



Marine
Management
Organisation

Marine Non-Licensable Activity Impacts Evidence: Seagrass beds, maerl beds, seahorses and stalked jellyfish (DRAFT)

September 2026



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Executive Summary

This document collates and analyses the best available evidence on the impacts of marine Non-Licensable Activities (mNLA) on marine protected area (MPA) features and will inform site level assessments of the impact of mNLA on MPAs as part of the Marine Management Organisation's (MMO) work to manage MPAs. mNLA has the potential to impact seagrass beds, maerl beds, seahorses and stalked jellyfish, therefore management of these activities may be required within an MPA. For each MPA, a site level assessment considering the site conservation objectives, spatial and temporal activity levels and exposure to natural disturbance will be completed to determine whether management will be required.

Available evidence indicates that physical disturbance is the primary mechanism through which mNLA may affect the MPA features considered in this document. The principal pressures identified include penetration and/or disturbance of the substratum below the surface of the seabed, including abrasion; abrasion or disturbance of the substrate on the surface of the seabed; physical change (to another sediment type) and, for some species, visual disturbance. Evidence demonstrates that seagrass beds and maerl beds are sensitive to physical disturbance, with the strongest evidence of impacts associated with anchoring activities. Risks to seahorses and stalked jellyfish are predominantly indirect and linked to changes in habitat condition. Maerl beds are classed as irreplaceable habitats and are particularly vulnerable to physical disturbance.

1 Introduction

Marine Management Organisation (MMO) is the principal regulator for England's seas, including leading the assessment and management of marine Non-Licensable Activities (mNLA) for marine protected areas (MPAs) inshore of 12 nautical miles (nm).

This document forms part of MMO's work to achieve the government's aim of identifying and implementing appropriate management measures in place for all inshore MPAs in English waters by the end of 2030. It is one of a suite of documents which focus on the interaction of designated features with mNLA, and it will support the delivery of site level assessments.

The potential for pressures resulting from mNLA and their impacts on designated features within MPAs have been assessed by gathering and analysing the available evidence for activity-feature interactions.

This document describes the pressures resulting from mNLA which may impact seagrass beds, maerl beds, seahorses and stalked jellyfish.

The Marine Non-Licensable Activity Impacts Evidence: Summary¹ provides further background information and details of other documents produced and the features and activities included within the scope of this programme of work.

1.1 Key definitions

A separate glossary in Marine Non-Licensable Activity Impacts Evidence: Methodology¹ includes the important terms used in this document. Wherever possible these are taken from [Natural England's Glossary of terms used within conservation advice packages \(CAP\)](#)². The following terms are particularly important when reading this document:

Designated feature ("feature") – a species, habitat, geological or geomorphological entity for which an MPA is identified and managed, this includes both designated and qualifying features.

Sensitivity – the sensitivity of a feature (species or habitat) is a measure that is dependent on the ability of the feature (species or habitat) to resist change and its ability (time taken) to recover from change (**Figure 1**).

¹ Marine Non-Licensable Activity Impacts Evidence documents are available: www.gov.uk/government/calls-for-evidence/marine-non-licensable-activities (last accessed 30 September 2026)

² Natural England's MPA Conservation Advice - Glossary of Terms www.designatedsites.naturalengland.org.uk/pdfs/MPA_CAGlossary_March2019.pdf (Last accessed 14 September 2026)

Pressure - the mechanisms through which an activity has an effect on a feature.

Impact - the consequence of a pressure/pressures (such as habitat degradation) where a change occurs that is different to that expected under natural conditions.

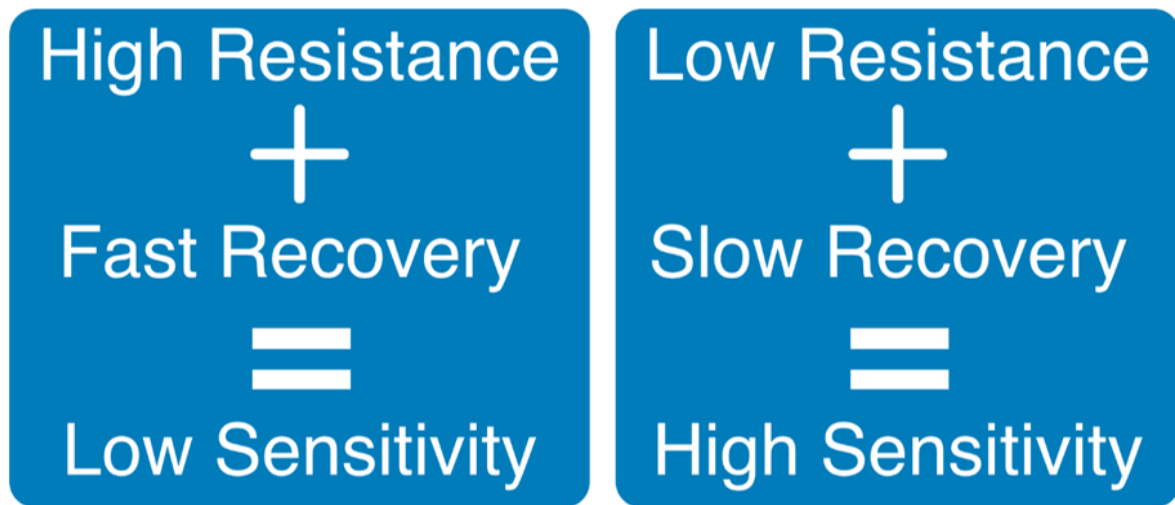


Figure 1: The approach to determine sensitivity from pressures for each feature and activity interaction.

1.2 Structure of this document

Section 2 lists the MPA features considered and references the evidence sources used in this document.

Section 3 describes the types of mNLA considered in this document.

Sections 4 to 6 describe the available evidence of the pressures resulting from the mNLA and impacts on the designated features. Where a feature is potentially sensitive to mNLA (based on its resistance to the pressure and ability to recover) the interaction is considered. Each section lists the pressures to which the features may be sensitive, using Natural England's CAPs and MMO judgement. It also lists those pressures which have not been assessed or where insufficient evidence has been found to assess sensitivity. Each section also details available evidence about the designated feature, its ability to resist and recover from change, and its resultant sensitivity.

Section 7 summarises the conclusions of the assessed pressure feature interactions within this review.

Annex 1 mNLA pressures on sensitive features – seagrass beds, maerl beds, seahorses and stalked jellyfish describes how feature-pressure interactions have been identified; and provides a table of all the potential pressure-feature interactions and the sensitivity assessment for each.

2 Overview of features

This section describes the different designated features which are considered in this document and identifies those features which have been identified as potentially sensitive to mNLA. **Table 1** provides links to descriptions of the features and their sensitivity to pressures. Information in **Table 1** is taken from the [Marine Life Information Network](#)³. **Annex 1** mNLA pressures on sensitive features – seagrass beds, maerl beds, seahorses and stalked jellyfish provides a summary of the pressures resulting from mNLA and the sensitivities of the features described in this document to those pressures. This has been identified through Natural England's CAPs and review of the available scientific literature.

Table 1: Descriptions of designated features.

Feature Name	Habitat and Species Description
Seagrass beds	Seagrass beds (subtidal) ⁴ Seagrass beds (intertidal) ⁵ Common eelgrass (<i>Zostera marina</i>) ⁶ Dwarf eelgrass (<i>Zostera noltii</i>) ⁷
Maerl beds	Lithothamnion corallioides ⁸ Phymatolithon calcareum ⁹
Seahorses	Long snouted seahorse (<i>Hippocampus guttulatus</i>) ¹⁰ Short snouted seahorse (<i>Hippocampus hippocampus</i>) ¹¹

³ Marine Life Information Network www.marlin.ac.uk (last accessed 17 April 2026)

⁴ *Zostera marina* www.marlin.ac.uk/habitats/detail/257 (last accessed 2 June 2026)

⁵ *Zostera noltii* www.marlin.ac.uk/habitats/detail/318 (last accessed 2 June 2026)

⁶ Common eelgrass www.marlin.ac.uk/species/detail/1282 (last accessed 2 June 2026)

⁷ Dwarf eelgrass www.marlin.ac.uk/species/detail/1409 (last accessed 2 June 2026)

⁸ Maerl (*Lithothamnion corallioides*) www.marlin.ac.uk/species/detail/1284 (last accessed 2 June 2026)

⁹ Maerl (*Phymatolithon calcareum*) www.marlin.ac.uk/species/detail/1210 (last accessed 2 June 2026)

¹⁰ Long snouted seahorse www.marlin.ac.uk/species/detail/1891 (last accessed 2 June 2026)

¹¹ Short snouted seahorse www.marlin.ac.uk/species/detail/1788 (last accessed 2 June 2026)

Feature Name	Habitat and Species Description
Stalked jellyfish	<i>Calvadosia campanulata</i> ¹² <i>Calvadosia cruxmelitensis</i> ¹³ <i>Haliclystus spp</i> ¹⁴

2.1 Seagrass beds

Seagrasses are marine flowering plants found in the UK and are unique among angiosperms in their ability to survive and pollinate while fully submerged in the marine environment (Unsworth and Cullen-Unsworth, 2017).

Seagrass forms beds, or meadows, in soft sediment intertidal and shallow subtidal regions such as shallow bays, lagoons and estuaries. Seagrass beds require sheltered environments, protected from significant wave action with sufficient levels of light and nutrients (Unsworth and Cullen-Unsworth, 2017). Availability of light, tidal exposure, wave action, associated turbidity and low salinity all determine seagrass survival and distribution (Unsworth and Cullen-Unsworth, 2017). Light availability for photosynthesis primarily controls the lower depth limit of seagrass beds (Unsworth and Cullen-Unsworth, 2017; Jackson et al., 2013) with desiccation, relating to duration and seasonality of tidal exposure, controlling the upper limit (Boese et al., 2009).

The formation and growth of seagrass beds occur via both sexual reproduction, simple flowers, with in-water pollination and dispersal of seeds; and asexual reproduction through vegetative spread of rhizomes, growing horizontally beneath the seabed (Jackson et al., 2013). Some plants and seedlings may also be dispersed by currents, establishing some distance from the original bed (Jackson et al., 2013).

Seagrass flowers produce pollen, which drifts in the water column to reach and fertilise flowers on branched flowering shoots. Seeds are produced and dispersed either directly or protected within a seed pod which is buoyant by surface currents. Eventually they sink and settle at depth, and in some cases, are redispersed by high energy conditions or through waterbirds (Jackson et al., 2013). The seeds then germinate and grow into a seedling, expanding into seagrass beds through rhizome elongation (Jackson et al., 2013).

¹² Stalked jellyfish www.marlin.ac.uk/species/detail/2101 (last accessed 2 June 2026)

¹³ St John's jellyfish www.marlin.ac.uk/species/detail/14 (last accessed 2 June 2026)

¹⁴ Kaleidoscope jellyfish www.marlin.ac.uk/species/detail/2051 (last accessed 2 June 2026)

Seagrass beds spread as rhizomes grow beneath the seabed, forming nodes where new shoots grow upwards, producing leaves to photosynthesise, and roots anchor downwards to absorb nutrients. The leaves slow wave energy over the beds, allowing mobilised sediments to settle within the seagrass (Howard-Williams, 2022). The spread of rhizomes binds the sediment which reduces erosion and creates stability for further colonisation (Howard-Williams, 2022).

Seagrass beds play an important role in shallow UK waters by providing key ecological services including sediment stabilisation, coastal protection, carbon sequestration, nutrient cycling, filtration of coastal waters, the provision of fish nurseries and enhancement to biodiversity (Orth et al., 2006a; Unsworth et al., 2022).

There are two species of seagrass in the UK: Common eelgrass (*Zostera marina*) is found in the intertidal to subtidal region, in fully submerged conditions down to approximately 10m deep, typically on sand, mud or coarse gravel. It is the dominant, and largest British seagrass species, forming dense beds with trailing leaves up to 2m long and 10mm wide. Common eelgrass has a wide but patchy distribution in English waters, found in the southwest of England, Lindisfarne in the northeast, the Solent and Isle of Wight in the south (Tyler-Walters and Hiscock, 2019; Elma et al., 2024).

Dwarf eelgrass (*Zostera noltii*) has a narrower niche, found higher on the shore in the intertidal to shallow subtidal region on fine sand and mud. It forms dense beds, with thinner, shorter leaves than common eelgrass, reaching only 20cm long and 1.5mm wide. Dwarf eelgrass also has a wide distribution in English waters with populations located in the Wash, Essex and Thames estuaries (Tyler-Walters and Hiscock, 2019).

