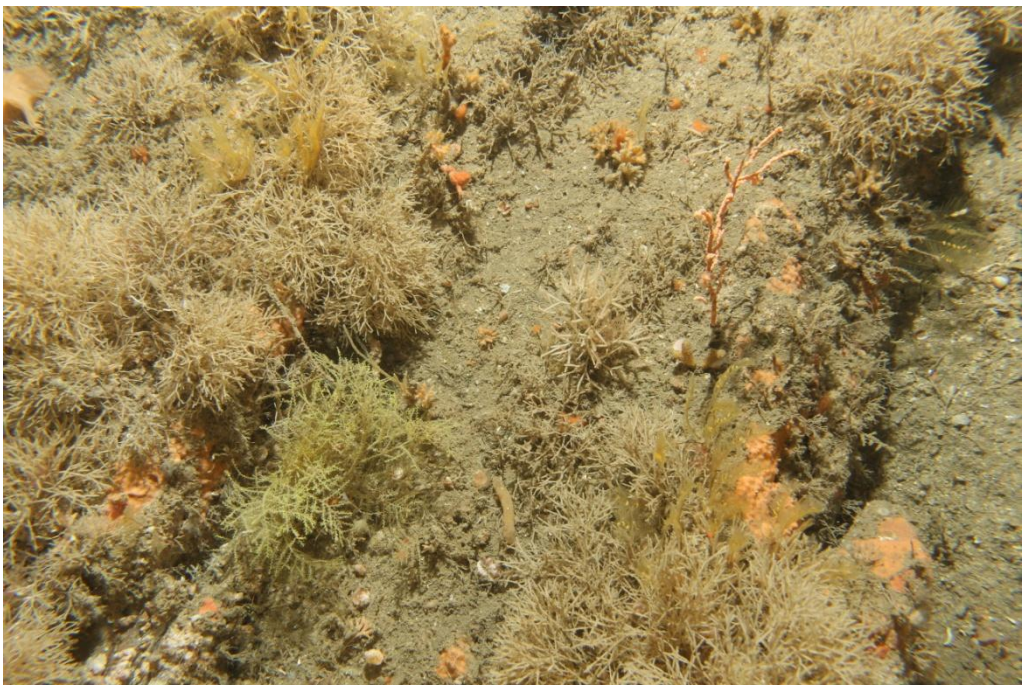
EDDYSTONE REEF CAMERA SURVEY ANALYSIS REPORT 2014-2015



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Executive summary

The Eddystone Reef is part of the Start Point to Plymouth Sound and Eddystone Special Area of Conservation (SAC). In January 2014 management measures were introduced to prohibit bottom-towed fisheries from using key areas within the SAC, thereby creating a mosaic of protected areas within the SAC that may provide protection to vulnerable reef-associated species. Ideally, newly established protected areas should be monitored over time to observe change in biological communities attributable to adopted management strategies.

This project is a collaborative partnership between the University of Exeter (Penryn Campus) (UoE), Cornwall Inshore Fisheries and Conservation Authority (CIFCA) and the Marine Conservation Society (MCS); funded by the Pig Shed Trust. The partners collaborated on the experimental design of the project, with MCS identifying the funding partner and co-ordinating the planning of the project, the CIFCA conducting surveys of benthic communities, and UoE analysing resulting data.

This report details activities for the first two years of the project, 2014-2015. Drop-down camera surveys in 2015 produced 428 images of the seabed that allowed identification of 1542 benthic organisms. Surveys conducted in 2014 resulted in 214 images which yielded 372 benthic organisms. All surveys were conducted over a short time-frame at a similar time of year. The highest average (mean) number of species (per image) were found on rock and reef features. There was an increase in the average number of species recorded per image among respective survey boxes across years. There was evidence for greater Bryozoa and Porifera abundance in box 1 on rock and reef features than other boxes for both survey years. Box 1 had the greatest abundance of bryozoans on circalittoral coarse and mixed sediments for both survey years. Box 1 also had a greater abundance of sea squirts and cup corals on circalittoral coarse and mixed sediments than other survey boxes for 2015. Surveys in 2015 have demonstrably built on the preliminary survey work of 2014 and have indicated that there may be a detectable change in seabed communities between areas that are closed, and those that remain open, to bottom-towed fishing gear; although, we caution this observation.

Contents

Executive summary 1

Introduction 3

Aims & Objectives 5

Method 6

Results 11

Discussion 27

References 29

Appendix 1: Substratum and image quality 30

Appendix 2: 2014 gallery of species 31

Appendix 3: 2015 gallery of species 35

Appendix 4: Species identification confidence 39

Introduction

On the 1st of January 2014 Cornwall Inshore Fisheries Conservation Authority (CIFCA) Closed Areas European Marine Sites (EMS) Byelaw came into force, this prohibited the use of bottom-towed fishing gear within EMS within the district. One such area that benefited from protection was the Eddystone Reef complex. The Eddystone Reef is situated approximately 9 nautical miles off the southern coast of Cornwall (South West UK) and comprises part of the Start Point to Plymouth Sound and Eddystone Special Area of Conservation (SAC). The Eddystone Reef was subsequently zoned to protect key site features (Figure 1). These benthic habitats are too deep (at over 45 m) to safely deploy SCUBA divers to monitor the effects of these fisheries closures, hence remote survey techniques are required to gather data. The benthic habitats of the Eddystone Reef provide an important opportunity to use remote seabed video and drop-down camera surveys to monitor and to quantify the response of these benthic ecosystems following the cessation of bottom-towed fishing effort.

A multi-partner collaborative consortium, led by the Marine Conservation Society (MCS), with CIFCA and the University of Exeter (UoE), have undertaken to survey these newly protected habitats to monitor for long-term changes to the seabed as it is released from towed gear fishing pressure. As well as gaining insight into the recovery of these habitats it is anticipated this project will foster a new collaborative working relationship between NGOs, regulators and others (such as Universities, and Statutory Nature Conservation Bodies) that will provide a progressive, more cohesive approach to UK marine conservation.

In this report we detail data collection and analysis activities for the first two years of the project at the Eddystone Reef complex.

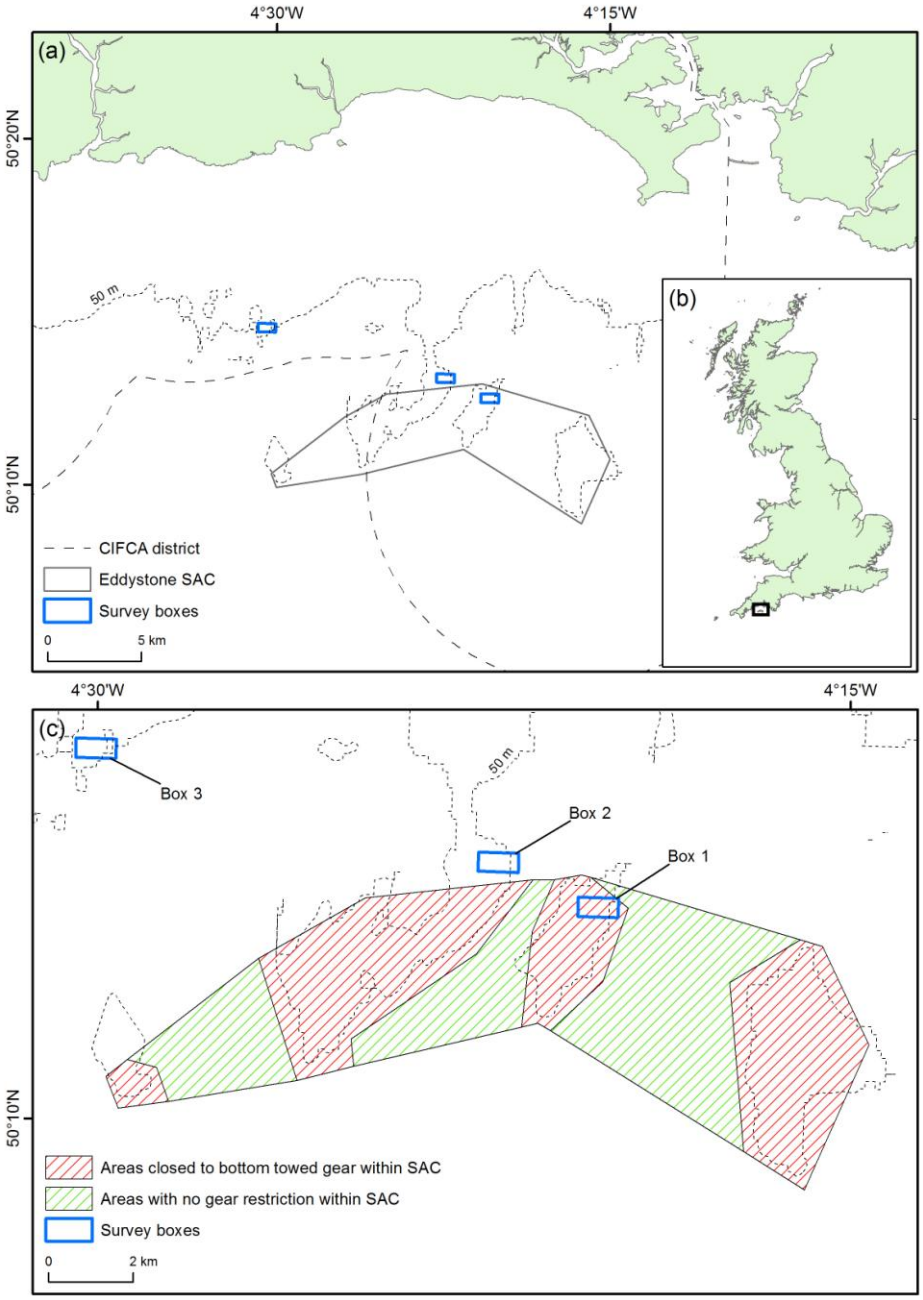


Figure 1. Eddystone Special Area of Conservation (SAC) study area. (a) Eddystone SAC (grey polygon) in relation to Cornwall Inshore Fisheries and Conservation Authority (CIFCA) district boundary (broken line polygon). Part (a) is located according to the inset (b). (c) Eddystone SAC detailing areas closed to bottom-towed gear (red hatched polygon) and areas with no gear restrictions (green hatched polygon). In all parts 50 m isobath is drawn and labelled; survey boxes are drawn as blue polygons and labelled in part (c). All map parts are drawn to differing spatial scales. Maps drawn to Projected Coordinate System: British National Grid Transverse Mercator.

Aims & Objectives

Aims of the project

1. To identify any changes to the seabed habitats of Eddystone Reef, now subject to new management restrictions of bottom-towed fishing gears.
2. To identify patterns in the diversity and abundance of sessile and mobile species and commercial species that are recorded during seabed photographic surveys.
3. To collaboratively report the results of the surveys to the local interest groups/stakeholders to illustrate the effects of management measures on commercial and biodiversity interests in Cornish waters.

Objectives of the project

1. Analyse high-resolution imagery of habitats, and the change in the extent and type of habitat over time that are subject to management measures.
2. To highlight how management of bottom-towed fishing gears might result in changes to seabed species and habitats.
3. To foster greater co-ordinated working between regulators, conservation advisors and NGOs, in light of new progressive spatial management of heavy impact mobile fishing gears.

Method

Data collection

Drop-down camera surveys were conducted in June-July 2014 and July 2015 (see Tables 1 and 2 for survey metadata). Still photographic images were collected in accordance with the Cornwall Inshore Fisheries and Conservation Authority (CIFCA) 2014 Field Report V0.3 (2014) and 2015 Eddystone Field Report July 2015 V0.2 (2015) (available seperatly from CIFCA). 2015 survey transects were conducted to mirror those established during 2014. Where this was not possible due to limitations imposed by tide or wind direction, transects were made that bisected 2014 survey routes (Figure 2). In 2014 images of very poor quality (image excessively blurred due to camera movement or seabed obscured by sediment suspension) were removed from the stills catalogue before transferring the data to the University of Exeter (UofE). In 2015 all images were transferred to UofE for analysis irrespective of image quality, four images were removed due to duplication.

Camera stills analysis

Analysis of the still images by the UoE was undertaken as follows. Firstly, images without spatial reference (no lon/lat recorded), or where no movement of the camera frame had been recorded (no change in lon/lat between successive images), or where the camera frame was not positioned on the seabed when the image was captured, were removed from the analysis.

