Natural England Evidence Project Report RP2918

Lower Fal and Helford Intertidal SSSI Baseline Survey 2012

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Lower Fal and Helford Intertidal SSSI Baseline Survey

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Summary

This project aimed to survey the littoral rock features throughout the five units of the Lower Fal and Helford Site of Special Scientific Interest (SSSI). Where possible, historical transects and survey locations were revisited to enable a comparison to baseline data. A total of 8 transects were undertaken as part of this study. Where a baseline is unavailable, these surveys aimed to establish one.

The objectives were to:

- carry out an integrated site assessment (ISA) of the Lower Fal and Helford Intertidal SSSI;
- assess the condition of the littoral rock features within the Lower Fal and Helford Intertidal SSSI;
- identify and evaluate any changes in distribution and abundance of species from historical data, where available; and
- provide baseline data where currently unavailable on the distribution and abundance of species in the Lower Fal and Helford Intertidal SSSI.

A total of 27 biotopes were recorded including a range of sheltered and moderately exposed intertidal rock biotopes with dominance of lichens, barnacles and fucoids. Two occurrences of the *Sargassum muticum* rockpool biotope were identified, *Sargassum muticum* being a non-native brown algae, as were two occurences of ephemeral algal dominated biotopes – potential indicators of nutrient input or disturbance.

These findings have been used in conjunction with those of Curtis (2011) to assess the condition of the site's littoral rocky habitat, which has been found to be favourable throughout the site. The findings established a comprehensive baseline for the site allowing the conservation objectives for the area to be updated, increasing the relevance of future surveys.

The information obtained through these surveys will also go forward to help inform the condition assessment for the Fal & Helford Special Area of Conservation (SAC), of which the Lower Fal & Helford Intertidal is a component SSSI.

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1. Introduction

1.1 The Fal Estuary and Helford River together form an excellent example of a ria (drowned river valley) system and support communities representative of those occurring in enclosed marine waters in south-western Britain (Langston and others 2003; Natural England 2011). It is for the most part very sheltered, although more exposed at the mouth. This results in extremely rich and varied marine life (CBRU 1992). The steep-sided Fal ria has extensive areas of shallow sediment banks either side of the main channel and is characterised by very slow tidal currents in most areas. Downstream of Turnaware Point the ria opens out into the Carrick Roads which is predominantly subtidal but fringed by rocky shores. Areas of intertidal mudflats are found mainly within tributaries including, particularly, that of the Percuil River with some shingle shores in the lower estuary between Restronguet Creek and Mylor Creek (Natural England 2011). The Helford is fairly narrow, widening at the entrance, with a number of relatively short, narrow and steeply sided branches and creeks. The upper reaches are extremely silted such that at low tide, up to 4 km of the upper reaches dry out apart from a narrow channel draining freshwater streams into the creeks. In the middle and lower reaches the fringing intertidal is generally a narrow strip of rocky shore with areas of sedimentary and mixed substratum habitats (Natural England [accessed 2013]).

1.2 The Lower Fal and Helford Intertidal Site of Special Scientific Interest (SSSI) was designated in 1997 to protect the intertidal sediment and rocky shores. The site encompasses sections of the shores of the Fal Estuary (Units 3 and 5), most of the Percuil Estuary (Unit 4) and most of the tidal portion of the Helford River (Units 1 and 2) (Figures 1- 2) (Natural England [accessed 2013]). The site has a number of overlapping designations, including the Fal and Helford Special Area of Conservation (SAC), Cornwall Area of Outstanding Natural Beauty (AONB) and the Helford Voluntary Marine Conservation Area (VMCA).

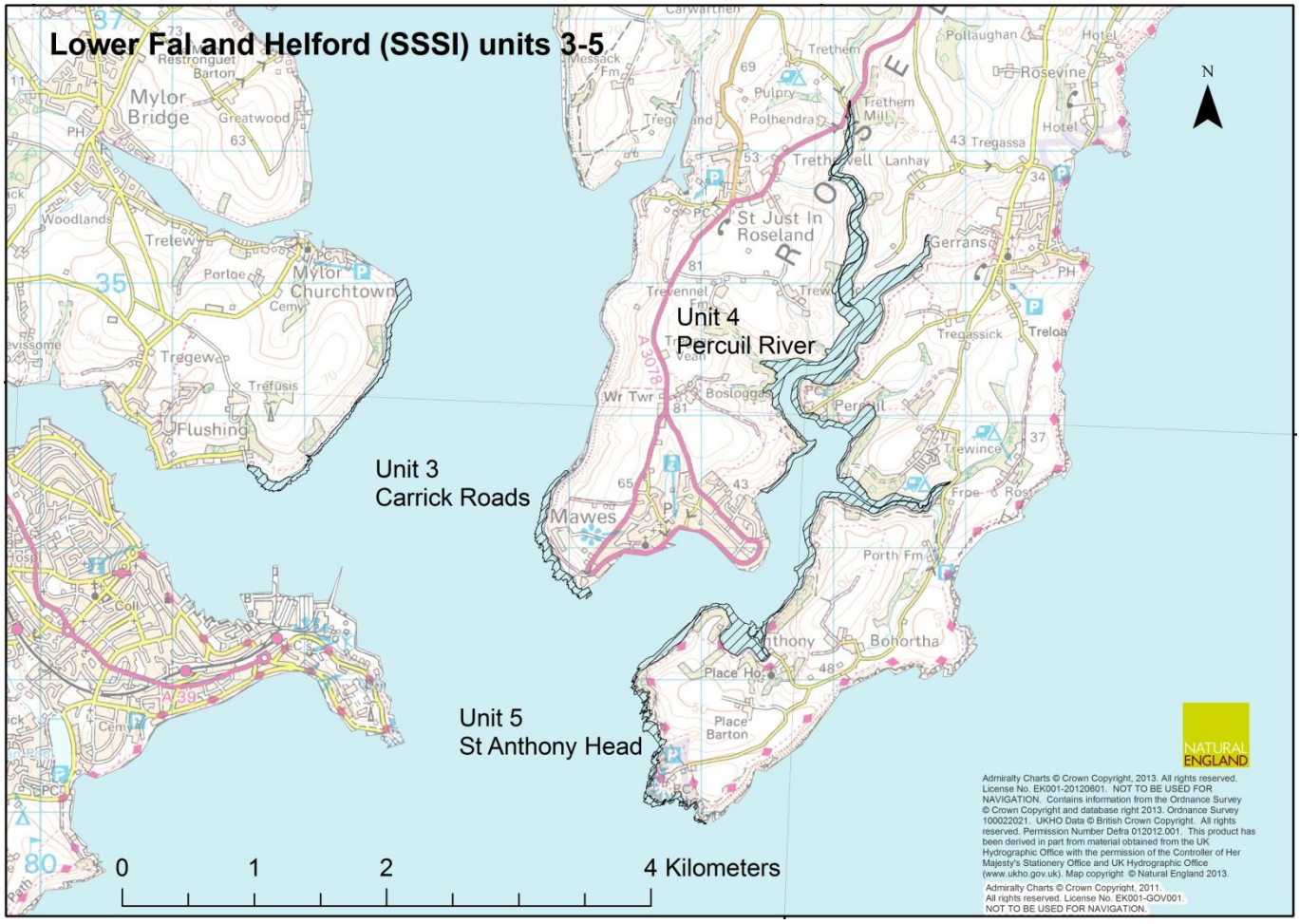

Figure 1: Boundary map of Lower Fal and Helford Intertidal SSSI: Units 3-5 Carrick Road, Percuil River and St Anthony Head

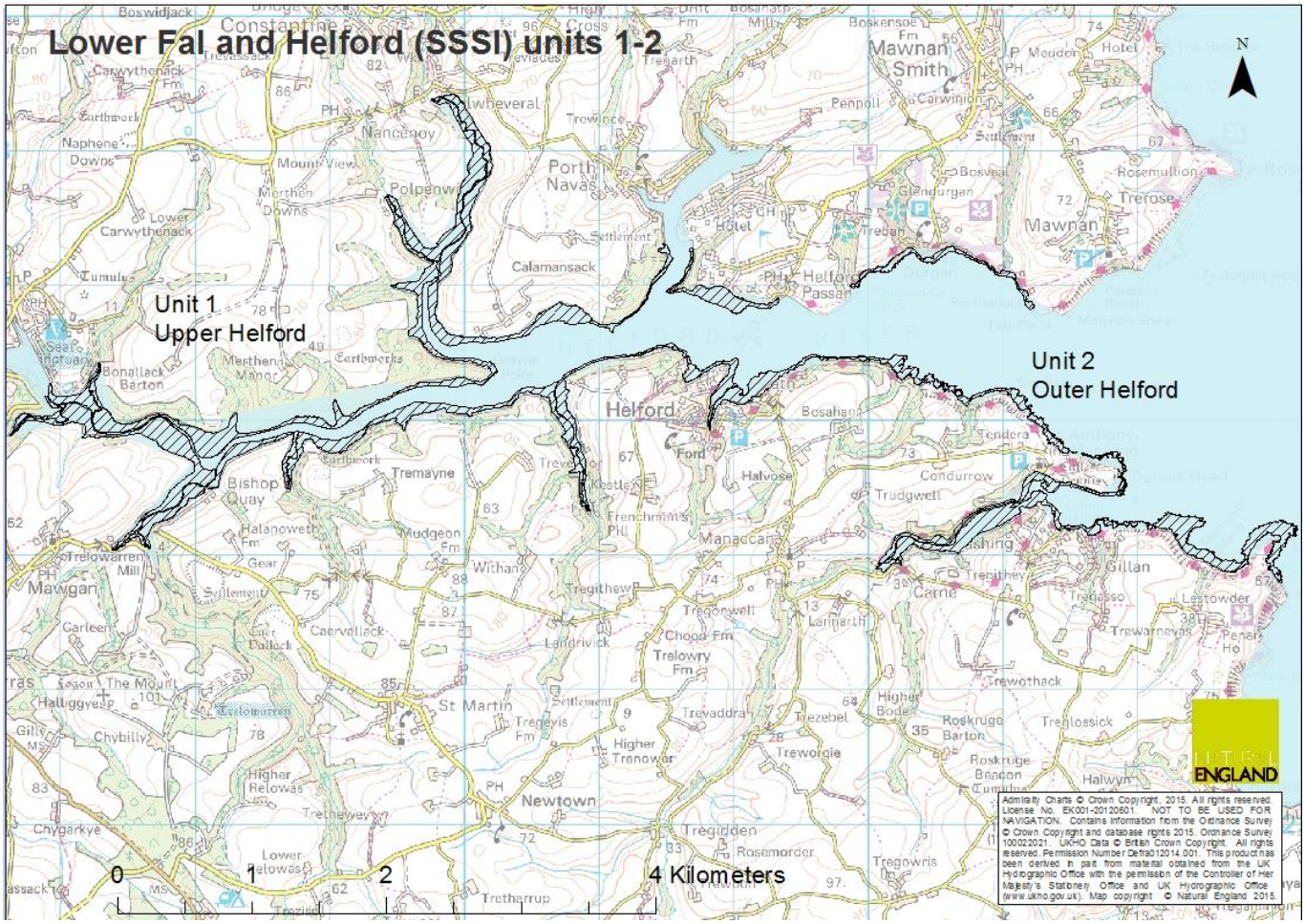

Figure 2: Boundary map of Lower Fal and Helford Intertidal SSSI: Unit 1 Upper Helford & Unit 2 Lower Helford

1.3 The Fal and Helford rivers have long been recognised for their variety and abundance of intertidal species, including a number of southern species not found elsewhere (Roberts and Edwards 1996). Rocky shore communities are characterised by the environmental conditions which create a pattern of zonation from lichen through barnacles to dense fucoids on the lower shore (NCC 1979). This is the expected pattern for the Fal and Helford rivers, and unfavourable condition could be identified as changes in this, for example an increase in non-native species or species associated with eutrophication e.g. green algal mats.

1.4 The Fal and Helford rivers have in the past been subject to eutrophication from both diffuse sources and sewage treatment works. In enclosed areas there have been toxic algal blooms, and an incident in 2002 affected both the Fal and Helford rivers, resulting in invertebrate mortalities (Langston and others 2003). In the UK there has been significant work to reduce nutrient input as required by the Nitrates Directive[1] and the Water Framework Directive[2]. However the OSPAR review of eutrophication status found Truro, Tresillian and Fal Estuary to be problem areas in both the 2003 and 2008 status reports (OSPAR, 2009).

1.5 Non-native species of note within rocky shore communities include *Sargassum muticum* which can overgrow and shade rockpool communities; *Crepidula fornicata* which competes with other filter feeders and can cause sediment to build up, and *Austrominius modestus* (formerly *Elminius modestus)* which competes with the native barnacle *Semibalanus balanoides* (Eno, Clark & Sanderson 1997). Non-native species are being found increasingly in the marine environment, and there is concern they may outcompete native species due to lack of predation. Within the interitdal area of the the Fal / Helford a

[1] **The Nitrates Directive http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:31991L0676:EN:NOT**
[2] **The Water Framework Directive http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32000L0060:EN:NOT**

range of non-native species have been recorded by a project by Cornwall Wildlife Trust, particularly non-native algae species. The non-native species documented so far within the Fal / Helford intertidal area are listed below in Table 1. Not all species recorded may be within the SSSI boundary, but they are within the area with potential to spread into the SSSI intertidal zones if not already present.

Table 1: Data provided by Lisa Rennocks, Investigate Invasives Project Officer, Cornwall Wildlife Trust

Non-native species name	Type of organism
Solieria chordalis	Red seaweed
Sargassum muticum	Brown seaweed
Austrominius modestus	Acorn barnacle / crustacean
Crepidula fornicata	Mollusc
Undaria pinnatifida	Brown seaweed
Asparagopsis armata	Red seaweed
Grateloupia turuturu	Red seaweed
Chrysymenia wrightii	Red seaweed
Bonnemasonia hamifera	Red seaweed
Codium fragile ssp. Tomentosoides	Green seaweed
Styela clava	Sea squirt / tunicate

1.6 The condition of the site may also be altered by the impact of unintended damage from coastal access, such as trampling activity from walking or marine sports activities like coasteering. Research has shown that trampling may significantly impact on intertidal algal cover (Tyler-Walters 2005) leading to a decrease in food availability for associated herbivorous grazers such as limpets, periwinkles and chitons. In particular, species such as *Ascophyllum nodosum* are paricularly sensitive to the effects of trampling (Boalch & Jephson 1981). Other algal types such as *Ulva* sp. may become more common in trampled areas (Tyler-Walters 2005). Mussels in the interitdal area may also be significantly reduced by the impact of trampling (Brosnan & Crumrine 1994). A sensitivity assessment by the Marine Biological Association concluded that caves and overhangs, as well as sponges and animal turf on vertical rock faces were also likely to be sensitive to the effects of trampling through activities like coasteering (Tyler-Walters 2005). Coasteering activity is currently provided by a small number of local companies, which is likely to be more frequent in summer months. Because levels of activity and coastal use can change, regular montitoring is essential to make sure that the condition of protected habitats and species is maintained.

1.7 For this study an Integrated Site Assessment (ISA) has been undertaken to inform a condition assessment for the site. An ISA is a Natural England monitoring programme used to assess environmental features and their management in Sites of Specieal Scientific Interest (SSSI) and Higher Level Stewardship scheme (HLS) agreements (Blackshaw 2014). The condition of site features can be surveyed and assessed using two approaches; rapid and detailed. A Rapid Site Assessment (RSA) records summary information on feature condition and relies on the professional judgement of advisers to a greater extent. RSAs do not have a minimum number of stops, whereas a Detailed Site Assessment (DSA) uses a more quantitative method of data collection with a minimum of 20 stops per feature assessment.

Features

1.8 The designated site area totals 263.51 hectares and has two Level One features and seven notified habitats (Table 2). During this study, the main focus was on intertidal species inhabiting rocky substrates and looked at the following notified features: Exposed rocky shores; Moderately exposed rocky shores; Sheltered rocky shores; and Shores of mixed substrata. This study did not focus on soft sediment based

substrates which require a different monitoring method, and which have been assessed by Curtis, L. (2011).

Table 2: Features and habitats covered by the Lower Fal and Helford Intertidal SSSI

Level 1 Features		
	H1 – Coastal: Intertidal	Sheltered sediment and rock Exposed and moderately exposed rocky shores
Notified Features	Exposed rocky shores (predominantly extremely exposed to wave action) Moderately exposed rocky shores Moderately exposed sandy shores (with polychaetes and bivalves) Muddy gravel shores Sheltered muddy shores (including estuarine muds) Sheltered rocky shores (predominantly sheltered to very sheltered from wave action) Shores of mixed substrata (stones and sediment)	

Previous condition

1.9 When these features are being managed in a way which maintains their nature conservation value, then they are said to be in 'favourable condition'. It is a Government target that 50% of the total area of SSSIs should be in favourable condition with at least 45% of the remaining area of SSSIs to be in a stage of recovery by 2020 (Natural England 2012). Previous site conditions have been established through 'rapid assessments' and were last reported on in summer 2009 (Table 3). Unit 1 (Upper Helford, Figure 2) and Unit 2 (Outer Helford, Figure 3) were found to be in 'unfavourable recovering' condition. The area classified as unfavourable recovering covers 66.5% of the total designated area. In Unit 1 reefs and littoral rock and inshore sublittoral rock were deemed to be in 'unfavourable recovering condition'. At the boundary area of Unit 1 and Unit 2 degradation was attributed to the placement of materials on the foreshoreaffecting the littoral rock habitat across both units at the site. Action was started to remedy this impact and consequently the unit was assessed as unfavourable but in a recovering Condition.

Table 3: Summary of known Unit conditions in June 2012

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Unit Number	**Unit Name**	**Unit area (Ha)**	**Condition at last assessment**	**Condition Summary**	**Date of last assessment**
Unit 1	Upper Helford	128.39	Unfavourable recovering	Degradation attributed to the placement of materials on the foreshore affecting the littoral rock habitat	August 2009
Unit 2	Outer Helford	47.07	Unfavourable recovering	Degradation attributed to the placement of materials on the foreshore affecting the littoral rock habitat.	September 2009
Unit 3	Carrick Roads	15.02	Favourable	Meeting objectives.	July 2009

Table continued…

Unit Number	Unit Name	Unit area (Ha)	Condition at last assessment	Condition Summary	Date of last assessment
Unit 4	Percuil River	65.08	Favourable	Meeting objectives.	July 2009
Unit 5	St. Anthony Head	7.95	Favourable	Meeting objectives. The site has a mixed algal community exhibiting well defined zonation of species, little or no ephemeral green algae and no physical damage or litter.	July 2009

1.10 Favourable condition for this site requires the maintenance of the extent of each habitat type, which may require restoration if evidence suggests a reduction in extent. The estimate of the extent of littoral rock is 70 ha and littoral sediment 190 ha (Cook 2010) . A number of measures have been identified that are required to complete the condition assessment, including: assessment of geographic distribution and extent of specified biotopes, assessment of the abundance of specified species and distribution of sediment types (Cook 2010).

