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North-West of Jones Bank Marine Conservation Zone (MCZ) Monitoring Report 2017

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Please Note:

This work was delivered by Cefas and JNCC on behalf of the Marine Protected Areas Survey Coordination & Evidence Delivery Group (MPAG) and sponsored by Defra. MPAG was established in November 2012 and continued until March 2020. MPAG, was originally established to deliver evidence for Marine Conservation Zones (MCZs) recommended for designation. In 2016, the programme of work was refocused towards delivering the evolving requirements for Marine Protected Area (MPA) data and evidence gathering to inform the assessment of the condition of designated sites and features by SNCBs, in order to inform Secretary of State reporting to Parliament. MPAG was primarily comprised of members from Defra and its delivery bodies which have MPA evidence and monitoring budgets and/or survey capability. Members included representatives from Defra, JNCC, Natural England, Cefas, the Environment Agency, the Inshore Fisheries Conservation Authorities (IFCAs) and the Marine Management Organisation (MMO)).

Since 2010, offshore MPA surveys and associated reporting have been delivered by JNCC and Cefas through a JNCC\Cefas Partnership Agreement (which remained the vehicle for delivering the offshore survey work funded by MPAG between 2012 and 2020).

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Abbreviations

ANOSIM	Analysis of Similarity
BSH	Broadscale Habitats
Cefas	Centre for Environment, Fisheries and Aquaculture Science
CP2	Charting Progress 2
CHP	Civil Hydrography Programme
Defra	Department for Environment, Food and Rural Affairs
EA	Environment Agency
EUNIS	European Nature Information System
FOCI	Feature of Conservation Interest
GES	Good Environmental Status
GMA	General Management Approach
HD	High Definition
IFCA	Inshore Fisheries and Conservation Authority
JNCC	Joint Nature Conservation Committee
NMBAQC	North East Atlantic Marine Biological Analytical Quality Control Scheme
MBES	Multibeam echosounder
MESH	Mapping European Seabed Habitats
MCZ	Marine Conservation Zone
MMO	Marine Management Organisation
MPA	Marine Protected Area
MPAG	Marine Protected Areas Group
MSFD	Marine Strategy Framework Directive
NE	Natural England
NIS	Non-Indigenous Species
OSPAR	The Convention for the Protection of the Marine Environment of the North-East Atlantic
PSA	Particle Size Analysis
PSD	Particle Size Distribution
RV	Research Vessel
SAC	Special Area of Conservation
SACFOR	Superabundant, Abundant, Common, Frequent, Occasional, Rare
SD	Standard Deviation
SIMPROF	Similarity profile
SNCB	Statutory Nature Conservation Body
SOCI	Species of Conservation Interest

SSS	Sidescan sonar
TOC	Total Organic Carbon
TON	Total Organic Nitrogen

Glossary

Definitions signified by an asterisk (*) have been sourced from Natural England and JNCC Ecological Network Guidance (NE & JNCC 2010).

Activity	A human action which may have an effect on the marine environment; e.g. fishing, energy production (Robinson *et al*. 2008).*
Anthropogenic	Caused by humans or human activities; usually used in reference to environmental degradation.*
Assemblage	A collection of plants and/or animals characteristically associated with a particular environment that can be used as an indicator of that environment. The term has a neutral connotation and does not imply any specific relationship between the component organisms, whereas terms such as 'community' imply interactions (Allaby 2015).
Benthic	A description for animals, plants and habitats associated with the seabed. All plants and animals that live in, on or near the seabed are benthos (e.g. sponges, crabs, seagrass beds).*
Biotope	The physical habitat with its associated, distinctive biological communities. A biotope is the smallest unit of a habitat that can be delineated conveniently and is characterised by the community of plants and animals living there.*
Broadscale Habitats	Habitats which have been broadly categorised based on a shared set of ecological requirements, aligning with level 3 of the EUNIS habitat classification. Examples of Broadscale Habitats are protected across the MCZ network.
Community	A general term applied to any grouping of populations of different organisms found living together in a particular environment; essentially the biotic component of an ecosystem. The organisms interact and give the community a structure (Allaby 2015).
Conservation Objective	A statement of the nature conservation aspirations for the feature(s) of interest within a site, and an assessment of those human pressures likely to affect the feature(s).*
EC Habitats Directive	The EC Habitats Directive (Council Directive 92/43/EEC on the Conservation of natural habitats and of wild fauna and flora) requires Member States to take measures to maintain natural habitats and wild species of European importance at, or restore them to, favourable conservation status.
Epifauna	Fauna living on the seabed surface.

EUNIS	A European habitat classification system, covering all types of habitats from natural to artificial, terrestrial to freshwater and marine.*
Favourable Condition	When the ecological condition of a species or habitat is in line with the conservation objectives for that feature. The term ‘favourable’ encompasses a range of ecological conditions depending on the objectives for individual features.*
Feature	A species, habitat, geological or geomorphological entity for which an MPA is identified and managed.*
Feature Attributes	Ecological characteristics defined for each feature within site-specific Supplementary Advice on Conservation Objectives (SACO). Feature Attributes are monitored to determine whether condition is favourable.
Features of Conservation Importance (FOCI)	Habitats and species that are rare, threatened or declining in Secretary of State waters.*
General Management Approach (GMA)	The management approach required to achieve favourable condition at the site level; either maintain in, or recover to favourable condition.
Impact	The consequence of pressures (e.g. habitat degradation) where a change occurs that is different to that expected under natural conditions (Robinson *et al*. 2008).*
Infauna	Fauna living within the seabed sediment.
Joint Nature Conservation Committee (JNCC)	The statutory advisor to Government on UK and international nature conservation. Its specific remit in the marine environment ranges from 12 - 200 nautical miles offshore.
Marine Strategy Framework Directive (MSFD)	The MSFD (EC Directive 2008/56/EC) aims to achieve Good Environmental Status (GES) of EU marine waters and to protect the resource base upon which marine-related economic and social activities depend.
Marine Conservation Zone (MCZ)	MPAs designated under the Marine and Coastal Access Act (2009). MCZs protect nationally important marine wildlife, habitats, geology and geomorphology, and can be designated anywhere in English and Welsh inshore and UK offshore waters.*
Marine Protected Area (MPA)	A generic term to cover all marine areas that are ‘A clearly defined geographical space, recognised, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values’ (Dudley 2008).*
Natura 2000	The EU network of nature protection areas (classified as Special Areas of Conservation and Special Protection Areas), established under the 1992 EC Habitats Directive.*
Natural England	The statutory conservation advisor to Government, with a remit for England out to 12 nautical miles offshore.

Non-indigenous Species	A species that has been introduced directly or indirectly by human agency (deliberately or otherwise) to an area where it has not occurred in historical times and which is separate from and lies outside the area where natural range extension could be expected (Eno *et al.* 1997).*
Pressure	The mechanism through which an activity has an effect on any part of the ecosystem (e.g. physical abrasion caused by trawling). Pressures can be physical, chemical or biological, and the same pressure can be caused by a number of different activities (Robinson *et al*. 2008).*
Special Areas of Conservation	Protected sites designated under the European Habitats Directive for species and habitats of European importance, as listed in Annex I and II of the Directive.*
Supplementary Advice on Conservation Objectives (SACO)	Site-specific advice providing more detailed information on the ecological characteristics or ‘attributes’ of the site’s designated feature(s). This advice is issued by Natural England and/or JNCC.

Executive Summary

Under the UK Marine and Coastal Access Act (2009), Defra is required to provide a report to Parliament every six years that includes an assessment of the degree to which the conservation objectives set for Marine Conservation Zones (MCZs) are being achieved. In order to fulfil its obligations, Defra has directed the Statutory Nature Conservation Bodies (SNCBs) to carry out a programme of Marine Protected Area (MPA) monitoring. Where possible, this monitoring will also inform assessment of the status of the wider UK marine environment; for example, assessment of whether Good Environmental Status (GES) has been achieved, as required under Article 11 of the Marine Strategy Framework Directive (MSFD).

The Joint Nature Conservation Committee (JNCC) are responsible for nature conservation within the North-West of Jones Bank MCZ. JNCC utilise evidence gathered by targeted environmental and ecological surveys and site-specific MPA reports in conjunction with other available evidence (e.g. activities, pressures, historical data, survey data collected from other organisations or data collected to meet different obligations). These data are collectively used to make assessments of the condition of designated features within sites, to inform and maintain up to date site-specific conservation advice and produce advice on operations and management measures for anthropogenic activities occurring at the site. This report, as a stand-alone document, therefore, **does not** aim to assess the condition of the designated features or provide advice on management of anthropogenic activities occurring at the site.

This monitoring report is informed by data acquired during a dedicated survey carried out at North-West of Jones Bank MCZ (CEND0917 during 2017) and will form part of the ongoing time series data and evidence for this MCZ.

North-West of Jones Bank MCZ is an offshore site located 168km south-west of England within the ‘Western Channel and Celtic Sea’ Charting Progress 2 (CP2) sea area. A number of habitat Features of Conservation Importance (FOCI) are designated for protection within North-West of Jones Bank MCZ. This report provides an initial data point in a monitoring time series for the ‘Subtidal mud’ Broadscale Habitat (BSH) and ‘Sea-pen and Burrowing Megafauna Communities’ habitat FOCI features designated within the MCZ.

The data acquired during the survey enabled the formation of a baseline monitoring assessment for the ‘Subtidal mud’ Broadscale Habitat and associated ‘Sea-pen and Burrowing Megafauna Communities’ habitat FOCI. Sampling enabled the distribution of both the ‘Subtidal mud’ Broadscale Habitat (BSH) and ‘Sea-pen and Burrowing Megafauna Communities’ habitat FOCI to be illustrated. The sample classified as ‘Subtidal mud’ BSH exceeded the mud content threshold of 20% with a minimum of 24% mud content observed.

Faunal analysis identified three infaunal assemblages and five epifaunal assemblages at the site. The assemblages showed similarity in contributing taxa though statistical differences were observed, resulting from the varying prevalence of key and influential fauna. No association was found between faunal assemblages and the supporting processes for which data were available.

A series of recommendations are made to improve future monitoring of the designated features within North-West of Jones Bank MCZ.

1 Introduction

North-West of Jones Bank Marine Conservation Zone (MCZ) is part of a network of sites designed to meet conservation objectives under the Marine and Coastal Access Act (2009). These sites are intended to contribute to an ecologically coherent network of Marine Protected Areas (MPAs) across the North-East Atlantic, as agreed under the OSPAR Convention and other international commitments to which the UK is a signatory.

Under the Marine and Coastal Access Act (2009), Defra is required to provide a report to Parliament every six years that includes an assessment of the degree to which the conservation objectives set for MCZs are being achieved. In order to fulfil its obligations, Defra has directed the SNCBs to carry out a programme of MPA monitoring. The SNCB responsible for nature conservation offshore (between 12nm and 200nm from the coast) is the JNCC.

This monitoring report explores data acquired from the first dedicated monitoring survey of the 'Subtidal mud' Broadscale Habitat (BSH) and 'Sea-pen and Burrowing Megafauna Communities' Habitat FOCI of North-West of Jones Bank MCZ. It will form the initial point in a monitoring time series against which feature condition can be assessed in the future. The specific aims of the report are discussed in more detail in Section 1.3.

1.1 Site overview

North-West of Jones Bank MCZ is an MPA situated offshore of south-west England (Figure 1. and Table 1). North-West of Jones Bank MCZ was recommended by the 'Finding Sanctuary' regional stakeholder group project. It is located within the jurisdictional area of the Marine Management Organisation (MMO) and falls within the wider 'Charting Progress 2'[1] (CP2) area 'Western Channel and Celtic Sea'. The site is neighboured by Greater Haig Fras MCZ and Haig Fras Special Area of Conservation (SAC) with South-West Deeps (West) MCZ 64km away. East of Haig Fras and the Isles of Scilly MCZs are more than 100km from North-West of Jones Bank MCZ (Figure 1.).

The MCZ is located 168km from the coast, with water depths ranging from 86 to 138m below sea level (chart datum). The designated features of the site are 'Subtidal coarse sediment', 'Subtidal sand', 'Subtidal mud' and 'Subtidal mixed sediments' BSHs as well as the 'Sea-pen and Burrowing Megafauna Communities' habitat FOCI[2].

[1] http://webarchive.nationalarchives.gov.uk/20141203170558tf_/http://chartingprogress.defra.gov.uk/ [accessed 02/12/19]
[2] http://www.legislation.gov.uk/ukmo/2016/14/pdfs/ukmo_20160014_en.pdf [accessed 02/12/19]

Table 1. North-West of Jones Bank MCZ site overview.

Charting Progress 2 Region	Western Channel and Celtic Sea
Spatial Area (km²)	397.97
Water Depth Range (m)	86 - 138
Broadscale Habitat (BSH) Features Present	**Designated**
A5.1 Subtidal coarse sediment	✓
A5.2 Subtidal sand	✓
A5.3 Subtidal mud	✓
A5.4 Subtidal mixed sediments	✓
Habitat FOCI Present	
Sea-pen and Burrowing Megafauna Communities	✓

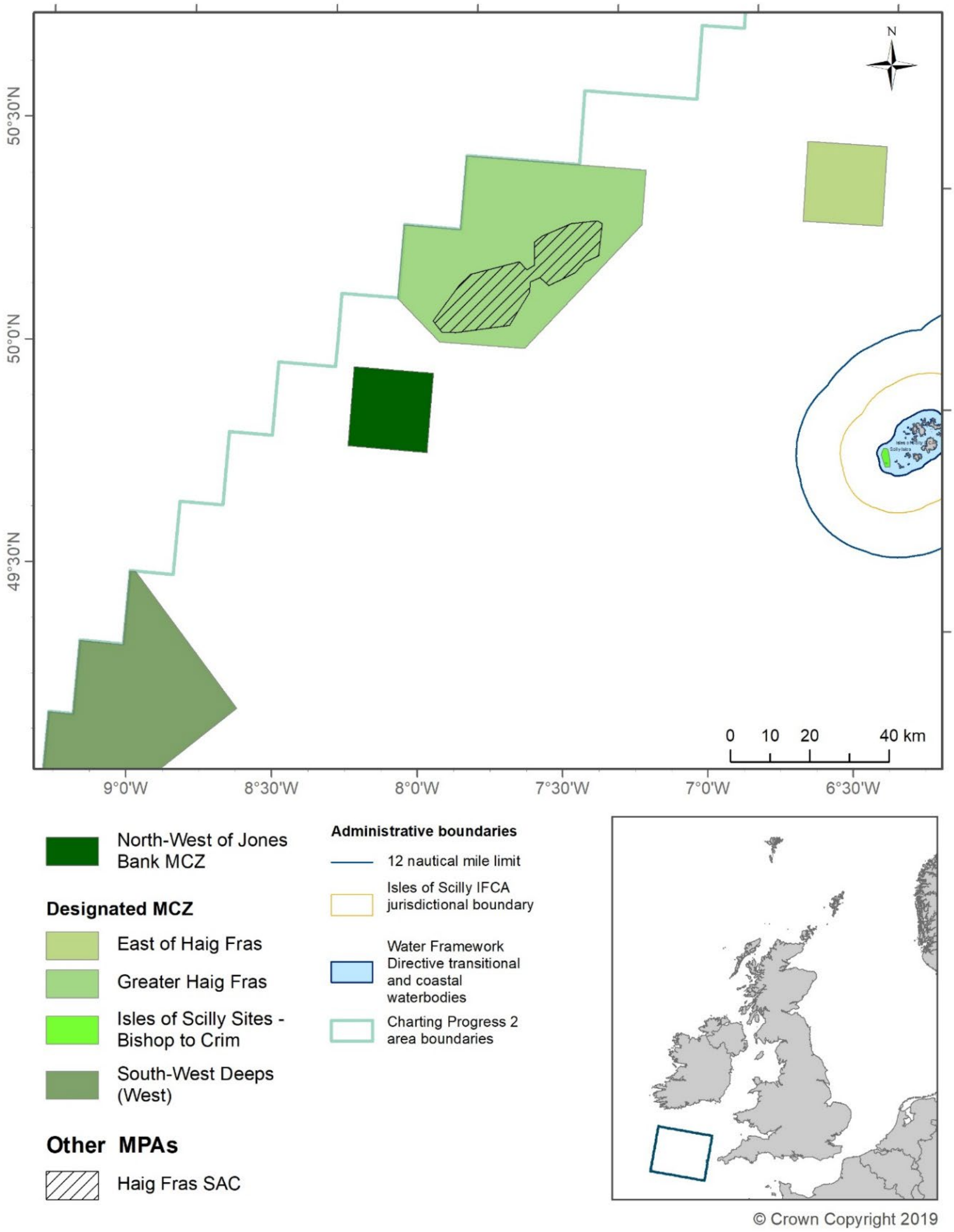

Figure 1. Location of the North-West of Jones Bank MCZ in the context of MPAs and management jurisdictions proximal to the site.

1.2 Existing data and habitat maps

Two surveys were carried out at North-West Jones Bank MCZ in 2012 (Coggan 2012; Gardlin 2012). Approximately 75% of the MCZ was covered by the multibeam echosounder (MBES) data from the first survey with a small contribution of MBES data from the second survey. Groundtruthing data were collected on both surveys using 0.1m^2 Day and Hamon grabs and underwater video. A BSH map was created by Jones *et al*. (2015) using data from both surveys with interpolation in areas with no underlying MBES data (Figure 2). The predicted extent of the 'Subtidal mud' BSH was used to plan the monitoring survey sample acquisition, the results of which are used to inform this report.

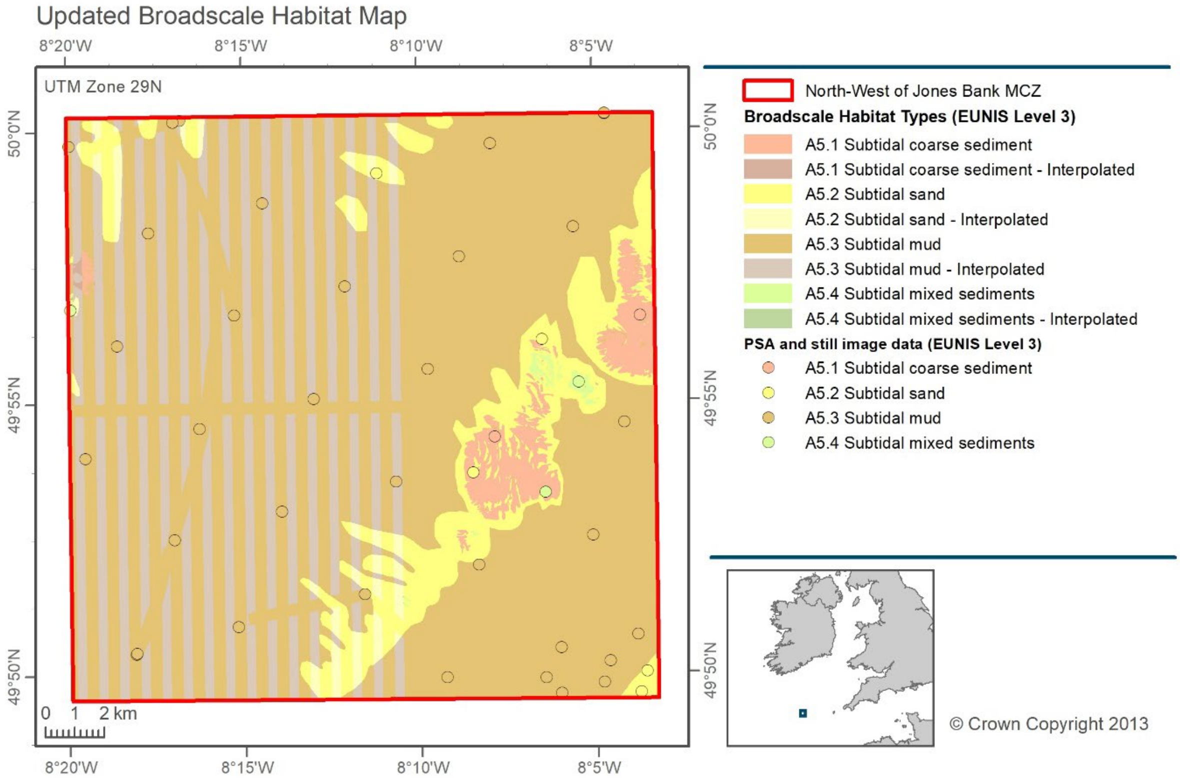

Figure 2. Map of the North-West Jones Bank MCZ showing the predicted extent of Broadscale Habitats (EUNIS Level 3) and the locations and habitat classifications (EUNIS Level 3) assigned to physical samples collected from the site in 2012 (Jones *et al.* 2015). Interpolated areas are those not covered by acoustic data.

1.3 Aims and objectives

1.3.1 High-level conservation objectives

High-level site-specific conservation objectives serve as benchmarks against which to monitor and assess the efficacy of management measures in maintaining a designated feature in, or restoring it to, 'favourable condition'.

As detailed in North-West of Jones Bank MCZ designation order[3], the conservation objectives for the site are that the designated features (JNCC 2018a):

- so far as already in favourable condition, remain in such condition; and

[3] http://www.legislation.gov.uk/ukmo/2016/14/pdfs/ukmo_20160014_en.pdf [accessed 02/12/19]

- so far as not already in favourable condition, be brought into such condition, and remain in such condition.

Supplementary Advice on Conservation Objectives have been produced for this site, but conservation objectives have not been set for the individual feature attributes for this site (JNCC 2018b).

JNCC (2018a) state that the condition of the protected features at the site is that the protected features are in unfavourable condition, and the General Management Approach (GMA) is to recover the protected features to favourable condition.

1.3.2 Definition of favourable condition

With respect to ‘Subtidal coarse sediment’, ‘Subtidal sand’, ‘Subtidal mud’, ‘Subtidal mixed sediments’ BSHs and ’Sea-pen and Burrowing Megafauna Communities’ habitat FOCI at the site, favourable condition means that (JNCC 2018a):

- extent is stable or increasing; and
- structures and functions, quality, and the composition of characteristic biological communities (which includes a reference to the diversity and abundance of species forming part of or inhabiting each habitat) are such as to ensure that they remain in a condition which is healthy and not deteriorating.

