



XODUS
DEVELOP



Deep Green Project EIA: Coordination

Habitat assessment report (CMACS, 2015b)

Minesto AB

Assignment Number: L100194-S00

Document Number: L-100194-S00-REPT-010

Xodus Group
Cheapside House, 138 Cheapside
London, UK, EC2V 6BJ

T +44 (0)207 246 2990
E info@xodusgroup.com
www.xodusgroup.com





Habitat assessment report (CMACS, 2015b)

L100194-S00

Client: Minesto AB

Document Type: Report

Document Number: L-100194-S00-REPT-010

			pp			
A01	02/12/2015	Issued for Use	CMACS	IMTD	JDM	-
R01	12.10.15	Issued for Review	CMACS	IMTD	JL	-
Rev	Date	Description	Issued By	Checked By	Approved By	Client Approval



Centre for Marine and Coastal Studies Ltd

Deep Green Project – Holyhead Deep

Habitat Assessment Report

CMACS Job Number: J3279

Prepared for: Xodus

FAO: Joanna Lester

Version	Date	Description	Prepared by	Checked by	Approved by
1	31/7/2015	First draft	Ken Neal	TJH	TJH
2	21/8/2015	Revisions after client comments	Ken Neal		
3	4/12/2015	Revised draft	Ken Neal	TJH	TJH

Report reference: Deep Green Project – Holyhead Deep

Head Office

CMACS Ltd
80 Eastham Village Road
Eastham
Wirral
CH62 0AW

Tel: +44 (0)151 327 7177
Fax: +44 (0)151 327 6344
e: info@cmacsltd.co.uk
web: www.cmacsltd.co.uk

Isle of Man

CMACS Ltd
Asahi House
10 Church Road
Port Erin
Isle of Man
IM9 6AQ



Centre for Marine and Coastal Studies Ltd

Table of Contents

1. Introduction	1
2. Methods	3
2.1 Sample station selection.....	3
2.2 Camera survey	3
2.3 Grab survey	4
2.3 Sample analysis	5
3. Survey	9
4. Habitats and species.....	9
4.1 Drop down camera	9
4.2 Particle size analysis	24
5. Habitats of conservation importance	24
6. Conclusions/summary.....	26
7. References.....	27
8. Plates	28

Appendices

Appendix 1: Field notes from Camera survey	1
Appendix 2: Field notes from Grab survey	1
Appendix 3. Drop down camera habitat and faunal data	1
Appendix 4. Particle size analysis data	1

List of Figures

Figure 1: Overview of project development area and associated cable route corridor.	2
Figure 2: Location of camera survey stations with PDA and CRC bathymetry.....	7
Figure 3: Location of grab survey stations with PDA and CRC bathymetry.....	8
Figure 4. Habitat types and reef quality in the PDA, CRC and on reference stations.....	11
Figure 5. Indicative biotope map based on side scan sonar mosaic and drop down camera images.	23

1. Introduction

The Deep Green Project proposed for Holyhead Deep is a tidal power project under development by Minesto Ltd. The Project will consist of three tidal generation units anchored to the seabed along with infrastructure such as an export cable to transfer power to shore and a subsea transformer.

As part of the application for consent to install the Project, an environmental impact assessment is required, which in turn needs characterisation data of the seabed to inform the assessment. Xodus Group on behalf of Minesto have contracted CMACS Ltd to carry out benthic characterisation surveys in the project development area (PDA) and associated cable route corridor (CRC).

This report provides an initial assessment of the habitats and biotopes present in the survey area (see Figure 1) using images of the seabed taken during the drop down camera survey. A later Environmental Baseline Report will characterise the sediments and infauna (from grab samples), and refine the biotope classifications based on that data and the information presented here.

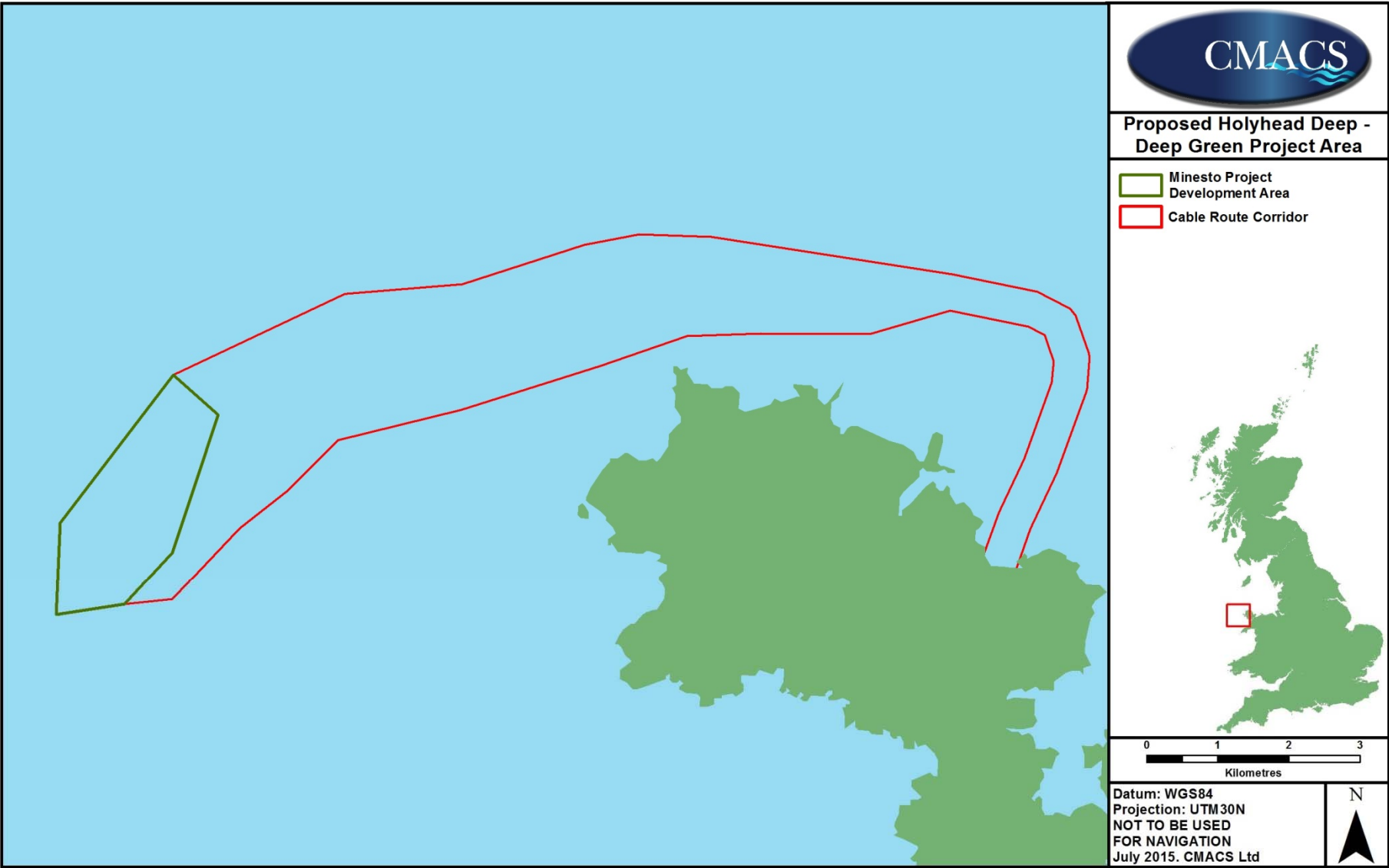


Figure 1: Overview of project development area and associated cable route corridor.

2. Methods

The environmental survey programme was designed to ground-truth the acoustic data acquired during the geophysical survey as well as characterise the biota that the benthic habitats support.

The environmental survey programme comprised:

- Drop down camera (Figure 2).
- Grab sampling (Figure 3).

2.1 Sample station selection

Sidescan sonar mosaics and bathymetric data derived from a geophysical survey (BibbyHydromap, 2015) of the PDA and CRC in June 2015 were used to differentiate seabed habitats. The large majority of the surveyed seabed habitat appeared in the side scan sonar mosaic to be coarse sediment with the remainder consisting of bedrock and areas that had a 'texture' that suggested biogenic reef may be present

A random stratified approach was taken to placing sample stations to ensure that adequate coverage was provided on all predicted habitats (Table 1). In addition, seven stations were added outside the PDA and CRC as reference stations, which could provide sample stations for any future monitoring. One of these stations (41) was subsequently moved into the CRC to investigate an area where side scan sonar records showed images suggesting the possibility of horse mussel reef. Depths of water at the sample stations ranged from 11 metres below Chart Datum at station 37 inshore on the CRC to 89 metres below Chart Datum at station 2 in the centre of the PDA. There was considerable surface relief at some locations in the survey area particularly between stations 17 and 22 and in the areas around stations 25 and 29 (see Figure 2 and Figure 3) indicating possible projections of bedrock through the surface sediments. A number of camera stations were located on these areas of relief to investigate the habitat type and epifauna.

Most of the stations placed were intended for both drop down camera survey and grab sampling but there were six stations that were suitable for camera survey only owing to the likely presence of bedrock or very large particles.

2.2 Camera survey

A Seaspyder drop down camera (see Plate 1) was deployed slowly to the seabed whilst the vessel drifted over the target. An ultra-short baseline (USBL) was attached to the camera so that the surveyors could ensure that the camera landed on the seabed within a 50m zone around the target. The lead biologist captured and logged stills and video imagery from each site in addition to associated data such as depth, time and brief notes on the sediment type and any identifiable epifauna (Appendix 1: Field notes from Camera survey).

A single position fix was obtained when the camera was first deployed to the seabed. On a subset of inshore stations, the camera was re-deployed on four further occasions at each

station by lifting off the seabed then lowering again within a few metres of the original target position. This approach became untenable at the majority of stations, however, as the depth of water combined with the strength of the current did not allow for the camera to be repositioned within the 50m zone.

Particular attention was paid to the potential presence of any habitat of conservation concern, particularly those known or suspected to occur in the vicinity (e.g. *Sabellaria spinulosa* or *Modiolus modiolus* reef under the EC Habitats Directive and UK Biodiversity Framework) or rare/sensitive species (e.g. those listed under the OSPAR Commission).

2.3 Grab survey

A standard weighted Hamon grab with a 0.1m² sample area was used for all the sediment sampling. All samples were collected from within 50m of the target location.

Upon contact with the seabed, the USBL was used to derive a positional fix. Upon retrieval of each sample the date, time and water depth were recorded, along with a description of the volume of sample and also the dominant sediment type. A digital photograph of each faunal grab was taken of the sample prior to any sieving. Notes were made on sediment type, colour, volume and any species of note in each grab sample (Appendix 2: Field notes from Grab survey). At each sample station, the intention was to collect two samples; one for faunal analysis with a second sample for contaminants and particle size analysis.

Grab samples of less than 5 litres (or 2.5 litres on hard-packed substrates) in volume were rejected. Samples were also rejected if the grab jaw was not properly closed.

After initial observations and photographs a representative subsample of approximately 500g was removed for particle size analysis (PSA) and total organic carbon (TOC) analysis. All sediment samples were frozen immediately on board the survey vessel.

Contaminants sampling and analysis will be described in a subsequent technical report.

Table 1. Selection notes for each sample station in the PDA and CRC.

