Natural England Commissioned Report NECR296

MSFD Sponge and Anthozoan Indicator Trial Lyme Bay 2017 & 2018

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Foreword

Natural England commission a range of reports from external contractors to provide evidence and advice to assist us in delivering our duties. The views in this report are those of the authors and do not necessarily represent those of Natural England.

Background

This report was commissioned to provide information on the trial of a sponge and anthozoan indicator for the Marine Framework Directive (MSFD). It will be used in the ongoing development of the indicator.

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Further information
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MSFD Sponge and Anthozoan Indicator Trial
Lyme Bay 2017 & 2018

Report to Natural England

A typical sponge assemblage on silty reef, Lyme Bay ©Lin Baldock, 2018

Prepared by
Lin Baldock
October 2018

Table of Contents

List of Tables

List of Figures and Plates

Summary

Surveys of fragile sponge and anthozoan communities on rocky reefs in Lyme Bay on the south coast of England were undertaken at eight locations by SCUBA divers in May 2017 and 2018. Sponges were categorised into nine morphological types and counts of anthozoa and these nine sponge morphologies were made in replicate 1m^2 quadrats.

At two sites sponge morphological categories were counted and a list of all sponge species for two quadrats at each site were collected.

Numbers of anthozoan taxa and sponge morphological types ranged from 5-8 on average at any one site, with the number of individuals ranging widely from none to over 600 anthozoa and five to 65 for individual sponges.

Comparison of the results of morphological analysis and species assessment for sponge assemblages at two sites in Lyme Bay clearly showed that low numbers of morphologies and individuals reflected a lower number of species in the same quadrat.

A total of 38 taxa were identified in the 4x1m^2 quadrats for which species data were obtained. Of these taxa over one third (38%) were encrusting forms.

The results of the Lyme Bay survey are compared with surveys undertaken in the Skomer marine reserve in Wales.

Recommendations are provided for improvements to the survey methodology.

Introduction

The aim of this project was to trial a method for collecting data on sponge and anthozoan communities to support the proposed Marine Strategy Framework Directive (MSFD) community indicator. These communities have been identified as a UK Biodiversity Action Plan (BAP) priority habitat as "fragile sponge and anthozoan communities on subtidal rocky habitats" (Maddock, A., 2011). These communities typically occur on bedrock and are dominated by large, slow growing taxa such as sea fans and branching sponges. Haynes et al (2014) undertook a review of available relevant data to support the indicator development process which would allow the assessment of these communities with respect to Good Environmental Status (GES). These authors identified two indicators:

- Indicator 1: Morphological richness and diversity of sponge assemblages;
- Indicator 2: Species composition and abundance of fragile sublittoral sponge and anthozoan assemblages.

Haynes et al. concluded that further data collection and testing were required to establish the range of natural variation within these communities before applying the above indicators to ecosystem-based management of human activities. There is considerable evidence that the species diversity of sponge communities correlates well with sponge morphological diversity (Bell & Barnes, 2001, Bell et al., 2006; Berman et al., 2013). The advantage of this approach is that sponges do not need to be identified to species level which is a highly specialized and time consuming task on a group that requires a great deal more taxonomic work. The use of sponge morphological diversity as a surrogate for sponge species diversity was tested in the present study as part of an evaluation of a tool for assessing fragile sponge and anthozoan communities.

Methods

Site selection

All survey sites were located within the Lyme Bay and Torbay Special Area of Conservation (SAC) on the south coast of England, and were chosen from a list provided by Dorset Seasearch (Figure 1). Sites were also all within the Lyme Bay Designated Area implemented under a statutory instrument in 2008 which prohibits dredging and trawling over 60 square miles of Lyme Bay. The sites selected were between 19m and 23m below chart datum on rocky reef in a habitat that was recorded as being representative of the biotope ***Eunicella verrucosa*** **and** ***Pentapora foliacea*** **on wave-exposed circalittoral rock (**CR.HCR.XFa.ByErSp.Eun.). The sites could be divided into those that were close to the boundary of the Designated Area and those far from the boundary where edge impacts might be expected to be less likely. The location of each survey site is provided in Table 1 and a brief description in Table 2 for the 2017 survey locations.

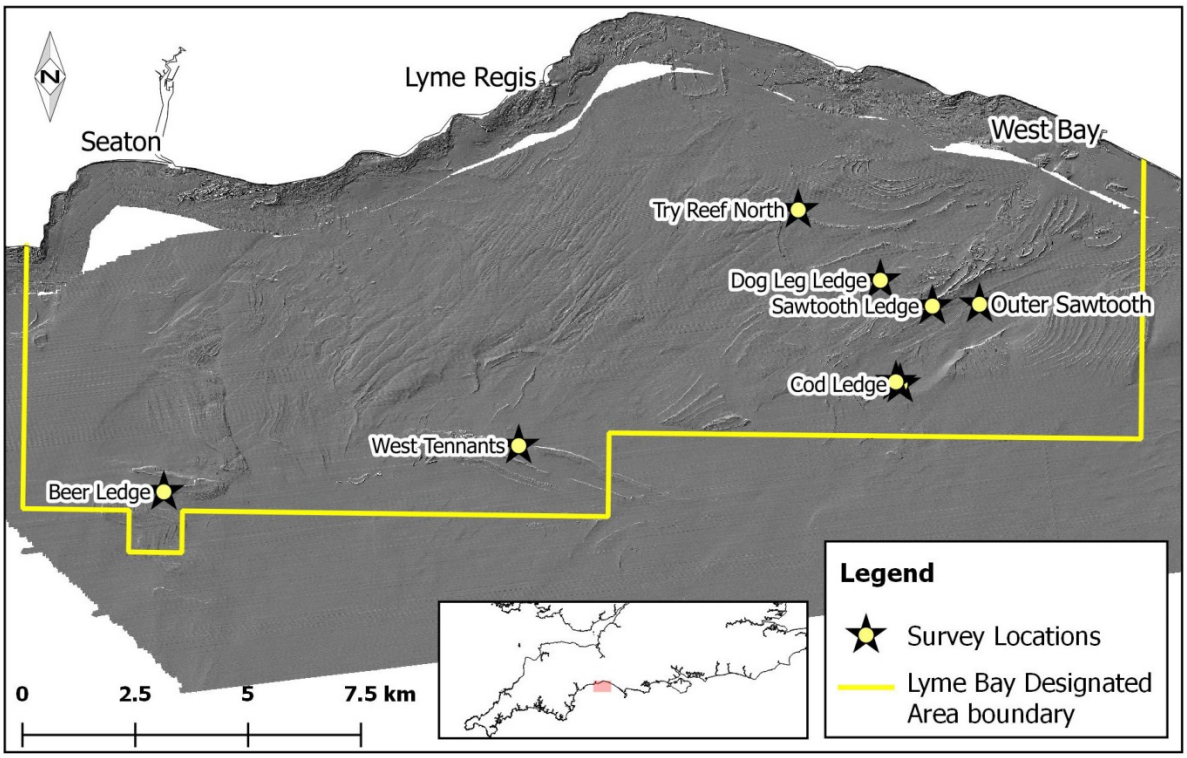


Figure 1 Survey Locations in Lyme Bay

Survey Methods

Surveys at each location were undertaken by SCUBA divers using the following methodology.

- Divers identified an area of rocky reef representative of the appropriate biotope at each site.
- A 25m tape was laid within this habitat.
- A 1m^2 quadrat was laid at 5m intervals along the tape ensuring suitable habitat comprised at least 25% of the quadrat area.
- The area inside the quadrat was gently wafted to remove fine sediment to uncover encrusting species whilst minimising disturbance to species that might contract.
- One diver then recorded the count of sponge morphs in the quadrat while the other recorded the count of anthozoan species. A small 10x10cm quadrat was used as necessary to make replicate counts of small, abundant species (e.g. the sandy creeplet *Epizoanthus couchi*) in order to provide an estimate of numbers in the whole quadrat.
- For the 2017 survey sites general notes regarding the wider habitat were made including details on dominant substrate types, characterising species and rugosity of the seabed
- The aim was to survey at least five quadrats at each location subject to divers not going into decompression.

Diver pairs at any one location were deployed approximately 50m apart.

Details of the nine sponge morphological types used in the present survey are provided in Annex 1. It should be noted that Haynes et al. (2014) included a tenth category (**burrowing**) which has been dropped for the purposes of the present study. A category "**undefined**" was used for cases where it was uncertain which category best fitted the sponge. These uncertainties were largely resolved following discussion after the QA dives.

Detailed sponge species survey

At two of the survey sites in 2018 a modified survey protocol was used to collect additional information on the diversity of sponge species. Divers produced as full a list as possible of sponge species for each quadrat together with a count of the number of each morphology to provide a Lyme Bay specific comparison of species and morphological diversity within a quadrat. Anthozoan counts were not included in these dives.

