Document Control

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Southern Inshore Fisheries and Conservation Authority (IFCA)

Marine Conservation Zone Fisheries Assessment (Part B)

Marine Conservation Zone: The Needles

Feature: Seagrass Beds

Broad Gear Type: Bottom Towed Fishing Gear

Gear type(s) Assessed: Beam trawl / Light Otter Trawl and Multi-rig trawl

Technical Summary

As part of the MCZ assessment process for the tranche 2 The Needles MCZ, it was identified that trawling (light otter trawl, beam trawl & Multi-rig) and its potential impacts require an in-depth assessment. The level of trawling within the site is considered to be 'very light', with trawling occurring over subtidal sediments on the north fringes of the site twice a year.

The potential pressures likely to be exerted by the activity upon designated features were identified as abrasion, disturbance and penetration of the seabed below and on the surface of the seabed, the removal of non-target species, smothering and siltation rate changes and changes in suspended solids. Scientific literature shows that trawling can lead to the immediate removal of the seagrass feature, as well as cause the resuspension of sediments which can smother the feature and associated species. Recovery of seagrass beds can take years to decades.

When considering that trawling occurs within The Needles MCZ, in combination with other evidence (scientific literature, feature data, sightings data) it was concluded the activity was likely to pose a significant risk to Seagrass Beds. As such, it is believed the activity will hinder the achievement of the designated features 'recover' general management approaches and that it is not compatible with the site's conservation objectives.

Existing management measures are therefore not considered sufficient to ensure that trawling remains consistent with the conservative objectives of the site. Therefore, additional management for bottom towed fishing gear will be introduced which will protect seagrass beds.

When scientific literature, fishing activity, sightings data and, existing and proposed management is considered, the management of BTFG will be considered sufficient to ensure that trawling remains consistent with the conservative objectives of the site. Fishing effort will continue to be monitored.

Contents

1 Introduction

1.1 Need for an MCZ assessment

This assessment has been undertaken by Southern IFCA in order to document and determine whether management measures are required to achieve the conservation objectives of The Needles Marine Conservation Zone (MCZ). Southern IFCA has duties under section 154 of the Marine and Coastal Access Act 2009 which states;

154 Protection of marine conservation zones

(1) The authority for an IFC district must seek to ensure that the conservation objectives of any MCZ in the district are furthered.
(2) Nothing in section 153(2) is to affect the performance of the duty imposed by this section.
(3) In this section—
    (a) "MCZ" means a marine conservation zone designated by an order under section 116;
    (b) the reference to the conservation objectives of an MCZ is a reference to the conservation objectives stated for the MCZ under section 117(2)(b).

Section 125 of the 2009 Act also requires that public bodies (which includes the IFCA) exercise its functions in a manner to best further (or, if not possible, least hinder) the conservation objectives for MCZs.

The MCZ assessment process complements Southern IFCA's assessment of commercial fishing activities in European Marine Sites (EMS) – designated to protect habitats and species in line with the EU Habitats Directive and Birds Directive. To bring fisheries in line with other activities, the Department for Environment, Food and Rural Affairs (DEFRA) announced on the 14th August 2012 the revised approach to manage fishing activities within EMSs. This change in approach promotes sustainable fisheries while conserving the marine environment and resources, securing a sustainable future for both.

Habitat and species feature data is continually being added to and updated. In 2020 Southern IFCA received updated habitat data regarding rock features. Therefore, this new data requires MCZ assessments to determine whether or not the conservation measures in place were appropriate to further the conservation objectives of the habitats and species for which the site has been designated (Marine and Coastal Access Act 2009).

This document forms the basis of a Marine Conservation Zone Assessment for the updated rock in The Needles MCZ feature data. The purpose of this document is to assess whether or not in the view of Southern IFCA, the Bottom Towed Fishing Gear activity will have a likely significant effect on the features and sub-features of the MCZ alone, and where appropriate in-combination with other plans or projects. The assessment ensures Southern IFCA meets its responsibilities as a competent authority by ensuring the conservation objectives of the Marine Conservation Zone are furthered with regards to fishing activity.

Southern IFCA have now completed a Part A Assessment of the activities over these features. This indicated that some pressures created by the activities are exerted on the features, and therefore are required to be assessed in a Part B Assessment. Therefore, this document contains the Part B Assessment for rock within The Needles MCZ with the Southern IFCA District.

1.2 Documents reviewed to inform this assessment

- Reference list (Section 9)
- Defra's matrix of fisheries gear types and European Marine Site protected features[1]
- Site map(s) – feature location and extent (Annex 1)
- Natural England's Advice on Operations for The Needles MCZ[2] (Annex 2)

[1] https://www.gov.uk/government/publications/fisheries-in-european-marine-sites-matrix
[2] https://designatedsites.naturalengland.org.uk/Marine/MarineSiteDetail.aspx?SiteCode=UKMCZ0040&SiteName=the%20needles&

- Fishing activity data (map(s), etc) (Annex 3)
- Fisheries Impact Evidence Database (FIED)

2 Information about the MCZ

2.1 Overview and designated features

The Needles MCZ was designated in January 2016 and covers the stretch of Solent adjacent to the northwest side of the Isle of Wight to just south of the Needles, including a series of sheltered bays. The site covers an area of approximately 11 km² and protects a number of rare and fragile habitats including chalk on the seabed, shallow water (infralittoral) rock and soft sediments which support communities of algae, sponges, sea squirts and delicate anemones. The site also protects seagrass beds in both Totland and Colwell Bays, together with rare and threatened species such as the Stalked jellyfish (*Lucernariopsis campanulata*) and Peacock's tail (*Padina pavonica*).

A summary of the site's designated features is provided in Table 1, together with the recommended General Management Approach (GMA) for each feature. The GMA required for a feature in a MCZ will either be for it to be maintained in favourable condition (if it is currently in this state), or for it to be recovered to favourable condition (if it is currently in a damaged state) and then to be maintained in favourable condition.

Table 1. Designated features and General Management Approach

Designated feature	General Management Approach
Moderate energy infralittoral rock	Maintain in favourable condition
High energy infralittoral rock	
Moderate energy circalittoral rock	
Stalked jellyfish (*Lucernariopsis campanulata*)	
Subtidal chalk	Recover to favourable condition
Subtidal coarse sediment	
Subtidal mixed sediments	
Subtidal sand	
Subtidal mud	
Sheltered muddy gravels	
Seagrass beds	
Peacock's tail (*Padina pavonica*)	
Native oyster (*Ostrea edulis)*	

Please refer to Annex 1 for site feature maps of broad-scale habitats and features of conservation importance. This feature data comes from the Natural England, 2019 data set given to Southern IFCA, containing a collation of marine habitat and species records that contribute to the designation of marine habitats and features. This corresponds with the feature data on Magic Map which represents Natural England's best available evidence (https://magic.defra.gov.uk/MagicMap.aspx).

2.2 Conservation Objectives

The site's conservation objectives apply to the Marine Conservation Zone and the individual species and/or habitat for which the site has been designated (the "Designated features" listed below).

The conservation objective of each of the zones is that the protected habitats:

1. are maintained in favourable condition if they are already in favourable condition
2. be brought into favourable condition if they are not already in favourable condition

SiteNameDisplay=The%20Needles%20MCZ&countyCode=&responsiblePerson=&SeaArea=&IFCAArea=&NumMarineSeasonality=&HasCA=1

For each protected feature, favourable condition means that, within a zone:

1. its extent is stable or increasing
2. its structure and functions, its quality, and the composition of its characteristic biological communities (including diversity and abundance of species forming part or inhabiting the habitat) are sufficient to ensure that its condition remains healthy and does not deteriorate

Any temporary deterioration in condition is to be disregarded if the habitat is sufficiently healthy and resilient to enable its recovery.

For each species of marine fauna, favourable condition means that the population within a zone is supported in numbers which enable it to thrive, by maintaining:

1. the quality and quantity of its habitat
2. the number, age and sex ratio of its population. Any temporary reduction of numbers of a species is to be disregarded if the population is sufficiently thriving and resilient to enable its recovery.

Any alteration to a feature brought about entirely by natural processes is to be disregarded when determining whether a protected feature is in favourable condition.

3 MCZ assessment process

3.1 Overview of the assessment process

The assessment of commercial fishing activities within the Studland MCZ will be undertaken using a staged process, akin to that proposed by the Marine Management Organisation (MMO)[3], for marine license applications. The assessment process comprises of an initial screening stage to establish whether an activity occurs or is anticipated to occur/has the potential to occur within the site. Activities which are not screened out are subject to a simple 'part A' assessment, akin to the Test of Likely Significant Effect required by article 6(3) of the Habitats Directive. The aim of this assessment is to identify pressures capable of significantly affecting designated features or their related processes. Fishing activities and their associated pressures which are not screened out in the part A assessment and then subject to a more detailed 'part B' assessment, where assessment is undertaken on a gear type basis. A part B assessment is akin to the Appropriate Assessment required by article 6(3) of the Habitats Directive. The aim of this assessment is to determine whether there is a significant risk of the activity hindering the conservation objectives of the MCZ. Within this stage of assessment, 'hinder' is defined as any act that could, either alone or in combination:

- in the case of a conservation objective of 'maintain', increase the likelihood that the current status of a feature would go downwards (e.g. from favourable to degraded) either immediately or in the future (i.e. they would be placed on a downward trend); or

- in the case of a conservation objective of 'recover', decrease the likelihood that the current status of a feature could move upwards (e.g. from degraded to favourable) either immediately or in the future (i.e. they would be placed on a flat or downward trend) (MMO, 2013).