Any temporary deterioration in condition is to be disregarded if the habitats are sufficiently healthy and resilient to enable its recovery. Any alteration to the features brought about entirely by natural processes is to be disregarded (JNCC 2018a).

The extent of a habitat feature refers to the total area at the site occupied by the qualifying feature and must also include consideration of its distribution. A reduction in feature extent has the potential to alter the physical and biological functioning of sediment habitat types (Elliott *et al.* 1998). The distribution of a feature influences the component communities present and can contribute to the condition and resilience of the feature (JNCC 2004).

Structure encompasses the physical components of a feature type and the key and influential species, i.e. those that have a core role in determining the structure and function of subtidal sedimentary environments, that are present. Physical structure refers to topography, sediment composition and distribution. Physical structure can have a significant influence on the hydrodynamic regime operating at varying spatial scales in the marine environment, as well as influencing the presence and distribution of associated biological communities (Elliott *et al*. 1998). The function of seabed features includes processes such as: sediment reworking (e.g. through bioturbation) and habitat modification, primary and secondary production and recruitment dynamics. Seabed features rely on a range of supporting processes (e.g. hydrodynamic regime, water quality and sediment quality) which act to support their functioning as well as their resilience (e.g. the ability to recover following impact).

1.3.3 Report aims and objectives

The primary aim of this monitoring report is to describe the attributes of the ‘Subtidal mud’ BSH and ‘Sea-pen and Burrowing Megafauna Communities’ habitat FOCI features within North-West of Jones Bank MCZ to form the first point in a Sentinel monitoring (Type 1) (Kröger & Johnston 2014) time series. The ‘Subtidal mud’ feature occupies the majority of the site and was selected as highest priority for monitoring effort. The distribution of ‘Subtidal coarse sediment’, ‘Subtidal mixed sediments’ and ‘Subtidal sand’ were limited and patchy within the site, and the majority of these features were included in fisheries closures proposed at the time the survey was planned (which therefore would not be at risk of damage from demersal trawling). These features were not considered a priority for this survey, as it was considered that there would be limited power to detect change in these BSHs over time. The 'Sea-pen and Burrowing Megafauna Communities' habitat FOCI occurs within the 'Subtidal mud' BSH. The results presented will be used to develop recommendations for future monitoring and inform future condition assessments of the designated features.

The broad objectives of this monitoring report are provided below:

1) Provide a description of the extent[4] and distribution of the 'Subtidal mud' BSH and 'Sea-pen and Burrowing Megafauna Communities' habitat FOCI at the site (see Table 2 for more detail), to enable subsequent condition monitoring and assessment.
2) Provide a description of the structural attributes of the 'A5.3 Subtidal mud' BSH and the 'Sea-pen and Burrowing Megafauna Communities' habitat FOCI at the site (see Table 2 for more detail), to enable subsequent condition monitoring and assessment.
3) Present any available evidence on the supporting processes of the designated features of the site.
4) Note observations of any habitat or species FOCI not covered by the designation order as features of the site.
5) Present evidence relating to non-indigenous species (Descriptor 2) and marine litter (Descriptor 10), to satisfy requirements of the MSFD.
6) Record any anthropogenic activities or pressures encountered during the dedicated monitoring survey.
7) Provide practical recommendations for appropriate future monitoring approaches for the designated features (e.g. metric selection, survey design, data collection approaches) with a discussion of their requirements.

Table 2. Feature attributes for 'Subtidal mud' and 'Sea-pen and Burrowing Megafauna Communities' covered by this report.

Features	Feature attributes	Outputs
Subtidal mud	Extent[5] and distribution	BSH and FOCI point locations.
	Sediment composition and distribution	PSA derived from sediment samples.
Sea-pen and Burrowing Megafauna Communities	Presence and spatial distribution of biological assemblages Key and influential species Characteristic assemblages	Identify patterns in biological assemblages. Identify any key and influential species. Describe variance in biological assemblage structure within and between the observed BSH and FOCI.

This report does not aim to assess the condition of the designated features. SNCBs use evidence from MCZ monitoring reports in conjunction with other available evidence (e.g. activities, pressures, sensitivities, historical data, survey data collected from other organisations or collected to address different drivers) to make assessments on the condition of designated features within an MCZ. Fishing effort was considered during survey

[4] Note that where current habitat maps are not available, extent will be described within the limits of available data.
[5] Note that is not possible to delineate the extent of 'Subtidal mud' using the point data acquired during the 2017 survey.

planning by JNCC and determined to be too low to enable interrogation through Operational (Type 2) or Investigative (Type 3) monitoring.

2 Methods

2.1 Survey design

In May 2017 a dedicated monitoring survey was conducted at the North-West of Jones Bank MCZ from RV *Cefas Endeavour*.

The design for the survey was informed by a power analysis. Based upon an agreed metric 'taxonomic richness' (*S*) (in the absence of a monitoring metric defined to describe an indicator within the MSFD descriptor framework) to represent community diversity derived from grab data acquired during 2012; the recommended number of grab samples to be collected from the 'Subtidal mud' BSH at North-West of Jones Bank MCZ to detect a 20% change in taxonomic richness was 71 (power = 0.8, p = 0.05). A regular triangular grid was used to position the sampling stations whilst ensuring that all stations were positioned more than 100m from site and BSH boundaries (Eggett *et. al*. 2018).

At each of the 71 stations, two 0.1m^2 Day grab deployments would be carried out to enable assessment of 1) physical sedimentary properties and infaunal analyses and 2) the measurement of total organic carbon (TOC) and total organic nitrogen (TON). Imagery data were acquired using a camera sledge along 200m transect tows from the same stations as the grab samples (Figure 3.; Table 3).

Table 3. Number of samples collected in each Broadscale Habitat (BSH).

Broadscale Habitat	Grab – PSA & Infauna	Grab – PSA, TOC & TON	Video	Still images
Subtidal mud	71	71	71	2000

The sample size of the imagery data previously acquired from the site was not sufficient to conduct a power analysis. As a substitute, epifaunal taxonomic richness (S) was derived from data acquired at an alternative, well-studied site with large areas of 'Subtidal mud'; the Fladen Grounds (including Central Fladen Nature Conservation Marine Protected Area) in the Northern North Sea. The analysis determined that 55 video tows would allow detection of a 20% change in species taxonomic richness (power = 0.8, p = 0.05) in 'Subtidal mud' across the Fladen Grounds. Due to the presence of patchy 'Subtidal coarse sediment', 'Subtidal sand' and 'Subtidal mixed sediments' BSHs across North-West of Jones Bank MCZ, additional video tows were included as a precautionary measure to increase the probability of acquiring sufficient 'Subtidal mud' samples to detect any future changes with sufficient power.

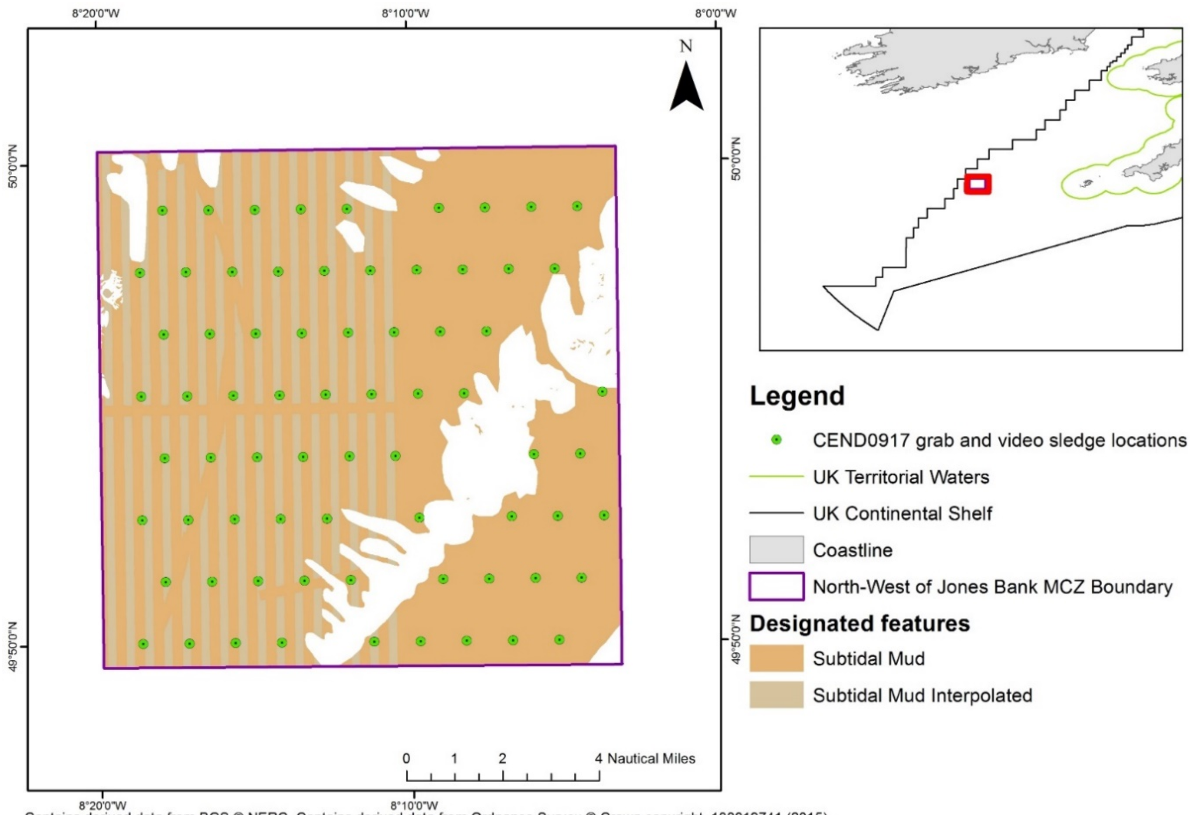

Figure 3. Location of ground truth stations targeted at North-West of Jones Bank MCZ in 2017.

2.2 Data acquisition and processing

2.2.1 Grab sampling

Sediment samples were acquired following two successful deployments at 71 stations. The maximum penetration of the Day grab into the sediment was recorded, to the nearest 0.5cm and the sediment surface visually inspected, to assess the validity of each deployment. This verified that the sample had not been compromised by wash out, under-sampling or excessive penetration. A 3cm diameter core was used to take a 5cm deep sub-sample of sediment from each grab sample. These were stored at -20°C prior to carrying out Particle Size Analysis (PSA) and benthic infauna analysis from the first successful sample and PSA, TOC and TON from the second successful sample.

The sediment for infaunal analyses was sieved over a 1mm mesh, photographed, then fixed in buffered 4% formaldehyde at sea.

The TOC and TON environmental components were analysed to investigate potential association with any variability in the infaunal assemblages of the ‘Subtidal mud’ BSH throughout the site. Long-term monitoring of these environmental components may assist with determining drivers of any future assemblage change.

2.2.2 Seabed imagery

Imagery data were also acquired from the 71 stations using a STR SeaSpyder ‘Telemetry’ camera system mounted on a towed sledge, following MESH recommended operating guidelines (Coggan *et al.* 2007). Video and still images were processed in accordance with North East Atlantic Marine Biological Analytical Quality Control Scheme (NMBAQC) epibiota interpretation guidelines (Turner *et al.* 2016). The substrata composition and epifauna present were recorded for each substratum observed in the imagery data over 5m assessment segments. However, if no change in BSH was observed these multiple segments would represent a single record in the final analysis. Changes in BSH covering less than 5m were considered incidental patches and recorded as part of the overall BSH description for that segment. Where appropriate, substrata and associated epifaunal observations were assigned to EUNIS classification codes following Parry *et al*. (2015). Identifiable taxa within observed BSHs were recorded according to their abundance (solitary taxa) or percentage cover (colonial taxa) and a semi-quantitative Superabundant, Abundant, Common, Frequent, Occasional, Rare (SACFOR) abundance score[6] was applied. Counts of sea-pens and burrows, including those made by the Norway Lobster *Nephrops norvegicus*, were also recorded to determine the presence of habitat that would meet the qualification criteria for the sea-pen and burrowing fauna FOCI to facilitate determining habitat FOCI qualification. Still images were filtered by image quality with only results from those categorised as 'Good' used for onward analysis (see Turner *et. al*. 2016). Scaling lasers were not visible in still images from station NWJB043 although sea-pens and burrow counts were able to be carried out. The field of view was assumed to be 1.182m^2 which was the mode value for field of view (Figure 4). All video data results were of suitable quality for use.

[6] http://jncc.defra.gov.uk/page-2684 [accessed 02/12/19]

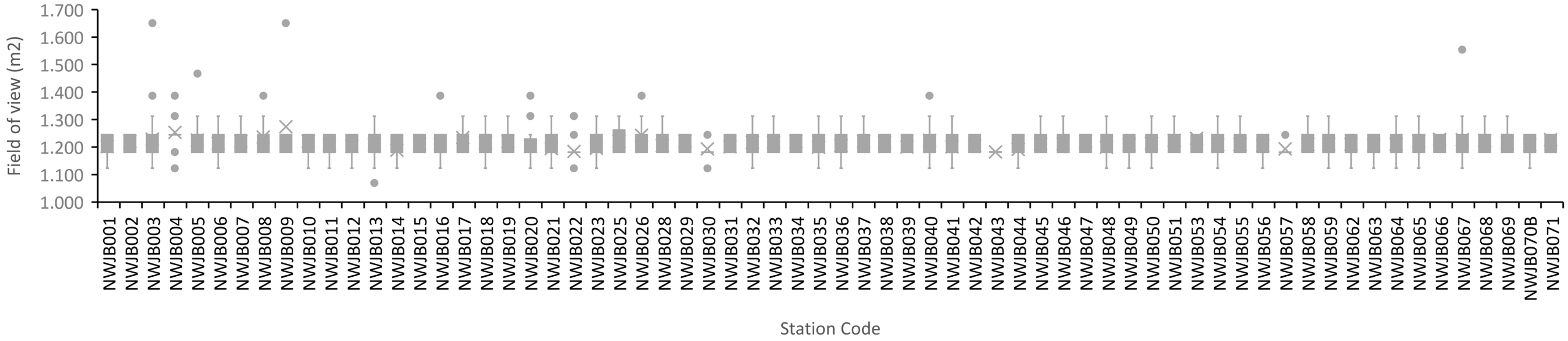

Figure 4. Field of view from still images at each sampling station within North-West of Jones Bank MCZ in 2017, collected using the STR SeaSpyder HD camera deployed on a camera sledge. 95% CI whiskers added to boxplots.

2.3 Data preparation and analysis

Statistical analyses were carried out using the multivariate statistical programme PRIMER v7 and the statistical programming language R.

2.3.1 Sediment particle size distribution (PSD)

Sediment samples were processed by Cefas following the recommended methodology of the NMBAQC scheme (Mason 2011). The less than 1mm sediment fraction was analysed using laser diffraction and the greater than 1mm fraction was dried, sieved and weighed at 0.5 ϕ (phi) intervals. These two sets of sediment distribution data were then merged and used to classify samples into sediment Broadscale Habitats. Sediment PSD data (half ϕ classes) were grouped into the percentage contribution of gravel, sand and mud based on the classification proposed by Folk (1954). In addition, each sample was assigned to one of four sediment BSH using a modified version of the classification model produced during the Mapping European Seabed Habitats (MESH) project (Long 2006).

2.3.2 Infaunal data preparation

Infaunal samples were processed to extract and identify all infauna present in each sample, and subsequently audited to ensure accurate extraction and consistent identification. Infauna were identified to the lowest taxonomic level possible, enumerated and weighed (blotted wet weight) to the nearest 0.0001g following the recommendations of the NMBAQC invertebrate scheme component (Worsfold *et al.* 2010; Worsfold & Hall 2017). The benthic infaunal data set was checked to ensure consistent nomenclature and identification policies against the World Register of Marine Species (WoRMS; http://www.marinespecies.org/). Discrepancies were resolved using expert judgement following the truncation steps presented in Annex 1.

2.3.3 Epifaunal data preparation

Results of imagery data processing were checked for consistency in identification and nomenclature against the WoRMS register A subset of videos and still images were reviewed to aid decision making during the truncation process (Annex 1).

2.3.4 Numerical and statistical analyses

Highly variable taxon counts were down weighted in the infaunal and epifaunal abundance matrices using a dispersion weighting factor of one and a Bray-Curtis similarity matrix was produced from the square root-transformed data (Clarke & Warwick 1994; Clarke *et al.* 2006).

Infaunal and epifaunal assemblages were assigned based on the non-hierarchical '*k*-R Clustering' method, whereby the optimum number of groups within the data set was determined using the ANOSIM *R* statistic to provide a value for *k*-group division and the SIMPROF algorithm to test whether a suitable number of groups had been reached (Min:2-Max:10) (Clarke *et al.* 2016). The choice of non-hierarchical clustering enables samples to be reallocated at latter points in the analysis without becoming isolated as similarity measures are developed during algorithm computation.

To avoid assumptions that the default group codes generated during *k*-R clustering are causally linked, infauna groups were given the prefix 'i' and epifauna groups the prefix 'e' (e.g. i*A*). Non-metric multidimensional scaling ordination (MDS) was carried out for both the infaunal and epifaunal data and symbols scaled by *S* to illustrate differences in *S* both within and between each *k*-R cluster group. Differences in metrics been infaunal *k*-R cluster groups were tested using non-parametric one-way analysis of variance on ranks (Kruskal-Wallis) which returns a test statistic “H” and a probability value *p*.

The presence of ‘Sea-pen and Burrowing Megafauna Communities’ habitat FOCI was identified in the imagery data using burrow density data. Burrow density (m^{-2}) was derived by dividing the total number of observed burrows by the area of seabed covered by each transect. To illustrate the variation in burrow density along a transect, density within still images was compared. Prior to this comparison the field of view of still image samples was checked for consistency (Figure 4) This demonstrated that the majority of images had a relatively consistent field of view making the comparison acceptable. The number of burrows from all still images within a station were compared using box and whisker plots to give the range of densities and an indicative measure of relative distribution or patchiness of burrows. All box and whisker plots illustrate the 25% to 75% interquartile range from the median and the whiskers 1.5 times the upper and lower quartiles.

2.3.5 Non-indigenous species (NIS)

The infaunal and epifaunal taxon lists generated from the infaunal samples and seabed imagery data were cross-referenced against lists of non-indigenous target species which have been selected for assessment of GES in British waters under MSFD Descriptor 2 and identified as significant by the British Non-Native Species Secretariat. These taxa are listed in Annex 10.

2.3.6 Marine litter

Occurrences of marine litter were derived imagery data during processing. This was reliant on processing staff to identify elements as anthropogenic in origin and introduced to the seabed.

3 Results

3.1 Benthic and environmental overview

The ‘Subtidal mud’ BSH was identified at all 71 stations sampled using both grab and imagery data. The other designated BSHs (see Table 1) were not targeted during the survey nor identified in subsequent analysis of acquired data. Rippling of the seabed surface was observed in imagery data at most stations with areas of planar seabed also present across the site. The presence of large mud areas indicated a low energy, depositionary environment which, considered against the lack of samples from other BSHs, precluded the need for hydrodynamic regime investigation to support previously predicted BSH distribution. The relative concentrations of TOC and TON can contribute to the understanding of how productive the benthic system is and enable inferences about its general condition. However, no clear trends were observed in sediment composition or concentrations of TOC and TON during 2017.

3.1.1 Particle size analysis (PSA)

Analysis of sediment samples for PSA illustrated that all samples were primarily composed of sand and mud. A negligible gravel fraction, comprised of small shell fragments, was found in 12 samples ranging from 0.1 - 2.6%. The sand and mud fractions ranged between 39.4 - 75.8% and 24.2 - 60.6% respectively, resulting in all samples being classified as ‘Subtidal mud’ (Figure 5.). No spatial trends in sediment granulometric properties were evident from the data collected (Figure 6.). The percentage contribution of sand and mud was analysed in conjunction with the infaunal data (see Section 3.3).

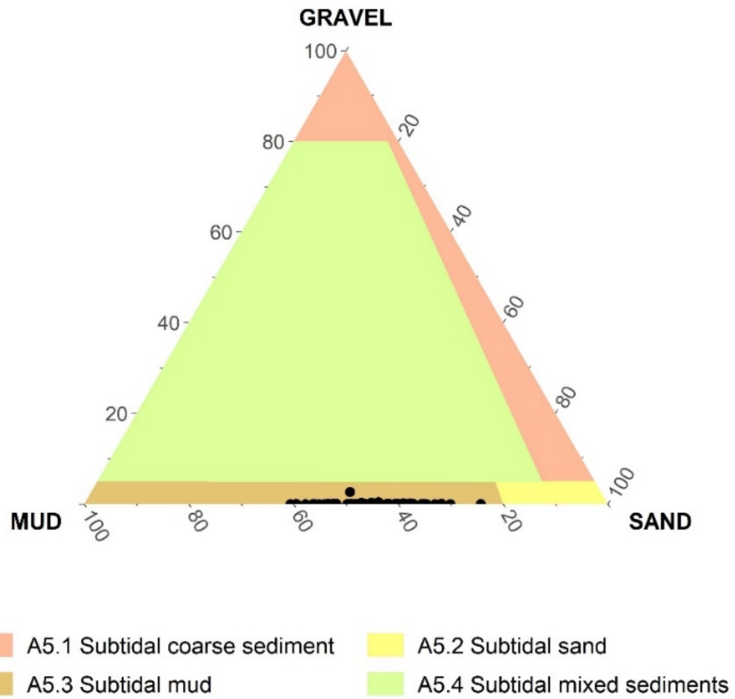

Figure 5. Classification of PSD (half phi) information for each sampling station (closed black circles) into one of the sediment Broadscale Habitats (coloured areas) plotted on a true scale subdivision of the Folk triangle (Folk 1954) into the simplified classification for UKSeaMap (Long 2006).