Each image (resolution: 5184 x 3456 pixels) was then examined at full frame using a 1920 x 1080 pixel monitor resolution and the following information recorded. The substratum was described and classified using EUNIS habitat classifications (e.g. circalittoral mixed sediments: 5.44). The substratum was further categorised based on the visible dominant (> 50%) bottom type using a four part classification system: fine (F) , medium (M), coarse (C) and rock/reef feature (R/R). The occurence of pink sea fan (*Eunicella verucosa*) colonies were also used as an indicator of the presence of rock or reef feature when the observed subtratum was covered with fine sand or silt veneers. Pink sea fans are associated with UK reefs (Hiscock 2007) of geogenic origin (bedrock or stony reef resulting from geological processes) as their basal holdfast requires a stable substratum on which to attach (Anonymous 1999). The clarity of each image (image quality) was

categorised using a three part classification system: good, moderate and poor. The number of laser marks present in each image were counted and the on-screen distance from screen edges to marks and between marks measured, these measurements were used to ascertain contact of the camera frame with the seabed.

Images were then viewed at full width and panned from top to bottom and the presence of all conspicuous benthic organisms noted. These were then identified to their highest taxonomic level (e.g. *Eunicella verucosa*), if this was not possible individuals were recorded by highest generic species description (e.g. bryozoa (encrusting), sea squirt, nudibranch, sponge (encrusting/cushion), sponge (erect)). If required the image was zoomed further to aid identification. Confidence in species identification was recorded on the following scale: low confidence (C1), moderate confidence (C2) and high confidence (C3). The total number of each species within the image was recorded. Where species were encrusting or turf forming (e.g. bryozoa/hydroid turf, encrusting bryozoa) a visual assessment of the percentage coverage of these species was made with the image viewed at full frame. A relative abundance SACFOR score, adapted from the Marine Nature Conservation Review (MNCR) SACFOR abundance scales (http://jncc.defra.gov.uk/), was then assigned for the species.

Table 1. Metadata for survey tows. Tows are described by survey box, date, start lon/lat, end lon/lat, total distance of tow (m: image to image), tow speed (ms^{-1}: mean), tow speed (knots: mean), images captured (n), distance between images (m), maximum and minimum distance between images (m) and total number of species counted. Longitude and latitude are given in decimal degrees WGS84.

Box	Tow ID	Date	Start lon	Start lat	End lon	End lat	Total distance (m)	Tow speed (ms^{-1}) (mean)	Tow speed (knots) (mean)	Images (n)	Dist. between images (m) (mean)	Max. dist. between images (m)	Min. dist. between images (m)	Species (n) (total)
1	20140716_Box_1_T1	16/07/2014	-4.328	50.217	-4.334	50.218	430	0.51	1.00	14	33	76	17	17
	20140716_Box_1_T2	16/07/2014	-4.332	50.214	-4.337	50.216	422	0.27	0.52	18	25	141	4	19
	20140716_Box_1_T3	16/07/2014	-4.327	50.215	-4.328	50.215	85	0.22	0.42	7	14	27	7	32
	20140731_Box_1_T1	31/07/2014	-4.337	50.217	-4.334	50.217	216	0.19	0.37	20	11	18	7	35
	20140731_Box_1_T2	31/07/2014	-4.337	50.215	-4.334	50.215	194	0.04	0.08	22	9	19	6	22
	20140731_Box_1_T3	31/07/2014	-4.337	50.218	-4.336	50.218	91	0.10	0.20	16	6	9	2	29
	20140731_Box_1_T4	31/07/2014	-4.332	50.217	-4.331	50.217	98	0.13	0.24	14	8	17	2	29
	20140731_Box_1_T5	31/07/2014	-4.338	50.216	-4.338	50.214	216	0.21	0.40	21	11	27	1	72
2	20140619_Box_2_T1	19/06/2014	-4.367	50.227	-4.366	50.225	272	0.17	0.34	28	10	20	4	33
	20140619_Box_2_T6	19/06/2014	-4.370	50.226	-4.370	50.223	307	0.39	0.76	13	26	41	19	43
	20140731_Box_2_T1	31/07/2014	-4.363	50.225	-4.363	50.226	87	0.10	0.20	15	6	10	2	16
	20140731_Box_2_T2	31/07/2014	-4.364	50.223	-4.364	50.224	134	0.16	0.31	15	10	15	2	19
3	20140716_Box_3_T1	16/07/2014	-4.503	50.245	-4.508	50.244	317	0.47	0.90	11	32	50	15	6

Table 2. Metadata for survey tows. Tows are described by survey box, date, start lon/lat, end lon/lat, total distance of tow (m: image to image), tow speed (ms^{-1}: mean), tow speed (knots: mean), images captured (n), distance between images (m), maximum and minimum distance between images (m) and total number of species counted. Longitude and latitude are given in decimal degrees WGS84.

Box	Tow ID	Date	Start lon	Start lat	End lon	End lat	Total distance (m)	Tow speed (ms^{-1}) (mean)	Tow speed (knots) (mean)	Images (n)	Dist. between images (m) (mean)	Max. dist. between images (m)	Min. dist. between images (m)	Species (n) (total)
1	20150709_Box_1_T1	09/07/2015	-4.338	50.216	-4.335	50.217	269	0.26	0.51	15	19	37	3	71
	20150709_Box_1_T3	09/07/2015	-4.338	50.217	-4.336	50.218	190	0.25	0.49	14	15	29	4	50
	20150709_Box_1_T5	09/07/2015	-4.337	50.215	-4.334	50.217	355	0.28	0.55	21	18	24	10	47
	20150709_Box_1_T8a	09/07/2015	-4.332	50.216	-4.329	50.218	322	0.26	0.51	20	17	23	13	81
	20150723_Box_1_T2	23/07/2015	-4.334	50.215	-4.336	50.216	199	0.16	0.31	21	10	11	5	57
	20150723_Box_1_T8	23/07/2015	-4.328	50.215	-4.329	50.216	202	0.15	0.29	23	9	12	2	180
	20150723_Box_1_T9	23/07/2015	-4.332	50.215	-4.332	50.217	160	0.14	0.26	20	8	12	3	65
2	20150709_Box_2_T1	09/07/2015	-4.363	50.226	-4.362	50.225	194	0.15	0.29	21	10	13	5	44
	20150709_Box_2_T2	09/07/2015	-4.364	50.225	-4.364	50.224	191	0.15	0.29	20	10	14	2	93
	20150709_Box_2_T3	09/07/2015	-4.366	50.228	-4.366	50.227	29	0.12	0.22	5	7	13	7	12
	20150709_Box_2_T3a	09/07/2015	-4.366	50.226	-4.364	50.228	319	0.26	0.50	20	17	24	12	50
	20150709_Box_2_T6	09/07/2015	-4.370	50.224	-4.366	50.226	354	0.29	0.55	19	20	41	13	71
	20150723_Box_2_T7	23/07/2015	-4.368	50.223	-4.365	50.224	257	0.20	0.39	21	13	24	2	112
	20150723_Box_2_T8	23/07/2015	-4.372	50.225	-4.370	50.226	227	0.18	0.35	22	11	18	1	97
	20150723_Box_2_T9	23/07/2015	-4.363	50.224	-4.361	50.225	153	0.15	0.28	20	8	12	2	50
3	20150709_Box_3_T2	09/07/2015	-4.504	50.247	-4.506	50.246	228	0.14	0.27	20	12	46	5	58
	20150709_Box_3_T3	09/07/2015	-4.498	50.246	-4.499	50.245	132	0.10	0.19	21	7	9	3	27
	20150709_Box_3_T4	09/07/2015	-4.500	50.247	-4.497	50.246	221	0.16	0.32	22	11	14	5	60
	20150709_Box_3_T5	09/07/2015	-4.505	50.248	-4.503	50.248	163	0.13	0.25	20	9	15	3	116
	20150723_Box_3_T6	23/07/2015	-4.507	50.245	-4.506	50.245	79	0.20	0.39	6	16	18	11	16
	20150723_Box_3_T6a	23/07/2015	-4.507	50.245	-4.503	50.246	276	0.20	0.40	21	14	25	9	84
	20150723_Box_3_T7	23/07/2015	-4.503	50.245	-4.499	50.246	284	0.22	0.44	20	15	22	11	60
	20150723_Box_3_T8	23/07/2015	-4.498	50.247	-4.496	50.249	252	0.25	0.48	16	17	21	12	41

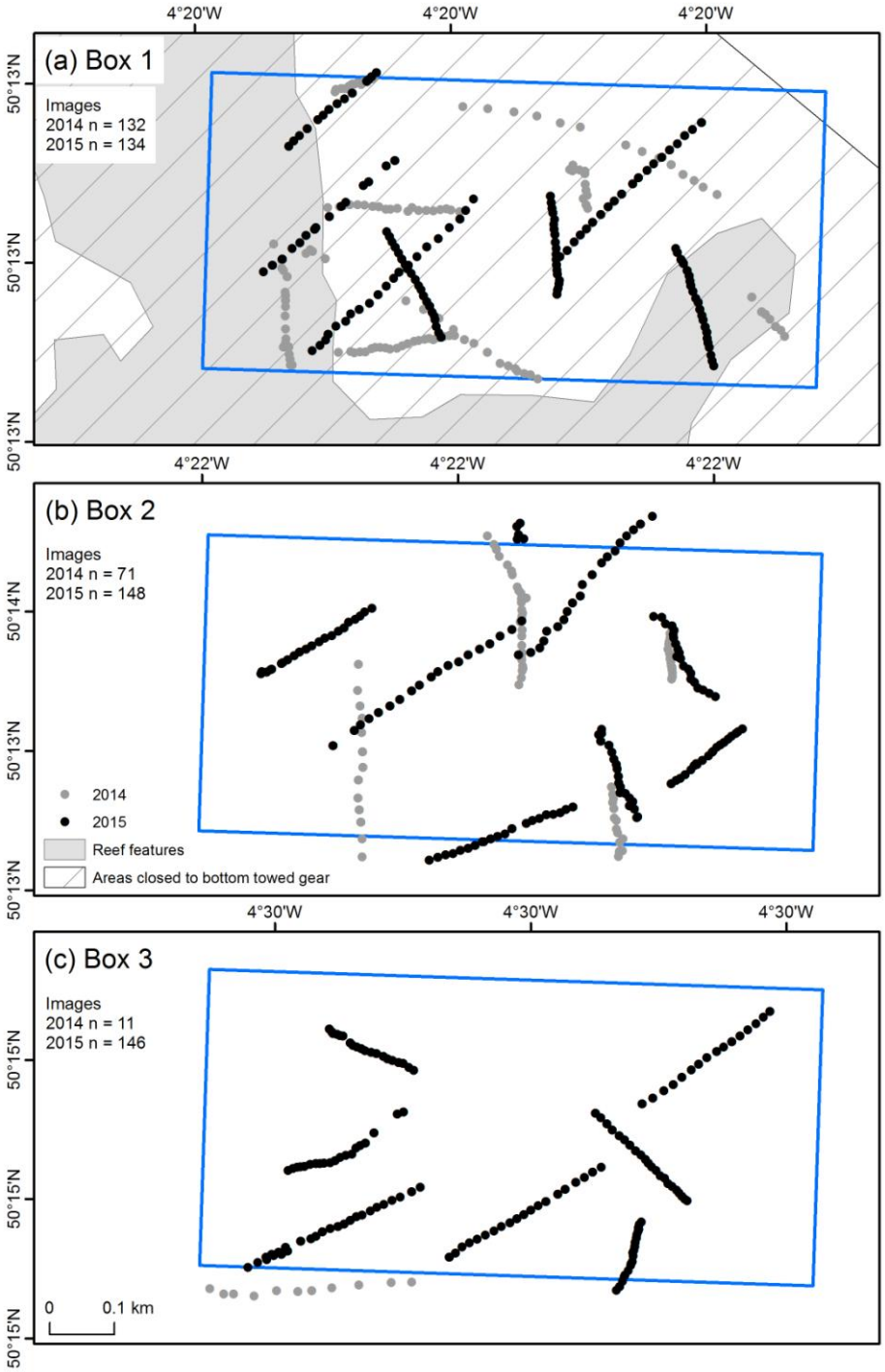


Figure 2. Eddystone Reef survey strategy for 2014 and 2015. Location of captured images; 2014: grey circles and 2015: black circles. 2015 survey transects were run to mirror those established during the 2014 season. Where this was not possible due to limitations imposed by tide or wind direction, transects were run that bisected 2014 survey routes. The total number of validated images captured for each survey season and survey box are detailed in the respective figure legend. In all parts survey boxes are drawn as blue polygons (0.44 km^2). In part (a) areas closed to bottom-towed gear within the SAC (grey hatched polygons), reef features (grey polygon) (Axelsson et al. 2006). All map parts are drawn to the same spatial scale. Maps drawn to Projected Coordinate System: British National Grid Transverse Mercator.

