Marine Management Organisation

MMO Stage 3 Site Assessment: Goodwin Sands MPA (DRAFT)

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MMO Stage 3 Site Assessment: Goodwin Sands MPA

Contents

Executive summary

This assessment analyses the impact of anchored nets and lines and traps on the designated features moderate energy circalittoral rock, Ross worm (*Sabellaria spinulosa*) reefs, subtidal coarse sediment and subtidal sand in the portion of Goodwin Sands Marine Protected Area (MPA) offshore of 6 nautical miles (nm) to determine whether a significant risk of hindering the conservation objectives of the site can be excluded. This assessment also analyses the impact of bottom towed gear on subtidal coarse sediment and subtidal sand in this portion of Goodwin Sands MPA. The assessment sets out the evidence considered and analyses the quality of that evidence.

The assessment finds that without further management, ongoing use of anchored nets and lines and traps on the Ross worm (*S. spinulosa*) reefs of Goodwin Sands MPA at the activity levels described may hinder the achievement of the conservation objectives of the MPA as a result of the impacts of abrasion or disturbance. This assessment also finds that without further management, ongoing use of bottom towed gear on subtidal coarse sediment and subtidal sand in Goodwin Sands MPA at the activity levels described may hinder the achievement of the conservation objectives of the MPA as a result of the impacts of abrasion or disturbance and penetration. Marine Management Organisation (MMO) will therefore introduce management measures to prohibit the use of anchored nets and lines and traps on the Ross worm (*S. spinulosa*) reefs, and bottom towed gears throughout the MPA.

1 Introduction

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

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

2 Site information

2.1 Overview

The following Natural England conservation advice package 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 in this assessment:

- Natural England Conservation Advice – Goodwin Sands MCZ[1]
- Defra Factsheet – Goodwin Sands MCZ[2]

Goodwin Sands MPA is located off Sandwich Bay, within the Southern North Sea, off the coast of Kent and is approximately 277 km^2 in area (**Figure 1**). The MPA straddles the 6 nm limit (1983 baseline), which marks the seaward boundary of the Kent and Essex IFC District within which fishing is regulated by the Kent and Essex Inshore Fisheries and Conservation Authority (IFCA) (0 to 6 nm). MMO are responsible for managing fishing in English waters beyond 6 nm. The area of the site within MMO's jurisdiction is 137 km^2. The relevant statutory nature conservation body for the site is Natural England (0 to 12 nm).

Animal-dominated moderate energy circalittoral rock is found primarily on shaded vertical rock faces within the eastern and southern sections of the site. This feature supports a range of species including bryozoans, pink sea-fan, cup corals, anemones, soft corals, sponges, sea squirts and red algae, as well as commercially important shellfish and fish. The distribution of *S. spinulosa* depends upon the underlying habitat and these species are often co-located with coarse sediment.

Subtidal sand and subtidal coarse sediments occur throughout the site, and the distribution of subtidal sand is particularly concentrated in the west of the site, inshore of 6 nm, where it makes up the Goodwin Sands themselves. These subtidal sediments are home to a range of species including flatfish, polychaetes, and bivalve molluscs. Blue mussels occur in the south of the site, inshore of 6 nm, and are themselves a designated feature of the MPA. The site also includes designation for English Channel outburst flood features. These are evidence of a megaflood that occurred approximately 200,000 years ago leading to the separation of England from mainland Europe.

[1] Goodwin Sands Conservation Advice Package: designatedsites.naturalengland.org.uk/Marine/MarineSiteDetail.aspx?SiteCode=UKMCZ0061 (last accessed 15 May 2023)

[2] Goodwin Sands Defra factsheet: www.gov.uk/government/uploads/system/uploads/attachment_data/file/914643/mcz-goodwin-sands-2019.pdf (last accessed 15 May 2023)

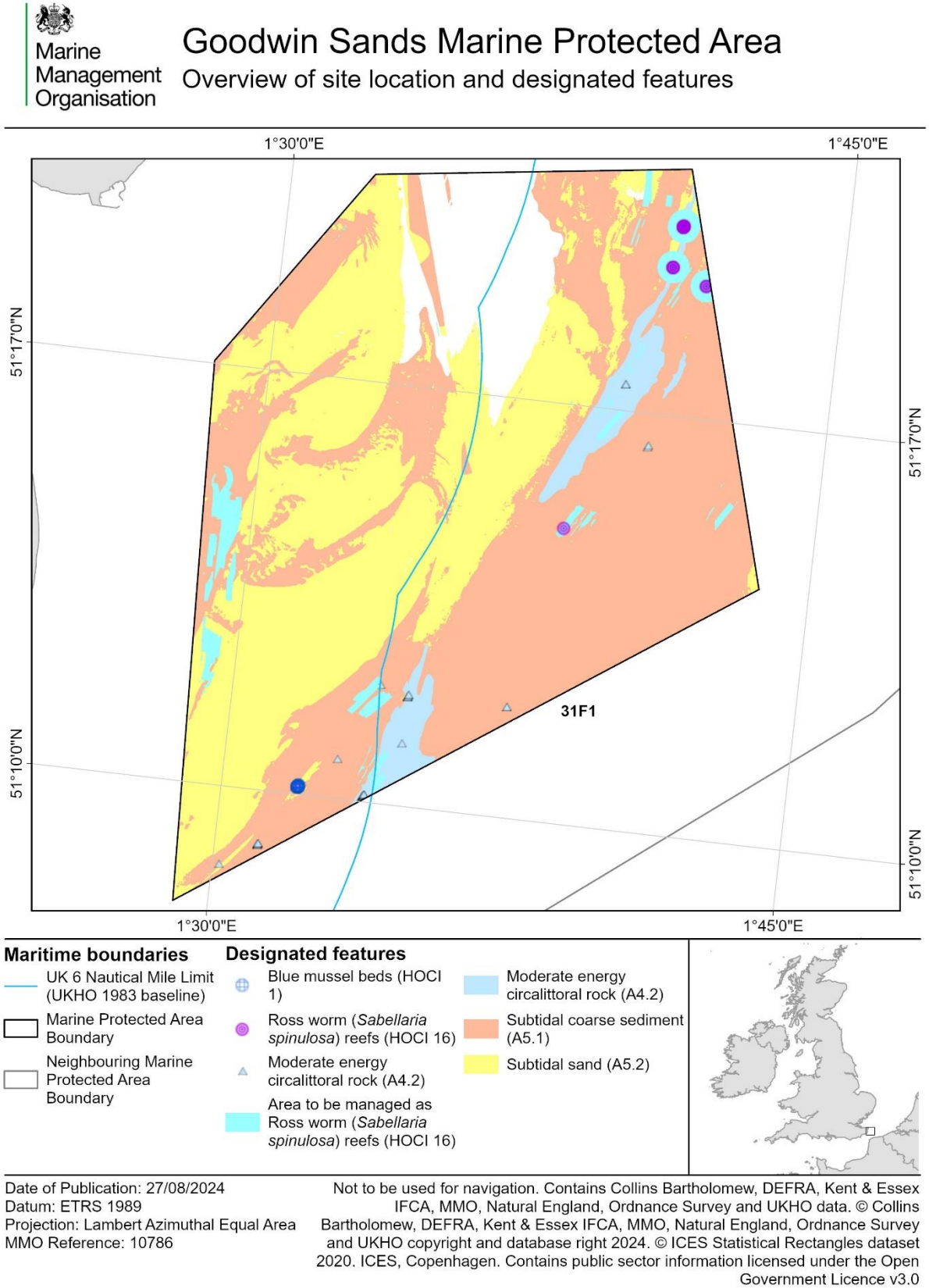

Figure 1. Site overview map.

Goodwin Sands MPA was designated as an MCZ in May 2019. The designated features and their general management approaches are set out in **Table 1**.

The general management approaches for the features of Goodwin Sands MPA have been set out based on a vulnerability assessment.

The favourable condition targets for most of the attributes of the moderate energy circalittoral rock and Ross worm (*S. spinulosa*) reefs features have been set as recover due to their high sensitivity to pressures from bottom towed gear.

The favourable condition target for the extent of subtidal biogenic reef attribute states that 'when *Sabellaria* reef develops within the site, its extent and persistence should not be compromised by human activities, accepting that, due to the naturally dynamic nature of the feature, its extent will fluctuate over time'.

Table 1: Designated features and general management approach.

Designated feature	General Management Approach
English Channel outburst flood features	Maintain in favourable condition
Subtidal coarse sediment	
Subtidal sand	
Blue mussel beds	Recover to a favourable condition
Moderate energy circalittoral rock	
Ross worm (*Sabellaria spinulosa*) reefs	

There is no direct 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. Biotope data for features is only available at the bioregion level for the Southern North Sea and Eastern Channel. More information on this can be found in Natural England's supplementary advice on conservation objectives - Goodwin Sands MCZ[1].

2.2 Scope of this assessment

The scope of this assessment covers fishing activities alone, and relevant activities in combination with fishing. It does not cover areas of this site inshore of 6 nm, for which Kent and Essex Inshore Fisheries Conservation Authority (IFCA) is the regulator.

Bottom towed gear interactions with the features moderate energy circalittoral rock and Ross worm (*S. spinulosa)* reefs have not been included in this assessment as they have already been addressed in the MMO Stage 2 assessment of Goodwin Sands MPA[3] and prohibited by the MMO Marine Protected Areas Bottom Towed Fishing Gear Byelaw 2023[4]. Stage 2 assessed the impacts of fishing using bottom towed gears on rock, rocky and biogenic reef in 13 MPAs.

[3] Stage 2 MPA Fisheries Assessment: www.gov.uk/government/publications/marine-protected-areas-bottom-towed-fishing-gear-byelaw-2023 (last accessed 22 April 2024).

[4] MMO Marine Protected Areas Bottom Towed Fishing Gear Byelaw 2023: www.gov.uk/government/publications/marine-protected-areas-bottom-towed-fishing-gear-byelaw-2023 (last accessed 22 April 2024).

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[5].

Part A assesses the interactions between pressures from fishing gears on 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

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.

