Document Control

Title	**The Canyons Marine Conservation Zone (MCZ) Marine Management Organisation (MMO) Fisheries Assessment**
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Revision History

Date	Author	Version	Status	Reason	Approver(s)
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The Canyons Marine Conservation Zone (MCZ) MMO Fisheries Assessment 2020

Contents

Glossary

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

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

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

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

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

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

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

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

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

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

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

FOCI – **feature of conservation importance**. This includes both habitats of conservation importance (HOCI) and species of conservation importance (SOCI). FOCI are one type of MCZ feature, the other being broad-scale habitats. More information can be found in the Ecological Network Guidance (Marine Conservation Zone Project) section 4.2.3[2]

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

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

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

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

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

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

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

[3] https://www.legislation.gov.uk/eudr/1992/43/contents

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

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

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

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

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

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

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

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

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

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

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[5] https://www.gov.uk/government/collections/marine-planning-in-england

[6] https://www.legislation.gov.uk/eur/2019/1241/contents

[7] https://www.legislation.gov.uk/ukpga/2009/23/contents

[8] https://www.legislation.gov.uk/nia/2013/10/contents

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

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

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

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

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

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

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

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

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

1. Summary

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

Table 1: Assessment Summary

Features	Activity/gear	Part A outcome	Part B outcome	In-combination assessment
Sea-pen and burrowing megafauna communities **AND** Deep-sea bed **AND** Coral gardens **AND** Cold-water coral reefs	Beam trawl (pulse/wing)	Not capable of affecting (other than insignificantly)	N/A	N/A
	Mussels, clams, oyster dredges			
	Pump scoop dredges (cockles, clams)			
	Suction dredges (cockles)			
	Jigging/trolling			
	Hand working (access from vessel)			
	Handlines (rod/gurdy)			
	Pots/creels (crustacea/gastropods)			
	Cuttle pots			
	Fish traps			
	Drift nets (pelagic)			
	Drift nets (demersal)			
	Crab tiling			
	Mid-water trawl (single) (semi pelagic)			
	Mid-water trawl (pair) (semi pelagic)			
	Purse seine	Capable of affecting (other than insignificantly)	Significant risk of hindering conservation objectives	N/A
	Longlines (demersal)			
	Longlines (pelagic)			
	Gill nets			

	Trammel nets			
	Entangling nets			
	Beam trawl (whitefish)			
	Beam trawl (shrimp)			
	Heavy otter trawl			
	Multi-rig trawls			
	Light otter trawl			
	Pair trawl			
	Anchor seine			
	Scottish/fly seine			

2. Introduction

Table 2: Site details

Name and legal status of site:	**Name of site**	**Legal status**
	The Canyons	Marine Conservation Zone (MCZ)

The Canyons Marine Conservation Zone (MCZ) is an offshore marine protected area (MPA, Table 2) located in the far south-west corner of the UK continental shelf, within ICES rectangle 25E0, 330 km from Land's End, and covers approximately 661 km^2. Due to its offshore location, the Marine Management Organisation (MMO) is responsible for the management of fishing within the Canyons MCZ. The site lies at the edge of the shelf, which drops away steeply to the oceanic abyssal plain at 2,000 m (Figure 1), giving rise to features such as deep-sea bed, cold-water corals and sea-pen and burrowing megafauna communities (Figure 2). Originally designated in Tranche 1 (2013), the MCZ had two additional features designated in the third Tranche of designations (2019) – coral gardens, and sea-pen and burrowing megafauna (Table 3).

The site is unique within the context of England's largely shallow seas due to its depth, sea-bed topography and the coral features it contains; the site is the only MCZ designated for coral gardens and coral reefs. There are two large canyons within the site, which add to its topographic complexity: the Explorer Canyon to the north and the Dangeard (also known as Dangaard) Canyon below it[10]. Cold-water coral reefs (*Lophelia pertusa*), an OSPAR threatened and/or declining habitat, have

[10] https://jncc.gov.uk/our-work/the-canyons-mpa/#summary

been found on the northernmost wall of the Explorer Canyon, which is the only known example recorded within English waters[11].

More specific information on how to achieve the conservation objectives of an MCZ is provided in the general management approach within the factsheet for each site[3].

The conservation objectives for The Canyons MCZ is that the protected features:

- so far as already in favourable condition, remain in such condition; and
- so far as not already in favourable condition, be brought into such condition, and remain in such condition.[12]

Table 3 shows the features for which this MCZ has been designated and their associated general management approach[13].

Table 3: Designated features and general management approach

Features	Feature Type	General Management Approach
Sea-pen and burrowing megafauna communities	Feature of conservation importance	Maintain in favourable condition
Deep-sea bed	Broad-scale habitat	Recover to favourable condition
Coral gardens	Feature of conservation importance	
Cold-water coral reefs	Feature of conservation importance	

2.1 Sea-pen and burrowing megafauna communities

Fine mud on the seabed provides habitat for animals to burrow beneath the surface, whose burrows in turn provide shelter to a range of other species. These burrowing communities include sea-pens which protrude from the surface of the mud and capture their food from the water column. Sea-pens can grow over 2 m in height but, like cold-water corals, they are slow growing and therefore at risk to damage from human pressures.[14]

Sea-pen and burrowing megafauna communities occur in a relatively small patch in the north west of the site. On stable plains of fine mud, areas of the seabed may be marked by mounds and burrows which are caused by the burrowing activities of animals below the surface, such as the Norway lobster *Nephrops norvegicus*. The burrows created by *Nephrops* offer shelter to a wide range of smaller animals, resulting in a diverse benthic community. Sea-pens, which protrude from the surface of the mud and can grow to more than 2 m in height. (JNCC, 2015).

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[11] https://webarchive.nationalarchives.gov.uk/20101014085102/http:/www.searchmesh.net/PDF/SWCanyons_FinalReport_v1.4_final.pdf
[12] https://hub.jncc.gov.uk/assets/d6db74b3-78b5-454b-bd23-d40b2c3c9835
[13] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/805607/mcz-the-canyons-2019.pdf
[14] https://www.gov.uk/government/publications/marine-conservation-zone-2013-designation-the-canyons

2.2 Deep-sea bed

Almost the entire site is comprised of deep-sea bed, encompassing a range of habitats, including the sub-features of the site of cold-water coral reefs, coral gardens and sea-pen and burrowing megafauna. The deep-sea bed begins at the edge of the continental shelf, which is usually at depths over 200 m. Just like in shallower areas, there can be various kinds of deep-sea bed, including bedrock, limestone pavements, boulders, gravel, sand and mud. Unique biological seabeds include 'bioherms', which are mounds or reefs of rock formed from the remains of marine organisms, and embedded within mineral rock. Living deep-sea reefs are formed by cold-water corals[15].

The deep-sea bed present within The Canyons MCZ contains a variety of substrata, including bedrock, biogenic reef, coral rubble, coarse sediment, mud and sand. Mini-mound features 3 m high and 50-150 m in length occur in the interfluves between the Dangaard and Explorer canyons, with the mounds consisting of shell, coarse sediment and coral rubble[16]. The interfluves found within The Canyons MCZ, which are the areas of shallower plateaus between the two canyons are by virtue of their shallower depth and position on the shelf edge likely to provide a more dynamic environment and therefore communities that will likely be more robust to pressures than the deeper elements of the Dangaard and Explorer canyons which provide habitats for long-lived, fragile species such as cold-water corals.

2.3 Cold-water coral reefs and coral gardens

Living deep-sea reefs are formed by cold-water corals. They can extend for several kilometres and be more than 20 m high. Much of the deep-sea bed is barren and inhospitable, so the cold-water coral reefs form oases, in which the number of different species can be three times as high as on the surrounding soft seabed.

A maximum abundance of 855 coral colonies per 100 m transects have been observed at this site with 31 coral types identified. Video tows within The Canyons MCZ have shown *Anthomastus* was mainly associated with 'sediment slope'. *Lophelia* formed reef structures and occurred in small patches in the '*Lophelia* and rock' substratum. *Acanella* and *Lophelia* were not seen in the same region. Large patches of *Acanella* observed throughout the canyon and *Isididae* dominate coral communities in the 'sediment' substratum (Morris *et al*., 2013).

Within the site there are cold-water corals known to be growing on one of the canyon walls. The reefs provide a source of food and shelter for many animals including fish, sea urchins, anemones and sponges. They are also thought to act as breeding grounds for commercially important fish species[17].

Coral gardens are made up of dense aggregations or colonies of one or more coral species and include hard cold-water corals as well as soft corals. Video tows within The Canyons MCZ have shown the presence of a range of coral species including:

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[15] https://webarchive.nationalarchives.gov.uk/20190308000040/http://jncc.defra.gov.uk/page-5806-theme=default
[16] https://www.bodc.ac.uk/resources/inventories/cruise_inventory/reports/jc166.pdf
[17] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/805607/mcz-the-canyons-2019.pdf

gorgonian corals, bubblegum corals *Paragorgia* sp, bamboo corals *Isididae*, black corals *Antipatharians* and scleractinian hard corals which comprised mostly of zigzag corals *Madrepora oculata* with some *Lophelia pertusa*[18].

Cold-water corals typically support a range of other organisms. The coral provides a three-dimensional structure and a variety of microhabitats that provide shelter and an attachment surface for other species. Cold-water corals can be long-lived but are extremely slow growing (at about 6 mm a year) making protection important for their conservation (JNCC, 2019).

2.4 Scope of this assessment

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

Table 4: Fishing activities covered by this assessment

Gear type		Gear Code	SNCB aggregated gear method
Towed (demersal)	Beam trawl (whitefish)	TBB	Demersal trawl
	Beam trawl (shrimp)		
	Beam trawl (pulse/wing)		
	Heavy otter trawl	OTB	
	Multi-rig trawls	TX	
	Light otter trawl	OTB	
	Pair trawl	PTB	
	Anchor seine	SDN	Demersal seines
	Scottish/fly seine	SSC	
Towed (pelagic)	Mid-water trawl (single)	TM	Pelagic fishing
	Mid-water trawl (pair)	PTM	
	Industrial trawls	TM	
Dredges (towed)	Scallop dredges	DRB	Dredges
	Mussels, clams, oyster dredgers	DRB / HMD	Dredges / Hydraulic dredges
	Pump scoop (cockles, clams)	HMP / HMD	Hydraulic dredges
Dredges (other)	Suction (cockles)	HMD	
	Tractor	CGD	Shore-based activities
Intertidal handwork	Hand working (access from vessel)	LHP	
	Hand work (access from land)	DRH	
Static - pots/traps	Pots/creels (crustacea/gastropods)	FPO	Traps
	Cuttle pots		
	Fish traps		
	Gill nets	GNS	Anchored nets/lines

[18] https://jncc.gov.uk/about-jncc/jncc-blog/archive/fauna-from-the-canyons/

Static - fixed nets	Trammel nets	GTR	
	Entangling nets	GN	
Passive - nets	Drift nets (pelagic)	GND	Pelagic fishing
	Drift nets (demersal)		Anchored nets/lines
Lines	Longlines (demersal)	LLS	
	Longlines (pelagic)	LLD	Pelagic fishing
	Handlines (rod/gurdy)	LHP	
	Jigging/trolling	LHP / LTL	
Seine nets and other	Purse seine	PS	
	Beach seines/ring nets	SB	Shore-based activities
	Shrimp push-nets	-	
	Fyke and stakenets	FYK / GNF	Anchored nets/lines
Miscellaneous	Commercial diving	-	Diving
	Bait dragging	-	Shore-based activities
	Crab tiling	-	
Bait collection	Digging with forks	-	

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.

Figure 1: The Canyons MCZ depth overview

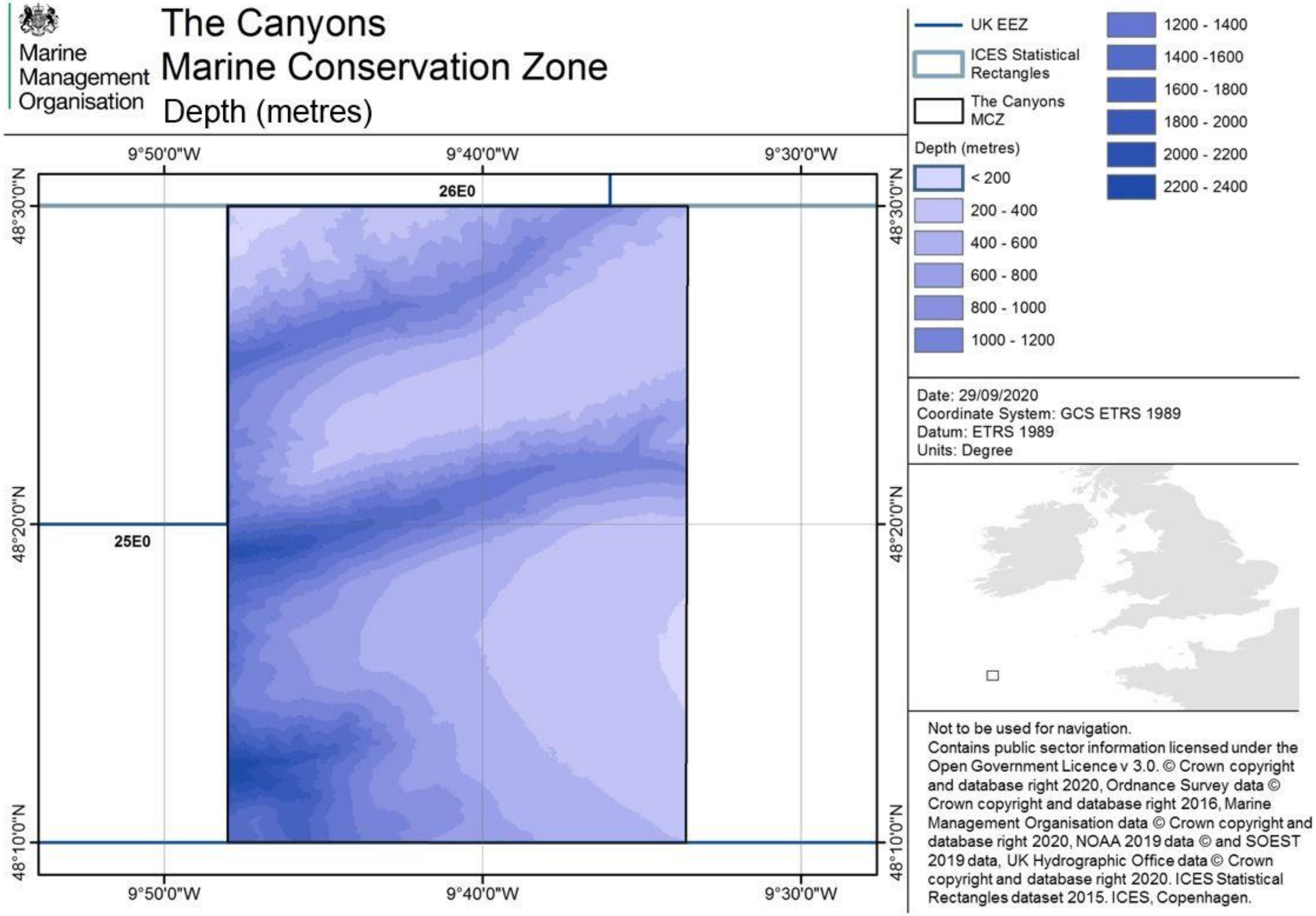
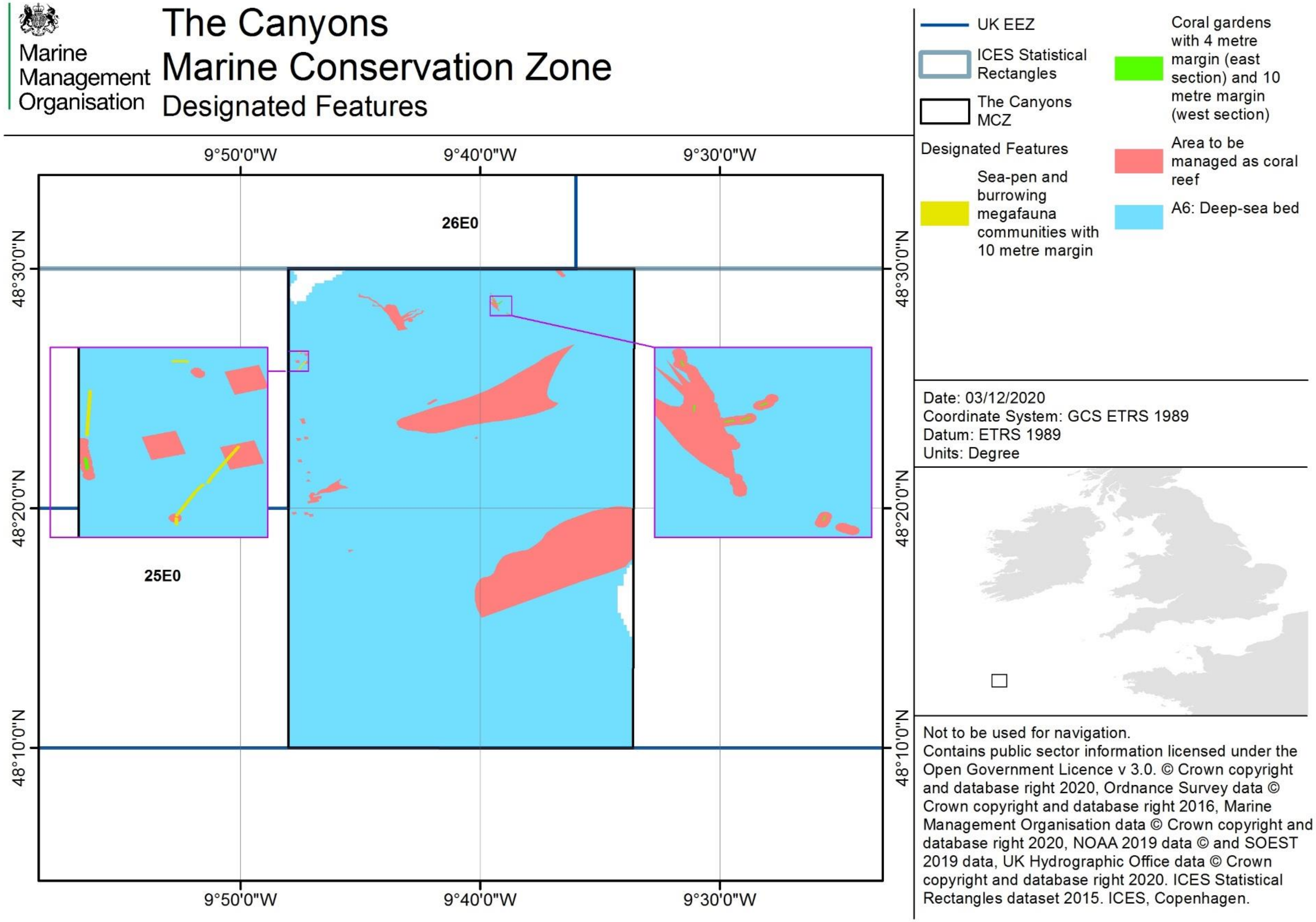


Figure 2: The Canyons MCZ designated features overview



3. Part A Assessment

Part A of this assessment was carried out in a manner that is consistent with the 'capable of affecting (other than insignificantly)' test required by section 126(1) (b) of the Marine and Coastal Access Act 2009[19].

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

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 pressures capable of affecting (other than insignificantly) the protected features of the MCZ?