If the part B assessment is unable to conclude that there is no significant risk of an activity hindering the conservation objectives of the MCZ, then the activity may be subject to management and consideration will be given to whether or not the public benefit of the activity outweighs the risk of damage to the environment; and if so, whether the activity is able to deliver measures of equivalent environmental benefit to the damage that is likely to occur to the MCZ.

3 https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/410273/Marine_conservation_zones_and_marine_licensing.pdf

3.2 Screening and part A assessment

The aim of the screening stage and part A assessment is to determine whether, under section 125 and 154 of MCAA, fishing activities occurring or those which have the potential to occur within the site are compatible with the conservation objectives of the MCZ.

The screening of commercial fishing activities in The Needles MCZ was undertaken using broad gear type categories. Sightings data collected by the Southern IFCA, together with officers' knowledge, was used to ascertain whether each activity occurs within the site, or has the potential to occur/is anticipated to occur in the foreseeable future. For these occurring/potentially occurring activities, an assessment of pressures upon MCZ designated features was undertaken using Natural England's Advice on Operations for the Feature (using an alternate designated site as the Conservation Advice for the Studland MCZ has not yet been produced.

Activities were screened out for further part B assessment if they satisfied one or more of the following criteria:

1. The activity does not occur within the site, does not have the potential to occur and/or is not anticipated to occur in the foreseeable future.

2. The activity does occur but the pressure(s) does not significantly affect/ interact with the designated feature(s).

3. The activity does occur but the designated feature(s) is not sensitive to the pressure(s) exerted by the activity.

3.2.1 Screening of commercial fishing activities based on occurrence

Initial screening was undertaken to identify the commercial fishing activities which currently occur within the site, together with those which have the potential to occur or/and are reasonably foreseen to occur in the future (Annex 3). To maintain consistency with Southern IFCA's assessment of commercial fishing activities in European Marine Sites, the individual gear types identified in Defra's matrix were assessed and these were grouped into broad gear types.

3.2.2 Screening of commercial fishing activities based on pressure-feature interaction

Fishing activities which were identified as occurring, have the potential to occur and/or are anticipated to occur in the foreseeable future within the site were screened with respect to the potential pressures which they may be exert upon designated features (Part A assessment). This screening exercise was undertaken using Natural England's Advice on Operations (Annex 2) and Supplementary Advice for The Needles MCZ. The Advice on Operations provides a broad scale assessment of the sensitivity of designated features to different activity-derived pressures, using nationally available evidence on their resilience (an ability to recover) and resistance (the level of tolerance) to physical, chemical and biological pressures. The assessments of sensitivity to these pressures are measured against a benchmark. It should be noted that these benchmarks are representative of the likely intensity of a pressure caused by typical activities, and do not represent a threshold of an 'acceptable' intensity of a pressure. It is therefore necessary to consider how the level of fishing intensity observed within the Needles MCZ compares with these benchmarks when screening individual activities.

Due to the broad-scale nature of the sensitivity assessments provided in Natural England's Advice on operations, each pressure is assigned a risk profile based upon the likelihood of the pressure occurring and the magnitude of the impact should that pressure occur. These risk profiles have been used, together with site-specific knowledge, to identify those pressures which could significantly affect designated features.

The Natural England Advice on Operations for the MCZs used is provided in Annex 2. The resultant activity pressure-feature interactions which have been screened in for bottom towed fishing gear for the part B assessment are summarised in Table 2 for sensitive designated features. The activity pressure-feature interactions which were screened out in the Part A Assessment are detailed in a standalone document ('Screening and Part A Assessment') for The Needles MCZ.

Table 2. Summary of fishing pressure-feature screening for seagrass beds and demersal trawls. Please not only pressures screened in for the Part B assessment are presented here.

Potential Pressures	Sensitivity	Considered in Part B Assessment?	Justification	Relevant Attributes (effected by identified pressures)
Abrasion/disturbance of the substrate on the surface of the seabed	S	Y	This gear type is known to cause abrasion and disturbance to the seabed surface. Further investigation is needed on the magnitude of the pressure including spatial scale/intensity of the activity and location of the activity in relation to the feature.	Distribution: presence and spatial distribution of biological communities; Extent and distribution; Structure and function: presence and abundance of key structural and influential species; Structure: biomass; Structure: sediment composition and distribution; Structure: species composition of component communities
Changes in suspended solids (water clarity)	S	Y	This gear is known to cause the resuspension of finer sediments therefore further assessment is required.	Supporting processes: light levels; Supporting processes: water quality - turbidity
Penetration and/or disturbance of the substratum below the surface of the seabed, including abrasion	S	Y	This gear type is known to cause penetration and disturbance to the seabed surface. Further investigation is needed on the magnitude of the pressure including spatial scale/intensity of the activity and location of the activity in relation to the feature.	Distribution: presence and spatial distribution of biological communities; Extent and distribution; Structure and function: presence and abundance of key structural and influential species; Structure: biomass; Structure: sediment composition and distribution; Structure: species composition of component communities
Removal of non-target species	S	Y	Impacts on the feature and associated community may occur through the removal of the feature itself, larger epifaunal and potentially infaunal species, whilst smaller organisms are likely to pass through the gear. Abrasion, resulting from contact with the gear, however is likely to disturb smaller species. General information on the designated features from the MCZ features catalogue indicates that Seagrass beds provide nursery habitat for young fish and shellfish, as well as a sheltered home for other animals such as pipefish and seahorses. Further investigation is needed as to the magnitude of disturbance to associated communities/species and	Distribution: presence and spatial distribution of biological communities; Structure and function: presence and abundance of key structural and influential species; Structure: species composition of component communities

			location of the activity in relation to the feature.	
Smothering and siltation rate changes (Light)	S	Y	This gear is known to cause the resuspension of finer sediments therefore further assessment is required.	Supporting processes: sedimentation rate; Supporting processes: water quality - turbidity

4 Part B Assessment

The aim of the part B assessment is for the IFCA to ensure that that there is no significant risk of a fishing activity hindering the conservation objectives of the MCZ; and to confirm that the authority is able to exercise its functions to further the site's conservation objectives.

In order to adequately assess the potential impacts of an activity upon a designated feature, it is necessary to consider the relevant attributes of that feature that may be affected. Attributes are provided in Natural England's Supplementary Advice on Conservation Objectives (SACOs) and represent the ecological characteristics or requirements of the designated species and habitats within a site. These attributes are considered to be those which best describe the site's ecological integrity and which if safeguarded will enable achievement of the Conservation Objectives. Each attribute has an associated target which identifies the desired state to be achieved; and is either quantified or qualified depending on the available evidence.

4.1 Assessment of trawling in the Needles MCZ

4.1.1 Summary of the Fishery

Trawling can take place all year round within the Needles MCZ. The level of activity is however very low with one to two vessels fishing one to two times a year on the fringes of the site using light otter trawls. The activity does not target a specific species. The species caught is dependent on the time of year and catches can include common sole (*Solea solea*) and European plaice (*Pleuronectes platessa*), with a bycatch of bass.

4.1.2 Technical gear specifications

Light otter trawls are used to fish for a number of fish species on the fringes of the Needles MCZ. There is also the potential for a beam trawl and multi-rig trawl to be used within the site, although it is not currently known to occur.

4.1.3 Light otter trawl

An otter trawl comprises of following design (see Figure 1). Two shaped panels of netting are laced together at each side to form an elongated funnel shaped bag (Seafish, 2015). The funnel tapers down to a cod-end where fish are collected (Seafish, 2015). The remaining cut edges of the net and net mouth are strengthened by lacing them to ropes to form 'wings' that are used to drive fish into the net (Seafish, 2015). The upper edge of the rope is referred to as the head line, the lower edge is referred to as the foot rope of fishing line and side ropes are known as wing lines (Seafish, 2015). Floats are attached to the headline to hold the net open and the foot rope is weighted to maintain contact with the seabed and prevent damage to the net (Seafish, 2015). The wings of the net are held open by a pair of trawl doors, also known as otter boards, and are attached to the wings by wires, ropes or chains known as bridles and sweeps (Seafish, 2015). The sweep connects the trawl door to top and bottom bridles which are attached to the headline and footrope of the net, respectively (Seafish, 2015). The choice of material used for the sweeps and bridles depends on the size of gear and nature of the seabed, with smaller inshore boats using thin wire and combination rope (Seafish, 2015). The trawl doors, which are made of wood or steel are towed through the water at an angle which causes them to spread apart and open the net in a horizontal direction (Seafish, 2015). The trawl doors are attached to the fishing vessel using wires referred to as trawl warps (Seafish, 2015). The trawl doors must be heavy enough to keep the net on the seabed as it is towed (Seafish, 2015). As the trawl doors are towed along the seabed, they generate a sediment cloud which helps to herd fish towards the mouth of the trawl (Seafish, 2015). The bridles and sweeps continue the herding action of the trawl doors as the trail on the seabed and disturb the sediment, creating a sediment cloud (Seafish, 2015). The length of the sweeps and bridles and distance between the two trawl doors is tuned to the target species (Seafish, 2015). Species such as lemon sole and plaice can be herded into the trawl over long distances and so the length of the sweeps is longer (Seafish, 2015).