This procedure involved identification of the sponge *in situ* or required the collection of samples to confirm identification of some sponge species, particularly encrusting forms. Each sample was collected by removing a small piece of the sponge colony and placing each in separate, clean zip-loc bag. On return to the laboratory these samples were given a brief description and preserved in individual containers in 75% ethanol.

Sponges were identified using spicule characters following treatment with dilute bleach. Spicule categories and sizes were then provided for each sample to facilitate identification. The main resources used for identification were Ackers et al. (2007) together with on-line information available from the Habitas Marine Life Guide web site (Picton & Morrow, 2018). The on-line key available for Sponges of the NE Atlantic (van Soest, 2018) was also used.

QA Dives

Prior to the full survey being carried out each member of the survey team did one dive which was allocated to ensuring that divers were familiar with the methodology and were consistent in their allocation of morphotypes (see Appendix 1) to the sponge assemblages. A short, interactive PowerPoint presentation was shown to ensure consistency between records of team members and site specific problems were discussed after the QA dive.

Results

Anthozoa and Sponge Morphology Surveys

The results for each survey quadrat at eight survey locations over the two years are presented in Table 3. Results from the QA dives are provided separately (Table 4). Average sample data for each survey location are summarised below.

Site	Number of replicates	No Taxa	Number of individuals	Species richness Margalef	Pielou's Evenness index	Shannon diversity Index	Distance (m) (1)
Beer Ledge 2017	13	5.9	36	1.49	0.82	1.45	600
Cod Ledge 2017	14	7.0	52	1.53	0.79	1.50	1100
West Tenants 2017	16	7.8	40	1.90	0.84	1.72	1500
Dog Leg Ledge 2017	17	6.1	60	1.26	0.73	1.28	3500
Outer Sawtooth Ledge 2017	16	8.7	128	1.82	0.74	1.57	3000
Cod Ledge 2018	6	7.3	60	1.57	0.67	1.34	1100
Sawtooth Ledge 2018	7	7.3	42	1.72	0.82	1.61	3000
Try Reef North 2018	10	6.7	44	1.57	0.77	1.45	5000

Summary statistics for each survey location.

Note: (1) Distance (m) – distance to the nearest boundary of the Lyme Bay Designated Area.

Sponge Species and Sponge Morphology Survey - 2018

The full list of sponge morphotypes and a list of the species identified in two quadrats at each of two locations are given in Table 5. The table below summarises the relationship between the morphological analysis and individual count method and the species assessment and morphological analysis. This clearly shows that low numbers of morphologies and individuals reflects a lower number of species in the same quadrat.

In all 38 taxa were identified in the 4x1m^2 quadrats for which species data were obtained. Of these taxa over one third (38%) were encrusting forms.

Date	09/05/2018	09/05/2018	10/05/2018	10/05/2018
Site	Cod Ledge	Cod Ledge	Sawtooth Ledge	Sawtooth Ledge
Replicate	D2_Q1	D2_Q2	D3_Q1	D3_Q2
Morphological Assessment				
Number of morphologies	3	2	5	5
Count (individuals)	19	24	43	30
Species Assessment				
Number of morphologies	5	3	6	7
Number of taxa	11	8	20	16

Relationship between morphological analysis and species assessment for sponge assemblages.

Note

There are no species of *Trachytedania* currently included on the British list though Goodwin & Picton (2011) report UK records for this genus from Lundy Island, Wales and Dorset (Weymouth Bay). *Trachytedania ferrolensis* is currently the only member of the genus

recorded from the northeast Atlantic (Cristobo & Urgorri, 2001) however Goodwin & Picton considered that further study is required to confirm whether or not the UK species is the same as that described from Portugal.

Discussion

The results of the sponge survey in Lyme Bay have shown that numbers of sponges per unit area are lower than those reported for sites around Skomer in west Wales (Berman et al., 2013) with lower numbers of both individual sponges (5-65m^{-2}) and fewer taxa (8-20 m^{-2}). This compares with values of 160-306 individuals m^{-2} and 15-35 taxa reported by Berman et al. demonstrating that site specific criteria need to be established in order to use such a method to assess anthozoan and sponge assemblages in a meaningful way. It is interesting to note that a total of 38 taxa were recorded from Lyme Bay from just four $1m^2$ quadrats while Berman et al reported a total of 59 taxa from a three year survey at three sites which suggests Lyme Bay has a diverse sponge fauna.

Comparison of the results of morphological analysis and species assessment for sponge assemblages at two sites in Lyme Bay clearly showed that low numbers of morphologies and individuals reflected a lower number of species in the same quadrat.

Berman et al. (2013) further demonstrated that their data showed significant seasonal and spatial variation among sponge assemblages from the Skomer marine reserve and these also varied according to habitat orientation. The authors concluded that the method was not appropriate for monitoring vertical or overhanging surfaces. This is likely also be true for Lyme Bay where such surfaces are dominated almost entirely by encrusting sponges hence simple morphological description of the community would imply very low diversity on vertical and overhanging surfaces when, in reality, they are highly diverse.

Selection of criteria to measure will depend on the aim of the monitoring programme. It is suggested that if anthropogenic impacts are of concern colony size, reflecting age and relative stability, in particular should be considered.

Size: both *Eunicella verrucosa* and many sponge species are slow growing and long-lived, many likely on a decadal scale. During the present survey large numbers of small *E. verrucosa* were recorded – up to 52 m^{-2} especially in 2018, these are unlikely all to survive since a mature seafan stand has relatively few individuals per unit area spaced at regular intervals (compare Plate 1 and Plate 2). Furthermore a quadrat size of only $1m^2$ would be too small adequately to sample such a biotope for either sponges or anthozoa.

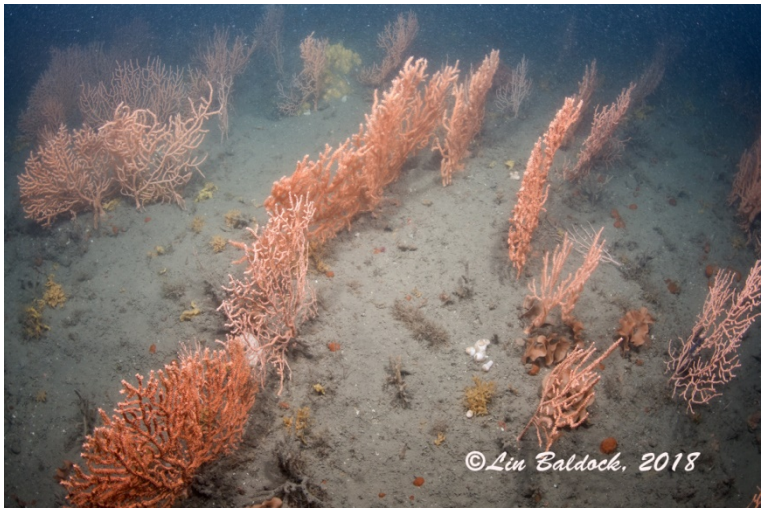
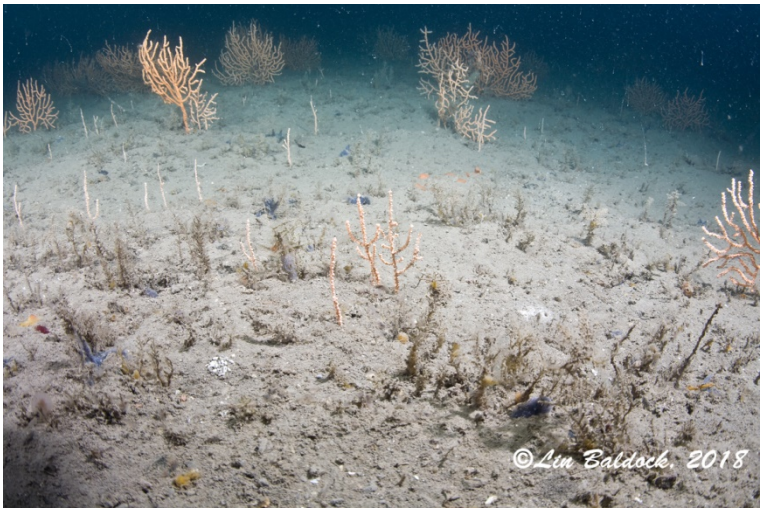


Plate 1 Mature stand of *Eunicella verrucosa* on a Lyme Bay reef showing arrangement in more or less regularly spaced rows.

A 1m^2 quadrat would not sample this habitat adequately.

Plate 2 A sparser stand of *Eunicella verrucosa* on a Lyme Bay reef showing mature individuals and a large number of juveniles scattered across the reef.

