Natural England Commissioned Report NECR104

Condition Assessment Monitoring for Reefs, Isles of Scilly European Marine Site - Diving Survey June 2011

First published 22 October 2012

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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

Under the requirements of the EU Habitats Directive the UK Government has established a series of Special Areas of Conservation (SACs) which, with Special Protection Areas, form a series known as Natura 2000 (N2K). Articles 11 and 17(1) of the Habitats Directive require that member states regularly assess the ecological condition of the designated features within the N2K series. Condition Assessment of European Marine Sites is carried out on a six yearly cycle, and it is the responsibility of Natural England to report this to Europe through the JNCC (Joint Nature Conservation Committee).

One of the qualifying marine features for SAC designation is the Annex 1 reef habitat. Monitoring studies on subtidal reef within the Isles of Scilly SAC were initiated during nine days of diving fieldwork in June 2011. A team of six divers undertook a total of 62 person-dives at 13 sites, spread between the north coast of St Martin's to the south coast of St Agnes.

A total of six attributes (assigned to the four sub-features of the 'reef' feature: kelp forest communities; vertical rock; subtidal rock and boulder communities; and subtidal faunal turf communities) were considered and a monitoring strategy for each was devised (referred to as 'tasks').

All six tasks were undertaken, with baseline monitoring data being acquired for all. All sites were recorded with video, including a number of recorded quadrats and transect positions. dGPS positions and accurate depth measurements of all sites were taken which, together with site diagrams, should provide sufficient information for biotope relocation in future visits.

The sublittoral monitoring events which this study has initiated will provide the baseline for a long-term monitoring programme. Comparisons have been made with earlier sublittoral studies (primarily species lists and abundances) and these show close similarities with the range of species present from the various biotopes and their abundances.

The results of this study will enable any changes to be monitored and so inform the site managers as to any adaptations that may need to be made to the future management of the SAC.

This report is being published to inform managers and to allow others to review the work, as well as to develop and adapt monitoring programmes for this and other SACs.

This report should be cited as:

IRVING, R.A. & NORTHEN, K.O. 2012. *Isles of Scilly SAC Diving Monitoring Studies, 2011*. Natural England Commissioned Reports, Number 104.

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Keywords - Condition assessment, monitoring, reefs, kelp forest communities, Special Area of Conservation (SAC), European Marine Site (EMS), Isles of Scilly

Further information
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ISSN 2040-5545

Summary

Monitoring studies on subtidal reef habitats within the Isles of Scilly SAC were initiated during nine days of diving fieldwork in June 2011. A team of six divers, based on the island of St Mary's, undertook a total of 62 person-dives at 13 sites, spread between the north coast of St Martin's to the south coast of St Agnes.

A total of six attributes (assigned to the four sub-features of the 'reef' feature: kelp forest communities; vertical rock; subtidal rock and boulder communities; and subtidal faunal turf communities) were considered and a monitoring strategy for each was devised (referred to as 'tasks'). Specifically, these tasks were:

- A2: Assessment of the *Laminaria hyperborea* and *L. ochroleuca* population size within the kelp forest community;
- A3: Assessment of the species composition of characteristic biotopes within kelp forests: monitoring the diversity of red algal species;
- B1: Assessment of the species composition of characteristic biotopes on vertical rock: presence and abundance of notable species of erect sponges, cup corals, and anthozoan communities;
- C2: Assessment of the characteristic species of bedrock & boulder communities: density and quality of pink sea fans *Eunicella verrucosa* and erect sponges;
- C3: Assessment of the species composition of characteristic biotopes on bedrock and boulders, for example, the sponge-dominated biotope (CR.HCR.XFa.ByErSp); and
- D2: An assessment of the species composition of characteristic biotopes within faunal turf communities: monitoring the diversity of species within a subset of biotopes, for example, dead man's fingers, red fingers, sponges and hydroids, sea fans, branching sponges, Devonshire cup corals and featherstars.

All six tasks were undertaken, with baseline monitoring data being acquired for all. Sites were chosen in part by using historical records of where targeted biotopes were known to occur and in part by using local expert knowledge. The methodology for each task was designed specifically for that task, utilising proven techniques such as transect lines and quadrats. Whilst descriptions of each site were obtained from *in situ* observations, the monitoring sites themselves were not marked or fixed in any way. Indeed, random quadrat placement (using randomly generated numbers to provide distances from a given point) was the method chosen for several of the tasks. All sites were recorded with video, including a number of recorded quadrats and transect positions. dGPS positions and accurate depth measurements of all sites were taken which, together with site diagrams, should provide sufficient information for biotope relocation in future visits.

The sublittoral monitoring events which this study has initiated will hopefully provide the baseline for a long-term programme (Natural England is obliged to report on the condition of the reef feature at least once every six years). It has therefore not been possible to compare the data collected from this study with other data collected from the Isles of Scilly using the same techniques. However, some comparisons have been made with earlier sublittoral studies (primarily species lists and abundances) and these show close similarities with the range of species present from the various biotopes and their abundances.

Acknowledgements

We should like to thank the following for their assistance with this project:

- Sangeeta McNair, Natural England Marine Adviser for help with logistics and for comments on the final report;
- Dale Clark, St Mary's Harbour Master for use of the store on the quay, St Mary's Harbour;
- Steve Watt, Isles of Scilly Inshore Fisheries and Conservation Authority (IFCA) Chief Fisheries Officer for use of the Isles of Scilly IFCA RIB *Matt Lethbridge* and for acting as its helmsman;
- Tim Allsop of St Martin's Diving Services for help with selecting appropriate sites, as well as his role as boat skipper of *Morvoren*;
- Anna Cawthray, for skippering the RIB and for diving supervision;
- Richard Perkins, for boat handling support;
- Chris Pirie, Natural England diving support and for comments on the final report;
- Gavin Black, Natural England diving support and for comments on the final report;
- Kevan Cook, Natural England diving support;
- Chris Williams, Natural England diving support;
- Ashley Cordingley, independent contractor diving support; and
- Dr Damon Stanwell-Smith, Pelagial Ltd., for assistance with methodology design, data analysis and for comments on the draft report.

Plate i The dive boat *Morvoren* alongside at St Martin's (KN)

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1 Introduction

1.1 The Isles of Scilly lie 28 miles (45 km) off the south-western tip of Cornwall and as such they are the most south-westerly part of Britain. The Isles consist of over 200 low-lying granite islands and rocks and they represent England's only oceanic archipelago.

1.2 The Isles of Scilly Special Area of Conservation (SAC) was designated in 2000 under the 1994 Habitat Regulations [1] (the UK statute for the implementation of the EC Habitats Directive 1992 [2]). The reason for the site's designation under article 4(4) of the Directive (92/43/EEC) is that it hosts particularly fine examples of the following habitats listed in Annex I [3]:

- Sandbanks which are slightly covered by sea water all the time. (Subtidal sandbanks)
- Intertidal mudflats and sandflats not covered by seawater at low tide. (Intertidal mudflats and sandflats)
- Grey seals
- **Reefs**

1.3 The above habitats are termed the SAC's "features of interest". The **reef feature** is described thus (Isles of Scilly SAC Management Scheme, 2010):

"Submarine, or exposed at low tide, rocky substrates and biogenic concretions, which arise from the seafloor in the sublittoral zone but may extend into the littoral zone where there is an uninterrupted zonation of benthic communities of algae and animal species including concretions, encrustations and corallogenic concretions. These reefs generally support a zonation of benthic (bottom-living) communities of algae and animals. Although rocky reefs can appear robust and resilient, the communities which live on them can be delicate, particularly in areas which are sheltered from strong wave action."

1.4 There are four **reef sub-features** listed in the Management Scheme, three of which are relevant to this study:

- Rocky shore communities [not relevant to the present study].
- **Kelp forest communities** - typically, rock surfaces in shallow water are dominated by leafy seaweeds such as kelps, characterised by *Delessaria sanguinea, Phycodrys rubens, Mastocarpus stellatus,* and *Membranoptera alata*.
- **Vertical Rock** - vertical rock faces support different types of species where currents channel through supplying food availability, and in some cases protection – in particular jewel anemones *Corynactis viridis*, yellow staghorn sponge A*xinella dissimilis*, dead man's fingers A*lyconium digitatum*, sunset cup corals *Leptosammia pruvoti* and erect sponge communities are characteristic of the Isles of Scilly.
- **Subtidal rock and boulder communities** - in deeper water there are fewer seaweeds and rock surfaces are covered by encrusting animals such as anemones, sponges and hydroids. The presence and continued well-being of species such as cup corals, *Parazoanthus anguicomis* and the pink seafan *Eunicella verrucosa* are important indicators of the general health of the rocky subtidal.

[1] The Conservation (Natural Habitats, &c.) Regulations 1994, Statutory Instrument No. 2716

[2] Council Directive 92/43/EEC on the conservation of natural habitats and of wild flora and fauna

[3] The full JNCC Citation for the Isles of Scilly can be seen at:
http://www.jncc.gov.uk/protectedsites/sacselection/sac.asp?EUCode=UK0013694

1.5 Within the Isles of Scilly SAC (Figure 1), Natural England are responsible for undertaking a **Condition Assessment** monitoring programme to inform Competent Authorities on the condition of the SAC interest features. The Condition Assessment is based on the Favourable Condition table given in Natural England's advice under Regulation 33(2) of the Conservation (Natural Habitats & c.) Regulations 1994 (now referred to as a Regulation 35 package under the Habitats & Species Regulations 2010). Condition Assessments are undertaken on a 6 year cycle and are reported to the Joint Nature Conservation Committee (JNCC). The JNCC collate the Condition Assessments from all marine SACs throughout the whole of the UK and then pass this information on to the Department of the Environment, Food and Rural Affairs (Defra).

1.6 It is important for both nature conservation and management and for the credible assessment of feature condition, that scientifically robust surveys of the reef feature are made. The UK Common Standards Monitoring Programme, led by the JNCC, requires monitoring of mandatory attributes in SACs across the UK. For reefs, a summary table of attributes that may define favourable condition of reefs is included in the Marine Monitoring Handbook (JNCC 2001).

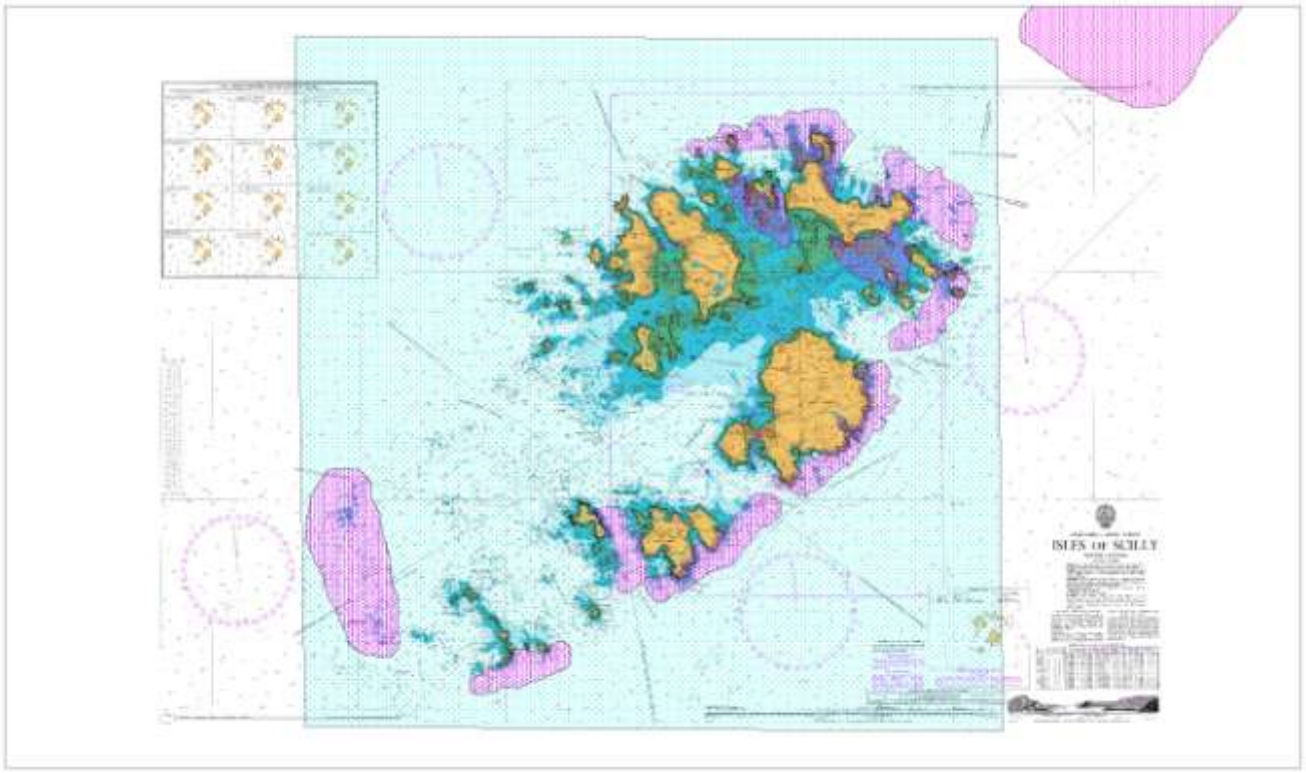


Figure 1 The Isles of Scilly Special Area of Conservation (SAC), marked as a blue square, and the newly recommended Marine Conservation Zones (rMCZs), marked in pink

1.7 The contract 'Isles of Scilly Monitoring Survey Co-ordinator 2011: Condition Assessment Monitoring for Reefs, Isles of Scilly European Marine Site **(**reference 20723)' was awarded by Natural England to Sea-Scope Marine Environmental Consultants on 23 May 2011. The Project Officer for the contract was Mrs Sangeeta McNair (Lead Marine Adviser, Truro Office).

Table 1 Favourable condition table for the post-moderated feature of 'Reefs', with recommended measures and attributes (extracted from Table 9.3.2, Isles of Scilly SAC Management Scheme, 2010)

Main / Sub-features	Attribute	Measure	Target	Monitoring Programme Identified / or ongoing
Kelp forest communities (sub-feature)	Characteristic species - *Laminaria hyperborea* & *L. ochroleuca* population size within kelp forest community	Densities and relative proportions of kelp species (particularly *L. hyperborea* and *L. ochroleuca*), measured during summer, twice during reporting cycle. *	Maintain the kelp community structure of the site, allowing for natural succession or known cyclical change. *	Survey work to identify areas of kelp forest, particularly displaying a range of wave exposure and tidal streams. *
	Species composition of characteristic biotopes	Monitoring the diversity of red algal species (Sp. List in FCT), Measured during summer, once during reporting cycle.	Presence and abundance of composite species should not deviate significantly from an established baseline, subject to natural change.	Survey work to identify areas of kelp forest, red algal species, and their species composition.
Vertical Rock (sub-feature)	Species composition of characteristic biotopes	Presence and abundance of composite species. Measured during summer, twice during reporting cycle.	Presence and abundance of composite species should not deviate significantly from the established baseline, subject to natural change.	Search for examples of, and survey, species compositions on vertical rock surface. The Isles of Scilly Marine Countdown project will go some way to highlighting example sites, and collection of information on notable species – some of which overlap as BAP species.
Subtidal Rock and Boulder communities / bedrock and boulders (sub-feature)	Species composition of characteristic biotopes, for example, sponge-dominated biotope (MCR.ErSPbolSH)	Presence and abundance of species (Sp. List in FCT) Measured during summer, once during reporting cycle.	Presence and abundance of composite species should not deviate significantly from an established baseline, subject to natural change.	More detailed surveys of species composition in chosen example sites, informed by Seasearch data. Potentially using ROV for deeper areas.
	Characteristic species: Density and quality of sea fans *Eunicella verrucosa* and erect sponges	Average density (counts in a fixed area) of *Eunicella* and erect sponges. Average proportion of damaged tissue epiphytic growth measured once during reporting cycle.	Average density of sea fans, proportion of damaged, or epiphytes branches should not deviate significantly from an established baseline, subject to natural change.	More detailed surveys of characteristic species in chosen example sites, informed by Seasearch data. Potentially using ROV for deeper areas.
Subtidal faunal turf communities (sub-feature)	Extent and diversity of characteristic biotopes on wave exposed and wave sheltered faunal turf communities	Extent of characteristic species. Measured once during summer, once during reporting cycle.	The extent of characteristic species should not deviate significantly from an established baseline subject to natural change.	Repeat Roxanne surveys, or similar such as side scan, plus multibeam to survey areas below 50m depth contour.
	Species composition of characteristic biotopes	Monitoring the diversity of species within a subset of biotopes, measured during summer, once during reporting cycle.	Presence and abundance of composite species should not deviate significantly from an established baseline, subject to natural change.	More detailed surveys of characteristic species in chosen example sites, informed by Seasearch data. Potentially using ROV for deeper areas.

* : These entries are missing from Table 9.3.2, Isles of Scilly SAC Management Scheme, 2010

1.8 For the present study, a total of six ‘tasks’ have been undertaken in order to initiate the monitoring of the recognised attributes of the sub-features, as set out in Table 2.

Table 2 List of reef attributes requiring monitoring using diving within the Isles of Scilly SAC. Tasks (abbreviated with Task Codes) were then designed to undertake repeatable monitoring of these attributes, as part of the Isles of Scilly Diving Monitoring Studies 2011.

Sub-feature	Attribute	Task Code	Comment
Kelp forest communities	Characteristic species - *Laminaria hyperborea* & *L. ochroleuca* population size within the kelp forest community	A2	
	Species composition of characteristic biotopes within kelp forests: monitoring the diversity of red algal species.	A3	Two ‘tasks’ were designed to monitor this attribute: (1) assessment of the algal species richness; and (2) assessment of the algal diversity.
Vertical rock	Species composition of characteristic biotopes on vertical rock: Presence and abundance of notable species of erect sponges, cup corals, and anthozoan communities.	B1	
Subtidal bedrock and boulder communities	Characteristic species of bedrock & boulder communities: density and quality of (for example, but not limited to) pink sea fans *Eunicella verrucosa* and erect sponges	C2	See footnote to table.
	Species composition of characteristic biotopes on bedrock & boulders, for example, sponge-dominated biotope (MCR.ErSPbolSH)	C3	
Subtidal faunal turf communities	Species composition of characteristic biotopes within faunal turf communities: Monitoring the diversity of species within a subset of biotopes, e.g*Alcyonium digitatum*, *Alcyonium glomeratum*, sponges, hydroids, *Eunicella verrucosa*, *Axinella infundibuliformis*, *Caryophyllia smithii* and *Antedon bifida*.	D2	

[Note that the Attribute (C1) ‘Distribution and range (extent) of circalittoral biotopes on subtidal bedrock & boulders, for example, those dominated by pink sea fans (*Eunicella verrucosa*), cup corals, and *Parazoanthus axinellae*/*P.anguicomis*(?)’ was not considered appropriate for monitoring using diving techniques. A more appropriate method would be to use drop-down video and to determine the distribution and extent of this particular biotope from the results].

2 Background

Previous studies

2.1 A number of studies have been undertaken within the Isles of Scilly nearshore sublittoral zone using scuba diving. However, the majority of these have centred on the description of habitats, their associated species and the respective abundances of those species (for example, Dipper, 1981; Hiscock, 1983). In 2001, Emu Ltd were commissioned by English Nature to 'fill in some gaps' in the distribution of certain sublittoral rock biotopes (Emu 2001). For the current monitoring work, use has been made of records on the Joint Nature Conservation Committee's Marine Recorder database (formerly the MNCR database) in particular, to acquire distribution maps which have been recorded from the islands (see Figures 2-8).

2.2 Early monitoring studies of sublittoral rocky substrata have taken place featuring selected species of particular nature conservation interest, including the sunset cup coral *Leptopsammia pruvoti*, the yellow cluster anemone *Parazoanthus axinellae*, red sea fingers *Alcyonium glomeratum* and certain branching sponges (for example, Hiscock, 1985; Irving, 1987). These monitoring studies were based on photographic records of re-locatable sites and individual species, and took place on an annual basis between 1984 and 1991. They were reviewed by Sarah Fowler & Graham Pilley of the Nature Conservation Bureau in 1992 (Fowler & Pilley, 1992). Whilst producing some extremely valuable information (such as the gradual loss of both *Leptopsammia pruvoti* and *Caryophyllia smithii* cup corals from Gap Point between 1984 and 1991), these data have not been able to provide direct comparisons with the present study's findings, but they have been used to prepare species lists for appropriate biotopes for recording forms.

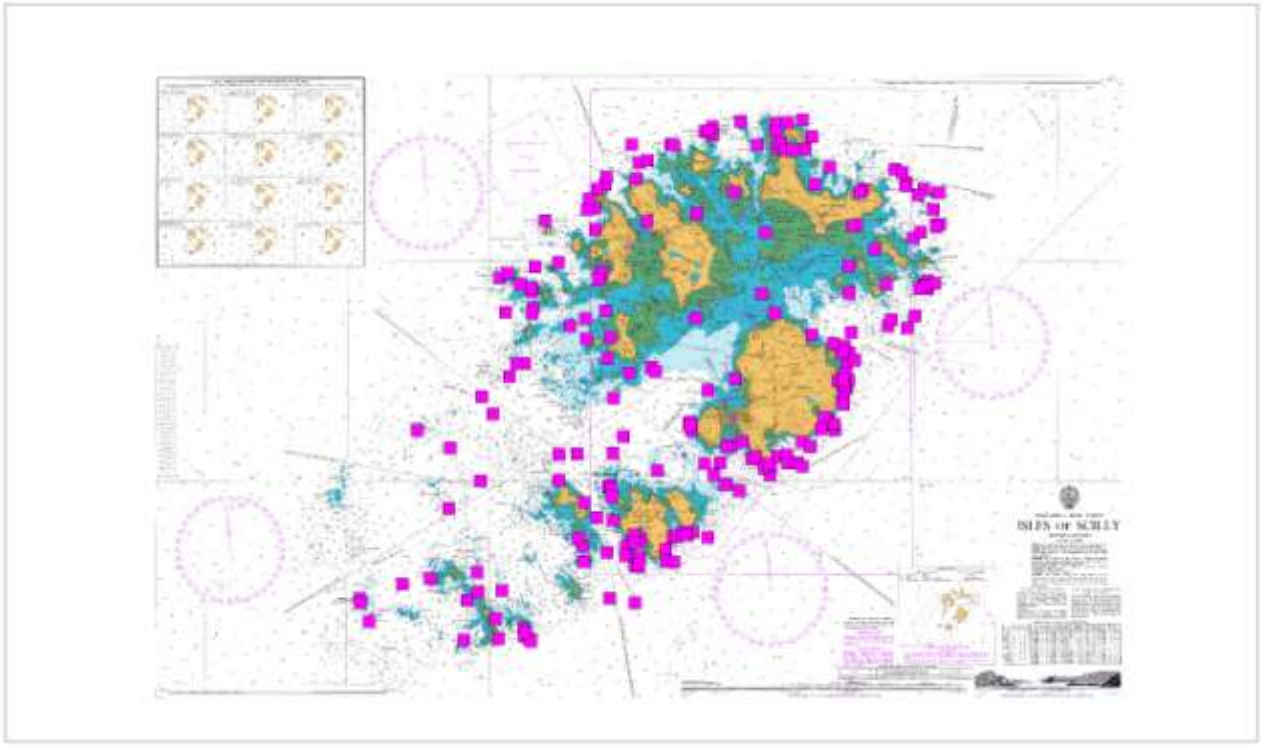


Figure 2 The locations of all 'subtidal rock' sites from Isles of Scilly historic data entered onto Marine Recorder (filtered as 'infralittoral rock' and 'circalittoral rock')

2.3 More recently, a number of volunteer Seasearch surveys have taken place throughout the archipelago, with groups typically staying for a week of diving based on St Martin's. Summary reports for each of these surveys are available (Seasearch 2005, 2006, 2007, 2008, 2009 &

2010). Some of the dives within these surveys have been targeted at certain habitats or particular species (for example, pink sea fans *Eunicella verrucosa* - Wood 2008); others have taken place at sites purely of interest to those on the survey. Seasearch Surveyor forms were completed for all dives and have been entered into the Marine Recorder database. The 2008 Isles of Scilly Biodiversity Audit (Lewis *et al*., 2008) also included descriptions of the various marine habitats and species present within the archipelago.

2.4 In order to assist with choosing suitable locations for possible monitoring sites, an interrogation of the data on Marine Recorder was undertaken based on the presence of certain biotopes and linked to MapInfo GIS. The following distribution maps were obtained (Figures 3 to 8).

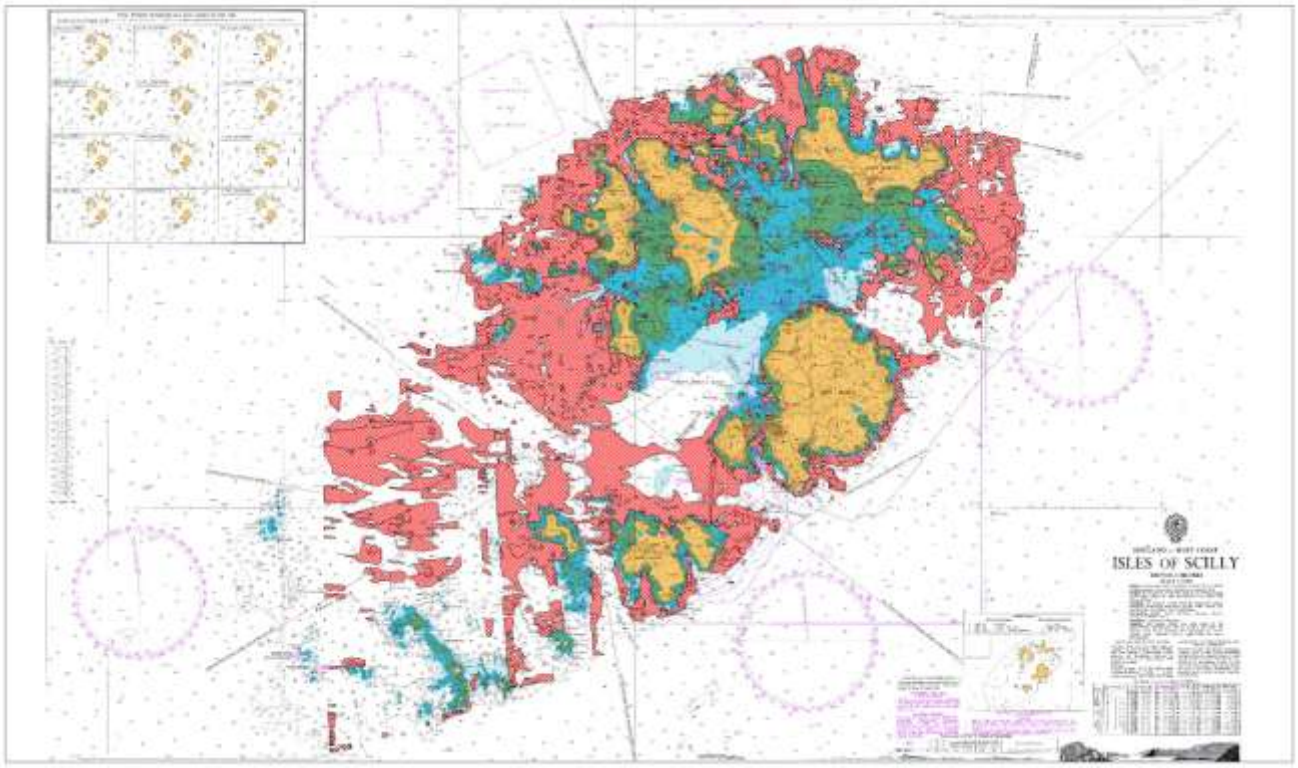


Figure 3 GIS plot using Roxanne-derived data of all seabed habitats featuring cobbles, boulders or bedrock

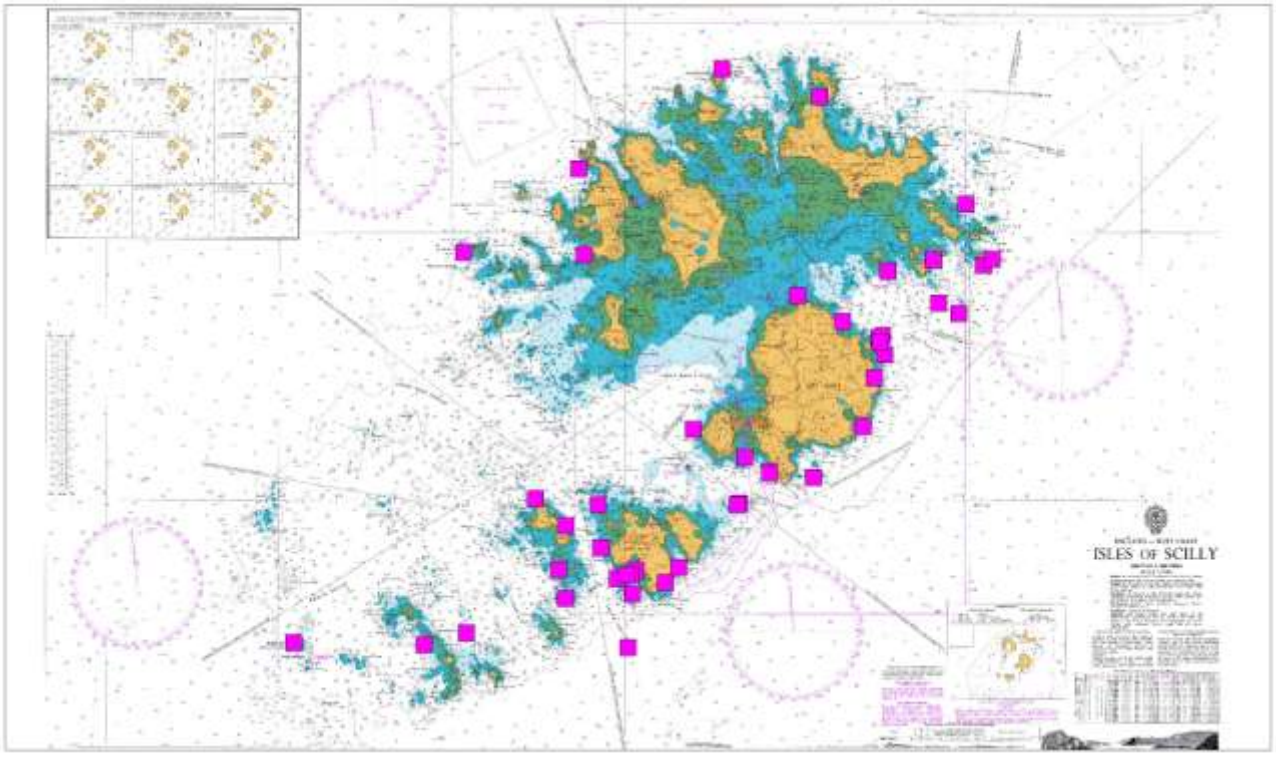


Figure 4 GIS plot of all historical sites featuring the kelp biotopes (refer to Task 2): IR.HIR.KFaR.LhypR.Loch and IR.LIR.K.LhypLoch

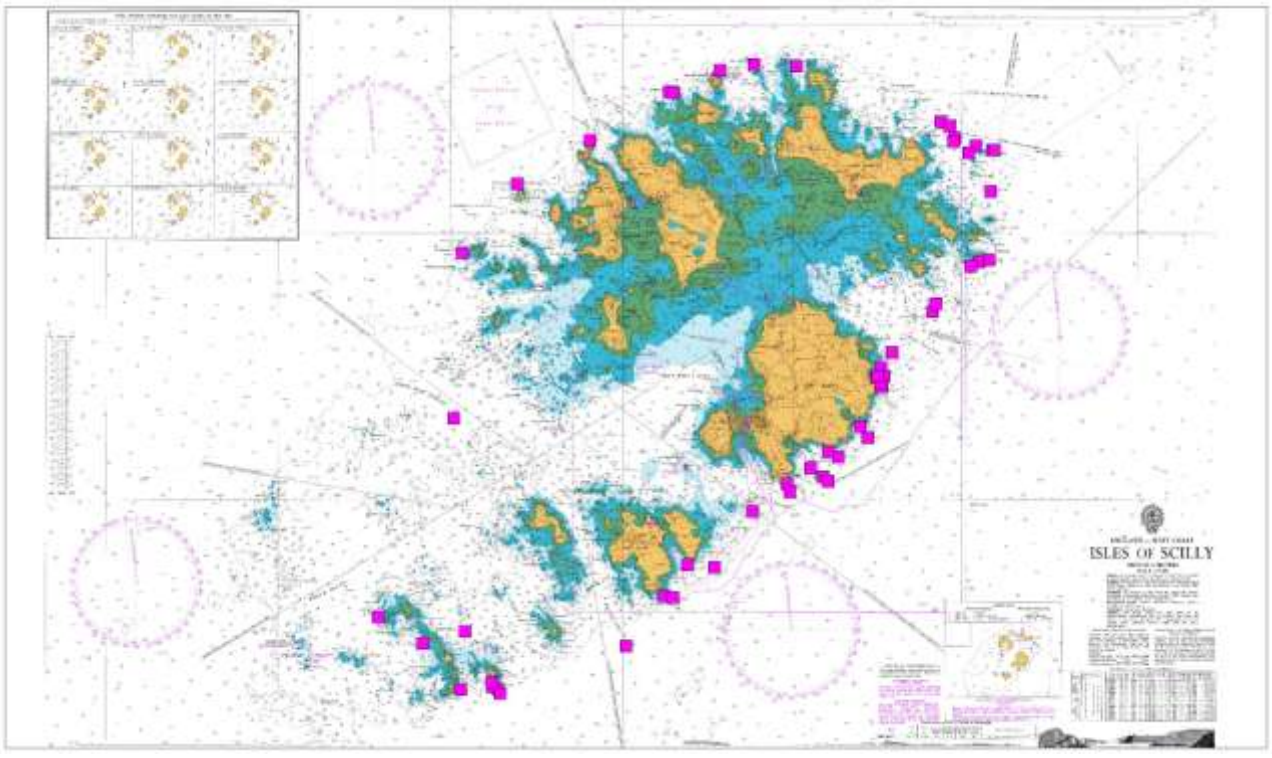


Figure 5 GIS plot of all historical sites featuring the four biotopes associated with circalittoral vertical rock (refer to Task B1): CR.HCR.XFa.SpAnVt; CR.HCR.XFa.CvirCri; CR.MCR.EcCr.CarSp; and CR.FCR.Cv.SpCup

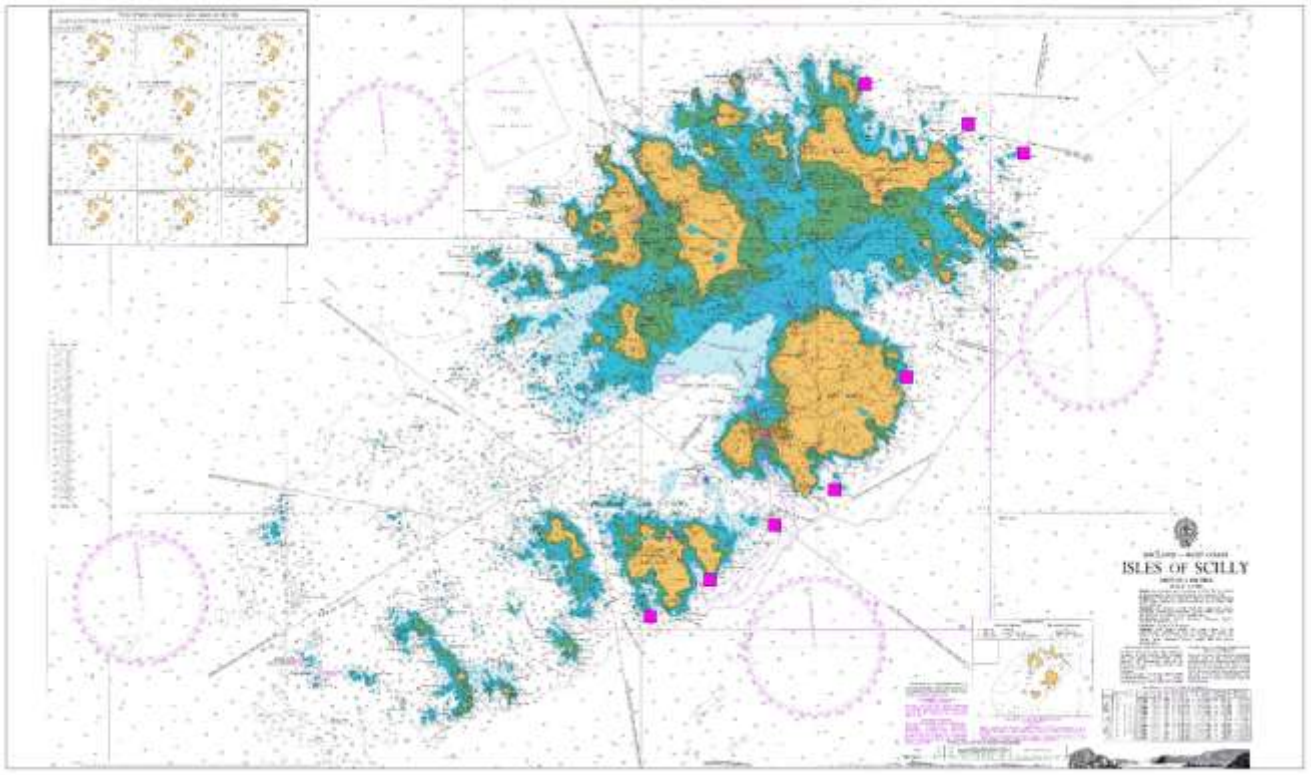


Figure 6 GIS plot of all historical sites featuring the biotope (refer to Task C2): CR.HCR.XFa.ByErSp.Eun

