Document Control

Title	**Studland Bay Marine Conservation Zone Marine Management Organisation (MMO) Marine Non-licensable Activity Assessment**
Authors	E Johnston, J Duffill Telsnig and H Armstrong
Approver	N Greenwood and T Dixon
Owner	E Johnston

Revision History

Date	Author	Version	Status	Reason	Approver(s)
10/06/2020	E Johnston	V0.1	Draft	Draft introduction and Part A	V Morgan
17/07/2020	E Johnston	V0.2	Draft	Draft Part B	V Morgan
23/07/2020	J Duffill Telsnig	V0.3	Draft	Draft Part C	V Morgan
29/07/2020	E Johnston	V0.4	Draft	Draft conclusion and final sections	V Morgan
05/08/2020	E Johnston & J Duffill Telsnig	V0.5	Draft	Draft full assessment	V Morgan
13/08/2020	J Duffill Telsnig & E Johnston	V0.6	Draft	Amendments following VM and NE comments	L Stockdale
25/08/2020	E Johnston & J Duffill Telsnig	V0.7	Draft	Amendments following LS comments	V Morgan
07/09/2020	E Johnston & J Duffill Telsnig	V0.8	Draft	Amendments following NE formal response	V Morgan
09/09/2020	J Duffill Telsnig	V0.9	Draft	Amendments following VM comments	L Stockdale
23/09/2020	E Johnston & J Duffill Telsnig	V1.0	Draft	Final draft for call for evidence	L Stockdale

10/02/2021	E Johnston	V2.0	Draft	Amendments following call for evidence	T Dixon
15/02/2021	E Johnston	V2.1	Draft	Amendment following TD comments	T Dixon
18/06/2021	E Johnston	V2.2	Draft	Amendments following stakeholder engagement	T Dixon
29/07/2021	E Johnston	V3.0	Final	Finalised assessment	T Dixon
17/11/2021	H Armstrong	V3.1	Final	Amendment	C Graham
24/11/2021	K Heath	V3.2	Final	Amendment – existing moorings	C Graham

This document has been distributed for information and comment to:

Title	Organisation	Date sent	Comments received
Draft Part A review	Natural England - M Chavner & G Black	09/07/2020	07/08/2020
Draft Part B review	Natural England - M Chavner & G Black	28/07/2020	07/08/2020
Full draft assessment review	Natural England - M Chavner & G Black	13/08/2020	28/08/2020

Studland Bay Marine Conservation Zone Marine Management Organisation Marine Non-Licensable Activity Assessment

Contents

Glossary

AoO - advice on operations. Contained within the conservation advice packages from Natural England and JNCC, the AoO details the pressure/gear combinations a feature may be sensitive to.

Attribute - Selected characteristic of an interest feature/sub-feature which contributes to the overall condition of the feature to which it applies.

Broad-scale habitat - A categorisation of habitats based on a shared set of ecological requirements. Broad-scale habitats are one type of MCZ feature, the other being FOCI. More information can be found in the Ecological Network Guidance (Marine Conservation Zone Project) section 4.2.3[1].

Byelaw - Byelaws are statutory measures which can be introduced by regulators to manage activities within their jurisdiction.

Conservation objectives - Conservation objectives are set for each designated feature of an MPA, to either maintain or restore a feature of the protected site. Set by Natural England for sites inshore of 12 nautical miles.

Defra - **Department for Environment Food and Rural Affairs**. A UK government department responsible for environment, food and rural affairs. Defra is supported by 33 agencies and public bodies.

[1] https://hub.jncc.gov.uk/assets/94f961af-0bfc-4787-92d7-0c3bcf0fd083

Designated features - Habitats or species within an MPA which have been designated as protected features.

EMS - **European marine site**. Any special protection areas (SPAs) and special areas of conservation (SACs) that are covered by tidal waters.

Exposure - The level at which a designated feature or its supporting habitat is open to a distressing influence resulting from the possible/likely effects of operations arising from human activities (e.g. marine non-licensable activity) currently occurring on the site. The assessment of exposure can include the spatial extent, frequency, duration and intensity of the pressure(s) associated with the activities, where this information is available.

FOCI - **feature of conservation importance**. This includes both habitats of conservation importance (HOCI) and species of conservation importance (SOCI). FOCI are one type of MCZ feature, the other being broad-scale habitats. More information can be found in the Ecological Network Guidance (Marine Conservation Zone Project) section 4.2.3[2]

General management approach - The approach advised by an SNCB for a particular feature in order to help achieve the conservation objectives for an MCZ; either maintaining or recovering a feature to favourable condition.

HOCI - **habitat of conservation importance**. Habitats that are threatened, rare, or declining. More information can be found in the Ecological Network Guidance (Marine Conservation Zone Project) section 4.2.3[3].

IFCA - **Inshore Fisheries Conservation Authority**. IFCAs are responsible for fisheries management from 0 to 6 nautical miles (nm). There are 10 IFCAs in England, each one funded by local authorities.

JNCC - **Joint Nature Conservation Committee**. A public body that advises the government on UK and international nature conservation. This includes aspects related to the marine environment from 12 nm to 200 nm.

Marine plans - The MMO marine plans have been designed to help manage the seas around England[4].

MPA - **Marine protected area**. Marine protected areas are protected sites with a marine element, this includes special areas of conservation (SAC), special protection areas (SPA) and marine conservation zones (MCZ).

MPA assessment - MPA site level assessments are carried out in a manner consistent with the requirements of Article 63 of the Habitats Regulations for EMSs and the requirements of section 126 of the Marine and Coastal Access Act 2009 for MCZs. For EMSs the assessments will determine whether, in light of the sites conservation objectives, fishing activities are having an adverse effect on the integrity of the site. For MCZs the assessments will determine whether there is a

[2] https://hub.jncc.gov.uk/assets/94f961af-0bfc-4787-92d7-0c3bcf0fd083
[3] https://hub.jncc.gov.uk/assets/94f961af-0bfc-4787-92d7-0c3bcf0fd083
[4] https://www.gov.uk/government/collections/marine-planning-in-england

significant risk of fishing activities hindering the conservation objectives and general management approach of the site.

MCZ - **Marine conservation zone**. Marine conservation zones protect species and habitats of national importance and are designated under the Marine and Coastal Access Act 2009.

Marine non-licensable activities - Activities occurring in the marine environment which do not require a marine licence. They are mainly recreational activities.

MMO - **Marine Management Organisation**. An executive non-departmental public body, sponsored by Defra. The MMO's purpose is to protect and enhance our precious marine environment and support UK economic growth by enabling sustainable marine activities and development.

Natural England - Government advisor for the environment in England. This includes aspects of the marine environment of 0 to 12 nautical miles.

Sensitivity assessment - Assessment of sensitivity of a species or habitat which takes into account ability to resist impacts, and rate of rate of recovery after an impact.

SNCB - **statutory nature conservation body**. A collective term for Natural Resources Wales (NRW), Joint Nature Conservation Committee (JNCC), Natural England (NE), Northern Ireland's Council for Nature Conservation and the Countryside (which generally works through the Northern Ireland Environment Agency) and NatureScot. These organisations have a statutory responsibility to provide conservation advice for MPAs and report on the condition of protected features.

SPIRIT - **SPatial InfoRmatIon Toolkit.** SPIRIT is the MMO Geographic Information System used for mapping environmental and other data.

SOCI - **species of conservation importance.** Species that are threatened, rare, or declining. More information can be found in the Ecological Network Guidance (Marine Conservation Zone Project) section 4.2.3

Target - This defines the desired condition of an attribute, taking into account fluctuations due to natural change.

1. Summary

Table 1 shows a summary of the outcomes of this assessment regarding the impact of marine non-licensable activities on the features of the site.

Table 1: Assessment summary.

Features (sub-features)	Activity	Part A outcome	Part B outcome	In-combination assessment

Long-snouted seahorse (*Hippocampus guttulatus*) Subtidal sand Seagrass beds Intertidal coarse sediment	Powerboating or sailing with an engine: anchoring **and** Sailing without an engine: anchoring	Capable of affecting (other than insignificantly)	Significant risk of hindering the site's conservation objectives	No significant risk of hindering the achievement of the site's conservation objectives
			No significant risk of hindering the site's conservation objectives	
Long-snouted seahorse (*Hippocampus guttulatus*) Subtidal sand Seagrass beds Intertidal coarse sediment	Powerboating or sailing with an engine: mooring **and** Sailing without an engine: mooring	Capable of affecting (other than insignificantly)	No significant risk of hindering the site's conservation objectives	No significant risk of hindering the achievement of the site's conservation objectives
Long-snouted seahorse (*Hippocampus guttulatus*)	Powerboating or sailing with an engine: launching and recovery, participation **and** Sailing without an engine: launching and recovery, participation	Capable of affecting (other than insignificantly)	No significant risk of hindering the site's conservation objectives	No significant risk of hindering the achievement of the site's conservation objectives
Subtidal sand		Not capable of affecting (other than insignificantly)	N/A	
Seagrass beds		Capable of affecting (other than insignificantly)	No significant risk of hindering the site's conservation objectives	
Intertidal coarse sediment		Not capable of affecting (other than insignificantly)	N/A	
Long-snouted seahorse (*Hippocampus guttulatus*)	Non-motorised watercraft (e.g. kayaks,	Not capable of affecting (other than insignificantly)	N/A	No significant risk of hindering the achievement of

Subtidal sand	windsurfing, dinghies)			the site's conservation objectives
Seagrass beds				
Intertidal coarse sediment				
Long-snouted seahorse (*Hippocampus guttulatus*)	Diving and snorkelling	Capable of affecting (other than insignificantly)	No significant risk of hindering the site's conservation objectives	No significant risk of hindering the achievement of the site's conservation objectives
Subtidal sand		Not capable of affecting (other than insignificantly)	N/A	
Seagrass beds				
Intertidal coarse sediment				

2. Introduction

Table 2 shows the name and legal status of the site.

Table 2: Site details.

Name and legal Status of site(s):	Name of site(s)	Legal status
	Studland Bay	Marine Conservation Zone (MCZ)

Studland Bay MCZ is an inshore site that covers an area of approximately 4 km². It is located on the south coast of Dorset in the eastern English Channel. The site encompasses Studland Bay, stretching from the edge of Shell Bay in the north to Old Harry Rocks in the south.

Studland Bay is sheltered from prevailing south-westerly winds and waves, and the shallow, sandy seabed provides the ideal habitat for dense seagrass beds to form. Seagrass beds provide cover and shelter for a variety of fish and invertebrate species including worms, crustaceans (such as crabs and lobsters) and molluscs (such as mussels and oysters). Seagrass roots are a vital stabiliser of surrounding sediments, reducing coastal erosion. Seagrass beds have been identified as intense carbon sinks, accumulating large carbon stocks in their sediments (Duarte and Krause-Jensen, 2017). Furthermore, seagrass beds also have a role as sources of carbon to adjacent ecosystems, with seagrass beds exporting, on average, 24.3% of their net primary production, which may be used by fauna or broken down in the sediments (Duarte and Krause-Jensen, 2017).

The seagrass within Studland Bay provides a valuable home to seahorses. Two seahorse species are known to be present within the site. Many other species can be found within the seagrass and surrounding areas of sand, such as pipefish, wrasses and juvenile species of commercially important fish, such as bass, bream, sole and plaice.

The areas of coarse gravelly and sandy sediment found between high and low tide and below the low water mark are ecologically important, supporting a wide variety of species including algae, crustaceans (such as crabs and lobsters) and sea stars.

This site was designated as an MCZ in May 2019. Table 3 shows the features for which the site has been designated and the associated conservation objectives. Figure 1 displays these designated features and Figure 2 shows the depth values throughout the bay. Further details related to targets of individual attributes and targets for the features are available in Natural England's Supplementary Advice on Conservation Objectives[5] within their Studland Bay MCZ conservation advice package and Table 11. Sections 2.1 to 2.4 detail characteristics of the features within the site (Table 3).

Table 3: Designated features and conservation objectives.

Feature	Conservation objectives of the Marine Conservation Zone
Intertidal coarse sediment Long-snouted seahorse (*Hippocampus guttulatus*) Subtidal sand Seagrass beds	Protected habitats: 1. are maintained in favourable condition if they are already in favourable condition 2. be brought into favourable condition if they are not already in favourable condition

2.1 Intertidal coarse sediment

Within Studland Bay MCZ, intertidal coarse sediment is primarily located along the upper shore at South Beach with a small patch present towards the northern end of Middle Beach (MESL, 2013). The present-day sediment sources are also thought to include inputs from the erosion of cliffs and coastal slopes in the southern part of Studland Bay (Royal Haskoning, 2010). Characterising taxa found associated with this sediment include worms belonging to the family Enchytraeidae and the phylum Nematoda (MESL, 2013).

2.2 Long-snouted seahorse (*Hippocampus guttulatus*)

Long-snouted seahorses, often known as spiny seahorses, are found in Studland Bay MCZ, commonly inhabiting the seagrass feature (Seasearch, 2015; Garrick-Maidment *et al*., 2013). From tagging work carried out in Studland Bay on five individuals (29 re-sightings), home ranges in this area were found to be between 30 and 400 m^2 (Garrick-Maidment *et al.,* 2010). Studland Bay is also a known breeding location for long-snouted seahorses[6]. Long-snouted seahorses can be up to 15 cm in length and are characterised by their long snouts (Neish, 2007). They have fleshy protuberances on the back of the neck, from the head to dorsal fin, and can be coloured from greenish-yellow through to reddish brown (Neish, 2007). Long-snouted seahorses are present in shallow waters, especially amongst algae and seagrasses, clinging by the tail or swimming upright (Neish, 2007).

[5] Natural England Conservation Advice: Supplementary Advice on Conservation Objectives – available online.
[6] Natural England Conservation Advice – available online.

2.3 Subtidal sand

Subtidal sand is the most common subtidal sediment habitat type in Studland Bay MCZ and supports the seagrass beds (Environment Agency, 2018; UKSeaMap, 2018). Hook Sands is a sandbank situated over the old channel out of Poole Harbour. Hook Sands provides an important sediment feed to Studland and it is important to maintain this overall circulation of sediment within this local system (Royal Haskoning, 2011). Within Studland Bay MCZ many species can be found within the seagrass and surrounding areas of subtidal sand, such as undulate ray (*Raja undulata)*, pipefish, wrasses and juvenile species of commercially important fish (Seasearch Dorset, 2014).

2.4 Seagrass beds

The designated species of seagrass found in Studland Bay MCZ is *Zostera marina* (Seasearch Dorset, 2014-2015). Seagrass beds are primarily found within the south and southwest corners of Studland Bay to approximately 4 m depth (Environment Agency, 2018; Jackson *et al*., 2013b). The bay is sheltered from prevailing winds from the south west, allowing seagrass to colonise and form large beds (Jackson *et al*., 2013b).

Seagrass beds have been shown to have an important role in sequestering atmospheric carbon (Green *et al.,* 2018). The seagrass beds also support a high diversity of fish, including pipefish, wrasses and undulate ray (*Raja undulata)*, and provide a nursery area for commercially important fish and shellfish, such as black bream (*Spondyliosoma cantharus)*, pollack (*Pollachius pollachius)*, cuttlefish (*Sepia officinalis)*, sole (*Solea solea)* and plaice (*Pleuronectes platessa)*. All six species of pipefish have been recorded in Studland Bay, including the rare Nilsson's pipefish (*Syngnathus rostellatus*) (Seasearch Dorset, 2014). The seagrass beds in Studland Bay support both species of seahorse found in UK waters, the long-snouted and short-snouted seahorse (Garrick-Maidment *et al.,* 2013). The seagrass beds are also an important food source for overwintering wildfowl such as brent geese (*Branta bernicla*) (Jackson *et al*., 2013b).

2.5 Scope of this assessment

The geographic scope of this assessment covers the entire site and includes all designated features (Figure 1). The entire site falls within 6 nautical miles (nm). This document assesses marine non-licensable activities only[7]. Marine non-licensable activities are those that do not require a marine licence under section 66 of the Marine and Coastal Access Act 2009[8]. These include shore and marine based activities such as beach recreation, sailing and powerboating. The Marine Management Organisation (MMO) is responsible for the management of marine non-licensable activities which take place within its jurisdiction (0-12 nm). However, there are many foreshore activities which already fall within the remit of existing Regulators. The MMO does not propose adding further layers of management

[7] Those activities requiring a marine licence e.g. moorings, are assessed via MMO marine licensing.
[8] www.legislation.gov.uk/ukpga/2009/23/section/66

unnecessarily and as such considers the following activities outside of scope due to existing regulatory presence:

- Walking (including dog walking);
- Motorised and non-motorised land craft;
- General beach recreation;
- Wildlife watching from the land;
- Coasteering; and
- Bait collection

Figure 1: Studland Bay MCZ designated features.
Please note, numerous surveys are used to produce feature data and therefore historical records may indicate presence of seagrass rather than established beds.

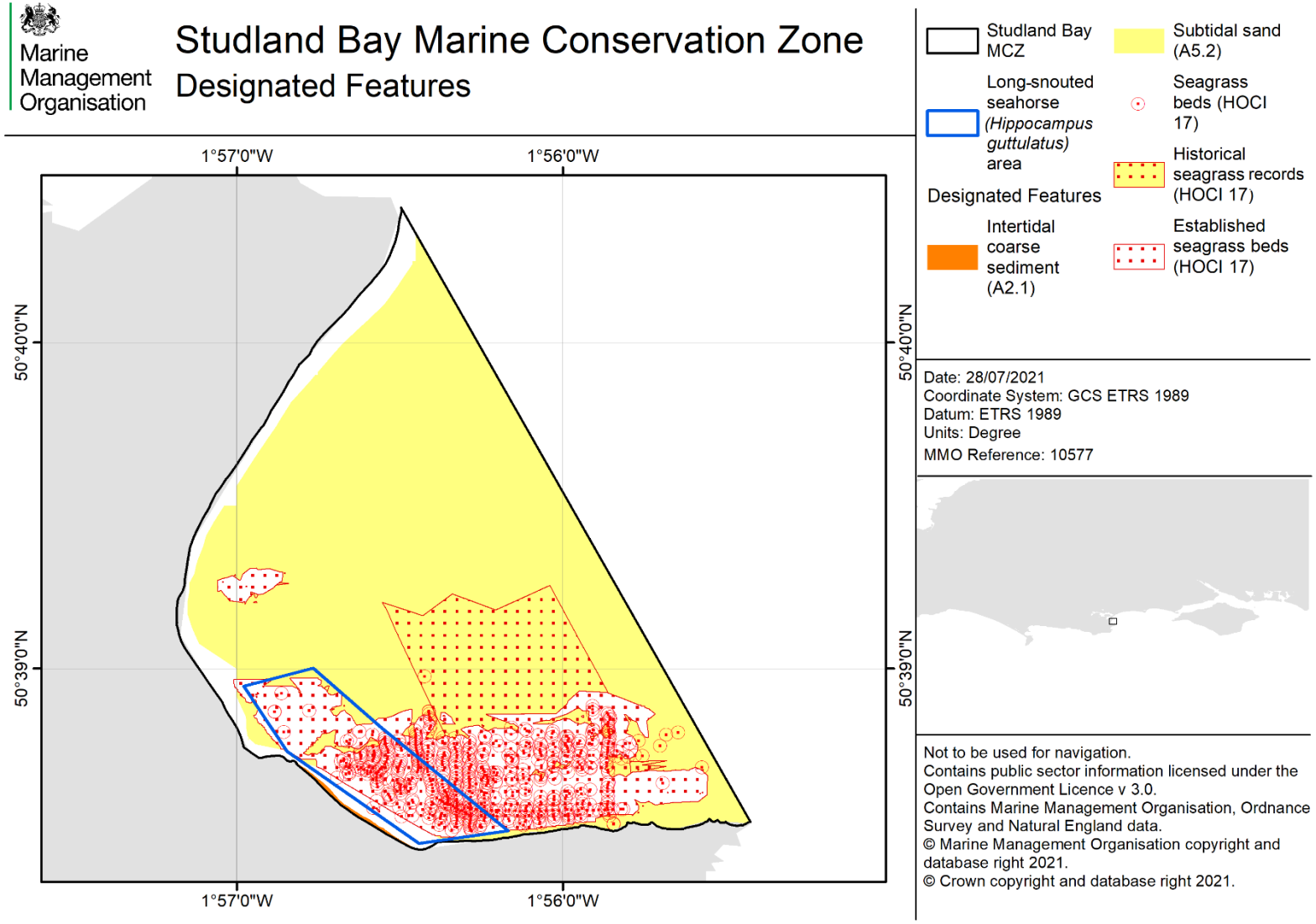
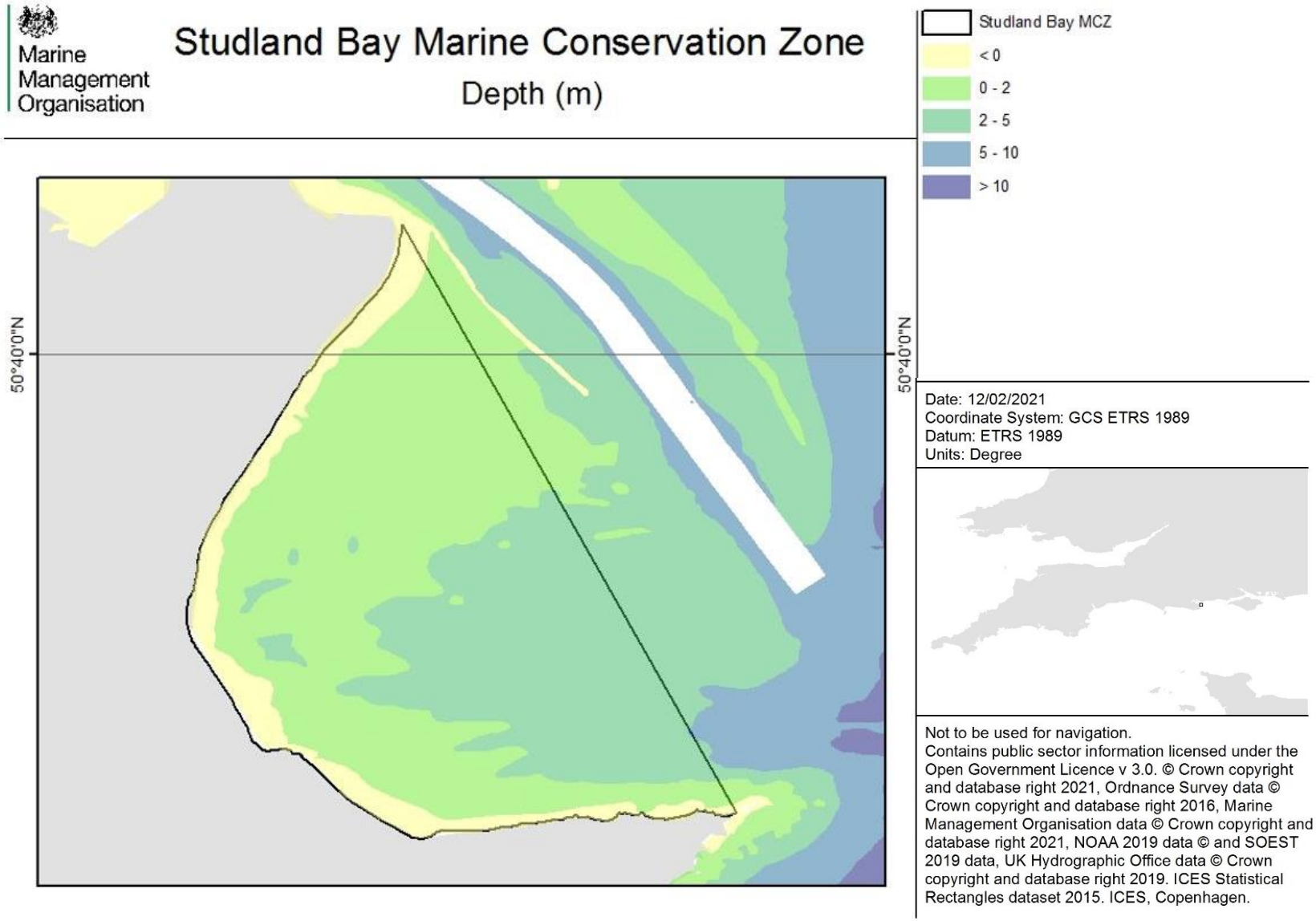


Figure 2: A map displaying the depth values in meters for Studland Bay MCZ. Source – UK Hydrographic Office (UKHO).



3. Part A Assessment

Table 4 shows the Natural England conservation advice package used to inform this assessment.