A 1m^2 quadrat would be suitable for this location



Size: papillate versus tubular - strictly colonies of *Polymastia* spp represented by a single papilla would be classified as "**tubular**" while larger colonies with many papillae would naturally classify as "**papillate**". Some of the Lyme Bay samples had *Polymastia* species represented by many single papillae with a few larger, presumably older multi-papillate colonies. The distinction between these is lost using morphological classification alone.

Size: arborescent taxa. Some samples had a few large, tall arborescent taxa (e.g. *Raspailia* and *Stelligera* spp) while others had many smaller ones represented by single branched specimens (especially *Stelligera rigida*).

Sample replication. It was the survey aim to obtain at least five replicates per diver pair at each site giving 15 replicates in total. This was not achieved in 2018 with a less experienced dive team.

Method of quadrat data collection. Berman et al. (2013) photographed each quadrat for analysis later. Given a standard set up of frame, camera and lighting it should be possible for a pair of divers to obtain 30 or more photographs during a 50 minute dive. Quadrat size might need to be less than 1m^2 but given the greater number of replicates which could be collected a similar total area would be sampled. Provided with a single, reliable camera set

up a dive team of six could potentially survey six sites each day instead of two as per the present survey. A further advantage of this method is that detailed analysis is left to a later date and carried out in comfortable, controlled conditions by one analyst avoiding the problems of inter-surveyor variability which are clearly an issue (Table 4).

Site descriptions. A brief overview of each dive location is very useful in interpreting the survey results and this should be included in the survey protocol and it should be ensured that divers provide a description for each site. In particular it was noted during the present survey that one site, Beer Ledge, showed evidence of disturbance in 2017. This site is close to the designated area boundary (600m) and could be subject to incursions by boats using bottom towed gear. Summary statistics showed this site to have the lowest count for both taxa and individuals. Information on colony size might have shown a preponderance of small colonies at this location.

Habitat selection. Careful consideration must be given to the type of habitat in which the survey method is used since the broad classification "*fragile sponge and anthozoan assemblages"* covers a wide range of discrete habitat types. For example mature stands of *Eunicella verrucosa* described above would require a different monitoring approach to that used in the present survey. The present method is also not suitable for monitoring overhangs or vertical walls which are largely dominated by sponge crusts (Plates 3, 4 & 5) and stony corals in Lyme Bay.

Plate 3 An overhang in Lyme Bay dominated by cup corals (*Caryophyllia inornata* and *Hoplangia durotrix*) and encrusting sponges.

Plate 4 A vertical bedrock reef dominated by encrusting and massive sponges.

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Plate 5 Hard corals, massive and encrusting sponges on a rocky overhang, Jersey. Habitats similar to this are known from Lyme Bay.

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Survey timing. Berman et a (2013) demonstrated seasonal changes in sponge assemblages therefore monitoring surveys should be carried out at the same time of year for a given site.

Reason for the monitoring programme. Bell et al. (2006) emphasised clearly defined reasons for the monitoring programme should be established at the start with the likely perceived threats identified. Once these are recognised good evidence of impact/no impact is required, minimising debatable outcomes that rely on weak statistical trends.

Berman et al. (2013) considered the technique developed for Skomer reefs did allow a cost effective and robust method for monitoring sponge assemblages in certain habitats and this would also apply to Lyme Bay. Sponges are an important component of many sublittoral habitats and the method does allow for the inclusion of information on sponge assemblages which would otherwise very likely be ignored. Bell et al. (2006) emphasised that the collection of morphological data should not replace gathering of species data but it does allow incorporation of information on sponge communities where taxonomic expertise and resources are limited. It is therefore important that effective techniques are developed for monitoring sponges and anthozoan assemblages.

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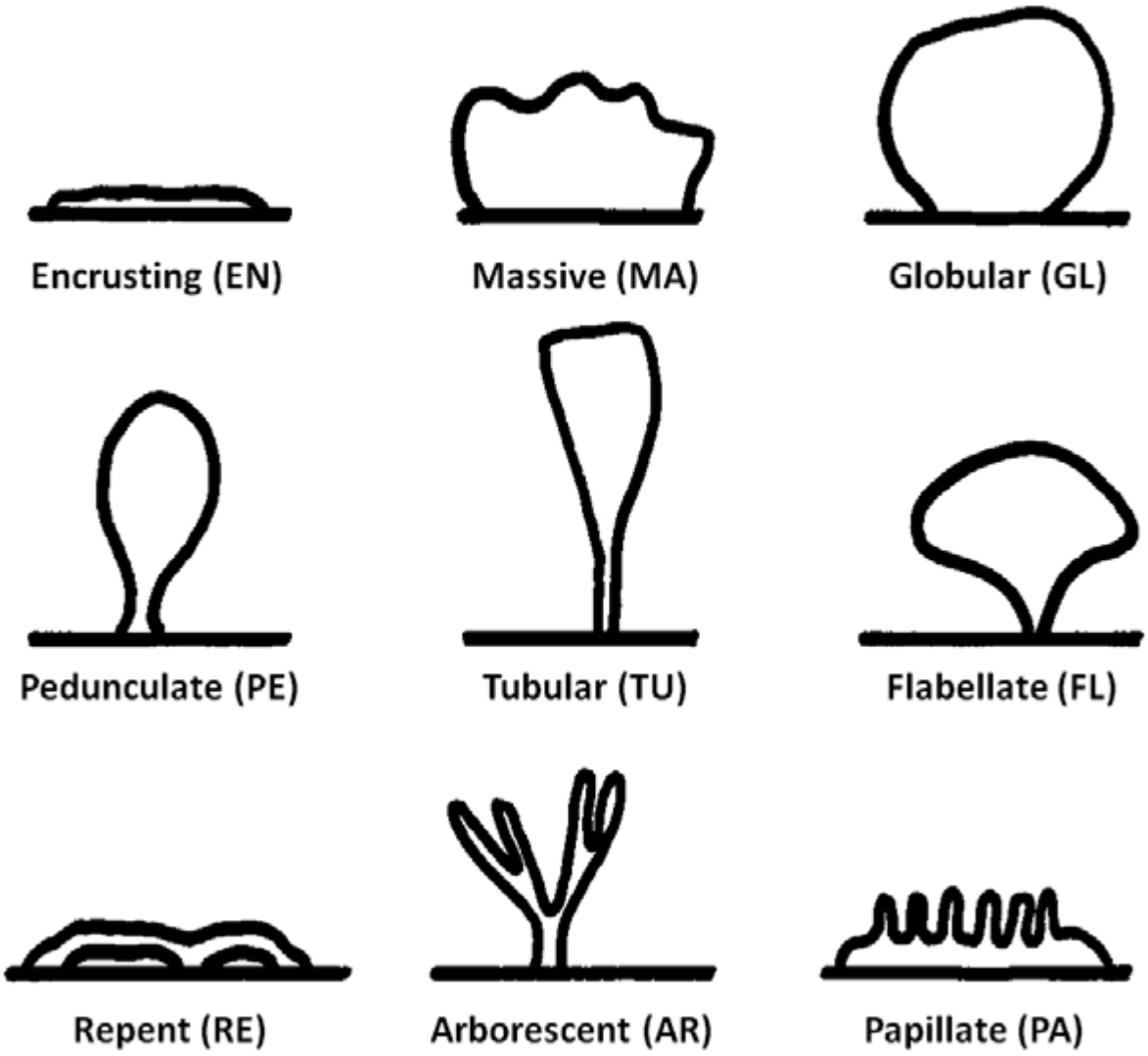
Annex 1 Sponge Morphological Types

After Bell et al. (2006) but with the addition of the category "**Tubular**". Note that Haynes et al. (2014) included a tenth category "**Burrowing**" which has been dropped.



It would be useful guidance for survey teams to have a verbal description of the salient features of each of these morphologies together with examples of common species for each category.

A training PowerPoint presentation or similar describing the use of the classification is essential to be discussed with the survey team prior to the first dive. This can usefully be repeated in discussion after the training/QA dive where *in situ* classification problems specific to the survey area can be further discussed.

Tables

Table 1 Survey site locations within Lyme Bay 2017-2018.

