Document Control

Title	**DRAFT Inner Dowsing, Race Bank and North Ridge Special Area of Conservation Marine Management Organisation Fisheries Assessment**
Authors	R Joyce, A Pearson-Ross, C Williams, E Johnston, J Duffill Telsnig, T Barnfield
Approver	V Morgan, N Greenwood
Owner	R Joyce

Revision History

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DRAFT Inner Dowsing, Race Bank and North Ridge Special Area of Conservation (SAC) Marine Management Organisation Fisheries Assessment 2020

1. Summary

Table 1 shows a summary of the outcomes of this assessment regarding the impact of fishing activities on site features.

Table 1: Assessment Summary

Feature	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)	Likely to have a significant effect	May result in adverse effect on site integrity	N/A
	Mussels, clams, oysters dredges			
	Pump scoop dredges (cockles, clams)	Not likely to have a significant effect	N/A	N/
	Suction dredges (cockles)			
	Hand working (access from vessel)			
	Longlines (pelagic)			
	Longlines (demersal)			Will not result in adverse effect on site integrity
	Pots/creels (crustacea/gastropods)	Likely to have a significant effect	Will not result in adverse effect on site integrity	
	Cuttle pots	Not likely to have a significant effect	N/A	N/A
	Fish traps			
	Drift nets (pelagic)			
	Drift nets (demersal)			
	Crab tiling			
	Digging with forks			
	Purse seine			
	Mid-water trawl (single) (pelagic)			
	Mid-water trawl (pair) (pelagic)			
	Gill nets	Likely to have a significant effect	Will not result in adverse effect on site integrity	Will not result in adverse effect on site integrity
	Trammels nets			
	Entangling nets			
	Beam trawl (whitefish)		May result in adverse effect on site integrity	N/A
	Beam trawl (shrimp)			
	Heavy otter trawl	Not likely to have a significant effect	N/A	
	Multi-rig trawls	Likely to have a significant effect	May result in adverse effect on site integrity	
	Light otter trawl			
	Pair trawl			
	Anchor seine			
	Scottish/fly seine			

	Scallop dredges			
H1170 Reef *Sabellaria spinulosa* reefs	Beam trawl (pulse/wing)	Management required. Red risk feature interactions not in scope of assessment	N/A	N/A
	Mussels, clams, oysters dredges			
	Pump scoop dredges (cockles, clams)			
	Suction dredges (cockles)	Not likely to have a significant effect		
	Hand working (access from vessel)			
	Longlines (pelagic)			
	Drift nets (pelagic)			
	Crab tiling			
	Digging with forks			
	Purse seine			
	Mid-water trawl (single) (pelagic)			
	Mid-water trawl (pair) (pelagic)			
	Pots/creels (crustacea/gastropods)	Likely to have a significant effect	May result in adverse effect on site integrity	N/A
	Cuttle pots	Not likely to have a significant effect	N/A	
	Fish traps			
	Longlines (demersal)	Likely to have a significant effect	May result in adverse effect on site integrity	N/A
	Drift nets (demersal)	Not likely to have a significant effect	N/A	
	Gill nets	Likely to have a significant effect	May result in adverse effect on site integrity	
	Trammels			
	Entangling			
	Beam trawl (whitefish)	Management required. Red risk feature interactions not in scope of assessment	N/A	N/A
	Beam trawl (shrimp)			
	Heavy otter trawl			
	Multi-rig trawls			
	Light otter trawl			
	Pair trawl			
	Anchor seine			
	Scottish/fly seine			
	Scallop dredges			

2. Introduction

Table 2 shows the name and legal status of the site. Inner Dowsing, Race Bank and North Ridge SAC is located off the south Lincolnshire coast, to the east of Skegness and extends eastwards and north from Burnham Flats on the North Norfolk coast.

Table 2: Site details

Name of site	Legal status
Inner Dowsing, Race Bank and North Ridge	Special Area of Conservation (SAC)

The SAC subject to this assessment is within International Council for the Exploration of the Sea (ICES) rectangle 35F0 and 35F1. The site is situated on the approaches to The Wash, and crosses the 6 nautical mile (nm) boundary and therefore falls under two different administrative areas: the District of the Eastern Inshore Fisheries and Conservation Authority (Eastern IFCA; 0 – 6 nm) and the Marine Management Organisation (MMO; beyond 6nm). These different administrative areas will be denoted as inshore (Eastern IFC District) and offshore (MMO area) throughout the assessment. The site is designated for the Annex I features 'Sandbanks which are slightly covered by sea water all the time' and 'Reef' (*Sabellaria spinulosa* reefs, Table 3). The sandbanks are important headland-associated offshore systems. Water depths are generally shallow and mostly less than 30 meters deep.

Inner Dowsing, Race Bank and North Ridge SAC crosses the 12 nm boundary and it is therefore covered by both Natural England (NE) and Joint Nature Conservation Committee (JNCC) who have provided joint advice on this conservation advice package[1]. In 2019, the site condition was reassessed and found to be in unfavourable condition and the conservation objective is to restore both features to favourable condition (Table 3).

The conservation objectives for the SAC are to ensure that, 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:

- the extent and distribution of qualifying natural habitats and habitats of the qualifying species
- the structure and function (including typical species) of qualifying natural habitats
- the structure and function of the habitats of the qualifying species

[1] The NE and JNCC conservation advice package https://designatedsites.naturalengland.org.uk/Marine/MarineSiteDetail.aspx?SiteCode=UK0030370&SiteName=Inner%20Dowsing,%20Race%20Bank%20and%20North%20Ridge%20SAC&SiteNameDisplay=Inner%20Dowsing,%20Race%20Bank%20and%20North%20Ridge%20SAC&countyCode=&responsiblePerson=&SeaArea=&IFCAArea=&NumMarineSeasonality=&HasCA=1

- the supporting processes on which qualifying natural habitats and the habitats of qualifying species rely
- the populations of each of the qualifying species
- the distribution of qualifying species within the site

Abundant Sabellaria spinulosa (*S. spinulosa)* agglomerations have consistently been recorded within the boundary of the site, the patches of reef have been found within 6 nm, in the 6 - 12 nm portion of the site and outside of 12 nm, the reef patches also straddle the aforementioned boundaries. Survey data indicate that reef structures are concentrated in certain areas of the site, with a patchy distribution of crust-forming aggregations across the site.

Figure 1 shows the best current understanding of the distribution of designated features within the Inner Dowsing, Race Bank and North Ridge SAC. Feature data was provided by email to the MMO by NE and JNCC on 29 July 2020.

Table 3: Designated features

Feature	**Sub-feature**	**Conservation objective**
Sandbanks which are slightly covered by sea water at all times	Subtidal sand, subtidal coarse sediment, subtidal mixed sediments	Restore feature to favourable condition
Reef	Subtidal biogenic reefs: *Sabellaria spinulosa.*	Restore feature to favourable condition

2.1 Sandbanks

Two areas of sandbanks which are slightly covered by water at all times feature in this site, the Inner Dowsing sandbank occurs beyond 6nm and the Race Bank sandbank which extends mostly beyond 12 nm (Figure 1).

The NE and JNCC conservation advice package for this site notes that sandbanks feature consists of three sub-features:

- subtidal coarse sediment;
- subtidal mixed sediment; and
- subtidal sand.

The crests and flanks of the sandbanks are characterised by low diversity communities of polychaete worms and amphipods. The troughs which separate the sandbanks contain a diverse mosaic of biotopes on mixed and gravelly sands. Biogenic reef created by *S. spinulosa* has consistently been recorded within the site and the aggregations provide additional hard substrate for the development of rich

epifaunal communities. Representative communities equate to a number of biotopes including SS.SSa.IFiSa.NcirBat (*Nephtys cirrosa* and *Bathyporeia* spp. in infralittoral sand) and SS.SSa.IFiSa.IMoSa (infralittoral mobile clean sand with sparse fauna) (Entec, 2008b). In more gravelly areas a diverse attached epifauna is present, including bryozoans, sponges, hydroids (*Hydrallmania falcata*, *Tubularia indivisa*) and tube building worms (*Pomatoceros* sp). The tube building amphipod *Ampelisca diadema* is also abundant in some areas. Mobile epifauna include a variety of brittle stars and small crabs as well as pink shrimp (*Pandalus montagui*) and lobster (*Homarus gammarus*). In a number of places mussel (*Mytilus edulis*) density is reasonably high (JNCC and NE, 2010a and 2010b).

The sandbanks provide an ideal spawning and nursery ground for commercially important fish such as the sandeel (*Ammodytes sp.)* and Atlantic herring (*Clupea harengus*) while also providing important feeding grounds for lemon sole (*Microstomus kitt*) and European plaice (*Pleuronectes platessa*).

Within the distribution of designated features (Figure 1), NE and JNCC have applied a 500 metre margin to the known area of sandbank as a result of uncertainty in relation to feature delineation, as well as potential for broad-scale migration of the sandbank feature as well as finer scale oscillation due to hydrological processes[2]. NE and JNCC have advised that the entire area (including the margin) should be managed as sandbank in order to incorporate these processes.

2.2 Reefs

S. spinulosa reefs are an ephemeral sub-feature which is subject to constant creation and destruction across its possible range, it can also exhibit relative stability and be continuously present in named areas for prolonged periods (Woo, 2008). Identified areas of *S. spinulosa* reef are therefore subject to a higher level of uncertainty than many other habitat features. *S. spinulosa* reefs provide vital attachment points for both infauna and epifauna, as well as stabilising sediments. They support a variety of bryozoans, hydroids, sponges and anemones as well as the common lobster, *Homarus gammarus*, and the commercially exploitable pink shrimp, *Pandalus montagui*. This site is one of only 12 in the UK that contains this form of reef, while extensive sandbanks are only found in the North Sea along the East Anglian coast (JNCC and NE, 2010a and 2010b).

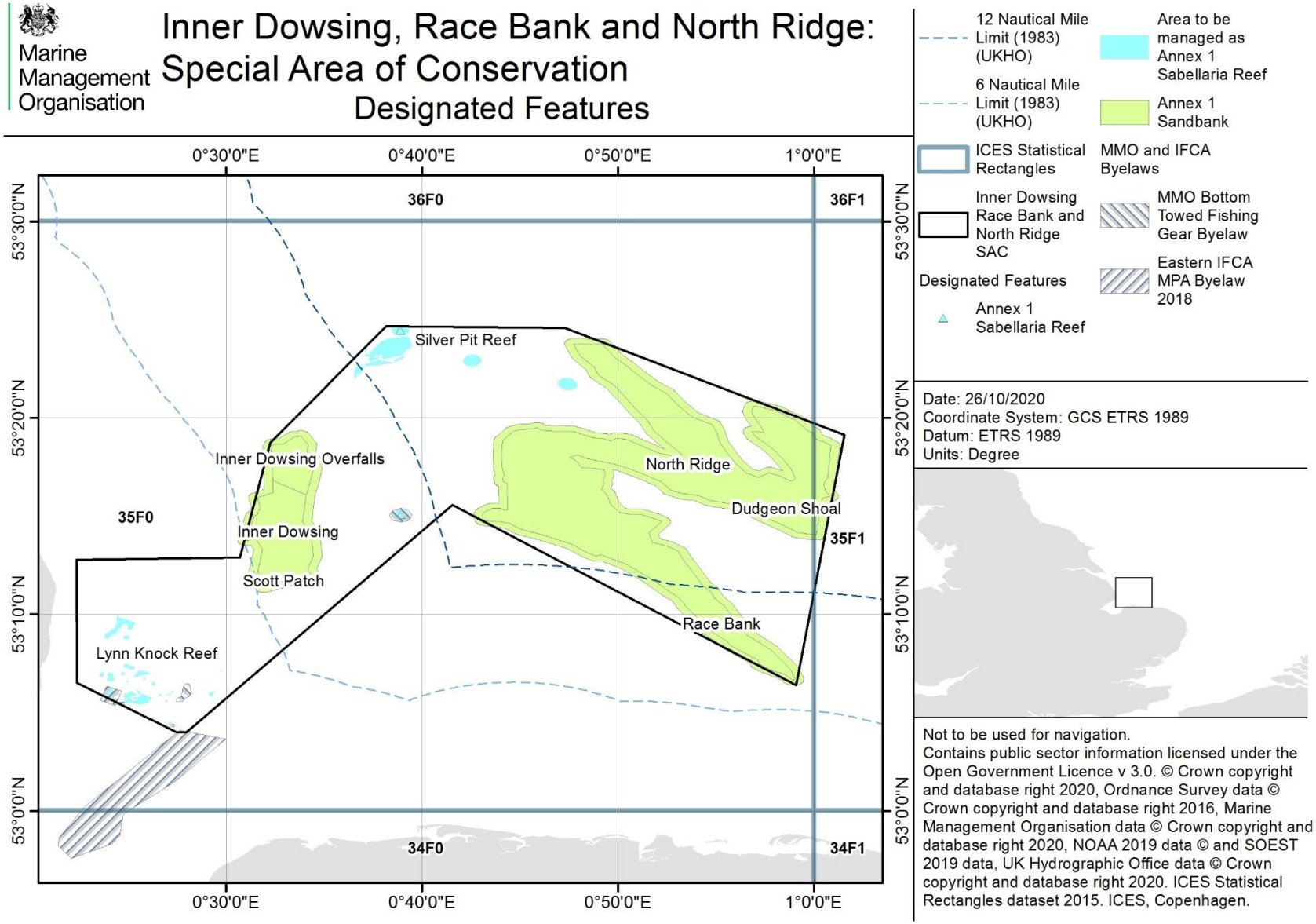
NE and JNCC have applied a 500 metre margin around reef polyline and point data, shown in Figure 1, in order to account for uncertainty in reef extent due to the inability of the ground truthing data used to provide information on reef extent[2].

[2] NE and JNCC Formal Advice to MMO, 11th September 2015

Areas of *S. spinulosa* reef are currently subject to management through an MMO byelaw prohibiting bottom towed gears over these areas. One of these areas lies between the 6-12 nm boundaries and the remaining two areas lie inshore of 6 nm[3]. There is an Eastern IFCA byelaw protecting the inshore section of the site, including a portion of the large sandbank and patch of *S. spinulosa* reef. However this only extends to the 6 nm boundary, and the portion of the large sandbank found in the offshore area of the site is currently not protected, further information can be found in Section 2.3 with Figure 1 detailing the site features and nautical boundaries.

[3] The MMO Inner Dowsing, Race Bank and North Ridge European Marine Site (Specified Areas) Bottom Towed Fishing Gear Byelaw www.gov.uk/government/publications/inner-dowsing-race-bank-and-north-ridge-european-marine-site-specified-areas-bottom-towed-fishing-gear-byelaw

Figure 1 : Inner Dowsing, Race Bank and North Ridge SAC feature data



2.3 Scope of this assessment – fishing activities assessed

The geographic scope of this assessment covers the site outside 6 nm (hereafter the 'MMO portion') therefore includes both designated features (Figure 1). In 2018, Eastern IFCA took over responsibility of the 0 nm – 6 nm area, and are currently developing management measures to protect *S. spinulosa* reef in the Lynn Knock area which fall under their jurisdiction.

All commercial fishing activities, excluding those specified below, have been included for assessment (Table 4):

- Pelagic fishing – the designated features of this site are seabed features and therefore will not be affected by pelagic fishing; and
- Shore based fishing – this assessment covers the portion of the site offshore of 6 nm (see Table 7 for examples of shore based fishing activities).

A revised approach to the management of commercial fisheries in European marine sites[4] was established in 2012 (see Annex 1 for further details).
A matrix was developed to aid regulators in assessing whether management measures should be introduced in marine protected areas[5]. Table 4 displays the matrix interactions for the aggregated method fishing activities and designated features. Interactions are considered a 'red risk' where it is clear that the conservation objectives for a feature (or sub-feature) will not be achieved because of its vulnerability to a type of fishing - irrespective of feature condition, level of pressure, or background environmental conditions in all EMSs where that feature occurs[6].

Table 4: Aggregated method fishing activities with amber or red interactions

Feature/Fishing gear type	Sandbank	Reef
Towed (demersal)		
Dredges (towed)		
Static (pots/traps)		
Static (anchored nets/lines)		

Interactions are considered an 'amber risk' where there is doubt as to whether conservation objectives for a feature (or sub-feature) will be achieved because of its sensitivity to a type of fishing[6]. Interactions classified as amber are subject to full assessment to determine whether management of activity is required to further the site's conservation objectives.

[4] www.gov.uk/government/publications/revised-approach-to-the-management-of-commercial-fisheries-in-european-marine-sites-overarching-policy-and-delivery
[5] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/31 0814/cefas_matrix_review.pdf
[6] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/310822/matrixbackground.pdf

As demersal trawls and dredging all have red interactions with *S. spinulosa* reef an assessment is not required and the interaction is automatically addressed through a management measure. In 2013, the MMO introduced the 'The MMO Inner Dowsing, Race Bank and North Ridge European Marine Site (Specified Areas) Bottom Towed Fishing Gear Byelaw[3] to prevent the red risk gear-feature interactions occurring over areas of identified *S. spinulosa* reef between the 6 and 12 nm boundaries (Figure 1). The large area of reef which straddled the 12 nm boundary as well as patch reefs outside 12 nm were not included in this byelaw as it was being assessed through the offshore process under the Common Fisheries Policy. Coupled with the knowledge that *S. spinulosa* reef is ephemeral and therefore has the potential to move and grow in the time since the byelaw was introduced, there is uncertainty as to whether the conservation objectives for this site are being met at this time due to the unrestricted access of demersal and pelagic towed gear as well as all dredged gear operating within the site over areas of reef which are unprotected by the byelaw. Therefore management measures will be considered to prohibit bottom-towed gear across the exposed *S. spinulosa* reefs and no assessment of bottom towed gear on the reef feature is required.

Table 5 shows the fishing activities classified as having amber interactions with features of this site beyond 6nm. The 'Matrix gear type' column shows the categories used in the Matrix. These are matched to the 'aggregated method' categories used in Natural England and JNCC conservation advice packages.

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.

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

Table 5: Fishing activities with amber interactions assessed for feature.

Feature	Matrix Gear Type	Gear Code	SNCB Aggregated Method
Sandbanks	Beam trawl (whitefish)	TBB	Towed (demersal/pelagic)
	Beam trawl (shrimp)		
	Beam trawl (pulse/wing)		
	Heavy otter trawl	OTB	
	Multi-rig trawls	TX	
	Light otter trawl	OTB	
	Pair trawl	PTB	
	Anchor seine	SDN	
	Scottish/fly seine	SSC	
	Towed gear (demersal/pelagic)	-	
	Scallop dredge	DRB	Dredges
	Mussel/clam/oyster dredge	DRB/HMD	
	Pump scoop (cockles, clams)	HMP/HMD	
	Suction dredge (cockles)	HMD	
***S. spinulosa* reefs and Sandbanks**	Pots/creels (crustacea/gastropods)	FPO	Traps
	Cuttle pots		
	Fish traps		
	Gill nets	GNS	Anchored nets/lines
	Trammels	GTR	
	Entangling	GN	
	Drift nets (demersal)	GND	
***S. spinulosa* reefs**	Long lines (demersal)	LLS	
	Commercial diving	-	Diving

3. Part A Assessment

Part A of this assessment was carried out in a manner that is consistent with the likely significant effect (LSE) test required by article 6(3) of the Council Directive 92/43/EEC on the Conservation of natural habitats and of wild fauna and flora (Habitats Directive)[7].

For each fishing activity, a series of questions were asked[8]:

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 if:
   i. the feature is not exposed to the pressure, and is not likely to be in the future; or
   ii. the effect/impact of the pressure is not likely to be significant.

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

The conservation advice package used to inform this assessment is provided in Table 6.

Table 6: Advice package used for assessment

Feature	Package	Link
Sandbank **and** Reef	NE and JNCC Conservation Advice for Inner Dowsing, Race Bank and North Ridge SAC (UK0030370)	https://designatedsites.naturalengland.org.uk/Marine/MarineSiteDetail.aspx?SiteCode=UK0030370&SiteName=inner%20dows&countyCode=&responsiblePerson=&SeaArea=&IFCAArea=&HasCA=1&NumMarineSeasonality=0&SiteNameDisplay=Inner%20Dowsing,%20Race%20Bank%20and%20North%20Ridge%20SAC

[7] http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:31992L0043&from=EN

[8] The test for likely significant effect under article 6(3) of the Habitats Directive is not required for activities which are directly connected to or necessary to site management, this includes fishing activities unless otherwise indicated.

3.1 Activities not taking place

Table 7 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 7: Activities not taking place and not likely to take place in the future.

Feature	Gear type	Justification
Sandbank **and** Reef	Heavy otter trawl	Ground conditions are unsuitable for heavy otter trawls.
	Cuttle pots	Gear codes used in gear register and logbooks do not distinguish cuttle pots from crab/lobster pots. However, expert opinion from local MMO and IFCA officers states with high confidence that cuttle pots are not used at this site.
	Fish traps	Fish traps are used in rivers and estuaries therefore this site is not a suitable location for this gear.
	Drift nets (demersal)	Does not occur at this site according to VMS*[9] and corroborated with local MMO and IFCA knowledge.
	Beach seine/ring nets	The SAC is at least 1km offshore and not subject to shore-based activities.
	Shrimp push nets	
	Fyke and stake nets	
	Hand-working (vessel/land access)	
	Crab tiles	
	Digging with forks	
	Bait dragging	Does not occur in the UK except in Poole Harbour.
	Pump scoop (cockles and clams)	Does not occur at this site according to VMS and corroborated with local MMO and IFCA knowledge.
	Suction (cockles)	Activity not thought to occur (seed mussel fishery may occur however, would require an IFCA byelaw dispensation and therefore its own Habitats Regulation Assessment, HRA) according to local MMO and IFCA.
	Commercial diving	Does not occur at this site according to VMS and corroborated with local MMO and IFCA knowledge.

[9] VMS – Vessel monitoring system to which, as of 1 January 2012, all vessels greater than 12 m in overall length should be fitted in accordance with Commission Regulation (EC) No 2244/2003 Article (2) 1 and Council Regulation (EC) No 1224/2009 Article 9(2).

3.2 Potential pressures exerted by the activities on the feature

For the remaining activities, potential pressures were identified using the NE conservation advice package identified in Table 6 and associated advice on operations tables. All pressures identified other than those categorised as 'not relevant' were included. Table 8 shows the potential pressures identified.

Table 8: Potential pressures on sandbank and *S. spinulosa* reef

Feature	Aggregated method	Potential pressures
Sandbank	Traps **and** Anchored nets/lines	Abrasion/disturbance of the substrate on the surface of the seabed
		Removal of non-target species
		Removal of target species
		Barrier to species movement
		Deoxygenation
		Hydrocarbon and polycyclic aromatic hydrocarbon (PAH) contamination
		Introduction of light
		Introduction or spread of invasive or non-indigenous species
		Litter
		Organic enrichment
		Penetration and/or disturbance of the substratum below the surface of the seabed, including abrasion
		Synthetic compound contamination (including pesticides, antifoulants, pharmeceuticals)
		Transition elements and organo-metal (e.g. trybutilin, TBT) contamination[10]
		Underwater noise changes
		Visual disturbance
	Demersal trawls **and** Demersal seines **and** Dredges	Abrasion/disturbance of the substrate on the surface of the seabed
		Changes in suspended solids (water clarity)
		Penetration and/or disturbance of the substratum below the surface of the seabed, including abrasion
		Removal of non-target species
		Smothering and siltation rate changes (light)
		Deoxygenation
		Hydrocarbon and PAH contamination
		Introduction of light
		Introduction or spread of invasive or non-indigenous species
		Litter
		Nutrient enrichment

[10] Includes those priority substances listed in Annex II of Directive2008/105/EC.

		Organic enrichment
		Physical change (to another sediment type)
		Synthetic compound contamination
		Transition elements and organo-metal (e.g. TBT) contamination
		Underwater noise changes
		Visual disturbance
	Dredges	Removal of target species
		Introduction of microbial pathogens
***S. spinulosa* reef**	Traps **and** Anchored nets/lines	Abrasion/disturbance of the substrate on the surface of the seabed
		Removal of non-target species
		Barrier to species movement
		Deoxygenation
		Hydrocarbon and PAH contamination
		Introduction or spread of invasive non-indigenous species
		Litter
		Organic enrichment
		Penetration and/or disturbance of the substratum below the surface of the seabed, including abrasion
		Synthetic compound contamination (including pesticides, antifoulants, pharmaceuticals)
		Transition elements and organo-metal (e.g. TBT) contamination

3.3 Significance of effects/impacts

To determine whether each pressure is capable of affecting (other than insignificantly) the site's features, the sensitivity assessments and risk profiling of pressures from the advice on operations section of the JNCC and NE conservation advice package[11] (Table 6) were used.

Table 9 and Table 10 identify the pressures from particular gears which are capable of affecting (other than insignificantly) each feature. Where a pressure from a particular gear is identified as not likely to have a significant effect, justification is provided. To ensure the effects of fishing activities in-combination with other activities (including other fishing activities) are fully assessed, the pressures from anchored nets/lines and traps (green 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 (Section 5).

11 https://designatedsites.naturalengland.org.uk/Marine/FAPMatrix.aspx?SiteCode=UK0030370&SiteName=inner%20dows&SiteNameDisplay=Inner+Dowsing%2c+Race+Bank+and+North+Ridge+SAC&countyCode=&responsiblePerson=&SeaArea=&IFCAArea=&NumMarineSeasonality=0

Table 9: Summary of pressures from specific activities on sandbank taken to Part B.

Potential pressures	Traps	Anchored nets/lines				Demersal Trawls				Demersal seines		Dredges	
	Pots	Gill nets	Set gill nets	Trammel net	Entangling nets	Bottom otter	Otter twin	Bottom pair	Beam	Scottish	Danish	Boat	Hand mechanised
Abrasion/disturbance of seabed surface substrate	LSE - surface disturbance is caused by contact between gear/anchors and the seabed. This occurs during setting of the pots/traps and/or by movement of the gear over the seabed, during rough weather or during retrieval.												
Removal of non-target species	LSE – bycatch is associated with almost all fishing activities and is related to factors such as the gear type and its design (i.e. its selectivity), the targeted species and effort.												
Removal of target species	LSE - species removed may be species forming part of the biotope (e.g. bivalves in sediment feature) or wider community composition associated with the designated feature. Incidental non-target catch including features of conservation importance may also be retained as part of targeted fisheries due to its commercial value.					No LSE – Pressure not considered relevant to gear types						LSE – see anchored nets/lines and traps for reasoning	
Barrier to species movement	No LSE – feature is not sensitive to this pressure					No LSE - Not relevant to this gear type.							
Deoxygenation	No LSE – anthropogenic hypoxia and anoxia are unlikely at this site as discards are not spatially concentrated and the site does not exhibit low-flow conditions. This pressure can also result from the release of deoxygenated ballast water, however all fishing vessels under 45 metres length have solid ballast[12]. No vessels over 45 metres length fish at this site and therefore deoxygenation through ballast water is unlikely.												
Hydrocarbon and PAH contamination	No LSE - Deliberate releases are already prohibited. Accidental discharges from fishing vessels leading to significant releases are extremely rare.												

