Lizard Point Special Area of Conservation

Condition Monitoring Survey 2017

First published February 2024

Natural England Research Report NECR533

www.gov.uk/natural-england

NATURAL ENGLAND

Natural England Research Report NECR533

Lizard Point Special Area of Conservation. Condition Monitoring Survey 2017

C. P. Cesar

Published February 2024

Catalogue code: NECR533

Project details

This report should be cited as:

Cesar, C.P., 2022. Lizard Point Special Area of Conservation. Condition Monitoring Survey. MPA Monitoring Programme Report No. NECR533. Department for Environment, Food and Rural Affairs (Defra).

Natural England Project Manager

Mike Young

Contractor

Environment Agency

Author

Dr Christopher P. Cesar, Environment Agency

Keywords

Monitoring, evidence, conservation, special areas of conservation (sac), habitats directive (the), coastal network (the).

Further information

This report can be downloaded from the Natural England Access to Evidence Catalogue: **http://publications.naturalengland.org.uk/** . For information on Natural England publications contact the Natural England Enquiry Service on 0300 060 3900 or e-mail **enquiries@naturalengland.org.uk**.

Executive summary

Special Areas of Conservation (SACs) are designated under the EU Habitats Directive for a range of species and habitats. Under Article 17 of the Directive, Statutory Nature Conservation Bodies (SNCBs) must report on the implementation of the Directive every six years. To inform this, SNCBs undertake a programme of SAC monitoring. To fulfil its obligations, the Department for Environment, Farming and Rural Affairs (Defra) has directed the 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) and enshrined into UK law under the UK Marine Strategy (UKMS).

Natural England is the SNCB responsible for marine nature conservation between 0 and 12 nm from the coast. SNCBs utilise evidence gathered by targeted environmental and ecological surveys and site specific MPA reports in conjunction with other evidence (including information on activities, pressures, historical data, and survey data collected by other organisations and to meet different obligations). These data are collectively used by SNCBs to assess 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 within the site. This report in itself does not aim to assess the condition of the designated features or provide advice on the management of anthropogenic activities occurring within the site.

This document explores environmental and ecological data acquired from a drop-down camera survey of Lizard Point SAC in 2017. This report will inform a later condition assessment and management activities for this site. The report compares the features of the SAC in 2017 with those recorded in previous surveys.

Lizard Point SAC is an inshore site at the most southerly point of mainland Great Britain. The site is characterised by rock cliffs interspersed with sandy coves. Coastal and offshore habitats are comprised of bedrock and boulders with areas overlain with mobile sediments. Within Lizard Point SAC, Annex I reef features and infralittoral and circalittoral rock subfeatures are designated for protection.

The majority of imagery data gathered in 2017 were assigned to circalittoral rock habitats, with infralittoral rock and subtidal sediments also recorded. Annex I reef habitats were identified in over half of the images captured in 2017 and these were widespread throughout the SAC. There was no indication that the extents of these features had changed in comparison with previous years data.

The biotopes and associated taxa recorded in the 2017 survey were typically at a relatively coarse resolution in comparison to historic data. Despite this, there was no evidence that there had been significant changes in the biotopes, notable species or ecological function and structure within the SAC.

A number of recommendations for future surveying, interpretation and assessment of the SAC are provided. These include aiming to maximise the resolution at which habitats and species are recorded, bespoke surveys aimed at quantifying the extents of designated features and subfeatures and the identification of key structural and functional taxa in future monitoring.

Contents

1. Introduction

Lizard Point SAC is part of a network of UK national sites designed to meet conservation objectives under the Conservation of Habitats and Species Regulations 2017 (as amended following the UK's withdrawal from the European Union). These sites are intended to contribute to an ecologically coherent network of MPAs across the North East Atlantic, as agreed under the Oslo Paris (OSPAR) Convention and other international commitments to which the UK is a signatory.

Every six years, the UK is required to report on the conservation status of habitats and species listed under Annexes I, II, IV and V of the European Council Directive 92/43/EEC, known as the Habitats Directive. In order to fulfil its obligations, Defra has directed the Statutory Nature Conservation Bodies (SNCBs) to carry out a programme of MPA monitoring. The SNCB responsible for nature conservation in inshore waters (between 0 nm and 12 nm from the coast) is Natural England (NE). Where possible, it is intended that this monitoring will also inform assessment of the status of the wider UK marine environment; for example, assessment of whether GES has been achieved, as required under Article 11 of the MSFD and enshrined into UK law under the UK Marine Strategy (UKMS).

This monitoring report primarily explores data acquired from the 2017 post-designation monitoring survey of Lizard Point SAC. The specific aims of the report are detailed in Section 1.3.

This report does not assess the condition of the designated features. The SNCBs use the evidence provided from this report and other sources to make assessments on the condition of designated features within an MPA. The preliminary condition assessments provided in Section 4.5 are therefore indicative only.

1.1 Site overview

Lizard Point Site of Community Importance (SCI) was formally submitted by the Government to the European Commission as a candidate Special Area of Conservation (cSAC) for its Annex 1 reef features in August 2010 and confirmed as a SCI in November 2011. The status of the site changed to an SAC in September 2017.

Lizard Point is the most southerly point on mainland Great Britain (Figure 1). The coastal upstanding rocky reef extends out to around 2 kilometres offshore and extends along the coastal margin for a distance of around 24 km from Pedngwinian Point in the west to Carrick Luz in the east. The coastline is characterised by rock cliffs inset with sandy coves. The site is exposed to the Atlantic Ocean, and experiences full salinity conditions given the absence of any freshwater land runoff (Axelsson and Dewey, 2011; Birchenough *et al*., 2008). The SAC covers an area of almost 14,000 ha.

Lizard Point has an unusual variety of bedrock origins. Both the coastal and offshore areas consist of submerged bedrock and boulders of complex geological origin, interspersed by extensive areas of thin, coarse mobile sediment overlying flat sedimentary bedrock to the south and east, and the flat metamorphic bedrock to the west (Birchenough *et al*., 2008). The exposed upstanding rocky reef extends to around 7 km offshore and reaches depths of up to 80 m.

This variety of bedrock is unique to the Lizard Point SCI with no other SAC in the area having a similar underlying geology (Birchenough *et al*., 2008). Based on information presented in previous data (i.e., Birchenough *et al*., 2008; Axelsson and Dewey, 2011), the Lizard Point cSAC Regulation 35 conservation advice documentation (Reg. 35) (Natural England, 2012) highlighted a number of 'key' biotopes and species within Lizard Point. These species include *Alcyonium glomeratum*, *Corynactis viridis*, *Pentapora fascialis* throughout). The pink sea fan *Eunicella verrucosa* is also considered worthy of note within the reef-dwelling fauna of Lizard Point SAC (Axelsson and Dewey, 2011). Although not designated for this SAC, this is listed as a UK BAP Priority Species (UK Biodiversity Action Plan, 2007).

Algae cover much of the exposed infralittoral rock, whilst the tideswept circalittoral rock surfaces are populated mostly by suspension feeding fauna, notably soft corals such as dead-man's fingers *Alcyonium digitatum*, ascidians, particularly *Dendrodoa grossularia*, sea anemones including jewel anemones *Corynactis viridis*, sandaled anemones *Actinothoe sphyrodeta* and Devonshire cup coral *Caryophyllia smithii*, as well as encrusting and massive sponges, especially the rock-boring *Cliona celata* at greater depths (Birchenough *et al*., 2008).

Horizontal circalittoral rock surfaces no deeper than ~25 m can also sustain foliose red and brown algae such as *Drachiella spectabilis*, *Delesseria sanguinea* and *Dictyopteris membranacea*. Deeper and more sheltered aspects are often covered with a thin organic veneer of hydroids, encrusting sponges and bryozoans, as well as erect examples such as the oaten pipes hydroid *Tubularia indivisa*, sea chervil *Alcyonidium diaphanum*, Ross coral *Pentapora fascialis* and occasionally the pink sea-fan priority BAP species, *Eunicella verrucosa* (Birchenough *et al*., 2008). 'Fragile sponge and anthozoan communities on rock habitats' (a habitat included in the UK Biodiversity Action Plan list of priority habitats; UKBAP, 2008) is also found in Lizard Point SCI, particularly on tideswept circalittoral rock surfaces (Axelsson and Dewey, 2011).

The Reg. 35 guidance (Natural England, 2012) in addition to previous monitoring reports (Birchenough *et al*., 2008; Axelsson and Dewey, 2011) also highlighted the key dominant biotopes present within Lizard Point SAC. Coastal upstanding reefs within the SAC were characterised by IR.HIR.KFar.LhypR ('*Laminaria hyperborean* with dense foliose red seaweeds on exposed infralittoral rock') and IR.HIR.KFar.FoR ('Foliose red seaweeds on exposed lower infralittoral rock'). Areas dominated by flat, rocky reef habitats were characterised by CR.HCR.XFa.ByErSp ('Bryozoan turf and erect sponges on tide-swept circalittoral rock') and CR.MCR.EcCr.CarSp ('*Caryophyllia (Caryophyllia) smithii*, sponges and crustose communities on wave-exposed circalittoral rock). CR.MCR.EcCr.CarSp also characterised much of the area dominated by offshore, upstanding reef habitats. CR.HCR.XFa.CvirCri ('*Corynactis viridis* and a mixed turf of crisiids, *Bugula*, *Scrupocellaria*, and *Cellaria* on moderately tide-swept exposed circalittoral rock') and CR.HCR.XFa.SpNemAdia ('Sparse sponges, *Nemertesia* spp. and *Alcyonidium diaphanum* on circalittoral mixed substrata') were also frequently recorded in this habitat.

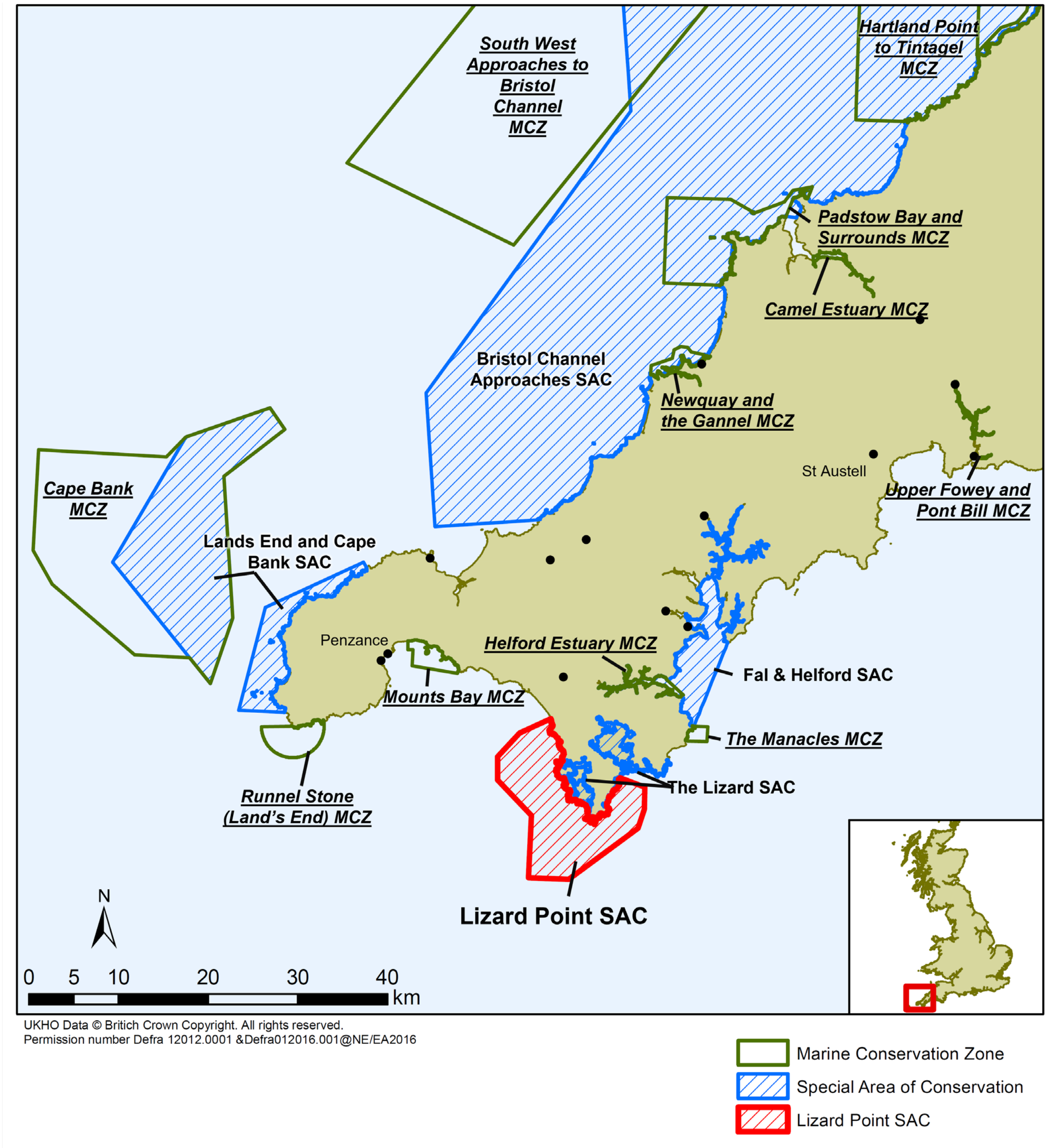

Figure 1. Location of Lizard Point SAC. Nearby SACs (bold font) and MCZs (underlined) are highlighted.

1.2 Existing data

Comparisons will be made between the 2017 monitoring data and baseline data gathered in August 2010. Baseline data were gathered by SeaStar Survey Ltd and the Centre for Environment, Fisheries and Aquaculture Science (Cefas) using a drop down camera survey (Axelsson and Dewey, 2011). Twenty one tow lines were surveyed within Lizard Point SAC, representing a total tow length of 48.1 km. These surveys gathered and analysed a total of 1298 still images. Of these, 709 images were gathered by SeaStar Survey Ltd in the nearshore zone of the SAC and 589 images were gathered by Cefas in the offshore region of the SAC. Infralittoral rock habitats were primarily located in the nearshore areas of the survey zone, with circalittoral rock habitats more common further offshore (Figure 2). Throughout the SAC, rocky reef habitats were interspersed with areas of sediment habitat (Figure 2). The data gathered in 2010 provide a baseline against which change can be compared with the 2017 data.

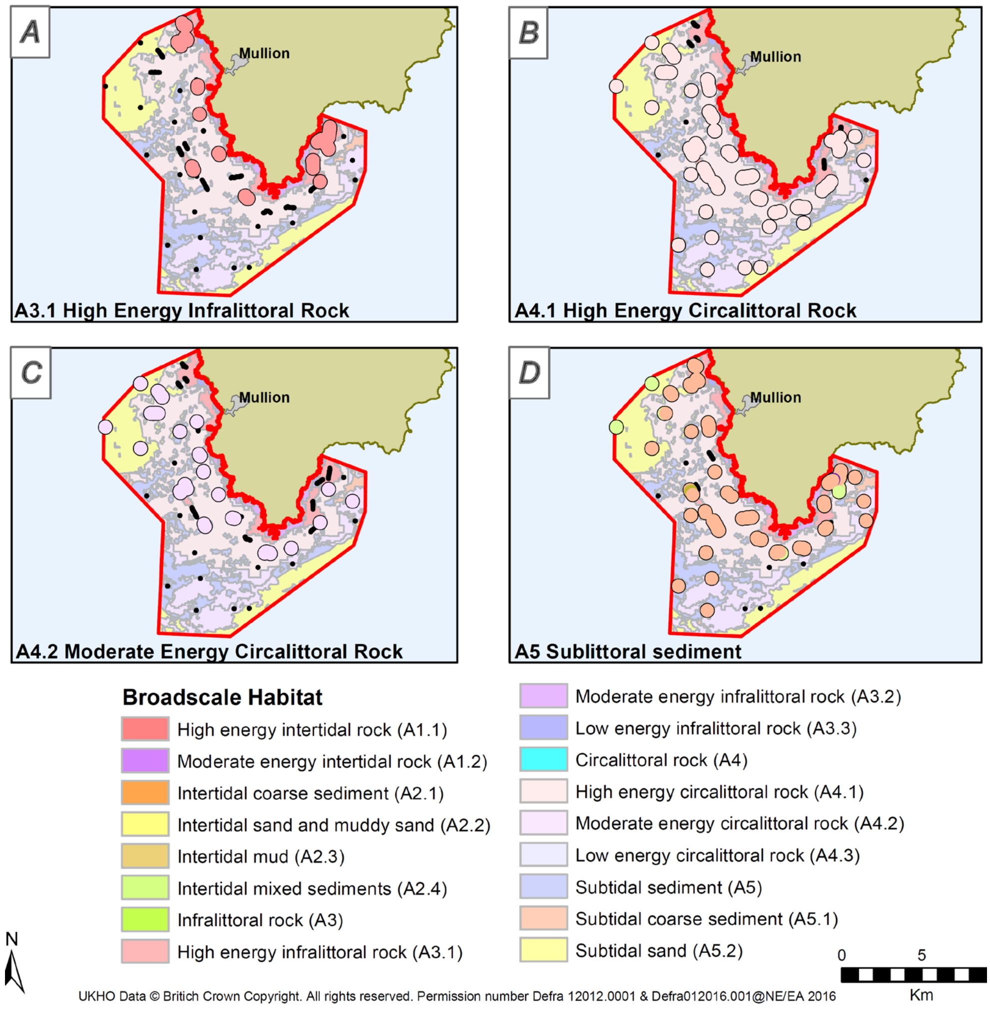

Figure 2. Distribution of still images assigned to Broadscale Habitats (BSHs) during the 2010 Lizard Point SAC survey. For sublittoral sediments (panel D), the majority of images were assigned to 'A5.1 Subtidal coarse sediment', with two images (green circles) assigned to 'A5.4 Subtidal mixed sediments'. Background polygons are the modelled BSHs taken from the Marine Evidence database.

1.3 Aims and objectives

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' conservation status.

As detailed on the Natural England Designated Sites View website (Natural England, 2022) the conservation objectives for the site, subject to natural change are:

1. The integrity of the site is maintained or restored as appropriate.
2. The site contributes to achieving the Favourable Conservation Status of its qualifying features.

Definition of favourable condition

Favourable conservation status, with respect to a habitat feature, means that, subject to natural change:

- Its extent and distribution are stable or increasing;
- Its structures and functions, including its quality, and the composition of its characteristic biological communities, are such as to ensure that it remains in a condition which is healthy and not deteriorating; and
- Its natural supporting processes are unimpeded.

The extent of a habitat feature refers to the total area in 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 habitats (Elliott *et al*., 1998). The distribution of a habitat feature influences the component communities present and represents the structure and function of the habitat (JNCC, 2004).

Structure encompasses the physical components of a habitat type, the key and influential species present, and incorporates topography, habitat 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. The function of habitat features includes processes such as: elemental cycling, benthic-pelagic coupling, habitat modification, primary and secondary production, and recruitment dynamics. Habitat features rely on a range of supporting processes (e.g., hydrodynamic regime, water quality) which act to support their functioning as well as their resilience (e.g., the ability to recover following impact).

Report aims and objectives

The primary aim of this report is to describe the attributes of the designated features within Lizard Point SAC. This information will contribute to the future assessment and monitoring of feature condition. The results presented will be used to develop recommendations for future monitoring, including the operational testing of specific metrics which may indicate whether the condition of the feature has been maintained, is improving or is in decline.

The broad objectives of this monitoring report are provided below:

1) Provide a description of the extent, distribution, structural and functional attributes of the designated features within the site (see Table 1 for more detail), to enable subsequent condition monitoring and assessment;
2) Note observations of any Annex I habitats, features of conservation importance and OSPAR Threatened and/or Declining Species and Habitats not covered as features of the site;
3) Present evidence relating to non-indigenous species (Descriptor 2) and marine litter (Descriptor 10), to satisfy requirements of the UK Marine Strategy (formerly MSFD);
4) Record any anthropogenic activities or pressures encountered during the dedicated monitoring survey;
5) 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.

Reporting sub-objectives (Objective 1)

To achieve Objective 1, a number of reporting sub-objectives will be addressed to provide evidence for Feature Attributes and supporting processes as defined in the Supplementary Advice on Conservation Objectives (SACOs) developed by Natural England for Lizard Point SAC[1]. The specific attributes that have been surveyed and described in this report are listed in Table 1. Additional attributes, largely pertaining to the physical and physico-chemical properties of the site, were beyond the scope of this monitoring work. Additional information on these attributes is available in the SACO.

[1] SACO for Lizard Point SAC (accessed 09/11/2021)

Table 1. Attributes monitored as part of the 2017 Lizard Point SAC condition assessment monitoring survey.

Feature/ Subfeature	Attribute	Target
Annexe I reefs; Infralittoral rock; Circalittoral rock	Extent and distribution	Maintain the total extent and spatial distribution of reef, infralittoral rock and circalittoral rock, and spatial distribution as defined on the map, subject to natural variation in sediment veneer
Annexe I reefs; Infralittoral rock; Circalittoral rock	Distribution: presence and distribution of biological communities	Maintain the presence and spatial distribution of reef, infralittoral rock and circalittoral rock communities
Annexe I reefs; Infralittoral rock; Circalittoral rock	Structure and function: presence and abundance of key structural and influential species	[Maintain OR Recover OR Restore] the abundance of listed species[2], to enable each of them to be a viable component of the habitat.
Annexe I reefs; Infralittoral rock; Circalittoral rock	Structure: species composition of component communities	Maintain the species composition of component communities
Annexe I reefs; Infralittoral rock; Circalittoral rock	Structure: non-native species and pathogens (habitat)	Restrict the introduction and spread of non-native species and pathogens, and their impacts

2. Methods

2.1 Survey design

The aim of the 2017 survey was to replicate the stations visited and methodologies adopted as part of the 2010 survey of Lizard Point SAC. These stations were selected to cover the relevant features: flat bedrock and upstanding offshore reef (Axelsson and Dewey, 2011). In addition to revisiting previously visited locations, additional stations were visited in 2017 that were not visited in 2010 (Figure 3).