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:
    a. the feature is not exposed to the pressure, and is not likely to be in the future; or
    b. the pressures are not capable of affecting (other than insignificantly) the protected features of the MCZ.

2. The pressure-feature interactions were included for assessment in Part B if:
    a. the feature is exposed to the pressure, or is likely to be in the future; and
    b. the pressure is capable of affecting (other than insignificantly) the feature; or
    c. it is not possible to determine whether the pressure is capable of affecting (other than insignificantly) the feature.

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

The Joint Nature Conservation Committee (JNCC) conservation advice package used to inform this assessment is provided in Table 5.

[19] www.legislation.gov.uk/ukpga/2009/23/contents

Table 5: Conservation Advice package used for the assessment

Feature	Package	Link
Sea-pen and burrowing megafauna communities **AND** Deep-sea bed **AND** Coral gardens **AND** Cold-water coral reefs	JNCC Conservation Advice for Marine Protected Areas The Canyons MCZ	https://jncc.gov.uk/our-work/the-canyons-mpa/

3.1 High risk interactions

To fast track management for particularly sensitive features where there is already sufficient evidence to support the interaction of certain gears as not being compatible with the conservation objectives of an MPA, the MMO has identified "high risk" gear-feature interactions, based on the Fisheries Impacts Guidance[20] written by JNCC and Natural England. Table 6 displays the gear-feature interactions based on unrestricted fishing access within the MCZ. Pelagic gears will not interact with the features and therefore will support the conservation objectives of the site and will not be included in the assessment. There is a high certainty that demersal towed and static gear will hinder the conservation objectives for coral gardens and cold-water coral reefs. There is more uncertainty for the other gear-feature interactions. Due to this uncertainty, all features and gears, excluding pelagic gears, will be assessed in Part B to determine if fishing activities will hinder the conservation objectives of the site.

[20] http://data.jncc.gov.uk/data/e94680ee-de2e-4ea0-8e65-b86b12893ae0/MCZs-and-fisheries-2011.pdf

Table 6: The potential impacts on the designated features from unrestricted access of different gear types[11]

Feature	Gear	Consequences for habitats/features	Will this help to meet the conservation objectives?	Certainty
All features	All pelagic gears	It is not expected that there would be any impact on the habitat/feature.	Maintain in favourable condition and recover to favourable condition: This will help to achieve the conservation objective.	High
Sea-pen and burrowing megafauna communities	All demersal towed gears	The habitat may be maintained in a modified state with altered sedimentary characteristics and reduced abundance of sea pens and burrowing species. There is risk that cumulative effects from ongoing fishing may result in increasing levels of modification. If fishing activity increases or expands to new areas, the degree of modification will be expected to increase	Maintain in favourable condition: This may help to achieve the conservation objective but with a significant risk of deterioration	High
	All demersal static gears	If fishing activity is low, direct impact on habitat will be minimal and seabed structure will be maintained. Impacts of high levels of activity on benthic species are unknown. At high activity levels, *Nephrops* burrow density may be reduced.	Maintain in favourable condition: This may help to achieve the conservation objective but with a potential risk of deterioration if fishing activity is high	Medium
Deep-sea bed	All demersal towed gears	The habitat may be maintained in a modified state with altered sedimentary characteristics and reduced abundance of fragile species. There is risk that cumulative effects from ongoing fishing may result in increasing levels of modification. If fishing activity increases or expands to new areas, the degree of modification will be expected to increase.	Recover to favourable condition: The conservation objective could not be achieved.	Low
	All demersal	The habitat may be maintained in a modified state. The degree of modification will be related to fishing effort and may be minor if activity is low. There is risk that	Recover to favourable condition: The conservation	Low

	static gears	cumulative effects from ongoing fishing may result in increasing levels of modification. If fishing activity increases or expands to new areas, the degree of modification will be expected to increase.	objective could not be achieved.	
Coral gardens **AND** cold-water coral reefs	All demersal towed gears	If trawling occurs, it is highly likely that there will be direct loss of the habitat.	Recover to favourable condition: The conservation objective could not be achieved.	High
	All demersal static gears	If fishing gear has direct contact, living corals will be killed and dead coral broken up (resulting in loss of habitat).	Recover to favourable condition: The conservation objective could not be achieved.	High

3.2 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: Fishing activities not taking place and unlikely to take place in the future (listed in JNCC Advice on Operations)

Feature	Gear type	Justification
Sea-pen and burrowing megafauna communities **AND** Deep-sea bed **AND** Coral gardens **AND** Cold-water coral reefs	Dredges	Vessel monitoring system (VMS) data were used to determine which fishing activities are not taking place in the Canyons MCZ. 6 years of VMS data show that this activity does not occur in the site.
	Electrofishing	
	Hydraulic dredges	
	Traps	
	Shore based activities	The Canyons MCZ has no shore component and so it is not subject to shore-based activities.

3.3 Potential pressures exerted by the activities on the feature

For the remaining activities (anchored nets/lines, demersal trawls, demersal seines, dredging and pelagic fishing), potential pressures were identified using the JNCC conservation advice identified in Table 5 and the associated advice on operations (AoO) tables. Table 8 shows the pressures identified. Truly pelagic fishing gears, i.e. those with no contact with the seabed (purse seines and mid water trawls) have no associated pressures considered relevant to the features and have not been included. However, some towed gears have the potential to interact with the seabed and have potential pressures on the features. There is not a specific aggregated method category for semi-pelagic towed gears, however in accordance with previous draft Joint Recommendations for fisheries management for other offshore sites[21], these gears have been categorised as bottom otter board trawls and included in the demersal trawls aggregated method gear group.

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

Table 8: Potential pressures for all features of the site. Red = potential pressure. Grey = pressure not relevant to feature.

Potential pressures	Cold-water coral reefs	Coral gardens	Deep-sea bed	Sea-pen and burrowing megafauna communities
	Anchored Nets/Lines, Demersal Trawls, Demersal Seines			
Abrasion/disturbance of the substrate on the surface of the seabed				
Changes in suspended solids (water clarity)				
Deoxygenation				
Hydrocarbon & PAH* contamination				
Introduction or spread of non-indigenous species				
Litter				
Introduction of light				
Nutrient enrichment				
Organic enrichment				
Penetration and/or disturbance of the substrate below the surface of the seabed				
Physical change (to another seabed type)				
Removal of non-target species				
Removal of target species				
Smothering and siltation rate changes				
Synthetic compound contamination				
Transition elements & organic-metal contamination				

3.4 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 conservation advice package and Pressure Activity Database (PAD)[22] were used.

Table 9 to Table 11identify 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 being capable of affecting (other than insignificantly), justification is provided. Current evidence and understanding suggests that deep-sea bed sub features are likely to have similar sensitivities to the identified pressures for the other designated features of the site and have therefore been considered together.

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

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

Table 9: Summary of pressures from specific activities on cold-water coral reefs and coral gardens taken to Part B

Potential pressures	Anchored nets/lines	Demersal seines	Demersal trawls
Abrasion/disturbance of the substrate on the surface of the seabed	Capable of affecting (other than insignificantly) – Abrasion/surface disturbance can be caused by contact between the gear/anchors and the sea bed.		
Deoxygenation	Although anchored nets and lines may contribute to deoxygenation due to discards, this is not considered likely to have an impact due to landing obligation[23].	Capable of affecting (other than insignificantly) - Deoxygenation can result from sediment mobilisation as well as the deposition of organic matter. Resuspension of organic rich sediments in the wake of towed gears can result in localised removal of oxygen in the water column or more anoxic conditions in the remaining substrate.	
Hydrocarbon & PAH contamination. Includes those priority substances listed in Annex II of Directive 2008/105/EC (IE)	Deliberate releases of oil or oil/water mixtures from vessels are already prohibited. Accidental discharges of such substances from fishing levels leading to significant releases are extremely rare.		
Introduction of light (NA)	This feature is at low risk from this pressure		
Introduction or spread of non-indigenous species (NA)	This feature is at low risk from this pressure		
Litter	This feature is at low risk from this pressure		

[23] http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv:OJ.L_.2016.352.01.0050.01.ENG

Organic enrichment	This feature is at low risk from this pressure		
Physical change (to another seabed type)	This feature is at low risk from this pressure		Capable of affecting (other than insignificantly) - Physical changes to seabed with interaction of bottom towed gear.
Penetration and/or disturbance of the substrate below the surface of the seabed	Capable of affecting (other than insignificantly) - Physical damage caused by persistent interaction with bottom towed gear.		
Removal of non-target species	Capable of affecting (other than insignificantly) - This pressure may result through bycatch from fishing gear.		
Removal of target species (NA)	This feature is at low risk from this pressure		
Siltation rate changes (Low), including smothering (depth of vertical sediment overburden)	This feature is at low risk from this pressure	Capable of affecting (other than insignificantly) - Pressure may result from physical disturbance of the sediment.	
Synthetic compound contamination (incl. pesticides, antifoulants, pharmaceuticals). Includes those priority substances listed in Annex II od Directive 2008/105/EC. (IE)	This feature is at low risk from this pressure		

Transition elements & organic-metal (e.g. TBT) contamination. Includes those Priority substances listed in Annex II of Directive 2008/105/EC. (IE)	This feature is at low risk from this pressure

Table 10: Summary of pressures from specific activities on deep-sea bed taken to Part B

Potential pressures	Anchored nets/lines	Demersal seines	Demersal trawls
Abrasion/disturbance of the substrate on the surface of the seabed	Capable of affecting (other than insignificantly) – Abrasion/surface disturbance can be caused by contact between the gear/anchors and the sea bed.		
Deoxygenation	Although anchored nets and lines may contribute to deoxygenation due to discards, this is not considered likely to have an impact due to landing obligation[24].	Capable of affecting (other than insignificantly) - Deoxygenation can result from sediment mobilisation as well as the deposition of organic matter. Resuspension of organic rich sediments in the wake of towed gears can result in localised removal of oxygen in the water column or more anoxic conditions in the remaining substrate.	
Hydrocarbon & PAH contamination. Includes those priority substances listed in	Deliberate releases of oil or oil/water mixtures from vessels are already prohibited. Accidental discharges of such substances from fishing levels leading to significant releases are extremely rare.		

[24] http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv:OJ.L_.2016.352.01.0050.01.ENG

<table>
<tr><td>Annex II of Directive 2008/105/EC (IE)</td><td colspan="2"></td></tr>
<tr><td>Introduction of light (NA)</td><td colspan="2">This feature is at low risk from this pressure</td></tr>
<tr><td>Introduction or spread of non-indigenous species (NA)</td><td colspan="2">This feature is at low risk from this pressure</td></tr>
<tr><td>Litter</td><td colspan="2">Though the feature is considered sensitive to this pressure, the risk of litter occurring due to lost fishing gear and from vessels is low due to the offshore nature of the site.</td></tr>
<tr><td>Organic enrichment</td><td colspan="2">This feature is at low risk from this pressure</td></tr>
<tr><td>Physical change (to another seabed type)</td><td>This feature is at low risk from this pressure</td><td>Capable of affecting (other than insignificantly) - Physical changes to seabed with interaction of bottom towed gear.</td></tr>
<tr><td>Physical change (to another sediment type)</td><td>This feature is at low risk from this pressure</td><td>Capable of affecting (other than insignificantly) - Physical changes to seabed with interaction of bottom towed gear.</td></tr>
<tr><td>Penetration and/or disturbance of the substrate below the surface of the seabed</td><td colspan="2">Capable of affecting (other than insignificantly) - Physical damage caused by persistent interaction with bottom towed gear.</td></tr>
<tr><td>Removal of non-target species</td><td colspan="2">Capable of affecting (other than insignificantly) - This pressure may result through bycatch from fishing gear.</td></tr>
<tr><td>Removal of target species (NA)</td><td colspan="2">This feature is at low risk from this pressure</td></tr>
</table>

Siltation rate changes (Low), including smothering (depth of vertical sediment overburden)	This feature is at low risk from this pressure	Capable of affecting (other than insignificantly) - Pressure may result from physical disturbance of the sediment.
Synthetic compound contamination (incl. pesticides, antifoulants, pharmaceuticals). Includes those priority substances listed in Annex II od Directive 2008/105/EC. (IE)	This feature is at low risk from this pressure	
Transition elements & organic-metal (e.g. TBT) contamination. Includes those Priority substances listed in Annex II of Directive 2008/105/EC. (IE)	This feature is at low risk from this pressure	

Table 11: Summary of pressures from specific activities on sea-pen and burrowing megafauna communities taken to Part B

Potential pressures	Anchored nets/lines	Demersal seines	Demersal trawls
Abrasion/disturbance of the substrate on the surface of the seabed	Capable of affecting (other than insignificantly) – Abrasion/surface disturbance can be caused by contact between the gear/anchors and the sea bed.		
Deoxygenation	This feature is at low risk from this pressure		
Hydrocarbon & PAH contamination. Includes those priority substances listed in Annex II of Directive 2008/105/EC (IE)	Deliberate releases of oil or oil/water mixtures from vessels are already prohibited. Accidental discharges of such substances from fishing levels leading to significant releases are extremely rare.		
Introduction of light (NA)	This feature is at low risk from this pressure		
Introduction or spread of non-indigenous species (NA)	This feature is at low risk from this pressure		
Litter	This feature is at low risk from this pressure		
Organic enrichment	This feature is at low risk from this pressure		
Physical change (to another seabed type)	This feature is at low risk from this pressure	Capable of affecting (other than insignificantly) - Physical changes to seabed with interaction of bottom towed gear.	

Physical change (to another sediment type)	This feature is at low risk from this pressure	Capable of affecting (other than insignificantly) - Physical changes to seabed with interaction of bottom towed gear.
Penetration and/or disturbance of the substrate below the surface of the seabed	Capable of affecting (other than insignificantly) - Physical damage caused by persistent interaction with bottom towed gear.	
Removal of non-target species	Capable of affecting (other than insignificantly) - This pressure may result through bycatch from fishing gear.	
Removal of target species (NA)	This feature is at low risk from this pressure	
Siltation rate changes (Low), including smothering (depth of vertical sediment overburden)	This feature is at low risk from this pressure	
Synthetic compound contamination (incl. pesticides, antifoulants, pharmaceuticals). Includes those priority substances listed in Annex II od Directive 2008/105/EC. (IE)	This feature is at low risk from this pressure	
Transition elements & organic-metal (e.g.	This feature is at low risk from this pressure	

TBT) contamination. Includes those Priority substances listed in Annex II of Directive 2008/105/EC. (IE)	

4. Part B Assessment

Part B of this assessment was carried out in a manner that is consistent with the ‘significant risk’ test required by section 126(2) of the Marine and Coastal Access Act 2009[10].

Table 12 shows the fishing activities and pressures identified in Part A which have been included for assessment in Part B. Pressures with similar potential impacts to a particular feature were grouped to save repetition during this assessment.

Table 12: Fishing activities and pressures included for Part B assessment

Feature	Aggregated Method	Pressures
Cold-water coral reefs **AND** Coral gardens	Anchored Nets/Lines Demersal Trawls Demersal Seines	• Abrasion/disturbance of the substrate on the surface of the seabed • Removal of non-target species • Deoxygenation • Penetration and/or disturbance of the substrate below the surface of the seabed
	Demersal Trawls	• Changes in suspended solids (water clarity) • Physical change (to another seabed type)
	Demersal Trawls Demersal Seines	• Smothering and siltation rate changes
Deep-sea bed	Anchored Nets/Lines Demersal Trawls Demersal Seines	• Abrasion/disturbance of the substrate on the surface of the seabed • Deoxygenation • Removal of non-target species • Penetration and/or disturbance of the substrate below the surface of the seabed
	Demersal Trawls Demersal Seines	• Physical change (to another seabed type) • Physical change (to another sediment type) • Smothering and siltation rate changes

Sea-pen and burrowing megafauna communities	Anchored Nets/Lines Demersal Trawls Demersal Seines	• Abrasion/disturbance of the substrate on the surface of the seabed • Removal of non-target species • Penetration and/or disturbance of the substrate below the surface of the seabed
	Demersal Trawls Demersal Seines	• Physical change (to another seabed type) • Physical change (to another sediment type)

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

Table 13 to Table 15 shows which targets were identified as important. The impacts of pressures on features were assessed against these targets to determine whether the activities causing the pressures are compatible with the site's conservation objectives. Deep-sea bed does not have attributes associated to the feature due to the feature being too broad to scope, as it covers every habitat and feature of conservation importance (FOCI) capable of existing below 200m. Therefore, the conservation objective of deep-sea bed and relevant pressures are listed in Table 15.

Table 13: Relevant favourable condition targets for identified pressures for cold-water coral reefs and coral gardens

Attribute	**Target**	**Relevant pressures**
Extent and distribution	Recover objective: It is important to conserve the full known extent and distribution of the biogenic habitat within a site. The extent of coral habitats can vary naturally due to environmental conditions, and future increases in temperature and sea-water acidity could lead to a decline in coral extent (Jackson *et al.,* 2014). Thus, activities should not be permitted that are likely to reduce the distribution of the biogenic habitats.	Relevant to: • Abrasion/disturbance of the substrate on the surface of the seabed. • Penetration and/or disturbance of the substrate below the surface of the seabed. • Removal of non-target species. • Removal of target species • Smothering and siltation rate changes. • Changes in suspended solids (water clarity).
Structure and function	Recover objective: • Coral composition	

	• Density of the coral colonies • Physical structure of the reef • Key and influential species • Characteristic communities present	
Supporting processes	Recover objective: • Hydrodynamic regime to be maintained. • Physical topography • Supporting habitat • Water and sediment quality to be maintained.	Relevant to: • Smothering and siltation rate changes. • Changes in suspended solids (water clarity).

Table 14: Relevant favourable condition targets for identified pressures for sea-pen and burrowing megafauna communities

Attribute	**Target**	**Relevant pressures**
Extent and distribution	Maintain objective: The extent of the Subtidal sedimentary habitats within the site must be conserved to their full known distribution.	Relevant to: • Abrasion/disturbance of the substrate on the surface of the seabed. • Penetration and/or disturbance of the substrate below the surface of the seabed. • Removal of non-target species. • Removal of target species • Smothering and siltation rate changes. • Changes in suspended solids (water clarity).
Structure and function	Maintain objective: • Finer scale topography • Sediment composition • Key and influential species • Characteristic communities	
Supporting processes	Maintain objective: • Hydrodynamic regime • Water and sediment quality	• Smothering and siltation rate changes. • Changes in suspended solids (water clarity).

Table 15: Conservation objective and relevant pressures for deep-sea bed

Feature	Conservation objective	Relevant pressures
Deep-sea bed	Recover to favourable condition	Relevant to: • Abrasion/disturbance of the substrate on the surface of the seabed • Deoxygenation • Removal of non-target species • Penetration and/or disturbance of the substrate below the surface of the seabed • Physical change (to another seabed type) • Physical change (to another sediment type) • Smothering and siltation rate changes

4.1 Fishing Activity Descriptions

4.1.1 Fisheries Access/existing management

Fishing vessels from numerous European countries are active in The Canyons MCZ but UK, French, Spanish, German, Irish and Dutch vessels are most prevalent.

There are a large number of technical measures in operation within The Canyons MCZ for stock management and conservation. In particular, the Deep-sea Regulation (EU) 2016/2336[25] (which restricts bottom contacting fishing activities over vulnerable marine ecosystems (VMEs) below 400m and prohibits mobile demersal fishing activities below 800m) and Regulation (EU) 2019/1241[26] (which prohibits use of entangling nets, trammel nets and bottom set gillnets below 600m, and restricts their use below 200m) may help to safeguard features of the site and improve site condition where they apply. However, these measures are not designed to achieve the conservation objectives of the site and the impacts from ongoing fishing activities still need to be assessed and managed where appropriate.

