Selsey Bill and the Hounds MCZ Drop-Down Camera and Grab Surveys 2023

Field Report

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Foreword

There are several legislative and policy drivers which underpin the need to monitor, assess and report upon habitats and species within the marine environment. Marine monitoring activity in Natural England therefore takes place in the context of the wider UK approach under the UK Marine Monitoring and Assessment Strategy. The overarching monitoring strategy describes two main functions of monitoring:

- To identify state and changes in state for an ecological component of biodiversity, and identify whether changes are due to natural change or as a result of anthropogenic activities,
- Information provided through this contract will inform the need for management measures; and to identify if management measures already in place are effective in meeting their objectives.

Following a prioritization process Selsey Bill & the Hounds MCZ has been selected for a survey which will contribute to evidence gathering to support condition assessment for the MCZ.

Natural England commission a range of reports from external contractors to provide evidence and advice to assist us in delivering our duties. The views in this report are those of the authors and do not necessarily represent those of Natural England.

Executive summary

Selsey Bill and the Hounds Marine Conservation Zone (MCZ) was designated in 2019 under the third tranche of MCZ designations. Following a prioritization process, Selsey Bill and the Hounds MCZ was selected for a survey that will contribute to evidence gathering to support condition assessment for the MCZ. Seastar Survey Ltd. was contracted by Natural England to undertake a drop-down camera and grab sampling survey of Selsey Bill and the Hounds MCZ. The survey was conducted in September 2023.

A total of 22 camera transects were completed, yielding 4 hours and 21 minutes of analysable footage and 376 still images. Grab sampling was attempted at 19 stations, with samples for macrobenthic invertebrate analysis successfully collected at 16 stations and samples for particle size analysis successfully collected at 17 stations. Due to the coarse nature of the substrate in the east of the MCZ, grab sampling was restricted to areas of soft sediment in the west of the MCZ around the Hounds, 'Streets' and 'Grounds' areas.

The underwater imagery data analysis results indicated that the seabed within the MCZ was fairly heterogenous, with a total of 16 biotopes identified. The west of the MCZ, including the area around the Hounds, was found to be composed of a mixture of mobile rippled sands and soft bored flat bedrock with sparse and/or patchy biota. By contrast, the east of the survey area was generally characterised by coarse sediments (gravel and pebbles) featuring dense seaweed communities. The centre of the MCZ was more patchy, with seaweed communities on sediment-affected rock, sands and mixed sediments all recorded.

The grab samples were characterised by medium to very fine sands and gravels. Around the Hounds, samples were characterised by the species *Iphinoe trispinosa* and *Chaetozone setosa*, while communities in samples from the central region of the MCZ were generally impoverished. A total of six soft sediment biotopes were identified following sample analysis.

Several habitats of conservation interest were identified. Subtidal sands and gravels were widespread throughout the MCZ. Blue mussel (*Mytilus edulis*) beds were identified at a single station in the inshore region of the MCZ, and patchy clay exposures were recorded at two stations. Annex I reef features were present either as flat bedrock or as areas of cobbles overlying soft sediments. Undulate skate, *Raja undulata*, a species of conservation interest, was identified from video footage at two sampling locations.

The results of all aspects of the analysis were mapped using ArcGIS to illustrate the distribution of the different habitats identified, however due to a lack of suitable acoustic data habitat maps could not be produced. It is strongly recommended that additional survey work is conducted as soon as possible to remedy this and to enable future monitoring of potential changes in the range, distribution and extent of the habitats and biotopes present in the MCZ. Despite this, the data collected and analysed as part of the 2023 survey are suitable for use as a baseline dataset against which potential future

changes can be measured, which will enable monitoring of the condition of the habitat features of conservation interest for which the MCZ was designated.

Contents

Introduction

There are several legislative and policy drivers which underpin the need to monitor, assess and report upon habitats and species within the marine environment. Marine monitoring activity at Natural England therefore takes place in the context of the wider UK approach under the UK Marine Monitoring and Assessment Strategy. The overarching monitoring strategy describes two main functions of monitoring:

- To identify state and changes in state for an ecological component of biodiversity, and identify whether changes are due to natural change or as a result of anthropogenic activities, and;
- To identify the need for management measures, and to identify if management measures already in place are effective in meeting their objectives.

Marine Conservation Zones (MCZs), together with other types of marine protected areas, will form the UK contribution to an international network of protected sites in the northeast Atlantic. The network will help to deliver the government's vision of clean, healthy, safe, productive and biologically diverse oceans and seas. MCZs protect typical, rare or declining habitats and species found in our seas.

Following a prioritization process, Selsey Bill and the Hounds MCZ was selected for a survey that will contribute to evidence gathering to support condition assessment for the MCZ.

Site description

Selsey Bill and the Hounds MCZ was designated in 2019 under the third tranche of MCZ designations. The site is located along the coast of the eastern English Channel and covers an area of ~16 km^2. The MCZ lies along the Manhood Peninsular between Chichester Harbour in the west and Pagham Harbour in the east and extends seaward to include the offshore rocky outcrops that make up 'the Hounds.'

The seabed within the MCZ mainly consists of moderate or low energy infralittoral rock, subtidal sand, and subtidal mixed sediments, however, the site also protects one of the best examples of peat and clay exposures on the southeast coast. The eastern regions of the MCZ are generally characterized by mixed sediments and subtidal sand.

Selsey Bill is well known for its high biodiversity and species richness, owing to the wide variety of habitats present and unusual seabed topography. In the southeast of the site is the Mixon Hole, characterised by a drowned river gorge kept open by strong tidal currents, and which boasts a dramatic 20 m drop in the seafloor exposing clay cliffs capped with limestone and supporting a rich diversity of habitats and species. The rocky exposures along the site that make up 'the Hounds' are dominated by dense red algae and mixed

animal turf, while the underlying clay provides habitat for mobile species such as edible crabs and spider crabs.

The MCZ hosts the following qualifying features of conservation interest which are the subject of the monitoring program:

- Bracklesham Bay geological feature;
- High Energy Infralittoral Rock;
- Moderate Energy Infralittoral Rock;
- Low Energy Infralittoral Rock;
- Moderate Energy Circalittoral Rock;
- Subtidal Sand;
- Subtidal Mixed Sediments, and;
- Peat and Clay Exposures.

The general management approach for the Bracklesham Bay geological feature and the subtidal sand and mixed sediment habitats to maintain these feature in a favourable condition; the aim for the five remaining habitat features is to recover these to a favourable condition. Favourable Conservation Status Definitions - TIN180 (naturalengland.org.uk)

Survey aims and objectives

In 2023 Natural England contracted Seastar Survey Ltd. ('Seastar') to undertake a drop-down camera and grab sampling survey of Selsey Bill and the Hounds MCZ. The objectives of the survey were:

- To acquire high quality underwater imagery data sufficient to verify the extent and distribution of subtidal rock habitats, and to determine the main characterising species present within these habitats in order that spatial and temporal comparisons can be made, as far as possible, with previous data collected using diving methods;
- To acquire and analyse sediment grab samples in order to provide high quality biological and sediment granulometry data of suitable resolution to enable temporal and spatial variability in the sediment broadscale habitat (BSH) extent, distribution and community structure to be determined;
- To identify and map the subtidal communities identified using grab and drop-down video (DDV) methods to the highest possible EUNIS level and compare, where possible, to previous habitat maps of the site in order highlight any significant changes;
- To identify and record the abundance and location of non-indigenous species (NIS) wherever encountered during surveys, and;
- To derive, where possible, any changes in condition of the subtidal sedimentary and rock habitats and the communities they support and form part of an ongoing time-series of data.

This report details the survey and analysis methods used, the results of the analysis of the acquired data, and a brief discussion of the findings.

Methodology

Sampling strategy

One of the objectives of the 2023 survey was to collect samples which would enable direct comparisons with previous datasets. To this aim, it was intended that sampling locations attempted in a previous grab survey conducted by the Environment Agency in 2014 (Godsell and Miller, 2016) would be repeated. The positions of the 20 sampling locations attempted in 2014 were therefore entered into Hypack survey management software and viewed superimposed on Admiralty charts to determine whether the sampling locations were feasible. Where potential issues were identified (e.g. if the original sampling location was in the intertidal or in a difficult to access location), sampling stations were moved. Based on the amount of time allowed for the survey, two additional sampling stations were also added to increase sampling intensity.

At each station, the aim was to conduct a ~10 min camera tow and to collect a grab sample for both particle size analysis (PSA) and macrobenthic invertebrate analysis, with the camera survey conducted prior to the grab survey. Due to the low sampling success rate reported by Godsell and Miller (2016), it was originally planned to sample all 22 locations using a 0.1 m^2 mini-Hamon grab. However, following an initial review of the underwater imagery data acquired during the camera survey, it was determined that the seabed substrate present at 13 stations was unsuitable for grabbing, being composed of hard substrate, cobbles, and/or highly consolidated coarse sediments. The seabed at the nine stations which were deemed suitable for grab sampling generally consisted of rippled shelly sands. In order to acquire the best quality grab samples, it was therefore decided, in agreement with Natural England, to conduct the grab sampling survey using a 0.1 m^2 Day grab.

In order to increase sampling intensity, 10 additional grab stations were added based on the preliminary review of the underwater imagery data. Grab sampling was therefore attempted at a total of 19 sampling stations.

The locations of all planned sampling stations are given in Table 1 and Figure 1.

Table 1: Locations of the planned sampling stations for the Selsey Bill and the Hounds MCZ drop-down camera and grab survey. Positions are WGS84.

Station name	Latitude	Longitude
SBTH01*	50.73910	-0.83597
SBTH02*	50.73657	-0.82651
SBTH03*	50.71474	-0.82490
SBTH04	50.73078	-0.81679
SBTH05	50.71111	-0.81037

Station name	Latitude	Longitude
SBTH06*	50.71682	-0.80718
SBTH07*	50.72219	-0.80572
SBTH08	50.71334	-0.79968
SBTH09	50.71116	-0.78457
SBTH10	50.72037	-0.78161
SBTH11	50.70090	-0.77871
SBTH12	50.72299	-0.76699
SBTH13	50.71466	-0.76774
SBTH14	50.70417	-0.76992
SBTH15	50.71210	-0.75921
SBTH16*	50.73739	-0.84344
SBTH17	50.73914	-0.82989
SBTH18	50.73524	-0.81846
SBTH19*	50.72515	-0.80674
SBTH20	50.72354	-0.81461
SBTH21*	50.71898	-0.81218
SBTH22	50.71011	-0.82232
SBTH23†	50.71826	-0.82082
SBTH24†	50.71984	-0.80627
SBTH25†	50.71826	-0.80163
SBTH26†	50.72159	-0.81049
SBTH27†	50.71477	-0.80767
SBTH28†	50.73320	-0.82441
SBTH29†	50.74016	-0.84128
SBTH30†	50.73847	-0.84935
SBTH31†	50.73425	-0.83782
SBTH32†	50.73933	-0.84622

* = stations deemed suitable for grab sampling following the camera survey.

† = additional grab sampling stations added following the camera survey.

