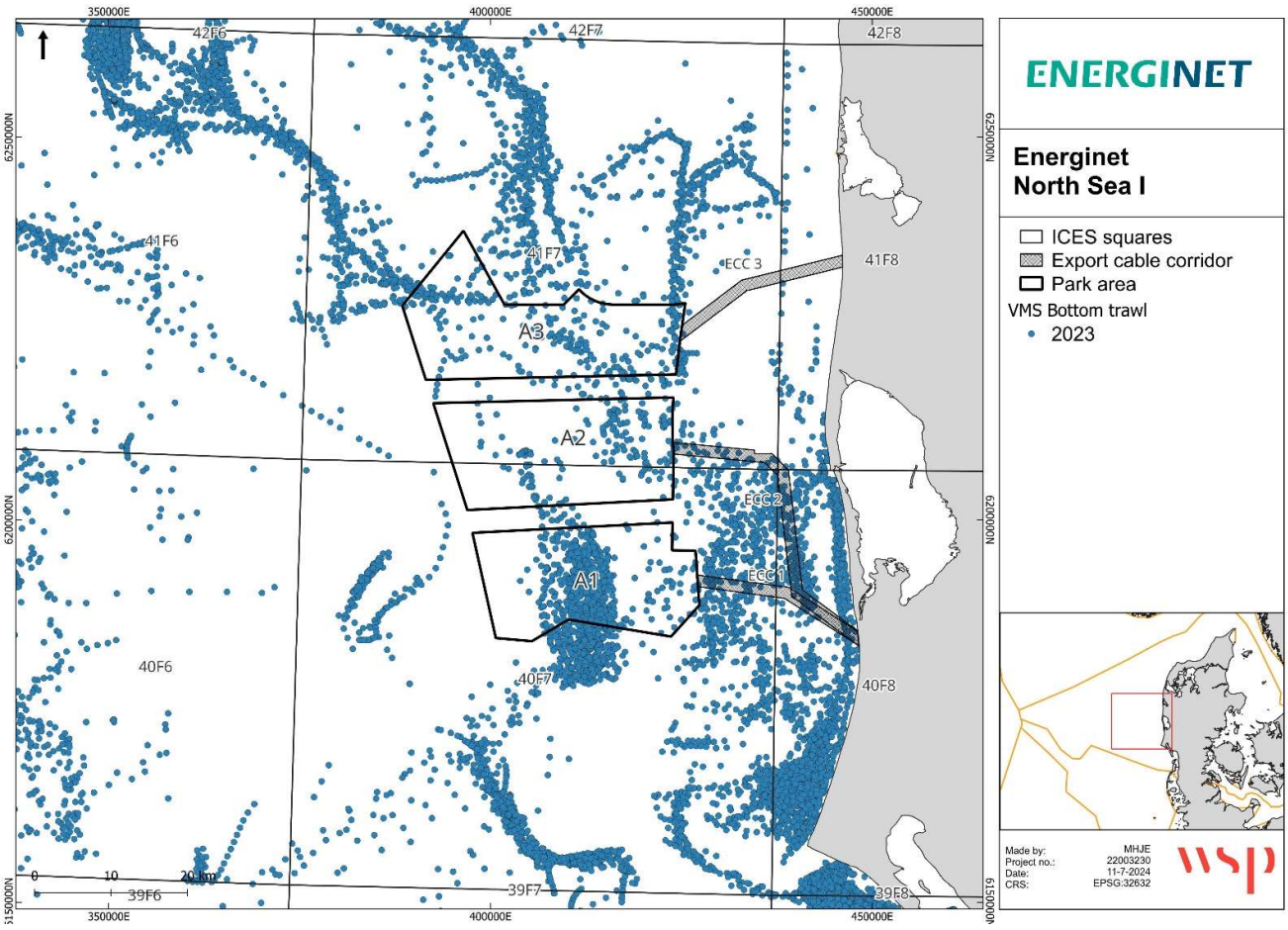
BEAM TRAWL 2023



BOTTOM TRAWL 2014



BOTTOM TRAWL 2023



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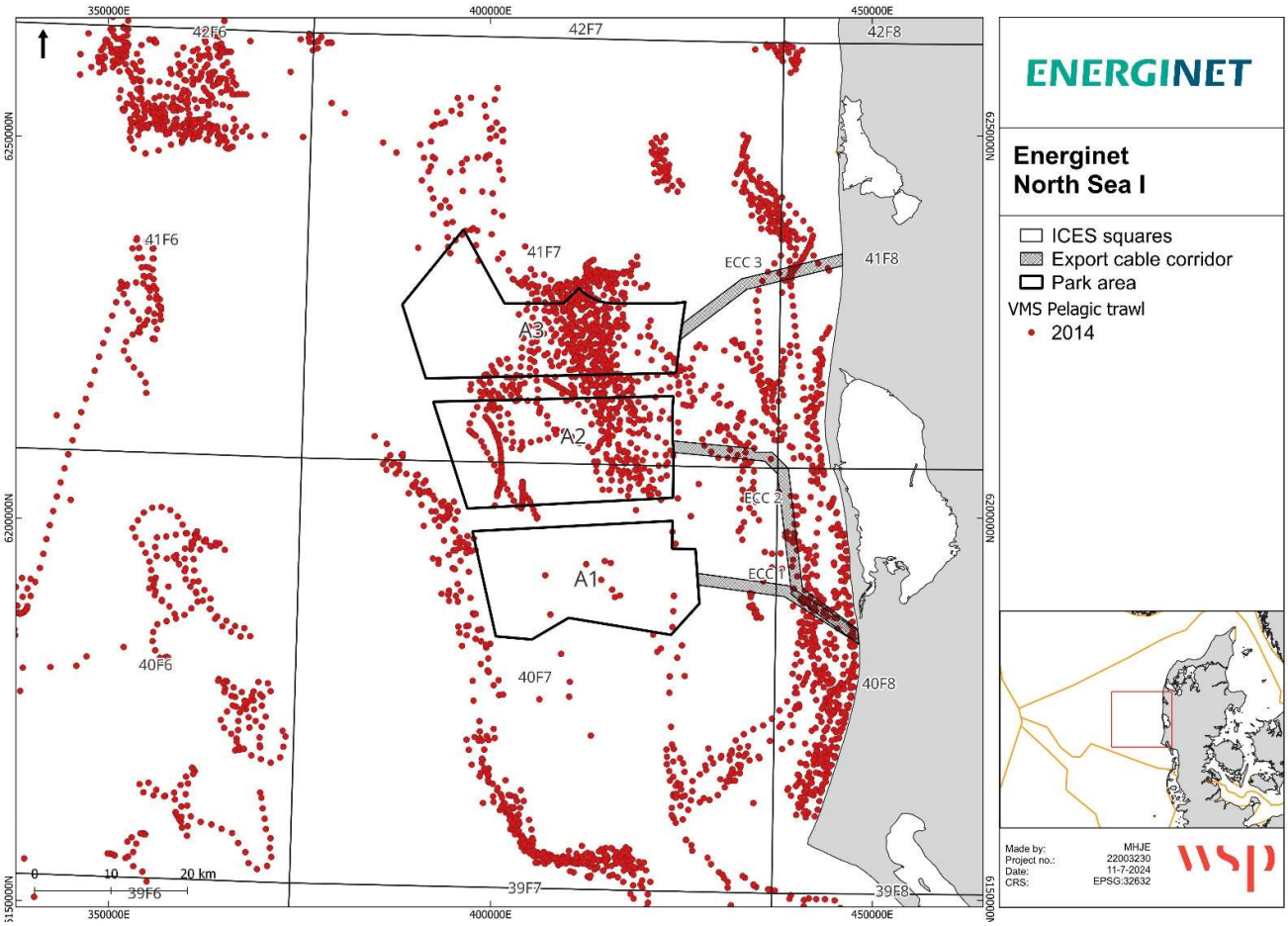
