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Lyme Bay Seabed Imagery Analysis – Summary Report

Prepared for

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1. INTRODUCTION

OceanEcology were commissioned by Devon and Severn Inshore Fisheries and Conservation Authority (D&S IFCA) to undertake the analysis of 11 hours of underwater video footage collected between June and July 2016 in order to ground truth the location and extent of the designated features within Lyme Bay, Devon. The analysis involved assigning and mapping EUNIS biotope classifications to underwater video tows collected at 26 stations within Lyme Bay SI, 7 stations from Lyme Bay Strip and 7 stations from Beer Reef. The areas covered ranged in depth from approximately 4 to 30 metres. In addition to the biotope analysis a scallop count was undertaken in order to provide D&S IFCA with information on the scallop stocks across the three surveyed areas.

This report provides a summary of the analytical techniques employed during the analysis of the underwater video tows, the biotopes encountered, notable species and the abundance of scallops across the area.

2. METHODS

2.1. Video Tow Analysis

All seabed imagery analysis was undertaken in line with the Joint Nature Conservation Committee (JNCC) epibiota remote monitoring interpretation guidelines (Turner et al. 2016).

Using VLC media player (http://www.videolan.org/vlc/index.en_GB.html) each video tow was initially scanned by eye rapidly (at approximately 4 x normal speed) in order to identify main habitats and segment the video tow into sections characterised by different habitats, each representing a distinct 'Sample' (Figure 1).

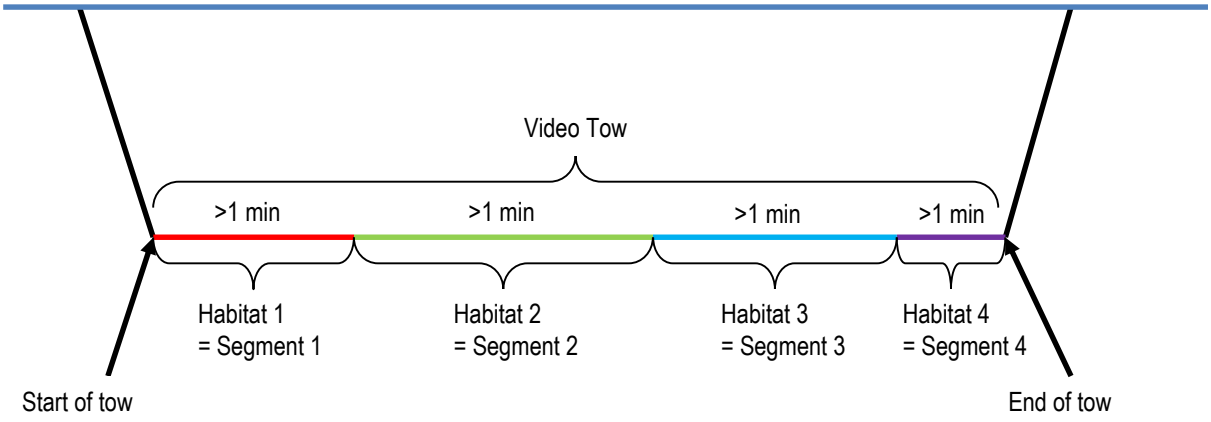


Figure 1. Simplified illustration of method for segmenting seabed video tows based on changes in habitat. Adapted from Marine Recorder Briefing Note, JNCC.

The tow was then viewed at normal speed and the following details were recorded in the adapted Cefas PROFORMA for each segment:

- A brief habitat description, noting physical (substrate type) and biotic characteristics
- Start and end time (from video overlay)
- Segment duration
- Start and end positions (from video overlay)
- Water depth (when available)
- Percentage substrate cover (e.g. bedrock, cobbles, shell, gravel, sand, mud, biogenic etc.)
- Broad Scale Habitat (BSH)
- Presence of any Habitat FOCI, Annex I Habitats and corresponding sub-features

- EUNIS and MNCR biotope codes and descriptors
- Visual quality of video

Determination of sediment type, such as coarse, mixed, sand etc. was facilitated using the adapted Folk sediment trigon (Long, 2006) incorporated into a sediment category correlation table. Percentage gravel (defined as boulders, cobbles, shells, granules, dead/live maerl), sand and mud were used to determine and assign EUNIS broad scale habitats. Where required, EUNIS categories for each of the video and still locations were considered from the information provided by the UKSeaMap 2016[1] utilising predictive habitat mapping where biotope maps were not available from existing surveys.

Therefore, for each segment, it was possible to determine the possible broad-scale modelled substrate and biological zone, i.e. whether the station received enough light for algal growth (infralittoral / circalittoral) or whether the station was likely to be 'wave disturbed' (circalittoral / deep circalittoral) (McBreen et al. 2011).

Sediments were noted as cobble / stony reef when 10 % or more of the seabed substratum was composed of granules larger than pebbles (≥64 mm, i.e. cobbles, and boulders) and the extent was identified to be >25 m^2 from the video footage (Irving, 2009) (see Table 1). When >30 % coverage was constituted by granules larger than pebbles a rock biotope and reef habitat was noted.

Table 1. Characteristics of Annex I 'stony reef' (from Irving, 2009).

Characteristic	Not a 'stony reef'	'Resemblance' to being a 'stony reef'		
		Low	Medium	High
Composition (proportion of boulders/cobbles (>64 mm))	<10 %	10-40 % matrix supported	40-95 %	>95 % clast-supported
Elevation	Flat seabed	<64 mm	64 mm - 5 m	>5 m
Extent	<25 m^2	>25 m^2		
Biota	Dominated by infaunal species			>80 % of species present composed of epibiotal species

Biotope mosaics were assigned according to guidelines set out by Parry (2015). In these video segments, more than one distinct substrate type was identified to be occurring in a patchwork, where patches were too small to be considered a separate biotope (<25m^2 as a working guide) but too large to be considered a feature of the main biotope. A rock / sediment mosaic was assigned to video segments where significant proportions of both rock (cobbles >64mm, boulders and bedrock) with any type of sediment (gravel, sand, mud etc.) were recorded e.g. areas of cobbles distinct from surrounding mixed sediments. In these areas, two biotopes were assigned and recorded with the most predominant biotope noted first (e.g. 'A3.116 / A5.23 mosaic').

A total of 40 video tows were analysed, of which 6 were split into separate segments representing distinctly different habitats. A total of 54 video segments were therefore analysed. Locations of the video tows are illustrated in Figure 2.