[2] The Lizard Point SAC Supplementary Advice refers the reader to Covey *et al*. (2016). A copy of this paper has been requested.

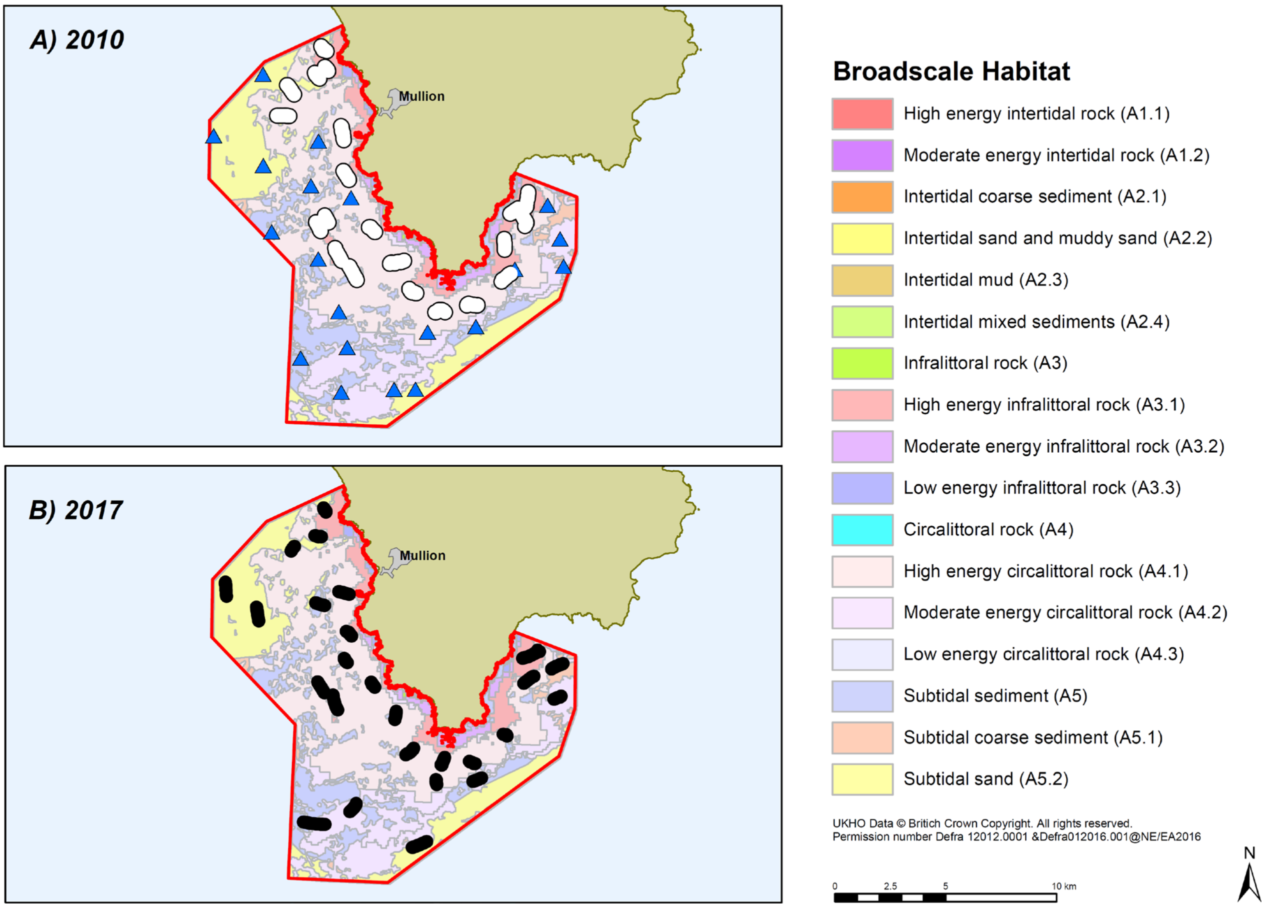

Figure 3. Location of images captured within Lizard Point SAC. A) The 2010 baseline survey was conducted by SeaStar Survey Ltd (white) and Cefas (blue triangles); B) The 2017 survey was conducted by the Cornish IFCA. Background polygons are the modelled BSHs taken from the Marine Evidence database

2.2 Data acquisition and processing

A drop camera survey of Lizard Point SAC was conducted over five days between August and October 2017 by the Cornwall Inshore Fisheries and Conservation Authority (CIFCA). Stations were accessed by the research vessel *RV Tiger Lily*. Detailed survey reports are provided by CIFCA (see Jenkin *et al*., 2017) and summarised here. Surveying was carried out in line with Mapping European Seabed Habitats (MESH) recommended operating guidelines for underwater video and photographic imaging techniques and aimed to replicate the methods adopted in the 2010 survey (Coggan *et al*., 2007).

The 2017 imagery survey was conducted using a drift tow approach with a SeaSpyder camera system. The SeaSpyder was 'flown' just above the seabed, recording video imagery. The camera frame was periodically landed on the seabed to allow high quality still images to be captured at a frequency of one image every 60 seconds. The targeted speed over ground of the survey vessel was aimed at 0.3 knots for the duration of every tow. This value varied between 0.3 and 1.5 knots depending on the tidal state. Tows were not carried out when the drift speed exceeded 1 knot. Field notes were made during each camera deployment, noting station and sample metadata, real-time observations of substrate and taxa, an initial assessment of the range of Broadscale Habitats (BSHs) seen and the general quality of the imagery.

2.3 Image analysis

Analysis of video and still imagery data was conducted by MarineSpace Ltd. (2018). Analyses followed the protocols detailed in JNCC and Natural England/Cefas guidance (Parry, 2015).

Video segments and still images were assigned to BSHs and information on the physical nature of the habitat were recorded, including substrate type and seabed morphology. Video segments containing the Annex I reef habitat were tagged. Taxa were identified to the highest taxonomic level practicable. Some taxa could not confidently be assigned to a particular taxon. In these instances, taxa were labelled according to morphological features (e.g., “Rhodophyta (foliose”). Taxon abundances were determined as counts or percentage cover and a semi quantitative SACFOR abundance was also recorded.

All imagery data were included in subsequent analyses. Current guidance (Turner *et al*., 2016) recommends that imagery data at less than ‘good’ quality are excluded from analysis. However, an important aim of the current report is to compare 2017 data with those gathered in 2010. All of the data gathered as part of the 2010 survey were included in the assessment (Axelsson and Dewey, 2011). No indication of image quality was recorded. As such, to enable comparison with historic data, all data gathered in 2017 were included in the analysis.

2.4 Data preparation and statistical analyses

Data preparation

Prior to analysis, taxonomic data were checked against information in the World Register of Marine Species[3] to ensure that taxonomic nomenclature was up to date and that there

[3] Available at https://www.marinespecies.org/ (accessed 11/05/2022)

were no taxon synonyms in the data which might artificially inflate apparent taxon abundances.

Digital imagery data are best suited for the identification and relative abundances of sessile taxa. Although highly motile taxa, including fish, are often observed in such data, imagery data are not an efficient methodology to quantify such aspects of the community. Occasional observations of fish taxa in imagery data will likely therefore give an artificial and inconsistent inflation of taxon richness which could potentially influence other trends in the data. As such, fish taxa were removed prior to statistical analysis of the data.

Prior to analysis, taxon abundance data were converted from ordinal SACFOR classes to numerical values. Values were assigned from 1 to 6 to reflect increasing taxon abundances, with 1 representing 'rare' and 6 representing 'superabundant' taxa. These converted numerical values allowed statistical analyses to be conducted on the data as described below.

Statistical analyses

Data were analysed using a combination of univariate and multivariate approaches as outlined below. Unless stated otherwise, all analyses were conducted in the R (version 4.02) software environment (R Core Team, 2020).

Univariate analyses

Ecologists often reduce multidimensional biological assemblage data to single variables which provide a univariate reflection of the multivariate biological diversity of the data. The use of univariate values allows traditional univariate statistical approaches, such as analysis of variance, to be carried out. As the taxonomic data are semi-quantitative in nature (i.e., using SACFOR abundance), univariate statistical analyses were restricted to taxon richness values (i.e., the number of taxa recorded in images) (*cf.* Curtis, 2017).

Multivariate analyses

Multivariate analyses can provide additional insight into the taxa that drive the differences between assemblages. It is common to transform taxon abundance data prior to conducting multivariate analyses to reduce the influence that highly abundant taxa have when comparing assemblages (Clarke and Warwick, 2001). In addition, data transformation is often carried out to satisfy statistical assumptions for certain analyses (Clarke and Warwick, 2001, but see Warton *et al.*, 2012). As the data analysed here can be considered as essentially transformations of quantitative data. As such, no additional transformation of this data was necessary.

Differences in the structure of assemblages between habitats were assessed using permutational multivariate analysis of variance using the 'adonis2' function in the R package 'vegan' (McArdle and Anderson, 2001; Oksanen *et al.*, 2022). Comparisons were based on 999 permutations of "Bray-Curtis" distance matrices. Where significant differences between assemblage groups were apparent (α = 0.05), post-hoc comparisons were calculated by re-running the adonis2 function for each pair of habitat groups. *P* values were adjusted for multiple comparisons using the Holm method (Holm, 1979) in the R function ‘p.adjust’.

Non-metric multidimensional scaling (nmMDS) ordination plots were produced to compare biological assemblages between BSHs. nmMDS plots allow us to visualise the similarity of multivariate assemblages in a reduced number of dimensions. Effectively, the distance between two points in a nmMDS ordination is a measure of how similar two samples are. Points in close proximity are more similar in terms of the identity and the abundance of taxa present. Ordinations were generated using the ‘metaMDS’ routine in the ‘vegan’ package for R (Clarke 1993; Oksanen *et al*., 2020).

The taxa driving differences between assemblages were highlighted using similarity percentages (SIMPER) (Clarke, 1993) using the ‘simper’ routine in the R package ‘vegan’. This function identifies the taxa contributing most to the Bray-Curtis dissimilarity between groups of samples.

2.5 Non-indigenous species (NIS)

The taxa recorded in the imagery data were cross-referenced against lists of non - indigenous species selected for the assessment of Good Environmental Status in GB waters under MSFD Descriptor 2, Ecological Status assessment for WFD Water Bodies (coastal and estuarine) and identified as significant by the GB Non-Native Species Secretariat. These taxa are listed in Appendix 2 Non-indigenous species.

3. Results

3.1 Imagery overview

The still images captured as part of the benthic habitat survey of Lizard Point SAC in 2017 were generally of ‘good’ quality (77.4% of images, n = 680), though some ‘poor’ (10.6%, n = 93) and ‘very poor’ (2.8%, n = 25) images were also captured. No visual quality was recorded for 9% of images (n = 81). The majority of the 100 video segments were of ‘good’ quality (91% of video segments). Some ‘poor’ video was captured (3%) in addition to some ‘very poor’ segments (5%). One video segment did not capture any seabed imagery.

There were some discrepancies in how imagery data were assigned to BSHs. This was apparent in both rock (Figure 4) and sediment (Figure 5) habitats. For example, the location of still images assigned to the ‘A4.1 High energy circalittoral rock BSH’ (Figure 5D) did not perfectly match the location of video segments assigned to this BSH (Figure 5C). Instead, it appears that many still images assigned to this BSH were gathered in the same location as video segments assigned to the closely related ‘A4.2 Moderate energy circalittoral rock’ (Figure 5E). This highlights the potentially subjective nature of biotope and habitat descriptions. This shows that even data gathered in the same location at the same time and by the same organisations can show inconsistencies in how habitats are defined. This is discussed further in Section 5.

The statistical assessments of imagery data in the following sections are based on the still image data. These data were captured at a higher resolution than the video data and as such these data provide a more realistic indication of the taxa present (MarineSpace Ltd., 2018).

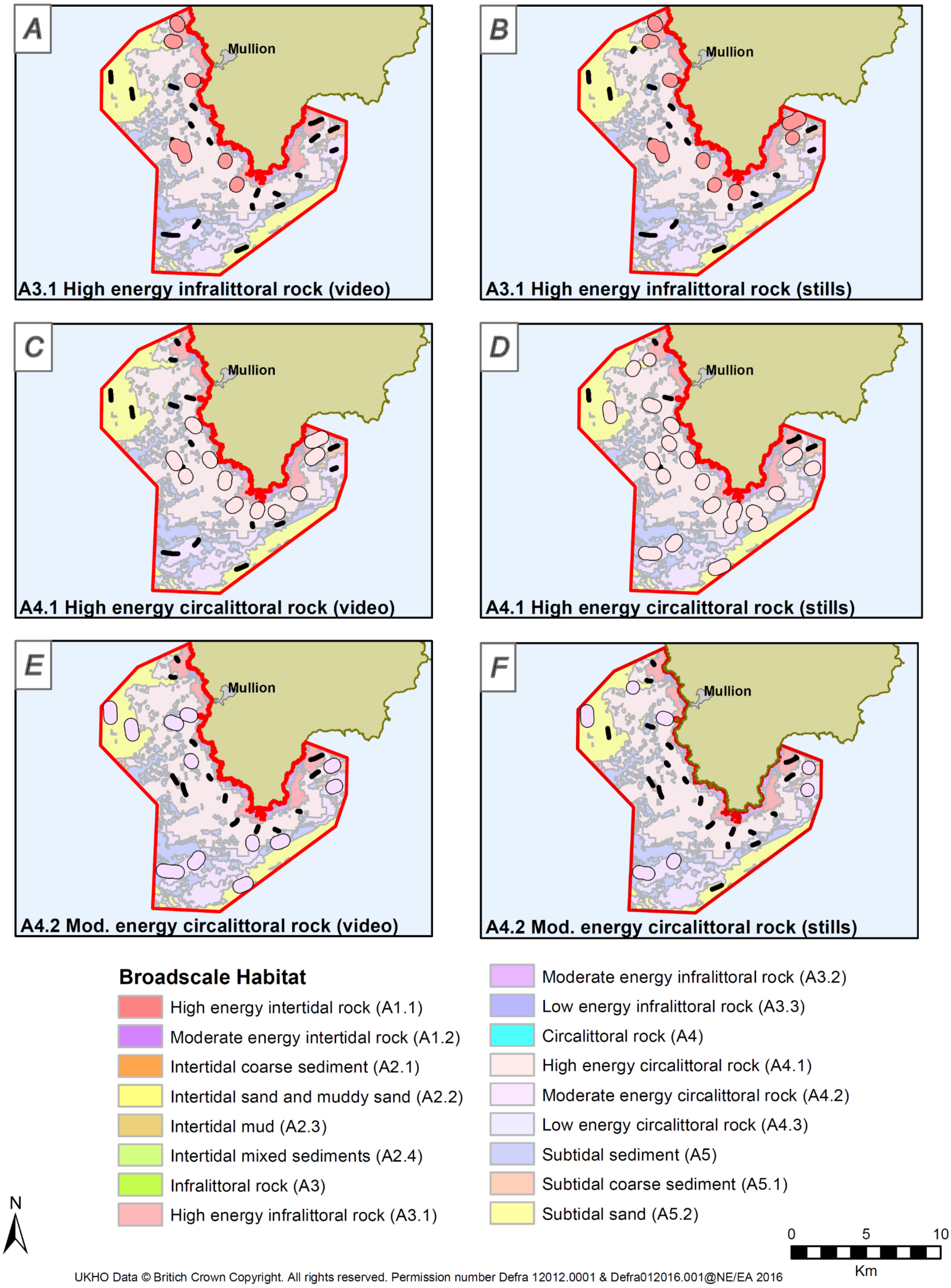

Figure 4. Distribution of video segments (left column) and still images (right column) assigned to rocky BSHs during the 2017 Lizard Point SAC survey. Background polygons are the modelled BSHs taken from the Marine Evidence database

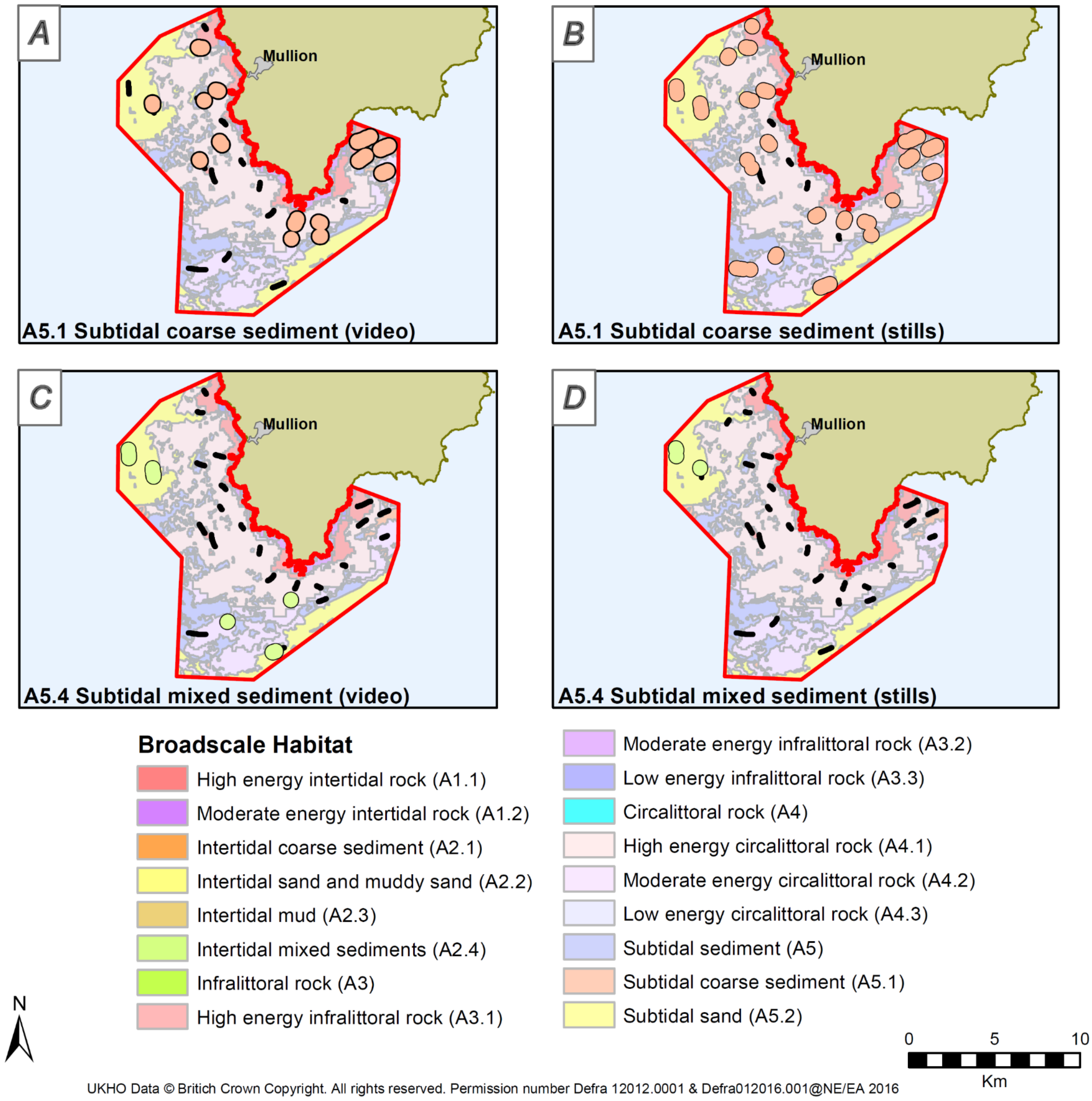

Figure 5. Distribution of video segments (left column) and still images (right column) assigned to sedimentary BSHs during the 2017 Lizard Point SAC survey. Background polygons are the modelled BSHs taken from the Marine Evidence database

3.2 Environmental overview (Objectives 1 and 2)

The seabed surveyed at Lizard Point SAC in 2017 was described as “diverse and complex” in the survey report (MarineSpace Ltd., 2018). Areas of rugged rock were recorded, characterised by kelp (*Laminaria*) and red algae. Numerous sponge, anemone, bryozoan and hydroid taxa were recorded. The 2017 survey identified and gathered data from infralittoral and circalittoral rocky habitats within Lizard Point SAC. Generally, infralittoral rocky habitats were recorded in shallower and nearshore areas of the SAC, with circalittoral rock habitats more common in deeper waters. Annex I reefs were recorded throughout the SAC (Figure 6). Over half (56%) of the video segments were tagged as being representative of this feature (Figure 7).

In addition to the reef features for which Lizard Point SAC is designated, sediment-dominated habitats were also common throughout the SAC in 2017. Although sediment habitats are not qualifying or designated features within Lizard Point SAC, Subtidal Sands and Gravels are included in the UK Biodiversity Action Plan[4]. Mosaics of coarse sediment and circalittoral rock were commonly recorded throughout the SAC. In addition to UK BAP sediment habitats, the presence of maerl was recorded in still images in 2017. Live maerl was recorded in six images in 2017, where maerl covered 5-10% of the benthic habitat and was interspersed with cobbles and pebbles (5 images) or was recorded in images characterised by bedrock and sediment habitats (1 image). Dead maerl was recorded in 2 images in 2017, with both instances within images dominated by boulders.

Broadly speaking, the distribution of habitats recorded in 2017 agreed with the predicted distribution of habitats from previous surveys and the Marine Evidence database modelling outputs. The distribution of the habitats recorded in 2017 and the assemblages associated with them are detailed in the sections below.