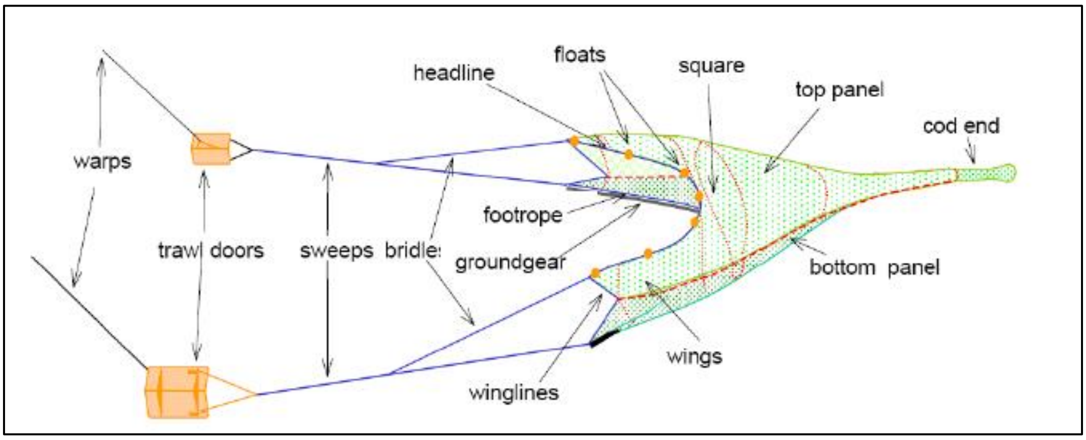

Figure 1. Key components of an otter trawl. **Source: www.seafish.org/upload/b2b/file/r_d/BOTTOM%20TRAWL_5a.pdf**

The mesh size of the net used varies depending on the type of trawl (Seafish, 2015). In the UK, there has been a move towards an increase in mesh size, particularly in the top panel and wings, in order to improve gear selectivity (Seafish, 2015).

The ground rope will have some form of ground gear attached to protect the netting from damage on the seabed (Seafish, 2015). The ground gear can largely vary. The most basic is where bare fishing line and the netting is laced directly to the rope of combination rope (Seafish, 2015). Chains may also be used and the style of attachment can vary (Seafish, 2015). Ground gear may also include bobbins and rock hoppers which commonly use small and large rubber discs (up to 600 mm) (Seafish, 2015).

The drag of the gear, combined with the floats on the headline, mean the weight of the trawl on the seabed is in the region of 10 to 20% of what it would be in air (Seafish, 2015).

A light otter trawl is one that uses anything less than the definition given for a heavy otter trawl, which include any of the following (MMO, 2014):

- Sheet netting of greater than 4 mm twine thickness
- Rockhoppers or discs of 200 mm or above in diameter
- A chain for the foot/ground line (instead of wire)

Generally, vessels will shoot and haul their gear over the stern of the boat (Seafish, 2015). Restrictions on vessels over 12 metres in length in the Southern IFCA district limits the size of gear that can be used within the district.

There is no typical gear set up used in the Solent and each individual has a different approach (Southern IFCA Committee Member Pers. Comm)[4]. The size and weight of trawl doors used in the Solent varies, however the largest doors likely to be used in the Solent are made of steel and measure approximately 52 x 38 inches, weighing 130 kg each (Southern IFCA Committee Member Pers. Comm). The ground rope used by the vessels ranges between 36 to 60 ft in length and commonly made of 16 mm wire with rubber discs of 4 to 6 inches, spaced 1 inch apart (Southern IFCA Committee Member Pers. Comm). The rubber discs are designed to maintain consistent contact with the seabed. Additional buoyancy may be attached to the ground rope to minimise contact with the seabed (Southern IFCA Committee Member Pers. Comm)**.** The length of the sweeps and bridles is approximately 90 ft (Southern IFCA Committee Member Pers. Comm). Trawls are towed at between 1 and 3.5 knots, depending on the state of the tide. In the Solent, the tow length is dependent on the level of weed and in some areas takes no longer than 10 minutes (Southern IFCA Committee Member Pers. Comm).

4.1.4 Beam trawl

A net is held open by a rigid framework to maintain trawl opening, regardless of towing speed, in addition to supporting the net (Seafish, 2015). The framework consists of a heavy tubular steel beam which is supported

[4] Information was provided by a Southern IFCA Committee Member who has valuable knowledge and experience of the fishery.

by steel beam heads at each end. Each beam head has wide shoes at the base which slide over the seabed (Seafish, 2015). A cone shaped net is towed from the framework, with the head rope attached to the beam and foot rope connected to the base of the shoes (Seafish, 2015). The footrope forms a 'U' shape curve behind the beam as it is towed over the seabed (Seafish, 2015). The beam is towed using a chain bridle which is attached to both shoes and at the centre of the beam; all coming together to form a single trawl warp which leads to the vessel (Seafish, 2015).

There are two types of beam trawl and these are referred to as 'open gear' and 'chain mat gear' (Seafish, 2015). Open gear uses a lighter rig, with a number of chains, known as 'ticklers', which are towed along the seabed across the mouth of the net (Figure 2) (Seafish, 2015). Tickler chains help to disturb fish from a muddy seabed. Open gear is used on clean and soft ground. Chain mat gear on the other hand is used for towing over harder and stonier seabed and if often used by larger vessels (Seafish, 2015). The chain mat gear uses a lattice work of chains which are towed from the back of the beam and attach to the footrope of the net (Figure 3) (Seafish, 2015). Lighter styles of beam, using fewer tickler chains and without a chain mat, are used to target shrimp (Seafish, 2015).

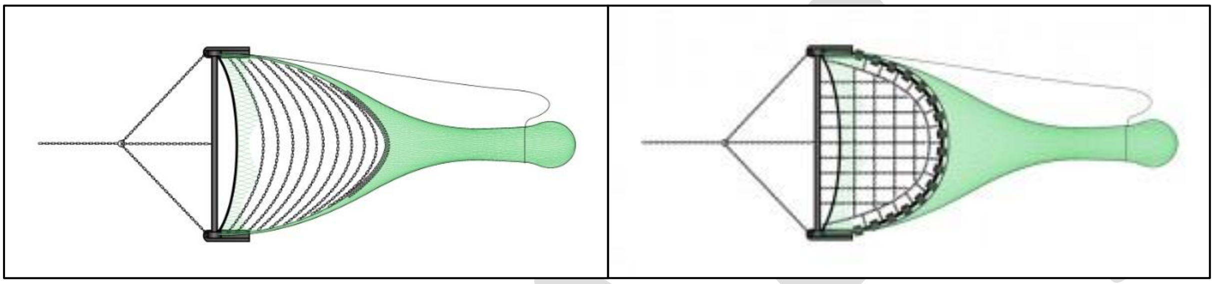

Figure 2. (a) 'Open gear' beam trawl, (b) 'Chain mat gear' beam trawl.

Generally, vessels below 12 metres, like those used in the Southern IFCA district, tow one trawl from the stern of the vessel (Seafish, 2015). The size of the beam towed, and the horsepower of many vessels, can be restricted by the local fishery regulations (Seafish, 2015). The sizes of trawls typically used in the Solent are approximately 3 m in width and weigh 650 kg with a chain matrix. These are not currently used within or on the fringes of the Needles MCZ.

4.1.5 Multi-rig trawl

A multi-rig rig demersal trawl uses a similar set up to a light otter trawl but occurs when two or more smaller trawls are towed side by side, as opposed to one. This makes it possible to fish a wider area without any increase in the drag of the gear. Typically, a multi-rig will be a twin- or triple- rig using two or three nets, respectively, side by side. A variety of configurations are used worldwide to target bottom-living species and the configuration chosen largely depends on the target species (Seafish, 2015). The configuration can vary based a number of components including the number of warps used, the length of the sweeps and bridles and the type of weight used to keep the inner wings of each net open (i.e. skid, trawl doors, chain clump weight, roller clump weight, depressor clump weight) (Seafish, 2015). The outer wings of outside nets are kept open using trawl doors (also known as otter boards), like an otter trawl.

4.1.6 Location, Effort and Scale of Fishing Activities

Light otter trawling takes place subtidally and occurs infrequently (1 to 2 times a year) on the outer northern and western fringes of the site on the edges of the main channel (known as the Needles Channel) in the western Solent.

