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| **Authors** | T Barnfield; E Johnston; T Dixon; K Saunders; E Siegal |
| **Approver(s)** | V Morgan; J Duffill Telsnig; N Greenwood |
| **Owner** | T Barnfield |

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# Dogger Bank Special Area of Conservation (SAC) MMO Fisheries Assessment 2020

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## Glossary of MPA terms

**AoO - advice on operations**. Contained within the conservation advice packages from Natural England and JNCC, the AoO details the pressure/gear combinations a feature may be sensitive to.

**Attribute** - Selected characteristic of an interest feature/sub-feature which contributes to the overall condition of the feature to which it applies.

**Broad-scale habitat** – A categorisation of habitats based on a shared set of ecological requirements. Broad-scale habitats are one type of MCZ feature, the other being FOCI. More information can be found in the Ecological Network Guidance (Marine Conservation Zone Project) section 4.2.3[1].

**Catch recording service** - The MMO catch recording service was developed to allow fishers to create and submit records of daily catches for English and Welsh under 10 metre flag vessels that fish in UK waters.

**Cefas - Centre for Environment, Fisheries and Aquaculture Science**. Cefas is a government agency that carries out research, consultancy and advisory work.

**Conservation objectives** - Conservation objectives are set for each designated feature of an MPA, to either maintain or restore a designated feature of the protected site.

**Designated features** – Habitats or species within an MPA which have been designated as protected features.

**EMS – European marine site**. Any special protection areas (SPAs) and special areas of conservation (SACs) that are covered by tidal waters.

**Exposure** - The level at which a designated feature or its supporting habitat is open to a distressing influence resulting from the possible/likely effects of operations arising from human activities (e.g. fishing) currently occurring on the site. The assessment of exposure can include the spatial extent, frequency, duration and intensity of the pressure(s) associated with the activities, where this information is available.

**Fishermap** - In 2012 the Fishermap project mapped the activities of the commercial fishing fleet, by interviewing skippers and collating data to show fishing activity and gear types used in map grid cells.

**FOCI – feature of conservation importance**. This includes both habitats of conservation importance (HOCI) and species of conservation importance (SOCI). FOCI are one type of MCZ feature, the other being broad-scale habitats. More

[1] https://hub.jncc.gov.uk/assets/94f961af-0bfc-4787-92d7-0c3bcf0fd083

information can be found in the Ecological Network Guidance (Marine Conservation Zone Project) section 4.2.3[2]

**General management approach** – The approach advised by an SNCB for a particular feature in order to help achieve the conservation objectives for an MCZ; either maintaining or recovering a feature to favourable condition.

**Habitats Directive** – Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora[3].

**HOCI – habitat of conservation importance**. Habitats that are threatened, rare, or declining. More information can be found in the Ecological Network Guidance (Marine Conservation Zone Project) section 4.2.3[4].

**IFCA – Inshore Fisheries Conservation Authority**. IFCAs are responsible for fisheries management from 0 to 6 nautical miles (nm). There are 10 IFCAs in England, each one funded by local authorities.

**ICES – International Council for the Exploration of the Sea.** ICES is an intergovernmental marine science organisation, providing evidence on the state and sustainable use of our seas and oceans.

**JNCC – Joint Nature Conservation Committee**. A public body that advises the government on UK and international nature conservation. This includes aspects related to the marine environment from 12 nm to 200 nm.

**Marine plans** – The MMO marine plans have been designed to help manage the seas around England[5].

**MCRS – minimum conservation reference size**. MCRS is the minimum size at which an ocean species can be landed for human consumption. MCRS for many species are listed in the annexes of the Technical Conservation Regulations (EU) 2019/1241[6]. Several pieces of domestic legislation also implement MCRS for certain species.

**MCZ – marine conservation zone**. Marine conservation zones are a type of MPA in English, Welsh and Northern Irish waters designated under the Marine and Coastal Access Act 2009[7] (for England and Wales) or The Marine Act (Northern Ireland) 2013[8] (for Northern Ireland).

[2] https://hub.jncc.gov.uk/assets/94f961af-0bfc-4787-92d7-0c3bcf0fd083
[3] https://www.legislation.gov.uk/eudr/1992/43/contents
[4] https://hub.jncc.gov.uk/assets/94f961af-0bfc-4787-92d7-0c3bcf0fd083
[5] https://www.gov.uk/government/collections/marine-planning-in-england
[6] https://www.legislation.gov.uk/eur/2019/1241/contents
[7] https://www.legislation.gov.uk/ukpga/2009/23/contents
[8] https://www.legislation.gov.uk/nia/2013/10/contents

**MPA** – **marine protected area**. Marine protected areas are protected sites with a marine element, this includes special areas of conservation (SAC), special protection areas (SPA) and marine conservation zones (MCZ).

**MPA assessment** – MPA site level assessments are carried out in a manner consistent with the requirements of Article 6(3) of the Habitats Directive for EMSs and the requirements of section 126 of the Marine and Coastal Access Act 2009 for MCZs. For EMSs the assessments will determine whether, in light of the site's conservation objectives, fishing activities are having an adverse effect on the integrity of the site. For MCZs the assessments will determine whether there is a significant risk of fishing activities hindering the conservation objectives and general management approach of the site.

**Natural England** - Government advisor for the environment in England. This includes aspects of the marine environment of 0 to 12nm.

**PAD** – **Pressure Activity Database**. This JNCC database supports the advice on operations for UK offshore MPAs and is used to determine whether pressures are likely to have a significant effect on a site's features.

**Pr-value** – **fishing footprint value**. Defines the level of pressure for a single average day of effort for a reference vessel or fisher (land-based) within a fleet, taking into account the gear used. The value can be multiplied by the number of vessels or fishers to give the total pressure for a particular gear over a specific time period.

**SAC** – **special area of conservation.** Special areas of conservation are MPAs put in place to protect habitats and species listed in Annexes I and II of Council Directive 92/43/EEC (the Habitats Directive).

**SCI** – **Site of community importance.** Defined by the Council Directive 92/43/EEC (the Habitats Directive) as a site which contributes significantly to the maintenance or restoration at a favourable conservation status of a natural habitat type or of a species in the biogeographical region or regions to which it belongs.

**Sensitivity assessment** – Assessment of sensitivity of a species or habitat which takes into account ability to resist impacts, and rate of rate of recovery after an impact.

**SNCB** - **statutory nature conservation body**. A collective term for Natural Resources Wales (NRW), Joint Nature Conservation Committee (JNCC), Natural England (NE), Northern Ireland's Council for Nature Conservation and the Countryside (which generally works through the Northern Ireland Environment Agency) and NatureScot. These organisations have a statutory responsibility to provide conservation advice for MPAs and report on the condition of protected features.

**SPA** – **special protection area**. Special protection areas are MPAs put into place to protect threatened bird species, designated under the Wild Birds Directive.

**SPIRIT** - **SPatial InfoRmatIon Toolkit**. SPIRIT is the MMO Geographic Information System used for mapping environmental and other data.

**SOCI** – **species of conservation importance**. Species that are threatened, rare, or declining. More information can be found in the Ecological Network Guidance (Marine Conservation Zone Project) section 4.2.3[9]

**Target** - This defines the desired condition of an attribute, taking into account fluctuations due to natural change.

**VMS** – **vessel monitoring system**. All commercial fishing vessels over 12 metres in length in UK waters must report their position via VMS when at sea. VMS devices on the vessels send regular reports of position and vector.

[9] https://hub.jncc.gov.uk/assets/94f961af-0bfc-4787-92d7-0c3bcf0fd083

# 1. Summary

Table 1 shows a summary of the outcomes of the current assessment regarding the impact of fishing gears on protected features.

**Table 1: Dogger Bank SAC fisheries assessment summary**

| Features | Activity/gear | Part A outcome | Part B outcome | Part C outcome: In combination assessment |
|---|---|---|---|---|
| H1110 Sandbanks which are slightly covered by sea water all the time | Beam trawl (pulse/wing) | Not likely to have a significant effect | N/A | N/A |
| | Mussels, clams, oyster dredges | | | |
| | Pump scoop dredges (cockles, clams) | | | |
| | Suction dredges (cockles) | | | |
| | Jigging/trolling | | | |
| | Hand working (access from vessel) | | | |
| | Handlines (rod/gurdy) | | | |
| | Longlines (demersal) | | | |
| | Longlines (pelagic) | | | |
| | Cuttle pots | | | |
| | Fish traps | | | |
| | Drift nets (pelagic) | | | |
| | Drift nets (demersal) | | | |
| | Crab tiling | | | |
| | Digging with forks | | | |
| | Purse seine | | | |
| | Mid-water trawl (single) (pelagic) | | | |
| | Mid-water trawl (pair) (pelagic) | | | |
| | Pots/creels (crustacea/gastropods) | Likely to have a significant effect | Will not result in adverse effect on site integrity | Will not result in adverse effect on site integrity |
| | Gillnets | | | |
| | Trammel nets | | | |
| | Entangling nets | | | |
| | Beam trawl (whitefish) | | May result in adverse | N/A |
| | Beam trawl (shrimp) | | | |
| | Heavy otter trawl | | | |

| | | | | |
|---|---|---|---|---|
| | Multi-rig trawls | | effect on site integrity | |
| | Light otter trawl | | | |
| | Pair trawl | | | |
| | Anchor seine | | | |
| | Scottish/fly seine | | | |
| | Mid-water trawl (single) (semi-pelagic) | | | |
| | Mid-water trawl (pair) (semi-pelagic) | | | |
| | Scallop dredges | | | |

## 2. Introduction

Table 2 shows the name and legal status of the site. Located in the Southern North Sea approximately 150 km north east of the Humber Estuary, Dogger Bank Special Area of Conservation (SAC) lies entirely outside the 12 nautical mile limit sharing its eastern boundary with the UK's economic exclusion zone (EEZ). The site covers an area of approximately 12,331 $km^2$ [10].

**Table 2: Site details**

| Name of site | Legal status |
|---|---|
| Dogger Bank | Special Area of Conservation (SAC) |

Dogger Bank SAC is an offshore marine protected area (MPA) designated to protect the Annex I sandbank feature - sandbanks which are slightly covered by sea water all the time (H1110)[11] (Figure 1), which covers the expanse of the designated area. The Dogger Bank is the largest single continuous expanse of shallow sandbank in UK waters and is a cross-border sandbank extending into German and Dutch waters where it is similarly protected as Dogger Bank SAC and Doggerbank SAC respectively (Figure 1). The southern area of the sandbank is covered by water seldom deeper than 20 m and extends within the SAC in UK waters down to 35 – 40 m deep. Its location in open sea exposes the bank to substantial wave energy and prevents the colonisation of the sand by vegetation on the shallower parts of the bank. The sediments range from fine sands containing many shell fragments on top of the bank to muddy sands at greater depths. In contrast to other UK sandbanks formed by hydrological, tidal processes, Dogger Bank was formed by geological, glacial processes prior to being submerged through sea level rise (Diesing et al., 2009). As a result, Dogger Bank is representative of a different sub-type of the

[10] https://hub.jncc.gov.uk/assets/26659f8d-271e-403d-8a6b-300defcabcb1
[11] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:31992L0043&from=EN

typical offshore Annex I sandbank feature (Eigaard et al 2016) compared to other sandbank sites designated in the region (e.g. North Norfolk Sandbanks and Saturn Reef, Inner Dowsing, Race Bank and North Ridge SAC and Haisborough, Hammond and Winterton SAC). Given that it comprises more than 70% of the UK Annex I sandbank resource, it is particularly important in terms of its contribution as part of an ecologically coherent network of MPAs (JNCC 2013). Due to the difference in its formation, unlike other UK sandbanks, Dogger Bank contains substantial areas of coarser sediments (including pebbles) and unique benthic communities associated with these sediments. Communities are dominated by the soft coral – dead man's fingers (*Alcyonium digitatum*), the bryozoan sea chervil (*Alcyonidium diaphanum)* and serpulid worms[10].

The sandbank supports commercially and ecologically important fish species including flat fish and sandeels as well as invertebrate communities characterised by infauna such as polychaete worms, amphipods and small clams, and epifauna such as hermit crabs, starfish and brittlestars.

The sandeels provide an important food source for a number of species including sea birds and marine mammals. As a result, the Dogger Bank region is also an important location for the Habitats and Species Directive Annex II listed species harbour porpoise (*Phocoena phocoena*) with approximately 52% of the Dogger Bank SAC overlapping with the Southern North Sea SAC which has been designated to protect them (Figure 1). Two other Annex II listed species, grey seal (*Halichoerus grypus*) and common seal (*Phoca vitulina*) are also known to visit the bank and are therefore included as non-qualifying features of the site along with harbour porpoise[10].

All countries with sites designated for the protection of Dogger Bank agreed in 2011 that its conservation status was 'unfavourable' (NSRAC 2011). This was based on a long history of demersal fishing activity on the Dogger Bank and comparison of the benthic communities present in association with similar undisturbed habitats suggesting that Dogger Bank has an excess of opportunistic species and a depleted community of long-lived species.

Table 3 shows the features for which Dogger Bank SAC has been designated and the associated conservation objective.

**Table 3: Designated features and general management approach.**

| Feature | Sub-features | High level conservation objective |
|---|---|---|
| Sandbanks which are slightly covered by sea water all the time (H1110) | Subtidal sand | Subject to natural change, the integrity of the site is maintained or restored as appropriate, and that the site contributes to achieving the Favourable Conservation Status of its qualifying features, by maintaining or restoring:<br>• the extent and distribution of qualifying natural habitats<br>• the structure and function (including typical species) of qualifying habitats<br>• the supporting processes on which qualifying natural habitats rely |
| | Subtidal coarse sediment | |
| | Subtidal mixed sediments | |
| | Subtidal mud | |

More information regarding the conservation objectives for the protected features of the Dogger Bank SAC is available in the site's conservation advice package (Table 5).

### 2.1 Sub-features of Dogger Bank 'sandbanks which are slightly covered by sea water all the time'

#### 2.1.1 Subtidal sand

Subtidal (or sublittoral as per EUNIS habitat classification[12]) sand forms the predominant component of the Dogger Bank sandbank and is typified by species commonly associated with fine/medium sands with little mud content including the white catworm (*Nephtys cirrosa)* and amphipods such as *Bathyporeia sp.* The large expanses of subtidal sand in the Dogger Bank SAC result in mobile epifaunal assemblages largely similar to other North Sea sandbanks including the presence of: common hermit crabs (*Pagurus bernhardus*), common starfish (*Asterias rubens*), flatfish species such as plaice (*Pleuronectes platessa*), sole (*Solea solea*) and yellow sole (*Buglossidium luteum*), sandeels (*Ammodytes spp.*), swimmer crabs (*Liocarcinus* spp.), and gobies (*Pomatoschistus* spp.) (Diesing et al., 2009, Eigaard et al., 2016a).

[12] https://www.eea.europa.eu/data-and-maps/data/eunis-habitat-classification

### 2.1.2 Subtidal coarse sediment

Among UK sandbanks, the presence of elongate patches of subtidal coarse sediments (comprising cobbles and pebbles) is unique to the Dogger Bank sandbank. While these features are common on storm dominated continental shelves, shallow sandbanks in the North Sea region tend to be composed of finer more mobile sands such as those of the sandbanks of North Norfolk Sandbanks and Saturn Reef SAC (Diesing et al., 2009).

The coarser sediments found at Dogger Bank SAC result in the presence of distinct communities due to the greater availability of micro-niches in these habitats. Certain infaunal species dominate including the polychaetes *Glycera lapidum* and *Notomastus* spp. and while epifauna is largely similar to nearby sandbanks (see above) the presence of coarse sediments allows for an abundance of additional species not routinely found in sandbank habitats, such as the burrowing sea urchin *Echinocardium cordatum*, masked crabs *Corystes cassivelaunus*, and attached species including the dead man's fingers soft coral *Alcyonium digitatum* and the bryozoan sea chervil *Alcyonidium diaphanum* (Diesing et al., 2009).

### 2.1.3 Subtidal mixed sediments

Subtidal mixed sediments are found in three small, isolated patches within the Dogger Bank sandbank (Figure 2) totalling an area of less than 7 $km^2$. These habitats incorporate a range of sediments including heterogeneous muddy gravelly sands and also mosaics of cobbles and pebbles embedded in or lying upon sand, gravel or mud. The habitats may support a wide range of infauna and epibiota including polychaetes, bivalves, echinoderms, anemones, hydroids and bryozoans[13]. Recent ground truthing surveys identified subtidal mixed sediments in the site via particle size analysis (PSA) but infaunal analysis of these samples revealed communities more closely associated with those occurring in the subtidal coarse and sand habitats (Diesing et al., 2009, Eigaard et al., 2016a).

### 2.1.4 Subtidal mud

Subtidal mud habitats are often dominated by polychaetes and echinoderms, in particular brittlestars such as *Amphiura* spp. and seapens such as *Virgularia mirabilis*. Through PSA, recent habitat surveys have identified subtidal mud in a few scattered, deeper locations within Dogger Bank SAC (Eigaard et al., 2016a, Eggleton et al., 2016). JNCC did not consider these areas to be sufficiently expansive to be included in the habitat map for the site hence its absence in Figure 2.

[13] https://eunis.eea.europa.eu/habitats/2503

**Figure 1: Dogger Bank SAC Location overview**

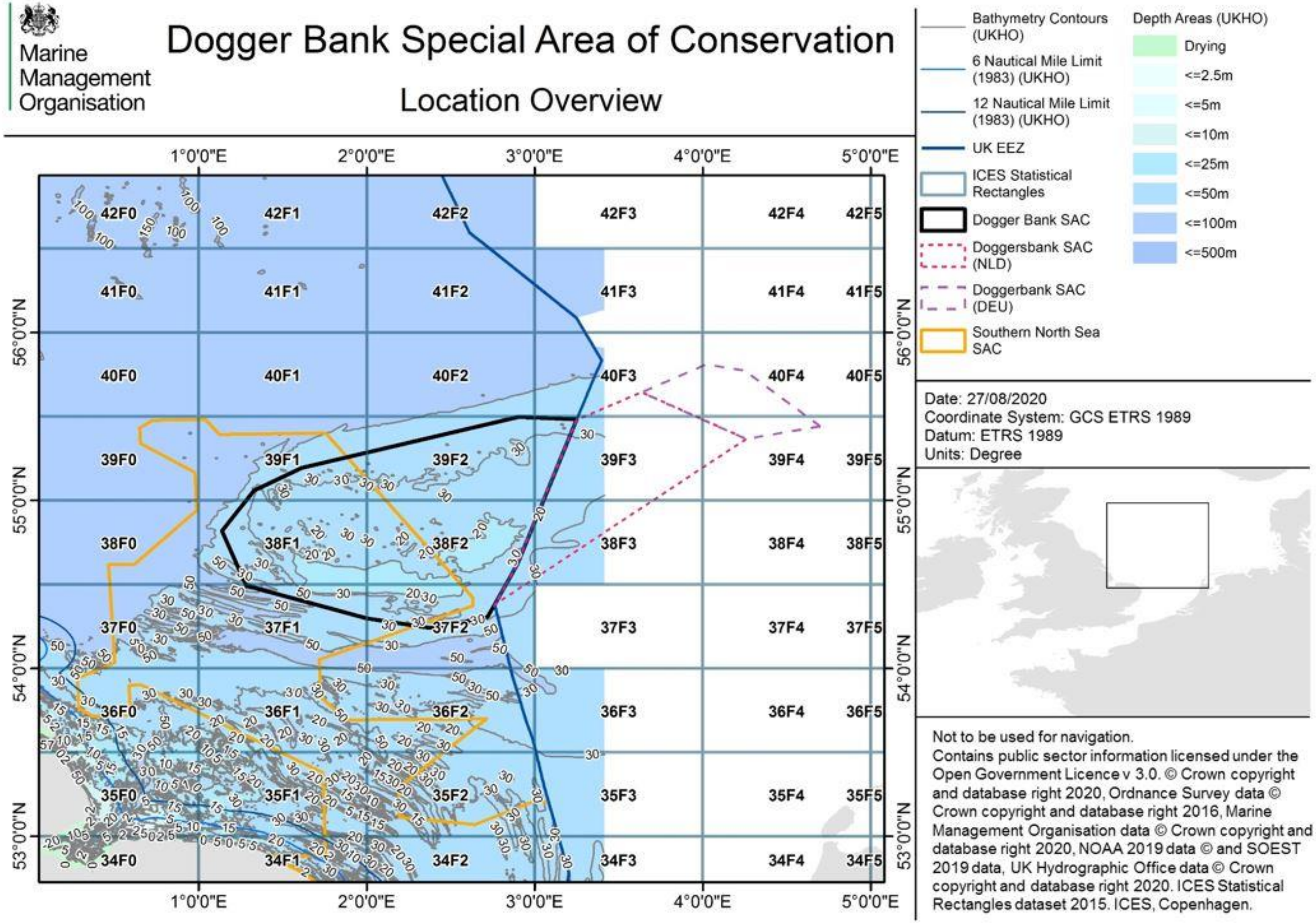
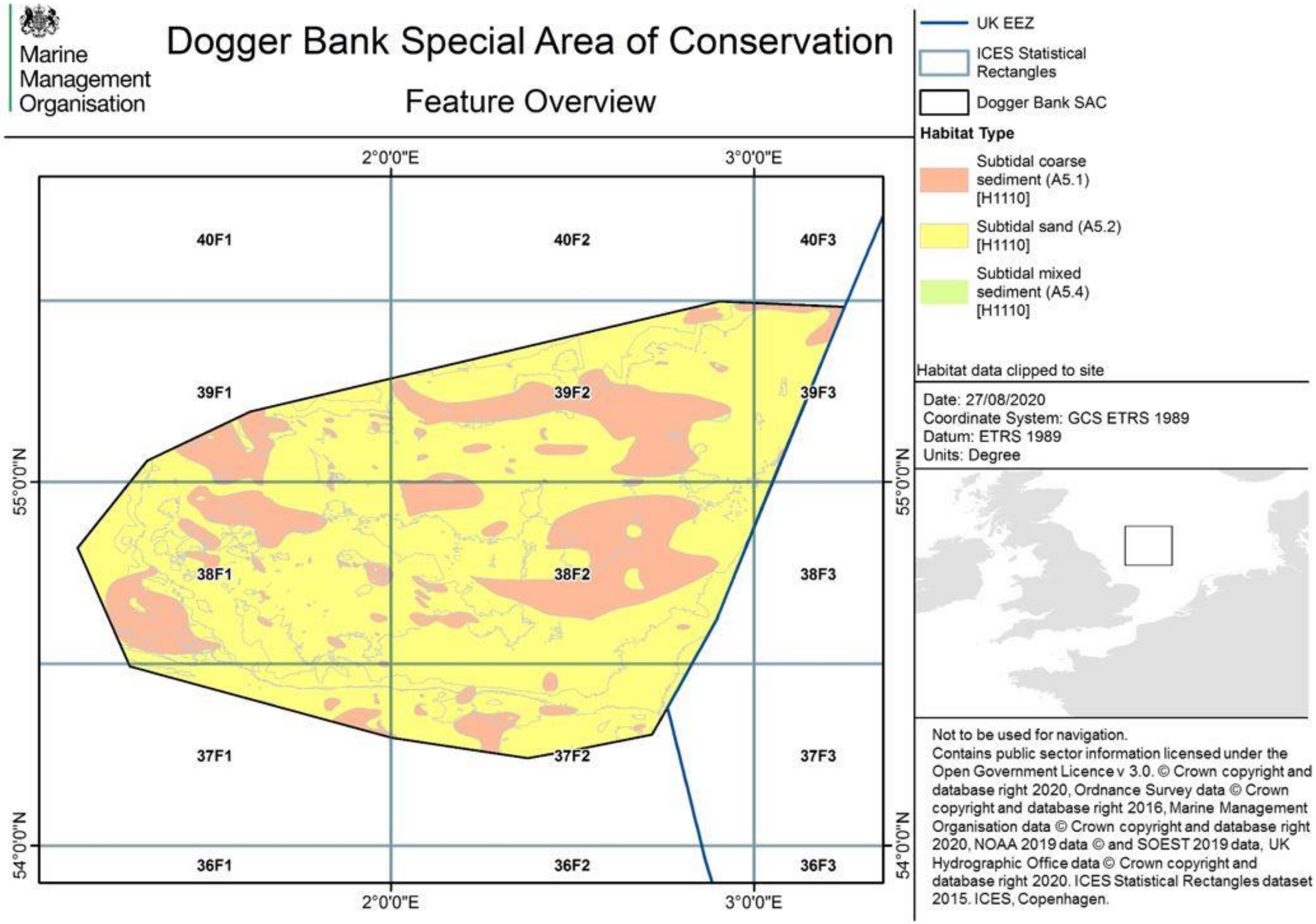


**Figure 2: Dogger Bank 'sandbanks that are slightly covered by seawater all the time'**



## 2.2 Scope of this assessment – fishing activities assessed

The geographic scope of this assessment covers the whole of the Dogger Bank SAC (Figure 2). All commercial fishing gears will be included for assessment (Table 4).

**Table 4: Fishing activities covered by this assessment**

| Gear type | | Gear Code | SNCB aggregated gear method |
|---|---|---|---|
| Towed (demersal) | Beam trawl (whitefish) | TBB | Demersal trawl |
| | Beam trawl (shrimp) | | |
| | Beam trawl (pulse/wing) | | |
| | Heavy otter trawl | OTB | |
| | Multi-rig trawls | TX | |
| | Light otter trawl | OTB | |
| | Pair trawl | PTB | |
| | Anchor seine | SDN | Demersal seines |
| | Scottish/fly seine | SSC | |
| Towed (pelagic) | Mid-water trawl (single) | TM | Pelagic fishing |
| | Mid-water trawl (pair) | PTM | |
| | Industrial trawls | TM | |
| Dredges (towed) | Scallops | DRB | Dredges |
| | Mussels, clams, oysters | DRB / HMD | Dredges / Hydraulic dredges |
| | Pump scoop (cockles, clams) | HMP / HMD | Hydraulic dredges |
| Dredges (other) | Suction (cockles) | HMD | |
| | Tractor | CGD | Shore-based activities |
| Intertidal handwork | Hand working (access from vessel) | LHP | |
| | Hand work (access from land) | DRH | |
| Static - pots/traps | Pots/creels (crustacea/gastropods) | FPO | Traps |
| | Cuttle pots | | |
| | Fish traps | | |
| Static - fixed nets | Gillnets | GNS | Anchored nets/lines |
| | Trammels | GTR | |
| | Entangling | GN | |
| Passive - nets | Drift nets (pelagic) | GND | Pelagic fishing |
| | Drift nets (demersal) | | Anchored nets/lines |
| Lines | Longlines (demersal) | LLS | |
| | Longlines (pelagic) | LLD | Pelagic fishing |
| | Handlines (rod/gurdy) | LHP | |
| | Jigging/trolling | LHP / LTL | |
| Seine nets and other | Purse seine | PS | |
| | Beach seines/ring nets | SB | Shore-based activities |
| | Shrimp push-nets | - | |

| | | | |
|---|---|---|---|
| | Fyke and stakenets | FYK / GNF | Anchored nets/lines |
| Miscellaneous | Commercial diving | - | Diving |
| | Bait dragging | - | Shore-based activities |
| | Crab tiling | - | |
| Bait collection | Digging wth forks | - | |

Commercial sea fishing has the potential to vary in nature and intensity over time. This assessment considers a particular range of recent and likely future activity based on activity levels and type as identified in section 4.1.

To ensure the achievement of the conservation objectives of the site is not hindered should future activity occur outside of this range, activity will be monitored at this site, and this assessment will be reviewed should certain limits be triggered. See section 8 for more information on ongoing monitoring and control at this site.

# 3. Part A Assessment

Table 5 shows the Joint Nature Conservation Committee (JNCC) conservation advice package used to inform this assessment.

**Table 5: Advice package used for assessment**

| Feature | Sub-features | Package | Link |
|---|---|---|---|
| H1110 Sandbanks which are slightly covered by sea water all the time | Subtidal sand | Dogger Bank MPA conservation advice | https://jncc.gov.uk/our-work/dogger-bank-mpa |
| | Subtidal coarse sediment | | |
| | Subtidal mixed sediments | | |
| | Subtidal mud | | |

Part A of this assessment was carried out in a manner that is consistent with the likely significant effect (LSE) test required by article 6(3) of the Council Directive 92/43/EEC on the Conservation of natural habitats and of wild fauna and flora (Habitats Directive)[14].

For each fishing activity, a series of questions were asked[15]:

1. Does the activity take place, or is it likely to take place in the future?

[14] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:31992L0043&from=EN
[15] The test for likely significant effect under article 6(3) of the Habitats Directive is not required for activities which are directly connected to or necessary to the management of the site. Fishing activities are not considered to be directly connected to or necessary to the management of the site unless otherwise indicated.

2. What are the potential pressures exerted by the activity on the feature?
3. Are the effects/impacts of the pressures likely to be significant?

For each activity assessed in Part A, there were two possible outcomes for each identified pressure-feature interaction:

1. The pressure-feature interactions were not included for assessment in Part B:
   a. If the feature is not exposed to the pressure, and is not likely to be in the future; or
   b. If the effect/impact of the pressure is not likely to be significant.

2. The pressure-feature interactions were included for assessment in Part B:
   a. If the feature is exposed to the pressure, or is likely to be in the future; and
   b. If the potential scale or magnitude of any effect is likely to be significant; or
   c. If it is not possible to determine whether the magnitude of any effect is likely to be significant.

Consideration of exposure to or effect of a pressure on a protected feature of the SAC includes consideration of exposure to or effect of that pressure on any ecological or geomorphological process on which the conservation of the protected feature is wholly or in part dependent.

### 3.1 High risk interactions

To fast track management for particularly sensitive features where there is already sufficient evidence to support the interaction of certain gears as not being compatible with the conservation objectives of an MPA, the MMO has identified “high risk” gear-feature interactions. For this purpose, and in accordance with JNCC advice, the MMO has made use of the Southern North Sea fisheries management options paper (JNCC 2015) which, while not including Dogger Bank SAC, considered management options for SACs in the region which are similarly designated for the H1110 sandbank feature. No high risk gear-feature interactions have been identified that are relevant to Dogger Bank SAC and therefore all gears will be assessed in this assessment.

### 3.2 Activities not taking place

Table 6 shows activities which are excluded from further assessment as they do not take place and are not likely to take place in the future.

**Table 6: Activities not taking place and not likely to take place in the future**

| Feature | Gear type | Justification |
| --- | --- | --- |
| H1110 Sandbanks which are slightly covered by sea water all the time | Beam trawl (pulse/wing) | The UK has banned pulse trawling in UK waters. This method will therefore not be included in this assessment. |
| | Mussel, clam, oyster dredges | These gears do not appear in the VMS data for Dogger Bank SAC and expert opinion from MMO marine officers states these gears are not used in the site. |
| | Pump scoop dredges (cockles, clams) | |
| | Suction dredges (cockles) | |
| | Jigging/trolling | |
| | Hand working (access from vessel) | |
| | Handlines (rod/gurdy) | |
| | Longlines (demersal) | |
| | Longlines (pelagic) | |
| | Cuttle pots | |
| | Fish traps | |
| | Trammel nets | |
| | Entangling nets | |
| | Drift nets (pelagic) | |
| | Drift nets (demersal) | |
| | Crab tiling | Dogger Bank is approximately 100 km offshore and so not subject to shore-based activities. |
| | Digging with forks | |
| | Hand work (access from land) | |
| | Tractor dredges | |
| | Beach seines/ring nets | |
| | Shrimp push-nets | |
| | Fyke and stakenets | |
| | Commercial diving | The site is not suitable for commercial dive fishing due to distance offshore, the strong tidal currents and waves. |
| | Bait dragging | Bait dragging does not take place in the UK outside of Poole Harbour. |

### 3.3 Potential pressures exerted by the activities on the feature

For the remaining activities, (traps, anchored nets, demersal trawls, purse seines, demersal seines, dredging and pelagic fishing) potential pressures were identified using the JNCC conservation advice identified in Table 5 and the associated advice on operations tables. Table 7 shows the pressures identified. Truly pelagic fishing gears, i.e. those with no contact with the seabed (purse seines and mid water trawls) have no associated pressures considered relevant to the sandbank feature and have not been included. However, semi-pelagic towed gears are likely to interact with the seabed and have potential pressures on sandbank features. There is not a specific aggregated method category for semi-pelagic towed gears, however in accordance with previous draft Joint Recommendations for fisheries management at Dogger Bank SAC[16], these gears have been categorised as bottom otter board trawls and included in the demersal trawls aggregated method gear group.