Sample station	Station selection notes	Sample station	Station selection notes
1	Possible <i>Sabellaria</i> reef.	22	Possible <i>Sabellaria</i> reef.
2	Possible <i>Sabellaria</i> reef.	23	Coarse ground.
3	Bedrock. Camera station only.	24	Possible <i>Sabellaria</i> reef.
4	Coarse ground.	25	Bedrock camera station only.
5	Coarse ground.	26	Coarse ground.
6	Coarse ground.	27	Possible <i>Sabellaria</i> reef.
7	Rougher ground investigated for possible stony reef.	28	Coarse ground.
8	Coarse ground.	29	Coarse ground.
9	Coarse ground.	30	Coarse ground.
10	Coarse ground.	31	Coarse ground.
11	Rougher ground investigated for possible stony reef.	32	Bedrock camera station only.
12	Coarse ground.	33	Coarse ground.
13	Coarse ground.	34	Coarse ground.
14	Reference station (near field).	35	Coarse ground.
15	Reference station (near field).	36	Bedrock camera station only.
16	Reference station (near field).	37	Fine sediment
17	Bedrock camera station only.	38	Cable route reference station.
18	Bedrock camera station only.	39	Cable route reference station.
19	Coarse ground.	40	Cable route reference station.
20	Possible <i>Sabellaria</i> reef.	41	Possible <i>Modiolus</i> reef.
21	Coarse ground		

2.3 Sample analysis

Drop down camera images

Images from each drop down camera station were used to describe the seabed habitat, estimate the abundance of fauna and flora, which in turn informed an assessment of the presence of Annex I habitat. Organisms such as anemones, decapods and gastropods were enumerated from each image whereas the abundance of organisms such as hydroids and sponges was estimated by percentage cover of the substratum.

The quality of biogenic reef (as defined by its 'reefiness') was assessed using the criteria of Gubbay (2007) and that of stony reef using the criteria of Irving (2009) but reference was also made to Limpenny *et al.* (2010) when assessing both types of reef.

Habitat and visible fauna were used to classify biotopes according to Connor *et al.* (2004), the side scan mosaic was then used to extrapolate the boundaries of each biotope within the PDA and CRC. Note that many biotope classifications are tentative and will be refined once infaunal data is available and will be the subject of a further report.

Particle size analysis

The majority of sediment samples contained a wide range of sediment particles from cobble to clay. Each sediment sample was first wet sieved over a 2mm mesh with the two fractions subsequently treated as follows:

- The fraction of particles 2mm in diameter and larger was dried at 80°C for at least 24 hours and then dry sieved over a half-phi sieve series (see Table 2 below)
- The fraction of particles 2mm and smaller was transferred to a bottle and left to stand to allow the very fine particles to settle out of suspension. Once the liquid and solid had separated, the excess water was siphoned off the top of the sample (taking care not to disturb the fine sediments) and the sediment analysed with a Coulter Laser Sizer.

Table 2. Half-phi sieve series for dry fractionation.

Mesh aperture, mm										
63.0	45.0	31.5	22.4	16.0	11.2	8.0	5.6	4.0	2.8	2.0

Once complete this information will be used to ground-truth the geophysical data as well as create a map of habitat types for the PDA and CRC.

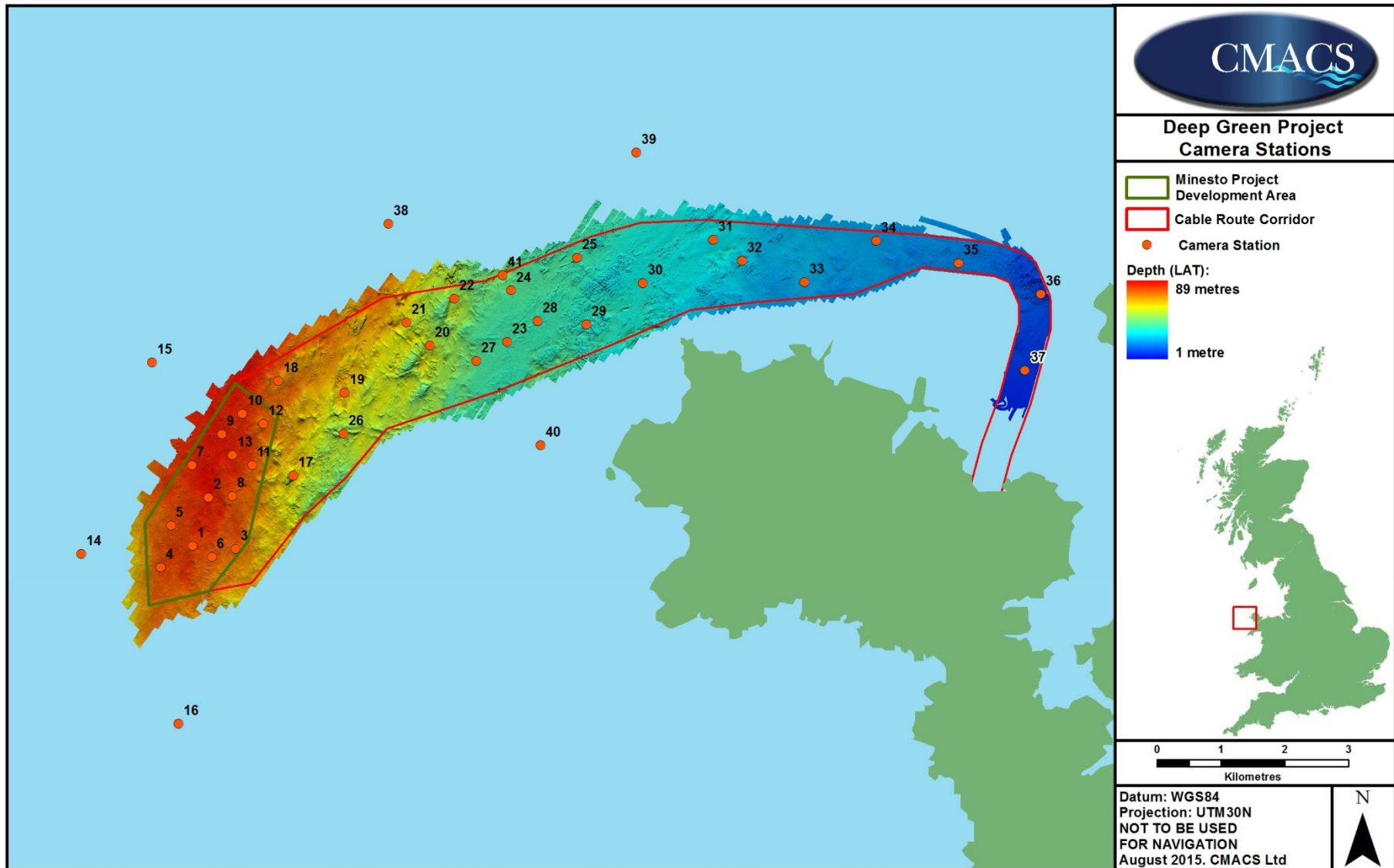


Figure 2: Location of camera survey stations with PDA and CRC bathymetry.

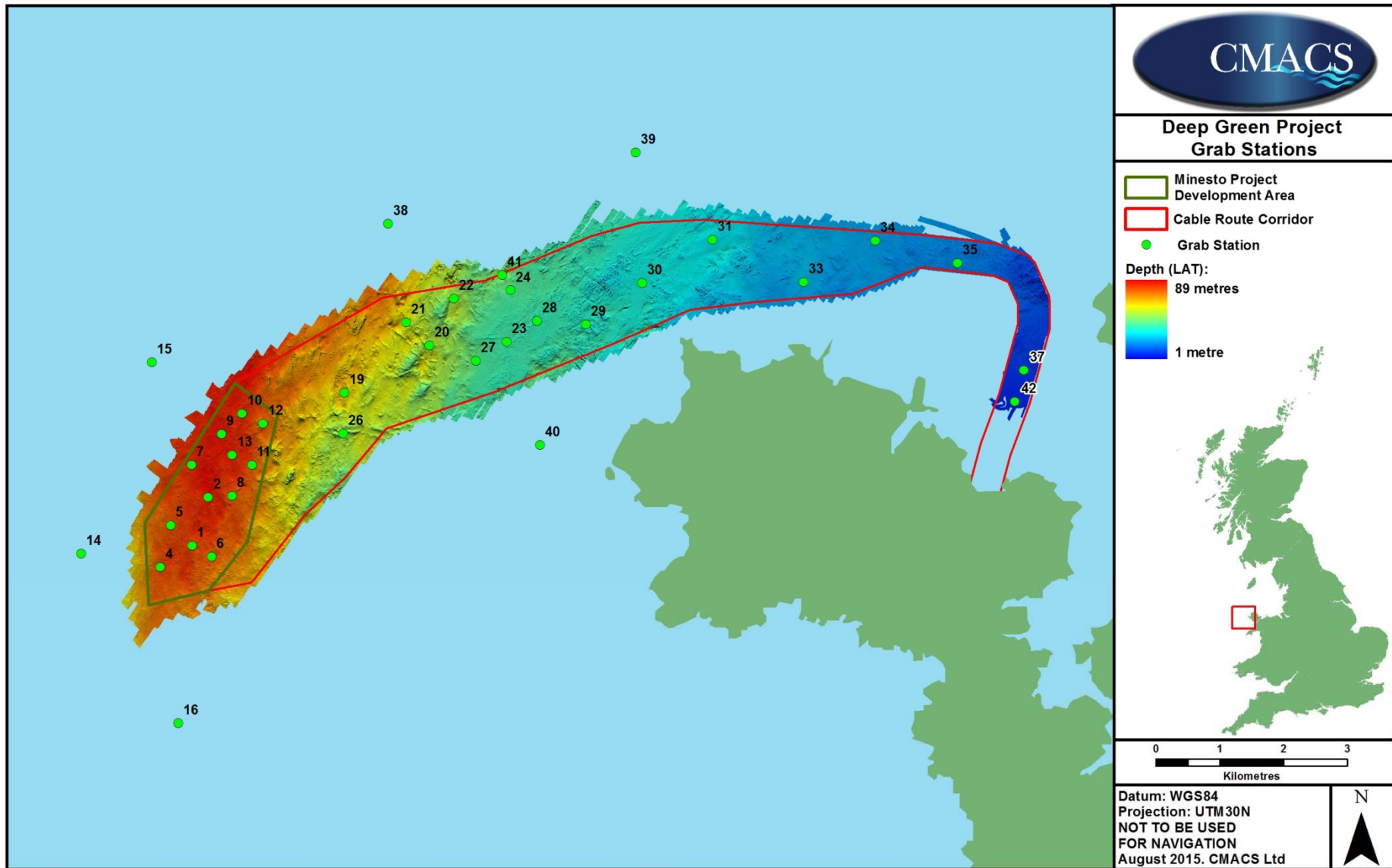


Figure 3: Location of grab survey stations with PDA and CRC bathymetry.

3. Survey

Video was obtained at all but one of the sample stations; no survey was attempted at station 40 owing to the vessel master's reservations regarding vessel safety on deploying equipment to the seabed close to the coast in strong tidal currents.

Stills images were obtained at thirty nine sample stations. Owing to equipment failure, a still image could not be obtained at Station 12 and habitat characterisation was undertaken using the video footage.

Grab samples were obtained from twenty three sample stations, with many failures owing to the very coarse nature of the seabed sediments which often prevented a suitable volume of sediment from being collected or particles became trapped in the jaw of the grab, leading to repeated sample rejection.