The number of vessels engaged in the activity is limited with 1 to 2 vessels. These vessels operate out of Cowes and Lymington. Both have historically used light otter trawls. One vessel has recently switched to a multi-rig trawl set up however it is not known to have been used within the Needles MCZ.

Sightings data displayed in Annex 3 illustrates trawl sightings data from 2009 to 2020. No sightings are present in the Needles MCZ. This is mostly due to the very low level of fishing activity that occurs in the site, but is also due to the risked based enforcement approach adopted by the IFCA which means patrols are focused in other areas of the district.

4.2 Co-location of fishing activity and features under assessment

Maps of the broad-scale habitat types can be found in Annex 1. This map can be used in conjunction with the knowledge of where fishing is known to occur to reveal where fishing activity occurs in relation to the designated features of the site.

There are two seagrass beds within the site, one in Colwell bay and the other in Totland Bay (Annex 1). Trawling occurs on the fringes of the site over subtidal coarse and mixed sediments.

4.3 Potential impacts

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

Very little research has been carried out on the impacts of dredge fishing and trawling over seagrass beds, particularly over the last decade.

Moore and Jennings (2000) suggest that fishing with mobile gear has major direct and indirect impacts on seagrass beds. The substrate holding the seagrass beds may be lost or destabilised, seagrass is uprooted and damaged (Tudela, 2004) and re-suspension of sediment reduces light intensity required for photosynthesis (Ardizzone *et al*., 2000).

Numerous studies have shown (Peterson et al 1987, Fonseca et al 1984, Neckles *et al*. 2005 and De Jonge and de Jong 1992) that shellfish dredging immediately reduce shoot density and biomass of seagrass, whilst also increasing the turbidity of the water column (Bishop *et al*., 2005) which in turn has indirect consequences for species assemblages.

In 1984, Fonseca *et al.* found that scallop dredging over eelgrass in North Carolina led to significant reductions in eelgrass biomass and shoot number. The effects were seen on eelgrass found in both hard and soft substrates (Fonseca *et al.,* 1984). Similarly, along the Mediterranean coast, *Posidonia oceanica* meadows have seen significant declines in density after trawling activity (Sánchez-Jerez & Esplá, 1996).

Further research on *Z. marina* found that other activities including hydraulic dredging for clams, dragging for *Mytilus edulis* and illegal trawling had significant impacts on the seagrass beds (Orth *et al.,* 2002; Neckles *et al.,* 2005). Large areas of 'scaring' within seagrass beds were found of Florida's coast caused by dredging for clams (Orth *et al.,* 2002). In Maine, eelgrass shoot density was reduced to as little as 3%, with total biomass below 1% after mussel dredging activity (Neckles *et al.,* 2005). Illegal trawling activity in Spain led to complete absence of seagrass beds (Rueda *et al.,* 2009).

In many countries hand held bottom towed fishing gears are used on intertidal sediment to collect bivalves and bait. Studies from the effects of these can be used to infer potential damage which could occur to intertidal seagrass beds from bottom towed fishing gears. Clam kicking (propeller modified to push the wash towards the boat which suspends sediment and clams, which are collected in a trawl towed behind) and clam raking at low intensities in North Carolina were found to decrease seagrass biomass by 25% (Peterson *et al.,* 1987). However, at high intensities clam kicking led to a 65% decrease in seagrass biomass (Peterson *et al.,* 1987). Conflictingly, Boese (2002) found that two weeks after clam raking in Z. marina beds in Oregon no significant effect of treatment was found despite leaf and rhizome material visibly removed during the experiment.

Sediment character

Bottom towed fishing gear activities can also change the sediment character of the benthos. Rueda *et al*. (2009) found that trawling led to an increase in the organic and mud content of the benthos where seagrass was previously found.

Towed demersal fishing gear has been shown to alter sedimentary characteristics and structure, particularly in subtidal muddy sand and mud habitats, as a result of penetration into the sediment (Jones, 1992; Gubbay & Knapman, 1999; Ball *et al*. 2000; Roberts *et al*. 2010). Surface organic material can be mixed into subsurface layers, changing the vertical distribution of sediment layers (Mayer *et al*., 1991; Jones, 1992). Sediment structure may change through the resuspension of sediment, nutrients and contaminants and relocation of stones and boulders (ICES, 1992; Gubbay & Knapman, 1999). Trawling can increase the fraction of fine sediment on superficial layers of the seabed (Queirós *et al*. 2006). As fine material is suspended, it can be washed away from the surface layers (Gubbay & Knapman, 1999). Trimmer *et al*. (2005) reported significant correlations between fishing intensity and sediment silt content (Queirós *et al*. 2006). It is thought that continual sediment resuspension, as a result of trawling, can lead to the accumulation of fine sediments in the superficial layers of sediment in areas that are trawled if there is an absence of significant advective transport (Jennings & Kaiser, 1998; Trimmer *et al*. 2005). Changes in sediment structure from coarse-grained sand or gravel to fine sand and coarse silt has been reported to occur within beam trawl tracks (Leth & Kuijpers, 1996).

Johnson *et al*. (2002) found a number of studies on the effects of otter trawling in gravel and variable habitats and these revealed trawling physically removed fine sediments and biogenic structures through the removal of structure-forming epifauna, moved or overturned stones and boulders, smoothed the seafloor and exposed sediment/shell fragments (Bridger, 1972; Auster *et al*., 1996; Collie *et al*., 1997; Engel & Kvitek, 1998; Freese *et al*., 1999; Johnson *et al*., 2002; Sewell and Hiscock, 2005).

In Estero Bay of the Californian coast, grain size analyses were used to detect any changes in sediment grain size as a result of experimental trawling using a small footrope otter trawl (61 ft head rope, 60 ft ground rope, 8 inch and 4 inch discs, 3.5 ft x 4.5 700 lbs ft trawl doors) (Lindholm *et al*., 2013). The study plots were located at a depth of 160-170 m and sediment analyses revealed the nature of the sediment to be coarse silt/fine sand (Lindholm *et al*. 2013). Post-trawl samples displayed the same grain size distribution as pre-trawl samples, albeit with a slight increase in silt content and 2% decrease in the fine sand fraction (Lindholm *et al*. 2013). Despite these differences, average mean grain size per plot indicated no visible differences between pre- and post- trawl samples and no quantifiable significant sedimentary differences were observed between trawled and control pots or between sample periods (Lindholm *et al*. 2013). These results are supported by a number of other studies including Tuck *et al*. (1998) and Schwinghamer *et al*. (1998), both of which reported no significant differences in sediment grain size in relation to trawling disturbance. Tuck *et al*. (1998) investigated the physical effects of trawling disturbance on a sheltered sealoch in Scotland at 35-40 m depth in an area characterised by 95% silt and clay using modified rockhopper ground gear without a net. Unfortunately, further details on the gear are not available. Schwinghamer *et al*. (1998) examined physical impacts of experimental otter trawling in the Grand Banks in an area of sandy habitat at 120-146 m depth using an Engel 145 otter trawl with 1250 kg oval otter boards and 46 cm rock hopper gear. Despite reporting no change in sediment grain size, acoustic data did reveal that trawling changed small-scale biogenic sediment structures (such as tubes and burrows) down to 4.5 cm (Schwinghamer *et al*. 1998), indicating a reduction in habitat complexity (Løkkeborg, 2005).

Experimental clam dredging activity in Langstone Harbour, using a modified oyster dredge, led to the removal of the coarse fraction of the sediment and larger sand and fine sediment fraction, with minor differences in the silt component (EMU, 1992). The sediment type for this area was muddy gravel (EMU, 1992). In contrast, a study assessing the impacts of suction dredging for common cockle in the Dutch Wadden Sea, revealed a loss of fine silts and subsequent increase in median grain size from 166.2 μm in 1988 to 179.1 μm in 1994 (Piersma *et al*., 2001). The sediment type in the study was sand. In addition, it was speculated that the loss of adult shellfish stocks as a result of suction dredging, may have also resulted in a reduction in the production of faeces and pseudofaeces which contribute to the silt component of the sediment (Piersma *et al*., 2001). The resuspension and dispersal of fine particles can lead to long term effects on particular sieve fraction (Pranovi & Giovanardi, 1994); potentially decreasing the clay portion of the sediment (Maier *et al*., 1998). Other changes in sediment character may also include a lack of consolidation of sediments (Aspden *et al*., 2004), the removal of stones and the removal of taxa that produce structure (i.e. tube-dwelling and burrowing organisms) (Johnson, 2002; Mercaldo-Allen & Goldberg, 2011). Such physical alterations can cause a reduction in sediment heterogeneity and structure available to biota as habitat (Johnson, 2002). In soft sediments, impacts on benthic fauna are likely to change sediment characteristics and vice versa (Piersma *et al*., 2001).