**Table 7: Potential pressures for all features of the site. Red = potential pressure. Grey = pressure not relevant to feature.**

| **Potential pressures** | **Subtidal coarse sediment** | **Subtidal sand** | **Subtidal mixed sediments** | **Subtidal mud** | **Subtidal coarse sediment** | **Subtidal sand** | **Subtidal mixed sediments** | **Subtidal mud** | **Subtidal coarse sediment** | **Subtidal sand** | **Subtidal mixed sediments** | **Subtidal mud** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Anchored Nets/Lines, Traps** | | | | **Demersal Trawls, Demersal Seines** | | | | **Dredges** | | | |
| Abrasion/disturbance of the substrate on the surface of the seabed | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red |
| Changes in suspended solids (water clarity) | Grey | Grey | Grey | Grey | Red | Red | Red | Red | Red | Red | Red | Red |
| Deoxygenation | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red |
| Hydrocarbon & PAH* contamination | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red |
| Introduction or spread of non-indigenous species | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red |
| Litter | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red |
| Nutrient Enrichment | Grey | Grey | Grey | Grey | Red | Red | Red | Red | Red | Red | Red | Red |
| Organic enrichment | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red |
| Penetration and/or disturbance of the substrate below the surface of the seabed | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red |
| Physical change (to another seabed type) | Grey | Grey | Grey | Grey | Red | Red | Red | Red | Red | Red | Red | Red |
| Removal of non-target species | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red | Red |
| Removal of target species | Red | Red | Red | Red | Grey | Grey | Grey | Grey | Red | Red | Red | Red |
| Smothering and siltation rate changes | Grey | Grey | Grey | Grey | Red | Red | Red | Red | Red | Red | Red | Red |

[16] https://fiskeristyrelsen.dk/media/8992/20160531_dogger_bank_background_document_final.pdf

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Synthetic compound contamination | | | | | | | | | | | | |
| Transition elements & organo-metal contamination | | | | | | | | | | | | |
| Introduction of microbial pathogens | | | | | | | | | | | | |

* polycyclic aromatic hydrocarbons

### 3.4 Significance of effects/impacts

To determine whether each pressure is likely to have a significant effect on the site's features, the sensitivity assessments and risk profiling of pressures from the advice on operations section of the JNCC conservation advice package and Pressures-Activities Database (PAD)[17] were used.

Table 8 identifies the pressures from particular gears that are likely to have a significant effect on each sub-feature. Where a pressure from a particular gear is identified as not being likely to significantly effect a sub-feature, justification is provided. Based on the JNCC assessment, it was concluded that all sediment features should be treated as having similar sensitivities to the identified pressures and have therefore been considered together.

To ensure the effects of fishing activities in-combination with other activities (including other fishing activities) are fully assessed, the pressures from fishing activities which are not likely to cause a significant effect but which do interact with the feature are considered in the in-combination aspect of the assessment (Part C, section 5).

[17] https://jncc.gov.uk/our-work/marine-activities-and-pressures-evidence/#jncc-pressures-activities-database

**Table 8: Summary of pressures from specific activities to be taken to Part B for all sediment features.**

| Potential pressures | Anchored Nets/Lines, Traps | Demersal Trawls | | | Demersal Seines | | | Dredges |
|---|---|---|---|---|---|---|---|---|
| | Gillnets, Pots/Creels | Otter Bottom Trawls | Otter Twin Trawls | Beam Trawls | Danish/ Anchor Seine | Scottish Seine | Scottish Pair Seines | Shellfish dredges |
| Abrasion/disturbance of the substrate on the surface of the seabed | LSE - from gear and associated lines or anchors. | | | | | | | |
| Changes in suspended solids (water clarity) | No LSE – Pressure not applied by gear type. | LSE - through contact and movement of the gear with and over the seabed. | | | | | | |
| Deoxygenation | No LSE – the sediment features are not deemed sensitive to this pressure at the benchmark. Dogger Bank is exposed to substantial wave energy making the accumulation of discards and associated hypoxia or any deoxygenation resulting from ballast water unlikely. | | | | | | | |
| Hydrocarbon & PAH contamination | No LSE – the sediment features are not deemed sensitive to this pressure at the benchmark. Deliberate releases are already prohibited. Accidental discharges from fishing vessels leading to significant releases are extremely rare. | | | | | | | |
| Introduction of microbial pathogens | No LSE – Pressure not applied by gear type. | | | | | | | No LSE – likelihood of shellfish fisheries transmitting disease is low due to |

| | | |
|---|---|---|
| | | strong wave exposure. |
| Introduction or spread of non-indigenous species | No LSE – The significant vector for the introduction of non-indigenous species is ballast water. Given the exposed nature of the site and the majority of fishing vessels being under 45 m and therefore using solid ballast[18] the sediment features are deemed to be at low risk from this pressure. | |
| Litter | No LSE – The exposure of the site to substantial wave energy make it unlikely that lost gear will persist at the site for long enough to cause a significant impact to the sediment features. | |
| Nutrient Enrichment | No LSE – Pressure not applied by gear type. | No LSE – the sediment features are is not deemed sensitive to this pressure at the benchmark. |
| Organic enrichment | No LSE – While some of the sediments present at Dogger Bank can be sensitive to this pressure it is deemed to be a low risk to the features and Dogger Bank SAC is subject to strong wave exposure and therefore discards are unlikely to accumulate. | |
| Penetration and/or disturbance of the substrate below the surface of the seabed | LSE - through contact of the gear with the seabed. | |
| Physical change (to another seabed type) | No LSE – Pressure not applied by gear type. | No LSE – While the sediments can be sensitive to this pressure it is deemed to be a low risk to the features. |
| Removal of non-target species | LSE - this pressure may result through bycatch from fishing gear. | |

[18] www.legislation.gov.uk/eudr/2002/35/pdfs/eudr_20020035_adopted_en.pdf

| | | | |
|---|---|---|---|
| Removal of target species | LSE - this pressure may result through targeted fishing over the feature. | LSE – Pressure not considered relevant to gear types in JNCC conservation advice on operations. However, as there are overlapping target species between gears, for consistency and to be precautionary, this pressure has been considered LSE for the purposes of this assessment. | LSE - this pressure may result through targeted fishing over the feature. |
| Smothering and Siltation rate changes | No LSE – Pressure not applied by gear type. | LSE - this pressure may result from physical disturbance and hydrodynamic action caused by the gear. | |
| Synthetic compound contamination | No LSE - Features not sensitive at the benchmark and pressure considered to be a low risk to the subtidal coarse sediment feature. | | |
| Transition elements & organo-metal contamination | No LSE - Features not sensitive at the benchmark and pressure considered to be a low risk to the subtidal coarse sediment feature. | | |

* polycyclic aromatic hydrocarbons

## 4. Part B Assessment

Part B of this assessment was carried out in a manner that is consistent with the appropriate assessment required by article 6(3) of the Habitats Directive.

Table 9 shows the fishing activities and pressures identified in Part A which have been included for assessment in Part B. Pressures with similar potential impacts to a particular feature were grouped to save repetition during this assessment.

**Table 9: Fishing activities and pressures included for Part B assessment.**

| **Feature** | **SNCB aggregated gear method** | **Fishing gear type** | **Pressures** |
|---|---|---|---|
| Sandbanks which are slightly covered by seawater all the time | Anchored Nets/Lines | Gillnets | • Abrasion/disturbance of the substrate on the surface of the seabed<br>• Penetration and/or disturbance of the substrate below the surface of the seabed<br>• Removal of target species<br>• Removal of non-target species |
| | Traps | Pots/creels | |
| | Demersal Trawls | Otter Twin Trawlers<br>Beam Trawls | |
| | Demersal Seines | Danish/ Anchor Seine<br>Scottish Seine<br>Scottish Pair Seines | |
| | Dredges | Shellfish dredging | |
| | Demersal Trawls | Otter Twin Trawlers<br>Beam Trawls | • Changes in suspended solids (water clarity)<br>• Smothering and siltation rate changes |
| | Demersal Seines | Danish/ Anchor Seine<br>Scottish Seine<br>Scottish Pair Seines | |
| | Dredges | Shellfish dredging | |

The important targets for favourable condition were identified within JNCC's conservation advice supplementary advice tables. 'Important' in this context means only those targets relating to attributes that will most efficiently and directly help to define condition. These attributes should be clearly capable of identifying a change in condition.

Table 10 shows which targets were identified as important. The impacts of pressures on features were assessed against these targets to determine whether the activities causing the pressures are compatible with the site's conservation objectives.

**Table 10: Relevant favourable condition targets for identified pressures for all sediment features.**

| Attribute | Target | Relevant pressures |
|---|---|---|
| Extent and distribution | **Restore objective:**<br>The feature extent within the site must be conserved to the full known distribution (sandbank feature calculated to be 12,331 $km^2$) based on:<br>- large-scale topography<br>- sediment composition<br>- biological assemblages | Relevant to:<br>• Abrasion/disturbance of the substrate on the surface of the seabed.<br>• Penetration and/or disturbance of the substrate below the surface of the seabed.<br>• Removal of non-target species.<br>• Removal of target species<br>• Smothering and siltation rate changes.<br>• Changes in suspended solids (water clarity). |
| Structure and function | **Restore objective:**<br>• Physical structure (finer scale topography and sediment composition and distribution) to be restored.<br>• Biological structure (characteristic communities) to be restored.<br>• Function to be restored | Relevant to:<br>• Abrasion/disturbance of the substrate on the surface of the seabed.<br>• Penetration and/or disturbance of the substrate below the surface of the seabed.<br>• Removal of non-target species.<br>• Removal of target species<br>• Smothering and siltation rate changes.<br>• Changes in suspended solids (water clarity). |

| | | |
|---|---|---|
| Supporting processes | **Maintain objective:**<br>• Hydrodynamic regime to be maintained.<br>• Water and sediment quality to be maintained. | Relevant to:<br>• Smothering and siltation rate changes.<br>• Changes in suspended solids (water clarity). |

### 4.1 Fishing Activity Descriptions

#### 4.1.1 Existing management

Fishing vessels from numerous European countries are active in the Dogger Bank SAC but UK, Belgian, German, Danish, and Dutch vessels are most prevalent. Swedish and Norwegian vessels are also active in the site, albeit to a lesser extent.

There are a large number of technical measures (including the 'Technical Conservation Regulations' - Regulation EU 2019/1241)[19] in operation within the Dogger Bank SAC for stock management and conservation. However, these measures are not designed to achieve the conservation objectives of the site (though they may contribute to the achievement of favourable condition) and the impacts from ongoing fishing activities still need to be assessed and managed where appropriate.

At time of writing, Dogger Bank SAC is subject to a temporary closure for scallop dredges. From Sunday 12 July 2020 to Sunday 28 February 2021 there is a suspension of scallop dredging in ICES rectangles 39F1, 39F2, 39F3, 38F1, 38F2, 38F3, 37F1 and 37F2. This was implemented to allow data gathering on the shellfish stock in response to concerns over an increase in scalloping in the area. The four UK Fisheries Administrations have also sought views and evidence on the impact of the potential implementation of a temporary closure of the king scallop (*Pectens maximus*) fishery in the Dogger Bank area including in SAC[20].

#### 4.1.2. Evidence Sources

To determine the levels of fishing activity, the following evidence sources were used:

- VMS data;
- fisheries landings data (logbooks and sales records);
- expert opinion from MMO marine officers;

[19] https://www.legislation.gov.uk/eur/2019/1241/contents
[20] https://www.gov.uk/government/consultations/call-for-evidence-dogger-bank-king-scallop-stock-closure-in-ices-rectangles-39f1-39f2-39f3-38f1-38f2-38f3-37f1-and-37f2#:~:text=The%20Marine%20Management%20Organisation%20put,in%20the%20Dogger%20Bank%20area.

- MMO and Royal Navy sightings;
- Spatial footprint analysis using Pr-values.

Table 11 summarises the description, strengths and limitations of some of the evidence sources used. For more information about the evidence sources used, please see Annex 1.

**Table 11: Summary of generic confidence associated with fishing activity evidence.**

| Evidence source | Confidence | Description, strengths and limitation |
|---|---|---|
| VMS data | High / Moderate | • Confidence in VMS is high for describing activity relating to larger vessels (>12m). but it does not describe activity of smaller vessels.<br>• There are assumptions in the processing that speed of 0-6 knots is "fishing speed". This may therefore include vessels travelling at these speeds, but which are not fishing, and exclude any fishing taking place above these speeds. Therefore, this may over or under-estimate fishing activity.<br>• VMS records the location, date, time, speed and course of the vessel. Fishing gear information has to be linked to the VMS data itself by either matching its logbook information where possible, using the fleet register which may not be up to date or through local marine officer knowledge of the said vessel.<br>• VMS data logs vessel movement and thus can act as a good proxy for mobile gear effort. However, it is more challenging to link VMS data to static gear effort (i.e. amount of gear, soak time etc).<br>• Null gear codes may be present in the data which may underrepresent fishing fleet.<br>• Non-UK VMS is of lower resolution, presented to just 3 decimal degrees. |
| Landings Data | High | • Annual data collated and reported to ICES statistical rectangles.<br>• Resolution too low to directly infer landings for MPAs. |
| Expert judgement | Low / Moderate | • Reliability/accuracy depends on the area, and the local knowledge of MMO staff. |
| Sightings data | High | • Taken from Royal Navy and MMO patrols and targets inspection.<br>• Covers all vessels, not limiting to size class.<br>• Does not account for patrolling/inspection effort. |
| Pr-values | Moderate/High | • Spatial footprint values do not include information for non-VMS vessels.<br>• The methodology used to calculate spatial footprints requires ‘matching’ of VMS data to |

| | | |
|---|---|---|
| | | specific gear types held on UK or EU fishing fleet registers. This therefore relies on these registers being kept up to date.<br>• There are assumptions in the processing that speed of 0-6 knots is "fishing speed". This may therefore include vessels travelling at these speeds, but which are not fishing, and exclude any fishing taking place above these speeds. Therefore, this may over or under-estimate fishing activity. |

### 4.1.3. Dogger Bank fishing fleet

Fishing activity throughout the site is mostly bottom towed gear, with the main gear types being bottom otter trawls and beam trawls. Danish seines are also commonly used by both EU member state (non-UK) and UK vessels. Fixed gillnet and mid water otter trawling is conducted almost exclusively by Danish vessels. Until recently there has been little potting activity occurring in Dogger Bank SAC, however 2019 saw a few UK vessels start fishing in the site with pots. Due to the distance from shore the Dogger Bank fishing fleet is entirely made up of larger vessels greater than 12 m in length with VMS. Additionally, UK VMS data is assigned landings data via analysis of logbooks. Confidence in the assessment of the Dogger Bank fleet is therefore high.

Up until recently there has been little to no scallop dredging occurring within the Dogger Bank SAC, however during the spring of 2020 a lucrative scallop stock was discovered (MMO marine officer, *pers. comm.,* high confidence) and there has been a rapid increase in scallop dredging activity by UK vessels exploiting this stock.

In order to bridge the gaps in available data, expert opinion from MMO coastal officers has been incorporated into this assessment. The following sections describe the gear types used within the site according to expert opinion.

#### 4.1.3.1. Aggregated Method: Anchored nets/lines

The Danish fleet appear to be the only nation using anchored nets in the Dogger Bank SAC. The vast majority of these vessels use gillnets (Savina, 2018) and target Dover sole (STECF FDI landings data 2012-2016). The nets can have anything in the region of 90-448 tiers with each tier ranging from 47 – 72 m in length (Savina, 2018). Fishing activity from these vessels is consistent through quarters 1-3, reducing in quarter 4. Other fishing gears associated with anchored nets/lines are not believed to occur in the site (Table 6).

#### 4.1.3.2 Aggregated Method: Demersal Trawls

Demersal trawling in Dogger Bank is conducted predominantly by UK, Dutch, Danish German and Belgian vessels respectively. The main target species for the UK fleet is plaice whereas non-UK vessels tend to land large quantities of plaice, sandeels and herring, the latter of which is most likely derived from semi-pelagic gears, which, as detailed previously are considered demersal trawls for the purpose of this assessment.

Semi-pelagic trawls are towed on or very close to the seabed with the trawl doors swimming several metres above. Both pelagic and bottom trawls can be rigged or adapted to conduct semi-pelagic trawling (Seafish, 2020).

Demersal trawls in use consist of otter bottom trawls, beam trawls and otter twin trawls, with otter bottom trawls being the most common for all nations other than the Dutch who favour the use of beam trawls in the site.

#### 4.1.3.3 Aggregated Method: Demersal Seines

A number of seining fishing activities occur within Dogger Bank including Danish or anchor seines, purse seines, pair seines and Scottish seines. However Danish seines are the most common with Danish vessels using this technique most frequently, targeting sandeels.

#### 4.1.3.4 Aggregated Method: Dredges

The 2014-2019 VMS and landings data available suggested limited or no scallop dredging occurred in Dogger Bank SAC. However, as supported by the VMS data (Figure 15), in spring of 2020 a lucrative stock of scallops was discovered in the Western portion of the site. This was initially exploited by English vessels but soon escalated to include vessels pertaining to the larger Scottish scallop fleet. In June, landings of scallops from the Dogger Bank area saw a tenfold increase compared to previous months (MMO marine officer, *pers. comm.,* high confidence). Initial unpublished landings data for June 2020 reveal these scallops account for 54% of all scallops landed by UK vessels. As noted previously, at the time of writing this assessment scallop dredging was prohibited in the area between 12 July 2020 and the 28 Februry 2021 in response to this activity and to allow analysis of this shellfish stock.

#### 4.1.3.5 Aggregated Method: Traps

From 2014 to 2018, limited potting activity took place in the site (Table 18), with potting in the area occurring predominantly outside of site, south of the Dogger Bank boundary (Figure 3 to Figure 7). However, VMS data shows that potting activity occurred to the west of the site in 2019 (Figure 8).

Within the site there are approximately three potting vessels, all over 15m which pot for crab, whelks and lobster, with the vast majority of the activity targeting crabs. These are UK vessels and between them, they work the site year round. Based on logbook information, the vessels are believed to lay 10-16 strings per day with approximately 100 pots per string.

#### 4.1.4. VMS & Landings Data

VMS and landings data are included from 2014 to the most up to date information available in order to provide at least five years of data for analysis. Currently, VMS data is available up to and including 2019, landings data is available up to 2018 for non-UK vessels and to 2019 for UK vessels.

Maps showing patterns of VMS fishing reports at Dogger Bank are displayed in Figure 3 to Figure 15. Landings derived from Dogger Bank SAC were calculated by combining a several data sources and using various methods (see Annex 1 for details).

##### 4.1.4.1 Demersal UK landings

Estimates of demersal gear landings from Dogger Bank SAC reveal UK vessels were responsible for approximately 9% of landings by weight between 2014 and 2018 (Table 17), with all landings attributed to vessels over 12 m in length (Table 15). This correlates with expert advice from MMO officers who advised no fishing activity from smaller vessels takes place within in the site due to the distance from the shore (see section 4.1.3). In 2016, UK vessels were responsible for 57% of landings, however this may be due to a considerable reduction in landings derived from non-UK vessels (Table 17), specifically the Danish fleet (Figure 11). The proportion of landings from UK vessels (versus non-UK vessels) from 2017 to 2019 remained comparable to previous years (Table 17).

UK landings remained relatively stable for most gears with the exception of UK beam trawls, which saw a considerable drop in 2016, continuing to 2019 (Table 15). This reduction in landings correlates with reduced VMS fishing activity from UK beam trawlers.

##### 4.1.4.2 Demersal non-UK landings

Non-UK landings from Dogger Bank SAC were estimated using the proportion of VMS fishing records inside the site compared with the ICES rectangle in which they were recorded (Table 12). Records of midwater otter trawls (OTM) and midwater pair trawls (PTM) were classified as demersal trawling, as the gears may come into contact with the seabed and can be considered semi-pelagic, particulary given the shallow nature of Dogger Bank. Demersal trawling is also considered the most appropriate STECF gear category. In 2014, EU landings were assigned to gear groups rather than individual gear codes; thus, one landings value is given for the group of demersal trawl/seine (Table 12 and Table 13).

Non-UK landings for the relevant rectangles are almost exclusively (>99%) from vessels over 12 m in length (Table 13). Non-UK landings estimated to be derived from the SAC remained relatively stable for most gears, except demersal trawls / seines, which saw a considerable decline in 2016 (Table 17). This correlates with a reduction in VMS demersal trawl/seine fishing activity, specifically bottom otter trawls and midwater otter trawls (Table 18). However, this decline from 2016 was not sustained, with landings in 2017 and 2018 being similar to those in 2014 and 2015 (Table 17).

#### 4.1.4.3 Gillnetting

The landings data supports conclusions drawn elsewhere that Dogger Bank is an important area for UK and non-UK demersal trawling and seining but VMS data suggests it is not a common fishing ground for gillnetting. VMS data shows considerable activity from gillnetting vessels across all years (Figure 3-Figure 8), yet only two tonnes of landings are estimated to be attributed to EU vessels from 2014 to 2018 within the SAC (Table 12) and just 12 tonnes across all eight ICES rectangles which intersect the SAC (Table 13).

VMS data suggests there are seven vessels conducting gillnetting within the SAC which are all Danish. The Fisheries and Agriculture Organisation (FAO) holds vessel information[21] for three of these vessels, which suggests their primary gear type switches regularly between set gillnets and Danish seines (as well as otter trawls for one vessel). These three vessels account for approximately 75% of the VMS fishing records between 2014 and 2019. Due to the lack of recorded gillnet landings, it is assumed that the non-UK VMS gillnetting records are more likely to be Danish demersal seine activity. Therefore, estimated landings from non-UK vessels were updated to account for this (Table 16 and Table 17). These updated landings lead to average decrease of 5% demersal seine landings within the SAC from 2015 to 2018, and 10% increase in demersal trawl/seine landings within the SAC in 2014 (Table 16). The decrease in demersal seine landings in 2015 to 2018 was due to the EU ‘gillnet’ vessels having a high amount of VMS fishing activity in the ICES rectangles compared to in the SAC. Therefore, when the VMS gillnet and Danish seine records were combined, the proportion of VMS reports in the SAC (versus the rectangles)

[21] https://www.fao.org/fishery/collection/fvf/en

was lower as compared to using Danish demersal seine records alone. This consequently resulted in a decrease in the landings estimated to be derived from the SAC.

#### 4.1.4.4 Potting

From 2014 to 2018, there was limited VMS activity (Table 18) and UK landings from pots (Table 14) in Dogger Bank SAC. However, in 2019 over 500 tonnes of crustacea were landed by UK potting vessels (Table 14). The 2019 UK potting landings corresponded with a large increase in the associated VMS records (Table 18). In contrast, UK landings from other gears decreased in 2019, with landings from bottom otter trawls, otter twin trawls and beam trawls being under half of those landed in 2018 (Table 14).

There were no non-UK landings attributed to pots/traps in Dogger Bank SAC (Table 12) or within the intersecting ICES rectangles (Table 13) in 2014 – 2018. Furthermore, no VMS records were attributed to pots/traps by non-UK vessels in 2014 - 2019 (Table 18).

#### 4.1.4.5 Scallop activity

Little to no scallop dredging occurred in Dogger Bank SAC from 2014 to 2019; however, during the spring of 2020 a scallop stock was discovered, part of which was within the Dogger Bank SAC. Due to this discovery and the subsequent temporary closure of the area (a suspension of scallop dredging in the eight intersecting ICES rectangles from 12 July 2020 to 28 February 2021) to allow data gathering and better understanding of the shellfish stock, more up to date VMS data and landings information is available for UK scallop dredging activities (mid-March to the end of July 2020). The VMS data indicates that dredging activity in 2020 was mostly in the western portion of the site (Figure 15). Estimates of boat dredge landings from Dogger Bank SAC were made using the landings recorded for ICES rectangles and the proportion of VMS fishing activity in that ICES rectangle which overlaps with the SAC.

Recent data indicates a significant increase in UK vessel landings of king scallop from the Dogger Bank area in this time period. From the start of 2020 up until 29 June 2020, 948 tonnes of king scallops were landed from four of the eight ICES rectangles that intersect Dogger Bank SAC, compared to an average of 1 tonne per year between 2015 and 2019. It is estimated the 30 scallop dredgers landed approximately 1,700 tonnes of fish and shellfish between 15 March 2020 and 30 July 2020 within the site.

#### 4.1.4.6 Sandeel landings

Sandeels are the main target species of the Danish dermersal seine fleet, and are also targeted by some non-UK demersal trawl vessels. Between 2014 and 2018, approximately 399,900 tonnes of sandeels were removed by non-UK demersal trawl/seine vessels from the eight ICES rectangles which intersect Dogger Bank SAC (based on STECF FDI landings data 2014-2018). Approximately 82% of these landings came from just two of the eight ICES rectangles intersecting the SAC: 39F1 (~259,300 tonnes) and 38F1 (~69,200 tonnes). Approximately 53% of these two rectangles (26% and 79% per rectangle respectively) falls within Dogger Bank SAC. Using a proportional area-based estimate, this equates to approximately 122,200 tonnes removed from the SAC via these two ICES rectangles alone. The total estimated figure for sandeel landings from non-UK vessels from the SAC from 2014 to 2018 is approximately 155,800 tonnes. In comparison, UK vessels landed approximately 2,300 tonnes of sandeels in the eight ICES rectangles from 2014 to 2018 (98 tonnes in 2019), which using a proportional area-based estimate equates to landings of approximately 1,100 tonnes in Dogger Bank SAC from 2014 to 2018 (78 tonnes in 2019).