Results

Building on the Eddystone Reef camera survey report 2014 this report presents analysis for 2015, together with updated analysis for 2014, necessitated by the refinement of the sub-division of the Phyla: Bryozoa and Porifera.

2014 surveys

The 2014 Eddystone Reef camera surveys (Figure 2) generated 226 images captured from survey boxes 1, 2 and 3 (east to west). Of these images, two were without spatial reference, four had duplicated spatial references, and six images were captured whilst the camera frame was not in contact with the sea bed, these images were not analysed. No images were rejected as a result of poor image quality.

The number of tows/images per survey box were; box 1 (tows (n = 8): images (n = 132)), box 2 (tows (n = 4): images (n = 71)) and box 3 (tows (n =1): images (n = 11)), (Figure 2 and metadata in Table 1).

The proportion of images captured per box by substratum was variable (Figure 3). The number of lasers present per image was variable, survey box 1 and survey box 3 had the highest proportion of images with 2 or more lasers present, survey box 2 had the highest proportion of images with only 1 laser present (Figure 4). Image quality across all survey boxes was predominately moderate/good with less than ~10% of images per survey box being classified as 'poor' (Figure 5). See Appendix 1 for examples of substratum and image quality.

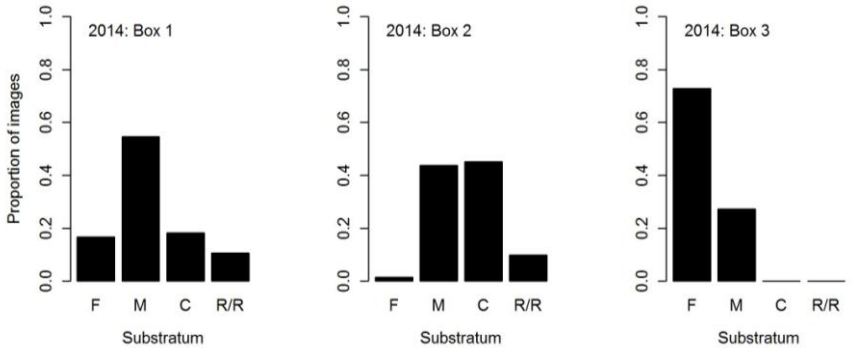


Figure 3. Proportion of images, categorised by substratum, per survey box. Substratum is identified as follows: fine (F), medium (M), coarse (C) and rock/reef (R/R). Fine, medium and coarse substratum are representative of circalittoral coarse or mixed sediments (EUNIS habitat codes 5.14 and 5.44 respectively). Rock or reef features are representative of circalittoral rock and other hard substrata (EUNIS habitat code A4).

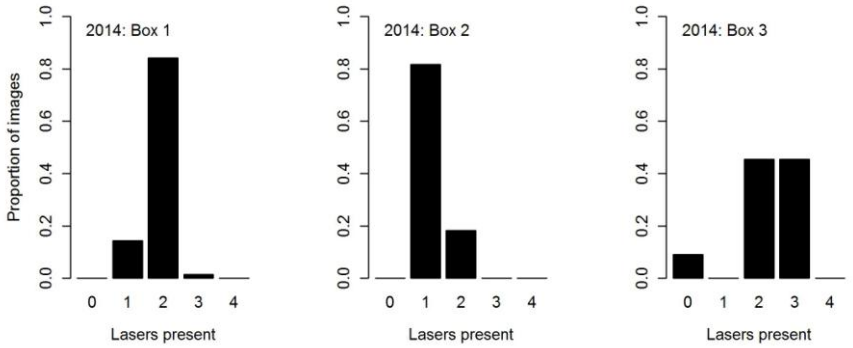


Figure 4. Proportion of images, categorised by number of lasers present in the image, per survey box.

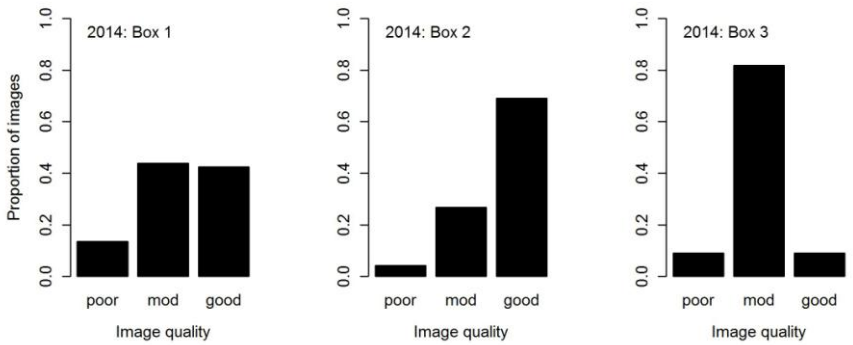


Figure 5. Proportion of images, categorised by image quality, per survey box. Image quality is identified as follows: poor, moderate (mod) and good.

Substratum rock/reef features had the highest average (mean) number of species per image for both survey box 1 and 2 (Figure 6). There was some variation in species assemblages and relative abundance, among substratum and between survey boxes (Figures 7, 8 and 9). There were nineteen species (identified by highest generic species description: see Table 3) from six Phyla in survey box 1, seventeen species from six Phyla in survey box 2, and four

species from four Phyla in survey box 3 (Figures 7, 8 , 9 and Table 3); see Appendix 2 for image gallery of key species.

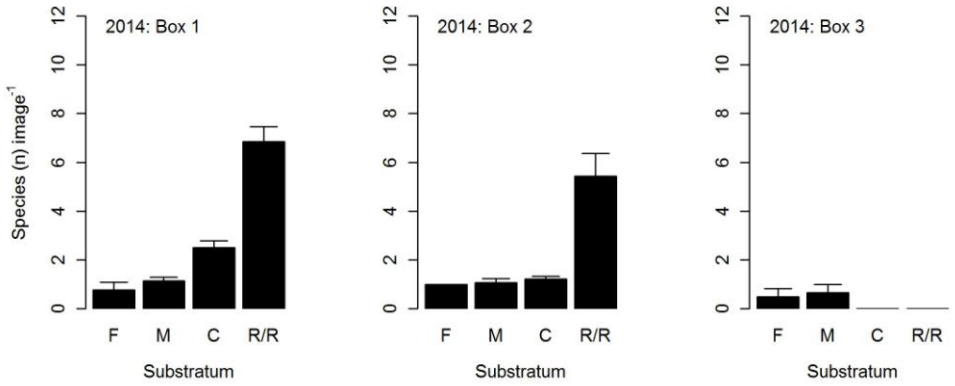


Figure 6. Species (n) per image, by substratum, per survey box. Bar graphs are drawn with mean and standard error bars. Substratum is identified as follows: fine (F), medium (M), coarse (C) and rock/reef (R/R).

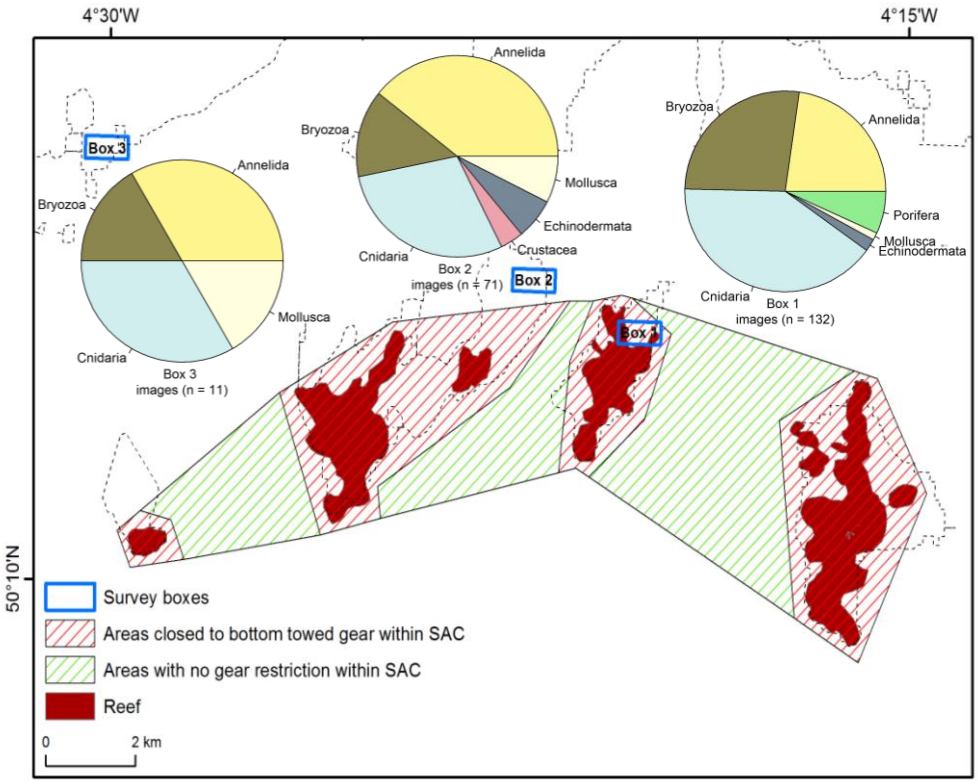


Figure 7. Eddystone Special Area of Conservation (SAC). Species assemblages, identified to Phylum, are drawn as pie charts. The total number of images are given. See Figures 8, 9 and Table 3 for breakdown by species and substratum. Survey boxes, areas closed to bottom-towed gear, areas with no restrictions and reef features drawn in accordance with the figure legend. 50 m isobath is drawn and labelled. Maps drawn to Projected Coordinate System: British National Grid Transverse Mercator.

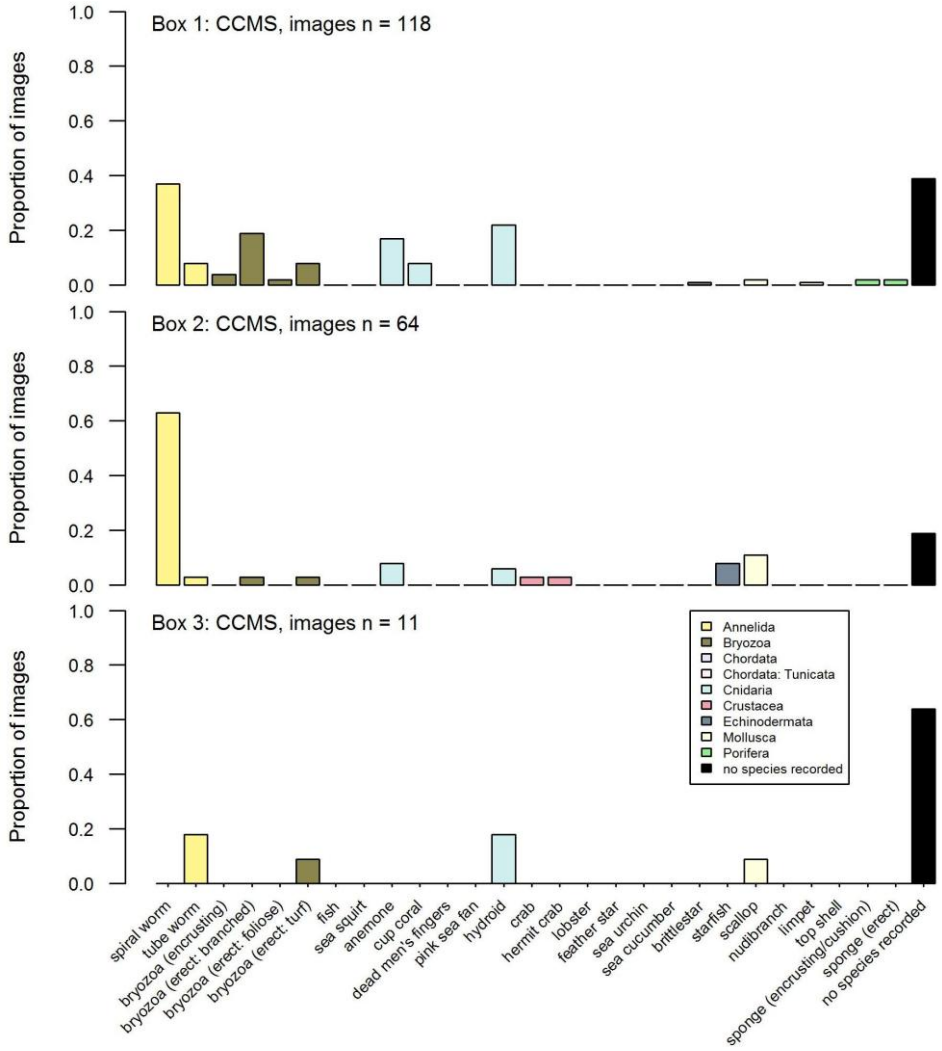


Figure 8. Relative abundance of species (proportion) for survey boxes 1, 2 and 3 on circalittoral coarse or mixed sediments (CCMS). Species identified by species description (see Table 3), grouped by Phyla, apportioned by survey box and substratum. Substrata are classified as: circalittoral coarse or mixed sediments (CCMS) EUNIS habitat codes 5.14 and 5.44; or rock/reef features (R/R), circalittoral rock and other hard substrata (EUNIS habitat code A4). Each bar represents the total number of images (n) with species present expressed as a proportion of the total number of images (n) captured within the survey box. Phyla are shaded in accordance with the figure legend. See Table 3 for further breakdown of species by highest taxonomic level and substratum.

