JNCC Report
No: 593

Community Analysis of Fulmar MCZ, Offshore Brighton MCZ and Western Channel MCZ

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July 2016

ISSN 0963-8901

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This report should be cited as:

Jones, L., Parry, M. & Wright, H. (2016). Community analysis of Fulmar MCZ, Offshore Brighton MCZ and Western Channel MCZ. *JNCC Report No. 593*. JNCC, Peterborough.

Summary

The Marine and Coastal Access Act 2009 allows for the creation of Marine Conservation Zones (MCZs). There are currently 50 MCZs designated within English and Welsh inshore and UK offshore waters providing protection to a range of nationally important marine wildlife, habitats, geology and geomorphology. Government policy dictates that establishment of MCZs should be based on the "best available evidence". To this effect a number of surveys have been undertaken to gather evidence on the composition of seabed habitats and communities within MCZ areas.

JNCC undertook statistical analysis on benthic community data collected from several offshore MCZs. The results of these analyses were then used to assign biotopes to the survey data based on both the Marine Habitat Classification for Britain and Ireland (Parry 2015[1]) and European Nature Information System (EUNIS[2]) classification scheme. Data analysed consisted of faunal abundance counts from both benthic grab samples and from video footage and still images. The data sets were rationalised before undertaking multivariate statistical analyses using the PRIMERv6 software package. Data from three offshore MCZs were analysed:

- Fulmar MCZ
- Offshore Brighton MCZ
- Western Channel MCZ

The following EUNIS biotopes were assigned after multivariate analysis of the survey data, the correlating Marine Habitat Classification for Britain and Ireland biotopes are provided in brackets:

Fulmar MCZ – 2x level 5 biotopes and 1x level 4 habitat

Community	**EUNIS classification**	**(Marine Habitat Classification for Britain and Ireland)**	**Level**
Infaunal community	A5.376 *Paramphinome jeffreysii*, Thyasira spp. and *Amphiura filiformis* in offshore circalittoral sandy mud	SS.SMu.OMu.PjefThyAfil	Level 5 biotope
Epifaunal community	A5.354 *Virgularia mirabilis* and Ophiura spp. with *Pecten maximus* on circalittoral sandy or shelly mud	SS.SMu.CSaMu.VirOphPmax	Level 5 biotope
	A5.44x Circalittoral mixed sediments, no matching biotope	SS.SMx.CMx	Level 4 habitat

[1] Parry, M.E.V. 2015. Guidance on Assigning Benthic Biotopes using EUNIS or the Marine Habitat Classification of Britain and Ireland, JNCC Report No. 546, ISSN 0963-8091. Available online at: http://jncc.defra.gov.uk/page-6967.

[2] EUNIS classification scheme. Accessed at http://eunis.eea.europa.eu/.

Offshore Brighton MCZ- 4x level 5 biotopes and 2x level 4 habitats

Community	**EUNIS classification**	**(Marine Habitat Classification for Britain and Ireland)**	**Level**
Infaunal community	A5.451 Polychaete-rich deep *Venus* community in offshore mixed sediments	SS.SMX.OMx.PoVen	Level 5 biotope
Epifaunal community	A5.445 *Ophiothrix fragilis* and/or *Ophiocomina nigra* brittlestar beds on sublittoral mixed sediments and/or A5.444 *Flustra foliacea* and *Hydrallmania falcata* on tide-swept circalittoral mixed sediments	SS.SMx.CMx.OphMx and/or SS.SMx.CMx.FluHyd	Level 5 biotopes
	A5.444 *Flustra foliacea* and *Hydrallmania falcata* on tide-swept circalittoral mixed sediments	SS.SMx.CMx.FluHyd	Level 5 biotope
	A5.44x Circalittoral mixed sediments, no matching biotope	SS.SMx.CMx	Level 4 habitat
	A4.13x Mixed faunal turf communities on circalittoral rock, no matching biotope	CR.HCR.XFa	Level 4 habitat

Western Channel MCZ – 3x level 5 biotopes

Community	**EUNIS classification**	**(Marine Habitat Classification for Britain and Ireland)**	**Level**
Infaunal community	A5.145 *Branchiostoma lanceolatum* in circalittoral coarse sand with shell gravel	SS.SCS.CCS.Blan	Level 5 biotope
Epifaunal community	A5.14 circalittoral coarse sediment and/or A4.212 *Caryophyllia smithii*, sponges and crustose communities on wave-exposed circalittoral rock	SS.SCS. CCS and/or CR.MCR.EcCr.CarSp	Level 5 biotopes

The main limitation of this project was that no aggregation was attempted of any taxa which could potentially be the same species identified at different levels or life stages. All listed taxa (including broad taxonomic groups where species were indeterminable) were included in the analysis, which could result in potential double counting of taxa under different taxonomic levels. A general lack of taxa present within the video/still data sets, and level of taxonomic identification that could be made from video/still data were also principal limitations.

Contents

1 Introduction

The Marine and Coastal Access Act 2009 allows for the creation of Marine Protected Areas (MPAs), called Marine Conservation Zones (MCZs). The establishment of MCZs are intended to protect a range of nationally important marine wildlife, habitats, geological and geomorphological features, and can be designated anywhere in English and Welsh inshore and UK offshore waters. To date, 50 MCZs have been designated within two tranches, 14 of these are located in offshore waters (>12 nautical miles from the coast).

Government policy dictates that establishment of MCZs should be based on "best available evidence". JNCC has therefore commissioned a range of research to collect information on the marine environment within offshore MCZs in order to provide the necessary evidence to underpin MCZ recommendations. Surveys were undertaken in a joint effort by Cefas and JNCC to gather evidence and verification of features within sites for the MCZ Project. These surveys (MB0120) involve collecting data to characterise the seabed habitats and their associated communities, enabling broad-scale mapping. The primary objectives of the survey were to collect acoustic and groundtruthing data to allow the production of an updated map which could be used to inform the presence of broad-scale habitats (BSH) and habitat features of conservation importance (FOCI), and allow estimates to be made of their spatial extent within the MCZs (Defra 2014).

Benthic community data collected as groundtruthing data from the MB0120 surveys can be used to identify biotopes within each MCZ. This will assist in summarising the communities and habitats present, which will help JNCC fulfil its role in providing advice for marine nature conservation and assist in the evaluation of the site's protected features for fisheries management options.

This report documents the statistical analyses carried out by JNCC on benthic community data collected from MB0120 surveys acquired in three offshore MCZs which were designated in the second tranche of MCZs (January 2016). The results of these analyses were used to assign biotopes to the survey data based on both the Marine Habitat Classification for Britain and Ireland (Parry 2015[3]) and the European Nature Information System (EUNIS)[4] classification scheme.

The data consisted of both faunal data collected using benthic grabs and drop-down camera systems (both video footage and still images). The benthic grab data was previously analysed and enumerated counts for infauna provided for each station. The faunal communities within the video and still image data were enumerated by a variety of methods, including SACFOR[5] and counts. Particle Size Analysis (PSA) data accompanied all infauna grab samples. Both benthic grab and dropdown camera data had the appropriate metadata, such as time of sampling, sample depth, sample position *etc*.

Data from the following three offshore MCZs were analysed, with Figure 1 showing their locations around the British Isles;

- Fulmar MCZ
- Offshore Brighton MCZ
- Western Channel MCZ

[3] Parry, M.E.V. 2015. Guidance on Assigning Benthic Biotopes using EUNIS or the Marine Habitat Classification of Britain and Ireland, JNCC Report No. 546, ISSN 0963-8091. Available online at: http://jncc.defra.gov.uk/page-6967.
[4] http://eunis.eea.europa.eu/.
[5] http://jncc.defra.gov.uk/page-2684.

The aim of this report is to examine the enumerated faunal data using various multivariate statistical techniques to elucidate the underlying faunal communities present within each MCZ. The assessments made on the faunal communities were used to inform assignment of biotopes, summarising the communities and habitats present.

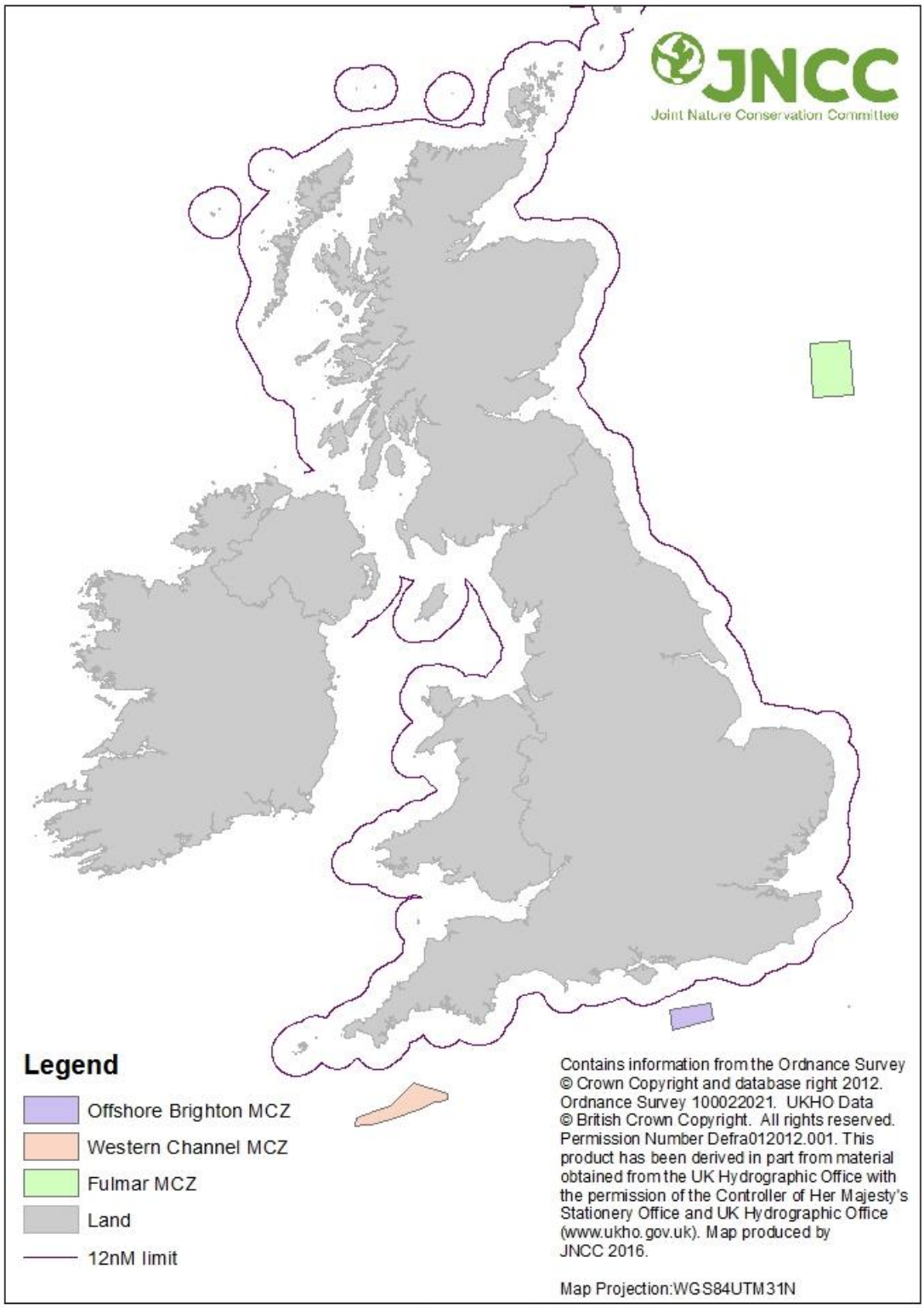


Figure 1: Location of MCZ sites analysed for community analysis.

2 Methodology

Each MCZ survey was conducted by different staff at different times and data sets were analysed by different contractors (prior to being provided to JNCC). Therefore each site was analysed independently and the results between the sites are not comparable. Within each site, benthic grab data and drop-down camera data were analysed separately due to differences in sampling equipment. The general methodologies employed during the multivariate data analysis are detailed below with site specific methodologies detailed in the relevant results section.

2.1 Benthic grab sample data

Three benthic grab sample data sets were analysed, one from each MCZ. Benthic grab samples were collected using a 0.1m^2 Hamon grab. Data were provided as a faunal data matrix detailing enumerated faunal counts at each survey station, with some presence/ absence records for epifaunal species. In addition to the faunal data, sediment particle size analysis (PSA) results were supplied for each station, along with relevant metadata regarding sample location and depth *etc*. The sediments have been described using the British Geological Survey Folk sediment trigon (based on Folk 1954).

2.1.1 Data rationalisation

The software algorithms used only discriminate between lines of text, therefore the main goal of the rationalisation was to ensure species were not duplicated within the data set, and that all taxa had an abundance that was measured on a comparable scale.

As each data set was examined independently, no attempt was made to rationalise fauna between MCZ areas in order to make different data sets comparable. Before any analysis was undertaken, any pelagic taxa found in the water column and therefore potentially independent of the seabed habitat were removed.

Due to time constraints no attempt was made to aggregate any taxa which could potentially be the same species identified at different levels or life stages; all other listed taxa (including broad taxonomic groups where species were indeterminable) were included in the analysis. Species identifications were kept as listed within the raw data, for example, no attempts were made to correct unaccepted species nomenclature.

2.1.2 Multivariate analyses

Resemblance matrices were constructed from each faunal data set using the Bray Curtis similarity measure. Cluster analysis was then undertaken, using group-averaged cluster mode, and the SIMPROF test applied to show evidence of structure within the groupings. The resultant dendrogram was then examined, and stations assigned to groups based on the pattern of clustering. Sediment PSA data was reviewed to show any trends between clustering patterns and the EUNIS sediment classification of samples. The SIMPER routine in PRIMER v6 was then undertaken to assess which taxa were characteristic in the sample groups defined from the cluster analysis.

2.1.3 Biotope designation

The characteristic taxa for each faunal group derived from the SIMPER analysis were used as a basis for biotope designation. The characteristic species were checked against the various biotope descriptions with the Marine Habitat Classification for Britain and Ireland (MHCBI) (Parry 2015) and the European Nature Information System (EUNIS) classification

scheme, also taking into account the sediment type derived from the PSA results and the depth from which the sample was collected.

Any biotopes that roughly matched the habitats and faunal communities identified from the samples were noted. This included highlighting any habitats that matched the sediment classification of the sample, and searching for matches between the characteristic species identified after SIMPER analysis of each sample with those listed within the biotope descriptions.

A more in-depth assessment of the faunal abundance data then followed. This process was more subjective, relying on the experience of the analyst to identify trends in the faunal data. Typical patterns examined included looking at which species were present, and what this implied about the sedimentary environment of the habitat, whether certain combinations of species were present, or species that were indicative of other fauna (e.g. commensal species). These trends were used to refine the number of initially selected possible biotopes to the most appropriate fit to the sample data. Where no appropriate biotopes could be found, a new biotope was proposed, following guidelines issued by JNCC (Parry 2015). All MHCBI biotopes were also recorded as their EUNIS habitat classification equivalents.

