Marine Management Organisation

MMO Stage 3 Site Assessment: Fulmar MPA (DRAFT)






...ambitious for our seas and coasts

Title: MMO Stage 3 Site Assessment: Fulmar MPA (DRAFT)
Contents

Executive summary

This assessment analyses the impact of anchored nets and lines, bottom towed gear and traps on the designated features subtidal sand, subtidal mud, subtidal mixed sediments, and ocean quahog (*Arctica islandica*) in Fulmar Marine Protected Area (MPA) to determine whether a significant risk of hindering the conservation objectives of the site can be excluded. The assessment sets out the evidence considered and analyses the quality of that evidence. **The assessment finds that fishing activities by bottom towed gear occurring in the site pose a significant risk of hindering the achievement of the conservation objectives of Fulmar MPA. As such the Marine Management Organisation (MMO) concludes that management measures are required.**

1 Introduction

This assessment considers whether fishing activities are compatible with the conservation objectives of Fulmar MPA.

This site is designated as a marine conservation zone (MCZ). This assessment uses the best available evidence to review site characteristics and fishing activity and determine if there is a significant risk of fishing activities hindering the conservation objectives of the site. If so, MMO will develop and introduce suitable management measures, such as MMO byelaws. If MMO byelaws are required, then these will be subject to public consultation and will require confirmation from the Secretary of State to come into effect.

2 Site information

2.1 Overview

The following Joint Nature Conservation Committee (JNCC) site information and Department for Environment Food and Rural Affairs (Defra) factsheet were used for background on site geography, designations, features, conservation objectives and general management approaches:

- JNCC Site JNCC Site Information - Fulmar MCZ[1]; and
- Defra Factsheet - Fulmar MCZ[2].

Fulmar MPA is situated in the North Sea approximately 224 km offshore of the Northumberland coast. It ranges from a depth of 50 to 100 m and covers an area of 2,437 km^2 (**Figure 1**).

Fulmar MPA was designated as an MCZ in 2016. Its habitats are important resources for marine animals, providing food, spawning areas and shelter. The designated features, subtidal mud, sand and mixed sediments, are home to species including burrowing anemones, brittlestars, slender sea-pens, venus clams, bivalves, worms, starfish, urchins, sea firs, sea mats, sea cucumbers, sea potatoes and ocean quahogs. The designated feature, Ocean quahog, a long-lived bivalve species (over 500 years) with a very slow growth rate taking up to 50 years to reach market size, are a feature of conservation importance and are included on the OSPAR list of threatened and/or declining species and habitats. They reach sexual maturity between five and seven years depending on locality and growth rate. Numbers in the North Sea have declined in relation to human impact to the seabed. These species provide important food sources for commercial fish species including flat fish and sand eels. The designated features and general management approaches are set out in **Table 1**.

[1] JNCC site information – Fulmar MCZ: jncc.gov.uk/our-work/fulmar (Last accessed 15 November 2023)

[2] Defra factsheet – Fulmar MCZ: www.gov.uk/government/publications/marine-conservation-zones-fulmar (Last accessed 15 November 2023)

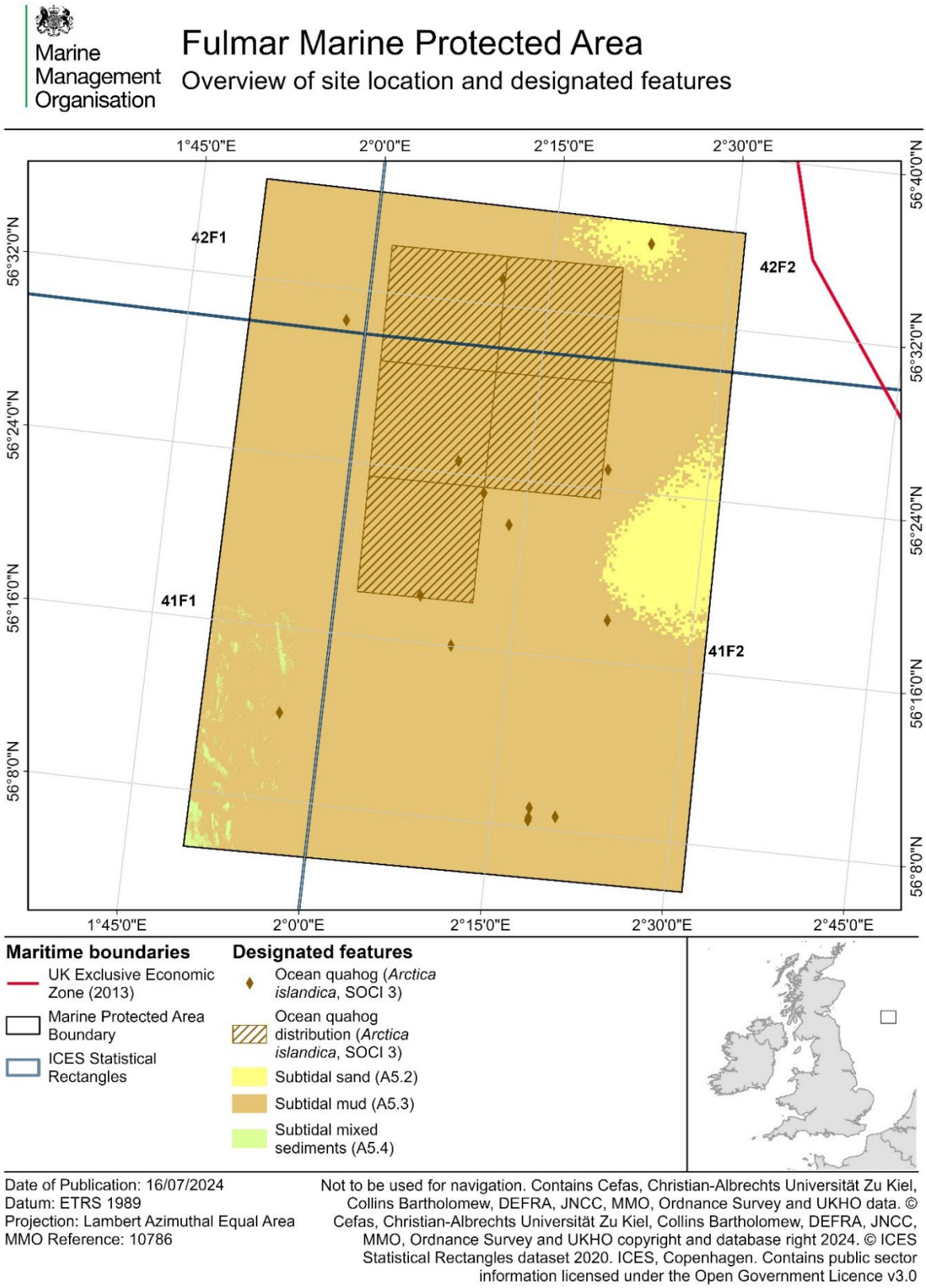

Figure 1: Fulmar MPA location overview.

Table 1: Designated features and general management approaches.

Designated feature	General management approach
Subtidal sand	Maintain in favourable condition.
Subtidal mud	
Subtidal mixed sediments	
Ocean quahog (*Arctica islandica*)	

There is no feature condition assessment available for this site; in its absence a vulnerability assessment, which includes sensitivity and exposure information for features and activities in a site, is used as a proxy for condition. More information on this can be found in JNCC's conservation advice statement for Fulmar[3].

2.2 Scope of this assessment

The scope of this assessment covers fishing activities alone, and relevant activities in combination with fishing. The assessment covers the whole of Fulmar MPA (**Figure 1**).

[3] JNCC conservation advice – Fulmar MCZ: hub.jncc.gov.uk/assets/1fb8f79b-6bc8-4627-ad62-6cbd7666070d (Last accessed 15 November 2023)

3 Part A - Identified pressures on the MPA

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 of the Marine and Coastal Access Act 2009[4].