**Figure 3: 2014 VMS Fishing Activity by gear type in Dogger Bank SAC**

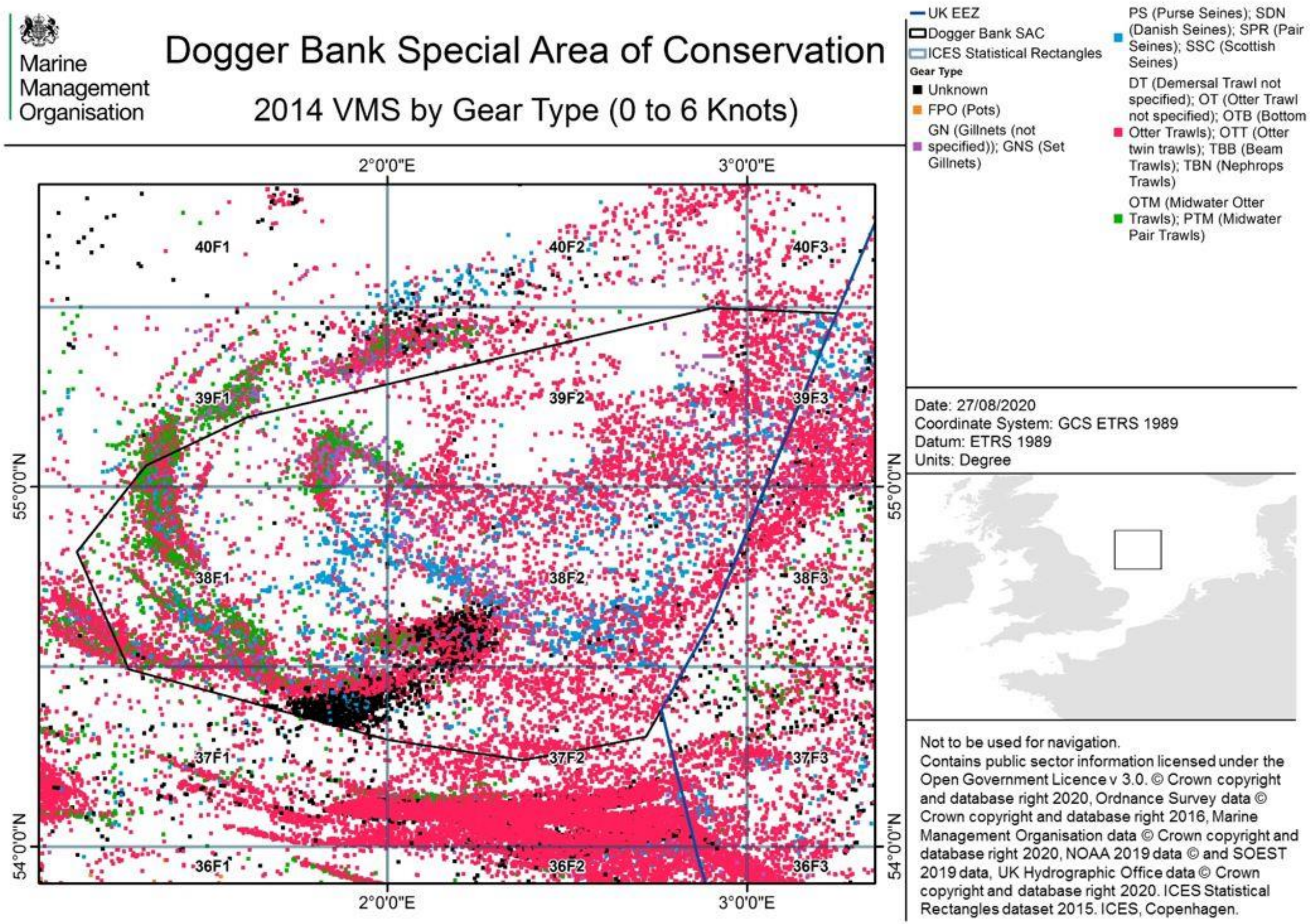


**Figure 4: 2015 VMS Fishing Activity by gear type in Dogger Bank SAC**

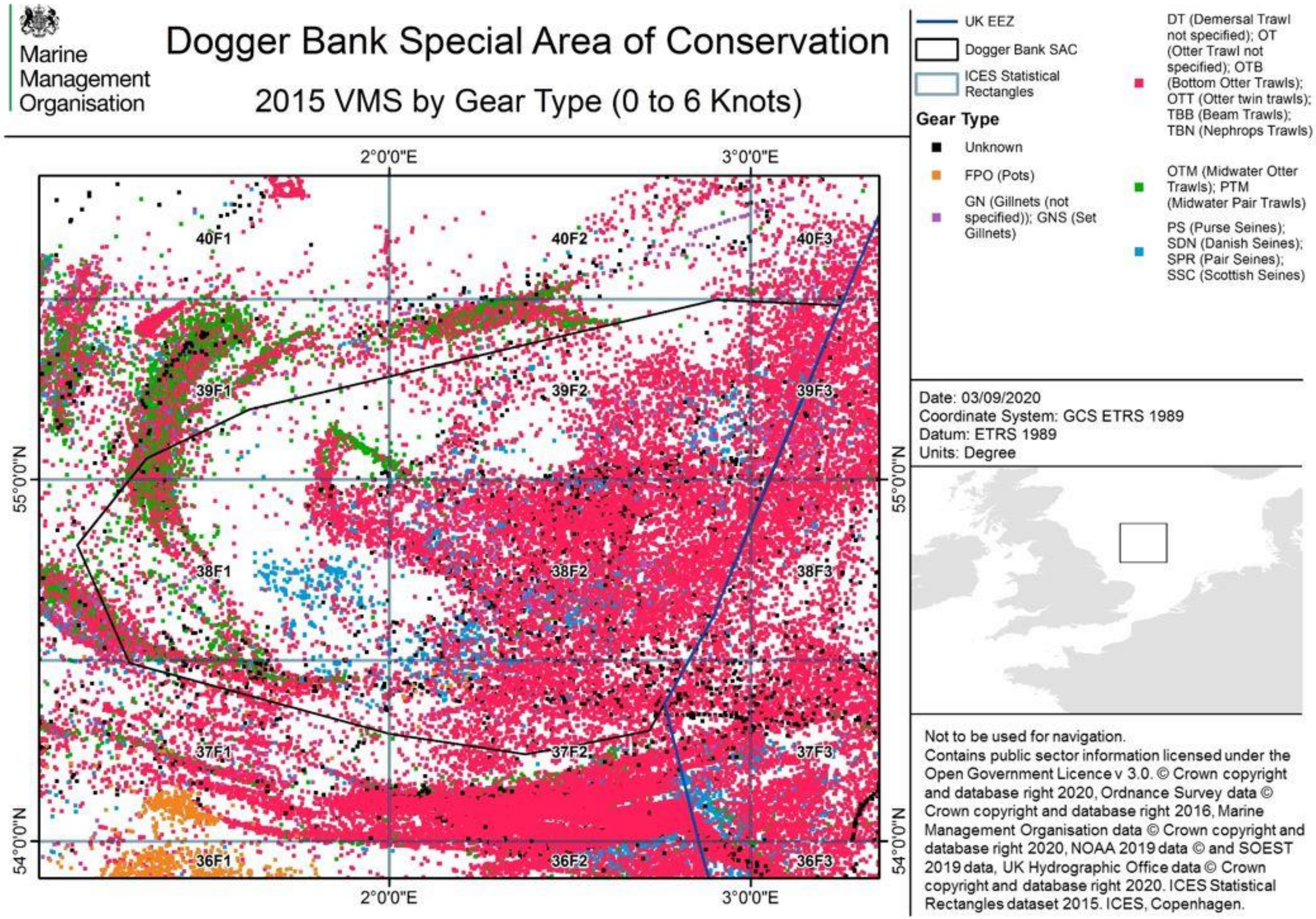


**Figure 5: 2016 VMS Fishing Activity by gear type in Dogger Bank SAC**

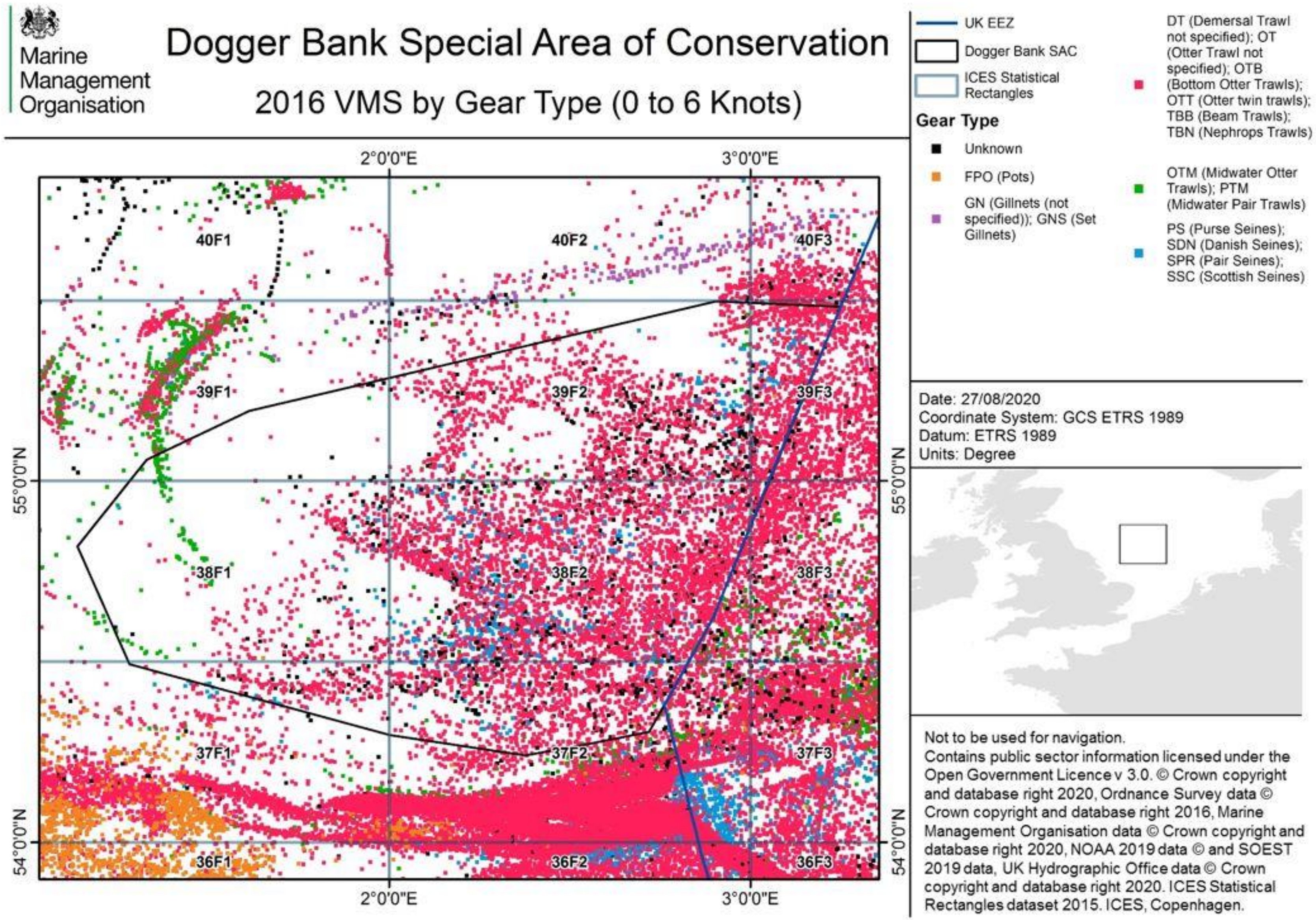


**Figure 6: 2017 VMS Fishing Activity by gear type in Dogger Bank SAC**

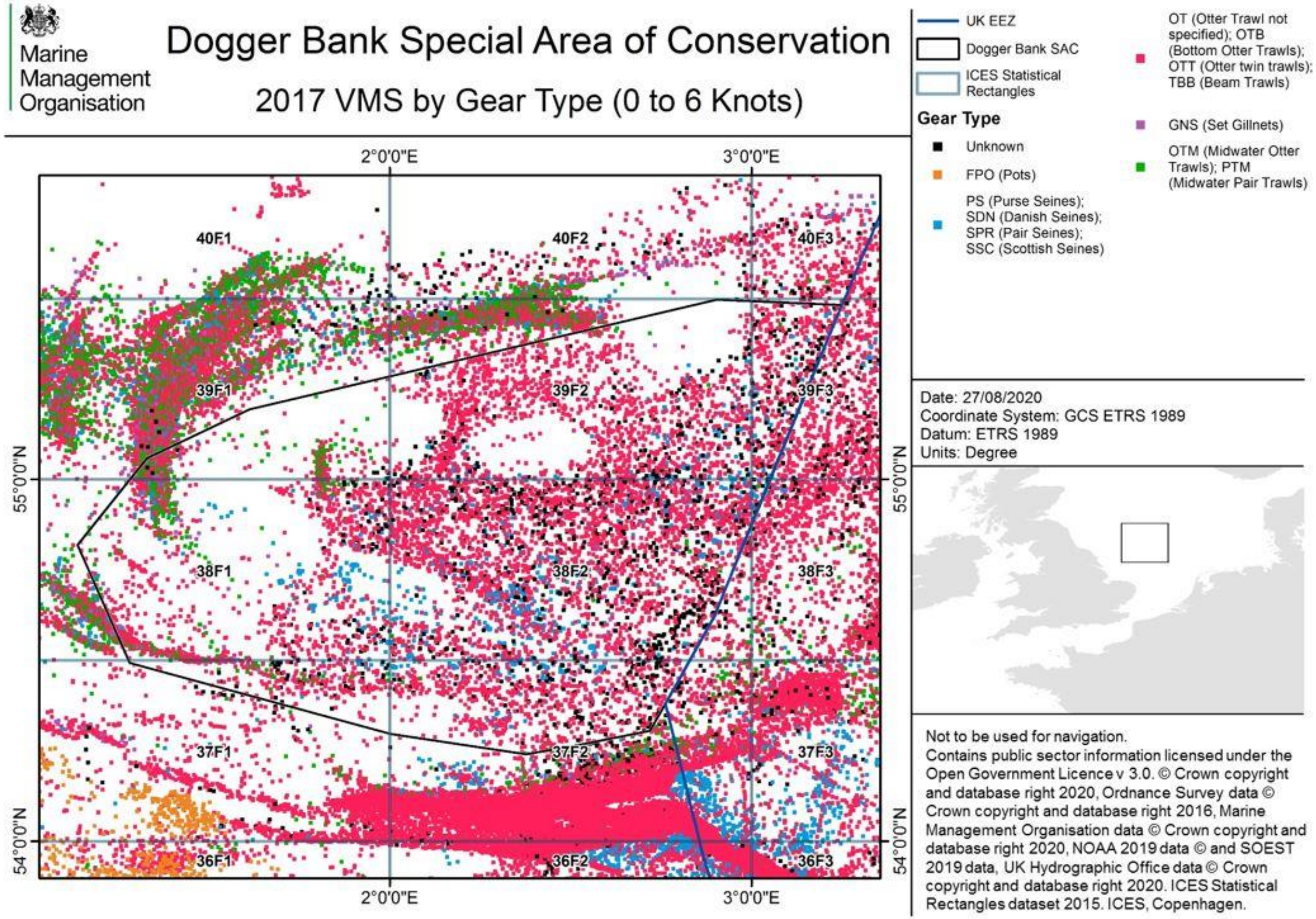


**Figure 7: 2018 VMS Fishing Activity by gear type in Dogger Bank SAC**

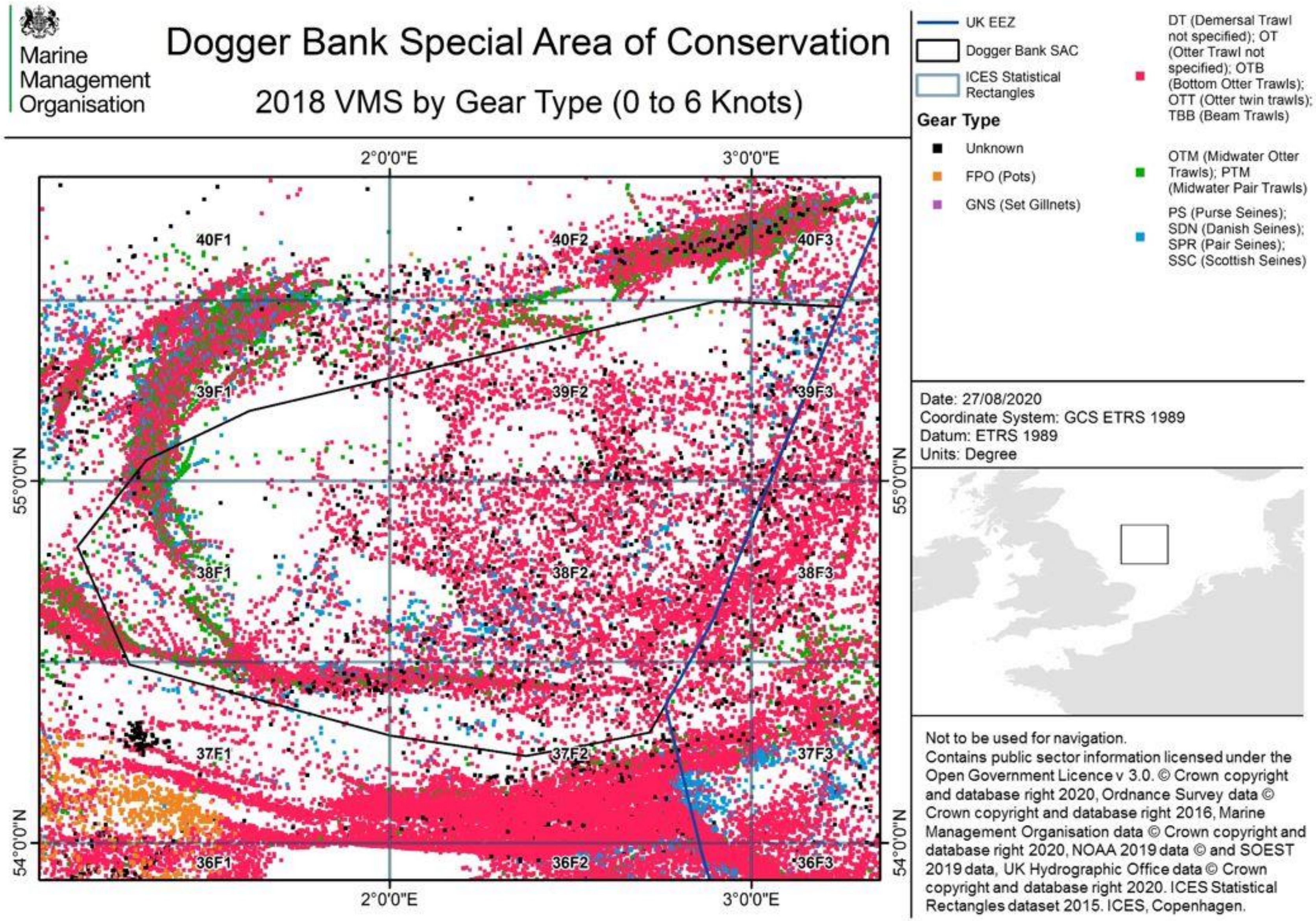


**Figure 8: 2019 VMS Fishing Activity by by gear type in Dogger Bank SAC**

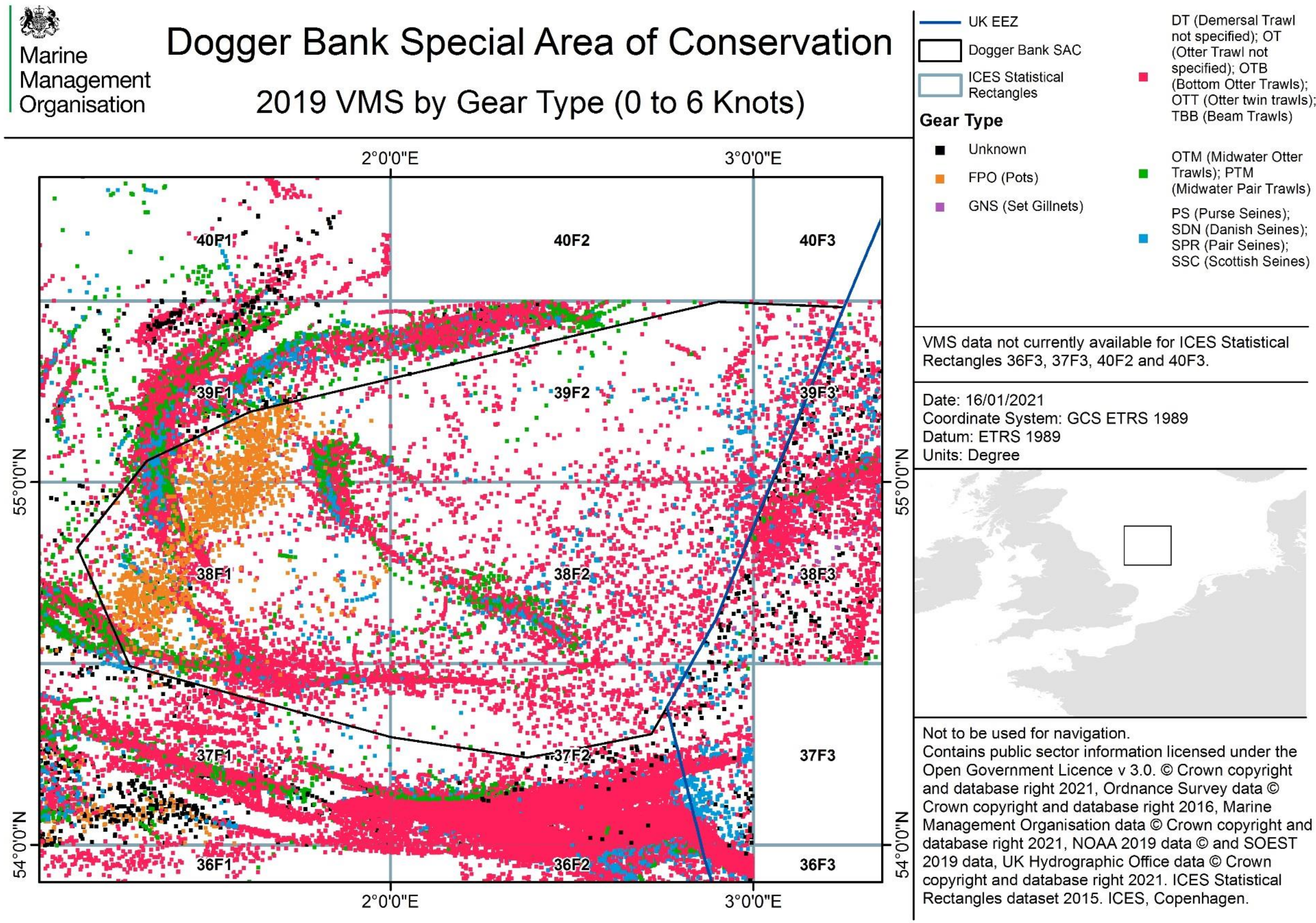


**Figure 9: 2014 VMS Fishing Activity by Nationality in Dogger Bank SAC**

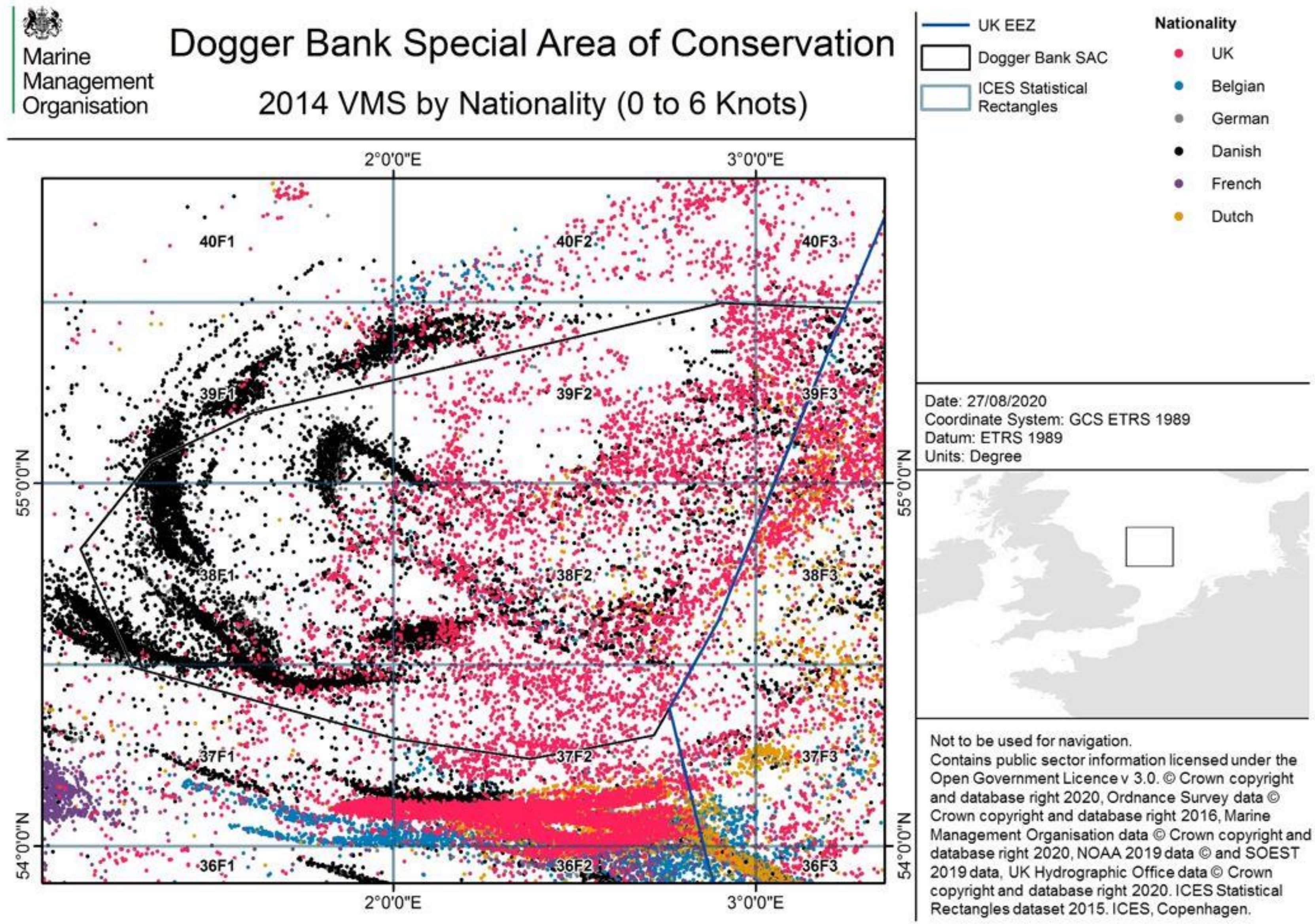


**Figure 10: 2015 VMS Fishing Activity by Nationality in Dogger Bank SAC**

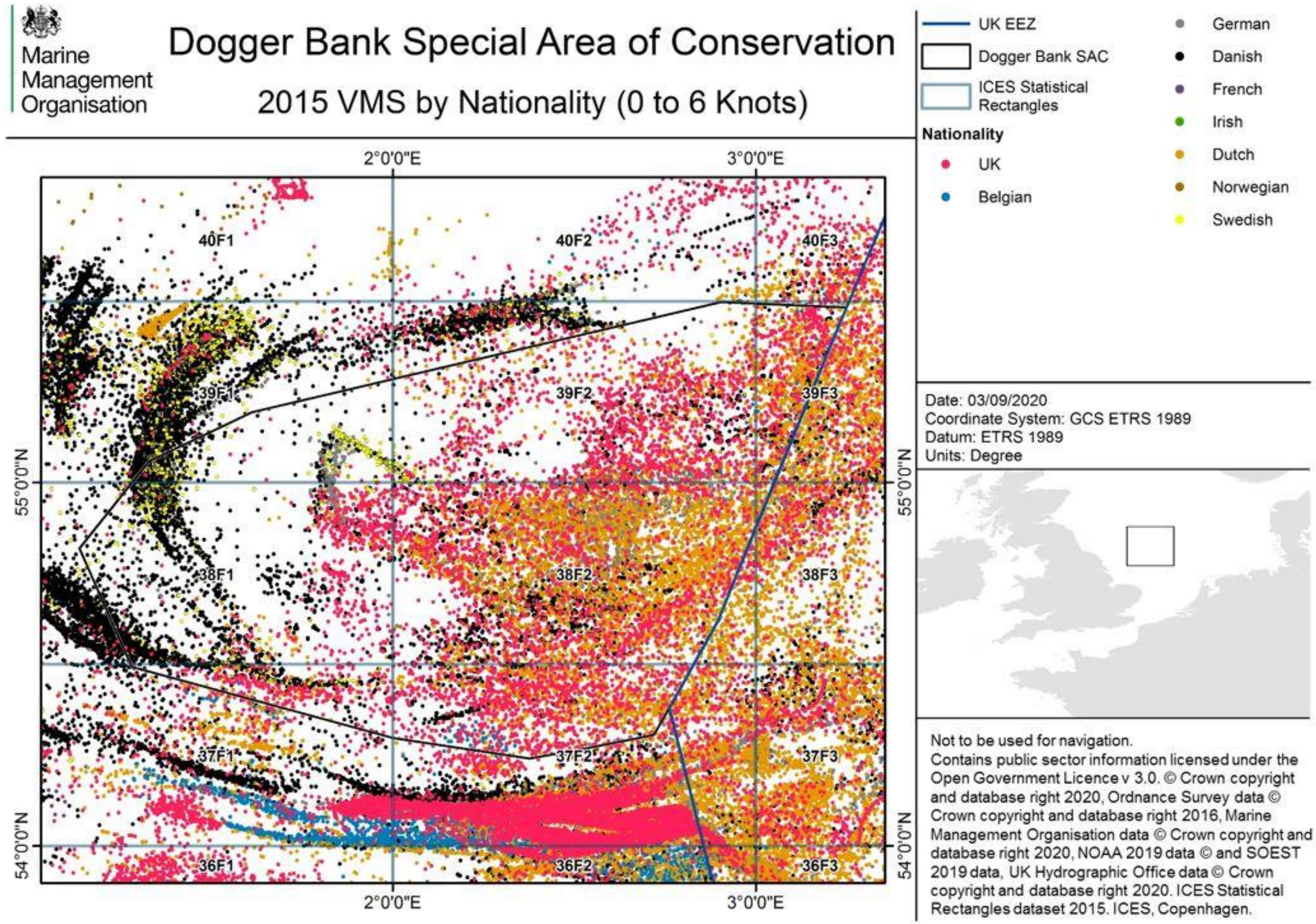


**Figure 11: 2016 VMS Fishing Activity by Nationality in Dogger Bank SAC**

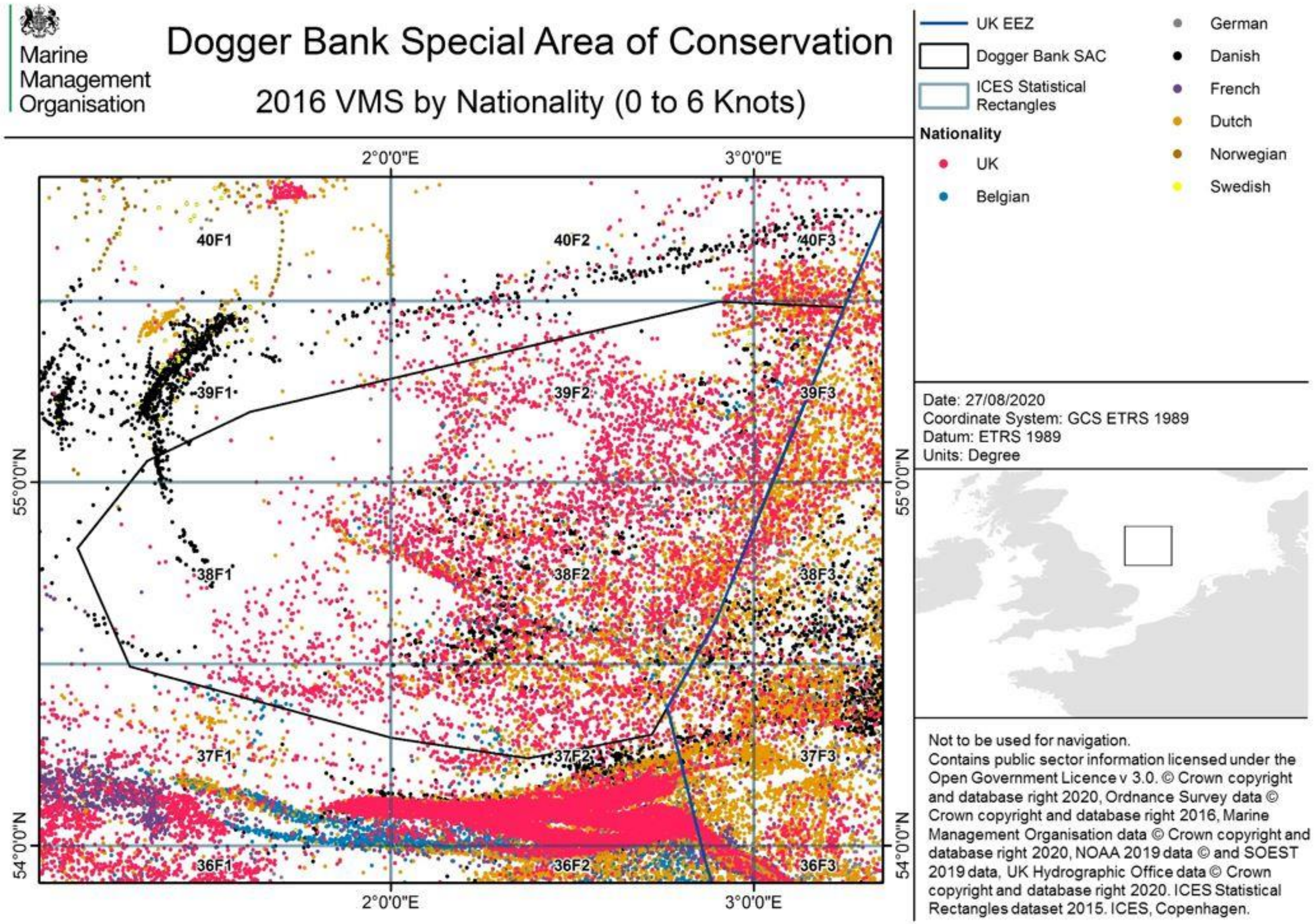


**Figure 12: 2017 VMS Fishing Activity by Nationality in Dogger Bank SAC**

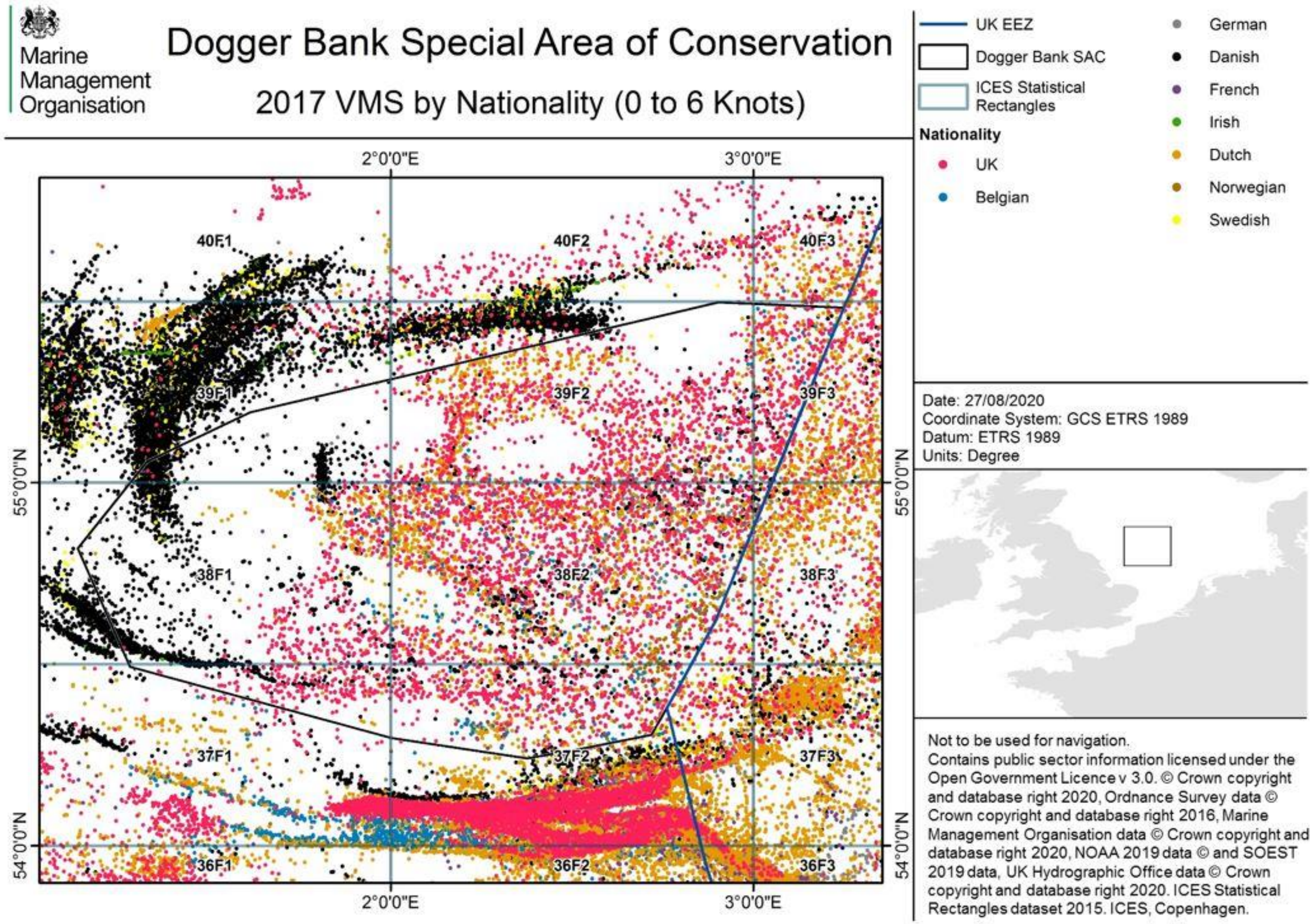


**Figure 13: 2018 VMS Fishing Activity by Nationality in Dogger Bank SAC**

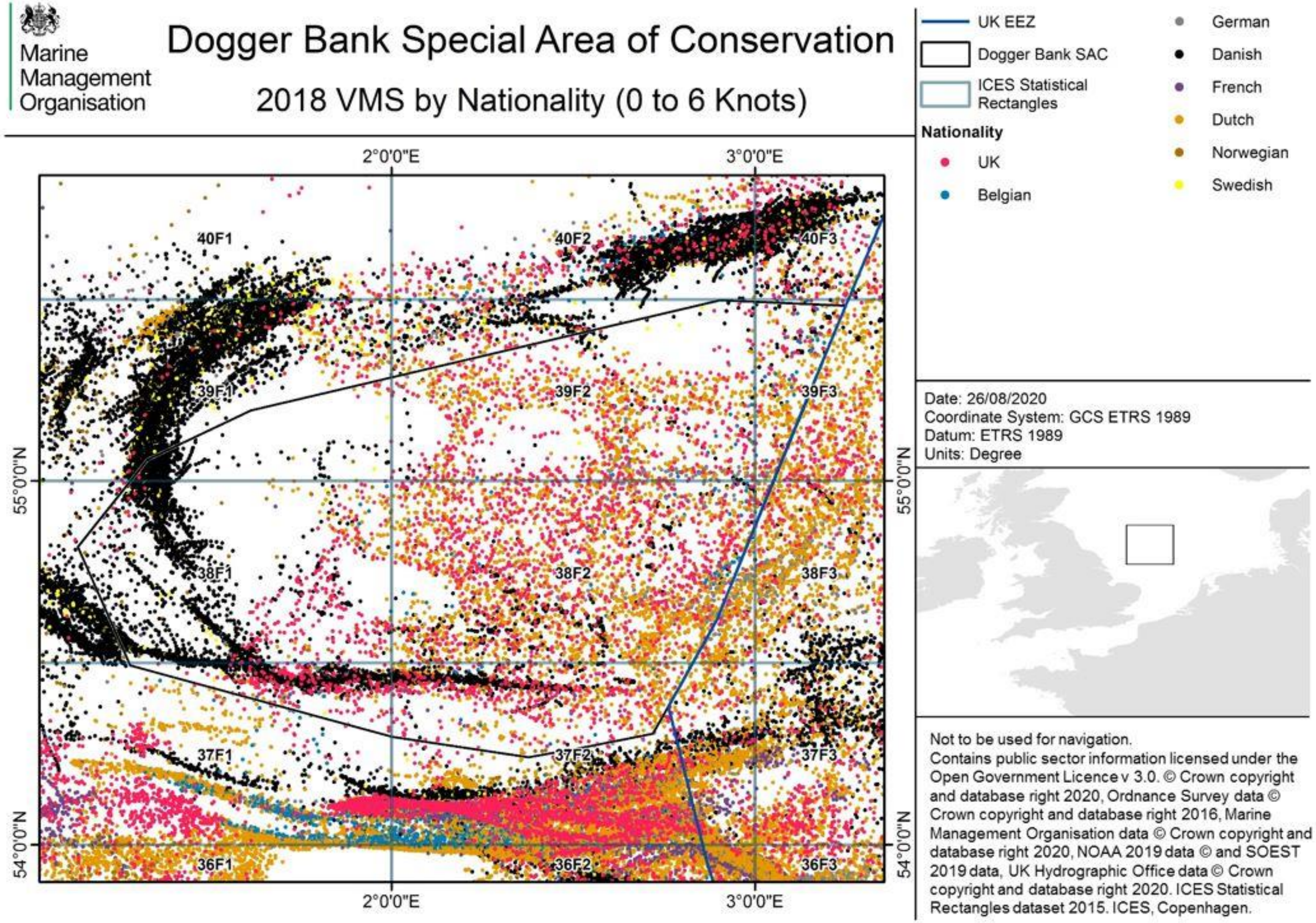


**Figure 14: 2019 VMS Fishing Activity by Nationality in Dogger Bank SAC**

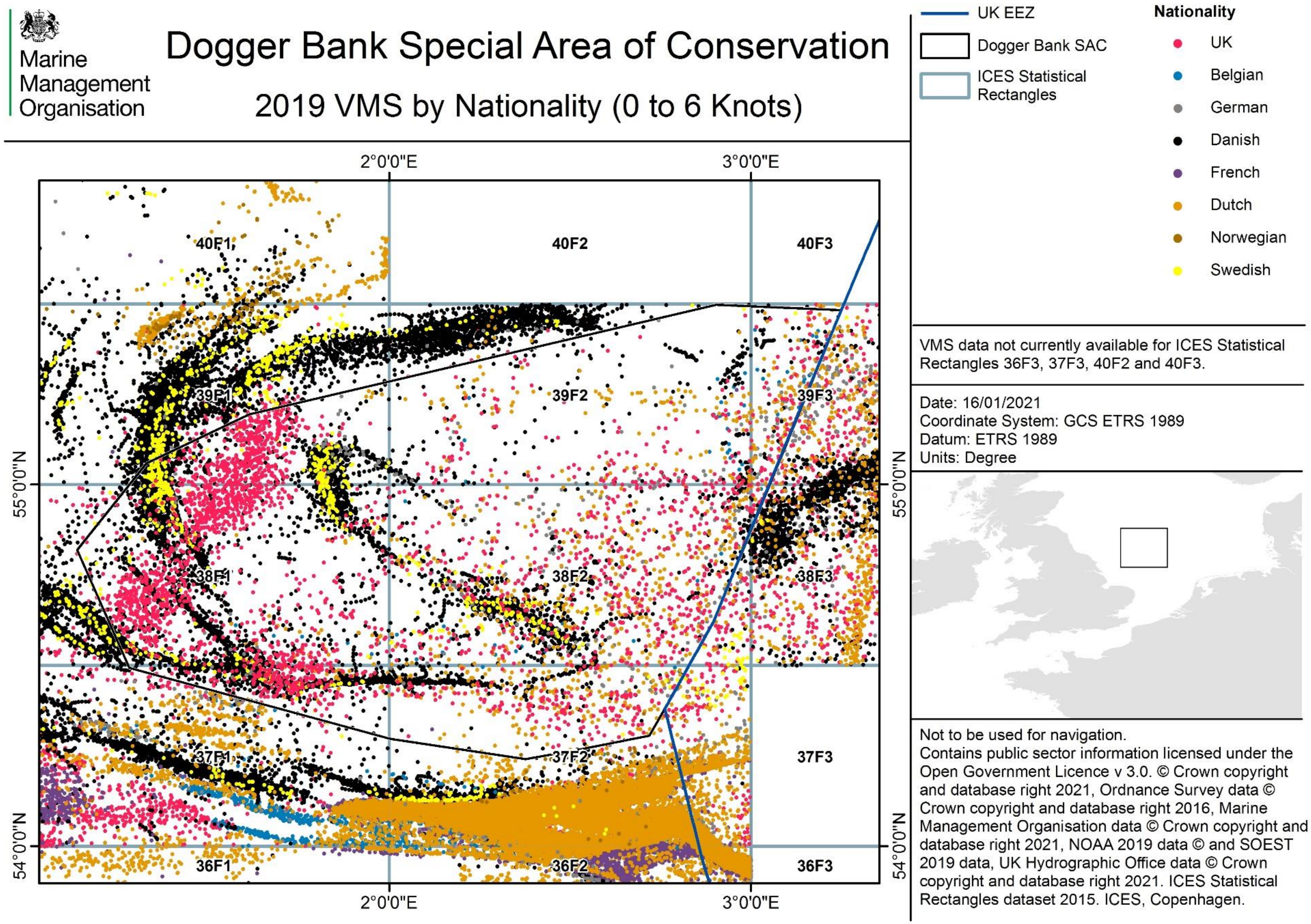


**Figure 15: 2020 VMS Fishing Activity by UK Scallop Dredges in Dogger Bank SAC from 15th March to 30th July 2020**

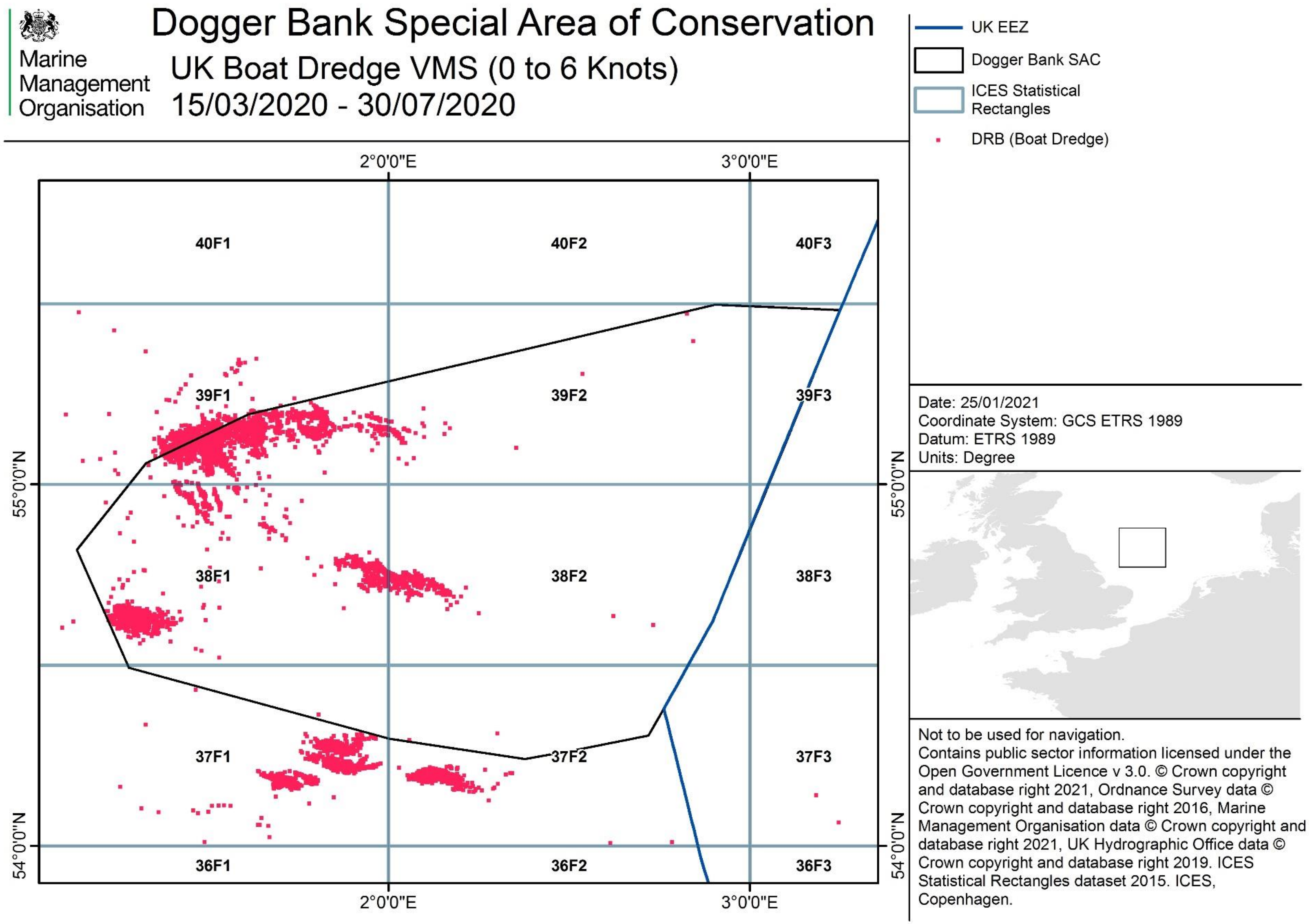


**Table 12: 2014-2018 STECF landings from non-UK vessels in Dogger Bank SAC estimated from VMS data.** Landings in Dogger Bank were estimated using the percentage of VMS points in Dogger (versus the ICES rectangles). To estimate landings from SDN gear, GNS VMS records were reassigned to SDN. In 2014, non-UK landings were given to gear-group level rather than individual gear codes; thus, one value is given for demersal trawl/seines. Gear codes: FPO = pots, GNS = set gillnets (anchored), NK = not known, OTB = bottom otter trawl, OTM = midwater otter trawl, OTT = otter twin trawl, PTM = pelagic pair trawl, SDN = Danish seines, SSC = Scottish seines and TBB = beam trawl.

<table>
<tr><th rowspan="2">Year</th><th colspan="10">Landings by gear (t)</th><th rowspan="2">Total landings (t)</th></tr>
<tr><th>FPO</th><th>GNS</th><th>NK</th><th>OTB</th><th>OTM</th><th>OTT</th><th>PTM</th><th>SDN</th><th>SSC</th><th>TBB</th></tr>
<tr><td>2014</td><td>-</td><td>1</td><td>-</td><td colspan="6">26,264</td><td>229</td><td>26,493</td></tr>
<tr><td>2015</td><td>-</td><td>-</td><td>-</td><td>19,153</td><td>1,453</td><td>100</td><td>-</td><td>355</td><td>84</td><td>1,979</td><td>23,123</td></tr>
<tr><td>2016</td><td>-</td><td>-</td><td>-</td><td>1,237</td><td>328</td><td>13</td><td>2</td><td>209</td><td>75</td><td>416</td><td>2,280</td></tr>
<tr><td>2017</td><td>-</td><td>1</td><td>52</td><td>21,423</td><td>2,290</td><td>36</td><td>22</td><td>137</td><td>165</td><td>226</td><td>24,352</td></tr>
<tr><td>2018</td><td>-</td><td>-</td><td>35</td><td>12,224</td><td>8,989</td><td>43</td><td>468</td><td>70</td><td>96</td><td>42</td><td>21,968</td></tr>
<tr><td>2014 - 2018</td><td>-</td><td>2</td><td>87</td><td colspan="6">9,237</td><td>2,892</td><td>98,218</td></tr>
</table>

* Following a precautionary approach, landings from 2015-2018 in ICES rectangles that contained no corresponding VMS (i.e. VMS for the specific gear/year/rectangle combination) were assumed landed in Dogger Bank SAC. This included assuming all GNS and PTM landings from 2015-2018 were landed in Dogger Bank SAC.

**Table 13: 2014-2018 STECF landings from non-UK vessels in ICES rectangles: 39F1, 39F2, 39F3, 38F1, 38F2, 38F3, 37F1, 37F2.** These landings (in the ICES rectangles intersecting Dogger Bank SAC) are used to estimate landings from within Dogger Bank SAC using the percentage of VMS points in Dogger. In 2014, non-UK landings are given to gear-group level rather than individual gear codes; thus, one value is given for demersal trawl/seines**.** Gear codes: FPO = pots, GNS = set gillnets (anchored), NK = not known, OTB = bottom otter trawl, OTM = midwater otter trawl, OTT = otter twin trawl, PTM = pelagic pair trawl, SDN = Danish seines, SSC = Scottish seines and TBB = beam trawl.

| Year | Vessel size (m) | Landings by gear (t) | | | | | | | | | | Total landings (t) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | FPO | GNS | NK | OTB | OTM | OTT | PTM | SDN | SSC | TBB | |
| 2014 | All | - | 3 | 2 | 63,488 | | | | | | 1,743 | 65,236 |
| | <15 | - | - | - | - | | | | | | 0.2 | 0.2 |
| | >15 | - | 3 | 2 | 63,488 | | | | | | 1,743 | 65,236 |
| 2015 | All | - | - | - | 106,669 | 13,032 | 973 | - | 425 | 349 | 5,124 | 126,573 |
| | <12 | - | - | - | - | 12 | - | - | - | - | - | 12 |
| | >12 | - | - | - | 106,669 | 13,020 | 973 | - | 425 | 349 | 5,124 | 126,561 |
| 2016 | All | - | 6 | - | 16,890 | 13,254 | 352 | 2 | 241 | 280 | 2,653 | 33,678 |
| | <12 | - | - | - | - | - | - | - | - | - | - | - |
| | >12 | - | 6 | - | 16,890 | 13,254 | 352 | 2 | 241 | 280 | 2,653 | 33,678 |
| 2017 | All | - | 2 | 52 | 168,251 | 21,626 | 203 | 22 | 221 | 388 | 1,641 | 192,406 |
| | <12 | - | - | - | - | - | - | - | - | - | - | - |
| | >12 | - | 2 | 52 | 168,251 | 21,626 | 203 | 22 | 221 | 388 | 1,641 | 192,406 |
| 2018 | All | - | 1 | 35 | 63,752 | 37,447 | 187 | 468 | 112 | 184 | 897 | 103,084 |
| | <12 | - | - | - | - | - | - | - | - | - | - | - |
| | >12 | - | 1 | 35 | 63,752 | 37,447 | 187 | 468 | 112 | 184 | 897 | 103,084 |
| 2014 - 2018 | All | - | 12 | 89 | 508,818 | | | | | | 12,058 | 520,977 |

**Table 14: Dogger Bank SAC 2014-2019 demersal gear landings from UK vessels (derived from UK VMS).** Gear codes: FPO = pots, GN = gillnets, OTB = bottom otter trawl, OTT = otter twin trawl, SDN = Danish seines, SSC = Scottish seines and TBB = beam trawl.

| Year | Species group | Landings by gear (t) | | | | | | | Total landings (t) |
|---|---|---|---|---|---|---|---|---|---|
| | | FPO | GN | OTB | OTT | SDN | SSC | TBB | |
| **2014** | All (t) | - | 0.2 | 878 | 122 | 211 | 67 | 1,099 | 2,377 |
| | Crustacea (t) | - | 0.0004 | 2 | 0.1 | - | 0.01 | 5 | 7 |
| | Mollusc (t) | - | - | 0.3 | 0.004 | - | 0.03 | 8 | 8 |
| | Demersal fish (t) | - | 0.2 | 876 | 122 | 211 | 67 | 1,086 | 2,361 |
| **2015** | All (t) | - | - | 1,717 | 117 | 117 | - | 1,627 | 3,578 |
| | Crustacea (t) | - | - | 2 | 0.2 | - | - | 12 | 15 |
| | Mollusc (t) | - | - | 1 | - | - | - | 8 | 9 |
| | Demersal fish (t) | - | - | 1,713 | 117 | 117 | - | 1,607 | 3,553 |
| **2016** | All (t) | - | - | 2,182 | 313 | - | - | 588 | 3,083 |
| | Crustacea (t) | - | - | 9 | 2 | - | - | 4 | 15 |
| | Mollusc (t) | - | - | 1 | 0.2 | - | - | 3 | 4 |
| | Demersal fish (t) | - | - | 2,171 | 311 | - | - | 581 | 3,063 |
| **2017** | All (t) | - | - | 2,087 | 377 | - | - | 232 | 2,696 |
| | Crustacea (t) | - | - | 8 | 3 | - | - | 3 | 15 |
| | Mollusc (t) | - | - | 2 | 0.4 | - | - | 2 | 4 |
| | Demersal fish (t) | - | - | 2,076 | 373 | - | - | 227 | 2,676 |
| **2018** | All (t) | - | - | 984 | 199 | - | - | 63 | 1,246 |
| | Crustacea (t) | - | - | 6 | 2 | - | - | 1 | 9 |
| | Mollusc (t) | - | - | 0.4 | 0.1 | - | - | 1 | 1 |
| | Demersal fish (t) | - | - | 978 | 196 | - | - | 61 | 1,235 |
| **2019** | All (t) | 513 | - | 411 | 83 | - | 1 | 19 | 1,027 |
| | Crustacea (t) | 508 | - | 2 | 1 | - | - | 0.3 | 512 |
| | Mollusc (t) | 4 | - | 1 | 0.2 | - | - | 1 | 7 |
| | Demersal fish (t) | | - | 408 | 82 | - | 1 | 17 | 508 |
| **2014 - 2019** | All (t) | 513 | 0.2 | 8,259 | 1,211 | 327 | 68 | 3,628 | 14,007 |
| | Crustacea (t) | 508 | 0.0004 | 29 | 8 | 0 | 0 | 26 | 572 |
| | Mollusc (t) | 4 | - | 6 | 1 | 0 | 0 | 22 | 34 |
| | Demersal fish (t) | - | 0.2 | 8,222 | 1,200 | 327 | 68 | 3,579 | 13,397 |

**Table 15: 2014-2019 landings from UK Vessels in ICES rectangles: 39F1, 39F2, 39F3, 38F1, 38F2, 38F3, 37F1, 37F2.** All landings are for vessels > 12 m, as no landings were recorded for UK vessels < 12 m in the eight rectangles. Gear codes: DRB = boat dredges, FPO = pots, GN = gillnets, OTB = bottom otter trawl, OTT = otter twin trawl, PTB = bottom pair trawl, SDN = Danish seines, SSC = Scottish seines, TBB = beam trawl and TBN = nephrops trawl.

| Year | Landings by gear (t) | | | | | | | | | | Total landings (t) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | DRB | FPO | GN | OTB | OTT | PTB | SDN | SSC | TBB | TBN | |
| **2014** | 0.1 | 16 | 2 | 2,207 | 362 | - | 225 | 154 | 2,559 | 125 | 5,650 |
| **2015** | | 121 | 0.3 | 3,292 | 300 | 34 | 143 | - | 2,787 | 189 | 6,866 |