As mentioned, sample depth and sediment composition were considered when assigning biotopes. However, any trends within the faunal data that matched any existing biotopes were used to define samples in preference to information from the physical environmental data. In these situations, depth or sediment composition mismatches to the assigned biotope were highlighted. Where insufficient faunal data were present to inform biotope designations, biotopes were assigned solely on sample depth and sediment classification.

Please note that designation of biotopes, even when based on the results of multivariate analysis, always involves a degree of subjectivity on the part of the analyst. Attempts have been made within the results section to explain the decisions made during biotope assignment, which should be borne in mind when considering the results of this report.

2.2 Video footage and still image sample data

Video footage and still images were acquired by either drop-down camera systems or towed camera systems. Faunal data was typically provided as SACFOR abundances. During the original analysis of the video footage, video transects were usually split into a number of segments where the analyst deemed changes in habitat occurred. Still images had been taken at approximately one minute intervals along each video transect.

2.2.1 Rationalisation

This process was largely the same as that outlined for the benthic grab sample data above. The software algorithms used only discriminate between lines of text, therefore the main goal of the rationalisation was to ensure species were not duplicated within the data set, and that all taxa had an abundance that was measured on a comparable scale.

Any pelagic taxa found in the water column and therefore potentially independent of the seabed habitat were removed. Due to time constraints no attempt was made to aggregate any taxa which could potentially be the same species identified at different levels or life stages; all other listed taxa (including broad taxonomic groups where species were indeterminable) were included in the analysis. Species identifications were kept as listed within the raw data, for example, no attempts were made to correct unaccepted species nomenclature.

Epifaunal data from video and stills were typically provided as SACFOR abundances, these were either ranked from 1-6 or transformed into presence/absence records. The method implied at each site is detailed in the relevant results section.

2.2.2 Multivariate analyses

The multivariate analyses of the video footage and still data were similar to those outlined for the benthic grab sample data. Faunal data were converted into resemblance matrices using the Bray Curtis similarity measure. Cluster analysis was then performed, using group-averaged cluster mode and SIMPROF to test the structure of the resultant dendrogram. Stations were assigned to groups based on their clustering within the dendrogram. SIMPER routines were then run to assess which taxa characterised the observed pattern of station groups within the dendrograms.

2.2.3 Biotope designation

Biotope designation of video and still image data followed the same procedure as for the benthic grab samples. The lack of PSA data for the video samples meant that sediment composition was based on estimates and descriptions made by the original analysts as recorded on the survey proformas.

3 Results

The results of the community analysis of each data set are presented separately below, with benthic grab samples reported first (infaunal data), followed by the results of the video and still analyses (epifaunal data). A summary of the biotopes found within each site are detailed in the Discussion (section 4).

3.1 Fulmar MCZ

3.1.1 Site description

Fulmar MCZ is an offshore site located approximately 224km from the Northumberland coast. The seabed of Fulmar MCZ is composed of subtidal mud and subtidal sand, with patches of subtidal mixed sediment. Fulmar MCZ was originally recommended by the Net Gain regional project in 2011 to help meet targets regarding subtidal coarse sediment and subtidal sand broad scale habitat features, and for the presence of the species FOCI ocean quahog. The presence of these features in the site was based on ground-truthing samples available from British Geological Survey (BGS) and their agreement with the modelled habitat map developed by the UKSeaMap project.

Since the site was recommended, more data for Fulmar MCZ have been collected through additional data analysis and the MB0120 survey of the site in May 2012, reported in version 4 of the Post-survey Site Report (Curtis *et al* 2015). Ground-truthing data were collected that confirmed the presence of subtidal mud and subtidal mixed sediments broad-scale habitats in the site. A new modelled habitat map based on the 2012 site survey data was also produced that has revised the extent of subtidal sand and subtidal coarse sediments at the site. The survey, along with other data sourcing work confirmed the presence of the species FOCI ocean quahog at the site.

3.1.2 Infaunal data methodology

Grab samples were taken using a 0.1m^2 Hamon grab at 65 stations in Fulmar MCZ. Particle size analysis results and species data were available for interpretation. Standard data rationalisation was applied; see section 2.1.1 for further details.

Using PRIMERv6 the species data were square root transformed and a cluster analysis performed. The resulting clusters were displayed in a dendrogram (Figure 2) and substrate information was displayed as symbols to help identify any links. SIMPER analysis was undertaken to identify characterising species for each cluster and discriminating species between clusters. The clusters were plotted on a map (Figure 3) to look for spatial patterns and overlain with PSA information from the corresponding grab to reveal any correlation with substrate type.

3.1.3 Infaunal data results

The cluster analysis identified 2 main clusters (j and g), 5 smaller clusters and 3 outliers (Figure 2). Stations in Cluster J tended to occur to the west of the site while cluster g occurred to the east (Figure 3). Cluster G was associated with a slightly higher proportion of stations recording sand substrates rather than mud, but there was no clear relationship between community and substrate as all clusters had stations with a range of substrate types.

PSA results showed mixed sediment at a number of stations associated with an area in the south-west corner of the site which has been designated as the broad-scale habitat A5.4

Subtidal mixed sediments. Raw PSA results reveal all stations had sandy mud substrate with some gravel, although the relative proportions vary across the site meaning different broad substrate types are assigned.

SIMPER analysis showed that all the clusters had similar characterising taxa, and differed just in the relative abundance of taxa. Cluster J was distinguished from Cluster G by a higher abundance of *Paramphinome jeffreysii* and *Pterolysippe cf. vanelli* but was otherwise very similar. Outliers generally recorded a lower number of taxa with some key taxa absent.

Overall it was considered that the same community was recorded across the whole site. SIMPER analysis was rerun with all clusters, but not outliers, grouped as a single community to identify overall characterising species (Table 1). This community recorded across the whole site was characterised by a range of polychaetes including *Paramphinome jeffreysii*, brittle star *Amphiura filiformis,* nemertean worms and a holothurian (*Labidoplax digitata*). This matches well with the biotope A5.376 *Paramphinome jeffreysii*, *Thyasira* spp. and *Amphiura filiformis* in offshore circalittoral sandy mud, particularly considering *Thyasira* was also recorded at some stations. The physical environment also matches this biotope, further information on the description of this biotope can be found in Section 3.1.4 of this report.

Table 1: Fulmar MCZ SIMPER results showing top ten characterising species for all clusters aggregated.

Species	Av. Abund	Av.Sim	Sim/SD	Contrib.%	Cum.%
Paramphinome jeffreysii	12.66	9.79	1.47	25.19	25.19
Amphiura filiformis	5.45	4.84	1.16	12.45	37.64
Myriochele heeri	5.27	3.42	0.86	8.81	46.45
Pterolysippe cf. vanelli	4.82	2.66	0.77	6.84	53.29
Scoloplos armiger	2.94	2.53	0.97	6.51	59.80
Goniada maculata	1.76	1.50	1.03	3.87	63.67
Nemertea indet.	1.92	1.34	1.04	3.45	67.11
Labidoplax digitata	1.84	1.17	0.78	3.01	70.12
Spiophanes kroyeri	1.65	1.09	0.79	2.80	72.92
Amphiura indet. juv.	1.98	1.06	0.66	2.72	75.65
Notomastus latericeus	1.94	0.93	0.60	2.39	78.04

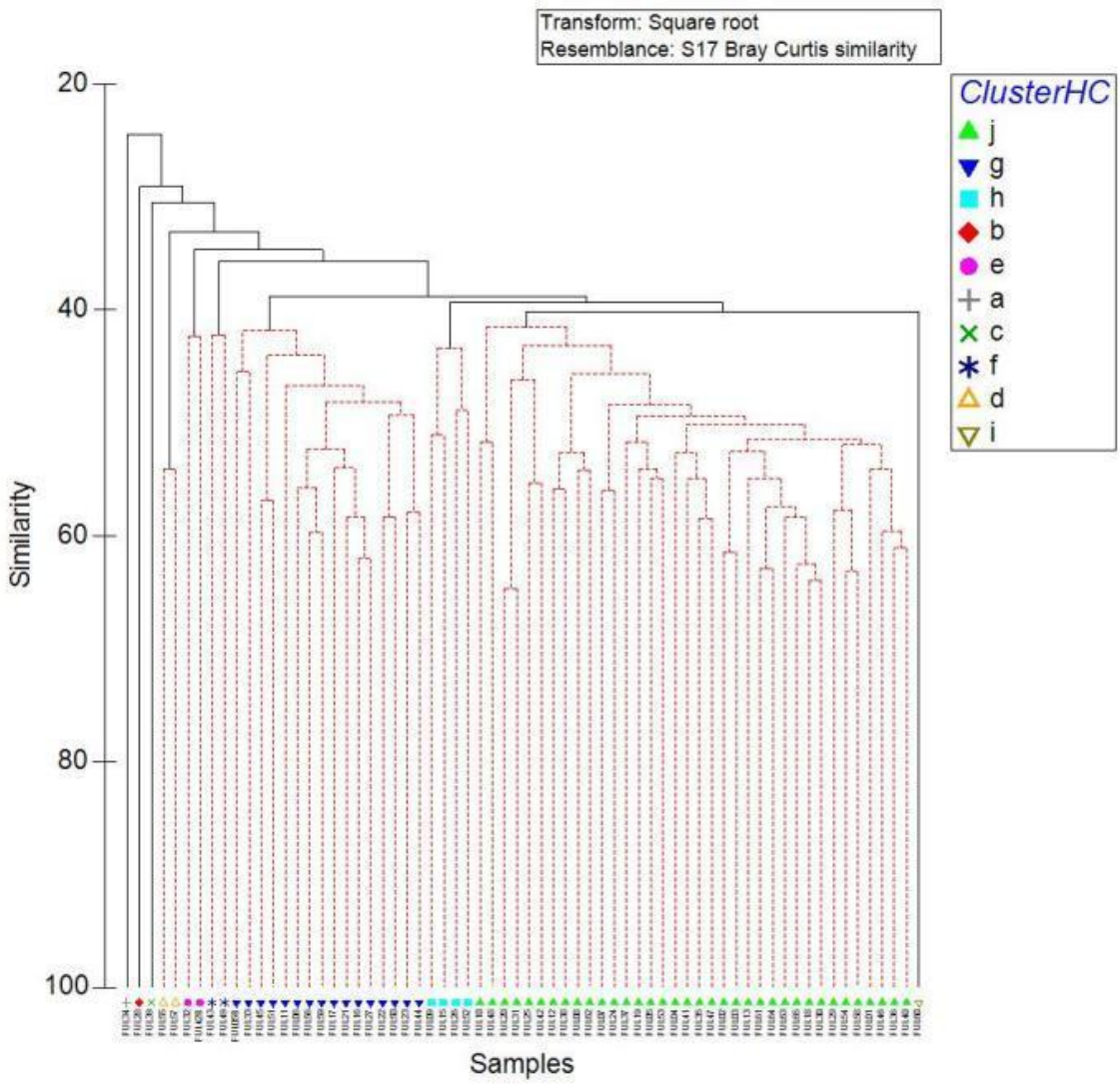


Figure 2: Fulmar MCZ Dendrogram from infaunal cluster analysis.

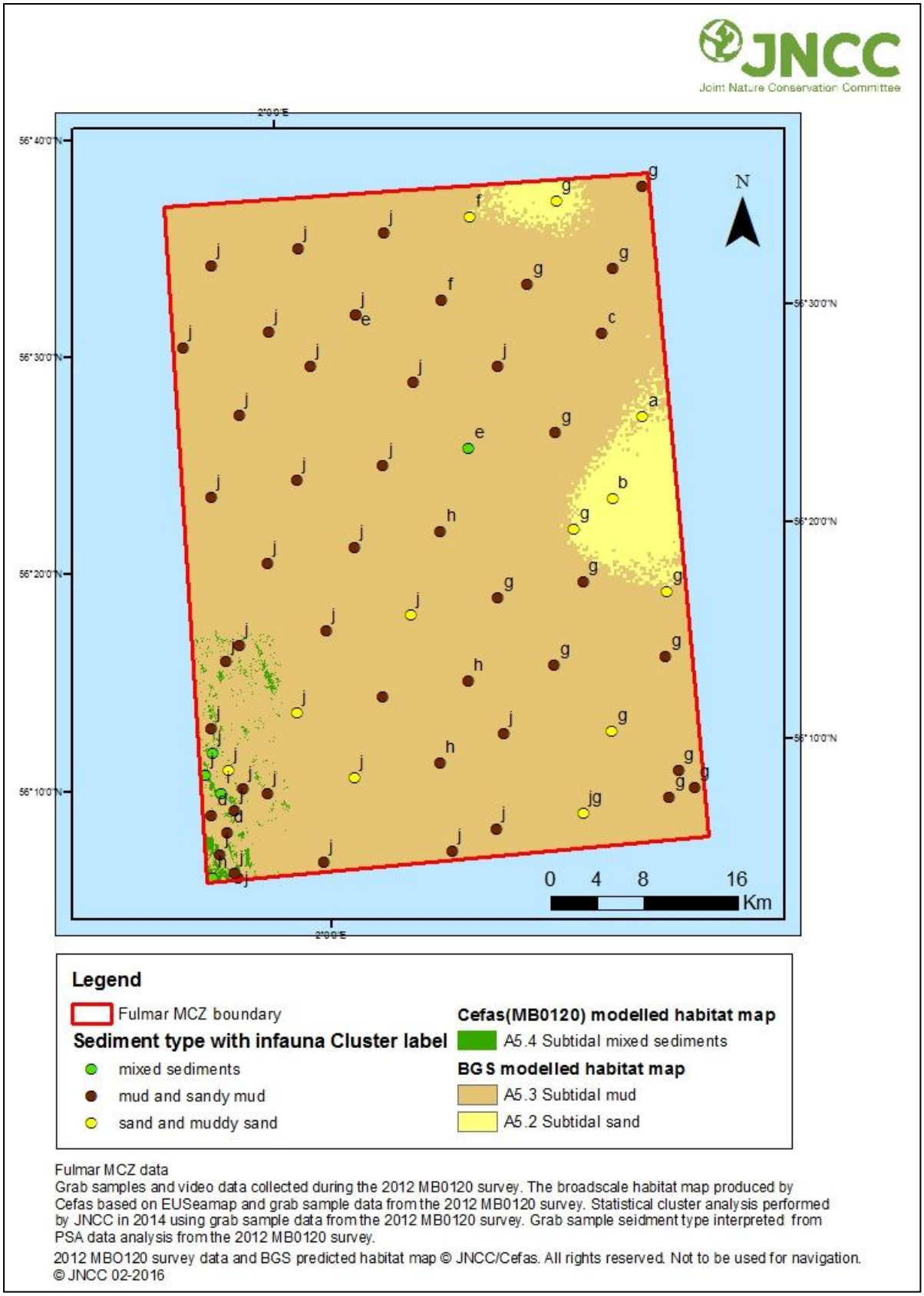


Figure 3: Fulmar MCZ Map of infauna clusters with PSA results.