4.1.2 Evidence Sources

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

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

[25] https://www.legislation.gov.uk/eur/2016/2336

[26] https://www.legislation.gov.uk/eur/2019/1241

- fishing industry information

Table 16 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 16: Summary of generic confidence associated with fishing activity evidence

Evidence source	Confidence	Description, strengths and limitation
VMS data	Medium/High	Confidence in VMS is high for describing activity relating to larger vessels (>12m). But VMS information was not developed specifically for management of MPAs, and does not describe activity of smaller vessels. There are assumptions in the processing that speeds greater than 0 and less than 6 knots is "fishing speed". This may therefore include vessels travelling at these speeds, but which are not fishing, and exclude any fishing taking place above these speeds. Therefore, this may over or under-estimate fishing activity. VMS records the location, date, time, speed and course of the vessel. Fishing gear information has to be linked to the VMS data itself by either matching its logbook information where possible, using the fleet register which may not be up to date or through local marine officer knowledge of the said vessel. VMS data logs vessel movement and thus can act as a good proxy for mobile gear effort. However, it is more challenging to link VMS data to static gear effort (i.e. amount of gear, soak time etc.). Null gear codes may be present in the data which may underrepresent fishing fleet. Non-UK VMS is of lower resolution, presented to just 3 decimal degrees.
Landings Data	High	Annual data collated and reported to ICES statistical rectangles. Resolution too low to directly infer landings for MPAs.
Expert opinion	Low / Moderate	Reliability/accuracy depends on the area, and the local knowledge of MMO staff.
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.

		There are assumptions in the processing that speed of 0-6 knots is "fishing speed". This may therefore include vessels travelling at these speeds, but which are not fishing, and exclude any fishing taking place above these speeds. Therefore, this may over or under-estimate fishing activity.

4.1.3 The Canyons MCZ fishing fleet

Fishing activity throughout the site is mostly bottom towed gear and long lines with the main gear types being bottom otter trawls, anchored lines and set longlines. Due to the distance from shore the Canyons fishing fleet is entirely made up of larger vessels greater than 12 m in length. The Canyons MCZ is an important fishery for both the UK and EU member states, with the vast majority of fishing taking place being from member state vessels, with UK vessels accounting for 1.7% of landings attributed to the site.

In order to bridge the gaps in available data, expert opinion from MMO coastal officers has been incorporated into this assessment. The following sections describe the gear types used within the site according to expert opinion. For gear type definitions, please see Annex 2.

4.1.3.1 Aggregated Method: Anchored nets/lines

The French and Spanish fleets appear to be the only nation using anchored nets in The Canyons MCZ. The vast majority of these vessels use gillnets opposed to trammel nets (MMO marine officer, *pers. comm.,* high confidence) and target hake (STECF FDI landings data 2012-2018). The nets can have anything in the region of 90-448 tiers with each tier ranging from 47 – 72 m in length (Savina, 2018).

Through the Regulation (EC) 2019/1241 fishing with static nets in water depths greater than 200m is prohibited, subject to certain derogations, in order to provide protection for sensitive deep-sea species[27].

4.1.3.2 Aggregated Method: Demersal trawls

Demersal trawling in The Canyons MCZ is conducted predominantly by UK, French, Dutch, Danish, Spanish and German vessels. VMS and landings indicate that the target species within The Canyons MCZ are largely horse mackerel, boarfish and monkfish.

Demersal trawls in use consist of otter bottom trawls, beam trawls and otter twin trawls, with otter bottom trawls being the most common for all nations.

Through the Deep-sea Regulation (EU) 2016/2336 demersal trawls are prohibited to fish below water depths of 800m to mitigate the potential damaging impacts of bottom trawling[28].

[27] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32019R1241

[28] https://eur-lex.europa.eu/legal-content/en/TXT/?uri=CELEX:32016R2336

4.1.3.3 Aggregated Method: Demersal Seines

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

4.1.4 VMS & 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 is available up to and including 2019, landings data is available up to 2018 for Non UK, EU Member State vessels and to 2019 for UK vessels (Table 16 to Table 20). Charts showing patterns of VMS reports at The Canyons MCZ are displayed in Figure 3 to Figure 12.

Landings derived from The Canyons MCZ have been calculated and estimated by combining a number of data sources and using various methods (see Annex 1 for details). The landings and VMS data support the conclusions drawn elsewhere that The Canyons MCZ is an important area for EU member states for demersal trawling/seining, long-lining and gillnetting. The VMS suggests the seining landings are most likely derived from purse seine gears rather than demersal seine gears and demersal trawl landings deriving from bottom otter and otter twin trawling.

UK fishing activity is more limited with landings and VMS data detailing gillnetting as the dominant gear type being used but in considerably lower numbers than EU vessels (Table 20).

Table 20 shows landings derived directly from the UK VMS data within The Canyons MCZ. A considerable 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 using best available evidence such as expert knowledge of MMO Officers. However, assigning gear codes to landing records was not possible and therefore data presented in Table 19 likely represents an underestimate of actual landings from within the site.

Estimates of demersal gear landings from The Canyons MCZ reveal UK vessels were responsible for approximately 5.7% of landings by weight between 2014 and 2016 (Table 17 and Table 20), of which, over 12 metre vessels (i.e. those with VMS) were responsible for 100%. This is in accordance with expert advice from MMO marine officers who advised that there is no fishing activity in the site from smaller vessels due to the distance from the shore (see section 4.1.3).

Similarly, EU member state landings for the rectangle are almost exclusively (>99%) from vessels over 15 m in length (Table 18) and therefore VMS data is likely to incorporate all fishing activity in the site. The landings attributed to pots/traps within the ICES rectangle (Table 18) are not considered to have been derived from The Canyons MCZ as all evidence suggests this gear type is not occurring in the site.

For EU vessels, while VMS activity for the main gear types has remained relatively constant (Table 20) the landings have varied. This is particularly true for longlining activity where landings increased 3-fold between 2014 and 2018 without a similar increase in VMS activity (Table 20). For UK vessels both landings and fishing activity have been decreasingly steadily, in 2018 just 0.5 tonnes of fish was landed from UK, compared with 100+ VMS records and 45 -87 tonnes of fish landed in 2014-2015 (Table 19 and Table 20).