4. Habitats and species

4.1 Drop down camera

The large majority of images showed a seabed of very coarse sediment, predominantly pebble and gravel but with varying proportions of cobble, boulder, sand and shells of dead bivalves (habitat and fauna descriptions and depth at each station are provided in Appendix 1: Field notes from Camera survey and Appendix 3. Drop down camera habitat and faunal data. In the PDA, the seabed consisted mainly of pebble and gravel with sand and/or cobble at a few stations (Figure 4) and a relatively small area supporting aggregations of *Sabellaria* (see section 5 for more details). At the western end of the CRC, the seabed consisted of coarser particles than in the PDA and there were also small areas of exposed bedrock. Bedrock became more prevalent further to the east in the PDA and was interspersed with areas of pebble and gravel as well as biogenic reef. In the more eastern parts of the CRC, there were finer sediments including areas of predominantly sand but also an area of pebble and gravel supporting encrusting growths of *Sabellaria* and another area of exposed bedrock. Overall the groundtruthing broadly confirmed the preliminary interpretation from acoustic data of generally coarse seabed with outcrops of bedrock, although there was slightly more bedrock in parts of the CDC than initially considered.

Epifauna was variable but generally sparse (with a few exceptions) and was principally made up of scour tolerant taxa including various anemones, hydroids, erect bryozoa and epifaunal polychaetes.

A selection of representative images of the different habitats are shown below, and all images can be made available on digital media upon request.

Thirteen broad biotope classifications were assigned (see Table 3 for summary along with associated water depths) which are described in full below and shown in Figure 5.

Note that at Station 32 two different biotopes were assigned to different photographs, and that at some locations more than one biotope was considered to be present.

Table 3. Biotopes assigned at each sample station.

Biotope	Stations	Depth range (metres)
CR.HCR.FaT	17, 18	56 to 71
CR.HCR.FaT.BalTub	23, 25, 38	35 to 38
CR.HCR.XFa	3	72
CR.LCR.BrAs.AntAsH	36	8
CR.MCR.Csab.Sspi	1, 24, 27	40 to 80
CR.MCR.Csab.Sspi/SS.SBR.PoR.SspiMx	16	66
CR.MCR.EcCr.UrtScr	19, 20, 21, 32	26 to 65
CR.MCR.EcCr.UrtScr/CR.HCR.FaT.BalTub	26, 28, 29	35 to 52
SS.SCS.ICS.SSh	30, 31	28 to 32
SS.SMX.CMx.FluHyd	6, 9, 10	77 to 87
SS.SMX.IMx	33, 34, 35, 37	6 to 22
SS.SMX.OMx	2, 4, 5, 7, 8, 11, 12, 13, 14, 39, 41	48 to 87
SS.SMX.OMx/CR.MCR.Csab	22	50
SS.SSA.IfSa.ScupHyd	32	26

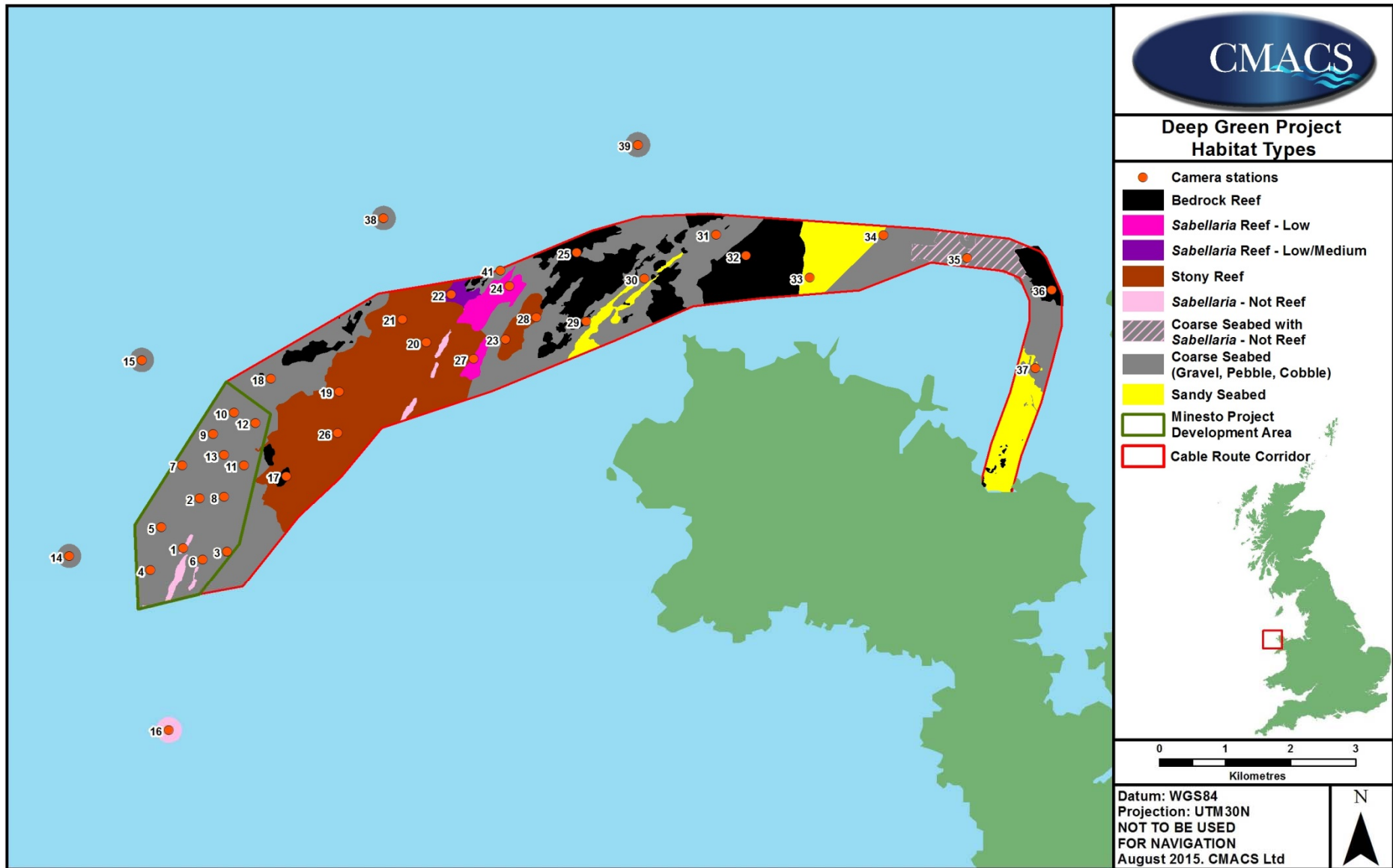


Figure 4. Habitat types and reef quality in the PDA, CRC and on reference stations.


CR.HCR.FaT 'Very tide-swept faunal communities'. Stations 17, 18.

Stations 17 and 18 were assigned this broad classification according to substratum type of bedrock, but could not be taken any further owing to the low diversity and abundance of the fauna.

Station 18 CR.HCR.FaT	Notes
	<p>Bedrock with dahlia anemone <i>Urticina</i> sp., barnacles (probably a species of <i>Balanus</i>) and a low faunal turf probably of erect bryozoa and hydroids. Mobile fauna is restricted to a single painted topshell <i>Calliostoma zizyphinum</i>.</p>


At three stations this biotope was further refined to CR.HCR.FaT.BalTub '*Balanus crenatus* and *Tubularia indivisa* on extremely tide-swept circalittoral rock' based on the abundance of barnacles but this can be considered as a 'best fit' as the epifauna at these stations was not as diverse as the biotope description suggests. Habitat at these stations was a mixture of boulder, cobble, pebble and gravel.

Stations 23, 25, 38.

Station 23 CR.HCR.FaT.BalTub	Notes
	<p>Boulder, cobble, pebble and gravel with abundant barnacles. Dahlia anemone are present as is a small area of hydroid. Mobile fauna includes small gastropods (possibly <i>Nucella lapillus</i>) and a hermit crab (a member of the Paguridae family of indeterminate species).</p>

CR.HCR.Xfa 'Mixed faunal turf communities'. Station 3.

Only Station 3 was included in this classification, which was assigned owing to the dense coverage of the hard substratum with sessile epifauna, mainly hydroids and bryozoans the majority of which could not be identified further.



Station 3 CR.HCR.Xfa	Notes
	Cobble with some pebble, gravel and shell fragments. The larger particles are covered with a turf of erect fauna which may include the hydroid <i>Hydrallmania falcata</i> and the sponge <i>Hemimycale columella</i> . CR.HCR.Xfa

CR.MCR.EcCr.UrtScr ‘*Urticina felina* and sand-tolerant fauna on sand-scoured or covered circalittoral rock’. Stations 19, 20, 21, part of 32.

This biotope was assigned to a number of stations mainly with habitat of cobble and pebble but with bedrock at one station. Epifauna was generally sparse and was characterised by scour-tolerant taxa such as dahlia anemone, keelworms (Serpulidae) and barnacles.


At a few stations, there was a slightly richer epifauna with characteristics of CR.MCR.EcCr.UrtScr but also some that matched CR.HCR.FaT.BalTub. To account for this, the stations in question (see Table 3) were classified as a combination of the two biotopes.

Stations 26, 28, 29

Station 21 CR.MCR.EcCr.UrtScr	Notes
	<p>Cobble, pebble and gravel with some shell fragments. A sparse covering of barnacles and faunal turf indicates regular disturbance of seabed particles. There are several dahlia anemones and a single common starfish <i>Asterias rubens</i>.</p>
Station 28 CR.MCR.EcCr.UrtScr/ CR.HCR.FaT.BalTub	Notes
	<p>Boulder and cobble with some pebble and shell. The larger particles are covered in a moderately rich epifauna of barnacles, ascidians (possibly <i>Dendrodoa grossularia</i> or <i>Distomus variolosus</i>) and the erect bryozoan <i>Alcyonidium diaphanum</i> as well as dahlia anemone <i>Urticina</i> sp. Mobile epifauna includes the sea urchin <i>Echinus esculentus</i>, the painted topshell <i>Calliostoma zizyphinum</i>, hermit crab and a small starfish.</p>


CR.MCR.CSab.Sspi ‘*Sabellaria spinulosa* encrusted circalittoral rock’. Stations 1, 24, 27.

There were five stations where honeycomb/ross worm was deemed to be in sufficient abundance that a *Sabellaria spinulosa* biotope could be assigned. Images generally showed a few aggregations of *Sabellaria* sp., mostly on coarse particles such as cobble and pebble but with some sand and possibly bedrock. Only Stations 22, 24 (see below) and 27 were deemed to have a sufficient abundance and elevation of *Sabellaria* aggregations to be considered as reef which is discussed further in the next section. At Station 16, the seabed was made up of finer sediment than at the other stations with *Sabellaria* and this shared as many features of the subtidal sediment biotope (SS.SBR.PoR.SSpiMx) as the circalittoral rock and has been classified as a combination of the two.

Station 24 CR.MCR.CSab.Sspi	Notes
	<p>Cobble and boulder (possibly bedrock) with elevated aggregations of <i>Sabellaria</i> sp.. A common starfish <i>Asterias rubens</i> and an indeterminate anemone species are also present.</p>

CR.LCR.BrAs.AntAsH 'Antedon spp., solitary ascidians and fine hydroids on sheltered circalittoral rock' Station 36.

This biotope was assigned to a single station that was in a sheltered location on the cable route, as evidenced by the prevalence of a layer of fine sediment over bedrock. The epifauna was quite limited, and the characterising brachiopods were not seen (although these are typically very small and difficult to see in camera images) but there were numerous feather stars *Antedon bifida* and lightbulb sea squirt *Clavelina lepadiformis* which gave a best match for this biotope.