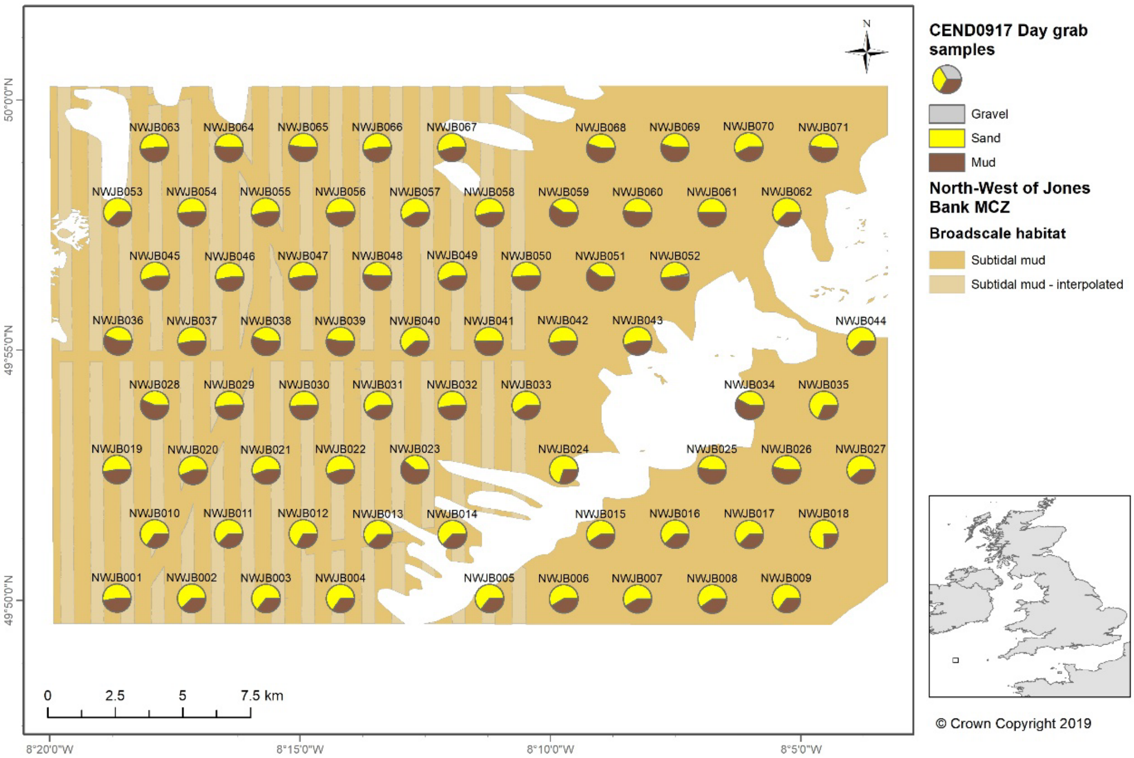

Figure 6. Sediment composition from 0.1m² PSA of Day grab sub-sample at North-West of Jones Bank MCZ in 2017.

3.2 Broadscale Habitats (BSH)

All stations characterised as 'Subtidal mud' using both Day grab (Figure 7) and imagery (Figure 8) data which supports the 'Subtidal mud' distribution in the existing seabed classification map (Jones *et al.* 2015). The distribution of grain sizes (Figure 9) illustrates that the majority of measurements lie between -0.5 - 10 ϕ, which encompasses most of the sand and mud classes on the Wentworth scale (Wentworth 1922). All stations, except for one, had ≥30% mud content.

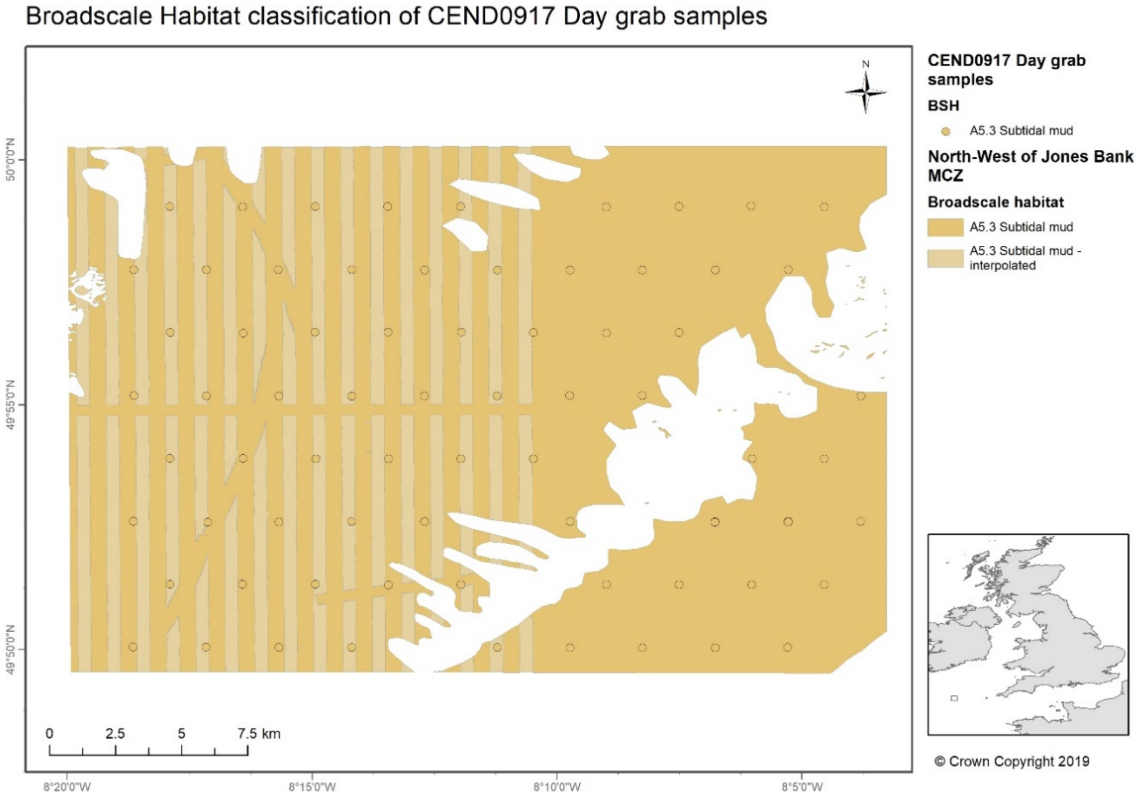

Figure 7. 0.1m^2 Day grab samples collected at North-West of Jones Bank MCZ in 2017, classified by BSH.

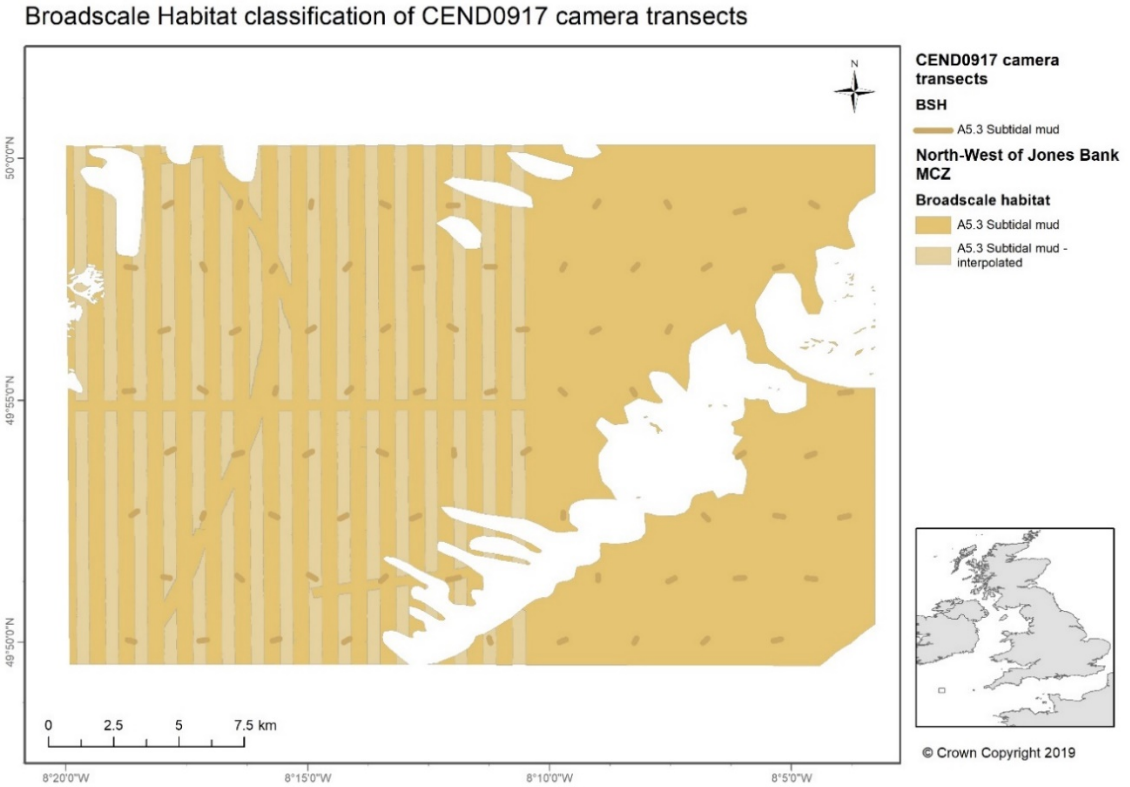

Figure 8. Video tows from North-West of Jones Bank MCZ in 2017, classified by BSH.

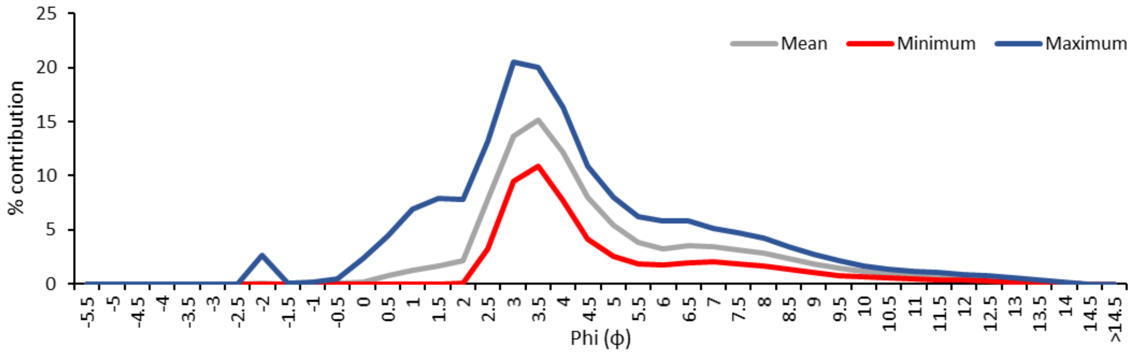

Figure 9. Distribution of grain sizes (ϕ class) from 0.1m^2 Day grab samples collected at North-West of Jones Bank MCZ in 2017.

3.3 Infaunal analysis

A total of 162 taxon records remained following truncation of the infaunal abundance data set from the 71 Day grab samples.

This included 70 polychaete (segmented worms) taxa, 31 arthropod taxa, 27 molluscan taxa, 15 cnidarian taxa and four echinoderm taxa. Other phyla (n = 8) accounted for the remaining 9.3% of the total taxa (15 taxa).

The most abundant taxa overall were the capitellid polychaete *Spiophanes kroyeri* (occurring in all 71 samples at an average abundance of 36 individuals per sample) and the bivalves *Phaxas pellucidus* (occurring in 58 of the samples at an average abundance of 22 individuals per sample) and *Corbula gibba* (occurring in 63 of the samples at an average abundance of 19 individuals per sample). Common taxa, occurring in >80% samples, were (in descending order of percentage occurrence) *Tubulanus polymorphus* (Nemertea), *Peresiella clymenoides* (Polychaeta), *Abyssoninoe hibernica* (Polychaeta), *Obelia dichotoma* (Cnidaria), *Praxillella affinis* (Polychaeta), *Galathowenia oculata* (Polychaeta) and *Magelona minuta* (Polychaeta).

Dasybranchus sp. (Polychaeta) accounted for the largest proportion of the biomass (26% of the total) whilst five taxa accounted for 60% of the total biomass at the site.

A table summarising the abundance and biomass values of the most dominant taxa is presented in Annex 2.

In total, three groups (i*A*, i*B* and i*C*), were identified from the *k*-R clustering (ANOSIM R = 0.58) of the infaunal abundance data (Table 4). Most samples (72%) were assigned to group i*A* which is distributed throughout the site (Figure 10.). Group i*B* was assigned to 10% of the samples and the remaining 18% were classified as group i*C*. The locations of samples classified by group are shown in Figure 10., with most of the group i*C* samples occurring in the south-east of the site.

The average within-group similarity was generally less than 50 % for each group, with a maximum of 49% for the largest, group i*A*. The number of taxa represented in group i*B* was notably lower than that of either of the other infaunal groups (Table 4).

Table 4. Group allocation of infaunal samples from North-West of Jones Bank MCZ in 2017 following *k*-R Clustering of the square root-transformed, dispersion weighted, Bray-Curtis resemblance abundance data. Information on the number of samples comprising each group showing average within-group similarity.

Group	Number of samples	Percentage of samples	Average within-group similarity (%)	Number of taxa in each group ($S_{i\ k\text{-R group}}$)
i*A*	51	72	49	135
i*B*	7	10	37	61
i*C*	13	18	47	121

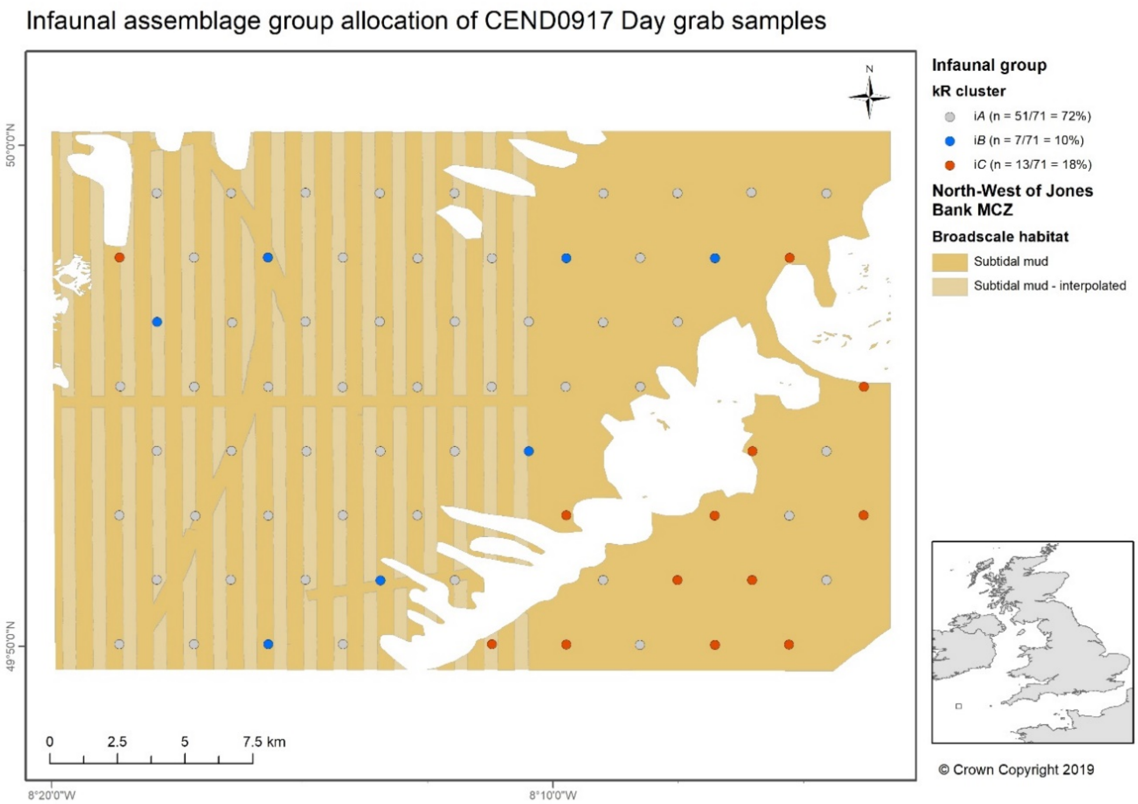

Figure 10. Distribution of infaunal groups assigned to each station following *k*-R clustering of the square root-transformed, Bray-Curtis resemblance abundance data from North-West of Jones Bank MCZ in 2017.

The results of the multivariate analysis showing the dissimilarity among infaunal assemblage groups (using a cut-off of 70% cumulative contribution) is presented in Annex 3. To investigate dissimilarity between samples, the abundances of taxa absent from one group and present in the other was reviewed for each comparison (Table 5).

Table 5. Average abundances of taxa in each infaunal *k*-R cluster group showing those which are absent in at least one comparison.

Taxon	i*A*	i*B*	i*C*
Ampelisca spinifer	0.1	Absent	0.5
Timoclea ovata	0.1	Absent	0.4
Ampharete lindstroemi Type A	0.1	Absent	0.5
Prionospio fallax	0.2	Absent	0.4
Eunoe nodosa	0.3	Absent	0.7
Nephtys kersivalensis	0.4	Absent	0.2
Nemertea	0.4	Absent	1.5
Bougainvilliidae	0.5	Absent	0.5
Aricidea (Acmira) laubieri	0.6	Absent	1.2
Ampelisca spinipes	0.9	Absent	1.3
Goniada maculata	Absent	0.1	0.5
Owenia spp.	Absent	0.1	0.7

Dissimilarity was highest between group i*B* and i*C* (67%). Contributing to this difference, nine taxa were absent from group i*B* and had only low abundances in group i*C* (on average, <one individual per sample within the group). Only three off these nine taxa were present, on average, in samples belonging to group i*C* with an abundance of greater than one individual per sample (Table 5). The remaining taxa were present with low average abundances.

The average dissimilarity between group i*A* and i*B* was 59%. Five taxa were absent from group i*B* but were, on average, present only in low abundances (<1 individual per sample) in group i*A* (Table 5). There were no taxa absent (to a cut-off of 70% cumulative contribution) from group i*B* that were present in group i*A*.

The average dissimilarity between group i*A* and i*C* was also 59%. There were no taxa absent from group i*C* that were present in group i*B*. Two taxa were absent from group i*A* and present in group i*C* with low average abundances (<1 individual per sample); *Goniada maculata* (0.5 per sample) and *Owenia* spp. (0.7 per sample). There were no taxa absent (to a cut-off of 70% cumulative contribution) from group i*C* that were present in group i*A*.

The mean abundance (per *k*-R cluster group) of a select number of important taxa was also investigated as a way of understanding any biologically relevant differences between each group. The top ten taxa responsible for each of the between group dissimilarities were chosen as potentially relevant taxa. For each comparison, the cumulative percentage contribution to the dissimilarity ranged from 18% - 27% and nine taxa were present in more than one comparison (Table 6).

A visualisation of the differences in abundances of the 22 taxa identified as driving the *k*-R cluster groups (i*A*, i*B* and i*C*), is presented as a shade plot (Figure 11). Abundances of the bivalve mollusc, *Phaxus pellucidus*, appear to be a key driver in the divisive clustering. Specimens were 1) present in all 13 samples classified as group i*C* (usually in abundances greater than 50 individuals per sample), 2) in very low numbers (maximum three individuals) or absent (n = 4) from the seven samples comprising group i*B* and 3) ranging in abundances from zero to 176 individuals in group i*A*. Other taxa of interest, when identifying biologically relevant differences between the infaunal *k*-R cluster groups, include the polychaetes *Spiophanes kroyeri*, *Magelona minuta* and *Peresiella clymenoides,* which demonstrate variable degrees of average abundance in each group (Table 6). It is worth noting, however, that whilst the abundances of these polychaetes differ, they are broadly similar (in contrast to *P. pellucidus*).

Table 6. The average number of individuals from taxa influencing differences between *k*-R cluster groups (SIMPER) from North-West of Jones Bank MCZ in 2017. Relative abundance indicated by green shade.

SIMPER Taxon	Average abundance in each *k*-R cluster group			Taxon present in the top ten most important taxa in the comparison between *k*-R cluster group		
	i*A*	i*B*	i*C*	i*A*-i*B*	i*A*-i*C*	i*B*-i*C*
Abyssoninoe Hibernica	3.1	4.0	2.6	P		P
Ampelisca spinipes	0.9	0.0	1.3			P
Eclysippe vanelli	1.6	0.3	3.0	P		P
Galathowenia oculate	2.1	1.1	1.1	P	P	P
Glycera unicornis	1.3	0.3	0.9	P	P	
Lumbrineris spp.	0.3	0.4	1.0		P	
Mediomastus fragilis	1.6	0.4	2.8		P	
Nephtys hystricis	1.0	0.6	0.8	P	P	
Nucula sulcata	1.5	1.9	1.5	P		
Peresiella clymenoides	4.3	3.6	9.9		P	P
Phaxas pellucidus	9.2	0.9	81.4		P	P
Poecilochaetus serpens	0.6	0.1	1.2		P	P
Prionospio dubia	1.3	1.1	2.0	P		P
Spiophanes kroyeri	38.6	36.7	24.8	P		
Thyasira polygona	0.8	0.6	1.1	P	P	P
Tubulanus polymorphus	3.9	3.4	4.9	P	P	P

A non-metric multidimensional scaling (MDS) ordination of the between sample similarities derived from *k*-R clustering, illustrating that the number of taxa per sample within-group i*C* is larger than that of the other groups (Annex 6), is presented in Figure 12. The non-metric MDS is used here for illustrative purposes only and the stress values are not representative of the analytical capability of the non-hierarchical statistical analyses used for categorisation nor the significance of the difference between groups.

The average number of taxa significantly varies between infaunal *k*-R cluster groups (H_{df2} = 33.1, p <0.0001) with samples allocated to group i*C* comprising, on average, more taxa. Similarly, group i*C* is more abundant (H_{df2} = 21.1, p <0.0001). There is no significant difference in the average total biomass (g wet weight per sample) of samples within each group nor in the depth of sediment penetration of the Day grab (H_{df2} = 0.79, p =0.675; H_{df2} = 2.6, p =0.268). Similarly, there is no significant difference in the amounts of TOC and TON in the samples within each group (H_{df2} = 0.95, p =0.621; H_{df2} = 1.1, p =0.590). Plots showing the mean and confidence interval (95 %) of the number of taxa (*S*), abundance (*N*), biomass (g), grab penetration, percentage contribution of sand and mud, TOC and TON for each of the infaunal *k*-R cluster groups are presented in Annex 6.