Part A assesses the interactions between pressures from fishing gears and the designated features of this site, screening for interactions that require further consideration. Assessment of interactions not screened out in Part A will form Part B Part B - Fishing activity assessmentof the assessment. For each activity assessed in Part A, there are two possible outcomes for each identified pressure-feature interaction:

1. The pressure-feature interactions **are not** included for assessment in Part B and screened out:
    a. if the feature is not exposed to the pressure, and is not likely to be in the future;
    b. the pressure is not capable of affecting the feature, other than insignificantly; or
    c. if MMO has information that the activity or pressure is not occurring in the site and/or does not need to be considered further.

2. The pressure-feature interactions **are** included for assessment in Part B:
    a. if the feature is exposed to the pressure, or is likely to be in the future;
    b. the pressure is capable of affecting the feature, other than insignificantly;
    c. if it is not possible to determine whether the pressure is capable of affecting the feature, other than insignificantly; or
    d. if MMO has information that the activity or pressure is occurring in the site and/or does need to be considered further.

Consideration of a pressure on a protected feature in an MPA includes consideration of the pressure's exposure to, or effect on, any ecological or geomorphological process on which the conservation of the protected feature is wholly or in part dependent.

3.1 Activities taking place

Table 2 lists all commercial fishing gears included for assessment. All other gears have been screened out of further assessment as they do not take place and are not likely to take place in the future, as there are no vessel monitoring system (VMS) records present within the site linked to these gear codes, nor do they appear in landings data for International Council for the Exploration of the Sea (ICES) statistical rectangles that overlap the site.

[4] For more information: www.legislation.gov.uk/ukpga/2009/23/section/126.

To determine fishing activity occurring within the site, the following evidence sources were used:

- VMS data;
- fisheries landings data (logbooks and sales records);
- ICES rectangle level fishing effort data in days (reference: MMO1264); and
- swept area ratio (SAR) data.

For more information about the above evidence sources, please see the MPA Site Assessment Methodology document[5], which describes each type of fishing activity evidence and summarises the strengths and limitations of each source.

Table 2: Fishing activities covered by this assessment present in VMS and landings data for Fulmar MPA, 2016 to 2021.

Gear Type	Gear name	Gear code	Justification
Bottom towed Gear	Beam trawl	TBB	Present in VMS data.
	Nephrops trawl	TBN	
	Scottish / fly seine	SSC	
	Twin bottom otter trawl	OTT	
	Bottom otter trawl	OTB	Present in VMS records and under 12 m vessel landings data for ICES statistical rectangles that overlap the site.
Midwater gear	Midwater otter trawl	OTM	Present in VMS data.
Miscellaneous	Not known	NK	

3.2 Pressures and activities screened out

This section identifies activities or pressures that are **occurring but do not need to be considered** for Fulmar MPA.

The gear types and pressures screened out on this basis are listed below with justification:

- **Midwater gears:** although the use of midwater gears does occur within Fulmar MPA, there is no feasible pathway for gears of this type to interact with benthic designated features under normal operation. These gears are not designed to operate on or near the seabed and are deployed entirely within

[5] MPA Site Assessment Methodology document: www.gov.uk/government/publications/stage-3-site-assessments (Last accessed 13 August 2024).

the water column. Therefore, the use of midwater gear within Fulmar MPA is not considered to be capable of affecting the designated features other than insignificantly and is not considered further within this assessment.

- **Unknown gear:** ‘other gear’ or 'miscellaneous gear' has been declared as having been used to land fish from this ICES statistical rectangle. The gear code used to report these landings does not provide any further information relating to the fishing method used. It is therefore not possible to assess the likelihood of this fishing method interacting with the seabed and it is not considered further within this assessment.

3.3 Pressures to be taken forward to Part B

The Stage 3 Fishing Gear MPA Impacts Evidence documents detail all pressures created by fishing activity on features of interest. The documents justify which pressures should be taken forward for consideration for each feature. This is documented in Table A1.2 in each of the Impacts Evidence documents:

- Stage 3 Fishing Gear MPA Impacts Evidence Anchored Nets and Lines[6];
- Stage 3 Fishing Gear MPA Impacts Evidence Bottom Towed Gear[7]; and
- Stage 3 Fishing Gear MPA Impacts Evidence Traps[8].

To determine whether a pressure should be taken forward for this particular site, **Table 3** uses the information from the Impacts Evidence documents, alongside site level information, including sensitivity assessments, risk profiling of pressures from conservation advice packages, and JNCC advice to assess the sensitivities of pressures on the designated features of the site.

Table 3 details the pressures for each gear type - anchored nets and lines (A), bottom towed gear (B) and traps (T) - to be assessed in Part B, taking into account the pressures screened out in **section 3.2.** While only bottom towed gear usage was recorded in the site during the period under consideration, potential impacts of anchored nets and lines and traps on the designated features are included here as a precautionary measure.

---

[6] Stage 3 Fishing Gear MPA Impacts Evidence Anchored Nets and Lines www.gov.uk/government/publications/marine-protected-areas-stage-3-impacts-evidence (Last accessed 13 August 2024)

[7] Stage 3 Fishing Gear MPA Impacts Evidence Bottom Towed Gears www.gov.uk/government/publications/marine-protected-areas-stage-3-impacts-evidence (Last accessed 13 August 2024)

[8] Stage 3 Fishing Gear MPA Impacts Evidence Traps www.gov.uk/government/publications/marine-protected-areas-stage-3-impacts-evidence (Last accessed 13 August 2024)

Key	
	Dark blue highlighting indicates that the feature is sensitive to this pressure from the gear type in this site, and that the interaction should be taken forward for consideration.
	Light blue highlighting indicates that feature is sensitive to the pressure in general, but the gear type is unlikely to exert this pressure to an extent where impacts are of concern in the site.
	Grey highlighting indicates that there is insufficient evidence to make sensitivity conclusions, or that a sensitivity assessment has not been made for this feature to this pressure from the gear type.
	If there is no highlighting within a cell, this indicates that the pressure from the gear type is not relevant to the feature, or that the feature is not sensitive to the pressure.

Table 3: Summary of pressures on designated features of Fulmar MPA to be taken forward to Part B.

Pressures	Designated features											
	Subtidal sand			Subtidal mud			Subtidal mixed sediments			Ocean quahog		
	A	B	T	A	B	T	A	B	T	A	B	T
Abrasion or disturbance of the substrate on the surface of the seabed												
Changes in suspended solids (water clarity)												
Hydrocarbon and polycyclic aromatic hydrocarbon (PAH) contamination												
Introduction of microbial pathogens												
Introduction or spread of invasive non-indigenous species												
Litter												
Organic enrichment												
Penetration and/or disturbance of the substrate below the surface of the seabed, including abrasion												
Physical change (to another seabed type)												
Removal of non-target species												
Removal of target species												
Siltation rate changes (low) including smothering (depth of vertical sediment overburden)												
Synthetic compound contamination												
Transition elements and organo-metal contamination												

4 Part B - Fishing activity assessment

Part B of this assessment was carried out in a manner that is consistent with the 'significant risk of hindering the achievement of the conservation objectives' test required by section 126 of the Marine and Coastal Access Act 2009[4].

Table 3 shows the fishing activities and pressures identified in Part A which have been included for assessment in Part B. The most relevant attributes of the designated features that could be compromised by fishing pressures were identified using the Fulmar MPA conservation advice package[3] and are shown in **Table 4**.

Table 4: Relevant favourable condition targets for identified pressures. (* = for subtidal mud, sand, and mixed sediments only).

Feature	Attribute	Target	Relevant pressures
Subtidal mud Subtidal sand Subtidal mixed sediments Ocean quahog	Extent and distribution Structure and function Supporting processes	Maintain	Relevant to: Abrasion or disturbance of the substrate on the surface of the seabed. Penetration and/or disturbance of the substrate below the surface of the seabed, including abrasion. Removal of non-target species. Changes in suspended solids (water clarity). * Siltation rate changes (low) including smothering (depth of vertical sediment overburden). *

4.1 Fisheries access and existing management

Non-UK vessels can operate within Fulmar MPA, provided that they have a licence issued by the UK to do so. Nationalities which fished within the MPA from 2016 to 2021 include Belgium, German, Danish, French, Irish, Dutch, Norwegian, Portuguese, Swedish, and UK vessels. VMS records indicate that UK and Dutch vessels were most prevalent.