Station 36 CR.LCR.BrAs.AntAsH	Notes
	<p>Silty bedrock or very large boulders. Identifiable epifauna was mainly feather stars and solitary ascidians but also with the erect bryozoan <i>Alcyonidium diaphanum</i>. There also appeared to be a short faunal turf and occasional fronds of a red alga</p>

SS.SCS.ICS.SSh 'Sparse fauna on highly mobile sublittoral shingle (cobbles and pebbles)'
Stations 30, 31.

The seabed at two stations was characterised by clean pebble and gravel, with an apparent lack of fine sediment, indicating that the sediment was mobile. At one station, there were cobbles the largest of which supported growths of mussels, which were probably *Musculus discors* and dahlia anemone were also present. The mussels were not at sufficient density to base a biotope classification on and the general lack of epifauna led to SS.SCS.ICS.SSh being assigned to this station.

Station 30 SS.SCS.ICS.SSh	Notes
	Cobble, pebble and gravel. Small aggregations of mussels, probably <i>Musculus discors</i> , on larger particles and one dahlia anemone.


SS.SMX.IMx 'Infralittoral mixed sediment' Stations 33, 34, 35, 37.

At two stations on the cable route, there were a variety of coarse sediment, predominantly gravel but with some cobble. Epifauna was sparse but more conspicuous than at station 30 (see above) which in combination with the likely presence of fine sediment and the relatively shallow depth of the station, it was designated as SS.SMX.IMx. The habitat at these stations are likely to be infauna-dominated and the biotope will be redefined upon interpretation of the grab faunal data.

Station 34 SS.SMX.IMx	Notes
	<p>Gravel and pebble with hermit crabs, hydroids and serpulid worms.</p>
Station 35 SS.SMX.IMx	Notes
	<p>Cobble and pebble with some boulder and gravel. Epifauna includes various hydroids and anemones with gastropods and the brittlestar <i>Ophiura albida</i></p>


SS.SMX.CMx.FluHyd '*Flustra foliacea* and *Hydrallmania falcata* on tide-swept circalittoral mixed sediment'. Stations 6, 9, 10.

There were three stations in the PDA, where the seabed was heavily encrusted with a faunal turf and all of them supported hornwrack *Flustra foliacea* though generally at low abundance. Other sessile fauna included sea anemones (*Sagartia* sp. and *Urticina* sp.), serpulid worms, the hydroid *Nemertesia antennina* and a sabellid worm at station 9.

Station 10 SS.SMX.CMx.FluHyd	Notes
	<p>Pebble and gravel with coarse sand. Sessile epifauna includes <i>Flustra foliacea</i>, the hydroid <i>Nemertesia antennina</i>, sea squirts of indeterminate species and anemones possibly <i>Sagartia</i> sp. Mobile fauna visible in the image was restricted to bloody henry starfish <i>Henricia</i> sp.</p>

SS.SSA.IFiSa.ScupHyd ‘*Sertularia cupressina* and *Hydrallmania falcata* on tide-swept sublittoral sand with cobbles or pebbles.’ Station 32 part.

There was one station towards the eastern end of the CRC where five images were obtained one of which showed bedrock and anemones (see CR.MCR.EcCr.UrtScr above) but the remainder showed a seabed of sand, gravel and dead bivalve shells. This supported a varied epifauna but hydroids dominated and the seabed in these images was classified as SS.SSA.IFiSa.ScupHyd.

Station 32 SS.SSA.IFiSa.ScupHyd	Notes
	<p>Coarse sand and horse mussel shell. The horse mussel shell supports growths of hydroids including <i>Hydrallmania falcata</i>. Other sessile fauna includes serpulid worms and small anemones of an indeterminate species.</p>

SS.SMX.OMx 'Offshore circalittoral mixed sediment'. Stations 2, 4, 5, 7, 8, 11, 12, 13, 14, 39, 41.

At most stations in the PDA the seabed was of coarse particles, mainly pebble and gravel but with variable proportions of cobble and sand. There were variable quantities of epifauna between stations but it is likely that these stations are infauna dominated and therefore the classification was limited to SS.SMX.OMx but this will be refined once grab data has been interpreted.

Station 7 SS.SMX.OMx	Notes
	<p>Pebble and gravel and some sand with <i>Modiolus</i> shell. Some of the larger particles support a faunal turf, a small patch of sponge and a hydroid that may be <i>Sertularia</i> sp.</p>
Station 13 SS.SMX.OMx	Notes
	<p>Pebble, gravel, shell fragments and broken <i>Sabellaria</i> tubes. Larger particles support faunal turf and serpulid worms. Mobile epifauna included a sea urchin <i>Psammechinus miliaris</i> and a crab of indeterminate species.</p>

Station 41 SS.SMX.OMx	Notes
	<p>Cobble, pebble and gravel with small aggregations of <i>Sabellaria</i> sp. This station was investigated for <i>Modiolus modiolus</i> reef which is further discussed in Section 0.</p>

SS.SMX.Omx/CR.MCR.Csab 'Offshore circalittoral mixed sediment' and 'Circalittoral Sabellaria reefs'. Station 22.

At this station in the CRC, the seabed had many characteristics of the offshore mixed sediments seen elsewhere (particularly in the PDA) but also had some seabed coverage of *Sabellaria* aggregations, though not sufficient to assign the station purely to a *Sabellaria* biotope. As a result, this station was assigned as a combination of the two biotopes.

Station 22 SS.SMX.Omx/CR.MCR.Csab	Notes
	<p>Gravel, pebble, cobble and probably boulder. Obvious epifauna consists of two relatively large aggregations of <i>Sabellaria</i> sp., anemones <i>Urticina</i> sp. and hydroids including <i>Hydrallmania falcata</i>.</p>

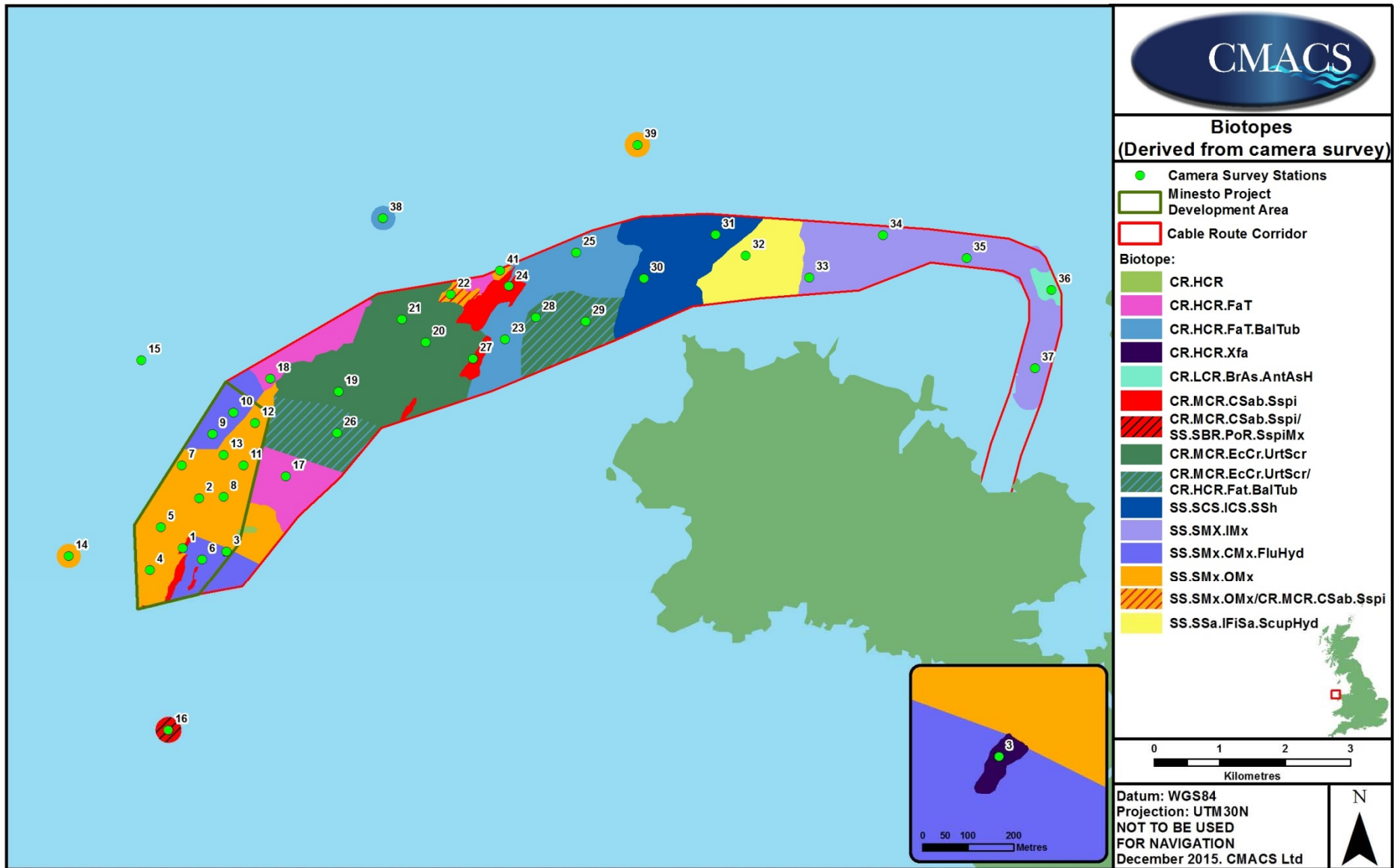


Figure 5. Indicative biotope map based on side scan sonar mosaic and drop down camera images.

4.2 Particle size analysis

Raw data is provided in Appendix 4. Particle size analysis data

Most samples were classified as muddy sandy gravel or sandy gravel, with exceptions at four sample stations: at station 27 (located in the middle of the cable route) there was very little mud with a low percentage of sand and the sediment at this station was classified as gravel; at stations 33 and 34 (located in the cable route just off the northern coast of Holy Island) the sand fraction was three times larger than the gravel fraction and the sediments at these stations were classified as gravelly sand. At station 42, the sediment sample was made up of fine sand and mud and therefore was classified as muddy sand.

5. Habitats of conservation importance

Benthic images were screened for potential Annex I habitats which, where possible, were classified into a quality category according to present guidelines. Any habitats of conservation importance were also noted.

Sabellaria reef

There were five stations (see Figure 4) where there were large aggregations of *Sabellaria* sp. which were assessed against “reefiness” according to the guidelines of Gubbay (2007) which are defined as follows:

Measure of 'reefiness'	Not a reef	Low	Medium	High
Elevation (average tube height, cm)	<2	2-5	5-10	>10
Area (m ²)	<25	25-10,000	10,000-1,000,000	>1,000,000
Patchiness (% cover)	<10	10-20	20-30	>30

Station	Elevation	Area ¹	Patchiness	Reef quality
1	<2	19,000m ²	10%	Not a reef
16	<2	Unknown	10-20%	Not a reef
22	5-10	140,000m ²	10%	Low-medium
24	2-5	398,000m ²	20%	Low
27	2-5	123,000m ²	10%	Low

Elevation and patchiness were estimated from still and video images, whilst the extent was estimated from sidescan images. At most stations where obvious aggregations of *Sabellaria* sp. were present, they were sparse and often restricted to encrusting the larger stones. The aggregations were generally not consolidating sediment and were typically of low elevation, and therefore were either considered to be “not a reef” (due primarily to lack of elevation), or

¹ These are estimates based on extrapolation of area from the sidescan mosaic.

of low 'reefiness' according to the guidance. At station 22, due to the combination of elevation appearing to be predominantly between 5 and 10cm, and the considerable area involved (estimated 140,000m²) the habitat is considered to represent low-medium reefiness, although even here the patchiness is estimated at around 10% which is at the lower limit of what is considered as reef.