The average percentage contribution of mud and sand significantly varies between infaunal *k*-R cluster groups (H_{df2} = 8.3, p =0.016; H_{df2} = 8.2, p =0.016 for mud and sand respectively) with samples allocated to group i*C* comprising, on average, more sand and slightly less mud. The sand fractions of i*A*, i*B* and i*C* ranged between 39.4 - 75.8%, 40.6 – 64.5% and 42.3 – 69.9% respectively and the mud fractions ranged between 22.4 – 60.6%, 35.5 – 59.4% and 30.0 – 57.7%.

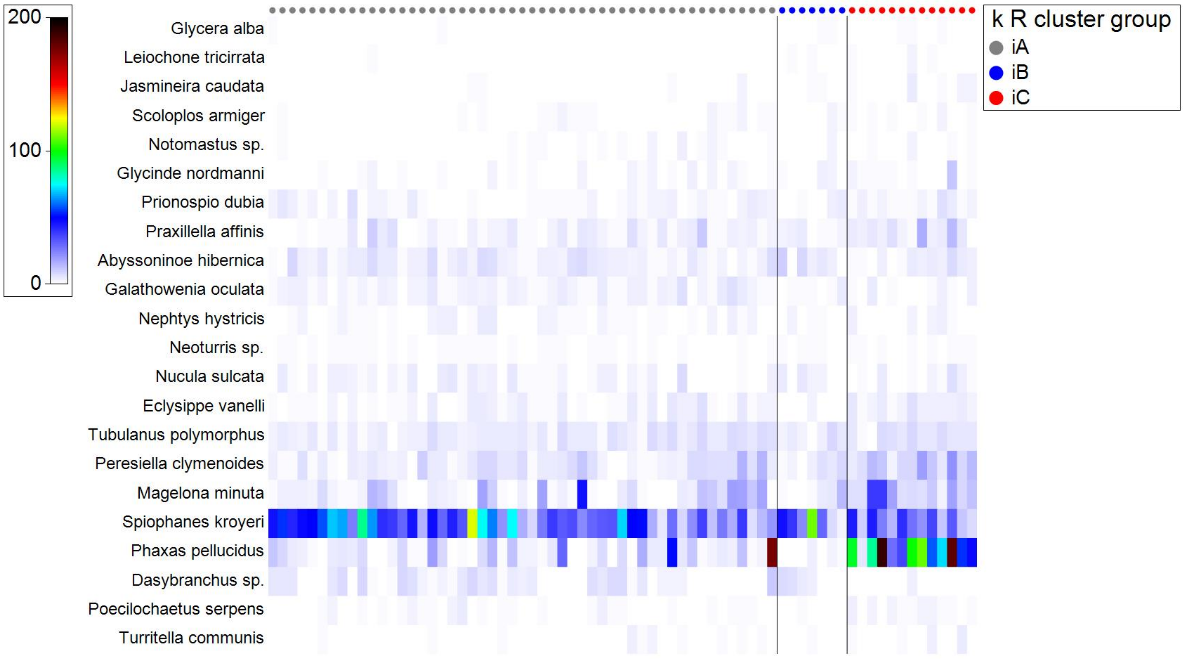

Figure 11. Shade plot showing the contribution of taxa (abundance values, colonial taxa presence = 1) to each of the *k*-R Cluster groups from North-West of Jones Bank MCZ in 2017. The samples are ordered by group allocation (grey, blue and red circles are groups i*A*, i*B* and i*C* respectivley) and the taxa are ordered by their similarity (Bray-Curtis).

To investigate the correlation between the percentage contribution of sand and the abundances of the species that appear to be key drivers in the divisive clustering, Spearman's *rho* rank correlation tests were performed. The abundance of *P. pellucidus* was not significantly correlated with the percentage contribution of sand (ρ = 0.19, p = 0.111). In contrast the abundance of *Spiophanes kroyeri* significantly decreased (ρ = -0.411, p = 0.000) whilst *Magelona minuta* and *Peresiella clymenoides* abundances both significantly increased in response to an increasing proportion of sand (ρ = 0.505, p = 0.000; ρ = 0.347, p = 0.003) (Annex 7).

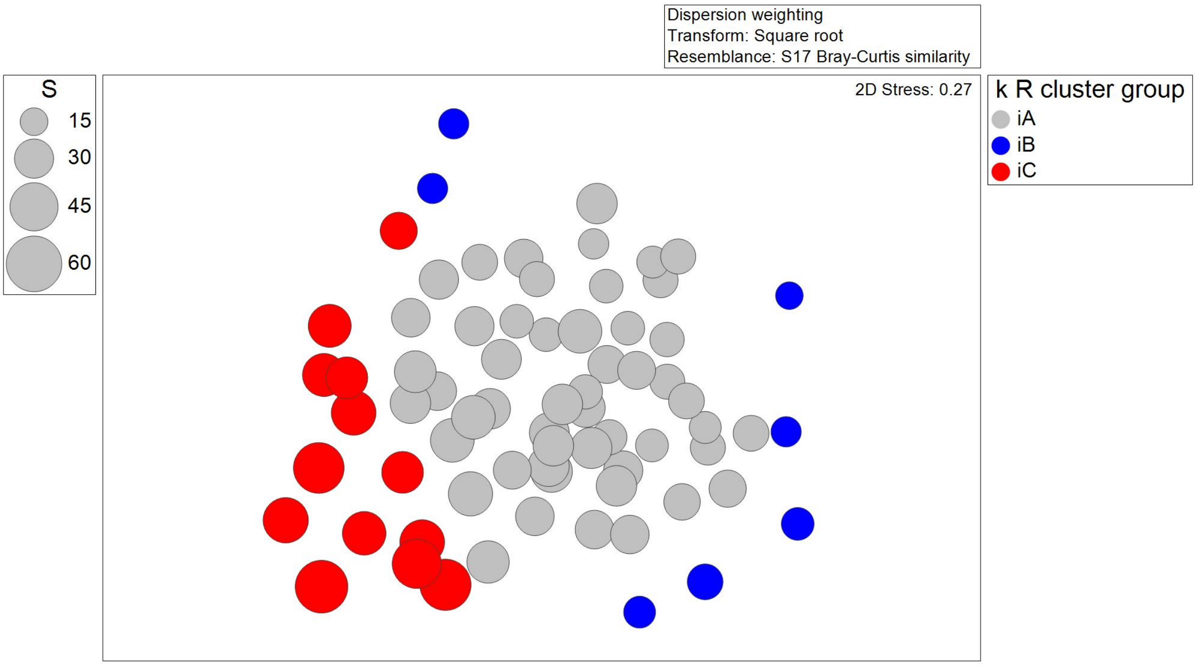

Figure 12. Non-metric multidimensional scaling (nMDS) ordination illustrating the number of taxa (*S*) in each 0.1m^2 Day grab sample from North-West of Jones Bank MCZ in 2017, categorised using the *k*-R cluster groups.

3.4 Epifaunal analysis

All of the habitats captured with seabed imagery imagery were characterised as 'Subtidal mud' BSH and all stations supported a description of 'Sea-pen and Burrowing Megafuna Communities' habitat FOCI. Imagery data were also assigned a biotope description from the EUNIS classification resulting in all habitats being classified as the level five biotope A5.361 (Sea-pens and burrowing megafauna in circalittoral fine mud; Connor *et al.* 2004). Some still images were classified as the level four biotope A5.36 SS.SMu.CFiMu (Circalittoral fine mud) due to the absence of *Virgularia mirabilis*.

Following *k*-R clustering of epifaunal data from video analysis, five groups were identified (Table 7). SIMPER analysis indicated a high level of within-group similarity (>63%) with dissimilarity between groups ranging from 45 - 83%, suggesting that whilst contributing taxa were similar in all groups, assemblage characterisation was highly dependent on the abundance of the most prevalent taxa. The relative abundance of the sea-pen *V. mirabilis* and prawns belonging to the infraorder *Caridea* spp. appears to have the greatest influence on the clustering of assemblages (Figure 13).

Assemblage e*D* had the highest membership comprising 49% of the samples whilst e*B* was the least represented with 7% of the samples classifed. Groups e*C* and e*E* both comprised 14% of samples whilst e*A* included 16% (Figure 14). There was no clear association between the cluster group and environmental variables or any obvious spatial distribution patterns. However, e*D* was distributed most across the north-west of the site (Figure 14).

Samples from across assemblage groups exhibited varying similarity. The non-metric MDS further illustrates the level of similarity between samples derived from *k*-R clustering whilst demonstrating that *S* was similar throughout the video data (Figure 15). The non-metric MDS is used here for illustrative purposes only and the stress values are not representative of the analytical capability of the non-hierarchical statistical analyses used for categorisation.

Table 7. The average number of epifaunal individuals from taxa influencing differences between *k*-R cluster groups (SIMPER) from North-West of Jones Bank MCZ in 2017. Relative abundance indicated by green shade.

	Average abundance in each *k*-R cluster group					Presence of taxa contributing up to 70% of between *k*-R cluster group comparison (Average dissimilarity)									
SIMPER taxon	e*A*	e*B*	e*C*	e*D*	e*E*	e*A* & e*B* (72.6)	e*A* & e*C* (46.8)	e*A* & e*D* (44.7)	e*A* & e*E* (59.3)	e*B* & e*C* (74.6)	e*B* & e*D* (62.6)	e*B* & e*E* (82.8)	e*C* & e*D* (55.8)	e*C* & e*E* (71.9)	e*D* & e*E* (44.6)
Virgularia mirabilis	46.6		26.8	85.1	191.6	P	P	P	P	P	P	P	P	P	P
Polychaeta			18.4				P	P		P			P		
Actiniaria	5.6	6.2					P								
Caridea		47.4		26.3		P		P		P	P	P	P		P

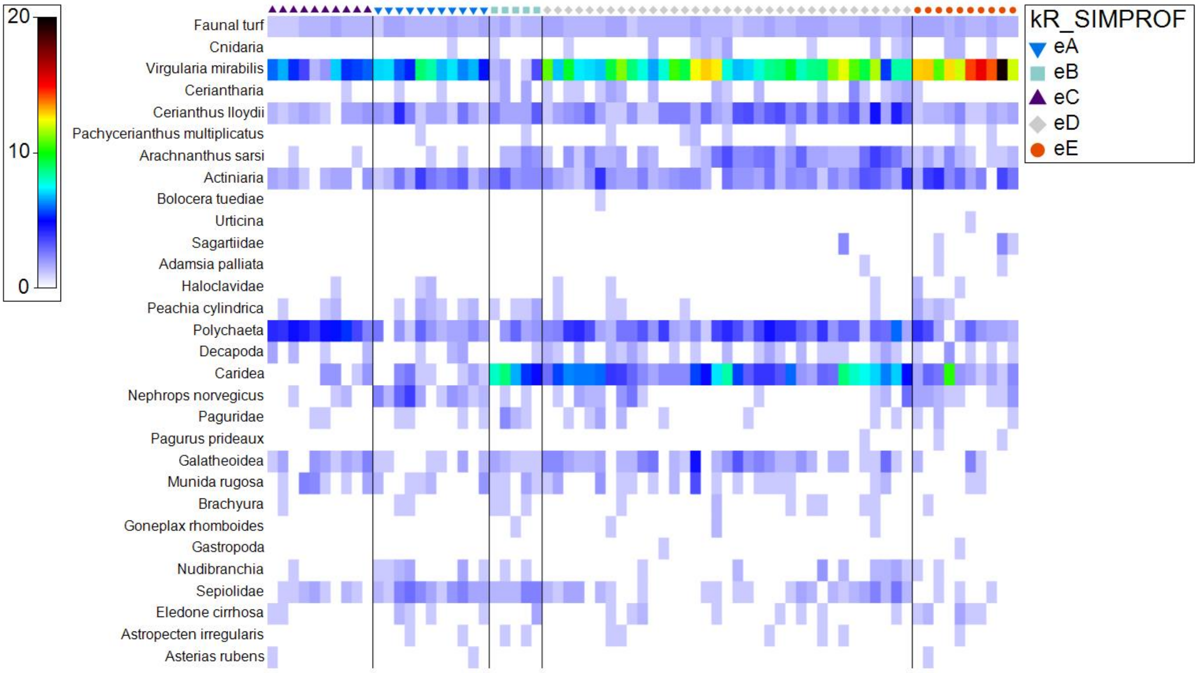

Figure 13. Shade plot of taxa contributing to epifaunal assemblages compared against results from *k*-R clustering (data from North-West of Jones Bank MCZ in 2017).

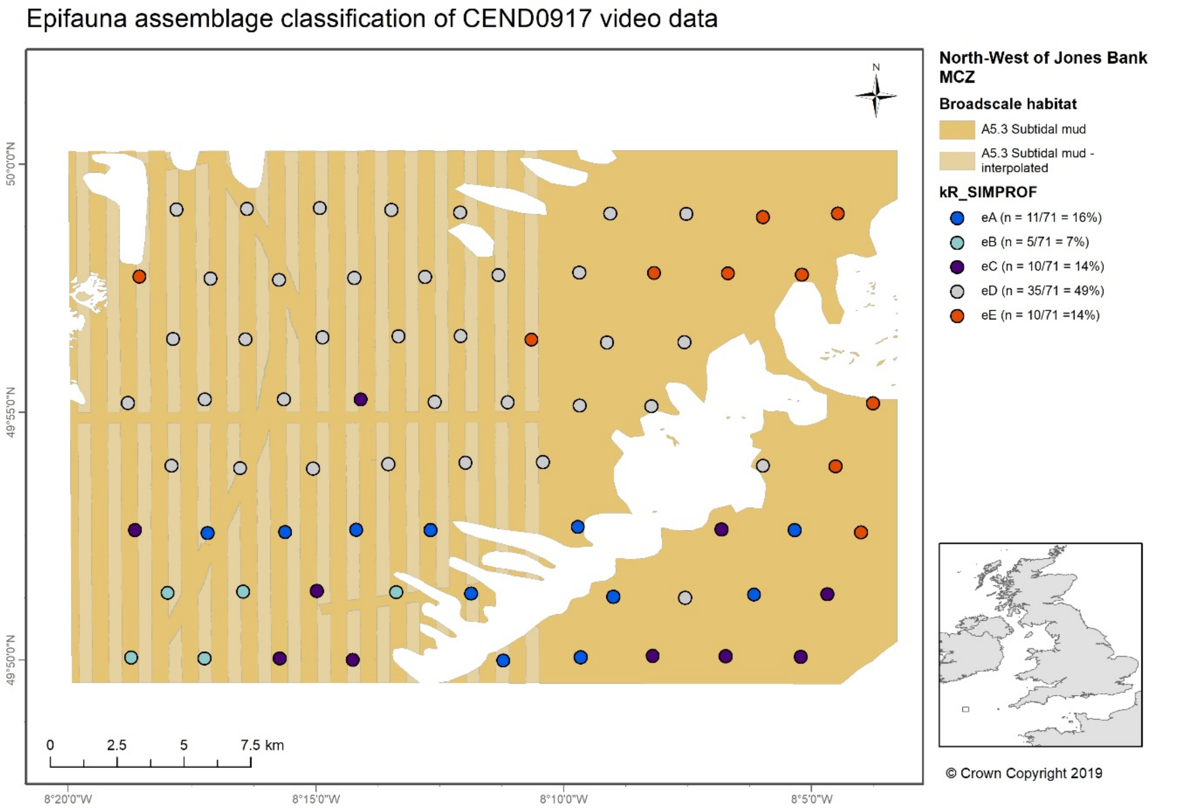

Figure 14. Spatial distribution of *k*-R cluster groups classified from the video data at North-West of Jones Bank MCZ in 2017.

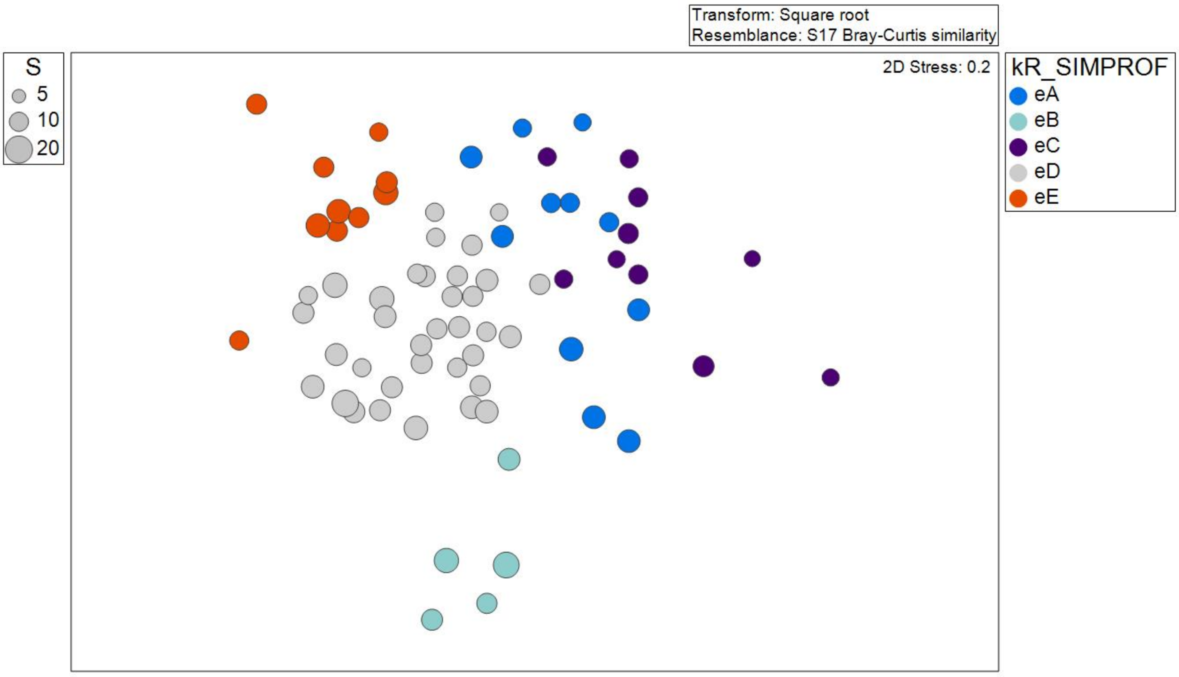

Figure 15. Non-metric MDS of *k*-R cluster groups with bubbles scaled according to taxonomic richness within video tows from North-West of Jones Bank MCZ in 2017.

3.5 Habitat Features of Conservation Importance (FOCI)

3.5.1 Sea-pen and Burrowing Megafauna Communities

Sea-pens *V. mirabilis* were observed throughout the site in varying densities (Figure 16.). There was a trend of increasing sea-pen density from the south-west to the north-east of the site which was correlated with depth (r = 0.69; ρ = 0.000) (Figure 16.; Figure 17.; Table 8). Burrows of various taxa were observed in the video data with a more south to north trend of increasing density across the site (Figure 18.; Figure 19.); this trend did not correlate with any available environmental data. Burrow density had a positive moderate-weak correlation with percentage mud content (inverse with sand content) and TOC (Table 8) derived from the grab samples. Burrow density varied within transects with some stations having very patchy distribution of burrows whilst other stations exhibited a more uniform burrow distribution (Figure 20.). It was not possible to explore this small-scale variability with the data available which was either collected at point locations or derived from acoustic data, neither of which can be used to adequately reflect biological distribution patterns along a transect because the point samples do not enable an assessment of patchiness and acoustic data are not comparable to biological distributions in the absence of strong contrast within those data.

Counterintuitively, there is no requirement for sea-pens to be present for an area to be characterised as ‘Sea-pens and Burrowing Megafauna Communities’ habitat FOCI (Robson 2014). Robson (2014) states “Burrowing megafauna is an essential element of the habitat, but sea-pens may, and by extension may not, be present”.

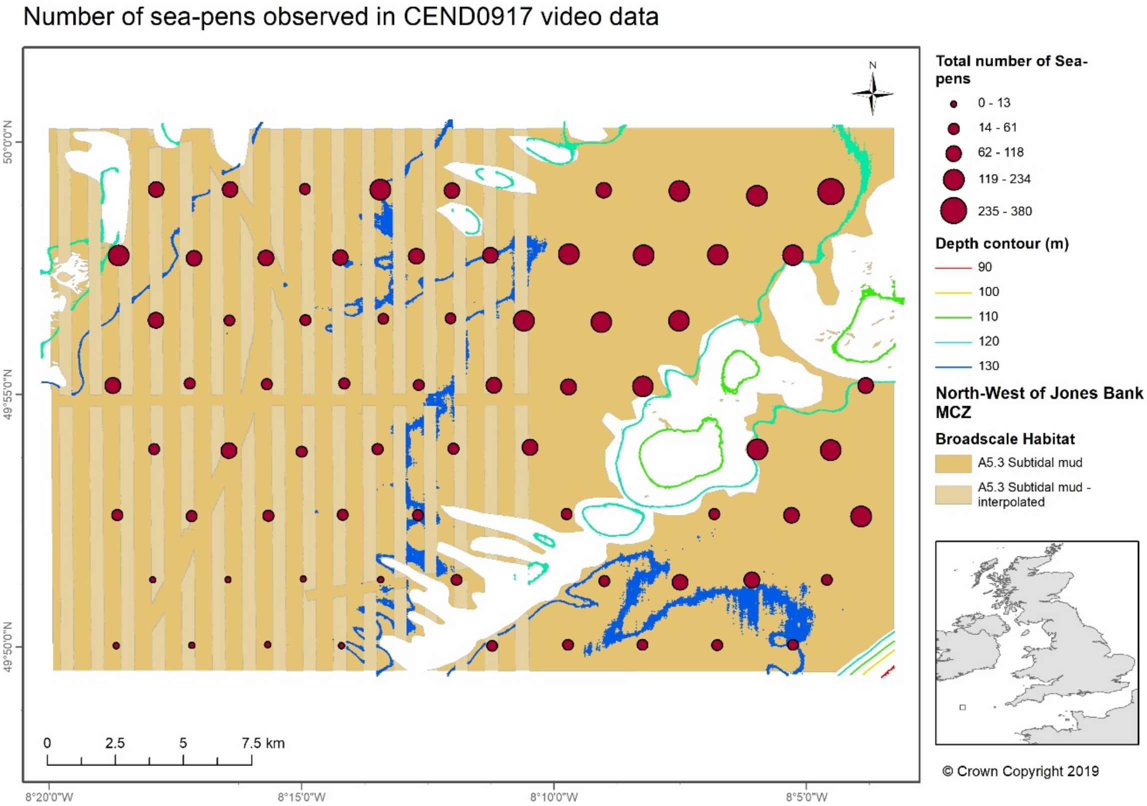

Figure 16. Spatial distribution of the total number of sea-pens observed at each video station in the North-West of Jones Bank MCZ in 2017. Contours derived from MBES bathymetry data.