3.1.4 Infaunal biotopes

EUNIS: A5.376 *Paramphinome jeffreysii*, *Thyasira* spp. and *Amphiura filiformis* in offshore circalittoral sandy mud.
MHCBI: SS.SMu.OMu.PjefThyAfil
Grab stations: All (outliers likely to be same biotope although community recorded was not complete).
Depth range: 67-86m
Substratum: Muddy sand with a small amount of gravel. Folk mostly mS with some gmS and gM. EUNIS mostly mud and sandy mud with some sand and muddy sand and a small number with mixed sediment.
Infaunal community: Diverse community dominated by polychaete *Paramphinome jeffreysii*.
Infaunal multivariate clusters: A, B, E, G, H, J

Figure 4: Example grab photographs of EUNIS biotope A5.376.

3.1.5 Epifaunal data methodology

Video transects were undertaken at 25 of the stations with stills taken at regular intervals. Species data were recorded as SACFOR[6] for all taxa and counts for a small number of taxa. As only a small proportion of the community was recorded as counts, SACFOR scores were converted into a scale from 1 to 6 and these results analysed in PRIMERv6. Pelagic species were not included in the analysis. Stills data and video data were analysed separately.

3.1.6 Epifaunal data results

Cluster analysis did not reveal any useful results as the data were not appropriate for this test. Each still generally only recorded a single species so it was not possible to use these as samples to assess community structure as cluster analysis simply clustered stills with the same species together. Cluster analysis of video data did not identify any significant clusters. Consequently, the raw species matrices were reviewed to look for patterns in epifaunal community.

All stations recorded a similar community dominated by seapens (identified as "Pennatulacea, most likely to be *Virgularia mirabilis*"), seastars and hermit crabs. The hydroid *Corymorpha nutans*, anemone *Bolocera tuediae,* gastropods of the family Buccinidae, and unidentified sea urchins and crustaceans occurred at a number of stations. Substrates were generally described as sandy mud, but some transects had patches of empty shell and living *Modiolus modiolus*. These were not dense enough to constitute large beds. The stations with patches of shelly substrate were spread around the centre of the site

[6] Marine Nature Conservation Review (MNCR) SACFOR abundance scale, http://jncc.defra.gov.uk/page-2684.

and not associated with the predicted coarse sediment on EUSeaMap or stations recording mixed sediment in the PSA (Figure 3).

Raw data indicates that the epifaunal community across the whole site matches the biotope A5.354 *Virgularia mirabilis* and *Ophiura* spp. with *Pecten maximus* on circalittoral sandy or shelly mud (SS.SMu.CSaMu.VirOphPmax). *Virgularia* and brittle stars which could be *Ophiura* were recorded across the site and a number of taxa mentioned in the description matched those recorded in concurrent grab samples (*Owenia fusiformis*, *Labidoplax buski*). Pectenidae (potentially *Pecten maximus*) were also recorded in a small number of transects. The small patches of shelly substrate with *Modiolus* could only be accurately assigned at level 4 to A5.44 circalittoral mixed sediments. The community is similar to A5.442 Sparse *Modiolus modiolus*, dense *Cerianthus lloydii* and burrowing holothurians on sheltered circalittoral stones and mixed sediments but no *Cerianthus lloydii* or burrowing holothurians were evident from the video data. There was evidence of burrowing activity at most stations but it was not clear which organisms were creating the burrows, and if they would be classed as 'burrowing megafauna'.

3.1.7 Epifaunal biotopes

EUNIS: A5.354 *Virgularia mirabilis* and *Ophiura* spp. with *Pecten maximus* on circalittoral sandy or shelly mud.
MHCBI: SS.SMu.CSaMu.VirOphPmax
Video stations: all (3, 5, 7, 8, 10, 12, 14, 17, 18, 25, 27, 30, 32, 34, 35, 37, 39, 42, 45, 46, 49, 53, 55, 56, 62).
Depth range: 69 - 90m
Substratum: Sandy mud with shell fragments.
Epifaunal community: Dominated by sea-pens (likely to be *Virgularia mirabilis*), seastars and hermit crabs. Evidence of burrowing activity.

Figure 5: Example stills of EUNIS biotope A5.354.

EUNIS: A5.44x Circalittoral mixed sediments, no matching biotope.
MHCBI: SS.SMx.CMx
Video stations: small sections of 14, 25, 27, 30, 32, 37, 42.
Depth range: 69 - 90m
Substratum: Sandy mud with shells (mixed sediments).
Epifaunal community: Patches of *Modiolus modiolus*.

Figure 6: Example stills of EUNIS biotope A5.44x.

3.1.8 Discussion

Particle size analysis (PSA) results showed mixed sediment at a number of stations associated with an area in the south-west corner of the site, which was designated as A5.1 Subtidal mixed sediments. Raw PSA results reveal all stations had sandy mud substrate with some gravel, although the relative proportions vary across the site meaning different broad substrate types are assigned. There was no clear relationship between biological community and substrate as all statistical clusters had stations with a range of substrate types.

Overall it was considered that the same infaunal community was recorded across the whole site. The infaunal community can be matched to A5.376 *Paramphinome jeffreysii*, *Thyasira* spp. and *Amphiura filiformis* in offshore circalittoral sandy mud while the epifaunal community can be matched to A5.354 *Virgularia mirabilis* and *Ophiura* spp. with *Pecten maximus* on circalittoral sandy or shelly mud (Figure 7).

Small patches of *Modiolus modiolus* on shelly substrate were recorded at a number of stations which do not match an existing biotope but would be assigned to A5.44 Circalittoral mixed sediments at EUNIS Level 4.

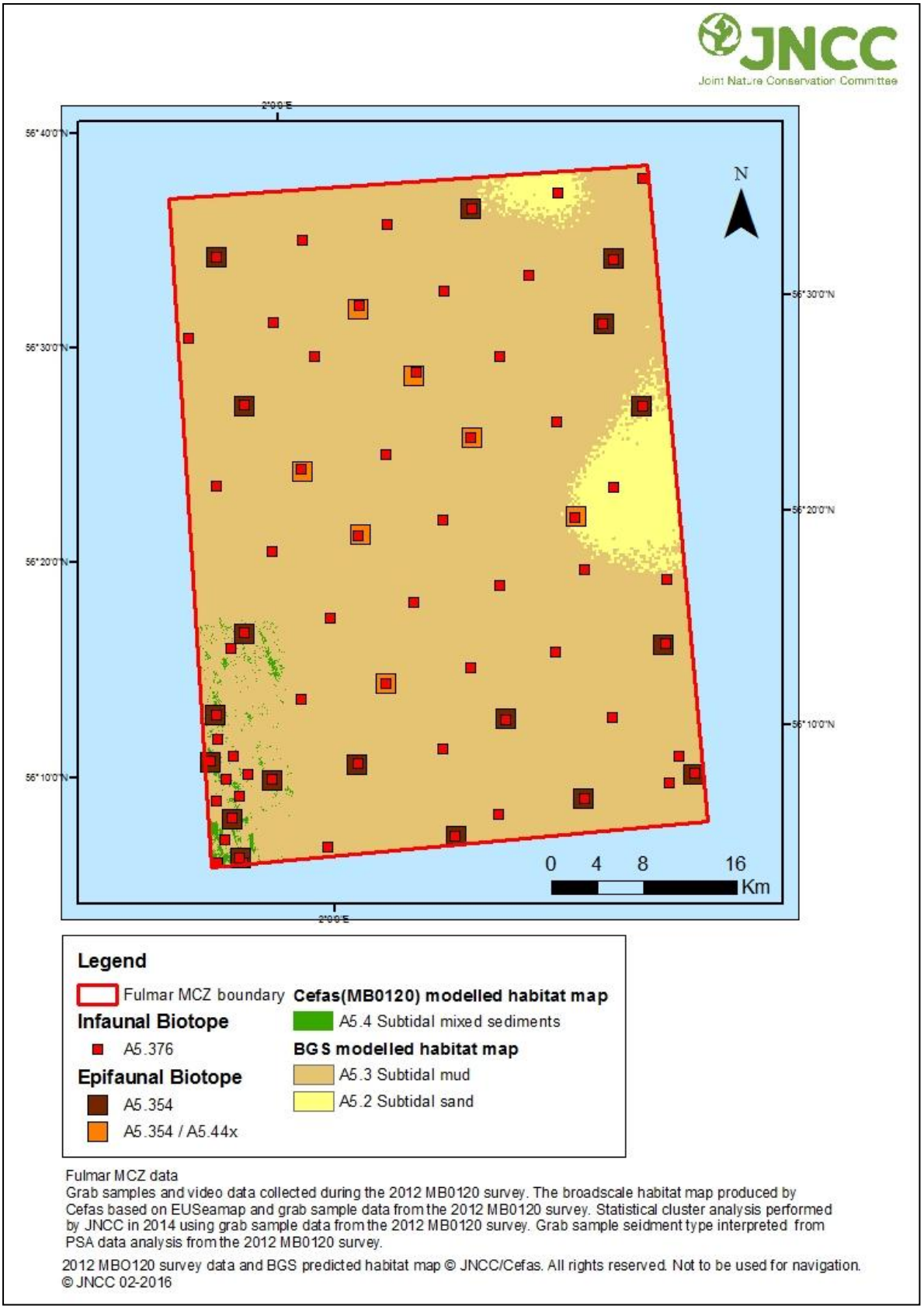


Figure 7: Fulmar MCZ Map of biotopes assigned based on infaunal and epifaunal data.

3.2 Offshore Brighton MCZ

3.2.1 Site description

Offshore Brighton MCZ is located in the eastern English Channel, approximately 45km south of Selsey Bill, West Sussex. The seabed is predominantly coarse sands, gravel and shingle with areas of exposed bedrock and mixed sediments. Offshore Brighton MCZ was originally recommended by the Balanced Seas Regional Project in 2011 to help meet targets regarding the broad-scale habitat features High energy circalittoral rock, Subtidal coarse sediment and Subtidal mixed sediments. The presence of these features in the site was based on ground-truthing samples available from British Geological Survey (BGS) and their agreement with the modelled habitat map developed by the UKSeaMap project.

The Eastern English Channel marine habitat map (James *et al* 2007) analysed biotopes for the eastern half of the MCZ and identified infaunal biotopes similar to A5.451 Polychaete-rich deep *Venus* communities in offshore mixed sediments and A5.141 *Pomatoceros triqueter* with barnacles and bryozoan crusts on unstable circalittoral cobbles and pebbles. This project also identified epifaunal biotopes possibly matching A5.445 *Ophiothrix fragilis* and/or *Ophiocomina nigra* brittlestar beds on sublittoral mixed sediments, plus other biotopes identified to level 4 A5.14 circalittoral coarse sediment and A5.15 deep circalittoral coarse sediment.

An MB0120 survey was undertaken for JNCC in June 2012 to provide further confirmation of the habitats present at the site; this is the primary source of data for the biotope analysis carried out in this report. In February 2012 a Cefas survey opportunistically took three video tows in the north-west quarter of the site and a preliminary interpretation of this data is also included here. Both of these surveys are included in the MB0120 Post Survey Site Report, version 4 (Dove *et al* 2015)

3.2.2 Infaunal data methodology- June 2012 data

Grab samples were taken using a 0.1m^2 Hamon grab at 36 stations in Offshore Brighton MCZ. Particle size analysis (PSA) results and species (or broader taxa) data were available for interpretation. Standard data rationalisation was applied; see section 2.1.1 for further details.

Using PRIMER v6 the species data were square-root transformed and a cluster analysis performed. The resulting clusters were displayed in a dendrogram (Figure 8) and substrate information was displayed as symbols to help identify any habitat associations. SIMPER analysis was undertaken to identify characterising species for each cluster and discriminating species between clusters.

The clusters were mapped (Figure 9) to look for spatial patterns and overlain with PSA data from the corresponding grab to reveal any potential correlation with substrate type. The incidence (presence/absence) of seventeen epifaunal taxa were also recorded, these were incorporated by converting all of the data (infaunal and epifaunal) to presence/absence and the analysis re-run. The results were compared to the abundance analysis, which was preferred for interpretation given the greater statistical power of the numeric data and the focus on infauna.

3.2.3 Infaunal data results- June 2012 data

The cluster analysis identified two main clusters (*c* and *d*), a smaller cluster (*b*) and an outlier (Figure 8). Each cluster was distributed widely across stations in the site with little evidence

of clusters being spatially concentrated (Figure 9). Clusters *c* and *d* occurred at stations where either mixed sediment or coarse sediment was recorded. Cluster *b* occurred only at stations where coarse sediment was recorded, although this cluster comprised of only three samples. PSA results found that stations fell into either mixed or coarse sediment types, and again these occurred widely across the site with no noticeable spatial pattern. All stations were dominated by gravel, with variable amounts of mud and/or sand and occasional shell. None of the PSA results indicated the presence of circalittoral rock, although Hamon grabs are not suited for assessing large cobbles, boulders or cohesive hard substrata. Video tow data suggested that bedrock occurred at one of twenty stations.

SIMPER analysis showed that all the four clusters had similar characterising taxa. Clusters *c* and *d* differed only in the relative abundance of taxa, namely *Sabellaria spinulosa* (more abundant in *d*) and *Ophiothrix fragilis, Glycymeris glycymeris* and *Nucula nucleus* (more abundant in *c*). Cluster *b* differed from clusters *c* and *d* by the absence of many species, suggesting this cluster's stations had a depauperate infauna by comparison or, more likely, that grab samples were not as successful as the volume of material captured at these stations was only small. Nevertheless, cluster *b* still contained characteristic species such as *Lumbrineris gracilis* and *Glycymeris glycymeris*.

Overall these clusters were considered to be the same community recorded across the whole site as there was substantial overlap in the species present. Cluster *a* (comprising one station) contained a much smaller range of species but all of these were found in at least one other location, suggesting this station comprised a small subset of infauna from the same overall community.

SIMPER analysis was rerun with clusters *b-d* (35 stations in total) grouped as a single community to identify the overall characterising species (Table 2). The community comprises a diverse range of polychaetes, particularly *Lumbrineris gracilis*, *Notomastus latericeus* and *Scalibregma celticum* with the bivalves *Glycymeris glycymeris* and *Nucula nucleus* and brittlestar *Ophiothrix fragilis*. This community is most similar to the biotope A5.451 polychaete-rich deep *Venus* community in offshore mixed sediments, with five of the top ten characterising species in the grab samples matching characterising species in this biotope (*Lumbrineris gracilis*, *Glycymeris glycymeris*, *Notomastus latericeus*, *Scalibregma* sp. and *Laonice bahusiensis*). However, the match is not exact and the community found in Offshore Brighton MCZ appears to have fewer bivalve species than predicted for A5.451. Infaunal analyses conducted for the Eastern English Channel Marine Habitat Map (James 2007) also indicate that mixed sediments biotopes in this part of the offshore English Channel are very similar to A5.451 and suggest that this biotope could be subdivided to create two new biotopes accounting for lower occurrences of venerid bivalves.

The cluster analysis using presence/absence data (and including 17 epifaunal taxa) found five clusters, but four of these were very similar to the clusters identified using abundance data. The additional cluster represented a new, single outlier which had a subset of the taxa found in the broader community and one species unique to the station (*Priapulus caudatus*).