Stony reef

There were nine stations (see Figure 4) where the proportion of large particles was high enough that they might be considered as stony reef which were assigned a reefiness under the following guidelines (Irving, 2009):

Characteristic	Not a 'stony reef'	'Reefiness'		
		Low	Medium	High
Composition Boulders/cobbles (>64mm)	<10%	10-40% (Matrix supported)	40-95%	>95% (Clast supported)
Elevation	Flat or undulating seabed	<64mm	64mm-5m	>5m
Extent	<25m ²	← >25m ² →		
Biota	Dominated by infauna			>80% epifauna
Patchiness	10%	10-50%	50-75%	>75%

Station	Composition	Elevation	Extent	Biota	Patchiness	Reef quality
3	10-40%	<64mm	>25m ²	>80% epifauna	20%	Medium
19	<10%	<64mm	>25m ²	<80% epifauna	10%	Low
20	<10%	<64mm	>25m ²	<80% epifauna	30%	Low
21	<10%	<64mm	>25m ²	<80% epifauna	25%	Low
23	80%	64mm-5m	>25m ²	Likely epifauna dominated	>75%	Medium
25	50%	64mm-5m	>25m ²	Likely epifauna dominated	50%	Medium
28	80%	<64mm	>25m ²	Likely epifauna dominated	>75%	Medium
29	70%	64mm-5m	>25m ²	Likely epifauna dominated	>75%	Medium
35	20%	<64mm	>25m ²	<80% epifauna	20%	Low

None of the stations were classified as high reefiness but there were five that were of medium and four of low reefiness. This was mainly of the basis of the physical characteristics as biota was limited in many cases.

Bedrock reef

There are no current guidelines specifically for determining the quality or reefiness of bedrock reef but there were four stations (17, 18, 32, 36) that could be qualified as this habitat. Arguably the elements of extent, patchiness and elevation could be used, whilst composition and biota are not relevant to assessing reefiness of bedrock. Although patchiness is unclear, the bedrock at the four stations identified as such was clearly between

64mm and 5m and extent was clearly over 25m², hence suggesting a medium reefiness according to these criteria. The substrate at station 32 was certainly patchy to some degree, since both sedimentary and bedrock biotopes were identified at this station (Table 3). The associated fauna at all four stations was neither rich nor diverse, typically consisting of scattered dahlia anemones with sparse hydroids, sponges and barnacles.

Possible horse mussel reef

The image from the seabed in the region of station 41, where possible horse mussel reef was identified from sidescan sonar records, were reviewed but there was no indication of *Modiolus* reef. No live *Modiolus* were seen, and only one or two empty shells. A few *Sabellaria* tubes were seen, although these were sparse and therefore did not present *Sabellaria* reef. This station was classified as SS.SMX.OMx.

Tide-swept channels – UK BAP habitat.

Tide-swept channels habitat was identified in the Scope of Works as being near, but not present, in the development area. Results from the drop down camera are in agreement with this; while the seabed was subject to strong tidal currents, it did not support the diverse array of epifauna that is typical of tide-swept channels such as that found between The Skerries and mainland Anglesey a few miles to the north-east of the PDA and CRC.

6. Conclusions/summary

The findings of the survey described here are in line with those of previous benthic investigations carried out in the same general area; a seabed of predominantly coarse particles with the presence of some Annex I habitat.

The drop down camera survey revealed that the seabed of very coarse sediment supported a limited epifauna, likely owing to scour from suspended particles in strong tidal flows.

Much of the cable route corridor was similar but also with bedrock at some locations and a much greater proportion of finer particles at stations near to the proposed landfall.

Three Annex I habitats were identified from the benthic images with low quality *Sabellaria* reef at two locations, low to medium quality *Sabellaria* reef at a further location, low or medium quality stony reef at nine locations and bedrock reef, tentatively described as medium reefiness, at a further four stations. No potential *Modiolus* reef was found.

7. References

BibbyHydromap (2015) Deep Green Project – Holyhead Deep. Project and Export Cable Route – Offshore Survey. Volume 2 – Results Report. A report Xodus Group.

Connor, D.W., Allen, J.H., Golding, N. Howell, K.L., Lieberknecht, L.M., Northern, K.O. and Reker, J.B. (2004). The Marine Habitat Classification for Britain and Ireland. Version 04.05 JNCC, Peterborough. ISBN 1 861 07561 8 (internet version).

Gubbay, S. (2007) Defining and managing *Sabellaria spinulosa* reefs: report of an inter-agency workshop. 1-2 May 2007. Joint Nature Conservation Committee, Peterborough. 405: 26pp.

Irving, R. (2009) The identification of the main characteristics of stony reef habitats under the Habitats Directive. JNCC Report No. 432.

Limpenny, D.S., Foster-Smith, R., Edwards, T.M., Hendrick, V.J., Diesing, M., Eggleton, J.D., Meadows, W.J., Crutchfield, Z., Pfeifer, S. & Reach, I.S. (2010) Best methods for identifying and evaluating *Sabellaria spinulosa* and cobble reef. ALSF Ref no MAL0008. Prepared for Natural England. 149pp.

8. Plates



Plate 1. Seaspider dropdown camera system provided by STR.

Appendix 1: Field notes from Camera survey

Site Number	Date	Time (BST)	Depth (m)	Fix on bottom	Image Number	Description & notes
36	24/6/15	16:15	12.6	48 to 50	18 to 23	Boulders covered in silt and epifauna. <i>Asterias rubens</i> , hydroids and one anemone.
35	24/6/15	16:42	22.1	52 to 56	24 to 31	Coarse seabed, pebble, gravel, some cobble. Possible encrusting <i>Sabellaria</i> , hydroids
34	24/6/15	17:06	25.0	57 to 61	32 to 37	Shelly gravel with hermit crab (one image) and hydroid, possibly <i>Rhizocaulus</i> .
33	24/6/15	17:16	26.2	62 to 66	38 to 43	Gravel and <i>Modiolus</i> shell. Hermit crab, some hydroid.
32	24/6/15	17:36	28.0	67	44	Only one image which was a veneer of sediment over bedrock, numerous <i>Urticina</i> sp.
37	24/6/15	18:08	10.8	68 to 72	45 to 50	Sand and silt
32	25/6/15	08:55	28.6	73 to 76	51 to 54	Gravel and shell, pebbles with abundant hydroids
31	25/6/15	09:20	30.8	77 to 81	55 to 59	Clean gravel and pebble. Two <i>Urticina</i> sp. in image 59.
30	25/6/15	09:35	34.5	82 to 86	60 to 64	Clean pebble and cobble, some encrusting growths and <i>Urticina</i> sp.
25	25/6/15	09:50	37.1	87 to 89	65 to 67	Cobbles and boulder over bedrock. Numerous <i>Urticina</i> sp., <i>Henricia</i> and <i>Crossaster</i> , hydroids.
29	25/6/15	15:50	N/A	N/A	68	Coarse seabed. Currents very strong and pulled camera over. Small-spotted catshark in video.
29	27/6/15	06:35	39.2	108	69	Boulder or cobbles with abundant epifauna including hydroids, <i>Urticina</i> and keelworm
28	27/6/15	06:49	40.7	109	70	Boulder and cobble with epifauna
24	27/6/15	07:00	43.8	110	71	Pebbles with <i>Sabellaria</i> and an <i>Asterias rubens</i>
41	27/6/15	07:29	51.9	111	72	Pebbles with some <i>Sabellaria</i> tubes

Site Number	Date	Time (BST)	Depth (m)	Fix on bottom	Image Number	Description & notes
23	27/6/15	07:48	42.5	112	73	Cobble, boulder with epifauna including <i>Urticina</i>
27	27/6/15	07:58	47.4	113	74	Pebble and gravel, some <i>Sabellaria</i> , prawn seen in video
22	27/6/15	08:09	53.8	114	75	Pebble and gravel, some <i>Sabellaria</i>
20	27/6/15	08:20	54.9	115	76	Pebble, gravel, shell and cobble
21	27/6/15	08:30	63.6	116	77	Pebble and cobble, <i>Urticina</i> , <i>Asterias</i> and hydroids
19	27/6/15	08:42	69.7	118	78	Cobble and pebble, one <i>Urticina</i>
26	27/6/15	08:55	55.0	119	79	Cobble and pebble
17	27/6/15	09:22	56.0	120	80	Bedrock with <i>Flustra</i> and sponges
11	27/6/15	09:30	82.6	122	81 & 82	Pebbles and cobbles, visibility not great owing to strong tide
8	27/6/15	09:38	83.6	123	83	Camera on its side? Some <i>Flustra</i> seen
2	27/6/15	09:49	N/A	N/A	-	No visibility, camera probably landed on its side
38	27/6/15	10:48	79.3	125	84	Gravel and pebble, one <i>Urticina</i>
39	27/6/15	11:37	39.8	126	85	Gravel and pebble, hydroids, barnacles and hermit crabs
18	29/6/15	14:44	74.0	173	86	Visibility not great, bedrock with barnacles and <i>Urticina</i> and painted topshell
12	29/6/15	14:54	71.0	175	87	Stills camera froze only got an image just as the camera lifted off the seabed. Seabed of pebbles with barnacles and hydroids
10	29/6/15	15:05	84.6	177	88	Pebble and cobble, <i>Flustra</i> and <i>Asterias</i> , hydroids

Site Number	Date	Time (BST)	Depth (m)	Fix on bottom	Image Number	Description & notes
9	29/6/15	15:17	88.4	178	89	Pebbles and gravel with some shell, hydroids. Dogfish on video
13	29/6/15	15:26	85.7	180	90	Pebble and sand with hydroids
7	29/6/15	15:41	86.8	181	91	Pebble and shell with hydroids and gravel
2	29/6/15	15:51	88.0	182	92 & 93	Pebble, gravel and shell. Hydroids and some encrusting <i>Sabellaria</i>
8	29/6/15	16:03	79.8	183	94	Cobble and pebble with <i>Asterias</i>
3	29/6/15	16:16	75.3	184	95	Cobble and boulder with hydroid
6	29/6/15	16:29	79.5	185	96	Pebble and gravel with <i>Urticina</i> and hydroid and <i>Flustra</i>
1	29/6/15	16:36	81.2	186	97 & 98	Sand and shell possibly with boulder or cobble
5	29/6/15	16:45	80.4	187	-	No still image – fault with camera, video okay. Pebble, gravel and cobble, quite clean some serpulids
4	29/6/15	16:57	81.5	188	99	Pebble and gravel
16	29/6/15	17:16	67.0	189	100	Sand, shell and gravel with hydroids. Broken <i>Sabellaria</i> tubes make up much of sediment, some pebble
14	29/6/15	17:36	51.6	190	101	Gravel, pebble and shell
15	29/6/15	17:50	63.9	191	102	Very poor visibility but looks like pebble and gravel with a starfish.