4.3.2 Smothering and siltation rate changes; Changes in suspended solids

Smothering effects

The resuspension of fine sediments takes place as fishing gear is towed along the seafloor (Johnson *et al*., 2002). Larger sand particles are redeposited near the dredge whilst measurable amounts of fine silt and clay particles remain in suspension and are potentially transported away by currents (Godcharles, 1971; Tuck *et al*., 2000). The effects of sediment resuspension include increased turbidity and thus a reduction in light, burial of benthic biota, smothering of adjacent areas including potential spawning areas, and negative effects on the feeding and metabolic rates of organisms (Johnson *et al*., 2002). These effects are site-specific and depend on grain size, sediment type, water depth, hydrological conditions, sensitivity of fauna, currents, tides and water mass properties (Coen, 1995).

Dale *et al.,* (2011) used a particle tracking model to determine the effect of a vessel towing eight dredges on either side in a water current of 0.1m per second. The model suggested that the majority of all sediment size classes suspended settles within 100 meters of the dredge (Dale *et al.,* 2011). Of the suspended sand and larger particles, only 10m from the dredge all but 3.6% of these particles will have settled (Dale *et al.,* 2011). However, of the fraction of silt that makes up the sediment, 92.5% persists in the water column 100m away from the dredge site (Dale *et al.,* 2011). The total sediment accumulation immediately outside the dredge is just 1.6mm, and, after 1 hour, just 8,2% of the suspended silt remains in suspension at 315m away from the dredge which is comparable to low natural suspended sediment levels (Dale *et al.,* 2011).

For a 48-minute dredge tow, in combination with tidal period, in the far field (where the sediment has been carried by the current away from the dredge site) the maximum suspended concentration is 0.24g per m cubed, with a maximum settled thickness of 0.0012mm (Dale *et al.,* 2011). If sediment hotspots from multiple vessels coincided it would take more than 15 tows for silt concentrations to match low natural levels, and more than 200 tows for the levels to equal that seen during stormy conditions (Dale *et al.,* 2011). The model therefore suggests that reefs in the area are only at risk if they are within 10m of the dredge site, and that those which lay further afield will not be significantly affected by changes in turbidity, siltation or smothering rates beyond natural levels (Dale *et al.,* 2011).

Resultant sediment plumes and areas of elevated turbidity can extend up to 30 metres beyond the dredge zone (Manning, 1957; Haven, 1979; Manzi *et al*., 1985; Maier *et al*., 1998), potentially transporting and redistributing sediment into adjacent areas (Vining, 1978). In most cases however, the amount of suspended sediment rapidly returns to low levels with distance from the dredge activity (Kyte *et al*., 1976; Maier *et al*., 1998) with 98% resettling within 15 m (Mercaldo-Allen & Goldberg, 2011). Effects of sediment plumes and enhanced turbidity levels appear to be temporary, with the majority of sediment plumes disappearing within hours of dredging (Maier *et al*., 1998). Dispersed sediments may take 30 minutes to 24 hours to resettle (Lambert & Goudreau 1996; Northeast Region EFHSC 200). Shallow water environments with high silt and clay content are likely to experience larger plumes and greater turbidity (Ruffin 1995; Tarnowski 2006).

In the context of natural disturbance, the resuspension of sediment caused by clam dredging in comparison to long-term wind-induced suspension of sediments, may be relatively minor (Auster & Langton 1999). Natural levels of turbidity, generated as a result of winds and tides, can produce particle loads equal to or exceeding that of dredging disturbance (Tarnowski, 2006). Organisms inhabiting inshore environments are therefore adapted to tolerate the resuspension of sediment at a certain level (Tarnowski, 2006). In addition, shellfish dredging only occurs in discrete areas, so the effects caused by resuspension will occur on a much smaller scale than those caused by natural disturbance (Wilber & Clarke, 2001).

The resuspension of sediment can impact upon benthic communities through smothering, burial and increased turbidity. These effects may extend to organisms living a distance away from the fished area (Kyte & Chew, 1975). If high levels of sediment are resuspended and exposure to such events is regular, impacts may be severe (Mercaldo-Allen & Goldberg, 2011). Increased turbidity can inhibit respiratory and feeding functions of benthic organisms, in addition to causing hypoxia or anoxia (Morgan & Chuenpagdee, 2003). Sediment resuspension can jeopardise the survival of bivalves and fish as a result of clogged gills and inhibition of burrowing activity (Dorsey & Pederson, 1998). Small organisms and immobile species are particularly vulnerable to smothering (Manning, 1957). A redistribution of finer sediment can also hinder the settlement of organisms if shell or cultch material is buried (Tarnowski, 2006). *Zostera nolti* seagrass beds experience 50% shoot mortality when buried in just 2cm of sediment, and 100% in 8cm (Cabaco et al., 2008). The severity of such impacts is largely determined by sediment type, the level of sediment burden and the tolerance of organisms which is largely related to their biology (i.e. size, relationship to substrate, life history, mobility) (Coen, 1995).

Studies conducted in England and Florida found that the redistribution of sediments caused through dredging activity did not result in the smothering of benthic organisms within the nearby area and impacts were found to be limited to the directly disturbed area of the dredge (Schroeder, 1924; Spencer *et al*., 1998). Estuarine ecosystems, where dredging typically takes place, are high variable environments with elevated and variable suspended sediment loads and the organisms living there are often well adapted to such conditions (Coen, 1995). Such organisms are therefore generally considered tolerant to short-term perturbations in sediment loads (Lutz, 1938; Kyte *et al*., 1975). Laboratory experiments have shown that the majority of estuarine infaunal species are able to survive burial depths of up to 20 cm or more (Coen, 1995). In contrast, epifaunal and non-motile species can suffer high mortality rates after burial (Coen, 1995).

4.3.3 Removal of non-target species / Removal of target species

Studies into the impacts of bottom towed fishing gears have focused on the physical effects to seagrass themselves. Rueda *et al.,* (2009) found that the density and richness of Mollusca species decreased significantly after eelgrass loss – particularly those gastropods usually associated with leaf/sediment substratum.

However, we can infer the impacts from research which has studied the effects of these methods in other benthic sediments. Bottom towed fishing gear can result in the mortality of non-target species through direct physical damage inflicted by the passage of the trawl or indirectly through damage, exposure and subsequent predation (Roberts *et al*. 2010). This can lead to long-term changes in the benthic community structure (Jones, 1992), including decreases in biomass, species richness, production, diversity, evenness (as a result of increased dominance) and alterations to species composition and community structure (Tuck *et al*., 1998; Roberts *et al*. 2010). Disturbance from repeated trawling selects for more tolerant species, with communities becoming dominated by smaller-bodied infaunal species with fast life histories, juvenile stages, mobile species and rapid colonists (Engel & Kvitek, 1998; Gubbay & Knapman, 1999; Kaiser *et al*. 2000; Jennings *et al*. 2001; Kaiser *et al*. 2002). In addition, larger individuals may become depleted more than smaller individuals (Jennings *et al*. 2002).

The impacts of fishing activities on benthic communities varies with gear type, habitat and between taxa (Collie *et al*. 2000; Thrush & Dayton, 2002; Kaiser *et al*. 2006). Reported effects are habitat-specific (Roberts *et al*. 2010). A meta-analysis conducted by Kaiser *et al*. (2006) revealed that soft-sediment, especially muddy sands were vulnerable to fishing impacts, with otter trawling and beam trawling all producing a significant immediate impact on this habitat. A number of studies found no detectable impacts, specifically in relation to different forms of trawling in sand habitats (Van Dolah *et al*., 1991; Kaiser & Spencer, 1996; Kenchington *et al*., 2001; Roberts *et al*., 2010), although this is not true in all cases. Such habitats are likely to be pre-adapted to higher levels of natural disturbance and are characterised by relatively resistant fauna (Kaiser *et al*. 2006).

Scallop Dredging

In a meta-analysis, scallop dredging was reported to cause an immediate reduction in mean abundance of animals from -22% to 98%, with the greatest declines observed for sea-fans and sponges in biogenic habitats (Kaiser *et al*., 2006).

Typically scallop dredging occurs over gravel or mixed substrata, although can occur in areas of mud or harder seabed type which support populations of the target species (Shumway and Parsons, 2006; Hinz *et* *al*., 2011). On mixed-substrate, sites which are not scallop dredged have been found to have significantly higher faunal turf coverage (Boulcott et al., 2014).

The level of the effect is varied depending on the gear type used (Hinz et al., 2009). When the effects of an otter trawl (with rock hopper ground rope), traditional scallop dredges (0.76m wide with 17 x 6cm teeth), and new scallop dredges (1.95m wide with rubber lip instead of teeth) were compared bycatch was found to be significantly higher in the two dredges. Epifauna biomass was only significantly reduced after dredging using the new scallop dredges. However, changes in abundance and biomass of scavengers and vulnerable species between treatments showed no significant differences. Similarly, infauna biomass showed only significant differences after impact for the new dredge type.