More information on non-UK vessel access to UK waters can be found on MMO's Single Issuing Authority page[9].

[9] The UK Single Issuing Authority: www.gov.uk/guidance/united-kingdom-single-issuing-authority-uksia (Last accessed on: 26 July 2023).

4.2 Fishing activity summary

Table A1. 1 to **Table A1. 6** in **Annex 1** display a detailed breakdown of fishing activity within Fulmar MPA. VMS and landings data show that there was very limited fishing activity at this site during the period under consideration, with some demersal trawling and extremely limited demersal seining. Of the fishing activities not screened out in Part A of this assessment, the most prevalent gears operating within the site were demersal trawls, averaging 34 VMS records per year between 2016 and 2021. The only other gear type in use were demersal seines, with an average of one VMS record per year.

Annual landings for over 12 m vessels mirror this pattern, with demersal trawls landing 9.21 tonnes (t) per year on average, in comparison to 0.08 t for demersal seines. For under 12 m vessels, only demersal trawl activity was evident from the data, with average landings of 0.01 t per year. VMS data indicate that demersal trawl activity was scattered throughout the site but was more intense on the eastern third and highest outside of the site on the east and west sides. Demersal seines were active along the site's eastern edge.

Surface SAR values for C-squares intersecting Fulmar MPA for demersal trawls ranged between 0.02 and 0.22 for the period between 2016 and 2020, whilst subsurface values were between 0.01 and 0. Surface SAR values for demersal seines ranged between 0.001 and 0 whilst subsurface values were 0. An SAR value of 1 means that each area C-square experiences a pass of fishing gear on average once a year. At the highest annual SAR value of 0.17 for all bottom towed gear combined means that at this current level of activity, there would be less than one pass of fishing gear per five years over a C-square.

There are no records of anchored nets and lines and traps in the MPA from VMS and ICES rectangle data.

4.3 Pressures by gear type

The Stage 3 Fishing Gear MPA Impacts Evidence documents for anchored nets and lines[6], bottom towed gear[7] and traps[8] collate and analyse the best available evidence on the impacts of different fishing gears on MPA features. This section summarises the analyses and conclusions of those documents, and considers these alongside site level information, including the nature and condition of the habitats and species present, the general management approaches for designated features, intensity of fishing activity taking place and exposure to natural disturbance.

In the context of MPA assessment, the pressures removal of target and non-target species refer to any damage, loss, or removal of species defined as a designated feature, or integral to the integrity of a designated feature (for example key structural or influential species). This may occur through intentional or unintentional catch associated with the act of commercial fishing.

Impacts from target and/or non-target removal pressures have been scoped out from this assessment in most cases, as the detail of key structural and influential species is yet to be fully defined and they are assessed more completely within the abrasion and penetration pressures. These pressures may require consideration as a result of any future evidence review, in conjunction with updated conservation advice from JNCC. Where separate consideration of these pressures is required, this has been stated but generally includes the following:

MPAs with certain designated species features or designated features that may contain key commercially targeted species have been highlighted as requiring separate consideration of the removal pressures. This includes MPAs with an active Nephrops fishery, where the habitat sea-pen and burrowing megafauna communities is a designated feature, or where fan mussels, ocean quahog, spiny lobster and pink sea fan are a designated species feature.

The designated feature in this site, ocean quahog, may be sensitive to removal of non-target species pressures. However, ocean quahog is not considered sensitive to removal pressures via static gear types, as removal of bivalves is highly unlikely through the use of static gear. As such, this feature is more fully assessed within the abrasion and penetration pressures.

There is limited survey information available for this site so available information has been used about what biotopes corresponding to the site's features exist in the Northern North Sea (sub-region 1a). Fulmar MPA's location in terms of sub-region was taken from evidence from 'Assigning the EUNIS classifications to UK's Offshore Regional Seas 2020' (Tillin *et al.*, 2020). Information about the biotopes in the site was extracted from the Biotope Presence-Absence spreadsheet of JNCC Report No.647, which lists those European Nature Information System (EUNIS) biotopes that were present, likely to be present ('possible'), or absent from each UK offshore sub-region based on survey data, environmental information, species records, literature and expert judgement (Tillin *et al.*, 2020). The benchmark for 'heavy' smothering is up to 30 cm of fine material deposited on the seabed from a single activity (up to 5 cm is characterised as light smothering).

Using this information biotopes were screened out if:

- they were not located in the same bioregion as Fulmar MPA;
- if they were only found in the inshore area; and
- if they were not sensitive or had low sensitivity to the relevant pressures in **Table 4**.

The resulting screened in biotopes are listed in **Table 5.**

Table 5: Biotopes in Northern North Sea sub-region 1a to be considered. (* indicates biotopes that are identified as 'possible').

Feature	Biotope name	Sensitivity
Subtidal sand	*Acrocnida brachiata* with *Astropecten irregularis* and other echinoderms in circalittoral muddy sand* (De-Bastos, Lloyd and Watson, 2023)	Abrasion, penetration; medium
	Owenia fusiformis and *Amphiura filiformis* in deep circalittoral sand or muddy sand* (De-Bastos, 2023)	
	Maldanid polychaetes and *Eudorellopsis deformis* in deep circalittoral sand or muddy sand* (Ashley, 2016)	
Subtidal mud	*Foraminiferans* and *Thyasira spp*. in deep circalittoral fine mud* (Tillin and Riley, 2016)	Smothering; medium
	Thyasira spp. and *Nuculoma tenuis* in circalittoral sandy mud (De-Bastos and Watson, 2023b)	Abrasion, penetration; medium
	Amphiura filiformis and *Nuculoma tenuis* in circalittoral and offshore muddy sand* (De-Bastos and Watson, 2023a)	
	Brissopsis lyrifera and *Amphiura chiajei* in circalittoral mud (De-Bastos and Budd, 2016)	
	Ampharete falcata turf with *Parvicardium ovale* on cohesive muddy sediment near margins of deep stratified seas* (De-Bastos and Hill, 2016)	
	Levinsenia gracilis and *Heteromastus filifirmis* in offshore circalittoral mud and sandy mud* (De-Bastos, 2016a)	
	Paramphinome jeffreysii, *Thyasira spp*. and *Amphiura filiformis* in offshore circalittoral sandy mud* (De-Bastos, 2016c)	
	Myrtea spinifera and polychaetes in offshore circalittoral sandy mud* (De-Bastos, 2016b)	
	Virgularia mirabilis and *Ophiura spp.* with *Pecten maximus* on circalittoral sandy or shelly mud (Hill *et al.*, 2024b)	Abrasion, change in suspended solids, smothering; medium Penetration; high.
	Virgularia mirabilis and *Ophiura spp*. with *Pecten maximus*, hydroids and ascidians on circalittoral sandy or shelly mud with shells or stones* (Hill *et al.*, 2024a)	

Feature	Biotope name	Sensitivity
	Seapens and burrowing megafauna in circalittoral fine mud (Hill *et al.*, 2023)	Abrasion; medium Penetration; high
	Burrowing megafauna and *Maxmuelleria lankesteri* in circalittoral mud* (Durkin and Tyler-Walters, 2022)	
	Seapens, including *Funiculina quadrangularis*, and burrowing megafauna in undisturbed circalittoral fine mud* (Tyler-Walters and Watson, 2023)	Abrasion, penetration; high
Subtidal mixed sediments	*Cerianthus lloydii* and other burrowing anemones in circalittoral muddy mixed sediment (Perry and Watson, 2024)	Abrasion, penetration, smothering; medium
	Cerianthus lloydii with *Nemertesia spp.* and other hydroids in circalittoral muddy mixed sediment* (Perry and Watson, 2023)	
	Ophiothrix fragilis and/or *Ophiocomina nigra* brittlestar beds on sublittoral mixed sediment* (De-Bastos *et al.*, 2023)	
	Flustra foliacea and *Hydrallmania falcata* on tide-swept circalittoral mixed sediment* (Readman and Watson, 2024)	Abrasion, penetration; medium

4.3.1 Anchored nets and lines

The relevant pressures on ocean quahog and subtidal sediment features of Fulmar MPA from anchored nets and lines were identified in **Table 4** and are:

- abrasion or disturbance of the substrate on the surface of the seabed$^{\Delta}$;
- penetration and/or disturbance of the substrate below the surface of the seabed, including abrasion$^{\Delta}$;
- removal of non-target species (for sediment features only);

As noted previously, impacts from the non-target removal pressure have been scoped out of this assessment, as it is assessed more completely within the abrasion and penetration pressures. Pressures marked with matching superscript symbols (Δ) have been consolidated due to the similar nature of their impacts on the sediment features.