[12] https://eur-lex.europa.eu/legal-content/en/ALL/?uri=CELEX:32002L0035

Introduction of light	No LSE - Fishing gears do not introduce light and operational / navigational lighting on vessels is unlikely to cause a significant impact due to water depths and temporary nature of light source.	
Introduction or spread of invasive species	No LSE – Ballast water is the principle source of invasive species in coastal freshwater and marine ecosystems[13]. Fishing vessels less than 45 metres length must have permanent ballast therefore this vector is not available.	
Litter	No LSE - The strong tidal currents and oceanic swells at the site make it unlikely that lost gear will persist at the site for long enough to cause a significant impact.	
Organic enrichment	No LSE – Area is not subject to low-flow or exposed at significant levels to sources of organic enrichment. Any organic material would be quickly washed away as a result of wave and tidal streams.	
Penetration and/or disturbance of the substratum below the surface of the seabed	No LSE – feature is sensitive to but at low-risk from this particular method, which generally does not occur at a level of concern.	LSE – Gear is designed to interact with the seabed. Tickler chains on beam trawls, trawl doors on an otter trawl can scour the seabed and scallop dredges cause substantial physical disruption to the seafloor by ploughing sediments and damaging organisms.
Synthetic compound contamination	No LSE - Potential source is from vessel hull antifouling treatments. TBT has been banned on vessels under 25m since 1987 and on all vessels since 2008. Copper wash can enter the marine environment but due to the strong tidal currents at this site, they are not likely to accumulate here.	
Transition elements and organo-metal contamination		
Underwater noise changes	No LSE – feature is not sensitive to this pressure at the benchmark.	
Visual disturbance	No LSE – feature is not sensitive to this pressure at the benchmark.	
Changes in suspended solids (water clarity)	No LSE - Not relevant to this gear type.	LSE - results from physical disturbance of the sediment, along with hydrodynamic action caused by the passage of towed gear, leading to entrainment and suspension of the substrate behind and around the gear components. Subtidal mixed sediment as a subfeature may be more sensitive.
Smothering and siltation rate changes (light)		
Physical change	No LSE – Sandbank will remain sandbank despite fishing pressures.	
Nutrient enrichment	No LSE - Not relevant to this gear type.	

[13] Drake and Lodge 2004

Introduction of microbial pathogens	No LSE - not relevant as pressure relevant to shellfish production areas only.

Table 10: Summary of pressures on *S. spinulosa* reef from specific activities taken to Part B

Potential pressures	**Traps**	**Anchored nets/lines**				
	Pots	Gill nets	Set gill nets	Trammel nets	Entangling nets	Demersal longlines
Abrasion/disturbance of the substrate on the surface of the seabed	LSE - The pressure can result from surface disturbance caused by contact between the gear and substrate, and occurs during setting of the gear and/or by movement of the gear over the seabed. Such physical disturbance can result in epifauna, especially emergent species such as erect sponges and coral, being dislodged or damaged, although there are limited studies of such effects.					
Removal of non-target species	LSE - bycatch is associated with almost all fishing activities and is related to factors such as the gear type and its design (i.e. its selectivity), the targeted species and effort. Although selective, pots/traps are associated with bycatch, including of non-target crustaceans. Anchored nets/lines can result in the entanglement and bycatch of a range of fauna.					
Barrier to species movement	No LSE - feature is sensitive to this pressure at the conservation advice package benchmark but the pressure does not occur at a level of concern, so the pressure is considered low-risk.					
Deoxygenation	No LSE – Insufficient evidence to assess sensitivity at the benchmark but the pressure does not occur at a level of concern.					
Hydrocarbon and PAH contamination	No LSE - Deliberate releases are prohibited under MARPOL. Accidental releases are infrequent. A sensitivity assessment has not been made for this pressure at the benchmark, but the pressure is low risk for this feature.					
Introduction or spread of invasive species	No LSE – this feature is not sensitive to this pressure at the benchmark.					
Litter	No LSE - the feature is low risk for this pressure as it is not thought to occur at a level of concern. The site is exposed to wave and tidal streams which may prevent litter from accumulating.					
Organic enrichment	No LSE - the feature is not sensitive to this pressure at the benchmark.					
Penetration and/or disturbance of the substratum below the surface of the seabed	No LSE - the pressure is low risk for this feature as reefs exist above the substrate therefore the assessment of penetration and/or disturbance below the surface of the seabed as this would require penetration below the reef itself and therefore it is unlikely to occur at a level of concern.					
Synthetic compound contamination	No LSE - Potential source is from vessel hull antifouling treatments. TBT has been banned on vessels under 25m since 1987 and on all vessels since 2008. Copper wash can enter the marine environment but due to the strong tidal currents at this site, they are not likely to accumulate here.					
Transition elements and organo-metal contamination						

4. Part B Assessment

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

Table 11 and Table 12 show the fishing activities and pressures included for assessment in part B. Pressures with similar potential impacts to a particular feature were grouped to save repetition during this assessment.

Table 11: Fishing activities and pressures included for Part B for sandbank

Aggregated Method	**Fishing gear type**	**Pressures**
Traps **and** Anchored nets/lines	Pots/creels	• Abrasion/disturbance of seabed surface substrate • Removal of target species • Removal of non-target species
	Gill nets	
	Trammel nets	
	Entangling nets	
Demersal trawl **and** Demersal seine	Beam trawl (whitefish)	• Abrasion/disturbance of seabed surface substrate • Penetration and/or disturbance of the substrate below the surface of the seabed, including abrasion • Removal of non-target species • Changes in suspended solids • Siltation rate changes
	Beam trawl (shrimp)	
	Beam trawl (pulse/wing)	
	Multi-rig trawls	
	Light otter trawl	
	Pair trawl	
	Scottish/fly seine	
	Anchor seine	
Dredges	Scallop dredge	• Abrasion/disturbance of seabed surface substrate • Penetration and/or disturbance of the substrate below the surface of the seabed, including abrasion • Removal of target species • Removal of non-target species • Changes in suspended solids • Siltation rate changes
	Seed mussel dredge	

Table 12: Fishing activities and pressures included for Part B for S. spinulosa reefs

Aggregated Method	Fishing gear type	Pressures
Traps **and** Anchored nets/lines	Pots/creels	• Abrasion/disturbance of seabed surface substrate • Removal of non-target species
	Gill nets	
	Trammel nets	
	Entangling nets	
	Drift nets (demersal)	
	Longlines (demersal)	

The supplementary advice tables of JNCC and NE's conservation advice identify targets for maintaining or recovering to a favourable condition of sandbank or *S. spinulosa* reef. The MMO have identified 'Important' targets which in this context means only those relating to attributes that are likely to be impacted by the pressures exerted by the activities being assessed.

Table 13 and Table 14 show which targets were identified as important for each feature. 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 3).

Table 13: Favourable condition targets for identified pressures for sandbanks[14].

Feature	Attribute	Target	Relevance/justification
Sandbank	Distribution: presence and spatial distribution of biological communities	Restore the presence and spatial distribution of subtidal sandbank communities.	Pressures identified in Part A Assessment could affect the distribution of communities.
	Extent and distribution	Restore the total extent and spatial distribution of subtidal sandbanks to ensure no loss of integrity, while allowing for natural change and succession.	Pressures identified in Part A Assessment will not affect the extent of the sandbank.
	Structure and function: presence and abundance of key structural and influential species	[Maintain OR Recover OR Restore] the abundance of listed species*, to enable each of them to be a viable component of the habitat.	Pressures identified in Part A Assessment could affect the abundance of species.
	Structure: non-native species and pathogens	Restrict the introduction and spread of non-native species and pathogens, and their impacts.	Pressures identified in Part A Assessment will not affect the introduction and spread of non-native species.
	Structure: sediment composition and distribution	Restore the distribution of sediment composition across the feature (and each of its subfeatures).	Pressures identified in Part A Assessment could affect the distribution of sediment composition.
	Structure: species composition of component communities	Maintain the species composition of component communities.	Pressures identified in Part A Assessment could affect the species composition.
	Structure: topography	Maintain the presence of topographic features, while allowing for natural responses to hydrodynamic regime, by preventing erosion or deposition through human-induced activity.	Pressures identified in Part A Assessment will not affect the topographic features.

14 https://designatedsites.naturalengland.org.uk/Marine/SupAdvice.aspx?SiteCode=UK0030370&SiteName=inner%20dowsing&SiteNameDisplay=Inner+Dowsing%2c+Race+Bank+and+North+Ridge+SAC&countyCode=&responsiblePerson=&SeaArea=&IFCAArea=&NumMarineSeasonality=

	Structure: volume	Maintain the existing (where no previous evidence exists) or best-known (where some evidence exists) volume of sediment in the sandbank, allowing for natural change.	Pressures identified in Part A Assessment will not affect the volume of sediment.
	Supporting processes: energy / exposure	Maintain the natural physical energy resulting from waves, tides and other water flows, so that the exposure does not cause alteration to the biotopes and stability, across the habitat.	Pressures identified in Part A Assessment will not affect the physical energy.
	Supporting processes: physico-chemical properties	Maintain the natural physico-chemical properties of the water.	Pressures identified in Part A Assessment will not affect the physio-chemical properties.
	Supporting processes: sediment contaminants	Restrict surface sediment contaminant levels to concentrations where they are not adversely impacting the infauna of the feature (and each of its subfeatures).	Pressures identified in Part A Assessment will not affect the surface sediment contaminant levels.
	Supporting processes: sediment movement and hydrodynamic regime	Maintain all hydrodynamic and physical conditions such that natural water flow and sediment movement are not significantly altered or prevented from responding to changes in environmental conditions.	Pressures identified in Part A Assessment will not affect the hydrodynamic and physical conditions.
	Supporting processes: water quality - contaminants	Restrict aqueous contaminants to levels equating to High Status according to Annex VIII and Good Status according to Annex X of the Water Framework Directive, avoiding deterioration from existing levels.	Pressures identified in Part A Assessment will not affect the aqueous contaminants.
	Supporting processes: water quality - dissolved oxygen	Maintain the dissolved oxygen (DO) concentration at levels equating to High Ecological Status (specifically ≥ 5.7 mg per litre (at 35 salinity) for 95 % of the year), avoiding deterioration from existing levels.	Pressures identified in Part A Assessment will not affect the dissolved oxygen concentration.
	Supporting processes: water quality - nutrients	Maintain water quality at mean winter dissolved inorganic nitrogen levels where biological indicators of eutrophication (opportunistic macroalgal and phytoplankton blooms) do not affect the integrity of the site and features, avoiding deterioration from existing levels.	Pressures identified in Part A Assessment will not affect the water quality.

	Supporting processes: water quality - turbidity	Maintain natural levels of turbidity (eg concentrations of suspended sediment, plankton and other material) across the habitat.	Pressures identified in Part A Assessment will not affect the turbidity levels.

Table 14: Favourable condition targets for identified pressures for *S. spinulosa* reef.[14]

Feature	Attribute	Target	Relevance/justification
Reef	Distribution: presence and spatial distribution of biological communities	Restore the presence and spatial distribution of reef communities.	Pressures identified in Part A Assessment could affect the distribution of reef communities.
	Extent and distribution	Restore the total extent, spatial distribution and types of reef (and each of its subfeatures).	Pressures identified in Part A Assessment could affect the extent and distribution of reef
	Structure and function: presence and abundance of key structural and influential species	[Maintain OR Recover OR Restore] the abundance of listed species*, to enable each of them to be a viable component of the habitat.	Pressures identified in Part A Assessment could affect the abundance of listed species.
	Structure: non-native species and pathogens	Restrict the introduction and spread of non-native species and pathogens, and their impacts.	Pressures identified in Part A Assessment will not affect the introduction and spread of non-native species.
	Structure: species composition of component communities	Restore the species composition of component communities.	Pressures identified in Part A Assessment could affect the composition of component communities.
	Supporting processes: energy / exposure	Restore the natural physical energy resulting from waves, tides and other water flows, so that the exposure does not cause alteration to the biotopes and stability, across the habitat.	Pressures identified in Part A Assessment will not affect the physical energy.

	Supporting processes: physico-chemical properties	Maintain the natural physico-chemical properties of the water.	Pressures identified in Part A Assessment will not affect the physico-chemical properties.
	Supporting processes: sedimentation rate	Maintain the natural rate of sediment deposition.	Pressures identified in Part A Assessment will not affect the rate of sediment deposition.
	Supporting processes: water quality - contaminants	Restrict aqueous contaminants to levels equating to High Status according to Annex VIII and Good Status according to Annex X of the Water Framework Directive, avoiding deterioration from existing levels.	Pressures identified in Part A Assessment will not introduce aqueous contaminants.
	Supporting processes: water quality - dissolved oxygen	Maintain the dissolved oxygen (DO) concentration at levels equating to High Ecological Status (specifically ≥ 5.7 mg per litre (at 35 salinity) for 95 % of the year), avoiding deterioration from existing levels.	Pressures identified in Part A Assessment will not affect the dissolved oxygen concentration.
	Supporting processes: water quality - nutrients	Maintain water quality at mean winter dissolved inorganic nitrogen levels where biological indicators of eutrophication (opportunistic macroalgal and phytoplankton blooms) do not affect the integrity of the site and features, avoiding deterioration from existing levels.	Pressures identified in Part A Assessment will not affect the nitrogen levels.
	Supporting processes: water quality - turbidity	Maintain natural levels of turbidity (eg concentrations of suspended sediment, plankton and other material) across the habitat.	Pressures identified in Part A Assessment will not affect the levels of turbidity.

4.1 Activity description: traps, anchored nets/lines, demersal trawls, demersal seines, and dredges

4.1.1 Existing management

The vast majority of vessels operating within Inner Dowsing, North Ridge and Race Bank SAC are UK vessels. However, there are a small number of French vessels known to fish within the SAC outside of 12nm.

There are a vast number of other Byelaws and Technical Measures in operation within the Inner Dowsing, Race Bank and North Ridge SAC for stock management and conservation. However, these measures are not designed to achieve the conservation objectives for the features of this site (though they may contribute to the achievement of Good Environmental Status) and the impacts from ongoing fishing activities still need to be assessed and managed where appropriate.

The use of bottom towed gear over some areas of known reef (Figure 1) have been prohibited by the MMO since the introduction of the Inner Dowsing, Race Bank and North Ridge European marine site (specified areas) bottom towed fishing gear byelaw[3] in 2013.

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);
- FisherMap stakeholder mapping;
- Defra commissioned project collating sightings per unit effort (SPUE) data;
- expert opinion from MMO marine officers and IFCA officers;
- fishing industry information;
- IFCA, MMO and Royal Navy sightings; and
- Spatial footprint analysis using Pr-values.

Table 15 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 15: Summary of generic confidence associated with fishing activity evidence

Evidence source	Confidence	Description, strengths and limitation
VMS data	High / Moderate	• Confidence in VMS is high for describing activity relating to larger vessels (>12 m). But VMS information was not developed specifically for management of MPAs, and does not describe activity in smaller vessels. • There are assumptions in the processing that speed of <6 knots is 'fishing speed'. • 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). • Known guard vessel data have been removed from these data. • Null gear codes are present in the data which may underrepresent fishing fleet. • Non-UK VMS is of lower resolution, presented to just three decimal degrees.
Fisheries landings data	High	• Annual data collated and reported to ICES statistical rectangles • Resolution too low to directly infer landings for MPAs
FisherMap	Low	• The data were collected in 2012 and are therefore relatively dated. • A condition of the research was that only those interviewees who explicitly gave permission for their data to be shared would have their own mapping represented in the final product shared with third parties. This equated to approximately 50% of responses. • The data are self-reported estimates. • The number of skippers who allowed their data to be used represent just over one fifth of the number of licensed under 15 m fishing vessels registered in England.
Defra 2015 (MB0117)	Low	• Based on work within inshore areas to describe fishing activity, but is limited by raw data and other limitations highlighted in the report.

Expert judgement	Low / Moderate	• This depends on the area, and the knowledge of the area from MMO and IFCA staff.
Fishing industry information	Moderate	• Information from the fishing industry regarding intensity of fishing occurring and gear types used in the site • Depends on the area and the amenability of the local fleet
Sightings data	High	• Taken from IFCA, 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	• 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.

4.1.3 Fishing gear types used

Fishing activity throughout the site is mostly potting, including whelk as well as crab and lobster pots. Demersal trawls, dredges and anchored nets/lines are also used in the site. In order to bridge the gaps in available data, expert opinion from MMO coastal officers and Eastern IFCA officers has been incorporated into this assessment. The following sections describe the gear types used within the site according to expert opinion. For gear type definitions, please see Annex 2.

SNCB Aggregated method: Demersal Trawls

Demersal trawling in the MMO portion of the site consists of white fish and brown shrimp beam trawling activity. The whitefish beam trawling is limited and carried out by approximately two under 10 m vessels (MMO coastal, *pers comms*). Vessels use 20 mm nets and fish between October and July (MMO coastal, *pers comms*). Kings Lynn and Boston fisheries are still largely beam trawlers targeting brown shrimp however this appears to be similarly limited, being conducted by seven under 10 metre beam trawlers which occasionally fish within the MMO portion of the site. (MMO coastal, *pers comms*).

VMS data suggests there is some demersal trawling occurring over the sandbank feature within the MMO portion of the site although not in large numbers, most demersal trawling activity occurring in the site is outside of the sandbank and *S. spinulosa* reef features (Figure 2 to Figure 6).

SNCB Aggregated method: Dredging

Dredging activity in the MMO portion of the site is limited and consists of shellfish dredging in the form of mussel seed prospecting and some previous hand mechanised dredge activity. The mussel seed prospecting occurs sporadically around the optimal period for relaying mussel seed in late summer (Eastern IFCA, *pers comms*). This fishery is small scale and generally will only occur one week of the year. The mussel seed beds if not fished will naturally be lost through predation or storm damage. This fishery resource has not been found in this site since 2012. There is some sporadic dredging, including hand mechanised dredges occurring in recent years (2015 – 2017) but this has seen a drastic decline in the area and is not known to occur over the reef or sandbank features.

SNCB Aggregated method: Traps

Within the site there are approximately ten under 10 metre potting vessels which pot for crab and lobster. Up to 6 of these fish regularly in the site on and around the 6 nm limit adjacent to the Inner Dowsing sandbank. The remaining four vessels fish more occasionally (MMO coastal, *pers comms*). There are seven whelk potters which fish regularly and a further seven whom fish occasionally (MMO coastal, *pers comms*).

A few vessels larger than 12 m use pots in the site however the vast majority of effort comes from just one vessel which is responsible for approximately 77% of the pot fishing pings occurring in the site. VMS data shows significant potting activity in the north of the site from 2015 onwards (Figure 3 to Figure 6).

Eastern IFCA and MMO Coastal indicated that potters do not target areas of *S. spinulosa* reefs. However, interaction may occur either through storm movement of pots or unintentional interaction due to the ephemeral nature of the feature. VMS data also appears to contradict that of the Eastern IFCA and MMO coastal officers with areas of reef being used heavily for potting (VMS, Figure 2 to Figure 6). This may be due to the potential for the 0-6 knot fishing speed metric to overestimate fishing activity where potting gears are concerned.

SNCB Aggregated method: Anchored nets/lines

The main netting fishery is gill netting which occurs occasionally in winter (depending on weather). There are six under 10 metre vessels fishing with long lines which work around the Inner Dowsing sandbank area in winter targeting cod (Eastern IFCA, *pers comms*).

4.1.4 VMS Data & Landings Data

VMS and landings data have been included from 2014 to the most up to date information available in order to provide at least five years of data for analysis. Currently, VMS data are available up to and including 2018, and landings data are available from 2012-2016 for Non UK, EU Member State vessels and to 2018 for UK vessels (Table 16 to Table 23).

In 2014, the VMS data shows a substantial amount of netting occurring within the sandbanks outside 12 nm and light demersal trawls across the site (Figure 2). From 2015 the VMS data shows a shift in activity from netting to potting with increased activity occurring in the offshore portion of the site adjacent to and over areas of known reef (Figure 3 to Figure 6). There is also increased Danish seining near the sandbank outside 12 nm in 2015, however this is a singular year trend as from 2016 onwards the main activity in the area is demersal and bottom towed gears. In 2018, towards the north of the site there is a large cluster of “unknown” fishing gears, this is close to a large area of reef on the 12 nm boundary.

Almost all VMS data comes from UK vessels which are prevalent in the site from 2014 – 2018 (Figure 7 to Figure 11). However, French vessels were present within Inner Dowsing, Race Bank and North Ridge SAC in 2014 using bottom towed gears near to and occasionally over areas of known *S. spinulosa* reef, although only in small numbers. From 2015 onwards French vessels are present to the north of the site along with Belgian vessels.

Spatially the majority of the fishing activity is focussed in the area inside 6 nm and outside 12 nm with very little activity occurring between 6 and 12 nm. VMS data indicates a decrease in fishing activity over the offshore section of sandbanks since 2014. However, due to the presence of under 12 m vessels fishing in the MMO portion of the site, the VMS data is unlikely to represent the majority of fishing effort occurring at this site.

Table 16 shows landings derived directly from the UK VMS data within the site. A significant proportion of the UK VMS fishing records within the site did not have gear codes or landings data attached, and therefore gear codes were manually assigned to the VMS records. However, assigning gear codes to landing records was not possible and therefore data presented in Table 16 likely represents an underestimate of actual landings from within the site.

The landings data presented in Table 18 and Table 19 were calculated using the proportion of UK VMS fishing pings within ICES rectangles 35F0 and 35F1 that intersect Inner Dowsing, Race Bank and North Ridge SAC (see Table 17 for the proportion of pings from each rectangle that intersect the site). Since there was a large amount of null gear codes within the VMS data at ICES rectangle level,

percentages for each year were applied across all gears present within the landings data for >12m vessels for each rectangle. When compared with the data derived from the UK VMS fishing records within the site, the landings calculated using this method do not appear to correlate closely. This is likely a result of the UK VMS datasets lacking gear codes and landings, which causes discrepancies when different methods to improve the resolution of this data are employed.

In order to estimate landings by UK vessels without VMS, the proportion of the area of ICES rectangles 35F0 and 35F1 that is occupied by Inner Dowsing, Race Bank and North Ridge SAC was calculated. The sea area of ICES 35F0 is 2710.35 km^2, of which 831.93km^2 is occupied by Inner Dowsing, Race Bank and North Ridge SAC. The sea area of ICES 35F1 is 3714km^2, of which 13.41km^2 is occupied by Inner Dowsing, Race Bank and North Ridge SAC. Therefore, Inner Dowsing, Race Bank and North Ridge SAC accounts for 30.69% of ICES Rectangle 35F0 and 0.36% of ICES Rectangle 35F1 respectively. These percentages were used to calculate the proportion of the total landings from the rectangles that can be attributed to Inner Dowsing, Race Bank and North Ridge SAC (Table 20 and Table 21). Potting landings appear to be relatively stable across the five year period, whilst landings from demersal trawls appear to be increasing. There are no clear patterns for landings from other gear types. It should be noted that a significant proportion of landings within the data for ICES rectangle 35F0 are attributed to the miscellaneous gear code, which makes it difficult to draw accurate conclusions from the data presented.

Non-UK VMS landings were estimated via the VMS proportion method, whereby the number of VMS reports within the site were used to calculate a percentage of the landings when compared to the number of reports within the rectangle (Table 23). France is the only EU member state to have registered VMS reports within the site, and these are limited in numbers. Therefore, a very small proportion of non-UK landings from the ICES rectangles can be attributed to the site. There were no non-UK VMS fishing pings in the portion of the site that sits within ICES rectangle 35F1, so no non-UK landings from the rectangle can be attributed to the site.