| **2016** | | 363 | 3 | 3,570 | 581 | - | - | 0.1 | 1,815 | 153 | 6,486 |
| **2017** | | 167 | - | 4,775 | 686 | - | - | - | 952 | 109 | 6,689 |
| **2018** | | 222 | - | 2,051 | 350 | - | - | - | 439 | 0.03 | 3,063 |
| **2019** | | 944 | - | 1,067 | 125 | - | - | 11 | 486 | - | 2,633 |
| **2014 - 2019** | | 1,833 | 5 | 16,962 | 2,404 | 34 | 368 | 165 | 9,038 | 577 | 31,387 |

**Table 16: 2014-2018 STECF original and updated SDN (Danish seines) landings from non-UK (EU) vessels in Dogger Bank SAC estimated from VMS data.** Updated values: GNS (set gillnets - anchored) VMS records were reassigned to SDN, giving an updated percentage of VMS in Dogger Bank SAC (versus the ICES rectangle) and thus updated estimated of landings from SDN.

| Year | EU SDN landings | | |
|---|---|---|---|
| | Original (t) | Updated (t) | % change |
| **2014*** | 23,781* | 26,264* | +10* |
| **2015** | 375 | 355 | - 5 |
| **2016** | 214 | 209 | - 2 |
| **2017** | 151 | 137 | - 9 |
| **2018** | 71 | 70 | - 2 |
| **2015 - 2018** | 810 | 771 | - 5 |

* 2014 are the landings for demersal trawls/seines

**Table 17: Updated 2014-2018 Dogger Bank SAC UK – EU landings comparisons.** Gear is grouped by beam trawl (TBB = beam trawl), demersal trawl/seine (OTB = bottom otter trawl, OTM = midwater otter trawl, OTT = otter twin trawl, PTM = pelagic pair trawl, SDN = Danish seines, and SSC = Scottish seines) and drift and fixed nets (GNS = set gillnets - anchored)**.** To estimate landings from SDN gear, the percentage of VMS points in Dogger (versus the ICES rectangles) GNS VMS records were reassigned to SDN**.**

| Year | Landings by gear and vessel nationality (t) | | | | | | | | | Total landings (t) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Beam trawl | | | Demersal trawl/seine | | | Drift and fixed nets | | | | | |
| | UK (t) | EU (t) | UK (%) | UK (t) | EU (t) | UK (%) | UK (t) | EU (t) | UK (%) | UK (t) | EU (t) | UK (%) |
| 2014 | 1,099 | 229 | 83 | 1,278 | 26,264 | 5 | 0.2 | 1 | 100 | 2,377 | 26,493 | 8 |
| 2015 | 1,627 | 1,979 | 45 | 1,951 | 21,144 | 8 | 0 | 0 | - | 3,578 | 23,123 | 13 |
| 2016 | 588 | 416 | 59 | 2,495 | 1,864 | 57 | 0 | 0 | - | 3,083 | 2,280 | 57 |
| 2017 | 232 | 226 | 51 | 2,464 | 24,074 | 9 | 0 | 1 | 0 | 2,696 | 24,352 | 10 |
| 2018 | 63 | 42 | 60 | 1,183 | 21,891 | 5 | 0 | 0 | - | 1,246 | 21,968 | 5 |
| 2014-2018 | 3,609 | 2,892 | 56 | 9,370 | 95,237 | 9 | 0.2 | 2 | 24 | 12,980 | 98,217 | 12 |

**Table 18: Dogger Bank SAC UK and EU VMS fishing records 2014-2019.** Gear codes: FPO = fishing pot, GN / GNS = gillnets (not specified) / set gillnets (anchored), OTB = bottom otter trawl, OTM = midwater otter trawl, OTT = otter twin trawl, PS = purse seines, PTM = pelagic pair trawl, SDN = Danish seines, SPR = pair seines, SSC = Scottish seines and TBB = beam trawl.

| Gear | UK / EU | Year(s) | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2014 - 2019 |
| **FPO** | **UK** | 2 | 21 | 7 | 0 | 5 | 762 | 797 |
| | **EU** | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **GN / GNS** | **UK** | 5 | 1 | 2 | 0 | 0 | 0 | 8 |
| | **EU** | 2,044 | 1,325 | 70 | 219 | 91 | 6 | 3,755 |
| **OTB** | **UK** | 2,465 | 3,287 | 3,082 | 2,981 | 1,929 | 456 | 14,200 |
| | **EU** | 5,851 | 3,158 | 875 | 3,638 | 4,770 | 5,819 | 24,111 |
| **OTM** | **UK** | 0 | 1 | 0 | 0 | 0 | 0 | 1 |
| | **EU** | 2,357 | 1,302 | 137 | 565 | 1,218 | 1,865 | 7,444 |
| **OTT** | **UK** | 125 | 169 | 340 | 448 | 333 | 89 | 1,504 |
| | **EU** | 1 | 52 | 17 | 522 | 1,091 | 127 | 1,810 |
| **PS** | **UK** | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | **EU** | 590 | 107 | 2 | 110 | 507 | 594 | 1,910 |
| **PTM** | **UK** | 1 | 1 | 0 | 0 | 0 | 0 | 2 |
| | **EU** | 0 | 56 | 5 | 0 | 0 | 0 | 61 |
| **SDN** | **UK** | 989 | 475 | 0 | 0 | 0 | 0 | 1,464 |
| | **EU** | 2,083 | 2,158 | 1,179 | 1,355 | 774 | 281 | 7,830 |
| **SPR** | **UK** | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | **EU** | 0 | 3 | 0 | 30 | 46 | 1 | 80 |
| **SSC** | **UK** | 38 | 45 | 0 | 0 | 0 | 4 | 87 |
| | **EU** | 86 | 71 | 285 | 228 | 114 | 285 | 1,069 |
| **TBB** | **UK** | 1,542 | 1,983 | 938 | 98 | 80 | 12 | 4,653 |
| | **EU** | 50 | 6,302 | 1,623 | 2,049 | 1,058 | 528 | 11,610 |

### 4.1.5 Spatial footprint analysis using Pr-values

The spatial footprint analysis used in this assessment is based on a report commissioned by Defra's Impact Evidence Group on the feasibility of using a spatial footprint method in appropriate assessments[22] (report reference: MMO1108). It should be noted that Pr-values are derived from VMS data, and therefore only captures vessels with VMS.

Analysis was undertaken of the total spatial footprint of fishing gears used each year. The total spatial footprint of a particular gear group was then compared to the total area of the feature, producing a ratio (Pr). A Pr-value of less than one means that the total spatial footprint of the gear in a given year was smaller than the total area of the feature. A Pr-value of more than one means that the total spatial footprint of the gear in a given year was greater than the total area of the feature. Estimates of the Pr-values for the different fishing gears in Dogger Bank SAC are displayed in Table 19 and Table 20.

The total gear footprint, which is the total area impacted by fishing gear, across the site each year is very low for pots and nets (0.0002 – 0.0042 $km^2$ – pots; 0.002 – 0.76 $km^2$ - nets). This likely due to the small footprint of pots and anchored nets on the seabed and the low fishing activity occurring within the site. Resultantly the Pr-values, representing a ratio of the annual spatial footprint of the gear over the extent of the sandbank feature (12,3450 $km^2$) have comparatively low values (0.000000003 – 0.0000034 - pots), 0.00000016 – 0.000061 - nets)). It is noted that potting activity increases significantly in 2019 with the total gear footprint increasing from 0.000038 $km^2$ in 2014 to 0.042 $km^2$ in 2019.

Activity from seine gears over the six years resulted in higher areas of impact than potting and netting, but remains much lower than demersal trawl activity. The total gear footprint ranges between 0.062 $km^2$ (2019) and 0.63 $km^2$ (2014) and corresponding Pr values of 0.0000050 and 0.000051.

In the analysis of the VMS data, four demersal trawl types were identified: OT, OTB, OTT and TBB. There were also a large number of VMS fishing records with no associated gear information. A gear type has been assigned to these fishing records by scrutinising the common gear types used by the individual vessel. Where a vessel was found to use multiple bottom towed gears the gear type "unspecified demersal trawl" (DT) was assigned.

Demersal trawls, particularly otter trawls, have a larger footprint on the seabed, both this and the amount of fishing activity are reflected in the larger figures in Table 19:

[22] http://randd.defra.gov.uk/Document.aspx?Document=12955_MMO1108SpatialFootprintAnalysisReport-FINAL.pdf, MARG Ltd in association with Envision Mapping Ltd, 2015

Spatial footprint (km2) values for VMS vessels on sandbank compared with potting, netting, and seine fishing.

To fully appreciate the impact of demersal trawling activity across the feature area the gear footprint and Pr values for trawling types have been combined as shown in Table 20. Demersal trawls combined result in an annual gear footprint for the sandbank feature ranging between 766.11 $km^2$ (2018) and 1885.71 $km^2$ (2015) with the corresponding Pr values being 0.062 and 0.15 respectively. This equates to between 6.2% and 15.3% of the sandbank feature's spatial footprint being impacted by demersal trawling in any given year. If the Pr values for the six years are combined it can be seen that 59% of the sandbank area will have been impacted by demersal trawling. However, this does not necessarily mean 59% of the sandbank has been impacted as there may be overlapping areas of impact (Figure 16).

Scallop dredging activity was almost non-existent in Dogger Bank SAC prior to 2020, however there was minimal VMS activity in 2016 (1 record) and 2019 (2 records). This resulted in total gear footprints of 0.089 and 0.18 $km^2$ and Pr values of 0.0000072 and 0.000014 respectively.

**Table 19: Spatial footprint (km²) values for VMS vessels on sandbank.** Gear codes: FPO = fishing pot, GN / GNS = gillnets (not specified) / set gillnets (anchored), DT = unspecified demersal trawl, OT = unspecified otter trawl, OTB = bottom otter trawl, OTM = midwater otter trawl, OTT = otter twin trawl, SDN = Danish seines, SSC = Scottish seines, DRB = boat dredge, and TBB = beam trawl.