[5] Marine and Coastal Access Act 2009: www.legislation.gov.uk/ukpga/2009/23/section/126 (last accessed 15 May 2023)

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);
- expert opinion from inshore fisheries and conservation officers; and
- swept area ratio (SAR) data.

For more information about the above evidence sources, please see the Stage 3 MPA Site Assessment Methodology document[6], which describes each type of fishing activity evidence and summarises the strengths and limitations of each source.

[6] 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 (2016 to 2021) and landings data (2016 to 2020) for Goodwin Sands MPA.

Gear type	Gear name	Gear code	Justification
Anchored nets and lines	Combined gillnet-trammel net	GTN	Present in under 12 m landings data for ICES statistical rectangles that overlap the site.
	Gill nets (not specified)	GN	
	Longline (unspecified)	LL	
	Longlines (demersal)	LLS	
	Set gillnet (anchored)	GNS	Present in VMS records and under 12 m landings data for ICES statistical rectangles that overlap the site.
	Trammel net	GTR	
Bottom towed gear	Beam trawl	TBB	Present in VMS records and under 12 m landings data for ICES statistical rectangles that overlap the site.
	Bottom otter trawl	OTB	
	Danish / anchor seine	SDN	Present in VMS records.
	Hand mechanised dredge	HMD	Present in under 12 m landings data for ICES statistical rectangles that overlap the site.
	Otter trawls (unspecified)	OT	
	Scottish / fly seine	SSC	Present in VMS records.
	Towed dredge	DRB	

Gear type	Gear name	Gear code	Justification
	Twin bottom otter trawl	OTT	Present in under 12 m landings data for ICES statistical rectangles that overlap the site.
Midwater gear	Drift gillnet	GND	Present in under 12 m landings data for ICES statistical rectangles that overlap the site.
	Hand-operated pole-and-line	LHP	
	Hook and line (unspecified)	LX	
	Jigging or trolling line	LTL	
	Midwater otter trawl	OTM	Present in VMS records and in under 12 m landings data for ICES statistical rectangles that overlap the site.
	Midwater pair trawl	PTM	
Traps	Pot/Creel	FPO	Present in under 12 m landings data for ICES statistical rectangles that overlap the site.
	Trap	FIX	
Miscellaneous	Not known	NK	Present in VMS records.

3.2 Activities and features screened out

This section identifies the activities or features that are **present or occurring but do not need to be considered** for Goodwin Sands MPA.

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

- **Bottom towed gear interactions with the features moderate energy circalittoral rock and Ross worm *(S. spinulosa)* reefs:** These interactions have not been included in this assessment as they have already been addressed in the Stage 2 assessment of Goodwin Sands MPA[3]. Stage 2 assessed the impacts of fishing using bottom towed gears on rock, rocky and biogenic reef in 13 MPAs. These features were chosen for Stage 2 as they are some of the most sensitive to the impacts of bottom towed gears.
- **Midwater gears:** although the use of midwater gears does occur within Goodwin Sands MPA, there is no feasible pathway for gears of this type to interact with benthic designated features, 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 Goodwin Sands MPA is not considered to be capable of affecting the designated features other than insignificantly and is not considered further within this assessment.
- **Miscellaneous and 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:

- **Blue mussel beds:** this feature is only present inshore of the 6 nm limit, so will not be considered in this assessment; and
- **Geological features:** these features are out of scope for this assessment as fishing activities are considered incapable of significantly impacting these features.

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[7]
- Stage 3 Fishing Gear MPA Impacts Evidence Bottom Towed Gear[8]; and
- Stage 3 Fishing Gear MPA Impacts Evidence Traps[9].

Bottom towed gear interactions with the features moderate energy circalittoral rock and Ross worm *(S. spinulosa)* reefs have not been included in this assessment as they have already been addressed in the Stage 2 assessment of Goodwin Sands MPA[3]. Stage 2 assessed the impacts of fishing using bottom towed gears on rock, rocky and biogenic reef in 13 MPAs. These features were chosen for Stage 2 as they are some of the most sensitive to the impacts of bottom towed gears.

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 Natural England advice to assess the sensitivities of pressures on the designated features of the site.

Table 3 details the pressures for each gear type - anchored nets and lines (A), bottom towed gear (B) and traps (T) – to be assessed in Part B, taking into account the pressures screened out in 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, or that the feature is not sensitive to the pressure.

[7] Stage 3 Fishing Gear MPA Impacts Evidence Anchored Nets and Lines: www.gov.uk/government/publications/stage-3-impacts-evidence (last accessed: 13 September 2024).
[8] Stage 3 Fishing Gear MPA Impacts Evidence Bottom Towed Gear: www.gov.uk/government/publications/stage-3-impacts-evidence (last accessed: 13 September 2024).
[9] Stage 3 Fishing Gear MPA Impacts Evidence Traps: www.gov.uk/government/publications/stage-3-impacts-evidence (last accessed: 13 September 2024).

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

Potential Pressures	Designated Feature									
	Moderate Energy Circalittoral Rock		Ross worm (*Sabellaria spinulosa*) reefs		Subtidal coarse sediment			Subtidal sand		
	A	T	A	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 PAH contamination										
Introduction of light										
Introduction of microbial pathogens										
Introduction or spread of invasive non-indigenous species										
Litter										
Organic enrichment										
Penetration and/or disturbance of the substrate below the surface of the seabed, including abrasion										
Physical change (to another sediment type)										
Removal of non-target species										
Removal of target species										
Smothering and siltation rate changes (light)										
Synthetic compound contamination										
Transition elements and organo-metal contamination										

4 Part B - Fishing activity assessment

Part B of this assessment was carried out in a manner that is consistent with the 'significant risk of hindering the achievement of the conservation objectives' test required by section 126 of the Marine and Coastal Access Act 2009[5].

Table 3 shows the fishing activities and pressures identified in Part A which have been included for assessment in Part B. The most relevant attributes of the designated features that could be compromised by fishing pressures were identified using the Goodwin Sands MPA conservation advice package[1] and are shown in **Table 4**.

Table 4: Relevant favourable condition targets for identified pressures.

Feature	Attribute	Target	Relevant Pressures
Moderate energy circalittoral rock	Distribution: presence and spatial distribution of biological communities	Recover the presence and spatial distribution of circalittoral rock communities.*	• Abrasion or disturbance of the substrate on the surface of the seabed • Removal of non-target species • Removal of target species
	Structure and function: presence and abundance of key structural and influential species	[Maintain OR Recover OR Restore] the abundance of listed species, to enable each of them to be a viable component of the habitat.	
	Structure: species composition of component communities	Recover the species composition of component communities.*	
	Supporting processes: sedimentation rate	Maintain the natural rate of sediment deposition.	
Ross worm (*Sabellaria spinulosa*) reefs	Extent of subtidal biogenic reef	When *Sabellaria* reef develops within the site, its extent and persistence should not be compromised by human activities, accepting	

Feature	Attribute	Target	Relevant Pressures
		that, due to the naturally dynamic nature of the feature, its extent will fluctuate over time.	• Abrasion or disturbance of the substrate on the surface of the seabed • Removal of non-target species • Removal of target species
	Structure and function: presence and abundance of key structural and influential species	[Maintain OR Recover OR Restore] the abundance of listed species, to enable each of them to be a viable component of the habitat.	
	Structure: population density	Recover the density of *Sabellaria* species across the feature.*	• Abrasion or disturbance of the substrate on the surface of the seabed.
	Structure: species composition of the community	Recover the species composition of the *Sabellaria* reef community.*	
	Supporting processes: sedimentation rate	Maintain the natural rate of sediment deposition.	
Subtidal coarse sediment / Subtidal sand	Distribution: presence and spatial distribution of biological communities	Maintain the presence and spatial distribution of subtidal coarse sediment / subtidal sand communities.	• Abrasion or disturbance of the substrate on the surface of the seabed
	Structure: sediment composition and distribution	Maintain the distribution of sediment composition types across the feature.	
	Structure and function: presence and abundance of key structural and influential species	[Maintain OR Recover OR Restore] the abundance of listed species, to enable each of them to be a viable component of the habitat.	• Abrasion or disturbance of the substrate on the surface of the seabed • Changes in suspended solids (water clarity) (subtidal sand only)
	Structure: species composition of component communities	Maintain the species composition of component communities.	

Feature	Attribute	Target	Relevant Pressures
			• Penetration and/or disturbance of the substrate below the surface of the seabed, including abrasion • Removal of non-target species • Removal of target species • Smothering and siltation rate changes (light)

* A recover target has been set as part of the General Management Approach due to this feature's high sensitivity to pressures from bottom towed gear.

4.1 Fisheries access and existing management

Non-UK vessels can operate within the region of Goodwin Sands MPA offshore of 12 nm, provided that they have a licence issued by the UK to do so. In the area of the site that lies within the 6 to 12 nm zone, UK licensed vessels from the Netherlands, Germany, Belgium and France can operate in the area.

More information on non-UK vessel access to UK waters can be found on MMO's Single Issuing Authority page[10].

Nationalities which fished within the MPA from 2016 to 2021 include vessels from the UK, Belgium, France and the Netherlands. VMS records indicate that vessels from France were the most prevalent.

The Kingfisher fishing restriction map (Seafish, 2023) contains information on MPA management measures for the portion of the site inside of 6 nm.

Offshore of 6 nm, Goodwin Sands MPA is subject to the following MMO byelaw:

- **Marine Protected Areas Bottom Towed Fishing Gear Byelaw 2023 –** prohibiting the use of bottom towed gear within specified areas of the MPA which contain high and/or moderate energy circalittoral rock and/or Ross worm (*Sabellaria spinulosa*) reefs.

4.2 Fishing activity summary

Table A1.1 to **Table A1.8** in Annex 1 display a detailed breakdown of fishing activity within Goodwin Sands 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 show that the most prevalent gears operated by over 12 m vessels within the site are demersal trawls, followed by demersal seines. Landings data show that the most prevalent gears operated by under 12 m vessels within the site are traps, demersal seines, demersal trawls and dredges.