Survey Date	**17/05/2017**	**17/05/2017**	**17/05/2017**	**18/05/2017**	**18/05/2017**	**18/05/2017**
Site	Beer Ledge	Beer Ledge	Beer Ledge	Cod Ledge	Cod Ledge	Cod Ledge
Dive	D1	D2	D3	D1	D2	D3
Lat	50.637066	50.636880	50.637932	50.660329	50.660502	50.660450
Lon	-3.055898	-3.057520	-3.056554	-2.825660	-2.760821	-2.826398
Distance (m)	600			1100		

Survey Date	**18/05/2017**	**18/05/2017**	**18/05/2017**	**19/05/2017**	**19/05/2017**	**19/05/2017**
Site	West Tenants	West Tenants	West Tenants	Dog Leg Ledge	Dog Leg Ledge	Dog Leg Ledge
Dive	D1	D2	D3	D1	D2	D3
Lat	50.647219	50.647448	50.647696	50.681020	50.681052	50.680535
Lon	-2.944936	-2.945563	-2.947110	-2.832237	-2.830298	-2.833389
Distance (m)	1500					

Survey Date	**19/05/2017**	**19/05/2017**	**19/05/2017**	**09/05/2018**	**09/05/2018**	**10/05/2018**
Site	Outer Sawtooth Ledge	Outer Sawtooth Ledge	Outer Sawtooth Ledge	Cod Ledge	Cod Ledge	Sawtooth Ledge
Dive	D1	D2	D3	D1	D3	D1
Lat	50.676464	50.677299	50.676650	50.660832	50.660832	N/A
Lon	-2.801048	-2.814197	-2.815770	-2.826999	-2.826999	N/A
Distance (m)	3000			1100		3000

Survey Date	**10/05/2018**	**10/05/2018**	**10/05/2018**	**10/05/2018**
Site	Sawtooth Ledge	Try Reef North	Try Reef North	Try Reef North
Dive	D2	D1	D2	D3
Lat	N/A	N/A	N/A	N/A
Lon	N/A	N/A	N/A	N/A
Distance (m)		5000		

Positions are WGS84
N/A – information not available
Distance (m) – distance to the nearest boundary of the Lyme Bay Designated Area.

Table 2 Survey site descriptions

Site	Survey Date	Description
Beer Ledge_D1	17/05/2017	23.4m BSL, 11ºC bottom temperature, 3m visibility. Gravel & sand on low lying rocky reef. Small boulders and scattered cobbles. Hydroids (esp. *Nemertesia antennina*) and bryozoans (e.g. *Cellaria* sp. and orange encrusting) dominant on rock. *Pecten maximus* frequent in sediments. Small patches of encrusting and massive sponges on rocks. Very flat seabed. 1st quadrat not reef - sand/muddy sediment. Other quadrats sediment covered rock.
Beer Ledge_D2	17/05/2017	Bedrock with layer of sand covering, very pitted with fissures. In some places more boulders and cobbles. Most significant species: *Pentapora foliacea* with *Nemertesia antennina* and rare *Eunicella* verrucosa. Some *Flustra foliacea* with *Amphilectus fucorum*, *Axinella dissimilis*, *Raspailia ramosa* and *Calliostoma zizyphynum*. Also areas of mixed substrate with *Maja brachydactyla, Aquipecten opercularis*. More sparse species: *Dysidea fragilis*, *Hemimycale collumella*, *Flabellina pedata* and *Simnia hiscockii*. Most of the area is coarse sediment. Took time to find suitable habitat hence only 3 quadrats completed. Sediment, coarse and silt on bedrock and some small boulders. Many damaged *Eunicella verrucosa*. Some areas of good density sponge and anthozoans. No small *Eunicella*.
Beer Ledge_D3	17/05/2017	23m BSL, 12ºC bottom temperature, 5m visibility. Flat upwards facing bedrock reef with patches of mixed sediment on top. *Pentapora* and *Eunicella* biotope, *Alcyonium digitatum* with lots of damage plus hydroids, bryozoans and scallops. Shot was on mixed sediment at 25m dominated by mixed queen and king scallops with some small numbers of reef species including *Alcyonium*. Swam 25m to get to reef which was raised approximately 1m from surrounding sediment. Edge of reef dominated by bryozoan turf with *Phallusia mammillata*. Bedrock with veneer of mixed sediment of shell, pebbles and small cobbles. Fauna of branching species, well fouled *Eunicella*. *Pentapora* colonies - most broken. Seabed generally looked disturbed. Frequent *Aequipecten opercularis* and *Pecten maximus*.

Table 2 Survey site descriptions continued

Site	Survey Date	Description
Cod Ledge_D1	18/05/2017	26m BSL, 12ºC bottom temperature, 6m visibility. Abundant holothurians, Pentapora foliacea, carpet of *Stolonica socialis*, *Alcyonium digitatum, Phallusia mammillata, Polymastia* spp., many branching sponges. Seabed of more or less level sediment with scattered pebbles and small cobbles. *Eunicella verrucosa* in good condition including a few juveniles. Flat silt covered bedrock with cobbles. Very good example of *Pentapora* and *Eunicella* biotope. Many *Eunicella* of varying sizes, extensive variety of sponges.
Cod Ledge_D2	18/05/2017	26m BSL, 12ºC bottom temperature, 6m visibility. Mostly bedrock with fine level of silt and some mixed sediment. Some outcrops of rock ledges but only 30cm high. Abundant *Eunicella verrucosa* including many juveniles. Large shoal of bib. Much higher diversity of sponges on the rock outcrops. Reef with a layer of sand/silt. *Eunicella* the dominant life - abundant and *Pentapora*.
Cod Ledge_D3	18/05/2017	26m BSL, 12ºC bottom temperature, 6m visibility. Flat or gently sloping bedrock covered with fine sediment. Sponges and anthozoans predominant. Few bryozoans or hydroids. Few cracks/crevices apparent. Flat bedrock with few fissures/crevices, gravel covering in places. *Eunicella verrucosa* common, diverse small sponges. *Epizoanthus couchii* present.
Dog Leg Ledge_D1	19/05/2017	25m BSL, 14ºC bottom temperature, 5m visibility. Mostly flat, some small outcrops of rock. Fine veneer of silt and sediment. Common *Eunicella verrucosa*, more damaged and some totally flattened. Good density of sponges and best density of anthozoans so far. Flat bedrock with sand/silt, with *Eunicella* with some red algae, *Nemertesia antennina, Aiptasia couchi, Stolonica socialis, Phallusia mammillata* and *Tritonia nilsodhneri*

Table 2 Survey site descriptions continued

Site	Survey Date	Description
Dog Leg Ledge_D2	19/05/2017	25m BSL, 12ºC bottom temperature, 6m visibility. Flat bedrock ledges, variable seabed with patches of cobbles, sediment patches, silty bedrock. Some fissures in rock. Limited quantity of turf species. Some small *Eunicella verrucosa*, erect hydroids and bryozoans. Very fouled, lots of *Hydralmania falcata*, some small red algae, a single *Pentapora foliacea*. Gently sloping bedrock with very low ledges interspersed with areas of mobile sediment on rock and cobbles. Scattered *Eunicella* - many fouled and some detached. *Phallusia mammillata, Pentapora*, selection of tall hydroids. Few branched sponges, many *Leucosolenia*.
Dog Leg Ledge_D3	19/05/2017	25m BSL, 12ºC bottom temperature, 5m visibility. Bedrock with fine sediment. Few wide cracks in rock surface, otherwise smooth. Still good numbers of *Eunicella verrucosa* but fewer sponges. Occasional hydroids. Very silty flat bedrock reef. *Eunicella* common, many chimney sponges, small patches of red algae (?*Drachiella heterocarpa), Stolonica socialis* and few hydroids present but not common.
Outer Sawtooth Ledge_D1	19/05/2017	25.8m BSL. Detailed description not available. Short description: low ledges, *Cellaria, Stolonica socialis, Pentapora foliacea* and *Aiptasia couchi* present.
Outer Sawtooth Ledge_D2	19/05/2017	24m BSL, 12ºC bottom temperature, 5m visibility. Ridges with abundant life - sponges, turf of hydroids and bryozoans the barren sediment in zig zags - sawtooth profile. Ledges are approx. 0.5m high, life on the upper edge next to sediment line. Very diverse branching sponges and extremely large *Eunicella verrucosa.* A series of low (30cm) ledges supporting a narrow strip of dense seafans and sponges on gently sloping dip slope with part covered by mixed shelly sediment. Well-developed sponges - arborescent (*Stelligera* and *Raspailia* spp), *Axinella dissimilis, Cliona celata*), tasselled clumps (pale yellow) and small massive species such as *Dysidea* and *Amphilectus*. Large *Pentapora* colonies frequent. Habitat appeared undisturbed and arborescent sponge colonies more abundant and larger than at any other of the survey sites.
Outer Sawtooth Ledge_D3	19/05/2017	23.5m BSL, 12ºC bottom temperature, 4m visibility. Flat rock with sand/silt. *Eunicella* and *Pentapora, Axinella dissimilis, Raspailia ramosa, Phallusia mammillata,* hydroids, *Cellepora pumicosa, Alcyonidium diaphanum*. Flat ledges, some small outcrops of flat rock. Fine sediment and some coarse in between. Very good diversity of sponges, medium *Eunicella*. good hydroid turf.