Hinz *et al*. (2011) investigated the impacts scallop dredging in Lyme Bay SCI, a marine protected area, adjacent to the Chesil Beach and Stennis Ledges MCZ, where Pink sea-fans occur. The study compared areas subject to different fishing activity levels. These were arranged around 4 voluntary reserved closed to fishing and included 2 fixed treatments with 2 levels (1. Protection i.e. stations inside the reserves (Closed) and outside (Open); 2. Past Fishing Activity i.e. stations that had been fished prior to the implementation of the reserves (Fished) and stations that had experienced no prior dredging or at very low intensities (Not Fished). Fished sites were estimated to have been dredged on average 1.2 times per year. The study found sessile emergent epifauna occurred at significantly lower levels and abundances at fished sites compared to unfished sites, with a significant negative effect on 3 out of 9 species analysed. The abundance of ross coral *Pentapora fascialis* and dead men's fingers *Alcyonium digitatum, and presence of Axinella dissimilis* (erect sponge) were 73%, 67% and 54% lower in fished sites compared to non-fished sites, respectively.

Trawling

A number of studies have identified common trends for certain species in response to trawling disturbance. The gastropod *Buccinum undatum* is shown to decline in areas of trawling disturbance (Tuck *et al*., 1998; Kaiser *et al*., 2000), with one study stating the effects of trawling persisted for 6 months into the recovery period (Tuck *et al*., 1998). Similarly, *Echinocarodium cordatum* has been identified as a fragile and highly vulnerable to trawling disturbance (Bergman & Hup, 1992; Bergman & van Santbrink, 2000), showing declines of 40 to 60% in density in one study (Bergman & Hup, 1992). Similar reductions were shown by the polychaete *Lanice conchilega* (Bergman & Hup, 1992), a species of polychaete which is highly incapable of movement in response to disturbance and therefore take a significant period of time to recolonise disturbed habitats (Goss-Custard, 1977). Other species that have been reported to exhibit adverse effects of trawling include the polychaete species *Nephtys* (Kaiser *et al*., 1998; Tuck *et al*., 1998) and *Magelona* (Bergman & Hup, 1992; Kaiser *et al*., 2000) and the emergent soft coral *Alcyonium digitatum* (Kaiser *et al*., 1998; 2000; Depestele *et al*., 2012). By contrast, the brittle star, *Ophiura* sp., has been reported to increase or remain constant in response to trawling disturbance (Tuck *et al*., 1998; Gubbay & Knapman, 1999; Kaiser *et al*., 2000; Callaway *et al*., 2007).

The relative impact of bottom towed fishing gear on benthic organisms is species-specific and largely related to their biological characteristics and physical habitat. The vulnerability of an organism is ultimately related to whether or not it is infaunal or epifaunal, mobile or sessile and soft-bodied or hard-shelled (Mercaldo-Allen & Goldberg, 2011). Fragile fauna (i.e. bivalves and sea cucumbers) have been shown to be particularly vulnerable to trawling damage and disturbance and sedentary and slowing moving species can be significantly lower (Kaiser & Spencer, 1996; Gubbay & Knapman, 1999). Motile groups and infaunal bivalves have shown mixed responses to trawling disturbance, with life history considerations such as habitats requirements and feeding modes likely to play a key role in determining a species response (McConnaughey *et al*., 2000; Johnson *et al*., 2002). In a meta-analysis of experimental fishing impact studies, conducted by Kaiser *et al*. (2006), otter trawling was found to have the greatest impact on suspension feeders in mud habitats, perhaps reflecting the depth of penetration from the otter doors, whilst the response of suspension feeders and deposit feeders to beam trawling was highly variable. The most negative effect on deposit feeders was found in gravel habitats and the most negative effect on suspension feeders was found in sand habitats (Kaiser *et al*., 2006). Suspension feeding bivalves, such as *Corbula gibba*, are largely unable to escape burial of more than 5 cm (Maurer *et al*., 1982) and are also sensitive to high sedimentation rates that may occur following intensive trawling (Howell & Shelton, 1970; Tuck *et al*., 1998). Having said this, larger-sized individuals have been shown to be more resistant to trawling disturbance as they are relatively robust (Bergman & van Santbrink, 2000).

Studies have revealed mixed effects on epifauna (organisms that inhabit the seabed surface). Jennings *et al*., (2001) found that chronic trawling disturbance had no significant effect on epifauna in the North Sea. Similarly, no long-term effects on the number of epifaunal species or individuals were detected by Tuck *et al*. (1998), although a number of species-specific changes in density did occur (increase in *Ophiura* sp. and decreases in *Hippoglossoides platessoides*, *Metridium senile* and *Buccinum undatum*). The lack of long-term effects detected by Tuck *et al*. (1998) is likely to be compounded by the fact that beam trawl gear used was not equipped with a net, as greater effects on epifauna may be expected. The removal of 7 tonnes of epifaunal was reported by Pitcher *et al*. (2000) during experimental trawling, however no significant changes in the density of epifauna were reported (Thrush & Dayton, 2002). Kenchington *et al*. (2001) investigated the impacts of otter trawling on benthic communities on a sandy bottom in Grand Banks, Newfoundland over a three-year period. Changes in the benthic community were sampled using an epibenthic sledge. The sled is largely used to sample epifauna and some infauna as the sled penetrates to a depth of 2 to 3 cm. Samples collected using the benthic sled revealed a 24% reduction in average biomass in trawled corridors compared to reference corridors. Hinz *et al*. (2009) investigated the biological consequences of long-term chronic disturbance caused by the otter trawl *Nephrops norvegicus* (Norway lobster) fishery along a gradient of fishing intensity over a muddy fishing ground in the north-eastern Irish Sea. The study reported reductions in epifaunal abundance of 81% from the lowest trawling effort recorded (1.3 times trawled/year) to the highest (18.2 times trawled/year). Over the same range of trawl intensities, epifaunal species richness decreased by 18%, while no effect was evident for epibenthic biomass.

4.3.4 Sensitivity analyses

A number of recent studies have endeavoured to map the sensitivity of habitats to different pressures (Tillin *et al*., 2010) and fishing activities (Hall *et al*., 2008).

Tillin *et al*. (2010) developed a pressure-feature sensitivity matrix, which in effect is a risk assessment of the compatibility of specific pressure levels and different features of marine protected areas. The approach used considered the resistance (tolerance) and resilience (recovery) of a feature in order to assess its sensitivity to relevant pressures (Tilin *et al*., 2010). Where features have been identified as moderately or highly sensitive to benchmark pressure levels, management measures may be needed to support achievement of conservation objectives in situations where activities are likely to exert comparable levels of pressure (Tilin *et al*., 2010). In the context of this assessment, the relevant pressures likely to be exerted are penetration and abrasion of the seabed and removal of non-target species. Sensitivity of subtidal sediment types to these pressures vary from not sensitive to high, generally with low confidence in these assessments (Table 7). Subtidal mixed sediments appear to be sensitive overall, followed by subtidal mud, whilst subtidal coarse sediment and sand appears to has relatively low sensitivity overall.

Hall *et al*. 2008 aimed to assess the sensitivity of benthic habitats to fishing activities. A matrix approach was used, composed of fishing activities and marine habitat types and for each fishing activity sensitivity was scored for four levels of activity (Hall *et al*., 2008). The matrix was completed using a mixture of scientific literature and expert judgement (Hall *et al*., 2008). The type of fishing activities chosen were ‘beam trawl & scallop dredges’ and ‘demersal trawls’ as these encompassed the fishing activities under consideration. Generally, stable habitat types exhibit high sensitivity to heavy gear intensities for beam trawls and scallop dredges and demersal trawls (Table 8). A large number of habitat types exhibit medium sensitivity to moderate gear intensities, except for beam trawls and scallop dredges in subtidal muddy sand and stable rich mixed sediments. All habitat types, except stable rich mixed sediments, exhibit low sensitivity to light fishing intensity and all habitat types exhibit low sensitivity to a single pass (Table 8). Generally, sensitivity across all habitat types is lower for light demersal trawls and seines, as would be expected (Table 8).

	Pressure				
Feature	Penetration and/or disturbance of the substrate below the surface of the seabed – structural damage to seabed >25mm	Shallow abrasion/penetration – damage to seabed surface and penetration <25mm	Surface abrasion: damage to seabed surface features	Removal of non-target species	Siltation rate changes (low)
Seagrass Beds	High (low)	High (High)	Low (Low)	High (high)	High (medium)

Table 3. Sensitivity of SAC features to different intensities (high, medium, low, single pass) of oyster/mussel dredging as identified by Hall et al. (2008).

Gear Type	**Habitat Type**	**Gear Intensity***			
		Heavy	Moderate	Light	Single pass
Beam trawls & scallop dredges	**Seagrass beds**	High	High	High	High
Demersal trawls	**Seagrass beds**	High	High	High	High
Light demersal trawls and seines	**Seagrass beds**	High	High	High	High
*Gear activity levels are defined as follows; Heavy – Daily in 2.5 nm x 2.5 nm, Moderate – 1 to 2 times a week in 2.5 nm x 2.5 nm Light – 1 to 2 times a month during a season in 2.5 nm x 2.5 nm, Single pass – Single pass of fishing activity in a year overall					

4.3.5 Recovery

Seagrass beds impacted by bottom towed gears can take years to recover from the effects. Orth *et al.* (2002) found that clam dredging scars in *P. oceanica* took more than three years to return to undisturbed levels. Whilst in *Z. marina* beds in Maine, recovery of beds from mussel dragging was found to be highly dependent on dragging intensity (Neckles *et al.,* 2005). Where dragging had been less intense and patches of seagrass were present recovery took as little as a year. However, where intensive dragging had cleared all seagrass Neckles *et al.* (2005) projected that it would require a mean of 10.6 years for recovery of eelgrass shoot density (based on a lateral patch expansion rate of 12.5cm per year).

