Marine Management Organisation

MMO Stage 3 Site Assessment: Greater Haig Fras MPA (Draft)

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Contents

Executive Summary

This assessment analyses the impact of anchored nets and lines, traps, and bottom towed gear on the designated features subtidal coarse sediments, subtidal mixed sediments, subtidal sand, subtidal mud, and sea-pen and burrowing megafauna communities in Greater Haig Fras 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 the use of anchored nets and lines and traps does not pose a significant risk of hindering the achievement of the conservation objectives of the MPA. However, bottom towed gears pose a significant risk of hindering the achievement of the conservation objectives of the MPA, and therefore, management measures should be implemented for bottom towed gears for the Greater Haig Fras MPA.

1 Introduction

This assessment considers whether fishing activities are compatible with the conservation objectives of Greater Haig Fras 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, Marine Management Organisation (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 force.

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 Information - Greater Haig Fras MCZ[1]
- Defra Factsheet - Greater Haig Fras MCZ[2]

Greater Haig Fras MPA is located in the Western Channel and Celtic Sea region to the west of Land's End and covers an area of approximately 2,048 km^2 **(Figure 1).** Fishing activity in the site is regulated by MMO. JNCC (beyond 12 nautical miles (nm)) are the relevant Statutory Nature Conservation body for the site.

Greater Haig Fras MPA was designated as a MCZ in 2016. The site is designated for subtidal coarse sediment, subtidal sand, subtidal mud, and subtidal mixed sediments which surround the Haig Fras rock complex geological feature; an isolated fully submarine granite bedrock outcrop which represents the only substantial area of rocky reefs in the Celtic Sea beyond the coastal margin and inshore waters. The subtidal rocky habitat within this site is already protected by Haig Fras Special Area of Conservation (SAC), however Greater Haig Fras MPA now also protects the broad-scale sedimentary habitats beyond the geological feature to the boundary extent of the site. The subtidal sediments in the site support a broad diversity of species including polychaete worms and bivalve molluscs which live within the sediment and echinoderms such as sea urchins and starfish occurring on the surface of the sediment as epifaunal species. In the deeper areas of the site, the biological community is characterised by sea-pen and burrowing megafauna communities and burrowing species such as mud shrimps and the Norway lobster *Nephrops norvegicus*.

[1] https://jncc.gov.uk/our-work/greater-haig-fras-mpa/ (last accessed 10 July 2023)
[2] Greater Haig Fras Marine Conservation Zone (publishing.service.gov.uk) (last accessed 10 July 2023)

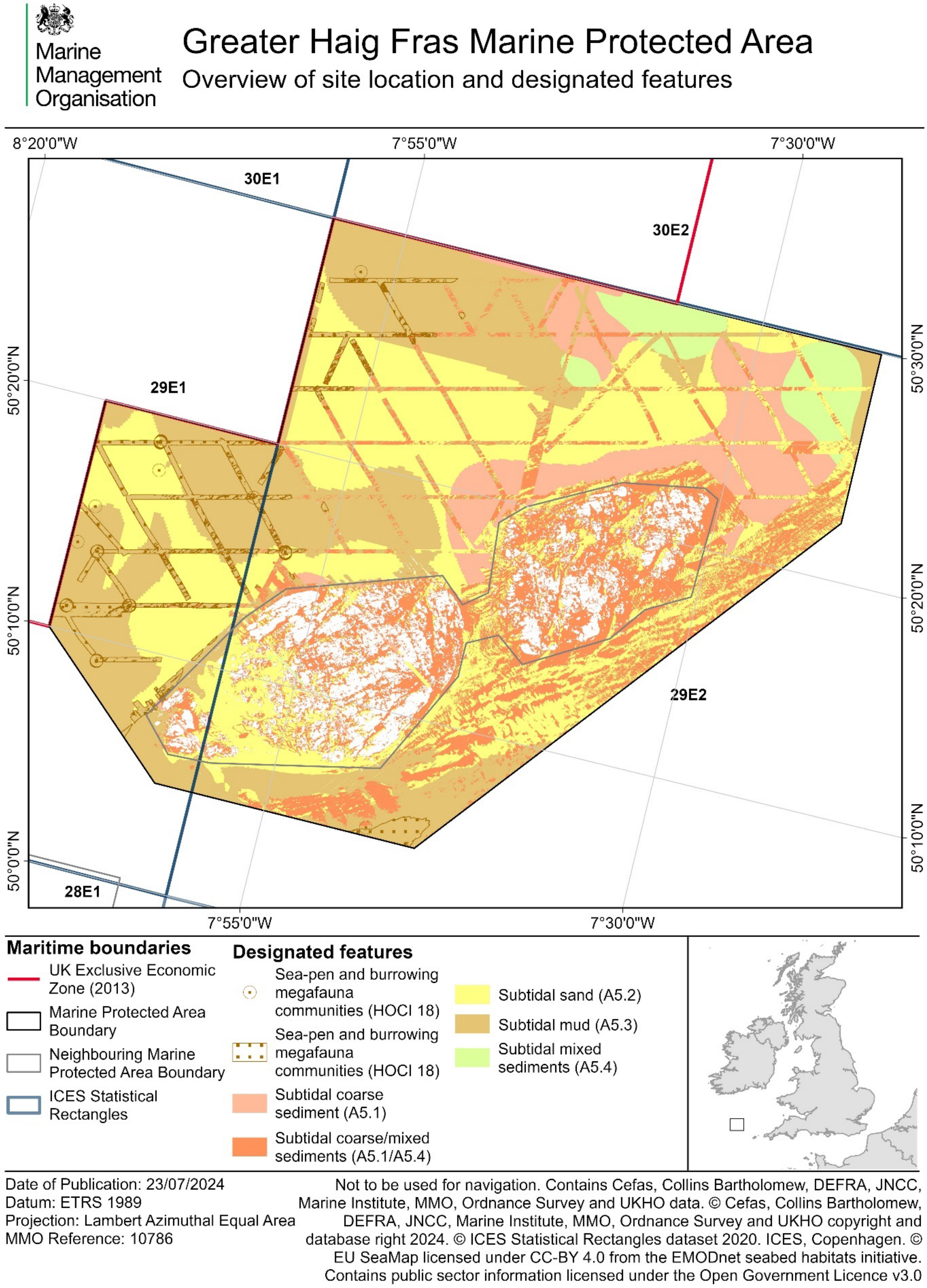

Figure 1: Site overview map.

The designated features and their general management approaches are set out below in **Table 1.**

The general management approaches for the features of Greater Haig Fras MPA have been set based on a vulnerability assessment.

Table 1: Designated features and general management approaches.

Designated feature	General management approach
Subtidal coarse sediments Subtidal mixed sediments Subtidal sand Subtidal mud Sea-pen and burrowing megafauna communities	**Recover to favourable condition** • extent is stable or increasing; and • structures and functions, quality, and the composition of characteristic biological communities (which includes a reference to the diversity and abundance of species forming part of or inhabiting each habitat) are such as to ensure that they remain in a condition which is healthy and not deteriorating. • supporting processes; water and sediment quality.
Haig Fras rock complex (geological feature)	**Maintain in favourable condition**

JNCC consider that the activities listed below are capable of significantly affecting the designated features of the site[3]:

- Mobile demersal fishing.

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.

2.2 Scope of this assessment

The scope of this assessment covers fishing activities alone, and relevant activities in combination with fishing. Greater Haig Fras MPA includes circalittoral rock (Annex 1) reef features, but these are not designated under this MPA. They are designated separately under the Haig Fras Special Area of Conservation (SAC). This is covered under the Haig Fras MPA site assessment.

[3] Greater Haig Fras MCZ Conservation Advice Statements (jncc.gov.uk) (last accessed 20 July 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 of 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

For more information about the above evidence sources, please see the Stage 3 MPA Site Assessment Methodology document, which describes each type of fishing activity evidence and summarises the strengths and limitations of each source.

[4] www.legislation.gov.uk/ukpga/2009/23/section/126

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.

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

- VMS data;
- fisheries landings data (logbooks and sales records);
- MMO catch recording project data;
- 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 Stage 3 MPA Site Assessment Methodology document[5], which describes each type of fishing activity evidence and summarises the strengths and limitations of each source.

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

Table 2: Fishing activities covered by this assessment present in VMS records (2016-2021) and landings data (2016-2020) for Greater Haig Fras MPA.

Gear type	Gear name	Gear code	Justification
Anchored nets and lines	Trammel net	GTR	Present in VMS data.
	Longlines (demersal)	LLS	
	Gill nets (not specified)	GN	Present in VMS records and under 12 m vessel landings data for ICES statistical rectangles that overlap the site.
	Set gillnet (anchored)	GNS	
Bottom towed gear	Twin bottom otter trawl	OTT	Present in VMS data.
	Towed dredge	DRB	
	Scottish / fly seine	SSC	
	Pair seine	SPR	
	Nephrops trawl	TBN	
	Danish / anchor seine	SDN	
	Beam trawl	TBB	
	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	Purse seine (ring net)	PS	Present in VMS data.
	Midwater pair trawl	PTM	
	Midwater otter trawl	OTM	
	Longlines (pelagic)	LLD	
	Hand-operated pole-and-line	LHP	
	Drift gillnet	GND	
Traps	Pot/Creel	FPO	Present in VMS records and under 12 m vessel landings data for ICES statistical rectangles that overlap the site.
Miscellaneous	Not known	NK	Present in VMS data.

3.2 Pressures, features and activities screened out

This section identifies activities or pressures that are **occurring but do not need to be considered** for Greater Haig Fras 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 Greater Haig Fras MPA, there is no feasible pathway for gears of this type to interact with benthic designated features as part of normal operation (not considering gear failure or net loss). These gears are not designed to operate on or near the seabed and are deployed entirely within the water column. Therefore, the use of midwater gear within Greater Haig Fras 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' 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.

The features screened out on this basis are listed below with justification:

- **Geological or geomorphological designated features**: these are out of scope for this assessment as fishing activities are considered incapable of significantly impacting these features. This is applicable to the Haig Fras rock complex.

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 the anchored nets and lines, bottom towed gear and traps 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

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[6] Stage 3 Fishing Gear MPA Impacts Evidence Anchored Nets and Lines: www.gov.uk/government/publications/stage-3-impacts-evidence (last accessed 19 August 2024)

[7] Stage 3 Fishing Gear MPA Impacts Evidence Bottom Towed Gear: www.gov.uk/government/publications/stage-3-impacts-evidence (last accessed 19 August 2024)

- 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 in and out in **Sections 3.1 and 3.2.**

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.