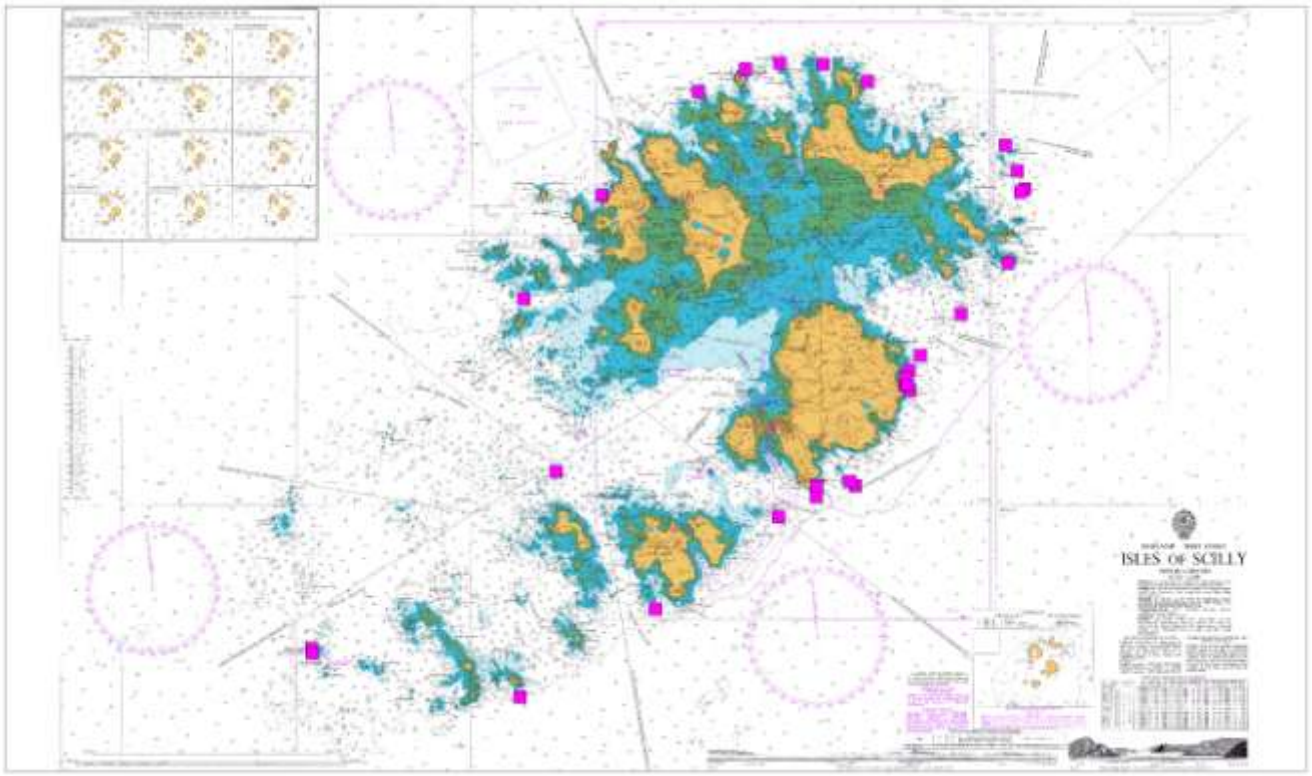


Figure 7 GIS plot of all historical sites featuring bedrock & boulder sponge communities (refer to Task C3): HCR.XFa.ByErSp.Eun

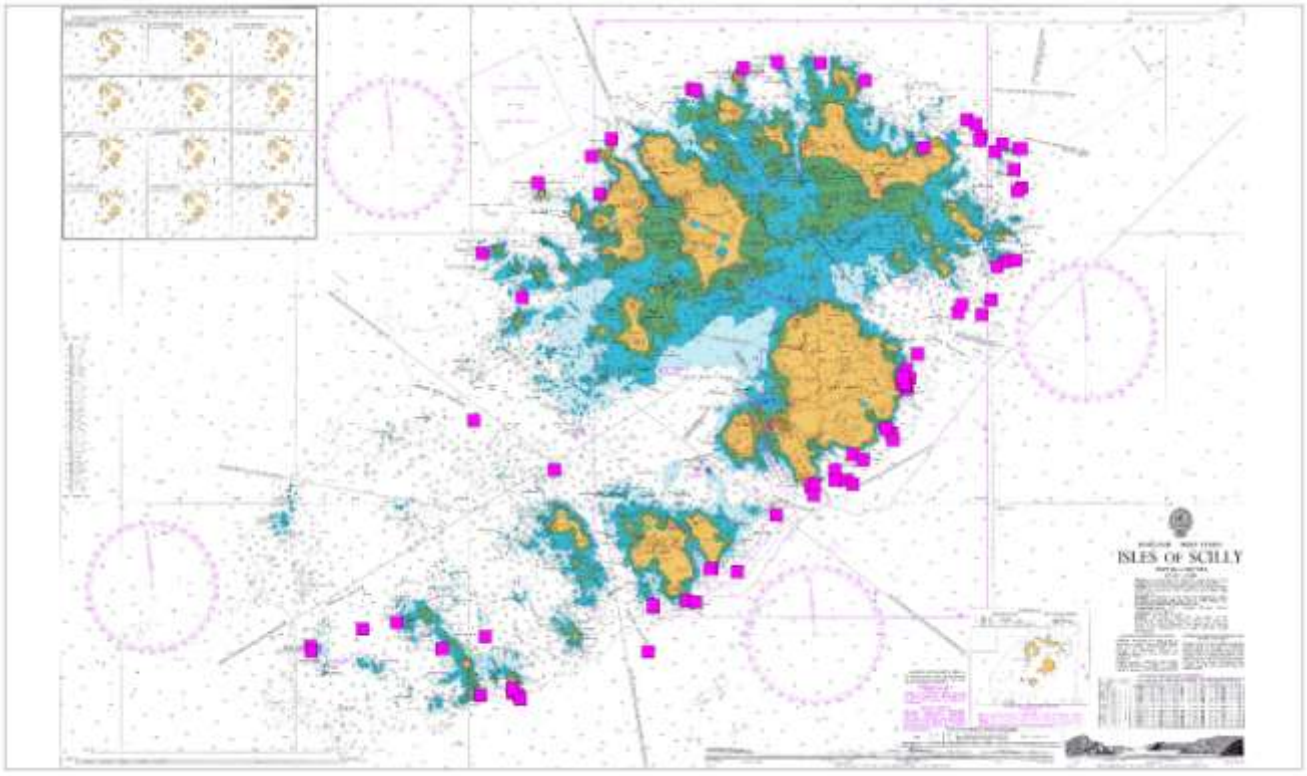


Figure 8 GIS plot of all historical sites featuring sites selected for 'faunal turf' (refer to Task D2): CR.HCR.XFa & CR.MCR.EcCr

[Addendum: A recent report by Angie Gall on the Marine Biodiversity Action Plan habitats and species of the Isles of Scilly (Gall, 2011), which includes several of the features displayed in the above Figures, was published in November 2011, unfortunately too late to be referred to in any detail in this report.]

Current study

Pre-survey planning

2.5 Pre-survey preparations included the production of a full Project Plan and Risk Assessment. These were submitted to the Project Officer and to Natural England's Diving Officer for approval prior to the commencement of the survey.

2.6 Other materials which were prepared included task-specific recording forms (printed onto waterproof paper) – see Appendix 7; and a selection of photographic images of species and a selection of pressed seaweeds for use in QA training (which typically took place the evening before a dive at a particular site).

Timing of the fieldwork

2.7 Diving fieldwork around the Isles of Scilly was carried out over nine days from 5th to 13th June 2011 (excluding single days at each end of the period for mobilisation and de-mobilisation). These dates were specified in the original contract.

Diving procedures

2.8 All diving was carried out under the auspices of the Health and Safety Executive's (HSE) Diving at Work Regulations (1997), and all scientific diving activities followed the Scientific and Archaeological Diving Projects Approved Code of Practice (ACOP). For the purposes of this contract, Natural England acted as the "Client" and the contractor as the "Contractor". As the contractor, Sea-Scope prepared a project plan and risk assessment; ensured that the dive team

was appropriately qualified with valid medicals and first aid certificates; ensured that a detailed daily log was kept; and that diving supervisors were appointed in writing.

2.9 Unusually, the diving supervisors were contracted by the client (Natural England) for this project and not the contractor.

The survey team

2.10 The diving team was made up of Natural England in-house staff, one contractor (Kate Northen, who was the Survey Leader) and one volunteer survey diver. A fifth Natural England diver had to withdraw from the team at short notice. This left an odd number of divers (potentially inefficient when operating a small dive team). Following discussions with the Project Officer, an experienced independent survey diver (Ashley Cordingley) was brought in to the team. Members of the dive team and the support staff are set out below:

Table 3 Members of the dive team and the support staff

Personnel	Position/Company	Role
Robert Irving	Principal Consultant, Sea-Scope	Project Manager
Kate Northen	Principal Consultant, Sea-Scope	Survey leader/Scientific Diver
Chris Pirie	Natural England	Scientific Diver
Gavin Black	Natural England	Scientific Diver
Kevan Cook	Natural England	Scientific Diver
Chris Williams	Natural England	Scientific Diver
Ashley Cordingley	Independent diving contractor	Scientific Diver
Tim Allsop	Diving charter skipper, St Martin's Diving Services	Site location advisor/skipper of *Morvoren*
Anna Cawthray	St Martin's Diving Services	Dive supervisor/ Skipper of RIB
Steve Watt	Isles of Scilly IFCA	Skipper of RIB

2.11 All divers were qualified to HSE Part IV level (or equivalent) and were all experienced scientific survey divers.

Boats and logistics

2.12 Three different boats, a hardboat and two RIBs, had been chartered for the project by Natural England prior to the commencement of the contract. In addition, an 'on-site advisor', Tim Allsop (Morvoren Charters/St Martin's Diving Services, Higher Town, St Martins), had been contracted to provide expert local knowledge about dive sites and diving conditions to the survey leader. A diving supervisor, Anna Cawthray, who worked alongside Tim Allsop, had also been contracted. Richard Perkins assisted with skippering the 6.3 m RIB on one day. Tim Allsop provided the hardboat '*Morvoren'*, an Offshore 105, licensed to carry 12 divers; and a 6.3 m / 115 hp RIB, able to carry 6 divers. A second RIB *Matt Lethbridge* (a Humber 7 m Ocean Pro RIB), belonging to the Isles of Scilly Inshore Fisheries and Conservation Authority (IFCA), was also chartered, though this craft was only licensed to carry six people, comprising four divers, one skipper and one diving supervisor.

2.13 The hardboat had been chartered for one day (Saturday, 11 June), this being the only day it was available when the booking was made. The Isles of Scilly IFCA RIB *Matt Lethbridge* was made

available for five survey days, through a direct inter-departmental agreement between the Isles of Scilly IFCA and Natural England. The 6.3 m RIB was used on the remaining three days.

2.14 The different Isles of Scilly licences under which each boat operated limited the geographical extent to where they were able to travel. Thus the hardboat was licensed to carry divers to the far western extremities of the archipelago, whilst the two RIBs were restricted to the more sheltered eastern fringes of St Agnes, St Mary's and St Martin's.

Selection of sites

2.15 Maps indicating the historical distribution of target biotopes (see Figures 4 to 8) gave an indication of the areas to be investigated for possible monitoring sites. Dive sites were then selected in consultation with Tim Allsop, the charter boat skipper who has over 30 years experience of diving the waters around the islands. Factors which had to be taken into account in deciding the best sites to visit were: (i) the predicted weather conditions each day (and associated sea conditions); (ii) the state of the tide (with respect to slack water times); and (iii) the habitat that was being sought which would feature the chosen attribute/task for the day. It had also been requested by the Project Officer that, wherever possible, sites were chosen within recommended Marine Conservation Zones (rMCZs).

3 Objectives

3.1 The **aim** of the Project (as stated in the project specification) was:

to supply a 'Survey Co-ordinator' who would use past surveys and reports, and NE guidance (in liaison with local knowledge provided by St Martin's Dive Services) in order to design, plan and deliver an agreed programme of surveys for June 2011 in order to monitor the Isles of Scilly SAC subtidal reef feature, through diving surveys.

3.2 Sea-Scope appointed Kate Northen (Principal Consultant) as the Survey Co-ordinator for the project and Robert Irving (Principal Consultant) as the Project Manager. The diving team was to be provided by Natural England using in-house staff members who were qualified to HSE Part IV standard or to the equivalent standard through BSAC or SAA qualifications.

3.3 The accompanying **objectives** (as stated in the project specification) were:

- to design and plan a survey using methods which would be repeatable and be able to supply sufficiently robust data to support statistical comparisons with future data sets;
- to select sites which should encompass the range of reef habitats covering varying exposures, aspects, tidal strengths and depth ranges;
- to select sites which will ensure a full coverage of all the varying habitats despite different prevailing weather conditions that may occur during the survey;
- wherever possible, to use known (existing) sites from previous surveys, balanced with new sites, particularly within the draft MCZ sites;
- to concentrate surveys on a broad range of reef habitat types and to identify key biotopes (in relation to reef sub-features), forming a baseline for future long-term monitoring; and
- to collect data required to provide a suitable baseline for the following attributes of the IoS SAC:
  - biotope composition;
  - distribution and spatial patterns of biotopes;
  - presence of representative / notable biotopes; and
  - species composition of representative or notable biotopes.

4 Methods

Pre-survey

The design of the recording methodology

4.1 Each task had its own recording methodology designed specifically to be able to measure the particular attribute in question. These are set out in the section 5 'Tasks & Results'. A number of factors had to be considered prior to deciding upon a suitable methodology for each task. These included:

- **Simplicity of technique**

It is important that whatever methodology is decided upon, the technique itself should not be over complicated or involve awkward-to-operate gear. Also, it should be easy to understand by the divers themselves so there is no ambiguity in what is being asked.

- **Repeatability of technique**

The technique needs to be both simple and yet robust. For visits in the future, it is likely to be repeated by a completely different survey team, so the level of diving required and the type of equipment being used need to be 'standard' and not over-complicated.

- **Non-reliance on species ID specialists**

Whilst it may be desirable to have a monitoring team entirely comprised of species identification experts, this is never likely to be the case. Methods therefore need to be structured around a basic knowledge of common species, which can be added to by carefully targeted QA training sessions. That said, it was necessary for the present study to have one member of the monitoring team with expertise in algal identification (for Task A3).

- **Non-permanent transect and quadrat location**

In certain circumstances[4], accurate repeatability of the positioning of quadrats or transect lines is essential. However, this requires considerable time, effort and equipment to establish fixed markers at suitable locations. In cases where no allowance has been made to establish permanent monitoring stations, the methodology has to rely on random sampling from within a given area (typically dictated by the extent of a particular biotope). To reduce the opportunity of stochastic change detection between sampling episodes, it is essential to obtain accurate position fixes of shot marker lines from the surface (using dGPS), and of producing imagery (sketches / photography / videography) of the monitoring station *in situ*.

- **Backing up observed records with video and stills photography**

The acquisition of visual data in the form of underwater video / stills photography is essential both to verify any *in situ* measurements made by survey divers and to keep a compelling visual record of the whole site to provide an 'overall impression'. For the present study, emphasis was placed on acquiring good high definition video footage from which 'screen grabs' can be selected for analysis.

[4] Such as when one wishes to constrain variability – i.e. desirable in most monitoring situations of limited sampling opportunities

- **Training of recorders prior to undertaking task (Quality Assurance training)**

This is an essential part of ensuring that the data acquired from the monitoring visit is accurate. It is important for the recorders to be familiar with the species they are likely to encounter and to know how to distinguish similar looking species. When possible, QA training sessions took place the evening before undertaking a particular task/technique.

On site logistics & techniques

Field survey logistics

4.2 As described in section 2.12 – 2.14, three boats were booked for the dive team to use. An Offshore 105 hardboat *Morvoren*, skippered by Tim Allsop; a 6.3 m RIB (also provided by St Martin's Diving Services); and a 7 m RIB provided by the Isles of Scilly IFCA. On the five days when the IoS IFCA RIB was being used, only four divers could be taken on board, leaving two of the team to undertake ancillary tasks including data entry and the preparation of voucher algal specimens.

Video and stills photography

4.3 Wherever possible, video footage was used to capture a visual record of each of the sites, as well as being used as a back-up recording tool for quadrats or belt transects.

4.4 The video camera used was a high definition Sony XR35O (Plate 1) with a Sony 1.8/2.9-34.8 lens 12x zoom, within a Light & Motion Bluefin 550 standard housing, with two SOLA 1200 re-chargeable LED lights (Plates 2 & 3). The camera itself had an internal 160GB hard disk drive, with a movie quality mode which could be set to high definition FX (1920x1080i, 24 Mbps) / FH (1920x1080i, 16 Mbps) / HQ (9 Mbps) or LP (5 Mbps). The camera could also be set to take still images at 7 Mp.

Plate 1 Sony XR350 video camera

Plate 2 Light and Motion Bluefin 550 housing

Plate 3 Two SOLA 1200 video lights attached by flexible arms to the housing

4.5 Underwater stills photographs were also taken from a number of sites, using a Panasonic TZ7 housed digital camera (12 Mp). These were able to help provide images for QA training sessions, and helped as a back-up for the video images.

Data generated (storage)

4.6 Data recorded under water were written onto pre-prepared recording forms (see Appendix 7) attached to A4-size dive slates. Each evening, data were transcribed from these forms into Excel spreadsheets. Once transcribed, the recording form was filed. Spreadsheets were backed up on a portable hard drive.

4.7 After returning from a dive, video footage was downloaded directly from the camera to a 500GB portable hard drive. Once this was completed, folders/files were named with key parameters including date, site name and the videographer (see Appendix 3).

Collection & pressing of algae

4.8 One of the requirements of Task A3 (monitoring the diversity of red algal species) was the collection of macroalgal samples, in part to allow for the confirmation of species identification in the field, and also to initiate a herbarium collection of voucher specimens. Macroalgal samples were collected from the infralittoral zone at three sites in numbered polythene bags (each bag relating to a 10 minute time interval of the 60 minute search period). Samples were later washed in sea water and laid out on cartridge paper with details written on the paper of the collection date, site and depth. They were then pressed and dried in an algal press. Each pressing has subsequently been scanned.

Post survey methods

Review of video clips

4.9 A total of 171 video clips (ranging in length from 6 seconds to 3 minutes 20 seconds) were reviewed using Windows Movie Maker (2010) software. Appropriate sequences were identified by their time signature as being suitable for screen grabs (i.e. a freeze-frame of the action presented as a photograph), of which two were selected to illustrate each site in this report. The video files have also been used to add additional habitat and species information for biotope assessments.

Biotope assignation

4.10 Wherever possible, biotopes have been assigned by the authors to those seabed communities where the monitoring tasks were undertaken, using the Joint Nature Conservation Committee (JNCC) Marine Habitat Classification (Connor *et al*. 2004).

Converting depths to chart datum

4.11 All *in situ* recorded depths (read from dive computers) were measured in metres below sea level (bsl). In order to eliminate the part of that measurement due to the state of the tide when the dive took place, these recorded depths were converted to below chart datum (bcd) depths utilising appropriate tide tables (St Mary's, Isles of Scilly, 2011).

5 Tasks and results

5.1 Fifteen sites were visited during the nine days of survey diving, thirteen of which were sites where actual monitoring studies took place (a familiarisation dive took place at Peninnis Head and the dive at Crow Sound was aborted due to inclement weather). The six attributes/tasks were spread amongst these thirteen sites (see Table 4 below). All of the selected sites lie in the south-east, east or north-east quadrants of the archipelago (Figure 9). The reasons for this distribution are: (1) the distribution of habitats required for the tasks in hand; (2) the prevailing weather conditions; (3) the distribution of rMCZ areas; and (4) the licence restrictions on the RIBs used (see also section 2.12 – 2.14).

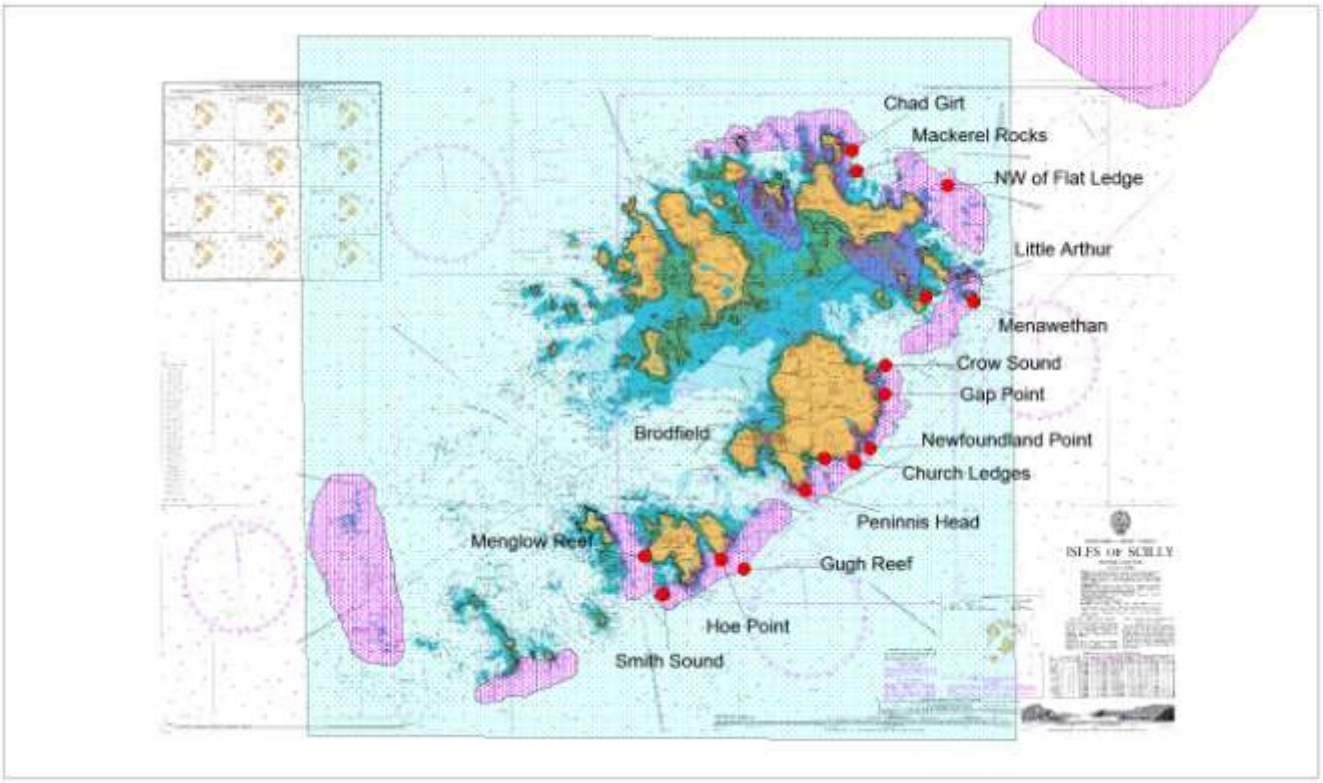


Figure 9 Locations of all subtidal sites visited during the current fieldwork

Table 4 Survey sites (arranged by task)

Site	Location	Task	Date	Video	Photo
Penninis Head	St Mary's	Familiarisation	05-Jun-11	Y	Y
Little Arthur	Eastern Isles	Kelp structure; diversity of red algae (A2 & A3)	06-Jun-11	N	N
Brodfield	St Mary's	Kelp structure; diversity of red algae (A2 & A3)	06-Jun-11	Y	N
Menawethan	Eastern Isles	Kelp structure (A2)	08-Jun-11	Y	N
Menglow Reef	St Agnes	Kelp structure; diversity of red algae (A2 & A3)	09-Jun-11	Y	Y
Mackerel Rocks	St Martin's	Diversity of red algae (A3)	13-Jun11	Y	Y
Gap Pt	St Mary's	Verticals (B1)	07-Jun-11	Y	N
Gap Pt	St Mary's	Verticals (B1) (2nd visit)	13-Jun11	Y	Y
Newfoundland Pt	St Mary's	Verticals (B1)	08-Jun-11	Y	N
Gugh Reef	St Agnes	Verticals (B1)	10-Jun-11	Y	N
Smith Sound	St Agnes	*Eunicella* density/condition (C2)	09-Jun-11	Y	Y
NW of Flat Ledge	St Martin's	Sponge community (C3)	11-Jun-11	Y	Y
Chad Girt, E of White Island	St Martin's	Sponge community (C3)	11-Jun-11	Y	Y
Church Ledges	St Mary's	Faunal turf (D2)	07-Jun-11	Y	N
Hoe Pt	St Agnes	Faunal turf (D2)	10-Jun-11	Y	Y

Familiarisation dive – Peninnis Head, St Mary's

5.2 On the first full day of the survey, a familiarisation dive was undertaken off Peninnis Head (at 49° 54.199' N, 06° 18.102' W), on the south-east coast of St Mary's. This provided the dive team with an opportunity to test survey cameras and to familiarise themselves with species they could encounter at the various monitoring sites. Brief descriptions of the habitats encountered and their associated species are given below.

Site description

5.3 In the infralittoral zone, the upward-facing bedrock supported a mixed kelp forest of *Laminaria hyperborea* and *Laminaria ochroleuca* at 11 to 15 m (bcd). The bedrock beneath the kelp canopy was grazed by the sea urchin *Echinus esculentus* and supported a sparse community of red and brown algae (characterised by *Dictyota dichotoma*, *Desmarestia aculeata*, *Heterosiphonia plumosa* and *Delesseria sanguinea*).

Table 5 Characterising species, biotopes and depths of reef sub-features at Penninis Head, St Mary's

Grazed kelp biotope	Verticals	Boulders	Bedrock
Depth: 10.9 – 14.9 m (bcd)	Depth: 14.9 – 20.0 m (bcd)	Depth: 17.0 – 20.0 m (bcd)	Depth: 20.9 m (bcd)
IR.MIR.KR.Lhyp.GzFt (Grazed *Laminaria hyperborea* forest with coralline crusts on upper infralittoral rock)	CR.HCR.XFa.SpAnVt (Sponges and anemones on vertical circalittoral bedrock); and CR.HCR.XFa.CvirCri (*Corynactis viridis* and a mixed turf of crisiids, *Bugula*, *Scrupocellaria* and *Cellaria* on moderately tide-swept exposed circalittoral rock).	CR.MCR.EcCr.CarSp (*Caryophyllia smithii*, sponges and crustose communities on wave-exposed circalittoral rock)	CR.MCR.EcCr.CarSp (*Caryophyllia smithii*, sponges and crustose communities on wave-exposed circalittoral rock)
Characterising species	Characterising species	Characterising species	Characterising species
Laminaria hyperborea *Dictyota dichotoma* *Composthamnion thuyoides* *Heterosiphonia plumosa* *Delesseria sanguinea* *Desmarestia aculeata* *Dictyopteris membranacea* Corallinaceae	*Dictyota dichotoma* Corallinaceae *Hemimycale columella* *Thymosia guernei* *Haliclona viscosa* *Tethya citrina* *Aglaophenia* sp. *Caryophyllia smithii* *Corynactis viridis* *Alcyonium digitatum* *Alcyonium glomeratum* *Pawsonia saxicola* *Stolonica socialis* *Clavelina lepadiformis*	*Polymastia boletiformis* *Suberites carnosus* *Aiptasia mutabilis* *Echinus esculentus* *Holothuria forskali*	*Delesseria sanguinea* *Kallymenia reniformis* *Dictyopteris membranacea* *Hemimycale columella* *Tethya citrina* *Suberites carnosus* *Axinella dissimilis* *Isozoanthus sulcatus* *Caryophyllia smithii* *Eunicella verrucosa* *Alcyonium digitatum* *Bugula* sp.

A2: Characteristic kelp species

Method

Table 6 Summary table of target, baseline, methods and rationale for the 'characteristic kelp species' attribute (Task A2) of the reef sub-feature 'kelp forest communities'

Sub-feature: (A)	**Kelp Forest Communities**
Attribute: (A2)	**Characteristic species - *Laminaria hyperborea* & *L. ochroleuca* population size within the kelp forest community**
Target:	Presence and abundance of composite species should not deviate significantly from an established baseline, subject to natural change.
Baseline:	Not measured before using this proposed methodology. Some records exist of the relative abundance of these two kelp species using MNCR Phase 2 methodology.
Comment:	Likely to include the biotopes (Connor *et al*. 2004): IR.HIR.KFaR.LhypR.Loch (Mixed *Laminaria hyperborea* and *Laminaria ochroleuca* forest on exposed infralittoral rock); IR.LIR.K.LhypLoch (Mixed *Laminaria hyperborea* and *Laminaria ochroleuca* forest on moderately exposed or sheltered infralittoral rock); and Dipper (1981) reports: "A typical situation was *L. hyperborea* forest above 10 m; mixed *L. hyperborea* and *L. ochroleuca* below this; and finally, just *L. ochroleuca* below about 16 m".
Summary of Method:	The chosen site(s) were within the upper infralittoral, i.e. the kelp forest. Using a 3-sided, 1 m^2 quadrat, the diver counted the number of individual kelps belonging to six species (the two specified above and four for possible future analysis) and recorded the data on a pre-prepared recording form, together with the depth of each quadrat. The species being sought were *Laminaria hyperborea*, *Laminaria ochroleuca*, *Saccharina latissima* (formerly *Laminaria saccharina*), *Saccorhiza polyschides*, *Laminaria digitata* and *Alaria esculenta*. Two divers undertook this task and were required to record from a minimum of 30 quadrats between them. In order for the quadrats to remain within the minimum and maximum depth boundaries of the biotope(s) in question, a 10 m long measuring tape transect line was reeled out along a depth contour within that band. Randomly-generated distances along that transect were pre-selected by each recorder, together with perpendicular distances away from the transect line (measured as fin kicks). Divers need to be familiar with the kelp species in question and be confident about identifying them. Individual *L. hyperborea* and *L. ochroleuca* plants can look very similar, especially if the stipe of the former has been grazed clean of epibiota. It is recommended that fresh samples of all species (if possible) are collected on the familiarisation dive at the start of the survey.
Rationale:	The northern kelp *Laminaria hyperborea* supports a diverse understorey of macroalgae (particularly species of red algae), with several species attached to the stipes of the kelp. The southern kelp *Laminaria ochroleuca*, on the other hand, has a much smoother stipe with few if any epiphytic red algae managing to attach to it. The proportion of *L. ochroleuca* to *L. hyperborea* in the Isles of Scilly is likely to increase as the surrounding waters gradually warm as a result of climate change, thus altering the biotope composition. This method provides a simple comparison of baseline ratios (*L. hyperborea*: *L. ochroleuca*. The ratio measure will provide the condition indicator for this particular attribute. The data obtained are comparable to similar recent studies undertaken elsewhere in the south-west, such as at Lundy (Irving, 2011) and in Plymouth Sound (Dr Nova Mieszkowska, *pers comm*.).

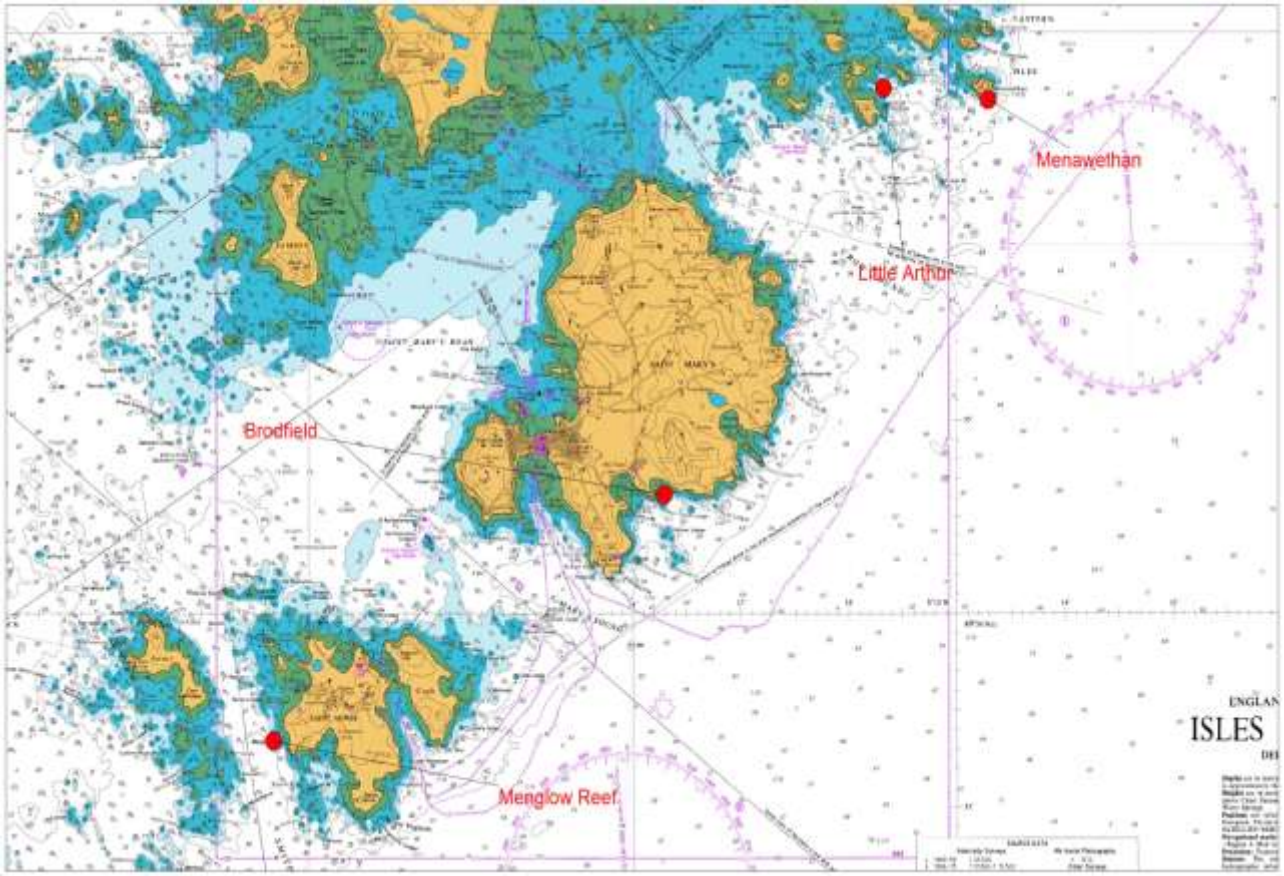


Figure 10 Location of the four sites where Task A2 was undertaken

Table 7 Information relevant to sites where Task A2 was undertaken

Site name	Lat./Long. (of marker shot)	Date visited	Depth range		Divers
			(BSL)	(BCD)	
Little Arthur, Eastern Isles	49° 56.712' N 006° 15.679' W	05-Jun-11	8.0 – 11.0 m	6.7 – 9.7 m	GB & CP
Menawethan, Eastern Isles	49° 56.652' N 006° 14.710' W	08-Jun-11	6.4 – 14.0 m	3.2 – 10.8 m	GB & CP
Brodfield, St Mary's	49° 54.613' N 006° 17.713' W	06-Jun-11	11.0 – 13.0 m	9.0 – 11.0 m	GB & CP
Menglow Reef, St Agnes	49° 53.340' N 006° 21.333' W	09-Jun-11	12.1 – 16.0 m	9.1 – 13.0 m	GB & CP

5.4 Four sites were selected for this Task as being representative of a range of energy levels from sheltered to exposed and tide-swept. Efforts were made at each site to undertake the studies within similar depth limits, though this was not always possible.

Little Arthur - Site description

5.5 Little Arthur is situated amongst the Eastern Isles complex of islands and is only exposed to the south-east. The infralittoral bedrock at the shallowest part of this reef is covered by a fine layer of silt and supports a dense forest of mixed *Laminaria hyperborea* and *Laminaria ochroleuca* (biotope: IR.LIR.K.LhypLoch - Mixed *Laminaria hyperborea* and *Laminaria ochroleuca* forest on

moderately exposed or sheltered infralittoral rock). Very few faunal species are found here, the most conspicuous being the grazing echinoid *Echinus esculentus* and the holothurian *Holothuria forskali*. Beneath the kelp canopy, the kelp stipes support a dense understorey of foliose algae on the *Laminaria hyperborea* kelp stipes. Foliose seaweeds are scattered on the coralline encrusted rock, though never densely. The delicate filamentous red alga *Bonnemaisonia asparagoides* is easily seen growing on the bedrock with its eye-catching bright pink/red colouration. Tasks A2 & A3 were undertaken at this site within the depth range of 6.7 – 9.7 m (bcd). [No video was taken at Little Arthur].

Menawethan - Site description

5.6 Menawethan lies to the SE of Trinity Rock at the eastern edge of the Eastern Isles. It is exposed to the south-east quarter. The site consists of rugged granite bedrock in the form of short vertical walls, steeply sloping faces and upward-facing surfaces too. The upper infralittoral is dominated by a dense forest of *Laminaria hyperborea* (approx. 12 plants/m^2), with a few *L. ochroleuca* kelps in amongst them. Grazing by *Echinus esculentus* is apparent on the bedrock beneath the kelp canopy, with encrusting coralline algae much in evidence. There are two biotopes represented here depending on depth: IR.HIR.KFaR.LhypR.Loch (Mixed *Laminaria hyperborea* and *Laminaria ochroleuca* forest on exposed infralittoral rock) and IR.MIR.KR.Lhyp.GzFt (Grazed *Laminaria hyperborea* forest with coralline crusts on upper infralittoral rock). Below the kelp zone, rock surfaces are covered by a short hydroid-bryozoan turf with branching sponges and anthozoans. Vertical rock faces are dominated by jewel anemones *Corynactis viridis* and plumose anemones *Metridium senile*. Task A2 was undertaken at this site within the depth range of 3.2 – 10.8 m (bcd).

[Video file: 08-Jun-11 Menawethan AC/08 June 2011 Menawethan Pt AC 025 (7)]

Plate 4 Video screen grab of *Laminaria hyperborea* holdfast, Menawethan

[Video file: 08-Jun-11 Menawethan AC/08 June 2011 Menawethan Pt AC 025 (8)]

Plate 5 Video screen grab of *Echinus esculentus* on a vertical face beneath the kelp forest

Brodfield - Site description

5.7 Brodfield is located on the south-east side of St Mary's, off Tolman Point. Although this reef site is in an embayment it is exposed to south-westerly winds but sheltered from tidal streams. The area selected to undertake the tasks of investigating kelp structure (A2) and red algal richness (A3) comprised a platform of upward-facing bedrock from 11.0 – 13.0 m bsl. The silted granite bedrock here supports a dense canopy of mixed *Laminaria hyperborea* and *Laminaria ochroleuca* kelp (biotope: IR.HIR.KFaR.LhypR.Loch - Mixed *Laminaria hyperborea* and *Laminaria ochroleuca* forest on exposed infralittoral rock). There is an understorey of foliaceous red and brown seaweeds (the latter including *Dictyota dichotoma*, *Dictyopteris membranacea* and *Halopteris filicina*), although encrusting seaweeds predominate, as the site is grazed by the sea urchin *Echinus esculentus*. The stipes of *Laminaria hyperborea* are densely colonised by epiphytic algae such as *Callophyllis laciniata*, *Phycodrys rubens*, *Membranoptera alata* and *Kallymenia reniformis*. Fauna is sparse in this community, restricted to the kelp stipes and holdfasts of *L. hyperborea* (for example, *Halichondria panicea* and *Membranipora membranacea*). Depth range of 9.0 – 11.0 m (bcd).