[4] https://jncc.gov.uk/our-work/uk-bap-priority-habitats/#list-of-uk-bap-priority-habitats (Accessed 14/03/2022)

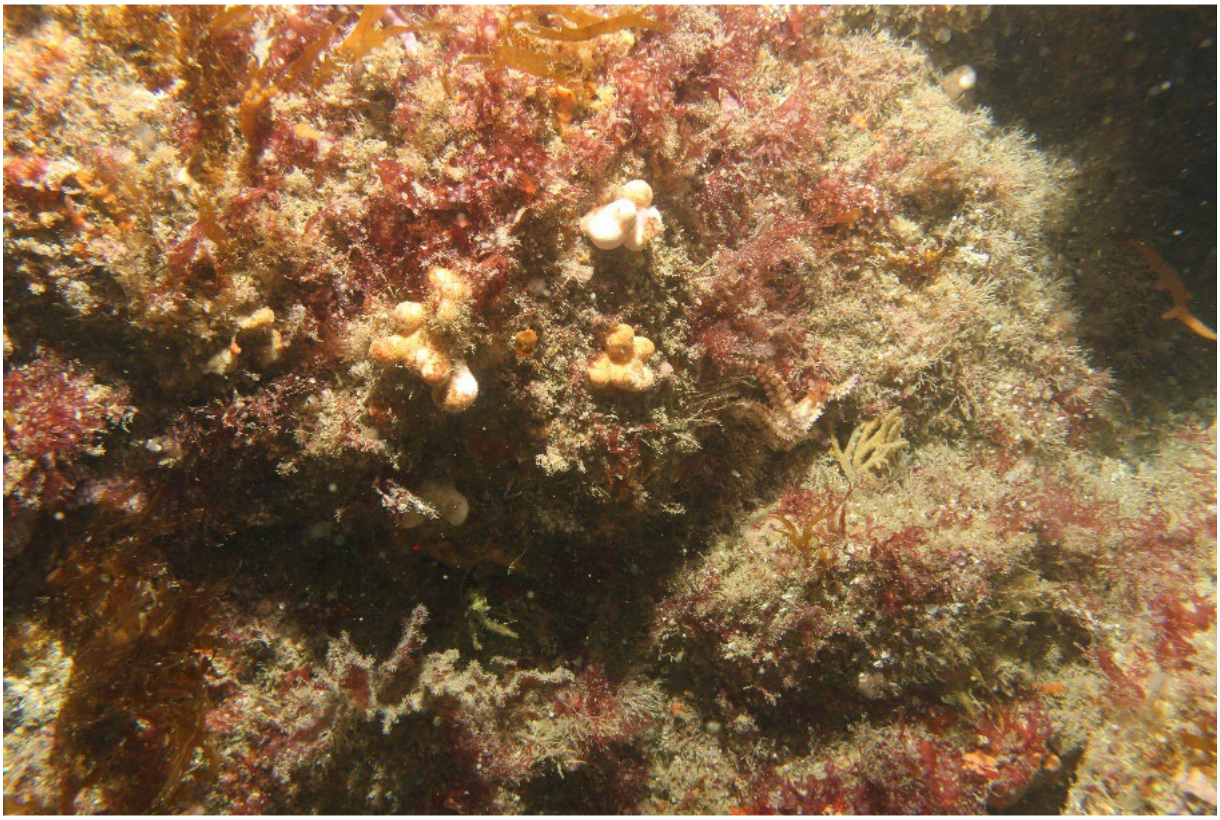

Figure 6. Representative image of Annex I reef habitat captured during the 2017 Lizard Point SAC survey. Image taken from MarineSpace Ltd. (2018).

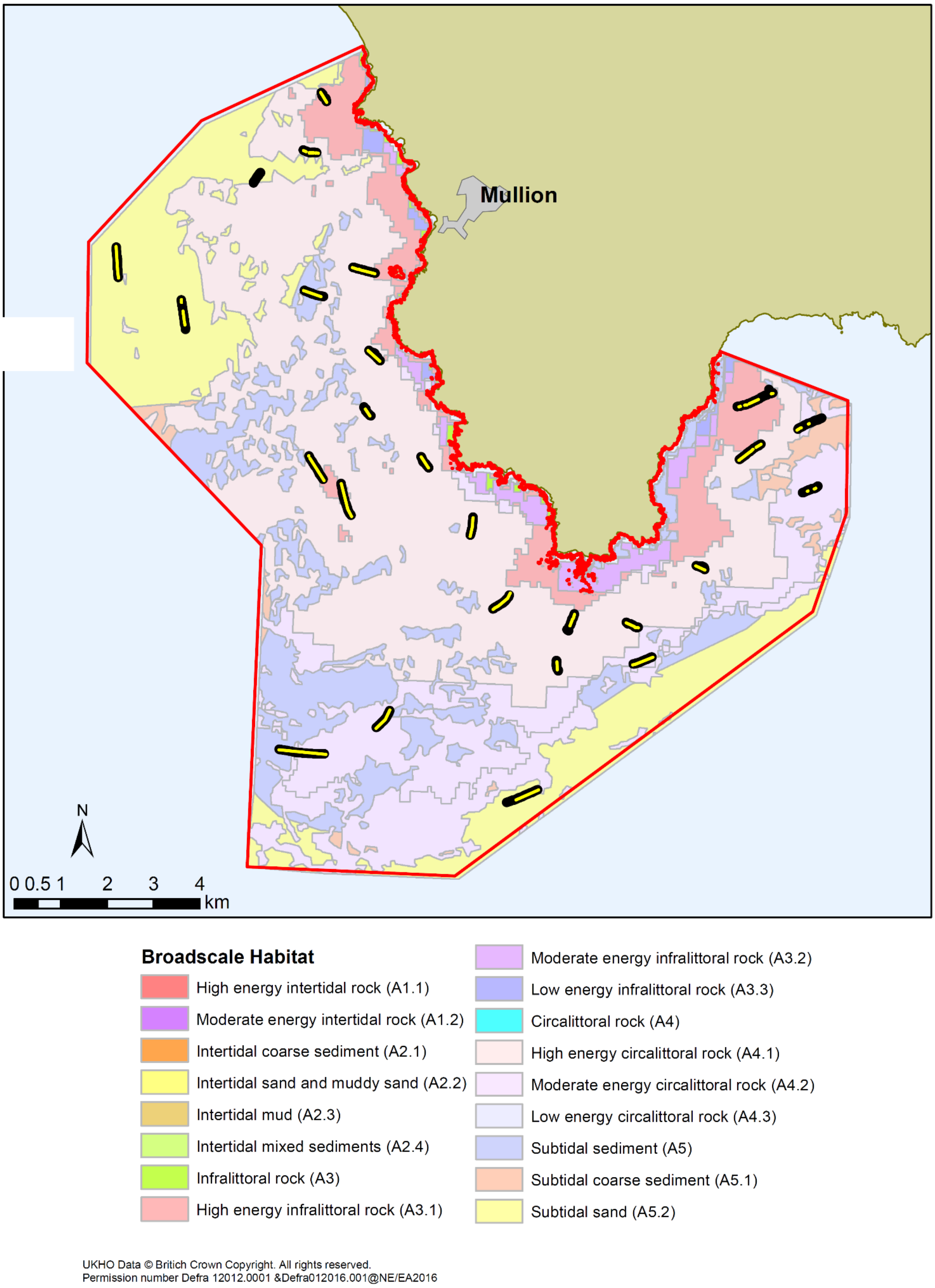

Figure 7. Video segments flagged as Annex I reef habitat during the 2017 Lizard Point SAC image survey. Video segments flagged as Annex I reef are highlighted in yellow. Annex I

reefs were assigned to 56 of the 100 video segments captured in the 2017 survey. Background polygons are the modelled BSHs taken from the Marine Evidence database.

3.3 Broadscale habitats (Objective 1)

The 2017 Lizard Point SAC survey identified three rock and two sediment BSHs (Table 2). The assigning of sediment BSHs to still and video imagery was based on visual clues only. Given that no supporting particle size analyses were conducted to ground truth these observations, caution is recommended when considering the images and videos assigned to sediment habitats. Broadscale habitats could not be assigned to 8 still image and 6 video segments. These data were removed from subsequent analyses.

The sections below provide a high level overview of the rock and sediment BSHs recorded in 2017. More detailed descriptions of the assemblages and biotopes within each BSHs are provided in Section 3.4.

Table 2. Number of still images and video segments assigned to Broadscale Habitats (BSHs) for the 2017 Lizard Point SAC survey. BSHs in bold are those habitats associated with Annex I Reefs, the designated feature for Lizard Point SAC.

Broadscale Habitat	Still images	Video segments
A3.1 - High energy infralittoral rock	**158**	**9**
A4.1 - High energy circalittoral rock	**449**	**23**
A4.2 - Moderate energy circalittoral rock	**60**	**25**
A5.1 - Subtidal coarse sediment*	199	29
A5.4 - Subtidal mixed sediment*	8	8
Not assigned	8	6

*Sediment BSHs were assigned based on visual cues only and no sedimentary data were gathered to specifically ground truth sediment properties. As such, images assigned to sedimentary BSHs should be considered as indicative only

Subtidal rock habitats

Approximately 18% of still images were assigned to the ‘A3.1 High energy infralittoral rock’ habitat (Table 2). These images were principally recorded in nearshore (<3.25 km) stations (Figure 4A,B) at a mean ± SD depth of 21.6 ± 4.0 m (values ranging between 15 and 33 m) (Table 3).

The most commonly recorded rocky BSH in 2017 in the still image survey was ‘A4.1 High energy circalittoral rock’ which was assigned to approximately half of the still images captured in 2017 (Table 2). This BSH was recorded throughout the SAC, ranging from nearshore stations, approximately 700 m off the west coast of Lizard Point, to stations towards the offshore extent of the SAC, over 5.5 km from land (Figure 4D). This BSH was recorded at depths ranging from 5 to 68 m, with a mean ± SD depth of 36.3 ± 9.2 m (Table 3). This BSH was less commonly recorded in the video data (Figure 4C).

Approximately 7% of still images were assigned to the 'A4.2 Moderate energy circalittoral rock' BSH. These were recorded at depths ranging from 27 to 36 m (mean ± SD = 31.1 ± 3.0 m). This habitat was recorded in nearshore and offshore stations, ranging from stations approximately 1 km off the coast at Mullion Cove, to stations over 7 km from land in the vicinity of the offshore extent of the SAC (Figure 4F). The geographic distribution of this BSH was similar for the video data, though a higher proportion of video segments were assigned to this BSH than within the still image data (Figure 4E)

Table 3. Mean ± standard deviation depth and % substratum cover for the three rocky Broadscale Habitats (BSHs) assigned to digital still images captured during the 2017 Lizard Point SAC monitoring survey All BSHs are associated with Annex I Reefs, the designated feature for Lizard Point SAC.

Physical characteristic	A3.1 High energy infralittoral rock (n = 158)	A4.1 High energy circalittoral rock (n = 448)	A4.2 Moderate energy circalittoral rock (n = 60)
Depth (m)	21.6 ± 4.04	36.3 ± 9.2	31.1 ± 3.0
Bedrock %	41.5 ± 39.8	29.6 ± 33.9	25.8 ± 30.3
Boulder %	24.4 ± 33.5	23.3 ± 29.1	24.9 ± 31.6
Cobble %	9.2 ± 15.8	12.8 ± 18.6	9.4 ± 16.4
Pebble %	5.3 ± 10.2	4.5 ± 8.2	2.8 ± 5.2
Finer sediments %	19.7 ± 13.7	29.8 ± 18.4	37.2 ± 16.8

Subtidal sediment habitats

Approximately 24% of still images and 37% of video segments were assigned to sediment BSHs (Table 2). As highlighted above, these habitats were assigned based on visual cues and no ground truth samples were taken for quantitative analysis of sediments.

The majority of images assigned to sediment habitats were assigned to the 'A5.1 Subtidal coarse sediment' BSH (representing approximately 22% of all image samples and 29% of video segments; Table 2). These images were distributed through the SAC at depths ranging from 17 to 53 m (mean ± SD = 32.4 ± 6.3 m) (Table 4; Figure 5A,B). This BSH was typically found interspersed with rocky habitats, suggesting a mosaic of habitats and/or shallow sediments overlying rocky BSHs.

Seven images (representing 0.8% of images captured) were assigned to the 'A5.4 Subtidal mixed sediment) BSH. No depth data were recorded for these images (Table 4). All still images assigned to this BSH were captured in the vicinity of the offshore extent in the north-west of the SAC at a distance of >4.7 km from shore (Figure 5D). In addition, video segments in the south and central area of the SAC were also assigned to this BSH (Figure 5C).

Table 4. Mean ± standard deviation depth and % substratum cover for the two sediment Broadscale Habitats (BSHs) assigned to digital still images captured during the 2017 Lizard Point SAC monitoring survey. Sediment BSHs were assigned based on visual clues only. No depth data was recorded for the 'A5.4 Subtidal mixed sediment' BSH.

Physical characteristic	A5.1 Subtidal coarse sediment (n = 198)	A5.4 Subtidal mixed sediment (n = 7)
Depth (m)	32.4 ± 6.31	NA
Bedrock %	1.2 ± 4.6	0
Boulder %	1.1 ± 4.3	0
Cobble %	4.6 ± 7.4	8.8 ± 10.9
Pebble %	11.5 ± 17.3	5.6 ± 6.2
Finer sediments %	81.5 ± 22.1	85.6 ± 13.2

3.4 Epibiota communities (Objectives 1 and 2)

A total of 77 taxa were recorded in the still imagery data gathered in 2017. Taxa highlighted as being of particular note within Lizard Point SAC were highlighted by Birchenough *et al*. (2008) and Axelsson and Dewey (2011) and are summarised in Section 1.1. The majority of these taxa were recorded in the 2017 survey. Algal taxa of note were generally restricted to nearshore environments (Figure 8). Faunal taxa of note were more widely distributed, with taxa recorded in both nearshore and offshore zones, though the recorded abundances of these taxa was higher in nearshore images (Figure 9). A number of taxa of note that have been recorded previously were not recorded in 2017. These include the soft coral *Alcyonium glomeratum*, the sandalled anemone *Actinothoe sphyrodeta*, the hydroid *Tubularia indivisa*, and the red algae *Drachiella spectabilis* and *Delesseria sanguinea*. Temporal changes in the distribution of these taxa are discussed further in Section 3.5.

Taxon richness values recorded in rocky habitats (mean ± SD = 6.7 ± 3.1 taxa per image) were significantly higher than those recorded in sediment habitats (mean ± SD = 1.4 ± 2.0 taxa per image) ($F_{1,872}$ = 516.2, P <2.2 x 10^{-16}). This is to be expected given that still and video imagery techniques do not readily record the infauna taxa that typically characterise sediment habitats. As sediment habitats are not a designated feature of Lizard Point SAC and infauna taxa are not reliably recorded with the techniques used in the 2017 survey, statistical comparisons and detailed descriptions of assemblages were conducted only on the rock BSHs for which benthic imagery methods are primarily designed.

Taxon richness values varied depending on the resolution at which biotopes were assigned to imagery data ($F_{2,871}$ = 31.6, P = 5.6 x 10^{-14}). Images assigned to higher resolution biotopes (i.e., MNCR level 5) had higher taxon richness values than images assigned to MNCR level 3 and level 4 biotopes (Holm adjusted post hoc pairwise comparisons significant at <1 x 10^{-16}).

Multivariate analysis showed that benthic assemblages significantly differed between rocky BSHs (Table 5A). Post hoc pairwise comparisons showed that assemblages within each of the three rocky BSHs differed from each other (Table 5B). Although all rock BSHs significantly differed from each other, the differences between MNCR level 2 habitats (i.e., 'A4 Circalittoral rock and other hard substrata' and 'A3 Infralittoral rock and other hard substrata') were more pronounced than differences within the MNCR level 2 'A.4 Circalittoral rock' habitat. This was reflected by both the relatively high F and R^2 statistics between the different MNCR level 2 habitats in comparison with those within the 'A.4 Circalittoral rock' habitat (Table 5B) and by the clustering of images by BSH in the non-metric multidimensional scaling plot (Figure 10).

MNCR (JNCC, 2022) biotopes assigned to imagery data are described in the following sections.

Table 5. Model outputs comparing multivariate assemblages between the three rock BSHs recorded within still imagery at Lizard Point SAC in 2017. A) Main effects model calculated using the 'adonis2' R package; B) Post hoc pairwise comparisons. P_{adj} values indicate those adjusted for multiple comparisons using the Holm (1979) method. BSH codes refer to Table 2.

A)

Predictors	DF	Sum of Sq.	R^2	*F*	*P*
Broadscale habitat	2	32.97	0.156	59.94	1×10^{-3}
Residual	647	177.98	0.844		
Total	649	210.93	1.00		

B)

Pairwise comparison	DF	R^2	F	*P*	$P_{adj.}$
A3.1 vs A4.1	1, 593	0.15	104.7	1.0×10^{-3}	3.0×10^{-3}
A3.1 vs A4.2	1, 210	0.19	49.3	1.0×10^{-3}	3.0×10^{-3}
A4.1 vs A4.2	1, 491	0.02	11.58	1.0×10^{-3}	3.0×10^{-3}

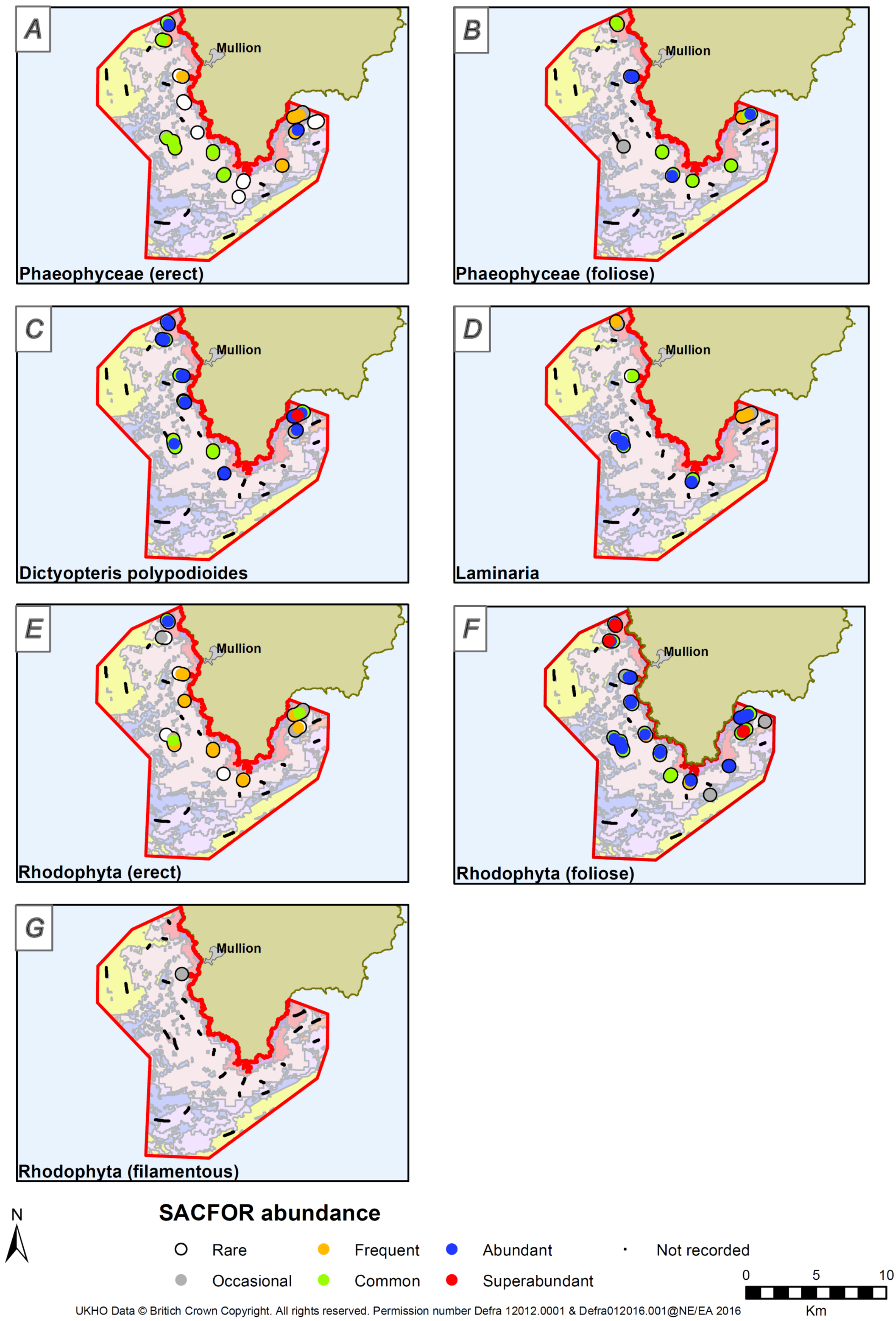

Figure 8. Distribution of algae taxa considered characteristic of Lizard Point SAC recorded in the 2017 survey (refer to Section 1.1). Taxa include brown algae (Class Phaeophyceae) (A-D) and red algae (Phylum Rhodophyta) (E-G). Background polygons are the modelled BSHs taken from the Marine Evidence database

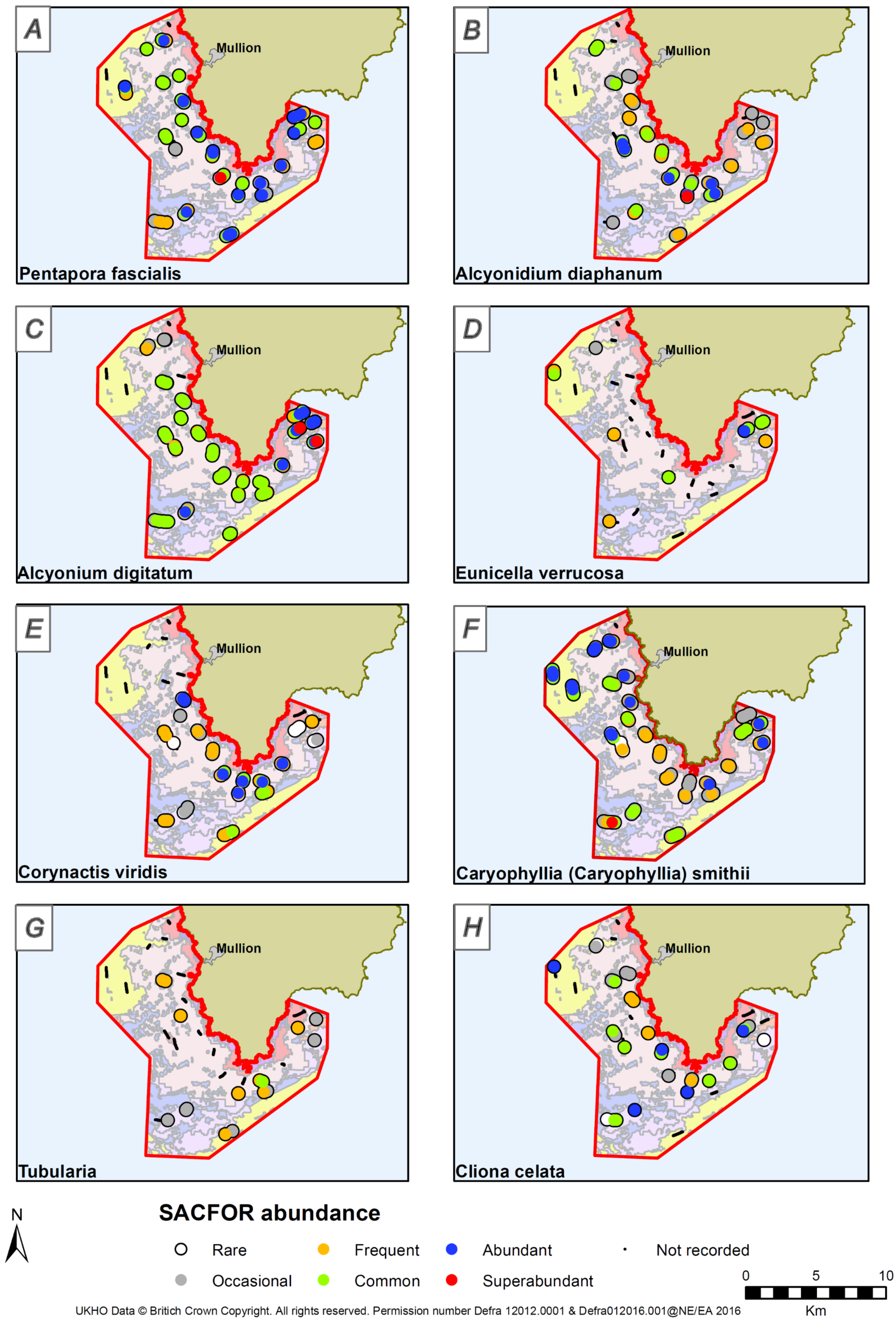

Figure 9. Distribution of fauna considered characteristic of Lizard Point SAC recorded in the 2017 survey (refer to Section 1.1). Taxa include bryozoans (A, B), anthozoans (C-F), hydrozoans (G) and porifera (H). Background polygons are the modelled BSHs taken from the Marine Evidence database.