Anchored nets and lines

According to VMS and landings data for over 12 m vessels, the use of anchored nets and lines in the area appears minimal. Between 2016 and 2021 there were only 6 VMS records on average per year. Under 12 m vessels using anchored nets and lines landed approximately 12 tonnes (t) per year on average between 2016 and

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

2020. Under 12 m landings are recorded at ICES rectangle level and 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 Goodwin Sands MPA that intersects ICES rectangle 31F1 was 43 days. Goodwin Sands MPA is entirely within ICES rectangle 31F1 and takes up 4.59% of the rectangle. Fishing effort days are derived from logbooks and is collected at ICES rectangle and then apportioned accordingly.

Kent and Essex IFCA have provided additional information regarding under 12 m vessel activities within Goodwin Sands MPA, sourced from four vessels identified as regularly using the MPA. The amount of gear used by fishers within the area is described by the number of hooks for anchored lines and metres of net for anchored nets. On average there are 0.01 hooks per day per 10,000 m^2 and 0.2 m of net per day per 10,000 m^2 of the whole MPA (including inshore of 6 nm) (Pers. comm. Kent and Essex IFCA., 2024).

Bottom Towed Gear

Demersal Seines

Between 2016 and 2021 there were on average 70 VMS records for demersal seines per year. Vessels over 12 m in length using Danish/anchor seines landed on average 4 t per year. Vessels over 12 m in length using Scottish/fly seines landed on average 25 t per year. There were no landings recorded from UK vessels under 12 m, so there is no fishing effort data for demersal seines.

Mean surface SAR values for demersal seine activity for C-squares intersecting Goodwin Sands MPA increased from 2 in 2016 to 7.60 in 2019. Mean subsurface SAR values increased from 0.06 in 2016 to 0.32 in 2019. The surface SAR for all bottom towed gears combined was 2.41 in 2016 and 8.17 in 2019. An SAR value of 1 means that each area C-square experiences a pass of fishing gear on average once a year. The surface SAR of 7.60 in 2019 indicates that each area C-square experienced more than 7 passes of fishing gear on average every year. Large portions of some of these C-squares, however, cover areas that are outside of the site, so some of this demersal seining activity may not be occurring within the site.

VMS activity shows that dfeatures but activity occurs throughout most of the site, over all four designated features, but concentrated in the east.

Demersal Trawls

According to VMS data, bottom otter trawls were the most frequently deployed gear type in Goodwin Sands MPA. Between 2016 and 2021 there were 160 VMS records on average per year. Records were highest in 2016 when there were 333 records decreasing over subsequent years to 43 records in 2021. Vessels over 12 m in

length using bottom otter trawls landed on average 22 t per year. Under 12 m landings data shows that vessels landed on average 3 t per year.

Between 2016 and 2021 there were only 20 VMS records on average for beam trawls per year. Vessels over 12 m in length using beam trawls landed on average 1 t per year, and vessels under 12 m in length landed 0.01 t per year.

Surface SAR values for demersal trawl activity for C-squares intersecting Goodwin Sands MPA increased from 0.41 in 2016 to 0.57 in 2019, and subsurface values decreased slightly from 0.13 in 2016 to 0.11 in 2019.

Average fishing effort recorded by UK vessels under 12 m in length using demersal trawls between 2016 and 2021 for the area of Goodwin Sands MPA that intersects ICES rectangle 31F1 was 19 days.

VMS activity shows that demersal trawling activity occurs throughout the majority of the MPA, apart from the northwest section of the MMO portion of the site.

Dredges

It appears there is minimal dredging activity within Goodwin Sands MPA, as there were no VMS records between 2016 and 2021, and vessels under 12 m in length using dredges landed on average 6.54 t per year.

Average fishing effort recorded by UK vessels under 12 m in length using dredges between 2016 and 2021 for the area of Goodwin Sands MPA that intersects ICES rectangle 31F1 was 5 days.

Traps

There were no VMS records for traps between 2016 and 2021. Under 12 m landings data indicate that there is trap activity occurring within the site; these vessels landed approximately 36.59 t per year on average between 2016 and 2020. Average fishing effort recorded by UK vessels under 12 m in length using traps between 2016 and 2021 for the area of Goodwin Sands MPA that intersects ICES rectangle 31F1 was 53 days.

Kent and Essex IFCA have provided additional information regarding under 12 m vessel activities within Goodwin Sands MPA, sourced from four vessels identified as regularly using the MPA. For traps the amount of gear used is described by the number of pots. On average there are 0.02 pots per day per 10,000 m^2 of the whole MPA (including inshore of 6 nm) (Pers. comm. Kent and Essex IFCA., 2024).

4.3 Pressures by gear type

The Stage 3 Fishing Gear MPA Impacts Evidence documents for anchored nets and lines[7], bottom towed gear[8] and traps[9] 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 and subtidal sand 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. For the purposes of benthic feature assessments, the physical effects of fishing gears on seabed communities are best addressed through the assessment of abrasion and penetration pressures. As there are no designated species features associated with Goodwin Sands MPA, and the detail of key structural and influential species is yet to be fully defined, we conclude that impacts from target and non-target removal pressures can be scoped out from further assessment of this site. We acknowledge that these pressures may require consideration as a result of any future evidence review, in conjunction with updated conservation advice from Natural England.

4.3.1 Anchored nets and lines

The following features of Goodwin Sands MPA have been considered in relation to the following pressures from anchored nets and lines:

- **Moderate energy circalittoral rock:**
  - abrasion or disturbance of the substrate on the surface of the seabed.
- **Ross worm (*S. spinulosa*) reefs:**
  - abrasion or disturbance of the substrate on the surface of the seabed.
- **Subtidal coarse sediment and subtidal sand:**
  - abrasion or disturbance of the substrate on the surface of the seabed.

Section 4.2 describes fishing activity within Goodwin Sands MPA and notes that there was an annual average of only 6 VMS records for anchored nets and lines between 2016 and 2021. These focussed over the east of the site, which is predominantly subtidal coarse sediment. Landings and fishing effort data suggest additional activity derived from the under 12 m UK fleet. However, fishing effort data and under 12 m landings are collected at ICES rectangle level and then apportioned as if they are distributed equally across the rectangle, which means that there is lower confidence as to the actual levels of activity taking place within the site. However, advice from Kent and Essex IFCA has indicated that the majority of under 12 m vessels using static gear occurred inshore of 6 nm, with only 11 vessels observed using static gear within the Goodwin Sands MPA between 2018 and 2023.

Only 6 of these observed were within the MMO portion of the MPA. In addition, the low amount of gear used by vessels fishing within the MPA, described in **section 4.2**, indicates that there is a low spatial footprint from anchored nets and lines within the site.

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.

Moderate energy circalittoral rock

As per section 7.3 of the anchored nets and lines Impacts Evidence document[7], while abrasion impacts from this gear type may cause sediment veneer disturbance and damage to epifaunal/epifloral communities, physical damage to the rock itself is unlikely. Some studies indicate that slow growing branching species and rock with erect branching species are considered particularly sensitive to damage from netting, whilst rock with low-lying fast growing faunal turf has been determined as having moderate sensitivity to moderate levels of netting. Repeated netting activity could damage reefs and the associated communities through cumulative damage. As the fishing activity data for the under 12 m fleet does not indicate where it occurs within the site, the use of anchored nets and lines may be occurring over the moderate energy circalittoral rock.

Of the 14 biotopes that could be found within the moderate energy circalittoral rock feature for the Southern North Sea & Eastern Channel regions (**Table 5**), nine have medium sensitivity to abrasion from anchored nets and lines (Tillin, 2016; Tillin and Hill, 2016; Tillin and Hiscock, 2016; Tyler-Walters, Mainwaring and Williams, 2022; De-Bastos *et al.*, 2023b; Readman, Lloyd and Watson, 2023a, 2023b; Tillin, Gibb, *et al.*, 2023; Tillin, Marshall, *et al.*, 2023) and five have low sensitivity. The low sensitivity biotopes all have high resilience to abrasion from anchored nets and lines.

The two medium sensitivity biotopes containing *S. spinulosa* (Tillin, Gibb, *et al.*, 2023; Tillin, Marshall, *et al.*, 2023) will be assessed as part of the Ross worm (*S. spinulosa*) reefs feature. The medium sensitivity biotope containing *Mytilus edulis* beds (Tyler-Walters, Mainwaring and Williams, 2022) is unlikely to be present in the MMO portion of the site as they have only been recorded inshore of 6 nm. The circalittoral faunal communities biotope and the cushion sponges and hydroid biotopes are unlikely to be present in the site as they are found in variable salinity environments which are usually further inshore or in saline lagoons (Readman, Lloyd and Watson, 2023a, 2023b). The biotope '*Hiatella*-bored vertical sublittoral limestone rock' is unlikely to be in the site because there is no vertical limestone rock in the site (Tillin, 2016).

The biotopes 'piddocks with a sparse associated fauna in sublittoral very soft chalk or clay' (Tillin and Hill, 2016), '*Polydora* sp. tubes on moderately exposed sublittoral

soft rock' (De-Bastos *et al.*, 2023b) and '*Urticina felina* and sand-tolerant fauna on sand-scoured or covered circalittoral rock' (Tillin and Hiscock, 2016) could be found within the site and are categorised with medium sensitivity because they include species that protrude from the surface and that could be removed by abrasion (such as sponges, bryozoans, ascidians, hydroids and anemones). However, it should be noted that this sensitivity to removal via abrasion was predominantly linked to studies using bottom towed gears rather than anchored nets and lines. Furthermore, many of the species listed in the biotopes reach sexual maturity quickly, can reproduce asexually to aid recovery of damaged populations, and can undertake resting stages that are very resistant of environmental perturbation.

Table 5: Moderate energy circalittoral rock biotopes that could be found within the Southern North Sea and Eastern Channel regions and their sensitivities to abrasion from static gear.