[Video file: 06-Jun-11 Brodfield kelp/2011 6 June Brodfield kelp 011]

Plate 6 Video screen grab of a diver investigating the kelp canopy,Brodfield

[Video file: 06-Jun-11 Brodfield kelp/2011 6 June Brodfield kelp 011]

Plate 7 Video screen grab of *Laminaria ochroleuca* fronds, Brodfield

Menglow Reef - Site description

5.8 Menglow Reef lies within Smith Sound, to the west of St Agnes. The site is exposed to the south and south-east and is tide-swept. The shallow parts of the reef consist of angular bedrock and boulders with a mixed kelp forest of *Laminaria hyperborea* and *Laminaria ochroleuca*, with *L.ochroleuca* being the dominant kelp (biotope: IR.HIR.KFaR.LhypR.Loch - Mixed *Laminaria hyperborea* and *Laminaria ochroleuca* forest on exposed infralittoral rock). The upward-facing rock is covered with pink encrusting algae, overlain with a thin layer of silt, together with occasional brown algae (*Dictyota dichotoma*, *Dictyopteris membranacea* and *Desmarestia aculeata*). Again, the site is noticeably grazed by sea urchins *Echinus esculentus*. Upward-facing

bedrock surfaces are interspersed with verticals (c. 1m high) colonised by jewel anemones *Corynactis viridis* and encrusting sponges (such as *Hemimycale columella*) and the red seaweed *Meredithia microphylla*. Tasks A2 & A3 were undertaken at this site within the depth range of 9.1 – 13.0 m (bcd).

[Video file: 09-Jun-11 Menglow/2011-06-09 Menglow (15)]

Plate 8 Video screen grab of a small vertical bedrock face beneath the kelp forest, with two *Echinus esculentus* urchins with 'hats' of loose seaweed

[Video file: 09-Jun-11 Menglow/2011-06-09 Menglow (24)]

Plate 9 Video screen grab of a diver recording algal species from in amongst the kelp forest, Menglow Reef

Video review of sites

5.9 A total of 32 video clips were taken during one dive at Menawethan; 25 clips at Brodfield; and 28 at Menglow Reef. The clips ranged in duration from 0:06 to 3:00 minutes. Subject matter included *Laminaria hyperborea* plants, from holdfast to frond; grazed bedrock beneath the kelp canopy; *Echinus esculentus* individuals; *L. hyperborea* holdfast and stipe stump (post-grazing); *Corynactis viridis* patches on vertical rock; and divers using the 3-sided 1 m^2 quadrats. A full list of clips is presented in Appendix 3.

Table 8 Summary table of the densities of each kelp species from all four sites

Site name: Menglow Reef Total no. of quadrats: 29 Depth range (bcd): 9.1 – 13.0 m							
	Laminaria hyperborea	*Laminaria ochroleuca*	*Saccorhiza polyschides*	*Saccharina. latissima*	*Alaria esculenta*	Young plants	All kelp plants
Total no. of plants (all Qs)	34	89	10	2	0	54	189
Mean density of plants/m^2	1.2	3.1	0.3	0.1	0.0	1.9	6.5
Site name: Brodfield Total no. of quadrats: 22 Depth range (bcd): 9.0 – 11.0 m							
	Laminaria hyperborea	*Laminaria ochroleuca*	*Saccorhiza polyschides*	*Saccharina. latissima*	*Alaria esculenta*	Young plants	All kelp plants
Total no. of plants (all Qs)	91	22	1	0	0	11	154
Mean density of plants/m^2	4.1	1.0	0.0	0.0	0.0	0.5	7.2
Site name: Menawethan Total no. of quadrats: 30 Depth range (bcd): 3.2 – 10.8 m							
	Laminaria hyperborea	*Laminaria ochroleuca*	*Saccorhiza polyschides*	*Saccharina. latissima*	*Alaria esculenta*	Young plants	All kelp plants
Total no. of plants (all Qs)	351	6	23	1	8	50	439
Mean density of plants/m^2	12.1	0.2	0.8	0.0	0.3	0.7	14.6
Site name: Little Arthur Total no. of quadrats: 31 Depth range (bcd): 6.7 – 9.7 m							
	Laminaria hyperborea	*Laminaria ochroleuca*	*Saccorhiza polyschides*	*Saccharina. latissima*	*Alaria esculenta*	Young plants	All kelp plants
Total no. of plants (all Qs)	153	28	5	0	0	23	209
Mean density of plants/m^2	4.9	0.9	0.2	0.0	0.0	0.7	6.7

Table 9 Comparisons of the mean densities of kelp plants from the four monitoring sites (See also Figure 11)

Site	*L hyperborea* mean density (/m^2)	*L ochroleuca* mean density (/m^2)	other spp. mean densities (/m^2)	Total mean densities (/m^2)	*Lh:Lo* ratio
Menglow	1.2	3.1	2.3	6.5	0.38 : 1
Brodfield	4.1	1.9	1.0	7.0	2.17 : 1
Menawethan	12.1	0.2	2.8	15.1	58.50 : 1
Little Arthur	5.1	0.9	0.9	7.0	5.46 : 1

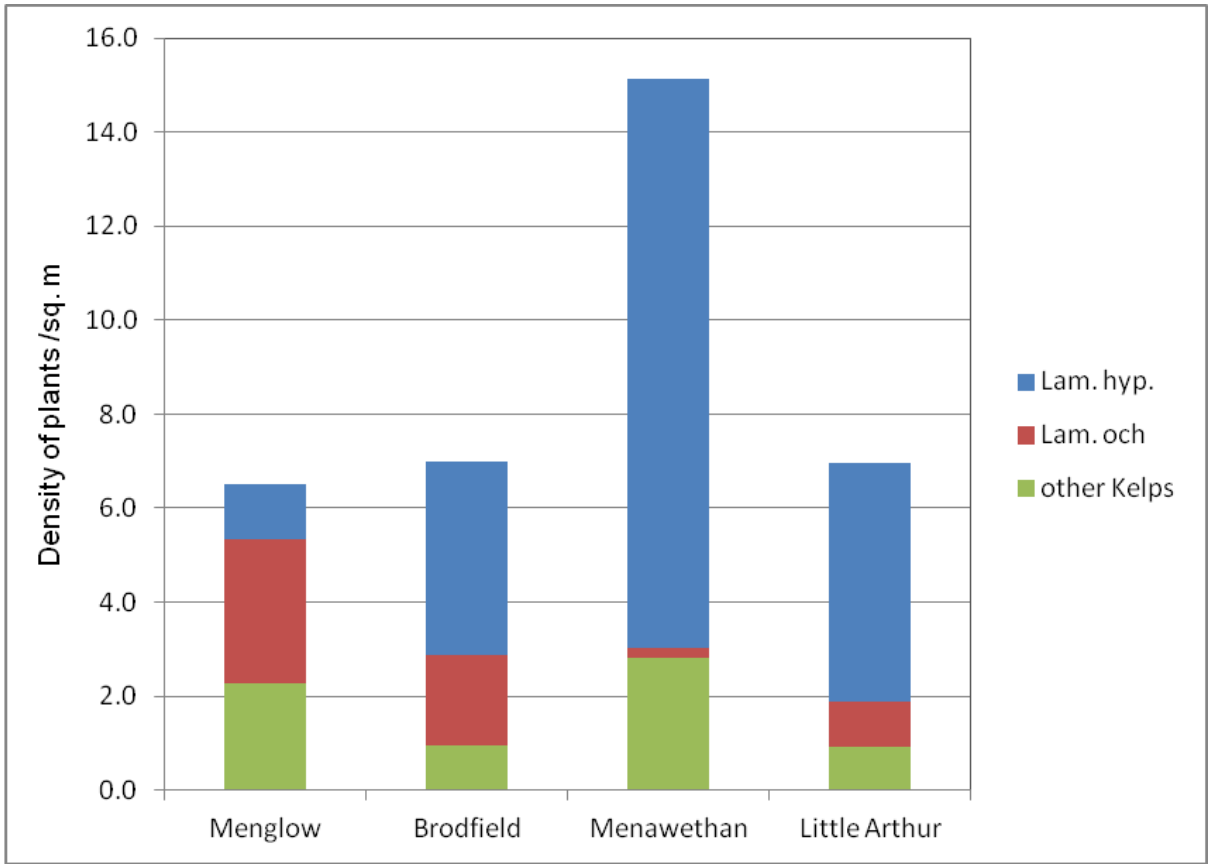


Figure 11 Comparisons of the different proportions of kelp species at each of the four monitoring sites

Discussion

5.10 Whilst *Laminaria hyperborea* remains the predominant forest-forming kelp species for much of the British Isles, in the Isles of Scilly the southern kelp *Laminaria ochroleuca* has a significant presence also. Essentially *L. hyperborea* is a northern species, as its species name suggests. *L. ochroleuca*, on the other hand, is a southern species whose northern extent encroaches into south-west Britain. The present northern limit of the range of *L. ochroleuca* is in the vicinity of Lundy, though its range may well creep further northwards under the influence of climate change. It has a firm stronghold in the Isles of Scilly, and is now the more common of the two species at certain sites within the archipelago.

5.11 *Laminaria ochroleuca* has the ability to resist other species of flora or fauna from settling on its stipe (fouling) while, by contrast, *Laminaria hyperborea* may support a considerable diversity and

abundance of epiflora (in particular) and epifauna. There are therefore considerable ecological implications on the kelp forest communities if the proportion of the two dominant kelp species (*L. hyperborea* and *L. ochroleuca*) changes significantly (see Connor *et al.* 2004 & Irving 2011). Interestingly, John (1969) suggests that the northern limit to the distribution of *L. ochroleuca* may be controlled by the amount of incident light rather than water temperature.

5.12 Three (of the four) sites chosen for this study (Little Arthur, Menawethan and Menglow Reef) have historic data on the two kelp biotopes visited during the present study (IR.HIR.KFaR.LhypR.Loch and IR.LIR.K.LhypLoch). However, the amounts of *Laminaria hyperborea* and *L. ochroleuca* present within kelp forests from these studies have been recorded using the MNCR SACFOR abundance scale* (Hiscock 1996) (or its predecessors), which is a semi-quantitative measure, and not by the number of plants per m^2 (see Table 13). So while *estimates* of abundances for *L. hyperborea* have typically been 'Abundant' from past records (for example, Hiscock, 1983, for all sites where infralittoral data were gathered); and for *L. ochroleuca* between 'Abundant' and 'Common' (again, for all sites where infralittoral data were gathered), it has not been possible to make direct comparisons of these abundances with the present density figures.

* For kelp plants, 'Abundant' = 1-9 plants / m^2 ; and 'Common' = 1-9 plants / 10 m^2 (Hiscock 1996)

5.13 The ratios of *Laminaria hyperborea* to *Laminaria ochroleuca* at Little Arthur (**5.5 : 1** with 181 individual plants of both species counted) and at Brodfield (**4.1 : 1** with 113 individual plants counted) were found to be very similar (Figure 12). However, the site at Little Arthur is relatively sheltered while that at Brodfield is probably more exposed, though both are likely to be sheltered from tidal streams. In addition, the counts at Little Arthur were undertaken within the depth range of 6.7 – 9.7 m (bcd), while those at Brodfield were a little deeper (9.0 – 11.0 m bcd). The differences in shelter/exposure, and possibly the depth at which the counts were made, reflect the different (though quite similar in terms of species composition) biotopes:

- Little Arthur: IR.LIR.K.LhypLoch (Mixed *Laminaria hyperborea* and *Laminaria ochroleuca* forest on moderately exposed or sheltered infralittoral rock); and
- Brodfield: IR.HIR.KFaR.LhypR.Loch (Mixed *Laminaria hyperborea* and *Laminaria ochroleuca* forest on exposed infralittoral rock).

5.14 The ratio of *Laminaria hyperborea* to *Laminaria ochroleuca* at Menawethan (**58.5 : 1** with 357 individual plants counted) shows considerable dominance of *L. hyperborea* at this site (Figure 12), within the depth range of 3.2 – 10.8 m (bcd). The average density of individual plants (of both species) was also particularly high at this site, at 12.1/m^2. Both of these findings may be a reflection of the shallower depth of this site.

5.15 The tide-swept site at Menglow Reef had a *L. hyperborea* : *L. ochroleuca* ratio of **0.4 : 1** (123 individual plants counted), with a noticeable predominance of *L. ochroleuca* (Figure 12). Recording here was undertaken at a deeper depth range than the other sites (9.1 – 13.0 m bcd), and it is known that *L. ochroleuca* tends to become the more dominant kelp at deeper depths within the infralittoral (Dipper 1981), so this may well explain the predominance of *L. ochroleuca* at this site.

5.16 It should be noted that there was little noticeable difference between the numbers of each species of kelp recorded within each quadrat between the two recorders (CP & GB). The numbers of 'young plants' was the most variable category between the two recorders. This category may have been used for plants of indeterminate identification too (besides young plants).

5.17 It will be important when repeats of this study are carried out that records are taken from very similar depth bands at each site to those from where recordings were made during the current study. In other words, divers will need to go down to the site with a specific 'below sea level target

depth' written on their slates. It will also be important for all recorders to be familiar with the differences between the two species prior to the study being carried out.

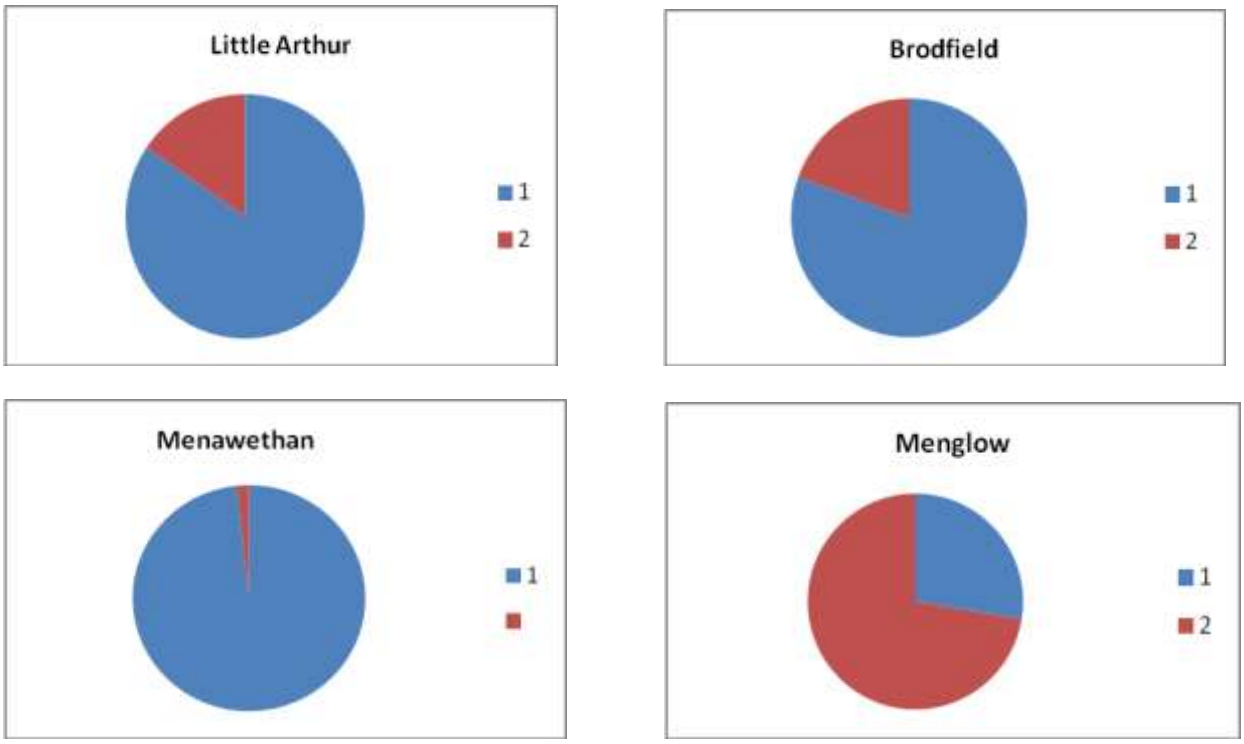


Figure 12 The ratios of *Laminaria hyperborea* (blue) to *Laminaria ochroleuca* (red) plants at the four monitoring sites in 2011

Maximum depth of kelp

5.18 In addition to undertaking Task A2, notes were taken of the maximum depth at which kelp plants were recorded from various sites. These data are set out in Table 10 below. These data may be of use for comparisons with other studies in the future.

Table 10 Maximum depths recorded of kelp species at various sites

Peninnis Head, St Mary's	*Laminaria hyperborea* & *Saccarhina latissima* recorded at 22 m bsl (20.9 m bcd) at their deepest point.
Hoe Point	No kelp seen
Gugh Reef	GB recorded *Laminaria ochroleuca* at 21.5 m bsl (17.2 m bcd) on top of a pinnacle. Other notes included the kelp park being dominated by *Laminaria ochroloeuca* with occasional *L. hyperborea* and an understorey of red algae. The deepest depth at which *Laminaria ochroleuca* was recorded was 23.5 m bsl (19.2 m bcd).
NW Flat Ledges	GB recorded *L. ochroleuca* sporeling recorded at 26.3 m (bsl) (23.2 m bcd). [RI comments that one should be very cautious about identifying a kelp sporeling to species level, as it is next to impossible to do with any confidence. Suggest this should just be '*Laminaria* sporeling', although given the depth it is more likely to be *L. ochroleuca*.].

5.19 The maximum depth to which kelp plants can grow gives a measurable index of water clarity (or water turbidity, viewed another way). A standardised measure of kelp depth has been developed by those monitoring rocky reefs within SACs off the Welsh coast on behalf of the Countryside

Council for Wales (Whittington *et al*., 2007). Briefly, this method is as follows: a suitable site consisting of steeply sloping bedrock is required. The site should provide a suitable even transition from kelp forest to kelp park and into the upper circalittoral. A 3 m long pole is held horizontally and moved from the deepest zone up the cliff by two divers. A series of depths are noted at which kelp plants are encountered, with the stipes of separate plants touching the pole at the same time. Recordings would be noted for the depth the first single kelp plant is encountered; the first 3 kelp plants (regarded as the max. depth of the kelp park); and of the first six plants (max. depth of the kelp forest).

5.20 Had time allowed, it was hoped to have undertaken this method at the Isles of Scilly as part of this monitoring programme. It is recommended that this task be incorporated into any future rocky reefs monitoring programme for the Isles of Scilly.

A3: Algal species richness & diversity of red algae within the kelp forest

Method

Table 11 Summary table of target, baseline, methods and rationale for the 'red algal species richness & diversity' attribute (Task A3) of the reef sub-feature 'kelp forest communities'

Sub-feature: (A)	**Kelp Forest Communities**
Attribute: (A3)	**Species composition of characteristic biotopes within kelp forests: monitoring the diversity of red algal species**
Target:	Presence and abundance of composite species should not deviate significantly from an established baseline, subject to natural change.
Baseline:	The diversity of algal species within kelp forests was recorded by Hiscock (1983). The species recorded for the Algal Diversity task were selected from Hiscock's (1983) initial list.
Summary of Method:	This study incorporated two methods: the first assessed the *species richness* of the red algae present within the kelp forest (i.e. the variety of species present); and the second assessed their *diversity* (which also takes into account their relative abundance). Both methods could be undertaken at the same site and simultaneously (if required). **Algal species richness**: One diver (an algal specialist) collected example specimens of all species of red algae encountered and identify as many as possible *in situ*, within a set time limit of 60 mins. This can be done within the same habitat as Task A2 (*Laminaria hyperborea* & *L. ochroleuca* population size within the kelp forest community). Recording/collection was done in 10 min. intervals, so that a cumulative species curve could be produced. Samples were collected in 6 separately labelled bags relating to each 10 min. time interval. Collected samples were identified after the dive once back on dry land, and were also pressed and kept as a reference collection. If conditions allow, these tasks should be undertaken at an exposed as well as a sheltered site. **Algal diversity**: The presence/absence of 9 pre-selected species was recorded from within randomly-placed 0.5 m x 0.5 m 3-sided quadrats within areas where *L. hyperborea* predominated. Red algae growing on both the rock surface and on kelp stipes were taken into account. Records were taken from as many quadrats as possible within the dive time, using a pre-prepared recording form. The pre-selected characterising red algal species were (in no particular order): *Kallymenia reniformis* *Delesseria sanguinea* *Membranoptera alata* (partic. on kelp stipes) *Phycodrys rubens* (partic. on kelp stipes) *Heterosiphonia plumose* *Pterosiphonia parasitica* *Sphaerococcus coronopifolius* *Dilsea carnosa* *Halurus equisetifolius*
Rationale:	Some of the red algal species occur in exposed kelp forests, while others occur in moderately sheltered or sheltered conditions. Some have distributions limited to the SW, while others have wider distributions which cover the much of Britain and Ireland. They have also been chosen to be fairly distinct in terms of their shape and form.

Table continued...

QA assists:

Kallymenia reniformis

Delesseria sanguinea

Membranoptera alata

Phycodrys rubens

Heterosiphonia plumosa

Pterosiphonia parasitica

Sphaerococcus coronopifolius

Halurus equisetifolius

Dilsea carnosa

Results

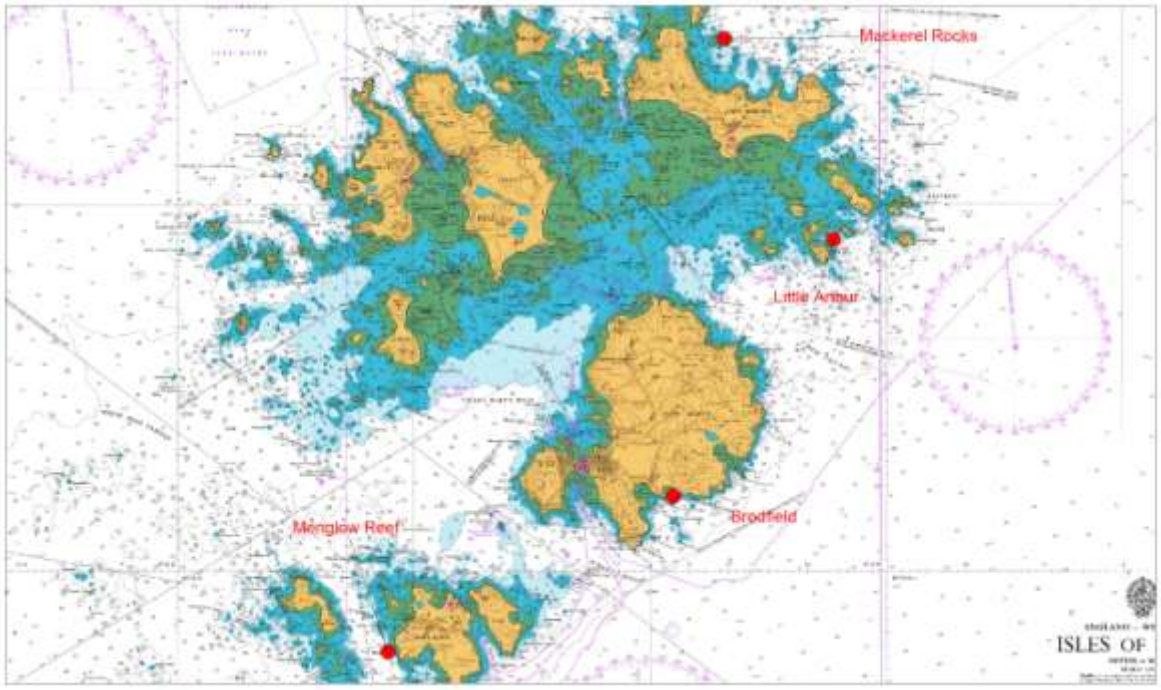


Figure 13 Location of sites where Task A3 was undertaken

Table 12 Information relevant to sites where Task A3 was undertaken

Site name	Lat./Long.	Date visited	Depth range		Divers
			(BSL)	(BCD)	
Little Arthur, Eastern Isles[1]	49° 56.712' N 006° 15.679' W	06-Jun-11	8.0 – 11.0 m	6.7 – 9.7 m	KN/(CW)
Brodfield, St Mary's[1]	49° 54.613' N 006° 17.713' W	06-Jun-11	11.0 – 13.0 m	9.0 – 11.0 m	KN/(CW)
Menglow Reef, St Agnes[1]	49° 53.340' N 06° 21.333' W	09-Jun-11	12.1 – 16.0 m	9.1 – 13.0 m	KN/(CW)
Mackerel Rocks, St Martin's[2]	49° 58.354' N 06° 17.059' W	13-Jun-11	16.9 – 19.7 m	12.1 – 14.9 m	CP/GB/KC

[1]An assessment of algal **species richness** was undertaken at these three sites

[2]An assessment of algal **diversity** was undertaken at this single site

Algal Species Richness

5.21 The algal species richness assessment task (Task A3 (i)) was undertaken at three sites: Little Arthur (Eastern Isles), Brodfield (east coast of St Mary's) and Menglow Reef (south-west coast of St Agnes). These sites were selected as being representative of a range of energy levels from sheltered to exposed and tide-swept. Records at all three sites were undertaken on upward-facing bedrock, from horizontal to gently sloping, in the upper infralittoral. All three sites comprised mixed *Laminaria hyperborea* and *Laminaria ochroleuca* kelp forest and recording was undertaken at the same time as Task A2 (*Laminaria hyperborea & L. ochroleuca* population size within the kelp forest community) at these same sites. The biotopes recorded at these sites were IR.HIR.KfaR.LhypR.Loch at the exposed Brodfield and tide-swept Menglow sites; and IR.LIR.K.LhypLoch at the relatively sheltered site of Little Arthur (see Table 12 for an explanation as to how the biotopes were determined). The species of macroalgae recorded at the three sites of Little Arthur, Brodfield and Menglow are set out in Table 13.

Table 13 The determination of kelp biotopes for each of the three sites

Kelp ratio	Density of *L. hyperborea* / *L ochroleuca* per m^2	SACFOR abundance	Energy regime	Biotope
Little Arthur	4.9 / 0.9 per m^2	A / C	LIR – sheltered	IR.LIR.K.LhypLoch
Brodfield	4.1 / 1.0 per m^2	A / A	HIR – exposed	IR.HIR.KfaR.LhypR.Loch
Menglow	1.2 / 3.1 per m^2	A / A	HIR – tide-swept	IR.HIR.KfaR.LhypR.Loch

The density results from Task A2 have been used to determine the SACFOR abundance (Hiscock 1996) and the corresponding biotope (Connor *et al*. 2004)

Table 14 Macroalgal species recorded from the 3 sites of Little Arthur (LA), Brodfield (B) and Menglow (M)

Species	Specimen	Site where recorded			Species	Specimen	Site where recorded		
		LA	B	M			LA	B	M
Acrosorium venulosum	Y		✓		*Laminaria hyperborea*	-	✓	✓	✓
Apoglossum ruscifolium	Y	✓	✓	✓	*Laminaria ochroleuca*	-	✓	✓	✓
Bonnemaisonia asparagoides	Y	✓	✓	✓	*Lomentaria articulata*	Y	✓	✓	✓
Brongniartella byssoides	Y	✓	✓	✓	*Membranoptera alata*	Y	✓	✓	✓
Calliblepharis ciliata	Y	✓	✓	✓	*Meredithia microphylla*	Y	✓		✓
Callophyllis laciniata	Y	✓	✓	✓	*Palmaria palmata*	Y	✓		✓
Ceramium nodulosum	PHOTO			✓	Phaeophyta indet. (crusts)	-	✓	✓	✓
Compsothamnion thuyoides	PHOTO	✓	✓	✓	*Phycodrys rubens*	Y	✓	✓	✓
Corallinaceae indet. (crusts)	-	✓	✓	✓	*Phyllophora crispa*	-		✓	
Cruoria sp.	-			✓	*Plocamium cartilagineum*	Y		✓	✓

Table continued...

Species	Specimen	Site where recorded			Species	Specimen	Site where recorded		
		LA	B	M			LA	B	M
Cryptopleura ramosa	Y	✓	✓	✓	*Polyneura bonnemaisonii*	Y	✓	✓	✓
Delesseria sanguinea	Y	✓	✓	✓	*Polysiphonia* sp.	PHOTO		✓	
Desmarestia aculeata	-	✓	✓	✓	*Pterosiphonia parasitica*	PHOTO	✓		✓
Dictyopteris membranacea	Y	✓	✓	✓	*Pterothamnion plumula*	PHOTO	✓	✓	✓
Dictyota dichotoma	Y	✓	✓	✓	*Radicilingua thysanorhizans*	PHOTO		✓	✓
Drachiella ?heterocarpa	Y	✓			Rhodophycota indet. (crusts)	-		✓	
Drachiella spectabilis	Y	✓	✓	✓	*Rhodophyllis divaricata*	Y	✓		
Erythroglossum laciniatum	Y	✓	✓	✓	*Rhodymenia pseudopalmata*	Y	✓	✓	✓
Halidrys siliquosa	-	✓	✓	✓	*Saccharina latissima*	-			✓
Halopteris filicina	Y	✓	✓	✓	*Saccorhiza polyschides*	-		✓	✓
Halurus equisetifolius	Y		✓		*Schottera nicaeensis*	Y		✓	✓
Halurus flosculosus	Y	✓		✓	*Spaerococcus coronopifolius*	Y/ PHOTO		✓	
Heterosiphonia plumosa	Y			✓	*Taonia atomaria*	Y	✓		
Hypoglossum hypoglossoides	Y		✓	✓	*Trailliella* sp.	-			✓
Kallymenia reniformis	Y	✓	✓	✓	*Ulva* sp.	Y	✓	✓	

Y='Yes' pressed specimen in herbarium; PHOTO = in situ or microscope image

Note that these were recorded within a total dive time of 60 mins. at each site

5.22 In total 50 algal species were recorded across the three sites. Pressed specimens of 31 species of red algae were made with additional *in situ* photographs, some pre-pressed photos and 5 images taken via the microscope camera (Plates 10 to 13) to verify the identification of small filamentous specimens. The end products associated with this task are:

- A catalogued herbarium of pressed specimens for future reference and QA training;
- Scans of the herbarium specimens (digital image JPEG format);
- Microscope images of small filamentous specimens (digital image JPEG format); and
- Additional images of some specimens *in situ* and some in water prior to pressing (digital image JPEG format).

Plate 10 The red alga *Bonnemaisonia asparagoides* (in a specimen tray), a species which characterised the kelp forests

Plate 11 Assorted red algae from Menglow Reef (Task A3), arranged on cartridge paper prior to pressing

Plate 12 Microscope image of the red alga *Pterosiphonia parasitica* (tetrasporangia visible in last order laterals)

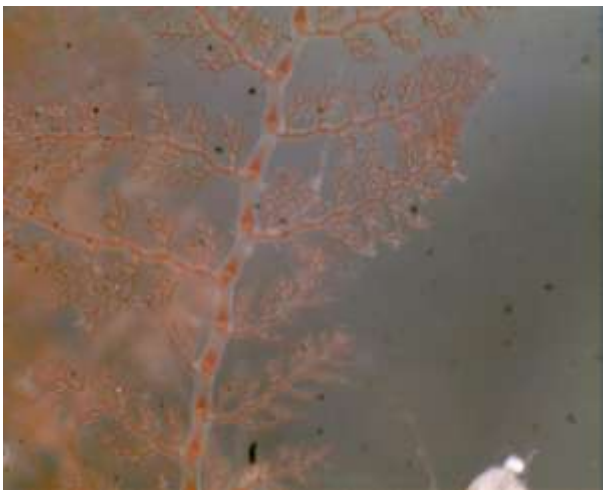


Plate 13 Microscope image of the red alga *Compsothamnion thuyoides*

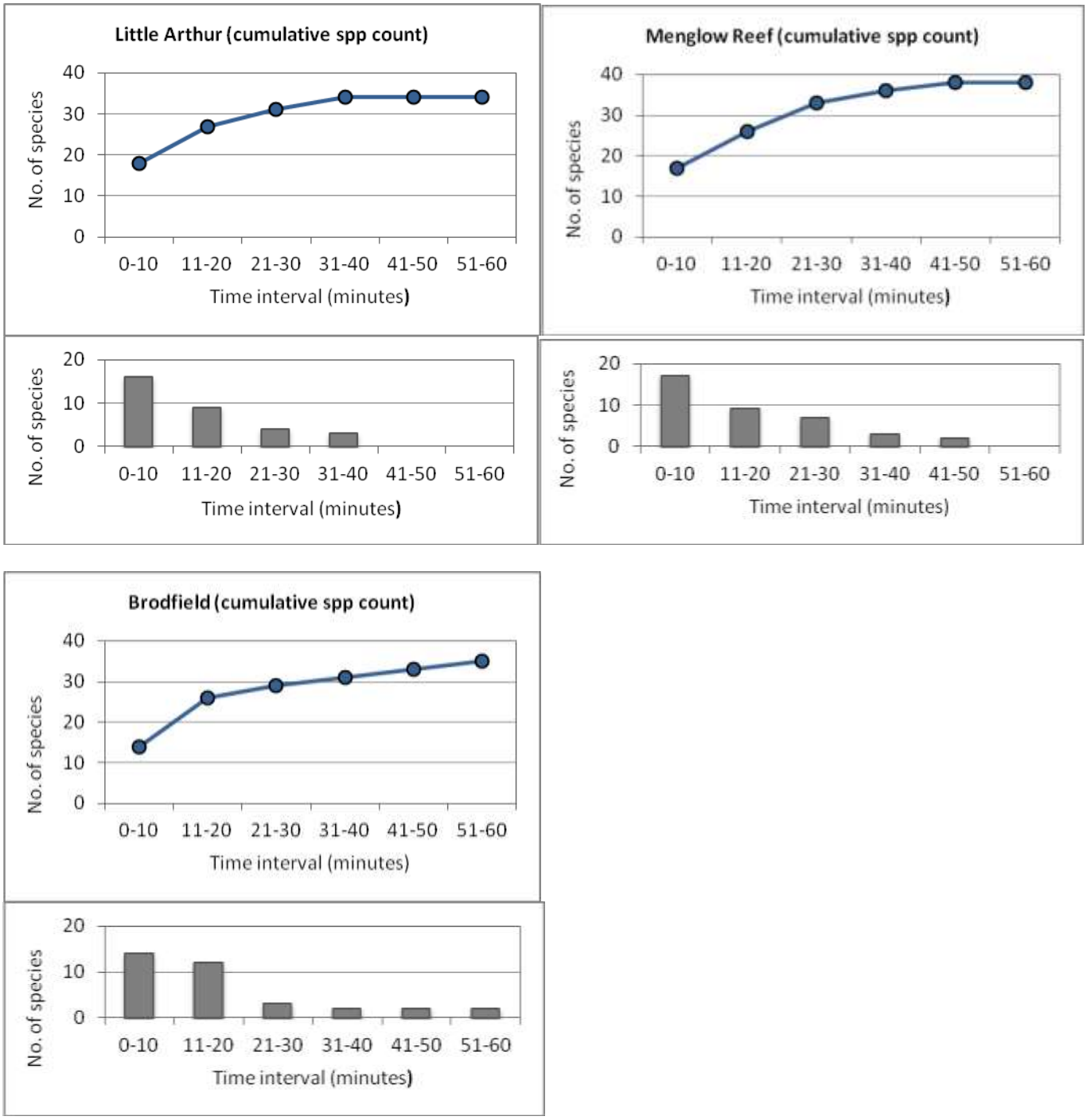


Figure 14 Cumulative species curves for macroalgal species recorded at 10 minute intervals at Little Arthur, Brodfield and Menglow Reef (upper); Quantitative representations of the number of species found per 10 minute interval from Little Arthur, Brodfield and Menglow Reef (lower)

Algal diversity

5.23 An assessment of algal diversity, using the presence/absence of nine selected species (see Table 15 below), was undertaken at just one site (Mackerel Rocks), due to time constraints. The data obtained are presented in Table 16 below.

Table 15 The pre-selected nine species used for the assessment of overall algal diversity

Kallymenia reniformis	*Pterosiphonia parasitica*
Delesseria sanguinea	*Sphaerococcus coronopifolius*
*Membranoptera alata (*partic. on kelp stipes*)*	*Dilsea carnosa*
*Phycodrys rubens (*partic. on kelp stipes*)*	*Halurus equisetifolius*
Heterosiphonia plumosa	

Table 16 The recording of pre-selected species recorded at Mackerel Rocks

Site: Mackerel Rocks **Date: 13-Jun-11**			**Recorder: CW** **Direction of transect: 30°**
Quadrat No.	**Depth (bsl)**	**Depth (bcd)**	**Listed species recorded / notes**
1	15.0 m	10.2 m	only bedrock – no algae
2	15.5 m	10.7 m	*Kallymenia reniformis*; *Heterosiphonia plumosa*
3	16.5 m	11.7 m	*Kallymenia reniformis*; *Delesseria sanguinea*; *Heterosiphonia plumosa*
4	16.4 m	11.6 m	*Kallymenia reniformis*; *Delesseria sanguinea*; *Heterosiphonia plumosa*; *Pterosiphonia parasitica*
5	18.4 m	13.6 m	*Kallymenia reniformis*; *Delesseria sanguinea*; *Heterosiphonia plumosa*; *Pterosiphonia parasitica*
6	19.0 m	14.2 m	*Kallymenia reniformis*; *Heterosiphonia plumosa*, *Halidrys siliquosa*; *Ceramium* sp.
7	18.3 m	13.5 m	vertical wall – only *Dictyota dichotoma* and *Kallymenia reniformis*.