Table 2 Survey site descriptions continued

Site	Survey Date	Description
West Tennants_D1	18/05/2017	26m BSL, 12ºC bottom temperature, 4m visibility. Low lying bedrock reef with small boulders and cobbles. *Eunicella* abundant, but a number dislodged more or less recently. Whole site slightly silty. *Pentapora* frequent but some fragmented/chipped. Flat silty bedrock, *Eunicella* very patchy almost all large some white. Some cobbles, lower abundance of turf species, some signs of damage. shot on large patch of mixed sediment very close to small ledge of bedrock reef. Q4 had one unattached *Eunicella*.
West Tennants_D2	18/05/2017	24.1m BSL, 12ºC bottom temperature, 3m visibility. Rock with distinctive silt covering, *Eunicella, Pentapora, Raspailia ramosa* and *Cliona celata.*
West Tennants_D3	18/05/2017	24m BSL, 12ºC bottom temperature, 5m visibility. Silty bedrock with *Eunicella* and diverse sponges, more silty than Cod ledge. Many small *Alcyonium digitatum*. Silty upwards facing flat bedrock with low rugosity. Gravel covering in places. *Eunicella* common, many small diverse sponges. Occasional cup corals and anemones.
James Bond Reef/QA dive	17/05/2017	24.7m BSL, 11ºC bottom temperature, 4m visibility. QA dive. Each pair placed 2 quadrats at set distance along the transect line and undertook a full sponge and anthozoan count. Although each pair aimed for the same points the transect was not permanently fixed so there could have been some movement, thus results are only directly comparable within each pair. Seabed of mounds of bedrock up to 1.5m high surrounded by seabed of mixed sediment.

Descriptive data for each survey site were not available for the 2018 survey.

Table 3 Data for each quadrat at each survey location

Date	**17/05/2017**	**17/05/2017**	**17/05/2017**	**17/05/2017**	**17/05/2017**	**17/05/2017**	**17/05/2017**
Site	**Beer Ledge**	**Beer Ledge**	**Beer Ledge**	**Beer Ledge**	**Beer Ledge**	**Beer Ledge**	**Beer Ledge**
Replicate	**D1_Q1**	**D1_Q2**	**D1_Q3**	**D1_Q4**	**D1_Q5**	**D2_Q1**	**D2_Q2**
Lat	**50.637066**	**50.637066**	**50.637066**	**50.637066**	**50.637066**	**50.636880**	**50.636880**
Lon	**-3.055898**	**-3.055898**	**-3.055898**	**-3.055898**	**-3.055898**	**-3.057520**	**-3.057520**
Urticina felina							
Aiptasia couchi							
Actinothoe sphyrodeta							
Cereus pedunculatus							
Sagartia troglodytes							
Alcyonium digitatum						1	
Metridium dianthus							
Eunicella verrucosa							1
Cerianthus lloydii							
Corynactis viridis		2					
Caryophyllia (Caryophyllia) smithii		1		1	3		
Epizoanthus couchii			5	10	4		
Isozoanthus sulcatus							
Porifera ARBORESCENT		4		2		9	9
Porifera FLABELLATE	5	2	7	2	1		
Porifera GLOBULAR	1						1
Porifera MASSIVE	4	3	3	8	6		1
Porifera PAPILLATE	2	3			1	2	1
Porifera PEDUNCULATE					1		
Porifera REPENT							
Porifera TUBULAR			1	4			1
Porifera UNDEFINED							1
Porifera CRUSTS	4	5	10	8	5		1

Table 3 Data for each quadrat at each survey location continued

Date	**17/05/2017**	**17/05/2017**	**17/05/2017**	**17/05/2017**	**17/05/2017**	**17/05/2017**	**18/05/2017**	**18/05/2017**
Site	**Beer Ledge**	**Beer Ledge**	**Beer Ledge**	**Beer Ledge**	**Beer Ledge**	**Beer Ledge**	**Cod Ledge**	**Cod Ledge**
Replicate	**D2_Q3**	**D3_Q1**	**D3_Q2**	**D3_Q3**	**D3_Q4**	**D3_Q5**	**D1_Q1**	**D1_Q2**
Lat	**50.636880**	**50.637932**	**50.637932**	**50.637932**	**50.637932**	**50.637932**	**50.660329**	**50.660329**
Lon	**-3.057520**	**-3.056554**	**-3.056554**	**-3.056554**	**-3.056554**	**-3.056554**	**-2.825660**	**-2.825660**
Urticina felina				2				
Aiptasia couchi								
Actinothoe sphyrodeta								
Cereus pedunculatus								
Sagartia troglodytes						2		
Alcyonium digitatum		10	13	5	11		9	8
Metridium dianthus								
Eunicella verrucosa	1						23	27
Cerianthus lloydii								
Corynactis viridis								
Caryophyllia (Caryophyllia) smithii	5				1			1
Epizoanthus couchii			4	28	60	30		20
Isozoanthus sulcatus								
Porifera ARBORESCENT	3	12	12	23	15	17	4	8
Porifera FLABELLATE								
Porifera GLOBULAR							3	3
Porifera MASSIVE	1	6	2	2		1	1	
Porifera PAPILLATE	3						12	4
Porifera PEDUNCULATE			2	1				2
Porifera REPENT								
Porifera TUBULAR					2	2		
Porifera UNDEFINED								
Porifera CRUSTS	2	20	4	4	11	11		2

Table 3 Data for each quadrat at each survey location continued

Date	**18/05/2017**	**18/05/2017**	**18/05/2017**	**18/05/2017**	**18/05/2017**	**18/05/2017**	**18/05/2017**	**18/05/2017**
Site	**Cod Ledge**	**Cod Ledge**	**Cod Ledge**	**Cod Ledge**	**Cod Ledge**	**Cod Ledge**	**Cod Ledge**	**Cod Ledge**
Replicate	**D1_Q3**	**D1_Q4**	**D1_Q5**	**D2_Q1**	**D2_Q2**	**D2_Q3**	**D2_Q4**	**D3_Q1**
Lat	**50.660329**	**50.660329**	**50.660329**	**50.660502**	**50.660502**	**50.660502**	**50.660502**	**50.660450**
Lon	**-2.825660**	**-2.825660**	**-2.825660**	**-2.760821**	**-2.760821**	**-2.760821**	**-2.760821**	**-2.826398**
Urticina felina								
Aiptasia couchi								
Actinothoe sphyrodeta								
Cereus pedunculatus								
Sagartia troglodytes								
Alcyonium digitatum	9	2	11					2
Metridium dianthus								
Eunicella verrucosa	36	29	34	19	31	6	10	35
Cerianthus lloydii			1					
Corynactis viridis								
Caryophyllia (Caryophyllia) smithii	3			2	9	9	11	
Epizoanthus couchii	4	12	6		12			
Isozoanthus sulcatus								
Porifera ARBORESCENT	6	5	9	5	9	2		2
Porifera FLABELLATE								1
Porifera GLOBULAR	4	1						
Porifera MASSIVE	1		2		13	3	10	1
Porifera PAPILLATE	4	6	4	1		1		2
Porifera PEDUNCULATE								1
Porifera REPENT								
Porifera TUBULAR	1	3			1			
Porifera UNDEFINED								
Porifera CRUSTS	4	4	2		1	10	19	1

Table 3 Data for each quadrat at each survey location continued

Date	18/05/2017	18/05/2017	18/05/2017	18/05/2017	18/05/2017	18/05/2017	18/05/2017	18/05/2017
Site	Cod Ledge	Cod Ledge	Cod Ledge	Cod Ledge	West Tenants	West Tenants	West Tenants	West Tenants
Replicate	D3_Q2	D3_Q3	D3_Q4	D3_Q5	D1_Q1	D1_Q2	D1_Q3	D1_Q4
Lat	50.660450	50.660450	50.660450	50.660450	50.647219	50.647219	50.647219	50.647219
Lon	-2.826398	-2.826398	-2.826398	-2.826398	-2.944936	-2.944936	-2.944936	-2.944936
Urticina felina								
Aiptasia couchi								
Actinothoe sphyrodeta								
Cereus pedunculatus								
Sagartia troglodytes								
Alcyonium digitatum		11	4	6	1		3	2
Metridium dianthus								
Eunicella verrucosa	18	12	12	11		3	2	6
Cerianthus lloydii								
Corynactis viridis								
Caryophyllia (Caryophyllia) smithii	1				1	1	1	
Epizoanthus couchii					8	18	8	6
Isozoanthus sulcatus								
Porifera ARBORESCENT	2	10	10	3	5	14	6	8
Porifera FLABELLATE								
Porifera GLOBULAR				1		1		
Porifera MASSIVE	4	3	2		5		2	3
Porifera PAPILLATE	1	9	11	10		4	3	
Porifera PEDUNCULATE	4		1	2				
Porifera REPENT					3			
Porifera TUBULAR	2	9	3		4	5	4	4
Porifera UNDEFINED								
Porifera CRUSTS	4		2		4	4	8	7