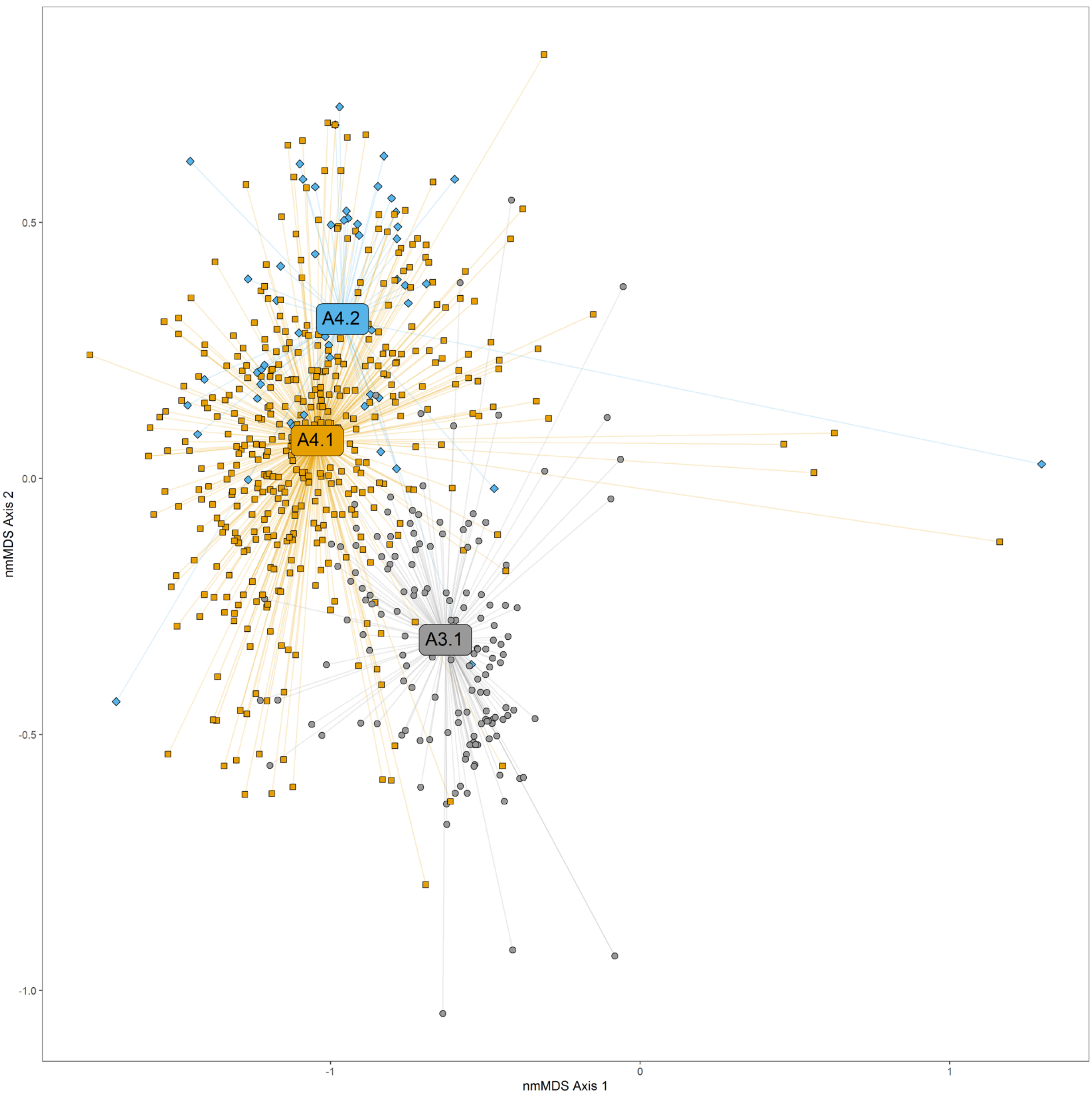

Figure 10. Non-metric multidimensional scaling (nmMDS) plots of SACFOR-derived taxon abundance data recorded in still imagery data within rocky habitats at Lizard Point SAC in 2017. Point shapes and colours indicate the three rock BSHs recorded in the survey. Label positions indicate the centroid for each BSH. BSH codes refer to Table 2. To aid visualisation, one sample containing only a single taxon was excluded from the 'A4.1' BSH data. Stress = 0.09.

High energy infralittoral rock (A3.1)

The 'A3.1 High energy infralittoral rock' BSH was the second most commonly recorded habitat in the 2017 still image survey (n = 158). A total of 53 taxa were recorded in still images within this BSH. Foliose red algae were the most commonly recorded taxa, being recorded in 84% of images within this BSH (n = 132). The median value of the numerically-converted SACFOR abundances for foliose red algae corresponded to this taxon being Common. The brown algae *Dictyopteris polypodioides* was also frequently recorded (present in 96 images, representing 61% of images assigned to this BSH), erect red algae (n = 61; 39% of images), in addition to encrusting sponges (Porifera) and bryozoans (present in 37% and 38% of images, respectively) were also recorded in many images. A representative image of this BSH is presented in Figure 11.

Images captured within this BSH were assigned to two MNCR biotopes. The majority of images (n = 137, representing 87% of images within this BSH) were assigned to the MNCR level 3 habitat ‘High energy infralittoral rock’ (IR.HIR). This biotope was assigned to near-shore stations across the width of the SAC (Figure 12). Fewer images (n = 21, 13% of images within this BSH) were assigned to the closely related level 4 habitat ‘Kelp with cushion fauna and/or foliose red seaweeds’ (IR.HIR.KFaR). Still images assigned to this biotope were clustered in an offshore area approximately 2.5 km south west of the Cornish coast (Figure 12). Despite being located further offshore, the mean ± SD depth of images assigned to the IR.HIR.KFaR biotope (19.2 ± 1.8 m) were slightly shallower than those assigned to IR.HIR (22.0 ± 4.1 m).

Taxon richness values did not significantly differ between the two biotopes ($F_{1,156}$ = 2.98, P = 0.09). Both of the recorded biotopes within this BSH are indicative of exposed rocky coasts with stable substrata composed of bedrock and/or boulders (JNCC, 2022).

Figure 11. Representative still images captured during the 2017 Lizard Point SAC survey assigned to biotopes within the 'A3.1 High energy infralittoral rock' BSH. Image taken from MarineSpace Ltd. (2018).

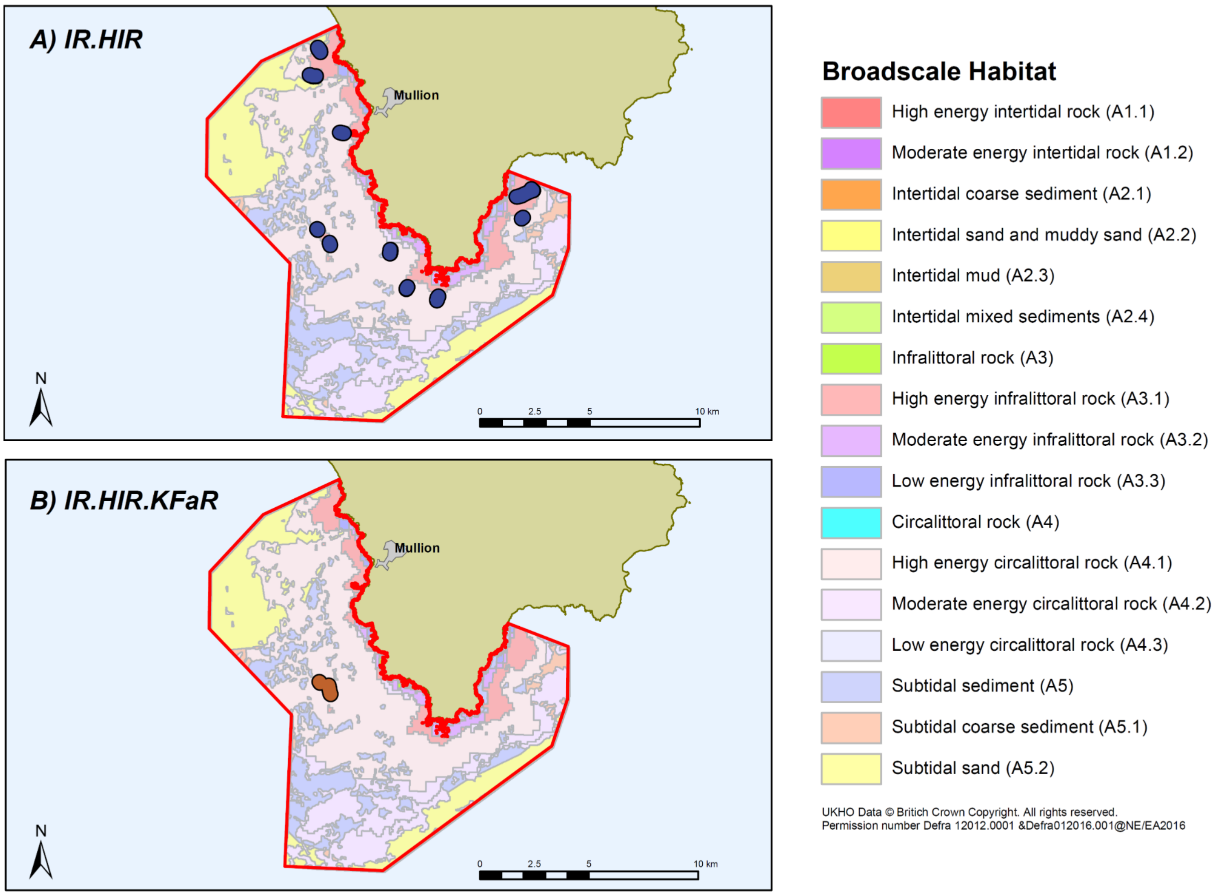

Figure 12. Distribution of still images captured during the 2017 Lizard Point SAC survey assigned to biotopes within the 'A3.1 High energy infralittoral rock' BSH. A) 'High energy infralittoral rock' (IR.HIR) biotope (n = 158); B) 'Kelp with cushion fauna and/or foliose red seaweeds' (IR.HIR.KFaR) biotope (n = 21). Background polygons are the modelled BSHs taken from the Marine Evidence database.

High energy circalittoral rock (A4.1)

The most commonly recorded BSH in the 2017 still imagery was 'A4.1 High energy circalittoral rock' (n = 449). A total of 72 taxa were recorded in still images assigned to this BSH. Characteristic taxa within this BSH were erect bryozoans which were present in 67% of images within this BSH (n = 299) and where observed, were typically recorded at 'Common' abundance. Other characteristic taxa included anthozoans, with the Devonshire cup coral *Caryophyllia (Caryophyllia) smithii* and Dead man's fingers *Alcyonium digitatum* recorded in 56% and 50% of images, respectively. Encrusting sponges (Porifera) were recorded in 50% of images, and erect morphologies (36% of images) and turf-forming morphologies (35% of images) of hydrozoans were commonly recorded. A representative image of this BSH is shown in Figure 13.

Images captured within this BSH were assigned to three MNCR biotopes. The majority of images were assigned to the MNCR level 4 biotope 'Mixed faunal turf communities' (CR.HCR.XFa) which was assigned to 94% (n = 424) of images within this BSH. This biotope was distributed throughout the SAC (Figure 14B) at a mean ± SD depth of 36.6 ± 9.3 m. Twenty four images (representing 5% of images within this BSH) were assigned to the closely-related MNCR level 5 biotope 'Bryozoan turf and erect sponges on tide-swept circalittoral rock' (CR.HCR.XFa.ByErSp). The mean depth of this biotope was 31.1 ± 1.3 m. Both of these biotopes were recorded in both near-shore and offshore locations (Figure 14B,C).

A single image (representing 0.2% of images within this BSH) was assigned to the MNCR level 3 biotope 'High energy circalittoral rock' (CR.HCR). This biotope was assigned based on physical characteristics of the habitat as no taxa were recorded. The image assigned to this biotope was captured approximately 2.8 km offshore (Figure 14A). No depth information was recorded for this biotope.

Images assigned to the CR.HCR.XFa.ByErSp biotope had significantly higher mean ± SD taxon richness (10.9 ± 2.3 taxa per image) compared with those in the CR.HCR.XFa biotope (6.7 ± 3.0) ($F_{2,446}$ = 25.2, P = 4.3 x 10^{-11}). SIMPER analysis showed that the relative abundances of erect bryozoans and turf-forming hydrozoans were the principal drivers which separated assemblages assigned to the CR.HCR.XFa.ByErSp biotope from CR.HCR.XFa. Both of these taxa were typically recorded at higher abundances in the CR.HCR.XFa.ByErSp biotope. This follows the overall trend of images assigned to higher resolution biotopes having typically higher taxon richness values (Section 3.4).

The three biotopes recorded within this BSH are associated with exposed rocky coasts, typically at depths between 10 and 30 m and bedrock and boulder substrates (JNCC, 2022).

Figure 13. Representative still image captured during the 2017 Lizard Point SAC survey assigned to biotopes within the 'A4.1 High energy circalittoral rock' BSH. Image taken from MarineSpace Ltd. (2018).

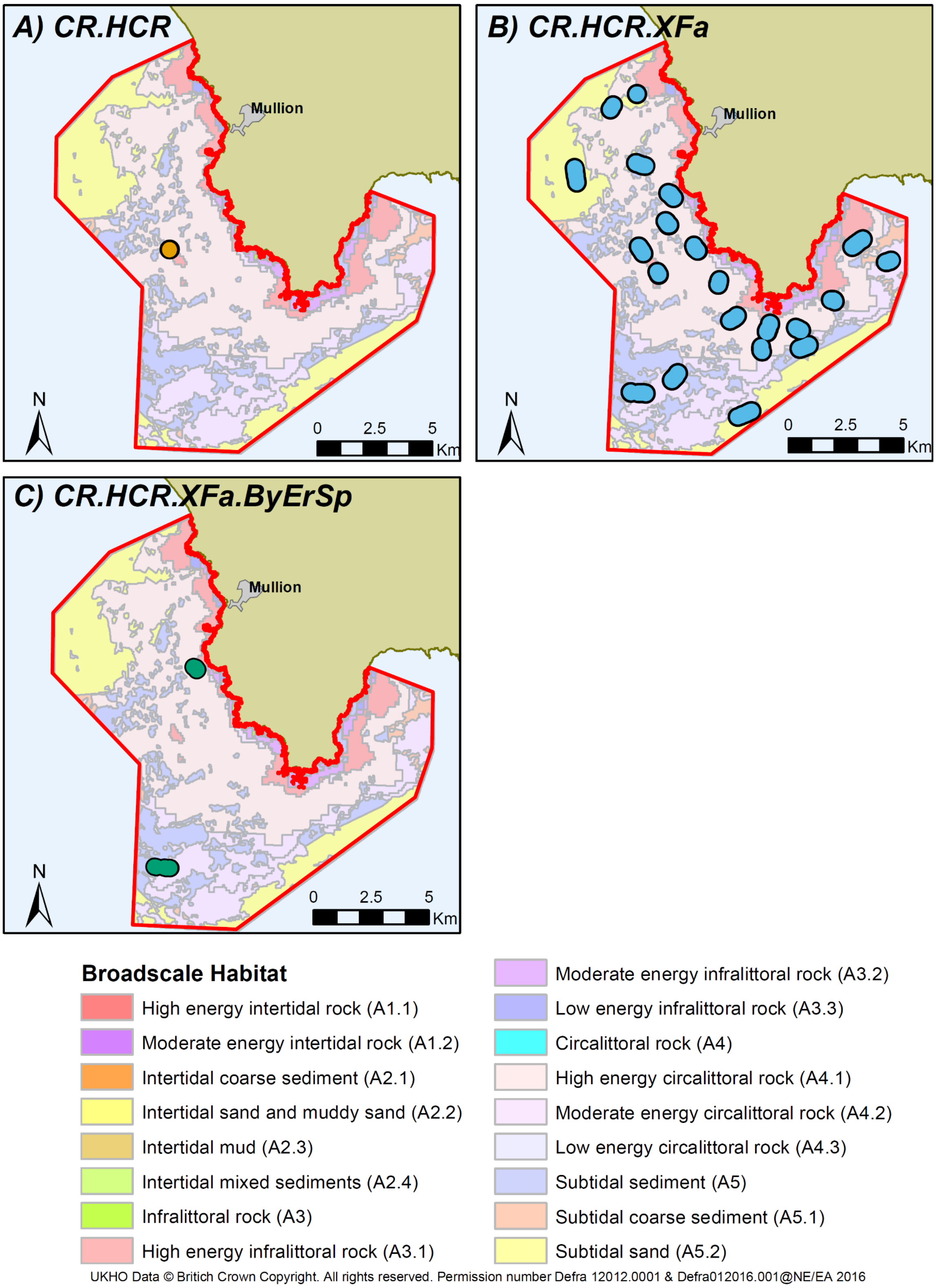

Figure 14. Distribution of images captured during the 2017 Lizard Point SAC survey assigned to biotopes within the 'A4.1 High energy circalittoral rock' BSH. A) High energy circalittoral rock (CR.HCR) (n = 1); B) Mixed faunal turf communities (CR.HCR.XFa) (n = 423); C) Bryozoan turf and erect sponges on tide-swept circalittoral rock' (CR.HCR.XFa.ByErSp) (n = 24). Background polygons are the modelled BSHs taken from the Marine Evidence database.

Moderate energy circalittoral rock (A4.2)

A total of 44 taxa were recorded in images assigned to the 'A4.2 Moderate energy circalittoral rock' BSH (n = 60). The most commonly recorded taxon within this BSH was the Devonshire cup coral *Caryophyllia (Caryophyllia) smithii*, recorded in 44 images (73% of images within this BSH). Where it was recorded, this taxon was typically recorded at 'Frequent' abundance. Encrusting sponges (Porifera) (53% of images) and encrusting bryozoans and hydrozoans (each present in 42% of images) were also commonly recorded. A representative image of this BSH is shown in Figure 15.

Of the 60 images assigned to this BSH, a single image was assigned to the MNCR level 5 biotope '*Caryophyllia (Caryophyllia) smithii*, sponges and crustose communities on wave-exposed circalittoral rock' (CR.MCR.EcCr.CarSp). This station was located approximately 2.7 km offshore at a depth of 33.2 m. Four taxa were observed within this single image.

The remaining 59 images within this BSH were assigned to the MNCR level 3 biotope 'Moderate energy circalittoral rock' (CR.MCR). This biotope was observed in both near- and off-shore stations (Figure 16). Images assigned to this biotope were captured at a mean ± SD depth of 31.0 ± 3.0 m. These images housed a mean ± SD taxon richness of 5.0 ± 3.2 taxa per image.