[8]Stage 3 Fishing Gear MPA Impacts Evidence Traps: www.gov.uk/government/publications/stage-3-impacts-evidence (last accessed 19 August 2024)

Table 3. Sensitivity to potential pressures from fishing activities on designated features of Greater Haig Fras MPA.

	Designated features														
	Sea-pen and burrowing megafauna communities			Subtidal coarse sediment			Subtidal mixed sediment			Subtidal mud			Subtidal sand		
Potential pressures	A	B	T	A	B	T	A	B	T	A	B	T	A	B	T
Abrasion or disturbance of the substrate on the surface of the seabed															
Barrier to species movement															
Changes in suspended solids (water clarity)															
Deoxygenation															
Hydrocarbon and polycyclic aromatic hydrocarbon (PAH) contamination															
Introduction of light															
Introduction of microbial pathogens															
Introduction or spread of invasive non-indigenous species															
Litter															
Nutrient enrichment															
Organic enrichment															
Penetration and/or disturbance of the substrate below the surface of the seabed, including abrasion															
Physical change (to another seabed type)															
Physical change (to another sediment type)															
Removal of non-target species															
Removal of target species															
Smothering and siltation rate changes															
Synthetic compound contamination															
Transition elements and organo-metal contamination															
Underwater noise changes															
Visual disturbance															

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[9].

Table 3 shows the fishing activities and pressures identified in Part A which have been included for assessment in Part B. The important targets for favourable condition were identified within JNCC's conservation advice supplementary advice tables and are shown in **Table 4**. '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 4: Relevant favourable condition targets for identified pressures.

Features	Attribute	Target	Relevant pressures
Subtidal coarse sediments Subtidal mixed sediments Subtidal sand Subtidal mud Sea-pen and burrowing megafauna communities	Extent and distribution: presence and spatial distribution of biological communities Structure and function: presence and abundance of key structural and influential species Supporting processes: sedimentation rate	Recover to favourable condition	Relevant to: • Abrasion or disturbance of the substrate on the surface of the seabed • Changes in suspended solids (water clarity) • Smothering and siltation rate changes • Penetration and/or disturbance of the substrate below the surface of the seabed, including abrasion • Removal of non-target species • Removal of target species

[9] www.legislation.gov.uk/ukpga/2009/23/section/126

4.1 Fisheries access and existing management

Non-UK vessels can operate within Greater Haig Fras 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 UK, Belgium, Spain, France, Faroe Islands, Ireland, Netherlands and Portugal. VMS records indicate that French, UK and Irish vessels were most prevalent. More information on non-UK vessel access to UK waters can be found on MMO's Single Issuing Authority page[10].

4.2 Fishing activity summary

Table A1. 1 to **Table A1. 8** in Annex 1 display a detailed breakdown of fishing activity within Greater Haig Fras MPA. When discussing weights from landings in this section, figures used are a total of weights from UK and EU member states.

Of the fishing activities not screened out in Part A of this assessment, VMS data shows that the most prevalent gear types operated by over 12 m vessels within the site are bottom otter trawls, followed by twin bottom otter trawls, set gillnet (anchored), longlines (demersal), gillnets (unspecified) and to a lesser extent pair seine, trammel nets, pots/creels, towed dredge, Danish / anchor seine, beam trawl and *Nephrops* trawl. Landings data for gears operated by under 12 m vessels in the site is minimal, with landings for all gear types operated by under 12 m vessels equating to less than 1.47 tonnes (t) on average across all gear types in the data reporting period of 2016 to 2020.

Anchored nets and lines:

According to VMS and landings data for over 12 m vessels, anchored nets and lines are the second most frequently deployed gear type in the site with an average count of 1,063 VMS records between 2016 and 2021, and approximately 151.9 tonnes landed on average between 2016 and 2020 across gillnets (unspecified), trammel nets, set gillnet (anchored) and long lines (demersal). Under 12 m vessels using anchored nets and lines landed approximately 1.37 tonnes per year on average in the same data reporting period.

Under 12 m landings are recorded at ICES rectangle level and for the purpose of assessment have been attributed to the MPA based on the proportion of the ICES rectangle it overlays. Average fishing effort recorded by UK vessels under 12 m in length using anchored nets and lines between 2016 and 2021 for the area of Greater Haig Fras MPA that intersects ICES rectangles 29E1 and 29E2 was 1.24 days. Greater Haig Fras MPA covers 8.85 % of ICES rectangle 29E1 and 42.68 % of ICES

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

rectangle 29E2. Fishing effort days are derived from logbooks and is collected at ICES rectangle and then apportioned accordingly.

Bottom Towed Gear:

Demersal Seines

According to VMS data for over 12 m vessels, the use of demersal seines in the site is relatively low when compared to demersal trawls with an average count of 74 VMS records between 2016 and 2021. Landings for vessels over 12 m equated on average to 8.47 tonnes between 2016 and 2020. No landings for vessels under 12 m vessels have been recorded for demersal seine fishing activity in the same data reporting period. No fishing effort data is available for demersal seines in ICES rectangles 29E1 or 29E2. SAR analysis for demersal seines indicate that mean annual surface SAR values for C-squares intersecting Greater Haig Fras MPA ranged between 0.06 and 0.33 and subsurface values between 0 and 0.02. A SAR value of one would indicate that each C-square experienced a pass of fishing gear on average once per year. SAR analysis uses VMS data, and therefore only captures over 12 m vessel activity. However, these values nevertheless indicate that demersal seine activity was low for the reporting period discussed.

Demersal Trawls

According to VMS data, bottom otter trawls are the most prevalent type of fishing gear deployed in Greater Haig Fras MPA. Between 2016 and 2021 there were 2,358 VMS records on average of this gear type per year. Twin bottom otter trawl activity also occurs within the site. Between 2016 and 2021 there were 724 VMS records on average of this gear type per year. Beam trawls and *Nephrops* trawls occur to a much lesser extent within the site with 13 and 4 VMS records on average of these gear types per year respectively. *Nephrops* trawls landed 0.98 t (in 2017 only) in the period 2016 to 2021. Vessels over 12 m in length using demersal trawls landed approximately 296.61 tonnes per year, whereas vessels under 12 m in length landed less than 0.01 tonnes in the same data reporting period. No fishing effort data is available for demersal trawls in ICES rectangles 29E1 or 29E2. SAR analysis for demersal trawls indicate that mean annual surface SAR values for C-squares intersecting Greater Haig Fras MPA ranged between 0.72 and 2.30, with a decreasing trend to the lowest figure in 2020. Subsurface values were between 0.07 and 0.31, again showing a decreasing trend to the lowest figure in 2020. A SAR value of one would indicate that each C-square experienced a pass of fishing gear on average once per year. SAR analysis uses VMS data, and therefore only captures over 12 m vessel activity. However, these values nevertheless indicate that demersal trawl activity has decreased since 2016 to less than one sweep per year.

Dredges

According to VMS data for over 12 m vessels, the use of towed dredges in the site is minimal with an average count of 16 VMS record between 2016 and 2021. No landings data has been recorded for vessels under 12 m or over 12 m in the same data reporting period. No fishing effort data is available for towed dredges in ICES rectangles 29E1 or 29E2. Mean annual surface and subsurface SAR values for dredging activity for C-squares intersecting the site equated to 0 between 2016 and 2020.

Traps

According to VMS data for over 12 m vessels, the use of pots/creels in the site is minimal with an average count of 32 VMS records between 2016 and 2021. While VMS records indicate that one vessel using traps operated within the MPA from 2016 to 2021, as there are no landings data associated with these records, it is likely this vessel was transiting through the site rather than fishing. Minimal landings of 0.10 tonnes have been recorded for vessels under 12 m. No fishing effort data is available for pots/creels in ICES rectangles 29E1 or 29E2.

4.3 Pressures by gear type

The Stage 3 Fishing Gear MPA Impacts Evidence documents for anchored nets and lines, bottom towed gear and traps 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.

As the designated features subtidal coarse sediment, subtidal mixed sediments, subtidal sand, and subtidal mud have similar sensitivities to the pressures identified for different gear types, these features have been considered together. Where there are differences between the features or the potential impacts of different gears within each grouping, this has been highlighted.

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 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, sea-pens and burrowing megafauna communities may be sensitive to removal of target and/or non-target species pressures. Removal of target species in this case is most relevant to Nephrops, as part of the burrowing megafauna element of the sea-pen and burrowing megafauna communities feature, commonly targeted using bottom towed gears. There are instances of fishing for Nephrops using traps (creels), however this is an uncommon fishing practice, generally limited to the Scottish inshore fleets and potentially a small number of English inshore vessels. Nephrops creel fisheries are not known to occur within Greater Haig Fras MPA. Removal of this species is not possible through the use of anchored nets and lines. In relation to removal of non-target species, due to the selectivity of traps for the target species and high probability of survival for any unwanted species caught and discarded, the impact of removal of non-target species on key burrowing megafauna species such as Nephrops is also not considered to be significant. As such, these features are more fully assessed within the abrasion and penetration pressures.

4.3.1 Anchored nets and lines

The following features of Greater Haig Fras MPA have been considered in relation to pressures from anchored nets and lines.

Subtidal coarse sediment; subtidal sand; subtidal mixed sediments; subtidal mud; Sea-pen and burrowing megafauna communities.

The relevant pressures on the features of Greater Haig Fras MPA (outlined above) from anchored nets and lines were identified in **Table 4** and are:

- abrasion or disturbance of the substrate on the surface of the seabed.

As noted above, impacts from the removal of non-target species pressure is not being considered in detail in this assessment, as it is assessed more completely within the abrasion pressure.

Impacts on these features relating to abrasion or disturbance of the substrate on the surface of the seabed occur primarily during setting and retrieval of nets and the associated ground lines and anchors, as well as by their movement over the seabed during rough weather.

Subtidal coarse sediment; subtidal mixed sediments; subtidal sand; and subtidal mud.

Biotope data for Greater Haig Fras MPA at bioregion level is consolidated in the JNCC Biotope Databases. Biotope data for the Western Channel and Celtic Sea was extracted from the Biotope Presence Absence Database[11] to determine the number of biotopes that are likely to be present at the site. Biotope sensitivity data was then extracted from The Marine Life Information Network (MarLIN) to outline biotopes sensitivity for the appropriate pressure. **Table A2. 1** to **Table A2. 4** of Annex 2 detail the list of biotopes that may be found within the sediment features of the site.