Table 4: Advice packages used for assessment.

Feature	Package	Link
Intertidal coarse sediment Long-snouted seahorse (*Hippocampus guttulatus*) Seagrass beds Subtidal sand	Natural England Conservation Advice for Marine Protected Areas Studland Bay MCZ - UKMCZ0072	https://designatedsites.naturalengland.org.uk/Marine/MarineSiteDetail.aspx?SiteCode=UKMCZ0072&SiteName=studland&SiteNameDisplay=Studland%20BayMCZ&countyCode=&responsiblePerson=&SeaArea=&IFCAArea=&NumMarineSeasonality=&HasCA=1

Part A of this assessment was carried out in a manner that is consistent with the 'capable of affecting (other than insignificantly)' test required by section 126(1)(b) of the Marine and Coastal Access Act 2009[9].

For each activity, a series of questions were asked:

1. Does the activity take place, or is it likely to take place in the future?
2. What are the potential pressures exerted by the activity on the feature?
3. Are the pressures capable of affecting (other than insignificantly) the protected features of the MCZ?

For each activity assessed in Part A, there were two possible outcomes for each identified pressure-feature interaction:

1. The pressure-feature interactions were not included for assessment in Part B if:
    a. the feature is not exposed to the pressure, and is not likely to be in the future; or
    b. the pressures are not capable of affecting (other than insignificantly) the protected features of the MCZ.
2. The pressure-feature interactions were included for assessment in Part B if:
    a. the feature is exposed to the pressure, or is likely to be in the future; and

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

b. the pressure is capable of affecting (other than insignificantly) the feature; or
c. it is not possible to determine whether the pressure is capable of affecting (other than insignificantly) the feature.

Consideration of exposure to or effect of a pressure on a protected feature of the MCZ includes consideration of exposure to or effect of that pressure on any ecological or geomorphological process on which the conservation of the protected feature is wholly or in part dependent.

3.1 Activities included in the assessment

Advice from MMO coastal officers indicates that, in addition to activities excluded from the scope of this assessment as described in section 2.5, there are no additional water-based activities to be excluded from this assessment as they do not take place.

Activities covered by this assessment include:

- Powerboating or sailing with an engine: mooring and/or anchoring
- Sailing without an engine: mooring and/or anchoring
- Powerboating or sailing with an engine: launching and recovery, participation
- Sailing without an engine: launching and recovery, participation
- Non-motorised watercraft (e.g. kayaks, windsurfing, dinghies)
- Diving and snorkelling

3.2 Potential pressures exerted by the activities on the feature

For the assessed activities, potential pressures were identified using the advice on operations section of the Natural England Conservation advice. Table 5 shows the potential pressures identified for each activity.

Table 5: Potential pressures for identified marine non-licensable activities on the features of the site.

Activity	Feature	Potential pressures
Powerboating or sailing with an engine: mooring and/or anchoring **and** Sailing without an engine: mooring and/or anchoring	Intertidal coarse sediment	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
		Physical change (to another sediment type)
		Hydrocarbon & PAH contamination[10]
		Litter
		Synthetic compound contamination (incl. pesticides, antifoulants, pharmaceuticals)

[10] Pressure only relevant to powerboating or sailing with an engine.

		Transition elements & organo-metal (e.g. TBT) contamination
		Organic enrichment
	Seagrass beds **and** Subtidal sand	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
		Physical change (to another sediment type)
		Hydrocarbon & PAH contamination[7]
		Introduction of light
		Introduction or spread of invasive non-indigenous species (INIS)
		Litter
		Organic enrichment
		Synthetic compound contamination (incl. pesticides, antifoulants, pharmaceuticals)
		Transition elements & organo-metal (e.g. TBT) contamination
	Subtidal sand	Visual disturbance
	Long-snouted seahorse	Abrasion/disturbance of the substrate on the surface of the seabed
		Hydrocarbon & PAH contamination[7]
		Introduction or spread of invasive non-indigenous species (INIS)
		Litter
		Synthetic compound contamination (incl. pesticides, antifoulants, pharmaceuticals)
		Transition elements & organo-metal (e.g. TBT) contamination
		Underwater noise changes
		Visual disturbance
Powerboating or sailing with an engine: launching and recovery, participation **and** Sailing without an	Intertidal coarse sediment	Abrasion/disturbance of the substrate on the surface of the seabed
		Hydrocarbon & PAH contamination[7]
		Litter
		Penetration and/or disturbance of the substratum below the surface of the seabed, including abrasion
		Synthetic compound contamination (incl. pesticides, antifoulants, pharmaceuticals)

engine: launching and recovery, participation		Transition elements & organo-metal (e.g. TBT) contamination
	Seagrass beds **and** Subtidal sand	Abrasion/disturbance of the substrate on the surface of the seabed
		Introduction of light
		Introduction or spread of invasive non-indigenous species (INIS)
		Litter
		Penetration and/or disturbance of the substratum below the surface of the seabed, including abrasion
		Synthetic compound contamination (incl. pesticides, antifoulants, pharmaceuticals)
		Transition elements & organo-metal (e.g. TBT) contamination
	Subtidal sand	Visual disturbance
		Underwater noise changes[7]
	Long-snouted sea horse	Abrasion/disturbance of the substrate on the surface of the seabed
		Collision BELOW water with static or moving objects not naturally found in the marine environment
		Hydrocarbon & PAH contamination[7]
		Introduction or spread of invasive non-indigenous species (INIS)
		Litter
		Synthetic compound contamination (incl. pesticides, antifoulants, pharmaceuticals)
		Transition elements & organo-metal (e.g. TBT) contamination
		Underwater noise changes[7]
		Visual disturbance
Non-motorised watercraft (e.g. kayaks, windsurfing, dinghies)	Intertidal coarse sediment **and** Seagrass beds	Abrasion/disturbance of the substrate on the surface of the seabed
		Litter
		Penetration and/or disturbance of the substratum below the surface of the seabed, including abrasion
	Seagrass beds	Introduction or spread of invasive non-indigenous species (INIS)
Diving and snorkelling [11]		Abrasion/disturbance of the substrate on the surface of the seabed

[11] Diving and snorkelling is not a recreational category in Natural England Conservation Advice, 'Diving' as a form of fishing has been used to assess pressures alongside Natural England advice.

	Intertidal coarse sediment **and** Seagrass beds **and** Subtidal sand **and** Long-snouted seahorse	Hydrocarbon & PAH contamination
		Litter
		Synthetic compound contamination (incl. pesticides, antifoulants, pharmaceuticals)
		Transition elements & organo-metal (e.g. TBT) contamination
	Seagrass beds **and** Subtidal sand **and** Long-snouted seahorse	Introduction or spread of invasive non-indigenous species (INIS)
	Intertidal coarse sediment **and** Seagrass beds **and** Subtidal sand	Penetration and/or disturbance of the substratum below the surface of the seabed, including abrasion
	Seagrass beds **and** Subtidal sand	Introduction of light
	Subtidal sand **and** Long-snouted seahorse	Underwater noise changes
		Visual disturbance
	Long-snouted seahorse	Collision BELOW water with static or moving objects not naturally found in the marine environment

Pressures determined to be relevant to fishing whilst diving have been removed (e.g. removal of target species).

3.3 Significance of effects/impacts

To determine whether each potential effect or impact is capable of affecting (other than insignificantly) the site's feature(s), the sensitivity assessments and risk profiling of pressures from the advice on operations section of the Natural England conservation advice were used.

Table 6 to Table 9 identify the pressures from particular activities which are capable of affecting (other than insignificantly) each feature. Where a pressure from a particular activity is identified as not capable of affecting (other than insignificantly), justification is provided. Features with similar sensitivities have been considered together.

To ensure the effects of marine non-licensable activities in-combination with other activities (including other marine non-licensable activities) are fully assessed, the pressures from activities which are not capable of affecting (other than insignificantly) but which do interact with the feature are included in the in-combination assessment (Part C).

Table 6: Summary of pressures from specific activities taken to Part B for intertidal coarse sediment.

Potential pressures	Powerboating or sailing with an engine: mooring and/or anchoring **and** Sailing without an engine: mooring and/or anchoring	Powerboating or sailing with an engine: launching and recovery, participation **and** Sailing without an engine: launching and recovery, participation	Non-motorised watercraft (e.g. kayaks, windsurfing, dinghies)	Diving and snorkelling
Physical change (to another sediment type)	Capable of affecting (other than insignificantly) - feature has high sensitivity to this pressure from this activity.	N/A	N/A	N/A
Abrasion/ disturbance of the substrate on the surface of the seabed	Not capable of affecting (other than insignificantly) – this feature is not sensitive to this pressure. Too shallow for mooring and anchoring in area feature is located.	Not capable of affecting (other than insignificantly) – this feature is not sensitive to this pressure from this activity		
Hydrocarbon & PAH contamination	Not assessed in Advice on Operations. Deemed not capable of affecting (other than insignificantly) – pressure does not occur at a level of concern.		N/A	Not capable of affecting (other than insignificantly) – pressure does not occur at a level of concern.
Litter	Not assessed in Advice on Operations. Deemed not capable of affecting (other than insignificantly) – MARPOL Annex V generally prohibits the discharge of all litter into the sea. Unless expressly provided otherwise, Annex V applies to all ships including recreational boats. There are substantial penalties for offenders dumping refuse at			

	sea and there are rules for ports and terminal operators to provide adequate disposal facilities ashore. Pressure from these activities are unlikely to be at a high enough level to be significant and other activities such as general beach recreation are likely to cause higher levels of litter.		
Synthetic compound contamination (incl. pesticides, antifoulants, pharmaceuticals)	Not assessed in Advice on Operations. Deemed not capable of affecting (other than insignificantly) – likely to be localised only and not at significant levels.	N/A	Not capable of affecting (other than insignificantly) – likely to be localised only and not at significant levels.
Transition elements & organo-metal (e.g. TBT) contamination	Not assessed in Advice on Operations. Deemed not capable of affecting (other than insignificantly) – likely to be localised only and not at significant levels.	N/A	Not capable of affecting (other than insignificantly) – likely to be localised only and not at significant levels.
Penetration and/or disturbance of the substratum below the surface of the seabed, including abrasion	Not capable of affecting (other than insignificantly) – this feature is not sensitive to this pressure from this activity		

Table 7: Summary of pressures from specific activities taken to Part B for seagrass beds.

Potential pressures	Powerboating or sailing with an engine: mooring and/or anchoring **and** Sailing without an engine: mooring and/or anchoring	Powerboating or sailing with an engine: launching and recovery, participation **and** Sailing without an engine: launching and recovery, participation	Non-motorised watercraft (e.g. kayaks, windsurfing, dinghies)	Diving and snorkelling
Abrasion/ disturbance of the substrate on the surface of the seabed	Capable of affecting (other than insignificantly) - feature has medium sensitivity to this pressure from this activity.	Capable of affecting (other than insignificantly) – for powerboating or sailing with an engine there is potential for abrasion of the seagrass during participation due to propellers and propeller wash.	Not capable of affecting (other than insignificantly) – These activities will mainly occur on the surface of the water or in the water column. Watercrafts will be underway prior to reaching feature. Therefore this pressure does not occur at a level of concern from these activities.	Not capable of affecting (other than insignificantly) – Abrasion/disturbance is likely to be minimal due to diving and snorkelling and therefore this pressure does not occur at a level of concern from these activities.
Penetration and/or disturbance of the substratum below the surface of the seabed,	Capable of affecting (other than insignificantly) - feature has high sensitivity to this pressure from this activity.	Not capable of affecting (other than insignificantly) – Boating and non-motorised watercraft activities will mainly occur on the surface of the water or in the water column. Watercrafts will be underway prior to reaching feature. Diving and snorkelling is unlikely to cause penetration and or disturbance of the substratum below the surface of the seabed. Therefore this pressure does not occur at a level of concern from these activities.		

including abrasion				
Physical change (to another sediment type)	Capable of affecting (other than insignificantly) - feature has high sensitivity to this pressure from this activity.	N/A	N/A	N/A
Hydrocarbon & PAH contamination	Not capable of affecting (other than insignificantly) – Accidental discharge of oil and fuel and potential overboard discharge of oil-contaminated bilge water from recreational boats may negatively impact the feature. However, boat owners can take simple measures such as those outlined in the Green Blue[12] to minimise accidental releases by carefully refuelling and maintaining their engines so they operate efficiently[13]. Although there may be periods of high boating activity within the MCZ, boats are unlikely to be re-fuelling or conducting maintenance operations due to the lack of facilities available, and with voluntary measures in place to minimise accidental releases of fuel and oil, it is considered that this pressure does not occur at a level of concern.	N/A	Not capable of affecting (other than insignificantly) – pressure does not occur at a level of concern.
Introduction of light	Not capable of affecting (other than insignificantly) - This refers to direct inputs of light from anthropogenic activities. As these activities are unlikely to produce	N/A	Not capable of affecting (other than insignificantly) –	

[12] https://thegreenblue.org.uk/you-your-boat/info-advice/water-pollution-prevention/oil-fuel/
[13] www.rya.org.uk/knowledge-advice/environmental-advice/Pages/oil-and-fuel.aspx

	continuous and long-lasting inputs of light, it is most likely to be minimal and therefore not significant.		pressure does not occur at a level of concern.
Introduction or spread of invasive non-indigenous species (INIS)	Not capable of affecting (other than insignificantly) - hull fouling has been identified as a potential pathway of introduction of non-native species. In Studland Bay several invasive non-indigenous species (INIS) are present in the subtidal sediments, most likely spread due to hull fouling. These species include wireweed *Sargassum muticum*, leathery sea squirt *Styela clava*, San Diego sea squirt *Botrylloides diegensis* and slipper limpet *Crepidula fornicate* (Environment Agency, 2018; Seasearch Dorset, 2015). Prevention of introductions and spread of INIS is the most economic management strategy (Leung *et al*., 2002; Lodge *et al*., 2006). Therefore voluntary measures and legislation have been implemented to reduce the risk of INIS. For example, since 2011 the government has been running the *Check Clean Dry* (CCD) public awareness campaign aimed at improving biosecurity amongst water users[14]. An EU Regulation on Invasive Alien Species came into force in 2015, which sought to address the problem of Invasive Alien Species across Europe through prevention, early warning, rapid response and management[15]. A European Code of	Not capable of affecting (other than insignificantly) – pressure does not occur at a level of concern	

[14] www.gov.uk/government/news/stop-the-spread-for-invasive-species-week
[15] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32014R1143

	Conduct on Recreational Boating[16] was also developed in 2016 under the Bern Convention. Under domestic legislation, the Wildlife and Countryside Act (1981) (as amended) provides a general prohibition on the release or allowing the escape of most non-native species of animal and many plants in England[17]. Although there may be periods of high boating activity within the MCZ, through voluntary measures and legislation, the risk of introduction and spread of INNS through recreational boating is likely to minimal and not at a level of concern for this pressure.			
Litter	Not capable of affecting (other than insignificantly) – MARPOL Annex V generally prohibits the discharge of all litter into the sea[18]. Unless expressly provided otherwise, Annex V applies to all ships including recreational boats. There are substantial penalties for offenders dumping refuse at sea and there are rules for ports and terminal operators to provide adequate disposal facilities ashore[19]. Pressure from these activities are unlikely to be at a high enough level to be significant and other activities such as general beach recreation are likely to cause higher levels of litter.			
Organic enrichment	Not capable of affecting (other than insignificantly) – Toilet systems from craft discharging directly to the water may lead to localised pollution. The effect of raw and treated sewage discharge from	N/A	N/A	N/A

[16] https://rm.coe.int/1680746815
[17] www.legislation.gov.uk/ukpga/1981/69/section/14
[18] www.imo.org/en/OurWork/Environment/PollutionPrevention/Garbage/Pages/Default.aspx
[19] www.rya.org.uk/knowledge-advice/environmental-advice/Pages/waste-management.aspx

	boats in fast flushing coastal areas is negligible. In this area it is likely to be localised only and not at significant levels.			
Synthetic compound contamination (incl. pesticides, antifoulants, pharmaceuticals)	Not assessed in Advice on Operations. Deemed not capable of affecting (other than insignificantly) – likely to be localised only and not at significant levels.		N/A	Not capable of affecting (other than insignificantly) – likely to be localised only and not at significant levels.
Transition elements & organo-metal (e.g. TBT) contamination	Not assessed in Advice on Operations. Deemed not capable of affecting (other than insignificantly) – likely to be localised only and not at significant levels.		N/A	Not capable of affecting (other than insignificantly) – likely to be localised only and not at significant levels.

Table 8: Summary of pressures from specific activities taken to Part B for subtidal sand.

Potential pressures	Powerboating or sailing with an engine: mooring and/or anchoring **and** Sailing without an engine: mooring and/or anchoring	Powerboating or sailing with an engine: launching and recovery, participation **and** Sailing without an engine: launching and recovery, participation	Diving and snorkelling
Abrasion/disturbance of the substrate on the surface of the seabed	Capable of affecting (other than insignificantly) - feature has medium sensitivity to this pressure from this activity.	Not capable of affecting (other than insignificantly) – These activities will mainly occur on the surface of the water or in the water column. Therefore this pressure does not occur at a level of concern from these activities.	
Penetration and/or disturbance of the substratum below the surface of the seabed, including abrasion	Capable of affecting (other than insignificantly) - feature has high sensitivity to this pressure from this activity.	Not capable of affecting (other than insignificantly) – this pressure does not occur at a level of concern from this activity.	
Physical change (to another sediment type)	Capable of affecting (other than insignificantly) – feature has high sensitivity to this pressure from this activity.	N/A	N/A
Hydrocarbon & PAH contamination	Not assessed in Advice on Operations. Deemed not capable of affecting (other than insignificantly) – Accidental discharge of oil and fuel and potential overboard discharge of oil-contaminated bilge water from recreational boats may negatively impact the feature. However, boat owners can take simple measures such as those outlined in the Green Blue[9] to minimise accidental releases by carefully refuelling and maintaining their engines so they operate efficiently[10].		Not assessed in Advice on Operations. Deemed not capable of affecting (other than insignificantly) – pressure does not occur at a level of concern.

	Although there may be periods of high boating activity within the MCZ, boats are unlikely to be re-fuelling or conducting maintenance operations due to the lack of facilities available, and with voluntary measures in place to minimise accidental releases of fuel and oil, it is considered that this pressure does not occur at a level of concern.	
Introduction of light	Not capable of affecting (other than insignificantly) – As these activities are unlikely to produce continuous and long-lasting inputs of light, it is most likely to be minimal and therefore not significant.	
Introduction or spread of invasive non-indigenous species (INIS)	Not capable of affecting (other than insignificantly) - hull fouling has been identified as a potential pathway of introduction of non-native species. In Studland Bay several invasive non-indigenous species (INIS) are present in the subtidal sediments, most likely spread due to hull fouling. These species include wireweed *Sargassum muticum*, leathery sea squirt *Styela clava*, San Diego sea squirt *Botrylloides diegensis* and slipper limpet *Crepidula fornicate* (Environment Agency, 2018; Seasearch Dorset, 2015). Prevention of introductions and spread of INIS is the most economic management strategy (Leung *et al*., 2002; Lodge *et al*., 2006). Therefore voluntary measures and legislation have been implemented to reduce the risk of INIS. For example, since 2011 the government has been running the *Check Clean Dry* (CCD) public awareness campaign aimed at improving biosecurity amongst water users[11]. An EU Regulation on Invasive Alien Species came into force in 2015, which sought to address the problem of Invasive Alien Species across Europe through prevention, early warning, rapid response and management[12]. A European Code of Conduct on Recreational Boating[13] was also developed in 2016 under the Bern Convention. Under domestic legislation, the Wildlife and Countryside Act (1981) (as amended) provides a general prohibition on the release or allowing the escape of most non-native species of animal and many plants in England[14].	Not capable of affecting (other than insignificantly) – pressure does not occur at a level of concern.

	Although there may be periods of high boating activity within the MCZ, through voluntary measures and legislation, the risk of introduction and spread of INNS through recreational boating is likely to minimal and not at a level of concern for this pressure.		
Litter	Not assessed in Advice on Operations. Deemed not capable of affecting (other than insignificantly) – MARPOL Annex V generally prohibits the discharge of all litter into the sea[15]. Unless expressly provided otherwise, Annex V applies to all ships including recreational boats. There are substantial penalties for offenders dumping refuse at sea and there are rules for ports and terminal operators to provide adequate disposal facilities ashore[16]. Pressure from these activities are unlikely to be at a high enough level to be significant and other activities such as general beach recreation are likely to cause higher levels of litter.		
Organic enrichment	Not capable of affecting (other than insignificantly) – Toilet systems from craft discharging directly to the water may lead to localised pollution. The effect of raw and treated sewage discharge from boats in fast flushing coastal areas is negligible. In this area it is likely to be localised only and not at significant levels.	N/A	N/A
Synthetic compound contamination (incl. pesticides, antifoulants, pharmaceuticals)	Not assessed in Advice on Operations. Deemed not capable of affecting (other than insignificantly) – likely to be localised only and not at significant levels.		
Transition elements & organo-metal (e.g. TBT) contamination	Not assessed in Advice on Operations. Deemed not capable of affecting (other than insignificantly) – likely to be localised only and not at significant levels.		

Visual disturbance	Not capable of affecting (other than insignificantly) – this feature is not sensitive to this pressure.	
Underwater noise changes	N/A	Not capable of affecting (other than insignificantly) – this feature is not sensitive to this pressure.

Table 9: Summary of pressures from specific activities taken to Part B for long-snouted seahorse.

Potential pressures	Powerboating or sailing with an engine: mooring and/or anchoring **and** Sailing without an engine: mooring and/or anchoring	Powerboating or sailing with an engine: launching and recovery, participation **and** Sailing without an engine: launching and recovery, participation	Diving and snorkelling
Abrasion/disturbance of the substrate on the surface of the seabed	Insufficient evidence to assess – required to be taken to further assessment.	Not capable of affecting (other than insignificantly) – this pressure does not occur at a level of concern from this activity.	
Hydrocarbon & PAH contamination	Not assessed in Advice on Operations. Deemed not capable of affecting (other than insignificantly) – Accidental discharge of oil and fuel and potential overboard discharge of oil-contaminated bilge water from recreational boats may negatively impact the feature. However, boat owners can take simple measures such as those outlined in the Green Blue[9] to minimise accidental releases by carefully refuelling and maintaining their engines so they operate efficiently[10]. Although there may be periods of high boating activity within the MCZ, boats are unlikely to be re-fuelling or conducting maintenance operations due to the lack of facilities available, and with voluntary measures in		Not assessed in Advice on Operations. Deemed not capable of affecting (other than insignificantly) – pressure does not occur at a level of concern.

	place to minimise accidental releases of fuel and oil, it is considered that this pressure does not occur at a level of concern.	
Introduction or spread of invasive non-indigenous species (INIS)	Not capable of affecting (other than insignificantly) - hull fouling has been identified as a potential pathway of introduction of non-native species. In Studland Bay several invasive non-indigenous species (INIS) are present in the subtidal sediments, most likely spread due to hull fouling. These species include wireweed *Sargassum muticum*, leathery sea squirt *Styela clava*, San Diego sea squirt *Botrylloides diegensis* and slipper limpet *Crepidula fornicate* (Environment Agency, 2018; Seasearch Dorset, 2015). Prevention of introductions and spread of INIS is the most economic management strategy (Leung *et al*., 2002; Lodge *et al*., 2006). Therefore voluntary measures and legislation have been implemented to reduce the risk of INIS. For example, since 2011 the government has been running the *Check Clean Dry* (CCD) public awareness campaign aimed at improving biosecurity amongst water users[11]. An EU Regulation on Invasive Alien Species came into force in 2015, which sought to address the problem of Invasive Alien Species across Europe through prevention, early warning, rapid response and management[12]. A European Code of Conduct on Recreational Boating[13] was also developed in 2016 under the Bern Convention. Under domestic legislation, the Wildlife and Countryside Act (1981) (as amended) provides a general prohibition on the release or allowing the escape of most non-native species of animal and many plants in England[14].	Insufficient Evidence to assess in Advice on Operations, deemed not capable of affecting (other than insignificantly) – pressure does not occur at a level of concern.