Both of the recorded biotopes are indicative of exposed and moderately exposed rocky coasts with stable substrata composed of bedrock and/or boulders (JNCC, 2022).

Figure 15. Representative still image captured during the 2017 Lizard Point SAC survey assigned to biotopes within the 'A4.2 Moderate energy circalittoral rock' BSH. Image taken from MarineSpace Ltd. (2018).

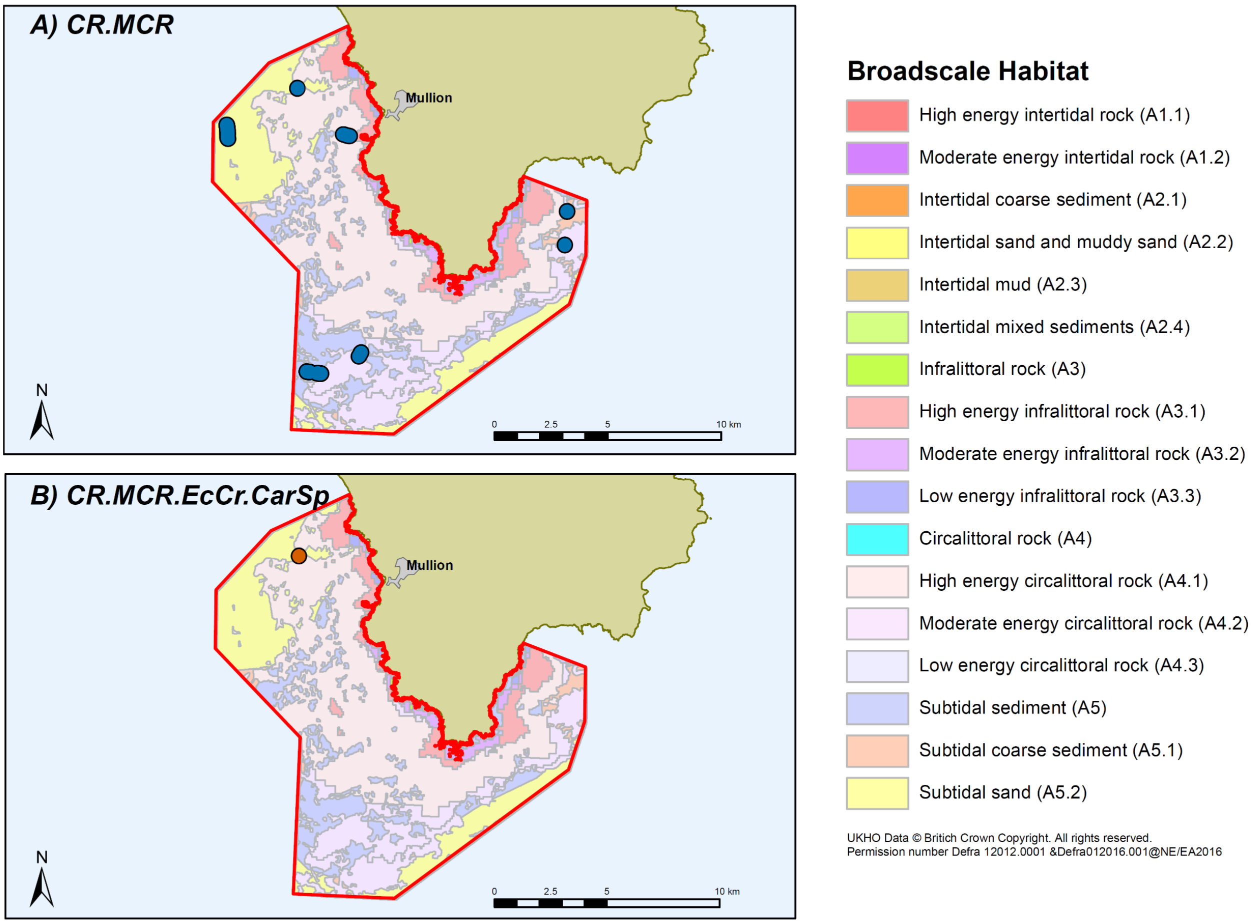

Figure 16. Distribution of images captured during the 2017 Lizard Point SAC survey assigned to biotopes within the 'A4.2 Moderate energy circalittoral rock' BSH. A) 'Moderate energy circalittoral rock' (CR.MCR) biotope (n = 59); B) '*Caryophyllia (Caryophyllia) smithii*, sponges and crustose communities on wave-exposed circalittoral rock' (CR.MCR.EcCr.CarSp) biotope (n = 1). Background polygons are the modelled BSHs taken from the Marine Evidence database.

Subtidal coarse sediment (A5.1)

All of the 199 images within the Subtidal coarse sediment BSH were assigned to a single MNCR level 4 biotope 'Circalittoral coarse sediment' (SS.SCS.CCS). As noted previously, imagery data are not suited for characterisation of sedimentary habitats. No taxa were recorded for 51% (n = 102) of images and only a single taxon was recorded in 16% (n = 31) of images. In total, 43 different taxa were recorded within this biotope, with a mean ± SD taxon richness of 1.4 ± 2.0 taxa per image. The most commonly-recorded taxa were erect bryozoans, the cup coral *Caryophyllia (Caryophyllia) smithii* and the starfish (*Marthasterias glacialis*). Many of the taxa recorded within this BSH are typically associated with rocky substrates and epifaunal habitats. This suggests that at least a proportion of the images recorded as subtidal coarse sediments recorded in 2017 likely represented a shallow sediment veneer over underlying rock habitat. A representative image of this BSH is presented in Figure 17.

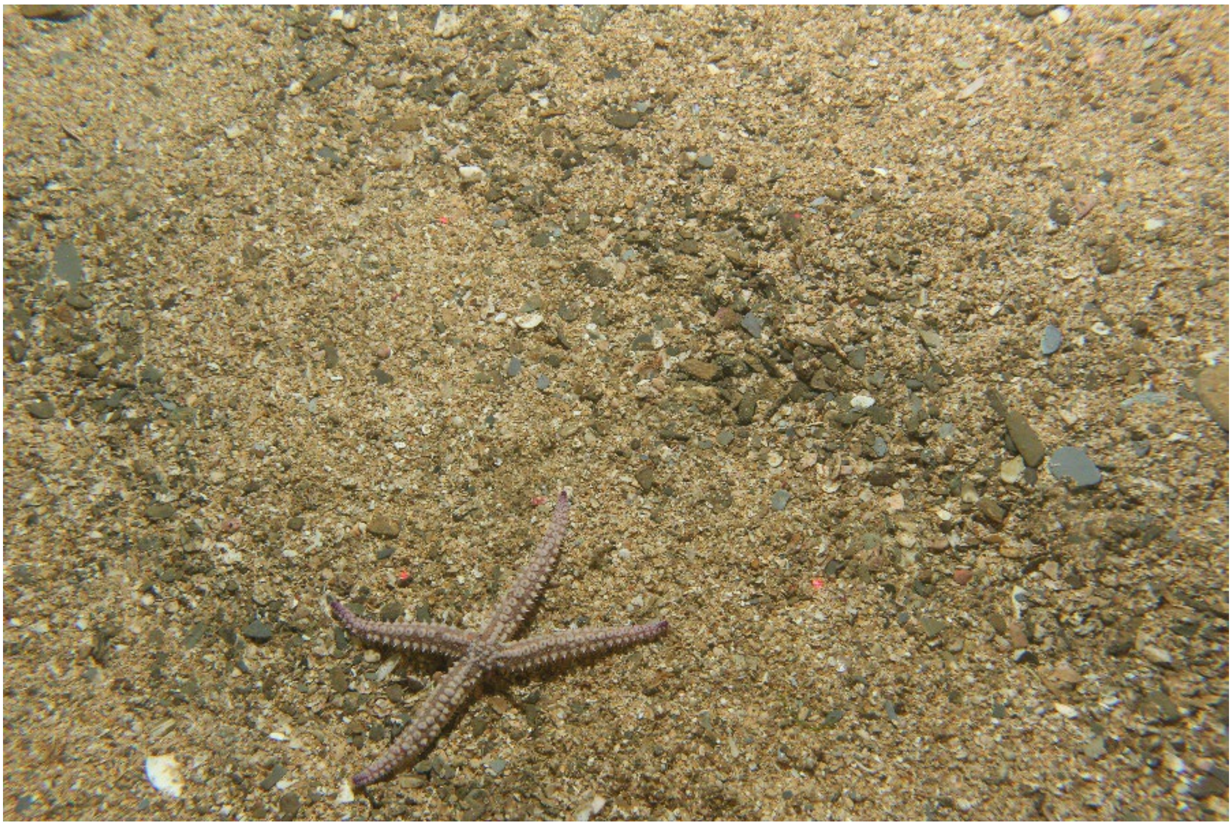

Figure 17. Representative still image captured during the 2017 Lizard Point SAC survey assigned to the 'A5.1 Subtidal coarse sediment' BSH. Image taken from MarineSpace Ltd. (2018).

Subtidal mixed sediment (A5.4)

The eight images within the Subtidal mixed sediment BSH were assigned to the MNCR level 3 biotope 'Subtidal mixed sediment' (SS.SMx). No taxa were recorded in seven of the images assigned to this biotope. Within one image, three taxa were observed: *Caryophyllia (Caryophyllia) smithii*, erect Hydrozoa and encrusting Porifera. As these taxa are typically associated with rocky substrates, this suggests the presence of a sediment veneer overlying rocky habitat.

Figure 18. Representative still image captured during the 2017 Lizard Point SAC survey assigned to the 'A5.4 Subtidal mixed sediment' BSH. Image taken from MarineSpace Ltd. (2018).

3.5 Temporal comparison

Reef feature extents

The distribution of the rocky BSH that represent the reef features of Lizard Point SAC were broadly similar in 2017 to those recorded in 2010. In 2010, the 'A3.1 High energy infralittoral rock' habitat was generally located in nearshore habitats and was recorded along the majority of the coastline within the SAC boundary (Figure 2A). This was comparable to the extent over which this habitat was recorded in the 2017 data (Figure 4A,B). Despite some minor differences in the location of observations of this habitat, there is no indication that the extent of this habitat within the SAC has significantly changed.

'A4.1 High energy circalittoral rock' habitats were the most commonly recorded rock habitats within both the 2010 and 2017 surveys. In both the 2010 and the 2017 surveys, this habitat was distributed throughout the SAC (Figure 2B; Figure 4C,D). There is no indication that the extent of this habitat has changed since the 2010 survey.

Some temporal difference in the extent and distribution of 'A4.2 Moderate energy circalittoral rock' was apparent between the two years. Occurrences within the 2017 survey (Figure 4E,F) were more patchily-distributed compared to what was observed in 2010 (Figure 2C).

The statistical analyses described in Section 3.4 showed that there was much similarity in the structure of assemblages assigned to the two circalittoral rock BSHs. In addition, there is considerable overlap in the descriptions of high and moderate energy circalittoral rock habitats, in terms of both the physical nature of the habitat and the plant and animal taxa associated with these habitats (JNCC, 2022). As such, there is potentially a high degree of subjectivity with regards to assigning imagery data to these two BSHs. It is likely that the apparent 'loss' of 'A4.2 Moderate energy circalittoral rock' in the 2017 data reflects a greater proportion of images being assigned to the high energy level 5 habitat in 2017, rather than a fundamental change to the physical and ecological components within the SAC.

Comparing the distribution of images assigned to circalittoral rock habitats at the MNCR level 2 level, there is no evidence that the extent of the two circalittoral rock habitats (EUNIS biotope A4) have changed between 2010 and 2017.

Taxon richness: overall trend

Comparisons were made between the 2017 still image data described in Section 3.4 and the data gathered as part of the 2010 survey (Axelsson and Dewey, 2011) to investigate whether there has been significant changes between the two monitoring events. These comparisons were made at the BSH (i.e., MNCR level 3) level. The use of broader habitat categories aims to avoid some of the subjectivity inherent in assigning biotopes (c.f. Drew *et al*., 2008). Furthermore, the resolution at which biotopes were assigned was not consistent between data sets. Biotopes within the 2017 data were typically assigned at a coarser resolution than those within the 2010 data (Table 6). As outlined above, sediment habitats were excluded from statistical comparisons.

Table 6. Proportion of still images assigned to different MNCR biotope levels in 2010 and 2017 at Lizard Point SAC.

MNCR biotope level	2010	2017
Level 3	0%	23.5%
Level 4	13.0%	73.7%
Level 5	67.2%	2.9%
Level 6	19.8%	0%

Comparing values against year nested within each BSH, taxon richness values in images gathered in 2017 were significantly lower than in 2010 (Table 7). Post hoc pairwise comparisons showed that richness values in 2017 were lower in all three rocky BSHs (all Holm adjusted pairwise comparisons significant at $P \leq 7.7 \times 10^{-7}$) (Figure 19).

Table 7. Nested ANOVA model summary outputs comparing taxon richness values recorded in reef habitats in 2010 and 2017 at Lizard Point SAC. Values for a given year are nested within BSH.

	DF	Sum of Sq	Mean Sq	*F*	*P*
BSH	2	1130	564.9	61.0	<0.001
BSH:Year	3	5971	1990.4	214.9	<0.001
Residuals	1525	14123	9.3		

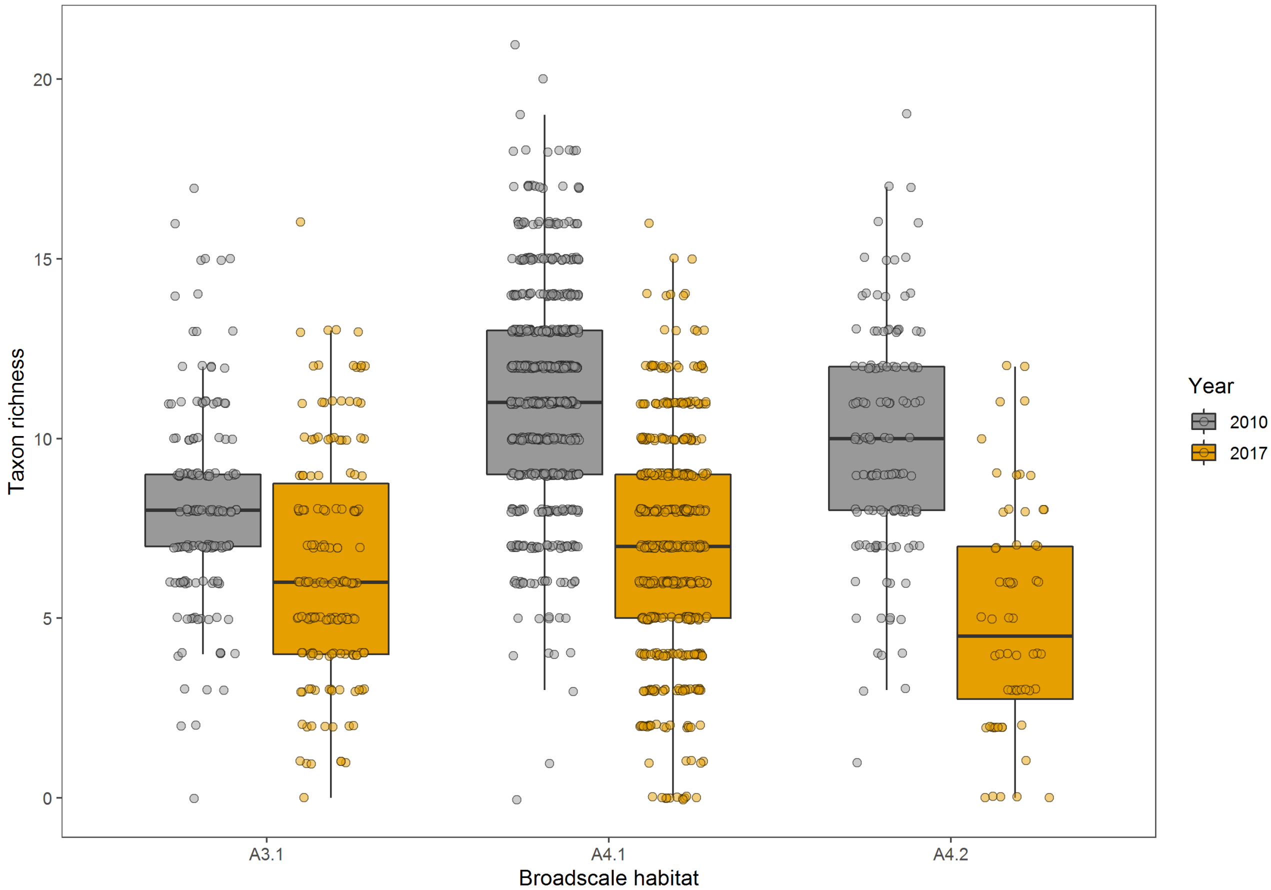

Figure 19. Taxon richness observed in three rock BSHs in 2010 and 2017 at Lizard Point SAC A small amount of random noise was added to the positions of individual points to enhance visualisation of discrete data.

Taxon richness: taxonomic resolution

There is potential that the apparent reduction in taxon richness values between 2010 and 2017 is a by-product of differences in the taxonomic resolutions at which taxa were recorded in 2010 and 2017. For example, if multiple bryozoan species recorded in 2010 were all recorded in 2017 as a single 'Bryozoa' taxon in 2017, then this would result in a potentially misleading difference in taxon richness between the two years.

The proportion of taxa recorded at the higher resolution Family, Genus and Species levels was slightly higher in 2010 than in 2017. The proportion of observations identified at the lower resolution Order, Class and Phylum levels was correspondingly higher in 2017 (Table 8). As such, there is the potential for the observed differences in taxon richness values to be linked to the differing taxonomic resolutions at which taxa were recorded.

To investigate the potential for reported taxonomic resolutions to be behind an apparent reduction in taxon richness between 2010 and 2017, statistical comparisons were re-run with reported taxon names replaced by the major taxonomic group to which the taxon belongs. For example, all bryozoan species recorded in 2010 and 2017 were re-labelled as Bryozoa. Major taxonomic groups included taxa identified reported at the Class (50% of observations across the two Lizard Point surveys) and Phylum level (47.9% of observations), with some taxa identified at the Order level (2.1% of observations).

After adopting a coarser taxonomic resolution, taxon richness values remained significantly different between years (Table 9). Post hoc comparisons showed that 2017 taxon richness values were significantly lower in the 'A4.1 High energy circalittoral rock' and 'A4.2 Moderate energy circalittoral rock' BSHs (Holm adjusted pairwise comparisons significant at $P \leq 1.8 \times 10^{-14}$) (Figure 20).

A significant difference in taxon richness values was also apparent in the 'A3.1 High energy infralittoral rock' BSH, however taxon richness values were higher in 2017 than in 2010 (Holm-adjusted $P = 9.9 \times 10^{-7}$) (Figure 20). This is the opposite relationship that was observed within this BSH using the 'reported' taxon information (see 'Taxon richness: overall trend' above), with images in 2010 more diverse than in 2017. This suggests that for this BSH at least, the observed difference was (at least in part) driven by differences in the taxonomic resolution at which taxa were recorded between the two surveys.

Table 8. Resolution at which observed taxa were identified in reef habitats in 2010 and 2017 at Lizard Point SAC.

	Percentage of observations (%)	
Taxonomic resolution	**2010**	**2017**
Phylum	21.7	24.3
Class	13.1	12.7
Order	0.1	4.7
Family	5.3	2.5
Genus	10.9	9.9
Species	46.0	43.5

Table 9. Nested ANOVA model summary outputs comparing taxon richness values based on major taxonomic groups as recorded in reef habitats in 2010 and 2017 at Lizard Point SAC. Values for a given year are nested within BSH.

	DF	Sum of Sq	Mean Sq	*F*	*P*
BSH	2	186	92.77	42.13	<0.001
BSH:Year	3	407	135.67	61.61	<0.001
Residuals	1522	3351	2.2		

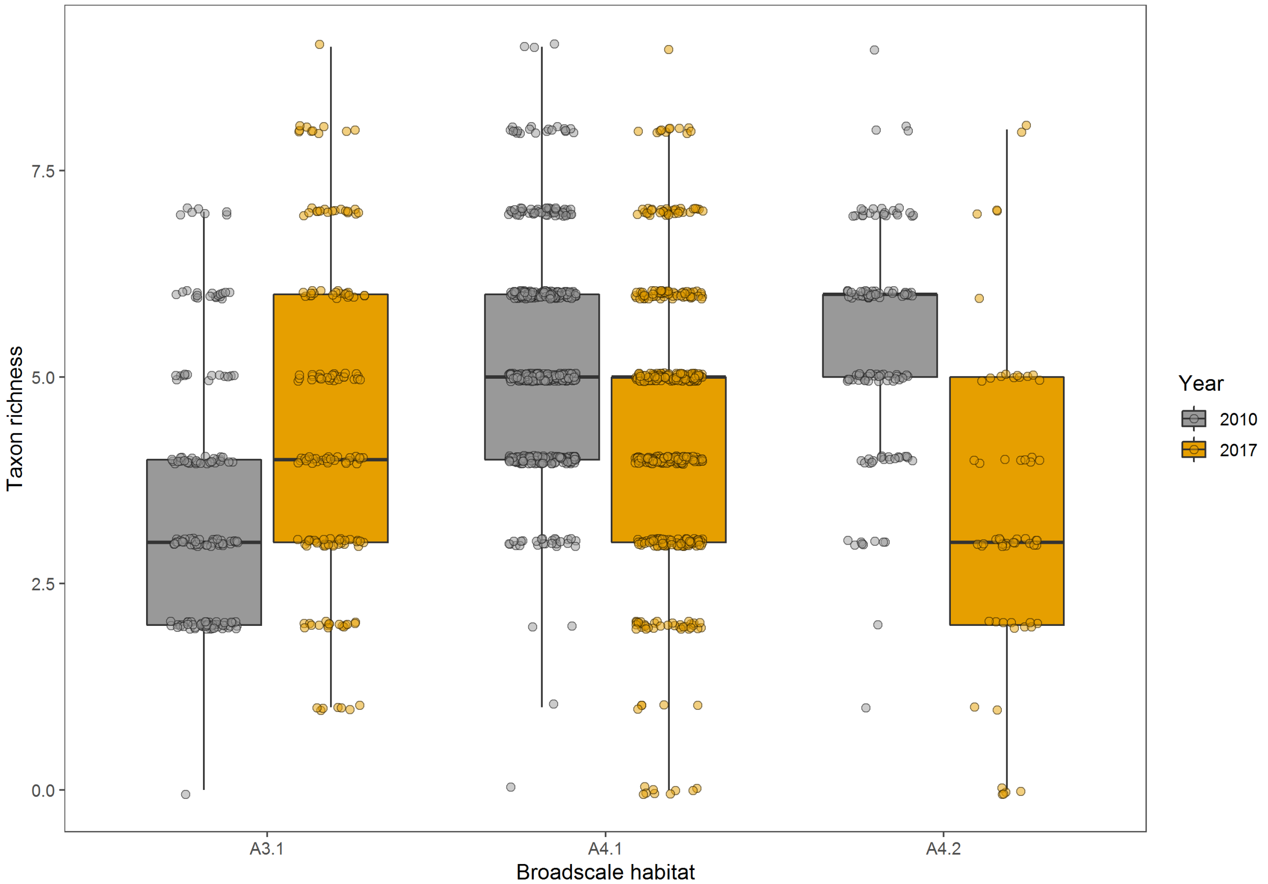

Figure 20. Taxon richness based on major taxonomic group as observed in three rock BSHs in 2010 and 2017 at Lizard Point SAC A small amount of random noise was added to the positions of individual points to enhance visualisation of discrete data. Significant increase between years was apparent in the 'A3.1 High energy infralittoral rock' BSH and significant decreases were apparent in the 'A4.1 High energy circalittoral rock' and 'A4.2 Moderate energy circalittoral rock' BSHs.