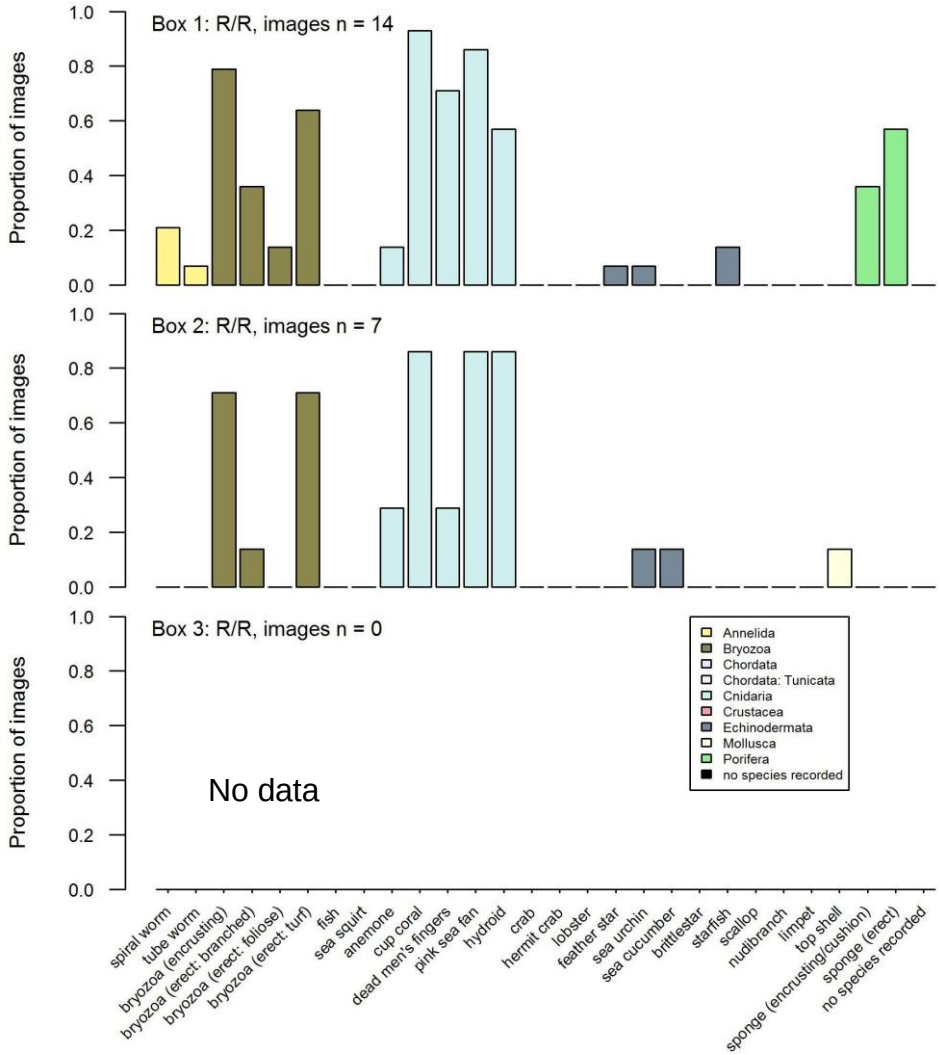


Figure 9. Relative abundance of species (proportion) for survey boxes 1, 2 and 3 on rock/reef features (R/R). Species identified by species description (see Table 3), grouped by Phyla, apportioned by survey box and substratum. Substrata are classified as: circalittoral coarse or mixed sediments (CCMS) EUNIS habitat codes 5.14 and 5.44; or rock/reef features (R/R), circalittoral rock and other hard substrata (EUNIS habitat code A4). Each bar represents the total number of images (n) with species present expressed as a proportion of the total number of images (n) captured within the survey box. Phyla are shaded in accordance with the figure legend. See Table 3 for further breakdown of species by highest taxonomic level and substratum.

Table 3. (a) Species list for survey box 1 described by Phylum/sub Phylum, Class, species description, common name, binomial name (scientific name). Number of images in which the species were present (by species description and by species Id.) are given and apportioned by substratum: circalittoral coarse or mixed sediments (CCMS) EUNIS habitat codes 5.14 and 5.44; or rock/reef features (R/R), circalittoral rock and other hard substrata (EUNIS habitat code A4).

Survey Box	Phylum/ sub Phylum	Class	Species description	Images (n) per substratum (by species description)			Species Id. (common name)	Species Id. (scientific name)	Images (n) per substratum (by species Id.)		
2014				**Total**	**CCMS**	**R/R**			**Total**	**CCMS**	**R/R**
Box 1	Annelida	Polychaeta	spiral worm	47	44	3	spiral worm	*Spirorbis sp.*	47	44	3
			tube worm	10	9	1	parchment worm	*Chaetopterus sp.*	6	6	0
							sand mason	*Lanice conchilega*	2	2	0
							no sp. id	no sp. id	2	1	1
	Bryozoa	Gymnolaemata	bryozoa (encrusting)	16	5	11	orange pumice bryozoa	*Cellepora pumicosa*	3	3	0
							no sp. id	no sp. id	14	3	11
			bryozoa (erect: branched)	28	23	5	finger bryozoa/sea chevril	*Alcyonidium diaphanum*	25	21	4
							monkey puzzle bryozoa	*Omalosecosa ramulosa*	5	3	2
			bryozoa (erect: foliose)	4	2	2	ross coral	*Pentapora foliacea*	4	2	2
		Gymnolaemata/ Stenolaemata	bryozoa (erect: turf)	19	10	9	no sp. id	no sp. id	19	10	9
	Cnidaria	Anthozoa	anemone	22	20	2	clock face anemone	*Peachia cylindrica*	1	1	0
							policeman anemone	*Mesacmaea mitchellii*	1	0	1
							buried/tube anemone	no sp. id	3	3	0
							colonial anemone	*Parazoanthus sp.*	1	0	1
							sandy creeplet	*Epizoanthus couchii*	15	14	1
							no sp. id	no sp. id	2	2	0
			cup coral	22	9	13	cup coral	*Caryophyllia sp.*	22	9	13
			dead men's fingers	10	0	10	dead men's fingers	*Alcyonium digitatum*	10	0	10
			pink sea fan	12	0	12	pink sea fan	*Eunicella verrucosa*	12	0	12
		Hydrozoa	hydroid	34	26	8	no sp. id	no sp. id	34	26	8
	Echinodermata	Crinoidea	feather star	1	0	1	rosy feather star	*Antedon bifida*	1	0	1
		Echinoidea	sea urchin	1	0	1	common sea urchin	*Echinus esculentus*	1	0	1
		Stelleroidea	brittlestar	1	1	0	no sp. id	no sp. id	1	1	0
			starfish	2	0	2	bloody henry	*Henrica sp.*	1	0	1
							seven-armed starfish	*Luidia ciliaris*	2	0	2
	Mollusca	Bivalvia	scallop	2	2	0	king scallop	*Pecten maximus*	1	1	0
							no sp. id	no sp. id	1	1	0
		Gastropoda	limpet	1	1	0	white tortoiseshell limpet	*Tectura virginea*	1	1	0
	Porifera	Demospongiae/ Calcarea	sponge (encrusting/cushion)	7	2	5	hedgehog sponge	*Polymastia boletiformis*	1	1	0
							boring sponge	*Cliona celata*	4	1	3
							no sp. id	no sp. id	3	1	2
			sponge (erect)	10	2	8	yellow staghorn sponge	*Axinella dissimilis*	1	1	0
							no sp. id	no sp. id	9	1	8
	No species recorded	NA	NA	46	46	0	NA	NA	46	46	0

Table 3. (b) Species list for survey box 2 described by Phylum/sub Phylum, Class, species description, common name, binomial name (scientific name). Number of images in which the species were present (by species description and by species Id.) are given and apportioned by substratum: circalittoral coarse or mixed sediments (CCMS) EUNIS habitat codes 5.14 and 5.44; or rock/reef features (R/R), circalittoral rock and other hard substrata (EUNIS habitat code A4).

Survey Box	Phylum/ sub Phylum	Class	Species description	Images (n) per substratum (by species description)			Species Id. (common name)	Species Id. (scientific name)	Images (n) per substratum (by species Id.)		
2014				**Total**	**CCMS**	**R/R**			**Total**	**CCMS**	**R/R**
Box 2	Annelida	Polychaeta	spiral worm	40	40	0	spiral worm	*Spirorbis sp.*	40	40	0
			tube worm	2	2	0	no sp. id	no sp. id	2	2	0
	Bryozoa	Gymnolaemata	bryozoa (encrusting)	5	0	5	orange pumice bryozoa	*Cellepora pumicosa*	2	0	2
							no sp. id	no sp. id	4	0	4
			bryozoa (erect: branched)	3	2	1	finger bryozoa/sea chevril	*Alcyonidium diaphanum*	2	2	0
							monkey puzzle bryozoa	*Omalosecosa ramulosa*	1	1	0
							no sp. id	no sp. id	1	0	1
		Gymnolaemata/ Stenolaemata	bryozoa (erect: turf)	7	2	5	no sp. id	no sp. id	7	2	5
	Cnidaria	Anthozoa	anemone	7	5	2	buried/tube anemone	*Sagartia sp.*	1	0	1
							sandy creeplet	*Epizoanthus couchii*	3	3	0
							cloak anemone	*Adamsia palliata*	2	2	0
							sea fan anemone	*Amphianthus dohrnii*	1	0	1
			cup coral	6	0	6	cup coral	*Caryophyllia sp.*	6	0	6
			dead men's fingers	2	0	2	dead men's fingers	*Alcyonium digitatum*	2	0	2
			pink sea fan	6	0	6	pink sea fan	*Eunicella verrucosa*	6	0	6
		Hydrozoa	hydroid	10	4	6	nodding hydroid	*Corymorpha nutans*	3	2	1
							no sp. id	no sp. id	9	3	6
	Crustacea	Malacostraca	crab	2	2	0	harbour crab	*Liocarcinus depurator*	1	1	0
							no sp. id	no sp. id	1	1	0
			hermit crab	2	2	0	anemone hermit crab	*Pagurus prideaux*	1	1	0
							common hermit crab	*Pagurus bernhadus*	1	1	0
	Echinodermata	Echinoidea	sea urchin	1	0	1	common sea urchin	*Echinus esculentus*	1	0	1
		Holothuroidea	sea cucumber	1	0	1	cotton spinner	*Holothuria forskali*	1	0	1
		Stelleroidea	starfish	5	5	0	common starfish	*Asterias rubens*	4	4	0
							seven-armed starfish	*Luidia ciliaris*	1	1	0
	Mollusca	Bivalvia	scallop	7	7	0	king scallop	*Pecten maximus*	2	2	0
							queen scallop	*Aequipecten opercularis*	2	2	0
							no sp. id	no sp. id	3	3	0
		Gastropoda	top shell	1	0	1	painted top-shell	*Calliostoma zizyphinum*	1	0	1
	No species recorded	NA	NA	12	12	0	NA	NA	12	12	0

Table 3. (c) Species list for survey box 2 described by Phylum/sub Phylum, Class, species description, common name, binomial name (scientific name). Number of images in which the species were present (by species description and by species Id.) are given and apportioned by substratum: circalittoral coarse or mixed sediments (CCMS) EUNIS habitat codes 5.14 and 5.44; or rock/reef features (R/R), circalittoral rock and other hard substrata (EUNIS habitat code A4).