Both common eelgrass and dwarf eelgrass are monoecious (male and female flowers occur on the same plant) and hydrophilous (pollen released onto the water) species, with pollen shown to travel at a maximum distance of 15m suggesting local environmental characteristics play a major role in dispersal (Kendrick et al., 2012).

2.2 Maerl beds

Maerl is the collective term for various species of a pink, twig-shaped, calcified red algae belonging to the Corallinaceae family. It is a free-living seaweed growing unattached to the seabed, forming intricate, three-dimensional structures which are made up of multiple branches called thalli. These can develop into extensive, structurally complex beds made up of a surface layer of live maerl and layers of dead maerl beneath. Every maerl bed is unique, differing in maerl composition and structural architecture (Tillin et al., 2022). Maerl absorbs minerals from the seawater to deposit calcium carbonate in its cell walls giving it its hard, rigid structure. Live maerl requires light to photosynthesise and grow. It occurs in shallow subtidal regions on open coasts or in tide-swept channels of marine inlets with its depth

determined by light availability and water turbidity (Grall and Hall-Spencer, 2025). Maerl thrives in areas of clear, clean water and moderate tidal flow, requiring both shelter from wave action to prevent burial of thalli and enough water movement to prevent smothering with silt (Wilson et al., 2004).

Maerl is fragile, long-lived and slow growing, with growth rates of 0.5 to 1.5mm per year in European species (Blake and Maggs, 2003), they are often many thousands of years old and if damaged would take tens or hundreds of years to recover, if at all (Tillin et al., 2022). Maerl beds are therefore considered an irreplaceable habitat where irreplaceability is defined as habitats which cannot be easily restored, recreated or replaced, and may be rare (based on extent, range and distribution) and/or unique in terms of environmental context and fragile (vulnerable and slow to recover) (Tillin et al., 2022). In Scotland live and dead maerl beds are considered Priority Marine Features (NatureScot, 2025).

Although rare in the UK, maerl beds provide important ecological services storing carbon and helping to oxygenate and clean the seawater and seabed (Grall and Hall-Spencer, 2025; Schubert et al., 2024). Maerl beds support exceptionally high levels of biodiversity, surpassing surrounding coastal habitats, and provide spawning and nursery areas for economically important species of fish, and broodstocks of large, edible crustaceans and bivalve molluscs (Grall and Hall-Spencer, 2025).

There are two main maerl bed forming species in English waters:

Phymatolithon calcareum is generally found on sand, mud or gravel seabeds in less than 20m of water. *P. calcareum* is the larger of the two species with unattached plants growing to approximately 7cm. It prefers areas protected from strong wave action but with reasonable to strong water flows. In southern areas of England it is often found together with *Lithothamnion corallioides*.

L. corallioides is similar to, and therefore commonly confused with, *P. calcareum*. Like *P. calcareum* it can vary in shape but is most often found as a bright pink three-dimensional lattice structure made up of highly branched nodules. Each plant may reach up to 5cm across. *L. corallioides* prefers warmer, southern English waters.

2.3 Seahorses

Seahorses are type of fish belonging to the Syngnathidae family. Seahorses show high site fidelity and are mainly found in shallow waters, predominantly associated with seagrass beds and algal habitats, swimming upright or using their prehensile tail to grip on to a holdfast such as seagrass (Foster and Vincent, 2004; Garrick-Maidment et al., 2010; Sabatini and Ballerstedt, 2007). They are ambush predators, camouflaging with their surroundings and feeding on live mobile prey, mostly small crustaceans such as amphipods, but also fish fry and other invertebrates (Foster and Vincent, 2004).

There are two species of seahorse found in the UK. Long snouted seahorse (*Hippocampus guttulatus*), also known as the spiny seahorse, can reach 15cm in length and is characterised by a long snout and fleshy protuberances present on the back of the neck running from the head to the dorsal fin creating a “mane” (Lourie, 2004; Sabatini and Ballerstedt, 2007). Long snouted seahorse colouration varies from greenish-yellow through to reddish-brown, speckled with bluish-white spots and flecks for camouflage (Sabatini and Ballerstedt, 2007). The distribution of long snouted seahorse in English waters is concentrated along the south coast (Sabatini and Ballerstedt, 2007).

Short snouted seahorse (*Hippocampus hippocampus*) may typically reach 15cm in length and has a short, upturned snout less than one third the length of its head (Lourie, 2004; Sabatini and Ballerstedt, 2007). They have a prominent spine above each eye and lack the “mane” present on long snouted seahorses (Lourie, 2004; Sabatini and Ballerstedt, 2007). Short snouted seahorse colouration varies from brown, orange, purple or black, occasionally with tiny white dots (Lourie, 2004). The distribution of short snouted seahorse in English waters is concentrated along the south coast of England (Sabatini and Ballerstedt, 2007).

In England both species are Species of Conservation Importance (Natural England and Joint Nature Conservation Committee (JNCC), 2010) and are protected under the [Wildlife and Countryside Act \(1981\)](#)¹⁵, OSPAR Threatened and Declining Species (OSPAR, 2026), NERC Section 41 priority species (NERC, 2022) and IUCN Red List species (IUCN, 2026).

2.4 Stalked jellyfish

Stalked jellyfish are a type of small Cnidaria, with species collectively referred to as Stauromedusae. They are typically less than 2cm in size, bell-shaped with a stalk and basal sucker used for attachment to a substrate. Stalked jellyfish have eight arms, each one with multiple tentacles and nematocysts (stinging cells) used to capture prey (Fenwick, 2017). They then use their arms to deliver the food to a central mouth (Fenwick, 2017). Whilst sedentary predators, some species can move, in a cartwheeling manner, and orientate themselves in an optimum position for feeding using the water current (Fenwick, 2017). Stalked jellyfish are found in rockpools and shallow coastal waters of the UK, mainly attached to seagrass and algae, most are an annual species that develop seasonally, reproduce, and die back until the following year (Tyler-Walters and Richards, 2017).

In the UK there are ten species of stalked jellyfish. Out of these, *Calvadosia campanulata*, *Calvadosia cruxmelitensis* and *Haliclystus* spp are listed as designated features of MPAs.

¹⁵ For more information: www.legislation.gov.uk/ukpga/1981/69

C. cruxmelitensis has a broad, funnel-shaped bell that can reach 1.8cm in diameter and 1.6cm in height (including the stalk), and a broad basal disc. Its eight arms are arranged in a circle with tentacle clusters of up to 35 tentacles per arm. *C.*

cruxmelitensis is usually maroon in colour with an olive-yellow centre (it's manubrium or mouth) and two parallel rows of vivid white nematocysts along its arms resembling the shape of a Maltese cross, inspiring its common name of the St. John's stalked jellyfish. It is also distinguishable from other species due to its stalkless appearance caused by its bell involuting around its base. In English waters *C. cruxmelitensis* has been recorded in the south-west of England and the Isles of Scilly. (Tyler-Walters and Richards, 2017).

C. campanulata has a larger funnel-shaped bell reaching 3cm in diameter and 4.5cm high (including the stalk). Each of its arms have a cluster of up to 45 tentacles and it has a warty, granular appearance. *C. campanulata* is uniform in colour with red, brown and olive-green colorations observed. It has two large white or turquoise spots on four of its sides and more randomly scattered nematocysts compared to *C. cruxmelitensis*. In English waters *C. campanulata* mainly occur in the south-west and has also been recorded in the Isles of Scilly (Tyler-Walters and Heard, 2017).

Haliclystus spp differ from the *Calvadosia* spp above as they have primary tentacles known as anchors on the membrane margin between each arm. Each of its arms have clusters of up to 120 secondary tentacles depending on the species. *H. auricula*, known as the Kaleidoscope jellyfish, is often confused with *H. octoradiatus*, known as the Spotted kaleidoscope jellyfish (spotted referring to the visible white nematocysts which are absent on the Kaleidoscope jellyfish), so UK distribution of specific species is not accurate. However for English waters, *Haliclystus* spp have been recorded in the west and south-west coast of England and Northumberland (Tyler-Walters and Neal, 2017).

3 mNLA detail of activities

Within MMO remit there are eight types of mNLA which are listed and defined below. This literature review considers all of these activities. Each has the potential to impose one or more pressures on the designated features described in this document.

1. Anchoring
2. Diving and snorkelling
3. Hovercraft
4. Motorised personal watercraft
5. Motorised watercraft
6. Non-motorised watercraft
7. Sailing
8. Wildlife watching at sea (commercial)

Certain methods of seagrass restoration may not require a marine licence, this has been considered as an additional section in this review. The aim of seagrass restoration is to restore seagrass beds through expansion of those existing, and creation of new seagrass habitats. Restoration methods in the UK consist of various methods including (but not limited to) the collection of seeds from a healthy seabed to cultivate in a lab and then relocating mats of adult plants into the sea at the restoration site, distributing viable seeds directly in the restoration site (reseeding), and translocating cores taken from healthy seagrass donor sites to a restoration site.

Seagrass restoration has the potential to interact with seagrass bed features during collection of seeds and transplants, including trampling. Seahorse features may also be disturbed during seed and transplant collection. Whilst included as a mNLA in this literature review, depending on the methods used, seagrass restoration may require a marine licence in some circumstances. MMO has published guidance (MMO, 2025a) on marine licence requirements with regards to seagrass restoration activities. For the purpose of this review, only methods which do not require a marine licence will be considered.

There may be additional activities or categories of activities which are identified at a site level which would be considered and included in a site level assessment.

3.1 Anchoring

This activity involves the dropping of an anchor by any vessel (with or without an engine) to secure a vessel to the seabed, temporarily, in order to prevent it drifting with the wind or current (Griffiths et al., 2017). Anchors are generally heavy metal

objects designed to dig into or hook onto the seabed. To create hold, the anchor is dropped and a length of chain is laid out on the seabed (Griffiths et al., 2017). The anchor is “set” (fixed in position) as some pulling force is exerted on the chain (Griffiths et al., 2017). As the vessel drifts, the dragging anchor carves furrows into the seabed or, scrapes on the surface of firm seabed, or the anchor may move sideways along the benthos (Griffiths et al., 2017). In addition, vessels at anchor in the intertidal area will impact the seabed when the hull/keel rests on the seabed as the tide goes out, also known as beaching.

Anchoring will impact features described in this document, as the activity is intended to interact with the seabed to secure the vessel.

3.2 Diving and snorkelling

Diving and snorkelling refer to swimming, either underwater or on the surface, using Self Contained Underwater Breathing Apparatus (scuba) or snorkelling equipment. This activity excludes the extraction of any sea fisheries resources during the activity (such as spearfishing). As divers or snorkelers will generally be positioned above the seabed, interaction between diving or snorkelling activity and the features covered in this review will be limited. However, there is potential for divers to make contact with the seabed during participation, and during entry if the diver enters the water by shore.

Several pressures associated with diving have potential to impact these features, including abrasion or disturbance of the seabed. Divers and snorkelers may kick epifaunal species, this can result in dislodgement or damage to fragile species such as stalked jellyfish. Seagrass beds may be trampled during entry if the diver or snorkeller enters the water by shore, and seahorse features may be visually disturbed by divers.

3.3 Hovercraft

A hovercraft, also known as an air-cushion vehicle (ACV), is a craft capable of travelling over land, water, mud or ice and other surfaces. Hovercraft are primarily used in sheltered environments, typically with large expanses of flat, intertidal areas such as mudflats or sandflats (Natural England, 2017a). Hovercraft has the potential to interact with designated features included in this review during launching and recovery.

3.4 Motorised personal watercraft

A motorised personal watercraft (MPW) is a recreational watercraft that the rider rides or stands on. Some models have an inboard engine driving a pump jet that has a screw-shaped impeller to create thrust for propulsion and steering. These craft are often referred by the brand names such as Jet Ski. The MPW category includes e-foils, “jet ski” and electric powered vessels. This can also include hydroflying. A

hydroflyer is a water sports device that allows a person to "fly" above the water, propelled by the force of water jets. It connects to a motorised personal watercraft, like a jet ski, via a long hose, and the rider controls the thrust and direction by shifting their weight. The high-pressure water jets propel the person on the hydroflyer above the water and below.

MPW have the potential to interact with designated features included in this review during launching and recovery and from propeller or jet wash. Seahorses may also be disturbed by underwater noise or jet wash.

3.5 Motorised watercraft

The use of motorised vessels, including motorboats (powerboats), sailing vessels and yachts in marine and estuarine waters. The motorised watercraft category includes watersports that involve being towed behind a motorised vessel, such as wakeboarding, waterskiing, parascending and parasailing as well as the impact of vessels carrying participants for other mNLA such as diving and snorkelling.

Motorised watercraft, have the potential to interact with designated features included in this review during launching and recovery and from propeller wash and boat wake. Seahorses may also be disturbed by underwater noise.