Assemblage structure

The above analyses show that taxon richness values were significantly lower in 2017 than in 2010. This was apparent when comparing both at the reported taxonomic resolution and when using a coarser resolution. Reduced taxon richness was only apparent in images assigned to circalittoral rock habitats. Within infralittoral rock habitats, there was an apparent increase in taxon richness between 2010 and 2017.

SIMPER analyses were conducted to identify the major taxonomic groups which discriminated between 2010 and 2017 assemblages. As the aim was to identify the taxa driving the apparent differences, rather than to identify differences in relative abundances between years, data were presence-absence transformed prior to SIMPER analysis.

Within the 'A3.1 High energy infralittoral rock' BSH, the majority of taxonomic groups were more frequently recorded in the 2017 data compared to 2010. Taxa belonging to bryozoan, anthozoan, sponge, and hydrozoan taxonomic groups were responsible for the majority of differences between 2010 and 2017 within this BSH (contributing to ~60% of differences between years) (Table 12, Appendix 1 Supporting data).

Within the 'A4.1 High energy circalittoral rock' BSH, relatively high occurrence of red algae (Rhodophyta) in 2010 compared to 2017 was the principal driver of difference between years (Table 13, Appendix 1 Supporting data). In addition, sponges (Phylum Porifera) and hydrozoans were more commonly recorded in 2010. Brown algae (Phaeophyceae) were also more commonly recorded in 2010. A number of taxa within this BSH were more commonly recorded in 2017. This includes ascidiaceans (tunicates and sea squirts), starfish, and crinoids.

Within the 'A4.2 Moderate energy circalittoral rock' BSH, bryozoans and holothurians were more commonly recorded in 2010 data compared with 2017 (Table 14, Appendix 1 Supporting data). As highlighted for the 'A4.1 High energy circalittoral rock' BSH, red algae were also more commonly recorded in 2010.

Circalittoral rock assemblages are typically dominated by faunal taxa. Although a number of algae taxa are associated with circalittoral rock habitats, they are generally not typical of these communities and with increasing depth, algal coverage is replaced by faunal taxa (JNCC, 2022). On average, images assigned to 'A4.1 High energy circalittoral rock' were captured at deeper depths in 2017 (mean ± SD = 36.3 ± 9.2 m) than in 2010 (34.5 ± 11.2 m) ($F_{1,1069}$ = 8.89, P = 2.9 x 10^{-3}). This could, at least in part, explain the apparent difference in red algae between the 2010 and 2017 data.

Within the 2010 'A4.1 High energy circalittoral rock' BSH imagery, 352 observations of red algae were recorded. The majority (n = 251, corresponding to 71% of observations) were recorded as red algal turfs. Where individual taxa were identified in 2010, these were made up of *Delessaria sanguinea* (n = 9, 3% of observations), *Stenogramma interruptum* (n = 3), *Calliblepharis ciliate* (n = 2), *Drachiella spectabilis* (n = 2), and *Plocamium cartilagineum* (n = 2). These taxa are typically associated with shallower waters, typically of less than 30 m depth (e.g., Ager, 2003; Sabatini, 2005; Tyler-Walters, 2006). In the 2017 data, all red algae within the 'A4.1 High energy circalittoral rock' BSH were recorded at the Phylum level (Phylum Rhodophyta).

Both the relatively shallow depths of the 2010 samples and the presence of red algal taxa associated with shallower waters suggests that this may be behind the observed differences in taxon richness values between the two years. That is, images assigned to the 'A4.1 High energy circalittoral rock' BSH in 2010 were more taxon rich than those gathered in 2017 in terms of the red algae recorded; this, at least in part, may have been driven by these images being recorded at relatively shallow depths, where red algae are typically more diverse.

Biotopes and notable taxa

As with the taxonomic data, the resolution at which biotopes were assigned was typically coarser in the 2017 data (Table 6). As such, a like for like comparison of the biotopes recorded in the two years would be uninformative. However, comparing the distribution of broadscale habitats between years is effectively the same as comparing biotopes at a coarser resolution, given that BSHs correspond to Level 3 MNCR biotopes (JNCC, 2018). As detailed in the 'Reef feature extents' section above, there was no evidence that the overall distribution of BSHs had changed between 2010 and 2017.

In addition to identifying a number of biotopes that characterised Lizard Point SAC, previous surveys and advice (Birchenough e*t al*., 2008; Axelsson and Dewey, 2011; Natural England, 2012) also identified a number of notable taxa which characterised the SAC (summarised in Section 1.1). Comparisons can therefore be made of individual taxa as a proxy for associated biological communities and biotopes between the two survey years.

Although taxa were typically identified at coarser resolutions in the 2017 data, a number of taxa considered either characteristic of Lizard Point SAC (Natural England, 2012), or those considered important in the classification of the biotopes which characterise the SAC (JNCC, 2022) were identified in the 2010 and 2017 data (Table 10).

The geographic range of those taxa recorded in both 2010 and 2017 were broadly similar between the two surveys (refer to Figure 22 in Appendix 1 Supporting data). Taxa such as *Pentapora fascialis* and *Caryophyllia (Caryophyllia (smithii)*, were widely distributed across the majority of the SAC in both surveys. Other taxa, such as *Eunicella verrucosa, Cliona celata* and *Tubularia* were more patchily-distributed in both the 2010 and 2017 surveys.

Not all of the notable taxa identified in 2010 were recorded in 2017. For example, the cnidarian *Tubularia indivisa* was not recorded in 2017. However, genus-level observations of *Tubularia* were recorded in 2017 (Table 10). In addition, the sandalled anemone *Actinothoe sphyrodeta* and the soft coral *Alcyonium glomeratum* were recorded in 2010, albeit in low numbers, and were not recorded 2017. The red algae *Delesseria sanguinea* and *Drachiella spectabilis* were not specifically recorded in 2017. It is unclear however whether these taxa were recorded under broader taxonomic levels or morphological descriptors. In 2017, no individual red algae species at all were recorded. All observations of red algae in 2017 were recorded as Phylum Rhodophyta. The distributions of taxa at broader taxonomic levels showed no significant changes between the two surveys (Figure 22 in Appendix 1 Supporting data). It is apparent that the distribution of red algae (Phylum Rhodophyta) was apparently broader in 2017 than was recorded in 2010.

Table 10. Observations of taxa considered as characteristic of Lizard Point SAC within rocky BSHs in the 2010 and 2017 surveys (refer to Section 1.1 and Natural England, 2012). Values indicate the percentage (and number) of images within each BSH in which each taxon was recorded.

	A3.1 - High energy infralittoral rock		A4.1 - High energy circalittoral rock		A4.2 – Moderate energy circalittoral rock	
Taxon	**2010**	**2017**	**2010**	**2017**	**2010**	**2017**
Pentapora fascialis	9.4% (15)	12.7% (20)	39.7% (229)	24.9% (112)	23.6% (30)	11.7% (7)
Alcyonidium diaphanum	11.3% (18)	15.8% (25)	86.7% (500)	28.5% (128)	87.4% (111)	5% (3)
Actinothoe sphyrodeta	0%	0%	0.5% (3)	0%	0%	0%
Alcyonium digitatum	33.1% (53)	31.6% (50)	71.8% (414)	49.7% (223)	59.1% (75)	20.0% (12)
Alcyonium glomeratum	0%	0%	0.3 (2)	0%	0%	0%
Eunicella verrucosa	0%	0%	5.9% (34)	1.3% (6)	0%	6.7% (4)
Corynactis viridis	1.3% (2)	12.0% (19)	33.1% (191)	31.0% (139)	2.4% (3)	3.3% (2)
Caryophyllia (Caryophyllia) smithii	5.6% (9)	19.0% (30)	62.6% (361)	56.3% (253)	63% (80)	73.3% (44)
Tubularia indivisa	0.6% (1)	6.0% (27)*	17.3% (100)	0%*	3.1% (4)	0%*
Cliona celata	3.8% (6)	3.2% (5)	9.4% (54)	7.6% (34)	4.7% (6)	1.7% (1)
Dictyopteris polypodioides	85.6% (137)	60.8% (96)	9.7% (56)	2.9% (13)	6.3% (8)	5% (3)
Delesseria sanguinea	10.0% (16)	0%	1.6% (9)	0%	0%	0%
Drachiella spectabilis	0.6% (1)	0%	0.3% (2)	0%	0%	0%

*Values for 2017 are based on genus-level occurrences of *Tubularia*.

3.6 Non-indigenous species (NIS) (Objective 3)

The taxa identified in the video and still imagery data in 2017 were cross-referenced against the list of non-indigenous species (NIS) compiled by Eno *et al.* (1997), the UKMS (formerly MSFD) UK priority monitoring species list 2020–2021 (GB Non-Native Species Secretariat, 2021) and the WFR (formerly WFD) Technical Advisory Group impact list (WFD UK TAG, 2015). No listed NIS taxa were recorded in the imagery data.

Within the 2017 data, many taxa were recorded at broad taxonomic levels, or using morphological descriptors, rather than at the species level provided in the NIS list (Appendix 2 Non-indigenous species). This includes taxa such as red algae (Rhodophyta), brown algae (Phaeophyceae), tunicates and sea squirts (Ascidiacea), and bryozoans. These broad taxonomic groups could potentially include NIS and so it is not possible to definitively conclude that no NIS were present in 2017.

Cross-checking against the 2010 data again found no species-level match with the NIS list. However, red algae belonging to genus *Polysiphonia* were recorded in 2010. This large genus contains approximately 200 species and includes the NIS species *P. subtilissima*. In addition, the 2010 data contained multiple observations of tunicates belonging to Family Didemnidae. This family contains the NIS species *Didemnum vexillum*. As such, it is not possible to rule out the presence of NIS in Lizard Point SAC, either within the 2017 data or within the 2010 data.

3.7 Marine litter (Objective 4)

Observations of marine litter were recorded at two stations in the still imagery data and within one segment of the video imagery data. The locations of these observations is provided in Figure 21.

In the video data, one observation was made of a ‘lobster pot and rope’. This observation was recorded towards the southern boundary of the SAC approximately 5.25 km offshore in a video segment assigned to the ‘A5.4 Subtidal mixed sediment’ BSH.

In the still imagery data, two records of litter were provided. One record of plastic litter was made within an image assigned to the ‘A4.1 High energy circalittoral rock’ BSH. This station was recorded at a depth of 50 metres and was located approximately 2 km offshore (Figure 21). This litter item was assigned to the litter code ‘A14 Plastic: other’ under the Marine Strategy Framework Directive (MSFD) guidance (Hanke, 2013). No additional information was provided as to the nature of this litter item.

A second litter item within the still imagery was assigned to the MSFD code ‘B8 Metal: other’. This item was located in the east of the SAC approximately 3 km offshore (Figure 21). The image was captured at a depth of 35 metres and was assigned to the ‘A5.1 Subtidal coarse sediment’ BSH. The brief description provided for this image indicated the presence of 'coarse sediment and metal litter which has been encrusted by Porifera and Bryozoa/Hydrozoa turf'.

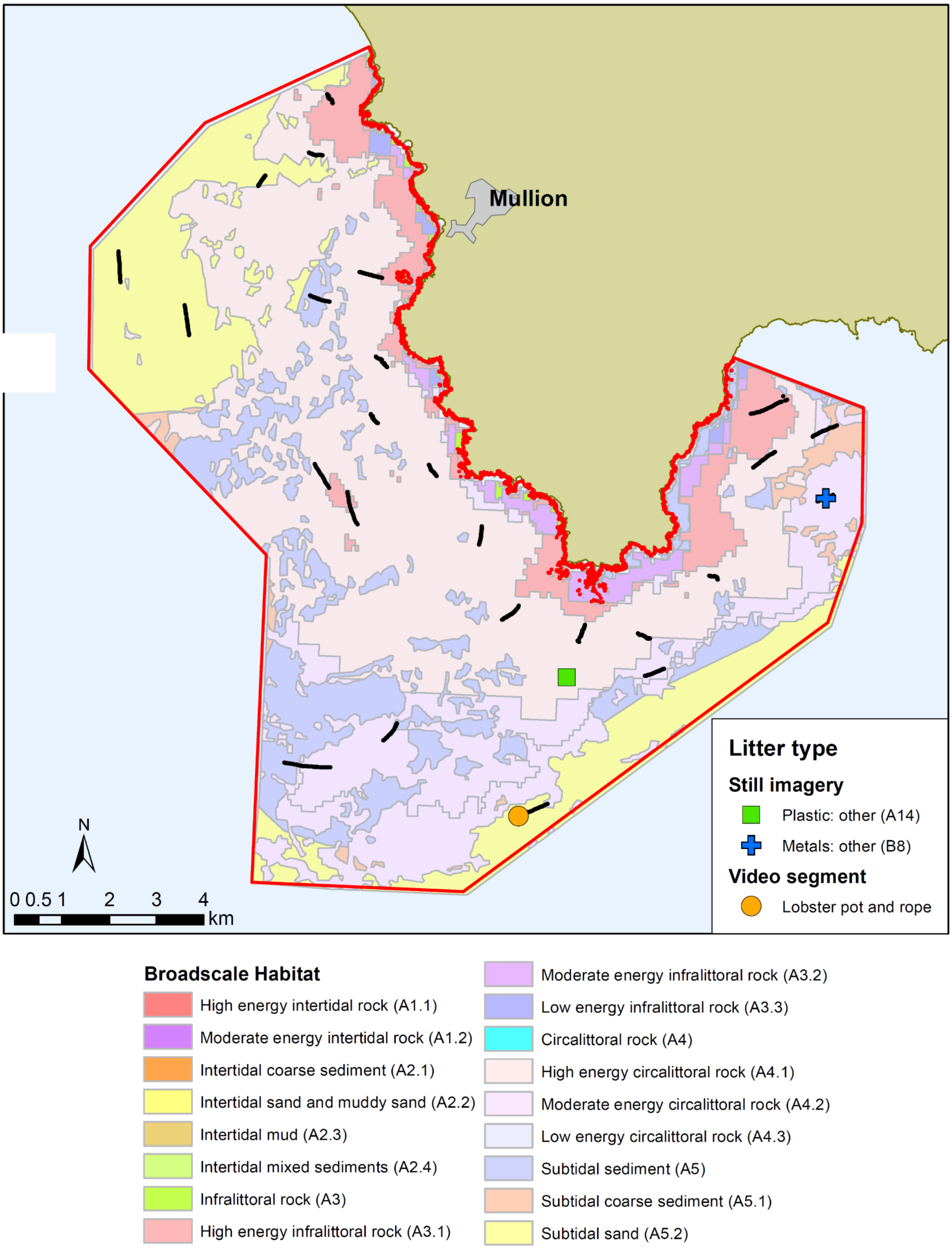

Figure 21. Location of litter captured in still and video imagery during the 2017 Lizard Point SAC survey. Background polygons are the modelled BSHs taken from the Marine Evidence database.

4. Discussion

The 2017 monitoring survey provided information on the designated features of Lizard Point SAC. This discussion reviews and summarises this evidence and provides an indicative assessment of the relevant features. No previous condition assessment has been published for Lizard Point SAC. However, the 2010 report (Axelsson and Dewey, 2011) did include preliminary condition assessments based on the data available at the time. Axelsson and Dewey's (2011) report concluded that the data gathered in 2010 were indicative of an 'excellent representativity' of Annex I reef habitats and that the habitats were in 'good' conservation status with all features recommended a grading of 'good' or 'excellent' (Axelsson and Dewey, 2011).

4.1 Extent of 'reef' features within Lizard Point SAC

Annex I reef was identified in over half of the video segments captured in 2017. The 2017 data were not gathered with the intention of mapping reef features within the SAC and so a specific assessment of the extent of reefs cannot be made. However, it is clear from the drop down camera data that reef habitats were widespread throughout the SAC. The extents of Annex I reefs were mapped in 2007 (Birchenough *et al*., 2008) and the extents inferred from the 2010 baseline survey data agreed with those data (Axelsson and Dewey, 2011).

The stations visited in 2017 did not match precisely with those visited previously, however most sites were in close proximity to those visited in 2010. As such, should the extent of Annex I reefs have changed substantially since 2010, then this would likely be apparent in the 2017 data. As recorded in 2010 (Axelsson and Dewey, 2011), rocky reef features were recorded throughout the SAC in 2017. There is no evidence that the extent of reefs has changed since the baseline survey. As there is no apparent change to the extent of Annex I reefs within the SAC, this corresponds to a **favourable assessment**. Given that the 2017 survey did not seek to explicitly quantify the extent of reefs, no data on the extent of individual reef subfeatures is available. As such, this assessment cannot be made with high confidence. Instead, this indicative assessment is made with **moderate confidence**. A specific survey would be required to rigorously assess the extent of reef features within Lizard Point SAC.

4.2 Presence, distribution, and composition of biological communities

It is difficult to confidently assess whether the assemblages and biotopes present within Lizard Point SAC have changed since 2010. This is linked to the different resolutions at which biotopes were assigned to the imagery data. Over 85% of images in 2010 were assigned to MNCR level 5 and level 6 biotopes. In 2017, only approximately 3% of images were assigned at this level, with the remaining images assigned to level 3 and level 4 biotopes. As such, we are not able to carry out a like for like comparison of biotopes *per se*. However, broadscale habitats correspond to MNCR level 3 biotopes. Comparison of BSH distributions shows that there has been no significant change in habitats at the broad scale since 2010 (see Section 'Reef feature extents').

As part of their assessment of the 2010 data, Axelsson and Dewey (2011) highlighted a number of taxa considered notable or characteristic of Lizard Point SAC and its associated biotopes. The distribution of individual taxa was therefore examined as a proxy for assessing changes to associated biological communities.

As with biotopes, the resolution at which taxonomies were assigned was generally coarser in 2017 than in 2010 and this reduces our confidence at which we can infer temporal changes. Despite this, a number of taxa considered notable by Axelsson and Dewey (2011) were recorded in 2017. There was no evidence of fundamental changes to the distribution of these taxa between 2010 and 2017.

The taxa identified by Axelsson and Dewey (2011) are indicative of a number of the biotopes which dominated various habitats within Lizard Point SAC in 2010. These taxa were generally widely distributed throughout Lizard Point SAC in 2017. This included taxa which are considered sensitive to physical disturbance (see Axelsson and Dewey, 2011), such as the Ross coral *Pentapora foliacia* which was widely distributed in both years. Some taxa, such as pink sea fan *Eunicella verrucosa* remained patchily-distributed in 2017 and this was similar to the distributions reported in 2010.

It is considered therefore that there is insufficient evidence to detect change in the identity and distribution of the biological communities recorded from previous monitoring of Lizard Point SAC. In addition, there is also insufficient evidence to conclude that the composition of biological communities has changed since the previous monitoring work. As such, this corresponds to **favourable condition** for both of these attributes. However, as this preliminary assessment is based on individual taxa in addition to data reported at a coarser resolution, the preliminary assessment must be made at **low confidence**.

4.3 Conservation of structure and function

Natural England guidance is currently under development on the identification of species that are key contributors to the structure and function of protected areas. Once relevant guidance is available, assessment of the structure and function of protected areas could be made with greater confidence.

Conservation of structure

As part of the 2010 survey, Axelsson and Dewey (2011) reasoned that the absence of static fishing gear in 2010 was evidence of conservation of structure, given that this implied that habitats were not being physically damaged by human activity. A single lobster pot was recorded in 2017. As this was in an area of the SAC characterised by 'A5.4 Subtidal mixed sediment' BSH, it is not indicative of impacts on the reef feature of the site.

Taxa considered as potentially sensitive to physical damage were highlighted by Axelsson and Dewey (2011). These are generally slow-growing, long-lived, delicate and/or sessile species, including Ross coral *Pentapora fascialis*, pink sea fan *Eunicella verrucosa*, and tunicates belonging to Family Styelidae. All of these taxa were recorded in 2017 and there was no evidence of substantial changes to their distributions since 2010. Furthermore, no damaged or diseased individuals were recorded. As such, this reflects that the structure of the SAC is under **favourable condition**. As there is currently no published guidance on the assessment of conservation of structure, this assessment is made with **low confidence**.