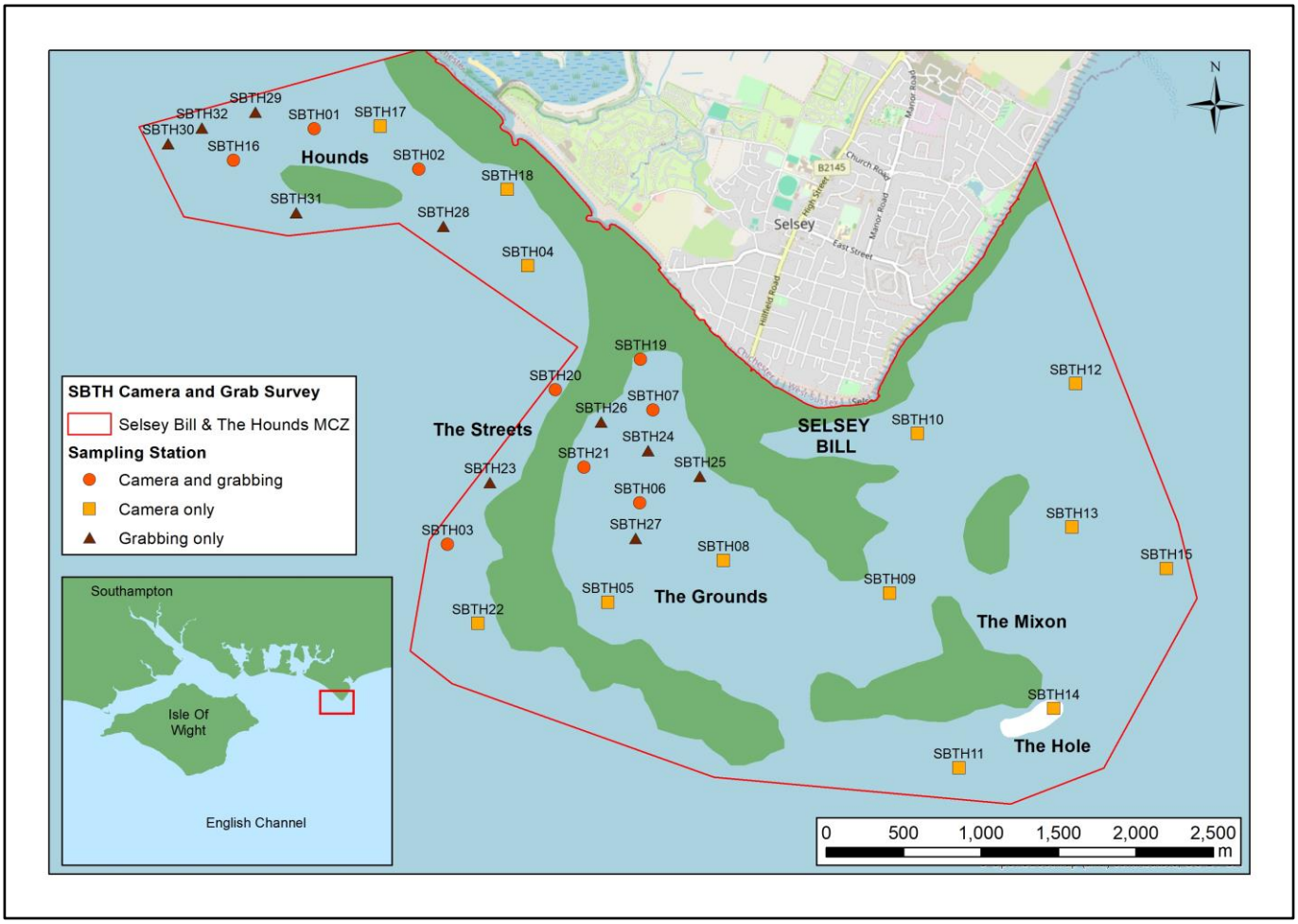

Figure 1: Locations of the planned sampling stations for the Selsey Bill and the Hounds MCZ drop-down camera and grab survey 2023.

Survey Overview

Survey operations were conducted from SV *Wessex Explorer*, a 15 m purpose-built inshore survey vessel equipped with an A-frame and winch and suitable for carrying out all aspects of the work. For the duration of the survey, *Wessex Explorer* worked out of Gosport Marina, in Portsmouth Harbour, and transited to and from the survey area each day.

The survey vessel and crew and survey personnel and equipment travelled to Gosport Marina on 12th September 2023. The camera survey equipment was mobilised and the camera system wet tested on 12th September 2023. Camera survey operations took place on 13th and 14th September 2023. Following the camera survey, on 15th September 2023, the camera system was demobilised, and grabbing equipment mobilised. Grab operations took place on 16th September 2023. On 18th September 2023, all survey equipment was demobilised and returned to Seastar's base in Hamble, and *Wessex Explorer* and crew returned to their home berth in Southampton.

Drop-down imagery survey

Camera system

An Imenco camera system, comprising a SubVIS Orca high-definition (HD) video camera and an OE14-408 underwater digital stills camera, was used for the camera survey. The video and stills cameras were mounted obliquely on the drop-down camera frame, with the high-powered OE11-442 underwater flashgun mounted opposite. A SeaLED-300 high-output lumen lamp was also mounted on the frame in such a manner so as to evenly illuminate the field of view and to minimise backscatter. The cameras, flashgun and lamp were linked to the surface using a 50 m soft umbilical.

The video camera was controlled using Imenco SubVIS SmartView software, and digital video files were saved via the software directly onto the survey laptop. The stills camera was controlled via a surface control unit and Graphic User Interface (GUI) software. Various camera settings (e.g., focal length, shutter speed) could be manually adjusted via the GUI. Still images were saved on an onboard memory card and uploaded periodically throughout each survey day. All imagery data files were backed up onto external hard-drives at the end of each survey day.

Survey navigation was achieved using a Leica GX1230 RTK GPS. The GPS was used in full RTK mode; within the GPS, satellite derived positions (WGS84 latitude and longitude) were updated in real-time with pseudo-range corrections from Leica Smartnet, via a GSM receiver. Used in full RTK mode, GPS positions were accurate to ± 0.03 m in three dimensions. The GPS antenna was mounted inboard and offsets between the antenna and the vessel's A-frame measured and entered into Hypack survey management software prior to the survey. The position of the camera was calculated in Hypack as a lay-back from the vessel's A-frame, and was based on vessel speed and heading, height of the A-frame, water depth, and the amount of towing cable deployed. Positional data were recorded in WGS84 latitude and longitude in Hypack and backed up onto external hard-drives at the end of each survey day.

Data acquisition

Good quality underwater imagery data is best achieved by steaming the survey vessel into the current (i.e. against the tide), enabling the camera to be towed behind the vessel at a steady speed and at a controlled height above the seabed. Due to the highly variable currents present in the survey area, two concentric target rings (50 m and 100 m radius) were drawn around each sampling station to act as a visual aid for the vessel skipper during the survey. During the drop-down camera survey, the vessel skipper selected the best transect bearing for the state of tide and prevailing weather conditions, then set the vessel up on the outer ring and follow the bearing in order to sample the central target position. During data acquisition the speed of the vessel was maintained at between 0.3 and 0.6 knots.

Prior to each deployment, a ‘clapperboard’ displaying the job number and survey title together with the date, station number and transect number was photographed and videoed as a quality assurance record. The camera frame was deployed from the stern of the vessel using the vessel winch and A-frame. The camera system was controlled from within the vessel’s wheelhouse, and constant communications were maintained throughout each deployment between the camera operator, skipper, winch operator, and personnel on the back deck managing the camera frame and umbilical.

Each camera deployment aimed to acquire approximately 10 minutes of seabed video footage. The camera frame was towed at a height of ~1 m above the seabed in order to reduce the impact on the benthic environment whilst maintaining a good view of the seabed. The height of the camera above the seabed was maintained by adjusting the amount of winch-wire out. The digital video feed was monitored throughout the deployment and still images were taken at approximately 30 second intervals, providing that the seabed was visible, and that good image quality could be reasonably ensured. Photographs were taken by landing the camera frame on the seabed (by paying out winch wire), in order to reduce the effects of currents and turbidity on image quality, to minimise the chance of obtaining blurred images, and to achieve a consistent field of view.

The camera system and navigation system were time synchronised at the start of each survey day, and the times were checked at the end of each day to ensure there was no drift. Navigation data were recorded throughout each transect, from when the camera system was deployed to when it was recovered back to deck. Camera deployment logs recorded the GPS time (in GMT, to the second) of the start and end of each video recording and the time each photograph was taken so that the position of each image could be extracted from the navigation data following the survey. Navigation checks of the GPS system were carried out against a known location in Gosport Marina at the start and end of the survey.

Grab sampling survey

At each sampling location the vessel set up on the proposed position and a 0.1 m^2 Day grab sampler was deployed over the side of the vessel. A ‘fix’ of GPS position and time was recorded in Hypack and manually logged in the logbook when the grab was determined to be on the seabed. The grab was recovered to deck and the sample inspected for quality.

Samples were to be rejected on the grounds of poor quality for the following reasons:

- Uneven surface indicative of striking the seabed at an angle;
- Washed out sample;
- Disturbed surface sediment;
- Contamination of the sediment (e.g. hagfish, paint chips, oil etc.);
- Sample touching the top of the grab;
- Sample <50 % of the grab’s capacity.

If the sample was not acceptable the vessel was repositioned on the sample location and the grab was redeployed. If after three attempts at a location a successful grab was not collected a new location was chosen close to the original station or the station was abandoned, depending on the nature of the sample failures.

If the sample was acceptable a brief description of the sediment was recorded (including appearance, texture, odour, etc.) and a labelled photograph taken.

A sub-sample was collected for PSA from each acceptable grab sample following the NMBAQC's Best Practice Guidance for PSA to support biological analysis (Mason, 2016). The PSA sub-sample was collected using a metal scoop to remove a 5 cm deep core from the grab sample, ensuring that at least 100 ml of sediment was collected. Any conspicuous biota was noted in the logbook and removed from the sub-sample before storing the sediment in labelled plastic bags.

Following sub-sampling for PSA the rest of the grab sample was processed for macrobenthic invertebrate analysis. The sediment in the grab was transferred to a dump tray and washed gently over a 1 mm field sieve. The sediment retained in the sieve was photographed before being transferred to a labelled plastic bucket and fixed using a 4 % buffered formaldehyde-seawater solution for subsequent laboratory analysis.

Achieved survey

Drop-down imagery survey

Underwater imagery data were successfully acquired at all 22 planned sampling stations. A summary of the imagery data collected is given in Table 2, and full drop-down camera logs are provided in Appendix I. The locations of the video tracks are shown in Figure 2.

Table 2: Summary of drop-down camera transects achieved as part of the Selsey Bill and The Hounds MCZ survey 2023.

Station name	Transect sample number	Date	Video duration (mm:ss)	Number of stills
SBTH01	572_01#01	13/09/2023	15:22	17
SBTH02	572_03#01	13/09/2023	15:31	18
SBTH03	572_13#01	13/09/2023	11:57	14
SBTH04	572_15#01	14/09/2023	14:23	20
SBTH05	572_20#01	14/09/2023	15:15	20
SBTH06	572_22#01	14/09/2023	12:51	20
SBTH07	572_17#01	14/09/2023	14:19	10
SBTH08	572_19#01	14/09/2023	15:34	21
SBTH09	572_18#01	14/09/2023	14:29	10

Station name	Transect sample number	Date	Video duration (mm:ss)	Number of stills
SBTH10	572_08#01	13/09/2023	15:42	21
SBTH11	572_07#01	13/09/2023	15:32	18
SBTH12	572_09#01	13/09/2023	15:01	21
SBTH13	572_10#01	13/09/2023	13:08	22
SBTH14	572_12#01	13/09/2023	15:20	17
SBTH15	572_11#01	13/09/2023	13:16	24
SBTH16	572_14#01	14/09/2023	13:55	20
SBTH17	572_02#01	13/09/2023	17:07	20
SBTH18	572_04#01	13/09/2023	08:50	12
SBTH19	572_16#01	14/09/2023	14:19	17
SBTH20	572_05#01	13/09/2023	16:05	10
SBTH21	572_21#01	14/09/2023	12:01	11
SBTH22	572_06#01	13/09/2023	11:44	13