The Greater Haig Fras MPA Community Analysis report[12] summarises the characterising species and communities of the site. Two survey stations characterised by deep, gravelly sand were found to contain *Goniadella gracilis, Chaetozone christie, Aponuphis bilineata, Polygordius and Pisione remota.* Two survey stations characterised by deep, muddy gravel were found to contain polychaetes such as *Dasybranchus spp*., *Hilbigneris gracilis* and *Spiophanes kroyeri* as well as the tube-dwelling anemone, *Cerianthus lloydii*. Thirty-four survey stations were found to contain high numbers of polychaete, *Dasybranchus spp*. and the bivalve mollusc, *Corbula gibba* along with other taxa such as *Terebellides stroemii*, *Glycera unicornis* and *Magelona minuta* across all subtidal sediment types in the site. Furthermore, 8 survey station in the MPA, characterised by deep, slightly gravelly sand contained high numbers of pea urchin, *Echinocyamus pusillus* and the bivalve mollusc, *Abra prismatica* and other taxa such as Nemertea and *Aonides paucibranchiata.*

For the subtidal coarse sediment feature, 13 biotopes have been identified which could be present in the site. As outlined in **Table A2. 1** in Annex 2, nine of these have low sensitivity to abrasion pressures and three are not sensitive to this pressure. One biotope does not have an assessment available on MarLIN. Therefore, these have not been considered further within this section.

For the subtidal mixed sediments feature, seven biotopes have been identified which could be present in the site. Four of these biotopes, shown in **Table A2. 2** in Annex 2, were identified as having medium sensitivity to abrasion. For the subtidal sand feature, 14 biotopes have been identified which could be present in the site, four of which have medium sensitivity, shown in **Table A2. 3** in Annex 2. For the subtidal mud feature, seventeen biotopes have been identified which could be present in the site, thirteen of which have medium sensitivity, as outlined in **Table A2. 4** in Annex 2.

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[11] JNCC report 647: Biotope Presence-Absence spreadsheet (revised July 2020). Available online: [Assigning the EUNIS classifications to UK's Offshore Regional Seas | JNCC Resource Hub]() (last accessed 28 November 2023).

[12] [Marine Conservation Zone Benthic Community Analysis (jncc.gov.uk)]() (last accessed 10 July 2023)

Generally, subtidal sediments are less sensitive, and likely to recover more quickly from fishing activity impacts than more fragile habitats such as biogenic reefs, however fishing activity still has the potential to negatively impact these habitats and hinder the conservation objectives of the sites in which they are protected, particularly with regard to the structure and function of the biological communities present. These habitats usually contain populations of sessile epifauna, and physical damage, disturbance or removal of such species usually leads to slow recovery rates. Studies indicate that slow growing branching species and erect branching species are considered particularly sensitive to damage from netting. Repeated netting activity could damage communities associated with this feature through cumulative impacts. However, sensitivity to removal via abrasion was predominantly linked to studies using bottom towed gears rather than anchored nets and lines.

As described in **section 4.2**, VMS activity data shows that anchored nets and lines activity is evenly distributed throughout the MPA and is occurring over the subtidal sediment features.

As described in section 9.4 of the anchored nets and lines Impacts Evidence document[6], there is limited information on the impacts of static gears on sand habitats or subtidal mud habitats, however available literature suggests that static gears such as anchored nets and lines have a relatively low impact on benthic communities in comparison to towed gears and are likely to be of limited concern to subtidal sand habitats. The impact of demersal nets and lines will likely be greatest on any epifauna present with resistance varying by species. Sensitivity of erect epifauna to abrasion impacts from anchored nets and lines in subtidal mud habitats is likely to be species dependent.

Section 9.4 of the anchored nets and lines Impacts Evidence document[6] indicates that these fishing methods 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 and relatively small footprint of the gear. Subtidal sediment habitats are considered resilient to all but intense fishing activity using anchored nets and lines on species rich sediment habitats or those with long-lived bivalves. Potential impacts of abrasion or disturbance of the substrate on the surface of the seabed on the features of the site are more likely to occur during the hauling of gear or the movement of gear along the seabed due to strong tides, currents, or storm activity.

Overall, given the good rates of resilience and recoverability of the biotopes present within the subtidal sediment features, and the likelihood that these biotopes already have some resilience to the described anchored nets and lines levels in the site, there is a low risk of significant impacts on the features at the levels described of activity relating to abrasion or disturbance of the substrate on the surface of the seabed. The site is also subject to moderate hydrodynamic energy of the Western Channel and Celtic Sea, so it is likely that these biological communities are acclimatised to some level of natural disturbance. It is unlikely that the use of anchored nets and lines at the described levels will pose a significant risk of hindering the achievement of the conservation objectives on the subtidal coarse sediments, subtidal mixed sediments, subtidal sand and subtidal mud features of Greater Haig Fras MPA.

Sea-pen and burrowing megafauna communities.

Table A2. 5 in Annex 2 outlines the sea-pen and burrowing megafauna communities biotopes with high or medium sensitivity to abrasion pressures that may be present in the site.

As described in section 4.3 of the anchored nets and lines Impacts Evidence document[6], there is currently not enough literature available to detail the impacts of the relevant pressures, 'abrasion or disturbance of the substrate on the surface of the seabed', 'removal of target species', and 'removal of non-target species' for this gear type. Therefore, evidence regarding traps will be used as a proxy due to similarities in their static nature and impact.

Burrowing megafaunas, such as Norwegian lobster *Nephrops norvegicus* are generally considered less sensitive to abrasion and penetration impacts than sea pens due to their motility and ability to move from areas of disturbance. Sea-pens, although able to retract into their burrows and bend in some instances, are fixed and unable to move from potential disturbance episodes. Therefore, this assessment focuses on the most sensitive component of this designated feature, sea-pens.

Research detailing the impacts of abrasion from traps 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. *Virgularia mirabilis* is able to retract into a burrow into which the whole colony can withdraw when disturbed, thus reducing the likelihood of damage or mortality from fishing activity. 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.

Based on the rationale above, given the good rates of resilience and recoverability in the biotopes present, there is a low risk of significant impacts to this feature relating to abrasion or disturbance of the substrate on the surface of the seabed. It is also likely that these biological communities are acclimatised to some level of natural disturbance, therefore it is unlikely that the ongoing use of anchored nets and lines will pose a significant risk of hindering the achievement of the conservation objectives of Sea-pen and burrowing megafauna communities of Greater Haig Fras Bank MPA.

Therefore, MMO concludes that the ongoing use of anchored nets and lines at described levels does not pose a significant risk of hindering the achievement of the conservation objectives of Greater Haig Fras MPA.

4.3.2 Bottom towed gear

The following features of Greater Haig Fras MPA have been considered in relation to pressures from bottom towed gear:

Subtidal coarse sediment; subtidal sand; subtidal mixed sediments; and subtidal mud.

The relevant pressures on the subtidal sediment features of Greater Haig Fras MPA (outlined above) from bottom towed gear were identified in **Table 4** and are:

- 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*;
- changes in suspended solids (water clarity)^; and
- smothering and siltation rate changes^.

Sea-pen and burrowing megafauna communities.

The relevant pressures on the sea-pen and burrowing megafauna communities' features of Greater Haig Fras MPA from bottom towed gear were identified in **Table 4** and are:

- 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*; and
- removal of target species.

Pressures marked with matching superscript symbols (* and ^) have been consolidated in this review to avoid repetition, due to the similar nature of their impacts on sediment habitats.

As noted above, impacts from the removal of non-target species pressure are not being considered in detail in this assessment, as they assessed more completely within the abrasion pressure. Removal of target species pressure is being considered however, in relation to *Nephrops* fisheries and sensitivity of sea-pen and burrowing megafauna communities.

Subtidal coarse sediment; subtidal sand; subtidal mixed sediments; subtidal mud.

- Abrasion or disturbance and penetration of the substrate on the surface of the seabed.

As outlined in **Table A2. 1** in Annex 2, three subtidal coarse sediment biotopes have been identified as having medium sensitivity to penetration pressures. The four subtidal mixed sediments biotopes identified in the anchored nets and lines section as having medium sensitivity to abrasion, have also been identified as having medium sensitivity to penetration, as shown in **Table A2. 2** in Annex 2. For the subtidal sand biotopes, five biotopes have been identified as having medium sensitivity to penetration, as outlined in **Table A2. 3** in Annex 2, with four being the same biotopes identified as having medium sensitivity to abrasion pressures in **section 4.3.1.**

For subtidal mud, **Table A2. 4** in Annex 2 outlines the three biotopes which have been identified as having a high sensitivity to penetration pressures. A further 11 biotopes have medium sensitivity, as outlined in **Table A2. 4** in Annex 2.

As described in section 8.4.1 of the bottom towed gear Impacts Evidence document[7], abrasion and penetration pressures from bottom towed gear can result in both physical and biological impacts on subtidal sediment features. Physical impacts include the creation of furrows and berms in the sediment from the trawl doors associated with bottom otter trawls; and the flattening of bottom features such as ripples and irregular topography by beam trawls and demersal seines. Physical impacts are unlikely, however, to significantly impact the large-scale topography of sediment features. Of more concern are the impacts on the biological structure of sediment habitats. Impacts on biological communities through damage and mortality of flora and fauna via surface and subsurface abrasion and penetration varies based on the levels of fishing activity and intensity, however the first pass of bottom towed gear over the seabed will remove the most sensitive components of the feature. This can lead to long term shifts in biological communities towards smaller, short-lived, opportunistic species that exhibit greater resilience to anthropogenic activity.

Demersal trawls can cause collision, crushing and uprooting as animals encounter or pass under the gear. Initial reductions in biomass, species richness and diversity, as well as changes in community structure are considered likely to be greatest on subtidal coarse sediments compared to subtidal sand. As outlined in section 8.5.1 of the bottom towed gear Impacts Evidence document[7], the first pass of a trawl has the largest initial impact on biomass and production in sediments whereas in areas of high trawling intensity, further increasing trawling intensity can have smaller additional effects on biomass and production (Hiddink *et al.*, 2006). Direct mortality due to otter trawling is considerable but has been found to be lower than that caused by beam trawling for a number of burrowing species, however research has shown that otter trawls remove, on average, around 6 % of faunal biomass per pass with the first trawl pass having the most significant impact.