The recovery of seagrass beds is highly variable and are dependent on the extent of removal. Rates may be slow where adjacent seed sources and viable grass beds are present, but can take between 60 and 100 years where the removal of rhizomes has occurred (Gonzalez-Correa *et al*., 2004; Moore and Jennings, 2000).

4.4 Existing management measures

All Bottom Towed Gears:

- **Bottom Towed Fishing Gear** byelaw 2016 – prohibits bottom towed fishing gear over sensitive features including reef features and seagrass within the District. However, seagrass in the needles is not currently protected.
- **Vessels Used in Fishing** byelaw – prohibits commercial fishing vessels over 12 metres from the Southern IFCA district. The reduction in vessel size also restricts the type of gear that can be used, with vessels often using lighter towed gear and restricted to carry less static gear.

Trawling:

- Southern IFCAs **Minimum Fish Sizes** Byelaw prohibits the taking of fish under the specified size (Black Seabream, Brill, Dab, Conger Eel, Flounder, Red Mullet, Shad, Turbot, Witch Flounder).
- A separate Minimum Size Southern IFCA byelaw exists for Skates and Rays and this states that no person shall take any ray that measures less than 40 cm between the extreme tips of the wings or any wing which measures less than 20 cm in its maximum dimension and which is detached from the body of a skate or ray.
- Other regulations include minimum sizes, mesh sizes and catch composition as dictated by European legislation. European minimum sizes, listed under Technical Conservation Regulation 1241/2019 and Bass Emergency Measures 2020/123 specify the minimum size for bass is 42 cm and plaice are 27cm.

5 Assessment of trawling on seagrass beds in the Needles MCZ.

Feature(s)/ Supporting habitat(s)	**Attribute**	**Target** (taken from the Solent Maritime SAC)	**Potential Pressure(s) and Associated Impacts**	**Nature and Likelihood of Impacts**	**Mitigation measures**
Seagrass beds	Distribution: presence and spatial distribution of biological communities;	Recover the presence and spatial distribution of subtidal seagrass bed communities.	Bottom towed fishing gear activity is known to cause abrasion, penetration and disturbance to the seabed surface and removal of target and non-target species. Dredging, trawling and dragging have all been shown to significantly affect seagrass beds. These activities can immediately significantly reduce the shoot number and biomass on both hard and soft substrates. Few studies have assessed the impacts of these activity on seagrass biological communities. However, one such study indicated that Mollusca numbers and richness decreased significantly after illegal trawling. Bottom towed gear can lead to the removal, damage or mortality of non-target & target species particularly epifaunal species, reduction in structural complexity and reduction in biodiversity and composition of benthic assemblages. The recovery of seagrass habitats after disturbance by bottom towed fishing gear activity has been found to take between 1 and 3+ years. Projections of recovery where all seagrass and rhizomes have been removed have been 10 to 100 years.	Demersal trawling is known to occur in the Solent, and on the fringes of the Needles MCZ. There are no recent sightings within the site. Historic sightings show that trawling has occurred in the most northern section of the site over subtidal sediments. The majority of seagrass habitats in the district have been protected by the Bottom Towed Fishing Gear Byelaw 2016 which prohibits all BTFG activities over sensitive features such as seagrass. However, new and updated data has been created since the protective byelaw was made and therefore there are areas within the site where the feature is not protected. Seagrass beds provide nursery habitat for a range of fish species as well as food for a number of waterfowl bird species. Many other animals live on, within or in the sediments of seagrass beds including seahorses, anemones, crabs, worms, bivalves, and molluscs. Scientific literature has indicated that dredging and trawling within seagrass beds can lead to the immediate removal of the substrate and designated feature. Recovery from such impact can vary greatly but is likely to be between 1 and 10+ years. Hall et al., 2008 assessed the sensitivity of seagrass bed to all bottom towed fishing	**Vessels Used in Fishing** byelaw – prohibits commercial fishing vessels over 12 metres from the Southern IFCA district. The reduction in vessel size also restricts the type of gear that can be used, with vessels often using lighter towed gear and restricted to carry less static gear.
	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			

				gear types at all fishing intensity levels to be high. BTFG activities occur at a very light intensity on the northern fringes of the site. Seagrass beds are highly sensitive to these types of fishing gear and have a long recovery period. If fishing were to occur over the habitats it could lead to the instant removal of the feature. Therefore, it is believed that bottom towed fishing gears will pose a significant risk to seagrass bed features within the Needles MCZ.	
	Structure: rhizome structure and reproduction;	Recover the extent and structure of the rhizome mats across the site, and conditions to allow for regeneration of seagrass beds	Addressed Above	Addressed Above	Addressed Above
	Structure Biomass;	Recover the leaf/shoot density, length, percentage cover, and rhizome mat across the feature at natural levels (as far as possible), to ensure a healthy resilient habitat.			
	Extent and distribution;	Recover the total extent and spatial distribution of seagrass beds.			
	Structure: sediment composition and distribution;	Maintain the distribution of sediment composition types across the sub-feature			

	Supporting processes: water quality – turbidity	Maintain natural levels of turbidity (e.g. concentrations of suspended sediment, plankton and other material) across the habitat.	Bottom towed fishing gear activity is known to cause abrasion, penetration and disturbance to the seabed surface, changes in suspended solids (water clarity) and smothering and siltation rate changes. Very few studies have focused on the effect of BTFGs to sediment character, turbidity and light levels. One such study found that trawling in seagrass beds significantly increased the carbon and mud content of the sediments. In sediment not containing seagrass BTFGs have been found to lead to the resuspension of sediment which can impact upon benthic communities through smothering, burial and increased turbidity. These effects may extend to organisms living a distance away from the fished area.	Demersal trawling is known to occur in the Solent, and on the fringes of the Needles MCZ. There are no recent sightings within the site. Historic sightings show that trawling has occurred in the most northern section of the site over subtidal sediments. The majority of seagrass habitats in the district have been protected by the Bottom Towed Fishing Gear Byelaw 2016 which prohibits all BTFG activities over sensitive features such as seagrass. However, new and updated data has been created since the protective byelaw was made and therefore there are areas within the site where the feature is not protected. Seagrass beds provide nursery habitat for a range of fish species as well as food for a number of waterfowl bird species. Many other animals live on, within or in the sediments of seagrass beds including seahorses, anemones, crabs, worms, bivalves, and molluscs. Research has found that high levels of sediment and regular exposure can cause sever impacts. Increased turbidity can inhibit respiratory and feeding functions of benthic organisms, and cause hypoxia or anoxia. Small organisms and immobile species are particularly vulnerable to smothering. The severity of the impact is determined by sediment type, the level of sediment burden and the sensitivity of organisms which is largely related to their biology (i.e. size, relationship to substrate, life history, mobility). Hall et al., 2008 assessed the sensitivity of seagrass bed to all bottom towed fishing	Addressed Above
	Supporting Processes – light levels	Maintain the natural light availability to the seagrass beds			
	Supporting processes: sedimentation rate,	Maintain the natural rate of sediment deposition			

				gear types at all fishing intensity levels to be high. Tillin et al. (2010) assessed the sensitivity of these habitats to changes in siltation and found seagrass beds to have a high sensitivity. BTFG activities occur at a very light intensity (twice per year) on the northern fringes of the site some distance away from seagrass beds. Therefore, it is believed that bottom towed fishing gears will not significantly increase suspended sediment concentrations, smothering and siltation rate of the seagrass features within the Needles MCZ.	

5.1 Site Condition

A condition assessment has not yet been completed by Natural England for the Needles MCZ. Additionally, this site is not underpinned by another MPA and therefore, no condition assessment of areas within the site are available.

6 Proposed mitigation measures

In recognition of the potential pressures of bottom towed fishing gear upon designated features and their supporting habitats, Southern IFCA recognises that management measures will need to be put in place to protect sensitive; seagrass beds from the effects of all forms of bottom towed fishing gears. This is due to the result of this MCZ assessment which has found that bottom towed fishing gears are likely to pose a significant risk to the seagrass features of the Needles MCZ.

Based on the findings of the assessment, the Authority is therefore required to develop management that will provide protection to the seagrass features within the site from the relevant fishing gears. Spatial closures, based on the most up to date data for the location of seagrass features, will be introduced and incorporated into appropriate management following best practice[5]. This will involve consultation with the local community and the consideration of formal advice from the Authorities Statutory Nature Conservation Body Natural England. Existing closures will be considered against the updated data to determine the most appropriate course of action to protect the features and ensure Southern IFCA meets its responsibilities afforded by the Marine and Coastal Access Act 2009.