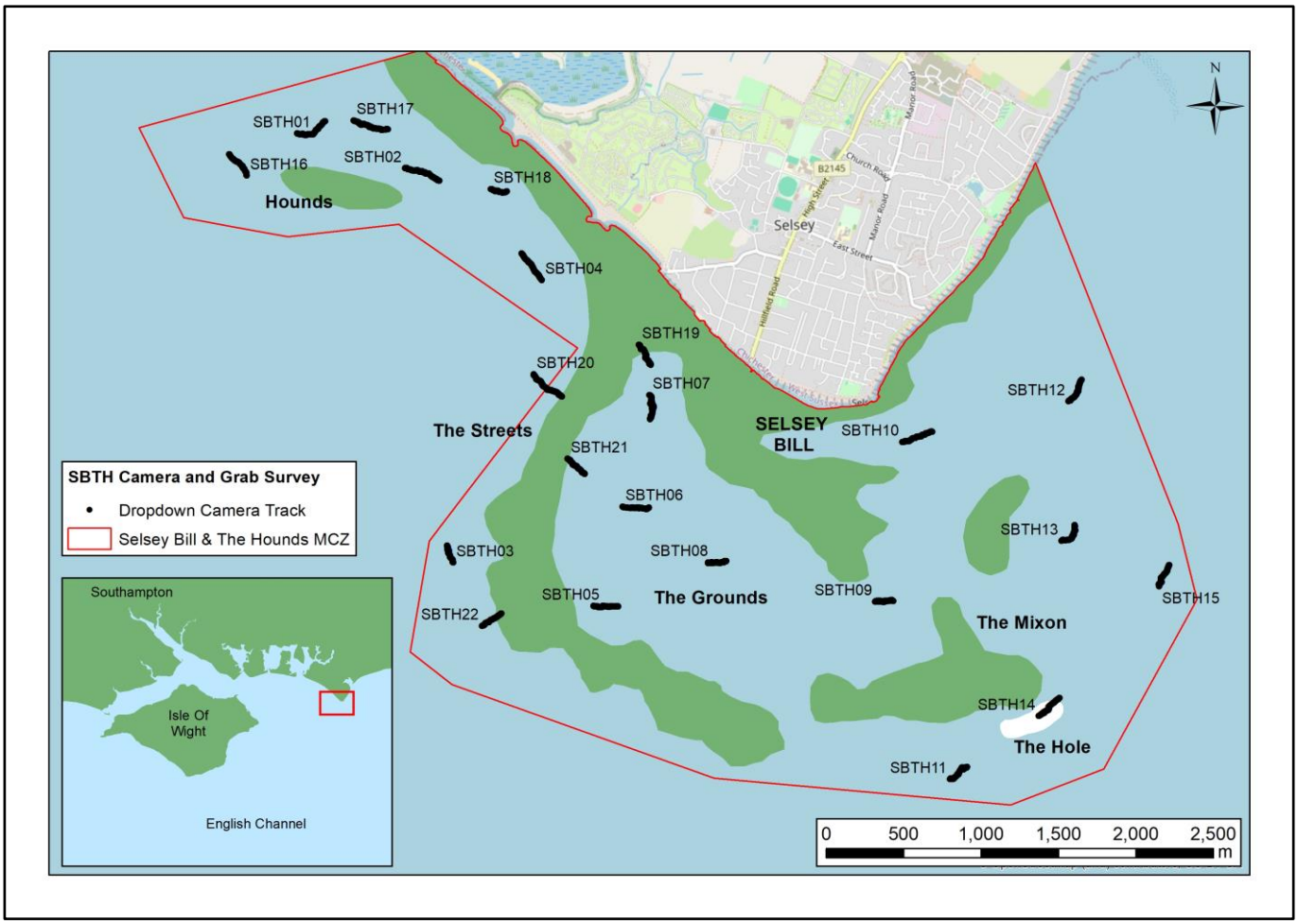

Figure 2: Underwater video tracks achieved as part of the Selsey Bill and the Hounds MCZ drop-down camera survey 2023.

Grab sampling survey

Grab samples were attempted at a total of 19 stations. Samples for macroinvertebrate analysis were successfully collected at 16 stations. Samples for PSA were successfully collected at 17 stations.

No samples were acquired at stations SBTH25 and SBTH30. Both attempts at SBTH25 resulted in washed-out samples due to a cobble in the grab sampler jaws; it was therefore considered likely that the seabed in this area was composed of stony ground and thus unsuitable for grab sampling. Similarly, at SBTH30 a piece of soft rock that had evidently been sheared from the seabed (freshly cut base) was present in the grab sampler; the station was therefore abandoned.

The grab sample collected at station SBTH02 was small (~45% of the grab capacity) and mainly consisted of hard substrate (cemented sediment/soft mudrock), with a small proportion of fine sand and mud. Given that previous attempts at this station had been unsuccessful, the grab sample was retained and processed for macroinvertebrate analysis only.

At stations SBTH06 and SBTH19 samples were collected for both macroinvertebrate analysis and PSA, however these were taken from two separate grab samples in each case. A visual assessment of the sediment type in the two grab samples at each station was made in order to ensure the PSA results were comparable to the macrofaunal assessment results.

An additional PSA sample was collected at station SBTH07. At this station, the first grab sample was unsuccessful while the second grab sample was small (~40% of the grab capacity). The second grab sample was therefore processed for PSA only in order to ensure that at least some information was acquired at this station. However, the final sample attempt at this station was of good quality and was therefore processed for both PSA and macroinvertebrate analysis. However, the first PSA sample was retained for analysis in order to provide additional data regarding the benthic environment in the vicinity of station SBTH07.

The first grab sample collected at station SBTH27 was small (~40% of the grab capacity); this sample was processed for PSA only in order to ensure that at least some information was acquired at this station. The subsequent two sample attempts at this station were unsuccessful and no additional samples were collected.

A summary of the collected grab samples is given in Table 3, and full grab sampling logs are provided in Appendix II. The locations of the acquired grab samples are shown in Figure 3.

Table 3: Summary of drop-down camera transects achieved as part of the Selsey Bill and The Hounds MCZ survey 2023. Positions are WGS84.

Station name	Sample number	Latitude	Longitude	Samples collected
SBTH01	572_24#01	50.739042	-0.835961	Macrofauna and PSA sub-sample taken from same grab.
SBTH02	572_37#03	50.737171	-0.826817	Macrofaunal sample only. Visual assessment of sediment.
SBTH03	572_26#01	50.714716	-0.824728	Macrofauna and PSA sub-sample taken from same grab.
SBTH06	572_29#01	50.716758	-0.808523	PSA sample only.
SBTH06	572_29#02	50.716639	-0.807705	Macrofaunal sample only. Visual assessment of sediment is same as 572_29#01.
SBTH07	572_31#02	50.722088	-0.805847	PSA sample only.
SBTH07	572_31#03	50.721623	-0.806152	Macrofauna and PSA sub-sample taken from same grab.
SBTH16	572_23#01	50.737734	-0.843586	Macrofauna and PSA sub-sample taken from same grab.
SBTH19	572_35#01	50.724949	-0.806321	Macrofaunal sample only.
SBTH19	572_35#02	50.72558	-0.806043	PSA sample only. Visual assessment of sediment is same as 572_35#01.
SBTH20	572_25#01	50.723443	-0.814309	Macrofauna and PSA sub-sample taken from same grab.
SBTH21	572_28#01	50.719043	-0.812258	Macrofauna and PSA sub-sample taken from same grab.
SBTH23	572_27#01	50.718168	-0.820745	Macrofauna and PSA sub-sample taken from same grab.
SBTH24	572_30#01	50.719958	-0.806587	Macrofauna and PSA sub-sample taken from same grab.
SBTH26	572_32#01	50.721646	-0.810683	Macrofauna and PSA sub-sample taken from same grab.
SBTH27	572_33#01	50.714741	-0.807785	PSA sample only.
SBTH28	572_36#02	50.733964	-0.825285	Macrofauna and PSA sub-sample taken from same grab.
SBTH29	572_38#01	50.740217	-0.841483	Macrofauna and PSA sub-sample taken from same grab.
SBTH31	572_41#01	50.734303	-0.837513	Macrofauna and PSA sub-sample taken from same grab.
SBTH32	572_40#01	50.739338	-0.846418	Macrofauna and PSA sub-sample taken from same grab.

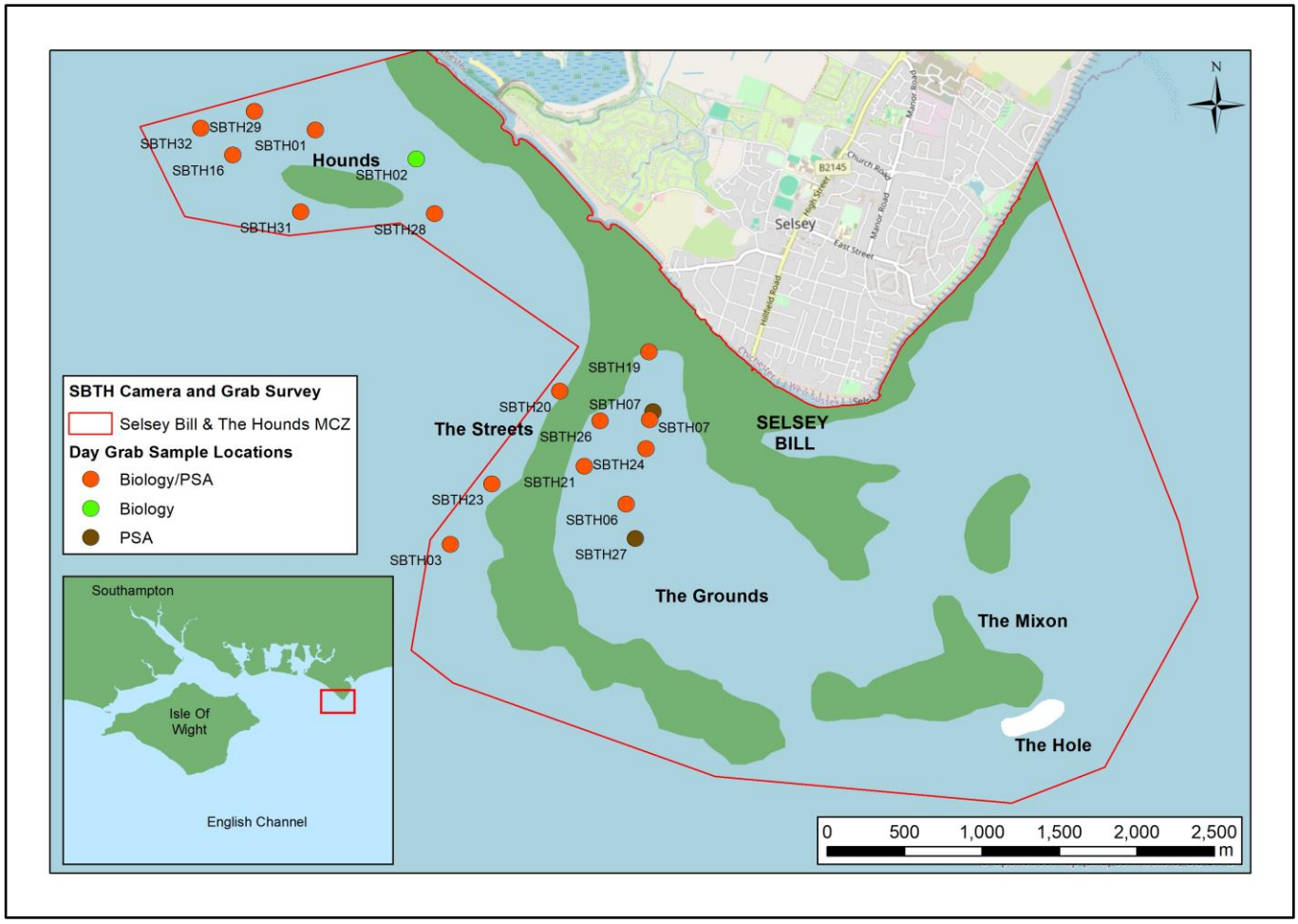

Figure 3: Locations of the achieved grab samples collected as part of the Selsey Bill and the Hounds MCZ grab survey 2023.

Laboratory analysis

Imagery analysis

Video analysis

The video analysis was conducted using software that enabled slow-motion, freeze frame and standard play analysis. During the first review, video footage was viewed at 2x - 4x normal speed in order to divide the footage into segments of different habitat types; any segments of video showing camera deployment and recovery were discounted from further review. Brief changes in habitat type, considered to be less than 5 m distance, were treated as incidental patches and not recorded as separate segments, however the presence of these habitats was recorded as part of the habitat description. The distance travelled by the camera was estimated based on the navigation data.

The start and end time and position of each segment was recorded, and each segment was then analysed in more detail. For each segment, all observations were recorded in a pro forma spreadsheet. Each video segment was assessed for quality, according to NMBAQC scheme guidelines (Turner *et al*., 2016). A description of the observed habitat and a BSH type was assigned to each video segment, and the presence of any visible impacts or modifiers (e.g., trawl marks, litter, evidence of strong currents etc.) was also recorded.