Survey Box	Phylum/ sub Phylum	Class	Species description	Images (n) per substratum (by species description)			Species Id. (common name)	Species Id. (scientific name)	Images (n) per substratum (by species Id.)		
2014				**Total**	**CCMS**	**R/R**			**Total**	**CCMS**	**R/R**
Box 3	Annelida	Polychaeta	tube worm	2	2	0	no sp. id	no sp. id	2	2	0
	Bryozoa	Gymnolaemata/ Stenolaemata	bryozoa (erect: turf)	1	1	0	no sp. id	no sp. id	1	1	0
	Cnidaria	Hydrozoa	hydroid	2	2	0	no sp. id	no sp. id	2	2	0
	Mollusca	Bivalvia	scallop	1	1	0	king scallop	*Pecten maximus*	1	1	0
	No species recorded	NA	NA	7	7	0	NA	NA	7	7	0

2015 surveys

The 2015 Eddystone Reef camera surveys (Figure 2) generated 468 images captured from survey boxes 1, 2 and 3 (east to west). Forty images were captured whilst the camera frame was not in contact with the sea bed, these images were not analysed. No images were rejected as a result of poor image quality, duplication of, or missing spatial reference.

The number of tows/images per survey box were; box 1 (tows (n = 7): images (n = 134)), box 2 (tows (n = 8): images (n = 148)) and box 3 (tows (n = 8): images (n = 146)), (Figure 2 and metadata in Table 2).

The proportion of images captured per box by substratum was variable (Figure 10). The number of lasers present per image was highly consistent, with 100% of all images from survey boxes 1 and 2, and 99.3% from survey box 3 having 3 or more lasers present (Figure 11). Image quality across all survey boxes was good, with over 99% of all images classified as moderate to good (Figure 12).

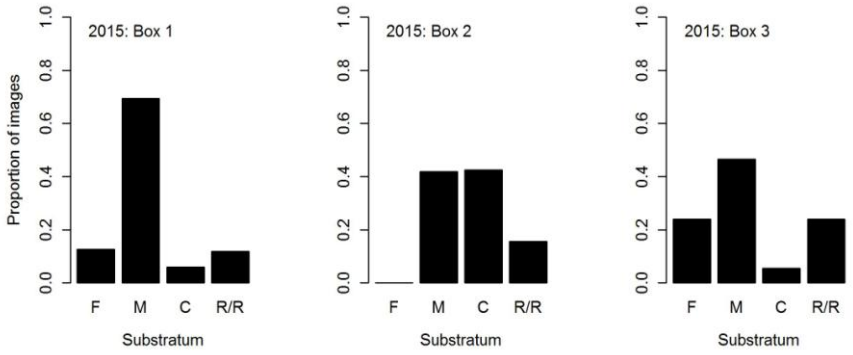


Figure 10. Proportion of images, categorised by substratum, per survey box. Substratum is identified as follows: fine (F), medium (M), coarse (C) and rock/reef (R/R). Fine, medium and coarse substratum are representative of circalittoral coarse or mixed sediments (EUNIS habitat codes 5.14 and 5.44 respectively). Rock or reef features are representative of circalittoral rock and other hard substrata (EUNIS habitat code A4).

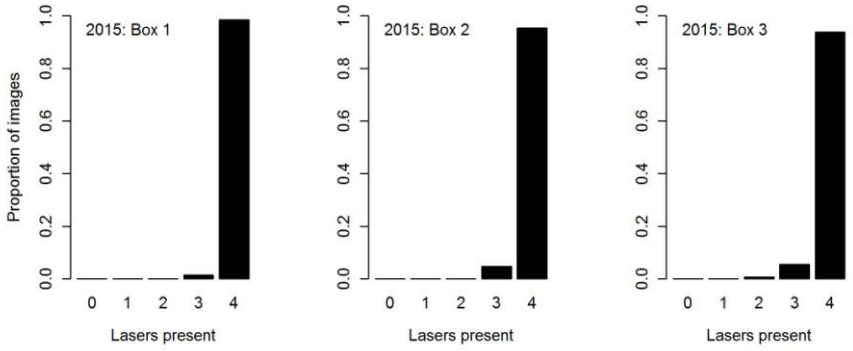


Figure 11. Proportion of images, categorised by number of lasers present in the image, per survey box.

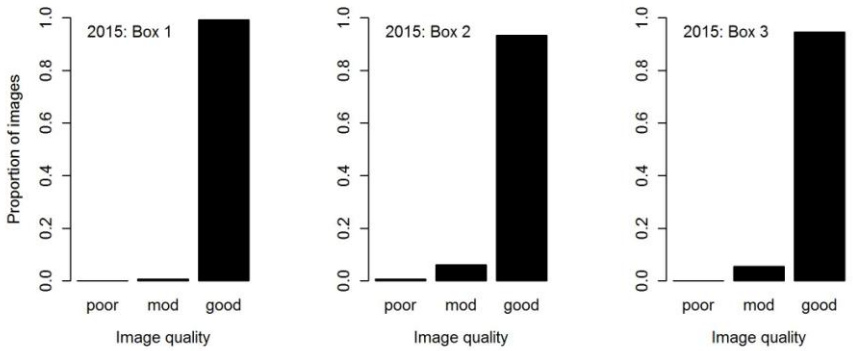


Figure 12. Proportion of images, categorised by image quality, per survey box. Image quality is identified as follows: poor, moderate (mod) and good.

The substratum rock/reef features had the highest average (mean) number of species per image for both survey box 1, 2 and 3 (Figure 13). There was some variation in species assemblages and relative abundance, among substratum and between survey boxes (Figures 14, 15 and 16). There were twenty-three species (identified by highest generic species description: see Table 4) from nine Phyla in survey box 1, twenty-five species from nine Phyla in survey box 2, and twenty-six species from nine Phyla in survey box 3

(Figures 14, 15 , 16 and Table 4); see Appendix 3 for image gallery of key species.

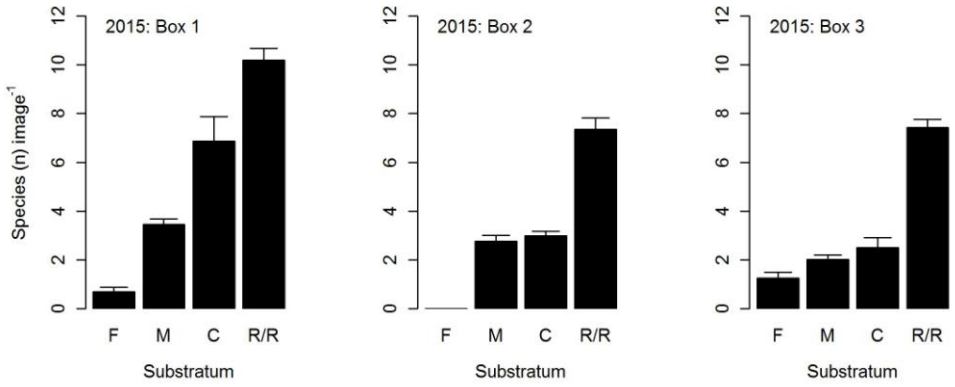


Figure 13. Species (n) per image, by substratum, per survey box. Bar graphs are drawn with mean and standard error bars. Substratum is identified as follows: fine (F), medium (M), coarse (C) and rock/reef (R/R).

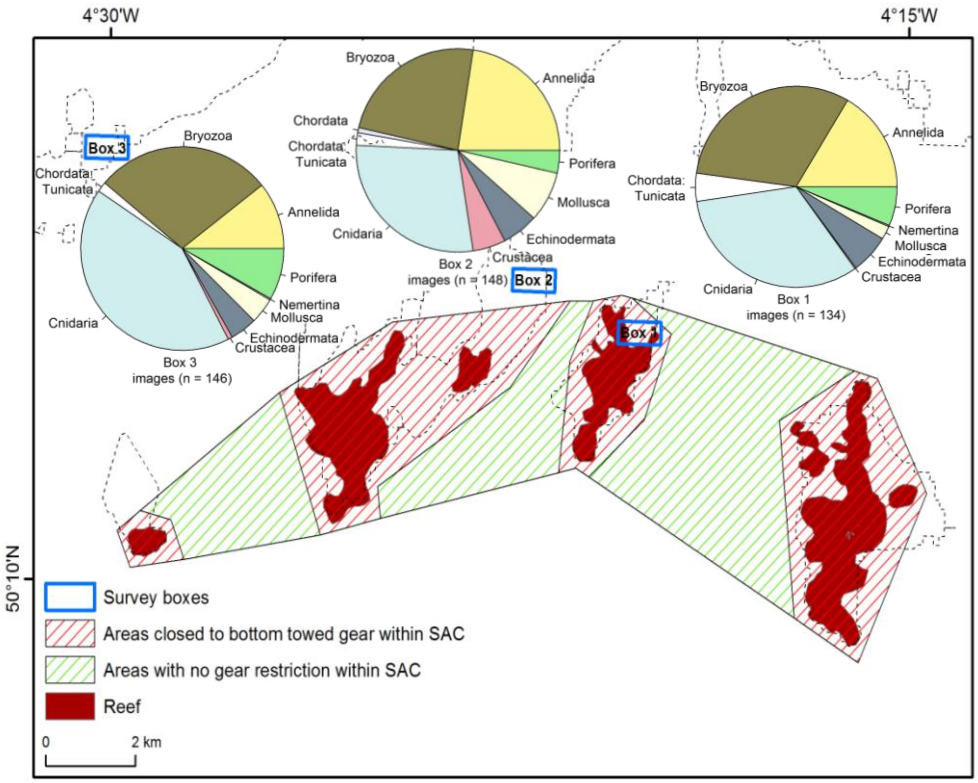


Figure 14. Eddystone Special Area of Conservation (SAC). Species assemblages, identified to Phylum, are drawn as pie charts. The total number of images are given. See Figures 15, 16 and Table 4 for breakdown by species and substratum. Survey boxes, areas closed to bottom-towed gear, areas with no restrictions and reef features drawn in accordance with the figure legend. 50 m isobath is drawn and labelled. Maps drawn to Projected Coordinate System: British National Grid Transverse Mercator.

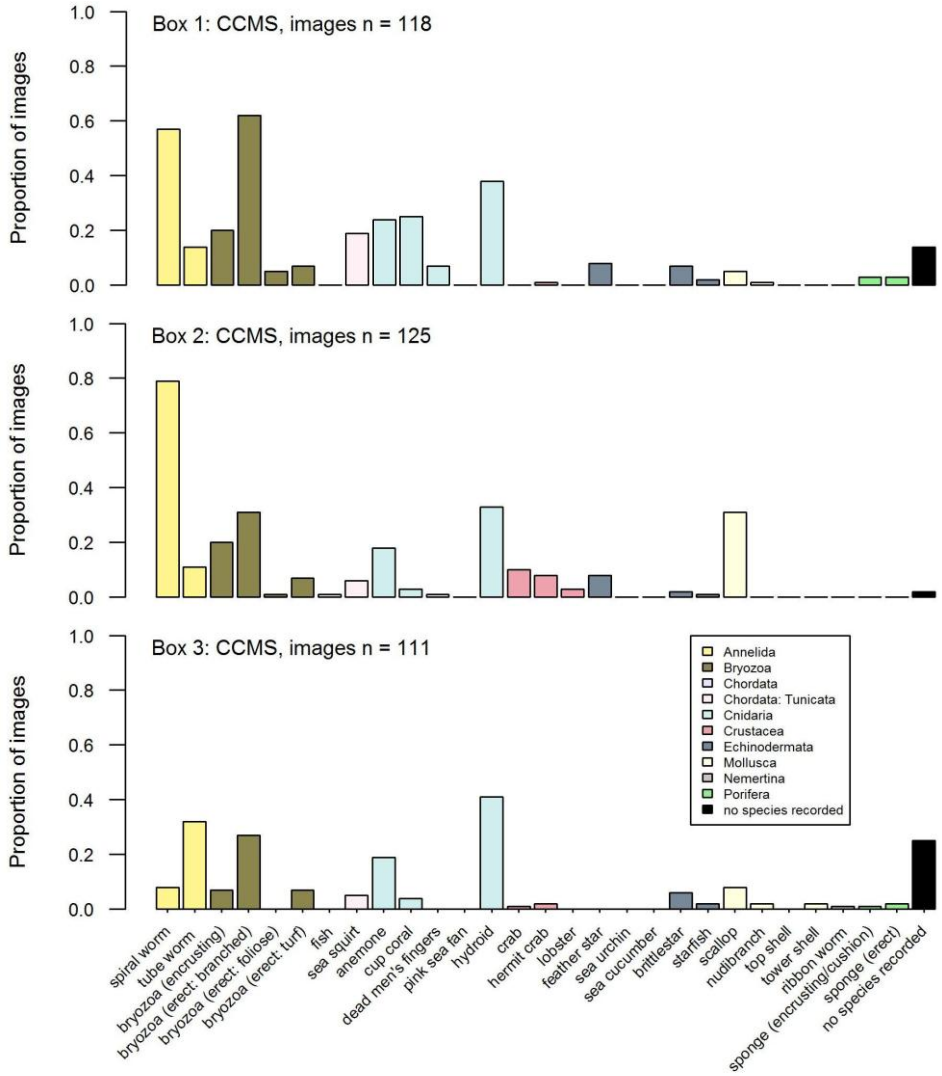


Figure 15. Relative abundance of species (proportion) for survey boxes 1, 2 and 3 on circalittoral coarse or mixed sediments (CCMS). Species identified by species description (see Table 4), grouped by Phyla, apportioned by survey box and substratum. Substrata are classified as: circalittoral coarse or mixed sediments (CCMS) EUNIS habitat codes 5.14 and 5.44; or rock/reef features (R/R), circalittoral rock and other hard substrata (EUNIS habitat code A4). Each bar represents the total number of images (n) with species present expressed as a proportion of the total number of images (n) captured within the survey box. Phyla are shaded in accordance with the figure legend. See Table 4 for further breakdown of species by highest taxonomic level and substratum.