Table 3 Data for each quadrat at each survey location continued

Date	18/05/2017	18/05/2017	18/05/2017	18/05/2017	18/05/2017	18/05/2017	18/05/2017	18/05/2017
Site	West Tenants	West Tenants	West Tenants	West Tenants	West Tenants	West Tenants	West Tenants	West Tenants
Replicate	D1_Q5	D1_Q6	D2_Q1	D2_Q2	D2_Q3	D2_Q4	D2_Q5	D3_Q1
Lat	50.647219	50.647219	50.647448	50.647448	50.647448	50.647448	50.647448	50.647696
Lon	-2.944936	-2.944936	-2.945563	-2.945563	-2.945563	-2.945563	-2.945563	-2.947110
Urticina felina								
Aiptasia couchi								
Actinothoe sphyrodeta								
Cereus pedunculatus								
Sagartia troglodytes								
Alcyonium digitatum	3	2						7
Metridium dianthus								
Eunicella verrucosa	2	6	2	3	4	8	2	2
Cerianthus lloydii								
Corynactis viridis								
Caryophyllia (Caryophyllia) smithii	2	2	4	3	1	3	3	1
Epizoanthus couchii	56	48	8	20		6	20	3
Isozoanthus sulcatus								
Porifera ARBORESCENT	3	8	1	1	2	3	6	10
Porifera FLABELLATE			3					
Porifera GLOBULAR							3	
Porifera MASSIVE	3	10	3			1	1	6
Porifera PAPILLATE	4		2		3	1	1	11
Porifera PEDUNCULATE								
Porifera REPENT								
Porifera TUBULAR	3		1				3	6
Porifera UNDEFINED								
Porifera CRUSTS	4	14	1	2	5	1	1	1

Table 3 Data for each quadrat at each survey location continued

Date	18/05/2017	18/05/2017	18/05/2017	18/05/2017	19/05/2017	19/05/2017	19/05/2017
Site	West Tenants	West Tenants	West Tenants	West Tenants	Dog Leg Ledge	Dog Leg Ledge	Dog Leg Ledge
Replicate	D3_Q2	D3_Q3	D3_Q4	D3_Q5	D1_Q1	D1_Q2	D1_Q3
Lat	50.647696	50.647696	50.647696	50.647696	50.681020	50.681020	50.681020
Lon	-2.947110	-2.947110	-2.947110	-2.947110	-2.832237	-2.832237	-2.832237
Urticina felina							
Aiptasia couchi					1	10	
Actinothoe sphyrodeta							
Cereus pedunculatus							
Sagartia troglodytes							
Alcyonium digitatum	5	7	11	6			
Metridium dianthus							
Eunicella verrucosa		3	4	3	11	17	11
Cerianthus lloydii							
Corynactis viridis							
Caryophyllia (Caryophyllia) smithii		3	1	3	3	1	2
Epizoanthus couchii	3			4	6	30	36
Isozoanthus sulcatus							
Porifera ARBORESCENT	4	3	5	14			
Porifera FLABELLATE							
Porifera GLOBULAR							
Porifera MASSIVE	3	1	4	3	2		4
Porifera PAPILLATE		2	5	6	11	1	4
Porifera PEDUNCULATE	1		1				
Porifera REPENT							
Porifera TUBULAR	1	1		6	5		4
Porifera UNDEFINED							
Porifera CRUSTS	6	4	2	4	1	3	11

Table 3 Data for each quadrat at each survey location continued

Date	**19/05/2017**	**19/05/2017**	**19/05/2017**	**19/05/2017**	**19/05/2017**	**19/05/2017**	**19/05/2017**
Site	**Dog Leg Ledge**	**Dog Leg Ledge**	**Dog Leg Ledge**	**Dog Leg Ledge**	**Dog Leg Ledge**	**Dog Leg Ledge**	**Dog Leg Ledge**
Replicate	**D1_Q4**	**D1_Q5**	**D2_Q1**	**D2_Q2**	**D2_Q3**	**D2_Q4**	**D2_Q5**
Lat	**50.681020**	**50.681020**	**50.681052**	**50.681052**	**50.681052**	**50.681052**	**50.681052**
Lon	**-2.832237**	**-2.832237**	**-2.830298**	**-2.830298**	**-2.830298**	**-2.830298**	**-2.830298**
Urticina felina							
Aiptasia couchi							
Actinothoe sphyrodeta							
Cereus pedunculatus							
Sagartia troglodytes							
Alcyonium digitatum							
Metridium dianthus							
Eunicella verrucosa	14	6	6	8	5	3	7
Cerianthus lloydii							
Corynactis viridis							
Caryophyllia (Caryophyllia) smithii					7	1	
Epizoanthus couchii	12	87	28		75	12	33
Isozoanthus sulcatus						75	20
Porifera ARBORESCENT				2			
Porifera FLABELLATE							
Porifera GLOBULAR					1		
Porifera MASSIVE			1				1
Porifera PAPILLATE	4	3	2	11	7	1	5
Porifera PEDUNCULATE							
Porifera REPENT							
Porifera TUBULAR	3	8	8	10	5	5	4
Porifera UNDEFINED							
Porifera CRUSTS	2	6			6	4	2

Table 3 Data for each quadrat at each survey location continued

Date	**19/05/2017**	**19/05/2017**	**19/05/2017**	**19/05/2017**	**19/05/2017**	**19/05/2017**	**19/05/2017**
Site	**Dog Leg Ledge**	**Dog Leg Ledge**	**Dog Leg Ledge**	**Dog Leg Ledge**	**Dog Leg Ledge**	**Dog Leg Ledge**	**Dog Leg Ledge**
Replicate	**D2_Q6**	**D3_Q1**	**D3_Q2**	**D3_Q3**	**D3_Q4**	**D3_Q5**	**D3_Q6**
Lat	**50.681052**	**50.680535**	**50.680535**	**50.680535**	**50.680535**	**50.680535**	**50.680535**
Lon	**-2.830298**	**-2.833389**	**-2.833389**	**-2.833389**	**-2.833389**	**-2.833389**	**-2.833389**
Urticina felina							
Aiptasia couchi							
Actinothoe sphyrodeta							
Cereus pedunculatus							
Sagartia troglodytes		1					
Alcyonium digitatum				2	2	2	
Metridium dianthus							
Eunicella verrucosa	13	13	10	21	17	12	10
Cerianthus lloydii							
Corynactis viridis							
Caryophyllia (Caryophyllia) smithii	2						2
Epizoanthus couchii	3	1				16	24
Isozoanthus sulcatus							
Porifera ARBORESCENT				1		2	1
Porifera FLABELLATE							
Porifera GLOBULAR							
Porifera MASSIVE				1		1	1
Porifera PAPILLATE	12	7	7	25	35	31	19
Porifera PEDUNCULATE					3	1	
Porifera REPENT							
Porifera TUBULAR	6	5	2	3		4	5
Porifera UNDEFINED							
Porifera CRUSTS	10	2			1	2	

Table 3 Data for each quadrat at each survey location continued

Date	**19/05/2017**	**19/05/2017**	**19/05/2017**	**19/05/2017**	**19/05/2017**
Site	**Outer Sawtooth Ledge**	**Outer Sawtooth Ledge**	**Outer Sawtooth Ledge**	**Outer Sawtooth Ledge**	**Outer Sawtooth Ledge**
Replicate	**D1_Q1**	**D1_Q2**	**D1_Q3**	**D1_Q4**	**D1_Q5**
Lat	**50.676464**	**50.676464**	**50.676464**	**50.676464**	**50.676464**
Lon	**-2.801048**	**-2.801048**	**-2.801048**	**-2.801048**	**-2.801048**
Urticina felina					
Aiptasia couchi					
Actinothoe sphyrodeta	1	2	3		
Cereus pedunculatus					
Sagartia troglodytes					
Alcyonium digitatum		20	5	9	13
Metridium dianthus					
Eunicella verrucosa	14	34	20	34	15
Cerianthus lloydii					
Corynactis viridis					
Caryophyllia (Caryophyllia) smithii		1	1		
Epizoanthus couchii		22	10		
Isozoanthus sulcatus				6	
Porifera ARBORESCENT	5	3			5
Porifera FLABELLATE					
Porifera GLOBULAR					
Porifera MASSIVE	3		1	5	1
Porifera PAPILLATE	7	8	4	5	7
Porifera PEDUNCULATE			1		
Porifera REPENT					
Porifera TUBULAR		1		1	1
Porifera UNDEFINED					
Porifera CRUSTS	4	27	1	1	3