A list of the encountered taxa was produced for each video segment, using species reference numbers as cited in the Marine Conservation Society Species Directory (Howson and Picton, 1997) with additional reference to the World Register of Marine Species (WoRMS Editorial Board, 2024) to avoid problems in species nomenclature. Taxa were identified to the lowest (i.e. most detailed) practical taxonomic level. Identification of taxa was only attempted where biota was considered to be large and conspicuous enough to be confidently and reliably identified. Where lifeforms could not be identified to a specific taxonomic group a brief description was used (e.g. mixed faunal turf). Sponge morphologies were divided into appropriate pre-defined categories after Berman *et al*. (2013). Where sponge species showed plasticity, separate records were made for each morphology type.

Assignment of biotopes

Following analysis of each video segment, the information recorded was reviewed and used to determine the most appropriate MNCR biotope according to JNCC (2022), following guidance outlined in Turner *et al*. (2016) and Parry (2019). Wherever possible biotopes were assigned at the biotope (level 5) or sub-biotope (level 6) level. However, where biological information was lacking (e.g., barren soft sediments with very little epifauna), biotopes were recorded at the biotope complex level (level 4). Where the seabed comprised a mosaic of more than one substrate type (e.g., <5 m alternating bands of exposed bedrock and coarse sediment) it was considered appropriate to assign more than one biotope to the same video segment. In these cases, the most dominant biotope was assigned as the ‘primary’ biotope and the other assigned as secondary.

Identification of Annex I habitats

The presence of any Annex I habitats and associated sub-features, including reef sub-features, was also recorded for each video segment. Reef features were determined using criteria outlined in Irving (2009), with a minimum of 10 % hard substrate (i.e. bedrock, boulders or cobbles) required for assignment of Annex I habitat. Due to difficulties inherent in estimating elevation from video footage, the assessment of ‘reefiness’ of stony reef habitats (Table 4) was primarily based on seabed composition, i.e. percentage coverage of hard substrate.

Table 4: The main characterising features of a stony reef, after Irving (2009).

Characteristic	Not a reef	Resemblance to being a stony reef		
		Low	Medium	High
Composition	< 10 %	10 - 40 %	40 - 95 %	> 95 %
Elevation	Flat seabed	< 64 mm	64 mm - 5 m	> 5 m
Extent	< 25 m^2	> 25 m^2		
Biota	Dominated by infaunal species	> 80 % of species epifauna		

Still image analysis

The still image analysis was undertaken following analysis of the video. Each still image was assessed for quality, according to NMBAQC scheme guidelines (Turner *et al*., 2016), and a brief description of the habitat and characterising biota present in each image recorded. All observations were recorded in a pro forma spreadsheet. A BSH was recorded based on the substrate type present.

Epibiota were identified, with taxa recorded to the best practical taxonomic level. A list of the encountered taxa was produced for each image, using species reference numbers as cited in the Marine Conservation Society Species Directory (Howson and Picton, 1997) with additional reference to the World Register of Marine Species (WoRMS Editorial Board, 2024) to avoid problems in species nomenclature. For each image, all biota was identified and enumerated. Taxon abundance data was recorded using the semi-quantitative SACFOR scale, with counts or percentage cover recorded where appropriate. The most appropriate MNCR biotope (JNCC, 2022) was assigned to each still image with reference to the parent video segment, following guidance outlined in Turner *et al*. (2016) and Parry (2019).

Sediment analysis

Particle size analysis

Particle size analysis (PSA) was carried out using wet and dry sieving at half phi intervals in accordance with NMBAQC guidelines. Samples were visually assessed and all marine biota (>1 mm) that was alive at the time of sampling were removed. A brief sediment description was noted in the PSA log, together with details of any biota removed, and any other pertinent sediment characteristics (e.g. presence worm tubes, shell fragments). For those samples where the mud fraction was found to exceed 5 %, laser diffraction was carried out by Kenneth Pye Associates Ltd. Two samples (SBTH07 and SBTH19) were analysed using laser diffraction in addition to wet and dry sieving.

The results were analysed to determine the proportions of gravel, sand, and mud within the samples and sediment names were assigned as per the modified Folk classification (1954).

Macrobenthic invertebrate analysis

In the laboratory, the macrobenthic invertebrate samples were washed through a 0.25 mm sieve in order to remove the fixative and any mud remaining in the sample. The sample retained on the sieve was then washed through a stack of sieves of different sizes (1.0 mm, 2.0 mm and 5.0 mm) in order to create uniform size fractions to improve sorting effectiveness. To further aid sorting, light organic matter and biota were floated off (elutriated) at an early stage and sorted separately. The retained contents of each sieve were then washed into a pot or sorting tray, with enough water to cover the sample. The sieve was checked to ensure no animals are left in the mesh, and then cleaned to prevent cross-contamination.

Larger fractions were examined by eye in sorting trays, searched in a methodical manner to minimise the risk of missing any biota. The finer residue fractions and elutriated material were sorted under a stereo-microscope. All quantitative biota was extracted; representative examples of qualitative taxa (e.g. encrusting or attached colonial taxa) were also extracted. The picked taxa were split by phyla and stored in glass vials in 80 % industrial methylated spirit (IMS) ready for identification.

Taxa were identified to the lowest practical taxonomic level with reference to WoRMS (WoRMS Editorial Board, 2024) for species nomenclature. Epifauna were identified and recorded when clearly attached to substrate.

Identified taxa were separated by major taxonomic group and preserved in 80 % IMS before being analysed for biomass by major taxonomic group. Taxa were removed from their sample vials and blotted dry to remove excess IMS before being weighed using a calibrated balance accurate to 5 decimal places. A reference collection, consisting of examples of each identified taxon, was also created.

All organisms were identified to the lowest possible taxonomic level (usually species) according to the NMBAQC Taxonomic Discrimination Protocol (TDP) and using the appropriate taxonomic keys and literature. Identified taxa were separated by major taxonomic group and analysed for blotted dry weight biomass to 5 decimal places.

Biotopes were assigned to each sample based on assessment of the dominant taxa present together with location, depth and PSA data.

GIS

The principal of habitat mapping is based on the acquisition of data which enable areas of consistent sonar reflectivity, areas of consistent depth or bathymetric features to be ground-truthed. The ground-truthing of acoustic data enables a substrate type or biotope to be assigned to areas of consistent sidescan sonar reflectivity or bathymetry.

Data derived from the underwater imagery analysis, including assigned biotopes, and from analysis of the grab samples, were incorporated into ArcGIS in order to display the distribution of the different habitats observed. However, as no suitable acoustic (i.e. bathymetry and sidescan sonar) data were available for the survey area, habitat maps could not be created. Instead, charts showing the range of identified substrate types and biotopes assigned to each video segment, still image and grab sample were generated to illustrate the general distribution of habitats in the survey area.

All GIS outputs were generated using ArcGIS v10.2 and were produced in accordance with MEDIN standards using the MESH data exchange format (DEF).

Results

Drop-down imagery results

All of the 22 videos and 376 still images acquired during the survey were analysed. The survey area was found to be fairly heterogenous, with a total of 16 biotopes identified. The distribution of biotopes identified during the imagery analysis is shown in Figures 4 and 5, and a summary of the analysis results for each video segment is given in Table 5. Full imagery analysis results are provided in Appendix III and Appendix IV.

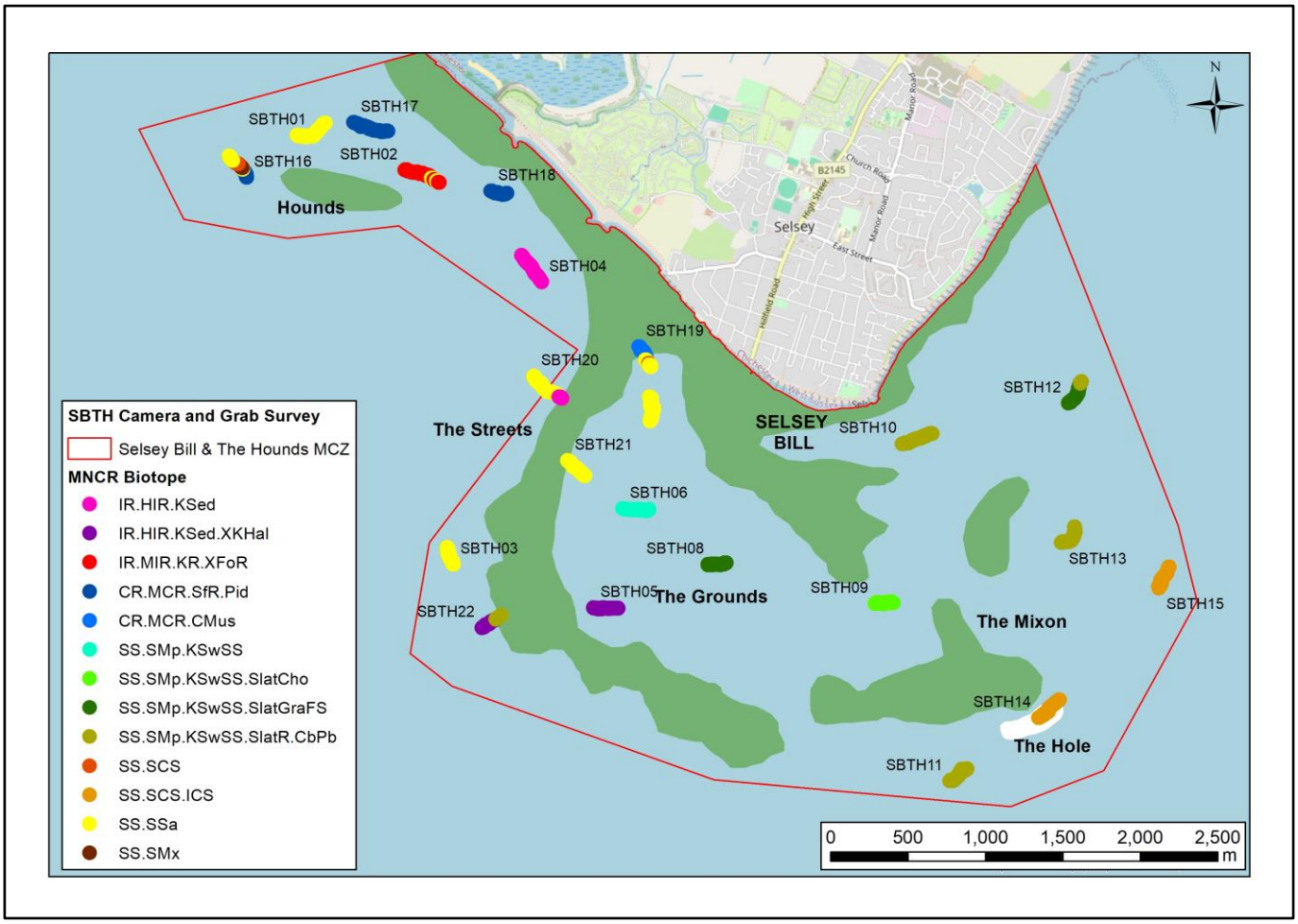

Figure 4: MNCR biotopes (JNCC, 2022) assigned to video segments analysed following the Selsey Bill and the Hounds MCZ drop-down camera survey 2023. Note that only primary biotopes are shown for clarity.

