

Document Control

Title	Dogger Bank Special Area of Conservation (SAC) MMO Fisheries Assessment
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Owner	T Barnfield

Revision History

Date	Author(s)	Version	Status	Reason	Approver(s)
19/06/2020	T Barnfield; E Johnston	V.A0.1	Draft	Introduction and Part A	V Morgan
06/07/2020	T Barnfield; E Johnston	V.A0.2	Draft	Internal QA of Introduction and Part A	V Morgan
07/07/2020	T Barnfield; E Johnston	V.A0.3	Draft	JNCC QA of Introduction and Part A	A Doyle
14/07/2020	T Barnfield; E Johnston	V.A0.4	Draft	Introduction and Part A JNCC comments	V Morgan
26/07/2020	T Barnfield; E Johnston	V.BC0.1	Draft	Part B and C	N Greenwood
29/07/2020	T Barnfield; E Johnston	V.BC0.2	Draft	Internal QA of Part B and C	N Greenwood
30/07/2020	T Barnfield; E Johnston	V.BC0.3	Draft	JNCC QA of Introduction and Part A	A Doyle
05/08/2020	T Barnfield; E Johnston	V.BC0.4	Draft	Part B and C JNCC comments	N Greenwood
06/08/2020	T Barnfield; E Johnston	V.1.0	Draft	Whole document compilation	N Greenwood
07/08/2020	T Barnfield; E Johnston	V.1.1	Draft	Whole document Internal QA	N Greenwood
18/08/2020	T Barnfield; E Johnston	V.1.2	Draft	Whole document JNCC QA	A Doyle
25/08/2020	T Barnfield; E Johnston	V1.3	Draft	Whole Document G7 QA	L Stockdale
25/08/2020	T Barnfield; E Johnston	V1.4	Draft	Update following G7 QA	L Stockdale
25/01/2021	T Barnfield; K Saunders; T Dixon; E Siegal	V2.0 – 2.4	Draft	Updates following new data availability and QA	N Greenwood; J Duffill Telsnig
01/02/2021	T Barnfield; K Saunders; E Siegal	V2.5	Draft	Finalise comments and updates	N Greenwood

22/04/2021	T Barnfield; K Saunders; E Siegal	V2.6 – 2.9	Draft	Amendments following formal consultation	T Dixon
04/06/2021	T Barnfield; K Saunders; E Siegal	V3.0	Final	Updates and finalising following final QC	T Dixon
14/07/2021	T Barnfield; K Saunders; E Siegal	V4.0	Final	Final QC	T Dixon

This document has been distributed for information and comment to:

Title	Organisation	Date sent	Comments received
Introduction and Part A	JNCC	07/07/2020	14/07/2020
Part B	JNCC	30/07/2020	05/08/2020
Full assessment	JNCC	18/08/2020	25/08/2020
Final version	JNCC	06/05/2020	28/05/2021

Dogger Bank Special Area of Conservation (SAC) Marine Management Organisation Fisheries Assessment

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Glossary

AoO - advice on operations. Contained within the conservation advice packages from Natural England and Joint Nature Conservation Committee (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.

Catch recording service - MMO's 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.

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 flora¹.

¹ <https://www.legislation.gov.uk/eudr/1992/43/contents>

Habitats Regulations – The Conservation of Habitats and Species Regulations 2017 (S.I. 2010/490)².

IFCA – Inshore Fisheries and 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 – MMO marine plans have been designed to help manage the seas around England³.

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) 2019/1241⁴. 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 2009⁵ (for England and Wales) or The Marine Act (Northern Ireland) 2013⁶ (for Northern Ireland).

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 63 of the Habitats Regulations and Article 28 of the Offshore Habitats Regulations 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.

² <https://www.legislation.gov.uk/ukxi/2017/1012/contents/made>

³ <https://www.gov.uk/government/collections/marine-planning-in-england>

⁴ <https://www.legislation.gov.uk/eur/2019/1241/contents>

⁵ <https://www.legislation.gov.uk/ukpga/2009/23/contents>

⁶ <https://www.legislation.gov.uk/nia/2013/10/contents>

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

Offshore Habitats Regulations – The Conservation of Offshore Marine Habitats and Species Regulations 2017 (S.I. 2007/1842)⁷.

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 Regulations).

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 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 InfoRmatlon Toolkit. SPIRIT is MMO’s Geographic Information System used for mapping environmental and other data.

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

⁷ <https://www.legislation.gov.uk/ukxi/2017/1013/contents/made>

VMS – vessel monitoring system. All commercial fishing vessels over 12 metres (m) 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.

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
	Bait dragging			
	Beach seines/ring nets			
	Commercial diving			
	Fyke and stakenets			
	Mussels, clams, oyster dredges			
	Pump scoop dredges (cockles, clams)			
	Suction dredges (cockles)			
	Jigging/trolling			
	Hand work (access from land)			
	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			
Shrimp push-nets				
Purse seine				
Mid-water trawl (single) (pelagic)				
Tractor				
Mid-water trawl (pair) (pelagic)				
Pots/creels (crustacea/gastropods)	Likely to have a	Will not result in	Will not result in	
Gillnets				

	Trammel nets	significant effect	adverse effect on site integrity	adverse effect on site integrity
	Entangling nets			
	Beam trawl (whitefish)		May result in adverse effect on site integrity	N/A
	Beam trawl (shrimp)			
	Heavy otter trawl			
	Multi-rig trawls			
	Light otter trawl			
	Pair trawl			
	Anchor seine			
	Scottish/fly seine			
	Semi-pelagic trawl			
	Scallop dredges			

2. Introduction

Table 2 shows the name and legal status of the site. Located in the Southern North Sea approximately 150 kilometres (km) north east of the Humber Estuary, Dogger Bank Special Area of Conservation (SAC) lies entirely outside the 12 nautical mile (nm) limit sharing its eastern boundary with the UK's exclusive economic zone (EEZ). The site covers an area of approximately 12,331 km²⁸.

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)⁹ (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

⁸ <https://hub.jncc.gov.uk/assets/26659f8d-271e-403d-8a6b-300defcabcb1>

⁹ <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:31992L0043&from=EN>

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 typical offshore Annex I sandbank feature (Eigaard et al 2016a) compared to other sandbank sites designated in the region (e.g. North Norfolk Sandbanks and Saturn Reef SAC, 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 worms⁸.

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, brittlestars and soft corals.

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 porpoise⁸.

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 conservation objectives.

Feature	Sub-features	High level conservation objective
Sandbanks which are slightly covered by sea water all the time (H1110)	Subtidal sand	<p>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:</p> <ul style="list-style-type: none"> • the extent and distribution of qualifying natural habitats • the structure and function (including typical species) of qualifying habitats • 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 sand (or sublittoral sand as per EUNIS habitat classification¹⁰) 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).

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

¹⁰ <https://www.eea.europa.eu/data-and-maps/data/eunis-habitat-classification>

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 km². 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 bryozoans¹¹. 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.

¹¹ <https://eunis.eea.europa.eu/habitats/2503>

Figure 1: Dogger Bank SAC Location overview

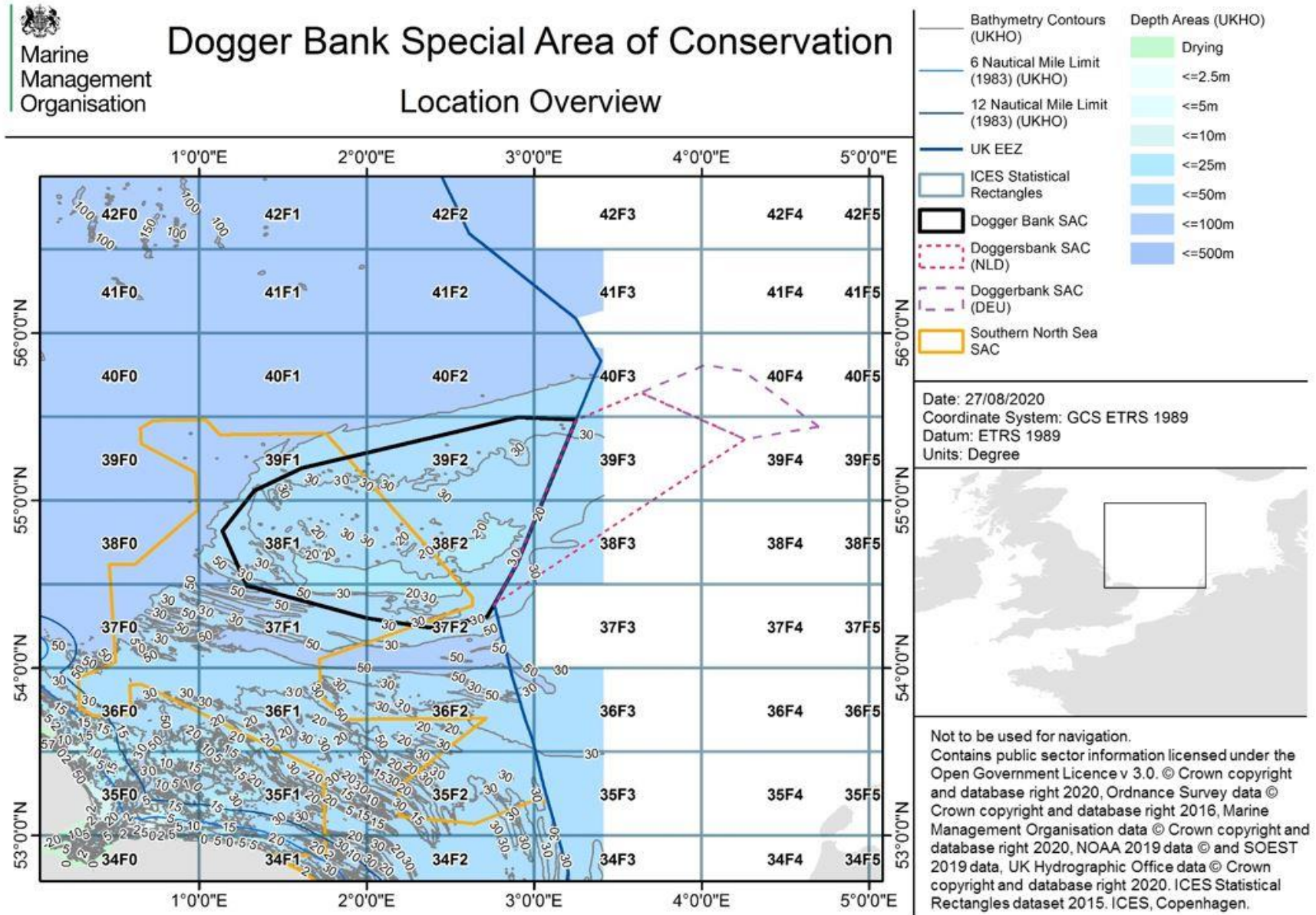
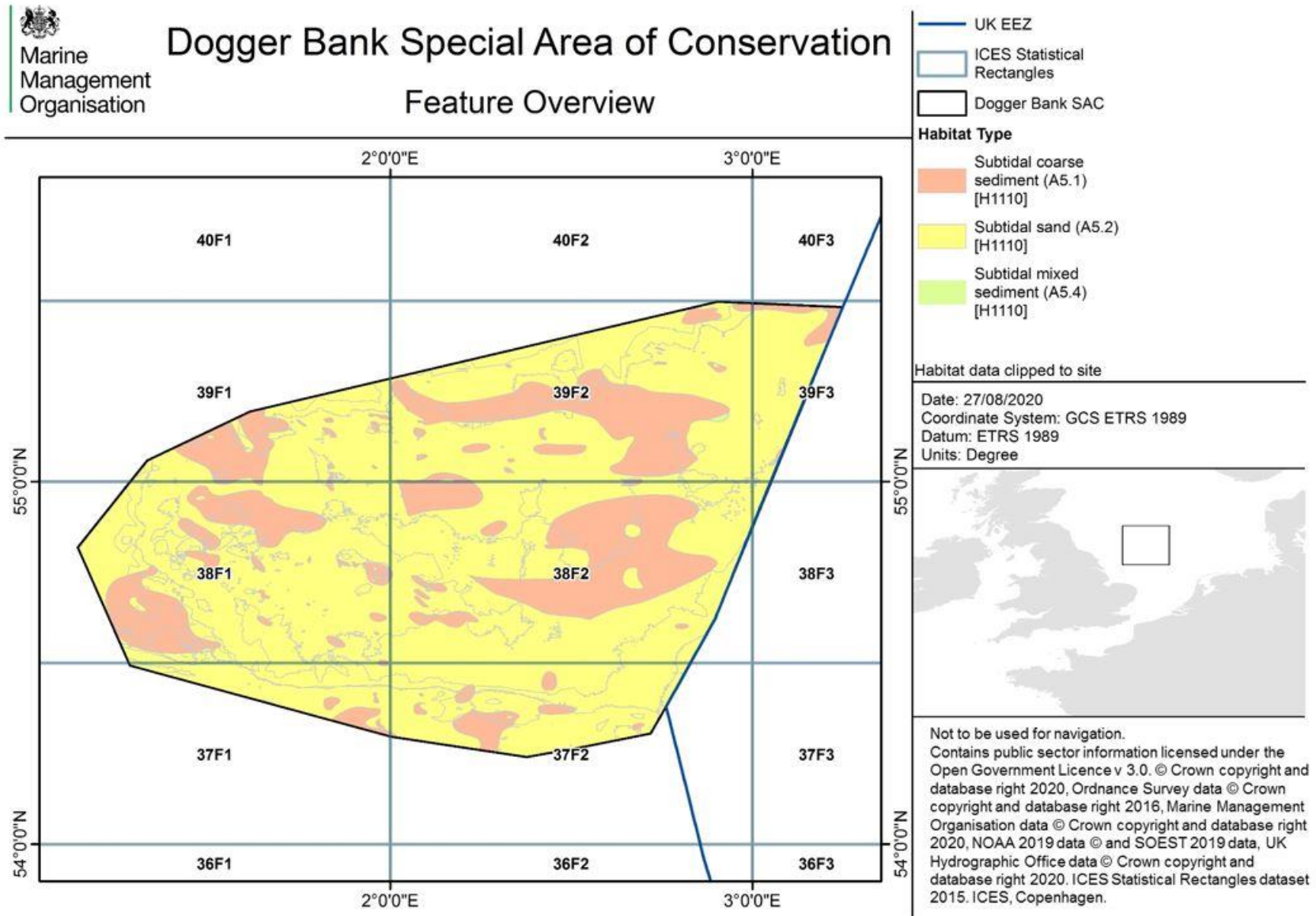


Figure 2: Dogger Bank SAC feature overview: 'sandbanks which are slightly covered by sea water all the time'



2.2 Scope of this assessment – fishing activities assessed

Fisheries assessments use the best available evidence to fully consider all impacts against the conservation objectives. If the assessment cannot conclude that use of certain fishing gear types is compatible with the site’s conservation objectives, appropriate management measures will be introduced. Although management measures implemented may cause displacement of fishing activity to areas outside of the SAC, or between areas of feature within the SAC, it is not possible to accurately predict the location (and thus the associated environmental costs) of displaced fishing activity. Furthermore, this potential displacement of fishing activity does not remove the requirement to introduce management to protect the designated features. MMO closely monitors fishing activity in every marine protected area (MPA) for which we are the lead regulator. MMO regularly reviews and updates fisheries assessments to reflect any such changes, including displacement of fishing activity, that have been observed.

The scope of this assessment covers fishing activities alone, and other plans or projects in combination with fishing. It does not cover other activities defined by MMO as marine non-licensable activities. Marine non-licensable activities include activities such as sailing and powerboating, as well as associated activities like anchoring. More information about MMO’s management of marine non-licensable activities can be found online¹².