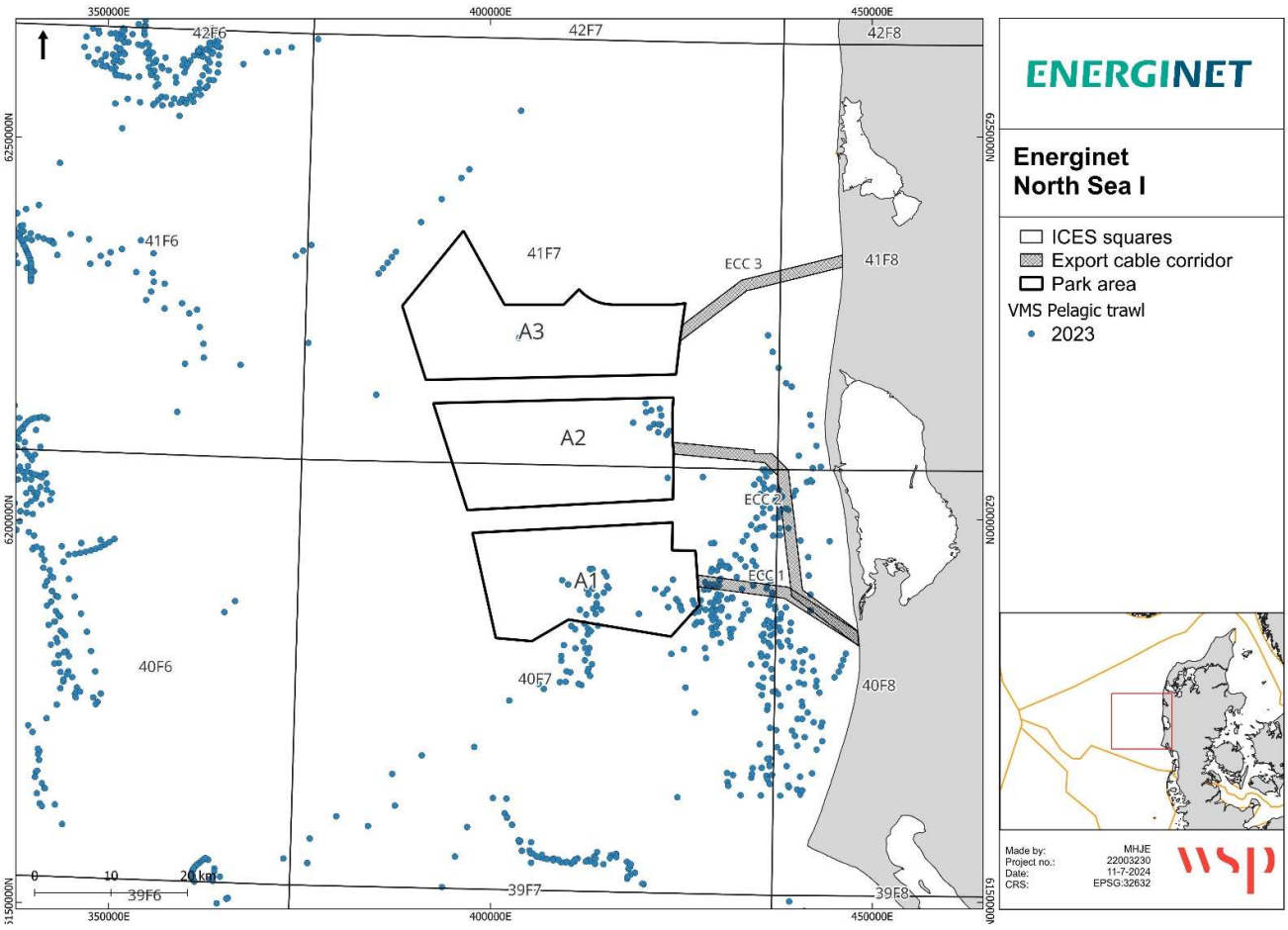


PELAGIC TRAWL 2023



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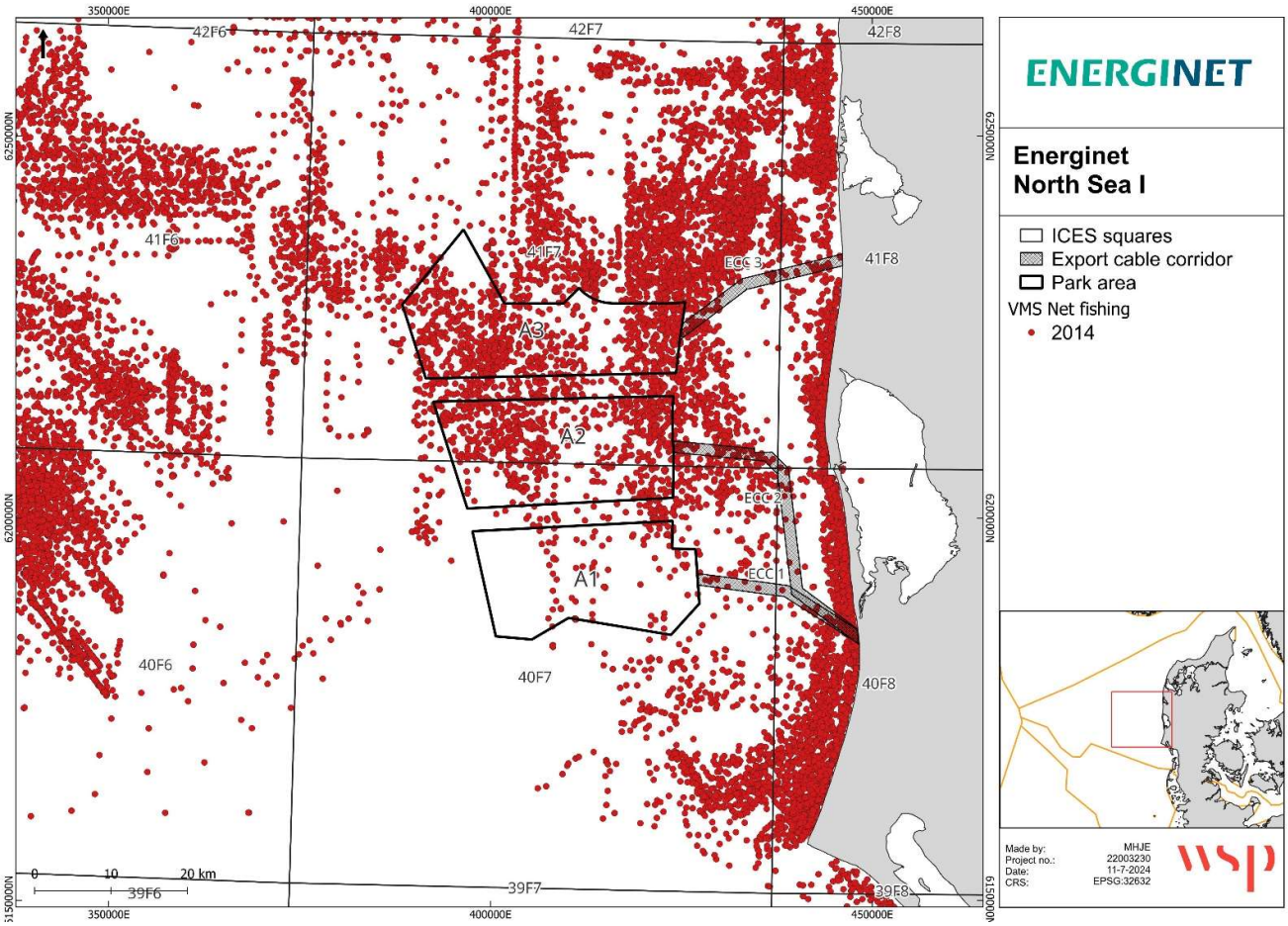

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