As detailed in section 4.2, bottom otter trawls are the most prevalent type of fishing gear deployed in Greater Haig Fras MPA. Given that the SAR values and VMS count data for the site indicate significant levels of demersal trawl activity, it is likely that the sedimentary features of the site are experiencing very regular exposure to abrasion and penetration pressures. The site is subject to the hydrodynamic energy of the Western Channel and Celtic Sea, so it is likely that biological communities are acclimatised to some level of disturbance. However, the site's dominance of low sensitivity biotopes may be a result of decades of bottom towed fishing activity that have shifted baselines for biological community structures towards more resilient, endemic fauna.

Communities in subtidal coarse sediment habitats are particularly sensitive to bottom towed gear activity because they generally contain large proportions of long-lived and more sessile epifauna which are easily damaged or removed by the pass of bottom towed gears leading to reduced diversity, abundance, and occurrences. There is limited information on the impacts of bottom towed gear on subtidal sand, but 'clean' sand and 'well sorted' sediments generally appear to have greater resilience to and recovery from, fishing disturbance. As the mud fraction of sand increases (for example muddy sand vs coarse sand) recovery times also increase, making muddy sediments more sensitive.

Very little evidence is available regarding the impact of bottom towed gears on subtidal mixed sediments; however, the biological communities are likely vulnerable and more susceptible to surface and subsurface penetration than subtidal sand and subtidal coarse sediments. Recovery may be slow with some research showing that two years post bottom towed gear fishing, the benthic community composition of a mixed coarse substratum area impacted by towed gear was approaching but still not matching the composition of an adjacent area where only static gears were permitted. Communities in gravel habitats are generally considered to be particularly sensitive to bottom towed gear activity, as such habitats contain large proportions of long-lived and more sessile epifauna which are easily damaged or removed by the pass of bottom towed gears leading to reduced diversity, abundance and occurrences. Research has shown that, compared with disturbed sites, subtidal coarse sediments undisturbed by bottom towed fishing gears were characterised by an abundance of bushy epifaunal taxa (bryozoans, hydroids, worm tubes) providing complex habitat for shrimp, polychaetes, brittle stars, mussels and small fish and as such had higher numbers of organisms, biomass, species richness and species diversity. Similarly, there is evidence to suggest the recovery of subtidal coarse sediments to disturbance may be longer than softer sediments, with studies demonstrating fragile species as showing no discernible recovery after four months of trawling taking place.

Despite the site's dominance of low sensitivity biotopes, relatively high swept area ratios for bottom towed gears indicate there is a risk of the abrasion and penetration pressures hindering the achievement of the conservation objectives. The site contains sensitive species and its dominance of low sensitivity biotopes may be a result of decades of bottom towed fishing activity that have shifted community baselines. Based on the rationale above, bottom towed gears have the potential to impact biological communities, and the overall ecosystem function of the subtidal coarse sediment and subtidal mixed sediments found in the site from abrasion, due to penetration or disturbance of the substrate on the surface of the seabed pressures. Given the resistance of the biotopes identified on the feature is low to this type of fishing activity, and recoverability is slow, it is likely that the ongoing use of bottom towed gear at the levels described at will pose a significant risk of hindering the achievement of the conservation objective of 'recover to favourable condition' of this feature of Greater Haig Fras MPA.

- Changes in suspended solids (water clarity) and smothering and siltation rate changes (light).

Tables A2.1 to A2.4 of Annex 2 details the list of biotopes that may be found within the sediment features which may be sensitive to the changes in suspended solids (water clarity) and smothering and siltation rate changes (light) pressures. One subtidal coarse sediment biotope was identified as having medium sensitivity to changes in suspended solids (water clarity). Three subtidal mixed sediments' biotopes were identified as having medium sensitivity to smothering and siltation rate changes (light). Lastly, two subtidal mud biotopes were identified as having medium sensitivity to both pressures.

As described in **section 4.2**, the majority of bottom towed gear activity in the site is being undertaken by vessels deploying bottom otter trawls. Research on the effects of sediment suspension by otter trawls used to inform the bottom towed gear Impacts Evidence document[7] demonstrated that activity over sandy substrates can cause a sediment concentration increase behind the gear of up to 0.43 cm3 per litre and an estimated 41.3 kg of sediment can be suspended by all otter trawl components (ground gear and trawl doors) per metre. Further research used to inform the Impacts Evidence document[7] on the effects of otter trawling on mud sediments found that a single trawling event by an otter trawl resulted in suspension of approximately 9.5 tonnes of sediment, including tens to hundreds of kilograms of associated particulate elements, per kilometre of track. The sediment plume in the near-bottom water was transported more than 1 km away over the following three to four days and elevated levels of re-suspended fine mud sediment were recorded for up to 5 days after their trawl disturbance event.

As described in section 8.4.2 of the bottom towed gear Impacts Evidence document[7], Changes in suspended sediment in the water column may have a range of biological effects on different species within the habitat, affecting their ability to feed or breathe. The impacts on the biological communities of sediment habitats from smothering and siltation as variable depending on the species present. Research used to inform the Impacts Evidence document[7] indicates that sedentary, filter or suspension feeders, such as the species identified in the biotopes with medium sensitivity and low resistance to the pressures described in this section were likely to be impacted most whereas mobile epifauna appear highly resilient and resistant.

Based on the rationale above for the relevant pressures identified, bottom towed gear activity has the potential to impact biological communities and the overall ecosystem function of the sediment feature found within the site. Given the sensitivity of biotopes identified within the sediment features, low resistance to this type of fishing activity and slow recoverability, it is likely that the ongoing use of bottom towed gear at the levels described will pose a significant risk of hindering the achievement of the conservation objective of Greater Haig Fras MPA.

Sea-pen and burrowing megafauna communities.

- Abrasion or disturbance and penetration of the substrate on the surface of the seabed.
- removal of target species

Table A2. 5 in Annex 2 outlines the sea-pen and burrowing communities biotopes with high or medium sensitivity to abrasion and penetration pressures that may be present in the site.

Burrowing megafauna, such as Norwegian lobster (*N.norvegicus*), a target species in this MPA, are generally considered less sensitive to abrasion and penetration impacts than sea-pens due to their motility and ability to move from areas of disturbance. Sea-pens, although able to retract into their burrows and bend in some instances, are fixed and unable to move from potential disturbance episodes. Hence, sea-pens are considered to be the species most at risk from the abrasion or disturbance and penetration pressure and therefore this part of the assessment focusses on this feature.

Section 4.2 of the bottom towed gear Impacts Evidence document[7] indicates that these fishing methods have the potential to damage the fragile components of the feature, such as sea-pens which can result in a change to the benthic community structure and the resuspension of sediment particles. Sea-pens are slow growing and particularly sensitive to trawling as the whole animal can be removed from their burrows. Overall, there is limited literature available on the interactions of bottom towed gear with sea-pen and burrowing megafauna communities, however, the feature is considered highly vulnerable to disturbance from this fishing method.

Bottom towed gears have the potential to significantly impact sea-pen and burrowing megafauna communities, therefore management of these fishing gears is required for this site. Given the low resilience of the feature biotopes to bottom towed gear, and slow recoverability, it is likely that the ongoing use of bottom towed gear at described levels will pose a significant risk of hindering the achievement of the conservation objectives of Greater Haig Fras MPA. This would also ensure the small *Nephrops* fishery was managed.

Therefore, MMO concludes that the ongoing use of bottom towed gear at described levels does pose a significant risk of hindering the achievement of the conservation objectives of Greater Haig Fras MPA.

4.3.3 Traps

The following features of Greater Haig Fras MPA have been considered in relation to pressures from traps:

Subtidal coarse sediment; subtidal sand; subtidal mixed sediments; subtidal mud; sea-pen and burrowing megafauna communities.

The relevant pressures on the features of Greater Haig Fras MPA (outlined above) from traps were identified in **Table 4** and are:

- abrasion or disturbance of the substrate on the surface of the seabed;
- removal of target species.

As noted above, impacts from the removal of target and non-target species pressure are not being considered in detail in this assessment, as they are assessed more completely within the abrasion pressure.

Impacts on these features relating to abrasion or disturbance of the substrate on the surface of the seabed occur primarily during setting and retrieval of traps, as well as by their movement over the seabed during rough weather.

Subtidal coarse sediment; subtidal sand; subtidal mixed sediments; subtidal mud.

Traps and anchored nets and lines fishing gear exert similar pressures on the biotopes associated with the sediment features of the site, therefore the biotopes identified as having medium sensitivity to abrasion in the anchored nets and lines section (**section 4.3.1**) also apply here for the traps section.

As described in section 9.4 of the traps Impacts Evidence document[8], abrasion impacts from this gear type are unlikely to be a concern unless they occur where particularly sensitive species are present or when fishing occurs at damaging levels of intensity. **Section 4.2** describes the fishing activity within Greater Haig Fras MPA. According to VMS data for over 12 m vessels, the use of pots/creels in the site is minimal with an average count of 32 VMS record between 2016 and 2021. No landings data has been recorded for vessels over 12 m in the same data reporting period, however minimal landings of 0.10 tonnes have been recorded for vessels under 12 m. Given the limited traps fishing activity being undertaken at the site, only limited interaction between traps and the sediment features is likely to be occurring.

There is limited primary evidence to indicate lasting impacts on sediment features from traps, however traps are considered of limited concern due to the generally high energy environments where these subtidal sediment features occur and the likely greater impact of natural disturbance in these environments compared with potting. Overall, traps are unlikely to adversely affect these features outlined in this section, and therefore are unlikely to pose a significant risk of hindering the conservation objectives of Greater Haig Fras MPA.

Sea-pen and burrowing megafauna communities
The main pressures on subtidal sediment features and sea-pen and burrowing megafauna communities of Greater Haig Fras MPA from traps were identified in **Table 4** and are:

- abrasion or disturbance of the substrate on the surface of the seabed.

As noted above, impacts from the removal of target and non-target species pressure is not being considered in detail in this assessment, as it is assessed more completely within the abrasion pressure.

Traps and anchored nets and lines fishing gear exert similar pressures on sea-pen and burrowing megafauna communities, therefore the narrative in the anchored nets and lines section also applies here for the traps section.

As described in section 4.3.1 of the traps Impacts Evidence document[8], abrasion impact from traps are possible through the interaction between the seabed and the gear itself, including associated lines and anchors. Of the five biotopes outlined for sea-pens in **Table A2. 5** in Annex 2**,** two have indicated high sensitivity to abrasion impacts of traps, whilst the remaining three have medium sensitivity.