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		
	Semi-pelagic trawl	OTB		
	Multi-rig trawls	TX		
	Light otter trawl	OTB		
	Pair trawl	PTB		
	Anchor seine	SDN		Demersal seines
	Scottish/fly seine	SSC		
Pair seine	SPR			
	Mid-water trawl (single)	OTM	Pelagic fishing	

¹² <https://www.gov.uk/government/publications/managing-marine-non-licensable-activities-in-marine-protected-areas>

Towed (pelagic)	Mid-water trawl (pair)	PTM	
	Industrial trawls	OTM	
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	Pelagic fishing
	Longlines (pelagic)	LLD	
	Handlines (rod/gurdy)	LHP	
	Jigging/trolling	LHP / LTL	
Seine nets and other	Purse seine	PS	Shore-based activities
	Beach seines/ring nets	SB	
	Shrimp push-nets	-	Anchored nets/lines
	Fyke and stakenets	FYK / GNF	
Miscellaneous	Commercial diving	-	Diving
	Bait dragging	-	Shore-based activities
	Crab tiling	-	
Bait collection	Digging with 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 there is no adverse effect on site integrity 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 28 of the Offshore Habitats Regulations.

For each fishing activity, a series of questions were asked¹³:

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

¹³ The test for likely significant effect under Article 28 of the Offshore Habitats Regulations 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.

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, MMO has identified “high risk” gear-feature interactions. For this purpose, and in accordance with JNCC advice, 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 are considered 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		

	Digging with forks	Dogger Bank is approximately 100 km offshore and so not subject to shore-based activities.
	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 and 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 SAC¹⁴, these gears have been categorised as bottom otter board trawls and included in the demersal trawls aggregated method gear group.

¹⁴ https://fiskeristyrelsen.dk/media/8992/20160531_dogger_bank_background_document_final.pdf

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 and 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
Synthetic compound contamination	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red
Transition elements and organo-metal contamination	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red
Introduction of microbial pathogens	Grey	Grey	Grey	Grey	Grey	Grey	Grey	Grey	Grey	Red	Red	Red

* 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)¹⁵ 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).

¹⁵ <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 and 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 ¹⁶ 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 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.	

¹⁶ 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 and 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 28 of the Offshore Habitats Regulations.

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 sea water all the time	Anchored Nets/Lines	Gillnets	<ul style="list-style-type: none"> • Abrasion/disturbance of the substrate on the surface of the seabed • Penetration and/or disturbance of the substrate below the surface of the seabed • Removal of target species • Removal of non-target species
	Traps	Pots/creels	
	Demersal Trawls	Otter Twin Trawlers Beam Trawls	
	Demersal Seines	Danish/ Anchor Seine Scottish Seine Scottish Pair Seines	
	Dredges	Shellfish dredging	<ul style="list-style-type: none"> • Changes in suspended solids (water clarity) • Smothering and siltation rate changes
	Demersal Trawls	Otter Twin Trawls Beam Trawls	
	Demersal Seines	Danish/ Anchor Seine Scottish Seine 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	<p>Restore objective: The feature extent within the site must be conserved to the full known distribution (sandbank feature calculated to be 12,331 km²) based on:</p> <ul style="list-style-type: none"> - large-scale topography - sediment composition - biological assemblages 	<p>Relevant to:</p> <ul style="list-style-type: none"> • Abrasion/disturbance of the substrate on the surface of the seabed. • Penetration and/or disturbance of the substrate below the surface of the seabed. • Removal of non-target species. • Removal of target species • Smothering and siltation rate changes. • Changes in suspended solids (water clarity).
Structure and function	<p>Restore objective:</p> <ul style="list-style-type: none"> • Physical structure (finer scale topography and sediment composition and distribution) to be restored. • Biological structure (characteristic communities) to be restored. • Function to be restored 	<p>Relevant to:</p> <ul style="list-style-type: none"> • Abrasion/disturbance of the substrate on the surface of the seabed. • Penetration and/or disturbance of the substrate below the surface of the seabed. • Removal of non-target species. • Removal of target species • Smothering and siltation rate changes. • Changes in suspended solids (water clarity).
Supporting processes	<p>Maintain objective:</p> <ul style="list-style-type: none"> • Hydrodynamic regime to be maintained. • Water and sediment quality to be maintained. 	<p>Relevant to:</p> <ul style="list-style-type: none"> • Smothering and siltation rate changes. • 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)¹⁷ 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 4 April 2021 there was a suspension of scallop dredging in ICES rectangles 39F1, 39F2, 39F3, 38F1, 38F2, 38F3, 37F1 and 37F2. This closure has now been lifted with the exception of Dogger Bank SAC. The scallop fishing closure in the Dogger Bank SAC will remain in place until the outcome of consideration of a proposed byelaw to ban all bottom towed gear in the area is decided. The temporary closure was implemented to enable improved scientific understanding of the scallop stock to be developed.

Since an initial temporary closure of the fishery was agreed with industry in July 2020, the UK Fisheries Administrations have conducted two calls for evidence and liaised regularly with industry representatives around managing the scallop stock. The temporary closure has since been extended three times in agreement with industry, including the Shellfish Industry Consultation Group, to enable better scientific understanding of the Dogger Bank scallop stock.

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

¹⁷ <https://www.legislation.gov.uk/eur/2019/1241/contents>

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	<ul style="list-style-type: none"> • Confidence in VMS is high for describing activity relating to larger vessels (>12m). but it does not describe activity of smaller vessels. • 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. • 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. • 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). • Null gear codes may be present in the data which may underrepresent fishing fleet.
Landings Data	High	<ul style="list-style-type: none"> • Annual data collated and reported to ICES statistical rectangles. • Resolution too low to directly infer landings for MPAs.
Expert judgement	Moderate	<ul style="list-style-type: none"> • Reliability/accuracy depends on the area, and the local knowledge of MMO staff.
Sightings data	High	<ul style="list-style-type: none"> • Taken from Royal Navy and MMO patrols and targets inspection. • Covers all vessels, not limiting to size class. • Does not account for patrolling/inspection effort.
Pr-values	Moderate/High	<ul style="list-style-type: none"> • Spatial footprint values do not include information for non-VMS vessels. • 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. • 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.
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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. As discussed in section 3.3 mid water trawls have no associated pressures considered relevant to the sandbank feature and have not been included in this assessment, however for completeness their activities shown in Figure 3 to Figure 8. 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 was a rapid increase in scallop dredging activity by UK vessels exploiting this stock. This activity led to the temporary closure of the scallop fishery as detailed previously.

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

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 turbot (STECF FDI landings data 2015-2018). 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. Sandeels and herring are 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. Usually the net is still in contact with the seabed albeit more lightly than in demersal trawling. 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. Most beam trawls in use by the Belgian fleet are the Sumwing beam trawl (J. Vlietinck, Rederscentrale (Belgian fisheries) 2021, *pers. comm.*) a hydrodynamic beam trawl where the heavy beam is replaced by a 'wing' which removes the need for beam shoes. This makes the gear itself lighter however standard beam trawl nets with tickler chains are still used (Seafish, 2021).

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 plaice (STECF FDI landings data 2015-2018).

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). At the time of writing, 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 04 April 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 the site, south of the Dogger Bank SAC boundary (Figure 3 to Figure 7). However, VMS data shows that potting activity occurred in the west of the site in 2019 (Figure 8).

Within the site there are a small number of potting vessels, all over 15 m 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 and 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. At the time of writing, 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 SAC are displayed in Figure 3 to Figure 15. Landings derived from Dogger Bank SAC were calculated by combining 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 10% of demersal trawl/seine (gear codes OTB, OTT, SDN and SSC) landings and 56% of beam trawl 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 61% 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 2018 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 and UK potting which saw increased landings in 2019 (Table 14, Table 15). These differences in

landings correlate with reduced VMS fishing activity from UK beam trawlers and increased VMS activity from UK potters.

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). 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 (Table 18). However, this decline from 2016 was not sustained, with landings in 2017 and 2018 being closer 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 to Figure 8), yet only two tonnes of landings are estimated to be attributed to non-UK 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 information¹⁸ 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% in 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

¹⁸ <https://www.fao.org/fishery/collection/fvf/en>

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) 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 from the SAC (Table 14). The 2019 UK potting landings corresponded with a large increase in the associated VMS records (Table 18).

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, a large portion 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 04 April 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 one 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 bottom otter trawl fleet but are also targeted by some UK and other non-UK vessels. A number of these vessels are likely to make use of semi-pelagic trawl gears however currently these are recorded as bottom otter trawl landings so determining landings derived from semi-pelagic trawling is not currently possible. Between 2014 and 2018, approximately 326,000 tonnes of sandeels were removed by non-UK demersal trawl (OTB) vessels from the eight ICES rectangles which intersect Dogger Bank SAC (based on STECF FDI landings data 2014-2018). Approximately 84% of these landings came from just two of the eight ICES rectangles intersecting the SAC: 39F1 (~227,600 tonnes) and 38F1 (~44,800 tonnes). Sandeel landings in Dogger Bank SAC were estimated from STECF landings and VMS data by calculating the percentage of OTB landings that are sandeels per ICES rectangle and applying this to the proportion of OTB landings derived from Dogger Bank SAC per ICES rectangle (as estimated using the proportion of VMS fishing records, Section 4.1.4.2) Using this approach, an estimated 38,000 tonnes of sandeels were removed from the SAC by non-UK OTB vessels from 2015 to 2018 via these two ICES rectangles alone. The total estimated figure for non-UK sandeel landings from the SAC from 2014 to 2018 is approximately 49,100 tonnes. In comparison, UK vessels landed approximately 2,200 tonnes of sandeels in the eight ICES rectangles from 2014 to 2018 (98 tonnes in 2019), which, using the proportional approach described above equates to landings of approximately 1,000 tonnes in Dogger Bank SAC from 2014 to 2018 (94 tonnes in 2019).