Appendix 2: Field notes from Grab survey

Sample number	Date	Time (UTC)	Depth (m)	Fix	Sample volume (litres)	Sediment description
35b	25/6/15	11:21	19.3	18091	5	Sand, gravel, pebble, larger particles, some epifauna. Attempt a (fix 18090) failed to obtain a suitable sample.
35d	25/6/15	11:34	19.7	18093	5	Sand, gravel, pebble, larger particles, some epifauna. Attempt c (fix 18092) failed to obtain a suitable sample.
34a	25/6/15	11:49	22.6	18094	6	Sand and gravel
34d	25/6/15	11:57	22.6	18097	2	Sand, gravel, pebble, <i>Sabellaria</i> aggregation. Kept for PSA but not contaminants. Attempts b & c (fixes 18095 and 18096) failed to obtain a suitable sample.
33a	25/6/15	12:11	24.8	18098	7	Shelly sand and gravel, some pebble, <i>Sabellaria</i> aggregations encrusting pebble
33b	25/6/15	12:13	24.2	18099	5	Shelly sand and gravel with some pebble
31b	25/6/15	12:32	30.5	18102	6	Coarse sand, pebble and gravel, large polychaete, hermit crab, anemone. Attempt a (fix 18101) failed to obtain a suitable sample.
31d	25/6/15	12:39	30.6	18104	7	Pebble and gravel with some coarse sand and shell. Attempt c (fix 18103) failed to obtain a suitable sample.
30	25/6/15	12:59	34.9	18105-7		Three attempts, all unsuccessful (no sample at all)
37	27/6/15	11:31	8.4	18127-34	≤2	3 attempts with Day grab, 5 attempts with Hamon grab. Small samples of fine sand and pebble. No sample taken.
41	29/6/15					3 attempts, no sample, a few grains of sand in grab (re-attempted on 1 st July)
24	29/6/15					As above
27b	29/6/15	07:25	47.6	18141	≈3	Small sample but taken for fauna. Attempt a (fix 18140) failed to obtain a suitable sample.
27c	29/6/15	07:34	44.9	18142	≈2	Small sample but taken for PSA only
20a	29/6/15	07:49	54.9	18143	≈3	Cobble, pebbles, some finer sediment, anemones, crab, hydroids.
20d	29/6/15	08:00	54.8	18146	≈2	1 large cobble and some pebbles. No sample kept. <i>Sabellaria</i> on the cobble. Attempts b & c (fixes 18144 and 18145) failed to obtain a suitable sample.
21	29/6/15	08:10	62.0	18147-49	≤1	Pebble and gravel. Some shell fragments and soft clay (?), barnacles. No sample obtained.
22c	29/6/15	08:39	53.2	18152	2-3	Pebble, gravel, shells, some sand and clay. <i>Sabellaria</i> tubes. Small sample but kept for fauna. Attempts a & b (fixes 18150 and 18151) failed to obtain a suitable sample.
22d	29/6/15	08:43	52.2	18153	2-3	As above. Kept for PSA but not enough fine sediment for contaminants
38b	29/6/15	09:03	79.5	18156	8	Pebbles, gravel, clay and shell fragments. Some barnacles and hydroids. Fix 18154 was a failure grab failed to fire. Attempt a (fix 18155) failed to obtain a suitable sample.

Sample number	Date	Time (UTC)	Depth (m)	Fix	Sample volume (litres)	Sediment description
38c	29/6/15	09:07	80.9	18157	8	Pebbles, gravel, clay and shell fragments. Some barnacles and hydroids.
19a	29/6/15	09:27	66.7	18158	3	Pebble and gravel, taken for fauna.
19e	29/6/15	09:54	68.8	18162	5	Pebble and gravel with clay and shell fragments. Attempts b to d (fixes 18159 to 18161) failed to obtain a suitable sample. Attempt c had a good sample but a large cobble was in the jaw of the grab
11b	29/6/15	10:14	84.3	18164	5	Clay, pebble, gravel, shell. Attempt a (fix 18163) obtained 3 litres of sediment - discarded.
11c	29/6/15	10:19	80.9	165	5	Clay, pebble, grave and shell
24c	29/6/15	10:56	44.3	166	5	Clay, pebble, gravel and shell. Taken for fauna. Attempts a & b (fixes 18167 and 18168) obtained a suitable sample but stones were caught in the jaws.
39	29/6/15	11:32	39.7	18169-72	≤1	Pebble, gravel, some sand and shell, encrusting <i>Sabellaria</i> , hydroids, <i>Psammechinus miliaris</i>
12b	1/7/15	12:09	76.7	19490	6	Some clay, mostly pebble, hydroids
12d	1/7/15	12:21	77.8	19492	5	Some clay and pebble, large cobble caught in jaws. Kept a PSA sample but not contaminants.
10a	1/7/15	12:35	86.7	19494	8	Clay and pebble and hydroids
10b	1/7/15	12:42	86.3	19495	8	Clay and pebble and hydroids
9b	1/7/15	12:58	88.7	19497	6	Clay, shell fragments, pebble and gravel, hydroid. 9a good sample but stones in jaws.
9c	1/7/15	13:05	88.4	19498	5	Clay, shell fragments, pebble and gravel, hydroid.
13b	1/7/15	13:23	88.3	19500	6	Clay, shell, pebble and gravel, <i>Sabellaria</i> tubes, hydroids 13a: good sample but stone in jaws
13c	1/7/15	13:29	87.4	19501	6	Clay, pebble and gravel, some shell and sand. Spider crab and large polychaete.
7a	1/7/15	13:37	86.8	19502	6	Attempt a: Stone in jaws. Mud, pebble and gravel, abundant hydroids, <i>Pisidia</i> , kept for fauna but note stone in jaws. Attempt b: 1 litre of sediment, gravel, pebble and shell fragments
7c	1/7/15	13:50	86.3	19504	6	Attempt c: cobble, pebble, gravel and clay Attempt d: 1 litre of sediment, station abandoned
2a	1/7/15	14:04	88.3	19506	5	First attempt large cobble in jaws (see photo). Sample kept for PSA. Second attempt less than 1 litre of sediment.
2c	1/7/15	14:15	88.7	19509	6	Kept for fauna. Clay, pebble and gravel. Crabs and hydroid.
8a	1/7/15	14:24	81.3	19510	8	Clay, pebble, hydroids. 2 nd attempt sample ≤1 litre.
8c	1/7/15	14:34	80.4	19512	6	Cobble, pebble and clay
6a	1/7/15	14:44	78.4	19513	8	Clay, sand, pebble.
6b	1/7/15	14:48		19514	≤1	Pebbles. Attempt c (fix 19515) also failed. Faunal sample only at this station

Sample number	Date	Time (UTC)	Depth (m)	Fix	Sample volume (litres)	Sediment description
1a	1/7/15	15:00	80.9	19517	4	First sample kept for fauna. Cobble and pebble with <i>Sabellaria</i> . Second sample <i>Sabellaria</i> 1 litre of sediment. Third attempt <1 litre of sediment
5a	1/7/15	15:17	79.5	19520	3	Cobble, pebble, gravel and clay. Fail
5b	1/7/15	15:22	79.8	19521	1	Cobble, pebble and gravel. Fail. Attempt c (fix 19522) <1 litre sediment.
4b	1/7/15	15:41	81.6	19524	5	Pebble, gravel, some clay, gravel
4c	1/7/15	15:47	81.3	19525	8	Cobble, pebble and clay
16a	1/7/15	16:00	64.3	19526	7	Cobble, pebble, gravel, sand and clay
16b	1/7/15	16:05	66.8	19527	8	Cobble, pebble, gravel, sand and clay
14a	1/7/15	16:20	49.3	19528	≈2	Pebble, gravel and shell, some sand. Hydroids. Attempt b (at 16:23, fix 19529) similar. Stones in jaws and samples rejected.
14c	1/7/15	16:23	49.0	19530	≤1	Pebble, gravel and shell, some sand. Stones in jaws and sample rejected.
15a	1/7/15	16:42	60.6	19531	8	Almost solid lump of clay with some pebble and gravel
15b	1/7/15	16:46	60.2	19532	8	Almost solid lump of clay with some pebble and gravel. <i>Asterias rubens</i> and <i>Pisa</i> sp. in sample.
41d	1/7/15	17:13	49.0	19533	≤1	Pebble and gravel some shell. Brittlestar. Attempt e (at 17:19, fix 19534) ≈2 litres of sediment; pebble, gravel and shell.
41f	1/7/15	17:22	49.1	19535	≈2	Pebble, gravel and shell
24d	1/7/15	17:28	42.3	19536	≤1	Pebble and gravel.

Appendix 3. Drop down camera habitat and faunal data

Station	Replicate	Annex I	Image quality	Habitat	Taxon	Abundance	SACFOR	Notes	Grab?	Biotope
1	n/a	No	M	Sand and broken shell (including some <i>Modiolus</i>) with one area of slightly exposed bedrock	<i>Henricia</i> sp.	1	A		Yes	CR.MCR.Csab.Sspi
					<i>Sagartia</i> sp.?	4	F			
					Paguridae indet	1	C			
					<i>Sabellaria</i> sp.	10%	F			
					Faunal turf	10%	F			
					<i>Flustra foliacea</i>	<1%	R			
2	n/a	No	G	Coarse sand, shell fragments and pebble	Actinaria indet	6	F		Yes	SS.SMX.OMx
					Serpulidae indet	2	F			
					<i>Sabellaria</i> sp.	≈1%	R			
					Hydroida indet	≈1%	R			
3	n/a	Stony reef of low 'reefiness'	M	Cobble with some pebble, gravel and shell fragments	Actinaria (<i>Sagartia</i> sp.?)	9	F	Faunal turf includes porifera (possibly <i>Hemimycale columella</i> amongst others), hydroids (possibly <i>Hydrallmania falcata</i> amongst others and small sessile ascidians.	No	Cr.HCR.Xfa
					Faunal turf	90%	S			
4	n/a	No	M	Clean pebble and gravel with some shell	Serpulidae indet	≤10	F	Analysis done on video, no still for this station.	Yes	SS.SMX.OMx
5	n/a	No	M	Clean pebble and gravel with some shell	Serpulidae indet	≤10	F		No	SS.SMX.OMx
6	n/a	No	G	Pebble and gravel with some sand and shell	<i>Flustra foliacea</i>	<5%	O		Yes	SS.SMX.CMx.FluHyd
					Actinaria indet (<i>Sagartia</i> ?)	2	F			
					<i>Urticina</i> sp.	1	C			
					<i>Nemertesia antennina</i>	2	A			
					Faunal turf	≈10%	F			
					Brachyura indet	1	C			
					Serpulidae indet	13	C			
					Ascidacea indet (<i>Molgula</i> sp.?)	1	F			
7	n/a	No	G	Pebble and gravel with some sand and <i>Modiolus</i> shell	<i>Gibbula cinerea</i> (?)	2	F		Yes	SS.SMX.OMx
					<i>Sertularia</i> sp. (?)	<1%	R			
					Faunal turf	≈10%	F			
					Porifera indet	<1%	R			
8	n/a	No	G	Pebble and gravel with some sand	<i>Asterias rubens</i>	1	A		Yes	SS.SMX.OMx
					<i>Henricia</i> sp.	1	A			
					<i>Urticina</i> sp.	1	C			
					Porifera indet (<i>Hemimycale</i> ?)	<1%	R			
					Erect branched sponge	1	C			
					Faunal turf	50%	A			
9	n/a	No	M	Gravel with pebbles and shell fragments	Sabellidae indet	1	A		Yes	SS.SMX.CMx.FluHyd
					<i>Flustra foliacea</i>	<1%	R			
					Faunal turf	10%	F			
					<i>Sagartia</i> sp.?	1	F			
					<i>Urticina</i> sp.	2	C			
					Serpulidae indet	5	F			
10	n/a	No	M	Pebble, gravel and coarse sand	<i>Henricia</i> sp.	2	A		Yes	SS.SMX.CMx.FluHyd
					<i>Flustra foliacea</i>	≈5%	R			
					Actinaria indet (<i>Sagartia</i> ?)	6	F			
					<i>Nemertesia antennina</i>	1	A			
					Ascidacea indet	5	F			
					Faunal turf	50%	A			