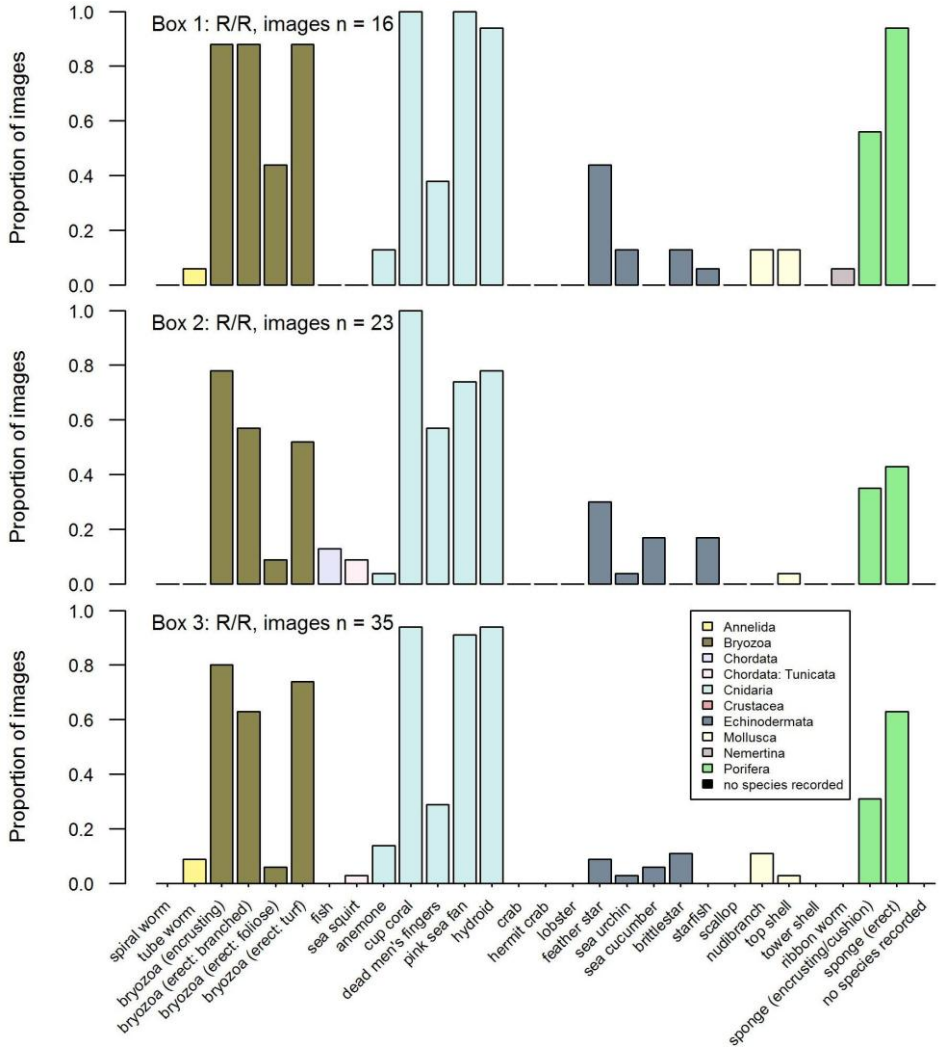


Figure 16. Relative abundance of species (proportion) for survey boxes 1, 2 and 3 on rock/reef features (R/R). Species identified by species description (see Table 4), grouped by Phyla, apportioned by survey box and substratum. Substrata are classified as: circalittoral coarse or mixed sediments (CCMS) EUNIS habitat codes 5.14 and 5.44; or rock/reef features (R/R), circalittoral rock and other hard substrata (EUNIS habitat code A4). Each bar represents the total number of images (n) with species present expressed as a proportion of the total number of images (n) captured within the survey box. Phyla are shaded in accordance with the figure legend. See Table 4 for further breakdown of species by highest taxonomic level and substratum.

Table 4. (a) Species list for survey box 1 described by Phylum/sub Phylum, Class, species description, common name, binomial name (scientific name). Number of images in which the species were present (by species description and by species Id.) are given and apportioned by substratum: circalittoral coarse or mixed sediments (CCMS) EUNIS habitat codes 5.14 and 5.44; or rock/reef features (R/R), circalittoral rock and other hard substrata (EUNIS habitat code A4).

Survey Box	Phylum/ sub Phylum	Class	Species description	Images (n) per substratum (by species description)			Species Id. (common name)	Species Id. (scientific name)	Images (n) per substratum (by species Id.)		
2015				**Total**	**CCMS**	**R/R**			**Total**	**CCMS**	**R/R**
Box 1	Annelida	Polychaeta	spiral worm	67	67	0	spiral worm	*Spirorbis sp.*	67	67	0
			tube worm	17	16	1	parchment worm	*Chaetopterus sp.*	6	6	0
							sand mason	*Lanice conchilega*	9	8	1
							no sp. id	no sp. id	3	3	0
	Bryozoa	Gymnolaemata	bryozoa (encrusting)	38	24	14	orange pumice bryozoa	*Cellepora pumicosa*	32	19	13
							no sp. id	no sp. id	15	7	8
			bryozoa (erect: branched)	87	73	14	finger bryozoa/sea chevril	*Alcyonidium diaphanum*	42	38	4
							monkey puzzle bryozoa	*Omalosecosa ramulosa*	68	54	14
							stags horn bryozoa	*Porella compressa*	2	1	1
							no sp. id	no sp. id	1	0	1
			bryozoa (erect: foliose)	13	6	7	ross coral	*Pentapora foliacea*	13	6	7
		Gymnolaemata/ Stenolaemata	bryozoa (erect: turf)	22	8	14	no sp. id	no sp. id	22	8	14
	Chordata: Tunicata	Ascidiacea	sea squirt	23	23	0	sea squirt (poss. fluted)	*Ascidiella sp.*	10	10	0
							gas mantle sea squirt	*Corella parallelogramma*	11	11	0
							no sp. id	no sp. id	3	3	0
	Cnidaria	Anthozoa	anemone	30	28	2	policeman anemone	*Mesacmaea mitchellii*	6	5	1
							buried/tube anemone	*Sagartia sp.*	1	1	0
							buried/tube anemone	no sp. id	3	2	1
							colonial anemone	*Parazoanthus sp.*	1	0	1
							sandy creeplet	*Epizoanthus couchii*	19	19	0
							cloak anemone	*Adamsia palliata*	1	1	0
			cup coral	46	30	16	cup coral	*Caryophyllia sp.*	46	30	16
			dead men's fingers	14	8	6	dead men's fingers	*Alcyonium digitatum*	14	8	6
			pink sea fan	16	0	16	pink sea fan	*Eunicella verrucosa*	16	0	16
		Hydrozoa	hydroid	60	45	15	no sp. id	no sp. id	60	45	15
	Crustacea	Malacostraca	hermit crab	1	1	0	anemone hermit crab	*Pagurus prideaux*	1	1	0
	Echinodermata	Crinoidea	feather star	17	10	7	rosy feather star	*Antedon bifida*	17	10	7
		Echinoidea	sea urchin	2	0	2	common sea urchin	*Echinus esculentus*	2	0	2
		Stelleroidea	brittlestar	10	8	2	sand brittlestar	*Ophiura albida*	4	4	0
							no sp. id	no sp. id	6	4	2
			starfish	3	2	1	bloody henry	*Henrica sp.*	1	1	0
							seven-armed starfish	*Luidia ciliaris*	1	0	1
							spiny starfish	*Marthasterias glacialis*	1	1	0
	Mollusca	Bivalvia	scallop	6	6	0	king scallop	*Pecten maximus*	1	1	0
							queen scallop	*Aequipecten opercularis*	2	2	0
							no sp. id	no sp. id	3	3	0
		Gastropoda	nudibranch	3	1	2	pink sea fan nudibranch	*Tritonia nilsodhneri*	2	0	2
							no sp. id	no sp. id	1	1	0
			top shell	2	0	2	painted top-shell	*Calliostoma zizyphinum*	2	0	2
	Nemertina	Anopla	ribbon worm	1	0	1	football jersey worm	*Tubulanus annulatus*	1	0	1
	Porifera	Demospongiae/ Calcarea	sponge (encrusting/cushion)	13	4	9	boring sponge	*Cliona celata*	2	0	2
							hedgehog sponge	*Polymastia boletiformis*	5	0	5
							no sp. id	no sp. id	8	4	4
			sponge (erect)	19	4	15	yellow staghorn sponge	*Axinella dissimilis*	1	0	1
							no sp. id	no sp. id	19	4	15
	No species recorded	NA	NA	16	16	0	NA	NA	16	16	0

Table 4. (b) Species list for survey box 2 described by Phylum/sub Phylum, Class, species description, common name, binomial name (scientific name). Number of images in which the species were present (by species description and by species Id.) are given and apportioned by substratum: circalittoral coarse or mixed sediments (CCMS) EUNIS habitat codes 5.14 and 5.44; or rock/reef features (R/R), circalittoral rock and other hard substrata (EUNIS habitat code A4).

Survey Box	Phylum/ sub Phylum	Class	Species description	Images (n) per substratum (by species description)			Species Id. (common name)	Species Id. (scientific name)	Images (n) per substratum (by species Id.)		
2015				**Total**	**CCMS**	**R/R**			**Total**	**CCMS**	**R/R**
Box 2	Annelida	Polychaeta	spiral worm	99	99	0	spiral worm	*Spirorbis sp.*	99	99	0
			tube worm	14	14	0	parchment worm	*Chaetopterus sp.*	3	3	0
							sand mason	*Lanice conchilega*	9	9	0
							no sp. id	no sp. id	2	2	0
	Bryozoa	Gymnolaemata	bryozoa (encrusting)	43	25	18	orange pumice bryozoa	*Cellepora pumicosa*	27	18	9
							no sp. id	no sp. id	27	12	15
			bryozoa (erect: branched)	52	39	13	finger bryozoa/sea chevril	*Alcyonidium diaphanum*	36	25	11
							monkey puzzle bryozoa	*Omalosecosa ramulosa*	28	23	5
							no sp. id	no sp. id	1	1	0
			bryozoa (erect: foliose)	3	1	2	ross coral	*Pentapora foliacea*	3	1	2
		Gymnolaemata/ Stenolaemata	bryozoa (erect: turf)	21	9	12	no sp. id	no sp. id	21	9	12
	Chordata	Actinopterygii	fish	4	1	3	common dragonet	*Callionymus lyra*	1	1	0
							cuckoo wrasse	*Labrus mixtus*	1	0	1
							goldsinny wrasse	*Ctenolabrus rupestris*	1	0	1
							turbot: topknot	*Zeugopterus punctatus*	1	0	1
	Chordata: Tunicata	Ascidiacea	sea squirt	10	8	2	sea squirt (poss. fluted)	*Ascidiella sp.*	4	3	1
							gas mantle sea squirt	*Corella parallelogramma*	2	2	0
							no sp. id	no sp. id	4	3	1
	Cnidaria	Anthozoa	anemone	23	22	1	clock face anemone	*Peachia cylindrica*	1	1	0
							policeman anemone	*Mesacmaea mitchellii*	1	1	0
							buried/tube anemone	no sp. id	1	1	0
							sandy creeplet	*Epizoanthus couchii*	9	9	0
							cloak anemone	*Adamsia palliata*	9	9	0
							sea fan anemone	*Amphianthus dohrnii*	1	0	1
							no sp. id	no sp. id	2	2	0
			cup coral	27	4	23	cup coral	*Caryophyllia sp*	27	4	23
			dead men's fingers	14	1	13	dead men's fingers	*Alcyonium digitatum*	14	1	13
			pink sea fan	17	0	17	pink sea fan	*Eunicella verrucosa*	17	0	17
		Hydrozoa	hydroid	59	41	18	nodding hydroid	*Corymorpha nutans*	1	1	0
							no sp. id	no sp. id	58	40	18
	Crustacea	Malacostraca	crab	12	12	0	harbour crab	*Liocarcinus depurator*	1	1	0
							no sp. id	no sp. id	11	11	0
			hermit crab	10	10	0	anemone hermit crab	*Pagurus prideaux*	9	9	0
							no sp. id	no sp. id	1	1	0
			lobster	4	4	0	squat lobster	*Munida rugosa*	4	4	0
	Echinodermata	Crinoidea	feather star	17	10	7	rosy feather star	*Antedon bifida*	17	10	7
		Echinoidea	sea urchin	1	0	1	common sea urchin	*Echinus esculentus*	1	0	1
		Holothuroidea	sea cucumber	4	0	4	cotton spinner	*Holothuria forskali*	4	0	4
		Stelleroidea	brittlestar	2	2	0	sand brittlestar	*Ophiura albida*	1	1	0
							no sp. id	no sp. id	1	1	0
			starfish	5	1	4	bloody henry	*Henrica sp.*	1	0	1
							common starfish	*Asterias rubens*	2	1	1
							seven-armed starfish	*Luidia ciliaris*	2	0	2
							spiny starfish	*Marthasterias glacialis*	1	0	1
	Mollusca	Bivalvia	scallop	39	39	0	king scallop	*Pecten maximus*	5	5	0
							queen scallop	*Aequipecten opercularis*	27	27	0
							no sp. id	no sp. id	9	9	0
		Gastropoda	top shell	1	0	1	painted top-shell	*Calliostoma zizyphinum*	1	0	1
	Porifera	Demospongiae/ Calcarea	sponge (encrusting/cushion)	8	0	8	hedgehog sponge	*Polymastia boletiformis*	4	0	4
			sponge (encrusting/cushion)	8	0	8	no sp. id	no sp. id	6	0	6
			sponge (erect)	10	0	10	no sp. id	no sp. id	10	0	10
	No species recorded	NA	NA	3	3	0	NA	NA	3	3	0