Influential species

A number of taxa were recorded in 2017 that could be regarded as influential with regards to the physical structure and ecological functioning of Lizard Point SAC. In addition, many of these taxa are likely to be sensitive to anthropogenic disturbance within the SAC (see Axelsson and Dewey, 2011). As such, these taxa have the potential to be considered as influential indicator species.

- Bryozoan taxa – bryozoans such as Ross coral *Pentapora fascialis* and sea chervil *Alcyonidium diaphanum* can form extensive turfs on exposed rock. They therefore have the potential to influence the physical nature of the benthic environment, impacting on the three-dimensional structure of the habitat. In addition, they have the potential to influence the functioning of the ecosystem, with many taxa acting as active filter feeders and therefore influencing benthic-pelagic coupling. These taxa have been shown to be widely distributed throughout the SAC in both the 2017 and 2010 surveys.
- Cnidarians and hydroids – similar to the bryozoans summarised above, cnidarians and hydrozoans were also widely distributed throughout the SAC. Again, these taxa influence the physical nature of the habitat and are generally considered as sensitive to physical disturbance. Some such as pink sea fan *Eunicella verrucosa* are large and slow-growing with associated communities relying on them for refugia (Readman *et al*., 2018). However, unlike other widespread cnidarians such as Dead man's fingers *Alcyonium digitatum*, pink sea fan was recorded in relatively few images in the 2010 and 2017 surveys.
- Brown and red algae – large brown algae, such as Laminariales were commonly recorded in nearshore reef habitats in both 2010 and 2017. In addition, various functional forms of red algae were also recorded in both surveys. However, red algae in 2017 were only recorded at the phylum level. Provided that a higher degree of taxonomic resolution can be recorded in future surveys (as highlighted in

Section 5), these macroalgae represent potentially important and highly influential taxa within Lizard Point SAC. They represent important food items for many taxa, they provide important habitats and refugia for many species, they are important primary producers, and they are important in the movement of energy and materials within the marine environment.

As the 2017 distributions of these potentially influential taxa were not substantially different to those recorded in 2010, preliminary assessment of is considered to be **favourable**. As no guidance on the selection and assessment of influential species has been published to date, this preliminary assessment is made with **low confidence**.

Conservation of function

The functioning of ecosystems is tied to both biotic and abiotic processes (Naeem *et al*., 2002). Ecosystem functions include the flow of energy and materials within the ecosystem, biogeochemical cycles, the productivity of biological components and the provision of habitat structure. To assess their contributions to ecosystem functioning, investigation of the biological traits displayed by taxa within protected areas would be beneficial. Biological traits analysis, in addition to assessments of taxonomic and functional diversity would provide evidence of how the functioning of the site is being conserved (Frid *et al*., 2008; Froján *et al*., 2011). This approach is recommended for future assessments within Lizard Point SAC and other protected areas (see Section 5).

As part of the 2010 survey work (Axelsson and Dewey, 2011) the conservation of function within Lizard Point SAC was graded highly. The results from the 2017 survey suggest no fundamental changes to the broadscale structure of the SAC features and the associated biological communities which drive ecosystem functioning. As such, Lizard Point SAC receives a preliminary assessment of **favourable condition** for conservation of function. Given that there is currently no published guidance on the assessment of conservation of function, this preliminary assessment is made with **low confidence**.

4.4 Non-native species and pathogens

No taxa listed on the non-indigenous species (NIS) list were recorded in the 2017 survey. There is the potential however, that NIS were present during the 2017 survey. As highlighted previously, many taxon records in 2017 were made either at relatively coarse taxonomic levels, or were made using morphological descriptors, rather than accepted taxonomic nomenclature. As such, taxa recorded under these broad groups could include NIS.

In addition to no observations made of NIS in 2017, there was also no explicit record of NIS in the 2010 data. However, records were made in 2010 of taxa at higher taxonomic levels which could potentially include NIS. For example, red algae of the genus

Polysiphonia were recorded in 2010. This is a highly polytypic genus, encompassing approximately 200 species. This includes NIS species.

In addition to no NIS taxa being identified within Lizard Point SAC, no evidence of pathogens were recorded in the survey data. Taxa such as the pink sea fan *Eunicella verrucosa* are susceptible to disease which manifests as a blackening or necrosis of the organism's body (e.g., Hall-Spencer *et al*., 2007). No observations of such necrosis were recorded in either the 2017 or 2010 data.

No NIS taxa were explicitly recorded in either the 2017 or 2010 surveys and no record of diseased taxa were made in either survey. As such, a preliminary assessment of **favourable condition** is made. As there is the potential for NIS to have been present, but grouped at a broader taxonomic level, this assessment can only be made at a **low confidence** level.

4.5 Preliminary condition assessment

Table 11. Summary of preliminary condition assessment of Lizard Point SAC (refer to Sections 4.1 to 4.4 for further information).

Feature/attribute	Feature/ Subfeature	Target	Preliminary condition assessment
Extent and distribution	Annexe I reefs; Infralittoral rock; Circalittoral rock	Maintain the total extent and spatial distribution of reef, infralittoral rock and circalittoral rock, and spatial distribution as defined on the map, subject to natural variation in sediment veneer	The 2017 survey did not assess habitat or feature extents. There was no indication of change from previous surveys. **Favourable assessment (moderate confidence)**.
Distribution: presence and distribution of biological communities	Annexe I reefs; Infralittoral rock; Circalittoral rock	Maintain the presence and spatial distribution of reef, infralittoral rock and circalittoral rock communities	No evidence of change from existing baseline. **Favourable assessment (low confidence)**.
Structure: species composition of component communities	Annexe I reefs; Infralittoral rock; Circalittoral rock	Maintain the species composition of component communities	No evidence of change from existing baseline. **Favourable assessment (low confidence)**.
Structure and function: presence and abundance of key structural and influential species	Annexe I reefs; Infralittoral rock; Circalittoral rock	[Maintain OR Recover OR Restore] the abundance of listed species, to enable each of them to be a viable component of the habitat.	*Structure*: **Favourable assessment (low confidence)** *Influential taxa*: **Favourable condition (low confidence)** *Function*: **Favourable condition (low confidence)**
Structure: non-native species and pathogens (habitat)	Annexe I reefs; Infralittoral rock; Circalittoral rock	Restrict the introduction and spread of non-native species and pathogens, and their impacts	No explicit identification of NIS or pathogens. **Favourable assessment** (**low confidence**)

5. Recommendations for future monitoring (Objective 5)

- **Maximise resolution of biotope and taxa identification** – it is important that assessments of changes over time are based on like-for-like comparisons. The current report aimed to assess change in multivariate assemblages between the 2010 and the 2017 surveys. However, the data gathered in 2010 were reported at higher biotope and taxonomic resolutions to those in 2017. This meant that the 2017 data were not directly comparable with those from 2010. Furthermore, the 2017 data were less informative than those from 2010. Taxa were typically reported at a coarser resolution in 2017, and so information on the identity of species within Lizard Point SAC in 2017 was likely to be incomplete. In addition, biotopes were recorded at a relatively coarse resolution in 2017. This means that we inherently lose higher level detail on the biological assemblages present at Lizard Point SAC in 2017 and we also have difficulty in interpreting whether or not the locations and extents of assemblages have changed between monitoring events. Future surveys should aim to maximise the quality of data reported, aiming to provide data that are informative and repeatable. This would ensure that any changes in the presence, location, extent and distribution of habitats and species are more readily detected.
- **Bespoke reef extent surveys** – to date, no bespoke surveys have been conducted to allow rigorous estimation of the extent of Annexe I reef habitats within the SAC. As such, it is difficult to confidently assess and infer whether the distribution of these habitats is changing over time. A bespoke survey would allow a more thorough assessment of change and would also inform the design of future monitoring work, allowing targeted monitoring of particular areas of reef habitat to be made.
- **Identification of key structural and functional taxa** – guidance is required to assist with the identification of key structural and functional taxa in protected sites. This would allow for the consistent and objective identification of such taxa and inform robust identification of trends over time.
- **Incorporation of biological traits analyses** – although informative, species composition, biodiversity measures and biotopes can provide only limited information on the ecological functioning of assemblages. The diversity of biological and ecological traits within assemblages could provide valuable additional insight into the ecological functioning of protected sites. This would give us an improved understanding of the condition of designated sites and provide valuable insight into the determination of key functional and structural taxa within the site. Furthermore, analyses could be carried out on the data already gathered, without modification to the sampling approaches already adopted. In addition, many traits, such as the morphological traits which are important mediators of many ecological functions (for

example, habitat provision and taxon palatability) are conserved even at relatively coarse taxonomic resolutions. As such, even where it is not possible to identify taxa to species level, valuable information on functional diversity and trait diversity can still be inferred.

- **Update habitat maps** – the information gathered in the 2017 Lizard Point SAC survey should be incorporated into an updated habitat map. Although the existing habitat map provided a reasonable prediction of the BSHs recorded in 2017, a number of minor discrepancies were apparent. An updated habitat map would provide a more realistic and up to date view of the distribution of habitats within Lizard Point SAC MCZ. This would inform future monitoring and provide a more accurate baseline against which future change could be compared.

References

AGER, O.E.D. 2003. *Drachiella spectabilis* Iridescent drachiella. In TYLER-WALTERS H. AND HISCOCK K. Marine Life Information Network: Biology and Sensitivity Key Information Reviews, [on-line]. Plymouth: Marine Biological Association of the United Kingdom. [cited 13-06-2022]. Available from: https://www.marlin.ac.uk/species/detail/1723

AXELSSON, M. AND DEWEY, S., 2011. Lizard Point cSAC and Land's End & Cape Bank cSAC baseline surveys 2010. Drop-down camera (stills photography and video) and Remotely Operated Vehicle (ROV) surveys. Southampton: SeaStar Survey Ltd.

BIRCHENOUGH, S.N.R., COGGAN, R.A., LIMPENNY, D.S, BARRIO-FROJAN, C., JAMES, J.W.C., TYLER-WALTERS, H., KIRBY, S. J. AND BOYD, S.E. 2008. Offshore Special Area of Conservation: The Lizard Point. SAC selection assessment. Acquisition of Survey data and preparation of Site Briefing Statements for Draft Marine Special Areas of Conservation within the 0-12 Nautical Mile Zone. A Report for CEFAS.

CLARKE, K.R. 1993. Non-parametric multivariate analyses of changes in community structure. Australian Journal of Ecology, 18, 117–143.

CLARKE, K.R. AND WARWICK, R. M. 2001. Change in marine communities: an approach to statistical analysis and interpretation, 2nd edition. PRIMER-E: Plymouth.

COGGAN, R., MITCHELL, A., WHITE, J. AND GOLDING, N. 2007. Recommended operating guidelines (ROG) for underwater video and photographic imaging techniques. Mapping European Seabed Habitats (MESH) video working group report v.11.2 [online]. Available online: http://www.emodnet-seabedhabitats.eu/PDF/GMHM3_Video_ROG.pdf [Accessed 25/05/2022].

CURTIS, L.A. 2017. Analysis of stills and video footage collected from Lyme Bay and Torbay Site of Community Importance. Report Number: ER17-326: Ecospan Environmental Limited Report to Natural England

DREW, S., SAVAGE, A., CHAPMAN, A., WATSON, H., POMFRET, J., SOTHERAN, I. AND FOSTER-SMITH, B. 2008. Natural England SAC Site Selection Assessment. Greater Thames Estuary. Contract FST20-18-030 Acquisition of survey data and preparation of site specific briefing statements for draft marine SACs.

ELLIOTT, M., NEDWELL, S., JONES, N., READ, S.J., CUTTS, N.D. AND HEMINGWAY, K.L. 1998. Volume II: Intertidal sand and mudflats and subtidal mobile sandbanks. An overview of dynamic and sensitivity characteristics for conservation management of marine SACs. UK Marine SACs project, Oban, Scotland. English Nature.

ENO, N.C., CLARK, R.A. AND SANDERSON, W.G. (eds.). 1997. Non-native marine species in British waters: a review and directory. Peterborough: Joint Nature Conservation Committee.

FRID, C.L.J., PARAMOR, O.A.L., BROCKINGTON, S. AND BREMNER, J. 2008. Incorporating ecological functioning into the designation and management of marine protected areas. In: Davenport, J., Burnell, G.M., Cross, T., Emmerson, M., McAllen, R., Ramsay, R. AND Rogan, E. Challenges to Marine Ecosystems, Developments in Hydrobiology, vol 202. https://doi.org/10.1007/978-1-4020-8808-7_7

FROJÁN, C.R.S.B., COOPER, K.M. BREMNER, J., DEFEW, E.C., HUSSIN, W.M.R.W., PATERSON, D.M. 2011. Assessing the recovery of functional diversity after sustained sediment screening at an aggregate dredging site in the North Sea. Estuarine, Coastal and Shelf Science, 92(3): 358-366.

GB NON NATIVE SPECIES SECRETARIAT. 2021. Marine Pathways Group. Reports, Documents and Links. MSFD UK Priority Monitoring Species List 2020–2021. Available from: http://www.nonnativespecies.org/index.cfm?pageid=597 [Accessed 04/05/2022].

HALL-SPENCER J.M., PIKE J. AND MUNN, C.B. 2007. Diseases affect cold water corals too: *Eunicella verrucosa* (Cnidaria: Gorgonacea) necrosis in SW England. Diseases of Aquatic Organisms 76: 87-97.

HANKE, G. 2013. Guidance on Monitoring of Marine Litter in European Seas. A guidance document within the Common Implementation Strategy for the Marine Strategy Framework Directive. Publications Office of the European Union, Luxembourg.

HOLM, S. 1979. A simple sequentially rejective multiple test procedure. Scandinavian Journal of Statistics, 6(2), 65–70.

JENKIN, A., STREET, K., TRUNDLE, C. AND NAYLOR, H., 2017. Lizard SCI Drop Down Video Survey. Cornwall Inshore Fisheries and Conservation Authority (CIFCA), Hayle.

JNCC. 2004. Common standards monitoring guidance for littoral rock and inshore sublittoral rock habitats. Peterborough, JNCC. Peterborough, UK. Available online:

Common Standards Monitoring Guidance for Littoral Rock and Inshore Sublittoral Rock Habitats (jncc.gov.uk) [accessed 18/03/2022].

JNCC. 2018. Correlation tables showing relationships between EUNIS (2004 and 2007 versions), the Marine Habitat Classification for Britain and Ireland (v15.03) and habitats listed for protection. Peterborough, JNCC. Peterborough, UK.

JNCC. 2022. The Marine Habitat Classification for Britain and Ireland Version 22.04. Available from: https://mhc.jncc.gov.uk/

MARINESPACE LTD. 2018. Video and Stills Analysis for Lizard Point SAC. MarineSpace Ltd., Southampton, UK.

MCARDLE, B.H. AND ANDERSON, M.J. 2001. Fitting Multivariate Models to Community Data: A Comment on Distance-Based Redundancy Analysis. Ecology, 82, 290-297. http://dx.doi.org/10.1890/0012-9658(2001)082[0290:FMMTCD]2.0.CO;2

NAEEM, S., LOREAU, M. AND INCHAUSTI, P. 2002. Biodiversity and ecosystem functioning: The emergence of a synthetic ecological framework. In: LOREAU, M., NAEEM, S. AND INCHAUSTI, P. (Eds). Biodiversity and ecosystem functioning. Synthesis and perspectives. Oxford University Press, New York: 3-11.

NATURAL ENGLAND, 2012. Lizard Point candidate Special Area of Conservation Formal advice under Regulation 35(3) of The Conservation of Habitats and Species Regulations 2010. Version 2.0.

NATURAL ENGLAND, 2022. Natural England Conservation Advice for Marine Protected Areas Lizard Point SAC. Designated Sites View website. Available online: https://designatedsites.naturalengland.org.uk/Marine/MarineSiteDetail.aspx?SiteCode=UK0030374&SiteName=lizard+point [accessed 12/04/2022].

OKSANEN, J., BLANCHET, F. G., FRIENDLY, M., KINDT, R., LEGENDRE, P., MCGLINN, D., MINCHIN, P.R., O'HARA, R.B., SIMPSON, G.L., SOLYMOS, P., STEVENS, M.H.H., SZOECS, E AND WAGNER, H., 2020. vegan: Community Ecology Package. R package version 2.5-7. https://CRAN.R-project.org/package=vegan

PARRY, M.E.V. 2015. Guidance on Assigning Benthic Biotopes using EUNIS or the Marine Habitat Classification of Britain and Ireland JNCC report No. 546 Joint Nature Conservation Committee, Peterborough http://jncc.defra.gov.uk/pdf/Report_546_web.pdf

R CORE TEAM, 2020. R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. URL https://www.R-project.org/

READMAN, J.A.J. AND HISCOCK, K. 2017. Eunicella verrucosa Pink sea fan. In TYLER-WALTERS H. AND HISCOCK K. Marine Life Information Network: Biology and Sensitivity Key Information Reviews, [on-line]. Plymouth: Marine Biological Association of the United Kingdom. [cited 14-06-2022]. Available from: https://www.marlin.ac.uk/species/detail/1121

READMAN, J.A.J., JACKSON, A. AND HISCOCK, K. 2018. Eunicella verrucosa and Pentapora foliacea on wave-exposed circalittoral rock. In TYLER-WALTERS, H. AND HISCOCK, K. (eds) Marine Life Information Network: Biology and Sensitivity Key Information Reviews, [on-line]. Plymouth: Marine Biological Association of the United Kingdom. [cited 14-06-2022]. Available from: https://www.marlin.ac.uk/habitat/detail/77

SABATINI, M. 2005. *Calliblepharis ciliata* Eyelash weed. In TYLER-WALTERS H. AND HISCOCK K. Marine Life Information Network: Biology and Sensitivity Key Information Reviews, [on-line]. Plymouth: Marine Biological Association of the United Kingdom. [cited 13-06-2022]. Available from: https://www.marlin.ac.uk/species/detail/2014

TURNER, J., HITCHIN, B., VERLING, E. AND VAN REIN, H. 2016. Epibiota Remote Monitoring from Digital Imagery: Interpretation Guidelines. NMBAQC/JNCC.

TYLER-WALTERS. 2006. *Delesseria sanguinea* Sea beech. In TYLER-WALTERS H. AND HISCOCK K. Marine Life Information Network: Biology and Sensitivity Key Information Reviews, [on-line]. Plymouth: Marine Biological Association of the United Kingdom. [cited 13-06-2022]. Available from: https://www.marlin.ac.uk/species/detail/1338

UK BIODIVERSITY ACTION PLAN. 2007. List of UK BAP Priority Marine Species. Available at: https://data.jncc.gov.uk/data/98fb6dab-13ae-470d-884b-7816afce42d4/UKBAP-priority-marine-species.pdf [Accessed 10/11/2022].

WARTON, D., WRIGHT, S.T. AND WANG, Y. 2012. Distance-based multivariate analyses confound location and dispersion effects. Methods in Ecology and Evolution, 3, 89-101. doi: 10.1111/j.2041-210X.2011.00127.x.

WFD UK TAG. 2015. Water Framework Directive UK Technical Advisory Group (WFD UK TAG) Revised classification of aquatic alien species according to their level of impact guidance paper v7.6 (22/07/2015). Available online: http://wfduk.org/sites/default/files/UKTAG%20classification%20of%20alien%20species%20working%20paper%20v8.pdf [Accessed 08/04/2022].

Appendix 1 Supporting data

Table 12. Contribution of major taxonomic groups to differences in A3.1 High energy infralittoral rock assemblages between 2010 and 2017 at Lizard Point SAC. Analysis based on presence-absence data to identify the taxa driving the differences. For each taxon, the contribution ± SD to between group dissimilarity is provided. For each taxon the highest values between the two years is in bold. Cumulative contributions are provided.

Major taxonomic group	Contribution ± SD	Mean 2010*	Mean 2017*	Cumulative %
Bryozoa	0.07 ± 0.07	0.36	**0.69**	18.37
Anthozoa	0.06 ± 0.07	0.36	**0.46**	33.52
Porifera	0.06 ± 0.07	0.32	**0.45**	48.35
Hydrozoa	0.05 ± 0.06	0.24	**0.31**	59.62
Asteroidea	0.04 ± 0.06	0.12	**0.34**	70.72
Ascidiacea	0.04 ± 0.06	0.01	**0.36**	81.13
Rhodophyta	0.02 ± 0.06	**0.99**	0.87	86.95
Phaeophyceae	0.02 ± 0.05	**0.99**	0.89	91.37
Echinoidea	0.01 ± 0.04	**0.10**	0.03	95.04
Crinoidea	0.01 ± 0.03	0.01	**0.05**	96.63
Holothuroidea	<0.01 ± 0.02	0.02	**0.02**	97.62
Gastropoda	<0.01 ± 0.02	0.01	**0.02**	98.42
Ophiuroidea	<0.01 ± 0.01	0.00	**0.02**	98.89
Mollusca	<0.01 ± 0.01	**0.01**	0.00	99.25
Polychaeta	<0.01 ± 0.01	**0.01**	0.00	99.47
Barnacle	<0.01 ± 0.01	**0.01**	0.00	99.67
Cnidaria	<0.01 ± 0.01	0.00	**0.01**	99.86
Sabellida	<0.01 ± 0.01	**0.01**	0.00	100

Table 13. Contribution of major taxonomic groups to differences in A4.1 High energy circalittoral rock assemblages between 2010 and 2017 at Lizard Point SAC. Analysis based on presence-absence data to identify the taxa driving the differences. For each taxon, the contribution ± SD to between group dissimilarity is provided. For each taxon the highest values between the two years is in bold. Cumulative contributions are provided.