There is no significant relationship between burrow density and sea-pen density (see Annex 8), however, both sea-pens and burrows exhibit a south-north increase though these patterns are also variable (Figure 16. and Figure 18.).

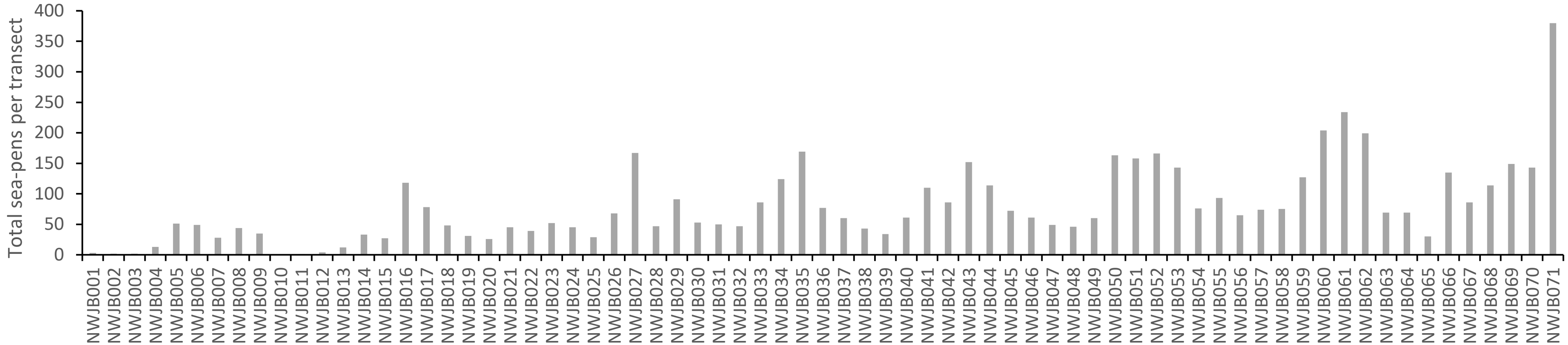

Figure 17. Total number of sea-pens observed at each video station at North-West of Jones Bank MCZ in 2017.

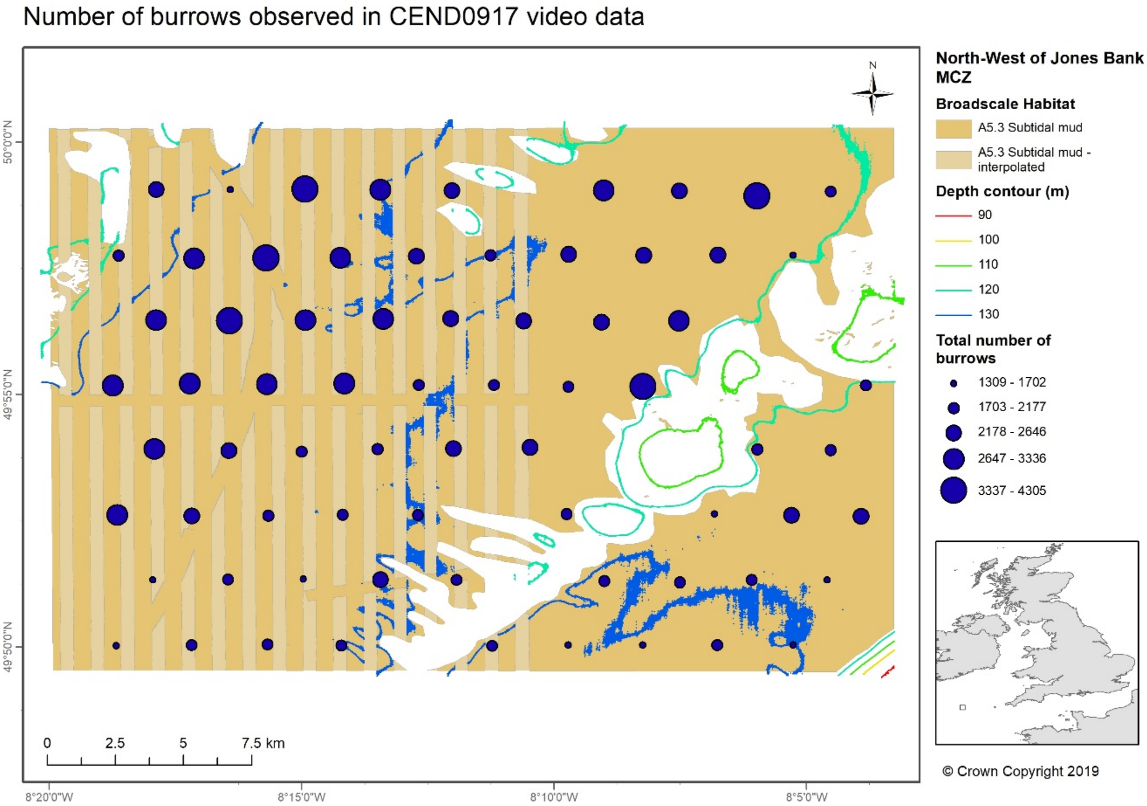

Figure 18. Total number of burrows observed at each video station at North-West of Jones Bank MCZ in 2017.

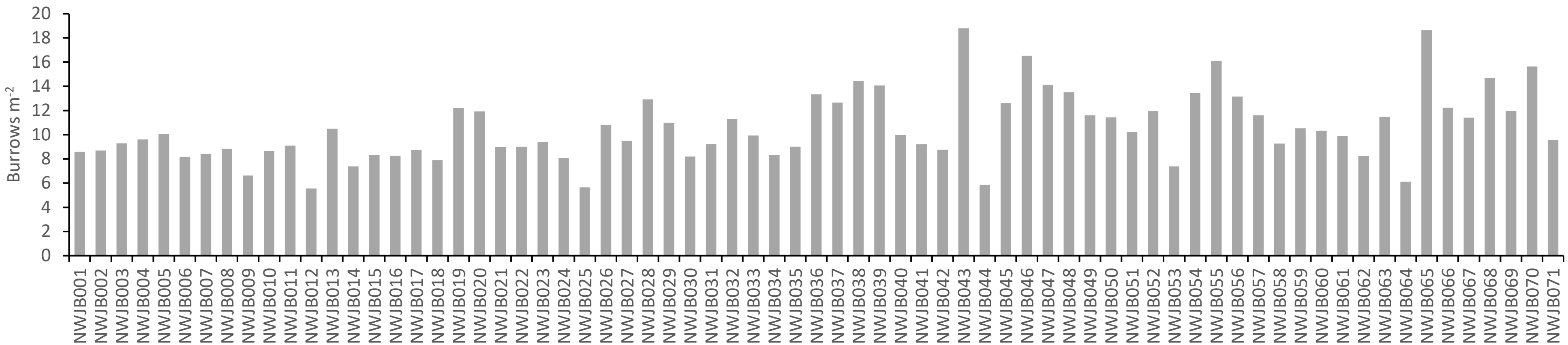

Figure 19. Density of burrows (m^{-2}) at each video station at North-West of Jones Bank MCZ in 2017.

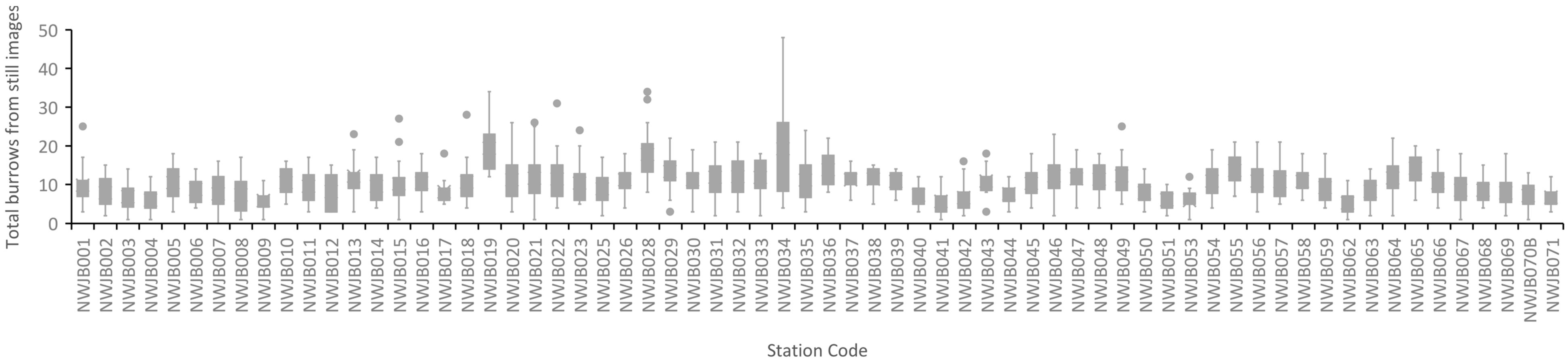

Figure 20. Range of burrow numbers observed from still images at each video station at North-West of Jones Bank MCZ in 2017.

3.6 Species FOCI

3.6.1 Undesignated species FOCI

The survey reported here was not designed to specifically monitor (or identify the presence of) species FOCI. As such, the absence of their occurrence in the acquired data should not be interpreted as an absence of species FOCI from the site.

No evidence of species FOCI was found in the data acquired during the 2017 survey.

3.7 Non-indigenous species (NIS)

There was no evidence of NIS from the sediment samples and imagery collected from within the North-West of Jones Bank MCZ in 2017 as assessed against the list in Annex 10.

3.8 Marine litter

One piece of litter was observed from the imagery data; a partially colonised and buried linear object (Figure 21.), potentially rope or wire, was observed at station NWJB064 located in the north-west corner of the site.

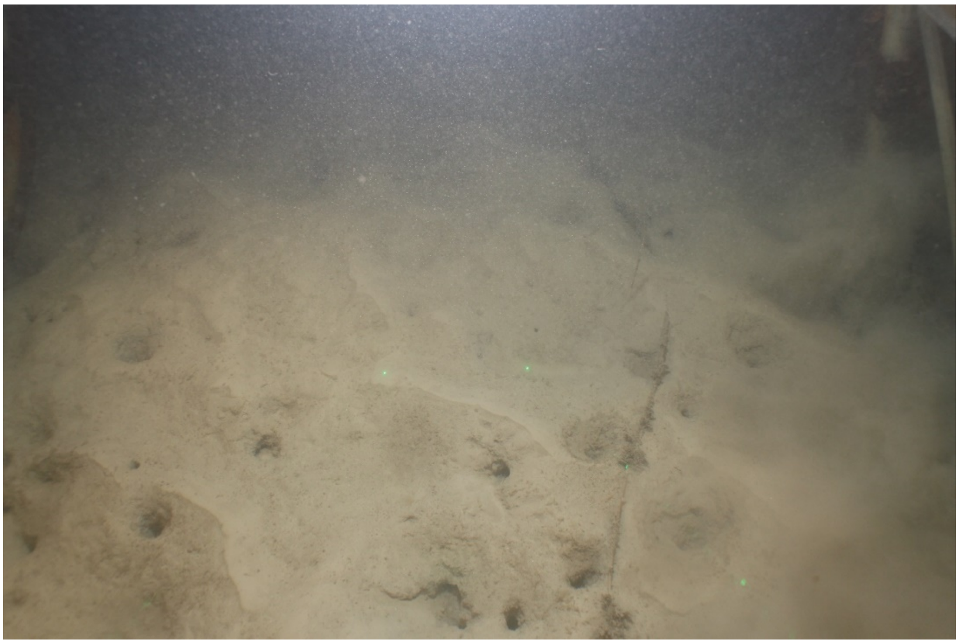

Figure 21. Observation of marine litter from video data at North-West of Jones Bank MCZ in 2017.

3.9 Anthropogenic activities and pressures

Anthropogenic activities were observed in imagery data at 52 of the 71 stations. These activities mostly manifest as bobbin tracks (Figure 22.) and trawl scars (Figure 23.), whilst multiple cable drags resulting from the camera sledge were observed (Figure 24.). Some trawl scars were recent, showing sharp edges around the incisions and others were relatively old with soft edges and epifauna present. No other evidence of anthropogenic activity was observed.

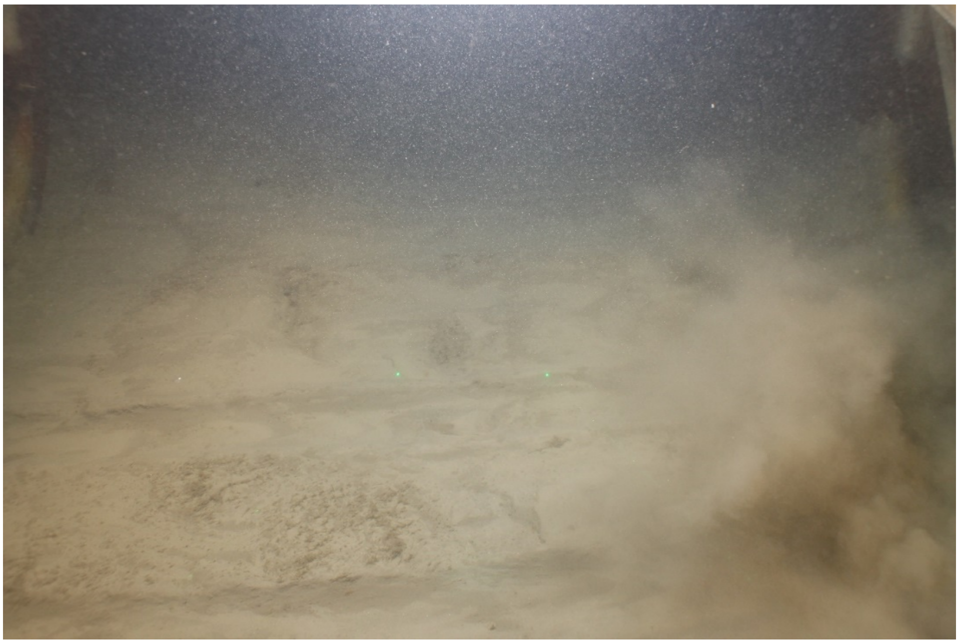

Figure 22. Bobbin tracks in the 'Subtidal mud' BSH at North-West of Jones Bank MCZ in 2017.

Figure 23. Trawl scar in the 'Subtidal mud' BSH at North-West of Jones Bank MCZ in 2017. Black lines (superimposed) indicate edges of scar.

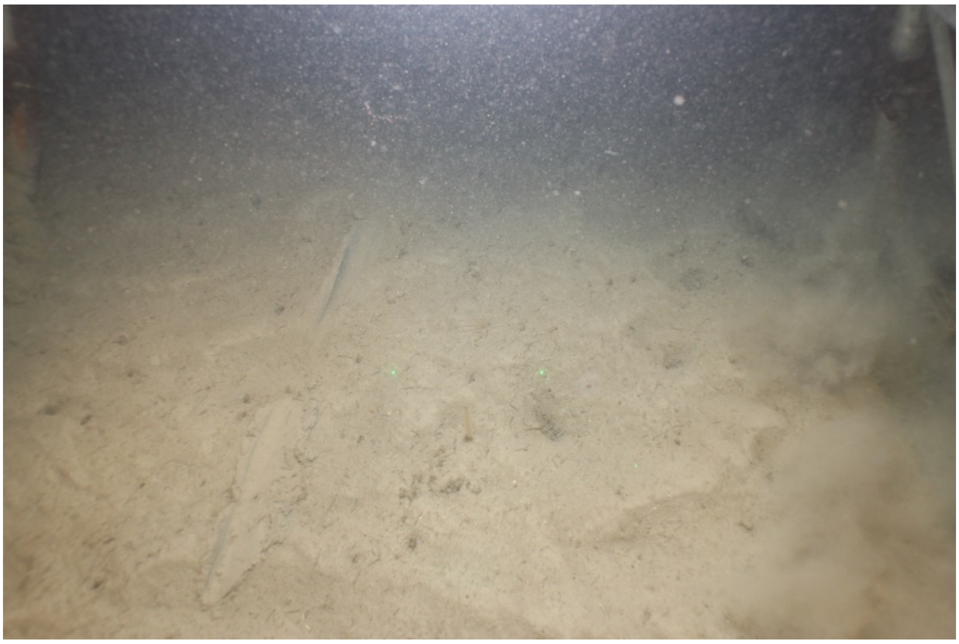

Figure 24. Camera sledge cable drag in the 'Subtidal mud' BSH at North-West of Jones Bank MCZ in 2017.

4 Discussion

This discussion presents evidence for future assessment and monitoring of two designated features of the North-West of Jones Bank MCZ, as required to achieve the report objectives stated in Section 1.3.3.

4.1 'Subtidal mud' BSH

The 'Subtidal mud' BSH was found throughout the sample stations targeted during the survey. The distribution and structure of the feature are discussed below.

4.1.1 Extent and distribution

The data acquired during the 2017 survey do not allow the calculation of a total extent for 'Subtidal mud' within the site, however the sampling points provide evidence that this BSH exists in the area predicted by the Jones *et al*. (2015) model. The 'Subtidal mud' BSH was universally distributed across the sampling stations. It is assumed that the extents from Jones *et al*. (2015) remain valid, however acoustic survey and cross-boundary sampling would be required to definitively verify this.

4.1.2 Sediment composition

The 'Subtidal mud' BSH comprises mud and sand fractions. The level of mud composition in sample locations is relatively high (≥24.2%) and in the absence of extreme events a reduction of the mud fraction to <20%, which would result in a BSH classification change, is unlikely. The water depth at the site will likely protect the 'Subtidal mud' BSH from storm events; similarly, the expanse of muddy sediments indicates a low energy environment suggesting normally prevailing environmental conditions will not modify the 'Subtidal mud' BSH. Fishing at the site is of very low intensity and does not involve sediment removal, further suggesting the 'Subtidal mud' BSH sampled will remain as such. The absence of samples from other BSHs prevents any investigation of whether the extent of the 'Subtidal mud' BSH might be increasing within the MCZ.

4.1.3 Biological assemblages

The benthic assemblages associated with each of the three infaunal *k*-R cluster groups differ due to small variations in the average abundance of a few taxa rather than the dominance of a single taxon, characterising assemblage or an influential absence of an assemblage component. The group assemblages are driven by changes in the relative abundance of fauna which may have little ecological significance and may also reflect finer-scale heterogeneity in environmental factors that have not been measured.

For example, abundances for the bivalve mollusc, *Phaxus pellucidus*, appeared to be a key driver in the divisive clustering, yet *P. pellucidus* can be locally abundant and dominate disturbed sediments suggesting it has some opportunistic traits (Rees *et al*. 1992).

The five epifaunal groups identified from video data reflected this observation. Five taxa appear to drive the differences between the assemblage groups through relative abundance, but the groups are inherently similar.

The difference in the percentage contribution of sand and mud among the infaunal groups is small and the strength of any relationships between a subset of key taxa and the percentage contribution of sand was generally low. Furthermore, the total amount of organic carbon and nitrogen was similar across all infaunal groups. This lack of complexity is mirrored by the epifaunal assemblages despite the identification of five assemblage classes. These differences reflect the differences in abundances of key taxa, rather than difference in the assemblages overall.

The structure of both the infaunal and epifaunal benthic assemblages vary slightly (Figure 12 and Figure 15), but the environmental conditions appear to be homogeneous across the 'Subtidal mud' BSH. Differences in the assemblages sampled may be due to the uneven distribution of taxa resulting from factors which have not been collected at this time, e.g. biological interactions such as inter- and intraspecific competition for resources. Such unevenness is evident in the variation in burrow densities observed between (Figure 18.) and within seabed imagery tows (Figure 20.). The burrows are likely created by the same species across the site but demonstrate the inherent patchiness of benthic assemblages within homogeneous classification units.

4.2 Sea-pen and Burrowing Megafauna Communities habitat FOCI

The 'Sea-pen and Burrowing Megafauna Communities' habitat FOCI was assessed for distribution and structure. The data collected do not enable an accurate assessment of extent.

4.2.1 Extent and distribution

The habitat FOCI was universally distributed across the sampling stations. It is assumed that the extent of the habitat FOCI is the same as that of the BSH 'Subtidal mud' for which the extent is taken from Jones *et al*. (2015). Assessing burrow density (burrows m^{-2}) across the length of a video tow (182 - 299m) (Figure 19) does not provide representative information about burrow distribution. For example, station NWJB034 has a burrow density of eight burrows m^{-2} (Figure 19), but data from still images illustrate a more sporadic distribution of burrow density with a range of 4 - 48 burrows/image (Figure 20). Similarly, at NWJB043, a station with the highest burrow density (19 burrows m^{-2}; Figure 19), still images indicate a relatively more uniform distribution of burrows (3 - 18 burrows/image; Figure 20).

4.2.2 Biological assemblages

There are a limited number of taxa that contribute to the structure of the 'Sea-pens and Burrowing Megafauna Communities' habitat FOCI. The definition of the feature is reliant on burrow density measures only and whilst the assemblage composition and resulting structure is identical to that of the 'Subtidal mud' BSH, results supporting the structure and extent of the habitat FOCI are not discussed further. However, the presence of sea-pens throughout the site would suggest that the structure of the habitat FOCI is well-developed. The varying densities of sea-pens between stations may be indicative of different stages of colonisation in response to fishing activities across the site or could be the result of biological and environmental effects not measured during the survey. The correlation of sea-pen density with depth is unlikely to be indicative of a driver of sea-pen colonisation success. *Virgularia mirabilis* are found at depths of 400m (Hill & Wilson 2000) which is far beyond the deepest areas of the MCZ. This would suggest that there are other drivers for the observed trend in sea-pen density distribution, such as temperature, which are not adequately measured to enable suitable testing of those relationships within this MCZ.