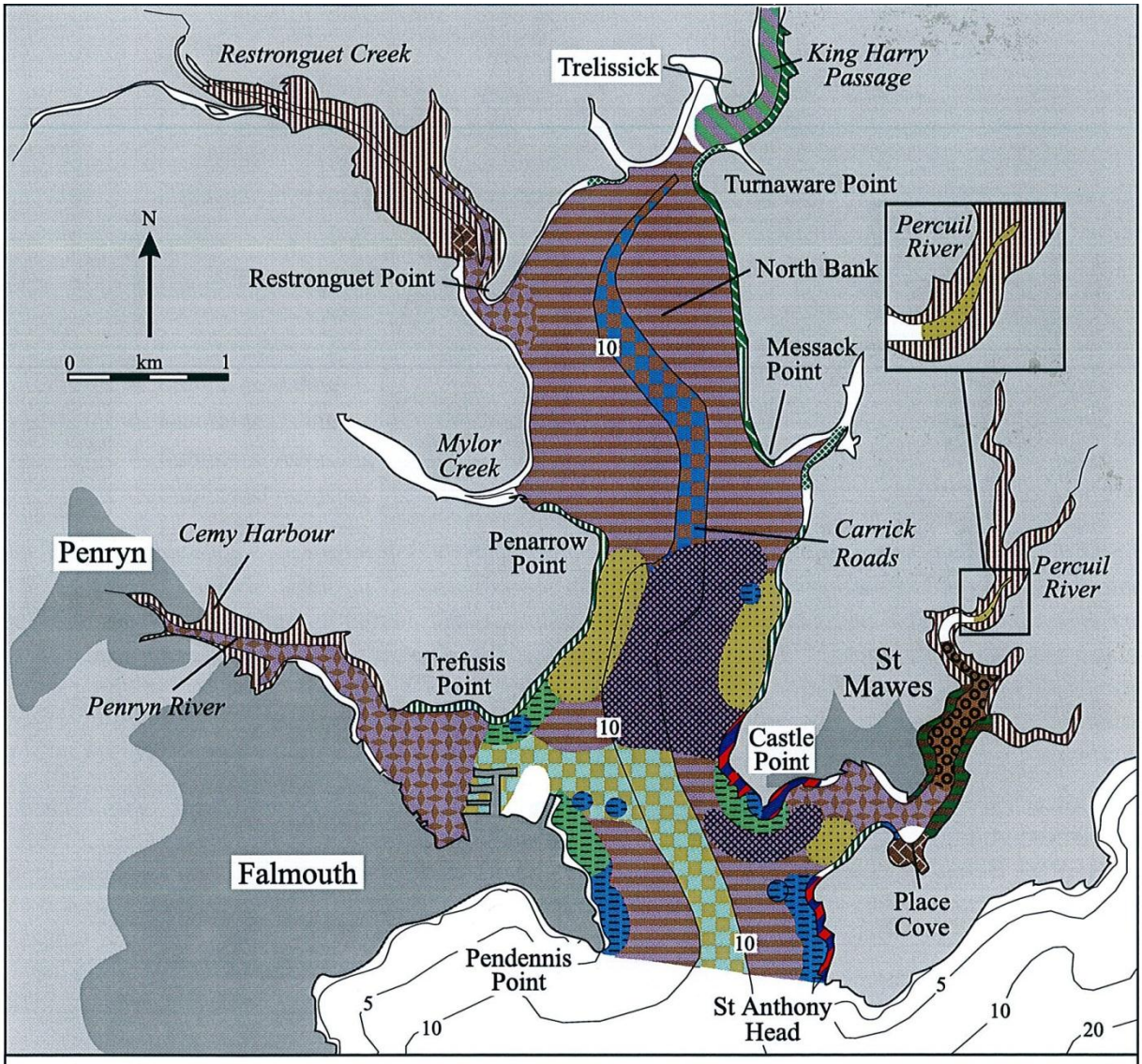
Previous research

1.11 Rostron (1985) conducted a survey of the Fal Estuary for the Nature Conservancy Council as part of The Field Studies Council surveys of harbours, rias and estuaries in Southern Britain. Rostron completed transect surveys of a number of sites in the river Fal, seven of which are inside the boundary of the Lower Fal and Helford Intertidal SSSI.

1.12 The Cornish Biological Records Unit surveyed the intertidal flora and fauna in the Fal Estuary in a report to the National Rivers Authority (CBRU 1992). In 1982 17 permanent transect lines were set up by the Roseland Voluntary Marine Conservation Area marine biology working group. This monitoring was reported on by Covey & Hocking in 1987. The CBRU group selected eleven intertidal transects for review. Of these three are within the boundary of the Lower Fal and Helford Intertidal SSSI: Transect 4 (Trefusis Point); Transect 5 (Mylor Churchtown (Badger's Wood)), and Transect 15 (St Anthony Amsterdam Point).

1.13 Moore, Smith & Northern (1999) published an overview of habitats in both the Fal and Helford Rivers, mentioning any notable features of the area as part of JNCC's Marine Nature Conservation Review (MNCR) series. The MNCR includes indicative biotope mapping for the area which can be compared to biotopes identified in this study (Figures 3 and 4). Biotope codes have been updated since the MNCR so the codes are not a direct match, however most have comparable codes in the current system, and these have been converted where possible using the JNCC translation table (Connor 2004[3]).

[3] **Conversion tables are available to download here http://jncc.defra.gov.uk/pdf/EUNIS_Correlation_2007-11_20101206v2.pdf**



Exposed/moderately exposed bedrock shore with fucoids and barnacles (BPat; XR; Him; FvesB)

Sheltered littoral rock with fucoids (BPat; Pel; Fspi; Asc.VS; Fser.VS; FserX)

Sheltered littoral rock and mixed substrata shores (Pel; Fspi; Asc; Fser; FvesX; FserX.T)

Mixed substrata shores (FvesX; FserX; HedStr)

Steep upper shore bedrock and sheltered lower shore mixed substrata with fucoids (Pel; Fspi; Asc.Asc; AscX; FvesX; FserX) and littoral soft mud (HedStr)

Sandy mud shores with *Hediste* and *Macoma* (MacAre; HedMac)

Littoral soft mud with *Hediste* (HedScr; HedStr; HedOl)

Sublittoral moderately exposed rock with *Laminaria hyperborea* (Lhyp.Ft; SCAs.ByH)

Sand-scoured rock outcrops with mixed kelps (XKScrR)/ephemeral red algae on cobbles (EphR)

Sublittoral mud (MarMu) with bedrock outcrops (XKScrR; AlcMaS; LsacX)

Sheltered sublittoral rock with *Laminaria saccharina* (Lsac.Ldig; Lsac.Ft)

Shallow sublittoral rock with kelp and sponges (LsacRS.FiR; CuSH; Flu.Hocu) and muddy gravel with sabellid worms, anthozoans, ascidians and polychaetes (Aasp; LsacX; Ost; VsenMtru; EstMx; PolMtru)

Sublittoral marine mixed sediments with sponges and ascidians (MarMu; FaMS; AlcMaS; Aasp; SubSoAS)

Sublittoral sediment with *Zostera marina* beds (Zmar)

Sublittoral muddy gravel (MarMu; FaMx; VsenMtru) with algae (LsacX)

Sublittoral estuarine mud (AphTub) with kelp on available hard substrata (LsacX)

Sublittoral estuarine mud (EstMu; AphTub)

Sublittoral maerl beds (Phy; MrlMx; Lcor)

Figure 3: Indicative distribution of the main biotopes in the Lower Fal Estuary (Moore and others 1999)

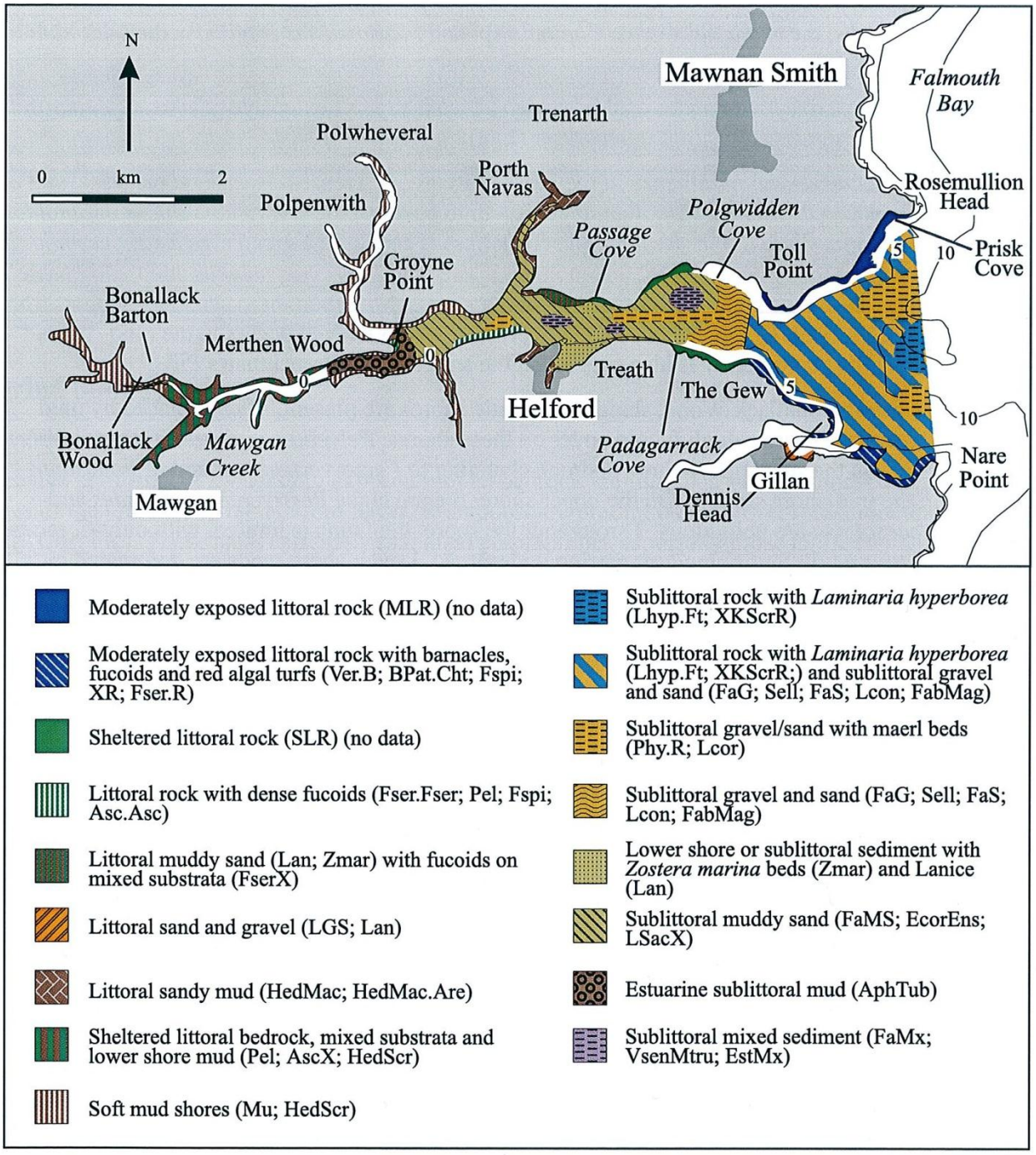


Figure 4: Indicative distribution of the main biotopes in the Helford River (Moore and others 1999). Updated information regarding the distribution of habitats in the sites is available through the online mapping tool, MAGIC[4].

1.14 Tompsett (2011) reviews transect surveys in the Helford Estuary from 1986 – 1999. In this time period six intensive surveys were undertaken at six sites, five of which are within the SSSI boundary. Tompsett identified a number of changes including the increase or reappearance of a number of species in the time since the 1987 tributyltin (TBT) ban. The transects also highlighted an increase in abundance and distribution of a number of non-natives including the slipper limpet *Crepidula fornicata*, Australasian barnacle *Eliminius modestus*, wireweed *Sargassum muticum* and the leathery seasquirt *Styela clava*.

1.15 Infralittoral sediments were surveyed by contractor Ecospan in autumn 2011 (Curtis 2011) and the results of this will be used to inform the condition assessment of the site for this feature.

[4] **MAGIC: http://www.magic.gov.uk/**

Aim

1.16 The infralittoral rock features was surveyed throughout the five units of the Lower Fal and Helford Intertidal SSSI. This was undertaken through a mixture of Marine Nature Conservation Review (MNCR) Phase I and II surveys, and by carrying out a series of transects, where species ID will be undertaken within quadrats throughout the zonation of the shores. Where possible, historical transects and survey locations will be revisited to enable a comparison to baseline data. Where a baseline is unavailable, these surveys will aim to establish one.

Objectives

- To carry out an integrated site assessment of the Lower Fal and Helford Intertidal SSSI.
- To assess the condition of the infralittoral rock features within the Lower Fal and Helford Intertidal SSSI.
- To identify and evaluate any changes in distribution and abundance of species from historical data where available.
- To provide baseline data where currently unavailable on the distribution and abundance of species in the Lower Fal and Helford Intertidal SSSI.

2. Methodology

Transect locations

2.1 At least one transect was conducted in each SSSI unit. There were five units in total. On the Fal Estuary, where possible the transects were replicates of the historic transects from the CBRU 1992 report which provides up to four seasons of semi-quantitative baseline data per site. Where no historic transects existed within that SSSI unit, the survey location was in the vicinity of sites where data was gathered for the Rostron 1985 survey which provided descriptive information on each site. In the Helford Estuary the CBRU transects were repeated in 2011 by the Helford Marine Conservation Group, therefore this ISA visited new sites with the aim of establishing a baseline (Table 4).

Table 4: Survey locations and comparison to available baseline data

Unit Name	Baseline Data	Baseline Transects	Grid Reference	July 2012 transect locations	Grid Reference
Upper Helford	-	-	-	Tremulon	SW 753 265
				Helford Jetty	SW 759 264
Outer Helford	-	-	-	Men-a-ver Point	SW 794 253
				Grebe Rock	SW 771 271
Carrick Roads	CBRU, 1992	Transect 4 (Flushing, Trefusis Point)	SW 817 335	Trefusis Point	SW 818 334
Percuil River	Rostron, 1985	Site no. 10 (Cellars Beach East)	SW 856 324	Cellars Beach East	SW 854 324
St. Anthony Head	CBRU, 1992	Transect 15 (St. Anthony, Amsterdam Point)	SW 849 324	Amsterdam Point	SW 847 322
	Rostron, 1985	Site no. 4 (Great Molunan)	SW 846 316	Great Molunan	SW 846 316

Figure 5: Transect locations for the Helford area – within Units 1 & 2

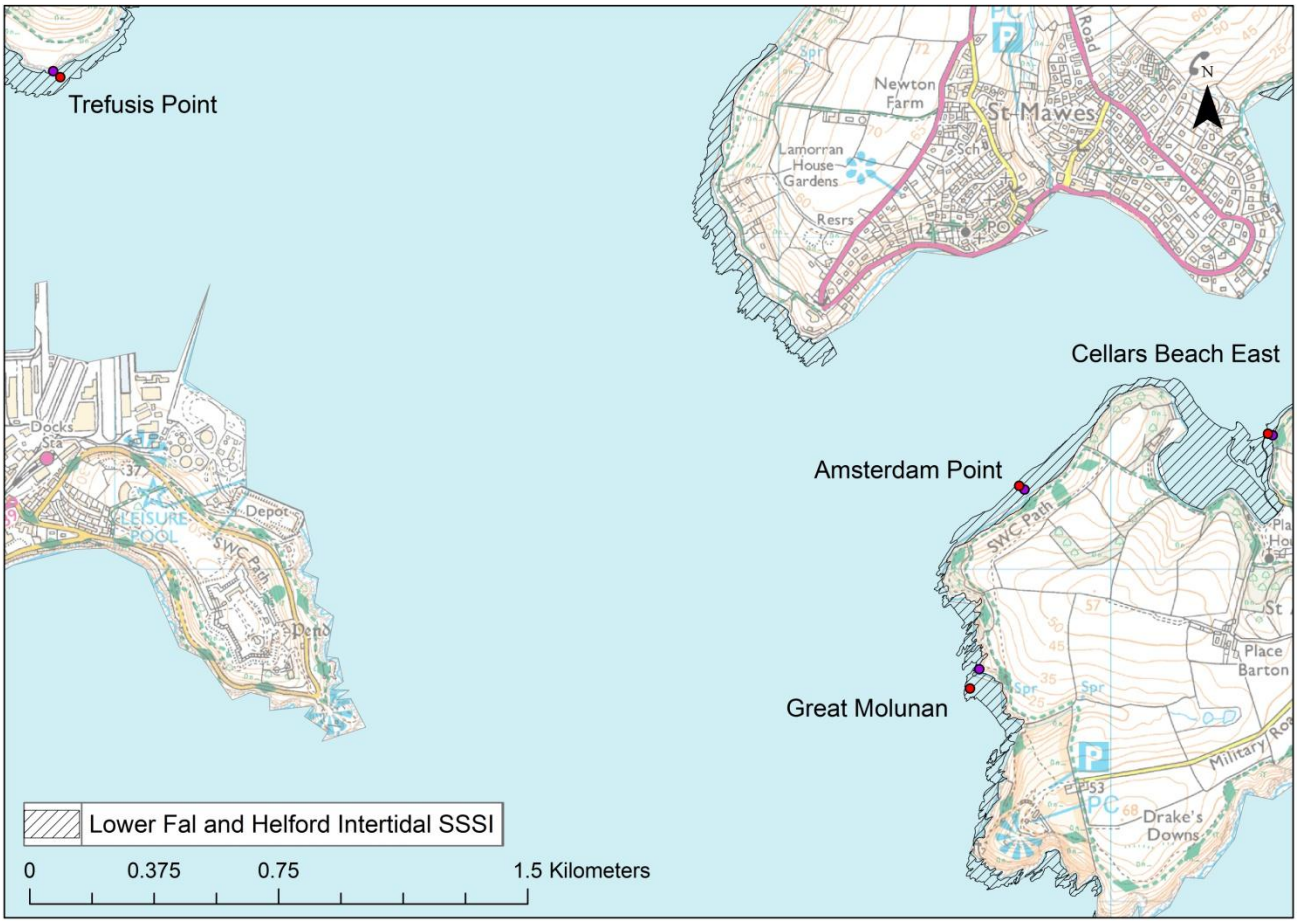


Figure 6: Transect locations for the Fal area – within Units 3-5

Rationale

2.2 In order to ensure that survey data collected was comparable to baseline data and at the same time enabled assessment of the condition of each attribute of the SSSI, the methodology used in the key baseline surveys (CBRU, 1992) was repeated. This includes detailed quantitative quadrat-based recording and semi-quantitative recording of biotopes to capture details that are missed by the quadrats.

2.3 The methods used were based on the Marine Nature Conservation Review standard methods for intertidal phase 1 and phase 2 surveys. A phase 1 survey identifies distribution and extent of biotopes over large areas, whereas a phase 2 survey entails collecting quantitative data, allowing detailed species lists for all biotopes to be produced. The level of detail varies between surveys and should ideally be used together for characterisation of the intertidal biological communities (Wyn and others, 2006). The methods followed the Common Standards Monitoring guidance ensuring comparability between sites (Davies and others 2001).

2.4 To help ensure quality control and to reduce surveyor bias a familiarisation day was held at the start of the survey to ensure surveyor familiarity with local conditions, species and biotope peculiarities.

Equipment

Per site

- MNCR recording forms
- Clipboard/ weather writer
- GPS unit
- 50 m tape measure
- 200 m string with poles
- 0.5 m by 0.5 m quadrat
- Camera
- Identification guides
- Collection bags
- Compass

Method

Establishing the transect

2.5 Surveys were carried out approximately two hours before low water on a falling tide. For survey sites with historical transects the transect line was located using the site description and compass bearings from the CBRU (1992) report, this involved lining up with landmarks on the opposite bank.
For survey sites which lacked historical data, a representative area of shore was selected with details recorded of obvious features to ensure that return surveys could be replicated effectively at the same site.

2.6 At each site photographs were taken of the starting point alongside GPS position. The transect was set using string fixed to the start point at the top of the shore and reeled out on a set bearing, either determined by previous surveys or perpendicular to the shore as far as possible. A tape measure was then reeled out along the transect extending 50 m taking care not to pull or drag the transect or tape measure along the rock to avoid disturbing any species present.

Biotope recording

2.7 Biotopes were recorded using the MNCR Littoral Habitat (detailed) form to describe the first biotope on the upper shore. The description included recording the substrate type, dominant and characterising species including both seaweeds and animals.

2.8 Surveyers then moved along the transect, noting the point at which the biotope changed, recording GPS co-ordinates and the new biotope description using the MNCR form. Biotopes were classified using the JNCC Marine Habitat Classificationfor Britain and Ireland Version 04.05 (Connor and others 2004).

2.9 Once reaching the lower seaward end of the transect, surveyors conducted an additional survey moving back up the transect which involved five minute timed searches within each biotope. To quantify species abundance, the SACFOR abundance scale was used (see separate sheet for SACFOR scale).

Quadrat recording

2.10 Quadrat surveys were also carried out moving downshore along the transect, using 0.5 m x 0.5 m quadrats to record percentage cover and abundance of species along the transect.

2.11 Data from quadrat surveys were recorded on a separate Quadrat Recording Form. Intervals for quadrat sampling followed previous surveys, and intervals of 5 m or 10 m were used depending on shore profile. For sites which lacked previous survey data, judgment on the width of the intertidal area (low tide mark to high tide mark) was used to determine quadrat intervals of 5 m or 10 m.