3.6 Non-motorised watercraft

Non-motorised watercraft covers a wide variety of paddle or wind-propelled sports. This includes canoeing (all types), kayaking (all types), kitesurfing, kite boarding, kite foiling, windsurfing, wingsurfing, wingfoiling, winging, kite winging, dinghies, stand up foil boarding and stand-up paddle boarding.

Non-motorised watercraft have the potential to interact with designated features included in this review during launching and recovery.

3.7 Sailing

This category includes sailing boats without a motor as well as sailing vessels with motors that remain unused while under sail. Sailing boats include dinghies, day boats or other small keelboats or yachts which may be taken out of water at end of use.

Sailing has the potential to interact with designated features included in this review during launching and recovery.

3.8 Wildlife watching from the sea (commercial)

This category covers wildlife watching from any commercial organised trip at sea from any vessel, this includes organised trips and excursions and refers to paid-for activities undertaken for the purpose of observing, photographing, or experiencing

marine and coastal wildlife in its natural environment. These activities are typically delivered by a commercial operator using a motorised or non-motorised vessel and may target species such as cetaceans, seabirds, seals, basking sharks or other marine fauna.

These trips can often access remote locations such as offshore islands or remote cliffs where birds and seals seek sanctuary from disturbance. Repeated wildlife-watching tours can impact seals and seabirds especially through disturbance, particularly when vessels approach too closely, visit colonies frequently, or operate during sensitive periods such as breeding, pupping, moulting or overwintering.

Wildlife watching does not have the potential to impact the designated features included in this review, so this activity has been scoped out for this literature review. Impacts from vessels have been considered in the sections above.

4 Anchoring

This section brings together and analyses the available evidence on how anchoring affects seagrass bed, maerl bed, seahorse and stalked jellyfish features; this includes recreational and commercial anchoring.

Natural England's Advice on Operations was used to identify potential pressures from anchoring and to inform the understanding of feature sensitivity to the pressure. Where a sensitivity assessment has not been undertaken or the evidence base is insufficient to assess sensitivity, the activity-pressure-feature combination has been included to capture all possible evidence that may impact the features. Marine Non-Licensable Activity Impacts Evidence: Methodology¹ details the process of how MMO judgement refined pressures for assessment.

High risk pressures associated with this activity with the potential to impact seagrass bed, maerl bed, seahorse and stalked jellyfish features are:

- abrasion/disturbance of the substrate on the surface of the seabed;
- penetration and/or disturbance of the substratum below the surface of the seabed, including abrasion; and
- physical change (to another sediment type).

High risk pressures associated with this activity have been identified using Natural England's CAP (**Annex 1** mNLA pressures on sensitive features – seagrass beds, maerl beds, seahorses and stalked jellyfish) and MMO judgement. These high risk pressures have been included in this review as they have been determined to be pressures commonly induced by anchoring at a level that has the potential to cause significant impacts on the features. This is because a single anchoring event is likely to result in these pressures at a damaging level, regardless of any site specific factors.

The following pressures were identified as low risk and are therefore not included in this document:

- hydrocarbon and polycyclic aromatic hydrocarbon (PAH) contamination;
- introduction of light;
- introduction or spread of invasive non-indigenous species (INIS);
- litter;
- organic enrichment;
- synthetic compound contamination (including pesticides, antifoulants, pharmaceuticals);
- transition elements and organo-metal (such as tributyltin (TBT)) contamination; and
- visual disturbance.

Low risk pressures associated with this activity have been identified using Natural England's CAP (**Annex 1** mNLA pressures on sensitive features – seagrass beds, maerl beds, seahorses and stalked jellyfish) and MMO judgement. These low risk pressures have not been included in this review as these pressures generally do not occur at a level of concern, as a result of anchoring. Should site specific factors increase the risk of these pressures, these would be considered in an individual site assessment.

4.1 Summary of the effects of anchoring on seagrass beds, maerl beds, seahorses and stalked jellyfish

Penetration and/or disturbance of the substrate below the surface of the seabed, including abrasion results from the deployment and setting of the anchor, and during retrieval as the anchor is recovered. Abrasion or disturbance of the substrate on the surface of the seabed may result from vessel beaching and the anchor chain (rode) moving across the seafloor as the vessel swings, abrading the surface whilst at anchor. Both pressures may impact seagrass and maerl beds. Physical change (to another sediment type) may result due to anchoring activity, altering the sediment characteristics within seagrass and maerl beds, particularly within anchor scars.

The pressure-feature interactions of the above pressures on seahorses and stalked jellyfish relate to the impact of anchoring activities on seagrass as an important habitat to both these features.

Anchoring is considered damaging to sensitive habitats due to the potential for anchors to be thrown by individual boats repeatedly from various locations, damaging multiple small areas (Hirst et al., 2017). Anchoring events are spatially and temporally unique, with the relative damage primarily correlated with the intensity of anchoring but also on the type of anchor or vessel (Collins et al., 2010) with larger, heavier anchors and vessels having a greater impact (Milazzo et al., 2004). The footprint of an anchoring event will also depend on deployment and retrieval events (for example dragged when set, if resetting was required, a furrow was made when retrieved), duration at anchor (length of exposure to tides and currents), length and weight of rode, level of swing, environmental conditions, sediment type, vessel windage (profile of vessel presented to the wind) and skill of the vessel crew (Griffiths et al., 2017).

4.1.1 Impacts of anchoring on seagrass

Seagrass beds occur in sheltered, shallow coastal areas which are typically attractive locations for anchoring boats (Unsworth et al., 2017). Impacts on seagrass beds caused by penetration and abrasion from anchoring, and physical change (to another sediment type) can occur during all phases of an anchoring event: during deployment, whilst the vessel is anchored, during anchor retrieval (Collins et al., 2010; Griffiths et al., 2017) and if a vessel is beached.

The deployment and setting of an anchor involves dropping the anchor and then dragging it through the substrate to lock it in place, penetrating, disturbing and abrading the seagrass bed within its footprint (Griffiths et al., 2017). This process can bend, damage and break seagrass shoots and leaves as it lands (Collins et al., 2010; Jackson et al., 2013) and uproot and tear rhizomes creating a furrow or depression as it is set (Collins et al., 2010; Griffiths et al., 2017).

Whilst anchored the rode may drag across the substrate in response to vessel movement from the change in tide or wind causing abrasion to the sediment and scouring of the seagrass bed (Griffiths et al., 2017). Incorrectly setting an anchor can cause “crabbing” (moving sideways) or dragging of the anchor through or on the sediment as it is not securely held (Griffiths et al., 2017). Abrasion from dragging of an anchor and rode across the substrate can also damage and remove leaves, shoots and uproot rhizomes (Milazzo et al., 2004; Collins et al., 2010). Surface abrasion may also occur when vessels are grounded (vessel beaching) whilst at anchor in the intertidal area when the tide goes out.

During retrieval (weighing), the anchor and chain (rode) are dragged along the seabed as the vessel moves away, further abrading and penetrating the substrate damaging the seagrass shoots and leaves and uprooting rhizomes (Griffiths et al., 2017). Damage to shoots and leaves may result in decreased photosynthesis, growth and reproduction processes (Collins et al., 2010). The damage and uprooting of rhizomes/roots may result in complete removal of seagrass from the sediment leaving bare patches referred to as anchor scars (Boese et al., 2009). The loss of rhizomes reduces sediment stability resulting in a decline in seagrass (Milazzo et al., 2004; Collins et al., 2010). The loss of seagrass canopy exposes the underlying sediment, making it vulnerable to resuspension and reducing water clarity, leading to decreased photosynthesis due to reduced light levels further reducing seagrass survival (Boese et al., 2009; Jackson et al., 2013; Unsworth et al., 2017).

The reduced seagrass density alters the sediment composition of anchor scars, areas which have been shown to have a lower silt fraction and organic content than the adjacent seagrass (Collins et al., 2010). Higher density seagrass beds and longer seagrass blades trap fine sediment particles (Luff et al., 2019). Therefore, the absence of seagrass canopy within anchor scars results in a lack of trapping and retention of fine sediment leading to coarser, less cohesive and more mobile sediment (Collins et al., 2010; Luff et al., 2019). Where the rhizome matt has been damaged by an anchor or rode, storm and wave action can mobilise and disperse the unprotected sediment, reducing cohesion of sediment and deepening the depression of the scar (Collins et al., 2010).

The general landscape of a seagrass bed comprises of a mosaic of vegetation and gaps (un-vegetated areas) which change in formation, frequency and scale over time (Bell et al., 1999). Gaps are recolonised by revegetation of seagrass via both sexual (seed recruitment) and asexual reproduction (shoot production from rhizomatic elongation) depending on species and location (Bell et al., 1999; Rasheed, 2004).

However, in areas of high anchoring activity, un-vegetated anchor scars may become larger and more frequent resulting in fragmentation of the seagrass bed (Unsworth et al., 2015).

Increased fragmentation leads to a decreased capacity for recovery to disturbance due to the reduced likelihood of a rhizome being close enough to facilitate recovery, and the potential reduction in sexual reproductive output of fragmented meadows (Unsworth et al., 2015). The impact of increased fragmentation from anchor scars is thought to be more damaging than area of seagrass lost (Jackson et al., 2013). Fragmentation results in the decrease of the core seagrass bed area, and the increase in exposed edge area (Jackson et al., 2013). Increased fragmentation can alter local hydrodynamics and channel water movements, which may increase shear stress around the exposed rhizomes and enhance erosion potential at damaged sites (Collins et al., 2010; Jackson et al., 2013). Erosion results in a depression of the sediment in scar areas (Jackson et al., 2013).

This increase in sediment mobility can hinder seagrass recovery and potentially reduce growth rates in surrounding undisturbed seagrass (Jackson et al., 2013). High erosion affects recovery of scars as bare patches are exposed to wave action and seagrass cover is reduced in areas where rhizome growth cannot keep up with erosion rate (Collins et al., 2010). Evidence suggests a critical threshold in the level of fragmentation where the negative effects that seagrass loss initiates, such as increased sediment resuspension and reduced sediment stability, further accelerate losses at rates greater than the seagrass can recover (Jackson et al., 2013). Therefore, depending on the level of anchoring activity at a site, fragmentation may accelerate seagrass losses at a faster rate than it can recover (Jackson et al., 2013).

Once fragmented, a seagrass bed loses stability, further reducing resilience as mortality risk is patch size-dependent, with losses often confined to smaller patches below a certain threshold size (Unsworth et al., 2015). It has been shown that increased levels of fragmentation result in a decreased capacity to resist impacts such as storms (Unsworth et al., 2015) and reduces their resilience to other stressors such as eutrophication (Unsworth et al., 2017; Luff et al., 2019).

Zostera species are not a physically robust seagrass (Jackson et al., 2013). They are monotypic with only horizontal elongating rhizomes, rather than both horizontal and vertical as with other species such as *Posidonia oceanica* (Jackson et al., 2013). This is why large, continuous meadows of common eelgrass are only found in level or gently sloping locations (Jackson et al., 2013). Therefore, sudden changes in sediment depth can restrict rhizome elongation expansion and inhibit recovery of anchor scars (Jackson et al., 2013).

The root system of *Zostera* species is generally confined to the top 20cm of sediment so is easily damaged and uprooted by an anchor or rode (Jackson et al., 2013). Burrowing species have been shown to take advantage of the exposed edges of damaged rhizome mats (Collins et al., 2010). This damage to the rhizome

structure and resulting undermining of the edge of the surviving seagrass by borrowing species has also been shown to severely impede recovery (Collins et al., 2010).

Published evidence for impacts from anchoring on *Zostera* species in the UK is limited due to the challenge of surveying precise areas before and after anchoring activity when vessels may anchor for varied timescales. A study conducted in Studland Bay, Dorset, assessing the impact of anchoring and mooring on common eelgrass concluded that there is potential for small vessel anchors to clear areas of seagrass resulting in scars of typically 1 to 4m² (Collins et al., 2010). The scars observed in this study consisted of a distinct step down (10 to 20cm) from the seagrass bed along at least one edge (Collins et al., 2010). This left the rhizome mat exposed to wave action, creating the risk of it being undercut, and providing the opportunity for shore crabs (*Carcinus maenas*) to establish burrows beneath the seagrass rhizomes, worsening the damage of the scar (Collins et al., 2010). It was considered that the largest furrows were created during retrieval, where the anchor was dragged through the sediment uprooting rhizomes (Griffiths et al., 2017).