	Although there may be periods of high boating activity within the MCZ, through voluntary measures and legislation, the risk of introduction and spread of INNS through recreational boating is likely to minimal and not at a level of concern for this pressure.		
Litter	Insufficient Evidence to assess in Advice on Operations. Deemed not capable of affecting (other than insignificantly) – MARPOL Annex V generally prohibits the discharge of all litter into the sea[15]. Unless expressly provided otherwise, Annex V applies to all ships including recreational boats. There are substantial penalties for offenders dumping refuse at sea and there are rules for ports and terminal operators to provide adequate disposal facilities ashore[16]. Pressure from these activities are unlikely to be at a high enough level to be significant and other activities such as general beach recreation are likely to cause higher levels of litter.		
Synthetic compound contamination (incl. pesticides, antifoulants, pharmaceuticals)	Not assessed in Advice on Operations. Deemed not capable of affecting (other than insignificantly) – likely to be localised only and not at significant levels.		
Transition elements & organo-metal (e.g. TBT) contamination	Not assessed in Advice on Operations. Deemed not capable of affecting (other than insignificantly) – likely to be localised only and not at significant levels.		
Collision BELOW water with static or moving objects not naturally found in the marine environment	N/A	Insufficient Evidence to assess in Advice on Operations, deemed not capable of affecting (other than insignificantly) – this pressure does not occur at a level of concern from this activity.	
Underwater noise changes	Capable of affecting (other than insignificantly) – feature has high sensitivity to this pressure from this activity. (Relevant to vessels with engines only).		Not capable of affecting (other than insignificantly) – noise associated with SCUBA gear is likely to be minimal and highly localised. This

		pressure does not occur at a level of concern from this activity.
Visual disturbance	Capable of affecting (other than insignificantly) – feature has high sensitivity to this pressure from this activity.	

4. Part B Assessment

Part B of this assessment was carried out in a manner that is consistent with the significant risk test required by Section 126(2) of the Marine and Coastal Access Act 2009[5].

Table 10 shows the activities and pressures included for assessment in Part B. Pressures with similar potential impacts to a particular feature were grouped to save repetition during this assessment.

Relevant targets for favourable condition for each feature were identified or inferred from Natural England supplementary advice on conservation objectives. Important targets are highlighted in Table 11. 'Important' in this context means only those targets relating to attributes that will most efficiently and directly help to define condition. These attributes should be clearly capable of identifying a change in condition. The impacts of pressures on features were then assessed against these targets to determine whether the activities causing the pressures are compatible with the sites' conservation objectives.

Table 10: Activities and pressures included for Part B assessment.

Natural England Aggregated Method	**Feature**	**Pressures**
Powerboating or sailing with an engine: mooring and/or anchoring **and** Sailing without an engine: mooring and/or anchoring	Intertidal coarse sediment	Physical change (to another sediment type)
	Seagrass beds **and** Subtidal sand	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
		Physical change (to another sediment type)
	Long-snouted seahorse	Abrasion/disturbance of the substrate on the surface of the seabed
		Visual disturbance
		Underwater noise changes
Powerboating or sailing with an engine (launching, recovery and participation) **and**	Long-snouted seahorse	Underwater noise changes
		Visual disturbance
		Abrasion/disturbance of the substrate on the surface of the seabed

Sailing without an engine: launching and recovery, participation		
Diving and snorkelling	Long-snouted seahorse	Visual disturbance

Table 11: Relevant favourable condition targets for identified pressures to intertidal coarse sediment, subtidal sand, seagrass beds and long-snouted seahorse. Red = targets that have been identified as important.

Feature	Attribute	Targets	Relevance/justification for Part B conclusion
Intertidal coarse sediment Subtidal sand Seagrass beds	Distribution: presence and spatial distribution of biological communities	• Maintain the presence and spatial distribution of intertidal coarse sediment, subtidal sand and seagrass bed communities.	Relevant to all pressures except visual disturbance and underwater noise changes
	Structure: species composition of component communities	• Maintain the species composition of component communities for subtidal sand and intertidal coarse sediment. • Recover the species composition of component communities for seagrass beds	
	Structure and function: presence and abundance of key structural and influential species	• Maintain the abundance of listed species[20], to enable each of them to be a viable component of the subtidal sand and intertidal coarse sediment features.	
		• Recover the abundance of listed species[17], to enable each of them to be a viable component of the seagrass feature.	
	Extent and distribution	• Recover the total extent and spatial distribution of seagrass beds.	
		• Maintain the total extent and spatial distribution of intertidal coarse sediment and subtidal sand.	Relevant to all pressures except visual disturbance and

[20] Listed species described in Marine Ecological Surveys Ltd. - November 2013 Report No. NESBMCZ1113

	Structure: sediment composition and distribution	• Maintain the distribution of sediment composition types across the feature/sub feature.	underwater noise changes
Seagrass beds	Extent of supporting habitat	• Maintain the area of habitat that is likely to support the sub feature.	Relevant to all pressures except visual disturbance and underwater noise changes
	Structure: biomass	• Recover the leaf / shoot density, length, percentage cover, and rhizome mat across the feature at natural levels (as far as possible), to ensure a healthy, resilient habitat.	
	Structure: rhizome structure and reproduction	• Recover the extent and structure of the rhizome mats across the site, and conditions to allow for regeneration of seagrass beds.	
	Supporting processes: morphology	• Maintain the natural physical form and coastal processes that shape the seagrass bed.	Relevant to all pressures except visual disturbance and underwater noise changes
	Supporting processes: sedimentation rate	• Maintain the natural rate of sediment deposition.	
Long-snouted seahorse	Population: population size	• Recover the population size within the site.	Relevant to all pressures
	Population: recruitment and reproductive capability	• Maintain the reproductive and recruitment capability of the species.	
	Presence and spatial distribution of the species	• Maintain the presence and spatial distribution of the species and their ability to undertake key life cycle stages and behaviours.	
	Structure and function: biological connectivity	• Recover connectivity of the habitat within sites and the wider environment to ensure larval dispersal and recruitment, and / or to allow movement of migratory species.	Relevant to all pressures except visual disturbance and underwater noise changes
	Supporting habitat:	• Recover the extent and spatial distribution of the following supporting habitats: seagrass.	

	extent and distribution		
Intertidal coarse sediment	Structure: sediment total organic carbon content	Maintain the total organic carbon (TOC) content in the sediment at existing levels	Anchoring/mooring activities do not occur over the intertidal coarse sediment feature.
	Structure: topography	Maintain the presence of topographic features, while allowing for natural responses to hydrodynamic regime, by preventing erosion or deposition through human-induced activity.	
Intertidal coarse sediment Subtidal sand Seagrass beds	Supporting processes: energy / exposure	Maintain the natural physical energy resulting from waves, tides and other water flows, so that the exposure does not cause alteration to the biotopes and stability, across the habitat.	Pressures will not alter natural physical energy.
	Supporting processes: sediment contaminants	Restrict surface sediment contaminants (<1cm from the surface) to below the OSPAR Environment Assessment Criteria (EAC) or Effects Range Low (ERL)	Pressures will not significantly introduce contaminants.
Seagrass beds	Supporting processes: light levels	Maintain the natural light availability to the seagrass bed.	Pressures will not significantly impact light levels.
All features	Structure: non-native species and pathogens	Reduce the introduction and spread of non-native species and pathogens, and their impacts.	Pressures will not significantly introduce non-native species and pathogens.
	Supporting processes: water quality - contaminants	Restrict aqueous contaminants to levels equating to High Status according to Annex VIII and Good Status according to Annex X of the Water Framework Directive, avoiding deterioration from existing levels.	Pressures will not significantly introduce contaminants.

All features	Supporting processes: physico-chemical properties	Maintain the natural physico-chemical properties of the water.	Pressures will not alter physico-chemical properties of the water.
	Supporting processes: water quality - dissolved oxygen	Maintain the dissolved oxygen (DO) concentration at levels equating to High Ecological Status avoiding deterioration from existing levels.	Pressures will not cause excessive nutrients or high turbidity, factors which can impact dissolved oxygen levels.
	Supporting processes: water quality - nutrients	Maintain water quality at mean winter dissolved inorganic nitrogen levels where biological indicators of eutrophication (opportunistic macroalgal and phytoplankton blooms) do not affect the integrity of the site and features [avoiding deterioration from existing levels].	Pressures will not cause high nutrient concentrations.
	Supporting processes: water quality - turbidity	Maintain natural levels of turbidity (e.g. concentrations of suspended sediment, plankton and other material) across the habitat.	Pressures will not cause a significant increase in turbidity.

4.1 Marine non-licensable activity evidence

4.1.1 Existing and past management

The National Trust is the landowner of Studland Bay and have established the following water management measures (Figure 3) which are detailed online:

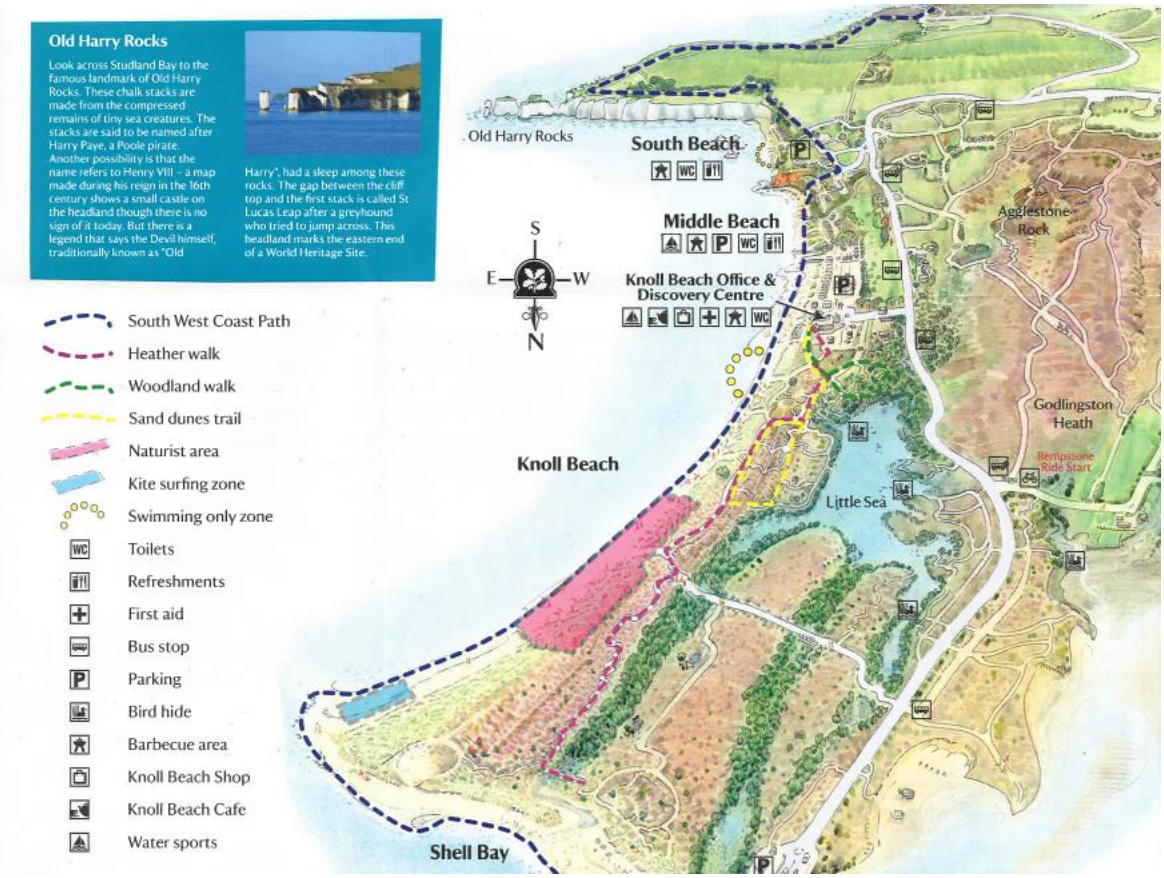
- Swimmers only zones at Knoll Beach and South Beach during the summer (no life guard service in place). These have been in place for approximately 18 years and are mainly used by families for swimming due to the shallow depths (National Trust, *pers comms).*
- Permit access kite surfing zone between Shell Bay and Knoll Beach[21].
- Personal watercraft and motorboats over 20hp are prohibited.

Dorset Council (previously Purbeck District Council) has a Seaside Pleasure Boats Byelaw (2013) which implements a 5 knot speed limit in Studland Bay for all watercraft[22]. This is marked by yellow buoys from Easter to the end of October. This byelaw has been made under section 76 of the Public Health Act 1961 for the prevention of danger, obstruction or annoyance to persons bathing in the sea or using the seashore. Please note, this management measure is not designed to

[21] National Trust kite surfing permit access, information available online.
[22] Swanage and Studland Water Safety Information, available online.

achieve the conservation objectives of the site and has been implemented due to health and safety concerns.

Figure 3: A map from the National Trust outlining the facilities and water management measures in Studland Bay.



Long-snouted seahorses (*Hippocampus guttulatus*) are protected under the Wildlife and Countryside Act 1981 (as amended) for the offences listed below. A wildlife licence is required from the MMO for any activity which may impact seahorses in the following ways:

- Possess or keep;
- Capture;
- Intentionally or recklessly disturb;
- Intentionally kill;
- Intentionally injure;
- Intentionally or recklessly damage or destroy place of shelter or protection of a seahorse.

All species of seahorse are protected under the Convention for International Trade in Endangered Species (CITES).

The Royal Yachting Association (RYA) have produced a leaflet in collaboration with Natural England, Dorset Wildlife Trust, Hampshire and Isle of Wight Wildlife Trust

and the Boat Owners Response Group which provides guidance on anchoring with care and best practice measures for boat users in Studland Bay[23].

A Voluntary No-Anchoring Zone (VNAZ) was introduced in October 2009 to test for differences in seagrass health with and without anchoring activity (Axelsson *et al*., 2012). The VNAZ remained in place until 2013.

The Southern Inshore Fisheries and Conservation Authority (IFCA) has a network of areas closed to Bottom Towed Fishing Gear[24], some of which are relatively close to the site. These closed areas are likely to produce positive benefits to marine organisms and habitats (Southern IFCA, *pers comms)*.

4.1.2 Evidence sources

- Marine protected area sum inspections (MPASum inspections)
- Automatic Identification System (AIS) data for recreational vessels
- Expert opinion provided by MMO coastal officers
- Stakeholder responses during the MMO's call for evidence
- Studland Bay MCZ Mooring Survey
- MMO1243 - High Priority Non-Licensable Activities in Marine Protected Areas (MPAs)

Table 12 provides a description, strengths and limitations of the evidence sources used. For more information about the evidence sources used, please see Annex 1 - MMO methodology. Minimal data is currently available for diving and snorkelling.

Table 12: Summary of generic confidence associated with marine non-licensable activity evidence.

Evidence source	Confidence	Description, strengths and limitations
MPASum inspections	High/ Moderate	MPASum inspections are carried out by MMO Marine Officers. This involves counting the occurrence of water-based activities within the site.
Automatic Identification System data	Low	AIS transmits information which is manually input and therefore is only as reliable as the operator. As not all vessels are required to have AIS this data is likely to be an underrepresentation of the activity within the site.
Expert opinion	Low / Moderate	Expert opinion provided by MMO coastal and IFCA officers. Confidence depends on the area, and the knowledge of the area from MMO and IFCA staff.
Stakeholder responses during	High	Information provided by stakeholders who are users of Studland Bay.

[23] RYA Anchoring with care guidance, available online.
[24] www.southern-ifca.gov.uk/byelaws

the MMO's call for evidence		
Studland Bay MCZ Mooring Survey	High	Survey carried out by Southern IFCA identifying locations of surface marked fixed moorings and other surface marker buoys within Studland Bay MCZ.
MMO1243 – Activity data layers	High	MMO1243 - High Priority Non-Licensable Activities in MPAs. MMO contracted project carried out by ABPmer collating data on non-licensable activities in marine protected areas.

4.1.3 Activity descriptions

4.1.3.1 Mooring and anchoring

Mooring and anchoring encompasses the following activities:

- **Powerboating or sailing with an engine: mooring and/or anchoring**
  This activity refers to anchoring and/or mooring by powerboats or sailing boats with an engine. This is defined as the use of motorised vessels, including motorboats, powerboats and yachts in marine waters (Natural England, 2017a).

- **Sailing without an engine: mooring and/or anchoring**
  This activity refers to anchoring and/or mooring by sailing boats without an engine. Sailing boats without an engine may include yachts, day boats or other small keelboats which are usually taken out of water at end of use (Natural England, 2017b).

The impacts of mooring and anchoring were grouped in Part A of this assessment due to the structure of the conservation advice. However, within Part B, mooring and anchoring are discussed separately due to differences in the impacts of these activities. From this point onwards, these activities will be named 'mooring' and 'anchoring'. Please see the definitions of each below.

Mooring definition

Mooring includes recreational vessels using a mooring such as a conventional swing mooring, trot mooring or advanced mooring systems, more commonly known as 'eco-mooring'. Swing moorings are the most widely used and consist of a buoy attached by chain to an anchoring point (block or anchor) (Griffiths *et al*., 2017). Trot moorings are deployed in rows of multiple, connected moorings (Griffiths *et al*., 2017). A large ground chain is laid along the seabed and anchored at each end, with multiple 'riser' chains with buoys attached at regular distances (Griffiths *et al*., 2017). Alternative advanced mooring systems are available that avoid the placement of large mooring blocks on the seabed and chain abrasion through the use of alternate mooring systems (Griffiths *et al*., 2017). Fixing methods including swivel and screws and the use of floats or elastic lines to avoid chain abrasion (Griffiths *et al*., 2017).

Anchoring definition

Anchored recreational vessels are watercrafts with a device which secures a vessel to the seabed, temporarily, in order to prevent it drifting with the wind or current (Griffiths *et al*., 2017). Anchors are designed to dig into or hook onto the seabed. In order to create hold, the anchor is dropped and a length of chain is laid out on the seabed to hold it horizontally on the seabed (Griffiths *et al*., 2017). The anchor is 'set' (fixed in position) as some pulling force is exerted on the chain but not enough to drag it and break it free (Griffiths *et al*., 2017).

Mooring and anchoring activity levels

Due to its location, Studland Bay offers significant shelter from prevailing weather conditions which makes it a popular anchorage for all vessels (MMO Coastal Officer, *pers comms*). Admiralty charts indicate a safe anchorage in the southern section of the bay. The Studland Bay area is also popular due to its pleasant beaches and scenery (MMO Coastal Officer, *pers comms*). A small percentage of vessels appear to moor overnight and use tenders to access South Beach and visit local amenities within walking distance (MMO Coastal Officer, *pers comms*).

Stakeholder responses during the call for evidence stated that Studland is a key stopping point on the South coast, as it is one of the only sheltered bays. It was stated that this area is a vital anchorage during emergencies and bad weather conditions. Stakeholders stated that the south west corner of the bay is preferred to anchor as the northern part is too shallow and exposed. Stakeholders suggested that motorboats tend to only anchor/moor during the daytime, whereas yachts anchor overnight, often arriving on Friday evening and departing on Sunday evening.

Stakeholders also commented that only approximately 13 moorings in the bay remain. Stakeholders stated that moorings are mostly suitable for smaller boats and many anchor because there are not enough moorings.

4.1.3.2 Powerboating or sailing with an engine: launching and recovery, participation

This activity is defined as the launching and recovery of motorised vessels or motorised vessels which are underway on the water. Motorised vessels include motorboats, powerboats and yachts which have an engine (Natural England, 2017a). This also includes water sports that are towed behind a motorised vessel, including wakeboarding, water skiing and parascending (Natural England, 2017a). In general, these activities take place in coastal, inshore and offshore waters where marina and berthing facilities or launch facilities are available (Natural England, 2017a). Most of motorised watercrafts is most concentrated around the South East and South coast, where there is the highest concentration of RYA marinas and clubs (Natural England, 2017a). Powerboating and sailing take place all year round, although the intensity of these activities is generally higher in the summer (Natural England, 2017a).

The MMO has also included motorised personal watercraft (such as jet skis) in this category due to the similarities in impacts caused by motorised personal watercraft and motorised vessels.

Vessels visit Studland Bay from across the South coast, coming from places such as the Isle of Wight, Poole, Weymouth, Portland, Christchurch and other marinas along the coastline (MMO Coastal Officer, *pers comms*). The National Trust has advised that most vessels visit Studland from Swanage or Poole Harbour. Within Studland Bay, there is a National Trust dinghy boat park and a slipway at Knoll Beach for small dinghies. Small tenders also recover on South Beach.

Information submitted by stakeholders during the call for evidence indicated that water sports, such as water skiing, take place in the Middle Beach area. The areas off South Beach and Middle Beach are also popular for personal watercraft.

4.1.3.3 Sailing without an engine: launching and recovery, participation

This activity is defined as the launching and recovery of sailing boats or sailing boats which are underway on the water. This includes sailing boats which do not have an engine. This activity has the potential to be undertaken along much of the UK coast and is only constrained by the availability of suitable launching spots (e.g. public slipways) (Natural England, 2017b). While non-motorised watercraft activity is undertaken widely along the UK coast, popular areas in England include the South East, South and South West coasts (Natural England, 2017b).

As described in 4.1.3.2, vessels visit Studland Bay from across the South coast, coming from places such as the Isle of Wight, Poole, Weymouth, Portland, Christchurch and other marinas along the coastline (MMO Coastal Officer, *pers comms*). The National Trust has advised that most vessels visit Studland from Swanage or Poole Harbour. Within Studland Bay, there is a National Trust dingy boat park and a slipway at Knoll Beach for small dinghies. Small tenders also recover on South Beach.

4.1.3.4 Diving and snorkelling

This activity is defined as swimming either underwater or on the surface, using Self Contained Underwater Breathing Apparatus (SCUBA) or snorkelling equipment (Natural England, 2017c). Diving and snorkelling take place along sections of the coast that have suitable water clarity and interesting underwater features such as rocky reefs, wrecks and wildlife (Natural England, 2017c). In 2015, approximately 350,000 people were involved in SCUBA diving activity in the UK (Arkenford, 2015, cited in Natural England, 2017c). No statistics were available for snorkelling, but the activity is widely undertaken (Natural England, 2017c).

Diving and snorkelling activity within Studland Bay MCZ is not thoroughly studied. Although it is renowned for its seahorse population, the seagrass offers a very diverse selection of sea life and this is appreciated by those who dive and snorkel in the area (MMO Coastal Officer, *pers comms*). It is also a shallow area which makes it suitable for secondary, recovery dives in a pleasant location for those who have been on deeper dives elsewhere and are returning to Poole following these activities

(MMO Coastal Officer, *pers comms*). Diving activity occurs from vessels and from divers entering the water from South Beach and Middle Beach (MMO Coastal Officer, *pers comms*). This happens at all states of the tide and throughout the day (MMO Coastal Officer, *pers comms*).

4.1.4 MPASum Inspections data

Figure 4 and Figure 5 display results for MPASum inspections carried out during summer 2020. The full MPASum inspection dataset can be found in Annex 3. Inspections were carried out from the beach in the south of Studland Bay (see Annex 1 for the location), due to the location of the seagrass feature in this area. The feature map for the site (Figure 1) shows that the seagrass feature covers a large area from the shore of South Beach extending outwards. Therefore, the activities recorded are likely to be occurring over the seagrass feature.

This data indicates that a large number of vessels moor or anchor in this area. A maximum of 129 vessels on any one day was recorded on Sunday 12 July 2020. This information indicates that the estimated numbers of vessels stopping within the MCZ using AIS data is an underrepresentation. This is due to the absence of AIS on board many recreational vessels. Furthermore, local experts state the number of vessels mooring or anchoring in the area peaks in August and as the count is a snapshot it is likely that additional vessels will be visiting the area throughout the day. Therefore, it is likely that during the peak season there may be hundreds of vessels anchoring or mooring in the area.

The data also indicates that there are high numbers of swimmers and snorkelers within the site. Between 1 June and 10 August 2020, over the course of 14 inspections, 261 swimmers and snorkelers were recorded in the southern area of the bay. With regards to diving, four divers and one dive boat with an unknown number of divers was recorded within this time frame.

MMO coastal officers report that Studland Bay is a seasonal location, which experiences significantly higher visitor numbers during the warmer months, than the rest of the year (MMO Coastal officer, *pers comms)*. The height of activity in the area is between June and September, although periods of fine weather during school holidays will also increase the activity levels (MMO Coastal officer, *pers comms)*. Activity occurs throughout the day, beginning from early morning (National Trust beach car parks open at 9:00 am) through to early evening. Local knowledge from MMO Coastal Officers is that Studland Bay has always attracted large numbers of people (diving, snorkelling, visiting the beach, anchoring yachts and motor-boats) and this does not appear to have changed significantly in 2020 (MMO Coastal officer, *pers comms)*.

Figure 4: Results of MPASum inspections for Studland Bay MCZ showing count data for mooring and anchoring activities.