4.3 Non-indigenous species

There was no evidence of non-indigenous taxa from the sediment samples and imagery collected from within either the 'Subtidal mud' BSH or 'Sea-pen and Burrowing Megafauna

Communities' habitat FOCI of North-West of Jones Bank MCZ in 2017 as assessed against the list in Annex 10. These lists are not exhaustive and must be regularly updated to ensure potential NIS are consistently scanned for. Furthermore, the assessment of NIS, particularly the tracking of their spread, relies on understanding the sampling effort (and the details of samples collected) of surveys in which none were found.

Understanding parameters such as potential introduction methods (vectors), likelihood of introduction/spread (assessed through assessment of taxon level traits) and environmental regime (e.g. *via* modelled climate change) enables a risk-based approach to the management of NIS. Although outside the scope of MPA monitoring, many of the variables which may prove useful for the effective management of NIS (e.g. water temperature, salinity) could be collected during subsequent surveys.

4.4 Marine litter

Current methods of assessing marine litter (Annex 9) are based on samples acquired through trawling either targeted for litter or as 'bycatch'. These assessments are not necessarily directly applicable to other forms of benthic sampling. The presence of a single piece of colonised litter (undetermined rope / wire) in the seabed imagery does not permit an accurate assessment of marine litter to be made.

4.5 Anthropogenic activities and pressures

Evidence of fishing activities and scientific investigation (i.e. camera sledge cable drags) were observed at the site. It was not possible to assess the effect of these activities on the feature attributes of interest.

5 Recommendations for future monitoring

A series of recommendations are presented below, designed to improve the reporting capability regarding feature attributes following future monitoring surveys.

5.1 Operational and survey strategy

Prioritisation of features for monitoring was an inherent pre-requisite at the North-West of Jones Bank MCZ. Sampling of all designated BSHs features within an MCZ should ideally be carried out, regardless of relative area, particularly when they have an associated GMA of 'recover'. However, there are instances where sampling all features may not be practical or achievable, particularly where the distinction between the BSHs is not clearly delineated or where such features are very spatially limited.

The survey design employed at the North-West of Jones Bank MCZ was limited to the 'Subtidal mud' BSH. In order to identify any future changes in the extent of the 'Subtidal mud' BSH, it is recommended that data are acquired beyond its delineated boundaries, aided by targeted cross-boundary acoustic data. This would supplement assessments of habitat map accuracy and confidence through time.

A number of sampling approaches may be adopted for describing the extent, distribution and character of BSHs, for example random stratification or regular grid designs (as used in this survey). Future surveys should consider the implications of any changes to the sampling design, in the context of reducing variability through time. For instance, returning to the same fixed grid stations would theoretically allow an improved comparison of any temporal changes in extent and distribution of substrates or communities.

Our ability to assess change from long-term monitoring data is inherently affected by the degree of small-scale spatial variability present within and between target stations. Detection of ecologically meaningful change is particularly difficult when there is a high degree of spatial variation within a site (e.g. habitat complexity is high). In such scenarios, replicate sampling within stations is generally advantageous, to allow quantification of this variance. Observation of a 'mosaic' of sediments and faunal assemblages based on a regular grid design may be an artefact of high small-scale variability. At North-West of Jones Bank MCZ, we observed the sediments and associated assemblages to be homogeneous, which infers that small-scale variability is low, and that a single grab per station may be appropriate. However, we cannot categorically state this without supporting data. As such, it is recommended that replication is conducted at a subset of stations to explore this further. The data from such stations could then be used to quantify the importance of small-scale variability for inferring changes based on a single-sample, large scale design.

The potential for differences in any faunal metric between surveys resulting from natural seasonal variability cannot presently be accounted for. Further, it is plausible that seasonal influences on faunal metrics will vary between BSHs as the taxa associated with different habitats are likely to display different recruitment mechanisms and growth rates. The cost associated with a design which allows the effect of seasonal variability on faunal metrics is prohibitive and is outside the remit of the current monitoring programme. The assumption is made, therefore, that the site would be revisited at a similar time of year.

The number of samples required to detect a given change between monitoring events can only be assessed with the appropriately defined monitoring metrics (or indicators). Until these metrics are developed and implemented, the number of samples planned for benthic monitoring is currently based on an alternative monitoring metric (e.g. species richness (*S*) used for the North-West of Jones Bank MCZ). It may transpire that the number of sediment samples acquired across the ‘Subtidal mud’ BSH exceeded that needed to detect a required change in the final monitoring metric. A *post hoc* power analysis should be carried out on any monitoring metrics which are subsequently identified as important to measure change.

Additional environmental sampling could be incorporated into future monitoring surveys to augment other long-term datasets (e.g. salinity and temperature data) can be acquired using both remote sensing and discrete, physical sampling methods. Consideration of additional parameters must ensure cost-effective and fit for purpose monitoring, whilst enabling comparison and integration with other large research and monitoring programmes.

Seabed imagery may not be a reliable method to empirically assess the presence or volume of marine litter. Other sampling techniques (e.g. scientific trawls for large items or grab sampling and processing for microplastics) may be more appropriate if this is a future requirement for MCZ monitoring.

5.2 Analysis and interpretation

The North-West of Jones Bank MCZ survey was designed in the absence of a defined monitoring metric. An assessment of how such a metric varies over time, with respect to the GMA, must include an understanding of how it varies in the wider ecosystem. A test, such as the Mann-Kendall Test for Monotonic Trend, can be used to assess the change of a chosen monitoring metric over time. Further work is required to develop metrics which can be used in a monitoring context. Likewise, the power to detect change in a metric must be assessed following the sample collection in a *post hoc* manner to ensure an adequate number of samples is acquired. The number of samples ultimately required for monitoring the ‘Subtidal mud’ BSH in the North-West of Jones Bank MCZ should be reviewed following the development of monitoring metrics. Generally, the number of taxa, as used presently, is not a reliable monitoring metric to assess temporal change when used in isolation, as it does not distinguish two entirely different assemblages when they contain the same number of taxa.

Future numerical analyses of the benthic assemblages must consider the relevant data manipulation methods when incorporating new datasets. Multivariate classifications of benthic assemblages must ensure nomenclature consistency through time. Failure to fully account for taxonomic changes when future data are analysed alongside the current data may artefactually influence assemblage composition and incorrectly identify taxa considered as ‘key and influential’ species.

Assessment of litter in seabed imagery is limited to large, anthropogenic inputs to the environment (e.g. lost equipment from fishing activities). Any temporal assessment of such items must take into consideration the potential for movement and burial/exposure which result from oceanographic processes. Similarly, when reporting on data from imagery techniques, the term ‘litter’ should be better defined, as current definitions (Annex 9) are based upon physical acquisition of litter sub-samples from trawl samples.

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Annex 1. Infauna data truncation

Raw taxon abundance and biomass matrices can often contain entries that include the same taxa recorded differently, erroneously or differentiated according to unorthodox, subjective criteria. Therefore, ahead of analysis, data should be checked and truncated to ensure that each row represents a legitimate taxon and they are consistently recorded within the dataset. An artificially inflated taxon list (i.e. one that has not had spurious entries removed) risks distorting the interpretation of pattern contained within the sampled assemblage.

It is often the case that some taxa have to be merged to a level in the taxonomic hierarchy that is higher than the level at which they were identified. In such situations, a compromise must be reached between the level of information lost by discarding recorded detail on a taxon's identity and the potential for error in analyses, results and interpretation if that detail is retained.

Details of the data preparation and truncation protocols applied to the infaunal datasets acquired at North-West of Jones Bank MCZ ahead of the analyses reported here are provided below:

- Taxa are often assigned as 'juveniles' during the identification stage with little evidence for their actual reproductive natural history (with the exception of some well-studied molluscs and commercial species). Many truncation methods involve the removal of all 'juveniles.' However, a decision must be made on whether removal of all juveniles from the dataset is appropriate or whether they should be combined with the adults of the same species where present. For the infaunal data collected at North-West of Jones Bank MCZ: taxa with 'juvenile' qualifiers were included in the dataset.
- Invalid taxa and fragments of countable taxa were removed from the data set, whilst the presence of colonial taxa was changed to a numeric value of one (Worsfold *et al*. 2010).
- Records of meiofauna (i.e., nematodes, copepods) were removed.
- Records of fish species were removed.
- Records indicating the presence of non-countable fragments of identified taxa were removed.

Truncation steps for the infaunal data

Truncation step	Truncation reason	Taxon name
Remove from infaunal analysis	Fragment	Glycera, *Glycinde nordmanni, Goniada, Ancistrosyllis groenlandica, Nephtys hombergii*, Lumbrineridae, Capitellidae, Maldanidae, *Galathowenia oculata*, *Owenia, Ditrupa arietina, Ampelisca spinipes*, Bivalvia, *Amphiura filiformis*
Remove from infaunal analysis	Taxa from NIOZ core sample	Tubulariidae, *Chaetoparia nilssoni, Marphysa bellii* Type A, *Terebellidae juvenile, Polycirrus, Apherusa bispinosa, Microjassa cumbrensis, Diastylis laevis*, Euphausiidae Unidentifiable, *Callianassa subterranea*, Bugulina
Include in infaunal analysis	Colonial taxa with presence recorded as numerical value of 1	*Astrorhiza limicola, Neoturris*, Bougainvilliidae, *Lovenella clausa, Earleria quadrata*, Eirenidae, *Halecium, Nemertesia, Plumularia setacea, Lytocarpia myriophyllum, Clytia gracilis, Clytia hemisphaerica, Obelia dichotoma*

Remove from infaunal analysis	Taxa not benthic invertebrates	Animalia eggs, Nematoda, *Loxosomella varians*, Copepoda, Actinopterygii eggs, Debris
Reported separately (following removal from infaunal analysis)	Not biological material	Plastic

Annex 2. Abundant infauna

Table showing a subset of taxa present at the North-West of Jones Bank MCZ in 2017 with the highest summed abundance and biomass values. The most frequently occurring taxa (present in greater than 80% of samples) and the most dominant in terms of biomass contribution (accounting for 60% total biomass) have values highlighted in bold.

Taxon	Summed abundance	Occurrence	Percentage contribution to total abundance	Mean abundance per sample	Summed biomass (*g*)	Percentage contribution to total biomass
Spiophanes kroyeri	2547	**71**	26	36	5.191	**6**
Tubulanus polymorphus	289	**68**	3	4	1.139	1
Peresiella clymenoides	371	**66**	4	5	0.350	0.4
Abyssoninoe hibernica	221	**65**	2	3	0.805	1
Corbula gibba	1333	**63**	14	19	1.614	2
Obelia dichotoma	63	**63**	N/A	N/A	N/A	N/A
Praxillella affinis	193	**60**	2	3	1.520	2
Galathowenia oculata	129	**60**	1	2	0.196	0.2
Phaxas pellucidus	1532	**58**	16	22	1.768	2
Magelona minuta	480	**58**	5	7	0.244	0.3
Nucula sulcata	111	44	1	2	7.212	**9**
Dasybranchus	163	37	2	2	22.446	**27**
Solenocera membranacea	6	6	0.1	0.1	5.040	**6**
Nephrops norvegicus	2	2	0.02	0.03	10.203	**12**

Annex 3. Infauna sample group allocation and multi variant analysis results

Group allocation following divisive *k*-R clustering of dispersion weighted, square root-transformed abundance data from North-West of Jones Bank MCZ in 2017 showing each of the 71 0.1m^2 Day grab samples infaunal assemblage group.

Sample (*Station code_Event number, Replicate_Attempt*)	*k*-R Group
NWJB071_1_A1	i*A*
NWJB070_2_A1	i*A*
NWJB069_3_A1	i*A*
NWJB068_4_A1	i*A*
NWJB067_5_A1	i*A*
NWJB066_6_A1	i*A*
NWJB065_7_A3	i*A*
NWJB064_8_A1	i*A*
NWJB063_9_A1	i*A*
NWJB054_11_A1	i*A*
NWJB056_13_A1	i*A*
NWJB057_14_A1	i*A*
NWJB058_15_A2	i*A*
NWJB060_17_A1	i*A*
NWJB052_20_A1	i*A*
NWJB051_21_A1	i*A*
NWJB050_22_A1	i*A*
NWJB049_23_A1	i*A*
NWJB048_24_A1	i*A*
NWJB047_25_A2	i*A*
NWJB046_26_A1	i*A*
NWJB036_28_A1	i*A*
NWJB037_29_A1	i*A*
NWJB038_30_A1	i*A*
NWJB039_31_A1	i*A*
NWJB040_32_A1	i*A*
NWJB041_33_A1	i*A*
NWJB042_34_A1	i*A*
NWJB043_35_A1	i*A*
NWJB035_37_A1	i*A*
NWJB032_40_A1	i*A*
NWJB031_41_A1	i*A*
NWJB030_42_A1	i*A*

Sample (*Station code_Event number, Replicate_Attempt*)	*k*-R Group
NWJB029_43_A1	i*A*
NWJB028_44_A1	i*A*
NWJB019_45_A1	i*A*
NWJB020_46_A1	i*A*
NWJB021_47_A1	i*A*
NWJB022_48_A1	i*A*
NWJB023_49_A1	i*A*
NWJB026_52_A1	i*A*
NWJB018_54_A1	i*A*
NWJB015_56_A1	i*A*
NWJB014_58_A1	i*A*
NWJB012_60_A1	i*A*
NWJB011_61_A1	i*A*
NWJB010_62_A1	i*A*
NWJB001_63_A1	i*A*
NWJB002_64_A1	i*A*
NWJB004_66_A1	i*A*
NWJB007_69_A1	i*A*
NWJB053_10_A1	i*C*
NWJB062_19_A1	i*C*
NWJB044_36_A2	i*C*
NWJB034_38_A1	i*C*
NWJB024_50_A1	i*C*
NWJB025_51_A1	i*C*
NWJB027_53_A1	i*C*
NWJB017_55_A1	i*C*
NWJB016_57_A1	i*C*
NWJB005_67_A1	i*C*
NWJB006_68_A1	i*C*
NWJB008_70_A1	i*C*
NWJB009_71_A1	i*C*
NWJB055_12_A1	i*B*
NWJB059_16_A1	i*B*
NWJB061_18_A1	i*B*
NWJB045_27_A1	i*B*
NWJB033_39_A1	i*B*
NWJB013_59_A1	i*B*
NWJB003_65_A1	i*B*

Results of a SIMPER analysis of the dispersion weighted and square root-transformed infaunal abundance data from North-West of Jones Bank MCZ in 2017, with a cut-off for low contributions of 70%, showing the average abundances, similarity (Bray-Curtis resemblance) and percentage and cumulative contribution of those taxa responsible for the within *k*-R cluster group similarity.

k-R cluster group	Taxon	Average abundance	Average similarity	Similarity SD	Contribution (%)	Cumulative contribution (%)
i*A*.	*Tubulanus polymorphus*	1.9	5.65	2.89	11.62	11.62
Average similarity: 48.67 %	*Spiophanes kroyeri*	1.52	4.42	3.3	9.08	20.7
	Galathowenia oculata	1.35	3.79	2.26	7.79	28.49
	Abyssoninoe hibernica	1.31	3.61	2.38	7.43	35.91
	Obelia dichotoma	0.94	3.19	2.56	6.54	42.46
	Glycera unicornis	1	2.58	1.34	5.31	47.77
	Peresiella clymenoides	0.98	2.53	1.77	5.19	52.96
	Eclysippe vanelli	0.84	1.73	1.05	3.56	56.52
	Praxillella affinis	0.71	1.6	1.29	3.29	59.81
	Prionospio dubia	0.77	1.56	0.89	3.2	63.01
	Nephtys hystricis	0.74	1.29	0.69	2.64	65.65
	Nucula sulcata	0.68	1.23	0.75	2.52	68.18
	Dasybranchus	0.67	1.21	0.72	2.49	70.67
i*C*.	*Tubulanus polymorphus*	2.09	3.93	2.02	8.4	8.4
Average similarity: 46.74 %	*Peresiella clymenoides*	1.59	3	3.72	6.42	14.83
	Eclysippe vanelli	1.34	2.58	5.74	5.51	20.34
	Spiophanes kroyeri	1.22	2.29	3.91	4.89	25.23
	Prionospio dubia	1.12	2.14	3.76	4.57	29.8
	Praxillella affinis	1.13	1.91	1.8	4.09	33.89
	Abyssoninoe hibernica	1.13	1.73	1.37	3.71	37.6
	Magelona minuta	0.97	1.7	3.35	3.63	41.23

k-R cluster group	Taxon	Average abundance	Average similarity	Similarity SD	Contribution (%)	Cumulative contribution (%)
	Phaxas pellucidus	0.93	1.62	3.32	3.47	44.7
	Poecilochaetus serpens	0.95	1.45	1.1	3.09	47.8
	Corbula gibba	0.83	1.28	2.42	2.73	50.53
	Ampharete falcata	0.83	1.25	1.85	2.68	53.21
	Ampelisca spinipes	0.83	1.25	1.11	2.68	55.89
	Obelia dichotoma	0.69	1.1	0.89	2.35	58.24
	Aricidea (Acmira) laubieri	0.75	1.08	1.13	2.3	60.54
	Abra nitida	0.78	1.07	1.21	2.28	62.83
	Owenia	0.65	0.87	0.73	1.86	64.69
	Lumbrineris	0.76	0.84	0.72	1.8	66.49
	Mediomastus fragilis	0.8	0.83	0.84	1.78	68.27
	Terebellides	0.71	0.82	0.87	1.75	70.02
i*B*.	*Tubulanus polymorphus*	1.66	6.05	1.45	16.32	16.32
Average similarity: 37.07 %	*Spiophanes kroyeri*	1.38	4.76	1.93	12.83	29.15
	Abyssoninoe hibernica	1.3	3.64	0.9	9.81	38.96
	Obelia dichotoma	0.86	3.62	1.53	9.75	48.72
	Peresiella clymenoides	0.87	2.88	1.32	7.77	56.49
	Praxillella affinis	0.69	2.5	1.42	6.75	63.24
	Galathowenia oculata	0.86	2.49	0.93	6.71	69.95
	Dasybranchus	0.68	1.52	0.6	4.11	74.05

Results of the SIMPER analysis of the dispersion weighted and square root-transformed infaunal abundance data from North-West of Jones Bank MCZ in 2017, with a cut-off for low contributions of 70%, showing the comparison of average abundances between *k*-R cluster groups iA and iC.

Taxon	Group i*A* average abundance	Group i*C* average abundance	Average dissimilarity	Dissimilarity SD	Contribution (%)	Cumulative contribution (%)
Galathowenia oculata	1.35	0.73	1.27	1.36	2.17	2.17
Nephtys hystricis	0.74	0.56	1.08	1.15	1.85	4.02
Thyasira polygona	0.62	0.74	1.08	1.09	1.84	5.86
Poecilochaetus serpens	0.51	0.95	1.04	1.25	1.77	7.63
Glycera unicornis	1.00	0.68	1.03	1.20	1.76	9.39
Tubulanus polymorphus	1.90	2.09	1.02	1.11	1.74	11.12
Peresiella clymenoides	0.98	1.59	1.00	1.39	1.71	12.83
Lumbrineris	0.29	0.76	0.98	1.12	1.68	14.51
Phaxas pellucidus	0.23	0.93	0.98	2.32	1.66	16.17
Mediomastus fragilis	0.61	0.80	0.95	1.33	1.62	17.79
Dasybranchus	0.67	0.07	0.94	1.12	1.60	19.39
Eclysippe vanelli	0.84	1.34	0.93	1.34	1.59	20.98
Owenia	0.00	0.65	0.93	1.23	1.58	22.56
Praxillella affinis	0.71	1.13	0.92	1.25	1.56	24.13
Nucula sulcata	0.68	0.64	0.91	1.26	1.55	25.68
Ampelisca spinipes	0.56	0.83	0.89	1.24	1.52	27.2
Abyssoninoe hibernica	1.31	1.13	0.89	1.17	1.51	28.71
Abra nitida	0.23	0.78	0.88	1.54	1.51	30.22
Phoronis	0.12	0.67	0.88	1.2	1.50	31.72
Aricidea (Acmira) laubieri	0.37	0.75	0.88	1.23	1.50	33.22
Prionospio dubia	0.77	1.12	0.86	1.12	1.47	34.69
Terebellides	0.39	0.71	0.85	1.25	1.44	36.13

Taxon	Group i*A* average abundance	Group i*C* average abundance	Average dissimilarity	Dissimilarity SD	Contribution (%)	Cumulative contribution (%)
Ampharete falcata	0.32	0.83	0.84	1.56	1.44	37.57
Magelona minuta	0.51	0.97	0.83	1.40	1.42	38.99
Nephtys hombergii	0.31	0.57	0.81	0.99	1.37	40.36
Eunoe nodosa	0.28	0.50	0.79	0.91	1.35	41.71
Corbula gibba	0.33	0.83	0.79	1.32	1.34	43.06
Falcidens crossotus	0.26	0.54	0.78	1.04	1.33	44.38
Scoloplos armiger	0.32	0.49	0.77	0.97	1.31	45.69
Spiophanes kroyeri	1.52	1.22	0.76	1.24	1.30	46.99
Cerebratulus	0.26	0.49	0.75	0.97	1.28	48.27
Parvicardium minimum	0.01	0.54	0.72	1.20	1.23	49.49
Bougainvilliidae	0.47	0.46	0.70	0.97	1.20	50.69
Nemertea	0.21	0.51	0.70	1.05	1.19	51.89
Neoturris	0.55	0.62	0.70	0.95	1.19	53.08
Ampelisca spinifer	0.05	0.42	0.68	0.79	1.15	54.23
Lovenella clausa	0.12	0.46	0.64	0.92	1.09	55.32
Notomastus	0.29	0.34	0.63	0.82	1.07	56.39
Leucothoe lilljeborgi	0.25	0.38	0.62	0.87	1.07	57.45
Glycinde nordmanni	0.24	0.48	0.62	1.05	1.05	58.50
Ampharete lindstroemi Type A	0.13	0.42	0.59	0.82	1.00	59.51
Timoclea ovata	0.06	0.38	0.58	0.79	0.99	60.50
Prionospio fallax	0.16	0.38	0.58	0.84	0.99	61.48
Nephtys kersivalensis	0.35	0.15	0.57	0.77	0.97	62.45
Goniada maculata	0.00	0.42	0.56	0.76	0.95	63.40

Taxon	Group i*A* average abundance	Group i*C* average abundance	Average dissimilarity	Dissimilarity SD	Contribution (%)	Cumulative contribution (%)
Turritella communis	0.16	0.33	0.55	0.75	0.94	64.34
Earleria quadrata	0.37	0.08	0.54	0.78	0.92	65.26
Jasmineira caudata	0.06	0.39	0.54	0.80	0.92	66.19
Prionospio multibranchiata	0.27	0.28	0.53	0.87	0.90	67.09
Nephtys incisa	0.28	0.19	0.51	0.69	0.88	67.97
Echinoidea juvenile	0.05	0.39	0.51	0.83	0.86	68.83
Scolelepis korsuni	0.22	0.19	0.48	0.69	0.81	69.64
Sorgenfreispira brachystoma	0.13	0.29	0.47	0.73	0.80	70.45

Results of the SIMPER analysis of the dispersion weighted and square root-transformed infaunal abundance data from North-West of Jones Bank MCZ in 2017, with a cut-off for low contributions of 70%, showing the comparison of average abundances between *k*-R cluster groups iA and iB.