[1] http://jncc.defra.gov.uk/ukseamap

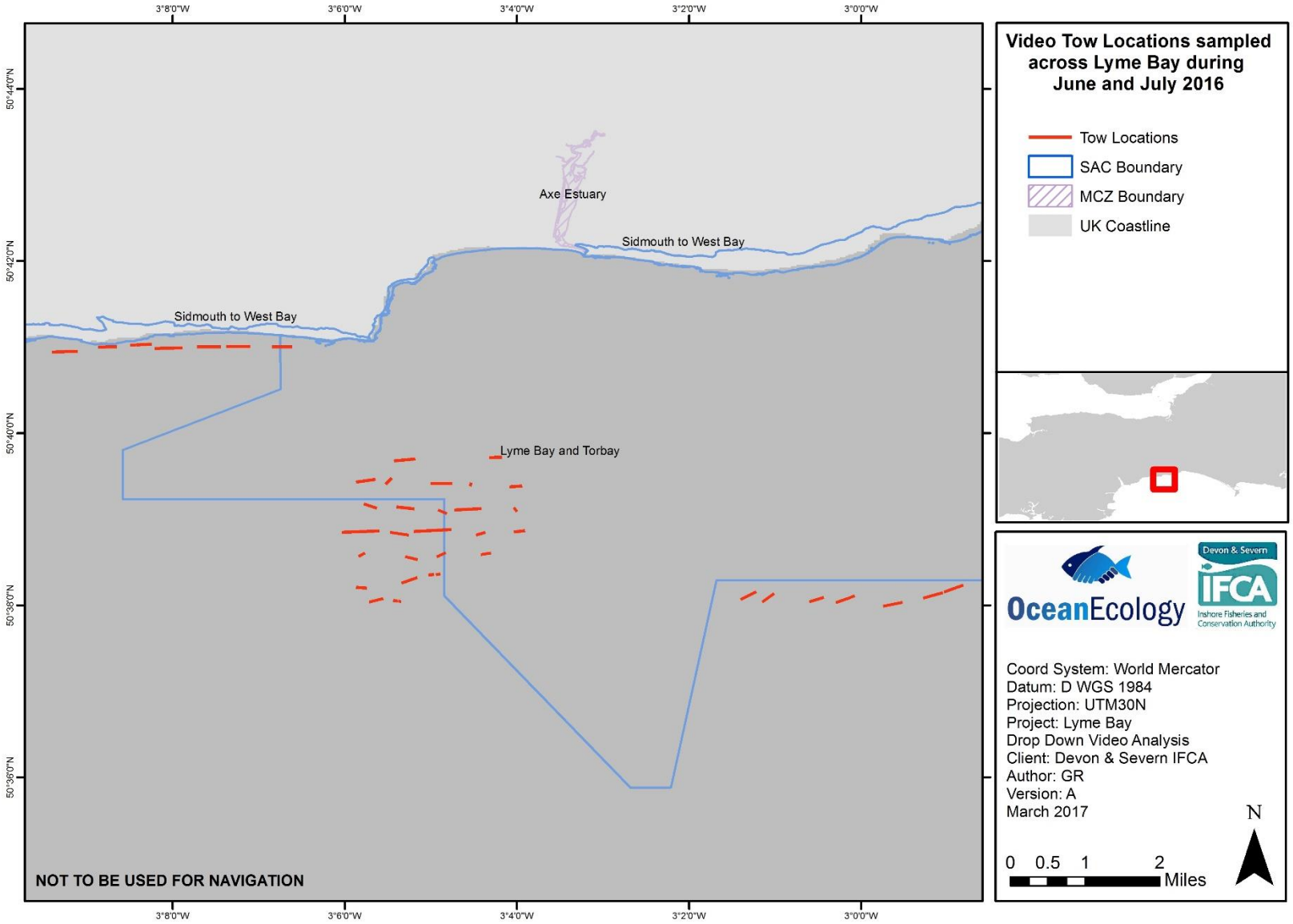


Figure 2. Map illustrating the locations of video tows sampled across Lyme Bay during June and July 2016.

2.2. Scallop Enumeration

Each video was viewed at a slower than normal speed to allow for all scallops (Pectinidae) to be identified to the lowest possible taxonomic level at which identification could be confidently achieved. The total number of scallops of each taxon was recorded for every video sample.

2.3. Mapping

All thematic maps presented in this report were created using ArcGIS 10.2.2 under **OceanEcology**'s user licence and all admiralty charts used as basemaps are presented under **OceanEcology**'s UK Hydrographic Office (UKHO) Copyright Licence No: 17400. All ArcGIS .shp files (also converted into MapInfo .tab files) accompany this report.

2.4. Quality Assurance

A total of 5 separate videos, representing 10% of the project were reanalysed by a separate **OceanEcology** ecologist for QA purposes. The individual stations for QA were selected randomly but it was ensured that at least 10% of each of the three areas was reanalysed. The majority of differences identified were related to percentage coverage of substrate type (e.g. cobbles, pebbles, sands) and the start and end points of segments. As such, differences noted between the original and QA analysis were not substantial enough to result in different biotopes being assigned on any occasion. All scallop identification was agreed by at least two ecologists.

3. RESULTS

3.1. Biotope Classification

The visual quality of the videos collected across Lyme Bay was generally good. This allowed for biotope determination and recording of the presence of Annex I habitats and species of interest for most video segments with a moderate to high degree of confidence. A number of segments were labelled as poor or very poor visibility where the distance between the camera and seabed reduced the visibility or where the substratum was obscured due to a dense canopy of kelp. Two video segments were labelled as zero visibility, thus no biotopes were recorded.

A total of 7 broad-scale habitats including two mosaic habitats were identified across Lyme Bay SI, Lyme Bay Strip and Beer Reef with the majority of stations characterised by 'A5.4 Subtidal mixed sediment' as shown in Figure 3. Within these broad-scale habitats, 13 biotopes at EUNIS Level 4 or above were identified as shown in Figure 4. The majority of sediment habitats were characterised by 'A5.44 Circalittoral mixed sediment', either with characteristic burrowing anemones (A5.441) or burrowing anemones and hydroids (A5.4411). The majority of rock habitats were identified as 'A3.215 Dense foliose red seaweeds on silty moderately exposed infralittoral rock'. The broad-scale habitats across the three areas and corresponding EUNIS biotopes in each area are mapped in Figures 5-8.

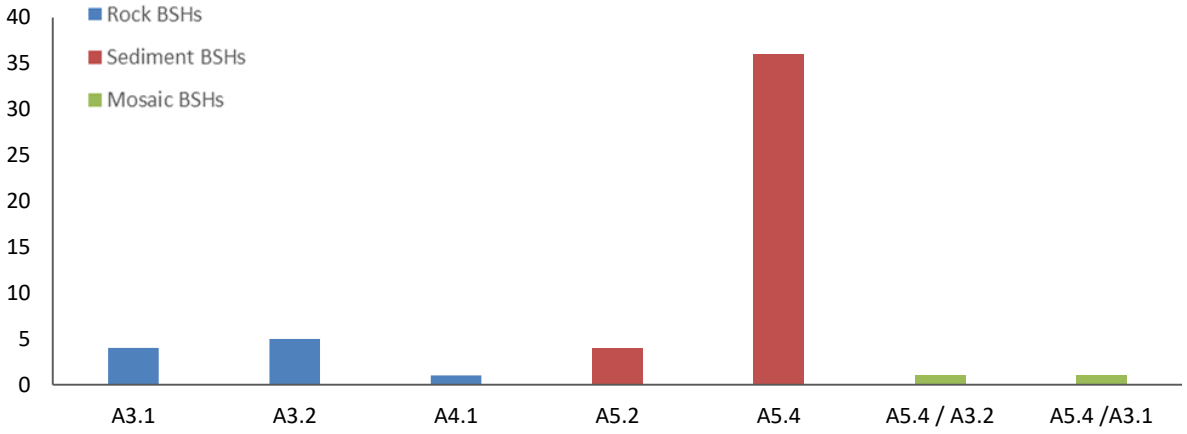


Figure 3. Histogram showing the frequency of occurrence of each of the EUNIS broad-scale habitats identified across Lyme Bay SI, Lyme Bay Strip and Beer Reef.