Impacts on sediment features relating to abrasion or disturbance of the substrate on the surface of the seabed occur primarily from the footrope and anchors during the hauling of gear, and during movement along the seabed due to tides, currents or storms. As set out in section 9.3 of the anchored nets and lines Impacts Evidence document[6], abrasion impacts from this gear type are unlikely to negatively impact the extent or distribution of any sediment feature, or structure and function of the

ecosystem in a significant manner due to the static nature of the gear type and small spatial footprint. Subtidal sediment habitats being considered as being resilient to all but intense fishing activity using anchored nets and lines, on species rich sediment habitats, or those with long-lived bivalves (such as ocean quahog). There is therefore some potential for damage to the biological communities present in intensively fished areas. Abrasion impacts are considered likely to be greatest on subtidal mixed sediments compared to subtidal sand as the coarser habitats often contain populations of more sensitive sessile epifauna.

Table 5 lists those biotopes which may exist in Fulmar MPA. Out of 21 possible biotopes three of the biotopes for subtidal sand have a medium sensitivity to abrasion and penetration pressures and two a medium sensitivity to removal of non-target species. For subtidal mud 11 biotopes have a medium sensitivity to abrasion, 10 to abrasion and removal of non-target species, seven to penetration, three to smothering and two to change in suspended solids. There are also four biotopes in subtidal mud that have a high sensitivity to penetration and one particularly sensitive biotope, 'seapens including *Funiculina quadrangularis*, and burrowing megafauna in undisturbed circalittoral fine mud', that has high sensitivity to abrasion, penetration, and removal of non-target species. With regards to subtidal mixed sediments, there were five biotopes that were medium sensitivity to abrasion, penetration, and removal of non-target species and one that was medium sensitivity to removal of non-target species pressure only.

Sea-pens, although able to retract into their burrows and bend in some instances, are fixed and unable to move from potential disturbance episodes. Research detailing the impacts of abrasion from anchored nets and lines on subtidal mud habitats considered three species of sea-pens and noted that species which cannot retract into the sediment and/or are more rigid are likely to be less tolerant to disturbance caused by potting but no lasting effects on the substrate were observed during the study. Similarly, even if uprooted, some sea-pens are able to reinsert themselves into the sediment. While these studies considered the impact of traps, the ability of sea-pens to flex under weight, reinsert following uprooting and retract into the sediment, will similarly aid in their resilience to demersal nets, lines, and their associated anchors. The potential for impact will be dependent on the intensity of fishing activity taking place with increasing activity increasing the likelihood of weights and ropes associated with nets and lines damaging, entangling, or removing epifaunal species. Using the evidence regarding traps as a proxy, suggests that anchored nets and lines are unlikely to significantly impact sea-pen and burrowing megafauna communities associated with the site.

There is a lack of literature describing the impacts of anchored nets and lines on ocean quahog. Although these gear types can cause some abrasion of the seabed, given the hard shell of ocean quahog and limited seabed contacts of these gears, they are unlikely to significantly impact the species. The literature suggests that

static gear for subtidal sediments are only a major concern if long-lived bivalves such as ocean quahog are present in association with high levels of fishing intensity. High densities have been defined as 9 pairs of anchors per area of 2.5 nautical miles (nm) by 2.5 nm. As described in **section 4.3**, there is no activity from anchored nets and lines in Fulmar MPA. The risk of pressures is therefore zero due to the absence of activity from anchored nets and lines. However, the gear type if present in the future is unlikely to create heavy disturbance over an extensive range. Due to the static nature of the gear and as such small footprint and limited seabed contact, impacts on benthic communities are relatively low and hence the resilience of the community should be maintained.

Therefore, with regards to the discussion above, **MMO concludes that, at the levels described, impacts from the use of anchored nets and lines does not pose a significant risk of hindering the achievement of the conservation objectives of Fulmar MPA.**

4.3.2 Bottom towed gear

Subtidal sediment features:

The relevant pressures on subtidal sediment features of Fulmar MPA from bottom towed gear were identified in **Table 4** and are:

- abrasion or disturbance of the substrate on the surface of the seabed$^{\Delta}$;
- penetration and/or disturbance of the substrate below the surface of the seabed, including abrasion$^{\Delta}$;
- removal of non-target species;
- siltation rate changes (low) including smothering (depth of vertical sediment overburden)* (for sediment features only); and
- changes in suspended solids (water clarity)* (for sediment features only).

As noted previously, impacts from the non-target removal pressure have been scoped out of this assessment, as it is assessed more completely within the abrasion and penetration pressures. Pressures marked with matching superscript symbols (Δ and *) have been consolidated due to the similar nature of their impacts on the sediment features.

As outlined in section 8.5 of the Impacts Evidence document bottom towed gear[7], the abrasion and penetration pressures caused by bottom towed gears have both biological and physical impacts to sediment features, varying based on levels of activity and fishing intensity. Physical impacts range from the creation of furrows and berms in the sediment, to the flattening of bottom features such as ripples and the homogenisation of sediments. Biological impacts include damage and mortality to flora and fauna on the seabed via surface and subsurface abrasion and penetration,

as well as long term shifts in biological communities towards smaller, short-lived, opportunistic species that exhibit greater resilience to anthropogenic activity.

Smothering, siltation rate and suspended solid changes occur when bottom towed gear connect with the seabed, causing the top layer of the sediment to mix with the surrounding water. This can affect the ability of some organisms to feed or breathe. The subsequent settling rate of different sediment types, and entrainment in prevailing currents, can result in a change in the structure and function of the feature in finer scale topography, sediment quality and sediment composition. The degree of impact will vary according to the amount of fishing activity, the gear used and the sediment type. Sediments and faunal communities react differently to these pressures depending on grain size, the degree of sediment impaction and frequency or severity of the pressure upon them.

Table 5 lists those biotopes which may exist in Fulmar MPA. Out of 21 possible biotopes three of the biotopes for subtidal sand have a medium sensitivity to abrasion and penetration pressures and two a medium sensitivity to removal of non-target species. For subtidal mud 11 biotopes have a medium sensitivity to abrasion, 10 to abrasion and removal of non-target species, seven to penetration, three to smothering and two to change in suspended solids. There are also four biotopes in subtidal mud that have a high sensitivity to penetration and one particularly sensitive biotope, 'seapens including *Funiculina quadrangularis*, and burrowing megafauna in undisturbed circalittoral fine mud', that has high sensitivity to abrasion, penetration, and removal of non-target species. With regards to subtidal mixed sediments, there were five biotope that were medium sensitivity to abrasion, penetration, and removal of non-target species and one that was medium sensitivity to removal of non-target species pressure only.

Ocean quahog:

The relevant pressures on the ocean quahog feature of Fulmar MPA from bottom towed gear were identified in **Table 4** and are:

- abrasion or disturbance of the substrate on the surface of the seabed[Δ];
- penetration and/or disturbance of the substrate below the surface of the seabed, including abrasion[Δ];
- removal of non-target species.