A SIMPER analysis was run with four of the clusters grouped as a single community (34 stations in total) to identify overall characterising species; one outlier cluster with high dissimilarity (scores of 76-82) and comprising two stations was excluded. Nine out of the top ten characterising species matched those found using the abundance data; only *Sabellaria spinulosa* was missing (although still present in the top 15), reflecting the change from numeric data (in which some stations had very high abundance of *Sabellaria spinulosa*) to incidence data. Given the similarities in clusters and characterising species, the presence/absence analysis supports the findings of the abundance analysis and selection of biotope A5.451.

Table 2: Offshore Brighton MCZ SIMPER results showing the top ten characterising taxa for the aggregated clusters B, C and D.

Species	Av. Abund	Av.Sim	Sim/SD	Contrib.%	Cum.%
Lumbrineris gracilis	8.40	5.57	1.48	17.97	17.97
Polynoidae - indeterminable	7.37	4.94	1.40	15.94	33.91
Glycymeris glycymeris	7.00	3.75	0.96	12.09	46.00
Notomastus latericeus	5.46	2.69	0.90	8.69	54.68
Ophiothrix fragilis	5.63	2.41	0.65	7.77	62.45
Scalibregma celticum	3.17	1.67	0.86	5.39	67.83
Nemertea - indeterminable	2.17	1.26	1.06	4.08	71.91
Nucula nucleus	6.66	1.26	0.44	4.08	75.99
Sabellaria spinulosa	8.23	0.90	0.31	2.91	78.90
Laonice bahusiensis	1.31	0.70	0.61	2.26	81.16

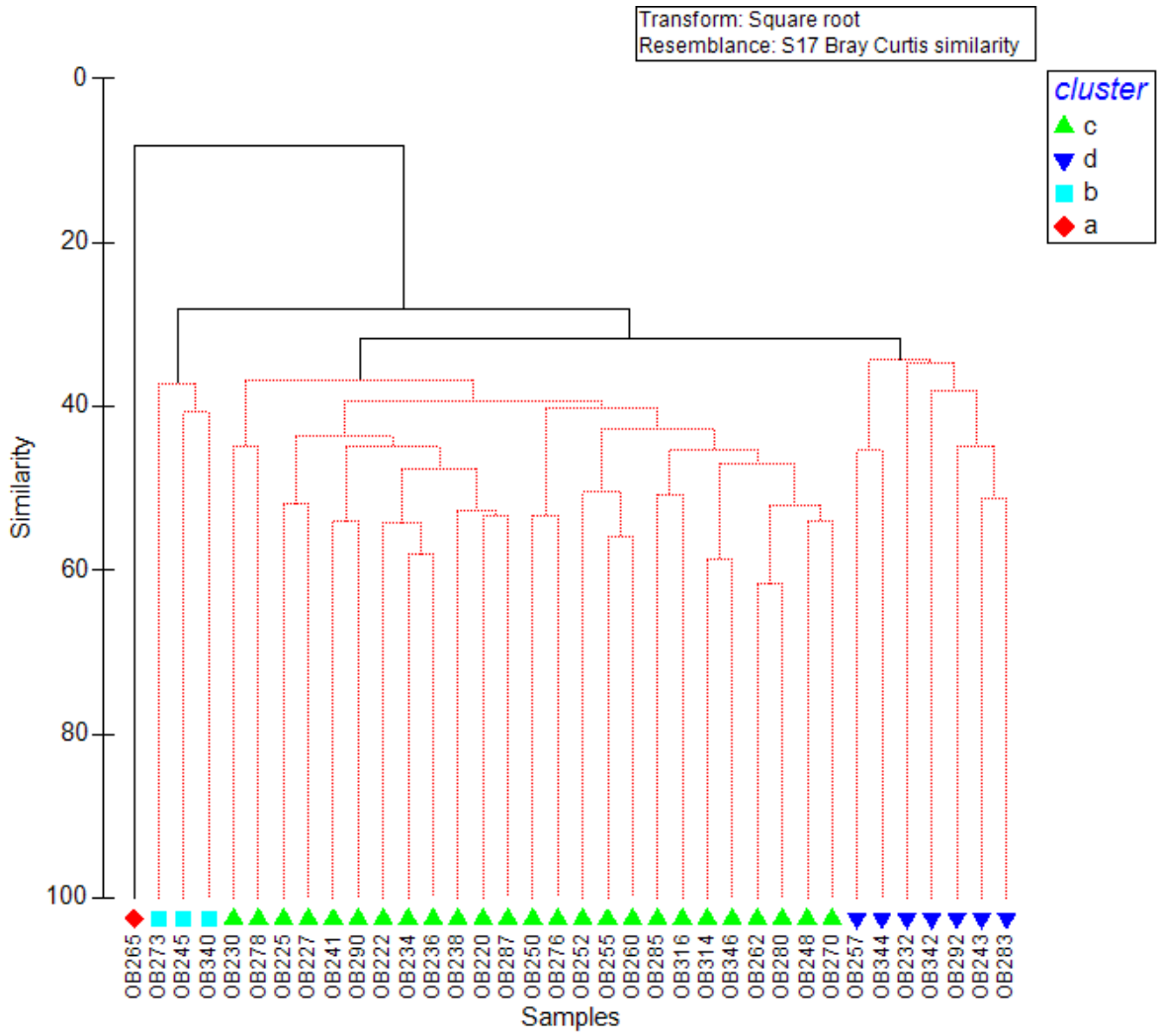
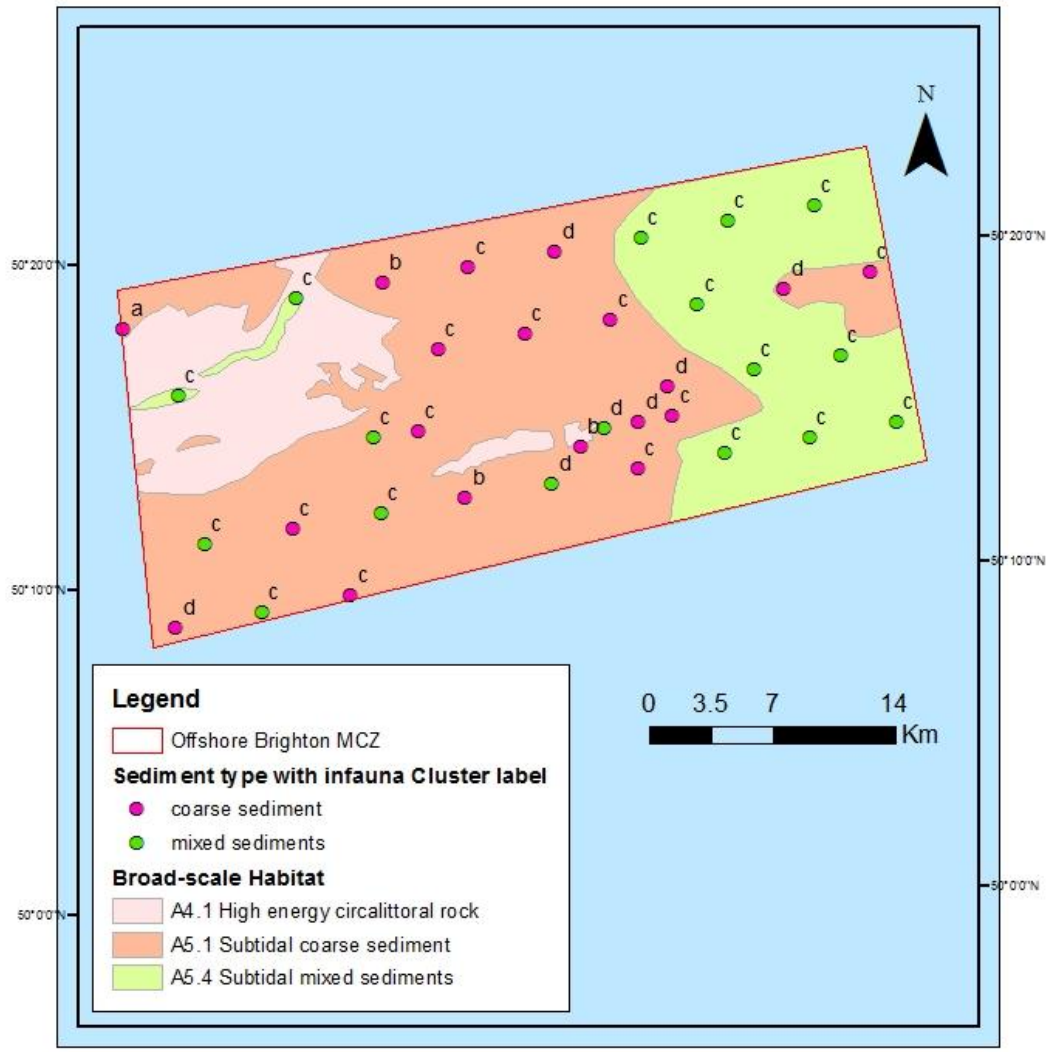


Figure 8: Offshore Brighton MCZ Dendrogram from infaunal cluster analysis.



Offshore Brighton MCZ data Grab samples and video data collected during the 2012 MB0120 survey. The broadscale habitat map produced by Cefas based on EUSeamap and grab sample data from the 2012 MB0120 survey.
Statistical cluster analysis performed by JNCC in 2014 using grab sample data from the 2012 MB0120 survey.
Grab sample sediment type interpreted from PSA data analysis from the 2012 MB0120 survey.

Figure 9: Offshore Brighton MCZ Map of infaunal clusters with PSA results.

3.2.4 Infaunal biotopes

EUNIS: A5.451 Polychaete-rich deep *Venus* community in offshore mixed sediments.
MHCBI: SS.SMX.OMx.PoVen
Grab stations: All except the outlier station OB_MX_01.
Depth range: 44-68m
Substratum: Muddy sand with a small amount of gravel. Folk trigon classes mostly mS with some gmS and gM. EUNIS mostly mud and sandy mud with some sand and muddy sand and a small number with mixed sediment.
Infaunal community: Diverse community of polychaetes, particularly *Lumbrineris gracilis*, with some bivalves.
Infaunal multivariate clusters: B, C, D.

Figure 10: Example grab photographs of EUNIS biotope A5.451.

3.2.5 Epifaunal data methodology- June 2012 data

Video transects were undertaken at 20 stations with stills taken at regular intervals during the transects. A contractor carried out an initial assessment of the video footage following data collection, viewing the videos at 2x normal speed and dividing the footage into segments of different substrata described using the British Geological Survey Folk sediment trigon (based on Folk 1954). The habitat-subdivided transect segments were therefore the sample unit for biotope analysis.

Species data were recorded using SACFOR[7] abundance scores for all taxa and these scores were converted into a scale from 1 to 6 for analysis in PRIMER. Pelagic species (*Callionymus lyra*, *Scyliorhinus canicula*, Gadidae sp. and Gobiidae sp.) were not included in the analysis. Stills data were not analysed statistically as relatively few species records were obtained per individual photograph, however the raw species matrices for stills data were reviewed.

3.2.6 Epifaunal data results

The cluster analysis identified two main clusters (*a* and *c*) and two small clusters (*b* and *d*; Figure 11). Cluster *c* included 15 separate video stations, cluster *a* five stations, cluster *b* two stations and cluster *d* comprised of only two video segments taken at a single station. Clusters *a* and *c* stations were widely distributed across the site while clusters *b* and *d* occurred in very few stations towards the north and west (Figure 12). Cluster *c* occurred at stations where PSA results (from Hamon grab data) indicated either mixed or coarse sediments were present. Grab data was not collected for cluster *a*, *b* or *d* stations but video observations of broad scale habitat suggest that clusters *a* and *b* were associated with either mixed or coarse sediments. The station contributing to cluster *d* contained a mosaic of muddy gravel, pebbles, cobbles and sand over bedrock.

SIMPER analysis showed some similarities and some differences between the communities in these clusters. Cluster *c* was characterised by relatively high abundance of *Ophiothrix fragilis* (although not in every station or video segment) and *Spirobranchus* sp. with *Hydrallmania falcata*, *Nemertesia* sp., *Aequipecten opercularis* and *Flustra foliacea*. Cluster *a* differed from *c* in the absence of *Ophiothrix fragilis* and *Nemetesia* sp., but other divergences came down to differences in the abundance of taxa only. Cluster *b* differed from cluster *c* in the absence of both *Ophiothrix fragilis* and *Hydrallmania falcate*, with further divergence again stemming from differences in the relative abundance of taxa not their incidence. These differences are supported by the taxa matrices of stills data, which show

[7] Marine Nature Conservation Review (MNCR) SACFOR abundance scale, http://jncc.defra.gov.uk/page-2684.

similar patterns of divergence between clusters *a*, *b* an d c. Cluster *d* differed from all other clusters by the absence of many taxa and was really only characterised by the presence of *Flustra foliacea* and encrusting sponges. Nevertheless, cluster *d* did differ from other clusters in the presence of bedrock, occurring beneath a mixed sediment veneer.

Ophiothrix fragilis occurred at eight of the 15 cluster *c* stations, and for this subset there are two likely biotope matches: A5.445 *Ophiothrix fragilis* and/or *Ophiocomina nigra* brittlestar beds on sublittoral mixed sediments, and A5.444 *Flustra foliacea* and *Hydrallmania falcata* on tide-swept circalittoral mixed sediments. *Ophiothrix fragilis* communities form beds over the top of other communities, hence it is justifiable to conclude that two biotopes occur in sympatry at these stations. A SIMPER analysis was re-run to characterise the epifauna at the eight stations where *Ophiothrix fragilis* was present (i.e. stations with both A5.445 and A5.444) and this reaffirmed *Ophiothrix fragilis*, *Spirobranchus* sp., *Aequipecten opercularis* and *Hydrallmania falcata* as characterising taxa of these communities (Table 3). Four of the top ten characterising genera identified from these video data matched those predicted for the A5.445 biotope.

Ophiothrix fragilis was absent from a subset of seven cluster *c* stations and all cluster *a* stations, so in these cases community A5.445 is not a suitable match. Nevertheless, the community in cluster *a* appeared similar to this subset of cluster *c* stations, suggesting biotope A5.444 is a reasonable match for both. A SIMPER analysis was re-run to characterise the A5.444 community by combining cluster *a* stations with the seven cluster *c* stations not containing *Ophiothrix*. This confirmed *Spirobranchus* sp., *Flustra foliacea*, *Aequipecten opercularis*, *Hydrallmania falcata*, *Nemertesia* sp. and *Urticina* sp. as key characterising species of this biotope. Five of the top ten characterising genera identified from these video data matched those predicted for the A5.444 biotope (Table 4).

The cluster *d* station contained a depauperate community which cannot be matched to an exact biotope at level 5 of the marine habitat classification. However, evidence for the broad substrata at this station indicates a mosaic of coarse or mixed sediment on top of bedrock, and therefore the EUNIS level 4 categories A4.13x Mixed faunal turf communities on circalittoral rock and A5.44x Circalittoral mixed sediments are deemed most relevant here. Cluster *b* stations lack two of the key characterising species of circalittoral mixed sediments communities and therefore it is also difficult to assign an exact biotope. It is likely that stations in cluster *d* and *b* have the same community as other mixed sediment areas across the site (A5.444) but grab samples taken at these stations did not sample the full community present. As this cannot be proved, A5.44x Circalittoral mixed sediments is the best match for cluster *b* based on available data.