Figure 3: 2014 VMS Fishing Activity by gear type in The Canyons MCZ

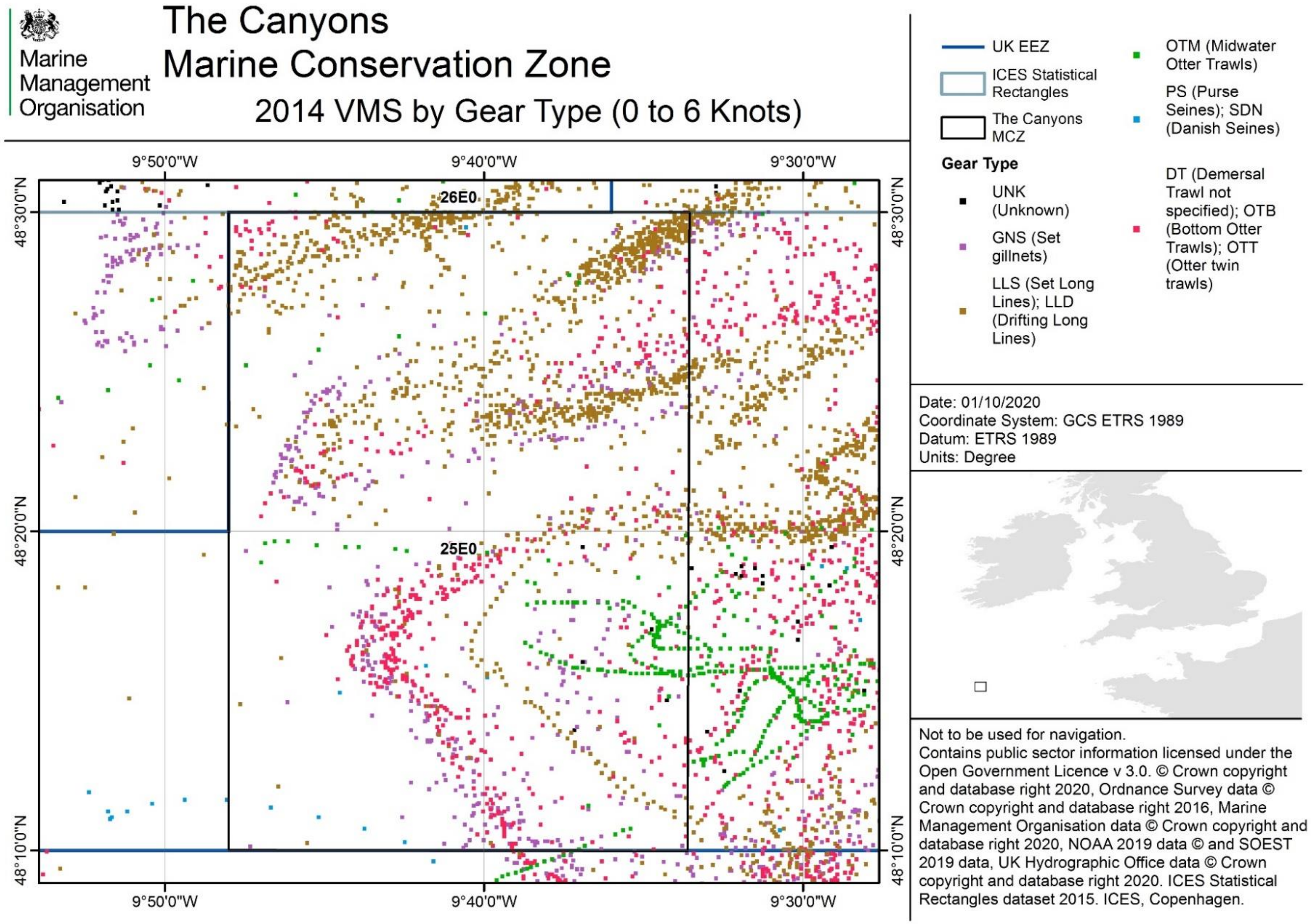


Figure 4: 2015 VMS Fishing Activity by gear type in The Canyons MCZ

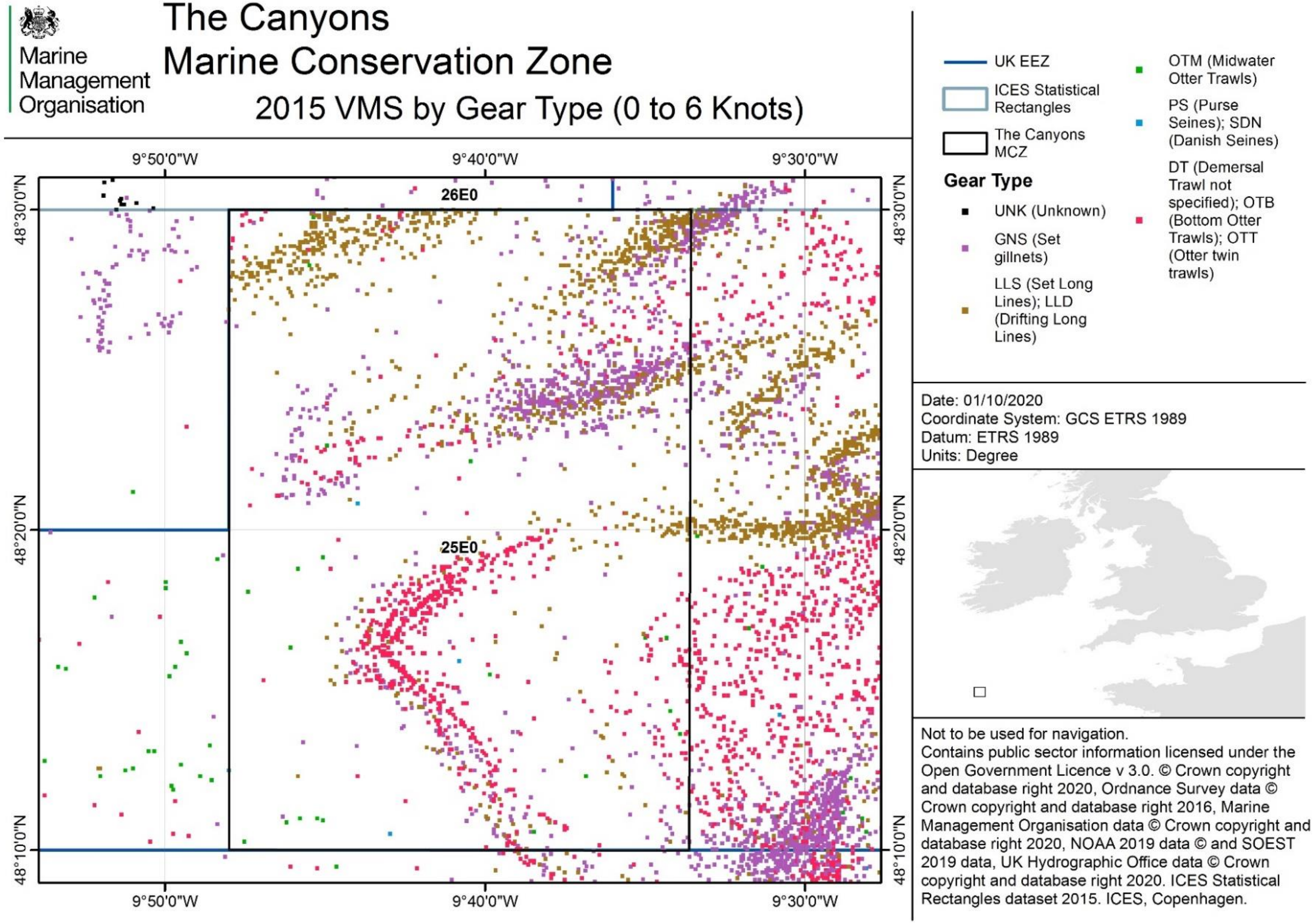


Figure 5: 2016 VMS Fishing Activity by gear type in The Canyons MCZ

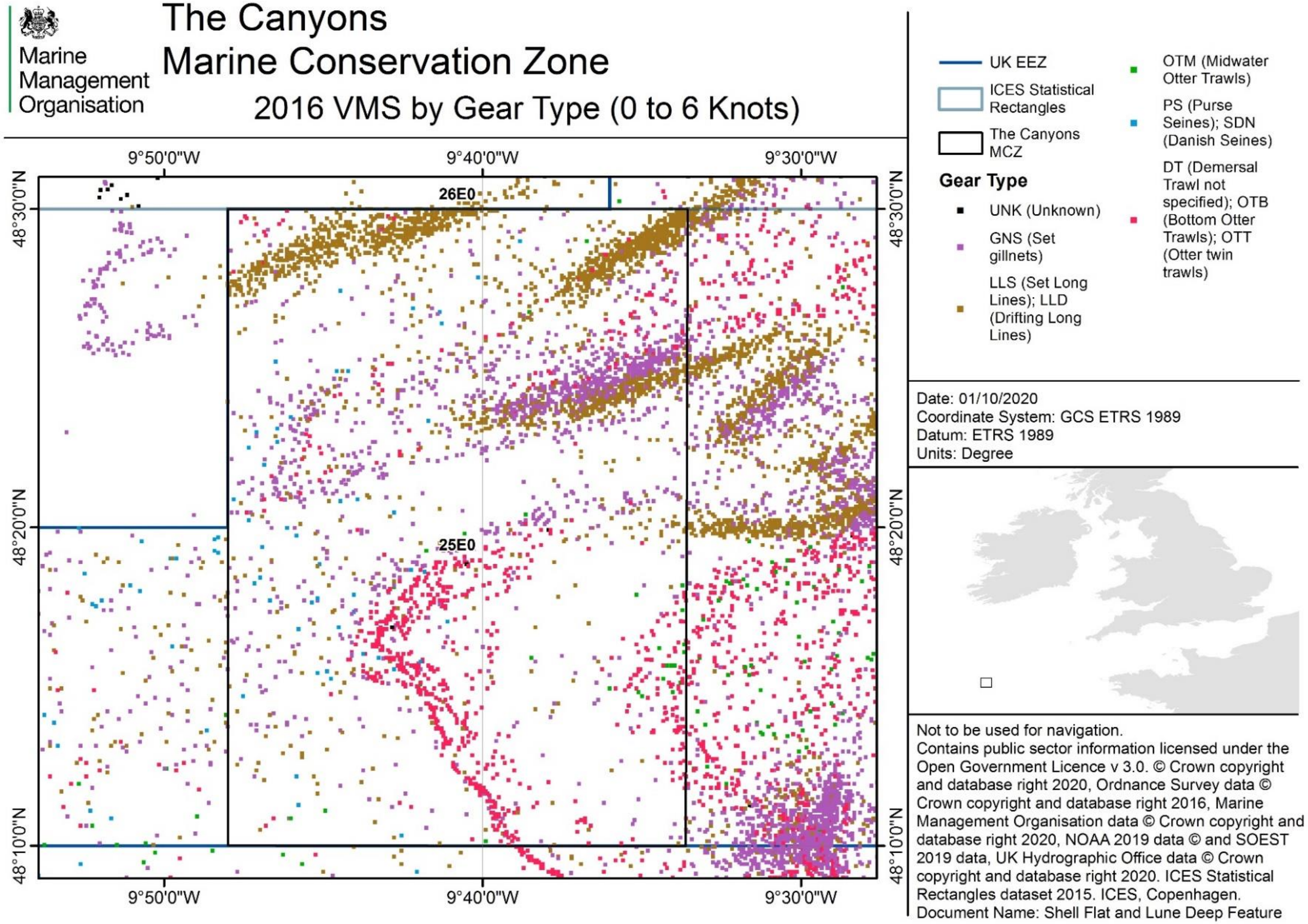


Figure 6: 2017 VMS Fishing Activity by gear type in The Canyons MCZ

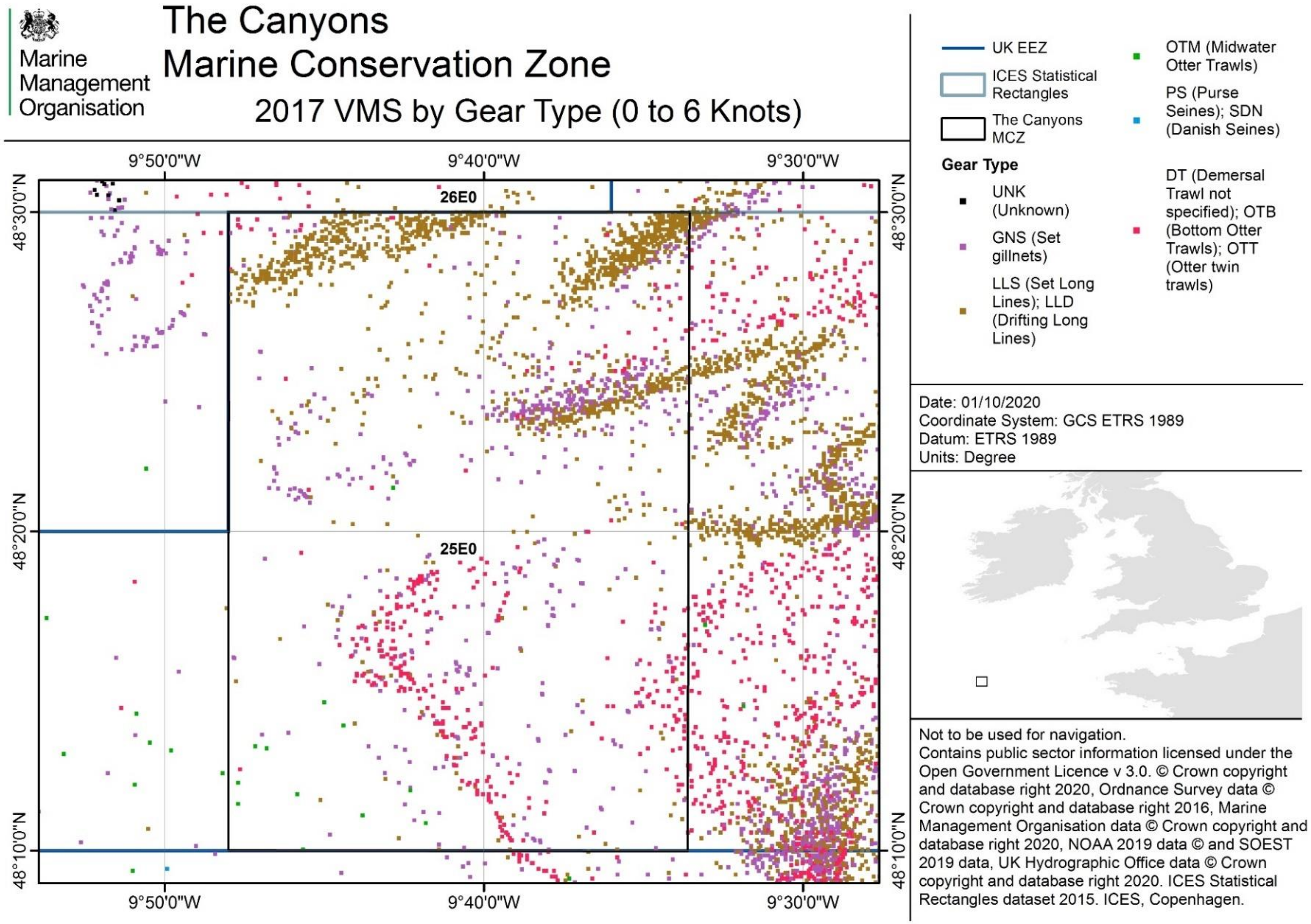


Figure 7: 2018 VMS Fishing Activity by gear type in The Canyons MCZ

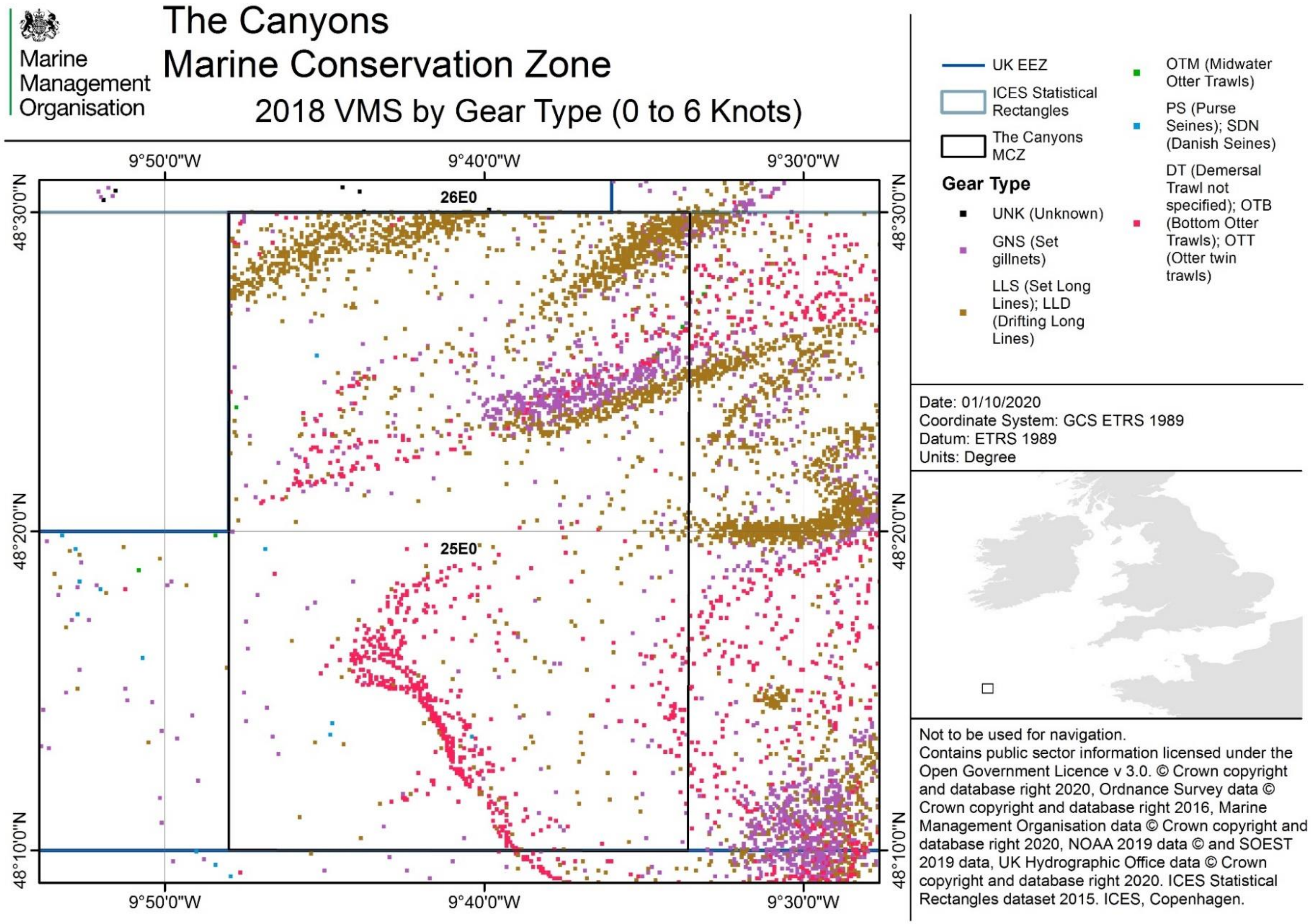


Figure 8: 2019 VMS Fishing Activity by gear type in The Canyons MCZ

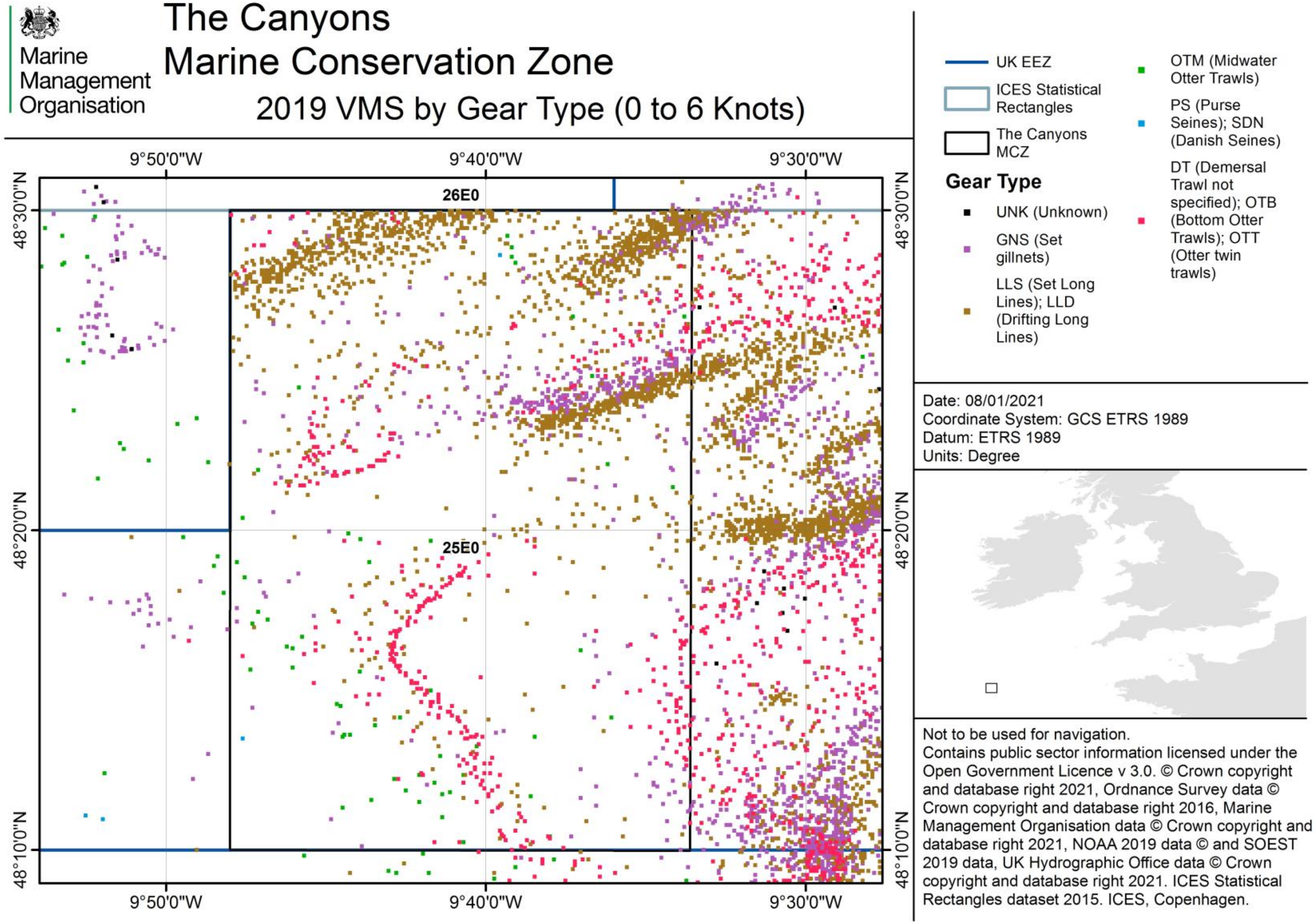


Figure 9: 2014 VMS Fishing Activity by Nationality in The Canyons MCZ

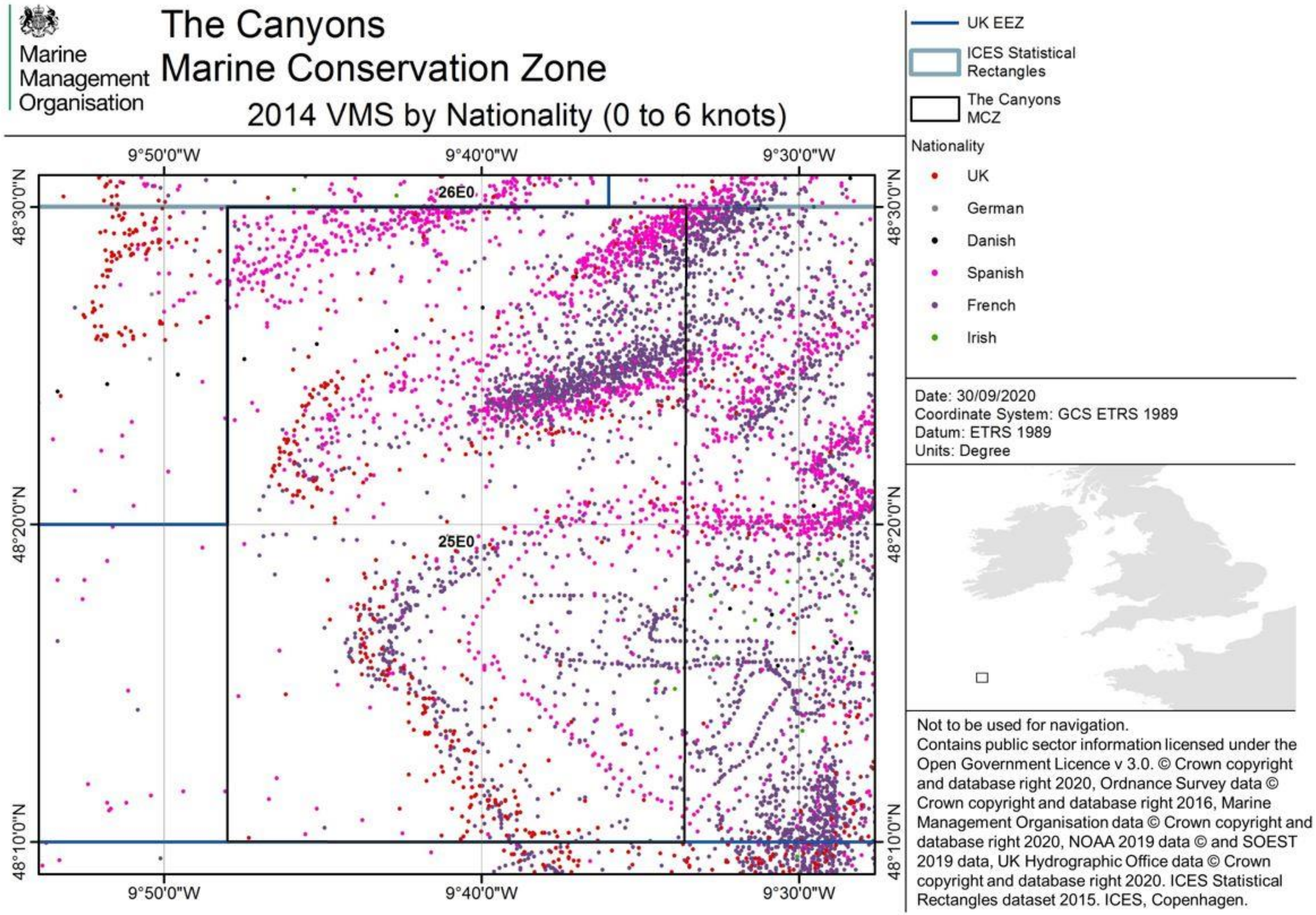


Figure 10: 2015 VMS Fishing Activity by Nationality in The Canyons MCZ

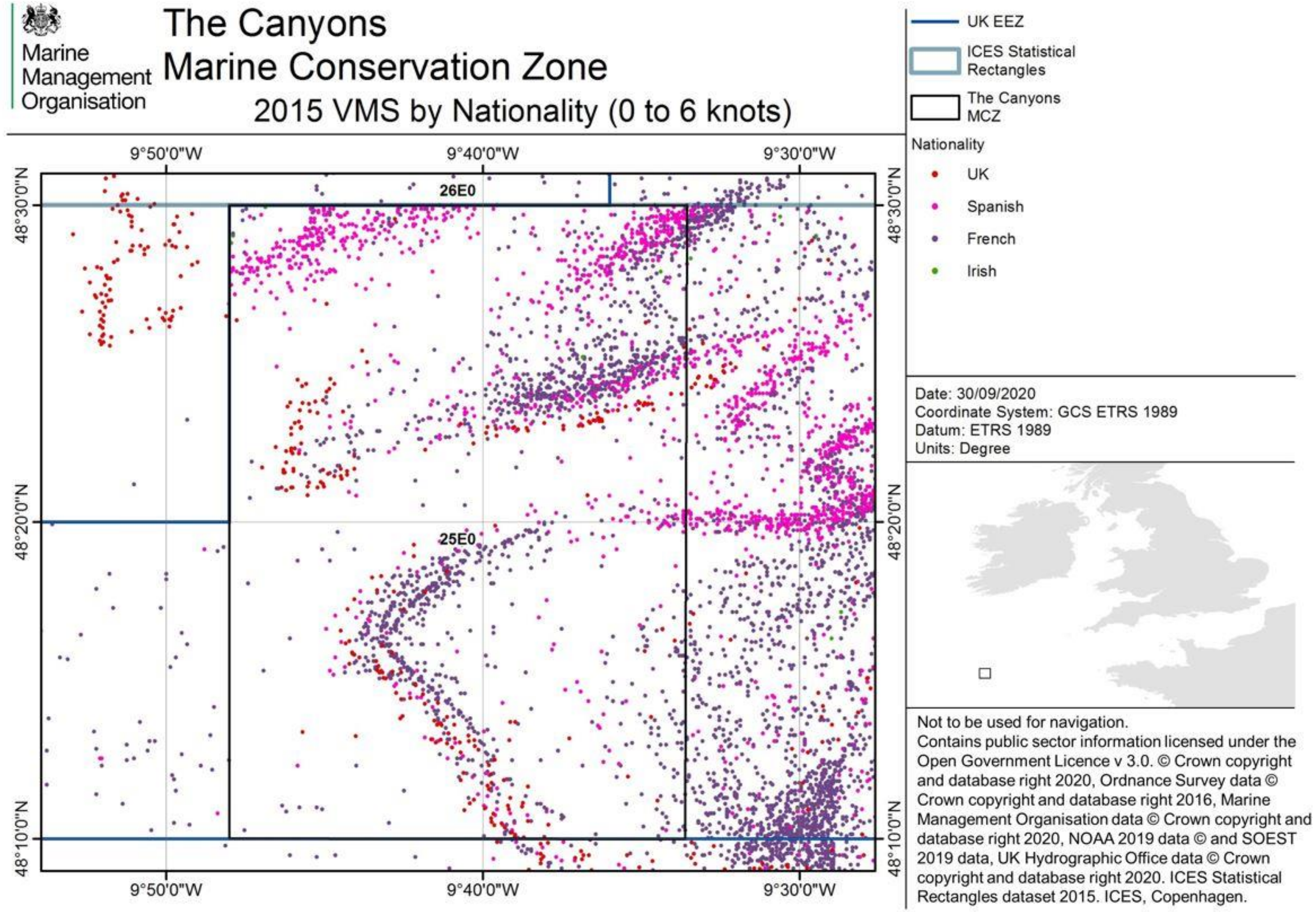


Figure 11: 2016 VMS Fishing Activity by Nationality in The Canyons MCZ

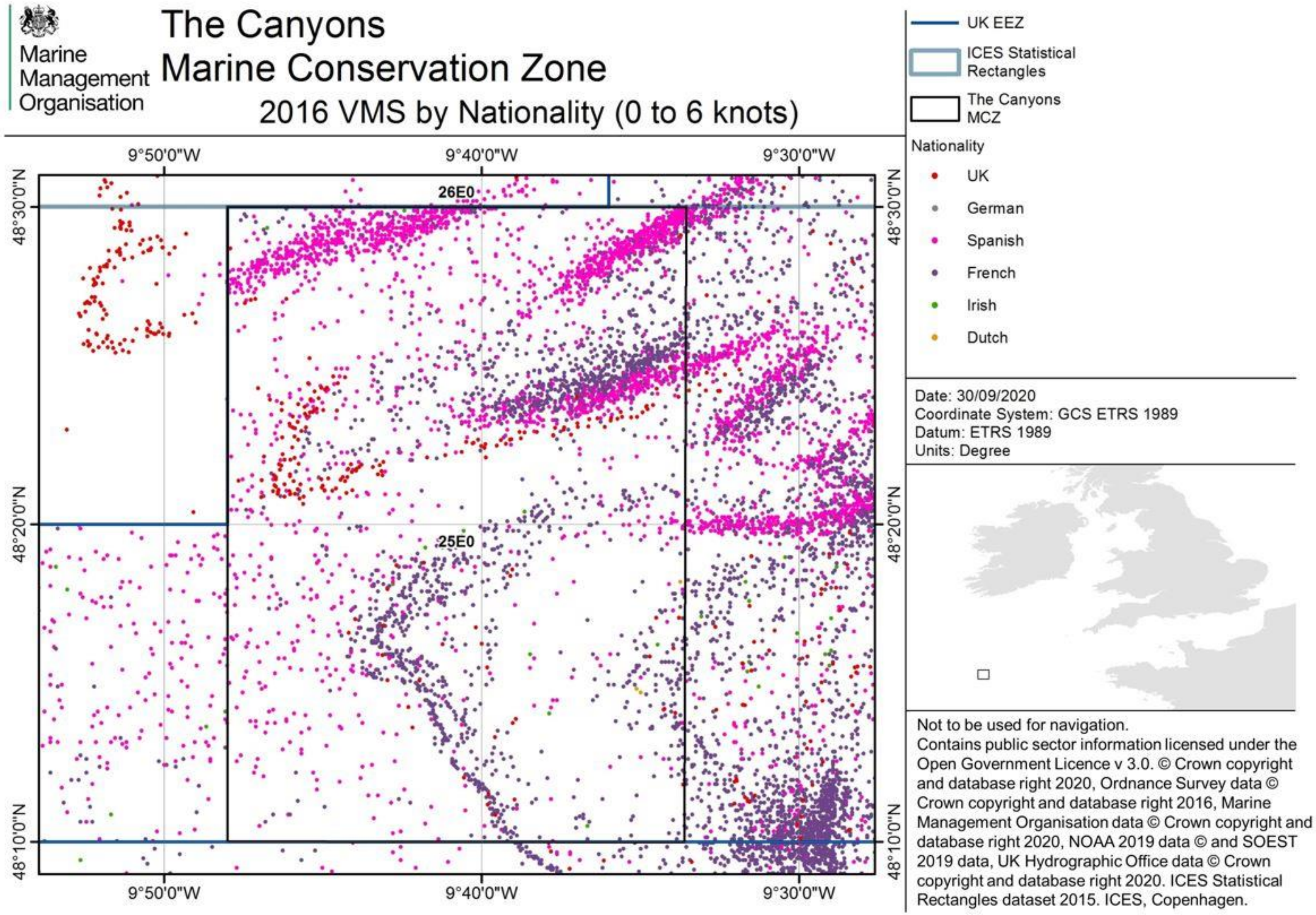


Figure 12: 2017 VMS Fishing Activity by Nationality in The Canyons MCZ

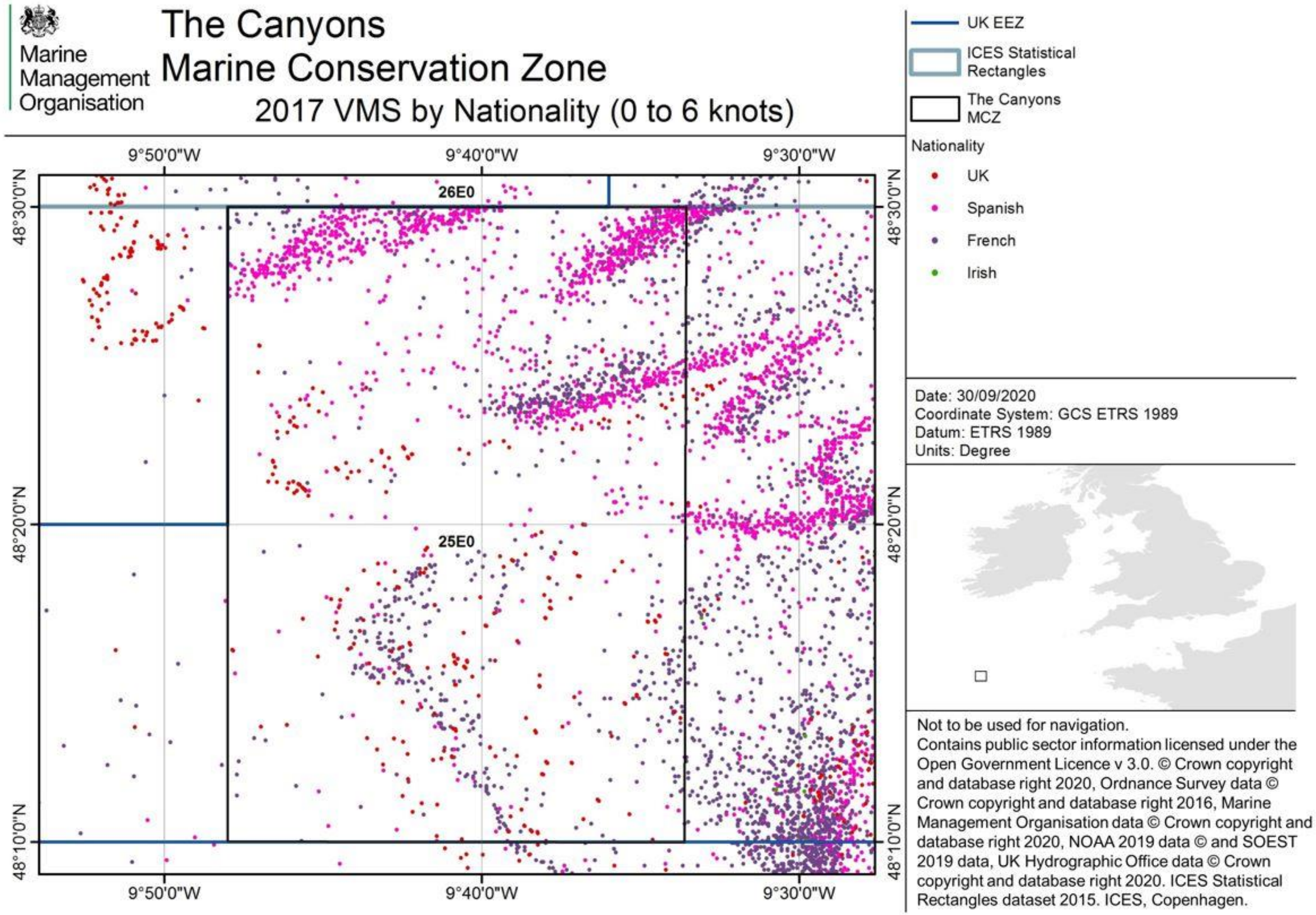


Figure 13: 2018 VMS Fishing Activity by Nationality in The Canyons MCZ

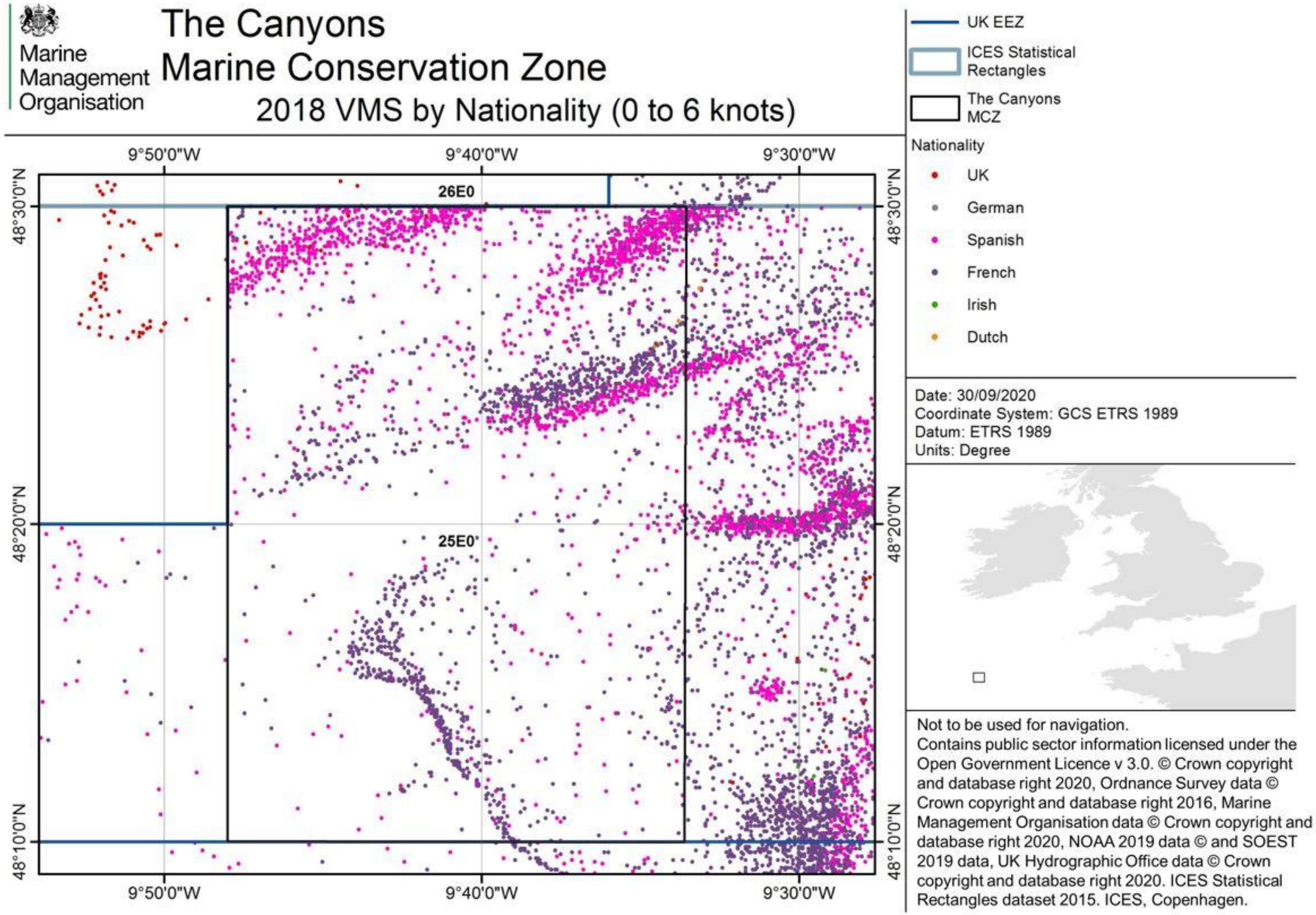


Figure 14: 2019 VMS Fishing Activity by Nationality in The Canyons MCZ

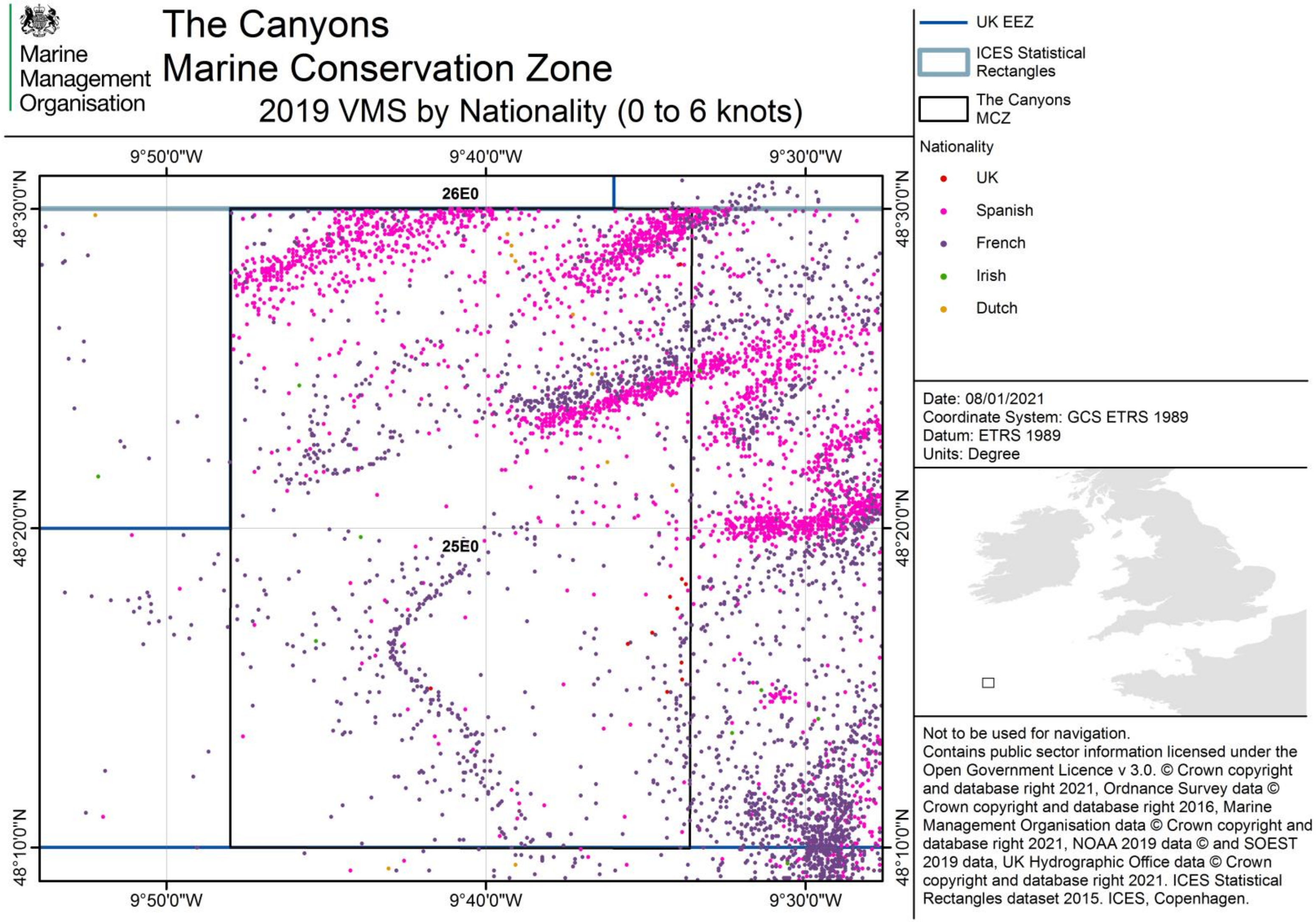


Table 17: 2014-2018 STECF landings from EU member state vessels in The Canyons MCZ estimated from VMS data. (2014 STECF data is not assigned to VMS gear types like other years, total provided).

Year	Landing by gear (t)		
	GNS	LLS	OTB
2014	930		
2015	1141	779	531
2016	1144	1281	561
2017	760	1133	330
2018	800	71	302
Annual Average 2015-2018	961.25	816	431

Table 18: 2014-2016 STECF landings from EU member state vessels in ICES rectangle 25E0 The Canyons VMS gear types were assigned to STECF landings gear categories as follows: Demersal trawl/seine = OTB, OTT, SDN; Drift and fixed nets = GNS, GTR, GN; Gears using hooks = LLS, LLD).

Year	Vessel size (m)	Landings by gear category (t)				Total landings (t)
		Demersal trawl/seine	Dredge	Drift and fixed nets	Gears using hooks	
2014	All	4,467	0	933	831	6,231
	<10	0	0	0	0	0
	10-15	0	0	0	0	0
	>15	4,467	0	933	831	6,231
2015	All	881	0	832	1,243	2,957
	<10	0	0	0	0	0
	10-15	0	0	1	0	1
	>15	881	0	831	1,243	2,955
2016	All	1,884	2	1,111	2,490	5,488
	<10	0	2	5	0	7
	10-15	0	0		1	1
	>15	1,884	0	1,106	2,489	5,479
2014-2016	All	7,232	2	2,877	4,564	14,675
	<10	0	2	5	0	7
	10-15	0	0	1	1	3
	>15	7,232	0	2,870	4,563	14,666

Table 19: The Canyons MCZ 2014-2019 demersal gear landings from UK vessels (derived from UK VMS)

Year	Species group	Total landings (t)			
		GNS	LLS	OTB	Total landings
2014	All	41.8	3.9	0	45.7
	Crustacea	0.6	0	0	0.6
	Mollusc	0	0	0	0
	Demersal fish	41.2	3.9	0	45.1
2015	All	83.7	0	0	83.7
	Crustacea	0.1	0	0	0.1
	Mollusc	0	0	0	0
	Demersal fish	83.6	0	0	83.6
2016	All	16.8	0	0.6	17.5