2.12 Quadrats were placed on the transect line so that they were divided in half by the transect line, so the survey area was 0.25 m either side of the transect with the top edge of the quadrat at the appropriate distance marked on the transect. Each quadrat was then photographed and GPS co-ordinates were recorded, with any drift material noted and removed.

2.13 Species were identified and quantified as number of individuals, or if too numerous to count an estimate of percentage cover of the quadrat was recorded. Algal cover was recorded on a percentage cover basis then surveyors lifted algae aside to record species beneath. Substrate within the quadrat was also recorded. Quadrat surveys were then repeated at the appropriate intervals down the shore until reaching the furthest extent of the shore exposed at extreme low water (spring low tides).

2.14 The survey method was non-destructive and disturbance to the shoreline habitat was kept to a minimum.

3. Results

3.1 The surveys took place at 8 locations across the SSSI (table 4), with a transect being carried out at each. Site description and site information of each location is provided, including photographs of the GPS starting point and location, to ensure the survey can be replicated effectively. A GPS reading for each of the zones and quadrat locations for each site are located in the appendix.

3.2 The data collected from each site is available on the Marine Recorder database[5], including quantitative data from the quadrat recordings.

3.3 The biotopes recorded at each location were classified using the JNCC Marine Habitat Classification for Britain and Ireland Version 04.05. These are comparable to the biotope codes recorded by Moore and others, 1998. A comparison is given to the littoral biotopes presented in Moore and others, 1998 where possible; however two of the locations (Helford Jetty and Grebe Rock) have no biotope recordings. A comparison to historical data, such as the permanent VMCA transect surveys, is undertaken where possible, although some of the locations lack directly comparable surveys.

Unit 1 Upper Helford

Tremulon SW 75320 26500

Site description

3.4 Steeply grading upper bedrock shore with close zonation. Small (<0.5 m) lichen zone, entering into a mixed *Pelvetia canaliculata* and *Ascophyllum nodosum* zone. Short barnacle zone associated with steep facing bedrock. Gently sloping *F. serratus* and lower shore zone.

Plate 1: Start of transect: 320° looking across the river at Tremulon © Natural England. OS grid ref. SW 752326500

[5] **Marine Recorder can be accessed here http://jncc.defra.gov.uk/page-1599**

Plate 2: Start of transect: 40° looking towards thatched cottage/ boathouse at Tremulon © Natural England. OS grid ref. SW 75323 26500

Plate 3: Location: looking west of transect line towards slipway, transect approximately 10m east from the bottom of the slipway © Natural England

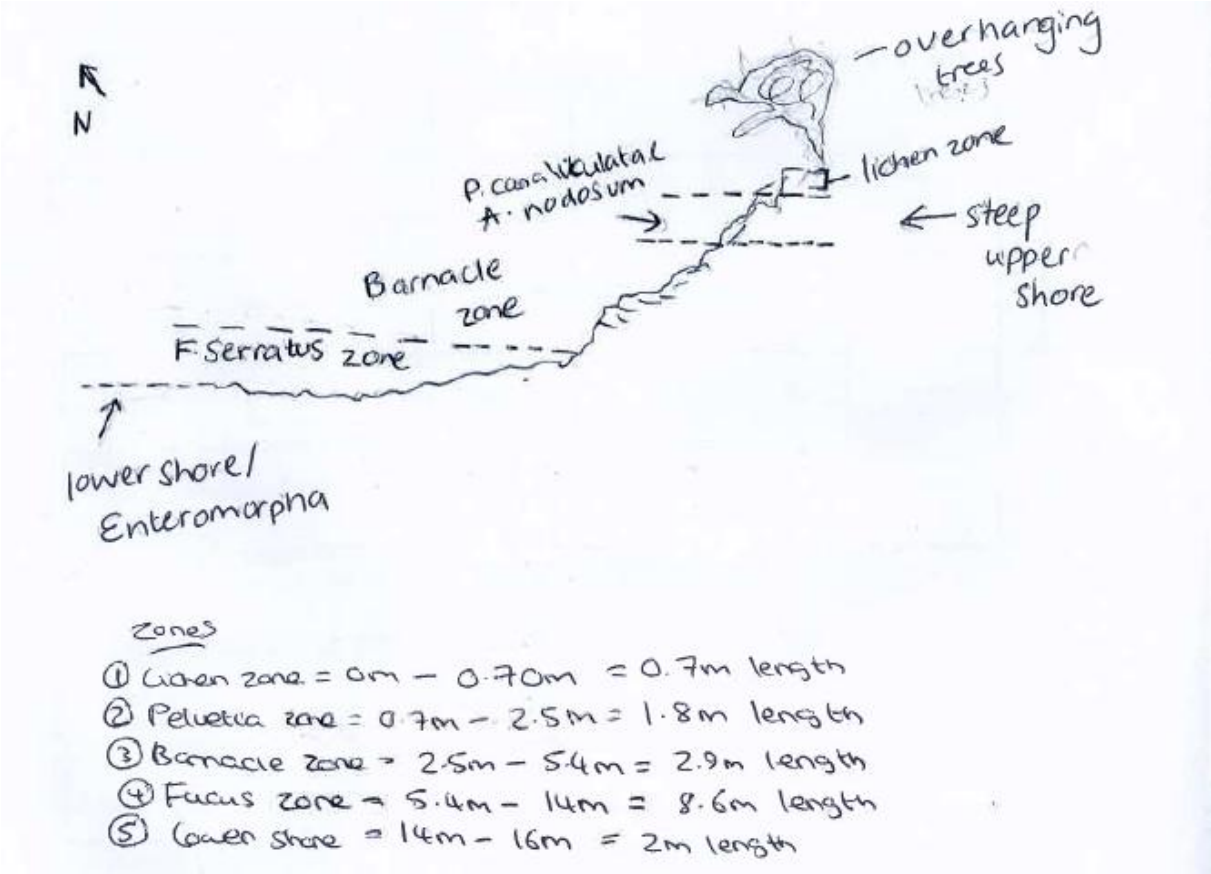


Figure 7: Shore profile at Tremulon

Site and survey information

Table 5: Tremulon site information

Physiographic type	Estuary
Salinity	Variable (18-40‰)
Wave exposure	Very Sheltered
Tidal streams	Weak (<1kn)
Geology	Slate and slate / shale
Littoral width	10-100 m
Littoral aspect	North-west
Conservation assessment	Not completed
Uses and Impacts	Mooring / beaching / launching

Table 6: Tremulon survey information

Date	3rd July 2012
Start Time	11:00
Duration	2hr 30 mins
Time of Low water	12:09
Tide Height	0.6 m
Recorders	Pat Sargeant, Sabrina Heiser, Louisa Knights, Rhiannon Pipkin

Table 7: Littoral habitats identified at Tremulon

Littoral Habitat	Distance from start of transect (m)	Dominant species	Biotope Code	EUNIS Code	Biotope Name
Lichen zone	0 – 0.7	*Verucaria maura*	LR.FLR.Lic.Ver.Ver	B3.1132	*V. maura* on exposed to very sheltered upper littoral fringe rock
P. canaliculata and *A. nodosum* zone	0.7 – 2.5	*P. canaliculata, A. nodosum, Hildenbrandia rubra,* various barnacles	LR.MLR.BF.PelB LR.LLR.FVS.AscVS	A1.211 A1.324	*P. canaliculata* and barnacles on moderately exposed littoral fringe rock *A. nodosum* and *F. vesiculosus* on variable salinity mid eulittoral rock
Barnacle zone	2.5 – 5.4	*Semibalanus balanoides, Mytilus edulis, Patella* sp.	LR.HLR.MusB.Sem.Sem	A1.1131	*S. balanoides, Patella vulgata* and *Littorina* spp. on exposed to moderately exposed or vertical sheltered eulittoral rock
F. serratus zone	5.4 - 14	*F. serratus, F. vesiculosus, M. edulis, C. montagui, Littorina* sp.	LR.LLR.FVS.FserVS	A1.326	*F. serratus* and large *M. edulis* on variable salinity lower eulittoral rock
Lower Shore Zone	14 - 16	*Enteromorpha* sp., *Ulva lactuca, S. balanoides,*	LR.FLR.Eph.EphX	A2.821	Ephemeral green and red seaweeds on variable salinity and/or disturbed eulittoral mixed substrata

1994 (Moore and others 1999)

3.5 Identified the area as littoral rock with dense fucoids.

Table 8: Littoral habitats identified by Moore and others (1999)

Biotope Recorded (Version 97_06)	Biotope Name	Converted Biotope (Version 01_15)	Present in 2012?
Fser	*F. spiralis* on moderately exposed to very sheltered upper eulittoral rock	No change	FserVS similar but in variable salinity areas
Pel	*P. canaliculata* on sheltered littoral fringe rock	Split into Pel and PelVS	PelB recorded – higher exposure than Pel with increased barnacle cover
Fspi	*F. spiralis* on moderately exposed to very sheltered upper eulittoral rock	Split into FspiB, Fspi and FspiVS	Not recorded
Asc.Asc	*A. nodosum* on full salinity mid eulittoral rock	Changed to Asc.FS	Asc.VS similar but in variable salinity areas

Species abundance and distribution

3.6 The steep shore profile creates a compacted upper shore with *Pelvetia* and *Ascophyllum* biotopes joined, this zone has very limited species diversity. A total of 49 species were recorded on the transect: *Littorina, Patella* and barnacle species dominate the fauna in this zone. The barnacle zone below this is larger and has slightly increased species diversity with red seaweeds, encrusting pink algae and *Mytilus edulis*. Occasional fucoids and sponges were also found. The *F. serratus* zone makes up the largest area of the shore with abundant fucoids and *M. edulis.* Faunal diversity is also increased in this zone with *Littorina* species common, *Patella* spp., *Gibbula* spp., *Carcinus maenas*, *Cerastoderma edule* and *Marthasterias glacialis* all occur occasionally. The lower shore community is restricted due to the mobile nature of the sediment with ephemeral green seaweeds dominant indicating sand scour. Individuals of the non-native species *Crepidula fornicata* were recorded on the lower shore as 'Occasional' in abundance, and *Crassostrea gigas* were also present but with a rare abundance.

Comparison to historic data

3.7 There are irregular but ongoing transect surveys in the Helford conducted by the Helford Voluntary Marine Conservation Area group. We have thus chosen to target different areas to expand the available data. This means that there is no historic data specific to Tremulon however comparisons can be made to other areas of the Helford. The site shows similarities to areas in Flushing Cove in terms of species diversity. Moore's (1999) biotope recording suggested that the area was dominated by fucoids, particularly *F. serratus, F. spiralis, P. canaliculata* and *A. nodosum*. This is a very similar pattern of cover to the current recordings with the exception of the *F. spiralis* cover which was not recorded. This may be site-specific as Tremulon has a very compressed shore profile. One notable change is the presence of *C. gigas,* the Pacific Oyster, which was not recorded in VMCA surveys until 2012 (Rennocks, 2013, ERCCIS *Pers. Comm*, 30 August.); there is one record on NBN gateway from Men-a-var recorded by JNCC in 1994.

Helford Jetty SW 75968 26415

Site description

3.8 Site consists of a bedrock spit approximately 15 m southeast of Helford Jetty, extending out towards Helford Passage. The shore was North-easterly facing and gently sloping. Hard slate bedrock, dominated by lichens grades into a *Pelvetia* zone (intermixed with *F. spiralis*, particularly in bedrock channels), which extends for approximately 4 m. Gently sloping *F. spiralis* zone on upwards facing bedrock (10.5 m littoral width). As shore descends pebbles and sediment become more abundant until barnacle zone.

Plate 4: Start of transect: 40° looking towards Helford Passage © Natural England. OS grid ref. SW 75968 26415

Plate 5: Centre of site: looking south west towards the start of transect line © Natural England. OS grid ref. SW 75989 26437

Plate 6: Start of transect: 100° looking towards house on the headland
© Natural England. OS grid ref. SW 75968 26415

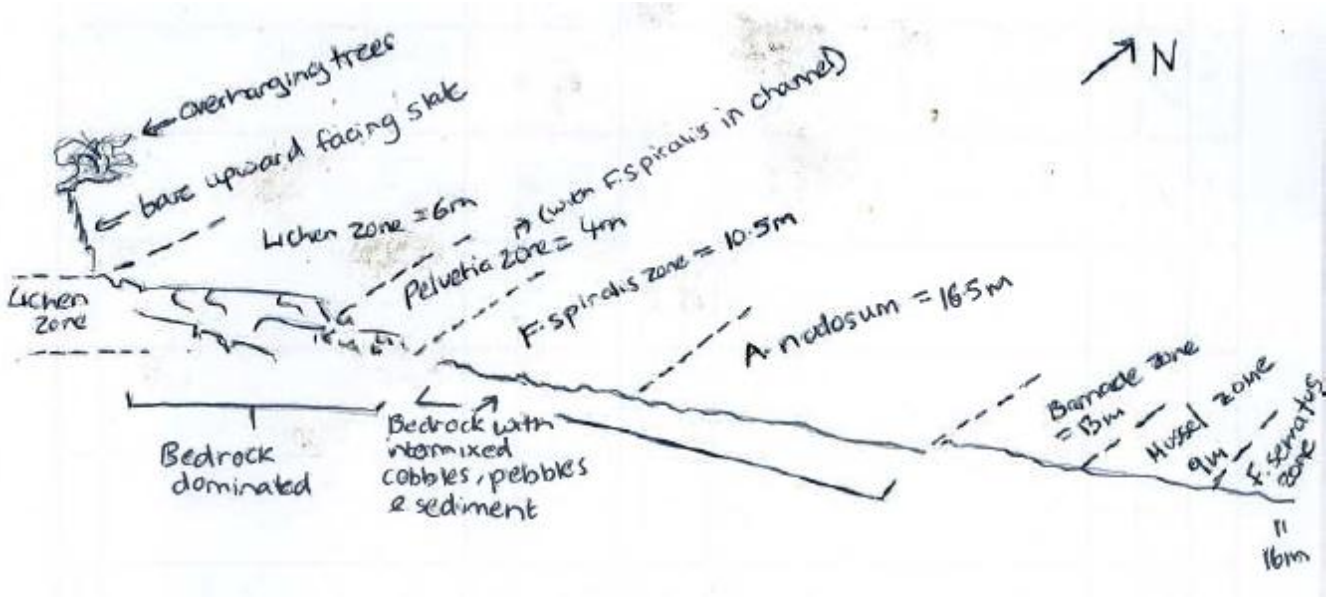


Figure 8: Shore profile at Helford Jetty

Site and survey information

Table 9: Helford Jetty site information

Physiographic type	Estuary
Salinity	Full (30-40‰)
Wave exposure	Sheltered
Tidal streams	Weak (<1kn)
Geology	Slate
Littoral width	10-100 m
Littoral aspect	North-east
Conservation assessment	Not completed
Uses and Impacts	Mooring / beaching / launching

Table 10: Helford Jetty survey information

Date	6th July 2012
Start Time	11:00
Duration	4hr 30 mins
Time of Low water	14:36
Tide Height	0.4 m
Recorders	Sabrina Heiser, Tom Hardy, Rhiannon Pipkin

Table 11: Littoral habitats identified at Helford Jetty

Littoral Habitat	Distance from start of transect (m)	Dominant species	Biotope Code	EUNIS Code	Biotope Name
Lichen zone	0 - 6	*V. maura, Xanthoria parietina,*	LR.FLR.Lic.YG above LR.FLR.Lic.Ver.Ver	B3.111 above B3.1132	Yellow and grey lichens on supralittoral rock above *V. maura* on exposed to very sheltered upper littoral fringe rock
P. canaliculata zone	6 - 10	*P. canaliculata,* various barnacles, *V. maura, Hildenbrandia* sp.	LR.MLR.BF.PelB	A1.211	*P. canaliculata* and barnacles on moderately exposed littoral fringe rock
F. spiralis zone	10 – 20.5	*F. spiralis, Littorina* spp., *V. maura, Amphipoda* sp.	LR.LLR.F.Fspi.X	A1.3122	*F. spiralis* on full salinity upper eulittoral mixed substrata
A. nodosum zone	20.5 - 37	*A. nodosum, Littorina sp.,* red weeds, barnacles.	LR.LLR.F.Asc.FS	A1.3141	*A. nodosum* on full salinity mid eulittoral rock
Barnacle zone	37 - 50	*Eliminius modestus, M. edulis, Patella* sp.	No code is available for areas dominated by this non-native barnacles however the community is most similar to LR.HLR.MusB.Sem.Sem (*S. balanoides, P. vulgata* and *Littorina* spp. on exposed to moderately exposed or vertical sheltered eulittoral rock) as *E. modestus* is likely to have outcompeted the native *S. balanoides*.		
Mussel zone	50 - 59	*M. edulis, E. modestus, Littorina* spp.	LS.LBR.LMus.Myt.Mx	A2.7211	*M. edulis* beds on littoral mixed substrata
F. serratus zone	59 - 75	*F. serratus, Spirorbis* sp., *Littorina* sp.	LR.LLR.F.Fserr.X	A1.3152	*F. serratus* on full salinity lower eulittoral mixed substrata

1994 (Moore and others 1999)

3.9 No bedrock habitat types were recorded in this area.

Species abundance and distribution

3.10 This gently sloping shore shows clear zonation with zones *P. canaliculata, F. spiralis, A. nodosum*, barnacles, mussels and *F. serratus* as you move down the shore each with a percentage cover of at least 60%. Diversity throughout the shore is higher than at Tremulon with 56 species recorded, despite the fact that the two sites are only approximately 600 m apart. This diversity is most notable in the *A. nodosum* and *F. serratus* zones. A number of non-native species have been recorded in the survey including *C. fornicata* which was frequent in the *F. serratus* zone; *E. modestus* which dominates the barnacle and mussel zones; *C. gigas* which was found occasionally; and there was one record of *Corella eumyota,* a non-native seasquirt.

Comparison to historic data

3.11 The most comparable site from the VMCA surveys is Helford Passage directly opposite on the north shore; this site has a very similar pattern of fucoid distribution with dominant *P. canaliculata, F. spiralis* and *A. nodosum*. Occurrences of *E. modestus* increased throughout the VMCA survey period and this has continued to the superabundance now observed. The presence of *C. eumyota* is the most notable change for the area; this colonial seasquirt is a non-native species that was first recorded in the UK in 2004 from three marina sites on the south coast. There are no records of *C. eumyota* in Cornwall on the NBN gateway and it has not been recorded in the Helford transect surveys. There is a subtidal record from a seasearch dive in May 2012 near the entrance of the Helford River (Rennocks, 2013, ERCCIS *Pers. Comm*, 30 August.)

Unit 2 Lower Helford

Men-a-ver approximate location SW 793 252

Site description

3.12 North facing, gently sloping bedrock platform within Lower Fal and Helford SSSI. Backed by cliffs with access via coast path to the east. Largely bedrock, upwards facing surfaces with some boulders, cobbles, pebbles and gravel in places. Wide zones, no *P. canaliculata* or *F. spiralis* zones apparent. Fucoids dominant on much of the shore with abundant grazing molluscs. Due to a technical issue, full details of transect measurements are not available for this site.