Figure 2: 2014 VMS fishing activity by gear type in Inner Dowsing, Race Bank and North Ridge SAC

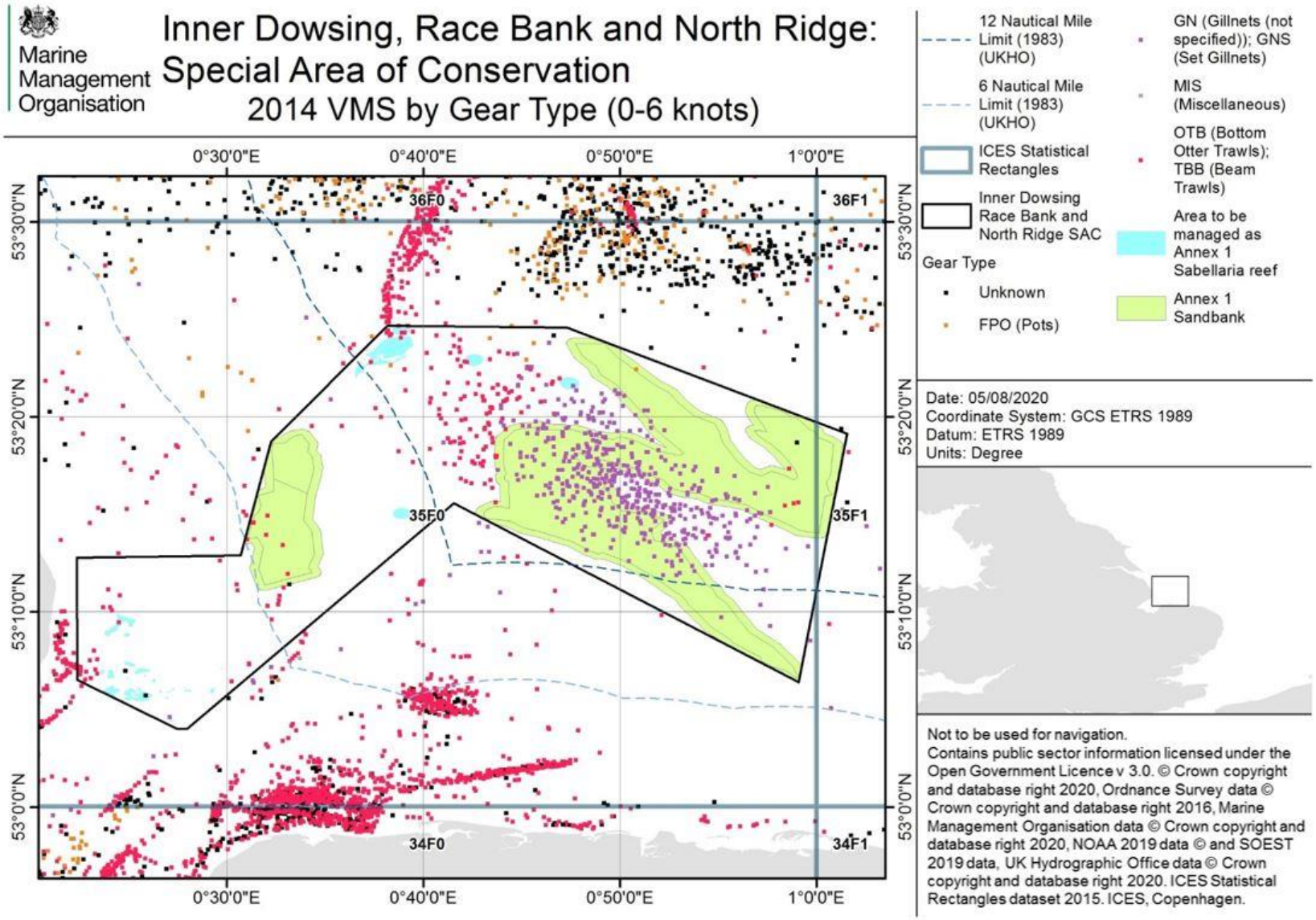


Figure 3: 2015 VMS fishing activity by gear type in Inner Dowsing, Race Bank and North Ridge SAC

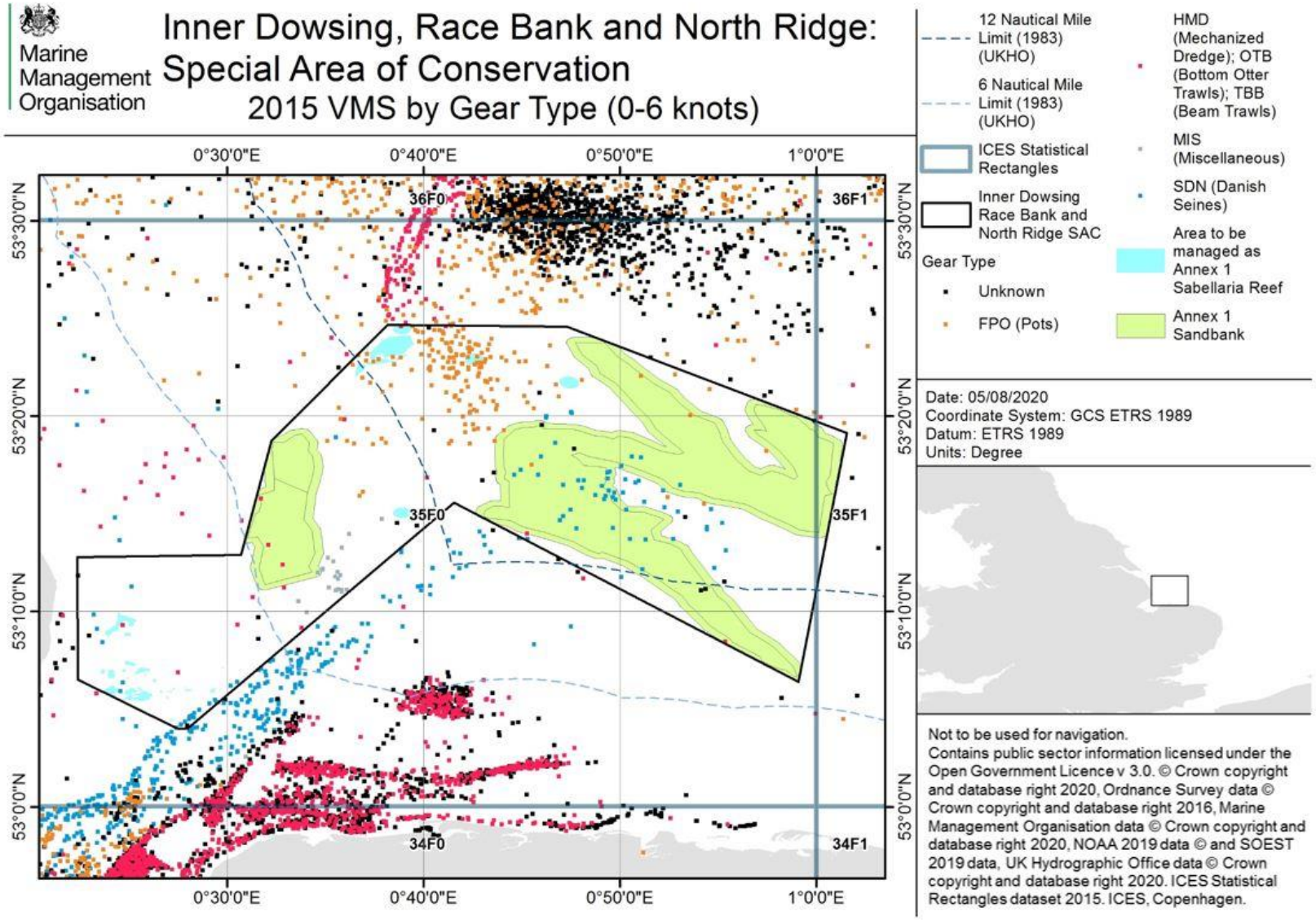


Figure 4: 2016 VMS fishing activity by gear type in Inner Dowsing, Race Bank and North Ridge SAC

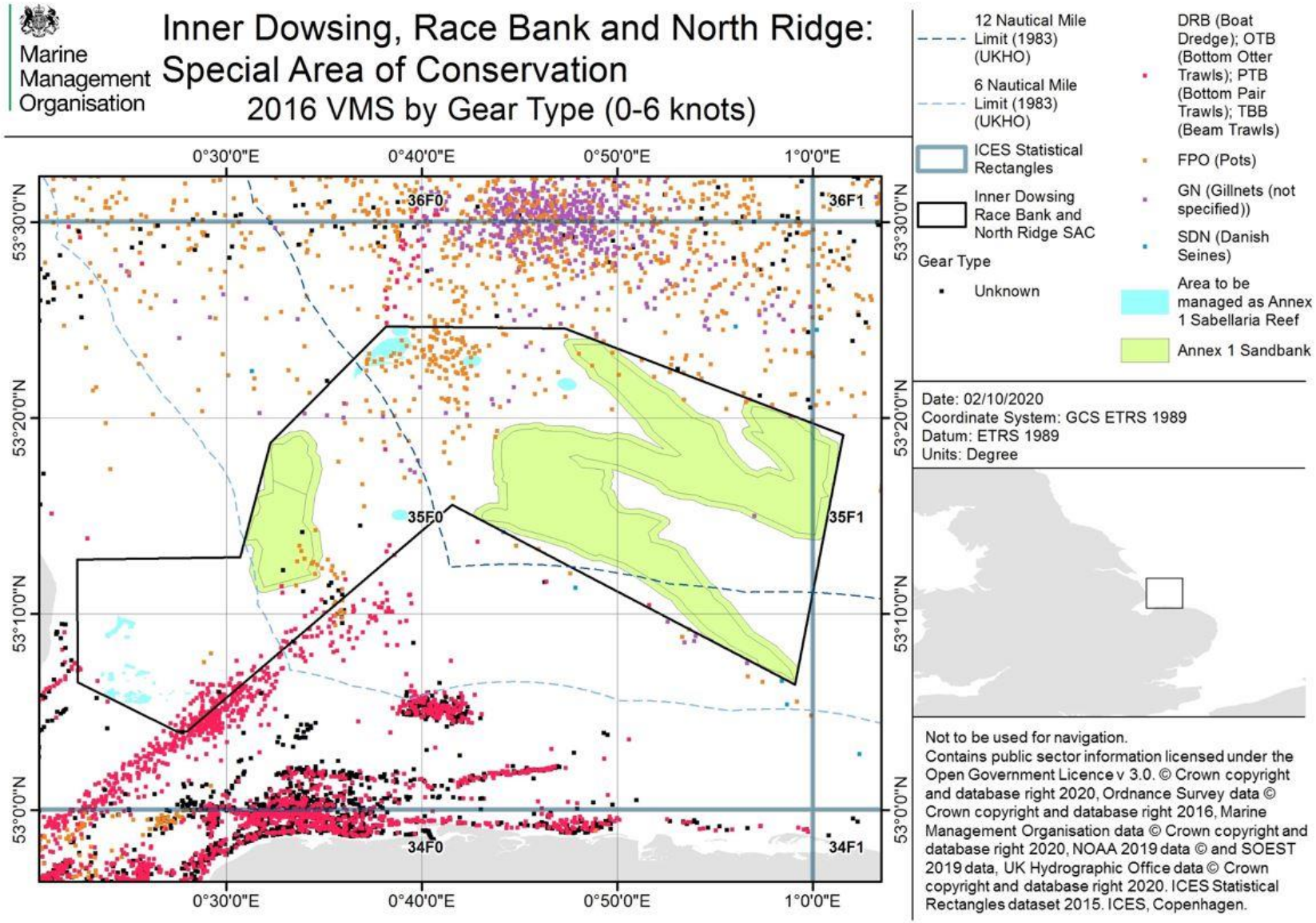


Figure 5: 2017 VMS fishing activity by gear type in Inner Dowsing, Race Bank and North Ridge SAC

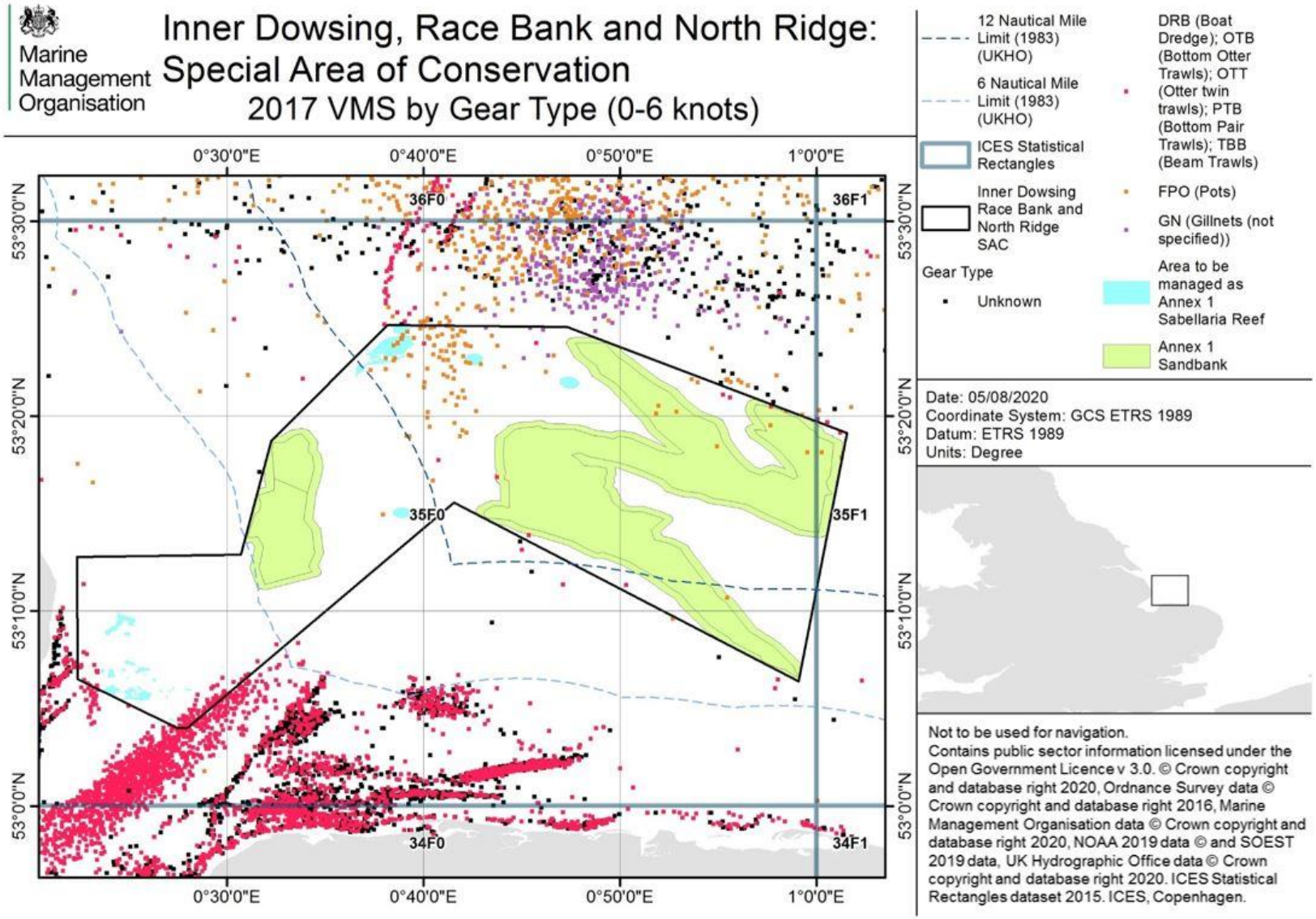


Figure 6: 2018 VMS fishing activity by gear type in Inner Dowsing, Race Bank and North Ridge SAC

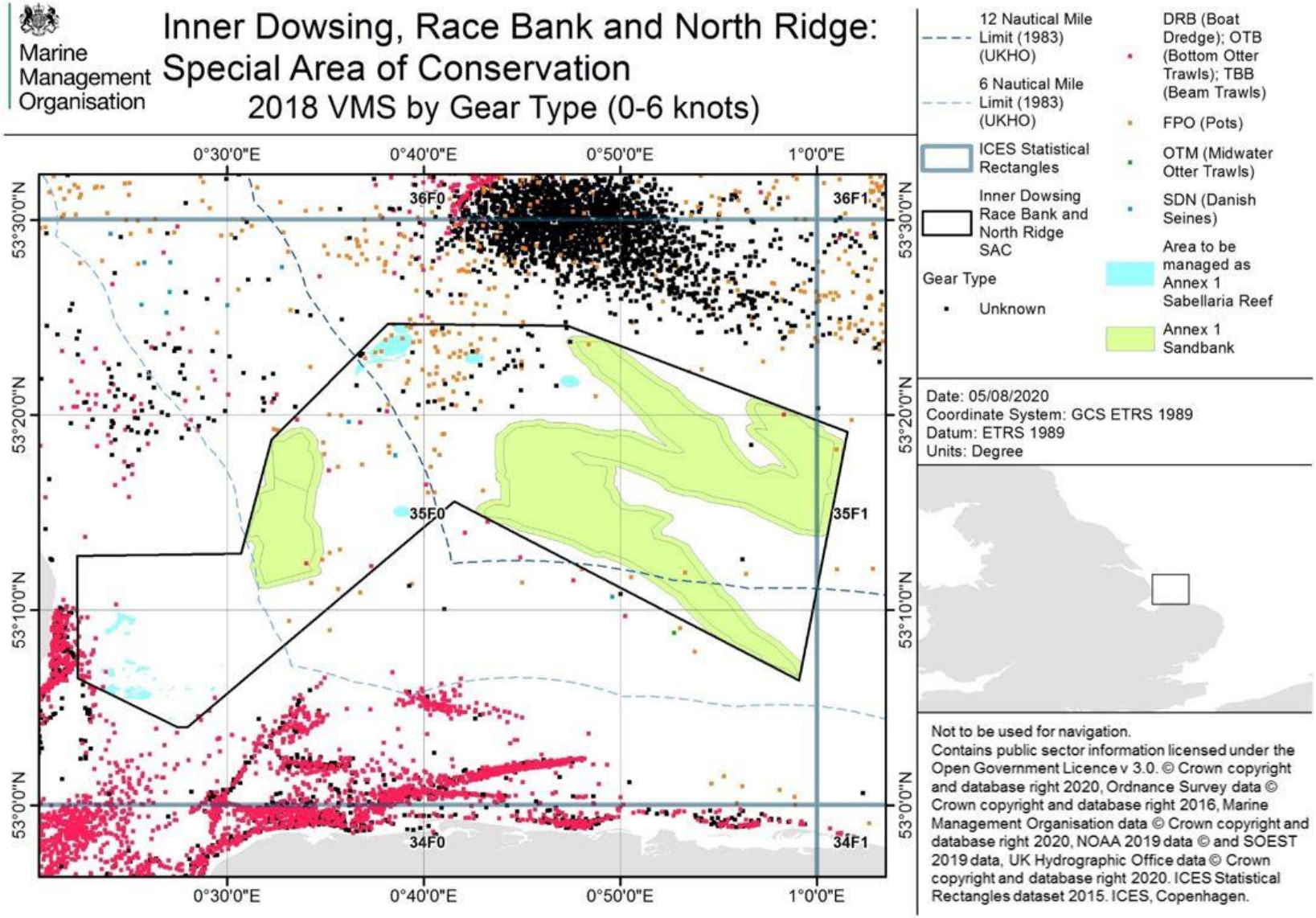


Figure 7: 2014 VMS fishing activity by nationality in Inner Dowsing, Race Bank and North Ridge SAC

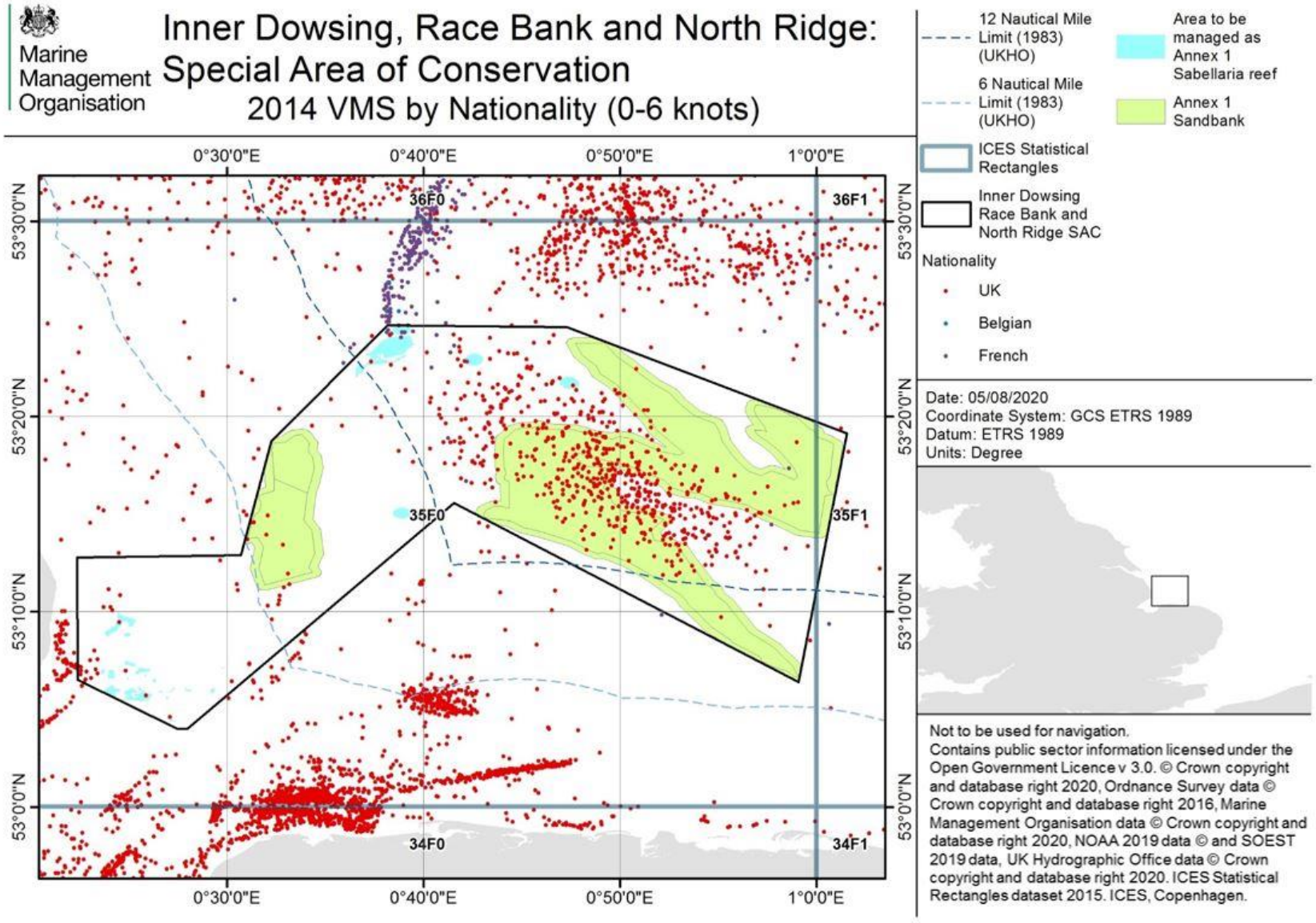


Figure 8: 2015 VMS fishing activity by nationality in Inner Dowsing, Race Bank and North Ridge SAC

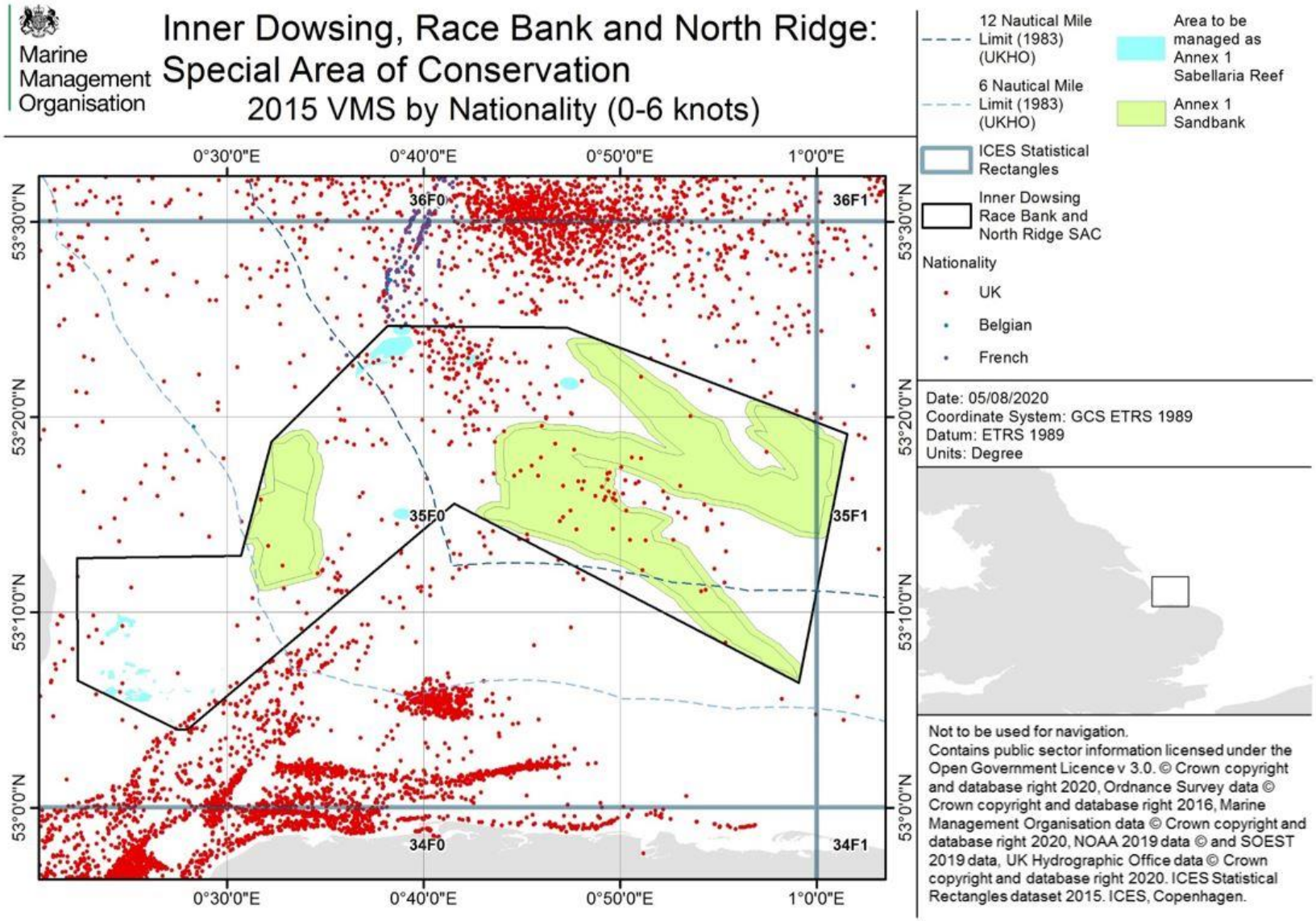


Figure 9: 2016 VMS fishing activity by nationality in Inner Dowsing, Race Bank and North Ridge SAC