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

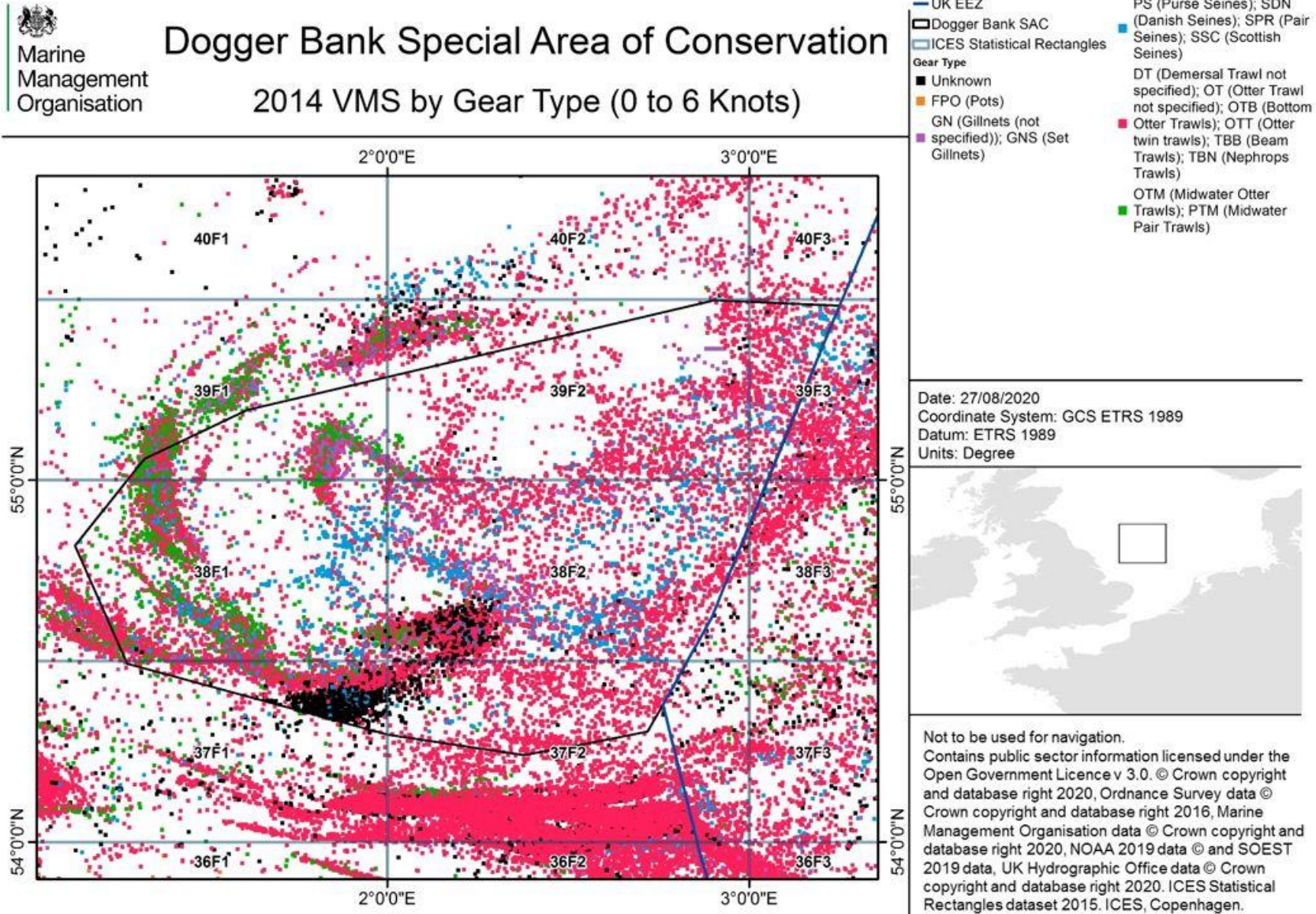


Figure 4: 2015 VMS Fishing Activity by gear type in Dogger Bank SAC

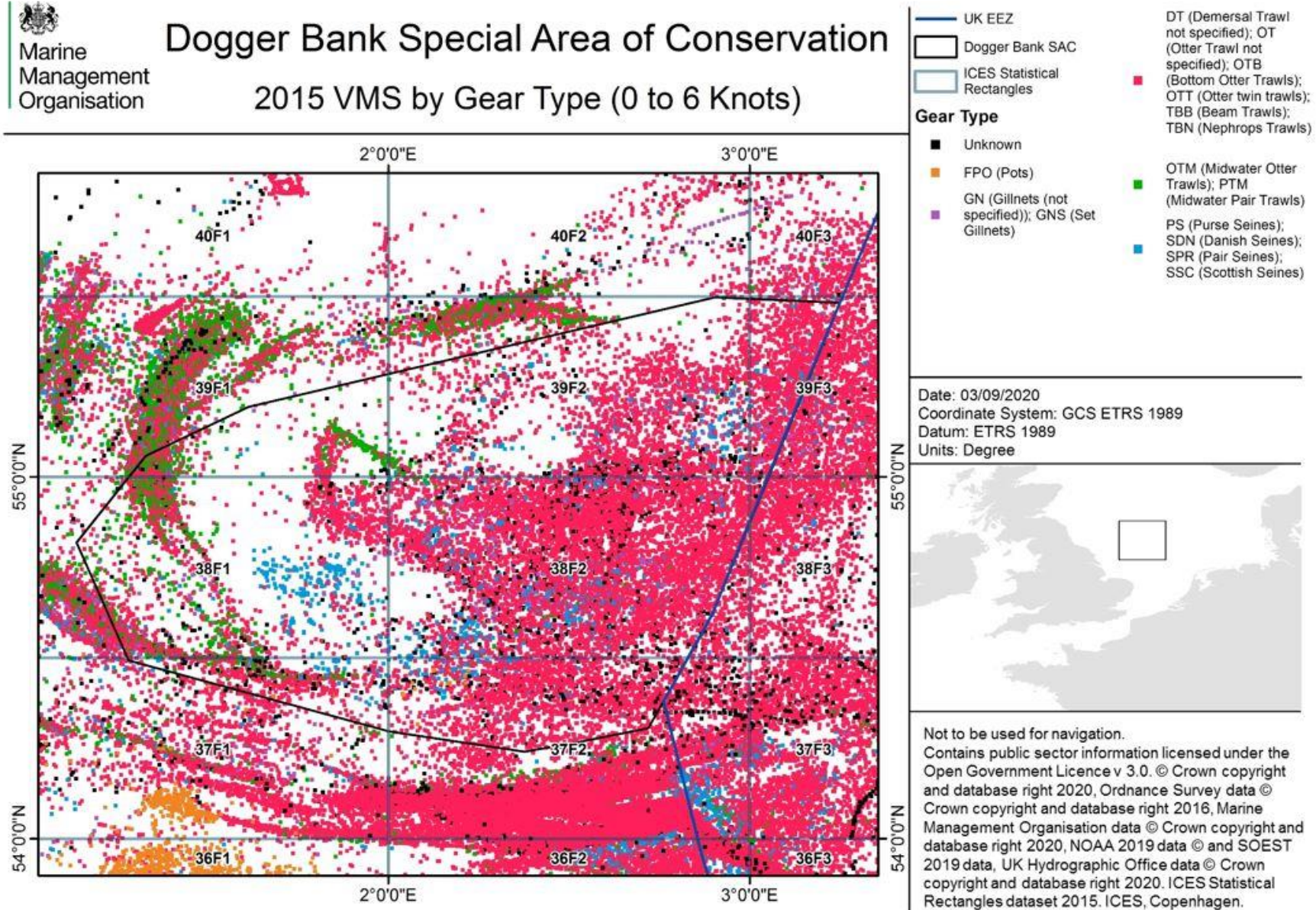


Figure 5: 2016 VMS Fishing Activity by gear type in Dogger Bank SAC

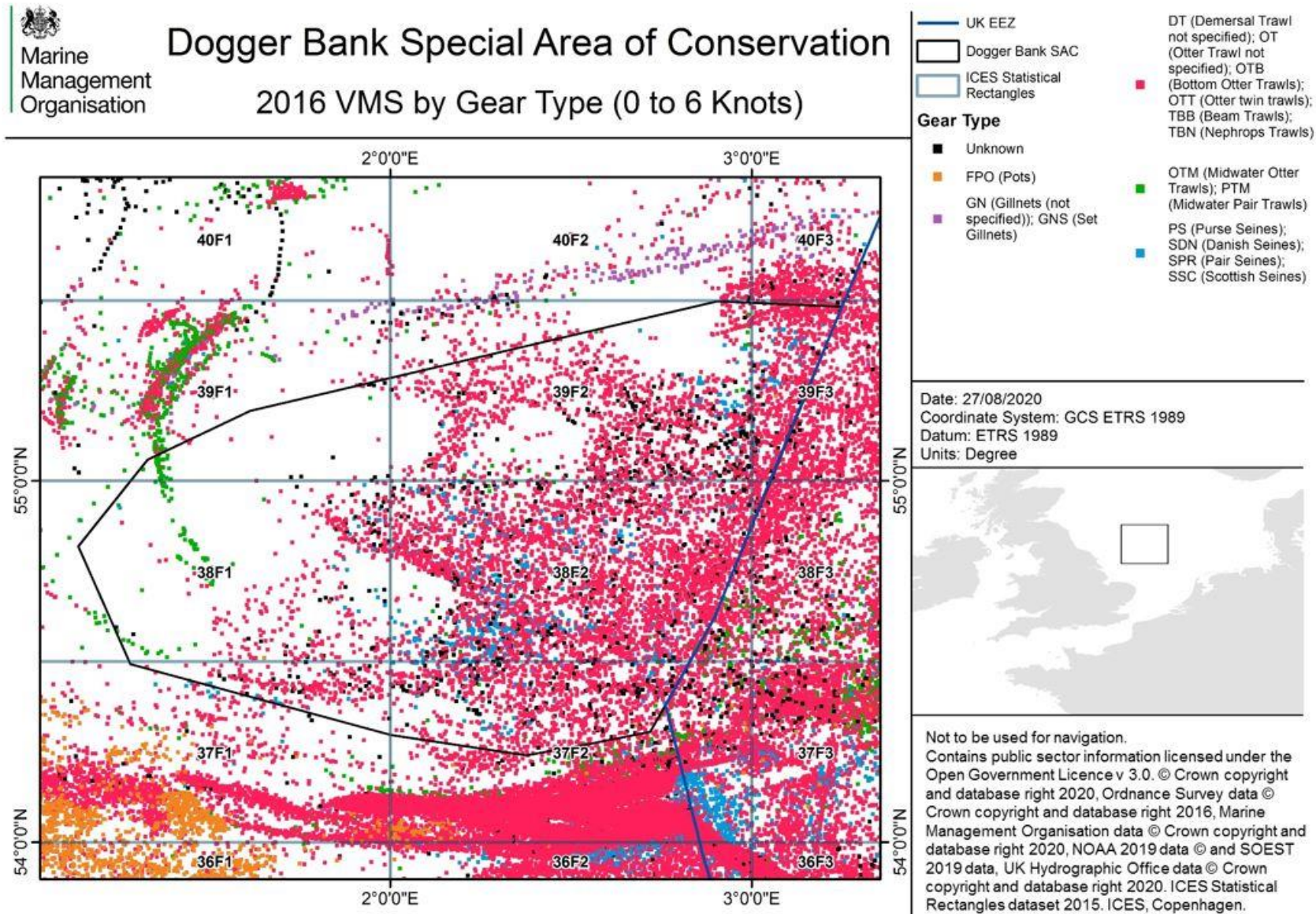


Figure 6: 2017 VMS Fishing Activity by gear type in Dogger Bank SAC

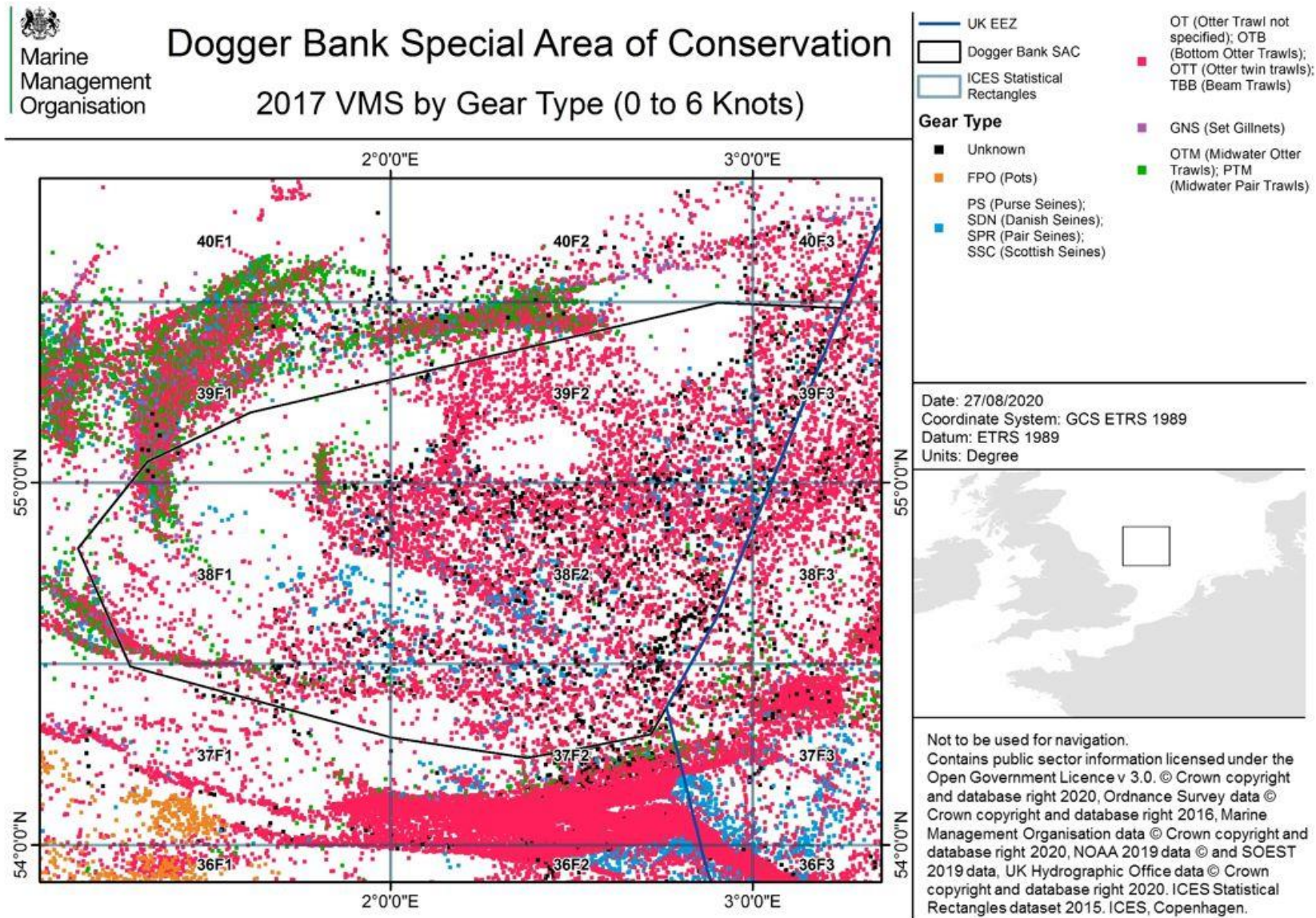


Figure 7: 2018 VMS Fishing Activity by gear type in Dogger Bank SAC

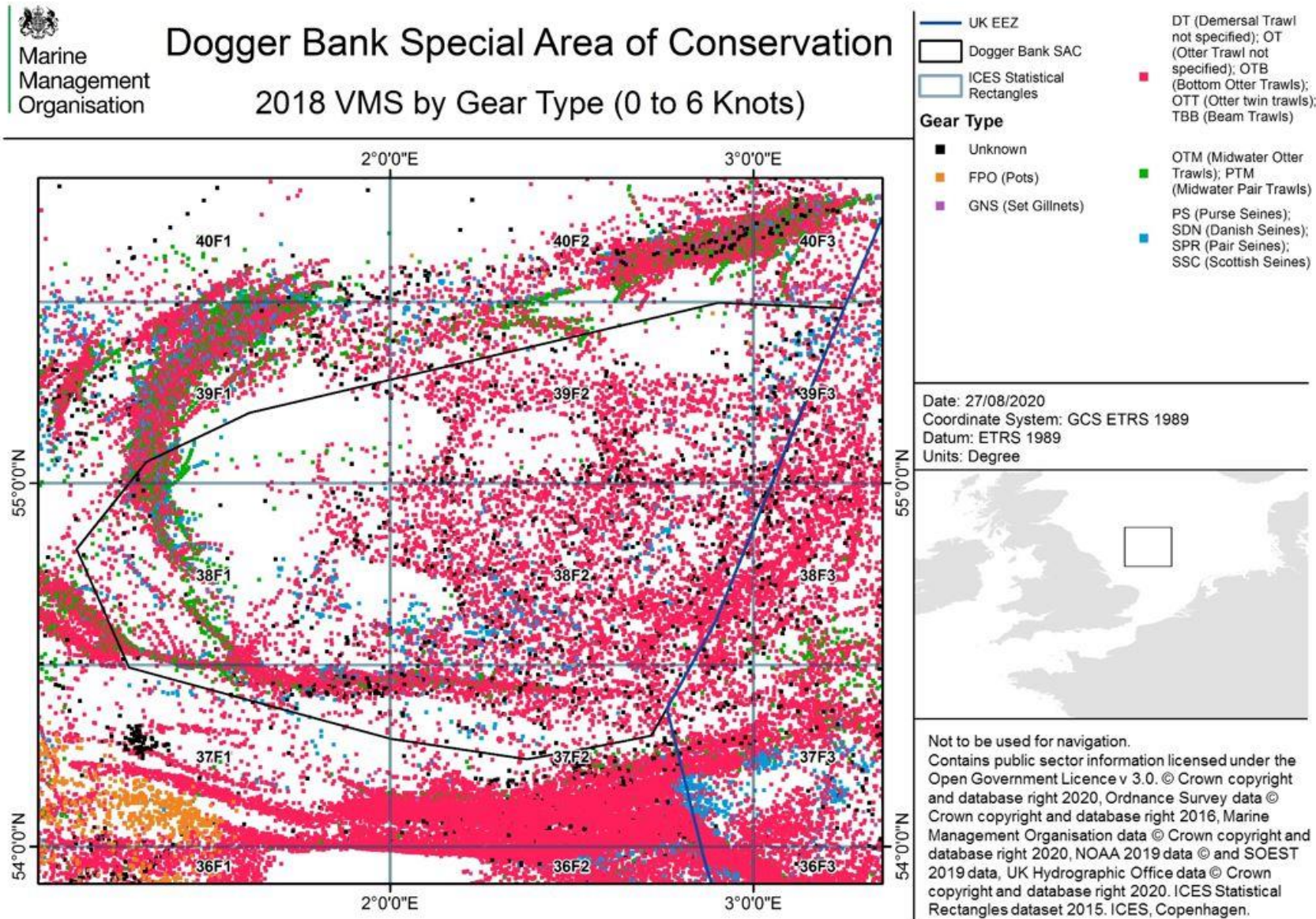


Figure 8: 2019 VMS Fishing Activity by gear type in Dogger Bank SAC

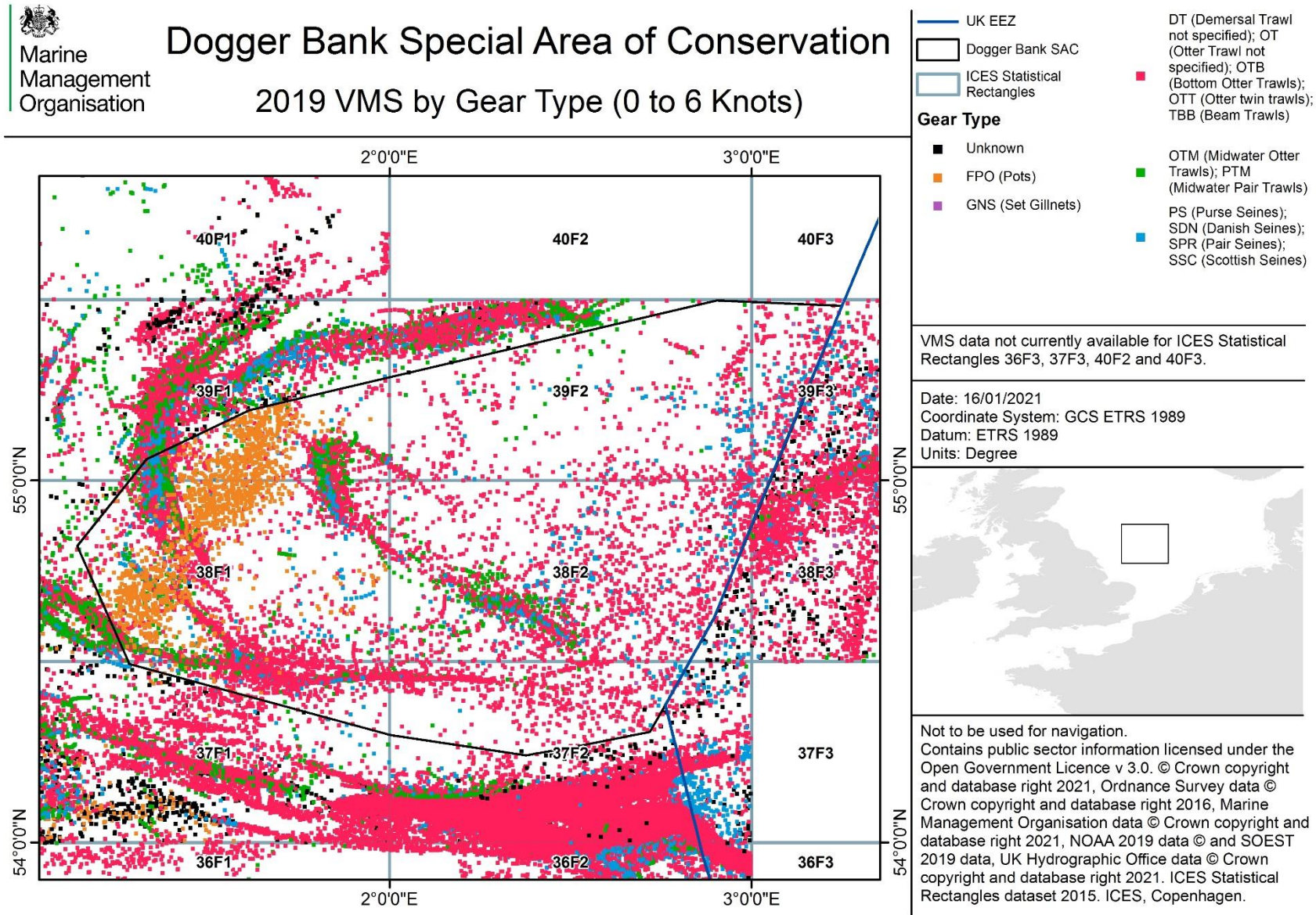


Figure 9: 2014 VMS Fishing Activity by Nationality in Dogger Bank SAC

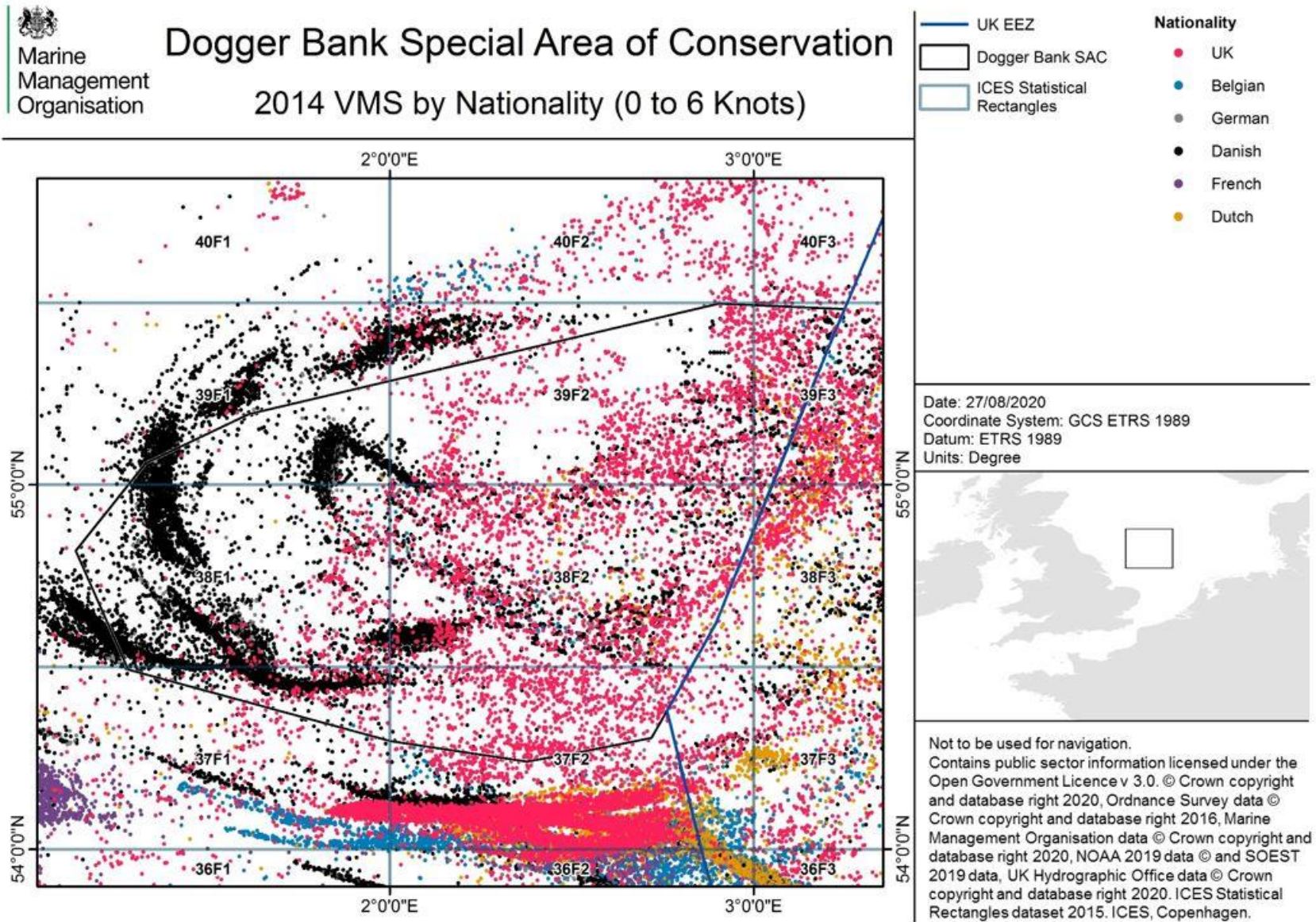


Figure 10: 2015 VMS Fishing Activity by Nationality in Dogger Bank SAC

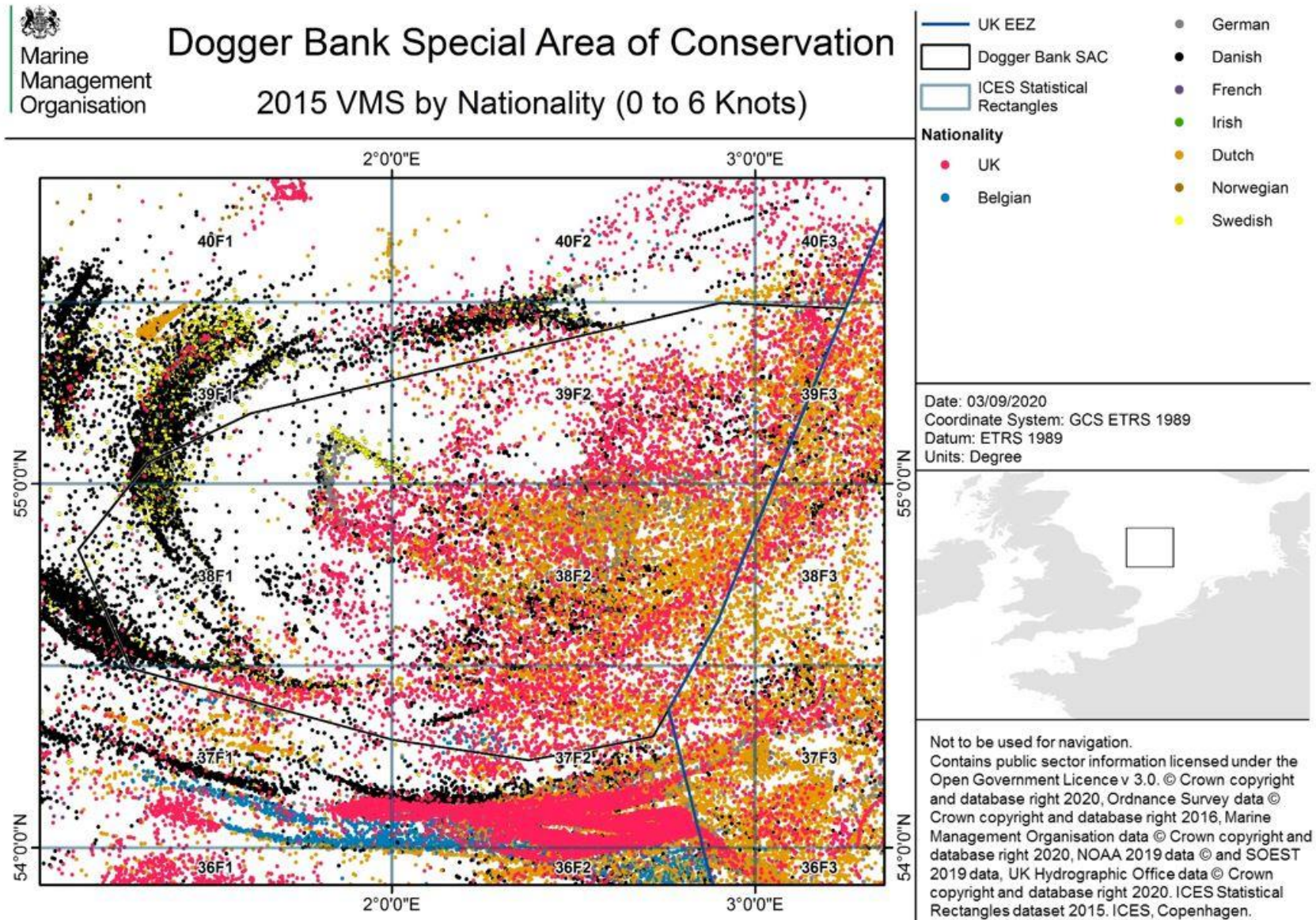


Figure 11: 2016 VMS Fishing Activity by Nationality in Dogger Bank SAC

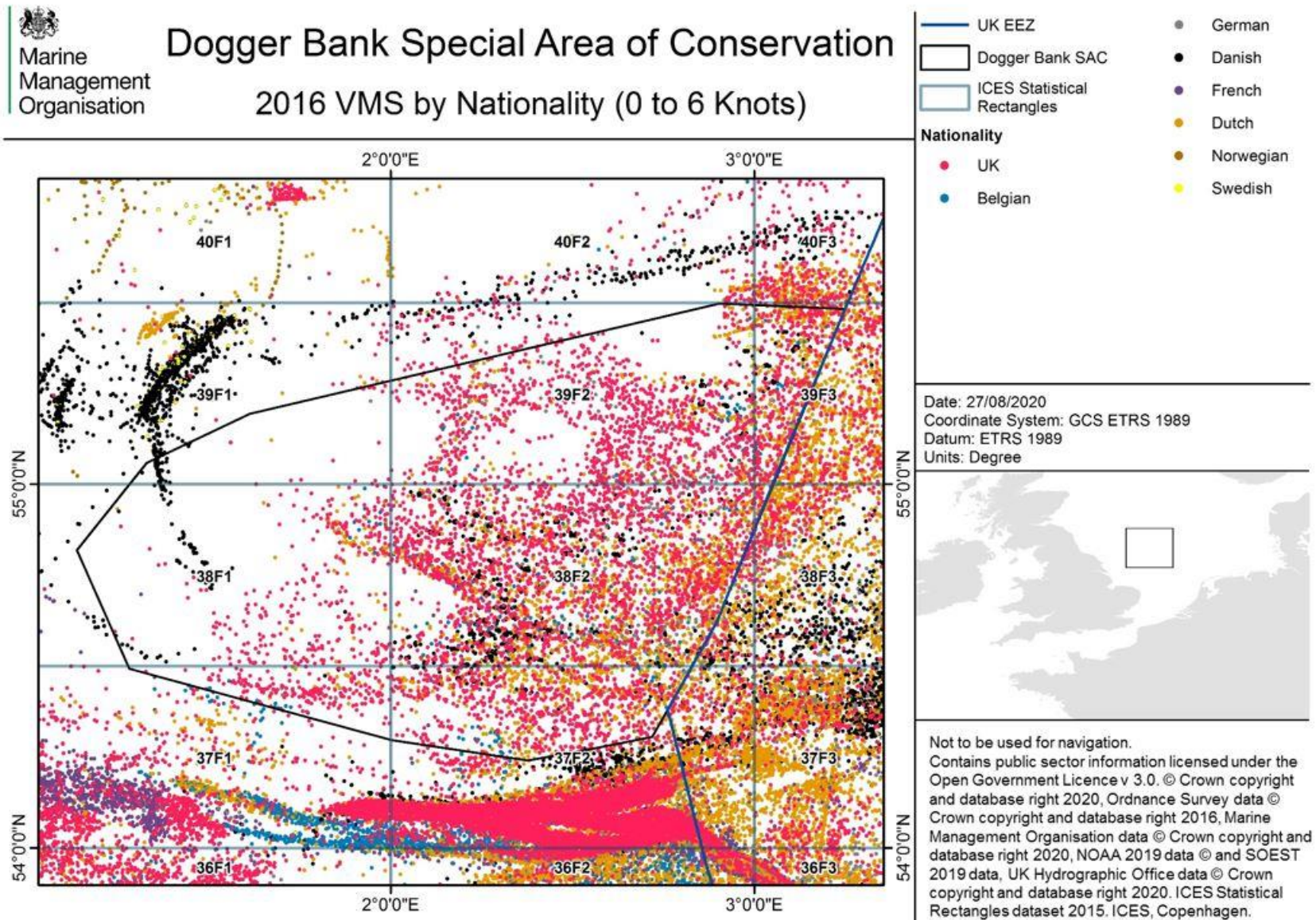


Figure 12: 2017 VMS Fishing Activity by Nationality in Dogger Bank SAC

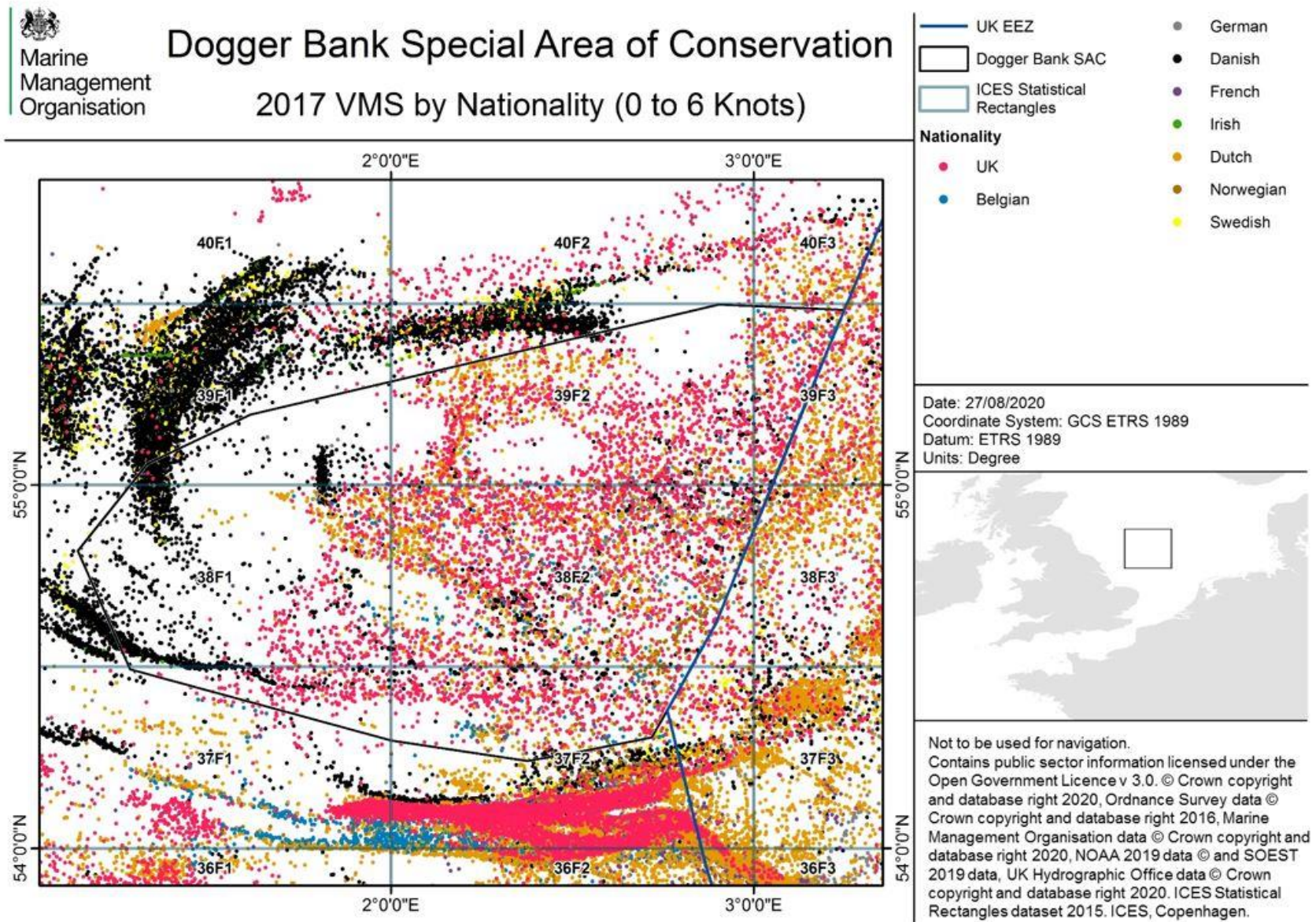


Figure 13: 2018 VMS Fishing Activity by Nationality in Dogger Bank SAC

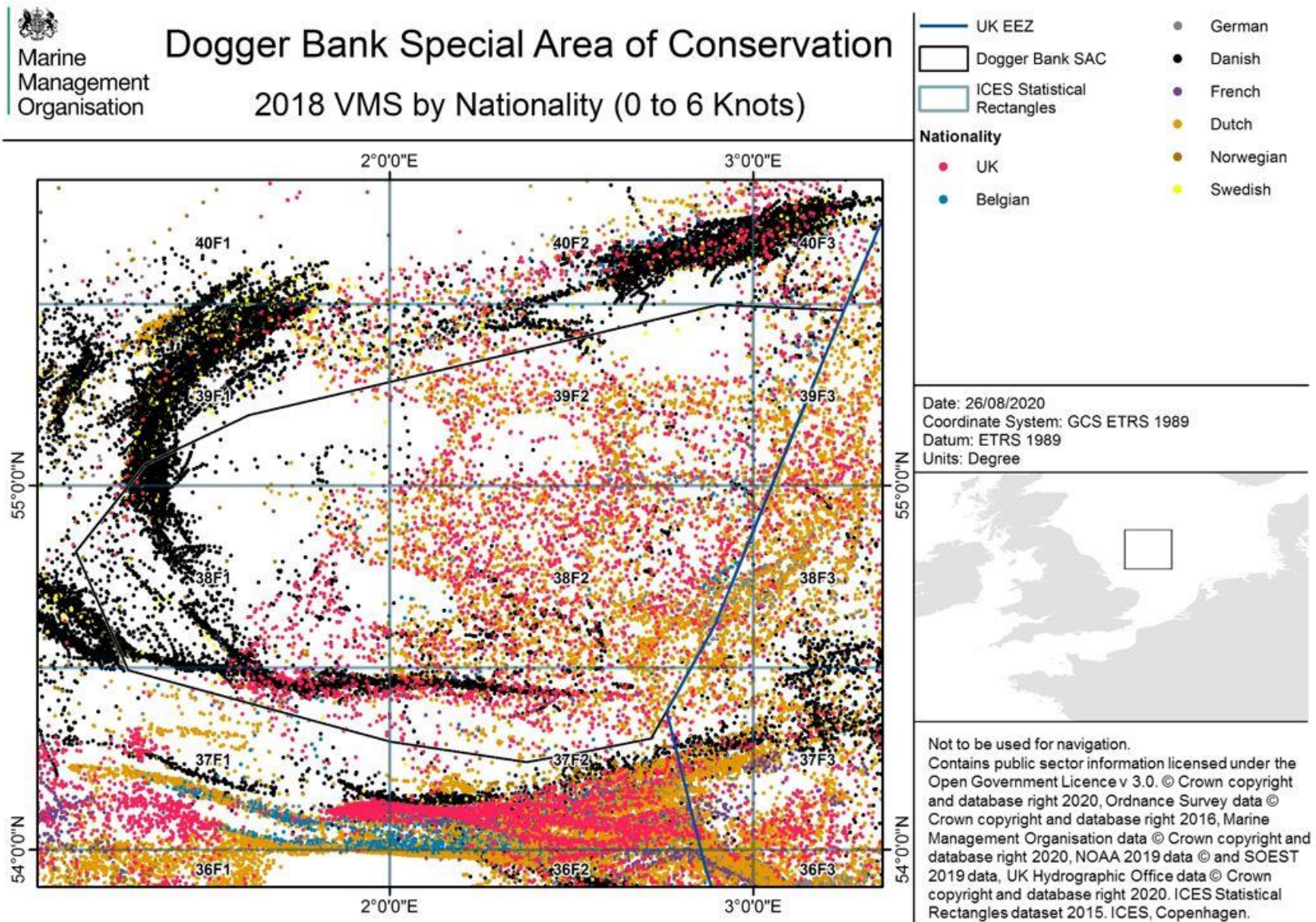
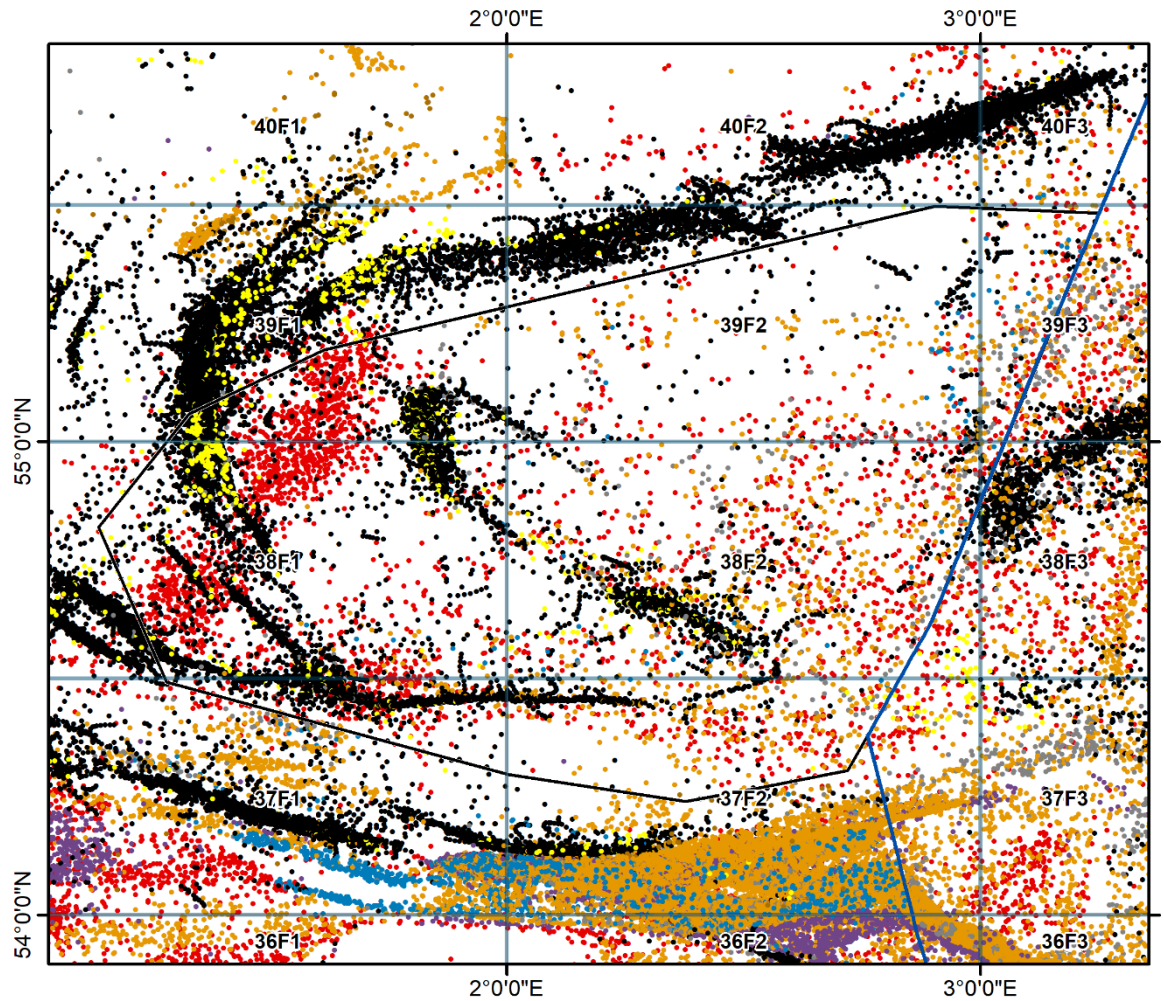


Figure 14: 2019 VMS Fishing Activity by Nationality in Dogger Bank SAC



Dogger Bank Special Area of Conservation

2019 VMS by Nationality (0 to 6 Knots)

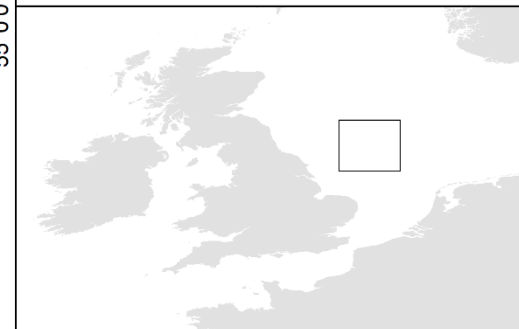


- UK EEZ
- Dogger Bank SAC
- ICES Statistical Rectangles
- Swedish

Nationality

- UK
- Belgian
- German
- Danish
- French
- Dutch
- Norwegian

Date: 07/03/2022
 Coordinate System: GCS ETRS 1989
 Datum: ETRS 1989
 Units: Degree MMO Reference: 10619



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

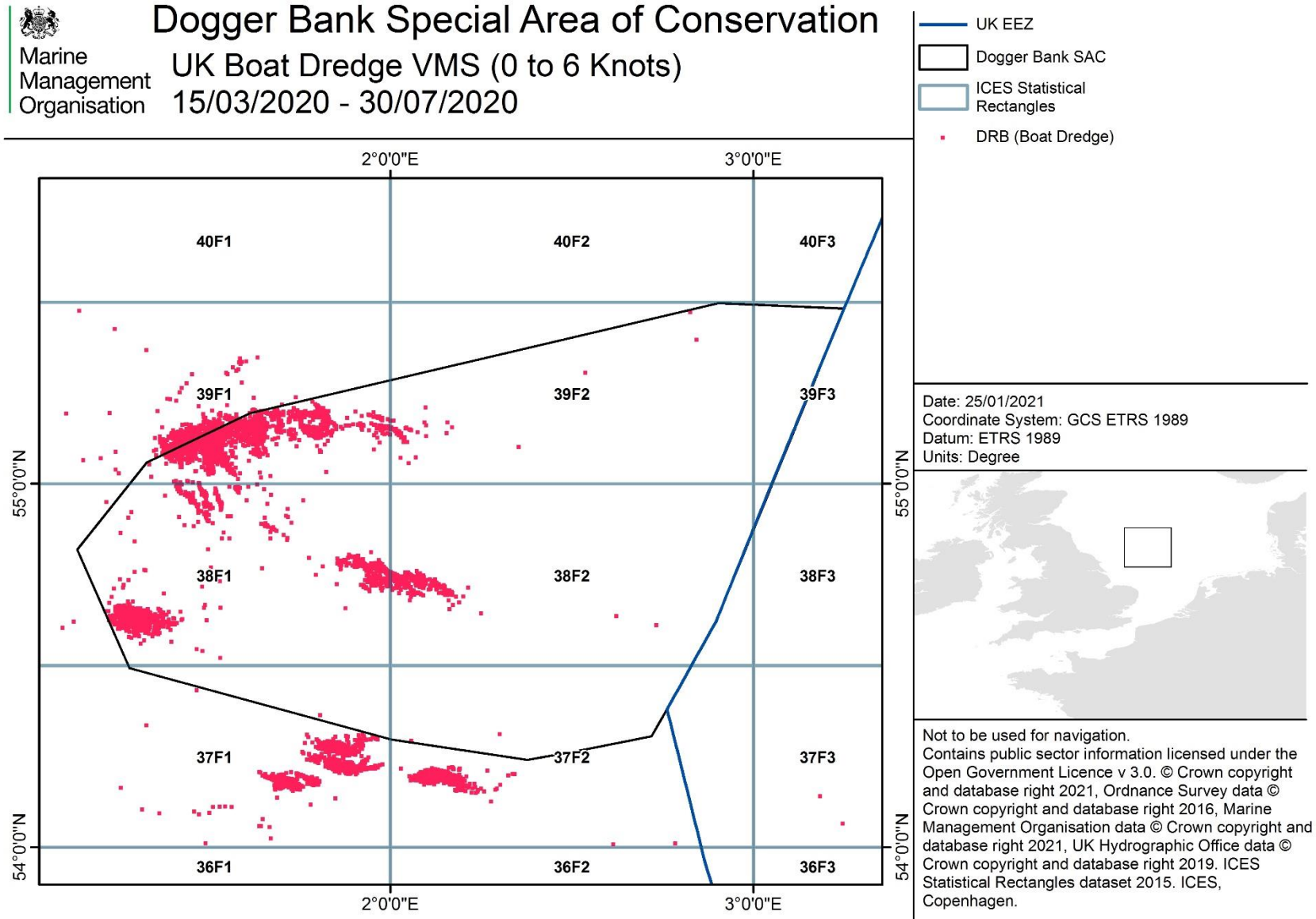