Burrowing megafaunas, such as Norwegian lobster *Nephrops norvegicus* are generally considered less sensitive to abrasion and penetration impacts than sea pens due to their motility and ability to move from areas of disturbance. Sea-pens, although able to retract into their burrows and bend in some instances, are fixed and unable to move from potential disturbance episodes. Therefore, this assessment focuses on the most sensitive component of this designated feature, sea-pens.

There is limited direct evidence of the impacts of static gears such as traps on the physical environment that sea-pen and burrowing megafauna communities inhabit. There is potential for impacts on the biological communities, however recovery from impacts has been demonstrated, such as sea-fans bending and sea-pens reinserting themselves following uprooting. Although studies have observed no lasting effects on the substrate, it remains unknown whether they would suffer from potential long-term effects if repeatedly uprooted. *Virgularia mirabilis* is able to retract into a burrow into which the whole colony can withdraw when disturbed, thus reducing the likelihood of damage or mortality from fishing activity. Overall, literature suggests that traps are unlikely to significantly impact sea-pen and burrowing megafauna communities. Given the limited trap fishing activity undertaken between 2016 and 2020, only limited interaction between traps and the sediment features is likely to be occurring. Overall, traps are unlikely to adversely affect the features outlined in this section and therefore are unlikely to pose a significant risk of hindering the conservation objectives of Greater Haig Fras MPA.

Therefore, MMO concludes that the ongoing use of traps at the levels described does not pose a significant risk of hindering the achievement of the conservation objectives of Greater Haig Fras MPA.

4.4 Part B conclusion

The assessment of anchored nets and lines, bottom towed gears, and traps on the subtidal coarse sediment; subtidal sand; subtidal mixed sediments; subtidal mud and Sea-pen and burrowing megafauna communities features of Greater Haig Fras MPA has concluded that:

- the ongoing use of anchored nets and lines and traps at the levels described does not pose a significant risk of hindering the achievement of the conservation objectives of the MPA;
- there is a significant risk of the ongoing use of bottom towed gears hindering the achievement of the conservation objectives of the MPA.

Management measures will therefore be implemented for bottom towed gears. **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 way in which the activity could impact the benthic features of 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 significant risk of hindering the achievement of the site's conservation objectives 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.

There may be operational and historic submarine cables within this MPA, these cables 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 operation and maintenance activity will be temporary with limited seabed impacts and is therefore unlikely to have significant in-combination effects with assessed fishing.

Bottom towed gears were identified in Part B as requiring management to avoid posing a significant risk of hindering the achievement of the site conservation objectives. Anchored nets and lines and traps are the only remaining fishing activities occurring within Greater Haig Fras 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 one project, within the 5 km buffer applied. **Table 5** shows this activity and the relevant category from the JNCC Pressures-Activities Database (PAD)[13].

Table 5: Summary of marine licensable activities and associated PAD categories.

Marine licence case reference number[14]	PAD Category	Description
MLA/2022/00239	Anchorage and moorings: Construction	Installation of 4 sets of floating buoy FLiDAR/seabed mooring with upward looking ADCP at a maximum of four locations to collect metocean data (wave and currents). Known as the Celtic Sea Metocean survey. Area of search 4 overlaps with the 5 km buffer of Greater Haig Fras MPA; specific locations for installation within these areas will be identified prior to deployment. Outside of the site boundary. **No direct or indirect pressure pathway for impact and therefore, no in-combination effects possible**

[13] JNCC Pressures-Activities Database (PAD**):** hub.jncc.gov.uk/assets/97447f16-9f38-49ff-a3af-56d437fd1951)

[14] Detail on the marine licence activity can be viewed on the public register of marine licence applications and decisions, searching by the marine licence case reference number: Marine case management system - Public register - MCMS (marinemanagement.org.uk) URL: www.marinelicensing.marinemanagement.org.uk/mmofox5/fox/live/MMO_PUBLIC_REGISTER

The PAD and **Table 3** from **section 3.3**, were 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 non-fishing activities 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 and non-fishing activities.

	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

Fisheries vs fisheries in-combination pressures will be considered in this section. The pressures exerted by the non-fishing activity will also be considered in-combination with the anchored nets and lines and traps fishing pressures.

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 **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 sea-pen and burrowing megafauna communities feature is considered not to be at significant risk from these pressures via static gear use in this site (**Section 4.3**). 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 annual average VMS records for over 12 m vessels within the MPA totalled 1095, 1063 for anchored nets and lines and 32 for traps. For under 12 m vessels, between 2016 and 2020, the annual average fishing effort estimated to have been derived from the MPA via anchored nets and lines was 1.24 days (Annex 1, calculated from **Table A1. 8**). For the same period (2016-2020), the total fishing effort (under 12s) estimated to have been derived from the MPA were 7.46 days for anchored nets and lines (Annex 1, calculated from **Table A1. 8**). There is no fishing effort data available for vessels under 12 m using traps. The fishing effort data is further supported by the estimated live weight landings for under 12 m vessels that equal an annual average of 1.47 tonnes, 0.10 tonnes for traps and 1.37 tonnes for anchored nets and lines, between 2016 and 2020 (**Section 4.2**).

The combined impacts from anchored nets and lines and traps could potentially increase the risk of negative effects from the pressure abrasion and disturbance of the substrate on the surface of the seabed. VMS records for over 12 m vessels using traps are concentrated around the western portion of the MPA over subtidal sand and subtidal mud features, with some activity further into the site within subtidal sand and subtidal coarse sediment features. VMS records show that anchored net and line activity occurs throughout the whole site, overlapping with traps around these sediment features. Available literature suggests that static gears have relatively low impact on subtidal sand and subtidal mud features and that sediment habitats are resilient to all but intense fishing activity. The most sensitive component of the burrowing megafauna feature is sea-pens as they are fixed within the sediment therefore are vulnerable to abrasion and disturbance from static gear activity. These species show some resilience to disturbance as they may be able to retract into their burrows and bend in some instances; similarly, some sea pens may reinsert themselves into the sediment if uprooted. Consequently, the impact of abrasion pressures on these species increases with the intensity of fishing activity. Considering that there were no landings recorded for the over 12 m vessels using traps, and annual average landings for under 12 m vessels were very low (0.10) it may be concluded that fishing intensity for traps is very low. In addition, with annual average landings from over 12 m vessels of 151.9 tonnes, and low average fishing effort for under 12 m vessels (1.24 days), the use of anchored nets and lines alone is considered to pose no risk to the conservation objectives of the site. As such, considering the resilience of the features affected and the addition of such low-level trap activity, any in-combination impact of anchored nets and lines and traps is considered insignificant.

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

Activities associated with the installation of floating buoy moorings which might cause abrasion or disturbance of the seabed relate to anchorage of buoys. These will be in-situ for a period of up to 12 months, with occasional maintenance visits planned in that period. These anchoring solutions can smother or impede the growth of biological communities within their footprint and have the potential to cause localised physical damage through abrasion and scouring of the substrate in which they are located, particularly in the highly hydrodynamic conditions of the Celtic Sea and Western Channel.

As detailed in **section 5.2.1** abrasion and disturbance of seabed surface substrate, at described activity levels anchored nets and lines and traps are not considered to be causing significant pressure through abrasion and disturbance. It is possible that activities linked to the gravity based mooring solution, in-combination with anchored nets and lines and traps may increase the potential for this pressure to have negative cumulative effects on the designated features of the MPA. However, the buoys and gravity based mooring solutions will be installed adjacent to and not within the boundary of the MPA. Therefore, there are no medium to high-risk pressure pathways associated with these marine licensable activities that could have an impact on the designated features within the site boundary and are therefore not considered further in this in-combination assessment.

Therefore, MMO concludes that the combined pressures from anchored nets and lines and traps and other relevant activities will not result in a significant risk of hindering the achievement of the conservation objectives for the Greater Haig Fras MPA.

5.4 Part C conclusion

MMO concludes that fishing in-combination with other relevant activities will not result in a significant risk of hindering the achievement of the conservation objectives for the Greater Haig Fras 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 bottom towed gear, anchored nets and lines and traps are capable of affecting (other than insignificantly) the designated features of Greater Haig Fras MPA.

Part B of this assessment concluded that ongoing use of bottom towed gear on the sedimentary features and sea-pen and burrowing megafauna communities feature of Greater Haig Fras MPA may result in a significant risk of hindering the achievement of the conservation objectives of the MPA. Part B also concluded that the ongoing use of anchored nets and lines and traps at the described levels does not pose a significant risk of hindering the achievement of the conservation objectives.

Part C of this assessment concluded that combined pressures from anchored nets and lines and traps and other relevant activities do not pose 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 conservation objectives, MMO propose to implement a byelaw to prohibit the use of bottom towed gear on the sedimentary features and sea-pen and burrowing megafauna communities feature of Greater Haig Fras 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[5] document.