Biotope	Sensitivity to abrasion from static gear
Sabellaria reefs on circalittoral rock (Tillin, Gibb, *et al.*, 2023)	Medium
Piddocks with a sparse associated fauna in sublittoral very soft chalk or clay (Tillin and Hill, 2016)	Medium
Polydora sp. tubes on moderately exposed sublittoral soft rock (De-Bastos *et al.*, 2023b)	Medium
Hiatella-bored vertical sublittoral limestone rock (Tillin, 2016)	Medium
Mytilus edulis beds with hydroids and ascidians on tide-swept exposed to moderately wave-exposed circalittoral rock (Tyler-Walters, Mainwaring and Williams, 2022)	Medium
Circalittoral faunal communities in variable salinity (Readman, Lloyd and Watson, 2023a)	Medium
Cushion sponges and hydroids on turbid tide-swept sheltered circalittoral rock (Readman, Lloyd and Watson, 2023b)	Medium
Urticina felina and sand-tolerant fauna on sand-scoured or covered circalittoral rock (Tillin and Hiscock, 2016)	Medium
Faunal and algal crusts on exposed to moderately wave-exposed circalittoral rock (Stamp and Tyler-Walters, 2016)	Low
Flustra foliacea on slightly scoured silty circalittoral rock (Readman, Lloyd and Watson, 2023c)	Low
Alcyonium digitatum, *Pomatoceros triqueter*, algal and bryozoan crusts on wave-exposed circalittoral rock (Stamp and Williams, 2021)	Low
Faunal and algal crusts with *Pomatoceros triqueter* and sparse *Alcyonium digitatum* on exposed to moderately wave-exposed circalittoral rock (Stamp, 2016)	Low
Alcyonium digitatum and faunal crust communities on vertical circalittoral bedrock (Readman and Williams, 2021)	Low

Using best available evidence there are no known records of these medium sensitivity biotopes present within Goodwin Sands MCZ at the current time. It must be acknowledged however that lack of data does not equate to confirmed absence, and hence confidence in an absence of these biotopes must be regarded as low. Potential does remain for one or more medium sensitivity biotopes to be present, and risk of abrasion impacts cannot be completely ruled out.

The site is subject to the high hydrodynamic energy of the Southern North Sea and Eastern Channel. It is likely that biological communities that dominate in Goodwin Sands MPA are acclimatised to some level of disturbance and will therefore have a degree of resilience to abrasion pressures. Given the relatively low intensity of anchored nets and lines activity within the site, together with the low scale of footprint for impacts from anchored nets and lines, and no current evidence to suggest sensitive biotopes are present; the risk of abrasion damage is considered unlikely to occur above the pressure benchmark for the moderate energy circalittoral rock feature.

Ross worm (*S. spinulosa*) reefs

As per section 8.3 of the anchored nets and lines Impacts Evidence document[7], abrasion impacts from this gear type could modify *S. spinulosa* reefs and associated communities. Research suggests that netting on *S. spinulosa* should have a low impact due to the small footprint of the gear. However, any loss of reef structure from abrasion can drive reduced abundance, biomass and species richness, and therefore impact ecosystem functioning. There is some evidence that physical disturbance can result in epifauna, especially emergent species such as erect sponges and coral, being dislodged or damaged. In addition, abrasion at the surface of reefs is likely to damage the ends of the worm tubes and may cause greater damage where areas are broken apart. Following disturbance, the reef structure itself may not disappear as its recovery capacity means damaged parts of the reef may be rebuilt depending on the extent and nature of the damage. Repeated netting activity could damage reefs and the associated communities through cumulative damage.

As the fishing activity data for the under 12 m fleet does not indicate where it occurs within the site, the use of anchored nets and lines may be occurring over the *S. spinulosa* reefs. There is therefore a risk of abrasion over this feature, which has a conservation objective to be brought into favourable condition. Of the three biotopes which could be found within the *S. spinulosa* reefs in Goodwin Sands MPA, all three are known to be present and have medium sensitivity to abrasion from anchored nets and lines (**Table 6**). The favourable condition target for the extent of subtidal biogenic reef attribute states that ‘when *Sabellaria* reef develops within the site, its extent and persistence should not be compromised by human activities, accepting that, due to the naturally dynamic nature of the feature, its extent will fluctuate over time’.

Table 6: Ross worm (*S. spinulosa)* reefs biotopes that could be found within the Southern North Sea and Eastern Channel regions and their sensitivities to abrasion from static gear.

Biotope	Sensitivity to abrasion from static gear
Sabellaria reefs on circalittoral rock (Tillin, Gibb, *et al.*, 2023)	Medium
Sabellaria spinulosa encrusted circalittoral rock (Tillin, Marshall, *et al.*, 2023)	Medium
Sabellaria spinulosa on stable circalittoral mixed sediment (Tillin *et al.*, 2022)	Medium

Subtidal coarse sediment and subtidal sand

Abrasion impacts are greater on subtidal coarse sediments compared to subtidal sand as the coarser habitats often contain populations of sessile epifauna. However, as per section 9.3 of the anchored nets and lines Impacts Evidence document[7], abrasion impacts from this gear type are unlikely to negatively impact the extent or distribution of any sediment feature or structure and function of the ecosystem in a significant manner, as 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.

Of the six biotopes which could be found within the subtidal coarse sediment in Goodwin Sands MPA, three have low sensitivity to abrasion from anchored nets and lines and three are not sensitive. These biotopes will not be discussed in further detail. Of the 10 biotopes which could be found within subtidal sand, eight have low sensitivity and one is not sensitive so will not be discussed further. The remaining biotope '*Echinocardium cordatum* and *Ensis* spp. in lower shore and shallow sublittoral slightly muddy fine sand' has medium sensitivity (De-Bastos *et al.*, 2023a). This biotope is generally only recorded from shallow inshore areas and there are currently no known records of it within Goodwin Sands MPA. It must be acknowledged however that lack of data does not equate to confirmed absence, and hence confidence in this biotope's absence must be regarded as low. Potential does remain for it to be present, and risk of abrasion impacts cannot be completely ruled out.

The site is subject to the high hydrodynamic energy of the Southern North Sea and Eastern Channel. It is likely that biological communities that dominate in Goodwin Sands are acclimatised to some level of disturbance and will therefore have a degree of resilience to abrasion pressures. Given the relatively low intensity of anchored nets and lines activity within the site, together with the low scale of footprint for impacts from anchored nets and lines, and no current evidence to suggest the medium sensitivity biotope is present; the risk of abrasion damage is considered unlikely to occur above the pressure benchmark for the subtidal coarse sediment and subtidal sand features.

With regards to the discussion above, the assessed activity levels and the evidence available for the impact of anchored nets and lines, **MMO concludes that impacts of abrasion or disturbance from ongoing use of anchored nets and lines at the activity levels described may result in a significant risk of hindering the achievement of the conservation objective of the MPA for the Ross worm (*Sabellaria spinulosa*) reefs feature.**

MMO concludes that the ongoing use of anchored nets and lines at the activity levels described does not pose a significant risk of hindering the achievement of the conservation objectives of the MPA for the features moderate energy circalittoral rock, subtidal coarse sediment, and subtidal sand.

4.3.2 Bottom towed gear

The following features of Goodwin Sands MPA have been considered in relation to the following pressures from bottom towed gear:

- **Subtidal coarse sediment and subtidal sand:**
    - Abrasion or disturbance of the substrate on the surface of the seabed$^{\Delta}$;
    - changes in suspended solids (water clarity)*;
    - penetration and/or disturbance of the substrate below the surface of the seabed, including abrasion$^{\Delta}$; and
    - smothering and siltation rate changes (light)*.

As noted in **section 3.3** bottom towed gear interactions with moderate energy circalittoral rock and Ross worm (*S. spinulosa)* reefs have not been included in this assessment as they have already been addressed in the MMO Stage 2 assessment of Goodwin Sands MPA[3].

Pressures marked with matching superscript symbols ($^{\Delta}$ and *) have been consolidated due to the similar nature of their impacts on the sediment features.

Section 4.2 describes fishing activity within Goodwin Sands MPA and notes that bottom otter trawls were the main gear type used by vessels over 12 m in the site. Demersal trawl VMS records occurred throughout most of the site, over both sediment features. **Section 4.2** also notes that the mean surface SAR value for demersal seines in 2019 was 7.60 and for all bottom towed gear was 8.17. This means that each area C-square intersecting Goodwin Sands MPA experienced on average more than 8 passes of bottom towed gear every year, which is extremely high. VMS records occurred throughout most of the site but were concentrated in the east over the subtidal coarse sediment.

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.

As per section 8.4 of the bottom towed gear Impacts Evidence document[8], the abrasion and penetration pressures from this gear type can have both biological and physical impacts. The 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 to the biological structure of sediment habitats. Biological impacts include damage and mortality to flora and fauna on the seabed via surface and subsurface abrasion and penetration, as well as long term shifts in biological communities towards smaller, short-lived, opportunistic species that exhibit greater resilience to anthropogenic activity.

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. The first pass of a trawl has the largest initial impact on biomass and production of sediments (Hiddink *et al.*, 2006) whereas in areas of high trawling intensity, further increasing trawling intensity can have smaller additional effects on biomass and production. Where sessile or attached epifauna are present, demersal seines have the potential to disturb or damage epifauna when the ropes of a seine net are closed to herd demersal fish.

Of the six biotopes which could be found within the subtidal coarse sediment in Goodwin Sands MPA, three have low sensitivity to abrasion from demersal seines, demersal trawls and dredges, and three are not sensitive. Additionally, two biotopes have low sensitivity to penetration from bottom towed gears and three are not sensitive, while the biotope ‘*Hesionura elongata* and *Microphthalmus similis* with other interstitial polychaetes in infralittoral mobile coarse sand’ has medium sensitivity to penetration from bottom towed gears (Marshall, Ashley and Watson, 2023). Evidence shows that the characterising species of this medium sensitivity biotope are likely to colonise areas where extraction or scour has occurred (Marshall, Ashley and Watson, 2023). As bottom towed gears are known to cause shifts in community structure, the presence of this biotope in the site could be a result of the pressures from bottom towed gears.