Ocean quahog are a species of conservation importance and an OSPAR threatened and/or declining species which are found in higher densities within finer sediments but can also be found in coarser sediments at smaller densities. As a burrowing species, ocean quahog are highly sensitive to physical habitat loss, and as such, extent and distribution of supporting habitats are important in maintaining the extent and distribution of the species. Living within the top 14 cm of sediment, ocean quahog can be damaged by the passing of bottom towed gear, which may result in

mortality and removal of a large proportion of the population and can be impacted when excavated from burrows by indirect increased mortality via predation. Section 6.3 of the bottom towed gear Impacts Evidence document[7] identifies and explains fully the potential impacts caused by penetration and abrasion and how these differ between the different bottom towed gears. Ocean quahog are highly sensitive to pressures caused by bottom otter, twin otter and beam trawls, the most used types of bottom towed gear in Fulmar MPA. Gear types using tickler chains cause a higher mortality than those without. Ocean quahog caught in beam and otter trawls have a 90 % mortality rate, the highest of all invertebrate species. Larger ocean quahog are more vulnerable to damage by bottom towed gear, as the ratio of shell thickness to shell size decreases with age, making them more fragile. However, juveniles are also vulnerable to damage by bottom towed gear as they live at shallower depths and are more likely to encounter and be damaged by the gear. Ocean quahog populations in the North Sea are often highly skewed, containing either adults or juveniles as opposed to representatives of both age class. This is likely due to direct mortality through bottom towed gear.

Conclusion:

As described in **section 4.3**, though levels of fishing activity are higher just outside of the site, there is ongoing activity within the MPA primarily bottom towed gear, especially bottom otter trawling. JNCC's supplementary advice on the conservation objectives of Fulmar MPA[3] states that subtidal mud extends across most of the site, subtidal sand forms large patches to the north-east and east of the site, subtidal mixed sediments are located in the centre and to the south west of the site, and the whole site is suitable for Ocean Quahog with survey data suggesting distribution throughout Fulmar MPA but in higher densities to the north. Therefore, the fishing activity outlined in **section 4.3** from demersal trawling across the site and demersal seining on the eastern boundary of the site overlap all the designated features.

Additionally, the first pass of fishing gear over the features causes the most damage (Hiddink *et al.*, 2006) so any interaction at all may be of concern, particularly with biotopes present that have a medium to high sensitivity to pressures created by bottom towed gear, as listed in **Table 5**. Concerns over the gear-feature impact pathway are heightened by the issues of changing fishing patterns over time in response to changes in target species and/or changes in the spatial distribution of target species in response to climate change and fisheries displacement, and competition with other activities and conservation measures for space.

Therefore, with regards to the discussion above, evidence available on the sensitivity of the features to bottom towed gear, particularly in relation to the potential presence of highly sensitive biotopes in subtidal mud, and the low resistance and slow recoverability of Ocean Quahog, **MMO concludes that, at the activity levels described, impacts from the use of bottom towed gear, in particular demersal**

trawling, poses a significant risk of hindering the achievement of the conservation objectives of Fulmar MPA.

4.3.3 Traps

The relevant pressures on Ocean Quahog and subtidal sediment features of Fulmar MPA from traps were identified in **Table 4** and are:

- abrasion or disturbance of the substrate on the surface of the seabed$^{\Delta}$;
- penetration and/or disturbance of the substrate below the surface of the seabed, including abrasion$^{\Delta}$;
- removal of non-target species (for sediment features only);

As noted previously, impacts from target removal pressures have been scoped out of this assessment, as it is assessed more completely within the abrasion and penetration pressures. Removal of non-target species has been considered however due to the presence of three biotopes within subtidal sand with a medium sensitivity to removal of non-target species but low sensitivity to abrasion, penetration, change in suspended solids, and siltation pressures. Pressures marked with matching superscript symbols (Δ) have been consolidated due to the similar nature of their impacts on the sediment features.

Table 5 lists those biotopes which may exist in Fulmar MPA. Out of 21 possible biotopes three of the biotopes for subtidal sand have a medium sensitivity to abrasion and penetration pressures and two a medium sensitivity to removal of non-target species. For subtidal mud 11 biotopes have a medium sensitivity to abrasion, 10 to abrasion and removal of non-target species, seven to penetration, three to smothering and two to change in suspended solids. There are also four biotopes in subtidal mud that have a high sensitivity to penetration and one particularly sensitive biotope, 'seapens including *Funiculina quadrangularis*, and burrowing megafauna in undisturbed circalittoral fine mud', that has high sensitivity to abrasion, penetration, and removal of non-target species. With regards to subtidal mixed sediments, there were five biotope that were medium sensitivity to abrasion, penetration, and removal of non-target species and one that was medium sensitivity to removal of non-target species pressure only.

As outlined in the Impacts Evidence documents, traps, and associated lines and anchors, may cause abrasion of subtidal sediments during setting and retrieval of gear, as well as from movement of set gear on the seabed as a result of storms, tides or currents. There is little primary evidence on the physical impact of traps on subtidal sediments, however the evidence that is available indicates that traps are not likely to be a concern unless used at particularly high levels of intensity, or if particularly sensitive species are present. As described in **section 4.3**, there is no activity from traps in Fulmar MPA.

Traps and anchored nets and lines fishing gear exert similar pressures on the ocean quahog feature, therefore the narrative in the anchored nets and lines section also applies here for the traps section. As outlined in section 6 of the traps Impacts Evidence document, there is a lack of literature describing the sensitivity of the species to impacts associated with the use of traps. Moreover, the use of traps can cause some abrasion of the seabed but given the hard shell of ocean quahog and limited seabed contact of these gears, they are unlikely to significantly impact the species. Additionally, traps are not known to target ocean quahog in UK waters and there is no evidence of individuals being caught as bycatch by traps.

Therefore, with regards to the discussion above, evidence available on the sensitivity of the features to traps, and lack trap activity, **MMO concludes that, at the activity levels described, impacts from the use of traps, does not pose a significant risk of hindering the achievement of the conservation objectives of Fulmar MPA.**

4.4 Part B conclusion

The assessment of anchored nets and lines, and traps on subtidal sand, subtidal mud, subtidal mixed sediments, and Ocean Quahog features of Fulmar MPA has concluded that the ongoing use of bottom towed gear will not result in a significant risk of hindering the achievement of the conservation objectives of the MPA. Management measures will therefore not be implemented anchored nets and lines, and traps for Fulmar MPA.

The assessment of bottom towed gear on subtidal sand, subtidal mud, subtidal mixed sediments, and Ocean Quahog features of Fulmar MPA has concluded that the ongoing use of bottom towed gear will result in a significant risk of hindering the achievement of the conservation objectives of the MPA. Management measures will therefore be implemented for bottom towed gear for Fulmar MPA.

Section 6 contains further details of these measures.

5 Part C - In-combination assessment

This section assesses the impacts of fishing activities in-combination with relevant activities taking place. This includes the following:

- fishing interactions assessed in Part B but which were not considered, alone, to pose a significant risk of hindering the achievement of the conservation objectives; and
- other activities: such as marine development infrastructure plans and projects that occur in the MPA.

ArcGIS software has been used to check relevant activities that occur within, or adjacent to, the assessed site where there could be a pathway for impact. To determine relevant activities to be included in this part of the assessment, a distance of 5 km was selected as suitable to capture any potential source receptor pathways that could impact the site in-combination with effects of the fishing activities assessed. A 5 km buffer was therefore applied to the site boundary to identify relevant activities. This assessment considers the in-combination impacts of marine licensable activities that are ongoing or upcoming, and with medium to high-risk pressure impact pathways as permitted fishing activity. As the models were run using ArcGIS in August 2023, any licences that ended before this date were screened out of the assessment.

The North Sea Transition Authority (NSTA) is responsible for regulating the oil, gas and carbon storage industries, and as such these activities fall outside of MMO's marine licensing remit. Oil, gas and carbon storage industry activities are not currently considered in this draft assessment, as information on the potential pressures exerted by associated activities is currently under review, and the likelihood of these activities resulting in an in-combination [adverse effect on site integrity (SACs) / significant risk of hindering the achievement of the site's conservation objectives (MCZs)] with fishing is expected to be very low. Following formal consultation, relevant oil, gas and carbon storage industry activities that could impact the site in combination with the effects of assessed fishing activities will be included before finalising this assessment, alongside marine licence applications submitted after August 2023.