	Crustacea	0	0	0	0
	Mollusc	0	0	0	0
	Demersal fish	16.8	0	0.6	17.4
2017	All	40	0	3.2	43.2
	Crustacea	0	0	0	0
	Mollusc	0	0	0	0
	Demersal fish	39.9	0	3.2	43.2
2018	All	0.1	0.5	0	0.5
	Crustacea	0	0	0	0
	Mollusc	0	0	0	0
	Demersal fish	0.1	0.5	0	0.5
2019	All	1.2	0	0	1.2
	Crustacea	0	0	0	0
	Mollusc	0	0	0	0
	Demersal fish	0.2	0	0	0
2014-2019	All	183.6	4.4	3.9	191.9
	Crustacea	0.8	0	0	0.8
	Mollusc	0	0	0	0
	Demersal fish	182.8	4.4	3.8	191

Table 20: The Canyons MCZ UK & EU VMS fishing records 2014-2019

Gear	UK / EU	Year(s)						
		2014	2015	2016	2017	2018	2019	2014 - 2019
GND / GNS	UK	190	137	88	194	1	11	621
	EU	106	535	1011	281	562	0	2495
OTB	UK	0	0	4	5	0	1	10
	EU	267	417	269	156	168	367	1644
LLD/LLS	UK	14	0	0	0	3	0	17
	EU	1234	914	1898	1238	1624	1726	7634
OTM	UK	0	0	0	0	0	1	1
	EU	130	1	5	10	4	53	203
PS	UK	0	0	0	0	0	0	0
	EU	7	2	48	0	4	2	63
PTB	UK	0	0	0	0	0	0	0
	EU	0	1	0	0	0	0	1
PTM	UK	0	0	0	0	0	0	0
	EU	0	19	20	2	0	0	41
SDN	UK	0	0	0	0	0	0	0
	EU	1	2	2	0	1	0	6

4.1.5 MMO and Royal Navy Sightings

Sightings data from The Canyons MCZ are limited but reveal a similar picture to that concluded by other data sources with vessels observed fishing in the site between 2014 and 2018 being demersal trawlers and long lining vessels.

4.1.6 Spatial footprint analysis using Pr-values

Analysis was undertaken of the total spatial footprint of fishing gear 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 1 means that the total spatial footprint of the gear in a given year was smaller than the total area of the feature. A Pr-value of more than one means that the total spatial footprint of the gear in a given year was greater than the total area of the feature. 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[29] (report reference: MMO1108). It should be noted that Pr-values are derived from VMS data, and therefore only capture vessels with VMS.

Analysis was undertaken of the total spatial footprint of fishing gear used each year. This total gear footprint was divided by the total area of the feature, in this instance

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

the whole of the MCZ, producing the Pr-value which was also calculated as a percentage. Estimates of the Pr-values for the fishing gear used at this site are displayed in Table 21 and Table 22. The assumptions used when calculating footprints are displayed in Annex 2.

Table 21: Pr-values for bottom towed gear from 2014-2019.

Year	Bottom otter trawl (OTB)			Otter twin trawl (OTT)		
	Total gear footprint area (km^2)	Pr-value	Pr-value %	Total gear footprint (km^2)	Pr-value	Pr-value %
2014	4.54	0.007	0.68	7.02	0.011	1.06
2015	1.97	0.003	0.30	2.27	0.003	0.34
2016	0.66	0.001	0.10	2.19	0.003	0.33
2017	0.32	4.79E-04	0.05	0.55	0.001	0.08
2018	0.22	3.29E-04	0.03	1.14	0.002	0.17
2019	0.23	5.21E-03	5.21E-01	0.04	6.32E-04	6.32E-02

Table 22: Pr-values for anchored nets and seine nets from 2014-2019.