Plate 7: Start of transect: looking east from transect marker rock, Dennis Head visible in the distance © Natural England. OS grid ref. SW 795 250

Plate 8: Start of transect: west from transect marker rock, looking to Nare Point © Natural Engalnd

Plate 9: Start of transect: south from transect marker rock looking down the transect © Natural England

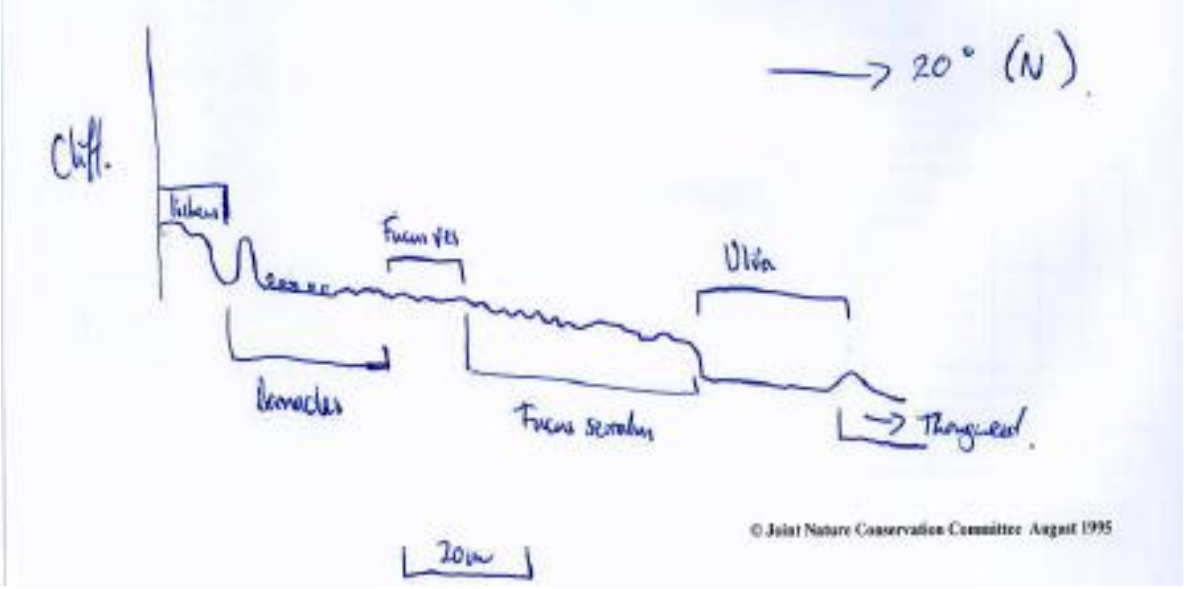


Figure 9: Shore profile at Men-a-ver

Site and survey information

Table 12: Men-a-ver site information

Physiographic type	Semi-enclosed coast
Salinity	Full (30-40‰)
Wave exposure	Moderately exposed
Tidal streams	Weak (<1kn)
Geology	Slate
Littoral width	10-100 m
Littoral aspect	North-east
Conservation assessment	Not completed
Uses and Impacts	Mooring / beaching / launching

Table 13: Men-a-ver survey information

Date	3rd July 2012
Start Time	10:50
Duration	4hrs
Time of Low water	12:09
Tide Height	0.6 m
Recorders	Fiona McNie, Angie Gall, Liz Bailey. Beth Tonkin

Littoral habitats
July 2012

Table 14: Littoral habitats identified at Men-a-ver

Littoral Habitat	Distance from start of transect (m)	Dominant species	Biotope Code	EUNIS Code	Biotope Name
Lichen zone	unavailable	*V. maura, X. parietina,*	LR.FLR.Lic.Ver.Ver	B3.1132	*V. maura* on exposed to very sheltered upper littoral fringe rock
Barnacle zone	unavailable	*C. montagui, Littorina spp., Patella spp.*	LR.HLR.MusB.Cht.Cht	A1.1121	*Chthamalus* spp. on exposed upper eulittoral rock
F. vesiculosus zone	unavailable	*F. vesiculosus, Osmundea pinnatifida, Gibbula* spp., *Patella* spp., *barnacles*	LR.MLR.BF.FvesB	A1.213	*F. vesiculosus* and barnacle mosaics on moderately exposed mid eulittoral rock
F. serratus zone	unavailable	*F. serratus,* red weeds, *Spirorbis* sp., encrusting pink	LR.MLR.BF.Fser.R	A1.2141	*F. serratus* and red weeds on moderately exposed lower eulittoral rock
Ulva zone	unavailable	*Ulva lactuca, S. muticum, Himanthalia elongata, Anemone viridis*	LR.FLR.Rkp.FK.Sar	A1.4121	*S. muticum in eulittoral rockpools*

1994 (Moore and others 1999)

3.13 Identified the area as moderately exposed littoral bedrock with barnacles, fucoids and red algal turfs.

Table 15: Littoral habitats identified by Moore and others (1999)

Biotope Recorded (Version 97_06)	Biotope Name	Converted Biotope (Version 01_15)	Present in 2012?
Ver B	*V. maura* and sparse barnacles on exposed littoral fringe rock	No change	Separate *V. maura* and barnacle zones were recorded – Ver.Ver and Cht.Cht
BPat.Cht	*Chthamalus* spp. on exposed upper eulittoral rock	MusB.Cht	MusB.Cht.Cht recorded
Fspi	*F. spiralis* on moderately exposed to very sheltered upper eulittoral rock	Split into FspiB, Fspi and FspiVS	Not recorded
XR	Mixed red seaweeds on moderately exposed lower eulittoral rock	Discontinued; records reassigned mostly to FR types (particularly Coff), MusB and Sem	Mixed red weeds found within Fser.R but not recorded as zone independent of fucoids.
Fser.R	*F. serratus* and red seaweeds on moderately exposed lower eulittoral rock	No Change	Yes

Species abundance and distribution

3.14 The gently sloping, moderately exposed and full salinity conditions at Men-a-ver support a wider range of species than the other Helford sites with 67 species recorded. The moderate exposure of the site reduces the dominance of fucoids allowing a wider range of species to be seen in each zone. There is a clearly defined lichen zone about a barnacle zone dominated by a mixture of *C. montagui, S. balanoides* and *E. modestus*. This then moves into a barnacle and *F. vesiculosus* mosaic and a *F. serratus* and red weed area before reaching a series of large rockpools dominated by *Ulva* spp. and *S. muticum*. The fauna present is varied and includes less common littoral species such as *Clavelina lepadiformis* the lightbulb seasquirt and *Morchellium argus* a colonial seasquirt on the lower shore.

Comparison to historic data

3.15 None of the VMCA survey sites are directly comparable with Men-a-ver due to its location and aspect, which are more like open coast than estuarine conditions. The biotope mapping conducted by Moore and others (1999) is almost identical with both surveys finding barnacles, fucoids and red algae. Moore and others recorded a zone of *F. spiralis* which was absent in July 2012 apart from a small amount in the barnacle zone. A *S. muticum* zone in rockpools was an addition from the 1994 survey; it was first recorded by the VMCA surveys in 1993 and had become widespread by 1999.

Grebe Rock SW 77133 27164

Site description

3.16 South facing intertidal zone comprising rocky outcrops in the supralittoral, coarse sediment beach and slate outcrops. No upper shore lichen zone, no *P. canaliculata* zone, a wide barnacle/*Patella* spp. zone which graded into *Fucus* spp. midshore biotopes. A large bedrock outcrop resulted in a discontinuous biotope transition down the transect. *Himanthalia elongata* zone starts and ends abruptly on a steep south facing rock slope.

Plate 10: Start of transect: south looking down the transect © Natural England
OS grid ref. SW 77133 27164

Plate 11: Location: looking east across transect ©Natural England

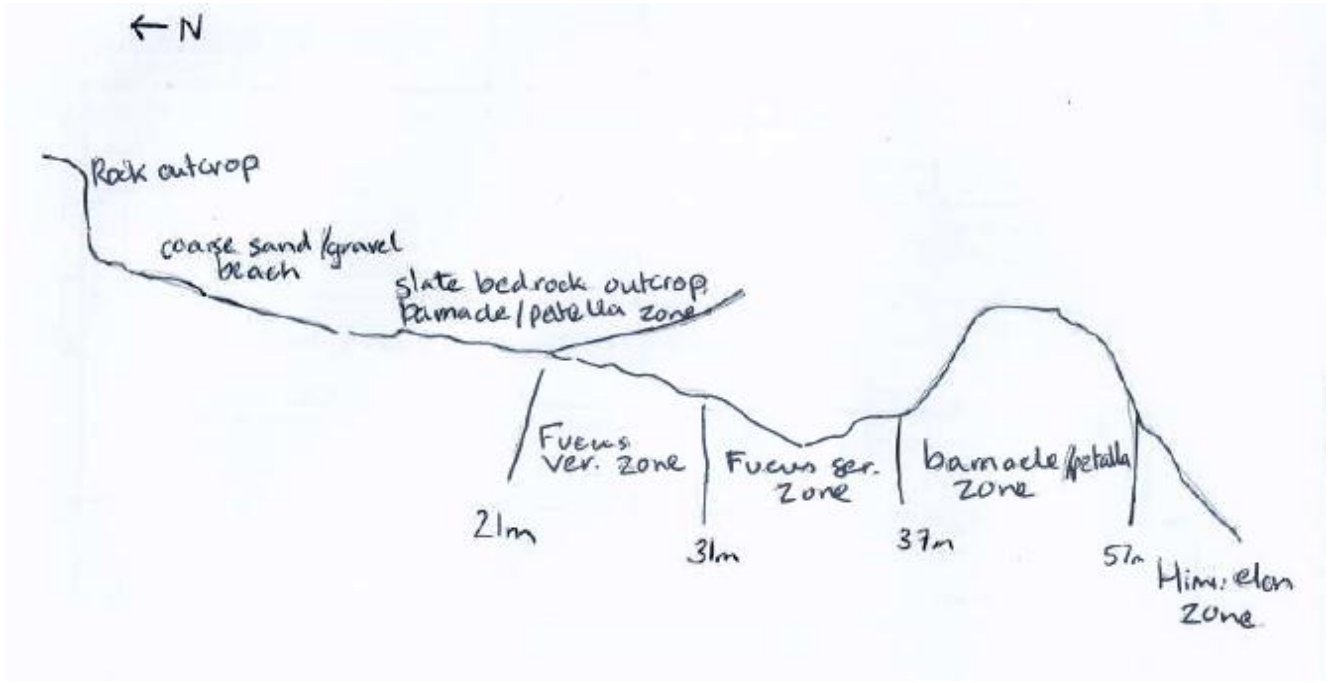


Figure 10: Shore profile at Grebe Rock

Site and survey information

Table 16: Grebe Rock site information

Physiographic type	Ria / voe
Salinity	Full (30-40‰)
Wave exposure	Moderately exposed
Tidal streams	Very Weak (<1kn)
Geology	Slate
Littoral width	10-100 m
Littoral aspect	South
Conservation assessment	Unspoilt / natural, representative, intrinsic appeal
Uses and Impacts	Recreational – facilities, popular beach mooring / beaching / launching

Table 17: Grebe Rock survey information

Date	3rd July 2012
Start Time	10:30
Duration	4hr 30 mins
Time of Low water	12:09
Tide Height	0.6 m
Recorders	Roger Covey, Jeremy Clitheroe, Wesley Smyth

Table 18: Littoral habitats identified at Grebe Rock

Littoral Habitat	Distance from start of transect (m)	Dominant species	Biotope Code	EUNIS Code	Biotope Name
Barnacle zone	11 – 21 and 37 - 57	*C. montagui, Phorcus lineatus*	LR.HLR.MusB.Cht.Cht	A1.1121	*Chthamalus* spp. on exposed upper eulittoral rock
Barnacle and *F. vesiculosus* zone	21 - 31	*F. vesiculosus, S. balanoides, O. pinnatifida, Patella* spp.	LR.MLR.BF.FvesB	A1.213	*F. vesiculosus* and barnacle mosaics on moderately exposed mid eulittoral rock
F. serratus zone	31 - 37	*F. serratus, Gibbula* spp., *Littorina* spp., *Patella* spp.	LR.LLR.F.Fserr.FS	A1.3151	*F. serratus* on full salinity sheltered lower eulittoral rock
H. elongata zone	57 onwards	*H. elongata, O. pinnatifida, Audouinella* sp., *S. balanoides*	LR.HLR.FR.Him	A1.123	*H. elongata* and red seaweeds on exposed to moderately exposed lower eulittoral rock

1994 (Moore and others 1999)

3.17 Identified the area as sheltered littoral rock but collected no data on biotope.

Species abundance and distribution

3.18 The site starts with a coarse sand and gravel zone which was not surveyed, with clear zonation to barnacle zone. This is followed by *F. vesiculosus* and *F. serratus* zones before a large rocky outcrop brings the biotope back to barnacle zone. The *H. elongata* zone then starts just at the water's edge. The barnacle zone is dominated by *C. montagui* which is super abundant, this moves to *S. balanus* & *F. vesiculosus* which are both abundant in the barnacle fucoid mosaic. In *F. vesiculosus* and *F. serratus* zones the rest of the community comprises red weed, small amounts of sponge and numerous molluscs including *Littorina* spp., *Patella* spp. and *Nucella lapillus*. Grebe rock has the lowest species number recorded for the Helford at 48 species; this is most likely a result of the limited intertidal area which only supports four biotopes one of which was not fully surveyed due to tidal inundation – *H. elongata* zone.

Comparison to historic data

3.19 The fact that no VMCA surveys have been conducted in this area of the Helford, combined with this area not being surveyed by Moore and others (1999), means there is no historical data to compare our findings to. Our results will thus provide a baseline for future surveys.

Unit 3 Carrick Roads

Trefusis Point SW 81815 33500

Site description

3.20 Angular slate shore, gently sloping with occasional serrated outcrops. Grassy area at top of shore leading to lichen zone. Distinct zones: lichen, *P. canaliculata*, and then extensive barnacle zone with some *Lichina pygmaea. F. serratus* zone at the bottom of the shore, grading into *H. elongata* below low water.

Plate 12: Location: north looking up the transect
© Natural Engalnd. OS grid ref. SW 81842 33477

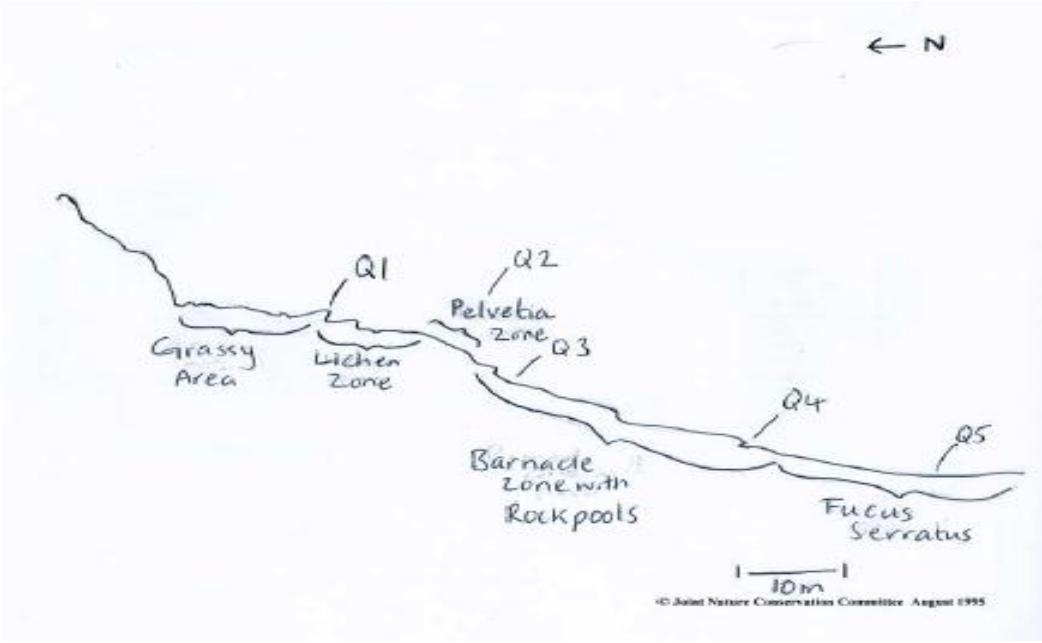


Figure 11: Shore profile at Trefusis Point

Site and survey information

Table 19: Trefusis Point site information

Physiographic type	Semi-enclosed coast
Salinity	Full (30-40‰)
Wave exposure	Exposed
Tidal streams	Very Weak (<1kn)
Geology	Slate
Littoral width	10-100 m
Littoral aspect	South-east
Conservation assessment	Unspoilt / natural, representative (for sector)
Uses and Impacts	Fishing – angling, litter and debris

Table 20: Trefusis Point survey information

Date	2nd July 2012
Start Time	10:15
Duration	3hrs
Time of Low water	11:09
Tide Height	0.8 m
Recorders	Rhiannon Pipkin, Louisa Knights, Sabrina Heiser, Pat Sargeant, Angie Gall, Liz Bailey, Fiona McNie, Beth Tonkin, Sangeeta McNair, Roger Covey, Tom Hardy, Wesley Smyth, Stephanie Ashman, Christine Singfield, Holly Latham, Ross Bullimore

Table 21: Littoral habitats identified at Trefusis Point

Littoral Habitat*	Dominant species	Biotope Code	EUNIS Code	Biotope Name
Lichen zone	*V. maura*	LR.FLR.Lic.Ver.Ver	B3.1132	*V. maura* on exposed to very sheltered upper littoral fringe rock
P. canaliculata zone	*P. canaliculata, Littorina saxatilis, C. montagui*	LR.MLR.BF.PelB	A1.211	*P. canaliculata* and barnacles on moderately exposed littoral fringe rock
Barnacle zone	*C. montagui, E. modestus, S. balanoides, Littorina* spp., *Patella* sp.	LR.HLR.MusB.Sem.Sem	A1.1131	*S. balanoides, P. vulgata* and *Littorina* spp. on exposed to moderately exposed or vertical sheltered eulittoral rock
Rockpools within barnacle zone	*Corallina officinalis, Ellisolandia elongata, Ceramium* sp.	LR.FLR.Rkp.Cor.Cor	A1.4111	Coralline crust and *C. officinalis* in shallow eulittoral rockpools
F. serratus zone	*F. serratus, Mastocarpus stellatus, O. pinnatifida, P. vulgata, Littorina* spp.	LR.MLR.BF.Fser.R	A1.2141	*F. serratus* and red seaweeds on moderately exposed lower eulittoral rock

*** Distance from start of transect not recorded at this site**

1994 (Moore and others 1999)

3.21 Identified the area as sheltered littoral rock with fucoids.

Table 22: Littoral habitats identified by Moore and others (1999)

Biotope Recorded (Version 97_06)	Biotope Name	Converted Biotope (Version 01_15)	Present in 2012?
Fspi	*F. spiralis* on moderately exposed to very sheltered upper eulittoral rock	Split into FspiB, Fspi and FspiVS	Not recorded
Asc.VS	*A. nodosum* and *F. vesiculosus* on variable salinity mid eulittoral rock	No change	Not recorded
Fser.VS	*F. serratus* and large *M. edulis* on variable salinity lower eulittoral rock	No change	Fser.R recorded
FserX	*F. serratus* on lower eulittoral mixed substrata	Fserr.X	

Species abundance and distribution

3.22 The upper and mid shore areas are barnacle dominated with limited species diversity. Mobile fauna is dominated by gastropods, predominantly *Littorina* spp. and *Patella* spp. The mid to lower shore zones are punctuated by shallow rockpools dominated by *Corallina* spp. and encrusting pink weed. *Ulva* spp. (formerly known as *Enteromorpha*) are found occasionally in the lower shore areas. Diversity increases moving into the fucoid dominated lower shore, with abundant *M. stellatus.* The total number of species recorded was 53.

Comparison to historic data

3.23 The species recorded at this site are comparable to the CBRU, 1992 survey and Covey & Hocking, 1987 survey. The method for measuring barnacle abundance has changed from counts in the historic data to percentage cover in the current survey. This change in method has limited the possibility for comparison however some changes can be identified: *Chthamalus stellatus* is only recorded from 2012; *E. modestus* was first recorded in CBRU, 1992; and in the lower shore has shown a significant increase which coincides with a decrease in the native *S. balanoides*. The native barnacle *S. balanoides* has been recorded as being outcompeted by *E. modestus* in other areas (Crisp, 1958). The distribution and abundance of *Ulva* species (formerly known as *Enteropmorpha* – Hayden and others 2003) has changed with distribution shifting from the upper and mid shore towards the lower shore. Algal cover has generally shown very little change in comparison with the 1986 data, potentially reversing a slight decrease noted by CBRU in 1992. Abundance of *Ulva* has significantly decreased suggesting a change to nutrient inputs in the area. In terms of biotopes recorded there seems to have been a decrease in the current survey in the number of fucoid dominated zones recorded in comparison to previous studies with no *F. spiralis* or *A. nodosum* zones identified and only one *F. serratus* zone. The presence of the dog whelk, *Nucella lapillus* was found to be occasional throughout the barnacle zone, whereas in previous surveys it has been reported as absent. This suggests the cease of TBT operations is likely to be having a positive effect on the abundance of *Nucella lapillus.*

Unit 4 Percuil River

Cellars Beach East SW 85487 32404

Site description

3.24 The shore sits with a north-westerly aspect under a canopy of oak trees. Lichen, *P. canaliculata* and *F. spiralis* zones are closely graded over approximately 2 m. Bedrock then gently slopes for *A. nodosum* zone which has a footpath passing through leading to the landing jetty/slipway. Barnacle zone sits on upstanding bedrock before dropping down by approximately 1 m to the *F. serratus* zone which sits on a pebble/gravel substratum. This gently grades into a lower shore pebble and mud zone, with extensive green algal mats.