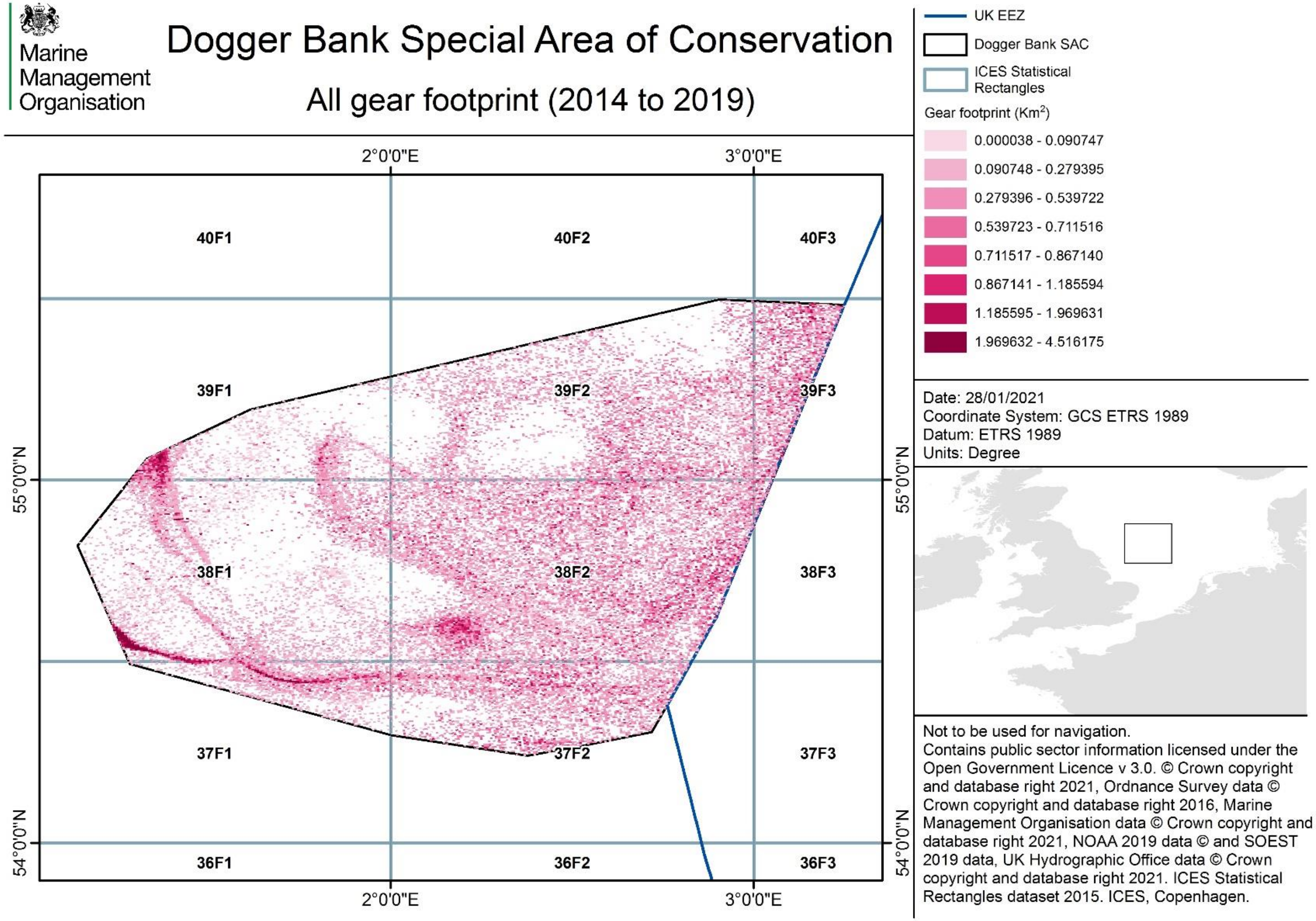
| Year | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 |
|---|---|---|---|---|---|---|
| **FPO** | | | | | | |
| Total gear footprint km² | 0.000038 | 0.00019 | 0.00019 | - | 0.00019 | 0.042 |
| Pr-value | 0.0000000031 | 0.000000015 | 0.000000015 | - | 0.000000015 | 0.0000034 |
| Pr value % | 0.00000031 | 0.0000015 | 0.0000015 | - | 0.0000015 | 0.00034 |
| **GN** | | | | | | |
| Total gear footprint km² | 0.00605 | 0.0020 | - | - | - | - |
| Pr-value | 0.00000049 | 0.00000016 | - | - | - | - |
| Pr value % | 0.000049 | 0.000016 | - | - | - | - |
| **GNS** | | | | | | |
| Total gear footprint km² | 0.76 | 0.38 | 0.042 | 0.095 | 0.054 | 0.012 |
| Pr-value | 0.000061 | 0.000031 | 0.0000034 | 0.0000077 | 0.0000044 | 0.00000098 |
| Pr value % | 0.0061 | 0.0031 | 0.00034 | 0.00077 | 0.00044 | 0.000098 |
| **DT** | | | | | | |
| Total gear footprint km² | 25.73 | 24.83 | 1.62 | - | 7.92 | - |
| Pr-value | 0.0021 | 0.0020 | 0.00013 | - | 0.00064 | - |
| Pr value % | 0.21 | 0.20 | 0.013 | - | 0.064 | - |
| **OT** | | | | | | |
| Total gear footprint km² | - | - | - | 1.089 | - | - |
| Pr-value | - | - | - | 0.000088 | - | - |
| Pr value % | - | - | - | 0.0088 | - | - |
| **OTB** | | | | | | |
| Total gear footprint km² | 685.34 | 628.69 | 610.89 | 692.61 | 485.81 | 1114.25 |
| Pr-value | 0.055 | 0.051 | 0.049 | 0.056 | 0.039 | 0.090 |
| Pr value % | 5.55 | 5.09 | 4.95 | 5.61 | 3.93 | 9.02 |
| **OTT** | | | | | | |
| Total gear footprint km² | 26.14 | 28.38 | 59.22 | 94.95 | 139.26 | 91.68 |
| Pr-value | 0.0021 | 0.0023 | 0.0048 | 0.0077 | 0.011 | 0.0074 |
| Pr value % | 0.21 | 0.23 | 0.48 | 0.77 | 1.13 | 0.74 |
| **TBB** | | | | | | |
| Total gear footprint km² | 400.19 | 1203.81 | 488.67 | 143.27 | 133.13 | 211.86 |
| Pr-value | 0.032 | 0.097 | 0.040 | 0.012 | 0.011 | 0.017 |
| Pr value % | 3.24 | 9.75 | 3.96 | 1.16 | 1.08 | 1.72 |

| | | | | | | |
|---|---|---|---|---|---|---|
| **SDN** | | | | | | |
| Total gear footprint km² | 0.63 | 0.49 | 0.14 | 0.20 | 0.13 | 0.062 |
| Pr-value | 0.000051 | 0.000040 | 0.000011 | 0.000016 | 0.000010 | 0.0000050 |
| Pr value % | 0.0051 | 0.0040 | 0.0011 | 0.0016 | 0.0010 | 0.00050 |
| **SSC** | | | | | | |
| Total gear footprint km² | 0.13 | 0.10 | 0.27 | 0.21 | 0.089 | 0.31 |
| Pr-value | 0.000011 | 0.0000083 | 0.000021 | 0.000017 | 0.0000072 | 0.000025 |
| Pr value % | 0.0011 | 0.00083 | 0.0021 | 0.0017 | 0.00072 | 0.0025 |
| **DRB** | | | | | | |
| Total gear footprint km² | - | - | 0.089 | - | - | 0.18 |
| Pr-value | - | - | 0.0000072 | - | - | 0.000014 |
| Pr value % | - | - | 0.00072 | - | - | 0.0014 |

**Table 20: Spatial footprint (km²) values for VMS vessels Demersal Trawling on sandbank.** Combined gear codes: DT, OT, OTB, OTT, TBB.

| Year | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 |
|---|---|---|---|---|---|---|
| **Demersal Trawl Combined Values** | | | | | | |
| Total gear footprint km² | 1,137.39 | 1,885.71 | 1,160.39 | 931.92 | 766.11 | 1,417.79 |
| Pr-value | 0.092 | 0.15 | 0.09 | 0.075 | 0.062 | 0.11 |
| Pr value % | 9.21 | 15.27 | 9.40 | 7.55 | 6.20 | 11.48 |

**Figure 16: Total Pr-values of all fishing gears in Dogger Bank SAC 2014-2019.**



### 4.1.6 MMO and Royal Navy Sightings

Sightings data from Dogger Bank SAC reveals a similar picture to that concluded by other data sources with the majority of vessels observed fishing in the site between 2014 and 2019 being demersal trawlers and seining vessels.

### 4.1.7 Summary

Dogger Bank SAC is an important area for both UK registered and non-UK fishing vessels using demersal gears. From 2014 to 2018, non-UK vessels landed approximately 95,200 tonnes from demersal trawls/seines and 2,900 tonnes from beam trawls, whereas UK vessels landed approximately 9,300 tonnes from demersal trawls/seines and 3,600 tonnes from beam trawls (Table 17). The VMS fishing records also indicate high levels of of demersal fishing activity in the site, particularly for bottom otter trawls (approximately 24,000 VMS records by non-UK vessels and 14,200 by UK vessels from 2014 to 2019) and beam trawls (approximately 11,600 VMS records by non-UK vessels and 4,700 by UK vessels from 2014 to 2019) (Table 18).

Gillnet activity was likely extremely low in Dogger Bank SAC. Few gillnet landings were recorded by non-UK vessels in the site (Table 12). Although VMS activity indicated that there was substantial gillnetting activity by non-UK vessels (Table 18), this is likely due to inaccurate/outdated gear information, as the VMS set gillnet activity was more likely to be demersal trawl/seine activities. Set or anchored gillnets will still be considered in this assessment as there is some, albeit limited, UK gillnet activity occurring in Dogger Bank SAC and we cannot be certain our assumptions regarding the non-UK gillnet activities are correct, nor that the activity will not occur/increase in the future.

Fishing activity in and around Dogger Bank SAC is almost exclusively conducted by larger vessels over 12 m in length, which are better able to travel the considerable distance to Dogger Bank from mainland Europe.

Some temporal variation in fishing activity in Dogger Bank SAC was evident. In 2016, landings from non-UK demersal trawls/seines dereased considerably; however, otherwise overall landings from non-UK vessels in Dogger Bank SAC remained relatively consistent across the five years (Table 17). In contrast, there was a sustained decline in beam trawl activity by UK vessels from 2016 onwards, as well as an increased potting landings in 2019 (Table 14). Scallop dredging by UK vessels also rapidly increased in 2020 prior to a temporary closure of the fishery.

It is clear there is an interaction between the fishing activity occurring and the protected Annex I sandbank feature of the Dogger Bank SAC. The sections below begin to explore the pressure that each fishing type exerts on the Dogger Bank sandbank feature.

For pressures where potential impacts to features are of a similar nature, those pressures have been consolidated to avoid repetition during this stage of the assessment. For each subsequent pressure, new information regarding the potential effects of that pressure could have on the feature has been discussed.

## 4.2 Abrasion/disturbance of the substrate on the surface of the seabed AND Penetration and/or disturbance of the substrate below the surface of the seabed, including abrasion

These pressures are relevant to anchored nets/lines, demersal trawls, demersal seines and dredges in Dogger Bank SAC. The impacts of these pressures have been assessed for the 'sandbanks which are slightly covered by sea water all the time' feature.

### 4.2.1 Impact of traps and anchored nets/lines

Abrasion from static gears (traps and anchored nets/lines) is possible through the interaction between the seabed and the gear itself (i.e. pots and nets) and associated lines and anchors. As penetration of the substrate by fishing pots and anchored nets/lines is likely to be minimal (Grieve et al., 2014), only abrasion is assessed further. Abrasion is particularly apparent during hauling of gear or the movement of gear along the seabed when subject to strong tides, currents or storm activity. However, interaction of lines, pots and anchors associated with the seabed is likely to be minimal. Evidence suggests that static gears have a relatively low impact on benthic communities in comparison to towed gears, as a result of the small footprint of the seabed affected (Roberts et al., 2010). In accordance with this, Hall et al. (2008) concluded that assuming they are set correctly, demersal static gears are not considered to have a significant impact on subtidal sand features. Anchored nets/lines and traps are unlikely to impact the extent and distribution or structure and function of the sandbank feature.

There is limited direct evidence of the impacts of static gears on subtidal sediments. However, Hall et al. (2008) reported that all static gears are not considered to be a 'major concern' for subtidal sediments and estimated no or low sensitivity to all but heavy[23] levels of fishing intensity on stable species rich sediments or sand and gravel with long-lived bivalves. Hall et al. (2008) categorised heavy levels of potting intensity as 5 pots lifted per hectare per day. In Dogger Bank SAC a maximum of

[23] Quantitative fishing intensity levels used are published in Hall et al 2008. Heavy potting intensity was defined as 'more than 5 pots lifted per hectare per day'.

1,600 pots are estimated to be laid per day per vessel (see Annex 2). Using the area of the sandbank feature and the number of days fished in 2019 a rough estimate of pots per hectare per day in the site is 0.00082.

As noted previously, VMS and landings data are contradictory with regard to anchored netting activity within Dogger Bank SAC and this activity is likely not occurring with any considerable regularity. Similarly, potting activity has been minimal in most years analysed with some limited activity occurring in 2019. The low levels of potting and gillnetting activity, combined with the minimal impacts predicted to be caused via surface abrasion and sub-surface penetration, suggest that these activities are not currently a cause of concern for the protected features of Dogger Bank SAC.

With regards to the discussion above and the assessed activity levels, the **MMO concludes that impacts of abrasion or penetration from anchored nets/lines and traps on the sandbank feature are compatible with the conservation objectives of the site and will not result in an adverse effect on site integrity.**

#### 4.2.2 Impact of demersal trawls

Bottom otter trawls, semi-pelagic trawls, otter twin trawls and beam trawls have been identified as gear types which may have an impact via surface and sub-surface abrasion and penetration on the sandbank feature.

*Otter trawls*

The trawl doors and associated ground gear of otter trawls can penetrate into sediments with the penetration depth dependent on the width of gear. The footrope, ground rope and bridles may also come into contact with the seabed (Grieve et al., 2011). Furrows and berms are created through physical impact of trawl doors on the sediment, causing furrows up to 35 cm deep (depending on the door weight and the hardness of the sediment) and resulting in irregular features on the seabed (Løkkeborg, 2005; Eigaard et al., 2016a). Otter trawling can create berms and furrows on sandy substrates, with repetitive trawling causing increased surface relief or roughness (Schwinghamer et al., 1998). Trawl doors can penetrate up to 10 cm into sand, gravel and mixed substrates, with associated chains penetrating up to 8 cm (Eigaard et al., 2016a; Humborstad et al., 2014). Particle size analysis of Dogger Bank sediment samples in 2014 reveal that the sandbank feature is made up of sediments and pebbles no greater than 2.5 cm in diameter (Eggleton et al., 2016). Otter trawls can create visible paths and furrows on substrates dominated by pebbles less than 6.5 cm in diameter (Freese et al., 1999) as occurring in Dogger Bank SAC. Eigaard et al. (2016 a,b) estimated that the subsurface ratio (proportion of the gear footprint where gear components penetrate the seafloor by 2 cm) for otter trawls ranges from 0.078 to 0.304, depending on target species. Otter trawls are unlikely to significantly impact the large-scale topography or sediment composition of the sandbank feature, however, impacts to the biological structure are likely and are discussed below.

*Semi-pelagic gear*

Semi-pelagic gears are designed to be towed on or very close to the seabed. Unlike bottom otter trawls, the semi-pelagic trawl doors do not come into contact with the seabed, instead swimming several metres above (Seafish, 2020). Generally, the board component of bottom otter trawls penetrates deepest into the sediment (Eigaard et al., 2016a) and therefore semi-pelagic doors reduce a significant portion of impact compared with bottom otter trawls, including the resuspension of sediments (Rijnsdorp et al., 2017). However, the overall footprint (surface area of the seafloor swept by the gear per unit of time), which is mainly affected by the ground rope and sweeps, will not be affected (Rijnsdorp et al., 2017).

While some information is available detailing the reduced impact of semi-pelagic gear compared to bottom otter trawls, there is little evidence regarding the remaining impact of semi-pelagic gear. As the net is usually still in contact with the seabed, albeit more lightly than in bottom otter trawls (Seafish, 2020), abrasion and some degree of penetration is still likely to occur, with no evidence suggesting otherwise. As per otter trawls, semi-pelagic gears are unlikely to significantly impact the large-scale topography or sediment composition of the sandbank feature, however, the potential impacts to the biological structure are discussed below.

*Beam trawls*

The main impacts from beam trawlers are from the ‘shoes’ or ‘sleds’, but if rockhoppers (wheels attached to the front of the trawl to help it bounce over obstacles) or tickler chains (chains which flush organisms out of the sediment into the trawl) are used, these can also impact the seabed (Tilin et al., 2010, Grieve et al., 2011). The chains of a beam trawl cover the whole width of the gear and are designed to penetrate the upper few centimetres of the sediment, ranging from a few centimetres to at least 8 cm (Løkkeborg, 2005). Beam trawl shoes and tickler chains penetrate up to 10 cm into sandy, coarse and mixed sediments (Eigaard et al., 2016a). Beam trawls can cause a flattening of bottom features such as ripples and irregular topography (Kaiser & Spencer, 1996). Side scan observations indicated that beam trawling creates clear marks in fine and medium sand habitats, with seabed roughness decreasing and hardness increasing directly after the trawls (Løkkeborg, 2005; Fonteyne, 2000). Tickler chains may also turn, displace and even remove larger pebbles and boulders in areas with mixed sediments (Eigaard et al., 2016a; JNCC, *pers. comm.*). Despite this, seabed characteristics of sandy substrates have been shown to return to their original condition in 15 hours following beam trawling (Løkkeborg, 2005). Eigaard et al. (2016 a,b) estimated that the subsurface ratio (proportion of the gear footprint where gear components penetrate the seafloor by 2 cm) for beam trawls ranges from 0.522 to 1.000, depending on target species. As above, beam trawls are unlikely to significantly impact the large-scale topography or sediment composition of the sandbank feature, however, impacts to the biological structure are likely and are discussed below.

*Impact on biological communities by demersal trawls*

Surface and sub-surface abrasion and penetration by demersal trawls (including semi-pelagic gear) may impact the biological communities found in the sandbank feature of Dogger Bank SAC. For example, demersal trawls may cause direct mortality for infaunal species such as bristleworms *Spiophanes bombyx*, bivalves *Tellina fibula*, polychaetes *Magelona filiformis* and amphipods *Bathyporeia* spp., which are typically found in sandy sediments of the site (Eggleton et al., 2016). Similarly, epifauna such as endobenthic bivalves *Mactra stultorum*, *Donax vittatus*; *Arctica islandica* and *Ensis* species; masked crab *Corystes cassivelaunus*; sea potato *Echinocardium cordatum* and more common species belonging to the groups Asteroidea, Cnidaria, Bryozoa and Paguridae can be impacted from trawls (Eggleton et al., 2016; Van Moorsel, 2011). Bottom trawling can also reduce the density of bioturbators, which in-turn impacts nitrogen cycling in the seabed (Olsgard et al., 2008). Fragile species such as the soft coral - dead man's fingers *Alcyonium digitatum* - are particularly vulnerable as they are highly sensitive to removal and displacement (Jager et al., 2018). This species is permanently attached to the substratum and once displaced does not have the ability to re-establish its attachment (Jager et al., 2018). Over time, there has been an indication that longer-lived species such as the bivalves, *Spisula subtruncata* and *Mactra stultorum,* have now been replaced by more opportunistic, short-lived bivalve feeders such as *Spiophanes bombyx*, *Amphiura filiformis* and *Phoronids* on Dogger Bank (Kröncke, 2011). This change, as well as reduction in fish species such as the thornback ray (*Raja clavata*) may be attributed to the historic use of bottom towed gear (Jak et al., 2009). Thornback ray were once found in greater numbers in Dogger Bank but are now considered scare (Jak et al., 2009). The decline in thornback ray highlights the potential impact of demersal trawling and the associated abrasion/penetration pressure on the biological communities of Dogger Bank SAC. The impacts of demersal trawling activity at the levels indicated in this assessment are not compatible with the restore extent and distribution and structure and function targets for the site with regards to the biological communities.

The impacts of demersal trawling on biological communities could, however, vary with several factors. For example, trawling impacts are likely to be greatest in unfished habitats and when gears penetrate deeper into the sediment (Sciberras et al., 2018). Trawling sensitivity may also vary with sediment type. For example, communities in gravel habitats may be particularly sensitive (Hiddink et al., 2017; Rijnsdorp et al., 2018), as such habitats contain large proportions of long-lived and more sessile epifauna (Bolam et al., 2017; Rijnsdorp et al., 2018). Muddy habitats may also be more sensitive to trawling than coarse habitats (Rijnsdorp et al., 2017; Rinsjdorp et al., 2020); although other studies indicate that benthic communities in muddy areas are less affected by trawling compared to those on sand and gravel (Hiddink et al., 2006b). Such conflicting evidence demonstrates that our understanding of how trawling impacts vary with habitat type remains incomplete (Hiddink et al., 2017). Furthermore, delineating habitat sensitivity by sediment type does not take into account species-specific sensitivities to trawling, for example the vulnerability of fragile epifaunal species (Hiddink et al., 2006b), such as dead man's fingers (Jager et al., 2018).

There is evidence to suggest the biological communities of Dogger Bank are relatively resilient to demersal trawling activity. A lack of trawling impacts on Dogger Bank benthic communities identified by Queirós et al. (2006) were suggested to be due to the benthic fauna being adapted to natural disturbance, as the fauna consists predominantly of small-bodied polychaetes that are not greatly affected by trawling. Furthermore, areas of high natural disturbance may be less sensitive to trawling due to such areas having low initial species biomass (Hiddink et al., 2006b).

However, demersal trawling has occurred in Dogger Bank SAC for decades (Plumeridge and Roberts, 2017). Intensive fishing - particularly the industrialisation of the North Sea steam trawl fleet - likely contributed to severe damage to Dogger Bank macrofauna communities in the 1920s to the 1950s (Plumeridge and Roberts, 2017). During which time, patches of the bivalves *Spisula subtruncata* and *Mactra stultorum*, which inhabited more of the north-eastern and central parts of the bank, disappeared almost completely (Kröncke, 2011). Such bivalves are yet to re-establish, likely due to fishing activity (Kröncke, 2011) and have instead been replaced by smaller, faster growing bivalves (Kröncke, 2011; Plumeridge and Roberts, 2017). Bottom trawling can shift biological communities towards short-lived species (Rijnsdorp et al., 2018), resulting in areas being dominated by short-lived species, such as polychaetes, which may be more resilient than long-lived species to the trawling activity (Josefson et al., 2018). Trawling removes the most sensitive species while allowing resilient organisms to remain (Hiddink et al., 2017), therefore the historic trawling activity is likely to have contributed towards the resilient communities present in the SAC.

Trawling can cause declines in benthic biota irrespective of habitat type (Hiddink et al., 2017) and can have large negative effects on the biomass and production of benthic communities across shallow, soft sediment areas in the North Sea, including in Dogger Bank (Hiddink et al., 2006b). Continued fishing may have led to the removal of less resilient long-lived species and the prevention of their recovery (Kröncke, 2011; Plumeridge and Roberts, 2017). The subtidal coarse sediment habitats of the sandbank feature maybe less resilient to trawling activity and although subtidal sand habitats may be more resilient, sufficient evidence is not available to rule out the potential for this resilience being a result of the decades of trawling activity. Therefore, trawling activity is not considered compatible with restoring the biological communities in Dogger Bank SAC.

VMS data shows that very high levels of demersal trawling take place throughout Dogger Bank SAC with a focus on the middle and eastern sections (Figure 3-Figure 8). This is indicative of intense trawling activity and therefore the impacts, described above, are likely to occur throughout the site.

With regards to the discussion above, the assessed activity levels and the limited evidence available for the impact of semi-pelagic gears, the **MMO concludes that impacts of abrasion or penetration from demersal trawls (including semi-pelagic) on the sandbank feature are not compatible with the conservation objectives of the site and may result in an adverse effect on site integrity.**

#### 4.2.3 Impact of demersal seines

Danish/anchor seines, Scottish seines and Scottish pair seines have been identified as gear types which may have an impact via surface and sub-surface abrasion and penetration on the sandbank feature. Purse seines are a pelagic gear and so are not assessed in this section as they are unlikely to make contact with the seabed.

Demersal seine hauls can impact the seabed either via contact of the seine rope or ground gear, with the largest impact by area coming from the seine rope when they are pulled together in the first phase of fishing operation (Eigaard et al., 2016a; Rijnsdorp, 2013). Scottish seines are expected to have a larger impact than Danish seines due to their weight, thicker ropes and larger area footprint (Eigaard et al., 2016a). The surface footprint of Scottish seines (1.6 $km^2$) and Danish seine (1.0 $km^2$), defined as the surface area covered during one hour of fishing, is relatively high compared to the otter trawl (0.3 – 1.2 $km^2$) and beam trawl (0.2 $km^2$) (Eigaard et al., 2016a,b; Rijnsdorp, 2015). The sub-surface footprint of Scottish seines (0.1 $km^2$) is estimated to be lower than the sub-surface footprint of otter trawls used for Nephrops (0.3 $km^2$) or beam trawl fisheries (0.2 $km^2$), potentially due to Scottish seines not containing otter boards and/or the lack of tickler chains or shoes used in beam trawls (Eigaard et al., 2016a,b; Rijnsdorp, 2015). As the physical structure of the feature is unlikely to be impacted by demersal seines, this activity is compatible with the conservation objective to restore the structure and function of the sandbank feature)

Given the absence of otter boards and lighter groundgear, seines tend to be considered as less damaging to seabed habitats via abrasion and penetration compared to other demersal gear types. Eigaard et al. (2016 a,b) estimated that the subsurface ratio to be < 0.001 for Danish seines and 0.050 for Scottish seines. In comparison, predicted sub-surface ratios for otter trawls ranged from 0.078 to 0.304 and from 0.522 to 1 for beam trawls, depending on target species (Eigaard et al., 2016 a,b). These predictions are in line with the conclusions of MBIEG (2020) which suggest that demersal seines alone may not have a significant impact on benthic communities via surface abrasion and subsurface penetration where sessile or attached epifauna are absent. However, Dogger Bank sandbanks are home to a wide range of sessile and attached epifauna including long-lived species such as *Alcyonium digitatum*, which are sensitive to the impact of abrasion through damage and removal as bycatch (van der Reijden et al. 2014; Verkempynck & van der Reijden, 2015 cited in Waardenburg, 2017). As a result, demersal seining may affect the structure and function of the benthic community. This impact would not be compatible with the favourable condition target of the site to restore the extent, distribution, structure and function of the sandbank feature. Abrasion/penetration pressure through removal of non-target species is explored further in section 4.4.3.

VMS data indicates that UK vessels use Scottish seines (in 2014, 2015 and 2019) and Danish seines (in 2014 and 2015) within the site (Table 18). Non-UK vessels mostly use Danish seines in addition to Scottish seines. VMS maps indicate that demersal seining within the site occurs at a much lower level than demersal trawling, with activity occurring sporadically throughout the site (Figure 3-Figure 8). However, the risk to long-lived species even at a low level could be significant.

With regards to the discussion above and the assessed activity levels, the **MMO concludes that impacts of surface abrasion on the sandbank feature from demersal seines alone are not compatible with the conservation objectives of the site and may result in an adverse effect on site integrity.**

### 4.2.4 Impact of dredges

Shellfish dredges have been identified as gear types which may have an impact via surface and sub-surface abrasion and penetration on the sandbank feature.

The ground gear of dredges used for catching molluscs is mostly homogenous across the entire width of the dredge, with the exception of scallop dredges, which have teeth protruding into the sediment (Eigaard et al., 2016a). Scallop dredges therefore produce a more uneven sediment furrow (Eigaard et al., 2016a; O'Neill et al., 2013). Scallop dredging can cause a flattening of irregular bottom topography by eliminating natural features such as ripples, bioturbation mounds and faunal tubes (Løkkeborg, 2005). The ground gear of dredges can penetrate up to 15 cm into sandy substrates (Eigaard et al., 2016a). Lambert et al. (2015) and Murray et al. (2015) demonstrated how tracks from scallop dredges persisted for up to ten months in coarse sediment, whereas dredge tracks were not found to be visible in sand. This impact on the physical structure of the sandbank is not compatible with the restore structure and function target for the site.

The epifauna and infaunal assemblages of both stable and dynamic fine sands are known to be susceptible to direct physical disturbance from dredges which penetrate and disturb the sediment (Roberts et al., 2010). A meta-analysis by Kaiser et al. (2006) indicated that both deposit- and suspension-feeders were consistently vulnerable to scallop dredging across gravel, sand and mud habitats. Slow-growing species, such as soft corals took much longer to recover (up to 8 yr) from scallop dredging than biota with shorter life-spans such as polychaetes (<1 yr) (Kaiser et al., 2006). Therefore, surface and sub-surface abrasion and penetration by demersal dredges may impact the biological communities found in the sandbank feature of Dogger Bank SAC. As described for demersal trawls in section 4.2.2, dredges may adversely impact infauna and epifauna found on the sandbank feature through direct physical impacts. This impact is not compatible with the restore extent and distribution and structure and function targets for the site with regards to the biological communities.

As discussed for demersal trawling (section 4.2.2), the sensitivity of biological communities to dredges may vary with several factors. The recovery rate of faunal assemblages can depend on the intensity of the disturbance: recovery rates from low intensity disturbance may take less time (< 100 days) than recovery from high intensity disturbance (> 200 days) (Dernie et al., 2003). Sensitivity can also depend on levels of natural disturbance and sediment mobility (Hall et al., 2008), with higher tidal velocity potentially driving faster recovery rates (Lambert et al., 2014). It could therefore be argued that in areas of high natural disturbance the benthic communities may be more resilient to dredging, as the benthic fauna may be adapted to a dynamic environment (Lambert et al., 2017). The southwest area of Dogger Bank could potentially thus be more resilient to dredging, as this is a shallow dynamic area favouring species adapted to sediment mobility (Wieking and Kröncke, 2003). Sensitivity to dredging impacts could also vary with sediment type, such as the fraction of sand versus gravel (Lambert et al., 2017). However, dredging reduces the epifauna abundance in both sand and gravel habitats, and such generalisations do not consider taxa-specific vulnerabilities to dredging, with soft corals suffering significant and enduring effects (Lambert et al., 2017). Although the impacts of scallop dredging on biological communities might vary, the intensity and extent of dredging that is sustainable, even in more resilient habitats, remains unclear (Stewart and Howarth, 2016).

VMS and landings data show that little to no dredging occurred within the site between 2014 and 2019. However, recent, unpublished VMS data from 2020 indicates that there has been a considerable rise in dredging for king scallops (*Pecten maximus*) in the site. If this activity continues impacts from dredges may become a concern to the site’s protected features.

With regards to the discussion above and the assessed activity levels, the **MMO concludes that impacts of abrasion or penetration from dredges on the**

**sandbank feature are not compatible with the conservation objectives of the site and may result in an adverse effect on site integrity.**

### 4.2.5 Pressure conclusion

Given the evidence above, surface abrasion and sub-surface penetration caused by traps, anchored nets/lines or demersal seines alone within Dogger Bank SAC is unlikely to hinder the restoration of the extent and distribution as well as structure and function of the sandbank feature. The **MMO conclude that anchored nets/lines, traps or demersal seines alone are compatible with the conservation objectives of the site and will not result in an adverse effect on site integrity via this pressure.**

There is a risk that surface abrasion and sub-surface penetration caused by demersal trawls and dredges may not help the achievement of favourable condition targets. However, as discussed for demersal trawls and dredges, the impacts of bottom-towed fishing on biological communities might vary (e.g. with sediment type), but also with previous exposure to the activity. In peripheral fishing areas, bottom-towed fishing may have less impacts on the status of the seabed than on core fishing grounds (Hiddink at al., 2006a; Jennings et al., 2012; Rijnsdorp et al., 2017), where species may be more resilient to trawling (ICES, 2017). Therefore, reducing bottom-towed fishing from peripheral fishing grounds, whilst keeping core fishing areas open, could achieve high improvements in seabed status for a low reduction in fishing effort (Hiddink at al., 2006a; Jennings et al., 2012; ICES, 2017). However, the higher resilience of species to trawling in core fishing grounds could be due to continuous fishing having already removed less resilient species (Hiddink et al., 2017). Furthermore, bottom towed gear can likely still impact biological communities in core fishing grounds, as biomass can be reduced with each pass of a bottom towed gear (e.g. Lambert et al., 2017). Therefore, even if the impacts vary, bottom towed fishing is likely to have negative impacts on biological communities across the Dogger Bank SAC and therefore dredging is not considered compatible with restoring the biological communities of the sandbank habitat.