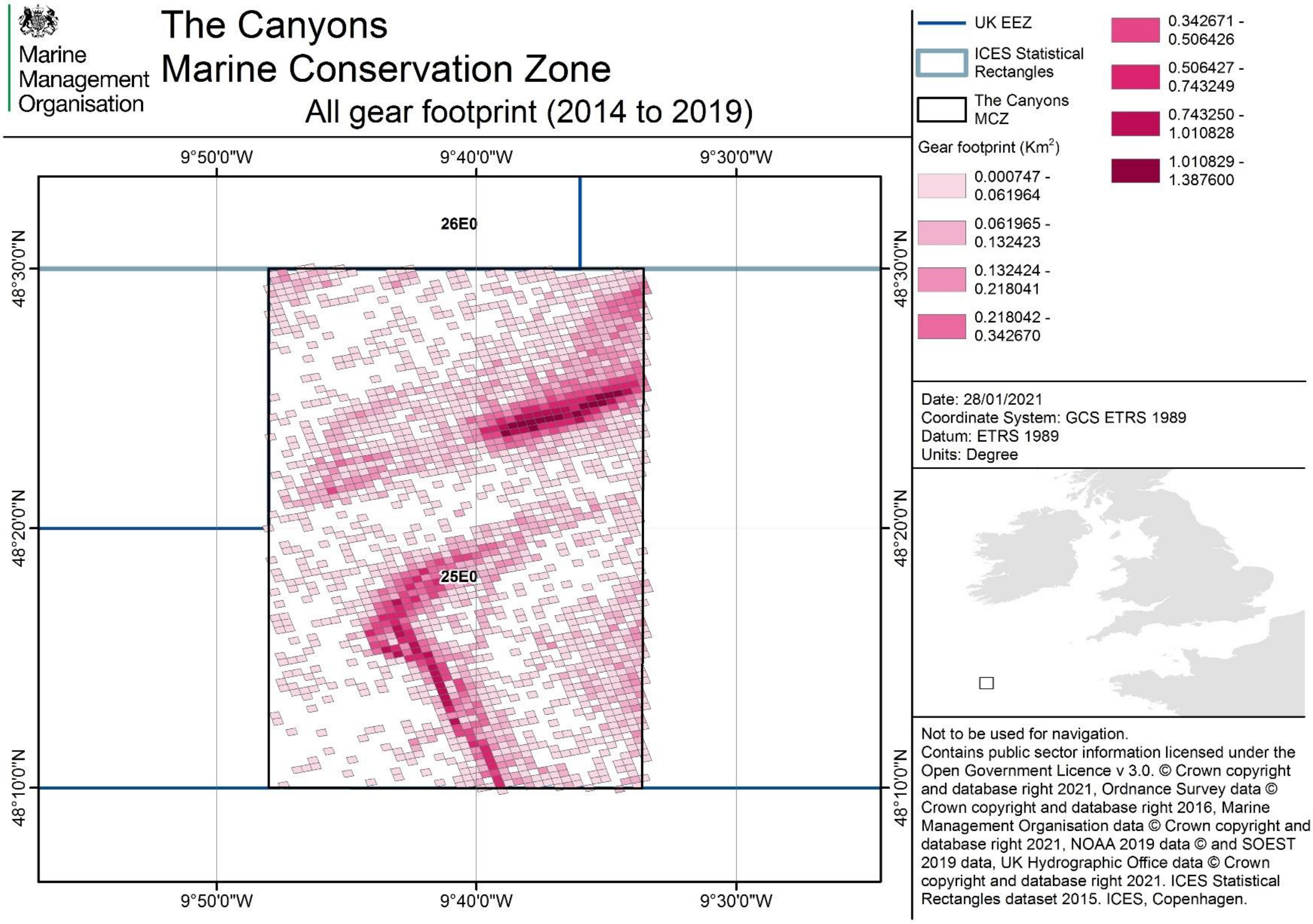
Year	Gill nets (GNS) and for 2014 also trammel nets (GTR)			Danish seines (SDN)		
	Total gear footprint (km^2)	Pr-value	Pr-value %	Total gear footprint (km^2)	Pr-value	Pr-value %
2014	GNS:10.81 GTR:9.04	GNS:0.02 GTR:0.01	GNS:1.63 GTR:1.36	0.001	1.12E-06	1.12E-04
2015	3.00	0.005	0.45	0.001	1.12E-06	1.12E-04
2016	6.98	0.01	1.05	0.002	3.37E-06	3.37E-04
2017	1.10	0.002	0.17	N/A		
2018	1.29	0.002	0.19			
2019	1.13	7.69E-03	7.69E-01			

The gears used most in the site by UK and non-UK vessels include otter trawls and gill nets (Table 21 and Table 22). There is also limited activity of Danish seines from 2014 to 2016 and activity by trammel nets during 2014.

The total gear footprint, which is the total area impacted by fishing gear, was highest for all gears apart from seines during 2014, followed by a general decline (Table 21 and Table 22).

The Pr-values, which is the total extent of the MPA (665 km^2) impacted by gear, are very small (1.12E-06 to 0.01), indicating that a small percentage of the site is impacted by gear (1.12E-04 to 1.64%).

Figure 15: All Gears Spatial Footprint in The Canyons MCZ 2014-2019



4.1.7 Summary

The Canyons MCZ is an important area for both UK and EU member state fishing vessels using demersal gears. With the exception of a reduced EU fleet in 2016, UK and EU landings and fishing intensity have remained relatively consistent over the last five to six years. MMO expert advice indicated dredging did not occur at The Canyons MCZ site, however in 2015 one vessel has used dredging gears within the site. This appears to be an anomaly and dredging has not been considered further.

Fishing activity in and around The Canyons MCZ is exclusively conducted by larger vessels over 12 m in length, which are better able to travel the considerable distance to The Canyons MCZ.

It is clear there is an interaction between the fishing activity occurring and the protected features of The Canyons MCZ. The sections below examines the pressures that each fishing type exerts on The Canyons MCZ features; cold-water coral reefs, coral garden, deep-sea bed and sea-pen and burrowing megafauna communities.

For pressures where potential impacts on features are of a similar nature, those pressures have been consolidated to avoid repetition during this stage of the assessment. To avoid further repetition, cold-water coral reefs and coral gardens have been consolidated throughout the assessment. For each subsequent pressure, information regarding the potential effects of that pressure on the feature has been discussed.

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

These pressures are relevant to anchored nets/lines, demersal trawls and demersal seines in The Canyons MCZ. The impacts of these pressures have been assessed against the feature cold-water coral reefs/coral gardens, deep-sea bed and the sea-pen and burrowing megafauna features.

The deep-sea bed feature is a broad scale habitat encompassing the majority of the site. The deepest elements of the deep-sea bed feature provides a unique habitat for fragile long lived species which are assumed to be as sensitive to the abrasion/penetrations pressure as the cold-water coral reef, coral gardens, and sea-pen and burrowing megafauna communities features. The shallower elements of the site such as the interfluves, provide a more dynamic and resilient area, which can be considered less likely to be severely impacted by such pressures.

4.2.1 Impact of anchored nets/lines

Gill nets have been identified as gear types which may have an impact via surface and sub-surface abrasion and penetration on sensitive features through associated lines and anchors. This is particularly apparent during hauling of gear or the movement of gear along the seabed when subject to strong tides, currents or storm activity. However, interaction of lines and anchors associated with nets and the seabed is likely to be minimal in single fishing trips, with evidence suggesting that static gears have a relatively low impact on coral communities in comparison to towed gears, as a result of the small footprint of the seabed affected (Roberts *et al*., 2010). Cumulative damage has proven to be significant (ICES advice 2005-2010), and given the slow growth rate of the reefs, they may take centuries to recover from damage, if at all (ICES, 2010).

Static demersal gears are likely to reduce the long-term natural distribution of cold-water coral reef features, as well as impacting the structure and function of the habitat and the long-term survival of its associated species. Hooks, lines, nets and ropes entangle corals and 'pluck' them during hauling (Grehan *et al*., 2004; ICES, 2010). Physical damage to the seabed has been observed which may be caused by dragged anchors (Grehan *et al*., 2004; ICES, 2010).

VMS and landings data for The Canyons MCZ indicate anchored nets and lines are occurring with considerable regularity. These levels of activity, combined with the slow growth and recovery rates of reefs from any potential damage caused via surface abrasion and sub-surface penetration, suggest that this activity is a cause of concern for the protected features: cold-water coral reefs and coral gardens within The Canyons MCZ.

With regards to the discussion above, the **MMO concludes that impacts of abrasion or penetration from anchored nets/lines alone on the cold-water coral reef, coral gardens, deep-sea bed and sea-pen and burrowing megafauna features of The Canyons MCZ may result in a significant risk of hindering the achievement of the site's conservation objectives.**

4.2.2 Impact of demersal trawls

Bottom otter trawls, otter twin trawls and beam trawls have been identified as gear types which can have a strong impact via surface and sub-surface abrasion and penetration of cold-water coral reef features.

The trawl doors and associated ground gear of trawls can penetrate into the reef, causing the breaking of living and dead corals resulting in loss of the physical structure of the reef. Increased mortality is the most obvious effect from mechanical impact by bottom trawling on coral reefs. Physical impact of the trawl gear result in corals being crushed or buried (Fosså *et al*., 2002).

Demersal towed gears reduce the long-term natural distribution of cold-water coral reef and coral garden features, as well as impacting the structure and function of the habitat and the long-term survival of its associated species. The passage of trawls may increase mortality of the coral by crushing, burying or wounding corals, increasing susceptibility to infection and epifaunal recruitment that may eventually smother corals (Fosså *et al*., 2002). The passing of a heavy trawl reduces the three-dimensional structure of the coral to rubble, decreasing the complexity of the habitat with impacts on the associated community composition (Koslow *et al*., 2001; Fosså *et al*., 2002).

Large, slow-growing species such as sea-pens are also particularly vulnerable to trawling disturbance (Dinmore *et al*, 2003).

Bottom trawling has many direct and indirect impacts, the latter of which has greater impacts to species such as sea-pens that are particularly vulnerable to trawling disturbance, while smaller individuals and species suffer lower mortality rates (Dinmore *et al.*, 2003). Considering the global benthic community, differential vulnerability to trawling leads to lower biomass and production of communities in heavily trawled areas and a dominance by smaller, faster growing individuals and species (Jennings *et al.*, 2001). The mortality of benthic invertebrates that are removed as trawl bycatch is high but the mortality rates caused by bottom trawling are significantly higher for animals that remain on the seabed (Queiros *et al.*, 2006). The higher mortality of organisms on the seabed is because they are damaged by the hard parts of the fishing gear, whereas those that are removed as bycatch receive less damage as they are more gently handled by the gear on the way into the net. (Queiros *et al.*, 2006).

With regards to the discussion above, the **MMO concludes that impacts of abrasion or penetration from demersal trawls alone on the cold-water coral, coral garden, deep-sea bed and sea-pen and burrowing megafauna features may result in a significant risk of hindering the achievement of the site's conservation objectives.**

4.2.3 Impact of demersal seines

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

Fishing with demersal towed gear such as seines can be a significant physical intervention in an otherwise stable, low energy environments such as those in which the deep-sea bed features of The Canyons MCZ can be found. Such disturbance causes sediment complexity to be reduced along with species diversity (Greathead *et al*., 2007).

There is evidence to indicate that their use can impact the structure and function of the habitats and the long term survival of their associated species. As with stable sand, burrowed mud and gravel habitats at shallower depths, it is likely that the use of demersal towed gears on deep-sea bed habitats will cause the abundance of fragile, long lived species to be reduced while abundance of robust scavenging species will increase (Hinz *et al*., 2012).

Studies into the impact of demersal trawls indicated the degree of modification would depend on the recovery rate of impacted organisms and levels of prevailing fishing activity (Dinmore *et al*., 2003). Trawls have significantly more impact than seines, however, slow growing species such as sea-pens are considered to be more vulnerable to such disturbance than smaller faster growing species, they will therefore suffer higher mortality rates (Dinmore *et al*., 2003).

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*., 2016; Rijnsdorp, 2013a). Scottish seines are expected to have a larger impact than Danish seines due to their weight, thicker ropes and larger area footprint (Eigaard *et al*., 2016). The surface footprint of Scottish seines (1.6 km^2) and Danish seine (1.0 km^2), defined as the surface area covered during one hour of fishing, is relatively high compared to the otter trawl (0.3 – 1.2 km^2) and beam trawl (0.2 km^2) (Eigaard *et al*., 2016; Rijnsdorp, 2015). The sub-surface footprint of Scottish seines (0.1 km^2) is estimated to be lower than the sub-surface footprint of otter trawls used for *Nephrops* (0.3 km^2) or beam trawl fisheries (0.2 km^2) (Eigaard *et al*., 2016; Rijnsdorp, 2015).

Given the absence of otter boards and lighter ground gear, 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 the sub-surface ratio to be 0.000 for Danish seines and 0.050 for Scottish seines. In comparison, predicted sub-surface ratios for otter trawls ranged from 0.078 to 0.304 and from 0.522 to 1.000 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 sub-surface 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 non-UK vessels mostly use Danish seines in addition to Scottish seines. VMS charts indicates that demersal seining within the site occurs at a much lower level than demersal trawling, with activity occurring sporadically throughout the site.

With regards to the discussion above, the **MMO concludes that impacts of surface abrasion on the cold-water coral, coral garden, deep-sea bed and sea-pen and burrowing megafauna communities feature from demersal seines alone may result in a significant risk of hindering the achievement of the site's conservation objectives.**

4.2.4 Pressure conclusion

Although it is unlikely that abrasion/penetration from anchored nets and lines, demersal trawling and demersal seining will have a significant effect on the long-term natural distribution of deep-sea bed. As the deep-sea bed supports fragile long-lived species such as the features of cold-water coral, coral gardens and sea-pen and burrowing megafauna, it is considered to be in parts, as vulnerable as these features.

Given the evidence above, surface abrasion and sub-surface penetration caused by anchored nets/lines or demersal trawls and demersal seines alone within The Canyons MCZ can be considered likely to hinder the restoration of the extent and distribution as well as structure and function of the cold-water coral reef, coral garden and sea-pen and burrowing megafauna features. The **MMO conclude that anchored nets/lines or demersal trawls and demersal seines alone may result in a significant risk of hindering the achievement of the sites conservation objectives (Table 23).**

Table 23: Pressure conclusion for abrasion/disturbance of the substrate on the surface of the seabed AND penetration and/or disturbance of the substrate below the surface of the seabed, including abrasion

Pressure	Feature	Favourable condition target	Gear type	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	Cold-water coral reefs **AND** Coral gardens **AND** Deep-sea bed **AND** Sea Pen and burrowing megafauna	Recover extent and distribution: It is important therefore to conserve the full known extent and distribution of the biogenic habitat within a site. The extent of coral habitats can vary naturally due to environmental conditions, and future increases in temperature and sea-water acidity could lead to a decline in coral extent (Jackson *et al.,* 2014). Thus, activities should not be permitted that are likely to reduce the distribution of the biogenic habitats.	Anchored nets/lines Demersal trawls Demersal seines	No No No
		Maintain: • Physical structure (finer scale topography and sediment composition and distribution) to be restored. • Biological structure (key and influential species and characteristic communities) to be restored.	Anchored nets/lines Demersal trawls	No No
			Demersal seines	No

4.3 Physical change (to another seabed type) AND physical change (to another sediment type)

In The Canyons MCZ physical change (to another seabed type) is relevant to demersal trawls for the cold-water coral reef/coral garden features. Physical change (to another seabed type and to another sediment type) is relevant to demersal trawls and seines for the deep-sea bed and sea-pen and burrowing megafauna features.

Mobile fishing gear is one of the best known sources of anthropogenic degradation of seabed habitat and associated benthic communities, such as through abrasion and penetration of gear.

The physical damage caused by persistent interaction with bottom towed gear could result in the loss of certain sensitive habitats, such as cold-water corals or sea-pens. For more resilient environments the change is unlikely to be permanent if the activity were to cease, although recovery rates may be slow in some cases (Kaiser *et al*., 2002).

4.3.1 Impact of demersal trawls

As outlined in 4.2.2, demersal trawls can have a strong negative impact on sensitive features such as cold-water corals and sea-pens. For example, the physical impact of trawl gear can crush or bury corals (Fosså *et al*., 2002).

Intensive trawling can cause the features to undergo physical changes to another seabed type or sediment type, if the features are removed or altered in a significant way. For example, trawling can reduce the three-dimensional structure of coral to rubble, also decreasing the complexity of the habitat and causing impacts on the associated community composition (Koslow *et al*., 2001; Fosså *et al*., 2002).

As both cold-water corals and sea-pens are slow-growing species, recovery rates from trawling are likely to be long, increasing the likelihood of long term physical changes to the structure and function of the habitat.

Deep-sea bed may also be vulnerable to physical changes to another sediment type due to demersal trawling, particularly for the more sensitive, deeper sections of the MCZ which may host long-lived and fragile species and may be less resilient than the shallower sections on the interfluves which may be more dynamic and resilient.

With regards to the discussion above, the **MMO concludes that impacts of physical change (to another seabed type or sediment type) from demersal trawls on the cold-water coral, coral garden, sea-pen and burrowing megafauna and deep-sea bed features may result in a significant risk of hindering the achievement of the site's conservation objectives.**

4.3.2 Impact of demersal seines

Although demersal seines tend to be considered less damaging to seabed habitats compared to demersal trawls, seines can still cause a significant physical intervention in stable, low energy environments such as The Canyons MCZ, as outlined in 4.2.1

The impacts of demersal seines on the designated features resulting in physical changes to another sediment type is likely to be a similar although lessened impact compared to demersal trawls, with disturbance from seines causing reduced sediment complexity (Greathead *et al*., 2007).

With regards to the discussion above, the **MMO concludes that impacts of physical change (to another sediment type) from demersal seines on sea-pen and burrowing megafauna and deep-sea bed features may result in a significant risk of hindering the achievement of the site's conservation objectives.**

4.3.3 Pressure conclusion

Given the evidence above, physical change (to another seabed type) caused by demersal trawls on the 'cold-water coral reef/coral garden' features and physical change (to another seabed type and to another sediment type) caused by demersal trawls and seines for the 'deep-sea bed' and 'sea-pen and burrowing megafauna' feature alone within The Canyons MCZ can be considered likely to hinder the restoration of the extent and distribution as well as structure and function of the cold-water coral reef, coral garden, sea-pen and burrowing megafauna, and deep-sea bed features. The **MMO conclude that demersal trawls and demersal seines alone may result in a significant risk of hindering the achievement of the sites conservation objectives (Table 24).**

Table 24: Pressure conclusion for physical change (to another seabed type) AND physical change (to another sediment type)

Pressure	Feature	Favourable condition target	Gear type	Compatible with the conservation objectives?
Physical change (to another seabed type)	Cold-water coral reefs **AND** And Coral gardens	Recover extent and distribution: It is important therefore to conserve the full known extent and distribution of the biogenic habitat within a site. The extent of coral habitats can vary naturally due to environmental conditions, and future increases in temperature and sea-water acidity could lead to a decline in coral extent (Jackson *et al.,* 2014). Thus, activities should not be permitted that are likely to reduce the distribution of the biogenic habitats.	Demersal trawls	No

Physical change (to another seabed type) **AND** Physical change (to another sediment type)	Sea-pen and burrowing megafauna **AND** Deep-sea bed	Maintain: • Physical structure (finer scale topography and sediment composition and distribution) to be restored. • Biological structure (key and influential species and characteristic communities) to be restored.	Demersal trawls Demersal seines	No No

4.4 Changes in suspended solids (water clarity) AND smothering and siltation rate changes AND deoxygenation

These pressures are relevant to demersal trawls and seines in The Canyons MCZ. The impacts of these pressures have been assessed for the cold-water coral reef/coral garden and deep-sea bed features.