NB For quadrats 4-7, photos are saved in 13th June/Mackerel Rocks folder

Discussion

5.24 The assemblage of species recorded for the assessment of algal richness is very similar to the assemblage recorded during the South-West Britain Sublittoral Survey in 1983 (Hiscock 1983). However, direct comparisons should not be made of the algal species recorded in 1983 with those recorded in 2011, as different techniques were employed to record the algae. Nonetheless, there would appear to be very little change during this 28 year period in the range of algae associated with the mixed kelp communities of the upper infralittoral. For instance, the variety of epiphytic algal species recorded from *Laminaria hyperborea* stipes in 1983 was found to be very similar to the stipe flora recorded in 2011.

5.25 The tide-swept site of Menglow Reef had the greatest algal species richness, with 40 species recorded. This concurred with Hiscock's findings in 1983, where the greatest number of species were found at tide-swept sites (Hiscock 1983). The relatively sheltered site of Little Arthur showed the fewest number of algal species recorded at only 34, and 37 species were recorded at

Brodfield. It should also be noted that the recording of algal species at both Menglow Reef and at Little Arthur was restricted due to diving safety considerations[5].

5.26 As can be seen from Figure 14, the cumulative species curves are flattening out towards the end of the recording period at Little Arthur and Menglow, suggesting the species count is representative of the likely total number of macroalgae to be found at these sites. The cumulative species curve at Brodfield, however, is still increasing, a possible indication that a higher species count could be achieved at that location.

[5] At Menglow reef, the algal recording diver (Task A3) was paired with a diver undertaking the quadrat counts of kelp species (Task A2). One consequence of this was that search areas for the algal recording had to be close to where the buddy diver was undertaking his quadrat counts, and search time was lost in having to follow him around. The reason why this was done was that it was considered unsafe for both divers undertaking the quadrat kelp counts to buddy each other as they could have been out of visual range of each other. At Little Arthur, the total time limit of the algal species search was reduced by 10 mins. as the buddy diver was running low on air and had to surface.

B1: Circalittoral vertical rock communities

Method

Table 17 Summary table of target, baseline, methods and rationale for the 'species composition of characteristic biotopes' attribute (Task B1) of the reef sub-feature 'vertical rock'

Sub-feature: (B)	**Vertical Rock**
Attribute: (B1)	**Species composition of characteristic biotopes on vertical rock: Presence and abundance of notable species of erect sponges, cup corals, and anthozoan communities**
Target:	Presence and abundance of composite species should not deviate significantly from the established baseline, subject to natural change.
Baseline:	None (to our knowledge) using this technique. However, a vertical circalittoral rock site at Gap Point, east side of St Mary's, was established as a photographic monitoring site in the 1980s (see Fowler & Pilley 1992), but has only been re-photographed on a couple of occasions since, most recently by Keith Hiscock in 2010 (K. Hiscock, *pers. comm.*).
Comment:	After discussions with the Project Officer, only vertical rock communities within the circalittoral zone were targeted for this study. This reflected the described biotopes (see below). CR.HCR.Xfa.SpAnVt (Sponges and anemones on vertical circalittoral bedrock); CR.HCR.Xfa.CvirCri (*Corynactis viridis* and a mixed turf of crisiids, *Bugula*, *Scrupocellaria* and *Cellaria* on moderately tide-swept exposed circalittoral rock); CR.MCR.EcCr.CarSp (*Caryophyllia smithii*, sponges and crustose communities on wave-exposed circalittoral rock);and CR.FCR.Cv.SpCup (Sponges, cup corals and anthozoans on shaded or overhanging circalittoral rock).
Summary of Method:	Circalittoral vertical rock exposures need to be between 1.5 m and 6.0 m high to be suitable. Once a suitable vertical face was located, a tape was reeled out from the top to the bottom of the feature, forming the mid-line of the transect. The distance on the tape at the start of the transect was noted, together with the depth. To assist with marking each horizontal band, the diver used a 1 m stick held at right-angles to one side of the tape. At 30 cm intervals along the main transect tape, the rod was held horizontally, close to the rock and those characterising species (see list below) which lay between 30 cm and 35 cm on the transect tape (i.e. a 5 cm wide band, 100 cm in length) were noted on the recording form (see Appendix 4) as being 'present' – indicated by a single '1' (using the 5-bar gate notation). This was done for both solitary and colonial forms. Thus a series of rectangular 'quadrats', each of 100 cm by 5 cm or 0.05 m^2, were recorded. In future, the intention is for transects to be positioned within the same location, but not to required precise relocation in a former position. Only the presence of those species listed on the recording form was noted. Finally, the distance on the tape at the top end of the transect was noted, together with the depth. As many belt transects as possible were undertaken within the time limit of the dive. The belt transect was then video-ed by a dedicated videographer. The purpose of the video was to allow for QA checks to be made at some later stage of the *in situ* species recording. 22 species regarded as being 'characteristic' of circalittoral vertical rock, from exposed to sheltered (wave action) & exposed to semi-exposed (tidal streams), were included on the recording form (selected from Hiscock, 1983): *Axinella dissimilis* *Tethya citrina* *Cliona celata* *Hemimycale columella* *Dysidea fragilis* *Haliclona amose* *Alcyonium digitatum* *Alcyonium glomeratum* *Corynactis viridis* *Actinothoe sphyrodeta* *Sagartia elegans* *Leptopsammia pruvoti* *Caryophyllia smithii* *Hoplangia durotrix* *Parazoanthus axinellae* *Parazoanthus anguicomis* *Echinus esculentus* *Marthasterias glacialis* *Holothuria forskali* *Antedon bifida* *Clavelina lepadiformis* *Stolonica socialis*

Table continued...

Rationale:	This method provides a straightforward means of being able to assess, with reasonable accuracy, the abundance of various 'characterising' species from this sub-feature. Clearly, the more (or longer) transects that can be recorded, the more accurate the assessment will be. The species were selected for their ease of identification and their conspicuousness. Together they provide examples from across the main benthic taxa represented within this sub-feature. The above list of species should be used as a 'core' list. Additional species *may* be added to it in future if thought necessary, though this will restrict the use of historical comparisons.

Results

5.27 The assessment of circalittoral vertical rock communities (Task B1) was undertaken at three sites (Figure 15 and Table 18).

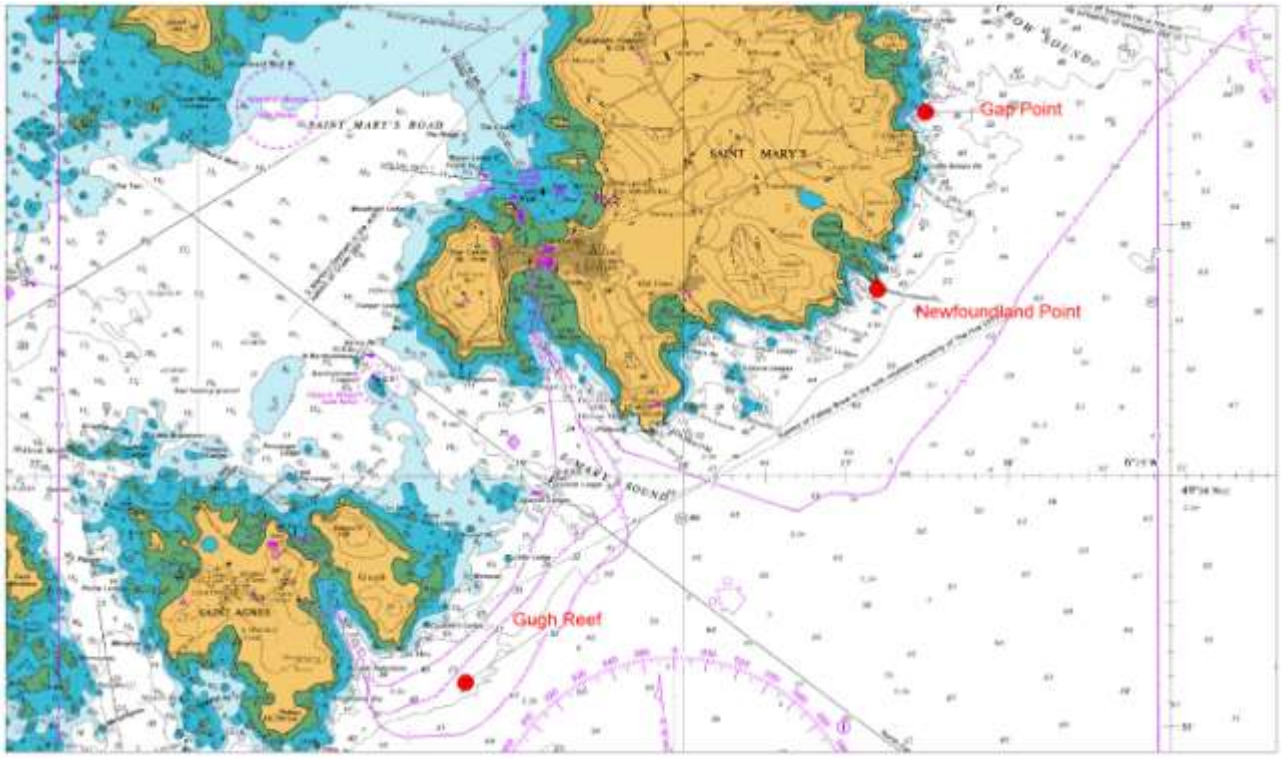


Figure 15 Location of the 3 sites where Task B1 was undertaken

Table 18 Information relevant to sites where Task B1 was undertaken

Site name	Lat./Long. (of marker shot)	Date(s) visited	Transect no./length	Depth range (BSL)	Depth range (BCD)	Diver
Gap Point, St Mary's	49° 55.452' N 006° 16.508' W	07-Jun-11	1 2.0 m	24.0 – 26.0 m	21.0 – 23.9 m	AC
		13-Jun-11	2 1.8 m	22.2 – 24.0 m	20.1 – 21.9 m	KC
		13-Jun-11	3 1.8 m	22.2 – 24.0 m	20.1 – 21.9 m	CP
Newfoundland Point, St Mary's	49° 54.746' N 006° 16.804' W	08-Jun-11	1 5.1 m	21.0 – 26.0 m	16.3 – 21.3 m	KC
		08-Jun-11	2 4.5 m	24.0 – 29.5 m	19.3 – 24.8 m	CP
Gugh Reef, St Agnes	49° 53.190' N 06° 19.345' W *	10-Jun-11	1 5.1 m	23.0 – 28.0 m	18.7 – 23.7 m	AC
		10-Jun-11	2 1.5 m	25.3 – 27.1 m	20.6 – 22.8 m	CP
		10-Jun-11	3 0.9 m	25.5 – 26.5 m	20.8 – 22.2 m	CP

* Note: actual site position at Gugh Reef taken from divers' SMB as being 49° 53.180' N, 06° 19.345' W

Gap Point, St Mary's

5.28 Three attempts were made to obtain data from this site, the first two being thwarted by poor weather conditions with the third visit being successful.

Site Description

5.29 Gap Point lies off the eastern side of St Mary's. It is largely sheltered from both wave action and tidal streams, which leads to it being a particularly silty site. There are large canyons and gullies here dropping down to 24 m (bcd), with vertical walls and occasional horizontal 'stepped' ledges and terraces. The circalittoral communities are dominated on upward-facing surfaces by erect branching sponges, *Nemertesia antennina* and *Alcyonium digitatum*; and on vertical surfaces by encrusting sponges, *Parazoanthus axinellae*, *Alcyonium glomeratum* and (rarely) *Leptopsammia pruvoti*.

Site diagram

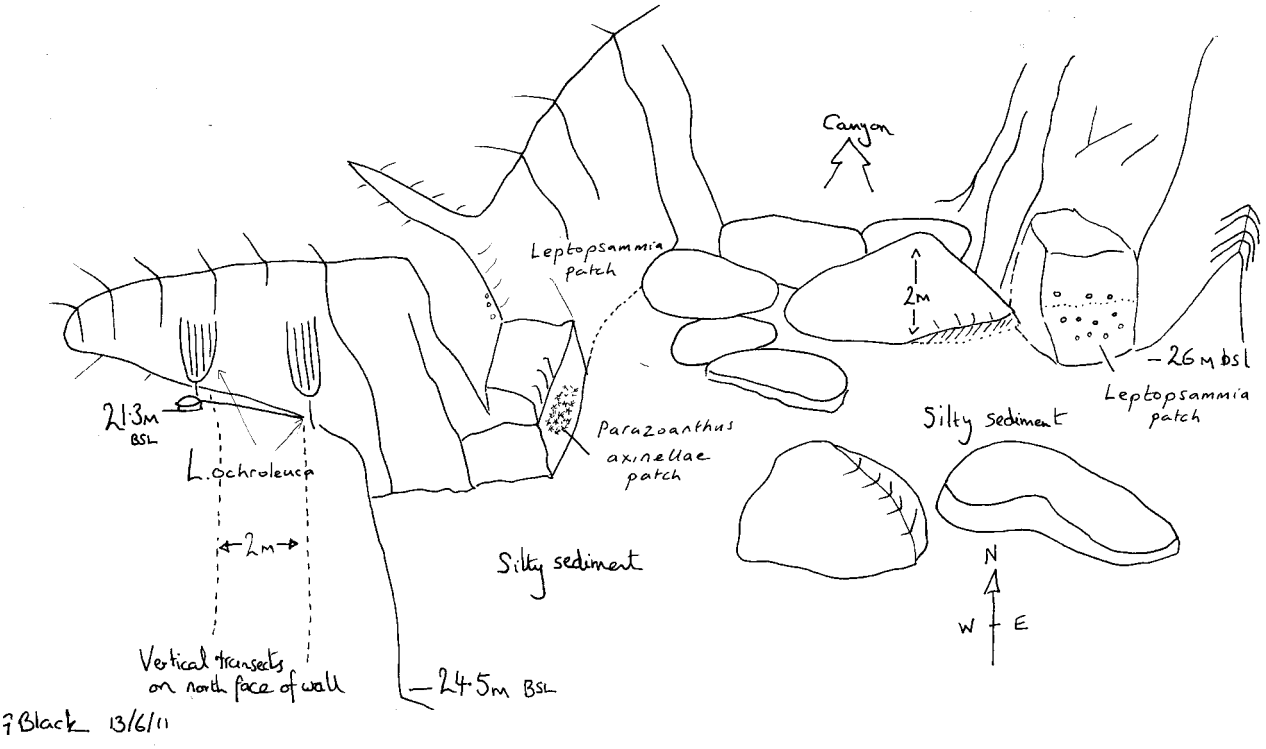
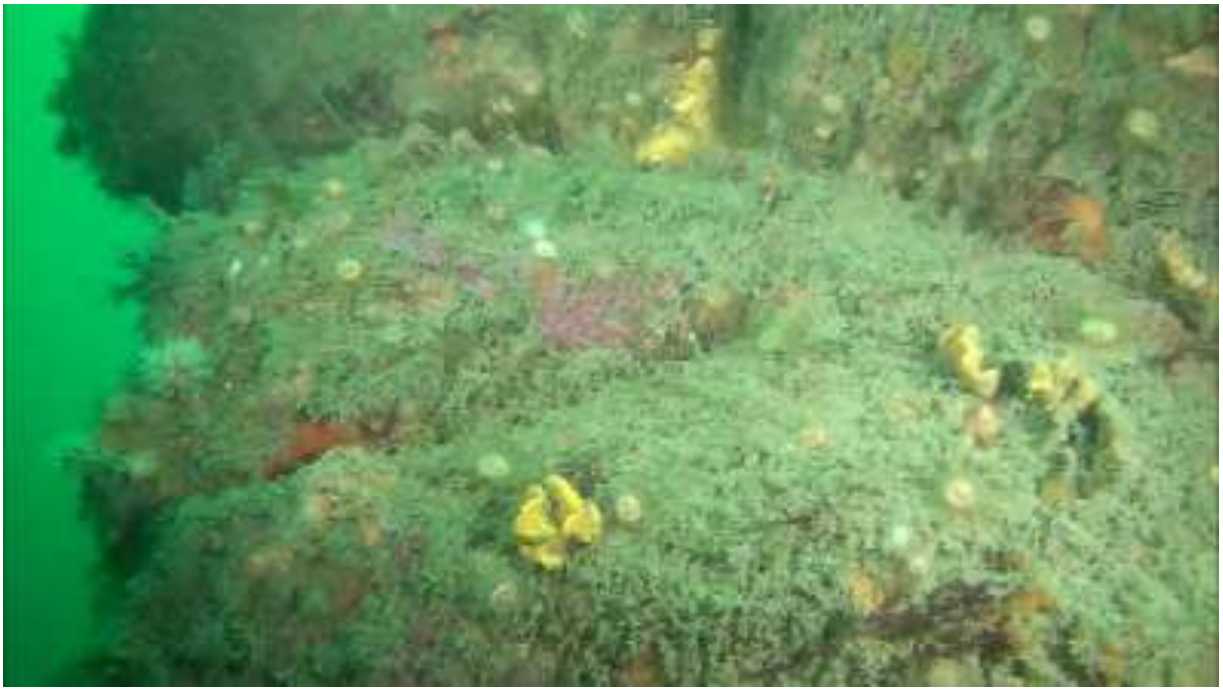


Figure 16 Sketch of the Gap Point site where monitoring of circalittoral vertical bedrock took place. Three short (~2 m) transects were undertaken here. The location of patches of the sunset cup coral Leptopsammia pruvoti (video-ed) and the yellow cluster anemone *Parazoanthus axinellae* are shown.

Video review of site

5.30 A total of 21 video clips (ranging in duration from 00:09 – 04:38 mins.) were taken at Gap Point. These were mostly of the vertical rock communities themselves (particularly where *Leptopsammia pruvoti* occurred), though there were also clips of divers actually recording from the vertical transects. Full details of each clip are included in the Video Log (see Appendix 3). Representative video screen grabs are presented below as Plates 14 & 15.



[Video file: 13-Jun-11 Gap Point/Gap Point 13 June 2011 012]

Plate 14 Video screen grab (snapshot 12) from Gap Point, showing edge of vertical section of bedrock wall

[Video file: 13-Jun-11 Gap Point/Gap Point 13 June 2011 012]

Plate 15 Video screen grab (snapshot 10) from Gap Point, showing circalittoral vertical rock community with the tunicate *Stolonica socialis* (centre) and two sunset cup corals *Leptopsammia pruvoti* (top left & lower right)

Newfoundland Point, St Mary's

Site Description

5.31 Newfoundland Point lies on the south-east side of St Mary's. The granite bedrock here drops away from the infralittoral kelp-dominated zone as a series of vertical walls with occasional

horizontal platforms, down to a silty seabed at approximately 25.3 m (bcd). The vertical walls are dominated by *Corynactis viridis* and encrusting coralline algae, together with occasional *Alcyonium digitatum*, *A. glomeratum*, encrusting sponges such as *Hemimycale columella* and massive sponges such as *Cliona celata*. Sloping surfaces have clumps of *Alcyonium glomeratum* and erect axinellid sponges, many of which have featherstars *Antedon bifida* attached to them. Also present are small *Sabella pavonina* tubes, the hydroid *Halecium halecinum* and the encrusting sponges *Hemimycale columella* and *Ciocalypta penicillus*, together with *Suberites carnosus*.

5.32 Re-location of vertical transects: to the SE of the pinnacle there are two vertical faces at 90° to each other. The vertical transects were laid on the slightly angled ledges at the base of these vertical walls, at between 16.3 – 17.8 m (bcd). A large patch of plumose anemones *Metridium senile* was present on the east-facing wall. The walls themselves have a diverse fauna dominated largely by jewel anemones *Corynactis viridis* and abundant sponges, with a short faunal turf with hydroids, bryozoans and ascidians (especially *Stolonica socialis*).

Site diagram

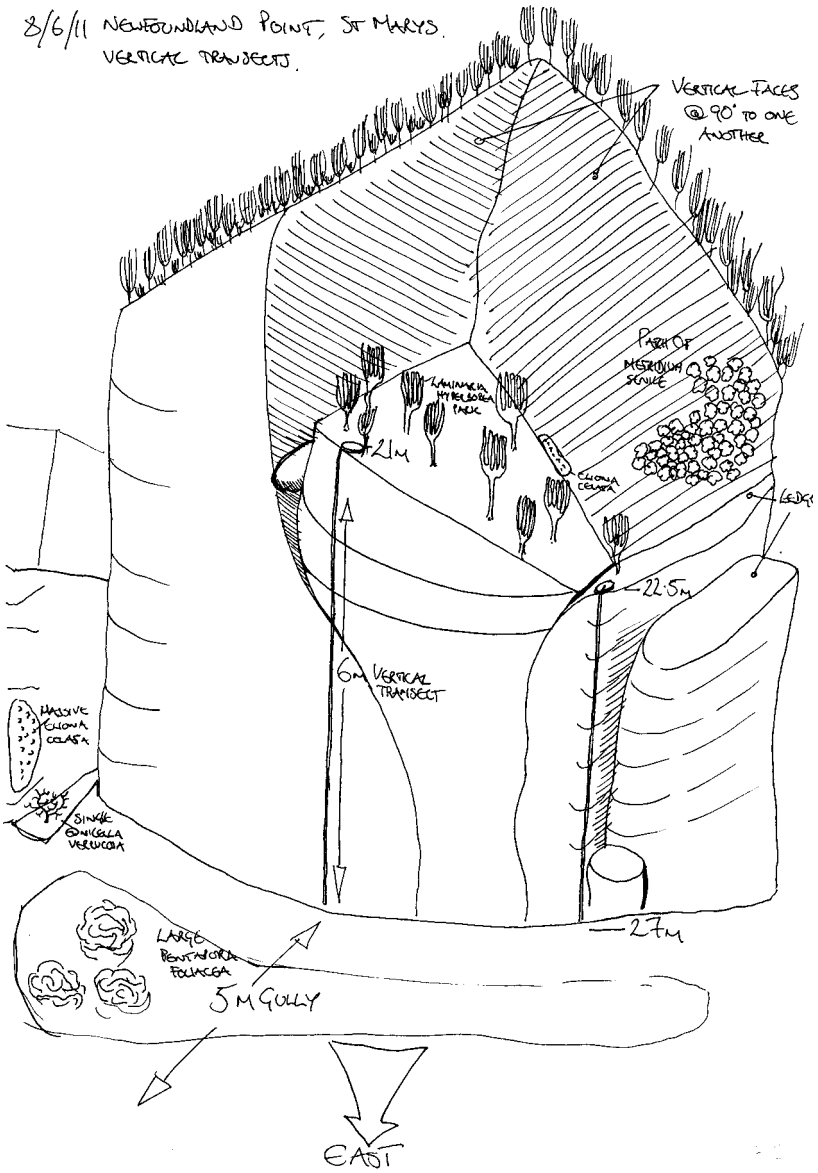


Figure 17 Sketch of the site at Newfoundland Point where monitoring of circalittoral vertical bedrock took place. The location of the two transects (one 6 m long and the other 4.5 m long) are shown.

Video review of site

5.33 A total of 24 video clips (ranging in duration from 00:04 – 03:29 mins.) were taken at Newfoundland Point. These were mostly of vertical rock communities, though there were also clips of divers recording from the vertical transects. Full details of each clip are included in the Video Log (see Appendix 3). Representative video screen grabs are presented below as Plates 16 & 17.

[Video file: 08-Jun-11 Newfoundland Pt AC / 08 June 2011 Newfoundland Pt AC 002]

Plate 16 Video screen grab from Newfoundland Point, showing circalittoral vertical rock community with scattered jewel anemones *Corynactis viridis* (pinkish form), bryozoan turf (grey-brown colour) and orange encrusting *Hemimycale columella* sponge (centre)

[Video file: 08-Jun-11 Newfoundland Pt AC / 08 June 2011 Newfoundland Pt AC 005]

Plate 17 Video screen grab from Newfoundland Point, showing short bryozoan turf with a spiny starfish *Marthasterias glacialis* and a clump of red sea fingers *Alcyonium glomeratum*

Gugh Reef, St Agnes

Site description

5.34 The site at Gugh Reef consists of a rounded granite pinnacle rising to 17.2 m (bcd) topped by sparse kelp park (*Laminaria ochroleuca* dominated with occasional *Laminaria hyperborea*) down to 19.2 m (bcd). The algal understorey features *Kallymenia reniformis* and *Delessaria sanguinea*. The pinnacle descends to the NNW steeply in a series of “steps” which become closer to a vertical orientation with depth.

5.35 Immediately below the kelp, the rock surface is dominated by *Metridium senile* and low lying *Pentapora foliacea* colonies. A deep crevice (ca. 0.5 m wide) runs down the vertical face of the pinnacle, in which *Corynactis viridis*, *Alcyonium digitatum*, *Caryophyllia smithii, Cliona celata* and possibly *Stelligera stuposa* were all present. Both vertical transects were placed to the left of this obvious crevice (one on the corner of the crevice and the other 2 m further to the left as the pinnacle is faced).

5.36 The following species were recorded during the visit to this site on 10th June 2011:

- *Laminaria ochroleuca*
- *Laminaria hyperborean*
- *Delessaria sanguine*
- *Kallymenia reniformis*
- *Metridium senile*
- *Pentapora foliacea*
- *Sagartia elegans*
- *Corynactis viridis*
- *Nemertesia antennina*
- *Cliona celata*
- *Holothuria forskali*
- *Luidia ciliaris*
- *Alcyonium digitatum*
- *Stelligera stuposa* (?)

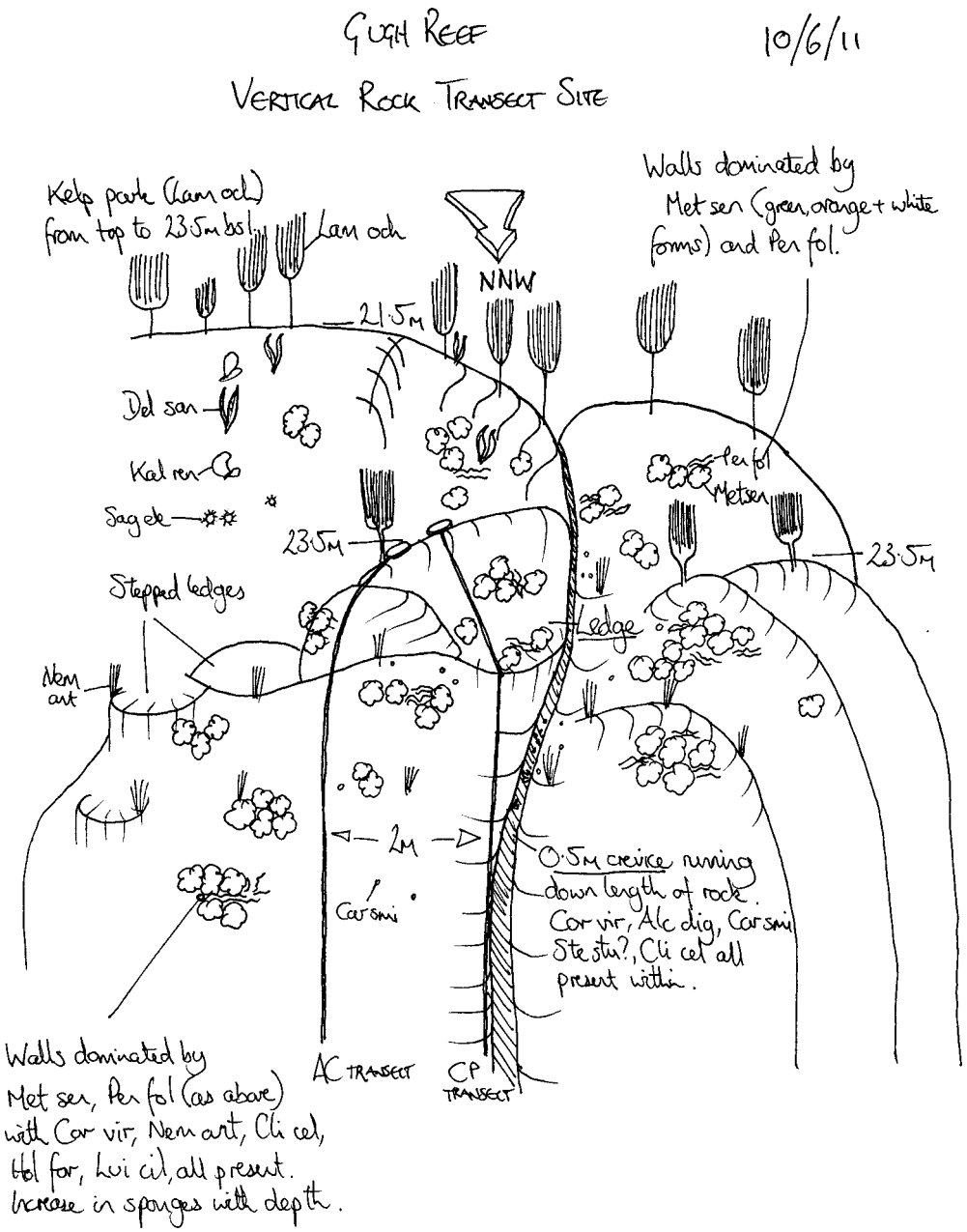
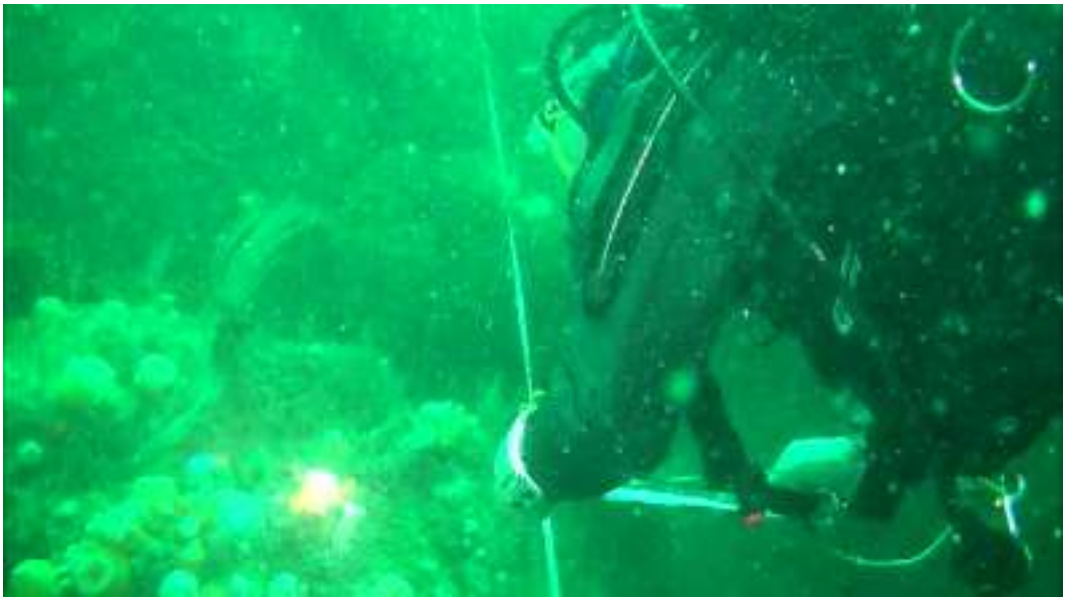


Figure 18 Sketch of the site at Gugh Reef where monitoring of circalittoral vertical bedrock took place. Three transects (5 m long, 1.5 m long and 0.9 m long) were undertaken here

Video review of site

5.37 A total of 11 video clips (ranging in duration from 00:08 – 03:09 mins.) were taken at Gugh Reef. These were mostly of vertical rock communities, though there were also clips of divers recording from the vertical transects. Full details of each clip are included in the Video Log (see Appendix 3). Representative video screen grabs are presented below as Plates 18 & 19.



[Video file: 10-Jun-11 Gugh Reef / Gugh Reef (7) cp L]

Plate 18 Video screen grab from Gugh Reef, showing a diver (whose torch beam is lighting up an area of rock) recording species adjacent to the vertical transect tape

[Video file: 10-Jun-11 Gugh Reef / Gugh Reef (8)]

Plate 19 Video screen grab from Gugh Reef, showing a diver recording species adjacent to the vertical transect tape. The bedrock here is dominated by white plumose anemones *Metridium senile*

Table 19 Summary of data from vertical transects undertaken at Gap Point, Newfoundland Point and Gugh Reef

Site:	Gap Point			N'fdl'd Pt.		Gugh Reef		
Vertical transect no.	1	2	3	1	2	1	2	3
Recorder	AC	KC	CP	KC	CP	AC	CP	CP
Vertical transect length (m)	2.0	1.8	1.8	5.1	4.5	5.1	1.5	0.9
Area covered (m^2)	0.2	0.35	0.35	0.9	0.8	0.9	0.3	0.2
Species (totals for given area)								
Axinella dissimilis	3	0	3	0	2	0	0	0
Tethya citrina	0	0	0	0	0	2	0	0
Cliona celata	0	0	0	0	0	0	0	0
Hemimycale columella	0	3	0	0	8	0	0	0
Dysidea fragilis	3	0	1	0	5	0	1	0
Haliclona viscosa	0	0	2	0	0	0	0	0
Alcyonium digitatum	1	1	0	5	2	1	4	0
Alcyonium glomeratum	2	2	3	1	0	2	0	0
Corynactis viridis	0	7	6	18	16	16	6	2
Actinothoe sphyrodeta	0	0	0	0	0	1	0	0
Sagartia elegans	0	0	0	0	0	5	6	0
Leptopsammia pruvoti	0	0	2	0	0	0	0	0
Caryophyllia smithii	4	7	7	6	4	0	0	0
Hoplangia durotrix	0	0	0	0	0	0	0	0
Parazoanthus axinellae	0	2	0	0	0	0	0	0
Parazoanthus anguicomis	0	0	0	0	0	0	0	0
Echinus esculentus	0	0	1	2	1	0	0	0
Marthasterias glacialis	0	0	0	3	0	0	0	0
Holothuria forskali	0	2	0	0	1	0	0	0
Antedon bifida	0	0	0	0	0	0	0	0
Clavelina lepadiformis	0	0	0	4	0	0	0	0
Stolonica socialis	4	0	0	0	0	0	0	0
Biotopes represented:	CR.HCR.Xfa.SpAnVt			CR.HCR.Xfa.SpAnVt		CR.HCR.Xfa.CvirCri		
	CR.FCR.Cv.SpCup			CR.MCR.EcCr.CarSp		CR.HCR.Xfa.SpAnVt		

Numbers given represent the total number of '1's (indicating the 'presence' of an individual) recorded for that particular species within successive areas of 100 cm x 5 cm covered on each horizontal 1 m recording 'bar', inspected at 30 cm vertical intervals

See also Appendix 6 – for all data recorded from these sites

Discussion

Method

5.38 The method for monitoring of circalittoral vertical bedrock communities takes into account the fact that, without permanent fixtures or topographical features to which transects can be attached or quadrats can be hung, the community on an exact patch of rock is not going to be re-assessed for the next (or any subsequent) monitoring visit. The whole premise of this type of sampling is its randomness but, as the circalittoral vertical bedrock biotopes which are being sought are restricted to just a few sites, some measure of the re-location of monitoring locations under water is desirable. It is important to remember that it is not how any particular individual sessile animal fares over time which is of relevance here but rather how the community as a whole fares, and for that to be done, representative samples from within that community/biotope are required.

5.39 Video clips of the site as a whole, and also of the transects themselves, provide a visual record of the site and can be important not only in checking the accuracy of the recording but also in giving an overview of the community as a whole, which can be very useful if the site(s) in question should show noticeable changes in their species composition in future.

5.40 The recording methodology used here provides an assessment of the relative abundance of the selected species, using a simplified scale. Future analysis of these categorical data (after further visits) can be undertaken by using a statistical package such as Primer. Simper analyses will provide an assessment of differences within the recorded communities, and MDS plots will provide data clusters based on time or ecological zone differences.

Biotopes represented

5.41 The task in question (B1 – Species composition of characteristic biotopes on vertical rock: presence and abundance of notable species of erect sponges, cup corals, and anthozoan communities) was undertaken at three sites: Gap Point, Newfoundland Point and Gugh Reef. Although all of these sites occur off the east to south-east coasts of their respective islands, they are still likely to experience considerable exposure to wave action from time to time, though exposure to tidal streams is expected to be slight.

5.42 Gap Point is relatively sheltered from wave exposure and tidal streams, with fine silty sediment accumulating on horizontal and sloping surfaces. The biotope which includes the sunset cup coral *Leptopsammia pruvoti* and the yellow cluster anemone *Parazoanthus axinellae* and which occurs on deep shaded or overhanging rock (CR.FCR.Cv.SpCup), is known to occur here, but the species present on the vertical transects indicate that each of the transects was probably within the biotope CR. HCR.XFa.SpAnVt (Sponges and anemones on vertical circalittoral bedrock).

5.43 The site at Newfoundland Point is moderately exposed to wave action and there are probably two biotopes represented on the vertical and steeply-sloping walls here: CR.HCR.XFa.SpAnVt (Sponges and anemones on vertical circalittoral bedrock) and CR.MCR.EcCr.CarSp (*Caryophyllia smithii*, sponges and crustose communities on wave-exposed circalittoral rock). It is difficult to confirm the presence of these biotopes with any certainty without a full species list and accompanying abundances.

5.44 Of the three sites, the one at Gugh Reef is the most exposed to wave action. The predominance of jewel anemones *Corynactis viridis* along the transects confirms this, as this anemone thrives at sites where water movement is strong. The presence of the biotopes CR.HCR.XFa.CvirCri (*Corynactis viridis* and a mixed turf of crisiids, *Bugula*, *Scrupocellaria* and *Cellaria* on moderately tide-swept exposed circalittoral rock) and CR.HCR.XFa.SpAnVt (Sponges and anemones on vertical circalittoral bedrock) confirms this.

5.45 Of the 21 species on the recording form, only three (*Cliona celata*, *Hoplangia durotrix* and *Parazoanthus anguicomis*) were not recorded from within the transect limits. Of these, *Hoplangia durotrix* would be restricted to the biotope CR.FCR.Cv.SpCup and its abundance within that biotope would probably be 'rare'. *Parazoanthus anguicomis* has (apparently) been recorded from the Isles of Scilly before, but its presence so far south is unusual to say the least. It appears on the species list here as it is mentioned in the original Natural England contract specification, but we would query its inclusion and usefulness. *Cliona celata* is a relatively common sponge of vertical, sloping and horizontal bedrock exposures and the fact of it not being recorded is probably a reflection of its low abundance at the sites visited.