Use of these gear types may impact the physical and biological structure of the sandbank feature via direct physical impacts from gear interacting with the seabed and species. This may impact the extent and distribution regarding large scale topography, sediment composition and biological assemblages. The **MMO conclude that demersal trawls, seines and dredges alone are not compatible with the conservation objectives of the site and may result in an adverse effect on site integrity via this pressure.**

**Table 21: Pressure conclusion for abrasion/disturbance of the substrate on the surface of the seabed AND penetration and/or disturbance of the substrate below the surface of the seabed, including abrasion based on assessed activity levels.**

| Pressure | Feature | Favourable condition target | SNCB aggregated gear method | Compatible with the conservation objectives? |
|---|---|---|---|---|
| Abrasion/disturbance of the substrate on the surface of the seabed<br><br>And<br><br>Penetration and/or disturbance of the substrate below the surface of the seabed, including abrasion | Sandbanks which are slightly covered by seawater all the time | **Restore extent and distribution:**<br>The feature extent within the site must be conserved to the full known distribution (sandbank feature calculated to be 12,331 $km^2$) based on:<br>- large-scale topography<br>- sediment composition<br>- biological assemblages | Anchored nets/lines | Yes |
| | | | Demersal trawls | No |
| | | | Demersal seines | No |
| | | | Dredges | No |
| | | **Restore structure and function:**<br>• Physical structure (finer scale topography and sediment composition and distribution) to be restored.<br>• Biological structure (key and influential species and characteristic communities) to be restored. | Anchored nets/lines | Yes |
| | | | Traps | Yes |
| | | | Demersal trawls | No |
| | | | Demersal seines | No |
| | | | Dredges | No |

## 4.3 Changes in suspended solids (water clarity) AND smothering and siltation rate changes

These pressures are relevant to demersal trawls, demersal seines and dredges in Dogger Bank SAC. The JNCC advice on operations does not consider traps and anchored nets/lines to be a risk to the features of Dogger Bank SAC via the pressures of changes in suspended solids and smoothing and siltation changes. The impacts of these pressures have been assessed for the 'sandbanks which are slightly covered by sea water all the time' feature. The impacts of demersal trawls, demersal seines and dredges have been grouped in this section due to the similarity in impacts caused by towed gear. Compatibility with conservation objectives and favourable condition targets has been considered for all gear types.

### 4.3.1 Impact of demersal trawls, demersal seines and dredges

When towed gear interacts with the seabed and ambient water this can result in regions of high velocity, high bed shear stress and possibly a fluidised bed (O'Neill and Summerbell, 2011). This may contribute to entrainment of sediment around and behind the gear, which is then dispersed in a cloud, creating a suspension with a vertical profile that depends on the turbulence and the particle settling velocities (O'Neill and Summerbell, 2011). The sediment then gradually settles as turbulence reduces. Suspension and settlement of sediments varies between the gear types used and the type of substrate.

Experiments using otter trawls on sand demonstrated that sediments can be suspended up to 80 cm above the seabed (O'Neill and Summerbell, 2011). Otter trawl components can cause a sediment concentration increase behind the gear of up to 0.43 $cm^3\ l^{-1}$ (O'Neill and Summerbell, 2011). Per metre towed, an estimated 41.3 kg $m^{-1}$ of sediment has been shown to be suspended by all otter trawl components (ground gear and trawl doors) in sandy substrates (O'Neill and Summerbell, 2011). Linders et al. (2018) concluded that sand is typically transported 10 to 100 m when in suspension. Detailed information for semi-pelagic gears is not currently available, however, the use of novel semi-pelagic doors has been shown to reduce resuspension of sediments when compared to bottom otter trawls (Rijnsdorp et al., 2017).

With regards to dredging, scallop dredges have been shown to entrain sandy sediments up to 30 m behind the gear (O'Neill et al., 2008). A study on sandy sediment grounds in Scotland demonstrated that the turbulent wake of scallop dredges entrains up to the equivalent of a 1 mm layer of sediment per unit of swept width (O'Neill et al., 2013).

Mobilisation of sediment can cause the release of nutrients, benthic infaunal mortality and the resuspension of phytoplankton cysts and copepod eggs (O'Neill and Summerbell, 2011). Increased turbidity and redistribution of sediments may be a risk to organisms that are vulnerable to increased levels of sediment particles in the water column and creates the potential for impacts via smothering (Linders et al., 2018; Gubbay and Knapman, 1999). Changes in suspended sediment in the water column may have a range of biological effects on different species within the habitat; affecting their ability to feed or breathe[24]. A prolonged increase in suspended particulates for instance can have several implications, such as affecting fish health, clogging filtering organs of suspension feeding animals and affecting seabed sedimentation rates (Elliot et al., 1998).

Many of the species found within the sandbank feature of Dogger Bank SAC are sedentary filter or suspension feeders, such as bivalves, which may be at risk from smothering caused by resuspension of sediment (Tillin and Tyler-Walters, 2014). However, evidence suggests that there are relatively low suspended sediment concentrations within the site of the order of 2 mg/l with a maximum of 10 mg/l (Doerffer and Fisher, 1994; Eleveld et al., 2004). Furthermore, the location of the site means that it is exposed to substantial wave energy and therefore the natural rate of dispersion of sediment plumes created by demersal gears will be high. This is compatible with favourable condition targets requiring maintenance of the hydrodynamic regime, water and sediment quality.

Tillin and Tyler-Walters (2014) concluded that both the resistance and resilience of erect, large, longer-lived epifaunal species with some flexibility was high to this pressure. For soft-bodied or flexible epifaunal species, Tillin and Tyler-Walters (2014) noted that increased turbidity could be beneficial for these species under certain conditions, and only up to a level that wasn't considered too high. Therefore, impacts on the biological communities of the sandbank feature from this pressure is likely to be minimal. This is compatible with favourable condition targets for the extent and distribution and structure and function of the sandbank feature in relation to biological communities.

VMS data shows that there are high levels of activity for demersal towed gears throughout the site between 2014 and 2019. However, given the discussion above, there is no evidence to suggest that this pressure is adversely affecting the features of Dogger Bank SAC. This pressure will be considered in combination with other plans and projects in Part C.

With regards to the discussion above and the assessed activity levels, the **MMO**

[24] JNCC Supplementary Advice of Conservation Objectives for Dogger Bank Special Area of Conservation https://data.jncc.gov.uk/data/26659f8d-271e-403d-8a6b-300defcabcb1/DoggerBank-3-SACO-v1.0.pdf

**concludes that impacts from changes in suspended solids (water clarity) AND smothering and siltation rate changes by demersal trawls (including semi-pelagic), demersal seines and dredges on the sandbank feature are compatible with the conservation objectives of the site and will not result in an adverse effect on site integrity.**

### 4.3.2 Pressure conclusion

Given the evidence above, impacts from changes in suspended solids, smothering and siltation caused by demersal trawls, demersal seines and dredges alone within Dogger Bank SAC are unlikely to hinder the restoration of the extent and distribution or structure and function of the sandbank feature. This pressure is also unlikely to hinder the maintenance of the hydrodynamic regime or water quality in the site. The **MMO conclude that demersal trawls, demersal seines and dredges are compatible with the conservation objectives of the site and will not result in an adverse effect on site integrity via this pressure.**

**Table 22: Pressure conclusion for changes in suspended solids (water clarity) AND smothering and siltation rate changes based on assessed activity levels.**

| Pressure | Feature | Favourable condition target | SNCB aggregated gear method | Compatible with the conservation objectives? |
|---|---|---|---|---|
| Changes in suspended solids (water clarity)<br><br>AND<br><br>Smothering and siltation rate changes | Sandbanks which are slightly covered by seawater all the time | **Restore extent and distribution:**<br>The feature extent within the site must be conserved to the full known distribution (sandbank feature calculated to be 12,331 $km^2$) based on:<br>- large-scale topography<br>- sediment composition<br>- biological assemblages | Demersal trawls | Yes |
| | | | Demersal seines | Yes |
| | | | Dredges | Yes |
| | | **Restore structure and function:**<br>• Physical structure (finer scale topography and sediment composition and distribution) to be restored.<br>• Biological structure (key and influential species and characteristic communities) to be restored. | Demersal trawls | Yes |
| | | | Demersal seines | Yes |
| | | | Dredges | Yes |
| | | **Maintain**<br>• Hydrodynamic regime to be maintained.<br>• Water and sediment quality to be maintained. | Demersal trawls | Yes |
| | | | Demersal seines | Yes |
| | | | Dredges | Yes |

## 4.4 Removal of non-target species

These pressures are relevant to anchored nets/lines, traps, demersal trawls, demersal seines and dredges in Dogger Bank SAC. The impacts of these pressures have been assessed for the 'sandbanks which are slightly covered by sea water all the time' feature.

### 4.4.1 Impact of anchored nets/lines and traps

Fixed nets such as gillnets have the potential to entangle non-target species. Species likely to become entangled include diving seabirds, seals and cetaceans (Gislason, 1994) and erect, branching benthic species such as pink sea fans (*Eunicella verrucosa*) (Eno et al., 2013). Characteristic communities within the subtidal sandbank feature of Dogger Bank include infauna and epifauna such as bivalves, polychaetes, echinoids, soft corals and bryozoans. The majority of these are unlikely to be removed by gillnets. One exception is dead man's finger soft coral, a species unique to Dogger Bank SAC in terms of North Sea sandbanks. Standing up to 250 mm tall (Picton et al., 2016), it is possible for these soft corals to be removed by the drift or hauling of anchored gillnets. However, there is little empirical evidence to support this and due to the limited netting activity in the site this is not considered to be of significant concern. Anchored net/line activity is therefore compatible with the favourable condition target to restore extent and distribution and structure and function with regards to the biological communities.

As noted previously, VMS and landings data are contradictory with regard to anchored netting activity within Dogger Bank SAC and it is likely not occurring with any considerable regularity. The low levels of gillnetting activity, combined with the minimal impacts predicted to be caused via the removal of non-target species, suggest that this activity is not currently a cause of concern for the protected features of Dogger Bank SAC.

Bycatch from crab and lobster pots around the UK is low. A Marine Stewardship Council report found that only 1% of total catch (excluding undersize and berried individuals returned to the sea before landing) was made up of bycatch in the crab potting fishery around the Shetland Islands (Hervás et al., 2012). Very little bycatch is expected from pots and traps as the design means that fish and shellfish can escape easily before the gear is hauled[25]. Any bycatch can also be released back into the sea immediately without harm. Epifauna such as sea fans have been shown to be able to recover from all creel impacts, by bending to avoid the impact of dropped creels and reinserting themselves following uprooting (Eno et al., 2001). Trap activity is therefore compatible with the favourable condition target to maintain

[25] https://seafish.org/gear-database/gear/pots-and-traps/

the distribution of subtidal sandbank communities and will not adversely impact species richness or species of ecological importance.

With regards to the discussion above and the assessed activity levels, the **MMO concludes that impacts from removal of non-target species by anchored nets/lines and traps on the sandbank feature are compatible with the conservation objectives of the site and will not result in an adverse effect on site integrity.**

### 4.4.2 Impacts of demersal trawls

Demersal trawls interact directly with the seabed and penetrate into the sediment, which may result in species occupying this area to be removed by passing trawls. As detailed previously, semi-pelagic gears are towed on or very close to the seabed. While the trawl doors are lifted off the seabed, the net continues to make contact (Seafish, 2020). Abrasion and penetration of sediment by semi-pelagic gear is reduced compared to true demersal trawls owing in large part to the removal of seabed/door contact (Rijnsdorp et al., 2017). The similar footprint of semi-pelagic and bottom otter trawl gear and the continued contact of the net with the seabed during a semi-pelagic trawl would suggest abrasion and penetration are still likely to occur, albeit to a reduced degree, particularly with regard to penetration (Rijnsdorp et al., 2017). Therefore, removal of non-target species is likely to be similar for epifauna, owing to the continued abrasion, and reduced for infauna due to reduced penetration although little evidence is available to quantify this remaining impact.

Mortality of non-target species caught by demersal gear such as beam trawls varies. One study found that mortality ranges from 0% for hermit crab, whelks and starfish to 100% for shells such as *Arctica islandica* (Gislason, 1994). De Groot and Lindeboom (1994) found that high mortalities occurred for undersized fish discarded, 50% or less for most crabs and molluscs and very little mortality (<10%) for starfish. Overall findings indicated a decrease of 0-85% from initial numbers for different mollusc species (De Groot & Lindeboom, 1994). *Arctica islandica* is a long-lived, slow growing and late maturing species found within the sandbank feature of Dogger Bank SAC. These life history characteristics make *A. islandica* particularly susceptible to overfishing, and recovery from population declines is particularly slow, as seen in the North Sea (OSPAR, 2009). This led to *A. islandica* being listed as an OSPAR threatened or declining species. It is likely that their removal by trawls will cause adverse effects on the dynamics of benthic communities as this contributes to the shift towards short-lived species.

Fisheries generated mortality results in a reduced abundance of long-lived benthic species and increased abundance of short-lived species, a change which has been observed in Dogger Bank SAC (Gislason, 1994; Kröncke, 2011). Changes in the benthic community structure of Dogger Bank may also be driven by hydroclimatic changes (Kröncke & Reiss, 2007). Decreased species numbers and an increased number of small polychaetes could also be due to changes in the North Atlantic Oscillation system, which in-turn is driving increased sea surface temperature and changes in food availability and sediment structure (Kröncke & Reiss, 2007). However, it is likely that both climate changes and fishing impacts cause changes in Dogger Bank macrofauna communities (Kröncke, 2011). The presence of climate-driven factors does not exclude the possibility that fishing also contributes to community changes, with continuous fishing potentially preventing the re-establishment of once-dominant bivalve communities (Kröncke, 2011). Jennings (1998) noted that within heavily fished areas, the removal of large epibenthic organisms can lead to long-term reductions in structural complexity and declines in the abundance of fishes associated with the epibenthic community. Therefore, it can be concluded that commercial beam trawling may affect the structure and composition of the benthic community in the North Sea (De Groot & Lindeboom, 1994). This impact is not compatible with the favourable condition target to restore extent and distribution and structure and function of the sandbank feature.

VMS data shows that very high levels of demersal trawling take place throughout Dogger Bank SAC with a focus on the middle and eastern sections (Figures 3 – 8). This is indicative of intense trawling activity and therefore the impacts, described above, are likely to occur throughout the site.

With regards to the discussion above, the assessed activity levels and the limited evidence available for the impact of semi-pelagic gears, the **MMO concludes that impacts from removal of non-target species by demersal trawls (including semi-pelagic) on the sandbank feature are not compatible with the conservation objectives of the site and may result in an adverse effect on site integrity.**

### 4.4.3 Impacts of demersal seines

Demersal seines have the potential to remove epifauna when the ropes of a seine net are closed up in order to herd demersal fish. Biotopes containing attached or sessile epifauna are considered sensitive to abrasion due to the removal of these non-target species (MBIEG, 2020). Observations in the North Sea show that seining caught 19 of the Dogger Bank typical species across the anthozoa, crustacea, echinoderm, mollusca and fish groups (van der Reijden et al. 2014; Verkempynck & van der Reijden, 2015 cited in Waardenburg, 2017). All fish species excluding *Raja clavata* were target species and all other species were bycatch. Bycatch included long-lived species: *Alcyonium digitatum* (10-28 years), *Arctica islandica* (100+ years), *Pagurus bernhardus* (6-10 years), *Buccinum undatum* (11-20 years) and *Neptunea antiqua* (21-100 years) (van der Reijden et al. 2014; Verkempynck & van der Reijden, 2015 cited in Waardenburg, 2017). The occurrence in bycatch as well as the sensitivity of *A. islandica* and *Buccinum undatum* to seining is also shown in further studies from the North Sea (Verschueren, 2015; Wijnhoven et al., 2013; Rijnsdorp et al., 2015).

Scottish seines can have low discard rates compared to beam trawls, and bycatch rates can also vary with species and mesh size, for example discard rates of *A. islandica* are on average 5 per hour for Scottish seines with mesh size 100 – 119 mm versus 1 per hour for mesh sizes over 120 mm (van der Reijden et al., 2014). Several factors can also influence the survival rates of bycatch species, such as the time fish spend on deck and fish body size, with smaller fish potentially suffering higher susceptibility to crushing (Benoît et al., 2010). However, Scottish seines do still encounter long-lived species, such as dead man's fingers *Alcyonium digitatum* (average discard rates are 2 per hour for mesh sizes 100-119 mm and 14 per hour for mesh sizes >120 mm; van der Reijden et al., 2014). Long-lived species have life history traits such as slow growth, late maturity and low fecundity. This results in slow recovery rates and high vulnerability to fishing disturbance. As a result, demersal seining may affect the structure and function of the benthic community. This impact would not be compatible with the favourable condition target of the site to restore extent and distribution and structure and function of the sandbank feature.

The studies above indicate that a number of species found within Dogger Bank SAC are vulnerable to removal by seining. VMS data indicates that demersal seining within the site occurs at a much lower level than demersal trawling, however, the risk to long-lived species even at a low level could be significant.

With regards to the discussion above and the assessed activity levels, the **MMO concludes that impacts from removal of non-target species by demersal seines on the sandbank feature are not compatible with the conservation objectives of the site and may result in an adverse effect on site integrity.**

#### 4.4.4 Impacts of dredges

According to available evidence, including VMS data, scallop dredges are the only form of dredge used within Dogger Bank SAC.

Dredges can cause large amounts of bycatch for a range of non-commercially targeted species, the majority of which is discarded damaged, dying or dead (Howarth and Stewart, 2014). Hinz et al. (2012) found that for every scallop captured by a Newhaven dredge, four individuals of bycatch were also caught. An assessment of the 10 most common bycatch species in the Irish Sea scallop fishery found that approximately 20 to 30 % of individuals suffered fatal damage after dredge capture (Shephard et al. 2009). Another study in the Irish Sea demonstrated how benthic communities are significantly altered by scallop dredging by comparing a previously fished closed area to a fished area over 6 years (Bradshaw et al., 2001). As observed in scallop fishing grounds in the Irish Sea, the majority of damage to large benthic invertebrates during scallop dredging can occur unobserved on the seabed (Jenkins et al., 2001). Due to crushing as animals pass under the gear and/or the initial encounter with the gear, benthic megafauna on the seabed that are encountered by dredges have similar (or even higher) levels of damage as those organisms landed on the deck as bycatch (Jenkins et al., 2001).

Hinz et al. (2012) studied the environmental impact of different types of queen scallop fishing gears, including dredges. Results showed that traditional scallop dredges contained larger amounts of non-target species such as invertebrates than other gear types such as otter trawls (Hinz et al., 2012). For example, clear negative impacts were found for the brittlestar, *Ophiura* (Hinz et al., 2012). Species such as brittlestars, as well as other benthic invertebrates, are known to be key members of the sandbank feature of Dogger Bank SAC.

Given the proven impact of scallop dredges on benthic communities, it is likely that continued scallop dredging within Dogger Bank SAC will hinder the site's favourable condition targets to restore extent of biological assemblages and biological structure of the sandbank.

VMS and landings data show that little to no scallop dredging occurred within the site between 2014 and 2019. However, recent, unpublished VMS data from 2020 indicates that there has been a considerable rise in dredging for king scallops (*Pecten maximus*) in the site (section 4.1.4 and Figure 15). If activity continues, impacts from dredges will become a concern for the site's protected features.

With regards to the discussion above and the assessed activity levels, the **MMO concludes that impacts from removal of non-target species by dredges on the sandbank feature are not compatible with the conservation objectives of the site and may result in an adverse effect on site integrity.**

### 4.4.5 Pressure conclusion

Given the evidence above, removal of non-target species caused by traps and anchored nets/lines alone within Dogger Bank SAC is unlikely to hinder the restoration of the extent and distribution as well as structure and function of the sandbank feature. The **MMO conclude that anchored nets/lines and traps alone are compatible with the conservation objectives of the site and will not result in an adverse effect on site integrity via this pressure.**

There is a risk that removal of non-target species caused by demersal trawls (including semi-pelagic), demersal seines and dredges may not help the achievement of favourable condition targets. Use of these gear types may impact the physical and biological structure of the sandbank feature via direct removal of species that are components of the characteristic communities of Dogger Bank. This may impact the extent and distribution regarding biological assemblages. The **MMO conclude that demersal trawls (including semi-pelagic), demersal seines or dredges alone are not compatible with the conservation objectives of the site and may result in an adverse effect on site integrity via this pressure.**

**Table 23: Pressure conclusion for removal of non-target species based on assessed activity levels.**

| Pressure | Feature | Favourable condition target | SNCB aggregated gear method | Compatible with the conservation objectives? |
|---|---|---|---|---|
| Removal of non-target species | Sandbanks which are slightly covered by seawater all the time | **Restore extent and distribution:** The feature extent within the site must be conserved to the full known distribution (sandbank feature calculated to be 12,331 $km^2$) based on: - large-scale topography - sediment composition - biological assemblages | Anchored nets/lines | Yes |
| | | | Traps | Yes |
| | | | Demersal trawls | No (biological assemblages) |
| | | | Demersal seines | No (biological assemblages) |
| | | | Dredges | No (biological assemblages) |
| | | **Restore structure and function:** • Physical structure (finer scale topography and sediment composition and distribution) to be restored. • Biological structure (key and influential species and characteristic communities) to be restored. | Anchored nets/lines | Yes |
| | | | Traps | Yes |
| | | | Demersal trawls | No |
| | | | Demersal seines | No |
| | | | Dredges | No |

## 4.5 Removal of target species

These pressures are relevant to traps, anchored nets/lines, demersal trawls, demersal seines and dredges in Dogger Bank SAC. The impacts of these pressures have been assessed for the 'sandbanks which are slightly covered by sea water all the time' feature.

### 4.5.1 Impacts of anchored nets/lines and traps

Landings data indicates that minimal gillnetting activity occurs in Dogger Bank SAC but what activity is occurring mostly targets sole (*Solea solea*). Sole are not listed as a 'key and influential' species (species that play a critical role in maintaining the structure and function of the protected feature) nor are they considered part of a 'characteristic community' (which includes representative communities, such as those covering large areas, and notable communities, such as those that are nationally or locally rare or are particularly sensitive)[24]. The sandbank feature of Dogger Bank SAC provides spawning and nursery grounds for sole, which migrate to the area (Ellis, 2012), and this species likely uses the site for feeding and thus benefits from a key function of the site (provision of nutrition)[24].

Given sole do not play a critical role in the structure and function of the sandbank feature nor are they considered a species component of the 'characteristic communities' of Dogger Bank SAC, their presence within the site is not linked to the achievement of the conservation objectives (Table 10). Due to the low levels of gillnetting activity (Table 12 and Table 14), this pressure is not considered occurring at a level of concern within the site. As this species is currently managed through total allowable catch (TAC) and other technical measures, sole will not be considered further in relation to management within Dogger Bank SAC for the pressure of removal of target species.

The main target species for pots in Dogger Bank SAC are edible crab (C*ancer pagurus*) and whelks (*Buccinum undatum*). As for sole, these species are not considered 'key and influential' to the structure and function of the sandbank feature nor are they considered a species component of the 'characteristic communities' of the site[24]. These species are subject to minimum conservation size legislation, making it illegal for them to be landed if they are below a certain size. This legislation aims to maintain a healthy stock size of sexually mature individuals. Given this legislation, the relatively low levels of landings (Table 14), and that the presence of these species is not linked to the achievement of the conservation objectives (Table 10), crab and whelks will not be considered further in relation to management within Dogger Bank SAC for the pressure of removal of target species.

Considering the low levels of trapping and gillnetting activity occurring in Dogger Bank SAC and that the target species are not 'key and influential' nor a species component of the 'characteristic communities' of the site, the **MMO concludes that impacts from removal of target species by anchored nets/lines and traps on the sandbank feature are compatible with the conservation objectives of the site and will not result in an adverse effect on site integrity.**

### 4.5.2 Impacts of demersal trawls and seines

UK vessels make use of demersal trawls to target plaice, whereas non-UK vessels, specifically Dutch, Danish, German and Belgian vessels, target plaice, sandeels and herring.

The main target species of the Danish demersal seine fleet is sandeels and therefore the impact of this fleet will be considered alongside that of sandeel removal via demersal trawls.

Neither plaice nor herring are listed as 'key and influential' species to the site nor are they species components of the site's 'characteristic communities'[24]. These species likely use the site for feeding and thus benefit from one of the site's key functions - provision of nutrition. However, as these species do not have a critical role in the structure and function of the sandbank feature, nor are they considered part of the site's 'characteristic communities', their presence within the site is not linked to the achievement of the site's conservation objectives (Table 10). Given that these species are currently managed through TACs and other technical measures, they will not be considered further in relation to management within Dogger Bank SAC for the pressure of removal of target species.

*Sandeels*

Unlike herring and plaice, sandeels are listed as a species component of the 'characteristic communities' of Dogger Bank SAC[24], and play an important role in nutrient provision within the site. By acting as a food source for a range of predators, sandeels are a key component of the foodweb dynamics and ecosystem of the North Sea (Arnott and Ruxton, 2002). Sandeels provide a critical mid-trophic link between zooplankton (their preferred prey) and higher trophic predators (Frederiksen et al., 2007), including fish, seabirds and mammals (Furness and Tasker, 2000; Furness, 2002). Reduction in sandeel abundance could consequently directly and indirectly impact the foodweb dynamics in the North Sea and ecosystem functioning (Frederiksen et al., 2007). As a food source for numerous predators, sandeels have a key role in nutrient provision, and thus likely play a significant role in the biological structure and function of the sandbank feature.

Being a burrowing species, sandeels may also play an important role within the site as a bioturbator, helping to cycle nutrients and oxygen between seawater and the seabed (Widdicombe et al., 2004). However, there is currently insufficient information available to determine the significance of the role this species plays as a bioturbator within the site.

Sandeels are also perhaps unique for a commercially targeted fish species in Dogger Bank SAC because, as well as being listed as a species component of the 'characteristic communities' of the site, they are also relatively sessile and constrained by their habitat preferences. Hatched larvae of lesser sandeels (*Ammodytes marinus*) can be transported considerable distances by ocean currents (Jensen et al., 2003). However, after metamorphosis, juveniles settle in suitable habitats and show high bank fidelity (Jensen et al., 2011). Although there may be some limited redistribution, lesser sandeels do not appear to migrate outside of their 'home sand bank' (Jensen et al. 2011). During the growth season (spring and early summer), sandeels move through the water column during the day to feed, whilst burying themselves in the sand at night (Windslade, 1974). Outside of their growth season, sandeels rarely leave their sand refuges (e.g. van Deurs et al. 2010). Sandeels also appear to display a strong preference for sand habitats with well-oxygenated sand and a low silt and clay content (Wright at al., 2000). Due to a lack of mixing between fishing grounds, there is an increased risk that sandeel fishing can have adverse effects at a local level, even if the species is within biologically safe limits at a population level (Jensen et al., 2011). Therefore, the removal of sandeels from Dogger Bank SAC may lead to a reduced sandeel stock at this local level with potential impacts on the sandbank feature.

For Dogger Bank sandbank to achieve favourable status and to avoid adverse effects on site integrity, the 'typical species' associated with the Annex 1 habitat must also be maintained at, or restored to, favourable conservation status (Article 1(e) Habitats directive[14]; Rees et al., 2013). Sandeels are considered a 'typical species' associated with the sandbank feature and are a species component of the 'characteristic communities' of the site[24]. Characteristic communities are addressed within the structure and function attribute of the conservation advice package (Table 10). The conservation objectives of Dogger Bank include to 'restore the structure and function of qualifying habitats', which includes restoring the biological structure (including characteristic communities).

Large quantities of sandeels were landed in the eight ICES rectangles intersecting Dogger Bank SAC (see section 4.1.4.6). This equated to substantial quantities of sandeel landings estimated to be derived from within the site. UK vessels landed approximately 1,100 tonnes of sandeels in the SAC from 2014 to 2018 (78 tonnes in 2019), whilst non-UK vessels landed approximately 155,800 tonnes of sandeels in the site from 2014 to 2018.

ICES advice in 2020 details how spawning-stock biomass for sandeels was below $B_{lim}$ (biomass limit reference point) and $B_{pa}$ (biomass precautionary reference point) and therefore MSY $B_{escapement}$ (biomass reference point within the ICES maximum sustainable yield, MSY, framework) in 2019 and at the beginning of 2020 (ICES, 2020a). These estimates are for the central and southern North Sea sandeel stock area 1r, which includes Dogger Bank. The MSY $B_{escapement}$ biomass reference point ensures that there are adequate escaping/surviving fish left to spawn and that there is 95% probability of the stock being above $B_{lim.}$ Stocks with spawning stock biomass below $B_{lim}$ level are considered to suffer from impaired recruitment (recruit overfished) and hence may not be able to sustain a fishery. Stocks with spawning stock biomass below $B_{pa}$ level are at risk (around 5-10%) of being below the $B_{lim}$ (Lart, 2019).

The lowest historical recruitment of sandeel stock 1r was observed in 2017 (ICES, 2020a). The introduction of very low recruitment in 2018, combined with a continual decrease in mean weight at-age led to a stock below MSY $B_{lim}$ and $B_{trigger}$ at the beginning of 2020 (ICES, 2020b). MSY $B_{trigger}$ is an indicator where if biomass levels decrease below this level, fishing should be reduced to below MSY levels and additional measures may be needed under the MSY precautionary approach. The herring assessment working group (HAWG) also estimated that the spawning stock biomass of sandeel stock 1r was at or below $B_{lim}$ from 2004 to 2007 and from 2013 to 2015 (ICES, 2020b). Accordingly, spawning stock biomass has repeatedly been fluctuating below MSY $B_{trigger}$ since 2004 (ICES, 2020a). For reasons that are unclear, the mean weight-at-age of this sandeel stock has also decreased over the last three decades, with the lowest values on record (for ages 3 and 4) observed in 2019 (ICES, 2020b).

However, recruitment of sandeels in 2019 for stock 1r was above the geometric mean of the time series (1983 – 2019) (ICES, 2020a). The 2019 year class was therefore expected to be large enough to contribute to an increase in spawning stock biomass and advised catch for 2020 (ICES, 2020a). ICES advice has changed year-to-year for this sandeel stock potentially due to interannual variability in biomass, recruitment and early maturation, which can be typical for short-lived species (ICES, 2020a).

Several factors affect the recruitment and survival of sandeel stocks in the North Sea, including internal regulatory factors (such as density dependence) and external regulatory factors (such as climate-driven changes in prey availability) (Arnott & Ruxton, 2002; van Deurs et al., 2009; Lindegren et al., 2018). Fishing mortality in the North Sea however also affects sandeel productivity, and likely largely contributed to abrupt stock declines in the late 1990s (Lindegren et al., 2018), which led to a period of low recruitment and biomass (ICES, 2020a; Lindegren et al., 2018). Despite being under quota regulations, sandeel biomass has remained low and has not returned to the productivity levels evident in the 1980s (ICES, 2020a; ICES, 2020b; Lindegren et al., 2018). Using estimates of spawning stock biomass for sandeel stock 1r from the HAWG report, the mean stock biomass was 425,562 (± 95,978 standard error of the mean) tonnes from 1983 to 1990, but 123,462 (± 23,902) tonnes from 2013 to 2020 (ICES, 2020b). Across all years (1983 – 2020), mean SSB was 243,096 tonnes (ICES, 2020b).

Although a range of factors contribute to the stock remaining in poor productivity, fishing mortality also significantly contributes to the productivity of North Sea sandeel stocks (Lindegren et al., 2018). Simulation models used to evaluate the importance of various factors in affecting sandeel recruitment and survival show that reducing fishing mortality lead to pronounced improvements in stock status (Lindegren et al., 2018). Considering that the sandeel stock in Dogger Bank (stock 1r) remains in poor condition relative to the 1980s (Lindegren et al., 2018) and that stock has been fluctuating below MSY $B_{trigger}$ since 2004, and that sandeel landings derived from Dogger Bank SAC were substantial, it is likely that demersal trawl and seine activity within Dogger Bank SAC are creating a potential risk to sandeel stocks in the area.