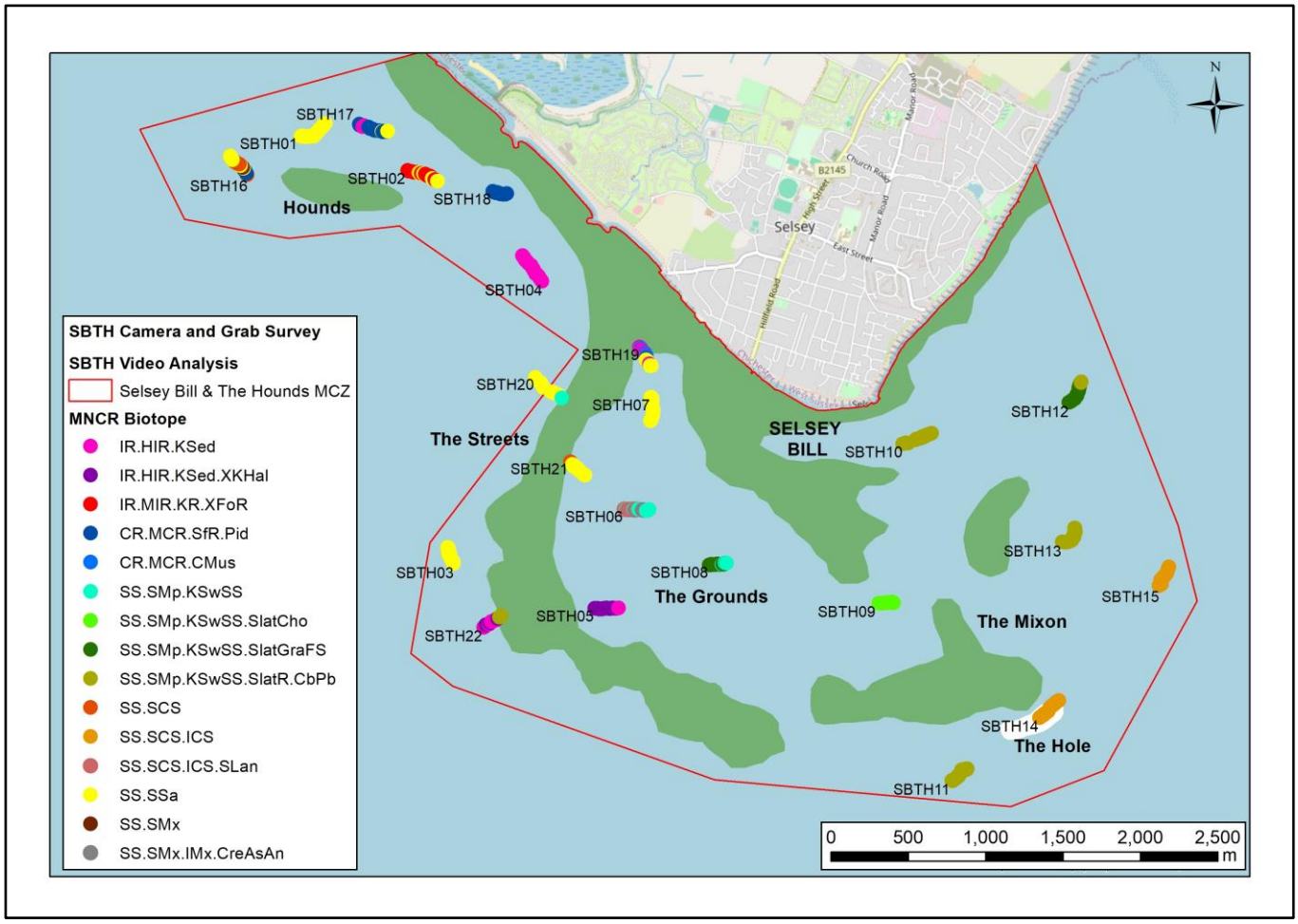

Figure 5: MNCR biotopes (JNCC, 2022) assigned to still images analysed following the Selsey Bill and the Hounds MCZ drop-down camera survey 2023. Note that only primary biotopes are shown for clarity.

Table 5: Summary of the MNCR biotopes (JNCC, 2022), Annex I habitats and habitats of conservation interest (HOCI) identified following analysis of the underwater imagery collected as part of the Selsey Bill and the Hounds MCZ survey 2023.

Video segment	General habitat description	MNCR Biotope(s)	Annex I	HOCI(s)
SBTH01_S1	Rippled slightly shelly sand with sparse/patchy seaweeds.	***SS.SSa**		Subtidal sands and gravels
SBTH02_S1	Dense red and brown seaweeds on sediment-affected flat bored bedrock with cobbles and shell.	***IR.MIR.KR.XFoR**	Reefs (rocky)	

Video segment	General habitat description	MNCR Biotope(s)	Annex I	HOCI(s)
SBTH02_S2	Mixed seaweeds on sediment-affected flat bored bedrock and cobbles with patches of bare shelly sand.	***IR.MIR.KR.XFoR** SS.SSa	Reefs (rocky)	Subtidal sands and gravels; Peat and clay exposures
SBTH02_S3	Shelly sand with patches of pebbles and cobbles with mixed seaweeds.	IR.MIR.KR.XFoR ***SS.SSa**		Subtidal sands and gravels
SBTH02_S4	Dense red and brown seaweeds on sediment-affected flat bored bedrock with cobbles and shell.	***IR.MIR.KR.XFoR**	Reefs (rocky)	
SBTH02_S5	Rippled shelly sand with sparse seaweeds.	***SS.SSa**		Subtidal sands and gravels
SBTH02_S6	Dense red and brown seaweeds on sediment-affected flat bored bedrock with cobbles and shell.	***IR.MIR.KR.XFoR**	Reefs (rocky)	
SBTH03_S1	Rippled sand.	***SS.SSa**		Subtidal sands and gravels
SBTH04_S1	Mixed red, brown and green seaweeds on sediment-affected flat bored soft rock with pebbles and cobbles.	***IR.HIR.KSed**	Reefs (rocky)	
SBTH05_S1	Dense stands of *Halidrys siliquosa* with mixed seaweeds on pebbles, cobbles and coarse sediment.	***IR.HIR.KSed.XKHal**	Reefs (stony)	Subtidal sands and gravels
SBTH06_S1	Seaweeds and *Lanice conchilega* on sand and shell with occasional boulders and patchy *Crepidula fornicata*.	***SS.SCS.ICS.Slan** SS.SMx.IMx.CreAsAn SS.SMp.KSwSS		Subtidal sands and gravels
SBTH07_S1	Rippled slightly shelly sand with patches of semi-exposed flat bedrock and patchy cobbles.	IR ***SS.SSa**	Reefs (rocky)	Subtidal sands and gravels
SBTH08_S1	*Gracilaria gracilis* with mixed red and brown seaweeds on pebbles and cobbles.	***SS.SMp.KSwSS.SlatGraFS**		Subtidal sands and gravels
SBTH09_S1	Dense *Chorda filum* with mixed red and brown seaweeds on pebbles.	***SS.SMp.KSwSS.SlatCho**		Subtidal sands and gravels

Video segment	General habitat description	MNCR Biotope(s)	Annex I	HOCI(s)
SBTH10_S1	Dense mixed seaweeds on pebbles, cobbles and gravel with patches of exposed clay.	***SS.SMp.KSwSS.SlatR.CbPb**		Subtidal sands and gravels; Peat and clay exposures
SBTH11_S1	Red seaweeds on pebbles and cobbles.	***SS.SMp.KSwSS.SlatR.CbPb**		Subtidal sands and gravels
SBTH12_S1	*Gracilaria gracilis* with mixed red and brown seaweeds on pebbles and gravel.	***SS.SMp.KSwSS.SlatGraFS**		Subtidal sands and gravels
SBTH12_S2	Dense stands of very fine red seaweed on gravel, pebbles and shell with patchy brown seaweeds.	***SS.SMp.KSwSS.SlatR.CbPb**		Subtidal sands and gravels
SBTH13_S1	Dense mixed seaweeds on pebbles and gravel.	***SS.SMp.KSwSS.SlatR.CbPb**	Reefs (biogenic)	Subtidal sands and gravels; *Mytilus edulis* beds
SBTH14_S1	Serpulids and patchy seaweeds with *Psammechinus miliaris* on gravel, pebbles and shell material.	***SS.SCS.ICS**		Subtidal sands and gravels
SBTH15_S1	Serpulids and patchy seaweeds with *Psammechinus miliaris* on clean gravel and pebbles.	***SS.SCS.ICS**		Subtidal sands and gravels
SBTH16_S1	Sand-covered bored bedrock with sparse faunal turf and red seaweeds on overlying cobbles and boulders.	CR.HCR.XFa ***CR.MCR.SfR.Pid** SS.SCS SS.SSa	Reefs (rocky; stony)	Subtidal sands and gravels
SBTH16_S2	Rippled slightly shelly sand.	***SS.SSa**		Subtidal sands and gravels
SBTH16_S3	Mixed sandy sediment and shell with red seaweeds on patchy sediment-covered cobbles and boulders.	IR.MIR.KR.XFoR SS.SCS SS.SSa ***SS.SMx**		Subtidal sands and gravels
SBTH16_S4	Rippled gravelly sand and shell with sparse seaweeds.	***SS.SCS**		Subtidal sands and gravels
SBTH16_S5	Rippled slightly shelly sand with sparse/patchy seaweeds.	***SS.SSa**		Subtidal sands and gravels

Video segment	General habitat description	MNCR Biotope(s)	Annex I	HOCI(s)
SBTH17_S1	Patchy mixed seaweeds on sand-covered soft bored bedrock with patches of rippled sand.	IR.HIR.Ksed ***CR.MCR.SfR.Pid** SS.SSa	Reefs (rocky)	Subtidal sands and gravels
SBTH18_S1	Sparse seaweeds on sand-affected soft piddock-bored bedrock.	***CR.MCR.SfR.Pid**	Reefs (rocky)	
SBTH19_S1	Patchy mixed seaweeds on sand-covered soft bored bedrock with patchy *Mytilus edulis* beds.	IR.HIR.Ksed CR.MCR.SfR.Pid ***CR.MCR.CMus**	Reefs (rocky; biogenic)	Subtidal sands and gravels; *Mytilus edulis* beds
SBTH19_S2	Sparse seaweeds on rippled sand with patches of semi-exposed flat bedrock.	***SS.SSa**		Subtidal sands and gravels
SBTH19_S3	Mixed seaweeds on patchy pebbles, cobbles and boulders overlying rippled sand.	IR.HIR.Ksed ***IR.MIR.KR.XFoR** SS.SSa	Reefs (stony)	Subtidal sands and gravels
SBTH19_S4	Sparse seaweeds on rippled sand with patches of semi-exposed flat bedrock.	IR.HIR.Ksed ***SS.SSa**	Reefs (rocky)	Subtidal sands and gravels
SBTH20_S1	Rippled sand.	***SS.SSa**		Subtidal sands and gravels
SBTH20_S2	Seaweeds on flat bedrock with a veneer of rippled sand.	***IR.HIR.Ksed** SS.SSa SS.SMp.KSwSS	Reefs (rocky; biogenic)	Subtidal sands and gravels; *Mytilus edulis* beds
SBTH21_S1	Rippled shelly sand.	SS.SCS ***SS.SSa**		Subtidal sands and gravels
SBTH22_S1	Dense mixed seaweeds including *Halidrys siliquosa* and kelps on sand-influenced rock.	IR.HIR.KSed ***IR.HIR.KSed.XKHal**	Reefs (rocky)	
SBTH22_S2	Mixed seaweeds on gravel, pebbles and cobbles.	IR.HIR.Ksed IR.HIR.KSed.XKHal ***SS.SMp.KSwSS.SlatR.CbPb**	Reefs (rocky; stony)	Subtidal sands and gravels

* Indicates primary biotope assigned to the video footage.

Soft sediment habitats were widely distributed throughout the survey area. Rippled sands and shelly sands (**SS.SSa**; 'Sublittoral sands and muddy sands') were most common in the west of the MCZ, particularly west of the Hounds and in the vicinity of 'the Streets' (see Figures 4 and 5), although at some stations, including SBTH02, SBTH07 and SBTH19,

rippled sands were only present as a thin veneer over occasionally exposed flat bedrock. By contrast, in the east of the MCZ sediments were generally coarser, being composed of gravels, pebbles and cobbles.

At stations SBTH14, located within Mixon Hole, and SBTH15, located in the extreme east of the survey area, the seabed was composed of clean gravel, pebbles and shell characterised by serpulid worms, coralline crusts, sparse and/or patchy red and brown seaweeds, and common small mobile fauna including the urchin *Psammechinus miliaris* and the topshell *Steromphala* spp.. No good biotope fit was found for the habitat observed; these stations were therefore assigned at the biotope complex level (**SS.SCS.ICS**; 'Infralittoral coarse sediment').