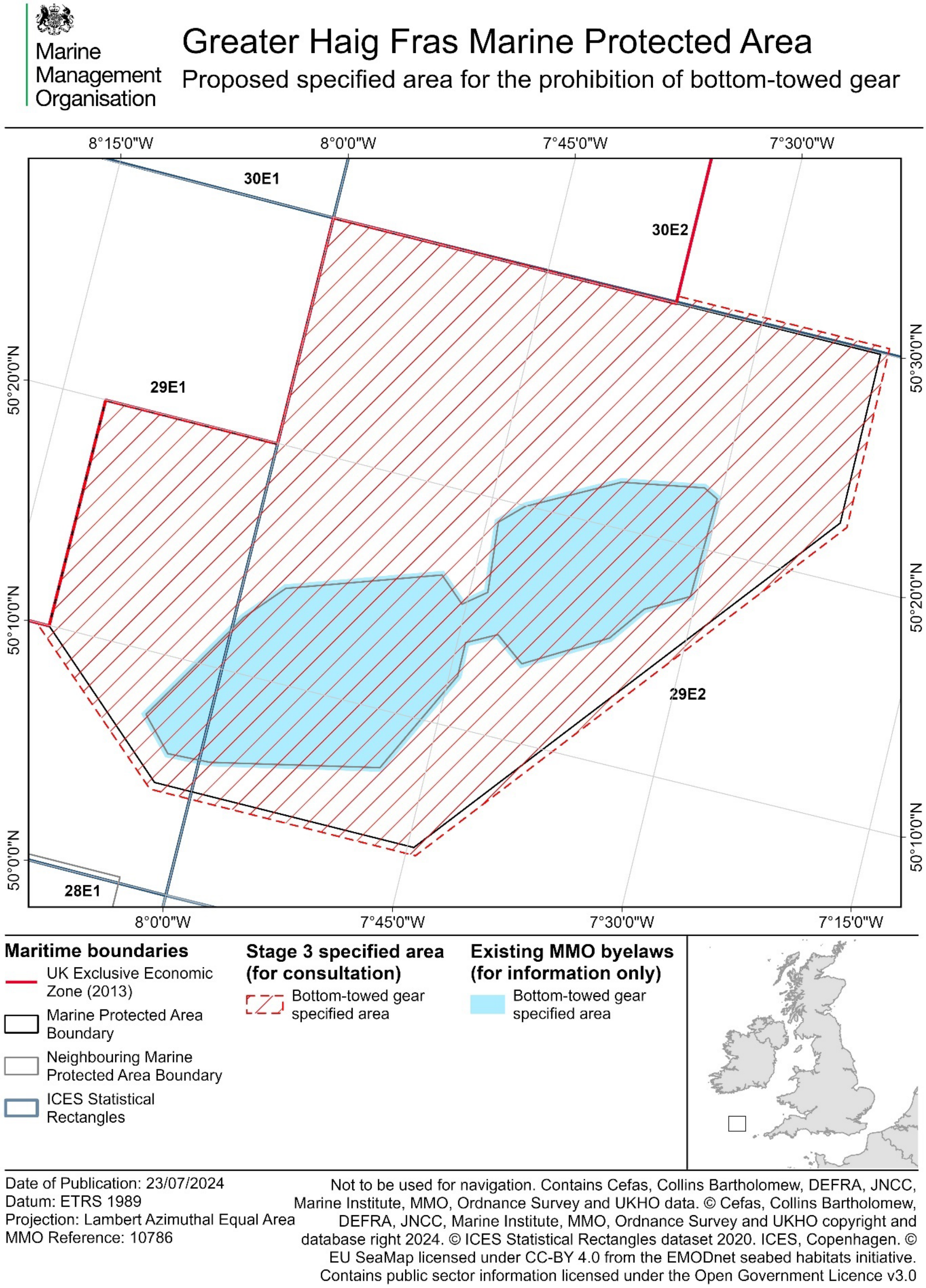

Figure 2: Map of proposed management.

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); and
- 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

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Annex 1: Fishing activity data

Table A1. 1: VMS record count per nation group (UK and EU Member State (EU)) and proportional activity (%), per gear, per gear group, per year (2016 to 2021), totals and annual average (2016 to 2021). All numbers are rounded to the nearest whole number.

			2016		2017		2018		2019		2020		2021		Total (2016 to 2021)		Average (2016 to 2021)
Gear group	Gear code	Nation group	Count	%	Count	%	Count	%	Count	%	Count	%	Count	%	Count	%	Count
Anchored Net/Line	GN	UK	308	100	148	100	134	100	109	100	97	100	195	100	991	100	165
	GN Total		**308**	**17**	**148**	**15**	**134**	**21**	**109**	**6**	**97**	**22**	**195**	**34**	**991**	**16**	**165**
	GNS	EU	399	38	543	75	324	70	424	89	87	61	0	0	1,777	58	296
	GNS	UK	660	62	182	25	136	30	53	11	55	39	187	100	1,273	42	212
	GNS Total		**1,059**	**58**	**725**	**75**	**460**	**71**	**477**	**25**	**142**	**32**	**187**	**33**	**3,050**	**48**	**508**
	GTR	UK	206	100	11	100	2	100	42	100	8	100	9	100	278	100	46
	GTR Total		**206**	**11**	**11**	**1**	**2**	**0**	**42**	**2**	**8**	**2**	**9**	**2**	**278**	**4**	**46**
	LLS	EU	258	100	88	100	53	100	1,294	100	190	100	175	98	2,058	100	343
	LLS	UK	0	0	0	0	0	0	0	0	0	0	3	2	3	0	1
	LLS Total		**258**	**14**	**88**	**9**	**53**	**8**	**1,294**	**67**	**190**	**43**	**178**	**31**	**2,061**	**32**	**344**
Anchored Net/Line Total			**1,831**	**26**	**972**	**15**	**649**	**16**	**1,922**	**36**	**437**	**17**	**569**	**17**	**6,380**	**22**	**1,063**
Demersal Seine	SDN	EU	51	100	42	100	0	0	2	100	2	100	0	0	97	100	16
	SDN Total		**51**	**31**	**42**	**49**	**0**	**0**	**2**	**3**	**2**	**13**	**0**	**0**	**97**	**22**	**16**
	SPR	EU	112	100	44	100	65	100	70	100	11	100	0	0	302	100	50
	SPR Total		**112**	**67**	**44**	**51**	**65**	**100**	**70**	**97**	**11**	**69**	**0**	**0**	**302**	**68**	**50**

			2016		2017		2018		2019		2020		2021		Total (2016 to 2021)		Average (2016 to 2021)
Gear group	**Gear code**	**Nation group**	**Count**	**%**	**Count**	**%**	**Count**	**%**	**Count**	**%**	**Count**	**%**	**Count**	**%**	**Count**	**%**	**Count**
	SSC	EU	3	100	0	0	0	0	0	0	3	100	38	100	44	100	7
	SSC Total		**3**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**3**	**19**	**38**	**100**	**44**	**10**	**7**
Demersal Seine Total			**166**	**2**	**86**	**1**	**65**	**2**	**72**	**1**	**16**	**1**	**38**	**1**	**443**	**2**	**74**
Demersal trawl	**OTB**	EU	3,279	99	3,966	100	2,132	100	2,311	100	921	100	1,497	100	14,106	100	2,351
	OTB	UK	17	1	18	0	3	0	1	0	0	0	0	0	39	0	7
	OTB Total		**3,296**	**79**	**3,984**	**82**	**2,135**	**79**	**2,312**	**90**	**921**	**63**	**1,497**	**53**	**14,145**	**76**	**2,358**
	OTT	EU	874	99	858	99	540	99	241	100	529	100	1,283	100	4,325	100	721
	OTT	UK	6	1	7	1	6	1	0	0	0	0	2	0	21	0	4
	OTT Total		**880**	**21**	**865**	**18**	**546**	**20**	**241**	**9**	**529**	**36**	**1,285**	**46**	**4,346**	**23**	**724**
	TBB	EU	19	100	17	100	25	100	2	100	7	100	5	100	75	100	13
	TBB Total		**19**	**0**	**17**	**0**	**25**	**1**	**2**	**0**	**7**	**0**	**5**	**0**	**75**	**0**	**13**
	TBN	EU	0	0	0	0	0	0	0	0	0	0	13	100	13	57	2
	TBN	UK	0	0	10	100	0	0	0	0	0	0	0	0	10	43	2
	TBN Total		**0**	**0**	**10**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**13**	**0**	**23**	**0**	**4**
Demersal trawl Total			**4,195**	**59**	**4,876**	**74**	**2,706**	**69**	**2,555**	**48**	**1,457**	**58**	**2,800**	**82**	**18,589**	**64**	**3,098**
Dredge	**DRB**	EU	90	100	3	100	1	100	0	0	3	100	0	0	97	100	16
	DRB Total		**90**	**100**	**3**	**100**	**1**	**100**	**0**	**0**	**3**	**100**	**0**	**0**	**97**	**100**	**16**
Dredge Total			**90**	**1**	**3**	**0**	**1**	**0**	**0**	**0**	**3**	**0**	**0**	**0**	**97**	**0**	**16**
Midwater - Gill Drift	**GND**	EU	75	100	16	100	5	100	0	0	0	0	0	0	96	100	16
	GND Total		**75**	**100**	**16**	**100**	**5**	**100**	**0**	**0**	**0**	**0**	**0**	**0**	**96**	**100**	**16**
Midwater - Gill Drift Total			**75**	**1**	**16**	**0**	**5**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**96**	**0**	**16**

			2016		2017		2018		2019		2020		2021		Total (2016 to 2021)		Average (2016 to 2021)
Gear group	**Gear code**	**Nation group**	**Count**	**%**	**Count**	**%**	**Count**	**%**	**Count**	**%**	**Count**	**%**	**Count**	**%**	**Count**	**%**	**Count**
Midwater - surrounding	**PS**	EU	30	100	67	100	35	100	38	100	219	100	0	0	389	100	65
	PS Total		**30**	**100**	**67**	**100**	**35**	**100**	**38**	**100**	**219**	**100**	**0**	**0**	**389**	**100**	**65**
Midwater - surrounding Total			**30**	**0**	**67**	**1**	**35**	**1**	**38**	**1**	**219**	**9**	**0**	**0**	**389**	**1**	**65**
Midwater Hook/Lines	**LHP**	EU	0	0	13	100	73	100	89	100	117	100	0	0	292	100	49
	LHP Total		**0**	**0**	**13**	**100**	**73**	**50**	**89**	**86**	**117**	**100**	**0**	**0**	**292**	**77**	**49**
	LLD	EU	0	0	0	0	72	100	14	100	0	0	0	0	86	100	14
	LLD Total		**0**	**0**	**0**	**0**	**72**	**50**	**14**	**14**	**0**	**0**	**0**	**0**	**86**	**23**	**14**
Midwater Hook/Lines Total			**0**	**0**	**13**	**0**	**145**	**4**	**103**	**2**	**117**	**5**	**0**	**0**	**378**	**1**	**63**
Midwater Trawl	**OTM**	EU	657	100	513	100	312	100	576	100	249	100	4	100	2,311	100	385
	OTM Total		**657**	**100**	**513**	**97**	**312**	**98**	**576**	**100**	**249**	**98**	**4**	**80**	**2,311**	**99**	**385**
	PTM	EU	0	0	17	100	7	100	0	0	5	100	1	100	30	100	5
	PTM Total		**0**	**0**	**17**	**3**	**7**	**2**	**0**	**0**	**5**	**2**	**1**	**20**	**30**	**1**	**5**
Midwater Trawl Total			**657**	**9**	**530**	**8**	**319**	**8**	**576**	**11**	**254**	**10**	**5**	**0**	**2,341**	**8**	**390**
Traps	**FPO**	EU	104	100	31	100	21	100	33	100	0	0	0	0	189	100	32
	FPO Total		**104**	**100**	**31**	**100**	**21**	**100**	**33**	**100**	**0**	**0**	**0**	**0**	**189**	**100**	**32**
Traps Total			**104**	**1**	**31**	**0**	**21**	**1**	**33**	**1**	**0**	**0**	**0**	**0**	**189**	**1**	**32**
Unknown	**NK**	EU	0	0	0	0	0	0	0	0	2	100	0	0	2	67	0
	NK	Faroe Islands	1	100	0	0	0	0	0	0	0	0	0	0	1	33	0
	NK Total		**1**	**100**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**100**	**0**	**0**	**3**	**100**	**1**
Unknown Total			**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**3**	**0**	**1**
Grand total			**7,149**	**10**	**6,594**	**9**	**3,946**	**6**	**5,299**	**8**	**2,505**	**4**	**3,412**	**5**	**28,905**	**7**	**4,818**

Table A1. 2: UK live weight landings tonnage (t) estimates by gear from vessels over 12 m in length in the MMO section of Greater Haig Fras MPA (2016 to 2020). All numbers are rounded to two decimal places.