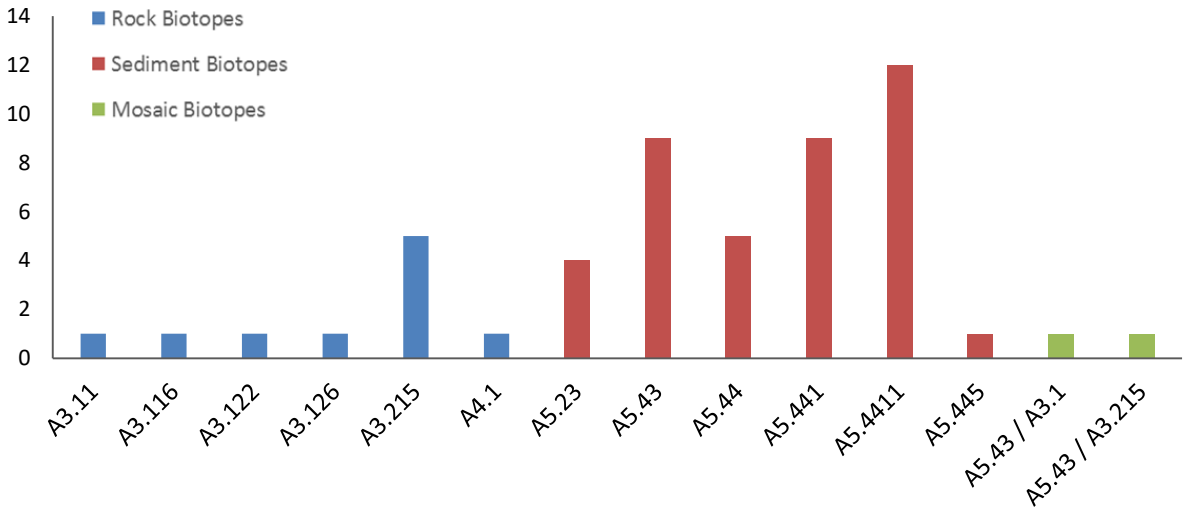


Figure 4. Histogram showing the frequency of occurrence of each of the EUNIS biotopes identified across Lyme Bay SI, Lyme Bay Strip and Beer Reef.

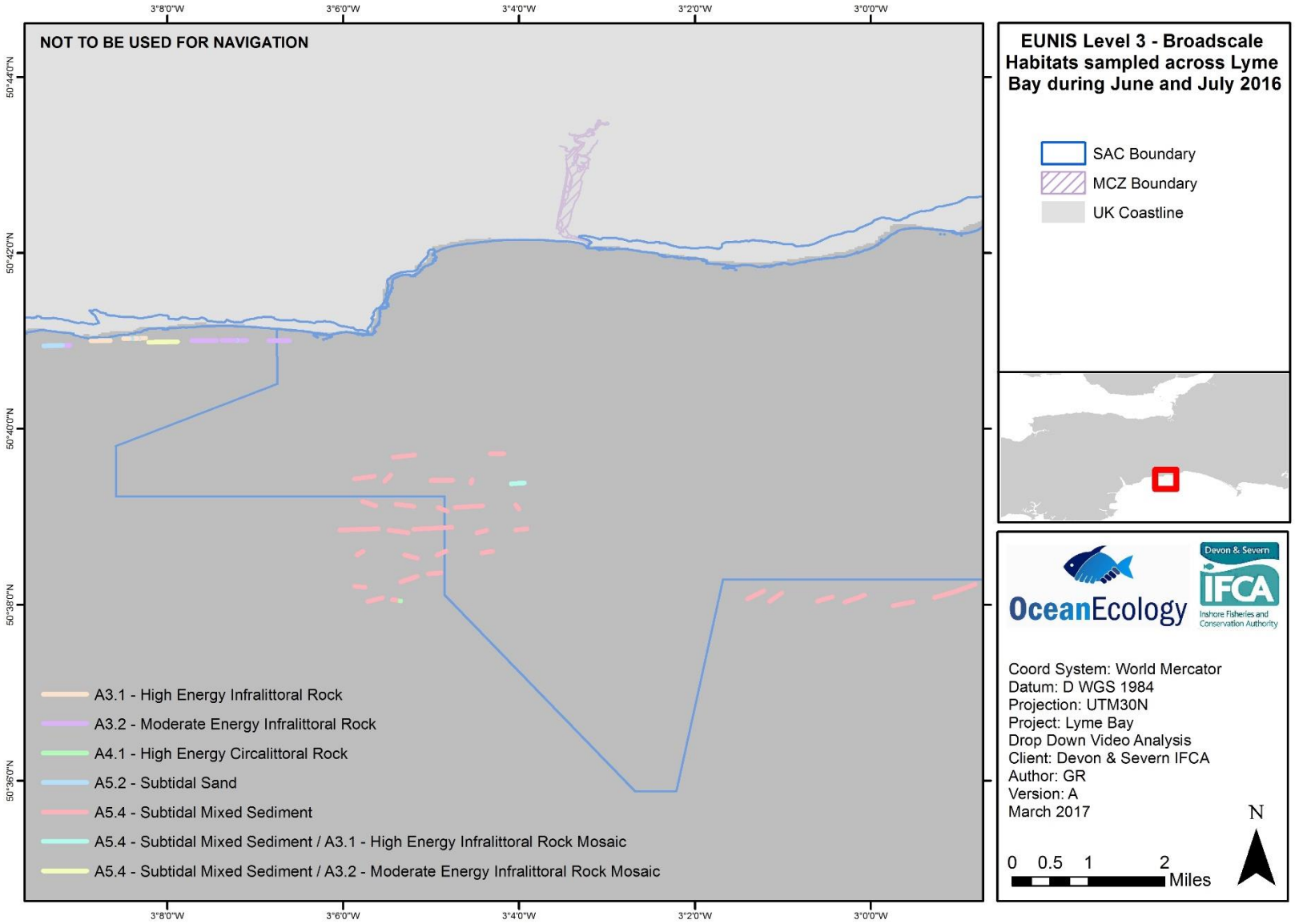


Figure 5. Map illustrating the broad-scale habitats identified along each of the video tows across Lyme Bay SI, Lyme Bay Strip and Beer Reef.