Bottom towed gear were identified in Part B as requiring management to avoid hindering the conservation objectives of the MPA. Anchored nets and lines, and traps, are the only remaining fishing activities occurring within Fulmar MPA that interact with the seabed. In-combination effects of these fishing activities as well as these activities in-combination with other relevant activities will be assessed in this section.

In accordance with the methodology detailed above, ArcGIS identified no other relevant activities occurring within or adjacent to Fulmar MPA, within the 5 km buffer

applied. Therefore, only fishing in-combination with other fishing activities are considered hereafter.

Table 3 from **section 3.3**, was used to identify medium-high risk pressures exerted by fishing and non-fishing activities to identify those which require in-combination assessment (**Table 6**).

Table 6 summarises the pressures exerted by fishing and identifies those exerted by both (Y: pressure exerted). Activity-pressure interactions are highlighted dark blue to illustrate an in-combination effect. Only fishing activity with no proposed or current fisheries management in place are considered.

Table 6: Pressures exerted by fishing.

	Fishing activities	
Potential pressures	**Anchored nets and lines**	**Traps**
Abrasion or disturbance of the substrate on the surface of the seabed	Y	Y
Removal of non-target species	Y	Y
Removal of target species	Y	Y

5.1 In-combination pressure sections

The fishing pressures exerted by anchored nets and lines, and traps will be considered in this section.

5.2 Fishing vs Fishing in-combination pressures

5.2.1 Abrasion and disturbance of the substrate on the surface of the seabed and removal of target and non-target species

As noted in Part B (**Section 4.3.1** nets and lines and **Section 4.3.3** traps), impacts from the removal of target and non-target species pressure is not being considered in detail in this assessment. In-combination impacts from the removal of target and non-target species pressures are more fully assessed under the pressure abrasion, as the detail of key structural and influential species is yet to be fully defined. Therefore, the removal pressures are not considered further in this in-combination assessment. The pressures may require further consideration as future evidence becomes available, in conjunction with updated conservation advice from JNCC and Natural England.

The combined impacts from anchored nets and lines and traps could potentially increase the risk of negative effects from the pressures abrasion and disturbance of

the substrate on the surface of the seabed. However, as stated in **section 4.2**, there is no activity from anchored nets and lines and traps, and therefore no in-combination impact possible.

Therefore, MMO concludes that the combined pressures from anchored nets and lines and traps will not result in a significant risk of hindering the conservation objectives for Fulmar MPA at the levels currently described.

5.3 Fishing vs non-fishing activities in-combination pressures

5.3.1 Abrasion and disturbance of the substrate on the surface of the seabed

The designated features of Fulmar MPA are sensitive to physical damage through surface abrasion and disturbance of the substrate from anchored nets and lines, and traps during gear deployment, movement of the gear on the seabed due to tidal movements and storm activity, and as the gear is dragged along the seabed during retrieval.

As detailed in **section 3.3** abrasion and disturbance of seabed surface substrate, at current activity levels anchored nets and lines and traps are not considered to be causing significant pressure through abrasion and disturbance.

Although there no marine licensable activities have been identified, there may be active submarine cables and pipeline (including KIS-ORCA Clyde to Judy and Vallhall to Clyde) within the MPA which are already in-situ and are unlikely to have any residual abrasion/removal pressure in-combination with the assessed fishing activity. Any abrasion/removal pressure from submarine cable or pipeline operation and maintenance activity is unlikely to have a significant risk of in-combination impacts with the assessed fishing activity.

Therefore, the MMO concludes that the combined pressures from anchored nets and lines and traps and other relevant activities will not cause a significant risk of hindering the site conservation objectives for Fulmar MPA.

5.4 Part C conclusion

MMO concludes that fishing in-combination will not result in a significant risk of hindering the site conservation objectives of Fulmar MPA.

Further management measures will not therefore be implemented for fishing activities currently occurring within the MPA.

6 Conclusion and proposed management

Part A of this assessment concluded that anchored nets and lines, bottom towed gears, and traps, alone, are capable of affecting (other than insignificantly) the designated features of Fulmar MPA.

Part B of this assessment concluded that, at the activity levels described, use of bottom towed gear on the sedimentary features of Fulmar MPA may cause a significant risk of hindering the achievement of the conservation objectives of the MPA as a result of the impacts of abrasion or disturbance, penetration and smothering, siltation rate and suspended solid changes, whilst anchored nets and lines, and traps will not.

Part C of this assessment concluded that, at the activity levels described, use of anchored nets and lines and traps, in combination with each other and with other relevant activities, will not result in a significant risk of hindering the achievement of the conservation objectives of the MPA.

To ensure that fishing activities do not result in a significant risk of hindering the achievement of the conservation objectives of the MPA, MMO will implement a byelaw to prohibit the use of bottom towed gear throughout Fulmar MPA.

Figure 2 shows the proposed management area in line with the conclusions set out above.

The boundaries of the proposed management area include an appropriate buffer zone to prevent direct damaging physical interactions between fishing activities and the designated features to be protected. The rationale for determining buffer size can be found in in Annex 2 of the Stage 3 MPA Site Assessment Methodology document[5].

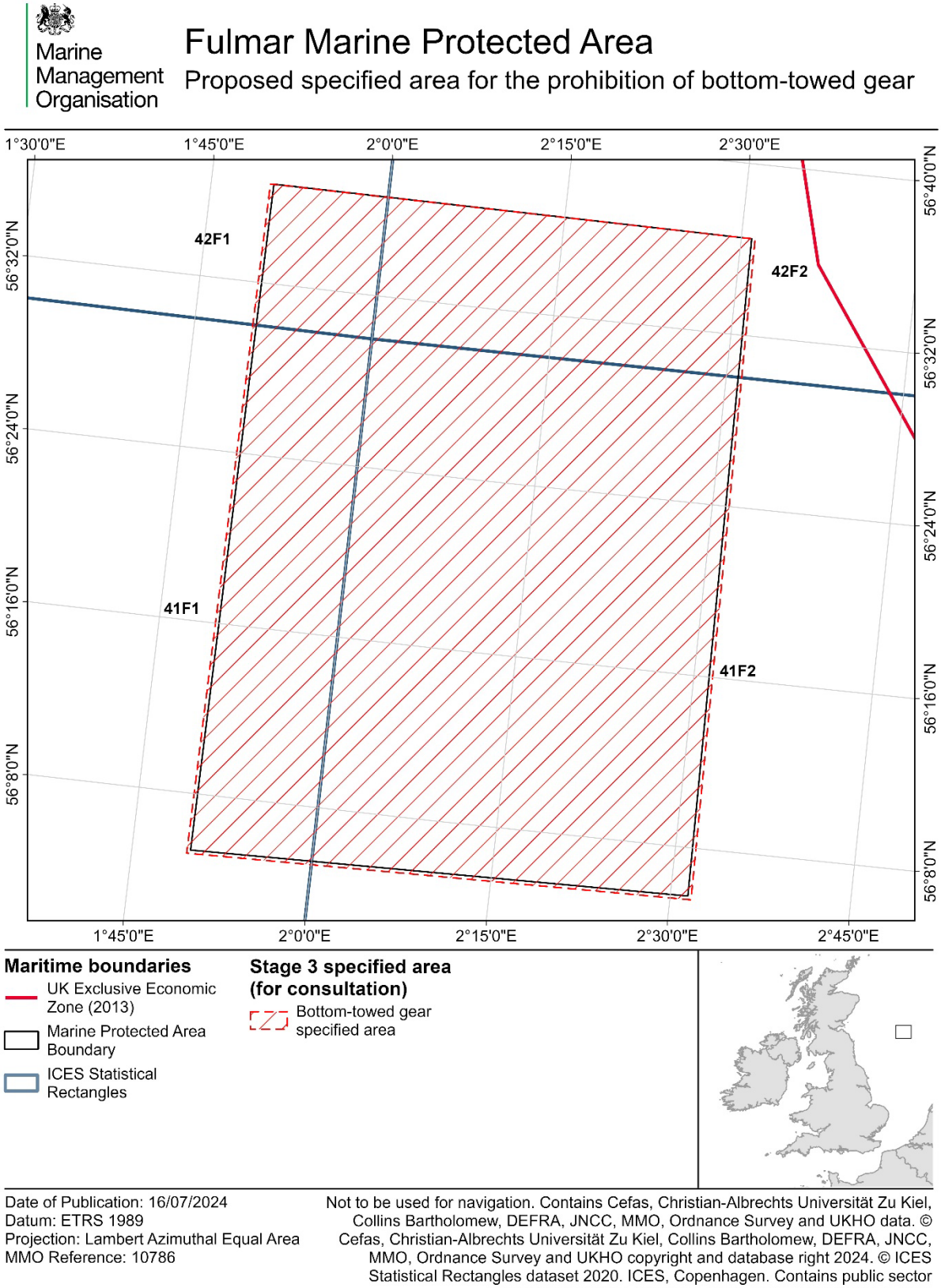

Figure 2: Map of proposed management.