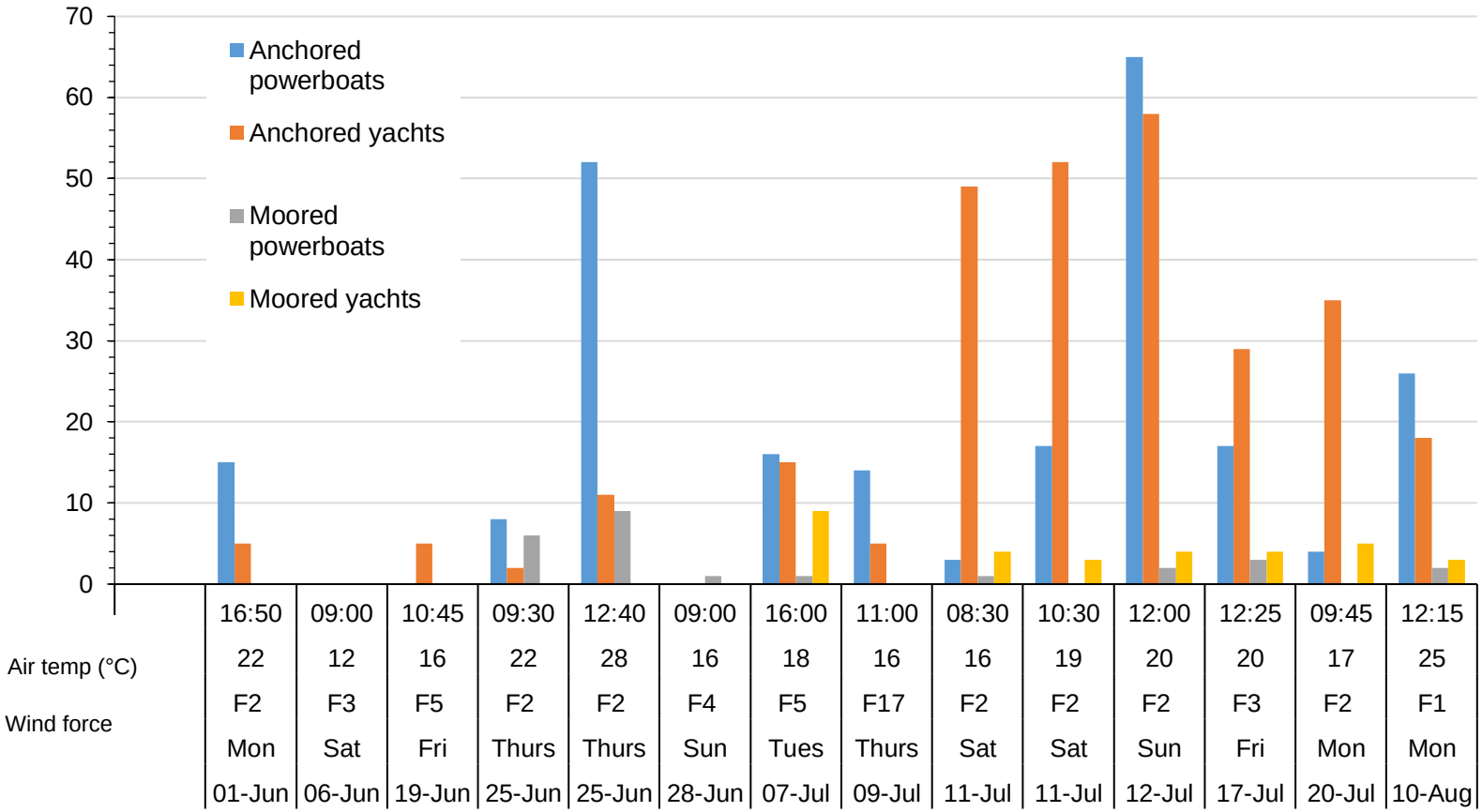
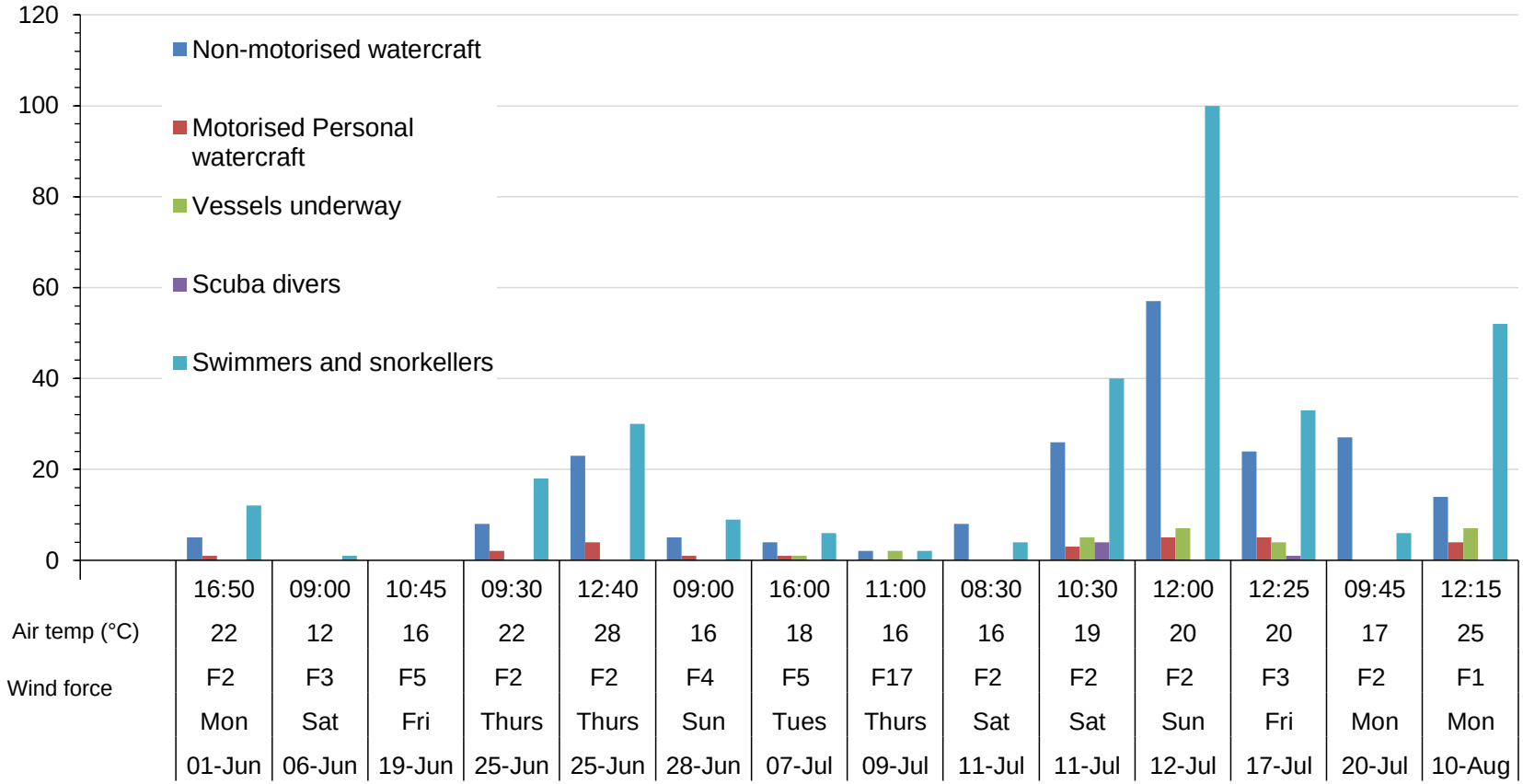


Figure 5: Results of MPASum inspections for Studland Bay MCZ showing count data for marine non-licensable activities excluding anchored or moored vessels (displayed in Figure 4).



4.1.5 Automatic Identification System (AIS) Data

Figure 6 to Figure 8 show AIS track line data for recreational vessels between 2015 and 2017 in Studland Bay MCZ. These figures show that recreational vessel activity within the site is high. It also demonstrates that activity occurs over the seagrass feature. AIS track line data does not indicate where vessels are anchored or moored, however, Figure 9 shows stationary AIS points in Studland Bay MCZ and stationary AIS points over seagrass feature. Please see Annex 1 – methodology for details on AIS data sources.

Table 13 shows the number of AIS tracks from recreational vessels occurring within the site by month. This demonstrates that activity is highest in the summer months, from June to September.

Table 13: Count of AIS tracks from recreation vessels located within Studland Bay MCZ between 2015 and 2017.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2015	1	0	3	59	49	81	136	149	140	35	14	11
2016	0	4	5	44	91	117	149	164	96	40	15	5
2017	2	14	6	62	39	97	174	152	135	29	24	7

The south and south west sections of Studland Bay are known preferred locations for mooring and anchoring of recreational vessels (MMO Coastal Officer, *pers comms*). The sheltered conditions in the south and southwest corners that favour the growth of the seagrass feature also make an appealing area to stop. Therefore, it can be predicted that stationary vessels indicated by AIS data are anchored or moored. Live AIS data was used to count the number of vessels that were stationary in the MCZ at different times between 11/07/20 and 26/07/20. The full dataset is included in Annex 2. This data shows that a high number of vessels end transit within Studland Bay MCZ. AIS data indicates that during the time period studied, vessels with AIS ending transit in Studland Bay MCZ, reach up to 28 at a specific time. The majority of these records are situated over the seagrass feature in the site.

Figure 6: 2015 AIS Track data for recreational vessels in Studland Bay MCZ.

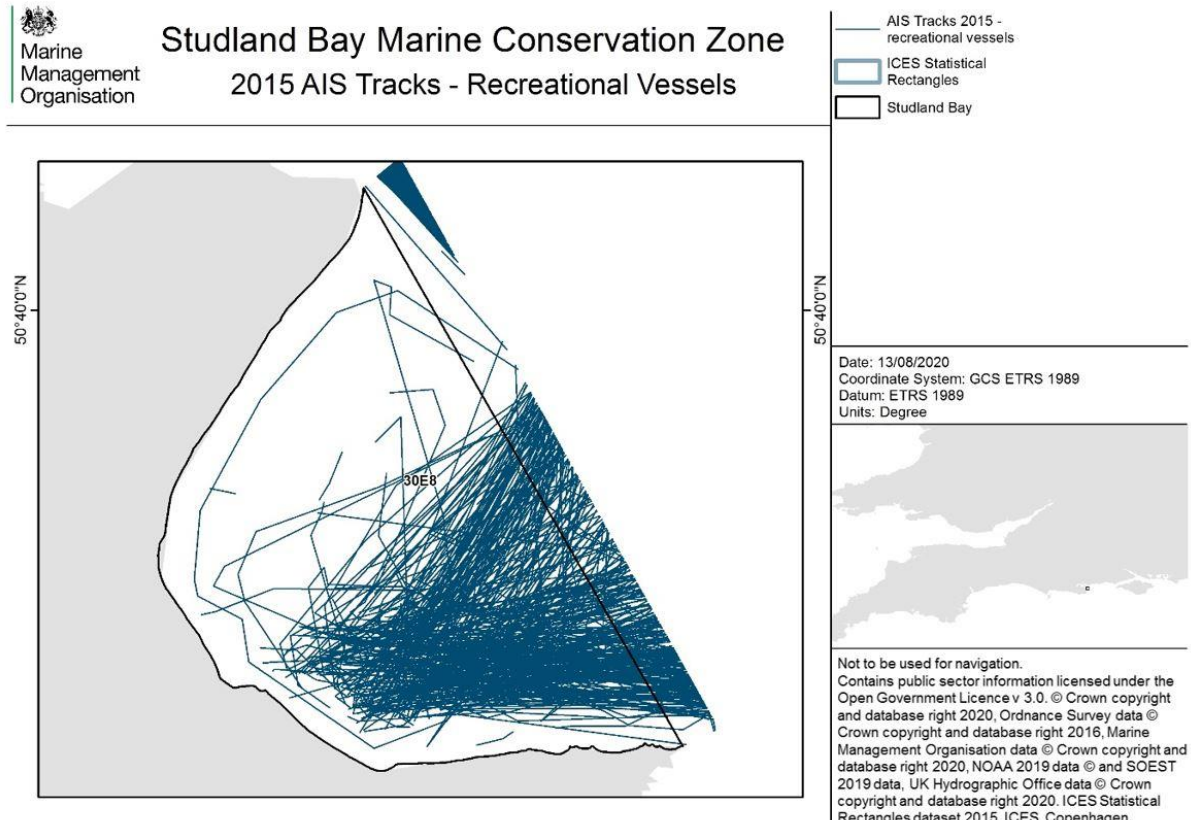


Figure 7: 2016 AIS Track data for recreational vessels in Studland Bay MCZ.

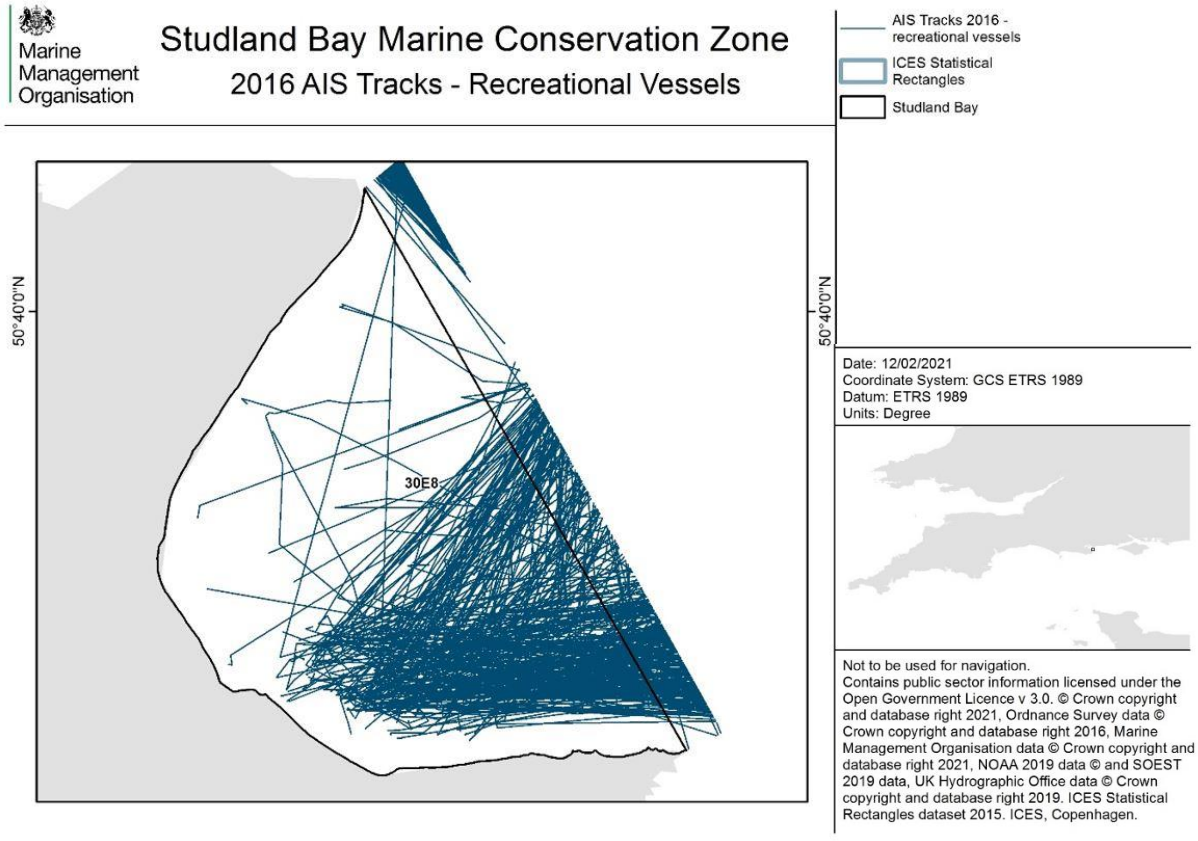


Figure 8: 2017 AIS Track data for recreational vessels in Studland Bay MCZ

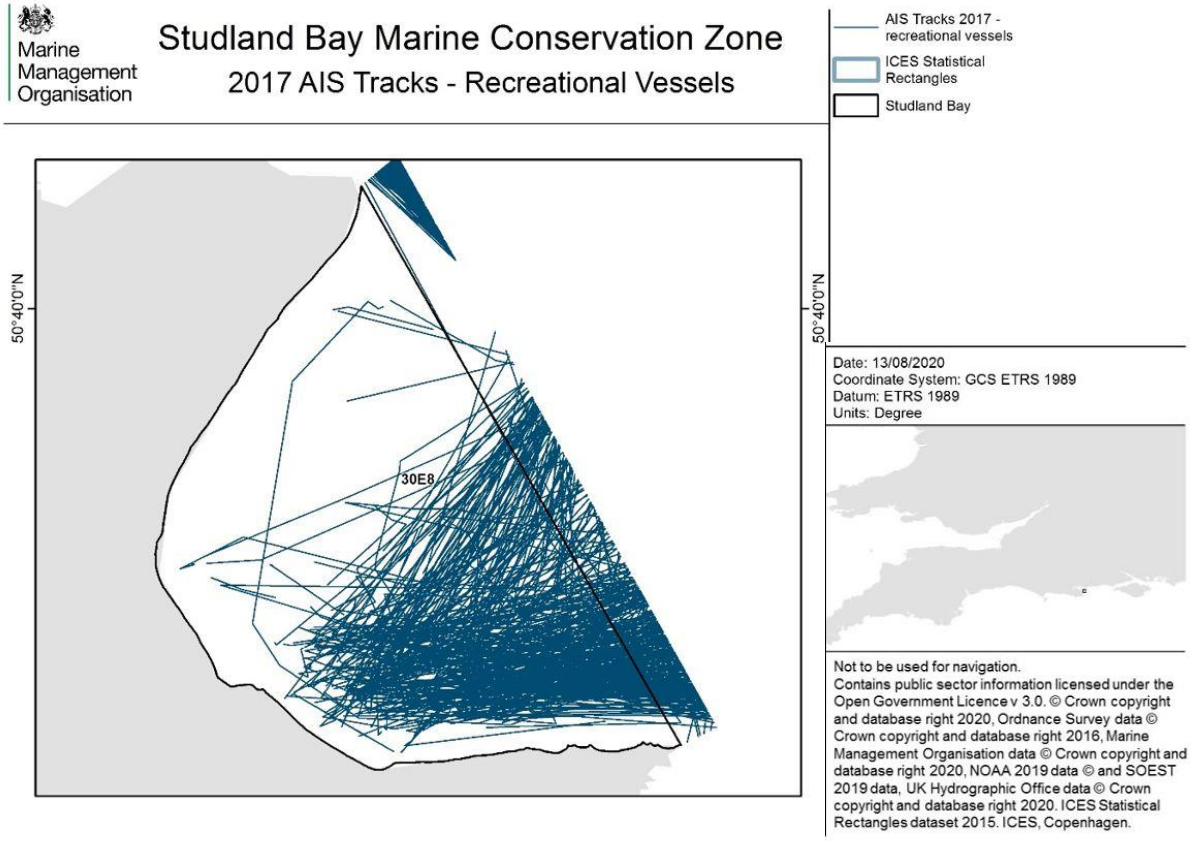
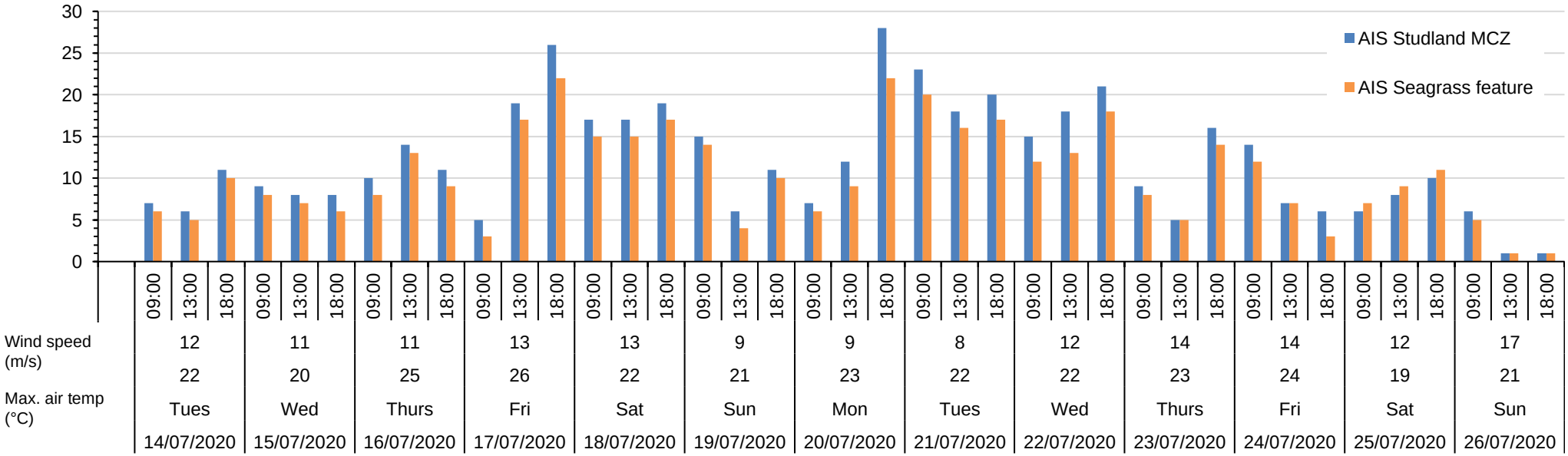


Figure 9: Stationary AIS points in Studland Bay MCZ and stationary AIS points over seagrass feature. Source - Marine Traffic.



4.1.6 Call for evidence activity information

During the call for evidence, stakeholders were asked questions about activity levels in Studland Bay MCZ. Table 14 summarises responses regarding activity levels and where the activity is most common. Information has only been included for activities taken forward to Part B in this assessment. Figure 10 summarises responses regarding general activity and changes in activity over time.

The call for evidence responses indicated that mooring of powerboats and sailing boats most commonly occurs off the South Beach area. Most respondents described mooring levels as medium in spring and high or very high in summer.

Responses indicated that anchoring of powerboats and sailing boats most commonly occurs off the South Beach area. Most respondents described anchoring levels as medium in spring and high or very high in summer.

Responses indicated that powerboating and sailing activity (launching, underway/sailing or recovering) most commonly occurs off the Middle Beach area. Most respondents described activity levels as low in spring and responded not sure or answered medium in summer.

Responses indicated that motorised personal watercraft activity most commonly occurs off the South Beach and Middle Beach area. Most respondents described activity levels as medium in spring and high or very high in summer.

Responses indicated that diving and snorkelling activity most commonly occurs off the South Beach area. Most respondents were not sure or described activity levels as low in the spring and responded not sure or answered medium or low in summer.

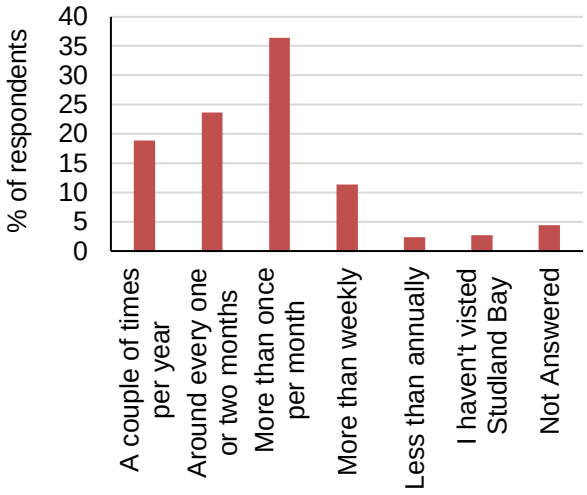
Most respondents to the call for evidence answered that on average they visit Studland Bay more than once per month, with most respondents visiting in the summer. Most respondents answered that they had seen a small change in the level of activities in the last year (2019-2020), but most answered that they had seen no change in activity levels in the long term (2015-2020).