Given the poor status of the sandeel stock, the sessile behaviour and strong habitat preferences of this species, the large quantities of sandeels estimated to be removed from the site and the potential local, Dogger Bank population impacts this may have, the removal of target species pressure where it concerns sandeels is likely to significantly impact the biological 'structure and function' of the sandbank feature via the reduced prevalence of this species – a component of the site's 'characteristic communities'. Therefore the **MMO concludes that impacts from removal of target species by demersal trawls (including semi-pelagic) and demersal seines on the sandbank feature are not compatible with the conservation objectives of the site and may result in an adverse effect on site integrity.**

### 4.5.3 Impacts of dredges

Scallops are not listed as 'key and influential' nor are they considered a species component of the 'characteristic communities' of Dogger Bank SAC[24] therefore removal of scallops as a target species is not likely to hinder the objective to restore the biological structure of the sandbank feature (Table 10). The **MMO therefore concludes that impacts from removal of target species by dredges on the sandbank feature are compatible with the conservation objectives of the site and will not result in an adverse effect on site integrity.**

### 4.5.4 Pressure conclusion

Given the evidence above, removal of target species by traps and anchored nets/lines alone within Dogger Bank SAC is unlikely to hinder the restoration of the extent and distribution as well as structure and function of the sandbank feature. The **MMO conclude that traps and anchored nets/lines alone are compatible with**

**the conservation objectives of the site and will not result in an adverse effect on site integrity via this pressure.**

Sandeels are considered a species component of the 'characteristic communities' of Dogger Bank, and thus the species are linked to the conservation objectives of the site, particularly to restore the biological structure, which includes restoring characteristic communities. Given the poor status of the sandeel stock 1r, the large quantities of sandeel estimated to be removed from Dogger Bank SAC and the species' relative importance for nutrient provision, the biological 'structure and function' of the sandbank feature is likely to be significantly impacted via this pressure where it concerns sandeels. The **MMO conclude that demersal trawls (including semi-pelagic) and demersal seines are not compatible with the conservation objectives of the site and the removal of sandeels may result in an adverse effect on site integrity via this pressure.**

Although scallop dredging may impact biological assemblages via the removal of non-target species, scallops themselves are neither a 'key and influential' species nor a species component of the site's 'characteristic communities'. Scallops likely do not play a critical role in the structure and function of the sandbank feature and the removal of scallops is not linked to the achievement of the conservation objectives. Therefore, the **MMO conclude that dredges alone are compatible with the conservation objectives of the site and will not result in an adverse effect on site integrity via this pressure.**

**Table 24: Pressure conclusion for removal of target species based on assessed activity levels.**

| Pressure | Feature | Favourable condition target | SNCB aggregated gear method | Compatible with the conservation objectives? |
|---|---|---|---|---|
| Removal of target species | Sandbanks which are slightly covered by seawater all the time | **Restore extent and distribution:** The feature extent within the site must be conserved to the full known distribution (sandbank feature calculated to be 12,331 $km^2$) based on: - large-scale topography - sediment composition - biological assemblages | Anchored nets/lines | Yes |
| | | | Traps | Yes |
| | | | Dredges | Yes |
| | | | Demersal seines | Yes |
| | | | Demersal trawls | Yes |
| | | **Restore structure and function:** • Physical structure (finer scale topography and sediment composition and distribution) to be restored. • Biological structure (key and influential species and characteristic communities) to be restored. | Anchored nets/lines | Yes |
| | | | Traps | Yes |
| | | | Dredges | Yes |
| | | | Demersal seines | No (biological structure) |
| | | | Demersal trawls | No (biological structure) |

### 4.6. Part B conclusion

The assessment of fishing pressures on the sandbank feature of Dogger Bank SAC has revealed that an adverse effect on site integrity cannot be ruled out where demersal trawl (including semi-pelagic), demersal seine and dredging activities occur. As such **the MMO conclude that management measures are required to restrict these activities within Dogger Bank SAC**. Section 7 contains further details of these measures.

With the introduction of the aforementioned management measures, **the MMO conclude that the remaining fishing activities (traps and anchored nets and lines), when considered in isolation, are compatible with the conservation objectives of the site and will not result in an adverse effect on site integrity of Dogger Bank SAC**.

# 5. Part C assessment

### 5.1 In combination assessment

This section assesses the effects of activities considered as compatible with the conservation objectives of Dogger Bank SAC in combination with other relevant activities taking place which includes the following**:**

- fishing activity/pressure combinations which were excluded in Part A of this assessment as having no likely significant effect (see Table 8);
- fishing interactions assessed in Part B but not resulting in adverse effect;
- plans and projects.

The MMO SPIRIT (SPatial InfoRmatIon Toolkit) system was used to check relevant activities that occur within, or adjacent to, the assessed site where there could be a pathway for disturbance. To determine plans and projects to be included in this part of the assessment, a distance of 5 km was selected as suitable to capture any potential source receptor pathways that could impact the site in combination with effects of the fishing activities assessed. A 5 km buffer was therefore applied to the site boundary to identify relevant plans and projects.

Demersal trawls, seines and dredges have been identified in Part B as requiring management to avoid adverse effects to site integrity and will therefore not be considered in Part C. Traps and anchored nets/lines are the only other fishing activities which interact with the seabed occurring within Dogger Bank SAC. In combination effects of these fishing activities with other plans/projects will be assessed in Part C.

## 5.2 Pressures exerted by fishing and plans or projects

In accordance with the methodology detailed above, the SPIRIT system identified military surface/firing danger areas, offshore windfarm construction, disposal sites, pipelines and submarine cables as potential plans or projects occurring within 5 km of Dogger Bank (Table 25).

No recreational activities were identified and no additional fishing activities to those already assessed in Part B occur within 5 km of the Dogger Bank SAC.

**Table 25: Other fishing activities and plans and projects considered in combination with traps and anchored nets and traps in Dogger Bank SAC.**

| Relevant activity | Description |
|---|---|
| Submarine cables | Numerous telecommunication cables run through the site and across the sandbank and there is the potential for the laying of further cables in conjunction with the Dogger Bank offshore windfarm soon to be constructed. |
| Military surface/firing danger areas | The Ministry of Defence make use of an area West of Dogger Bank for firing practice. The area of activity is outside of Dogger Bank SAC but within 5 km. |
| Offshore windfarm construction | Three offshore windfarms have been licensed for construction within Dogger Bank SAC. |
| Disposal sites | Three disposal sites for use in the construction of the Dogger Bank offshore windfarms occur within the Dogger Bank SAC. |
| Offshore windfarm operation and maintenance | With the construction phase completed (estimated 2023 – 2025) the three offshore wind farms will move into the operation phase and require general maintenance. |
| Pipelines | Numerous pipelines run through the site and across the sandbank feature. |

To identify the specific pressures that the activities exert on the Dogger Bank SAC sandbank feature, the MMO has used JNCC's PAD[17] and the AoO section of JNCC's Dogger Bank SAC conservation advice package (Table 5).

Use of JNCC's AoO and PAD required the identified activities to be matched to the appropriate categories and activities. Table 26 and Table 27 show how the activities were matched.

**Table 26: Categories from the PAD that have been used to inform pressures information for disposal sites.**

| Name of plan/project | PAD category | PAD activity |
|---|---|---|
| Disposal sites | Extraction (and disposal) of non-living resources | Dredge and spoil disposal |
| Military surface/firing danger areas | Sea surface military activity | Defence and national security |

**Table 27: Categories from the AoO that have been used to inform pressures information for identified fishing and non-fishing activities.**

| Name of plan/project | AoO category | AoO activity |
|---|---|---|
| Submarine cables | Cables | Power cable: laying burial and protection |
| | | Power cable: operation and maintenance |
| | | Telecommunication cable: operation and maintenance |
| Offshore windfarm construction | Renewable energy | Offshore wind: during construction |
| Offshore windfarm operation and maintenance | Renewable energy | Offshore wind: operation and maintenance |
| Pipelines | Oil, gas and carbon capture storage | Pipelines |

A list of pressures has been collated from the AoO and/or PAD for the above activities. It is only those pressures that are relevant to both the fishing activities (traps and anchored nets/lines) and the project or plans, that have been discussed below . Pressures from plans or projects that are not associated with the fishing activities are not within the scope of this assessment.

All pressure-feature interactions from fishing other than those identified as “Not Relevant” (the evidence base suggests that there is no interaction of concern between the pressure and the feature OR the activity and the feature could not interact) have been considered.

From these considerations, Table 28 details the pressures exerted by military firing activity; power cables: laying, burial and protection and operation and maintenance; telecommunication cables: operation and maintenance; offshore wind: during construction and operation and maintenance; disposal sites; pipelines; traps and anchored net/line fishing activities. Pressures highlighted green have been screened out as not requiring further consideration in this assessment as they are not exerted by the trap or anchored net/line fishing activities occurring within Dogger Bank SAC. Table 28 also indicates pressures which are exerted by each activity (Y – pressure exerted, N – pressure not exerted).

**Table 28: Pressures exerted by traps and anchored net/line fishing and non-fishing activities occurring in Dogger Bank SAC. Non fishing pressures similarly exerted by traps and anchored nets/lines require further assessment and are highlighted in red.**

| Pressure | Exerted by Telecommunication cable: operation & maintenance | Exerted by Power cable: operation & maintenance | Exerted by Power cable: laying, burial and protection | Exerted by Offshore wind: during construction | Exerted by Offshore wind: Operation & maintenance | Exerted by Sea surface military activity | Exerted by Dredge and soil disposal | Exerted by Pipelines | Exerted by traps and anchored nets/lines |
|---|---|---|---|---|---|---|---|---|---|
| Abrasion/disturbance of the substrate on the surface of the seabed | Y | Y | Y | Y | Y | Y | Y | Y | Y |
| Changes in suspended solids (water clarity) | Y | Y | Y | Y | Y | Y | Y | N | N |
| Deoxygenation | N | Y | Y | N | N | Y | Y | Y | Y |
| Electromagnetic changes | N | Y | N | N | N | N | N | N | N |
| Habitat structure changes - removal of substratum (extraction) | N | N | Y | Y | Y | Y | N | Y | N |
| Hydrocarbon & PAH contamination. Includes those priority substances listed in Annex II of Directive 2008/105/EC. | Y | Y | Y | Y | Y | Y | Y | Y | Y |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Introduction of other substances (solid, liquid or gas) | N | N | N | Y | Y | Y | Y | Y | N |
| Introduction or spread of invasive non-indigenous species (INIS) | Y | Y | Y | Y | Y | Y | Y | Y | Y |
| Litter | Y | Y | Y | Y | Y | Y | N | Y | Y |
| Nutrient enrichment | N | Y | Y | N | N | Y | Y | Y | N |
| Organic enrichment | N | N | N | N | N | N | N | N | Y |
| Penetration and/or disturbance of the substrate below the surface of the seabed, including abrasion | Y | Y | Y | Y | Y | Y | N | Y | Y |
| Physical change (to another seabed type) | Y | Y | Y | Y | Y | N | Y | Y | N |
| Physical change (to another sediment type) | N | N | N | N | N | N | Y | N | N |
| Radionuclide contamination | N | N | N | N | N | N | Y | N | N |
| Removal of non-target species | N | N | N | N | N | N | N | N | Y |
| Removal of target species | N | N | N | N | N | N | N | N | Y |
| Siltation rate changes (high), including smothering (depth | N | N | Y | Y | Y | N | Y | N | N |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| of vertical sediment overburden) | | | | | | | | | |
| Siltation rate changes (low), including smothering (depth of vertical sediment overburden) | Y | Y | Y | Y | Y | Y | Y | Y | N |
| Synthetic compound contamination (incl. pesticides, antifoulants, pharmaceuticals). Includes those priority substances listed in Annex II of Directive 2008/105/EC. | Y | Y | Y | Y | Y | Y | Y | Y | Y |
| Temperature changes - local | N | Y | N | N | N | N | N | N | N |
| Transition elements & organo-metal (e.g. TBT) contamination. Includes those priority substances listed in Annex II of Directive 2008/105/EC. | Y | Y | Y | Y | Y | Y | Y | Y | Y |
| Vibration | Y | Y | Y | Y | Y | N | N | Y | N |
| Water flow (tidal current) changes, including sediment | Y | Y | Y | Y | Y | N | N | Y | N |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| transport considerations | | | | | | | | | | |
| Wave exposure changes - local | N | N | N | N | N | Y | N | N | N | N |

### 5.2.1 Abrasion/disturbance of the substrate on the surface of the seabed AND Penetration and/or disturbance of the substrate below the surface of the seabed, including abrasion

Abrasion/disturbance of the substrate is relevant to all plans, projects and traps and anchored nets/line fishing activities; however, the Dogger Bank SAC sandbank feature is not considered sensitive to the pressure associated with sea surface military activity as it is derived from propellers and ship movements causing scour around berth pockets and channel margins which does not occur in the site.

Penetration and/or disturbance of the substrate below the surface of the seabed, including abrasion is relevant to all plans, projects and traps and anchored net/line fishing activities with the exception of dredge and soil disposal. As above, the Dogger Bank SAC sandbank feature is not considered sensitive to the pressure associated with sea surface military activity.

As discussed in section 4.2.1, traps and anchored nets/lines have minimal interaction with the seabed. Traps interact with the seabed where they lay and via the string joining the pots/traps, gillnets interact with the seabed where anchors have been used to secure the net. As gillnets and traps are not towed over the seabed, abrasion and penetration of substrate only occurs in the small distances when traps/nets/anchors drift or drag through currents and/or wave action. Gillnetting and potting activity levels over the five years studied was very low.

Throughout operation and maintenance, telecommunication and power cables may need to be reburied or uncovered for repair. Abrasion and physical disturbance will occur from this activity. Usually free-swimming burial machines are deployed to rebury exposed sections of cable (BERR, 2008). Disturbance may also occur through anchoring of vessels which may cause abrasion via deployment, subsequent dragging and locking in of the anchor, as well as scour of the anchor chain whilst in use and upon recovery. The anchors of large ships may penetrate the seabed up to depths of approximately 1 metre (Luger & Harkes, 2013). There are two disused BT telecommunications cables running through the site, connecting the UK to Denmark and Germany respectively. These cables are disused and will require no maintenance. There is an active Ta Ta North Europe telecommunications cable connecting England to the Netherlands. There are also 2 active Tampnet telecommunications cables connecting England to the Draupner oil platform. The frequency of maintenance to existing cables will be low. Additionally, this can be a marine licensable activity[26] dependent on the type of cable, whether cable protection is required and if emergency repair of a cable is required. If a marine licence is required licence conditions would be put in place to mitigate against any significant impacts to the features of the site. If no licence is required, developers may still be subject to assessment under Habitat Regulations if they have the potential to affect a Natura 2000 site (such as Dogger Bank SAC)[27]. Therefore, it is unlikely that operation and maintenance of existing

[26] https://www.gov.uk/government/publications/marine-licensing-exempted-activities/marine-licensing-exempted-activities#cables-pipelines-oil-and-gas-and-carbon-capture-storage

[27] https://www.thecrownestate.co.uk/media/1784/submarine-cables-and-offshore-renewable-energy-installations-proximity-study.pdf

submarine cables will have a significant in-combination impact with fishing and other activities via this pressure.

Pipelines are predicted to cause abrasion and penetration disturbance to a maximum of 100 m either side of the pipelines. Beyond this, disturbance may be caused through maintenance of the pipeline when anchors are used to secure vessels. There are multiple pipelines which intersect the site, with a total length of 457.7 km. These are mostly towards the southern boundary. As discussed above for submarine cables, given that these pipelines are already in place, there are no potential in-combination impacts through installation. Maintenance of pipelines can be a marine licensable activity, apart from during emergency repairs[26], and generally licence conditions would be put in place to mitigate against any significant impacts to the features of the site. Consequently, it is unlikely that pipelines will have a significant in-combination impact with fishing and other activities via this pressure.

The laying, burial and protection of power cables will also lead to seabed abrasion and sub-surface penetration. Ploughing, trenching, rock placement and anchor placement will result in these pressures. The footprint of the seabed disturbed by cable installation machinery could be 5-10 m wide per cable trench for ploughing and trenching (Aecome Intertek, 2011; Nemo Link, 2013). Cables laid at the surface may cause abrasion where there is high wave activity, evidence suggests in shallow waters less than 20 m, marks from cables ranged from 6-45 cm in width (Carter et al., 2009). Alternatively, cables may instead be buried at depths of 1 to 2 metres (Aecom Intertek, 2011; Nemo Link, 2013). As described above, anchors of vessels associated with cable installation will also cause disturbance. Existing cables within the site were granted licences between 2002 and 2015. Given that these cables are already in place, there are no potential in-combination impacts through laying, burial and protection via this pressure.

Four offshore windfarm sites have been consented inside Dogger Bank SAC. These are Dogger Bank A, Dogger Bank B, Dogger Bank C and Sofia. Both turbine arrays and the associated cables are located within Dogger Bank SAC. Two disposal sites have been licensed in Dogger Bank SAC for use during construction of the windfarms and there is the potential for laying of further cables to service the windfarms.

Abrasion and penetration, from installation of cables via the pathways described above, is likely to have an in-combination effect with fishing activities. Furthermore, construction of windfarms, installation of turbine foundations and associated infrastructure will lead to penetration and abrasion via placement of infrastructure, scour protection and use of jack up barges or other installation vessels (Polet & Depestle, 2010). Turbine foundations penetrate into the seabed with typical pile diameters being between 4 and 5 m in the OSPAR area (OSPAR, 2008a). Anchoring of vessels used in windfarm installation may also cause abrasion and penetration as described above in relation to cable maintenance. Similar impacts will occur throughout operation and maintenance of the windfarm via the use of jack up legs or anchors for associated vessels (DECC, 2011; ABPmer, 2011). It is estimated that an 11.5 tonne anchor penetrates up to 0.88 m in soft sediment when dropped and dragged for 87 m (Luger and Harkes, 2013).

Construction of these windfarms is estimated to start from 2022 and the two consented disposal sites will be used to dispose of spoil generated from installation of foundations and seabed preparation (Forewind, 2014b). This is estimated to be the top 0.75 cm of the sediment (Forewind, 2014b). The deposition of spoil may cause disturbance via abrasion and will be most severe when coarser sediment is disposed of on finer substrates. The material proposed to be disposed of in construction of the windfarms will be identical to the existing seabed material and so impacts are likely to be minimal (Forewind, 2014b).

Leased areas for these windfarms are located over the subtidal sand bank feature of the SAC where fishing activities occur. However, the pressures associated with the construction, operation and maintenance of the windfarm, taking into account the impacts of fishing on the site has previously been assessed and, subject to agreed deemed marine licence (DML) conditions and implementation of mitigation, the pressures were not considered to result in an adverse effect on the integrity of the site in view of its conservation objectives. Equally, the construction, operation and maintenance of proposed windfarms were not deemed to impact upon the trajectory of habitat recovery (subject to licence conditions and mitigation being implemented), regardless of any future management measures that may be adopted[28].

**The MMO conclude that abrasion/disturbance and penetration pressures associated with traps and anchored nets/lines, in combination with the plans/projects/activities occurring in the site are compatible with the conservation objectives of the site and will not result in an adverse effect on site integrity.**

### 5.2.2 Deoxygenation

This pressure is relevant to traps and anchored net/line fishing activities, pipelines, power cable: laying, burial, protection and operation and maintenance, sea surface military activity and disposal sites.

The main pathway of deoxygenation from fishing is through discards and the release of deoxygenated ballast water. Dogger Bank SAC is exposed to substantial wave energy and the majority of fishing vessels active in the site are under 45 metres in length and therefore have solid ballast[29]. As a result, the accumulation of discards and associated hypoxia or any deoxygenation resulting from fishing vessel ballast water is unlikely.

For other plans and projects, the main source of deoxygenation is associated with sediment mobilisation and increase of suspended sediments.

Modern equipment and techniques reduce the re-suspension of sediment during cable burial, repair and removal, however, increases in suspended sediment may occur (OSPAR, 2012). The magnitude of this depends on the silt fraction, the equipment used and background levels (OSPAR, 2012). With regards to impacts caused during maintenance of cables, the frequency

[28] https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010051/EN010051-002090-Habitats%20Regulations%20Assessment.pdf
[29] www.gov.uk/government/uploads/system/uploads/attachment_data/file/441098/MGN_501_Combined.pdf

of this activity will be low. Furthermore, this can be a licensable activity (depending on the type of cable, whether cable protection is required and/or whether emergency repair is required). If a licence is required, licence conditions would be put in place to mitigate against any significant impacts to the features of the site. If no licence is required, developers may still be subject to assessment under Habitat Regulations if they have the potential to affect the site[27]. Therefore, it is unlikely that operation and maintenance of existing submarine cables will have a considerable in-combination impact with fishing and other activities via these pressures.

The construction of the Dogger Bank offshore windfarms may contribute to this pressure. The use of dredging to prepare the seabed for windfarm foundations may cause localised and temporary increases in suspended solids within the water column (Forewind, 2013; ABPmer, 2011). This will only occur in the initial construction phase and therefore this activity will not have continued in-combination impacts with fishing activities. During operation of windfarms, scour will occur around the base of the foundations due to hydrological changes, leading to the liberation of sediment and formation of sediment plumes. Once the foundations have been scoured to their equilibrium depth, there will be an absence of sediment for further scouring (Forewind, 2013). Therefore, impacts from this activity are likely to be short-lived. The Habitats Regulation Assessment carried out for Dogger Bank Teesside A & B offshore windfarms, found that the effects during construction would be temporary, short-term and negligible in magnitude (DECC, 2015). It was concluded that the worst-case impact would mean the site would remain within its current natural environmental range (DECC, 2015). The dragging of anchors used in maintenance and repair activities for windfarms may cause increased suspended sediment (The Green Blue, 2009). This impact is likely to be localised and temporary and maintenance activities will be infrequent (The Green Blue, 2009). Therefore, it is unlikely that construction, operation and maintenance of wind farms will have a considerable long-term impact via these pressures.

The disposal sites associated with the Dogger Bank windfarms may change the redox conditions in the former surface layer considerably and anoxic conditions (oxygen deficiency and sulphide production) may develop shortly after disposal (OSPAR, 2008b). The release of organic rich sediments during disposal can result in the localised removal of oxygen from the surrounding water, substances which consume oxygen, nutrients and harmful materials, bonded to the sediments, can be released into the water relatively easily and thus reduce its oxygen content or cause an increase in the concentration of nutrients or harmful materials (OSPAR, 2009b) OSPAR, 2008b). Following the initial placement of dredged material at a disposal site, there is the potential for some localised reduction in dissolved oxygen concentrations in the water column. However, given the dynamic nature of Dogger Bank SAC, the water column is likely to be rapidly re-oxygenated, making any changes localised and very short-lived (OSPAR, 2008b).

There are multiple pipelines within Dogger Bank SAC, with the majority being located towards the southern boundary. Seabed currents and the type of sediment will affect the accumulation and scouring of sediment around pipelines. As described for foundations of windfarms, once pipelines have been scoured to their equilibrium depth, there will be an absence of sediment for further scouring therefore limiting resuspension and ultimately deoxygenation.

The surface military activities are not thought to result in the disturbance of the sediment at Dogger Bank SAC and therefore the main pathway for deoxygenation is not present.

While a number of plans and project contribute to this pressure in combination with anchored nets/lines the impacts are likely to be minimal, short-lived and temporary in nature. **As such the MMO consider that the combined pressure from traps and anchored nets/lines and other plans/projects are compatible with the conservation objectives of the site and will not result in an adverse effect on site integrity**.

#### 5.2.3 Hydrocarbon & PAH contamination

This section is also relevant to transition elements & organo-metal (e.g. TBT) contamination. The primary route of chemicals of concern is via vessel oil and fuel and therefore covered by hydrocarbon and PAH contamination. Synthetic compound contamination is not considered further as these compounds are likely to originate from terrestrial sources.

These pressures are relevant to all plans, projects and traps and anchored net/line fishing activities however the Dogger Bank SAC sandbank feature is only considered sensitive to the pressure associated with pipelines, sea surface military activity, disposal sites and fishing activities.

Polycyclic aromatic hydrocarbons (PAH) in vessel oil and fuel are of environmental concern when released into the water. Fishing vessels of all gear types may contribute to this pressure in-combination with military vessels. However, deliberate releases of oil or oil/water mixture from ships are prohibited within the North West European Waters Special Area, established by the International Maritime Organisation (IMO) under MARPOL Annex I in 1999[30]. This area includes all waters around the UK and its approaches. While Navy vessels are exempt from MARPOL, they are expected to act in a manner consistent with MARPOL in so far as is reasonable and practicable[31]. Accidental discharges may occur, however significant releases are extremely rare. Releases of significant amounts of oil are typically from large shipping vessels and tankers. Sea surface military vessels are therefore unlikely to contribute considerably to the minor, existing impact from fishing vessels via this pressure.

Hydrocarbon and PAH contamination may occur through antifouling compounds like copper wash and TBT from ship coatings. However, fishing and MOD vessels comply with IMO standards for hull coatings and so are unlikely to contribute via this pathway.

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[30] https://www.imo.org/en/OurWork/Environment/SpecialAreasUnderMARPOL/Pages/Default.aspx
[31] www.mar.ist.utl.pt/mventura/Projecto-Navios-I/IMO-Conventions%20%28copies%29/MARPOL.pdf

Pipelines may be a source of hydrocarbon and PAH contamination. Additionally, cuttings from drilling operations and old cutting piles may contain organic-phase drilling fluids which may be disturbed during decommissioning of the pipelines (BEIS, 2019). Results from surveys undertaken across the SAC indicate that there is very little contamination from either heavy or trace metals or hydrocarbons, with the majority of samples reporting levels similar to background levels (BEIS, 2019). Therefore, pipelines are unlikely to contribute to the existing impact from fishing vessels via this pressure.

The disposal sites to be utilised for the construction of the Dogger Bank offshore windfarms may contribute to this pressure. However, environmental monitoring for offshore windfarm construction has shown that the seabed material due to be dredged and disposed of is not heavily contaminated and so contamination from this activity is unlikely (Forewind, 2014b).

**The MMO conclude that these pressures associated with traps and anchored nets/lines, in combination with the plans/projects/activities occurring in the site are compatible with the conservation objectives of the site and will not result in an adverse effect on site integrity.**

### 5.2.4 Introduction or spread of invasive non-indigenous species (INIS)

This pressure is relevant to all plans, projects and trap and anchored net/line fishing activities.

Aquatic organisms may be transferred to new locations through biofouling which takes place on all craft, even if recently cleaned or anti-fouled (IMO, 2012). Ballast water of vessels may also be a vector for transferral (OSPAR, 2009a). Military vessels, and vessels associated with installation, operation or maintenance of submarine cables, offshore windfarms and pipelines may therefore transport organisms.

With regards to submarine cables, offshore wind farms and pipelines, the artificial structures themselves may encourage the spread of INIS. It has been demonstrated that new artificial substrata offer opportunities for INIS to enter an area, or if already present, allows them to expand their population size and hence strengthen their strategic position (Kerckhof et al., 2011). This is particularly important for the obligate intertidal hard substrata species, for which offshore habitat is rare to non-existent (Kerckhof et al., 2011). Despite this, the Environmental Statement prepared for Dogger Bank Teesside A and B found that no INIS were identified as present in the area during the site-specific surveys (Forewind, 2014a). Furthermore, this report refers to the post construction monitoring report for the Barrow offshore wind farm which demonstrated no evidence of INIS on or around the monopiles (Forewind, 2014a).

For fishing vessels, ballast water is the principal vector for invasive non-indigenous species. VMS data shows that the majority of fishing vessels visiting the site are smaller than 45 m in length which means they use solid ballast. Additionally, for vessels using ballast water, the International Convention for the Control and Management of Ships' Ballast Water and

Sediments[32] requires them to manage ballast water and sediments to a certain standard to prevent the spread of organisms. This means that the contribution of fishing activities to this pressure is minimal. Therefore, in-combination effects with other activities are unlikely to mean that fishing will have a significant impact via this pressure.

Disposal sites for windfarm construction will not introduce INIS as spoil will be sourced from within the site.

**The MMO conclude that this pressure associated with traps and anchored nets/lines, in combination with the plans/projects/activities occurring in the site are compatible with the conservation objectives of the site and will not result in an adverse effect on site integrity.**

#### 5.2.5 Litter

This pressure is relevant to trap and anchored net/line fishing activities and all plans/ projects with the exception of disposal sites.

For installation, operation and maintenance of submarine cables, offshore wind farms, military activities and pipelines, this pressure is relevant to the vessels associated with the activity. Vessels may release litter accidentally, due to inappropriate storage, or deliberately (Potts & Hasting, 2011; Lozano & Mouat, 2009). Litter may include pallets, strapping bands and drums or materials related to the construction of infrastructure. Similarly, military vessels may also contribute to marine litter via accidental or deliberate releases.

Litter released by fishing vessels may include galley waste, fish boxes, floats/buoys, nets, ropes, weights and microplastic particles resulting from disintegration of plastic gear (Lozano & Mouat, 2009). These may cause damage to benthic habitats through abrasion or ghost fishing.

All vessels, bar those attaining to the Navy, adhere to MARPOL requirements which prohibit the discharge of plastics. While exempt, Navy vessels are expected to act in a manner consistent with MARPOL so far as is reasonable and practicable[31] and therefore releases of litter is likely to be minimal from all vessels.

The exposure of this site means that any marine litter that does occur, is unlikely to persist in the same location long enough to cause damage to the sand bank feature, for example via abrasion. Therefore, it is unlikely that this pressure will be significant when considered in combination with non-fishing activities.

**The MMO conclude that this pressure associated with traps and anchored nets/lines, in combination with the plans/projects/activities occurring in the site are compatible with**

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[32] https://www.imo.org/en/About/Conventions/ListOfConventions/Pages/International-Convention-for-the-Control-and-Management-of-Ships'-Ballast-Water-and-Sediments-(BWM).aspx

**the conservation objectives of the site and will not result in an adverse effect on site integrity.**

### 5.3 Part C conclusion (fishing in combination with relevant activities)

MMO concludes, taking into account the introduction of management measures for demersal trawls, seines and dredges outlined in section 6, that fishing activities in-combination with other relevant activities will not adversely affect the site integrity of Dogger Bank SAC nor achievement of its conservation objectives.

## 6. Assessment result

### 6.1 Fishing alone

The MMO consider that bottom towed gear (demersal trawls, including semi-pelagic, demersal seines and dredging) activities alone may result in an adverse effect on site integrity of Dogger Bank SAC.

The MMO consider that traps and anchored nets/lines, will not result in an adverse effect on site integrity of Dogger Bank SAC.

### 6.2 In-combination

As with the assessment of fishing alone, this section assumes that management for bottom towed gear will be introduced. When the pressures from traps and anchored nets/lines were combined and considered alongside pressures from the potential non-fishing activities taking place, none were identified which likely result in a significant negative impact on the designated features. Therefore, the MMO concludes that traps and anchored nets/lines assessed, in-combination with other known activities, are compatible with the conservation objectives of the site and will not result in an adverse effect on site integrity of Dogger Bank SAC.

## 7. Management options

**Option 1:** No fisheries restrictions. Introduce a monitoring and control plan within the site.

**Option 2:** Reduce/limit pressures (zoned management). Due to the potential impacts of demersal and semi-pelagic trawls, demersal seines and dredges on the features of the site, management will be introduced to reduce the risk of the conservation objectives not being achieved. This may be through a zoned management approach prohibiting bottom towed gears over a proportion of the sandbank habitat.

**Option 3:** Remove/avoid pressures (whole site prohibition). Demersal and semi-pelagic trawls, demersal seines and dredges will be prohibited in all areas of the site with appropriate buffering.

Management option 1 is not sufficient to protect Dogger Bank SAC due to likely adverse effects to site integrity from fishing with bottom towed gear.

Option 2 is also not sufficient. This option would prohibit bottom towed gears from a proportion of the site but would maintain areas 'open' to bottom towed fishing. There is currently not sufficient evidence to allow identification of areas where ongoing bottom towed fishing can continue at either an unlimited or limited level of intensity without undermining the site's conservation objectives. This option may also increase levels of bottom towed fishing activity in open areas due to displacement from 'closed' areas. This would increase impacts from bottom towed fishing in the open areas increasing the risk of undermining the conservation objectives of the Dogger Bank SAC.

Option 3, prohibition of the use of bottom towed gear across the whole site, is therefore the only way to ensure that there is no adverse effect on site integrity from fishing activities. This option would remove the impact of bottom towed fishing from all areas of the site. This will help to achieve the conservation objectives of the site and give the best possible chance of restoring the qualifying sandbank habitat to favourable condition.

An MMO byelaw will therefore be proposed to prohibit bottom towed fishing across the whole site (Figure 17). The boundaries of the proposed management area include an appropriate buffer zone of 150 – 300 m. This is to prevent direct damaging physical interactions between a fishing activity and the designated features.