Plate 13: Start of transect: 100° looking east up the transect © Natural England
OS grid ref. SW 85478 32403

Plate 14: Start of transect: northwest down the transect towards house on opposite bank © Natural England. OS grid ref. SW 85487 32404

Plate 15: Location: north towards slipway (submerged at high water) © Natural England. OS grid ref. SW 85487 32404

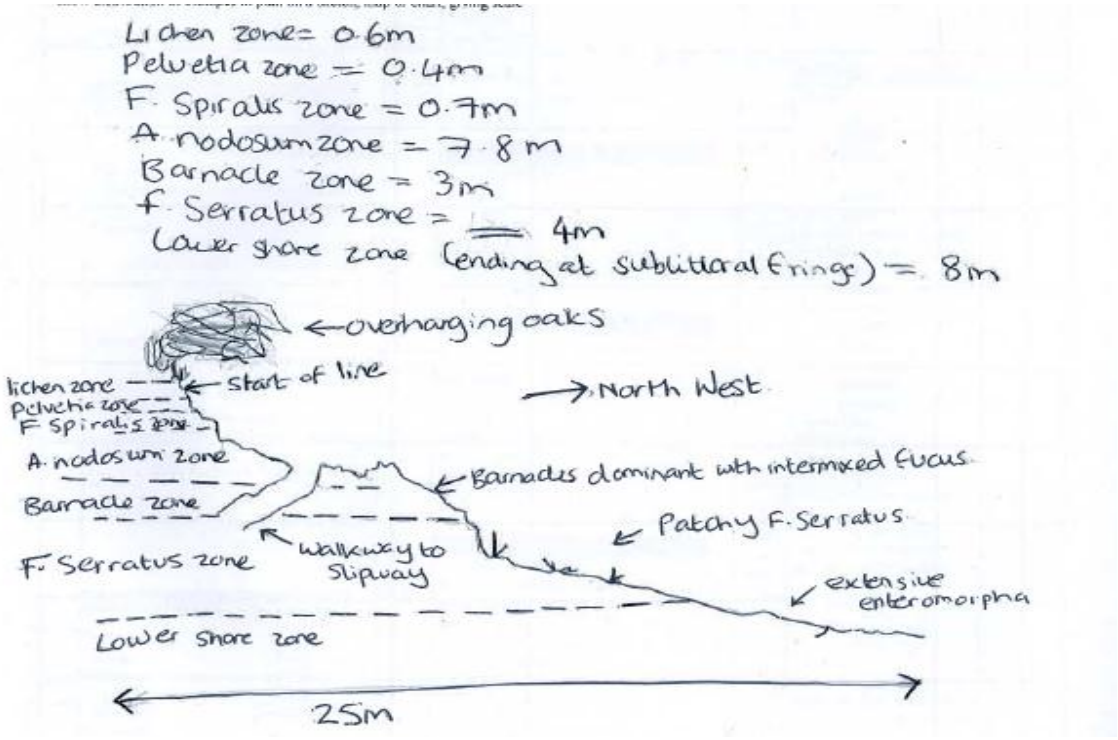


Figure 12: Shore profile at Cellars Beach East

Site and survey information

Table 23: Cellars Beach East site information

Physiographic type	Ria /voe
Salinity	Full (30-40‰)
Wave exposure	Very sheltered
Tidal streams	Very Weak (<1kn)
Geology	Slate
Littoral width	10-100 m
Littoral aspect	North-west
Conservation assessment	Not completed
Uses and Impacts	Mooring / beaching / launching

Table 24: Cellars Beach East survey information

Date	5th July 2012
Start Time	11:00
Duration	4hrs 30mins
Time of Low water	13:03
Tide Height	0.4 m
Recorders	Rhiannon Pipkin, Sabrina Heiser, Tom Hardy, Stephanie Ashman, Christine Singfield, Kimara McCrindle

Table 25: Littoral habitats identified at Cellars Beach East

Littoral Habitat	Distance from start of transect (m)	Dominant species	Biotope Code	EUNIS Code	Biotope Name
Lichen Zone	0.5 – 1.1	*V. maura*	LR.FLR.Lic.Ver.Ver	B3.1132	*V. maura* on exposed to very sheltered upper littoral fringe rock
P. canaliculata Zone	1.1 – 1.5	*P. canaliculata, C. montagui, Hildenbrandia* sp., *Littorina spp.*	LR.MLR.BF.PelB	A1.211	*P. canaliculata* and barnacles on moderately exposed littoral fringe rock* *found in sheltered areas on steep vertical faces.
F. spiralis Zone	1.5 – 2.2	*F. spiralis, Patella* spp., *E. modestus, Littorina* spp.	LR.LLR.F.Fspi.FS	A1.3121	*F. spiralis* on full salinity sheltered upper eulittoral rock
A. nodosum Zone	2.2 – 10	*A. nodosum, Cladophora* spp., *C. montagui, Polysiphonia* spp.	LR.LLR.F.Asc.FS	A1.3141	*A. nodosum* on full salinity mid eulittoral rock
Barnacle Zone	10 – 13	*S. balanoides, F. serratus, Littorina* spp., *M. edulis,* pink encrusting weed	LR.HLR.MusB.Sem.FvesR	A1.1132	*S. balanoides, F. vesiculosus* and red seaweeds on exposed to moderately exposed eulittoral rock
F. serratus Zone	13 – 17	*F. serratus, F. vesiculosus, Spirobranchus* sp., *L. obtusata, C. maenas*	LR.LLR.F.Fserr.X	A1.3152	*F. serratus* on full salinity lower eulittoral mixed substrata
Lower shore Zone	17 – 25	Green algal mats, *Littorina* spp., fucoids, *C. fornicata*	LR.FLR.Eph	A1.45	Ephemeral green or red seaweed communities (freshwater or sand-influenced)

1994 (Moore and others 1999)

3.25 Identified the area as steep upper shore bedrock and sheltered lower shore mixed substrata with fucoids and littoral soft mud.

Table 26: Littoral habitats identified by Moore and others (1999)

Biotope Recorded (Version 97_06)	Biotope Name	Converted Biotope (Version 01_15)	Present in 2012?
Pel	*P. canaliculata* on sheltered littoral fringe rock	Split into Pel and PelVS	Similar biotope PelB recorded
Fspi	*F. spiralis* on moderately exposed to very sheltered upper eulittoral rock	Split into FspiB, Fspi and FspiVS	Yes - New biotope Fspi.FS recorded, previous records would have been recorded as Fspi
Asc.Asc	*A. nodosum* on full salinity mid eulittoral rock	Changed to Asc.FS	Yes
AscX	*A. nodosum* on mid eulittoral mixed substrata	Is now Asc.X	No Asc on mixed substrata recorded in this location
FvesX	*F. vesiculosus* on mid eulittoral mixed substrata	Split into Fves.X and FvesVS	No – *F. vesiculosus* found within F.serX zone but does not form individual zone at this location
FserX	*F. serratus* on lower eulittoral mixed substrata	Fserr.X	Yes
HedStr	*Hediste diversicolor* and *Streblospio shrubsolii* in sandy mud or soft mud shores	Biotopes reassigned to MEst or Hed.Str	Sediment biotopes are not included in this survey

Species abundance and distribution

3.26 The upper shore is an area of vertical bedrock with very short and species poor biotopes of lichen, *P. canaliculata* and *F. spiralis*. These are followed by *A. nodosum* and barnacle zones on upwards facing bedrock that are intersected by a slipway. These are the most biodiverse zones on the shore with 28 and 21 species respectively. Below this the substratum changes to mixed cobbles, pebbles and gravel dominated by *F. serratus* then green algal mats. A total of 52 species were recorded.

Comparison to historic data

3.27 Historic data available for comparison includes Rostron 1985, Tompsett, 2011 and Moore and others, 1999. Rostron (1985) found a similar pattern of zonation and range of species with lichen splash zone, followed by areas of *P. canaliculata, F. spiralis* and *F. serratus* dominating in the midshore. Rostron (1985) identify the lower shore as extremely rich, supporting fragile life such as nesting *Gobius flavenscens*, crustaceans, polychaetes and ascidians. The species list from 2011 shows a move towards a more green algae dominated lower shore with a slightly reduced species total, which may be due to slight variation in tidal cycle during survey dates. Rostron (1985) recorded approximately 60 species. Moore and others (1999) recorded a very similar range of biotopes to the 2011 survey but again with the absence of a green algae dominated zone, suggesting that this is a more recent development possibly linked to increased nutrient output in the estuary.

Unit 5 St Anthony Head

Great Molunan SW 84604 31700

Site description

3.28 Gently sloping slate bedrock outcrop at the northern end of the sandy beach Great Molunan. Access to the beach is only possible via the coast path which limits the human influence at the site. The upper shore is dominated by a large, clearly zonated lichen area. The mid and lower shore areas are limited with barnacle and rockpool zone transitioning straight into a kelp zone with no fucoid dominated areas.

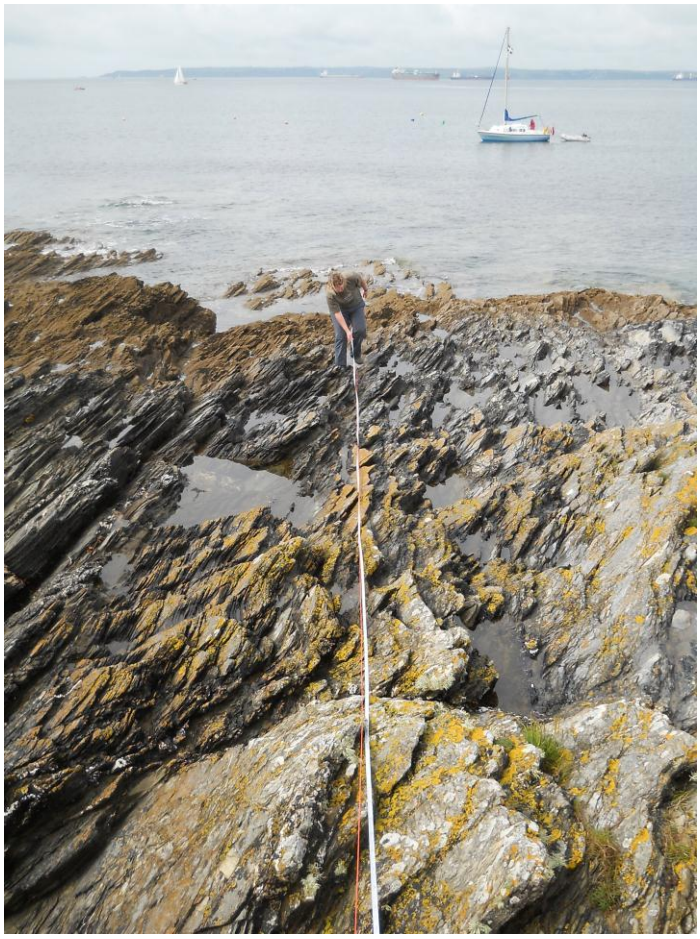


Plate 16: Location: southwest looking down the transect © Natural England

Plate 17: Location: northeast looking up the transect © Natural England

Figure 13: Shore profile at Great Molunan

Site and survey information

Table 27: Great Molunan site information

Physiographic type	Semi-enclosed coast
Salinity	Full (30-40‰)
Wave exposure	Sheltered / moderately exposed
Tidal streams	Weak (<1kn)
Geology	Slate
Littoral width	10-100 m
Littoral aspect	South-west
Conservation assessment	Not completed
Uses and Impacts	none

Table 28: Great Molunan survey information

Date	4th July 2012
Start Time	09:50
Duration	4hrs 10mins
Time of Low water	13:03
Tide Height	0.4 m
Recorders	Liz Bailey, Angie Gall, Fiona McNie

Table 29: Littoral habitats identified at Great Molunan

Littoral Habitat*	Dominant species	Biotope Code	EUNIS Code	Biotope Name
Yellow Lichen Zone	*V. maura, Lecanora altra, Xanthoria parietina, Ramalina siliquosa*	LR.FLR.Lic.YG	B3.111	Yellow and grey lichens on supralittoral rock
Black Lichen Zone	*V. maura, L. saxatilis*	LR.FLR.Lic.Ver.Ver	B3.1132	*V. maura* on exposed to very sheltered upper littoral fringe rock
Barnacle and Lichina pygmaea Zone	*L. pygmaea, Melarhaphe neritoides, C. montagui*	LR.HLR.MusB.Cht.Lpyg	A1.1122	*Chthamalus* spp. and *Lichina pygmaea* on steep exposed upper eulittoral rock
Barnacle Zone	*C. stellatus, S. balanoides, Patella* spp.	LR.HLR.MusB.Cht.Cht above LR.HLR.MusB.Sem.Sem	A1.1121 above A1.1131	*Chthamalus* spp. on exposed upper eulittoral rock *above S. balanoides*, *P. vulgata* and *Littorina* spp. on exposed to moderately exposed or vertical sheltered eulittoral rock
Rockpools; within Barnacle Zone (These represent a number of biotopes)	*Corallina* spp., *Ceramium* sp., encrusting pink algae	LR.FLR.Rkp.Cor	A1.411	Coralline crust-dominated shallow eulittoral rockpools
	H. elongata, Laminaria digitata, Leathesia marina	LR.FLR.Rkp.FK	A1.412	Fucoids and kelp in deep eulittoral rockpools
	S. muticum	LR.FLR.Rkp.FK.Sar	A1.4121	*S. muticum* in eulittoral rockpools
Kelp Zone	*L. digitata, H. elongata, F. serratus, Corallina* spp., red algal turf	IR.MIR.KR.Ldig.Ldig	A3.2111	*L. digitata* on moderately exposed sublittoral fringe bedrock

* Distance from start of transect not recorded at this site.

1994 (Moore and others 1999)

3.29 Identified the area as exposed/moderately exposed bedrock shore with fucoids and barnacles.

Table 30: Littoral habitats identified by Moore and others (1999)

Biotope Recorded (Version 97_06)	Biotope Name	Converted Biotope (Version 01_15)	Present in 2012?
Bpat	Barnacles and *Patella* spp. on exposed or moderately exposed, or vertical sheltered, eulittoral rock	Split on basis of different dominant genera (*Chthamalus* and *Semibalanus*) into MusB.Cht and MusB.Sem	Yes
XR	Mixed red seaweeds on moderately exposed lower eulittoral rock	Discontinued; records reassigned mostly to FR types (particularly Coff), MusB and Sem	No – red algal turf present below kelp but not as separate biotope
Him	*H. elongata* and red seaweeds on exposed lower eulittoral rock	No change	No - recorded within rockpools but not on rock
FvesB	*F. vesiculosus* and barnacle mosaics on moderately exposed mid eulittoral rock	No change	No - fucoids only recorded within kelp zone

Species abundance and distribution

3.30 The large splash zone has limited species diversity and is clearly zonated grading from yellow to black lichen followed by a mosaic of *L. pygmaea* and barnacles. Fucoids are absent from the barnacle dominated midshore but *Patella* spp. and *M. edulis* are present. The midshore is interspersed with a number of rockpools, some of which are shallow and dominated by *Corallina* spp. The deeper pools are dominated by *H. elongata* and *S. muticum* with a range of species present. The shore ends with a kelp zone that includes overhangs and gullies with a very wide range of species (approximately 40 in this zone). *L. digitata* is super abundant, with abundant *H. elongata, F. serratus, Corallina* spp. and red algal turf. Sponges, ascidians and bryozoans were common on overhangs.

Comparison to historic data

3.31 The species distribution identified at this site matches the habitat description in Rostron (1985) almost exactly although the full species list is not given by Rostron so a full comparison is not possible. Rostron (1985) identified a splash zone with extensive lichen cover followed by a midshore dominated by barnacles with negligible fucoid cover. She identified the lower shore as dominated by a wide range of algae including *Laminaria* spp. and *F. serratus*. Our findings and Rostron's (1985) do not match those of Moore and others (1999), however this can be due to the terrain which is particularly rugose – leading to the unusual range in biotopes recorded. In contrast, Moore and others (1999) covered a much wider area than just Great Molunan which may explain the difference in species observed.

Amsterdam Point SW 84740 32241

Site description

3.32 Initial steeply sloping zonation of bedrock lichen zone, *P. canaliculata* zone and barnacle zone, grading to gently sloping sediment shore intermixed with *A. nodosum*. Zone ends at rocky bedrock outcrops where a barnacle and *F. serratus* zone stretches for approximately 20 m. Bedrock then drops down to *H. elongata* zone.

Plate 18: Start of transect: southeast up the transect to the marker © Natural England. OS grid ref. SW 84740 32241

Plate 19: Location: north west down the transect from the transect marker © Natural England

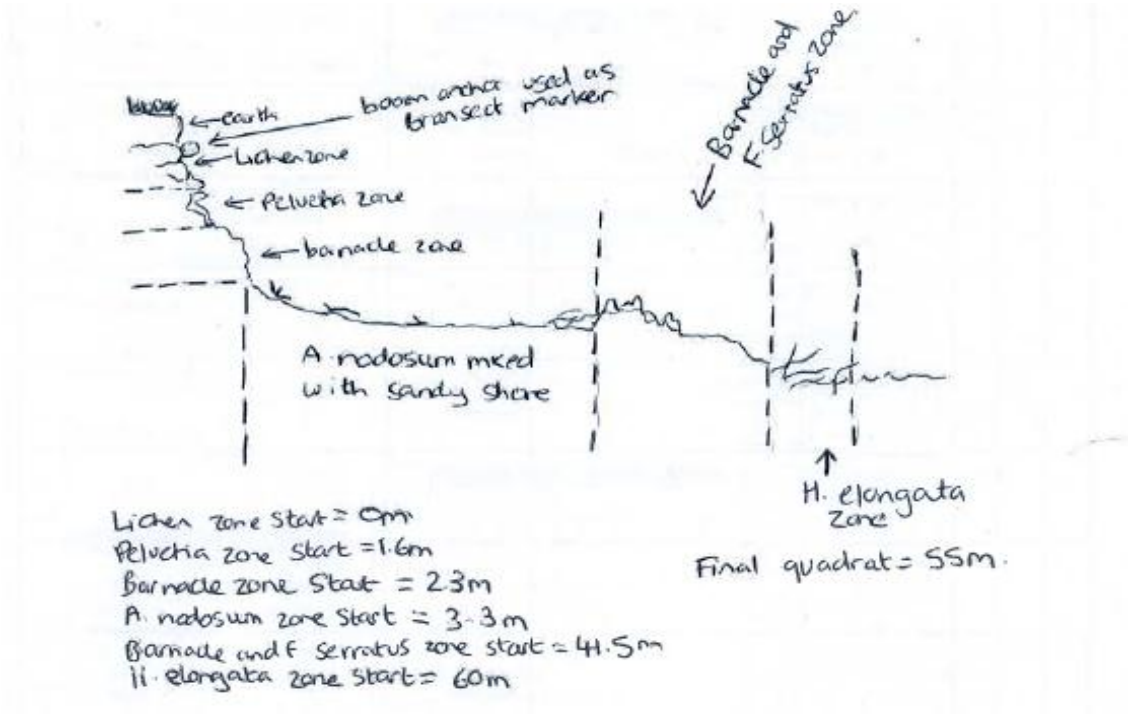


Figure 14: Shore profile at Amsterdam Point

Site and survey information

Table 31: Amsterdam Point site information

Physiographic type	Ria / voe
Salinity	Full (30-40‰)
Wave exposure	Sheltered
Tidal streams	Weak (<1kn)
Geology	Slate
Littoral width	10-100 m
Littoral aspect	North-east
Conservation assessment	Not completed
Uses and Impacts	None recorded