Table 14: Summary of activity levels and locations as indicated by responses to the 2020 call for evidence (Spring = March, April, May; Summer = June, July, August)

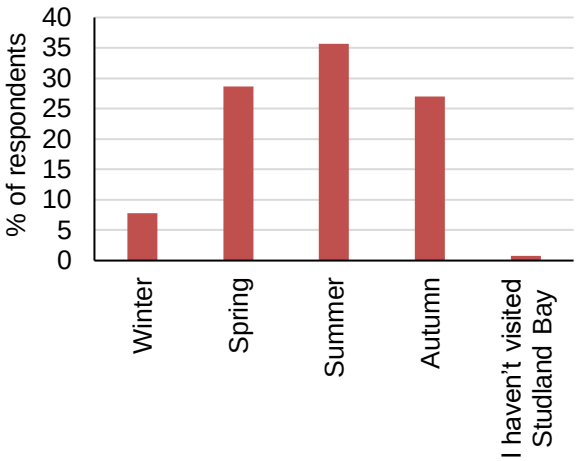
Activity type	Level of activity				Where is the activity most common?
	Spring		Summer		
	Level	% responses	Level	% responses	
Moored powerboats or sailing boats	Very high High Medium Low Not sure	4 10 50 24 13	Very high High Medium Low Not sure	29 34 16 10 11	South Beach area
Anchored powerboats or sailing boats	Very high High Medium Low Not sure	8 17 51 19 5	Very high High Medium Low Not sure	43 42 9 2 4	South Beach area
Powerboats or sailing boats – launching, underway/sailing or recovering	Very high High Medium Low Not sure	3 7 26 37 27	Very high High Medium Low Not sure	14 16 24 20 26	Middle Beach area
Motorised personal watercraft (e.g. jet-skis)	Very high High Medium Low Not sure	7 19 40 21 13	Very high High Medium Low Not sure	32 35 17 5 12	South Beach and Middle Beach area
Diving and snorkelling	Very high High Medium Low Not sure	0 3 22 35 40	Very high High Medium Low Not sure	4 13 24 22 37	South Beach area

Figure 10: Summary of survey answers regarding general activity at Studland Bay received during the call for evidence

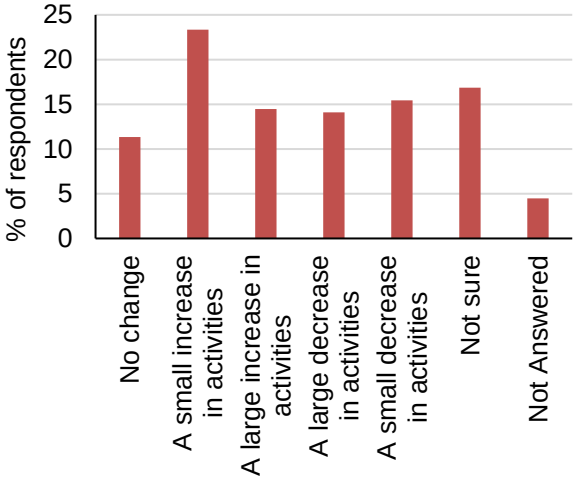
a) On averge, how often do you visit Studland Bay?



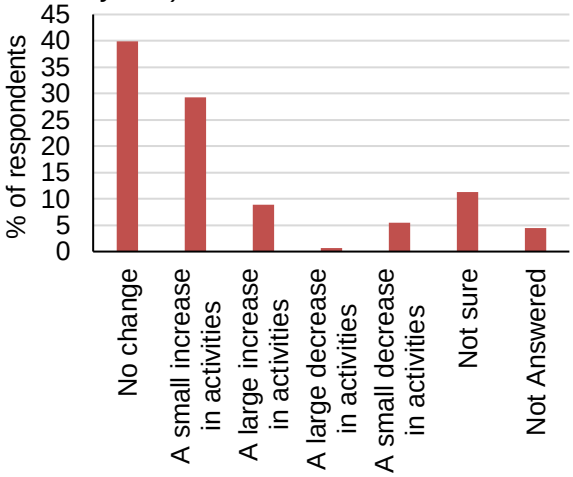
b) Generally, in which seasons do you visit Studland Bay?



c) On average, have you seen a change in the level of activities this year compared to last year?



d) Have you seen a change in activities over the long term (last five years)?



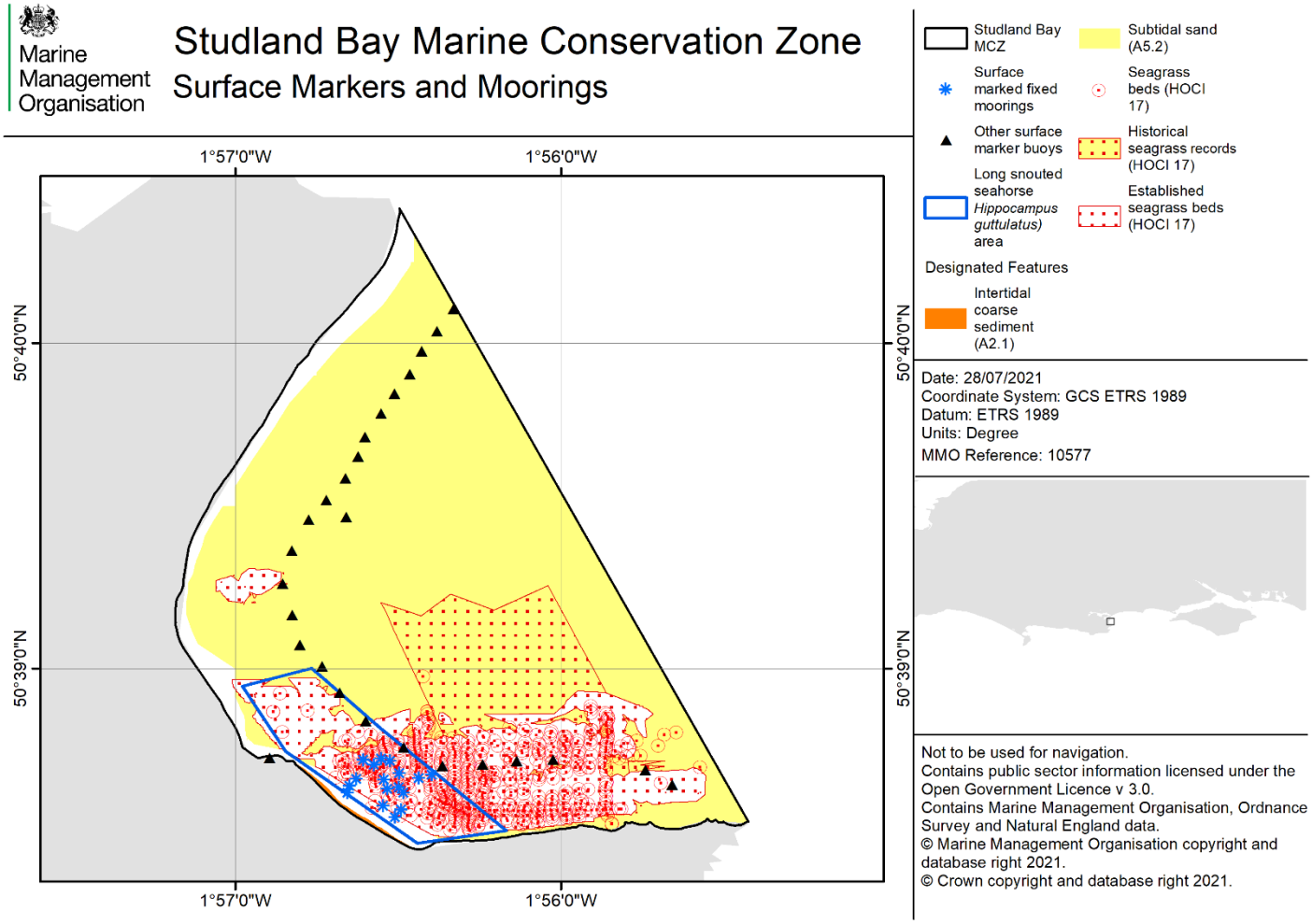
4.1.7 Mooring survey

Under the Marine and Coastal Access Act, 2009[25], the installation and maintenance of moorings can be a licensable marine activity, although certain exemptions can apply[26].

Figure 11 displays data from a Studland Bay MCZ mooring survey carried out on 2 June 2021 (see Annex 1 for methodology). This shows that at the time of the survey, there were 17 surface marked fixed moorings within Studland Bay MCZ. This survey also recorded the presence of 27 other surface marker buoys at the time of the survey, which are not for mooring purposes.

Information provided by stakeholders during the call for evidence in 2020 suggested that there are approximately 13 usable moorings remaining in Studland Bay and that this is lower than the original number because many have degraded and the buoys and chains no longer exist.

Figure 11: The location of surface marked fixed moorings and other surface marker buoys within Studland Bay MCZ (survey date: 2 June 2021).



[25] www.legislation.gov.uk/ukpga/2009/23/part/4
[26] www.legislation.gov.uk/uksi/2011/409/article/25

4.1.8 MMO1243 – Activity data layers

Figure 12 and Figure 13 show the findings from project MMO1243, indicating the areas where the studied marine non-licensable activities occur within Studland Bay MCZ. A range of sources were used to obtain spatial data for these activities which were then validated through stakeholder consultation.

This data indicates that powerboating and sailing mooring areas are located in the south west corner of Studland Bay. Powerboating and sailing anchorage areas are shown to be located in the southern section of the site, extending from shallow areas to the seaward boundary of the MCZ. Powerboating and sailing launching and recovery sites are shown to be located on the shore line in the middle of Studland Bay. Recreational SCUBA diving areas are shown to be located in the north eastern corner of the MCZ. Motorised personal watercraft activity and powerboating and sailing participation are shown to take place throughout the MCZ.

Figure 12: Activity data layers from MMO1243 indicating the areas where motorised personal watercraft, powerboat and sailing activity occur.

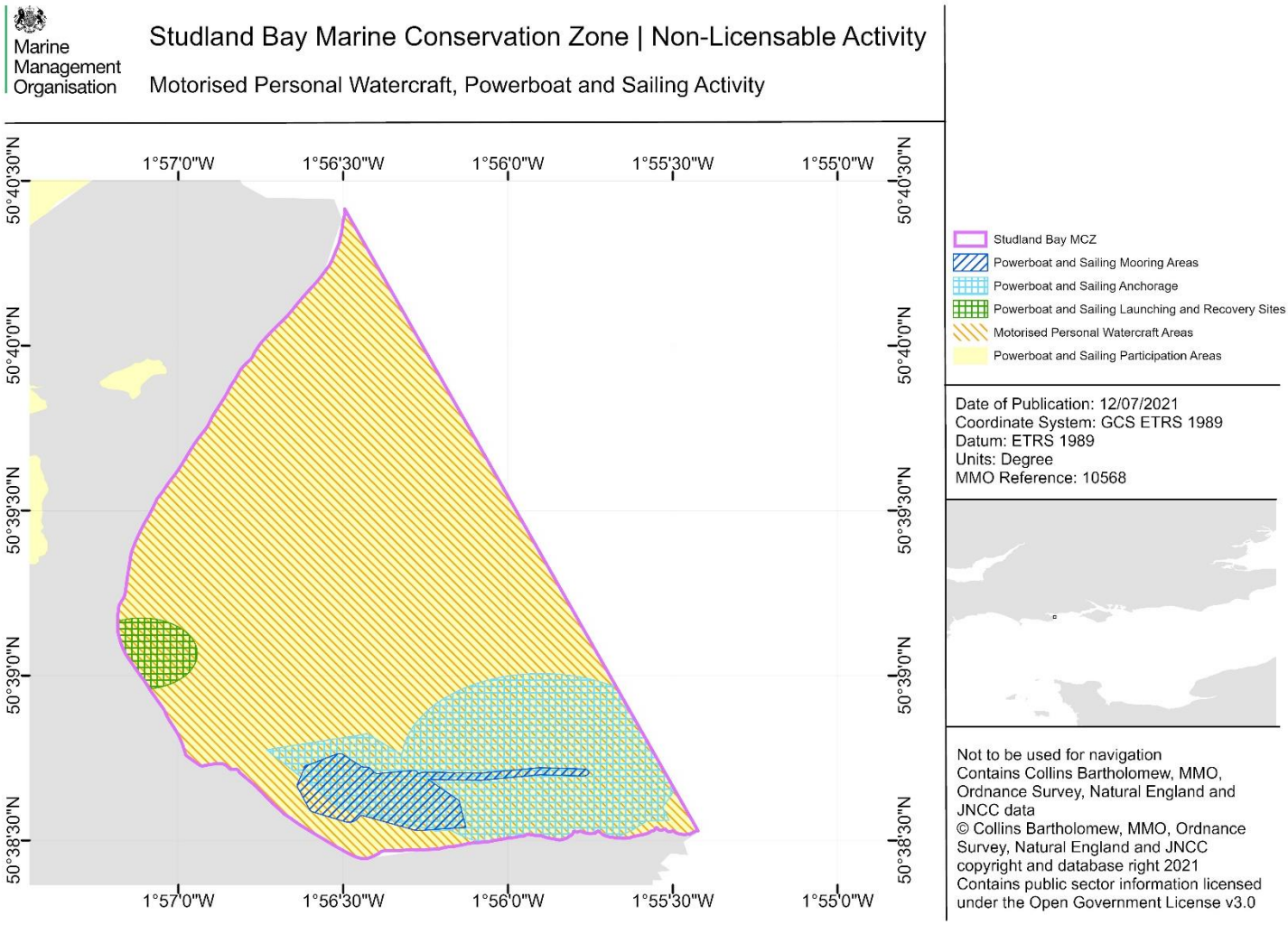
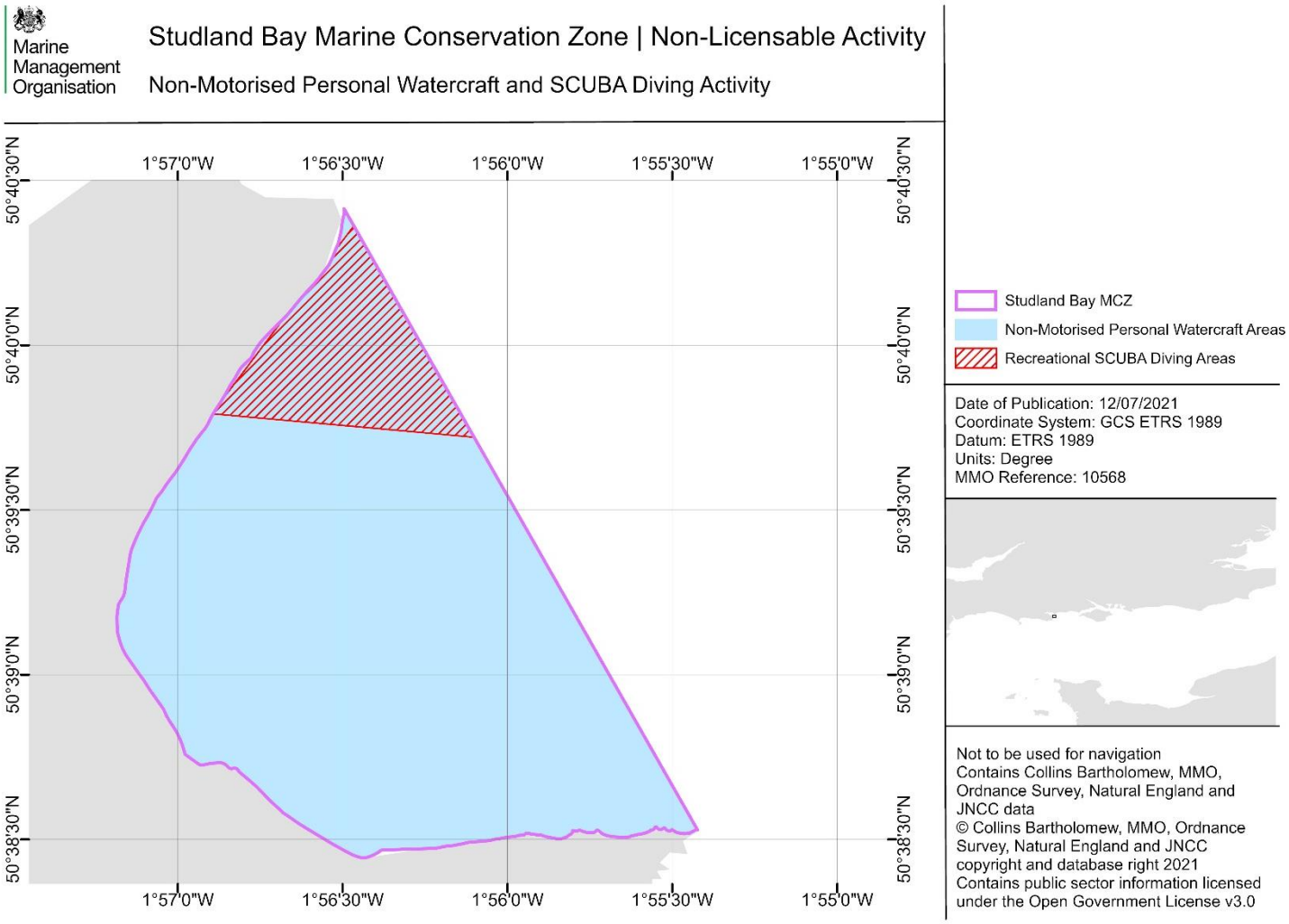


Figure 13: Activity data layers from MMO1243 indicating the areas where non-motorised personal watercraft and SCUBA diving activity occur.



4.1.9 Summary

The evidence in the preceding sections indicate that there is an interaction between marine non-licensable activities and features within Studland Bay MCZ. The sections below investigate the pressures that each activity type exerts on the features of the site.

For pressures where potential impacts to features are of a similar nature, those pressures have been consolidated to avoid repetition during this stage of the assessment. For each subsequent pressure, new information regarding the potential effects that pressure could have on the feature has been discussed. This does not mean that the narrative discussed in previous pressure discussions is not transferable to the pressure being discussed.

4.2 Abrasion/disturbance of the substrate on the surface of the seabed AND Penetration and/or disturbance of the substratum below the surface of the seabed, including abrasion

This pressure is relevant to mooring, anchoring and powerboating or sailing with/without an engine (launching, recovery and participation). These impacts are related to seagrass beds, subtidal sand and long-snouted seahorse

4.2.1 Impacts of anchoring on seagrass beds

The deployment, dragging and recovery of anchor chains can have direct impacts on seagrass via surface abrasion and sub-surface penetration (Collins *et al*., 2010). Direct impacts from anchoring occur during the deployment phases (Griffiths *et al*., 2017). During anchor 'setting', when the anchor is dropped onto the substratum and is dragged to set, it penetrates and disturbs sediments within its footprint (Griffiths *et al*., 2017). Whilst at anchor, the chain may drag across the substratum as the position of the vessel changes in response to tide or wind leading to abrasion, or the anchor may move sideways, 'crabbing' in the sediment (Abdullah, 2008 cited in Griffiths *et al*., 2017). A poorly set anchor may also drag through or on the sediment (Griffiths *et al*., 2017). During anchor retrieval (weighing), the anchor and chain are dragged along the substratum as the vessel manoeuvres, and leave an anchorage scar (Griffiths *et al*., 2017). The footprint of penetration and disturbance of the sediment by an anchor will also depend on factors such as the size, weight and type of anchor (smaller anchors have smaller footprints) (Griffiths *et al*., 2017). Studies have shown that the directly reported anchor footprint (not including the chain) may vary from approximately 0.16m^2 to furrows 5 m wide (Griffiths *et al*., 2017). Furthermore, Collins *et al. (*2010) showed that small vessel anchors have been found to cause surface scars of typically 1-4 m^2. Chain abrasion for recreational vessels in 0-5 m depths was estimated in a study by Griffiths *et al.* (2017). Chain abrasion was conservatively estimated to be 60 m^2, with a worst case scenario estimate of 482 m^2 (Griffiths *et al*., 2017).

Where rhizome mats have been penetrated by anchors, storm and wave action mobilises and disperses unprotected sediment, reducing cohesion of sediment and forming a depression or scar (Collins *et al*., 2010). 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). In Studland Bay, anchoring activity during peak periods is high which makes the formation of anchor scars throughout the seagrass beds likely.

Guidance published by the RYA informs boat users that anchoring can cause damage to sensitive seafloor plants, particularly seagrass[24]. RYA guidance suggests that boat users should choose an anchorage away from sensitive areas[27].

The creation of scars within seagrass beds can cause habitat fragmentation, this is defined as the emergence of discontinuities in a habitat patch (Jackson *et al*., 2013a). Increases in habitat fragmentation are thought to be more damaging than

[27] https://www.rya.org.uk/knowledge-advice/environmental-advice/Pages/anchoring-and-mooring.aspx

the total area of seagrass lost due to impacts (Jackson *et al*., 2013a). This increase in habitat fragmentation can channel water movements, increasing erosion potential at the damaged sites (Jackson *et al*., 2013a). Increased sediment mobility will impede recovery and may also reduce growth rates of surrounding seagrass (Hastings, 1995). Recovery is therefore likely to be lower, not only in deeper parts of the seagrass, but also in more wave and current swept parts of the bed (Jackson *et al.,* 2013a). Scar sites from mooring and anchoring in Studland Bay have been shown to have significantly lower average shear stress than in the seagrass beds, indicating that sediment within scars is less cohesive and more mobile (Collins *et al*., 2010). Continued scouring of the vegetated scar can result in a depression in the sediment. Evidence suggests that there is a critical threshold in fragmentation of seagrass beds at which the negative effects initiated by seagrass loss (for example, sediment resuspension and reduction), further accelerates losses at rates greater than seagrass can recover (Jackson *et al*., 2013a). Species of seagrass from the genus *Zostera* are monomorphic and do not have any vertical rhizomes (Duarte *et al.,* 1994). This restriction to horizontal elongation of the roots explains why large continuous beds are only found in gently sloping locations (Jackson *et al*., 2013a). Sudden changes in sediment depth can inhibit recovery of the seagrass into bare patches (Jackson *et al*., 2013a). Therefore, the depression of the seabed caused by a disturbance, for example anchoring, can restrict the expansion of seagrass (Jackson *et al*., 2013a).

Collins *et al.* (2010) also demonstrated an impact on the biological communities of Studland Bay from anchoring, with a total fauna seagrass to scar ratio of 1134:339. This indicates 1134 species within seagrass compared to 339 within scars. The diversity within seagrass was also higher, with 50 families/species compared to 38 in scars (Collins *et al*., 2010).

A survey investigating the effectiveness of a VNAZ compared to a controlled zone (CTZ) where anchoring could occur in Studland Bay investigated parameters associated with the seagrass beds and seagrass health (Axelsson *et al*., 2012). The data collected between April 2010 and October 2011 suggest higher numbers and larger-sized bare sediment patches present in the CTZ compared to the VNAZ, with several large patches in the western and north-western sections of the CTZ (Axelsson *et al*., 2012). In October 2011, the seabed in the VNAZ was smooth and homogenous whilst the seabed in the CTZ was noticeably different being uneven and undulating (Axelsson *et al*., 2012). There were consistent significant differences in seagrass cover between the VNAZ and the CTZ, this was thought to follow a seasonal pattern (Axelsson *et al*., 2012). There were significant differences in shoot density between and within the VNAZ and the CTZ but not consistently from 2009 to 2011 (Axelsson *et al*., 2012). There was a significant difference in mean shoot density between the VNAZ and CTZ in October 2010 but not in October 2011 (Axelsson *et al*., 2012). These observed variations in seagrass shoot density appeared to be independent of a seasonal cycle (Axelsson *et al*., 2012). Statistical results did not show a consistent significant difference between the VNAZ and the CTZ, however, the report found that there was a trend of increasing differences in shoot density between the two zones, suggesting a need for continued monitoring of

the seagrass shoot density in the VNAZ and CTZ at Studland Bay (Axelsson *et al*., 2012).

Few studies document post-disturbance recovery of seagrass, either due to lack of long-term monitoring programmes or because many seagrass beds have failed to recover following disturbance (Erftemeijer and Lewis, 2006; Short and Wyllie-Echeverria, 1996). Despite the fact that *Zostera marina* can produce large numbers of seeds each season, seed dispersal and survival is unpredictable due to stochastic events and seedling mortality is high (Duarte and Sand-Jensen 1990; Paling *et al.,* 2001; Orth *et al.* 2002; Orth *et al.,* 2006). Pollination is hydrophilous and is assumed to be limited to the extent of beds themselves (Jackson *et al*., 2013a). 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*., 2013a). Where seeds do settle successfully, germination to a mature plant can take between 1 and 2 years (Dawes, 1981). Recovery of seagrass is further disrupted by continued disturbance, for example, if anchoring events do not cease. In tourist spots, such as Studland Bay, anchoring intensity is often related to good weather conditions, which means that intensity is likely to be highest at the same time as seagrass growth, with implications for recovery (Jackson *et al*., 2013a).