During a monitoring survey of Studland Bay Marine Conservation Zone (MCZ) conducted by Natural England in July 2021, anchor damage to seagrass beds was apparent at a number of sites with freshly exposed roots and rhizomes above the sediment surface, detached plants and “ploughed” furrows (Doggett and Northen, 2023). At one site, a furrow at least 6 to 7m long through the seagrass and seabed sediment was left behind, very likely resulting from the retrieval and dragging of an anchor (Doggett and Northen, 2023). On one occasion survey divers directly observed the damage caused by the retrieval of a nearby anchor where seagrass shoots and rhizomes were dislodged (Doggett and Northen, 2023). Areas of patchy seagrass where vessels are known to anchor were reported with visible signs of erosion and exposed rhizomes around some of the seagrass bed edges (Doggett and Northen, 2023). This is consistent with the physical disturbance caused by anchoring, suggesting the patches are potentially a result of historical anchor damage.

A study conducted by Bockel et al. (2024) on *P. oceanica* in the French Mediterranean used three landscape indices (decline, patch cohesion and landscape division) to assess anchoring impact. The landscape indices quantified the proportion of living meadow and level of fragmentation and demonstrated that both large and small boat anchoring had an impact on seagrass meadows (Bockel et al., 2024).

The ability of seagrass beds to recover is mainly species-specific and dependant on rhizome persistence or availability of sexual or asexual propagules (Unsworth et al., 2015; Rasheed, 2004). The level of fragmentation that has occurred will also be a factor as a small, isolated patch of seagrass, if subject to stress, may have a reduced recovery capacity if it is dependent upon self-recruitment and regeneration (Unsworth et al., 2015). The ability to overcome negative ecological feedbacks is

another factor in seagrass bed recovery. Negative feedbacks occur when biotic or abiotic conditions of a site are changed sufficiently after the loss of seagrass to prevent its recovery, even after the original stressors are remediated (Unsworth et al., 2024). For example, the loss of seagrass exposes the seabed to wave action causing sediment resuspension and increased turbidity (Jackson et al., 2013), which in turn reduces light required for photosynthesis and growth, resulting in a negative feedback loop impeding recovery (Jackson et al., 2013).

Evidence for recovery of *Zostera* species in UK waters is limited. Common eelgrass is a perennial species which uses a large proportion of its resources for root and rhizome maintenance, reproducing mainly by asexual propagation from the growth of adjacent rhizomes (Boese et al., 2009; Jackson et al., 2013). One plant, however, can produce 200 seeds per season, which are dispersed via shoot detachment once fully developed (Jackson et al., 2013). Seeds may settle within the seagrass bed or float within shoots outside, depending on dispersal on the tide or currents, with germination and growth to a mature plant taking between one and two years (Jackson et al., 2013). However, seed dispersal and survival are unpredictable, and seedling mortality is usually high (Orth et al., 2006a; Jackson et al., 2013). Also, pollination is hydrophilous and assumed to be limited to the extent of the source seagrass bed (Jackson et al., 2013). Therefore, the formation of new patches outside existing beds by sexual propagules or drifting rhizome fragments is a rare event, which has implications for the natural recovery of locations where seagrass has been lost (Jackson et al., 2013).

As rhizome growth of *Zostera* species are restricted to the horizontal elongation of rhizomes only, sudden changes in depth such as the depression of the seabed caused by disturbance from an anchor and subsequent erosion, or mounding of sediment from waves and currents, may inhibit the recovery of seagrass into bare patches (Jackson et al., 2013).

Boese et al. (2009) studied the recolonization of experimentally created gaps within intertidal perennial and annual common eelgrass beds in Oregon, USA. Two zones were studied, the lower intertidal with almost continuous seagrass, and an upper intertidal transition zone where there were patches of perennial and annual common eelgrass (Boese et al., 2009). The study found that recovery began within a month after disturbance in the lower intertidal continuous perennial beds and was complete after two years, whereas plots in the transition zone took almost twice as long (Boese et al., 2009). This would indicate that whilst scars created within a subtidal perennial seagrass bed may recover within two years of disturbance ceasing, intertidal patches of seagrass prone to disturbance are more vulnerable and less likely to recover (Boese et al., 2009).

The recovery potential and mode of common eelgrass beds are heavily impacted by the timing of disturbance (Boardman and Ruesink, 2025). A study by Boardman and Ruesink (2025) conducted in Washington, USA, looked at recovery of common eelgrass after disturbance (dredging during oyster farming) to determine if clonal

shoots and/or seedlings contribute to recovery and if timing of disturbance affected either mode. The results indicated that timing is a key factor when determining the extent to which a common eelgrass bed will recover and by which mechanism. It found that seagrass beds disturbed during the early growing season (EGS) (January to April) were estimated to have more than double the vegetative shoot density of those disturbed in the late growing season (LGS) (May to September). There was also a higher contribution of new shoots from seedlings following EGS relative to LGS disturbance (Boardman and Ruesink, 2025). The study demonstrated that common eelgrass has higher recovery when disturbed during EGS versus LGS time periods (Boardman and Ruesink, 2025). It has been found across multiple studies that the mechanism for common eelgrass recovery is variable depending on severity and frequency of disturbance (Boardman and Ruesink, 2025).

In the UK, anchoring intensity in areas of tourism is likely to be at its height during good weather conditions, which corresponds to the highest seagrass growth and aligns with the LGS period, leading to implications for recovery (Jackson et al., 2013; Boardman and Ruesink, 2025).

Another factor influencing seagrass recovery is the position of the disturbed site in the seagrass bed (Tassone et al., 2024). A study conducted in Virginia, USA compared recovery of common eelgrass in plots where shoots were removed at edge and central sites of a seagrass bed (Tassone et al., 2024). Results showed that recovery was more rapid in the central sites matching control site shoot density in 24 months, compared to incomplete recovery at edge sites with an estimation of 158 months required (Tassone et al., 2024). This was likely due to storm-driven sediment erosion limiting the recovery potential at edge sites where hydrodynamic forces affected clonal growth of rhizomes and seedling recruitment (Tassone et al., 2024). The experiment indicates that disturbance susceptibility, ability to recover and recovery rate is affected by position within a seagrass bed (Tassone et al., 2024).

There have been a few studies in the UK assessing the recovery of common eelgrass after the installation of Advanced Mooring Systems (AMS). Whilst these studies are focussed on the impact of mooring activity, pressures from the mooring riser chain on seagrass beds are the same key pressures caused by anchoring activities (abrasion, penetration and/or disturbance of the seabed, physical change (to another sediment type)). However, MMO notes that there are limitations to using mooring as a proxy for anchoring activity due to the short term disturbance of an anchoring event compared to longer term disturbance of a fixed mooring.

A swing mooring consists of a buoy attached by a chain to a fixed anchoring point on the seabed. When a vessel is attached to a swing mooring its movement (in response to changes in the tide, wind, waves and currents) translates to tension and slack in the mooring chain. This movement of the chain has the potential to cause abrasion to the substrate and seagrass bed from the dragging and scraping of the chain within its footprint leading to scars and fragmentation equivalent to disturbance caused by anchoring (Griffiths et al., 2017; Unsworth et al., 2017). Therefore,

recovery of the disturbed area is comparable when these pressures have been removed. AMS (MMO, 2025b) work by keeping the mooring riser chain off the seabed using subsurface buoys, limiting contact and reducing scour and abrasion of the seagrass from the chain.

In 2019 a number of AMS were installed in place of traditional swing moorings in Cawsand Bay, Plymouth Sound, UK (Solandt et al., 2024). These sites were monitored regularly and four years after AMS installation a 212% increase in seagrass density was recorded within the zone previously abraded by the moorings and riser chains (Solandt et al., 2024). Blade length of the longest seagrass shoots also increased over the test period (Solandt et al., 2024).

Another study monitoring the ecological impact of replacing traditional swing moorings with modified moorings (also using floats on the riser chain) on common eelgrass beds was conducted in the Salcombe ria, Devon, UK (Luff et al., 2019). Luff et al (2019) found that after three years seagrass density surrounding the modified mooring was over twice as high as that of the standard mooring, with blade length also exceeding that of the standard mooring. In addition, seagrass-associated epifaunal species richness was twice as high surrounding the modified mooring, and sediment composition was considerably finer (Luff et al., 2019).

In 2021, 10 initial AMS were installed in Studland Bay MCZ, Dorset, UK and a voluntary no anchor zone (VNAZ) was introduced by MMO to protect the seagrass bed that is a designated feature of the MCZ (MMO, 2023). Ecological monitoring is ongoing, however surveys conducted in 2024 found signs of seagrass recovery within the VNAZ. New seagrass shoots were also recorded growing in previously bare patches, with measurements of 25 anchor scars decreasing in area since 2021 (MMO, 2025c).

A study conducted in Massachusetts, USA, monitoring the recovery of common eelgrass after the installation of modified moorings found that recovery was variable and contingent on the location and size of scar, with few complete recoveries five years post installation. Whilst most scars started to revegetate once pressures were removed, the study highlights how the magnitude of seagrass recovery is context-dependent (Seto et al., 2024).

The potential consequences of seagrass loss are significant, resulting in the reduction of ecosystem service value of seagrasses. Seagrass beds support food security both directly and indirectly providing key fishing grounds, a nursery area for commercially important fish, and trophic support to adjacent fisheries through carbon export; stimulating productivity (Unsworth et al., 2019). It has been found that seagrass beds are a valuable nursery habitat for 20% of world's largest 25 fisheries including the Atlantic cod (*Gadus morhua*) (Unsworth et al., 2019) and commercially valuable juvenile fish species have been documented in common eelgrass beds in the UK (Bertelli and Unsworth, 2014). Increased fragmentation has an impact on associated fauna with studies showing reduced species richness, abundance and

density in unvegetated scars compared to areas of high seagrass cover (Collins et al., 2010; McCloskey and Unsworth, 2015; Luff et al., 2019). This may be a result of species requirements for high density seagrass, which offers increased cover from predators (McCloskey and Unsworth, 2015). The reduced seagrass density in scar areas may impact carbon stocks as the increased sediment deposition in seagrass beds encourages the sequestration of organic carbon, contributing to the reduction of greenhouse gases (Luff et al., 2019). The loss of seagrass will release carbon and the breakdown of rhizomes from increased erosion will actually result in them becoming a carbon source (Jackson et al., 2013).

Impacts from anchoring pressures are likely to be localised and of short duration and recovery can begin when the anchor is removed (Griffiths et al., 2017). However, pressures are inconsistent, varying between locations and seasons, and anchoring is generally free and unregulated (Howard-Williams, 2022). This variation makes the impacts of anchoring on seagrass beds difficult to measure and quantify, making it an unknown threat (Howard-Williams, 2022). The impact of these pressures on seagrass beds will vary according to the intensity of anchoring activity taking place, however, these pressures have the potential to impact seagrass beds through alteration, damage or destruction to flora, fauna and the seabed with implications for ecosystem function and processes.

The resilience of seagrass and its ability to recover from anchoring activity depends on a combination of the environmental conditions of the site (including modifications resulting from the disturbance such as fragmentation, destabilisation and reduced light availability), growth rates of the seagrass and the location, timing, frequency (repeated versus one off event) and intensity of the disturbance (Jackson et al., 2013; Unsworth et al., 2015; Tassone et al., 2024; Boardman and Ruesink, 2025).

Due to anchorage hotspots often coinciding with sites consisting of seagrass beds (Unsworth et al., 2022), the potential of impact from penetration, abrasion and disturbance and physical change (to another sediment type) caused by anchoring is high. Precaution is required with regards to management proposed for anchoring activity, as despite attempts to develop an appropriate risk assessment to identify thresholds and “tipping points” for resistance and resilience of seagrass to anchoring, this has been unsuccessful due to uncertainties regarding level of impact and recovery (Griffiths et al., 2017).

MMO’s latest review since the establishment of the VNAZ in Studland Bay MCZ in 2021, indicates that anchoring over protected areas of seagrass is continuing to decrease with an increase in the use of AMS by boaters, resulting in the recovery of seagrass to a more favourable condition (MMO, 2023). Whilst ecological monitoring is ongoing to inform an updated seagrass condition assessment, this suggests that the management measures introduced at this site have been successful for recovery.

MMO concludes that anchoring on seagrass beds may result in a significant risk of hindering achievement of the conservation objectives of the MPA, dependent on site specific sensitivities and the level of activity within a site. This is because of the impacts of penetration and/or disturbance of the substratum below the surface of the seabed, including abrasion; abrasion/disturbance of the substrate on the surface of the seabed; and physical change (to another sediment type) caused by this activity. A site level assessment will determine whether the activity is hindering the achievement of MPA conservation objectives.

4.1.2 Impacts of anchoring on seahorses and stalked jellyfish

The impact of anchoring activity is discussed in relation to the pressures on seagrass as a supporting habitat of seahorses and stalked jellyfish. Pressures of penetration, abrasion and physical change (to another sediment type) impacts the substrate rather than the species.