Table 3 Data for each quadrat at each survey location continued

Date	**19/05/2017**	**19/05/2017**	**19/05/2017**	**19/05/2017**
Site	**Outer Sawtooth Ledge**	**Outer Sawtooth Ledge**	**Outer Sawtooth Ledge**	**Outer Sawtooth Ledge**
Replicate	**D1_Q6**	**D2_Q1**	**D2_Q2**	**D2_Q3**
Lat	**50.676464**	**50.677299**	**50.677299**	**50.677299**
Lon	**-2.801048**	**-2.814197**	**-2.814197**	**-2.814197**
Urticina felina				
Aiptasia couchi		1	24	6
Actinothoe sphyrodeta				
Cereus pedunculatus				
Sagartia troglodytes				
Alcyonium digitatum	2			2
Metridium dianthus				
Eunicella verrucosa	17	5	2	4
Cerianthus lloydii				
Corynactis viridis				
Caryophyllia (Caryophyllia) smithii			2	2
Epizoanthus couchii		24	500	12
Isozoanthus sulcatus				
Porifera ARBORESCENT	4	13	11	24
Porifera FLABELLATE				
Porifera GLOBULAR		1		
Porifera MASSIVE	2	4	10	29
Porifera PAPILLATE	1	4	5	1
Porifera PEDUNCULATE	1			
Porifera REPENT		1		
Porifera TUBULAR	1	3	3	
Porifera UNDEFINED		4	10	
Porifera CRUSTS		18	10	7

Table 3 Data for each quadrat at each survey location continued

Date	**19/05/2017**	**19/05/2017**	**19/05/2017**	**19/05/2017**
Site	**Outer Sawtooth Ledge**	**Outer Sawtooth Ledge**	**Outer Sawtooth Ledge**	**Outer Sawtooth Ledge**
Replicate	**D2_Q4**	**D2_Q5**	**D3_Q1**	**D3_Q2**
Lat	**50.677299**	**50.677299**	**50.676650**	**50.676650**
Lon	**-2.814197**	**-2.814197**	**-2.815770**	**-2.815770**
Urticina felina				
Aiptasia couchi	5	3		2
Actinothoe sphyrodeta				
Cereus pedunculatus				
Sagartia troglodytes				
Alcyonium digitatum			5	6
Metridium dianthus				
Eunicella verrucosa	8	6	2	7
Cerianthus lloydii				
Corynactis viridis				
Caryophyllia (Caryophyllia) smithii		2		1
Epizoanthus couchii	600	20	5	17
Isozoanthus sulcatus				
Porifera ARBORESCENT	15	21	10	19
Porifera FLABELLATE				2
Porifera GLOBULAR	1		1	
Porifera MASSIVE	18	19	3	4
Porifera PAPILLATE	2			
Porifera PEDUNCULATE				
Porifera REPENT	1			
Porifera TUBULAR	6	2	4	2
Porifera UNDEFINED				
Porifera CRUSTS	5	12	7	6

Table 3 Data for each quadrat at each survey location continued

Date	**19/05/2017**	**19/05/2017**	**19/05/2017**	**09/05/2018**	**09/05/2018**
Site	**Outer Sawtooth Ledge**	**Outer Sawtooth Ledge**	**Outer Sawtooth Ledge**	**Cod Ledge**	**Cod Ledge**
Replicate	**D3_Q3**	**D3_Q4**	**D3_Q5**	**D1_Q1**	**D1_Q2**
Lat	**50.676650**	**50.676650**	**50.676650**	**50.660832**	**50.660832**
Lon	**-2.815770**	**-2.815770**	**-2.815770**	**-2.826999**	**-2.826999**
Urticina felina					
Aiptasia couchi		1			
Actinothoe sphyrodeta					2
Cereus pedunculatus				2	
Sagartia troglodytes					
Alcyonium digitatum	2	2	1		
Metridium dianthus					
Eunicella verrucosa	6	12	15	20	13
Cerianthus lloydii					
Corynactis viridis					
Caryophyllia (Caryophyllia) smithii	2	1		1	1
Epizoanthus couchii	2	13		3	
Isozoanthus sulcatus					
Porifera ARBORESCENT	11	7	1	1	3
Porifera FLABELLATE	3	2			
Porifera GLOBULAR					
Porifera MASSIVE	10	3	8	5	13
Porifera PAPILLATE	3	2	1	5	5
Porifera PEDUNCULATE					
Porifera REPENT			1		
Porifera TUBULAR	6	1			2
Porifera UNDEFINED					
Porifera CRUSTS	3	3	7	2	
Number of taxa					

Table 3 Data for each quadrat at each survey location continued

Date	09/05/2018	09/05/2018	09/05/2018	09/05/2018	10/05/2018	10/05/2018	10/05/2018
Site	Cod Ledge	Cod Ledge	Cod Ledge	Cod Ledge	Sawtooth Ledge	Sawtooth Ledge	Sawtooth Ledge
Replicate	D3_Q1	D3_Q2	D3_Q3	D3_Q4	D1_Q1	D1_Q2	D1_Q3
Lat	50.660832	50.660832	50.660832	50.660832	N/A	N/A	N/A
Lon	-2.826999	-2.826999	-2.826999	-2.826999	N/A	N/A	N/A
Urticina felina							
Aiptasia couchi							
Actinothoe sphyrodeta							
Cereus pedunculatus					2		
Sagartia troglodytes							
Alcyonium digitatum		1			2	5	2
Metridium dianthus							
Eunicella verrucosa	34	52	39	39	6	6	1
Cerianthus lloydii							
Corynactis viridis							
Caryophyllia (Caryophyllia) smithii	1	5	7	5	3		
Epizoanthus couchii		30		11		2	18
Isozoanthus sulcatus							
Porifera ARBORESCENT			2	4			
Porifera FLABELLATE							
Porifera GLOBULAR		1					
Porifera MASSIVE	1	3	5	2	15	1	10
Porifera PAPILLATE	5	7	3	2			
Porifera PEDUNCULATE							
Porifera REPENT							1
Porifera TUBULAR		5	4	2	3	1	1
Porifera UNDEFINED							
Porifera CRUSTS	1	6	1	5	8	7	13

Table 3 Data for each quadrat at each survey location continued

Date	10/05/2018	10/05/2018	10/05/2018	10/05/2018	10/05/2018	10/05/2018	10/05/2018
Site	Sawtooth Ledge	Sawtooth Ledge	Sawtooth Ledge	Sawtooth Ledge	Try Reef North	Try Reef North	Try Reef North
Replicate	D2_Q1	D2_Q2	D2_Q3	D2_Q4	D1_Q1	D1_Q2	D1_Q3
Lat	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Lon	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Urticina felina							
Aiptasia couchi					13	30	1
Actinothoe sphyrodeta							
Cereus pedunculatus							
Sagartia troglodytes							
Alcyonium digitatum	1	3	2	2			2
Metridium dianthus	1		2				
Eunicella verrucosa	19	16	11	11	1		
Cerianthus lloydii							
Corynactis viridis							
Caryophyllia (Caryophyllia) smithii	4	1	2		1	1	1
Epizoanthus couchii					3		7
Isozoanthus sulcatus							
Porifera ARBORESCENT		1		1			
Porifera FLABELLATE					2	2	
Porifera GLOBULAR		4		1			1
Porifera MASSIVE	3	5	7	2	16	16	14
Porifera PAPILLATE	15	5	10	1	7	1	1
Porifera PEDUNCULATE							6
Porifera REPENT	1						
Porifera TUBULAR				1	2		
Porifera UNDEFINED							
Porifera CRUSTS	15	17	14	7	19	11	25

Table 3 Data for each quadrat at each survey location continued

Date	10/05/2018	10/05/2018	10/05/2018	10/05/2018	10/05/2018	10/05/2018	10/05/2018
Site	Try Reef North	Try Reef North	Try Reef North	Try Reef North	Try Reef North	Try Reef North	Try Reef North
Replicate	D1_Q4	D2_Q1	D2_Q2	D2_Q3	D2_Q4	D3_Q1	D3_Q2
Lat	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Lon	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Urticina felina							
Aiptasia couchi	68						
Actinothoe sphyrodeta							
Cereus pedunculatus							
Sagartia troglodytes							
Alcyonium digitatum	2	3	2	2			
Metridium dianthus							
Eunicella verrucosa		6	1		1		
Cerianthus lloydii							
Corynactis viridis							
Caryophyllia (Caryophyllia) smithii					1		
Epizoanthus couchii				2			
Isozoanthus sulcatus				20	5		
Porifera ARBORESCENT	3		3	1	9	7	17
Porifera FLABELLATE							
Porifera GLOBULAR		1		1	1		
Porifera MASSIVE	4	7	7	2	6	6	7
Porifera PAPILLATE		7	8	3	2	2	3
Porifera PEDUNCULATE							
Porifera REPENT			1				
Porifera TUBULAR						1	2
Porifera UNDEFINED							
Porifera CRUSTS	16	7	2	1		2	7