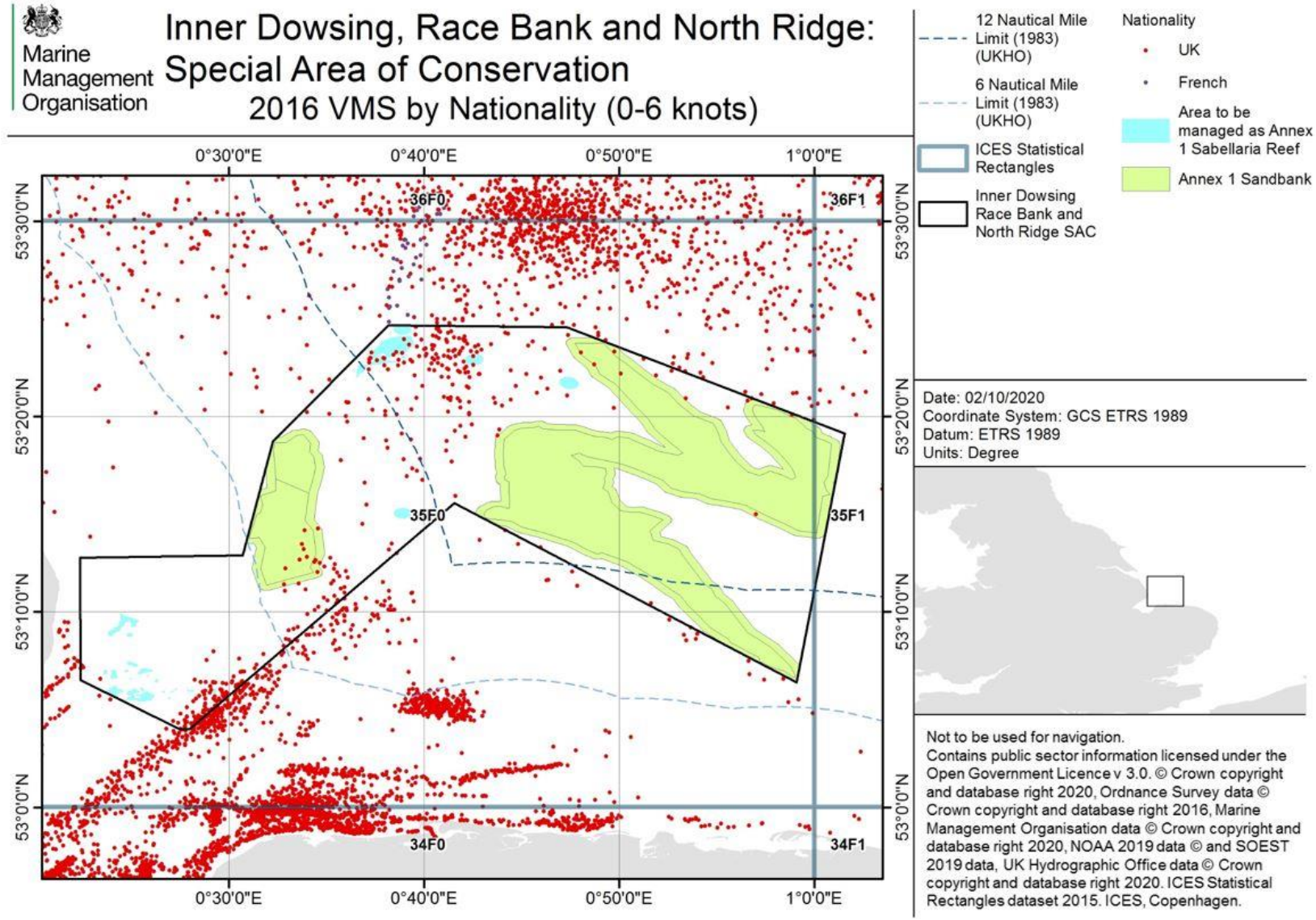


Figure 10: 2017 VMS fishing activity by nationality in Inner Dowsing, Race Bank and North Ridge SAC

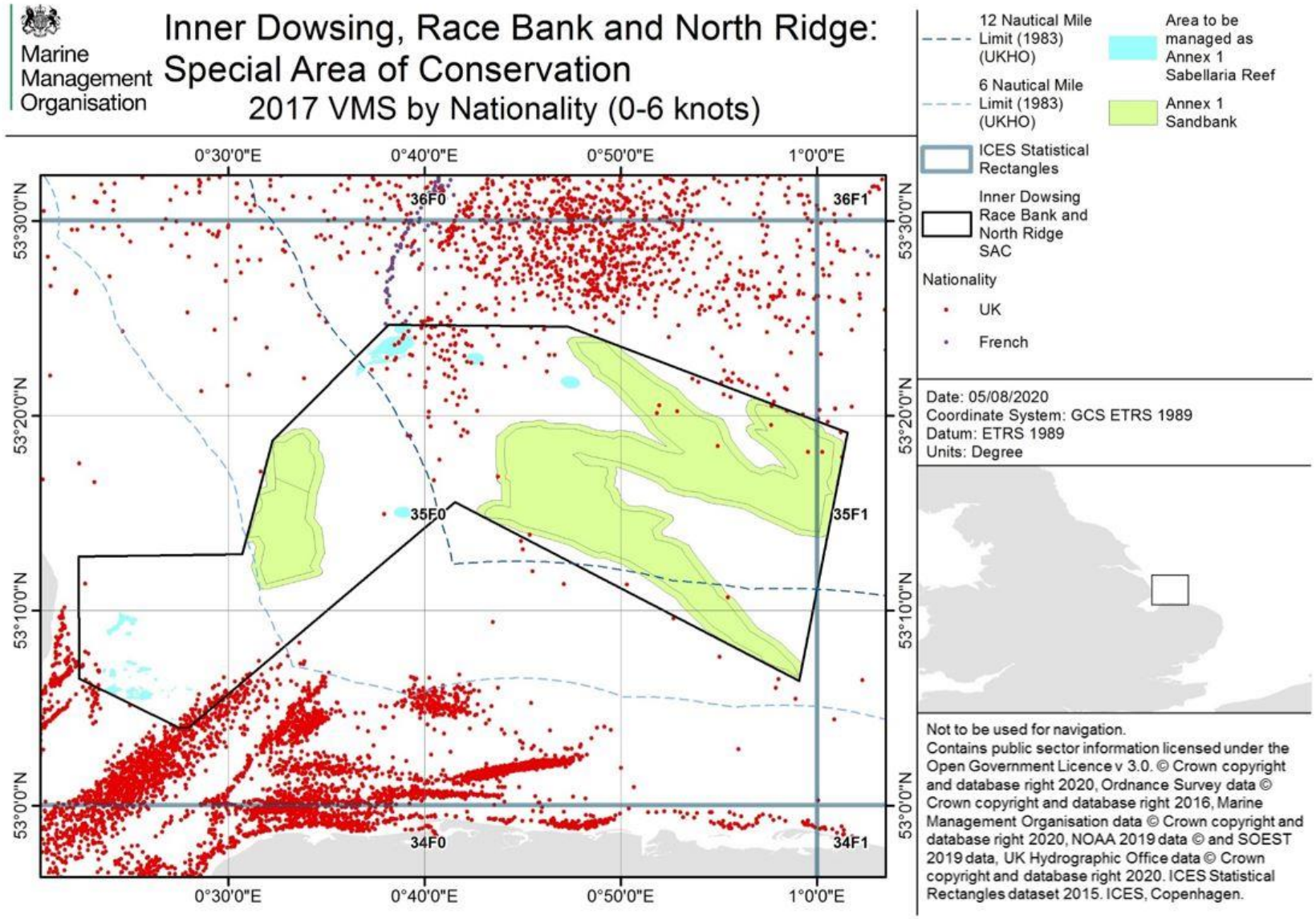


Figure 11: 2018 VMS fishing activity by nationality in Inner Dowsing, Race Bank and North Ridge SAC

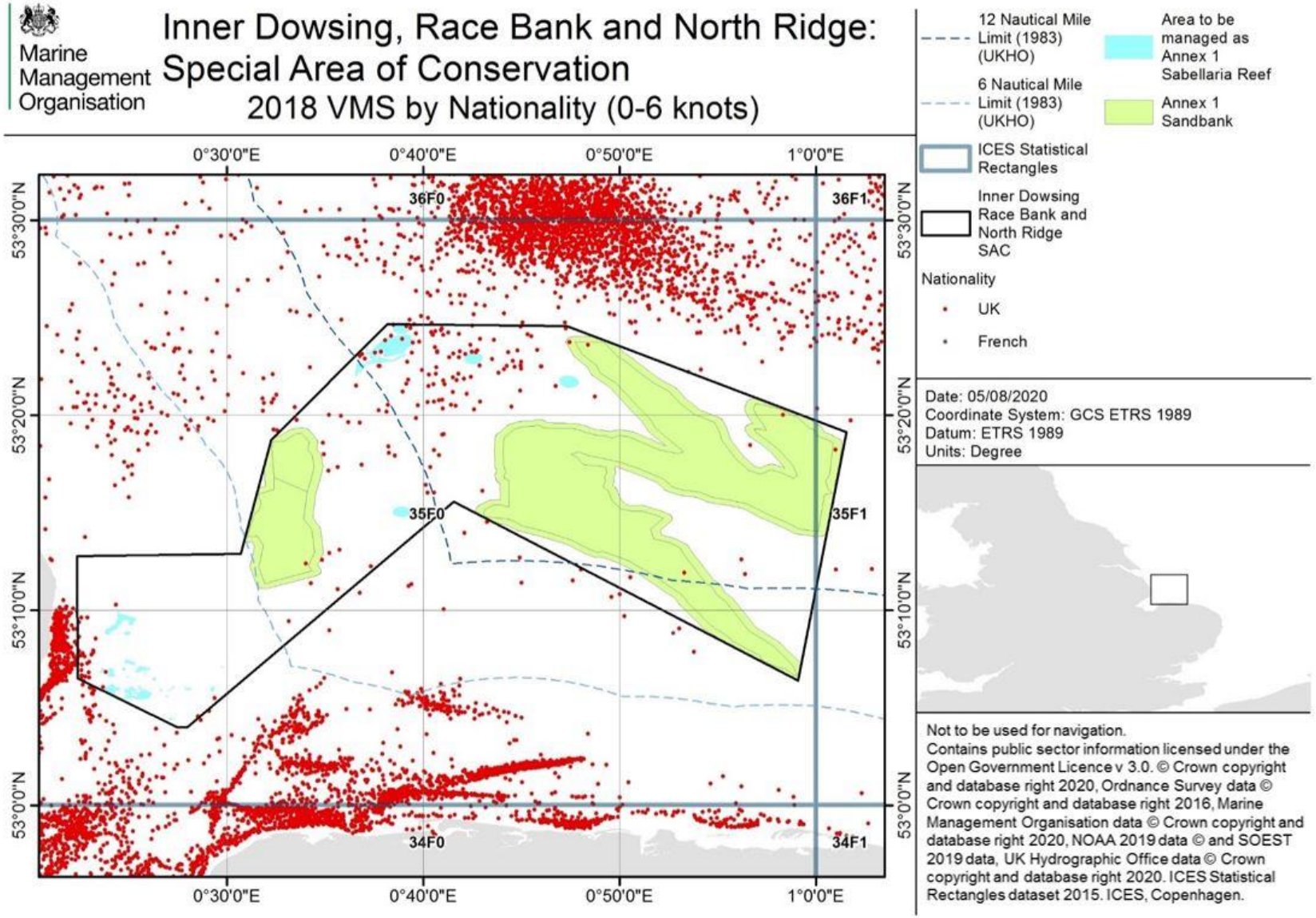


Table 16: Inner Dowsing, Race Bank and North Ridge SAC 2014-2018 demersal gear landings (tonnes) from UK vessels (derived from UK VMS)

Year	Species group	Landings by gear (t)			Total landings (t)
		FPO	OTB	TBB	
2014	All	3	-	7	10
	Crustacea	2	-	7	9
	Mollusc	1	-	-	1
	Demersal fish	-	-	-	-
2015	All	143	-	2	145
	Crustacea	142	-	2	144
	Mollusc	1	-	-	1
	Demersal fish	-	-	-	-
2016	All	145	1	--	146
	Crustacea	124	1	-	125
	Mollusc	21	-	-	21
	Demersal fish	-	-	-	-
2017	All	44	2	6	52
	Crustacea	40	2	6	48
	Mollusc	4	-	-	4
	Demersal fish	-	-	-	-
2018	All	40	2	9	51
	Crustacea	39	2	9	50
	Mollusc	1	-	-	1
	Demersal fish	-	-	-	-
2014-2018	All	375	5	24	404
	Crustacea	347	5	24	376
	Mollusc	28	-	-	28
	Demersal fish	-	-	-	-

Table 17: Proportion of VMS pings that intersect Inner Dowsing, Race Bank and North Ridge SAC from those within ICES rectangles 35F0 and 35F1

	UK VMS fishing pings in ICES 35F0	UK VMS fishing pings in the portion of the site within 35F0	Percentage (%)
2014	2925	668	22.84
2015	2828	299	10.57
2016	3124	329	10.53
2017	4875	181	3.71
2018	5221	169	3.24
	UK VMS fishing pings in ICES 35F1	**UK VMS fishing pings in the portion of the site within 35F1**	**Percentage (%)**
2014	738	0	0
2015	815	0	0
2016	3379	0	0
2017	3320	3	0.09
2018	3093	1	0.03

Table 18: Estimated UK VMS Landings for Inner Dowsing, Race Bank and North Ridge SAC based on the proportion of UK VMS fishing pings from ICES Rectangle 35F0 that intersect the site.

Landings by live weight (t) by >12m vessels from ICES 35F0 and the section of Inner Dowsing, Race Bank and North Ridge SAC within it						
Gear		**2014**	**2015**	**2016**	**2017**	**2018**
DRB	35F0	0.00	45.32	0.00	10.01	1.80
	Site	0.00	4.79	0.00	0.37	0.06
FPO	35F0	226.02	117.22	59.19	99.56	64.63
	Site	51.62	12.39	6.23	3.69	2.09
MIS	35F0	1,181.67	1,455.87	0.00	0.00	0.00
	Site	269.89	153.89	0.00	0.00	0.00
OTB	35F0	0.28	0.00	4.94	3.50	23.86
	Site	0.06	0.00	0.52	0.13	0.77
PTB	35F0	0.00	0.00	0.44	0.80	0.00
	Site	0.00	0.00	0.05	0.03	0.00
TBB	35F0	170.61	89.87	75.57	109.61	152.55
	Site	38.97	9.50	7.96	4.07	4.94

Table 19: Estimated UK VMS Landings for Inner Dowsing, Race Bank and North Ridge SAC based on the proportion of UK VMS fishing pings from ICES Rectangle 35F1 that intersect the site.

Landings by live weight (t) by >12m vessels from ICES 35F1 and the section of Inner Dowsing, Race Bank and North Ridge SAC within it.						
Gear		**2014**	**2015**	**2016**	**2017**	**2018**
DRB	35F1	12.00	5.72	0.19	0.00	0.00
	Site	0.00	0.00	0.00	0.00	0.00
FPO	35F1	622.44	245.05	455.97	626.12	794.63
	Site	0.00	0.00	0.00	0.56	0.24
MIS	35F1	4.01	2.03	0.00	0.00	0.00
	Site	0.00	0.00	0.00	0.00	0.00
TBB	35F1	25.94	8.08	1.61	0.00	0.01
	Site	0.00	0.00	0.00	0.00	0.00

Table 20: Estimated UK Non-VMS Landings for Inner Dowsing, Race Bank and North Ridge SAC based on the proportion of the area (km2) of ICES Rectangle 35F0 that the site occupies.

Landings by live weight (t) in ICES Rectangle 35F0 and the area of Inner Dowsing, Race Bank and North Ridge SAC within it.						
Gear		**2014**	**2015**	**2016**	**2017**	**2018**
DRB	35F0	1.70	0.00	0.00	73.81	6.00
	Site	0.52	0.00	0.00	22.65	1.84
DRH	35F0	804.88	95.56	201.49	0.00	0.00
	Site	247.02	29.33	61.84	0.00	0.00
FPO	35F0	462.60	385.28	513.64	398.03	473.97
	Site	141.97	118.24	157.64	122.15	145.46
GEN	35F0	0.00	0.18	0.00	0.00	0.00
	Site	0.00	0.05	0.00	0.00	0.00
GN	35F0	0.19	1.67	0.12	0.00	0.00
	Site	0.06	0.51	0.04	0.00	0.00
GND	35F0	0.04	0.00	0.00	0.00	0.00
	Site	0.01	0.00	0.00	0.00	0.00
LL	35F0	7.04	7.62	1.07	0.18	0.42
	Site	2.16	2.34	0.33	0.05	0.13
MIS	35F0	647.14	2174.23	0.00	1773.38	964.05
	Site	198.61	667.27	0.00	544.25	295.87
OT	35F0	4.10	0.11	0.92	0.00	0.00
	Site	1.26	0.03	0.28	0.00	0.00
OTB	35F0	0.57	0.67	0.68	0.84	2.02
	Site	0.17	0.21	0.21	0.26	0.62
OTT	35F0	0.00	0.13	0.00	0.00	0.00
	Site	0.00	0.04	0.00	0.00	0.00
TBB	35F0	58.29	23.42	74.23	46.72	131.24
	Site	17.89	7.19	22.78	14.34	40.28

Table 21: Estimated UK Non-VMS Landings for Inner Dowsing, Race Bank and North Ridge SAC based on the proportion of the area (km2) of ICES Rectangle 35F1 that the site occupies.

Landings by live weight (t) in ICES Rectangle 35F1 and the area of Inner Dowsing, Race Bank and North Ridge SAC within it.						
Gear		**2014**	**2015**	**2016**	**2017**	**2018**
FPO	35F1	455.59	649.50	659.06	540.41	483.16
	Site	1.64	2.34	2.37	1.95	1.74
GN	35F1	0.00	0.00	0.00	0.46	0.18
	Site	0.00	0.00	0.00	0.002	0.001
GND	35F1	0.15	0.00	0.00	0.41	0.63
	Site	0.001	0.00	0.00	0.001	0.002
LL	35F1	0.26	0.00	1.43	0.02	0.11
	Site	0.001	0.00	0.01	0.0001	0.0004
LLS	35F1	0.00	0.00	0.00	0.00	0.21
	Site	0.00	0.00	0.00	0.00	0.001
MIS	35F1	1.88	25.46	0.00	0.00	0.00
	Site	0.01	0.09	0.00	0.00	0.00
OT	35F1	0.14	0.00	0.00	0.00	0.00
	Site	0.00	0.00	0.00	0.00	0.00
PTB	35F1	0.03	0.00	0.00	0.00	0.00
	Site	0.0001	0.00	0.00	0.00	0.00
TBB	35F1	0.00	0.00	0.23	0.00	0.14
	Site	0.00	0.00	0.001	0.00	0.001

Table 22: Non UK ICES rectangle landings (t) from STECF data for ICES Rectangles 35F0 and 35F1.

Year	2012	2013	2014	2015	2016	Grand Total
Beam trawl	113.78	84.09	112.31	66.44	72.62	449.23
O15M	113.78	84.09	112.31	66.44	72.62	449.23
35F0	4.36	0.50	0.00	0.00	0.00	4.86
35F1	109.42	83.60	112.31	66.44	72.62	444.38
Demersal trawl/seine	132.93	54.54	60.00	44.23	6.71	298.41
O15M	132.93	54.54	60.00	44.23	6.71	298.41
35F0	128.21	14.30	55.01	44.23	5.93	247.68
35F1	4.72	40.23	5.00	0.00	0.78	50.73
Drift and fixed nets	0.00	0.37	0.00	0.00	0.00	0.37
O10M To 15M	0.00	0.37	0.00	0.00	0.00	0.37
35F1	0.00	0.37	0.00	0.00	0.00	0.37
Grand Total	246.70	139.00	172.31	110.67	79.33	748.01

Table 23: Estimated Non UK landings (t) from within Inner Dowsing, Race Bank and North Ridge SAC based on the proportion of VMS pings within the site. There are no Non-UK VMS pings in the portion of the site within 35F1.

Year	Nat	Gear	Pings in SAC	Pings in 35F0	Proportion of pings in SAC	35F0 landings	Estimate of landings from SAC
2014	FRA	OTB	17	177	9.60%	55.01	5.28
2015	FRA	OTB	2	113	1.76%	16.55	0.29
2016	Null	-	0	-	0	0	0
2017	FRA	OTB	1	27	3.70%	44.23	1.64
2018	Null	-	0	-	0	0	0

4.1.5. VMS spatial footprint

The spatial footprint analysis used in this assessment is based on a report commissioned by Defra's Impact Evidence Group on the feasibility of using a spatial footprint method in appropriate assessments[15] (report reference: MMO1108). It should be noted that Pr-values are derived from VMS data, and therefore only captures vessels with VMS.

Analysis was undertaken of the total spatial footprint of fishing gears used each year. The total spatial footprint of a particular gear group was then compared to the total area of the feature, producing a ratio (Pr). A Pr-value of less than one means that the total spatial footprint of the gear in a given year was smaller than the total area of the feature. A Pr-value of more than one means that the total spatial footprint of the gear

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

in a given year was greater than the total area of the feature. Estimates of the Pr-values for the different fishing gears in Inner Dowsing, Race Bank and North Ridge SAC are displayed in Table 24 and Table 25. The assumptions used when calculating footprints are displayed in Annex 2.

The total VMS report area calculates the sum of unique cell areas (0.2025km^2) where VMS reports occur. Over the sandbank feature, this peaked in 2014 for demersal trawls and gillnetting activity while dredging and potting activity peaked in 2016 and 2016-17 respectively. The only seine netting activity occurring over sandbanks occurred in 2015.

Due to the relatively small footprint of pots and anchored nets on the seabed and the little fishing activity occurring within the site, the total gear footprint for the sandbank feature, which is the total area impacted by fishing gear, is very low (0.00002 – 0.00034 km^2 (pots) 0.0007 – 0.32 km^2 (nets)) as are the Pr-values, which is the total extent of the sandbank feature (302 km^2) impacted by the gears (<0.000001 (pots), 0.000002 – 0.0004 (nets)).

Demersal trawls have a larger foot print on the seabed which is reflected in the larger figures in Table 24 compared with potting and netting despite less activity occurring. However, the area of impact and PR values remain low. Demersal trawls combined result in a total gear footprint for the sandbank feature of 0.1 – 2.8 km^2 and Pr-values of 0.005 – 0.0092 between 2014 and 2018.

Similarly, low levels of activity from dredge and seine gears over the five years also result in low areas of impact and Pr-values over the sandbank feature (Table 24).

Only bottom otter trawl (2014-2018), pot (2015-2018) and gillnet (2014 only) activity has occurred over the reef feature. As noted previously the small footprint of gillnets and pots means that despite reasonable levels of activity over the reef feature, only small areas are impacted, with Pr-values not exceeding 0.000003 for pots and 0.000030 for nets.

As for the *S. spinulosa* reef feature, the highest impacts to reef are from demersal trawling activity, specifically bottom otter trawls. However, areas of impact and Pr-values over the reef feature remain low peaking in 2014 (0.19 km^2 and 0.02 respectively) then decreasing to a consistent 0.05 km^2 and 0.004 through 2016-2018 (Table 25). However, the Pr-value analysis considers the entire site and the vast majority of demersal trawl activity over the reef feature appears to occur in the inshore (inside 6 nm) portion of the site (Figure 2 to Figure 6) outside of the scope of this assessment. Areas of impact for demersal trawls on the reef feature in the MMO portion of the site are therefore likely to be even smaller than reported here.

It is likely that certain parts of the site are subject to more frequent levels of fishing (Figure 12 and Figure 13). It also should be noted that this only represents the activity of vessels with VMS which are likely to represent a small proportion of the fishing activity at the site. Pr-values must also be treated with a high degree of caution as they rely on numerous assumptions about size and behaviour of gear, and frequency of use.

Table 24: Spatial footprint (km^2) values for VMS vessels on sandbank

Year	2014	2015	2016	2017	2018
OTB					
Total VMS report area	4.657500	3.037500	1.215000	2.835000	0.202500
Total gear footprint	0.868139	0.351948	0.140779	0.351948	0.023463
Pr-value	0.002877	0.001166	0.000467	0.001166	0.000078
Pr value %	0.287692	0.116632	0.046653	0.116632	0.007775
OTT					
Total VMS report area	-	-	-	0.202500	
Total gear footprint	-	-	-	0.045598	
Pr-value	-	-	-	0.000151	
Pr value %	-	-	-	0.015111	
TBB					
Total VMS report area	1.417500	0.202500	-	-	0.405000
Total gear footprint	1.894056	0.270579	-	-	0.541159
Pr-value	0.006277	0.000897	-	-	0.001793
Pr value %	0.627670	0.089667	-	-	0.179334
DRB					
Total VMS report area	-	-	0.405000	0.202500	0.810000
Total gear footprint	-	-	0.177081	0.088540	0.354162
Pr-value	-	-	0.000587	0.000293	0.001174
Pr value %	-	-	0.058683	0.029341	0.117366
FPO					
Total VMS report area	0.202500	1.822500	3.442500	3.442500	2.025000
Total gear footprint	0.000002	0.000018	0.000034	0.000034	0.000020
Pr-value	<0.000001	<0.000001	<0.000001	<0.000001	<0.000001
Pr value %	0.000001	0.000006	0.000011	0.000011	0.000007
GN					
Total VMS report area	47.99250	-	1.417500	0.405000	
Total gear footprint	0.121549	-	0.002563	0.000732	
Pr-value	0.000403	-	0.000008	0.000002	
Pr value %	0.040280	-	0.000849	0.000243	
GNS					
Total VMS report area	0.202500	-	-	-	
Total gear footprint	0.000366	-	-	-	
Pr-value	0.000001	-	-	-	
Pr value %	0.000121	-	-	-	
SDN					
Total VMS report area	-	7.290000	-	-	
Total gear footprint	-	0.028386	-	-	
Pr-value	-	0.000094	-	-	
Pr value %	-	0.009407	-	-	

Table 25: Spatial footprint (km^2) values for VMS vessels on *S. spinulosa* reef

Year	2014	2015	2016	2017	2018
OTB					
Total VMS report area	1.215000	0.202500	0.405	0.405000	0.202500
Total gear footprint	0.187706	0.023463	0.046926	0.046926	0.046926
Pr-value	0.015526	0.001941	0.003882	0.003882	0.003882
Pr value %	1.552630	0.194079	0.388158	0.388158	0.388156
FPO					
Total VMS report area		2.430000	2.430000	2.227500	1.8225
Total gear footprint		0.000034	0.000030	0.000032	0.000018
Pr-value		0.000003	0.000003	0.000003	0.000002
Pr value %		0.000285	0.000251	0.000268	0.000151
GN					
Total VMS report area	0.202500				
Total gear footprint	0.000366				
Pr-value	0.000030				
Pr value %	0.003028				

Figure 12: Spatial footprint analysis of all fishing gears over sandbank within Inner Dowsing, Race Bank and North Ridge SAC.