At stations 09 – 13, also located in the east of the MCZ, sediments comprised gravel, pebbles and cobbles characterised by a range of macrophyte-dominated communities. The most commonly assigned biotope was **SS.SMp.KSwSS.SlatR.CbPb** ('Red seaweeds and kelps on tide-swept mobile infralittoral cobbles and pebbles'), however where the red seaweed *Gracilaria gracilis* was prevalent the biotope **SS.SMp.KSwSS.SlatGraFS** ('*Saccharina latissima*, *Gracilaria gracilis* and brown seaweeds on full salinity infralittoral sediment') was assigned. At SBTH09 dense stands of the brown seaweed *Chorda filum* were observed on pebbles; the biotope **SS.SMp.KSwSS.SlatCho** ('*Saccharina latissima* and *Chorda filum* on sheltered upper infralittoral muddy sediment') was assigned to records at this station, although the observed sediments differed from those described for this biotope. Despite the biotopes assigned, kelps were entirely absent from these areas, although a wide range of red and brown seaweeds were present. Species commonly identified in these habitats included *Jania rubens*, *Calliblepharis ciliata*, *Polyides rotunda*, *Cladostephus spongiosus*, *Dictyota dichotoma* and *Taonia atomaria*.

At station SBTH06, located in the centre of the survey area within the area known as 'the Grounds,' two soft sediment biotopes were identified that were not observed elsewhere in the MCZ. The first half of the transect was characterised by sparse seaweeds on sand with high numbers of the sand mason worm *Lanice conchilega* (although this species, being small, more readily observed in the still images than the video records). The biotope **SS.SCS.ICS.SLan** ('Dense *Lanice conchilega* and other polychaetes in tide-swept infralittoral sand and mixed gravelly sand') was therefore recorded. In addition, patches of the slipper limpet *Crepidula fornicata*, a NIS, were present throughout the transect. Most appeared to be dead shell material, however, some living stacks were identified. The biotope **SS.SMx.IMx.CreAsAn** ('*Crepidula fornicata* with ascidians and anemones on infralittoral coarse mixed sediment') was assigned to five still images from this station where live *C. fornicata* were recorded, however as very few stacks were present overall, this biotope was not assigned to the video records.

Hard substrate habitats in the survey area generally consisted of flat bedrock. At most stations the rock present was generally heavily sediment influenced and at least partially inundated with sand, and the associated biotic communities associated were therefore generally impoverished. At several stations holes created by boring bivalves were present in the rock surface, and piddock siphons were recorded at stations 02, 17, 18 and 19, all

located in the inshore region of the survey area. Where epibiota was sparse, the biotope complex **CR.MCR.SfR.Pid** ('Soft rock communities') was assigned. However, where bored soft rock was observed in conjunction with seaweed communities, a range of biotopes were identified. Where dense red seaweeds were present on sand- and silt-covered bedrock or boulders, the biotope **IR.MIR.KR.XFoR** ('Dense foliose red seaweeds on silty moderately exposed infralittoral rock'). More frequent however were mixed seaweed communities on sand- or gravel- inundated flat bedrock (**IR.HIR.KSed**; 'Sediment-affected or disturbed kelp and seaweed communities'), which were identified at a total of seven stations. A wide range of red, brown and green seaweeds were observed at these stations, including *Cryptopleura ramosa*, *P. rotunda*, *C. filum*, *C. spongiosus*, *D. dichotoma*, *T. atomaria*, and *Ulva lactuca*. At stations SBTH05 and SBTH22, dense stands of the brown seaweed *Halidrys siliquosa* were observed; the biotope **IR.HIR.KSed.XKHal** ('*Halidrys siliquosa* and mixed kelps on tide-swept infralittoral rock with coarse sediment') was therefore assigned to records from these stations.

Blue mussel (*Mytilus edulis*) beds were identified at SBTH19. These existed as patches overlying sand-covered flat bored bedrock together with red seaweeds. The biotope complex **CR.MCR.CMus** ('Circalittoral mussel beds on rock') was therefore assigned to records from this station. Mussels were also identified on sands and gravels at SBTH13 and SBTH20, however, due to the fact that densities of *M. edulis* were low (rare to occasional), and that only small patches were visible beneath a seaweed canopy, the biotope **SS.SBR.SMus.MytSS** ('*Mytilus edulis* beds on sublittoral sediment') was not assigned.

Sediment analysis results

Particle size analysis

A summary of the results of the PSA is given in Table 6. Full results are provided in Appendix V. The distribution of sediment types identified is shown in Figure 6.

Table 6: Summary of the particle size analysis results of core samples collected as part of the Selsey Bill and the Hounds MCZ grab survey 2023.

Station name	Sample no.	% Gravel	% Sand	% Mud	Classification
SBTH01	572_24#01	0.20	96.10	3.76	Sand
SBTH03	572_26#01	0.00	98.90	1.14	Sand
SBTH06	572_29#01	58.16	40.58	1.24	Sandy gravel
SBTH07	572_31#02	0.12	79.26	20.62	Muddy sand
SBTH07	572_31#03	8.88	90.15	1.06	Gravelly sand
SBTH16	572_23#01	0.11	97.21	2.75	Sand

Station name	Sample no.	% Gravel	% Sand	% Mud	Classification
SBTH19	572_35#02	0.18	67.36	32.46	Muddy sand
SBTH20	572_25#01	0.00	95.87	4.12	Sand
SBTH21	572_28#01	0.16	98.81	1.06	Sand
SBTH23	572_27#01	0.00	98.67	1.35	Sand
SBTH24	572_30#01	8.87	89.62	1.58	Gravelly sand
SBTH26	572_32#01	0.97	98.02	1.06	Sand
SBTH27	572_33#01	74.86	24.00	1.15	Sandy gravel
SBTH28	572_36#02	1.35	94.99	3.71	Slightly gravelly sand
SBTH29	572_38#01	1.34	93.86	4.86	Slightly gravelly sand
SBTH31	572_41#01	0.72	96.93	2.44	Sand
SBTH32	572_40#01	0.10	96.86	3.10	Sand

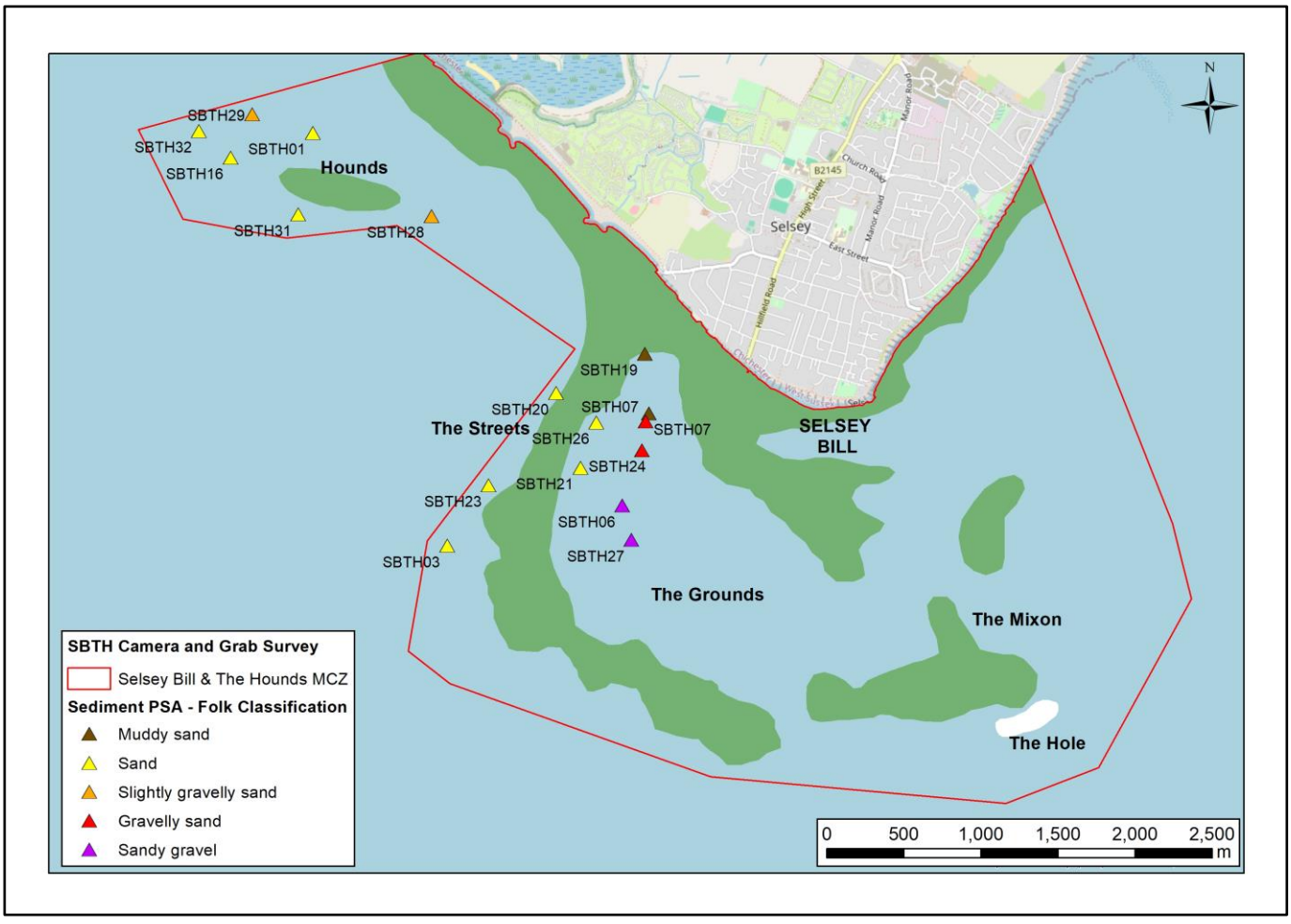

Figure 6: Sediment types identified following particle size analysis of samples collected as part of the Selsey Bill and the Hounds MCZ grab survey 2023.

The sediments in the survey area were generally characterised by sands and gravels. Samples SBTH06 and SBTH27, both located in the centre of the MCZ in the middle of the area known as 'the Grounds' were dominated by gravel (58.16 and 74.96 % respectively) with lower quantities of sand (40.58 and 24.00 %) and were classified as sandy gravel. Samples SBTH07 (572_31#03) and SBTH24, both located to the north of SBTH06, also contained significant proportions of gravel (~8.9 % in both cases), and were therefore classified as gravelly sand.

By contrast, samples SBTH07 (572_31#02) and SBTH19, also located within the Grounds area, albeit further inshore, were classified as muddy sand, containing 20.62 and 32.46 % mud, respectively.

The majority of the samples however were classified either as sand (nine samples) or slightly gravelly sand (two samples). The sands throughout the survey area primarily consisted of medium to very fine sands. The samples collected from around the Hounds in the northwest of the MCZ (stations 01, 16, 28, 29, 31 and 32), were generally characterised by very fine (0.063 – 0.125 mm) sands (54.45 – 84.78 %), while those taken from west of 'the Streets' (stations 03, 20 and 23) were dominated by fine (0.125 – 0.250 mm) sands (78.98 – 90.45 %). The samples collected from within the Grounds area were more variable, with both fine sands (12.43 – 67.11 %) and medium (0.25 – 0.50 mm) sands (2.48 – 43.67 %) dominating.

Macrobenthic invertebrate analysis

Macrofaunal abundance

The macrofaunal analysis identified a total of 657 individuals and 81 taxa (not including non-countable epifaunal taxa). The highest numbers of both individuals (N) and taxa (S) were recorded in samples collected from around the Hounds (7 samples, total N = 546, $\overline{x}$ N = 78, $\overline{x}$ S = 18) with far lower numbers recorded in samples from the Grounds (6 samples, total N = 85, $\overline{x}$ N = 14, $\overline{x}$ S = 6) and the Streets (3 samples, total N = 26, $\overline{x}$ N = 9, $\overline{x}$ S = 6).

A summary of the most abundant taxa present in the samples is given in Table 7 and the full results of the macrobenthic invertebrate analysis are provided in Appendix VI.