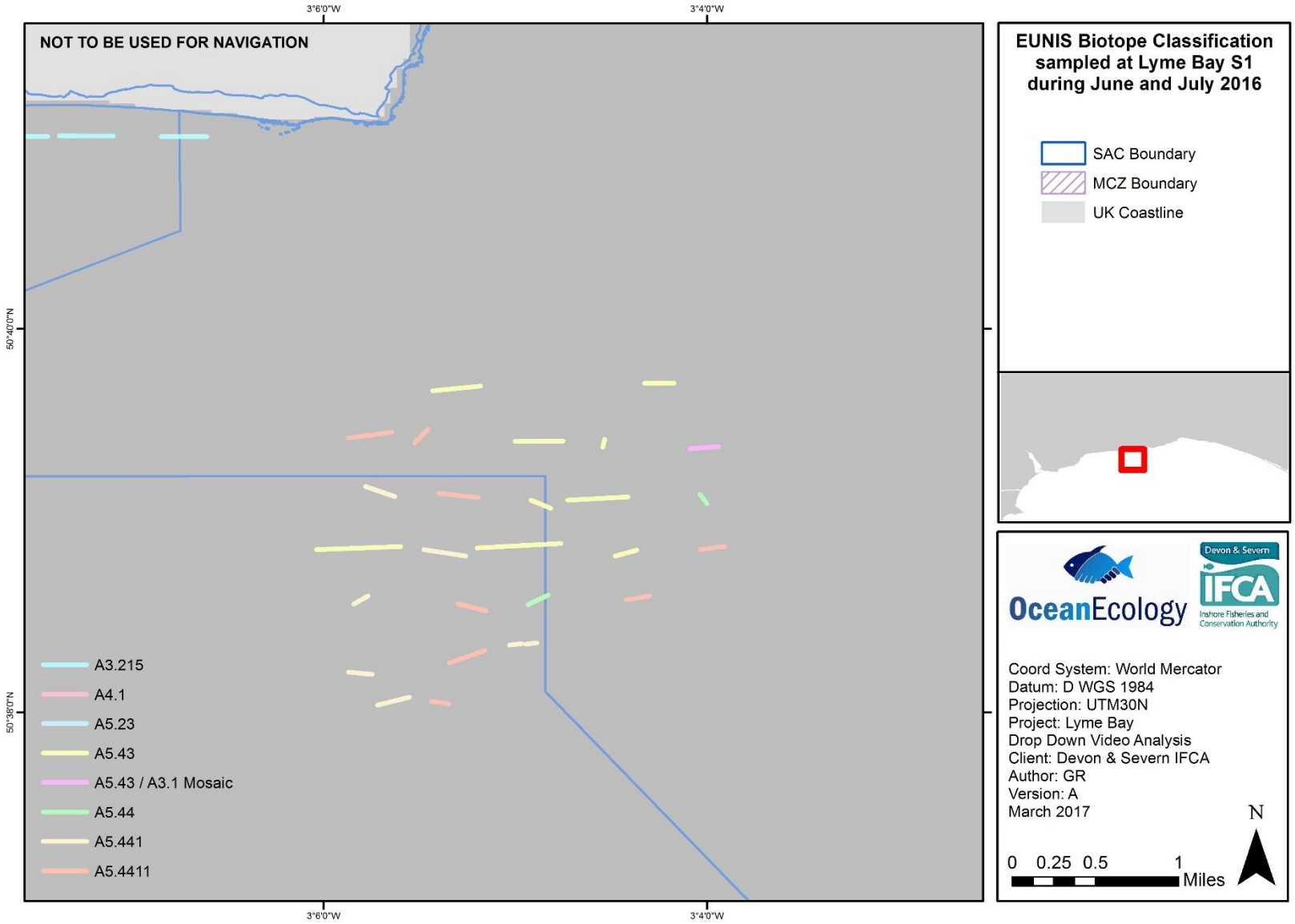


Figure 6. Map illustrating the EUNS biotopes identified along each of the video tows across Lyme Bay SI.

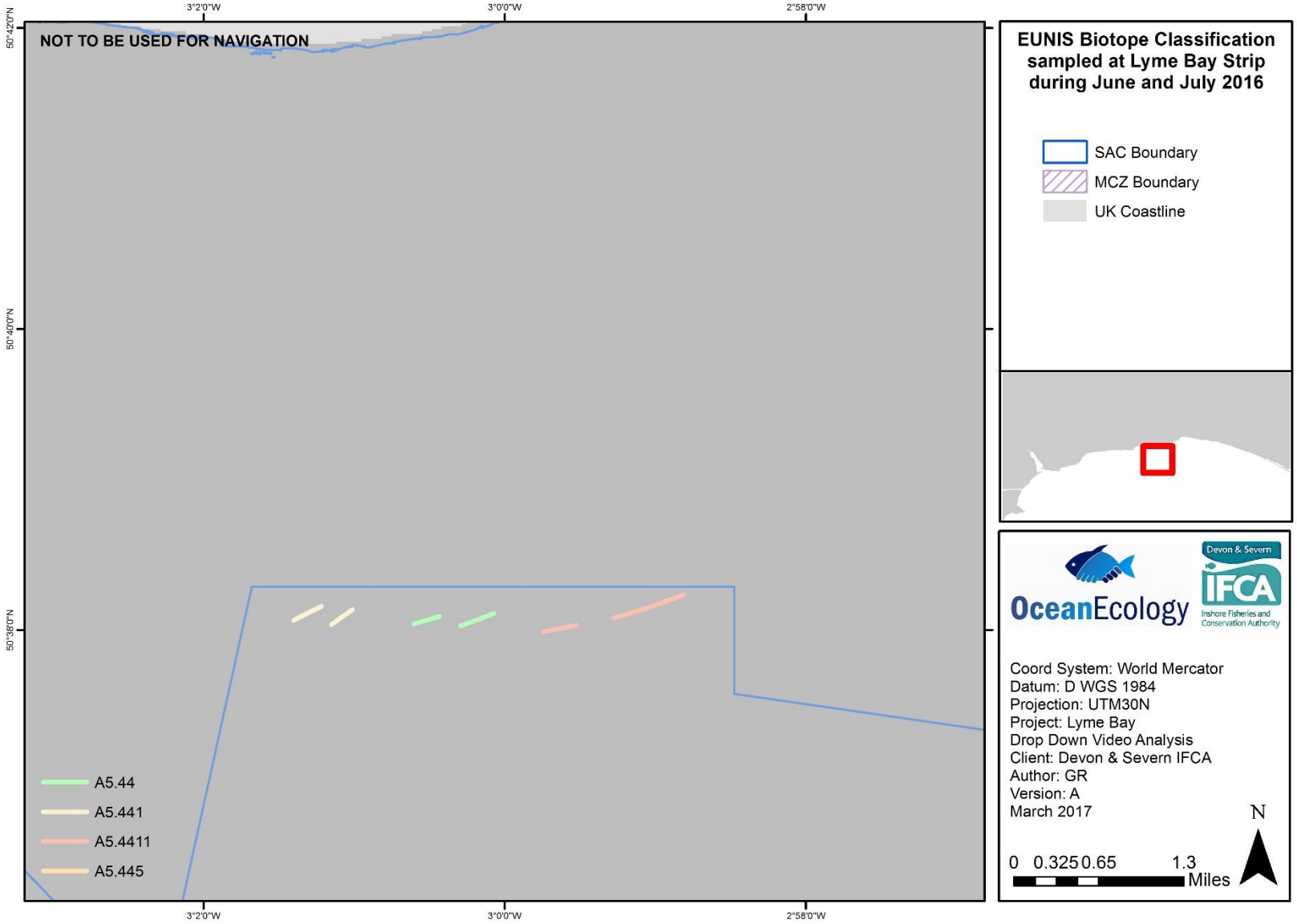


Figure 7. Map illustrating the EUNS biotopes identified along each of the video tows across Lyme Bay Strip.