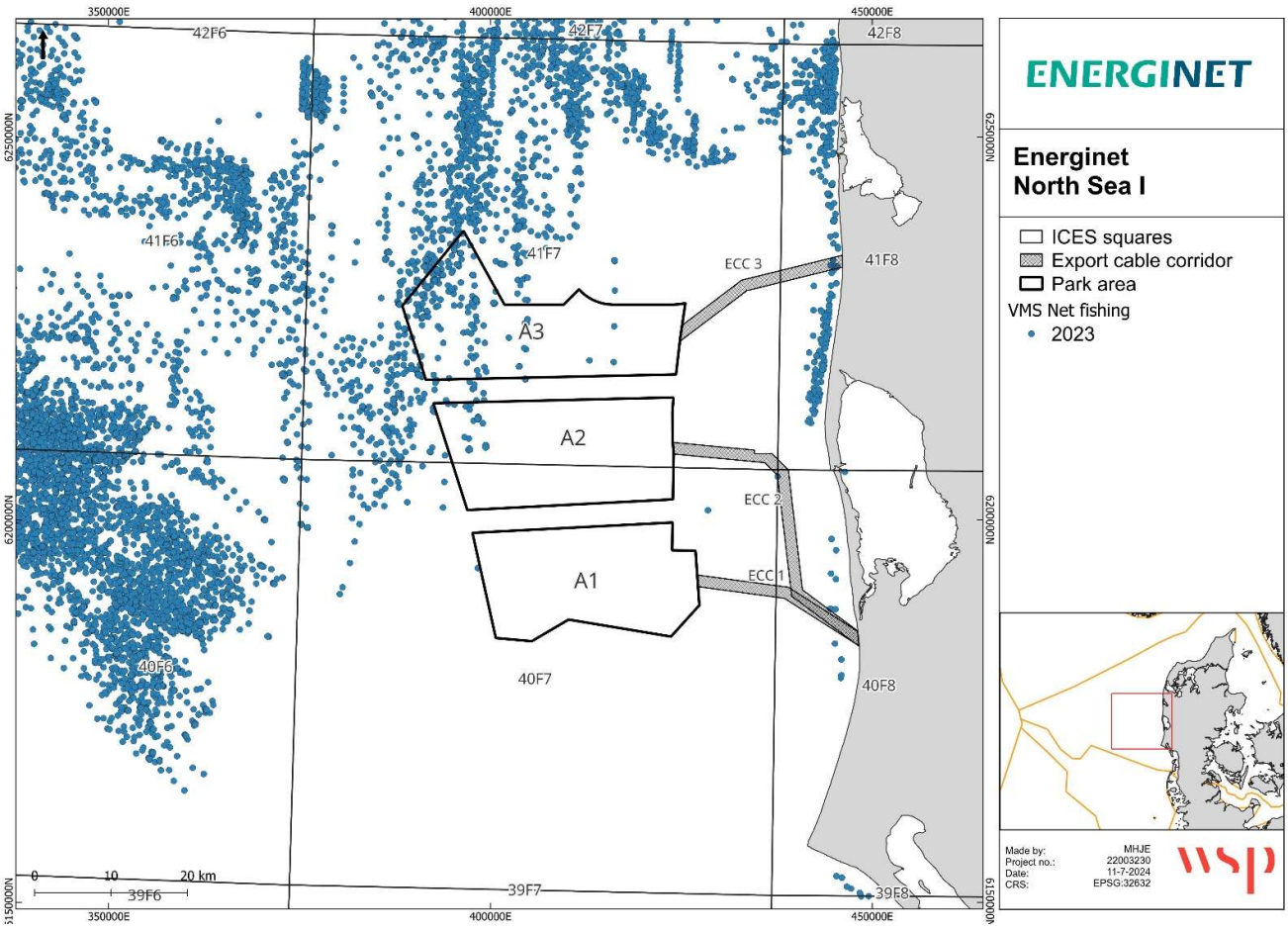

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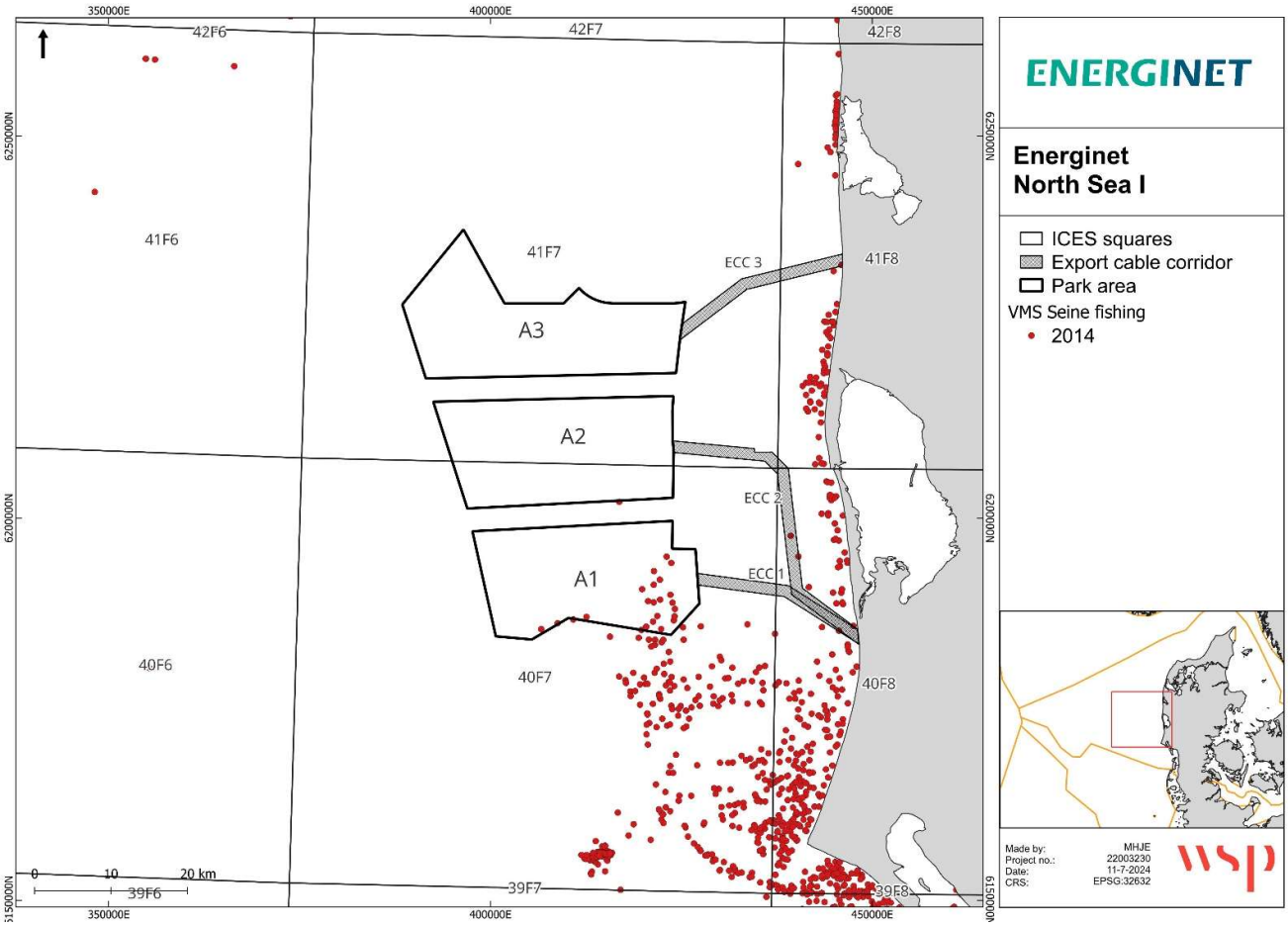
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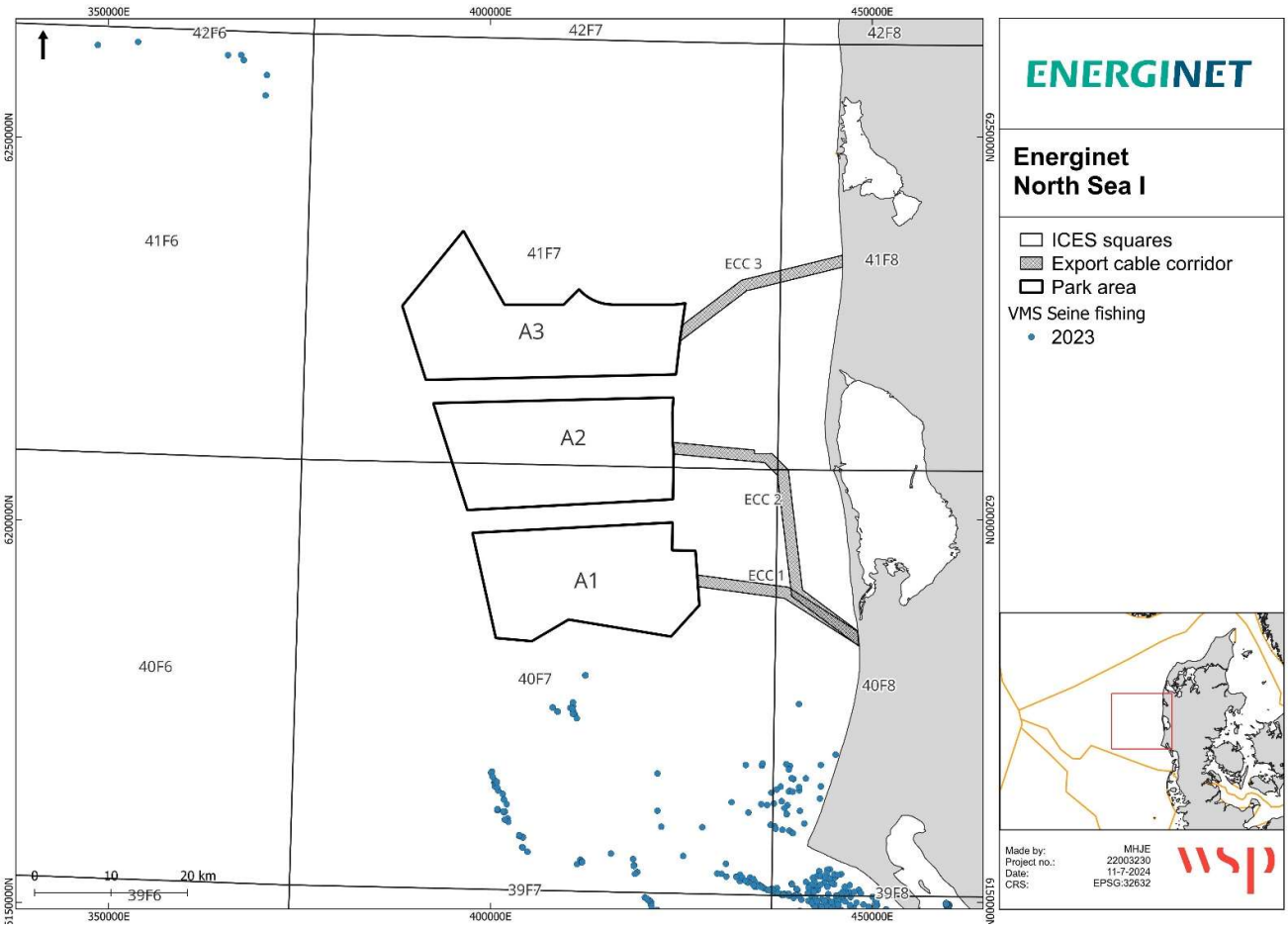