C2: Sea fans and erect sponges

Method

Table 20 Summary table of target, baseline, methods and rationale for the 'characteristic species – sea fans and erect sponges' attribute (Task C2) of the reef sub-feature 'subtidal bedrock & boulder communities'

Sub-feature: (I)	**Subtidal bedrock & boulder communities**
Attribute: (C2)	**Characteristic species of bedrock & boulder communities: density and quality of (for example, but not limited to) pink sea fans *Eunicella verrucosa* and erect sponges**
Target:	Average density of sea fans, proportion of damaged, or epiphytes branches should not deviate significantly from an established baseline, subject to natural change.
Baseline:	There have been specific Seasearch trips which have measured the overall condition of sea fans from the archipelago (see Wood 2008). However, the general conclusion of these records was that there are "relatively few sea fans present, and it is only on two wrecks where they are common". The locations of suitable habitats/biotopes in which to put divers would rely on local knowledge.
Comment:	Likely to be based on the biotope CR.HCR.Xfa.ByErSp.Eun (*Eunicella verrucosa* and *Pentapora foliacea* on wave-exposed circalittoral rock) (Connor *et al*., 2004).
Summary of Method:	Once a suitable site was selected, a pair of divers swam along a succession of 10 m long transects in a pre-determined direction over upward-facing bedrock and boulders. The divers swam either side of the measuring tape transect and inspected each sea fan they encountered within a band width of 2 m per diver. Thus the total area covered was 40 m^2 for each 10 m transect. It was hoped that each diving pair would complete at least 4 of these 10 m transects within the limit of their dive. However, the depth and difficulties in deciding where to lay the transect meant that only one 10 m transect was undertaken by each of the two diving pairs. Results were written onto pre-prepared recording forms taken under water on A4-size slates. Predominant cover organisms on each sea fan were also noted on the recording form, as well as the presence of the sea fan nudibranch *Tritonia nilsodhneri* and/or its eggs The number of branching sponges encountered within the 10 m x 2 m belt (identified to species if possible, but not essential) was noted too. Each sea fan encountered was awarded a 'condition score', ranging from 1 to 5: Scoring system for assessing the condition of *Eunicella verrucosa* individuals (after Wood 2003, based on Irving *et al*.,1996). See also Plates below.

Score	% cover	Comment
5	Pristine or < 5%	No epibiota (or hardly any).
4	5% - 20%	Partial covering of sea fan by epibiota.
3	20% - 50%	Up to half of sea fan affected by epibiota.
2	50% - 80%	A large proportion of the sea fan has epibiota covering it, with only a small amount of 'healthy' fan apparent.
1	> 80%	Dense cover (almost total) of epibiota.

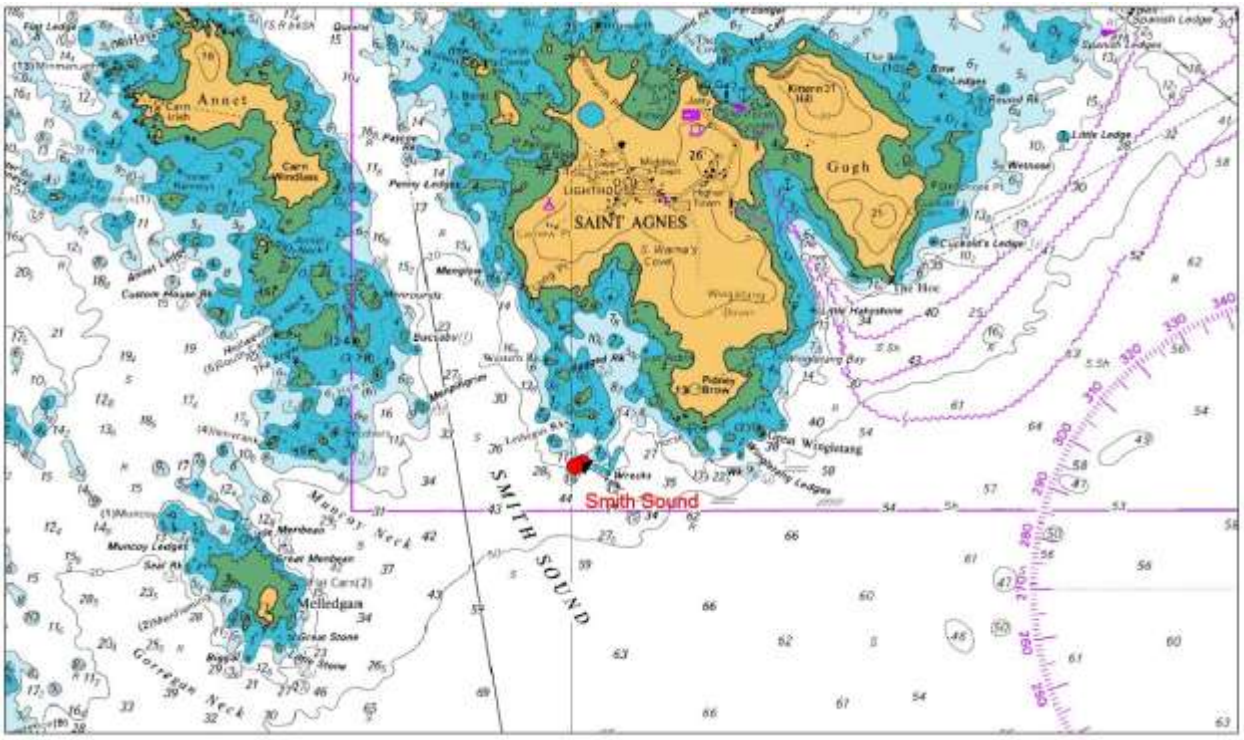
Condition Score	5	4	3	2	1
	Pristine or < 5% cover	5 – 20% cover	20 – 50% cover	50 – 80% cover	> 80% cover

Table continued...

Rationale:	Assessments of the density & condition of pink sea fans using the same methodology have been undertaken at Lundy since 1995 (see Irving & Northen 2004) as well as by Seasearch surveys (see Wood 2003 & 2008). Thus, not only will these data provide a baseline for future monitoring studies, but also meaningful comparisons can be made with populations elsewhere in the south-west.

Note that the Attribute (C1) 'Distribution and range (extent) of circalittoral biotopes on subtidal bedrock & boulders, for example, those dominated by pink sea fans (*Eunicella verrucosa*), cup corals, and *Parazoanthus axinellae*/*P.anguicomis*(?)' was not considered appropriate for monitoring using diving techniques

Results



Note that the overlapping red dots mark the location of the SMBs of the two pairs of divers

Figure 19 Location of the only site where Task C2 was undertaken

Table 21 Information relevant to sites where Task C2 was undertaken

Site name	Lat./Long. (of marker shot)	Date(s) visited	Transect length	Depth (BSL)	Depth (BCD)	Diver
Smith Sound	49° 52.846' N 006°.20.990' W	09-Jun-11	10 m	30.0 m	25.4 m	GB CW
			10 m	27.0 m	22.4 m	KC AC

Table 22 Data relating to sea fans and branching sponges surveyed

Diver	Area covered	No. of *Eunicella*	*Eunicella* condition scores (no. of fans given within each category)					*Tritonia* adults	*Tritonia* eggs	No. of erect sponges
			5 (pristine)	4	3	2	1 (>80% cover)			
GB	20 m^2	7	3	3	1	0	0	0	0	5
CW	20 m^2	8	5	1	1	1	0	2	0	12
KC	20 m^2	1	1	0	0	0	0	0	0	0
AC	20 m^2	3	3	0	0	0	0	2	0	0

Note that a '0' indicates that no sea fans or branching sponges were recorded within the confines of the belt transect, but that they may have been present in the vicinity of the transect

Description of site

5.46 The monitoring site was at the eastern end of Smith Sound, to the south of St Agnes. The seabed was of silted circalittoral bedrock and very large boulders with Devonshire cup corals *Caryophyllia smithii*, erect and massive sponges (for example, *Axinella infundibuliformis*, *Cliona celata*), with sea fans *Eunicella verrucosa* only being seen occasionally. The bedrock and boulders were heavily grazed by sea urchins *Echinus esculentus*. The shot was positioned at 18 m bsl (13.4 m bcd) from which point the divers headed due south. The site dropped off steeply beyond the area of the transect into the deep circalittoral.

Site diagram

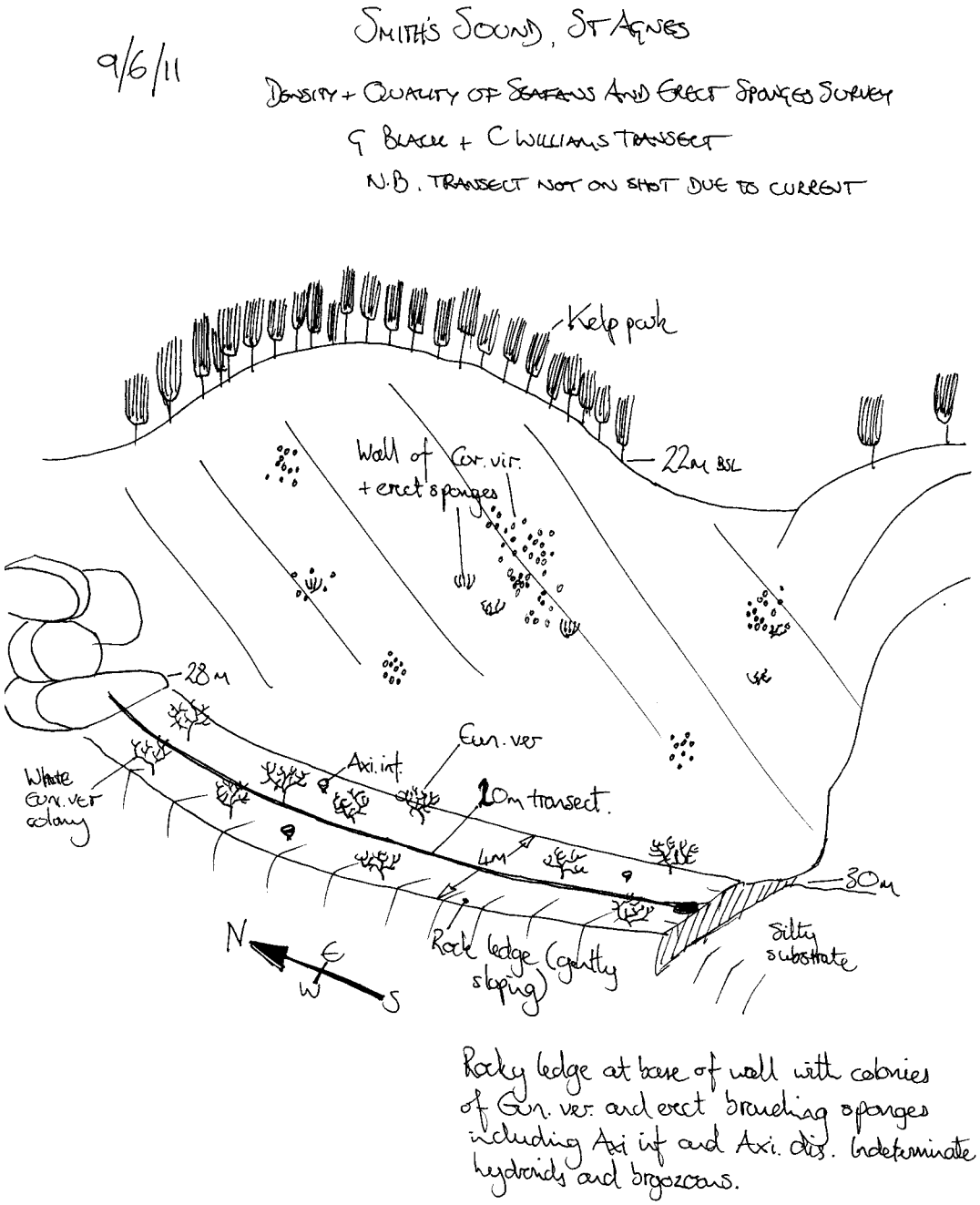
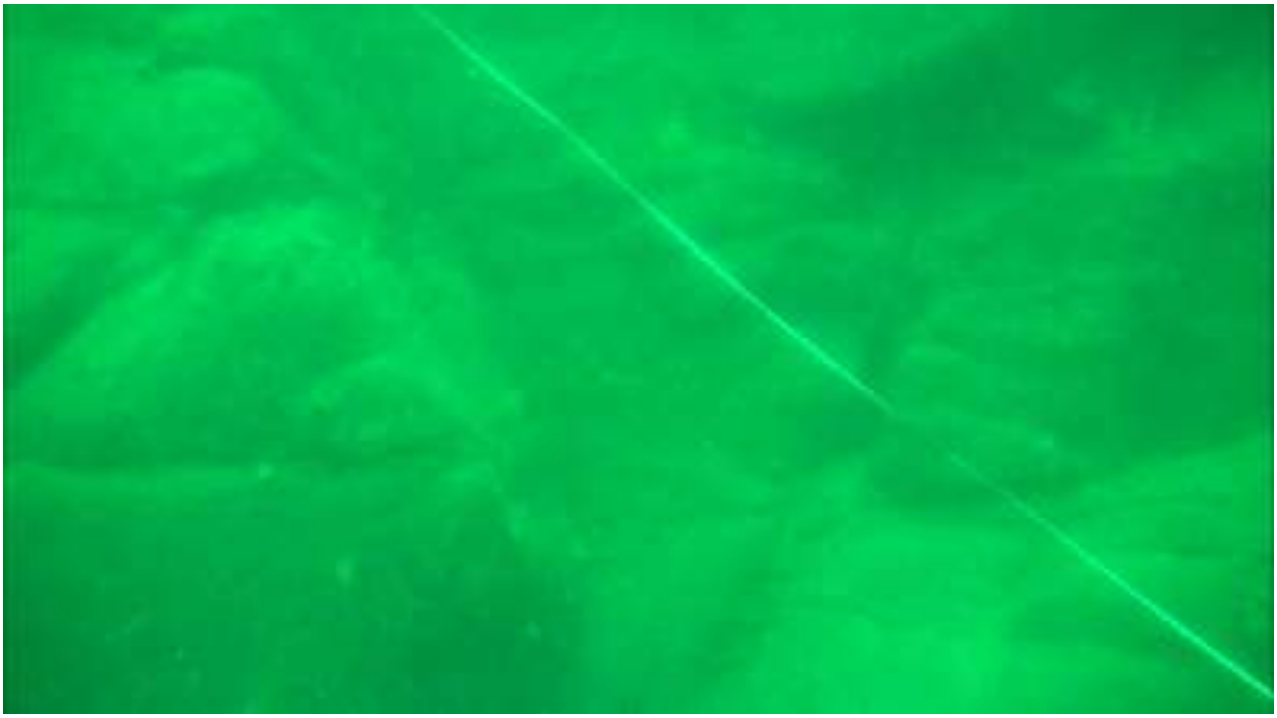


Figure 20 Sketch of the layout of one of the monitoring transects at Smith Sound

Video review of site

5.47 Just 3 video clips (ranging in duration from 00:04 – 01:23 mins.) were taken at Smith Sound. These included footage of the transect line, the surrounding community & close-ups of *Eunicella verrucosa* sea fans. Full details of each clip are included in the Video Log (see Appendix 3). Representative video screen grabs are presented below as Plates 20 & 21.



[Video file: 09-Jun-11 Smith Sound / 2011-06-09 Smith Sound 002]

Plate 20 Video screen grab from Smith Sound, showing the transect tape running over heavily grazed very large boulders and bedrock

[Video file: 09-Jun-11 Smith Sound / 2011-06-09 Smith Sound 003]

Plate 21 Video screen grab from Smith Sound, showing one of the very few sea fans *Eunicella verrucosa* encountered

Smith Sound (CW)

Plate 22 Photograph of a single *Eunicella verrucosa* pink sea fan in pristine condition (condition score 5)

Smith Sound (CW)

Plate 23 Photograph of a single *Eunicella verrucosa* – one of the less common white individuals (condition score 4)

Discussion

5.48 As pointed out in the Method section above, there are relatively few sea fans present within the Isles of Scilly and it is only on two wrecks where they are recorded as being common (Wood 2008). The Smith Sound site was known to have the sought-after biotope present (CR.HCR.Xfa.ByErSp.Eun - *Eunicella verrucosa* and *Pentapora foliacea* on wave-exposed circalittoral rock, Connor *et al*., 2004), but within this biotope, sea fans were relatively poorly represented. Unfortunately, it was also a relatively deep site (seabed at approximately 27-30 m bsl or 22 – 25 m bcd) which meant the divers did not have long to complete the task within their no-stop times. It should be stressed that obtaining the mean condition score of as many individual sea fans as possible is the most important part of this task. Thus the 10 m long transects should be laid out where the greatest density of sea fans is apparent. Obtaining a mean density of sea fans within the given area of the belt transect will always be of less importance, as this figure will vary considerably depending on the density of sea fans encountered at any particular site.

5.49 Ideally, sea fans from at least two other sites should be assessed for this task, if time and weather conditions allow. Thus, when all of the data is collated, an overall ‘condition score’ for the Isles of Scilly as a whole can be determined, rather than simply from one site which may well have sea fans which are untypically healthy or similarly untypically fouled. Other possible site locations where this task could have been undertaken (had time allowed) are given in Figure 6.

C3: Bedrock & boulder sponges

Method

Table 23 Summary table of target, baseline, methods and rationale for the 'species composition of characteristic biotopes – bedrock and boulder sponges' attribute (Task C3) of the reef sub-feature 'subtidal bedrock & boulder communities'

Sub-feature: (I)	**Subtidal bedrock & boulder communities**
Attribute: (C3)	**Species composition of characteristic biotopes on bedrock & boulders, for example, sponge-dominated biotope (MCR.ErSPbolSH)**
Target:	Presence and abundance of composite species should not deviate significantly from an established baseline, subject to natural change.
Baseline:	None (to our knowledge) using this methodology. Location of biotope from historical records and local expert knowledge.
Comment:	The MCR.ErSPbolSH biotope is from the 1997 JNCC Biotope Manual (Connor *et al*. 1997). It has now been superceded in the 2004 classification (Connor *et al*. 2004) by 3 different biotopes: **HCR.Xfa.ByErSp.Eun (*Eunicella verrucosa* and *Pentapora foliacea* on wave-exposed circalittoral rock)**; HCR.Xfa.ByErSp.DysAct (Mixed turf of bryozoans and erect sponges with *Dysidea fragilis* and *Actinothoe sphyrodeta* on tide-swept wave-exposed circalittoral rock); and HCR.Xfa.ByErSp.Sag (Mixed turf of bryozoans and erect sponges with *Sagartia elegans* on tide-swept circalittoral rock). Of these three, **only the first one (featuring *Eunicella*) has been recorded from the Isles of Scilly**.
Summary of Method:	Firstly, the biotope in question (HCR.Xfa.ByErSp.Eun) must be confirmed as being present. A pair of divers laid a 20 m long tape out over the (assumed, roughly horizontal) seabed, forming the centre line of a 20 m transect. The direction in which the tape was laid depended upon the topography of the site, the prevailing current and the highest density of conspicuous species (which should be targeted), and was recorded. Each diver has with him/her two 0.5 m x 0.5 m quadrats. These were placed at 4 m intervals along each side of the tape, in an alternating manner (i.e. quadrats on the LH side of the tape were placed at 0 m, 4 m etc. and those on the RH side were placed at 2 m, 6 m etc. The exact positioning of the quadrats depended upon the local topography). A video record was made of each quadrat by a third diver. Within each quadrat, up to 25 characterising species were searched for (as listed on the recording form). The form was used as a checklist. If one individual of any particular species was present, a score of **1** was written down. Where more than one individual occurred, a score of **2** was written down. No other numbers appeared on the recording form. Note that this project is undertaken within the same biotope as project C2 (condition assessment of sea fans and branching sponges), so could be undertaken at the same site as project C2 and even at the same time, if there are a sufficient number of divers available and the extent of the biotope allows for all of the divers to be working together without getting in each other's way or, perhaps most importantly, stirring up the silt. The 25 'characteristic' species listed on the recording form were selected from Hiscock (1983): *Polymastia boletiformis* *Stelligera stuposa* *Cliona celata* *Axinella dissimilis* *Raspailia hispida* *Raspailia ramose* *Dysidea fragilis* *Homaxinella subdola* *Nemertesia antennina* *Nemertesia amose* *Alcyonium digitatum* *Alcyonium glomeratum* *Eunicella verrucosa* *Parazoanthus axinellae* *Actinothoe sphyrodeta* *Caryophyllia smithii* *Crissidae* *Alcyonidium diaphanum* *Bugula amose* *Pentapora foliacea* *Marthasterias glacialis* *Echinus esculentus* *Holothuria forskali* *Clavelina lepadiformis* *Stolonica socialis*
Rationale:	This method provides a straightforward means of being able to assess, with reasonable accuracy, the abundance of various 'characterising' species from this sub-feature. The species were selected for their ease of identification and their conspicuousness and together they provide examples from across the range of benthic taxa represented within this sub-feature.

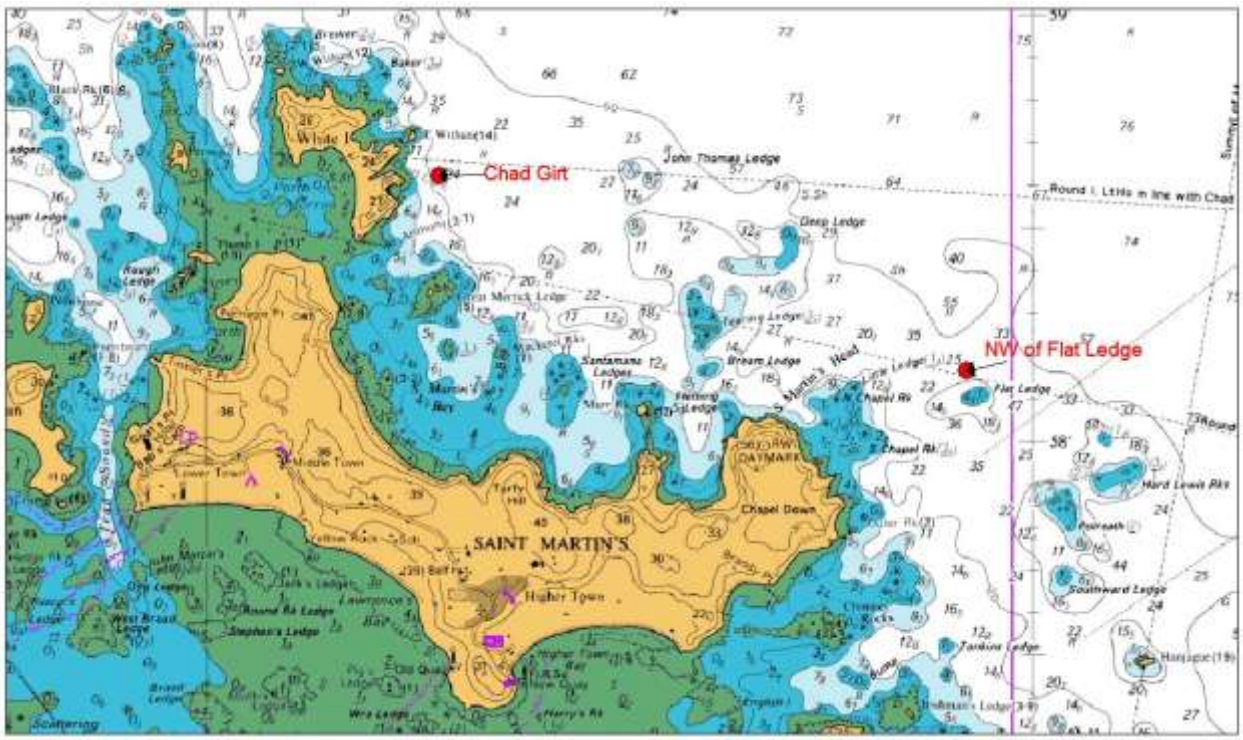


Figure 21 Location of the two sites where Task C3 was undertaken

Table 24 Information relevant to sites where Task C3 was undertaken

Site name	Lat./Long. (Position of shot)	Date(s) visited	Transect length	Depth range (BSL)	Depth range (BCD)	Diver
NW Flat Ledge, St Martin's	49° 58.168' N 006° 15.241' W	11-Jun-11	25 m	23-28 m	19.9-24.9 m	KC
		11-Jun-11	25 m	23-28 m	19.9-24.9 m	CP
Chad Girt, St Martin's	49° 58.625' N 006° 17.158' W	11-Jun-11	15 m	27 m	22.3 m	KC
		11-Jun-11	15 m	27 m	22.3 m	CP

NW Flat Ledge, St Martin's

Site Description

5.50 Flat Ledge is a small, discrete reef lying approximately 800 m off the north-east point of St Martin's. The survey site lay to the north-west of the shallowest part of the reef, within the upper circalittoral zone. It consisted of silted and sediment-covered circalittoral bedrock ridges interspersed with steps, characterised by plumose anemones *Metridium senile* (A), the hydroids *Nemertesia antennina* (F) and *Nemertesia ramosa* (F), jewel anemones *Corynactis viridis* (C), and the Ross bryozoan *Pentapora foliacea* (most likely biotope match: CR.HCR.XFa.ByErSp.Eun – *Eunicella verrucosa* and *Pentapora foliacea* on wave-exposed circalittoral rock).

5.51 From the shot, the direction of travel was 120°. The shot was at 23 m (bsl) (19.9 m bcd) with the survey continuing to 28 m bsl (24.9 m bcd).

Site diagram

5.52 [No sketch was made of this site].

Table 25 Species recorded by KN in the vicinity of the NW Flat Ledge monitoring site on 11th June 2011

	Abundance							Abundance					
Species	**P**	**R**	**O**	**F**	**C**	**A**	**Species**	**P**	**R**	**O**	**F**	**C**	**A**
Dictyota dichotoma			✓				*Corynactis viridis*					✓	
Halurus equisetifolius		✓					*Caryophyllia smithii*			✓			
Hypoglossum ?hypoglossoides			✓				*Epizoanthus couchi*	✓					
Plocamium cartilagineum			✓				*Metridium senile*						✓
Shottera nicaensis	✓						*Eunicella verrucosa*			✓			
Rhodophycota indet.			✓				*Salmacina dysteri*			✓			
Corallinaceae						✓	*Balanus crenatus*	✓					
							Calliostoma zizyphinum			✓			
Clathrina coriacea	✓						*Cellaria* sp.			✓			
Cliona celata			✓				Crisidae indet.				✓		
Dysidea fragilis			✓				*Bugula flabellata*	✓					
Haliclona viscosa			✓				*Pentapora foliacea*	✓					
Myxilla incrustans			✓				*Omalosecosa ramulosa*		✓				
Polymastia boletiformis				✓			*Luidia ciliaris*	✓					
Raspalia hispida		✓					*Henricia sanguinolenta*	✓					
Stelligera rigida			✓				*Marthasterias glacialis*	✓					
Halecium halecinum		✓					*Antedon bifida*	✓					
Nemertesia antennina				✓			*Echinus esculentus*			✓			
Nemertesia ramosa				✓			*Holothuria forskali*			✓			
Alcyonium digitatum			✓				*Clavelina lepadiformis*	✓					
Alcyonium glomeratum	✓						*Scyliorhinus canicula*			✓			

Abundance categories: P: present; R: rare; O: occasional; F: frequent; C: common; A: abundant

Video review of site

5.53 Video footage was taken of all 8 of the quadrats from which species data were obtained along the monitoring transect line. The substratum was of silty, fine sediment overlying rock with small fragments of shell gravel within it. There was a sparse cover of hydroid-bryozoan turf (including Crissidae, *Bugula* spp. and *Cellaria* sp.) and occasional foliose red algae. Predominant species included the ascidian *Stolonica socialis*, the sponge *Polymastia boletiformis*, dead man's fingers *Alcyonium digitatum*, red sea fingers *Alcyonium glomeratum*, the Ross bryozoan *Pentapora foliacea* and the featherstar *Antedon bifida*.

[Video file: 11-Jun-11 NW Flat Ledge St Martins GB / 110611 NW Flat Ledge, St Martins GB 009 Overview]

Plate 24 Video screen grab from the NW Flat Ledge transect, showing the yellow sponge *Polymastia boletiformis*, a sea urchin *Echinus esculentus* on the left and plumose anemones *Metridium senile* on the right

[Video file: 11-Jun-11 NW Flat Ledge St Martins GB / 110611 NW Flat Ledge, St Martins GB 013 RHS KC Q4]

Plate 25 Video screen grab from the NW Flat Ledge transect Quadrat 4 (RHS KC), showing an ageing colony of *Pentapora foliacea* on the left, a white plumose anemone *Metridium senile* (to the bottom) and the yellow sponge *Myxilla sulphurea* (bottom right)

Chad Girt, off White Island

Site Description

5.54 Chad Girt lies off the east coast of White Island which itself lies off the NW point of St Martin's. The site is exposed to the north-east and lies close to the wreck of the *Tabasco*. Chad Girt forms a discrete area of angular bedrock, bounded on one side by fine sediment and on the other by boulders. The monitoring transect was laid out at 27 m bsl (22.3 m bcd), on a bearing of 230° from the shot, on uneven though roughly horizontal surfaces. The silted upper circalittoral bedrock supported a diverse faunal community characterised by a broad range of sponges (particularly several axinellid species, *Suberites carnosus*, *Polymastia boletiformis* and *Hemimycale columella*) together with occasional foliose red algae. Other characterising species included frequent/common *Caryophyllia smithii* interspersed with occasional/rare *Alcyonium glomeratum*. Both *Pentapora foliacea* and *Eunicella verrucosa* were rare. Away from the transect, some of the vertical faces were dominated by *Corynactis viridis*. Two dead heavily encrusted *Eunicella verrucosa* were also noted. (Most likely biotope match: CR.HCR.XFa.ByErSp.Eun – *Eunicella verrucosa* and *Pentapora foliacea* on wave-exposed circalittoral rock).

Site diagram

5.55 [No sketch was made of this site].

Table 26 Species recorded by KN at Chad Girt on 11th June 2011

	Abundance							Abundance					
Species	**P**	**R**	**O**	**F**	**C**	**A**	**Species**	**P**	**R**	**O**	**F**	**C**	**A**
Dictyota dichotoma			✓				red Porifera crust				✓		
Dictyopteris membranacea			✓				orange Porifera crust				✓		
Apoglossum ruscifolium		✓					*Alglaophenia* sp	✓					
Brongniatella byssoides	✓						*Halecium halecinum*				✓		
Calliblepharis ciliata			✓				*Nemertesia antennina*		✓				
Drachiella spectabilis		✓					*Caryophyllia smithii*				✓		
Heterosiphonia plumosa			✓				*Cereus pedunculatus*			✓			
Kallymenia reniformis			✓				*Isozoanthus sulcatus*		✓				
Plocamium cartilagineum			✓				*Sagartia elegans*			✓			
Pterothamnion sp	✓						*Alcyonium digitatum*			✓			
Corallinaceae			✓				*Alcyonium glomeratum*			✓			
Axinella dissimilis	✓						*Eunicella verrucosa*		✓				
Ciocalypta penicillus			✓				Sabellidae			✓			
Cliona celata			✓				*Simnia patula*		✓				
Dysidea fragilis			✓				*Cellaria fistulosa*					✓	
Haliclona viscosa			✓				Crisidae	✓					

Table continued...

Species	Abundance P	R	O	F	C	A	Species	Abundance P	R	O	F	C	A
Hemimycale columella				✓			*Pentapora foliacea*	✓					
Homaxinella subdola			✓				*Echinus esculentus*				✓		
Polymastia mammilaris	✓						*Marthasterias glacialis*	✓					
Raspailia ramosa			✓				*Holothuria forskali*	✓					
Suberites carnosus	✓						*Ascidia mentula*	✓					
Tethya citrina			✓				*Didemnum maculosm*		✓				

Abundance categories: P: present; R: rare; O: occasional; F: frequent; C: common; A: abundant

Video review of site

5.56 Video footage was taken of each of the 7 quadrats placed along the monitoring transect. Full details of the footage is provided in the Video Log (see Appendix 3). Two screen grabs from this footage are presented here as Plates 26 & 27 below.

[Video file: 11-Jun-11 Chad Girt sponges CW / 110611 Chad Girt CW 018 LHS CP Q1]

Plate 26 Video screen grab of Chad Girt Quadrat 1 (LHS/CP), showing the sponge *Suberites carnosus* and scattered red foliose algae within the lower LH corner of the quadrat

[Video file: 11-Jun-11 Chad Girt sponges CW / 110611 Chad Girt CW 021 RHS KC Q2]

Note this quadrat is subdivided into quarters by temporary string dividers

Plate 27 Video screen grab of Chad Girt Quadrat 2 (RHS/KC), showing an erect, branching axinellid sponge, silty hydroid-bryozoan turf, Devonshire cup coral *Caryophyllia smithii* and scattered red foliose algae within the lower RH corner of the quadrat

Table 27 Listed species recording data from NW Flat Ledge and Chad Girt

Site:	NW Flat Ledge								Chad Girt						
Transect length (m)	25 m								15 m						
Recorder:	CP	KC	CP	KC	KC	CP	CP	KC	CP	KC	CP	KC	CP	KC	CP
Quadrat No.	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7
Quadrat pos'n on transect	0	3	4	7	13	16	20	24	0	2	4	6	8	10	12
Species															
Polymastia boletiformis		○							●		○		●	●	○
Stelligera stuposa						○						●	●	●	○
Cliona celata									○			○		○	
Axinella dissimilis	●	○							○		●		○		○
Raspailia hispida										●	○			●	
Raspailia ramosa							○								○
Dysidea fragilis										●		○		●	
Homaxinella subdola														○	○
Nemertesia antennina				●	●	○	●	○			○			○	
Nemertesia ramosa			○		●										
Alcyonium digitatum		○						○		○					
Alcyonium glomeratum		○								●		●		○	
Eunicella verrucosa														○	
Parazoanthus axinellae															
Actinothoe sphyrodeta															
Caryophyllia smithii		○		○	○	○		●	●	●	●	●	●	●	●
Crissidae															
Alcyonidium diaphanum														○	
Bugula plumosa			●												
Pentapora foliacea					●	○	●	●						○	
Marthasterias glacialis															
Echinus esculentus															
Holothuria forskali															
Clavelina lepadiformis				○											
Stolonica socialis	●	●	●	●											

Scoring system: a 'O' indicates one individual is present within the quadrat; a '●' indicates more that one individual is present within the quadrat

Discussion

5.57 With regard to the method which has been devised for this task, randomly-placed quadrats could have been used within the biotope, but by using a transect with pre-determined positions for each quadrat, any possible preferred 'placement' of a quadrat by the recorder is eliminated. The 4 m gap between quadrats on each side of the tape, and the alternating pattern of these gaps, is there to minimise any disturbance which one diver may create when undertaking his/her quadrat assessment. The simple scoring system provides an indication of abundance – this method was chosen in preference to the standard SACFOR method (which can be interpreted differently by different workers); and an even simpler presence/absence system (which gives no measure of abundance at all). Future analysis of these categorical data (after further visits) can be undertaken by using a statistical package such as Primer. Simper analyses will provide an assessment of differences within the recorded communities, and MDS plots will provide data clusters based on time or ecological zone differences.

5.58 It is important that the highest concentration of sponges be targeted when laying out the transect line. As precise accuracy for re-locating the area of seabed being monitored is not required, it is not necessary to start the transect line from the shot, although should the shot land amongst a concentration of sponges on future visits, then this piece of good fortune should be made the most of and the transect line started from the shot. Again, the video recording is for helping to assess the diligence of the recorders and for providing an overview of the community as a whole.

5.59 Future records from these sites are bound to show variations in the abundances of different species within the sponge community. The crucial part of any subsequent statistical analysis will be to determine how much change can take place within the abundance of any given species (and also of the composition of the community as a whole) before alarm bells start sounding indicating that all is not well with any particular species or the overall community. One then has to determine if the observed change is due to a natural phenomenon or to some anthropogenic factor. Consistency in selecting the correct biotope prior to the start of recording will be very important and is a task that only an experienced diver familiar with the biotope in question can be entrusted to do.

5.60 Although both sites have been allocated the same biotope (CR.HCR.XFa.ByErSp.Eun), there were clearly differences between them, with neither of the characteristic species (*Eunicella verrucosa* nor *Pentapora foliacea*) being more than occasional. The site at Chad Girt was found to be particularly rich in erect and encrusting sponge species (such as *Axinella dissimilis, Polymastia boletiformis, Stelligera stuposa* and *Raspailia hispida)*. Monitoring of this Task on a subsequent visit would benefit from data being obtained from a similar sponge-dominated site to Chad Girt.

D2: Faunal turf communities

Method

Table 28 Summary table of target, baseline, methods and rationale for the 'species composition of characteristic within faunal turf communities' attribute (Task D2) of the reef sub-feature 'subtidal faunal turf communities'

Sub-feature: (D)	**Subtidal faunal turf communities**
Attribute: (D2)	**Species composition of characteristic biotopes within faunal turf communities: Monitoring the diversity of species within a subset of biotopes, for example, dead man's fingers, red fingers, sponges and hydroids, sea fans, *Axinella infundibuliformis*, Devonshire cup corals, *Antedon bifida***
Target:	Presence and abundance of composite species should not deviate significantly from an established baseline, subject to natural change.
Baseline:	None (of which we are aware).
Comment:	***Likely*** to include the following biotopes (as listed by Munro & Nunny 1998 – using JNCC marine biotope classification v97.06):

Original biotope code (v97.06)	Current biotope status (v04/05)
ECR.Alc	Discontinued – records re-assigned to Xfa and to some KfaR biotopes
MCR.ByH	Merged into CR.HCR.Xfa (Mixed faunal turf communities)
MCR.GzFa	Biotopes from Xfa, Efa and ByH now included as CR.MCR.EcCr (Echinoderms and crustose communities)

Summary of Method:

A pair of divers laid a 20 m long tape out over the (assumed, roughly horizontal) seabed, forming the centre line of a 20 m transect. The direction in which the tape was laid depended upon the topography of the site, the prevailing current and the highest density of conspicuous species (which should be targeted), and was recorded. Each diver has with him/her two 0.5 m x 0.5 m quadrats. These were placed at 4 m intervals along each side of the tape, in an alternating manner. (i.e. quadrats on the LH side of the tape were placed at 0 m, 4 m etc. and those on the RH side were placed at 2 m, 6 m etc. The exact positioning of the quadrats depended upon the local topography). A video record was also made of each quadrat by a third diver.