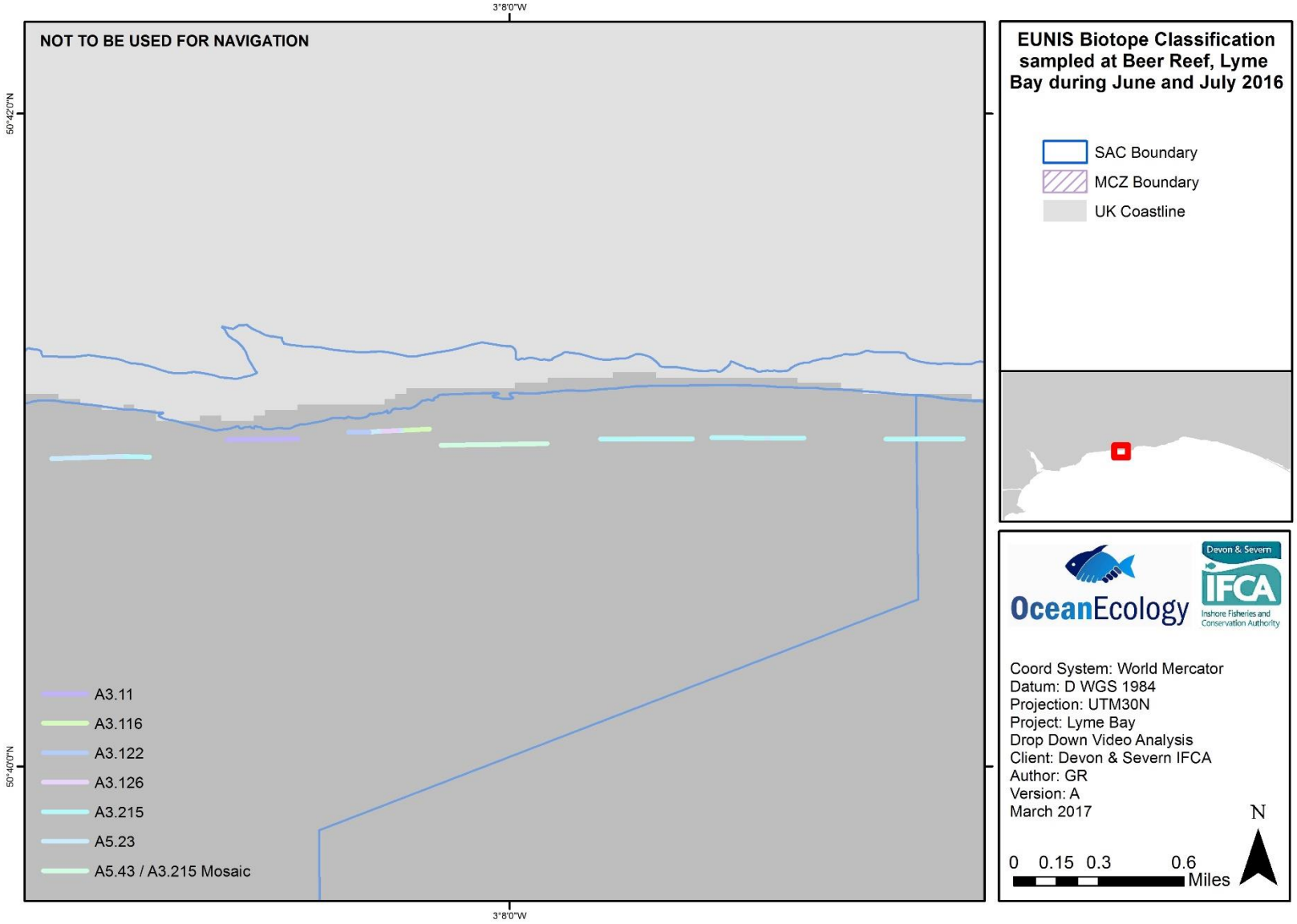


Figure 8. Map illustrating the EUNS biotopes identified along each of the video tows across Beer Reef.

Lyme Bay SI

Lyme Bay SI was characterised by mixed sediments comprised of pebbles and shells with a muddy veneer, and areas of muddy sand with poorly sorted coarse sediments on the surface. Fauna was dominated by burrowing anemones (*Ceriantharia* sp.), and hydroids (including *Halecium* sp. and *Nemertesia* sp.) particularly in areas of more stable cobbles and boulders. The most frequently occurring biotopes were 'A5.43 Infralittoral mixed sediment' and 'A5.4411 *Cerianthus lloydii* with *Nemertesia* spp. and other hydroids in circalittoral muddy mixed sediment', closely followed by 'A5.441 *Cerianthus lloydii* and other burrowing anemones in circalittoral muddy mixed sediment' as shown in Figures 6 and 9.

Scallops were recorded frequently throughout every segment aside from the single station assigned as a rock biotope and characterised by boulders with silt veneer and hydroids. This area was not defined as Annex I 'reef' as it was identified at the end of a video tow and therefore the extent (i.e. whether it covered an area >25m^2) was unknown. A single station was assigned a mixed sediment / rock mosaic habitat where the substratum was composed of areas of cobble reef with frequent patches of mixed sediments throughout (Low confidence Annex I 'reef').

The majority of the stations analysed in Lyme bay SI were noted to be in a transitional zone between the infralittoral and circalittoral (recorded depths of 20-26m). In these areas it appeared that light was reaching the seabed, suggesting an infralittoral habitat, however the faunal community was characteristic of those described for the circalittoral zone. Where this occurred, the most appropriate EUNIS classification was chosen based on the faunal communities that were identified.

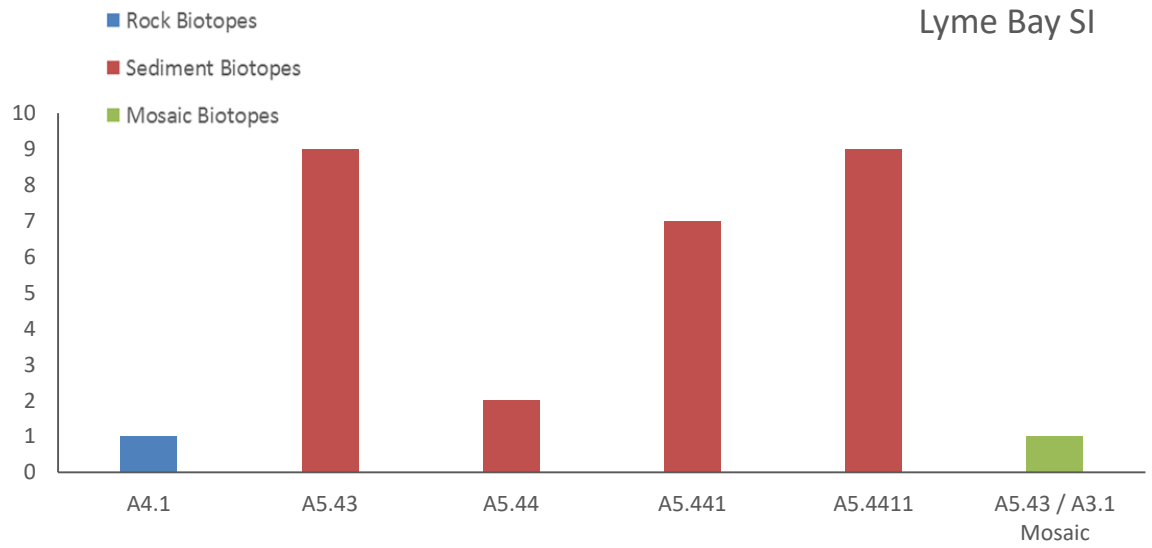


Figure 9. Histogram showing the frequency of occurrence of each of the EUNIS biotopes identified in Lyme Bay SI.

Lyme Bay Strip

Lyme Bay Strip was characterised entirely by the broad-scale habitat 'A5.4 Subtidal Mixed Sediment', with some areas dominated by *Ceriantharia* sp. and frequent hydroids (Figures 7 and 10). The substrate was similar to that of the Lyme Bay SI area, however higher proportions of shell and shell fragments were noted, particularly tower shells. In general scallops were recorded less frequently than in the shallower habitats in Lyme Bay SI, and in particular there were notably fewer *P. maximus* in comparison. Other fauna identified included Buccinidae,

Paguridae and *Cancer pagurus*. *Ophiothrix* spp. were identified as a biotope defining species in one video section, although the distribution was patchy.

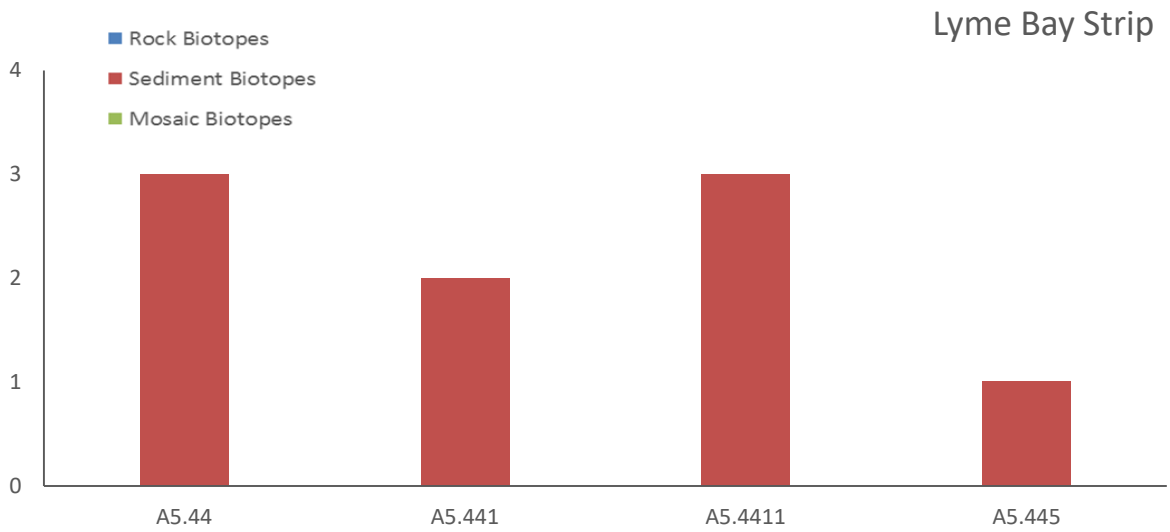


Figure 10. Histogram showing the frequency of occurrence of each of the EUNIS biotopes identified in Lyme Bay Strip.