Table 7: Total abundance of macrofaunal taxa identified in grab samples collected as part of the Selsey Bill and the Hounds MCZ grab survey 2023. Taxa shown comprise 70 % of total individuals identified. Note some cells are left deliberately blank

Taxon	Qualifier	Abundance (total no. in all samples)
Iphinoe trispinosa		166
Nucula nitidosa		85
Magelona johnstoni		31

Taxon	Qualifier	Abundance (total no. in all samples)
Spiophanes bombyx		25
Bathyporeia tenuipes		25
Nephtys	sp. juv	20
Nephtys cirrosa		20
Chaetozone setosa		18
Monocorophium sextonae		14
Glycera alba		12
Nephtys kersivalensis		10
Dipolydora coeca		10
Pisidia longicornis		10
Scoloplos armiger		9
Athanas nitescens		9

Overall, the macrofauna was dominated by Crustacea (45.7 %), followed by Polychaeta (38.1 %) and Mollusca (16.1 %). The most abundant taxon overall was the cumacean *Iphinoe trispinosa*, which was present in 7 of the 16 samples. Six of these samples were collected from around the Hounds, with abundances of up to 40 individuals 0.1 m^{-2} recorded. The bivalve *Nucula nitidosa* was also common in samples from around the Hounds, being recorded in 4 samples in densities of up to 57 individuals 0.1 m^{-2}. Other common species predominantly found in this area included the polychaetes *Magelona johnstoni*, *Spiophanes bombyx* and *Chaetozone setosa*.

Away from the Hounds, the most common taxa included the polychaete *Nephtys cirrosa*, which was recorded in seven samples from the Grounds and the Streets, and the amphipod *Bathyporeia tenuipes*.

Sample SBTH02 was found to have a somewhat distinctive community compared to other stations in the survey area, with several taxa (including the polychaetes *Dipolydora coeca* and *Eunereis longissima*, the amphipods *Monocorophium sextonae* and *Maera grossimana*, the carid shrimp *Athanas nitescens* and *Eualus cranchii*, the porcelain crab *Pisidia longicornis* and the bivalves *Venerupis corrugata* and *Barnea candida*) only being recorded at this station.

Biotopes

Examining the macrobenthic invertebrate results together with the PSA results and the locations of the samples (taking into account factors including shelter and depth), a total of six biotopes were identified.

Six of the seven samples collected around the Hounds were assigned the biotope **SS.SCS.ICS.CumCset** ('Cumaceans and *Chaetozone setosa* in infralittoral gravelly

sand'), which, despite the coarse sediment classification, occurs in very fine to medium sands with low proportions of gravel. The samples at stations 16, 28 and 31 were devoid of *C. setosa*, however this biotope was considered an appropriate assignment due to the high numbers of *I. trispinosa*.

Due to the presence of *V. corrugata* and the high numbers of amphipods including *Monocorophium* spp. and *M. grossimana*, sample SBTH02 was assigned the biotope **SS.SMx.IMx.VcorAsquAps** ('*Venerupis corrugata*, *Amphipholis squamata* and *Apseudes latreilli* in infralittoral mixed sediment'). However, as the grab sample contained a sheared-off chunk of soft rock in the grab sample, it was deemed appropriate to also assign a hard substrate biotope at this station. The presence of the white piddock, *B. candida*, several examples of which were extracted from boreholes in the rock, meant that the biotope complex **CR.MCR.SfR** ('Soft rock communities') was also assigned to this sample.

Samples collected from the western side of the Streets area were generally characterised by fine sands with very low numbers of individuals (4 – 13, $\overline{x}$ = 9). These samples were therefore assigned the biotope **SS.SSa.IFiSa.IMoSa** ('Infralittoral mobile clean sand with sparse fauna'). This biotope was also assigned to sample SBTH07 (572_31#03).

The communities recorded within the Grounds area were also generally impoverished. Where the errant polychaete *Glycera* sp. was recorded (SBTH19 and SBTH24) the biotope **SS.SCS.ICS.Glap** ('*Glycera lapidum* in impoverished infralittoral mobile gravel and sand') was assigned. Where low numbers of both *N. cirrosa* and *B. tenuipes* were present (SBTH21 and SBTH26), the biotope **SS.SSa.IFiSa.NcirBat** ('*Nephtys cirrosa* and *Bathyporeia* spp. in infralittoral sand') was recorded.

At station SBTH06, the sand mason worm *L. conchilega* was recorded in sandy gravel with low numbers of other polychaetes, including the cirratulid *Cirriformia tentaculata*. The biotope **SS.SCS.ICS.SLan** ('Dense *Lanice conchilega* and other polychaetes in tide-swept infralittoral sand and mixed gravelly sand') was therefore recorded.

The biotopes assigned to each grab sample are given in Table 8, and the distribution of the assigned biotopes is shown in Figure 7.

Table 8: MNCR biotopes (JNCC, 2022) assigned to grab samples collected as part of the Selsey Bill and the Hounds MCZ grab survey 2023.

Station name	Sample no.	Area	Sediment type	MNCR biotope
SBTH01	572_24#01	Hounds	Sand	SS.SCS.ICS.CumCset
SBTH02	572_37#03	Hounds	[No PSA sample]	SS.SMx.IMx.VcorAsquAps /CR.MCR.SfR
SBTH03	572_26#01	The Streets	Sand	SS.SSa.IFiSa.NcirBat
SBTH06	572_29#02	The Grounds	Sandy gravel	SS.SCS.ICS.Slan

Station name	Sample no.	Area	Sediment type	MNCR biotope
SBTH07	572_31#03	The Grounds	Gravelly sand	SS.SSa.IFiSa.IMoSa
SBTH16	572_23#01	Hounds	Sand	SS.SCS.ICS.CumCset
SBTH19	572_35#01	The Grounds	Muddy sand	SS.SCS.ICS.Glap
SBTH20	572_25#01	The Streets	Sand	SS.SSa.IFiSa.IMoSa
SBTH21	572_28#01	The Grounds	Sand	SS.SSa.IFiSa.NcirBat
SBTH23	572_27#01	The Streets	Sand	SS.SSa.IFiSa.IMoSa
SBTH24	572_30#01	The Grounds	Gravelly sand	SS.SCS.ICS.Glap
SBTH26	572_32#01	The Grounds	Sand	SS.SSa.IFiSa.NcirBat
SBTH28	572_36#02	Hounds	Slightly gravelly sand	SS.SCS.ICS.CumCset
SBTH29	572_38#01	Hounds	Slightly gravelly sand	SS.SCS.ICS.CumCset
SBTH31	572_41#01	Hounds	Sand	SS.SCS.ICS.CumCset
SBTH32	572_40#01	Hounds	Sand	SS.SCS.ICS.CumCset

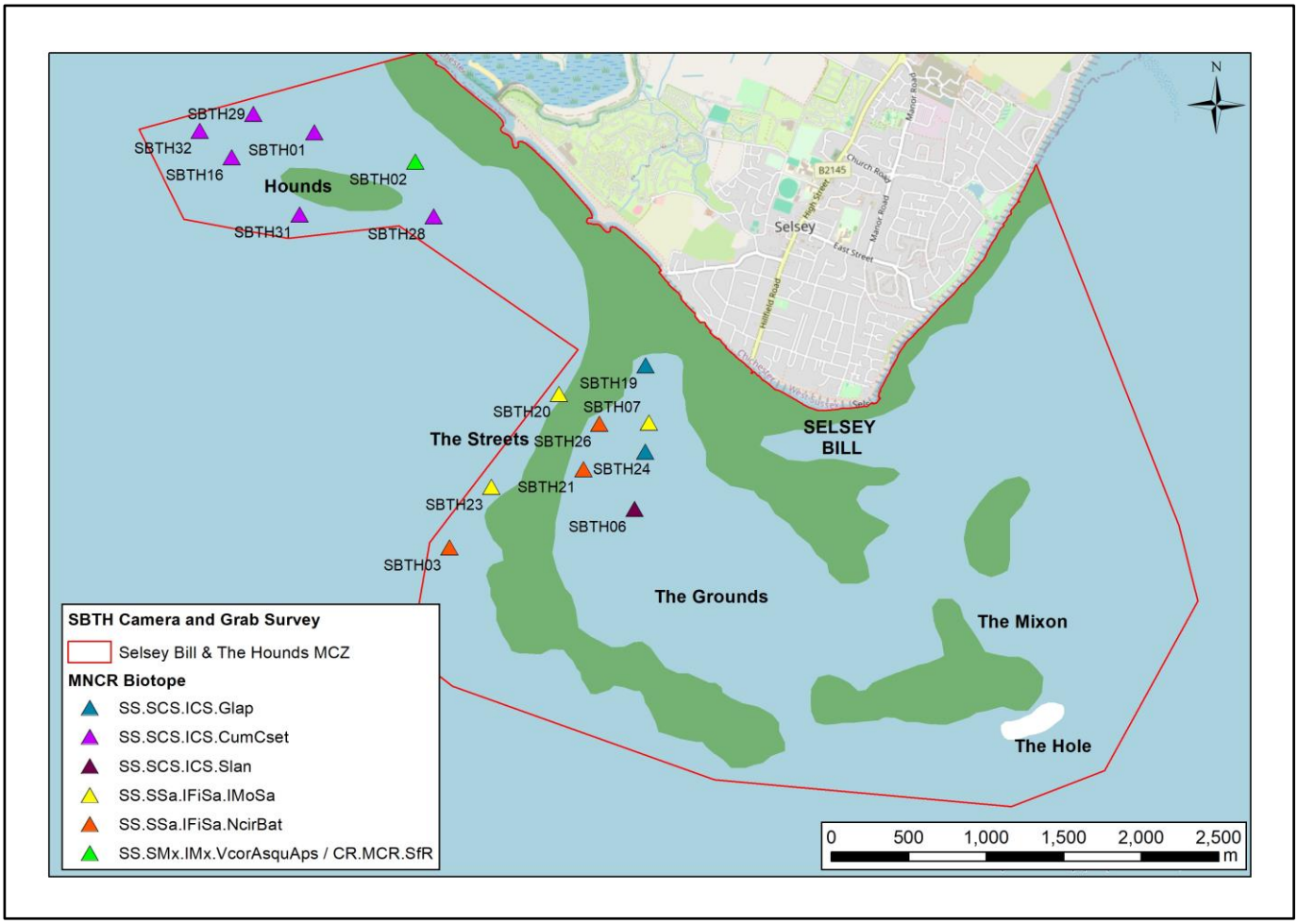

Figure 7: MNCR biotopes (JNCC, 2022) assigned to macrobenthic invertebrate samples collected as part of the Selsey Bill and the Hounds MCZ grab survey 2023

Habitats and species of interest

Habitats of conservation interest

The habitat of conservation interest (HOCI) 'subtidal sands and gravels' was identified throughout the survey area, and was assigned to 31 of the 37 video segments analysed. Sands were most common in the west of the MCZ, being present either as areas of rippled fine sand with minor shell and gravel components or as a thin veneer over flat bedrock. Gravels were more common in the east of the survey area, where sediments were generally composed of gravel and pebbles with occasional cobbles. In contrast to the relatively barren sands in the west of the MCZ, these gravels were characterised by often dense seaweed communities. The grab sample results also indicate the presence of 'subtidal sands and gravels' at every station where PSA samples were collected.

The HOCI ‘peat and clay exposures’ was recorded at SBTH02 and SBTH10. In both cases patches of exposed blue clay were present with a thin veneer of shelly fine sand. These areas were however very limited in size and did not appear to form distinct habitats.

Blue mussel (*M. edulis*) beds were identified on sand-inundated rock at SBTH19, in the inshore of the MCZ on the boundary of the intertidal zone. The beds were not extensive and were instead limited to small patches interspersed with rippled sands and exposed soft bored bedrock. The mussels themselves were generally overgrown with finely branching and filamentous red seaweeds, although ‘clean’ areas of mussels were also observed. Small patches of *M. edulis* were also identified at SBTH13 and SBTH20 on sands and gravels, however due to the limited size of the patches and the dense canopy of overlying seaweeds, it is unlikely that these could be considered true mussel beds.

Rocky and stony Annex I reef sub-features were also recorded in the survey area. Rocky reef was mainly present as flat, often soft/bored bedrock and was generally restricted to the west of the MCZ, particularly around the Hounds and the Streets. Areas of rock were generally heavily sand-influenced and associated biotic communities were usually impoverished.