Gear group	Gear code	2016	2017	2018	2019	2020	Total (2016 to 2020)	Average (2016 to 2020)
Anchored Net/Line	GN	87.16	49.43	52.56	30.51	26.36	246.02	49.20
	GNS	213.46	90.49	38.71	12.79	11.62	367.07	73.41
	GTR	13.54	6.56	1.79	6.46	0.72	29.06	5.81
Anchored Net/Line Total		**314.16**	**146.48**	**93.06**	**49.76**	**38.69**	**642.15**	**128.43**
Demersal trawl	OTB	2.96	2.52	0.42	0.56	0	6.47	1.29
	OTT	1.23	1.34	0.71	0	0	3.28	0.66
	TBN	0	0.98	0	0	0	0.98	0.20
Demersal trawl Total		**4.19**	**4.85**	**1.13**	**0.56**	**0**	**10.73**	**2.15**
Grand Total		**318.35**	**151.33**	**94.19**	**50.32**	**38.69**	**652.88**	**130.58**

Table A1. 3: EU27 live weight landings tonnage (t) estimates by gear from vessels over 12 m in length in the MMO section of Greater Haig Fras MPA (2016 to 2020). All numbers are rounded to two decimal places.

Gear group	Gear code	2016	2017	2018	2019	2020	Total (2016 to 2020)	Average (2016 to 2020)
Anchored Net/Line	GNS	2.18	4.55	2.48	1.82	1.19	12.22	2.44
	LLS	15.35	12.14	1.61	63.96	11.88	104.94	20.99
Anchored Net/Line Total		**17.53**	**16.69**	**4.09**	**65.78**	**13.07**	**117.16**	**23.43**
Demersal Seine	SDN	10.23	6.97	0	0	0	17.21	3.44
	SSC	0.05	0	0	0	25.09	25.14	5.03
Demersal Seine Total		**10.28**	**6.97**	**0.00**	**0.00**	**25.09**	**42.35**	**8.47**
Demersal trawl	OTB	174.20	218.03	79.63	76.04	51.77	599.67	119.93

Gear group	Gear code	2016	2017	2018	2019	2020	Total (2016 to 2020)	Average (2016 to 2020)
	OTT	281.09	208.10	152.56	153.11	70.02	864.89	172.98
	TBB	3.43	1.89	1.46	0.16	0.81	7.74	1.55
Demersal trawl Total		**458.72**	**428.01**	**233.65**	**229.31**	**122.60**	**1,472.29**	**294.46**
Midwater - surrounding	PS	0	0.59	0	0	0	0.59	0.12
Midwater - surrounding Total		**0**	**0.59**	**0**	**0**	**0**	**0.59**	**0.12**
Midwater Hook/Lines	LLD	0	0	41.72	8.54	0	50.27	10.05
Midwater Hook/Lines Total		**0**	**0**	**41.72**	**8.54**	**0**	**50.27**	**10.05**
Midwater Trawl	OTM	0	0.17	0.48	0	0	0.65	0.13
	PTM	0	228.97	66.35	0	0	295.32	59.06
Midwater Trawl Total		**0**	**229.13**	**66.83**	**0**	**0**	**295.96**	**59.19**
Grand Total		**486.53**	**681.40**	**346.29**	**303.63**	**160.77**	**1,978.62**	**395.72**

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

ICES rectangle	Percentage overlap (%)
29E1	8.85
29E2	42.68

Table A1. 5: UK live weight landings tonnage (t) estimates by gear from vessels under 12 m in length for the MMO section of Greater Haig Fras MPA (2016 to 2020). All numbers are rounded to two decimal places.

Gear group	Gear code	2016	2017	2018	2019	2020	Total (2016 to 2020)	Average (2016 to 2020)
Anchored Net/Line	GN	0	0.26	0	0	3.53	3.78	0.76
	GNS	0	0	0	0	0	0	0
Anchored Net/Line Total		**0**	**0.26**	**0**	**0**	**3.53**	**3.78**	**0.76**
Grand total		**0**	**0.26**	**0**	**0**	**3.53**	**3.78**	**0.76**

Table A1. 6: EU27 live weight landings tonnage (t) estimates by gear from vessels under 12 m in length for the MMO section of Greater Haig Fras MPA (2016 to 2020). All numbers are rounded to two decimal places.

Gear group	Gear code	2016	2017	2018	2019	2020	Total (2016 to 2020)	Average (2016 to 2020)
Anchored Net/Line	GNS	0	0.12	0.00	2.95	0	3.06	0.61
Anchored Net/Line Total		**0**	**0.12**	**0.00**	**2.95**	**0**	**3.06**	**0.61**
Demersal trawl	OTB	0	0	0	<0.01	0	<0.01	<0.01
Demersal trawl Total		**0**	**0**	**0**	**<0.01**	**0**	**<0.01**	**<0.01**
Traps	FPO	0	0	0.49	0.01	0	0.49	0.10
Traps Total		**0**	**0**	**0.49**	**0.01**	**0**	**0.49**	**0.10**
Grand Total		**0**	**0.12**	**0.49**	**2.96**	**0.00**	**3.56**	**0.71**

Table A1. 7: Mean annual surface and subsurface SAR values for C-squares intersecting the MMO section of Greater Haig Fras MPA (2016 to 2020).

Gear group	SAR category	2016	2017	2018	2019	2020
Demersal Seines	Surface	0.07	0.15	0.06	0.05	0.33
	Subsurface	<0.01	0	<0.01	<0.01	0.02
Dredges	Surface	0	0	0	0	0
	Subsurface	0	0	0	0	0
Demersal Trawls	Surface	2.15	2.30	1.35	1.31	0.72
	Subsurface	0.31	0.28	0.21	0.24	0.07
Bottom Towed Gear	Surface	2.22	2.45	1.41	1.37	1.05
	Subsurface	0.31	0.29	0.21	0.24	0.08

Table A1. 8: Fishing effort (days) recorded by UK vessels under 12 m in length, separated by gear type for the area of Greater Haig Fras MPA that intersects the marine portion of ICES rectangles 29E1 and 29E2 (2016 to 2021). ICES rectangle level data has been apportioned to the MPA based on the percentage area of the ICES rectangle that intersects the MPA (Table A1. 4).

Gear group	Fishing effort (days at sea)							
	2016	2017	2018	2019	2020	2021	Total (2016 to 2021)	Average (2016 to 2021)
Anchored nets and lines	0	0.43	0	0	2.91	4.12	7.46	1.24
Static gear total	**0**	**0.43**	**0**	**0**	**2.91**	**4.12**	**7.46**	**1.24**
MPA total	**0**	**0.43**	**0**	**0**	**2.91**	**4.12**	**7.46**	**1.24**

Annex 2: Biotope information

Table A2. 1: Subtidal coarse sediment biotopes that may be found within Greater Haig Fras MPA with sensitivity to the abrasion / disturbance and penetration of the substrate on the surface of the seabed, smothering and siltation rate changes (light) and changes in

Biotope	Sensitivity
Sparse fauna on highly mobile sublittoral shingle (cobbles and pebbles)(Tillin, 2023)	Abrasion: Not sensitive Penetration: Not sensitive Changes in suspended solids (water clarity): Not sensitive Smothering and siltation rate changes (light): Not sensitive
Moerella spp. with venerid bivalves in infralittoral gravelly sand (Tillin and Watson, 2023e)	Abrasion: Low Penetration: Low Changes in suspended solids (water clarity): Low Smothering and siltation rate changes (light): Low Removal of target species: Medium
Hesionura elongata and *Microphthalmus similis* with other interstitial polychaetes in infralittoral mobile coarse sand (Marshall, Ashley and Watson, 2023)	Abrasion: Low Penetration: Medium Changes in suspended solids (water clarity): Not sensitive Smothering and siltation rate changes (light): Low
Glycera lapidum in impoverished infralittoral mobile gravel and sand (Tillin and Watson, 2023c)	Abrasion: Low Penetration: Low Changes in suspended solids (water clarity): Not sensitive Smothering and siltation rate changes (light): Low Removal of target species: Medium
Dense *Lanice conchilega* and other polychaetes in tide-swept infralittoral sand and mixed gravelly sand (McQuillan, Tillin and Watson, 2023)	Abrasion: Not sensitive Penetration: Not sensitive Changes in suspended solids (water clarity): Not sensitive Smothering and siltation rate changes (light): Not sensitive
Pomatoceros triqueter with barnacles and bryozoan crusts on unstable circalittoral cobbles and pebbles (Tyler-Walters, Tillin and Watson, 2024)	Abrasion: Low Penetration: Low Changes in suspended solids (water clarity): Not sensitive Smothering and siltation rate changes (light): Not sensitive