Beer Reef

Beer Reef was characterised by extensive cobble reef with areas of fine sand and small patches of mixed sediments. The majority of habitats (9 segments out of 14) were identified as rock, composed of stable cobbles and boulders and assigned as Annex I 'Reef' (stony/cobble reef). Most biotopes within the rock areas were recorded as 'A3.215 Dense foliose red seaweeds on silty moderately exposed infralittoral rock' where frequent patches of foliose red algae were identified colonising the tops of stable boulders and cobbles. In shallower areas the faunal communities were instead dominated by dense kelp such as *Laminaria hyperborea* or by more scour tolerant and opportunistic species such as *Laminaria saccharina* and *Halidrys siliquosa*. Areas of 'A5.23 Infralittoral fine sand' with sparse visible fauna were recorded as distinct biotopes in four of the video segments. Within a sand biotope a small, but distinct area of maerl was identified, formed into waves in the sediment (see Section 3.6). A single biotope mosaic was recorded where expanses of silty mixed sediment and cobbles were broken up by areas of stable boulders and cobbles.

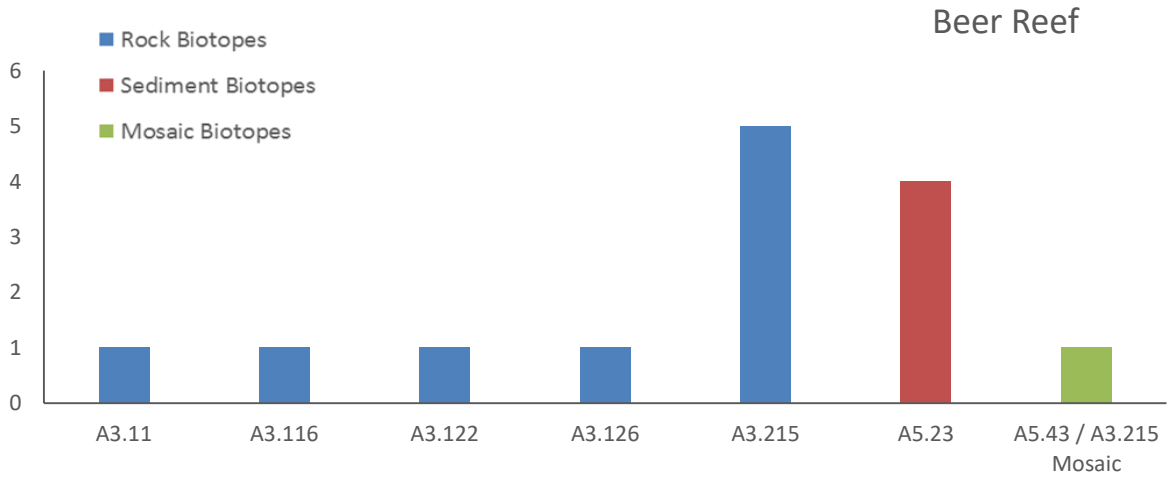


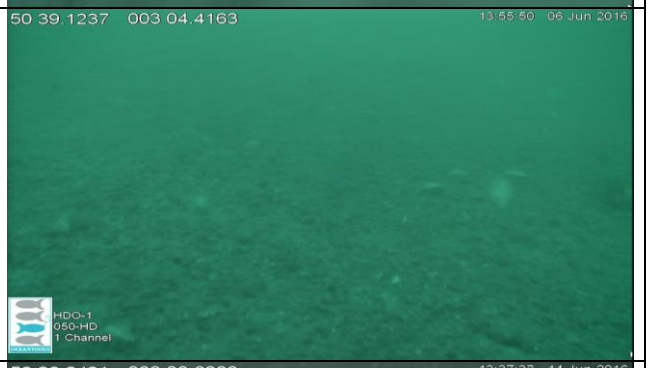
Figure 11. Histogram showing the frequency of occurrence of each of the EUNIS biotopes identified in Beer Reef.

3.2. Sediment Biotopes

Examples of each of the sediment biotopes identified across Lyme Bay are provided below in Table 2.

'Subtidal Sands & Gravels' were recorded in 4 of the 54 video segments and represented the only Habitat FOCI recorded across the site.

Table 2. Sediment biotopes identified across Lyme Bay.

EUNIS Code	MNCR Code	MNCR Descriptor	Example Video Still
A5.23	SS.SSa.IFiSa	Infralittoral fine sand	
A5.43	SS.SMx.IMx	Infralittoral mixed sediment	
A5.44	SS.SMx.CMx	Circalittoral mixed sediment	
A5.441	SS.SMx.CMx.CIloMx	*Cerianthus lloydii* and other burrowing anemones in circalittoral muddy mixed sediment	

A5.4411	SS.SMx.CMx.ClloMx.Nem	*Cerianthus lloydii* with *Nemertesia* spp. and other hydroids in circalittoral muddy mixed sediment	
A5.445	SS.SMx.CMx.OphMx	*Ophiothrix fragilis* and/or *Ophiocomina nigra* brittlestar beds on sublittoral mixed sediment	

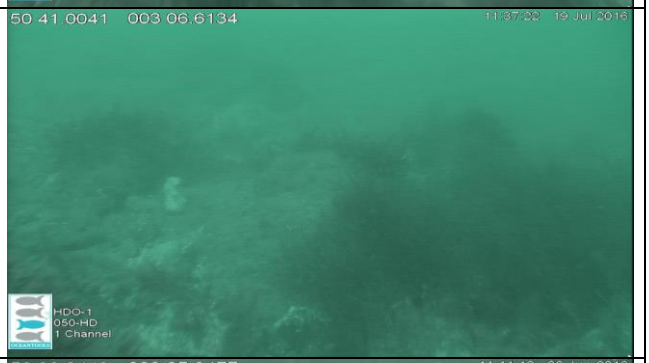
3.3. Rock Biotopes and Annex I Features

Examples of each of the rock biotopes identified are provided in Table 3.

Annex I 'Reef' was noted in 8 of the 40 tows and 11 of the 54 resulting segments, and all were characterised as 'Stony Reef'.

Table 3. Rock/reef biotopes identified across Lyme Bay.

EUNIS Code	MNCR Code	MNCR Descriptor	Example Video Still
A3.11	IR.HIR.KFaR	Kelp with cushion fauna and/or foliose red seaweeds	
A3.116	IR.HIR.KFaR.FoR	Foliose red seaweeds on exposed lower infralittoral rock	

A3.122	IR.HIR.KSed .LsacSac	*Laminaria saccharina* and/or *Saccorhiza polyschides* on exposed infralittoral rock	
A3.126	IR.HIR.KSed .XKHal	*Halidrys siliquosa* and mixed kelps on tide-swept infralittoral rock with coarse sediment	
A3.215	IR.MIR.KR.X FoR	Dense foliose red seaweeds on silty moderately exposed infralittoral rock	
A4.1	CR.HCR	High energy circalittoral rock	

3.4. Rock / Sediment Mosaic Biotopes

Mosaic habitats were recorded in 2 out of the 54 video segments, shown below in Table 4.

Table 4. Rock/sediment mosaic biotopes identified across Lyme Bay.