Of the 10 biotopes which could be found within subtidal sand, eight have low sensitivity to abrasion from bottom towed gears, one is not sensitive, while the biotope ‘*E. cordatum* and *Ensis* spp. in lower shore and shallow sublittoral slightly muddy fine sand’ has medium sensitivity to abrasion from bottom towed gears (De-

Bastos *et al.*, 2023a). In addition, the biotopes '*E. cordatum* and *Ensis* spp. in lower shore and shallow sublittoral slightly muddy fine sand' (De-Bastos *et al.*, 2023a) and 'sublittoral sand in low or reduced salinity' (Tillin and Tyler-Walters, 2016) have medium sensitivity to penetration from bottom towed gears, while the remaining eight have low sensitivity. The two medium sensitivity biotopes are generally only recorded from shallow inshore areas and there are currently no known records of them within Goodwin Sands MCZ. It must be acknowledged however that lack of data does not equate to confirmed absence, and hence confidence in this biotope's absence must be regarded as low. Potential does remain for it to be present, and risk of abrasion impacts cannot be completely ruled out.

The pressure 'changes in suspended solids (water clarity)' is only relevant for the subtidal sand feature. The 'smothering and siltation rate changes (light)' pressure is relevant to both sediment features. The biotopes for both these features range from not sensitive to low sensitivity for these pressures from bottom towed gears.

Given that the swept area ratios for the site indicate high levels of demersal seine activity, it is likely that the sedimentary features of Goodwin Sands are experiencing very regular exposure to the abrasion and penetration pressures. The site is subject to the high hydrodynamic energy of the Southern North Sea and Eastern Channel, so it is likely that biological communities that predominate in Goodwin Sands MPA are acclimatised to some level of disturbance. This could explain why the majority of biotopes present within the site are listed as low sensitivity to abrasion and penetration from bottom towed gears. However, this dominance may be the result of decades of bottom towed fishing activity that have shifted baselines for biological community structures towards more resilient, endemic fauna. The first pass of a trawl has the largest and most damaging initial impact on biomass and production of sediments, causing high levels of mortality. Subsequent passes have additional effects and repeated passes allow little time for species to recover. This contributes to a shift in the biological community, removing the most sensitive species while allowing resilient organisms to remain, suggesting that infrequent trawling may be sufficient to maintain a community in an altered state.

Bottom towed gears contact a much larger area of the seabed than static gears meaning that they have an impact on a spatial scale much larger than anchored nets and lines or traps. Despite the site's dominance of low sensitivity biotopes, 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 for subtidal coarse sediment and subtidal sand. The site does contain 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.

With regards to the discussion above, the assessed activity levels and the evidence available for the impact of bottom towed gears, **MMO concludes that the ongoing use of bottom towed gear at the activity levels described may result in a**

significant risk of hindering the achievement of the conservation objectives of the MPA.

4.3.3 Traps

The following features of Goodwin Sands MPA have been considered in relation to the following pressures from traps:

- **Moderate energy circalittoral rock:**
  - Abrasion or disturbance of the substrate on the surface of the seabed.
- **Ross worm (*S. spinulosa*) reefs:**
  - Abrasion or disturbance of the substrate on the surface of the seabed.
- **Subtidal coarse sediment and subtidal sand:**
  - Abrasion or disturbance of the substrate on the surface of the seabed.

Section 4.2 describes fishing activity within Goodwin Sands MPA and notes that, although there are no VMS records for the site, fishing effort and landings data for under 12 m vessels show that the use of traps is occurring in the site. These vessels landed approximately 36.59 t per year on average between 2016 and 2020 In addition the low amount of gear used by under 12 m vessels fishing within the MPA, described in **section 4.2**, indicates that there is a low spatial footprint from traps within the site.

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

Moderate energy circalittoral rock

As per section 7.3 of the traps Impacts Evidence document[9], abrasion impacts from this gear type are unlikely to impact the rocky substrate itself but may impact associated taxa. Most of the literature before 2015 has suggested that traps are unlikely to significantly impact rocky reef biotopes. However, more recent studies suggest that traps will have negative impacts on the biological functions of reef habitats at increased spatial and temporal densities. Studies show that upright and branching species that protrude from the reef (such as sponges or bryozoans) were found to be particularly vulnerable to damage from the hauling of pots.

As per **section 4.3.1**, only the medium sensitivity biotopes ‘piddocks with a sparse associated fauna in sublittoral very soft chalk or clay’ (Tillin and Hill, 2016), ‘*Polydora* sp. tubes on moderately exposed sublittoral soft rock’ (De-Bastos *et al.*, 2023b) and ‘*Urticina felina* and sand-tolerant fauna on sand-scoured or covered circalittoral rock’ (Tillin and Hiscock, 2016) could be present within Goodwin Sands MPA. These biotopes are categorised as sensitive to abrasion from traps because they include species that protrude from the surface and that could be removed by abrasion but it should be noted that this sensitivity was predominantly linked to studies using bottom towed gears rather than traps. Furthermore, many of the

species listed in the biotopes reach sexual maturity quickly, can reproduce asexually to aid recovery of damaged populations, and can undertake resting stages that are very resistant of environmental perturbation.

Using best-available evidence there are no known records of these medium sensitivity biotopes present within Goodwin Sands MPA at the current time. It must be acknowledged however that lack of data does not equate to confirmed absence, and hence confidence in an absence of these biotopes must be regarded as low. Potential does remain for one or more medium sensitivity biotopes to be present, and risk of abrasion impacts cannot be completely ruled out.

The site is subject to the high hydrodynamic energy of the Southern North Sea and Eastern Channel. It is likely that biological communities that dominate in Goodwin Sands are acclimatised to some level of disturbance and will therefore have a degree of resilience to abrasion pressures. Given the relatively low intensity of trap activity within the site, together with the low scale of footprint for impacts from traps, and no current evidence to suggest sensitive biotopes are present; the risk of abrasion damage is considered unlikely to occur above the pressure benchmark for the moderate energy circalittoral rock feature.

Ross worm (*Sabellaria spinulosa*) reefs

As per section 8.3 of the traps Impacts Evidence document[9], abrasion impacts from this gear type can cause direct physical impacts to Ross worm (*S. spinulosa*) reefs which may have biological implications for the polychaetes forming the reef and the flora and fauna associated with the reef. Traps can damage and fragment the reef, reducing the amount of habitat it can provide for other species. Studies evidencing this damage, however, are limited and the intensity of the activity causing the abrasion is likely to change the level of impact on the reef and its recoverability.

There is limited evidence that physical disturbance can result in epifauna, especially emergent species such as erect sponges and coral, being dislodged or damaged. In addition, abrasion at the surface of reefs is likely to damage the ends of the worm tubes and may cause greater damage where areas are broken apart. Following disturbance, the reef structure itself may not disappear as its recovery capacity means damaged parts of the reef may be rebuilt depending on the extent and nature of the damage.

As the fishing activity data for the under 12 m fleet does not indicate where it occurs within the site, the use of traps may be occurring over the *S. spinulosa* reefs. There is therefore a risk of abrasion over this feature, which has a conservation objective to be brought into favourable condition. Of the three biotopes which could be found within the *S. spinulosa* reefs in Goodwin Sands MPA, all three are known to be present and have medium sensitivity to abrasion from anchored nets and lines (**Table 6**). The favourable condition target for the extent of subtidal biogenic reef attribute states that ‘when *Sabellaria* reef develops within the site, its extent and

persistence should not be compromised by human activities, accepting that, due to the naturally dynamic nature of the feature, its extent will fluctuate over time'.

Subtidal coarse sediment and subtidal sand

As per section 9.4 of the traps Impacts Evidence document[9], 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. Under 12 m fishing activity data show that the use of traps may be occurring over the subtidal coarse sediment and subtidal sand features of the site, but this is unlikely to be at damaging levels of intensity.

Of the 16 biotopes which could be found within the subtidal coarse sediment and subtidal sand features in Goodwin Sands MPA, the subtidal sand biotope '*E. cordatum* and *Ensis* spp. in lower shore and shallow sublittoral slightly muddy fine sand' has medium sensitivity to abrasion from traps (De-Bastos *et al.*, 2023a). This medium sensitivity biotope is generally only recorded from shallow inshore areas and there are currently no known records of it within Goodwin Sands MCZ. It must be acknowledged however that lack of data does not equate to confirmed absence, and hence confidence in this biotope's absence must be regarded as low. Potential does remain for it to be present, and risk of abrasion impacts cannot be completely ruled out.

The site is subject to the high hydrodynamic energy of the Southern North Sea and Eastern Channel. It is likely that biological communities that dominate in Goodwin Sands are acclimatised to some level of disturbance and will therefore have a degree of resilience to abrasion pressures. Sediment biotopes also generally have greater recoverability rates to abrasion from static gears like traps as opposed to bottom towed gears because the spatial footprint of static gears is so much smaller. It is also less likely for the same area of sediment to be repeatedly impacted by a trap, allowing more time for the biotopes to recover between exposure to the abrasion pressure.

Given the relatively low intensity of trap activity within the site, together with the low scale of footprint for impacts from traps, and no current evidence to suggest the medium sensitivity biotope is present; the risk of abrasion damage is considered unlikely to occur above the pressure benchmark for the subtidal coarse sediment and subtidal sand features.

With regards to the discussion above, the assessed activity levels and the evidence available for the impact of traps, **MMO concludes that impacts of abrasion or disturbance from ongoing use of traps at the activity levels described may result in a significant risk of hindering the achievement of the conservation objective of the MPA for the Ross worm (*S. spinulosa*) reefs feature.**

MMO concludes that the ongoing use of traps at the activity levels described does not pose a significant risk of hindering the achievement of the conservation objectives of the MPA for the features moderate energy circalittoral rock, subtidal coarse sediment, and subtidal sand.

4.4 Part B conclusion

The assessment of anchored nets and lines and traps on the designated feature Ross worm (*Sabellaria spinulosa*) reefs in Goodwin Sands MPA has revealed that these fishing activities may result in a significant risk of hindering the achievement of the conservation objectives of the MPA at the activity levels described. Management measures will therefore be implemented for anchored nets and lines and traps on Ross worm (*Sabellaria spinulosa*) reefs to ensure that there is no significant risk of hindering the conservation objectives of the MPA.

The assessment of bottom towed gear on the designated features subtidal coarse sediment and subtidal sand in Goodwin Sands MPA has revealed that these fishing activities may result in a significant risk of hindering the achievement of the conservation objectives of the MPA at the activity levels described. Management measures will therefore be implemented for bottom towed gear to ensure that there is no significant risk of hindering the conservation objectives of the MPA.