Boese *et al*. (1999) studied the recolonization of experimentally created gaps within intertidal perennial and annual *Zostera marina* beds. Two zones were studied, the lower intertidal almost continuous seagrass, and an upper intertidal transition zone where there were patches of perennial and annual *Zostera marina (*Boese *et al*., 1999). They 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*., 1999). 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*., 1999).

The potential consequences of seagrass loss are significant. Fragmentation and loss of seagrass causes reduction in primary production and halts carbon sequestration (Jackson and Beaumont, 2012 cited in Jackson *et al*., 2013a). Erosion of rhizomes increases as seagrass leaves no longer attenuate currents (Jackson and Beaumont, 2012 cited in Jackson *et al*., 2013a). Sediments will still lock up carbon, however, the area becomes a source of carbon due to breakdown of rhizomes (Jackson and Beaumont, 2012 cited in Jackson *et al*., 2013a). These changes have resultant impacts on overall carbon sequestration and implications for climate change.

AIS data demonstrates that recreational boating activity is high over the seagrass feature. MPASum inspections data confirms that a large number of boats visiting this area anchor over the feature. Regardless of the size of scars caused by each anchoring event, the high frequency of anchoring events means that the potential impact on the seagrass is high. Furthermore, considering the information above

regarding seagrass recoverability, the regular anchoring activity is likely to be hindering the recovery of seagrass in the MCZ.

The MMO concludes that impacts by abrasion or penetration from anchoring on the seagrass feature may result in a significant risk of hindering the achievement of the site's conservation objectives.

4.2.2 Impacts of anchoring on long-snouted seahorse

This pressure is discussed in relation to the impact on the supporting habitats of long-snouted seahorse as abrasion impacts the substrate rather than the species.

Hippocampus guttulatus prefers complex habitats, including dense seagrass beds, algal beds, and epifaunal communities that colonize hard substrates[28]. Seahorses use their tails to attach to benthic structures, such as seagrass blades, to shelter and hunt for zooplankton prey[28].

A total of 145 long-snouted seahorse records exist for Studland Bay between 2004 and 2017, with 11 confirmed sightings within the 6 years prior to designation[28]. Records over 2004-2017 include 44 females and 74 males, of which 25 were recorded as pregnant males, and 29 records stated as juvenile/young seahorses[28]. Up to January 2020, there were just 4 records from the last 6 years, despite volunteer dive surveys being carried out by the Seahorse Trust in 2019[28]. On 22 May 2020, The Seahorse Trust reported sightings of at least 16 seahorses within the MCZ, and further reported a total of 98 sightings from surveys completed between 22 May 2020 and 26 July 2020 (The Seahorse Trust, *pers comms*).

The removal or damage to areas of seagrass by anchoring described in section 4.2.1 reduces the available habitat to seahorses, with scars reducing habitat connectivity and spatial distribution of seagrass. Seagrass is used as holdfasts or foraging areas for seahorses. Damage to and/or removal of this vegetation increases the vulnerability of seahorses during storms and reduces the likelihood of them breeding. 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). Jackson et al. (2006) concluded that the survival of temporary juvenile fish may be improved in the contiguous seagrass landscapes, due to protection from predation, higher densities of smaller food items and greater environmental stability associated with larger "core" areas (Bowden *et al*., 2001; Hovel and Lipcius, 2001; Salita *et al*., 2003). This suggests that the target to recover the population size of long-snouted seahorses requires protection of the seagrass habitat.

The MMO concludes that indirect impacts to long-snouted seahorses through abrasion or penetration from anchoring on seagrass beds may result in a significant risk of hindering the achievement of the site's conservation objectives.

[28] Natural England Conservation Advice – available online.

4.2.3 Impacts of anchoring on subtidal sand

The seagrass and subtidal sand features of the site overlap, with seagrass being a sediment biotope of subtidal sand. As such, the impacts described for seagrass beds are relevant to subtidal sand. Anchors will penetrate into subtidal sand features and chains associated with anchors cause abrasion. Impacts discussed in sections 4.2.2 and 4.2.1 indicate that these activities are not compatible with the site's conservation objectives due to impacts on the seagrass biotope itself as well as the species associated with the seagrass biotope.

AIS data indicates that recreational boating occurs over areas where only the subtidal sand feature is present. Potential anchoring by vessels in this area will therefore reduce the ability for seagrass beds to expand.

In terms of the subtidal sand feature alone, it is unlikely that anchoring will reduce its extent and distribution. With regards to species found within subtidal sand only, observational records have found that the shallow water and sandy plains of Studland Bay support a number of species. These include a range of burrowing bivalves and worms such as lugworm (*Arenicola sp*.) and sandmason worm (*Lanice conchilega*), hermit and masked crabs, as well as a variety of commercially important flatfish such as plaice (*Pleuronectes platessa*) and sole (*Solea solea*) (Seasearch Dorset, 2015). The position of infaunal benthic communities within the sediment mean they are relatively protected from temporary surface disturbance such as scour from anchor/mooring chains (Griffiths *et al*., 2017). Fine sands are relatively cohesive and therefore resistant to erosion following surface disturbance (Griffiths *et al*., 2017). Actively burrowing, robust bivalves typical of sand shores and sandbanks, are likely to be more tolerant of abrasion and subsurface pressure than thin-shelled species found in stable muds (Griffiths *et al*., 2017).

The MMO concludes that due to the potential impacts to the seagrass biotope of the subtidal sand feature, impacts by abrasion or penetration from anchoring may result in a significant risk of hindering the achievement of the site's conservation objectives.

4.2.4 Impacts of mooring on seagrass beds, long-snouted seahorse and subtidal sand

The impacts of moorings on seagrass beds, long-snouted seahorse and subtidal sand have been assessed together in this section.

Conventional swing moorings have a chain connected to a block or anchor on the seabed. Multiple studies have shown that as the chain moves with winds and the tides on the seabed, it clears areas of seagrass in the vicinity (Collins *et al*., 2010; Walker *et al*., 1989; Lenihan *et al*., 1990; Hastings *et al*., 1995; Creed and Amado Filho, 1999; Francour et al., 1999; Marbà *et al*., 2002; Milazzo *et al*., 2004; Montefalcone *et al*., 2008). Seagrass may be cleared as the heavy chains associated with moorings uproot rhizomatous tissue and tear shoots of seagrass (Bourque *et al*., 2015). Sediment scour may also occur around anchoring blocks due to eddying of currents, and the anchors themselves may create a hard structure for the settlement of competitive algae (Jackson *et al*., 2013a). Swing moorings have

been shown to produce significant seagrass scour, for example, one study reported an approximate nine metre radius of seagrass cleared around the mooring (Demers *et al*., 2013). In an earlier study, Walker *et al*. (1989) found that circular or semi-circular depressions of bare sand caused by mooring chains within seagrass beds could range from 3 to 300m^2 depending on boat size (cited in Jackson *et al*., 2013a). Permanent moorings mean that there is persistent pressure via abrasion from the chain dragging on the seabed (Jackson *et al*., 2013a).

Despite the potential impacts of moorings discussed above, impacts of moorings are managed through existing processes. The installation and maintenance of moorings is a licensable activity under Part 4 of the Marine and Coastal Access Act 2009[29]. The determination of a marine licence application involves thorough assessment when applications are within a marine protected area, such as Studland Bay MCZ.

As described in section 4.1.4, there are a number of existing moorings in Studland Bay MCZ. These moorings pre-date the MMO marine licensing system and were granted amnesty when marine licensing was introduced. There are a number of existing swing moorings in Studland Bay MCZ. The MMO has records of these moorings and commissioned a survey recording their locations as of June 2021. Details can be found in Annex 2 of the Habitat Protection Strategy[30]. It is thought that many of the moorings are in a state of disrepair and are no longer usable. The MMO recognise that there may be a potential impact from these moorings through the pressures discussed above.

Many of the moorings have been in place for many years and predate the marine licensing system introduced under the Marine and Coastal Access Act 2009, and the designation of the MCZ. MMO are not currently planning to remove them but will keep this under review.

The MMO concludes that due to the management of impacts of moorings through the marine licensing process, impacts by abrasion or penetration from mooring will not result in a significant risk of hindering the achievement of the site's conservation objectives.

4.2.5 Impacts of powerboating or sailing with/without an engine (launching, recovery and participation) on seagrass beds

Recreational vessels and watercraft are launched and recovered from the shores of Studland Bay. Vessels in shallow waters of Studland are likely to be small in size and so the draft is unlikely to be deep enough to interact with the seagrass during launching and recovery.

Due to seagrass being found at shallow depths, there is a risk of interaction whilst vessels are underway. Turbulence from propeller wash and boat wakes can resuspend sediments, break off leaves, dislodge sediments and uproot plants (d'Avack *et al*, 2014). Koch (2002) established that physical damage from boat wakes was greatest at low tide but concluded that negative impacts of boat-

[29] www.legislation.gov.uk/ukpga/2009/23/part/4
[30] https://www.gov.uk/government/publications/managing-marine-non-licensable-activities-studland-bay-next-steps

generated waves were marginal on seagrass habitats. Engine propellers can shear leaves and in severe cases when operating in too shallow water, can tear through the rhizomal mat of seagrass beds, creating unvegetated, linear troughs of varying lengths (Zieman 1976; Dawes *et al*., 1997; Madley *et al*., 2004). The amount of destruction from scar-producing events depends on water depth and the size, speed and path of the vessel (Madley *et al*., 2004). Scars may expand and merge to form larger denuded areas. A study by Kenworthy *et al.* (2002) determined that recovery of seagrass to propeller impact depended on species, with recovery times ranging from 1.4 to 9.5 years.

AIS data demonstrates that recreational boating activity is high over the seagrass feature. However, there is no strong evidence that vessels are causing damage to the seagrass beds in Studland Bay via propeller wash or direct damage.

The MMO concludes that impacts via abrasion/disturbance of the substrate on the surface of the seabed from powerboating or sailing with an engine (launching, recovery and participation) on seagrass beds will not result in a significant risk of hindering the achievement of the site's conservation objectives.

4.2.6 Pressure conclusion

The discussion above indicates that anchoring is likely to cause impacts to the protected features of Studland Bay MCZ through surface abrasion and sub-surface penetration and disturbance. This pressure predominantly causes impacts to the seagrass feature along with the associated biological community.

Mooring, powerboating or sailing with/without an engine (launching, recovery and participation) are not likely to cause impacts to seagrass beds in Studland Bay MCZ through surface abrasion.

The MMO conclude that abrasion/disturbance of the substrate on the surface of the seabed AND penetration and/or disturbance of the substratum below the surface of the seabed by anchoring alone may result in a significant risk of hindering the achievement of the site's conservation objectives (Table 15).

Table 15: Abrasion/disturbance of the substrate on the surface of the seabed AND Penetration and/or disturbance of the substratum below the surface of the seabed, including abrasion assessment for mooring and anchoring and powerboating or sailing with/without an engine (launching, recovery and participation).

Pressure	Activity	Interest feature	Favourable condition target	Compatible with conservation objectives?
Abrasion/disturbance of the substrate on the surface of	Anchoring	Subtidal sand	• Maintain the presence and spatial distribution of subtidal sand communities.	N (seagrass biotope)

the seabed **and** Penetration and/or disturbance of the substratum below the surface of the seabed, including abrasion			• Maintain the total extent and spatial distribution of subtidal sand.	Y
			• Maintain the abundance of listed species[17], to enable each of them to be a viable component of the habitat.	N (seagrass biotope)
			• Maintain the distribution of sediment composition types across the feature/sub feature.	Y
			• Maintain the species composition of component communities for subtidal sand.	N (seagrass biotope)
		Seagrass beds	• Maintain the presence and spatial distribution of seagrass bed communities.	N
			• Recover the total extent and spatial distribution of seagrass beds.	N
			• Maintain the distribution of sediment composition types across the feature/sub feature.	N
			• Recover the species composition of component communities for seagrass beds	N
			• Maintain the area of habitat that is likely to support the sub feature.	N
			• Recover the leaf / shoot density, length, percentage cover, and rhizome mat across the feature at natural levels (as far as possible), to ensure a healthy, resilient habitat.	N
			• Recover the extent and structure of the rhizome	N

			mats across the site, and conditions to allow for regeneration of seagrass beds.	
			• Maintain the natural physical form and coastal processes that shape the seagrass bed.	N
			• Maintain the natural rate of sediment deposition.	N
		Long-snouted seahorse	• Recover the population size within the site.	N
			• Maintain the reproductive and recruitment capability of the species.	N
			• Maintain the presence and spatial distribution of the species and their ability to undertake key life cycle stages and behaviours.	N
			• Recover connectivity of the habitat within sites and the wider environment to ensure larval dispersal and recruitment, and / or to allow movement of migratory species.	N
			• Recover the extent and spatial distribution of the following supporting habitats: seagrass.	N
	Mooring **and** Powerboating or sailing with/without an engine (launching, recovery and participation)	Subtidal sand	• Maintain the presence and spatial distribution of subtidal sand communities.	Y
			• Maintain the total extent and spatial distribution of subtidal sand.	Y
			• Maintain the abundance of listed species[17], to enable each of them to be a viable component of the habitat.	Y

			• Maintain the distribution of sediment composition types across the feature/sub feature.	Y
			• Maintain the species composition of component communities for subtidal sand.	Y
		Seagrass beds	• Maintain the presence and spatial distribution of seagrass bed communities.	Y
			• Recover the total extent and spatial distribution of seagrass beds.	Y
			• Maintain the distribution of sediment composition types across the feature/sub feature.	Y
			• Recover the species composition of component communities for seagrass beds	Y
			• Maintain the area of habitat that is likely to support the sub feature.	Y
			• Recover the leaf / shoot density, length, percentage cover, and rhizome mat across the feature at natural levels (as far as possible), to ensure a healthy, resilient habitat.	Y
			• Recover the extent and structure of the rhizome mats across the site, and conditions to allow for regeneration of seagrass beds.	Y
			• Maintain the natural physical form and coastal processes that shape the seagrass bed.	Y

			• Maintain the natural rate of sediment deposition.	Y
		Long-snouted seahorse	• Recover the population size within the site.	Y
			• Maintain the reproductive and recruitment capability of the species.	Y
			• Maintain the presence and spatial distribution of the species and their ability to undertake key life cycle stages and behaviours.	Y
			• Recover connectivity of the habitat within sites and the wider environment to ensure larval dispersal and recruitment, and / or to allow movement of migratory species.	Y
			• Recover the extent and spatial distribution of the following supporting habitats: seagrass.	Y

4.3 Physical change (to another sediment type)

This pressure is relevant to mooring and anchoring. These impacts are related to seagrass beds, subtidal sand and intertidal coarse sediment.

4.3.1 Impacts of anchoring on seagrass beds and subtidal sand

Anchoring may cause physical change to another sediment type through damage to and removal of the seagrass feature. Anchoring activity over the subtidal sand feature is only likely to cause physical change to another sediment type where there is seagrass associated with this feature. Impacts are therefore grouped for these features.

As discussed in section 4.2.1, interaction of anchors with areas of seagrass can cause scars to form where seagrass can no longer survive, thus changing the characteristics of the substrate. Collins *et al*. (2010) found that scars at Studland Bay had a lower silt fraction and organic content than the adjacent seagrass, leading to a coarser sediment structure. It was also demonstrated that anchor scars create a lowering of the sediment, with a 10-20 cm step down from the seagrass along at least one edge (Collins *et al*., 2010). This leaves the seagrass rhizome mat exposed to wave action and creates the risk of it being undercut, worsening the damage

cause by the scar (Collins *et al*., 2010). *Zostera marina* expands via horizontal elongation of rhizomes and sudden changes in sediment depth can inhibit recovery of seagrass into bare patches (Jackson *et al*., 2013a). Loss of seagrass exposes the seabed to wave action causing resuspension and increased turbidity (Jackson *et al*., 2013a). This results in a feedback loop impeding recovery of seagrass (Jackson *et al*., 2013a). The formation of new patches of seagrass outside existing perennial beds by sexual propagules or drifting rhizome fragments is rare which means that natural recovery of seagrass is slow (Jackson *et al*., 2013a). These factors mean that once seagrass is removed by anchoring, there is a risk that the area will permanently change to a different sediment type.

The MMO concludes that impacts via physical change (to another sediment type) from anchoring may result in a significant risk of hindering the achievement of the site's conservation objectives.

4.3.2 Impacts of mooring on seagrass beds and subtidal sand

Mooring may cause physical change to another sediment type through damage to and removal of the seagrass feature. Mooring activity over the subtidal sand feature is only likely to cause physical change to another sediment type where there is seagrass associated with this feature. Impacts are therefore grouped for these features. Despite potential impacts, as discussed in section 4.2.4, the impacts of moorings are managed through the marine licensing process.

The MMO concludes that, due to the management of impacts of moorings through the marine licensing process, impacts via physical change (to another sediment type) from mooring will not result in a significant risk of hindering the achievement of the site's conservation objectives.

4.3.3 Impacts of mooring and anchoring on intertidal coarse sediment

The impacts of mooring and anchoring have been grouped for this pressure.

The intertidal coarse sediment feature is primarily located along the upper shore at South Beach with a small patch present towards the northern end of Middle Beach (MESL, 2013). Regardless of activity levels, given that the sediment is already classed as coarse, it is unlikely that there is the potential for the broad scale habitat to be changed in this area as any addition of fine sediment is likely to be very minimal. Furthermore, given that this feature is located close to the shore, there are no moorings and anchoring does not take place on this area. This is demonstrated by recreational boating AIS data which shows that vessels are not active over the feature. Intertidal coarse sediment is therefore not at risk from physical change to another sediment type caused by mooring and anchoring.

The MMO concludes that impacts via physical change (to another sediment type) from mooring and anchoring will not result in a significant risk of hindering the achievement of the site's conservation objectives.

4.3.4 Pressure conclusion

The discussion above indicates that mooring and anchoring is likely to cause impacts to some of the protected features of Studland Bay MCZ through physical

change to another sediment type. This pressure predominantly causes impacts to the seagrass feature.

The MMO conclude that physical change (to another sediment type) may result in a significant risk of hindering the achievement of the site's conservation objectives (Table 16).

Table 16: Physical change (to another sediment type) assessment for mooring and anchoring.

Pressure	Activity	Interest feature	Favourable condition target	Compatible with conservation objectives?
Physical change (to another sediment type)	Anchoring	Subtidal sand	• Maintain the presence and spatial distribution of subtidal sand communities.	N (seagrass biotope)
			• Maintain the total extent and spatial distribution of subtidal sand.	Y
			• Maintain the abundance of listed species[17,] to enable each of them to be a viable component of the habitat.	N (seagrass biotope)
			• Maintain the distribution of sediment composition types across the feature/sub feature.	Y
			• Maintain the species composition of component communities for subtidal sand.	N (seagrass biotope)
		Seagrass beds	• Maintain the presence and spatial distribution of seagrass bed communities.	N
			• Recover the total extent and spatial distribution of seagrass beds.	N
			• Maintain the distribution of sediment composition types across the feature/sub feature.	N
			• Recover the species composition of component communities for seagrass beds	N

			• Maintain the area of habitat that is likely to support the sub feature.	N
			• Recover the leaf / shoot density, length, percentage cover, and rhizome mat across the feature at natural levels (as far as possible), to ensure a healthy, resilient habitat.	N
			• Recover the extent and structure of the rhizome mats across the site, and conditions to allow for regeneration of seagrass beds.	N
			• Maintain the natural physical form and coastal processes that shape the seagrass bed.	N
			• Maintain the natural rate of sediment deposition.	N
	Mooring	Subtidal sand	• Maintain the presence and spatial distribution of subtidal sand communities.	Y
			• Maintain the total extent and spatial distribution of subtidal sand.	Y
			• Maintain the abundance of listed species[17], to enable each of them to be a viable component of the habitat.	Y
			• Maintain the distribution of sediment composition types across the feature/sub feature.	Y
			• Maintain the species composition of component communities for subtidal sand.	Y
		Seagrass beds	• Maintain the presence and spatial distribution of seagrass bed communities.	Y

			• Recover the total extent and spatial distribution of seagrass beds.	Y
			• Maintain the distribution of sediment composition types across the feature/sub feature.	Y
			• Recover the species composition of component communities for seagrass beds	Y
			• Maintain the area of habitat that is likely to support the sub feature.	Y
			• Recover the leaf / shoot density, length, percentage cover, and rhizome mat across the feature at natural levels (as far as possible), to ensure a healthy, resilient habitat.	Y
			• Recover the extent and structure of the rhizome mats across the site, and conditions to allow for regeneration of seagrass beds.	Y
			• Maintain the natural physical form and coastal processes that shape the seagrass bed.	Y
			• Maintain the natural rate of sediment deposition.	Y
	Anchoring **and** Mooring	Intertidal coarse sediment	• Maintain the presence and spatial distribution of intertidal coarse sediment communities.	Y
			• Maintain the total extent and spatial distribution of intertidal coarse sediment.	Y
			• Maintain the abundance of listed species[17], to enable each of them to be a viable component of the habitat.	Y

			• Maintain the distribution of sediment composition types across the feature/sub feature.	Y
			• Maintain the species composition of component communities for intertidal coarse sediment.	Y

4.4 Underwater noise changes

This pressure is relevant to mooring, anchoring and powerboating or sailing with an engine (launching, recovery and participation) and impacts on long-snouted seahorses only. The assessment of these activities has been combined due to the similarity in impacts.

4.4.1 Impacts of powerboating or sailing with an engine (launching, recovery and participation, and mooring and/or anchoring) on long-snouted seahorse

Small motorised craft (including recreational craft) produce relatively low levels of noise (75-159 dB re 1µPa m) with the output characteristics highly dependent on speed and other operational characteristics (OSPAR, 2009 cited in Natural England, 2017a). Many of these sources have greater sound energy in higher frequency bands (i.e. above 1,000 Hz) than large ships (Natural England, 2017a). Whilst motorised vessels are anchoring or mooring, the use of engines for positioning will cause underwater noise changes. Vessels may also keep engines running whilst anchored or moored. Additionally, anchoring can cause underwater noise changes due to noise created when the chain is fed out and recovered.

Seahorses have been shown to respond negatively to underwater noise. Anderson *et al*. (2011) studied responses of seahorses (*Hippocampus erectus)* in noisy (123-137 dBrms re 1 µPa) and quiet (110-119 dBrms re 1 µPa) tanks for one month. 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). In situ experiments on *Hippocampus guttulatus* in Portugal investigated impacts of transient motorboat sound (63.4dB to 127.6dB) and constant sound produced by anchored motorboats (up to 137.1 dB) above seahorses (Palma *et al*., 2019). Increases in respiratory rate and opercula movements per minute were observed in response to noise levels (Palma *et al*., 2019). Furthermore, 30.6% of the animals abandoned the observation location in an attempt to avoid the negative sound stimuli (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).

AIS data shows that that there is high recreational vessel activity within the site, particularly over the seagrass feature in the southern area of the bay. Water sports

involving motorised vessels also take place off Knoll Beach. However, within Studland Bay MCZ, there is a water safety byelaw. This implements a 5 knot speed limit between 15 March and 30 September for pleasure boats each year and is marked by yellow buoys during the summer. Whilst this byelaw has been made for safety purposes, the reduction in the speed of vessels at times of peak activity, means that underwater noise will be lower. This therefore, reduces the impacts of these vessels on the protected features of this site.

4.4.2 Pressure conclusion

The MMO conclude that underwater noise changes from mooring, anchoring and powerboating or sailing with an engine (launching, recovery and participation) will not result in a significant risk of hindering the achievement of the site's conservation objectives (Table 17).

Table 17: Underwater noise changes assessment for powerboating or sailing with an engine (launching, recovery and participation, and mooring and/or anchoring).

Pressure	Activity	Interest feature	Favourable condition target	Compatible with conservation objectives?
Underwater noise changes	Powerboating or sailing with an engine (launching, recovery and participation) **and** Mooring **and** Anchoring	Long-snouted seahorse	• Recover the population size within the site.	Y
			• Maintain the reproductive and recruitment capability of the species.	Y
			• Maintain the presence and spatial distribution of the species and their ability to undertake key life cycle stages and behaviours.	Y

4.5 Visual disturbance

This pressure is relevant to mooring, anchoring, diving and snorkelling and powerboating or sailing with/without an engine (launching, recovery and participation). These impacts are only related to long-snouted seahorses.

4.5.1 Impacts of diving and snorkelling on long-snouted seahorses

Flashlights and interactions with divers may cause behavioural stresses to seahorses which are suggested to negatively impact feeding, breeding, and resting habits (Claassens and Hodgson, 2017; MMO, 2014b). A study on the effects of photographer approach on seahorse behaviour found that divers using action cameras attached to extension poles approached seahorses more closely, causing significantly more behavioural disruptions such as escape responses as well as physical contact (Giglio *et al*., 2018). Stressed seahorses have been shown to

change their vocalization in response to disturbance by increasing the number of clicks they produce (Giglio *et al*., 2018). 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 (Olivera *et al*., 2014; Anderson *et al*., 2011).