Table 4 Data for each quadrat at each QA survey dive

Date	**17/05/2017**	**17/05/2017**	**17/05/2017**	**17/05/2017**	**17/05/2017**	**17/05/2017**	**17/05/2017**
Site	**JB Reef QA Dive**	**JB Reef QA Dive**	**JB Reef QA Dive**	**JB Reef QA Dive**	**JB Reef QA Dive**	**JB Reef QA Dive**	**JB Reef QA Dive**
Replicate	**D1_Diver_1_Q1**	**D1_Diver_2_Q1**	**D1_Diver_1_Q2**	**D1_Diver_2_Q2**	**D2_Diver_1_Q1**	**D2_Diver_2_Q1**	**D2_Diver_1_Q2**
Lat	**50.687917**	**50.687917**	**50.687917**	**50.687917**	**50.687917**	**50.687917**	**50.687917**
Lon	**-2.832401**	**-2.832401**	**-2.832401**	**-2.832401**	**-2.832401**	**-2.832401**	**-2.832401**
	Diver 1	**Diver 2**	**Diver 1**	**Diver 2**	**Diver 1**	**Diver 2**	**Diver 1**
Anthozoa							
Eunicella verrucosa	12	9			10	12	
Corynactis viridis							
Caryophyllia (Caryophyllia) smithii	1	1			2	2	
Epizoanthus couchii	75				125	80	
Isozoanthus sulcatus							
Number of taxa	3	2			3	3	
Count	91	10	0	0	140	97	0
Sponge Morphologies							
Porifera ARBORESCENT							1
Porifera FLABELLATE							
Porifera GLOBULAR	2		1				1
Porifera MASSIVE	3				3	4	5
Porifera PAPILLATE	4		5		3	3	6
Porifera PEDUNCULATE		2					
Porifera REPENT							
Porifera TUBULAR	3		5	11	1	4	
Porifera UNDEFINED							
Porifera CRUSTS	9	6	8	20	12	26	11

Table 4 Data for each quadrat at each QA survey dive

Date	**17/05/2017**	**17/05/2017**	**17/05/2017**	**17/05/2017**	**17/05/2017**	**08/05/2018**	**08/05/2018**
Site	**JB Reef QA Dive**	**JB Reef QA Dive**	**JB Reef QA Dive**	**JB Reef QA Dive**	**JB Reef QA Dive**	**James Bond Reef**	**James Bond Reef**
Replicate	**D2_Diver_2_Q2**	**D3_Diver_1_Q1**	**D3_Diver_2_Q1**	**D3_Diver_1_Q2**	**D3_Diver_2_Q2**	**D1_Diver 1_Q1**	**D1_Diver 2_Q1**
Lat	**50.687917**	**50.687917**	**50.687917**	**50.687917**	**50.687917**	**50 41.230**	**50 41.230**
Lon	**-2.832401**	**-2.832401**	**-2.832401**	**-2.832401**	**-2.832401**	**002 49.890**	**002 49.890**
	Diver 2	**Diver 1**	**Diver 2**	**Diver 1**	**Diver 2**	**Diver 1**	**Diver 2**
Anthozoa							
Eunicella verrucosa						15	14
Corynactis viridis		14	7				
Caryophyllia (Caryophyllia) smithii			1			2	
Epizoanthus couchii		300	20			5	1
Isozoanthus sulcatus							
Number of taxa		2	3			3	2
Count	0	314	31	0	0	25	15
Sponge Morphologies							
Porifera ARBORESCENT						10	11
Porifera FLABELLATE							
Porifera GLOBULAR	1			1			
Porifera MASSIVE	6	2	7	3	6	3	
Porifera PAPILLATE	14			6	1	15	4
Porifera PEDUNCULATE				1		1	
Porifera REPENT						3	4
Porifera TUBULAR	2					27	21
Porifera UNDEFINED						1	
Porifera CRUSTS	11	10	12	4	7	6	2

Table 4 Data for each quadrat at each QA survey dive

Date	**08/05/2018**	**08/05/2018**	**08/05/2018**	**08/05/2018**	**08/05/2018**	**08/05/2018**	**08/05/2018**	**08/05/2018**
Site	**James Bond Reef**	**James Bond Reef**	**James Bond Reef**	**James Bond Reef**	**James Bond Reef**	**James Bond Reef**	**James Bond Reef**	**James Bond Reef**
Replicate	**D1_Diver 1_Q2**	**D1_Diver 2_Q2**	**D2_Diver 1_Q1**	**D2_Diver 2_Q1**	**D3_Diver 1_Q1**	**D3_Diver 2_Q1**	**D3_Diver 1_Q2**	**D3_Diver 2_Q2**
Lat	**50 41.230**	**50 41.230**	**50 41.230**	**50 41.230**	**50 41.230**	**50 41.230**	**50 41.230**	**50 41.230**
Lon	**002 49.890**	**002 49.890**	**002 49.890**	**002 49.890**	**002 49.890**	**002 49.890**	**002 49.890**	**002 49.890**
	Diver 1	**Diver 2**	**Diver 1**	**Diver 2**	**Diver 1**	**Diver 2**	**Diver 1**	**Diver 2**
Anthozoa								
Eunicella verrucosa	17	19	13	13	15	15	16	14
Corynactis viridis								
Caryophyllia (Caryophyllia) smithii		3	3	2	2	1	1	
Epizoanthus couchii			1		5			
Isozoanthus sulcatus								
Number of taxa	1	2	3	2	3	2	2	1
Count	17	22	20	15	25	16	17	14
Sponge Morphologies								
Porifera ARBORESCENT	7	12	8	5	13	11	5	5
Porifera FLABELLATE		6	1	4				
Porifera GLOBULAR		11						1
Porifera MASSIVE	5	1					5	6
Porifera PAPILLATE	8		10	3	3	4		6
Porifera PEDUNCULATE			2		3			
Porifera REPENT	2	7	4		2		1	3
Porifera TUBULAR	20	12	23	11	15	16	11	7
Porifera UNDEFINED			1	23	1			
Porifera CRUSTS	14	6	9		12	14	12	12

Table 5 Sponge morphology counts and species list

Date	**09/05/2018**	**09/05/2018**	**10/05/2018**	**10/05/2018**
Site	**Cod Ledge**	**Cod Ledge**	**Sawtooth Ledge**	**Sawtooth Ledge**
Replicate	**D2_Q1**	**D2_Q2**	**D3_Q1**	**D3_Q2**
Lat	**50.660832**	**50.660832**	**N/A**	**N/A**
Lon	**-2.826999**	**-2.826999**	**N/A**	**N/A**
Porifera ARBORESCENT	4	11	17	11
Porifera FLABELLATE			3	
Porifera GLOBULAR				
Porifera MASSIVE	8	13	2	2
Porifera PAPILLATE			12	6
Porifera PEDUNCULATE				
Porifera REPENT				
Porifera TUBULAR				1
Porifera UNDEFINED				
Porifera CRUSTS	7		4	5
No of morphologies	**3**	**2**	**5**	**5**
Count of individuals	**19**	**24**	**38**	**25**

Table 5 Sponge morphology counts and species list

Date	**09/05/2018**	**09/05/2018**	**10/05/2018**	**10/05/2018**
Site	**Cod Ledge**	**Cod Ledge**	**Sawtooth Ledge**	**Sawtooth Ledge**
Replicate	**D2_Q1**	**D2_Q2**	**D3_Q1**	**D3_Q2**
Lat	**50.660832**	**50.660832**	**N/A**	**N/A**
Lon	**-2.826999**	**-2.826999**	**N/A**	**N/A**
Porifera Dark red crust				P
Clathrina				P
Leucosolenia			P	P
Sycon ciliatum	P		P	P
Halisarca dujardinii			P	
Dysidea fragilis	P	P	P	P
Cliona celata				
Cliona celata BORING			P	P
Adreus fascicularis			P	
Polymastia				
Polymastia boletiformis			P	P
Polymastia penicillus	P		P	
Stelligera rigida		P	P	P
Stelligera stuposa	P		P	P
Suberitidae Sp 1 orange crust			P	
Suberitidae SP 2				
Axinella dissimilis			P	P
Halicnemia patera				P
Haliclona sp				
Haliclona (Halichoclona) fistulosa		P	P	
Haliclona (Haliclona) oculata				P
Haliclona (Haliclona) simulans				
Haliclona (Rhizoniera) viscosa				
Iophon hyndmani			P	P
Crella (Yvesia) rosea		P		
Biemna variantia				
Amphilectus fucorum	P			
Hemimycale columella	P	P	P	
Hymedesmia sp 1				
Hymedesmia sp 2	P			
Hymedesmia (Hymedesmia) jecusculum	P	P	P	
Phorbas			P	
Phorbas fictitius				P
Phorbas plumosus				
Myxilla (Myxilla) fimbriata			P	
Raspailia (Clathriodendron) hispida	P	P	P	P
Raspailia (Raspailia) ramosa	P	P	P	P
Trachytedania sp	P			
No of taxa	**11**	**8**	**20**	**16**