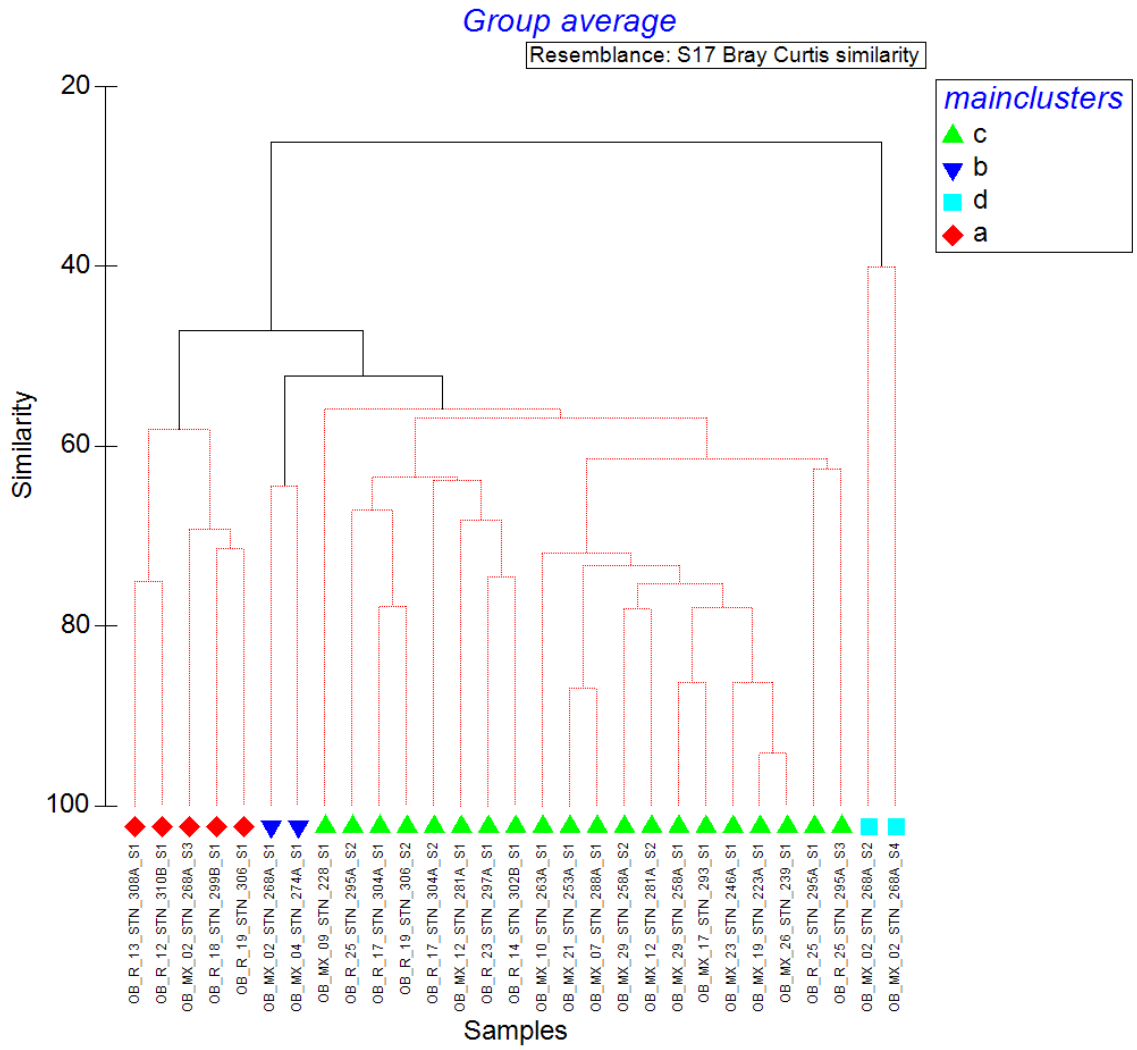
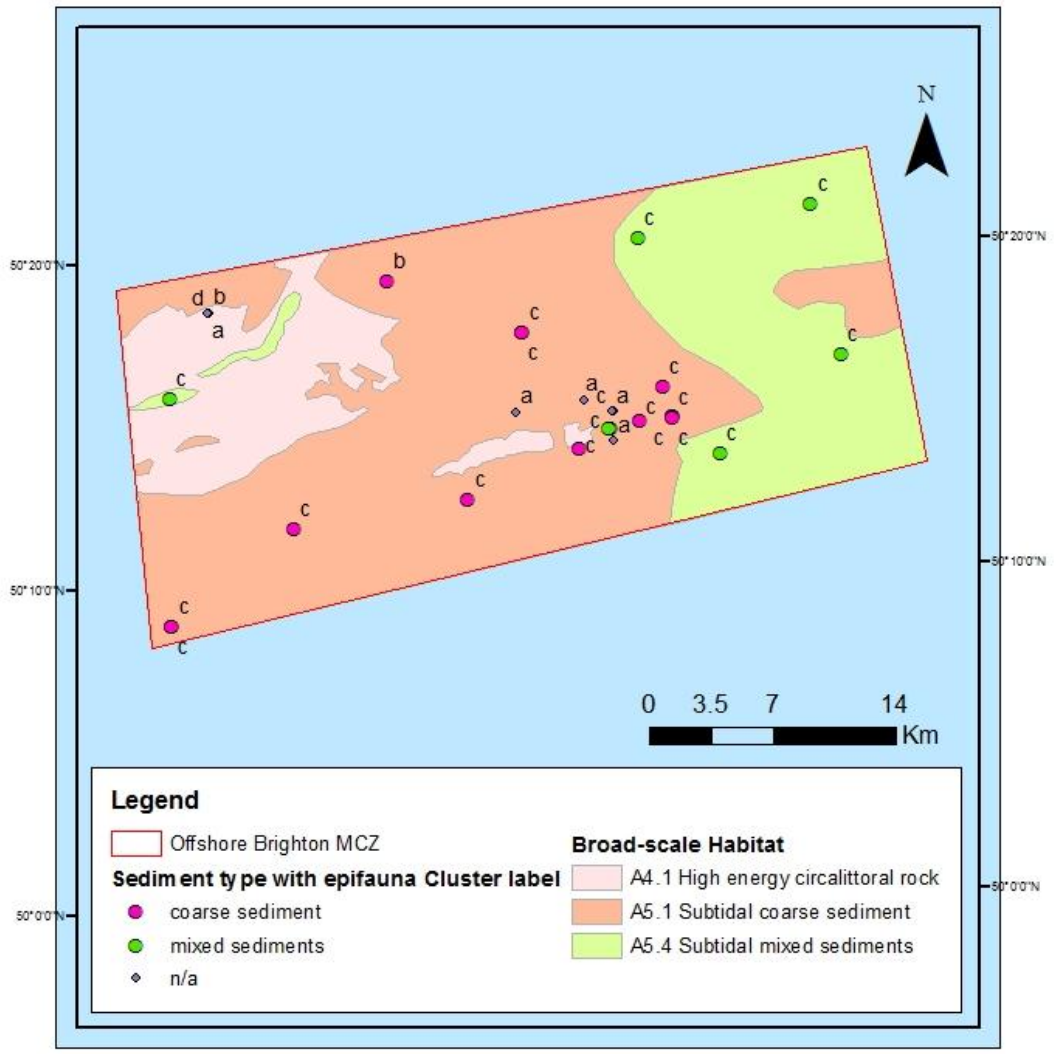


Figure 11: Offshore Brighton MCZ Dendrogram from cluster analysis of video SACFOR data.



Offshore Brighton MCZ data Grab samples and video data collected during the 2012 MB0120 survey. The broadscale habitat map produced by Cefas based on EUSeamap and grab sample data from the 2012 MB0120 survey.
Statistical cluster analysis performed by JNCC in 2014 using grab sample data from the 2012 MB0120 survey.
Grab sample sediment type interpreted from PSA data analysis from the 2012 MB0120 survey.

Figure 12: Offshore Brighton MCZ Map of epifaunal clusters with PSA results**.**

3.2.7 Epifaunal biotopes

EUNIS: A5.445 *Ophiothrix fragilis* and/or *Ophiocomina nigra* brittlestar beds on sublittoral mixed sediment and/or A5.444 *Flustra foliacea* and *Hydrallmania falcata* on tide-swept circalittoral mixed sediment.
MHCBI: SS.SMx.CMx.OphMx /SS.SMx.CMx.FluHyd
Clusters: subset of *c*
Video stations (and video segments): 223 (S1), 239 (S1), 253 (S1), 258 (S2), 263 (S1), 281 (S2), 288 (S1), 293 (S1), 295 (S1 and S3).
Depth range: 45-68m
Substratum: Mostly muddy gravel (Folk trigon class mG) with some muddy sandy gravel (msG). Occasional gravel (G) and gravely muddy sand (gmS) and scarce patches of shell.

Epifaunal community: Dominated by *Ophiothrix fragilis* and *Spirobranchus* sp. over a community of *Hydrallmania falcata*, *Flustra foliacea* and *Nemertesia* sp.

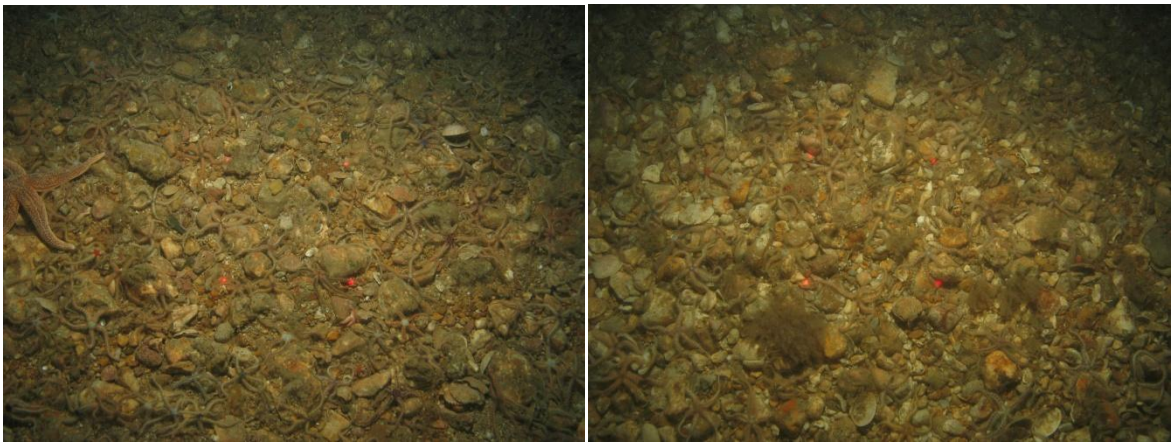


Figure 13: Example stills of EUNIS biotope A5.445.

Table 3: SIMPER results showing the ten characterising taxa for A5.445/A5.444.

Species	Av.Abund	Av.Sim	Sim/SD	Contrib%	Cum.%
Ophiothrix fragilis	4.75	17.57	3.75	24.68	24.68
Spirobranchus sp.	2.75	9.40	2.05	13.20	37.89
Aequipecten opercularis	2.17	7.80	5.17	10.96	48.84
Unidentified hydroid	2.00	7.74	5.56	10.87	59.71
Unidentified faunal turf	1.83	6.08	2.12	8.54	68.25
Hydrallmania falcata	2.25	5.93	1.35	8.32	76.57
Unidentified encrusting bryozoan	0.92	3.19	2.03	4.48	81.05
Asterias rubens	1.67	3.08	0.65	4.32	85.37
Paguridae sp.	1.33	2.94	0.85	4.13	89.50
Nemertesia sp.	1.50	2.37	0.61	3.33	92.83

EUNIS: A5.444 *Flustra foliacea* and *Hydrallmania falcata* on tide-swept circalittoral mixed sediment.
MHCBI: SS.SMx.CMx.FluHyd
Clusters: *a* and subset of *c*.
Video stations (and video segments): 228 (S1), 268 (S3), 281 (S1), 295 (S2), 297 (S1), 299 (S1), 302 (S1), 304 (S1 and S2), 306 (S1 and S2), 308 (S1), 310 (S1).
Depth range: 45-52m (where depth data available)
Substratum: Gravel (Folk trigon class G), muddy gravel (mG) or muddy sandy gravel (msG) and occasional sandy gravel (sG) or sandy gravely mud (sgM). Occasional or scarce patches of *Sabellaria spinulosa*, shell or cobble.
Epifaunal community: *Spirobranchus* sp. with the bryozoan *Flustra foliacea*, hydroids *Hydrallmania falcata* and *Nemertesia* sp. and bivalve *Aequipecten opercularis*. Occasional patches of barnacles.

Figure 14: Example stills of EUNIS biotope A5.444.

Table 4: SIMPER results showing the nine characterising taxa for A5.444.

Species	Av.Abund	Av.Sim	Sim/SD	Contrib%	Cum.%
Spirobranchus sp.	3.00	13.86	4.01	24.58	24.58
Flustra foliacea	2.46	8.85	2.18	15.70	40.28
Unidentified hydroid	1.92	7.65	1.96	13.58	53.86
Aequipecten opercularis	1.85	5.03	1.11	8.91	62.77
Hydrallmania falcata	1.77	4.25	0.88	7.55	70.32
Unidentified encrusting bryozoan	0.85	3.15	1.41	5.59	75.91
Nemertesia sp.	1.69	3.15	0.72	5.59	81.50
Urticina sp.	1.15	2.82	0.58	5.01	86.50
Unidentified faunal turf	1.15	2.03	0.59	3.60	90.11

EUNIS: A5.44x Circalittoral mixed sediments (no matching biotope at level 5).
MHCBI: SS.SMx.CMx
Clusters: *b*.
Video stations (and video segments): 268 (S1) and 274 (S1).
Depth range: 47m (where depth data available)
Substratum: Muddy sandy gravel (Folk trigon class msG).
Epifaunal community: *Spirobranchus* sp., *Asterias rubens*, *Flustra foliacea*, *Nemertesia* sp.

Figure 15: Example still of EUNIS biotope A5.44x.

Table 5: SIMPER results showing the nine characterising taxa for A5.44x.

Species	Av.Abund	Av.Sim	Sim/SD	Contrib%	Cum.%
Asterias rubens	3.00	10.17	n/a	15.79	15.79
Spirobranchus sp.	3.00	10.17	n/a	15.79	31.58
Aequipecten opercularis	2.00	6.78	n/a	10.53	42.11
Flustra foliacea	3.00	6.78	n/a	10.53	52.63
Henricia sp.	2.00	6.78	n/a	10.53	63.16
Nemertesia sp.	2.50	6.78	n/a	10.53	73.68
Unidentified hydroid	2.50	6.78	n/a	10.53	84.21
Pentapora facialis	1.00	3.39	n/a	5.26	89.47
Unidentified encrusting bryozoan	1.00	3.39	n/a	5.26	94.74

EUNIS: A5.44x Circalittoral mixed sediments/A4.13x Mixed faunal turf communities on circalittoral rock (no matching biotopes at level 5).
Clusters: *d*.
MHCBI: SS.SMx.CMx/CR.HCR.XFa
Video stations (and video segments): 268 (S2 and S4).
Depth range: Not available.
Substratum: A mosaic habitat of muddy pebbles, cobbles and sand on bedrock (msG/ Rock).
Epifaunal community: *Flustra foliacea* and encrusting sponges.