Table 12: 2014-2018 STECF landings from non-UK vessels in Dogger Bank SAC estimated from VMS data. Landings in Dogger Bank were estimated using the percentage of VMS points in Dogger (versus the ICES rectangles). To estimate landings from SDN gear, GNS VMS records were reassigned to SDN. In 2014, non-UK 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, OTT = otter twin trawl, SDN = Danish seines, SSC = Scottish seines and TBB = beam trawl.

Year	Landings by gear (t)								Total landings (t)
	FPO	GNS	NK	OTB	OTT	SDN	SSC	TBB	
2014	-	1	-	26,264				229	26,494
2015	-	-	-	19,153	100	355	84	1,979	21,670
2016	-	-	-	1,237	13	209	75	416	1,950
2017	-	1	52	21,423	36	137	165	226	22,041
2018	-	-	35	12,224	43	70	96	42	12,510
2014 - 2018	-	2	87	81,685				2,892	84,665

* 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, OTT = otter twin 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	OTT	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	973	425	349	5,124	113,540
	<12	-	-	-	-	-	-	-	-	-
	>12	-	-	-	106,669	973	425	349	5,124	113,540
2016	All	-	6	-	16,890	352	241	280	2,653	20,423
	<12	-	-	-	-	-	-	-	-	-
	>12	-	6	-	16,890	352	241	280	2,653	20,423
2017	All	-	2	52	168,251	203	221	388	1,641	170,758
	<12	-	-	-	-	-	-	-	-	-
	>12	-	2	52	168,251	203	221	388	1,641	170,758
2018	All	-	1	35	63,752	187	112	184	897	65,169
	<12	-	-	-	-	-	-	-	-	-
	>12	-	1	35	63,752	187	112	184	897	65,169
2014 - 2018	All	-	12	89	422,967				12,058	435,126

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. To estimate landings from SDN gear GNS VMS records were reassigned to SDN. 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, OTT = otter twin trawl, SDN = Danish seines, SSC = Scottish seines and TBB = beam trawl.

Year	Landings	Landings by gear							Total landings
		FPO	GNS	OTB	OTT	SDN	SSC	TBB	
2014	UK (t)	0	0.2	1,278				1,099	2,377
	EU (t)	0	1	26,264				229	26,494
	UK (%)	-	17	5				83	8
2015	UK (t)	0	0	1,717	117	117	0	1,627	3,578