North Sea I
ICES squares
Export cable corridor
Park area
VMS Seine fishing
2014
Made by: MHJE
Project no.: 22003230
Date: 11-7-2024
CRS: EPSG:32632

SEINE 2023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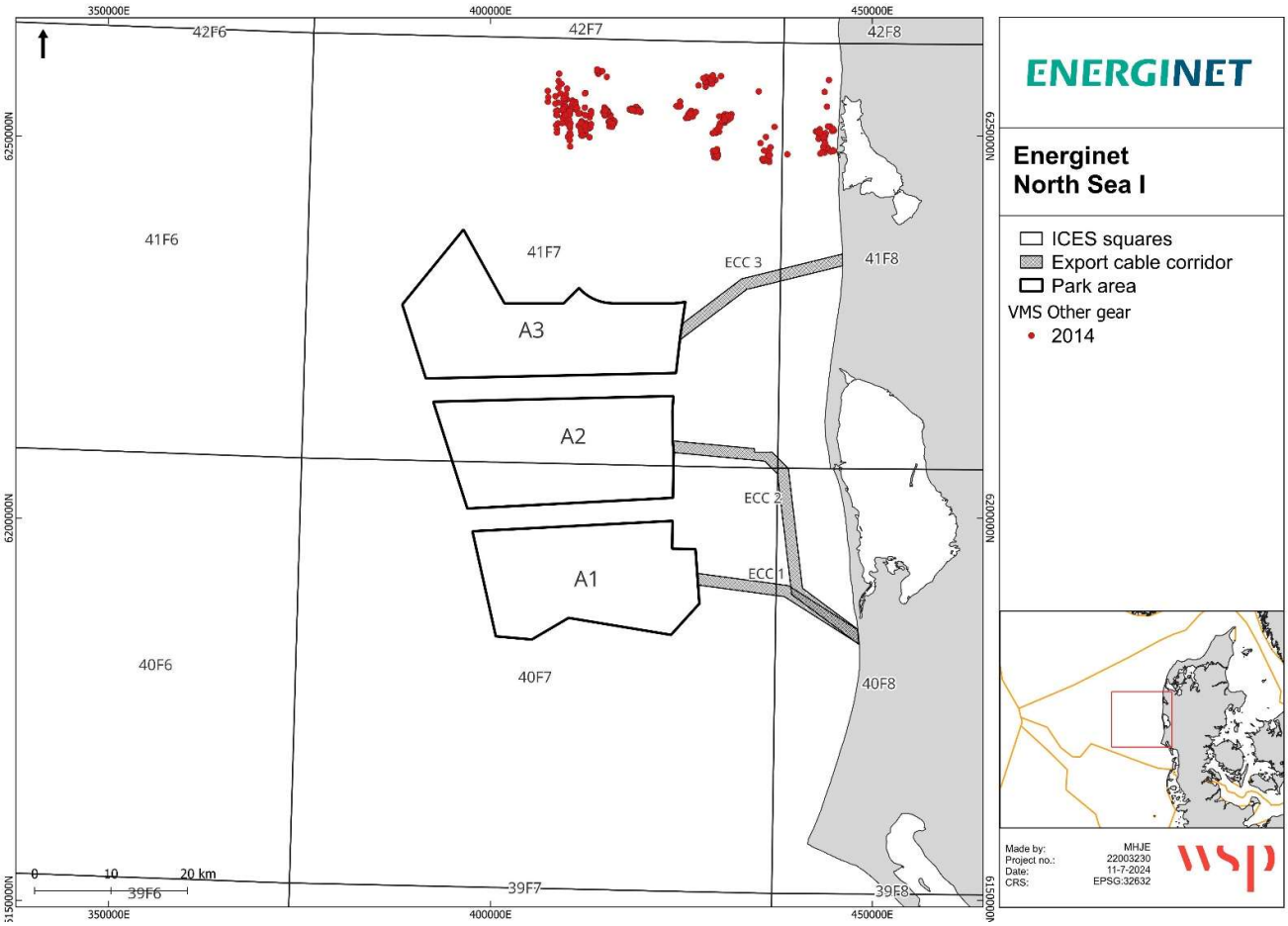
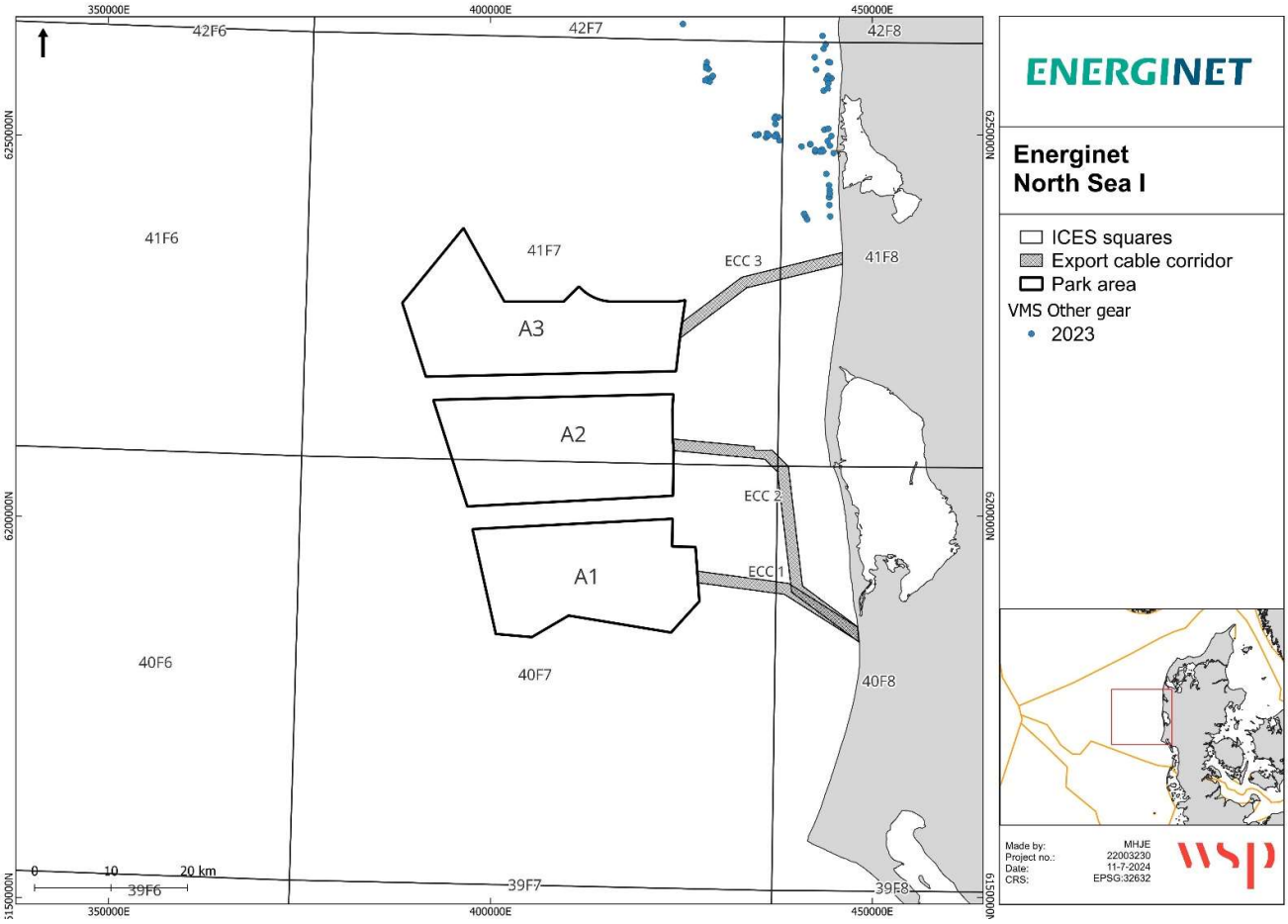
North Sea I
ICES squares
Export cable corridor
Park area
VMS Seine fishing
2023
Made by: MHJE
Project no.: 22003230
Date: 11-7-2024
CRS: EPSG:32632
wsp

OTHER GEAR 2014



OTHER GEAR 2023



8.2 APPENDIX 2 – INTERVIEWED FISHERS

- Claus Reedtz Sparrevohn, biologist, Ph.D., (DPPO)
- Jens Rasmussen, pelagic fisher (DPPO), HM 379 Lingbank, Hanstholm
- Andre Sanders, beam and bottom trawl fisher (DFPO), L610 Inger Katrine, Thyborøn
- Jesper Kobberholm, beam and bottom trawl fisher (DFPO), L299 Mallemukken, Hvide Sande
- Lars Høj, trawl fisher (DFPO), Mette Janni, Hvide Sande
- Enevold Mose, trawl fisher (DFPO), RI17 Simone, Hvide Sande
- Bo Balle Svendsen, bottom trawl fisher (DFPO), RI140, Hvide Sande