Both species of seahorse are associated with seagrass habitats, with long snouted more often than short snouted (Garrick-Maidment, 2007; Woodall et al., 2018). Studies propose that higher densities of seahorses are generally found in and around seagrass beds rather than in neighbouring unvegetated areas of the seafloor due to the food supply, protection they provide and availability of holdfasts for anchorage (Foster and Vincent, 2004; Bluemel et al., 2023). Long seagrasses potentially provide maximized prey density and capture efficiency, as well as predator avoidance (Foster and Vincent, 2004).

Research conducted in Studland Bay, Dorset, UK, studied the movement and behaviour of a pair of long snouted seahorse over a six week period (Garrick-Maidment et al., 2010). When observed outside of the seagrass bed, they showed signs of stress determined by colour change and body posture, and the overall territory of the study pair was found to be primarily within the seagrass bed (Garrick-Maidment et al., 2010).

All species of stalked jellyfish found in the UK are associated with seagrass beds, in particular common eelgrass (Tyler-Walters and Richards, 2017).

The removal or damage to areas of seagrass by anchoring described in **section 4.1.1** reduces the available habitat to seahorses and stalked jellyfish, with scars reducing habitat connectivity and spatial distribution of seagrass.

It is recognised globally that habitat loss, destruction and fragmentation is one of the main threats to most seahorse species (Pearce and Selley, 2024). Declines in seagrass beds may be detrimental to seahorses due to loss of food sources, reduced holdfast availability and increased vulnerability to predation and storms (Pearce and Selley, 2024). There is evidence to suggest that as fragmentation of seagrass increases, the number of small and cryptic fish species (such as

seahorses) decreases and the number of larger benthic predators increases (Salita et al., 2003).

Potential sediment resuspension and increased turbidity caused by anchoring activity on seagrass beds also has the potential to impact seahorses due to the importance of light for reproduction, feeding and growth (Pearce and Selley, 2024; Planas et al., 2013). Research shows that light is a strong controlling factor in triggering reproduction in both long snouted and short snouted seahorse (Pearce and Selley, 2024; Planas et al., 2013). Visual cues are crucial to mate selection, courtship and mate bonding in short snouted seahorse, which are behaviours vital to reproduction, suggesting increased sedimentation may have a detrimental impact on the breeding success of seahorses (Pearce and Selley, 2024; Vincent, 1995; Lin et al., 2021). Light has also been found to be a key factor in prey capture success in seahorses, which was found to decrease as turbidity increased (Pearce and Selley, 2024). Reduced prey capture success leads to reduced feeding and growth, influencing sexual maturity and reproduction (Curtis et al., 2017; Pearce and Selley, 2024; James and Heck, 1994).

Seahorses are sensitive to underwater noise (Selley et al., 2023) so there is also the potential that anchoring “hotspots” will lead to an increase in underwater noise from a higher frequency of boat engines stopping and starting in close proximity. The impact of this pressure on seahorses is assessed in **section 5.1.2**.

Although likely to avoid the source of disturbance, it has also been suggested that there is the possibility of seahorses being crushed by the movement of an anchor rode and the death of a pregnant male would result in the likely loss of the developing brood (Garrick-Maidment et al., 2010; Griffiths et al., 2017). Stalked jellyfish are likely to be vulnerable due to their inability to move and avoid the mechanical disturbance caused by anchoring activity on seagrass beds, however at this time no studies have been found to support this.

Due to seahorses showing high site fidelity and establishing breeding territories in seagrass beds (Foster and Vincent, 2004) and the sedentary nature of stalked jellyfish (Tyler-Walters and Richards, 2017), anchoring activity has the potential to pose a threat to the survival, reproduction and population of these species through habitat association. It has been suggested that a decline in seagrass habitat will also lead to a decline in its associated species (Collins et al., 2010; Garrick-Maidment et al., 2010). The impact of the pressures associated with anchoring on seahorses and stalked jellyfish will therefore vary according to the intensity of activity taking place and the level of damage caused to the seagrass bed.

MMO conclude that anchoring on seahorses and stalked jellyfish may result in a significant risk of hindering achievement of the conservation objectives of the MPA, dependent on site specific sensitivities and the level of activity within a site. This is because of the impacts of penetration and/or disturbance of the substratum below the surface of the seabed, including abrasion;

abrasion/disturbance of the substrate on the surface of the seabed; and physical change (to another sediment type) caused by this activity. A site level assessment will determine whether the activity is hindering the achievement of MPA conservation objectives.

4.1.3 Impacts of anchoring on maerl beds

Impacts on maerl beds caused by penetration, disturbance and abrasion from anchoring can occur during all phases of an anchoring event. Fragile maerl beds are easily damaged by the anchor deployment, setting and retrieval, and by the scouring and abrasion of the rode when dragged along the seabed (Birkett et al., 1998; Twigger-Ross et al., 2021).

Figure 2 shows anchoring locations overlapping with maerl bed in the Fal and Helford SAC. Anchor location data and images were collected during Side Scan Sonar (SSS) surveys conducted by Cornwall Inshore Fisheries Conservation Authority (CIFCA) in 2020. **Figure 3** shows a map produced by CIFCA detailing snapshots taken during one of the SSS surveys which show patterns believed to be caused by ship's anchor cables whilst they were anchored in the bay (Sturgeon et al., 2021). These images have been geolocated (georeferencing is accurate to within approximately 3m) onto in **Figure 2**.

Direct evidence measuring the impacts of anchoring on maerl is scarce, however pressures caused by other activities such as mooring, dredging and bottom towed fishing are comparable and used as a proxy below. MMO notes that there are limitations to using these alternative activities as a proxy for anchoring activity due to the short term disturbance of an anchoring event compared to longer term disturbance of a fixed mooring, and the scale of impact from dredging and bottom towed fishing activities.

The motion of chains from moorings have been observed to crush maerl (Birkett et al., 1998). Penetration from anchor deployment and abrasion from anchor rodes may have an equivalent impact. Maerl creates a complex habitat with gaps between the interlocking lattices, providing a wide range of niches for infaunal and epifaunal invertebrates living on and in between branches (Birkett et al., 1998; Griffiths et al., 2017). Crushing maerl damages the lattice structure, reducing the interstitial space therefore reducing available habitat for associated species (Birkett et al., 1998; Hall-Spencer and Moore, 2000; Griffiths et al., 2017). Abrasion from the rode may break up maerl nodules into smaller, lighter fragments resulting in easier displacement by wave action (Griffiths et al., 2017). The loss in structural heterogeneity results in reduced biodiversity and restriction of water flow through the bed (Griffiths et al., 2017).

Fal and Helford SAC IFCA Side Scan Sonar

Scan and Anchoring locations with Maerl beds

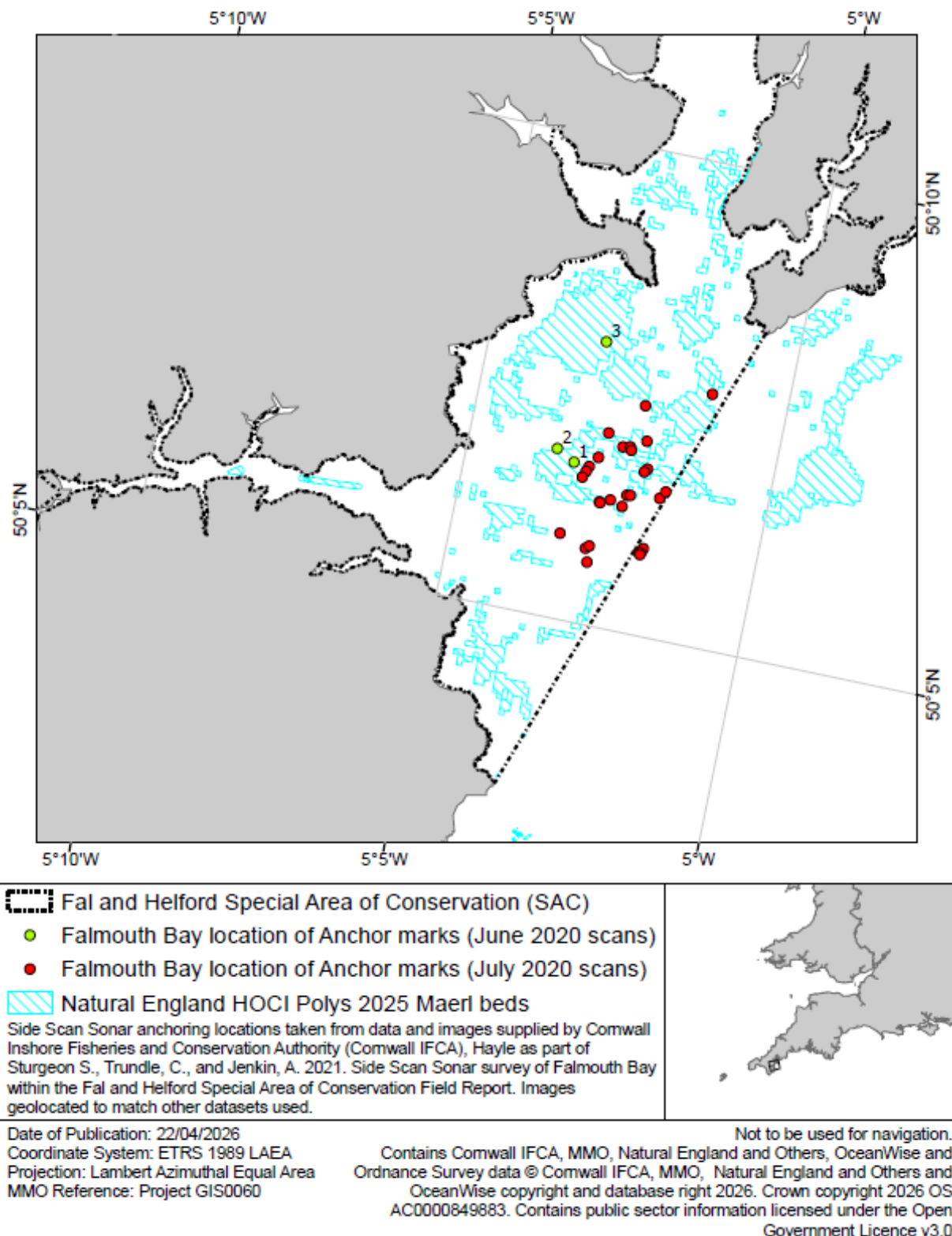


Figure 2: Map of Fal and Helford SAC showing anchor locations, maerl beds and referenced geolocated side scan sonar snapshots of anchor damage from Figure 3

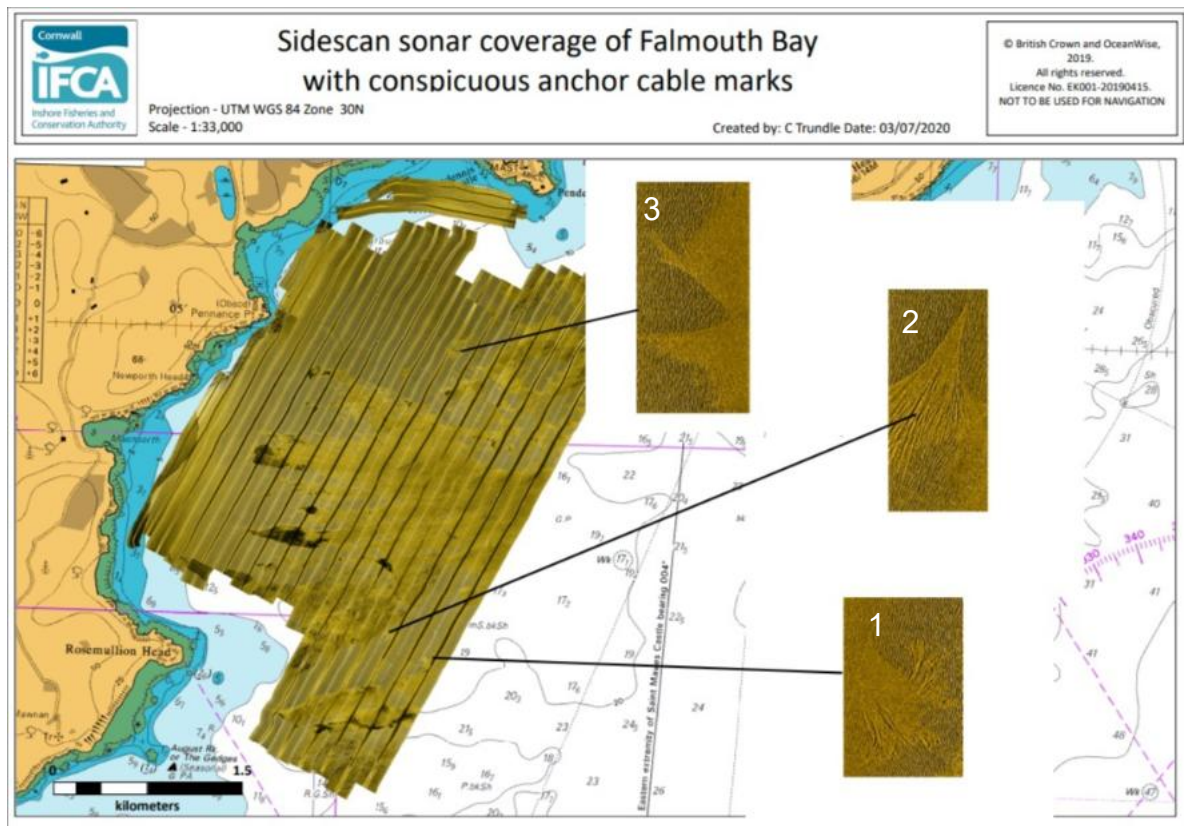


Figure 3: CIFCA side scan sonar coverage showing location and snapshots of anchor damage from Figure 3 which are referenced in Figure 2.