Section 6 contains further details of these measures.

5 Part C - In-combination assessment

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

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

ArcGIS software has been used to check relevant activities that occur within, or adjacent to, the assessed site where there could be a pathway for impact. To determine relevant activities to be included in this part of the assessment, a distance of 5 km was selected as suitable to capture any potential way in which the activity could impact the benthic features of the site in-combination with effects of the fishing activities assessed. Goodwin Sands MPA straddles the 6 nm limit and therefore, only activities that are within 5 km of the portion of the site seawards of the 6 nm limit were considered. This assessment considers the in-combination impacts of marine licensable activities that are ongoing or upcoming, and with the same 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. 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 historic and operational submarine cables within this MPA and its buffer, these cables are already in-situ and are unlikely to have any residual abrasion or 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 activity.

In Part B, anchored nets and lines and traps were identified as requiring management over areas of Ross worm (*S. spinulosa*) reefs, and bottom towed gear was identified as requiring management over subtidal coarse sediment and subtidal sand to avoid posing a significant risk of hindering the achievement of the site's

conservation objectives. Bottom towed gear interactions with moderate energy circalittoral rock and Ross worm (*S. spinulosa)* reefs have already been addressed in the MMO Stage 2 assessment of Goodwin Sands MPA[3] and prohibited by the MMO Marine Protected Areas Bottom Towed Fishing Gear Byelaw 2023[4]. Anchored nets and lines and traps over moderate energy circalittoral rock, subtidal coarse sediment and subtidal sand are the only remaining interactions within Goodwin Sands MPA that need to be considered. 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 three active marine licences within the 5 km buffer applied.

Table 7 shows these licences and the relevant categories from the JNCC Pressures-Activities Database (PAD)[11]. Details on these licences can be viewed on the public register of marine licence applications and decisions by searching for the marine licence case reference number[12].

[11] JNCC Pressures-Activities Database (PAD): hub.jncc.gov.uk/assets/97447f16-9f38-49ff-a3af-56d437fd1951 (last accessed 11 March 2024).

[12] Public register of marine licence applications and decisions: marinelicensing.marinemanagement.org.uk/mmofox5/fox/live/MMO_PUBLIC_REGISTER (last accessed 11 March 2024)

Table 7: Summary of marine licensable activities and associated PAD categories.

Marine licence case reference number	PAD Category	Description
MLA/2020/00262	• Dredge and spoil disposal; • Power cable: - laying, burial and protection; - operation and maintenance.	GridLink Interconnector linking the existing electricity grids in the UK and France. The planned cable route goes through the northeast of Goodwin Sands MPA. **Possible in-combination effect.**
MLA/2013/00072/5	Dredge and spoil disposal	Nemo Link - UK to Belgium Interconnector to allow transfer of electrical power between the high voltage grid systems of Belgium and the UK. The cable route goes through the north of Goodwin Sands MPA. The license end date for this activity is 31 December 2115 but construction of the Nemo Link cable was completed in November 2019. **No direct or indirect pressure pathway for in-combination impact as construction has been completed and ongoing pressures from infrastructure do not overlap with pressures from fishing. Therefore, no in-combination effects possible.**
MLA/2023/00222	Physical sampling	Aggregates key resource area (KRA) survey: vibrocore sampling. Sampling to ground truth existing datasets and provide information on KRAs for aggregates. The Thames estuary KRA is outside of Goodwin Sands MPA but overlaps with the 5 km buffer. **No direct or indirect pressure pathway for impact and therefore, no in-combination effects possible.**

Marine licence case reference number	PAD Category	Description
33119/051108/19	Offshore wind: construction	Thanet Offshore Wind Farm export cables Construction of Thanet Offshore Wind Farm was completed in September 2010. The cable route goes through a small portion of the northwest corner of the inshore portion of Goodwin Sands MPA (managed by Kent and Essex IFCA) and the 5 km buffer of the MMO portion of the MPA. It does not spatially overlap with the MMO portion of the MPA. **No direct or indirect pressure pathway for impact and therefore, no in-combination effects possible.**
MLA/2015/00462	Offshore wind: operation and maintenance	Thanet Offshore Wind Farm export cable corridor The cable route goes through a small portion of the northwest corner of the inshore portion of Goodwin Sands MPA (managed by Kent and Essex IFCA) and the 5 km buffer of the MMO portion of the MPA. It does not spatially overlap with the MMO portion of the MPA. **No direct or indirect pressure pathway for impact and therefore, no in-combination effects possible.**

The PAD and **Table 3** were used to identify medium to high risk pressures exerted by fishing and non-fishing activities to identify those which require in-combination assessment (**Table 8**).

Table 8 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 8: Pressures exerted by fishing and non-fishing activities.

	Non-fishing activities		Fishing activities	
Potential pressures	**Dredge and spoil disposal**	**Power cable: laying, burial and protection; operation and maintenance**	**Anchored nets and lines**	**Traps**
Abrasion or disturbance of the substrate on the surface of the seabed	Y	Y	Y	Y
Removal of non-target species			Y	Y
Removal of target species			Y	Y

5.1 Fishing vs Fishing in-combination pressures

Fisheries vs fisheries in-combination pressures will be considered in this section.

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

As noted in **section 4.3**, impacts from the removal of target and non-target species pressure are not being considered in detail in this assessment. In-combination impacts from the removal of target and non-target species pressures are more fully assessed under the pressure abrasion, as the detail of key structural and influential species is yet to be fully defined. Therefore, the removal pressures are not considered further in this in-combination assessment. The pressures may require further consideration as future evidence becomes available, in conjunction with updated conservation advice from JNCC and Natural England.

Section 4.2 describes fishing activity within the MMO portion of Goodwin Sands MPA and notes that the use of anchored nets and lines and traps was almost exclusively from under 12 m vessels. Average annual landings from anchored nets and lines, and traps was approximately 12 t and 36.59 t respectively and average annual fishing effort in days was approximately 43 days and 53 days respectively. This results in a combined annual average from anchored nets and lines and traps of 48.59 t and 97 days.

The combined impacts from anchored nets and lines and traps over the features moderate energy circalittoral rock, subtidal coarse sediment and subtidal sand could potentially increase the risk of negative effects from the pressure abrasion and disturbance of the substrate on the surface of the seabed. However, under 12 m landings and UK under 12 m fishing effort (days) are both collected at ICES rectangle level and then apportioned to the site based on percentage overlap. This reduces the confidence in the actual levels of activity taking place within the MMO portion of the MPA, as it suggests fishing activity is distributed equally across the rectangle. The MMO portion of Goodwin Sands MPA only takes up 4.6 % of ICES rectangle 31F1.

To support the assessment of Goodwin Sands MPA, Kent and Essex IFCA have provided additional advice. Kent and Essex IFCA whelk landings data from 2012 to 2022 suggest that whelk potting in the area including Goodwin Sands MPA has declined since 2020 and the area is now very rarely used for whelk potting. Kent and Essex IFCA officer knowledge and vessel sightings suggest that the majority of under 12 m vessels using traps and anchored nets and lines in ICES rectangle 31F1 occurred inshore of 6 nm, with the majority of traps occurring along the coastline. Additionally, between 2018 and 2023 Kent and Essex IFCA officers only observed 11 vessels using static gear within Goodwin Sands MPA, only 6 of which were in the MMO portion of the MPA, so the spatial footprint of this activity is low.

Kent and Essex IFCA have provided additional data on under 12 m vessel activities, indicating that the use of anchored nets and lines and traps in the offshore portion of Goodwin Sands MPA are unlikely to overlap (Pers. comm. Kent and Essex IFCA., 2024). In addition, their surveys of fishers using the area have highlighted the approximate amount of gear used. On average there are 0.02 pots per day per 10,000 m^2 of the whole MPA (including inshore of 6 nm). Amount of gear for anchored nets and lines is described by number of hooks for anchored lines and metres of net for anchored nets. On average there are 0.01 hooks per day per 10,000 m^2 and 0.2 m of net per day per 10,000 m^2 of the whole MPA. This information in sourced from 4 vessels identified as regularly using Goodwin Sands MPA, and indicates that the spatial footprint of this gear type is low.

Given the activity level described, the low scale of footprint for impacts from both these static gear groups, and no current evidence to suggest sensitive biotopes are present within the circalittoral rock or sediment features, MMO does not consider the in-combination effect from these activities as likely to cause a significant risk of hindering the achievement of the conservation objectives. The sensitivities of the circalittoral rock and sediment features within the site are described in **section 4.3**.

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 Goodwin Sands MPA at the activity levels described.

5.2 Fishing vs non-fishing activities in-combination pressures

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

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

The moderate energy circalittoral rock, subtidal coarse sediment and subtidal sand designated features of Goodwin Sands 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 GridLink Interconnector (MLA/2020/00262) which might cause abrasion or disturbance of the seabed relate to dredge and spoil disposal, the laying, burial and protection of power cable and power cable operation and maintenance. The licence end date is 31 December 2071 and the planned cable route goes through the northeast of Goodwin Sands MPA, as such there is potential for in-combination effects regarding the abrasion pressure.

As detailed in **section 5.1.1**, anchored nets and lines and traps at the activity levels described are not considered to be causing significant pressure through abrasion and disturbance. It is possible that activities linked to the GridLink Interconnector, in-combination with anchored nets and lines and traps may increase the potential for this pressure to have negative cumulative effects on the moderate energy circalittoral rock, subtidal coarse sediment and subtidal sand features of the MPA. However, as sediment will not be removed or altered during trenching, and as cable installation is a one-off event, the underlying character of the habitat is likely to remain similar to that of pre-development and the seabed will immediately be available for re-establishment by biological communities. In addition, the cable will be laid in a sandy area in the north of the site, where biotopes are considered resilient to abrasion and disturbance and the impacts of static fishing gear at described levels are considered low due to the small footprint of the gear It is unlikely therefore that there would be a significant in-combination risk of hindering the achievement of the conservation objectives. Therefore, the scale of the in-combination impacts from abrasion and disturbance of the substrate on the surface of the seabed between anchored nets and lines and traps and non-fishing activity is considered insignificant.

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 Goodwin Sands MPA.