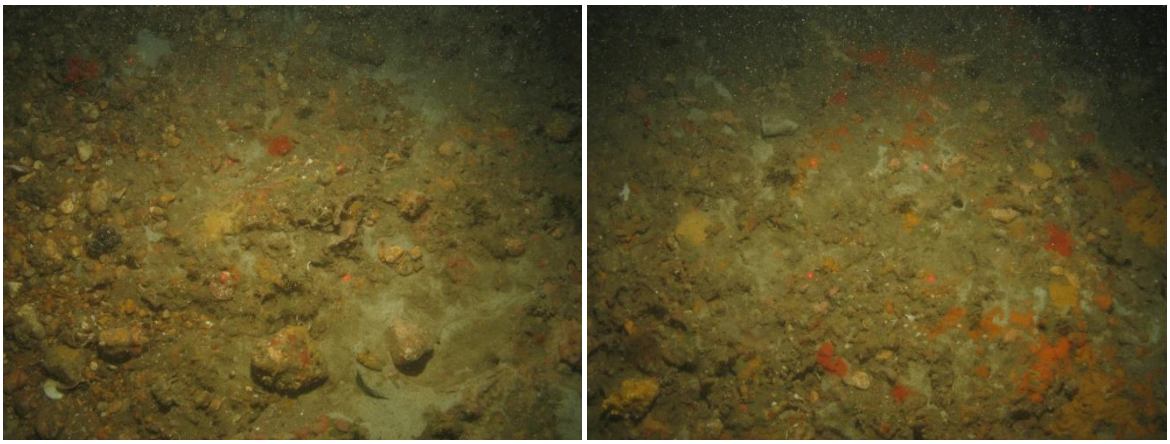


Figure 16: Example stills of EUNIS biotope A5.44x/A4.13x.

Table 6: SIMPER results showing the two characterising taxa for A4.13x/A5.44x.

Species	Av.Abund	Av.Sim	Sim/SD	Contrib%	Cum.%
Flustra foliacea	3.00	20.00	n/a	50.00	50.00
Unidentified encrusting sponge	2.00	20.00	n/a	50.00	100.00

3.2.8 Preliminary Video Analysis- February 2012 data

The video and stills data collected opportunistically in February 2012 appear to support the findings above. Due to time constraints only a preliminary interpretation of the February 2012 data was undertaken. The two westerly stations of the three provide further indication of a rock/sediment mosaic in the north-west corner of the site. Within the sediment component of the mosaic there is occasional evidence of fine material (possibly mud) in small quantities on top of the more widespread pebbles and cobbles; however, without grab data it is difficult to distinguish whether this is coarse or mixed sediments. The presence of *Flustra foliacea*, unidentified hydroids (possibly *Hydrallmania falcate*), barnacles and *Spirobranchus* sp., *Crossaster papposus* and *Pagurus* sp. suggests an epifaunal biotope similar to A5.444 *Flustra foliacea* and *Hydrallmania falcata* on tide-swept circalittoral mixed sediments.

The third station in this dataset is towards the centre of the site and comprises coarse or mixed sediments but with no evidence of rock. A fine mud-like material can be observed deposited on the top of some of the gravel, pebbles and cobbles but again it is not possible to distinguish coarse from mixed sediments without additional grab data. The epifaunal biotope is dominated by brittlestars and to a lesser extent hydroids (possibly including *Hydrallmania falcata*) and *Flustra foliacea*, which matches the A5.445/A5.444 biotope combination described above. Initial observations suggest that this station's habitat and biotope are similar to the brittlestar-dominated stations in cluster *c* of the June 2012 data.

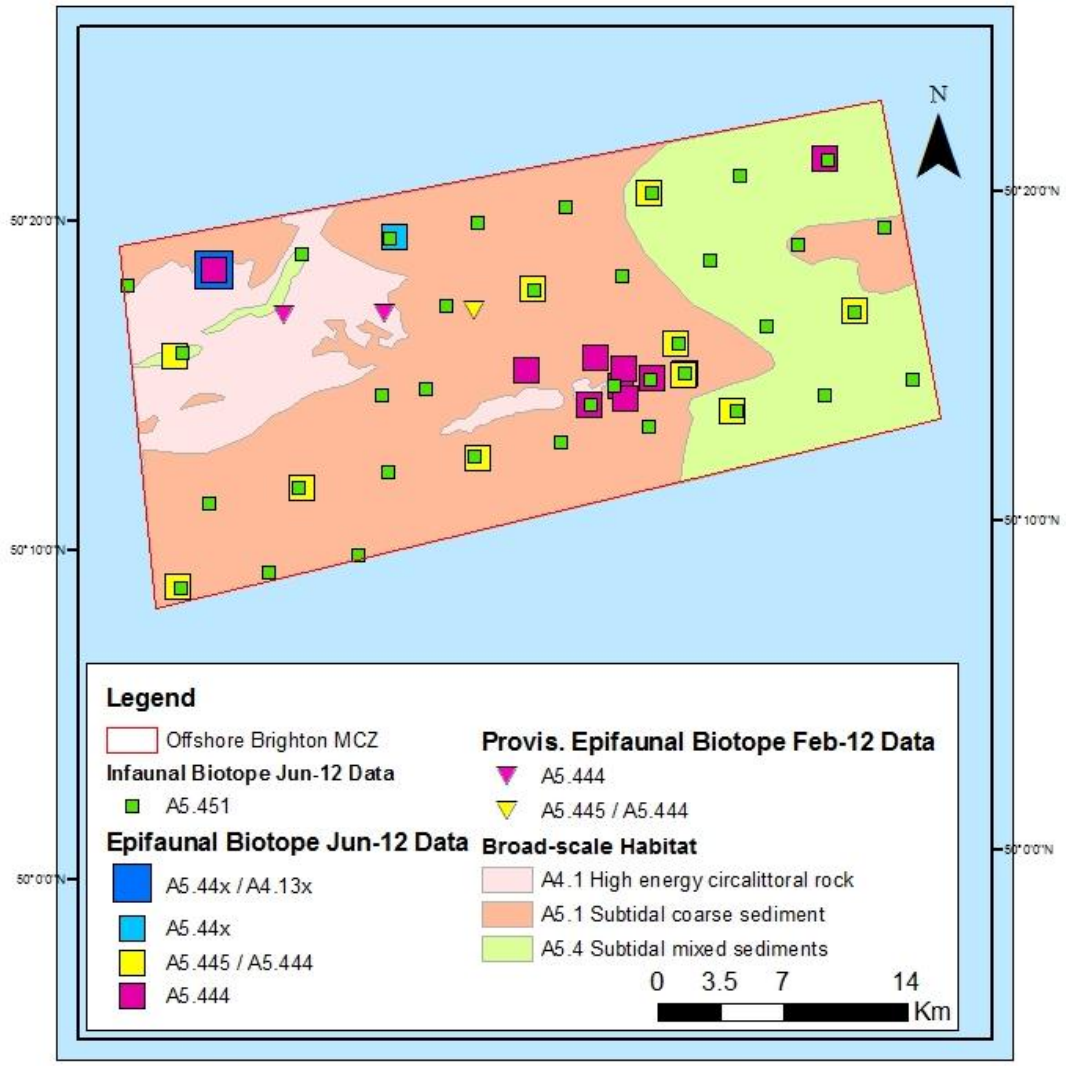
3.2.9 Discussion

Overall, evidence from the Offshore Brighton MCZ datasets suggests that all sampling stations comprise a circalittoral coarse or mixed sediments component. Circalittoral rock (including bedrock) may contribute to a rock/sediment mosaic in a small minority of locations, concentrated in the north-west of the site.

The infaunal community across the site can be matched to A5.451 Polychaete-rich deep *Venus* community in offshore mixed sediments. However, the match is not exact and the community found in Offshore Brighton MCZ appears to have fewer bivalve species than predicted for A5.451. Infaunal analyses conducted for the Eastern English Channel Marine Habitat Map (James *et al* 2007) also indicate that mixed sediments biotopes in this part of the offshore English Channel are very similar to A5.451 and suggest that this biotope could be subdivided to create two new biotopes accounting for lower occurrences of venerid bivalves.

The epifaunal community is dominated by A5.444 *Flustra foliacea* and *Hydrallmania falcata* on tide-swept circalittoral mixed sediments, followed by A5.445 *Ophiothrix fragilis* and/or *Ophiocomina nigra* brittlestar beds on sublittoral mixed sediments (Figure 17). Epifaunal analyses conducted for the eastern English Channel Marine habitat Map (James *et al* 2007) also indicated the biotope A5.445 was present.

At a minority of stations the epifaunal biotope could not be precisely determined or has yet to be statistically analysed; this includes the three stations where bedrock was apparent but, nevertheless, initial evidence does not suggest a rocky biotope is present.



Offshore Brighton MCZ data Grab samples and video data collected during the 2012 MB0120 survey. The broadscale habitat map produced by Cefas based on EUSeamap and grab sample data from the 2012 MB0120 survey.
Statistical cluster analysis performed by JNCC in 2014 using grab sample data from the 2012 MB0120 survey.
Grab sample sediment type interpreted from PSA data analysis from the 2012 MB0120 survey.

Figure 17: Offshore Brighton MCZ Map of biotopes assigned based on infaunal and epifaunal data.

3.3 Western Channel MCZ

3.3.1 Site description

Western Channel MCZ is situated approximately 54km off the south coast of England to the south-east of the Lizard Peninsula. The site is an area of continental shelf that is predominantly coarse sediments with a mixed distribution of sand across the site extent.

Western Channel MCZ was recommended by the Finding Sanctuary regional project in 2011 for the broad-scale habitats Moderate energy circalittoral rock, Subtidal coarse sediment and Subtidal mixed sediments. Since the regional MCZ project recommended this site, Subtidal sand has also been identified through the MB0120 survey undertaken in 2012 (Jones *et al* 2014).

An interpreted broad scale habitat map has been produced based on acoustic data and ground-truth samples collected during the MB0120 JNCC/Cefas survey in 2012 and acoustic data gathered in 2005 as part of the Civil Hydrography Programme (CHP). These data are presented in the Post-survey Site report version 10 (Jones *et al* 2014). The map shows a mosaic of predominantly sublittoral coarse sediment with patches of sublittoral sand which appears to be associated with wave features. The acoustic signature from survey shows the presence of sand waves throughout the site known as Barchan dunes. These crescent-shaped sand dunes are produced by the action of wind predominately from one direction.

3.3.2 Infaunal data methodology

Grab samples were taken using a 0.1m^2 Hamon grab at 63 stations in Western Channel MCZ. Particle size analysis (PSA) results and species data were available for interpretation. Standard data rationalisation was applied, see section 2.1.1 for further details.

Using PRIMER v6 the species data were square root transformed and a cluster analysis performed. The resulting clusters were displayed in a dendrogram (Figure 18). SIMPER analysis was undertaken to identify characterising species for each cluster and discriminating species between clusters. The clusters were plotted on a map (Figure 19) to look for spatial patterns and overlain with PSA information from the corresponding grab to reveal any correlation with substrate type.

Some taxa were recorded as present rather than counts, in particular colonial organisms such as sponges and hydroids. In order to include these taxa, the whole dataset was converted into presence/absence data and reanalysed in PRIMER. This is not as powerful as the analysis on numerate (count) data as a single record of a taxon in a sample will be given the same weight as a taxon with high abundance in the sample.

3.3.3 Infaunal data results

Cluster analysis of count data found ten significant clusters and four outliers (Figure 18). These clusters were not associated with changes in substrate as coarse sediment (sG or gS) was recorded at all stations. Grab samples that were taken in areas recorded as rippled sand on the video and retained less coarse material in the sieve did not appear to have significantly different infaunal communities. Clusters do not show any spatial pattern, indicating that the community across the site was patchy and heterogeneous (Figure 19).

SIMPER analysis showed that most clusters had similar characterising species which generally included nemertean worms, nematode worms, the pea urchin *Echinocyamus pusillus*, the lancelet *Branchiostoma lanceolatum* and the polychaetes *Glycera lapidum* and

Aponuphis bilineata. Clusters tended to be discriminated by shifts in the relative abundance of species suggesting that a similar community was present across the site. Some clusters were discriminated by the presence of encrusting species such as serpulid *Hydroides elegans*/*norvegica* and coral worm *Filograna implexa*, which could relate to whether a large shell or pebble was retained in the grab.

SIMPER analysis was rerun with all clusters expect D and outliers aggregated to the same group as they were considered to be variants of the same community. The top characterising taxa for this community are listed in Table 7. This community matches the biotope A5.145 *Branchiostoma lanceolatum* in circalittoral coarse sand with shell gravel, that also lists *Nematoda, Pisione remota, Glycera lapidum, Aonides paucibranchiata, Polygordius, Echinocyamus pusillus* and *Branchiostoma lanceolatum* as characterising species. The depth range and substrate type described for this biotope also matches the Western Channel MCZ data from the MB0120 survey.

The cluster analysis performed on the presence/absence data also resulted in a large number of clusters. The characterising species for all clusters were similar to those identified in the count data, with the addition of 'Porifera' (sponge) which also characterised most clusters. Some smaller clusters were characterised by some additional species such as hydroids and bryozoans which is likely to be due to the proportion of stony material retained in the grab for those stations. Overall it was considered that the results for this analysis support the conclusions made based on the count data.