Biotope	Sensitivity
Mediomastus fragilis, *Lumbrineris* spp. and venerid bivalves in circalittoral coarse sand or gravel (Tillin and Watson, 2023d)	Abrasion: Low Penetration: Low Changes in suspended solids (water clarity): Low Smothering and siltation rate changes (light): Low
Protodorvillea kefersteini and other polychaetes in impoverished circalittoral mixed gravelly sand (Tillin and Watson, 2023g)	Abrasion: Low Penetration: Low Changes in suspended solids (water clarity): Not sensitive Smothering and siltation rate changes (light): No evidence (NEv)
Neopentadactyla mixta in circalittoral shell gravel or coarse sand (Tyler-Walters, Durkin and Watson, 2023)	Abrasion: Not sensitive Penetration: Medium Changes in suspended solids (water clarity): Medium Smothering and siltation rate changes (light): Not sensitive Removal of non-target species: Medium
Branchiostoma lanceolatum in circalittoral coarse sand with shell gravel (Tillin and Watson, 2023a)	Abrasion: Low Penetration: Medium Changes in suspended solids (water clarity): Not sensitive Smothering and siltation rate changes (light): Low
Scallops on shell gravel and sand with some sand scour	No assessment available
Glycera lapidum, *Thyasira* spp. and *Amythasides macroglossus* in offshore gravelly sand (Tillin and Watson, 2023b)	Abrasion: Low Penetration: Low Changes in suspended solids (water clarity): Not sensitive Smothering and siltation rate changes (light): Low
Hesionura elongata and *Protodorvillea kefersteini* in offshore coarse sand (Tillin and Ashley, 2016)	Abrasion: Low Penetration: Low Changes in suspended solids (water clarity): No evidence (NEv) Smothering and siltation rate changes (light): No evidence (NEv)

Table A2. 2: Subtidal mixed sediments biotopes that may be found within Greater Haig Fras MPA with sensitivity to the abrasion / disturbance and penetration of the substrate on the surface of the seabed, smothering and siltation rate changes (light) and changes in

Biotope	Sensitivity
Venerupis senegalensis, *Amphipholis squamata* and *Apseudes latreilli* in infralittoral mixed sediment (Tillin, Rayment and Watson, 2023)	Abrasion: Low Penetration: Low Changes in suspended solids (water clarity): Low Smothering and siltation rate changes (light): Low
Cerianthus lloydii and other burrowing anemones in circalittoral muddy mixed sediment (Perry and Watson, 2024)	Abrasion: Medium Penetration: Medium Changes in suspended solids (water clarity): Not sensitive Smothering and siltation rate changes (light): Medium
Cerianthus lloydii with *Nemertesia* spp. and other hydroids in circalittoral muddy mixed sediment (Perry and Watson, 2023)	Abrasion: Medium Penetration: Medium Changes in suspended solids (water clarity): Not sensitive Smothering and siltation rate changes (light): Medium
Mysella bidentata and *Thyasira* spp. in circalittoral muddy mixed sediment (De-Bastos, Marshall and Watson, 2023)	Abrasion: Low Penetration: Low Changes in suspended solids (water clarity): Not sensitive Smothering and siltation rate changes (light): Not sensitive
Flustra foliacea and *Hydrallmania falcata* on tide-swept circalittoral mixed sediment (Readman and Watson, 2024)	Abrasion: Medium Penetration: Medium Changes in suspended solids (water clarity): Not sensitive Smothering and siltation rate changes (light): Not sensitive
Ophiothrix fragilis and/or *Ophiocomina nigra* brittlestar beds on sublittoral mixed sediment (De-Bastos, Hill, Garrard, *et al.*, 2023)	Abrasion: Medium Penetration: Medium Changes in suspended solids (water clarity): Not sensitive Smothering and siltation rate changes (light): Medium
Polychaete-rich deep *Venus* community in offshore mixed sediments (Tillin and Watson, 2023f)	Abrasion: Low Penetration: Low Changes in suspended solids (water clarity): Low Smothering and siltation rate changes (light): Low

Table A2. 3: Subtidal sand biotopes that may be found within Greater Haig Fras MPA with sensitivity to the abrasion / disturbance and penetration of the substrate on the surface of the seabed, smothering and siltation rate changes (light) and changes in suspended s

Biotope	Sensitivity
Echinocardium cordatum and *Ensis* spp. in lower shore and shallow sublittoral slightly muddy fine sand (De-Bastos, Hill, Lloyd, *et al.*, 2023)	Abrasion: Medium Penetration: Medium Changes in suspended solids (water clarity): Not sensitive Smothering and siltation rate changes (light): Not sensitive
Amphiura brachiate with *Astropecten irregularis* and other echinoderms in circalittoral muddy sand (De-Bastos, Lloyd and Watson, 2023)	Abrasion: Medium Penetration: Medium Changes in suspended solids (water clarity): Not sensitive Smothering and siltation rate changes (light): Low
Maldanid polychaetes and *Eudorellopsis deformis* in deep circalittoral sand or muddy sand (Ashley, 2016)	Abrasion: Medium Penetration: Medium Changes in suspended solids (water clarity): Not sensitive Smothering and siltation rate changes (light): Not sensitive
Owenia fusiformis and *Amphiura filiformis* in deep circalittoral sand or muddy sand (De-Bastos, 2023)	Abrasion: Medium Penetration: Medium Changes in suspended solids (water clarity): Not sensitive Smothering and siltation rate changes (light): Low
Semi-permanent tube-building amphipods and polychaetes in sublittoral sand (De-Bastos, Rayment, *et al.*, 2023)	Abrasion: Low Penetration: Medium Changes in suspended solids (water clarity): Low Smothering and siltation rate changes (light): Low

Table A2. 4: Subtidal mud biotopes that may be found within Greater Haig Fras MPA with sensitivity to the abrasion / disturbance and penetration of the substrate on the surface of the seabed, smothering and siltation rate changes (light) and changes in suspended so

Biotope	Sensitivity
Amphiura filiformis and *Nuculoma tenuis* in circalittoral and offshore muddy sand (De-Bastos and Watson, 2023a)	Abrasion: Medium Penetration: Medium Changes in suspended solids (water clarity): Not sensitive Smothering and siltation rate changes (light): Not sensitive
Virgularia mirabilis and *Ophiura* spp. with Pecten maximus on circalittoral sandy or shelly mud (Hill *et al.*, 2024b)	Abrasion: Medium Penetration: **High** Changes in suspended solids (water clarity): Medium Smothering and siltation rate changes (light): Medium
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)	Abrasion: Medium Penetration: **High** Changes in suspended solids (water clarity): Medium Smothering and siltation rate changes (light): Medium
Sea-pens and burrowing megafauna in circalittoral fine mud (Hill *et al.*, 2023)	Abrasion: Medium Penetration: **High** Changes in suspended solids (water clarity): Not sensitive Smothering and siltation rate changes (light): Not sensitive
Ampharete falcata turf with *Parvicardium ovale* on cohesive muddy sediment near margins of deep stratified seas (De-Bastos and Hill, 2016)	Abrasion: Medium Penetration: Medium Changes in suspended solids (water clarity): Not sensitive Smothering and siltation rate changes (light): Low
Sagartiogeton undatus and *Ascidiella aspersa* on infralittoral sandy mud (Readman and Watson, 2023)	Abrasion: Medium Penetration: Medium Changes in suspended solids (water clarity): Not sensitive Smothering and siltation rate changes (light): Not sensitive
Amphiura filiformis, *Mysella bidentata* and *Abra nitida* in circalittoral sandy mud (De-Bastos, Marshall and Watson, 2023)	Abrasion: Medium Penetration: Medium Changes in suspended solids (water clarity): Not sensitive Smothering and siltation rate changes (light): Not sensitive

Biotope	Sensitivity
Thyasira spp. and *Nuculoma tenuis* in circalittoral sandy mud (De-Bastos and Watson, 2023b)	Abrasion: Medium Penetration: Medium Changes in suspended solids (water clarity): Not sensitive Smothering and siltation rate changes (light): Not sensitive
Burrowing megafauna and *Maxmuelleria lankesteri* in circalittoral mud (Durkin and Tyler-Walters, 2022)	Abrasion: Medium Penetration: Medium Changes in suspended solids (water clarity): Not sensitive Smothering and siltation rate changes (light): Not sensitive
Brissopsis lyrifera and *Amphiura chiajei* in circalittoral mud (De-Bastos and Budd, 2016)	Abrasion: Medium Penetration: Medium Changes in suspended solids (water clarity): Not sensitive Smothering and siltation rate changes (light): Not sensitive
Levinsenia gracilis and *Heteromastus filifirmis* in offshore circalittoral mud and sandy mud (De-Bastos, 2016a)	Abrasion: Medium Penetration: Medium Changes in suspended solids (water clarity): Not sensitive Smothering and siltation rate changes (light): Not sensitive
Paramphinome jeffreysii, *Thyasira* spp. and *Amphiura filiformis* in offshore circalittoral sandy mud (De-Bastos, 2016c)	Abrasion: Medium Penetration: Medium Changes in suspended solids (water clarity): Not sensitive Smothering and siltation rate changes (light): Not sensitive
Myrtea spinifera and polychaetes in offshore circalittoral sandy mud (De-Bastos, 2016b)	Abrasion: Medium Penetration: Medium Changes in suspended solids (water clarity): Not sensitive Smothering and siltation rate changes (light): Not sensitive
Ampelisca spp., *Photis longicaudata* and other tube-building amphipods and polychaetes in infralittoral sandy mud (Tyler-Walters, De-Bastos and Watson, 2023)	Abrasion: Low Penetration: Medium Changes in suspended solids (water clarity): Low Smothering and siltation rate changes (light): Low

Table A2. 5: Sea-pen and burrowing megafauna communities' biotopes that may be found within Greater Haig Fras MPA with high / medium sensitivity to penetration and/or disturbance of the substrate below the surface of the seabed, smothering and siltation rate change

Biotope	Sensitivity
Seapens and burrowing megafauna in circalittoral fine mud (Hill *et al.*, 2023)	Penetration: High Smothering and siltation rate changes (light): Not sensitive Changes in suspended solids (water clarity): Not sensitive
Seapens, including *Funiculina quadrangularis,* and burrowing megafauna in undisturbed circalittoral fine mud (Tyler-Walters and Watson, 2023)	Penetration: High Smothering and siltation rate changes (light): Not sensitive Changes in suspended solids (water clarity): Not sensitive
Burrowing megafauna and *Maxmuelleria lankesteri* in circalittoral mud (Durkin and Tyler-Walters, 2022)	Penetration: High Smothering and siltation rate changes (light): Not sensitive Changes in suspended solids (water clarity): Not sensitive
Brissopsis lyrifera and *Amphiura chiajei* in circalittoral mud (De-Bastos and Budd, 2016)	Penetration: Medium Smothering and siltation rate changes (light): Not sensitive Changes in suspended solids (water clarity): Not sensitive
Atrina fragilis and echinoderms on circalittoral mud (Tyler-Walters, 2022)	Penetration: High Smothering and siltation rate changes (light): Medium Changes in suspended solids (water clarity): Medium