5.3 Part C conclusion

MMO concludes that different fishing gear types in-combination, and fishing in-combination with other relevant activities will not result in a significant risk of hindering the achievement of the conservation objectives for the Goodwin Sands MPA.

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

6 Conclusion and proposed management

Part A - Identified pressures on the MPA 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 Goodwin Sands MPA.

In **Part B** - Fishing activity assessment, anchored nets and lines and traps were identified as requiring management over areas of Ross worm (*S. spinulosa*) reefs, and bottom towed gear was identified as requiring management over subtidal coarse sediment and subtidal sand to avoid posing a significant risk of hindering the achievement of the site's conservation objectives. Bottom towed gear interactions with moderate energy circalittoral rock and Ross worm (*S. spinulosa)* reefs have already been addressed in the MMO Stage 2 assessment of Goodwin Sands MPA[3] and prohibited by the MMO Marine Protected Areas Bottom Towed Fishing Gear Byelaw 2023[4]. Part B also concluded that the ongoing use of anchored nets and lines and traps on the moderate energy circalittoral rock and sedimentary features of Goodwin Sands MPA at the described levels does not pose a significant risk of hindering the achievement of the conservation objectives.

Part C - In-combination assessment 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 of the MPA, MMO will implement a byelaw to prohibit the use of bottom towed gear on the sedimentary features of Goodwin Sands MPA. In addition, MMO will implement a byelaw to prohibit the use of anchored nets and lines and traps on the feature Ross worm (S. spinulosa) reefs within Goodwin Sands MPA.

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

The boundaries of the proposed management area include an appropriate buffer zone to prevent direct damaging physical interactions between fishing activities and the designated features to be protected. The rationale for determining buffer size can be found in in Annex 2 of the Stage 3 MPA Site Assessment Methodology document[6].

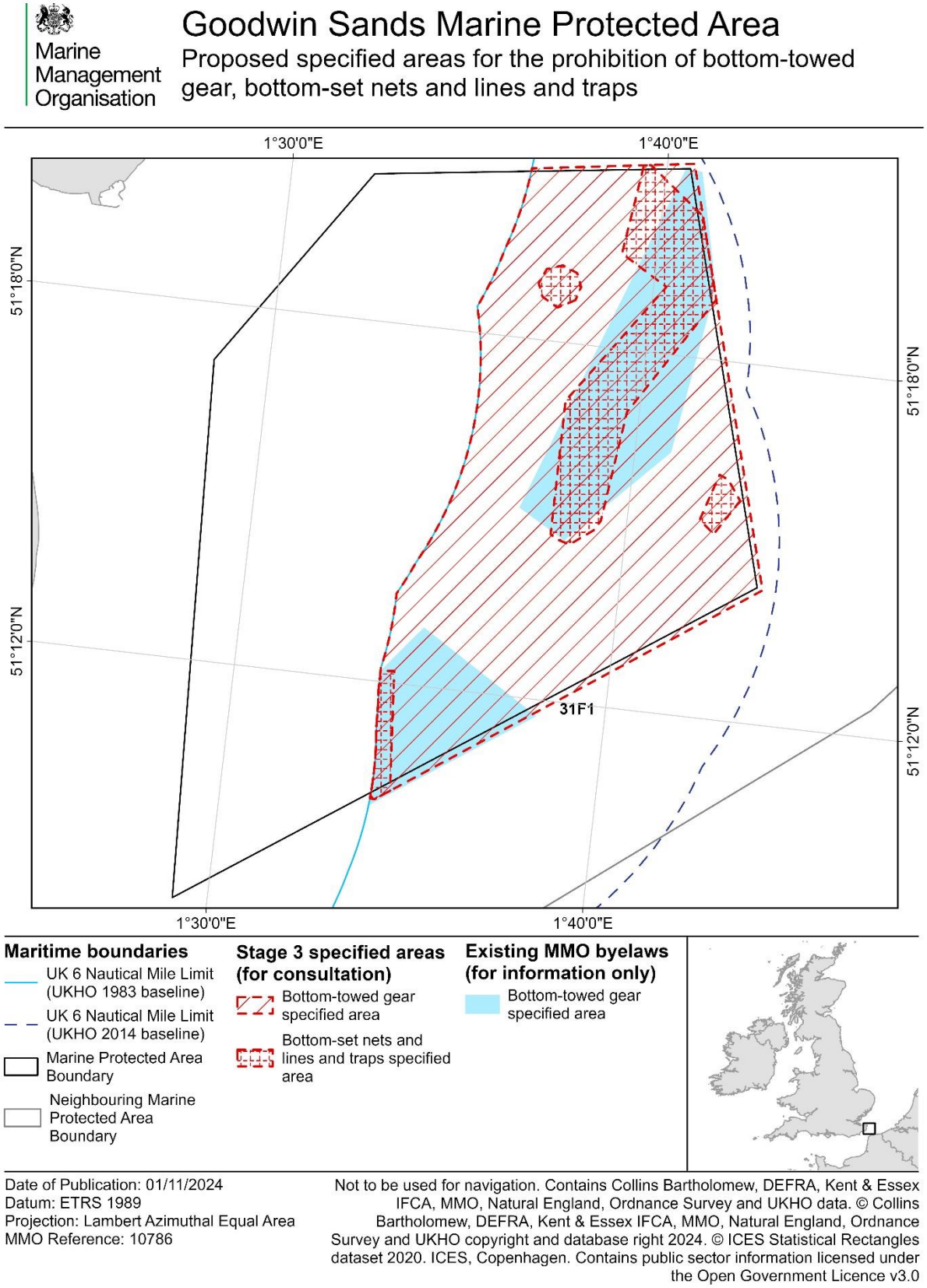

Figure 2: Map of proposed management.

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.

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Annexes

Annex 1: Fishing activity data

Table A1.1: VMS record count and proportion per nation group (UK and EU Member State) and proportional activity (%), per gear, per gear type and per year (2016 to 2021), totals and annual average 2016 to 2021 for Goodwin Sands MPA.

			2016		2017		2018		2019		2020		2021		Total (2016 to 2021)		Annual average (2016 to 2021)
Gear group	**Gear code**	**Nation group**	**Count**	**%**	**Count**	**%**	**Count**	**%**	**Count**	**%**	**Count**	**%**	**Count**	**%**	**Count**	**%**	**Count**
Anchored net/line	GNS	EU Member State	0	0	0	0	2	100	4	100	19	100	0	0	25	100	4
	GNS total		**0**	**0**	**0**	**0**	**2**	**100**	**4**	**57**	**19**	**66**	**0**	**0**	**25**	**66**	**4**
	GTR	EU Member State	0	0	0	0	0	0	3	100	10	100	0	0	13	100	2
	GTR Total		**0**	**0**	**0**	**0**	**0**	**0**	**3**	**43**	**10**	**34**	**0**	**0**	**13**	**34**	**2**
Anchored net/line total			**0**	**0**	**0**	**0**	**2**	**1**	**7**	**2**	**29**	**9**	**0**	**0**	**38**	**2**	**6**
Demersal seine	SDN	EU Member State	25	100	14	100	31	100	44	90	54	90	8	53	176	91	29
	SDN	UK	0	0	0	0	0	0	5	10	6	10	7	47	18	9	3
	SDN total		**25**	**51**	**14**	**58**	**31**	**97**	**49**	**42**	**60**	**45**	**15**	**22**	**194**	**46**	**32**

			2016		2017		2018		2019		2020		2021		Total (2016 to 2021)		Annual average (2016 to 2021)
Gear group	**Gear code**	**Nation group**	**Count**	**%**	**Count**	**%**	**Count**	**%**	**Count**	**%**	**Count**	**%**	**Count**	**%**	**Count**	**%**	**Count**
	SSC	EU Member State	0	0	1	10	0	0	6	9	16	22	3	6	26	11	4
	SSC	UK	24	100	9	90	1	100	61	91	56	78	50	94	201	89	34
	SSC Total		**24**	**49**	**10**	**42**	**1**	**3**	**67**	**58**	**72**	**55**	**53**	**78**	**227**	**54**	**38**
Demersal seine total			**49**	**13**	**24**	**7**	**32**	**11**	**116**	**32**	**132**	**40**	**68**	**42**	**421**	**22**	**70**
Demersal trawl	OTB	EU Member State	333	100	219	100	132	94	145	100	73	90	38	88	940	98	157
	OTB	UK	0	0	0	0	8	6	0	0	8	10	5	12	21	2	4
	OTB total		**333**	**99**	**219**	**100**	**140**	**100**	**145**	**78**	**81**	**55**	**43**	**90**	**961**	**89**	**160**
	TBB	EU Member State	5	100	0	0	0	0	40	100	67	100	0	0	112	96	19
	TBB	UK	0	0	0	0	0	0	0	0	0	0	5	100	5	4	1
	TBB total		**5**	**1**	**0**	**0**	**0**	**0**	**40**	**22**	**67**	**45**	**5**	**10**	**117**	**11**	**20**
Demersal trawl total			**338**	**86**	**219**	**65**	**140**	**47**	**185**	**51**	**148**	**45**	**48**	**30**	**1,078**	**57**	**180**
Midwater trawl	OTM	EU Member State	3	60	64	100	89	100	33	100	4	100	1	100	194	99	32

			2016		2017		2018		2019		2020		2021		Total (2016 to 2021)		Annual average (2016 to 2021)
Gear group	**Gear code**	**Nation group**	**Count**	**%**	**Count**	**%**	**Count**	**%**	**Count**	**%**	**Count**	**%**	**Count**	**%**	**Count**	**%**	**Count**
	OTM	UK	2	40	0	0	0	0	0	0	0	0	0	0	2	1	0
	OTM total		**5**	**100**	**64**	**68**	**89**	**72**	**33**	**67**	**4**	**21**	**1**	**2**	**196**	**58**	**33**
	PTM	EU Member State	0	0	0	0	12	34	6	38	4	27	0	0	22	16	4
	PTM	UK	0	0	30	100	23	66	10	63	11	73	44	100	118	84	20
	PTM total		**0**	**0**	**30**	**32**	**35**	**28**	**16**	**33**	**15**	**79**	**44**	**98**	**140**	**42**	**23**
Pelagic trawl total			**5**	**1**	**94**	**28**	**124**	**42**	**49**	**14**	**19**	**6**	**45**	**28**	**336**	**18**	**56**
Unknown	**NK**	EU Member State	0	0	0	0	0	0	5	100	0	0	0	0	5	100	1
Unknown total			**0**	**0**	**0**	**0**	**0**	**0**	**5**	**1**	**0**	**0**	**0**	**0**	**5**	**0**	**1**
Grand total			**392**	**1**	**337**	**0**	**298**	**0**	**362**	**1**	**328**	**1**	**161**	**0**	**1,878**	**0**	**313**