Deoxygenation from anchored nets/lines has the potential to impact sensitive features where discard rates are high particularly in areas of low currents (Canyons Advice on operations). Due to and EU regulations implementing a discard ban/landing obligation, the MMO do not consider the features of the Canyons MCZ to be at risk of this from pressure due to anchored nets/lines alone.

4.4.1 Impact of demersal trawls and demersal seines

The impacts of demersal trawls and demersal seines have been grouped in this section due to the similarity in impacts caused by towed gear.

Indirect impacts on cold-water coral reefs from trawling may arise as a result of increased levels of suspended particles in the water column causing smothering and polyp mortality (Larsson and Purser, 2011). Corals are slow growing so any damage will take many years to repair if ever (ICES, 2010).

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

Experiments using otter trawls on sand demonstrated that sediments can be suspended up to 80 cm above the seabed (O'Neill and Summerbell, 2011). Otter trawl components can cause a sediment concentration increase behind the gear of up to 429 µl/l (O'Neill and Summerbell, 2011). Per metre towed, an estimated 41.3

kg m^{-1} of sediment has been shown to be suspended by all otter trawl components (ground gear and trawl doors) in sandy substrates (O'Neill and Summerbell, 2011). Linders *et al*., (2018) concluded that sand is typically transported 10 to 100 m when in suspension.

Mobilisation of sediment can cause the release of nutrients, benthic infaunal mortality and the resuspension of phytoplankton cysts and copepod eggs (O'Neill and Summerbell, 2011). Increased turbidity and redistribution of sediments may be a risk to organisms that are vulnerable to increased levels of sediment particles in the water column and creates the potential for impacts via smothering (Linders *et al*., 2018; Gubbay and Knapman, 1999). Changes in suspended sediment in the water column may have a range of biological effects on different species within the habitat; affecting the ability to feed or breathe[30]. A prolonged increase in suspended particulates for instance can have a number of implications, such as affecting fish health, clogging filtering organs of suspension feeding animals, such as corals and affecting seabed sedimentation rates (Elliot *et al*.,1998).

Hydrodynamic regime also effects the movement, size structure and sorting of sediment particles, and can therefore influence the supporting habitat. As the deep-sea bed of The Canyons MCZ supports a range of different sedimentary types the hydrodynamic regime which may be impacted upon by the smothering and in consequence impact upon the coral and sea-pen and burrowing mega communities found within the site.

Cold-water corals feed on zooplankton and other organic matter, therefore cold-water coral habitats require hydrographic conditions that result in a supply of sufficient organic matter to the seabed. Coral habitats occur where hydrodynamic conditions re-suspend particulate organic matter (POM) from the seabed into the water column, or where downwelling brings a fresh supply of POM from the sea surface (Meinis *et al.*, 2007; Davies *et al.,* 2009). The presence of various coral species is influenced by current velocities (Jones *et al.,* 2009; Tracey *et al*., 2011). Moreover, the shape and orientation of coral reefs and carbonate mounds can be driven by the prevailing currents (Davies *et al.,* 2009; Buhl-Mortensen *et al.*, 2010; Järnegren and Kutti, 2016). Although corals require water movement to supply them with POM, feeding rates can reduce at high velocities (Purser *et al.,* 2010) suggesting that coral habitats may require a certain range of current velocities to develop. The hydrodynamic regime transports coral larvae as well as food. Changes to the hydrodynamic regime can alter the source and number of new recruits to coral habitats (Fox *et al.,* 2016). Morphology of sponges can be influenced by local hydrodynamics (De Clippele *et al*., 2017).

It is therefore important to conserve the prevailing hydrodynamic regime, in order to maintain the supply of food and larval recruits, and the supporting habitat of the coral habitats.

Regular bottom trawling on the interfluves of submarine canyons can reduce the seabed complexity at both broad (Puig *et al*., 2012; Daly *et al*., 2018) and fine scale (Pearman, 2020), which will have an effect on the benthic communities and their

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[30] http://data.jncc.gov.uk/data/d6db74b3-78b5-454b-bd23-d40b2c3c9835/TheCanyons-3-SACO-V2.0.pdf

diversity. Furthermore, those studies demonstrate that, apart from the direct mechanical impact of the trawling on the seabed, and the resulting increased turbidity at those locations, the unique geomorphology of submarine canyons can cause impacts to reach over a much larger distance and depth range, owing to the formation of turbidity currents. The sediments brought into suspension by the trawling activity will be transported downslope, and eventually will flow into the canyon, smothering fauna on the lower canyon flanks and in the deeper reaches of the canyon system.

VMS data shows that there is an active presence of demersal towed gears throughout the site between 2014 and 2018, and as such there is evidence to suggest that this pressure alone is adversely affecting the features of The Canyons MCZ.

Studies have shown that demersal seines though having a large footprint, are largely superficial when comparing against other demersal gear such as trawls, and although there is some contact with the seabed this is considered less likely to cause smothering and siltation or impacts on the water clarity (Deerenberg *et al*., 2010).

Deep-sea bed may also be vulnerable to such pressures in the more sensitive deeper areas, which support cold-water coral communities and a range of assemblages characterised by feather stars *Leptometraceltica*, burrowing anenomes, squat lobster *Munida sp.* barnacles and deep-sea sea pens *Kophobelemnon sp*.[31].

With regards to the discussion above, the **MMO concludes that impacts from changes in suspended solids (water clarity) AND smothering and siltation rate changes AND deoxygenation alone by demersal trawls may result in a significant risk of hindering the achievement of the sites conservation objectives.**

The **MMO conclude that impacts from changes in suspended solids (water clarity) and smothering and siltation rate changes alone by demersal seines will not result in a significant risk of hindering the achievements of the site's conservation objectives**.

4.4.2 Pressure conclusion

Given the evidence above, impacts from changes in suspended solids, smothering and siltation caused by demersal trawls alone within The Canyons MCZ are likely to hinder the restoration of the extent and distribution or structure and function of the cold-water coral feature. This pressure is likely to hinder the recovery of the hydrodynamic regime or water quality in the site. The **MMO conclude that demersal trawls may result in a significant risk of hindering the achievement of the site's conservation objectives (Table 25).**

Table 25: Pressure conclusion for changes in suspended solids (water clarity) AND smothering and siltation rate changes

[31] https://www.bodc.ac.uk/resources/inventories/cruise_inventory/reports/jc166.pdf

Pressure	Feature	Favourable condition target	Gear type	Compatible with the conservation objectives?
Changes in suspended solids (water clarity) **AND** Smothering and siltation rate changes	Cold-water coral reef **AND** Coral Gardens **AND** Deep-sea bed	Recover extent and distribution: It is important therefore to conserve the full known extent and distribution of the biogenic habitat within a site. The extent of coral habitats can vary naturally due to environmental conditions, and future increases in temperature and sea-water acidity could lead to a decline in coral extent (Jackson *et al.,* 2014). Thus, activities should not be permitted that are likely to reduce the distribution of the biogenic habitats.	Demersal trawls Demersal seines	No Yes
		Maintain structure and function: • Physical structure (finer scale topography and sediment composition and distribution) to be restored. • Biological structure (key and influential species and characteristic communities) to be restored.	Demersal trawls Demersal seines	No Yes

4.5 Removal of non-target species

These pressures are relevant to anchored nets/lines, demersal trawls and demersal seines in The Canyons MCZ. The impacts of these pressures have been assessed for the cold-water coral reef/coral garden, deep-sea bed and sea-pen and burrowing megafauna features.

4.5.1 Impact of anchored nets/lines

Fixed nets such as gill nets have the potential to entangle non-target species. Hooks, lines, nets and ropes can entangle corals and 'pluck' them during hauling (Grehan *et al*., 2004; ICES, 2010). Static demersal gears are likely to reduce the long-term natural distribution of cold-water coral reef features where they remove them in this way, as well as impacting the structure and function of the habitat and the long term survival of its associated species.

The impacts of anchored longlines have been reviewed by Clark *et al*., (2016). Studies conducted on deep-sea bed have shown that both the weights and lines impact the seabed and can cause physical damage to habitats. The spatial extent of impact depends on the gear and setting deployed. For example, most studies have been conducted in the South Atlantic, where the spatial impacts of 'trot' line systems are estimated to extend 10-100 meters from the immediate vicinity of the longline and are mainly incurred during hauling (Sharp, 2010; Farrugia and Keningale, 2018; Welsford *et al*., 2014). Additionally, sea pens and corals have been reported to comprise longline bycatch (Duran Muñoz *et al*., 2011). The cumulative impacts of weighted line systems used in longline fisheries is under studied and not yet fully understood (Brewin *et al*., 2020).

Due to the lack of knowledge of the condition of the coral reef in The Canyons MCZ prior to the introduction of fishing efforts, there is little site based empirical evidence to support this and recent surveys in the site (MESH 2007) observed the cold water coral reef was observed at the seaward entrance to, and within Explorer Canyon between 743-925m. It was also associated with areas of sediment covered and exposed bedrock on the canyon flanks. In addition, areas of reef rubble were observed in the vicinity of intact reef which may be evidence of fishing activities impacting upon the features of The Canyons MCZ, this has been spotted both within the canyon but more commonly on the interfluves of Dangaard Canyon associated with the mini-mound structures of the deep-sea bed.

The **MMO concludes that removal of non-target species by anchored nets/lines on the cold-water coral, coral garden, deep-sea bed and sea-pen and burrowing megafauna features may result in a significant risk of hindering the achievement of the site's conservation objectives.**

4.5.2 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 trawls, this could be true for the deep-seabed, sea-pen and burrowing megafauna, cold-water coral reef and coral gardens which may come into direct contact with gear.

Mortality of non-target species caught by demersal trawls varies. One study on trawling gear on the uppermost layer of the seabed of the North Sea 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, and Lindeboom, 1994).

Jennings (1998) noted that within heavily fished areas, the removal of large epibenthic organisms can lead to long-term reductions in structural complexity and declines in the abundance of fishes associated with the epibenthic community. It can therefore be concluded that commercial trawling may affect the structure and composition of benthic communities (De Groot and Lindeboom, 1994).

Wheeler *et al*., (2005) studied the impacts of trawling on coral communities in the European continental margin and indicated that comparisons between trawled and non-trawled mounds are startling. Trawl marks are clearly visible on side-scan sonar records, with visual imagery showing higher abundance of dead coral and coral rubble at trawled sites compared to untrawled sites, therefore coral habitat destruction can occur on a scale that impacts coral growths on entire mounds.

VMS data shows that demersal trawling takes place at low intensities throughout The Canyons MCZ. However, despite low levels of trawling taking place, impacts related to the removal of non-target species are still likely to occur. The **MMO concludes that removal of non-target species by demersal trawls on the cold-water coral reef, coral garden, deep-sea bed and sea-pen and burrowing megafauna communities features may result in a significant risk of hindering the achievement of the site's conservation objectives.**

4.5.3 Impacts of demersal seines

During demersal seine fishing, when the seine net ropes are closed to herd demersal fish, there is the potential for removal of epifauna, such as cold-water coral reef and sea-pen and burrowing megafauna communities.

Studies in the North Sea outline the effects of seabed disturbance by bottom contacting fisheries, such as increased mortality rates of non-target species (Bergman and Santbrink, 2000), increased scavenger abundance (Groenewold and Fonds, 2000), changed food web structures (Groenewold 2000, Hinz *et al*., 2017), changed size distributions (Van Kooten *et al*., 2015), and reduced abundances (Duineveld *et al*., 2007). Apart from the direct physical contact with parts of the fishing gear, there are also effects of compaction of the sediment. This evidence varies by gear type, with seines having less of an impact than other demersal gear types.

Long-lived species have life history traits such as slow growth, late maturity and low fecundity. This results in slow recovery rates and high vulnerability to fishing disturbance. Sea-pens such as *Virgularia mirabilis* are able to withdraw rapidly into the sediment when disturbed, an ability which should provide some protection from dislodgement (Hughes *et al*., 1998).

The studies above indicate that several species found within The Canyons MCZ are vulnerable to removal by seining. VMS data indicates that demersal seining within the site occurs at a much lower level than demersal trawling, however, the risk to fragile, long-lived species even at a low level could be significant. The **MMO concludes that removal of non-target species by demersal seines on the cold-water coral reef, coral garden, deep-sea bed and sea-pen and burrowing megafauna communities features may result in a significant risk of hindering the achievement of the site's conservation objectives.**

4.5.4 Pressure conclusion

Given the evidence above, there is a risk that removal of non-target species caused by anchored nets and lines, demersal trawls and demersal seines may not aid the achievement of favourable condition targets. Use of these gear types may impact the physical and biological structure of the features via direct removal of characteristic species. This may impact the extent and distribution regarding biological assemblages. The **MMO conclude that anchored nets/lines, demersal trawls and demersal seines alone may result in a significant risk of hindering the achievement of the site's conservation objectives (Table 26).**

Table 26: Pressure conclusion for removal of non-target species

Pressure	**Feature**	**Favourable condition target**	**Gear type**	**Compatible with the conservation objectives?**
Removal of non-target species	Cold-water coral reef **AND** Coral gardens **AND** Deep-sea bed **AND** Sea-pen and burrowing megafauna	Restore extent and distribution: It is important therefore to conserve the full known extent and distribution of the biogenic habitat within a site. The extent of coral habitats can vary naturally due to environmental conditions, and future increases in temperature and sea-water acidity could lead to a decline in coral extent (Jackson *et al.,* 2014). Thus, activities should not be permitted that are likely to reduce the	Anchored nets/lines Demersal trawls Demersal seines	No No No

		distribution of the biogenic habitats.		
		Restore structure and function: • Physical structure (finer scale topography and sediment composition and distribution) to be restored. • Biological structure (key and influential species and characteristic communities) to be restored.	Anchored nets/lines Demersal trawls Demersal seines	No No No

4.6. Part B conclusion

The assessment of fishing pressures on the cold–water coral, coral garden, deep-sea bed and sea-pen and burrowing megafauna features of The Canyons MCZ has revealed that a significant risk of hindering the achievement of the sites conservation objectives cannot be ruled out where demersal trawl, demersal seine and anchored nets and lines occur. As such **the MMO conclude that management measures are required to restrict these activities from The Canyons MCZ**. Section 7 contains further details of these measures.

5. Part C Assessment

5.1 In-combination assessment

This section assesses the effects of activities considered as compatible with the conservation objectives of The Canyons MCZ 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 but which may have an effect on conservation features (see Table 8);
- fishing interactions assessed in Part B but not resulting in adverse effect; and
- plans and projects.

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

Demersal trawls, demersal seines and anchored nets/lines have been identified in Part B as requiring management. There are no other fishing activities occurring within the site and therefore there is no current requirement to assess in combination impacts of fishing activities. However the management options do not rule out impacts to all features/areas of the site and so fishing activities are assessed in combination with other projects/plans.

5.2 Pressures exerted by fishing and plans or projects

In accordance with the methodology detailed above, the SPIRIT system identified submarine cables and military practice activities occurring within 5 km of The Canyons MCZ (Table 27).

No recreational activities were identified and no additional fishing activities to those already assessed in Part B occur within 5 km of The Canyons MCZ.

Table 27: Other fishing activities and plans and projects considered in combination with anchored nets/lines, demersal trawls and demersal seines in the Canyons MCZ

Relevant activity	Description	Feature(s) where a pathway exists
Submarine cables (existing and proposed)	• Gemini South telecommunication cable within site (Porthcurno to USA) - disused and cable in sections as pieces were removed. • Reliance Globalcom Submarine Cable outside site but within 5 km (Porthcurno to Meditteranean) • Amitié Telecommunications Cable System outside site but within 5 km MLA/2020/00173	Deep-sea bed
Military Practice Area	GB practice and exercise area (surface fleet)	All

To identify the specific pressures that the activities exert on the feature of this site, the MMO has used JNCC's PAD[32] and the AoO section in JNCC's conservation advice package for The Canyons MCZ (Table 5).

Use of JNCC's AoO and PAD required the identified activities to be matched to the appropriate categories and activities. Table 28 and Table 29 shows how the activities were matched.

Table 28: Categories from the PAD that have been used to inform pressures information

Name of plan/project	PAD Category	PAD Activity
Military Practice Area	Sea surface military activity	Defence and national security

Table 29: Categories from the AoO that have been used to inform pressures information for identified fishing and non-fishing activities.

Name of Activity	AoO Operation	Activity
Submarine cables (existing and proposed)	Other man-made structures	Telecommunication cable: Laying, burial and protection; Telecommunication cable: Operation and maintenance

Table 30 displays a list of pressures that have been collated from the AoO and/or PAD for the above activities. Table 30 indicates pressures which are exerted by each activity (Y – pressure exerted, N – pressure not exerted). As this is a fisheries assessment, only those pressures that are relevant to both fishing and the project or plans are to be assessed in-combination. Pressures from plans or projects that are not associated with the fishing activities are not within the scope of this assessment. These pressures are screened out and highlighted in green in Table 30.

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.

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

Table 30: Pressures exerted by fishing and non-fishing activities occurring in The Canyons MCZ. Non-fishing pressures similarly exerted by fishing require further assessment and are highlighted in red.

Pressure	Exerted by Telecommunication cable: laying, burial and protection	Exerted by Telecommunication cable: operation & maintenance	Exerted by sea surface military activity	Exerted by anchored nets/lines	Exerted by demersal trawls	Exerted by demersal seines
Abrasion/disturbance of the substrate on the surface of the seabed	Y	Y	N	Y	Y	Y
Above water noise	N	N	Y	N	N	N
Changes in suspended solids (water clarity)	Y	Y	N	N	Y	Y
Deoxygenation	Y	N	N	Y	Y	Y
Habitat structure changes – removal of substratum (extraction)	N	Y	N	N	N	N
Litter	Y	Y	N	Y	Y	Y
Penetration and/or disturbance of the substrate below the surface of the	Y	Y	N	Y	Y	Y

seabed, including abrasion						
Physical change (to another seabed type)	Y	Y	N	N	Y	Y
Physical change (to another sediment type)	Y	Y	N	N	Y	Y
Physical loss (to land or freshwater habitat)	Y	Y	N	N	N	N
Removal of non-target species	N	N	N	Y	Y	Y
Smothering and siltation rate changes (Light)	Y	Y	N	N	Y	Y
Smothering and siltation rate changes (Heavy)	N	Y	N	N	N	N
Temperature increase	Y	Y	N	N	N	N
Temperature decrease	Y	Y	N	N	N	N
Underwater noise changes	N	N	Y	N	N	N
Visual disturbance	N	N	Y	N	N	N

Water flow (tidal current) changes, including sediment transport considerations	Y	Y	N	N	N	N

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

Abrasion/disturbance of the substrate and penetration/disturbance of substrate below the surface are relevant to telecommunication cables (laying, burial and protection as well operation and maintenance) and anchored nets/lines, demersal trawls and seines.