Major taxonomic group	Contribution ± SD	Mean 2010*	Mean 2017*	Cumulative %
Rhodophyta	0.05 ± 0.05	**0.49**	0.17	13.57
Ascidiacea	0.04 ± 0.05	0.19	**0.4**	25.37
Porifera	0.04 ± 0.06	**0.92**	0.66	36.63
Hydrozoa	0.03 ± 0.06	**0.95**	0.73	45.92
Asteroidea	0.03 ± 0.05	0.11	**0.28**	54.64
Crinoidea	0.03 ± 0.05	0.11	**0.19**	61.91
Bryozoa	0.02 ± 0.05	**0.94**	0.84	68.46
Anthozoa	0.02 ± 0.05	**0.92**	0.87	74.7
Phaeophyceae	0.02 ± 0.04	**0.13**	0.07	79.59
Gastropoda	0.01 ± 0.03	**0.1**	0.06	83.43
Ophiuroidea	0.01 ± 0.03	0.05	**0.1**	87.19
Sabellida	0.01 ± 0.03	**0.1**	0.01	89.89
Holothuroidea	0.01 ± 0.03	**0.07**	0.03	92.24
Echinoidea	0.01 ± 0.03	**0.06**	0.03	94.36
Decapoda	0.01 ± 0.03	0.02	**0.06**	96.28
Barnacle	0.01 ± 0.02	**0.05**	0	97.65
Mollusca	<0.01 ± 0.02	**0.04**	0	98.66
Polychaeta	<0.01 ± 0.01	**0.02**	0	99.09
Bivalvia	<0.01 ± 0.01	**0.01**	0.01	99.51
Terebellidae	<0.01 ± 0.01	**0**	**<0.01**	99.84
Cnidaria	<0.01 ± 0.01	**0**	**<0.01**	99.91
Arthropoda	<0.01 ± <0.01	**0**	**<0.01**	99.96
Amphipoda	<0.01 ± <0.01	**<0.01**	0	100

Table 14. Contribution of major taxonomic groups to differences in A4.2 Moderate energy circalittoral rock assemblages between 2010 and 2017 at Lizard Point SAC. Analysis based on presence-absence data to identify the taxa driving the differences. For each taxon, the contribution ± SD to between group dissimilarity is provided. For each taxon the highest values between the two years is in bold. Cumulative contributions are provided.

Major taxonomic group	Contribution ± SD	Mean 2010*	Mean 2017*	Cumulative %
Bryozoa	0.06 ± 0.07	**0.98**	0.55	15.32
Holothuroidea	0.05 ± 0.05	**0.43**	0.04	27.46
Rhodophyta	0.04 ± 0.05	**0.39**	0.09	38.91
Hydrozoa	0.04 ± 0.06	**0.91**	0.78	48.37
Porifera	0.03 ± 0.06	**0.96**	0.76	57.29
Asteroidea	0.03 ± 0.05	0.19	**0.2**	65.93
Ascidiacea	0.03 ± 0.05	0.17	**0.24**	74.47
Anthozoa	0.03 ± 0.05	**0.87**	0.87	81.67
Echinoidea	0.02 ± 0.04	**0.17**	0.02	86.44
Phaeophyceae	0.01 ± 0.03	0.06	**0.07**	89.43
Sabellida	0.01 ± 0.03	**0.09**	0	91.88
Barnacle	0.01 ± 0.03	**0.09**	0	94.26
Crinoidea	0.01 ± 0.03	0.03	**0.04**	96.13
Gastropoda	0.01 ± 0.02	**0.04**	0.04	97.93
Ophiuroidea	<0.01 ± 0.02	0.01	**0.02**	98.81
Mollusca	<0.01 ± 0.02	**0.02**	0	99.31
Terebellidae	<0.01 ± 0.01	0	**0.01**	99.78
Polychaeta	<0.01 ± 0.01	**0.01**	0	100

*Mean values represent numerically-converted SACFOR values, ranging from 1 = Rare to 6 = Super-abundant

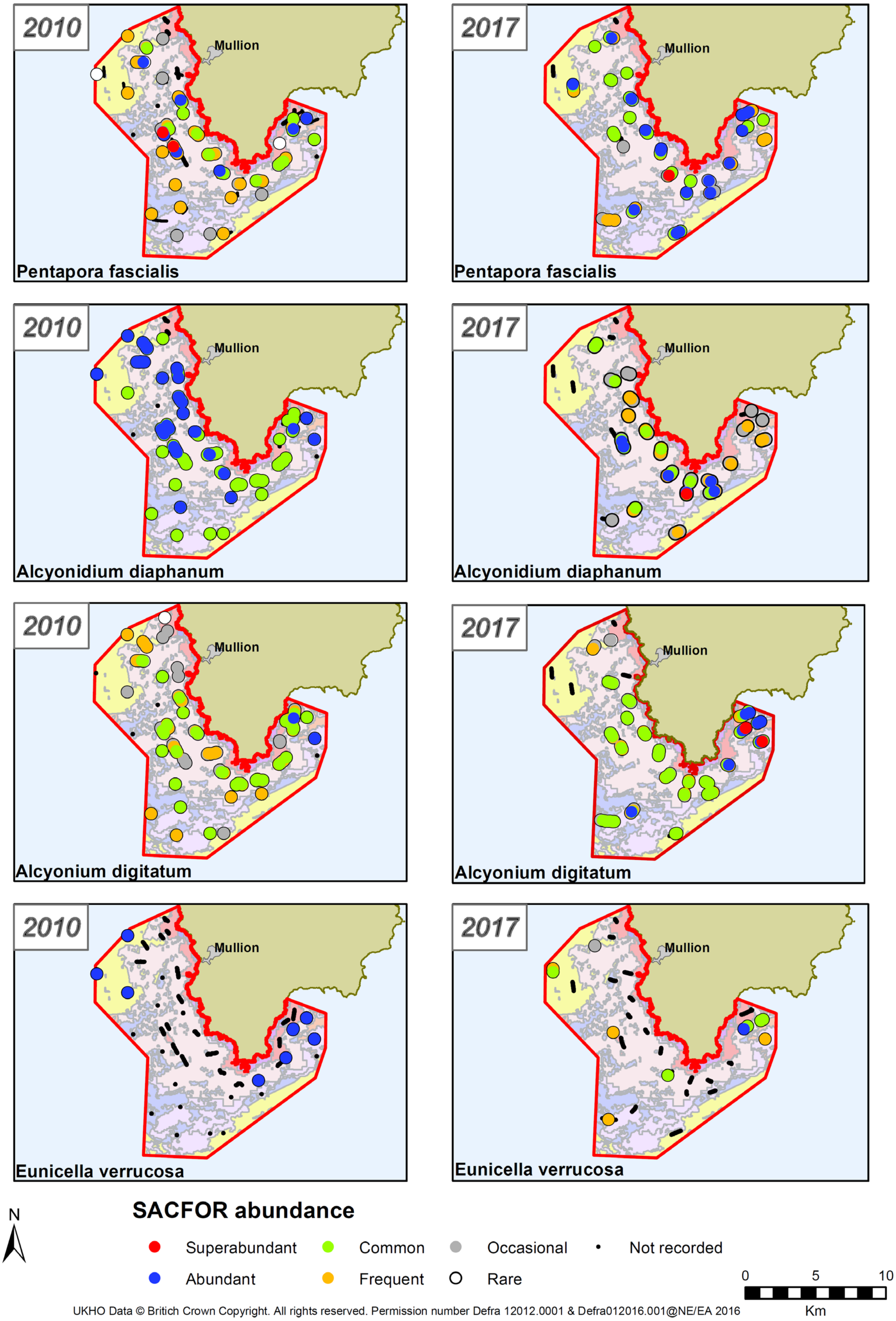

Figure 22 (continued overleaf)

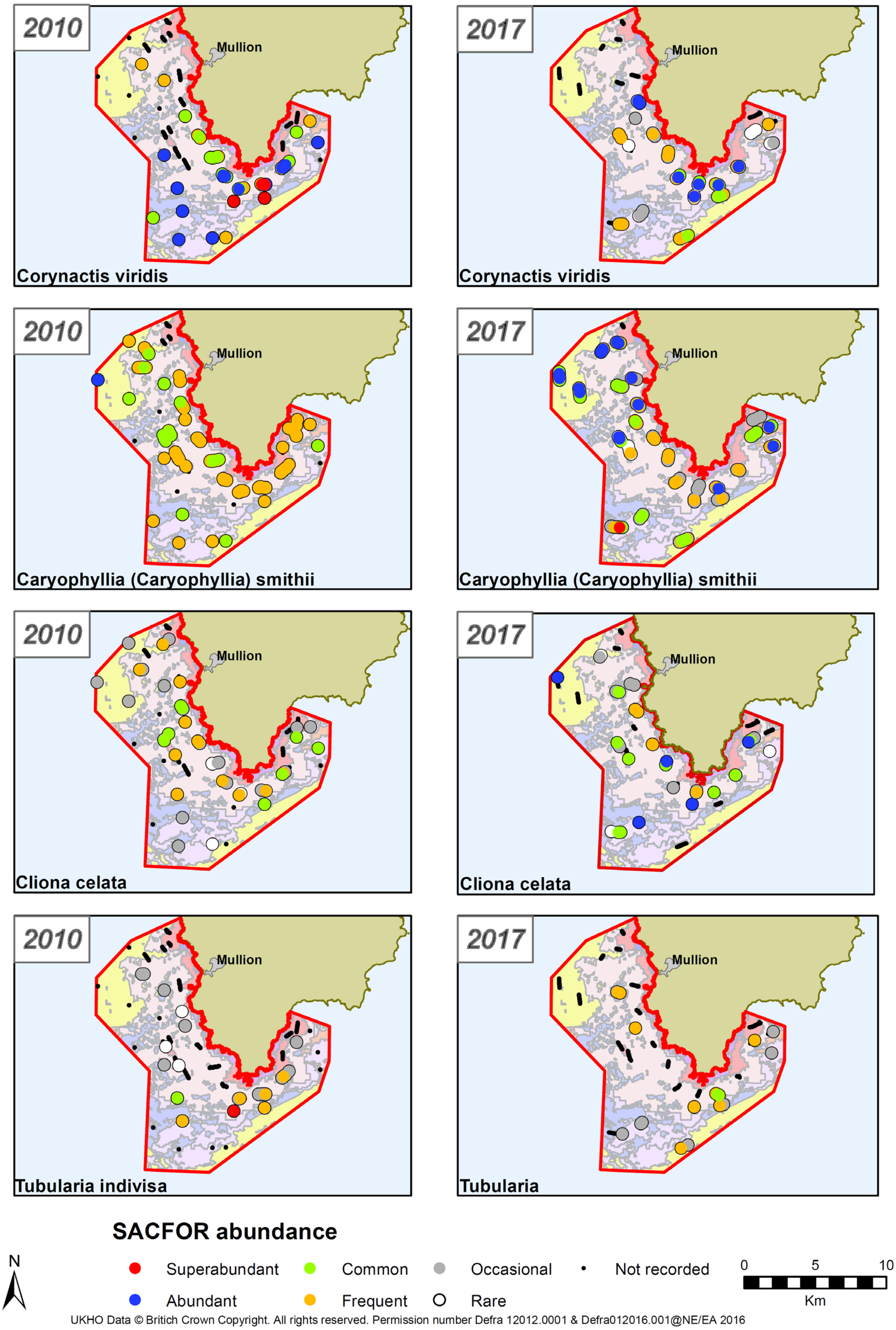

Figure 22 (continued overleaf)

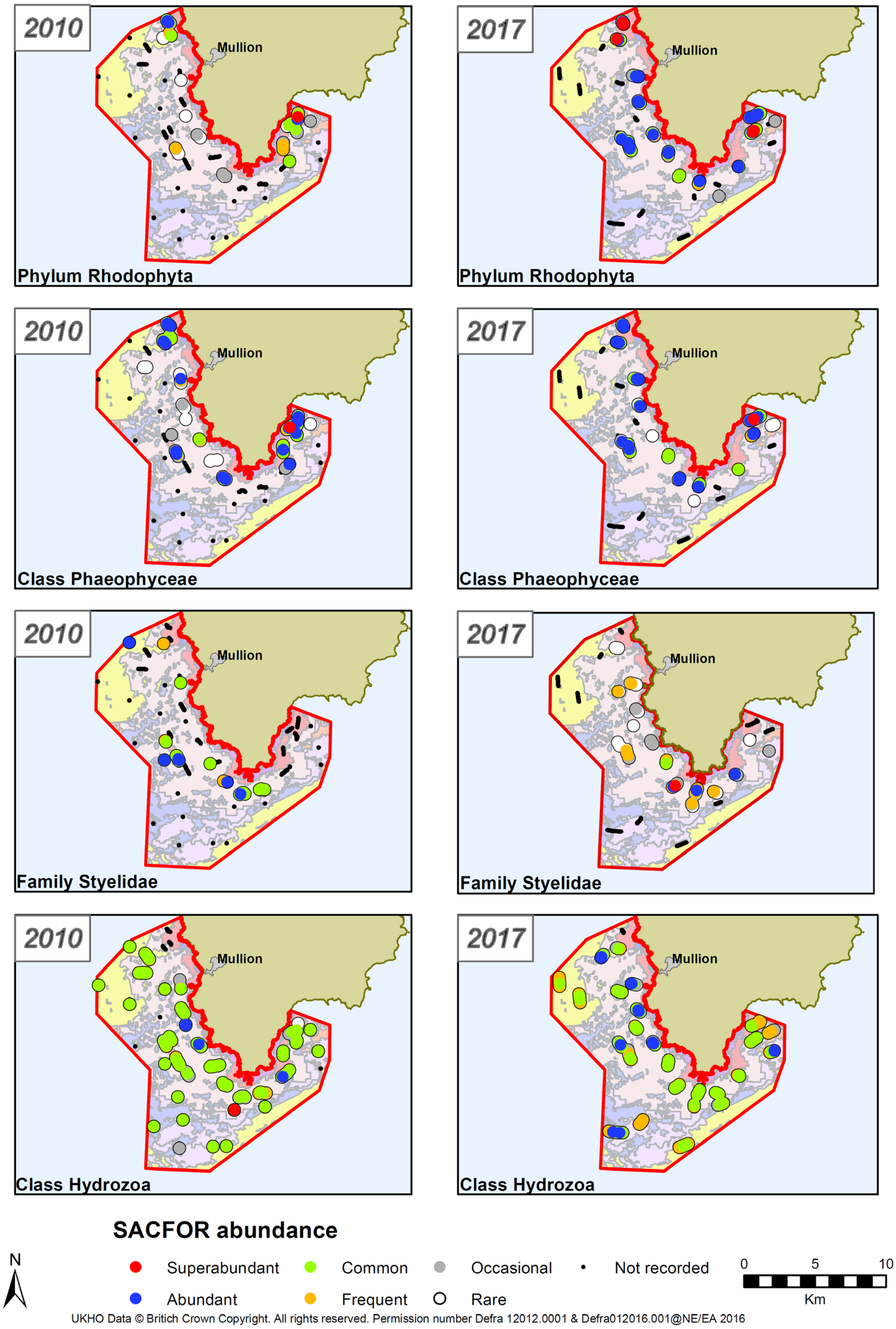

Figure 22. Comparison of the distribution of selected taxa within Lizard Point SAC in the 2010 and 2017 surveys. These taxa are considered characteristic of Lizard Point SAC and associated habitats (refer to Section 1.1). A number of these 'characteristic' taxa were only recorded in a single year (see Table 10). Only those taxa recorded in both 2010 and 2017 are displayed. The cnidarian *Tubularia* was identified only to genus level in 2017. Background polygons are the modelled BSHs taken from the Marine Evidence database.

Appendix 2 Non-indigenous species

Priority taxa listed as non-indigenous species (present and horizon) which have been selected for assessment of Good Environmental Status in GB waters under UKMS (formerly MSFD) Descriptor 2 (GB Non-Native Species Secretariat, 2021).

Species	List 2020-2021	AphiaID
Acartia tonsa	Present	345943
Agarophyton vermiculophyllum	Present	1327786
Arcuatula senhousia	Present (new addition)	505946
Alexandrium catenella	Horizon	231873
Amphibalanus amphitrite	Present	421137
Amphibalanus reticulatus	Horizon	421140
Asparagopsis armata	Present	144438
Asterias amurensis	Horizon	254497
Asterocarpa humilis	Present	250047
Boccardia proboscidea	Present (new addition)	327249
Bonnemaisonia hamifera	Present	144442
Botryocladia wrightii	Present (new addition)	1313615
Caprella mutica	Present	146768
Caulacanthus okamurae	Present	496188
Caulerpa racemosa	Horizon	144472
Caulerpa taxifolia	Horizon	144476
Celtodoryx ciocalyptoides	Horizon	559274
Cephalothrix simula	Present (new addition)	573293

Species	List 2020-2021	AphiaID
Ciona savignyi	Horizon (new addition)	250292
Corella eumyota	Present (new addition)	173223
Crepidula fornicata	Present	138963
Diadumene lineata	Present	395099
Didemnum vexillum	Present	25012
Dyspanopeus sayi	Horizon	107412
Ensis leei	Present	876640
Eriocheir sinensis	Present	107451
Ficopomatus enigmaticus	Present	130988
Grateloupia turuturu	Present	295880
Hemigrapsus sanguineus	Present	158417
Hemigrapsus takanoi	Present	389288
Hesperibalanus fallax	Present	733520
Heterosigma akashiwo	Present	160585
Homarus americanus	Horizon	156134
Megabalanus coccopoma	Horizon	149682
Magallana gigas	Present	836033
Megabalanus tintinnabulum	Horizon (new addition)	106225
Megabalanus zebra	Horizon	394986
Mizuhopecten yessoensis	Horizon	393716
Mnemiopsis leidyi	Present	106401

Species	List 2020-2021	AphiaID
Mulinia lateralis	Horizon (new addition)	156870
Ocinebrellus inornatus	Horizon	578702
Paralithodes camtschaticus	Horizon	233889
Polysiphonia subtilissima	Horizon	144674
Pseudochattonella verruculosa	Horizon	531446
Pseudodiaptomus marinus	Present (new addition)	360352
Rapana venosa	Horizon	140416
Rhopilema nomadica	Horizon	232032
Sargassum muticum	Present	494791
Schizoporella japonica	Present	470388
Styela clava	Present	103929
Telmatogeton japonicus	Present	118154
Undaria pinnatifida	Present	145721
Urosalpinx cinerea	Present	140429
Watersipora subatra	Present	816025

List of abbreviations

BSH	Broadscale Habitats
Cefas	Centre for Environment, Fisheries and Aquaculture Science
CHP	Civil Hydrography Programme
CP2	Charting Progress 2
CSA	Case Study Area
Defra	Department for Environment, Food and Rural Affairs
DORIS	Dorset Integrated Seabed survey
EA	Environment Agency
EUNIS	European Nature Information System
FLAG	Fisheries Local Action Group
FOCI	Feature of Conservation Interest
GES	Good Environmental Status
GMA	General Management Approach
SOIFCA	Southern Inshore Fisheries and Conservation Authority
JNCC	Joint Nature Conservation Committee
NMBAQC	North East Atlantic Marine Biological Analytical Quality Control Scheme
MarLIN	Marine Life Information Network
MBES	Multibeam echosounder
MCZ	Marine Conservation Zone
MonCoG	Monitoring Coordination Group
MPA	Marine Protected Area
NE	Natural England
NIS	Non-Indigenous Species

nMDS	Non-metric Multidimensional Scaling
OSPAR	The Convention for the Protection of the Marine Environment of the North-East Atlantic
PCA	Principal Components Analysis
PSA	Particle Size Analysis
PSD	Particle Size Distribution
RV	Research Vessel
SAC	Special Area of Conservation
SACFOR	Superabundant-Abundant-Common-Frequent-Occasional-Rare scale
SACO	Supplementary Advice on Conservation Objectives
SAD	Site Assessment Document
SIMPER	Similarity Percentages analysis
SIMPROF	Similarity Percentages analysis
SNCB	Statutory Nature Conservation Body
SOCI	Species of Conservation Interest
SSS	Sidescan sonar
UKMS	UK Marine Strategy

Glossary

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

Activity	A human action which may have an effect on the marine environment; e.g. fishing, energy production (Robinson, Rogers and Frid, 2008).*
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.
Habitats of Conservation Importance (HOCI)	Habitats that are rare, threatened, or declining in Secretary of State waters.*
Impact	The consequence of pressures (e.g. habitat degradation) where a change occurs that is different to that expected under natural conditions (Robinson, Rogers and Frid, 2008).*

Infauna	Fauna living within the seabed sediment.
Inshore Fisheries and Conservation Authority (IFCA)	The lead authority for managing inshore fisheries, securing the right balance between social, economic and natural benefits for a sustainable marine environment.
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 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).*
MNCR	The Marine Habitat Classification for Britain and Ireland lists all seafloor habitats currently known to occur in UK waters and was developed by JNCC's Marine Nature Conservation Review.
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.
NMBAQC	The North-East Atlantic Marine Biological Analytical Quality Control Scheme provides a source of external Quality Assurance (QA) for laboratories engaged in the production of marine biological data.

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, Rogers and Frid, 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.*
Species of Conservation Importance (SOCI)	Habitats and species that are rare, threatened or declining in Secretary of State waters.*
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.
UK Marine Strategy (UKMS)	The UK Marine Strategy now enshrines the principles of the EU's Marine Strategy Framework Directive in to UK law.

Natural England is here to secure a healthy natural environment for people to enjoy, where wildlife is protected and England's traditional landscapes are safeguarded for future generations.

Natural England publications are available as accessible pdfs from www.gov.uk/natural-england.

Should an alternative format of this publication be required, please contact our enquiries line for more information: 0300 060 3900 or email enquiries@naturalengland.org.uk.

Catalogue code: NECR533

www.gov.uk/natural-england

NATURAL ENGLAND