EUNIS Code	MNCR Code	MNCR Descriptor	Example Video Still
A5.43 / A3.1 Mosaic	SS.SMx.Imx / IR.HIR Mosaic	Infralittoral mixed sediment / High energy infralittoral rock Mosaic	
A5.43 / A3.215 Mosaic	SS.SMx.Imx / IR.MIR.KR.XFoR Mosaic	Infralittoral mixed sediment / Dense foliose red seaweeds on silty moderately exposed infralittoral rock Mosaic	

3.5. Scallop Enumeration

In July 2008 an area of 60 nautical miles of Lyme Bay was declared a Marine Protected Area (MPA) and permanently closed off by the Statutory Instrument to scallop dredging and bottom trawling in what was the largest ever closure of a marine area in British waters. Both the Lyme Bay SI and the Lyme Bay Strip survey areas fall within the closed area, whilst Beer Reef is open but not thought to be fished due to its close proximity to the shore. The primary purpose for establishing this closure was to protect marine biodiversity, particularly across the rich reef habitats in the area known to support species of high conservation importance and species vulnerable to damage caused by bottom fishing gear such as erect sponges and gorgonians (sea fan) (Attrill et al. 2012). In addition the closure aimed to aid the recovery of the benthic habitats that thought to have been degraded by fishing activities .

Scallops are of important conservational interest, and with a large volume of historical survey data available they have been recognised as important indicator species for measuring the recovery of benthic species in Lyme Bay (Jackson et al. 2008). **OceanEcology** were requested to carry out scallop enumeration during the analysis of the video tows in order to gain an understanding of the effectiveness of the flying array camera system in identifying and counting scallop numbers, and to inform scallop stock assessments.

Three scallop taxa were identified in the video analysis; the king scallop (*Pecten maximus*), queen scallop (*Aequipecten* sp.) and scallops that were unidentifiable to species/genus level due to video quality or size and therefore recorded as Pectinidae. Examples of each are shown in Plate 1. Scallops were identified in two of the three areas surveyed; Lyme Bay SI and Lyme Bay Strip. None were recorded in Beer Reef. In terms of count per

unit hour, similar numbers were recorded in the two areas, with an average of 480 ± 65 (mean ± SE) in Lyme Bay SI and 466 ± 76 in Lyme Bay Strip (Figure 12). *P. maximus* was found to be more abundant in Lyme Bay SI compared to Lyme Bay Strip with averages of 77 ± 9 and 18 ± 12 respectively. *Aequipecten* sp. on the other hand was found to be more abundant in Lyme Bay Strip with an average of 415 ± 70 compared to 354 ± 58 per hour counted in Lyme Bay SI. A slightly higher number of unidentifiable scallops were recorded in Lyme Bay SI with an average of 49 ±11 compared to 33 ± 12. The raw counts of the scallops along each tow are illustrated in Figure 13.

Plate 1. Examples of the three scallop taxa identified. Left: King scallop, *Pecten maximus*. Centre: Queen scallop, *Aequipecten* sp.. Right: unidentified scallop, Pectinidae.

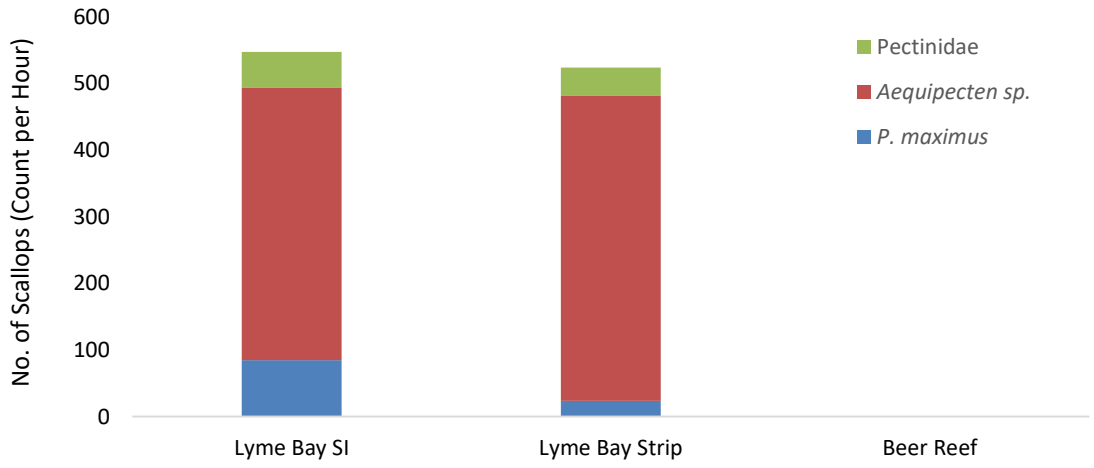


Figure 12. Histogram showing the average count per hour of scallops in Lyme Bay SI, Lyme Bay Strip and Beer Reef.

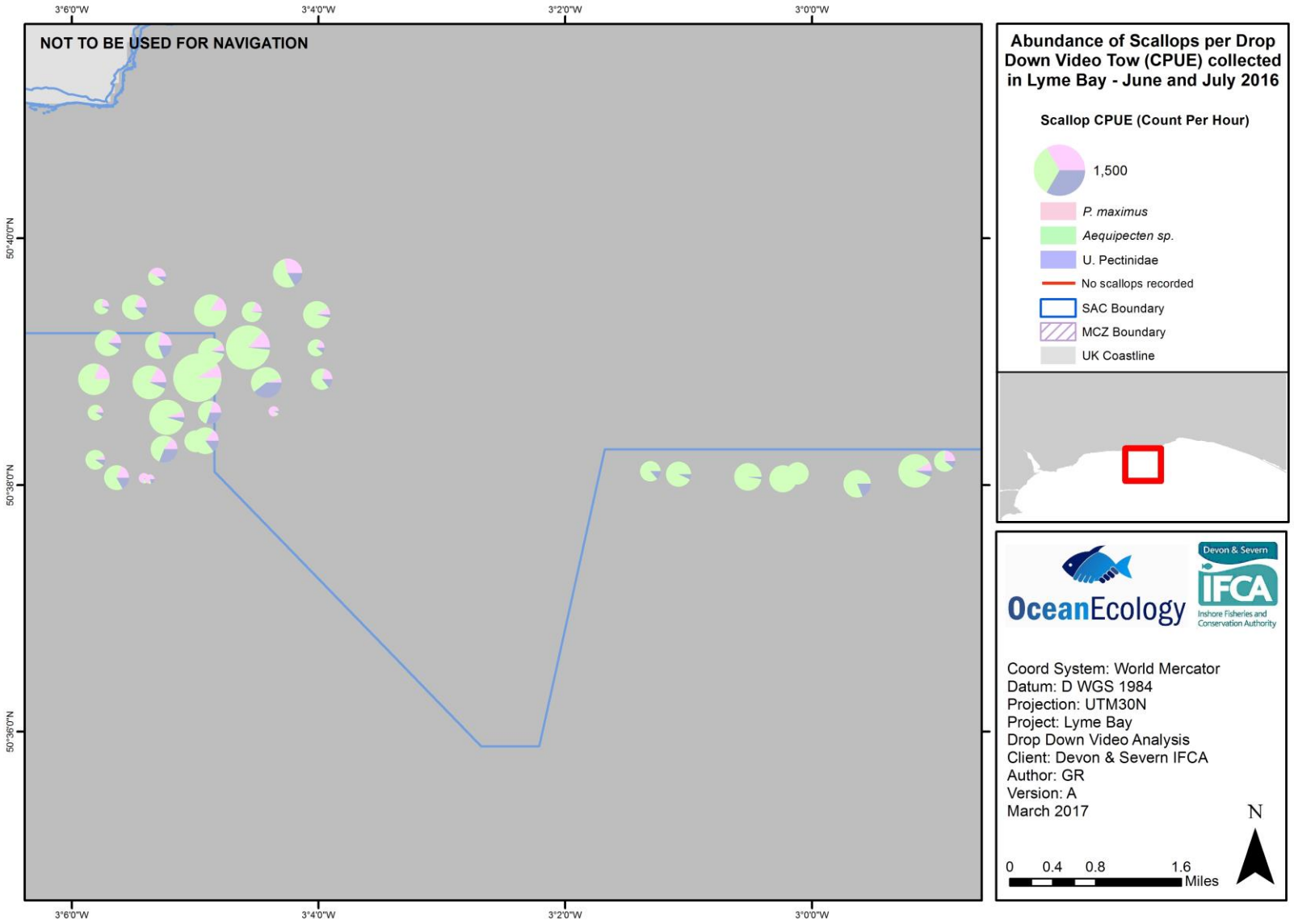


Figure 13. Map illustrating the abundance of scallops per video tow in Lyme Bay SI and Lyme Bay Strip during June and July 2016.