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

Gear group	Gear code	2016	2017	2018	2019	2020	Total (2016 to 2020)	Average (2016 to 2020)
Demersal seine	SDN	0.00	0.00	0.00	1.64	2.41	4.05	0.81
	SSC	17.76	17.66	0.18	39.45	32.65	107.71	21.54
Demersal seine total		**17.76**	**17.66**	**0.18**	**41.09**	**35.06**	**111.75**	**22.35**
Demersal trawl	OTB	0.00	0.00	4.63	0.00	1.57	6.20	1.24
Demersal trawl total		**0.00**	**0.00**	**4.63**	**0.00**	**1.57**	**6.20**	**1.24**
Midwater trawl	OTM	11.17	0.00	0.00	0.00	0.00	11.17	2.23
	PTM	0.00	460.03	574.23	227.70	368.09	1,630.05	326.01
Midwater trawl total		**11.17**	**460.03**	**574.23**	**227.70**	**368.09**	**1,641.23**	**328.25**
Grand total		**28.94**	**477.68**	**579.05**	**268.79**	**404.72**	**1,759.18**	**351.84**

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

Gear group	Gear code	2016	2017	2018	2019	2020	Total (2016 to 2020)	Average (2016 to 2020)
Anchored net/line	GTR	0.00	0.00	0.00	0.003	0.00	0.003	0.001
Anchored net/line total		**0.00**	**0.00**	**0.00**	**0.003**	**0.00**	**0.003**	**0.001**
Demersal seine	SDN	7.61	2.09	2.35	2.26	1.70	16.01	3.20
	SSC	0.00	1.25	0.00	5.12	9.97	16.34	3.27
Demersal seine total		**7.61**	**3.34**	**2.35**	**7.37**	**11.67**	**32.35**	**6.47**
Demersal trawl	OTB	30.85	22.06	16.80	23.64	9.53	102.87	20.57
	TBB	0.45	0.00	0.00	2.59	2.41	5.44	1.09
Demersal trawl total		**31.30**	**22.06**	**16.80**	**26.23**	**11.94**	**108.31**	**21.66**
Midwater trawl	OTM	30.20	248.75	239.23	312.62	113.65	944.44	188.89
	PTM	0.00	0.00	0.00	0.00	0.44	0.44	0.09
Midwater trawl total		**30.20**	**248.75**	**239.23**	**312.62**	**114.09**	**944.89**	**188.98**
Grand total		**69.10**	**274.15**	**258.38**	**346.22**	**137.70**	**1,085.55**	**217.11**

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

ICES rectangle	Percentage overlap (%)
31F1	4.59

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

Gear group	Gear code	2016	2017	2018	2019	2020	Total (2016 to 2020)	Average (2016 to 2020)
Anchored net/line	GN	6.39	5.22	6.98	4.66	3.66	26.91	5.38
	GNS	3.71	3.60	0.57	0.62	0.06	8.57	1.71
	GTR	2.11	1.66	1.38	1.73	1.41	8.29	1.66
	LL	0.00	0.0007	0.00	0.00	0.00	0.0007	0.0001
Anchored net/line total		**12.21**	**10.49**	**8.93**	**7.01**	**5.13**	**43.76**	**8.75**
Demersal trawl	OT	6.88	2.46	0.00	0.00	0.00	9.34	1.87
	OTB	0.27	3.27	4.96	2.61	3.43	14.55	2.91
	OTT	0.04	0.01	0.00	0.00	0.00	0.05	0.01
	TBB	0.01	0.02	0.00	0.00	0.00	0.03	0.01
Demersal trawl total		**7.19**	**5.76**	**4.96**	**2.61**	**3.43**	**23.96**	**4.79**
Dredge	DRB	1.26	1.12	1.60	2.75	25.96	32.69	6.54
Dredge total		**1.26**	**1.12**	**1.60**	**2.75**	**25.96**	**32.69**	**6.54**
Midwater - gill drift	GND	0.60	0.04	0.00	0.00	0.90	1.55	0.31
Midwater - gill drift total		**0.60**	**0.04**	**0.00**	**0.00**	**0.90**	**1.55**	**0.31**
Midwater - hook/lines	LHP	0.00	0.00	0.00	0.00	0.01	0.01	0.00
	LX	0.00	0.09	0.04	0.39	0.42	0.94	0.19
Midwater - hook/lines total		**0.00**	**0.09**	**0.04**	**0.39**	**0.43**	**0.96**	**0.19**
Midwater trawl	OTM	0.00	0.10	0.00	0.77	2.60	3.46	0.69
	PTM	0.40	0.07	0.00	0.00	0.00	0.48	0.10
Midwater trawl total		**0.40**	**0.17**	**0.00**	**0.77**	**2.60**	**3.94**	**0.79**
Traps	FIX	0.06	0.02	0.00	0.00	0.00	0.08	0.02
	FPO	40.52	32.03	16.25	25.20	38.76	152.76	30.55
Traps total		**40.58**	**32.05**	**16.25**	**25.20**	**38.76**	**152.84**	**30.57**
Grand total		**62.24**	**49.72**	**31.78**	**38.73**	**77.22**	**259.69**	**51.94**

Table A1.6: EU27 live weight landings tonnage (t) estimates by gear from vessels under 12 m in length for the MMO section of Goodwin Sands MPA (2016 to 2020).

Gear group	Gear code	2016	2017	2018	2019	2020	Total (2016 to 2020)	Average (2016 to 2020)
Anchored net/line	GTR	4.47	3.28	2.94	2.57	1.03	14.29	2.86
	GNS	0.00	0.81	0.26	0.13	0.18	1.37	0.27
	GTN	0.00	0.00	0.00	0.004	0.00	0.004	0.001
Anchored net/line total		**4.47**	**4.08**	**3.20**	**2.70**	**1.21**	**15.66**	**3.13**
Demersal seine	SSC	0.00	0.00	0.20	0.04	0.14	0.38	0.08
Demersal seine total		**0.00**	**0.00**	**0.20**	**0.04**	**0.14**	**0.38**	**0.08**
Dredge	DRB	0.02	0.00	0.00	0.00	0.00	0.02	0.00
Dredge total		**0.02**	**0.00**	**0.00**	**0.00**	**0.00**	**0.02**	**0.00**
Midwater - hook/lines	LHP	0.17	0.18	0.09	0.01	0.06	0.51	0.10
	LTL	0.00	0.02	0.01	0.00	0.00	0.02	0.00
Midwater - hook/lines total		**0.17**	**0.20**	**0.10**	**0.01**	**0.06**	**0.53**	**0.11**
Traps	FPO	1.22	0.88	3.45	13.75	10.81	30.11	6.02
Traps total		**1.22**	**0.88**	**3.45**	**13.75**	**10.81**	**30.11**	**6.02**
Grand total		**5.88**	**5.16**	**6.95**	**16.50**	**12.21**	**46.70**	**9.34**

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

Gear group	SAR Category	2016		2017		2018		2019		2020	
		Mean	Max	Mean	Max	Mean	Max	Mean	Max	Mean	Max
Demersal seine	Surface	2.00	11.86	2.39	15.53	1.42	9.15	7.60	39.49	6.78	34.20
	Subsurface	0.06	0.30	0.10	0.66	0.04	0.20	0.32	1.65	0.31	1.47
Demersal trawl	Surface	0.41	4.88	0.22	2.23	0.16	1.41	0.57	3.45	0.33	2.06
	Subsurface	0.13	1.84	0.05	0.50	0.04	0.43	0.11	0.83	0.06	0.39
Dredge	Surface	0.001	0.01	0.00	0.00	0.001	0.01	0.001	0.01	0.001	0.02
	Subsurface	0.001	0.01	0.00	0.00	0.001	0.01	0.001	0.01	0.001	0.02
Bottom towed gear total	**Surface**	**2.41**	**16.75**	**2.61**	**17.77**	**1.58**	**10.57**	**8.17**	**42.95**	**7.11**	**36.28**
	Subsurface	**0.19**	**2.15**	**0.15**	**1.16**	**0.08**	**0.64**	**0.44**	**2.49**	**0.37**	**1.88**

Table A1.8: Fishing effort (days) recorded by UK vessels under 12 m in length, separated by gear type for the area of Goodwin Sands MPA that intersects the marine portion of ICES rectangle 31F1 (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)	Annual average (2016 to 2021)
Demersal trawl	31.41	21.77	21.24	16.31	12.19	9.71	112.63	18.77
Dredge	5.00	3.63	3.53	4.80	4.20	6.20	27.36	4.56
Bottom towed gear total	**36.41**	**25.39**	**24.78**	**21.11**	**16.39**	**15.91**	**139.99**	**23.33**
Midwater - gill drift	5.09	0.28	0.05	0	0.18	0.05	5.64	0.94
Midwater trawl	0.87	0.37	0	0.55	0.83	0	2.62	0.44
Midwater - hooks and lines	0.21	0.73	0.55	2.91	3.00	3.15	10.55	1.76
Midwater gear total	**6.17**	**1.38**	**0.60**	**3.46**	**4.01**	**3.20**	**18.80**	**3.13**
Traps	78.61	62.52	35.32	39.84	52.78	50.30	319.37	53.23
Anchored nets and lines	69.54	51.37	44.84	34.99	27.10	32.69	260.54	43.42
Static gear total	**148.15**	**113.89**	**80.16**	**74.83**	**79.89**	**82.99**	**579.91**	**96.65**
MPA total	**190.72**	**140.67**	**105.53**	**99.40**	**100.28**	**102.10**	**738.70**	**123.12**