Table 32: Amsterdam Point survey information

Date	4th July 2012
Start Time	10:30
Duration	4hrs 30mins
Time of Low water	13:03
Tide Height	0.4 m
Recorders	Jeremy Clitheroe, Sabrina Heiser Rhiannon Pipkin, Lindsey Leyden

Table 33: Littoral habitats identified at Amsterdam Point

Littoral Habitat	Distance from start of transect (m)	Dominant species	Biotope Code	EUNIS Code	Biotope Name
Lichen zone	0 – 1.6	*V. maura*	LR.FLR.Lic.Ver.Ver	B3.1132	*V. maura* on exposed to very sheltered upper littoral fringe rock
P. canaliculata Zone	1.6 – 2.3	*P. canaliculata, V. maura, S. balanoides*	LR.MLR.BF.PelB	A1.211	*P. canaliculata* and barnacles on moderately exposed littoral fringe rock
Barnacle zone	2.3 – 3.3	Barnacle species not recorded therefore biotope identification not possible.			
A. nodosum zone	3.3 – 41.5	*A. nodosum, Spirobis sp., Littorina* spp., *S. balanoides, F. vesiculosus, P. vulgata,* Pink encrusting algae	LR.LLR.F.Asc.X	A1.3142	*A. nodosum* on full salinity mid eulittoral mixed substrata
Barnacle and *F. serratus* zone	41.5 - 60	*S. balanoides, F. serratus*	LR.MLR.BF.Fser	A1.214	*F. serratus* on moderately exposed lower eulittoral rock
Rockpools	Within *A. nodosum* and barnacle/*F. serratus* zones	Pink encrusting algae, *Corallina* spp.	LR.FLR.Rkp.Cor.Cor	A1.4111	Coralline crusts and *Corallina officinalis* in shallow eulittoral rockpools
H. elongata zone	60 onwards	*H. elongata, C. crispus, M. stellatus. L. articulata*	LR.HLR.FR.Him	A1.123	*H. elongata* and red seaweeds on exposed lower eulittoral rock

1994 (Moore and others 1999)

3.33 Identified the area as sheltered littoral rock with fucoids.

Table 34: Littoral habitats identified by Moore and others (1999)

Biotope Recorded (Version 97_06)	Biotope Name	Converted Biotope (Version 01_15)	Present in 2012?
BPat	Barnacles and *Patella* spp. on exposed or moderately exposed, or vertical sheltered, eulittoral rock	Split on basis of different dominant genera (*Chthamalus* and *Semibalanus*) into MusB.Cht and MusB.Sem	Yes
Pel	*P. canaliculata* on sheltered littoral fringe rock	Split into Pel and PelVS	Similar biotope PelB recorded
Fspi	*F. spiralis* on moderately exposed to very sheltered upper eulittoral rock	Split into FspiB, Fspi and FspiVS	No – *F. spiralis* only recorded occasionally within barnacle zone
Asc.VS	*A. nodosum* and *F. vesiculosus* on variable salinity mid eulittoral rock	No change	Similar biotope Asc.X recorded
Fser.VS	*F. serratus* and large *M. edulis* on variable salinity lower eulittoral rock	No change	No – *F. serratus* and barnacle zone recorded
FserX	*F. serratus* on lower eulittoral mixed substrata	Fserr.X	

Species abundance and distribution

3.34 The shore starts with an almost vertical rock face with very compressed and species-poor lichen, *P. canaliculata* and barnacle zones. After this the substratum becomes more mixed with sand, cobbles and pebbles and bedrock. This area is dominated by *A. nodosum* and has much higher species diversity. The littoral height increases slightly after this as bedrock with barnacles and fucoids takes over. In both areas rockpools are present with higher species diversity than the surrounding habitats. In some of the deeper pools small amounts of maerl are present. The final zone is more species diverse; dominated by *H. elongata* it has a range of other algae including *Laminaria* spp., *Ulva lactuca* and various red weeds. This zone also has a range of fauna including bryozoan, sponge, ascidian and an unidentified species of stalked jellyfish. All three UK species of stalked jellyfish are BAP species due to their status as threatened or declining, and the presence of them is therefore significant.

Comparison to historic data

3.35 The dominant species in each zone show very little change between surveys with areas of dominant lichen, barnacles and fucoids depending on position and substrate. *F. spiralis* shows the most significant change. In the 1991 and 1992 surveys it dominated the mid shore (quadrats 10 and 20 m) with cover ranging between 65 and 100%. In 2011 the only recording was occasional patches in the barnacle zone around 3 m, however this is similar to the pattern of distribution Covey & Hocking found in 1987 with a maximum of 5% coverage. Barnacle species composition fluctuated in the historic data with a trend of increasing *E. Modestus.* In Tompsett 2011 barnacles were not identified to species level in the quadrats so comparison is not possible. This pattern is also similar to the comparison with the biotope recording of Moore and others (1999) in 1994 with very similar biotopes to those found in 2011 with the exception of a *F. spiralis* zone that was present in 1994.

4. Conclusion

4.1 Rocky shore communities identified at each survey location are composed of a range of dominant species; lichen, barnacle and fucoid dominated zones were common and a total of 27 biotopes were recorded. The vast majority of biotopes recorded are those associated with natural rocky shore habitat zonation and show that the area has the expected range of communities.

4.2 Biotopes of note include two records of LR.FLR.Eph; Ephemeral green or red seaweed communities (freshwater or sand-influenced). These biotopes can be associated with nutrient input and suggest that the area may still be experiencing eutrophication. On a site by site basis this biotope is more variable, with increases in some areas and decreases in others, suggesting localised effects. There is evidence that winter Dissolved Inorganic Nitrogen levels are unfavourable across 48.5% of the SAC, based on Environment Agency data (Ben C. Green, *Pers. Comm.*, Natural England / Environment Agency, 2013)

4.3 Another notable biotope is LR.FLR.Rkp.FK.Sar; *S. muticum* in eulittoral rockpools. *S. muticum* is known to effect understorey communities in rockpools (Eno, Clark & Sanderson, 1997) and was not recorded in the Fal biotope mapping in 1999 (Moore and others 1999). However it has been recorded in the Helford since 1993 (Tompsett, 2011) and has shown no signs of significant increase.

4.4 The biotope LR.LLR.F.Fspi; *F. spiralis* dominated areas has shown a significant decrease in distribution and has been lost from three sites where it had been previously recorded. There is no clear cause indicated, however it may be part of natural cyclical growth or reduced growth over successive poor summers in the UK[6] since coupled with potential slight increase in wave exposure in poor weather. It is not possible to draw firm conclusions about the cause of the decrease in this study.

4.5 Species records include the increase in abundance of the non-native barnacle *E. modestus* which is a continuation of the increase recorded in previous studies. Whilst it is known that this species outcompetes the native barnacle *S. balanoides* (Eno, Clark & Sanderson, 1997) impacts on the rocky shore community as a whole seem limited (JNCC, no date). Thus the increase in this species is not regarded as a significant factor in the condition of the site.

4.6 The dog whelk *N. lapillus* was recorded as absent by CBRU (1992) who suggested the cause of this was organotin toxicity which is associated with previous working methods at Falmouth docks combined with tidal mixing of sediment. Slow recruitment of the species has hampered its recovery since the use of organotins was banned in 2003 (Maritime & Coastguard Agency [accessed 2013]). Our survey has found an increase in this species suggesting that organotin toxin levels in the area may have decreased which will improve the condition of the site.

4.7 Since the previous condition assessment in 2009, materials that had been placed on the foreshore, and which had been associated with the decline in condition of the site have been removed. The range of species identified in this area (Tremulon) are now as would be expected in a non-impacted area.

4.8 These findings have been used in conjunction with the findings of Curtis (2011) for the littoral sediment feature to complete the condition assessment for the site. As the expected range of biotopes were identified and impacts of non-native species and nutrient enrichment on community structure and diversity are not significant the area has been identified as being in favourable condition (Table 17).

[6] **http://metofficenews.wordpress.com/2012/07/12/the-uks-wet-summer-the-jet-stream-and-climate-change/**

Condition assessment

Table 35: Summary of updated unit conditions

Unit Number	Unit Name	Unit area (Ha)	Current Condition	Condition Summary
Unit 1	Upper Helford	128.39	Favourable	Materials that had been placed on the foreshore, and which had been associated with the decline in condition of the site, have been removed. Following the previous assessment there are no signs of damage. Meeting objectives.
Unit 2	Outer Helford	47.07	Favourable	
Unit 3	Carrick Roads	15.02	Favourable	Meeting objectives.
Unit 4	Percuil River	65.08	Favourable	Meeting objectives.
Unit 5	St. Anthony Head	7.95	Favourable	Meeting objectives.

The site has a mixed algal community exhibiting well defined zonation of species, little or no ephemeral green algae and no physical damage or litter.

5. Bibliography

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Appendix 1 Raw data from July 2012

Unit 1 Upper Helford

Table A: Tremulon phase II species list and abundances using SACFORN scale

Littoral habitat zone	Lichen	*Pelvetia* and *Ascophyllum*	Barnacle	*Fucus serratus*	Lower shore
Start of zone grid reference	SW 75320 26500	SW 75325 26503	SW 75321 26501	SW 75320 26509	SW 75317 26513
Species					
Audouinella			R		
Actinia equina			C		
Ascophyllum nodosum		C	R		
Asterina gibbosa					R
Austrominius modestus (formerly *Elminius modestus*)		O			
Balanus balanus			R		C
Botryllus schlosseri				R	
Caloplaca marina		R	R		
Carcinus maenas		C	R	O	O
Cerastoderma edule				O	R
Chondrus crispus			A	R	
Chthamalus montagui		C		C	O
Crassostrea gigas					R
Crepidula fornicata					O
Desmarestia aculeata				R	
Doris pseudoargus (formerly *Archidoris pseudoargus*)					R
Encrusting pink algae			A		O
Ulva spp.				O	A
Fucus serratus			R	A	O
Fucus vesiculosus			R	C	R
Gibbula sp.			O	O	
Halichondria panicea			O		
Hildenbrandia rubra		C			
Hymeniacidon perlevis (formerly *Hymeniacidon perleve)*			O		R
Littorina littorea		C			
Littorina mariae/ obtusata		O			
Littorina sp.			O	C	O
Marthasterias glacialis					R
Mastocarpus stellatus				O	
Mytilus edulis			A	A	O
Padina pavonica					R
Patella depressa			O		
Patella sp.				O	R

Patella vulgata		C	C		
Pelvetia canaliculata		A			
Polyplacophora sp.				R	
Polysiphonia sp.		O	O	O	
Rhizocarpon geographicum		R			
Semibalanus balanoides		C	SA		
Tephromela atra var.atra (formerly *Tephromela atra)*	O				
Tephromela atra var.atra var.atra (formerly *Lecanora atra)*	R				
Ulva lactuca				R	C
Verucaria sp.	SA				
Xanthoria parietina	R				

Table B: Quadrat species counts for Tremulon

Littoral habitat zone		Lichen	*Pelvetia* and *Ascophyllum*	Barnacle	*Fucus serratus*	Lower shore
Quadrat grid reference		SW 753 26500	SW 75325 26503	SW 75321 26501	SW 75320 26509	SW 5317 26513
Species	Abundance					
Audouinella	%			2		
Ascophyllum nodosum	%		80			
Balanus balanus	%			5		
Caloplaca marina	Count		1	2		
Cerastoderma edule	Count				2	
Cladophora rupestris	%		5	1		
Chondus crispus	%				5	
Chthamalus montagui	%		30		20	15
Crepidula fornicata	Count			2		
Eliminius modestus	%		10			
Encrusting pink algae	%		5			
Ulva spp.	%			80		
Fucus serratus	%			1	10	
Fucus vesiculosus	%			0.5	60	
Gibbula umbilicalis	Count			5	10	7
Hildenbrandia sp.	%		25			
Littorina littorea	Count		7	1	12	
Littorina mariae/ obtusata	Count		11		9	
Littorina sp.	Count			1		
Mytilus edulis	%				30	
Mytilus edulis	Count					60
Patella depressa	Count		1		1	2
Patella vulgata	Count		9		3	25
Phorcus lineatus (formerly *Osilinus lineatus)*	Count				2	
Polyplacophora sp.	Count				1	
Polysiphonia sp.	%		0.5			1
Rhizocarpon geographicum	%	0.5				
Semibalanus balanoides	%					60
Spirobranchus sp.*(formerly Pomatoceros* sp.)	%			1		
Tephromela atra var.atra	%	5				
Tephromela atra var.atra var.atra (formerly *Lecanora atra)*	%	5				
Ulva lactuca	%			5		
Verucaria sp.	%	80				
Xanthoria parietina	%	0.5				

Table C: Helford Jetty phase II species list and abundances using SACFORN scale

Littoral habitat zone	Lichen	*Pelvetia*	*F. spiralis*	*F. spiralis* rockpools	*Ascophyllum*	Barnacle	Mussel	*F. serratus*
Start of zone grid reference	SW 77133 27164	SW 75972 26417	SW 75974 26420	SW 75974 26420	SW 75981 26429	SW 75993 26441	SW 76004 26446	SW 76092 26453
Species								
Acanthochitona criniata					R			
Aequipecten opercularis								R
Alyconidium sp.								C
Amphipoda sp.			C		O	F		
Annelida sp.			R					
Armeria maritima	C							
Ascophyllum nodosum			R		SA	R		
Audouinella sp.			F			O		
Aulactinia verrucosa					R			
Botryllus schlosseri							R	O
Carcinus maenas		C	O		O	R	R	O
Cerastoderma edule				R				R
Chaetomorpha linum				C				
Corella eumyota							R	
Crassostrea gigas							R	O
Crepidula fornicata							R	F
Electra pilosa								C
Eliminius modestus		F			F	SA	A	O
Encrusting pink algae				R	F			R
Fucus serratus						R	O	SA
Fucus spiralis		F	A		R	R	R	
Fucus vesiculosus					O			O
Gibbula umbilicalis				R	O	R	R	O
Halichondria panicea					R	R	R	
Hildenbrandia rubra		C	F		F	R	R	R
Littorina littorea			A		C			C
Littorina mariae/ obtusata			F		C		R	O
Littorina saxatilis		O	O			C	F	
Marthasterias glacialis						R		
Mastocarpus stellatus				C	R		R	O
Mytilus edulis				R	C	A	A	O

Ophiothrix sp.					R	R	R	
Osmundea sp.						R		
Pagrus sp.								O
Patella sp.			O		C	C	F	
Peltigera canina	R							
Pelvetia canaliculata		A						
Phorcus lineatus (formerly *Osilinus lineatus)*		O	F		O	O	R	
Plantago maritima	C							
Polysiphonia sp.					F	R		O
Rhizocarpon geographicum	R							
Rissoa sp.					O	O		
Semibalanus balanoides		F	R		F			
Spirobis sp.		R		R	R			F
Spirobranchus sp. *(formerly Pomatoceros sp.)*							O	F
Ulva sp.								R
Verucaria sp.	A		F					
Xanthoria parietina	F							

Table D: Quadrat species counts for Helford Jetty

Littoral habitat zone		Lichen	*Pelvetia*	*F. spiralis*	*Ascophyllum*	Barnacle	Mussel	*F. serratus*
Quadrat grid reference		SW 75968 26415	SW 75972 26417	SW 75974 26420	SW 75981 26429	SW 75993 26441	SW 76004 26446	SW 76009 26453
Species	Abundance							
Acanthochitona criniata	Count				1			
Aequipecten opercularis	Count							1
Amphipoda sp.	Count		10	10	5	30		
Annelida sp.	Count			5				
Armeria maritima	%	20						
Ascophyllum nodosum	%				85			
Audouinella sp.	%			20				
Aulactinia verrucosa	Count				1			
Carcinus maenas	Count		1	1	3	1		1
Clava multicornis	%				1			
Crassostrea gigas	Count							1
Crepidula fornicata	Count							1
Eliminius modestus	%		3	2	13	60	30	10
Encrusting pink algae	%				15			2
Fucus serratus	%						3	95
Fucus spiralis	%		40	65	15		2	
Fucus vesiculosus	%							2
Gibbula umbilicalis	Count				16		3	4
Halichondria panicea	%				1			
Hildenbrandia sp.	%		25	15	10	2	5	5
Littorina littorea	Count			19	20			18
Littorina mariae/ obtusata	Count			12	13		1	4
Littorina saxatilis	Count		2	1		60	20	
Mastocarpus stellatus	%				2			
Mytilus edulis	Count				10	7		2

Mytilus edulis	%						60	
Ocrolechia parella	%	20						
Ophiothrix sp.	Count				2			
Pagrus sp.	Count							1
Patella sp.	Count		1		5	12		
Peltigera canina	%	1						
Pelvetia canaliculata	%		60					
Phorcus lineatus(formerly *Osilinus lineatus)*	Count		3	3		2	2	
Polysiphonia sp.	%							5
Rhizocarpon geographicum	%	5						
Rissoa sp.	Count					6		
Semibalanus balanoides	%		2	3	13			
Spirobis sp.	%				1			2
Spirobranchus sp.(formerly *Pomatoceros* sp.)	%						2	5
Verucaria sp.	%	25						
Xanthoria parietina	%	5						

Unit 2 Lower Helford

Table E: Men-a-ver phase II species list and abundances using SACFORN scale

Littoral habitat zone	Lichen	Barnacle	*Fucus vesticulosus*	*Fucus serratus*	*Ulva* and red weed (rockpool)
Start of zone grid reference	GPS unavailable	GPS unavailable	GPS unavailable	GPS unavailable	GPS unavailable
Species					
Actinia equina			R	R	
Amphipholis squamata				R	
Anemone viridis		R			F
Aplidium sp.(formerly *Sidnyum* sp.)					R
Ascophyllum nodosum			O	R	
Asterina gibbosa				R	
Balanus balanus					
Calliostoma zizyphinum				R	R
Carcinus maenas				R	
Cellepora pumicosa				P	
Chaetomorpha linum		R	O		
Chondracanthus acicularis					F
Chondus crispus				O	
Chthamalus montagui		A	O		
Cladophora sp.			R	O	
Cladostephus spongiosus					R
Clavelina lepadiformis					R
Colopomenia peregrina					O
Corallina officianalis		F			
Corallina sp.					F
Cystoseira tamariscifolia					O
Dictyota dichotoma					F
Dynamena pumila				R	
Electra pilosa				P	
Eliminius modestus		F	P	O	O
Encrusting pink algae		C		A	
Flustrellidra hispida				P	
Fucus serratus				A	
Fucus spiralis		O			
Fucus vesiculosus		O	C	O	
Gibbula cineraria				O	F
Gibbula umbilicalis			C	C	F
Halichondria panicea					P
Hildenbrandia sp.				P	
Himanthalia elongata				P	C
Hymeniacidon perlevis (formerly *Hymeniacidon perleve)*		R	F		P
Littorina littorea		C		C	O
Littorina mariae/ obtusata				C	
Littorina saxatilis		C	R		
Lomentaria articulata				O	
Mastocarpus stellatus		O		C	F
Mesophylumm lichenoides					O

Morchellium argus				R	R
Nassarius incrassatus(formerly *Hinia incrassate)*					R
Nucella lapillus		F	F	F	
Ocenebra erinacea					O
Osmundea pinnatifida		C	C	C	
Pagrus bernhardus					R
Patella depressa			F		
Patella sp.		C			
Patella ulyssiponensis					O
Patella vulgata		C	C	C	P
Perforatus perforates (formerly *Balanus perforatus)*			F	R	
Phorcus lineatus (formerly *Osilinus lineatus)*		C	F		
Porcellana platychelys				F	
Ramalina siliquosa	F				
Sargassum muticum		R			F
Semibalanus balanoides		F	R		
Spirobis sp.			C	A	
Spirobranchus triqueter			R		
Tephromela atra var.atra var.atra (formerly *Lecanora atra)*	F				
Ulva intestinalis		R	O		
Ulva lactuca					A
Vertebrata lanosa (formerly *Polysiphonia lanosa)*			R		
Verucaria sp.	S				
Xanthoria parietina	O				