Potential stony reef was recorded at 4 stations (05, 16, 19 and 22) and consisted primarily of cobbles overlying soft sediments. Reef composition and elevation were low throughout, although occasional boulders of medium elevation were observed at SBTH16 and SBTH19. Areas of potential stony reef were generally characterised by dense seaweed communities dominated by *H. siliquosa* and a range of foliose and finely branching red seaweeds including *C. ramosa* and *P. rotunda*, however on some of the larger boulders silt-influenced mixed faunal turf communities (**CR.HCR.XFa**) were recorded together with encrusting sponges.

Species of conservation interest

Undulate skate, *Raja undulata*, was identified from video records at SBTH11 and SBTH15, with a total of 3 individuals observed. This species is listed as a species of conservation importance (SOCI) in England and Wales, a species of principal importance (SPI) in England and is listed as Endangered by the IUCN Red List of Threatened Species.

Non-indigenous species

The slipper limpet *C. fornicata*, assumed to have been introduced to the UK from America between 1887 and 1890 (Rayment, 2008), was frequently observed in imagery records. Apparently live (i.e. attached) *C. fornicata* were recorded at 7 stations (04, 06, 09-12 and 15), although numbers were generally low and only a very few ‘stacks’ were identified. Dead *C. fornicata* shell material was more common, however, being recorded at a total of 11 stations (02, 04, 06, 09, 11, 12, 14, 15, 16, 17 and 19). This species was most common at SBTH06, where densities were sufficient to assign the biotope **SS.SMx.IMx.CreAsAn** to some still images. In addition, a single *C. fornicata* was recorded in the grab sample collected at SBTH06.

The leathery sea squirt *Styela clava*, a species native to the northwest Pacific which was first identified in the UK in 1953 (Neish, 2007), was also identified in the video and still imagery, being recorded at a total of 6 stations (02, 05, 09, 11, 13 and 22).

A possible NIS was flagged in a single still image from SBTH16; a very small patch of the encrusting compound sea squirt *Botrylloides* sp. was present on a pebble in image 572_14#01_06. Species in this genus can be difficult to identify to species level except in certain situations, particularly in drop-down imagery. Given the colouration and arrangement of the zooids, it is likely that the species was the native *B. leachii*, however the NIS *B. diegensis* could not be ruled out.

Evidence of anthropogenic impacts

During the camera survey, pot markers were present at the planned end of line at SBTH18. Video recording was stopped early in order to avoid the risk of the camera frame snagging on any fishing gear present. Similarly, pot markers was present at the desired start of the video transect at SBTH22, on the 100 m outer ring of the planned target. The start of the transect line was moved accordingly in order to maintain a safe distance from any fishing gear.

No fishing gear was observed in any of the underwater imagery records, however a single item of litter was identified at SBTH14, although the item could not be positively identified.

Discussion

Achieved survey

The 2023 survey succeeded in acquiring high quality underwater imagery data and grab samples. The analysis of the acquired data enabled the identification of the range of habitats present in the MCZ as well as the identification and enumeration of the main characterising species of the different habitats present. Despite concerns expressed in Godsell and Miller (2016), the survey demonstrated that drop-down camera work and successful grab sampling are eminently possible within the Selsey Bill and the Hounds MCZ, including those areas with fast tidal flows or which are in close proximity to exposed rocky reef habitats, providing suitable techniques are employed.

All of the 22 planned camera transects were successfully carried out, yielding 4 hours and 21 minutes of analysable footage and 376 still images. Data were collected from all regions of the Selsey Bill and the Hounds MCZ. All imagery data acquired were analysed.

Grab samples were attempted at a total of 19 stations. Samples for macrobenthic invertebrate analysis were successfully collected at 16 stations, and samples for PSA were successfully collected at 17 stations. Due to the coarse nature of the substrate in the east of the survey area, grab sampling was restricted to areas of soft sediment in the western half of the MCZ, in the areas known as the Hounds, the Streets and the Grounds. All samples collected were analysed.

The data collected and analysed as part of this survey are suitable for use as a baseline dataset against which potential future changes can be measured, which will enable monitoring of the condition of the habitat features of conservation interest for which the MCZ was designated.

Presence and condition of habitats of interest

A summary of the qualifying features of conservation interest for Selsey Bill and the Hounds MCZ identified from the underwater imagery data is given in Table 9. In addition to those features identified following analysis of the imagery records, the habitat feature ‘subtidal sands’ was identified at 15 of the 17 stations at which PSA samples were collected.

Table 9: Summary of the drop-down camera transect locations at which the qualifying habitat features of conservation interest of the Selsey Bill and the Hounds MCZ were identified following the 2023 survey. Note some cells are left deliberately blank

Feature of conservation interest	SBTH01	SBTH02	SBTH03	SBTH04	SBTH05	SBTH06	SBTH07	SBTH08	SBTH09	SBTH10	SBTH11	SBTH12	SBTH13	SBTH14	SBTH15	SBTH16	SBTH17	SBTH18	SBTH19	SBTH20	SBTH21	SBTH22
High energy infralittoral rock				●	●												○		○	●		●
Moderate energy infralittoral rock		●														●			●			
Low energy infralittoral rock																						
Moderate energy circalittoral rock																●	●	●	●			
Subtidal sand	●	●	●				●									●	●		●	●	●	
Subtidal mixed sediments						○										●						
Peat and clay exposures		○								●												

● = Identified from video footage and still images.
○ = Identified from still image(s) only.

All of the qualifying features of conservation interest for which the MCZ was designated were identified with the exception of low energy infralittoral rock. High energy infralittoral rock was most common in the Streets area of the MCZ and was generally characterised by dense, heavily sediment-affected seaweed communities, often dominated by the brown seaweed *H. siliquosa*. Moderate energy infralittoral rock was primarily observed around the Hounds and in the inshore-most region of the Grounds, either on flat bored bedrock (at SBTH02) or on cobbles and boulders (SBTH16 and SBTH19). When occurring on boulders, associated biota was sparse, limited to patchy foliose and erect branching red seaweeds, however at SBTH02 a more diverse range of seaweed species and morphotypes were recorded.

Moderate energy circalittoral rock was present around the Hounds in the form of sand-covered soft bored flat bedrock (**CR.MCR.SfR.Pid**); this habitat was also identified from the chunk of bedrock present in the grab sample taken at SBTH02. Mussel beds on rock (**CR.MCR.CMus**) were also recorded at SBTH19 in the inshore-most region of the Grounds, however these were present only as small patches and were often overgrown with finely branching and filamentous seaweeds. The underlying bedrock observed at this sampling location was also characterised by dense holes created by boring bivalves.

Subtidal sands were commonly recorded in the MCZ, particularly in the western half of the survey area in the vicinity of the Hounds and the Streets, where rippled mobile sands were observed. The results of the macrobenthic invertebrate analysis indicate that the biological communities associated with the sands in the MCZ are fairly impoverished, particularly in the centre of the MCZ around the Streets and in the Grounds, with low numbers of individuals and low species diversity recorded.

Mixed sediment biotopes were relatively rare in the survey area, limited to a short video segment at SBTH16 and the area characterised by *C. fornicata* material at SBTH06. The seabed in the eastern half of the MCZ was however found to be primarily composed of subtidal coarse sediments (gravel and pebbles) characterised by dense seaweed communities. In some cases these sediments featured patchy cobbles. Mosaics of cobbles overlying soft sediments such as those observed at stations SBTH05, SBTH08, SBTH19 and SBTH22 (all located in the central region of the MCZ) are included in some definitions of mixed sediments. Depending on the definition used, therefore, the subtidal mixed sediments habitat feature may be considered to be more widespread in the MCZ if only data regarding substrate is taken into account.

Clay exposures were observed at two stations (SBTH02 and SBTH10). In both cases, small patches of exposed blue clay were present underneath a thin veneer of shelly fine sand. In contrast to previous reports, clay was not recorded within the Mixon Hole, with the seabed observed instead consisting primarily of pebbles and shell material. However, it should be noted that only a single camera transect (SBTH14) was conducted in this area.

Issues encountered

During the drop-down camera survey, it was found that the currents in the MCZ were extremely variable in terms of speed and direction. On several transects, depending on the state of the tide, strong currents affected the ability of the field team to control the height and aspect of the camera frame, as well as the underwater visibility, meaning that video quality was frequently poor. Video records were therefore not used to enumerate biota, but rather to create a presence/absence species list for each video segment. Despite this, however, 79 % of still images were deemed to be of either good or excellent quality, with just 18 still images (<5 %) classified as very poor quality and therefore of limited use.

Despite the very high overall quality of the still images, species identification proved difficult in some cases. The vast majority of biotic communities recorded were characterised by seaweeds, particularly foliose and erect branching red seaweeds, which can be extremely difficult to identify to species level, particularly in imagery. While efforts were made to identify taxa as far as reasonably possible, many identifications were stopped at the morphological level (e.g. ‘Rhodophyta - erect fine branching’ or ‘Phaeophyceae - filamentous/filiform’) and several species identifications were flagged as uncertain (e.g. ‘*Polyides rotunda* – incerta, possible *Furcellaria lumbricalis*’). Resolution

could potentially be improved via the collection and expert identification of local physical samples of seaweed species, which can then be compared to the species observed in the imagery records, although this should be undertaken with care.

Due to the presence of coarse sediments and hard substrate identified following the camera survey, grab sampling was deemed to be impractical for large parts of the survey area, particularly in the eastern half of the MCZ. It was considered that even the use of a Hamon grab would not achieve acceptable samples in areas where cobbles were frequent. Grab sampling operations were therefore restricted to the western and central regions of the MCZ, with no grabbing attempted in the east of the MCZ. Even where fine sediments were present, however, these often existed as thin veneers over flat, soft bedrock meaning that grab volumes were sometimes low. The decision to geographically restrict grabbing operations did however mean that a Day grab could be employed, resulting in higher quality grab samples.

Whilst surveys have been conducted within the MCZ previously, these have been mostly restricted to Seasearch dive observations and/or surveys focusing on geographically limited areas within the MCZ (e.g. Mixon Hole, Sluice Rocks, East Beach). This, together with the fact that dive survey and drop-down video techniques do not produce readily comparable data outputs, means that few conclusions can be drawn regarding temporal change within the MCZ. However, some limited qualitative comparisons are possible where the surveys overlap. For example, observational descriptions of the seabed around the Hounds from a dive survey in 2018 records the presence of red foliose seaweeds and faunal turf on soft bored rock, similar to the habitat observed at SBTH02 in the 2023 survey. Similarly, the limited number of successful grab samples collected in 2014 by the Environment Agency (Godsell and Miller, 2016) means that statistical comparisons with the current biological community data are not recommended.

One of the objectives of the survey was to map the subtidal communities present in the MCZ and hence to verify the extent of subtidal rock habitats. The principal of habitat mapping is based on the acquisition of both acoustic and ground-truthing data, which enables a substrate type or biotope assigned to the ground-truthing data to be assigned to areas of consistent sidescan sonar reflectivity or bathymetry. No recent acoustic data for the MCZ were available, which meant that habitat maps of the MCZ could not be created. It is therefore strongly recommended that a survey is commissioned to collect suitable acoustic data (i.e. sidescan sonar and bathymetry) within the MCZ. It is also strongly recommended that this survey be conducted as soon as possible to ensure that the data acquired can be used in conjunction with the underwater imagery and grab sample data presented in this report in order to create a fully up-to-date, predictive habitat map. This would seem a particularly important task as the current broadscale habitat map for the Selsey Bill and the Hounds MCZ (accessible via https://www.gov.uk/government/publications/marine-conservation-zones-selsey-bill-and-the-hounds) contains some very large data gaps and also suggests the presence of large areas of low energy infralittoral rock (which is erroneously shown extending into the intertidal), which was not identified in the present survey. Creation of a habitat map would enable future monitoring of potential changes in the range, distribution and extent of the

qualifying habitat features of conservation interest of the MCZ and their component biotopes.

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Appendices

The appendices to this report have been appended separately to ensure all information is presented accurately. The appendices are as follows;

- Appendix I: Drop-down camera logs
- Appendix II: Grab sampling logs
- Appendix III: Video imagery analysis results
- Appendix IV: Still imagery analysis results
- Appendix V: Grab sample sediment particle size analysis results
- Appendix VI: Macrobenthic invertebrate analysis results

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