Station	Replicate	Annex I	Image quality	Habitat	Taxon	Abundance	SACFOR	Notes	Grab?	Biotope
11	n/a	No	M	Cobble , pebble and gravel	Serpulidae indet	2	F	Numerous attachment scars of barnacles on most cobbles and some pebbles	Yes	SS.SMX.OMx
					Faunal turf	10-20%	F			
12	n/a	No	n/a	Cobble , pebble and gravel	Serpulidae indet	12	C	Data derived from video, no still for this station.	Yes	SS.SMX.OMx
13	n/a	No	M	Pebble, gravel, shell fragments and broken <i>Sabellaria</i> tubes	Brachyura indet	1	C		Yes	SS.SMX.OMx
					<i>Psammechinus miliaris</i>	1	C			
					Faunal turf	10-20%	F			
					Serpulidae indet	6	F			
14	n/a	No	G	Clean pebble and gravel. Possibly some cobble.	Serpulidae indet	17	C	Encrusting bryozoa	No	SS.SMX.OMx
					Present					
15	n/a	?	P	Barely visible, gravel and shell	<i>Henricia</i> sp.	1	A		Yes	
16	n/a	No	G	Mostly broken <i>Sabellaria</i> tubes with gravel and pebble	<i>Sabellaria</i> sp.	10-20%	F	Scattered low-lying aggregations of <i>Sabellaria</i> which provide attachment for hydroids.	Yes	CR.MCR.Csab. Sspi/SS.SBT.PoR.SspiMx
					Hydroida indet	10-20%	F			
					<i>Halecium</i> sp (?)	1	C			
17	n/a	Yes. Bedrock reef	M	Bedrock with some gravel.	<i>Flustra foliacea</i>	10%	C		No	CR.HCR.FaT
					Yellow sponge (porifera indet)	10%	C			
					Hydroida indet	<1%	R			
					<i>Urticina</i> sp.	1	C			
					Faunal turf	80%	S			
18	n/a	Yes. Bedrock reef	M	Bedrock	<i>Calliostoma zizyphinum</i>	2	F		No	CR.HCR.FaT
					<i>Urticina</i> sp.	8	C			
					Barnacles (<i>Balanus balanus</i> ?)	<1%	R			
					Faunal turf	20%	C			
19	n/a	Yes. stony reef of low 'reefiness'	G	Cobble, pebble and gravel	<i>Urticina</i> sp.	2	C		Yes	CR.MCR.EcCr.UrtScr
					Serpulidae indet	14	C			
					Barnacles indet	<1%	R			
					Faunal turf	10%	F			
20	n/a	Yes. stony reef of low 'reefiness'	G	Cobble, pebble and gravel with shell fragments and possibly some bedrock.	<i>Urticina</i> sp.	3	C		Yes	CR.MCR.EcCr.UrtScr
					<i>Sabellaria</i> sp.	≈1%	R			
					Hydroida indet	<1%	R			
					Barnacles (<i>Balanus balanus</i> ?)	1	F			
					Serpulidae indet	2	F			
21	n/a	Yes. stony reef of low 'reefiness'	G	Cobble, pebble and gravel with shell fragments.	<i>Asterias rubens</i>	1	A	Faunal turf includes a few encrusting tubes of <i>Sabellaria</i>	No	CR.MCR.EcCr.UrtScr
					<i>Urticina</i> sp.	3	C			
					Barnacle	5%	R			
					Faunal turf	20%	C			
22	n/a	No	G	Pebble and gravel with shell fragments	<i>Sabellaria</i> sp.	10%	F		Yes	SS.SMX.OMx/CR.MCR.Csab
					<i>Urticina</i> sp.	2	C			
					Serpulidae indet	4	F			
					<i>Flustra foliacea</i>	<1%	R			
					<i>Hydrallmania falcata</i>	5%	O			
Hydroida indet	5%	O								
23	n/a	Yes. Stony reef of low or medium reefiness	G	Boulder, cobble, pebble and gravel	<i>Urticina</i> sp.	3	C		No	CR.HCR.FaT.BalTub
					Serpulidae indet	1	F			
					Paguridae indet	1	C			
					Muricidae indet	13	A			
					Barnacles	80%	S			
					Hydroida indet	<1%	R			

Station	Replicate	Annex I	Image quality	Habitat	Taxon	Abundance	SACFOR	Notes	Grab?	Biotope
24	n/a	Potentially <i>Sabellaria spinulosa</i> reef of	G	Boulder, cobble, pebble, possibly bedrock	<i>Sabellaria</i> sp.	20%	F		Yes	Cr.MCR.CSab
					<i>Asterias rubens</i>	1	C			
					Actinaria indet	1	C			
25	a	Yes. Stony reef of low or medium reefiness	G	Boulder, cobble and pebble	<i>Henricia</i> sp.	1	A		No	
					<i>Urticina</i> sp.	9	C			
					Barnacle	60%	A			
					Serpulidae indet	4	F			
					Actinaria indet	1	C			
					Gastropoda indet	1	A			
25	b	Yes. Stony reef of low or medium reefiness	G	Boulder, cobble and pebble	<i>Urticina</i> sp.	2	C		No	CR.HCR.FaT.BalTub
					Actinaria indet	2	C			
					Porifera indet	1%	R			
					Barnacle	40%	A			
					Hydroida indet	5%	F			
					Serpulidae indet	3	F			
					Muricidae indet	1	C			
25	c	Yes. Stony reef of low or medium reefiness	G	Bedrock, cobble and pebble.	<i>Crossaster papposus</i>	1	A		No	
					<i>Urticina</i> sp.	2	C			
					<i>Calliostoma zizyphinum</i>	2	F			
					Barnacle	40%	A			
					Hydroid (possibly Sertularia)	1%	O			
26	n/a	Yes. Stony reef of low reefiness	G	Boulder, cobble and pebble. Some sand and gravel.	<i>Urticina</i> sp.	1	C		No	CR.MCR.EcCr.UrtScr/CR.HC R.FaT.BalTub
					Gastropoda indet	2	C			
					Barnacle	50%	A			
					Serpulidae indet	5	F			
					Faunal turf	5%	O			
27	n/a	No	G	Cobble and pebble. Some sand and gravel.	<i>Sabellaria</i> sp.	10%	F		Yes	CR.MCR.Csab.Sspi
					<i>Urticina</i> sp.	1	C			
					<i>Buccinum undatum</i>	1	C			
					Actinaria indet	1	C			
					Compound ascidian?	<1%	R			
					Serpulidae indet	8	F			
					Hydroid (possibly Sertularia)	<1%	R			
<i>Diodora graeca</i> ?	1	C								
28	n/a	Yes. Stony reef of low or medium 'reefiness'	G	Boulder, cobble with some pebble and shell.	<i>Echinus esculentus</i>	1	A		No	CR.MCR.EcCr.UrtScr/CR.HC R.FaT.BalTub
					<i>Calliostoma zizyphinum</i>	1	F			
					<i>Urticina</i> sp.	3	C			
					Paguridae indet	1	C			
					Asteroidea juvenile	1	C			
					Actinaria indet	1	C			
					<i>Tubularia</i> sp.	<1%	R			
					Hydroida indet	5%	O			
					Barnacles	20%	C			
					Alcyonidium?	5%	C			
					Asciacea (Distomus or Dendrodoa)	10%	F			

Station	Replicate	Annex I	Image quality	Habitat	Taxon	Abundance	SACFOR	Notes	Grab?	Biotope
29	n/a	Yes. Stony reef of low or medium 'reefiness'	G	Boulder and cobble with some pebble and shell	<i>Urticina</i> sp.	8	C		No	CR.MCR.EcCr.UrtScr/CR.HC R.FaT.BalTub
					Barnacle	40%	A			
					<i>Calliostoma zizyphinum</i>	1	F			
					<i>Alcyonidium</i> ?	1%	O			
					Porifera indet	1%	R			
					Serpulidae indet	2	F			
Hydroida indet	10%	C								
30	a	No	G	Gravel and pebble with some cobble and boulder.	Mussel aggregation (<i>Musculus</i> sp.?)	1%	R	No	SS.SCS.IC.S.SSh	
				Hydroida indet	<1%	R				
30	b	No	G	Gravel and pebble with some cobble and boulder.	Mussel aggregation (<i>Musculus</i> sp.?)	1%	R			
				Hydroida indet	<1%	R				
30	c	No	G	Gravel and pebble with some cobble and boulder.	Mussel aggregation (<i>Musculus</i> sp.?)	5%	R			
				Hydroida indet	<1%	R				
30	d	No	G	Gravel and pebble with some cobble and boulder.	Mussel aggregation (<i>Musculus</i> sp.?)	<1%	R			
				Hydroida indet	<1%	R				
				<i>Urticina</i> sp.	2	C				
30	e	No	G	Gravel and pebble with some cobble and boulder.	Mussel aggregation (<i>Musculus</i> sp.?)	1%	R			
				Hydroida indet	<1%	R				
				<i>Urticina</i> sp.	2	C				
31	a	No	G	Mostly clean gravel and pebble with some cobble	Barnacle	<1%	R	Yes	SS.SCS.IC.S.SSh	
				Serpulidae indet	2	F				
				<i>Gibbula cinerea</i> (?)	1	F				
31	b	No	G	Clean gravel and pebble with some cobble	Barnacle	<1%	R			
				Serpulidae indet	5	F				
				<i>Gibbula cinerea</i> (?)	3	F				
				Hydroida indet	<1%	R				
31	c	No	G	Clean gravel and pebble with some cobble	<i>Urticina</i> sp.	1	C			
				Barnacle	<1%	R				
31	d	No	G	Clean gravel and pebble with some cobble	Barnacle	<1%	R			
				Serpulidae indet	1	F				
				<i>Gibbula cinerea</i> (?)	1	F				
				Hydroida indet	<1%	R				
31	e	No	G	Clean gravel and pebble with some cobble	<i>Urticina</i> sp.	2	C			
				Barnacle	<1%	R				
				Faunal turf	<1%	R				
				Serpulidae indet	1	F				
				<i>Gibbula cinerea</i> (?)	1	F				