### Marine Plans

Dogger Bank SAC lies within the East Marine Plan Area. The East Marine Plan[33] was adopted in 2014. Management decisions will be compliant and made in accordance with relevant policies. Consideration of policies will be detailed in the regulatory triage assessment which will accompany the proposed management.

[33] https://www.gov.uk/government/collections/east-marine-plans

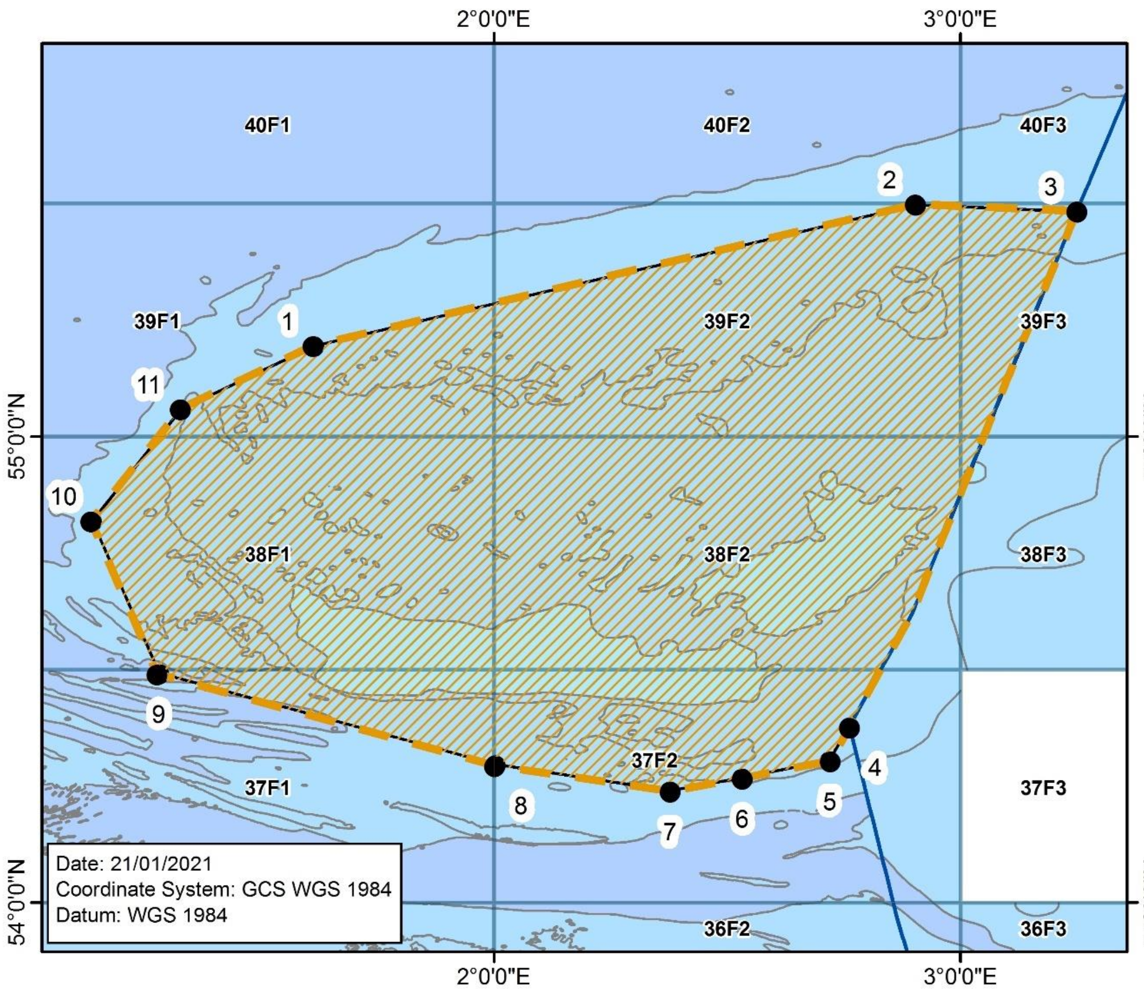
**Figure 17: A map of the proposed management area for Dogger Bank SAC**

Marine Management Organisation

# Dogger Bank Special Area of Conservation

(Specified Area)

Bottom Towed Fishing Gear Byelaw 2021




Bathymetry Contours (UKHO)

UK EEZ

ICES Statistical Rectangles

Dogger Bank SAC

Specified area (bottom towed fishing prohibited)

Depth Areas (UKHO)

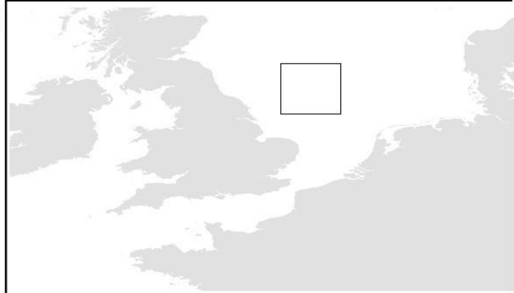
<=25m

<=50m

<=100m

Specified area boundary coordinates

| Point | Latitude | Longitude |
|---|---|---|
| 1 | 55° 11' 42.08" N | 1° 36' 44.33" E |
| 2 | 55° 29' 54.67" N | 2° 54' 13.37" E |
| 3 | 55° 29' 1.35" N | 3° 15' 1.21" E |
| 4 | 54° 22' 34.78" N | 2° 45' 45.53" E |
| 5 | 54° 18' 14.87" N | 2° 43' 14.79" E |
| 6 | 54° 16' 0.07" N | 2° 31' 55.66" E |
| 7 | 54° 14' 20.45" N | 2° 22' 39.16" E |
| 8 | 54° 17' 38.18" N | 2° 0' 5.77" E |
| 9 | 54° 29' 26.25" N | 1° 16' 38.33" E |
| 10 | 54° 49' 7.89" N | 1° 8' 7.69" E |
| 11 | 55° 3' 33.3" N | 1° 19' 37.24" E |



Not to be used for navigation.

## 8. Review of this assessment

MMO will review this assessment every five years or earlier if significant new information is received.

Such information could include:

- updated conservation advice;
- updated advice on the condition of the feature;
- considerable change in activity levels.

To coordinate the collection and analysis of information regarding activity levels, and to ensure that any required management is implemented in a timely manner, a monitoring and control plan will be implemented for this site. This plan will be developed in line with the MMO Monitoring and Control Plan framework.

Monitoring of activity levels will occur through a combination of surface surveillance and ongoing monitoring of VMS and landings data. Should activity levels increase considerably or in a manner that could affect the site features, this will trigger further investigation into the level and distribution of the activity, including consultation with JNCC regarding current site condition. Any subsequent evidence gathered will be used to assess the need for further management measures.

Monitoring will be recorded through annual MPA reporting. Dogger Bank SAC is categorised as Tier 2 which means an individual report is produced by the MMO's Marine Conservation Team for this site annually between June and August. The report includes VMS data for fishing activity over the reporting period and a 5-year period as well as information on inspected/observed activities, intelligence and non-compliant activity (if applicable). Coastal questionnaires are completed by local MMO officers regarding any changes in activity within the site. This will act as an early warning system for potential negative impacts on the site. If the report determines that a change in fishing activity is a risk to the conservation objectives of the site, an assessment of the site will be triggered regardless of whether a review is due. An increase in activity above that identified in this assessment, will initiate discussion with JNCC following the annual MPA report.

Possible management measures include an MMO emergency byelaw, which can be implemented immediately for up to 12 months, or a (non-emergency) MMO byelaw which would be subject to public consultation before implementation.

An overview of the monitoring and control process is illustrated in Annex 3.

## 9. Conclusion

MMO have had regard to best available evidence and through consultation with relevant advisors and the public, conclude that, provided that appropriate management measures for the fishing activities identified above are implemented, all remaining fishing activities are compatible with the conservation objectives of this marine protected area.

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# Annex 1 - MMO methodology

**The need for assessment**

In 2012, the Department for Environment, Food and Rural Affairs (Defra) announced a revised approach to the management of commercial fisheries in European marine sites (EMS)[34]. The objective of this revised approach is to ensure that all existing and potential commercial fishing activities are managed in accordance with the provisions of Article 6 of the Habitats Directive[35]. The revised approach was extended to include management of commercial fisheries in marine conservation zones (MCZ) in 2014[36].

This approach was being implemented using an evidence based, risk-prioritised, and phased basis. Risk prioritisation is informed by using a matrix of the generic sensitivity of the sub-features of EMS to a suite of fishing activities. These activity/sub-feature interactions have been categorised according to specific definitions, as red, amber, green or blue[37].

Activity/sub-feature interactions identified within the matrix as amber required a site-level assessment to determine whether management of activity is required to conserve site features. Activity/sub-feature interactions identified within the matrix as green also require a site level assessment if there are "in-combination effects" with other plans or projects.

Site-level assessments are carried out in a manner consistent with the requirements of Article 6(3) of the Habitats Directive for EMS and the requirements of section 126 of the Marine and Coastal Access Act 2009 for MCZ. For EMS the assessments will determine whether, in light of the sites conservation objectives, fishing activities are having an adverse effect on the integrity of the site. For MCZ the assessments will determine whether there is a significant risk of fishing activities hindering the conservation objectives of the site.

**Assessment process**

The fisheries assessments have three stages:

Part A: A coarse assessment using generic sensitivity information to identify which fishing activities can be discounted from further assessment (Part B) as they are not taking place or not a significant concern.

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[34] www.gov.uk/government/publications/revised-approach-to-the-management-of-commercial-fisheries-in-european-marine-sites-overarching-policy-and-delivery
[35] Council Directive 92/43/EEC on the Conservation of natural habitats and of wild fauna and flora
[36] The MMO responsibilities in relation to management of MCZs are laid out in Sections 125 to 133 of the Marine and Coastal Access Act 2009
[37] Managing Fisheries in MPAs matrix: www.gov.uk/government/publications/fisheries-in-european-marine-sites-matrix

Part B: An in-depth analysis to assess the effects of remaining pressures on the features of the site

Part C: An in-combination assessment between all fishing and non-fishing activities occurring.

**Sources of evidence**

Evidence used in the assessments falls into two broad categories:

1. Fishing activity information. This includes patterns, intensity, and trends of fishing activities and types of gear used.
2. Ecological information, in particular the location, condition and sensitivity of designated features.

**Fishing activity information**

**VMS data**

VMS data are derived from positional information reported by UK and non-UK vessels carrying vessel monitoring system (VMS). Since 2015 all commercial fishing vessels of 12 metres and over in length have been required to report their position, course and speed at regular intervals using VMS. Prior to 2015 this requirement applied to commercial fishing vessels of 15 metres and over.

VMS data were analysed in ArcGIS. VMS reports not associated with fishing activity were removed. These included reports with speeds greater than 6 knots (indicating non-fishing) and reports from vessels known to be performing guard ship duties for marine developments.

For UK vessels gear type and landings were assigned to VMS data by matching each report to gear types recorded in relevant landings declarations, logbooks and the Community Fishing Fleet Register.

For EU member state (non-UK) vessels only gear types are assigned to the VMS data as individual vessel landings are not available.

**Landings data**

Landings data are recorded at International Council for the Exploration of the Sea (ICES) statistical rectangle[38] level through landings declarations and logbooks.

In areas where a high proportion of landings came from vessels with VMS, landings data from vessels with VMS were linked to VMS-derived location reports to provide spatial estimates of where landings were derived from within an ICES rectangle (see VMS data above).

For vessels that do not require VMS (<12 m in length) or non-UK vessels where landings are not assigned to VMS reports (see VMS data above), landings from within specified areas (e.g. MPA's or area of feature) are estimated using the proportion of VMS reports (for VMS vessels) or the relative size of the MPA/Feature area compared to the sea area of the containing ICES rectangle(s).

Non-UK landings data was obtained from the Fisheries Dependent Information (FDI) database from the Scientific, Technical and Economic Committee for Fisheries (STECF). STECF landings data were assigned separate nationalities in 2014, allowing estimates of non-UK landings. However, for the years 2015 to 2018, STECF data were not assigned to nationalities and was given for all nations (UK and non-UK). Therefore, to obtain non-UK landings for 2015 to 2018, UK landings were subtracted from the landings for all nations.

Landings data are analysed to determine quantities of landings by gear group and vessel size group.

**Vessel Sightings data**

Sighting information is recorded into the Monitoring Control and Surveillance System (MCSS). It is collected by various bodies such as MMO coastal staff, IFCAs, Navy patrols and other relevant agencies and contains the following:

1. Date and time of sighting
2. Reporting body
3. Vessel name, ID, gear type
4. Approximate location of vessel
5. Approximate speed of vessel
6. Whether the vessel is: Laid/tied up, steaming or fishing.

**MMO expert opinion on fishing activity**

MMO marine officers provided information on fishing activity within MPAs. Information included number and size of vessels fishing, target species, type and amount of fishing gear used and

[38] ICES statistical rectangles are part of a widely used grid system for North Eastern Atlantic waters. For more information see: www.ices.dk/marine-data/maps/Pages/ICES-statistical-rectangles.aspx

seasonal trends in activity. Confidence levels were provided alongside expert opinion and estimates were provided where exact numbers were not known.

**Fishing Industry Information**

Where possible and achievable, information from the fishing industry regarding current fishing locations, intensity and gear types has been used to build the evidence base for the assessment.

**Ecological information**

The fisheries assessments use the conservation advice packages produced by Natural England and the Joint Nature Conservation Council (https://jncc.gov.uk/our-work/marine-activities-and-pressures-evidence/#jncc-pressures-activities-database). These provide information on the features of the site, their area and conditions. The packages also contain advice on operations and supplementary advice documents which allow the assessment of which pressure/gear combinations a feature may be sensitive too.

For some assessments, further ecological information has also been provided by Natural England. This information is available in the relevant assessments.

**Sensitivity and vulnerability**

The following definitions of sensitivity and vulnerability are used in MMO assessments. Sensitivity is defined as:

***a measure of tolerance (or intolerance) to changes in environmental conditions.***[39]
Vulnerability is defined as: ***a combination of the sensitivity of a feature to a particular pressure/activity, and its exposure to that pressure***

[39] Tilin *et al* 2010, Roberts *et al* 2010

# Annex 2 - Assumptions used to calculate spatial footprint (Pr-values)

## 1. Pr-value background

### 1.1. Introduction

The MMO are required to assess the impacts of all fisheries on designated features and habitats within marine protected areas (MPAs) in English waters.

The application of a "footprint" approach has been promoted by previous authors (such as Jennings *et al.*, 2012[40]) as a method to quantify fishing pressure within an area of interest (AOI) such as a 'fishing impact equation' where:

$$Fishing\ footprint\ (Pr) = \frac{Fishing\ effort\ within\ AOI * Area\ fished\ by\ indiviual\ vessel\ in\ 1\ day}{Total\ area\ of\ MPA/feature}$$

Generating a "fishing footprint value" (Pr) aims to define the level of pressure for a single average day of effort for a reference vessel or fisher (land-based) within a fleet, taking into account the gear used. This value could be multiplied by the number of vessels or fishers to give the total pressure for a particular gear over a specific time period e.g. a calendar year.

This aims to inform assessments concerning the level of impact that is acceptable for maintaining integrity of the site or feature. This approach can also be used to help define the spatial extent of the fisheries activities (in relation to feature size) or simply identify where interactions exist with features (which may in itself signify adverse effect and warrant management measures). The equation can also be used to model "worst case" scenarios to help define upper limits of potential impact, which can be refined to more realistic levels with local expert judgement.

However the factors involved in calculating the area of interaction and level of impact can be complex depending on the range of vessels, fishing effort and gear types used in the area, temporal or spatial patterns of activity within the fishery, the frequency of impacts and resilience of the habitats concerned, and any cumulative impacts of different types of gear. The incorporation of these factors will need to be considered when calculating the equation, along with the availability and robustness of data to provide such information for current and future assessments.

In order to calculate the fishing pressure effectively for each gear, a clear understanding of the three parameters that define the fishing pressure must be obtained.

#### *1.1.1. Fishing effort*

In order to calculate fishing effort there are two specific variables that must be defined for each gear type:

- **Effort** (the number of effort units for a particular gear type) and

[40] Jennings, S., Lee, J., Hiddink, J.G., 2012. Assessing fishery footprints and the trade-offs between landings value, habitat sensitivity, and fishing impacts to inform marine spatial planning and an ecosystem approach. ICES J. Mar. Sci. 69, 1053–1063. doi:10.1093/icesjms/fss050

- **Area of interaction** (the area of contact from a unit of gear)

A source of effort data is vessel monitoring system (VMS) data as this represents high quality independent data that can be linked to logbook data for UK vessels to verify and merge catch and effort datasets. Area of interaction is defined as the actual impact of the individual gear type based on the proportion of gear in contact with the bottom and this information can be sourced from scientific literature and/or interviews (see section 3.1 for further details).

*1.1.2. Area of interest*

The area of interest (AOI) could be defined as the MPA itself or designated features within a specific MPA. Data sources on the distribution and extent of designated features could be obtained from statutory nature conservation bodies (SNCBs) such as Natural England and the Joint Nature Conservation Committee (JNCC).

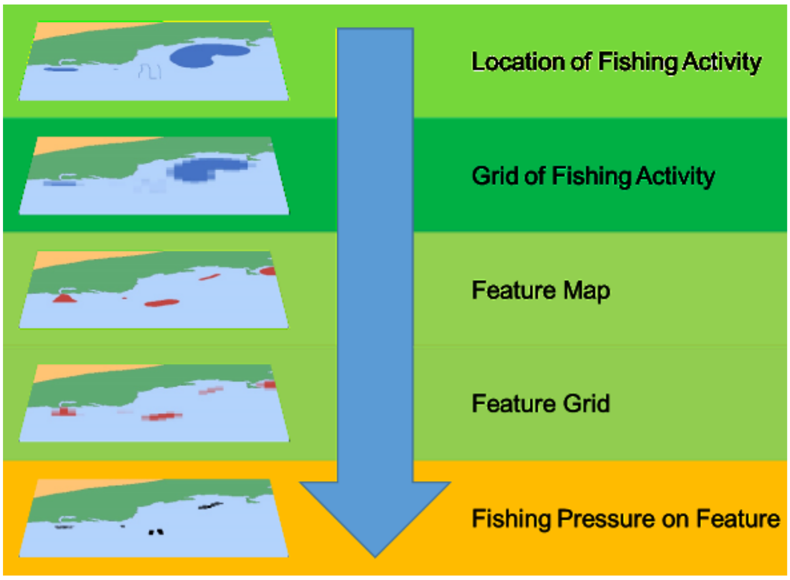
### 1.2. Developing the equation further

In order to determine the level of impact of fishing activity on designated features, the sensitivity of the feature should be incorporated into the proposed fisheries footprint calculation to help determine the extent to which the interaction is likely to cause an adverse effect. The sensitivity of the feature may be influenced by the time of recovery of a feature, the level of natural disturbance, cumulative impacts etc. This was identified through the fisheries European Marine Site (EMS) matrix and further scientific literature reviews.

Fishing effort also varies in terms of both the spatial and temporal distribution, potentially leading to clustering and non-uniform distribution of fishing effort across a single feature. Therefore gaining an understanding of intensity of fishing on a feature would be useful in identifying potential cumulative impacts.

To incorporate clumping or non-uniform distribution of fishing effort a geospatial system was developed (Figure 18).

**Figure 18: An example of input layers and stages for geospatial calculations**




Spatial and temporal data was obtained in the form of VMS data to map fishing activity (effort). Area of interaction with the seabed from different gears was calculated using scientific literature and interviews with informed individuals. Feature maps of designated features within MPAs were obtained from SNCBs. From this the following can be calculated for the different gear types:

- Single VMS report gear footprint ($m^2$): This calculates the gear fishing footprint equivalent to a single VMS report across a cell area (0.2025 $km^2$) over a 2hr time frame.
- Total VMS report area ($km^2$): This calculates the sum of unique cell areas (0.2025 $km^2$) where VMS reports occur.
- Total gear footprint ($km^2$): This is the total area impacted by fishing gear. This is calculated by multiplying the total number of VMS reports by cell area (0.2025 $km^2$) and the single VMS report gear footprint.
- Pr-value: Total extent of AOI impacted by gear (as a ratio). This is calculated by dividing total gear footprint by the AOI.
- Pr-value percentage (%): Percentage of AOI impacted by gear.

## 2. Analysis

### 2.1. Single VMS report gear footprint

The types of gear currently included in the gear calculators which calculates the single VMS report gear footprint are described in Table 29.

**Table 29: A description of gear and the gear code used.**

| IFISH Code | Gear | Brief Description |
|---|---|---|
| DRB | Boat dredges | Two types; one that is dragged along seabed, another that is like a benthic scoop that penetrates the sea bottom. Targets mussels, clams, scallops, crab etc. |
| DT | Unspecified demersal trawl | Where vessels were not assigned a gear code in the VMS data this has been assigned via investigation of the recent gear used by the vessel, where multiple demersal towed gears had been used recently it was assigned as unspecified demersalt trawl. |
| FPO | Pots | Cages/baskets made from various materials and come in various sizes. Mainly set on the bottom, sometimes designed for mid-water use. Pots target fish, crustaceans and cephalopods. |
| GN/GNS | Gillnets (not specified) /Set gillnets (anchored) | A gillnet is a wall of netting that hangs in the water column. Set gillnets are anchored in the seabed and held down by the heavy rope line. They can be either vertical (with a float line) or flat (without a float line). Targets coastal species. |
| HMD | Mechanized dredges | Hydraulic dredges dig and wash out mussels from the seabed. It is considered a harvesting machine when the same gear collects the mussels and hauls them on board. |
| OT | Unspecified otter trawl | Unspecified otter trawls could be mid water or bottom otter trawls, it was not specified. Following the precautionary principle we have assumed these are bottom otter trawls |
| OTB | Otter trawls - bottom | Dragged along bottom and has an extended top panel to stop fish escaping upwards. Targets bottom and demersal species. |
| OTT | Otter twin trawls | Two identical trawls fixed together to increase the fishing area. Two otter boards to hold mouths open, one at each far end. The connection between the two trawls is a rope which joins the connection between the two pulling. Usually targets shrimp. |
| SDN | Demersal seine – anchor seine | A net shot in the open sea using very long ropes to lay out the net and ropes on the seabed prior to hauling from a boat at anchor. |
| SSC | Demersal seine - Scottish/fly seine | Gear is shot on the seabed in a rounded triangle shape with very long weighted ropes attached to each end of the net. The net is gradually hauled in with the vessel maintaining station using its engine power rather than an anchor as in anchor seining. |
| TBB | Beam trawls | Mouth of trawl is permanently held open by a beam with guides/skids attached. This disturbs bottom fish which rise up and get caught. |
| TBN | Nephrops trawls | Adapted to be selective for Nephrops with mall holed mesh. Some have devices to allow the inevitable larger bycatch to escape. |

Each gear type has a gear calculator which calculates the gear fishing footprint for a cell area over a 2 hour time frame. A cell is 450m by 450m (20250 $m^2$) or 0.2025 $km^2$, 2 hours was chosen as it is the maximum time allowed between VMS reports. This is calculated as 0.083 or one twelfth of a day.

The calculation is as follows for trawls or dredge gears:

$$Single\ VMS\ report\ = \frac{\text{Total width of gear (m)} * \text{Total length hauled per day (m)}}{\text{Area of cell size } (20250m^2)} * \text{2hr period (0.083)}$$

The calculation is as follows for nets & lines, pots & traps, hand-gathering or single position gears:

$$Single\ VMS\ report\ = \frac{\text{Area of impact from one unit of gear } (m^2) * \text{No.of operations in one day}}{\text{Area of cell size } (20250m^2)} * \text{2hr period (0.083)}$$

This gives an estimate of the area (in $m^2$) impacted by gear from a single VMS report based on the different fishing gears (Table 30). However this does assume the same size gear and amount of operations/hauls occurs for each gear type regardless of other variables (e.g. boat length, engine power, bylaws in place etc). See section 3.1 for assumptions made about the gear calculations.

**Table 30: Estimate of different gears fishing footprint across a cell area for a two hour period.**

| Gear | Single VMS report gear fishing footprint over cell area ($m^2$) |
|---|---|
| TBB | 2.00 |
| OTT | 1.01 |
| DRB | 0.44 |
| OTB | 1.24 |
| OT | 0.45 |
| HMD | 0.06 |
| TBN | 0.20 |
| GNS | 0.01 |
| GN | 0.01 |
| FPO | 0.00 |
| DT | 0.89 |
| SDN | 0.00 |
| SSC | 0.01 |

### 2.2. Pr-value model

The Pr-value model requires several datasets as inputs including:

- Annual UK VMS data for >12m vessels
- Annual Non-UK VMS data >12m vessels
- Single VMS report gear footprint calculations
- MPA sites and designated feature data

Assumptions about the datasets are included in Section 3.
The pr-value model has the following steps:

1. The UK and non-UK VMS data is clipped to the area of interest (MPA site or designated feature within site)
2. VMS reports which are denoted as 'fishing' are chosen (vessels travelling between >0 and <6 knots)
3. VMS reports from the same vessels which are less than 2 hours apart (7080 seconds exactly, see Section 3.4 for explanation) are excluded
4. The processed VMS data (VMS reports= fishing & ≥ 2 hours) is joined to the gear calculations data
5. A grid is created across the area of interest, with cell sizes of 450m by 450m
6. The grid and processed VMS data are joined together.
7. Gear not included in the current gear calculators is excluded.
8. The cell area is calculated as 0.2025 $km^2$ for each cell.
9. Total gear footprint is calculated by multiplying single VMS report gear footprint by the cell area (0.2025 $km^2$). This is then multiplied by the number of VMS reports per gear type.
10. The VMS report area and total gear footprint is summed by gear type
11. A summary table is created which includes:

- AOI field ($km^2$)
- AOI name (text)
- Total VMS report area ($km^2$): Sum of unique cell areas (0.2025 $km^2$) where VMS reports occur.
- Total gear footprint ($km^2$): Total area impacted by fishing gear. $\text{Total no. of fishing VMS reports} * \text{cell area } (0.2025) * \text{single VMS report gear footprint}$
- Pr-value: Total extent of AOI impacted by gear. $\frac{Total\ gear\ footprint}{AOI}$
- Pr-value percentage (%): Percentage of AOI impacted by gear. $\frac{Total\ gear\ footprint}{AOI} * 100$

## 3. Pr-value Assumptions

### 3.1. Gear Calculators

A cell is 450 m by 450 m or 0.2025 $km^2$. Two hours was chosen as it is the maximum time allowed between VMS reports. These were chosen so that a beam trawler (the largest swept area) will have covered the whole cell in 2 hrs.
Current gear calculations are based on the following defaults:

**Boat dredges (DRB):**

- Based on one vessel with two tow bars each carrying eight dredges of 75 cm.Trawl wheels/skids not added as no data on size could be found. Data from: https://www.researchgate.net/publication/269629387_Review_of_habitat_dependent_impacts_of_mobile_and_static_fishing_gears_that_interact_with_the_sea_bed.
- No information on number of hauls and length found. Assumption made that a 12 hour shift is undertaken with 6 hauls. Haul speed assumed to be similar to other bottom towed gear.

**Pots (FPO):**

- Data taken from Annexes to: "Feasibility study on applying a spatial footprint approach to quantifying fishing pressure".

- Based on a pot 50 cm by 70 cm and hauling 1300 pots per day.

**Gillnets/ Set Gillnets (GN/GNS):**

- Based on a vessel shooting 102.5 tiers each 71 m. Each tier has 2 anchors at 2 x 0.5 m. Foot rope 3 m wide drag. Info derived from seafish report on a workshop on the physical effects of fishing activities on Dogger Bank and Annexes to: Feasibility study on applying a spatial footprint approach to quantifying fishing pressure.
- 5.5 nets hauled per day. Info derived from seafish report on a workshop on the physical effects of fishing activities on Dogger Bank and MMO coastal.

**Mechanised dredges (HMD):**

- Based on 1 cage with a total width of 74". Data from http://spo.nmfs.noaa.gov/mfr444/mfr4441.pdf
- Haul duration 10.12 hours. Data from http://www.seafish.org/media/Publications/SR348.pdf
- Haul speed 4 knots. Data from http://www.seafish.org/media/Publications/SR348.pdf

**Otter trawls/ Otter trawls – bottom (OT/OTB):**

- Based on a vessel with one 75 m trawl with two 1.2 m x 0.65 m otter boards and with 60 % ground rope interaction. Information derived from fishing industry advice during Dogger Bank SAC call for evidence (Oct 2020) and seafish report on a workshop on the physical effects of fishing activities on Dogger Bank.
- Haul duration 4 hours, from an MMO officer.
- Haul speed 3 knots, from an MMO officer.

**Otter twin trawls (OTT):**

- Based on a vessel with two 12 m trawls with two 1.2 m x 0.65 m otter boards and with 60 % ground rope interaction and 1 clump of 0.6 m. Information derived from seafish report on a workshop on the physical effects of fishing activities on Dogger Bank and Annexes to: Feasibility study on applying a spatial footprint approach to quantifying fishing pressure.
- Haul duration 4 hours, from an MMO officer.
- Haul speed 4 knots, from an MMO officer.

**Beam trawls (TBB):**

- Based on a vessel with two 12 m trawls, four 720 mm shoes and 2 tickler chains with 60% interaction with the seabed. Information derived from seafish report on a workshop on the physical effects of fishing activities on Dogger Bank and Annexes to: Feasibility study on applying a spatial footprint approach to quantifying fishing pressure.
- Haul duration 4 hours. Information derived from seafish report on a workshop on the physical effects of fishing activities on Dogger Bank and MMO coastal.
- Haul speed 6 knots. Information derived from fishing industry advice during Dogger Bank SAC call for evidence (Oct 2020).

**Nephrops trawls (TBN):**

- Based on a vessel with two 3.5 m beam trawls, 4 x 0.2 feet and 60% ground rope interaction. Information derived from Annexes to: Feasibility study on applying a spatial footprint approach to quantifying fishing pressure.

- Haul duration 2 hours. Information derived from Annexes to: Feasibility study on applying a spatial footprint approach to quantifying fishing pressure.
- Haul speed 1.5 knots. Information derived from Annexes to: Feasibility study on applying a spatial footprint approach to quantifying fishing pressure.

**Demersal trawls (DT):**

- Based on average:
  - number of beams/nets trawl
  - width of beam/net
  - number of shoes/boards
  - width of shoes/boards
  - hauls per day
  - haul duration
  - haul speed

- Information derived from TBN, TBB, OTT and OTB gears (above).

**Danish seines (SDN):**

- Based on a vessel shooting a 2.25 $km^2$ net. Information derived from marine institute estimates[41]
- 4 hauls per day, from an MMO officer

**Scottish seines (SDN):**

- Based on a vessel shooting a 2.854 $km^2$ net. Information derived from seafish[42]
- Scottish seines only takes place in daylight hours. 5 hauls per day are estimated to take place based on the average number of daylight hours (12) and the haul duration ~ 2.25 hours (median of 1.5 – 3 hrs[43])

### 3.2. VMS data assumptions

It has been assumed that:

- Non-UK VMS data is accurate although only presented to 3 decimal degrees for latitude and longitude.
- UK data is complete or null gear codes are processed and corrected.
- 'Fishing' VMS reports are vessels travelling between 0-6kts.
- VMS data is only available for > 12 m vessels.

### 3.3. MPA sites and designated features assumptions

It has been assumed that:

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[41] https://seafish.org/gear-database/wp-content/uploads/2015/06/Seine-Net-Fishing-Workshop_Report_May2008.pdf.
[42] https://seafish.org/gear-database/wp-content/uploads/2015/06/Seine-net-CR47.pdf
[43] https://seafish.org/gear-database/gear/scottish-seine/)

- The data used for the outline of the MPAs is accurate, although there may be very minor inaccuracies due to differences in projection.

### 3.4. Pr-value assumptions

It has been assumed that:

- The model does not have false fishing VMS reports such as vessels moving between 0-6kts but not fishing.
- VMS reports from the same vessels which are less than 2 hours apart (7080 seconds to allow for a grace period) are duplicated and therefore are removed.
- All gear is included in the gear calculators to be used in the model. Gear not included in the gear calculators are removed.

# Annex 3 - Monitoring and Control Process

**Figure 19: Monitoring and control process**