MPASum inspections indicate that there are high numbers of swimmers and snorkelers within the site. Between 1 June and 20 July, over the course of 13 inspections, 261 swimmers and snorkelers were recorded in the southern area of the bay. Despite large numbers, these swimmers and snorkelers are likely to only be located within the marked swimming zones (Figure 3) and are unlikely to be actively seeking out seahorses. With regards to diving, four divers and one dive boat with an unknown number of divers was recorded within this time frame. Whilst this may be an underestimate of the numbers of divers, it is predicted that this activity occurs at low levels. There is no evidence to suggest that swimmers, snorkelers or divers are causing visual disturbance to seahorses in Studland Bay. Furthermore, long-snouted seahorses are protected under the Wildlife and Countryside Act 1981 (as amended) for multiple offences listed (see section 4.1.1). A wildlife licence is required from the MMO for any activity which may disturb seahorses. Divers must have a wildlife licence if they are seeking seahorses or carrying out an activity which is likely to disturb them, for example, photography or filming. If a licence is granted, this provides the applicant with a legal route to cause an offence such as disturbance and therefore some disturbance of seahorses may occur, although this is minimised under a wildlife licence through licence conditions. The MMO is aware that there may be instances of disturbance which is not regulated through wildlife licensing due to incidental encounters. However, these are predicted to be minimal.

The MMO concludes that impacts via visual disturbance from diving and snorkelling will not result in a significant risk of hindering the achievement of the site's conservation objectives.

4.5.2 Impacts of mooring, anchoring and powerboating or sailing with/without an engine (launching, recovery and participation) on long-snouted seahorses

The launching and recovery of vessels and vessels underway on the water are visual stimuli which may cause disturbance to seahorses. The deployment of anchor chains is a visual stimulus which may also cause disturbance to seahorses. MPASum inspections and AIS data indicates that recreational boating activity (including vessels underway, mooring and anchoring) is high over the seagrass feature which long-snouted seahorses inhabit. However, it is not known whether prolonged or recurrent exposure to visual disturbance may induce stress or result in displacement of seahorses[31]. There is little evidence to suggest that these activities are having a significant impact on long-snouted seahorses in Studland Bay MCZ via visual disturbance.

The MMO concludes that impacts via visual disturbance from mooring, anchoring and powerboating or sailing with/without an engine (launching,

[31] Natural England Conservation Advice – available online.

recovery and participation) will not result in a significant risk of hindering the achievement of the site's conservation objectives.

4.5.4 Pressure conclusion

The MMO conclude that visual disturbance from diving and snorkelling and powerboating or sailing with/without and engine (mooring and/or anchoring, and launching, recovery and participation) will not result in a significant risk of hindering the achievement of the site's conservation objectives (Table 18).

Table 18: Visual disturbance assessment for diving and snorkelling and powerboating or sailing with/without an engine (mooring and/or anchoring, and launching, recovery and participation).

Pressure	Activity	Interest feature	Favourable condition target	Compatible with conservation objectives?
Visual disturbance	Diving and snorkelling **and** Powerboating or sailing with/without an engine (launching, recovery and participation) **and** Mooring **and** Anchoring	Long-snouted seahorse	• Recover the population size within the site.	Y
			• Maintain the reproductive and recruitment capability of the species.	Y
			• Maintain the presence and spatial distribution of the species and their ability to undertake key life cycle stages and behaviours.	Y
			• Recover the population size within the site.	Y
			• Maintain the reproductive and recruitment capability of the species.	Y
			• Maintain the presence and spatial distribution of the species and their ability to undertake key life cycle stages and behaviours.	Y
			• Recover the population size within the site.	Y
			• Maintain the reproductive and recruitment capability of the species.	Y

			• Maintain the presence and spatial distribution of the species and their ability to undertake key life cycle stages and behaviours.	Y

4.6 Part B conclusion

It is concluded that mooring, diving, snorkelling, powerboating and sailing with/without an engine (launching, recovery and participation), when considered in isolation, will not result in a significant risk of hindering the achievement of the site's conservation objectives.

The assessment of marine non-licensable activity pressures on the subtidal sand, seagrass and long-snouted seahorse features has determined that anchoring activity may result in a significant risk of hindering the achievement of the site's conservation objectives.

The MMO conclude that management measures are required to exclude these pressures from Studland Bay MCZ.

Section 7 contains further details of the proposed management measures.

5. Part C - In-combination assessment

This section assesses the effects of activities considered as compatible with the conservation objectives of Studland Bay MCZ in-combination with other relevant activities taking place which includes the following:

- Marine non-licensable activity/pressure combinations which were excluded in Part A of this assessment but which could have an effect on the feature;
- fishing activities;
- plans and projects.

5.1 Pressures exerted by all marine non-licensable activities

Activity/pressure interactions considered not capable of affecting the site alone in Part A and so excluded from the Part B assessment are now considered in-combination. Despite Part B identifying significant risks from anchoring, this activity is still included in the in-combination assessment for non-significant pressures. Management of the significant pressures may not exclude these pressures in combination with other activities.

Remaining activities which are considered to have a possible in-combination impact are highlighted in red. Activities included in the in-combination assessment are identified in Table 19 to
Table 22.

Table 19: Summary of activity/pressure interactions included in in-combination assessment for intertidal coarse sediment.

Potential pressures	Powerboating or sailing with an engine: mooring and/or anchoring **and** Sailing without an engine: mooring and/or anchoring	Powerboating or sailing with an engine: launching and recovery, participation **and** Sailing without an engine: launching and recovery, participation	Non-motorised watercraft (e.g. kayaks, windsurfing, dinghies)	Diving and snorkelling
Abrasion/disturbance of the substrate on the surface of the seabed	No interaction likely	N/A	No interaction likely	N/A
Hydrocarbon & PAH contamination	No interaction likely	No interaction likely	N/A	No interaction likely
Litter	No interaction likely	No interaction likely	No interaction likely	No interaction likely
Synthetic compound contamination (incl. pesticides, antifoulants, pharmaceuticals)	No interaction likely	No interaction likely	N/A	No interaction likely
Transition elements & organo-metal (e.g. TBT) contamination	No interaction likely	No interaction likely	N/A	No interaction likely
Penetration and/or disturbance of the substratum below the surface of the seabed, including abrasion	No interaction likely	No interaction likely	No interaction likely	No interaction likely
Physical change (to another sediment type)	No interaction likely	N/A	N/A	N/A

Table 20: Summary of activity/pressure interactions included in in-combination assessment for subtidal sand.

Potential pressures	Powerboating or sailing with an engine: mooring and/or anchoring **and** Sailing without an engine: mooring and/or anchoring	Powerboating or sailing with an engine: launching and recovery, participation **and** Sailing without an engine: launching and recovery, participation	Non-motorised watercraft (e.g. kayaks, windsurfing, dinghies)	Diving and snorkelling
Introduction of light	No interaction likely	No interaction likely	N/A	No interaction likely
Hydrocarbon & PAH contamination	No interaction likely	No interaction likely	N/A	No interaction likely
Litter	No interaction likely	No interaction likely	N/A	No interaction likely
Synthetic compound contamination (incl. pesticides, antifoulants, pharmaceuticals)	No interaction likely	No interaction likely	N/A	No interaction likely
Transition elements & organo-metal (e.g. TBT) contamination	No interaction likely	No interaction likely	N/A	No interaction likely
Organic enrichment	No interaction likely	N/A	N/A	N/A
Penetration and/or disturbance of the substratum below the surface of the seabed, including abrasion	Significant alone in Part B	No interaction likely	N/A	No interaction likely
Introduction or spread of invasive non-	No interaction likely	No interaction likely	N/A	No interaction likely

indigenous species (INIS)				
Visual disturbance	No interaction likely	No interaction likely	N/A	No interaction likely
Underwater noise changes	N/A	No interaction likely	N/A	No interaction likely
Abrasion/disturbance of the substrate on the surface of the seabed	Significant alone in Part B	Possible interaction – discussed in section 5.1.1	N/A	Possible interaction – discussed in section 5.1.1
Physical change (to another sediment type)	Significant alone in Part B	N/A	N/A	N/A

Table 21: Summary of activity/pressure interactions included in in-combination assessment for seagrass beds.

Potential pressures	Powerboating or sailing with an engine: mooring and/or anchoring **and** Sailing without an engine: mooring and/or anchoring	Powerboating or sailing with an engine: launching and recovery, participation **and** Sailing without an engine: launching and recovery, participation	Non-motorised watercraft (e.g. kayaks, windsurfing, dinghies)	Diving and snorkelling
Introduction of light	No interaction likely	No interaction likely	N/A	No interaction likely
Hydrocarbon & PAH contamination	No interaction likely	No interaction likely	N/A	No interaction likely
Litter	No interaction likely	No interaction likely	No interaction likely	No interaction likely
Synthetic compound contamination (incl. pesticides, antifoulants, pharmaceuticals)	No interaction likely	No interaction likely	N/A	No interaction likely

Transition elements & organo-metal (e.g. TBT) contamination	No interaction likely	No interaction likely	N/A	No interaction likely
Organic enrichment	No interaction likely	N/A	N/A	N/A
Penetration and/or disturbance of the substratum below the surface of the seabed, including abrasion	Significant alone in Part B	No interaction likely	No interaction likely	No interaction likely
Introduction or spread of invasive non-indigenous species (INIS)	No interaction likely	No interaction likely	No interaction likely	No interaction likely
Abrasion/disturbance of the substrate on the surface of the seabed	Significant alone in Part B	Significant alone in Part B	Possible interaction – discussed in section 5.1.1	
Physical change (to another sediment type)	Significant alone in Part B	N/A	N/A	N/A

Table 22: Summary of activity/pressure interactions included in in-combination assessment for long-snouted seahorse.

Potential pressures	Powerboating or sailing with an engine: mooring and/or anchoring **and** Sailing without an engine: mooring and/or anchoring	Powerboating or sailing with an engine: launching and recovery, participation	Sailing without an engine: launching and recovery, participation	Non-motorised watercraft (e.g. kayaks, windsurfing, dinghies)	Diving and snorkelling
Hydrocarbon & PAH contamination	No interaction likely	No interaction likely	No interaction likely	N/A	No interaction likely

Litter	No interaction likely	No interaction likely	No interaction likely	N/A	No interaction likely
Synthetic compound contamination (incl. pesticides, antifoulants, pharmaceuticals)	No interaction likely	No interaction likely	No interaction likely	N/A	No interaction likely
Transition elements & organo-metal (e.g. TBT) contamination	No interaction likely	No interaction likely	No interaction likely	N/A	No interaction likely
Underwater noise changes	Significant alone in Part B.	Significant alone in Part B	No interaction likely	N/A	No interaction likely
Visual disturbance	Significant alone in Part B.	Significant alone in Part B.	Significant alone in Part B.	N/A	Significant alone in Part B
Introduction or spread of invasive non-indigenous species (INIS)	No interaction likely	No interaction likely	No interaction likely	N/A	No interaction likely
Abrasion/disturbance of the substrate on the surface of the seabed	Significant alone in Part B	Possible interaction – discussed in section 5.1.1	Possible interaction – discussed in section 5.1.1	N/A	Possible interaction – discussed in section 5.1.1
Collision BELOW water with static or moving objects not naturally found in the marine environment	N/A	No interaction likely	No interaction likely	N/A	No interaction likely

5.1.1 Abrasion/disturbance of the substrate on the surface of the seabed

Diving may cause in-combination impacts via abrasion or disturbance of the substrate for subtidal sand, seagrass beds and long-snouted seahorse. It is assumed that the abrasion and disturbance pressure related to long-snouted seahorse is for the supporting habitats. Snorkelling is not considered a risk via this pressure as participants in this activity do not spend long periods of time on the seabed.

Divers could disturb the substrate during dives by placing a body part or equipment on the features. However, best practice measures such as those outlined below by the Seahorse Trust[32] will reduce the amount of disturbance occurring:

- Maintain good buoyancy control - by swimming just above the seagrass and the seabed and avoiding trailing themselves and their gear in the substrate, divers reduce disturbance to the soft sediments and the seagrass.
- Keep diving gear tidy- attach loose hoses, survey equipment and other dive gear securely. This will also avoid damage to the habitat as well preventing equipment loss which adds to the marine litter.
- Avoid sharp, sudden changes in direction when in the seagrass- fins and the wash created by them can stir up the sediment and potentially damage the seagrass. When in the habitat, change direction slowly and kick gently. Moving with care will also help maintain the visibility.
- Do not pull at or hold onto the seagrass, even if you are drifting. If you need to slow down or stop, brace yourself gently on the seabed and settle carefully.

The amount of diving activity taking place within the MCZ is currently unknown, but any impacts via abrasion are likely to minimal and highly localised.

The launching and recovery of powerboats, sailing boats and non-motorised watercraft generally occurs on the shoreline or slipway, away from the sensitive features of the site so abrasion/disturbance impacts are likely to be minimal. Underway craft are also unlikely to have a significant interaction with sensitive site features via abrasion/disturbance.

The MMO concludes that the pressure from the remaining marine non-licensable activities in combination is compatible with the conservation objectives of the site.

5.2 Pressures exerted by marine non-licensable activities and plans or projects

This section assesses pressures exerted by marine non-licensable activities and plans or projects in combination.

The MMO SPIRIT (Spatial InfoRmatIon Toolkit) system was used to check regulated

[32] https://www.theseahorsetrust.org/pdf/Diving_protocol_for_seahorse_seagrass_surveys_KD_3.pdf

and unregulated activities that occur within the site, where there could be a pathway for disturbance. These activities are displayed in **Table 23**.

Table 23: Licensed activities considered in-combination with marine non-licensable activities included in this assessment.

Relevant activity	Description	Features where a pathway exists
Diving	Wildlife licences for surveying seahorses by diving.	Subtidal sand, seagrass beds, long-snouted seahorse
Eco-moorings	Marine licence for ten eco-moorings in Studland Bay (installation due at the time of this assessment).	Seagrass beds, intertidal coarse sediment

There are currently three wildlife licences for surveying seahorses or seagrass beds by diving licensed across English waters (0-12 nm) which include Studland Bay MCZ. These activities have the same pressures and possible interaction as diving, as outlined in section 5.1.1. They also have the following licence condition: diving practices outlined in the Seahorses and Sea-grass Diving Protocol[30] published by The Seahorse Trust must be adhered to during all filming dives.

For the licensed eco-moorings, a list of pressures has been collated and only those pressures that are relevant to both marine non-licensable activities and the licensed activity have been discussed below. Pressures from the licensed activity that are not associated with marine non-licensable activities are not within the scope of this assessment. From these considerations, Table 24 details the pressures exerted by the licensed eco-moorings and marine non-licensable activities.

Table 24: Pressures exerted by licensed eco-moorings and marine non-licensable activities occurring in Studland Bay MCZ. Pressures exerted by licensed and marine non-licensable activities requiring further assessment are highlighted in red.

Potential pressures	Exerted by licensed eco-moorings	Exerted by diving, snorkelling, powerboating and sailing with/without an engine (launching, recovery and participation)
Abrasion/disturbance of the substrate on the surface of the seabed	Y	Y
Penetration and/or disturbance of the substratum below the surface of the seabed, including abrasion	Y	Y
Changes in suspended solids (water clarity)	Y	N
Introduction of light	Y	Y
Introduction or spread of invasive non-indigenous species (INIS)	Y	Y
Organic enrichment	Y	Y
Physical change (to another sediment type)	Y	Y
Physical loss (to land or freshwater habitat)	N	N
Smothering and siltation rate changes (Light)	Y	N
Water flow (tidal current) changes, including sediment transport considerations	Y	N

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

Marine non-licensable activities and the licensed eco-moorings have the potential to impact seagrass beds through abrasion/disturbance of the substrate on the surface of the seabed. Studland bay is popular with recreational vessels who use the bay to moor their vessels especially in the summer. As a result of this, the seagrass beds currently experience abrasion and disturbance from these vessels. The licensed eco moorings will provide ten positions for vessels to moor, negating the use of their own anchors. The mooring lines are suspended in the water by way of an elastomer riser

and a buoy at the top to prevent the mooring lines scouring the seafloor below during low tides. The eco-moorings will provide additional moorings for vessels using the Bay, thus reducing the need for anchoring which in turn will reduce the damage to the seagrass beds. Therefore, an in-combination effect with pressures caused by marine non-licensable activities is not likely.

The MMO conclude that the abrasion/disturbance pressure associated with marine non-licensable activities, in combination with the plans/projects occurring in the site, are compatible with the conservation objectives of the site.

5.2.2 Penetration and/or disturbance of the substratum below the surface of the seabed, including abrasion

Marine non-licensable activities and the licensed eco-moorings have the potential to impact seagrass beds through penetration and/or disturbance of the substratum below the surface of the seabed, including abrasion. There will be penetration, abrasion, and disturbance of the substrate and substratum during the initial placement of the eco-mooring anchors, however, there is not expected to be any during the operation of the eco-moorings. Therefore, an in-combination effect with pressures caused by marine non-licensable activities is not likely.

The MMO conclude that the penetration/disturbance pressure associated with marine non-licensable activities, in combination with the plans/projects occurring in the site, are compatible with the conservation objectives of the site.

5.2.3 Introduction of light

Marine non-licensable activities and the licensed eco-moorings have the potential to impact seagrass beds through introduction of light. The planned schedule of works is for the ten eco-moorings to be placed over five days dependent on the weather, this will be carried out in daylight so there is no risk from the introduction of light on the MCZ. Therefore, an in-combination effect with pressures caused by marine non-licensable activities is not likely.

The MMO conclude that the introduction of light pressure associated with marine non-licensable activities, in combination with the plans/projects occurring in the site, are compatible with the conservation objectives of the site.

5.2.4 Introduction or spread of invasive non-indigenous species (INIS)

Marine non-licensable activities and the licensed eco-moorings have the potential to impact seagrass beds through INIS. The installation of the eco-moorings will be undertaken by divers operating from a small workboat, there is unlikely to be any risk from the introduction or spread of INIS in the area as a result of the works. Whilst the moorings do provide a surface for colonisation by INIS, the divers following the check, clean, dry process will reduce the risk of INIS being introduced as a result of the installation. Therefore, an in-combination effect with pressures caused by marine non-licensable activities is not likely.

The MMO conclude that the introduction or spread of INIS pressure associated with marine non-licensable activities, in combination with the plans/projects occurring in the site, are compatible with the conservation objectives of the site.

5.2.5 Organic enrichment

Marine non-licensable activities and the licensed eco-moorings have the potential to impact seagrass beds through organic enrichment. The proposal to place ten eco-moorings is unlikely to lead to a significant increase in nutrient enrichment, using the advice on operations matrix for anchorages/mooring, the examples given as sources of nutrient enrichment are not part of the proposal. Therefore, an in-combination effect with pressures caused by marine non-licensable activities is not likely.

The MMO conclude that the organic enrichment pressure associated with marine non-licensable activities, in combination with the plans/projects occurring in the site, are compatible with the conservation objectives of the site.

5.2.6 Physical change (to another sediment type)

Marine non-licensable activities and the licensed eco-moorings have the potential to impact seagrass beds and intertidal coarse sediment through physical change (to another sediment type). The location of the proposed moorings is not in an area of mapped intertidal coarse sediment, there will be no interaction between the proposed moorings and this feature. With regards to seagrass beds, other than the area immediately where the anchoring rods for the eco-moorings are to be placed, there is not expected to be any impact to the sediments beneath. Therefore, an in-combination effect with pressures caused by marine non-licensable activities is not likely.

The MMO conclude that the physical change (to another sediment type) pressure associated with marine non-licensable activities, in combination with the plans/projects occurring in the site, are compatible with the conservation objectives of the site.

5.3 Pressures exerted by marine non-licensable activities and fishing activity

This section assesses pressures exerted by marine non-licensable activities and fishing in combination.

Expert opinion by Southern IFCA suggested that limited levels of potting and netting may occur in the MCZ. Table 25 outlines the activity/pressure interactions which are included in the in-combination assessment.

Table 25: Pressures exerted by fishing and marine non-licensable activities occurring in Studland Bay MCZ. Pressures exerted by fishing and marine non-licensable activities requiring further assessment are highlighted in red.

Potential pressures	Traps	Anchored nets/lines	Exerted by diving, snorkelling, powerboating and sailing with/without an engine (launching, recovery and participation)
Abrasion/disturbance of the substrate on the surface of the seabed	Y	Y	Y
Removal of target species	Y	Y	N
Removal of non-target species	Y	Y	N

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

Expert opinion from Southern IFCA states that there is limited pot fishing activity in Studland Bay MCZ. Activity levels are very low due to the risk of losing gear because of the amount of boats which anchor in Studland bay throughout the summer, and there is also minimal gain in the site due to most of the site being very shallow, tidal and sandy and not ideal potting habitat.

One vessel has been known to set a very small number of crab and lobster pots on the fringes of the site to the north along the 'Training Bank'. This is a bank of rocks laid from the end of Studland peninsula to the north of the bay, forming an underwater barrier which directs currents to stop sand collecting in Poole Harbour (Bird, 1995). The 'Training Bank' is located outside the MCZ. Crab and lobster potting is more likely to occur where the reef features begin around Old Harry Rocks to the far south of the Bay.

There are also very low activity levels for netting due to the reasons outlined above. Based on local knowledge, fishers might use fixed nets (for flat fish and other species) in the site with the potential for up to six small inshore vessels occasionally working in the area. Due to the shallow nature of the site, netting is more likely to take place on the fringes.

Due to the very low activity levels of potting and netting taking place, and the likelihood that the activities will take place on the fringes of the MCZ away from the most sensitive long-snouted seahorse and seagrass features, **the MMO conclude that the pressure from fishing activity in combination with marine non-licensable activity is not likely to cause a significant risk of hindering the achievement of the site's conservation objectives.**

5.4 Pressures exerted by marine non-licensable activities, plans or projects and fishing

This section assesses pressures exerted by marine non-licensable activities, plans or projects and fishing in combination. Abrasion/disturbance of the substrate on the surface of the seabed is the only pressure exerted and requiring further assessment for the marine non-licensable activities, plans or projects and fishing activities discussed in this section.

As discussed above, licensed activities occurring within the site include diving and eco-moorings. The impacts of these activities are managed through the wildlife licensing and marine licensing process, therefore minimising the pressure via abrasion/disturbance applied to the site. Fishing activity occurs at very low levels and away from sensitive features of the MCZ so impacts via abrasion/disturbance are likely to be very low. Therefore, the abrasion/disturbance pressure exerted by licensed activities and fishing activities in combination with marine non-licensable activities is unlikely to cause a significant risk of hindering the achievement of the site's conservation objectives.

The MMO conclude that the abrasion/disturbance pressure associated with marine non-licensable activities, plans/projects and fishing within the site in combination, is compatible with the conservation objectives of the site.

5.5 Part C conclusion

Taking into account options for introducing management for anchoring (outlined in section 7), the MMO conclude that remaining marine non-licensable activities, in-combination with licensed and fishing activities, are not likely to cause a significant risk of hindering the achievement of the site's conservation objectives.

6. Assessment result

6.1 Marine non-licensable activity alone

Due to the management of the installation of moorings through the marine licensing process, mooring activities alone are not capable of affecting (other than insignificantly) seagrass, subtidal sand, intertidal coarse sediment and long-snouted seahorse features and will not cause a significant risk of hindering the achievement of the site's conservation objectives.

Powerboating or sailing with an engine (launching and recovery, participation) activities alone are not capable of affecting (other than insignificantly) seagrass and long-snouted seahorse features and will not cause a significant risk of hindering the achievement of the site's conservation objectives.

Sailing without an engine (launching and recovery, participation) activities alone are not capable of affecting (other than insignificantly) long-snouted seahorse and will not cause a significant risk of hindering the achievement of the site's conservation objectives.

Diving and snorkelling activities alone are not capable of affecting (other than insignificantly) long-snouted seahorse features and will not cause a significant risk of hindering the achievement of the site's conservation objectives.

Anchoring activities alone are capable of affecting (other than insignificantly) subtidal sand, seagrass and long-snouted seahorse features of the site and cause a significant risk of hindering the achievement of the site's conservation objectives.

The MMO conclude that management measures are required to exclude these pressures from Studland Bay MCZ.

Section 7 contains further details of the proposed management measures.