Station	Replicate	Annex I	Image quality	Habitat	Taxon	Abundance	SACFOR	Notes	Grab?	Biotope	
32	a	Yes. Bedrock reef	G	Bedrock with a veneer of sand and shell in places	<i>Urticina</i> sp.	4	C		No	CR.MCR.EcCr.UrtScr	
					Faunal turf	15%	F				
					Majidae indet	1	C				
					<i>Sabellaria</i> sp.	<1%	R				
32	b	No	G	Modiolus shell and sand	Hydroida indet	40%	S	Hydroid turf includes some <i>Hydrallmania falcata</i>	No	SS.SSA.IFiSa.ScupHyd	
					Actinaria indet	1	C				
					Serpulidae indet	9	F				
32	c	No	G	Gravel and pebble with some shell.	<i>Buccinum undatum</i>	1	C	Hydroid turf includes some <i>Hydrallmania falcata</i>	No	SS.SSA.IFiSa.ScupHyd	
					Hydroida indet	20%	A				
					<i>Flustra foliacea</i>	<1%	R				
					Serpulidae indet	3	F				
32	d	No	M	Gravel and pebble with some shell.	Whelk/hermit crab	1	C		No	SS.SSA.IFiSa.ScupHyd	
					Hydroida indet	20%	A				
					Serpulidae indet	2	F				
32	e	No	M	Gravel and pebble with some shell.	<i>Urticina</i> sp.	1	C	Hydroid turf includes some <i>Hydrallmania falcata</i>	No	SS.SSA.IFiSa.ScupHyd	
					Serpulidae indet	5	F				
					Hydroida indet	20%	A				
33	a	No	G	Sand, gravel and Modiolus shell.	Serpulidae indet	5	F		Yes	SS.SMX.IMx	
33	b	No	G	Sand, gravel and Modiolus shell.	Serpulidae indet	3	F				
33	c	No	G	Sand, gravel and Modiolus shell.	Serpulidae indet	1	F				
					Paguridae indet	2	C				
33	d	No	G	Sand, gravel and Modiolus shell.	Serpulidae indet	1	F				
					Paguridae indet	1	C				
					Hydroida indet	<1%	R				
33	e	No	G	Sand, gravel and Modiolus shell.	Serpulidae indet	1	F				
					Hydroida indet	<1%	R				
34	a	No	M	Gravel with some pebble and shell	Paguridae indet	1	C		Yes	SS.SMX.IMx	
					<i>Ophiura albida</i>	4	F				
34	b	No	M	Gravel with some pebble and shell	Hydroida indet	5%	O				
					Hydroida indet	3%	O				
34	c	No	M	Gravel with some pebble and shell	Gastropoda indet	1	C				
					Hydroida indet	<1%	R				
34	d	No	M	Gravel with some pebble and shell	Paguridae indet	4	C				
					Serpulidae indet	4	F				
					Hydroida indet	3%	O				
34	e	No	G	Gravel with some pebble and shell	Paguridae indet	1	C	Hydroid turf may include <i>Rhizocaulus verticillatus</i> and/or <i>Sertularia</i>	Yes	SS.SMX.IMx	
					Serpulidae indet	2	F				

Station	Replicate	Annex I	Image quality	Habitat	Taxon	Abundance	SACFOR	Notes	Grab?	Biotope		
35	a	Yes, potential biogenic reef of low 'reefiness'	G	Gravel with some pebble and shell	<i>Sabellaria</i> sp.	40%	S		Yes	SS.SMX.IMx		
					<i>Urticina</i> sp.	1	C					
					Sabellidae indet	1	A					
35	b	No	G	Gravel and sand with shell	Serpulidae indet	1	F					
					35	c	No	G			Sand and gravel with shell	Hydroida indet
Sabellidae indet	1	A										
<i>Ophiura albida</i>	1	F										
35	d	No	G	Pebble, cobble and boulder with some shell	Hydroida indet	1%	O					
					<i>Ophiura albida</i>	1	F					
					<i>Nemertesia antennina</i>	1	A					
					Faunal turf	10%	F					
					Actinaria indet	2	C					
35	e	Yes. Rocky reef of low reefiness	M	Boulder, cobble, pebble, gravel and shell	Gastropoda indet	15	C					
					Faunal turf	30%	C					
36	a	Yes. Rocky or bedrock reef	G	Large boulders or bedrock	Sabellidae indet	1	A		No	CR.LCR.BrAs (impoverished)		
					Rhodophyta indet	5%	O					
					Faunal turf	85%	S					
					<i>Clavelina lepadiformis</i>	1%	O					
					<i>Alcyonidium diaphanum</i>	2	A					
36	b	Yes. Rocky or bedrock reef	G	Large boulders and bedrock with some silt	<i>Asterias rubens</i>	1	C					
					<i>Clavelina lepadiformis</i>	5%	F					
					<i>Antedon bifida</i>	5%	C					
					Faunal turf	50%	S					
36	c	Yes. Bedrock reef	G	Silty bedrock	<i>Urticina</i> sp.	1	C					
					<i>Antedon bifida</i>	5%	C					
					Rhodophyta indet	<1%	R					
					<i>Clavelina lepadiformis</i>	5%	F					
37	a	No	P	Silt with occasional cobble	Faunal turf	5%	F					
					Faunal turf	5%	F					
37	b	No	G	Silt with occasional cobble	<i>Ophiura albida</i>	1	F					
					37	c	No	P	Silt with occasional cobble	None visible		
										37	d	No
37	e	No	G	Silt, a few pebbles	<i>Antedon bifida</i>	1	C					
					38	n/a	No	G	Pebble and gravel	<i>Urticina</i> sp.	1	C
Barnacle	40%	A										
Faunal turf	5%	O										
39	n/a	No	G	Cobble, pebble and gravel	Paguridae indet	2	C		Faunal turf includes some encrusting tubes of <i>Sabellaria</i>	No		
					<i>Psammechinus miliaris</i>	1	C					
					Hydroida indet	5%	O					
					Faunal turf	15%	F					
41	n/a	No	G	Cobble, pebble and gravel	Serpulidae indet	8	F		No	SS.SMX.OMx		
					<i>Sabellaria</i> sp.	5%	F					
					Actinaria indet	1	C					

Appendix 4. Particle size analysis data

Station	Mesh size, mm														Mesh size, µm										Gravel	Sand	Mud	Sediment type
	90.0	63.0	45.0	31.5	22.4	16.0	11.2	8.0	5.6	4.0	2.8	2.0	1.4	1.0	707	500	355	250	177	125	88	63	<63					
DG2	0.0	0.0	0.0	18.8	11.3	2.1	1.8	0.9	1.1	2.0	4.3	6.4	9.3	13.7	11.3	5.5	4.9	2.2	0.8	0.5	0.4	0.4	2.4	48.7	48.9	2.4	Sandy Gravel	
DG4	0.0	50.1	0.0	7.0	6.0	0.5	3.0	2.8	2.7	1.6	1.6	1.3	1.1	2.5	3.5	3.6	5.5	2.7	0.6	0.3	0.4	0.4	2.9	76.5	20.6	2.9	Muddy Sandy Gravel	
DG7	0.0	0.0	24.0	28.1	2.4	1.1	1.5	1.9	3.9	3.5	2.7	2.1	3.1	5.1	6.2	4.5	4.5	1.8	0.6	0.3	0.3	0.3	2.4	71.1	26.5	2.4	Sandy Gravel	
DG8	19.6	16.6	24.2	4.8	2.6	2.2	1.9	1.6	1.0	0.8	1.1	1.1	0.9	2.4	4.0	4.7	5.0	1.2	0.7	0.4	0.4	0.3	2.4	77.6	20.0	2.4	Muddy Sandy Gravel	
DG9	0.0	0.0	30.6	10.1	11.1	1.9	1.7	0.9	1.4	3.4	5.4	4.0	3.3	5.7	4.8	3.4	3.6	1.6	0.6	0.4	0.5	0.5	4.9	70.7	24.4	4.9	Muddy Sandy Gravel	
DG10	0.0	0.0	23.2	25.4	5.5	7.6	2.5	1.1	0.8	0.6	1.2	1.4	1.9	3.9	6.8	5.0	3.8	1.4	0.7	0.6	0.6	0.6	5.5	69.2	25.3	5.5	Muddy Sandy Gravel	
DG11	0.0	0.0	27.1	27.4	4.8	0.8	5.2	1.9	2.4	2.1	2.3	2.5	3.8	4.1	4.2	3.2	3.1	1.1	0.6	0.3	0.4	0.3	2.4	76.5	21.1	2.4	Muddy Sandy Gravel	
DG12	0.0	0.0	38.7	12.3	5.2	6.6	3.2	3.7	2.6	2.0	2.1	2.4	3.1	3.7	2.9	2.1	2.2	1.2	0.8	0.6	0.6	0.5	3.7	78.7	17.6	3.7	Muddy Sandy Gravel	
DG13	0.0	0.0	17.5	19.7	13.7	3.5	2.6	1.5	1.1	0.9	1.0	1.3	2.5	8.5	10.9	5.2	3.7	1.2	0.6	0.4	0.5	0.4	3.2	63.0	33.9	3.2	Sandy Gravel	
DG15	0.0	0.0	16.4	18.6	8.4	3.7	2.0	1.3	2.4	2.3	2.5	2.0	2.4	5.2	6.3	5.4	7.1	4.5	1.6	0.6	0.8	0.7	6.0	59.5	34.5	5.9	Muddy Sandy Gravel	
DG16	0.0	0.0	46.7	0.0	1.8	2.1	1.7	1.8	1.8	1.4	1.9	2.3	1.8	4.4	9.8	8.7	5.8	2.4	0.6	0.3	0.4	0.4	4.1	61.3	34.6	4.1	Muddy Sandy Gravel	
DG19	0.0	0.0	37.5	11.3	3.4	5.7	3.4	2.1	2.3	2.7	3.5	3.9	3.4	4.4	3.7	1.8	1.4	1.1	1.3	0.9	0.9	0.6	4.6	75.9	19.5	4.6	Muddy Sandy Gravel	
DG22	0.0	0.0	0.0	26.5	14.5	3.3	3.6	2.5	2.0	1.6	1.7	2.4	4.0	5.5	6.8	8.0	8.6	4.3	1.3	0.4	0.4	0.4	2.2	58.1	39.8	2.2	Sandy Gravel	
DG27	0.0	0.0	32.1	6.5	19.8	6.0	2.3	5.8	3.2	1.9	2.0	2.0	3.5	4.0	3.5	2.2	2.2	1.6	0.5	0.1	0.1	0.1	0.4	81.8	17.8	0.4	Gravel	
DG31	0.0	0.0	0.0	13.5	15.2	3.7	4.4	7.6	8.4	6.7	6.3	4.2	4.6	6.9	7.4	4.3	2.8	1.5	1.0	0.3	0.2	0.1	1.0	69.9	29.1	1.0	Sandy Gravel	
DG33	0.0	0.0	0.0	0.0	0.7	1.0	1.2	2.6	4.6	5.3	5.2	2.6	7.5	13.9	15.8	11.2	12.7	9.2	3.5	0.8	0.5	0.1	1.6	23.2	75.1	1.6	Gravelly Sand	
DG34	0.0	0.0	0.0	0.0	0.0	1.4	2.0	2.4	6.1	7.2	5.2	3.2	5.6	8.6	10.2	8.0	11.0	15.5	8.9	1.4	0.7	0.3	2.1	27.6	70.3	2.1	Gravelly Sand	
DG35	0.0	0.0	21.2	14.7	0.0	1.4	4.2	2.6	3.8	4.2	4.6	3.9	4.5	5.6	5.0	3.8	4.9	4.3	4.3	2.4	1.5	0.6	2.6	60.5	37.0	2.6	Sandy Gravel	
DG38	0.0	0.0	18.0	10.0	11.4	6.5	4.3	1.8	2.7	2.4	3.5	3.9	6.8	8.6	5.2	2.3	2.3	2.2	1.7	0.8	0.7	0.5	4.4	64.6	31.0	4.4	Muddy Sandy Gravel	
DG42	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	9.9	23.7	25.6	8.3	32.6	0.0	67.4	32.3	Muddy Sand	

All table values are percentages of the sample in each fraction.