	EU (t)	0	0	19,153	100	355	84	1,979	21,670
	UK (%)	-	-	8	54	25	0	45	14
2016	UK (t)	0	0	2,182	313	0	0	588	3,083
	EU (t)	0	0	1,237	13	209	75	416	1,950
	UK (%)	-	-	64	96	0	0	59	61
2017	UK (t)	0	0	2,087	377	0	0	232	2,696
	EU (t)	0	1	21,423	36	137	165	226	21,989
	UK (%)	-	0	9	91	0	0	51	11
2018	UK (t)	0	0	984	199	0	0	63	1,246
	EU (t)	0	0	12,224	43	70	96	42	12,475
	UK (%)	-	-	7	82	0	0	60	9
2014 - 2018	UK (t)	0	0.2	9,370				3,609	12,980
	EU (t)	0	2	81,685				2,892	84,578
	UK (%)	-	11	10				56	13

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, OTT = otter twin 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	1336	1,371
	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	882	14,626
	EU	5,851	3,158	875	3,638	4,770	5,819	24,111
OTT	UK	125	169	340	448	333	386	1,801
	EU	1	52	17	522	1,091	127	1,810
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	15	98
	EU	86	71	285	228	114	285	1,069
TBB	UK	1,542	1,983	938	98	80	25	4,666
	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 assessments¹⁹ (report reference: MMO1108). It should be noted that Pr-values are derived from VMS data, and therefore analysis only captures vessels with VMS. This analysis is therefore likely to be an underrepresentation of the spatial footprint of fishing gears from all vessels in the SAC. The best available evidence for non-VMS vessels can be found in the subsequent sections.

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 ($2E-04$ – $4.2E-03\text{km}^2$ – 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 ($12,3450\text{ km}^2$) have comparatively low values ($3E-09$ – $3.4E-06$ - pots), $1.6E-07$ – $6.1E-05$ - nets). It is noted that potting activity increases significantly in 2019 with the total gear footprint increasing from $3.8E-05\text{ km}^2$ 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 $5.0E-06$ and $5.1E-05$.

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.