Table 4. (c) Species list for survey box 2 described by Phylum/sub Phylum, Class, species description, common name, binomial name (scientific name). Number of images in which the species were present (by species description and by species Id.) are given and apportioned by substratum: circalittoral coarse or mixed sediments (CCMS) EUNIS habitat codes 5.14 and 5.44; or rock/reef features (R/R), circalittoral rock and other hard substrata (EUNIS habitat code A4).

Survey Box	Phylum/ sub Phylum	Class	Species description	Images (n) per substratum (by species description)			Species Id. (common name)	Species Id. (scientific name)	Images (n) per substratum (by species Id.)		
2015				**Total**	**CCMS**	**R/R**			**Total**	**CCMS**	**R/R**
Box 3	Annelida	Polychaeta	spiral worm	9	9	0	spiral worm	*Spirorbis sp.*	9	9	0
			tube worm	38	35	3	parchment worm	*Chaetopterus sp*	27	27	0
							sand mason	*Lanice conchilega*	9	9	0
							no sp. id	no sp. id	3	0	3
	Bryozoa	Gymnolaemata	bryozoa (encrusting)	36	8	28	orange pumice bryozoa	*Cellepora pumicosa*	20	8	12
							no sp. id	no sp. id	22	0	22
			bryozoa (erect: branched)	52	30	22	finger bryozoa/sea chevril	*Alcyonidium diaphanum*	17	11	6
							monkey puzzle bryozoa	*Omalosecosa ramulosa*	36	23	13
							stags horn bryozoa	*Porella compressa*	4	0	4
							no sp. id	no sp. id	2	0	2
			bryozoa (erect: foliose)	2	0	2	ross coral	*Pentapora foliacea*	2	0	2
		Gymnolaemata/ Stenolaemata	bryozoa (erect: turf)	34	8	26	no sp. id	no sp. id	34	8	26
	Chordata: Tunicata	Ascidiacea	sea squirt	7	6	1	sea squirt (poss. fluted)	*Ascidiella sp.*	1	1	0
							gas mantle sea squirt	*Corella parallelogramma*	3	2	1
							no sp. id	no sp. id	3	3	0
	Cnidaria	Anthozoa	anemone	26	21	5	policeman anemone	*Mesacmaea mitchellii*	3	3	0
							buried/tube anemone	no sp. id	11	10	1
							sandy creeplet	*Epizoanthus couchii*	9	7	2
							parasitic anemone	*Calliactis parasitica*	1	1	0
							sea fan anemone	*Amphianthus dohrnii*	3	0	3
							no sp. id	no sp. id	1	1	0
			cup coral	37	4	33	cup coral	*Caryophyllia sp.*	37	4	33
			dead men's fingers	10	0	10	dead men's fingers	*Alcyonium digitatum*	10	0	10
			pink sea fan	32	0	32	pink sea fan	*Eunicella verrucosa*	32	0	32
		Hydrozoa	hydroid	79	46	33	no sp. id	no sp. id	79	46	33
	Crustacea	Malacostraca	crab	1	1	0	harbour crab	*Liocarcinus depurator*	1	1	0
			hermit crab	2	2	0	no sp. id	no sp. id	2	2	0
	Echinodermata	Crinoidea	feather star	3	0	3	rosy feather star	*Antedon bifida*	3	0	3
		Echinoidea	sea urchin	1	0	1	common sea urchin	*Echinus esculentus*	1	0	1
		Holothuroidea	sea cucumber	2	0	2	cotton spinner	*Holothuria forskali*	2	0	2
		Stelleroidea	brittlestar	11	7	4	sand brittlestar	*Ophiura albida*	7	4	3
							no sp. id	no sp. id	7	3	4
			starfish	2	2	0	bloody henry	*Henrica sp.*	1	1	0
							common starfish	*Asterias rubens*	1	1	0
	Mollusca	Bivalvia	scallop	9	9	0	king scallop	*Pecten maximus*	3	3	0
							queen scallop	*Aequipecten opercularis*	5	5	0
							no sp. id	no sp. id	1	1	0
		Gastropoda	nudibranch	6	2	4	pink sea fan nudibranch	*Tritonia nilsodhneri*	4	0	4
							yellow-edge Polycera	*Polycera faeroensis*	1	0	1
							no sp. id	no sp. id	2	2	0
			top shell	1	0	1	painted top-shell	*Calliostoma zizyphinum*	1	0	1
			tower shell	2	2	0	tower shell	*Turritella communis*	2	2	0
	Nemertina	Anopla	ribbon worm	1	1	0	football jersey worm	*Tubulanus annulatus*	1	1	0
	Porifera	Demospongiae/ Calcarea	sponge (encrusting/cushion)	12	1	11	boring sponge	*Cliona celata*	4	0	4
							hedgehog sponge	*Polymastia boletiformis*	3	0	3
							no sp. id	no sp. id	8	1	7
			sponge (erect)	24	2	22	no sp. id	no sp. id	24	2	22
	No species recorded	NA	NA	28	28	0	NA	NA	28	28	0

Discussion

The 2015 Eddystone drop-down camera surveys produced 428 images which yielded 1542 benthic organisms. In contrast, the 2014 surveys gathered 214 analysable images that allowed identification of 372 benthic organisms. All surveys were conducted over a short time-frame at a similar time each year. The 2015 surveys provided for a balanced survey effort across survey boxes.

There was a marked improvement in the number of lasers present between years, with all images in 2015 having 2 or more lasers present, this compared with 86%, 18% and 91% for boxes 1, 2 and 3 respectively in year 2014. Similarly, there was a marked improvement in image quality with less than 0.5% of all images captured in 2015 categorised as poor compared with ~10% in 2014. There was an increase in the average (mean) number of species recorded per image among respective survey boxes across years. The 2015 survey protocol has seen refinements made to the lighting rig and improved 'trigger response' of the remote camera. This has combined to provide sharper images with reduced movement of the camera frame at the moment of image capture. This in turn may have allowed for an increase in the detection of species within the images and has almost certainly allowed for an increase in confidence in species identification (Appendix 4).

The 2015 surveys indicated that substratum composition is similar between survey boxes 1 and 3, being a mosaic of sediment, pebble, cobble, shell with rock and reef features. Survey box 2 differs marginally to that found in boxes 1 and 3; whilst rock and reef features are present, the surrounding substratum is largely dominated by medium/coarse cobble and shell.

Rock and reef features were predominantly host to mixed Bryozoa, Cnidaria and Porifera communities. There was evidence for greater Bryozoa and Porifera abundance in box 1 on rock and reef features than other boxes for both survey years. Box 1 had the greatest abundance of bryozoans on circalittoral coarse and mixed sediments for both survey years. Box 1 also had a greater abundance of sea squirts on circalittoral coarse and mixed sediments than other survey boxes for 2015. This was a species that was not detected in 2014, possibly due to the reduced image quality. There was also a greater abundance of cup corals on circalittoral coarse and mixed sediments in box 1, this is a species that is seen in abundance on rock and reef features throughout all survey boxes. These specimens often manifested themselves as solitary individuals within the substratum. Box 2 had the greatest abundance of spirorbids, this potentially reflects the

coarser nature of the substratum which is dominated by medium to coarse cobble and shell. This box also had greatest abundance of crustaceans and scallops.

The 2015 surveys have demonstrably built on the preliminary survey work of 2014 and have indicated that there may be a detectable change in seabed communities between areas that are closed, and those that remain open, to bottom-towed fishing gear. Further surveys in future years, using the same survey protocol adopted for 2015, will offer insight as to whether these potential trends are sustained and become more apparent over time as managed areas begin to recover. The collection of future data at the site may also allow for the application of modern-day statistical approaches to examine changes and difference in seabed community composition in later years as the dataset grows.

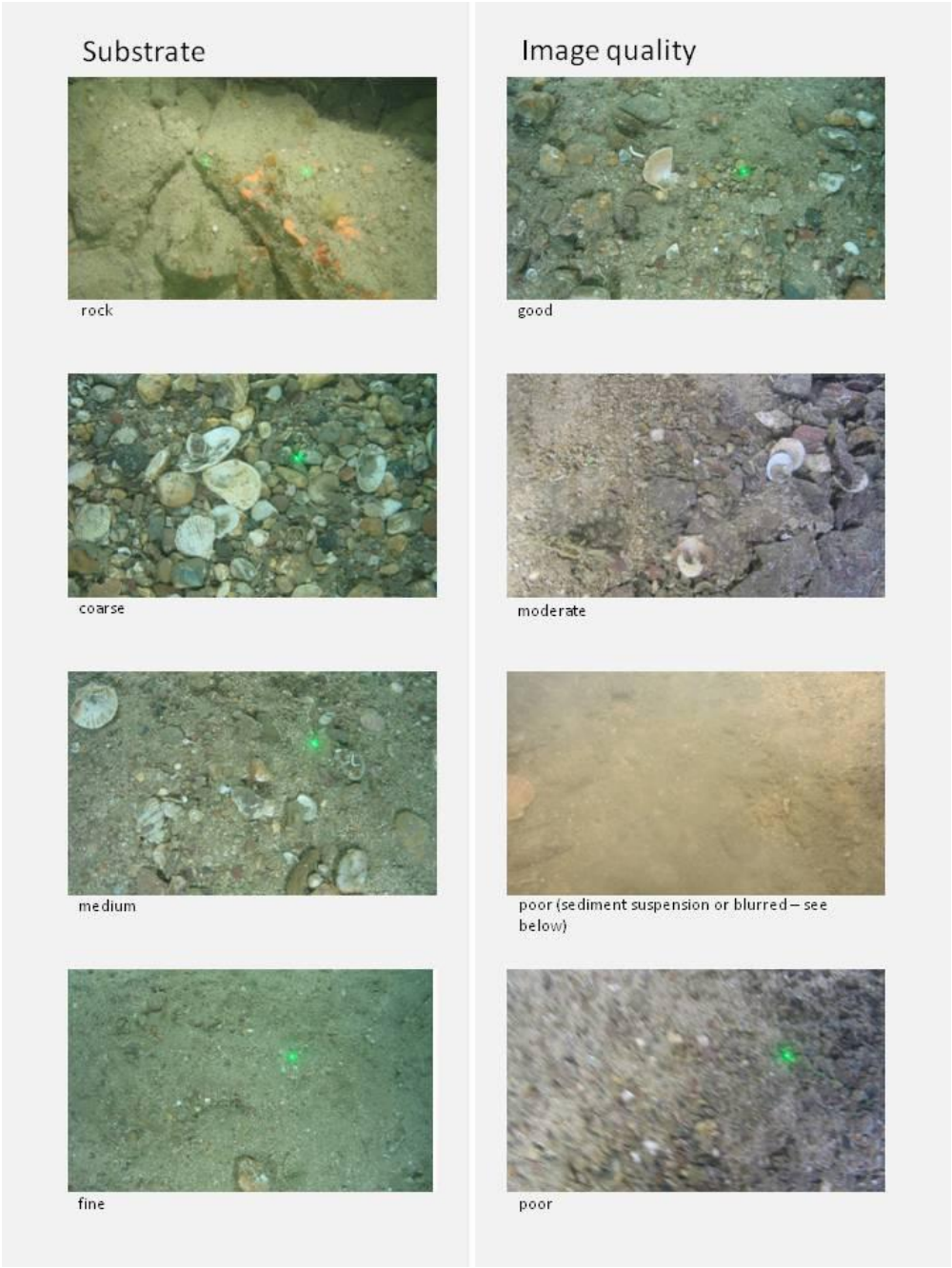
References

Anonymous, (1999). Pink sea-fan (*Eunicella verrucosa*). Species Action Plan. In UK Biodiversity Group. Tranche 2 Action Plans. English Nature for the UK Biodiversity Group, Peterborough.