Anchored nets/lines, demersal trawls and demersal seines have been identified in Part B as activities which may result in a significant risk to achieving the conservation objectives of the site via this pressure.

Throughout operation and maintenance, telecommunication and power cables may need to be reburied or uncovered for repair. Abrasion and physical disturbance will occur from this activity. Usually free-swimming burial machines are deployed to rebury exposed sections of cable (BERR, 2008). Disturbance may also occur through anchoring of vessels which may cause abrasion via deployment, subsequent dragging and locking in of the anchor, as well as scour of the anchor chain whilst in use and upon recovery. The anchors of large ships may penetrate the seabed up to depths of approximately 1 metre (Luger and Harkes, 2013). There is one submarine cable within the site and one within 5 km of the site boundary. The cable within the site is disused and therefore the cable will require no maintenance. The cable outside the site will not cause abrasion/penetration to the designated features. Maintenance to cables is a licensable activity, if there was a positive determination on applications for maintenance of any existing or future cables, 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 submarine cables will have a significant in combination impact with fishing and other activities via this pressure.

The laying, burial and protection of power cables will lead to seabed abrasion and sub-surface penetration. Ploughing, trenching, rock placement and anchor placement will result in these pressures. The footprint of the seabed disturbed by cable installation machinery could be 5-10 m wide per cable trench for ploughing and trenching (Aecom Intertek, 2011; Nemo Link, 2013). Cables laid at the surface may cause abrasion where there is high wave activity, evidence suggests in shallow waters less than 20 m, marks from cables ranged from 6-45 cm in width (Carter *et al*., 2009). Alternatively, cables may instead be buried at depths of 1 to 2 metres (Aecom Intertek, 2011; Nemo Link, 2013). As described above, anchors of vessels associated with cable installation will also cause disturbance. There is one proposed cable to be installed close to the southern boundary of the site. The planned route of this cable does not enter the Canyon MCZ and therefore this activity is unlikely to have a significant in combination impact with fishing via surface abrasion and sub-surface penetration.

Having already taken into account the proposed management, the MMO conclude that abrasion/disturbance and penetration pressures associated with fishing, in combination with the plans/projects/activities occurring in the site will not result in significant risk to the site's conservation objectives being

achieved.

5.2.2 Changes in suspended solids (water clarity) AND smothering and siltation rate changes (light) AND deoxygenation

This pressure is relevant to telecommunications cables (laying, burial, protection) and anchored net/lines, demersal trawls and seines.

Demersal trawls have been identified in Part B as an activity which may result in a significant risk to achieving the conservation objectives of the site via this pressure. Demersal seines have been deemed to not result in a significant risk alone.

Demersal trawls interact with the seabed and cause mobilisation of sediment, indirectly leading to smothering and deoxygenation. The main pathway of deoxygenation from fishing is through discards and the release of deoxygenated ballast water. The Canyons MCZ is exposed to substantial wave energy and the majority of fishing vessels active in the site are under 45 metres in length and therefore have solid ballast. As a result, the accumulation of discards and associated hypoxia or any deoxygenation resulting from fishing vessel ballast water is unlikely.

For submarine cables the main source of deoxygenation is associated with sediment mobilisation and increase of suspended sediments.

Modern equipment and techniques reduce the re-suspension of sediment during cable burial, repair and removal, however, increases in suspended sediment may occur (OSPAR, 2012). The magnitude of this depends on the silt fraction, the equipment used and background levels (OSPAR, 2012). With regards to impacts caused during maintenance of cables, the frequency of this activity will be low. Furthermore, this is a licensable activity and therefore licence conditions would be put in place to mitigate against any significant impacts to the features of the site. Therefore it is unlikely that laying, burial and protection of submarine cables will have a considerable in combination impact with fishing via these pressures.

Having already taken into account the proposed management, the MMO consider that the combined pressure from fishing and other plans/projects will not result in significant risk to the site's conservation objectives being achieved

5.2.3 Litter

This pressure is relevant to telecommunication cables (laying, burial and protection as well operation and maintenance) and anchored nets/lines, demersal trawls and seines.

For installation, operation and maintenance of submarine cables, 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.

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 and 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 and therefore release 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 reach the deep sea bed features of the Canyons MCZ. However, due to the low energy where the features are found, any litter that does occur is likely to persist for a long time. Given the low likelihood of litter reaching the deep sea bed features, the MMO believe it is unlikely that this pressure will be significant when considered in combination with non-fishing activities.

Having already taken into account the proposed management, the MMO conclude that this pressure associated with fishing, in combination with the plans/projects/activities occurring in the site will not result in significant risk to the site's conservation objectives being achieved.

5.2.4 Physical change (to another seabed type) AND physical change (to another sediment type)

This pressure is relevant to telecommunications cables (laying, burial, protection and operation and maintenance) and demersal trawls and seines.

Demersal trawls and demersal seines have been identified in Part B as activities which may result in a significant risk to achieving the conservation objectives of the site via this pressure.

With regards to the installation of cables, the cables themselves as well as protective structures such as concrete mattresses, rock dumping and grout/frond mattresses, will result in a change of habitat type (Aecom Intertek, 2011; Nemolink, 2013; BERR, 2008; OSPAR, 2012).

As discussed in section 5.2.1, there is one disused submarine cable within the site and one within 5 km of the site boundary. The cable outside the site will have no impact to the designated features within the site. The cable within the site is disused and therefore the cable will require no maintenance and cause no impact via this pathway.

There is one proposed cable to be installed close to the southern boundary of the site. The planned route of this cable does not enter the Canyons MCZ and therefore this activity is unlikely to have a significant in combination impact with fishing via physical change to another seabed or sediment type.

Having already taken into account the proposed management, the MMO consider that the combined pressure from fishing and other plans/projects will not result in significant risk to the site's conservation objectives being achieved.

5.3 In-combination conclusion

MMO concludes, taking into account the introduction of management measures for demersal trawls and seines, and anchored nets and lines outlined in section 7 , that fishing activities in combination with other relevant activities will not significantly risk the site's conservation objectives being achieved.

6. Assessment result

6.1 Fishing alone

The MMO consider that there is a pathway for impact from bottom towed gear (demersal trawls and demersal seines) and in some instances, anchored net and line activities, and that the impacts alone are of significant risk to hinder the conservation objectives of the site.

6.2 In-combination

This section assumes that management for demersal trawls, demersal seines and anchored nets and lines will be introduced where there is a pathway for impact from fishing alone.

For features with no pathway for impact of anchored nets and lines, their pressures in combination with pressures from non-fishing activity has been assessed. The MMO conclude that where the use of anchored nets and lines are not of significant risk to hindering the conservation objectives when considered in isolation they are similarly not a significant risk to hindering the conservation objectives when considered in-combination.

7. Proposed management

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 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.

Option 4: Remove/avoid and reduce/limit pressures – zoned management for all demersal gears, with additional zoned management over the coral gardens and cold-water coral features for anchored nets and lines.

Options 1 and 4 would result in a significant risk of fishing hindering the conservation objectives of the MCZ. This is due to from fishing with gears that interact with the seabed not being compatible with the site's conservation objectives. This option would therefore not meet the MMO's duties under the Marine and Coastal Access Act 2009

Options 3 would remove the risk of fishing hindering the conservation objectives of the MCZ, but would introduce unnecessary financial costs to fishers using the site in ways which do not pose a risk to the conservation objectives.

Option 2 is therefore the most appropriate option to best further the conservation objectives of the site and remove the risk of fishing hindering the conservation objectives of the MCZ.

The proposed management area has been developed using best available evidence including advice from the 2017 JNCC/Cefas Canyons MPA monitoring survey and has been designed to incorporate raw feature data indicative of the features of the site. At the time of this assessment the monitoring report for this survey is in development and is yet to be formally published by JNCC.

Management to be introduced:

Therefore, the following management measure will be introduced:

- An MMO byelaw to prohibit use of all bottom-towed fishing gear and anchored nets and lines within a zoned area to protect the coral garden, cold-water coral reef and sea-pen and burrowing megafauna communities features.

Figure 14 includes a map showing the proposed management measures.

The Canyons MCZ lies within the South West Offshore Marine Plan[33] area. The Draft South West Offshore Marine Plan became a material consideration in January 2020. The decision in this assessment will be compliant and made in accordance with relevant draft policies. Consideration of policies will be detailed in the regulatory triage assessment which will accompany the proposed management.

8. Review of this assessment

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

Such information could include:

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

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

Monitoring of activity levels will occur through a combination of surface surveillance and ongoing monitoring of VMS and landings data. Should activity levels increase considerably or in a manner that could affect the site features, this will trigger further investigation into the level and distribution of the activity, including consultation with

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[33] https://www.gov.uk/government/publications/draft-south-west-marine-plan-documents

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

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

An overview of the monitoring and control process is illustrated in Annex 4.

9. Conclusion

MMO having had regard to best available evidence and through consultation with relevant advisors and the public, concludes that, provided that the management measures identified above are implemented, fishing activities at levels similar to the years analysed are compatible with the conservation objectives and general management approach of this marine protected area.

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Annex 1 - MMO methodology

The need for assessment

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

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

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

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

Assessment process

The fisheries assessments have three stages:

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

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

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

[35] Council Directive 92/43/EEC on the Conservation of natural habitats and of wild fauna and flora

[36] The MMO responsibilities in relation to management of MCZs are laid out in Sections 125 to 133 of the Marine and Coastal Access Act 2009

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

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

Sources of evidence

Evidence used in the assessments falls into two broad categories:

1. Fishing activity information. This includes patterns, intensity, and trends of fishing activities and types of gear used.

2. Ecological information, in particular the location, condition and sensitivity of designated features.

Fishing activity information

VMS data

VMS data are derived from positional information reported by UK and EU member state 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 EU member state vessels only gear types are assigned to the VMS data as individual vessel landings are not available.

Landings data

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

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

For vessels that do not require VMS (<12 m in length) or EU member state 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

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

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.

Vessel Sightings data

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

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

MMO and expert opinion on fishing activity

MMO marine officers provided information on fishing activity within MPAs. Information included number and size of vessels fishing, target species, type and amount of fishing gear used and seasonal trends in activity. Confidence levels were provided alongside expert opinion and estimates were provided where exact numbers were not known.

Fishing Industry Information

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

Ecological information

The fisheries assessments use the conservation advice packages produced by Natural England and the Joint Nature Conservation 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 and vulnerability

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

Sensitivity is defined as:

a measure of tolerance (or intolerance) to changes in environmental conditions.[39]

Vulnerability is defined as:

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

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

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

1. Pr-value background

1.1. Introduction

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

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

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

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

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

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

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

1.1.1. Fishing effort

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

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

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

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

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

1.1.2. Area of interest

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

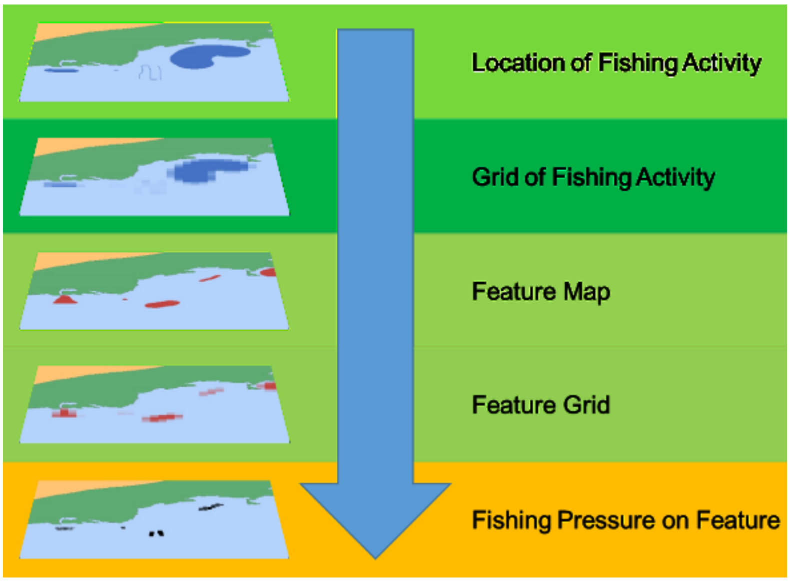
1.2. Developing the equation further

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

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

To incorporate clumping or non-uniform distribution of fishing effort a geospatial system was developed (Figure 1).

Figure1: 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 ($0.2025km^2$) 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 ($0.2025km^2$) 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 1.

Table 1: 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.
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:

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

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

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

This gives an estimate of the area (in m^2) impacted by gear from a single VMS report based on the different fishing gears (Table 2). 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 2: 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	0.207651
DRB	0.437237
OTB	0.098342
OT	0.098342
HMD	0.057756
TBN	0.2025
GNS	0.151265
GN	0.151265
GTR	0.151265
FPO	0.000004
SDN	0.003689

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 0.2025km^2 for each cell.
9. Total gear footprint is calculated by multiplying single VMS report gear footprint by the cell area (0.2025km^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 2hrs.

Current gear calculations are based on the following defaults:

Boat dredges (DRB):

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

Pots (FPO):

- Data taken from Annexes to: "Feasibility study on applying a spatial footprint approach to quantifying fishing pressure".
- Based on a pot 500cm by 700m and hauling 30 pots per day.

Gillnets/ Set Gillnets (GN/GNS):

- Based on a vessel shooting 10 tiers each 132m. Each tier has 2 anchors at 2 x 0.5m. Foot rope 3m wide drag. Info derived from seafish report on a workshop on the physical effects of fishing activities on Dogger Bank and Annexes to: Feasibility study on applying a spatial footprint approach to quantifying fishing pressure.
- 5.5 nets hauled per day. Info derived from seafish report on a workshop on the physical effects of fishing activities on Dogger Bank and MMO coastal.

Mechanised dredges (HMD):

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

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

- Based on a vessel with one 12m trawl with two 1.2m x 0.65m otter boards and with 60 % ground rope interaction. Information derived from seafish report on a workshop on the physical effects of fishing activities on Dogger Bank.
- Haul duration 4 hours, from an MMO officer.
- Haul speed 4 knots, from an MMO officer.

Otter twin trawls (OTT):

- Based on a vessel with two 12m trawls with two 1.2m x 0.65m otter boards and with 60 % ground rope interaction and 1 clump of 0.6m. Information derived from seafish report on a workshop on the physical effects of fishing activities on

Dogger Bank and Annexes to: Feasibility study on applying a spatial footprint approach to quantifying fishing pressure.
- Haul duration 4 hours, from an MMO officer.
- Haul speed 4 knots, from an MMO officer.

Beam trawls (TBB):

- Based on a vessel with two 12m trawls, four 720mm shoes and 2 tickler chains with 60% interaction with the sea bed. Information derived from seafish report on a workshop on the physical effects of fishing activities on Dogger Bank and Annexes to: Feasibility study on applying a spatial footprint approach to quantifying fishing pressure.
- Haul duration 4 hours. Information derived from seafish report on a workshop on the physical effects of fishing activities on Dogger Bank and MMO coastal.
- Haul speed 4 knots. Information derived from seafish report on a workshop on the physical effects of fishing activities on Dogger Bank and MMO coastal.

***Nephrops* trawls (TBN):**

- Based on a vessel with two 3.5m beam trawls, 4 x 0.2 feet and 60% ground rope interaction. Information derived from Annexes to: Feasibility study on applying a spatial footprint approach to quantifying fishing pressure.
- Haul duration 2 hours. Information derived from Annexes to: Feasibility study on applying a spatial footprint approach to quantifying fishing pressure.
- Haul speed 1.5 knots. Information derived from Annexes to: Feasibility study on applying a spatial footprint approach to quantifying fishing pressure.

3.2. VMS data assumptions

It has been assumed that:

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

3.3. MPA sites and designated features assumptions

It has been assumed that:

- The data used for the outline of the MPAs is accurate, although there may be very minor inaccuracies due to differences in projection.
- Designated features areas are up to date and complete.

3.4. Pr-value assumptions

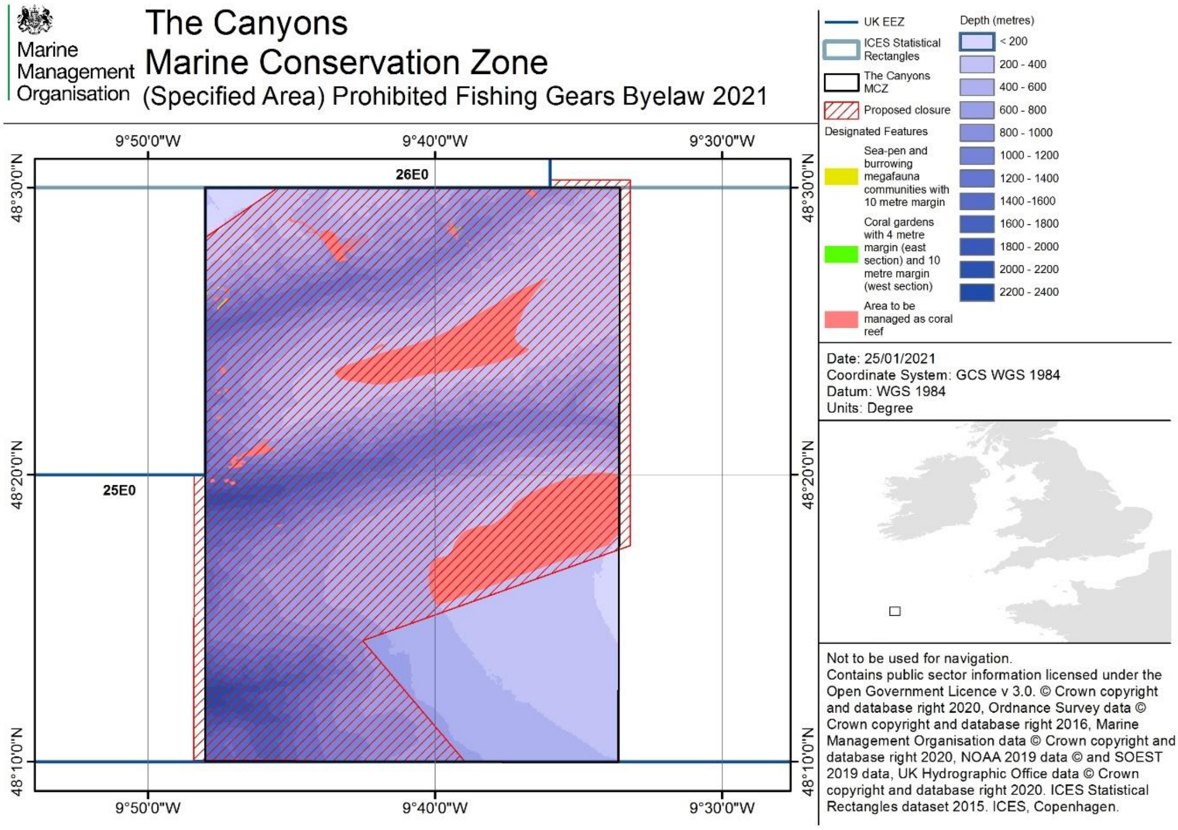
It has been assumed that:

- The model does not have false fishing VMS reports such as vessels moving between 0-6kts but not fishing.

- VMS reports from the same vessels which are less than 2 hours apart (7080 seconds to allow for a grace period) are duplicated and therefore are removed.
- All gear is included in the gear calculators to be used in the model. Gear not included in the gear calculators are removed.

Annex 3 – Proposed management measures

Figure 15: Proposed management options for The Canyons MCZ



Annex 4 - Monitoring and Control Process

Figure 16: Monitoring and control process