¹⁹http://randd.defra.gov.uk/Document.aspx?Document=12955_MMO1108SpatialFootprintAnalysisReport-FINAL.pdf, MARG Ltd in association with Envision Mapping Ltd, 2015

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: 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 km² (2018) and 1885.71 km² (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 km² and Pr values of 7.2E-06 and 1.4E-05 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, OTT = otter twin trawl, SDN = Danish seines, SSC = Scottish seines, DRB = boat dredge, and TBB = beam trawl.

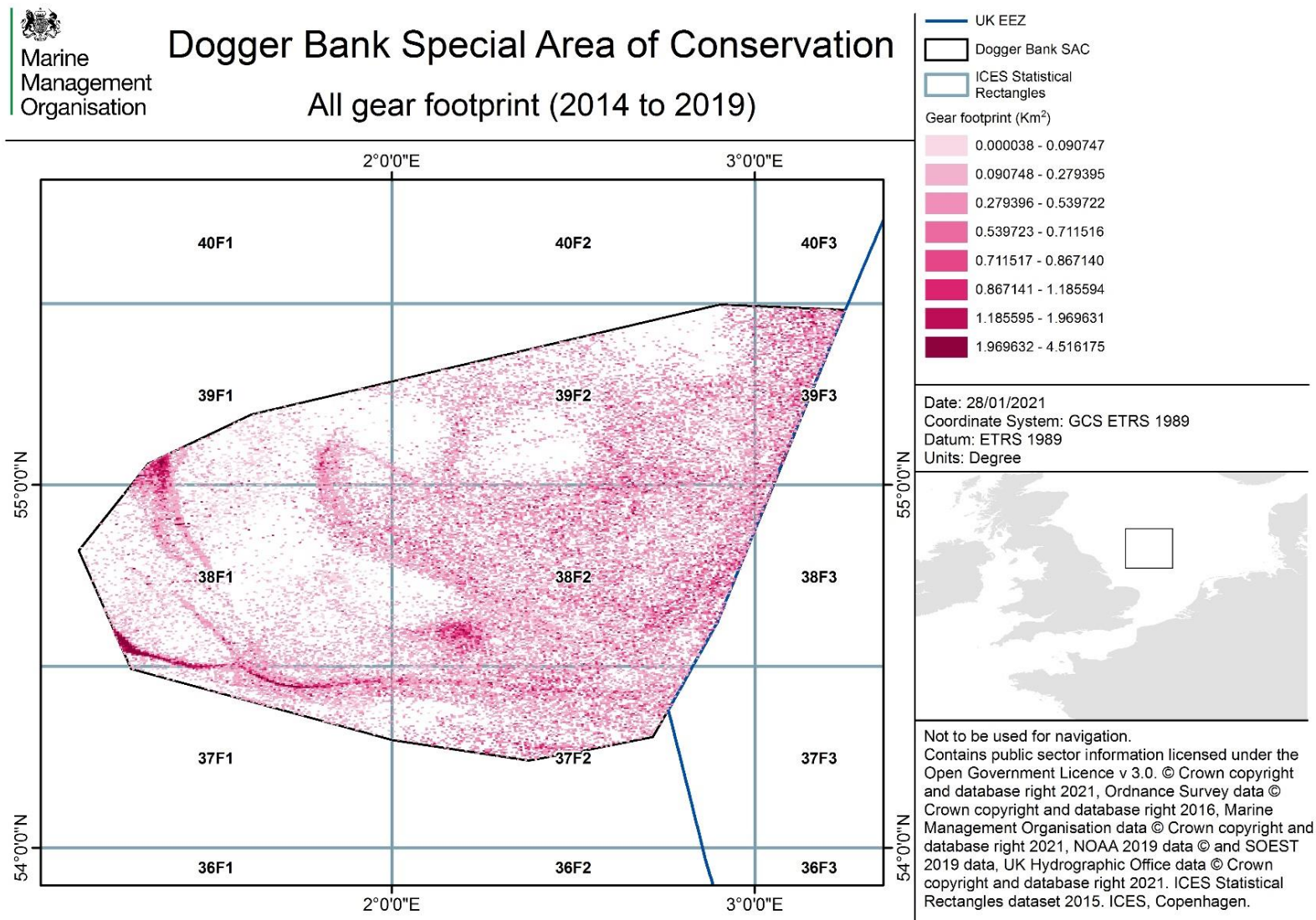
Year	2014	2015	2016	2017	2018	2019
FPO						
Total gear footprint km ²	3.8E-05	1.9E-04	1.9E-04	-	1.9E-04	0.042
Pr-value	3.1E-09	1.5E-08	1.5E-08	-	1.5E-08	3.4E-06
Pr value %	3.1E-07	1.5E-06	1.5E-06	-	1.5E-06	3.4E-04
GN						
Total gear footprint km ²	6.05E-03	2.0E-03	-	-	-	-
Pr-value	4.9E-07	1.6E-07	-	-	-	-
Pr value %	4.9E-05	1.6E-05	-	-	-	-
GNS						
Total gear footprint km ²	0.76	0.38	0.042	0.095	0.054	0.012
Pr-value	6.1E-05	3.1E-05	3.4E-06	7.7E-06	4.4E-06	9.8E-07
Pr value %	6.1E-03	3.1E-03	3.4E-04	7.7E-04	4.4E-04	9.8E-05
DT						
Total gear footprint km ²	25.73	24.83	1.62	-	7.92	-
Pr-value	2.1E-03	2.0E-03	1.3E-04	-	6.4E-04	-

Pr value %	0.21	0.20	0.013	-	0.064	-
OT						
Total gear footprint km ²	-	-	-	1.089	-	-
Pr-value	-	-	-	8.8E-05	-	-
Pr value %	-	-	-	8.8E-03	-	-
OTB						
Total gear footprint km ²	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 km ²	26.14	28.38	59.22	94.95	139.26	91.68
Pr-value	2.1E-03	2.3E-03	4.8E-03	7.7E-03	0.011	7.4E-03
Pr value %	0.21	0.23	0.48	0.77	1.13	0.74
TBB						
Total gear footprint km ²	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 km ²	0.63	0.49	0.14	0.20	0.13	0.062
Pr-value	5.1E-05	4.0E-05	1.1E-05	1.6E-05	1.0E-05	5.0E-06
Pr value %	5.1E-03	4.0E-03	1.1E-03	1.6E-03	1.0E-03	5.0E-04
SSC						
Total gear footprint km ²	0.13	0.10	0.27	0.21	0.089	0.31
Pr-value	1.1E-05	8.3E-06	2.1E-05	1.7E-05	7.2E-06	2.5E-05
Pr value %	1.1E-03	8.3E-04	2.1E-03	1.7E-03	7.2E-04	2.5E-03
DRB						
Total gear footprint km ²	-	-	0.089	-	-	0.18
Pr-value	-	-	7.2E-06	-	-	1.4E-05
Pr value %	-	-	7.2E-04	-	-	1.4E-03

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 km ²	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 81,700 tonnes from demersal trawls and seines and 2,900 tonnes from beam trawls, whereas UK vessels landed approximately 9,400 tonnes from demersal trawls/seines and 3,600 tonnes from beam trawls (Table 17). The VMS fishing records also indicate high levels of demersal fishing activity in the site, particularly for bottom otter trawls (approximately 24,000 VMS records by non-UK vessels and 14,600 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 and seines decreased 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, at recent activity levels, 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 heavy²⁰ 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 five pots lifted per hectare per day. In Dogger Bank SAC a maximum of 1,600 pots are estimated to be laid per day per vessel (see Annex 2). Using the area

²⁰ Quantitative fishing intensity levels used are published in Hall et al 2008. Heavy potting intensity was defined as 'more than five pots lifted per hectare per day'.

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, **MMO conclude 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 centimetres (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., 2004). 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 doors of bottom otter trawls penetrate deepest into the sediment (Eigaard et al., 2016a) and therefore semi-pelagic doors reduce a significant portion of impact compared with traditional 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. 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 and 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 *Macra 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 *Macra 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 scarce (Jak et al., 2009). 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; Rijnsdorp 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 conflicting evidence with regard to the biological communities of Dogger Bank SAC and their relative resilience to demersal trawling activity. Areas of high natural disturbance may be less sensitive to trawling due to such areas having low initial species biomass (Hiddink et al., 2006b). 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. Diesing et al. (2013) estimated that, as a shallow area with high natural disturbance, fishing disturbance was below that of natural disturbance in Dogger Bank. However, this study assumed the area impacted by otter trawls was 2 x 2 m (i.e. only the otter boards impacted the seabed), whereas including the full width of an otter trawl would increase the gear width (and possibly the area impacted) by an order of magnitude or more (Diesing et al., 2013). In contrast, van Denderan et al. (2015) sampled areas of Dogger Bank and detected trawling effects which they attributed to the relatively stable environmental conditions of Dogger Bank (low bed shear stress). It should also be noted that natural disturbance and fishing disturbance are not directly comparable with fishing resulting in pressures not associated with natural disturbance such as crushing and damage to infauna resulting from penetration into the sediment (ABPmer and Ichthys Marine, 2015). Therefore, the direct impacts of trawled fishing gear may not directly relate to the impacts of sediment mobilisation caused through natural disturbance, and it would be wrong to preclude negative impacts due to fishing disturbance in areas of high natural disturbance (Diesing et al., 2013).

However, demersal trawling has occurred in Dogger Bank SAC for decades (Plumeridge and Roberts, 2017). It has been suggested that intensive fishing - particularly the industrialisation of the North Sea steam trawl fleet - may have caused 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 central 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, **MMO conclude 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 km²) and Danish seine (1.0 km²), defined as the surface area covered during one hour of fishing, is relatively high compared to the otter trawl (0.3 – 1.2 km²) and beam trawl (0.2 km²) (Eigaard et al., 2016a, b; Rijnsdorp, 2015). The sub-surface footprint of Scottish seines (0.1 km²)

is estimated to be lower than the sub-surface footprint of otter trawls used for Nephrops (0.3 km²) or beam trawl fisheries (0.2 km²), 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 ground gear, seines tend to be considered as less damaging to seabed habitats (Polet and Depestele, 2010) via abrasion and penetration compared to other demersal gear types. Eigaard et al. (2016a, 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., 2016a, 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 covered in section 4.4 below) (van der Reijden et al. 2014; Verkempynck and 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, **MMO conclude 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 lifespans 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). However, van Denderan et al. (2015) sampled areas of Dogger Bank and found them to be relatively stable and not subject to high natural disturbance (low bed shear stress). As such, trawling effects were detected with the activity resulting

in community compositions comparable with those in areas subject to high natural disturbance.

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, at the time of writing, 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, **MMO conclude 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. **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 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 et 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 et 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. **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 And Penetration and/or disturbance of the substrate below the surface of the seabed, including abrasion	Sandbanks which are slightly covered by sea water 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
			Demersal trawls	No
			Demersal seines	No
			Dredges	No
		Restore structure and function: • Physical structure (finer scale	Anchored nets/lines	Yes

		topography and sediment composition and distribution) to be restored.	Traps	Yes
		• Biological structure (key and influential species and characteristic communities) to be restored.	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 cm³ litre⁻¹ (O'Neill and Summerbell, 2011). Per metre towed, an estimated 41.3 kilogram (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 millimetre (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 breathe²¹. 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 (Elliott 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 milligrams per litre (mg/l) with a maximum of 10 mg/l (Doerffer and Fischer, 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

²¹ JNCC Supplementary Advice of Conservation Objectives for Dogger Bank Special Area of Conservation <https://data.jncc.gov.uk/data/26659f8d-271e-403d-8a6b-300defcabc1/DoggerBank-3-SACO-v1.0.pdf>

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, **MMO conclude 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. **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 aggregate gear method	Compatible with the conservation objectives?
Changes in suspended solids (water clarity)	Sandbanks which are slightly covered by	Restore extent and distribution: The feature extent within the site must be conserved to the full	Demersal trawls	Yes

AND Smothering and siltation rate changes	sea water all the time	known distribution (sandbank feature calculated to be 12,331 km ²) based on: - large-scale topography - sediment composition - biological assemblages	Demersal seines	Yes
			Dredges	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.	Demersal trawls	Yes
			Demersal seines	Yes
			Dredges	Yes
		Maintain • Hydrodynamic regime to be maintained. • 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 SAC 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 and Morrow, 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 hauled²². 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 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, **MMO conclude 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.**

²² <https://seafish.org/gear-database/gear/pots-and-traps/>

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 and 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 Commission, 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 and 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 and 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

and Kaiser (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 and 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 central and eastern sections (Figure 3 to 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, **MMO conclude 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, Echinodermata, Mollusca and fish groups (van der Reijden et al., 2014; Verkempynck and 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 and 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 (Verschuere, 2015; Wijnhoven et al., 2013; Rijnsdorp 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 five per hour for Scottish seines with mesh size 100 – 119 mm versus one 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 two 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, **MMO conclude 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 ten 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 six 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, at the time of writing, 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, **MMO conclude 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. **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. **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 sea water 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)²¹. The sandbank feature of Dogger Bank SAC provides spawning and nursery grounds for sole, which migrate to the area (Ellis et al., 2012), and this species likely uses the site for feeding and thus benefits from a key function of the site (provision of nutrition)²¹.

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 (*Cancer 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 site²¹. These species are subject to minimum conservation size legislation, making it illegal for them to be retained 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, **MMO conclude 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

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.

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'²¹. 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 community' of Dogger Bank SAC²¹, 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 functional 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 sea water 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 (Winslade, 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 et 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.

Sandeels are considered a species component of the 'characteristic communities' of the site²¹. 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 1,000 tonnes of sandeels in the SAC from 2014 to 2018 (94 tonnes in 2019), whilst non-UK vessels landed approximately 49,100 tonnes of sandeels in the site from 2014 to 2018.

ICES advice in 2021 details how spawning-stock biomass for sandeels was above B_{lim} (biomass limit reference point) but below B_{pa} (biomass precautionary reference point) and therefore $MSY B_{escapement}$ (biomass reference point within the ICES maximum sustainable yield, MSY , framework) in 2020 (ICES, 2021). 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_{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 (Wright et al., 2018), including internal regulatory factors (such as density dependence) and external regulatory factors (such as climate-driven changes in prey availability) (Arnott and Ruxton, 2002; Daunt et al., 2017; van Deurs et al., 2009; Lindegren et al., 2018; MacDonald et al., 2015). 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, 2021; 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 ($\pm 95,978$ standard error of the mean) tonnes from 1983 to 1990, but 123,462 ($\pm 23,902$) tonnes from 2013 to 2020 (ICES, 2020b). Across all years (1983 – 2020), mean standing stock biomass 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 led 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.

There is considerable uncertainty around the impacts of sandeel fishing on the site. However, due to the association of sandeels with food provision and their strong habitat preferences (and therefore the potential for localised depletion in the site due to current fishing pressure), we cannot rule out an adverse effect on site integrity through the removal of this target species. As it cannot be ruled out that the removal of target species pressure where it concerns sandeels is not impacting the biological 'structure and function' of the sandbank feature via the reduced prevalence of this functional species, **MMO conclude that impacts from removal of 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.**

4.5.3 Impacts of demersal seines

Landings data indicates that considerable seining activity occurs in Dogger Bank SAC but what activity is occurring almost exclusively targets plaice (*Pleuronectes platessa*). As detailed in section 4.5.2, plaice are currently managed through TACs and other technical measures and are not listed as 'key and influential' species to the site nor are they species components of the site's 'characteristic communities'²¹. As such they will not be considered further in relation to management within Dogger Bank SAC for the pressure of removal of target species.

MMO conclude that impacts from removal of target species by demersal seines 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 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 SAC²¹ 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). **MMO therefore conclude 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.**

4.5.5 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. **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 SAC, 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. **MMO conclude that demersal trawls (including semi-pelagic trawls) 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, **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 sea water 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	Yes
			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 **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, **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 InfoRmatlon 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 (including semi-pelagic), seines, 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: 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	Four 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.
Surface infrastructure	Numerous active and two precommissioned platforms (oil and gas) are located within the Dogger Bank SAC. They occur mainly in the south of the site.
Subsurface infrastructure	Numerous (oil and gas) pipeline protection structures and some valves, manifolds, well heads and tee pieces. All are located in the south of the Dogger Bank SAC associated with platforms and pipelines.
Wellheads	Numerous wellheads dispersed across the whole Dogger Bank SAC. A higher concentration is observed in the south of the area. These are noted to be exploration, development and appraisal wellheads.
Offshore oil and gas infrastructure operations and maintenance	The majority of the oil and gas infrastructure is operational, and it can be inferred there will be associated operations and maintenance activities.
Offshore oil and gas infrastructure decommissioning	As oil and gas reserves have a finite lifespan it can be assumed there will be decommissioning activities when infrastructure reaches the end of its productive life. It is likely these activities will take place in the near future.
Hydrocarbon fields	Hydrocarbon fields are present across the southern extents of the Dogger Bank SAC.
Oil and gas exploratory activities	Hydrocarbon fields are present within the Dogger Bank SAC. It can be

	assumed exploratory activities to exploit these fields and potential new reserves will be taking place. The presence of exploratory wellheads supports this. Oil and gas exploratory activities comprise geophysical activities and physical drilling of boreholes.
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To identify the specific pressures that the activities exert on the Dogger Bank SAC sandbank feature, MMO has used JNCC's PAD¹⁵ 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.