Water movement is a key factor concerning the distribution of maerl to prevent the burial of live thalli and smothering with silt and fine sediments (Wilson et al., 2004). Burial and sedimentation may result in loss of live maerl due to lack of light for photosynthesis and reduction of water movement around the thalli limiting gas exchange resulting in detrimental effects on the algae (Wilson et al., 2004).

To provide an example of sensitivity to similar pressures, bottom towed fishing has been used as a proxy. Scallop and clam dredging have been proven to severely degrade maerl and its biodiversity and ecosystem function (Grall and Hall-Spencer, 2025). A study looking at the impact of scallop dredges on maerl beds in the Clyde Sea area, Scotland, reported that a single dredge caused over 70% reduction in live maerl thalli on previously unfished grounds, with no recovery after four years (Hall-Spencer and Moore, 2000). The passing dredge also re-suspended sand and silt that settled over a wide area (up to 15m from the dredged track), increasing sedimentation and turbidity resulting in reduced light availability and the burial and smothering of the living maerl (Hall-Spencer and Moore, 2000).

Maerl habitats have a very low resilience to abrasion (Tillin et al., 2022) and are considered to have very low recovery rates from pressures that lead to damage and loss of beds (Griffiths et al., 2017). Maerl is a very slow growing habitat, which is effectively non-renewable (Twigger-Ross et al., 2021). In addition, the complex architecture of maerl beds is generally a result of the accumulation of both live and dead maerl over centuries (Bernard et al., 2019).

The recovery potential of maerl beds has been characterised by OSPAR as poor, meaning that only partial recovery is likely within 10 years and full recovery may take up to 25 years or not at all depending on conditions and how degraded it is (Hall-Spencer et al., 2010; Griffiths et al., 2017). Maerl beds may never recover from severe disturbance such as removal or complete smothering by sediment (Hall-Spencer et al., 2010; Griffiths et al., 2017). Maerl is also very slow to recruit as it rarely produces reproductive spores, newly settled thalli have never been found in the UK (Griffiths et al., 2017). Maerl scored highly for irreplaceability in the Natural England Irreplaceable Marine Habitat assessment meaning it is classed as a rare, fragile, vulnerable habitat, not easily restored, recreated or replaced (Tillin et al., 2022). Therefore, even small disturbances may have a devastating long-term effect (Griffiths et al., 2017).

The loss of maerl bed habitats has the potential for significant ecological consequences. Maerl beds sequester and store inorganic carbon, which can buffer the adverse effects of ocean acidification (Grall and Hall-Spencer, 2025). They can also accumulate considerable amounts of organic carbon through settlement and trapping of organic matter between and underneath the calcareous thalli, which can be stored in deposits they create over millennia (Grall and Hall-Spencer, 2025). Damaging and disturbing the maerl can result in the release of seabed carbon stores due to sediment mixing and damage to biological communities (Grall and Hall-Spencer, 2025). Disturbance from anchoring activity therefore has the potential to impact carbon storage.

Studies have shown that areas with lower shellfish dredging pressure had more live maerl, greater sediment heterogeneity and fewer broken maerl thalli, with higher total species richness and more rare species (Grall and Hall-Spencer, 2025). Equivalent physical damage caused by penetration and abrasion from anchoring activity may therefore have the potential to reduce the complexity of the habitat structure, resulting in a decrease in both biodiversity of associated species and provision of important nursery grounds.

The main management measure which would assist the conservation of this habitat is protection from physical damage (Hall-Spencer et al., 2010). Whilst the literature generally recommends prohibiting maerl extraction and the use of bottom towed gear (Hall-Spencer et al., 2010), anchoring activity has the potential to result in comparable pressures which may have a detrimental, long lasting effect on maerl bed habitats.

The fragile structure and extremely slow growth rate of maerl makes it a highly vulnerable, irreplaceable habitat. Due to the lack evidence directly assessing the impact of anchoring activity on maerl beds, combined with its scarcity and importance for biodiversity, management is proposed. Regardless of the level and frequency of anchoring events occurring at a site, any individual anchoring event occurring in areas of maerl bed means that the potential impact from penetration,

abrasion and disturbance is high. Impacts of these pressures to the physical structure of the maerl bed habitat are highly detrimental with little to no recovery.

MMO concludes that anchoring on maerl beds is likely to result in a significant risk of hindering achievement of the conservation objectives of the MPA at any level of activity. This is because the impacts of penetration and/or disturbance of the substratum below the surface of the seabed, including abrasion; and abrasion/disturbance of the substrate on the surface of the seabed caused by this activity even at low levels are likely to present a significant risk of hindering achievement of the site's conservation objectives.

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5 Diving, snorkelling, hovercraft, motorised personal watercraft, motorised watercraft, non-motorised watercraft and sailing

This section brings together and analyses the available evidence on the launching, recovery and participation of hovercraft, motorised personal watercraft, motorised watercraft, non-motorised watercraft and sailing and how these affect seagrass bed, seahorse and stalked jellyfish features. The impact of participation in diving and snorkelling on seahorses is also addressed in this section. The maerl bed feature has been scoped out due to its subtidal location meaning a low risk of pressure-feature interaction associated with these activities.

These activities have been grouped together as the associated pressures they have on the features overlap. Trampling is also included in this section as this may occur during the entry and exit to participate in these mNLA.

Natural England's Advice on Operations was used to identify potential pressures from these activities and to inform the understanding of feature sensitivity to the pressure. Where a sensitivity assessment has not been undertaken or the evidence base is insufficient to assess sensitivity, the activity-pressure-feature combination has been included to capture all possible evidence that may impact the features.

High risk pressures associated with this activity with the potential to impact seagrass bed, seahorse and stalked jellyfish features are:

- abrasion/disturbance of the substrate on the surface of the seabed;
- penetration and/or disturbance of the substratum below the surface of the seabed, including abrasion;
- underwater noise changes; and
- visual disturbance (to seahorses).

High risk pressures associated with this activity have been identified using Natural England CAP (**Annex 1** mNLA pressures on sensitive features – seagrass beds, maerl beds, seahorses and stalked jellyfish) and MMO judgement.

These high risk pressures have been included in this review as they have been determined to be pressures commonly induced by these activities a level that has the potential to cause significant impacts on the features.

The following pressures were identified as low risk and are therefore not included in this document:

- collision below water with static or moving objects not naturally found in the marine environment;
- hydrocarbon and PAH contamination;
- introduction of light;

- introduction or spread of INIS;
- litter;
- synthetic compound contamination (including pesticides, antifoulants, pharmaceuticals); and
- transition elements and organo-metal (such as TBT) contamination.

Low risk pressures associated with this activity have been identified using Natural England CAP (**Annex 1** mNLA pressures on sensitive features – seagrass beds, maerl beds, seahorses and stalked jellyfish) and MMO judgement. These low risk pressures have not been included in this review as these pressures generally do not occur at a level of concern, as a result of these activities. Should site specific factors increase the risk of these pressures, these would be considered in an individual site assessment.

5.1 Summary of the impacts from mNLA on seagrass beds, seahorses and stalked jellyfish

Seagrass is limited to shallow, protected waters and soft sediments which are often open to public access (d'Avack et al., 2014). The close proximity to the shore and intertidal coastal zones means that seagrass beds are easily accessible by humans entering and exiting the water for marine recreational activities. This exposes seagrass beds in intertidal and shallow subtidal areas to disturbances such as trampling, boat propeller damage and abrasion from equipment associated with mNLA.

Due to the seagrass being an important habitat for seahorses and stalked jellyfish, these features may also be impacted by association.

5.1.1 Impacts of launching, recovery and participation of mNLA on seagrass beds, seahorses and stalked jellyfish.

Penetration and abrasion of the substrate below the surface of the seabed on seagrass beds may result during the launching and recovery of equipment used in mNLA. Abrasion or disturbance of the substrate on the surface (and surface features) of the seabed on seagrass beds, seahorses and stalked jellyfish may result when accessing the sea over the intertidal area from the launching and recovery (dragging) of equipment used in association with mNLA, from trampling when entering and exiting the water (including when carrying equipment) to participate in these activities, and during participation from an engine's propeller.

As stated above, seagrass is not physically robust with *Zostera* species having a shallow root system with horizontal growing rhizomes making them vulnerable to damage by abrasion (d'Avack et al., 2014).

Wading through shallow waters to enter and exit for mNLA (including diving and snorkelling from shore) or launching and recovering equipment associated with mNLA inherently involves trampling of the substrate (d'Avack et al., 2014). Trampling

on seagrass beds can damage the rhizomes and bury seeds, preventing germination (Howard-Williams, 2022). There are limited data on the impacts of trampling on seagrass globally, and no UK based studies (Howard-Williams, 2022). A study conducted in Puerto Rico on *Thalassia testudinum* showed that seagrass biomass was inversely related to trampling intensity and duration (Eckrich and Holmquist, 2000). The study recorded recovery occurring within a period of seven months after trampling ceased but reduced seagrass cover was still visually distinguishable fourteen months later (Eckrich and Holmquist, 2000). It also proposed that wading depth may influence trampling disturbance with less force exerted by an individual at greater depths due to the effects of buoyancy meaning impact was greatest in shallow areas (Eckrich and Holmquist, 2000).

A study conducted by Major et al. (2004) in Willapa Bay, USA investigating trampling on *Zostera japonica* determined impact was greatest on seagrass beds growing in soft, muddy substratum showing a significant decrease in shoot density, compared to no impact detected on seagrass growing in hard packed sand.

As seagrass beds are restricted to low energy environments, boats passing in close proximity can create waves. Boat wake causes turbulence which may resuspend sediments, break off leaves, dislodge sediments and uproot plants (d'Avack et al., 2014). These damages have been shown to be greatest at low tide, however have a marginal impact on seagrass beds (Koch, 2002).

There is also the potential of engine propellers physically damaging seagrass beds by shearing leaves and cutting into the substrate, resulting in narrow dredged channels through the vegetation known as propeller scars in severe cases (d'Avack et al., 2014). These scars may expand and merge through erosion resulting larger bare areas and fragmentation of the seagrass bed. A study in Florida, USA looking at a variety of seagrass species determined that recovery after propeller impact was species and growth rate dependent taking up to nine and a half years (Kenworthy et al., 2002). Geographical and climatic region may also have an impact on recovery rates (d'Avack et al., 2014).

Impact and recovery from pressures caused by trampling and boat propellers on seagrass beds is difficult to determine as will vary depending on a number of factors. Intertidal habitats are more exposed to penetration and abrasion pressures as they are more readily accessible than subtidal beds (d'Avack et al., 2014). Wading depth (Eckrich and Holmquist, 2000) and type of substratum (Major et al., 2004) will determine impact from trampling, and the tidal state will influence the level of propeller damage (Koch, 2002). Seasonal effects are also an important consideration as damage induced from mNLA activities in winter is likely to have a lesser impact than damage occurring during the growing season (d'Avack et al., 2014). Impacts will also be site specific depending on intensity, duration and type of mNLA involved in launching, recovery and participation.

The launching and recovery of vessels associated with mNLA from “unofficial access” points using a vehicle and trailer from a location without a slipway may cause abrasion to seagrass beds (Natural England, 2017b). However this is considered unlikely to be a frequent pressure as the use of established slipways is normal procedure, which in general are accessible at high and low tides which minimises disturbance to the sediment (Natural England, 2017b). As such, this pressure-feature interaction is acknowledged but expert judgment considers it negligible (Natural England, 2017b). This is also the case for hovercrafts which may cause abrasion to seagrass beds through the launching and recovery by the skirt of the hovercraft, or by the hull when the craft is grounded on the foreshore (Natural England 2017a). Impact from hovercrafts is likely to be very localised so risk will be assessed at site level ([Natural England CAP](#)¹⁶).