Taxon	Group *iA* average abundance	Group *iB* average similarity	Average dissimilarity	Dissimilarity SD	Contribution (%)	Cumulative contribution (%)
Abyssoninoe hibernica	1.31	1.3	1.8	1.45	3.07	3.07
Glycera unicornis	1	0.29	1.73	1.38	2.95	6.02
Eclysippe vanelli	0.84	0.16	1.62	1.42	2.76	8.78
Tubulanus polymorphus	1.9	1.66	1.61	1.23	2.73	11.52
Prionospio dubia	0.77	0.57	1.56	1.29	2.66	14.18
Galathowenia oculata	1.35	0.86	1.56	1.27	2.65	16.83
Nucula sulcata	0.68	0.73	1.48	1.24	2.51	19.34
Nephtys hystricis	0.74	0.49	1.45	1.13	2.47	21.81
Spiophanes kroyeri	1.52	1.38	1.42	1.34	2.43	24.24
Thyasira polygona	0.62	0.4	1.42	1.02	2.42	26.66
Dasybranchus	0.67	0.68	1.39	1.25	2.37	29.02
Ampelisca spinipes	0.56	0	1.12	0.97	1.92	30.94
Poecilochaetus serpens	0.51	0.14	1.12	0.89	1.91	32.85
Mediomastus fragilis	0.61	0.27	1.11	1.25	1.89	34.74
Peresiella clymenoides	0.98	0.87	1.1	1.27	1.87	36.62
Neoturris	0.55	0.57	1.04	0.97	1.78	38.39
Scoloplos armiger	0.32	0.34	1.01	0.84	1.73	40.12
Bougainvilliidae	0.47	0	1	0.93	1.7	41.82
Lumbrineris	0.29	0.34	0.98	0.83	1.67	43.49
Earleria quadrata	0.37	0.29	0.92	0.88	1.57	45.06
Praxillella affinis	0.71	0.69	0.91	1.26	1.56	46.61
Magelona minuta	0.51	0.4	0.9	1.25	1.54	48.15

Taxon	Group *iA* average abundance	Group *iB* average similarity	Average dissimilarity	Dissimilarity SD	Contribution (%)	Cumulative contribution (%)
Nephtys hombergii	0.31	0.2	0.9	0.78	1.53	49.68
Notomastus	0.29	0.2	0.85	0.69	1.45	51.13
Nephtys incisa	0.28	0.2	0.83	0.69	1.42	52.55
Glycinde nordmanni	0.24	0.34	0.81	1.01	1.39	53.94
Terebellides	0.39	0.1	0.81	0.88	1.38	55.32
Aricidea (Acmira) laubieri	0.37	0	0.73	0.72	1.24	56.55
Falcidens crossotus	0.26	0.16	0.72	0.71	1.23	57.79
Nephtys kersivalensis	0.35	0	0.72	0.69	1.23	59.02
Cerebratulus	0.26	0.14	0.7	0.68	1.19	60.21
Scalibregma inflatum	0.08	0.29	0.7	0.68	1.19	61.4
Leucothoe lilljeborgi	0.25	0.14	0.67	0.68	1.14	62.54
Kirkegaardia	0.04	0.29	0.66	0.65	1.13	63.66
Prionospio multibranchiata	0.27	0.12	0.65	0.78	1.11	64.77
Glycera alba	0.04	0.29	0.64	0.65	1.1	65.87
Leiochone tricirrata	0.02	0.29	0.62	0.64	1.06	66.93
Ampharete falcata	0.32	0.13	0.59	1.07	1	67.93
Corbula gibba	0.33	0.25	0.59	1.14	1	68.93
Scolelepis korsuni	0.22	0.11	0.58	0.67	0.98	69.91
Eunoe nodosa	0.28	0	0.54	0.6	0.92	70.82

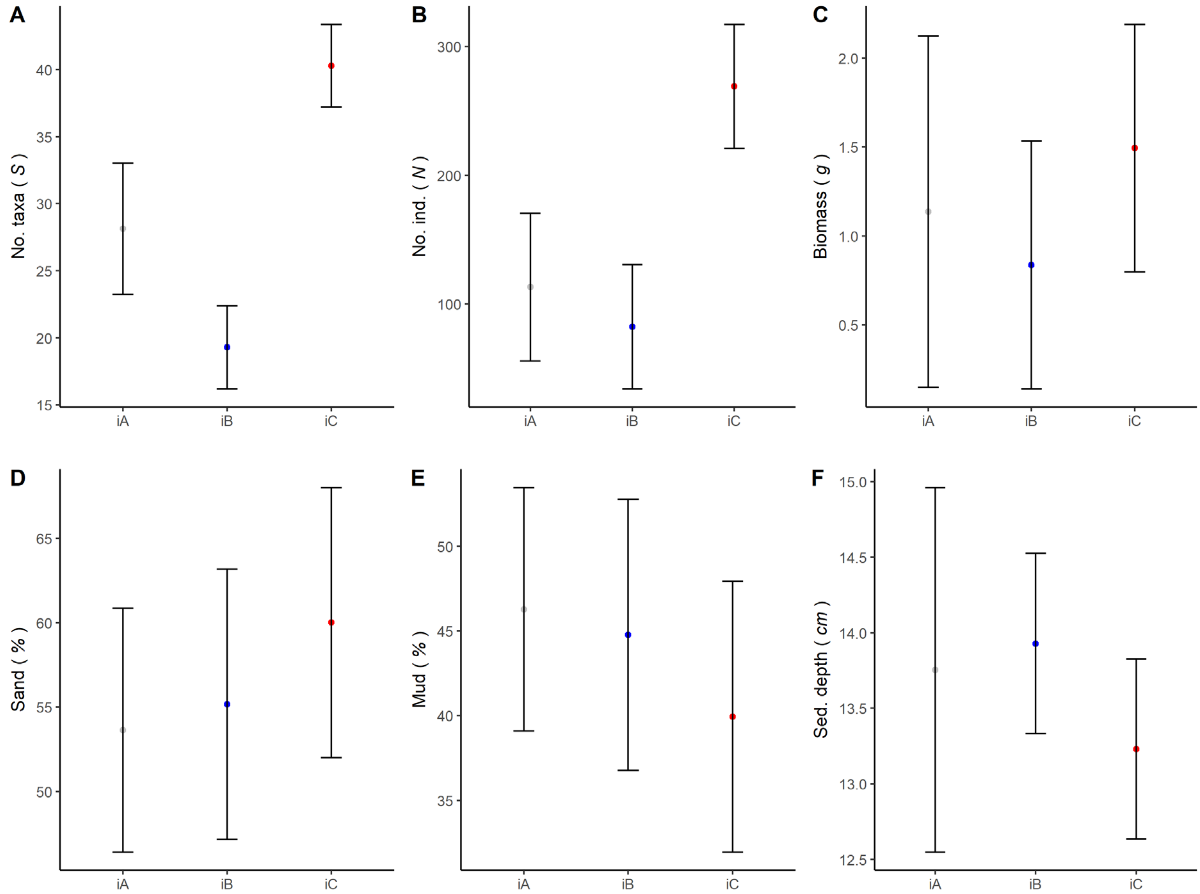
Results of the SIMPER analysis of the dispersion weighted and square root-transformed infaunal abundance data from North-West of Jones Bank MCZ in 2017, with a cut-off for low contributions of 70%, showing the comparison of average abundances between *k*-R cluster groups iC and iB.

Taxon	Group i*C* average abundance	Group i*B* average abundance	Average dissimilarity	Dissimilarity SD	Contribution (%)	Cumulative contribution (%)
Eclysippe vanelli	1.34	0.16	1.87	2.75	2.79	2.79
Tubulanus polymorphus	2.09	1.66	1.47	1.24	2.19	4.98
Abyssoninoe hibernica	1.13	1.3	1.45	1.3	2.17	7.15
Poecilochaetus serpens	0.95	0.14	1.4	1.47	2.08	9.23
Prionospio dubia	1.12	0.57	1.35	1.56	2.01	11.24
Ampelisca spinipes	0.83	0	1.33	1.64	1.98	13.22
Phaxas pellucidus	0.93	0.06	1.32	3.23	1.97	15.19
Thyasira polygona	0.74	0.4	1.25	1.01	1.86	17.05
Galathowenia oculata	0.73	0.86	1.24	1.17	1.85	18.9
Peresiella clymenoides	1.59	0.87	1.24	1.4	1.84	20.74
Aricidea (Acmira) laubieri	0.75	0	1.17	1.48	1.74	22.49
Lumbrineris sp.	0.76	0.34	1.15	1.13	1.72	24.21
Nucula sulcata	0.64	0.73	1.13	1.31	1.69	25.9
Abra nitida	0.78	0.11	1.1	1.59	1.63	27.53
Nephtys hystricis	0.56	0.49	1.08	1.03	1.62	29.15
Dasybranchus sp.	0.07	0.68	1.08	1.07	1.61	30.76
Ampharete falcata	0.83	0.13	1.07	1.88	1.6	32.36
Mediomastus fragilis	0.8	0.27	1.05	1.28	1.56	33.92
Nephtys hombergii	0.57	0.2	1.04	1.04	1.56	35.48
Spiophanes kroyeri	1.22	1.38	1.03	1.26	1.53	37.01
Terebellides	0.71	0.1	1.02	1.29	1.52	38.53
Owenia	0.65	0.14	1	1.16	1.5	40.02

Taxon	Group i*C* average abundance	Group i*B* average abundance	Average dissimilarity	Dissimilarity SD	Contribution (%)	Cumulative contribution (%)
Glycera unicornis	0.68	0.29	1	1.08	1.49	41.51
Phoronis	0.67	0.1	0.99	1.21	1.48	43
Magelona minuta	0.97	0.4	0.99	1.44	1.48	44.48
Corbula gibba	0.83	0.25	0.99	1.45	1.47	45.95
Praxillella affinis	1.13	0.69	0.95	1.21	1.42	47.36
Scoloplos armiger	0.49	0.34	0.93	0.99	1.38	48.75
Falcidens crossotus	0.54	0.16	0.92	1.05	1.37	50.12
Cerebratulus	0.49	0.14	0.84	0.94	1.26	51.38
Eunoe nodosa	0.5	0	0.79	0.75	1.18	52.56
Neoturris	0.62	0.57	0.79	0.94	1.18	53.74
Parvicardium minimum	0.54	0.08	0.78	1.16	1.16	54.9
Ampelisca spinifer	0.42	0	0.77	0.77	1.14	56.04
Glycinde nordmanni	0.48	0.34	0.75	1.15	1.13	57.17
Bougainvilliidae	0.46	0	0.74	0.88	1.1	58.27
Lovenella clausa	0.46	0.14	0.73	0.92	1.09	59.35
Nemertea	0.51	0	0.73	0.88	1.08	60.44
Goniada maculata	0.42	0.14	0.7	0.82	1.04	61.47
Notomastus	0.34	0.2	0.68	0.74	1.02	62.49
Leucothoe lilljeborgi	0.38	0.14	0.67	0.83	1.01	63.5
Jasmineira caudata	0.39	0.21	0.67	0.93	1.01	64.5
Timoclea ovata	0.38	0	0.65	0.76	0.97	65.47
Leiochone tricirrata	0.26	0.29	0.65	0.79	0.96	66.43
Glycera alba	0.23	0.29	0.62	0.77	0.93	67.36

Taxon	Group i*C* average abundance	Group i*B* average abundance	Average dissimilarity	Dissimilarity SD	Contribution (%)	Cumulative contribution (%)
Ampharete lindstroemi Type A	0.42	0	0.59	0.77	0.89	68.24
Turritella communis	0.33	0.11	0.58	0.71	0.87	69.12
Prionospio fallax	0.38	0	0.57	0.78	0.85	69.97
Obelia dichotoma	0.69	0.86	0.57	0.74	0.85	70.82

Annex 4. Plots of infauna *k*-R cluster groups against abundance, number of species, biomass, sand and mud content and grab penetration depth



Plots showing mean (coloured circle) and 95 % confidence intervals (bars) for metrics derived from the abundance infauna data matrix (a, b, & c), the PSD analysis (d & e) and ship board processing of the 0.1m^2 Day grab samples (f) for each infaunal group (the number of samples in infaunal groups iA, iB and iC is 51, 7 and 13 respectively) from North-West of Jones Bank MCZ in 2017.

Annex 5. Epifauna data truncation

Where appropriate, organisms enumerated using percentage cover, but with small values, were converted to presence-only measurements of abundance (Presence = 1).

Adamsia palliata has a commensal relationship with *Pagurus prideaux* and coincident records of both species were adjusted to reflect this. Records of *Pagurus* sp. were transferred to *P. prideaux* where *A. palliata* was observed in the same 'sample' whilst *A. palliata* records were changed from percentage cover to counts.

Hydroid records were combined into an unidentified faunal turf, whilst tentative identifications for all taxa were combined into a lower taxonomic level.

Specific identifications of polychaetes (Terribellida [17], *M. sarsi* [9], *S. pavonina* [325], *S. pavonina* tube only [284]) were combined to Polychaeta because of the difficulty in accurately identifying polychaetes without microscopic analysis of specimens.

All records of fish were removed.

Truncation steps for the epifaunal data from North-West of Jones Bank MCZ in 2017.

Taxon ID	Qualifier	Change	Abundance	Method used for estimation of abundance
Animalia	red??nudibranch	Add to Nudibranchia	8	0. count
Polychaeta	Tube	Remove	0	SACFOR
U_faunal turf		Change to 1	0	1. percentage cover
Cnidaria			9	0. count
Hydrozoa		Change to 1 add to U_Faunal turf	0	1. percentage cover
Lytocarpia myriophyllum		Change to 1 add to U_Faunal turf	4	1. percentage cover
Anthozoa		combine with Cnidaria	12	0. count
Anthozoa	anemone sp A	combine with Cnidaria	1	0. count
Anthozoa	anemone sp B	combine with Cnidaria	1	0. count
Pennatulacea		Remove	0	0. count
Virgularia mirabilis			5694	0. count
Ceriantharia			40	0. count
Cerianthus lloydii			341	0. count
Pachycerianthus multiplicatus			10	0. count
Arachnanthus sarsi			173	0. count
Actiniaria	indet.	Add to Actiniaria indet	251	0. count

Actiniaria	sp A (Halcampidae/ Edwardsiidae?)	Add to Actiniaria indet	106	0. count
Bolocera tuediae			1	0. count
Urticina	sp		1	0. count
Sagartiidae			12	0. count
Adamsia palliata		Change to counts, match with P. prideaux	3	1. percentage cover
Halcampoides abyssorum	tentative	Add to Actiniaria indet	1	0. count
Haloclavidae			10	0. count
Peachia cylindrica			32	0. count
Polychaeta	indet.		0	0. count
Terebellida		Add to Polychaeta	17	0. count
Taxon ID	**Qualifier**	**Change**	**Abundance**	**Method used for estimation of abundance**
Myxicola sarsi		Add to Polychaeta	9	0. count
Sabella pavonina		Add to Polychaeta	325	0. count
Sabella pavonina	tube only	Add to Polychaeta	284	0. count
Serpulidae		Remove	0	1. percentage cover
Decapoda			54	0. count
Caridea			1331	0. count
Nephrops norvegicus			99	0. count
Paguridae			29	0. count
Pagurus prideaux			3	0. count
Galatheoidea			166	0. count
Munida rugosa			69	0. count
Brachyura			15	0. count
Goneplax rhomboides			5	0. count
Gastropoda			2	0. count
Nudibranchia			25	0. count
Coleoidea		Combine with Sepiolidae	3	0. count
Sepiolidae			119	0. count
Eledone cirrhosa			27	0. count
Astropecten irregularis			10	0. count
Asterias rubens			3	0. count
Pisces		Remove	1	0. count
Myxine glutinosa		Remove	1	0. count

Scyliorhinus	juv	Remove	1	0. count
Actinopterygii		Remove	22	0. count
Conger conger		Remove	1	0. count
Trisopterus luscus		Remove	1	0. count
Sebastidae		Incorrect - *Capros aper*. Remove	1	0. count
Pleuronectiformes		Remove	72	0. count
Lepidorhombus whiffiagonis		Remove	9	0. count
Pleuronectes platessa		Remove	1	0. count

Truncated taxon list for the epifauna data from North-West of Jones Bank MCZ in 2017.

Taxon ID
Faunal turf
Cnidaria
Virgularia mirabilis
Ceriantharia
Cerianthus lloydii
Pachycerianthus multiplicatus
Arachnanthus sarsi
Actiniaria
Bolocera tuediae
Urticina
Sagartiidae
Adamsia palliata
Haloclavidae
Peachia cylindrica
Polychaeta
Decapoda
Caridea
Nephrops norvegicus
Paguridae
Pagurus prideaux
Galatheoidea
Munida rugosa
Brachyura
Goneplax rhomboides
Gastropoda
Nudibranchia
Sepiolidae
Eledone cirrhosa
Astropecten irregularis
Asterias rubens

Annex 6. Epifauna multi variant analysis sample group allocation and results

Sample allocation to *k*-R cluster class for North-West of Jones Bank MCZ in 2017.

Factor Groups Sample	Cut-off for low contributions: 70% *k*-R_SIMPROF
NWJB009_STN_73_A1	e*C*
NWJB008_STN_74_A1	e*C*
NWJB007_STN_75_A1	e*C*
NWJB004_STN_78_A1	e*C*
NWJB003_STN_79_A1	e*C*
NWJB012_STN_84_A1	e*C*
NWJB018_STN_90_A1	e*C*
NWJB025_STN_93_A1	e*C*
NWJB019_STN_99_A1	e*C*
NWJB039_STN_114_A1	e*C*
NWJB006_STN_76_A1	e*A*
NWJB005_STN_77_A1	e*A*
NWJB014_STN_86_A1	e*A*
NWJB015_STN_87_A1	e*A*
NWJB017_STN_89_A1	e*A*
NWJB026_STN_92_A1	e*A*
NWJB024_STN_94_A1	e*A*
NWJB023_STN_95_A1	e*A*
NWJB022_STN_96_A1	e*A*
NWJB021_STN_97_A1	e*A*
NWJB020_STN_98_A1	e*A*
NWJB002_STN_80_A1	e*B*
NWJB001_STN_81_A1	e*B*
NWJB010_STN_82_A1	e*B*
NWJB011_STN_83_A1	e*B*
NWJB013_STN_85_A2	e*B*
NWJB016_STN_88_A1	e*D*
NWJB028_STN_100_A1	e*D*
NWJB029_STN_101_A1	e*D*
NWJB030_STN_102_A1	e*D*
NWJB031_STN_103_A1	e*D*
NWJB032_STN_104_A1	e*D*
NWJB033_STN_105_A1	e*D*
NWJB034_STN_106_A1	e*D*
NWJB036_STN_111_A1	e*D*
NWJB037_STN_112_A1	e*D*
NWJB038_STN_113_A1	e*D*
NWJB040_STN_115_A1	e*D*
NWJB041_STN_116_A1	e*D*

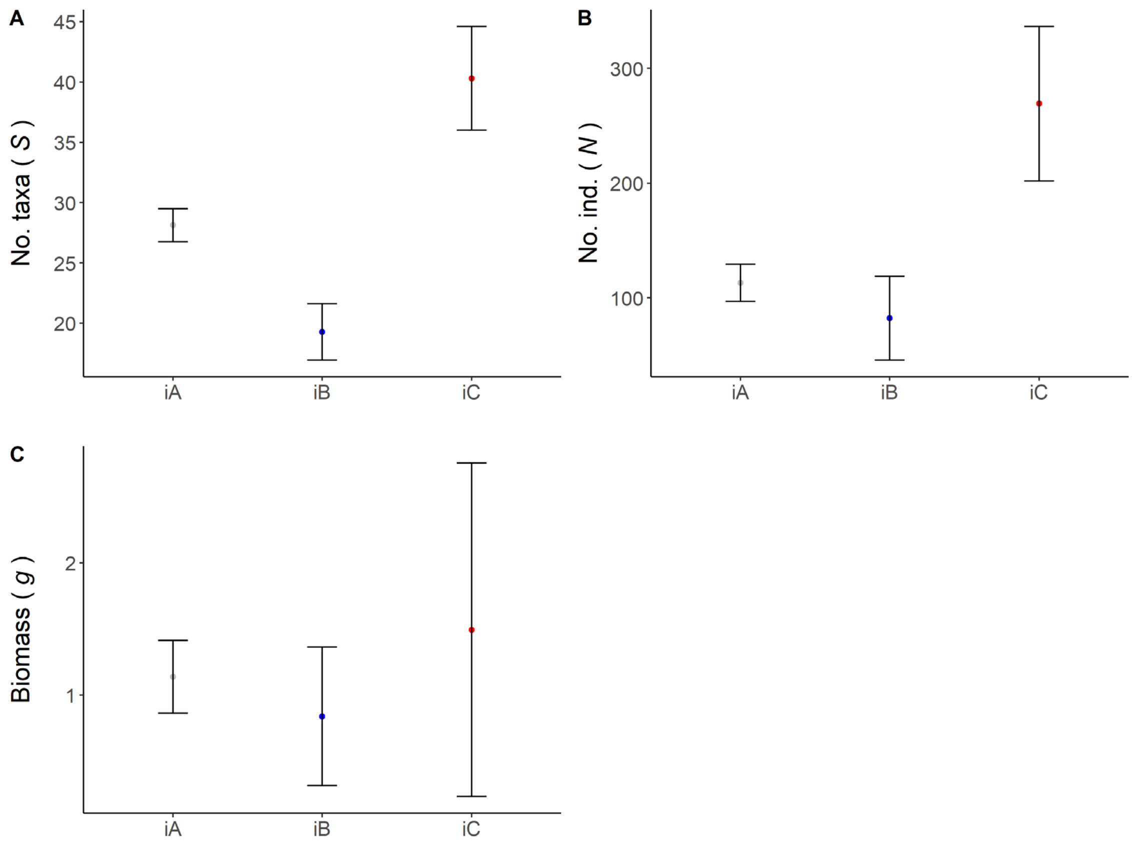
NWJB042_STN_117_A1	*eD*
NWJB043_STN_118_A1	*eD*
NWJB052_STN_119_A1	*eD*
NWJB051_STN_120_A1	*eD*
NWJB049_STN_122_A1	*eD*
NWJB048_STN_123_A1	*eD*
NWJB047_STN_124_A1	*eD*
NWJB046_STN_125_A1	*eD*
NWJB045_STN_126_A1	*eD*
NWJB054_STN_128_A1	*eD*
NWJB055_STN_129_A1	*eD*
NWJB056_STN_130_A1	*eD*
NWJB057_STN_131_A1	*eD*
NWJB058_STN_132_A1	*eD*
NWJB059_STN_133_A1	*eD*
NWJB069_STN_139_A1	*eD*
NWJB068_STN_140_A1	*eD*
NWJB067_STN_141_A1	*eD*
NWJB066_STN_142_A1	*eD*
NWJB065_STN_143_A1	*eD*
NWJB064_STN_144_A1	*eD*
NWJB063_STN_145_A1	*eD*
NWJB027_STN_91_A1	*eE*
NWJB035_STN_107_A1	*eE*
NWJB044_STN_108_A1	*eE*
NWJB050_STN_121_A1	*eE*
NWJB053_STN_127_A1	*eE*
NWJB060_STN_134_A1	*eE*
NWJB061_STN_135_A1	*eE*
NWJB062_STN_136_A1	*eE*
NWJB071_STN_137_A1	*eE*
NWJB070B_STN_138_A1	*eE*

Within-group similarity for k-R cluster groups from SIMPER analysis of epifauna data from North-West of Jones Bank MCZ in 2017.