Table F: Quadrat species counts for Men-a-ver

Quadrat distance from start of transect		0 m	10 m	20 m	30 m	40 m	50 m
Quadrat grid reference		GPS unavailable	GPS unavailable	GPS unavailable	GPS unavailable	GPS unavailable	GPS unavailable
Species	Abundance						
Amphipod	Count				1		
Asterina gibbosa	Count				1		
Botryllus schlosseri	%				0.5		
Calliostoma zizyphinum	Count					1	
Carcinus maenas	Count					1	
Cellepora pumicosa	%					0.5	
Ceramium sp.	%						10
Chondus crispus	%					5	
Chthamalus montagui	%	1	40				
Chthamalus sp.	%			0.5			
Chondracanthus acicularis	%						5
Corallina sp.	%						1
Dynamena pumila	%				0.5		
Electra pilosa	%					0.5	
Eliminius modestus	%		5	1		0.5	
Encrusting pink algae	%			20	80	20	
Flustrellidra hispida	%				0.5		
Fucus serratus	%				70	100	
Fucus vesiculosus	%		5	10	30		
Gibbula cineraria	Count				5	5	6
Gibbula umbilicalis	Count		5		22		1
Halichondria panicea	%			0.5	2		
Hildenbrandia sp.	%					2	
Himanthalia elongata	%					0.5	0.5
Hymeniacidon perlevis (formerly *Hymeniacidon perleve)*	%		1	3			5
Littorina littorea	Count		1		7	1	
Littorina mariae/ obtusata	Count			4	10	15	
Littorina saxatilis	Count	5	16				
Lomentaria articulata	%				1		
Mastocarpus stellatus	%						1
Nucella lapillus	Count		2	2	1		
Osmundea sp.	%		5	5	0.5		2
Patella depressa	Count			7			2
Patella sp.	Count	7	18	21		2	

Patella vulgata	Count		20	11	1	3	
Perforatus perforatus (formerly *Balanus perforatus)*	Count			14	1		
Phorcus lineatus (formerly *Osilinus lineatus)*	Count		15	6			
Spirobranchus triqueter	%				0.5	0.5	1
Semibalanus balanoides	%		1				0.5
Spirobis sp.	%			20	30	5	
Ulva intestinalis	%						5
Ulva lactuca	%						3

Table G: Grebe Rock phase II species list and abundances using SACFORN scale

Littoral habitat zone	Barnacle	Barnacle and *Fucus vesiculosus*	*Fucus serratus*	*H. elongata*
Start of zone grid reference	SW 77134 27151	SW 77149 27135	SW 77155 27135	SW 77158 27123
Species				
Actinia equina	R			
Ahnfeltia plicata		R		
Aglaothamnion sp.			R	
Alyconidium gelatiosum			R	
Anurida maritima	R			
Asterina gibbosa				R
Audouinella sp.				F
Balanus crenatus				
Callithamnion sp.	R			
Ceramium sp.		R		
Chthamalus montagui	SA			
Corallina officianalis			R	R
Electra pilosa				R
Eliminius modestus	O			
Encrusting pink algae	R	O	C	
Fucus serratus		R	A	R
Fucus vesiculosus		A	O	
Fucus sp.	R			
Gibbula cineraria		O	F	
Gibbula umbilicalis	R			
Halichondria panicea		R		
Hildenbrandia rubra			R	
Himanthalia elongata				C
Hymeniacidon perlevis (formerly *Hymeniacidon perleve)*		R		
Laminaria digitata				R
Leathesia marina (formerly *Leathesia difformis)*		R		
Lipophrys pholis			R	
Littorina littorea	O	O	F	
Littorina mariae/ obtusata		O	O	
Littorina saxatilis	O	O		
Lomentaria articulata			R	O
Mastocarpus stellatus		R	O	
Membranipora membranacea				O
Mytilus edulis	R			
Nucella lapillus	R	O	O	
Ocenebra erinacea			R	
Osmundea pinnatifida		F	O	F

Patella depressa	O	F	O	
Patella vulgata	C	F	F	
Perforatus perforatus (formerly *Balanus perforatus)*		R	O	
Phorcus lineatus (formerly *Osilinus lineatus)*	F	F	O	
Spirobranchus triqueter	R			
Semibalanus balanoides	O	A		F
Spirobis sp.		R	O	
Ulva sp.				O
Verucaria maura	R	O		

Table H: Quadrat species counts for Grebe Rock

Littoral habitat zone		Barnacle	Barnacle and *Fucus vesiculosus*	*Fucus serratus*
Quadrat grid reference		SW 77134 27151	SW 77149 27135	SW 77155 27135
Species	Abundance			
Ahnfeltia plicata	%		1	
Aglaothamnion sp.	%			1
Anurida maritima	Count	1		
Ceramium sp.	%		1	
Chthamalus montagui	%	90		
Eliminius modestus	%	3		
Encrusting pink algae	%			50
Fucus serratus	%		5	80
Fucus vesiculosus	%		15	20
Fucus sp.	%	1		
Gelidium spinosum (formerly *Gelidium latifolium)*	%		1	
Gibbula cineraria	Count		4	5
Gibbula umbilicalis	Count	1	9	
Hymeniacidon perlevis (formerly *Hymeniacidon perleve)*	%		1	
Leathesia marina (formerly *Leathesia difformis)*	NA	P		
Littorina littorea	Count		16	29
Littorina mariae/ obtusata	Count		4	16
Mastocarpus stellatus	%			2
Nucella lapillus	Count		2	
Osmundea pinnatifida	%		5	P
Patella depressa	Count	8	8	4
Patella vulgata	Count	7	8	2
Perforatus perforatus (formerly *Balanus perforatus)*	Count		1	1
Phorcus lineatus (formerly *Osilinus lineatus)*	Count	7	1	
Spirobranchus triqueter	%			1
Semibalanus balanoides	%		20	
Spirobis sp.	%		1	
Verucaria maura	%	1		

Unit 3 Carrick Roads

Table I: Trefusis Point phase II species list and abundances using SACFORN scale

Littoral habitat zone	Lichen	*Pelvetia*	Barnacle	Rockpools in barnacle	*Fucus serratus*
Start of zone grid reference	SW 81815 33500	SW 81853 33500	SW 81824 33490	SW 81824 33490	SW 81836 33482
Species					
Actinia equina				R	
Ahnfeltia plicata					R
Armeria maritima	R				
Asterina gibbosa				R	
Balanus crenatus					F
Caloplaca marina	O				
Cancer pagarus					R
Ceramium				C	
Chthamalus montagui		P	A		
Chthamalus stellatus			R		
Corallina officianalis				A	
Corella eumyota				R	
Cystoseira tamariscifolia				R	
Dynamena pumila					O
Ectocarpus sp					O
Eliminius modestus			A		F
Ellisolandia elongate (formerly *Corallina elongate)*				C	
Encrusting pink algae		R	F		
Ulva spp.			R		O
Fucus serratus					A
Fucus vesiculosus					R
Gibbula umbilicalis			F		
Halopteris filicina				O	
Halichondria panicea			O		O
Hildenbrandia sp.				O	O
Himanthalia elongata				R	
Hymeniacidon perlevis (formerly *Hymeniacidon perleve)*			O		R
Leathesia marina (formerly *Leathesia difformis)*				F	
Lichina pygmaea		R			
Littorina littorea		O	O		C
Littorina mariae/ obtusata					O
Littorina saxatilis		C	O		
Lomentaria articulata					O

Mastocarpus stellatus					A
Morchellium argus				R	
Melarhaphe neritoides	O	P			
Mytilus edulis			R		
Nucella lapillus			O		O
Osmundea pinnatifida			O	R	C
Patella sp.		O	C		
Patella ulyssiponensis				R	
Patella vulgata					C
Pelvetia canaliculata		C			
Phorcus lineatus (formerly *Osilinus lineatus)*			C	F	
Plantago maritima	O				
Spirobranchus triqueter				R	O
Ramalina sp.	O				
Semibalanus balanoides			A	O	O
Spirobis sp					O
Tephromela atra var.atra var.atra (formerly *Lecanora atra)*	F				
Ulva lactuca		O			O
Verucaria sp	C				
Xanthoria parietina	F				

Quadrat species counts
See Appendix 2.

Unit 4 Percuil River

Table J: Cellars Beach East phase II species list and abundances using SACFORN scale

Littoral habitat zone	Lichen	*Pelvetia*	*F. spiralis*	*Ascophyllum*	Barnacle	*Fucus serratus*	Lower shore
Start of zone grid reference	SW 85487 32404	SW 85487 32404	SW 85487 32404	SW 85487 32404	SW 85482 32403	SW 85477 32403	SW 85473 32409
Species							
Actinia equina				O			
Amphipoda sp.				R	R	O	R
Annelida sp.				R			
Armeria maritima	O						
Ascophyllum nodosum				A	R	O	
Asterina gibbosa					R		
Bostrychia scorpioiodes		A	P				
Bryozoa sp.					R		
Caloplaca marina	C						
Carcinus maenas		R		R		O	C
Cerastoderma edule							R
Chthamalus montagui		C		C			
Cladophora sp.				F			
Corella eumyota						O	R
Crepidula fornicata							F
Eliminius modestus			P	C	C		
Encrusting pink algae			P	C	C	O	
Fucus serratus				O	R	A	A
Fucus spiralis			P				C
Fucus vesiculosus						C	O
Gibbula cineraria			P				
Gibbula umbilicalis			P	O	O	O	R
Green algal mats							A
Halichondria panicea				F	O		R
Hildenbrandia sp.		C	P	R	R	R	
Littorina littorea		O					F
Littorina mariae/ obtusata			P	O	O	F	F
Littorina saxatilis		O	P	O			C

Littorina sp.					F		
Mastocarpus stellatus							O
Melarhaphe neritoides (formerly *Littorina neritoides)*	R						
Mytilus edulis				R	O		
Ophlitaspongia papilla				R			
Ophiura sp.				R	R		
Pagrus sp.							F
Patella sp.			P	R			
Pelvetia canaliculata		A					
Perforatus perforatus (formerly *Balanus perforatus)*				R	R		
Phorcus lineatus (formerly *Osilinus lineatus)*			P		O		
Platyhelminthes sp.					R		
Polysiphonia sp.				A	R	O	
Ramalina sp.	R						
Rhizocarpon geographicum	R						
Rhodothamniella floridula				O			
Rissoa sp.				R			
Sabella pavonina							C
Semibalanus balanoides					F		
Spirobis sp.				F	R	O	C
Spirobranchus sp. (formerly *Pomatoceros sp.)*					R	F	F
Ulva sp.				R		R	
Venerupis corrugata				R			
Verucaria sp.	SA						

Table K: Quadrat species counts for Cellars Beach East

Littoral habitat zone		*F. spiralis*	*Ascophyllum*	Lower shore	*Fucus serratus*	Lower shore barnacle
Quadrat grid reference		SW 85487 32404	SW 85481 32412	SW 85473 32409	SW 85475 32403	SW 85479 32405
Species	Abundance					
Actinia equina	Count		1			
Amphipoda sp.	Count		1			
Ascophyllum nodosum	%		60			2
Bifurcaria bifurcata	%					0.5
Carcinus maenas	Count				1	
Chthamalus montagui	%	10				
Cladophora sp.	%		5			
Crepidula fornicata	Count			2		
Eliminius modestus	%	20	20			20
Encrusting pink algae	%		50			20
Fucus serratus	%		25	20	25	
Fucus spiralis	%	65				
Fucus vesiculosus	%				25	
Gibbula umbilicalis	Count		6		1	2
Green algal mats	%				25	
Halichondria panicea	%		1			2
Hildenbrandia sp.	%	30			2	
Littorina littorea	Count			5		
Littorina mariae/ obtusata	Count	2	13		20	
Littorina saxatilis	Count		8			1
Littorina sp.	Count			1		
Mytilus edulis	%		1			4
Ophlitaspongia papilla	%		1			
Oshurkovia littoralis	%		2			
Pagrus sp.	Count			3		
Patella sp.	Count	1	5			25
Pelvetia canaliculata	%	2				
Perforatus perforatus (formerly *Balanus perforatus)*	%					0.5
Phorcus lineatus (formerly *Osilinus lineatus)*	Count	2	2			1
Polysiphonia sp.	%	30	5			1
Sabella pavonina	Count				2	
Semibalanus balanoides	%	15				10
Spirobis sp.	%		10	0.5	1	
Spirobranchus sp.	Count			1		

(formerly *Pomatoceros sp.)*						
Ulva sp.	%		0.5	5		

Unit 5 St Anthonys Head

Table L: Great Molunan phase II species list and abundances using SACFORN scale

Littoral habitat zone	Yellow lichen	Black lichen	Lichen and barnacle	Barnacle	Rockpools within barnacle	Kelp
Start of zone grid reference	SW 84604 31700	SW 84601 31694	SW 84598 31689	SW 84585 31663	SW 84593 31675	SW 84576 31642
Species						
Actinia equina			F			
Asparogopsis armarta					P	
Asterina phylactica					R	
Botryllus schlosseri						R
Calliblepharis jubata						O
Calliostoma zizyphinum						O
Caloplaca marina		P				
Calophyllis laciniata						P
Ceramium sp.					A	
Cladophora sp.						P
Clavelina lepadiformis						P
Chthamalus montagui			A	A		P
Chthamalus stellatus			A			P
Codium sp.					F	
Colpomenia peregrina					P	
Corallina officianalis					A	
Corallina sp.						A
Corynactis viridis					R	
Crithmum maritimum	F					
Cryptopleura ramosa						O
Dilsea carnosa						P
Dynamena pumila						O
Electra pilosa						R
Eliminius modestus			R			P
Ellisolandia elongate (formerly *Corallina elongate)*					A	
Elysia viridis					P	
Encrusting pink algae			P	R	A	
Flustrelidra hispida						O
Fucus serratus						A
Fucus spiralis			O			
Gastroclonium ovatum					O	
Gibbula cineraria						R
Gibbula umbilicalis			R	F	C	
Halopteris filicina					R	
Halichondria panicea				P		R
Himanthalia elongata					A	A
Hymeniacidon perlevis (formerly *Hymeniacidon perleve)*				R		O

Idotea granulosa						P
Laminaria digitata					F	S
Leathesia marina (formerly *Leathesia difformis)*					F	
Lichina pygmaea			A	P		
Littorina archena		P				
Littorina littorea		R	R			
Littorina mariae/ obtusata					P	
Littorina saxatilis		F				
Littorina sp.		C				
Lomentaria articulata						O
Mastocarpus stellatus					O	C
Melarhaphe neritoides			C	P		
Mesophyllum lichenoides					A	C
Mytilus edulis			R	P		
Nassarius incrassatus (formerly *Hinia incrassate)*					P	
Nucella lapillus				O	C	
Osmundea osmundea						R
Osmundea sp.				P		
Palmaria palmata					O	R
Patella depressa			C	C		
Patella pellucida (formerly *Helcion pellucidum)*						F
Patella sp.			C		C	F
Patella vulgata		R		F		C
Pelvetia canaliculata			R			
Perforatus perforatus (formerly *Balanus perforatus)*				P		F
Phorcus lineatus (formerly *Osilinus lineatus)*			F			
Plantago maritima	F					
Polyides rotundus						R
Spirobranchus triqueter					R	P
Ramalina siliquosa	O					
Red algal turf						A
Scrupocellaria sp.						P
Sargassum muticum					C	
Semibalanus balanoides				A		P
Sycon ciliatum (formerly *Sycon ciliate)*						P
Tephromela atra var.atra var.atra (formerly *Lecanora atra)*	C	P				
Trivia monacha				P		

Ulva clathrata						P
Ulva intestinalis			R		R	P
Ulva lactuca				R	O	
Verucaria sp.	P	A				
Xanthoria parietina	C					
Brown lichen	P					
Grey/white lichen	P	P				
Yellow lichen		O				
Encrusting orange bryozoan						O

Table M: Quadrat species counts for Great Molunan

Littoral habitat zone		Yellow lichen	Black lichen	Lichen and barnacle	Rockpools within barnacle	Barnacle		Kelp	
Quadrat distance from start of transect		0 m	10 m	20 m	30 m	40 m	50 m	60 m	70 m
Quadrat grid reference		SW 84604 31700	SW 84601 31694	SW 84598 31687	SW 84590 31673	SW 84585 31663	SW 84579 31657	SW 84572 31644	SW 84576 31642
Species	Abundance								
Calliblepharis jubata	%								5
Caloplaca marina	%		20						
Ceramium sp.	%				2			10	
Chondus crispus	%								5
Chthamalus montagui	%			65		5	20		
Chthamalus sp.	%							8	
Chthamalus stellatus	%			0.5	5	45		2	12
Corallina sp.	%				10			20	30
Crithmum maritimum	%	2							
Cryptopleura ramosa	%								7
Dilsea carnosa	%								1
Electra pilosa	%								0.5
Eliminius modestus	%			0.5	0.5		0.5		3
Encrusting pink algae	%				40		0.5	5	0.5
Fucus serratus	%							5	10
Gastroclonium ovatum	%								0.5
Gibbula umbilicalis	Count				12	1	7		
Himanthalia elongata	%							1	3
Hymeniacidon perlevis (formerly *Hymeniacidon perleve)*	%				0.5		0.5	1	
Idotea granulosa	Count								1
Laminaria digitata	%								25
Leathesia marina (formerly *Leathesia difformis)*	%				0.5			1	0.5
Lichina pygmaea	%			30					
Littorina archena	%		30						
Littorina saxatilis	Count		4						
Littorina sp.	Count			22					

Lomentaria articulata	%							0.5	
Melarhaphe neritoides	%			0.5		1	0.5	0.5	
Mesophyllum lichenoides	%								0.5
Mytilus edulis	%						0.5		
Nucella lapillus	Count								2
Osmundea sp.	%						2	5	
Patella depressa	Count			1	27	65	44	15	27
Patella sp.	Count			18	26	5		2	3
Patella vulgata	Count					5	5	2	9
Perforatus perforatus (formerly *Balanus perforatus)*	%							0.5	
Plantago maritima	%	7							
Ramalina siliquosa	%	8							
Semibalanus balanoides	%				1	50	70	40	10
Ulva clathrata	%							2	
Ulva lactuca	%				0.5			5	1
Ulva sp.	%				1				
Verucaria maura	%	5	40						
Xanthoria parietina	%	20							
Grey/white lichen	%	20	5						
Brown lichen	%	10							

Table N: Amsterdam Point phase II species list and abundances using SACFORN scale

Littoral habitat zone	Lichen	*P. canaliculata*	Barnacle	*A.nodosum*	Rockpools	Barnacle/ *F. serratus*	Rockpools	*H. elongata*
Start of zone grid reference	SW 84740 32241	SW 84746 32202	SW 84746 32202	SW 84759 32231	SW 84759 32231	SW 84733 32239	SW 84733 32239	SW 84724 32252
Species								
Anemonia viridis					R			R
Arenicola sp. casts				C				
Ascophyllum nodosum			R	A				
Asparagopsis armata							O	O
Asterina gibbosa					R			C
Botryllus schlosseri								R
Bryozoa sp.							O	P
Carcinus maenas					C			R
Ceramium sp.							O	
Clavelina lepadiformis					R			
Chondus crispus								O
Cladophora sp.		R	R					
Corallina officianalis							C	
Corallina sp.						O		
Crangon crangon					O			
Crassostrea gigas						R		
Echinus esculentas								O
Ectocarpus sp.				P				
Eliminius modestus				O				
Ellisolandia elongate (formerly *Corallina elongate)*							C	
Encrusting pink algae				C			C	
Ulva spp.								
Fucus serratus				O			O	P
Fucus spiralis			O					
Fucus vesiculosus				C				

Gibbula umbilicalis				O		C		O
Gobius paganellius							O	
Hildenbrandia rubra		O	O	O	O			
Himanthalia elongata							O	SA
Hydroid sp.			SA					
Hymeniacidon perlevis (formerly *Hymenciacidon perleve)*						O		
Laminaria ochrolecua								O
Laminiaria digitata								O
Leathesia marina (formerly *Leathesia difformis)*							O	
Littorina littorea				A				
Littorina mariae/ obtusata				A				P
Littorina saxatilis								
Littorina sp.		C						
Lomentaria articulata								C
Mastocarpus stellatus				O				
Mytilus edulis				C				
Nucella lapillus				O				
Ochrolechia parella	O							
Ophiothrix sp.					R			
Osmundea pinnatifida						R		
Patella depressa						O		
Patella sp.			C					
Patella vulgata				C		C		
Pelvetia canaliculata		A						
Perforatus perforatus (formerly *Balanus perforatus)*				O		C		
Phorcus lineatus (formerly *Osilinus lineatus)*		O	C					
Plantago maritima	O							

Ramalina siliquose	R							
Sargassum muticum							R	
Semibalanus balanoides		C		C		SA		
Spirobis sp.				A		O		
Spirobranchus sp. (formerly *Pomatoceros* sp.)						R		
Ulva lactuca							R	O
Verucaria maura	SA	A	C					
Xanthoria parietina	R							
Chiton					R			
Maerl							R	
Stalked jellyfish								R
Unidentified sponge								R

Quadrat species counts

See Appendix 2.