The impact and recovery of abrasion and penetration pressures on seahorses and stalked jellyfish are linked to their association with seagrass habitat.

Stalked jellyfish are small and soft-bodied and not likely physically robust with tiny early life stages which are and potentially susceptible to physical disturbance (Tyler-Walters and Richards, 2017). Most importantly if their macroalgal or seagrass substratum is damaged or removed by abrasion they are likely to be lost (Tyler-Walters and Richards, 2017). Recovery will, therefore, depend on the recovery of the seagrass bed and subsequent recolonization of the area by stalked jellyfish (Tyler-Walters and Richards, 2017).

Similarly, a reduction in seagrass bed may result in the loss of available habitat for seahorses leading to a decrease in local abundance of the resident population (Nash et al., 2021). Whilst seahorses are mobile and able to move to an alternative location, the resulting pressures may be detrimental if widespread as their poor swimming ability will restrict recoverability (Nash et al., 2021).

MMO concludes that participation of mNLA (diving, snorkelling, hovercraft, motorised personal watercraft, motorised watercraft and sailing) on seagrass beds, seahorses and stalked jellyfish may result in a significant risk of hindering achievement of the conservation objectives of the MPA, dependent on site specific sensitivities and the level of activity within a site. This is because of the impacts of penetration and/or disturbance of the substratum below the surface of the seabed, including abrasion; and abrasion/disturbance of the substrate on the surface of the seabed caused by these activities. A site level assessment will determine whether the activity is hindering the achievement of MPA conservation objectives.

¹⁶ Natural England Conservation Advice – Whitsand and Looe Bay MCZ
www.designatedsites.naturalengland.org.uk/Marine/FAPMatrix.aspx?SiteCode=UKMCZ0021 (last accessed 17 April 2026)

MMO concludes that trampling, launching and recovery on seagrass beds, seahorses and stalked jellyfish may result in a significant risk of hindering achievement of the conservation objectives of the MPA, dependent on site specific sensitivities and the level of activity within a site. This is because of the impacts of abrasion/disturbance of the substrate on the surface of the seabed; penetration and/or disturbance of the substratum below the surface of the seabed, including abrasion; caused by trampling, launching and recovery for this activity. However, as trampling, launching and recovery is not within MMO remit, these impacts will not be assessed or managed by MMO.

5.1.2 Impacts of participation of mNLA on seahorses

Due to their unique morphology and behaviour, seahorses are particularly vulnerable to acoustic and visual disturbances (Spoto et al., 2026). Boat noise resulting from participation of motorised personal watercraft, motorised watercraft and hovercraft, and the presence of divers and snorkelers may have a negative impact on seahorses. Pressures from diving are likely to be more targeted due to the ability to spend duration at depth, compared to surface activities, and the nature of searching for species within seagrass habitat leading to close encounters.

Underwater noise changes result from the engine noise produced by motorised vessels participating in mNLA. Small motorised craft produce relatively low levels of noise (75 to 159 decibels (dB) per 1 micropascal metre (μ Pa) with the output characteristics highly dependent on speed and other operational characteristics (OSPAR, 2009 cited in Natural England, 2017b). Many of these sources have greater sound energy in higher frequency bands (for example above 1,000 Hz) than large ships (Natural England, 2017b). Whilst motorised vessels are anchoring or mooring, the use of engines for positioning will also cause underwater noise changes. Vessels may also keep engines running whilst anchored or moored.

Seahorses are sensitive to underwater noise (Selley et al., 2023) so if boat noise is taking place it may result in a negative impact to seahorse populations in the vicinity.

A study evaluating the effects of underwater noise as a source of acoustic stress in long snouted seahorses in Portugal found that when subjected to short-term (63.4 to 127.6dB) and constant (up to 137.1dB) motorboat noise there was an immediate physiological and behavioural response (Palma et al., 2019). Seahorse breathing rate significantly increased and 37.5% of individuals were observed abandoning the location likely an attempt to swim away from the area (Palma et al., 2019).

Seahorses require contact with holdfasts and shelter due to their poor swimming ability and only abandon these in specific occasions, such as feeding in the absence of currents or due to stress (Palma et al., 2019). Abandonment behaviour can be detrimental to seahorses potentially leading to increased predation, poor local recruitment and fragmentation in the population at a larger scale (Nash et al., 2021).

Another study compared the response of captive *H. erectus* in noisy (123 to 137 decibels Root Mean Square (dBrms) re 1 μ Pa) and quiet (110 to 119 dBrms re 1

μPa) tanks for one month (Anderson et al., 2011). Seahorses displayed a chronic stress response and animals in loud tanks showed more irritation behaviour, pathological and distress behaviour, lower weight, worse body condition, higher plasma cortisol and other blood measures indicative of stress, and more parasites in their kidneys (Anderson et al., 2011).

Stressed seahorses have been shown to change their vocalization in response to disturbance by increasing the number of clicks they produce (Giglio et al., 2019). Seahorses generate sounds during feeding, courtship, competition and stress and therefore a change in sound patterns may result in the separation of pair-bonded individuals (Anderson et al., 2011).

Visual disturbance to seahorses may result during diving and potentially snorkelling activity (if diving below the surface of the water) if occurring at site where seahorses reside.

Whilst studies have shown the presence of divers (including photography) can lead to behavioural changes in seahorses, which may be detrimental to their fitness and survival (Giglio et al., 2019; Spoto et al., 2026), there is limited evidence examining the impact of diving and snorkelling activity on seahorses without photography.

A study on the effects of diver and photographer approach on the species *H. reidi* behaviour found that divers using action cameras attached to extension poles approached seahorses more closely, causing significantly more behavioural disruptions such as escape responses compared to divers using a compact camera and non-camera users (Giglio et al., 2019). The response of detaching and swimming may result in the individual becoming visible to predators and prey (as relies on camouflage) and disrupts normal behaviour (Giglio et al., 2019). However, most diver interactions observed in the study did not cause a significant change in behaviour (Giglio et al., 2019).

Another study examined the opercular beat rate (OBR) (the frequency of operculum (specialised gill cover) movements reflecting the respiratory rate) of long snouted and short snouted seahorses in the Mediterranean to measure physiological stress in the presence of divers and intense light exposures (Spoto et al., 2026). The results indicated a level of stress from underwater photography evidenced by acute alternations in their respiratory rates (Spoto et al., 2026). Both species exhibited a reduction in OBR with over 14% of long snouted seahorses displaying thanatosis or “death feigning” response, which is a resting behaviour characterised by immobility, whether attached to a holdfast or not, and a cessation of opercular movements for extended periods (Spoto et al., 2026). Seahorses primarily rely on camouflage, with thanatosis being a secondary defence mechanism (Spoto et al., 2026). Both species demonstrated the ability to recover quickly (within five minutes) indicating that stress induced by diver presence and underwater photography is acute and significant, but short-lived (Spoto et al., 2026).

Other evidence from studies assessing impacts on other seahorse species suggests that visual cues such as flash photography have no significant impact on retinal anatomy, feeding, or behaviour as although high flash intensity led to decreased resting and more startled behaviour, it was concluded that flash photography from divers was typically unlikely to be at an intensity and frequency that would cause stress (Harasti and Gladstone, 2013; De Brauwer et al., 2019).

According to [Natural England's CAP](#)¹⁷ there is currently no consensus within published evidence regarding the long-term impacts of stress responses from the visual disturbance of diving activities and it is not known whether prolonged or recurrent exposure to visual disturbance may induce stress or result in displacement of seahorses. However it is likely that due to the limited encounters that occur, disturbance from divers is not a significant pressure limiting seahorse populations in English waters (Selley et al., 2023).

Furthermore, both species of seahorse are protected under the [Wildlife and Countryside Act \(1981\)](#)¹⁵. A [marine wildlife licence](#) (MMO, 2021) is required from MMO for any activity which may disturb seahorses. Intentionally disturbing seahorses without a wildlife licence may lead to enforcement action. Divers and snorkelers must have a wildlife licence if they are seeking seahorses or intending to do something likely cause a disturbance such as photography or filming of seahorses.

As well as issuing wildlife licences, MMO has published a [Seagrass and Seahorse Diving Guidance Note](#) (MMO, 2025b), which provides advice for those who dive or snorkel on seagrass beds, including how to reduce any potential disturbance if you encounter a seahorse whilst snorkelling or diving.

MMO concludes that participation of mNLA (diving, snorkelling, hovercraft, motorised personal watercraft and motorised watercraft) on seahorses may result in a significant risk of hindering achievement of the conservation objectives of the MPA, dependent on site specific sensitivities and the level of activity within a site. This is because of the impacts of underwater noise changes caused by this activity. A site level assessment will determine whether the activity is hindering the achievement of MPA conservation objectives.

MMO concludes that participation in diving and snorkelling on seahorses may result in a significant risk of hindering achievement of the conservation objectives of the MPA, dependent on site specific sensitivities and the level of activity within a site. This is because of the impacts of visual disturbance

¹⁷ Natural England Conservation Advice – Torbay MCZ.
www.designatedsites.naturalengland.org.uk/Marine/FAPMatrix.aspx?SiteCode=UKMCZ0019 (Last accessed 17 April 2026)

caused by this activity. A site level assessment will determine whether the activity is hindering the achievement of MPA conservation objectives.

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6 Seagrass restoration

6.1 Impacts of seagrass restoration on seagrass beds and seahorses

Seagrass restoration may have the potential to negatively impact seagrass beds during the activity of seed and core collection from donor sites, and when replanting seeds and cores at restoration sites.

Seed removal requires balance to maintain some seed for essential ecosystem functions such as providing genetic variation, new growth in less healthy seagrass beds and being a food source for species including waterfowl, invertebrates and certain fish (Orth et al., 2006b).

Natural England's Advice on Operations does not include seagrass restoration so potential pressures from this activity have been identified through engagement with Natural England and MMO judgement.

Depending on the restoration method, high risk pressures associated with this activity with the potential to impact seagrass bed features are:

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

The pressures abrasion, penetration and disturbance of the substrate may occur from trampling whilst collecting from donor sites and transplanting into restoration sites, as well as when digging up and extracting cores from the seagrass bed. These pressures have been addressed in **section 5.1.1** and **section 4.1.1** although will likely be occurring at a smaller scale during restoration activity.

The impact of removal of target species for seed collection (picking shoots with spathes, removal of full shoot with intact rhizome, and removal of cores of whole sections of seagrass with shoots, rhizomes and sediment) and unintentional removal of non-target species (associated epiflora and fauna species) when removing seagrass will depend on method, scale and frequency of collection.

Typically, restoration involves the harvesting of donor seeds or plants from natural beds which may lead to donor bed disturbance and damage if it is being done on a scale requiring large amounts of donor material. There is therefore the potential that sourcing donor material from natural meadows may cause further decline if overharvested (Van Katwijk et al., 2021) or taken from seagrass beds in unfavourable or recovering condition.

Studies on donor bed disturbance and recovery of donor beds in the UK are limited, however it is generally considered that seed collection has a lower donor bed impact than core extraction (Gamble et al., 2021). This is due to seed and shoot collection removing a limited amount of plant tissue and leaving rhizomes intact for regrowth, compared to core extraction requiring the excavation of shoots, rhizomes and sediment (Gamble et al., 2021). Recovery of *Zostera* species donor beds after core extraction has been recorded between 7 and 12 months depending on species and site condition (Valle et al., 2015; Matheson et al., 2017; Zhang et al., 2020; Torres-conde et al., 2024).

It is an offence under section 140 of the [Marine and Coastal Access Act 2009](#)¹⁸ to intentionally pick, collect, cut, uproot or destroy, any plant in an MCZ which is a protected feature of that MCZ and in doing so significantly hinders, or may significantly hinder, the achievement of the conservation objectives stated for the MCZ.

Depending on the method and scale of restoration activities, the collection of donor seeds and deployment of seeds or plants to the restoration site may be classed as a [marine licensable activity](#) (MMO, 2026).

If the restoration methods do not require a marine licence MMO [guidance](#) (MMO, 2025b), advises applicants to liaise with Natural England on methods and suitable locations, to ensure the restoration activity can be carried out without significantly hindering the achievement of the conservation objective of the MCZ that the seagrass bed is a designated feature of and to avoid committing an offence.