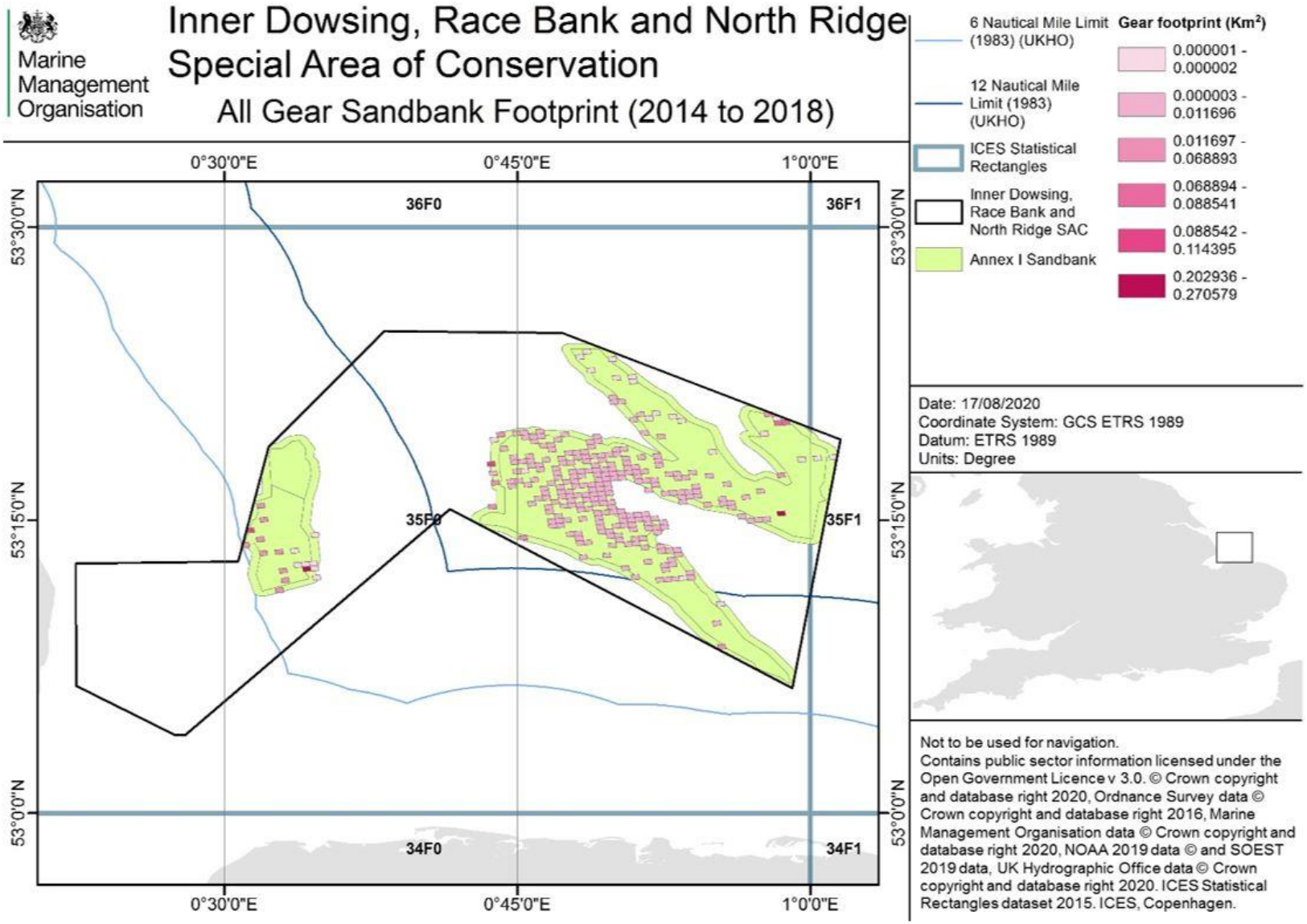
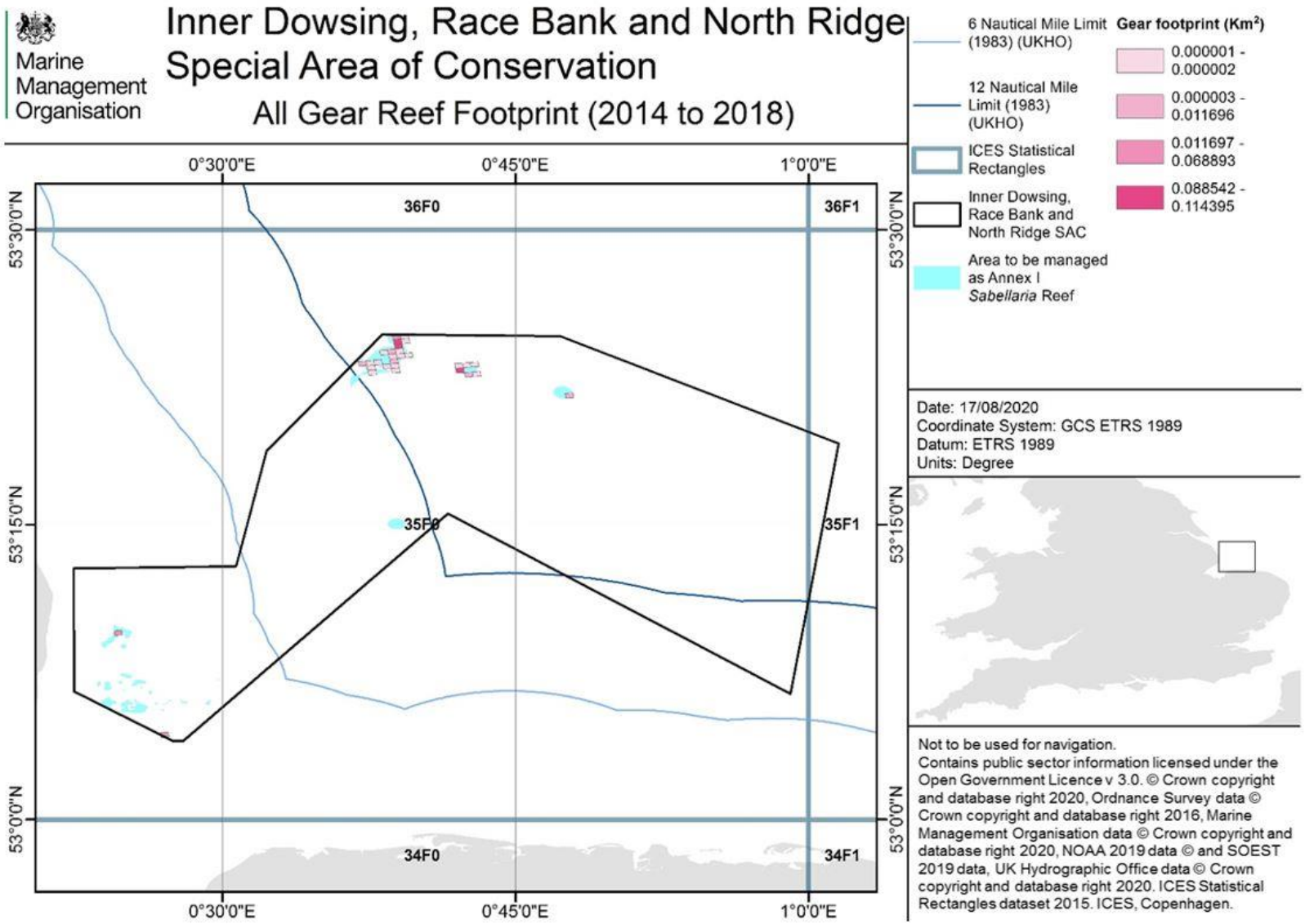


Figure 13: Spatial footprint analysis of all fishing gears over reef within Inner Dowsing, Race Bank and North Ridge SAC



4.1.6 FisherMap

In 2012 the FisherMap project aimed to map the activities of the commercial fishing fleet. Interviews were conducted with approximately 1000 skippers of the under 15 m fishing fleet. Of those interviewed, 594 gave their permission for their data to be shared with third parties.

FisherMap data represents the number of fishers that indicated they fish within the site boundary over a year's fishing activity (collected from a series of monthly totals of vessel numbers per grid cell) using a particular gear type (des Clers et al., 2008; des Clers, 2010). Inner Dowsing, Race Bank, North Ridge boundary has been overlaid with this data (Figure 14 to Figure 18).

FisherMap data indicated that the majority of the demersal towed gear fishing activity by the under 15m fleet took place inshore of 6 nm limit and an area to the south east of the Inner Dowsing sandbank (see Figure 1 for labels of named sandbanks and reefs).

There was some demersal towed gear activity on the sandbanks between the 6 nm to 12 nm; the number of demersal towed gear fishing vessel visits for the various sandbank areas is shown in Table 26. Table 27 shows the number of static gear visits over the areas of *S. spinulosa* reef.

Table 26: Number of under 15 metre fishing vessel visits per year over each of the sandbank areas by gear type[16]

Sandbank	Number of fishing vessel visits per year by gear type				
	Bottom towed gear	Dredges	Pots	Lines	Nets
Inner Dowsing Overfalls	21-60	11-30	41-80	11-60	-
Inner Dowsing	41-150	31-100	41-70	11-60	-
Scott Patch	41-100	31-100	31-70	11-40	-
Race Bank	51-60	-	61-150	11-30	-
North Ridge	1-30	1-10	41-80	11-20	-
Dudgeon Shoal	11-40	-	51-70	11-20	-

Table 27: Number of under 15 metre fishing vessel visits per year over each of the reef areas by gear type[13]

***S. spinulosa* reef**	Number of fishing vessel visits per year by gear type		
	Pots	Lines	Nets
Lynn Knock Reef	21-80	11-60	11-40
Silver Pit Reef	21-80	11-20	-

[16] As these areas fall over a number of grid cells the highest number of visits has been recorded.

Figure 14: Inner Dowsing, Race Bank and North Ridge SAC FisherMap (2012) - Bottom Towed Gear

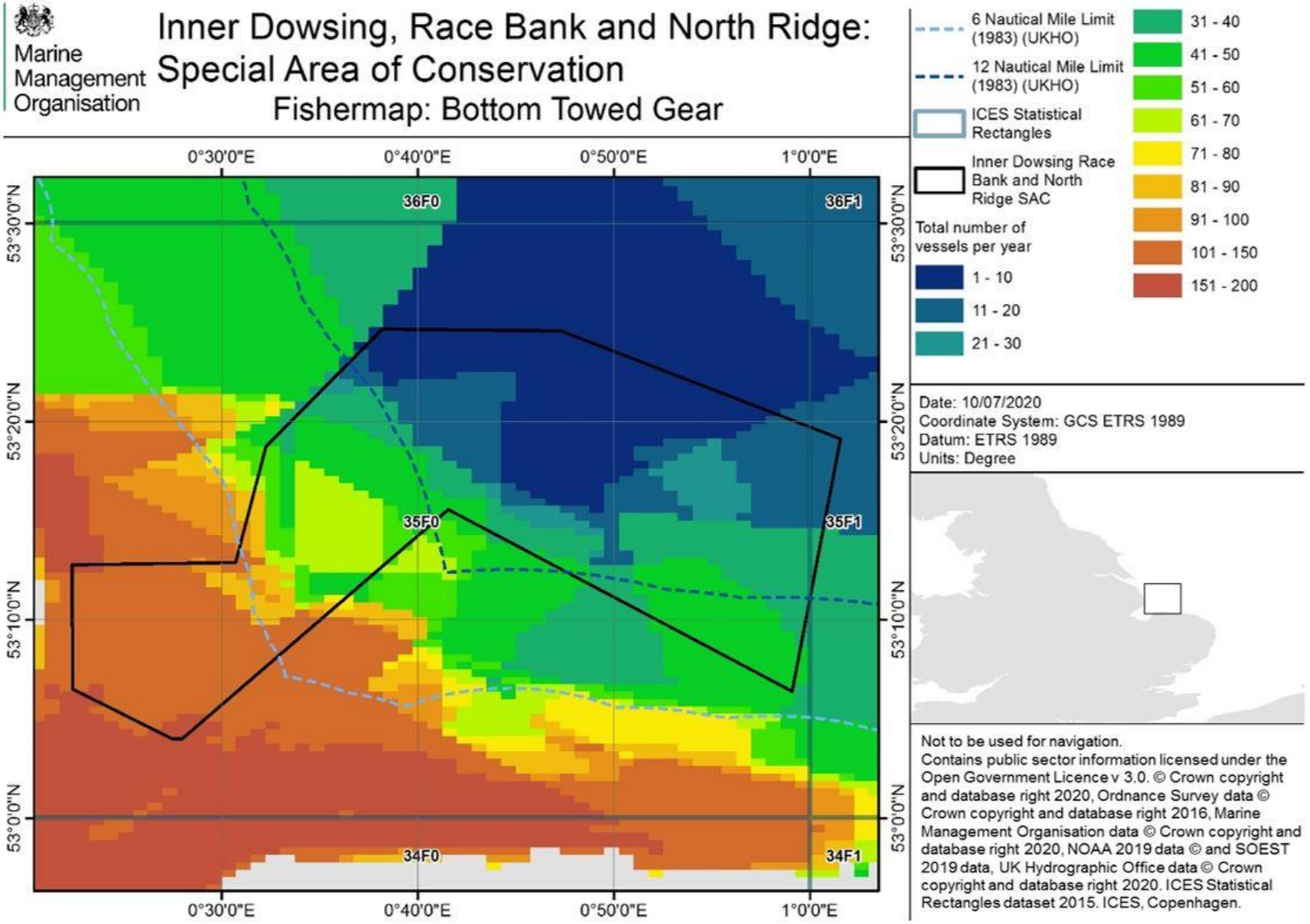


Figure 15: Inner Dowsing, Race Bank and North Ridge SAC FisherMap (2012) – Dredges

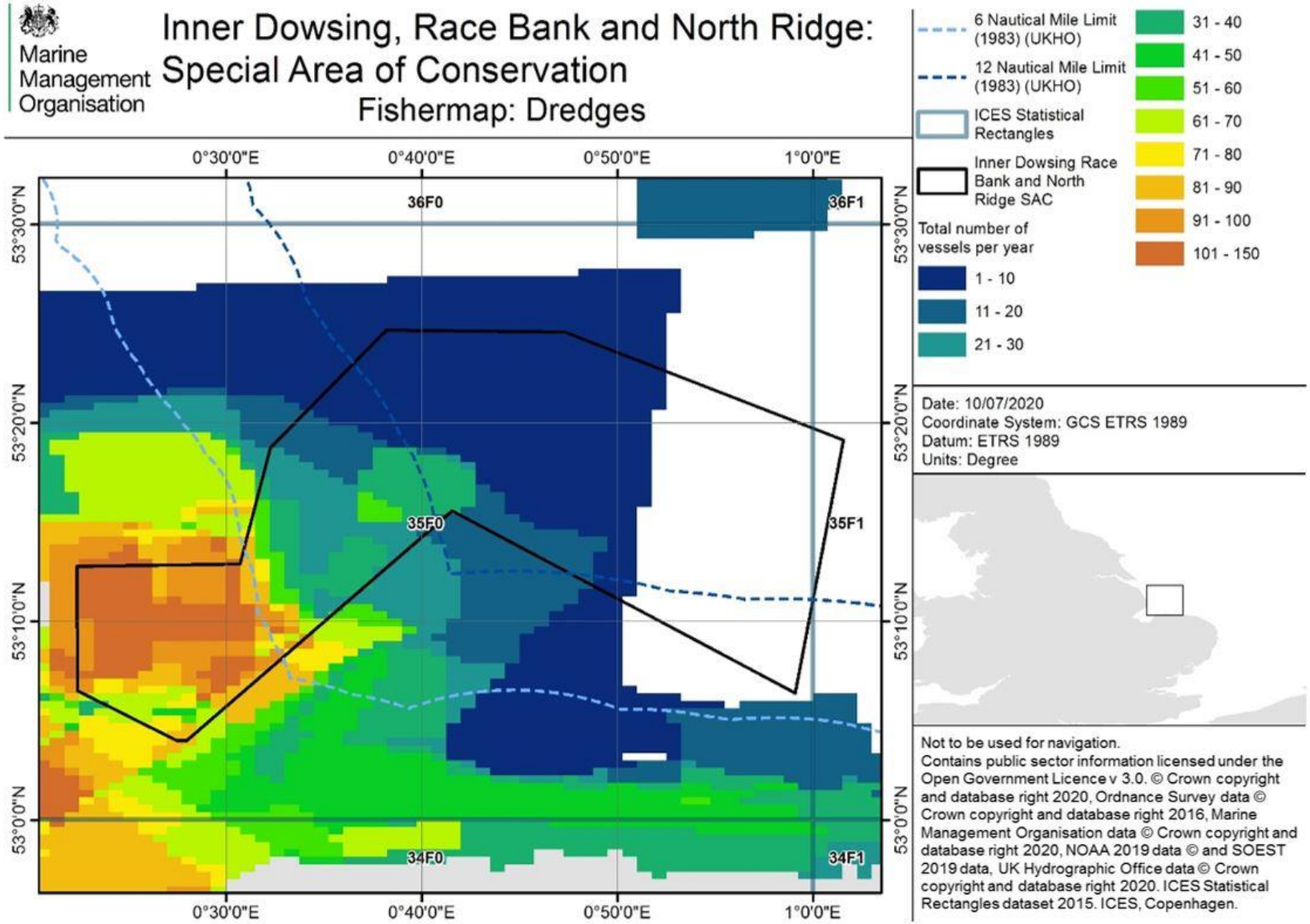


Figure 16: Inner Dowsing, Race Bank and North Ridge SAC FisherMap (2012) - Pots

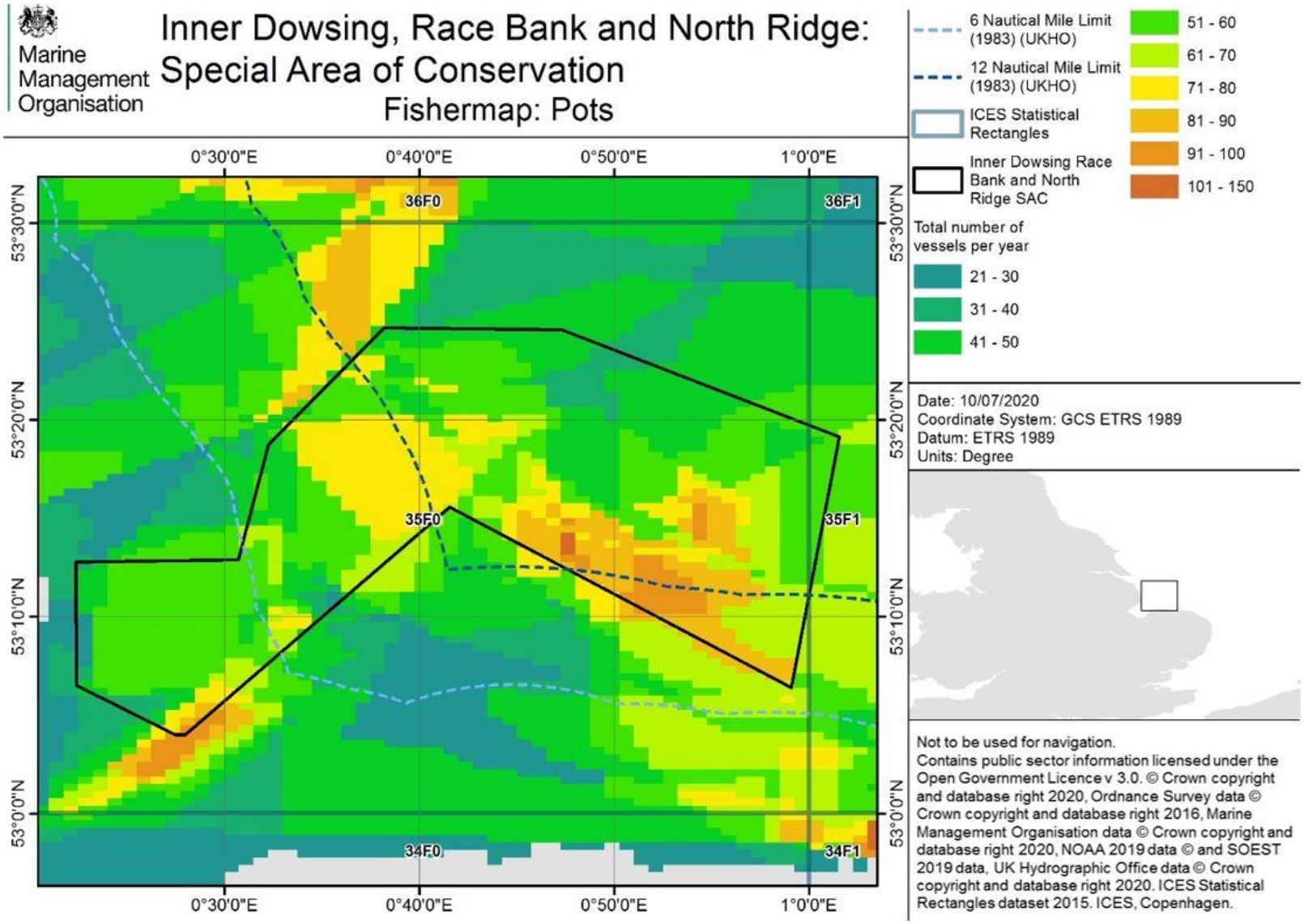


Figure 17: Inner Dowsing, Race Bank and North Ridge SAC FisherMap (2012) – Nets

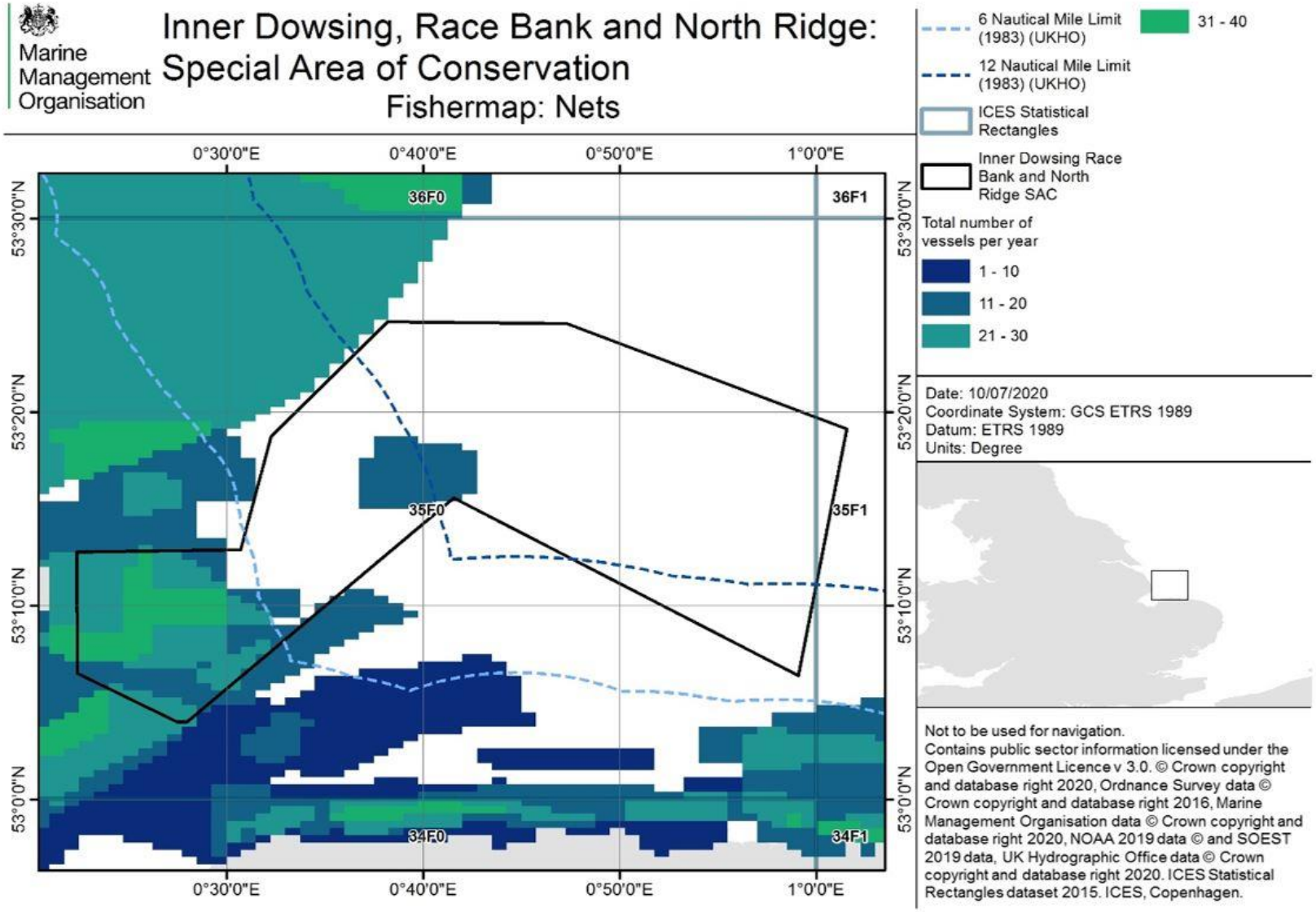
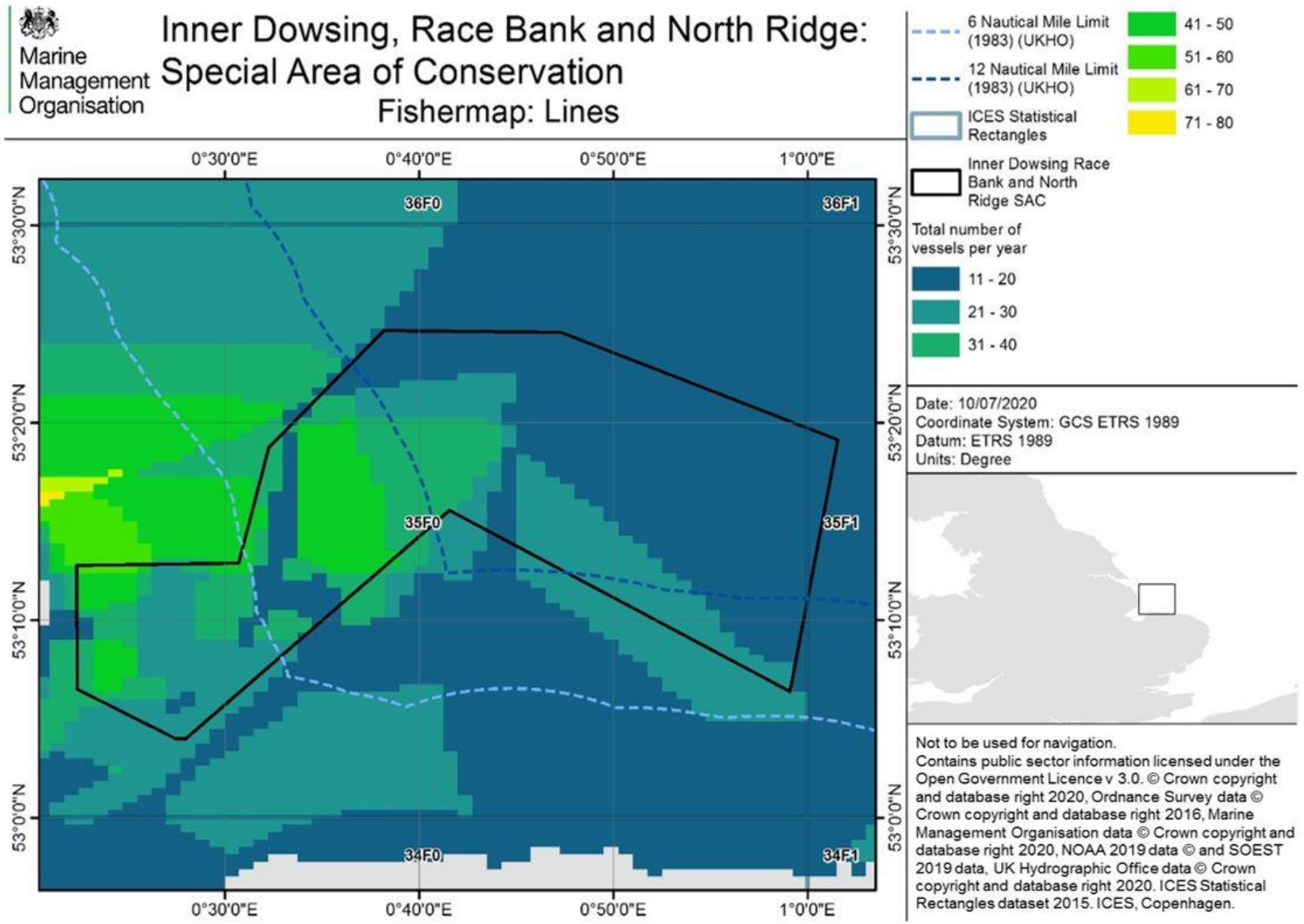


Figure 18: Inner Dowsing, Race Bank and North Ridge SAC FisherMap (2012) – Lines



4.1.7 Sightings per unit effort

In 2014, a Defra commissioned project used sightings data to collate sightings data from MMO, IFCA and Navy surveillance from 2010-2012 inclusive and create a gridded geographic data layer of sightings per unit effort (SPUE = number of sightings / surveillance effort) (Vanstaen and Breen, 2014).