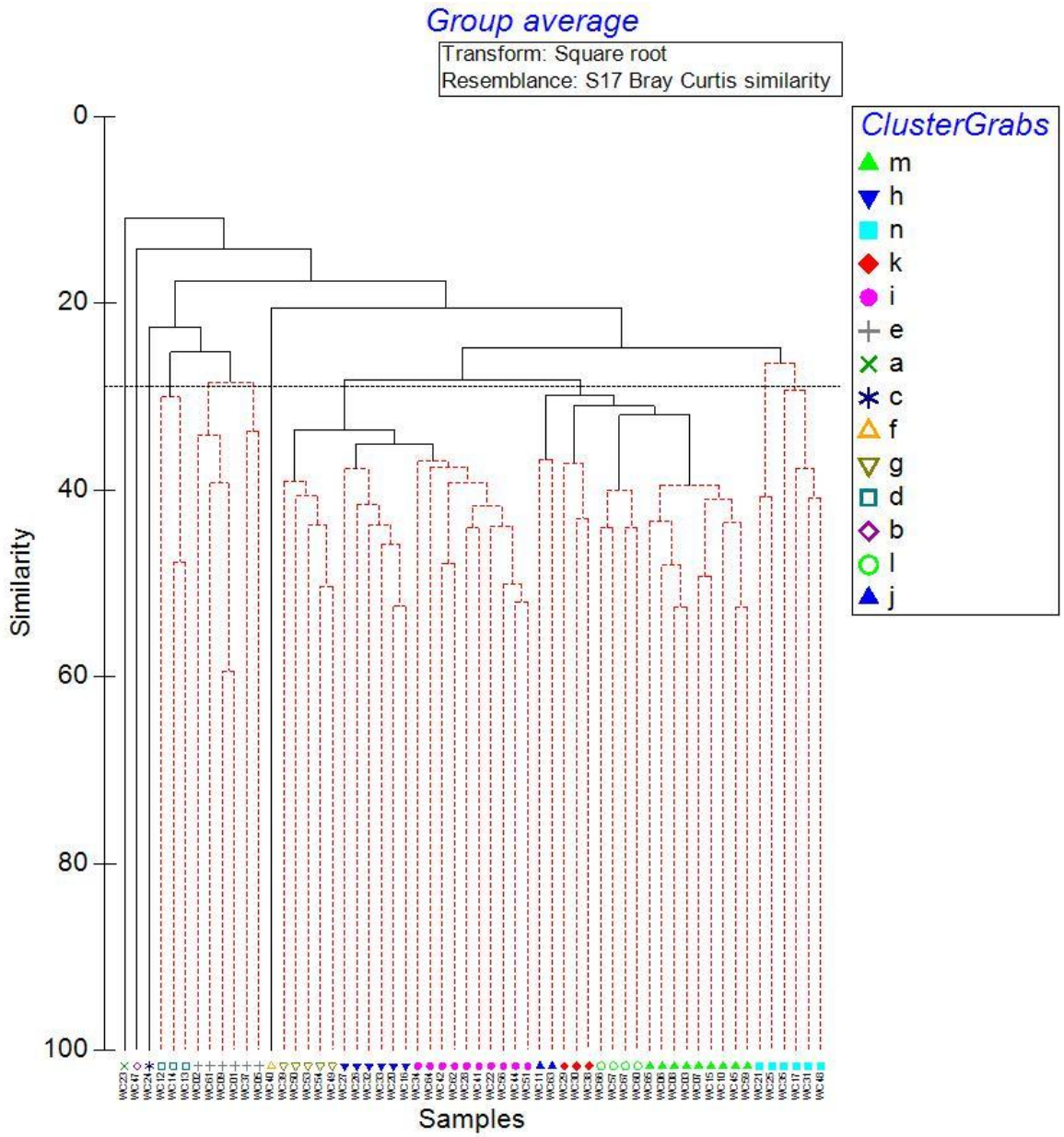
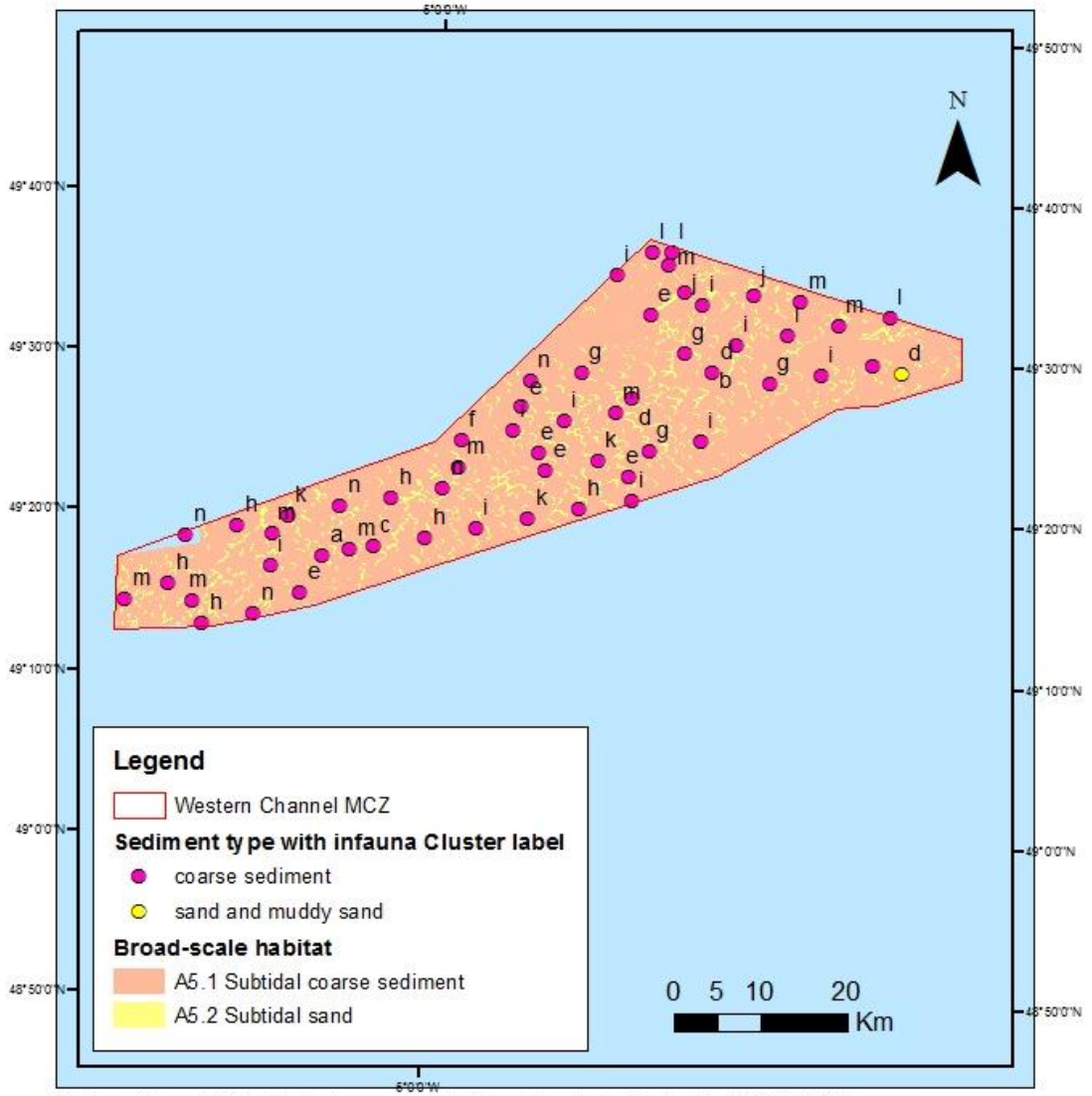


Figure 18: Western Channel MCZ Dendrogram from infaunal cluster analysis.



Western Channel MCZ data Grab samples and video data collected during the 2012 MB0120 survey. The broadscale habitat map produced by Cefas based on EUSeamap and grab sample data from the 2012 MB0120 survey. Statistical cluster analysis performed by JNCC in 2014 using grab sample data from the 2012 MB0120 survey. Grab sample sediment type interpreted from PSA data analysis from the 2012 MB0120 survey.

Figure 19: Western Channel MCZ Map of infaunal clusters with PSA results.

Table 7: Western Channel MCZ SIMPER results showing top 12 characterising species for aggregated clusters (cluster D and outliers excluded).

Species	Av.Abund	Av.Sim	Sim/SD	Contrib%	Cum.%
Echinocyamus pusillus	5.02	2.68	1.19	11.81	11.81
NEMATODA	6.92	2.16	0.75	9.52	21.33
NEMERTEA	3.24	1.58	1.24	6.99	28.33
Aponuphis bilineata	3.02	1.07	0.65	4.74	33.07
Hydroides elegans/*norvegica*	7.10	1.04	0.44	4.60	37.67
Glycera lapidum	1.90	1.04	0.89	4.60	42.27
Pisione remota	3.20	1.02	0.43	4.52	46.79
Syllis H Garwood Key	1.80	0.77	0.75	3.42	50.21
Polygordius	2.29	0.75	0.42	3.30	53.51
Harmothoe (*Malmgreniella*) *ljungmani*	1.51	0.71	0.64	3.15	56.66
Goniadella gracilis	1.65	0.69	0.59	3.03	59.69
Branchiostoma lanceolatum	1.41	0.68	0.61	3.00	62.69
Aonides paucibranchiata	1.49	0.53	0.58	2.36	65.05

3.3.4 Infaunal biotopes

EUNIS: A5.145 Branchiostoma lanceolatum in circalittoral coarse sand with shell gravel.
MHCBI: SS.SCS.CCS.Blan
Grab stations: all (outliers and cluster D likely to be same biotope although community recorded was not complete).
Depth range: 85-111m
Substratum: Gravely coarse sand with shell fragments, some stations with pebbles and cobbles. Folk gS or sG. EUNIS coarse sediment, except one station which was sand and muddy sand.
Infaunal community: Diverse community characterised by taxa including pea urchin *Echinocyamus pusillus*, polychaete, nematode and nemertean worms, and lancelet *Branchiostoma lanceolatum.*
Infaunal multivariate clusters: E – J

Figure 20: Example grab photographs of EUNIS biotope A5.145.

3.3.5 Epifaunal data methodology

Video transects were undertaken at 38 of the stations with stills taken at regular intervals. Species data were recorded for each video section as SACFOR[8] for all taxa and counts for some taxa, but not colonial organisms. As only a small proportion of the community was recorded as counts, SACFOR and count data were combined and converted into presence/absence and these results analysed in PRIMER. Pelagic species were not included in the analysis. Stills data were not analysed statistically but the raw species matrix was reviewed.

3.3.6 Epifaunal data results

Cluster analysis of presence/absence video data found 1 large cluster (f) and a smaller cluster (d) with a number of outliers (Figure 21). These clusters were spread across the site indicating a patchy community (Figure 22).

SIMPER analysis revealed that cluster f was characterised by a larger range of fauna, including fauna that attaches to hard substrate such as hydroids (e.g. *Nemertesia antennina*), sponges, cup corals (*Caryophyllia smithii*) and anemones (*Urticina* and *Metridium senile*)(see Table 8). Cluster D was characterised by only hermit crabs and decapods, and outliers also had a much smaller species list. Looking at the raw stills, it appears stations in Cluster F were associated with substrates with large shells or cobbles and boulders with attached fauna, and these were associated with other mobile taxa such as sea urchin *Echinus esculentus* and seastars. Other clusters were associated with rippled sand sediments; which lacked hard substrate and, consequently, associated fauna. Coarse sediment with sparse fauna cannot be matched to any biotope in the classification and has been assigned to A5.14 circalittoral coarse sediment.

Although substrate associated with clusters other than F appears to be rippled sand, concurrent grab samples taken indicate it actually consists gravely sand and would be classed as coarse sediment broad substrate type as well as areas with more obvious gravel and shelly material.

Where hard substrate is present, the community can be matched to A4.212 *Caryophyllia smithii*, sponges and crustose communities on wave-exposed circalittoral rock, although *Caryophyllia smithii* was not recorded at every station in Cluster F, only where larger cobbles and boulders are present. Species mentioned in the description of this biotope which were also present in the Western Channel MCZ data include *Caryophyllia smithii, Nemertesia antennina*, *Nemertesia ramosa*, *Abietinaria abietina*, *Alcyonium digitatum*, *Echinus esculentus* and *Marthasterias glacialis.*

[8] Marine Nature Conservation Review (MNCR) SACFOR abundance scale, http://jncc.defra.gov.uk/page-2684.

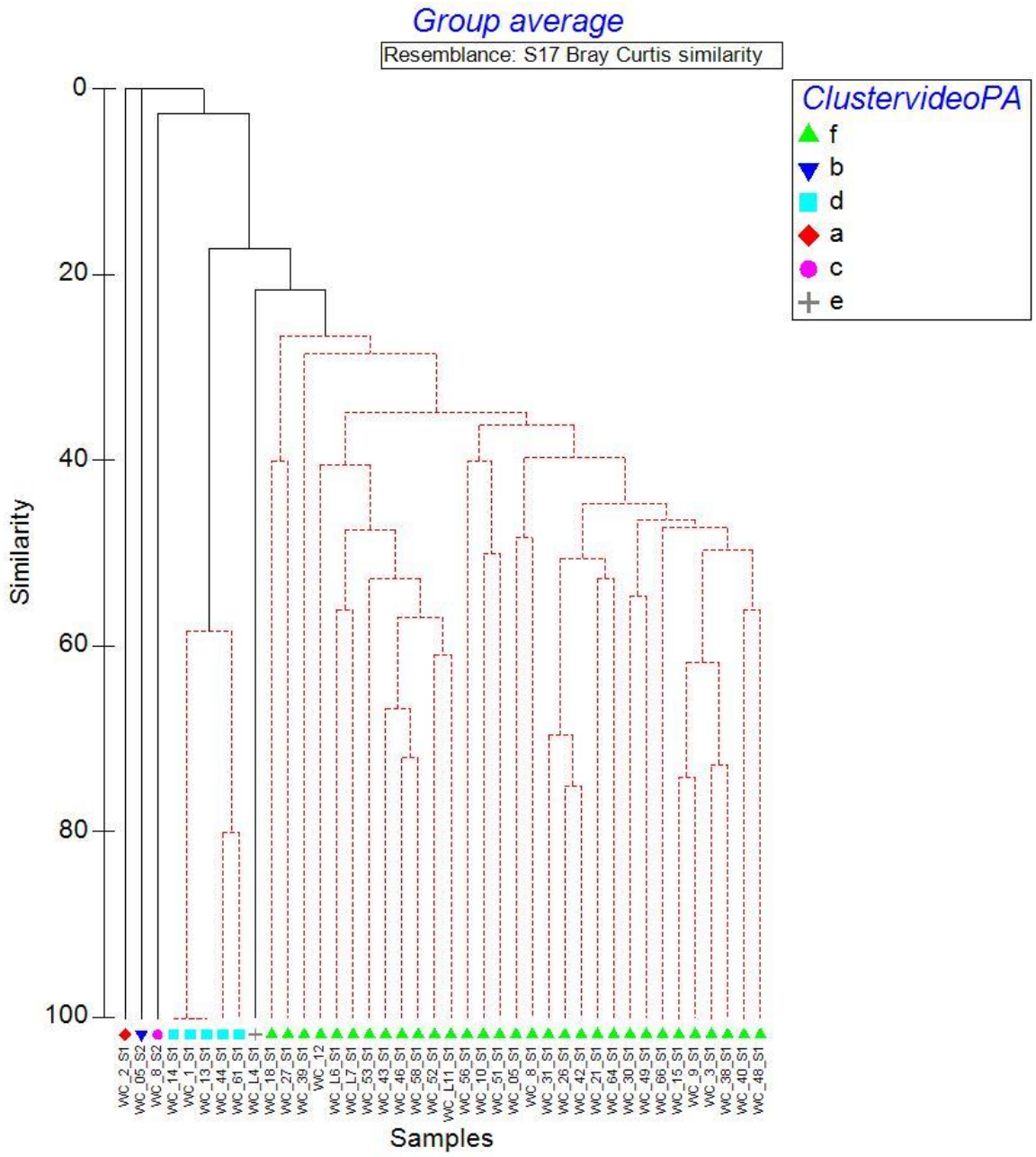
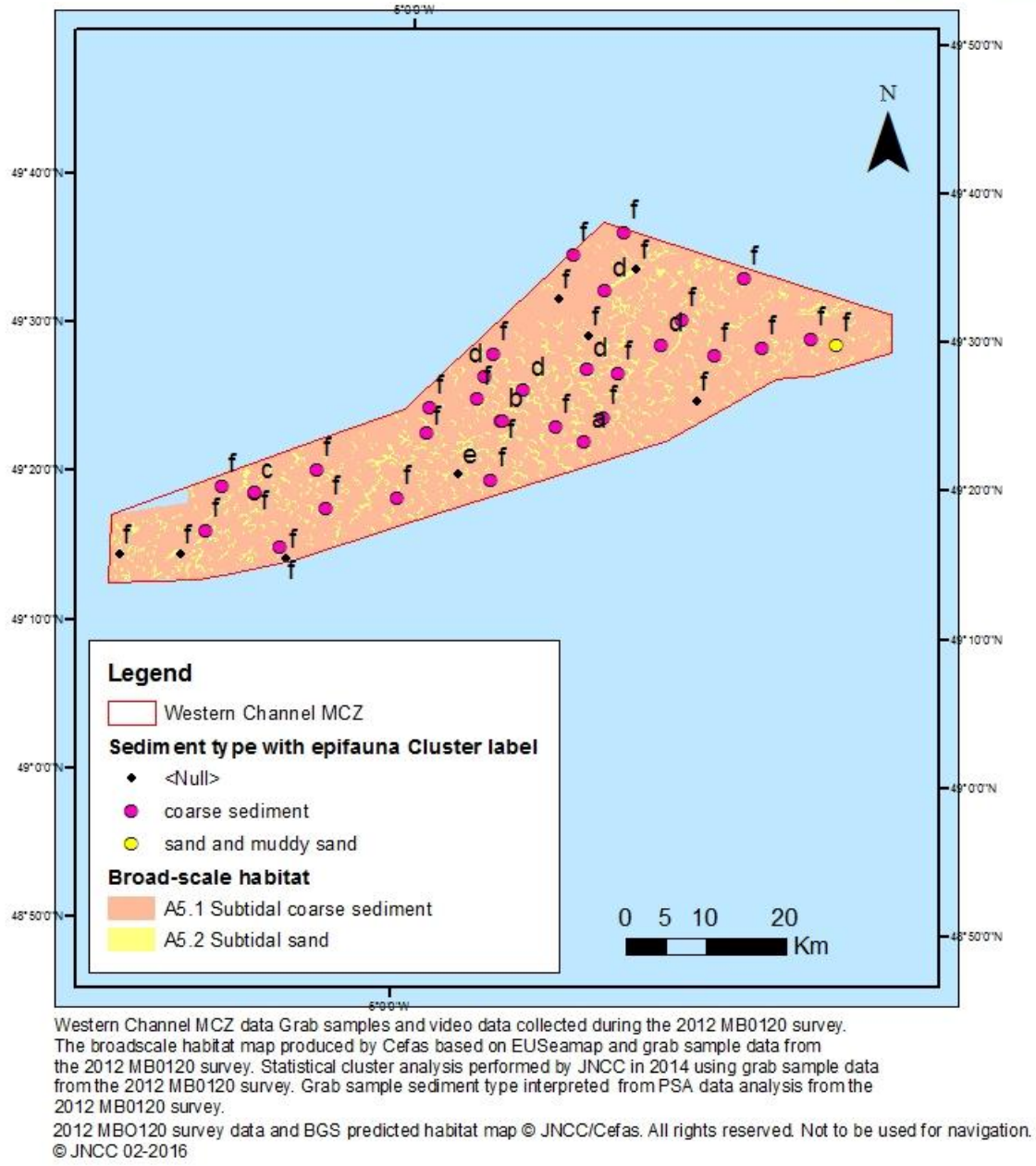