If the scope of the restoration project is determined as a marine licensable activity, MMO will assess the impact of the restoration activity on seagrass beds when determining the granting of a marine licence and minimising any potential impact through licence conditions to ensure it can be carried out without significantly hindering the achievement of the conservation objective of the MCZ.

As a wild flowering plant, the removal or uprooting of seagrass plants is prohibited under Section 13(1) (b) under the [Wildlife and Countryside Act \(1981\)](#)¹⁵ which means that restoration activity may also require appropriate consent from Natural England again lowering the risk of the activity significantly hindering the achievement of the conservation objective of the MCZ.

As seagrass is an important habitat for seahorses, there is the potential for seagrass restoration activities to impact seahorses. However as detailed in **section 5.1.2** seahorses are protected under the [Wildlife and Countryside Act \(1981\)](#)¹⁵ (as amended) so any activity involving methods likely to disturb seahorses or damage the habitat they live in would require a [marine wildlife licence](#) (MMO, 2021) granted by MMO minimising the risk of impact on seahorses through licence conditions. This risk will be assessed further through wildlife licence consent where applicable and project specific liaison with Natural England.

¹⁸ For more information: www.legislation.gov.uk/ukpga/2009/23/section/140

MMO concludes that seagrass restoration on seagrass beds and seahorses may result in a significant risk of hindering achievement of the conservation objectives of the MPA, dependent on site specific sensitivities and the level of activity within a site. This is because of the impacts of removal of target species; and removal of non-target species caused by this activity. A site level assessment will determine whether the activity is hindering the achievement of MPA conservation objectives.

MMO concludes that seagrass restoration on seagrass beds and seahorses may result in a significant risk of hindering achievement of the conservation objectives of the MPA, dependent on site specific sensitivities and the level of activity within a site. This is because of the impacts of abrasion/disturbance of the substrate on the surface of the seabed; penetration and/or disturbance of the substratum below the surface of the seabed, including abrasion; caused by trampling for this activity. However, as trampling is not within MMO remit, these impacts will not be assessed or managed by MMO.

7 Conclusion

This document has reviewed and synthesised the available evidence on the impacts from mNLA and their pressures on seagrass beds, maerl beds, seahorses and stalked jellyfish designated within MPAs. The review considered evidence relating to anchoring, launching and recovery of watercraft, participation in mNLA, diving and snorkelling and seagrass restoration.

The evidence indicates that physical disturbance is the primary mechanism through which mNLA may affect the features considered in this document. The principal pressures identified include penetration and/or disturbance of the substratum below the surface of the seabed, including abrasion; abrasion or disturbance of the substrate on the surface of the seabed; physical change (to another sediment type) and, for some species, visual disturbance.

Available evidence consistently demonstrates that seagrass beds and maerl beds are sensitive to physical disturbance. Anchoring can damage above-ground and below-ground structures through direct contact with anchors and anchor chains, resulting in loss of shoots, uprooting of rhizomes, habitat fragmentation and changes to sediment characteristics. Maerl beds are particularly vulnerable and classed as irreplaceable habitats because of their fragile structure, slow growth rates and limited recovery potential.

For seahorses and stalked jellyfish, impacts are closely linked to the condition of supporting habitats. Evidence suggests that damage to seagrass habitats may indirectly affect seahorses through habitat loss and reduced shelter, feeding and breeding opportunities. Similarly, stalked jellyfish may be affected through damage to the habitats and substrates upon which they rely. Evidence for direct effects on these species is more limited than for habitat features.

The evidence base varies considerably between features and activities. Whilst impacts of fragmentation of seagrass beds are relatively well studied, impacts from anchoring on *Zostera* species in the UK is limited. Additionally, evidence relating to stalked jellyfish, seahorses and some activity-feature interactions remains limited. Consequently, conclusions for some interactions rely on feature ecology, sensitivity assessments and interpretation of analogous evidence.

This review provides the evidence base to support site level assessment of activity-feature interactions and should be considered alongside information relating to feature condition, conservation objectives, activity levels, spatial overlap, natural variability and the availability of suitable habitat.

Overall, the evidence indicates that mNLA have the potential to impact seagrass beds, maerl beds, seahorses and stalked jellyfish where activities result in direct or indirect disturbance of sensitive habitats and species. Whether these impacts represent a risk of hindering the achievement of conservation objectives will depend on site specific exposure,

feature sensitivity and recovery potential, and will be determined through site level assessment.

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Annex 1 mNLA pressures on sensitive features – seagrass beds, maerl beds, seahorses and stalked jellyfish

This annex summarises the pressures resulting from mNLA and their potential impact on seagrass beds, maerl beds, seahorses and stalked jellyfish.

Natural England's CAPs provide generic information on pressures that may be exerted by all marine industries and their potential impact on designated features within the Advice on Operations (AoO) section. Natural England's AoO is an evidence-based product which can be used to guide MPA assessments, together with bespoke advice from JNCC and Natural England. This is explained further in [Natural England's conservation advice guidance](#). The sensitivities of designated features to mNLA pressures were derived using a staged approach.

Stage 1

Natural England's CAPs, including Natural England's AoO have been used by MMO to determine the sensitivities of each feature to the potential pressures from mNLA, based on actual or representative sites to highlight subject areas for evidence gathering. This has been done by identifying the marine protected areas that are in scope for this programme of works that contain seagrass beds, maerl beds, seahorses and stalked jellyfish and reviewing the AoO available for each site. The information from the AoO was collated into tables (**Table A1. 2** to **Table A1. 5**), with the highest sensitivity for each pressure-feature interaction being recorded (**Table A1. 1** for the sensitivity categories). Natural England also provided additional guidance about pressure/feature interactions that should be considered.

Stage 2

An evidence-gathering activity was then carried out. Evidence gathering and analysis was focussed on interactions that were deemed sensitive (**Table A1. 2** to **Table A1. 5**) and high risk (highlighted in red in the AoO table), as these are likely to be the most relevant interactions to be considered at each site level assessment (**Table A1. 1**). Interactions where there is insufficient evidence (IE) are not considered further here, but these interactions will be considered in site level assessments. In addition Site specific sensitivities for each pressure-feature interaction will be used at the site level assessment stage.

All the pressures from the mNLA categories described in section 2 and the potential sensitivity of seagrass beds, maerl beds, seahorses and stalked jellyfish are displayed in **Table A1. 2** to **Table A1. 5** respectively. The tables summarise all the interactions according to the key in **Table A1. 1**. The pressures listed in **Table A1. 2** to **Table A1. 5** are defined within Natural England's AoOs. Where multiple sensitivities exist for features, the most precautionary sensitivity has been displayed. Site specific sensitivities will be used at the site level assessment stage.

Table A1. 1: Interaction key for mNLA and designated features/supporting habitats.

Key	
S	Indicates feature is sensitive to the pressure.
IE	Indicates there is insufficient evidence to make sensitivity conclusions and therefore the feature may be sensitive to the pressure.
NA	Indicates the feature has not been assessed and therefore it may be sensitive to the pressure.
NS	Indicates feature is not sensitive to pressure.
	Indicates no pathway / no interaction between feature and pressure
*	Pressure only relevant to powerboating or sailing with an engine and hovercraft and recreational diving
**	Pressure only relevant to powerboating or sailing with an engine and sailing without an engine
***	Used Advice on Operations for: leisure relevant pressures only)
****	Used Advice on Operations for: diving (relevant pressures only)
"	Pressure - feature interaction relevant to both snorkelling and recreational diving (non-fishing)

Table A1. 2: Summary of the sensitivities of seagrass bed features to potential pressures from mNLA.

Potential pressures	Non-motorised watercraft			Powerboating, sailing with or without an engine: launching and recovery, participation and hovercraft			Powerboating, sailing with or without an engine: mooring and/or anchoring			Snorkelling*** and recreational diving****		
	Seagrass beds	Intertidal seagrass beds	Subtidal seagrass beds	Seagrass beds	Intertidal seagrass beds	Subtidal seagrass beds	Seagrass beds	Intertidal seagrass beds	Subtidal seagrass beds	Seagrass beds	Intertidal seagrass beds	Subtidal seagrass beds
Abrasion or disturbance of the substrate on the surface of the seabed	S	S		S	S	S	S	S	S	S"	S"	S
Hydrocarbon and polycyclic aromatic hydrocarbon (PAH) contamination*				S	S	S	S	S	S	S	S	S
Introduction of light**				S	S	S	S	S	S	S	S	S
Introduction or spread of invasive non-indigenous species (INIS)	S	S		S	S	S	S	S	S	S	S	S
Organic enrichment							S	S	S			
Penetration and/or disturbance of the substrate below the surface of the seabed, including abrasion	S	S		S	S	S	S	S	S	S"	S"	S

Potential pressures	Non-motorised watercraft			Powerboating, sailing with or without an engine: launching and recovery, participation and hovercraft			Powerboating, sailing with or without an engine: mooring and/or anchoring			Snorkelling*** and recreational diving****		
	Seagrass beds	Intertidal seagrass beds	Subtidal seagrass beds	Seagrass beds	Intertidal seagrass beds	Subtidal seagrass beds	Seagrass beds	Intertidal seagrass beds	Subtidal seagrass beds	Seagrass beds	Intertidal seagrass beds	Subtidal seagrass beds
Physical change (to another sediment type)							S	S	S			
Synthetic compound contamination				S	S	S	S	S	S	S	S	S
Transition elements and organo-metal (such as TBT) contamination				NS	NS	NS	NS	NS	NS	NS	NS	NS

Table A1. 3: Summary of the sensitivities of maerl bed features to potential pressures from mNLA.

Potential pressures	Non-motorised watercraft	Powerboating, sailing with or without an engine: launching and recovery, participation and hovercraft	Powerboating, sailing with or without an engine: mooring and/or anchoring	Snorkelling*** and recreational diving****
Abrasion or disturbance of the substrate on the surface of the seabed	S	S	S	S"
Hydrocarbon and polycyclic aromatic hydrocarbon (PAH) contamination*		S	S	S
Introduction of light**		S	S	S
Introduction or spread of invasive non-indigenous species (INIS)	S	S	S	S
Organic enrichment			S	
Penetration and/or disturbance of the substrate below the surface of the seabed, including abrasion	S	S	S	S"
Physical change (to another sediment type)			NS	
Synthetic compound contamination		IE	IE	IE
Transition elements and organo-metal (such as TBT) contamination		IE	IE	IE

Table A1. 4: Summary of the sensitivities of seahorse features to potential pressures from mNLA.

Potential pressures	Non-motorised watercraft		Powerboating, sailing with or without an engine: launching and recovery, participation and hovercraft		Powerboating, sailing with or without an engine: mooring and/or anchoring		Snorkelling*** and recreational diving****	
	Long snouted seahorse	Short snouted seahorse	Long snouted seahorse	Short snouted seahorse	Long snouted seahorse	Short snouted seahorse	Long snouted seahorse	Short snouted seahorse
Abrasion or disturbance of the substrate on the surface of the seabed			IE	IE	IE	IE	IE"	IE"
Collision BELOW water with static or moving objects not naturally found in the marine environment**			IE	IE			IE	IE
Introduction or spread of invasive non-indigenous species (INIS)			IE	IE	IE	IE	IE	IE
Litter			IE	IE	IE	IE	IE"	IE"
Underwater noise changes*				S			S	S
Visual disturbance			S	S	S	S	S"	S"

Table A1. 5: Summary of the sensitivities of stalked jellyfish features to potential pressures from mNLA.

Potential pressures	Non-motorised watercraft			Powerboating, sailing with or without an engine: launching and recovery, participation and hovercraft			Powerboating, sailing with or without an engine: mooring and/or anchoring			Snorkelling*** and recreational diving ****		
	<i>Calvadosia campanulata</i>	<i>Calvadosia cruxmelitensis</i>	<i>Haliclystus spp</i>	<i>Calvadosia campanulata</i>	<i>Calvadosia cruxmelitensis</i>	<i>Haliclystus spp</i>	<i>Calvadosia campanulata</i>	<i>Calvadosia cruxmelitensis</i>	<i>Haliclystus spp</i>	<i>Calvadosia campanulata</i>	<i>Calvadosia cruxmelitensis</i>	<i>Haliclystus spp</i>
Abrasion or disturbance of the substrate on the surface of the seabed				S	S	S	S	S	S	S"	S"	S"
Introduction of light**				IE	IE	IE	IE	IE	IE	IE	IE	IE
Introduction or spread of invasive non-indigenous species				IE	IE	IE	IE	IE	IE	IE	IE	IE
Organic enrichment							S	NS	S			
Penetration and/or disturbance of the substrate below the surface of the seabed, including abrasion				S		S	S		S	S"		S"
Physical change (to another seabed type)							S	S	S			
Physical change (to another sediment type)							S		S			