Figure 19 to Figure 21 have been included below for gear types where activity was observed (mobile gear - trawling, and static gear - potting). No activity was observed for dredging, netting, angling, lining or “other” gear types.

Figure 19: Sightings per unit effort - mobile gear

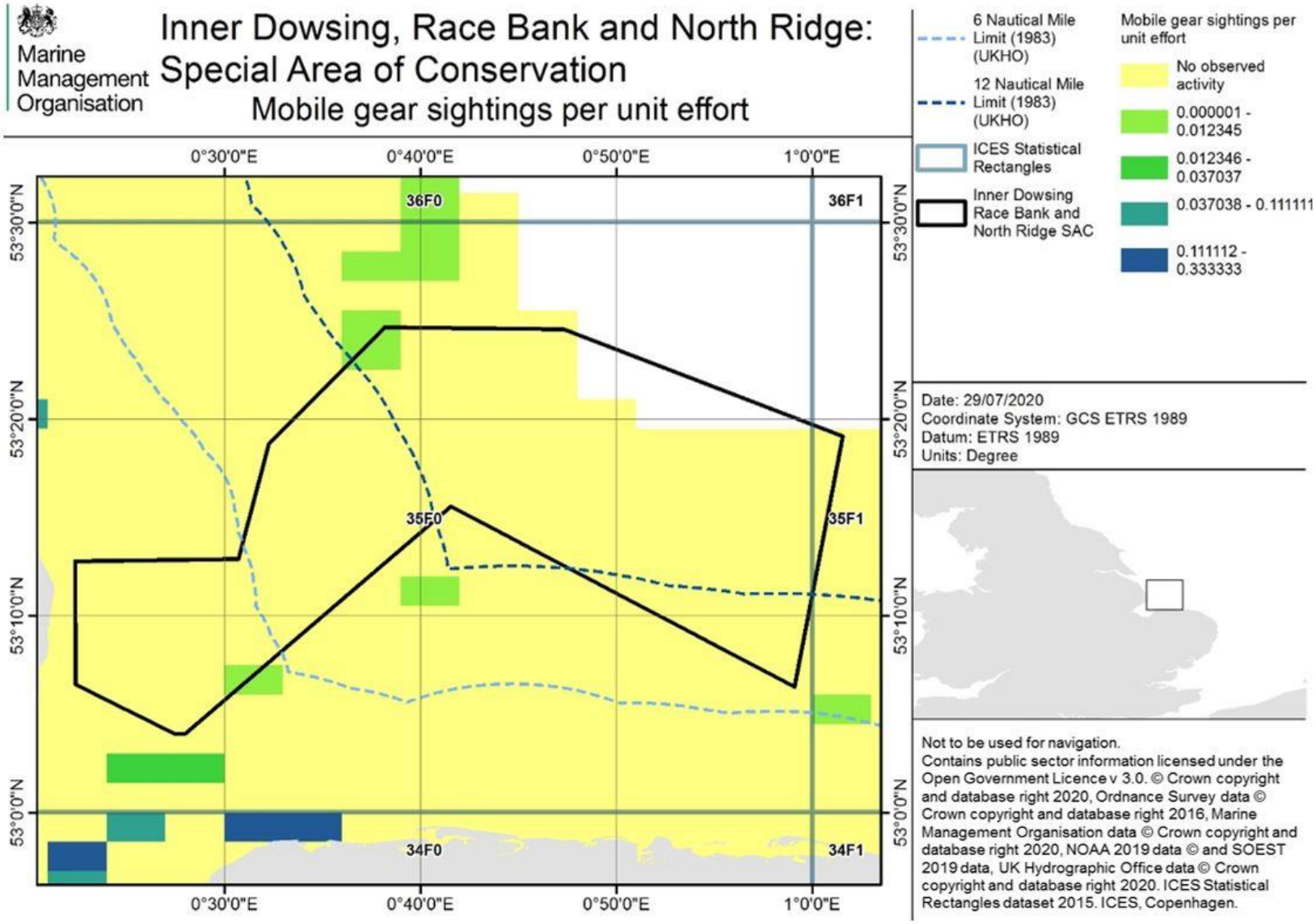


Figure 20: Sightings per unit effort - trawling

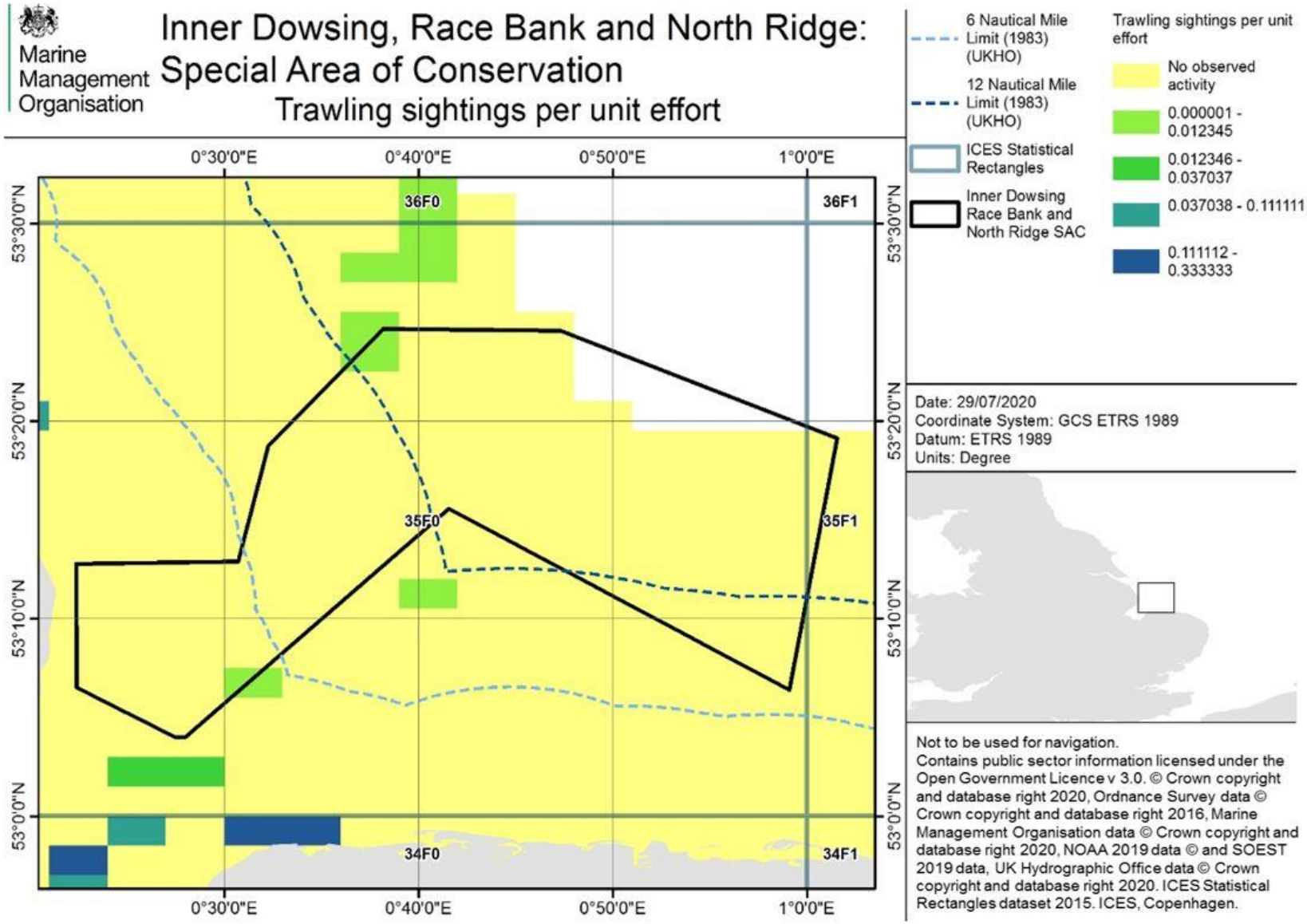
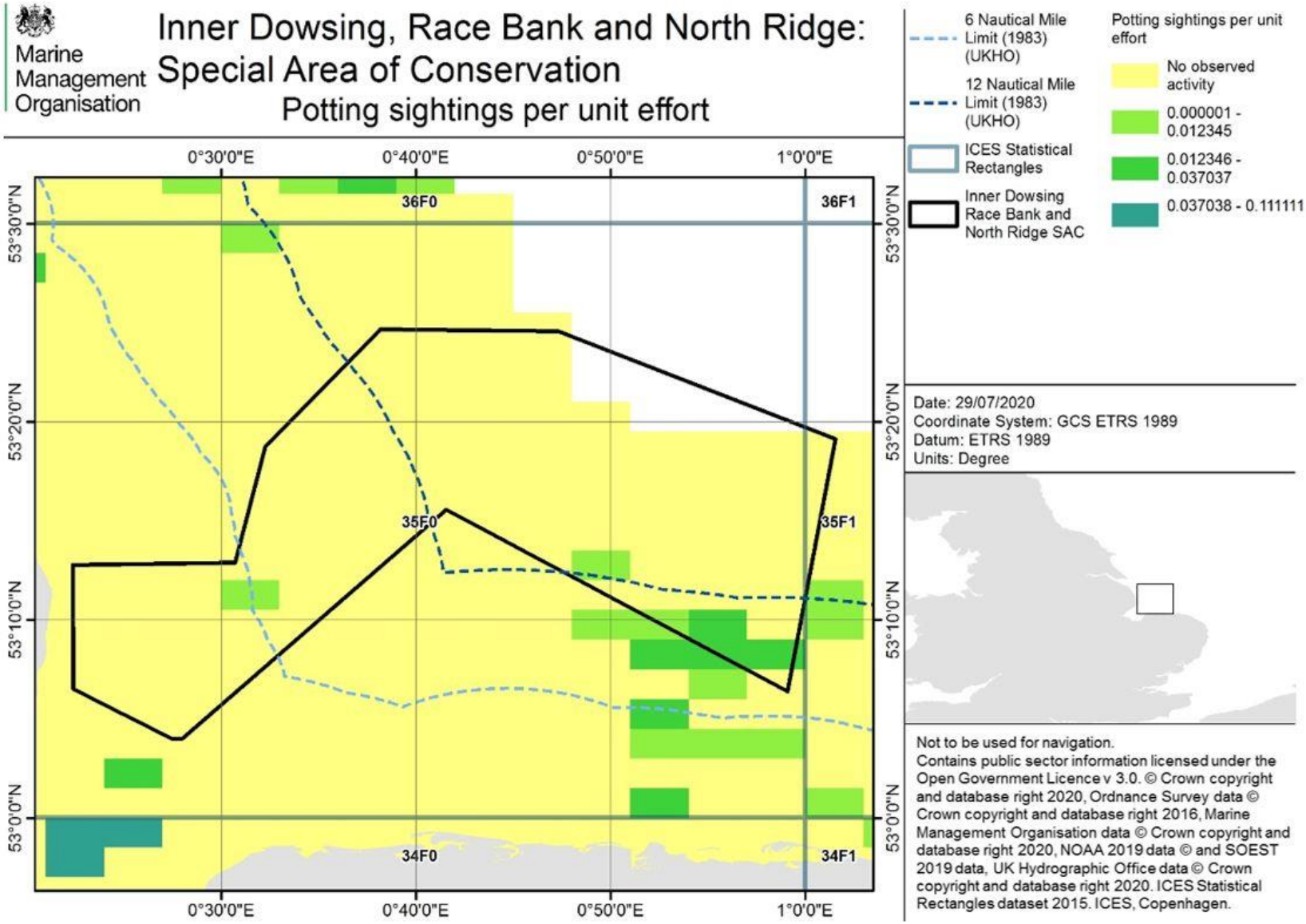


Figure 21: Sightings per unit effort: static gear - potting



4.1.8 Summary

The MMO portion of Inner Dowsing, Race Bank and North Ridge SAC is an important area for UK fishing vessels using potting gears. While gillnetting and demersal longlining, demersal trawls, dredging and seine netting activities have occurred in the years analysed this has been with little apparent regularity or intensity.

The location of the site and its straddling of the inshore 6nm IFCA district and offshore 6 – 12 nm MMO waters results in a fishing fleet comprising of both small (under 12 m) and large (over 12 m) vessels. Within the MMO portion of the site the available evidence suggests that the majority of activity from larger (VMS) vessels occurring over the sandbank and reef features between 2014 and 2018 is from potting, gillnetting and seining, however levels of gillnetting appears to have reduced considerably from 2015 onwards and seining activity only occurred in a few of the years analysed. For larger vessels, potting appears to be the only gear to be interacting with the features with any kind of regularity. Spatial footprint analysis is similar for all gear types analysed between 2014 and 2018 showing small gear footprints and Pr-values.

Understanding the activity of the under 12m fleet is more difficult but all evidence suggests activity is low with relatively few vessels engaged in fishing activity particularly in the MMO portion of the site which is more difficult to reach by smaller vessels due to the distance from shore. Demersal longline activities appear to be reserved for the smaller inshore fleet with no records of longlining activity occurring in the VMS data however this too appears to be of low intensity (MMO coastal *pers comms.)* and more commonly occurring over the less sensitive sandbank features than reef (Figure 18).

Individually, the fisheries evidence sources used in this assessment each suffer from limitations for example in terms of fleet coverage, confidence and age. However, when considered together they provide a consistent picture of mostly low levels of fishing activity in and around the sandbanks and *S. spinulosa* reefs of the Inner Dowsing, Race Bank and North Ridge SAC.

Despite the relatively low levels of activity it is clear there is interaction and or the potential for interaction between the fishing activity occurring and the protected Annex I sandbank and reef features of the Inner Dowsing, Race Bank and North Ridge SAC. The sections below examine the pressure that each fishing type exerts on the features of the site.

4.2 Abrasion/disturbance of seabed surface substrate and penetration of the substrate on and below the surface of the seabed

These pressures are relevant to traps, anchored nets/lines, demersal trawls, demersal seines and dredges for the sandbank feature. For the *S. spinulosa* reef feature only the abrasion/disturbance of seabed surface substrate pressure is considered a LSE to be assessed and therefore only traps and anchored nets/line gears apply this pressure.

The pressures 'abrasion/disturbance of seabed surface substrate' and 'penetration and/or disturbance of the substrate below the surface of the seabed, including abrasion' are considered together here due to the similarities in the nature of the pressures, and the evidence available to assess impacts.

Abrasion/disturbance and penetration of seabed surface substrate can damage sedimentary habitats by direct damage to infauna and epifauna, particularly in more stable sediments where organisms tend to be more adapted to a lower energy environment and therefore longer-lived, less resilient to sediment movement and direct abrasion and have lower rates of recoverability (Tilin et al. 2010).

4.2.1 Sandbank

Natural England and JNCC have advised that the three sandbank sub-features vary in terms of relative sensitivity. The subtidal mixed sediments subfeature contains a wider diversity of epifauna making it more sensitive to pressures associated with fishing than subtidal sand and subtidal coarse sediment.

The Annex I sandbanks at Inner Dowsing Race Bank and North Ridge SAC contain a mosaic of physical habitats (such as subtidal sand, coarse and mixed sediments) with correspondingly different biological communities. The fauna associated with the crests of sandbanks is predominantly low diversity communities typical of disturbed, mobile sediment environments (Institute of Estuarine and Coastal Studies (IECS), 1995; IECS, 1999; Foster-Smith and Sotheran, 1999; Centrica Energy, 2009; Centre for Environment Fisheries and Aquaculture Sciences (Cefas), 2013), although higher diversity assemblages can occur when cobbles or pebbles provide a firmer attachment surface (Foster-Smith and Sotheran, 1999; Centrica Energy, 2009; Cefas, 2013). Along the flanks of the banks, and towards the troughs between the banks the sediments tend to be slightly more stable. In these regions infaunal and epifaunal communities are more diverse (IECS, 1995; IECS, 1999; Foster-Smith and Sotheran, 1999; Centrica Energy, 2009; Cefas, 2013).

4.2.1.1 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. This is more likely to occur during hauling of gear or when the gear is subject to strong tides, currents or storm activity. 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.

There is limited direct evidence of the impacts of static gears on subtidal sediments. However Hall et al. (2008) reported that all static gears are not considered to be a 'major concern' for subtidal sediments and estimated no or low sensitivity to all but heavy[17] levels of fishing intensity on stable species rich sediments or sand and gravel with long-lived bivalves. Hall et al. (2008) categorised heavy levels of potting intensity as 5 pots lifted per hectare per day. In Inner Dowsing, Race Bank and North Ridge SAC 30 pots are estimated to be laid per day per vessel (see Annex 2) Annex 2 - Assumptions used to calculate spatial footprint (Pr-values). Using the area of the sandbank feature and the number of VMS potting records over said feature a rough estimate of pots per hectare per day in the site is 0.00017. While this only accounts for larger vessels with VMS it is unlikely the inclusion of smaller vessels will increase this to anywhere near the heavy levels described by Hall et al. (2008).

As noted previously, evidence from VMS suggests for larger vessels, gill netting is no longer occurring with any kind of regularity in the site and landings evidence for smaller inshore vessels suggests their gillnetting activity levels are similarly low. While potting activity has increased since 2014 in particular for larger vessels with VMS, the majority of activity does not appear to occur over the sandbank feature. The exact location of the potting activities of smaller vessels is not known but they are likely to target similar areas to larger vessels albeit perhaps closer inshore. Fishermap data contradicts that of VMS and suggests the highest levels of potting activity occur over the Race Bank sandbank in the offshore portion of the site, however it is assumed this activity can be most likely attributed to larger vessels given the distance from shore and as these larger vessels are included within VMS data, the Fishermap data is not considered to represent the most up to date location of potting activities.

Given the levels of sensitivity of subtidal sandbanks (subtidal mixed sediment is classed as medium sensitivity and subtidal sand is classed as not sensitive to

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

medium sensitivity) at this site to abrasion and disturbance, and the low levels of static gear fishing activity on the sandbank features, **MMO has concluded that abrasion, disturbance and penetration of the substrate on and below the surface of the seabed pressures associated with traps and anchored nets/lines are compatible with the conservation objectives of the site and will not result in an adverse effect on site integrity.**

4.2.1.2 Impact of demersal trawls

As it is pulled across the seabed, various parts of demersal trawl can cause abrasion or disturbance of the seabed surface substrate. For beam trawlers the main effects are from the 'shoes' or 'sleds', which on the largest vessels can penetrate the seabed up to 6 cm. For otter trawls the otter boards/doors can penetrate the sediment between 0.7 – 1.9 cm depending on the width of gear, and the footrope, ground rope and bridles may also come into contact with the seabed (Grieve et al. 2011).

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, penetrating up to 2.2 cm (Tilin et al. 2010, Grieve et al. 2011).

The effects of demersal trawling on sedimentary habitats can vary depending on site conditions (e.g. wave/tidal energy) with low mobility sediments being more sensitive due to the more developed epifauna and infauna (Hall et al. 2008, Lambert et al. 2014). Evidence of the impacts of towed gears varies depending on the gear type. Demersal trawling in the site is predominantly beam trawling for shrimp, which uses lighter gear than whitefish beam trawls and does not use tickler chains.

Hall et al. (2008) determined sensitives of different sediment types to types of demersal towed gears at different levels of activity. Available evidence suggests demersal towed gear activity in the MMO portion of the site is low with few VMS records and few landings deriving from these gears. What little activity does occur does not appear to be concentrated over the sandbank feature. As such demersal trawling activity would fall into the 'low' category as described by Hall et al. (2008).

At this low level of activity, both unstable coarse sediments with robust fauna and species rich mixed sediments had low levels of sensitivity to shrimp trawling. Unstable coarse sediments with robust fauna were also reported to have low sensitivity to other kinds of demersal towed gear, however species rich mixed sediment were reported to have medium sensitivity to other demersal towed gear. Given that the more sensitive sandbank sub-feature at this site is classed as having moderate diversity, it is likely that its sensitivity falls between these two.

Kaiser et al. (2006) undertook a meta-analysis of 101 fishing impact manipulations and reported that beam trawling resulted in an immediate 70% reduction on benthic fauna of subtidal sand (based on 2 studies providing 53 data points). However by 2 to 7 days after the fishing event, no change was detectable (based on one study with 8 data points). Similarly, muddy sand was found to experience a 35% reduction in benthic fauna immediately following beam trawling (based on two studies providing 61 data points), although this effect had disappeared after one week (based on one study providing 2 data points). An immediate reduction in benthic fauna in gravel sediments of around 40% was also reported (two studies providing 28 data points), although this was not statistically significant. There were no longer-term studies available for gravel sediments.

Kaiser et al. (1998) reported that beam trawling on high mobility sand in greater than 30 metres depth was found to have no detectable effect on benthic infauna 24 hours after fishing or when the feature was assessed 6 months later.

Evidence suggests the sandbank feature has relatively low sensitivity to the effects of demersal trawling activity. Despite this assessment, given the recover condition of the sandbank feature in the site and the requirement to recover the feature to favourable status the **MMO is taking a precautionary approach and concludes that abrasion, disturbance and penetration of the substrate on and below the surface of the seabed pressures may not be compatible with the conservation objectives of the site and an adverse effect on site integrity due to demersal trawls cannot be ruled out**.

4.2.1.3 Impact of dredges

The potential for abrasion and disturbance from dredging is due to occasional scallop dredging and mussel prospecting for seed mussel (*Mytilus edulis*). Mussel seed beds are ephemeral therefore mussel prospecting can occur sporadically around the optimal period for relaying in late summer. This fishery is small scale and generally will only occur one week of the year. If not fished, the mussel seed beds will naturally be lost through predation or storm damage.

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 that 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). A study by 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 year) from scallop dredging than biota with shorter life-spans such as polychaetes (<1 year) (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. As described for demersal trawls in section 4.2.1.2, 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.

Mussel prospecting is a non-licensable activity and will only require a consent to land the fishery or to relay the mussel seed on to prospective aquaculture beds. The potential for this fishery to occur is limited to late summer as this is the optimal time for successful transportation of seed. It is not envisaged that the current scale or magnitude of this potential fishery will have a significant effect on the site however; this potential activity will be monitored in the site. Mussel seed prospecting depends on the recruitment of mussel seed and tends to be less of an impact than scallop dredging (Hall et al. 2008).

VMS data, Fishermap and SPUE data suggests activity levels in the site are very low but interaction with the sandbank feature does occur. Given the unfavourable condition of the sandbank feature in the site and the requirement to recover the feature to favourable status the **MMO is taking a precautionary approach and concludes that abrasion, disturbance and penetration of the substrate on and below the surface of the seabed pressures may not be compatible with the conservation objectives of the site and an adverse effect on site integrity due to dredges cannot be ruled out**.

4.2.1.4 Impact of demersal seines

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). The surface footprint of Danish seines (1.0 km^2), defined as the surface area covered during one hour of fishing, is relatively high compared to the otter trawl (0.3 – 1.2 km^2) and beam trawl (0.2 km^2) (Eigaard et al. 2016a, Rijnsdorp, 2015). The physical structure of the feature is unlikely to be impacted and therefore

this activity is considered compatible with the structure and function target for the site.

Given the absence of otter boards and lighter groundgear, seines tend to be considered as less damaging to seabed habitats via abrasion and penetration compared to other demersal gear types. Eigaard et al. (2016 a,b) estimated that the subsurface ratio to be 0.000 for Danish seines. In comparison, predicted sub-surface ratios for otter trawls ranged from 0.078 to 0.304 and from 0.522 to 1.000 for beam trawls, depending on target species (Eigaard et al. 2016 a,b). These predictions are in line with the conclusions of MBIEG (2020) which suggest that demersal seines alone may not have a significant impact on benthic communities via surface abrasion and subsurface penetration. Where sessile or attached epifauna are absent this is compatible with the restore extent and distribution and structure and function targets of the site in relation to biological communities. However, impacts of abrasion and penetration through removal of non-target species may exist and are assessed in section 4.4.