7 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 site's feature(s);
- significant increase in activity levels.

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

References

Ashley, M. (2016) ‘Maldanid polychaetes and Eudorellopsis deformis in offshore circalittoral sand or muddy sand’, in Tyler-Walters, H. (ed.) *Marine Life Information Network: Biology and Sensitivity Key Information Reviews*. Plymouth. Available at: www.marlin.ac.uk/habitats/detail/1105.

De-Bastos, E. (2016a) ‘Levinsenia gracilis and Heteromastus filiformis in offshore circalittoral mud and sandy mud’, in Tyler-Walters, H. and Hiscock, K. (eds) *Marine Life Information Network: Biology and Sensitivity Key Information Reviews*. Plymouth. Available at: www.marlin.ac.uk/habitats/detail/1108.

De-Bastos, E. (2016b) ‘Myrtea spinifera and polychaetes in offshore circalittoral sandy mud’, in Tyler-Walters, H. (ed.) *Marine Life Information Network: Biology and Sensitivity Key Information Reviews*. Plymouth. Available at: www.marlin.ac.uk/habitats/detail/1110.

De-Bastos, E. (2016c) ‘Paramphinome jeffreysii, Thyasira spp. and Amphiura filiformis in offshore circalittoral sandy mud’, in Tyler-Walters, H. and Hiscock, K. (eds) *Marine Life Information Network: Biology and Sensitivity Key Information Reviews*. Plymouth. Available at: www.marlin.ac.uk/habitats/detail/1109.

De-Bastos, E. (2023) ‘Owenia fusiformis and Amphiura filiformis in offshore circalittoral sand or muddy sand’, in Tyler-Walters, H. (ed.) *Marine Life Information Network: Biology and Sensitivity Key Information Reviews*. Plymouth. Available at: www.marlin.ac.uk/habitats/detail/381.

De-Bastos, E. and Budd, G.C. (2016) ‘Brissopsis lyrifera and Amphiura chiajei in circalittoral mud’, in Tyler-Walters, H. and Hiscock, K. (eds) *Marine Life Information Network: Biology and Sensitivity Key Information Reviews*. Plymouth. Available at: www.marlin.ac.uk/habitats/detail/139.

De-Bastos, E. and Hill, J. (2016) ‘Ampharete falcata turf with Parvicardium ovale on cohesive muddy sediment near margins of deep stratified seas’, in Tyler-Walters, H. and Hiscock, K. (eds) *Marine Life Information Network: Biology and Sensitivity Key Information Reviews*. Plymouth. Available at: www.marlin.ac.uk/habitats/detail/75.

De-Bastos, E.S.R., Hill, J.M., Garrard, S.L. and Watson, A. (2023) ‘Ophiothrix fragilis and/or Ophiocomina nigra brittlestar beds on sublittoral mixed sediment’, in Tyler-Walters, H. (ed.) *Marine Life Information Network: Biology and Sensitivity Key Information Reviews*. Plymouth. Available at: www.marlin.ac.uk/habitats/detail/1068.

De-Bastos, E.S.R., Lloyd, K.A. and Watson, A. (2023) ‘Acrocnida brachiata with Astropecten irregularis and other echinoderms in circalittoral muddy sand’, in Tyler-Walters, H. (ed.) *Marine Life Information Network: Biology and Sensitivity Key Information Reviews*. Plymouth. Available at: www.marlin.ac.uk/habitat/detail/1079.

De-Bastos, E.S.R. and Watson, A. (2023a) ‘Amphiura filiformis and Ennucula tenuis in circalittoral and offshore sandy mud’, in Tyler-Walters, H. (ed.) *Marine Life Information Network: Biology and Sensitivity Key Information Reviews*. Plymouth. Available at: www.marlin.ac.uk/habitats/detail/1107.

De-Bastos, E.S.R. and Watson, A. (2023b) ‘Thyasira spp. and Ennucula tenuis in

circalittoral sandy mud', in Tyler-Walters, H. (ed.) *Marine Life Information Network: Biology and Sensitivity Key Information Reviews*. Plymouth. Available at: www.marlin.ac.uk/habitats/detail/1106.

Durkin, O.C. and Tyler-Walters, H. (2022) 'Burrowing megafauna and Maxmuelleria lankesteri in circalittoral mud', in Tyler-Walters, H. (ed.) *Marine Life Information Network: Biology and Sensitivity Key Information Reviews*. Plymouth. Available at: www.marlin.ac.uk/habitats/detail/387.

Hiddink, J.G., Jennings, S., Kaiser, M.J., Queirós, A.M., Duplisea, D.E. and Piet, G.J. (2006) 'Cumulative impacts of seabed trawl disturbance on benthic biomass, production, and species richness in different habitats', *Canadian Journal of Fisheries and Aquatic Sciences*, 63(4), pp. 721–736.

Hill, J.M., Tyler-Walters, H., Garrard, S.L. and Watson, A. (2023) 'Seapens and burrowing megafauna in circalittoral fine mud', in Tyler-Walters, H. and Hiscock, K. (eds) *Marine Life Information Network: Biology and Sensitivity Key Information Reviews*. Plymouth. Available at: www.marlin.ac.uk/habitats/detail/131.

Hill, J.M., Tyler-Walters, H., Garrard, S.L. and Watson, A. (2024a) 'Virgularia mirabilis and Ophiura spp. With Pecten maximus, hydroids and ascidians on circalittoral sandy or shelly mud with shells or stones', in Tyler-Walters, H. (ed.) *Marine Life Information Network: Biology and Sensitivity Key Information Reviews*. Plymouth. Available at: www.marlin.ac.uk/habitats/detail/147/.

Hill, J.M., Tyler-Walters, H., Garrard, S.L. and Watson, A. (2024b) 'Virgularia mirabilis and Ophiura spp. with Pecten maximus on circalittoral sandy or shelly mud', in Tyler-Walters, H. and Hiscock, K. (eds) *Marine Life Information Network: Biology and Sensitivity Key Information Reviews*. Plymouth. Available at: www.marlin.ac.uk/habitats/detail/66/.

Perry, F. and Watson, A. (2023) 'Cerianthus lloydii with Nemertesia spp. and other hydroids in circalittoral muddy mixed sediment', in Tyler-Walters, H. (ed.) *Marine Life Information Network: Biology and Sensitivity Key Information Reviews*. Plymouth. Available at: www.marlin.ac.uk/habitats/detail/1092.

Perry, F. and Watson, A. (2024) 'Cerianthus lloydii and other burrowing anemones in circalittoral muddy mixed sediment', in Tyler-Walters, H. (ed.) *Marine Life Information Network: Biology and Sensitivity Key Information Reviews*. Plymouth. Available at: www.marlin.ac.uk/habitats/detail/1091.

Readman, J.A.J. and Watson, A. (2024) 'Flustra foliacea and Hydrallmania falcata on tide-swept circalittoral mixed sediment', in Tyler-Walters, H. and Hiscock, K. (eds) *Marine Life Information Network: Biology and Sensitivity Key Information Reviews*. Plymouth. Available at: www.marlin.ac.uk/habitats/detail/74.