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 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
Surface infrastructure	Oil, gas and carbon capture storage	Oil and gas production
Subsurface infrastructure	Oil, gas and carbon capture storage	Oil and gas production
Well Heads	Oil, gas and carbon capture storage	Oil and gas production Oil and gas exploration and installation
Offshore oil and gas infrastructure operations and maintenance	Oil, gas and carbon capture storage	Oil and gas production
Offshore oil and gas infrastructure decommissioning	Oil, gas and carbon capture storage	Oil and gas decommissioning
Hydrocarbon Fields	Oil, gas and carbon capture storage	Oil and gas exploration and installation
Oil and gas exploratory activities	Oil, gas and carbon capture storage	Oil and gas exploration and installation

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; oils and gas surface and subsurface infrastructure, wellheads, infrastructure operations and maintenance, 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 and maintenance	Exerted by Power cable: operation and maintenance	Exerted by Power cable: laying, burial and protection	Exerted by Offshore wind: during construction	Exerted by Offshore wind: Operation and maintenance	Exerted by Sea surface military activity	Exerted by Dredge and soil disposal	Exerted by Pipelines	Exerted by Oil and gas production	Exerted by Oil and gas exploration and installation	Exerted by Oil and gas decommissioning	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	N	Y	Y	Y
Changes in suspended solids (water clarity)	Y	Y	Y	Y	Y	Y	Y	N	N	N	Y	N
Deoxygenation	N	Y	Y	N	N	Y	Y	Y	Y	N	N	Y
Electromagnetic changes	N	Y	N	N	N	N	N	N	N	N	N	N
Habitat structure changes - removal of substratum (extraction)	N	N	Y	Y	Y	Y	N	Y	N	Y	Y	N
Hydrocarbon and PAH contamination. Includes those priority substances listed in Annex II of Directive 2008/105/EC.	Y	Y	Y	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	Y	Y	Y	N
Introduction or spread of invasive non-indigenous species (INIS)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Litter	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y
Nutrient enrichment	N	Y	Y	N	N	Y	Y	Y	N	N	N	N
Organic enrichment	N	N	N	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	Y	Y	Y
Physical change (to another seabed type)	Y	Y	Y	Y	Y	N	Y	Y	N	N	Y	N
Physical change (to another sediment type)	N	N	N	N	N	N	Y	N	N	N	N	N

Radionuclide contamination	N	N	N	N	N	N	Y	N	Y	N	N	N
Removal of non-target species	N	N	N	N	N	N	N	N	N	N	N	Y
Removal of target species	N	N	N	N	N	N	N	N	N	N	N	Y
Siltation rate changes (high), including smothering (depth of vertical sediment overburden)	N	N	Y	Y	Y	N	Y	N	N	N	N	N
Siltation rate changes (low), including smothering (depth of vertical sediment overburden)	Y	Y	Y	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	Y	Y	Y
Temperature changes - local	N	Y	N	N	N	N	N	N	N	N	N	N
Transition elements and 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	Y	Y	Y
Vibration	Y	Y	Y	Y	Y	N	N	Y	Y	Y	Y	N
Water flow (tidal current) changes, including sediment transport considerations	Y	Y	Y	Y	Y	N	N	Y	Y	N	Y	N
Wave exposure changes - local	N	N	N	N	N	Y	N	N	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 with the exception of oil and gas production. 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 do 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 spoil 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 albeit with an increase in potting in 2019.

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 m (Luger and 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 Tata 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 activity²³ dependent on the type of cable, whether cable protection

²³ <https://www.gov.uk/government/publications/marine-licensing-exempted-activities/marine-licensing-exempted-activities#cables-pipelines-oil-and-gas-and-carbon-capture-storage>

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 the Habitats Regulations if they have the potential to affect a Natura 2000 site (such as Dogger Bank SAC)²⁴. Therefore, it is unlikely that operation and maintenance of existing submarine cables 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. 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). For example, it is estimated that an 11.5 tonne anchor can penetrate up to 0.88 m in soft sediment when dropped and

²⁴ <https://www.thecrownestate.co.uk/media/1784/submarine-cables-and-offshore-renewable-energy-installations-proximity-study.pdf>

dragged for 87 m (Luger and Harkes, 2013), although this estimation was based on a site to the north of Norderney, Germany, in the southern North Sea.

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, 2014). This is estimated to be the top 0.75 cm of the sediment (Forewind, 2014). 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, 2014).

Leased areas for these windfarms are located over the subtidal sand bank feature of the SAC where fishing activities occur. However, the pressures on the site associated with the construction, operation and maintenance of the windfarm have 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 adopted²⁵.

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 repairs²³, 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.

Oil and gas production comprises the operation of platforms including supporting supply and maintenance vessels. Abrasion is not an identified pressure for oil and gas production, however penetration from anchors from support vessels is, as with the operation and maintenance of telecommunication and power cables, discussed above. Mooring chains for vessels may also scour the seabed as they rotate with the tide.

²⁵<https://infrastructure.planninginspectorate.gov.uk/wpcontent/ipc/uploads/projects/EN010051/EN010051-002090-Habitats%20Regulations%20Assessment.pdf>

Oil and gas exploration and installation includes seismic surveys, exploratory wells and the installation of structures above and below the sea surface followed by drilling operations, and includes operations by supporting vessels.

Seismic surveys do not interact with the designated feature of the sandbank and are therefore unlikely to have in-combination effects with traps and anchored nets/lines, therefore are not considered further here.

Exploratory drilling operations and installation of platform foundations and associated infrastructure will lead to penetration and abrasion via placement of infrastructure, scour protection around spudcans and use of jack-up barges or other installation and exploratory drilling vessels. Abrasion may also occur as cuttings from drilling operations can build up into piles around the platforms in areas where currents are generally weak (DTI, 2001) and as previously described penetration and abrasion can also occur via anchored and moored vessels.

Decommissioning activities comprise the plugging and abandonment of wells, removal of structures and associated habitat, use of explosives, cutting and drilling. Disturbance of drill risings and cuttings may occur. To facilitate this, other activities include placement of rock cover to remaining structures or to provide base for jack-up legs and operation by supporting vessels, vessel discharges, use of remotely operated vehicles, lifting and jack-up rigs.

During decommissioning, abrasion disturbance and or penetration of the seabed may occur due to the use of vessels carrying out decommissioning works with either jack-up legs which cause depressions on the seabed (DECC, 2011) or anchors (ABPmer, 2011). Additional rock protection may be placed on the seabed where required leading to abrasion/disturbance (DECC, 2011). Temporary excavation pits may be required to access buried structures or enable the removal of structures at or below the seabed level (ConocoPhillips, 2015). Clearance of the redundant foundation and well templates of any overlying cuttings material is required to enable removal operations. Damage to the seabed may be caused by deployment of anchors from vessels used in decommissioning of the oil and gas installation, the subsequent dragging and locking of the anchors and movement of the chain on the seabed causing abrasion and scour whilst at anchor and upon recovery (The Green Blue, 2009).

As with marine licensable activities, offshore oil and gas activities are subject to the Conservation of Offshore Marine Habitats and Species Regulations 2017 and other legislation²⁶, and are therefore obliged to complete appropriate assessments of the impacts of activities to marine protected areas. This is regulated by the Oil and Gas Authority (OGA) for exploration and development and the Offshore Petroleum

²⁶ <https://www.gov.uk/guidance/oil-and-gas-offshore-environmental-legislation>

Regulator for Environment and Decommissioning (OPRED) for decommissioning. Therefore, it is unlikely that oil and gas production, exploration and installation and decommissioning will have a significant in-combination impact with fishing and other activities via this pressure.

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, disposal sites and oil and gas production.

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 ballast²⁷. 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 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 the Habitats Regulations if they have the potential to affect the site²⁴. 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.

²⁷

www.gov.uk/government/uploads/system/uploads/attachment_data/file/441098/MGN_501_Combined.pdf

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 and 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).

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.

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 pathway of deoxygenation by oil and gas production is also through sediment mobilisation and increased suspension of sediments, as well as the deposition of organic matter. During production, offshore drilling activities can discharge large amounts of drill cuttings and result in increased sedimentation around oil and gas installations, which can lead to an increased risk of oxygen depletion (Tranum et al., 2010). However, as for other plans and projects, the extent and nature of the changes depends on the hydrodynamics of the area. Given the dynamic nature of Dogger Bank SAC, the water column is likely to be rapidly re-oxygenated. Furthermore, the sandbank feature is not considered sensitive to the pressure of deoxygenation for oil and gas production.

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, 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 and PAH contamination

This section is also relevant to transition elements and organo-metal (e.g. Tributyltin (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. Three sandbank sub-features (subtidal coarse sediment, subtidal mixed sediments and subtidal sand) are considered not sensitive to this pressure for oil and gas activities (exploration and installation, production, and decommissioning), whereas there is insufficient evidence to assess the sensitivity of subtidal mud to this pressure for oil and gas 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 and vessels used in the oil and gas industry. 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 1999²⁸. 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 practicable²⁹. 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 and oil and gas support vessels are therefore unlikely to contribute considerably to the minor, existing impact from fishing vessels via this pressure.

Organo-metal contamination may occur through antifouling compounds like copper wash and TBT from ship coatings. However, fishing, Ministry of Defence, oil and gas, cabling and windfarm vessels comply with IMO standards for hull coatings³⁰ and so are unlikely to contribute via this pathway.

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, 2014).

Pipelines and oil and gas activities (exploration and installation, production and decommissioning) may be a source of hydrocarbon and PAH contamination. Cuttings from drilling operations and old cutting piles may contain organic-phase drilling fluids, which may be disturbed during decommissioning of pipelines and oil and gas infrastructure (BEIS, 2019). Cuttings are often discharged in piles at the location of oil and gas wells, and these piles have been identified as possible sources of hydrocarbon release in the North Sea (Breuer et al., 2004). Although during oil and gas production, cuttings piles may remain largely undisturbed, during decommissioning of offshore infrastructure, cuttings piles can be disturbed (BEIS, 2019). This can lead to the release of hydrocarbons and contaminated cuttings into the marine environment following remobilisation of residues of oil still found in the piles and natural leaching from the piles into the water column (BEIS, 2019). However, monitoring undertaken at oil and gas infrastructure sites within the SAC recorded no evidence of cuttings piles from drilling activities and although there may be some localised disturbance of contaminated sediments during decommissioning, any contamination is predicted to rapidly disperse (BEIS, 2019). Furthermore, 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,

²⁸ <https://www.imo.org/en/OurWork/Environment/SpecialAreasUnderMARPOL/Pages/Default.aspx>

²⁹ www.mar.ist.utl.pt/mventura/Projecto-Navios-I/IMO-Conventions%20%28copies%29/MARPOL.pdf

³⁰ https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/236102/8284.pdf

pipelines and oil and gas activities are unlikely to contribute to the existing impact from fishing vessels via this pressure.

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, pipelines and oil and gas activities (exploration and installation, production, and decommissioning) 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, 2014). 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, 2014).

Oil and gas activities provide direct and indirect pathways for the introduction of INIS (OGP, 2010) and the sandbank feature is considered sensitive to this pressure from oil and gas production, exploration and installation, and decommissioning. Structures (e.g. rigs and platforms) can directly introduce INIS if, for example, a biofouled rig is towed across biogeographic boundaries (Wanless et al., 2010), however, removing encrusting or fouling organisms from rig surfaces before relocation reduces the risk of spreading INIS (Macreadie et al., 2011; Wanless et al., 2010). Oil and gas structures can also indirectly facilitate INIS by providing significant habitat (Fowler et al., 2020). However, North Sea oil and gas platforms are not expected to play a large role in the distribution of invasive species (IMSA Amsterdam, 2011), with shipping

(ballast water) and climate change considered the most important factors (IMSA Amsterdam, 2011). The Habitats Regulations Assessment undertaken by the Department for Business Energy and Industrial Strategy (BEIS, 2019) in respect to future oil and gas decommissioning activities in Dogger Bank SAC did not identify this pressure as one that could affect the qualifying features of the SAC.

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 Sediments³¹ 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.

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, pipelines, and oil and gas production, exploration and installation and decommissioning This pressure is relevant to the vessels and platforms associated with the activity. Vessels may release litter accidentally, due to inappropriate storage, or deliberately (Potts and Hasting, 2011; Lozano and 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

³¹ [https://www.imo.org/en/About/Conventions/ListOfConventions/Pages/International-Convention-for-the-Control-and-Management-of-Ships'-Ballast-Water-and-Sediments-\(BWM\).aspx](https://www.imo.org/en/About/Conventions/ListOfConventions/Pages/International-Convention-for-the-Control-and-Management-of-Ships'-Ballast-Water-and-Sediments-(BWM).aspx)

gear (Lozano and Mouat, 2009). These may cause damage to benthic habitats through abrasion or ghost fishing.

Vessels of any type operating in the marine environment including hydrofoil boats, air-cushion vehicles, submersible, floating craft and fixed or floating platforms, bar those attaining to the Navy, adhere to MARPOL Convention requirements²⁸ 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 practicable²⁹ 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 fishing activities.

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.

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

MMO conclude, 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

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.

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, MMO conclude 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.

With regard to management option 2, MMO has analysed the best available habitat and biotope evidence available for Dogger Bank SAC and using JNCC's marine evidence-based sensitivity assessment (MarESA)³² assigned likely sensitivities of the habitats to the pressures associated with bottom towed gears. While this identified some areas of the sandbank habitat considered to have lower sensitivity, the habitat data and therefore its sensitivity is derived from environmental variables used in the habitat modelling process. The low sensitivity of the modelled habitat data is therefore directly linked to natural disturbance. As discussed previously, despite their expected low sensitivity it would be wrong to conclude that additional disturbance imposed by fishing, on top of background natural disturbance, is inconsequential to these habitats, as fishing impacts may provide additional sources of mortality (Diesing et al., 2013). This is particularly important considering the current unfavourable status of the sandbank feature that has been attributed, in large

³² <https://jncc.gov.uk/our-work/marine-sensitivity-assessments/#marine-evidence-based-sensitivity-assessment-maresa>

part, to the long history of demersal fishing activity that has taken place (NSRAC 2011).

Option 2 may result in increased bottom towed gear activity and associated impacts in areas that remain open to bottom towed gears due to displacement from prohibited areas. This is likely to hinder the conservation objective to restore the sandbank habitat of Dogger Bank SAC to favourable status, particularly in areas that remain open to bottom towed gears. Given the uncertainty and conflicting evidence regarding the impact of bottom towed gears on the sandbank feature, MMO cannot, beyond reasonable scientific doubt, in light of the conservation objectives, rule out an adverse effect on site integrity if areas of Dogger Bank SAC remain open to bottom towed gears. Following the management decision tree detailed in Annex 4 and the precautionary approach, MMO must therefore conclude that management option 2 would put furthering the conservation objectives of Dogger Bank SAC at significant risk and therefore this option is not considered sufficient to avoid an adverse effect on site integrity.

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 certain fishing activities. This option would remove the impact of bottom towed fishing from all areas of the site and is the most likely to contribute to furthering 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 implemented 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.

MMO has produced a Regulatory Triage Assessment (RTA) which considers the wider impacts of the proposed management measures including environmental and socio-economic impacts. The estimated monetised total cost to UK businesses over ten years is expected to be £4,127,885 (2020 present value). This includes an equivalent annual net direct cost to business (EANDCB) of £479,558 (2020 present value). For further details please see the Dogger Bank SAC RTA published alongside this assessment.