Within each quadrat, up to 17 characterising species were searched for (as listed on the recording form). The form was used as a checklist. If one individual was present of any particular species, a score of **1** was written down. Where more than one individual occurred, a score of **2** was written down. No other numbers should appear on the recording form.

The 17 'characteristic' species recorded from within the 0.25 m^2 quadrats (extracted from Hiscock, 1983) were:

Cliona celata	*Axinella infundibuliformis*	*Alcyonium glomeratum*	*Marthasterias glacialis*
Polymastia boletiformis	*Axinella dissimilis*	*Caryophyllia smithii*	*Asterias rubens*
Pachymatisma johnstonia	*Nemertesia antennina*	*Alcyonidium diaphanum*	*Echinus esculentus*
	Metridium senile	*Luidia ciliaris*	*Antedon bifida*
	Alcyonium digitatum		*Holothuria forskali*

Rationale: This method provides a straightforward means of being able to assess, with reasonable accuracy, the abundance of various 'characterising' species from this sub-feature. The species have largely been selected for their ease of identification and their conspicuousness and together they provide examples from across the main benthic taxa represented within this sub-feature.

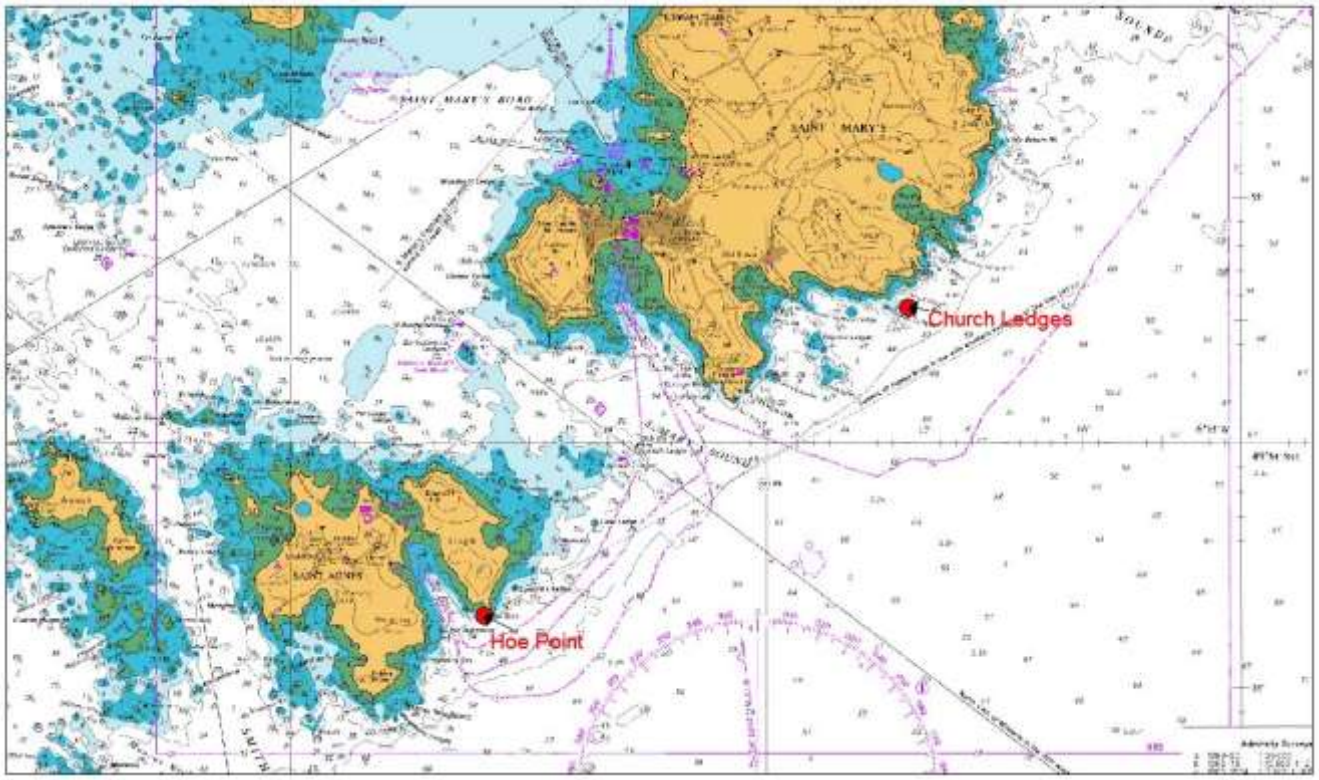


Figure 22 Location of the two sites where Task D2 was undertaken

Table 29 Information relevant to sites where Task D2 was undertaken

Site name	Lat./Long. (of shot marker)	Date(s) visited	Transect length	Depth range (BSL)	Depth range (BCD)	Diver
Church Ledges, St Mary's	49° 54.552' N 006° 17.111' W	07-Jun-11	20 m	21.0 – 23.0 m	19.6 – 21.6 m	AC
		07-Jun-11	20 m	21.0 – 23.0 m	19.6 – 21.6 m	KC
Hoe Point, St Agnes	49° 53.294' N 006° 19.795' W	10-Jun-11	20 m	26.5 m	23.2 m	CP
		10-Jun-11	20 m	26.5 m	23.2 m	CW

Church Ledges, St Mary's

Site Description

5.61 This site consisted of a large, steep-sided grazed platform at 21-23 m bsl (19.6 – 21.6 m bcd) with several undulations and fissures, surrounded by vertical walls. The upper sections of the walls were kelp-dominated, with C*orynactis viridis* and A*lcyonium digitatum* below. The horizontal survey site was typified by encrusting red and purple algae, with *Caryophyllia smithii, Alcyonium digitatum* and *Alcyonium glomeratum* in clumps. There were also large patches of clear (grazed) bedrock.

Site diagram

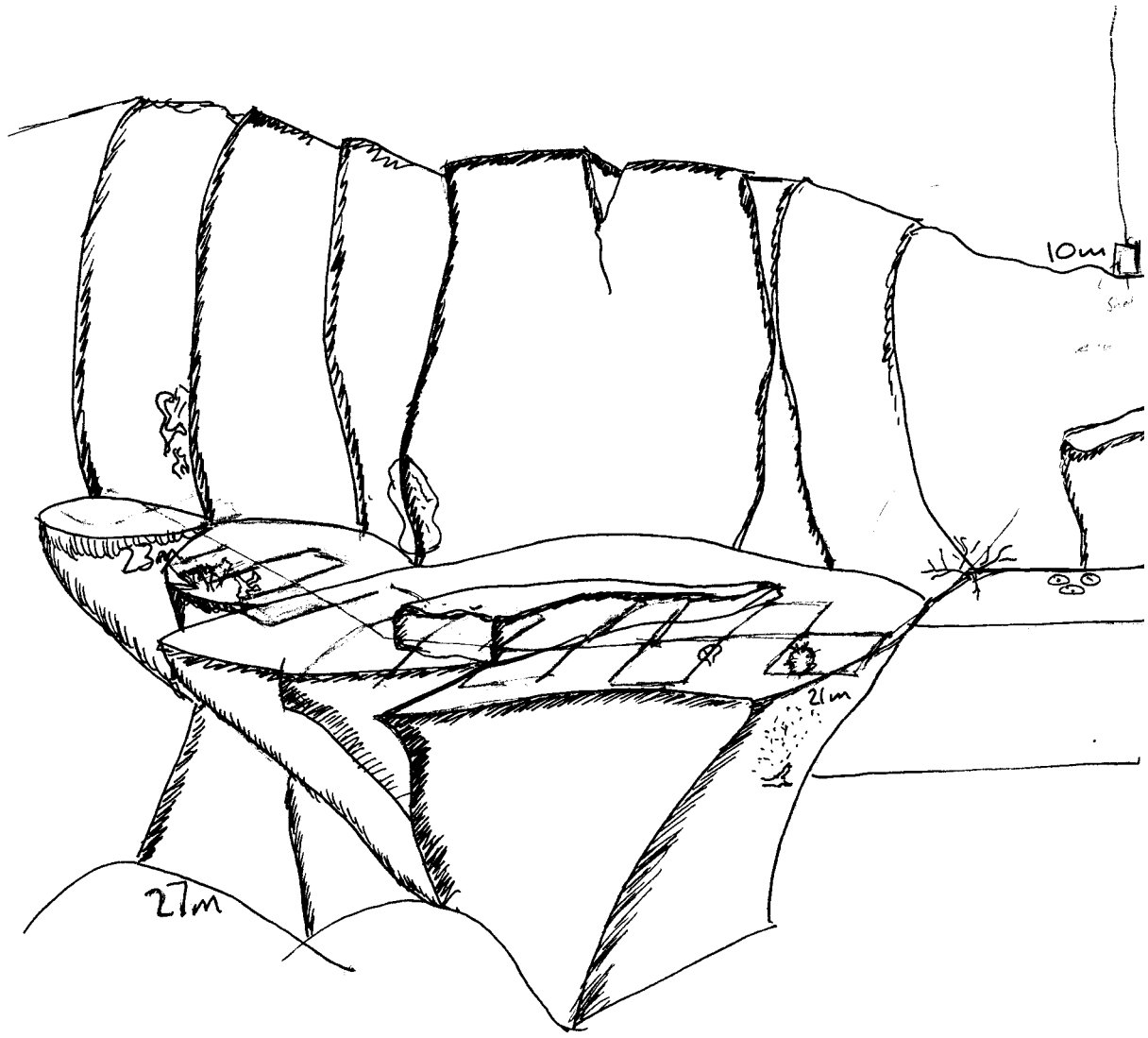


Figure 23 Sketch of the Church Ledges monitoring site, showing the location of the transect and the positions of the monitoring quadrats on alternate sides of the transect (AC)

Video review of site

5.62 Just two short video clips were taken at Church Ledges, though it should be noted that, inadvertently, these were not representative of the actual biotope from which data was obtained. Both clips gave an overview of grazed granite bedrock and boulders. Full details of each clip are included in the Video Log (see Appendix 3). Representative video screen grabs are presented below as Plates 28 & 29.

[Video file: 07-Jun-11 Church Ledges / 070611 Church Ledges Isles of Scilly Chris W 006-1]

Plate 28 Video screen grab of seabed adjacent to the Church Ledges transect, showing heavily grazed very large, large and small granite boulders. A number of common sea urchins *Echinus esculentus* are visible

[Video file: 07-Jun-11 Church Ledges / 070611 Church Ledges Isles of Scilly Chris W 006-2]

Plate 29 Video screen grab of seabed adjacent to the Church Ledges transect, showing heavily grazed very large granite boulders. A number of common sea urchins *Echinus esculentus* are visible as well as one of the recording divers

Hoe Point, St Agnes

Site Description

5.63 A south-facing slope of continuous, large and very large granite boulders, with encrusting Corallinaceae apparent on grazed surfaces which were also covered with a short hydroid-bryozoan turf and red (and brown) foliose algae. The short faunal turf, not hugely diverse, covered all boulder surfaces, and consisted largely of hydroids and bryozoans, with abundant *Caryophyllia smithii* and common *Alcyonium digitatum;* the brown alga *Dictyopteris membranacea* was also present. Mobile species included abundant *Echinus esculentus* and *Holothuria forskali.*

5.64 The transect was placed perpendicular to the slope at ca. 25 m bsl (21.7 m bcd), over continuous boulders. Approximately 8 m west of the end of the transect, a large, sloping granite ridge with a sheer east-facing wall running north/south bounds the area. The top of the end of the ridge (at its maximum height of 4 m) lies at 22-23 m bsl (18.7 – 19.7 m bcd). The ridge wall then descends sharply to 27 m bsl (23.7 m bcd) onto boulders. A very large single boulder (ca. 3 m tall) was situated just below and halfway along the transect. At the east end of the transect lay a series of huge, angular, granite boulders (many >2 m in diameter).

Table 30 Other species recorded while carrying out overview (SACFOR abundances)

Alcyonium digitatum	*C*	*Marthasterias glacialis*	*R*	*Hemimycale collumella*	*R*
Holothuria forskali	*A*	*Cliona celata*	*R*	*Ctenolabrus rupestris*	*O*
Echinus esculentus	*A*	*Aglaophenia pluma*	*O*	*Corynactis viridis*	*R*
Dictyopteris membranacea	*A*	*Trivia sp.*	*R*	*Pawsonia saxicola*	*R*
Caryophyllia smithii	*A*	*Calliostoma zizyphinum*	*R*	*Haliclona viscosa*	*R*
Alcyonium glomeratum	*F*	*Megatrema* (on *C. smithii)*	*R*		
Nemertesia antennina	*F*	*Labrus mixtus*	*A*		

Site diagram

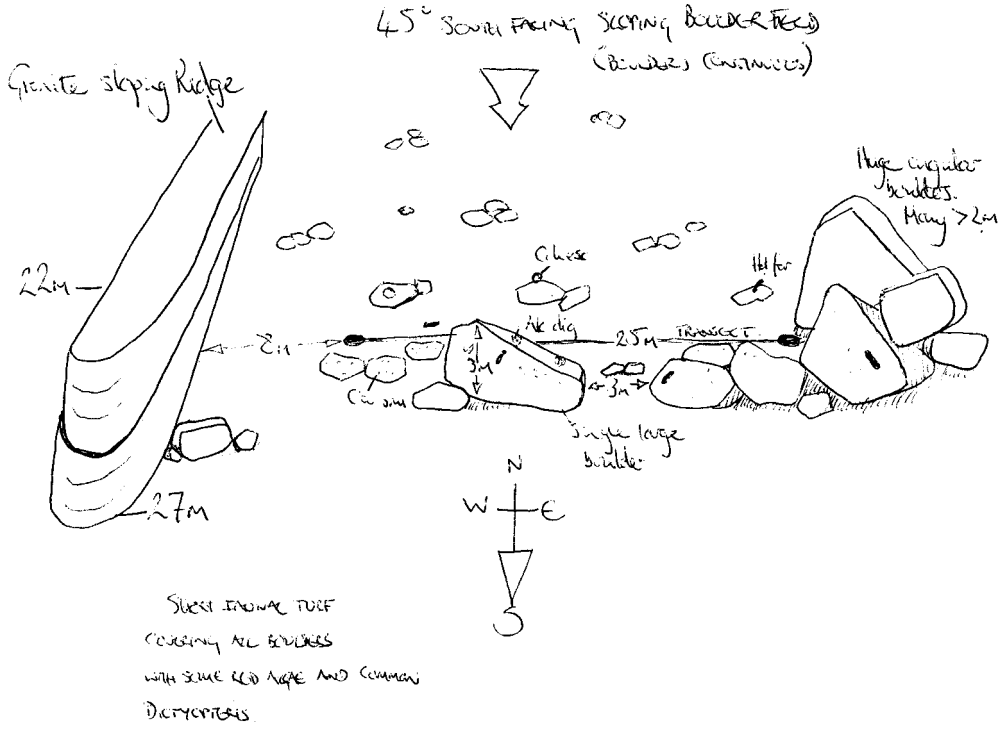
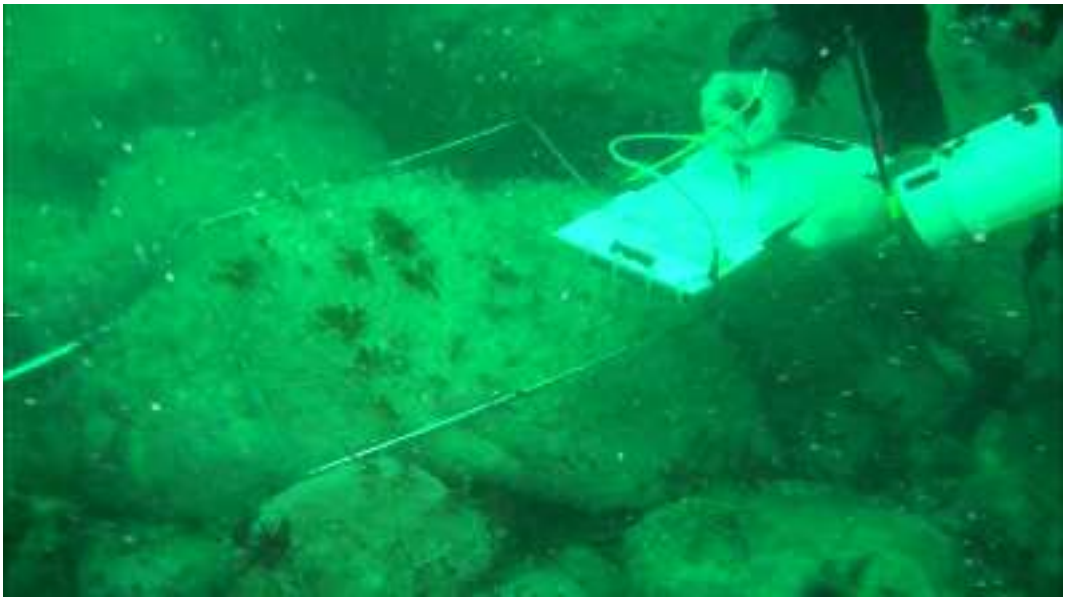


Figure 24 Sketch of the Hoe Point monitoring site, with transect in place

Video review of site

5.65 A total of 33 video clips (ranging in duration from 00:05 – 00:50 mins.) were taken at Hoe Point. These included each of the quadrats recorded by the divers, as well as footage of the site. Full details of each clip are included in the Video Log (see Appendix 3). Representative video screen grabs are presented below as Plates 30 & 31.



[Video file: 10-Jun-11 Hoe Point / Hoe Point (7)]

Plate 30 Video screen grab of diver recording from a 0.25 m2 quadrat adjacent to the transect tape, Hoe Point

[Video file: 10-Jun-11 Hoe Point / Hoe Point (14)]

Plate 31 Video screen grab of the transect tape at the Hoe Point monitoring site. The seabed consists of granite bedrock and boulders heavily grazed by sea urchins *Echinus esculentus*. Also visible in the picture are the holothurian *Holothuria forskali* and a female cuckoo wrasse *Labrus mixtus*

Table 31 Listed species recording data from Church Ledges and Hoe Point

Site:	Church Ledges, St Mary's									Hoe Point, St Agnes										
Transect length (m)	20 m									20 m										
Recorder:	AC	KC	AC	KC	AC	KC	AC	KC	AC	CP	CW	CP	CW	CP	CW	CP	CW	CP	CW	CP
Quadrat No.	1	1	2	2	3	3	4	4	5	1	1	2	2	3	3	4	4	5	5	6
Quadrat pos'n on transect	0	2.7	4	6.7	8	11.8	12	14	16	0	2	4	6	8	10	12	14	16	18	20
Species																				
Cliona celata			○																	
Polymastia boletiformis																				
Pachymatisma johnstonia		○																		
Axinella dissimilis						●														
Axinella infundibuliformis																				
Nemertesia antennina																			●	●
Metridum senile						●		○	●											
Alcyonium digitatum		●		●	●	○		●	●											
Alcyonium glomeratum						○	●													
Caryophyllia smithii		●		●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Alcyonidium diaphanum																				
Luidia ciliaris																				
Marthasterias glacialis																				
Asteria rubens																				
Echinus esculentus				○	○															
Antedon bifida																				
Holothuria forskali								○												

Scoring system: a '○' indicates one individual present within the quadrat; a '●' indicates more that one individual present within the quadrat.

Discussion

5.66 For this task, the species composition of the biotope is what is being assessed, with a measure of presence/absence and abundance of individual species being recorded. Again, it will be of great importance for future monitoring events to ensure that the same biotope is chosen prior to embarking upon actual data recording. The current results present a baseline against which future monitoring events can be compared. Changes in presence/absence and also in the abundance of each of the 17 'targetted' species are bound to occur and a 'threshold of change' of species will need to be agreed as part of future analysis of the acquired data. The recording methodology used here provides an assessment of the relative abundance of the selected species, using a simplified scale. Future analysis of these categorical data (after further visits) can be undertaken by using a statistical package such as Primer. Simper analyses will provide an assessment of differences within the recorded communities, and MDS plots will provide data clusters based on time or ecological zone differences.

5.67 The video record has three purposes: it provides a tool for species recognition QA training prior to the next data recording dive; it can help to re-locate the habitat/biotope where the transects from the present study were undertaken (though there is no need to re-lay transects in these exact positions during future visits); and it can provide a quick visual assessment of the site. However, note that the video clips obtained from Church Ledges should not be used for the purposes of site familiarisation, as the clips were not filmed in the same area as where the monitoring transect was positioned.

6 Discussion

Data acquisition and analysis

The design of appropriate monitoring methodology

6.1 The bespoke monitoring techniques designed for the present study provide information about the specific attributes of the sublittoral rock feature which characterises the Isles of Scilly SAC. Ideally, the design of such monitoring studies should be to try to distinguish natural from man-induced change within the marine environment, though this may never be achieved in practice.

6.2 Clearly, the detection of change will only be possible after a number of data-collecting events have taken place. How frequently these events take place will depend upon Natural England's task prioritisation and financial resources. There is an optimum frequency to monitoring visits: if a visit is made just once every six years, it will take at least 3 visits (i.e. a minimum of 12 years) before any kind of trend in conservation status is detected. Is this too long before any possible changes to management practices be implemented? Visiting on an annual basis, on the other hand, is likely to detect trends quicker but is likely to be prohibitively expensive. It should also be borne in mind that future visits should always take place at a similar time of year (this is certainly true for the assessment of algal populations).

6.3 Finally, when considering methods designed for the collection of long-term data for monitoring change in marine ecosystems, one should be very wary of altering them at any stage in the future. Should this happen, there is a high risk that data collected from different points in time will not be comparable.

Putting the methods into practice

6.4 The questions which could be posed to assess whether the monitoring studies initiated during this survey have been successful might include:

1) Have sufficient data been collected to make meaningful sense?

For the majority of the Tasks, sufficient data have been acquired in order to provide statistically robust baselines. For a couple of the Tasks however, an insufficient quantity of data was acquired to provide a statistically robust baseline. These include the assessment of sea fans and erect sponges (Task C2) for which only one site, Smith Sound, was visited; and the assessment of the diversity of algal species (Task A3 (ii)), which was only undertaken at Mackerel Rocks.

2) Were enough sites visited which gave a range of conditions?

It would be useful to select a few sites from more exposed locations (outwith the bounds of the licences which the survey boats were operating under), but the chances of re-visiting such sites regularly in future would be in doubt (due to the more exposed conditions). As it was, sites were spread over a considerable area, with 11 of the 13 sites lying within recommended Marine Conservation Zones (Figure 1), the exceptions being Mackerel Rocks and Little Arthur. This means 6 out of the 8 rMCZ zones within the SAC now have monitoring sites within them, as part of this survey.

3) What were the difficulties encountered on site?

One of the major difficulties encountered during the present study has been the depth at which studies were undertaken at several of the sites, leading to considerable restrictions on the length of time able to be spent acquiring data within no-stop dive limits. This was particularly noticeable

for the dive at Smith Sound where the task was to lay a series of 10 m long belt transects and to assess sea fans and erect sponges within them. Not only were the sea fans and sponges very sparsely distributed, but only two 10 m long (by 4 m wide) transects were undertaken by the four divers, at depths of 27 m and 30 m (bsl) respectively. A shallower site would have allowed more transects to have been completed. The use of Nitrox as a breathing gas would also allow for a longer bottom time, should visits to deeper sites be inevitable (see also section 6.23 – 6.24). Other points are discussed below.

6.5 Unfortunately, within the programme of work, no time was built in for the assessment of inter-worker variability. This should be included for the next monitoring visit as it provides an additional level of confidence in the data collected. Several of the Tasks would be suitable for this, particularly those involving quadrat counts. The method is very simple - two (or more) recorders just carry out counts from the same quadrat, or from two adjacent quadrats (which avoids unnecessary waiting time).

Assessment of results from the 2011 studies and comparisons with earlier work

Kelp community structure: *Laminaria hyperborea* & *L. ochroleuca* (Task A2)

6.6 The range of results from this study made it quite difficult to decipher what the 'state of play' is with regard to what the proportions of these two species of kelp are within the archipelago. Clearly the ratios vary from site to site, its exposure, the depth where the sampling was undertaken and, crucially, the biotope in question. It will be important when repeats of this study are undertaken that the same biotope is confirmed as being present and that the depth at which the transect is laid is the same. However, it should be possible to use the ratios acquired *for each site* from the present study as baseline figures on which to compare others.

6.7 Historical studies can confirm the distribution/location of the various kelp biotopes, but they are unable to provide direct comparisons of densities of plants. This is largely due to the all encompassing abundance categories used such as 'Common' (1-9 plants/10 m^2) or 'Abundant' (1-9 plants/m^2), This study now provides a useful baseline against which subsequent studies can be compared.

6.8 This particular task could provide a useful study of inter-worker variability, as it is relatively straightforward to undertake. Repeat counts by different recorders would need to be carried out using the same quadrat(s). However, it would be necessary to build sufficient time into any future monitoring programme to allow this to happen. For the current study, the same two recorders (CP & GB) undertook quadrat counts from all four sites which provided some degree of consistency (see Table 10).

Algal species richness and diversity studies (Task A3)

6.9 The assemblage of species recorded from the upper infralittoral mixed kelp communities was found to be very similar to the assemblage recorded from these same sites during the South-West Britain Sublittoral Survey in 1983 (Hiscock 1983). Although one should be cautious in making direct comparisons (as different techniques were employed to record the algae from each study), there would appear to be very little change during this 28 year period in the range of algae associated with these communities.

6.10 By collecting algal samples during 10 minute intervals (for the species richness study), a good indication is provided as to whether the maximum number of recordable species present at the site is being reached. This appeared to be the case at each site visited. The maximum collecting time of 60 minutes would seem to be sensible. This study does require an algal specialist however, or at least someone who is able to identify specimens to species level back 'in the lab.'. The herbarium (now in Natural England's possession) prepared from samples taken during this study, together with *in situ* photographs of species, should assist in the training of less experienced surveyors in algal identification. Again, this study now provides a useful baseline against which subsequent studies can be compared.

Circalittoral vertical bedrock communities (Task B1)

6.11 On future visits, the relocation of the correct vertical bedrock biotope(s) for this study at the three sites will be very important. It would make sense to try to relocate the same area of seabed at each site using the diagrams, video clips and photographs available, rather than to try to find the same biotope elsewhere. However, the precise relocation of the vertical transect line itself is not necessary once the correct biotope has been confirmed.

6.12 If possible, a greater number of data points should be acquired (i.e. more transects, or more sampling points within each transect), which will help even out any anomalies in the records.

Density & condition of seafans and erect sponges (Task C2)

6.13 Whilst the methodology for this study has been proven elsewhere, it was unfortunate that not more data points were collected in 2011. Just one site (the east end of Smith Sound) was visited, and that was quite a deep site (thus limiting the recording time of the surveyors). Not only were there very few sea fans to measure, there was also a dearth of erect sponges. For the next monitoring visit it is recommended that one if not two additional sites be targeted for this study. With just one site being visited in 2011 and with so few data points taken from that site, meaningful comparisons with other data (for example, those obtained by Seasearch divers – see Wood 2003 & 2008) has not been possible.

Sponge-dominated biotope on circalittoral bedrock & boulders (C3)

6.14 It has not been possible to correlate the findings of the present study with historical records due to variations in the recording methodology. The sites chosen, particularly that at Chad Girt, were found to have the required biotope as being present and would provide the opportunity to elicit more data points in future. Again, relocation of this biotope prior to recording will be essential for any future visit. It may be that the same biotope showing a similar richness of sponge species can be found at another site too.

Circalittoral faunal turf communities (D2)

6.15 Historical records reveal that the two main biotopes encompassing this community are present at a large number of sites scattered around the eastern and northern boundaries of the islands within the archipelago (Figure 8). Whilst a considerable amount of species data exists from these sites, the data are unable to be used to compare with data collected during the present study as the acquisition methods are not the same. Again, a greater number of data points should be aimed for during the next monitoring visit (i.e. more sites, more transects within each site, or more sampling points within each transect) as the number obtained during the present study may prove to be inadequate for robust statistical analysis.

Survey logistics

6.16 Undertaking a diving survey of this sort in the Isles of Scilly present a number of challenges which require attention prior to the commencement of diving operations in the field. In the light of the experience gained during the present survey, several of these are discussed below.

Depth & time restrictions

6.17 As an offshore oceanic archipelago, the clarity of the waters surrounding the Isles of Scilly can be exceptional, although sheltered sites can still suffer from the re-suspension of fine, settled sediment. For more exposed sites, the minimal turbidity in the water column allows algae to grow to deeper depths than would be expected on the mainland. This means that tasks which need to be undertaken in the lower circalittoral zone (i.e. where only faunal species are present) can only be done at depths > 25 m below sea level. If no-stop times are to be respected, these greater depths limit the time available to the surveyor to perform his/her tasks.

Tides

6.18 Diving on a high water slack period can add up to 6 m to the depth of a dive and reduce the no-stop time considerably. Unfortunately for the current survey, diving was only possible over the high water slack period, as the low water slack periods occurred too early or too late in the day. The high water slack is also considerably shorter in duration (just 1 hour) than the low water slack (3 hours) (Tim Allsop, *pers. comm*.).

6.19 In order to alleviate the aforementioned problems, we would suggest that future surveys conducted within the Isles of Scilly SAC are undertaken **either** over two separate one week periods **or** over a single 14 day period, with a team of 6 or 8 divers to maximise boat time etc. This would provide:

1) one week over a spring tide (no greater than a 4.3m tide) to dive on low water slack water on the east coast (Tim Allsop, *pers. comm*.); and
2) one week over a good neap tide to dive on slack water on the west coast.

Procedures in the field

6.20 Several of the Tasks require a transect (with quadrats) to be laid within a certain biotope. For those sites chosen for these Tasks, sufficient time should be allowed within the dive programme to carry out the following dive procedure (after a pre-dive familiarisation of species):

- One dive (2 divers) to relocate the site (as best as possible), to assess the site and to lay out a 10 m transect line (or possibly 2x 10 m transect lines) across that part of the site which best represents the biotope in question; [note that it may be possible to perform this task using a drop-down video camera set-up, thus avoiding the possibility of wasted dives if the correct biotope is not found. However, such a set-up requires additional kit (incuding an on-board monitor with waterproof protection), for which there may be insufficient space in a RIB];
- One dive (2 divers) to record an overview of the site (sketch, habitat description etc.), video the site layout, Phase 2 recording and species collection (away from transect line!) for QA familiarisation of species; and finally
- A dive with 2 (possibly 4, if available) divers recording along the transect line(s).

Accommodation

6.21 Accommodation needs to be booked well in advance (12 months ahead to ensure both a hardboat and suitable accommodation). It is also important to have all the team (divers, supervisor) accommodated in one location. Such accommodation needs to offer suitable space for evening QA/ computers/ group discussions; wet space for specimen work-up; and with dive kit preferably in the same location, or kept on board the diving hard boat or at the quay from where the divers are operating. This would allow the survey to be conducted most efficiently.

An alternative operations base

6.22 An alternative to arranging accommodation on one of the islands would be to charter a liveaboard diving vessel which could accommodate the whole dive team. There are a number of advantages if this option is chosen: firstly, the whole dive team is based in the one place, which would ease communications; secondly, there would be on-site wet space for both specimen work-up as well as for stowing dive kit; thirdly, meals for all would be prepared and consumed on board, saving considerable time, particularly in the evenings; fourthly, cylinders could be filled on board, even with a nitrox gas mix (see below); and fifthly, a RIB tender would provide the opportunity to split the dive team and dive at two sites simultaneously. This could be combined with employing local personnel, such as Tim Allsop, as for this survey, to work alongside in identifying the sites. Another point which would have to be borne in mind would be the need for the skipper of the liveaboard to have the appropriate Isles of Scilly boatman licences to be able to access all sites.

This will need careful consideration and liaison between Natural England representatives and local dive operators.

Breathing gas – nitrox vs. air

6.23 It has been standard practice for several years for professional marine biological diving survey teams to use an enhanced oxygen breathing air ('nitrox') with SCUBA gear. The use of nitrox gives longer bottom times and also increases safety margins (if used correctly). Its use would be strongly recommended when dives between 15 and 35 m are being undertaken. It is also widely anecdotally reported by survey divers that they fee less tired when utilising nitrox breathing gas at the end of each diving day and so are significantly more efficient with post-dive monitoring activities during a survey.

6.24 Unfortunately, there is not a ready supply of nitrox on the Islands. For this to be done, oxygen in large 'J' cylinders would need to be imported in advance from the mainland, which adds an additional level of complexity to the survey logistics. However, the safety of the divers within the survey team must be paramount. The nature of scientific diving to undertake monitoring requires as long a bottom time as possible within no-decompression stop times. The use of a live-aboard with an onboard supply of nitrox for future surveys should be given due consideration, or the use of Nitrox from the Islands if it should become available in the future.

Quality Assurance training

6.25 The task loading when undertaking sublittoral monitoring tasks can be extremely high and all participating divers should be adequately trained in the use of dthe underwater survey equipment being used and be of a competent level in taxonomic identification.

6.26 For a survey of this sort, it is important to ensure that there is a sufficient lead time to get historical data analysed and to then send Quality Assurance (QA) material on species identification and survey techniques to members of the dive team well in advance of the survey.

6.27 Sufficient time should be built in to the programme to facilitate adequate QA – on both pre-dive familiarisation and work up of specimens at the end of each day (Plate 32).

Plate 32 It is important to make use of fresh material wherever possible for QA training during the survey itself

6.28 The characteristic kelp species study (Task A2) could provide a useful study of inter-worker variability, as it is relatively straightforward to undertake. Repeat counts by different recorders would need to be carried out using the same recording quadrat(s). However, it would be necessary to build sufficient time into any future monitoring programme to allow this to happen. For the current study, the same two recorders (CP & GB) undertook quadrat counts from all four sites which provided some degree of consistency at least (see Table 10).

7 Recommendations

7.1 The following recommendations are made in light of the findings of the current project.

Refinements to methods

- In general, we would strongly recommend that the methods tailored for the Tasks described in this report are adhered to carefully in future, to ensure subsequent analysis of the data is not complicated by taking into consideration 'tweaks' to the methodology used in collecting the data. It *may* be possible to add further species to specific recording forms if it is thought this will add to the sum of the data (rather than retract from it).
- For Task A2 (*Laminaria hyperborea* & *L. ochroleuca* population size within the kelp forest community) it is important for the transect line to be laid as close to the horizontal as possible within the chosen biotope, not deviating more than one metre shallower or deeper than the depth of the starting point. This is to try to limit the skewing of the results by *L. ochroleuca* becoming more dominant at deeper depths within the infralittoral zone. It will be important for the same depth ranges to be used at each site for this study. As below chart datum depths have been quoted in this report, it should be possible to calculate appropriate below sea level depths at each site in future.
- No sites have been permanently marked for subsequent visits. Permanent marking of sites requires additional equipment, can be time-consuming and will require maintenance in future. The present methodologies have been designed using a random distribution of sample points within known locations. Whilst it is important for any subsequent monitoring survey to try to relocate the 2011 sites wherever possible, it may still be possible to visit new sites, though any subsequent comparisons of collected data could only be done if the biotopes represented are the same.

Logistics

- We suggest that repeat diving monitoring surveys are arranged either over **a full 14 day period**, or as **two separate weeks** coinciding with neap and spring tides. These periods would allow for dives to take place during low water slack periods (thus avoiding high water slack periods).
- Splitting the monitoring tasks into first week or second week tasks would be worth considering in future, though clearly prevailing weather conditions will play a big part in whether this is possible or not. By repeating the same task(s) within the space of a few days, divers can become familiar with the required method(s) more quickly, and overall task loading could be reduced.
- It is important to have all of the team (divers & supervisor) accommodated in one location.
- Serious consideration should be given to the use of a **live-aboard diving platform** (with its own RIB for picking up divers) which would eliminate many of the logistical problems encountered during the present survey. However, this would need to be arranged with the involvement and cooperation of local diving personnel, as the skipper of any live-aboard would require an appropriate licence to be able to cover the whole of the survey area.
- If local boats are to be used, **ensure the boat skipper hired has a licence to cover the whole survey area.** This would allow visits to more of the western sites in the archipelago, which the present survey was unable to access, though this in part was also due to inclement weather conditions.
- It is recommended that **Nitrox (probably at 32%) be used consistently** as the breathing gas mixture of choice by all dive team members.

Additional studies

- A study of the maximum depth of kelp at various sites, using a standard methodology (Whittington *et al*., 2007) should be seriously considered for inclusion for the next monitoring survey.
- It is recommended that some form of assessment of inter-worker variability be built in to the work programme for Quality Assurance purposes.

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Appendix 1 Daily activities

Table A Log of fieldwork responsibilities

Date	Site	Task	Surveyors	Videography	Site notes	Other notes
Sat 4th June	Arrival					Arrive St Mary's late afternoon.
Sun 5th June	Penninis Head St Marys	Familiarisation	All	Yes - overview of kelp		
Mon 6th June	Brodfield, St Marys	A2 kelp structure; A3 algal diversity	GB/CP – recording kelp structure KN – collecting algae	CW - video		
	Little Arthur Eastern Isles	A2 kelp structure; A3 algal diversity	GB/CP – recording kelp structure KN – collecting algae	CW - video		
Tues 7th June	Gap Pt, St Marys	B1 Verticals	KC/AC – recording verticals KN – Site overview	CW - Video of AC transect Video overview of site		Outcome: only one transect record from AC.
	Church Ledges, St Marys	D2 Faunal turf	AC/KC – Recording faunal turf	CW - video		
Weds 8th June	Newfoundland Pt, St Marys		KC/CP Recording verticals	AC - video		
	Menawethan Eastern Isles	A2 kelp structure	GB/CP – recording kelp structure	AC - video		

Table continued...