Group e*A*	Average similarity: 68.67				
Species	Avg Abund	Avg Sim	Sim/SD	Contrib%	Cum.%
Virgularia mirabilis	46.64	47.99	3.83	69.89	69.89
Actiniaria	5.64	4.22	1.77	6.15	76.04
Group e*B*	Average similarity: 63.11				
Caridea	47.4	38.70	3.19	61.32	61.32
Actiniaria	6.2	5.70	6.86	9.03	70.35
Group e*C*	Average similarity: 63.83				
Virgularia mirabilis	26.8	26.95	1.43	42.22	42.22
Polychaeta	18.4	24.53	2.66	38.42	80.64
Group e*D*	Average similarity: 66.73				
Virgularia mirabilis	85.11	43.52	3.73	65.23	65.23
Caridea	26.29	9.23	1.28	13.84	79.06
Group e*E*	Average similarity: 73.76				
Virgularia mirabilis	191.6	66.53	6.22	89.90	89.90

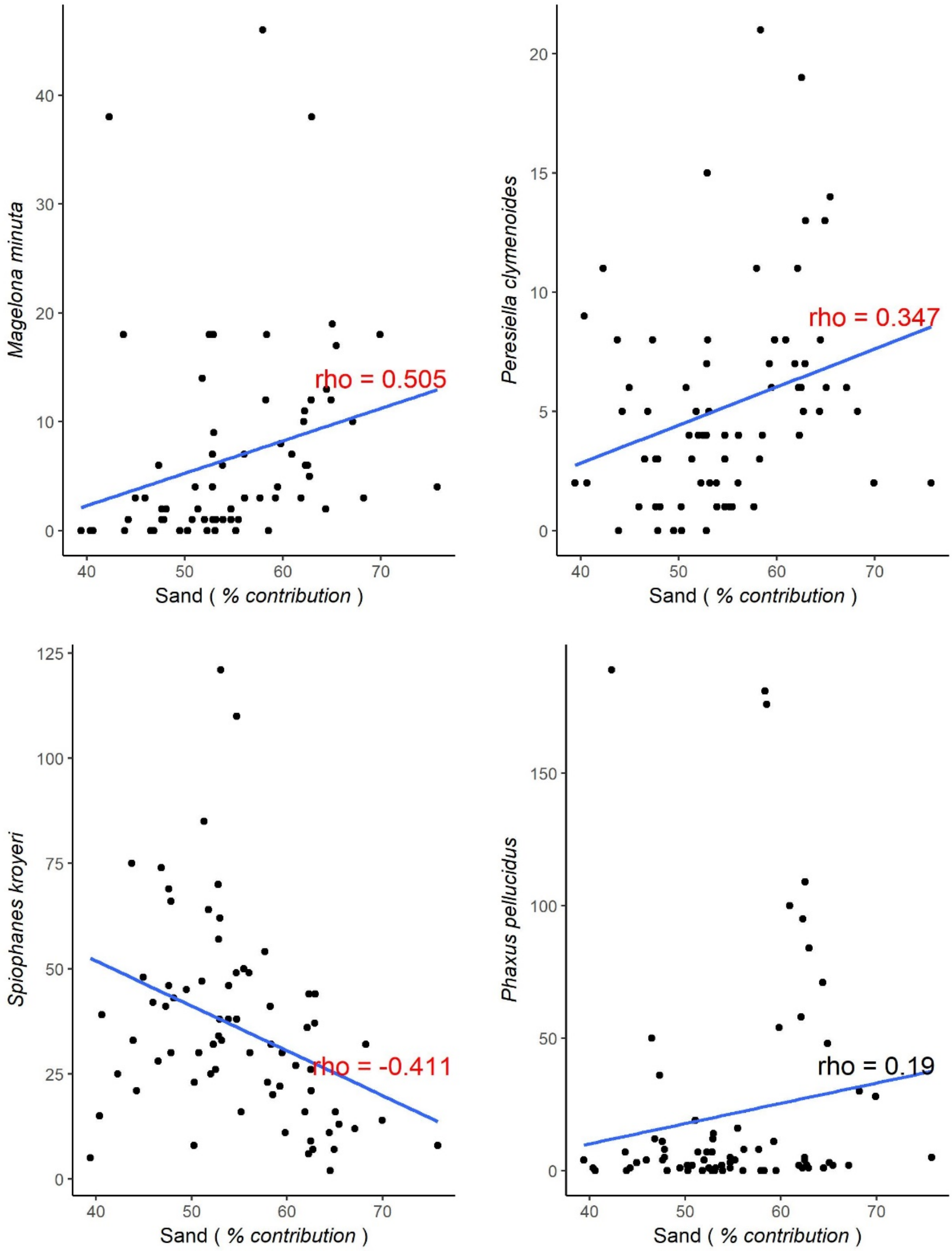
Between group similarity for k-R cluster groups from SIMPER analysis of epifauna data from North-West of Jones Bank MCZ in 2017.

Groups e*C* & e*A*	Average dissimilarity = 46.79%					
	Group eC	Group eA				
Species	Avg Abund	Avg Abund	Avg Diss	Diss/SD	Contrib%	Cum.%
Virgularia mirabilis	26.8	46.64	17.29	1.25	36.95	36.95
Polychaeta	18.4	3.73	10.87	2.19	23.23	60.18
Actiniaria	2.1	5.64	2.79	1.26	5.96	66.15
Nephrops norvegicus	0.4	4.09	2.78	0.95	5.94	72.09
Groups e*C* & e*B*	Average dissimilarity = 74.64%					
	Group e*C*	Group e*B*				
Caridea	1.3	47.4	31.21	2.74	41.82	41.82
Virgularia mirabilis	26.8	3.6	16.01	1.74	21.45	63.27
Polychaeta	18.4	4	10.06	2.27	13.48	76.74
Groups e*A* & e*B*	Average dissimilarity = 72.56%					
	Group e*A*	Group e*B*				
Caridea	1.73	47.4	27.47	2.65	37.86	37.86
Virgularia mirabilis	46.64	3.6	26.36	3.08	36.34	74.2
Groups e*C* & e*D*	Average dissimilarity = 55.82%					
	Group e*C*	Group e*D*				
Virgularia mirabilis	26.8	85.11	27.18	1.78	48.7	48.7
Caridea	1.3	26.29	11.1	1.38	19.89	68.59
Polychaeta	18.4	9.57	5.39	1.51	9.66	78.25
Groups e*A* & e*D*	Average dissimilarity = 44.66%					
	Group e*A*	Group e*D*				
Virgularia mirabilis	46.64	85.11	17.45	1.43	39.07	39.07
Caridea	1.73	26.29	10.09	1.36	22.6	61.67
Polychaeta	3.73	9.57	3.08	1.14	6.9	68.56
Cerianthus lloydii	4.45	6.34	2.18	1.14	4.89	73.45
Groups e*B* & e*D*	Average dissimilarity = 62.56%					
	Group e*B*	Group e*D*				
Virgularia mirabilis	3.6	85.11	34.12	3.18	54.54	54.54
Caridea	47.4	26.29	13.26	1.43	21.19	75.73
Groups e*C* & e*E*	Average dissimilarity = 71.90%					
	Group e*C*	Group e*E*				
Virgularia mirabilis	26.8	191.6	54.9	3.97	76.35	76.35
Groups e*A* & e*E*	Average dissimilarity = 59.27%					
	Group e*A*	Group e*E*				
Virgularia mirabilis	46.64	191.6	44.93	3.34	75.81	75.81
Groups e*B* & e*E*	Average dissimilarity = 82.81%					
	Group e*B*	Group e*E*				
Virgularia mirabilis	3.6	191.6	57.99	5.46	70.03	70.03
Groups e*D* & e*E*	Average dissimilarity = 44.64%					
	Group e*D*	Group e*E*				
Virgularia mirabilis	85.11	191.6	27.87	1.77	62.42	62.42
Caridea	26.29	14.2	7.03	1.12	15.76	78.18



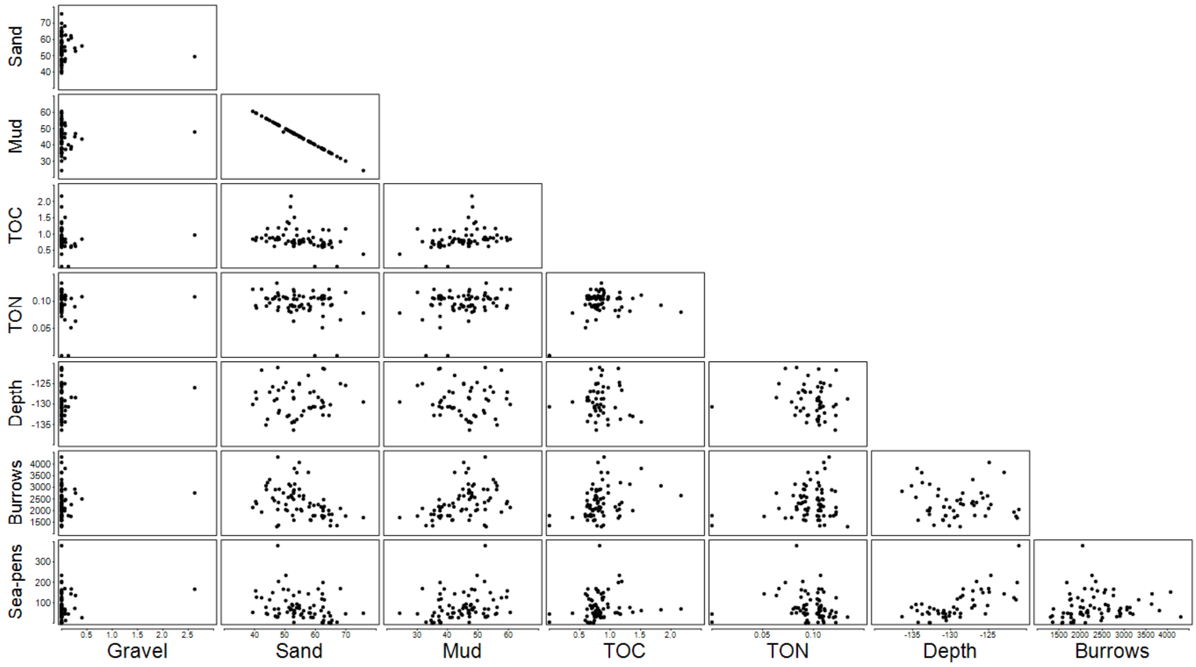
Plots showing mean (coloured circle) and 95 % confidence intervals (bars) for metrics derived from the on-board processing and sediment analyses of the Day grab samples from North-West of Jones Bank MCZ in 2017 for each infaunal group (the number of samples in infaunal groups iA, iB and iC is 51, 7 and 13 respectively).

Annex 7. Correlation of assemblage-driving taxa with sand content



Correlations between the percentage contribution of sand (derived from the PSD analysis) and a select number of taxa (identified from reviewing the SIMPER analysis of the dispersion weighted, square root-transformed abundance data between the *k*-R cluster groups and the average abundances of taxa driving the divergence) for North-West of Jones Bank MCZ in 2017. Significant correlations are indicated in red.

Annex 8. Scatterplot of Sea-pen numbers against burrow density



Draftsman plot of environmental variables Gravel (%), Sand (%), Mud (%), TOC (g), TON (g) and Depth (m) against total number of sea-pens and total number of burrows observed at North-West of Jones Bank MCZ in 2017.

Pearson correlations and significance value of environmental variables Gravel (%), Sand (%), Mud (%), TOC (g), TON (g) and Depth (m) against total number of sea-pens and total number of burrows observed at North-West of Jones Bank MCZ in 2017. Significant (***ρ*** ≤0.05) correlations in italics.

	Gravel	Sand	Mud	TOC	TON	Sea-pens	Burrows	Depth
Gravel								
Sand	-0.07, 0.589							
Mud	0.02, 0.841	*-1.00, 0.000*						
TOC	0.01, 0.967	*-0.31, 0.008*	*0.31, 0.008*					
TON	0.01, 0.907	*-0.25, 0.034*	*0.25, 0.034*	*0.33, 0.006*				
Sea-pens	0.16, 0.178	*-0.26, 0.027*	*0.26, 0.031*	0.14, 0.244	-0.12, 0.310			
Burrows	0.09, 0.457	*-0.42, 0.000*	*0.42, 0.000*	*0.33, 0.005*	0.17, 0.165	0.12, 0.319		
Depth	0.11, 0.446	0.05, 0.749	-0.05, 0.722	-0.04, 0.806	-0.11, 0.425	*0.69, 0.000*	-0.10, 0.469	

Annex 9. Marine litter categories

Categories and sub-categories of litter items for Sea-Floor from the OSPAR/ICES/IBTS for North-East Atlantic and Baltic. Guidance on Monitoring of Marine Litter in European Seas, a guidance document within the Common Implementation Strategy for the Marine Strategy Framework Directive, MSFD Technical Subgroup on Marine Litter, 2013.

A: Plastic	B: Metals	C: Rubber	D: Glass/ Ceramics	E: Natural products/ Clothes	F: Miscellaneous
A1. Bottle	B1. Cans (food)	C1. Boots	D1. Jar	E1. Clothing/ rags	F1. Wood (processed)
A2. Sheet	B2. Cans (beverage)	C2. Balloons	D2. Bottle	E2. Shoes	F2. Rope
A3. Bag	B3. Fishing related	C3. Bobbins (fishing)	D3. Piece	E3. Other	F3. Paper/ cardboard
A4. Caps/ lids	B4. Drums	C4. Tyre	D4. Other		F4. Pallets
A5. Fishing line (monofilament)	B5. Appliances	C5. Other			F5. Other
A6. Fishing line (entangled)	B6. Car parts				
A7. Synthetic rope	B7. Cables				
A8. Fishing net	B8. Other				
A9. Cable ties					
A10. Strapping band					
A11. Crates and containers					
A12. Plastic diapers					
A13. Sanitary towels/ tampons					
A14. Other					

Related size categories
A: ≤ 5*5cm = 25cm²
B: ≤ 10*10cm = 100cm²
C: ≤ 20*20cm = 400cm²
D: ≤ 50*50cm = 2500cm²
E: ≤ 100*100cm = 10000cm²
F: ≥ 100*100cm = 10000cm²

Annex 10. Non-indigenous species lists

Taxa listed as NIS (present and horizon) which have been selected for assessment of Good Environmental Status in GB waters under MSFD Descriptor 2 (Stebbing *et al.* 2014).

Species name	List	Species name	List
Acartia (Acanthacartia) tonsa	Present	*Alexandrium catenella*	Horizon
Amphibalanus amphitrite	Present	*Amphibalanus reticulatus*	Horizon
Asterocarpa humilis	Present	*Asterias amurensis*	Horizon
Bonnemaisonia hamifera	Present	*Caulerpa racemose*	Horizon
Caprella mutica	Present	*Caulerpa taxifolia*	Horizon
Crassostrea angulata	Present	*Celtodoryx ciocalyptoides*	Horizon
Crassostrea gigas	Present	*Chama sp.*	Horizon
Crepidula fornicata	Present	*Dendostrea frons*	Horizon
Diadumene lineata	Present	*Gracilaria vermiculophylla*	Horizon
Didemnum vexillum	Present	*Hemigrapsus penicillatus*	Horizon
Dyspanopeus sayi	Present	*Hemigrapsus sanguineus*	Horizon
Ensis directus	Present	*Hemigrapsus takanoi*	Horizon
Eriocheir sinensis	Present	*Megabalanus coccopoma*	Horizon
Ficopomatus enigmaticus	Present	*Megabalanus zebra*	Horizon
Grateloupia doryphora	Present	*Mizuhopecten yessoensis*	Horizon
Grateloupia turuturu	Present	*Mnemiopsis leidyi*	Horizon
Hesperibalanus fallax	Present	*Ocenebra inornate*	Horizon
Heterosigma akashiwo	Present	*Paralithodes camtschaticus*	Horizon
Homarus americanus	Present	*Polysiphonia subtilissima*	Horizon
Rapana venosa	Present	*Pseudochattonella verruculosa*	Horizon
Sargassum muticum	Present	*Rhopilema nomadica*	Horizon
Schizoporella japonica	Present	*Telmatogeton japonicus*	Horizon
Spartina townsendii var. anglica	Present		
Styela clava	Present		
Undaria pinnatifida	Present		
Urosalpinx cinerea	Present		
Watersipora subatra	Present		

Additional taxa listed as NIS in the JNCC ‘Non-native marine species in British waters: a review and directory’ report by Eno *et al*. (1997) which have not been selected for assessment of Good Environmental Status in GB waters under MSFD.

Species name (1997)	**Updated name (2017)**
Thalassiosira punctigera	
Thalassiosira tealata	
Coscinodiscus wailesii	
Odontella sinensis	
Pleurosigma simonsenii	
Grateloupia doryphore	
Grateloupia filicina var. luxurians	*Grateloupia subpectinata*
Pikea californica	
Agardhiella subulate	
Solieria chordalis	
Antithamnionella spirographidis	
Antithamnionella ternifolia	
Polysiphonia harveyi	*Neosiphonia harveyi*
Colpomenia peregrine	
Codium fragile subsp. Atlanticum	
Codium fragile subsp. tomentosoides	*Codium fragile* subsp. *atlanticum*
Gonionemus vertens	
Clavopsella navis	*Pachycordyle navis*
Anguillicoloides crassus	
Goniadella gracilis	
Marenzelleria viridis	
Clymenella torquata	
Hydroides dianthus	
Hydroides ezoensis	
Janua brasiliensis	
Pileolaria berkeleyana	
Ammothea hilgendorfi	
Elminius modestus	*Austrominius modestus*
Eusarsiella zostericola	
Corophium sextonae	
Rhithropanopeus harrissii	
Potamopyrgus antipodarum	

Species name (1997)	Updated name (2017)
Tiostrea lutaria	*Tiostrea chilensis*
Mercenaria mercenaria	
Petricola pholadiformis	
Mya arenaria	

Annex 11. Acknowledgement

Marine Conservation Zone (MCZ) Monitoring Report 2017

MPA Monitoring Programme

Contract Reference: MB0129

Report Number: 20

Version 4

April 2020

Marine Protected Areas Survey Coordination & Evidence Delivery Group

This work was delivered by Cefas and JNCC on behalf of the Marine Protected Areas Survey Coordination & Evidence Delivery Group (MPAG) and sponsored by Defra. MPAG was established in November 2012 and continued until March 2020. MPAG, was originally established to deliver evidence for Marine Conservation Zones (MCZs) recommended for designation. In 2016, the programme of work was refocused towards delivering the evolving requirements for Marine Protected Area (MPA) data and evidence gathering to inform the assessment of the condition of designated sites and features by SNCBs, in order to inform Secretary of State reporting to Parliament. MPAG was primarily comprised of members from Defra and its delivery bodies which have MPA evidence and monitoring budgets and/or survey capability. Members included representatives from Defra, JNCC, Natural England, Cefas, the Environment Agency, the Inshore Fisheries Conservation Authorities (IFCAs) and the Marine Management Organisation (MMO)).

Since 2010, offshore MPA surveys and associated reporting have been delivered by JNCC and Cefas through a JNCC\Cefas Partnership Agreement (which remained the vehicle for delivering the offshore survey work funded by MPAG between 2012 and 2020).

Cefas

JNCC

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