Figure 21: Western Channel MCZ Dendrogram from cluster analysis of video presence/absence data.



Western Channel MCZ data Grab samples and video data collected during the 2012 MB0120 survey. The broadscale habitat map produced by Cefas based on EUSeamap and grab sample data from the 2012 MB0120 survey. Statistical cluster analysis performed by JNCC in 2014 using grab sample data from the 2012 MB0120 survey. Grab sample sediment type interpreted from PSA data analysis from the 2012 MB0120 survey.

Figure 22: Western Channel MCZ Map of epifaunal clusters with PSA results.

Table 8: Western Channel MCZ SIMPER results showing characterising species for Cluster f.

	Av.Abund	Av.Sim	Sim/SD	Contrib%	Cum.%
Nemertesia antennina	0.9	7.49	1.76	19.82	19.82
Paguridae	0.84	6.23	1.45	16.46	36.28
Caryophyllia smithii	0.71	4.47	0.95	11.82	48.1
CONICA	0.58	2.84	0.68	7.52	55.63
BRYOZOA	0.45	1.58	0.49	4.19	59.81
PORIFERA	0.45	1.56	0.49	4.12	63.93
Urticina	0.39	1.36	0.39	3.59	67.52
Nemertesia ramosa	0.39	1.28	0.4	3.39	70.91
Echinus esculentus	0.39	1.21	0.4	3.2	74.11
Abietinaria abietina	0.39	1.18	0.4	3.13	77.24
Pecten maximus	0.39	1.15	0.4	3.04	80.28
DECAPODA	0.39	1.11	0.4	2.93	83.22
Sabellidae	0.35	1.05	0.36	2.78	85.99
Metridium senile	0.35	1.03	0.36	2.71	88.71
Ophiura	0.29	0.76	0.28	2.01	90.72

3.3.7 Epifaunal biotopes

EUNIS: A5.14 Circalittoral coarse sediment and/or A4.212 *Caryophyllia smithii*, sponges and crustose communities on wave-exposed circalittoral rock.
MHCBI: SS.SCS. CCS and/or CR.MCR.EcCr.CarSp
Video stations: 3, 5(S1), 8(S1), 9, 10, 12, 15, 18, 21, 26, 27,30, 31, 38, 39, 40, 42, 43, 44, 46, 48, 49, 51, 52, 53, 56, 58, 64, 66, L6, L7, L11.
Depth range: 87-110m
Substratum: Gravely sand with shell fragments to rippled sand with occasional cobbles and boulders. EUNIS mosaic of predominantly BSH coarse sediment with some rock. Folk gS, sG and (g)S.
Epifaunal community: Sparse community of mobile species such as hermit crabs (Paguridae), decapod crustaceans (Decapoda) and brittle stars (Ophiura) and scallop *Pecten maximus*. Rock / shell material associated with encrusting organisms including cup coral *Caryophyllia smithii*, hydroids *Nemertesia antennina*, Nemertesia ramosa, *Abietinaria abietina*, *Conica* (accepted name *Leptothecata*), sabellid worms, sponges (Porifera) and bryozoa as well as anemones *Urticina* and *Metridium senile*, sea urchin *Echinus esculentus*.
Multivariate clusters: f (plus station 44).

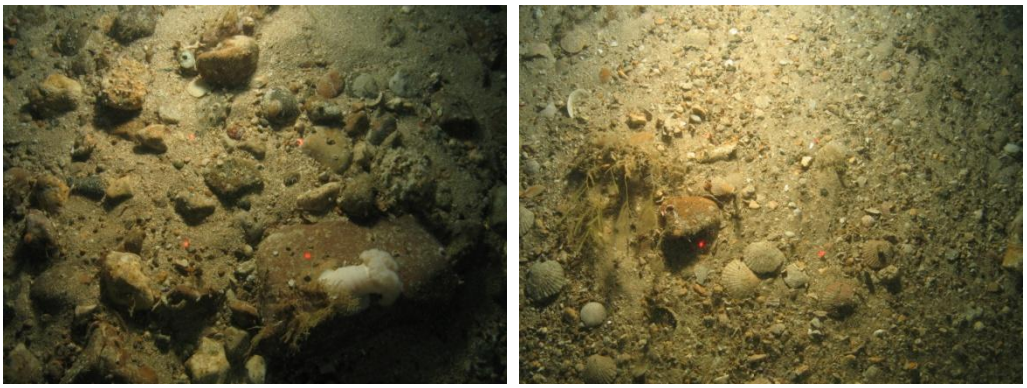


Figure 23: Example stills of EUNIS biotope A5.14/A4.212.

EUNIS: A5.14 Circalittoral coarse sediment.
MHCBI: SS.SCS.CCS
Video stations: 1, 2, 5(S2), 8(S2), 13, 14, 61, L4.
Depth range: 87-98m
Substratum: Rippled coarse sand. EUNIS coarse sediment. Folk gS and sG.
Epifaunal community: Sparse community of hermit crabs and decapods.
Multivariate clusters: a - e

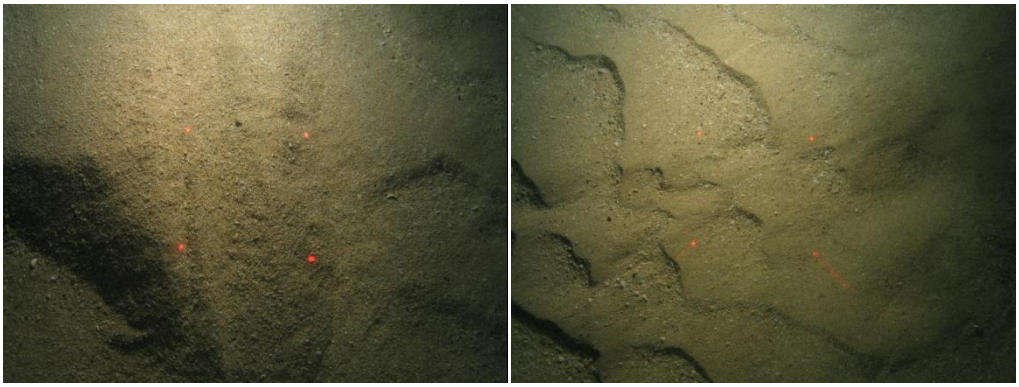


Figure 24: Example stills of EUNIS biotope A5.14.

3.3.8 Discussion

Overall, the whole Western Channel MCZ site comprises a heterogeneous circalittoral coarse sediment habitat with patchy substrate that changes from rippled coarse sand to more gravely, shelly sand. Based on infaunal data, the whole site could be assigned the biotope A5.145 *Branchiostoma lanceolatum* in circalittoral coarse sand with shell gravel (Figure 25).

Occasional pebbles, cobbles and boulders are present across the site, most commonly in patches of more gravely, shelly sediment, and these are associated with the biotope A4.212 *Caryophyllia smithii*, sponges and crustose communities on wave-exposed circalittoral rock.

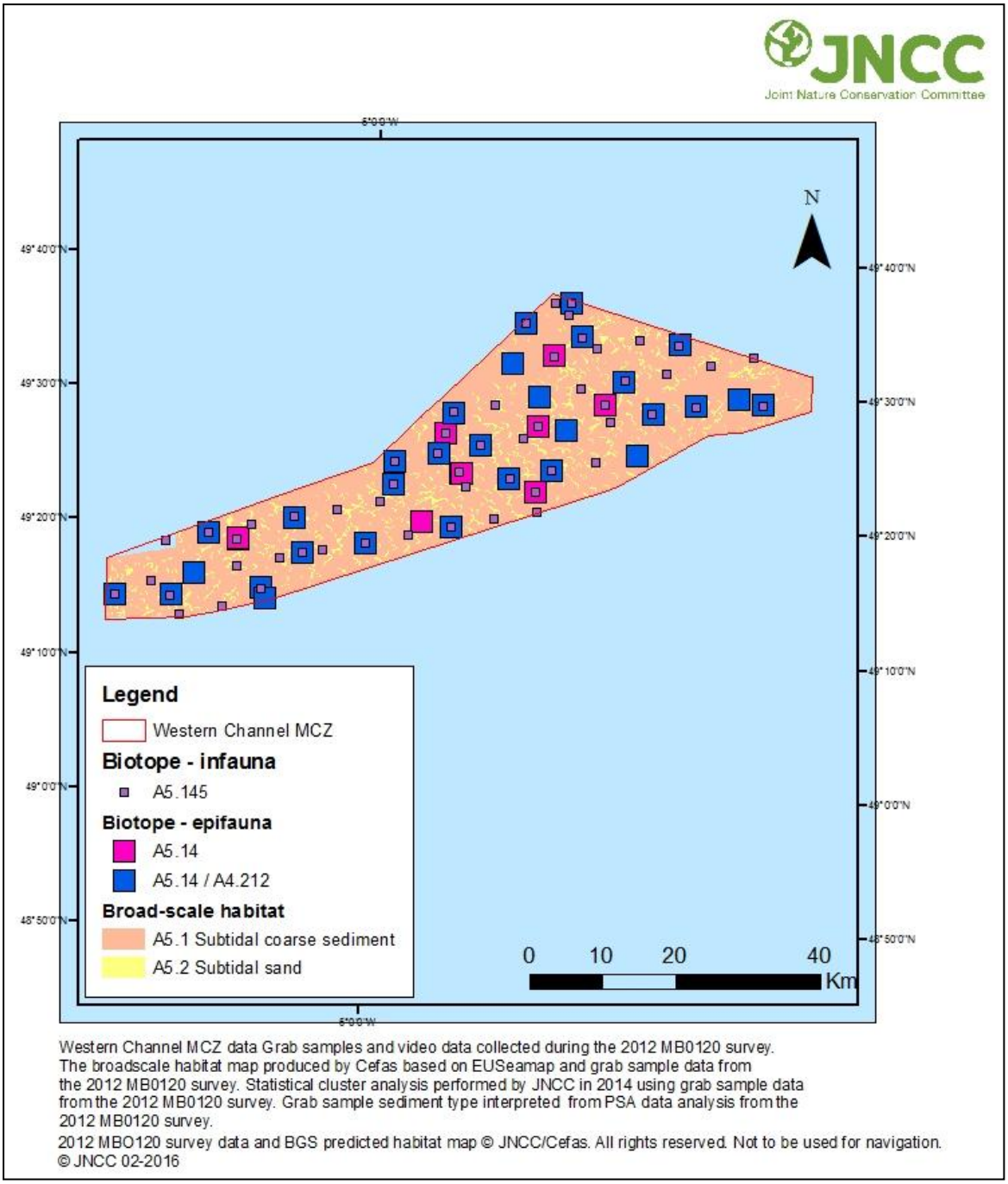


Figure 25: Western Channel MCZ Map of biotopes assigned based on infaunal and epifaunal data.

4 Limitations

There were several limitations encountered during the course of this project. Below is a summary list of the problems and potential limitations encountered during analysis:

- Potential double counting of taxa under different taxonomic levels
- Fauna recorded as counts and present/absent within the same data matrix
- Identifications made to low taxonomic levels based solely on video and still images

The main limitation was that no aggregation was attempted of any taxa which could potentially be the same species identified at different levels or life stages. All listed taxa (including broad taxonomic groups where species were indeterminable) were included in the analysis. This could result in potential double counting of taxa under different taxonomic levels.

Some of these limitations reflected the nature of the equipment employed. For example, faunal identifications can be more certain when material is collected by a grab compared to that seen in a still image or within video footage. In general, limitations were more pronounced with the video and still data sets compared to the benthic grab sample data.

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