6.2 In-combination

The MMO consider that whilst there is a pathway for disturbance by anchoring, the following in-combination factors are not sufficient to affect (other than insignificantly) the features of the site and will not cause a significant risk of hindering the achievement of the site's conservation objectives:

- All marine non-licensable activities and all pressures combined;
- All marine non-licensable activities in-combination with fishing and existing licenced activity within the site.

7. Management options

Option 1: No additional management. Introduce a monitoring and control plan within the site.

Option 2: Voluntary no anchor zone(s).

Option 3: Statutory no anchor zone(s).

Option 4: Prohibition of anchoring in all areas of the site.

Management option 1 is not sufficient to protect Studland Bay MCZ due to the levels of anchoring activity occurring at the site, as well as the evidence for the damage caused by anchoring on the features of the site.

Management option 4 has not been taken forward because the impacted features occur in one area of the site. Therefore, a zoned approach is sufficient to meet the conservation objectives.

Management option 2 has been decided as the appropriate option for managing anchoring. This option will reduce/limit the pressures caused by anchoring activity within the MCZ in order to meet the conservation objectives of the site. A voluntary approach has been decided over management option 3 due to the nature of anchoring activity in the MCZ and the associated benefits of a participatory approach. A statutory measure may be considered if necessary, in the future, subject to monitoring of the voluntary measure. More information about considerations

involved in moving to a statutory measure can be found in the Studland Bay MCZ Habitat Protection Strategy.[33]

Marine Plans

Studland Bay MCZ lies within the South Marine Plan Area. The South Marine Plans[34] were adopted in 2018. The decision in this assessment is compliant and made in accordance with relevant policies.

8. Review of this assessment

MMO will review this assessment every five years or earlier if significant new information is received.

Such information could include:

- updated conservation advice;
- updated advice on the condition of the feature; and/or
- significant change in activity levels.

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

Monitoring of activity levels will occur through a combination of MMO MPA inspections, ongoing monitoring of marine non-licensable activity data and consideration of new sources of data. This occurs on an annual basis. Should activity levels increase significantly or in a manner that could affect the site's features, this will trigger further investigation into the level and distribution of the activity, including consultation with Natural England regarding current site condition. Any subsequent evidence gathered would be used to assess the need for further management measures.

Possible management measures include an MMO emergency byelaw, which can be implemented immediately for up to 12 months, or a (non-emergency) MMO byelaw which would be subject to public consultation before implementation.

An overview of the monitoring and control process is illustrated in Annex 4.

9. Conclusion

The MMO has had regard to best available evidence and through consultation with relevant advisors and the public, conclude that, provided that the appropriate management measures for the marine non-licensable activities identified above are

[33] Studland Bay MCZ Habitat Protection Strategy – available online.
[34] http://www.gov.uk/government/collections/south-marine-plans

implemented, all remaining marine non-licensable activities are compatible with the conservation objectives of this marine protected area.

10. References

Anderson, P.A., Berzins, I.K., Fogarty, F., Hamlin, H.J. and Guillette, L.J. (2011). Sound, stress, and seahorses: The consequences of a noisy environment to animal health. *Aquaculture*, 311, p129-138.

Asplund, T.R. (2000). The effects of motorized watercraft on aquatic ecosystems: Wisconsin Department of Natural Resources, Bureau of Integrated Science Services.

Axelsson, M., Allen, C. and Dewey, S. (2012). Survey and monitoring of seagrass beds at Studland Bay, Dorset – second seagrass monitoring report. Seastar Survey Ltd, Report to The Crown Estate and Natural England.

Bird, E. (1995). Geology and Scenery of Dorset. Ex Libris Press, 1. The Shambles, Bradford on Avon, Wiltshire. 207 pp. ISBN 0 948578 72 6.

Boese, B.L., Kaldy, J.E., Clinton, P.J., Eldridge, P.M and Folger, C.L. (2009). Recolonization of intertidal *Zostera marina* L. (eelgrass) following experimental shoot removal. *Journal of Experimental Marine Biology and Ecology.* 374, p69-77.

Bourque, A.S., Kenworthy, W.J., and Fourqurean, J.W. (2015). Impacts of physical disturbance on ecosystem structure in subtropical seagrass meadows. *Marine Ecology Progress Series,* 540, p27-41.

Bowden, D.A., Rowden, A.A. and Attrill, M.J. (2001). Effect of patch size and in-patch location on the infaunal macroinvertebrate assemblages of *Zostera marina* seagrass beds. *Journal of Experimental Marine Biology and Ecology.* 259, p133-154.

Claassens, L. and Hodgson, A.N. (2017). Gaining insights into in situ behaviour of an endangered seahorse using action cameras. *Journal of Zoology*, 304(2), p98-108.

Collins, K.J., Suonpaa, A.M. and Mallinson, J.J. (2010). The impacts of anchoring and mooring in seagrass, Studland Bay, Dorset, UK. *International Journal of the Society for Underwater Technology*, 29(3), p117-123.

Creed, J.C., Amado Filho, G.M. (1999). Disturbance and recovery of the macroflora of a seagrass (*Halodule wrightii Ascherson*) meadow in the Abrolhos Marine National Park, Brazil: an experimental evaluation of anchor damage. *Journal of Experimental Marine Biology and Ecology*, 235 (2), p285-306.

Critchley A.T., Nienhuis P.H., Verschuure K. (1987). Presence and development of populations of the introduced brown alga *Sargassum muticum* in the southwest Netherlands. *Hydrobiologia*, 151/152, p245-255

d'Avack, E.A.S., Tillin, H., Jackson, E.L. and Tyler-Walters, H. (2014). Assessing the sensitivity of seagrass bed biotopes to pressures associated with marine activities. JNCC Report No. 505. Peterborough, Joint Nature Conservation Committee.

Dawes, C. J. (1981). Marine Botany. Wiley, New York.

Dawes C.J., Andorfer, J., Rose, C., Uranowski, C. and Ehringer, N. (1997). Regrowth of the seagrass *Thalassia testudinum* into propeller scars. *Aquatic Botany,* 59, p139-155.

Demers, M., Davis, A. and Knott, N. (2013). A comparison of the impact of 'seagrass-friendly' boat mooring systems on *Posidonia australis. Marine Environmental Research*, 83, p.54-62.

den Hartog, C. (1997). Is *Sargassum* a threat to eelgrass beds? *Aquatic Botany*, 58, p37-41

Duarte, C. M., and Sand-Jensen, Y.K. (1990). Seagrass colonization: Patch formation and patch growth in *Cymodocea nodosa*. *Marine Ecology Progress Series,* 65, p193-200.

Duarte, C. and Krause-Jensen, D. (2017). Export from Seagrass Meadows Contributes to Marine Carbon Sequestration. *Frontiers in Marine Science*, 4.

Duarte, C. M., Marbã¡, N. Agawin, J. Cebrian, S. Enriquez, M. D. Fortes, M. E. Gallegos, M. Merino, B. Olesen, and K. Sand-Jensen. 1994. Reconstruction of seagrass dynamics: age determinations and associated tools for the seagrass ecologist. *Marine Ecology Progress Series,* 107, p195-195.

Erftemeijer, P. L. A., and Lewis, R. R. R. (2006). Environmental impacts of dredging on seagrasses: a review. *Marine Pollution Bulletin*, 52, p1553-1572.

Environment Agency (2018). Studland Bay Subtidal Seagrass Survey September 2018 - Summary Report: Environment Agency.

Garrick-Maidment, N., Durant, E. and Newman, J. (2013). Year 5 report on the Seahorse Tagging Project at South Beach, Studland Bay in Dorset run by The Seahorse Trust.

Garrick-Maidment N., Trewhella, S., Hatcher, J., Collins, K. and Mallison, J. (2010). Seahorse Tagging Project, Studland Bay, Dorset, UK. *Marine Biodiversity Records*, 3, p4.

Giglio, V., Ternes, M., Kassuga, A. and Ferreira, C. (2018). Scuba diving and sedentary fish watching: effects of photographer approach on seahorse behavior. *Journal of Ecotourism*, 18(2), p142-151.

Givernaud T., Cosson J., Givernaud-Mouradi A. (1989). Etude des populations de *Sargassum muticum* (Yendo) Fensholt sur les côtes de Basse-Narmandie (France). M. Elliot, J.-P. Ducrotoy (Eds.), *Estuarine and Coastal Sciences Association Symposium*, Caen, p129-132

Green, A., Chadwick, M. A. and Jones, P. J. S. (2018). Variability of UK seagrass sediment carbon: Implications for blue carbon estimates and marine conservation management. PLoS One, 13.

Griffiths, C.A., Langmead, O.A., Readman, J.A.J. and Tillin, H.M. (2017). Anchoring and mooring Impacts in English and Welsh Marine Protected Areas: Reviewing sensitivity, activity, risk and management. A report to Defra Impacts Evidence Group.

Hastings, K., Hesp, P. and Kendrick, G.A. (1995). Seagrass loss associated with boat moorings at Rottnest Island, Western Australia. *Ocean and Coastal Management*, 26, p225-246.

Hovel, K. A., Fonseca, M.S., Myer, D.L., Kenworthy, W.J. and Whitfield, P.E. (2002). Effects of seagrass landscape structure, structural complexity and hydrodynamic regime on macrofaunal densities in North Carolina seagrass beds. *Marine Ecology-Progress Series,* 243, p11-24.

Jackson, E. L., Attrill, M.J., Rowden, A.A. and Jones, M. (2006). Seagrass complexity hierarchies: influence on fish groups around the coast of Jersey (English Channel). *Journal of Experimental Marine Biology and Ecology,* 330, p38-54.

Jackson, E.L., Griffiths, C.A. and Durkin, O. (2013a). *A guide to assessing and managing anthropogenic impact on marine angiosperm habitat - Part 1: Literature review*. Natural England Commissioned Reports, Number 111.

Jackson, E. L., Griffiths, C. A. and Durkin, O. (2013b) A guide to assessing and managing anthropogenic impact on marine angiosperm habitat - Part 2: MAIA Interreg Study on Studland Bay (Currently unpublished): Natural England.

Kenworthy, W.J., Fonseca, M.S., Whitfield, P.E. and Hammerstrom, K.K. (2002). Analysis of seagrass recovery in experimental excavations and propeller-scar disturbances in the Florida Keys National Marine Sanctuary. *Journal of Coastal Research,* 37, p75-85.

Koch, E.W. (2002). Impact of boat-generated waves on a seagrass habitat. *Journal of Coastal Research*, 37, p66-74.

Lenihan, H.S., Oliver, J.S., Stephenson, M.A. (1990). Changes in hard bottom communities related to boat mooring and tributyltin in San Diego Bay: a natural experiment. *Marine Ecology Progress Series,* 60, p147-160.

Leung B., Lodge D.M., Finnoff D., Shogren J.F., Lewis M.A., Lamberti G. (2002).An ounce of prevention or a pound of cure: bioeconomic risk analysis of invasive species. *Proceedings of the Royal Society of London. Series B*, 269, p2407-2413

Lodge, D.M., Williams, S., MacIsaac, H.J., Hayes, K., Leung, B., Reichard, S., Mack, R.N., Moyle, P.B., Smith, M., Andow, D.A., Carlton, J.T., McMichael, A. (2006). Biological invasions: recommendations for US policy and management. *Ecological Applications*, 16, p2035-2054

Madley, K. Krolick, J and Sargent, B. (2004). Assessment of Boat Propeller Scar damage within the Greater Charlotte Harbor Region. Charlotte Harbour National Estuary Program. December 2004.

Marine Ecological Surveys Limited (MESL) (2013). Verification Survey of Intertidal Sediments within the Studland Bay rMCZ. Final Report - November 2013: Marine Ecological Surveys Limited (MESL).

MMO (2014a). Mapping UK Shipping Density and Routes from AIS. A report produced for the Marine Management Organisation, pp 35. MMO Project No: 1066. ISBN: 978-1-909452-26-8.

MMO (2014b). The effects of flash photography on UK seahorse species. London: The Marine Management Organisation.

Natural England (2017a) Natural England Evidence Information Note EIN027. Marine recreation evidence briefing: motorised watercraft. Available online.

Natural England (2017b) Natural England Evidence Information Note EIN028. Marine recreation evidence briefing: non-motorised watercraft including paddlesports. Available online.

Natural England (2017c) Natural England Evidence Information Note EIN036. Marine recreation evidence briefing: diving and snorkelling. Available online.

Natural England Conservation Advice for Marine Protected Areas Studland Bay MCZ - UKMCZ0072 Available online.

Neish, A.H. (2007). *Hippocampus guttulatus* Long-snouted seahorse. In Tyler-Walters H. and Hiscock K. (eds) Marine Life Information Network: Biology and Sensitivity Key Information Reviews, [online]. Plymouth: Marine Biological Association of the United Kingdom. Available online.

Oliveira, T. P. R., Ladich, F., Abed-Navandi, D., Souto, A. S., and Rosa, I. L. (2014). Sounds produced by the longsnout seahorse: A study of their structure and functions. *Journal of Zoology*, 294, p114–121.

Orth, R. J., M. Harwell, and G. Inglis. (2006). Ecology of seagrass seeds and seagrass dispersal processes. Pages 111-133. A.W.D. Larkum, R. J. Orth, and C. M. Duarte, editors. Seagrasses: Biology, Ecology and their Conservation. Springer.

Orth, R. J., K. L. Heck, and D. J. Tunbridge. (2002). Predation on seeds of the seagrass *Posidonia australis* in Western Australia. *Marine Ecology Progress Series,* 244, p81-88.

Paling, E. I., Van Keulen, M., Wheeler, K.D., Phillips, J., Dyhrberg, R. and Lord, D.A. (2001). Improving mechanical seagrass transplantation. *Ecological Engineering,* 18, p107-113.

Palma, J., Magalhães, M., Correia, M. and Andrade, J. (2019). Effects of anthropogenic noise as a source of acoustic stress in wild populations of *Hippocampus guttulatus* in the Ria Formosa, south Portugal. *Aquatic Conservation: Marine and Freshwater Ecosystems*, 29(5), p751-759.

Reusch T.B.H., Williams S.L. (1999). Macrophyte canopy structure and the success of an invasive marine bivalve. *Oikos*, 84, p398-416

Royal Haskoning (2010). Poole and Christchurch Bays SMP2 Subcell 5f: Review of Coastal Processes and Geomorphology. Appendix C Baseline Process Understanding.

Royal Haskoning. (2011). Poole and Christchurch Bays Shoreline Management Plan Review Sub-cell 5f Section 4. Policy Development Zone 3.

Salita, J. T., Ekau, W., and Saint-Paul, U. (2003). Field evidence on the influence of seagrass landscapes on fish abundance in Bolinao, northern Philippines. *Marine Ecology Progress* Series, 247, p183-195.

Saunders, C., Selwyn, J. Richardson, S. May, V., and Heeps, C. (2000). A review of the effects of recreational interactions within UK European marine sites: Countryside Council for Wales (UK Marine SACs Project).

Seasearch Dorset. (2014). FS 15: Studland Bay rMCZ Seasearch Site Surveys 2014: Seasearch.

Seasearch Dorset. (2015). FS 15: Studland Bay rMCZ Seasearch Site Surveys 2015: Seasearch.

Short, F.T. and Wyllie-Echeverria, S. (1996). Natural and human induced disturbances of seagrasses. *Environmental Conservation*, 23, p17-27

UKSeaMap. (2018). UKSeaMap 2018 [Online]. [Accessed by Natural England 21/11/2019].

Unsworth, R.K.F., Williams, B. L. and Cullen-Unsworth, L.C. (2017). Rocking the Boat: Damage to Eelgrass by Swinging Boat Moorings. *Frontiers in Plant Science*, 8.

Walker, D.I., Lukatelich, R.J., Bastyan, G., McComb, A.J., (1989). Effect of boat moorings on seagrass beds near Perth, Western Australia. *Aquatic Botany,* 36 (1), p69-77.

Williams, S. (2007). Introduced species in seagrass ecosystems: Status and concerns, *Journal of Experimental Marine Biology and Ecology*, 350(1–2), p89-110.

Zieman, J.C. (1976). The ecological effects of physical damage from motor boats on turtle grass beds in southern Florida. *Aquatic Botany,* 2, p127–139.

Annex 1 – MMO methodology

Assessment process

Marine non-licensable assessments have three stages:

Part A: A coarse assessment using generic sensitivity information to identify which marine non-licensable activities can be discounted from further assessment (Part B) as they are not taking place or not a significant concern.

Part B: An in-depth analysis to assess the effects of remaining pressures on the features of the site, and a pressure in-combination assessment.

Part C: An in-combination assessment between all activities occurring

Sources of evidence

Evidence used in the assessments falls into two broad categories:

1. Marine non-licensable activity information. This includes patterns, intensity and trends of marine non-licensable activities.

2. Ecological information, in particular the location, condition and sensitivity of designated features.

Marine non-licensable activity information

MPASum inspection data

MPASum inspections are carried out by MMO Marine Officers. This involves counting the occurrence of water-based activities within the site from a set location over 4 to 5 minutes. The following activities are recorded:

- Powerboats at anchor
- Yachts at anchor
- Powerboats on mooring
- Yachts on mooring
- Non-motorised watercraft
- Motorised Personal watercraft
- Vessels underway
- Scuba divers
- Swimmers and snorkelers

Alongside activity data, environmental conditions are recorded. This includes information on:

- Date
- Time
- Weather

- Temperature
- Sea state
- Wind force and direction

Figure 14 indicates the location from which inspections took place in Studland Bay MCZ.

Figure 14: Satellite map displaying the location from which MPASum inspections were carried out on South Beach in Studland Bay (50.6427° N, 1.9440° W). Source – Google Earth.

Automatic Identification System data

It is a legal requirement for vessels of 300 gross tonnage or more and all passenger vessels irrespective of size to have AIS installed. These vessels use AIS-A. Other vessels do not legally require AIS. AIS-B is a non-mandatory form of AIS typically used by small commercial craft, fishing vessels and recreational vessels (MMO, 2014a). To prevent overloading of the available bandwidth, transmission power is restricted to 2 Watts, giving a range of up to 10 nautical miles (MMO, 2014a). Information regarding use patterns by these types of craft from AIS sources alone will therefore significantly underplay the true frequency and use patterns (MMO, 2014a).

AIS transmits information which is manually input and therefore is only as reliable as the operator. As not all vessels are required to have AIS this data is likely to be an underrepresentation of the activity within the site.

AIS trackline data is processed by ABPmer and provided to the MMO up to 2017. AIS tracks for recreational vessels only was extracted and plotted for 2015-2017. This data also indicates the number of AIS tracks recorded per month.

Marine Traffic displays live AIS data. Marine Traffic indicates whether vessels are stationary or underway depending on the vessel speed. It can be assumed that stationary vessels indicated by AIS data are anchored or moored. Live AIS data from Marine Traffic was used to count the number of vessels that were stationary over the seagrass feature at different times during the summer period in 2020.

Expert opinion

Expert opinion provided by MMO coastal and IFCA officers. MMO may provide additional information and intelligence on the marine non-licensable activities happening within the site to support MPASum inspections. IFCA officers provide information on the fishing activities within the site which includes information on number and size of vessels fishing, target species, type and amount of fishing gear used and seasonal trends in activity.

Stakeholder responses during MMO call for evidence

A call for evidence was carried out for Studland Bay MCZ between 28 October and 15 December 2020. This sought evidence and views from stakeholders on the features and activity in the site, as well as on proposed management measures.

Studland Bay MCZ Mooring Survey

Southern IFCA carried out a moorings survey in Studland Bay MCZ on 2 June 2021 which was commissioned by the MMO. This survey recorded the positions of surface marked fixed moorings and other surface marker buoys in Studland Bay MCZ.

MMO1243 – High Priority Non-Licensable Activities in MPAs

ABPmer were contracted by the MMO to carry out this project to identify, collate and validate marine non-licensable activity data for a number of selected MPAs, including Studland Bay MCZ.

Ecological information

The fisheries assessments use the conservation advice packages produced by Natural England and the Joint Nature Conservation Committee. These provide information on the features of the site, their area and conditions. The packages also contain an advice on operations and supplementary advice documents which allow the assessment of which pressure/gear combinations a feature may be sensitive too.

For some assessments, further ecological information has also been provided by Natural England. This information is available in the relevant assessments.

Sensitivity and vulnerability

The following definitions of sensitivity and vulnerability are used in MMO assessments.

Sensitivity is defined as:
a measure of tolerance (or intolerance) to changes in environmental conditions.[35]

Vulnerability is defined as:
a combination of the sensitivity of a feature to a particular pressure/activity, and its exposure to that pressure/activity.

[35] Tilin *et al.,* 2010; Roberts *et al.,* 2010

Annex 2 – AIS data

Table 26: Stationary AIS points recorded within Studland Bay MCZ and over seagrass feature. Source - Marine Traffic.

Date	Max. daily air temperature (°C)	Max. daily wind speed (mph)	Day	Time	Count AIS (stationary)	
					Studland MCZ	Seagrass feature
11/07/2020	23	Unknown	Saturday	06:40	24	20
14/07/2020	22	12	Tuesday	09:00	7	6
				13:00	6	5
				18:00	11	10
15/07/2020	20	11	Wednesday	09:00	9	8
				13:00	8	7
				18:00	8	6
16/07/2020	25	11	Thursday	09:00	10	8
				13:00	14	13
				18:00	11	9
17/07/20	26	13	Friday	09:00	5	3
				13:00	19	17
				18:00	26	22
18/07/20	22	13	Saturday	09:00	17	15
				13:00	17	15
				18:00	19	17
19/07/20	21	9	Sunday	09:00	15	14
				13:00	6	4
				18:00	11	10
20/07/20	23	9	Monday	09:00	7	6
				13:00	12	9
				18:00	28	22
21/07/20	22	8	Tuesday	09:00	23	20
				13:00	18	16
				18:00	20	17
22/07/20	22	12	Wednesday	09:00	15	12
				13:00	18	13
				18:00	21	18
23/07/20	23	14	Thursday	09:00	9	8
				13:00	5	5
				18:00	16	14
24/07/20	24	14	Friday	09:00	14	12
				13:00	7	7
				18:00	6	3
25/07/20	19	12	Saturday	09:00	6	7
				13:00	8	9
				18:00	10	11
26/07/20	21	17	Sunday	09:00	6	5
				13:00	1	1
				18:00	1	1

Annex 3 – MPASum Inspection data

Table 27: Results of MPASum inspections for Studland Bay MCZ showing count data for marine non-licensable activities.

Date	Time	Weather	Air temperature (°C)	Sea state	Wind force & direction	Anchored vessels		Moored vessels		Non-motorised watercraft	Motorised Personal watercraft	Vessels underway	Scuba divers	Swimmers and snorkelers
						Powerboats	Yachts	Powerboats	Yachts					
01/06/20 Monday	1650	Sunny	22	Calm	F2 ESE	15	5	0	0	5	1	0	0	12
06/06/20 Saturday	0900	Light cloud	12	Calm	F3 W	0	0	0	0	0	0	0	0	1
19/06/20 Friday	1045	Overcast	16	Moderate	F5 WSW	0	5	0	0	0	0	0	0	0
25/06/20 Thursday	0930	Sunny	22	Calm	F2 E	8	2	6	0	8	2	0	0	18
25/06/20 Thursday	1240	Sunny	28	Calm	F2 E	52	11	9	0	23	4	0	0	30
28/06/20 Sunday	0900-1010	Sunny intervals	16	Slight	F4 WSW	0	0	1	0	5	1	0	0	9
07/07/20 Tuesday	1600	Light cloud	18	Slight	F5 SW	16	15	1	9	4	1	1	0	6
09/07/20 Thursday	1100	Warm but overcast	16	Calm	F17 SW	14	5	0	0	2	0	2	0	2
11/07/20 Saturday	0830	Sunny	16	Calm	F2 SW	3	49	1	4	8	0	0	0	4

11/07/20 Saturday	1030	Sunny	19	Calm	F2 SW	17	52	0	3	26	3	5	4	40
12/07/20 Sunday	1200	Sunny	20	Calm	F2 SSE	65	58	2	4	57	5	7	0	100
17/07/20 Friday	1225	Overcast	20	Calm	F3 NNW	17	29	3	4	24	5	4	1 *	33
20/07/20 Monday	0945	Sunny	17	Calm	F2 SW	4	35	0	5	27	0	0	0	6
10/08/20 Monday	1215	Sun, light cloud and hot	25	Calm	F1SSW	26	18	2	3	12	4	7	0	52

* 1 flagged dive boat (no. divers unknown)

Annex 4 - Monitoring and Control Process

Figure 15: Monitoring and control process