Appendix 2 Comparison to historic data

Unit 3 Carrick Roads

Table O: Quadrat data for Trefusis Point

Quadrat	Species	July 2012	CBRU Autumn 1992	CBRU Spring 1992	Covey & Hocking Autumn 1987
0m	*Caloplaca marina*	0.5%	Not surveyed		
	Littorina saxatilis	1			
	Ramalina sp.	2%			
	Tephromela atra var.atra var.atra (formerly *Lecanora atra)*	0.5%			
	Verucaria sp.	20%			
	Xanthoria parietina	2%			
10m	*Actinia equina*	-	-	-	1
	Carcinus maenas	-	3	-	-
	Chthamalus montagui	40%	-	20	100
	Corallina officianalis	-	-	-	2%
	Encrusting pink algae	0.5%	-	-	-
	Ulva spp.	-	20%	30%	-
	Fucus serratus	-	-	-	5%
	Fucus vesiculosus	-	1%	-	-
	Littorina littorea	3	-	-	6
	Littorina saxatilis	68	2	-	-
	Patella sp.		-	-	2
	Patella vulgata	5			
	Pelvetia canaliculata	5%	-	20	-
	Phorcus lineatus (formerly *Osilinus lineatus)*	4	-	-	-
	Verucaria sp.	20%	-	-	-
20m	*Actinia equina*	-	1	3	-
	Chthamalus montagui	4%	450	500	800
	Chthamalus stellatus	0.5%	-	-	-
	Eliminius modestus	0.5%	275	-	-
	Encrusting pink algae	15%	-	-	-
	Fucus serratus	-	-	-	25%
	Gibbula umbilicalis	31	-	-	-
	Lipophrys pholis	1	-	-	-
	Littorina littorea	1	2	3	-
	Littorina mariae/ obtusata	-	-	-	3
	Littorina saxatilis	2	3	50	20
	Patella depressa	2	-	-	-
	Patella sp.	26	-	-	15
	Patella ulyssiponensis	8	-	-	-
	Patella vulgata	4	11	14	-
	Perforatus perforatus	-	-	-	30
	Phorcus lineatus	15	1	-	-

	(formerly *Osilinus lineatus)*				
	Polyplacophora sp.	1	-	-	-
	Semibalanus balanoides	0.5%	1250	1400	600
30m	*Actinia equina*	-	1	-	-
	Ahnfeltia plicata	0.5%	-	-	-
	Cladostephus spongiosus	0.5%	-	-	-
	Chondus crispus	0.5%	-	-	-
	Chthamalus montagui	-	150	-	-
	Chthamalus stellatus	-	-	-	-
	Eliminius modestus	0.5%	250	180	-
	Encrusting pink algae	25%	-	-	10%
	Fucus serratus	80%	-	-	100%
	Gibbula umbilicalis	12	-	-	-
	Hildenbrandia sp.	10%	-	-	-
	Littorina littorea	1	-	-	
	Littorina mariae/ obtusata	2	-	-	-
	Nucella lapillus	2	-	-	-
	Patella depressa	34	-	-	-
	Patella sp.	1	-	-	-
	Patella ulyssiponensis	-	4	-	-
	Patella vulgata	-	13	18	-
	Perforatus perforatus	-	-	-	-
	Semibalanus balanoides	-	3000	3000	150
40m	*Asterina gibbosa*	1	-	-	-
	Calliostoma zizyphinum	1%	-	-	-
	Chondus crispus	5%	-	-	-
	Chthamalus montagui	-	325	400	-
	Corallina officianalis	-	-	-	10%
	Eliminius modestus	10%	200	60	-
	Encrusting pink algae	40%	-	-	-
	Ulva spp.	-	15%	15%	-
	Fucus serratus	30%	-	9%	50%
	Fucus vesiculosus	-	1%	-	-
	Gibbula cineraria	2	-	-	-
	Gibbula umbilicalis	7	-	-	-
	Halichondria panicea		-	-	2%
	Hildenbrandia sp.	1	-	-	-
	Himanthalia elongata	1%	-	-	-
	Hymeniacidon perlevis (formerly *Hymeniacidon)*	0.5%	-	-	-
	Littorina littorea	1	-	2	-
	Littorina mariae/ obtusata	-	-	3	-
	Littorina saxatilis	-	-	5	-
	Lomentaria articulata	2%	-	-	5%
	Mastocarpus stellatus	50%	-	-	50%
	Nassarius incrassatus (formerly *Hinia incrassate)*	2	-	-	-

	Nucella lapillus	2	-	-	-
	Osmundea pinnatifida	1%	-	-	-
	Palmaria palmata	2%	-	-	-
	Patella sp.	16	-	-	-
	Patella ulyssiponensis	-	7	-	-
	Patella vulgata	-	10	17	-
	Semibalanus balanoides	10%	1125	2400	-
	Ulva lactuca	1%	-	-	-

Unit 4. Percuil River

Table P: Species data for Cellars Beach East (Presence)

Species	**1985** (Rostron, 1985)	**2011**
Audouinella sp.	P	
Anguilla anguilla	P	
Actinia equina	P	P
Amphipholis squamata	P	
Amphipoda sp.	P	P
Annelida sp.		P
Armeria maritima		P
Ascophyllum nodosum	P	P
Asterina gibbosa	P	P
Bifurcaria bifurcata		P
Bostrychia scorpioiodes		P
Botryllus schlosseri	P	
Bryozoa sp.		P
Callithamnion sp.	P	
Caloplaca marina	P	P
Calyptraea chinensis	P	
Carcinus maenas	P	P
Ceramium sp.	P	
Cerastoderma edule		P
Cereus pedunculatus	P	
Ciona intestinalis	P	
Chthamalus montagui	P	P
Chthamalus stellatus	P	
Chylocladia verticillata	P	
Cladophora sp.		P
Clavelina lepadiformis	P	
Chorda filum	P	
Corella eumyota		P
Crepidula fornicata	P	P
Cystoclonium purpureum	P	
Eliminius modestus	P	P
Encrusting pink algae	P	P
Fucus serratus		P
Fucus spiralis	P	P
Fucus vesiculosus	P	P
Galathea squamifera	P	
Gelidium spp.	P	
Gibbula cineraria		P
Gibbula umbilicalis		P
Gobiusculus flavescens	P	
Gracilariopsis longissima (recorded as synonym – *Gracilaria verrucosa*)	P	
Green algal mats	P – *Ulva*	P
Halichondria panicea	P	P
Hildenbrandia sp.		P
Lepidochitona cinerea	P	

Littorina littorea	P	P
Littorina mariae/ obtusata		P
Littorina saxatilis		P
Littorina sp.		P
Lomentaria articulata	P	
Marthasterias glacialis	P	
Mastocarpus stellatus	P	P
Melarhaphe neritoides (formerly *Littorina neritoides)*	P	P
Morchellium argus	P	
Mytilus edulis		P
Nassarius incrassatus	P	
Necor puber (recorded as synonym – *Liocarcinus puber*)	P	
Ophlitaspongia papilla		P
Ophiura sp.	P	P
Oshurkovia littoralis		P
Pagrus sp.		P
Palmaria palmata	P	
Patella sp.	P	P
Pelvetia canaliculata	P	P
Perforatus perforatus (formerly *Balanus perforatus)*	P	P
Pholis gunnellus	P	
Phorcus lineatus (formerly *Osilinus lineatus)*		P
Pisidia longicornis	P	
Pterothamnion sp. (recorded as synonym – *Antithamnion plumula*)	P	
Platyhelminthes sp.		P
Polynoidea sp.	P	
Polysiphonia sp.	P	P
Ramalina sp.	P	P
Rhizocarpon geographicum		P
Rhodothamniella floridula		P
Rissoa sp.		P
Sabella pavonina		P
Semibalanus balanoides	P	P
Spirobis sp.		P
Spirobranchus sp.(formerly *Pomatoceros* sp.)	P	P
Styela clava	P	
Suberites domuncula	P	
Syngnathus acus	P	
Ulva sp.		P
Venerupis corrugata		P
Verucaria sp.	P	P
Xanthoria siliquosa	P	

Unit 5 St Anthony Head

Table Q: Species data for Great Molunan (Presence)

Species	**1985** (Rostron, 1985*)	**2011**
Actinia equina	P	P
Apoglossum ruscifolium	P	
Asparogopsis armarta		P
Asterina phylactica		P
Botryllus schlosseri	P	P
Calliblepharis jubata		P
Calliostoma zizyphinum	P	P
Caloplaca marina	P	P
Calophyllis laciniata		P
Ceramium sp.		P
Cladostephus spongiosus	P	
Cladophora sp.		P
Clavelina lepadiformis		P
Chthamalus montagui		P
Chthamalus stellatus		P
Chthamalus sp.	P	
Codium sp.		P
Colpomenia peregrina		P
Corallina officianalis	P	P
Corallina sp.		P
Corynactis viridis		P
Crithmum maritimum		P
Cryptopleura ramosa		P
Dilsea carnosa		P
Dynamena pumila		P
Electra pilosa		P
Eliminius modestus		P
Ellisolandia elongate (formerly *Corallina elongate)*		P
Elysia viridis		P
Encrusting pink algae	P	P
Flustrelidra hispida		P
Fucus serratus	P	P
Fucus spiralis		P
Gastroclonium ovatum		P
Gelidium spinosum (formerly *Gelidium latifolium)*	P	
Gelidium pusillum	P	
Gibbula cineraria	P	P
Gibbula umbilicalis	P	P
Grantia compressa (Recorded as *Scypha compressa*)	P	
Halopteris filicina		P
Halichondria panicea		P
Himanthalia elongata	P	P
Hymeniacidon perlevis (formerly		P

Hymeniacidon perleve)		
Idotea granulosa		P
Laminaria digitata	P	P
Laminaria hyperborea	P	
Leathesia marina (formerly *Leathesia difformis)*		P
Lichina pygmaea	P	P
Littorina archena		P
Littorina littorea		P
Littorina mariae/ obtusata	P	P
Littorina neritoides	P	
Littorina saxatilis (Recorded as *L. neglecta, L. nigrolineata and L. rudis* in 1985)	P	P
Littorina sp.		P
Lomentaria articulata	P	P
Mastocarpus stellatus	P	P
Melarhaphe neritoides		P
Mesophyllum lichenoides		P
Mytilus edulis	P	P
Nassarius incrassatus (formerly *Hinia incrassate)*		P
Nucella lapillus		P
Osmundea osmundea		P
Osmundea pinnatifida (Recorded as Laurencia pinnatifida)	P	
Osmundea sp.		P
Palmaria palmata		P
Patella depressa		P
Patella pellucida (Recorded as Patina pellucida)	P	
Patella pellucida (formerly *Helcion pellucidum)*		P
Patella sp.	P	P
Patella vulgata	P	P
Pelvetia canaliculata		P
Perforatus perforatus (formerly *Balanus perforatus)*	P	P
Phorcus lineatus (formerly *Osilinus lineatus)*	P	P
Plantago maritima		P
Polyides rotundus		P
Spirobranchus triqueter		P
Ramalina siliquosa		P
Red algal turf		P
Scrupocellaria sp.		P
Sargassum muticum		P
Semibalanus balanoides		P
Sphaeromatidae sp.	P	
Spirobis sp.	P	
Sycon ciliatum		P
Tephromela atra var.atra var.atra (formerly *Lecanora atra)*		P
Trivia monacha		P
Ulva clathrata		P
Ulva intestinalis		P

Ulva lactuca		P
Verucaria sp.	P	P
Xanthoria parietina		P
Brown lichen		P
Grey/white lichen		P
Yellow lichen		P
Encrusting orange bryozoan	P	P

* A full species list for this site is not included in this report; this information is gathered from the habitat description.

Table R: Quadrat data for Amsterdam Point

Quadrat	Species	July 2012	CBRU Autumn 1992	CBRU Spring 1992	CBRU Autumn 1991	Covey & Hocking Autumn 1987
4m	*Actinia equina*				16	
	Ascophyllum nodosum	90%				
	Barnacle cover		3%	5%	5%	
	Chthamalus montagui		30	50	40	
	Gibbula umbilicalis				7	
	Littorina littorea			1	1	
	Littorina saxatilis		3	2	2	
	Littorina sp.	3				
	Pelvetia canaliculata		1%	10%	0%	
	Phorcus lineatus (formerly *Osilinus lineatus)*		2	0	0	0
	Polysiphonia sp.	1%				
10m	*Amphipoda* sp.	5				
	Ascophyllum nodosum	20%				
	Cladophora sp.	5%				
	Chthamalus montagui		00	0	0	0
	Dynamene bidentata					
	Ectocarpus sp.	5%				
	Eliminius modestus		00	0	0	0
	Encrusting pink algae	5%				
	Ulva spp.		0	0	5%	
	Fucus serratus	50%	0	0	5%	
	Fucus spiralis		100%	100%	65%	5%
	Fucus vesiculosus		0	0	0	30%
	Gibbula umbilicalis	1	0	0	5	
	Hildenbrandia rubra	2%				
	Isopoda sp.	1				
	Littorina littorea	1	2	0	0	1
	Littorina mariae/ obtusata	10	6	13	2	
	Littorina saxatilis		4	0	0	0
	Patella vulgata		0	0	5	
	Polysiphonia sp.	2%				
	Semibalanus balanoides		200	300	400	
	Spirobis sp.	3%				
20m	*Arenicola* sp. casts	5%				
	Balanus crenatus		40	0	0	0
	Carcinus maenas		1	1	1	
	Cerastoderma edule	1				
	Chthamalus montagui		150	100	90	15000
	Ectocarpus sp.	1%				
	Eliminius modestus		200	0	0	0
	Fucus serratus		0	0	2	
	Fucus spiralis		75%	100%	70%	
	Fucus vesiculosus		0	0	2%	

	Gibbula umbilicalis	1	0	0	0	1
	Isopoda sp.	7				
	Littorina littorea		15	3	0	5
	Littorina mariae/ obtusata	1	4	5	5	
	Littorina saxatilis		3	0	4	2
	Patella sp.		0	0	0	12
	Patella vulgata		3	4	0	
	Phorcus lineatus (formerly *Osilinus lineatus)*		0	4	3	4
	Semibalanus balanoides		1300	1800	1000	
	Spirobis sp.	20%				
30m	*Amphipoda* sp.	30				
	Ascophyllum nodosum		30%	20%	20%	30%
	Balanus crenatus		50	10	0	20
	Carcinus maenas	3				
	Chthamalus montagui		150	200	150	8000
	Ectocarpus sp.	1%				
	Eliminius modestus		200	0	0	0
	Encrusting pink algae	20%				
	Fucus serratus	30%	0	0	1	
	Fucus spiralis		0	0	0	2%
	Fucus vesiculosus	40%				
	Gibbula umbilicalis	11	1	0	1	1
	Hildenbrandia rubra	1%				
	Isopoda sp.	5				
	Littorina littorea	80	0	5	0	3
	Littorina mariae/ obtusata	16	0	3	1	
	Littorina saxatilis		4	0	0	0
	Mytilus edulis	7				
	Pagarus bernhardus		0	0	1	
	Patella sp.	6	0	0	0	9
	Patella vulgata		7	3	0	
	Perforatus perforatus (formerly *Balanus perforatus)*		4	0	0	0
	Phorcus lineatus (formerly *Osilinus lineatus)*		0	3	2	1
	Semibalanus balanoides		2000	6000	5000	
40m	*Actinia equina*		1	0	0	1
	Anemonia viridis		0	1	0	
	Asterina gibbosa	1				
	Ascophyllum nodosum	15%	75%	75%	60%	5%
	Cladophora sp.	1%				
	Ectocarpus sp.	1%				
	Eliminius modestus	5%	50			
	Encrusting pink algae	30%				
	Fucus serratus		0	0	0	50%
	Fucus vesiculosus	20%				
	Gibbula cineraria		0	0	3	
	Gibbula umbilicalis	40	2	4	0	1

	Littorina littorea	20	1	3	1	8
	Littorina mariae/ obtusata	8				
	Pagarus bernhardus		0	0	1	
	Patella sp.	16	0	0	0	5
	Patella vulgata		15	1	0	
	Perforatus perforatus (formerly *Balanus perforatus)*		60	60	50	30
	Phorcus lineatus (formerly *Osilinus lineatus)*	5				
	Polysiphonia sp.	15%				
	Semibalanus balanoides	5%	1000	1200	1000	
	Ulva lactuca		0	0	2	
50m	*Asterina gibbosa*	1			*	
	Ascophyllum nodosum		20%	0		
	Cladophora sp.	1%	5%	5%		
	Corallina sp.	2%				
	Eliminius modestus		150	40		
	Encrusting pink algae	40%				
	Fucus serratus	70%	50%	50%		60%
	Gibbula umbilicalis	24	2	0		
	Littorina littorea	2				
	Littorina mariae/ obtusata	7	5	0		
	Lomentaria articulata	1%				
	Mastocarpus stellatus	2%		0		1%
	Nymphon sp.	3				
	Ophiothrix sp.	3				
	Patella sp.	20	0	0		1
	Patella vulgata		4	4		
	Perforatus perforatus (formerly *Balanus perforatus)*		200	250		50
	Spirobranchus triqueter	1				
	Semibalanus balanoides		1800	2400		200
	Spirobis sp.	15%	0	0		
55m	*Actinia equina*		3	1		
	Corallina sp.	5%				
	Eliminius modestus	P	60	10		
	Fucus serratus		40%	40%		10%
	Gibbula umbilicalis	22	4	2		
	Hymeniacidon perlevis (formerly *Hymeniacidon perleve)*	2%				
	Littorina littorea		8	6		
	Littorina mariae/ obtusata		4	4		
	Lomentaria articulata					1%
	Mastocarpus stellatus	1%				5%
	Osmundea sp.	10%				
	Patella depressa	5				
	Patella sp.	40				
	Patella vulgata		8	9		

	Perforatus perforatus (formerly *Balanus perforatus)*	2%	100	110		
	Polysiphonia sp.	10%				
	Spirobranchus triqueter	1				
	Semibalanus balanoides	P	90	80		50
	Spirobis sp.	1%				
	Chiton	1				

* 41m was low water mark for this survey

Table S: Comparison of substrate and dominant species along transect at Amsterdam Point

2011			**1992 (CBRU, 1992)**		
Distance from start of transect (m)	Substrate	Dominant species	Distance from start of transect (m)	Substrate	Dominant species (in order of dominance)
0 – 1.6	Bedrock	Lichen	0 – 1.1	Bedrock	Lichen
1.6 – 2.3	Bedrock	*P. canaliculata*	1.1 – 3.5	Bedrock covered by boulders	*P. canaliculata, F. spiralis and C. montagui*
2.3 – 3.3	Bedrock	Barnacles			
3.3 – 41.5	Fine sand (65%), bedrock, cobbles, pebbles	*A. nodosum*	3.5 – 9	Medium sand, pebbles, cobbles, boulders, bedrock	*F. spiralis, P. canaliculata, C. montagui*
			9 – 24	Bedrock	*F. spiralis, barnacles*
			24 – 43	Bedrock, cobbles	*A. nodosum, barnacles*
Rockpools 3 – 60	Bedrock	*Corallina* spp.	Rockpools 9 – 60	Bedrock	*Corallina* spp., *Lithothamnion* spp.
41.5 - 60	Bedrock	Barnacles and *F. serratus*	43 - 48	Bedrock, boulders, cobbles	*A. nodosum, barnacles*
			48 - 59	Bedrock, boulders, fine and medium sand	*F. serratus,* barnacles
60 -	Bedrock (90%), cobbles	*H. elongata*	60	Fine sand	Not surveyed

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