7 Conclusion

In order to conclude whether types of bottom towed fishing gear (trawling) pose a significant risk, it is necessary to assess whether the impacts of the activities will hinder the achievement of the general management approach of the designated feature (seagrass beds) of 'recover to favourable condition' and the sites conservation objectives, namely:

"The conservation objective of each of the zones is that the protected habitats:

1. are maintained in favourable condition if they are already in favourable condition
2. be brought into favourable condition if they are not already in favourable condition

For each protected feature, favourable condition means that, within a zone:

1. its extent is stable or increasing
2. its structure and functions, its quality, and the composition of its characteristic biological communities (including diversity and abundance of species forming part or inhabiting the habitat) are sufficient to ensure that its condition remains healthy and does not deteriorate

Any temporary deterioration in condition is to be disregarded if the habitat is sufficiently healthy and resilient to enable its recovery.

Having reviewed a wide range of evidence, including scientific literature, IFCO knowledge, habitat feature mapping, it has been concluded that bottom towed fishing gear activity as it is currently managed is likely to pose a significant risk to seagrass beds within the Needles MCZ.

The review of the research into the impacts of bottom towed fishing gear on seagrass beds reported the habitat to have high sensitivity to a single pass. It was determined that the potential for fishing activity to occur over or in close proximity to the features of the site could prevent the ability of seagrass beds to attain its 'recover' general management approach. In summary, this was based upon the following evidence:

[5] http://www.association-ifca.org.uk/Upload/About/ifca-byelaw-guidance.pdf

- IFCO knowledge indicates that trawling occurs on the fringes of the site over subtidal sediment at a very low intensity.
- Sightings data shows historic trawl sightings in the north of the site and outside in the Solent.
- A review of scientific literature demonstrated that bottom towed fishing gear at any intensity can lead to the direct removal, damage and mortality of the feature seagrass species.
- Sensitivity of seagrass habitats to pressures associated with trawls is high.
- Seagrass habitat recovery can take years to over a decade.

It is therefore recognised that the activities have the potential to pose a significant risk upon the seagrass feature attributes:

- Distribution: presence and spatial distribution of biological communities
- Structure and function: presence and abundance of key structural and influential species
- Structure: species composition of component communities
- Structure: rhizome structure and reproduction
- Structure: biomass
- Extent and distribution
- Structure: sediment composition and distribution

In recognition that the feature will be at risk from BTFG activity, additional management measures are required to ensure the MCZs conservation objective can be furthered. The location, timing, duration and intensity of bottom towed fishing gear within the site will be influenced by new management measures being developed, which will protect the sensitive feature (seagrass beds), by prohibiting all BTFG activities over the feature. This is to support the general management approach of the features discussed to/at a favourable condition.

When the above evidence, fishing activity levels, current and, proposed management measures are considered it has been concluded that bottom towed fishing gear will not pose a significant risk to the achievement of sites conservation objectives to ‘recover’ seagrass beds to favourable condition. Southern IFCA must seek to ensure that the conservation objectives of any MCZ in the district are furthered.

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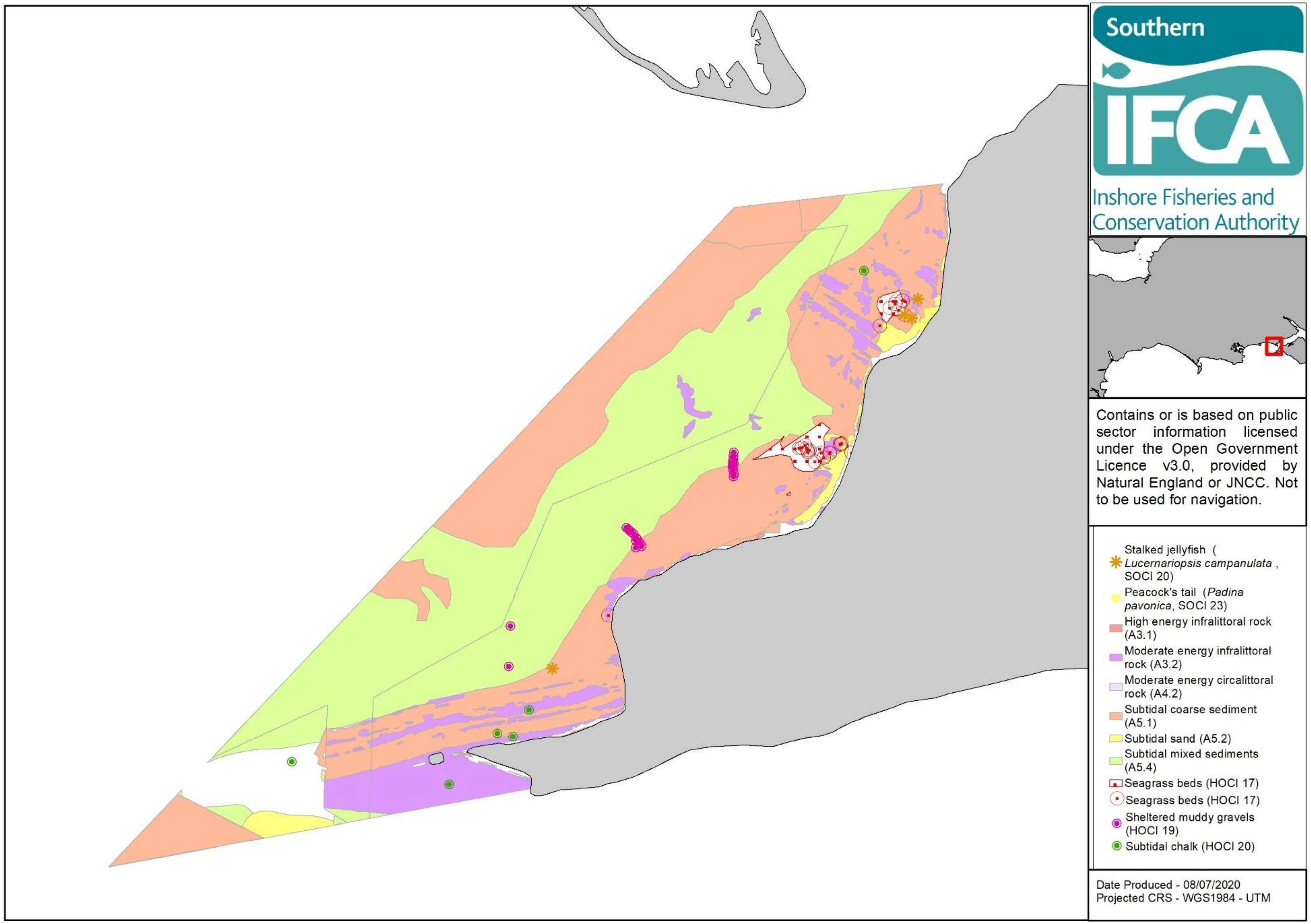
Annex 1. Broadscale habitat and species map for the Needles Marine Conservation Zone.



Annex 2. Advice on operations for commercial trawling activity in the Needles MCZ

	Habitat										Species		
Pressure Name	High energy infralittoral rock	Moderate energy infralittoral rock	Seagrass beds	Sheltered muddy gravels	Subtidal chalk	Subtidal coarse sediment	Subtidal mixed sediments	Subtidal mud	Subtidal sand	Moderate energy circalittoral rock	Native oyster	Peacock's tail	Stalked jellyfish (Calvadosia campanulata)
Abrasion/disturbance of the substrate on the surface of the seabed	S	S	S	S	S	S	S	S	S	S	S	S	S
Changes in suspended solids (water clarity)	S	S	S	S	S	S	S	S	S	S	S	NS	S
Penetration and/or disturbance of the substratum below the surface of the seabed, including abrasion		S	S	S	S	S	S	S	S	S	S		S
Removal of non-target species	S	S	S	S	S	S	S	S	S	S	S	S	S
Smothering and siltation rate changes (Light)	NS	S	S	S	S	IE	S	S	S	S	S	S	S
Deoxygenation	IE	S	NS	S	IE	S	S	S	S	S	NS	NS	IE
Hydrocarbon & PAH contamination	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Introduction of light	S	S	S	IE	S	IE	IE	NS	S	IE	NS	NS	IE
Introduction or spread of invasive non-indigenous species (INIS)	S	S	S	S	S	IE	S	S	S	S	S	IE	IE
Litter	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nutrient enrichment	S	NS	S	NS	NS	NS	NS	NS	NS	NS	NS	NS	S

Organic enrichment	S	S	S	S	NS	S	S	S	S	S	IE	NS	S
Physical change (to another seabed type)	S	S		S						S	S	S	S
Physical change (to another sediment type)			S		S	S	S	S	S		NS		S
Synthetic compound contamination (incl. pesticides, antifoulants, pharmaceuticals)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Transition elements & organo-metal (e.g. TBT) contamination	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Underwater noise changes							NS	NS	NS	NS			
Visual disturbance		NS			NS		NS	NS	NS	NS			

Annex 3. Fishing activity maps using trawl sightings data from 2009-2020 in the Needles MCZ.