Axelsson, M., Dewey, S., Chaddock, S, and Duke, S (2006) Seastar Survey: Survey of the reef habitat around Eddystone Rocks, Plymouth.

Hiscock, K. (2007) *Eunicella verrucosa*. Pink sea fan. Marine Life Information Network: Biology and Sensitivity Key Information Sub-programme [on-line]. Plymouth: Marine Biological Association of the United Kingdom. *http://www.marlin.ac.uk/speciesfullreview.php?speciesID=3317*.

Appendix 1: Substratum and image quality



The dominant substratum for each image was categorised using a 4 part classification system: rock, coarse, medium and fine. The clarity of each image (image quality) was categorised using a 3 part classification system: good, medium and poor. Examples for each of these categories is shown above.

Appendix 2: 2014 gallery of species

20140716_Box_1_1_004 finger bryozoa/sea chevril (*Alcyonidium diaphanum*)

20140731_Box_1_1_004 spiral bryozoa (Bugula sp.)

20140731_Box_1_1_008 monkey puzzle bryozoa (*Omalosecosa ramulosa*)

20140731_Box_1_3_013 bryozoa: ross coral (*Pentapora foliacea*)

20140731_Box_1_3_015 bryozoa: ross coral (*Pentapora foliacea*) with mixed byozoa turf (no sp id)

20140731_Box_1_5_014 encrusting bryozoa (no sp id)

20140716_Box_1_3_003 pink seafans (*Eunicella verrucosa*)

20140731_Box_1_5_014 dead men's fingers (*Alcyonium digitatum*)

Images are identified as follows: e.g. 20140716[date: yyyymmdd], Box_1_1[Survey box 1, tow number 1], 004[image number]. Species are identified by common name and where possible, binomial name (scientific name).

20140731_Box_1_5_009 hedgehog sponge (*Polymastia boletiformis*)

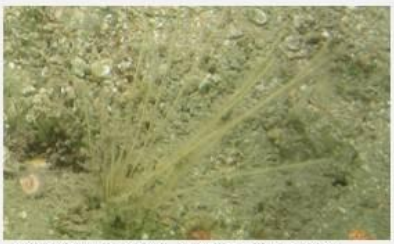
20140731_Box_1_5_017 branched sponge (no sp id)

20140731_Box_1_5_017 boring sponge (*Cliona celata*)

20140619_Box_2_6_005 nodding hydroid (*Corymorpha nutans*)

20140731_Box_1_5_008 hydroid (no sp id)

20140731_Box_1_1_011 hydroid (no sp id)



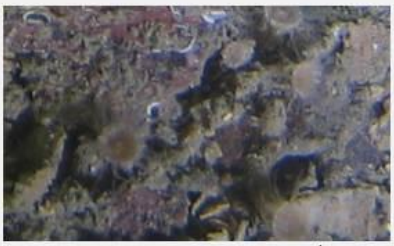
20140619_Box_2_6_007 hydroid (no sp id)

20140731_Box_1_3_005 hydroid (no sp id)

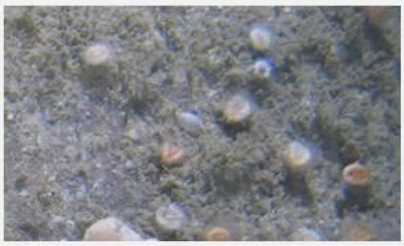
Images are identified as follows: e.g. 20140716[date: yyyymmdd], Box_1_1[Survey box 1, tow number 1], 004[image number]. Species are identified by common name and where possible, binomial name (scientific name).

20140731_Box_1_2_004 burrowing anemone (no sp id)

20140731_Box_1_1_011 burrowing anemone (*Peachia cylindrica*)



20140731_Box_1_1_018 anemone: sandy creeplet (*Epizoanthus couchii*)



20140731_Box_1_5_017 cup coral (*Caryophyllia smithii*)

20140731_Box_2_1_004 anemone hermit crab (*Pagurus prideaux*) with cloak anemone (*Adamsia carciniopados*) (also inset)

20140731_Box_1_1_0013fan worm: sand mason (*Lanice conchilega*)

20140619_Box_2_1_024 common hermit crab (*Pagurus bernhadus*)

20140619_Box_2_1_017 harbour crab (*Liocarcinus depurator*)

Images are identified as follows: e.g. 20140716[date: yyyymmdd], Box_1_1[Survey box 1, tow number 1], 004[image number]. Species are identified by common name and where possible, binomial name (scientific name).

20140619_Box_2_1_019 common starfish (*Asterias rubens*)

20140731_Box_2_2_005 seven armed starfish (*Luidia ciliaris*)

20140731_Box_1_5_019 rosy feather star (*Antedon bifida*)

20140731_Box_1_5_018 common sea urchin (*Echinus esculentus*)

20140619_Box_2_6_013 king scallop (*Pecten maximus*)

20140731_Box_2_1_009 queen scallop (*Aequipecten opercularis*)

20140619_Box_2_6_012 painted top-shell (*Calliostoma zizyphinum*)

20140731_Box_1_2_017 limpet: white tortoiseshell (*Tectura virginea*)

Images are identified as follows: e.g. 20140716[date: yyyymmdd], Box_1_1[Survey box 1, tow number 1], 004[image number]. Species are identified by common name and where possible, binomial name (scientific name).

Appendix 3: 2015 gallery of species

20150709_Box_1_T8a_002 finger bryozoa/sea chevril (*Alcyonidium diaphanum*)

20150709_Box_1_T8a_007 monkey puzzle bryozoa (*Omalosecosa ramulosa*) with bryozoa and hydroid turf

20150723_Box_1_T8_019 bryozoaturf (Cellaria sp.) and monkey puzzle bryozoa (*Omalosecosa ramulosa*)

20150709_Box_3_T5_015 stagshorn bryozoa (*Porella compressa*)

20150723_Box_1_T8_023 bryozoa: ross coral (*Pentapora foliacea*) with byozoa turf (no sp id)

20150723_Box_2_T8_006 encrusting bryozoa (no sp id) with cup corals (Caryophyllia sp.)

20150709_Box_3_T4_007 pink sea fan (*Eunicella verrucosa*) with pink sea fan nudibranchs (*Tritonia nilsodhneri*)

20150723_Box_3_T6a_011 dead men's fingers (*Alcyonium digitatum*) with cup corals (Caryophyllia sp.)

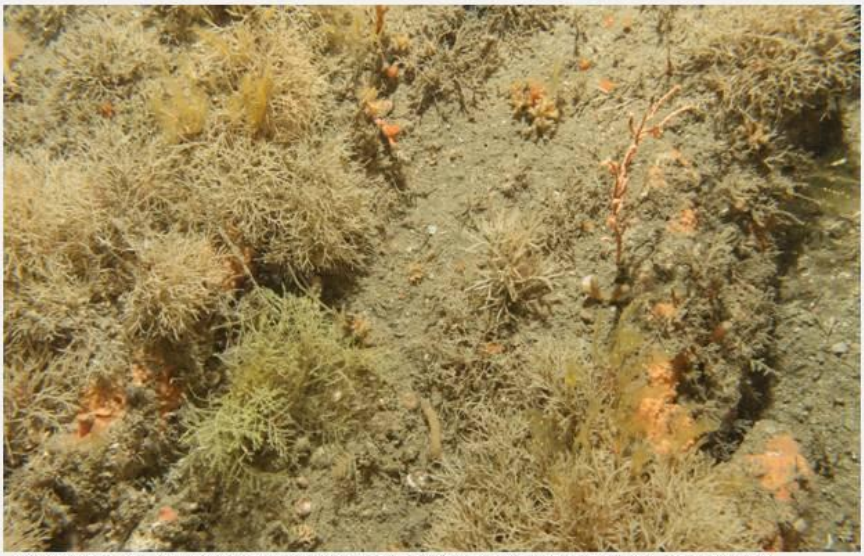
Images are identified as follows: e.g. 20150716[date: yyyymmdd], Box_1_1[Survey box 1, tow number 1], 004[image number]. Species are identified by common name and where possible, binomial name (scientific name).

20150723_Box_1_T8_025 hedgehog sponge (*Polymastia boletiformis*)

20150723_Box_1_T8_025 branched sponge (no sp id)

20150723_Box_3_T6a_008 boring sponge (*Cliona celata*)

20150709_Box_2_T6_009 nodding hydroid (*Corymorpha nutans*)



20150723_Box_1_T8_034 mixed hydroid and bryozoa turf (no sp id) with pink sea fan, encrusting and monkey puzzle bryozoans, cup corals and sponge species

Images are identified as follows: e.g. 20150716[date: yyyymmdd], Box_1_1[Survey box 1, tow number 1], 004[image number]. Species are identified by common name and where possible, binomial name (scientific name).

20150709_Box_1_T5_006 policeman anemone (*Mesacmaea mitchellii*)

20150709_Box_2_T3a_010 clockface anemone (*Peachia cylindrica*)

20150723_Box_1_T8_003 anemone (Sagartia sp.)

20150709_Box_3_T4_022 parasitic anemone (*Calliactis parasitica*)

20150709_Box_2_T3_001 anemone hermit crab (*Pagurus prideaux*) with cloak anemone (*Adamsia carciniopados*)

20150709_Box_2_T1_012 harbour crab (*Liocarcinus depurator*)

20150709_Box_2_T1_008 queen scallops (*Aequipecten opercularis*)

20150709_Box_2_T3a_012 king scallop (*Pecten maximus*)

Images are identified as follows: e.g. 20150716[date: yyyymmdd], Box_1_1[Survey box 1, tow number 1], 004[image number]. Species are identified by common name and where possible, binomial name (scientific name).

20150709_Box_1_T8a_020 bloody henry (Henrica sp.)

20150709_Box_2_T1_005 common starfish (*Asterias rubens*)

20150723_Box_2_T7_006 spiny starfish (*Marthasterias glacialis*), rosy feather stars (*Antedon bifida*) and goldsinny wrasse (*Ctenolabrus rupestris*)

20150709_Box_3_T5_002 common sea urchin (*Echinus esculentus*)

20150709_Box_3_T4_007 nudibranch: yellow-edge Polycera (*Polycera faeroensis*)

20150709_Box_2_T6_001 sea cucumber: cotton spinner (*Holothuria forskali*)

20150709_Box_1_T8a_004 brittle star: sand brittle star (*Ophiura albida*)

20150709_Box_1_T8a_015 gas mantle sea squirt (*Corella parallelogramma*) below sea chevril (*Alcyonidium diaphanum*)

Images are identified as follows: e.g. 20150716[date: yyyymmdd], Box_1_1[Survey box 1, tow number 1], 004[image number]. Species are identified by common name and where possible, binomial name (scientific name).

Appendix 4: Species identification confidence

Species identification confidence per survey box. Species were identified to their highest taxonomic level (e.g. *Eunicella verucosa*), if this was not possible species were recorded by highest generic species description (e.g. bryozoa (encrusting), sea squirt, nudibranch, sponge (encrusting/cushion), sponge (erect)). Confidence in species identification was recorded on the following scale: low confidence (C1), moderate confidence (C2) and high confidence (C3).The total number of species (n) are identified by confidence classification, and expressed as a percentage (%) per survey box.

Year	Survey box	Id. confidence					
		Low		Moderate		High	
		(n)	%	(n)	%	(n)	%
2014	1	16	6	204	80	35	14
	2	11	10	79	71	21	19
	3	1	17	5	83	0	0
2015	1	19	3	500	91	6	6
	2	12	2	453	86	64	12
	3	29	5	382	83	51	11