MMO strives to avoid any unnecessary costs to the fishing industry, financial or otherwise in the development of management measures, however, MMO has legal obligations in relation to SACs under the Conservation of Offshore Marine Habitats and Species Regulations 2017 Regulation 6³³ to ensure compliance with the Habitats

³³ <https://www.legislation.gov.uk/ukxi/2017/1013/contents/made>

Directive³⁴. Of particular relevance to marine conservation is section 6(2): to avoid the deterioration of habitats and disturbance of designated species. The proposed management measure outlined in the assessment are deemed necessary to meet this duty.

Marine Plans

Dogger Bank SAC lies within the East Marine Plan Area. The East Marine Plan³⁵ 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.

³⁴ <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:31992L0043>

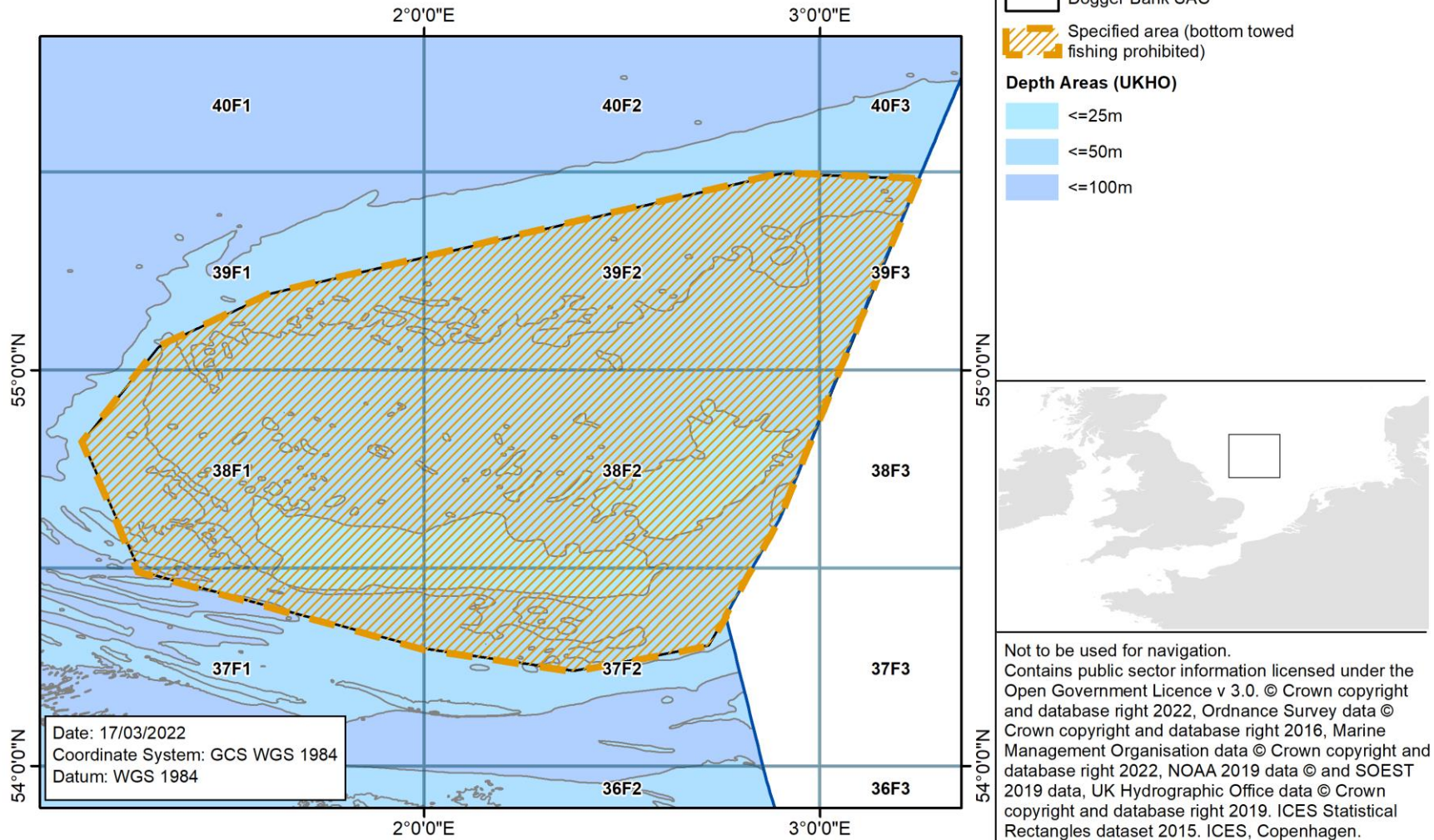
³⁵ <https://www.gov.uk/government/collections/east-marine-plans>

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



Marine
Management
Organisation

Dogger Bank Special Area of Conservation (Specified Area) Bottom Towed Fishing Gear Byelaw 2022



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 MMO's 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 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 has 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)³⁶. 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 63 of the Habitats Regulations. The revised approach was extended to include management of commercial fisheries in marine conservation zones (MCZ) in 2014³⁷.

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 blue³⁸.

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 63 of the Habitats Regulations 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 site’s 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.

³⁶ www.gov.uk/government/publications/revised-approach-to-the-management-of-commercial-fisheries-in-european-marine-sites-overarching-policy-and-delivery

³⁷ 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

³⁸Managing Fisheries in MPAs matrix: www.gov.uk/government/publications/fisheries-in-european-marine-sites-matrix

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.

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 rectangle³⁹ 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.

³⁹ 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

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 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.⁴⁰

Vulnerability is defined as: ***a combination of the sensitivity of a feature to a particular pressure/activity, and its exposure to that pressure***

⁴⁰ 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

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.*, 2012⁴¹) as a method to quantify fishing pressure within an area of interest (AOI) such as a ‘fishing impact equation’ where:

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

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

⁴¹ 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

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
- **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).

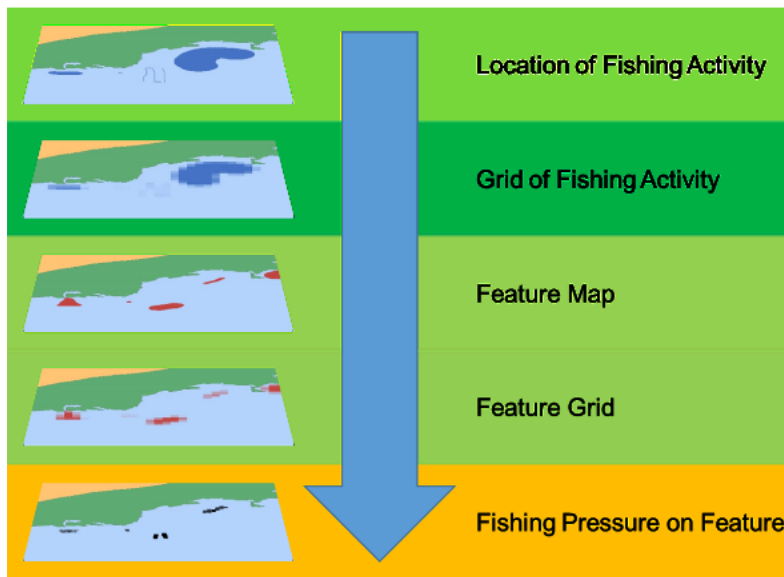
1.2. Developing the equation further

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 demersal 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 -	Gear is shot on the seabed in a rounded triangle shape with very long weighted ropes attached to each end of

	Scottish/fly seine	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 m²) or 0.2025 km², 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:

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

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

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

This gives an estimate of the area (in m²) 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 (m²)
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 and ≥ 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 km² for each cell.
9. Total gear footprint is calculated by multiplying single VMS report gear footprint by the cell area (0.2025 km²). 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 (km²)
- AOI name (text)
- Total VMS report area (km²): Sum of unique cell areas (0.2025 km²) where VMS reports occur.
- Total gear footprint (km²): Total area impacted by fishing gear.
Total no. of fishing VMS reports * cell area (0.2025) * single VMS report gear footprint
- Pr-value: Total extent of AOI impacted by gear. $\frac{\text{Total gear footprint}}{\text{AOI}}$
- Pr-value percentage (%): Percentage of AOI impacted by gear.
 $\frac{\text{Total gear footprint}}{\text{AOI}} * 100$

3. Pr-value Assumptions

3.1. Gear Calculators

A cell is 450 m by 450 m or 0.2025 km². 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 km² net. Information derived from marine institute estimates⁴²
- 4 hauls per day, from an MMO officer

Scottish seines (SDN):

- Based on a vessel shooting a 2.854 km² net. Information derived from seafish⁴³
- Scottish seines only take 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 hrs⁴⁴)

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 0-6 knots.
- VMS data is only available for > 12 m vessels.

3.3. MPA sites and designated features assumptions

It has been assumed that:

- 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.

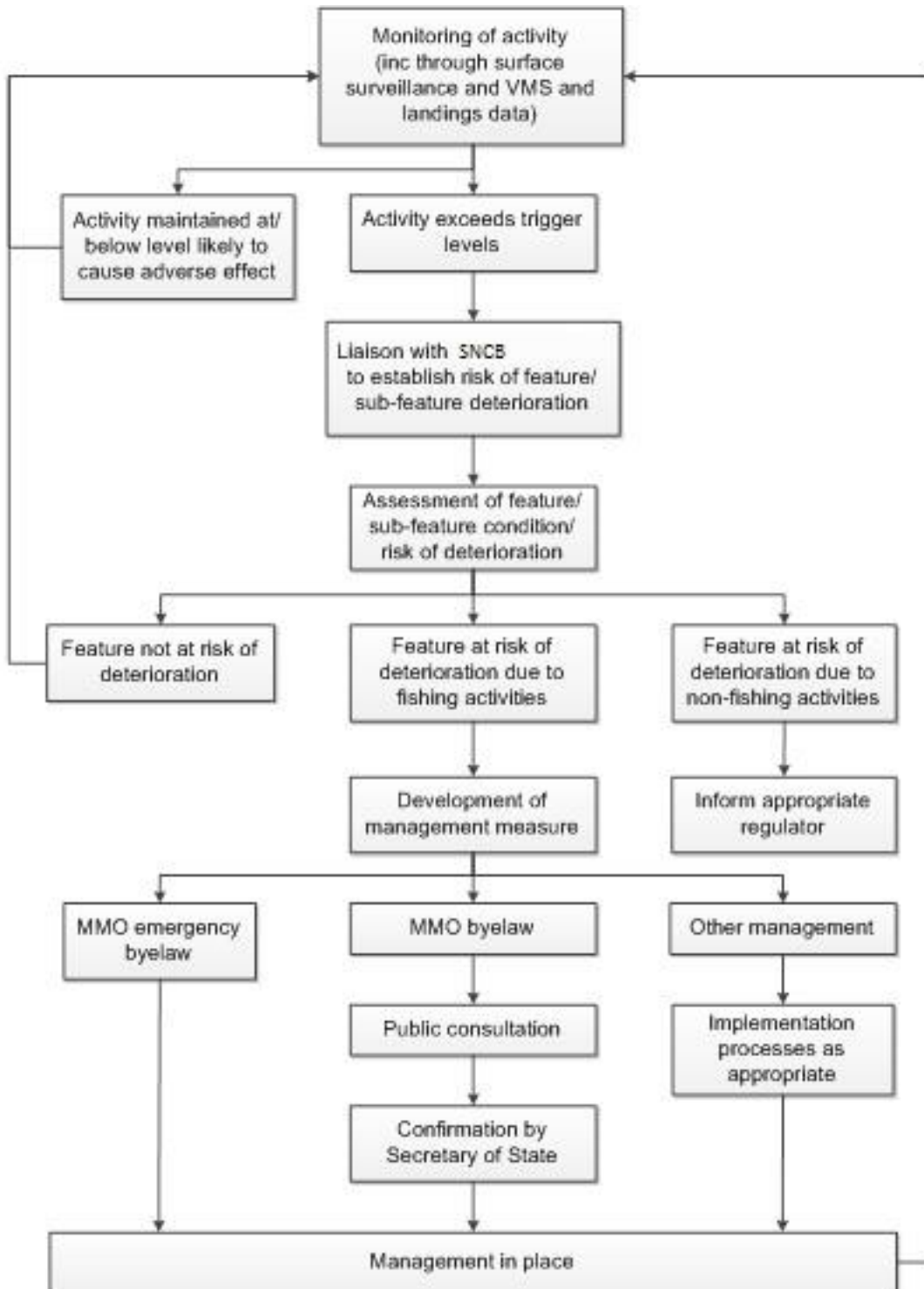
⁴² https://seafish.org/gear-database/wp-content/uploads/2015/06/Seine-Net-Fishing-Workshop_Report_May2008.pdf

⁴³ <https://seafish.org/gear-database/wp-content/uploads/2015/06/Seine-net-CR47.pdf>

⁴⁴ <https://seafish.org/gear-database/gear/scottish-seine/>

Annex 3 - Monitoring and Control Process

Figure 19: Monitoring and control process



Annex 4 - MMO MPA management decision tree

MMO has legal obligations in relation to Marine Conservation Zones (MCZs) and European Marine Sites (EMS) which include Special Areas of Conservation (SAC) and Special Protection Areas (SPA):

- Under the Conservation of Habitats and Species Regulations, 2017 reg 9 and Conservation of Offshore Marine Habitats and Species Regulations, 2017 reg 6 to secure compliance with the requirements of the Habitats Directive. Of particular relevance to marine conservation is section 6(2): to avoid the deterioration of habitats and disturbance of designated species; and
- Under the Marine and Coastal Access Act, 2009 125(2)(a) to consider using its functions that best furthers the conservation objectives stated for the MCZ.

Site-level assessments are carried out in a manner consistent with the requirements of section 126 of the Marine and Coastal Access Act 2009 for MCZ and Article 6(3) of the Habitats Directive for EMS, which relates to assessments completed for plans and projects.

The assessments determine whether:

- For EMS, fishing activities are having an adverse effect on the integrity of the site.
- For MCZ, there is a significant risk of fishing activities hindering the conservation objectives of the site.

If this is the case MMO has a legal duty to appropriately manage these activities to ensure compliance with the Habitats Regulations and MaCAA. Proposed management measures generally fall within one of two approaches:

1. Reduction of pressures associated with fishing gear(s) of concern:
 - zoned management (partial site/feature prohibition of these gears)
2. Removal of pressures associated with fishing gear(s) of concern:
 - a whole site/feature prohibition of these gears

To determine the most appropriate management approach MMO adheres to the decision tree detailed in Figure 20.

MMO make use of the best available habitat/biotope data and JNCC's Marine Evidence-based Sensitivity Assessment (MarESA), along with SNCB conservation advice and scientific evidence provided in the fisheries assessment to identify areas within the site where the feature(s) may be suitably resilient, or of lower sensitivity (resistant) to the pressures associated with the fishing gear(s) of concern. If the feature(s) present are identified from the scientific evidence-base as being potentially more resilient and/or resistant to the gear(s) of concern, consideration is given to areas within the site where these feature(s) are present that could potentially remain open, either with or without restrictions on fishing activity levels.

As an independent coastal State, MMO in its assessment of the evidence must fulfil its regulatory duties and responsibility to ensure compliance with the Conservation of Offshore Marine Habitats and Species Regulations 2017; to exercise all relevant functions to ensure compliance with the Habitats Regulations. Having regard to the current conservation status of the site/feature(s) and the site's conservation objectives, MMO must be satisfied beyond reasonable scientific doubt, that fishing gear(s) of concern can continue within the site/feature(s) at reduced capacity (zoned management approach) and/or restricted activity levels without compromising compliance with its regulatory duties and responsibilities. MMO will act in accordance with the precautionary principle, and this includes when the scientific evidence-base indicates that an adverse effect on the integrity of the site (EMS) and/or significant risk of hindering the conservation objectives of the site (MCZs) cannot be avoided.

If MMO is not satisfied, beyond reasonable scientific doubt, that a reduce/limit management approach will allow compliance with its duties under the Habitats Regulations/MaCAA, a removal of pressure will be deemed necessary for the gear/feature interaction(s) and a full site/feature(s) prohibition of the fishing gear(s) of concern will be implemented (whole site prohibition).

Figure 20. MMO MPA management decision tree