VMS data indicates that only UK vessels appear to use seine gears in the site and only Danish/anchor seines. This does not appear to be a common gear type used in the site but it does occur in higher levels slightly further south (Figure 2 to Figure 6).

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

4.2.2 *Sabellaria spinulosa* reef

Abrasion/disturbance of the seabed can impact *S. spinulosa* reefs in several ways. Physical abrasion can break off or damage parts of the reef, reducing its extent and reducing growth rates. This pressure includes unintentional removal of *S. spinulosa* reef by fishing gears targeting other species.

Abrasion/disturbance of seabed surface substrate may also result in higher sediment loads, which could affect reef formation. However high suspended sediment loads would be unlikely to affect *S. spinulosa* reef as they are evolved to exist in, and are dependent on such conditions to promote reef growth. Therefore, the reef is not considered to be sensitive to changes (increases) in suspended sediments loads (JNCC and NE 2013).

4.2.2.1 Impact of traps and anchored nets/lines

Static gears can damage *S. spinulosa* reef through gear (demersal longlines, pots, nets and their associated anchors or lines) striking or becoming entangled with the

reef. This is most likely to occur upon deployment, through movement of gear on the benthos due to tide, current and storm activity, and as the gear is dragged along the seafloor on retrieval (Coleman et al. 2013, Grieve 2014).

Walmsley et al. (2015) noted that there is no primary evidence on the impact of potting on *S. spinulosa* reef. However sensitivity assessments based on expert knowledge are available. Table 28 shows a summary of several sensitivity assessments which have considered the sensitivity of *Sabellaria spp.* to impacts from static gears.

Table 28: Summary of sensitivity assessments for potting impacts on *S. spinulosa* reef

Reference	Summary	Notes
Eno et al. (2013)	Honeycomb-worm (*S. alveolata*) reefs have medium sensitivity to all levels of potting and to high levels of netting or lining. These reefs have low or no sensitivity to all other levels of netting or lining.	Sensitivity was generated by combining semi-quantitative scores for resilience and recoverability. Quantitative fishing intensity levels were not published. Intensity levels were based on fishing practices around Wales. Sensitivity was not assessed for *S. spinulosa* reef and evidence suggests *S. spinulosa* is more fragile than *S. alveolata* and would therefore show greater sensitivity to these gears and levels of intensity (Gibb et al. 2004).
Hall et al. (2008)	Biogenic reef on sediment habitats have medium sensitivity to heavy levels of potting and low sensitivity to all other levels of potting.	Sensitivity was assessed in terms of various factors including degree of physical disturbance, size of area damaged, effect on fauna and community makeup. Fishing intensity levels are quantified in Appendix 3 of the report.
Roberts et al. (2010)	*S. spinulosa* reefs may be affected by the use of static and towed fishing gears.	Assessment was based on existing literature. Sensitivity is assessed as a combination of resistance and resilience.
Tilin et al. (2010)	*S. spinulosa* reefs have a low sensitivity to surface abrasion.	Sensitivity assessments were based on a combination of resistance (tolerance) and resilience (recovery). Sensitivities were assessed in terms of pressure benchmarks rather than particular activities. The pressure benchmark for surface abrasion was “damage to seabed surface features.

Gibb et al. (2014) reviewed the sensitivity of *S. spinulosa* reef to various pressures, including abrasion/disturbance of seabed sediment, however this pressure was not linked directly to static fishing gears. Gibb et al. (2014) cites studies which show *S. alveolata* reefs recovered within 23 days from trampling, walking and stamping (Cunningham et al. 1984).

However Cunningham et al. (1984) also reported that more severe damage caused by kicking and jumping on the reef was still not fully repaired 23 days later. *S. alveolata* reefs may also be less fragile than *S. spinulosa* reefs, meaning the impacts of abrasion/disturbance may be greater and recovery times longer (Gibb et al. 2014) than those observed in *S. alveolata* by Cunnigham el (1984).

VMS data suggests for larger vessels, potting activity occurs in close proximity to, but rarely directly over, the *S. spinulosa* reef. However, given the length of a potting string and the uncertainty of the location of the string in accordance with the VMS location it is certainly possible that pots are laid within the *S. spinulosa* reef area. For smaller vessels, exact locations for use of static gear is unknown but they are likely to be in similar areas to the larger vessels and Fishermap and SPUE data suggest activity levels, while low, could potentially be occurring in areas of *S. spinulosa* reef.

Given the unfavourable condition of the reef feature in the site and the requirement to recover the feature to favourable status the **MMO is taking a precautionary approach and concludes that abrasion, disturbance and penetration of the substrate on and below the surface of the seabed pressures may not be compatible with the conservation objectives of the site and an adverse effect on site integrity due to traps, anchored lines/nets cannot be ruled out**.

4.2.3 Summary of abrasion, disturbance of seabed surface substrate and penetration of the substrate on and below the surface of the seabed pressures on sandbank and reef features

4.2.3.1 Sandbank

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

There is a risk that surface abrasion and sub-surface penetration caused by demersal trawls and dredges may not help the achievement of favourable condition targets. Use of these gear types may impact the physical and biological structure of

the sandbank feature via direct physical impacts from gear interacting with the seabed and species. This may impact the extent and distribution regarding large scale topography, sediment composition and biological assemblages. The **MMO conclude that demersal trawls 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.**

4.2.3.1 *S. spinulosa* reef

While expert opinion from Eastern IFCA indicate that potters are unlikely to target *S. spinulosa* reef areas other evidence suggests an interaction of traps and anchored nets/lines cannot be ruled out. The impact of anchors and weighted pots landing on *S. spinulosa* reef is likely to be similar to the damage exerted by Cunningham et al. (1984) on *S. alveolata* reefs through trampling/stamping/kicking and jumping etc and while recovery is possible in reasonable time frames, given the increased sensitivity of *S. spinulosa compared with S. alveolata* (Gibb et al. 2014) and the current unfavourable condition of the feature in the site and the requirement to recover the feature to favourable status the **MMO is taking a precautionary approach and concludes that, despite current apparently low activity levels, the abrasion, disturbance and penetration of the substrate on and below the surface of the seabed pressures exerted by traps and anchored nets/lines may not be compatible with the conservation objectives of the site and an adverse effect on site integrity of these gears cannot be ruled out (Table 29).**

Table 29: Sandbank and reef features abrasion/disturbance and penetration assessment

Pressure	Feature	Favourable condition target	Activity	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	Sandbank	Restore the total extent and spatial distribution of subtidal sandbanks to ensure no loss of integrity, while allowing for natural change and succession.	Traps	Yes
			Nets	Yes
			Demersal trawl	No
			Dredges	No
			Demersal seines	Yes
		Restore the presence and spatial distribution of subtidal sandbank communities.	Traps	Yes
			Nets	Yes
			Demersal trawl	No
			Dredges	No
			Demersal seines	Yes
Abrasion or disturbance of the substrate on the surface of the seabed	Reef (*S. spinulosa reef*)	No reduction in extent of reef, subject to natural change.	Pots	No
			Nets	No
		Reef shows no significant decline in community with different growth phases present, subject to natural change.	Lines	No
		Reef shows no significant decline in community with different growth phases present, subject to natural change.	Pots	No
			Nets	No
		Maintain age/size class structure of individual species, subject to natural change.	Lines	No
		Maintain age/size class structure of individual species, subject to natural change.	Pots	No
			Nets	No
			Lines	No

4.3 Removal of target species

Fishing gears are designed to remove (target) species from the marine environment. Impacts of traps, anchored nets/lines and dredges have been assessed for this pressure on the sandbank feature. No likely significant effect was determined for demersal trawls and seines in Part A so these gear types are not considered in this section.

4.3.1 Sandbank

4.3.1.1 Impacts of traps

Traps in this area target crustacea and gastropod molluscs. In terms of crustacea, lobsters and crabs are the most common target species and whelks are the predominant gastropod mollusc caught. Between 2014 and 2018 an estimated total of 76.82 tonnes were landed by over 12m UK potting vessels within the site. VMS charts indicate that potting by UK vessels with VMS over the sandbank feature is minimal and so these vessels are unlikely to be having a significant impact on target species within the sandbank feature. An estimated 695.5 tonnes were also landed from non-VMS UK potting vessels during this time period, with an estimated 120.58 to 147.2 tonnes landed each year. This data indicates that landings from non-VMS vessels from within the site has remained consistent between 2014 and 2018. Pr-values indicate a low footprint from potting activity between 2014 and 2018, with a total gear footprint over the sandbank feature of 0.00002 – 0.00034 km^2. Given that traps can be altered with the appropriate use of mesh sizes in cover netting and escape gaps, juvenile target species are at low risk from traps[18]. Consistency in effort in addition to protection of juvenile stock reduces the risk to target species.

Considering the discussion above, the **MMO concludes that impacts from removal of target species by 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.**

4.3.1.2 Impacts of anchored nets/lines

Anchored nets in this area target bass, cod, pollock, sole and anglerfish. There are no landings estimated from anchored nets/lines from over 12 m UK vessels within the site between 2014 and 2018. Despite this, VMS charts show that anchored nets/lines are used over the sandbank feature in 2014, however, in subsequent years activity is absent over the sandbank feature. Landings from anchored nets/lines from non-VMS UK vessels are minimal, estimated at 5.7 tonnes between 2014 and 2018. Non-UK landings from anchored nets/lines are also very low, with the only record in STECF data being in 2013 from French vessels at 0.37 tonnes. Pr-

values are consistent with these low activity levels with the total gear footprint between 2014 and 2018 being 0.0007 – 0.32 km^2. These low activity levels suggest that there is low risk of impacts on target species within the site.

Considering the discussion above, the **MMO concludes that impacts from removal of target species by anchored nets/lines on the sandbank feature are compatible with the conservation objectives of the site and will not result in an adverse effect on site integrity.**

4.3.1.3 Impacts of dredges

Dredges in this area target seed mussels and scallops. Seed mussel dredging occurs sporadically typically occurring during one week in late summer (Eastern IFCA, *pers comms*). This fishery is considered to be small scale and therefore is unlikely to have a significant impact. Landings from dredges from UK vessels are estimated at 368.42 tonnes from 2014 to 2018. This is skewed by an estimated 247.54 tonnes being landed in 2014 with landings in subsequent years not rising above 62 tonnes. There are no landings recorded from dredges from non-UK vessels. VMS data indicates minimal dredging activity over the sandbank feature with an average Pr-value of 0.00068 between 2014 and 2018. This suggest that dredging is not a significant risk to target species.

Considering the discussion above, the **MMO concludes that impacts from removal of target 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.**

4.3.2 Summary of removal of target species Sandbank assessment

Given the evidence above, removal of target species within the site is unlikely to hinder the targets to restore the presence and distribution or maintain species composition of sandbank communities. The **MMO conclude that traps, anchored nets/lines and 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 30).**

Table 30: Removal of target and non-target species assessment

Pressure	Feature	Favourable condition target	Activity	Compatible with the conservation objectives?
Removal of target species	Sandbank	Restore the presence and spatial distribution of subtidal sandbank communities.	Traps	Yes
			Anchored nets/lines	Yes
			Dredges	Yes
		Maintain the species composition of component communities.	Traps	Yes
			Anchored nets/lines	Yes
			Dredges	Yes

4.4 Removal of non-target species

Fishing may remove by-catch (non-target) species, depending on the gear, methods used and ecological makeup of the fishery. Impacts of traps, anchored nets/lines, demersal trawls, demersal seines and dredges have been assessed for this pressure on the sandbank features. Impacts of traps and anchored nets/lines have been assessed for the *S. spinulosa* reef feature.

4.4.1 Sandbank

4.4.1.1 Impacts of traps

In terms of non-target species, by-catch 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 by-catch in the crab potting fishery around the Shetland Islands (Hervás et al. 2012). Very little by-catch is expected from pots and traps as the design means that fish and shellfish can escape easily before the gear is hauled[18]. Any by-catch can also be released back into the sea immediately without harm[1]. 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). Trapping 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.

Considering the discussion above, the **MMO concludes that impacts from removal of non-target species by traps on the sandbank feature are compatible**

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

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

4.4.1.2 Impacts of anchored nets/lines

Anchored nets such as gill nets have the potential to damage and/or remove non-target species. Species that are 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 sandbank feature are not known to include the species listed above, with epifauna mostly consisting of bryozoans, sponges and hydroids on more gravelly areas. Given that anchored nets are not towed, these species are unlikely to be removed by gill nets. Anchored net/line activity is therefore compatible with the favourable condition target to restore the presence and distribution or maintain species composition of sandbank communities.

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

4.4.1.3 Impacts of demersal trawls

Demersal trawls interact directly with the seabed and penetrate into the sediment which means that species occupying this area may be removed by passing gear.

Demersal trawls and dredges may remove crabs, lobsters, molluscs and sessile epifauna as by-catch. 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 (solid-shelled or very small species (De Groot & Lindeboom, 1994). Mobile epifauna, attached epifauna, polychaete worms and amphipods are characteristic of the sandbank feature of the site. These may therefore be removed or damaged by demersal trawls.

VMS data indicates that demersal trawling by over 12 m vessels over the sandbank feature has declined since 2014 with only a small number of records in recent years. The majority of activity takes place outside the boundary of the site and does not frequently take place over the sandbank feature. Expert opinion states that two under 10 m beam trawlers are active within the site. Despite the activity levels being

low, due to the restore target for presence and spatial distribution of subtidal sandbank communities, any activity happening over the feature will not be compatible with this target.

Considering the discussion above and the restore objective for sandbank communities, the **MMO concludes that impacts from removal of non-target species by demersal trawls on the sandbank feature may not be compatible with the conservation objectives of the site and may result in an adverse effect on site integrity.**

4.4.1.4 Impacts of demersal seines

When the ropes of a seine net are closed up in order to herd demersal fish, there is the potential for removal of epifauna.

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 species which are characteristic of the sandbank community of Inner Dowsing Race Bank North Ridge SAC. These include brittlestars (*Ophiura sp.),* queen scallop (*Aequipecten opercularis*) and edible crab (*Cancer pagarus)* (Waardenburg, 2017). Bioengineers such as bryozoa, for example *Flustra foliacea* found in the site, are also estimated to be sensitive to demersal seining (Waardenburg, 2017).

VMS data indicates that demersal seining only took place over the sandbank feature in 2015. Despite the activity levels being low, due to the restore target for presence and spatial distribution of subtidal sandbank communities, any level of activity happening over the feature would not be compatible with this target.

Considering the discussion above and the restore objective for sandbank communities, the **MMO concludes that impacts from removal of non-target species by demersal seines on the sandbank feature may not be compatible with the conservation objectives of the site and may result in an adverse effect on site integrity.**

4.4.1.5 Impacts of dredges

Dredges can cause large amounts of by-catch for a range of non-commercially targeted species, the majority of which is discarded damaged, dying or dead (Howarth and Stewart, 2014). Dredges penetrate into the sediment and so may remove both infauna and epifauna from the sandbank feature.

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 effects were found for the brittlestar, *Ophiura 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 Inner Dowsing Race Bank North Ridge SAC.

VMS data indicates that dredging activity by over 12 m vessels over the sand bank feature has declined since 2014 with only a small number of records in recent years. The majority of activity takes place outside the boundary of the site and does not frequently take place over the sandbank feature. Expert opinion describes dredging is described to be sporadic and not been known to occur over the reef or sandbank features. Despite the activity levels being low, due to the restore target for presence and spatial distribution of subtidal sandbank communities, any activity happening over the feature will not be compatible with this target.

Considering the discussion above and the restore objective for sandbank communities, the **MMO concludes that impacts from removal of non-target species by dredges on the sandbank feature may not be compatible with the conservation objectives of the site and may result in an adverse effect on site integrity.**

4.4.2 *Sabellaria spinulosa* reef

Removal of non-target species refers to the removal of organisms associated with, and important to, *S. spinulosa* reef, and does not include the direct removal of *S. spinulosa* reef by fishing gears. Direct removal is covered by the abrasion assessment. The assessment for traps and anchored nets/line has been combined due to similarity in impacts.

4.4.2.1 Impacts of traps and anchored nets/lines

Gibb et al. (2014) reported that although evidence for ecological interaction between *S. spinulosa* and other species was limited, no evidence for significant biological effects from the removal of non-target species associated with *S. spinulosa* reef was identified.

There is some evidence that the stabilisation of sediments by the sand mason worm *Lanice conchilega* may facilitate formation of *S. alveolata* reefs which may also be possible for *S. spinulosa* (Gibb et al. 2014). However, *L. conchilega* is very unlikely to be removed by static gears.

Removal of non-target species may in fact be beneficial through removal of predators such as the butterfish *Pholis gunnelis* and dragonet *Callionymus lyra*, common starfish *Asterias rubens* or competitors such as the brittlestar *Ophiothrix gragilis* (Gibb et al. 2014). Dense aggregations of the brittle star, *Ophiothrix fragilis*, have been suggested to compete with *S. spinulosa* for space and food and potentially to consume the gametes inhibiting recruitment (George & Warwick 1985 cited in Gibb et al. 2014). Removal of this species as by-catch could potentially be beneficial to the reef biotopes.

As static fishing gears do not appear to remove species which are important to *S. spinulosa* reef, Gibb et al. (2014) classified *S. spinulosa* reef as not sensitive to removal of non-target species.

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

4.4.3 Summary of removal of non-target species assessment

Given the evidence above, removal of non-target species is unlikely to hinder the targets to restore the presence, spatial distribution and abundance of reef communities. The **MMO conclude that traps and anchored nets/lines alone are compatible with the conservation objectives of the site and will not result in an adverse effect on site integrity via this pressure (Table 31).**

The removal of non-target species by demersal trawls, demersal seines and dredges within the site may hinder the target to restore the presence and distribution of subtidal sandbank communities. The **MMO conclude that demersal trawls, demersal seines and dredges alone may not be compatible with the conservation objectives of the site and may result in an adverse effect on site integrity via this pressure (Table 31).**

Traps and anchored nets/lines are unlikely to hinder the conservation objectives. The **MMO conclude that traps and anchored nets/lines alone are compatible with the conservation objectives of the site and will not result in an adverse effect on site integrity via this pressure (Table 31).**

Table 31: Removal of non-target species assessment

Pressure	Feature	Favourable condition target	Gear type	Compatible with the conservation objectives?
Removal of non-target species	*S. spinulosa* reef	Restore the presence and spatial distribution of reef communities.	Traps	Yes
			Anchored nets/lines	Yes
		[Maintain OR Recover OR Restore] the abundance of listed species, to enable each of them to be a viable component of the habitat.	Traps	Yes
			Anchored nets/lines	Yes
	Sandbank	Restore the presence and spatial distribution of subtidal sandbank communities.	Traps	Yes
			Anchored nets/lines	Yes
			Demersal Trawl	No
			Demersal seines	No
			Dredges	No
		Maintain the species composition of component communities.	Traps	Yes
			Anchored nets/lines	Yes
			Demersal Trawl	Yes
			Demersal seines	Yes
			Dredges	Yes

4.5 Siltation rate changes (low) including smothering and changes in suspended solids (water clarity) on the sandbank feature

4.5.1 Impacts of demersal trawl, seines and dredges

Demersal towed gears such as demersal trawls, seines and dredges will generate a plume of suspended sediment as the gear is pulled across the seabed. This can result in increased suspended solids and siltation rates as sediment resettles, potentially impacting sandbank communities through smothering of organisms.

The amount of material brought into suspension is dependent on the gear being used and the makeup of the seabed (O'Neill and Summerbell, 2011). The sandbank feature consists of subtidal coarse sediment, subtidal mixed sediment and subtidal

sand. Subtidal coarse and subtidal mixed sediment tend to produce less of a plume than subtidal sand. Finer sediments, such as muddy sand, have been shown to produce a plume similar to background levels of sedimentation (O'Neill and Summerbell, 2011).

ABPmer and Ichthys Marine (2015, 2015a) modelled sedimentation levels resulting from the use of demersal towed gears over sedimentary habitats in two sites in the Southern North Sea and estimated that for sandy sediments with a 20% silt fraction, the amount of sediment mobilised by a beam trawl through hydrodynamic drag equates to a sediment depth of between 3.4 mm and 9.7 mm (average across the gear footprint).

Dynamic sand communities and gravelly muddy sand communities are relatively high energy habitats, meaning that species will be adapted to high levels of sediment disturbance (JNCC and NE 2013). As the plume eventually degrades to background levels the main impacts will be immediately behind the head of the gear (O'Neill and Summerbell, 2011). Most organisms in this area will be affected more by the physical destruction caused by the fishing gear which has been discussed in section 4.2.

VMS data shows that little activity related to demersal trawls, seines and dredges occurred across the sandbank feature between 2014 and 2018 (Figure 2 to Figure 6). The area of impact and Pr-values across the sandbank feature also remains low, for example for demersal trawls the combined result in a total gear footprint for the sandbank feature is 0.1 – 2.8 km^2 and Pr-values are 0.005 – 0.0092 between 2014 and 2018. No activity for dredging was recorded in 2014 and 2015 and the total gear footprint for the sandbank feature is 0.18 – 0.35 km^2 and Pr-values are 0.0006 – 0.001 between 2016 -2018. Seining activity only took place in 2015, with total gear footprint for the sandbank feature is 0.03 km^2 and a Pr-value of 0.000094.

4.5.2 Summary of siltation rate and changes in suspended solids assessment

Given the low levels of fishing using demersal towed gears over the sandbank features in this site, and the small level of sediment suspended by these gears, the effects on the communities related to siltation rate changes is likely to be negligible. Therefore, The **MMO conclude that demersal trawls, seines and 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 32).**

Table 32: Siltation rate changes (low) and water clarity assessment

Pressure	Interest feature	Favourable condition target	Activity	Capable of affecting feature?	Will the conservation objectives be hindered?
Siltation rate changes (low), including smothering (depth of vertical sediment overburden) **and** changes in suspended solids (water clarity)	Sandbank	Restore the presence and spatial distribution of subtidal sandbank communities.	Demersal Trawl and Seines	Yes	No
			Dredges	Yes	No
		Restore the distribution of sediment composition across the feature (and each of its subfeatures).	Demersal Trawl and Seines	Yes	No
			Dredges	Yes	No
		Maintain the species composition of component communities.	Demersal Trawl and Seines	Yes	No
			Dredges	Yes	No
		Maintain all hydrodynamic and physical conditions such that natural water flow and sediment movement are not significantly altered or prevented from responding to changes in environmental conditions.	Demersal Trawl and Seines	Yes	No
			Dredges	Yes	No

4.6 Part B conclusion

4.6.1 Fishing on sandbanks

The assessment of fishing pressures on the sandbank feature within the MMO portion of Inner Dowsing, Race Bank and North Ridge SAC has revealed that an adverse effect on site integrity cannot be ruled out where demersal trawl, demersal seine and dredging activities occur. As such **the MMO conclude that management measures are required to restrict these activities over the sandbanks features within the MMO portion of the site**. Section 7 contains further details of these measures.

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

4.6.2 Fishing on *Sabellaria spinulosa* reef

The assessment of fishing pressures on the reef feature within the MMO portion of Inner Dowsing, Race Bank and North Ridge SAC has revealed that an adverse effect on site integrity cannot be ruled out where demersal trawl, demersal seine, dredging (red risk gear/feature interactions), traps and anchored nets/lines activities (amber risk gear/feature interactions) occur. As such **the MMO conclude that management measures are required to restrict these activities over the reef features within the MMO portion of the site**. Section 7 contains further details of these measures.

5. Part C assessment

This section assesses the effects of activities considered as compatible with the conservation objectives of Inner Dowsing, Race Bank and North Ridge 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 (Table 8);
- fishing interactions assessed in Part B but not resulting in adverse effect;
- plans and projects.

The MMO SPIRIT (SPatial InfoRmatIon Toolkit) system was used to check relevant activities that occur within, or adjacent to, the assessed site where there could be a pathway for disturbance. SPIRIT includes information on all activities for which the

MMO has received a marine licence application as well as infrastructure already in place in the marine environment. 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 which could impact the site in combination with effects of the fishing activities assessed.

Demersal trawls, seines and dredges have been identified as a red risk interaction for the reef feature and therefore assessment was not required. In Part B it was identified that demersal trawls, seines and dredges required management for the sandbank feature and traps and anchored nets/lines activities required management for the reef feature to avoid adverse effects to site integrity. Therefore these fishing activities will not be considered in Part C. Anchored nets/lines and traps for the sandbank feature are the other fishing activities occurring within 5 km of Inner Dowsing, Race Bank and North Ridge SAC. Therefore in combination effects of anchored nets/lines and traps with other project/plans for the sandbank feature will be assessed in Part C.

5.1 Pressures exerted by fishing and plans and 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 Inner Dowsing, Race Bank and North Ridge SAC (Table 33).

Several recreational activities were identified using SPIRIT, including Royal Yachting Association (RYA) clubs, RYA offshore routes and RYA general boating areas. Inner Dowsing, Race Bank and North Ridge SAC is at least 1 km offshore with submerged features, it is highly unlikely that there will be any contact through these activities and the designated features. No additional fishing activities to those already assessed in Part B occur within 5 km of the Inner Dowsing, Race Bank and North Ridge SAC.

To identify the specific pressures that the above activities exert on the feature of this site the MMO has used the Advice on Operations (AoO) section in Natural England and JNCC's conservation advice package for Inner Dowsing, Race Bank and North Ridge SAC. This required identified activities to be matched against the activity categories used in the conservation advice (Table 34).

Table 33: Plans and projects considered in combination with fishing activities included in this assessment

Relevant Activity	Description
Pipelines	Five pipelines run through the site
Submarine Cables	Several submarine cables run through the site
Well Heads	Two well heads are located within the site
Disposal Sites	Two open disposal sites ID: HU126 Racebank OWF, HU123 Sherringham shoal drillings
Offshore Wind Farm: Lincs Wind Farm Limited	Active/in operation
Offshore Wind Farm: Lynn Wind Farm Ltd	Active/in operation
Offshore Wind Farm: Inner Dowsing Wind Farm Ltd	Active/in operation
Offshore Wind Farm: Race Bank Wind Farm Ltd	Active/in operation
Hanson Aggregates Ltd, Westminster Gravels Limited, Dong Energy RB (UK) Limited	Two aggregate dredging licences: - MLA/2013/00336/3 area 106/3 valid until 2029 - MLA/2015/00452/5 area 515/1 valid until 2037 One other dredging licence - MLA/2015/00452/5 area Racebank Offshore Wind Farm valid until 2030
Lincs Offshore Wind Farm Q&M Licence, Lynn Offshore Wind Farm Q&M Licence, Lincshore Beach Renourishment Works	Two deposit licenses within Lincs, Lynn and Inner Dowsing Offshore Farms - MLA/2014/00276 valid until 2038 - MLA/2014/00291 valid until 2038 One disposal of dredged material licence within Mablethorpe to Skegness - MLA/2016/00014/1

Table 34: Categories from the AoO section that have been used to inform pressures information for identified activities and Amber and Green fishing activities.