Tillin, H.M., Hughes, E., Readman, J.A.J., Hiscock, K. and Last, E.K. (2020) *Assigning the EUNIS classifications to UK's Offshore Regional Seas*, *JNCC Report No. 647*. Peterborough. Available at: https://hub.jncc.gov.uk/assets/34032043-c2d5-4fe4-952e-3bfe211ca6eb.

Tillin, H.M. and Riley, K. (2016) 'Foraminiferans and Thyasira sp. in deep circalittoral fine mud', in Tyler-Walters, H. and Hiscock, K. (eds) *Marine Life Information*

Network: Biology and Sensitivity Key Information Reviews. Plymouth. Available at: www.marlin.ac.uk/habitats/detail/215.

Tyler-Walters, H. and Watson, A. (2023) ‘Seapens, including Funiculina quadrangularis, and burrowing megafauna in undisturbed circalittoral fine mud’, in Tyler-Walters, H. (ed.) *Marine Life Information Network: Biology and Sensitivity Key Information Reviews*. Plymouth. Available at: www.marlin.ac.uk/habitats/detail/239/.

Annexes

Annex 1: Fishing activity data

Table A1. 1 VMS record count per nation group (UK, EU Member State or European Free Trade Association (EFTA)) and proportional activity (%), per gear, per gear group, per year (2016 to 2021), totals and annual average (2016 to 2021).

			2016		2017		2018		2019		2020		2021		Total (2016 to 2021)		Annual average (2016 to 2021)
Gear group	Gear code	Nation group	Count	%	Count	%	Count	%	Count	%	Count	%	Count	%	Count	%	Count
Demersal seine	SSC	EU	0	0	0	0	1	100	2	50	0	0	0	0	3	60	1
	SSC	UK	0	0	0	0	0	0	2	50	0	0	0	0	2	40	0
	SSC total		**0**	**0**	**0**	**0**	**1**	**100**	**4**	**100**	**0**	**0**	**0**	**0**	**5**	**100**	**1**
Demersal seine total			**0**	**0**	**0**	**0**	**1**	**1**	**4**	**9**	**0**	**0**	**0**	**0**	**5**	**2**	**1**
Demersal trawl	OTB	EU	0	0	18	72	35	76	5	19	9	69	0	0	67	47	11
	OTB	UK	29	100	7	28	11	24	22	81	4	31	4	100	77	53	13
	OTB total		**29**	**97**	**25**	**89**	**46**	**51**	**27**	**71**	**13**	**81**	**4**	**100**	**144**	**70**	**24**
	OTT	EU	0	0	0	0	7	21	0	0	0	0	0	0	7	18	1
	OTT	UK	0	0	3	100	26	79	2	100	0	0	0	0	31	82	5
	OTT total		**0**	**0**	**3**	**11**	**33**	**37**	**2**	**5**	**0**	**0**	**0**	**0**	**38**	**18**	**6**
	TBB	EU	0	0	0	0	11	100	9	100	3	100	0	0	23	100	4
	TBB total		**0**	**0**	**0**	**0**	**11**	**12**	**9**	**24**	**3**	**19**	**0**	**0**	**23**	**11**	**4**

			2016		2017		2018		2019		2020		2021		Total (2016 to 2021)		Annual average (2016 to 2021)
Gear group	**Gear code**	**Nation group**	**Count**	**%**	**Count**	**%**	**Count**	**%**	**Count**	**%**	**Count**	**%**	**Count**	**%**	**Count**	**%**	**Count**
	TBN	UK	1	100	0	0	0	0	0	0	0	0	0	0	1	100	0
	TBN total		**1**	**3**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**0**
Demersal trawl total			**30**	**60**	**28**	**80**	**90**	**94**	**38**	**84**	**16**	**76**	**4**	**80**	**206**	**82**	**34**
Midwater trawl	OTM	EU	5	100	0	0	4	100	2	100	5	100	1	100	17	100	3
	OTM total		**5**	**100**	**0**	**0**	**4**	**100**	**2**	**100**	**5**	**100**	**1**	**100**	**17**	**100**	**3**
Midwater trawl total			**5**	**10**	**0**	**0**	**4**	**4**	**2**	**4**	**5**	**24**	**1**	**20**	**17**	**7**	**3**
Unknown	NK	EFTA	5	33	7	100	1	100	1	100	0	0	0	0	14	58	2
	NK	N/A	10	67	0	0	0	0	0	0	0	0	0	0	10	42	2
	NK total		**15**	**100**	**7**	**100**	**1**	**100**	**1**	**100**	**0**	**0**	**0**	**0**	**24**	**100**	**4**
Unknown total			**15**	**30**	**7**	**20**	**1**	**1**	**1**	**2**	**0**	**0**	**0**	**0**	**24**	**10**	**4**
Grand total			**50**	**0**	**35**	**0**	**96**	**0**	**45**	**0**	**21**	**0**	**5**	**0**	**252**	**0**	**42**

Table A1. 2: UK live weight landings tonnage (t) estimates by gear from vessels over 12 m in length in the MMO section of Fulmar MPA (2016 to 2020).

Gear group	Gear code	2016	2017	2018	2019	2020	Total (2016 to 2020)	Average (2016 to 2020)
Demersal seine	SSC	0	0	0	0.42	0	0.42	0.08
Demersal seine total		**0**	**0**	**0**	**0.42**	**0**	**0.42**	**0.08**
Demersal trawl	OTB	6.46	1.23	3.77	8.03	0.61	20.09	4.02
	OTT	0	0.22	4.93	0.32	0	5.47	1.09
	PTB	0	0	0	0	0	0	0
	TBN	0.08	0	0	0	0	0.08	0.02
Demersal trawl total		**6.53**	**1.45**	**8.70**	**8.35**	**0.61**	**25.64**	**5.13**
Midwater trawl	PTM	0	0	0	0	0	0	0
Midwater trawl total		**0**	**0**	**0**	**0**	**0**	**0**	**0**
Grand total		**6.53**	**1.45**	**8.7**	**8.77**	**0.61**	**26.06**	**5.21**

Table A1. 3: EU27 live weight landings tonnage (t) estimates by gear from vessels over 12 m in length in the MMO section of Fulmar MPA (2016 to 2020).

Gear group	Gear code	2016	2017	2018	2019	2020	Total (2016 to 2020)	Average (2016 to 2020)
Demersal trawl	OTB	0	2.08	9.20	3.48	5.63	20.39	4.08
Demersal trawl total		**0**	**2.08**	**9.20**	**3.48**	**5.63**	**20.39**	**4.08**
Midwater trawl	OTM	0	0	0	152.84	126.27	279.11	55.82
Midwater trawl total		**0**	**0**	**0**	**152.84**	**126.27**	**279.11**	**55.82**
Grand total		**0**	**2.08**	**9.20**	**156.32**	**131.89**	**299.50**	**59.90**

Table A1. 4: Percentage of each ICES rectangle intersected by the MMO section of Fulmar MPA.

ICES rectangle	Percentage overlap (%)
41F1	13.60
41F2	42.29
42F1	3.60
42F2	11.32

Table A1. 5: EU27 live weight landings tonnage (t) estimates by gear from vessels under 12 m in length for the MMO section of Fulmar MPA (2016 to 2020).

Gear group	Gear code	2016	2017	2018	2019	2020	Total (2016 to 2020)	Average (2016 to 2020)
Demersal trawl	OTB	0	0	0.03	0	0	0.03	0.01
Demersal trawl total		**0**	**0**	**0.03**	**0**	**0**	**0.03**	**0.01**
Grand total		**0**	**0**	**0.03**	**0**	**0**	**0.03**	**0.01**

Table A1. 6: Mean annual surface and subsurface SAR values for C-squares intersecting the MMO section of Fulmar MPA (2016 to 2020).

Gear group	SAR category	2016	2017	2018	2019	2020
Demersal seines	Surface	0	0	0	0.01	0
	Subsurface	0	0	0	<0.01	0
Demersal trawls	Surface	0.04	0.02	0.08	0.05	0.03
	Subsurface	0.01	<0.01	0.01	0.01	0.01
Bottom towed gear	Surface	0.04	0.02	0.08	0.17	0.03
	Subsurface	0.01	0	0.01	0.01	0.01