3.6. Other Notable Species

A number of species of interest were noted during the analysis of the video footage which included aggregations of calcareous serpulid tubes, brown crabs (*Cancer pagurus*), starfish aggregations, the ross coral (*Pentapora fascialis*), burrowing anemones (*Ceriantharia* spp.) and various fish including cuckoo wrasse (*Labrus mixtus*) and pouting (*Trisopterus luscus*).

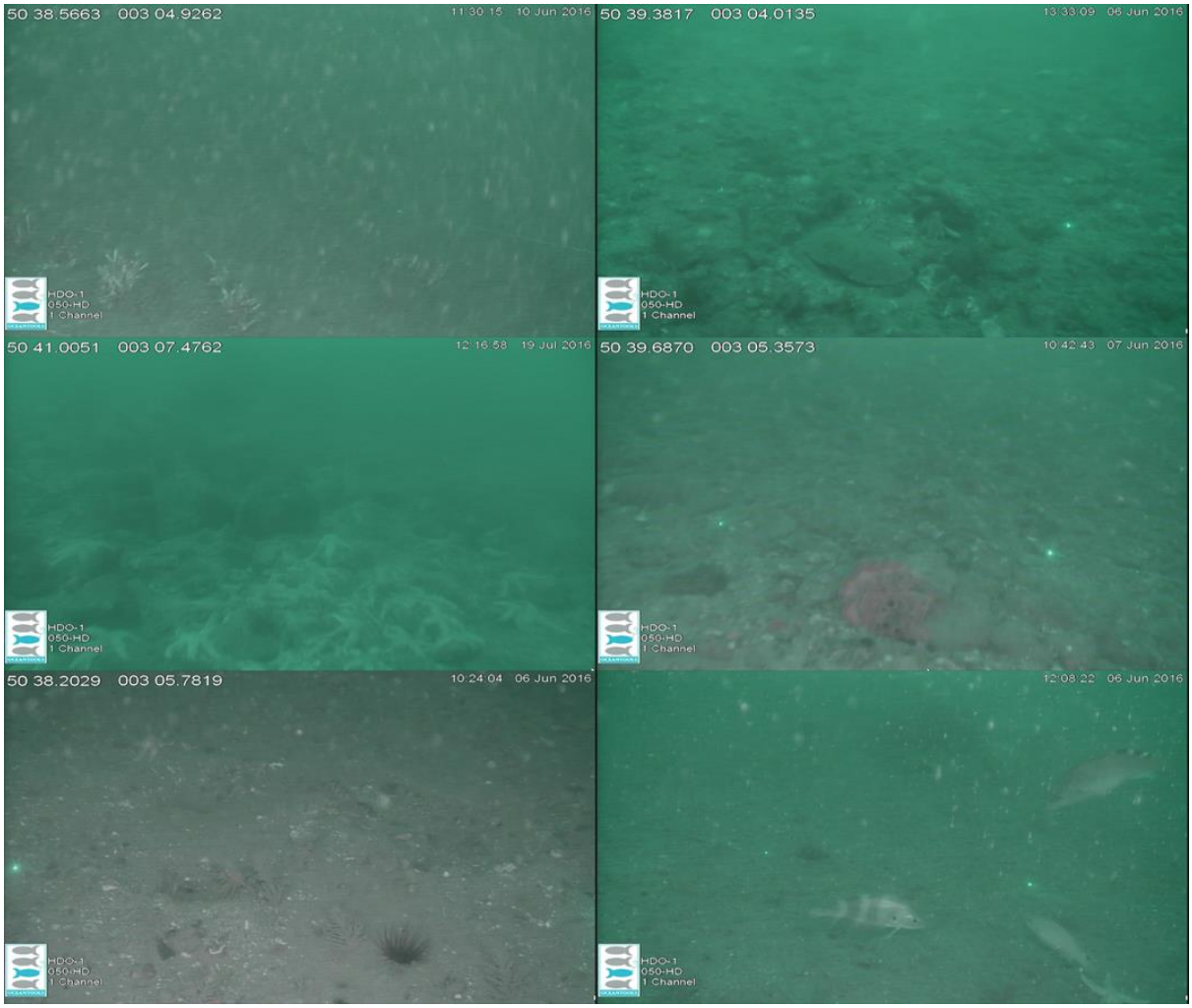


Plate 2. Notable species recorded during the analysis of video tows from the Lyme Bay. Top left: calcareous serpulid tubes. Middle Left: Starfish aggregation. Bottom left: burrowing anemone, *Ceriantharia* sp. Top right: a brown crab (*C. pagurus*) buried into the sediment. Middle right: ross coral (*P. fascialis*). Bottom right: fish including the cuckoo wrasse (*L. mixtus*) and a pouting (*T. luscus*).

Maerl

A small area of maerl formed into waves was identified at a depth of 6 m within a sand biotope and lasted for approximately 13 seconds of video footage (13:00:10 – 13:00:23, Beer Reef_5, shown in Plate 3). This occurrence is not surprising considering similar beds have previously been recorded in Lyme Bay further offshore at a depth of 19 m (Wood, 2007).

Maerl is a collective term for a number of hard chalky species of red seaweeds which can form beds of unattached nodules and branches on the seabed which provide an important habitat for a diverse array of marine life. Maerl beds are found off the southern and western coasts of Britain and Ireland, as far north as Shetland, but being a

slow growing (1 mm per year) and very fragile species it is thought to have declined substantially in some areas particularly from impacts of scallop dredging, bottom trawling, aquaculture and pollution (UK BAP, 2008). As a result of this, maerl bed habitats are of significant conservational interest and have been designated a UK BAP Priority Habitat, listed in Annex I of the Habitats Directive as a sub-feature of sandbanks and on the OSPAR List of Threatened and/or Declining Species and Habitats (UK BAP, 2008; OSPAR, 2010). In addition certain maerl species are recognised as Species of Principal Importance for the purpose of conservation of biodiversity under the Natural Environment and Rural Communities Act 2006 (NERC Act, 2006).

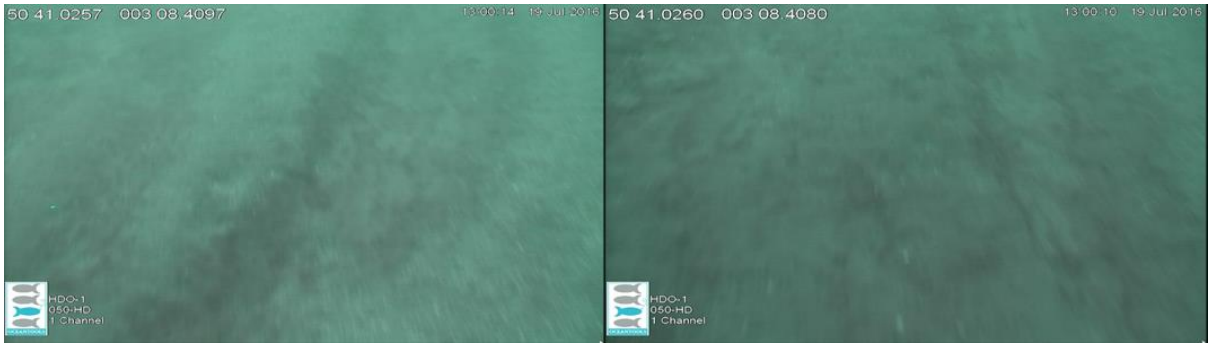


Plate 3. Images of the area of Maerl identified the Beer Reef.

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