Date	Site	Task	Surveyors	Videography	Site notes	Other notes
Thurs 9th June	Smith Sound St Agnes	C2 *Eunicella* density	KC/AC – recording KN – Overview	KN - video Overview of site + close-up of *Eunicella*	Both sides of one transect recorded (AC RHS, KC LHS)	Dive terminated early (one diver reached no stop time, other two still had 10 minutes bottom time (on air).
			GB/CW - recording		Site overview diagram & description (GB/CW)	Only one transect achieved – divers drifted off the shot on descent and had to swim to find suitable location for survey – they laid a transect at 29m but no more suitable bedrock for another transect within the agreed depth limit of 30m bsl. The site sloped off steeply, limiting selection of monitoring stations.
	Menglow Reef St Agnes	A2 Kelp structure; A3 algal diversity	GB/CP – recording kelp structure KN – collecting algae	CW – video Overview of site, kelp structure and algal close-ups; methodology		
Fri 10th June	Hoe Pt St Agnes	D2 Faunal turf	CP/CW – Recording GB – site overview	AC - video		
	Gugh Reef St Agnes	B1 Verticals	CP/AC – Recording GB – site overview	CW - video	AC – one vertical record CP – 2 records	c. 22 mins only for no-stop time.
Sat 11th June	NW of Flat Ledge, NE of St Martins	C3 Sponge community transect	CP – LH 4 stations KC – RH 3 stations KN – site overview & phase II	GB – video of quadrats (thinks he may have missed quadrat 2 of 4, thinks he videoed all of KC's sites). No overview video.		
	Chad Girt E of White Island	C3 Sponge community transect	CP - LH 4 stations (last one was incomplete due to bottom time) CK – 3 stations completed KN – site overview & phase II	CW - video	Yes	Very rich sponge site but may be difficult to re-locate.

Table continued...

Date	Site	Task	Surveyors	Videography	Site notes	Other notes
Sun 12th June					Attempted to get to Gap Point – sea too rough (SE f6). Dived a nearby, more sheltered site – dive aborted as visibility was too poor and a lot of detrital algae had accumulated in the vicinity. Returned to St Mary's and worked up other material.	
Mon 13th June	Mackerel Rocks St Martin's	A3 Algal diversity	CP – ? GB – recording KC – ? CW – video & photography & recording!			
	Gap Point St Mary's	B2 Verticals	KC – recording CP - recording			
Tues 14th June						Travel day – depart St Mary's on *Scillonian* for Penzance.

Appendix 2 Wind conditions

Predicted and actual weather conditions during the survey period 4th to 10th June 2011, taken from the Windguru web site on 04 June & on 07 June 2011: (**www.windguru.cz**). Note that the lack of colour for certain times results from a glitch in the data copying process.

Day Date (June 2011)	Sa 04.	Sa 04.	Sa 04.	Sa 04.	Su 05.	Su 05.	Su 05.	Su 05.	Su 05.	Su 05.	Su 05.	Su 05.	Mo 06.	Mo 06.	Mo 06.	Mo 06.	Mo 06.	Mo 06.	Mo 06.	Mo 06.	Tu 07.	Tu 07.	Tu 07.	Tu 07.	Tu 07.	Tu 07.	Tu 07.	Tu 07.	We 08.	We 08.	We 08.	We 08.	We 08.	We 08.	We 08.	We 08.
Time (24 hr)	13h	16h	19h	22h	01h	04h	07h	10h	13h	16h	19h	22h	01h	04h	07h	10h	13h	16h	19h	22h	01h	04h	07h	10h	13h	16h	19h	22h	01h	04h	07h	10h	13h	16h	19h	22h
Wind speed	5	4	5	5	4	4	4	3	2	4	5	5	6	6	6	5	4	4	5	5	4	4	5	5	5	5	5	5	5	5	5	4	5	5	5	5
Wind gusts	6	5	6	6	5	4	4	4	3	4	5	6	6	6	6	5	5	5	5	6	5	5	5	5	6	6	5	6	6	5	5	5	5	5	5	5

Actual conditions recorded (for most of the day)

NE f4 | **N f3-4** | **NW – SW f4--5** | **W f5** | **NW f5**

Th 09.	Th 09.	Th 09.	Th 09.	Th 09.	Th 09.	Th 09.	Th 09.	Fr 10.	Fr 10.	Fr 10.	Fr 10.	Fr 10.	Fr 10.	Fr 10.	Fr 10.	Sa 11.	Sa 11.	Sa 11.	Sa 11.	Sa 11.	Sa 11.	Sa 11.	Sa 11.	Su 12.	Su 12.	Su 12.	Su 12.	Su 12.	Su 12.	Su 12.	Su 12.	Mo 13.	Mo 13.	Mo 13.	Mo 13.	Mo 13.	Mo 13.	Mo 13.	Mo 13.
01h	04h	07h	10h	13h	16h	19h	22h	01h	04h	07h	10h	13h	16h	19h	22h	01h	04h	07h	10h	13h	16h	19h	22h	01h	04h	07h	10h	13h	16h	19h	22h	01h	04h	07h	10h	13h	16h	19h	22h
5	5	4	4	3	4	4	4	4	4	4	3	3	4	4	4	3	1	2	2	1	2	3	5	5	6	7	7	6	6	6	6	6	6	6	5	4	4	3	2
5	5	4	4	4	4	4	4	4	4	4	3	3	4	5	4	3	1	2	2	1	2	4	5	6	8	9	8	8	7	8	7	8	7	7	6	5	4	3	2

W f3-4 | **NW f3** | **NE f2-3 increasing SW f4-5** | **SW f6-7** | **SW 4-5**

Figure A Predicted and actual weather conditions during the survey period 4th to 10th June 2011

Appendix 3 Video Log

Table B Video log

Task	Site	Video	Notes	Location (Folder details)	File name / duration	Description of footage	Screen grabs
Familiarisation	Peninnis Head, St Marys					N/A	
Kelp structure & algal diversity	Brodfield, St Marys		GB/CP – recording kelp structure KN – collecting algal	06-Jun-11 Brodfield kelp	2011 6 June Brodfield kelp 003 00:46 mins.	Kelp forest – assorted algae	
					2011 6 June Brodfield kelp 004 02:24 mins.	Kelp forest – partic. ephiphytes on kelp stipes, for example, *Delesseria sanguinea*	
					2011 6 June Brodfield kelp 005 03:02 mins.	Diver measuring kelp density within quadrat	
					2011 6 June Brodfield kelp 006 02:03 mins.	Kelp forest – example of *Laminaria ochroleuca* plant	00:02
					2011 6 June Brodfield kelp 007 01:20 mins.	Recording algal diversity & diver swimming with quadrat & tape	
					2011 6 June Brodfield kelp 008 00:48 mins	Footage of a single *L. ochroleuca* plant	00:03
					2011 6 June Brodfield kelp 009 00:41 mins.	Footage of single *L. hyperborea* plant with epiphytic red algae on stipe	
					2011 6 June Brodfield kelp 010 01:12 mins.	KN recording & collecting epiphytic algae	
					2011 6 June Brodfield kelp 011 02:31 mins.	Divers recording kelp density	01:35 ✓
					2011 6 June Brodfield kelp 012 01:03 mins.	Transect tape & individual *L. hyperborea* plant.	

Table continued...

Task	Site	Video	Notes	Location (Folder details)	File name / duration	Description of footage	Screen grabs
					2011 6 June Brodfield kelp 013 00:46 mins.	Individual *L. ochroleuca* plant.	00:43 ✓
					2011 6 June Brodfield kelp 014 01:25 mins.	Understorey algae.	00:56
					2011 6 June Brodfield kelp 015 00:25 mins.	Divers in amongst kelp	
					2011 6 June Brodfield kelp 016 01:48 mins.	KN investigating understorey algae	
					2011 6 June Brodfield kelp 017 00:51 mins.	Individual plants, particularly *Saccorhiza polyschides*.	
					2011 6 June Brodfield kelp 018 00:54 mins.	Corkwing wrasse in amongst kelp	00:13 ✓
					2011 6 June Brodfield kelp 019 00:27 mins.	KN close-up recording	
					2011 6 June Brodfield kelp 020 01:36 mins.	*L. ochroleuca* individual plant.	00:23
					2011 6 June Brodfield kelp 021 00:14 mins.	Within the kelp forest understorey.	00:04
					2011 6 June Brodfield kelp 022 00:16 mins.	*Desmerestia* sp. within understorey	
					2011 6 June Brodfield kelp 023 00:48 mins.	Snakelocks anemone on kelp frond.	00:10 ✓
					2011 6 June Brodfield kelp 024 00:27 mins.	Murky kelp forest shot	
					2011 6 June Brodfield kelp 025 00:53 mins.	*Laminaria ochroleuca* with epiphytes – individual plant.	00:10
					2011 6 June Brodfield kelp 026 01:35 mins.	Divers recording in amongst kelp	
					2011 6 June Brodfield kelp 027 00:35 mins.	Footage of canopy from above, showing both *L. hyperborea* and *L. ochroleuca* fronds.	00:28 ✓

Table continued...

Task	Site	Video	Notes	Location (Folder details)	File name / duration	Description of footage	Screen grabs
Kelp structure & algal diversity	Menawethan	AC		08-Jun-11 Menawethan AC	08 June 2011 Menawethan Pt AC 026 00:07 mins.	Out of focus clapperboard	
					08 June 2011 Menawethan Pt AC 025 (1) 00:06	Diver with SMB reel. (timed at 08:57)	
					08 June 2011 Menawethan Pt AC 025 (2) 00:23	Kelp canopy (timed at 11:27)	
					08 June 2011 Menawethan Pt AC 025 (3) 01:02	Diver struggling to release a delayed SMB	
					08 June 2011 Menawethan Pt AC 025 (4) 00:48	Diver swimming alongside kelp.	
					08 June 2011 Menawethan Pt AC 025 (5) 00:14	Image of *Alaria esculenta* in amongst other kelp species.	
					08 June 2011 Menawethan Pt AC 025 (6) 00:34	Bedrock under kelp canopy with holdfasts.	00:07
					08 June 2011 Menawethan Pt AC 025 (7) 00:21	Bedrock under kelp canopy with holdfasts.	00:05 ✓
					08 June 2011 Menawethan Pt AC 025 (8) 00:31	*Echinus esculentus* attached to vertical bedrock below kelp line.	✓
					08 June 2011 Menawethan Pt AC 025 (9) 00:30	Bedrock with Corallinaceae and *Corynactis viridis*.	00:18, 00:28
					08 June 2011 Menawethan Pt AC 025 (10) 00:14	*Tubularia indivisa* forest!	00:02
					08 June 2011 Menawethan Pt AC 025 (11) 00:06	Bedrock surface with *Corynactis viridis*.	
					08 June 2011 Menawethan Pt AC 025 (12) 03:00	Diver with large quadrat looking for a place to put it!	
					08 June 2011 Menawethan Pt AC 025 (13) 00:31	Grazed bedrock with solitary *L. hyperborea* from holdfast to blade.	
					08 June 2011 Menawethan Pt AC 025 (14) 00:06	Murky shot of moving kelp stipe.	

Table continued...

Task	Site	Video	Notes	Location (Folder details)	File name / duration	Description of footage	Screen grabs
					08 June 2011 Menawethan Pt AC 025 (15) 00:02	Too short to describe!	
					08 June 2011 Menawethan Pt AC 025 (16) 00:15	Shot of an individual *L. ochroleuca*.	
					08 June 2011 Menawethan Pt AC 025 (17) 00:45	*Marthasterias glacialis* at base of kelp plant, with an *Echinus* individual on nearby bedrock.	00:05
					08 June 2011 Menawethan Pt AC 025 (18) 00:39	*L. hyperborea* plant attached to the stipe of another individual, with an *Echinus esculentus* as well.	
					08 June 2011 Menawethan Pt AC 025 (19) 00:37	Shot of *Corynactis viridis* patches on ?vertical bedrock beneath kelp canopy.	
					08 June 2011 Menawethan Pt AC 025 (20) 00:50	Mixed kelp forest.	00:06
					08 June 2011 Menawethan Pt AC 025 (21) 00:48	*Echinus esculentus* individual grazing on kelp stipe.	00:32
					08 June 2011 Menawethan Pt AC 025 (22) 00:19	*Alcyonium glomeratum* colony.	00:15
					08 June 2011 Menawethan Pt AC 025 (23) 00:10	*L. hyperborea* kelp holdfast stump.	
					08 June 2011 Menawethan Pt AC 025 (24) 00:25	*L. hyperborea* individual kelp plant.	
					08 June 2011 Menawethan Pt AC 025 (25) 00:22	Shot of *L. ?hyperborea* blade/stipe.	
					08 June 2011 Menawethan Pt AC 025 (26) 00:05	Shot of *L. ?hyperborea* blade/stipe. V. short sequence.	
					08 June 2011 Menawethan Pt AC 025 (27) 00:36	Grazed bedrock surface with under-canopy foliose algae and faunal turf.	
					08 June 2011 Menawethan Pt AC 025 (28) 01:09	In amongst dense kelp forest with attempt to film diver recording from quadrat.	
					08 June 2011 Menawethan Pt AC 025 (29) 01:16	Diver swimming around on edge of kelp forest.	
					08 June 2011 Menawethan Pt AC 025 (30) 00:21	Diver with SMB reel hovering at decompression safety stop.	

Table continued...

Task	Site	Video	Notes	Location (Folder details)	File name / duration	Description of footage	Screen grabs
					08 June 2011 Menawethan Pt AC 025 (31) 00:11	Young seal swimming in open water close to kelp forest.	
					08 June 2011 Menawethan Pt AC 025 (32) 00:46	Footage on surface in boat, of sea surface and shore, finishing with divers surfacing.	
Kelp structure & algal diversity	Menglow Reef, St Agnes	CW	GB/CP – recording kelp structure	09-Jun-11 Menglow	2011-06-09 Menglow (1) 00:19 mins.	Diver placing 3-sided large quadrat in amongst kelp forest.	
			KN – collecting algal species		2011-06-09 Menglow (2) 00:04 mins.	Clapperboard	
					2011-06-09 Menglow (3) 00:12 mins.	Clapperboard	
					2011-06-09 Menglow (4) 00:38 mins.	Overview of kelp canopy with divers alongside transect tape.	
					2011-06-09 Menglow (5) 00:32 mins.	Overview of kelp canopy with divers alongside transect tape.	
					2011-06-09 Menglow (6) 00:38 mins.	Overview of kelp canopy with divers alongside transect tape.	
					2011-06-09 Menglow (7) 00:38 mins.	Epiphytic red algae growing on *L. hyperborea* stipe	
					2011-06-09 Menglow (8) 01:03 mins.	Single *L. ochroleuca* plant, with clean stipe.	
					2011-06-09 Menglow (9) 03:42 mins.	Transect tape running through kelp forest. Diver placing quadrat at pre-determined ‘random’ position. Diver writing on slate.	
					2011-06-09 Menglow (10) 00:56 mins.	Transect tape running through kelp forest, with diver getting himself organised towards the end.	
					2011-06-09 Menglow (11) 02:21 mins.	Single *Saccorhiza polyschides* plant.	
					2011-06-09 Menglow (12) 01:59 mins.	Transect tape running through kelp, with shot towards end of *L. ochroleuca* plant.	

Table continued...

Task	Site	Video	Notes	Location (Folder details)	File name / duration	Description of footage	Screen grabs
					2011-06-09 Menglow (13) 01:03 mins.	*Echinus esculentus* grazing on bedrock beneath kelp.	
					2011-06-09 Menglow (14) 00:53 mins.	*Delesseria sanguinea* & *Halidrys siliquosa* in amongst kelp.	
					2011-06-09 Menglow (15) 01:05 mins.	*Desmerestia*, *Dictyota, Callophyllis* and *Nitophyllum* in amongst kelp, plus an *Echinus esculentus*.	00:29✓
					2011-06-09 Menglow (16) 00:08 mins.	Solitary *Echinus esculentus*.	
					2011-06-09 Menglow (17) 00:24 mins.	*Aglaophenia pluma* hydroids growing on *Halidrys siliquosa*.	
					2011-06-09 Menglow (18) 00:49 mins.	Single *Saccorhiza polyschides* plant with clean stipe.	
					2011-06-09 Menglow (19) 00:14 mins.	Lush, fine growth of *Ectocarpus* brown filamentous weed on old *Saccorhiza polyschides* stipe.	
					2011-06-09 Menglow (20) 02:42 mins.	Diver placing quadrat close to transect tape, sorting out 'caught-up' weeds and then recording from quadrat. Good example of technique.	
					2011-06-09 Menglow (21) 00:38 mins.	Diver placing quadrat. Poor.	
					2011-06-09 Menglow (22) 00:19 mins.	Overview of kelp canopy. Poor.	
					2011-06-09 Menglow (23) 01:22 mins.	Overview of transect tape, and then of diver recording. Poor quality.	
					2011-06-09 Menglow (24) 02:05 mins.	KN recording and collecting algae from under the kelp canopy.	01:31✓
					2011-06-09 Menglow (25) 00:46 mins.	Transect tape stretching across a sandy gully, with kelp on both sides.	
					2011-06-09 Menglow (26) 01:05 mins.	Vertical wall in amongst kelp park, with faunal turf dominated by encrusting Corallinaceae & *Corynactis viridis*.	
					2011-06-09 Menglow (27) 00:23 mins.	Progressing from vertical face onto sloping face above, with *Echinus esculentus* and understorey flora.	

Table continued...

Task	Site	Video	Notes	Location (Folder details)	File name / duration	Description of footage	Screen grabs
					2011-06-09 Menglow (28) 00:15 mins.	V. short sequence of epiphytic red algae on *L. hyperborea* stipe.	
Algal diversity	Mackerel Rocks		Recording algae from quadrats	13-Jun-11 Mackerel Rocks	Mackerel Rocks 13 June 2011 001 00:36 mins.	Measuring tape attached to kelp plant and running through kelp forest. Poor quality.	
					Mackerel Rocks 13 June 2011 002 01:13 mins.	Measuring tape passing through kelp forest.	
					Mackerel Rocks 13 June 2011 003 01:13 mins.	Diver placing 0.25 m^2 quadrat beside measuring tape.	
					Mackerel Rocks 13 June 2011 004 00:33 mins.	Divers undertaking quadrat work within kelp forest.	
					Mackerel Rocks 13 June 2011 005 00:50 mins.	Diver releasing SMB from within kelp forest.	
					Mackerel Rocks 13 June 2011 006 01:21 mins.	Fish fry & adult goldsinny, plus good quality shot of *Saccorhiza polyschides* plant.	
					Mackerel Rocks 13 June 2011 007 00:37 mins.	Good quality shot of *Saccorhiza polyschides* plant.	
					Mackerel Rocks 13 June 2011 008 00:38 mins.	Poor quality shot of kelp forest and a diver's back.	
					Mackerel Rocks 13 June 2011 009 00:52 mins.	Diver inspecting algal species within kelp forest.	
					Mackerel Rocks 13 June 2011 010 01:47 mins.	Diver finishing algal recording within a 0.25 m^2 quadrat, followed by video record of same quadrat. Good example of technique.	
					Mackerel Rocks 13 June 2011 011 00:36 mins.	Diver placing 0.25 m^2 quadrat on boulder seabed beneath measuring tape.	
					Mackerel Rocks 13 June 2011 012 00:49 mins.	Diver recording algae from within a 0.25 m^2 quadrat. Good example of technique.	
					Mackerel Rocks 13 June 2011 013 01:00 mins.	Shot of *Halidrys* to start but then gets immersed in kelp fronds.	
					Mackerel Rocks 13 June 2011 014 00:19 mins.	Overview shot of kelp – poor quality.	

Table continued...

Task	Site	Video	Notes	Location (Folder details)	File name / duration	Description of footage	Screen grabs
					Mackerel Rocks 13 June 2011 015 00:53 mins.	Shot of diver sorting himself out prior to recording from quadrat.	
					Mackerel Rocks 13 June 2011 016 02:12 mins.	Excellent shot of *L. ochroleuca* plants, following their fronds then stipes down to understorey algae. Fist half of sequence better than second.	
					Mackerel Rocks 13 June 2011 017 01:03 mins.	Shot of *Kallymenia reniformis* at base of kelp stipe.	
					Mackerel Rocks 13 June 2011 018 01:07 mins.	Example of urchin-grazed understorey, with encrusting Corallinaceae obvious.	00:57✓
					Mackerel Rocks 13 June 2011 019 00:23 mins.	Good example of urchin-grazed understorey algae.	00:04✓
					Mackerel Rocks 13 June 2011 020 00:36 mins.	Fish fry (?2-spotted gobies) in water column above kelp canopy.	
					Mackerel Rocks 13 June 2011 021 02:18 mins.	General overview of kelp forest, followed by diver recording from quadrat and inspecting his slate/recording form.	
					Mackerel Rocks 13 June 2011 022 00:40 mins.	Diver reeling in measuring tape.	
					Mackerel Rocks 13 June 2011 023 00:31 mins.	Pair of divers ascending to surface at end of dive.	
					Mackerel Rocks 13 June 2011 024 00:44 mins.	Close-up of silty hydroid attached to kelp frond.	
					Mackerel Rocks 13 June 2011 025 00:22 mins.	Overview of kelp canopy with solitary diver beside measuring tape.	
					Mackerel Rocks 13 June 2011 026 02:33 mins.	Diver placing quadrat close to measuring tape and then recording from it. Good example of technique.	
					Mackerel Rocks 13 June 2011 027 00:23 mins.	Shot of diver recording from quadrat. Poor quality.	
					Mackerel Rocks 13 June 2011 028 00:54 mins.	Poor quality but useful overview of site as a whole.	
					Mackerel Rocks 13 June 2011 029 00:28 mins.	Diver reeling up measuring tape. Good example of technique.	

Table continued...

Task	Site	Video	Notes	Location (Folder details)	File name / duration	Description of footage	Screen grabs
					Mackerel Rocks 13 June 2011 030 00:07 mins.	Full face shot of GB winding in his SMB line in mid water.	
					Mackerel Rocks 13 June 2011 031 00:22 mins.	GB winding in his SMB line in mid water.	
					Mackerel Rocks 13 June 2011 032 00:17 mins.	GB winding in his SMB line in mid water.	
					Mackerel Rocks 13 June 2011 033 00:12 mins.	GB indicating OK to surface.	
					Mackerel Rocks 13 June 2011 034 00:11 mins.	Out of focus shot of GB & CP back on RIB.	
					Mackerel Rocks 13 June 2011 035 00:24 mins.	Surface shot: zoom-in & zoom-out of shag on rock.	
Verticals	Gap Point, St Marys	CW	Video of AC 's transect. Video of site	07-Jun-11 Gap Point CW	070611 Gap Point Isles of Scilly Chris W 002 AC VT1 03:17 mins.	Very silty water with distant views of divers. Then, smooth vertical bedrock face with silty hydroid-bryozoan turf, *Caryophyllia smithii*, thin encrusting sponges, a few erect sponges and *Alcyonium glomeratum*.	
					070611 Gap Point Isles of Scilly Chris W 004 00:11 mins.	KN with small housed camera.	
					070611 Gap Point Isles of Scilly Chris W 005 00:09 mins.	Divers on boat on surface.	
Verticals	Gap Point			12-Jun-11 Gap Point attempt	Gap Point 12 June 2011 001 00:08 mins.	Diagram of monitoring site layout (from Hiscock, 1985)	
					Gap Point 12 June 2011 002 00:0800:15 mins.	Overview. Surge-y and silty footage of vertical. Poor quality.	
					Gap Point 12 June 2011 003 00:48 mins.	Overview. General shots of vertical bedrock faces. Surge-y & silty.	
					Gap Point 12 June 2011 004 00:48 mins.	Overview. General shots of vertical bedrock faces. Surge-y & silty.	

Table continued...

Task	Site	Video	Notes	Location (Folder details)	File name / duration	Description of footage	Screen grabs
					Gap Point 12 June 2011 005 02:10 mins.	Close-ups of vertical faces, showing bryozoan turf species (crissidae, *Bugula* spp & *Scrupocellaria* sp.), *Corynactis viridis*, *Caryophyllia smithii* & encrusting sponges.	01:24
					Gap Point 12 June 2011 006 00:45 mins.	Surface shots within RIB, with spray droplets on lens affecting focus.	
Verticals	Gap Point			13-Jun-11 Gap Point	Gap Point 13 June 2011 001 00:50 mins.	Overview. Blurry and silty.	
					Gap Point 13 June 2011 002 02:19 mins.	Close-ups of vertical faces, alongside transect tape.	01:02 (saved as Snapshot 9).
					Gap Point 13 June 2011 003 00:24 mins.	Short overview sequence, featuring a single *Eunicella verrucosa* on a ledge.	
					Gap Point 13 June 2011 004 00:12 mins.	Overview – poor distant shot.	
					Gap Point 13 June 2011 005 00:46 mins.	Amusing notice from TA re. location of *Leptopsammia*. Shots of vertical wall at monitoring site 1.	00.36
					Gap Point 13 June 2011 006 03:48 mins.	Monitoring site 1 – with *Leptopsammia*. Good quality shot at slow speed.	00:22, 01:05, 03:25
					Gap Point 13 June 2011 007 01:56 mins.	Good quality shot at slow speed, but which ends in a cloud of silt.	
					Gap Point 13 June 2011 008 04:13 mins.	Footage of vertical faces but in rather silty conditions, so not good quality.	
					Gap Point 13 June 2011 009 00:29 mins.	Monitoring site 1 – with *Leptopsammia*. Good quality shot but speed too fast.	
					Gap Point 13 June 2011 010 01:38 mins.	Monitoring site 1 – with *Leptopsammia*. Poor quality shot with suspended matter in evidence.	
					Gap Point 13 June 2011 011 00:17 mins.	Distance shot of diver – poor quality.	
					Gap Point 13 June 2011 012 00:15 mins.	Divers de-kitting equipment in RIB tied to quayside.	

Table continued...

Task	Site	Video	Notes	Location (Folder details)	File name / duration	Description of footage	Screen grabs
Verticals	Gugh Reef, St Agnes	CW	CP/AC – Recording GB – site overview	10-Jun-11 Gugh Reef	Gugh Reef (1) 01:13 mins.	Under canopy beneath kelp park, dominated by *Metridium senile*, *Pentapora foliacea* & small foliose algae.	00:19
					Gugh Reef (2) 00:45	Overview of steeply-sloping rockface, with dense *Metridium senile* obvious.	
					Gugh Reef (3) 00:06	Crevice with *Corynactis viridis*, in amongst bryozoan turf and red algae.	00:03
					Gugh Reef (4) 00:19	Under canopy beneath kelp park, dominated by *Metridium senile* & small foliose algae. With Ballan wrasse.	
					Gugh Reef (5) 00:12	Two vertical tapes with two divers recording.	
					Gugh Reef (6) 00:08	Under canopy beneath kelp park, dominated by *Metridium senile*, *Pentapora foliacea* & small foliose algae.	00:02
					Gugh Reef (7) cp L 03:03	Diver recording beside vertical transect line.	00:06✓
					Gugh Reef (8) 01:25	Overview of site, with transect line and divers, and bedrock dominated by *Metridium senile*.	00:58✓
					Gugh Reef 033 02:20	Shot of bedrock surface, dominated by *Metridium senile* and *Pentapora foliacea*.	01:01
					Gugh Reef 034 ac 02:29	Vertical transect tape with bedrock behind dominated by *Metridium senile*.	00:05, 00:38
					Gugh Reef 039 AC R 02:29	Vertical transect tape with bedrock behind dominated by *Metridium senile*.	00:04; 00:23
Verticals	Newfoundland Point, St Marys	AC		08-Jun-11 Newfoundland Pt AC	08 June 2011 Newfoundland Pt AC 001 00:08 mins.	Clapperboard (incorrectly labelled with 'kelp' being the diving task).	
					08 June 2011 Newfoundland Pt AC 002 01:53 mins.	Vertical bedrock wall with faunal turf shot in close-up.	01:18✓

Table continued...

Task	Site	Video	Notes	Location (Folder details)	File name / duration	Description of footage	Screen grabs
					08 June 2011 Newfoundland Pt AC 003 000 20 mins.	Sloping bedrock with small solitary *Eunicella verrucosa*.	
					08 June 2011 Newfoundland Pt AC 004 00:23 mins.	Vertical bedrock wall with very large *Cliona celata*.	00:12
					08 June 2011 Newfoundland Pt AC 005 00:43 mins.	Faunal turf on vertical wall with *Marthasterias glacialis* and *Alcyonium glomeratum*.	00:05✓
					08 June 2011 Newfoundland Pt AC 006 01:29 mins.	Sloping bedrock ledge with *Alcyonium glomeratum*, erect axinellid sponges and *Antedon bifida* featherstars.	00:18
					08 June 2011 Newfoundland Pt AC 007 00:27 mins.	Vertical transect marked by measuring tape running up cliff, with diver and 1 m measuring rod recording species.	
					08 June 2011 Newfoundland Pt AC 008 00:12 mins.	Ledge with *Pentapora foliacea*.	
					08 June 2011 Newfoundland Pt AC 009 00:07 mins.	Large axinellid branching sponge (probably *Axinella dissimilis*) with distinctive red colouration.	
					08 June 2011 Newfoundland Pt AC 010 00:04 mins.	Patch of *Hemimycale columella* on vertical bedrock.	00:02
					08 June 2011 Newfoundland Pt AC 011 00:03 mins.	V. short footage of sponge-dominated faunal turf on ledge.	
					08 June 2011 Newfoundland Pt AC 012 T1 CP 03:29 mins.	LHS of vertical transect, with *Corynactis viridis* and short faunal turf.	03:00
					08 June 2011 Newfoundland Pt AC 013 T2 KC 01:48 mins.	LHS of another vertical transect, with more crevices and non-vertical bedrock surfaces.	
					08 June 2011 Newfoundland Pt AC 014 01:55 mins.	Overview of cliff, with portrait shot of *Myxilla sulphurea*, and colourful patches of jewel anemones and *Hemimycale columella* sponge.	01:23, 01:35
					08 June 2011 Newfoundland Pt AC 015 01:21 mins.	Representative vertical cliff community to start with, but then quality decreases with poor, out of control sequence.	

Table continued...

Task	Site	Video	Notes	Location (Folder details)	File name / duration	Description of footage	Screen grabs
					08 June 2011 Newfoundland Pt AC 016 01:09 mins.	Upper circalittoral near-vertical wall with sparse red and brown algae as well as assorted encrusting sponges and jewel anemones.	00:08
					08 June 2011 Newfoundland Pt AC 017 00:32 mins.	Sequence following a Ballan wrasse *Labrus bergylta*.	
					08 June 2011 Newfoundland Pt AC 018 00:36 mins.	Sequence following a Ballan wrasse *Labrus bergylta*, followed by lower infralittoral cliff with patches of white *Metridium senile* plumose anemones on lower edge of kelp park.	
					08 June 2011 Newfoundland Pt AC 019 00:31 mins.	Vertical cliff just below kelp park, with dense *Corynactis viridis* and patches of white *Metridium senile*.	
					08 June 2011 Newfoundland Pt AC 020 01:43 mins.	Patch of *Clavelina lepadiformis* with sparse brown alga *Dictyopteris membranacea*. Lower down on a small ledge, a massive *Cliona celata*.	00:15
					08 June 2011 Newfoundland Pt AC 021 00:07 mins.	Ballan wrasse disappearing into kelp.	
					08 June 2011 Newfoundland Pt AC 022 00:10 mins.	Short sequence not worth recording.	
					08 June 2011 Newfoundland Pt AC 023 01:14 mins.	Patches of *Corynactis viridis* on vertical surfaces in amongst kelp.	00:14
					08 June 2011 Newfoundland Pt AC 024 00:22 mins.	Dense kelp canopy at top of cliff.	
Eunicella density	Smith Sound, St Agnes	KN	GB/CW – recording KC/AC – recording KN – Overview & video	09-Jun-11 Smith Sound	2011-06-09 Smith Sound 001 00:04 mins.	Clapperboard shot (wrongly dated as 08-Jun-11)	
					2011-06-09 Smith Sound 002 01:23 mins.	Overview of site with transect line laid out over uneven though smooth bedrock. Sparse *Cliona celata*, *Alcyonium digitatum* and *Holothuria forskali*. Bedrock surface with encrusting Corallinaceae common.	00:10✓

Table continued...

Task	Site	Video	Notes	Location (Folder details)	File name / duration	Description of footage	Screen grabs
					2011-06-09 Smith Sound 003 01:13 mins.	Close-up of bedrock turf, together with two *Eunicella verrucosa* sea fans.	01:13✓
Sponge community	NW Flat Ledge, St Martin's	CP	Taken on photo camera	Dive video clips from NE	11Jun11 NW Flat Ledge LHS CP Q1.AVI 00:25 mins.	Record of individual quadrat.	
					11Jun11 NW Flat Ledge LHS CP Q2.AVI 00:28 mins.	Record of individual quadrat.	
		GB		11-Jun-11 NW Flat Ledge St Martins GB	110611 NW Flat Ledge, St Martins GB 005 RHS KC Q1 LHS CP Q1 01:12 mins.	A very quick record of 2 quadrats. RHS KC Q1 – predominant species included bushy bryozoans (*Cellaria, Crissidae, Bugula* spp.), *Stolonica socialis*, *Alcyonium digitatum*, *A. glomeratum*, *Polymastia boletiformis* etc. LHS CP Q1 – very similar, though with more sparse, foliose red algae and *Dictyota dichotoma*, and *Corynactis viridis*.	
					110611 NW Flat Ledge, St Martins GB 006 LHS CP Q2 00:30 mins.	As above.	
					110611 NW Flat Ledge, St Martins GB 007 overview 00:34 mins.	Overview of monitoring transect. Shows more *Echinus esculentus* and *Alcyonium digitatum* apparent.	
					110611 NW Flat Ledge, St Martins GB 008 RHS KC Q3 (? Should this be Q2) 00:09 mins.	Dominant species in quadrat: *Metridium senile* and *Nemertesia antennina*, with short bryozoan turf spp.	
					110611 NW Flat Ledge, St Martins GB 009 Overview 00:42	Overview of surrounding topography/communities.	00:17 mins. (saved as Snapshot 4)
					110611 NW Flat Ledge, St Martins GB 010 RHS KC Q3 00:36 mins.	Quadrat dominated by *Metridium senile*, *Nemertesia ramosa*, *Corynactis viridis* and hydroid-bryozoan turf.	
					110611 NW Flat Ledge, St Martins GB 011 LHS CP query Q3 00:42 mins.	Quadrat dominated by *Nemertesia antennina* and *N. ramosa*, *Metridium senile*, *Pentapora foliacea* and hydroid-bryozoan turf.	00:09 mins. (saved as Snapshot 5)

Table continued...

Task	Site	Video	Notes	Location (Folder details)	File name / duration	Description of footage	Screen grabs
					110611 NW Flat Ledge, St Martins GB 012 LHS CP Q4 00:57 mins.	Quadrat dominated by *Nemertesia antennina* and *N. ramosa*, *Metridium senile*, *Pentapora foliacea* and hydroid-bryozoan turf.	
					110611 NW Flat Ledge, St Martins GB 013 RHS KC Q4 00:52 mins.	Quadrat dominated by *Dictyota dichotoma*, low-lying rhodophycota, *Myxilla sulphurea*, *Pentapora foliacea*, *Nemertesia antennina*, *Metridium senile*.	00:20 mins. (saved as Snapshot 6)
					110611 NW Flat Ledge, St Martins GB 014 overview 00:23 mins.	Overview – showing *Corynactis viridis* on vertical faces, *Echinus esculentus* and *Cliona celata* clumps.	00:08 mins. (saved as Snapshot 7)
					110611 NW Flat Ledge, St Martins GB 015 overview 00:22 mins.	Overview – clumps of *Salmacina dysteri* associated with *Pentapora foliacea* colonies.	00:20 mins. (saved as Snapshot 8)
					110611 NW Flat Ledge, St Martins GB 016 overview 00:20 mins.	Overview – similar community to that recorded in Q1.	
Sponge community	Chad Girt, St Martin's	CW		Folder: 11-Jun-11 Chad Girt sponges CW	110611 Chad Girt CW 018 LHS CP Q1	Video of Q1 (CP) Upward-facing silted bedrock with *Suberites carnosus*, *Polymastia boletiformis* & *Caryophyllia smithii*	Suggested grab at 00:47 mins. (saved as Snapshot 1)
					110611 Chad Girt CW 019 RHS KC Q1	Video of Q1 (KC) Partially inclined bedrock with hydro-bryozoan turf, axinellids, *Dictyopteris*, *Hemimycale columella*, *Alcyonium glomeratum*	
					110611 Chad Girt CW 020 LHS CP Q2	Video of Q2 (CP) *Suberites*, *Polymastia*, *Axinella* sp.	
					110611 Chad Girt CW 021 RHS KC Q2	Video of Q2 (KC) *Suberites carnosus*, *Polymastia boletiformis*, *Hemimycale columella*, *Caryophyllia smithii*	Suggested grab at c. 01:01 mins. (saved as Snapshot 2)

Table continued...

Task	Site	Video	Notes	Location (Folder details)	File name / duration	Description of footage	Screen grabs
					110611 Chad Girt CW 022 LHS CP Q3	Video of Q3 (CP) Axinellids, *Polymastia boletiformis*, *Caryophyllia smithii*,*Suberites carnosus* & *S. ficus*, silty hydro-bryozoan turf	Silty clip
					110611 Chad Girt CW 023 RHS KC Q3	Video of Q3 (KC)	Clip of only 5 secs. duration.
					110611 Chad Girt CW 024 RHS KC Q3	Video of Q3 (KC) *Polymastia boletiformis*, *Hemimycale columella*, *Caryophyllia smithii*, axinellids,	Repeat of above clip. Suggested grab at c. 00:24 mins.
					110611 Chad Girt CW 025 LHS CP Q4	Video of Q4 (CP) *Pentapora foliacea*, *Axinella dissimilis*, axinellids, *Caryophyllia smithii*, *Isozoanthus sulcatus*	
Faunal turf community	Church Ledges, St Marys	CW		07-Jun-11 Church Ledges	070611 Church Ledges Isles of Scilly Chris W 006	Heavily grazed large boulders with *Echinus* and *Holothuria forskali*.	00:14✓, 00:25✓
					070611 Church Ledges Isles of Scilly Chris W 007	Diver untangling herself from the SMB line.	
	Hoe Point, St Agnes	AC	CP/CW – Recording GB – site overview	10-Jun-11 Hoe Point	1_Hoe Point L CP 1 00:21 mins.	Record of quadrat, lying on silty turf on top side of a large boulder, with sparse *Dictyota dichotoma* and *Caryophyllia smithii*.	
					2_Hoe Point R CW 1 00:21 mins.	Record of quadrat, lying on small boulders, with silty turf, sparse foliose algae.	
					3_Hoe Point L CP 2 00:38 mins.	Large & small boulders with Corallinaceae, sparse foliose algae, burrowing holothurians in crevices and silty hydroid-bryozoan turf.	
					4_Hoe Point R CW 2 00:21 mins.	Large & v. large boulders with Corallinaceae, sparse foliose algae and silty hydroid-bryozoan turf.	
					5_Hoe Point L CP 3 00:33 mins.	V. large & small boulders with sparse *Caryophyllia smithii*, Corallinaceae, sparse foliose algae and silty hydroid-bryozoan turf.	