Name of Activity	NE aoo Operation	Activity
Pipelines	Oil, gas and carbon capture storage	Pipelines
Submarine Cables	Cables	Power cable: operation and maintenance
Well Heads	Oil gas and carbon capture storage	Oil and gas production
Disposal Sites	Ports and harbours (construction and maintenance)	Capital dredging disposal Maintenance dredging disposal
Offshore Wind Farms	Electricity from renewable energy sources	Offshore wind: operation and maintenance, Offshore wind: during construction
Aggregate Dredging	Aggregates extraction	Aggregate dredging
Demersal Trawl	Fishing	Demersal trawl
Dredges	Fishing	Dredges
Traps	Fishing	Traps
Anchored Nets	Fishing	Anchored nets/lines

Information in the Inner Dowsing, Race Bank and North Ridge SAC conservation advice package was used to determine which pressure-feature interaction to include in this part of the assessment.

A list of pressures has been collated from fishing activity, and it is only those pressures that have been discussed below. Equally if a multiple plans or projects give off a pressure that fishing does not contribute towards, those pressures 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 35 details the pressures exerted by military firing activity; power cables: laying, burial and protection and operation and maintenance; telecommunication cables: operation and maintenance; offshore wind: during construction and operation and maintenance; disposal sites; pipelines; traps fishing activities; 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 traps and anchored net/line fishing activities occurring within Inner Dowsing, Race Bank and North Ridge SAC.

Table 35 also indicates pressures which are exerted by each activity (Y – pressure exerted, N – pressure not exerted).

Table 35: Pressures exerted by fishing and non-fishing activities occurring in Inner Dowsing, Race Bank and North Ridge SAC. Non fishing pressures similarly exerted by anchored nets/lines and traps require further assessment and are highlighted in red.

Pressure	Telecommunication cable: operation & maintenance	Power cable: operation & maintenance	Power cable: laying, burial & protection	Offshore wind: during construction	Offshore wind: Operation & maintenance	Sea surface military activity	Dredge and soil disposal	Pipelines	Anchored nets/lines	Traps
Abrasion/disturbance of the substrate on the surface of the seabed	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Changes in suspended solids (water clarity)	Y	Y	Y	Y	Y	Y	Y	N	N	N
Deoxygenation	N	Y	Y	N	N	Y	Y	Y	Y	Y
Electromagnetic changes	N	Y	N	N	N	N	N	N	N	N
Habitat structure changes - removal of substratum (extraction)	N	N	Y	Y	Y	Y	N	Y	N	N
Hydrocarbon & PAH contamination.	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	N	N
Introduction or spread of invasive non-indigenous species (INIS)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Litter	Y	Y	Y	Y	Y	Y	N	Y	Y	Y
Nutrient enrichment	N	Y	Y	N	N	Y	Y	Y	N	N
Organic enrichment	N	N	N	N	N	N	N	N	Y	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

Physical change (to another seabed type)	Y	Y	Y	Y	Y	N	Y	Y	N	N
Physical change (to another sediment type)	N	N	N	N	N	N	Y	N	N	N
Radionuclide contamination	N	N	N	N	N	N	Y	N	N	N
Removal of non-target species	N	N	N	N	N	N	N	N	Y	Y
Removal of target species	N	N	N	N	N	N	N	N	Y	Y
Siltation rate changes (high), including smothering (depth of vertical sediment overburden)	N	N	Y	Y	Y	N	Y	N	N	N
Siltation rate changes (low), including smothering (depth of vertical sediment overburden)	Y	Y	Y	Y	Y	Y	Y	Y	N	N
Synthetic compound contamination (incl. pesticides, antifoulants, pharmaceuticals).	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Temperature changes - local	N	Y	N	N	N	N	N	N	N	N
Transition elements & organo-metal (e.g. TBT) contamination.	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Vibration	Y	Y	Y	Y	Y	N	N	Y	N	N
Water flow (tidal current) changes, including sediment transport considerations	Y	Y	Y	Y	Y	N	N	Y	N	N

Wave exposure changes - local	N	N	N	N	N	Y	N	N	N	N

5.2 In-combination pressure discussion for remaining pressures

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

This pressure is relevant for all anchored nets/lines in addition to traps and all plans and projects. Sensitivity of the Inner Dowsing, Race Bank and North Ridge SAC conservation feature to physical damage from static gears and anchored nets/lines is through surface abrasion from pots, through deployment, movement of gear on the benthos due to strong tidal current and storm activity; and as the gear is dragged along the seafloor during retrieval. However the Inner Dowsing, Race Bank and North Ridge SAC sandbank feature is not considered sensitive to the pressure associated with sea surface military activity as it is derived from propellers and ship movements causing scour around berth pockets and channel margins which does not occur the site.

Decommissioning, burial, protection and maintenance of submarine cables as well as maintenance of offshore windfarms may have impacts due to the physical disruption of the sediment. Vessels associated with these activities will anchor or use jack-up legs which will penetrate into the sediment. Anchor handling of vessels within the anchor corridor will cause disturbance up to 1 km on each side of the cable through embedment in the substrate as well as subsequent scouring during retrieval, although the pressure exerted will be low when smaller anchors are used. Despite this, the frequency of maintenance to existing cables will be low. Additionally, this is a licensable activity, if there was a positive determination on applications for maintenance, licence conditions would be put in place to mitigate against any significant impacts to the features of the site. 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.

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, these are mostly towards the northern boundary. Given that these pipelines are already in place, there are no potential in combination impacts through installation. Maintenance of pipelines is a licensable activity, therefore 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.

There are currently 3 aggregate dredging licences which are valid up until the years 2029, 2030 and 2037. Although the activity has the potential to cause structural

damage by removing the surface layers of the sediment, the licenses have a condition requiring applicants to ensure no extraction of materials representing Annex 1 sandbank habitat takes place.

The MMO conclude that abrasion/disturbance and penetration pressures associated with anchored nets/lines and traps, 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 for traps, all anchored nets/lines in combination with submarine cables, well heads and pipelines.

Discards are not spatially concentrated at this site and it is not an area of low flow so the conditions for localised hypoxia or anoxia of the sea bed are not present. Given the size and dynamics of the site the combined effects of fishing and plans or projects would not reduce oxygen concentration over a prolonged period, capable of affecting the Water Framework Directive[19] status.

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 is a licensable activity and so licence conditions would be put in place to mitigate against any significant impacts to the features of the site. 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.

With regards to pipelines and well heads, seabed currents and the type of sediment will affect the accumulation and scouring of sediment around these structures. Once the structures have been scoured to their equilibrium depth, there will be an absence of sediment for further scouring therefore limiting resuspension and ultimately deoxygenation.

The MMO conclude that this pressure associated with anchored nets/lines and traps, 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.

[19] https://ec.europa.eu/environment/water/water-framework/index_en.html

5.2.3 Hydrocarbon & PAH contamination AND Transition elements & organo-metal (e.g. TBT) contamination.

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

This pressure is relevant for all gears in combination with all plans or projects and includes consideration of priority substances listed in Annex II of Directive 2008/105/EC.

Polycyclic aromatic hydrocarbons (PAH) in vessel oil and fuel are of environmental concern when released into the water. Fishing vessels of all gear types may contribute to this pressure in combination with military vessels. However, deliberate releases of oil or oil/water mixture from ships are prohibited within the North West European Waters Special Area, established by the International Maritime Organisation (IMO) under MARPOL Annex I in 1999[20]. This area includes all waters around the UK and its approaches. While Navy vessels are exempt from MARPOL, they are expected to act in a manner consistent with MARPOL in so far as is reasonable and practicable[21]. Accidental discharges may occur, however significant releases are extremely rare. Releases of significant amounts of oil are typically from large shipping vessels and tankers. Sea surface military vessels are therefore unlikely to contribute considerably to the minor, existing impact from fishing vessels via this pressure.

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

Pipelines may be a source of hydrocarbon and PAH contamination. Additionally, cuttings from drilling operations and old cutting piles may contain organic-phase drilling fluids which may be disturbed during decommissioning of the pipelines (BEIS, 2019). However, results from surveys undertaken in other areas of the North Sea demonstrate very little contamination from heavy or trace metals or hydrocarbons, with the majority of samples reporting levels similar to background levels (BEIS, 2019). Therefore pipelines are unlikely to contribute to the existing impact from fishing vessels via this pressure.

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

Through licencing processes all material disposed at sea would have passed Cefas testing to be below Action Level 2.

The MMO conclude that this pressure associated with anchored nets/lines and traps, 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 for anchored nets/lines and traps in combination with submarine cables, offshore wind farms, well heads and pipelines.

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, 2009). Military vessels, and vessels associated with installation, operation or maintenance of submarine cables, offshore windfarms and pipelines may therefore transport organisms.

With regards to submarine cables, offshore wind farms and pipelines, the artificial structures themselves may encourage the spread of INIS. It has been demonstrated that new artificial substrata offers 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-existing (Kerckhof et al. 2011). Despite this, numerous monitoring for the construction of other wind farms have shown no presence of INIS associated with infrastructure (Forewind, 2014). This pressure is unlikely to have a significant in combination impact with fishing.

For fishing vessels, ballast water is the principal vector for invasive non-indigenous species. VMS data shows that the majority of fishing vessels visiting the site are smaller than 45 m in length which means they use solid ballast. Additionally, for vessels using ballast water, the International Convention for the Control and Management of Ships' Ballast Water and Sediments[22] 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.

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

The MMO conclude that this pressure associated with anchored nets/lines and traps, 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 pressures is relevant to anchored net/line and traps fishing activities and all plans/ projects with the exception of disposal sites.

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

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

All vessels, bar those attaining to the Navy, adhere to MARPOL requirements which prohibit the discharge of plastics. While exempt, Navy vessels are expected to act in a manner consistent with MARPOL so far as is reasonable and practicable[23] and therefore releases of litter is likely to be minimal from all vessels.

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

The MMO conclude that this pressure associated with anchored nets/lines and traps, 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.

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

5.2.6 Organic enrichment

This pressure is relevant for traps, all anchored nets/lines but is not exerted by any plans or projects. Degraded remains from these fishing gears in combination will not result in significant impacts to the site as the tidal range and water movement would not allow levels to reach the pressure benchmark.

The MMO conclude that this pressure associated with anchored nets/lines and traps, 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 In-combination conclusion

MMO concludes, taking into account the introduction of management areas for demersal trawls, seines and dredges outlined in section 7, that fishing activities in combination with other relevant activities are not adversely affecting the site integrity of Inner Dowsing, Race Bank and North Ridge SAC.

6. Assessment result

6.1 Fishing alone

The MMO consider that for both features (sandbank and *S. spinulosa* reef) there is a pathway for disturbance from bottom-towed gear (demersal trawl, demersal seine and dredging) and the impacts alone are not compatible with the conservation objectives of the site and may result in adverse effect on site integrity. **Therefore the MMO conclude that management measures are required to restrict these activities over both the sandbank and reef features within the MMO portion of the site.**

The MMO consider that for the sandbank feature there is not a pathway for disturbance from traps, anchored nets/lines, and therefore these activities alone will not result in adverse effect on site integrity.

The MMO consider that for the *S. spinulosa* reef feature there is a pathway for disturbance from traps, anchored nets/lines, and the impacts alone are not compatible with the conservation objectives of the site and may result in adverse effect on site integrity. **Therefore the MMO conclude that management measures are required to restrict these activities over the reef features within the MMO portion of the site.**

6.2 In-combination

For the sandbank feature, when pressures from traps and anchored nets/lines fishing activities were combined and considered alongside pressures from the potential non fishing activities taking place, none were identified which may result in adverse effect on site integrity. **Therefore the MMO concludes that assessed fishing activities from traps and anchored nets/lines, in-combination with other known activities, are compatible with the conservation objectives of the site and are not causing an adverse effect on site integrity.**

7. Management options

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

Option 2: Reduce/limit pressures. Due to the potential impacts of demersal trawls, demersal seines, dredges, traps and anchored nets/lines on the features of the site, zoned management will be introduced to ensure the achievement of the conservation objectives.

Option 3: Remove/avoid pressures (whole site prohibition). Demersal trawls, demersal seines and dredges, traps and anchored nets/lines will be prohibited in all areas of the site.

At this time, the MMO does not believe that management option 1 is sufficient to protect Inner Dowsing, Race Bank and North Ridge SAC due to likely adverse effects to site integrity from fishing with gears that interact with the seabed.

The introduction of any management measures will be subject to a separate process, including appropriate levels of consultation.

Inner Dowsing, Race Bank and North Ridge SAC lies within the East Marine Plan Area. The East Marine Plan[24] 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.

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

8. Review of this assessment

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

Such information could include:

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

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

Monitoring of activity levels will occur through a combination of surface surveillance and ongoing monitoring of VMS and landings data. Should activity levels, including those fishing activities not currently considered a risk to the features, 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 Natural England and 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. Inner Dowsing, Race Bank and North Ridge SAC is categorised as Tier 2 which means an individual report is produced by the MMO's Marine Conservation Team for this site annually between June and August. The report includes VMS data for fishing activity over the reporting period and a 5-year period as well as information on inspected/observed activities, intelligence and non-compliant activity (if applicable). Coastal questionnaires are completed by local MMO officers regarding any changes in activity within the site. This will act as an early warning system for potential negative impacts on the site. If the report determines that a change in fishing activity is a risk to the conservation objectives of the site, an assessment of the site will be triggered regardless of whether a review is due. An increase in activity above that identified in this assessment, will initiate discussion with Natural England and JNCC following the annual MPA report.

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

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

9. Conclusion

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

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Annex 1 - MMO methodology

The need for assessment

In 2012, the Department for Environment, Food and Rural Affairs (Defra) announced a revised approach to the management of commercial fisheries in European marine sites (EMS)[25]. The objective of this revised approach is to ensure that all existing and potential commercial fishing activities are managed in accordance with the provisions of Article 6 of the Habitats Directive[26]. The revised approach was extended to include management of commercial fisheries in marine conservation zones (MCZ) in 2014[27].

This approach was being implemented using an evidence based, risk-prioritised, and phased basis. Risk prioritisation is informed by using a matrix of the generic sensitivity of the sub-features of EMS to a suite of fishing activities. These activity/sub-feature interactions have been categorised according to specific definitions, as red, amber, green or blue[28].

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

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

Assessment process

The fisheries assessments have three stages:

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

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:

[25] www.gov.uk/government/publications/revised-approach-to-the-management-of-commercial-fisheries-in-european-marine-sites-overarching-policy-and-delivery
[26] Council Directive 92/43/EEC on the Conservation of natural habitats and of wild fauna and flora
[27] 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
[28]Managing Fisheries in MPAs matrix: www.gov.uk/government/publications/fisheries-in-european-marine-sites-matrix

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 Other Member States (OMS) vessels carrying the EU mandated 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 OMS vessels only gear types are assigned to the VMS data as individual vessel landings are not available.

Landings data

Landings data are recorded at International Council for the Exploration of the Sea (ICES) statistical rectangle[29] 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 OMS 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).

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

Spatial footprint analysis

See Annex 2 for how spatial footprint analysis using Pr-values were calculated.

[29] 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

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.

SPUE Fisheries sightings data

Sightings data between 2010 and 2012 were collated and analysed to produce Sightings Per Unit Effort figures for a Defra commissioned Cefas project published in 2014 to better understand trends in inshore fisheries[30].

These data were displayed as national layers of sightings (of certain fishing activities; trawling, potting, netting etc) per unit effort.

MMO and IFCA expert opinion on fishing activity

MMO marine officers and IFCA inshore fisheries and conservation 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.

Fishermap data

Source: 2012 Marine Conservation Zone Project Stakmap Commercial Fishing under 15m vessels lines summary by month. In 2012, the Fishermap project conducted interviews with almost 1000 skippers of the under 15 m fishing fleet, with the aim of mapping the activities of the commercial fishing fleet. Of those interviewed, 594 gave their permission for their data to be shared with third parties.

[30] http://randd.defra.gov.uk/Default.aspx?Menu=Menu&Module=More&Location=None&Completed=1&ProjectID=18126

The data was presented as a year's activity, collected from a series of monthly totals of vessel visits, per grid cell. Summary data is provided as a series of monthly totals of vessel visits per grid cell. Fishermap data and expert opinion is used to calculate numbers of under 15 m vessels operating in a given site.

Ecological information

The fisheries assessments use the conservation advice packages produced by Natural England and the Joint Nature Conservation Committee. 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, vulnerability and site integrity

The following definitions of sensitivity, vulnerability and site integrity are used in MMO assessments.

Sensitivity is defined as:

a measure of tolerance (or intolerance) to changes in environmental conditions.[31]

Vulnerability is defined as:

a combination of the sensitivity of a feature to a particular pressure/activity, and its exposure to that pressure/activity.

Site integrity is defined as:

The integrity of a site is the coherence of its ecological structure and function, across its whole area, that enables it to sustain the habitat, complex of habitats and/or the levels of populations of the species for which it was designated, and reference the following guidance document.[32]

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

[32] https://www.gov.uk/guidance/appropriate-assessment

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

1. Pr-value background

1.1. Introduction

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

The application of a "footprint" approach has been promoted by previous authors (such as Jennings *et al.*, 2012[33]) as a method to quantify fishing pressure within an area of interest (AOI) such as a 'fishing impact equation' where:

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

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

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

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

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

1.1.1. Fishing effort

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

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

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

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

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

1.1.2. Area of interest

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

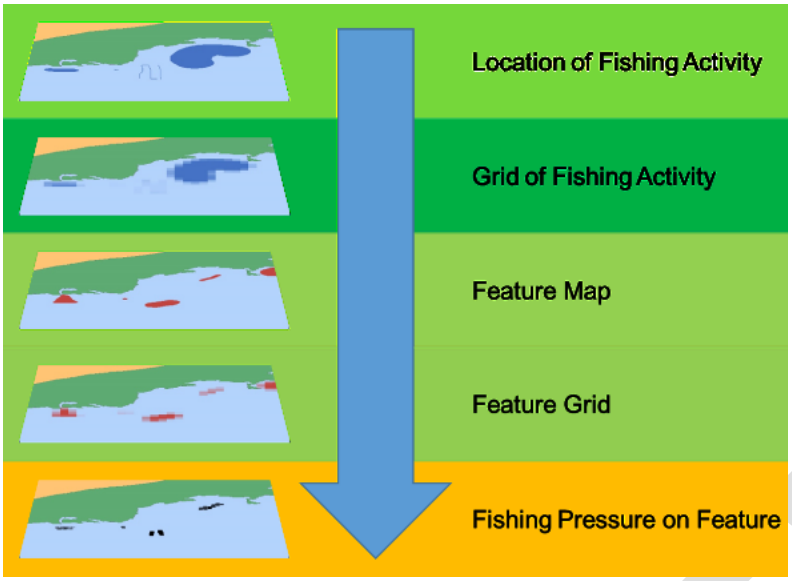
1.2. Developing the equation further

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

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

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

Figure 22: 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 (0.2025km^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 36.

Table 36: A description of gear and the gear code used

IFISH Code	Gear	Brief Description
DRB	Boat dredges	Two types; one that is dragged along sea bed, another that is like a benthic scoop that penetrates the sea bottom. Targets mussels, clams, scallops, crab etc.
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 sea bed 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 sea bed. It is considered a harvesting machine when the same gear collects the mussels and hauls them on board.
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	Danish seine	A weighted rope is anchored at one end by a marker buoy, while the other is attached to the vessel. The vessel sweeps in a circular motion to deploy the rope and the attached net. Once deployed, the gear is towed in, and the net winched onto the vessel to collect species forced into the path of the net.
SSC	Scottish seine	Similar to the above but hauled while the vessel is stationary using its own engine power rather than an anchor.
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 by-catch 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 (20250m^2) or 0.2025km^2, 2 hours was chosen as it is the maximum time allowed between VMS reports. This is calculated as 0.083 or one twelfth of a day.

The calculation is as follows for trawls or dredge gears:

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

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

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

This gives an estimate of the area (in m^2) impacted by gear from a single VMS report based on the different fishing gears (Table 37). 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 37: Estimate of different gears fishing footprint across a cell area for a two hour period.

Gear	Single VMS report gear fishing footprint over cell area (m^2)
TBB	1.336195
OTT	0.225177
DRB	0.437237
OTB	0.115868
OT	0.115868
HMD	0.057756
TBN	0.034159
GNS	0.001808
GN	0.001808
FPO	0.00001
SDN	0.003689
SSC	0.005849

2.2. Pr-value model

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

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

Assumptions about the datasets are included in Section 3.

The pr-value model has the following steps:

1. The UK and non-UK VMS data is clipped to the area of interest (MPA site or designated feature within site)

2. VMS reports which are denoted as 'fishing' are chosen (vessels travelling between >0 and <6 knots)
3. VMS reports from the same vessels which are less than 2 hours apart (7080 seconds exactly, see Section 3.4 for explanation) are excluded
4. The processed VMS data (VMS reports= fishing & ≥ 2 hours) is joined to the gear calculations data
5. A grid is created across the area of interest, with cell sizes of 450m by 450m
6. The grid and processed VMS data are joined together.
7. Gear not included in the current gear calculators is excluded.
8. The cell area is calculated as 0.2025 km^2 for each cell.
9. Total gear footprint is calculated by multiplying single VMS report gear footprint by the cell area (0.2025 km^2). This is then multiplied by the number of VMS reports per gear type.
10. The VMS report area and total gear footprint is summed by gear type
11. A summary table is created which includes:
    - AOI field (km^2)
    - AOI name (text)
    - Total VMS report area (km^2): Sum of unique cell areas (0.2025km^2) where VMS reports occur.
    - Total gear footprint (km^2): Total area impacted by fishing gear. $\text{Total no. of fishing VMS reports} * \text{cell area } (0.2025) * \text{single VMS report gear footprint}$
    - Pr-value: Total extent of AOI impacted by gear. $\frac{Total\ gear\ footprint}{AOI}$
    - Pr-value percentage (%): Percentage of AOI impacted by gear. $\frac{Total\ gear\ footprint}{AOI} * 100$

3. Pr-value Assumptions

3.1 Gear Calculators

A cell is 450m by 450m or 0.2025 km^2. Two hours was chosen as it is the maximum time allowed between VMS reports. These were chosen so that a beam trawler (the largest swept area) will have covered the whole cell in 2 hours.

When calculating P-values the gear type assigned by the MMO statistical team is used. If no gear has been assigned then if the vessel has an assigned statistical gear in the same year that gear is used. If no match can be found then the primary gear type assigned in the Food and Agriculture Organization of the United Nations (FAO) fishing vessel database is used.

DRB:

- Based on a 16.28 m scallop vessel with 2 x 6.7 m dredge bars each with two shoes at 720 mm wide. Each dredge bar has 8 x 76 cm dredges (Lart, 2012).
- Number of vessels and days spent fishing: derived from VMS/landings records.

FPO:

- Size of pot: based on MMO coastal officer advice – 120 cm x 70 cm.
- Number of vessels and days spent fishing: derived from VMS/landings records.
- Number of pots used by vessels: derived from local fisherman – 30 pots per day.

GN/GNS:

- Based on a vessel shooting 10 tiers each 132m. Each tier has 2 anchors at 1.0 m x 0.5 m (MMO coastal officer has corrected this from 0.5 cm x 0.5 cm). 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.

HMD:

- Based on 1 cage with a total width of approximately 1.9 m. Data from http://spo.nmfs.noaa.gov/mfr444/mfr4441.pdf
- Haul duration 10 - 12hrs. Data from http://www.seafish.org/media/Publications/SR348.pdf
- Haul speed 4 knots. Data from http://www.seafish.org/media/Publications/SR348.pdf

OT/OTB:

- Based on a vessel with 4m net width, two 0.65m otter boards, 60 % groundrope interaction. 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. 4 m net width and 0.65 m board width comes from MMO coastal team.
- Number of vessels and days spent fishing: derived from VMS/landings records.

OTT:

- Based on a vessel with 2 * 4m trawl, two 0.65 m otter boards, 60 % groundrope interaction and 1 clump of 0.6 m. 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. 4m net width and 0.65m board width comes from MMO coastal team (Inner Dowsing). Haul duration 4 hours, from MMO officer.
- Haul speed 4 knots, from MMO officer.

TBB:

- Based on a vessel with 2 x 12 m trawl, four 720 mm shoes and 2 tickler chains with 60% interaction with the sea bed. 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.

- Haul duration 4 hours. Info derived from seafish report on a workshop on the physical effects of fishing activities on Dogger Bank and MMO coastal.

- Haul speed 4 knots. Info derived from seafish report on a workshop on the physical effects of fishing activities on Dogger Bank and MMO coastal.

TBN:

- Based on a vessel with 2 x 3.5 m beam trawls, 4 x 0.2 m feet and 60% ground rope interaction. Info derived from Annexes to: Feasibility study on applying a spatial footprint approach to quantifying fishing pressure.

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

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

SDN:

- As this gear is not trawled and the total area impacted by the gear is available, this has been considered a net / line gear.
- Specific details were not available however the marine institute estimates the area of impact as being on average 2.25 km^2. https://seafish.org/gear-database/wp-content/uploads/2015/06/Seine-Net-Fishing-Workshop_Report_May2008.pdf.
- SDN only takes place in daylight hours. Hauls per day (4) is estimated on the average number of daylight hours (12) and the haul duration ~ 3 hours.

SSC:

- As this gear is not trawled and the total area impacted by the gear is available (below), this has been considered a net / line gear.
- Specific details were not available however the according to seafish a seiner with 13 coils of rope lead to 2854 m^2 area of impact. https://seafish.org/gear-database/wp-content/uploads/2015/06/Seine-net-CR47.pdf
- SSC only takes place in daylight hours. Hauls per day (5) is estimated on the average number of daylight hours (12) and the haul duration ~ 2.25 hours (median of 1.5 – 3 hours as described by seafish: https://seafish.org/gear-database/gear/scottish-seine

Annex 3 - Monitoring and Control Process

Figure 23: Monitoring and control process