Table continued...

Task	Site	Video	Notes	Location (Folder details)	File name / duration	Description of footage	Screen grabs
					6_Hoe Point R CW 3 00:17 mins.	Small boulders with a few pebbles and coarse sand. *Caryophyllia smithii*, Corallinaceae, sparse foliose algae and silty hydroid-bryozoan turf.	
					7_Hoe Point R CW 4 00:26 mins.	Large boulders with single *Echinus esculentus*, *Caryophyllia smithii*, Corallinaceae, sparse foliose algae and silty hydroid-bryozoan turf.	
					8_Hoe Point L CP 4 00:25 mins.	Large boulders with *Caryophyllia smithii*, Corallinaceae, sparse foliose algae and silty hydroid-bryozoan turf.	
					9_Hoe Point CW 5 00:24 mins.	V. large boulder with single *Holothuria forskali*, *Caryophyllia smithii*, Corallinaceae, sparse foliose algae and silty hydroid-bryozoan turf.	
					10_Hoe Point R CW 5 00:17 mins.	V. large boulder with *Caryophyllia smithii*, Corallinaceae, sparse foliose algae and silty hydroid-bryozoan turf.	
					11_Hoe Point L CP 5 00:29 mins.	V. large boulder with *Caryophyllia smithii*, Corallinaceae, sparse foliose algae and silty hydroid-bryozoan turf.	
			Hoe Point (1) renamed Hoe Point (23), as out of chronological order (RI 28/10/11)		Hoe Point (2) 00:05 mins.	Surface shot of diver in boat.	
					Hoe Point (3) 00:09 mins.	Surface shot of GB & CW sitting on the side of the boat about to dive.	
					Hoe Point (4) 01:35 mins.	Diver (CW) laying out transect line.	
					Hoe Point (5) 00:38 mins.	Overview of grazed bedrock, with occasional *Alcyonium digitatum*, *Echinus*, sparse *Dictyota* and common Corallinaceae.	
					Hoe Point (6) 00:27 mins.	Cluster of *Alcyonium glomeratum*.	

Table continued...

Task	Site	Video	Notes	Location (Folder details)	File name / duration	Description of footage	Screen grabs
					Hoe Point (7) 00:31 mins.	Diver recording from quadrat beside transect line.	00:05✓
					Hoe Point (8) 00:19 mins.	Female cuckoo wrasse being tracked.	
					Hoe Point (9) 00:06 mins.	Female cuckoo wrasse being tracked, with background of site showing boulders.	00:05
					Hoe Point (10) 00:08 mins.	Poor shot of site.	
					Hoe Point (11) 00:09 mins.	Female cuckoo wrasse being tracked, with background of site showing boulders.	00:10
					Hoe Point (12) 00:29 mins.	Close-up of *Caryophyllia smithii* individual on rock surface.	
					Hoe Point (13) 00:20 mins.	Close-up of bedrock ridge with *Holothuria forskali* and *Caryophyllia smithii*.	
					Hoe Point (14) 00:35 mins.	Male & female cuckoo wrasse being tracked, with background of transect line showing boulders.	00:25✓
			(Note no clip 15).		Hoe Point (16) 00:09 mins.	Diver signalling to videographer to film quadrat while he reels up the tape.	
					Hoe Point (17) 00:21 mins.	Overview of site, showing *Echinus*, *Holothuria* and clumps of *Alcyonium digitatum*.	
					Hoe Point (18) 00:12 mins.	GB being silly whilst reeling in SMB.	
					Hoe Point (19) 00:51 mins.	Two divers reaching a safety decompression stop in mid-water.	
					Hoe Point (20) 00:08 mins.	Unplanned shot of 'guff' in water column.	
					Hoe Point (21) 00:13 mins.	Shot of recording slate with site diagram on it.	
					Hoe Point (22) 00:40 mins.	Diver being silly close to surface.	
					Hoe Point (23) 00:10 mins.	Shot of dive computer reading 4.6 m depth and dive time of 31 mins.	

Appendix 4 Photo log

Table C Photo log

Site	Date	Photo ref. (as ID'd by CP)	By	Comment
Peninnis Head	**05-Jun-11**	**65 images**	**CP**	**Images labelled by CP (under 'edit' folder)**
Peninnis Head	05-Jun-11	Alcyonium glomeratum.jpg	CP	
Peninnis Head	05-Jun-11	Aslia lefevrei or Pawsonia saxicola 1.jpg	CP	
Peninnis Head	05-Jun-11	Aslia lefevrei or Pawsonia saxicola 2.jpg	CP	
Peninnis Head	05-Jun-11	Axinella dissimilis.jpg	CP	
Peninnis Head	05-Jun-11	Cliona celata.jpg	CP	
Peninnis Head	05-Jun-11	Dictyota dichotoma.jpg	CP	Most of photo of ?*Heterosiphonia plumosa*
Peninnis Head	05-Jun-11	DSCF3165.jpg	CP	
Peninnis Head	05-Jun-11	DSCF3166.jpg	CP	
Peninnis Head	05-Jun-11	DSCF3171.jpg	CP	
Peninnis Head	05-Jun-11	DSCF3178.jpg	CP	
Peninnis Head	05-Jun-11	DSCF3184.jpg	CP	
Peninnis Head	05-Jun-11	DSCF3191.jpg	CP	*Corynactis viridis* + sponges
Peninnis Head	05-Jun-11	DSCF3192.jpg	CP	(same as above)
Peninnis Head	05-Jun-11	DSCF3193.jpg	CP	(same as above)
Peninnis Head	05-Jun-11	DSCF3194.jpg	CP	
Peninnis Head	05-Jun-11	DSCF3196.jpg	CP	
Peninnis Head	05-Jun-11	DSCF3198.jpg	CP	
Peninnis Head	05-Jun-11	DSCF3202.jpg	CP	
Peninnis Head	05-Jun-11	DSCF3203.jpg	CP	
Peninnis Head	05-Jun-11	DSCF3204.jpg	CP	
Peninnis Head	05-Jun-11	DSCF3205.jpg	CP	
Peninnis Head	05-Jun-11	DSCF3206.jpg	CP	
Peninnis Head	05-Jun-11	DSCF3209.jpg	CP	
Peninnis Head	05-Jun-11	DSCF3210.jpg	CP	
Peninnis Head	05-Jun-11	DSCF3211.jpg	CP	
Peninnis Head	05-Jun-11	DSCF3212.jpg	CP	
Peninnis Head	05-Jun-11	DSCF3213.jpg	CP	
Peninnis Head	05-Jun-11	DSCF3214.jpg	CP	
Peninnis Head	05-Jun-11	DSCF3215.jpg	CP	
Peninnis Head	05-Jun-11	DSCF3216.jpg	CP	
Peninnis Head	05-Jun-11	DSCF3217.jpg	CP	
Peninnis Head	05-Jun-11	DSCF3218.jpg	CP	
Peninnis Head	05-Jun-11	DSCF3219.jpg	CP	

Table continued...

Site	Date	Photo ref. (as ID'd by CP)	By	Comment
Peninnis Head	05-Jun-11	DSCF3221.jpg	CP	
Peninnis Head	05-Jun-11	DSCF3224.jpg	CP	
Peninnis Head	05-Jun-11	DSCF3225.jpg	CP	
Peninnis Head	05-Jun-11	DSCF3226.jpg	CP	
Peninnis Head	05-Jun-11	DSCF3227.jpg	CP	
Peninnis Head	05-Jun-11	DSCF3228.jpg	CP	
Peninnis Head	05-Jun-11	DSCF3229.jpg	CP	
Peninnis Head	05-Jun-11	DSCF3230.jpg	CP	
Peninnis Head	05-Jun-11	DSCF3231.jpg	CP	
Peninnis Head	05-Jun-11	DSCF3232.jpg	CP	
Peninnis Head	05-Jun-11	DSCF3233.jpg	CP	
Peninnis Head	05-Jun-11	DSCF3234.jpg	CP	
Peninnis Head	05-Jun-11	DSCF3235.jpg	CP	
Peninnis Head	05-Jun-11	DSCF3236.jpg	CP	
Peninnis Head	05-Jun-11	DSCF3237.jpg	CP	
Peninnis Head	05-Jun-11	DSCF3238.jpg	CP	
Peninnis Head	05-Jun-11	DSCF3239.jpg	CP	
Peninnis Head	05-Jun-11	DSCF3240.jpg	CP	
Peninnis Head	05-Jun-11	DSCF3241.jpg	CP	
Peninnis Head	05-Jun-11	Echinus.jpg	CP	
Peninnis Head	05-Jun-11	Haliclona viscosa.jpg	CP	
Peninnis Head	05-Jun-11	Haliclona viscosa 3.jpg	CP	
Peninnis Head	05-Jun-11	Hemimycale columella.jpg	CP	
Peninnis Head	05-Jun-11	Hemimycale columella 2.jpg	CP	
Peninnis Head	05-Jun-11	L ochroleuca2.jpg	CP	
Peninnis Head	05-Jun-11	L ochroleuca1.jpg	CP	
Peninnis Head	05-Jun-11	Luidia ciliaris.jpg	CP	
Peninnis Head	05-Jun-11	Marthasterias glacialis.jpg	CP	
Peninnis Head	05-Jun-11	Pentapora foliacea.jpg	CP	
Peninnis Head	05-Jun-11	Polycera faeroensis.jpg	CP	
Peninnis Head	05-Jun-11	Simnia patula.jpg	CP	Note this may be *Simnia hiscockiana*.
Peninnis Head	05-Jun-11	Suberites carnosus.jpg	CP	
Menglow Reef	**09-Jun-11**	**15 images**	**CW**	**Algal specimens in sorting trays for QA** (as labelled by CW)
Menglow Reef	09-Jun-11	Apoglossum.jpg	CW	
Menglow Reef	09-Jun-11	Brogniartella.jpg	CW	
Menglow Reef	09-Jun-11	Delesseria sanguinea.jpg	CW	
Menglow Reef	09-Jun-11	Dictyopteris.jpg	CW	
Menglow Reef	09-Jun-11	Dictyota dichotoma.jpg	CW	
Menglow Reef	09-Jun-11	DSCF6046.jpg	CW	
Menglow Reef	09-Jun-11	DSCF6047.jpg	CW	
Menglow Reef	09-Jun-11	Halopteris.jpg	CW	

Table continued...

Site	Date	Photo ref. (as ID'd by CP)	By	Comment
Menglow Reef	09-Jun-11	Kallymenia.jpg	CW	
Menglow Reef	09-Jun-11	Membranoptera.jpg	CW	
Menglow Reef	09-Jun-11	Phycodrys.jpg	CW	
Menglow Reef	09-Jun-11	Plocamium.jpg	CW	
Menglow Reef	09-Jun-11	Plocamium 2.jpg	CW	
Menglow Reef	09-Jun-11	Red A.jpg	CW	
Menglow Reef	09-Jun-11	Red B.jpg	CW	
Smith Sound	**09-Jun-11**	**14 images**	**CW**	***Eunicella verrucosa* images**
Smith Sound	09-Jun-11	09062011 Smith Sound CW1	CW	View of *Eunicella verrucosa*.
Smith Sound	09-Jun-11	09062011 Smith Sound CW2	CW	View of *Eunicella verrucosa*.
Smith Sound	09-Jun-11	09062011 Smith Sound CW3	CW	View of *Eunicella verrucosa*.
Smith Sound	09-Jun-11	09062011 Smith Sound CW4	CW	View of *Eunicella verrucosa*.
Smith Sound	09-Jun-11	09062011 Smith Sound CW5	CW	View of *Eunicella verrucosa*.
Smith Sound	09-Jun-11	09062011 Smith Sound CW6	CW	View of *Eunicella verrucosa*.
Smith Sound	09-Jun-11	09062011 Smith Sound CW7	CW	*Pentapora foliacea.*
Smith Sound	09-Jun-11	09062011 Smith Sound CW8	CW	View of *Eunicella verrucosa*.
Smith Sound	09-Jun-11	09062011 Smith Sound CW9	CW	*Caryophyllia smithii* (out of focus).
Smith Sound	09-Jun-11	09062011 Smith Sound CW10	CW	View of *Eunicella verrucosa*.
Smith Sound	09-Jun-11	09062011 Smith Sound CW11	CW	View of *Eunicella verrucosa*.
Smith Sound	09-Jun-11	09062011 Smith Sound CW12	CW	View of *Eunicella verrucosa*.
Smith Sound	09-Jun-11	09062011 Smith Sound CW13	CW	View of *Eunicella verrucosa*.
Smith Sound	09-Jun-11	09062011 Smith Sound CW14	CW	View of *Eunicella verrucosa*.
Hoe Point	**10-Jun-11**	**6 images**	**CP**	**Faunal turf transect – quadrat photos**
Hoe Point	10-Jun-11	10Jun11 Hoe Point Quadrat LHS CP Q2.1	CP	Close-up view of parts of each quadrat
Hoe Point	10-Jun-11	10Jun11 Hoe Point Quadrat LHS CP Q2.2	CP	Close-up view of parts of each quadrat
Hoe Point	10-Jun-11	10Jun11 Hoe Point Quadrat LHS CP Q2.3	CP	Close-up view of parts of each quadrat
Hoe Point	10-Jun-11	10Jun11 Hoe Point Quadrat LHS CP Q4.1	CP	Close-up view of parts of each quadrat
Hoe Point	10-Jun-11	10Jun11 Hoe Point Quadrat LHS CP Q6.1	CP	Close-up view of parts of each quadrat
Hoe Point	10-Jun-11	10Jun11 Hoe Point Quadrat LHS CP Q6.2	CP	Close-up view of parts of each quadrat
Chad Girt	**11-Jun-11**	**15 images**	**CP**	**Sponge transect on bedrock/boulders - Quadrats**
Chad Girt	11-Jun-11	11Jun11 Chad Girt Quadrat LHS CP Q1.1.jpg	CP	Close-up view of parts of each quadrat
Chad Girt	11-Jun-11	11Jun11 Chad Girt Quadrat LHS CP Q1.2.jpg	CP	Close-up view of parts of each quadrat
Chad Girt	11-Jun-11	11Jun11 Chad Girt Quadrat LHS CP Q1.3.jpg	CP	Close-up view of parts of each quadrat
Chad Girt	11-Jun-11	11Jun11 Chad Girt Quadrat LHS CP Q1.4.jpg	CP	Close-up view of parts of each quadrat
Chad Girt	11-Jun-11	11Jun11 Chad Girt Quadrat LHS CP Q1.5.jpg	CP	Close-up view of parts of each quadrat
Chad Girt	11-Jun-11	11Jun11 Chad Girt Quadrat LHS CP Q1.6 (2).jpg	CP	Close-up view of parts of each quadrat

Table continued...

Site	Date	Photo ref. (as ID'd by CP)	By	Comment
Chad Girt	11-Jun-11	11Jun11 Chad Girt Quadrat LHS CP Q2.1.jpg	CP	Close-up view of parts of each quadrat
Chad Girt	11-Jun-11	11Jun11 Chad Girt Quadrat LHS CP Q2.2.jpg	CP	Close-up view of parts of each quadrat
Chad Girt	11-Jun-11	11Jun11 Chad Girt Quadrat LHS CP Q2.3.jpg	CP	Close-up view of parts of each quadrat
Chad Girt	11-Jun-11	11Jun11 Chad Girt Quadrat LHS CP Q2.4.jpg	CP	Close-up view of parts of each quadrat
Chad Girt	11-Jun-11	11Jun11 Chad Girt Quadrat LHS CP Q2.5.jpg	CP	Close-up view of parts of each quadrat
Chad Girt	11-Jun-11	11Jun11 Chad Girt Quadrat LHS CP Q4.1.jpg	CP	Close-up view of parts of each quadrat
Chad Girt	11-Jun-11	11Jun11 Chad Girt Quadrat LHS CP Q4.2.jpg	CP	Close-up view of parts of each quadrat
Chad Girt	11-Jun-11	11Jun11 Chad Girt Quadrat LHS CP Q4.3.jpg	CP	Close-up view of parts of each quadrat
Chad Girt	11-Jun-11	11Jun11 Chad Girt Quadrat LHS CP Q4.4.jpg	CP	Close-up view of parts of each quadrat
Chad Girt	**11-Jun-11**	**5 images**	**CW**	**Sponge transect on bedrock/boulders – general photos**
Chad Girt	11-Jun-11	DSCF6127	CW	General view of sponges on silty rock
Chad Girt	11-Jun-11	DSCF6128	CW	General view of sponges on silty rock
Chad Girt	11-Jun-11	DSCF6129	CW	General view of sponges on silty rock
Chad Girt	11-Jun-11	DSCF6130	CW	General view of sponges on silty rock
Chad Girt	11-Jun-11	DSCF6131	CW	General view of sponges on silty rock
NW Flat Ledge	**11-Jun-11**	**6 images**	**CP**	**Sponge transect on bedrock/boulders**
NW Flat Ledge	11-Jun-11	11Jun11 NW Flat Ledge Quadrat LHS CP Q2.jpg	CP	Close-up view of parts of each quadrat
NW Flat Ledge	11-Jun-11	11Jun11 NW Flat Ledge Quadrat LHS CP Q3.1.jpg	CP	Close-up view of parts of each quadrat
NW Flat Ledge	11-Jun-11	11Jun11 NW Flat Ledge Quadrat LHS CP Q3.2.jpg	CP	Close-up view of parts of each quadrat
NW Flat Ledge	11-Jun-11	11Jun11 NW Flat Ledge Quadrat LHS CP Q4.1.jpg	CP	Close-up view of parts of each quadrat
NW Flat Ledge	11-Jun-11	11Jun11 NW Flat Ledge Quadrat LHS CP Q4.2.jpg	CP	Close-up view of parts of each quadrat
NW Flat Ledge	11-Jun-11	11Jun11 NW Flat Ledge Quadrat LHS CP Q4.3.jpg	CP	Close-up view of parts of each quadrat
Gap Point	**13-Jun-11**	**7 images**	**CW**	***Leptopsammia pruvoti* on vertical faces**
Gap Point	13-Jun-11	DSCF6137_Leptopsammia pruvoti Gap Point IoS CP	CW	*Leptopsammia pruvoti* within vertical rock community.
Gap Point	13-Jun-11	DSCF6138	CW	*Leptopsammia pruvoti* within vertical rock community.
Gap Point	13-Jun-11	DSCF6139	CW	*Leptopsammia pruvoti* within vertical rock community.
Gap Point	13-Jun-11	DSCF6140	CW	*Leptopsammia pruvoti* within vertical rock community.
Gap Point	13-Jun-11	DSCF6141	CW	*Leptopsammia pruvoti* within vertical rock community.

Table continued...

Site	Date	Photo ref. (as ID'd by CP)	By	Comment
Gap Point	13-Jun-11	DSCF6142	CW	*Leptopsammia pruvoti* within vertical rock community.
Gap Point	13-Jun-11	DSCF6143	CW	*Leptopsammia pruvoti* within vertical rock community.
Mackerel Rocks	**13-Jun-11**	**21 images**	**CW**	***In situ* photos of algae**
Mackerel Rocks	13-Jun-11	DSCF6146.jpg	CW	*In situ* photo of alga growing on silty rock surface.
Mackerel Rocks	13-Jun-11	DSCF6147.jpg	CW	*In situ* photo of alga growing on silty rock surface.
Mackerel Rocks	13-Jun-11	DSCF6148.jpg	CW	*In situ* photo of alga growing on silty rock surface.
Mackerel Rocks	13-Jun-11	DSCF6149.jpg	CW	*In situ* photo of alga growing on silty rock surface.
Mackerel Rocks	13-Jun-11	DSCF6150.jpg	CW	*In situ* photo of alga growing on silty rock surface.
Mackerel Rocks	13-Jun-11	DSCF6151.jpg	CW	*In situ* photo of alga growing on silty rock surface.
Mackerel Rocks	13-Jun-11	DSCF6152.jpg	CW	*In situ* photo of alga growing on silty rock surface.
Mackerel Rocks	13-Jun-11	DSCF6153.jpg	CW	*In situ* photo of alga growing on silty rock surface.
Mackerel Rocks	13-Jun-11	DSCF6154.jpg	CW	*In situ* photo of alga growing on silty rock surface.
Mackerel Rocks	13-Jun-11	DSCF6155.jpg	CW	*In situ* photo of alga growing on silty rock surface.
Mackerel Rocks	13-Jun-11	DSCF6156.jpg	CW	*In situ* photo of alga growing on silty rock surface.
Mackerel Rocks	13-Jun-11	DSCF6157.jpg	CW	*In situ* photo of alga growing on silty rock surface.
Mackerel Rocks	13-Jun-11	DSCF6158.jpg	CW	*In situ* photo of alga growing on silty rock surface.
Mackerel Rocks	13-Jun-11	DSCF6159.jpg	CW	*In situ* photo of alga growing on silty rock surface.
Mackerel Rocks	13-Jun-11	DSCF6160.jpg	CW	*In situ* photo of alga growing on silty rock surface.
Mackerel Rocks	13-Jun-11	DSCF6161.jpg	CW	*In situ* photo of alga growing on silty rock surface.
Mackerel Rocks	13-Jun-11	DSCF6162.jpg	CW	*In situ* photo of alga growing on silty rock surface.
Mackerel Rocks	13-Jun-11	DSCF6163.jpg	CW	*In situ* photo of alga growing on silty rock surface.
Mackerel Rocks	13-Jun-11	DSCF6164.jpg	CW	*In situ* photo of alga growing on silty rock surface.
Mackerel Rocks	13-Jun-11	DSCF6165.jpg	CW	*In situ* photo of alga growing on silty rock surface.
Mackerel Rocks	13-Jun-11	DSCF6166.jpg	CW	*In situ* photo of alga growing on silty rock surface.
Mackerel Rocks	13-Jun-11	DSCF6167.jpg	CW	*In situ* photo of alga growing on silty rock surface.

Table continued...

Site	Date	Photo ref. (as ID'd by CP)	By	Comment
Mackerel Rocks	13-Jun-11	DSCF6168.jpg	CW	*In situ* photo of alga growing on silty rock surface.
Mackerel Rocks	13-Jun-11	DSCF6169.jpg	CW	*In situ* photo of alga growing on silty rock surface.
Surface photos				
	13-Jun-11	DSCF6136.jpg	CW	Surface shot of outboard engines.
	13-Jun-11	DSCF6174.jpg	CW	4 NE divers: Chris Williams, Kevan Cook, Chris Pirie & Gavin Black.
		June IoS 059.jpg	?	IoS IFCA RIB alongside St Mary's Quay with divers.
		Mackerel Rocks_13Jun11_CW_DSCF6144.jpg	CW	View of concrete slope half in water.
		Mackerel Rocks_13Jun11_CW_DSCF6170.jpg	CW	Surface view of the nearby rocks
		Mackerel Rocks_13Jun11_CW_DSCF6171.jpg	CW	Surface view of the nearby rocks
		Mackerel Rocks_13Jun11_CW_DSCF6172.jpg	CW	Surface view of the nearby rocks
		Surfacing off Hoe Point_10Jun11_CP.jpg	CP	

Appendix 5 Pressed algal specimens

Table D Log of pressed algal specimens & photographic images

	Specimen	Site Menglow	Brodfield	Little Arthur
Acrosorium venulosum			1	
Apoglossum ruscifolium	*Y*	*1*	*2*	*1*
Bonnemaisonia asparagoides	*Y*	*1*	*1*	*1*
Brongniartella byssoides	*Y*	*1*	*1*	
Calliblepharis ciliata	*Y*	*1*	*1*	
Callophyllis laciniata	*Y*	*1*	*2*	*1*
Ceramium nodulosum	*PHOTO*			
Compsothamnion thuyoides	*PHOTO*			
Corallinaceae indet. (crusts)	-			
Cruoria	-			
Cryptopleura ramosa	*Y*	*2*	*2*	
Delesseria sanguinea	*Y*	*2*		
Desmarestia aculeata				
Dictyopteris membranacea	*Y*	*1*	*1*	
Dictyota dichotoma	*Y*	*1*	*2*	*1*
Drachiella ?heterocarpa	*Y*			*1*
Drachiella spectabilis	*Y*	*?1*	*1*	*1*
Erythroglossum laciniatum	*Y*	*2/?1*		*1*
Halidrys siliquosa				
Halopteris filicina	*Y*		*1*	
Halurus equisetifolius	*Y*		*1*	
Halurus flosculosus	*Y*			*1*
Heterosiphonia plumosa	*Y*	*1*		
Hypoglossum hypoglossoides	*Y*	*1*		
Kallymenia reniformis	*Y*	*1*	*1*	*2*
Laminaria hyperborea	-			
Laminaria ochroleuca	-			

Table continued...

	Specimen	Site Menglow	Brodfield	Little Arthur
Lomentaria articulata	*Y*		*1*	*1*
Membranoptera alata	*Y*	*1*	*1*	
Meredithia microphylla	*Y*	1		1
Palmaria palmata	*Y*			1
Phaeophyta indet. (crusts)	-			
Phycodrys rubens	*Y*	1	1	
Phyllophora crispa	*Y*		1	
Plocamium cartilagineum	*Y*	2		
Polyneura bonnemaisonii	*Y*	1	1	1
Polysiphonia sp.	*PHOTO*			
Pterosiphonia parasitica	*PHOTO*	2		
Pterothamnion plumula	*PHOTO*	1	2	
Radicilingua thysanorhizans	*PHOTO*			
Rhodophycota indet. (crusts)	-			
Rhodophyllis divaricata	*Y*			1
Rhodymenia pseudopalmata	*Y*	1	1	1
Saccharina latissima	-			
Saccorhiza polychides	-			
Schottera nicaeensis	*Y*	1	1/?1	
Spaerococcus coronopifolius	*PHOTO/Y*		1	
Taonia atomaria	*Y*			1
Trailliella sp.	-			
Ulva sp.	Y		1	1

Appendix 6 Vertical transect data (Task B1)

Table Ei Vertical transect data (Task B1) – Gap Point

Site:	**Gap Point**																				
Vertical transect no.	1					Total (see Table 19)	2							Total (see Table 19)	3							Total (see Table 19)
Recorder:	AC						KC								CP							
Vertical transect length (m)	2.0						1.8								1.8							
Area covered (m^2)	0.25						0.35								0.35							
Dist. along transect (m)	0.0	0.3	0.6	0.9	1.2		0.0	0.3	0.6	0.9	1.2	1.5	1.8		0.0	0.3	0.6	0.9	1.2	1.5	1.8	
Species																						
Axinella dissimilis		1	1	1		3								0			1?			1	1	3
Tethya citrina						0								0								0
Cliona celata						0								0								0
Hemimycale columella						0		1	1	1				3								0
Dysidea fragilis		1	1	1		3								0					1			1
Haliclona viscosa						0								0	1	1						2
Alcyonium digitatum		1				1							1	1								0
Alcyonium glomeratum		1	1			2		1				1		2				1	1	1	?	3
Corynactis viridis						0	1	1	1	1	1	1	1	7	1	1		1	1	1	1	6
Actinothoe sphyrodeta						0								0								0
Sagartia elegans						0								0								0

Table continued...

Site:	Gap Point																						
Leptopsammia pruvoti					0								0						1	1	2		
Caryophyllia smithii	1	1	1	1	4	1	1	1	1	1	1	1	7	1	1	1	1	1	1	1	7		
Hoplangia durotrix					0								0								0		
Parazoanthus axinellae					0		1				1		2								0		
Parazoanthus anguicomis					0								0								0		
Echinus esculentus					0								0				1				1		
Marthasterias glacialis					0								0								0		
Holothuria forskali					0				1			1	2								0		
Antedon bifida					0								0								0		
Clavelina lepadiformis					0								0								0		
Stolonica socialis	1	1	1	1	4								0								0		

Table Eii Vertical transect data (Task B1) – Newfoundland Point

Site:	Newfoundland Point																																		
Vertical transect no.	1																		Total (see Table 19)	2																Total (see Table 19)
Recorder:	KC																			CP																
Vertical transect length (m)	4.8 m																			4.5 m																
Area covered (m^2)	0.85																			0.35																
Dist. along transect (m)	0.0	0.3	0.6	0.9	1.2	1.5	1.8	2.1	2.4	2.7	3.0	3.3	3.6	3.9	4.2	4.5	4.8			0.0	0.3	0.6	0.9	1.2	1.5	1.8	2.1	2.4	2.7	3.0	3.3	3.6	3.9	4.2	4.5	
Species																																			
Axinella dissimilis																		0												1				1	2

Table continued...

Site:	Newfoundland Point																																		
Tethya citrina																		0																	0
Cliona celata																		0																	0
Hemimycale columella																		0		1	1						1	1	1		1		1	1	8
Dysidea fragilis																		0	1	1		1		1		1									5
Haliclona viscosa																		0																	0
Alcyonium digitatum				1	1	1							1		1			5																	2
Alcyonium glomeratum													1					1																	0
Corynactis viridis	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	18	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	16
Actinothoe sphyrodeta																		0																	0
Sagartia elegans																		0																	0
Leptopsammia pruvoti																		0																	0
Caryophyllia smithii						1	1	1	1		1	1						6	1		1							1						1	4
Hoplangia durotrix																		0																	0
Parazoanthus axinellae																		0																	0
Parazoanthus anguicomis																		0																	0
Echinus esculentus										1	1							2										1							1
Marthasterias glacialis					1						1		1					3																	0
Holothuria forskali																		0	1																1
Antedon bifida																		4																	0
Clavelina lepadiformis		1			1	1		1										0																	0
Stolonica socialis																		0																	2

Table Eiii Vertical transect data (Task B1) – Gugh Reef

Site:	Gugh Reef																																						
Vertical transect no.	1																					2										3							
Recorder:	AC																					CP										CP							
Vertical transect length (m)																																							
Area covered (m^2)																																							
Dist. along transect (m)	0.0	0.3	0.6	0.9	1.2	1.5	1.8	2.1	2.4	2.7	3.0	3.3	3.6	3.9	4.2	4.5	4.8	5.1	Total (see Table 19)	0.0	0.3	0.6	0.9	1.2	1.5	1.8	Total (see Table 19)	0.0	0.3	0.6	0.9	Total (see Table 19)
Species																																							
Axinella dissimilis																			0								0					0
Tethya citrina														1	1				2								0					0
Cliona celata																			0								0					0
Hemimycale columella																			0								0					0
Dysidea fragilis																			0				1				1					0
Haliclona viscosa																			0								0					0
Alcyonium digitatum				1															1	1	1	1	1				4					0
Alcyonium glomeratum							1											1	2								0					0
Corynactis viridis	1	1	1	1	1	1	1	1	1	1	1	1	1	1			1	1	16	1	1	1	1	1	1		6		1	1		2
Actinothoe sphyrodeta						1													1								0					0
Sagartia elegans	1							1		1		1		1					5	1	1	1	1	1	1		6					0
Leptopsammia pruvoti																			0								0					0
Caryophyllia smithii																			0								0					0
Hoplangia durotrix																			0								0					0

Table continued...

Site:	Gugh Reef		
Parazoanthus axinellae	0	0	0
Parazoanthus anguicomis	0	0	0
Echinus esculentus	0	0	0
Marthasterias glacialis	0	0	0
Holothuria forskali	0	0	0
Antedon bifida	0	0	0
Clavelina lepadiformis	0	0	0
Stolonica socialis	0	0	0

Appendix 7 Recording forms

Table F Kelp forest structure recording form

Kelp Forest Structure Recording Form		Date:		Recorder/s:			
Field Site No.		Site name:					
1 m x 1 m 3-sided quadrats		dGPS Position:					
	Species:	***L. hyperborea***	***L. ochroleuca***	***Saccorhiza polyschides***	***Saccharina latissima***	***Alaria esculenta***	**Young kelp plants (ID uncertain) /?*L. digitata***
Quadrat No.	Depth (m bsl)	Rough stipe with epiphytes. Round in X-section.	Smooth stipe with no epiphytes (though possibly encrusting bryozoans). Golden patch at base of blade.	Massive lobose base with small projections. Flat stipe with wavy edges, partic. at base.	Single undivided ribbon-like blade with crinkly edge. Short thin stipe.	Narrow, slightly crinkly blade with midrib. Club-like repro. bodies on short stipe.	
Q1							
Q2							
Q3							
Q4							
Q5							
Q6							
Q7							
Q8							
Q9							
Q10							
Q11							
Q12							
Q13							
Q14							
Q15							
Q16							
Q17							
Q18							
Q19							
Q20							

Table G Kelp forest / red algae recording form

Kelp Forest / Red algae Recording Form							Date:		Recorder/s:		
Field Site No.			Depth: m				Site name:				
0.5 m x 0.5 m 3-sided quadrats							dGPS Position:				
	Selected species	***Kallymenia reniformis***	***Delesseria sanguinea***	***Membranoptera alata***	***Phycodrys rubens***	***Heterosiphonia plumosa***	***Pterosiphonia parasitica***	***Sphaerococcus coronopifolius***	***Dilsea carnosa***	***Halurus equisetifolius***
	Notes									
Quadrat No.	Depth (m bsl)									
Q1										
Q2										
Q3										
Q4										
Q5										
Q6										
Q7										
Q8										
Q9										
Q10										

Table H Vertical rock – Species composition records

Survey Date		Depth at base of transect (m)	
Recorder		Depth at top of transect (m)	
Field Site No.		Distance on tape at transect base (m)	
Site name		Distance on tape at transect top (m)	
Site Latitude (N):	Site Longitude (W):		

Species	Depth below start of vertical transect (m)																						
	0.0	0.3	0.6	0.9	1.2	1.5	1.8	2.1	2.4	2.7	3.0	3.3	3.6	3.9	4.2	4.5	4.8	5.1	5.4	5.7	6.0	6.3	6.6	6.9
Axinella dissimilis																								
Tethya citrina																								
Cliona celata																								
Hemimycale columella																								
Dysidea fragilis																								
Haliclona viscosa																								
Alcyonium digitatum																								
Alcyonium glomeratum																								
Corynactis viridis																								
Actinothoe sphyrodeta																								
Sagartia elegans																								
Leptopsammia pruvoti																								
Caryophyllia smithii																								
Hoplangia durotrix																								
Parazoanthus axinellae																								
Parazoanthus anguicomis																								
Echinus esculentus																								
Marthasterias glacialis																								
Holothuria forskali																								
Antedon bifida																								
Clavelina lepadiformis																								
Stolonica socialis																								

Table I Density & quality of sea fans and erect sponges

Survey: Isles of Scilly Diving Monitoring Survey 2011		Date:
Density & quality of sea fans and erect sponges		Location:
Surveyor(s):	dGPS position:	Start: End:
Condition Score: **5**: < 5% cover/pristine **4**: 5% - 20% cover **3**: 20% - 50% cover **2**: 50% - 80% cover **1**: > 80% cover		

10 m Transect No.	Depth at start of transect	Direction (°) of transect	No. of *Eunicella verrucosa* within 10m (5-bar gate notation)	*Tritonia nilsodneri* no./fan	*Tritonia* eggs no./fan	Condition score (1 – 5)	Cover organisms (most obvious first) (include *Amphianthus* anemone, *Solidobalanus* barnacle, *Simnia* spindle shell)	No. of erect, branching sponges (5-bar gate notation)
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								

Table J Circalittoral sponge-dominated communities on bedrock & boulders – Species composition recording form

Circalittoral sponge-dominated communities on bedrock & boulders - Species Composition Recording Form	Date:	Recorder/s:
Field Site No.	Site name:	
0.5 m x 0.5 m quadrats placed along a near-horizontal transect, with **the** presence of one (1) or more (2) individuals of a species being recorded on this recording form.		
Depth (at start of horizontal belt transect):	Depth (at end of horizontal belt transect):	
dGPS Position:	Direction of transect, start → end (°):	

	Position of Q along tape:					
Species	Personal species ID notes	**Q1**	**Q2**	**Q3**	**Q4**	**Q5**
Polymastia boletiformis						
Stelligera stuposa						
Cliona celata						
Axinella dissimilis						
Raspailia hispida						
Raspailia ramosa						
Dysidea fragilis						
Homaxinella subdola						
Nemertesia antennina						
Nemertesia ramosa						
Alcyonium digitatum						
Alcyonium glomeratum						
Eunicella verrucosa						
Parazoanthus axinellae						
Actinothoe sphyrodeta						
Caryophyllia smithii						
Crissidae						
Alcyonidium diaphanum						
Bugula plumosa						
Pentapora foliacea						
Marthasterias glacialis						
Echinus esculentus						
Holothuria forskali						
Clavelina lepadiformis						
Stolonica socialis						

Other notes (including noteworthy or rare species which have avoided being recorded by this method):

Table K Circalittoral faunal turf communities – Species composition recording form

Circalittoral faunal turf communities – Species Composition Recording Form	Date:	Recorder/s:
Field Site No.	Site name:	

0.5 m^2 x 0.5 m^2 quadrats placed along a near-horizontal transect, with **the** presence (only) of one or more individuals of a species being recorded on this recording form.

Depth (at start of horizontal belt transect):	Depth (at end of horizontal belt transect):
dGPS Position:	Direction of transect, start → end (°):

	Position of Q along tape:					
Species	Personal species ID notes	**Q1**	**Q2**	**Q3**	**Q4**	**Q5**
Cliona celata						
Polymastia boletiformis						
Pachymatisma johnstonia						
Axinella dissimilis						
Axinella infundibuliformis						
Nemertesia antennina						
Metridium senile						
Alcyonium digitatum						
Alcyonium glomeratum						
Caryophyllia smithii						
Alcyonidium diaphanum						
Luidea ciliaris						
Marthasterias glacialis						
Asterias rubens						
Echinus esculentus						
Antedon bifida						
Holothuria forskali						

Other notes (including noteworthy or rare species which have avoided being recorded by this method):